Studebaker

SHOP MANUAL

1947-1948-1949

CHAMPION
COMMANDER

PREPARED BY THE GENERAL SERVICE DEPARTMENT
THE STUDEBAKER CORPORATION
SOUTH BEND 27, INDIANA
PRICE $2.50

FOREWORD

This 1947 Studebaker Shop Manual is published as a service reference guide on 6G and 14A models including diagnosis information and general specifications.

The Table of Contents and Index are placed at the front of the book for easy reference.

The sections are placed in alphabetical sequence according to major subjects.

At the end of each section there are ruled spaces for inserting references to pertinent articles as they appear in forthcoming issues of the SERVICE BULLETIN. Also, blank space is provided beneath the Bulletin Reference chart for additional notes.

Pages are numbered consecutively, as are all illustrations, beginning with the first page of text matter.

The section title and page number appear at the upper outside corner of the page in bold face type.

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SERIAL NUMBERS

Starting car serial numbers of the 1947 models are as follows:

Champion (6G)	G-212501
Commander (14A)	4232501

Starting engine serial numbers for the 1947 models are as follows:

Champion (6G)	236001
Commander (14A)	H-182001

BODY

The Champion and Commander bodies are constructed entirely of metal and consist of several major panel and kit assemblies. These assemblies are clearly illustrated in figures 1 through 4.

The floor panel consists of three separate stampings welded together. The instrument board, which is attached to the cowl panel with eight bolts, is a separate stamping and adds greatly to the strength of the body.

Hole covers are provided in the floor panel at the following locations: the gas tank unit inspection cover under the spare wheel in the trunk compartment, the transmission governor inspection cover to the right of the center of the tunnel, the transmission clearance cover in the center of the tunnel, the clutch housing bolt hole cover in front of the transmission clearance cover, and the brake cylinder cover directly behind the brake pedal. A cover is also provided for the hole in which the Climatizer can be installed.

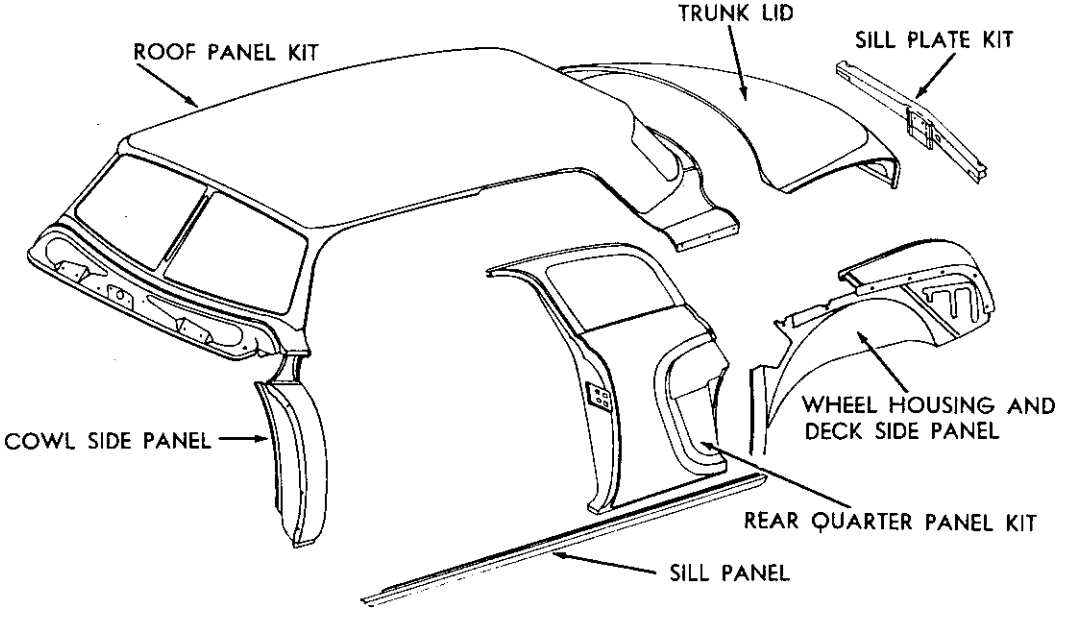


FIG. 1.—CHAMPION AND COMMANDER TWO-DOOR SEDANS

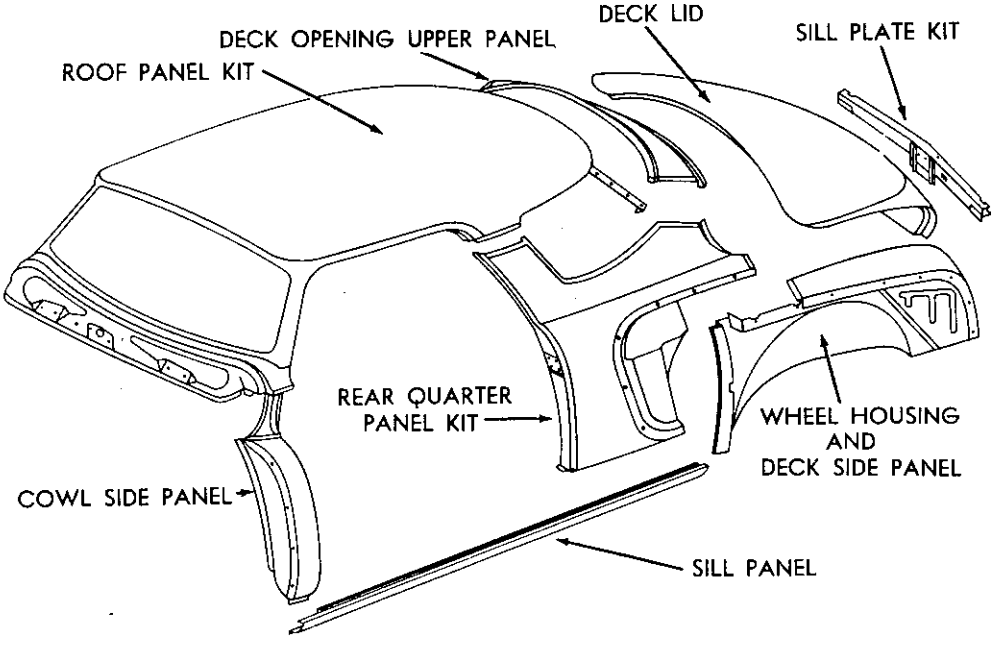


FIG. 2.—CHAMPION AND COMMANDER COUPES FOR FIVE PASSENGERS

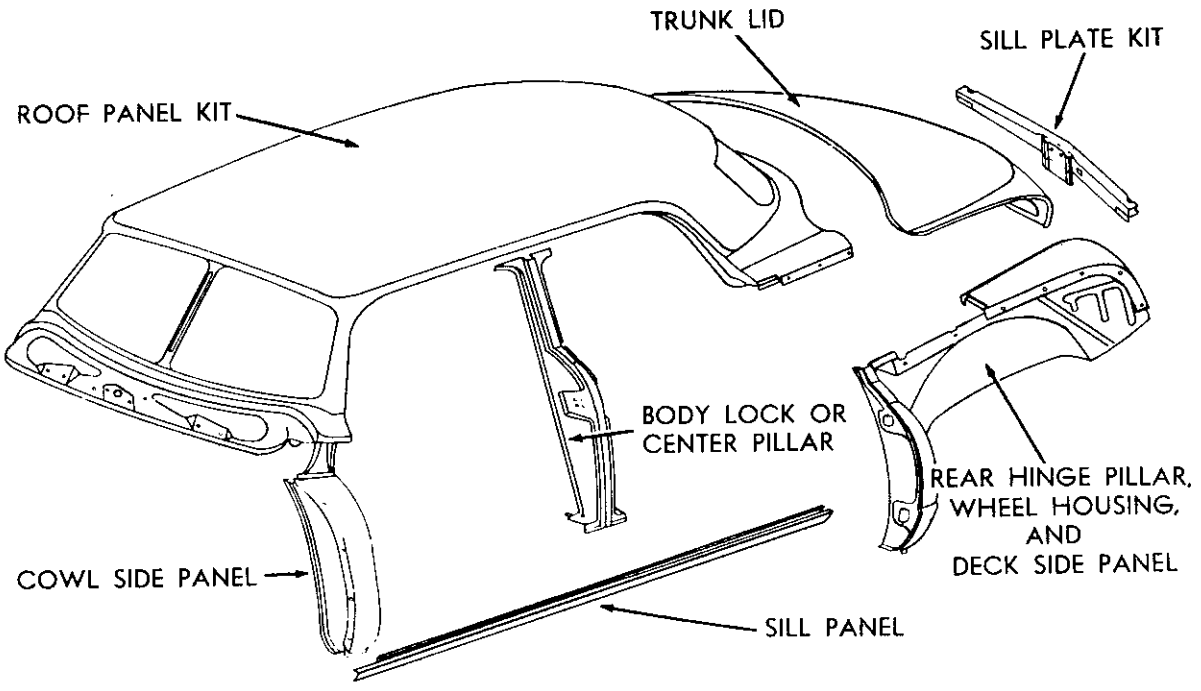


FIG. 3.—CHAMPION AND COMMANDER FOUR-DOOR SEDANS

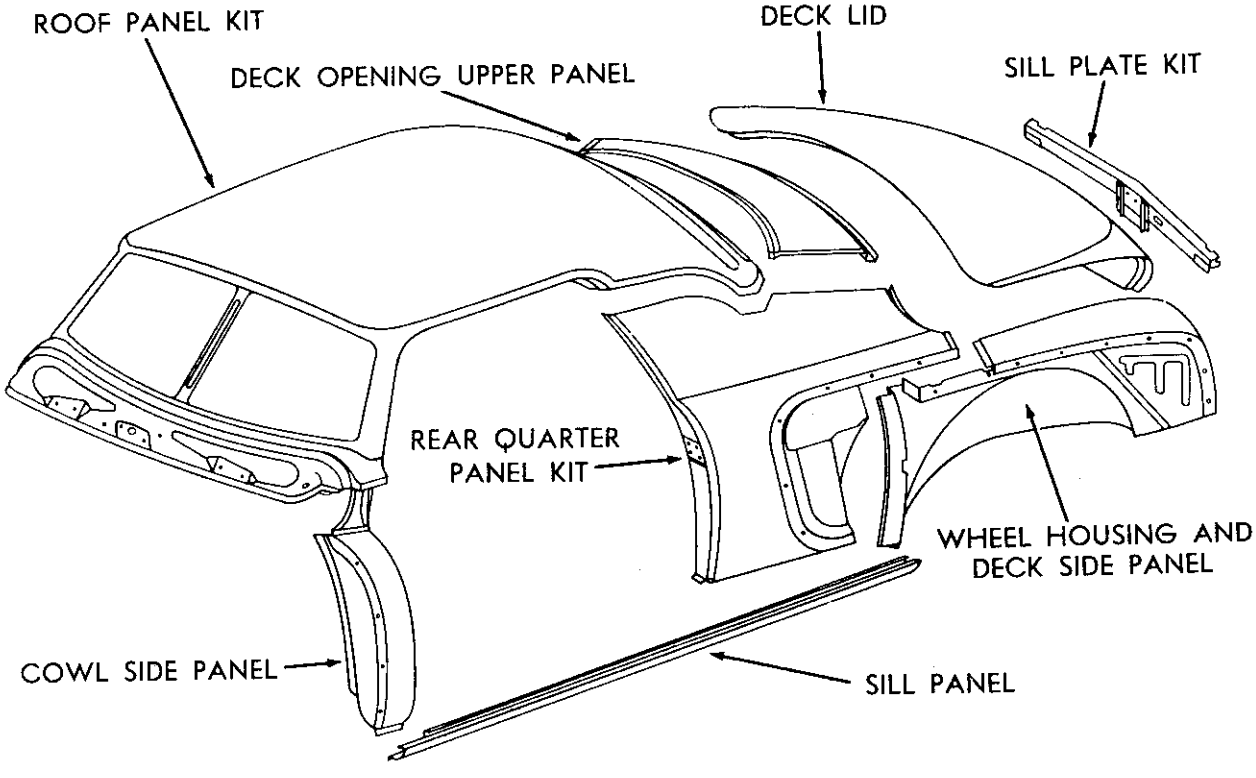


FIG. 4.—CHAMPION AND COMMANDER COUPES FOR THREE PASSENGERS

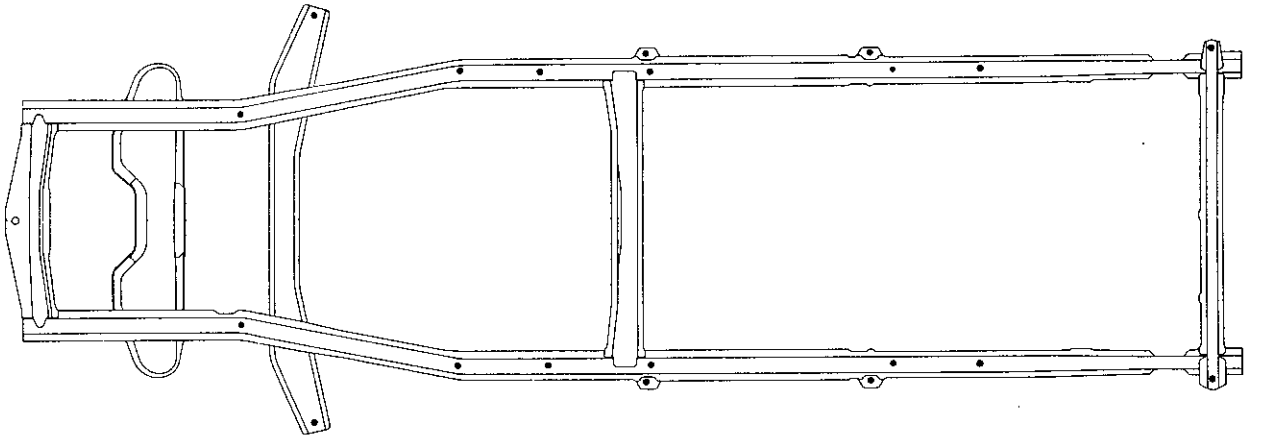


FIG. 5.—THE HEAVY DOTS (•) INDICATE BODY BOLT HOLES

Body Bolt Location

CHAMPION AND COMMANDER The body is rigidly attached to the frame with twenty body bolts. The single-bolt attachments are located at the following points: one on each cowl bracket, one at each outer edge of the engine rear support cross member, two under each end of the front seat, two just behind each end of the center frame cross member, two in front of each rear wheel housing, one at the center of each rear wheel housing, and one at each end of the gas tank cross member (see Fig. 5).

Instrument Board

Removal

CHAMPION AND COMMANDER Disconnect one battery cable at the battery, the hood lock control wire at the hood lock latch lever, and the hood lock control wire tube at the hood lock latch plate. Then remove the clips which hold the hood lock wire tube to the left front fender skirt.

Remove the front seat cushion and shift the front seat as far rearward as possible. Cover the front seat back, the hinge post trim, and the door trim panels to prevent their becoming soiled.

Remove the two sleeve nuts which hold the instrument case on the instrument board. Then push the case forward (away from the steering wheel) out of the board.

Uncouple the speedometer cable at the speedometer head. After unscrewing the jamb nut on the front of the instrument board which holds the hood lock control sleeve in place, pull the hood lock control assembly rearward (toward the steering wheel) out of the dash grommet and instrument board. Then pull the windshield wiper control knob off the shaft; and after removing the spanner nut from the sleeve on the back of the instrument board, push the control sleeve forward out of the board.

Remove the instrument lamp and lighting switch knobs from the switch. Remove the spanner nut which holds the switch sleeve to the instrument board, and push the switch and circuit breaker forward out of the board. Then, after removing the ignition switch span-

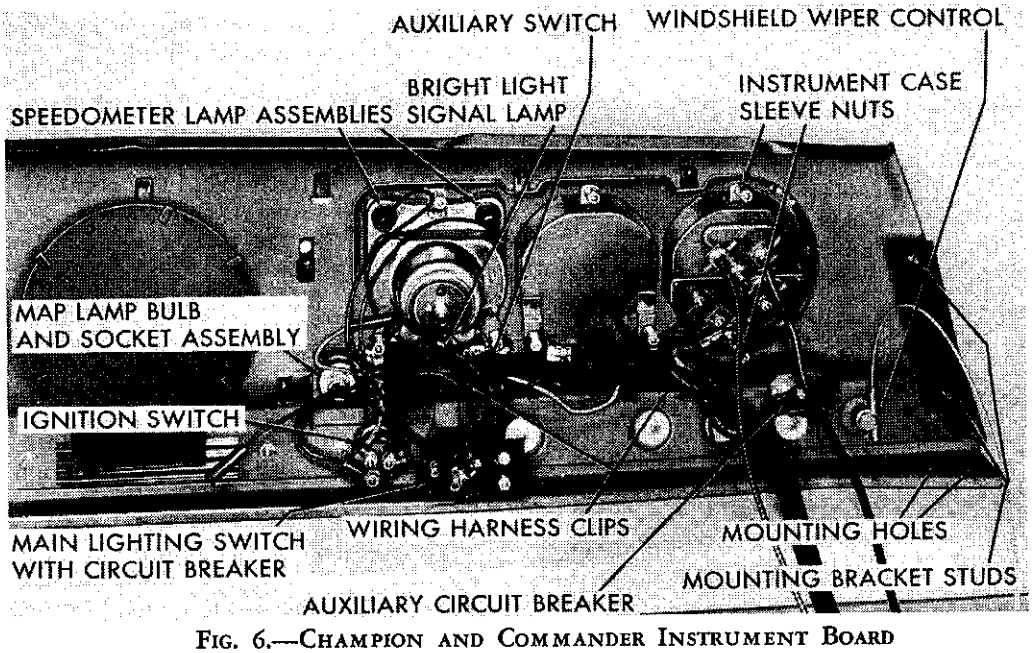


FIG. 6.—CHAMPION AND COMMANDER INSTRUMENT BOARD

ner nut on the back of the instrument board, push the switch forward out of the board.

Remove the map lamp auxiliary switch from the instrument board. Pull forward on the speedometer lamp bulb and socket assemblies and on the bright light signal lamp assembly to disconnect these assemblies from the speedometer. Then remove the map lamp bulb and socket assembly from its holder, the wiring harness from the instrument board clips, and the auxiliary lighting circuit breaker from the instrument board.

Remove the windshield garnish mouldings. Then remove the two bolts and nuts from each instrument board body bracket and the two nuts and washers from the studs on each bracket.

Disconnect the parking brake bracket from the instrument board flange. Remove the steering post bracket to instrument board bolts and detach the bracket from the brace rod and instrument board. Then loosen the steering post bracket clamp bolt and slide the bracket down the post. Removing the center screw from the top flange of the instrument board will then permit the removal of the board.

Installation

CHAMPION AND COMMANDER Place the instrument board in its correct position. Start the four attaching bolts, the four bracket stud nuts, the steering post bracket bolts, and the top flange center screw. Having done this, tighten these bolts, nuts, and screws uniformly and securely. Then install the windshield garnish moulding.

Install the auxiliary lighting circuit breaker and the map lamp auxiliary switch on the instrument board. Clip the wiring harness to the instrument board and install the map lamp bulb and socket assembly in its holder. Then install the speedometer lamp bulb and socket assemblies and the bright light signal lamp assembly in the speedometer head.

Install the ignition switch and the lighting switch with the circuit breaker on the instrument board, tightening the spanner nuts securely. Then install the instrument lamp and lighting switch knobs on the lighting switch.

Insert the windshield wiper control sleeve in the hole in the instrument board, and install the spanner nut on the sleeve and the control knob on the shaft.

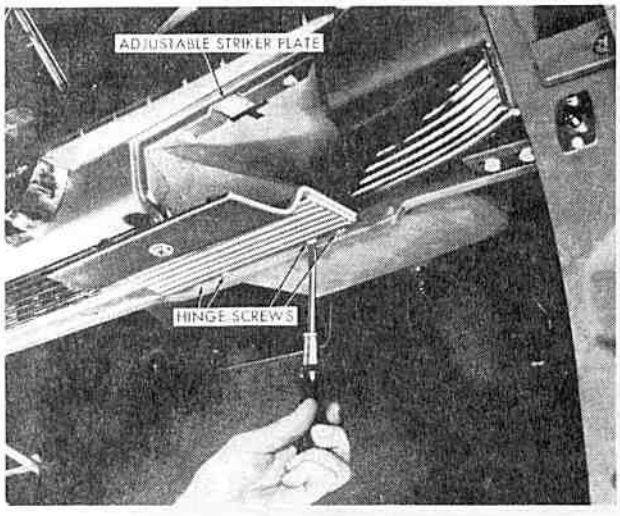


FIG. 7

After pulling the hood lock control assembly forward through the hole in the instrument board and through the dash grommet, install the jamb nut, which holds the hood lock control sleeve in place, on the front of the instrument board. Then attach the speedometer cable to the speedometer head and install the instrument case on the instrument board.

Install the clips which hold the hood lock wire tube to the left front fender. Then connect the hood lock control wire tube to the latch plate, the hood lock control wire to the latch lever, and the battery cable to the battery.

Remove the protective coverings from the upholstery and install the front seat cushion.

PACKAGE COMPARTMENT DOOR ADJUSTMENT To adjust the compartment door, loosen the four hinge screws on the under side of the instrument board (see Fig. 7). After moving the door in or out to increase or decrease the spring tension of the hinges, tighten the screws to maintain the adjustment. The compartment door striker plate should then be adjusted so that the door will lock properly.

Headlining

Removal

CHAMPION AND COMMANDER Remove the rear vision mirror, sun visors, windshield garnish mouldings, both rear quarter window assemblies, assist straps, dome lamp assembly, rear seat back, and rear windows and weatherstrip. The tacks which hold the headlining to the nailing strips around the rear window, quarter windows, and windshield should then be removed.

With a sharp knife, cut the headlining loose over the doors and around the sides of the car, shearing along a line parallel to the lower edge of the roof and about one inch above the weather cords located above the doors. After the headlining has been cut loose, the drive screws which hold the ends of the bows to the roof frame are accessible. Removing these screws will permit the removal of the headlining and bow assembly.

With a putty knife, remove the lining which remains in the car by pushing up on the lining between the headlining side retainer and the roof to disengage the material from the retainer teeth.

Installation

CHAMPION AND COMMANDER Remove the bows from the old lining and insert them in the corresponding listings in the new headlining. The installation of the bows in the proper listings is important.

Place the new lining in the car and install the rear bow with the drive screws. With the rear bow hanging in an inverted position, push the sides of the lining near the rear bow up under the lining retainer, engaging the lining retainer teeth. Then swing the rear bow to its proper position. Working forward, repeat this operation on each bow.

Stretch the lining around the rear window, windshield, and rear quarter window openings and tack the lining to the tacking strips. Then install the windshield garnish mouldings, the rear windows, and the rear quarter windows.

To complete the installation, install the sun visors, rear view mirror, dome lamp, assist straps, and rear seat back. Be sure to clean any upholstery which may have been soiled.

Door Disassembly

Champion and Commander

DOOR WINDOW GARNISH MOULDING AND VENTILATOR ASSEMBLY Remove the Phillips head screws which hold the garnish moulding to the door (be sure to remove the screw which is hidden by the ventilator wing). Then remove the garnish moulding and the ventilator assembly from the door (see Fig. 8).

To remove the ventilator assembly from the garnish moulding, loosen the two lower pivot clamp bolts (see Fig. 9) and drill out or cut off the top pivot point rivet.

To remove the ventilator handle, drive the retaining pin out of the handle with a punch.

INSIDE DOOR AND WINDOW REGULATOR HANDLE Press the escutcheon plate in toward the door trim to expose the retaining pin which holds the regulator handle in position. Using a punch, drive the pin out of the handle and remove the handle from the door (see Fig. 10). Then remove the Phillips head screw from the inside door handle and remove the door handle and escutcheon plate.

ARM REST Remove the two metal screws which hold the metal retaining plate to the arm rest. After removing the retaining plate, remove the two long screws which were concealed by the plate. The arm rest can then be removed.

DOOR TRIM PANEL To remove the trim panel, release the retaining clips by prying the panel away from the door (see Fig. 11). After removing the trim panel, be sure to remove the coil springs from the window regulator and remote control shafts.

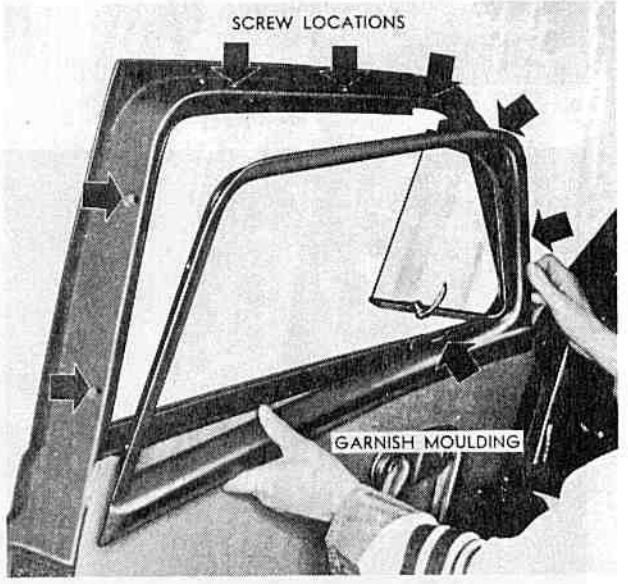


FIG. 8

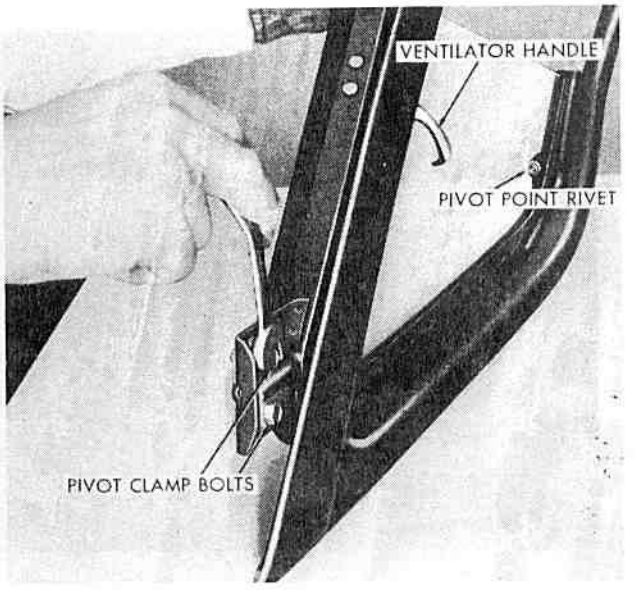


FIG. 9

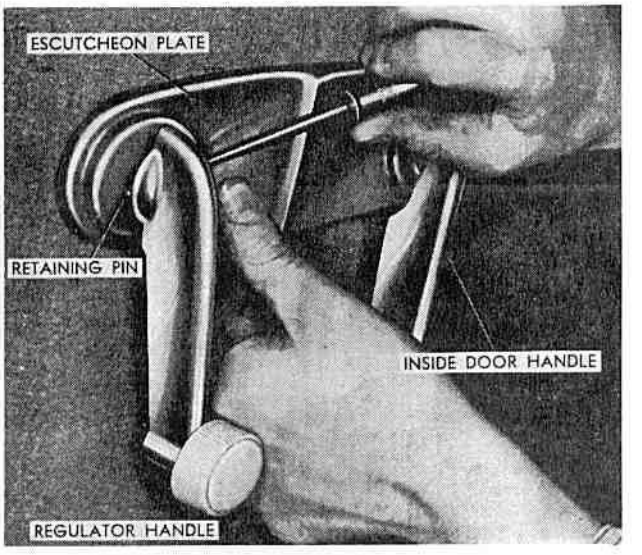


FIG. 10

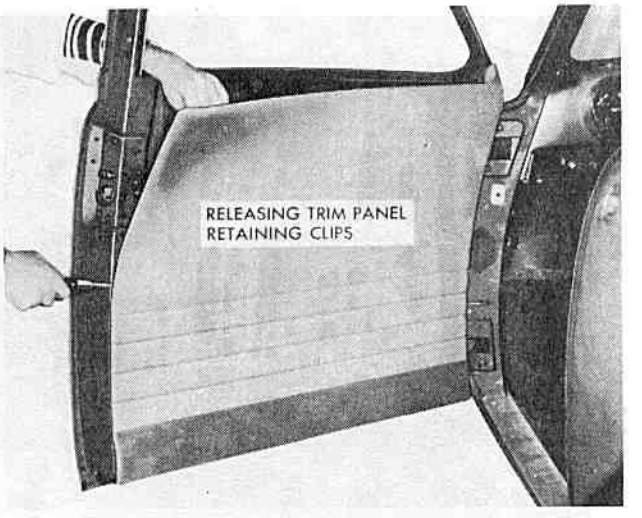


FIG. 11

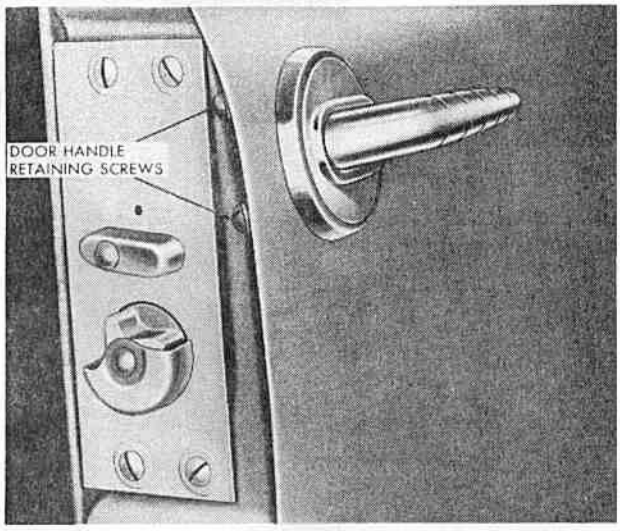
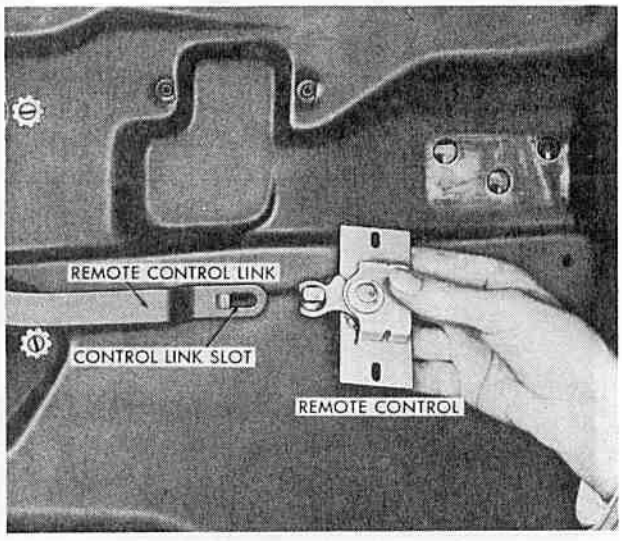


FIG. 12



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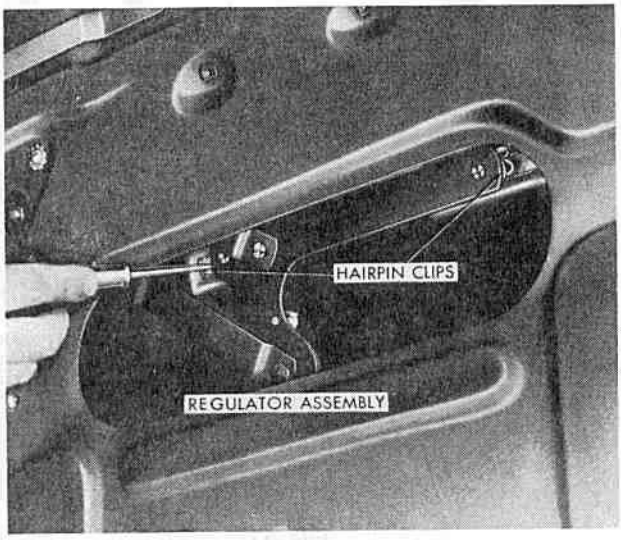


FIG. 14

OUTSIDE DOOR HANDLE Remove the two retaining screws and star washers from the inner edge of the door panel and remove the outside door handle assembly (see Fig. 12).

LOCK CYLINDER With the glass raised and the tape removed from the inspection hole, reach through the opening and remove the lock cylinder horseshoe retainer. The lock cylinder can then be pulled out of the door.

REMOTE CONTROL Remove the two screws and star washers which hold the remote control to the door. To remove the control, turn it 90° clockwise and pull it out of the control link slot (see Fig. 13).

LOCK ASSEMBLY Remove the pivot screw and washers from the remote control bell crank. After removing the four screws which hold the door lock to the door, remove the lock and the remote control links.

DOOR WINDOW GLASS With the window glass fully lowered, use a punch to remove the two hairpin clips and washers holding the regulator arm to the door glass lift channel (see Fig. 14). Then pull the regulator rollers out of the lift channel slots, turn the glass approximately 45° clockwise, and remove the glass from the door (see Fig. 15).

DOOR WINDOW REGULATOR Remove the four screws and star washers which hold the window regulator to the door panel. Then remove the regulator through the inspection hole in the door (see Fig. 16).

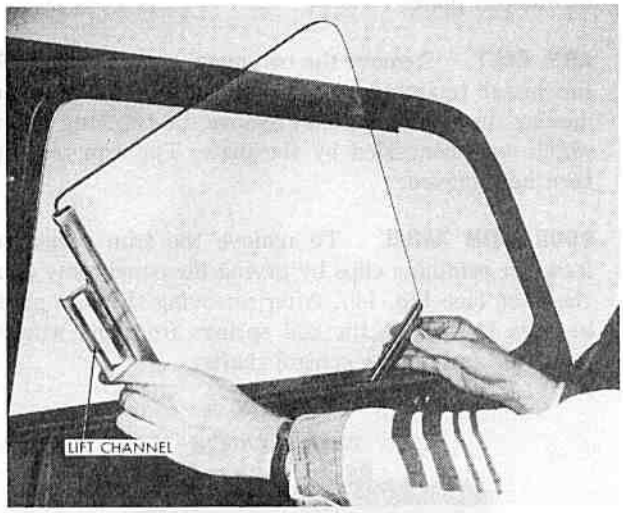


FIG. 15

FIG. 16

DOOR WINDOW FRONT RUN To remove the front run, remove the four screws and star washers which hold the run in the door panel (see Fig. 21).

DOOR WINDOW REAR RUN Disengage the window run to door lower clip. Then remove the run, breaking it loose from the cement (see Fig. 17).

WINDOW WEATHERSEALS — INNER AND OUTER The inner weatherseal is stitched to the garnish moulding and can be replaced only with a special stitching machine. To remove the outer weatherseal, release the clips by prying the weatherseal loose from the door with a putty knife or a similar tool (see Fig. 18).

WINDOW REVEAL MOULDING To remove the window reveal moulding, release the clips with a dull putty knife or similar tool and pry the moulding loose from the door (see Fig. 19). Be careful not to mar the finish.

DOOR CHECK Remove the rivet located at the doorpost end of the check link. Then remove the door check assembly by pulling it through the small inspection hole in the door panel (see Fig. 20).

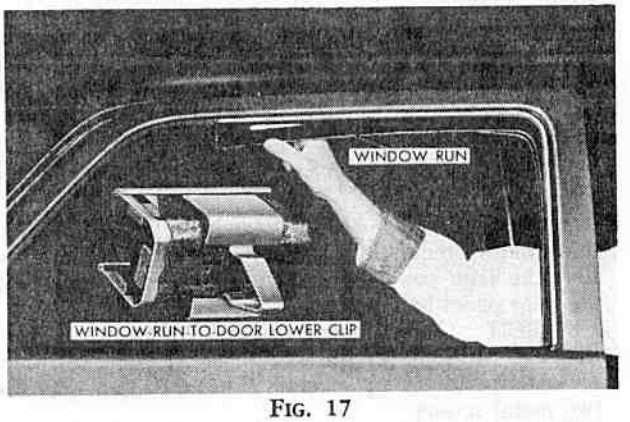


FIG. 17

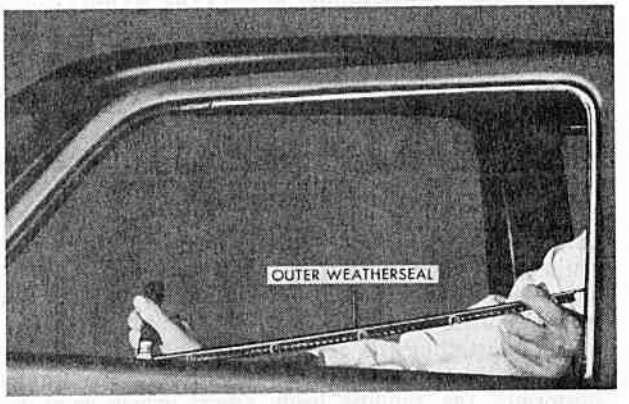


FIG. 18

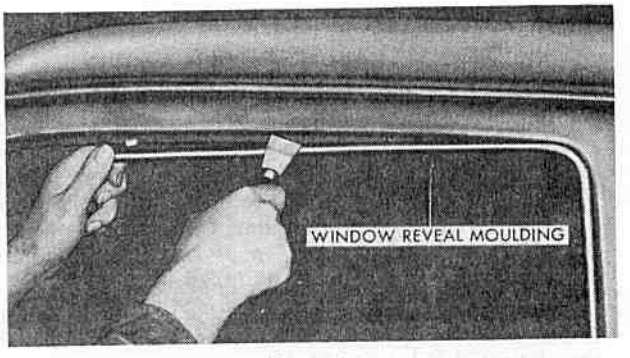


FIG. 19

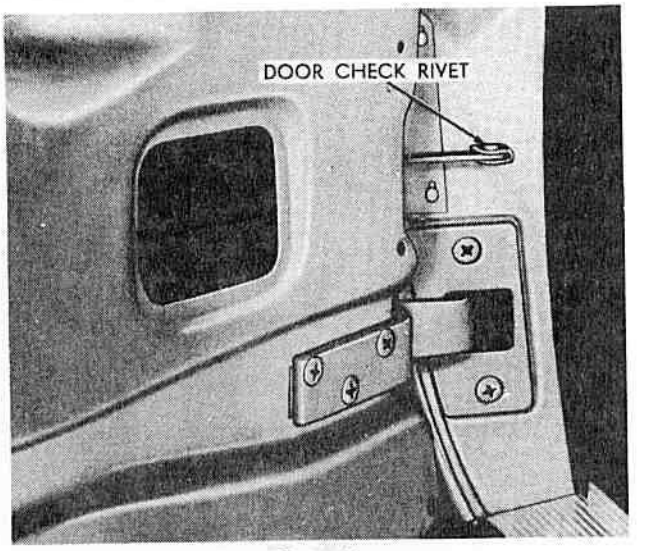


FIG. 20

Door Reassembly

Champion and Commander

DOOR CHECK Place the door check assembly in its proper position by putting it through the small inspection hole and the slot in the door. Then attach the check link to the door post with a new rivet.

WINDOW REVEAL MOULDING Place the clips on the window reveal. Then press the moulding over the clips and align the moulding with the reveal.

WINDOW WEATHERSEAL—OUTER Insert the weatherseal clips in the holes provided in the window opening and press the weatherseal into position.

DOOR WINDOW REAR RUN When installing the door window run, thoroughly clean all surfaces to which cement is to be applied. Apply an approved window run cement to the run and to the door and install the window run by pressing the lower clip into position.

DOOR WINDOW FRONT RUN Place the window run in the door and fasten it to the inner door panel with the four screws and star washers.

DOOR WINDOW REGULATOR Place the window regulator in the door and fasten it to the inner door panel with the four screws and star washers.

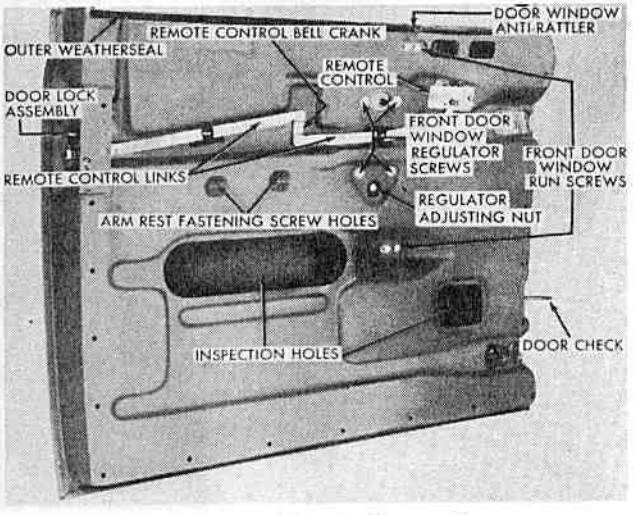


FIG. 21.—INNER FRONT DOOR PANEL

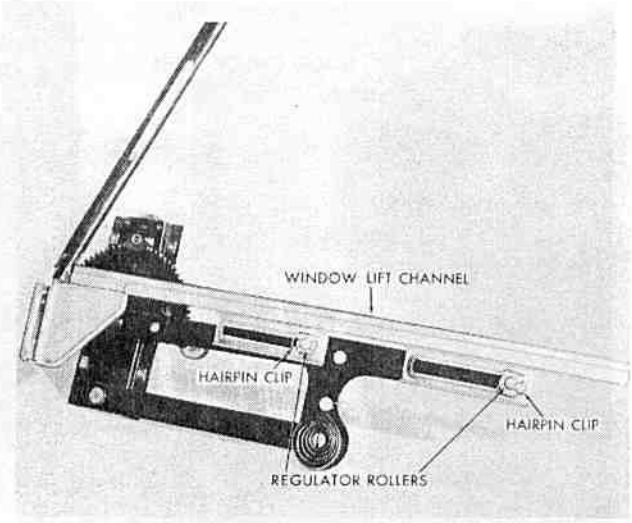


FIG. 22

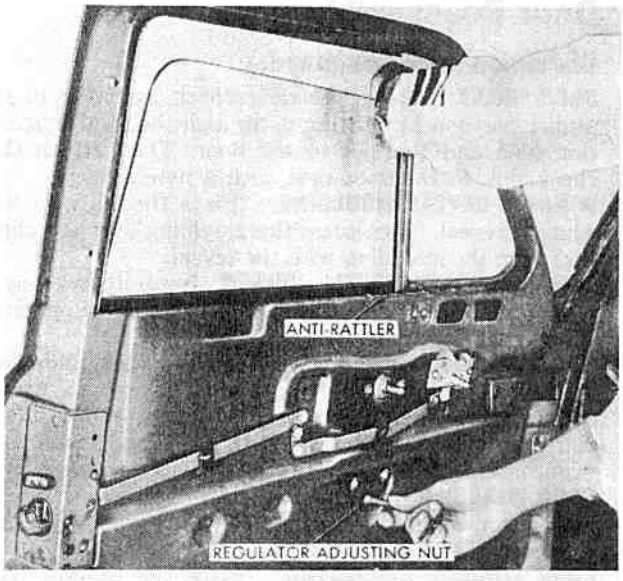


FIG. 23

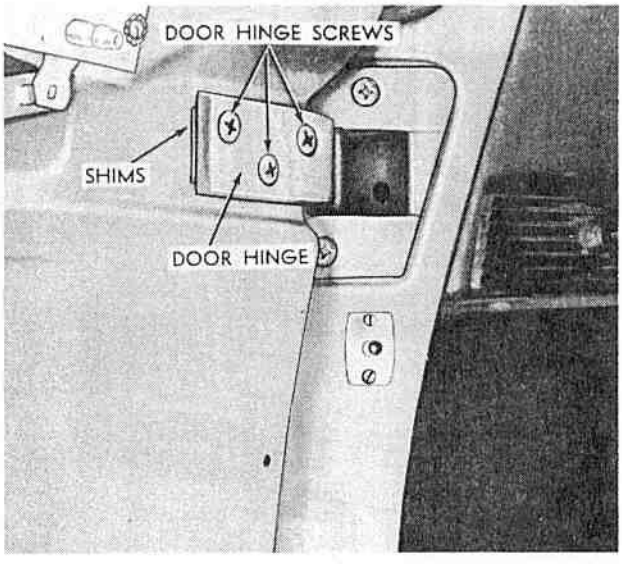


FIG. 24

DOOR WINDOW GLASS Tilt the window 45° clockwise and lower the glass into its position. Insert the regulator rollers in the slots in the window lift channel and lock the rollers in position with the two hairpin clips. Figure 22 illustrates the proper installation of the hairpin clips.

Align the glass to fit the window opening with the regulator adjusting nut (see Fig. 23). For further adjustment move the window guide to the right or left in the slots provided in the door.

To eliminate excessive door glass side play or binding, loosen the two anti-rattler screws and move the anti-rattler in or out as required.

LOCK ASSEMBLY Install the door lock with control links on the door and secure the lock in position with the four screws. Then fasten the bell crank to the inner door panel with the pivot screw and washers.

REMOTE CONTROL Connect the remote control to the control link and install the remote control on the door panel with the two screws and star washers.

LOCK CYLINDER Insert the lock cylinder in the door being sure that the square shaft properly engages the lock assembly. Then, with the glass raised, reach through the large inspection hole and install the lock cylinder horseshoe retainer.

OUTSIDE DOOR HANDLE Install the door handle, insert the two screws with star washers, and tighten the screws securely.

DOOR TRIM PANEL After placing the coil springs on the window regulator and remote control shafts, install the trim panel by inserting the retainer clips in the door panel holes.

ARM REST Install the arm rest on the inner panel with the two long screws. The retaining plate can then be fastened to the under side of the arm rest with the two metal screws.

INSIDE DOOR AND WINDOW REGULATOR HANDLE Place the escutcheon plate in its position on the trim panel, and pressing on the plate, install the regulator handle and retaining pin. Then install the inside door handle, insert the Phillips head screw in the handle, and tighten it securely.

DOOR WINDOW GARNISH MOULDING AND VENTILATOR ASSEMBLY Place the ventilator assembly in the garnish moulding, install a new rivet in the upper pivot point brackets, and tighten the lower pivot clamp bolts until there is sufficient tension on the ventilator wing. Then install the ventilator handle and washers and lock the handle in place with the retaining pin.

After installing the garnish moulding and ventilator assembly in the window opening, insert and tighten uniformly the Phillips head screws which hold the moulding to the door.

Door Alignment

CHAMPION AND COMMANDER Provisions are made for door alignment at both the door hinges and the striker plate. The door hinges are adjustable at the door side of the hinge. For proper adjustment, loosen the screws which hold the hinge to the door and move the door in the desired direction. Further adjustments are possible with the insertion of shims between the hinge and the door panel. (See Fig. 24.)

To obtain the proper striker plate adjustment, loosen the four retaining screws and move the striker plate in the elongated holes provided.

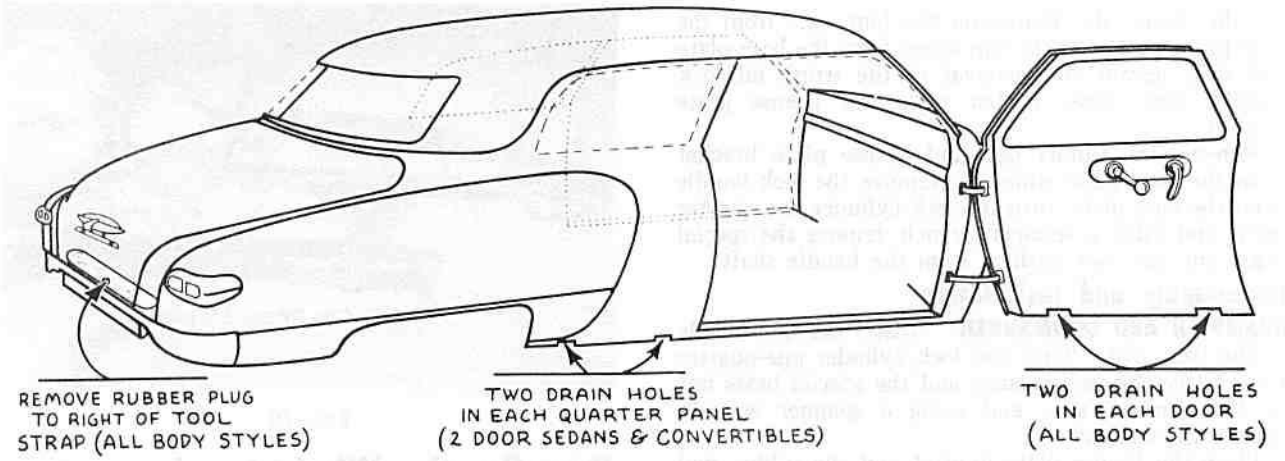


FIG. 25

Body Drain Holes

CHAMPION AND COMMANDER Two drain holes in the bottom of each door provide proper drainage of the door panels. Another drain hole is located in the tool compartment to the right of the tool strap. The two-door sedans and the convertibles have in addition two drain holes in each rear quarter panel which provide drainage for the rear quarter window (see Fig. 25).

Check all drain holes periodically to see that they are free of foreign matter, and if necessary, clean them with a small wire brush to prevent rusting of the doors, quarter panels, and tool compartment.

Trunk Lid Alignment

CHAMPION AND COMMANDER For trunk lid alignment, the following adjustments can be made at the hinges and the striker plate (see Figs. 26 and 27).

For side adjustment of the lid, loosen the bolts which hold the hinges to the trunk lid, move the lid sideways in the desired direction, and tighten the bolts.

For front and rear adjustment, loosen the bolts which hold the hinges to the body, move the lid in the direction necessary to correct the misalignment, and tighten the bolts.

To move the lid closer to or away from the body opening, loosen the bolts which hold the hinges to the wheel housings and the body. When making this adjustment, insert or remove the necessary number of shims between the top of the hinges and the body.

If any of the foregoing operations have been performed, striker plate adjustment will probably be necessary. Adjust the striker plate so that the latch on the trunk lock properly contacts the striker plate and the lower edge of the lid fits tightly against the weatherstrip. This adjustment can be made by the movement of the striker plate in its elongated holes or by the removal or addition of shims between the plate and the body (see Fig. 27).

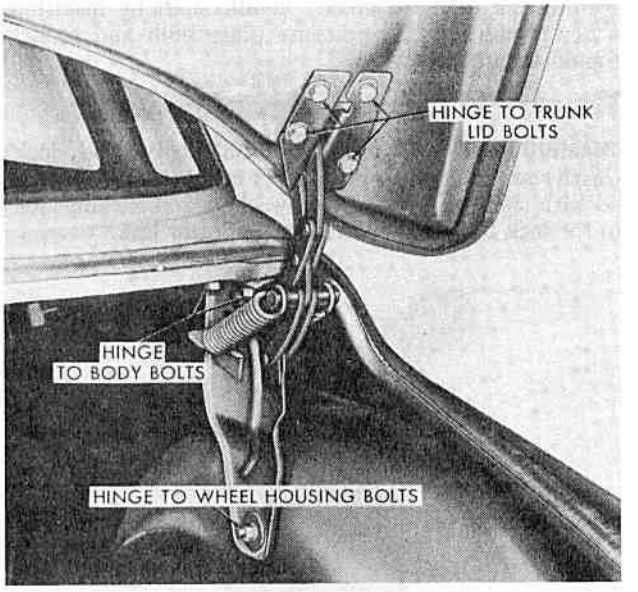


FIG. 26

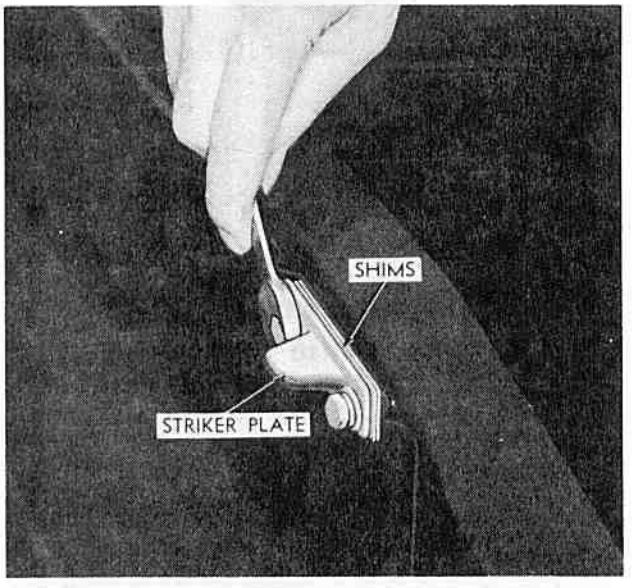


FIG. 27

Trunk Lid Lock Handle and Base Plate

Removal and Disassembly

CHAMPION AND COMMANDER After removing the license plate bulb and socket, disconnect the lock assembly link from the trunk lid handle shaft by remov-

ing the cotter pin. Removing the four nuts from the base plate studs and the cap screw from the base plate will then permit the removal of the trunk lid lock handle, base plate, rubber pad, and license plate bracket.

Remove the rubber pad and license plate bracket from the base plate studs. To remove the lock handle from the base plate, turn the lock cylinder one-quarter turn; and using a spanner wrench, remove the special brass nut and two washers from the handle shaft.

Reassembly and Installation

CHAMPION AND COMMANDER Insert the lock handle in the base plate. Turn the lock cylinder one-quarter turn; place the two washers and the special brass nut on the handle shaft; and using a spanner wrench, tighten the nut securely.

Place the license plate bracket and the rubber pad on the base plate and install the assembly on the trunk lid, tightening the nuts securely. Connect the lock assembly link to the trunk lid handle shaft by inserting a new cotter pin. The license plate bulb and socket should then be installed.

Trunk Lid Lock (Latch) Assembly

CHAMPION AND COMMANDER The trunk lid lock (latch) assembly (see Fig. 28) is fastened to the trunk lid with three screws and lock washers and is connected to the lock handle shaft with a connector link.

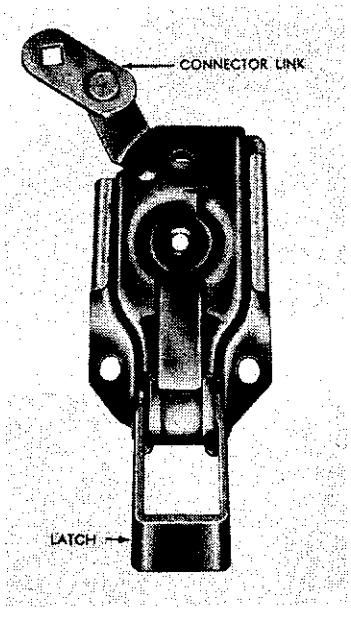


FIG. 28

Trunk Lid Handle Lock Cylinder

Removal and Installation

CHAMPION AND COMMANDER Turn the key in the lock cylinder one-quarter turn either way. Inserting a paper clip or small punch in the hole below the cylinder, push the plunger in and pull the cylinder out of the handle (see Fig. 29).

To install the cylinder, turn the key one-quarter turn, press in the plunger, and insert the cylinder in the handle. Then, after turning the key to either the locked or the unlocked position, move the cylinder slightly until the plunger drops into its position.

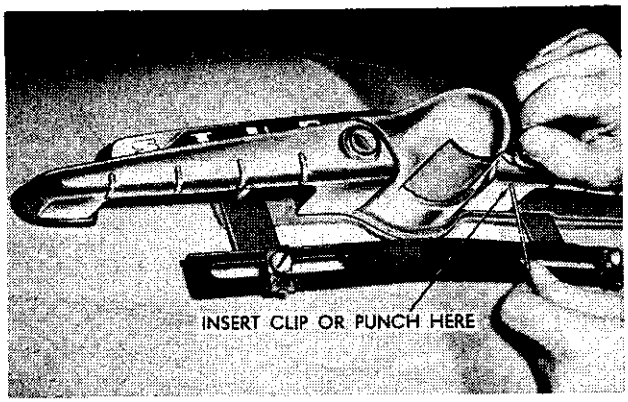


FIG. 29

Rear Quarter Window and Regulator (Two-Door Sedans)

Removal

CHAMPION AND COMMANDER Remove the rear seat cushion, back, arm rest cover, and arm rest. Then remove the rear quarter window garnish moulding, regulator handle, and escutcheon ring.

Remove the screw which holds the front of the rear quarter trim panel to the door lock striker post. Gently prying inward on the front nailing strip, roll the strip forward to expose the heads of the tacks. Then remove the tacks, being careful not to break the nailing strip.

After removing the tacks and nails which hold the rear of the trim panel to the nailing strip, carefully remove the trim panel. Then pull the sealing tape off the inspection holes; and after lowering the window, disengage the lift channel guide from the rear run.

Adjust the window height so that the window regulator lift arm pin is accessible through the inspection hole. After disengaging the pin from the lift channel, remove the glass through the window opening. Flatten the inner flange of the run as required to facilitate the removal of the glass from the run.

Remove the four screws and lock washers which hold the window regulator to the rear quarter panel. Then remove the regulator through the front inspection hole.

Installation

CHAMPION AND COMMANDER Insert the window regulator through the front inspection hole. Then install the four screws and lock washers which hold the regulator to the rear quarter panel. Delay the final tightening of the screws until the window has been properly aligned.

Lower the glass and lift channel through the window opening, engaging the front guide on the lift channel with front window run. With the lift channel resting on the regulator, tilt the glass; and reaching through the rear inspection hole, engage the rear guide on the lift channel with the rear window run. Then engage the regulator lift arm pin with the lift channel.

Shift the window regulator in its slots until the window travels freely in its runs and has no tendency to tilt forward or backward. When the regulator has been properly positioned, securely tighten the four screws which hold the regulator to the rear quarter panel.

Cover the inspection holes with sealing tape. Tack the front edge of the trim panel to the front nailing

strip. Then swing the unfastened edge of the trim panel into position, being sure that the escutcheon plate spring is on the regulator shaft, and tack the rear edge of the trim panel to the rear nailing strip.

Install the screw which holds the front of the trim panel to the door lock striker post. Then install the escutcheon ring, regulator handle, garnish moulding, arm rest and cover, and rear seat back and cushion.

Windshield

Removal

CHAMPION AND COMMANDER Remove the center clip from the top of the inner center bar. Then remove the rear view mirror and inner center bar. After the inner center bar has been removed, the outer center bar with rubber weatherstrip will come off easily.

Remove the inside windshield garnish moulding. Using a putty knife or similar tool, press the rubber weatherstrip over the flange of the windshield opening (see Fig. 30). Then remove the windshield from the weatherstrip by pushing inward on the upper outside corner of the glass (see Fig. 31).

Installation

CHAMPION AND COMMANDER Apply an approved sealer to the glass channel in the windshield rubber weatherstrip and place the windshield in the weatherstrip. Then apply an approved bedding putty to the inside surface of the windshield-opening flange; press the glass and weatherstrip into the windshield opening; and using a putty knife or a similar tool, pry the weatherstrip over the flange of the windshield opening.

Install the inside windshield garnish moulding and place the outer center bar with the rubber weatherstrip in its position. The installation of the inner center bar, the rear view mirror, and the center clip at the top of the center bar can then be accomplished.

NOTE.—The installation of both sections of the windshield requires the following procedure.

Place the rubber weatherstrip on a bench, apply an approved sealer to the glass channel in the weatherstrip, and insert the two sections of the windshield in the weatherstrip. Place a piece of twine around the weatherstrip under the lip with the loose ends of the twine centered at the bottom of the windshield. Then apply an approved bedding putty to the inside surface of the windshield-opening flange, and press the glass and weatherstrip into the windshield opening.

Inserting two tapered hard wood blocks between the upper and lower edges of the two sections of the windshield, work the two sections outward toward the sides of the body. Then pull the twine toward the center of the windshield so that the lip of the weatherstrip will be forced over the flange of the windshield opening.

Rear Window Glass

Removal

CHAMPION AND COMMANDER Remove the inner center bar, rubber weatherstrip, and outer moulding. Using a putty knife or a similar tool, press the rubber weatherstrip over the flange of the rear window opening. Then remove the rear window by pushing inward on the upper outside corner of the glass.

Installation

CHAMPION AND COMMANDER Apply an approved sealer to the glass channel in the rear window rubber weatherstrip and insert the glass in the weatherstrip. Place a piece of twine around the weatherstrip under the lip with the loose ends of the twine centered at the bottom of the rear window. Then tie a string around the center of the glass and the weatherstrip to hold the weatherstrip in place.

Apply an approved putty to the inside surface of the rear window opening flange, apply liquid soap to the inner edges of the center strip and the two outer corners, and press the glass and weatherstrip into the rear window opening. Then remove the string tied around the center of the glass and the weatherstrip and pull the ends of the twine toward the center of the glass so that the lip of the weatherstrip will be forced over the flange of the rear window opening.

Install the outer moulding and the inner weatherstrip and center bar.

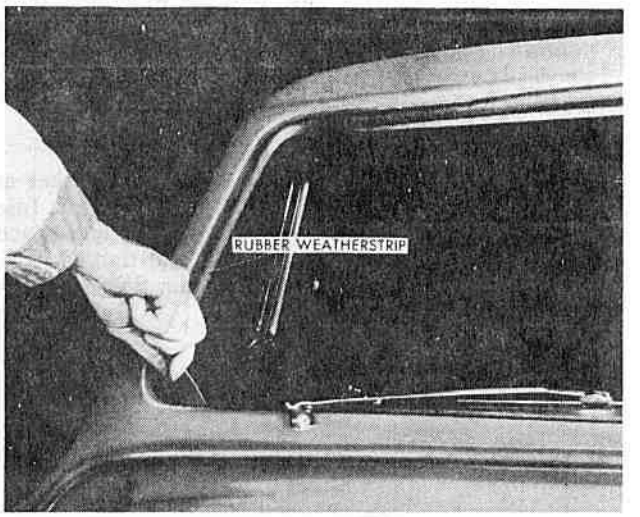


FIG. 30

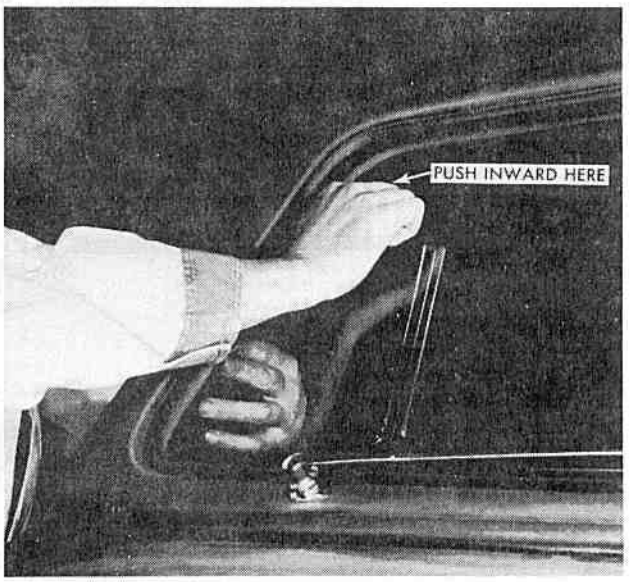


FIG. 31

Windshield Wiper

● The windshield wiper motor used on the Champion and Commander models drives both wiper arms, is of the vacuum type, and employs a two-way cable system. The cables run on pulleys which are attached to the inner side of the cowl.

Removal

CHAMPION AND COMMANDER Remove the control cable from the wiper motor. Remove the wiper motor from the auxiliary drive connector by removing the two attaching screws.

Relieve the tension on the cables by loosening the cable tensioner lock nuts, pressing the pulleys toward the center of the car, and then retightening the nuts. Removing the cables from the auxiliary drive connector will then permit the removal of the auxiliary drive connector and the cable tensioners from the cowl.

To remove a driver unit, pull the wiper arm off the shaft and remove the special nut with a spanner wrench. The driver unit, spacer, and gasket can then be easily removed.

Installation

CHAMPION AND COMMANDER Place the gasket and spacer on the hole provided for the driver unit. Insert the driver unit through the hole, gasket, and spacer; install the special nut on the unit; and tighten it with a spanner wrench. The wiper arm can then be pressed on the driver unit.

Install the cable tensioners and the auxiliary drive connector on the cowl. Install the two cables over the tensioner pulleys, hooking the ends in the auxiliary drive connector. Be careful not to kink or fracture the cables during installation.

NOTE.—Cable linkages and tensioners are not interchangeable and must be installed as designated by the stamping; i.e., those stamped "R" must be installed on the right-hand side of the car; those stamped "L," on the left-hand side.

For proper adjustment of the cable tensioner, loosen the nut and tap the stud lightly to unseat the lock washer. Doing this permits the tensioner to take up automatically any slack in the cables. Tighten the nut firmly to hold the pulleys in the new position. Each tensioner must be adjusted separately. Be sure that the cables operate without contacting any part of the body, accessories, or wiring system.

Install the wiper motor on the auxiliary drive connector; tighten the two attaching screws securely. Be sure, when installing the motor, that the rubber saddle is on the end of the motor shaft and is inserted evenly in the auxiliary drive connector. To facilitate installation, wet the rubber saddle. After installing the wiper motor, complete the installation procedure by connecting the control cable to the wiper motor.

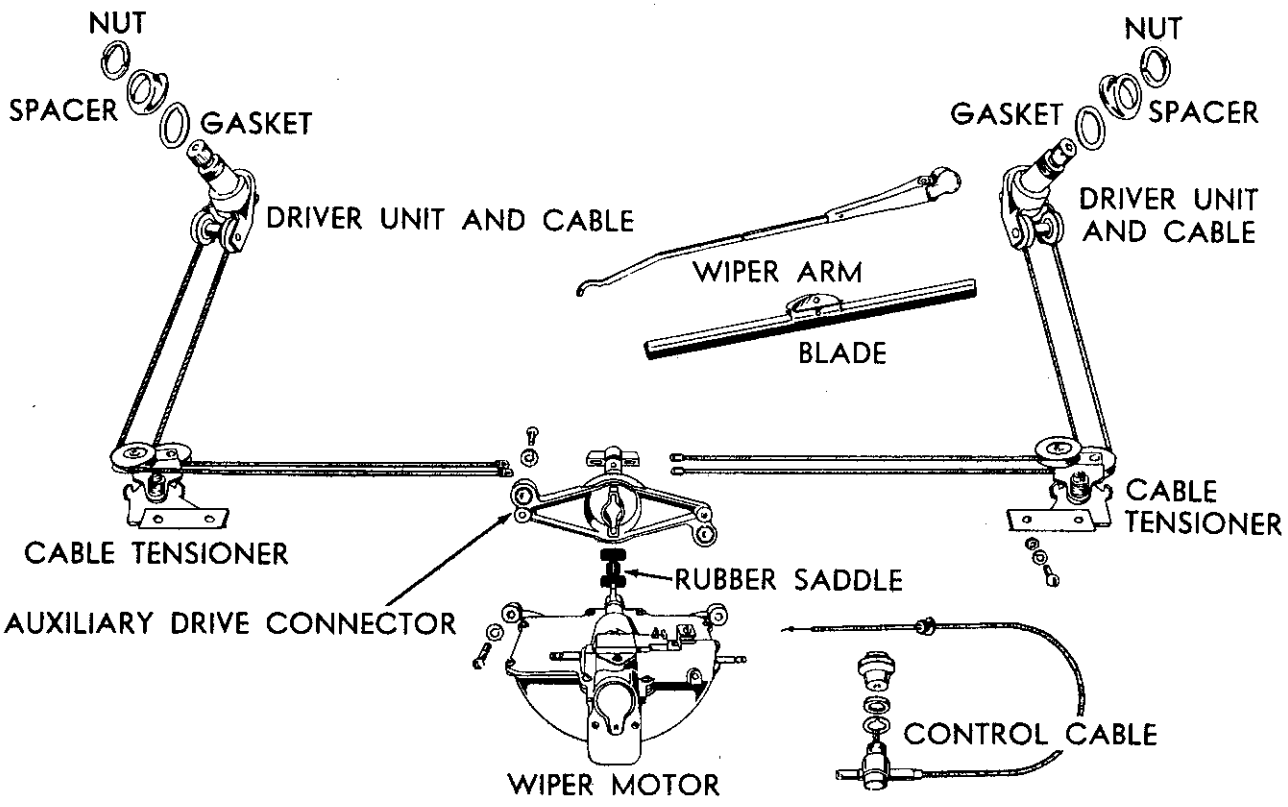


FIG. 32.—CHAMPION AND COMMANDER WINDSHIELD WIPER ASSEMBLY

Seats

Rear Seat

CHAMPION AND COMMANDER The rear seat back is held in place with two inverted hooks at the top and three studs and nuts at the bottom.

Front Seat

CHAMPION AND COMMANDER The front seat back is attached to the seat frame with two clips at the top and three metal screws at the bottom.

Two cap screws on each side of the seat frame hold the frame to the seat track. On each seat track, the rear cap screw is located under the foot rest.

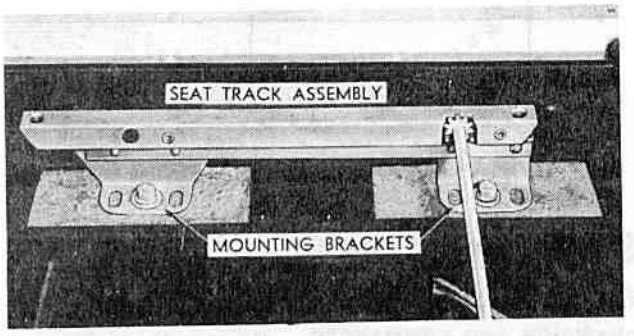


FIG. 33

Front Seat Track Adjustment

CHAMPION AND COMMANDER Four cap screws fasten the seat track directly to the chassis frame. Three holes are provided in each seat track mounting bracket. In production the mounting cap screws are inserted through the center holes. If this factory setting is not satisfactory, the seat track assembly may be moved forward or backward as required (see Fig. 33).

Hood

Alignment

CHAMPION AND COMMANDER For hood alignment, observe the following procedure.

Unhook both hinge springs and loosen slightly the three bolts which hold each hinge plate to the cowl (see Fig. 34). Then loosen the four cap screws which attach the hood latch plate to the upper air deflector (see Fig. 35).

Close the hood and shift it until proper alignment and spacing have been obtained. (To prevent hinge slippage when raising the hood, it will be necessary to keep the hood hinge to cowl bolts fairly tight.) Then raise the hood and securely tighten the hinge to cowl bolts.

Install the hood hinge springs and lower the hood allowing the dovetail to center the hood latch plate. Then raise the hood, and without disturbing the centered position of the latch plate, securely tighten the four cap screws.

If, after the preceding adjustments, the hood is not properly aligned with the fenders or grille assembly, shift the fenders or the grille, or both, if necessary, to obtain proper alignment.

Lock Adjustment

CHAMPION AND COMMANDER The hood lock may be adjusted at the dovetail (see Fig. 36). If the hood is loose at the latch plate, the dovetail bolt should be raised (turned clockwise); if, however, too much pressure is required to close the hood, the bolt should be lowered (turned counterclockwise).

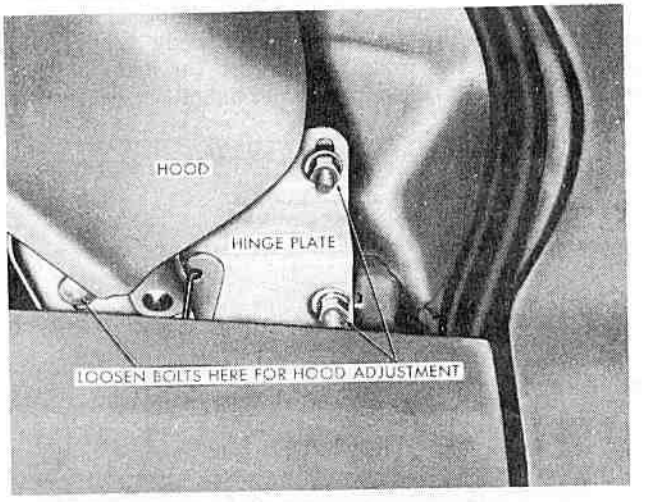


FIG. 34

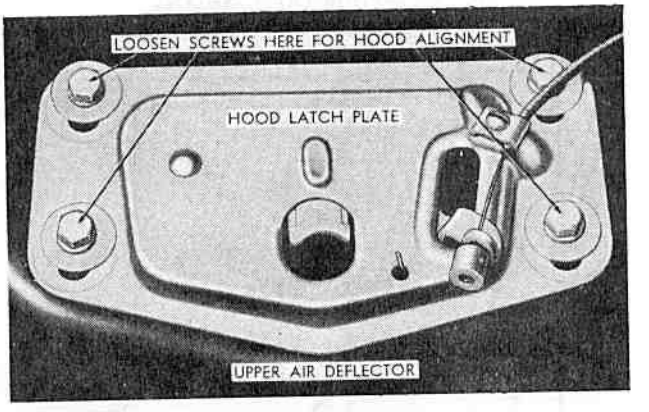


FIG. 35

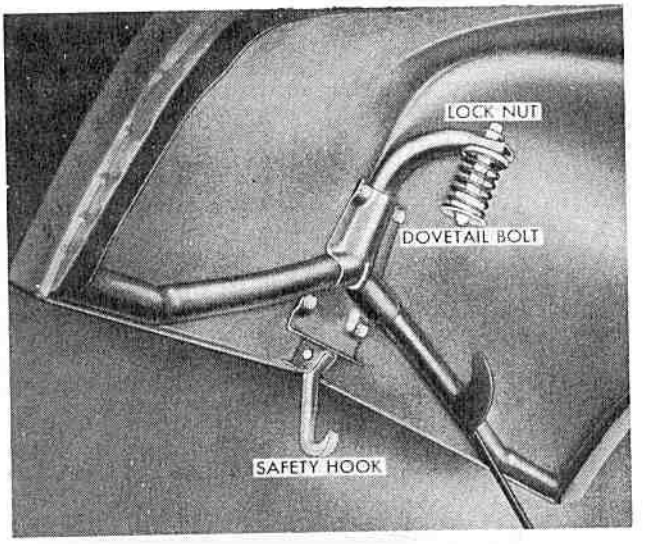


FIG. 36

Floor Carpet Installation

CHAMPION AND COMMANDER The front and rear floor carpets should be securely fastened to the floor pan with the scuff plate retaining screws. Additional screws are provided in an envelope in the tool compartment. The "X" marks in figures 37 through 40 show the correct points at which the additional screws should be installed on the different body types. Be sure to install the front floor carpet (or mat) under the steering post dash rubber grommet.

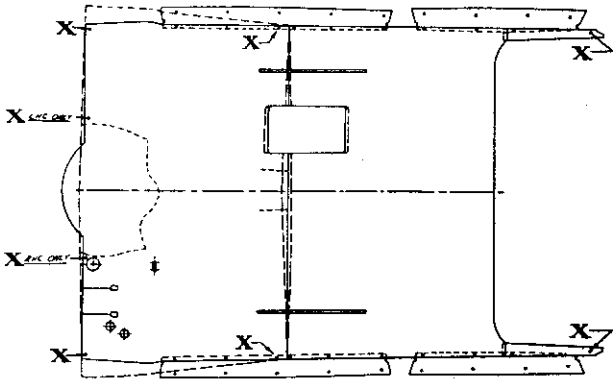


FIG. 37.—FOUR-DOOR SEDANS

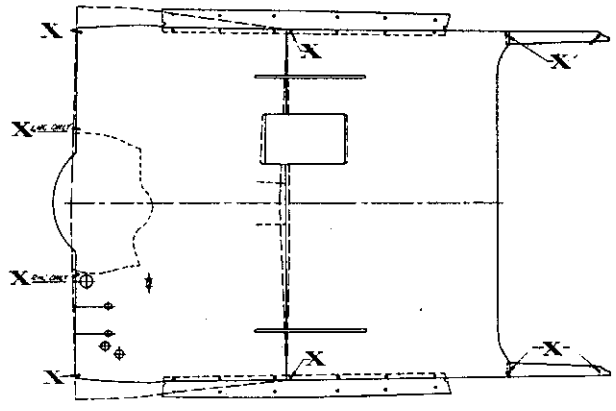


FIG. 38.—TWO-DOOR SEDANS

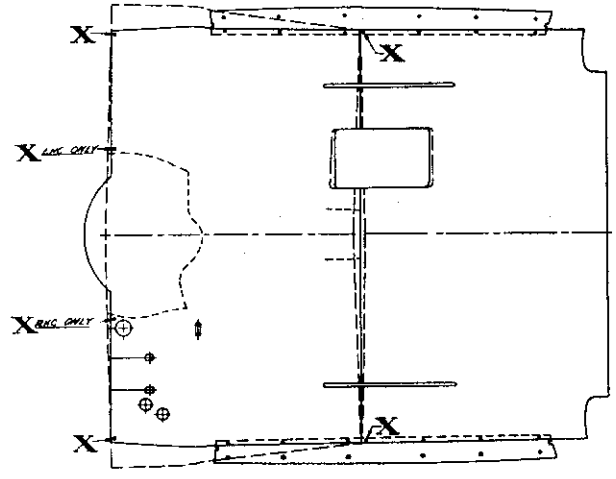


FIG. 39.—COUPES FOR FIVE PASSENGERS

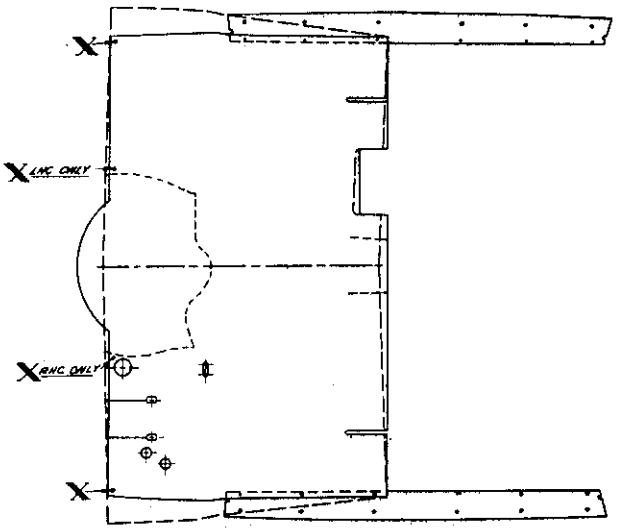


FIG. 40.—COUPES FOR THREE PASSENGERS

Shroud Ventilators

Removal

CHAMPION AND COMMANDER Remove the right inside ventilator door and frame assembly by removing the four retaining screws. With the control handle in the down position, unhook the spring from the connector link and the connector link from the outside door. Then remove the two cap screws which hold the control handle bracket to the cowl, thus permitting the removal of the control handle.

To remove the outside ventilator door, first remove the insect screen from the fender. Removing the two nuts and washers on the inside of the door will then permit the removal of the door from the fender.

To accomplish the disassembly and removal of the fender to cowl ventilator duct, remove the four cap screws which hold the two sections of the duct together.

NOTE.—The construction of the left shroud ventilator is the same as that of the right ventilator with the exception of an inside insect screen substituted for the right inside ventilator door and frame assembly.

Installation

CHAMPION AND COMMANDER Place the two sections of the fender to cowl ventilator duct in position and insert and securely tighten the four cap screws.

Place the outside ventilator door in the fender and fasten it to the bolts with the two washers and nuts. Then secure the insect screen to the fender flange with the two small metal screws.

Attach the connector link to the outside ventilator door and fasten the control handle in its position with the bracket and two cap screws. Then hook the spring to the connector link, and install the inside ventilator door and frame assembly, securely tightening the four retaining screws.

Body Wiring Diagrams

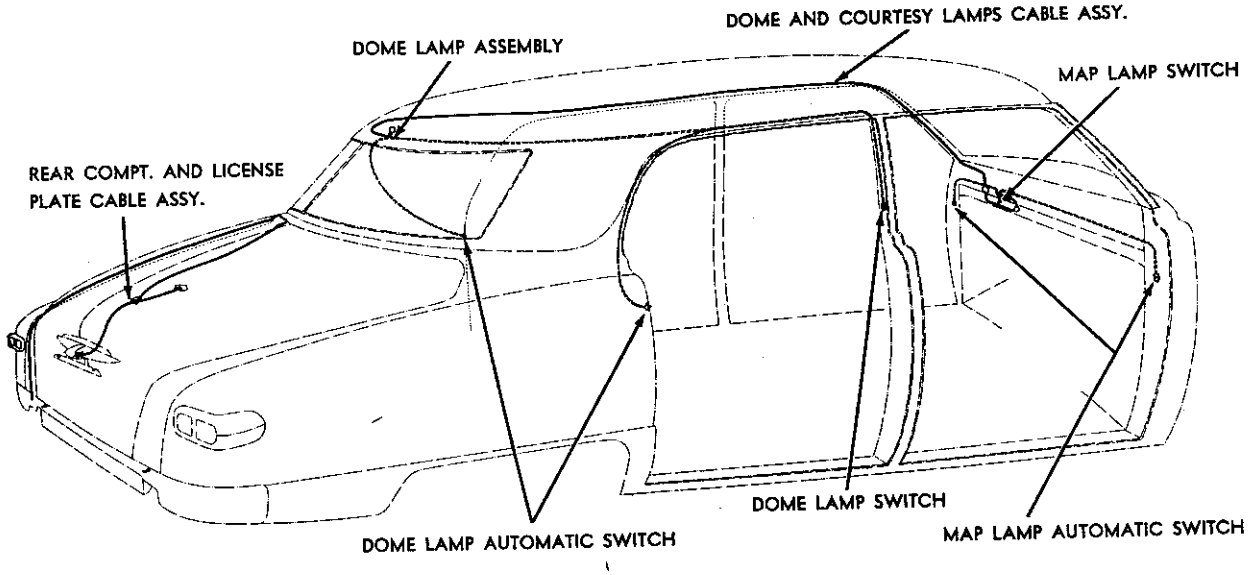


FIG. 41.—CHAMPION AND COMMANDER FOUR-DOOR MODELS

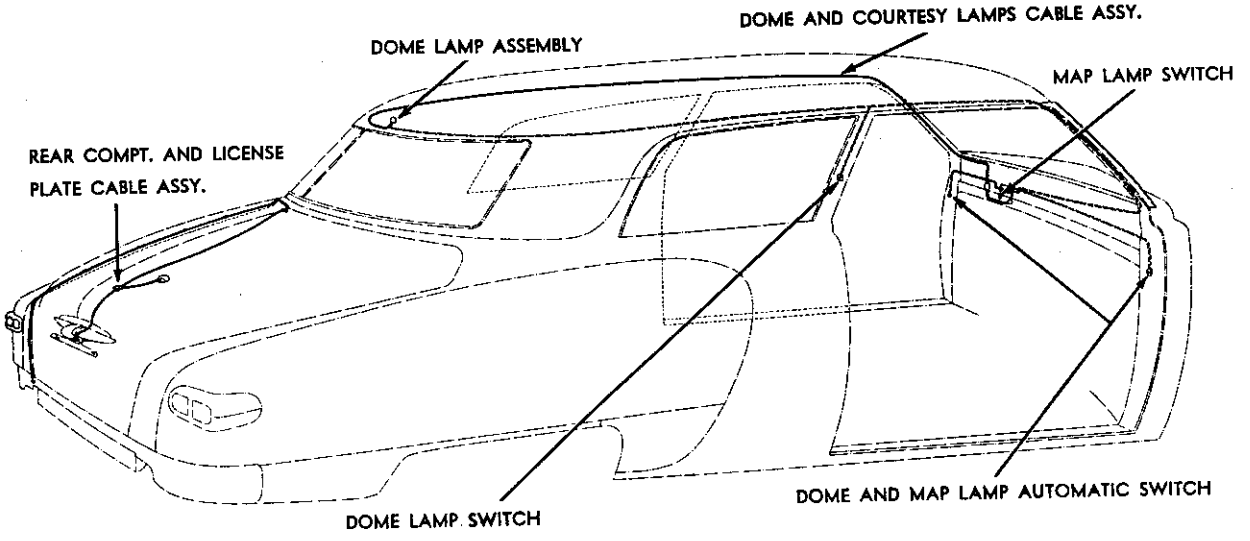


FIG. 42.—CHAMPION AND COMMANDER TWO-DOOR MODELS

Care of Car Finish

● Enamel should not be subjected to a wax application of any kind during the first 90 days in order to provide sufficient time for the finish to dry thoroughly.

Normally enamel does not require a preservative. It is necessary only to wash the car to restore the original luster. If the use of a polish is desired because of exposure of the finish to the elements, any disintegrating process which may occur can be retarded by the periodic application of a protective coat of Glitter Glaze or Studebaker Body Cleaner and Polish. These products have been approved by our Engineering Department. Avoid the use of any other glaze or waxes unless they are fully guaranteed not to harm the finish.

Applications of polish may be made every six weeks in hot weather and every three months in cold weather; application of wax, twice a year. Do not become alarmed if a small amount of color is removed when cleaning or polishing, as this is a natural condition with most finishes.

Washing the Car

● When washing the car, first saturate all foreign substances on the finish with water. Then use a clean sponge and running water for the removal of dirt. Dry the body with a clean, damp chamois skin — use a straight horizontal or vertical motion rather than a circular motion. It is important that separate sponges and chamois skins be used on the body and chassis.

If alcohol, or an anti-freeze mixture having an alcoholic content, is spilled on the finish, it should be immediately flushed off with water.

Chromium and nickel plated finishes are of a perishable nature and will deteriorate if not properly cared for. These parts should be kept clean and free from dirt and foreign matter. For cleaning chromium plated parts use either clear water and a clean cloth or Studebaker Chromium Cleaner. To protect the finish after the parts are cleaned, either rub with a clean cloth that has been lightly saturated with oil, or apply a coating of wax.

Care of Cloth Upholstery

● The use of a vacuum cleaner and a thorough brushing of the upholstery will usually brighten the interior noticeably. Remove the cushions from the car when brushing foreign particles from the fabric.

The Studebaker Fabric Cleaner AC-159 is recommended for cleaning upholstery. It is effective in removing all types of stains and does not harm the upholstery.

Upholstery can be washed safely with soap and water. Use lukewarm water and a neutral soap. The suds should be good and frothy, not watery. Apply in moderate quantities with a damp cloth, sponge, or soft brush. Remove soap suds with a clean, damp cloth or sponge; then wipe the surface several times with a dry cloth. While the material is still damp, brush it lightly with a whisk broom or brush of medium stiffness. Permit air to circulate freely over the wet upholstery. When dry, brush again to loosen any minute matting. Always brush fabric with the lay of the pile or nap.

Sometimes after long, hard use, the surface of mohair may become slightly flattened. To give the pile its original resiliency, dry steam the flattened spot liberally. If no dry steam is available, a damp cloth should be spread over the surface and a hot flat iron touched to it very lightly, or a cloth dampened with hot water should be spread over the flattened spot for about ten minutes. If the pile has been pressed down heavily, it may be necessary to repeat the process several times. While still damp, the upholstery should be brushed lightly with a whisk broom or brush of medium stiffness. When thoroughly dry, the material should again be brushed.

Removing Stains

● The following suggestions may be helpful in removing stains from the upholstery. Use hot water on upholstery only when its use is specifically called for.

Blood

● Rub the stain with a clean cloth dampened with cold water, not hot water.

Candy

● If the candy does not contain chocolate, remove the stain by rubbing it with a cloth moistened with very hot water. Remove a chocolate stain by rubbing it with a cloth and lukewarm water and then sponging it with Studebaker Fabric Cleaner or carbon tetrachloride.

Chewing Gum

● Moisten the gum with Studebaker Fabric Cleaner, carbon tetrachloride, toluol, or a good grade of lacquer thinner. Work the gum off the fabric with a dull knife while it is still moist.

Fruit

● Rub the stain vigorously with a cloth dampened with very hot water. Let the fabric dry; then sponge the stain with Studebaker Fabric Cleaner or carbon tetrachloride.

Grease and Oil

● Use gasoline, Studebaker Fabric Cleaner, or carbon tetrachloride. If the fabric is saturated with oil, pour the cleaning fluid on the stain and soak up the fluid by pressing a white blotter on the spot. Then sponge the stain with a cloth dampened in the cleaning fluid.

Ice Cream

● Rub the stain vigorously with a cloth dampened with very hot water. Let the fabric dry; then sponge the stain with Studebaker Fabric Cleaner or carbon tetrachloride. If the stain is persistent, use a cloth moistened with warm soap sups, then a cloth moistened with cold water. After the fabric has dried, sponge the stain with Studebaker Fabric Cleaner or carbon tetrachloride.

Lipstick

● Pour a little Studebaker Fabric Cleaner or carbon tetrachloride on the stain and immediately press a clean blotter firmly on the spot. Repeat this procedure until the stain has been removed.

Paint and Lacquer

● Rub the stain with a cloth saturated in turpentine; then sponge it with a cold, damp cloth.

Shoe Polish

● Black or tan polish can be removed with a cloth saturated in Studebaker Fabric Cleaner or carbon tetrachloride. White polish will usually come off with a stiff brush. If not, moisten the stain with cold water, let it dry, and then brush it.

Urine

● After sponging the stain with a clean cloth dampened with lukewarm soap suds, rub the stain with a clean cloth dampened with cold water. Then pour a mixture composed of one part household ammonia and five parts of water on the spot. Allow the solution to soak in for a minute and then rub the spot with a clean, wet cloth.

Water Spots

● Sponge the entire panel with a clean cloth dampened with cold water. Sponge the spot with a cloth moistened with Studebaker Fabric Cleaner or carbon tetrachloride.

Body Lubrication

CHAMPION AND COMMANDER Body lubrication is an important maintenance service, which, if neglected, often results in annoying squeaks, noises, and excessive wear.

The individual lubrication points require specific kinds of lubricant. For the location of these points and the type of lubricant advised, refer to the Body Lubrication Chart, Fig. 43. Several lubrication operations which are not included in the chart should also be performed occasionally. If the seat track squeaks, it should be lubricated with light oil; the windshield wiper pulley bearings should also be lubricated with light oil; and light grease should be applied to the wiper cables where they run over the pulleys.

Lubrication of the window regulator without the removal of the trim panels from the doors or rear quarter panels usually results in improper lubrication and the soiling of upholstery. If regulators which have been removed appear dry, lubricate them with a high melting point grease.

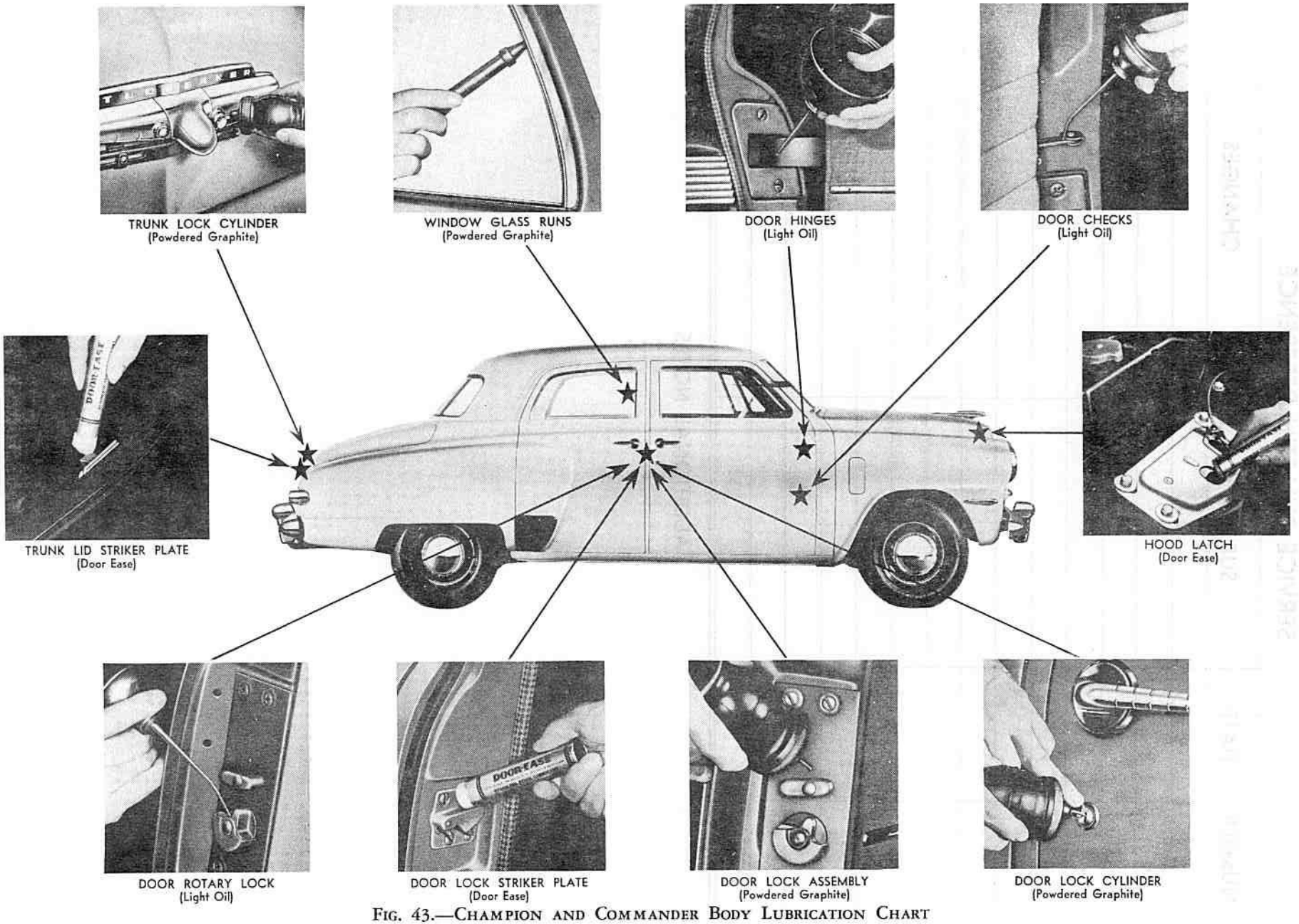


FIG. 43.—CHAMPION AND COMMANDER BODY LUBRICATION CHART

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

CONVERTIBLE BODY—1947 MODELS

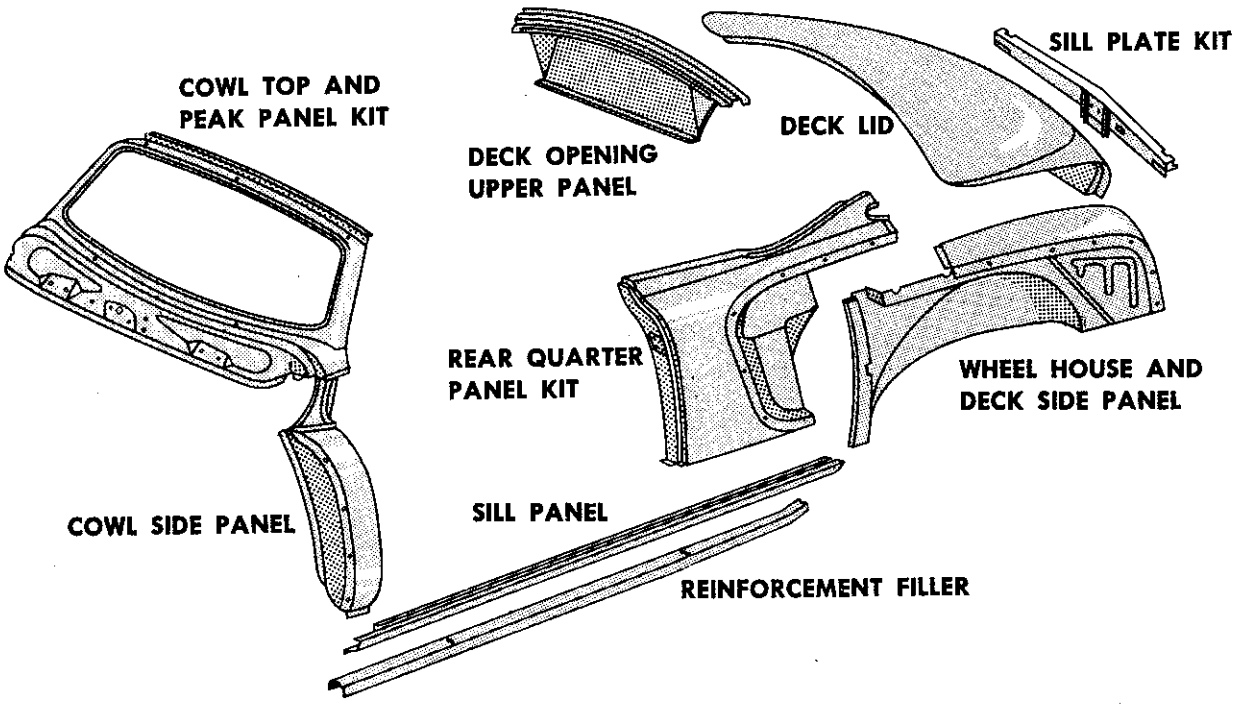


FIG. 43a.—CONVERTIBLE PANEL KITS

Body Panel Assemblies

The panel assemblies of the Convertible model are illustrated in Fig. 43a. The top, when lowered, fits into a compartment between the deck opening upper panel and the deck lid panel.

Body Bolt Location

The body is rigidly attached to the frame with twenty-four body bolts. The single bolt attachments are located at the following points: one on each cowl bracket, one at each outer edge of the engine rear support cross member, three under each end of the front seat, three just behind each end of the center frame cross member, two in front of each rear wheel housing, one at the center of each rear wheel housing, and one at each end of the gas tank cross member (see Fig. 43b).

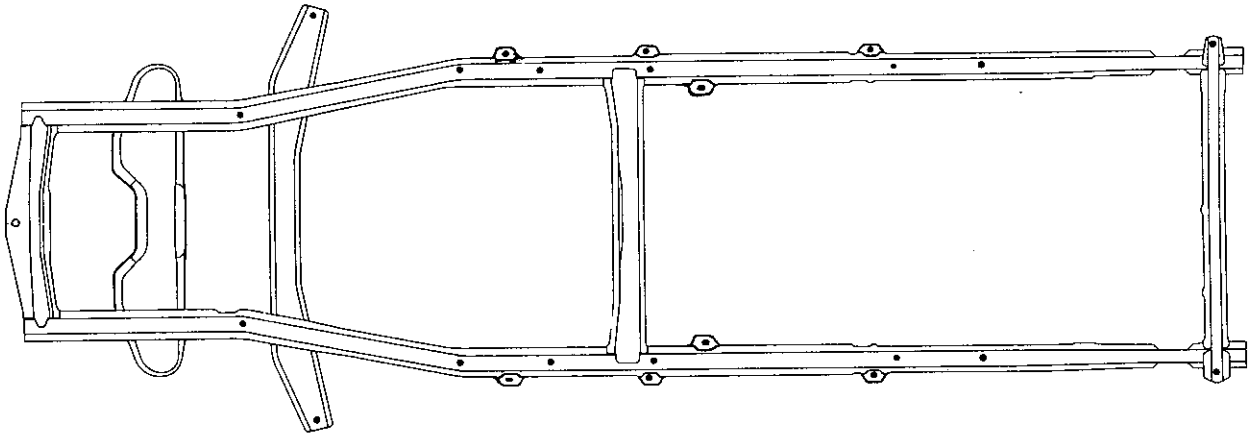


FIG. 43b.—BODY BOLT LOCATION

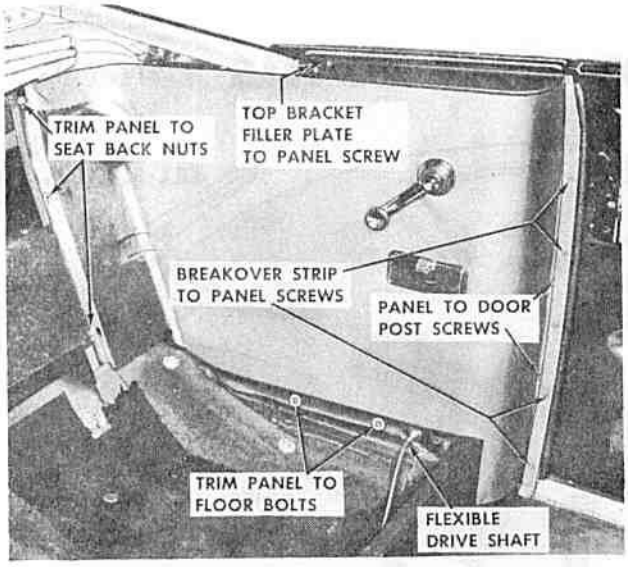


FIG. 43c.

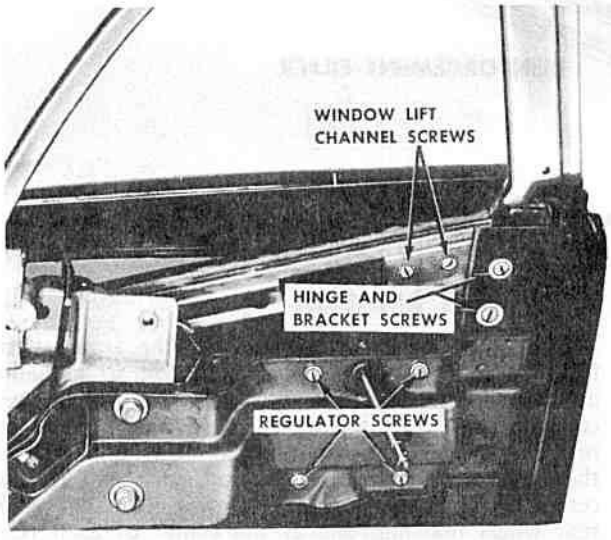


FIG. 43d.

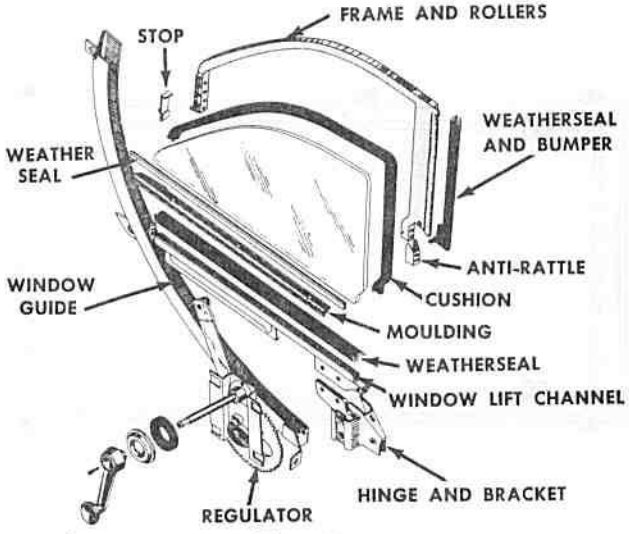


FIG. 43e.

Rear Quarter Trim Panel

REMOVAL

Lower the top. Remove the rear seat cushion and the seat back. Remove the rear quarter window regulator handle and the escutcheon plate. See Fig. 43c. Remove the six Phillips head screws holding the breakover strip to the trim panel *(the top screw and clip are located beneath the weatherseal at the top of the door pillar post)*. Remove this strip and then remove the five trim panel-to-door post screws. Remove the two trim panel-to-floor bolts and washers. Remove the three panel-to-seat back panel nuts and washers. Remove the front top bracket filler plate-to-trim panel screw. Lift the panel upward until the rear flange of the upper ledge clears the filler plate and at the same time disengage panel from the rear seat back studs.

INSTALLATION

When installing the trim panel, first engage the seat back studs; then align the trim panel-to-door post holes and install the five screws. The remaining screws, bolts, and nuts can then be installed.

Rear Quarter Window Assembly

REGULATOR, REMOVAL

Raise rear quarter window. Remove the rear quarter trim panel as outlined in the preceding section. Remove the four screws and washers holding the regulator to the frame brace (see Fig. 43d). Disengage the regulator arm stud from the lift channel and remove the regulator.

REGULATOR, INSTALLATION AND ADJUSTMENT

Install the regulator, screws, and washers in the frame brace. Engage the regulator arm stud in the lift channel run. Raise and lower the window to determine that the window travels freely in the channel. Securely tighten the four regulator screws.

WINDOW ASSEMBLY, REMOVAL

Remove the rear quarter trim panel as explained in Rear Quarter Trim Panel Removal section. Remove the two window lift channel screws and star washers (see Fig. 43d). Next remove the window regulator arm stud from the lift channel. Remove the assembly from the window channel through the window opening. Parts of the rear quarter window and regulator are shown in Fig. 43e.

WINDOW ASSEMBLY, INSTALLATION AND ADJUSTMENT

Insert assembly in window opening, tilting it so that the bottom end of the rollers assembly can enter the window below the window channel stop. Engage the regulator arm stud in the window lift channel. Install the two window lift channel screws and star washers.

Raise the top and then raise the rear quarter window and door window. If the rear quarter window frame is not properly aligned to the door window frame, three adjustments are provided to correct the misalignment. The window channel back stop is

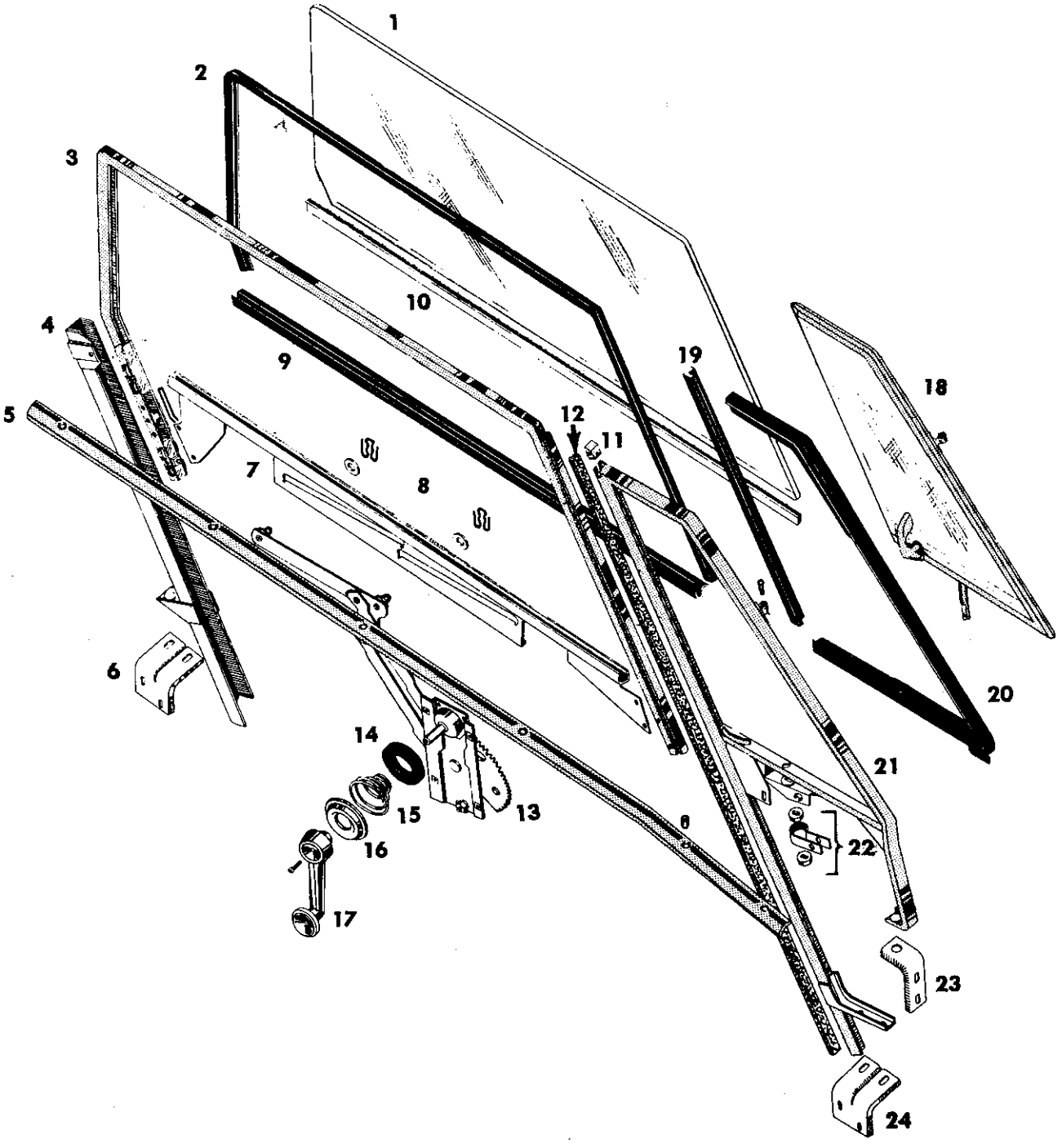


FIG. 43f.

KEY TO PARTS OF DOOR WINDOW AND VENTILATOR ASSEMBLIES

1. DOOR WINDOW GLASS
2. CUSHION
3. FRAME AND ROLLERS
4. GUIDE
5. MOULDING
6. REAR GUIDE BRACKET
7. LIFT CHANNEL
8. HAIR PIN CLIPS
9. WEATHERSEAL
10. WEATHERSEAL
11. STOP
12. LINER
13. REGULATOR
14. GASKET
15. SPRING
16. ESCUTCHEON
17. REGULATOR HANDLE
18. VENTILATOR
19. WEATHERSTRIP
20. WEATHERSTRIP
21. VENTILATOR FRAME
22. TENSION SPRING
23. VENTILATOR FRAME FRONT BRACKET
24. VENTILATOR FRAME REAR BRACKET

set in an elongated hole and determines the height to which the window frame can be raised. It may be necessary, however, to move the complete rear quarter window assembly forward to meet the door window frame. Loosen the two window channel hinge adjustment screws and move the bracket forward. Tighten the screws.

If the rear quarter window frame does not fit properly against the weather cord, shim at the bottom window channel hinge adjustment screw to move the window frame inward or shim at the top screw to move the window frame outward.

Door Window and Ventilator Assemblies

DOOR WINDOW ASSEMBLY, REMOVAL

Remove door trim panel. Partially lower window to expose door window lift channel in large inspection hole. Remove the two hairpin clips holding the regulator arm to the door window lift channel. Disengage the regulator arm studs from the lift channel. Then remove the door window front guide stop (located at the top of the ventilator window frame) and lift the door window assembly through the window opening. See Fig. 43f on page 18C for parts of the door window assembly.

VENTILATOR ASSEMBLY, REMOVAL

Remove door trim panel. Remove door window assembly as outlined in the preceding section. Remove the ventilator frame-to-door bolt. See Fig. 43g. Then remove the lower ventilator frame rear bracket nuts located inside the front inspection hole. Reach through this inspection hole and remove the nuts holding the ventilator frame front bracket to the door face. Lift the ventilator assembly out of the window opening.

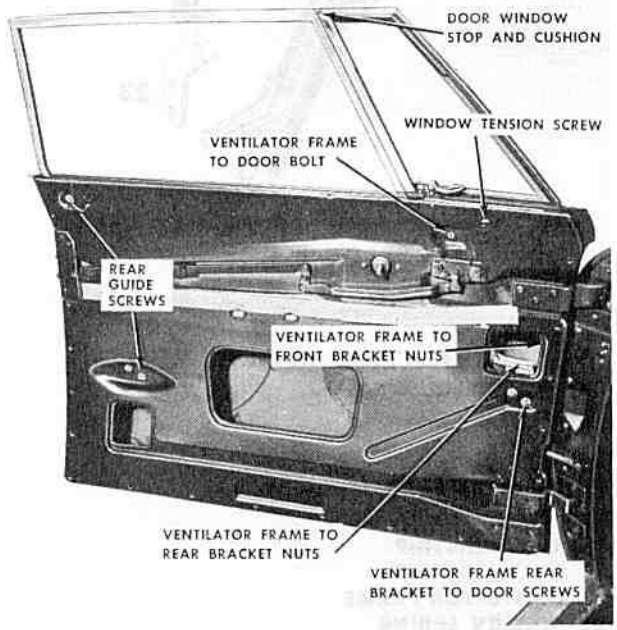


FIG. 43g.

VENTILATOR ASSEMBLY, INSTALLATION AND ADJUSTMENT

To install the ventilator assembly, lower the assembly through the window opening. Install the ventilator frame rear bracket nuts. Install the ventilator frame-to-door bolt and then reach through the front inspection hole and install the ventilator frame front bracket nuts. Install door window assembly as explained in the following section. Finally, install the door window front guide stop with the two Phillips head screws.

The height of the ventilator assembly may be adjusted by loosening the two adjustment screws located just below the small front inspection hole. Loosen the two frame front bracket-to-door face nuts and move the frame rear bracket up or down as required. Inward or outward adjustment of the assembly is made at the ventilator frame-to-rear-bracket nuts.

DOOR WINDOW ASSEMBLY, INSTALLATION AND ADJUSTMENT

Start the window in the door window guides and lower the window through the opening. Install the front guide stop and rubber cushion with the two Phillips head screws. Install the regulator arm pins in the window lift channel and lock in position with the two hairpin clips.

If the window does not travel high enough to cushion against the underside of the top side rail, the rear guide may be raised by loosening the two guide adjustment screws located just above the lower rear inspection hole. It may be necessary after moving the rear guide to raise the ventilator assembly (see above, Ventilator Assembly, Installation and Adjustment).

Rear Window

REPLACEMENT

Raise the top. Remove the 22 Phillips head screws from the inside of the rear window retaining moulding. Remove the moulding. Remove any old or broken glass.

Place new glass in position and position the moulding. Install the 22 Phillips head screws.

Electric Motor and Lift Assembly

The convertible top is raised or lowered by an electric motor and two lift assemblies. The electric motor and one lift assembly are located inside the left rear quarter trim panel; a flexible drive shaft assembly transmits power from the left gear box to a second lift assembly located inside the right rear quarter trim panel.

The top mechanism control lever is located just below the lower left edge of the instrument panel. Moving the lever to the left raises the top and to the right, lowers it.

When the top reaches the limit of its travel in the desired direction (up or down), an automatic circuit breaker protects the motor until the control lever is released to its neutral position.

The electric motor and the two lift assemblies are illustrated in Fig. 43h. The protective canvas cover on the assembly pictured at the left has been removed to show the worm screw. The gear boxes and worm screws are prelubricated and require no further lubrication. The flexible drive shaft assembly transmits power to the right hand gear box and worm screw.

The electric motor is protected from dirt and dust by a rubber cover. The slot in the end of the motor drive shaft and the slot in the end of the gear box shaft, set at right angles to one another, are connected by a rubber and steel coupling. A 75-ampere circuit breaker, mounted at the upper center on the engine side of the firewall, guards the motor against short circuit and overload. See Fig. 43i.

REMOVAL OF POWER UNIT

Lower the top. Disconnect the battery ground strap. Remove the rear seat cushion and seat back. Remove the trim panel. Remove the cotter pin from the castellated nut. Remove bolt, rubber washer, flat washer, and bronze spacer bushing from the lift shaft to top link. Remove the bolt and lower the upper end of the lift assembly to the floor of the car. Disconnect the motor ground strap from the frame brace. Disconnect and pull out the flexible drive shaft from the gear box. Remove the cotter pin and washer from the lift floor bracket clevis pin (see Fig. 43j). Remove the clevis pin from the bracket, disconnect the green and the black wires from the junction block, and lift out the complete assembly.

INSTALLATION OF POWER UNIT

Connect the wiring harness to the junction block (green wire to the top terminal, black wire to the middle terminal). Install the assembly in the lift-to-floor bracket and install the clevis pin, washer, and cotter pin. Connect the upper end of the lift assembly to the lift shaft to top link by installing the bronze spacer bushing, rubber washers, bolt, castellated nut, and cotter pin. Connect the flexible drive shaft assembly to the gear box. Connect the motor ground strap to the frame brace. Install the trim panel, rear seat back, and cushion. Connect the battery ground strap.

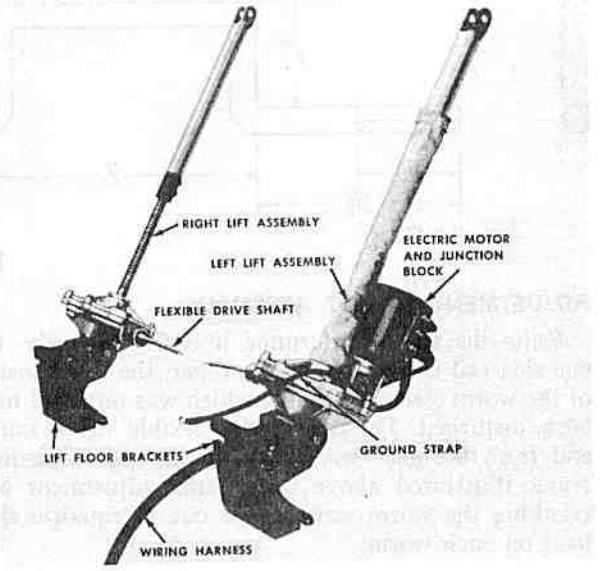


Fig. 43h.

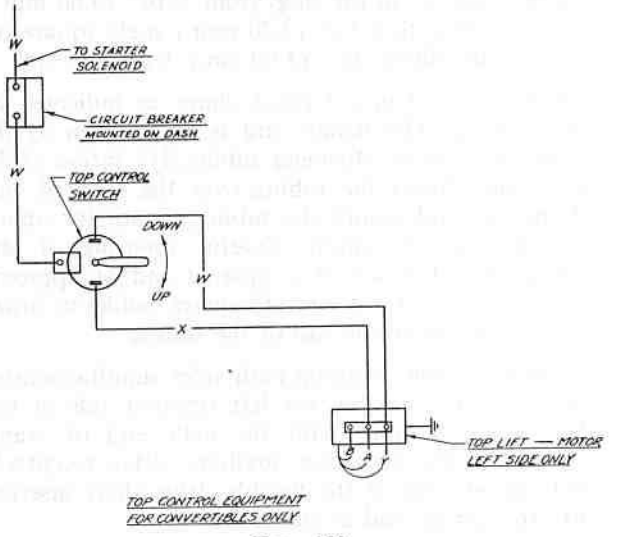


Fig. 43i.

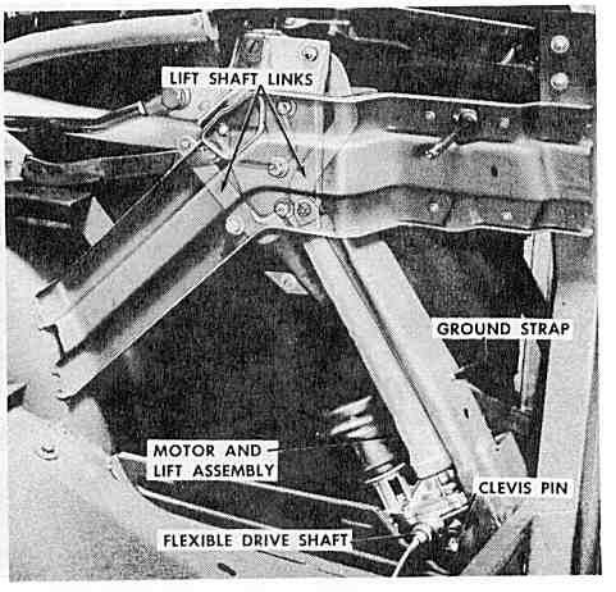


Fig. 43j.

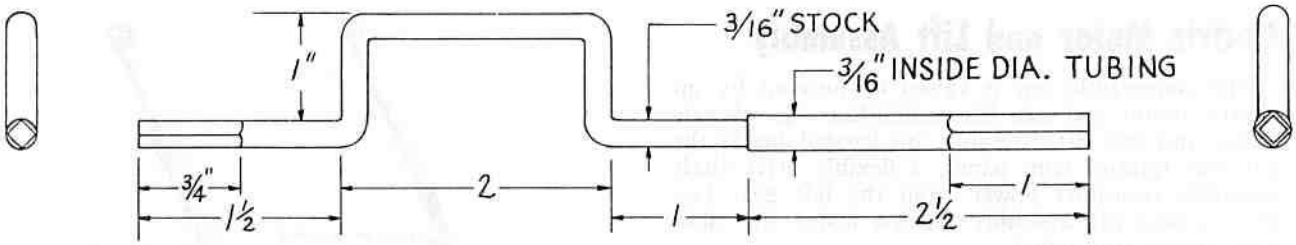


FIG. 43k.

ADJUSTMENT OF LIFT ASSEMBLY

Raise the top to determine if it fits correctly. If one side rail is higher than the other, the adjustment of the worm screw of the lift which was removed has been disturbed. Disconnect the flexible drive shaft end from the gear box and with the top adjusting crank illustrated above correct the adjustment by cranking the worm screw in or out to equalize the load on each worm.

The top adjusting crank for manual adjustments can be made up in the shop from 3/16" (4,80 mm.) rod stock filed to a 1/8" (3,20 mm.) male square on one end for about 3/4" (1,90 cm.) from the end.

Bend the rod into a crank shape as indicated in the drawing. The female end is made from 3/16" (4,80 mm.) inside diameter tubing 2½ inches (6,35 cm.) long. Insert the tubing over the squared end of the rod and pound the tubing square for about one inch of its length. Careful squaring of the tubing should result in a squared end of approximately 1/8" (3,20 mm.) inside square. Solder or braze to crank at the inside end of the tubing.

NOTE.—When cranking both sides simultaneously, use the crank only on the left (motor) side of the flexible drive shaft, with the male end of crank inserted in the gear box auxiliary drive receptacle and the left end of the flexible drive shaft inserted into the female end of the crank.

REMOVAL OF MOTOR ONLY (TO REPLACE MOTOR OR TO INSTALL NEW COUPLING)

Disconnect the battery ground strap. Remove the rear seat cushion and seat back. Remove the rear quarter trim panel. Remove the two nuts and lock washer from each motor-to-gear box through bolt. Lift the motor with bolts from the gear housing (see Fig. 43l).

INSTALLATION OF NEW COUPLING

When installing a new coupling (see Fig. 43m), the slotted end of the gear box drive shaft must be at a right angle to the slotted end of the motor drive shaft.

INSTALLATION OF ELECTRIC MOTOR

Start the through bolts into the gear box housing. Align the slotted end of the motor drive shaft to the coupling, then push the motor through bolts down into position in the gear box housing. Install the lock washer and nuts. Install the rear quarter trim panel, rear seat back, and cushion. Connect the battery ground strap.

REMOVAL AND INSTALLATION OF FLEXIBLE DRIVE SHAFT

Disconnect the drive shaft assembly at the point indicated in Fig. 43m and pull the assembly out of the gear box. Remove the drive shaft end from the other gear box and remove the shaft assembly.

When installing a new shaft assembly, take care not to kink or bend the drive shaft shell.

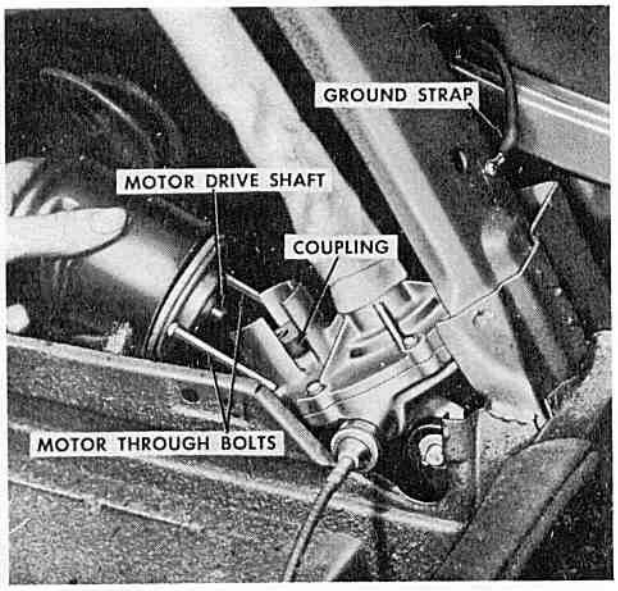


FIG. 43l.

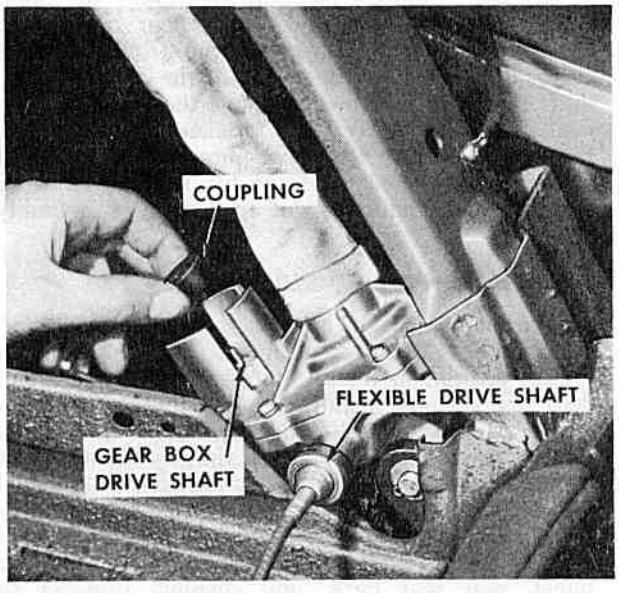


FIG. 43m.

REMOVAL AND INSTALLATION OF WIRING HARNESS

Disconnect the battery ground strap. Remove the front and rear seat cushions and the rear seat back. Remove the left rear quarter trim panel and disconnect the black and green wires from the junction block. Fold back the front and rear floor carpets on the left side. Raise the floor insulating material. Disconnnect the black and green wires from the control switch terminal. Remove the left cowl kick pad and pull the harness down through the cowl panel. Remove the screws holding the wiring harness to the floor pan clips and remove the wiring harness.

When installing the wiring harness, first run the harness up through the cowl panel to the switch. Connect the wires to the proper terminals. Slide the other end of the harness through the holes provided in the rear seat heel board and then connect the black wires to middle terminal and the green wires to top terminal on the motor junction block. Install the harness in the floor pan clips and install the screws.

REMOVAL AND INSTALLATION OF CONTROL SWITCH

Remove the set screw from the control switch lever. Remove the lever from the shaft. Remove the flange nut holding the switch to the mounting bracket. Remove the switch by pushing the switch shaft up through the hole in the mounting bracket. Disconnect the black and the green wires from the switch terminals.

To install switch assembly, reverse the removal procedure.

REMOVAL AND INSTALLATION OF CIRCUIT BREAKER

Disconnect the battery ground strap. Disconnect the two black wires from circuit breaker terminals. Remove the two flat head screws. Remove circuit breaker. Reverse this procedure to install.

Top Cover

REMOVAL

Lower top. Remove the chrome moulding from the header.

Raise and lock the top. Remove all tacks holding cover to header. Remove the tacks holding the top pads at header.

At the rear bow remove the Phillips head screw from the ornamental binding tips on the concealing strip. Remove tacks, concealing strip, and discard.

Remove Phillips head screw and dress washer from the rear quarter side rail on each side. Pull out the window weatherstrip from rear quarter side rail. Remove the retainer thus exposed. Pull top cover away from the side rail.

Remove the cover boot fasteners along the rear deck, ornamental tips, tacks, concealing strip, and tacks holding rear curtain.

Remove top cover, being careful not to damage the rear window nor to mar the chrome rear window moulding.

INSTALLATION OF TOP COVER

Raise and securely lock the top. Closely inspect all nailing strips. Tighten all strips which appear to be loose. Use additional drive screws (Part No. 1267X1) for this purpose. If any of the strips are broken or damaged, replace with new strips.

Lay out new cover on trimmer's bench and install rear window frames and glasses with new weatherstrips. Start all screws before any tightening is done. When frames, glasses, and weatherstrips are properly aligned and all screws are started, proceed to tighten moderately and progressively to avoid breaking the glasses. Starting studs made from ⅛" (3,20 mm.) bronze brazing rod will aid in the proper assembly of the rear window glasses. The studs should be ¾" (1,90 cm.) long and should be threaded on one end with ¼" (6,40 mm.) of #6-32 thread. Twelve studs are required. The starting studs are screwed into every other hole of the outer member of the frame. Then the back curtain, which comes with the holes already punched, is placed over the studs, after which the two glasses with weatherstrips attached are placed over the outer member of the frame. This operation is followed by placing the inner member of the frame over the glasses. The retaining screws are then started in the ten holes not occupied by the starting studs. The studs are then removed and replaced by the remaining retaining screws.

Lay out the new tie strap covers on the bows (finished sides of seams down), with the inner seams of the covers in line with the ends of the tubular cushions which extend across the No. 1 and No. 2 bows. Tack the front end of the center panel of the cover to the nailing strip at the front edge of the header. Stretch the tie strap panel rearward to the body nailing strip. The distance between the rear edge of the No. 2 top bow and the front edge of the rear top bow is 21⅛" (53,66 cm.). A slotted piece of wood can easily be cut to slip over these two bows at their center point so as to hold them firmly in place. See Fig. 43n.

Tack the tie strap cover central panel securely at all five points of bow and body contact. Repeat this process on the opposite side of the top.

On the central panel of the tacked down tie strap cover lay three strips of 3" (7,62 cm.) webbing. Arrange one strip of webbing just inside the outer seam; another, just inside the inner seam; and the third, overlapping the other two, in the center. Start the front end of the webbing at the inset nailing piece on the front bow, not at the nose nailing

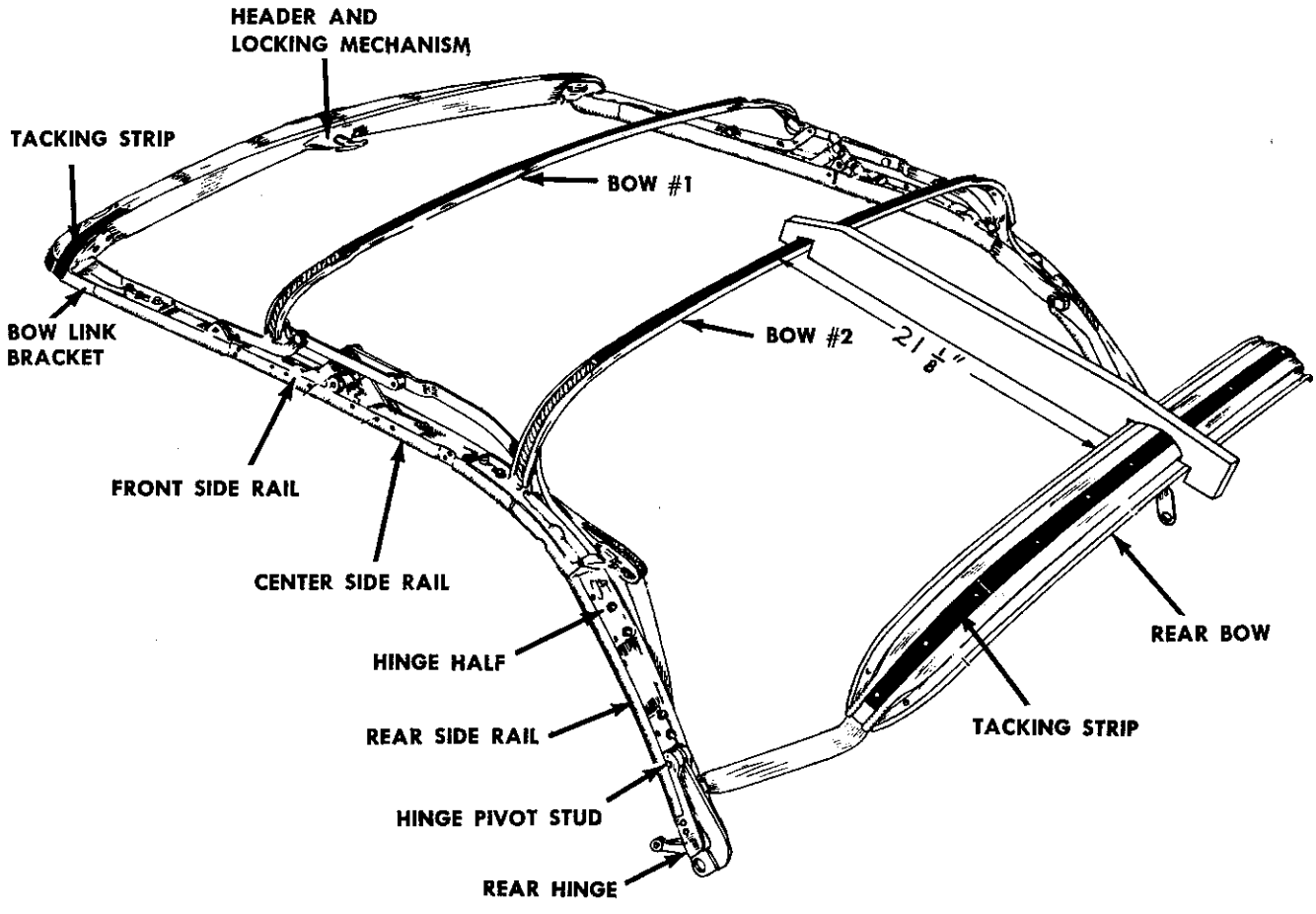

HEADER AND
LOCKING MECHANISM
TACKING STRIP
BOW #1
BOW LINK
BRACKET
BOW #2
21 1/8"
FRONT SIDE RAIL
CENTER SIDE RAIL
HINGE HALF
REAR SIDE RAIL
HINGE PIVOT STUD
REAR HINGE
REAR BOW
TACKING STRIP

FIG. 43n.

strip. Stretch the webbing rearward to the body nailing strip and secure with tacks there and at intermediate and rear bows. On each side of the top, between the header and No. 1 bow, the No. 1 bow and No. 2, No. 2 and rear bow, and between rear bow and the rear deck, place a piece of 3/8" (9,60 mm.) thick blue wadding 6½" (16,51 cm.) wide over the webbing. Over these four pieces of wadding, place one piece 6½" (16,51 cm.) wide and long enough to reach from the rear deck to the header tacking strip. Fold the outer panel of the cover inward over the blue wadding and tack at all five points. Fold the inner panel of the cover outward to lap over the outer panel and tack at the header, rear bow, and body only. Do not tack at intermediate bows. Secure the lap of the inner panel to the outer panel throughout the entire length with cement. Repeat this process on the opposite side of the top.

Lay the new top cover on the top bows in the proper position and place a few temporary tacks at the bottom of the back curtain. Check the fit of the quarter panels of the new cover at the top of the body quarter panels and remove and replace temporary tacks as required to obtain a smooth fit around the bottom of the new cover. Throw top cover rearward over the trunk cover and grasp the top edge of the back curtain to stretch upward and forward over the top of the rear bow. When back curtain has been stretched smoothly between body and rear bow, tack top of rear curtain to rear bow permanently. Neatly trim off excess material of back curtain forward of rear bow tack line. Pull top cover forward to front bow, recheck fit and alignment of side panels of new cover with bows and temporarily tack only the front ends of the cover side panels to the header front nailing strip. Stretch and temporarily tack rear ends of cover side panels to rear bow nailing strip. Check center panel of new cover for wrinkles. Remove and replace temporary tacks as required to accomplish a smooth cover application. When the surface is satisfactory, pemanently fit the front ends of the cover side panels around the rounded nose of the header. To do this it will be necessary to cut diagonally toward the far rear corners of the top for not to exceed 1" (2,54 cm.). Use extreme caution to avoid extending the diagonal cuts beyond the points which will be covered by the nose moulding. Lap the material to make a wrinkle free front corner. Grasp the rear edge of the new cover and stretch rearward over the rear bow. Tack the rear edge of the cover to the rear bow nailing strip permanently and cut off excess cover material in the rear of the rear bow tack line. Permanently tack the back curtain to the body nailing strip.

Install new wired closing strips at bottom of back curtain and across top of rear bow to cover tack lines at these points. Finish the closing strips by closing throughout their entire length and install the ornamental metal ends with screws.

Use top boot as a template and install the snap fastener bases through the closing strip and the body metal. Use a 3/32" (2,40 mm.) drill to start the base screws. Locate the snap fastener bases carefully and check with the top boot as each base is installed.

Use approved snap fastener tool and install snap fasteners along the lower edges of the top cover quarter panels at the locations indicated by the bases which were not removed. Cement top quarter panel to rear quarter side rail, install retainer and moulding. Align and securely install the chrome moulding on the leading edge of the header. Unlock, lower top, raise top, and lock to check installation of the newly applied cover for need of adjustment.

Top Bows and Header

HEADER, REPLACEMENT

Lower top. Remove the header chrome moulding. Raise top. Remove all tacks holding top cover to tacking strip and tacks holding tie straps to header. Lower top. Remove the bolts from each front side rail. Header can now be slipped forward and out of front side rails.

No. 1 AND No. 2 BOWS

Partially lower top and fold back top cover and pads. Remove the four bolts holding these linkages to the side rails. If it is desired to remove one individual bow from the linkage, it will be necessary to derivet the bow from the link arm at each end.

REAR BOW

Raise top. Remove ornamental tip, concealing strip, and all tacks holding the cover, rear curtain, and tie straps to the bow. Remove bolt at lower ends of bow.

Top Cross Brace

Commander

On the 14A Commander convertible top, two stabilizing top cross braces run between the top bows and the top cover from the left end of the header diagonally to a punched flange at the right of the top of the top storage well, and from the right end of the header to the punched flange at the left corner of the well.

The braces are bolted to the header and are attached at the rear by means of an adjustable turnbuckle which is covered for appearance by a sleeve.

The braces and sleeves are made of the same material as the top. The braces are backed by felt padding to protect the top cover from frictional wear.

With the top raised and resting (but not locked) on the windshield pilots, the cross brace turnbuckles should be adjusted so that the braces are taut. Do not so tighten the turnbuckles that the header is pulled either to right or left from its resting position on the pilots. After this adjustment, the top may be locked in place. The braces, properly adjusted, act to stabilize any tendency toward lateral motion between the top header and the windshield.

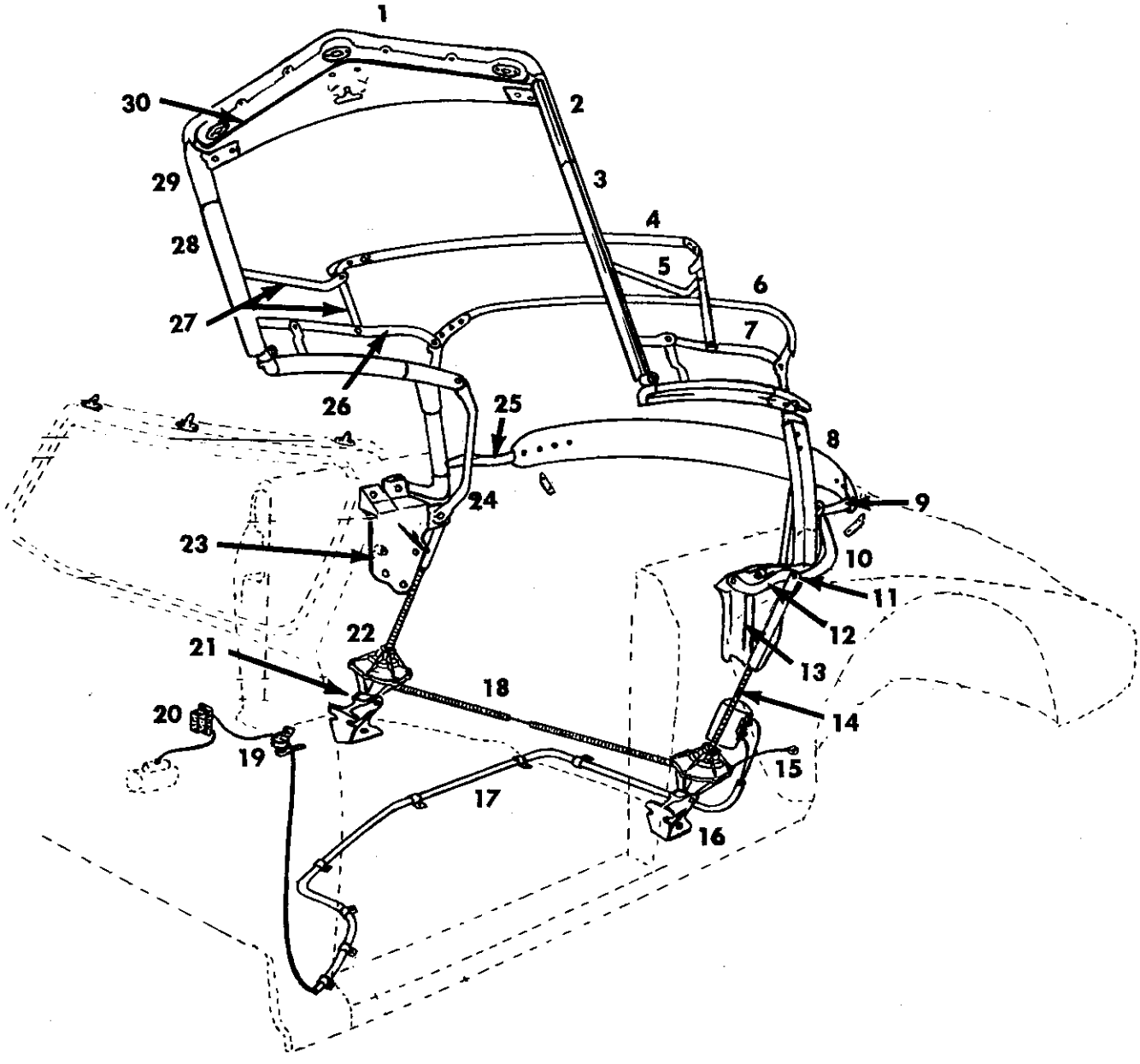


FIG. 43o.

1. HEADER AND LOCKING MECHANISM
2. HEADER TO SIDE RAIL BRACKET
3. SIDE RAIL W/LINK, HINGE, AND BRACKET
4. NO. 1 BOW
5. NO. 1 BOW CONTROL LINKS
6. NO. 2 BOW
7. TOP OPERATING LINK
8. TOP REAR BOW
9. REAR BOW SLAT IRON
10. LIFT SHAFT TO LOWER HINGE LINK
11. LIFT SHAFT SPACER AND BOLT
12. LIFT SHAFT TO BODY BRACKET LINK
13. TOP BODY BRACKET
14. LIFT AND MOTOR
15. GROUND CABLE
16. LIFT TO FLOOR BRACKET
17. WIRING HARNESS
18. FLEXIBLE DRIVE SHAFT AND CORE
19. LIFT CONTROL SWITCH
20. LIFT CIRCUIT BREAKER
21. LIFT TO FLOOR BRACKET
22. TOP RIGHT LIFT
23. TOP BODY BRACKET
24. TOP BALANCE LINK
25. REAR BOW SLAT IRON
26. TOP OPERATING LINK
27. BOW CONTROL LINKS
28. SIDE RAIL W/LINK, HINGE, AND BRACKET
29. HEADER TO SIDE RAIL BRACKET
30. WEATHERSEAL

Top Assembly

REMOVAL

The entire assembly consisting of top cover, bows, side rails, and linkages can be removed as a unit. Raise top but do not lock it on the pilots. Remove the fastening studs at the rear deck, the concealing strips and tips, and all tacks along the rear deck. Remove the master adjustment bolts holding the top balance links to the top brackets. Remove the bolts, washers, and spacers holding the top links tc the lift shafts. The top now can be lifted free of the car.

INSTALLATION

Lower top assembly into position, connect the top balance links and install the master adjusting bolts. Connect the lift shaft to top links with the bolt heads to the outside of car and the rubber washers between the top links and the lift shafts, one on each side of the bronze spacer bushing. Install the nut but do not tighten it excessively. Use new cotter pin. Raise top till it just clears the lock studs.

Examine nailing strip and report if it should be replaced. Moderately stretch and tack all elements of the tie straps to the body nailing strip. Tack back curtain to body nailing strip. Use only 6 ounce Japanned tacks and space the tacks approximately 1″ (2,54 cm.) apart. Use extreme care in the tacking of the back curtain to the body. Avoid wrinkles or bulges. Raise top and lock. Inspect back curtain for smooth fit around quarters and install new closing strip. Close strip to conceal tacks and install metal terminals.

Use the top boot as a template and carefully install the snap fastener base studs. Check with boot after each base is installed. Use a 3/32″ (2,40 mm.) drill to start the base screws.

Install the top boot along top of rear seat and put boot bag in trunk.

Top Alignment

Three adjustment points are provided to align the top. The master adjustment for clearance between the top side rails and the rear quarter top sections to the window glasses is made at the serrated nut of the top balance link (see Fig. 43o). The bow assembly at this point is slotted and serrated on each side so that the correct position can be obtained. Adjustment here controls the height and length of the side rails and determines top cover tension. To make this adjustment, support the side rail, lift the top off of the header pilots, and loosen the master adjustment bolts. Then move the top forward or rearward to the desired position.

For correct fit of the front of the top to the header pilots, loosen the three bolts set in the elongated slots on each top side rail and move the top header forward or rearward to obtain perfect fit.

The third adjustment is made at the worm screw of the lift assembly. If either one of the lift assemblies is removed, the worm screw length may be disturbed. Disconnect the flexible drive shaft end from the gear box and with the crank (illustrated in Fig. 43k) adjust the length by screwing the worm up or down to equalize the load on each worm without putting a strain on the top linkage.

Care of the Top

The 1947 Studebaker Convertible is equipped with a Jonarts Clean Easy two-ply top. The face of the material is made of cotton and rayon rubberized to a cotton back, producing a waterproof material. The color is fast, vat-dyed into the fabric, assuring long life and uniformity.

Traffic grime or other soiling may be removed by washing the top with a sudsy mixture of mild soap and warm water. Strong solvents, naphtha, or carbon tetrachloride are not recommended for cleaning this fabric. Some spots can be removed with art gum rubber and a suede brush.

Mud splashings can be washed or doused off with cool water.

The life of the top can be materially lengthened if care is taken *to lower the top only when it is dry.*

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

BRAKE SYSTEM

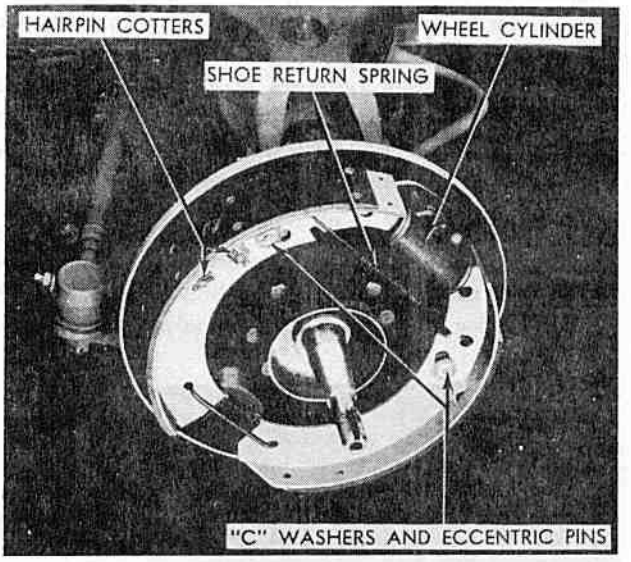


FIG. 44.—FRONT BRAKE

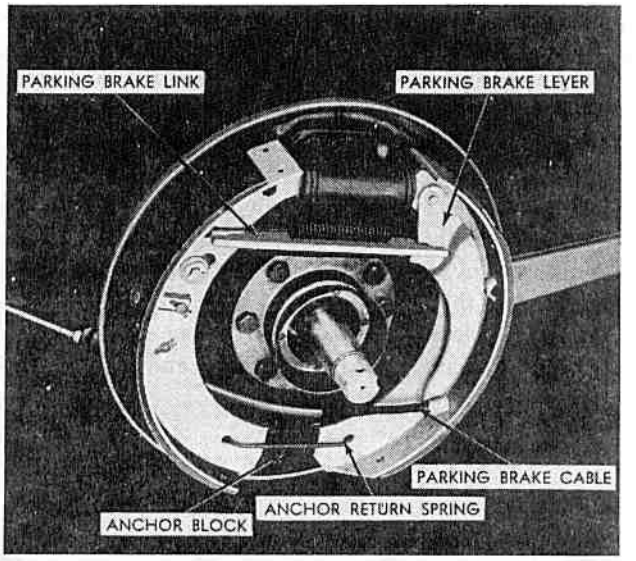


FIG. 45.—REAR BRAKE

The 1947 Champions and Commanders are equipped with Wagner Lockheed Hydraulic, self-centering, self-adjusting brakes. A column of fluid forced through special tubes transmits the pressure applied by the foot pedal to the brake shoes in each wheel assembly by displacing the pistons in the wheel cylinders. The equalized pressure, which does not permit braking action until all shoes contact the drums, makes the brake system self-equalizing.

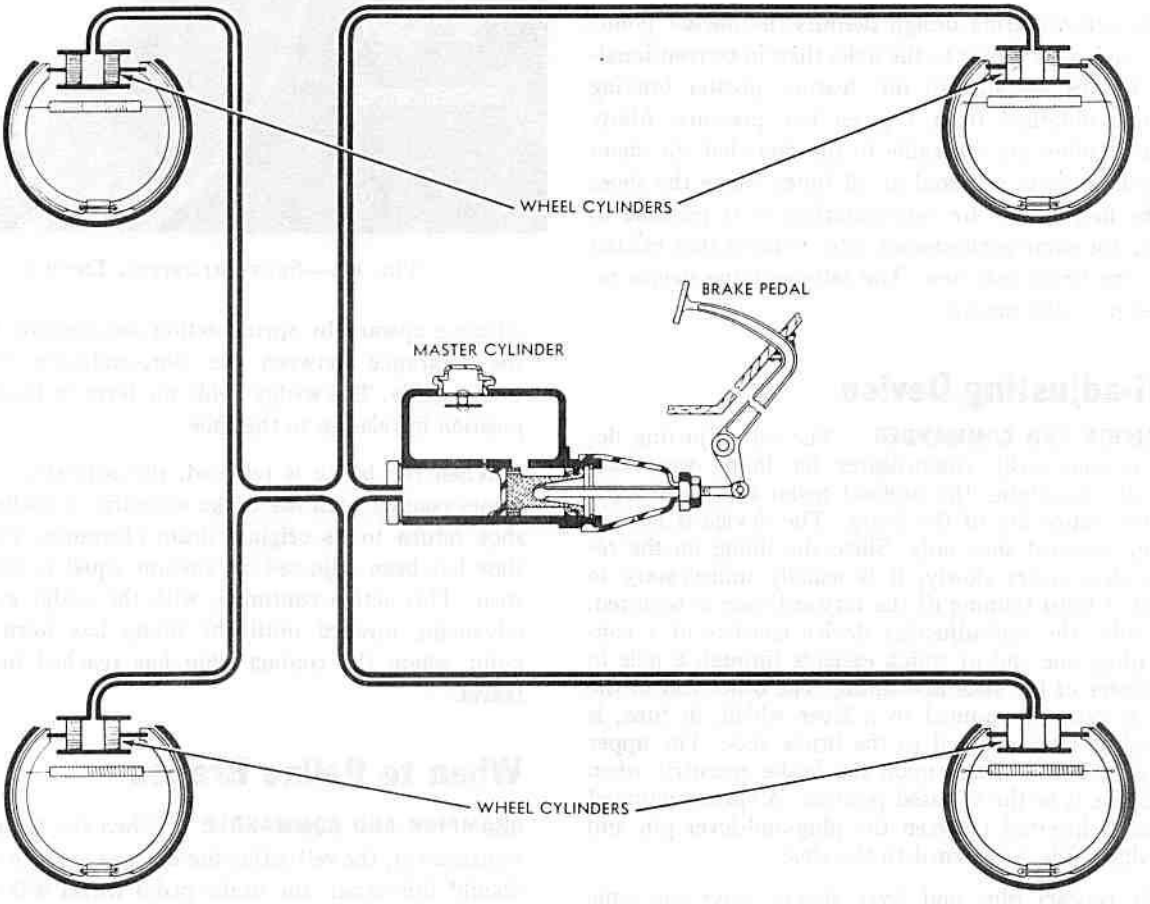


FIG. 46.—HYDRAULIC BRAKE SYSTEM

Self-centering Device

CHAMPION AND COMMANDER In the new brake, conventional brake-shoe anchor pins have been eliminated. The lower ends of the shoes abut against a solid block rigidly attached to the backing plate. This block is machined so that its sides are aligned radially to the axle. Rounded abutments on the lower ends of the shoes allow the shoes to rock laterally on the sides of the block. When the brakes are applied, the shoes center themselves by moving radially along the sides of the block until they are in their proper positions in relation to the drum. This freedom of shoe movement results in increased braking efficiency and greatly simplifies shoe adjustment problems.

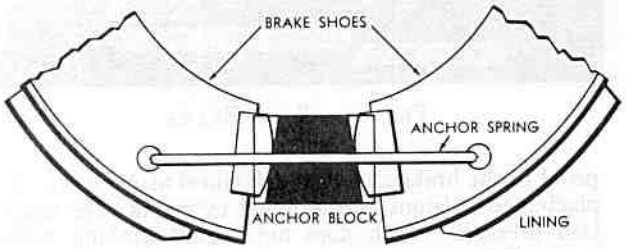


FIG. 47.—SELF-CENTERING DEVICE

The self-centering design permits the anchor points to be higher, or closer to the axle, than in conventional-type brakes. Because of this feature, greater braking effort is obtained from a given line pressure. Many brake troubles are traceable to the fact that the shoes are not properly centered at all times. Since the shoes of the new brake are self-centering, it is possible to realize the same performance after relining that existed when the brake was new. The self-centering device requires no maintenance.

Self-adjusting Device

CHAMPION AND COMMANDER The self-adjusting device automatically compensates for lining wear and virtually maintains the original pedal travel throughout the entire life of the lining. The device is located on the forward shoe only. Since the lining on the reverse shoe wears slowly, it is usually unnecessary to adjust it until relining of the forward shoe is required. Basically, the self-adjusting device consists of a contact plug, one end of which extends through a hole in the center of the shoe and lining. The other end of the plug is centrally pinned to a lever which, in turn, is pinned at its lower end to the brake shoe. The upper end of the lever bears upon the brake eccentric when the brake is in the released position. A spring-actuated wedge is inserted between the plug-and-lever pin and a wedge guide is fastened to the shoe.

The contact plug and lever always move the same distance from the brake eccentric when the shoes are applied. During a brake application, the shoe is forced against the drum by fluid pressure and carries with it the contact plug which is held at its original position in relation to the lining surface by means of a light holding spring. For purposes of explanation, we can assume that the contact end of the plug does not wear inasmuch as the actual wear has been found to be very slight and is compensated for by the lever.

With subsequent brake applications, and as lining wear occurs, the contact plug when pushed inward by the brake drum moves the adjusting lever in relation to the wedge guide and allows the adjusting wedge to

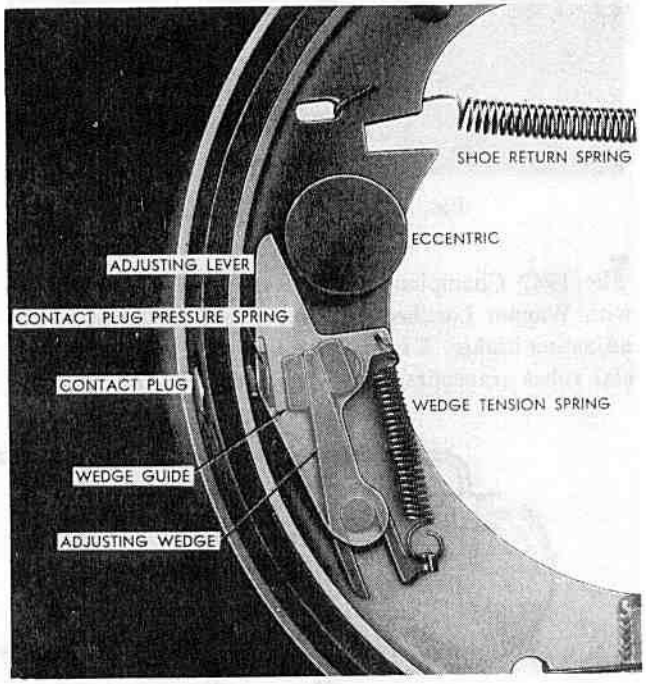


FIG. 48.—SELF-ADJUSTING DEVICE

advance upward by spring action and thereby take up the clearance between the plug-and-lever pin and wedge guide. The wedge holds the lever in its adjusted position in relation to the shoe.

When the brake is released, the adjusting lever resumes contact with the brake eccentric. This limits the shoe return to its original drum clearance. Thus, the shoe has been adjusted an amount equal to the lining wear. This action continues, with the wedge gradually advancing upward until the lining has worn to the point where the contact plug has reached maximum travel.

When to Reline Brakes

CHAMPION AND COMMANDER When the lining needs replacement, the self-adjusting device ceases to operate. Should this occur, the brake pedal travel will increase and the driver is warned that the brakes need relining.

Relining Instructions

Shoe Removal and Disassembly

CHAMPION AND COMMANDER To remove the front wheel brake shoes, place a clamp across the wheel cylinder boots. Remove the anchor spring, the shoe return spring, and the C-washers from the brake shoe eccentric pins. Each shoe is removed by pulling the heel of the shoe away from the anchor block, lifting it from the backing plate until it is clear of the eccentric pin, and then pulling it away from the wheel cylinder. (See Fig. 49.)

To remove the rear wheel brake shoes, place a clamp across the wheel cylinder boots. Remove the anchor spring and the shoe return spring, pull the parking lever toward the center of the brake, and unhook the cable. Then remove the C-washers from the brake shoe eccentric pins and remove each shoe in the same manner as followed for the front wheel brakes. (See Fig. 49.)

To disassemble the self-adjusting device, press the contact plug inward until the wedge has fully advanced. Remove the hairpin cotters. Maintain pressure on the contact plug while removing the wedge tension spring and while withdrawing the adjusting lever. Remove the wedge, wedge guide, contact plug, and contact plug pressure spring. (See Fig. 50.)

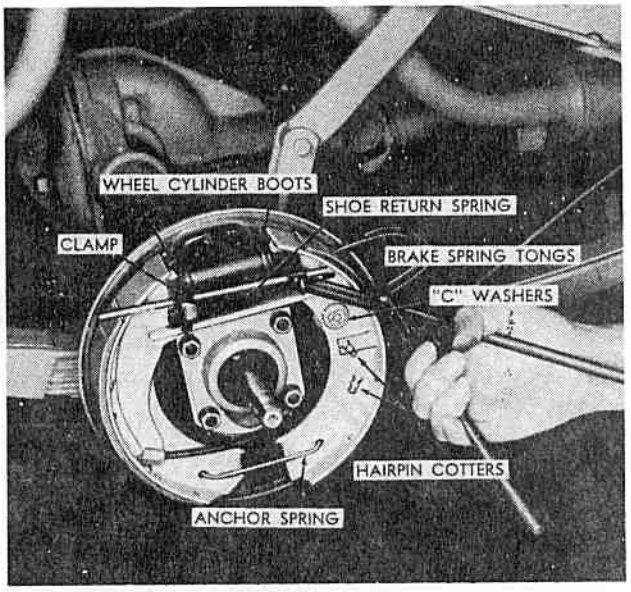


FIG. 49

Relining Brake Shoes

CHAMPION AND COMMANDER Remove the old lining and reline the shoes. Predrilled lining sets, designed for the self-centering, self-adjusting brakes, are available from The Studebaker Parts and Accessories Division and Parts Depots. (Lining kits include new contact plugs and the Plug Adjusting Gage FL-1047.)

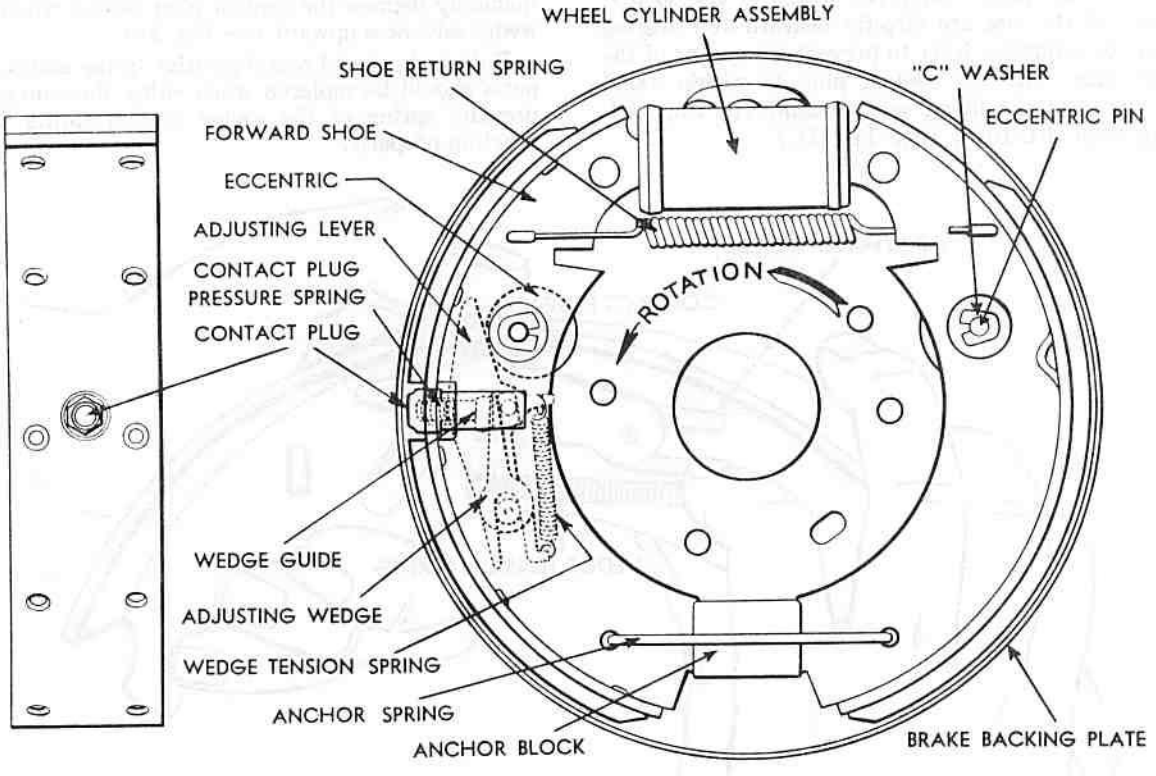


FIG. 50.—CONSTRUCTION OF THE CHAMPION AND COMMANDER FRONT BRAKE

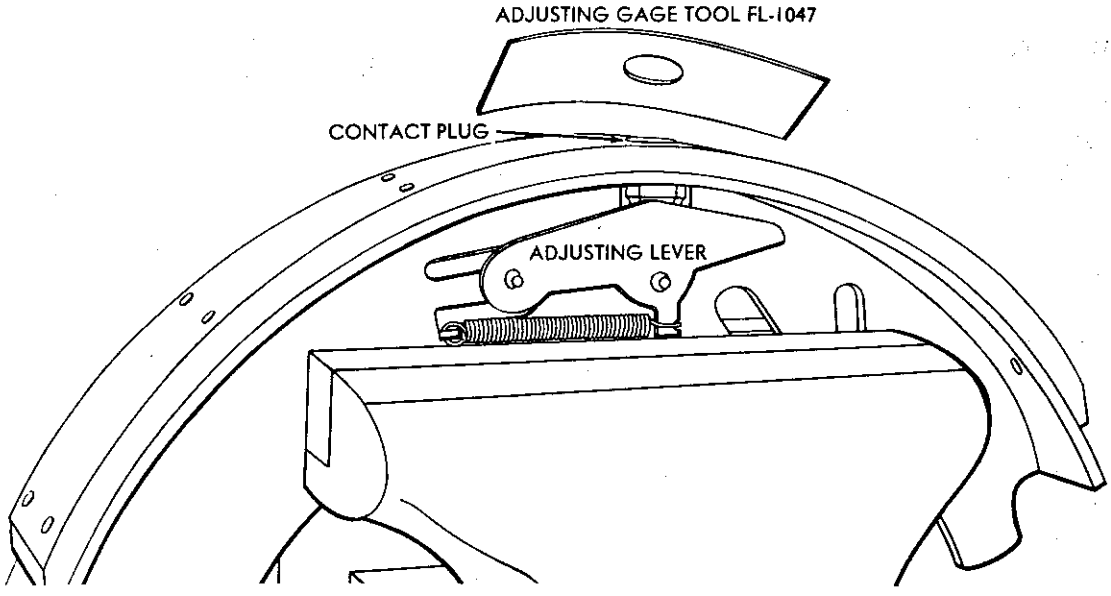


FIG. 51

Rivet the linings to the shoes, making sure that there is approximately 1/16" (1,588 mm.) clearance between the 3/4" (19,050 mm.) contact plug lining hole and the contact plug.

Always use a new contact plug when reassembling the self-adjusting device. All other parts of the self-adjusting device should be cleaned, inspected for wear or damage, and replaced if necessary.

Completely retract the adjusting wedge while pressing the contact plug. Clamp the shoe in a vise so that the jaws of the vise are directly beneath and bearing against the adjusting lever to prevent movement of the contact plug. File the contact plug to within .005" (0,13 mm.) of the lining surface using the Plug Adjusting Gage FL-1047. (See Fig. 51.)

Inspection of Self-adjusting Device

CHAMPION AND COMMANDER For the self-adjusting device to function properly, the end of the contact plug must either be level with, or extend not more than .005" (0,13 mm.) above, the lining surface.

To test the contact plug pressure spring, compress the contact plug, fully retract the wedge, and hold it in a fully retracted position while pressing and releasing the contact plug (see Fig. 52). With the wedge still in the fully retracted position, release the contact plug, then the wedge. To test the wedge action, manually depress the contact plug, noting whether the wedge advances upward (see Fig. 53).

Both tests should reveal positive spring action. Worn parts should be replaced when either the contact plug pressure spring or the wedge tension spring fails to function properly.

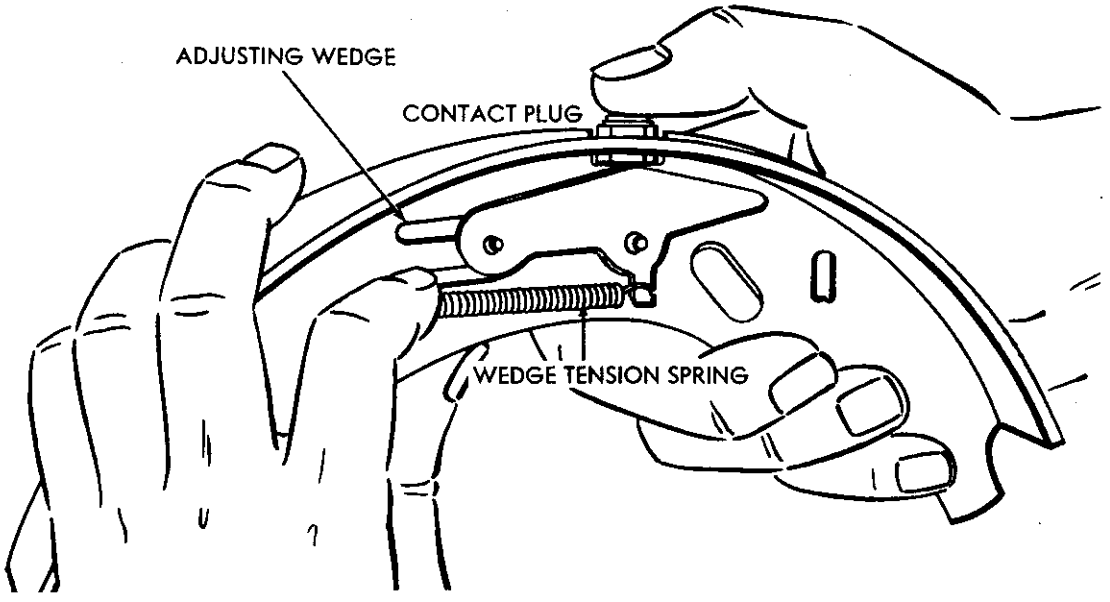


FIG. 52

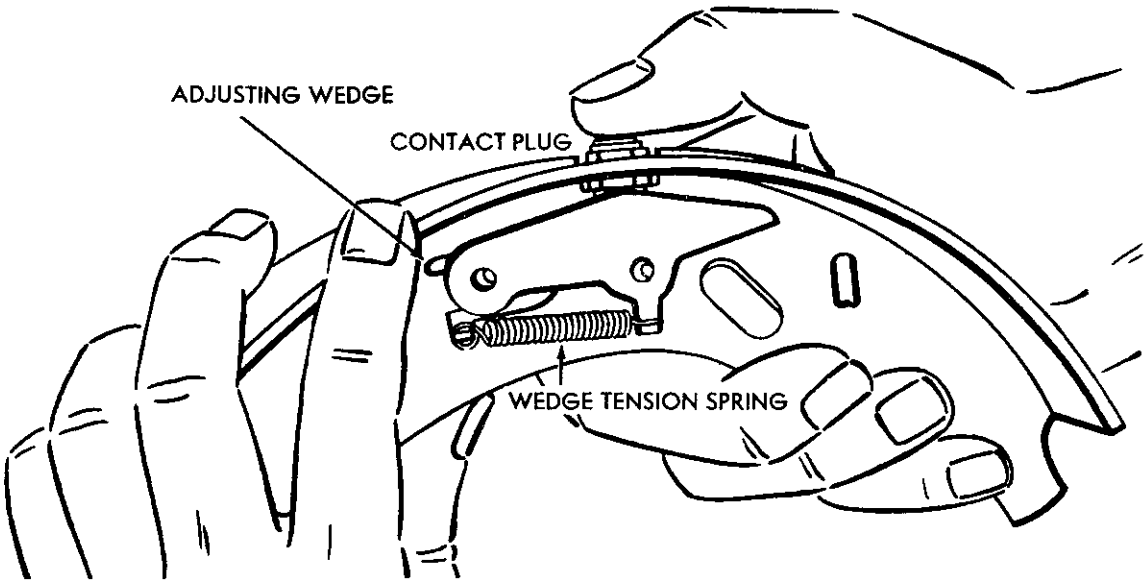
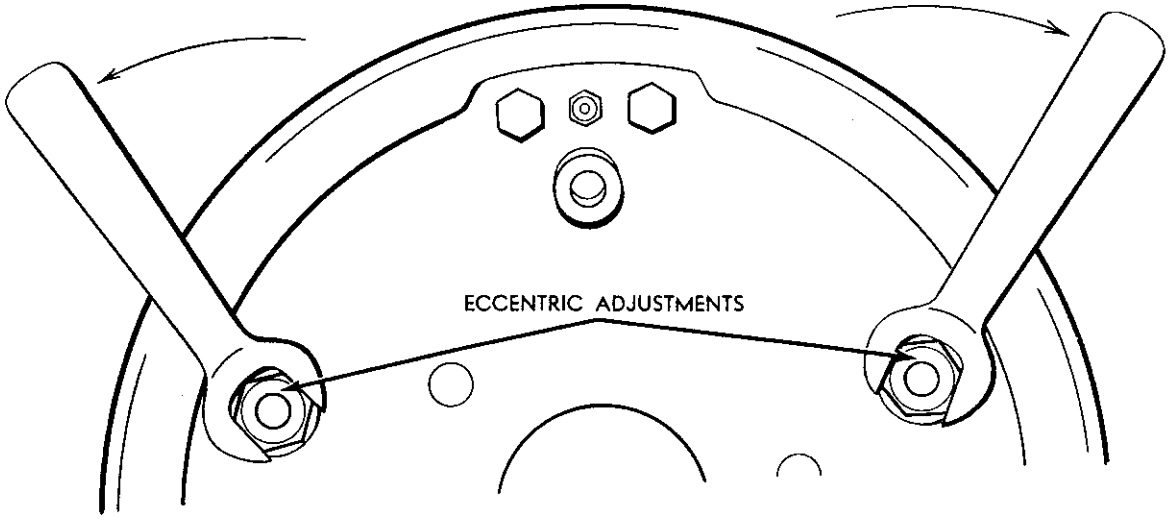


FIG. 53

Brake Reassembly and Initial Adjustment

CHAMPION AND COMMANDER Do not lubricate any part of the brake. Before mounting the shoes upon the backing plate, fully retract (pull downward) the adjusting wedge while pressing on the contact plug. Mount the shoes. Remove the wheel cylinder clamps. Rotate the shoe adjusting eccentrics to the released position and center the shoes so that the brake drum can be installed.

The initial adjustment is made by manually setting the front and rear shoe eccentrics (see Fig. 54). *The parking brake must be in the released position during adjustment.* Adjust the lining clearance by rotating the eccentric adjustment away from the wheel cylinder with the wrench handle pointed outward. To adjust the front shoe, rotate the drum forward and bring the shoe into *easy contact* with the drum until a slight drag is noted; then back off the eccentric until the drum turns freely. *To avoid damaging the self-adjusting device, do not apply more force to the eccentric than is necessary to bring the shoe into easy contact with the drum.* When adjusting the rear shoe, rotate the drum backward and bring the shoe into contact with the drum; then back off the eccentric until the drum turns freely.



REAR BACKING PLATE (BACK VIEW)

FIG. 54

Brake Pedal and Master Cylinder Adjustment

CHAMPION AND COMMANDER Too much free motion of the brake pedal reduces the effective travel of the master cylinder piston; too little free travel may cause blocking of the by-pass port and may prevent the brakes from releasing. For this reason, adjust the brake pedal by loosening the lock nut on the piston rod and turning the larger nut until not less than 1/4" (6,350 mm.) and not more than 3/8" (9,525 mm.) free pedal travel exists (see Fig. 55).

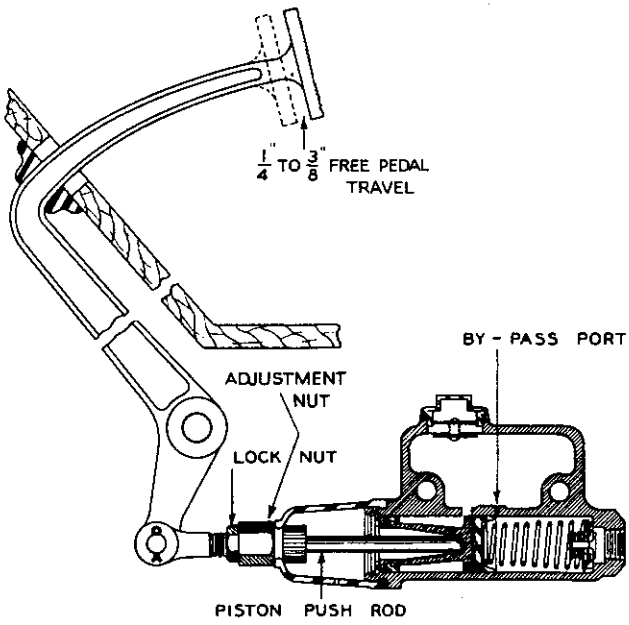


FIG. 55

Bleeding the Hydraulic System

CHAMPION AND COMMANDER The proper operation of the hydraulic brakes requires a "solid column" of fluid in the system. If air bubbles are present in the fluid, it is necessary to bleed the system. The necessity for this operation is indicated by a soft or spongy pedal.

Manual Bleeding

● The reservoir must be full during the bleeding operation. The Wagner FL-304 Automatic Refiller eliminates all possibility of air entering the system because of a lack of fluid during the bleeding operation (see Fig. 56).

Slip the bleeder drain hose over the bleeder screw on one of the wheel cylinders and allow the bleeder hose to hang in a clean container, preferably glass. Loosen the bleeder screw not more than one full turn and depress the brake pedal slowly; then allow the pedal to return slowly to the released position. This operation, which expels all the air from the system, should be repeated approximately ten times.

Watch the flow from the bleeder hose, being sure that the hose is submerged in the fluid in the container. When air bubbles cease to appear, depress the brake pedal and close the bleeder connection. Fluid withdrawn from the system should not be used again.

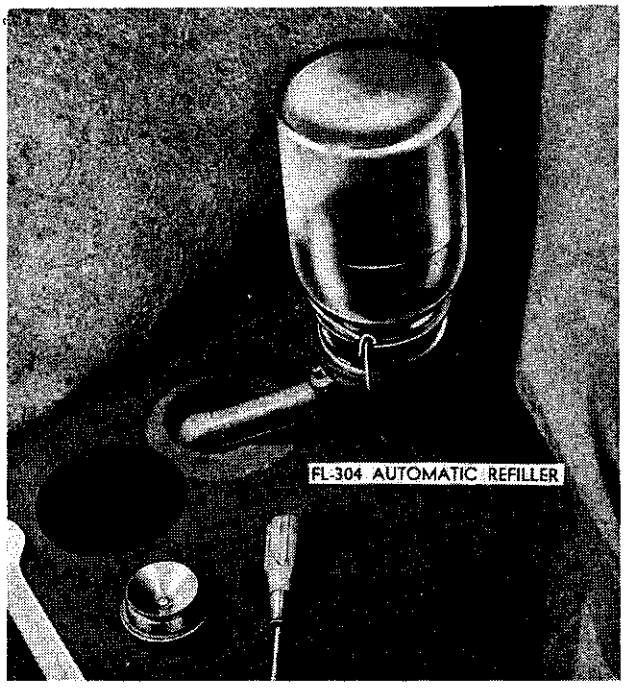


FIG. 56

To bleed the entire system, perform this operation at each wheel. Then fill the master cylinder reservoir to within 1/2" (12,7 mm.) from the top.

Pressure Bleeding

● The Wagner Fluid-Bal FL-308 facilitates the bleeding operation by introducing fluid under pressure into the master cylinder. The repair man then bleeds the four wheels in order. Constant pressure is maintained, no fluid is lost or spilled, and the job is completed in minimum time.

NOTE.—*Bleed the hill holder at the screw plug provided at the top of the unit.*

Servicing the Master Cylinder

CHAMPION AND COMMANDER The fluid reservoir and the cylinder barrel are an integral casting. The reservoir is provided with a combination filler and breather cap which maintains atmospheric pressure on the fluid at all times.

Remove the master cylinder from the car. To disassemble the unit, remove the clamp ring which fastens the boot to the cylinder. Then remove the push rod and boot assembly, the piston stop wire, and the piston stop. The stop wire is made of spring steel and should be handled carefully. The piston, the two cups, the return spring and retainer, and the check valve can now be easily removed.

After the master cylinder has been dismantled, perform the following inspections and operations.

If the port hole is closed, run a wire through the hole.

If the primary cup is grooved, replace it with a new one.

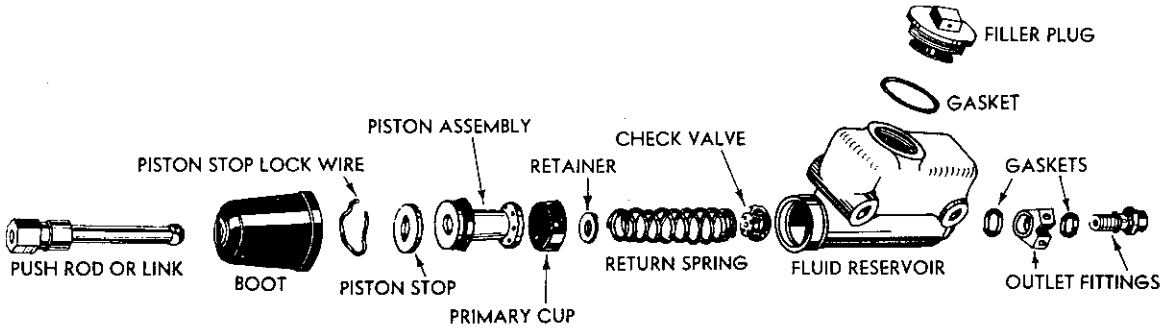


FIG. 57.—PARTS OF CHAMPION AND COMMANDER MASTER CYLINDER

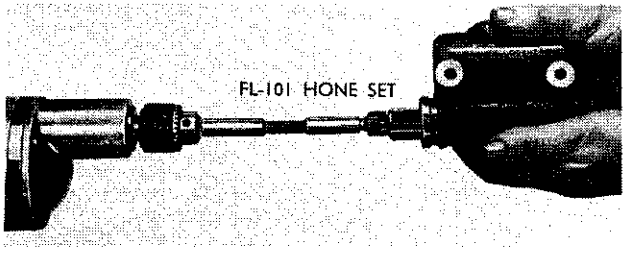


FIG. 58

If the cylinder bore is pitted or scratched, hone the cylinder wall with the FL-101 Hone Set (see Fig. 58) to restore the highly polished surface necessary for efficient operation. When honing a cylinder, use the FL-114 NoGo Gage Set to determine the diameter of the cylinder bore. The FL-134 Burring Tool should be used after the honing operation to remove the sharp edges on the by-pass port.

Presence of mineral oil in the system causes the deterioration, softening, and expansion of the rubber parts and necessitates the replacement of the primary cup, secondary cup, check valve, and valve seat. These parts are included in the Master Cylinder Repair Kit.

The cylinder and parts must be washed in clean alcohol (do not use gasoline, kerosene, or oil) and dipped in Wagner Lockheed brake fluid before the unit is reassembled.

Servicing the Wheel Cylinders

CHAMPION AND COMMANDER Disconnect the tubing or hose at the wheel cylinder inlet and unhook the brake shoe return spring. Remove the two cap screws which hold the cylinder to the backing plate.

CAUTION.—*Prevent the brake fluid from coming in contact with the brake lining.*

Disassemble the wheel cylinder by removing the two rubber boots and perform the following inspections and operations.

If the cylinder bore is pitted or scratched, hone the cylinder walls with the FL-101 Hone Set. When honing a cylinder, use the FL-114 NoGo Gage Set to check the diameter of the cylinder bore.

Pistons must be free from burrs.

Rubber boots which have been in contact with grease will no longer adequately protect the cylinder from foreign matter. Should the boots show evidence of grease, replace the boots and grease retainers. If mineral oil is present in the system, replace the rubber cups.

The cylinder and parts must be washed in clean alcohol (do not use gasoline, kerosene, or oil) and dipped in Wagner Lockheed fluid before the unit is reassembled.

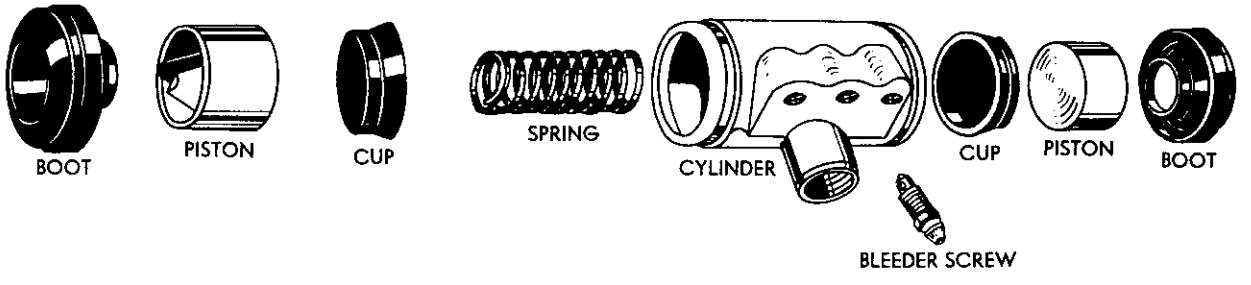


FIG. 59.—PARTS OF CHAMPION AND COMMANDER WHEEL CYLINDER

Hill Holder

● The hill holder is special equipment for the Champion and standard equipment for the Commander. While the car is on an upgrade, the ball check valve of the hill holder prevents the return of the brake fluid from the wheel cylinders as long as the clutch pedal is depressed. This action prevents the car from rolling back after it has been stopped on an upgrade. The connecting linkage should be adjusted to open the hill holder valve simultaneously with the engagement of the clutch.

When the clutch is engaged, the rubber seal is held away from the valve seat to allow the return of the brake fluid (see Fig. 60).

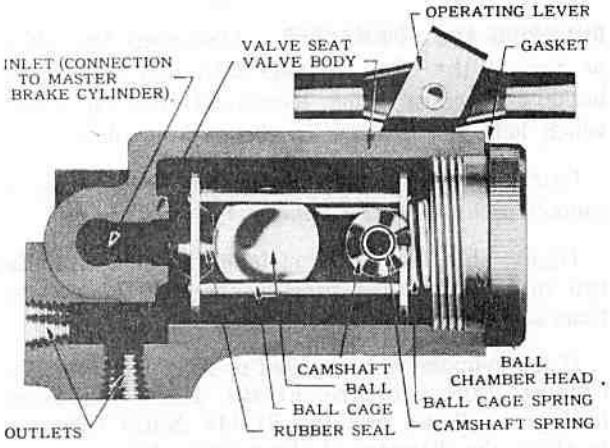


FIG. 60

When the clutch is disengaged, the rubber seal moves to the rear allowing the ball to stop the return of the fluid to the master cylinder. With the car on a down grade, the ball will roll away from the rubber seal, allowing the fluid to return to the master cylinder through a hole in the center of the rubber seal (see Fig. 61).

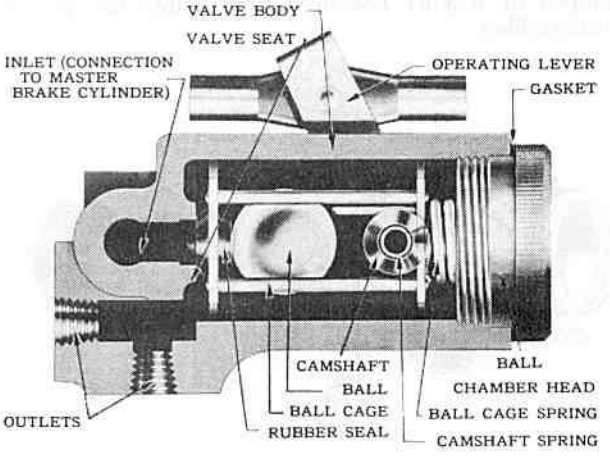


FIG. 61

Adjustment

CHAMPION AND COMMANDER When making a clutch pedal adjustment, also adjust the hill holder to clutch pedal rod. Loosen the lock nut on the end of the control rod and turn the adjustment nut either to the right or the left to provide simultaneous hill holder release and clutch pedal engagement. When the correct adjustment has been obtained, tighten the lock nut (see Fig. 62).

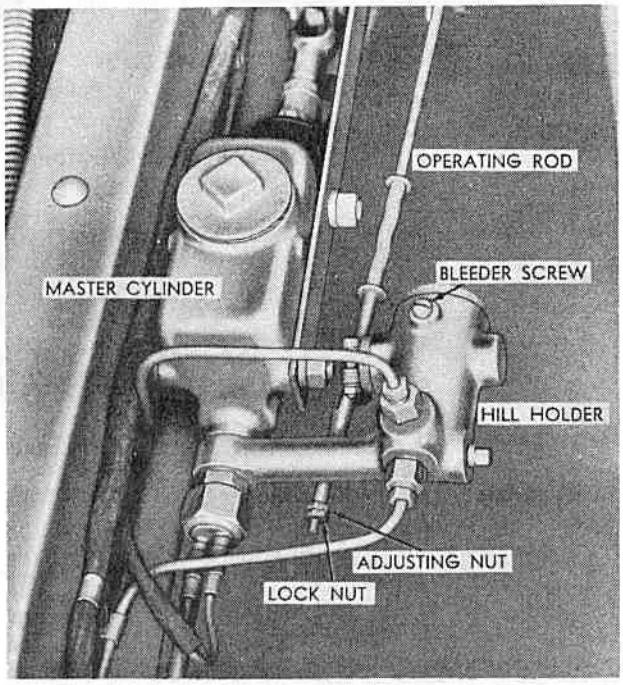


FIG. 62

Flushing the System

CHAMPION AND COMMANDER Use only genuine Wagner Lockheed Fluid in the braking system. Failure to comply with this recommendation not only may render the brakes inoperative but also will automatically cancel the standard warranty. If mineral oil has been installed in the braking system through error, it is important that the system be thoroughly cleaned and all rubber parts be replaced as set forth in the following operations.

Attach the air bleeder tube to the fitting on one wheel cylinder, open the fitting and pump out all old fluid by alternately depressing and releasing the foot brake pedal. Fill the master cylinder reservoir with a good quality alcohol and pump it through the system and out the open bleeder connection. Add alcohol and continue the operation until all traces of the oil or other foreign matter have been flushed from the master cylinder and from the lines leading to the wheel.

After removing the bleeder tube and closing the bleeder fitting, proceed to the other wheels and repeat the flushing operation until all four lines to the wheels are clean. To maintain a maximum pressure in the line to the open fitting, only one bleeder fitting should be opened at a time.

Remove all wheel cylinders and the master cylinder and disassemble them. After removing the piston cups,

thoroughly wash and clean all parts in a good quality alcohol.

Install new rubber parts. (These should be installed in every case where mineral oil has been introduced in the system, even though there are no visible signs of failure.) Inspect and clean the master cylinder before installing the new cups.

Reassemble the wheel cylinders and the master cylinder and install them on the car. Then install genuine Wagner Lockheed Fluid and air bleed the system as previously described.

Parking Brake Adjustment

CHAMPION AND COMMANDER Adjustment of the parking brake linkage is made at the cable clip, located below the front propeller shaft. To make an adjustment, perform the following operations.

Raise the car until the rear wheels are clear of the floor. Set the parking brake lever 4 or 5 notches from its fully released position. Loosen the front nut on the threaded end of the cable at the cable clip, and tighten the rear nut until a heavy drag is felt when rotating the rear wheels by hand. Tighten the front nut to maintain the adjustment. Then release the parking brake fully and make sure there is no brake shoe drag as the rear wheels are rotated.

BRAKE SYSTEM — DIAGNOSIS

PEDAL GOES TO FLOORBOARD

CAUSES

1. Normal wear of lining.
2. Brake shoes not properly adjusted.
3. Leak in system.
4. Air in system.
5. Pedal improperly set.
6. No fluid in supply tank.

ALL BRAKES DRAG

CAUSES

1. Mineral oil in system.
2. Pedal improperly set (insufficient play).

ONE WHEEL DRAGS

CAUSES

1. Weak or broken brake shoe return or anchor spring.
2. Clogged or crimped hydraulic brake line.
3. Brake shoe set too close to drum.
4. Piston cups distorted.
5. Loose wheel bearings.

CAR PULLS TO ONE SIDE

CAUSES

1. Grease-soaked or fluid-soaked lining.
2. Shoes improperly set.
3. Backing plate loose on axle.
4. Different makes of lining.
5. Tires not properly inflated.
6. Clogged or crimped hydraulic brake line.

SPRINGY, SPONGY PEDAL

CAUSES

1. Brake shoes not properly adjusted.
2. Shoe surface not square with drum.
3. Air in system.

EXCESSIVE PRESSURE ON PEDAL, POOR STOP

CAUSES

1. Brake shoes not properly adjusted.
2. Improper lining.
3. Oil or fluid on lining.
4. Lining making partial contact.

OVERLY SENSITIVE BRAKES

CAUSES

1. Brake shoes not properly adjusted.
2. Loose brake backing plates.
3. Grease-soaked or fluid-soaked lining.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

CLIMATIZER
(OPTIONAL EQUIPMENT)

The Climatizer is a fresh-air heating and ventilating system. Fresh air passes through an air duct, an oil-impregnated filter, and then through the Climatizer heating core. The filtered air is discharged below the front seat and distributed uniformly throughout the car interior. The large volume of fresh air, heated as required, not only assists the action of the windshield defroster but also prevents the frosting of car windows. (See Fig. 63.)

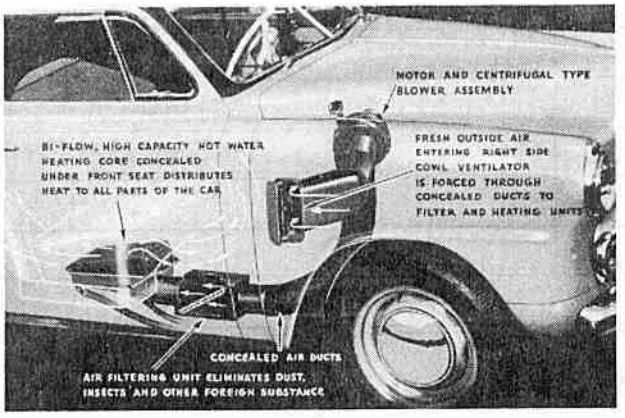


FIG. 63

The defroster, which includes a heating booster, forces heated air through flexible tubes and built-in air ducts to remove the condensation and frost from the windshield. Figure 64 illustrates the high-powered motor and blower with the heating coil at the air intake.

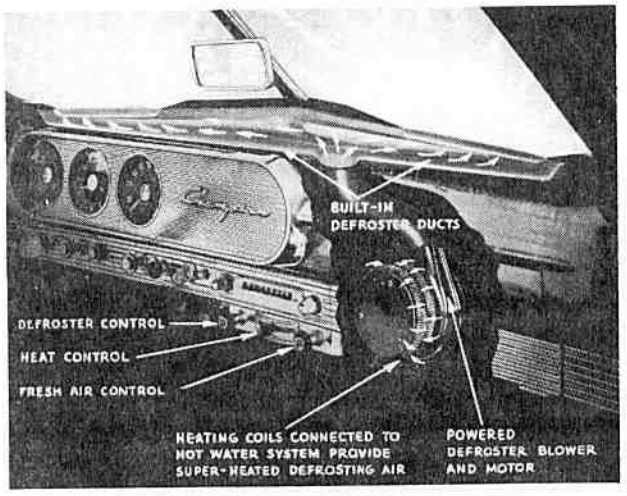


FIG. 64

Climatizer Operation

CHAMPION AND COMMANDER The procedure for operating the Climatizer is as follows:

Open the outside right air intake at the cowl by raising the small handle located on the inside of the right side cowl panel to the up position. In extremely cold weather, the air intake may be closed during the first minute of operation so that cold air may be avoided during the warm-up period. The inside door next to the Fresh Air Control lever and left cowl ventilator door should be closed for satisfactory Climatizer operation.

Shift the Thermo-Control lever to the right to the position which gives the temperature desired by the car occupants.

If maximum air circulation is desired, turn the Fresh Air "A" Motor control knob to the right to its first position. Turning the switch farther to the right decreases the air flow. When the car is in motion, the Climatizer will operate efficiently without the aid of the Fresh Air Motor. Air pressure generated by the speed of the car forces air through the Climatizer system and into the car.

NOTE.—Maximum heat is obtained with the Thermo-Control lever in the full right position, the Fresh Air knob in the first position to the right, the Fresh Air Control lever in the up position, and the inside ventilator door closed.

Defroster Operation

CHAMPION AND COMMANDER The rotary switch "D" (on the lower left of the Climatizer panel) controls the operation of the defroster. Maximum hot air flow through the defroster ducts is obtained with the rotary switch in the first position to the right. Turning the switch farther to the right decreases the air flow.

Summer Operation

CHAMPION AND COMMANDER When using the Climatizer solely as a ventilating system, move the Thermo-Control lever to the full left position and regulate the volume of air with the Fresh Air Control. When the windows are closed during severe rain or dust storms, the Climatizer may be used to provide an ample amount of filtered fresh air for passenger comfort and also to prevent moisture from gathering on the inside of the windows.

Climatizer Filter

CHAMPION AND COMMANDER The frequency with which the filter needs servicing is governed by the operating conditions. If the car is operated under dusty conditions, especially when the system is used both for heating in winter and ventilation in summer, the filter will need frequent cleaning.

To clean the filter, remove the bottom plate from the heater housing and remove the filtering element. Wash the element in clean kerosene, allow it to dry thoroughly to eliminate odor, and saturate it with clean engine oil. Allow the excess oil to drip off the element before reinstalling.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

CLUTCH

Single-plate, dry-disc type clutches are used in the Champions and Commanders. The service procedures and the construction of the two clutch assemblies are very similar. A prelubricated, ball-type clutch release bearing equipped with a wear plate is used with both clutches.

There is no adjustment for wear provided in the clutch itself. An individual adjustment is provided for each lever in manufacture, but the adjusting nut is locked in position and should never be disturbed unless the clutch is dismantled for the replacement of parts.

The clutch pedal should have a minimum of 3/4" to 1" (19,05 mm. to 25,40 mm.) free travel before the resistance of the release mechanism can be felt. If less than 3/4" (19,05 mm.) free pedal travel exists, corrective adjustments should be made, because this condition, if allowed to persist, will cause premature wear of the clutch and the release bearing.

NOTE.—Champions before Serial No. G-217064 require from 1/2" to 3/4" (12,70 mm. to 19,05 mm.) free pedal travel.

The hill holder rod adjustment should be checked whenever a clutch pedal adjustment is made. A properly adjusted control rod will provide simultaneous hill holder release with clutch engagement.

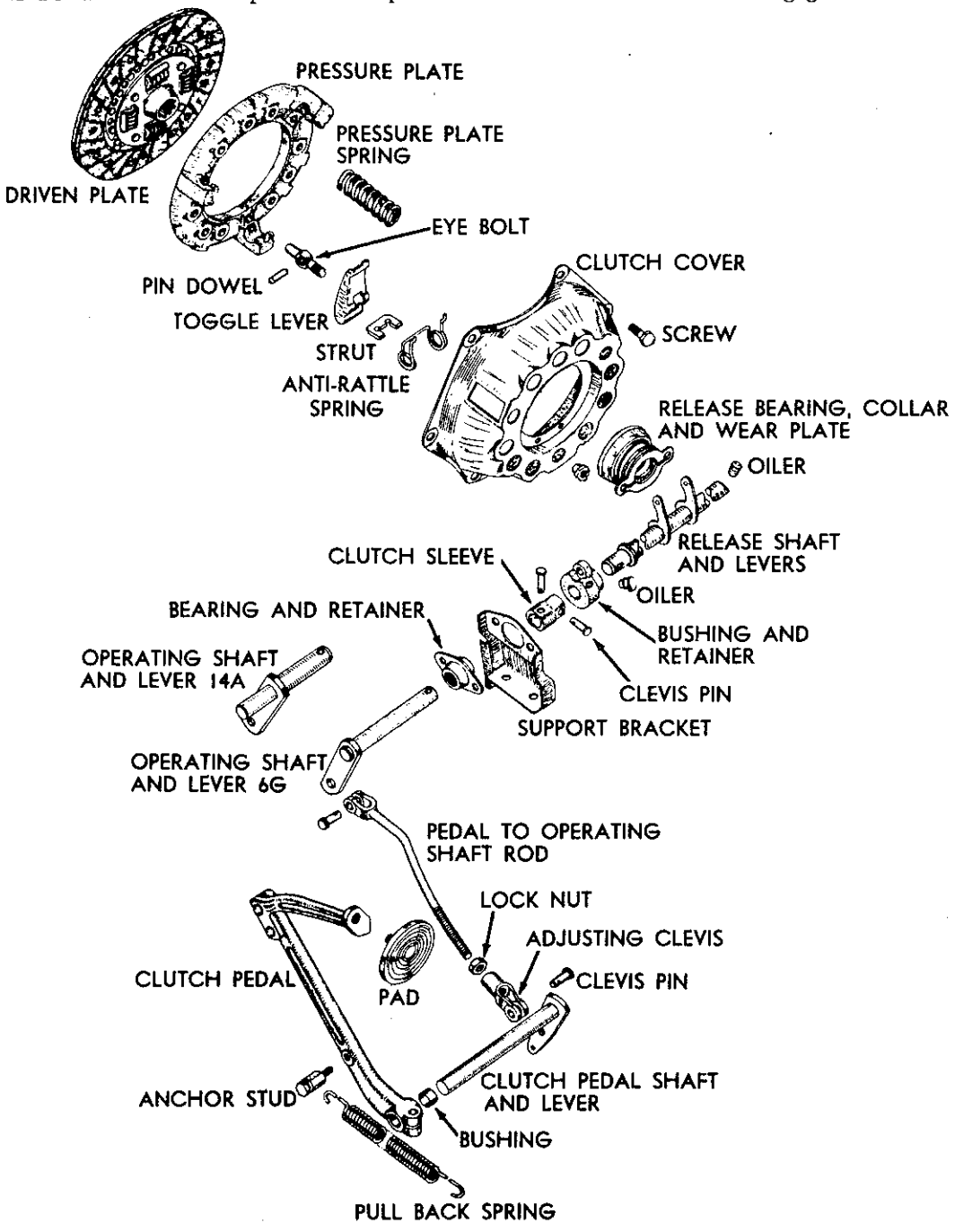


FIG. 65.—PARTS OF THE CLUTCH AND RELEASE MECHANISM

Clutch Removal

CHAMPION Remove the engine with the driven plate and pressure plate assembly (see "Engine Removal" in the "Engine" section). Then block the clutch pressure plate release fingers and remove the clutch pressure plate and driven plate. To remove the clutch housing, disconnect the operating shaft from the release shaft and remove the four cap screws and lock washers which hold the housing to the transmission.

COMMANDER Raise the rear of the car, rest it on sturdy stands placed under the axle housing, and remove the transmission as outlined in the "Transmission" section.

Raise the hood and disconnect one battery terminal. Then remove the starter mounting cap screws and suspend the starter motor clear of the flywheel housing.

After removing the front floor carpet or mat and the floor plates, remove the clutch housing mounting cap screws and bolts which are accessible through the inspection hole.

Remove the two speedometer cable retainer screws from the cross member and move the speedometer cable to an out-of-the-way position.

After protecting the oil pan from damage, place an adjustable jack under the rear end of the engine and remove the nuts and bolts with the insulators, washers, and spacers from the rear engine mounting.

Disconnect the parking brake cable from the lever, the clutch operating shaft from the release shaft, and the brake pedal return spring from the frame cross member.

Loosen the exhaust pipe flange nuts at the manifold, remove the exhaust pipe support bracket, loosen the clamp, and rotate the bracket out of the way.

Remove the rear engine support cross member. Then remove the remaining clutch housing mounting bolts and remove the clutch housing from the engine rear plate.

Block the clutch pressure plate release fingers and remove the clutch pressure plate and driven plate.

Pressure Plate

Disassembly

CHAMPION AND COMMANDER Place the pressure plate assembly on the bed of an arbor press and insert a wood block under the pressure plate so that the cover is free to move down. Punch mark the cover and a pressure plate lug, as illustrated in figure 66, before disassembling the unit. Place a wooden block on the spring bosses across the top of the cover and compress the assembly. The adjusting nuts can then be easily removed. Release the press slowly to prevent the springs from flying out. Then remove the pressure plate cover.

To remove the toggle levers, grasp the lever and eyebolt between the thumb and fingers so that the inner end of the lever and the upper end of the eyebolt are as close to each other as possible. Keeping the eyebolt pin seated in its socket in the lever, lift the strut over the ridge on the end of the lever, and lift the lever and eyebolt off the pressure plate.

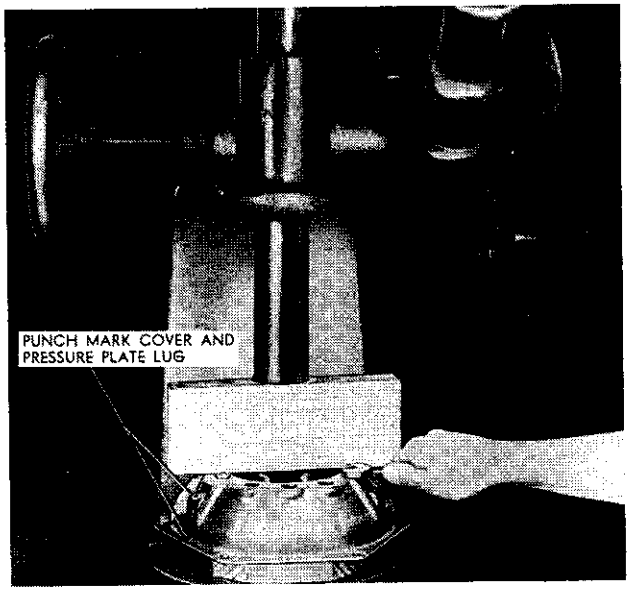


FIG. 66

Reassembly

CHAMPION AND COMMANDER Before reassembling the pressure plate assembly, coat the pressure plate lugs and lever pins with a thin film of Lubriplate.

To reinstall the toggle lever, eyebolt, and strut on the pressure plate, insert the lower end of the eyebolt in the hole in the pressure plate with the short end of the lever near the strut under the hook of the pressure plate. Assemble the lever, eyebolt, and pin, holding the lever and eyebolt as close together as possible. With the other hand insert the strut in the slots of the pressure plate lug, drop it slightly, and tilt the lower edge until it touches the vertical milled surface of the lug (see Fig. 67). Then slide the strut upward in the slots of the lug, lift it over the ridge on the short end of the lever, and drop it into the groove of the lever (see Fig. 68).

Assemble the pressure springs on the pressure plate as illustrated in figure 69. Then center spring boss of each group on the Champion clutch is not used.

To complete the assembly of the pressure plate, lay the cover on top of the pressure plate and assembled parts. Be sure the punch marks on the cover and pressure plate lug are matched to maintain proper balance. Place the pressure plate on a wooden block on the arbor press bed, slowly compress the cover (be sure the eyebolts and pressure plate lugs are guided through the proper holes in the cover), and screw down the adjusting nuts until they are flush with the top eyebolts. Then release the press.

On the Champion the toggle lever adjustment may be made with the flywheel either in the car or on the bench. For lever adjustment on the Commander, the flywheel must be installed on the crankshaft. Install the Clutch Aligning Gage J-2045 in the pilot bearing, being sure that the gage is centered properly and locked tightly in place. Place the driven member over the gage against the flywheel and mount the pressure plate assembly on the flywheel. Tighten the cover retaining screws to 13-15 foot-pounds (1,8-2,1 kilogram-meters) torque, tightening each one only a turn or two at a time to avoid distortion of the cover.

Depress each toggle lever several times with a hammer handle to settle all parts in their proper positions. Place a straight-edge on top of the pressure plate case across opposite bosses. The measurement from the inner side of the straight-edge to the contact points at the inner ends of the toggle lever should be 11/16" (17,463 mm.) on the Champion and 39/64" (15,478 mm.) on the Commander. Adjust one toggle lever to the correct measurement by turning the toggle lever adjusting nut. After installing the adjusting fixture on the clutch aligning gage, set the finger of the fixture on the adjusted toggle lever. Then, using the adjusting fixture, set the other two levers to the height of the adjusted lever. (See Fig. 70.)

After adjusting the height of each toggle lever, stake the nuts with a dull punch as illustrated in figure 71.

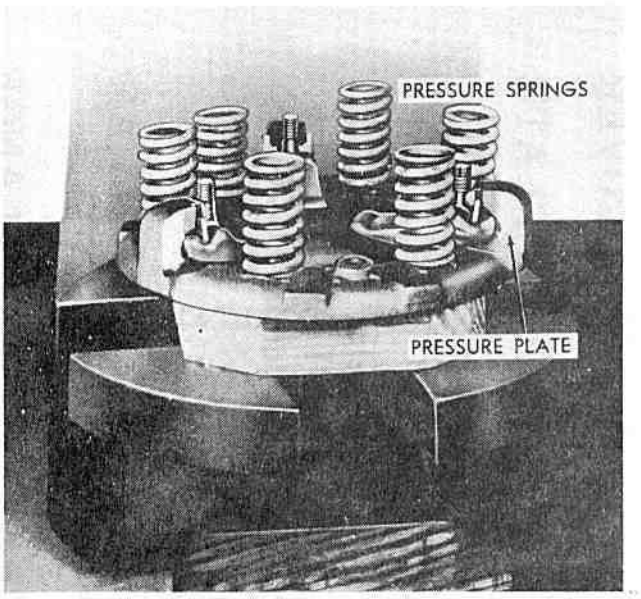


FIG. 69

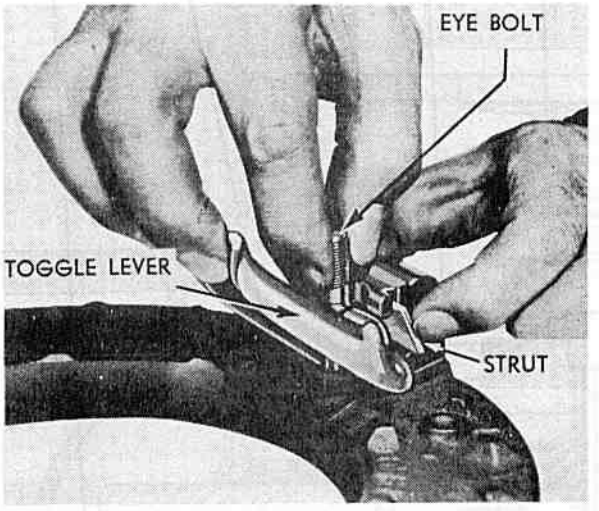


FIG. 67

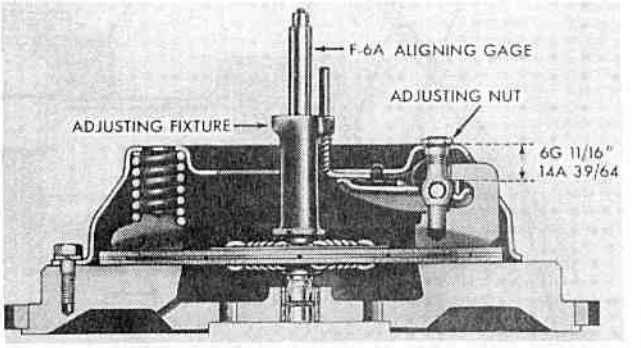


FIG. 70

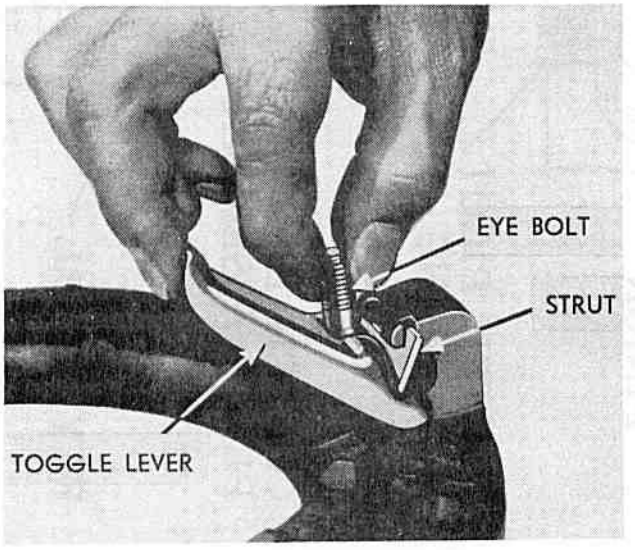


FIG. 68

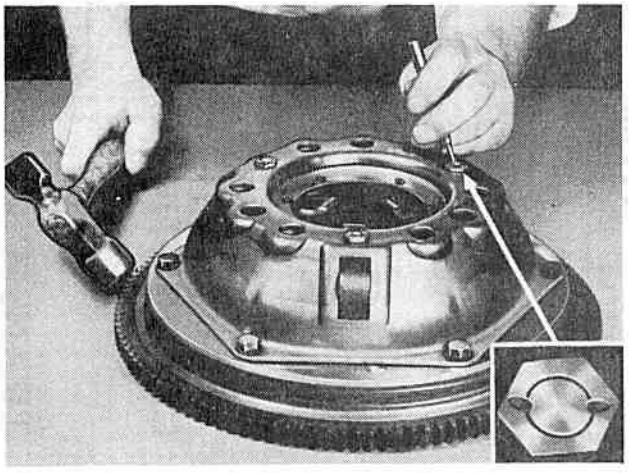


FIG. 71

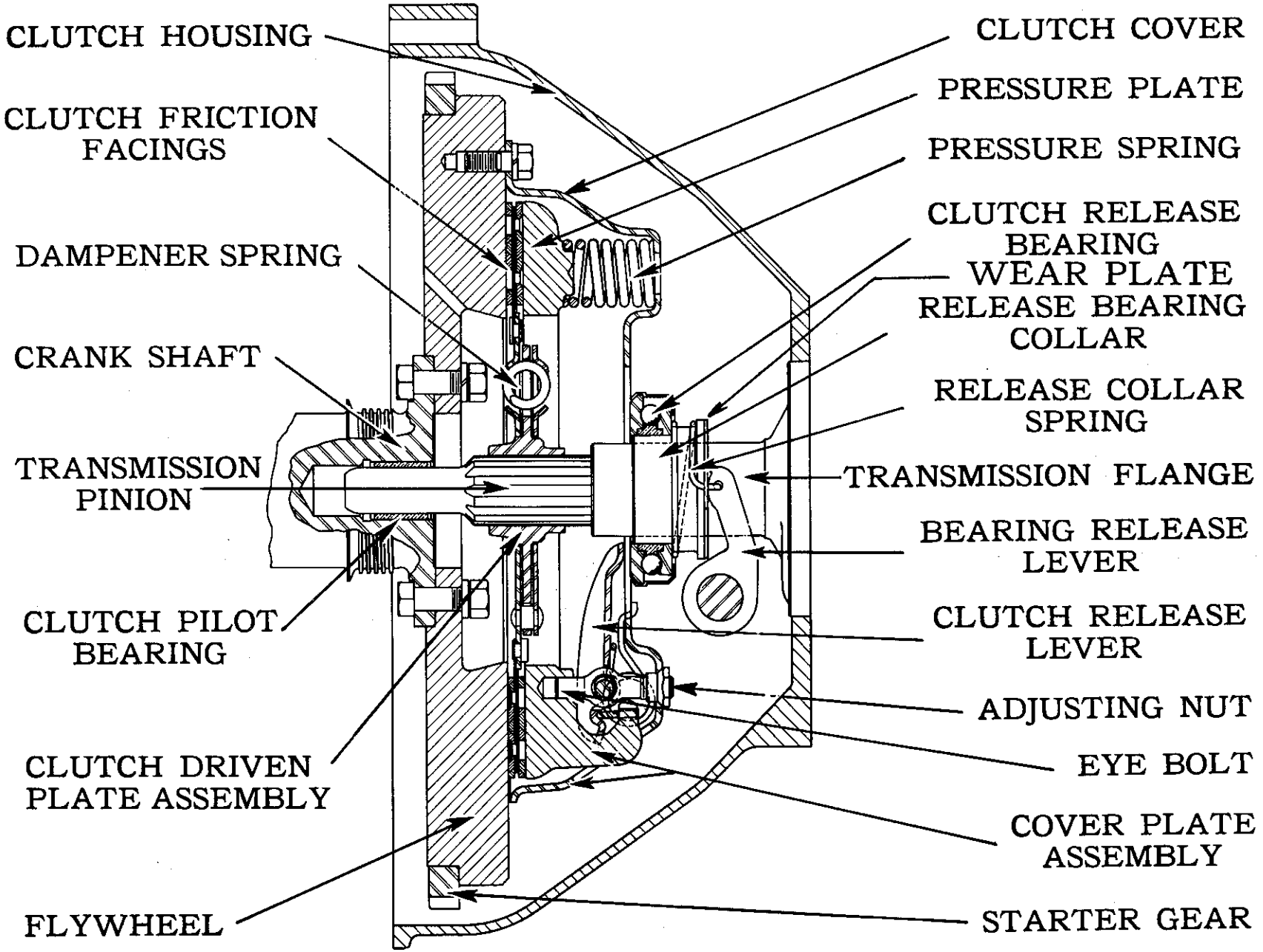


FIG. 72.—CONSTRUCTION OF THE COMMANDER CLUTCH ASSEMBLY

Driven Plate

CHAMPION In the event that the transmission is changed from the overdrive type to the conventional type, or vice versa, the clutch driven plate assembly should be changed accordingly. The driven plate used with the Champion overdrive transmission has four lavender hub damper springs, whereas the driven plate used with the conventional transmission has two lavender and two black hub damper springs.

COMMANDER The same clutch driven plate is used with either the Commander overdrive or conventional transmission.

Driven Plate Reconditioning

CHAMPION AND COMMANDER No reconditioning of the driven plate other than replacing the friction facings is recommended. Friction facing replacement requires extreme care and should be attempted only by those who have the proper tools and riveting equipment. Use only facings supplied through the Studebaker Parts and Accessories Division.

To remove the old facings, drill out the rivets (do not punch them out) with a 3/16″ (4,763 mm.) diameter drill to prevent damage and distortion to the driven plate.

To install the friction facing, place the facing on the flywheel side of the driven plate, line up the countersunk holes with the rivet holes in the cushion spring "A" of section "B-B" as illustrated in figures 73, 74, and 75, and assemble the facing on the cushion spring which is convex at this point. These holes are in line with the neck of the cushion spring. Insert the rivet head in the counter bore and roll, do not split, the rivet against the cushion spring. Rivet each cushion spring to this facing before installing the other facing.

Turn the driven plate over and line up the countersunk holes of the pressure plate facing with the holes in the cushion spring as illustrated in section "C-C" of figures 73, 74, and 75. Insert a rivet in the counter bore and roll, do not split, the rivet against cushion spring "A." The rivet holes for this facing are those nearer the edge of the cushion spring. Each rivet goes through only one facing.

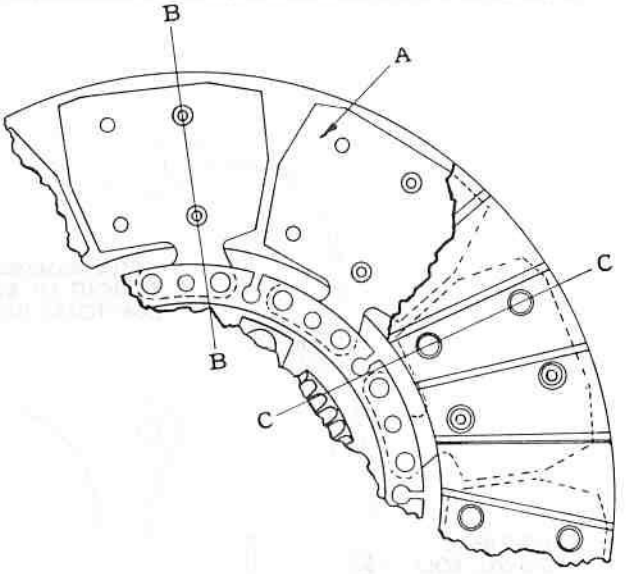


FIG. 73

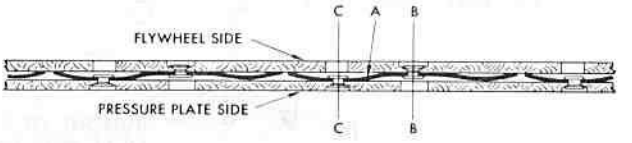


FIG. 74

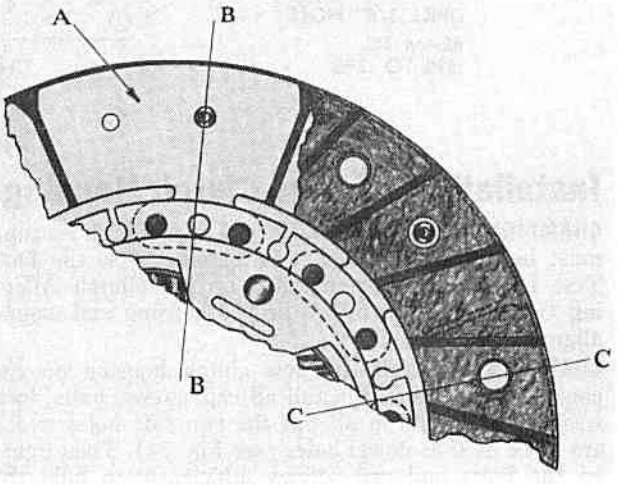


FIG. 75

Installation of the Driven Plate and Pressure Plate Assembly

CHAMPION (Engine Removed) **AND COMMANDER** (Engine in Chassis) To replace the clutch assembly, use the Clutch Aligning Gage J-2045. Insert and centralize the gage in the pilot bearing and tighten it firmly. Slip the clutch driven plate, which should always be installed with the long end of the hub away from the flywheel, over the aligning gage and fit it tightly against the flywheel. To prevent pressure plate distortion during installation, place a 3/8″ (9,525 mm.) wooden block between each release lever and the rim of the clutch cover. Install the clutch assembly on the flywheel and tighten the cover retaining screws securely. Tighten the cover retaining screws to 13-15 foot-pounds (1,8-2,1 kilogram-meters) torque. Tightening each cap screw one or two turns at a time avoids cover distortion. (See Fig. 76.)

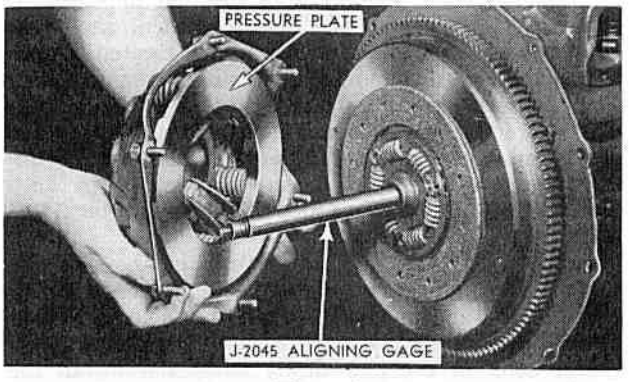


FIG. 76

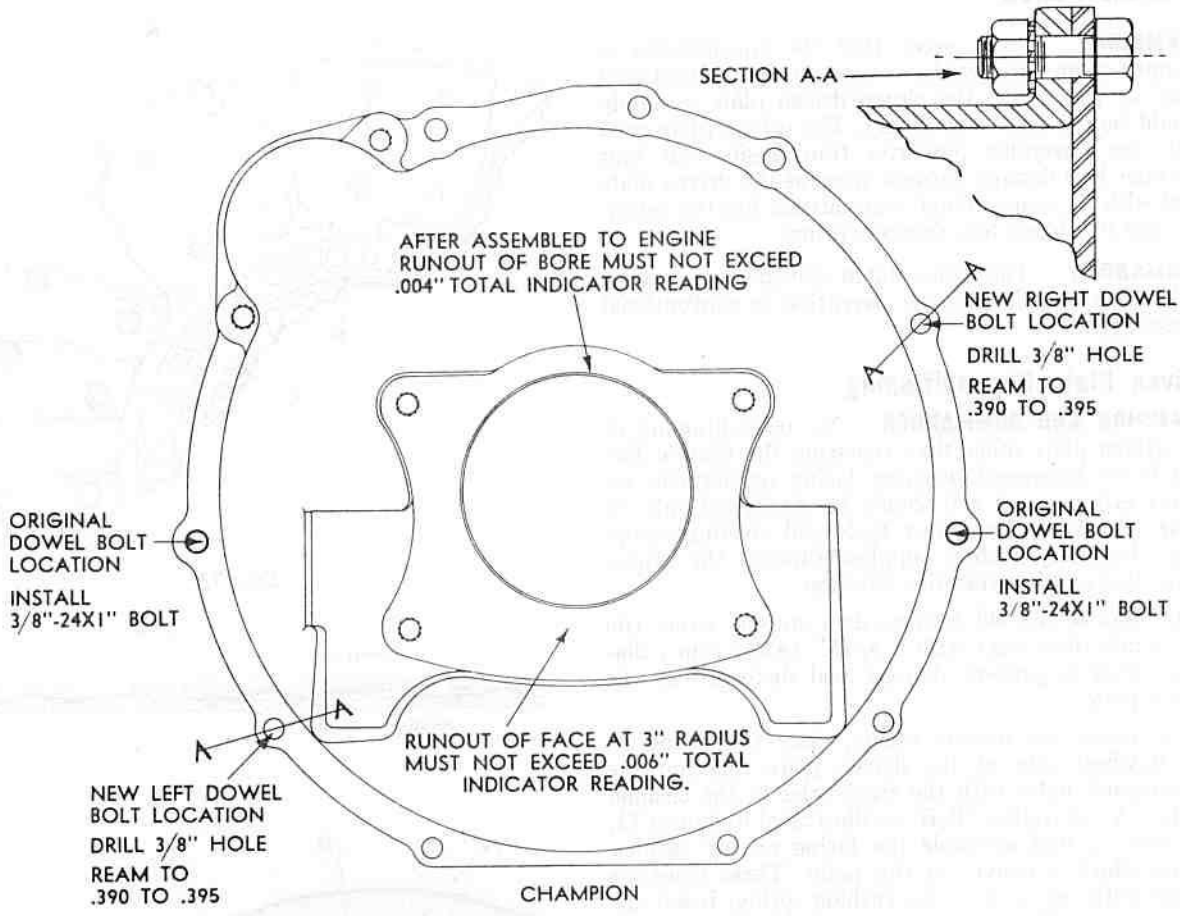


FIG. 77

Installation of New Clutch Housing

CHAMPION AND COMMANDER A new clutch housing must be redoweled when it is installed. Use the Dial Test Indicator 196-A installed on the Clutch Aligning Gage J-2045 to insure proper housing and engine alignment.

CHAMPION Install the new clutch housing on the engine rear plate and install all cap screws, bolts, lock washers, and nuts in all but the two side holes which are to be used as dowel holes (see Fig. 77). Then tighten the bolts and cap screws sufficiently to hold the clutch housing in place and assemble the clutch aligning gage and the dial test indicator.

Obtain a total reading from the dial indicator by revolving the engine. The bore alignment should be correct within .004" (0,10 mm.). The desired reading can be obtained by moving the housing around with a lead hammer. When a satisfactory position for the clutch housing is obtained, tighten all cap screws and bolts and recheck the dial indicator reading by revolving the engine at least one complete turn. Then check the total face reading. This should be .006" (0,15 mm.). (See Fig. 78.)

Using a 3/8" (9,525 mm.) drill, enlarge the two holes to be used as new dowel positions (see Fig. 77, Sec. "A-A") and finish by reaming the hole to .3900"-.3905" (9,9060-9,9187 mm.). Then insert the original dowel bolts in the new dowel holes and install the 3/8" (9,525 mm.) bolts, lock washers, and nuts in the old dowel holes.

Remove the housing from the engine and install it on the transmission, connecting the operating shaft to the release shaft. Then install the engine in the chassis, following the procedure outlined under "Engine Installation" in the "Engine" section.

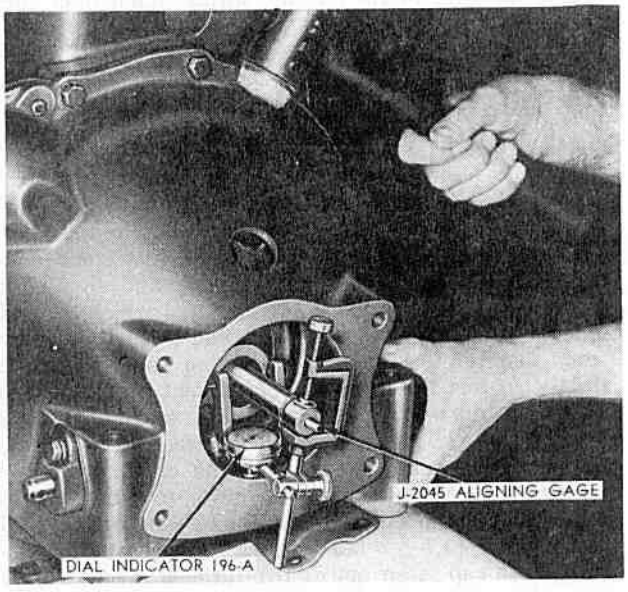


FIG. 78

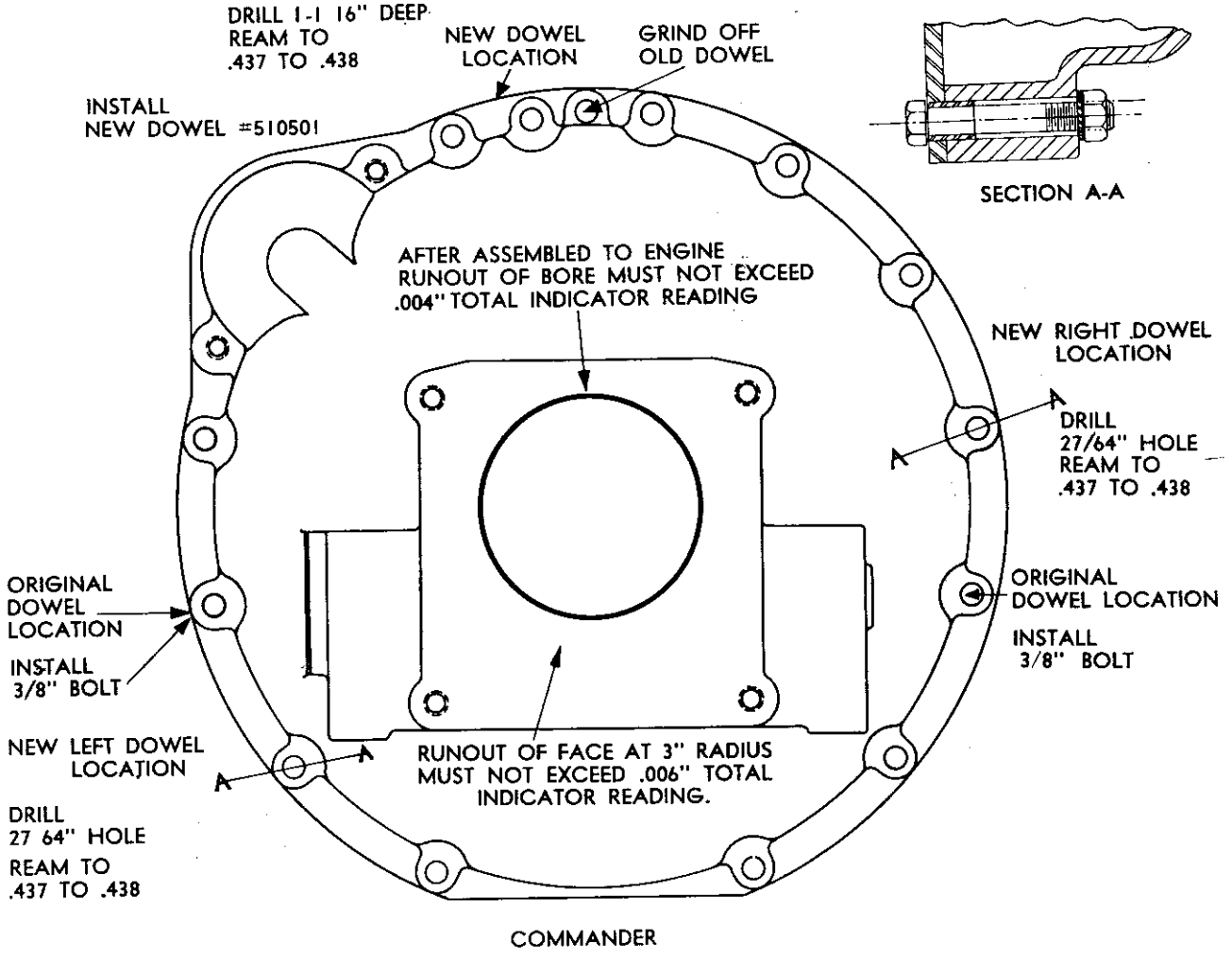


FIG. 79

COMMANDER Before the installation of a new clutch housing, the top dowel must be removed or ground off slightly below the surface of the rear engine plate.

Install the clutch housing on the engine rear plate and install all cap screws, bolts, lock washers, and nuts in all but the two side holes which are to be used as new dowel holes (see Fig. 79). Then tighten the bolts and cap screws sufficiently to hold the housing in place and assemble the clutch aligning gage and dial test indicator.

Obtain a total reading from the dial indicator by revolving the engine. The bore alignment should be correct within .004" (0,10 mm.). The desired reading may be obtained by moving the housing around with a lead hammer. When a satisfactory position for the clutch housing is obtained, tighten all cap screws and bolts and recheck the dial indicator reading by revolving the engine at least one complete turn. Then check the total face reading. This should be .006" (0,15 mm.). (See Fig. 78.)

Using a 27/64" (10,716 mm.) drill, drill a new dowel hole 1-1/16" (26,988 mm.) deep at the top of the housing to the left of the original dowel. Then ream this hole to .437"-.438" (11,099-11,125 mm.) diameter 1" (25,4) mm.) deep and insert a new dowel, Studebaker Part No. 510501. (See Fig. 79.)

Drill two new side dowel holes (see Fig. 79, Sec. "A-A") with a 27/64" (10,716 mm.) drill; then ream the holes to .437"-.438" (11,099-11,125 mm.). Insert the original ring dowels from the engine side through the engine plate and into the clutch housing and install the original bolts, lock washers, and nuts. Install new 3/8" (9,525 mm.) bolts, lock washers, and nuts in the original dowel holes.

Install the rear engine support cross member, tighten the mounting bolts securely, and install both rear engine support insulators, spacers, washers, nuts, and cotter pins. Now remove the jack from the rear of the engine and tighten the exhaust pipe flange nuts and support bracket.

Connect the brake pedal return spring, the clutch linkage, and the parking brake cable (install all pins and cotter pins except the clutch adjusting clevis cotter pin). Then adjust the clutch as outlined in this section under "Clutch Pedal Travel Adjustment."

Install the transmission as outlined in the "Transmission" section and remove the rear axle stands.

Install the floor plates and the front floor carpet or mat. Then install the starter motor and connect the battery cable.

Installation of Original Clutch Housing

COMMANDER Assemble the clutch housing on the engine; install all the retaining bolts, the exhaust pipe bracket, lock washers, and cap screws. Tighten the bolts evenly in sequence to assure correct assembly.

Install the rear engine support cross member, tighten the mounting bolts securely, and install both rear engine support insulators, spacers, washers, nuts, and cotter pins. Now remove the jack from the rear of the engine and tighten the exhaust pipe flange nuts and support bracket.

Connect the brake pedal return spring, the clutch linkage, and the parking brake cable (install all pins and cotter pins except the clutch adjusting clevis cotter pin). Then adjust the clutch as outlined in this section under "Clutch Pedal Travel Adjustment."

Install the transmission as outlined in the "Transmission" section and remove the rear axle stands.

Install the floor plates and the front floor carpet or mat. Then install the starter motor and connect the battery cable.

Clutch Release Shaft and Bearing, Operating Shaft and Support Bearing

CHAMPION AND COMMANDER The clutch release shaft rotates in bronze bushings which are provided with oilers.

The ball-type clutch release bearing is prelubricated and is equipped with a wear plate.

The outer end of the clutch operating shaft is supported by a special prelubricated bearing and bracket assembly.

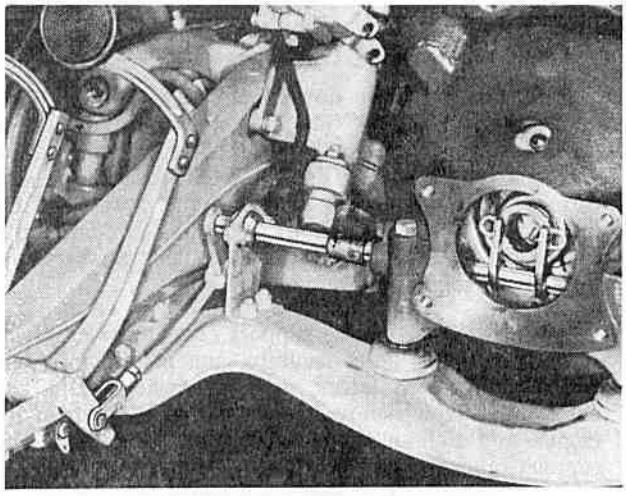


FIG. 80.—CLUTCH RELEASE MECHANISM

Clutch Pedal Travel Adjustment

CHAMPION AND COMMANDER The clutch pedal should have a minimum of 3/4" to 1" (19,05 mm. to 25,40 mm.) free travel before the resistance of the release mechanism is felt (see Fig. 81). To adjust the amount of free travel, unhook the pullback spring which is located on the outside of the frame, loosen the lock nut, and remove the cotter pin and clevis pin from the adjustable clevis at the rear end of the clutch pedal to operating shaft lever rod. Turn the clevis to the left or right, as required, until 3/4" to 1" (19,05 mm. to 25,40 mm.) free travel is obtained.

NOTE.—Champions before Serial No. G-217064 require from 1/2" to 3/4" (12,70 mm. to 19,05 mm.) free pedal travel.

After making the adjustment, reassemble the clevis (use a new cotter pin), tighten the lock nut, reinstall the pullback spring with the long hook forward, and check the hill holder adjustment.

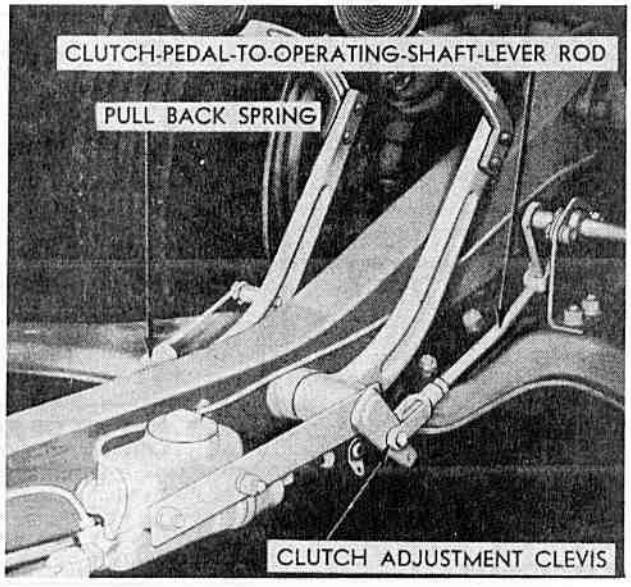


FIG. 81

CLUTCH DIAGNOSIS

ENGINE CLUTCH SLIPPING

CAUSES

1. Driver riding clutch pedal.
2. Insufficient or no clutch pedal lash.
3. Clutch release shaft tight in housing.
4. Weak or broken clutch pressure springs.
5. Grease or oil on clutch friction facings.
6. Badly worn or burned friction facings.
7. Friction facings improperly installed on clutch driven plate.
8. The use of incorrect type of friction facings.
9. Clutch toggle levers improperly adjusted.
10. Improper assembly of unit parts of clutch.

ENGINE CLUTCH GRABS OR CHATTERS DURING ENGAGEMENT

CAUSES

1. Loss of tension in clutch facing cushioning plates.
2. Use of incorrect type of clutch facings.
3. High spots on clutch friction facings.
4. Clutch friction facings coated with gum.
5. Clutch shifter shaft tight in housing.
6. Facings loose on driven plate.
7. Driven plate loose at hub.
8. Excessive lash in power transmitting units.
9. Clutch driven plate tight on transmission pinion shaft splines.

10. Clutch case or pressure plate assembly loose on flywheel.
11. Clutch pressure plate badly cracked or broken.
12. Incorrect assembly of unit parts of clutch.
13. Hill holder not properly adjusted.

ENGINE CLUTCH NOISES

DESCRIPTION

Engine clutch noises are usually encountered when the engine is idling. It is important that a noisy release bearing be correctly diagnosed, because a release bearing noise is somewhat similar to that produced by a worn transmission pinion bearing.

CAUSES

1. Clutch noisy when disengaged (pedal depressed).
   a) Clutch release bearing worn, dirty, damaged, or broken.
   b) Clutch release bearing binding in release shaft arms.
   c) Crankshaft clutch pilot bearing worn, damaged, broken, or inadequately lubricated.
   d) Clutch toggle levers improperly adjusted and bottoming against driven plate hub.
2. Clutch noisy when engaged (pedal released).
   a) Misalignment of transmission with engine assembly causing slight movement of clutch driven plate hub on hub insulator. (Noise noticeable with engine idling or at low road speeds.)
   b) Clutch driven plate hub loose on transmission pinion splines.
   c) Clutch driven plate dampener springs weak or broken.

ENGINE CLUTCH SPINNING (DRAGGING) WHEN DISENGAGED

CAUSES

1. Incorrect clutch pedal adjustment (too much pedal lash).
2. Incorrect release lever adjustment.
3. Warped or distorted clutch driven plate.
4. Clutch facing cushioning plates distorted.
5. High spots on friction facings.
6. Clutch driven plate facings incorrectly installed or loose.
7. Clutch driven plate hub tight on pinion shaft splines.
8. Rough, distorted, or burred pinion shaft splines.

ABNORMAL OR PREMATURE ENGINE CLUTCH FACING WEAR

CAUSES

1. Insufficient pedal lash.
2. Driver rides clutch pedal.
3. Driver slips clutch excessively during time of engagement.
4. Abnormal and unnecessary use of clutch.
5. Weak or broken clutch pressure plate springs.
6. Badly warped clutch pressure plate.
7. Use of incorrect type of friction facings.
8. Friction facings improperly installed.

ENGINE CLUTCH PEDAL PULSATION

DESCRIPTION

Clutch pedal pulsation has often been termed a nervous pedal. When a slight pressure is applied on the pedal when the engine is running, the pedal will vibrate or bounce with every revolution of the engine. As the pressure on the pedal is increased, the pulsation will cease.

CAUSES

1. Clutch toggle levers unevenly adjusted.
2. Clutch case sprung by improper installation.
3. Clutch release shaft arms not parallel.
4. Clutch release shaft bent.
5. Clutch pedal pullback spring missing or broken.
6. Severe case of misalignment between transmission and engine assembly.
7. Flywheel not properly seated on crankshaft flange.
8. Bent crankshaft flywheel flange.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

The water pump and fan assembly on the Champion and Commander models is mounted on the front of the cylinder block. A thermostat, located between the upper radiator hose and the cylinder block, restricts the flow of water to the radiator until the efficient operating temperature is reached. The water pumps, which are similar in design, have prelubricated shaft ball bearings and nonadjustable pump packings.

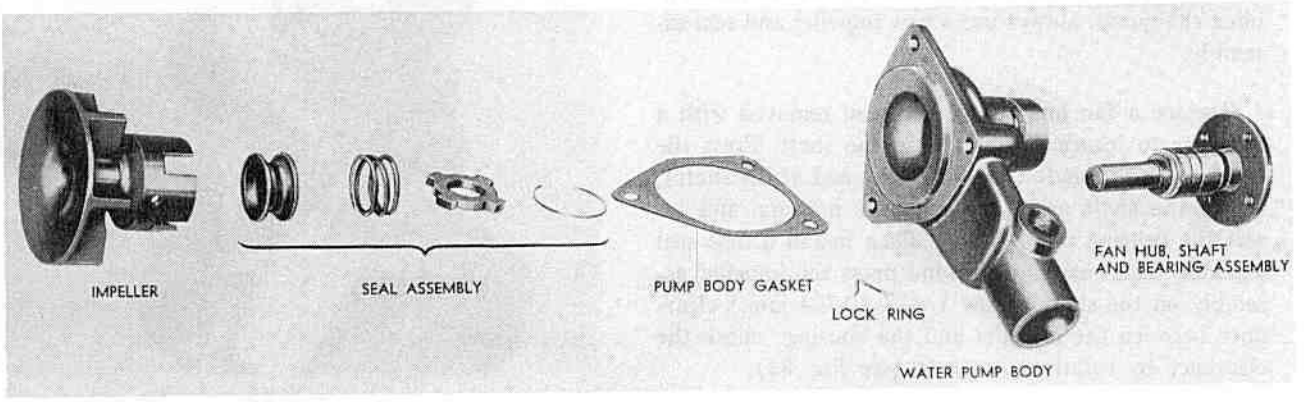


FIG. 82.—PARTS OF THE CHAMPION WATER PUMP

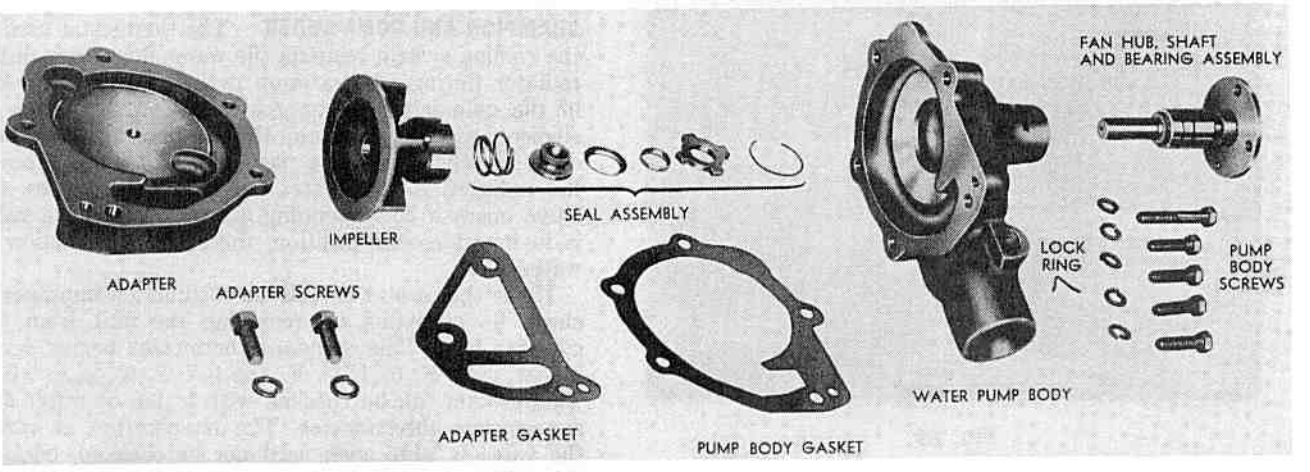


FIG. 83.—PARTS OF THE COMMANDER WATER PUMP

Water Pump and Fan Assembly

Removal

CHAMPION AND COMMANDER Drain the cooling system completely. Loosen the fan belt and remove the fan blades. Then disconnect the lower radiator hose at the pump connection and complete the removal of the assembly by removing the mounting cap screws.

Disassembly

CHAMPION AND COMMANDER The bearing lock ring must be removed before the water pump can be disassembled. The shaft and bearing assembly can then be pressed out of the water pump impeller and on out the front of the housing (see Fig. 84).

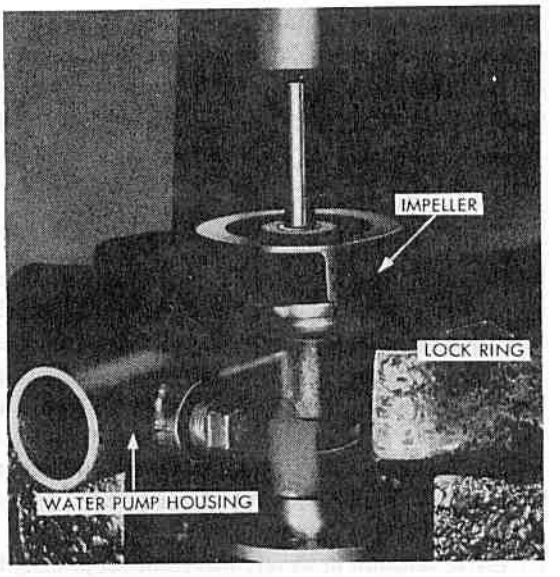


FIG. 84

Reassembly

CHAMPION AND COMMANDER Inspect the parts for damage or wear. If the thrust seal surface has become rough because of long usage, it should be refaced with the Water Pump Facing Tool J-1501. In reassembling the pump, always use a new impeller and seal assembly.

Replace a fan hub which has been removed with a new one to insure a tight fit on the shaft. Press the fan hub on the shaft (flush with the end of the shaft), install the shaft and bearing in the housing, and insert the bearing retainer clip. Then install a new seal assembly in a new impeller and press the impeller assembly on the shaft. Allow 1/32″ (0,794 mm.) clearance between the impeller and the housing; check the clearance by rotating the shaft (see Fig. 85).

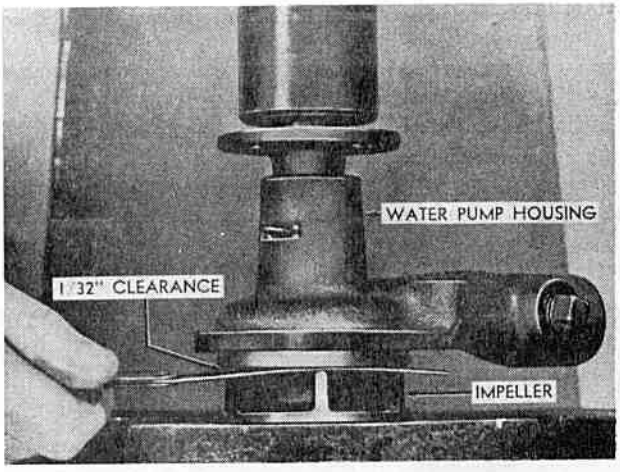


FIG. 85

Installation

CHAMPION AND COMMANDER Using new gaskets, install the water pump assembly on the engine. Then connect the lower radiator hose, refill the cooling system, and check the pump and hose connections for leaks.

Fan Belt Replacement and Adjustment

CHAMPION AND COMMANDER The fan belt should be adjusted until there is from 3/8″ to 1/2″ (9,525 mm. to 12,700 mm.) movement of the belt. To adjust the fan belt tension, loosen the generator adjusting arm lock bolt nut and the two lower support bolts and pry the generator outward (see Fig. 86). When the correct belt tension is obtained, tighten the two bolts and the adjusting arm lock bolt nut and recheck the belt adjustment. The fan belt should be kept reasonably tight. Excessive tension, however, will result in placing undue strain on the fan and generator bearings.

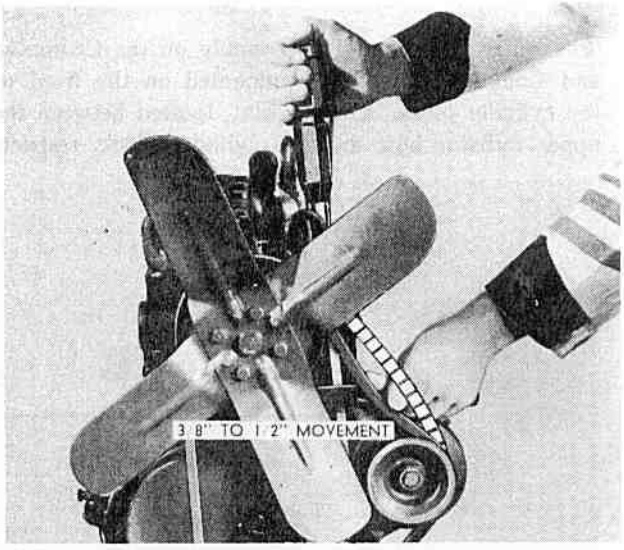


FIG. 86

Thermostat

CHAMPION AND COMMANDER The thermostat used in the cooling system restricts the water flow through the radiator during the warm-up period. When the water in the cylinder block approaches the temperature of efficient engine operation, the thermostat valve will open slightly to permit a partial flow of water through the radiator. As the water temperature increases, the valve opens a corresponding amount. When the valve is in its wide-open position, there is no restriction to water flow.

If the thermostat is believed to function improperly, check its operation by removing the unit from the cylinder head. The standard thermostat begins opening at 151° F. to 155° F. (66.12° C. to 68.33° C.). Thermostats can be checked with a pan of water and an accurate thermometer. The temperature at which the valve is wide open need not be checked, because this will automatically be correct if the start-to-open setting is correct.

When installing a thermostat, place the bellows end downward. An error in this respect will render the thermostat inoperative and cause severe overheating.

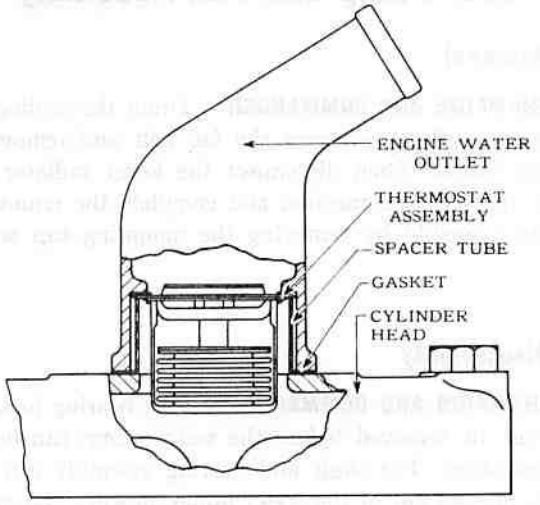


FIG. 87.—CONSTRUCTION OF THE THERMOSTAT

Draining the System

CHAMPION AND COMMANDER To drain the cooling system completely, drain the radiator, the block, the Climatizer, and the defroster (see Fig. 88).

Filling the System

CHAMPION AND COMMANDER After the cooling system has been drained and the engine has been permitted to cool, the thermostat valve will be closed. Although the thermostat is provided with a hole which acts as a vent when the system is refilled, the hole is necessarily very small to insure minimum water circulation through the radiator during the initial warm-up period. The cooling system should, therefore, be filled slowly.

If the system is filled too rapidly, the radiator upper tank will fill and a gurgling sound will be heard as the air escapes through the thermostat vent hole. Should this occur, continue to add fluid until the gurgling noise ceases, indicating that all the air has escaped. The engine should then be started and operated until the thermostat opens. If necessary, add sufficient fluid to bring the level in the radiator between two and three inches from the top of the filler pipe.

Cooling System Corrosion

CHAMPION AND COMMANDER Because lime and other minerals, which are usually present in many kinds of water, induce corrosion of metals, one pint of Studebaker Cooling System Rust Inhibitor or any other approved inhibitor should be added to the cooling system of every new car before delivery. This will help protect the metal components of the entire cooling system. The advisability, however, of seasonally flushing the system should not be disregarded.

Most of the permanent or treated alcohol type antifreeze compounds contain a satisfactory rust inhibitor. When one of these solutions is used, additional rust inhibitor is unnecessary.

Flushing the System

CHAMPION AND COMMANDER If a rust inhibitor is not used, it will be necessary to drain and flush the cooling system more frequently. The frequency of the flushing will depend on the local water conditions.

A cleaning solution, such as that available through our Parts and Accessories Division, should be used in connection with an approved radiator flusher. A radiator cleaner containing a strong caustic solution must not be used, as such a solution will have a detrimental effect on the cooling system.

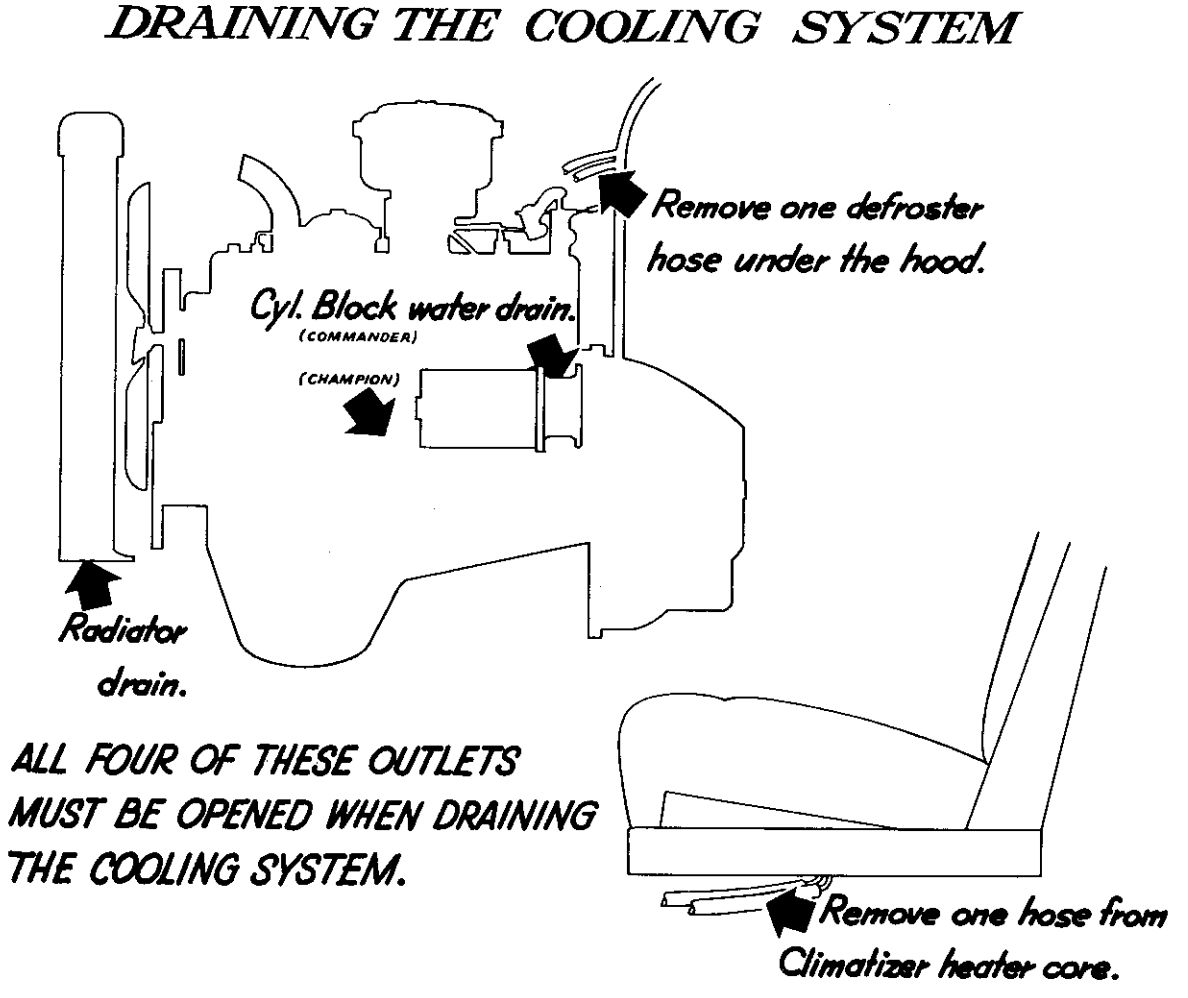


FIG. 88

Anti-Freeze Solution

CHAMPION AND COMMANDER To avoid the loss of expensive anti-freeze solutions, be sure that there is no leakage at either the hose connections or the cooling system gaskets. All alcohol anti-freeze solutions must be periodically tested, and a sufficient quantity of alcohol should be added in compensation for any loss that may have occurred through evaporation.

CAUTION.—Do not spill any alcoholic solution on the painted surfaces, because the alcohol may damage the finish.

The following tables indicate the correct quantity of the various anti-freeze solutions required for protection at the temperatures indicated:

Anti-Freeze Charts

CHAMPION

COOLING SYSTEM CAPACITY 10 U. S. Qts.; 8.35 Imp. Qts.; 9,46 Liters

Quantity of Anti-Freeze required for protection to temperatures indicated.

DEGREES		U. S. QUARTS					IMPERIAL QUARTS					METRIC LITERS				
F	C	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE
+20	− 6.7	2.0	2.0	2.0	2.5	3.5	1.7	1.7	1.7	2.1	2.9	1,9	1,9	1,9	2,4	3,3
+10	−12.2	3.0	3.0	3.0	3.5	5.0	2.5	2.5	2.5	2.9	4.2	2,8	2,8	2,8	3,3	4,7
0	−17.8	3.5	4.0	4.0	4.5	6.0	2.9	3.4	3.4	3.8	5.0	3,3	3,8	3,8	4,3	5,7
−10	−23.3	4.0	4.5	4.5	5.0	7.0	3.4	3.8	3.8	4.2	5.8	3,8	4,3	4,3	4,7	6,6
−20	−28.8	4.5	5.0	5.0	5.5	8.5	3.8	4.2	4.2	4.6	7.1	4,3	4,7	4,7	5,2	8,0
−30	−34.4	5.0	5.5	6.0	6.0	10.0	4.2	4.6	5.0	5.0	8.3	4,7	5,2	5,7	5,7	9,5
−40	−40.0	6.0		6.5	6.5		5.0		5.4	5.4		5,7		6,2	6,2	
−50	−45.5	6.5		7.5	7.0		5.4		6.3	5.8		6,2		7,1	6,6	

COMMANDER

COOLING SYSTEM CAPACITY 13.00 U. S. Qts.; 10.82 Imp. Qts.; 12,30 Liters

Quantity of Anti-Freeze required for protection to temperatures indicated.

DEGREES		U. S. QUARTS					IMPERIAL QUARTS					METRIC LITERS				
F	C	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE	PRESTONE	THERMO-ROYAL	DENATURED ALCOHOL	DISTILLED GLYCERINE	G. P. A. GLYCERINE
+20	− 6.7	2.0	2.5	2.5	3.0	4.5	1.7	2.1	2.1	2.5	3.8	1,9	2,4	2,4	2,8	4,3
+10	−12.2	3.5	4.0	4.0	4.5	6.0	2.9	3.4	3.4	3.8	5.0	3,3	3,8	3,8	4,3	5,7
0	−17.8	4.5	5.0	5.0	5.5	8.0	3.8	4.2	4.2	4.6	6.7	4,3	4,7	4,7	5,2	7,6
−10	−23.3	5.5	6.0	6.0	6.0	9.5	4.6	5.0	5.0	5.0	7.9	5,2	5,7	5,7	5,7	9,0
−20	−28.8	6.0	6.5	6.5	7.0	11.0	5.0	5.4	5.4	5.8	9.2	5,7	6,2	6,2	6,6	10,4
−30	−34.4	6.5	7.5	7.5	7.5	13.0	5.4	6.3	6.3	6.3	10.8	6,2	7,1	7,1	7,1	12,3
−40	−40.0	7.5		9.0	8.5		6.3		7.5	7.1		7,1		8,5	8,0	
−50	−45.5	8.5		10.0	9.0		7.1		8.3	7.5		8,0		9,5	8,5	

COOLING SYSTEM DIAGNOSIS

EXCESSIVE ENGINE TEMPERATURES

CAUSES

1. Ignition timing too late or too early.
2. Engine fan belt slipping.
3. Abnormal water loss from cooling system.
4. Radiator tubes restricted or clogged.
5. Radiator core surface restricted by grille covers, emblems, etc.
6. Radiator core covered with heavy paint or dirt accumulation.
7. Engine thermostat not opening properly.
8. Engine thermostat reversed when installed.
9. Deteriorated or collapsed water pump inlet hose.
10. Pump impeller loose on shaft.
11. Abnormal clearance of impeller in pump housing.
12. Abnormal sludge or dirt accumulation in radiator or water jacket of engine block.
13. Any condition that will result in preignition.
14. Spark modifier stuck and not advancing timing.
15. Restriction of water transfer holes in engine block or cylinder head.
16. Cylinder head gasket improperly installed.
17. Engine fan blades not set at proper pitch.
18. Foreign object, such as wooden plug in cylinder head, which floats and occasionally obstructs water circulation.
19. High frictional resistance in engine assembly resulting from:
    - *a)* Insufficient internal clearance.
    - *b)* Internal misalignment.
    - *c)* Use of heavy engine oil.
    - *d)* Insufficient oil circulation.
20. Dragging brakes.
21. Tight wheel bearings.
22. Abnormal frictional resistance in power transmitting units.
23. Use of too fast a rear axle gear ratio or oversize tires in mountainous areas.
24. Use of certain types of anti-freeze solutions in warm weather.
25. Clutch slipping.

WATER LOSS FROM COOLING SYSTEM

CAUSES

1. Radiator leaks.
2. Radiator or water pump hose leakage.
3. Cooling system drain plug or valve leakage.
4. Water pump leakage.
5. Cooling system gasket leakage.
6. Cylinder block or cylinder head cracked (leaking externally or internally).
7. Loose radiator upper tank baffle plate.
8. Combustion gases leaking into cooling system because of poor seal of cylinder head gasket due to faulty gasket or loose cylinder head cap screws.
9. Engine thermostat not functioning properly or operating without a thermostat.
10. Air leak occurring at water pump seal assembly (loss at high speed only).
11. Engine overheating resulting in water boiling and loss through overflow pipe.

WATER PUMP NOISES

DESCRIPTION

Water pump noises are rare and are often difficult to locate. A noisy water pump, however, can generally be detected by the use of a sounding rod against the water pump body. Water pump noises are usually indicated by a scraping sound, squeal, or bump.

CAUSES

1. Pulley loose on pump shaft.
2. Pump impeller loose on pump shaft.
3. Excessive end play of pump shaft.
4. Impeller blades rubbing water pump housing.
5. Impeller broken or pin sheared.

FAN NOISES

DESCRIPTION

Fan noises due to the condition of the fan belt are usually apparent by a squeak or squeal in the forward part of the engine when the engine is idling or when the engine is rapidly accelerated.

Fan noises have various characteristics but can generally be located when the engine is idling. Paragraphs *a)*, *b)*, and *d)* under Cause No. 1 will be indicated by a continuous squeak or squeal, while paragraph *a)* under Cause No. 2 will cause an intermittent thud. Paragraph *c)* under Cause No. 2 will cause a light metallic rattle at low speed with an uneven engine idle. The fan blades striking the radiator or fan belt will cause a decided scraping sound. Paragraphs *f)*, *g)*, and *h)* under Cause No. 2 will generally cause a whir or hum at the higher engine speeds.

CAUSES

1. Fan belt noises.
    - *a)* Belt adjusted too tight (squeak).
    - *b)* Belt adjusted too loose (squeak on acceleration).
    - *c)* Grease, rust, or foreign matter on fan belt or pulleys.
    - *d)* Incorrect type or make of fan belt.
    - *e)* Fan belt badly worn or burned.
    - *f)* Misalignment of fan belt pulleys.
2. Fan noises.
    - *a)* Excessive water pump shaft end play.
    - *b)* Fan blades loose on hub.
    - *c)* Crankshaft, generator, or fan pulleys cracked or distorted.
    - *d)* Fan hub loose and turning on shaft.
    - *e)* Fan blades striking fan belt or radiator.
    - *f)* Unbalanced fan blade assembly.
    - *g)* Uneven pitch of fan blades.
    - *h)* Bent or distorted fan blades.

PREMATURE FAN BELT BREAKAGE OR RAPID WEAR

CAUSES

1. Tight adjustment causing abnormal stretch.
2. Loose adjustment causing excessive slippage.
3. Use of incorrect type belt.
4. Oil on belt causing deterioration.
5. Misalignment of belt pulleys.
6. Belt striking or rubbing on fan blades.
7. Excessive friction in water pump or generator causing overload on belt.
8. Sustained high speeds.
9. Broken or rough fan pulley flanges.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

ELECTRICAL SYSTEM

Six to eight volt battery ignition systems with the positive pole grounded are used on the Champion and Commander models. High-output, shunt-wound generators with fully automatic current and voltage controls carry the increased loads imposed upon the battery by such equipment as radios, fan-driven heaters, cigar lighters, fog lamps, and other accessories. Both models are equipped with non-spill batteries on which caps and vents prevent overfilling.

The starter motor on each model is provided with a Bendix drive. Completely depressing the clutch pedal operates the starter switch which is located on the floorboard.

The ignition systems are protected against weather and shorting by the latest type of lacquered high tension cables. Distributor caps are thoroughly waterproofed, and the coils are located in high, protected positions.

Six-lobe cam distributors with single sets of breaker points are used on both models. They are the full automatic advance type equipped with vacuum spark modifiers.

Sealed beam head lamps with the light source, reflector, and lens in one sealed unit are used on both models.

Storage Battery

● A 100-ampere-hour battery is used on the Champion and Commander models and is located under the hood in a carrier fastened to the left fender. The clamp bolts and the terminals should be securely tightened at all times. Do not, however, tighten the clamp bolts sufficiently to crack the battery case. Cover the terminals liberally with vaseline to prevent corrosion.

When a new car is received by the dealer, the battery is ordinarily sufficiently charged. If the car is placed in storage for over thirty days before being sold, the battery should be checked and recharged if necessary.

Under ordinary operating conditions, the battery should be checked at 1,000 mile (1.609 km.) intervals as follows:

1. Check the specific gravity of the battery solution for the state of charge.
2. See that the level of the battery solution is at the proper height.
3. See that the battery terminals are clean and tight.

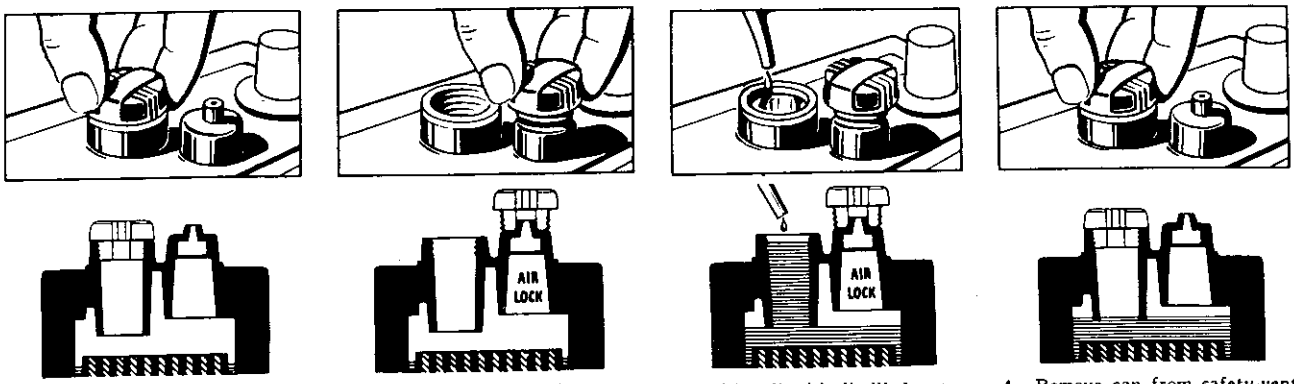
Fully charged cells should read between 1.280 and 1.300. In order to prevent freezing in cold weather, test the battery frequently to make sure the gravity is kept as near 1.280 as possible. A discharged battery will freeze at a little below the freezing point of water.

When a new car is sold, the battery should be registered at the nearest Willard Battery service station so that the owner may receive the benefits of the Willard 90-day insurance policy. A service card on which the registration date can be written should also be obtained. The Willard Storage Battery Company insures every new Willard battery for 90 days from date of purchase provided the battery is registered immediately upon sale of the car at the nearest Willard service station. If any repairs are necessary, they will be made without charge. Recharging, however, is not considered repairing, and the owner is expected to pay for this service.

Filling the Battery

CHAMPION AND COMMANDER When adding distilled water, unscrew the filler well cap and force it on the safety-fill vent which is adjacent to the filler hole. This will form an air-lock in the cell. Then take a hydrometer reading and return the solution to the cell, discarding any excess. If necessary, add distilled water until the water level is near the top of the filler well opening. After filling, remove the cap from the vent and replace it in the filler hole. Removal of the cap from the vent will allow the solution in the battery to seek its proper level.

The accompanying illustrated steps show the operation of the air-lock in preventing overfilling of the battery.



1. Remove filler-cap.
2. Place cap on safety-vent forming air lock in breather-chamber.
3. Fill well with distilled water. Air lock prevents solution rising above bottom of well.
4. Remove cap from safety-vent and solution drops to correct level. Replace cap in filler hole.

FIG. 89

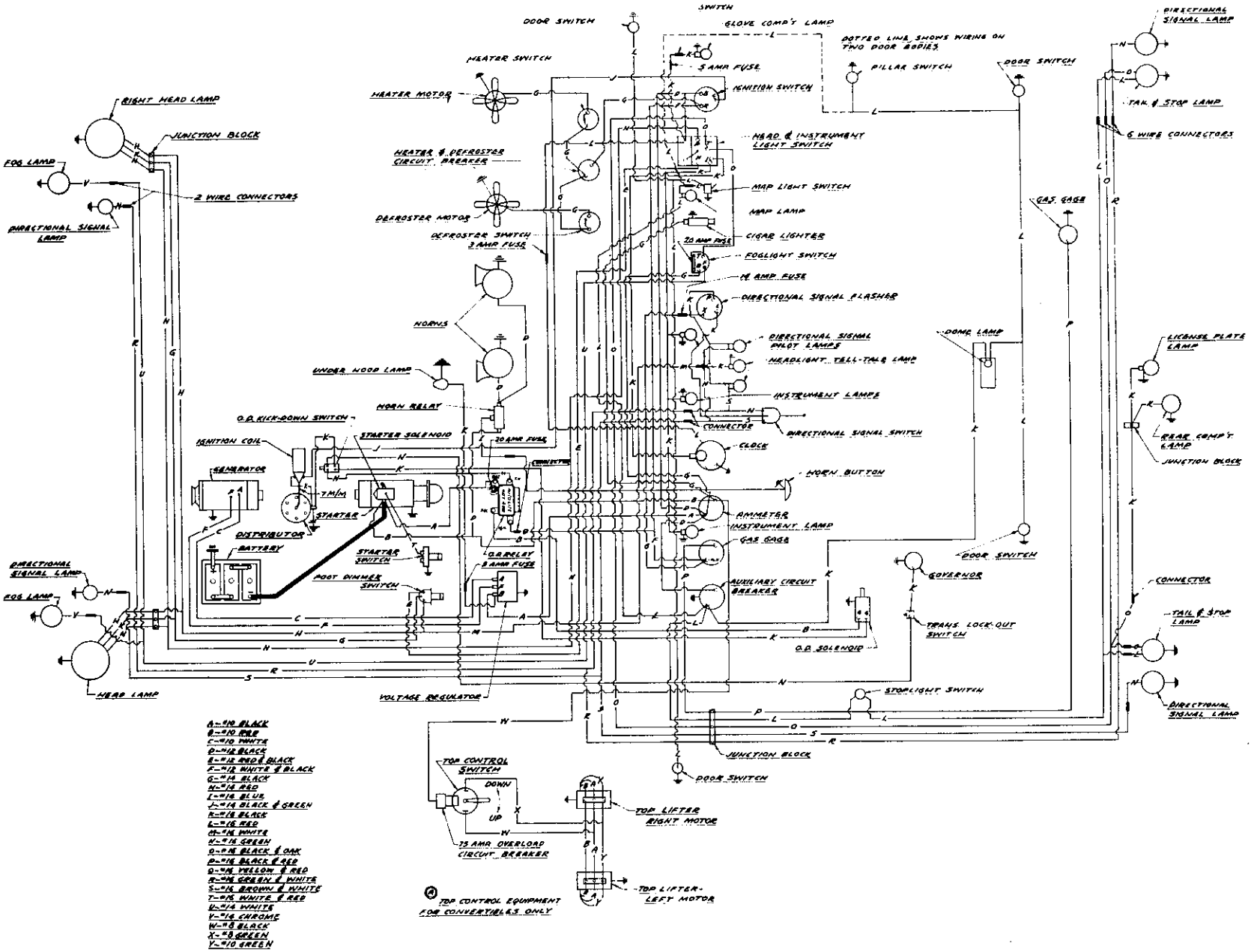


FIG. 90.—WIRING DIAGRAM OF CHAMPION AND COMMANDER ELECTRICAL SYSTEM

Generator

CHAMPION AND COMMANDER High-output, full-current and voltage-controlled, shunt-wound generators are mounted on the left front corner of both engines. Each generator is air-cooled by a fan at the forward end, so that the best operating temperature is maintained and the danger of overheating under a normal load is eliminated.

Commutators which become dirty or discolored should be polished with 00 sand paper. If the commutator is rough or worn so that the mica surface and the copper bars are nearly even, the commutator should be trued and the mica undercut. The generator brushes should be examined periodically and worn brushes should be replaced. The operation of the generator, which can be checked with a calibrated voltmeter and ammeter, should conform to the curve shown in figure 94.

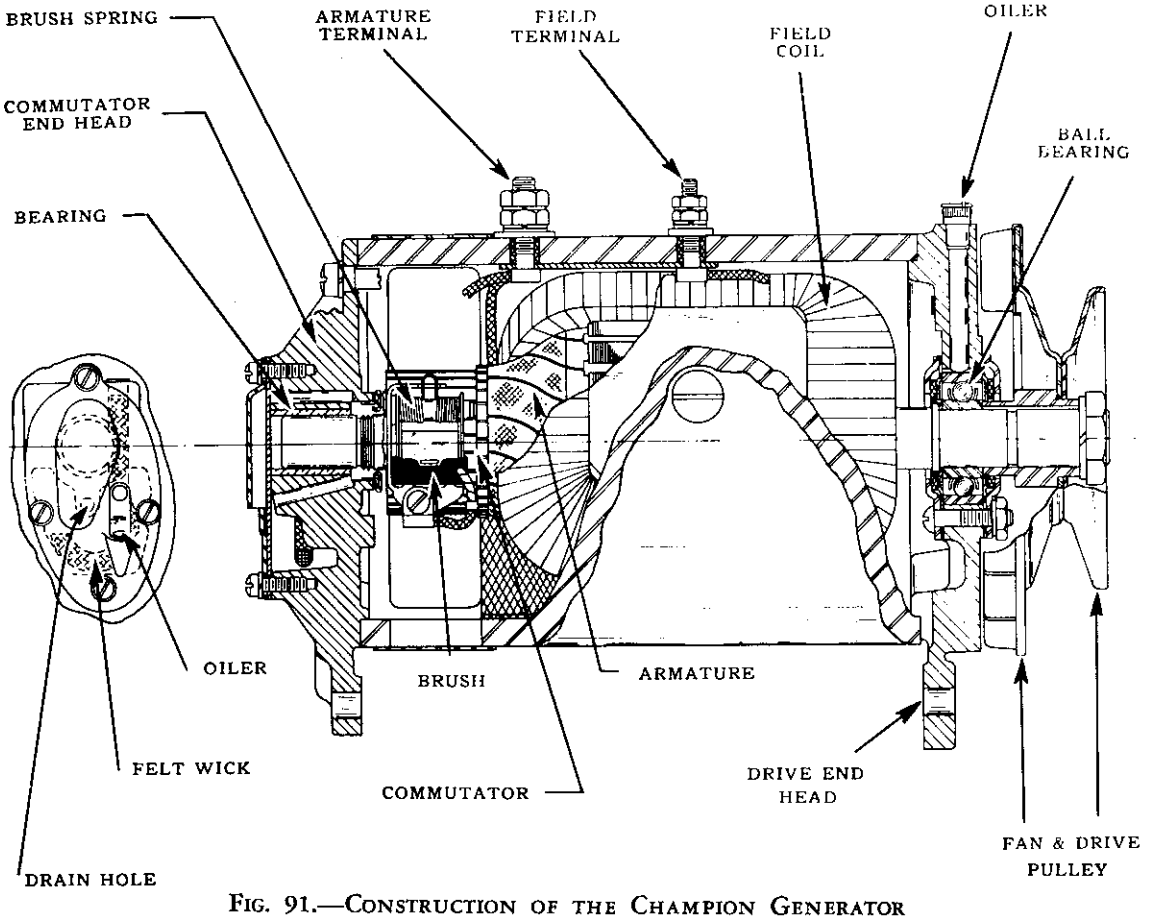


FIG. 91.—CONSTRUCTION OF THE CHAMPION GENERATOR

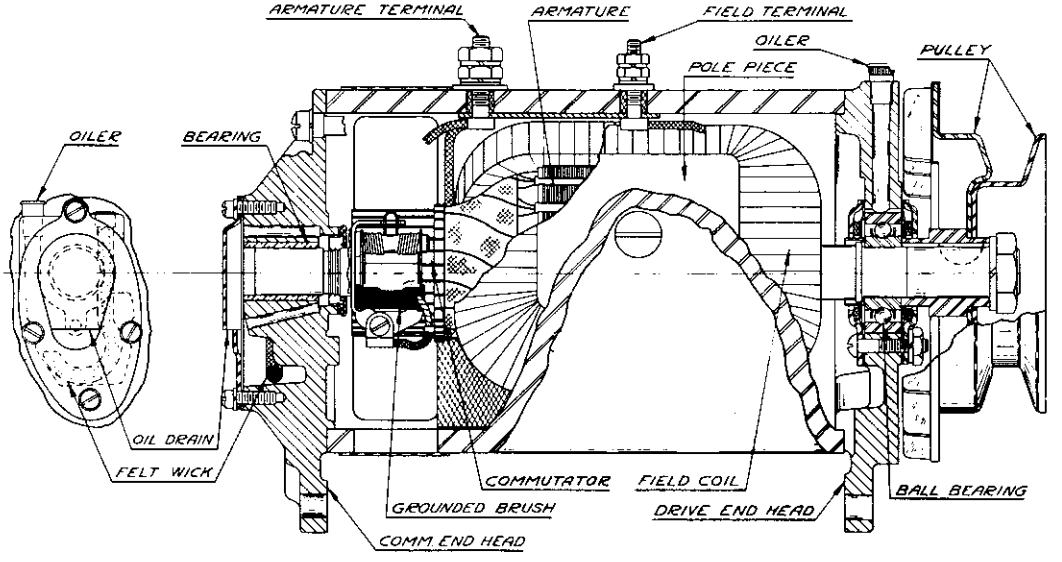


FIG. 92.—CONSTRUCTION OF THE COMMANDER GENERATOR

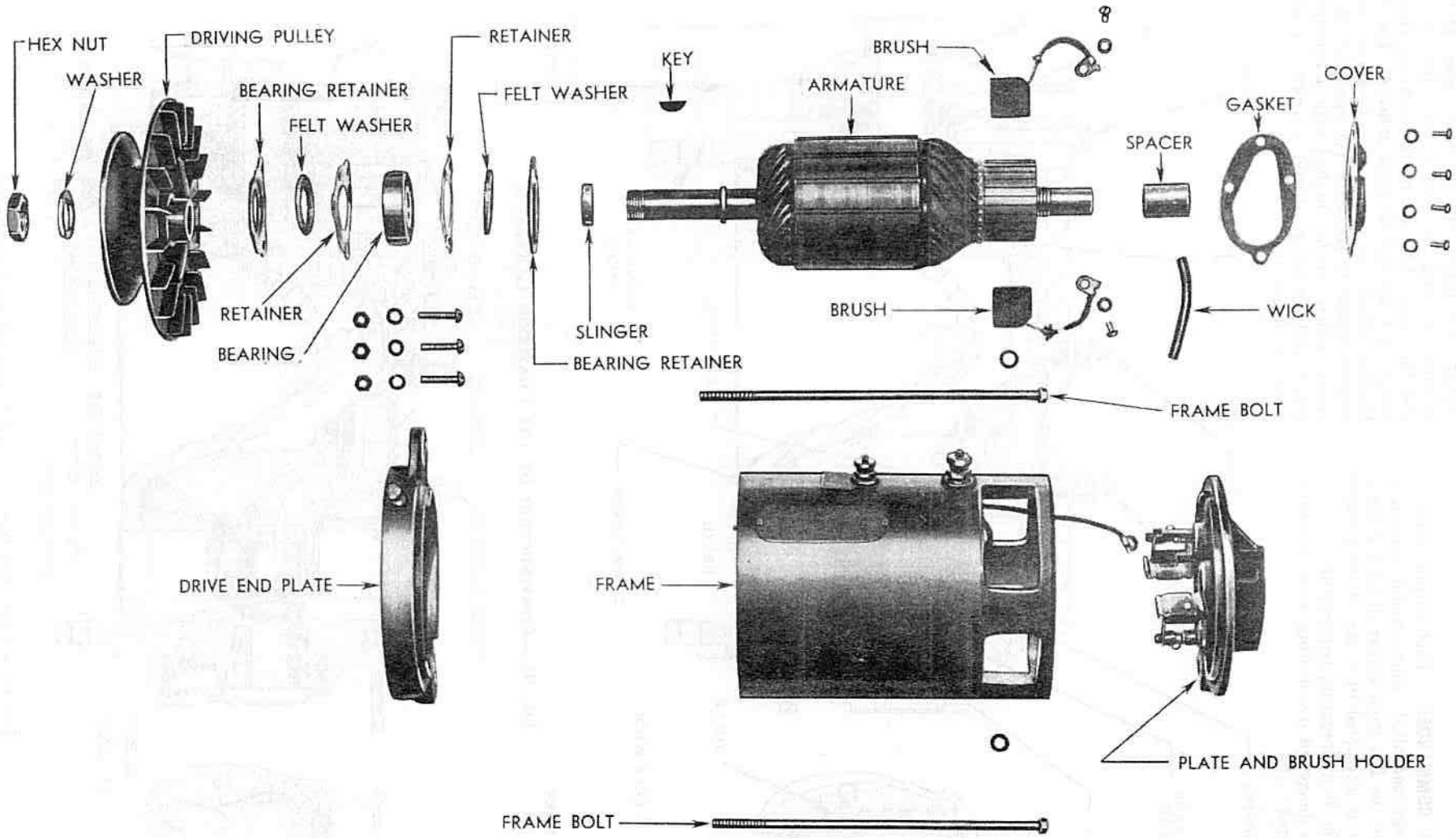


FIG. 93.—PARTS OF THE CHAMPION AND COMMANDER GENERATOR

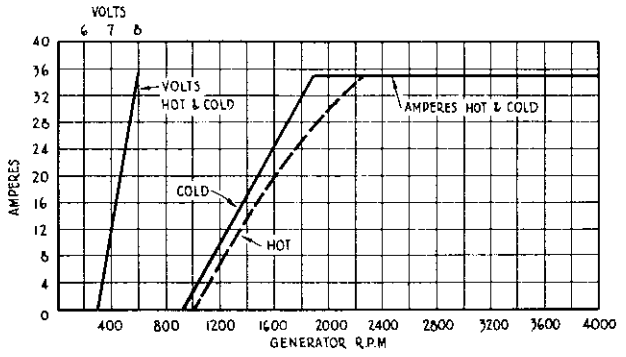


FIG. 94

Current and Voltage Regulators

CHAMPION AND COMMANDER The current and voltage regulator consists of a cut-out relay, a current regulator, and a voltage regulator. The unit automatically keeps the battery fully charged but prevents overcharging or excessive voltages which might result in damage to the various electrical units.

The function of the cut-out relay is to connect the battery to the generator when the car is in operation (generator charging) and to disconnect the battery from the generator when the engine is not running.

The current regulator unit limits the maximum amperage output of the generator. When the generator output reaches its predetermined maximum, the regulator points open, cutting in a resistance in the generator field circuit which reduces the output. When the output drops, the points close immediately. This in turn cuts out the resistance, and the output again rises. These cycles occur so rapidly that the points, vibrating at a high frequency, hold the output constant at its predetermined maximum.

The voltage regulator protects the battery by holding the voltage of the electrical system within predetermined limits. The operation of this unit is similar to that of the current regulator and depends on the state of charge in the battery.

To test the regulator assembly, connect an accurate ammeter with heavy, short leads between the regulator B terminal and the lead removed from this terminal, and connect an accurate voltmeter across the regulator B terminal and a ground (see Fig. 95).

Check the battery to see that it is fully charged (specific gravity at least 1.250). If the battery is not fully charged, replace it for the duration of the test with a fully charged one.

Start the engine and set it at a speed equal to approximately 30 miles (48,3 km.) per hour in high gear.

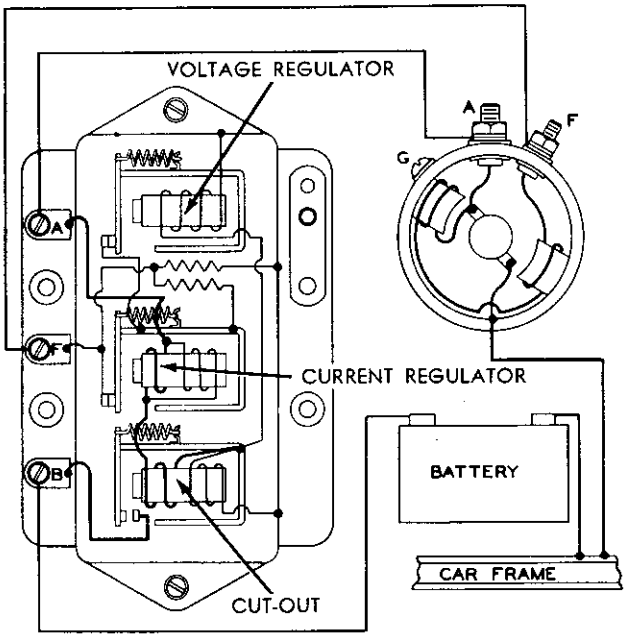


FIG. 95

Run the engine for several minutes or until the voltage remains constant before taking any meter readings. The voltmeter should register between 7.20 and 7.50 volts at room temperature (approximately 70° F. [21° C.]). If the readings are within these limits, the voltage regulator unit is functioning correctly. Use the battery voltage chart when checking the operation of the voltage regulators in both models (see Fig. 96).

To test the current regulator, use the same connections as already noted for both the ammeter and voltmeter. Add an electrical load of a current value in excess of 33 amperes (by turning on lights, radio, heater, or inserting a suitable resistance) at a point between the car ammeter and the battery. If the current regulator is functioning properly, the test ammeter will show a reading from 33 to 35 amperes. Since the regulator seal should not be broken, any regulator which has been proved inoperative by the preceding procedure should be referred to an official Auto-Lite service station.

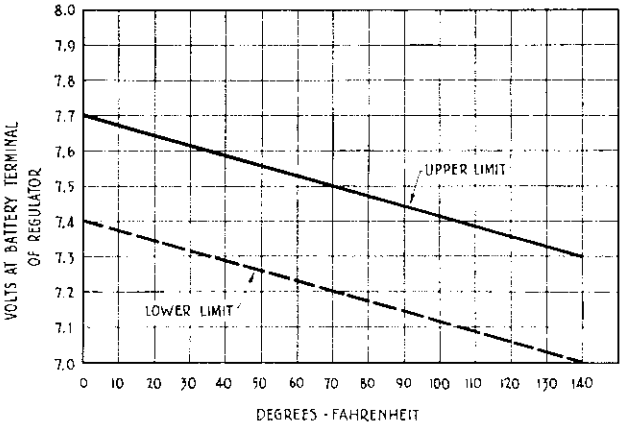


FIG. 96

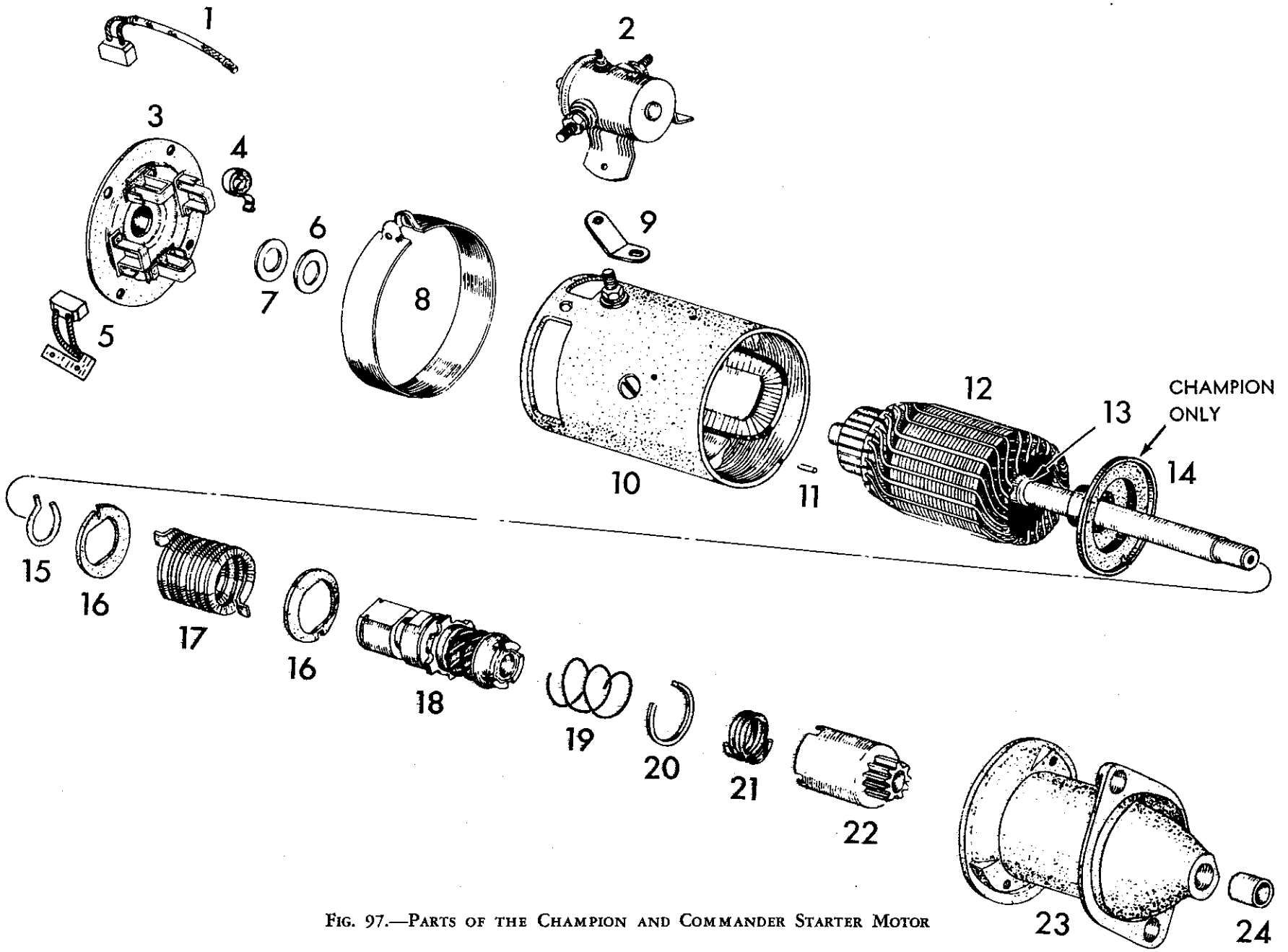


FIG. 97.—PARTS OF THE CHAMPION AND COMMANDER STARTER MOTOR

Starter Motor

CHAMPION AND COMMANDER The starter motor is equipped with a Bendix drive. Depressing the clutch pedal operates the starter switch located on the floorboard. When the starter switch is operated, the solenoid switch on the starter motor is energized and the circuit to the starter motor is then closed.

Periodic inspection of the motor and brushes and frequent tightening and lubrication of the terminals are the only requirements for normal starter motor operation.

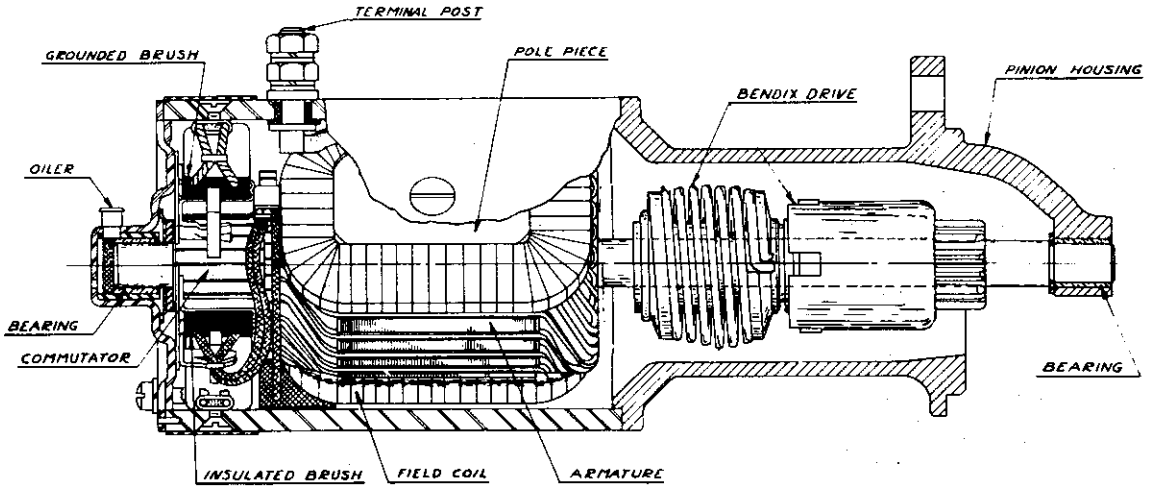


FIG. 98.—CONSTRUCTION OF THE COMMANDER STARTER MOTOR

KEY TO PARTS OF STARTER MOTOR (FIG. 97)

1. FIELD END BRUSH
2. STARTER SWITCH
3. COMMUTATOR END PLATE
4. STARTER MOTOR BRUSH SPRING
5. STARTER MOTOR GROUNDED BRUSH
6. ARMATURE SPACER
7. ARMATURE THRUST WASHER
8. COMMUTATOR SHIELD
9. STARTER SWITCH TO MOTOR CONNECTOR
10. STARTER MOTOR CASE
11. DOWEL PIN
12. STARTER MOTOR ARMATURE
13. THRUST WASHER
14. INTERMEDIATE BEARING (CHAMPION ONLY)
15. LOCK RING
16. BENDIX DRIVE SPRING PLATE
17. BENDIX DRIVE SPRING
18. BENDIX DRIVE SCREW SHAFT
19. SPRING
20. LOCK RING
21. SPRING
22. PINION AND BARREL
23. HOUSING WITH BUSHING
24. BUSHING

Circuit Breakers and Fuses

CHAMPION AND COMMANDER Tension circuit breakers used in the electrical system are designed to open the electrical circuit intermittently when a short or overload occurs. After a short interval, the breaker will again close to complete the circuit. If, however, the current flow is still excessive, the breaker will continue to open and close the circuit until the trouble is located and corrected.

One 30-ampere circuit breaker is located on the back of the main lighting switch and protects the circuit which includes the head lamps, parking lamps, tail lamps, and instrument panel lamps.

The second circuit breaker, a 15-ampere unit, is located behind the instrument panel on the left side. This unit protects the body lamps and the stop lamps.

NOTE.—On cars having right-hand control, the circuit breaker is on the right side of the instrument panel.

A third circuit breaker, a 15-ampere unit used with the Climatizer and defroster installations, is located on the back of the Thermo-Control panel.

All other accessory circuits are protected by auxiliary fuses. The following table lists the fuses required for the various electrical accessories.

Fog lamps	— 20 ampere
Overdrive solenoid relay	— 20 ampere
Directional signals	— 14 ampere
Radio	— 14 ampere
Instrument board compartment lamp	— 5 ampere
Under-hood lamp	— 5 ampere
Clock	— 3 ampere

Ignition System

DISTRIBUTOR ASSEMBLY

● Six-lobe cam distributors with a single set of breaker points are used on both models. These distributors are the full automatic advance type provided with vacuum spark modifiers.

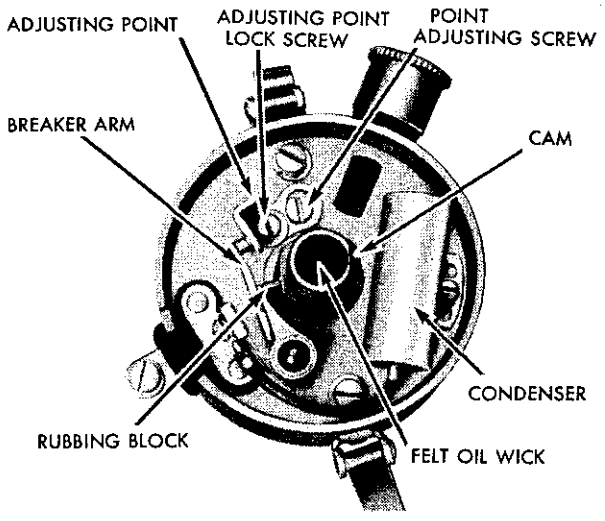


FIG. 99.—CHAMPION AND COMMANDER DISTRIBUTOR

Removal

CHAMPION AND COMMANDER The distributor and oil pumps on all models are driven as a unit by the camshaft. To remove the distributor, remove the cap, disconnect the primary wire, and loosen the bolt in the distributor clamp arm. The distributor driveshaft is so constructed that, if the distributor is removed, it can be installed only in its original position.

Inspection

CHAMPION AND COMMANDER Whenever any work is performed on the distributor, the breaker arm tension should be checked. A pull of from 17 to 20 ounces (0,4819 to 0,5670 kgs.) should be required to open the points. Make adjustments by shifting the breaker point arm spring at its point of attachment to the distributor plate bracket (see Fig. 100).

Examine the points to make sure that they are contacting each other squarely. If they are not, use Distributor Point Aligning Tool No. 38 to align the points.

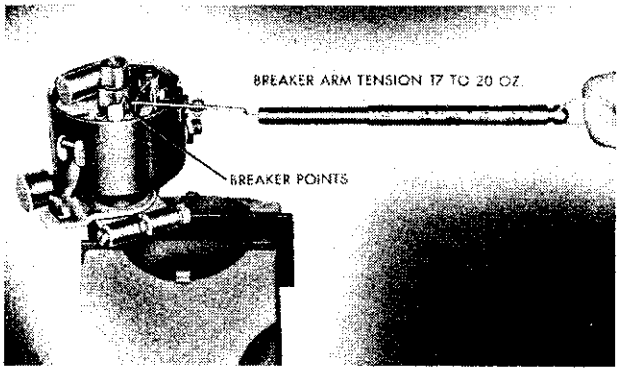


FIG. 100

Adjusting and Testing

CHAMPION AND COMMANDER The distributor breaker point gap should be set at .020" (0,51 mm.). To space the points, loosen the adjusting point lock screw and place the breaker arm bumper block on a high point of the cam. Turn the point adjusting screw to bring the points up to the proper spacing. Then tighten the lock nut and again check the spacing.

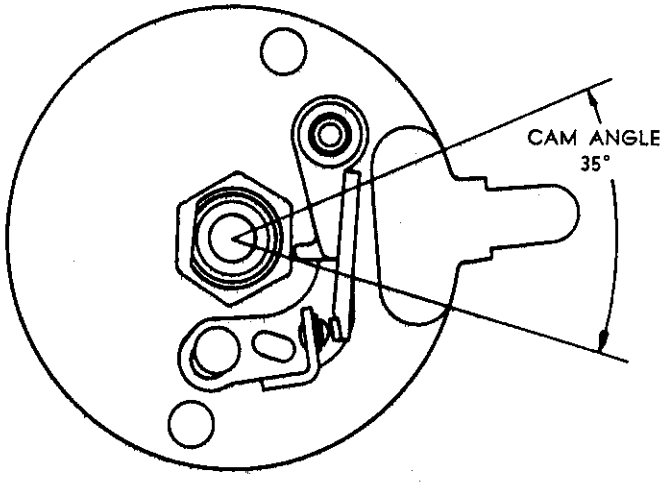


FIG. 101

Cam angle is defined as the rotation of the distributor cam in degrees during which the distributor points are closed. The cam angle on both models is 35°. (See Fig. 101.)

If possible, the distributor should be checked on an approved electrical analyzer. Follow the procedure for the proper model in the instruction book provided with the analyzer. Any approved analyzer will, when used according to the manufacturer's directions, check the condenser, breaker points, automatic or centrifugal advance, vacuum advance, and cam angle. The readings obtained from these tests should come within the tolerances set up in figures 102, 103, 104, and 105.

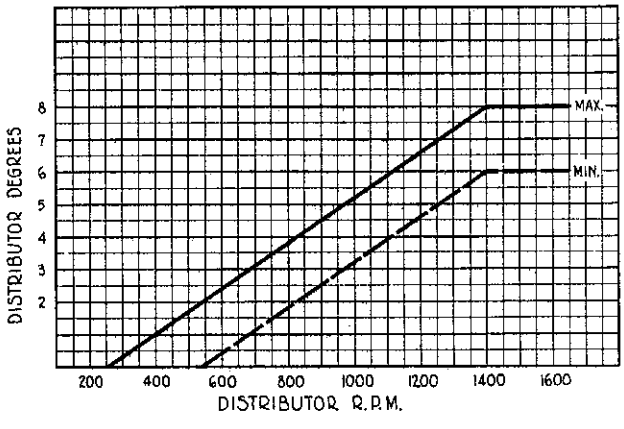


FIG. 102.—SPARK ADVANCE CURVE 6G

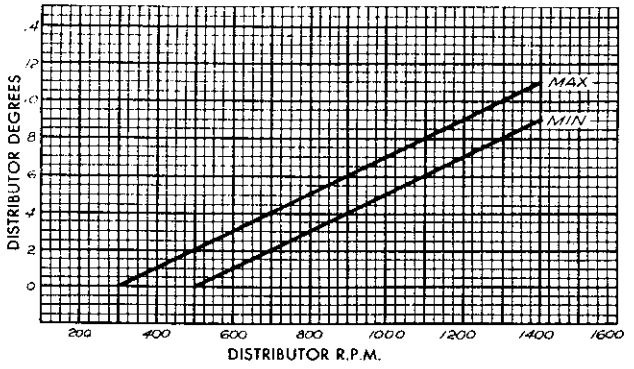


FIG. 103.—SPARK ADVANCE CURVE 14A

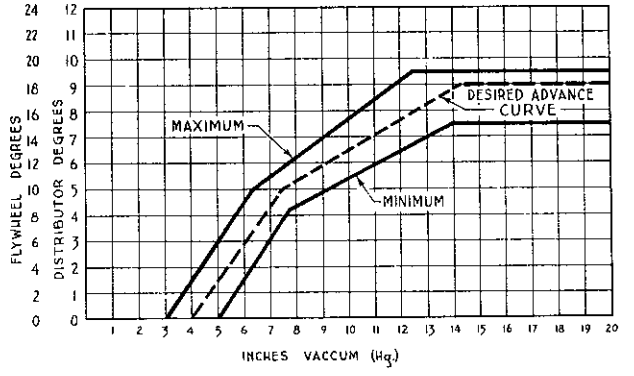


FIG. 104.—VACUUM ADVANCE CURVE 6G

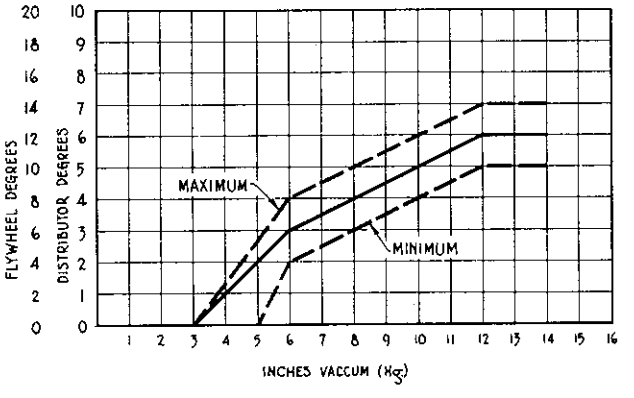


FIG. 105.—VACUUM ADVANCE CURVE 14A

Installation and Timing

CHAMPION AND COMMANDER To obtain the correct ignition timing, be sure that the oil pump shaft tongue which drives the distributor is assembled properly. This tongue can be seen by looking down the distributor shaft hole. Figure 106 illustrates the correct position of the oil pump shaft tongue with the No. 1 piston in its firing position.

Before tightening the distributor clamp arm, insert a .020" (0,51 mm.) feeler between the modifier control arm and the clamp. This will be sufficient clearance to prevent binding during operation.

The spark on the Champion and Commander is timed with the ignition (IGN) mark on the vibration

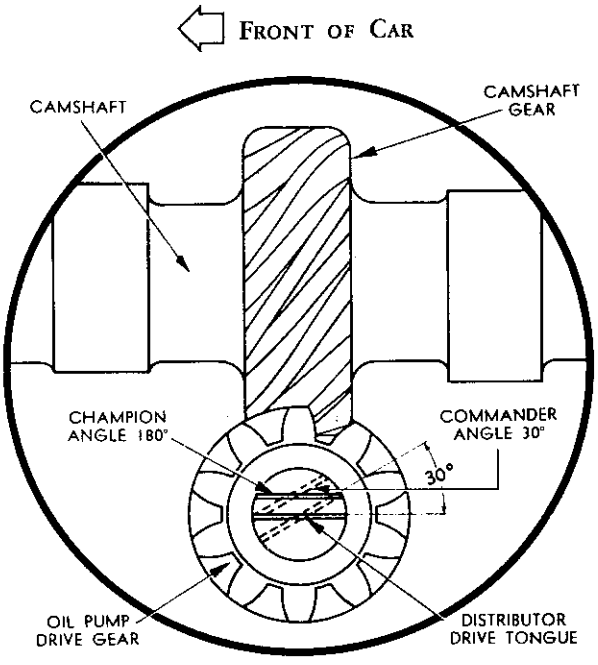


FIG. 106.—OIL PUMP TONGUE POSITIONS 6A AND 14A

damper flywheel directly under the timing pointer on the timing gear cover (see Fig. 107). With the timing mark in the correct position, the breaker points should just have started to break. If they have not, the distributor arm clamp bolt should be loosened and the distributor rotated until the points have just broken. Use an accredited neon timing light, hooked up in series with the No. 1 spark plug, for checking the timing. With the engine running at idle speed, the light should show the ignition (IGN) mark in the correct position. The firing order for both models is 1-5-3-6-2-4.

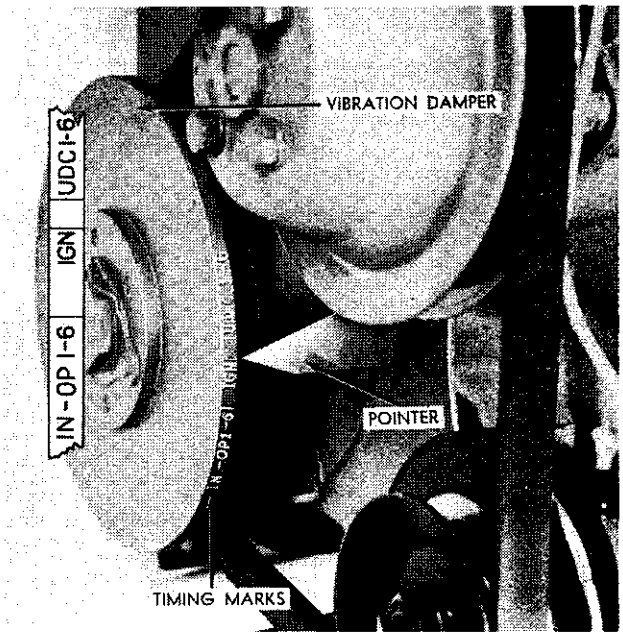


FIG. 107

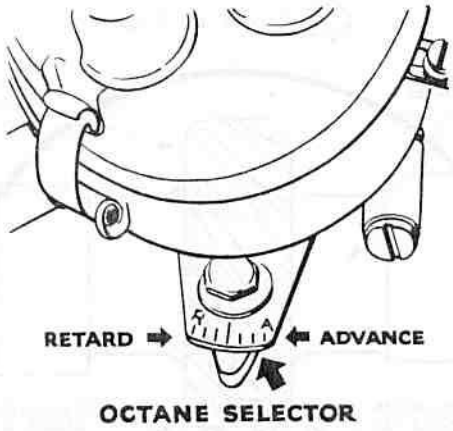


FIG. 108

The octane selector is the device by which the ignition timing may be adjusted to conform to the octane rating of the gasoline being used (see Fig. 108). The ignition should be timed with the pointer centered. After the ignition has been timed correctly, adjust the selector until the motor "pings" when the engine is hot and pulling hard. Then retard the selector until the "ping" just disappears.

IGNITION COIL

CHAMPION AND COMMANDER The ignition coil is located above the distributor and under the spark plug cable bracket. A clamp fastens the coil to the throttle control bell crank bracket. The bell crank bracket is secured to the cylinder head by two cylinder head cap screws.

SPARK PLUGS

CHAMPION AND COMMANDER Maximum engine efficiency requires that the spark plugs be in excellent condition. Champion J9 or J7 (14 mm.) spark plugs are used in both models. (The J7 spark plug is identical with the J9 plug formerly used.) Spark plugs should be cleaned and respaced at 5,000 mile (8.046 km.) intervals. An electrode gap of .025" (0,64 mm.) is recommended. It is preferred that this gap be checked with a wire gage (see Fig. 109). After cleaning and respacing, test the spark plugs under pressure. For peak engine efficiency, spark plugs should be replaced every 10,000 miles (16.090 km.).

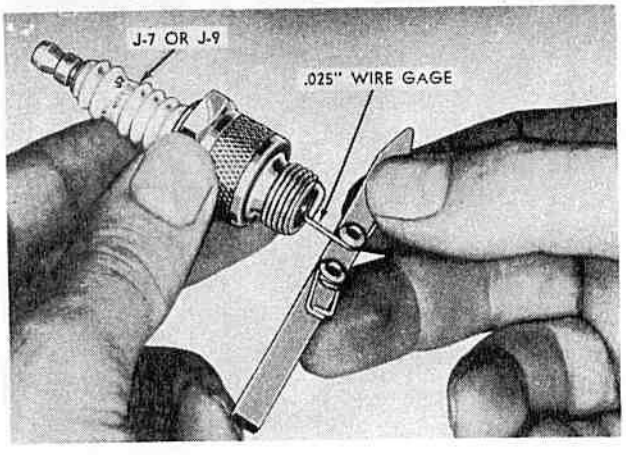


FIG. 109

Horn Adjustment

CHAMPION AND COMMANDER Adjustment of the air-tone horn consists of barely loosening the adjusting lock nut and turning the adjusting nut until the proper tone is obtained (see Fig. 110).

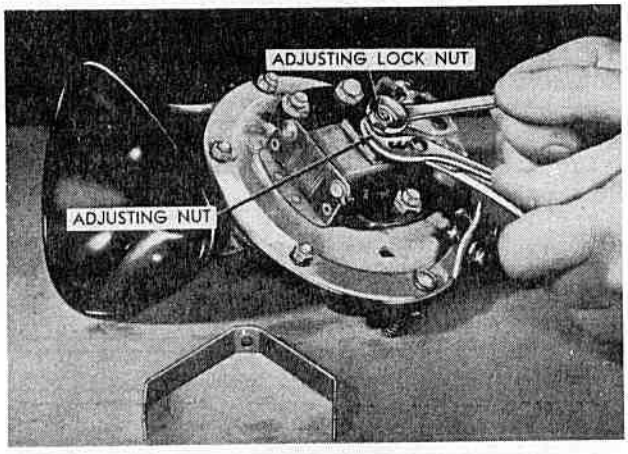


FIG. 110

Horn Ring and Button

(Regal Deluxe Steering Wheel)

● The horn circuit is completed by contact between the horn ring and the metal plate on the steering wheel. This clearance is controlled by a sponge rubber pad. The following directions will simplify the removal and installation of the newly designed horn ring and button.

Removal

CHAMPION AND COMMANDER Remove the button from the steering wheel. It may be necessary to insert a screw driver or similar tool in the recess on the outside edge of the button above the horn ring to force the button up and out. Remove the three screws from the horn ring and lift it off the steering wheel. Then remove the sponge rubber pad and the three fiber spacers.

Installation

CHAMPION AND COMMANDER Install the three fiber spacers in the sponge rubber pad and place the pad with spacers on the steering wheel. Place the horn ring on the sponge rubber pad, insert the three screws, and tighten them securely.

The rubber lock ring must be installed in the recess on the horn button and lightly coated with soapy water. Then place the lower side of the button in the opening in the horn ring and force the button into place.

NOTE.—If the rubber lock ring has been stretched or damaged, it will have to be replaced before a satisfactory lock will be obtained.

Head Lamps

● Sealed beam head lamps are used on both the Champion and Commander models. These lamps are so designed that the light source, the reflector, and the lens are all assembled in one sealed unit. When the filament burns out or the lens breaks, the entire unit must be replaced. This assures maximum lighting efficiency throughout the entire life of the car.

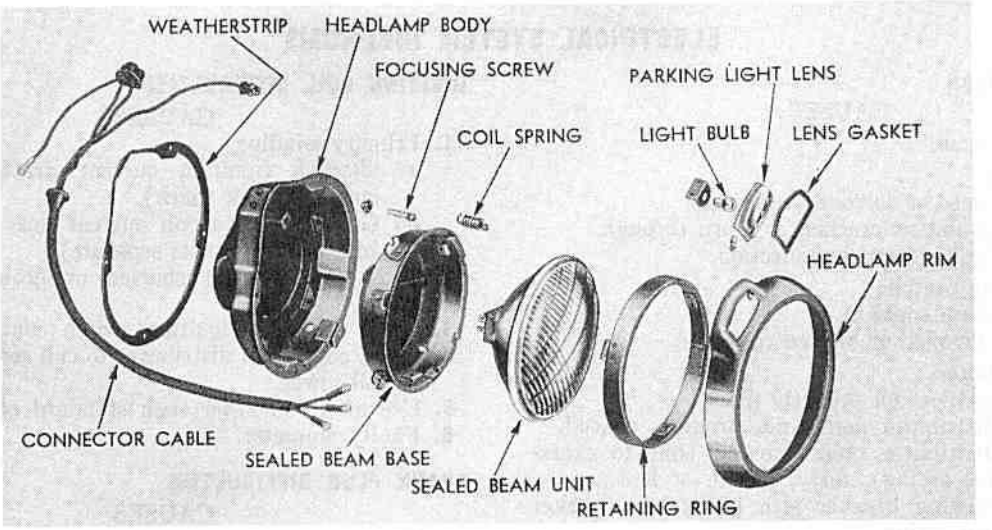


FIG. 111.—PARTS OF THE CHAMPION HEAD LAMP

Sealed Beam Replacement

CHAMPION AND COMMANDER Remove the head lamp rim and loosen the three screws in order to remove the sealed beam unit retaining ring (see Fig. 113). Remove the unit retaining ring, taking care that the unit does not fall. Then pull the unit carefully outward and disconnect it by pulling off the socket.

When installing a new sealed beam unit, be sure that the socket is connected securely and that all retaining screws are tight.

Adjustment

CHAMPION AND COMMANDER To adjust the head lamps, use either an adjusting screen or a head lamp tester. The screw at the top of the head lamp body controls the vertical adjustment of the head lamp beam, whereas the screw at the left of the head lamp body controls the horizontal adjustment of the beam (see Fig. 114).

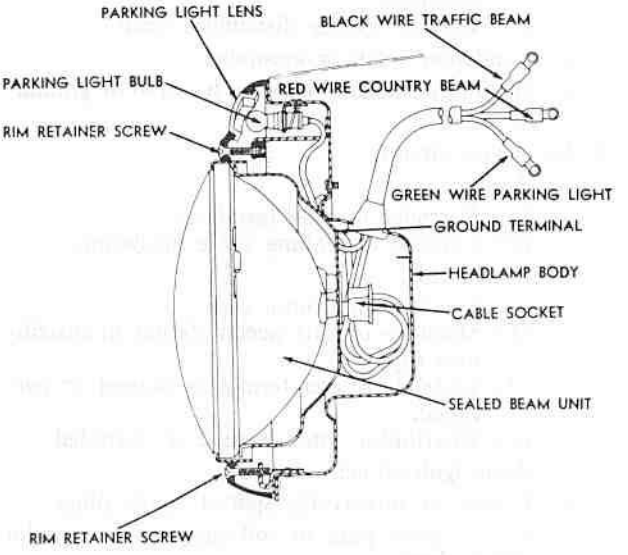


FIG. 112.—CONSTRUCTION OF THE CHAMPION HEAD LAMP

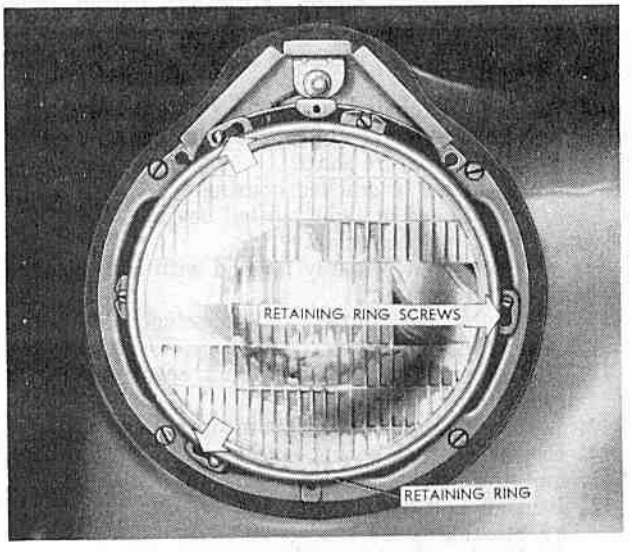


FIG. 113

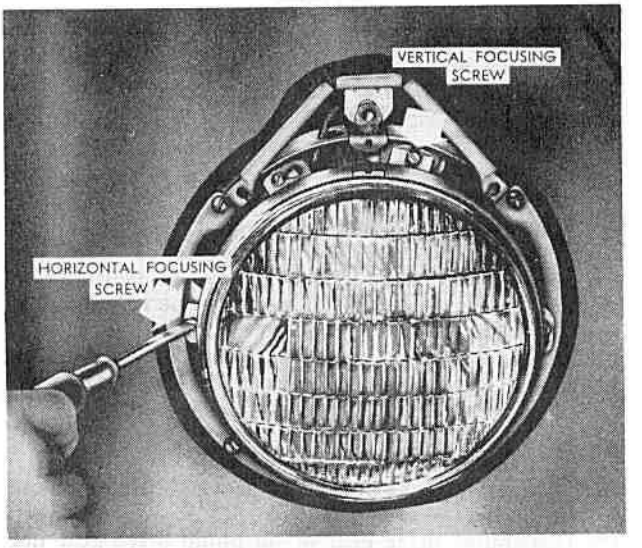


FIG. 114

ELECTRICAL SYSTEM DIAGNOSIS

FAULTY IGNITION

CAUSES

1. Primary circuit.
   - *a)* Wiring.
     - (1) Loose or corroded terminals.
     - (2) Insulation cracked or worn through.
     - (3) Faulty ground connection.
   - *b)* Ignition switch.
     - (1) Loose contacts.
     - (2) Corroded or burned contacts.
   - *c)* Distributor.
     - (1) Ignition not properly timed.
     - (2) Distributor points not properly spaced.
     - (3) Distributor points coated (due to excessive arcing), dirty, pitted, or loose.
     - (4) Sticking breaker arm or broken breaker arm spring.
     - (5) Low cam lobe.
     - (6) Excessive clearance of distributor shaft bushings.
     - (7) Bent or sprung distributor shaft.
   - *d)* Condenser weak or grounded.
   - *e)* Overdrive solenoid improperly wired or grounded.
2. Secondary circuit.
   - *a)* Wiring.
     - (1) Corroded or loose terminals.
     - (2) Cracked or leaking cable insulation.
   - *b)* Distributor.
     - (1) Cracked distributor cap.
     - (2) Moisture or dirt accumulation in distributor cap.
     - (3) Distributor cap terminals burned or corroded.
     - (4) Distributor rotor burned or corroded.
   - *c)* Weak ignition coil.
   - *d)* Faulty or incorrectly spaced spark plugs.
   - *e)* Use of spark plug to coil suppressor on radio installations.

DISTRIBUTOR — INCORRECTLY ADJUSTED OR DAMAGED

CAUSES

1. Breaker point gap incorrect.
2. Breaker points burned, cracked, pitted, or dirty.
3. Ignition timing too late or too early.
4. Distributor cap cracked.
5. High tension cable sockets corroded.
6. Condenser open or shorted (check with new condenser).
7. Spark modifier stuck or leaking.
8. Breaker arm spring weak or broken.
9. Breaker arm rubbing block loose or badly worn.
10. Breaker arm plate loose or not properly grounded.
11. Automatic advance plate free on distributor base.
12. Distributor cap inserts bent, loose, or badly burned.
13. Insufficient clearance between distributor cap inserts and rotor.
14. Grounded rotor or broken rotor spring.
15. Distributor shaft or bushings worn.
16. Distributor drive gear or coupling sheared or loose on shaft.
17. Distributor drive gear or oil pump drive gear not properly assembled (timed).

IGNITION COIL DIFFICULTIES

CAUSES

1. Primary winding.
   - *a)* Shorted (ignition current draw abnormally large — weak spark).
   - *b)* Grounded (ignition current does not drop to zero when contacts separate).
2. Secondary winding shorted or grounded (weak spark).
3. Loose or faulty ignition switch contacts.
4. Loose contact of distributor to coil secondary cable in coil tower.
5. Use of a coil other than standard equipment.
6. Faulty ammeter.

SPARK PLUG DIFFICULTIES

CAUSES

1. Plug does not fire or spark is weak.
   - *a)* Porcelain cracked.
   - *b)* Porcelain carbonized or burned.
   - *c)* Moisture or dirt accumulation on porcelain.
   - *d)* Electrode gap not properly spaced (spark will not jump at high speed).
   - *e)* Weak ignition coil.
2. Electrodes and porcelain burn at low mileages.
   - *a)* Use of too hot an operating plug.
   - *b)* Use of certain types of gasoline having a detrimental effect on porcelain.
3. Fouled plugs.
   - *a)* Use of too cold an operating plug.
   - *b)* Excessively rich carburetor mixture.
   - *c)* Engine oil passing piston rings.
4. Use of some types of spark plugs and coil suppressors in radio installations.

STARTING MOTOR INOPERATIVE OR NOT OPERATING PROPERLY

CAUSES

1. Dead or undercharged battery.
2. Poor battery ground or corroded battery terminals.
3. Starting motor to battery cable broken or terminal cracked.
4. Teeth on starter pinion or flywheel broken.
5. Use of heavy engine oil in cold weather.
6. Teeth on starter pinion or flywheel burred, causing starter to stick.
7. Poor ground for starting motor due to broken ground cable.
8. Starting switch not operating properly.
9. Excessive resistance to rotation due to:
   - *a)* Bent armature shaft.
   - *b)* Distorted or cracked housing.
   - *c)* Misaligned or tightly fitted bearings.
   - *d)* Lack of lubrication.
   - *e)* Starter not properly aligned with engine.
10. Armature shorted.
11. Dirty, burned, pitted, or excessively lubricated commutator surface.
12. High mica between commutator segments due to commutator wear.
13. Brush ring grounded or set incorrectly.
14. Excessive brush spring tension causing rapid commutator and brush wear.
15. Brushes not functioning properly due to:
    - *a)* Sticking brush holders.
    - *b)* Weak or broken springs.

c) Bent brush holder arms.
d) Brushes worn too short.
e) Brushes sticking in guides.
f) Incorrect type of brushes.
g) Brush connections or pig tails loose.

STARTER DRIVE NOISES

DESCRIPTION

The most common starter drive noise due to causes Nos. 1, 2, and 5 is a pronounced grind when the starter motor is operating. This grind is similar to, but louder than, the normal starter noise when the engine is being cranked and should not be confused. A hissing noise will indicate cause No. 3, while cause No. 4 will be indicated by an intermittent rubbing noise. If the starting motor is not rigidly attached, a knock or "bump" will be heard when the starter pinion engages.

CAUSES

1. Starter pinion teeth chipped or damaged.
2. Flywheel gear teeth chipped or damaged.
3. Sprung or distorted drive shaft.
4. Starter motor not properly mounted (misaligned).
5. Starter motor loose on engine.
6. Starter motor armature shaft bearing worn, broken, or dirty.

GENERATOR INOPERATIVE OR NOT CHARGING PROPERLY

CAUSES

1. Slipping fan belt.
2. Ammeter indicates incorrect or no charging rate (check with master ammeter).
3. Generator pulley loose on shaft.
4. Relay points remaining open.
5. Incorrect size generator drive pulley.
6. Too low an engine idle speed.
7. Improper regulator operation.
8. Greasy, charred, or glazed commutator.
9. Sticking brush holder arms — brushes worn too short.
10. Brushes soft or oily (excessive lubrication).
11. Shorted, open, or burned out field coils.

GENERATOR AND GENERATOR DRIVE NOISES

DESCRIPTION

The most common of generator noises is a squeak resulting from causes Nos. 1 and 2. Causes Nos. 3 and 7 are usually indicated by a knock at low speed although cause No. 3 may sometimes also cause a squeak. An intermittent knock increasing in frequency as the speed is increased will indicate cause No. 4. A whine usually indicates causes Nos. 6 and 8.

CAUSES

1. Worn, damaged, or defective generator bearings.
2. Insufficient bearing lubrication.
3. Pulley loose on shaft.
4. Cracked pulley.
5. Excessive end play of generator shaft.
6. Misalignment of generator belt.
7. Generator loose on engine.
8. Generator brush noises resulting from:
   a) High mica insulators between commutator bars.
   b) High commutator bars.
   c) Rough commutator.
   d) Dirty commutator.
   e) Improperly seated brushes.
   f) Hard spots in generator brushes.
   g) Insufficient or excessive brush spring tension.
   h) Generator brushes loose in holder.
   i) Loose field magnets striking armature.

FREQUENT RECHARGING OF BATTERY NECESSARY

CAUSES

1. Insufficient current flow to battery.
   a) Inoperative generator.
   b) Too low an engine idle speed.
   c) Loose connections in external circuit.
   d) Corroded connections in external circuit (especially at battery terminals and frame ground strap).
   e) Slipping fan belt.
   f) Incorrect size generator drive pulley.
   g) Regulator out of adjustment.
   h) Ammeter registering higher charging rate than actual (check with master ammeter).
2. Excessive starting load causing abnormal current flow from battery.
   a) Frequent use of starter motor.
   b) Excessive use of the starter motor due to difficulty in starting.
   c) High mica between commutator bars or badly worn or burned commutator.
3. Excessive lighting load due to:
   a) Car operation confined largely to night driving.
   b) Tail and stop lamp wires reversed.
   c) Stop light switch inoperative (closed at all times).
   d) Use of spot lights.
   e) Unnecessary use of head lamps while parking.
   f) Ground or short in the lighting circuit.
4. Abnormal accessory load due to use of:
   a) Car radio.
   b) Car heater (electrically operated).
   c) Windshield defroster.
   d) Cigar lighter.
   e) Electric clock.
5. Internal discharge of battery.
   a) Plates badly sulphated.
   b) Cell leak due to cracked jar or sealing compound.
   c) Water level not at proper height.
   d) Plate separators ineffective.

ERRATIC HEAD LAMPS

CAUSES

1. Sealed Beam Units loose in sockets.
2. Loose or dirty connections between Sealed Beam Units and cable terminals.
3. Poor contacts in lamp switch.
4. Low or discharged battery.
5. Battery plates badly sulphated.
6. Improperly grounded head lamp bodies.
7. Faulty frame to battery ground (Sealed Beam Units burn out quickly).
8. Faulty generator action.
9. Faulty regulator operation.
10. Intermittent short circuit or ground in wiring assembly.
11. Loose connections at ammeter.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

ENGINE

Six cylinder L-head engines with slip-in, steel-back, microbabbitt-lined connecting rod and main bearings are used on the Champion and Commander models. The crankshafts are supported by four main bearings. One-piece, cast-iron camshafts with case-hardened wearing surfaces are supported at four points by steel-back, babbitt-lined, split bushings.

Lubrication is supplied by pressure to the valve tappets. Tappet adjusting screws on the Champion are self-locking, while those on the Commander employ the use of a lock nut.

A millionth of an inch is the equivalent of approximately 1/3000 of the thickness of a human hair. This degree of measurement may seem unbelievable, but the profilometer, used in testing finely machined Studebaker parts, measures surface irregularities within a millionth of an inch.

Many engine parts are required to be ground so perfectly that the maximum permissible surface irregularities are less than ten-millionths of an inch. We recommend, therefore, that crankshafts be replaced instead of reconditioned. Because even well-equipped shops cannot duplicate the fine finishes on Studebaker-produced parts, always use parts obtained from a Studebaker Parts Depot.

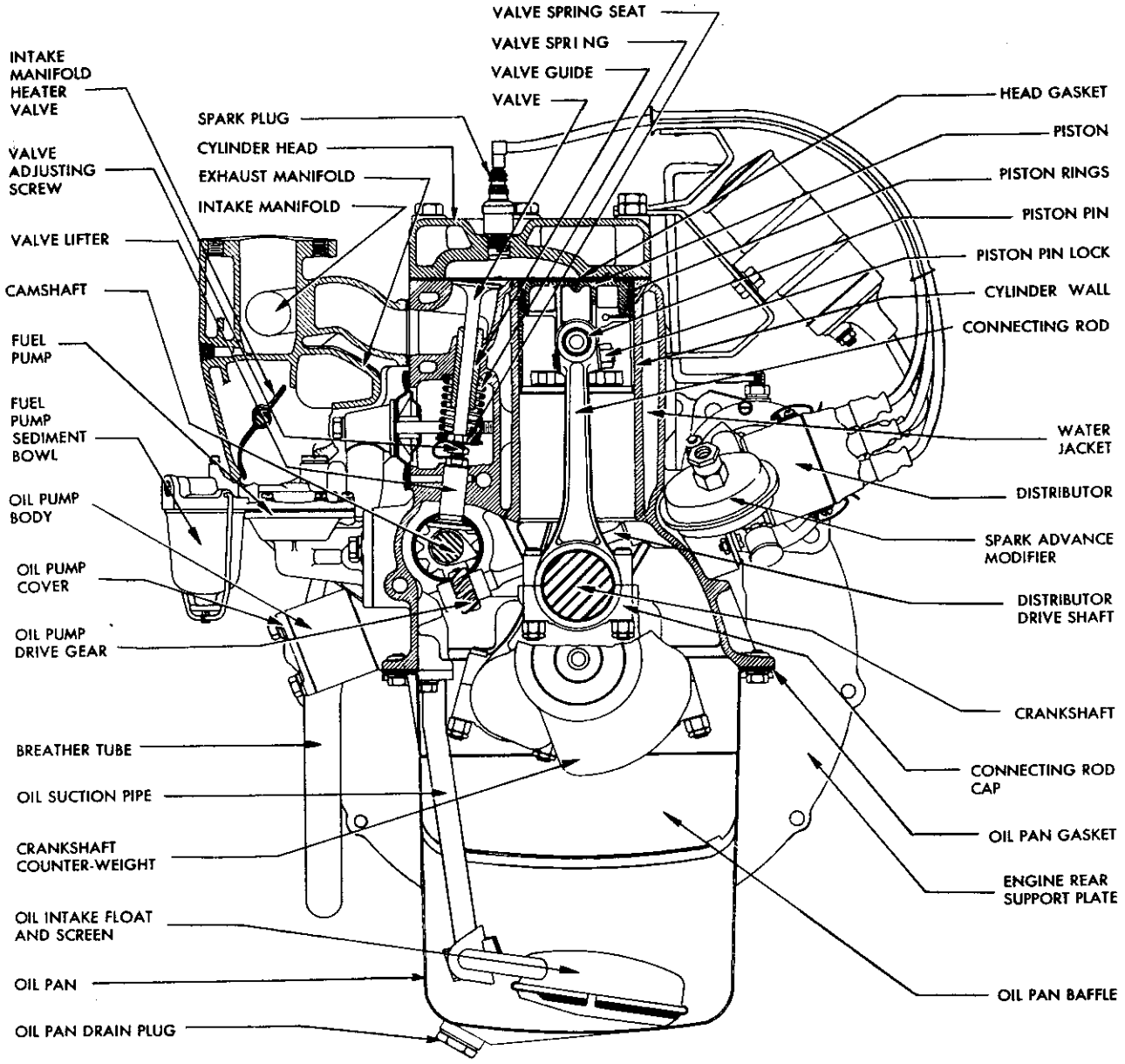


FIG. 115.—CHAMPION ENGINE END VIEW

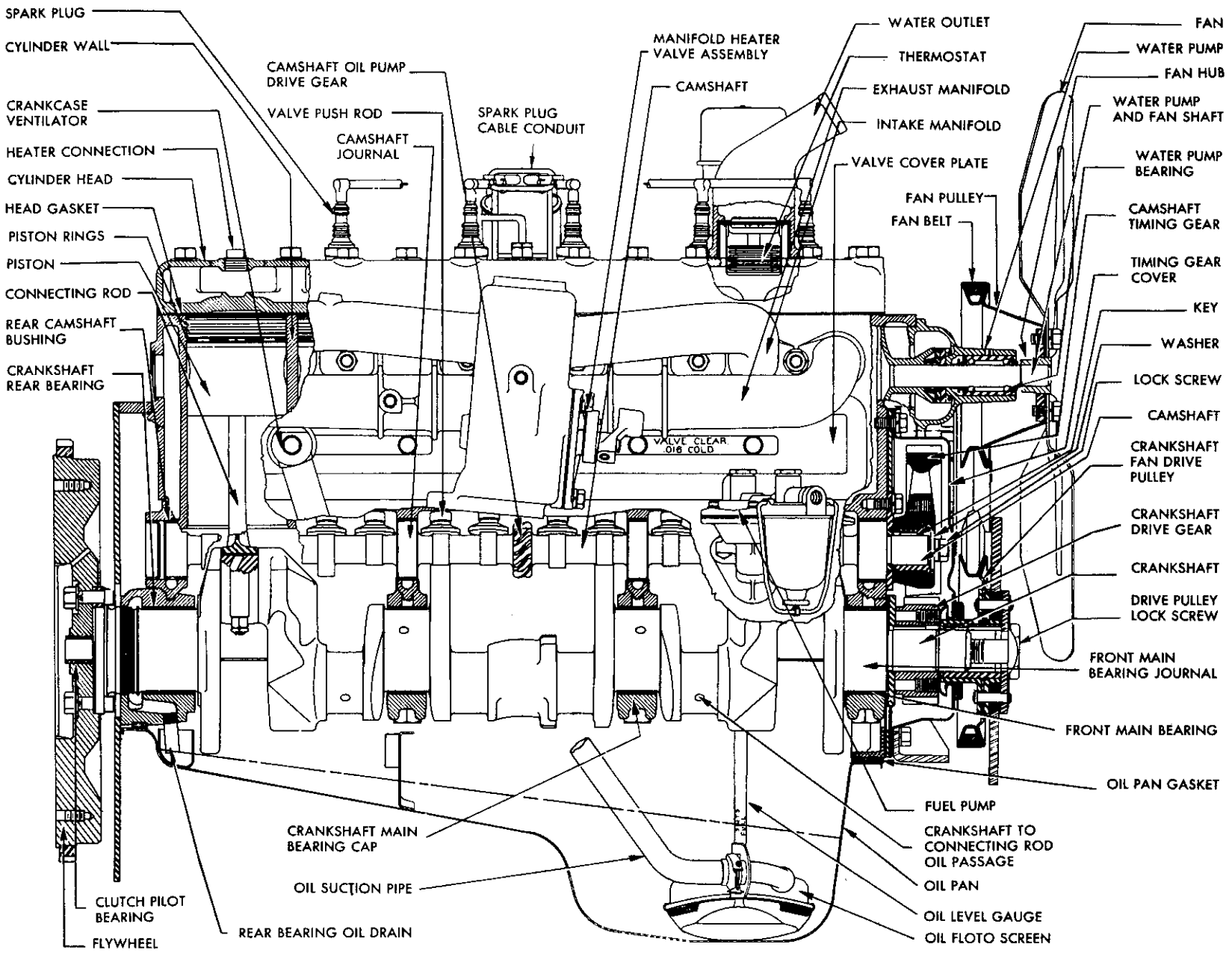


FIG. 116.—CHAMPION ENGINE SIDE VIEW

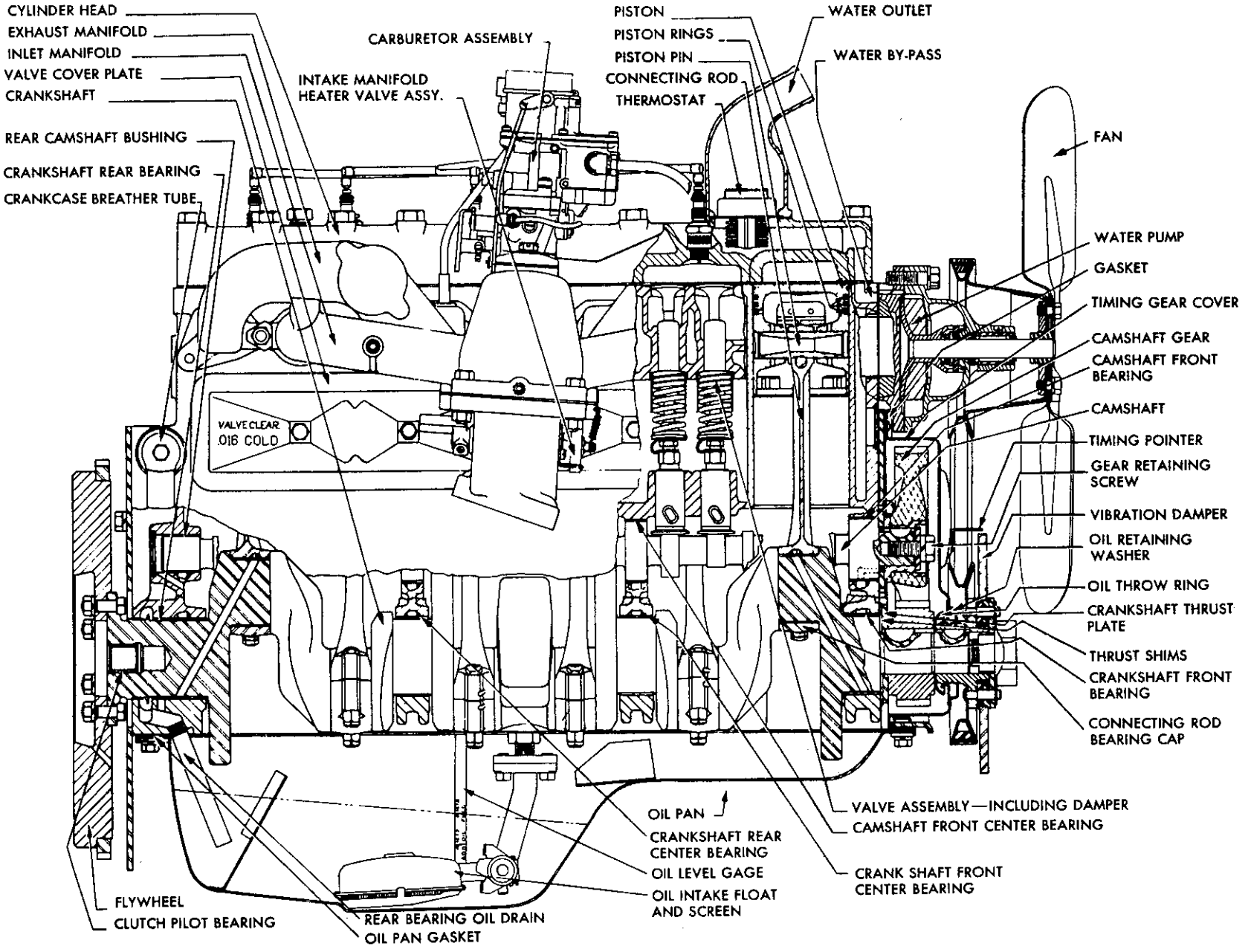


FIG. 117.—COMMANDER ENGINE SIDE VIEW

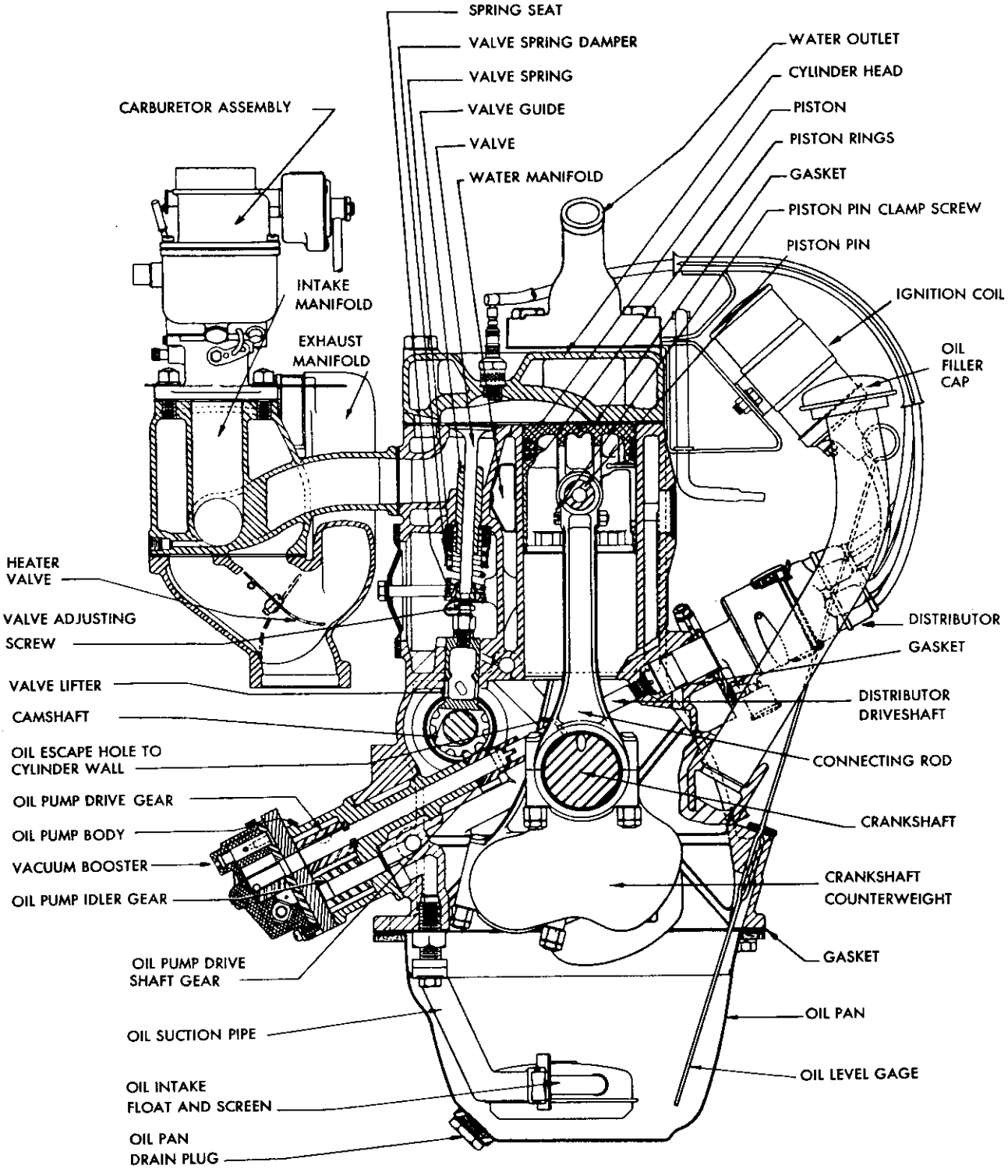


FIG. 118.—COMMANDER ENGINE END VIEW

Engine Oiling System

● All Studebaker engines use full pressure lubrication systems supplied by camshaft-driven, helical gear oil pumps. Oil galleries drilled into the block eliminate broken oil lines. The valve tappets are pressure-lubricated, and the timing gears are lubricated with oil bypassed by the oil pressure relief valve.

Some manufacturers use drilled connecting rods to supply oil under pressure to the piston pins, which, in turn, feed the oil to the cylinder walls. Studebaker engineers, however, feeling that positive lubrication to the cylinder walls is of first importance, have designed the oiling system so that a jet of oil, supplied through small drilled holes in the connecting rods, is forced directly against the cylinder walls and up inside the pistons to the pins.

CRANKCASE VENTILATION

CHAMPION AND COMMANDER The crankcase is ventilated by the passage of air through the oil filler cap, to the crankcase, and out of the breather tube. An oil-coated filter element is contained in both the filler cap and the breather tube. The element in the breather tube is held in place with a cotter pin. (See Fig. 119.)

When servicing the filler caps, wash them in kerosene, drain them thoroughly, and coat them with a good grade of engine oil. The servicing of breather tube filter elements requires the same procedure and necessitates the removal of the element from the tube.

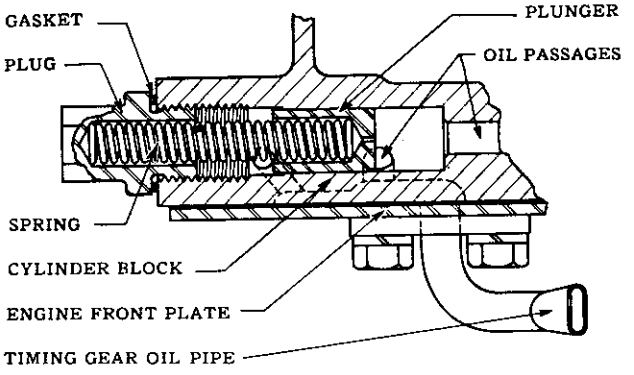


FIG. 120.—COMMANDER OIL PRESSURE RELIEF VALVE

To avoid damage to engine parts, service the filler cap and breather tube filter elements regularly. Severe dust conditions, of course, require more frequent servicing of these units.

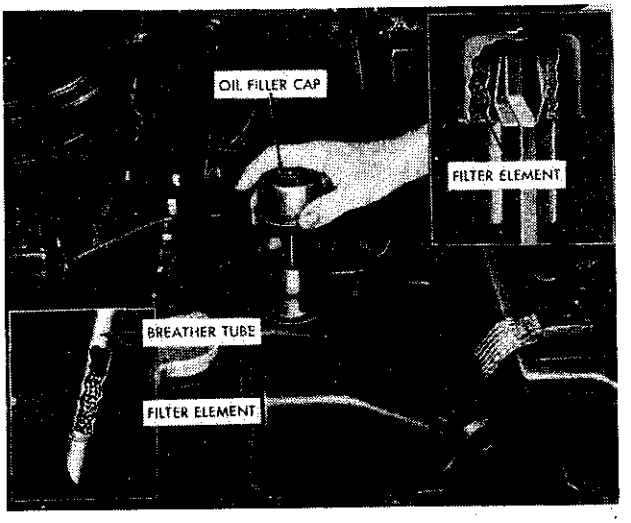


FIG. 119

OIL PRESSURE RELIEF VALVE

CHAMPION AND COMMANDER · The oil pressure relief valve is located at the lower right-hand front corner of the engine. The valve has been preset to open at 40 pounds pressure (2,8 kgs.). If necessary, an adjustment can be made by the insertion of shims between the outer end of the spring and the screw plug.

Timing gears are lubricated at high speeds by the oil which by-passes the relief valve. In addition, oil metered through a drilled hole in the valve provides constant lubrication of the timing gears. It is, therefore, important that the valve be kept clean and in proper operating condition. If the small hole in the valve becomes plugged, the timing gears will not receive sufficient lubrication at low speeds.

At least once a year remove the valve and clean it with a cleaning solution. Using a fine wire, remove all carbon deposits from the hole in the valve.

NOTE.—Do not plug the hole to increase oil pressure, for this not only will not accomplish the intended purpose but also will result in premature failure of the timing gears.

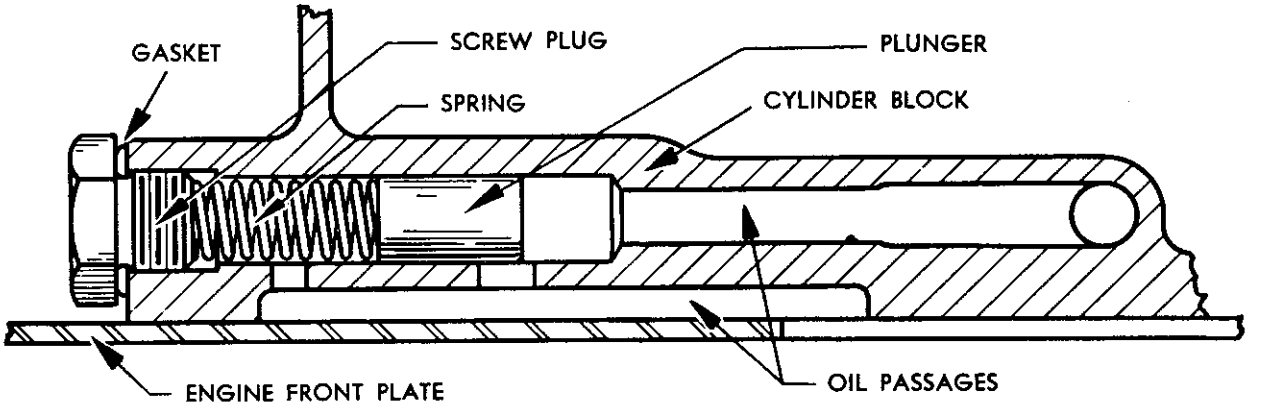


FIG. 121.—CHAMPION OIL PRESSURE RELIEF VALVE

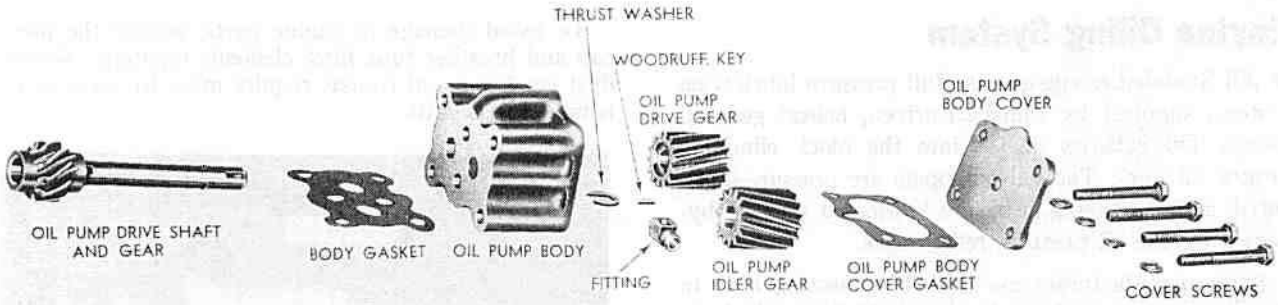


FIG. 122.—PARTS OF THE CHAMPION OIL PUMP

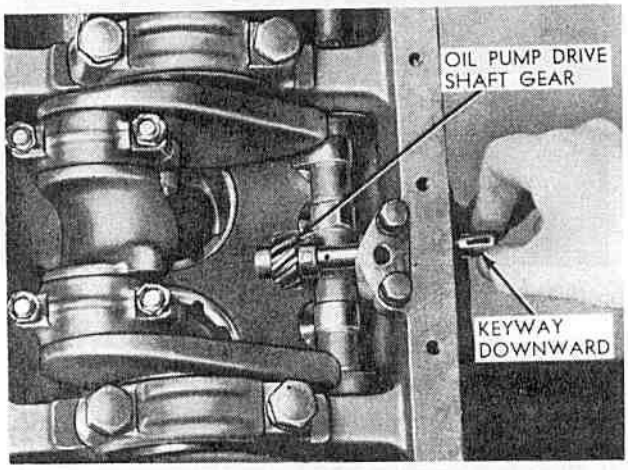


FIG. 123

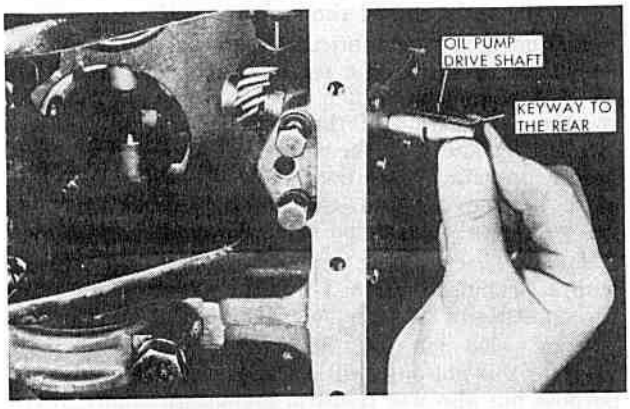


FIG. 124

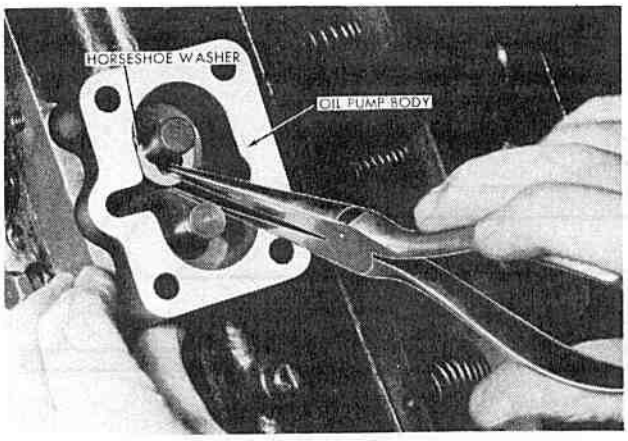


FIG. 125

OIL PUMPS

● The quiet, efficient helical gear oil pumps used in the Champion and Commander engines draw oil through the Floto oil screen, which takes the clean oil from just below the top surface of the oil in the pan. The oil pumps are driven from the camshaft by helical type gears. A tongue at the inner end of the oil pump drive shaft drives the distributor shaft. Piece-by-piece removal or installation of the Champion oil pump is necessary.

Removal

CHAMPION After removing the four cover screws and washers, remove the pump body cover, gasket, and idler gear. Removing the drive gear, Woodruff key, and horseshoe-shaped thrust washer will then permit the removal of the oil pump body and gasket. If the removal of oil pump drive shaft and gear is necessary, the oil pan must be removed.

Installation

CHAMPION To obtain correct ignition timing, use the following procedure to install the oil pump drive shaft and gear.

Crank the engine until the No. 1 piston is on its compression stroke and until the "UDC 1-6" mark on the vibration damper flywheel is directly under the pointer on the timing gear cover. Start to engage the oil pump drive shaft gear with the camshaft gear. The keyway in the drive shaft should point downward (see Fig. 123). Pulling the shaft and gear assembly into mesh will then rotate the keyway to the rear (see Fig. 124).

Place a new gasket and the oil pump body over the drive shaft and install the horseshoe-shaped washer (see Fig. 125), Woodruff key, and drive gear. Then install the idler gear, a new cover gasket, and the pump body cover and secure the entire assembly in place with the four washers and cover screws.

After installing the pump assembly, disconnect the oil pressure gage fitting from the oil pump body and prime the pump with engine oil.

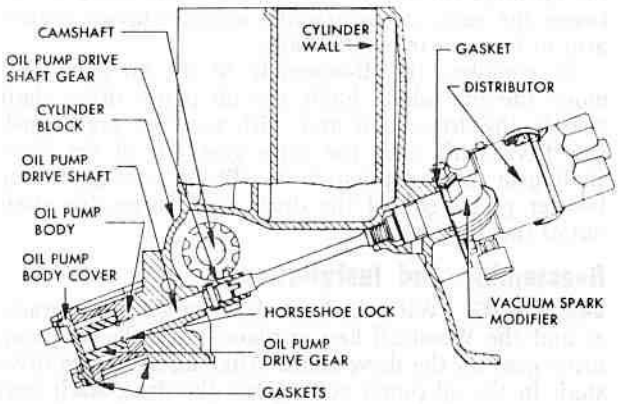


FIG. 126.—CONSTRUCTION OF THE CHAMPION OIL PUMP AND DISTRIBUTOR ASSEMBLY

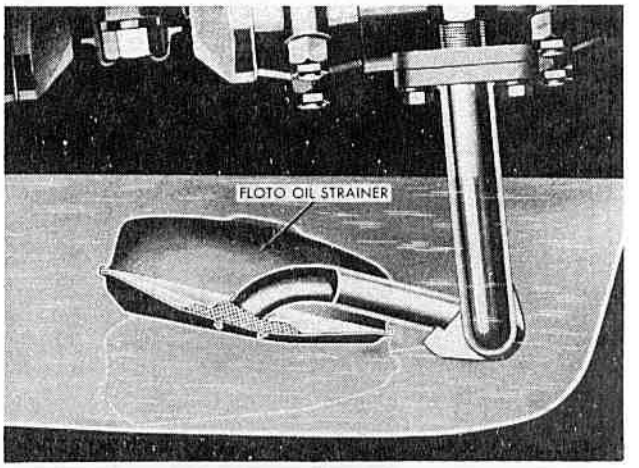


FIG. 127.—FLOTO OIL STRAINER

Removal and Disassembly

COMMANDER Place the car under a chain hoist and a little to the right of the chain hoist hook. Turn the front wheels to the right as far as possible and drain the radiator core.

Remove the bolts which hold the front engine support insulator to the front engine support. Then remove the hood from the hinge arms.

Remove the center cylinder head cap screw and replace it with an engine eye lifting bolt. Attach the lifting hook of the chain hoist to the lifting bolt. The chain should slant upward approximately 15 degrees to the left of the perpendicular.

Remove the cap screws which hold the starter to the clutch housing, and without disconnecting the wires, place the starter to the left of the parking brake cable.

After removing the cotter pin and inner clevis pin from the clutch operating shaft sleeve, move the operating shaft and sleeve toward the frame as far as possible. Then remove the engine rear support bolts, lower insulators, and spacers.

Remove the inlet hose from the water pump and the outlet hose from the radiator core.

Remove the pipe which connects the vacuum booster to the manifold tee. Disconnect the oil pressure gage pipe from the pump elbow, loosen the upper coupling nut at the bottom of the flexible coupling, and swing the pipe out of the way. Do not bend the pipe.

Lift the engine slowly until the bottom of the right side of the front engine support insulator is 1-5/8″ (41,27 mm.) above the support. The right front corner of the cylinder head should then be 17-1/4″ (438,15 mm.) from the nearest point on the right front fender skirt. If the distance is not this great, lever the engine into position with a stout piece of wood. Block the engine to maintain this position.

With a standard 5/32″ (3,969 mm.) Allen wrench, remove the eight No. 10 screws which hold the booster body to the adapter plate. Then remove the booster body, gasket, and vane.

Insert a 3/16″ (4,763 mm.) drift punch through the hole in the outer end of the rotor and pull the rotor off the shaft. Then remove the booster base plate and gasket.

Using a standard 7/32″ (5,556 mm.) Allen wrench, remove the four screws which hold the oil pump assembly to the cylinder block. Then remove the booster adapter plate, the gasket, and the idler gear.

Work the pump out of the engine by gently twisting it from side to side. When the drive shaft gear has almost cleared the cylinder block opening, swing the bottom of the pump to the right (or forward) and continue the downward travel. When the pump clears

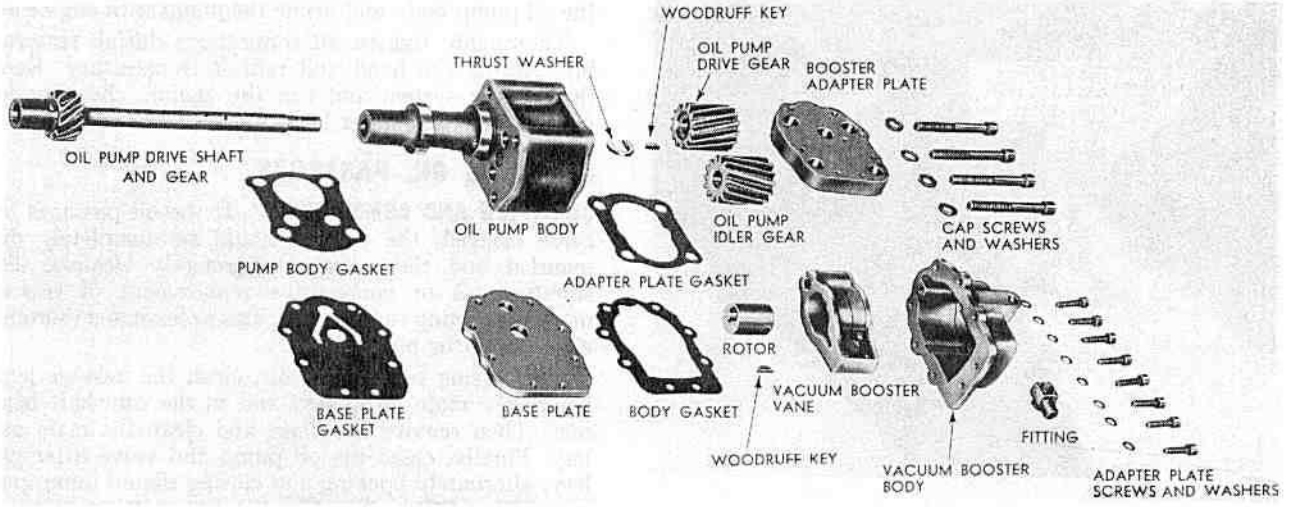


FIG. 128.—PARTS OF THE COMMANDER OIL PUMP AND VACUUM BOOSTER

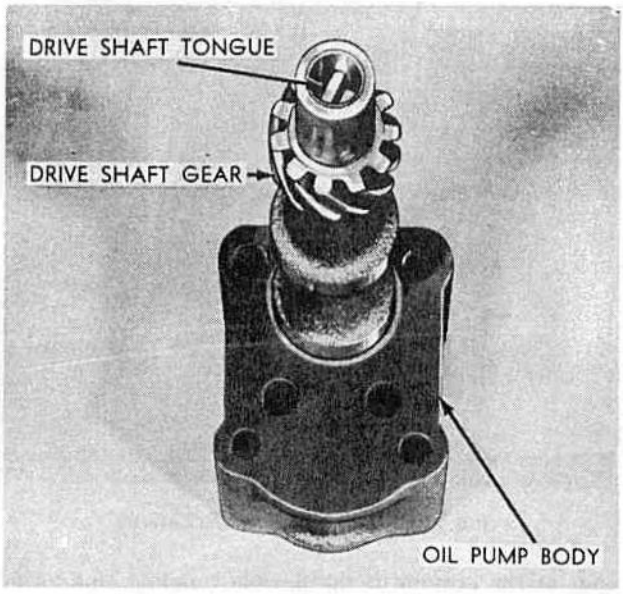


FIG. 129

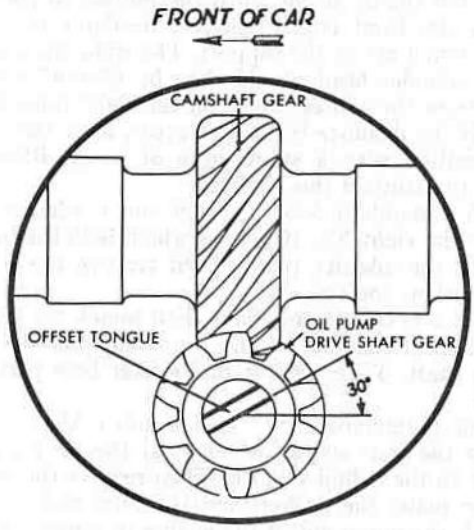


FIG. 130

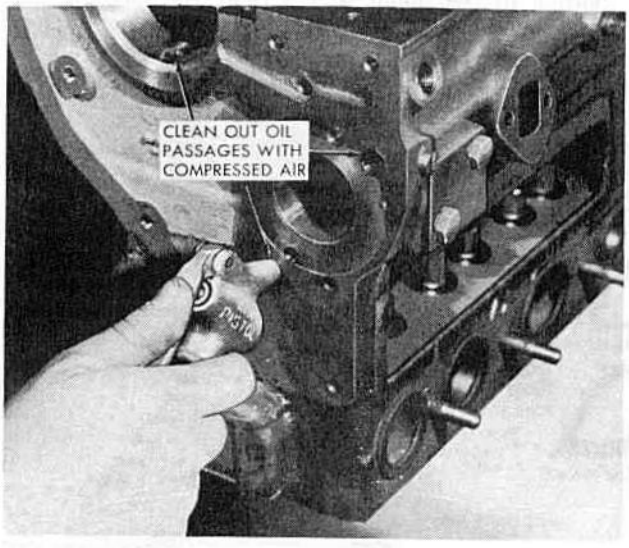


FIG. 131

the opening, the end of the booster shaft will pass between the ends of the steering knuckle upper control arm to frame rear bracket bolts.

To complete the disassembly of the oil pump, remove the pin which holds the oil pump drive shaft gear to the drive shaft and, with an arbor press, push the drive shaft with the drive gear out of the drive shaft gear and oil pump body. Then, pressing on the booster pump end of the drive shaft, press the shaft out of the drive gear.

Reassembly and Installation

COMMANDER With the horseshoe-shaped thrust washer and the Woodruff key in place, press the oil pump drive gear on the drive shaft. After inserting the drive shaft in the oil pump body, press the drive shaft gear on the drive shaft, being sure to align the holes in the gear and shaft. Then lock the gear on the shaft with a new 3/16″ (4,763 mm.) pin and peen the pin securely in position.

To obtain the proper end play when installing a new drive shaft and drive shaft gear, press the drive shaft gear on the shaft, placing a .003″ (0,0762 mm.) feeler between the faces of the gear and the pump body. Then, using the hole in the drive shaft gear as a pilot, drill a hole in the shaft, ream it to 3/16″ (4,763 mm.), and insert a new pin. Peen the pin securely in position.

A tongue on the inner end of the oil pump drive shaft drives the distributor shaft through a mating groove (see Fig. 129).

Before installing the oil pump, turn the crankshaft until the No. 1 piston is on the compression stroke and the "UDC 1-6" marking on the vibration damper flywheel is directly under the timing pointer. With the key in the end of the booster pump shaft facing toward the rear of the car, start to engage the oil pump drive shaft gear with the camshaft gear. When full engagement has been obtained, the key will point almost straight downward.

With the oil pump in the proper position, the offset tongue, as viewed through the distributor mounting hole, is approximately 30 degrees from horizontal (see Fig. 130). As an additional check, install the distributor. The distributor rotor should line up with the No. 1 terminal in the distributor cap.

When assembling and installing the oil pump, always use new gaskets. After installing the pump assembly, disconnect the oil pressure gage fitting from the oil pump body and prime the pump with engine oil.

Thoroughly tighten all connections during reassembly. Adjust the hood and refit it if necessary. Refill the cooling system and run the engine, checking for oil, gasoline, and water leaks.

CLEANING OIL PASSAGES

CHAMPION AND COMMANDER If the oil passages become clogged, the engine should be completely dismantled and the passages thoroughly cleaned. The simultaneous or consecutive replacement of two or more connecting rod bearings also necessitates thorough cleaning of the oil passages.

First, using compressed air, clean the passage leading to the main oil gallery and to the camshaft bearings. Then remove the plugs and clean the main gallery. Finally, clean the oil pump and valve lifter gallery, alternately opening and closing the oil pump passage with a finger. (See Fig. 131.)

ENGINE OIL PAN

Removal

CHAMPION AND COMMANDER Accomplish the removal of the engine oil pan by removing the engine from the chassis and placing it in an engine stand.

Installation

CHAMPION Before installing the oil pan, inspect the engine front plate gasket and replace it if necessary. Install the side pan gaskets, fitting them tightly against the front plate gasket. After placing the oil pan filler block (see Fig. 132) and gasket in position, use a drift to align the filler block holes with those in the engine front plate. Insert the screws through the engine front support bracket, the timing gear cover, and the engine front plate and thread them into the filler block. Do not tighten them securely.

After the rear gasket has been installed in the rear bearing cap groove, use pilot screws to guide the oil pan into position. Tighten the oil pan screws uniformly and securely. Then tighten the timing gear cover to filler block screws securely.

NOTE.—When installing a new engine in a 1947 Champion, be sure the oil pan filler block is of malleable iron. Do not use the die-cast filler block which was used on former models.

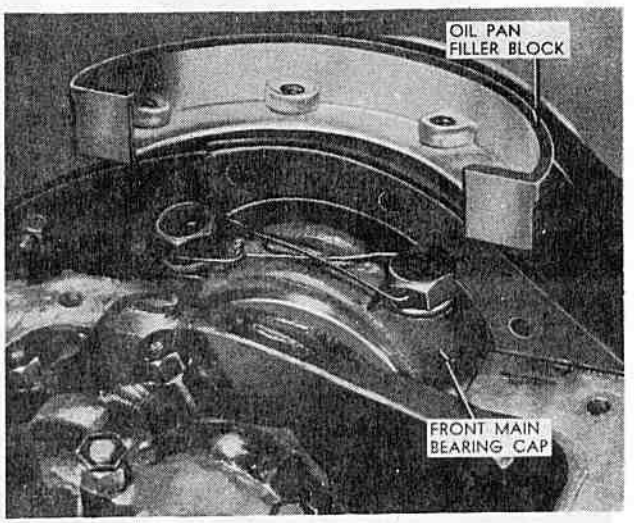


FIG. 132

COMMANDER When installing the oil pan on the engine, use a new gasket and tighten the cap screws uniformly and securely. After the engine has been installed in the chassis, the car should be run for several minutes at a speed the equivalent of 20 to 25 miles (32,20 to 40,25 km.) per hour and a thorough check for oil leaks made at the pan gasket.

Crankshaft and Main Bearings

● Studebaker crankshafts are strong and perfectly balanced, and the crankshaft journals are ground and polished to a mirror-finish. Four removable steel-back main bearings lined with babbitt support the crankshaft in both the Champion and Commander engines.

A crankshaft connecting rod journal which is worn, tapered, out-of-round, or scored in excess of .0015″ (0,0381 mm.) can be reconditioned without the removal of the crankshaft from the engine. This should, however, never be attempted unless it is known that the main bearing journals are not damaged and that the oil passages are clean.

To recondition the crankshaft and install undersized main bearings, reduce the journal diameters by the amount which the bearings are undersized. For example: if .010″ (0,254 mm.) undersized main bearings are to be installed in a Champion engine, the original journal diameter of 2.4370″ to 2.4375″ (61,899 mm. to 61,912 mm.) should be reduced to 2.4270″ to 2.4275″ (61,645 mm. to 61,658 mm.).

MAIN BEARING CLEARANCES

CHAMPION AND COMMANDER Use an accredited bearing oil leak detector to determine whether abnormal bearing clearances exist (see Fig. 133). Correct clearance ranges from .0005″ to .0025″ (0,00127 mm. to 0,06350 mm.). Never file bearing caps to compensate for excessive bearing clearance (see Fig. 134). Instead, replace the bearings, using the following procedure to determine the amount of clearance.

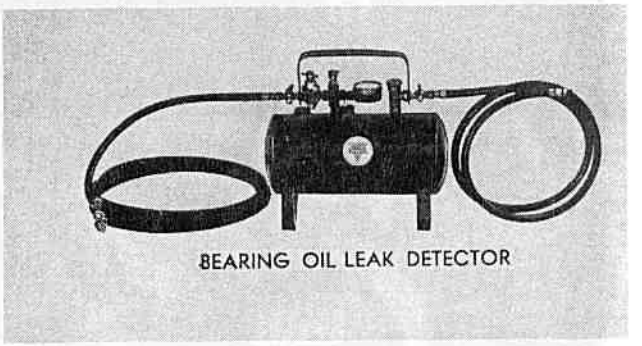


FIG. 133

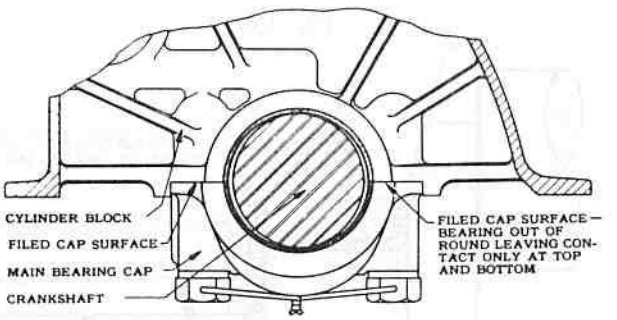


FIG. 134

Using a micrometer, select paper of various thicknesses — .002″ (0,0508 mm.), .003″ (0,0762 mm.), .004″ (0,1016 mm.), etc. — and cut the paper in strips approximately 1/2″ (12,70 mm.) wide and 3/4″ (19,05 mm.) long. Place a piece of this paper on the crankshaft (see Fig. 135), install the bearing cap, and tighten the bearing cap screws securely. If the crankshaft turns freely, the bearing clearance is greater than the thickness of the paper used. Selecting a thicker piece of paper, repeat the procedure. If the crankshaft cannot be turned or can be turned only with effort, use a thinner strip of paper. When a strip equal in thickness to the bearing clearance is used, the crankshaft will afford only a slight resistance to rotation.

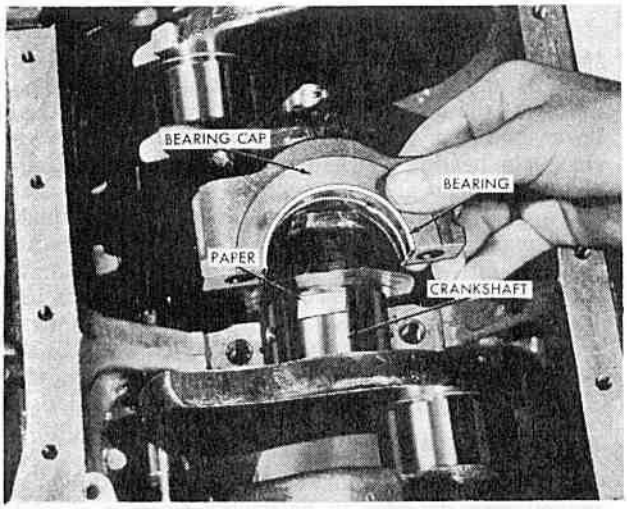


FIG. 135

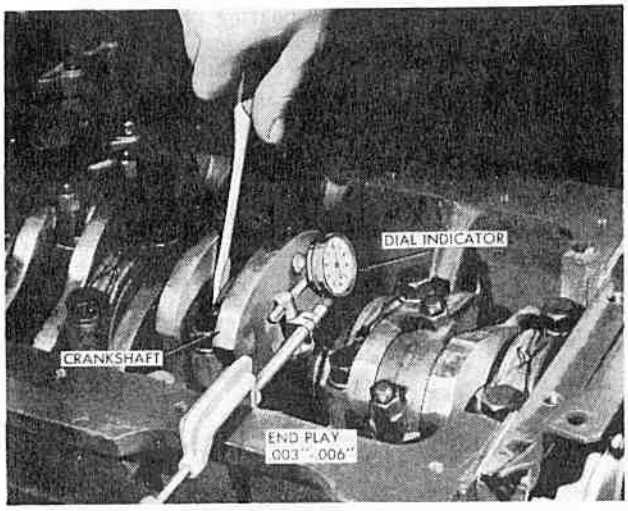


FIG. 136

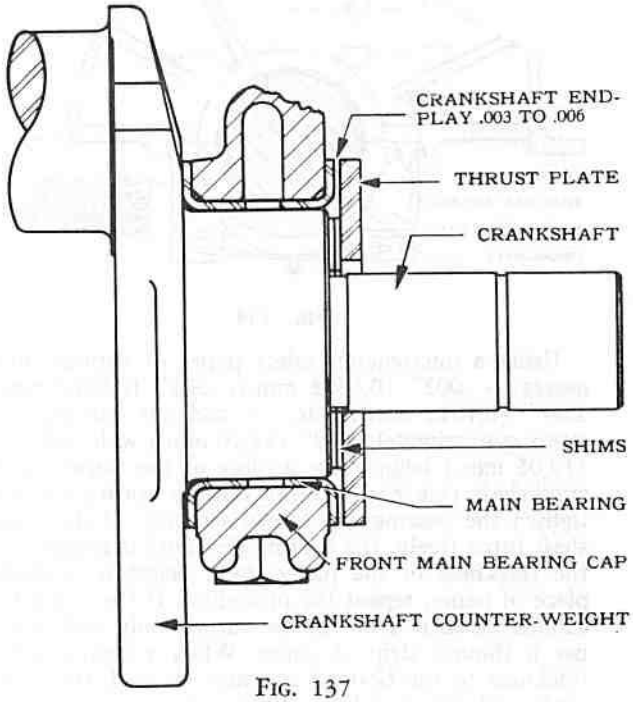


FIG. 137

CRANKSHAFT END PLAY

CHAMPION AND COMMANDER Crankshaft end play should be from .003" to .006" (0,0762 mm. to 0,1524 mm.). To check the end play, mount a dial indicator on the block so that the indicator button contacts a counterweight on the crankshaft. Then, using a screw driver, obtain an end-play reading by moving the crankshaft forward and rearward (see Fig. 136). End play is controlled by shims located between the vertical surface of the front main bearing journal and the crankshaft thrust washer (see Fig. 137). Add or remove the necessary number of these shims to obtain the correct end play.

INSTALLATION OF MAIN BEARINGS

CHAMPION AND COMMANDER Use a torque-indicating wrench to tighten the main bearing cap screws to 88-93 foot-pounds (12,2-12,9 kilogram-meters) torque (see Fig. 138).

Specially treated wood oil seals are used at the rear main bearings. Whenever the rear main bearing cap is removed, new seals should be used. Install these seals carefully. Figure 139 clearly illustrates the correct installation procedure.

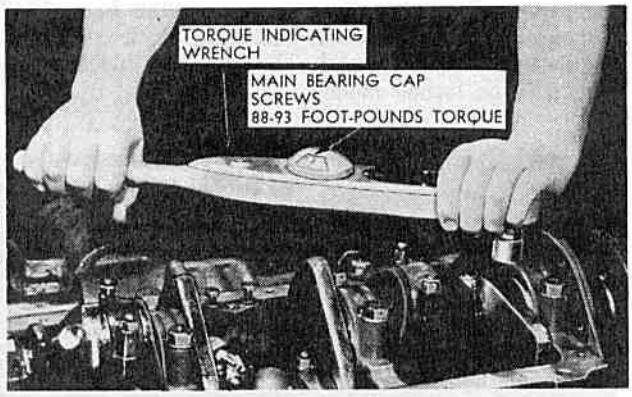


FIG. 138

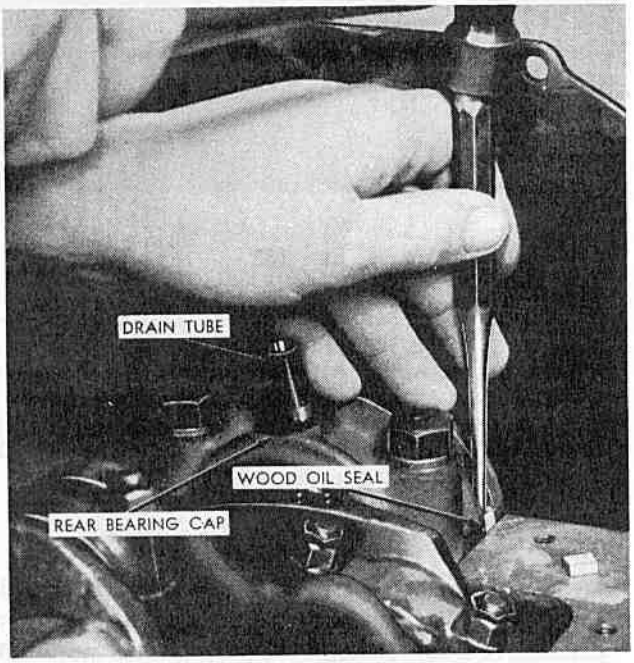


FIG. 139

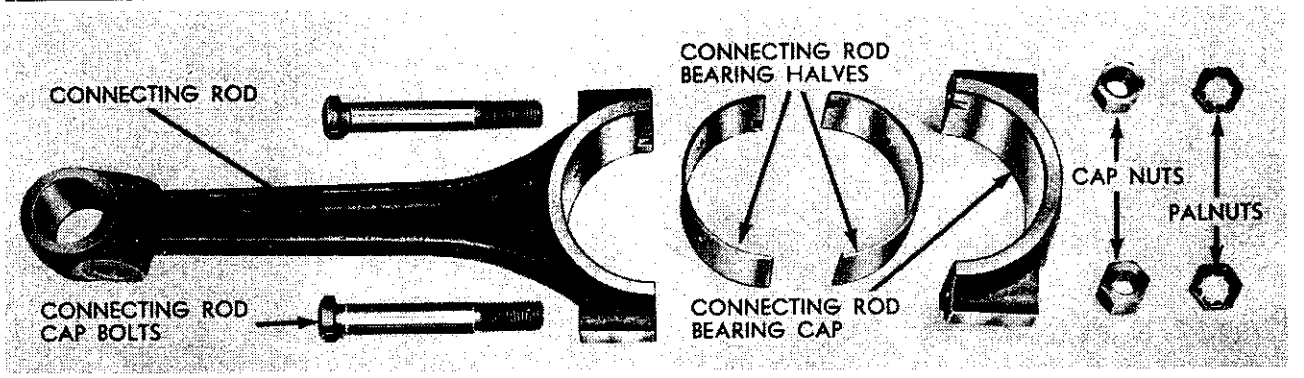


FIG. 140.—CONNECTING ROD AND BEARING ASSEMBLY

Connecting Rods and Rod Bearings

● Interchangeable type, steel-back, microbabbitt-lined connecting rod bearings are used in the Champion and Commander engines. A tongue on each bearing half seats in a corresponding groove in the connecting rod or cap. When installing new connecting rod bearings, carefully clean the bearing backs, the rods, and the caps and inspect them for burrs.

CONNECTING ROD AND BEARING CLEARANCES

CHAMPION AND COMMANDER The connecting rod bearing clearance should be .0005″ (0,0127 mm.) to .002″ (0,050 mm.), and the connecting rod side clearance should be .005″ (0,127 mm.) to .009″ (0,228 mm.). Use an accredited bearing oil leak detector to determine whether abnormal connecting rod bearing clearances exist.

Before connecting rods are installed, the connecting rod journals should always be examined. Journals which are out-of-round, tapered, rough, or scored in excess of .0015″ (0,0381 mm.) should be reconditioned.

Never file bearing caps to compensate for excessive bearing clearance; instead, replace the bearings. To determine the amount of clearance, use the procedure which is thoroughly explained in the section devoted to main bearing clearances (see p. 69).

ROD ALIGNMENT

CHAMPION AND COMMANDER Before installing a connecting rod, remove the bearing inserts and check the rod alignment with an approved connecting rod aligner. If the piston is not perpendicular to the crankshaft journal (rod bent) or if the piston is not parallel to the journal (rod twisted), align the rod with an approved bending tool. Always recheck the alignment after bending the rod.

ROD INSTALLATION

CHAMPION AND COMMANDER A connecting rod must be properly installed with the oil hole at the lower end of the rod on the camshaft side of the engine. Connecting rods and bearing caps in production engines are stamped with the bore number on the camshaft side of the connecting rod. All rods used for replacement should be marked in this manner.

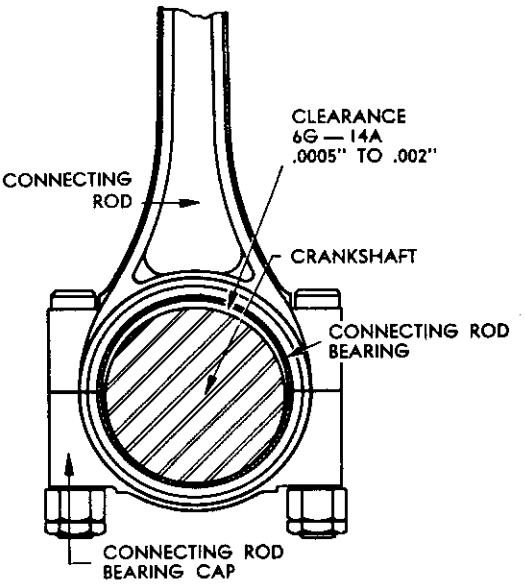


FIG. 141.—CONNECTING ROD BEARING CLEARANCE

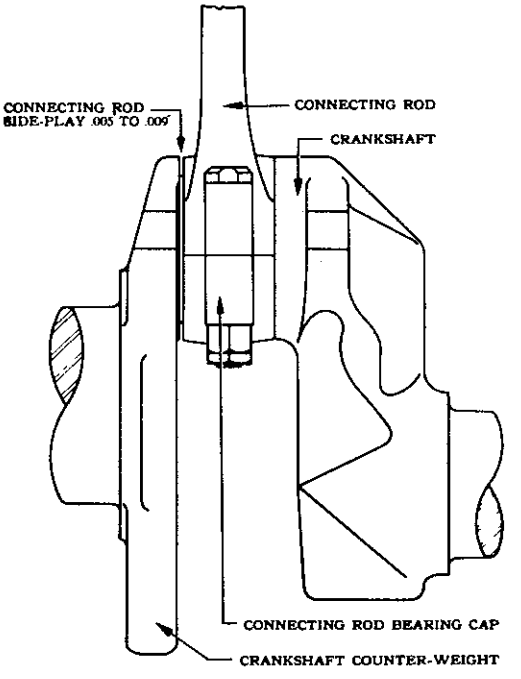


FIG. 142.—CONNECTING ROD SIDE CLEARANCE

Using a torque wrench, tighten the connecting rod cap bolt nuts on the Champion to 28-32 foot-pounds (3,9-4,4 kilogram-meters) torque and on the Commander to 52-54 foot-pounds (7,2-7,5 kilogram-meters) torque. After the cap bolt nuts have been tightened, the Palnuts should be installed with the open face away from the nut. Tighten the Palnuts until they just contact the cap bolt nuts; then tighten them an additional one-third turn with a wrench. Always use new Palnuts.

Cylinders, Pistons, and Rings

● The cylinder walls in Studebaker engines are mirror-finished. The pistons are bearing-metal-plated aluminum alloy, each having one oil ring and two compression rings; and being T-slotted and cam ground, the pistons provide maximum oil control and long economical life. A heat dam at the top of the piston reduces the travel of combustion chamber temperatures to the piston skirt.

CYLINDER BORE MARKINGS

CHAMPION AND COMMANDER The cylinder bore size is stamped on the top face of the cylinder next to the bore. On Champion engines, bore sizes vary from 3.0000″ (76,20 mm.), stamped "0," to 3.0025″ (76,26 mm.), stamped "25." On Commander engines, sizes vary from 3.3125″ (84,138 mm.), stamped "25," to 3.3145″ (84,188 mm.), stamped "45." The total variation of any single cylinder bore is less than .001″ (0,0254 mm.).

CYLINDER RECONDITIONING

CHAMPION AND COMMANDER To prevent cracked or broken piston ring lands or broken top rings, remove the cylinder ridge at the upper end of the cylinder bore with an accredited ridge reamer. This should always be done before a piston is removed.

When fitting new pistons, recondition the cylinders if the bores are scored or if they are out-of-round or tapered in excess of .002″ (0,0508 mm.). Use an accredited cylinder gage to check the cylinder bores (see Fig. 143). After reconditioning the cylinders with an accredited cylinder hone, *be sure to clean all traces of abrasive from all parts of the engine.*

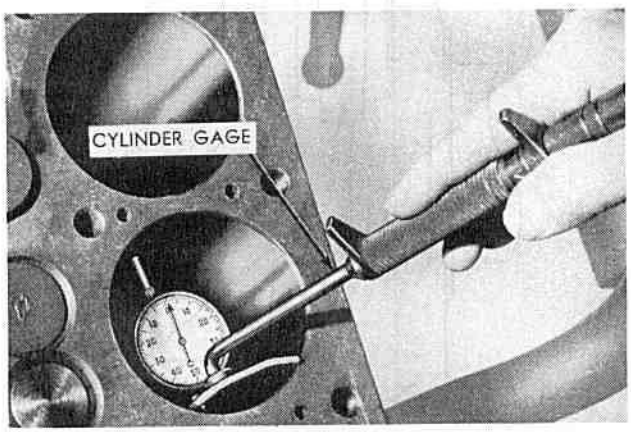


FIG. 143

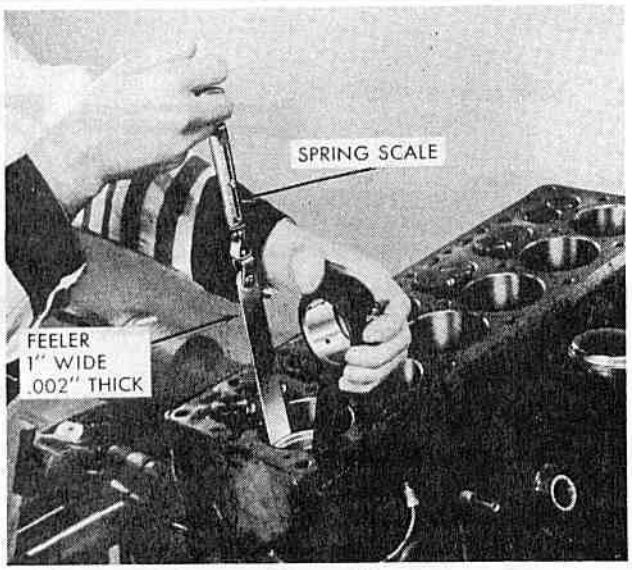


FIG. 144

FITTING PISTONS

CHAMPION AND COMMANDER A feeler gage of proper thickness should be inserted on the camshaft side of the cylinder. A piston should then be inserted in the cylinder in the inverted position, with the slotted side away from the camshaft, and with the bottom edge of the piston about 1″ (25,4 mm.) below the top surface of the cylinder bore. Use a spring scale to measure the pull necessary to withdraw the feeler gage. The proper spring scale readings are as follows: with a feeler gage 1″ (25,4 mm.) wide and .002″ (0,0508 mm.) thick, a pull of 11 to 16 lb. (4,99 to 7,25 kgs.) on the Champion and 14 to 19 lb. (6,350 to 8,618 kgs.) on the Commander. (See Fig. 144.)

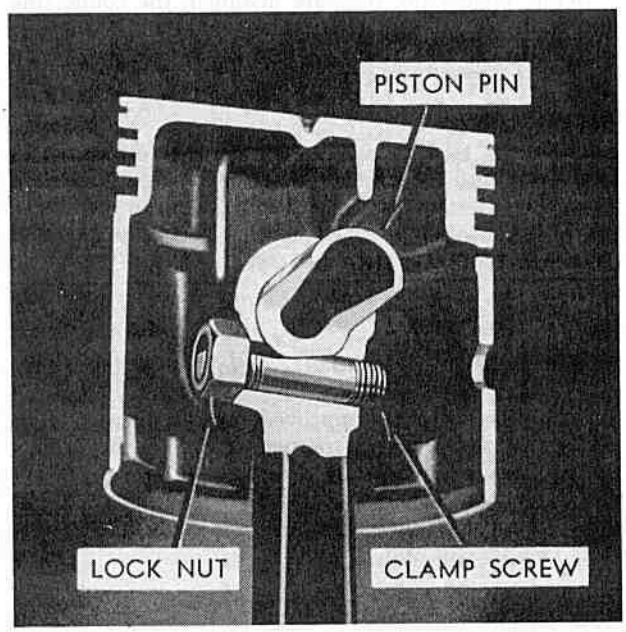


FIG. 145.—CONSTRUCTION OF THE PISTON PIN AND CLAMP SCREW

PISTON PIN REMOVAL AND INSTALLATION

CHAMPION AND COMMANDER Place the connecting rod and piston assembly on the Piston Pin Assembly

Tool J-1293. Remove the lock nut and star washer from the clamp screw (see Fig. 146), and by tightening this lock nut on the other end of the clamp screw, remove the screw from the connecting rod. Then slide the piston and connecting rod off the piston pin.

FIG. 146

To install the piston pin, place it on the assembly tool and slide the piston and connecting rod into position (see Fig. 147). The oil hole and number on the connecting rod should be on the side of the piston which is opposite the T-slot. Then insert the piston pin clamp screw in the connecting rod, install the star washer and lock nut on the heavy boss side, and tighten the nut securely. Be sure to align the flat surface on the piston pin with the flat surface on the clamp screw.

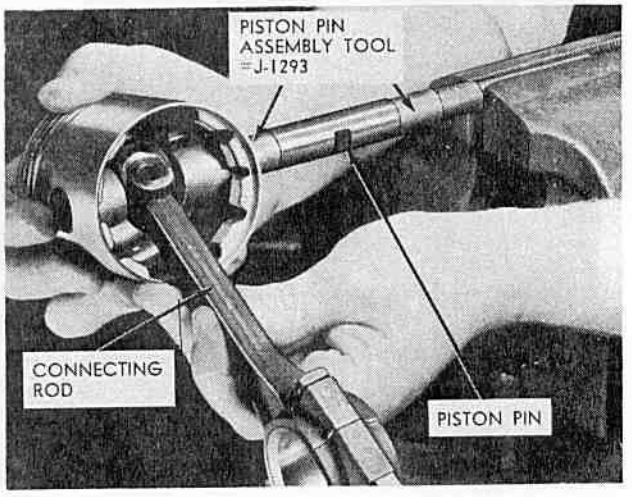


FIG. 147

FITTING PISTON PINS

CHAMPION AND COMMANDER The piston pins should be fitted to a clearance of from .0001" to .0003" (0,00254 mm. to 0,00762 mm.). This represents a light finger-push fit at a room temperature of about 70° F. (21° C.) (see Fig. 148). When fitting piston pins, use an accredited piston pin hone. Pistons in service stock are fitted with piston pins.

FIG. 148

PISTON RINGS

● Two compression rings and one oil control ring are used on the pistons of both engines. Be sure to install the rings in the proper grooves with the correct side of the rings up (see Fig. 149).

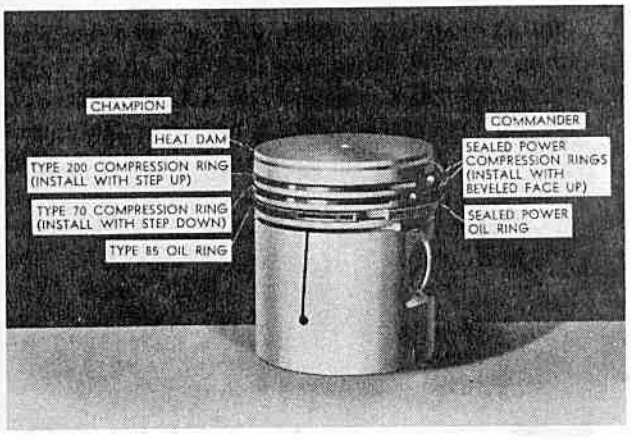


FIG. 149

Piston Ring Chart

SPECIFICATIONS	TOP RING		2ND RING		3RD RING	
	6G	14A	6G	14A	6G	14A
TYPE	Compression	Compression	Compression	Compression	Oil Control	Oil Control
WIDTH	3/32" (2,381 mm.)	3/32" (2,381 mm.)	1/8" (3,175 mm.)	3/32" (2,381 mm.)	5/32" (3,969 mm.)	3/16" (4,763 mm.)
GAP CLEARANCE	.007" to .017" (0,1778 mm. to 0,4318 mm.)	.009" to .014" (0,2286 mm. to 0,3556 mm.)	.007" to .017" (0,1778 mm. to 0,4318 mm.)	.009" to .014" (0,2286 mm. to 0,3556 mm.)	.007" to .017" (0,1778 mm. to 0,4318 mm.)	.009" to .014" (0,2286 mm. to 0,3556 mm.)

FIG. 150

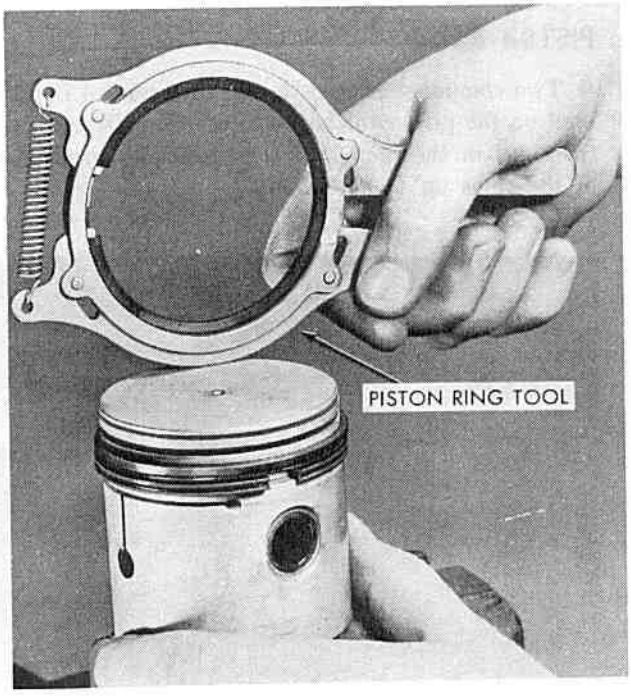


FIG. 151

Clearance

CHAMPION AND COMMANDER The gap clearances of piston rings, which are given in the chart, should be measured with a feeler gage (see Fig. 150). Increase gap clearance by filing the rings with an accredited piston ring file. Do not install rings which have gap clearances greater .than those specified. An oversized ring can be filed as much as .010" (0,254 mm.) for the obtainment of proper gap clearance. Undersized rings should, however, never be used.

Installation

CHAMPION AND COMMANDER Piston rings which are properly fitted should turn freely in the grooves. Install the rings with an accredited piston ring tool (see Fig. 151). Before installing the piston assembly in the cylinder, lubricate the rings, the piston, and the connecting rod bearing. Space the ring gaps uniformly around the piston, being sure that no two ring gaps are aligned. Insert the piston in the cylinder bore with the T-slot away from the camshaft. To avoid damaging piston rings, use an accredited piston ring compressor when installing the piston in the cylinder (see Fig. 152).

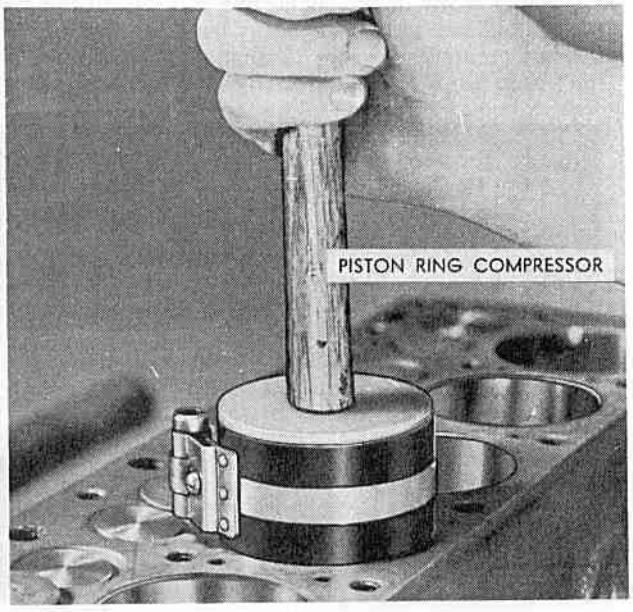


FIG. 152

Camshaft and Timing Gears

● Steel-back, babbitt-lined, split bushings, lubricated under pressure, support the camshafts in Studebaker engines. The timing gears are the helical type. The crankshaft gear is made of cast iron and the camshaft gear of celeron. For camshaft journal diameters and bushing clearances, refer to the "General Specifications" section.

Removal

CHAMPION AND COMMANDER Remove the vibration damper assembly, and with Universal Puller HM-925, remove the fan drive pulley. Then remove the timing gear cover, and using the same puller, remove the crankshaft and camshaft gears (see Fig. 153).

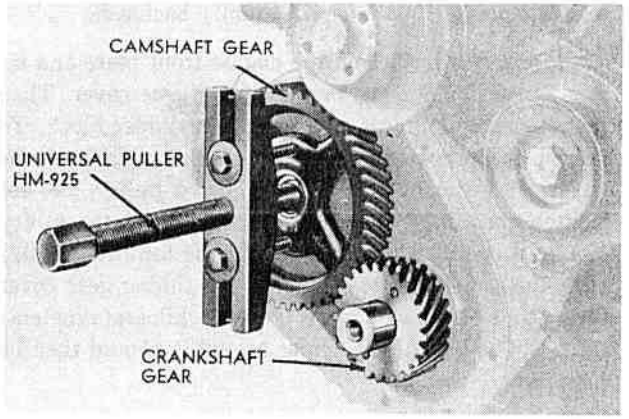


FIG. 153

If the removal of the camshaft is intended, the camshaft gear should not be removed. Remove the gear and shaft as a unit.

Before attempting the removal of the camshaft, remove the cylinder head, valves, valve springs, and oil pump and invert the engine so that the tappets will not interfere with the camshaft removal. Removing the two cap screws and lock washers which attach the camshaft timing gear thrust plate (or washer) to the cylinder block will then permit the removal of the camshaft (see Fig. 154). To remove the camshaft bushings, use Camshaft Bushing Removing and Installing Tool J-2036-A. After the camshaft has been removed from the cylinder block, the camshaft gear can be removed from the shaft with Universal Puller HM-925.

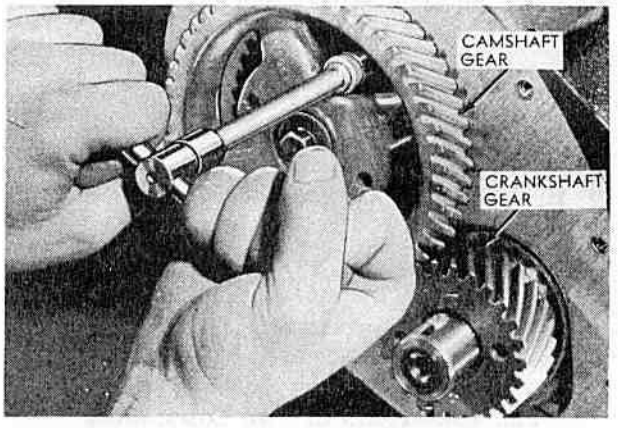


FIG. 154

Installation

CHAMPION AND COMMANDER Install the camshaft bushings with Camshaft Bushing Removing and Installing Tool J-2036-A. Then carefully slide the camshaft into its position.

Camshaft end thrust is taken by a thrust plate (or washer) which is located between the front camshaft bearing and the camshaft gear (see Fig. 155). A .004" to .008" (0,1016 mm. to 0,2032 mm.) end play is permissible. The end play is regulated by the amount by which the thickness of the thrust spacer exceeds that of the thrust plate. *If, however, a new thrust plate and thrust spacer are installed, the end play should be from .004" to .006" (0,1016 mm. to 0,1524 mm.).* Use a micrometer to measure both parts (see Fig. 156).

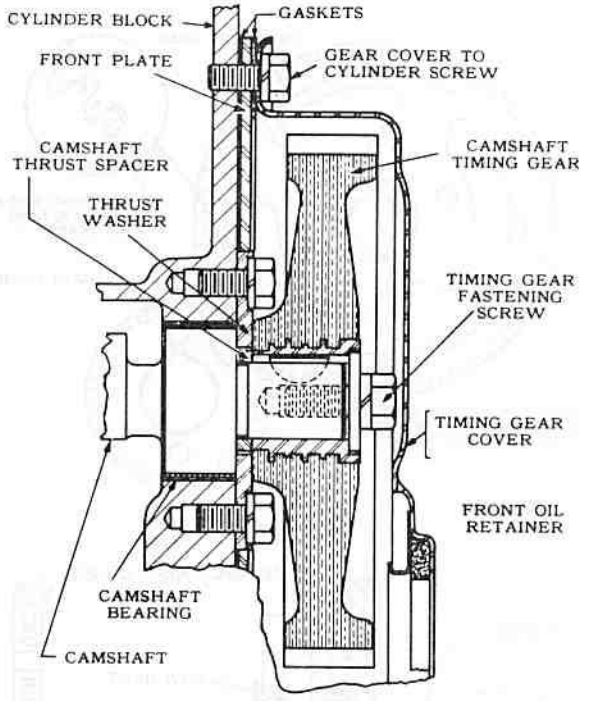


FIG. 155

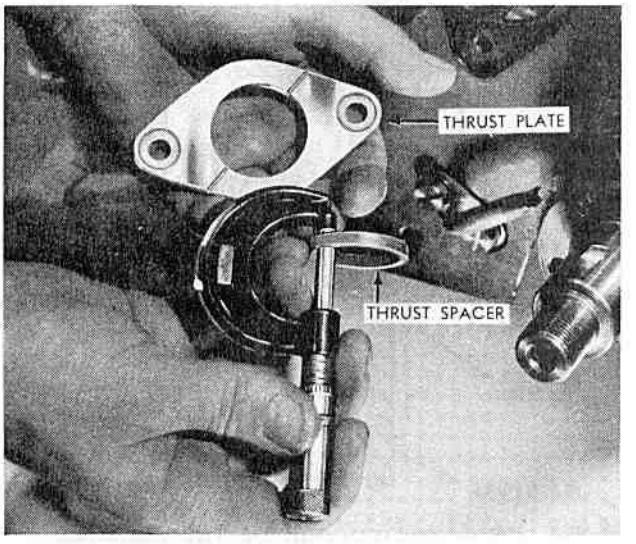


FIG. 156

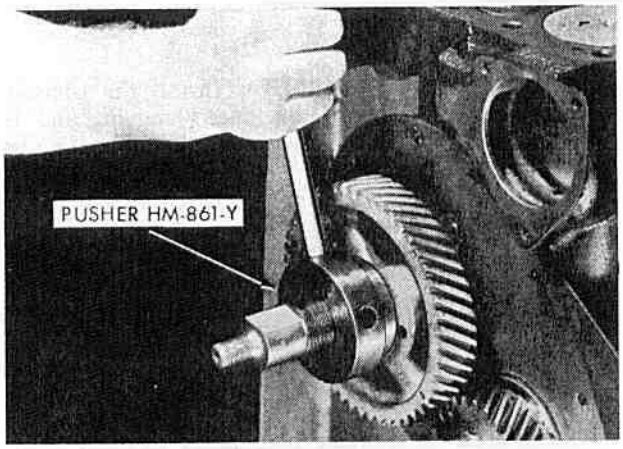


FIG. 157

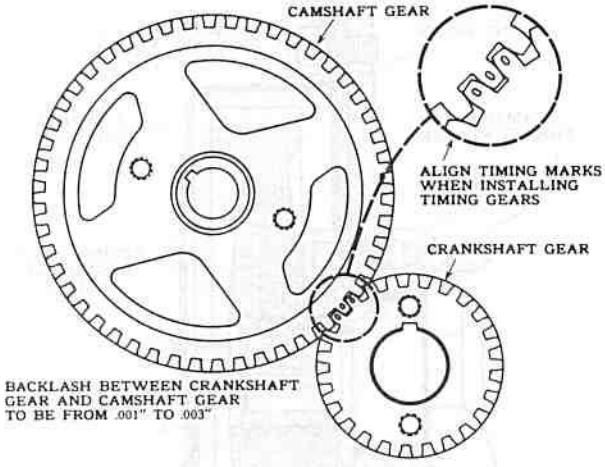


FIG. 158

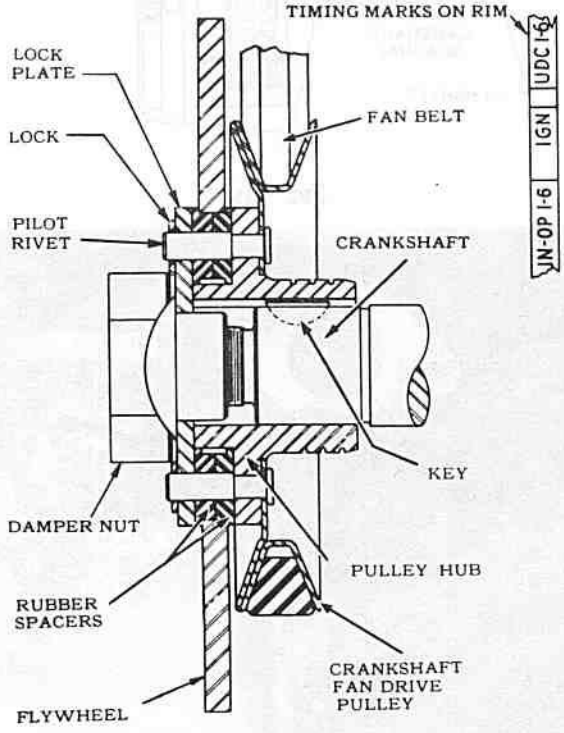


FIG. 159.—CONSTRUCTION OF THE CHAMPION VIBRATION DAMPER

Use Pusher HM-861-Y to install the crankshaft and camshaft gears (see Fig. 157). Driving these gears into position may damage internal parts of the engine and may cause severe oil leakage at the camshaft rear bearing expansion plug. Correct valve timing can be obtained only if the timing marks of the gears are aligned, that is, the marked tooth on the camshaft gear must be between the two marked teeth on the crankshaft gear (see Fig. 158).

The camshaft gears for both engines are obtainable in three sizes and are marked "S" for standard, "H" for high limit, and "L" for low limit. The crankshaft gear is available in the standard size only. Whenever new gears are installed, they should be selected to give a maximum of .003" (0,0762 mm.) backlash.

Place a new gasket on the engine front plate and insert a new felt washer in the timing gear cover. Then install the timing gear cover on the cylinder block. To permit the proper alignment of the felt washer in the cover with the hub of the fan drive pulley, do not tighten the timing gear cover screws until the pulley has been installed. After installing the fan drive pulley with Pusher HM-861-Y, tighten the timing gear cover screw to 13-17 foot-pounds (1,8-2,4 kilogram-meters) torque. The vibration damper assembly should then be installed.

Vibration Damper

CHAMPION AND COMMANDER The vibration damper consists of a flywheel driven through rubber discs. Oscillations of this flywheel during periods of crankshaft torsional vibration tend to neutralize or dampen such vibrations. No adjustments are necessary. If the vibration damper does not function correctly, the rubber discs should be replaced. Timing marks for both the valves and the ignition are located on the outside rim of the vibration damper flywheel (see Figs. 159 and 160). Tighten the crankshaft vibration damper cap screw on the Champion to 130-140 foot-pounds (18,0-19,4 kilogram-meters) torque and the vibration damper nut on the Commander to 160-170 foot-pounds (22,1-23,5 kilogram-meters) torque.

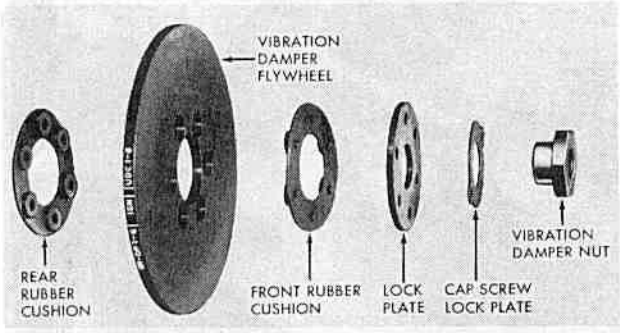


FIG. 160.—PARTS OF THE COMMANDER VIBRATION DAMPER

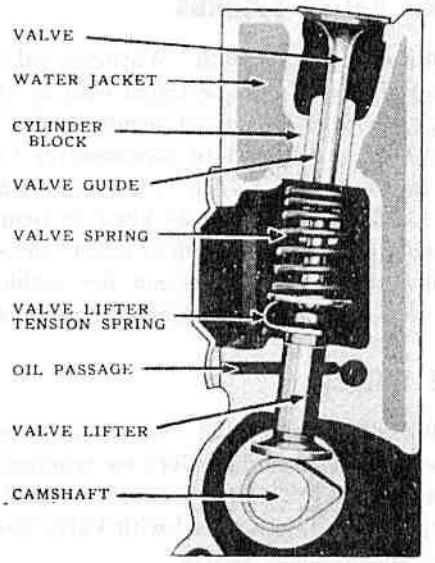


FIG. 161.—CONSTRUCTION OF THE CHAMPION VALVE MECHANISM

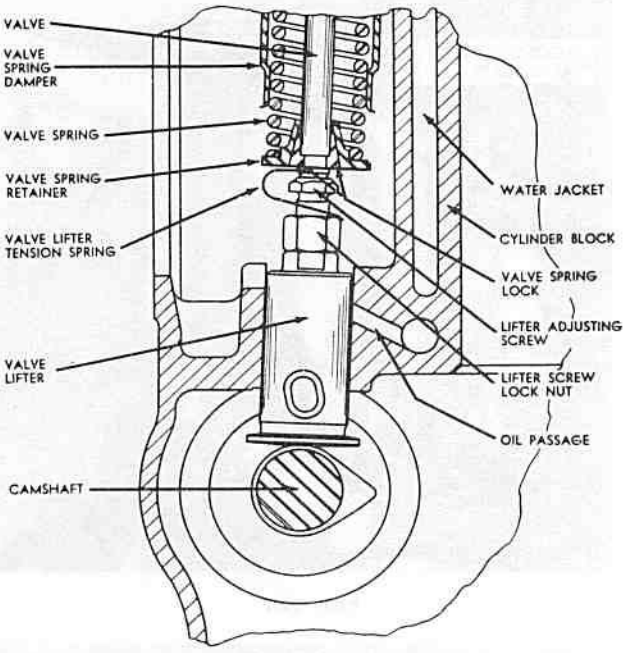


FIG. 162.—CONSTRUCTION OF THE COMMANDER VALVE MECHANISM

Valves and Valve Lifters (Tappets)

● The valves used in the Champion and Commander engines are similarly constructed. The tappets on the Champion, however, use a self-locking adjusting screw, whereas those on the Commander use a lock nut to anchor the adjusting screw at the correct setting. Studebaker valve seats are not inserted, but are an integral part of the engine block.

Removal

CHAMPION AND COMMANDER After removing the cylinder head, remove the valve lifter tension springs, and with a valve spring compressor remove the valve spring seats or locks (see Fig. 163). Then remove the valves from the engine block, and using a large screw driver or similar tool, remove the valve springs and retainers (with dampers on the Commander).

Valve lifters must be removed from below. This necessitates the removal of the oil pan and the camshaft from the engine. Both removal procedures are covered in this section.

CAUTION.—Do not use the barrel-type tappets used in former Commander engines in the 1947 Commander engine.

Installation

CHAMPION AND COMMANDER Insert the valve lifters and install the camshaft. Using a large screw driver or similar tool, install the valve springs and retainers (with dampers on the Commander). The closed coil of the spring should always be installed upward. Then install the valves, and with Tool No. CF-11 inserted under the retainer, compress the valve springs and insert the valve spring locks (seats).

NOTE.—On the Champion, the flanged part of the retainer should fit over the flat surface on the edge of the lower coil of the spring, and the tongue on the retainer should fit in the groove in the spring lock (see Fig. 164).

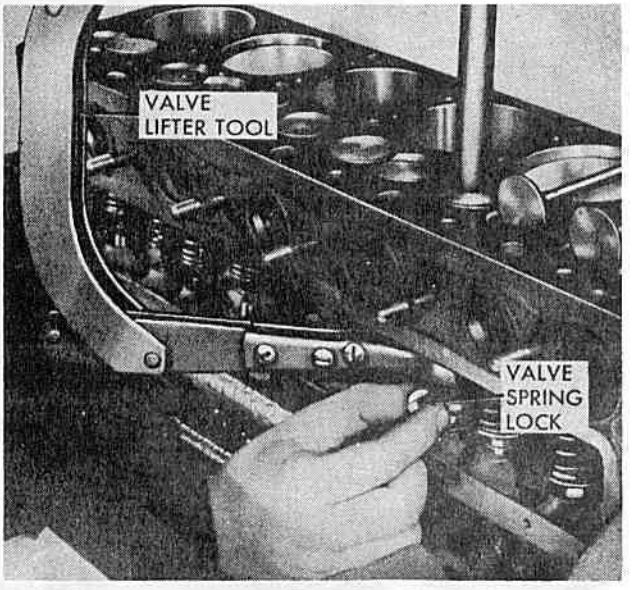


FIG. 163

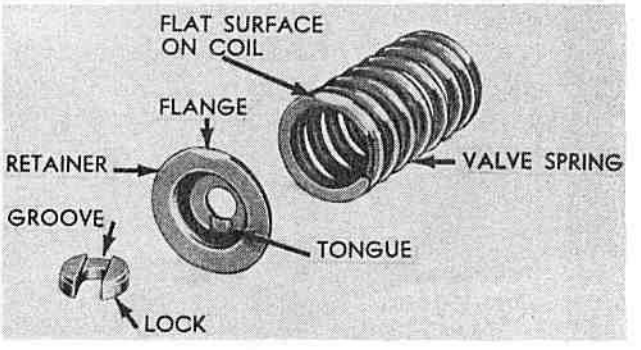


FIG. 164

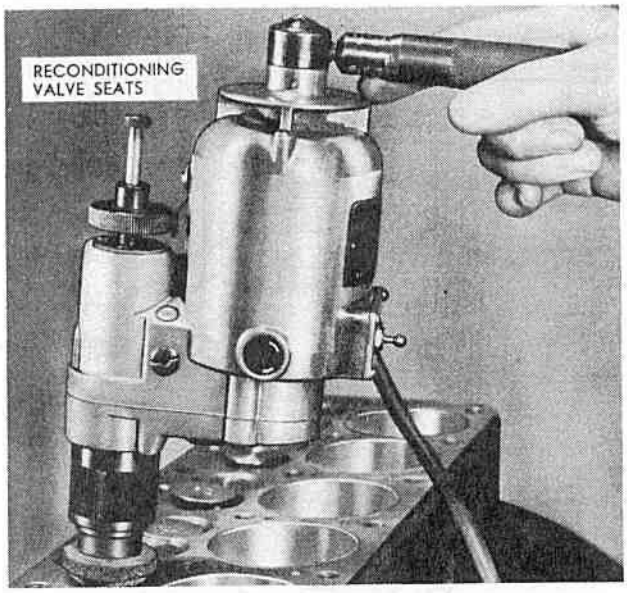


FIG. 165

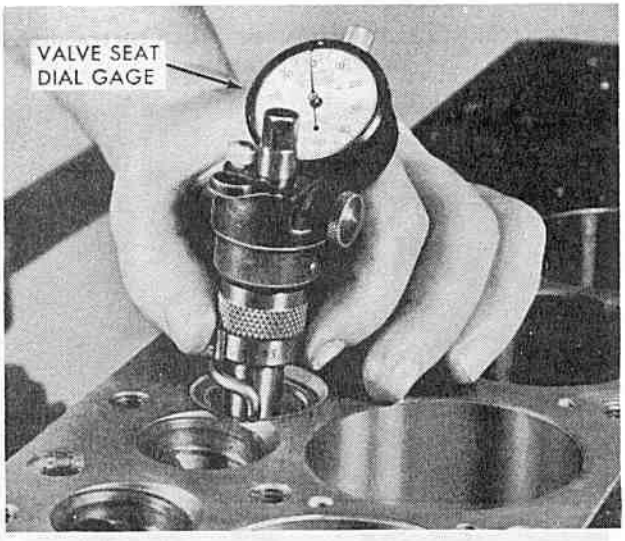


FIG. 166

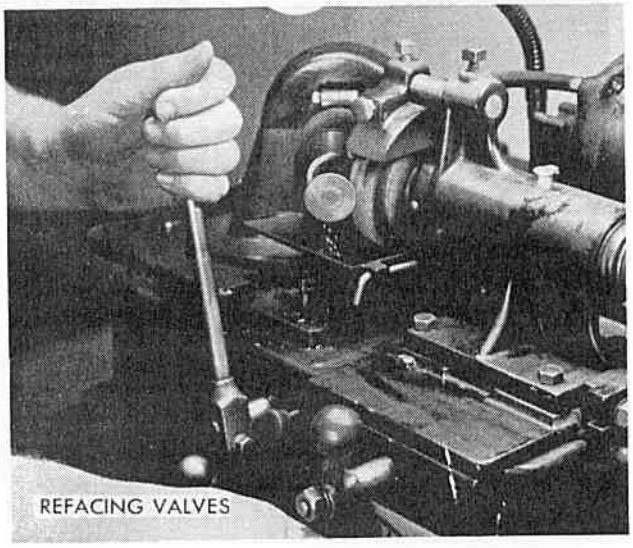


FIG. 167

TESTING VALVE SPRINGS

CHAMPION AND COMMANDER Whenever valve springs are removed, they should be tested with an accredited valve spring tester. It should require from 77 to 85 lb. (34,93 to 38,55 kgs.) to compress the Champion springs to a length of 1-7/16" (36,51 mm.) and from 125 to 135 lb. (56,70 to 61,24 kgs.) to compress the Commander springs to a length of 1-3/4" (44,45 mm.). Any valve spring which does not test within 10 per cent of these specifications should be replaced.

VALVE GUIDES

CHAMPION AND COMMANDER The valve guides should be inspected whenever the valves are removed. If they are worn so that the clearance exceeds .0035" (0,0889 mm.), they should be replaced with Valve Stem Guide Remover and Replacer J-2034.

RECONDITIONING VALVES AND SEATS

CHAMPION AND COMMANDER Use an accredited valve grinder to recondition the valve seats (see Fig. 165). All valve seats should be ground to an angle of 45 degrees and the width of the seats maintained at 3/32" (2,381 mm.) After reconditioning the valve seats, inspect them for runout with a valve seat dial gage (see Fig. 166).

The valves should also be ground at a 45-degree angle. Use an accredited valve refacer for this operation (see Fig. 167). After reconditioning the valves and seats, grind the valves lightly by hand with a fine compound (see Fig. 168).

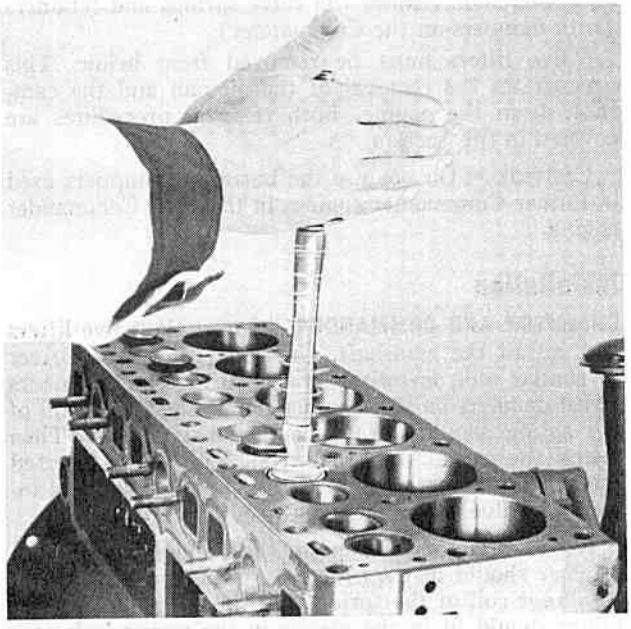


FIG. 168

VALVE TAPPET ADJUSTMENT

CHAMPION AND COMMANDER The slotted tappet adjusting screw of the Champion is self-locking (see Fig. 169), whereas the adjusting screw on the Commander requires a lock nut. When a Champion tappet adjusting screw is replaced, the torque required to turn the screw should be measured. A force of at least 25 inch-pounds (0,29 kilogram-meters) should be required to turn the screw (see Fig. 170). This is approximately a 4-pound (1,814 kgs.) pull at the end of a 6" (152,4 mm.) wrench.

The tappet clearance should be set at .016" (0,4064 mm.) with the engine cold. Remove the distributor cap, and turning the crankshaft clockwise until the No. 1 piston is on the compression stroke and the "UDC 1-6" marking on the vibration damper flywheel is directly under the timing pointer, adjust the No. 1 intake and exhaust valve-tappet clearance.

Connect a 6-volt, single-contact, timing light to the primary wire on the distributor and to a ground, and turning on the ignition switch, adjust the distributor so that the points just open (bulb lights). Then rotating the crankshaft clockwise until the bulb again lights, adjust the No. 5 intake and exhaust valve-tappet clearance. Repeat this procedure, following the firing order (1-5-3-6-2-4).

VALVE TIMING

CHAMPION AND COMMANDER To determine whether the valve timing of the engine is correct without dismantling the engine, adjust the tappet clearance of the No. 1 intake valve at .020" (0,5080 mm.). Turn the crankshaft clockwise until the No. 6 piston is on the compression stroke and the "IN-OP 1-6" marking on the vibration damper flywheel is several inches away from the pointer. Then grasp the tappet and continue to move it up and down, turning the crankshaft slowly ahead until no up-and-down clearance can be felt (see Fig. 171). When there is no clearance, the No. 1 intake valve begins to open, and if the valve timing is correct, the "IN-OP 1-6" marking should be directly below the pointer. If the flywheel marking is noticeably out of alignment with the pointer, the valve timing is incorrect.

NOTE.—Perform this timing operation carefully, turning the crankshaft slowly to locate the exact point at which the intake valve opens.

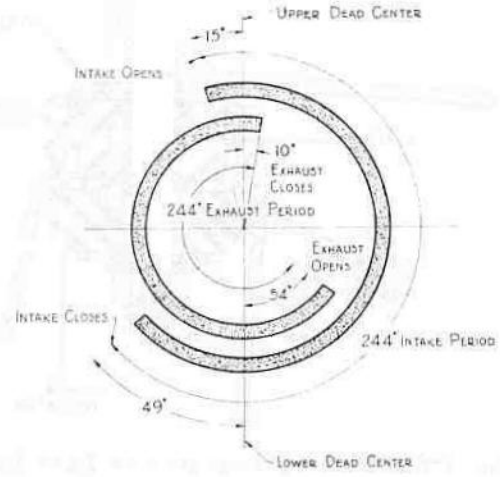


FIG. 172.—VALVE TIMING CHART

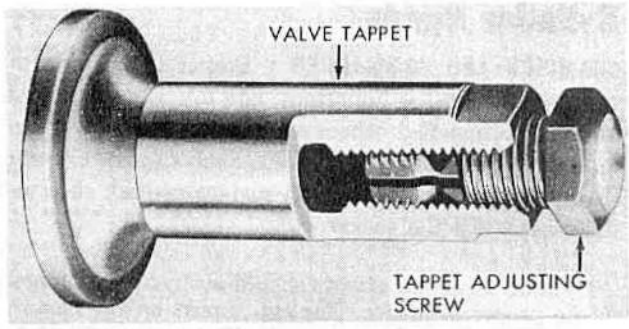


FIG. 169

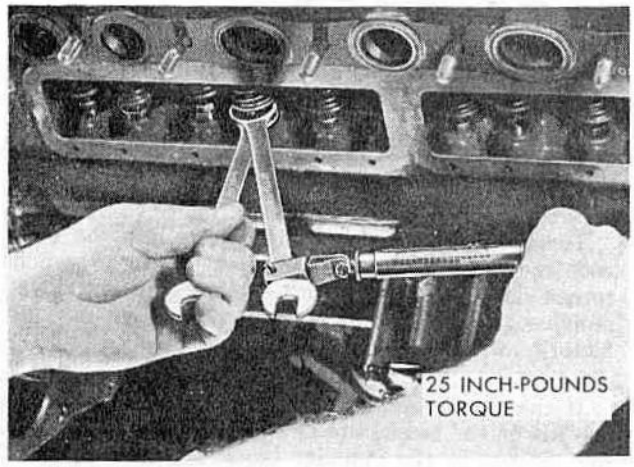


FIG. 170

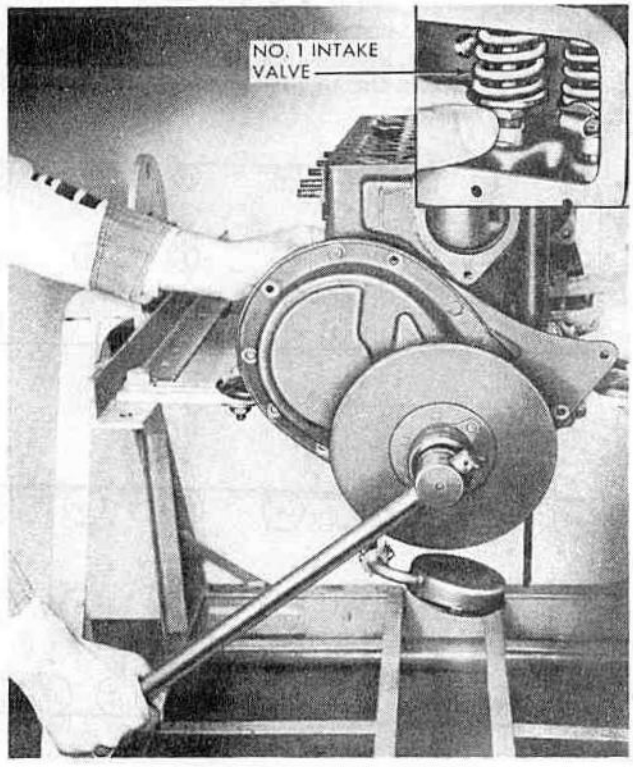


FIG. 171

Cylinder Heads

CHAMPION AND COMMANDER Proper installation of the cylinder head is important, and a new gasket must always be installed whenever a cylinder head is removed. A light film of Perfect Seal Gasket Cement should be used on the bottom surface of both the cylinder head and the gasket.

Cylinder head cap screws should always be tightened in the proper sequence. The cap screws on the Champion should be tightened to 46-50 foot-pounds (6,4-6,9 kilogram-meters) torque and on the Commander to 80-85 foot-pounds (11,1-11,8 kilogram-meters) torque (see Figs. 173 and 174). If, however, the threads in the cylinder block are corroded or filled with dirt, an incorrect reading will be obtained from the torque wrench, because a large precentage of the torque will be absorbed by the threads.

To overcome this condition, use the following methods to check thread tightness.

Turn the cylinder head cap screws into the block with the head and gasket off. If a cap screw can be turned down with the fingers so that only one thread remains exposed, the cap screw should tighten satisfactorily with the head and gasket installed.

If the cap screws do not turn in freely and if the threads on the screws are clean and in good condition, the threads in the cylinder block should be cleaned with a standard-sized tap (an oversized tap will cut the threads). Be careful not to cross-thread when using the tap.

Applying white lead or a similar seal on the threads of the cap screw, install the head and gasket on the block. The white lead, acting as a lubricant on the threads, facilitates the tightening of the cap screw to the proper tension.

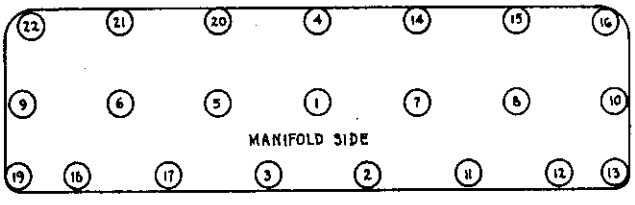


FIG. 173

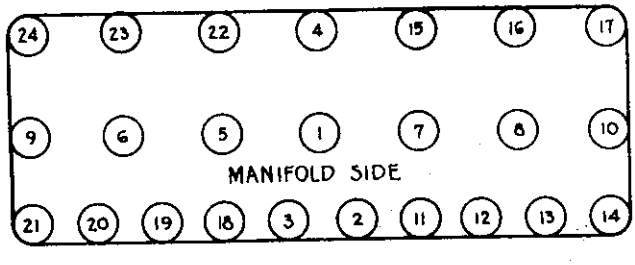


FIG. 174

Engine Supports

CHAMPION AND COMMANDER The engines are supported at the front by a single, bonded-rubber mounting and at the rear by two mountings of the biscuit type with the compression regulated by spacer tubes. Never shorten the spacers to increase the compression of the rubber biscuits. Tighten the rear mounting bolts with a torque wrench; to avoid damage to the spacer tubes, tighten to 25-30 foot-pounds (3,457-4,149 kilogram-meters) torque.

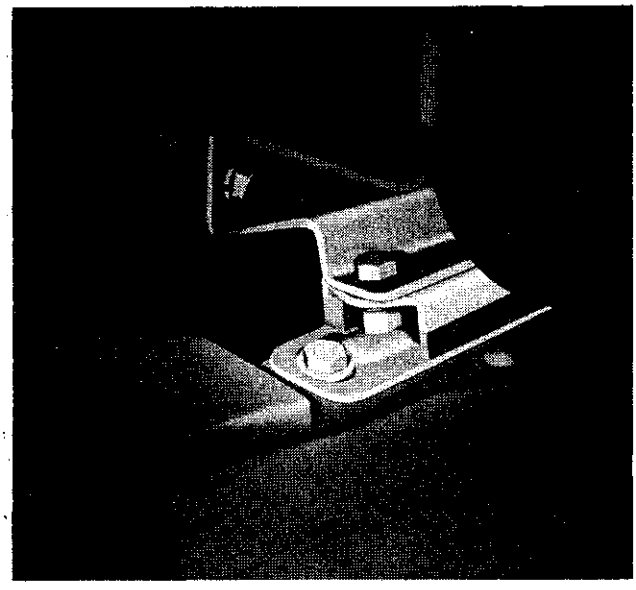


FIG. 175.—FRONT ENGINE SUPPORT

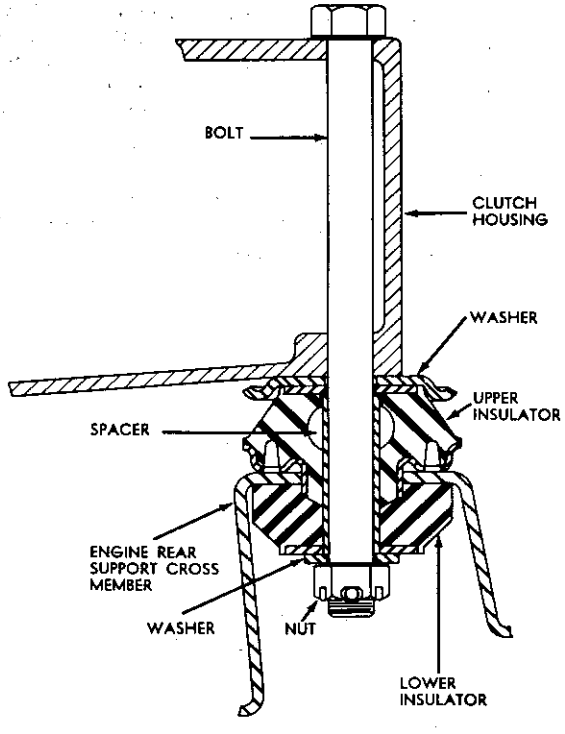


FIG. 176.—CONSTRUCTION OF THE REAR ENGINE SUPPORT

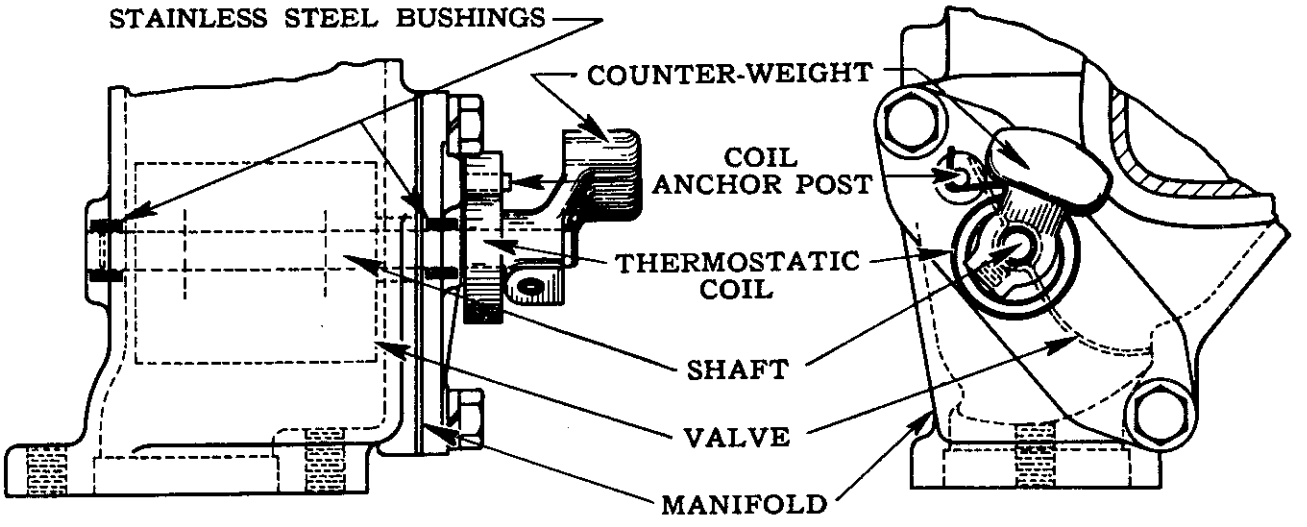


FIG. 177.—CONSTRUCTION OF THE CHAMPION MANIFOLD HEATER VALVE

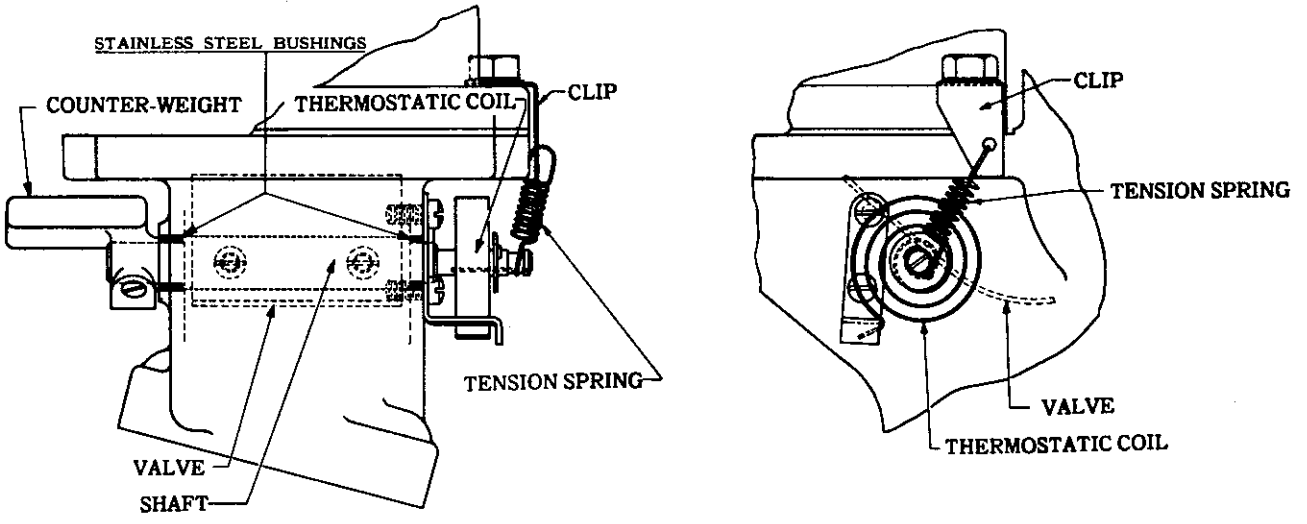


FIG. 178.—CONSTRUCTION OF THE COMMANDER MANIFOLD HEATER VALVE

Manifolds and Exhaust System

● The one-piece manifold to cylinder gasket should be installed on the Champion with the raised rings away from the cylinder block and on the Commander with the seams facing the block. With the engine cold, tighten the retaining nuts evenly and securely, starting in the center and working outward.

MANIFOLD HEATER VALVE

CHAMPION AND COMMANDER Inlet manifold heater valves, being thermostatically operated, provide the correct amount of heat to the gasoline-air mixture which enters the cylinders. The construction of the heater valve used on each model is clearly illustrated in figures 177 and 178.

To test the tension of a thermostat coil, unhook the coil from the pin. With the heater valve in the closed position (counterweight up) the hook in the end of the coil should assume the position shown in figure 179. At 70° F. (21° C.) this is approximately 90 degrees clockwise from the coil anchor point.

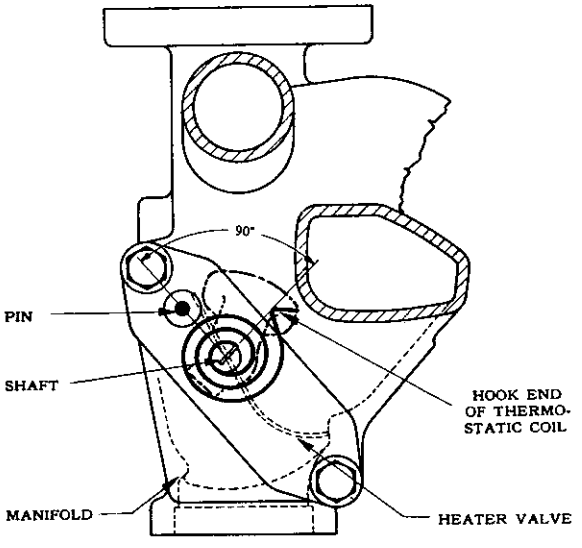


FIG. 179

Stainless steel bushings have been provided in the manifold to minimize the possibility of heater valves sticking. If, however, the valve should stick, lubricate the shaft with a mixture of kerosene and soda or with Bendix Carburetor Cleaner.

In extreme cases remove the shaft and reduce the diameter to give .005" (0,1270 mm.) clearance. Do not ream the bushings.

EXHAUST AND TAIL PIPE

CHAMPION AND COMMANDER Full power type mufflers, which minimize the horsepower lost in back pressure, are used on both models. Since the exhaust system is mounted on rubber hammocks, vibration and noise are not transmitted to the frame and body. To prevent the possibility of rattles and exhaust-gas leaks, inspect the system periodically and tighten the clamp and mounting bolts.

Engine Removal and Installation

● Observance of the following step-by-step procedure will facilitate the removal and installation of the engine:

Removal — Champion

1. Place the car under a good full-swiveling chain hoist.

2. Drain the cooling system.

3. Remove the hood assembly by removing the cotter pins and the four nuts which hold the hood hinge arms to the hood studs.

4. Remove the center cylinder head cap screw and replace it with an engine eye lifting bolt. Then attach the lift chain of the hoist to the lifting bolt and take up the slack in the chain. The eye lifting bolt must be in good condition and must be used only with the cylinder head installed on the block.

5. Remove both clutch housing to engine rear plate dowel bolts and nuts. Then remove the four additional bolts and nuts which hold the bottom of the clutch housing to the engine rear plate.

6. Roll back the right front corner of the front floor mat or carpet, remove five of the six metal screws which hold the clutch housing cover plate to the front floor pan, and swing the cover left and rearward to expose the top of the clutch housing.

7. Remove the three 3/8" (9,525 mm.) cap screws which hold the top of the clutch housing to the engine block.

8. Disconnect the battery ground strap from the battery ground post.

9. Remove the three sheet metal screws which hold the left side of the radiator core to the core support.

10. Remove the head lamp wiring harness from the radiator and fender clips.

11. Remove the two cap screws which hold the engine water outlet to the cylinder head and block.

12. Disconnect the two wires from the generator and the black and green primary wire from the ignition coil.

13. Remove the cotter pin and clevis pin which connect the accelerator cross shaft to the push rod.

14. Disconnect the heat indicator from the cylinder head.

15. Remove the two 7/16" (11,113 mm.) cap screws which hold the starter to the clutch housing, and, without disconnecting the wires, place the starter to the left of the parking brake cable.

16. Remove the inlet hose from the water pump. Then remove the three sheet metal screws which hold the right side of the radiator core to the core support.

17. Lift the radiator core carefully out of the core support, positioning the fan and the head lamp wiring harness to provide clearance for the inlet hose and the radiator outlet fitting.

18. Remove the four 5/16" (7,938 mm.) cap screws which hold the fan blades and pulley to the fan hub. Then remove the fan blades and pulley and place the head lamp wiring harness over the top of the radiator core support.

19. Disconnect the flexible fuel pump coupling from the front gasoline pipe.

20. Remove the two nuts which hold the exhaust pipe flange to the exhaust manifold. Then lower the pipe off the manifold studs.

21. Loosen the engine breather pipe cap screw to permit the pipe to swing without injury to the gasket.

22. Pull the rubber vacuum tube off the manifold fitting and disconnect the flexible coupling from the upper oil pressure gage pipe.

23. Remove the one remaining bolt (the bolt to which the oil pressure gage pipe is attached) and nut which hold the clutch housing to the engine rear plate.

24. Remove the front engine support from both the front frame cross member and the front engine insulator.

25. Roll the car rearward to cause engine and clutch housing separation. Slowly pull the engine up and forward, keeping the engine tilted until the clutch pressure plate clears the transmission pinion and the engine rear plate clears the center tie rod.

26. Move the engine rearward and turn the rear of the engine 45 degrees to the right. Then slowly lift the engine from the chassis.

27. Place the assembly in an engine stand.

Installation — Champion

1. Align the clutch driven plate with the clutch pilot bearing and lubricate the clutch pilot bearing with wheel bearing grease.

2. Locate the car or hoist so that the lift chain of the hoist will exert a definite rearward force on the engine as it is lowered into position.

3. To facilitate the entry of the transmission pinion splines into the clutch driven plate, shift the transmission into conventional high gear to permit the rotation of the pinion shaft when the car is moved.

4. Keep the rear end of the engine tilted downward as it nears the end of its descent.

5. After the front end of the transmission pinion has entered the clutch pressure plate case, move the car slightly forward to facilitate spline engagement.

6. Temporarily align the clutch housing with the engine rear plate, using two 1/4" x 8" (6,350 mm. x 203,200 mm.) tapered drifts. Coat the two dowel bolts with a film of white lead before installing them. Tighten the dowel bolts with the nuts; *do not drive them into place.*

7. Thoroughly tighten all connections while reinstalling the engine assembly in the chassis. Adjust the hood and refit it if necessary. Refill the cooling system and check for proper oil level. Then run the engine, checking for oil, gasoline, and water leaks.

Removal — Commander

1. Place the car under a good full-swiveling chain hoist.

2. Drain the cooling system.

3. Remove the hood from the hood hinge arms.

4. Disconnect the battery ground strap from the cylinder head cap screw.

5. Remove the exhaust pipe hanger clamp located near the front of the muffler. After removing the exhaust pipe front support bracket from the clutch housing, remove the support bracket and clamp from the exhaust pipe.

6. Remove the nuts which hold the exhaust pipe flange to the manifold.

7. Disconnect the front parking brake cable from the rear cable at the clamp. Move the front cable forward to an out-of-the-way position.

8. Disconnect the speedometer cable from the transmission. On overdrive transmissions, the overdrive wiring and control cable should also be disconnected.

9. Disconnect the shift rods from the transmission and remove the two U-bolts which hold the two needle bearings to the transmission companion flange. Lever the front end of the front propeller shaft to the left and use Universal Joint Clamp J-881-A to keep the needle bearings in position and free from foreign matter.

10. Remove the four cap screws and lock washers which hold the transmission to the clutch housing. Then remove the transmission.

11. Remove the cotter pin and inner clevis pin from the clutch operating shaft sleeve and move the operating shaft and sleeve toward the frame as far as possible.

12. Remove the engine rear support bolts, lower insulators, and spacers.

13. Remove the bolts which hold the front engine support insulator to the front engine support.

14. Remove the center cylinder head cap screw and replace it with an engine eye lifting bolt. The eye lifting bolt must be in good condition and must be used only with the cylinder head installed on the block. Attach the lifting hook of the chain hoist to the lifting bolt and take up the weight of the engine.

15. Without disconnecting the horn wires, remove the right horn from the cowl and place it on top of the windshield wiper motor.

16. Pull the rubber vacuum tube off the manifold fitting and disconnect the flexible coupling from the upper oil pressure gage pipe.

17. Remove the engine breather tube.

18. Disconnect the flexible gasoline pipe coupling from the fuel pump.

19. Remove the inlet hose from the water pump and the outlet hose from the radiator core.

20. Remove the head lamp wiring harness from the radiator clips and remove the six sheet metal screws which hold the radiator core to the core support.

21. Carefully lift the radiator core out of the core support, turning the fan blades clockwise to provide clearance for the inlet hose and the radiator outlet fitting.

22. Remove the fan blades and pulley from the fan hub.

23. Disconnect the two wires from the generator and the black and green primary wire from the ignition coil.

24. After disconnecting the starter solenoid switch connector (strap) from the starter post terminal, remove the two screws which hold the solenoid switch to the starter motor. Then, without disconnecting the wires, place the solenoid switch to the left of the parking brake cable.

25. Remove the cotter pin and clevis pin which connect the accelerator cross shaft to the push rod.

26. Disconnect the heat indicator from the cylinder head.

27. Push the car rearward so that a slight forward pull will be exerted on the lift chain as the engine is raised. Keeping the rear end of the engine lower than the front end, slowly pull the engine upward and forward until the front end of the engine enters the core support opening. Then swing the rear end of the engine to the right and rearward to clear the core opening and slowly lift the engine from the chassis.

28. Place the assembly in an engine stand.

Installation — Commander

1. Before installing the engine, align the clutch driven plate with the pilot bearing and lubricate the clutch pilot bearing with wheel bearing grease.

2. Thoroughly tighten all connections while reinstalling the engine assembly in the chassis. When installing the transmission, move the release shaft back and forth to prevent the release bearing from binding on the transmission front flange.

3. Adjust the hood and refit it if necessary. Refill the cooling system and check for proper oil level. Then run the engine, checking for oil, gasoline, and water leaks.

Engine Tune-up

● Engine tune-up, one of the most important of the maintenance services, determines whether or not the automobile will perform with maximum economy and efficiency. It is, therefore, important that this service be performed on the engine every spring and fall. The following tune-up information should be helpful to the mechanic.

COMPRESSION

● An engine without reasonably high and uniform compression cannot be effectively tuned. The compression of each cylinder should, therefore, be tested before any other tune-up operations are performed.

After warming up the engine, remove the spark plugs and insert an accredited compression gage in a spark plug hole. With the throttle in the wide-open position, crank the engine with the starter motor and record the highest gage reading. Repeat this test on all cylinders. There should be not more than a 10-pound (0,7 kg.) variance among cylinders.

CYLINDER HEAD

● Cylinder head cap screws should always be tightened in the proper sequence. The cap screws on the Champion should be tightened to 46-50 foot-pounds (6,4-6,9 kilogram-meters) torque and on the Commander to 80-85 foot-pounds (11,1-11,8 kilogram-meters) torque (see Figs. 173 and 174). Tighten cylinder head cap screws with the engine cold.

VALVE TAPPET ADJUSTMENT

● An engine will not perform efficiently if the valve tappets are not properly adjusted. With the engine cold, set both the intake and exhaust valve-tappet clearance at .016″ (0,4064 mm.)

IGNITION SYSTEM

● Clean and respace the spark plugs. An electrode gap of .025″ (0,635 mm.) is recommended. This gap should be checked with a wire gage. For peak engine efficiency, the spark plugs should be replaced every 10,000 miles (16.090 km.).

Clean the distributor cap and rotor and check them for cracks or corrosion. If the distributor points are burned, replace them; if they are out of alignment, align them. Set the breaker point gap at .020″ (0,51 mm.). Inspect the condenser wiring for breakage and check the efficiency of the condenser with an accredited condenser tester. Check the vacuum spark modifier for proper operation.

Inspect the primary and secondary wiring for breakage, corroded terminals, and poor insulation. The ignition coil should be checked with an accredited coil tester.

Center the octane selector and time the ignition. For complete timing instructions, refer to "Distributor Assembly" in the section "Electrical System."

BATTERY

● Check the condition and the state of charge of the battery. Also check the condition of the ground strap, the battery to starter switch cable, and all terminals. Cover the terminals liberally with Vaseline to prevent corrosion.

ELECTRICAL WIRING, STARTER, AND GENERATOR

● Inspect the condition of the wiring and the tightness of the electrical connections under the hood and dash. Check the starter and generator for proper operation.

COOLING SYSTEM

● Check the level of the coolant. Check the entire cooling system for leaks, the fan belt for proper adjustment, and the generator attaching bolts for tightness. The fan belt should be kept reasonably tight; excessive tension, however, will result in placing undue strain on the fan and generator bearings.

MANIFOLDS AND HEATER VALVE

● With the engine cold, tighten the manifold retaining nuts evenly and securely, starting in the center and working outward.

Check the manifold heater valve for freedom of operation. If the valve should stick, lubricate the shaft with a mixture of kerosene and soda or with Bendix Carburetor Cleaner.

FUEL SYSTEM

● Clean the fuel pump bowl and strainer and install a new bowl gasket. If the bowl and strainer are excessively dirty, clean out the gas line and, if necessary, the gas tank. Check the fuel pump for proper pressure.

Inspect the throttle linkage and check the throttle valve for full opening. If the car is equipped with an overdrive, also check the operation of the overdrive accelerator kickdown switch.

Clean the carburetor air cleaner. If necessary, clean and adjust the carburetor, including the thermostatic choke control. Install new gaskets if the carburetor is disassembled. With the engine idling at normal operating temperatures and with the air cleaner installed, adjust the carburetor idle screw and the idle stop screw.

ROAD TEST

● After completing the tune-up inspections and adjustments, road test the car to determine whether any other mechanical deficiencies are affecting the operating efficiency of the car.

ENGINE DIAGNOSIS

ENGINE STARTS HARD OR WILL NOT START

CAUSES

1. Improper carburetion due to:
   - *a)* Carburetor passages restricted by water, ice, or corrosion.
   - *b)* Insufficient quantity or lack of gasoline in carburetor.
     - (1) Clogged or restricted fuel line from pump to carburetor.
     - (2) Clogged or dirty carburetor screen (Champion).
     - (3) Inoperative fuel pump.
     - (4) Low carburetor float level.
   - *c)* Air leaks at intake manifold or in the carburetor due to:
     - (1) Loose manifold and carburetor attaching nuts.
     - (2) Leaking intake manifold or carburetor gaskets.
     - (3) Leaks occurring in vacuum line connections at intake manifold.
     - (4) Warped carburetor manifold attaching flanges.
     - (5) Cracked intake manifold.
     - (6) Leak at air horn gasket or throttle shaft bearing.
   - *d)* Poor grade, old, or stale fuel in combination with cold weather.
   - *e)* Cylinders and manifold flooded with gasoline.
2. Electrical difficulties.
   - *a)* Battery.
     - (1) Battery low or completely discharged.
     - (2) Battery terminals loose or badly corroded.
     - (3) Improper battery ground.
   - *b)* Ignition.
     - (1) Primary circuit.
       - *(a)* High resistance due to corroded, dirty, or loose connections.
       - *(b)* Ignition out of time.
       - *(c)* Weak or grounded condenser.
       - *(d)* Distributor breaker points improperly spaced, dirty, or loose.
       - *(e)* Breaker arm sticking, springs weak or broken, or arm grounded.
       - *(f)* Loose or grounded distributor terminal post.
     - (2) Secondary circuit.
       - *(a)* Corroded cable terminals.
       - *(b)* Chafed or cracked insulation on cables.
       - *(c)* Ignition coil weak, or inoperative.
       - *(d)* Moisture on ignition coil, terminals, distributor cover, spark plug porcelains, or in distributor.
       - *(e)* Improper type of plug.
       - *(f)* Cracked distributor cover.
       - *(g)* Improper installation of secondary cables (not correct for engine firing order).
       - *(h)* Spark plugs damaged, dirty, wet, porcelains cracked, or gap improperly spaced.
       - *(i)* Rotor contact spring bent or broken.
       - *(j)* Distributor rotor grounded.
       - *(k)* Distributor cap center terminal (inner) broken or missing.
     - (3) Ignition switch.
       - *(a)* Loose contacts.
       - *(b)* Corroded or burned contacts.
   - *c)* Starter motor.
     - (1) Starter motor inoperative or not operating properly.
     - (2) Congealed engine oil due to the use of too heavy a grade of oil or to the formation of sludge.
     - (3) Starter motor pinion stuck in flywheel gear.
     - (4) Starter switch not operating properly.
3. Poor engine compression resulting from:
   - *a)* Loose cylinder head cap screws.
   - *b)* Spark plugs loose in head.
   - *c)* Improperly installed or damaged cylinder head gasket.
   - *d)* Poorly seating valves.
   - *e)* Weak or broken valve springs.
   - *f)* Valves holding open due to insufficient tappet clearance.
   - *g)* Valves holding open due to stems being warped, corroded, or gummed.
   - *h)* Badly worn, broken, weak, or stuck piston rings.
4. Unusual causes.
   - *a)* Valves improperly timed.
   - *b)* Broken or loose camshaft or distributor drive gear.
   - *c)* Cracked cylinder block.
   - *d)* Water in cylinders.
   - *e)* Excessive internal friction of engine assembly.

LOSS OF OR UNEQUAL ENGINE COMPRESSION

DESCRIPTION

When the engine is running at a speed which is equal to a road speed of 15 and 20 miles (24,14 and 32,18 km.) per hour, unequal compression among cylinders can often be detected by the sound of the exhaust at the end of the tail pipe. Unequal compression gives an unequal exhaust. Before any corrective measures are undertaken, also check items affecting ignition and carburetion to determine definitely that a compression loss is occurring. A loss of compression in all cylinders can generally be detected by a decrease in power, speed, and acceleration. It is important, however, that a compression gage be used to determine accurately the compression before any corrective work is undertaken.

TEST

Use a compression gage to determine the compression of the cylinders. Remove the spark plugs and insert the gage in the spark plug hole of each cylinder. With the carburetor throttle wide-open, crank the engine with the starter motor and record the maximum pressure indicated on the gage. After recording the compression readings, place approximately a teaspoonful of engine oil on the top of the piston and repeat the check. If the pressure indicated on the gage shows a decided increase, there is probably a compression

loss past the pistons and rings. If the pressure does not increase, the valves are seating improperly. A head gasket leakage between two cylinders will be indicated by a low pressure reading for two adjacent cylinders.

CAUSES

1. Valves seating improperly.
   a) Valves holding open due to insufficient tappet clearance.
   b) Sticking valves.
      (1) Insufficient stem to guide clearance.
      (2) Gum or carbon deposits on valve stems and in valve guides.
   c) Warped or broken valve heads or bent valve stems.
   d) Burned, pitted, or distorted valve seats.
   e) Weak or broken valve springs.
2. Compression loss past pistons and rings.
   a) Excessive clearance between pistons and cylinder walls.
   b) Eccentric or tapered cylinder bores.
   c) Scored cylinder walls.
   d) Scored pistons or piston ring faces.
   e) Insufficient piston ring end gap.
   f) Piston rings stuck in ring grooves (gum or carbon deposit).
   g) Insufficient piston ring tension.
   h) Excessive clearance of rings in ring grooves (worn grooves or undersize rings).
3. Cylinder head gasket leakage.
   a) Faulty head gasket.
   b) Loose cylinder head cap screws.
   c) Incorrect type of gasket.
   d) No gasket seal.
   e) Spark plug gasket leakage.
   f) Warped cylinder head.

LACK OF POWER OR HIGH SPEED PERFORMANCE

DESCRIPTION

In attempting to diagnose and correct lack of power or high speed performance, the service man should first of all determine whether the performance is normal or whether the owner's complaint is only imaginary. A comparison of the affected car with other cars of the same model will definitely determine this point.

TEST

Maximum acceleration and speed should be checked with a stop watch over a definite distance. The service man should have an accurately measured course where maximum speed trials can be made without undue interference from other traffic. A general idea of the condition of the car can be obtained during the maximum speed test and definite checks should be made covering causes Nos. 3, 4, 7, 8, 11, 12, 14, 15, and 18.

The altitude at which a car is operated has a decided effect upon performance. A car adjusted for normal altitudes will lack performance at high altitudes, whereas a car which operates normally at high altitudes may have a lean carburetor adjustment and show signs of preignition when operated at sea level.

CAUSES

1. Insufficient or unequal engine cylinder compression.
2. Improper ignition timing.
3. Inoperative automatic heat control valve (valve held in closed position).
4. Improper carburetion.
5. Restricted carburetor air inlet resulting from:
   a) Dirty carburetor air cleaner
   b) Choke valve not completely opening.
6. Improper adjustment of metering rod (see carburetor adjustment instructions).
7. Carburetor throttle lever loose on shaft.
8. Throttle linkage not properly adjusted and carburetor throttle valve not completely opening.
9. Improper fuel pump operation.
10. Partially restricted or clogged exhaust pipe, muffler, or tail pipe.
11. Excessive engine temperatures.
12. Preignition.
13. Excessive engine friction resulting from:
   a) Inadequate internal clearances (especially connecting rods).
   b) Use of heavy engine oil.
   c) Use of piston inner rings.
14. Clutch slippage.
15. Excessive rolling resistance resulting from:
   a) Dragging brakes.
   b) Tight wheel, pinion, differential, or transmission bearings.
   c) Misalignment in power transmitting units.
   d) Misalignment of rear axle.
   e) Underinflated tires.
16. Use of too fast a rear axle gear or oversize tires.
17. Incorrect valve timing.
18. Inaccurate speedometer (gives impression of lack of performance).
19. Vacuum spark modifier not operating properly.

ENGINE MISFIRES WHEN IDLING — NORMAL ENGINE TEMPERATURES

CAUSES

1. Improper carburetion resulting from:
   a) Float or fuel level too high.
   b) Float or fuel level too low.
   c) Restricted or partially clogged idle air passage or jet.
   d) Air leak occurring between upper and lower carburetor body around idle tube.
   e) Air leak occurring around the carburetor throttle shaft.
2. Air leaks in intake manifold or carburetor resulting from:
   a) Loose manifold connections or leaks occurring in vacuum lines.
   b) Loose manifold nuts.
   c) Broken or damaged intake manifold or carburetor gaskets.
   d) Crack in manifold.
   e) Warped or damaged manifold contacting surface.
3. Improper ignition.
4. Weak ignition coil.
5. Spark plug difficulties.
6. Uneven compression.
7. Heat control valve held open or weak control spring.

8. Unusual causes.
   a) Slight water leaks occurring in the cylinder or combustion chamber.
   b) Slight leakage occurring at check valves in the fuel pump.
   c) Air leak occurring around the intake valve stem because of excessive valve stem to guide clearance.

ENGINE MISFIRES AT LOW SPEED (BELOW 20 M.P.H. [32,18 KM.]) ON PULL

CAUSES

Same causes as listed under "Engine Misses When Idling — Normal Engine Temperatures."

ENGINE MISFIRES AT HIGH SPEEDS

CAUSES

Please refer to "Lack of Power or High Speed Performance," causes 1, 2, 3, 4, 5, 9, 10, 11, 12, and 17.

CRANKSHAFT KNOCKS

DESCRIPTION

Noises classified as crankshaft knocks are usually dull, heavy, metallic knocks which increase in frequency as the speed and the load on the engine increases or become more noticeable at extremely low speed when the engine is idling unevenly.

TEST

The most common crankshaft knock, due to excessive bearing clearance, is usually apparent as an audible "bump" under the following circumstances: when the engine is pulling hard, when a cold engine is started, during acceleration, or at speeds above 35 miles (56,32 km.) per hour. If excessive clearance exists at only one or two of the crankshaft journals, the "bump" will be less frequent and less pronounced. Alternate short-circuiting of each spark plug will usually determine the approximate location of a loose bearing.

Before attempting any corrections, check causes 6, 7, and 8 which can easily be confused with excessive clearance. Causes 3, 4, and 5 will cause a knock very similar to loose main bearings, and it is usually impossible to diagnose these causes accurately without the removal of the crankshaft.

Excessive crankshaft end play causes a sharp noise or rap which occurs at irregular intervals, usually at idling speeds, and in bad cases can generally be detected by the alternate release and engagement of the clutch. To detect a loose flywheel, advance the engine idle to a speed which is the equivalent of 10 to 15 miles (16,09 to 24,14 km.) per hour. Turn off the ignition switch and then, when the engine has almost stopped, turn the switch on. If this operation is repeated several times and if, of course, the flywheel is loose, one distinct knock will be noted every time the switch is turned on.

At low engine speeds with an uneven idle, a loose crankshaft gear can generally be detected by a sharp clatter. When testing for either of those conditions, short-circuit one or two spark plugs to produce an extremely uneven idle.

CAUSES

1. Excessive bearing clearance (radial).
2. Excessive end play.
3. Eccentric or out-of-round journals.
4. Sprung crankshaft.
5. Bearing misalignment.
6. Insufficient oil supply.
7. Low oil pressure.
8. Badly diluted oil (thin).
9. Loose flywheel.
10. Loose crankshaft gear.
11. Unusual causes.
    a) Broken crankshaft web.
    b) Distorted crankcase.

CONNECTING ROD NOISES

DESCRIPTION

Connecting rod noises are usually a light pound or knock of much less intensity than main bearing knocks. The noise is usually evident with the engine idling and becomes louder when the engine speed is slightly increased. On some engines connecting rod noise is most pronounced at a speed of approximately 30 miles (48,27 km.) per hour when running with a light engine load. Connecting rod noises should not be confused with piston or piston pin noises.

TEST

Short-circuiting the spark plugs usually locates a connecting rod noise. The noise cannot generally be entirely eliminated by a short circuit, but will ordinarily be considerably reduced. If causes 2, 3, and 4 are causing the noise, it may be impossible to reduce the noise to any great extent; a slight change, however, should be noticed as each spark plug is shorted.

CAUSES

1. Excessive bearing clearance on crank pin (radial).
2. Insufficient oil supply.
3. Low oil pressure.
4. Badly diluted oil (thin).
5. Misaligned connecting rods.
6. Eccentric out-of-round or crank pin journal tapered.

PISTON NOISES

DESCRIPTION

The most common piston noise is a slap, which is due to the rocking of the piston from side to side in the cylinder. Although in some engines piston slap causes a clicking noise, it usually causes a hollow, muffled, bell-like sound. Slight piston noises that occur when the engine is cold and disappear after the engine is warm do not ordinarily warrant a correction. Piston ring noises generally cause a click, snap, or sharp rattle on acceleration.

TEST

Short-circuiting the spark plugs will reduce some piston and ring noises; with other noises, however, this method is sometimes confusing. To detect piston slap more accurately, drive the engine at low speeds under a load. The noise generally increases in intensity as the throttle is opened and additional load applied. On some engines with very loose pistons, a piston rattle is encountered at speeds between 30 and 50 miles (48,27 and 80,45 km.) per hour when the engine is not being accelerated.

To eliminate piston and ring noises momentarily, put one to two ounces (28,35 to 56,70 grams) of very heavy engine oil into each cylinder through the spark plug hole. Crank the engine for several revolutions with the ignition off, until the oil has worked down past the piston rings. Then install the spark plugs, start the engine, and determine whether the noise still exists. If not, the noise is probably due to one of the following causes:

CAUSES

1. Excessive piston to cylinder bore clearance.
2. Eccentric or tapered cylinders.
3. Insufficient piston pin clearance.
4. Connecting rod misalignment.
5. Piston or rings interfering with ridge at top of cylinder bore.
6. Piston interfering with carbon accumulation at top of cylinder bore.
7. Piston interfering with cylinder head gasket.
8. Collapsed piston skirts.
9. Broken piston rings.
10. Excessive vertical clearance of ring in ring groove.
11. Pin hole out-of-square with piston.
12. Ring lands not properly relieved.

PISTON PIN NOISES

DESCRIPTION

The most common piston pin noise is the result of excessive piston pin clearance. This provides a sharp, metallic, double knock, generally audible with the engine idling and the spark fully advanced. On some engines, however, the noise is more noticeable at car speeds of 25 to 35 miles (40,23 to 56,32 km.) per hour. Interference between the upper end of the connecting rod and the pin boss is difficult to diagnose and can be mistaken for a loud valve tappet noise.

TEST

Allow the engine to run at idle speed with the spark fully advanced. In most cases a sharp, metallic, double knock will be evident when the spark plug in the cylinder with the loose piston pin is short-circuited. When the spark plug is shorted, the knock will become more audible. Retarding the spark will generally reduce the intensity of the knock. If the pins in all cylinders are loose, a metallic rattle, which is impossible to short out in any one cylinder, will be heard.

As piston, piston pin, and connecting rod noises are easily confused, it is suggested that the piston and connecting rod be removed and a bench test for piston pin looseness be conducted before actual corrective work is undertaken.

CAUSES

1. Excessive piston pin clearance.
2. Loose piston pin locking pin.
3. Piston pin loose in upper end of connecting rod.
4. Piston pin rubbing cylinder wall.
5. Connecting rod end rubbing piston pin boss.
6. Insufficient piston pin clearance (causes piston slap).

VALVE AND VALVE LIFTER (PUSH ROD) NOISES

DESCRIPTION

Noisy valve action has a characteristic clicking noise occurring usually at regular intervals. Inasmuch as the valves are operated by the camshaft running at one-half engine or crankshaft speed, the frequency of valve action noise is generally lower than that of other engine noises. If one or two of the valves or valve lifters are causing the noise, the clicking sound will be intermittent; if, however, the majority of the valves are causing the noise, the clicking may be continuous, increasing in intensity as the engine speed is increased.

TEST

Excessive valve stem to tappet clearance is a common cause of valve action noise. To determine whether the noise is due to this common cause, insert a thickness gage between the valve stem and the tappet adjusting screw. Then idle the engine. If the clicking noise ceases, the clearance is probably excessive, and the adjusting screw should be readjusted. Never reduce the valve stem to tappet clearance to a setting which is below factory specifications, because too little clearance is likely to result in burned valves.

If readjustment of the valve stem to tappet clearance does not eliminate the noise, check the condition and the clearances of the valve assembly as outlined in the following causes:

CAUSES

1. Common causes.
   a) Excessive valve stem to tappet clearance.
   b) Excessive clearance of push rod in guide.
   c) Push rod (lower end) scored, chipped, rough, worn, or broken.
   d) Push rod adjustment screws.
      (1) Face worn.
      (2) Face not properly machined.
      (3) Threads stripped or crossed.
   e) Weak valve springs.
2. Unusual causes.
   a) Excessive valve stem to guide clearance.
   b) Insufficient valve stem to guide clearance.
   c) Warped valve head.
   d) Valve head face that is not concentric with stem axis.
   e) Valve seat face that is not concentric with stem axis.
   f) Very rough surface on cams.

SPARK KNOCK (PREIGNITION OR DETONATION)

DESCRIPTION

Spark knock (preignition or detonation) causes a metallic ringing sound, often described as a "ping" and is usually encountered when the engine is laboring or accelerating rapidly, or is overheated.

TEST

Drive the car until the engine temperatures have become normal; then accelerate rapidly in high gear. If a spark knock is present, a pinging sound will be heard during at least a part of the accelerating period. To increase the intensity of the ping, cover the radiator to cause the engine to labor at excessive engine temperatures.

CAUSES

1. Large carbon deposits in combustion chamber.
2. Ignition timed too early.
3. Faulty automatic distributor advance (weak springs).
4. Inoperative spark advance modifier.
5. Spark plugs.
   a) Incorrect type of plug (using a plug which is too hot).
   b) Porcelains or electrodes carbonized or burned.
6. Sharp metallic edges in combustion chamber.
7. Cylinder head gasket projecting in combustion chamber.
8. Hot engine valves resulting from:
   a) Incorrect width of valve seats.
   b) Insufficient tappet clearance.
   c) Use of wrong type of valve.
   d) Thin-edged valves.
9. Excessive engine temperatures.
10. Poor grade of fuel.
11. Old or stale fuel.
12. Excessively lean carburetor mixture.
13. Inoperative automatic heat control valve (valve held in closed position).

ENGINE BACKFIRING THROUGH CARBURETOR

DESCRIPTION

If a cold engine backfires through the carburetor when it is started, an incorrect air-gasoline mixture is entering the cylinders. This condition is unavoidable and will, if the carburetor and choke adjustments are correct, automatically correct itself when the engine reaches normal operating temperatures. Correct continual backfiring after the engine has become warm or after considerable operation by checking the following causes:

CAUSES

1. Improper ignition timing.
2. Improperly seating valves, especially intake.
3. Incorrect valve timing.
4. Preignition from any source.
5. Excessively lean or abnormally rich carburetor mixture.
6. Intake manifold air leaks.
7. Defective cylinder head gasket (especially between cylinders).
8. Poor quality of fuel.
9. Secondary wires improperly installed (crossed) in distributor cap.
10. Distributor governor sticking.

MISCELLANEOUS ENGINE NOISES

DESCRIPTION

Engine noises are sometimes very difficult to find, and it is impossible to describe and suggest accurately the methods for locating all of the noises which may occur. The causes listed below are those which are most frequently encountered.

Causes Nos. 1, 2, and 3 usually result in a heavy thud, whereas cause No. 5, a manifold heater valve rattle, is apparent as a light metallic rattle or vibration.

CAUSES

1. Engine loose in frame.
2. Engine supports loose or broken.
3. Flywheel loose on crankshaft.
4. Crankshaft fan pulley loose on crankshaft.
5. Manifold heater valve rattling.
6. Thin-walled manifold (roaring noise).
7. Foreign object in exhaust manifold or passages.
8. Loose exhaust pipe at manifold connections.
9. Interference of exhaust line with frame.
10. Exhaust to inlet manifold gaskets blown.
11. Engine striking dash.
12. Transmission rubbing floor pan.
13. Loose engine accessories such as generator, water pump, engine fan, horn, etc.
14. Excessive timing gear backlash (sharp rap occurs).

ENGINE TORSIONAL VIBRATION

DESCRIPTION

Because of unavoidable manufacturing tolerances, torsional vibration is more severe in some engines than in others. Torsional vibration will not be apparent throughout the entire engine-speed range, but may be apparent as a high-pitched whir at a definite speed within a range of 3 or 4 miles (4,83 or 6,44 km.) per hour. A slight torsional vibration may be normal, and the service man should not attempt a correction unless the vibration becomes severe.

CAUSES

1. Excessive timing gear lash (.003" [0,0762 mm.] or more).
2. Eccentric timing gear (usually result of high key).
3. Timing gears loose on cam or crankshaft.
4. Excessive clearance at camshaft forward bearing.
5. Excessive clearance at crankshaft forward bearing.
6. Engine slightly loose in mountings.
7. Clutch linkage cross shaft not free or lubricated properly.

ENGINE VIBRATION — ESPECIALLY HIGH SPEED

CAUSES

1. Unequal compression of engine cylinders.
2. Engine misfires at high speeds.
3. Unbalanced fan or loose fan blade.
4. Incorrect adjustment of biscuit type engine mounting.
5. Loose engine mountings.
6. Engine support loose on frame or cylinder block.
7. Unbalanced or sprung crankshaft.
8. Excessive engine frictional resistance resulting from:
   a) Insufficient internal clearances.
   b) Scored pistons.

EXCESSIVE ENGINE OIL CONSUMPTION

DESCRIPTION

Driving speed and general condition of the engine have a decided effect upon oil consumption. It must be remembered that sustained high road speeds require greater oil consumption to provide adequate lubrication than do moderate speeds in city driving. It must also be remembered that the modern engine holds from a pint to a quart of oil in suspension for from 5 to 10 minutes after the engine has been stopped. For this reason, an accurate check of the oil level cannot be obtained until after the engine has been stopped and allowed to stand for several minutes on a level floor. If the engine is actually burning too much oil, gray smoke will emerge from the exhaust pipe whenever the engine is accelerated after it has idled for a short period of time.

TEST

Before any corrections of excessive oil consumption are made, a test drive of 50 to 100 miles (80,45 to 160,90 km.) should be made with oil which has a known viscosity and is not excessively diluted. This test should be made at the average speed at which the car owner usually drives. Before the test is started, the crankcase should be filled to the proper level, the engine operated until the normal operating temperature is reached, and the oil allowed to drain for 10 minutes. This quantity should then be carefully weighed and reinstalled in the crankcase. After the test has been run, the oil should be drained as soon as possible and the car allowed to stand for 10 minutes before the quantity of oil drained out is weighed.

If excessive oil consumption is encountered, a very careful check for leaks should be made before the engine is disassembled. Spread papers on the floor of the garage under the front end of the car and run the engine for several minutes at a speed the equivalent of 20 to 25 miles (32,18 to 40,23 km.) per hour. A severe oil leak will be indicated by the dripping of oil on the paper.

CAUSES

1. Loss from external leaks.
   a) Oil pan gasket damaged or improperly installed.
   b) Oil pan gasket flange distorted or cap screws loose.

c) Oil pan drain plug loose or gasket damaged.
d) Oil pan cracked.
e) Rear main bearing cap oil seals improperly installed or loose.
f) Timing gear cover or plate gasket damaged or improperly installed.
g) Timing gear cover flange distorted or cap screws loose.
h) Timing gear cover cracked.
i) Valve cover plate gasket damaged or improperly installed.
j) Valve cover plate gasket surfaces dirty, or cover plates distorted or loose.
k) Breather housing or housing tube stud loose.
l) Oil pump cover gasket loose or improperly installed.
m) Loose fuel pump gasket.
n) Leaks at crankshaft fan drive pulley because of:
(1) Eccentric pulley hub.
(2) Timing gear cover not properly centered on pulley hub.
(3) Rough pulley hub.
(4) Restricted oil return groove on pulley hub.
o) Camshaft rear bearing Welch plug loose or improperly installed.
p) Leaks at oil filter lines.
q) Leaks at flexible oil gage pipe connector.

2. Poor quality or improper viscosity of engine oil.
3. Badly diluted engine oil.
4. More than recommended amount of oil in engine pan.
5. Excessive oil pressure.
6. Sustained high road speeds (requires greater oil consumption for adequate lubrication).
7. Abnormal piston to cylinder wall clearance or scuffed pistons.
8. Eccentric or tapered cylinder bores.
9. Piston ring difficulities.
a) Badly worn or scuffed piston rings.
b) Broken piston rings.
c) Piston rings stuck in ring grooves (gum or carbon deposit).
d) Improper piston ring combination.
e) Piston rings loose in ring grooves.
f) Insufficient end gap clearance of rings.
g) Insufficient ring tension.
10. Excessive radial or axial clearance of main or connecting rod bearings.
11. Out-of-round crankshaft journals.
12. Abnormally high crankcase temperatures.
13. Distortion of cylinder block because of uneven tightening of cylinder head cap screws.
14. Excessive clearance between intake valve stems and guides.

OIL PRESSURE — ENGINE

DESCRIPTION

The engine oil pressure gage should register from 20 to 40 lb. (1,4 to 2,8 kgs.) at 40 (64,36 km.) miles per hour with warm oil.

CAUSES

1. Low oil pressure.
a) Use of very light or badly diluted engine oil.
b) Water, sludge, ice, or dirt restricting oil pump intake screen.
c) Oil relief valve not seating properly because of:
(1) Foreign substance on valve seat or valve face.
(2) Weak or broken valve spring.
d) Air leaks occurring in oil pump suction line.
e) Loose oil pump body or cover, or improperly installed gaskets.
f) Badly worn or damaged oil pump gears.
g) Excessive clearance of pump gears in pump body.
h) Pressure loss in the distributing line due to:
(1) Improperly installed or loose gaskets.
(2) Fractured tubes, pipes, or webs, or loose connections.
i) Excessive clearance of main, connecting rod, or camshaft bearings.
j) Inaccurate oil pressure gage.
k) Excessive clearances at valve pushers.

2. High oil pressure.
a) Use of heavy engine oil.
b) Relief valve not opening because of:
(1) Heavy or stiff relief valve spring.
(2) Relief valve stuck.
c) Restricted or partially clogged distributing line or oil passage at relief valve.
d) Inaccurate oil pressure gage.

INOPERATIVE ENGINE OIL FILTER (IF SO EQUIPPED)

CAUSES

1. Filter inlet or outlet passages or pipes clogged or restricted.
2. Filter inlet or outlet passages, pipes, or connections leaking.
3. Filter body clogged and should be changed.

OIL PUMP AND DISTRIBUTOR DRIVE NOISES

DESCRIPTION

Oil pump and distributor drive noises are usually encountered when the engine is idling. A grind or growl usually indicates causes Nos. 1 and 2, while a whine indicates causes Nos. 3 and 9. A chatter usually accompanies causes Nos. 4 to 7 inclusive, while a fairly heavy bump indicates a loose pump mounting. A hydraulic rap is similar to a main bearing knock, and the frequency of the rap varies with the engine speed.

TEST

With the use of a sounding rod placed near the oil pump and the distributor, causes Nos. 1 to 9 inclusive can usually be located without the disassembly of any parts. To diagnose cause No. 10, firmly grip the oil pressure gage line, noting whether a pulsation or bump is apparent.

CAUSES

1. Worn or damaged oil pump and distributor driven gear.
2. Worn or damaged camshaft drive gear.
3. Improper mesh of drive and driven gears.
4. Couplings loose on shaft.
5. Excessive clearance of shaft in oil pump body of distributor bracket bushings.
6. End play in distributor drive shaft.
7. End play in oil pump drive shaft.
8. Oil pump not rigidly mounted.
9. Damaged or scuffed oil pump gears.
10. Oil pump hydraulic rap.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

FRAMES

The box-section frame used on the Champion and Commander models provides extreme rigidity. Its shape and construction is entirely new. Kick-ups over both the front suspension and rear axle make possible a low, flat mid-section. Side rails as well as cross members are box sections and are double flanged at the bottom for greater strength.

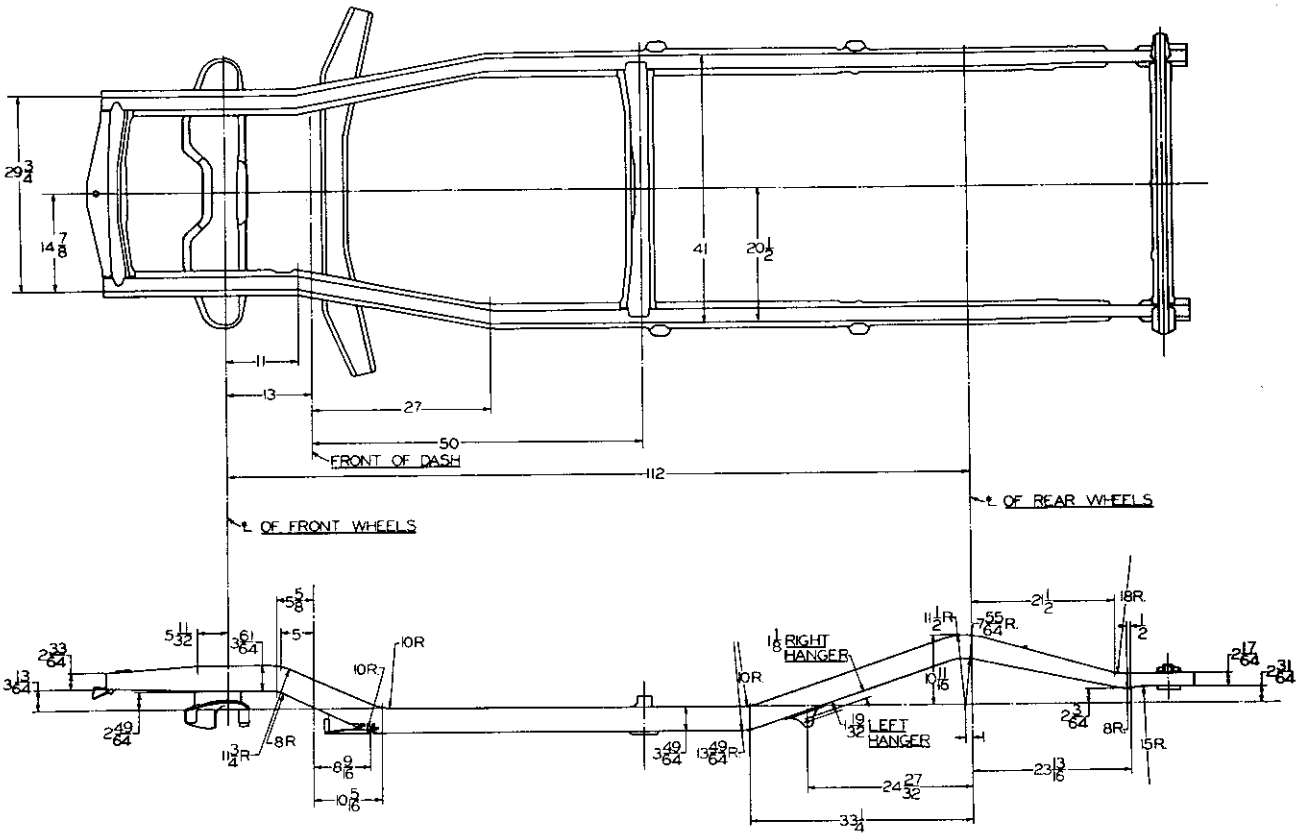


FIG. 180.—CHAMPION CHASSIS FRAME DIMENSIONS

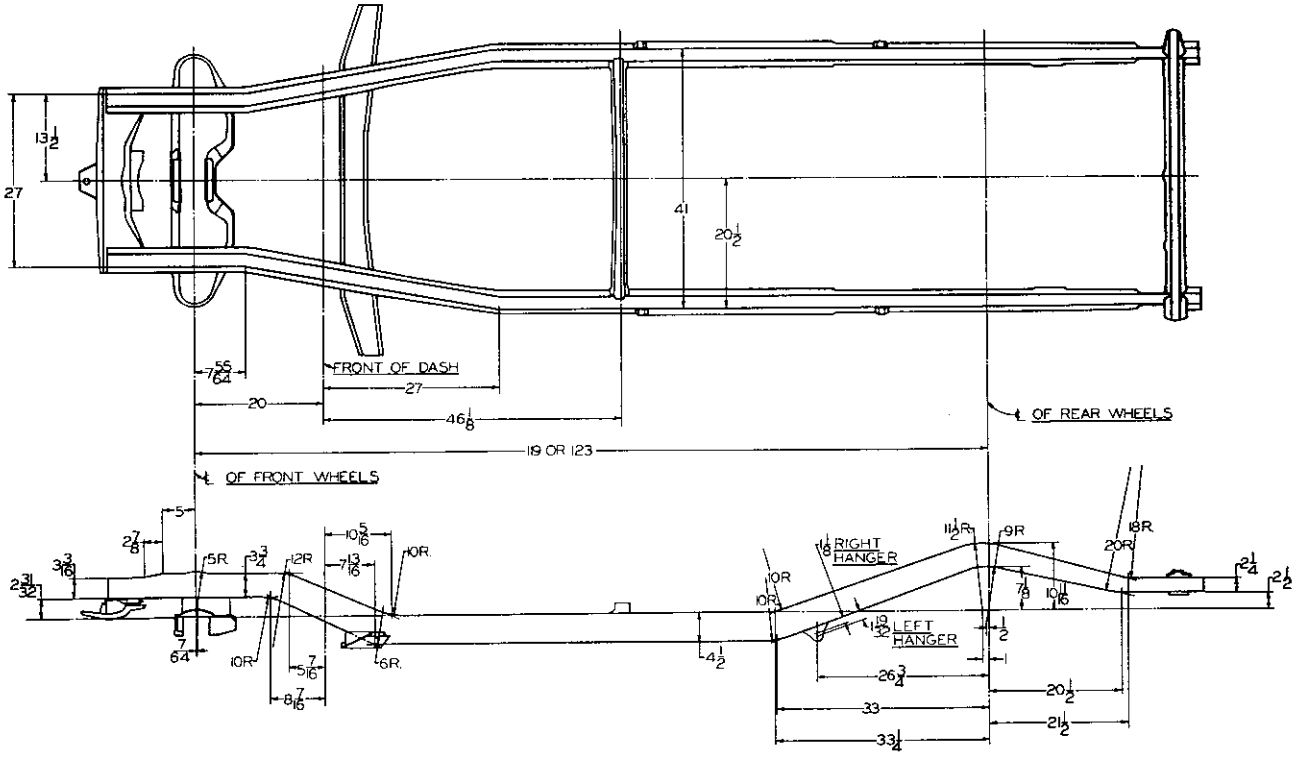


FIG. 181.—COMMANDER CHASSIS FRAME DIMENSIONS

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

FRONT SUSPENSION AND STEERING SYSTEM

The planar suspension system used on the Champion and Commander models permits each end of the spring to float freely on a rubber pad located on the top of each lower control arm. The spring is encased in the front frame cross member and is fastened by U-bolts to a heavy steel plate bolted to the center of the cross member.

The steering knuckles are supported by upper and lower control arms and all pivot points employ long-wearing threaded steel bushings. The control arms maintain proper wheel alignment and serve as torque arms to resist braking torque.

The shock absorbers are mounted on the side of the frame between the upper control arm brackets; the shock absorber arms are fastened to the center of the upper control arms.

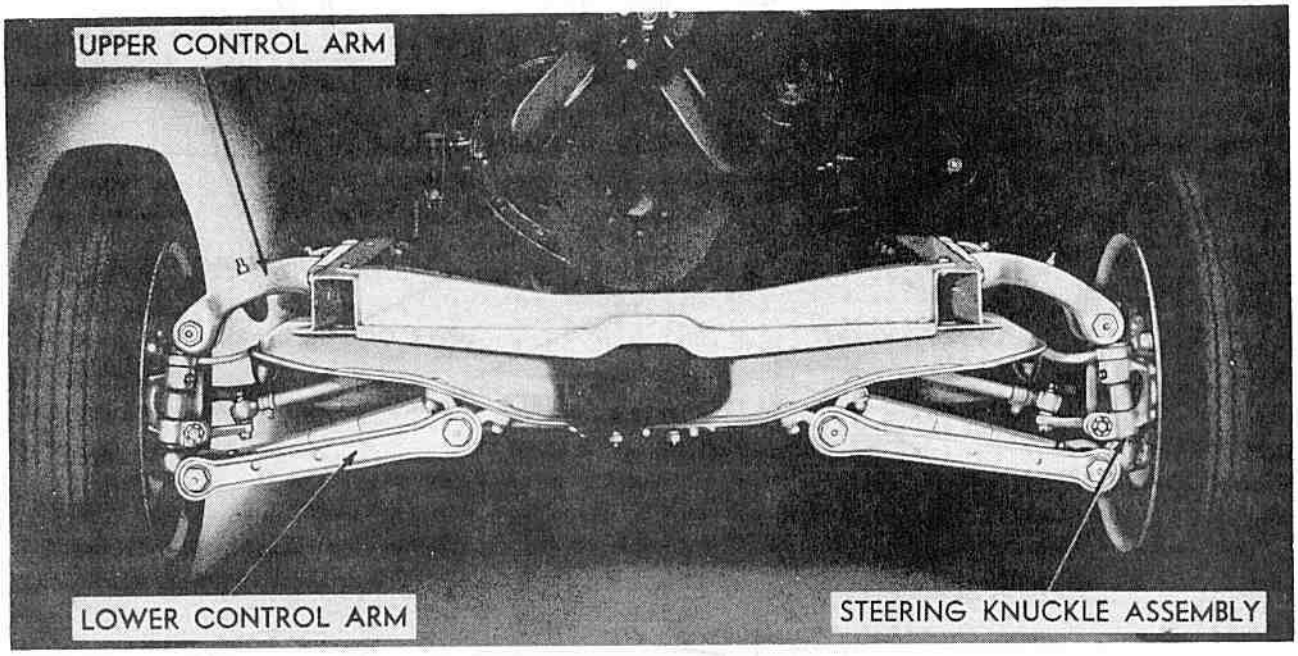


FIG. 182.—FULL FRONT VIEW OF CHAMPION FRONT SUSPENSION

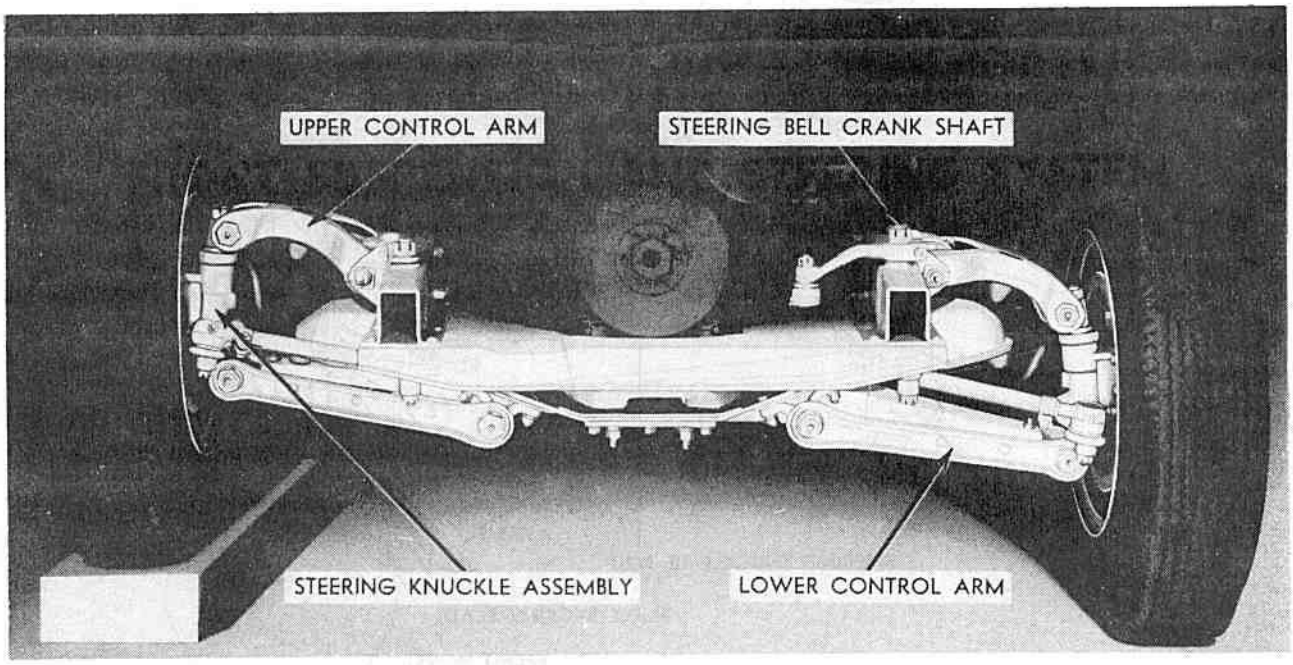


FIG. 183.—FULL FRONT VIEW OF COMMANDER FRONT SUSPENSION

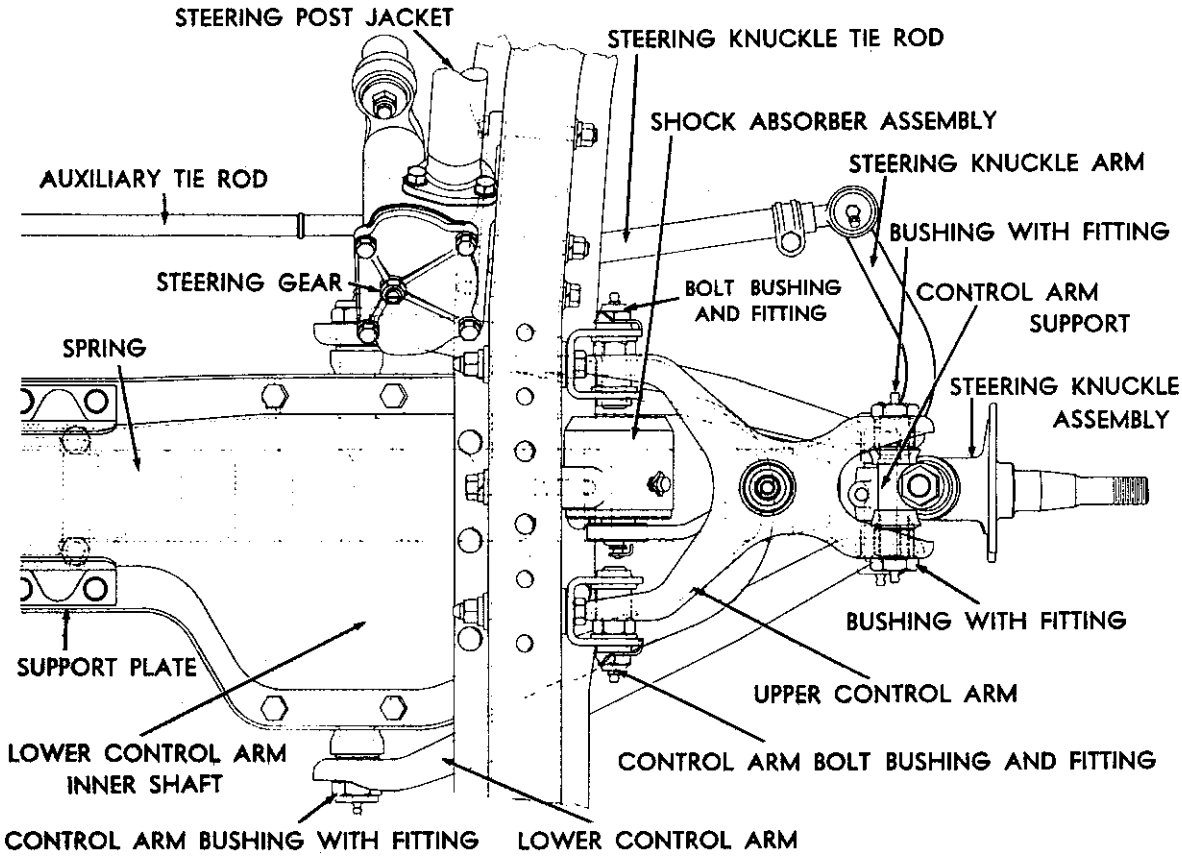


FIG. 184.—CONSTRUCTION OF THE CHAMPION FRONT SUSPENSION (TOP VIEW)

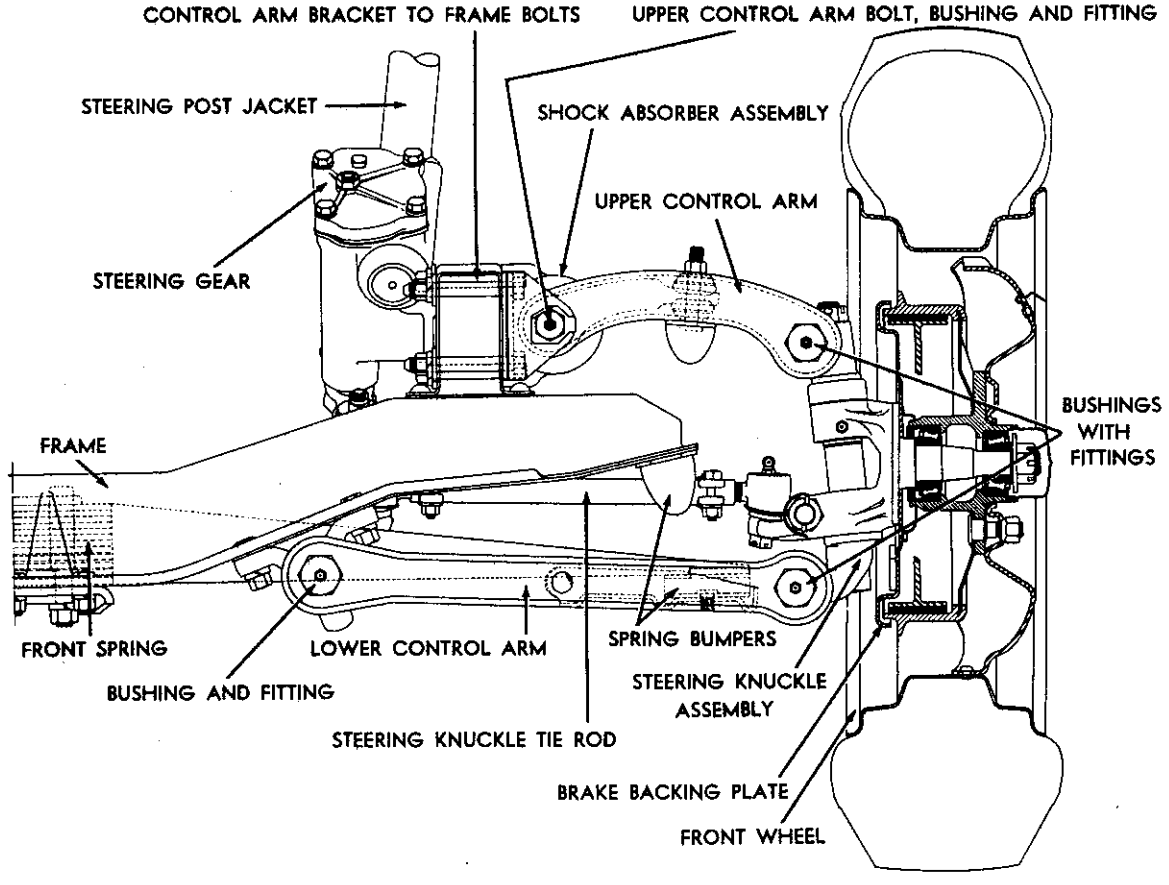


FIG. 185.—CONSTRUCTION OF THE CHAMPION FRONT SUSPENSION (FRONT VIEW)

Front Spring

Removal

CHAMPION AND COMMANDER The removal of the front spring requires the use of Universal Puller HM-925 and Front Spring Unloader Adapters HM-925-17, -18, -19.

Raise the front end of the car, remove the wheel and tire assembly, and unhook the outer end of one outer tie rod from the steering arm.

Place the spring unloader puller plate (HM-925-19) across the top outer end of the front frame cross member and attach the puller arms and nuts (HM-925-17) to the puller plate. Then place the guide plate center pad (HM-925-18) directly below the puller plate on the underside of the spring and hook the puller (HM-925) to the puller arms. (See Fig. 186.)

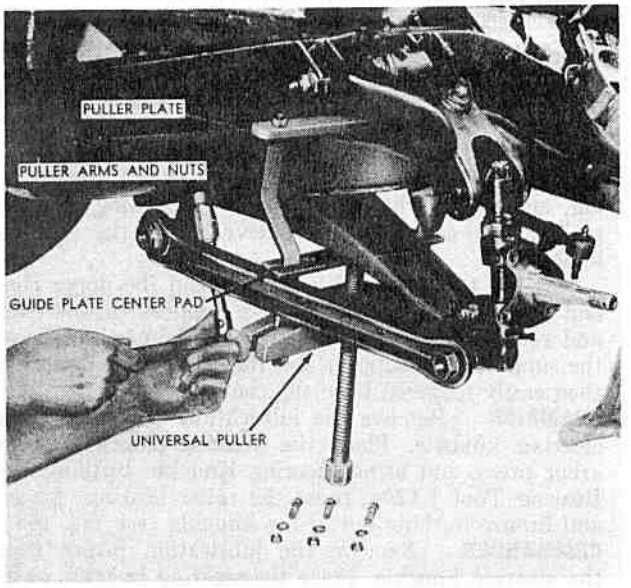


FIG. 186

Compress the spring by tightening the puller until the lower control arm is relieved of the spring tension. Then remove the four lower control arm inner shaft bolts and swing the inner end of the control arm down.

Remove the six bolts which hold the front spring plate to the center of the front frame cross member. Then remove the puller and slide the spring over the inner shaft of the opposite lower control arm.

After removing the front spring, unscrew the four U-bolt nuts and remove the front spring plate from the spring.

Installation

CHAMPION AND COMMANDER The installation of the front spring also requires the use of Universal Puller HM-925 and Front Spring Unloader Adapters HM-925-17, -18, -19.

Install the front spring plate on the spring and tighten the four U-bolt nuts sufficiently to hold the spring plate in place. Slide one end of the spring over the inner shaft of the lower control arm which is fastened to the front frame cross member. Then, using two punches, align the two spring-plate holes nearest the control arm which is attached to the cross member with the corresponding two holes in the front frame cross member.

Place the universal puller with the adapters in position and compress the front spring sufficiently to permit the installation of the six bolts which hold the front spring plate to the front frame cross member. Then swing the inner end of the lower control arm in position, install the four lower control arm inner shaft bracket bolts, and attach the outer end of the outer tie rod to the steering arm.

After removing the puller, install the wheel and tire assembly and lower the front end of the car. Then tighten the front spring U-bolt nuts with a torque-indicating wrench (see "General Specifications" for torque readings.)

Steering Knuckle and Control Arms

Removal

CHAMPION AND COMMANDER Raise the front end of the car and remove the wheel and the hub and drum assembly. Then detach the brake backing plate from the steering knuckle and suspend the backing plate in an out-of-the-way position.

Unhook the outer end of the outer tie rod from the steering arm. Place the spring unloader puller plate (HM-925-19) across the top outer end of the front frame cross member and attach the puller arms and nuts (HM-925-17) to the puller plate. Then place the guide plate center pad (HM-925-18) directly below the puller plate on the underside of the spring and attach the puller (HM-925) to the puller arms.

Compress the spring by tightening the puller until the lower control arm is relieved of the spring tension. Then remove the four lower control arm inner shaft bolts, swing the inner end of the control arm down, and remove the puller.

Disconnect the shock absorber arm from the upper control arm by removing the rebound bumper bolt. Then remove the four nuts which hold the upper control arm brackets to the frame (see Fig. 187). The upper and lower control arm and steering knuckle assembly can now be removed from the frame. Be sure to note the number and thickness of the shims used at both the front and rear upper control arm frame brackets.

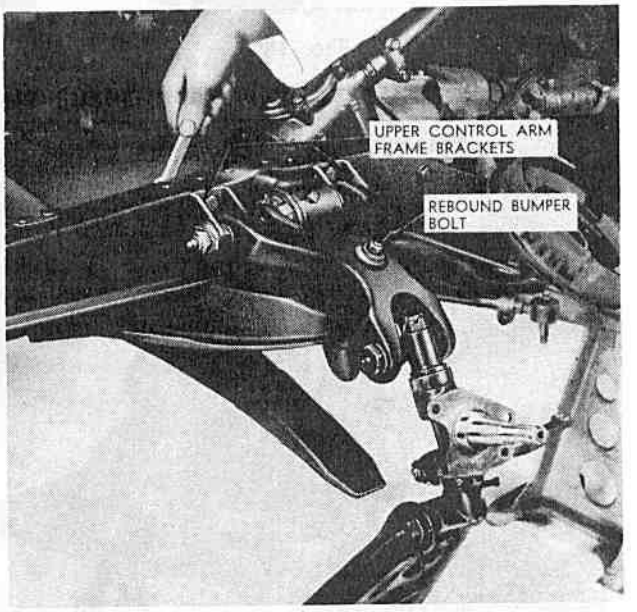


FIG. 187

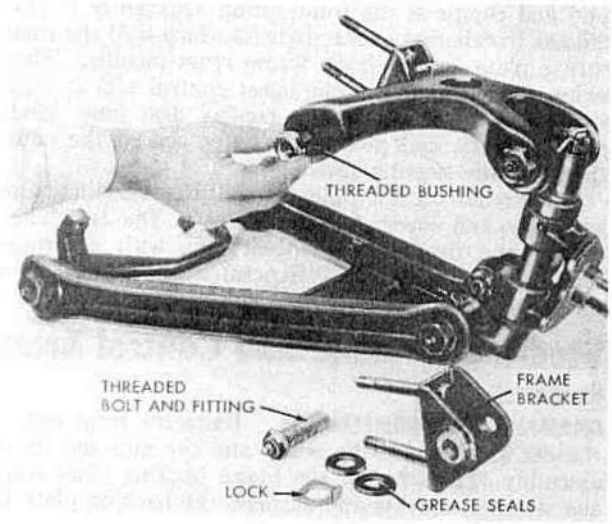


FIG. 188

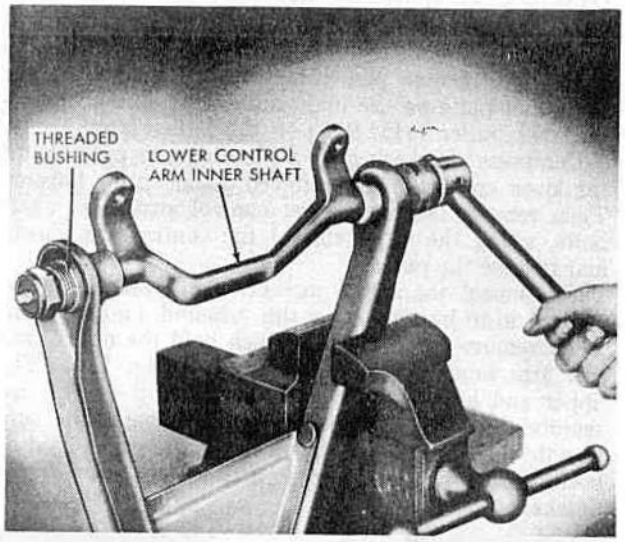


FIG. 189

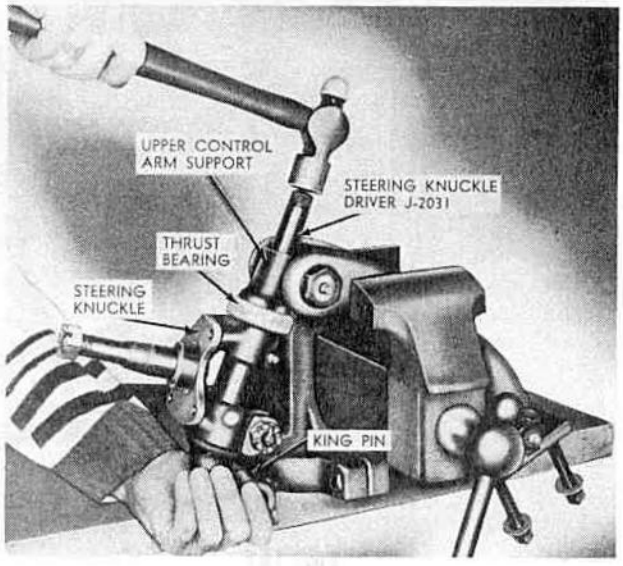


FIG. 190

Disassembly

CHAMPION AND COMMANDER After removing the threaded bolts from the inner ends of the upper control arm, remove the control arm brackets, locks, and rubber seals. Continue the disassembly of the front suspension by removing the two threaded bushings from the inner ends of the upper control arm (see Fig. 188). Then remove the threaded bushings from the inner ends of the lower control arm and remove the lower control arm inner shaft and rubber seals (see Fig. 189).

Remove the threaded bushings from the outer end of the lower control arm and drive out the tapered key which locks the lower control arm pin to the steering knuckle pin. Driving out the lower control arm pin with a brass drift will then permit the removal of the rubber seals and the lower control arm.

After securely fastening the upper control arm in a vise, remove the cotter pin and nut from the upper end of the steering knuckle king pin. Then replace the support nut with Steering Knuckle Driver J-2031 and drive the steering knuckle king pin out of the upper control arm support (see Fig. 190).

Remove the tool, the Woodruff key, the thrust bearing, and shims from the king pin. The king pin and cork gasket can then be removed from the steering knuckle.

Remove the threaded bushings from the upper control arm, move the control arm support to one side, and remove the rubber seal from the opposite side of the support. The support and the other rubber seal are then easily removed from the control arm.

CHAMPION Remove the lubrication fitting from the steering knuckle. Place the steering knuckle in an arbor press, and using Steering Knuckle Bushing and Bearing Tool J-1294, press the roller bearing, spacer, and bronze bushing out of the knuckle (see Fig. 191).

COMMANDER Remove the lubrication fitting from the steering knuckle. Place the steering knuckle in an arbor press, and using Steering Knuckle Bushing and Bearing Tool J-2042-1, press the bearing and bushing out of the knuckle.

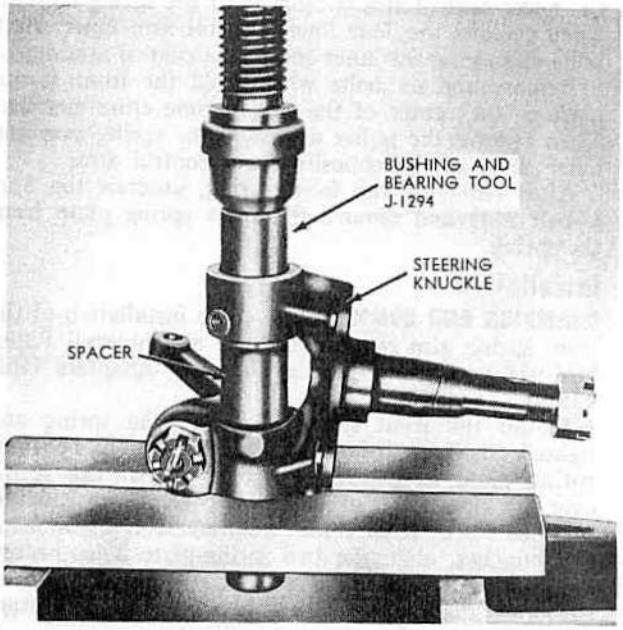


FIG. 191

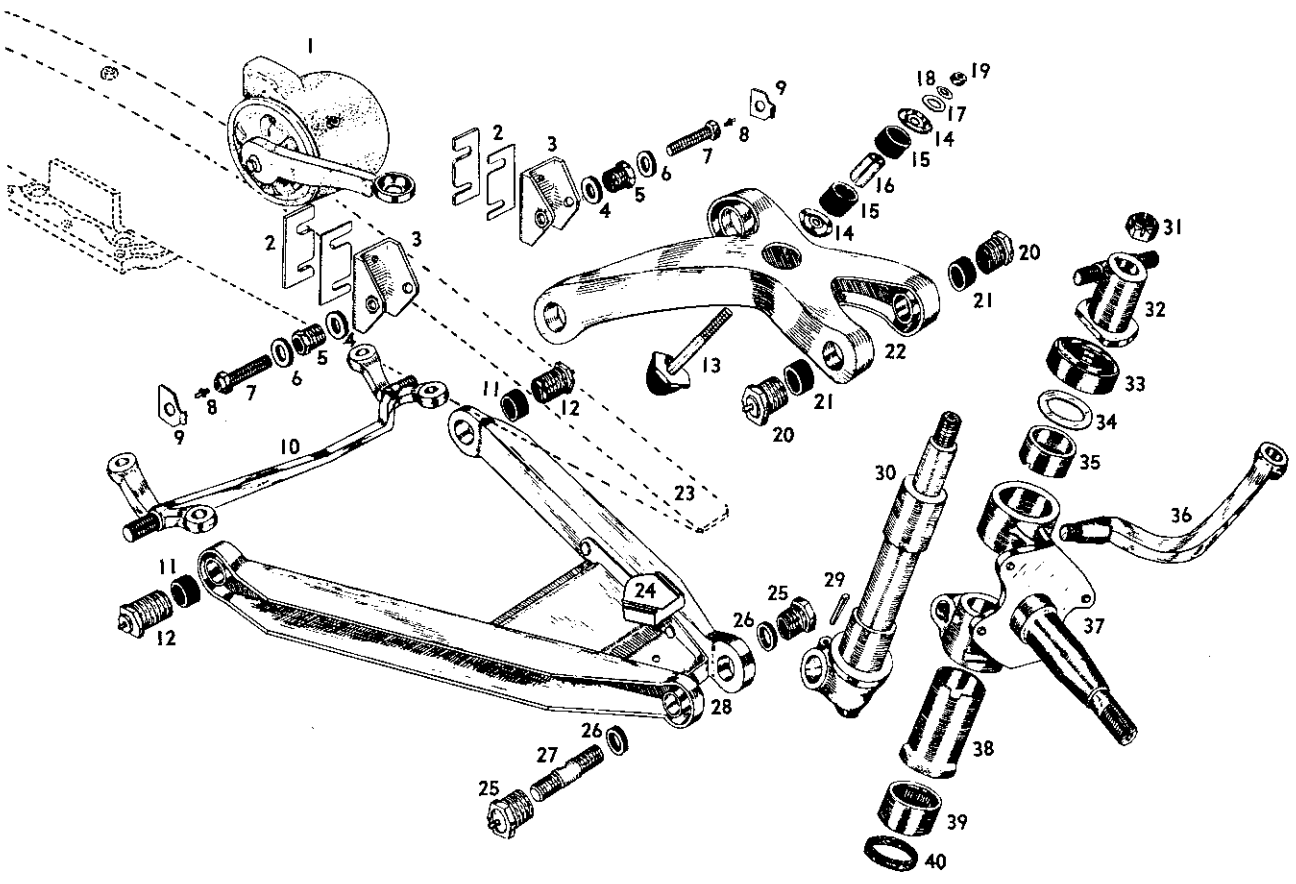


FIG. 192

KEY TO PARTS OF CHAMPION PLANAR SUSPENSION

1. SHOCK ABSORBER ASSEMBLY
2. CAMBER ADJUSTMENT SHIMS
3. BRACKET
4. GREASE SEAL
5. BUSHING
6. GREASE SEAL
7. STEERING KNUCKLE CONTROL ARM BOLT
8. GREASE FITTING
9. LOCK PLATE
10. LOWER CONTROL ARM INNER SHAFT
11. GREASE SEAL
12. BUSHING WITH FITTING
13. UPPER CONTROL ARM REBOUND BUMPER
14. RETAINER
15. GROMMET
16. SPACER
17. WASHER
18. LOCK WASHER
19. NUT
20. BUSHING WITH FITTING
21. GREASE SEAL
22. STEERING KNUCKLE UPPER CONTROL ARM
23. SPRING
24. SPRING PAD
25. BUSHING WITH FITTING
26. GREASE SEAL
27. LOWER CONTROL ARM PIN(OUTER)
28. STEERING KNUCKLE LOWER CONTROL ARM
29. TAPERED KEY
30. STEERING KNUCKLE KING PIN
31. SUPPORT NUT
32. UPPER CONTROL ARM SUPPORT
33. THRUST BEARING
34. STEERING KNUCKLE SHIMS
35. BUSHING
36. STEERING KNUCKLE ARM
37. STEERING KNUCKLE
38. SPACER
39. ROLLER BEARING
40. STEERING KNUCKLE KING PIN GASKET

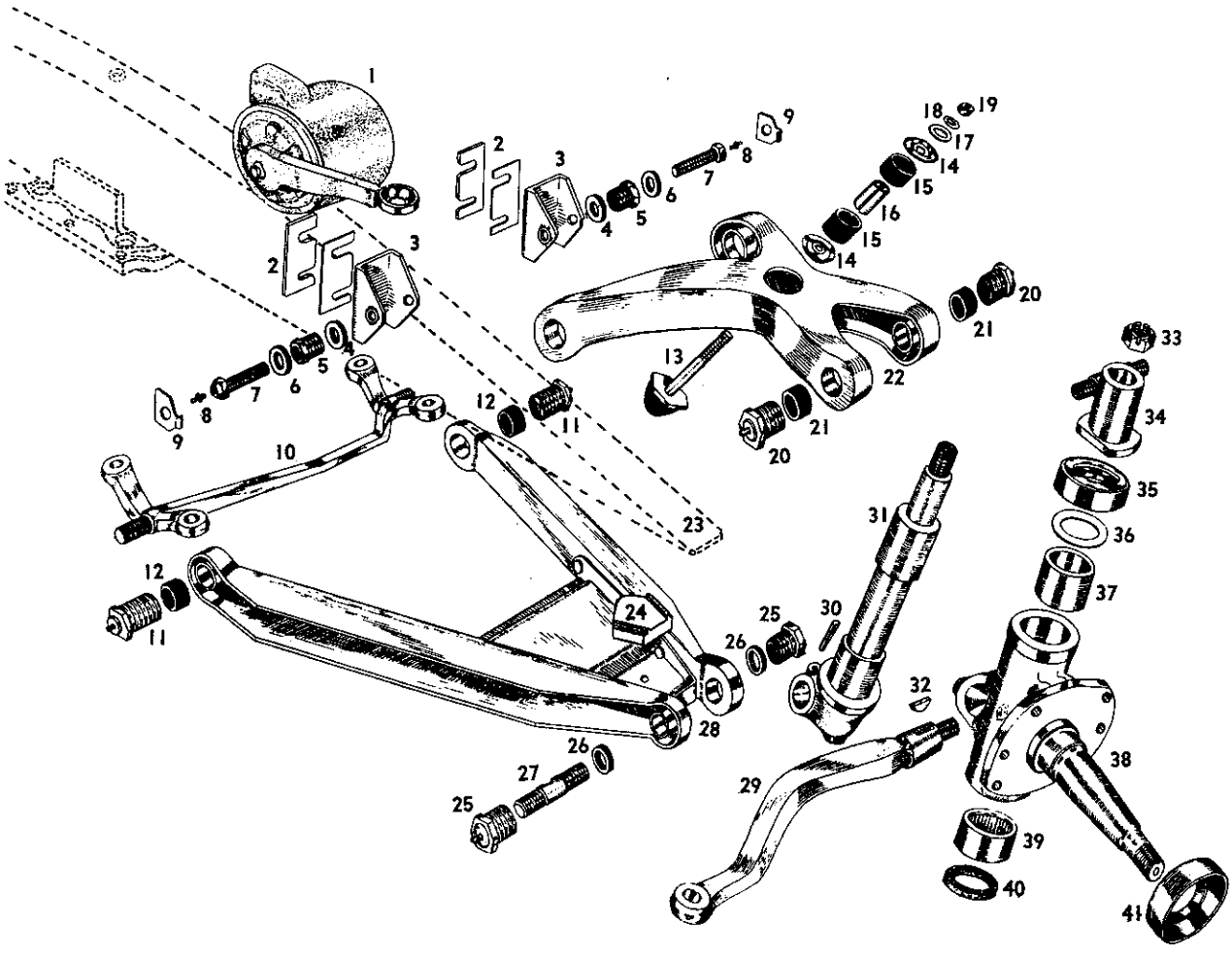


FIG. 193

KEY TO PARTS OF COMMANDER PLANAR SUSPENSION

1. SHOCK ABSORBER ASSEMBLY
2. CAMBER ADJUSTMENT SHIMS
3. BRACKET
4. GREASE SEAL
5. BUSHING
6. GREASE SEAL
7. STEERING KNUCKLE CONTROL ARM BOLT
8. GREASE FITTING
9. LOCK PLATE
10. LOWER CONTROL ARM INNER SHAFT
11. BUSHING WITH FITTING
12. GREASE SEAL
13. UPPER CONTROL ARM REBOUND BUMPER
14. RETAINER
15. GROMMET
16. SPACER
17. WASHER
18. LOCK WASHER
19. NUT
20. BUSHING WITH FITTING
21. GREASE SEAL
22. STEERING KNUCKLE UPPER CONTROL ARM
23. SPRING
24. SPRING PAD
25. BUSHING WITH FITTING
26. GREASE SEAL
27. LOWER CONTROL ARM PIN(OUTER)
28. STEERING KNUCKLE LOWER CONTROL ARM
29. STEERING KNUCKLE ARM
30. TAPERED KEY
31. STEERING KNUCKLE KING PIN
32. STEERING KNUCKLE ARM WOODRUFF KEY
33. SUPPORT NUT
34. UPPER CONTROL ARM SUPPORT
35. THRUST BEARING
36. STEERING KNUCKLE SHIMS
37. BUSHING
38. STEERING KNUCKLE
39. ROLLER BEARING
40. STEERING KNUCKLE KING PIN GASKET
41. OIL SLINGER

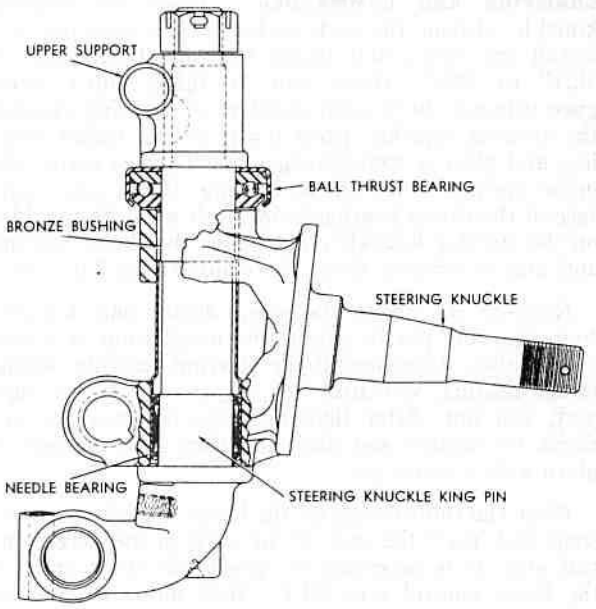


FIG. 194.—CONSTRUCTION OF THE CHAMPION STEERING KNUCKLE

Reassembly

CHAMPION After inserting Pilot J-1294-3 in the lower section of the steering knuckle, place the knuckle in an arbor press. Then slide the bronze bushing on the Steering Knuckle Bushing and Bearing Tool J-1294 and press the bushing into the upper section of the knuckle until the bushing and knuckle are flush. Be sure to line up the oil hole in the bushing with the lubrication-fitting hole in the knuckle (see Fig. 195).

Slide the Pilot J-1294-3 and the spacer on Tool J-1294. After aligning the notch in the spacer with the lubrication-fitting hole, press the spacer into position (see Fig. 196).

Slide the Pilot J-1294-4 and the roller bearing on Tool J-1294 and press the bearing into the steering knuckle until the shoulder on the pilot is flush with the surface of the knuckle (see Fig. 197). Then install the lubrication fitting.

NOTE.—When pressing the bearing into the steering knuckle, be sure that the pressure is being applied to the lettered end of the bearing.

COMMANDER After inserting Pilot J-2042-2 in the lower part of the steering knuckle, place the knuckle in an arbor press. Then slide the bronze bushing on the Steering Knuckle Bushing and Bearing Tool J-2042-1 and press the bushing into the knuckle until the bushing and knuckle are flush.

Slide the Pilot J-2042-2 and the roller bearing on Tool J-2042-1 and press the bearing into the steering knuckle until the shoulder on the pilot is flush with the surface of the knuckle. Then install the lubrication fitting.

NOTE.—When pressing the bearing into the steering knuckle, be sure that the pressure is being applied to the lettered end of the bearing.

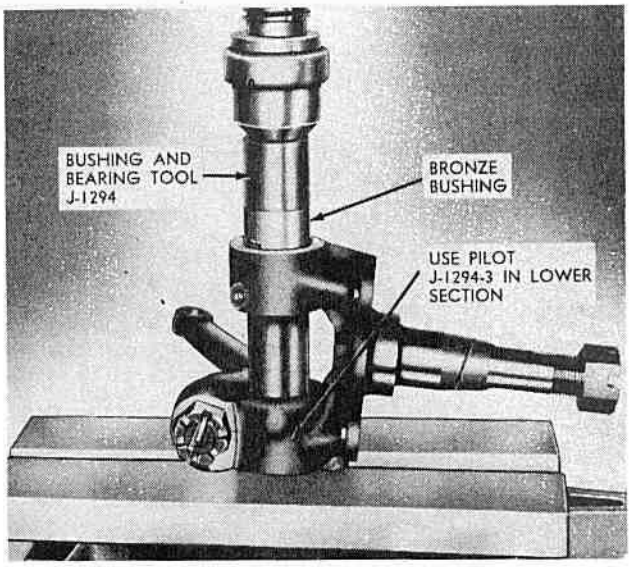


FIG. 195

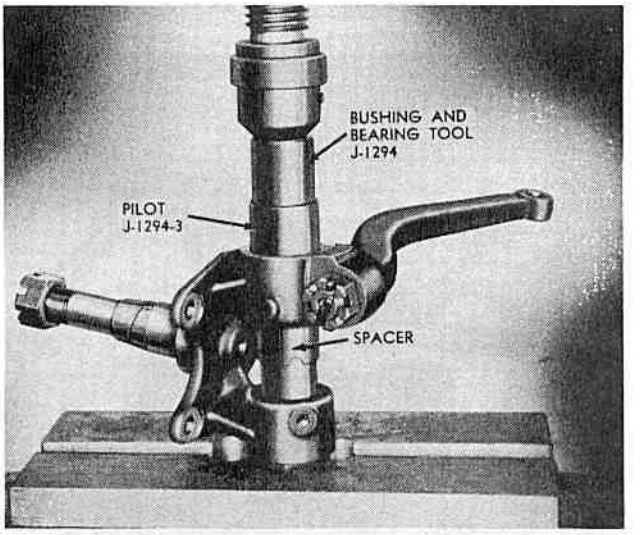


FIG. 196

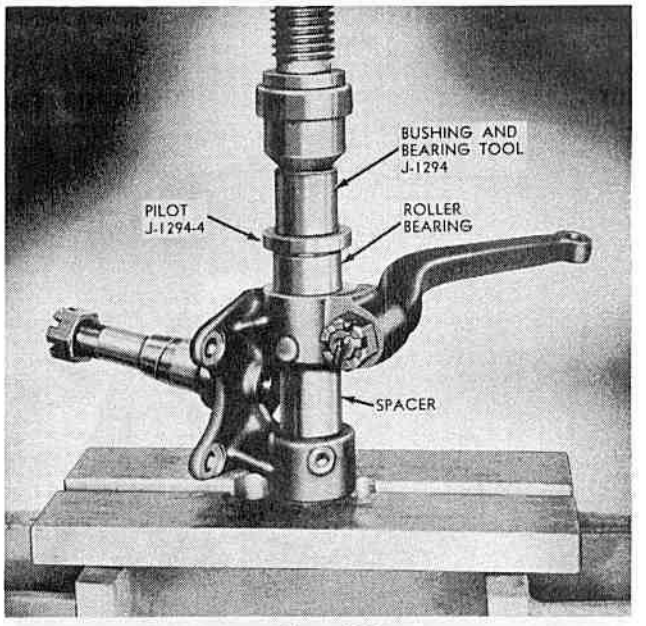


FIG. 197

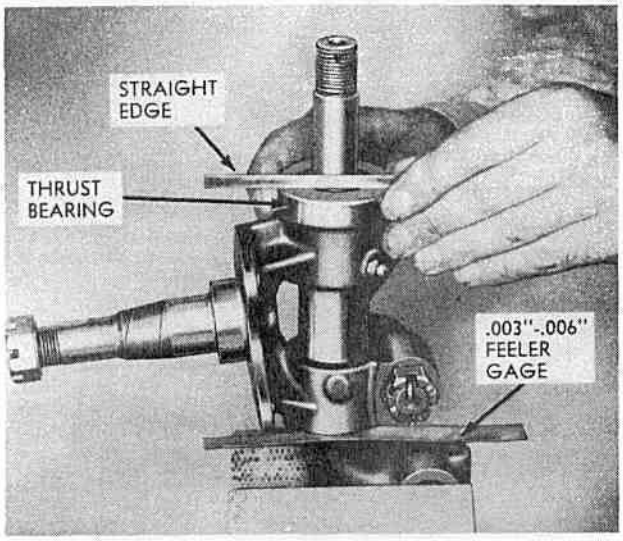


FIG. 198

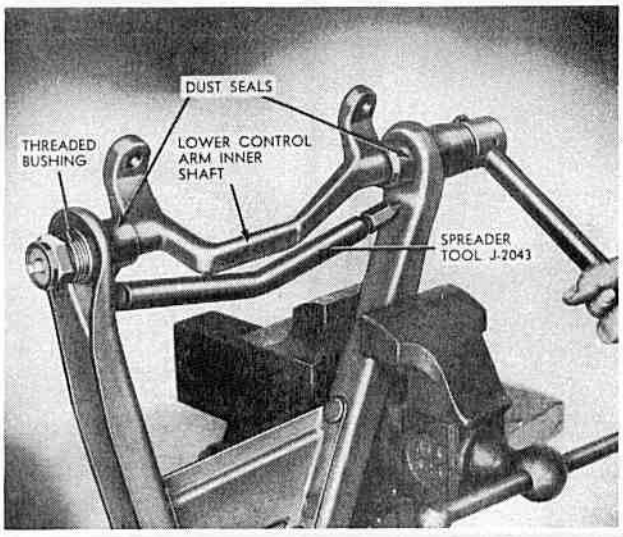


FIG. 199

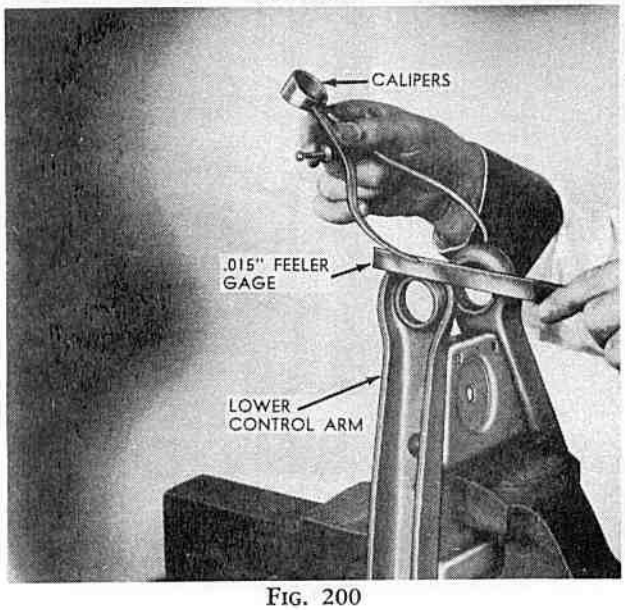


FIG. 200

CHAMPION AND COMMANDER Place the steering knuckle without the cork gasket on the king pin and install the shims and thrust bearing. Then insert a .003" to .006" (0,076 mm. to 0,150 mm.) feeler gage between the bottom shoulder of the king pin and the steering knuckle, press down on the thrust bearing, and place a straight-edge (small scale) across the upper surface of the thrust bearing. If the upper surface of the thrust bearing is not flush with the shoulder on the steering knuckle pin, remove the thrust bearing and add or remove shims as required (see Fig. 198).

Remove the thrust bearing, shims, and knuckle from the king pin to permit the installation of a new cork gasket. Then install the steering knuckle, shims, thrust bearing, Woodruff key, upper control arm support, and nut. After tightening the nut securely, recheck for correct end play and then lock the nut in place with a cotter pin.

Place the rubber seals on the lower control arm inner shaft and insert the ends of the shaft in the lower control arm. It is necessary to spread the inner ends of the lower control arm .015" (0,38 mm.) to prevent a bind at the threaded bushings. Inserting Spreader Tool J-2043, tighten the threaded tip of the tool finger-tight. Another one-half turn will then spread the ends .015" (0,38 mm.). With the spreader still in position, install the threaded bushings, tightening them securely. Be sure the control arm turns freely on the inner shaft. (See Fig. 199.)

It is also necessary to spread the outer ends of the lower control arm .015" (0,38 mm.). Determine the correct outside dimension by adjusting the caliper setting to include a .015" (0,38 mm.) feeler gage inserted between the outside edge of the control arm and one prong of the pair of calipers (see Fig. 200).

Place the steering knuckle king pin and the two rubber seals between the outer ends of the lower control arm. Insert the lower control arm pin and lock it in place with the tapered key. Then install Spreader Tool J-2044 between the inner surfaces of the control arm outer ends and spread the outer ends until the outside dimension is equal to the distance between the points of the calipers (see Fig. 201).

With the king pin centered between the outer ends of the lower control arm, install the threaded bushings and tighten them securely (see Fig. 202). Then remove the spreader tool. Be sure the control arm turns freely on the pin.

Insert the upper control arm support between the outer ends of the control arm and install the rubber seals. Using the procedure outlined for the lower control arm, spread the outer ends of the upper control arm .015" (0,38 mm.). Then, with the support centered between the outer ends of the control arm, install the threaded bushings and tighten them securely. Be sure that the control arm turns freely on its support.

Install the two threaded bushings in the inner ends of the upper control arm. Place the rubber seals, brackets, and locks on the inner ends of the control arm; and with the control arm ends centered in the brackets, insert the threaded bolts and tighten them securely. Be sure that the brackets turn freely. Then bend the ears of the locks.

Installation

CHAMPION AND COMMANDER To install the steering knuckle and control arms, attach the upper control arm brackets to the frame, inserting the same number and thickness of shims that were removed at both the front and rear brackets. After securely tightening the bracket bolts, fasten the shock absorber arm to the control arm with the rebound bumper bolt.

Compress the spring with Universal Puller HM-925 and Front Spring Unloader Adapters HM-925-17, -18, -19. Attach the inner shaft to the front frame cross member with the four bolts. Then remove the puller and hook the outer end of the outer tie rod to the steering arm.

Attach the brake backing plate to the steering knuckle and install the hub and drum assembly and the wheel.

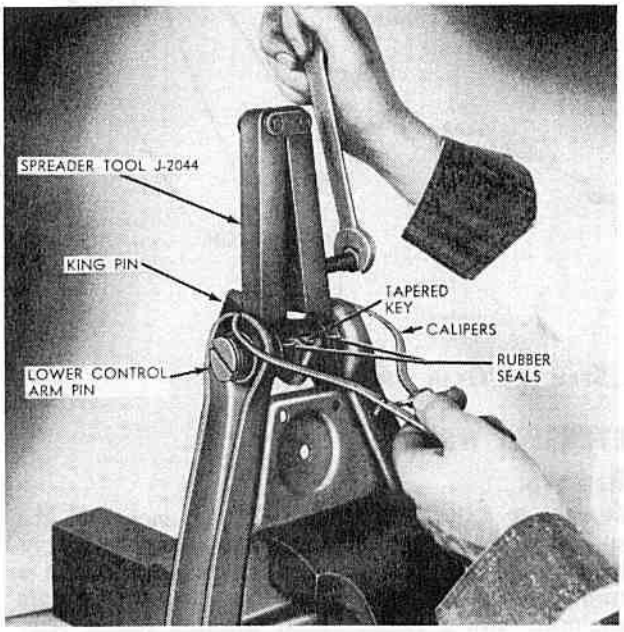


FIG. 201

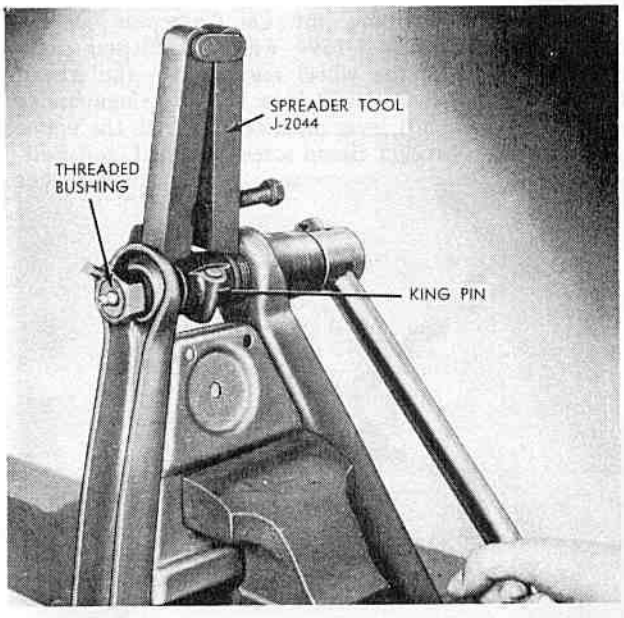


FIG. 202

Steering System

● The steering gears used on the Champion and Commander models are the twin lever, variable ratio type. The steering gear cam lever shaft is serrated for attachment to the steering gear arm. The gear case is attached to the frame side member.

On the Champion the auxiliary steering arm support threads into a steel bushing which, in turn, threads into the auxiliary steering arm. On the Commander two steering bell crank assemblies rotate on needle bearings housed in the front frame bearing support tubes.

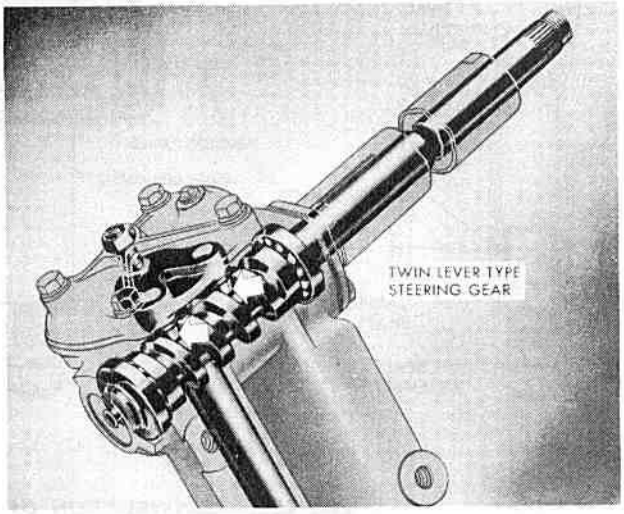


FIG. 203.—THE STEERING GEAR

STEERING GEAR ADJUSTMENTS

CHAMPION AND COMMANDER The steering post end play should be adjusted first. Place jacks under the outer ends of the control arms, back off the cam lever shaft adjusting screw, and remove the cap screws which hold the steering gear housing top cover to the steering gear case. Then add or remove the necessary number of shims to obtain proper steering post adjustment. The shims must be split before they can be removed or installed. (See Fig. 204.)

NOTE.—All end play should be eliminated; there should, however, be no drag when the wheel is turned.

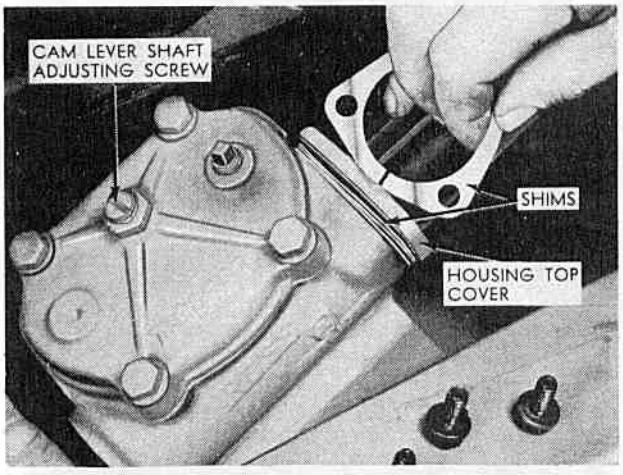


FIG. 204

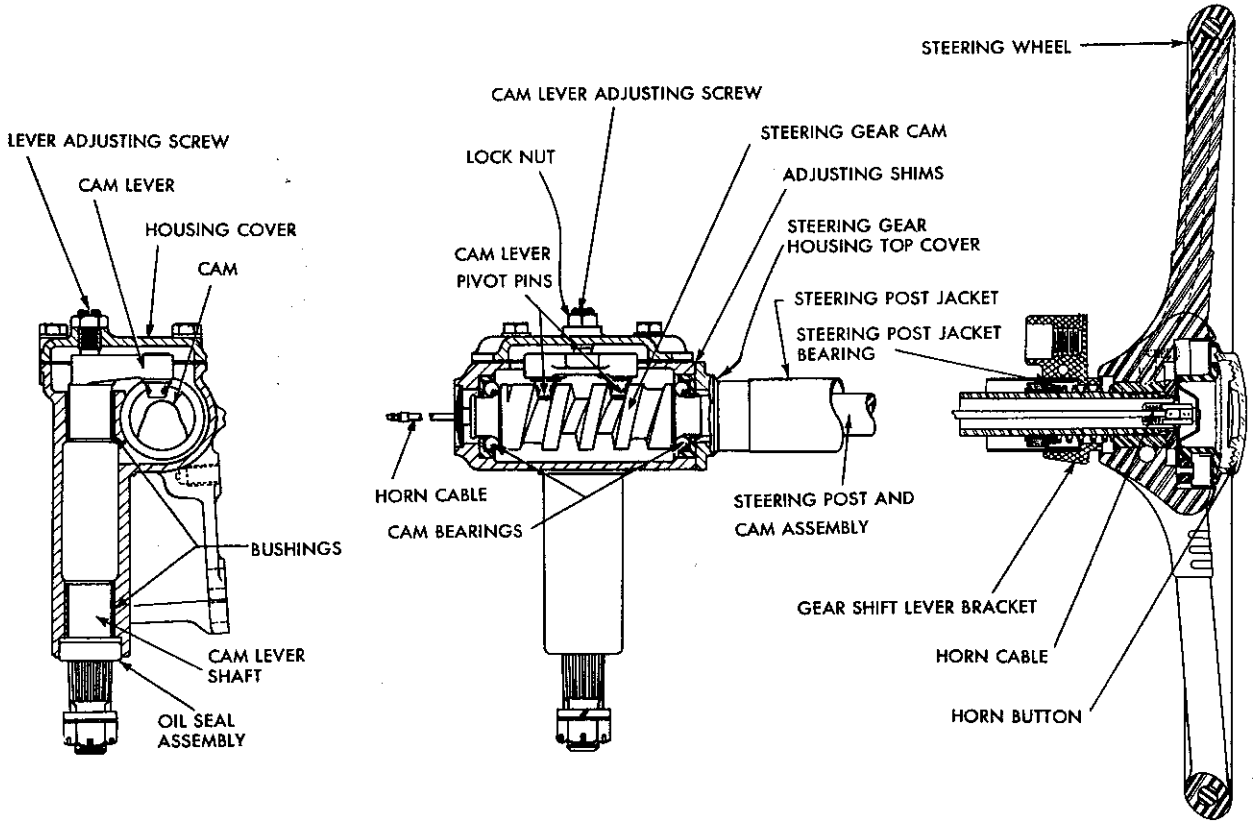


FIG. 205.—CONSTRUCTION OF THE STEERING GEAR ASSEMBLY

After the steering post end play adjustment has been made, the cam lever shaft can be adjusted with the adjusting screw which projects through the gear case cover. Loosen the lock nut, which holds the adjusting screw in place, just enough to permit screw adjustment. Then, turning the screw to the right or left, adjust the cam lever shaft so that the high spot on the cam can hardly be felt as the steering wheel is turned past the center of travel. (See Fig. 206.)

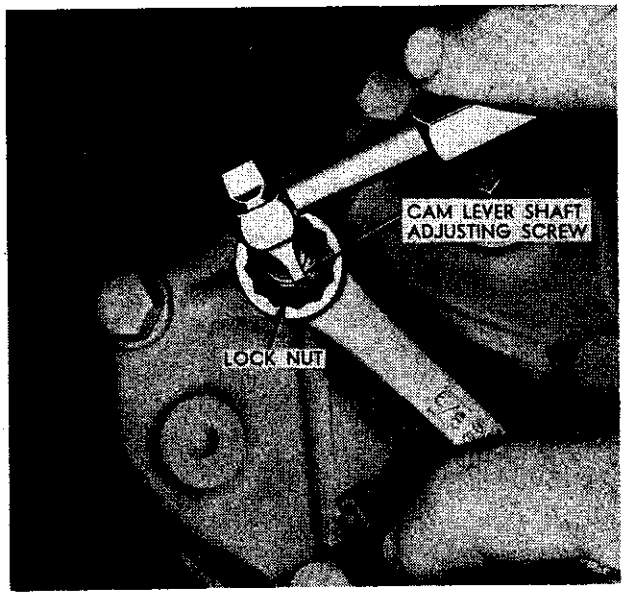


FIG. 206

STEERING WHEEL

Removal

CHAMPION AND COMMANDER The removal of the steering wheel necessitates the removal of the horn button. To do this, twist the button one-third of a turn, holding the steering wheel stationary. On cars equipped with a Regal Deluxe Steering Wheel, refer to the section, "Electrical System," for the detailed procedure.

Remove the retaining nut. On Champion Deluxe models, install Puller J-1594 with the adapter plate under the hub of the wheel and remove the wheel. On the Champion Regal Deluxe and the Commander models, the gearshift lever must be removed, the upper gearshift shaft bracket clamp screw loosened, and Pull-

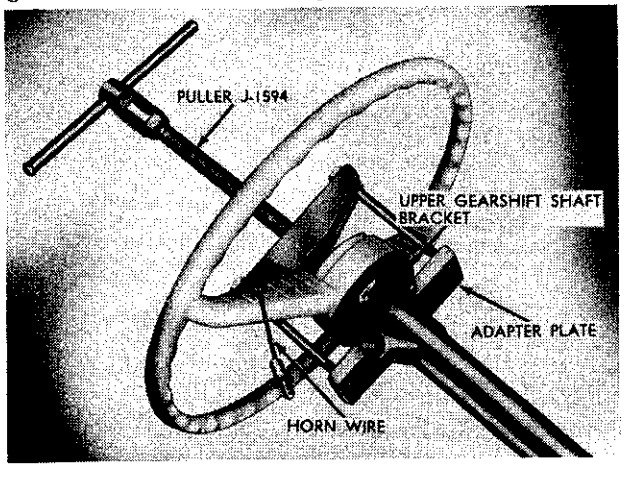


FIG. 207

er J-1594 installed with the adapter plate under the gearshift shaft bracket. (See Fig. 207.)

NOTE.—The removal of the horn wire is unnecessary.

Installation

CHAMPION AND COMMANDER Turn the steering post until the cam lever shaft is on the center of the high spot of the cam. Then place the steering wheel on the steering tube serrations with the spokes in a horizontal position.

STEERING GEAR ARM

Removal

CHAMPION To disassemble the insulated arm, remove the two cotter pins, castellated nuts, and washers from the arm. After pulling the arm out of the adapter, remove the rubber insulators from the adapter and the cotter pin, castellated nut, and washer from the cam lever shaft. Then, using Puller J-871-O, complete the removal procedure by removing the adapter from the shaft.

COMMANDER Remove the cotter pin, castellated nut, and lock washer from the cam lever shaft. Then, using Puller J-871-O, remove the steering gear arm from the shaft.

Installation

CHAMPION Insert the rubber insulators in the holes in the adapter and place the adapter and lock washer on the cam lever shaft, *being sure to align the punch marks on the adapter and shaft.* Tighten the castellated nut on the shaft and lock it in place with a new cotter pin. After placing the washer on each steering gear arm bolt, install the steering gear arm on the adapter. Then place the washers and the castellated nuts on the steering gear arm bolts, tighten the nuts securely, and lock them in place with new cotter pins.

COMMANDER Place the steering gear arm on the cam lever shaft, *being sure to align the punch marks on the arm and shaft.* Then install the lock washer and castellated nut on the shaft, tighten the nut securely, and lock it in place with a new cotter pin.

AUXILIARY STEERING ARM

Disassembly

CHAMPION Loosen the threaded bushing in the auxiliary arm but *do not try to remove it.* Disconnect the steering arm support from the frame support bracket and unscrew the support from the threaded bushing in the auxiliary arm (left hand thread). Then remove the threaded bushing from the auxiliary arm and the rubber seal from the steering arm support.

Reassembly

CHAMPION Install the threaded bushing in the auxiliary steering arm. After placing the rubber seal on the steering arm support, screw the support into the bushing until the threads bottom; then back off the support approximately 1/2 turn. *If the support is not backed off, the wheels will turn only to the right.*

Attach the steering arm support to the frame support bracket with the two bolts and tighten them securely. Then tighten the threaded bushing to 105-115 foot-pounds (14,5-15,9 kilogram-meters) torque.

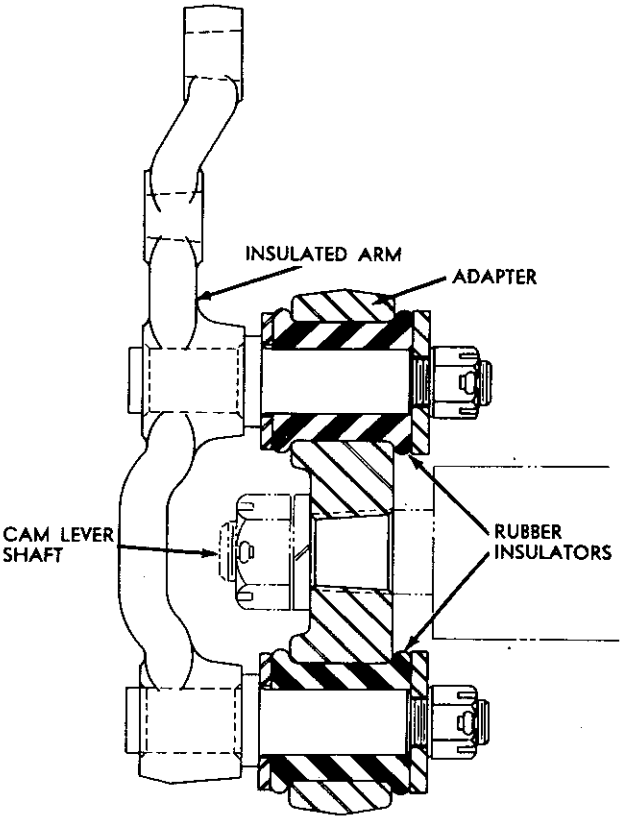


FIG. 208.—CONSTRUCTION OF THE CHAMPION STEERING GEAR ARM

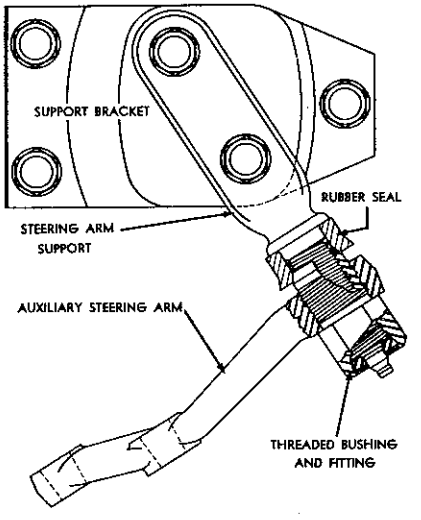


FIG. 209.—CONSTRUCTION OF THE CHAMPION AUXILIARY STEERING ARM

STEERING BELL CRANK ASSEMBLIES

Removal

COMMANDER Unhook the reach rod from the bell crank operating lever and the two tie rods from the bell crank. After removing the cotter pin, nut, and washer from the bell crank shaft, remove the pinch bolt from the operating lever. Then remove the operating lever and thrust washer from the shaft, thus permitting the removal of the bell crank and shaft from the bearing support tube.

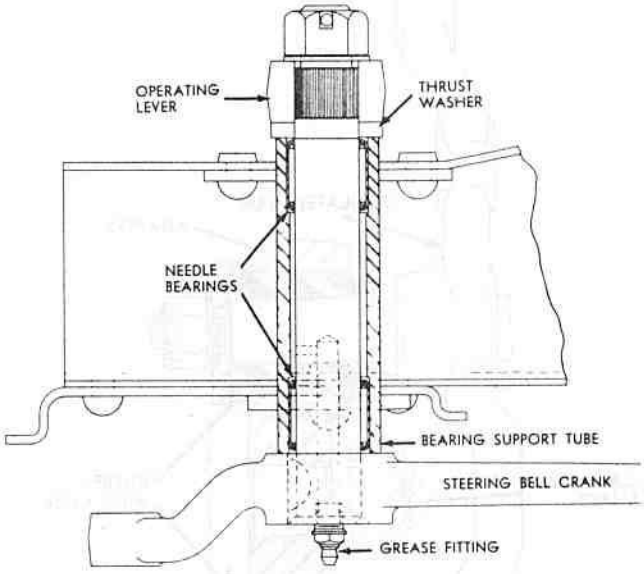


FIG. 210.—CONSTRUCTION OF THE COMMANDER STEERING BELL CRANK AND SHAFT

Insert Driver Adapter J-2033-3 in the bearing support tube and rest it on the upper surface of the lower needle bearing. Inserting Driver J-2033-2 in the support tube, drive the upper needle bearing out of the upper end of the tube. To remove the lower needle bearing, place the Driver Adapter J-2033-3 on the top of the bearing. Then insert Pilot J-2033-1 in the upper bearing recess, and using Driver J-2033-2, drive the lower bearing out of the support tube.

Installation and Adjustment

COMMANDER Insert Pilot J-2033-1 in the upper needle bearing recess, place the lower bearing on Driver J-2033-2, and drive the bearing into the bearing support tube until the shoulder of the driver is flush with the tube. After removing the pilot from the support tube, place the upper bearing on the driver. Then drive the bearing into the tube until, as before, the shoulder of the driver is flush with the tube.

NOTE.—When installing the needle bearings in the support tubes, be sure to drive against the lettered end of the bearing. Do not tap or pound directly on the bearings with a hammer.

Insert the steering bell crank shaft in the support tube and install the thrust washer and operating lever on the shaft. Be sure to align the punch marks on the shaft and operating lever. Then insert the pinch bolt, but do not tighten it.

After installing the washer and nut on the shaft, adjust the bell crank by tightening the shaft nut until there is no end play. The shaft should, however, turn freely in the support tube. After obtaining the proper adjustment, tighten the operating lever pinch bolt; lock the shaft nut in place with a new cotter pin; and attach the two tie rods to the bell crank and the reach rod to the operating lever.

NOTE.—The preceding adjustment procedure will also apply to the other steering bell crank.

WHEEL ALIGNMENT

● Wheel alignment is defined as the mechanics of properly adjusting all the factors of the front and rear wheels so that the car steers with the least possible effort and tire wear is reduced to a minimum.

Correct wheel alignment is dependent on proper toe-in, camber, caster, king pin inclination, and toe-out on turns. To correct misalignment, several adjustments may be necessary and should be made on an accredited wheel aligning machine. Before making these adjustments, however, check all tires for pressure and the wheel bearings for looseness. Correct wheel balance and proper shock absorber operation are also factors which promote easy steering, riding comfort, and reduced tire wear.

Camber

CHAMPION AND COMMANDER The specified wheel camber is $1/2° \pm 1/4°$. Camber should be checked with the car unloaded, with the car on a level floor or platform, and with the tires properly inflated. To insure that the wheels are in their natural running position, bounce the car up and down several times by grasping the front bumper.

To change the camber, add or remove shims between the steering knuckle upper control arm brackets and the frame as required (see Fig. 211). It is necessary to add or remove the same number and thickness of shims at both the front and rear brackets. The addition or removal of one thin shim changes the camber approximately 1/4°. The thick shim is equal to four thin shims.

NOTE.—Toe-in should always be readjusted after every camber adjustment.

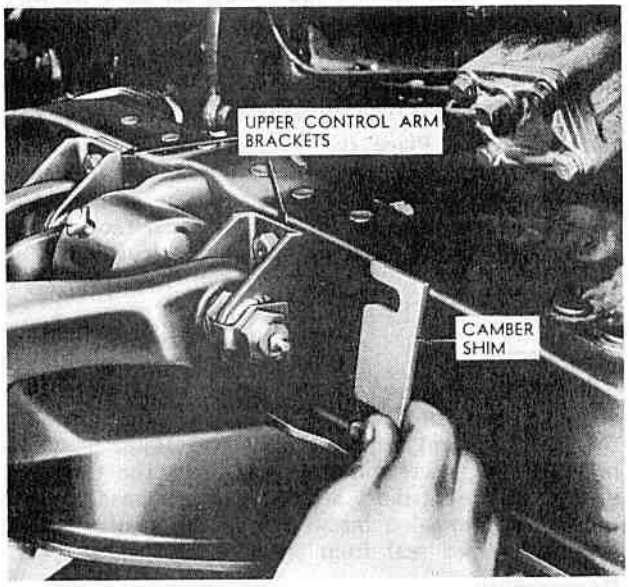


FIG. 211

Caster

CHAMPION AND COMMANDER The caster is determined by the relation of the steering knuckle control arms to the frame. The caster angle cannot be adjusted from its original factory setting which, with the car unloaded and the tires properly inflated, is from 0° to +1°. Incorrect caster indicates either that the king pin and its support are not properly centered in the control arms, or that chassis parts are bent.

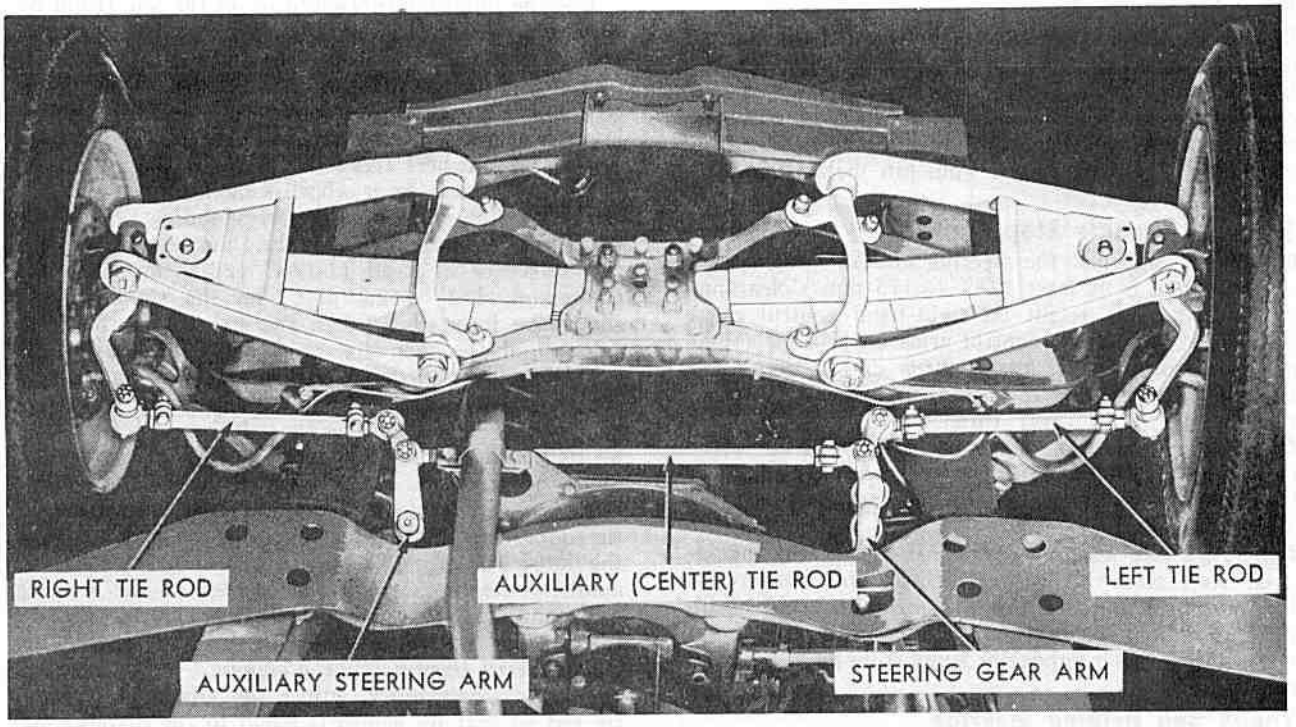


FIG. 212.—GENERAL VIEW OF THE CHAMPION STEERING SYSTEM

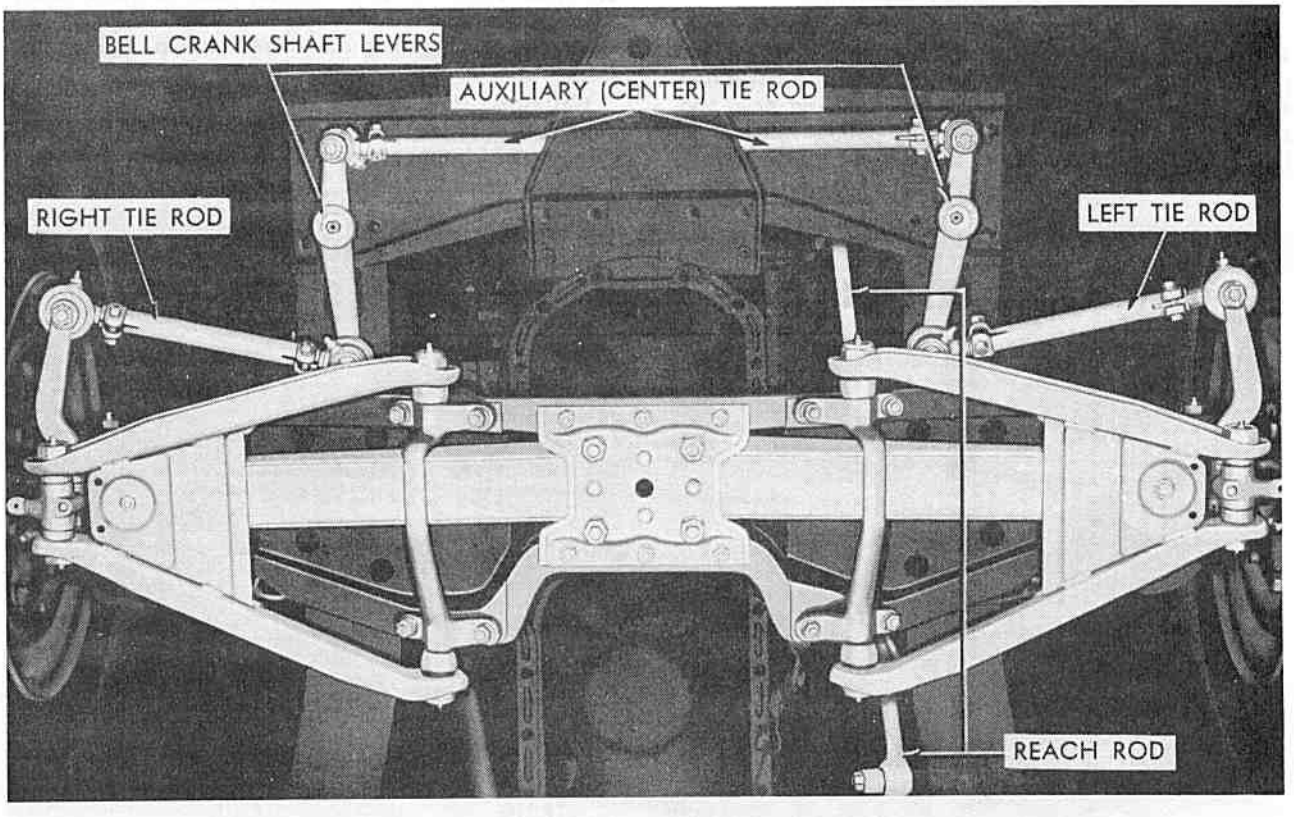


FIG. 213.—GENERAL VIEW OF THE COMMANDER STEERING SYSTEM

King Pin Inclination

CHAMPION AND COMMANDER Be sure that the camber is within the recommended specifications before checking the king pin inclination. The specified king pin inclination is 5-1/2° and should be checked with the car unloaded, with the car level, and with the tires properly inflated. Incorrect king pin inclination indicates bent chassis parts.

Steering Knuckle Stop Screws

CHAMPION Adjust the steering knuckle stop screws so that there is at least 1/8″ (3,175 mm.) clearance between the left (right on right-hand control cars) backing plate and the control arms on full left (right on right-hand control cars) turns and between the steering gear arm and the frame on full right (left on right-hand control cars) turns.

COMMANDER Adjust the stop screws so that there is at least 1/8″ (3,175 mm.) clearance between the backing plates and the control arms on full turns in either direction.

CHAMPION AND COMMANDER After obtaining the desired stop screw adjustment, check the freedom of movement of the steering system during its entire turning radius. There should be no interference between the steering linkage or supporting parts and any chassis parts.

Toe-in and Related Steering Linkage Adjustments

CHAMPION AND COMMANDER The steering tie rod and reach rod ends are non-adjustable. They do, however, automatically compensate for wear. Should excessive looseness develop in these connections, owing to a lack of lubricant or to high mileage, it will be necessary to replace the complete assemblies.

Check the steering gear to see that the cam lever shaft is on the center of the high spot of the cam. Then place the steering wheel on the steering tube serrations with the spokes in a horizontal position and keep the steering wheel in this position throughout the entire toe-in and steering linkage adjustment procedure.

Use the following procedure to set the left (right on right-hand control cars) front wheel in its straight-ahead position.

Attach a string to the rear bumper, and drawing the string tightly across the outside of the two tires below the hub covers, fasten it to the front bumper.

The front wheel tread being wider than the rear wheel tread, each front wheel is farther from the center line of the car than the corresponding rear wheel. Therefore, a block of wood, the thickness of one-half the difference in tread (1-1/8″ [28,58 mm.] on the Champion, 1/2″ [12,7 mm.] on the Commander), should be inserted between the string and the front sidewall of the rear tire (see Fig. 214). Adjust the left (right on right-hand control cars) tie rod so that the string will contact both the front and rear sidewall of the front tire. The tie rod clamps should then be tightened and not disturbed during the remainder of the adjustments.

On the Champion, adjust the auxiliary (center) tie rod so that its length is equal to the distance from the lubricant fitting in the threaded bushing on the auxiliary steering arm to the center of the steering gear cam lever shaft (see Fig. 215). (This is necessary to maintain correct alignment on turns.) Then tighten the auxiliary (center) tie rod clamps.

On the Commander, adjust the auxiliary (center) tie rod so that its length is equal to the distance between the lubricant fittings on the two steering bell crank shafts (see Fig. 216). (This is necessary to maintain correct alignment on turns.) Then tighten the auxiliary (center) tie rod clamps.

To set the toe-in, adjust the right (left on right-hand control cars) tie rod only. The toe-in should be set from 1/16″ to 1/8″ (1,588 mm. to 3,175 mm.) with an accredited toe-in gage or wheel aligning machine. After obtaining the correct toe-in, tighten the clamps securely.

CAUTION.—On the Champion, tighten all tie rod clamps so that the clamp bolts are in a horizontal position on the bottom side of the tie rods.

FIG. 214

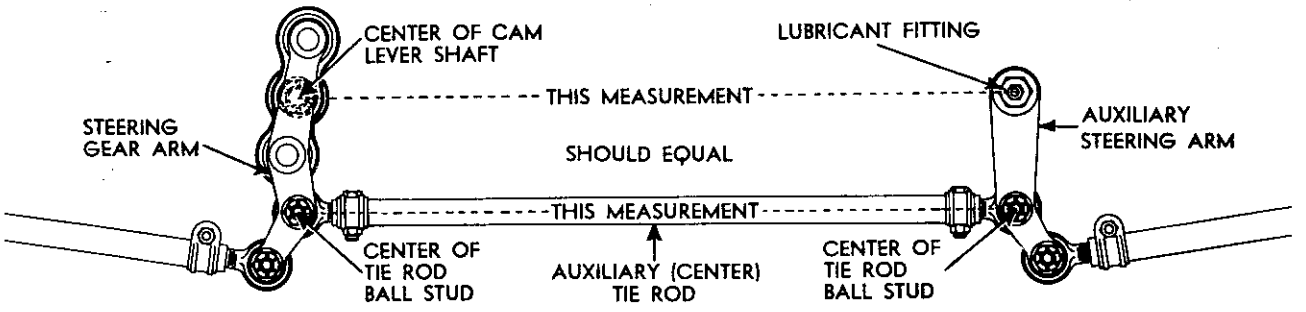


FIG. 215

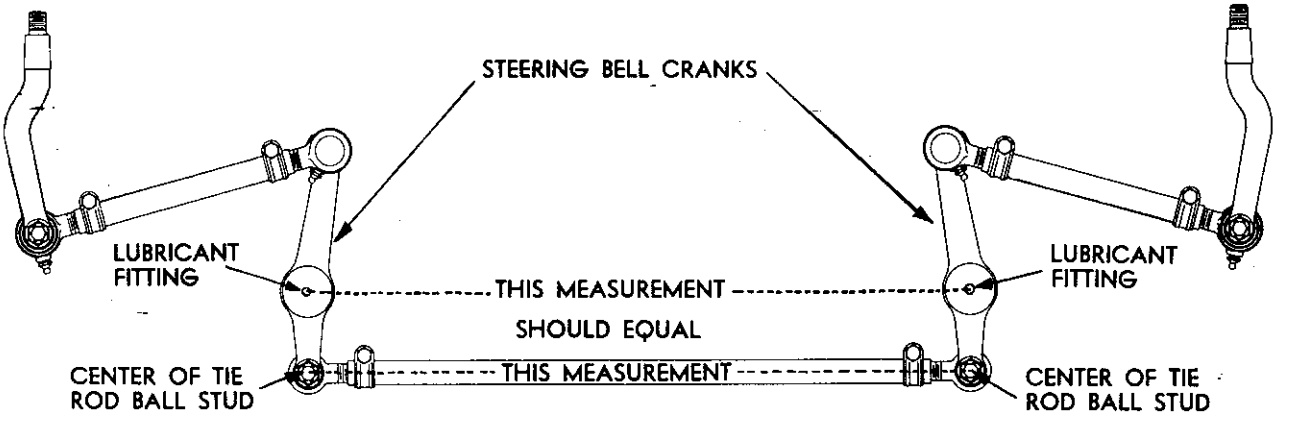


FIG. 216

STEERING DIAGNOSIS

ABNORMAL FREENESS IN STEERING SYSTEM

DESCRIPTION

To provide ease of steering, a small amount of backlash of the steering wheel is necessary, and the entire steering system must not be adjusted so as to cause a binding action in any part.

CAUSES

1. Excessive looseness in steering gear assembly due to:
   a) Improper adjustment.
   b) Cam lever shaft bushings oversize or badly worn.
   c) Cam lever pivot pins worn, chipped, or rough.
   d) Steering gear cam worn, chipped, rough, distorted, or adjusted off center.
   e) Steering gear cam bearings worn, broken, or incorrectly adjusted.
   f) Steering wheel loose on post.
2. Loose or worn steering tie rod and reach rod ends.
3. Loose front wheel bearings.
4. Loose or worn steering knuckle, bearings, bushings, and pins.
5. Steering knuckle arms loose at steering knuckle.
6. Steering knuckle arm balls loose in arms.
7. Cam lever shaft end play.
8. Loose auxiliary steering arms.
9. Unusual causes.
   a) Steering gear case loose on chassis frame.
   b) Excessive clearance of steering post in upper jacket bushing.

CAR STEERS HARD

CAUSES

1. Tires underinflated or unequally inflated.
2. Tires oversize or abnormally worn.
3. Abnormal friction in steering tie rod or reach rod joints due to:
   a) Lack of lubrication or improper type of lubricant.
   b) Dirt accumulation.
   c) Ball seat or arm ball scored, rough, or galled.
   d) Arm ball worn out of round (tight on turns).
4. Abnormal friction in steering gear assembly due to:
   a) Lack of lubrication or improper type of lubricant.
   b) Steering cam shaft pivot pins meshed too deeply with steering gear cam (not sufficient end play of cam lever shaft).
   c) Steering gear cam bearings adjusted too tightly.
   d) Steering gear cam lever shaft bearings rough, scored, or otherwise damaged.
   e) Insufficient clearance of cam lever shaft in bushings.
   f) Cam lever shaft bushings not in proper alignment.
   g) Steering gear cam thrust bearings broken, galled, rough, or chipped.
   h) Insufficient clearance of steering post upper bushing on post.
   i) Steering gear cam or tube sprung or distorted.
   j) Misalignment of steering gear assembly due to method of mounting at chassis frame and instrument board bracket.

5. Excessive friction of steering knuckles resulting from:
   a) Lack of lubrication of steering knuckles and knuckle thrust bearings.
   b) Galled, rough, or scored knuckle pins.
   c) Insufficient clearance between steering knuckle bushings and knuckle pins.
   d) Insufficient clearance between steering knuckle roller bearings and knuckle pins.
   e) Insufficient end play of steering knuckle.
   f) Thrust bearing races galled, rough, scored, or full of dirt.
6. Unusual causes.
   a) Insufficient knuckle pin inclination.
   b) Improper front wheel camber (reverse or excessive).
   c) Incorrect front wheel toe-in.

SHIMMY OR FRONT WHEEL WOBBLE

DESCRIPTION

High and low speed shimmy are often confused by the service man. Although many of the causes are identical, the two conditions have absolutely different characteristics.

Many times a vibration or movement in the steering wheel only is termed shimmy; this is, however, an incorrect term and should be avoided. Front wheel shimmy often causes steering movement, but this movement is originated at the front wheels and is transferred to the steering wheel.

Low speed shimmy, or front wheel wobble as the name implies, can be simply described as a rapid series of oscillations of the wheel and tire assembly on the knuckle pin. In other words the front wheels attempt to point alternately to the right and left.

High speed shimmy or front wheel tramp can be simply described as a gallop. In other words, the condition encountered is very similar to a condition which would be evident if the front wheels were decidedly "egg shaped." In case of severe high speed shimmy, the front tires actually leave the pavement; while in mild cases, one front wheel appears deflated and the other appears inflated. This condition alternates rapidly between the front wheels.

LOW SPEED SHIMMY

CAUSES

1. Tires underinflated or unequally inflated.
2. Excessive freedom or looseness of steering knuckle thrust bearings.
3. Worn or loose steering gear parts.
4. Worn or loose steering linkage parts.
5. Loose front spring U-bolts.
6. Front springs too flexible because of:
   a) Weak chassis springs.
   b) Inadequate shock absorber control due to:
      (1) Insufficient or incorrect type of fluid in instrument.
      (2) Improper adjustment.
      (3) Abnormal internal clearances.
7. Incorrect front wheel camber resulting from:
   a) Front wheel bearings adjusted too loosely.
   b) Recess cut on underneath side of steering knuckle spindle by rotation of outer bearing cone.
   c) Steering knuckle bushings or pins worn or loose.
   d) Bent steering knuckle yoke or spindle.
   e) Improper adjustment.
8. Unequal front wheel camber (variation of more than 1/2 degree).
9. Irregularities in front wheel tire tread.

HIGH SPEED SHIMMY OR WHEEL TRAMP

CAUSES

1. Items affecting low speed shimmy or wheel wobble.
2. Front wheel, hub, brake drum, and tire assembly out of balance.
3. Front tires and wheels wobble or do not run true (maximum permissible 1/8" [3,175 mm.]).
4. Front wheel tire tread eccentricity or run-out (maximum permissible 1/16" [1,588 mm.]).
5. Rear wheel and tire assemblies out of balance.
6. Rear wheel wobble or run-out.
7. Unusual cause.
   a) Dragging front wheel brakes.

STEERING WANDER OR ROAD WEAVE

CAUSES

1. Tires underinflated or unequally inflated (front and rear).
2. Incorrect or unequal front wheel camber.
3. Worn or loose king pins and bushings.
4. Excessively tight king pins and bushings.
5. Improperly adjusted steering gear or linkage.
6. Excessive front wheel toe-in.
7. Rear axle shifted on rear springs.
8. Cross wind.
9. Type of road surface.
10. Tight tie rod ends.
11. Loose U-bolts.

STEERING KICKBACK

DESCRIPTION

Steering kickback is registered on the steering wheel as a very rapid movement of the steering wheel and is the result of one front wheel having encountered a bump or obstruction in the road surface. A small amount of steering wheel movement must be expected and is normal when the car is driven over an excessively rough road or when the front wheels strike an unusual obstruction.

CAUSES

1. Tires improperly inflated.
2. Chassis springs sagged.
3. Insufficient shock absorber control.
4. Worn, loose, or improperly adjusted steering gear parts.
5. Worn, loose, or improperly adjusted steering linkage parts.

STEERING GEAR RATTLES

CAUSES

1. Insufficient lubricant in steering gear assembly.
2. Incorrect grade of lubricant used in steering gear assembly.
3. Excessive lash between cam lever pivot pins and cam.
4. Steering gear cam bearings broken, damaged, or incorrectly adjusted.
5. Excessive radial clearance of cam lever shaft in case bushings.
6. Abnormal clearance at steering connections.
7. Steering post jacket clamp loose on jacket or instrument panel.
8. Steering post jacket loose at lower end.
9. Steering gear loose on chassis frame.
10. Steering gear arm loose on cam lever shaft.
11. Excessive looseness in steering linkage.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

GASOLINE SYSTEM

Single-barrel, downdraft carburetors are used on the Champion and Commander models. The carburetor air cleaners, which may be the oil-coated or the wet type, should be serviced regularly in accordance with the conditions in which the automobile is operated.

Delayed-action, single-wire, electric gasoline gages are used on both models. When the ignition switch key is turned to the "On" position, a short interval of time elapses before the gage needle registers the amount of fuel in the gasoline tank. This delayed action stabilizes the gage needle during rough-road operation.

Gasoline Consumption

● It is a well established fact that gasoline consumption increases sharply with increased car speed. Therefore, when investigating a report of unsatisfactory fuel consumption, conduct an actual mileage test with an accredited mileage tester. The accompanying charts are computed on the assumption that all mechanical units affecting fuel consumption are in good condition and that the test is conducted on a level road in both directions at a constant speed.

Gasoline Mileage Chart

Models	Miles per Hour	Miles per Gallon	Kilometers per Hour	Kilometers per Liter	Miles per Hour	Miles per Imperial Gallon
6G Champion without overdrive (4.1 to 1 axle)	20	26	32,2	11,05	20	31.2
	40	23	64,4	9,80	40	27.6
	60	19	96,6	8,10	60	22.8
6G Champion with overdrive (4.56 to 1 axle)	40	26	64,4	11,05	40	31.2
	60	22	96,6	9,40	60	26.4
14A Commander without overdrive (4.09 to 1 axle)	20	21	32,2	8,90	20	25.2
	40	19	64,4	8,10	40	22.8
	60	16	96,6	6,80	60	19.2
14A Commander with overdrive (4.55 to 1 axle)	40	23	64,4	9,80	40	27.6
	60	19	96,6	8,10	60	22.8

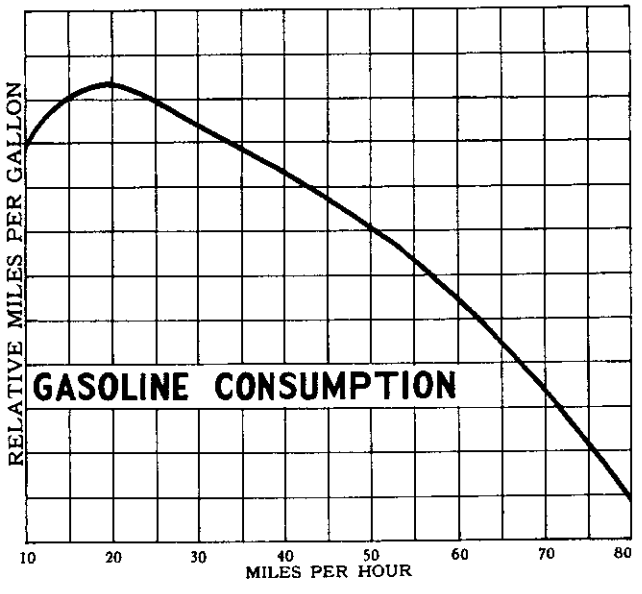


FIG. 217

Gasoline Gage

● A delayed-action, single-wire, electric gasoline gage is used on the Champion and Commander models. A removable plate provided under the spare wheel in the trunk compartment floor facilitates the inspection and removal of the gasoline gage tank unit.

CHAMPION AND COMMANDER Use the following instructions for checking the gas gage system.

Check all wiring connections, being sure that they are clean and properly connected. If this does not eliminate the difficulty, check the wire connecting the tank unit and gas gage for a ground.

To check this wire, disconnect it from the tank unit. With the ignition switch on, the gage should register "Empty." Failure of the gage to do so requires that the other end of the wire be disconnected from the gas gage. If the gage now registers "Empty," the wire should be repaired or replaced. If the gage still does not show "Empty," replace the gage (dash unit).

To check this wire for an open circuit, disconnect the wire from the tank unit. Then turn on the ignition switch and ground the wire. A "Full" reading should

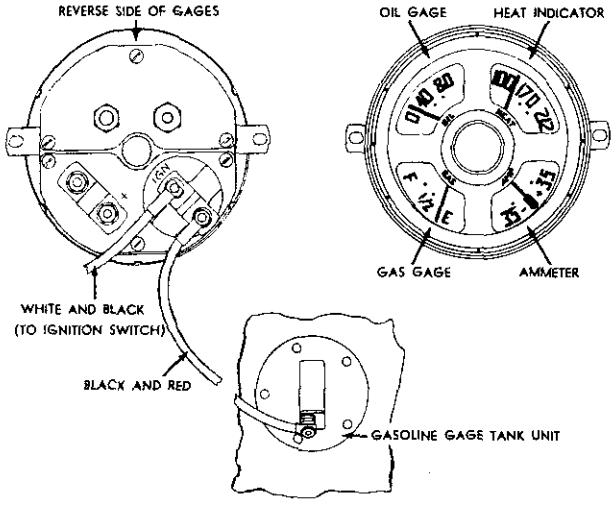


FIG. 218.—GASOLINE GAGE SYSTEM

register on the gage. If the gage does not register "Full," ground the terminal post to which the wire leading from the tank unit to the gage is attached. If the gage now registers "Full," repair or replace the wire. If the gage still does not register "Full," replace the gage (dash unit).

Use a master tank unit which is known to be accurate to check the gas tank unit. Disconnect the tank unit and connect the master tank unit to the wire which leads to the gas gage (dash unit). Then connect a ground wire from the master unit to the frame. This grounding operation is important.

Raise the float slowly, allowing time for the gage to register. If the gage registers correctly, the old tank unit is at fault and should be repaired or replaced.

NOTE.—If the test indicates that the trouble is in the tank unit, determine whether or not the unit is operating freely with no binding action at any point of its travel. If there is interference, correct this condition by bending the unit arm or wire slightly. Then recheck the unit and, if the gage registers correctly, reinstall the unit in the tank. The gasoline gage should register "Empty" with a one or two gallon reserve in the tank. Obtain the proper setting by bending the float arm.

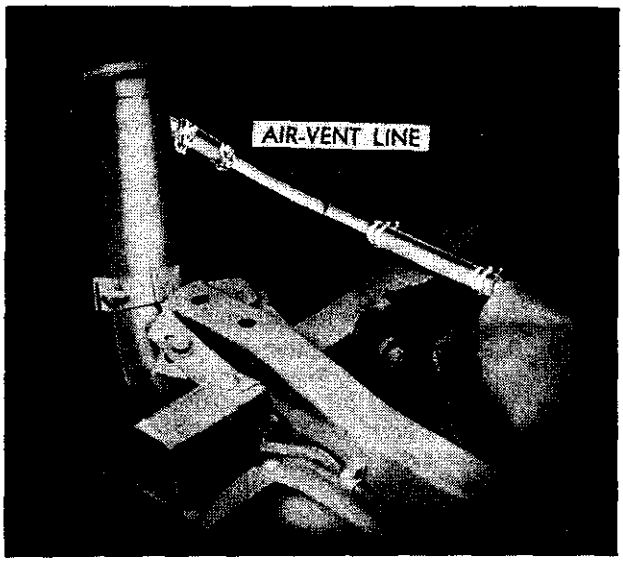


FIG. 219

Gasoline Tank

CHAMPION AND COMMANDER The gasoline tank, which is supported at the rear of the frame by three mountings, has a capacity of 17 U. S. gallons (14.16 Imp. gals.; 64,34 liters). An air-vent line extends from the top of the tank to the top of the filler neck (see Fig. 219).

The filler cap and neck are completely enclosed in the left rear fender and are thus protected from the accumulation of road water and dirt. Any water or foreign matter which may have collected in the tank can be drained through the small plug located at the bottom of the tank.

Carburetor Air Cleaner

● Dust particles are highly abrasive and tend to score and cut the smooth glasslike surfaces of working parts in an engine. The installation, therefore, of the proper type of air cleaner will decrease frictional wear, improve operating efficiency, and increase engine life.

Certain states have been universally designated by the industry as dusty areas. Since all engines should be adequately protected, all passenger cars shipped to dealers in these areas are equipped with oil bath air cleaners (see Fig. 220).

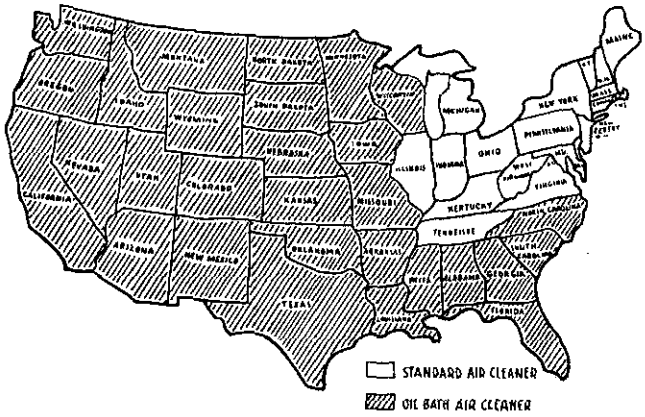


FIG. 220

Oil Bath Type

CHAMPION AND COMMANDER The wet type air cleaner is intended for use in territories where dust conditions are severe. It must be serviced regularly so that serious damage to engine parts may be avoided. Under extreme dust conditions it may be necessary to service the unit daily.

To service wet type (oil bath) cleaner:

1. Remove the filtering element.
2. Wash the element in kerosene and drain thoroughly.
3. Clean oil reservoir and fill to indicated level. Refer to the decalcomania on the outside of the cleaner for the proper grade of oil.
4. Reinstall element.

Oil-coated Type

CHAMPION AND COMMANDER The air cleaners used on both models are similar in construction and operation. They must be serviced regularly so that serious

damage to the engine parts may be avoided. Where dust conditions prevail, it may be necessary to service the unit daily, or more often under severe dust conditions.

To service standard (oil-coated type) cleaners:

1. Remove the filter element.
2. Wash element in kerosene and drain thoroughly.
3. Submerge in a good grade of engine oil.
4. Allow excess oil to drip off element and reinstall the cleaner.

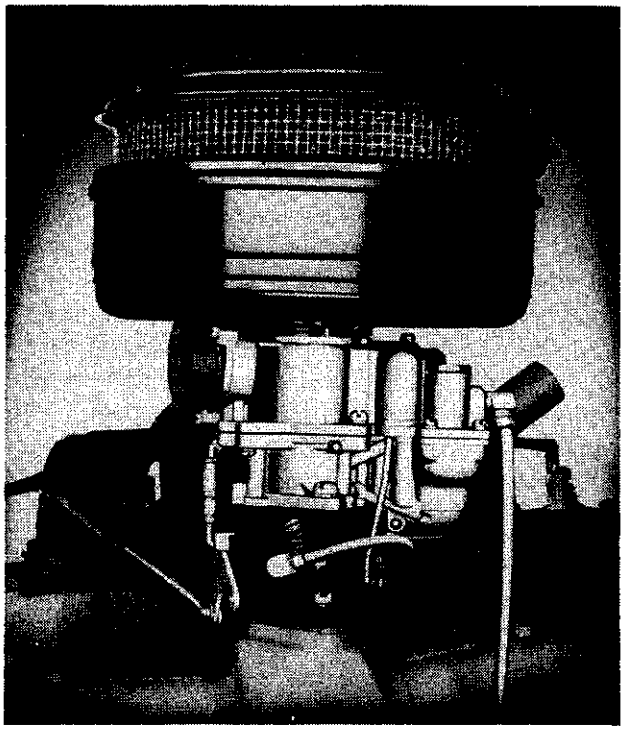


FIG. 221.—OIL-COATED AIR CLEANER

Fuel Pumps

● The fuel pumps on the Champion and Commander models are similarly constructed. They are located on the right side of the engine and are actuated by an eccentric which is an integral part of the camshaft.

CHAMPION AND COMMANDER The sediment bowl should be removed and cleaned periodically. When installing the bowl, be sure that the gasket is in good condition. Fuel pump pressure should be checked every 10,000 miles (16.090 km.) or whenever unsatisfactory fuel economy is reported. To check the pressure, install an accredited fuel pump and vacuum gage between the carburetor and the fuel pump. If the pump is functioning satisfactorily, the gage should register a reading of 4 to 5 lb. (0,2812 to 0,3516 kgs.).

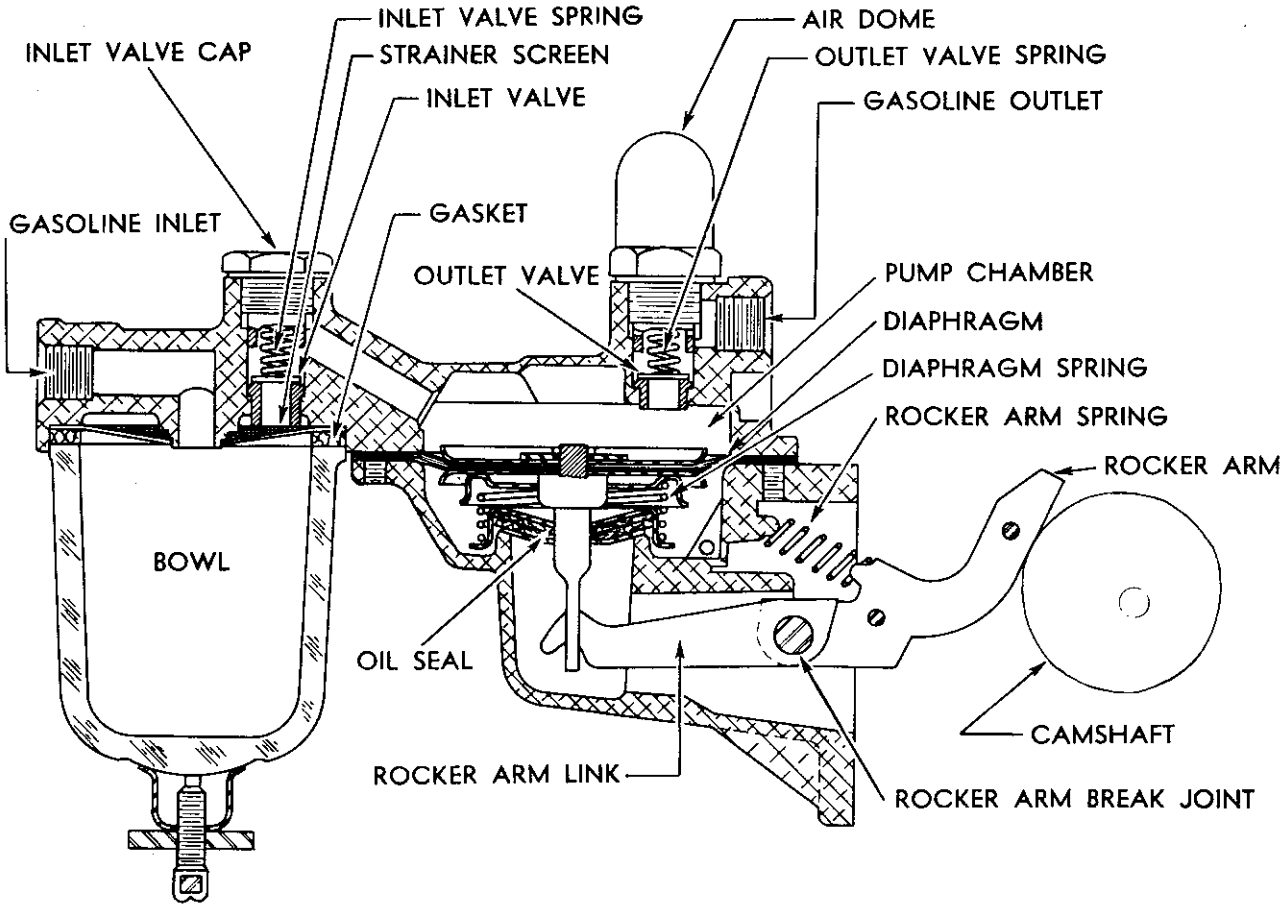


FIG. 222.—CONSTRUCTION OF THE CHAMPION AND COMMANDER FUEL PUMP

Carburetors

● Single-barrel, downdraft carburetors equipped with accelerating pumps, vacuum economizers, and automatic chokes are used on the Champion and Commander models. The accelerating pumps enrich the mixture momentarily to care for suddenly applied loads on the engines, providing fast and smooth acceleration. For sustained loads, such as hill climbing, the vacuum economizer — operated by the change in intake manifold vacuum — supplies the necessary extra fuel. Automatic chokes supply the correct mixture for starting the engine and for the warm-up period.

Whenever a report of excessive fuel consumption is made, other factors, such as an inoperative heat control valve or incorrect ignition timing, in addition to the carburetor, should receive attention. Driving habits and operating conditions should also be considered.

The Carter Carburetor, Model WE 532 S, is used on Champions; the Stromberg Carburetor, Model BXOV-26, is used on Commanders.

CARTER CARBURETOR (MODEL WE 532 S)

● The Carter Carburetor used on the Champion employs five systems during the full range of its operation. Figures 223 through 227 name and fully illustrate these systems.

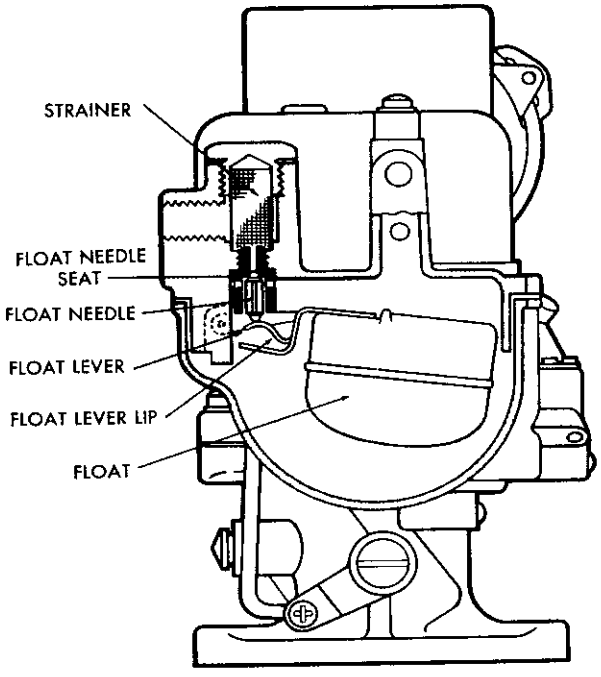


FIG. 223.—FLOAT SYSTEM

Gasoline enters the fuel bowl through the fuel bowl strainer and the needle valve. The neele valve is controlled by the float and the height of the fuel level in the bowl.

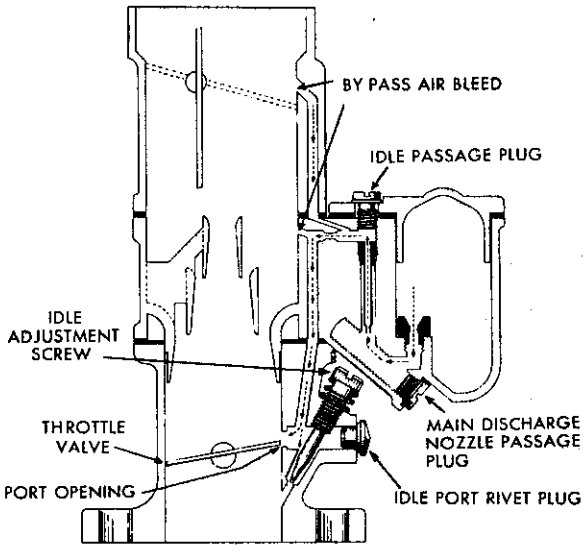


FIG. 224.—LOW-SPEED SYSTEM

The dotted arrows indicate the direction of the flow of fuel through the parts and passages of the low-speed system.

Two idle by-pass air bleeds — one located above the choke valve, the other below — provide the proper fuel mixture when the engine is idling. The upper by-pass air bleed also aids in balancing the atmospheric pressure in the low-speed system when the choke valve is closed.

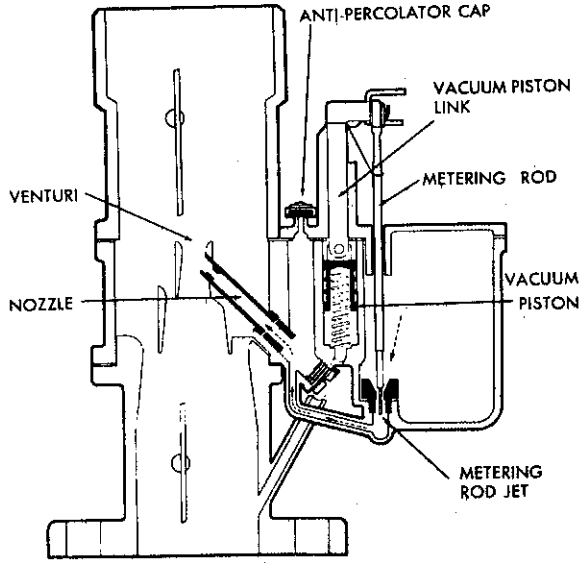


FIG. 225.—HIGH-SPEED SYSTEM

The dotted arrows indicate the direction of the flow of fuel through the parts and passages of the high-speed system.

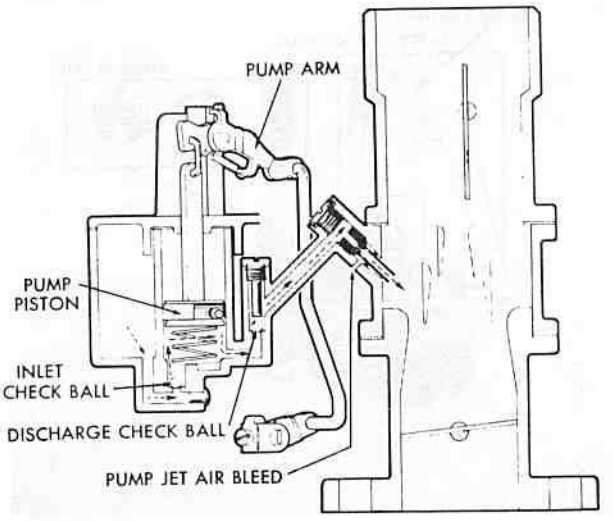


FIG. 226.—ACCELERATING PUMP SYSTEM

The dotted arrows indicate the direction of the flow of fuel through the accelerating pump system.

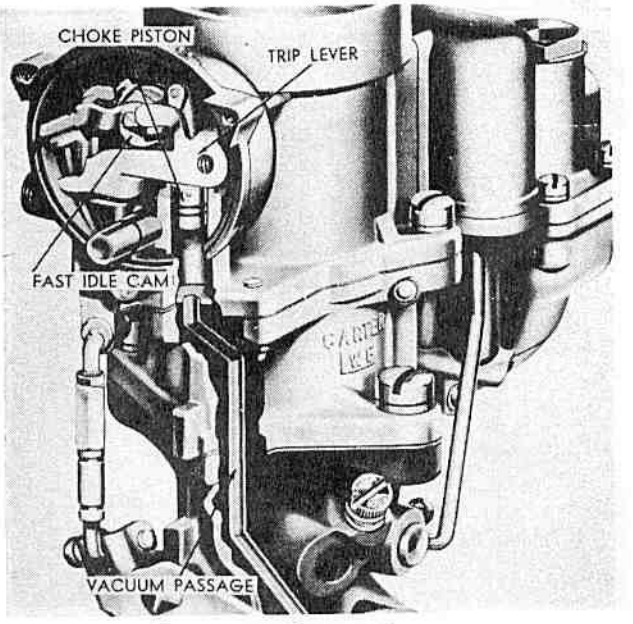


FIG. 227.—CHOKE SYSTEM

This figure illustrates the choke mechanism with a cutaway view of the vacuum passage. The fast idle cam and link, choke trip lever, and choke piston are located in the climatic control body. In this way these parts are protected from dirt or other foreign matter.

Disassembly

CHAMPION Remove the dust cover and the air horn assembly, tilting the latter during removal so that the choke connecting rod can be removed from the throttle valve shaft lever. Then remove the air horn gasket and detach the choke connecting rod from the fast idle link.

Disconnect the throttle connector rod by removing the pin spring from the upper end of the rod and the retainer and spring from the lower end. Then, after taking out the four bowl cover screws and the idle passage screw plug and gasket, remove the bowl cover assembly. Next remove the idle adjustment screw and spring from the throttle body. (See Fig. 228.)

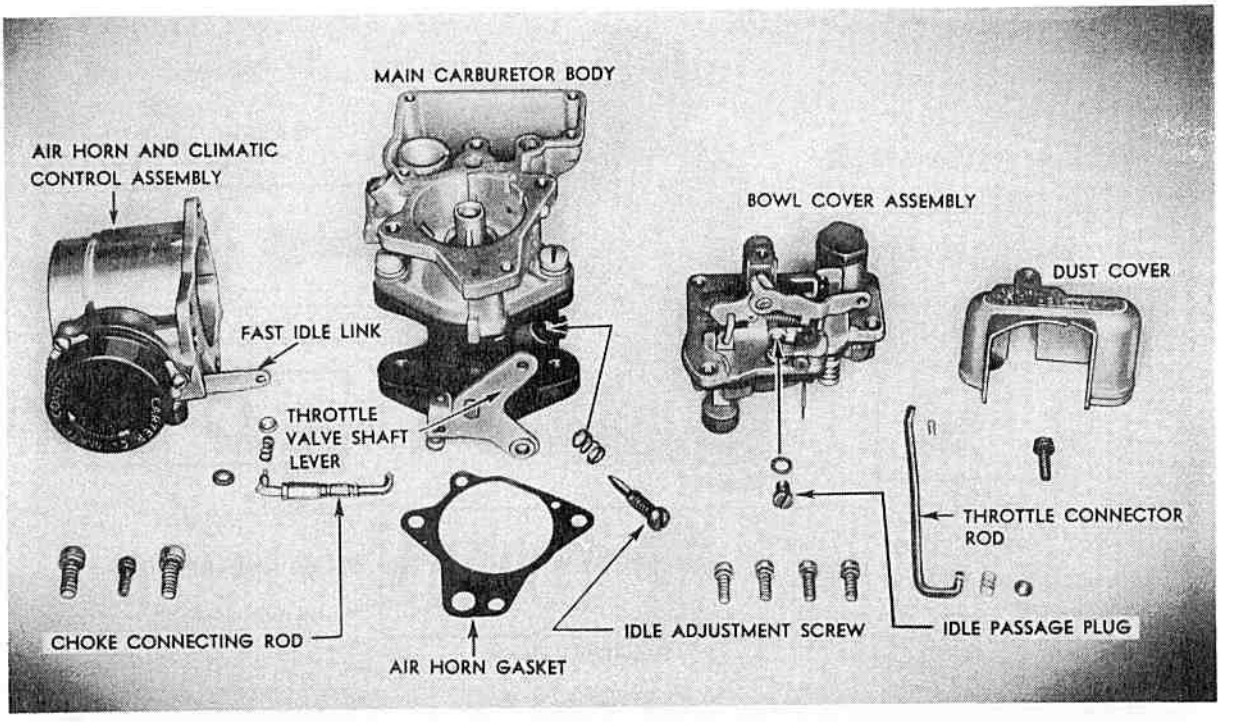


FIG. 228

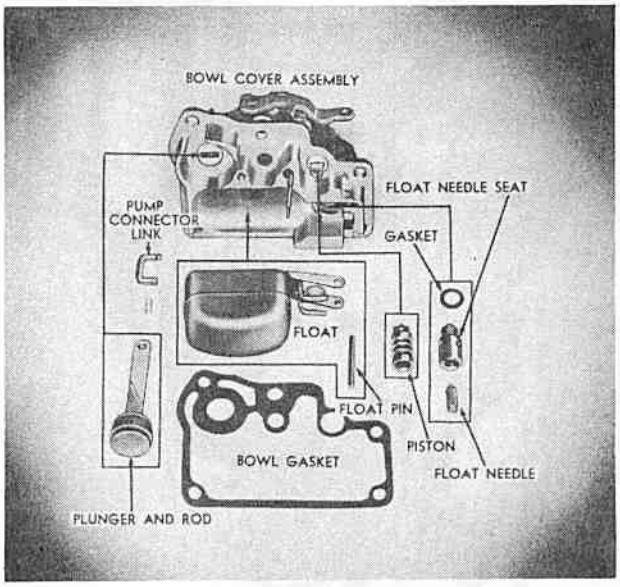


FIG. 229

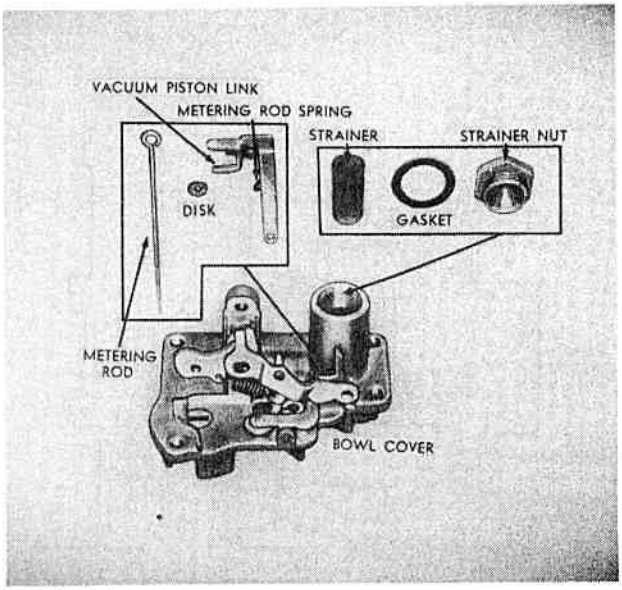


FIG. 230

To disassemble the bowl cover assembly (see Fig. 229), turn the vacuum piston 90° counterclockwise and unhook it from the vacuum piston link. Then, after removing the pin spring and pump connector link, remove the accelerating pump plunger and rod assembly.

Remove the bowl cover gasket. Removing the float lever pin will permit the removal of the float and lever assembly and the float needle. Then, with Jet Wrench J-816-6, remove the float needle seat and gasket.

Remove the vacuum piston link with the metering rod spring and the metering rod and disk from the bowl cover. Then remove the fuel bowl strainer nut, gasket, and strainer. (See Fig. 230.)

Remove the vacuum piston spring and the accelerating pump spring. After removing the accelerating pump strainer, use Retainer Ring Removing Tool J-1306 to remove the accelerating pump inlet check ball retainer ring. Turning the carburetor body upside down will then remove the inlet check ball.

Remove the pump discharge jet passage plug and gasket, using Jet Wrench J-816-6. With Jet Wrench J-816-2, remove the pump jet. Again using Jet Wrench J-816-6, remove the pump discharge check ball retainer screw plug and gasket. The pump check ball can then be easily removed.

Using Jet Wrench J-816-1, remove the low speed jet; and using Jet Wrench J-816-6, remove the metering rod jet and gasket. (See Fig. 231.)

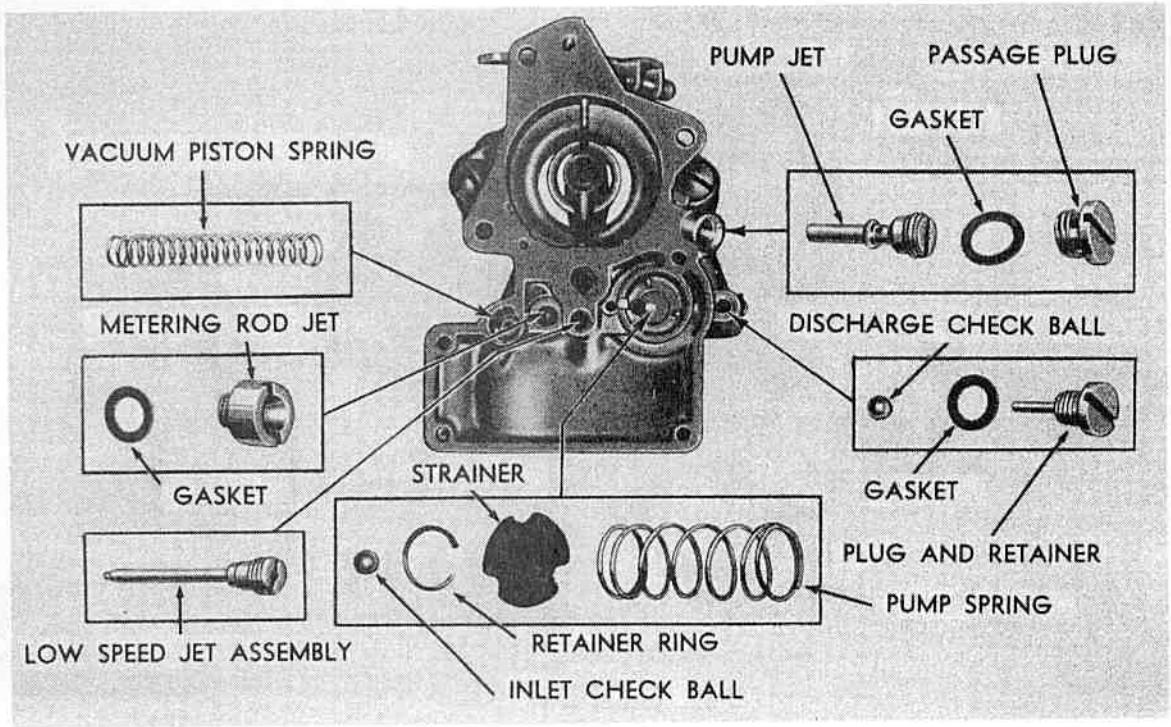


FIG. 231

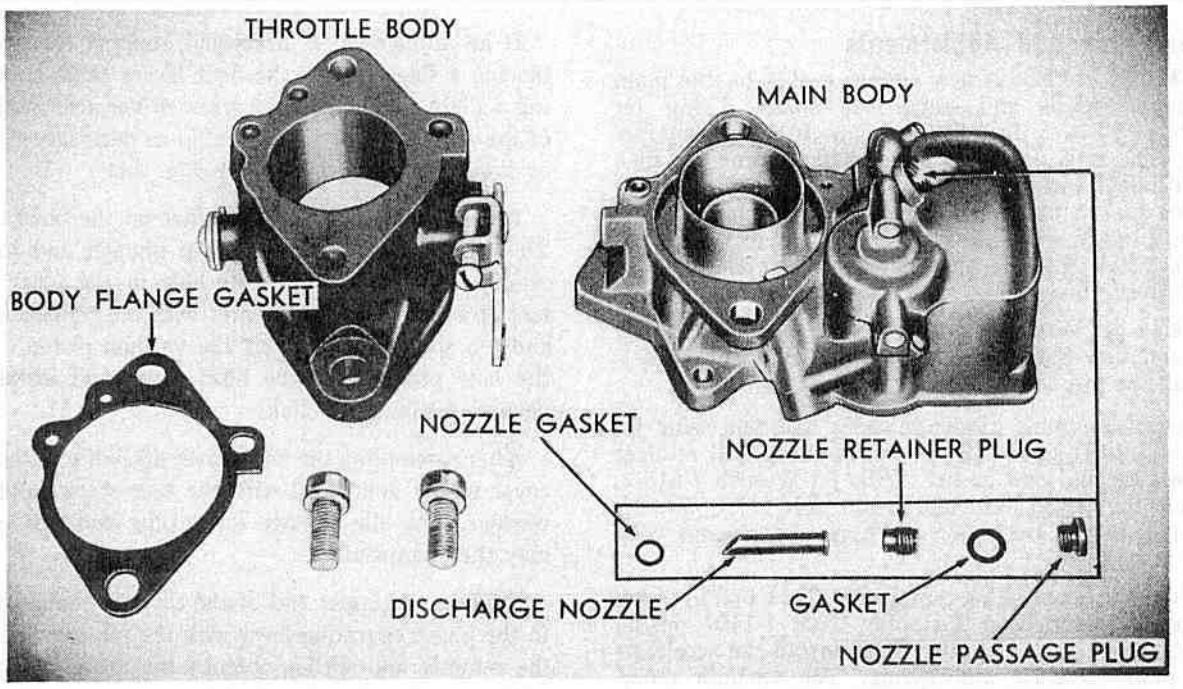


FIG. 232

Take out the two screws and remove the main carburetor body and gasket from the throttle body. Using Jet Wrench J-816-6, remove the main discharge nozzle passage plug. The main discharge nozzle retainer plug can then be removed with Jet Wrench J-816-2. To remove the main discharge nozzle, use Jet Extractor J-508. Be sure that the small copper gasket which fits around the seat of the nozzle has also been removed. (See Fig. 232.)

Remove the climatic control housing with thermostat and gasket. To remove the baffle plate, the choke trip lever, and the fast idle link, remove the screw which holds them to the climatic control body.

Remove the choke valve from the choke valve shaft. Turn the shaft and lever counterclockwise to remove the choke piston from the cylinder. Then pull the shaft out of the climatic control body and remove the fast idle cam from the shaft. (See Fig. 233 for parts of climatic control.)

Cleaning and Inspecting

CHAMPION All carburetor parts and passages should be cleaned thoroughly with Bendix Cleaner AC-1328, rinsed with solvent, and blown out with compressed air before the carburetor is reassembled.

CAUTION.—*When blowing out the climatic control housing with compressed air, support the thermostat coil with a thumb or finger to prevent the distortion of the thermostat.*

Inspect all parts for wear or damage. If a replacement of parts is necessary, use the Carburetor Repair Kit, Studebaker Part No. 519675. When reassembling the carburetor, always replace all gaskets with new ones.

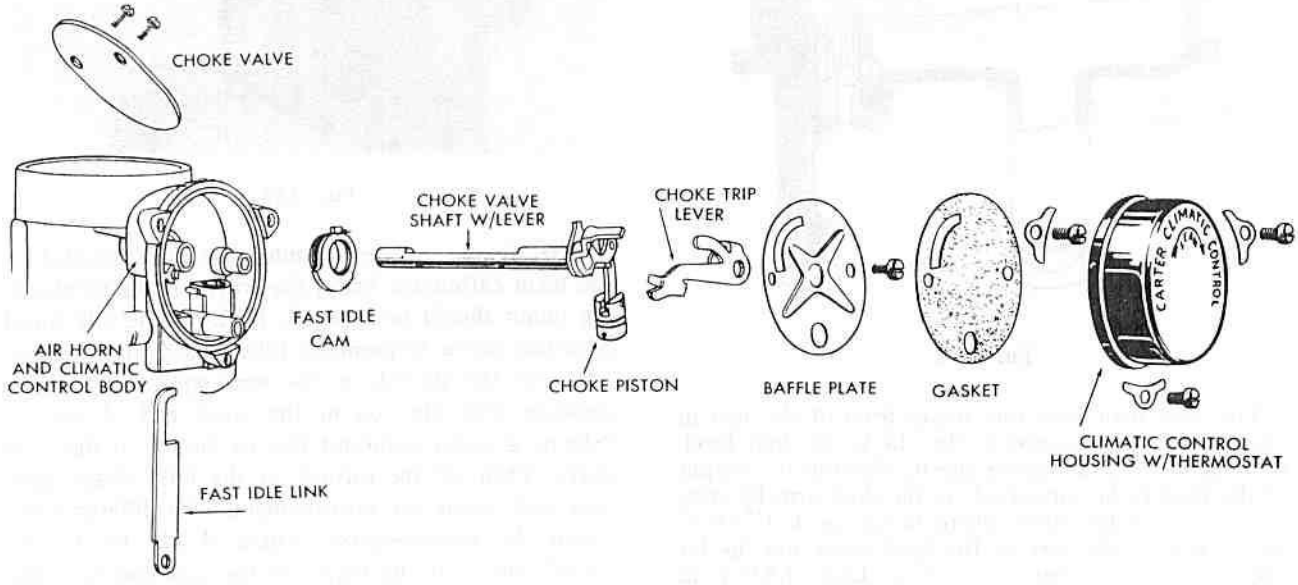


FIG. 233

Reassembly and Adjustments

CHAMPION Place a new copper gasket on the main discharge nozzle and install the nozzle. Using Jet Wrench J-816-2, install the main discharge retainer plug. The main discharge nozzle passage plug can then be installed with Jet Wrench J-816-6. After installing a new gasket, attach the main carburetor body to the throttle body with the two screws and lock washers. Next install the idle adjustment screw and spring in the throttle body.

Using Jet Wrench J-816-6, install the metering rod jet and new gasket; and using Jet Wrench J-816-1, install the low speed jet.

Install the pump discharge check ball, and using Jet Wrench J-816-6, install the pump check ball retainer screw plug and new gasket. With Jet Wrench J-816-2, install the pump jet; and again using Jet Wrench J-816-6, install the pump discharge jet passage plug and new gasket.

Drop the accelerating pump inlet check ball in place. Using Retainer Ring Installing Tool J-1407, install the check ball retainer ring. Then install the accelerating pump strainer and spring. The vacuum pump spring should also be placed in its well at this time.

Before reassembling the float bowl cover assembly, lubricate the pump operating countershaft with No. 3 graphite grease. Install the fuel bowl strainer, new gasket, and nut. With Jet Wrench J-816-6, install the float needle seat and new gasket. Then install the float needle, and holding the float and lever assembly in position, insert the float lever pin.

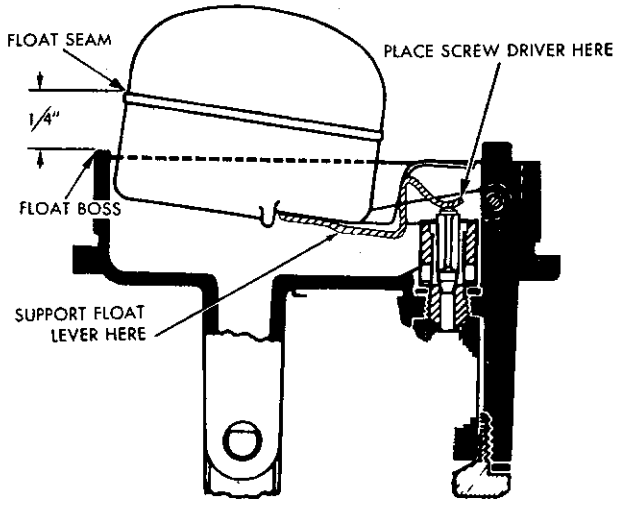


FIG. 234

The float maintains the proper level of the fuel in the bowl of the carburetor. To check the float level, turn the bowl cover upside down, allowing the weight of the float to be supported by the float arm lip resting on the needle valve. There should be 1/4" (6,35 mm.) between the boss on the bowl cover and the far edge of the float seam. Use Float Gage J-818-6 to check the float level.

If an adjustment is necessary, support the float by placing a finger under the float lever; then, by exerting a slight pressure with a screw driver against the tip of the float lever lip, bend the lip as necessary to raise or lower the float level. (See Fig. 234.)

Install a new bowl cover gasket on the bowl cover. To install the accelerating pump plunger and rod assembly, insert the rod in its hole in the bowl cover and attach it to the pump arm with the connector link and pin spring. Then insert the vacuum piston link in the hole provided in the bowl cover and install the vacuum piston on the link.

After assembling the bowl cover assembly, attach the cover to the float bowl with the four screws and lock washers. The idle passage screw plug and new gasket may then be installed.

Connect the upper end of the throttle connector rod to the pump operating lever with the pin spring; using the retainer and spring, connect the lower end of the rod to the throttle valve shaft lever.

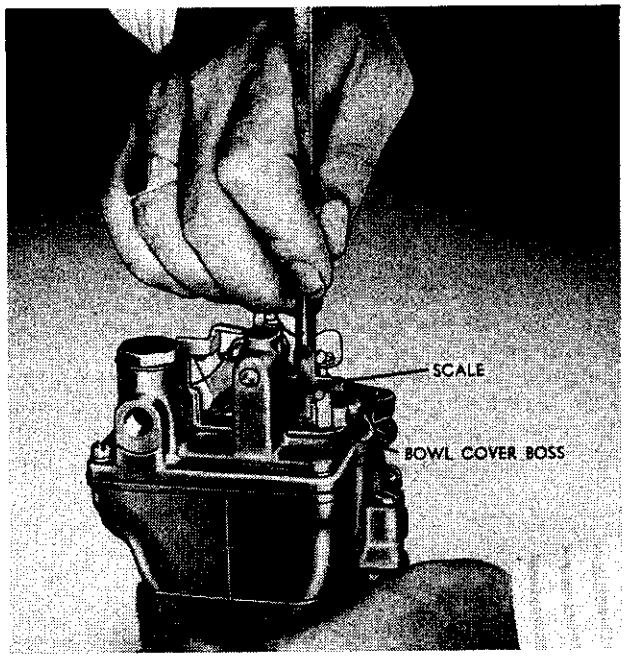


FIG. 235

After the bowl cover assembly has been installed on the main carburetor body, the travel of the accelerating pump should be checked. Back off the idle speed adjusting screw to permit a fully closed throttle position. Set the throttle in the wide-open position and measure from the top of the lower end of the accelerating pump connector link to the top of the bowl cover. Then set the throttle in the fully closed position and repeat the measurement. The difference between the measurements, which should be 17/64" (6,747 mm.), is the travel of the accelerating pump plunger. (See Fig. 235.)

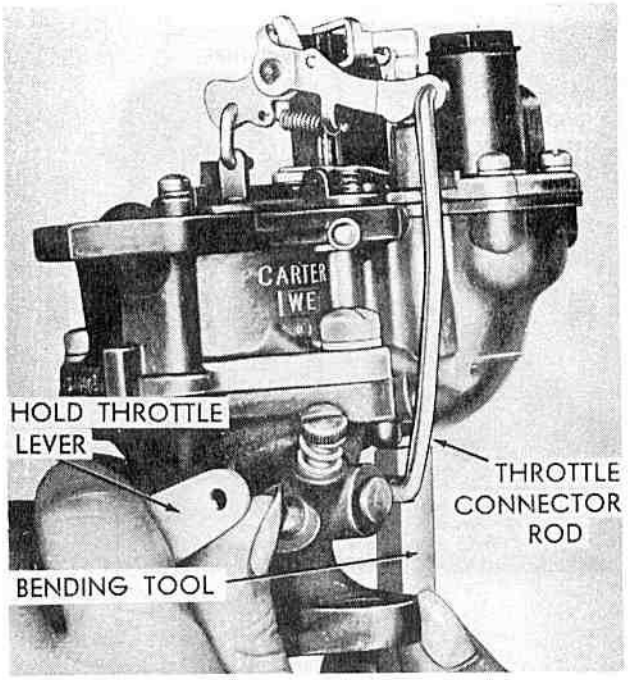


FIG. 236

If the travel of the accelerating pump plunger is incorrect, adjust the travel by bending the throttle connector rod with Bending Tool J-1137 at the point shown in figure 236.

Insert Metering Rod Gage J-1265 in place of the metering rod, seating the tapered end of the gage in the metering rod jet. With the throttle valve closed (be sure the idle speed adjusting screw permits the throttle valve to close completely), press down lightly on the vacuum piston link. There should be less than .005" (0,13 mm.) clearance between the metering rod pin and the shoulder in the notch of the gage. The gage must not contact the pin. (See Fig. 237.)

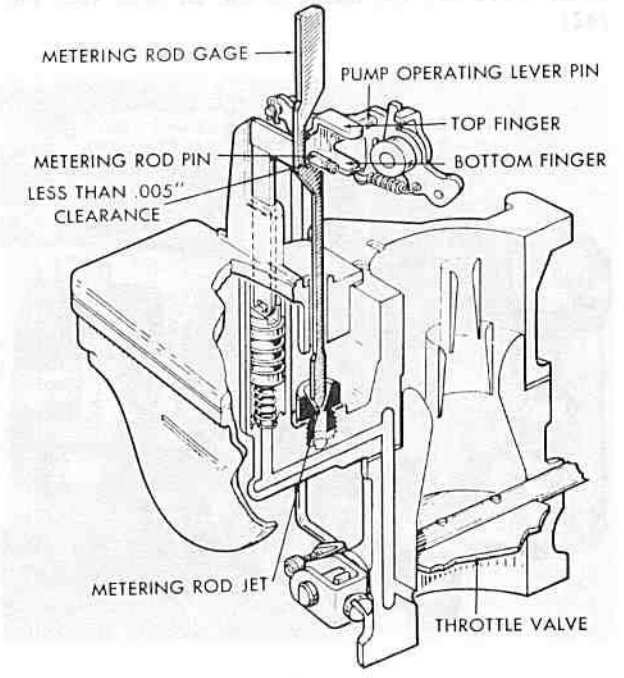


FIG. 237

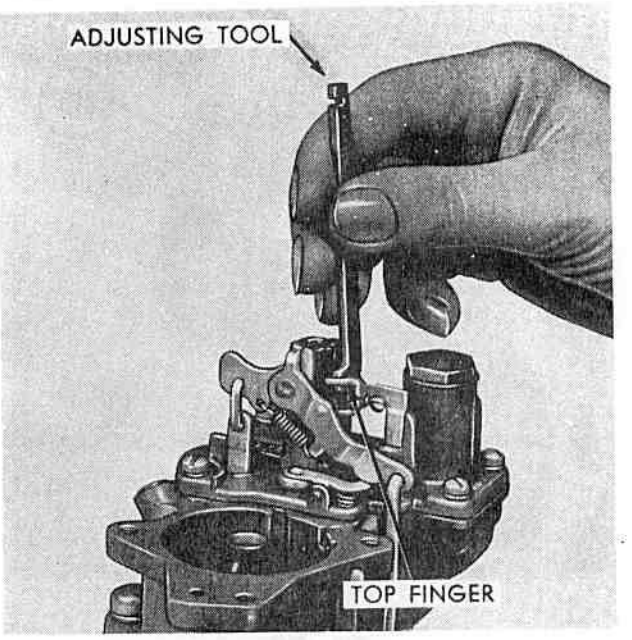


FIG. 238

If an adjustment is necessary, bend the top finger of the vacuum piston link to obtain the proper clearance (see Fig. 238). Use Adjusting Tool J-1389.

After adjusting the top finger of the vacuum piston link, check the clearance between the bottom of the pump operating lever pin and the bottom finger of the vacuum piston link (see Fig. 239), using a 3/16" (4,763 mm.) gage (Float Gage J-818-3). If an adjustment is necessary, bend the lower finger of the vacuum piston link to obtain the proper clearance. Use Adjusting Tool J-1389.

Install the metering rod and disk, being sure that the metering rod spring is hooked around the rod. If it is not, movement of the metering rod in the jet may prevent the correct metering of fuel.

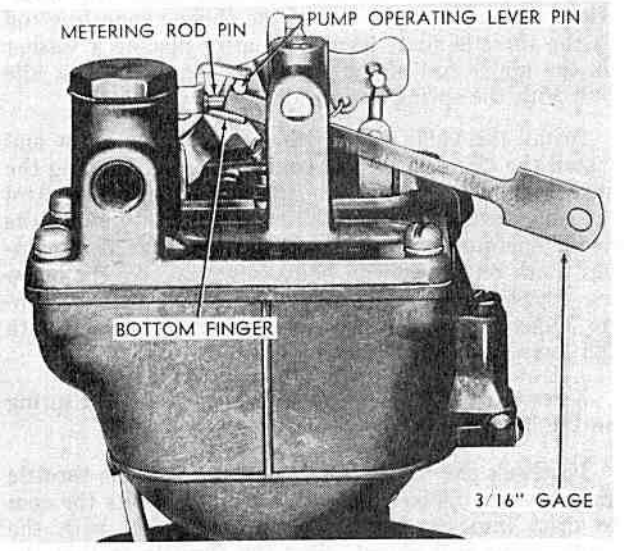


FIG. 239

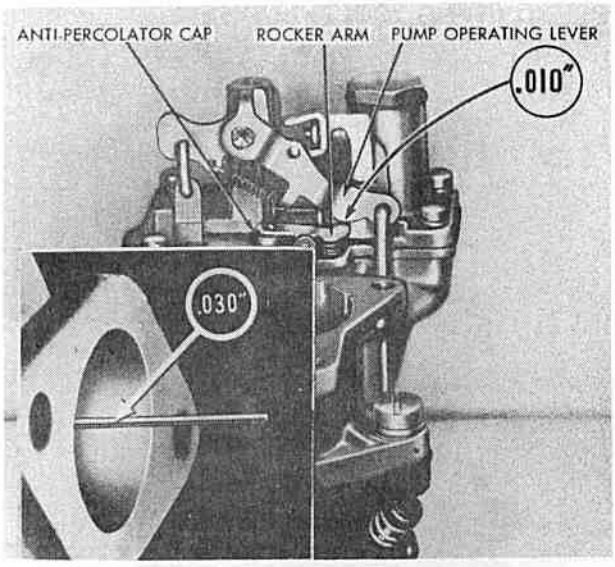


FIG. 240

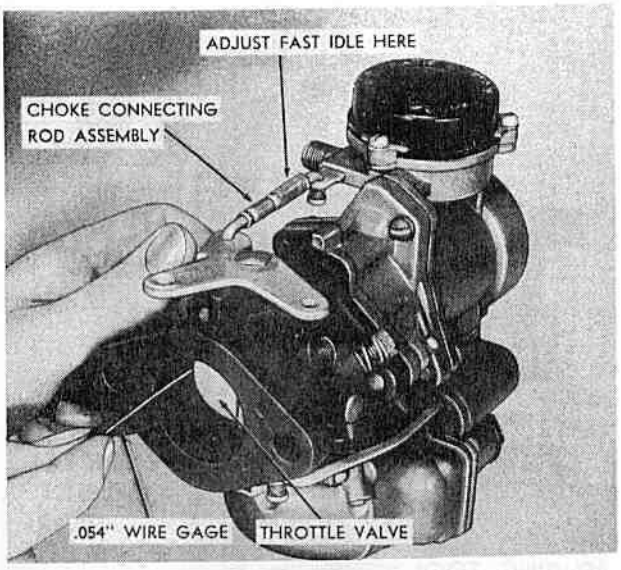


FIG. 241

To check the seating of the anti-percolator cap, insert a .030" (0,76 mm.) wire, Gage No. J-1633, in the throttle body opposite the idle port. With the throttle closed on the wire, there should be .010" (0,25 mm.) clearance between the anti-percolator rocker arm and the pump operating lever (see Fig. 240). If an adjustment is necessary, bend the anti-percolator rocker arm to obtain the proper clearance.

Install the air horn, new gasket, and dust cover on the main carburetor body. Slide the fast idle cam assembly on the choke shaft; insert the choke shaft in the air horn; and revolve the shaft, lever, and cam to slide the piston into the cylinder. Then lock the fast idle cam spring around the bosses of the cam and the choke lever shaft.

Install the choke valve with the trademark up, seating the valve before tightening the screws. The valve must not bind in any position but fall free of its own weight. Install the fast idle link and choke trip lever. Then attach the lower end of the choke connecting rod to the throttle shaft lever, and after placing a washer on the upper end of the rod, attach it to the fast idle link with the spring and retainer.

Install the baffle plate with the attaching screw and install the climatic control housing gasket. Holding the choke in the open position, place the climatic control housing against the climatic control body with the notch one-quarter turn clockwise from the center index mark on the control body. Then revolve the housing counterclockwise to align the notch and the center index mark, and lock the housing in place with the screws and retainers.

NOTE.—Be careful not to hook the thermostat spring on the hot air tube.

To check the fast idle adjustment, open the throttle and close the choke valve. Doing this permits the cam to drop into its fast idle position. Then, with the choke valve still closed, close the throttle so that the choke trip lever contacts the fast idle cam; and using the .054" (1,37 mm.) Wire Gage KMO-480, check the clearance between the throttle valve and the bore on the side opposite the idle port. (See Fig. 241.)

If an adjustment is necessary, loosen the lock nut on the choke connecting rod assembly. Adjust the threaded sleeve to obtain the correct clearance of the throttle valve and tighten the lock nut against the sleeve. To prevent distortion of the choke linkage, hold the sleeve securely while tightening the lock nut. The choke mechanism must not bind in any position.

To check the choke unloading mechanism, open the throttle wide and insert a 3/16" (4,763 mm.) gage (Float Gage J-818-3) between the low side of the choke valve and the inside of the air horn (see Fig. 242).

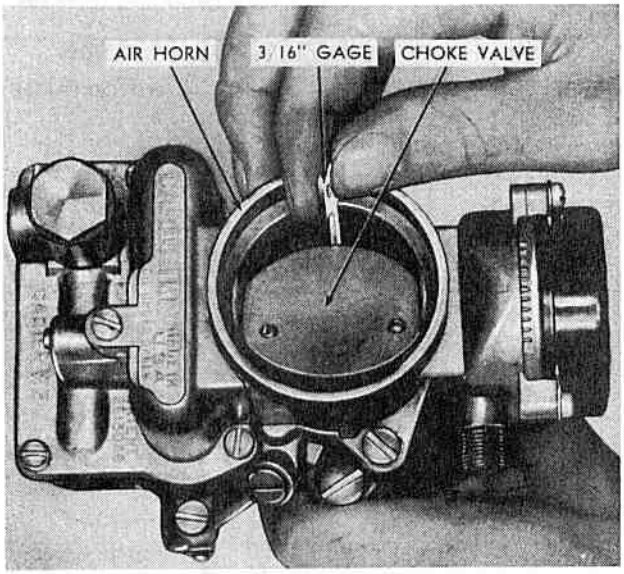


FIG. 242

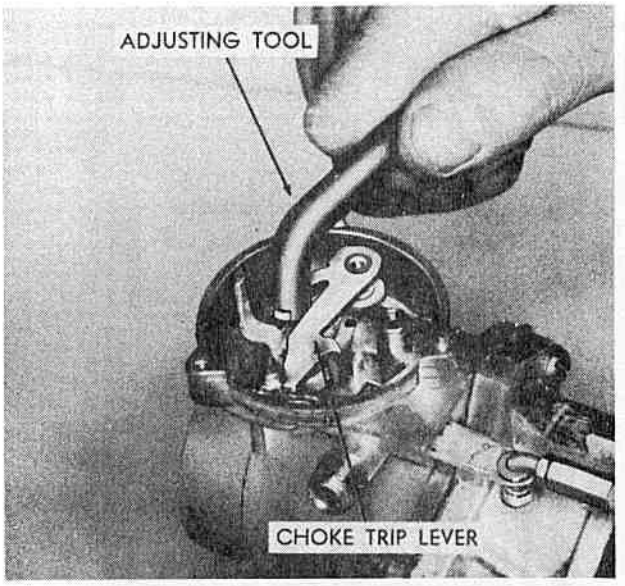


FIG. 243

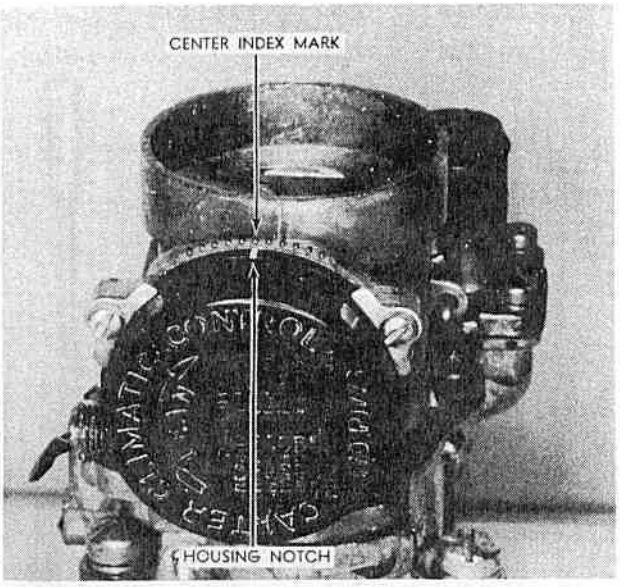


FIG. 244

If it is necessary to make an adjustment, remove the climatic control housing, gasket, and baffle plate. Then, using Unloader Adjusting Tool KMO-478, bend the upper finger on the choke trip lever up or down as required until the correct clearance is obtained (see Fig. 243).

Before attempting an adjustment of the climatic control, it is important first to check thoroughly all other items that affect the warm-up period. In production the notch on the climatic control housing and the center index mark on the control body are in line (see Fig. 244). This setting should be satisfactory for average operating conditions. Under extreme weather conditions, however, or for use of fuels of other than standard octane ratings, change the adjustment by rotating the climatic control housing counterclockwise for a long warm-up period or clockwise for a short warm-up period. Do not move the housing more than one notch for each adjustment.

Adjust the idle mixture by turning the idle adjustment screw clockwise for a lean mixture or counterclockwise for a rich mixture. The correct adjustment should be between 1/2 and 1-1/2 turns. Idle adjustment should be made with the carburetor air cleaner installed and with the engine running at normal operating temperature. The idle speed of the engine should be set at a speed equivalent to 8 to 10 miles (12,9 to 16,1 km.) per hour in high gear.

Metering Rods

CHAMPION Metering rods are available in several sizes to provide proper fuel-air ratio at different altitudes. The part number is stamped on the metering rod.

CARTER PART NO.	ALTITUDE
75-484	Up to 4,000 ft. (up to 1.219 m.)
75-493	4,000 to 8,000 ft. (1.219 to 2.438 m.)
75-494	8,000 to 12,000 ft. (2.438 to 3.657 m.)
75-495	Over 12,000 ft. (over 3.657 m.)

Carburetor Tools

CHAMPION The tools illustrated in figure 245 and listed below are required to service the Carter Model WE 532 S Carburetor. These tools are included in the Carburetor Tool Kit No. J-505-SC.

KEY TO TOOLS IN FIGURE 245

HINCKLEY-MYERS NO.	CARTER NO.	TOOL
J-1389	T-109-105	ADJUSTING TOOL
J-818-3	T-109-28	FLOAT LEVEL GAGE
J-818-6	T-109-31	FLOAT LEVEL GAGE
J-508	T-109-55	JET EXTRACTOR
J-816-1	T-109-59	JET WRENCH (SCREW DRIVER BIT 3/16" BLADE)
J-816-2	T-109-58	JET WRENCH (SCREW DRIVER BIT 1/4" BLADE)
J-816-6	T-109-57	JET WRENCH (SCREW DRIVER BIT 5/16" BLADE)
J-816-5	T-109-51	WRENCH HANDLE
J-1633	T-109-29	ANTI-PERCOLATOR GAGE
J-1265	T-109-102	METERING ROD GAGE 2.468
J-1306	T-109-56	RETAINER RING REMOVING TOOL
KMO-481	T-109-42	RIVET EXTRACTOR, LARGE
KMO-480	T-109-188	.054" WIRE GAGE
KMO-478	T-109-187	UNLOADER ADJUSTING TOOL
J-1137	T-109-41	BENDING IRON
J-1407	T-109-122U (INC. T-109-123)	RETAINER RING INSTALLING TOOL

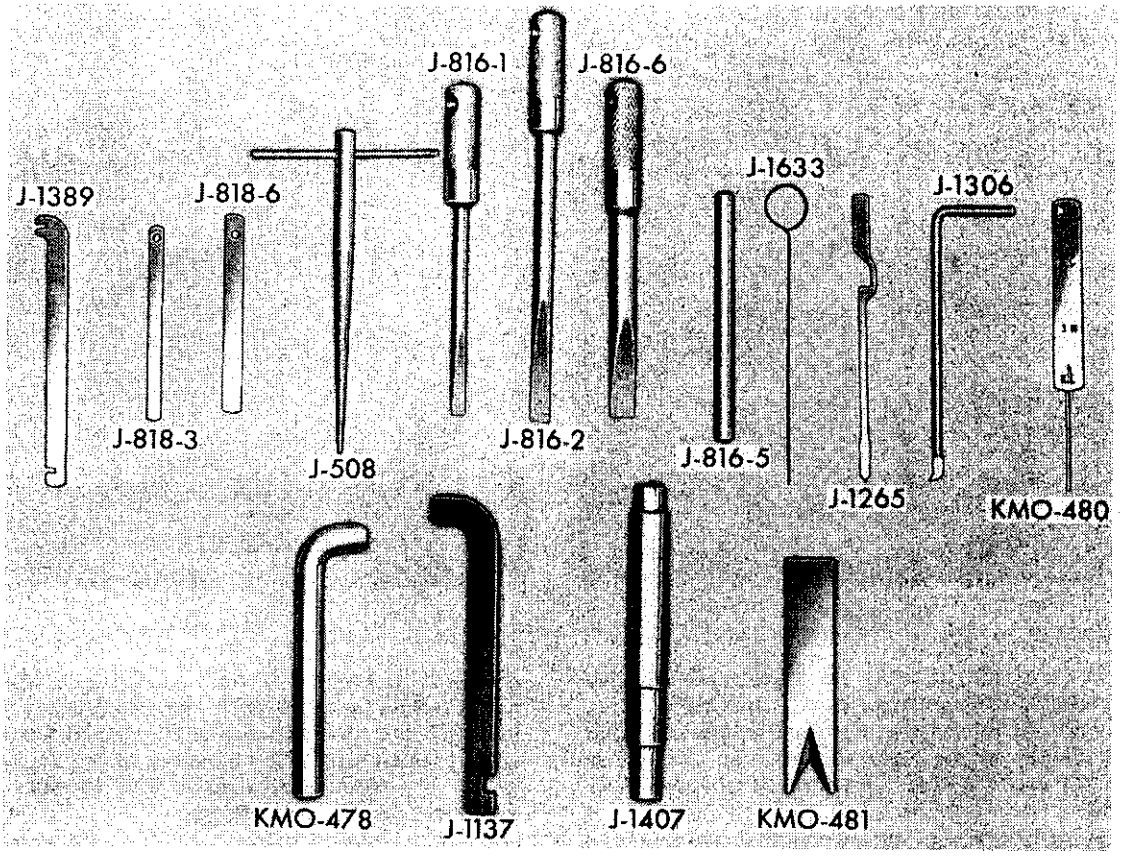


FIG. 245.—TOOLS REQUIRED TO SERVICE CARTER WE 532 S CARBURETOR

STROMBERG CARBURETOR (MODEL BXOV-26)

● The Stromberg Carburetor used on the Commander employs six systems during the full range of its operation. Figures 246 through 251 name and fully illustrate these systems.

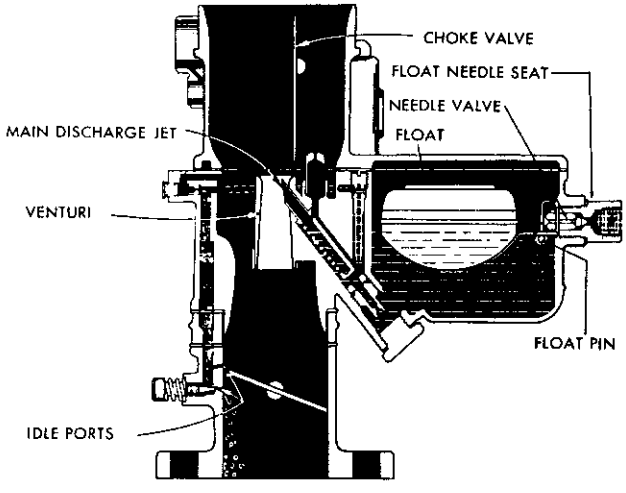


FIG. 246.—FLOAT SYSTEM

Gasoline enters the fuel bowl through the needle valve. The needle valve, controlled by the float, maintains the height of the fuel level in the bowl.

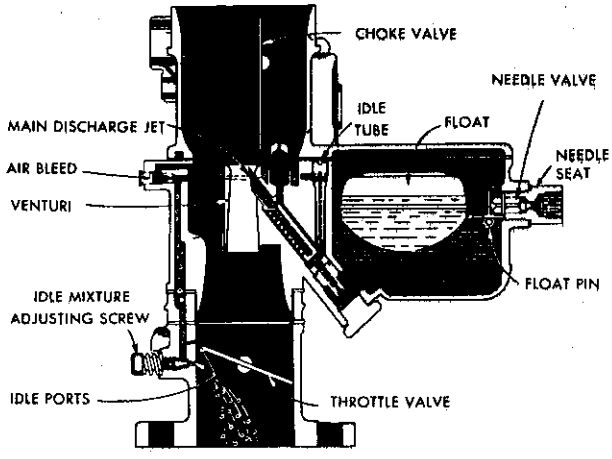


FIG. 247.—LOW-SPEED SYSTEM

The illustration clearly indicates the direction of the flow of fuel through the parts and passages of the low-speed system.

★

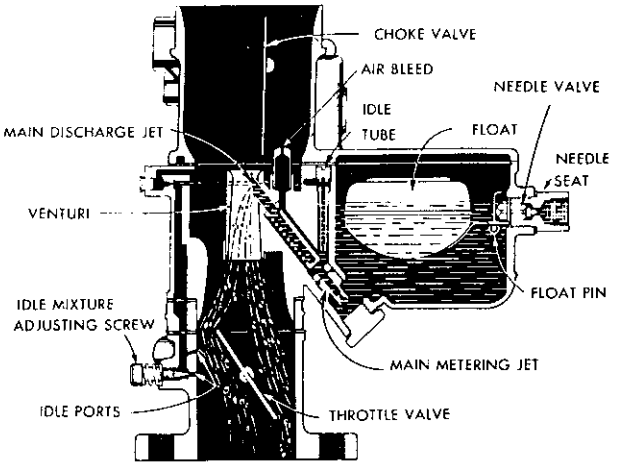


FIG. 248.—MAIN METERING SYSTEM

The illustration clearly indicates the direction of the flow of fuel through the parts and passages of the main metering system.

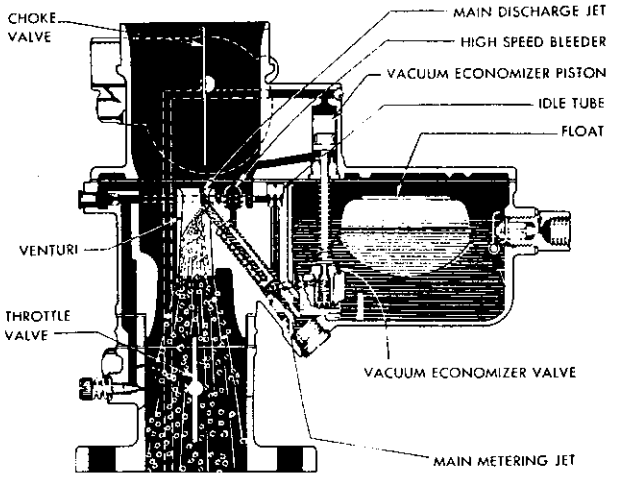


FIG. 249.—VACUUM ECONOMIZER OR POWER ENRICHMENT SYSTEM

During acceleration or hard pulling, the intake manifold vacuum decreases. The economizer piston rod then opens the by-pass valve and allows an extra flow of gas to provide an enriched mixture for increased acceleration and power.

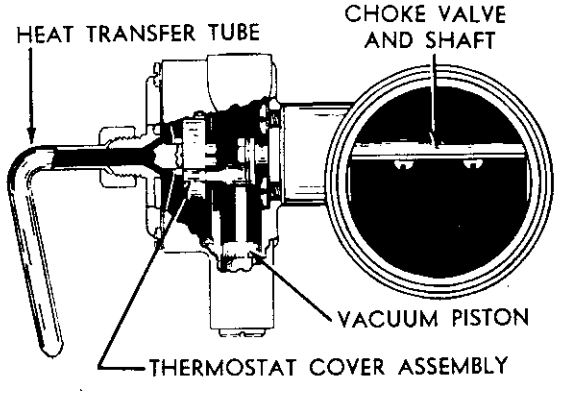


FIG. 250.—CHOKE SYSTEM

The Automatic Choke Control is an integral part of the carburetor. The vacuum piston and thermostat are directly connected to the carburetor choke valve and accurately control the opening and closing of the choke valve under varying operating temperatures. A tube leading from the exhaust manifold to the thermostat chamber transmits the heat which governs the tension of the thermostat spring.

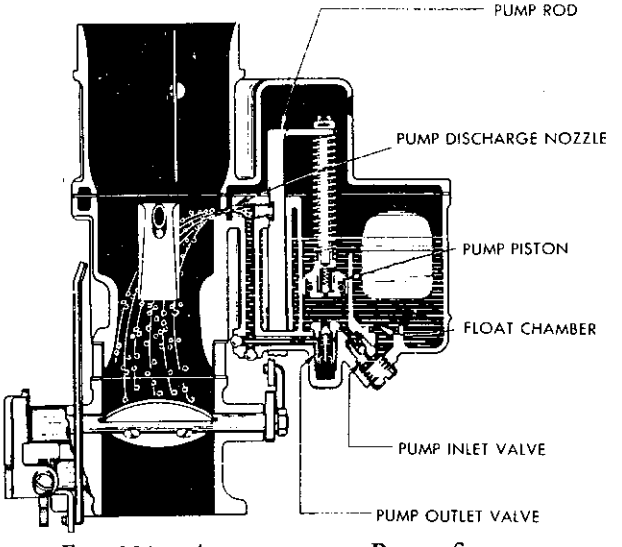


FIG. 251.—ACCELERATING PUMP SYSTEM

The illustration clearly indicates the direction of the flow of fuel through the accelerating pump system.

Disassembly

COMMANDER Disconnect and remove the fast idle rod from the air horn and throttle body. Then, after taking out the six screws and lock washers, remove the air horn from the main body.

Remove the idle needle valve and spring from the throttle body. Inserting Spanner Wrench KMO-269-5 in the slots of the vacuum economizer retaining plug, unscrew the economizer piston assembly and remove it from the air horn. (See Fig. 252.)

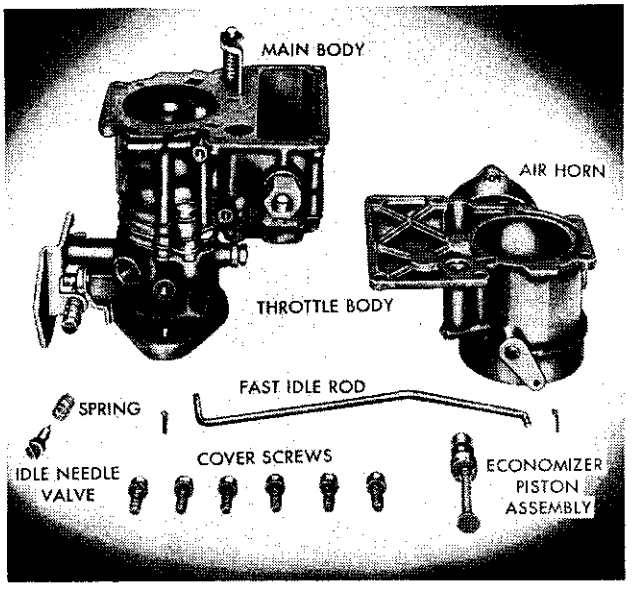


FIG. 252

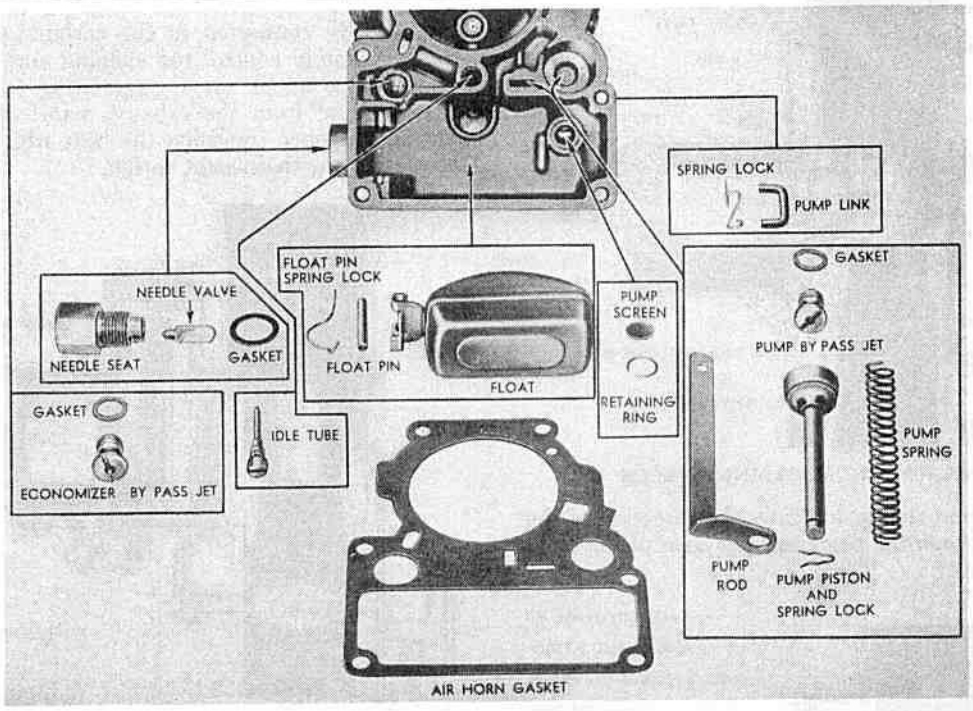


FIG. 253

Disconnect the accelerating pump rod from the pump lever by removing the spring lock and pump link. After removing the accelerating pump piston and rod assembly with gasket from the main carburetor body, remove the hair spring lock which attaches the piston to the rod. The disassembly of the accelerating pump piston and rod assembly can then be easily accomplished.

Remove the float needle valve, seat, and gasket from the main carburetor body. Removing the float fulcrum pin spring lock will then permit the removal of the float and fulcrum pin. The spring lock may be disengaged with a small screw driver. Hold a hand over the float chamber to prevent the spring from striking the face or being lost.

Remove the accelerating pump screen and retainer clip from the bottom of the float bowl. Using Jet Wrench J-816-6, remove the pump by-pass jet and gasket, and with the same wrench remove the vacuum economizer by-pass jet and gasket. To remove the idle tube, use Jet Wrench J-816-1. (See Fig. 253.)

To remove the throttle body, spacer, and two gaskets from the main carburetor body, take out the two screws and lock washers. Using Jet Wrench J-816-6, remove the main metering jet plug and the accelerating pump inlet check valve plug from the main carburetor body. Be sure that the copper gaskets which fit around the plug seats have been removed. The removal of the pump inlet check valve can be accomplished with Jet Wrench J-816-2. Use Handle J-1503-3A and Jet Wrench J-1561 to remove the main metering jet. The main discharge nozzle can then be removed with Remover KMO-269-S4. (See Fig. 254.)

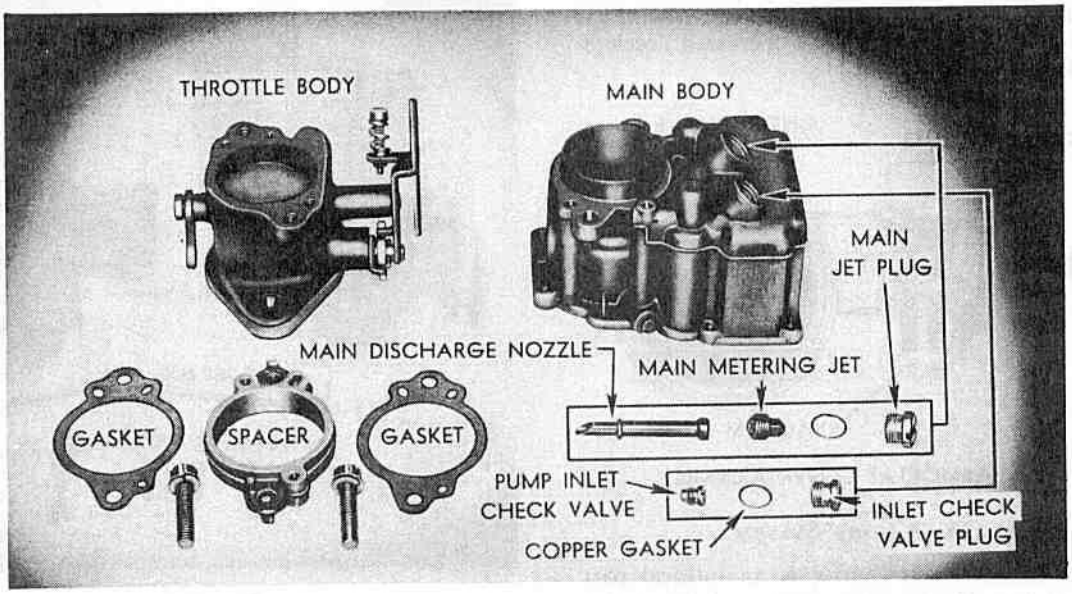


FIG. 254

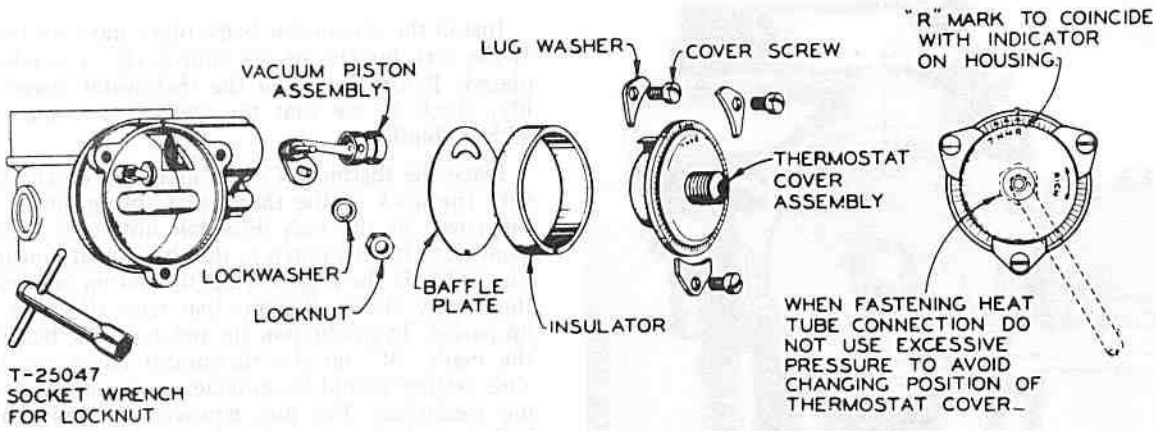


FIG. 255

Remove the thermostat cover assembly, the cork insulator, and the baffle plate. Then, with Socket Wrench KMO-269-S10, remove the lock nut and lock washer from the choke shaft. The removal of the vacuum piston from the cylinder in the automatic choke housing can then be accomplished. (See Fig. 255.)

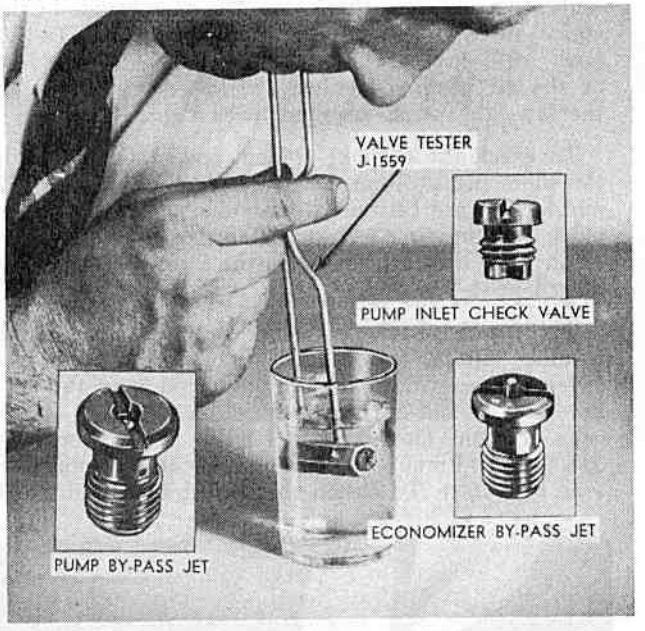


FIG. 256

Cleaning, Inspecting, and Testing

COMMANDER All carburetor parts and passages should be cleaned thoroughly with Bendix Cleaner AC-1328, rinsed with solvent, and blown out with compressed air before the carburetor is reassembled.

Inspect all parts for wear or damage. If a replacement of parts is necessary, use the Carburetor Repair Kit, Studebaker Part No. 518557. When reassembling the carburetor, always replace all gaskets with new ones.

A leak in the accelerating pump inlet check valve, the accelerating pump by-pass jet, or the vacuum economizer by-pass jet will result in improper performance of the engine. Whenever the carburetor is disassembled, these valves should be tested with Valve Tester J-1559 (see Fig. 256). If leakage in any of the valves is indicated by bubbles, the valve should be replaced.

Reassembly and Adjustments

COMMANDER Install the main discharge nozzle, and with Handle J-1503-3A and Jet Wrench J-1561 install the main metering jet. To install the pump inlet check valve, use Jet Wrench J-816-2. Using Jet Wrench J-816-6, install the main metering jet plug and the accelerating pump inlet check valve plug. Be sure that the two new copper gaskets which fit around the plug seats have been installed. Then place the spacer with two new gaskets on the carburetor main body and attach the throttle body to the main body with the two screws and lock washers.

Install the idle tube with Jet Wrench J-816-1. Using Jet Wrench J-816-6, install the vacuum economizer by-pass jet (No. 54) and new gasket; and with the same wrench install the accelerating pump by-pass jet (No. 63) and new gasket. Then install the accelerating pump screen and retainer clip in the bottom of the float bowl.

Install the float, fulcrum pin, and fulcrum pin spring lock in the float bowl. After inserting the float needle valve in its seat, install the seat and new gasket on the main carburetor body.

After placing the spring on the accelerating pump piston, insert the piston and spring in the accelerating pump well. Place a new air horn gasket on the main carburetor body, insert the accelerating pump rod in the slot, and attach the rod to the piston with the hair spring lock. Then attach the accelerating pump rod to the center hole in the pump lever by installing the pump link and spring lock.

Install the idle needle valve and spring in the throttle body. Then insert the vacuum economizer piston assembly in the well in the air horn, and using Spanner Wrench KMO-269-5, tighten the retaining plug securely.

Place the air horn on the main carburetor body and secure it with only two cover screws and lock washers (the cover must again be removed for float level adjustment). Then, using new cotter pins, connect the fast idle rod to the fast idle cam lever and the choke shaft lever.

To assemble the automatic choke control, first place the vacuum piston in the cylinder. Do not use any type of lubricant on the piston or in the cylinder. Then place the vacuum piston lever on the choke shaft, install the lock washer and lock nut, and tighten the lock nut securely.

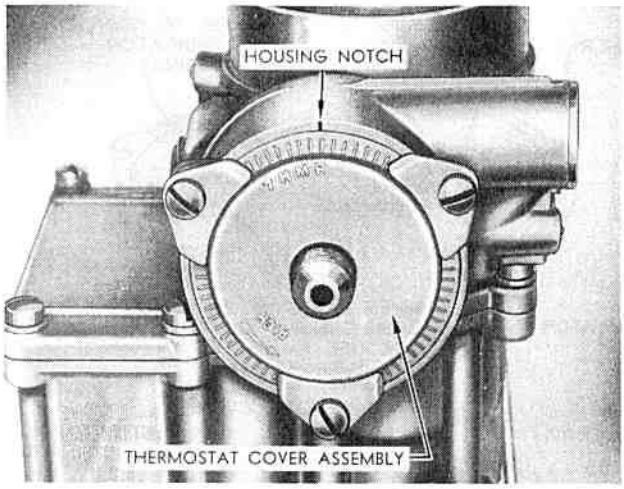


FIG. 257

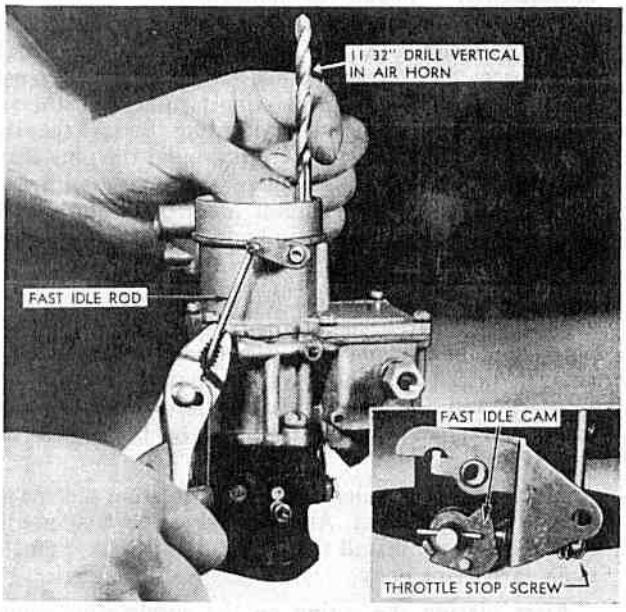


FIG. 258

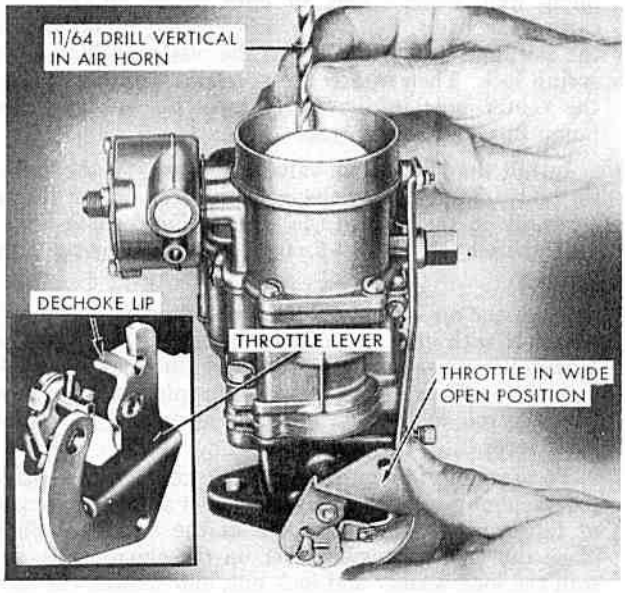


FIG. 259

Install the thermostat baffle plate and cork insulator. If the cork buckles or fits improperly, it should be replaced. Before installing the thermostat cover assembly, check to see that the choke valve opens freely without binding.

Place the thermostat cover assembly on the housing with the hook of the thermostat spring down. Rotate the cover in the rich direction until the mark "R" coincides with the notch in the thermostat housing (see Fig. 257). If the engine tends to load up or overchoke, thoroughly check all items that may affect the warm-up period. In production the notch on the housing and the mark "R" on the thermostat cover are in line. This setting should be satisfactory for average operating conditions. For use, however, of fuels having a higher or lower than standard volatility, it may be necessary to change the adjustment to provide satisfactory starting and warm up. When highly volatile fuels are consistently used, it may be necessary to set the cover on mark "H."

With the throttle stop screw on the lowest step of the fast idle cam, check the fast idle adjustment by closing the choke valve until the edge of the next higher step contacts the screw. The narrow side of the choke valve should just contact an 11/32" (8,731 mm.) drill held vertically against the inside surface of the air horn. To adjust the valve opening, bend the fast idle rod as required. (See Fig. 258.)

To check the dechoke setting, open the throttle to the wide-open position. There should be 11/64" (4,37 mm.) clearance between the narrow side of the choke valve and the air horn. To obtain the correct adjustment, bend the dechoke lip on the throttle lever as required. (See Fig. 259.)

The fuel level should be checked while the engine is idling with the car on a level floor. Take out the two cover screws, remove the air horn, and raise the gasket into an out-of-the-way position. Using a depth gage or scale, check the fuel level, which should be 5/8" (15,875 mm.) below the top of the float chamber (see Fig. 260). To obtain the correct fuel level, bend

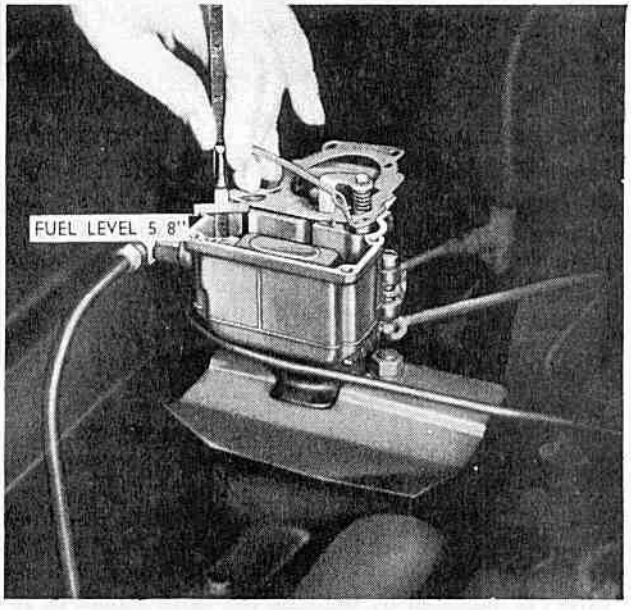


FIG. 260

the float arm with Tool No. KMO-269-5. Then reinstall the air horn on the main carburetor body and secure in place with the six cover screws and lock washers.

Adjust the idle mixture by turning the idle needle valve clockwise for a lean mixture or counterclockwise for a rich mixture. Idle adjustment should be made with the carburetor air cleaner installed and with the engine running at normal operating temperature. The idle speed of the engine should be set at a speed equivalent to 8 to 10 miles (12,9 to 16,1 km.) per hour in high gear.

Main Metering Jets

COMMANDER Main metering jets are available in several sizes to provide proper fuel-air ratio at different altitudes. The jet size is stamped on the jet.

Jet Size	Altitude
.057″	Up to 4,000 ft. (up to 1.219 m.)
.055″	4,000 to 8,000 ft. (1.219 to 2.438 m.)
.053″	8,000 to 12,000 ft. (2.438 to 3.657 m.)
.051″	Over 12,000 ft. (over 3.657 m.)

Carburetor Tools

COMMANDER The tools illustrated in figure 261 are required to service the Stromberg Model BXOV-26 carburetor. These tools are included in the Carburetor Tool Kit No. J-505-SC.

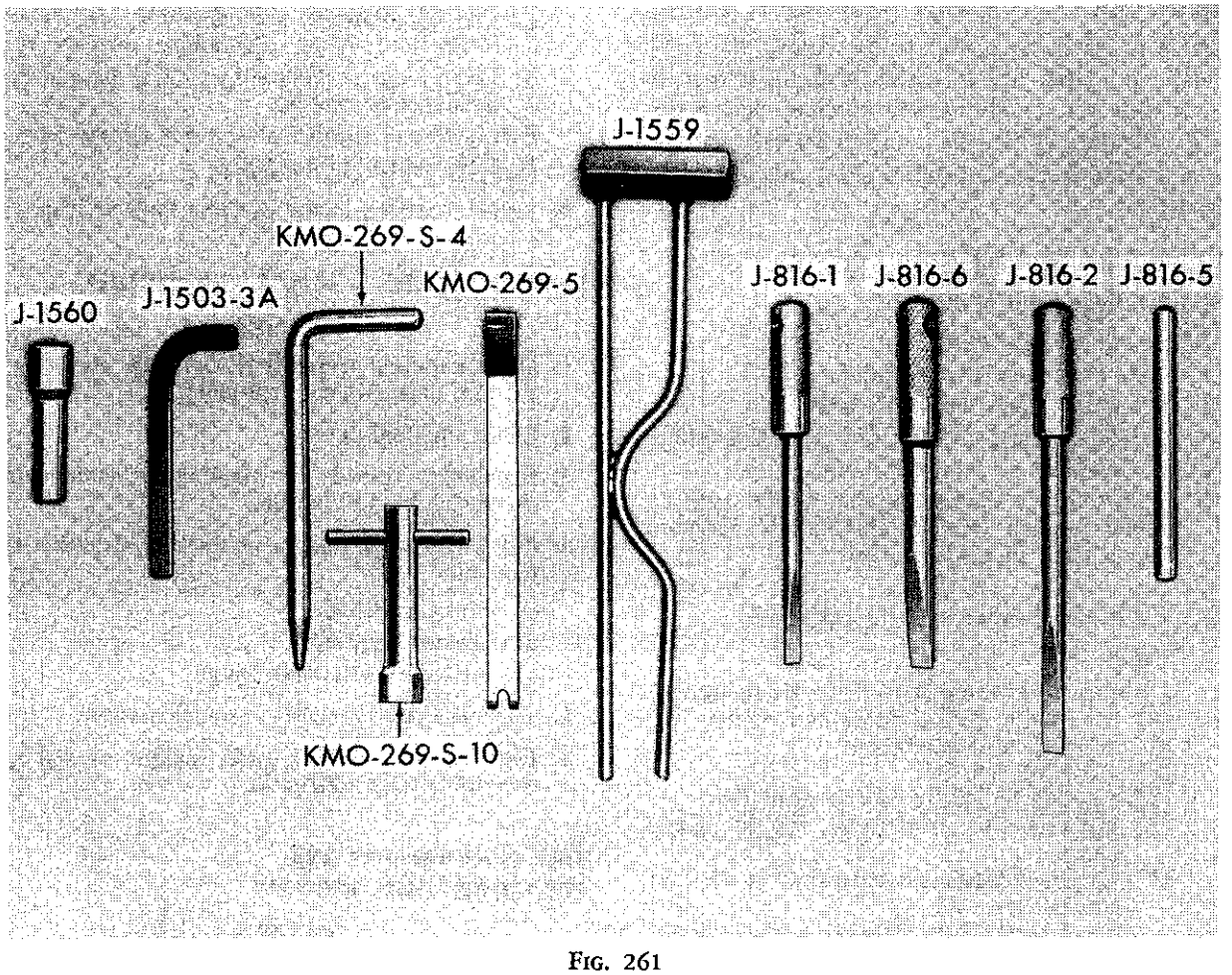


Fig. 261

KEY TO TOOLS IN FIGURE 261

HINCKLEY-MYERS NO.	STROMBERG NO.	TOOL
J-1561	T-24924	SOCKET
J-1503-3A		WRENCH HANDLE
KMO-269-S4	T-24967	REMOVER
KMO-269-S10	T-25047	SOCKET WRENCH
KMO-269-S5	T-24733	SPANNER WRENCH
J-1559	T-24970	VALVE TESTER
J-816-1		JET WRENCH (SCREW DRIVER BIT 3/16″ BLADE)
J-816-2		JET WRENCH (SCREW DRIVER BIT 1/4″ BLADE)
J-816-6		JET WRENCH (SCREW DRIVER BIT 5/16″ BLADE)
J-816-5		WRENCH HANDLE

GASOLINE DIAGNOSIS

EXCESSIVE GASOLINE CONSUMPTION

DESCRIPTION

Before any corrective measures are undertaken, conduct a test run at a car speed of approximately 30 miles (48,3 km.) per hour using a test tank or an accredited mileage tester. An accurate record of the mileage obtained should be kept. The test should be made in conventional gear on a level road at constant speed, both directions of the road. If the gasoline economy obtained is low, the causes listed below should be checked and a second test run made over the same course under similar conditions. It is often advisable to invite the owner to accompany the service man on a test run to insure that the owner is familiar with the actual economy obtained during the test. At this time the service man can explain that the type of operation has a material effect upon gasoline economy.

CAUSES

1. Caused by type of operation
   - *a)* Sustained high speed.
   - *b)* Long periods of idle operation.
   - *c)* Abnormally fast engine idle speed.
   - *d)* Numerous starts and stops in congested traffic.
   - *e)* Car operated on short trips only.
   - *f)* Failure to use engine warming devices such as engine cooling system thermostat, radiator covers, etc., in cold weather.
2. Caused by units other than the carburetor
   - *a)* Faulty ignition due to:
     - (1) Incorrect timing (especially, late ignition).
     - (2) Improperly spaced distributor points.
     - (3) Weak ignition condenser.
     - (4) Weak ignition coil.
     - (5) Cracked or chafed wiring insulation.
     - (6) Defective or incorrectly spaced spark plugs.
     - (7) Incorrect distributor automatic or vacuum advance.
   - *b)* Restricted or partially clogged carburetor air cleaner.
   - *c)* Abnormal rolling resistance due to:
     - (1) Dragging brakes.
     - (2) Tight wheel bearings.
     - (3) Excessive front wheel toe-in or toe-out.
     - (4) Excessive friction in power transmitting units.
     - (5) Underinflated tires.
   - *d)* Fuel pump diaphragm leakage.
   - *e)* Excessive fuel pump pressure.
   - *f)* Poor engine compression.
   - *g)* Partially clogged or restricted exhaust pipe, muffler, or tail pipe.
   - *h)* Preignition.
   - *i)* Engine clutch slippage.
3. Condition caused by improper carburetor adjustment
   - *a)* Float level too high.
   - *b)* Float leaking and partially filled with fuel.
   - *c)* Float needle valve leaking.
   - *d)* Improper adjustment of accelerating pump.
   - *e)* Improper adjustment of metering rod (Carter carburetor).
   - *f)* Internal leakage in carburetor due to:
     - (1) Improperly seating accelerating pump valve.
     - (2) Fractured passages.
   - *g)* Use of improper size metering rod (Carter carburetor) or jet (Stromberg carburetor).
   - *h)* Loose plugs or damaged gasket at base of main discharge jet nozzles.
   - *i)* Carburetor throttle stop screw set too fast.
   - *j)* External carburetor leaks.
4. Leaks occurring in the gasoline tank or lines.

MANIFOLD LEAKS — INTAKE AND EXHAUST

CAUSES

1. Loose manifold connections or leaks occurring in vacuum lines (intake manifold).
2. Loose manifold nuts.
3. Insufficient threads on manifold attaching studs permitting nuts to bottom.
4. Distortion or misalignment existing at gasket surfaces on:
   - *a)* Intake manifold.
   - *b)* Exhaust manifold.
   - *c)* Carburetor attaching flange.
5. Damaged or improperly installed gaskets.
6. Restriction in exhaust pipe, muffler, or tail pipe (excessive back pressure).

FUEL PUMP LEAKAGE AND INSUFFICIENT FUEL DELIVERY

CAUSES

1. Restricted gasoline tank cap vent or vent line.
2. Restricted or partially clogged gasoline tank to fuel pump line.
3. Air leak occurring at connections or in gasoline tank to fuel pump lines.
4. Restricted or partially clogged gasoline tank outlet pipe assembly.
5. Air leak occurring above fuel level in gasoline tank outlet pipe assembly.
6. Restricted or partially clogged fuel pump screen.
7. Fuel pump filter bowl loose.
8. Damaged or improperly installed bowl gasket.

9. Punctured or worn out diaphragm.
10. Leak around diaphragm shaft or pull rod.
11. Loose valve seats in fuel pump.
12. Improperly seating fuel pump valves (replace).
13. Sticking fuel pump valves.
14. Rocker arm shaft (pin) out of position.
15. Broken rocker arm.
16. Vapor in line between tank and pump (vapor lock).

FUEL PUMP NOISE

DESCRIPTION

Although fuel pump noise is generally lighter than tappet noise, the two sounds are very similar. Like tappet noise, a fuel pump noise is encountered at camshaft speed.

TEST

Allow the engine to idle and check for noise with a sounding rod against the fuel pump body. In some instances fuel pump noise can be detected by tightly gripping the pump body with the hand and noting if a "bump" or vibration is felt.

CAUSES

1. Weak or broken rocker arm contact spring.
2. Worn rocker arm or rocker arm pin.
3. Fuel pump body loose on engine.
4. Scored operating lever or camshaft eccentric.
5. Interference of fuel pump lever with inner surface of crankcase.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

LUBRICATION

Engine Oil

High grade mineral oil, purchased from a reliable oil company, should be used in the Champion and Commander models. The use of castor oil, so-called run-in oils, or other organic oils must be avoided.

The S.A.E. viscosity numbers shown in the engine oil chart are commonly used by oil companies.

When S.A.E. 10 or S.A.E. 20 oil is specified, it is permissible to use an oil from a container marked "S.A.E. 10-10W" or "S.A.E. 20-20W," respectively.

Checking Oil Level

● The oil level gage is marked to indicate the oil level in the crankcase. The "Full" mark indicates the crankcase capacity. Oil should be added when the level drops to the point marked "Add Oil." Do not carry the oil level above the "Full" mark.

Initial Operation

● Engine oil should be changed at the end of the first 500 miles (804 km.) and again after the first 1,500 miles (2.414 km.) of the car operation. After this period, the oil should be changed regularly, the frequency depending on the condition of the oil as affected by operating and atmospheric conditions.

Average Driving Conditions

● Under average driving conditions (10,000 to 12,000 miles [16.094 to 19.308 km.] per year), it will usually be satisfactory to change oil four times yearly. Seasonal changes can ordinarily be made at the regular draining periods.

Dust Conditions

● Under severe dust conditions, it is advisable to change the engine oil more frequently. Proper servicing of the carburetor air cleaner and oil filter (see "Lubrication Operations") will be of material assistance in minimizing contamination of the engine oil under these conditions.

Cold Weather Operation

● Short runs in cold weather with frequent stops and starts increase the possibility of crankcase dilution, because the engine does not reach normal operating temperature. The oil should be changed more frequently under these conditions.

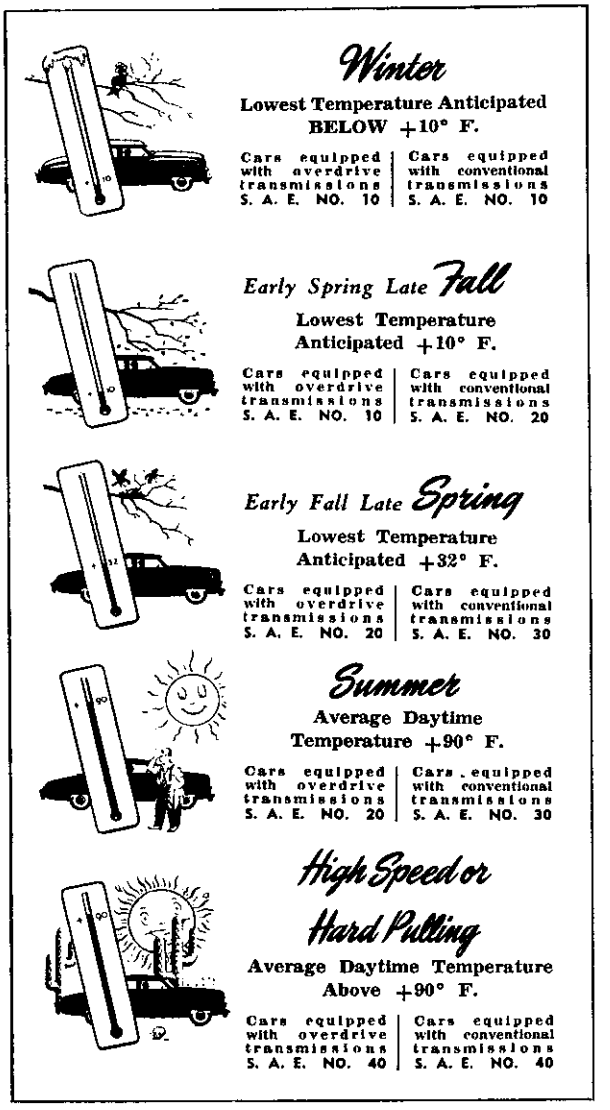
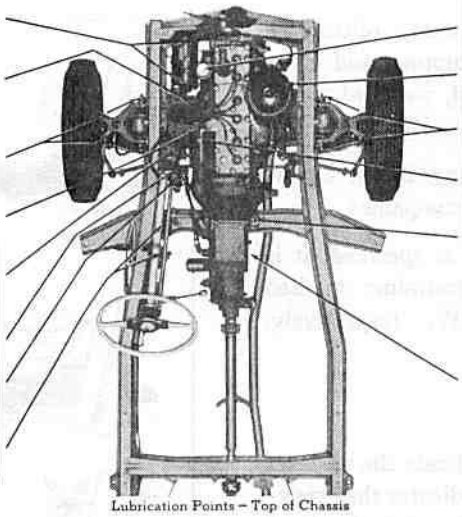


FIG. 262.—ENGINE OIL CHART

BODY LUBRICATION

Refer to the "Body" section for complete lubrication information.

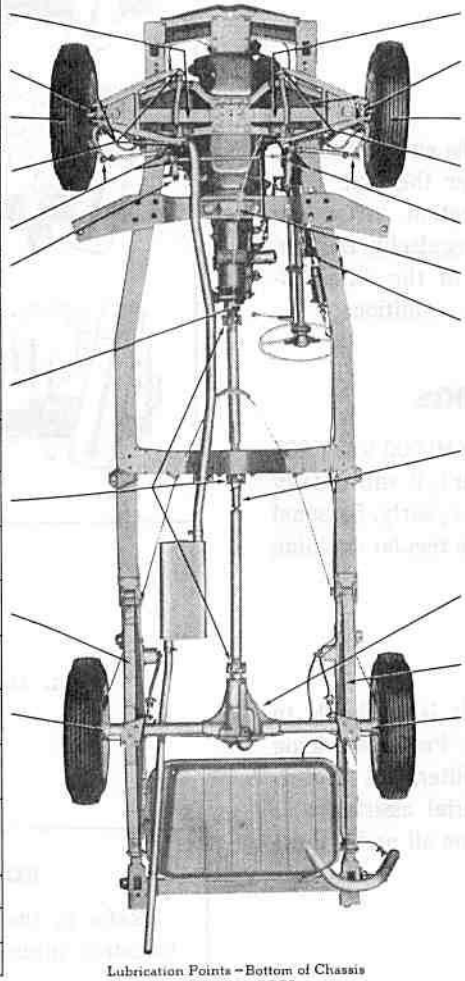
	★		GENERATOR – 2 Oilers – SAE No. 20 Engine Oil
	★		DISTRIBUTOR – SAE No. 20 Engine Oil on Felt Under Rotor. Small Amount of Vaseline on Cam. Wheel Bearing Lubricant in Grease Cup.
		★	UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	THROTTLE CONTROLS – Engine Oil
	★		STEERING GEAR – Special Lubricant as Approved by Ross Tool and Gear Company of Lafayette, Indiana.
★			GEAR SHIFT CONTROL CASE – Remove Plug – Light Weight Chassis Lubricant
		★	GEAR SHIFT RODS – Engine Oil
		★	CLUTCH PEDAL LINKAGE – 2 Clevis Pins – Engine Oil



Lubrication Points – Top of Chassis

			ENGINE OIL PAN FILLER TUBE – Check Oil Level When Purchasing Gasoline
			CARBURETOR AIR CLEANER – Service according to Instructions in Text.
★			UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
	★		STARTER MOTOR – 1 Oiler – SAE No. 20 Engine Oil
★			CLUTCH RELEASE SHAFT – 2 Oilers – Engine Oil
			CLUTCH RELEASE BEARING – No Lubricant Required
	★	★	TRANSMISSION – Conventional and Overdrive CHECK LEVEL DRAIN AND FLUSH LUBRICANT – SAE No. 40 Engine Oil or a High Grade Mineral Oil Gear Lubricant of SAE No. 90 Viscosity for Both Summer and Winter. Gear Lubricants Containing Any Extreme Pressure Ingredients, Such as Lead, Sulphur, or Chlorine Compounds Must Not Be Used.

★			SPRING LEAVES – Graphite Spring Lubricant
		★	STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
★			FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
		★	LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
		★	AUXILIARY ARM BUSHING – 1 Fitting – Light Weight Chassis Lubricant
★			SPEEDOMETER CABLE – SAE No. 90 Gear Lubricant
		★	UNIVERSAL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			SPRING LEAVES – Graphite Spring Lubricant
★			REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)



Lubrication Points – Bottom of Chassis

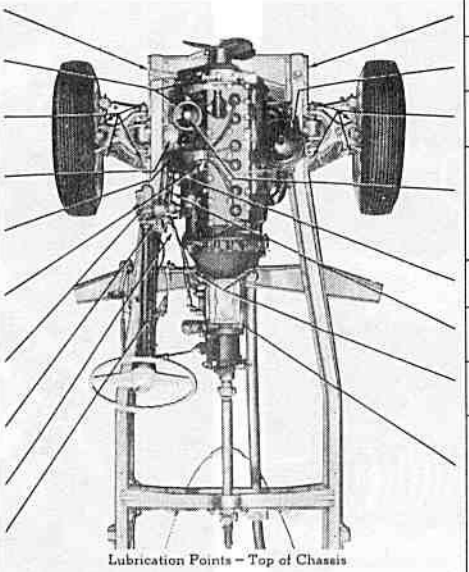
		★	SPRING LEAVES – Graphite Spring Lubricant
★			STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
		★	FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
★			LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
★			TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			PARKING BRAKE LINKAGE – Spray – Engine Oil
★			CLUTCH AND BRAKE PEDALS – 1 Fitting – Light Weight Chassis Lubricant
★			PROPELLER SHAFT SPLINES – 1 Fitting – Light Weight Chassis Lubricant
	★	★	REAR AXLE – CHECK LEVEL DRAIN AND FLUSH LUBRICANT – Use Studebaker Hypoid Lubricant or Any S.A.E. No. 90 Hypoid Lubricant Manufactured by a Reputable Oil Company. Do Not at Any Time Mix Various Brands of Hypoid Lubricants.
		★	SPRING LEAVES – Graphite Spring Lubricant
		★	REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)

CHAMPION

The Lubrication Periods Established Are for Average Use and Should Be Changed to Suit Individual Operating Conditions.

FIG. 263

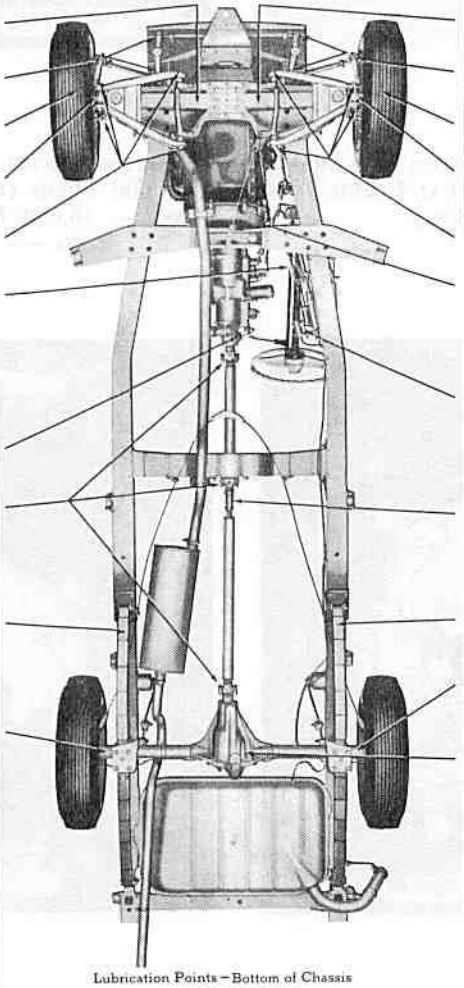
		★	STEERING BELL CRANK SHAFT – 1 Fitting – Light Weight Chassis Lubricant
	★		GENERATOR – 2 Oilers – SAE No. 20 Engine Oil
		★	UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
			ENGINE OIL PAN FILLER TUBE – Check Oil Level When Purchasing Gasoline
	★		DISTRIBUTOR – SAE No. 20 Engine Oil on Felt Under Rotor. Small Amount of Vaseline on Cam. Wheel Bearing Lubricant in Grease Cup.
		★	THROTTLE CONTROLS – Engine Oil
	★		STEERING GEAR – Special Lubricant as Approved by Ross Tool and Gear Company of Lafayette, Indiana.
★			GEAR SHIFT CONTROL CASE – Remove Plug – Light Weight Chassis Lubricant
		★	GEAR SHIFT RODS – Engine Oil
		★	CLUTCH AND BRAKE PEDALS – 1 Fitting – Light Weight Chassis Lubricant



Lubrication Points – Top of Chassis

STEERING BELL CRANK SHAFT – 1 Fitting – Light Weight Chassis Lubricant	★		
CARBURETOR AIR CLEANER – Service according to Instructions in Text.			
UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant	★		
OIL FILTER – Under Normal Conditions, the Oil Filter Cartridge Should Be Replaced after Five to Six Thousand Miles of Operation. Where Severe Dust and Dirt Conditions Prevail, It Will Be Necessary to Replace the Oil Filter Cartridge at Correspondingly Lower Mileages. DIRTY OIL on the Oil Level Gage Is an Indication that the Filter Cartridge Needs Replacing.			
STARTER MOTOR – 1 Oiler – SAE No. 20 Engine Oil		★	
STEERING REACH ROD – 2 Fittings – Light Weight Chassis Lubricant	★		
CLUTCH RELEASE SHAFT – 2 Oilers – Engine Oil	★		
TRANSMISSION – Conventional and Overdrive CHECK LEVEL DRAIN AND FLUSH LUBRICANT – SAE No. 40 Engine Oil or a High Grade Mineral Oil Gear Lubricant of SAE No. 90 Viscosity for Both Summer and Winter. Gear Lubricants Containing Any Extreme Pressure Ingredients, Such as Lead, Sulphur, or Chlorine Compounds Must Not Be Used.		★	★

★			SPRING LEAVES – Graphite Spring Lubricant
		★	TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
		★	STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
		★	LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	CLUTCH PEDAL LINKAGE – 2 Clevis Pins – Engine Oil
			CLUTCH RELEASE BEARING – No Lubricant Required
★			SPEEDOMETER CABLE – SAE No. 90 Gear Lubricant
		★	UNIVERSAL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			SPRING LEAVES – Graphite Spring Lubricant
★			REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)



Lubrication Points – Bottom of Chassis

SPRING LEAVES – Graphite Spring Lubricant			★
TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant	★		
FRONT WHEEL BEARINGS – Wheel Bearing Lubricant			★
STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant	★		
LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant	★		
PARKING BRAKE LINKAGE – Spray – Engine Oil	★		
HILL-HOLDER LINKAGE – Spray – Engine Oil	★		
PROPELLER SHAFT SPLINES – 1 Fitting – Light Weight Chassis Lubricant	★		
SPRING LEAVES – Graphite Spring Lubricant			★
REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant			★
REAR AXLE – CHECK LEVEL DRAIN AND FLUSH LUBRICANT – Use Studebaker Hypoid Lubricant or Any S.A.E. No. 90 Hypoid Lubricant Manufactured by a Reputable Oil Company. Do Not at Any Time Mix Various Brands of Hypoid Lubricants.		★	★
1,000 Miles (1.609 Km.)			
5,000 Miles (8.046 Km.)			
10,000 Miles (16.090 Km.)			

COMMANDER

The Lubrication Periods Established Are for Average Use and Should Be Changed to Suit Individual Operating Conditions.

FIG. 264

Lubrication Operations

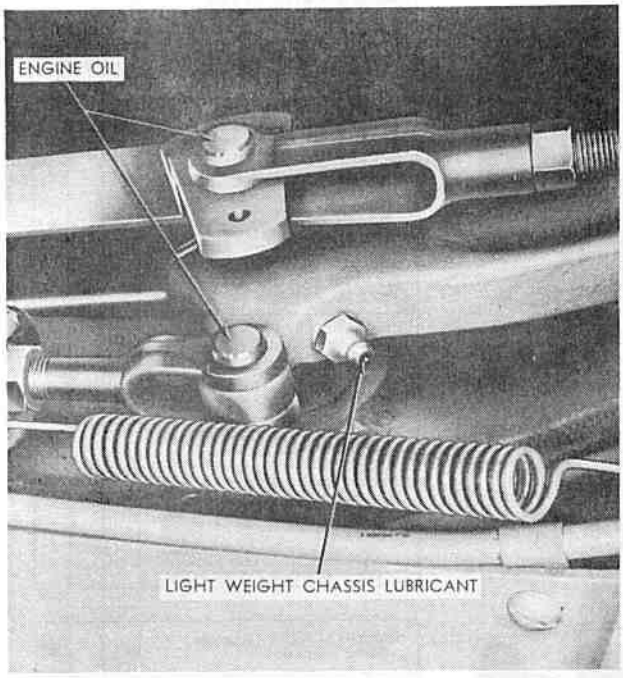


FIG. 265

CHAMPION AND COMMANDER — CLUTCH AND BRAKE PEDAL ARM, CLUTCH AND BRAKE PEDAL CLEVIS PINS — 1,000 MILES (1.609 KM.).

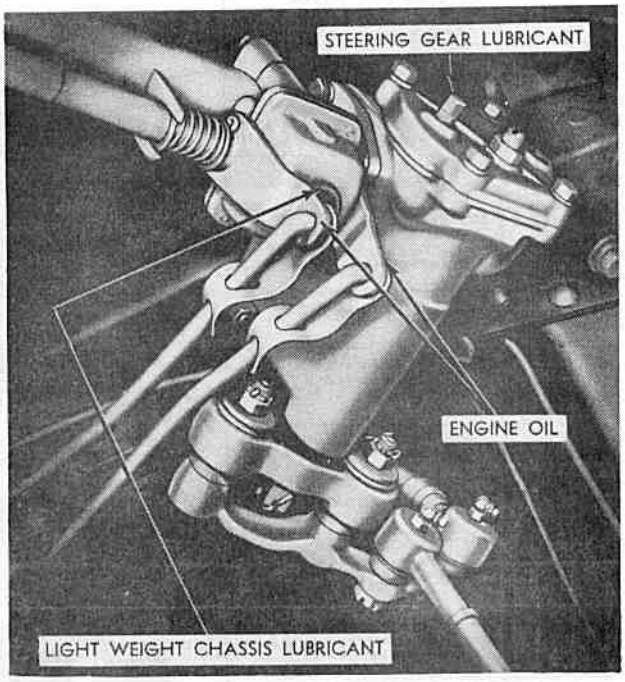


FIG. 267

CHAMPION AND COMMANDER — STEERING GEAR BOX — 5,000 MILES (8.045 KM.); GEAR SHIFT CONTROL CASE — 10,000 MILES (16.094 KM.); GEAR SHIFT RODS — 1,000 MILES (1.609 KM.).

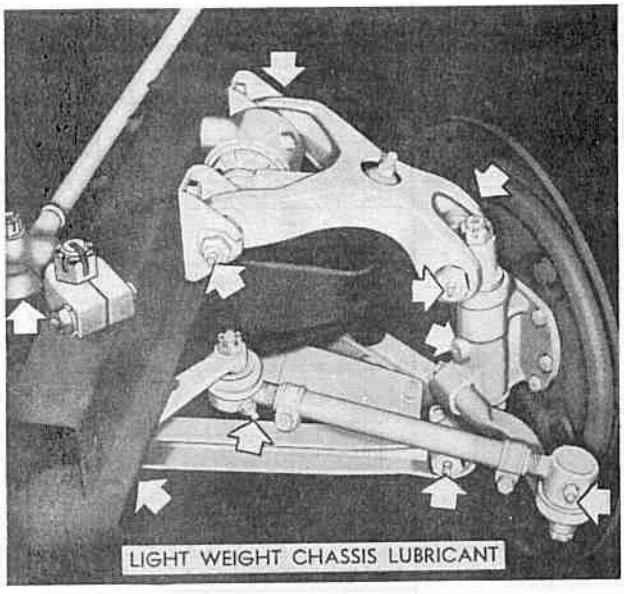


FIG. 266

CHAMPION AND COMMANDER — UPPER AND LOWER CONTROL ARMS (FRONT)—1,000 MILES (1.609 KM.).

COMMANDER — STEERING REACH ROD AND STEERING BELL CRANK SHAFTS — 1,000 MILES (1.609 KM.).

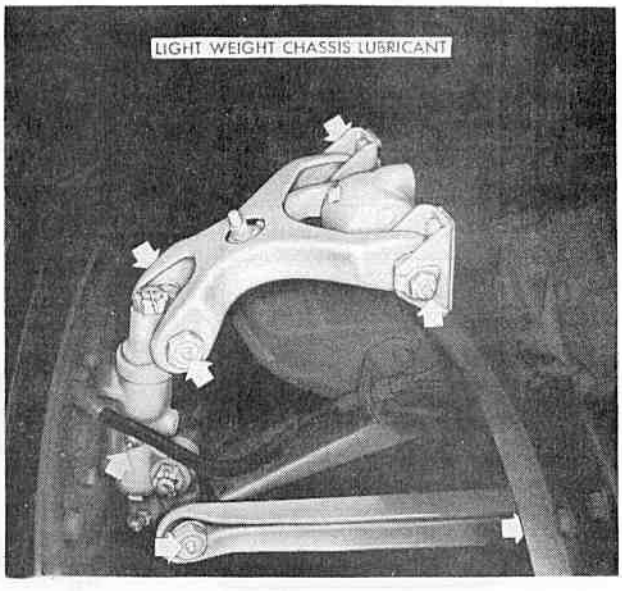


FIG. 268

CHAMPION AND COMMANDER — UPPER AND LOWER CONTROL ARMS (REAR), STEERING KNUCKLES — 1,000 MILES (1.609 KM.).

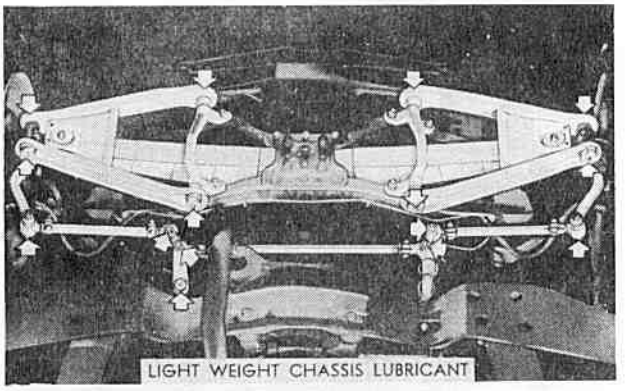


FIG. 269

CHAMPION — LOWER CONTROL ARM BUSHINGS, TIE ROD BALL JOINTS, AUXILIARY STEERING ARM — 1,000 MILES (1.609 KM.).

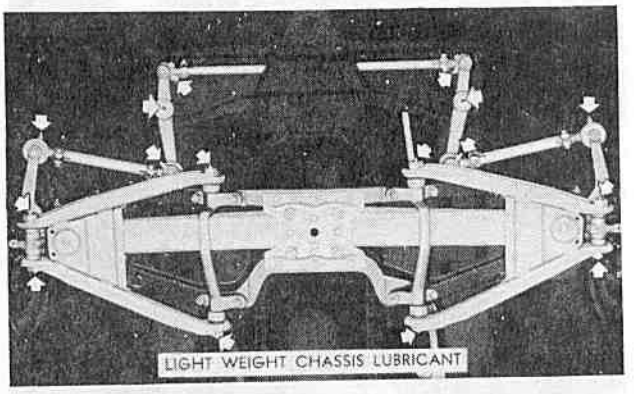


FIG. 271

COMMANDER—LOWER CONTROL ARM BUSHINGS AND TIE ROD BALL JOINTS — 1,000 MILES (1.609 KM.).

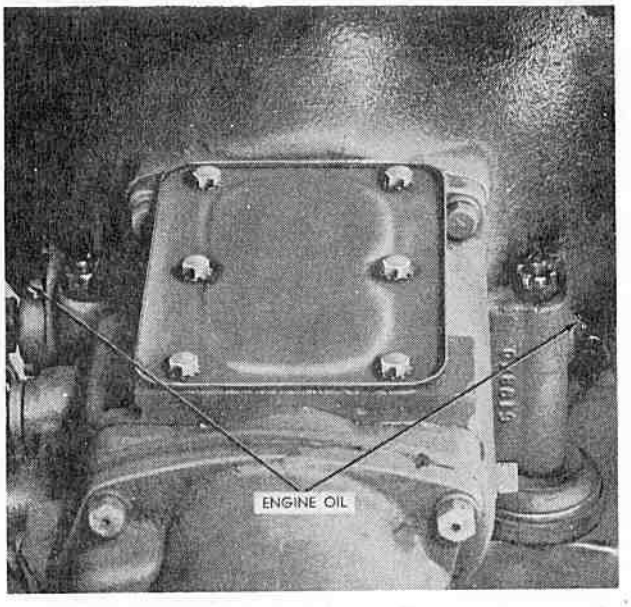


FIG. 270

CHAMPION AND COMMANDER — CLUTCH RELEASE SHAFT — 1,000 MILES (1.609 KM.).

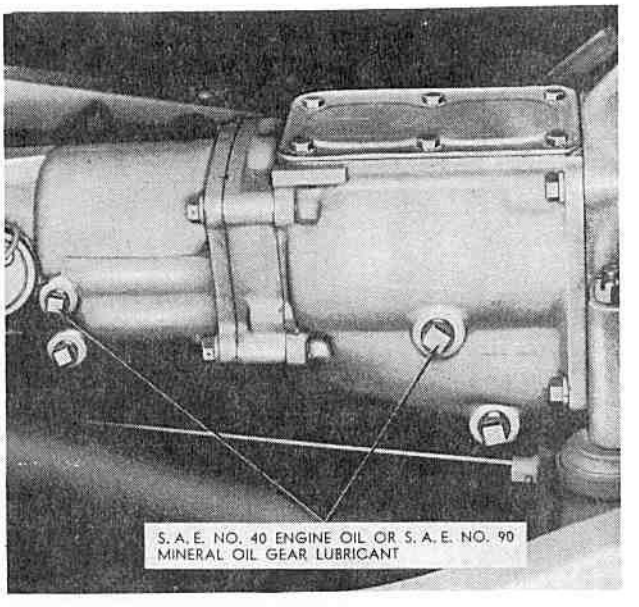


FIG. 272

CHAMPION AND COMMANDER — TRANSMISSION (OVERDRIVE AND CONVENTIONAL) — CHECK LEVEL 5,000 MILES (8.045 KM.) AND DRAIN AND FLUSH AT 10,000 MILES (16.094 KM.).

Use S.A.E. No. 40 engine oil or S.A.E. No. 90 mineral oil gear lubricant, summer or winter. Gear lubricants containing any extreme pressure ingredients, such as lead, sulphur, or chlorine compounds must not be used.

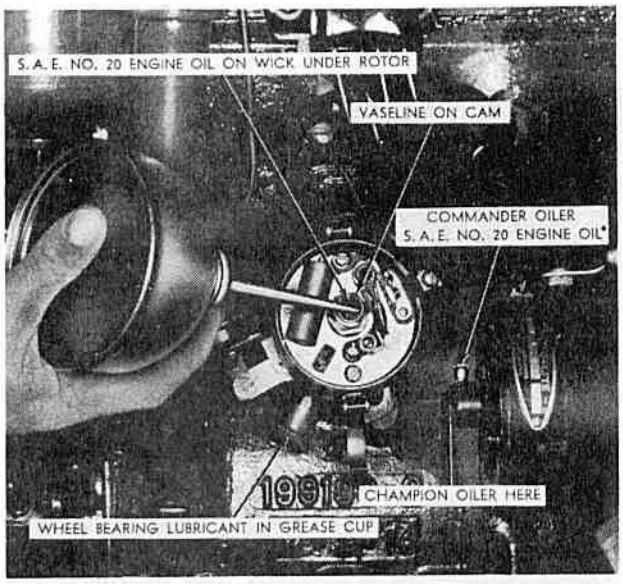


FIG. 273

CHAMPION AND COMMANDER — STARTER MOTOR, DISTRIBUTOR — 5,000 MILES (8.045 KM.).

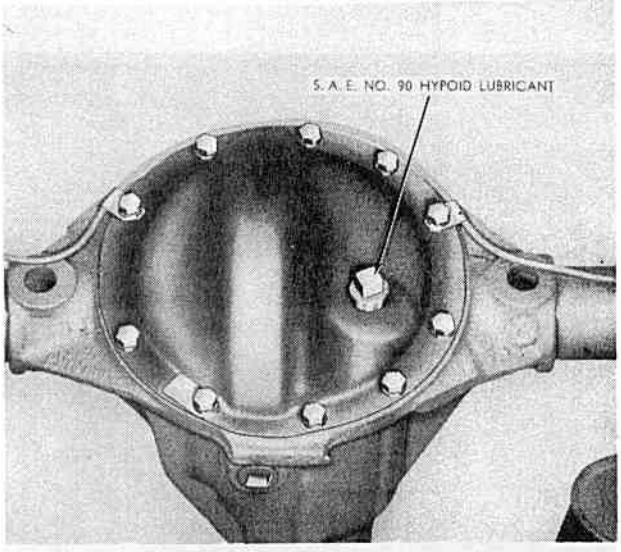


FIG. 274

CHAMPION AND COMMANDER — REAR AXLE — CHECK LEVEL — 5,000 MILES (8.045 KM.). DRAIN AND FLUSH — 10,000 MILES (16.094 KM.).

Use Studebaker hypoid lubricant or any S.A.E. No. 90 hypoid lubricant manufactured by a reputable oil company. Do not mix various brands of hypoid lubricants.

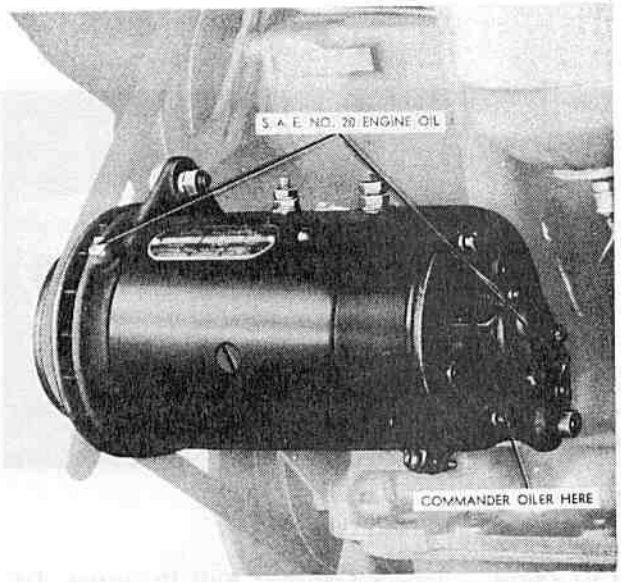


FIG. 275

CHAMPION AND COMMANDER — GENERATOR — 5,000 MILES (8.045 KM.).

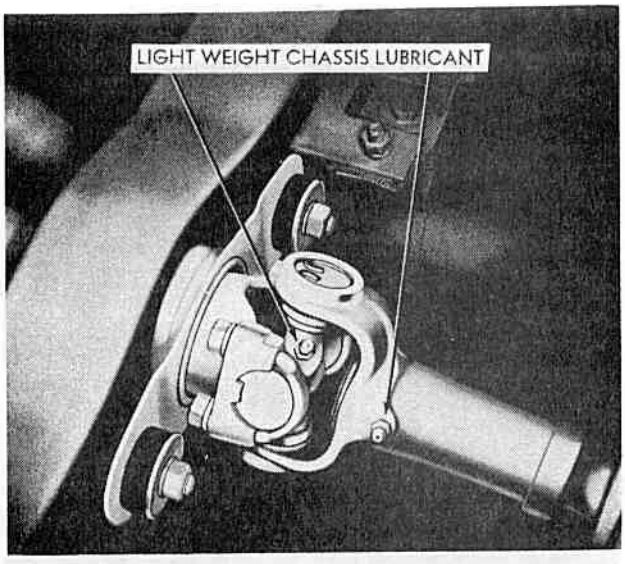


FIG. 276

CHAMPION AND COMMANDER — UNIVERSAL JOINTS, PROPELLER SHAFT SPLINES — 1,000 MILES (1.609 KM.).

Each universal joint is equipped with a lubrication fitting. Lubricate with light weight chassis lubricant, using a low pressure hand gun or a pressure gun equipped with a pressure control extension coupling (maximum pressure setting not to exceed 1,500 to 1,600 lb. [105,45 to 112,48 kgs.]).

The splines at the front end of the rear propeller shaft should also be lubricated with light weight chassis lubricant.

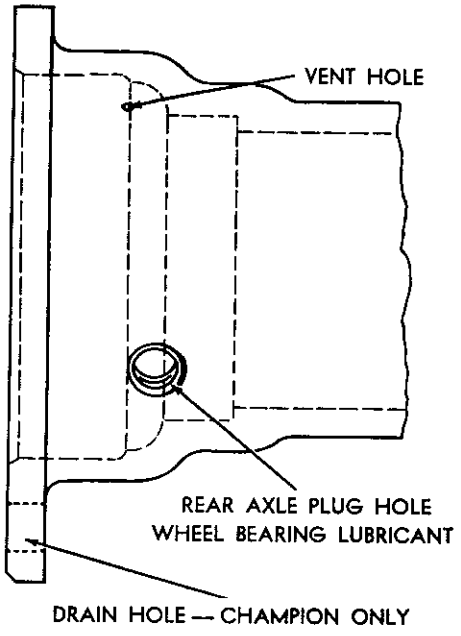


FIG. 277

CHAMPION AND COMMANDER — AXLE SHAFT BEARINGS — 10,000 MILES (16.094 KM.).

Axle shaft bearings should be lubricated with wheel bearing lubricant. The axle housing is equipped with a pipe plug near each brake backing plate, instead of a lubrication fitting. To lubricate the axle shaft bearings, remove the pipe plugs temporarily, and insert lubrication fittings.

There is a 7/64" (2,778 mm.) vent hole *above* each pipe plug hole. Open this vent hole with a piece of wire before lubricating.

Lubricate with a low pressure hand gun or a pressure gun equipped with a pressure control extension coupling (maximum pressure setting not to exceed 1,500 to 1,600 lb. [105,45 to 112,48 kgs.]), until the lubricant is forced out of the vent hole.

On the Champion, a drain hole is located just *below* each pipe plug hole for the purpose of draining off any lubricant which might seep into the outer retainer assembly. Make sure this drain hole is open. After the lubrication has been completed, remove the lubrication fittings and reinstall the pipe plugs.

CHAMPION AND COMMANDER — CARBURETOR AIR CLEANER

● Service regularly to avoid serious damage to engine parts. Where dust conditions prevail, it may be necessary to service the unit daily, or more often under severe dust conditions. Refer to the section, "Gasoline System," for detailed service information.

CHAMPION AND COMMANDER — SHOCK ABSORBERS

● The fluid level in the shock absorbers should be inspected after every 5,000 miles (8.045 km.) of operation. If refilling is necessary, always use Houdaille L-1404 fluid. Refer to the section, "Springs and Shock Absorbers," for detailed service information.

THE LUBRICATION PERIODS ESTABLISHED ARE FOR AVERAGE USE AND SHOULD BE CHANGED TO SUIT INDIVIDUAL OPERATING CONDITIONS

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

PREPARING CAR FOR DELIVERY

The factory exercises extraordinary care to insure the proper operation of all instruments and controls, the proper fit and adjustment of each part and the correct anchorage of each bolt, nut, and coupling. New parts, however, do not always operate freely or retain their original adjustment. Because of these facts and because of possible disarrangements which may be incurred in shipping, it is essential that each new car be thoroughly inspected and serviced before delivery.

There is no more opportune time for the dealer to secure a permanent customer than when the car is initially serviced. In the preparation of the new car for delivery, the dealer's service department should, therefore, use this first opportunity to convince the customer of the ability and thoroughness of its mechanics. A new car purchaser may be unaware of the painstaking detail required in the preparation of a new car, but he readily notices any improper operation which is the inevitable result of careless or casual servicing. Annoying conditions, necessitating frequent returns to the service station during the early period of ownership, dampen the customer's enthusiasm and invariably deprive the dealer organization of continued patronage.

Form No. H350, "Preparation of New Car for Retail Delivery," is placed in the package compartment of each car before it leaves the factory and should be used by every dealers' service organization as a guide for preparing new cars for delivery. The form, which is the same for Champions and Commanders, includes complete instructions on the procedure for its use.

2-15-46

H350

Studebaker

PREPARATION OF NEW CAR FOR RETAIL DELIVERY

This side used for **PASSENGER CARS** -See other side for truck

INSTRUCTIONS: Made by dealer at the time of preparing new car for delivery. When completed, detach the stub and tie it securely to the steering wheel. File the remaining section according to serial number of car in the New Car Preparation Department, and when car is sold, transfer to purchaser's file in service department.

Delivered to_____ Address _____

Serial No._____ Engine No._____ Key No. _____

OPERATIONS WHICH SHOULD BE PERFORMED

CAR ON FLOOR

- ☐ Check hood and hood lock, and adjust if necessary.
- ☐ Fill radiator to proper level. Install anti-freeze if needed.
- ☐ Check specific gravity of storage battery with a hydrometer and add water if necessary. Check battery cables and hold-down bolts for tightness.
- ☐ Inspect fan belt adjustment and generator attaching bolts for tightness.
- ☐ Inspect electrical connections under hood and dash for tightness
- ☐ Tighten cylinder head cap screws in proper sequence with tension wrench (see Shop Manual).
- ☐ Tighten manifold nuts.
- ☐ Inspect manifold heat valve for free operation.
- ☐ Check automatic choke for freeness of operation. Check throttle for full opening, and overdrive solenoid control switch operation (if so equipped).
- ☐ Clean out fuel pump bowl if necessary.
- ☐ Inspect distributor point gap, and adjust if necessary.
- ☐ Check spark modifier for freeness of operation and for complete retard at idle speeds.
- ☐ Check ignition timing and adjust if necessary.
- ☐ Inspect carburetor air cleaner and service if necessary.
- ☐ Adjust carburetor idle speed and idle mixture.
- ☐ Tighten all wheel disc to hub nuts.
- ☐ Check all lights and horn for proper operation.
- ☐ Inspect head lamps for aim; adjust if necessary.
- ☐ Raise front end of car and with front wheels in straight ahead position check steering wheel to see if cam lever is on high spot of cam.
- ☐ Inflate all tires to recommended pressure and check front wheel alignment.
- ☐ Check brake fluid level in master cylinder.
- ☐ Check doors, windows, and keys for proper operation.
- ☐ Check tools and pack in proper compartment.
- ☐ Examine thoroughly for all shortages.

CAR ON LUBRICATION HOIST

- ☐ Check engine oil level before raising car. Change oil if car has been driven over 500 miles.
- ☐ General lubrication (see Lubrication Chart).
- ☐ Inspect for oil, gas, and water leaks.
- ☐ Inspect front wheel bearings and lubricate if necessary. Adjust wheel bearings and install new cotter pins.
- ☐ Inspect all steering connections for lightness and make sure all cotter pins are in place.
- ☐ Tighten all spring U-bolts.
- ☐ Inspect hydraulic brake system for fluid leaks.
- ☐ Inspect shock absorber mounting and link bolts for tightness.
- ☐ Inspect muffler and tail pipe mountings for proper alignment and tightness.
- ☐ Inspect parking brake cable clevis and cotter pins for proper installation.
- ☐ Inspect for excessive rear axle shaft bearing end play and make sure wheels turn freely.

DRIVING TEST

- ☐ Front seat adjusting mechanism
- ☐ Starter operation
- ☐ Clutch operation, including free pedal travel
- ☐ Windshield wiper operation
- ☐ Operation of all gages on instrument panel
- ☐ Operation of gear shift in all forward speeds and reverse
- ☐ Operation of all accessories
- ☐ Brake operation
- ☐ Hill-holder (if so equipped) for simultaneous release with clutch engagement
- ☐ Squeaks and rattles

FINAL

- ☐ Make any required adjustments after road test, retest if necessary.
- ☐ Lay rear carpet, remove covering from upholstery, and thoroughly clean inside of car.
- ☐ Wash and polish car including glass and plated parts.
- ☐ Write serial number on Service Policy and deliver to office.

Do not wax during first 90 days.

Lubricated by_____ Inspected by_____ Adjustments made by_____

Repair Order No._____ Date_____ Signed_____
New Car Delivery Department

This car Serial No._____ was prepared for retail delivery on Repair Order No._____

Signed_____
New Car Delivery Department

FORM NO. H350

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

PROPELLER SHAFTS AND UNIVERSAL JOINTS

The Champion and the Commander models are equipped with two propeller shafts which are supported by a bearing assembly at the center frame cross member. The slip yoke is located at the front of the rear propeller shaft.

Needle bearing type universal joints equipped with lubrication fittings are used on both models. Each bearing assembly includes a cork lubricant seal and a dust shield.

Propeller Shafts

Removal and Disassembly

CHAMPION AND COMMANDER To remove the propeller shafts and the support bearing assembly, first remove the two U-bolts which hold the center universal joint assembly to the front propeller shaft rear flange. Then slide the slip yoke rearward on the rear propeller shaft splines.

After removing the cap screw and washers which hold the intermediate flange to the front propeller shaft, punch-mark the end of the shaft and the adjacent edge of the flange and remove the flange with Puller No. J-2046. Then remove the nuts and washers that hold the support assembly to the center frame cross member and pull the support assembly from the splines of the front propeller shaft.

Remove the propeller shaft support bearing by pressing it out of the support with a piece of tubing fitted against the outer bearing race. To clean the support bearing, wipe it with a clean cloth. *This bearing is prelubricated and should not be washed in gasoline or any cleaning solvent.*

Disconnect the front and rear propeller shafts at the universal joints and remove them from the car.

Reassembly and Installation

CHAMPION AND COMMANDER To install the support bearing, fit a piece of tubing against the outer bearing race and press the bearing into the support until the outer bearing race is flush with the front edge of the support (be sure not to damage the seal retainers). Place the bearing dust shield on the front propeller shaft splines, fasten the front of the shaft to the transmission, and install the propeller shaft support bearing assembly.

Install the propeller shaft intermediate flange, screw, and washers, aligning the punch-marks on the shaft and the flange. Then connect the rear propeller shaft to the rear axle companion flange and to the propeller shaft intermediate flange.

Universal Joints

Disassembly

CHAMPION AND COMMANDER With a pair of pliers, remove the snap rings which retain the bearing assemblies in the universal joint yoke (see Fig. 278). Then remove the two bearings with an arbor press.

Reassembly

CHAMPION AND COMMANDER When reassembling universal joints, always install new cork washers. After installing the cross and cork washers in the yoke, press the bearing assemblies into position with an arbor press. Be sure the snap rings are properly installed.

To facilitate reassembly, use Universal Joint Clamp J-881-A when installing the bearings in the three companion flanges. Press the bearings until they fit in the companion flange recess, and then tighten the retaining U-bolts (see Fig. 279).

For lubrication information on propeller shaft splines and universal joints, refer to the "Lubrication" section.

FIG. 278

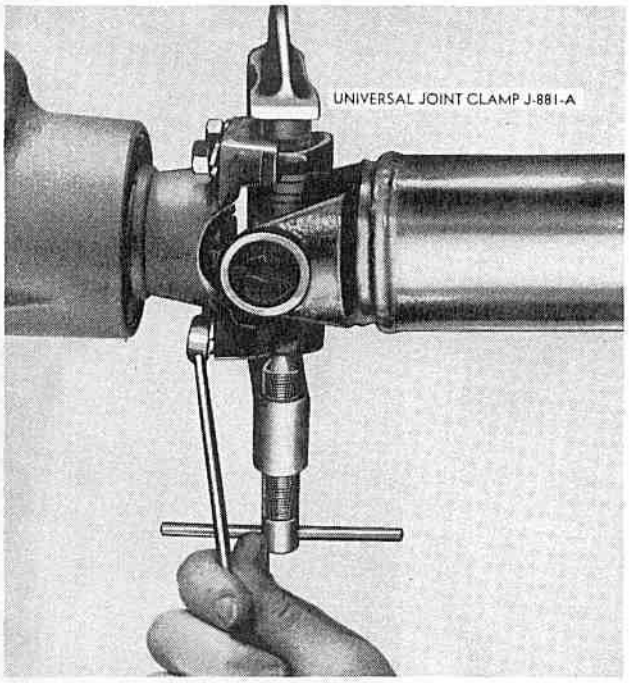


FIG. 279

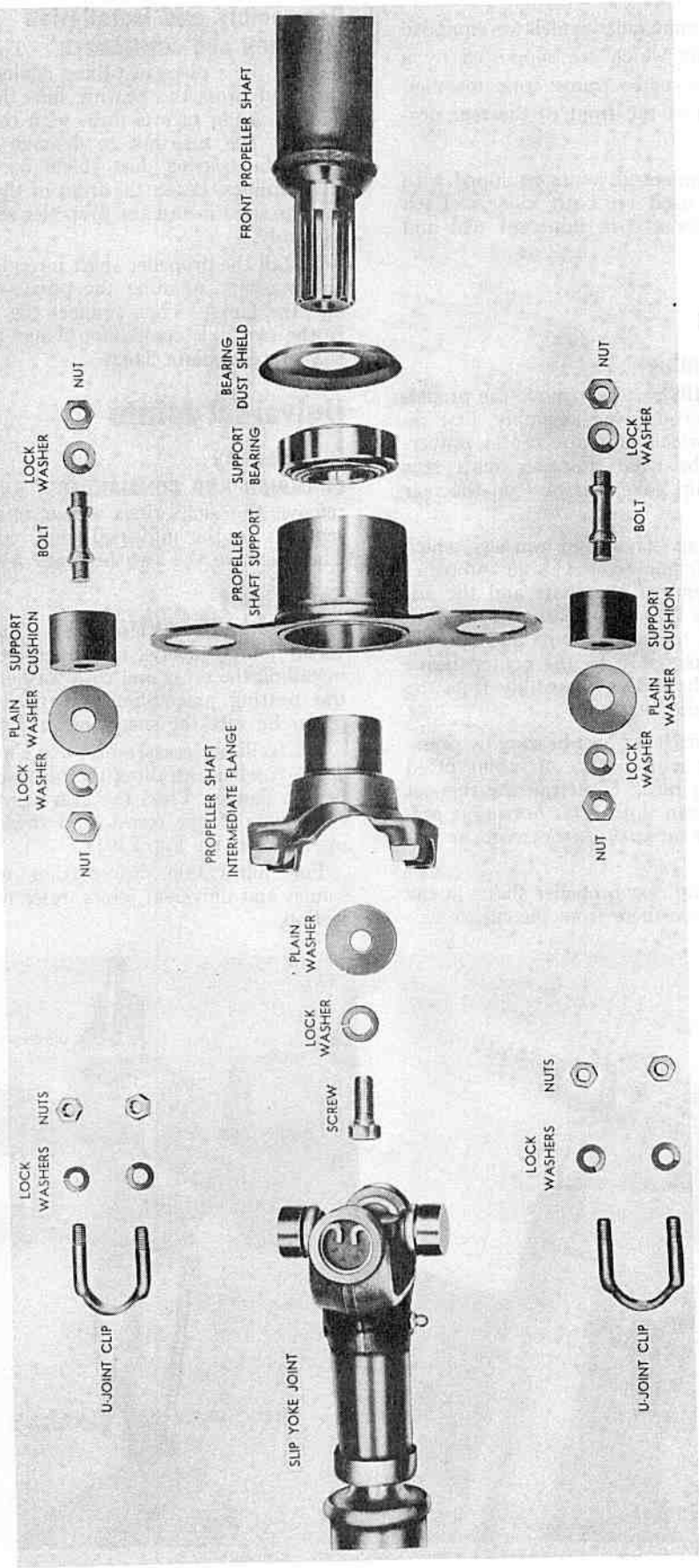


FIG. 280.—PARTS OF THE PROPELLER SHAFT SUPPORT ASSEMBLY

PROPELLER SHAFTS AND UNIVERSAL JOINTS DIAGNOSIS

VIBRATION

CAUSES

1. Worn universal joint crosses.
2. Broken or worn universal joint bearings.
3. Bent propeller shaft.
4. Arrows not properly aligned at slip joint.
5. Loose propeller shaft support mounting.
6. Loose universal joint U-bolt nuts.
7. Universal joint bearings not seated properly in flange or yoke.
8. Intermediate flange not properly aligned with front propeller shaft yoke.

SQUEAK, METALLIC RATTLE, CLICK, OR GROWL

CAUSES

1. Lack of lubrication.
2. Worn universal joint seals.
3. Broken or worn universal joint bearings.
4. Worn universal joint cross.
5. Universal joint bearings not seated properly in flange or yoke.
6. Propeller shaft support mounting studs loose.
7. Propeller shaft support bearing worn, brinelled, or rough.
8. Loose intermediate flange.
9. Propeller shaft support improperly installed (upside down).

UNIVERSAL JOINT LUBRICANT LOSS

CAUSES

1. Worn seals.
2. Broken or worn bearings.
3. Worn cross.
4. Bearings not seated properly in flange or yoke.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

REAR AXLE

The rear axle assemblies used on the Champion and Commander models are the same in general design and are the hypoid, semi-floating type with shim adjustments provided for the bearings and for the ring gear and pinion. The assembly on the Commander, however, is necessarily composed of larger and heavier parts than that on the Champion.

The axle shafts are splined at the inner ends to fit into splines in the differential side gears. The outer ends are tapered and provided with keyways for attaching the rear wheel hubs. Side thrust from the wheels, which are supported on tapered roller bearings pressed on the axle shafts, is transferred from one shaft to the other by a thrust block straddling the differential pin.

The general construction of the Champion rear axle is illustrated in the line drawing and exploded view which follow. Inasmuch as the Champion and Commander rear axles are similarly designed, the line drawing and exploded view also illustrate the general construction of the Commander rear axle.

A stamped cover on the rear of the axle housing permits the inspection and flushing of the differential assembly. The rear axle lubricant level should be checked every 5,000 miles (8.045 km.). The lubricant should be drained and the axle refilled to the bottom level of the filler plug hole every 10,000 miles (16.094 km.). Studebaker hypoid lubricant or any hypoid lubricant (S.A.E. No. 90) manufactured by a reputable oil company may be used. *Do not, at any time, mix various brands of hypoid lubricants.* Should there be any doubt concerning the brand of lubricant previously used, the rear axle housing should be flushed with a light engine oil. Never use kerosene for flushing.

NOTE.—The rear axle gear ratio is stamped on a plate attached to the assembly by one of the cover cap screws.

Rear Axle Shafts

Bearing Adjustment and Oil Seal Removal and Installation

CHAMPION AND COMMANDER Remove the rear wheel hub cover, axle nut, and washer; loosen the rear wheel retaining nuts; and raise the car to provide sufficient clearance for the removal of the rear wheel. The hub and drum assembly can then be removed with an accredited wheel hub puller, preferably Puller J-446-A for the Champion and J-596-A for the Commander. All accumulated grease should be removed from the backing plate and the brake drum assembly.

Use the dial test indicator to check the axle shaft end play (see Fig. 281). The recommended tolerance ranges from .001" to .005" (0,025 mm. to 0,130 mm.). End play adjustment is controlled by shims which are located between the brake backing plates and the rear axle flanges. Shims are available in thicknesses of .003", .005", .010", and .030" (0,076 mm., 0,130 mm., 0,250 mm., and 0,760 mm.). (See Fig. 282.)

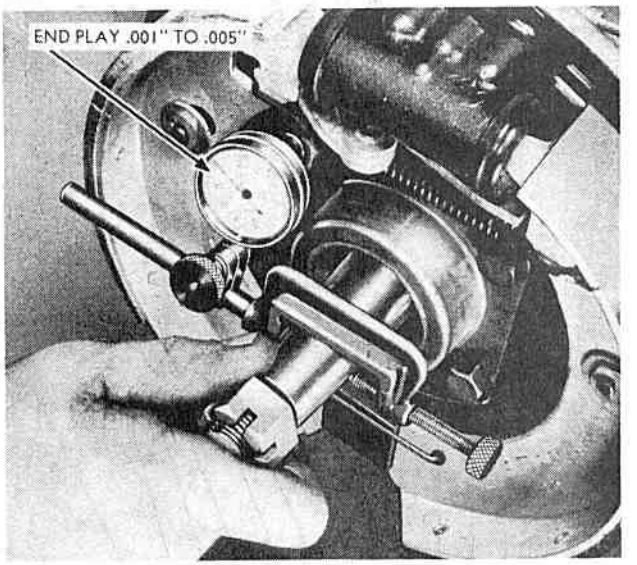


FIG. 281

Remove the rear brake backing plate retaining bolts and outer oil seal, pull the plate assembly outward and up over the end of the shaft, and suspend the assembly from the frame in an out-of-the-way position. Remove the adjustment shims, disassemble the outer oil seal assembly, and install a new seal washer.

Remove the rear axle shaft, bearing, and cup with the Rear Axle Shaft Puller HM-931. Remove the inner oil seal by using Rear Axle Grease Retainer Remover J-943. A new oil seal should always replace the old one.

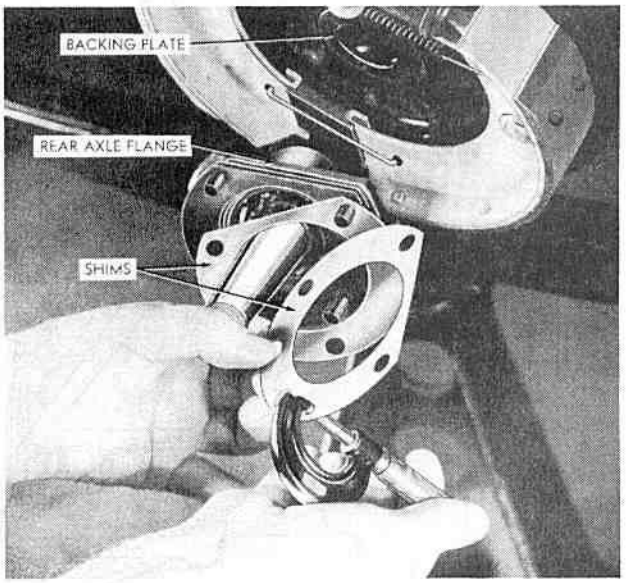


FIG. 282

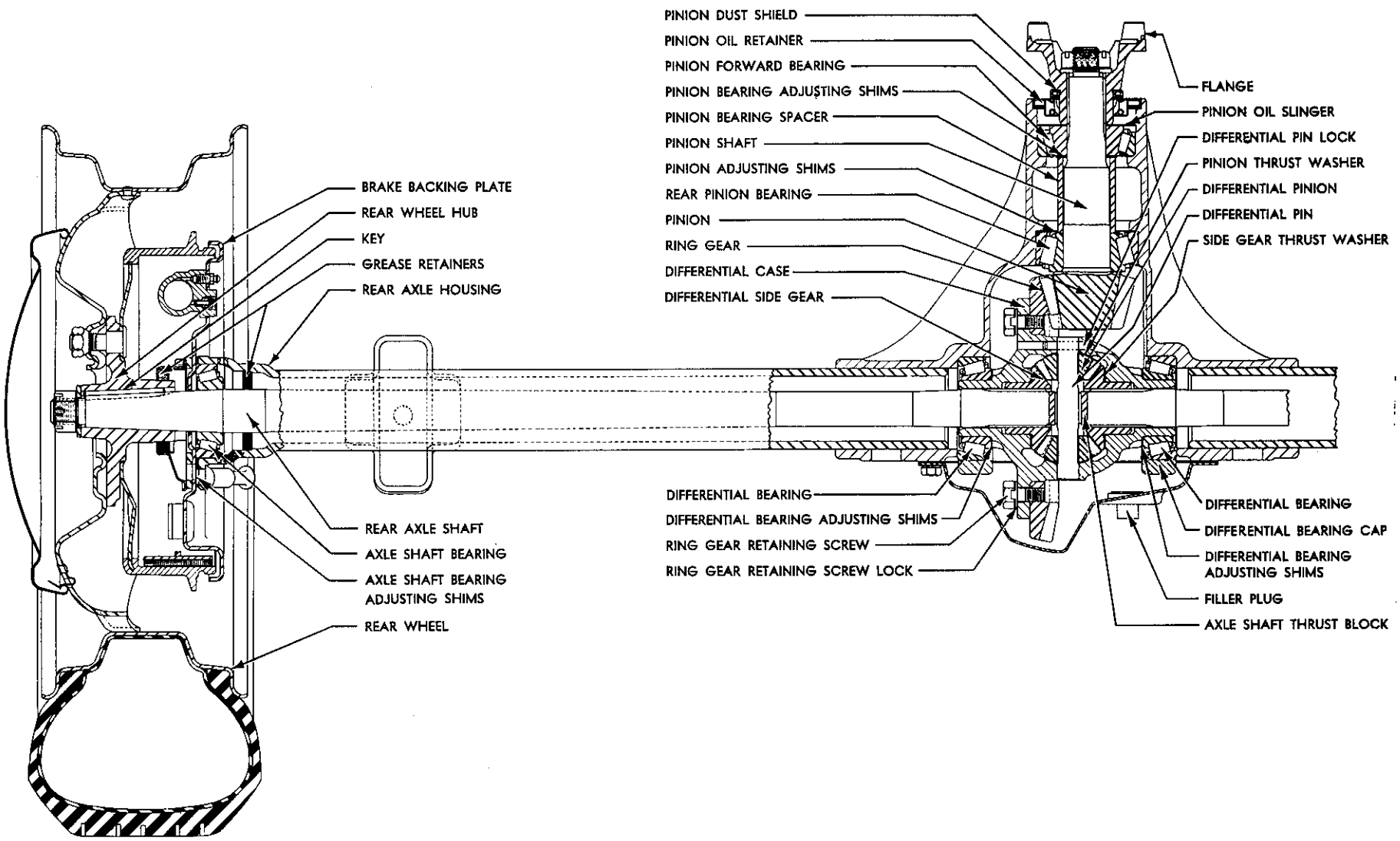


FIG. 283.—CONSTRUCTION OF THE REAR AXLE

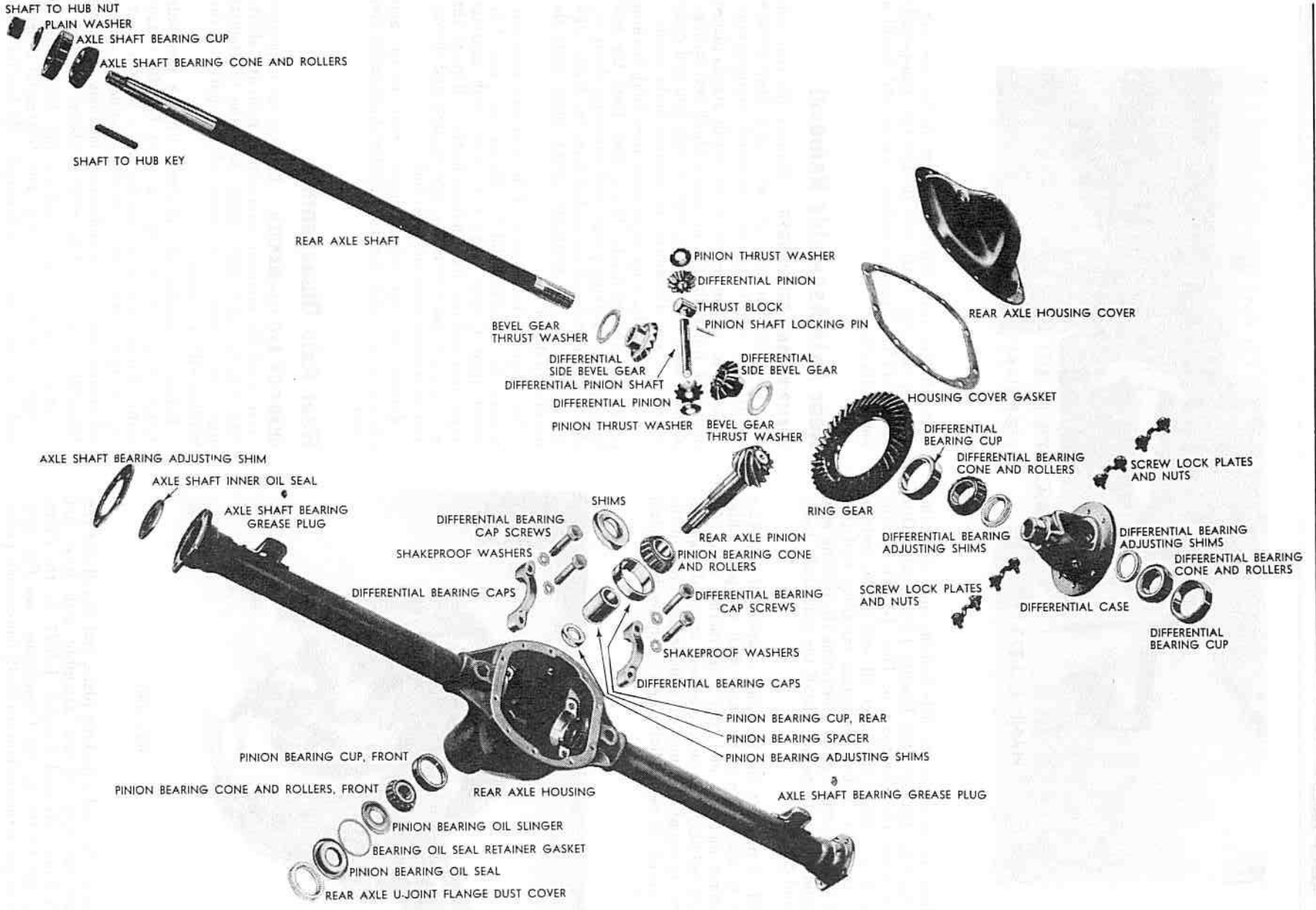


FIG. 284.—PARTS OF THE REAR AXLE

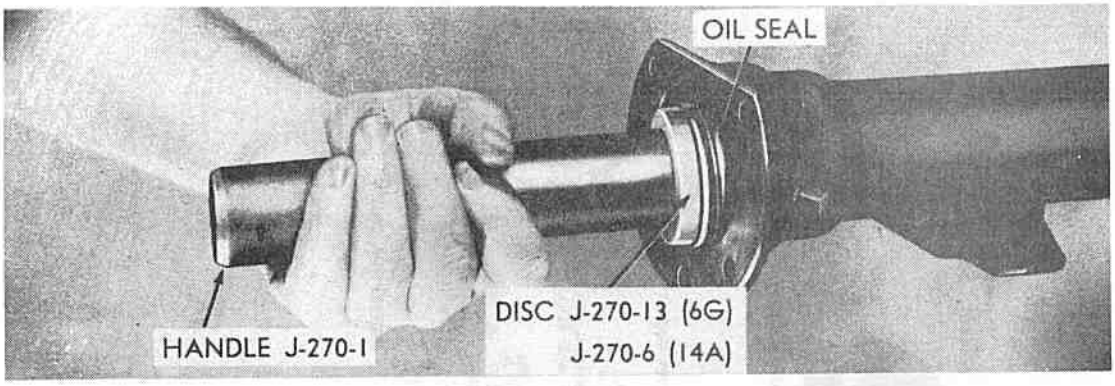


FIG. 285

Clean the inside of the axle housing and, using the Bearing Cup Replacer Set Handle J-270-1 with Disc J-270-13 for the Champion or Disc J-270-6 for the Commander, install the inner oil seal in the housing (see Fig. 285). This combination installing tool prevents seal distortion. After lubricating the bearing with a recommended lubricant, install the axle shaft, bearing, and cup.

Add or subtract the necessary number of adjusting shims to obtain the correct axle shaft end play (adding shims increases end play; subtracting shims decreases end play). Be sure to remove or install approximately an equal thickness of shims at each end of the axle housing so as to retain the axle shafts in a central position.

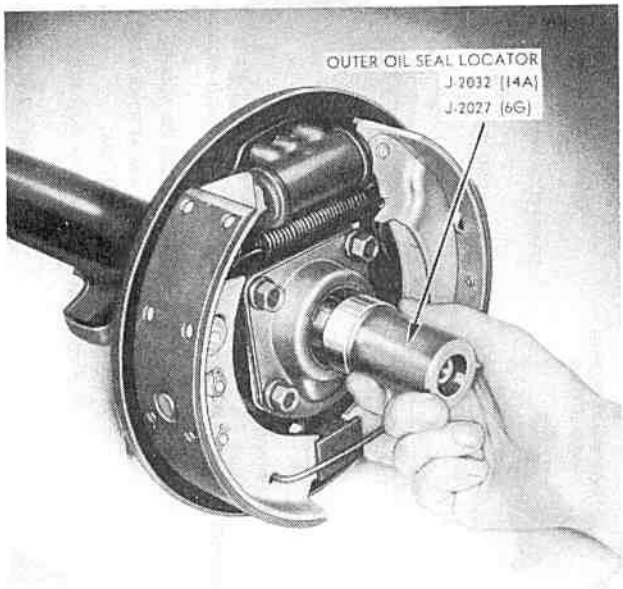


FIG. 286

Install the brake backing plate, and install and centralize the outer oil seal assembly with Rear Axle Shaft Outer Oil Seal Locator, J-2027 for the Champion and J-2032 for the Commander (see Fig. 286). Tighten the retaining bolts to 35-40 foot-pounds (4,841-5,532 kilogram-meters) torque. Then install the dial test indicator and check the axle shaft for the desired end play (.001" to .005" [0,025 mm. to 0,130 mm.]).

Install the rear wheel hub and drum assembly. Tighten the axle shaft nut to 120-130 foot-pounds (16,596-17,979 kilogram-meters) torque and install a new cotter pin.

Rear Axle Assembly Removal

CHAMPION AND COMMANDER Remove the rear hub covers and the rear axle nut cotter pins. Then remove the axle nuts and loosen the rear wheel retaining nuts.

Raise the car and rest it on two sturdy stands placed under the frame directly in front of both rear springs. Remove both rear wheels, remove both hub and drum assemblies, and disconnect the parking brake cable.

Remove the backing plate bolts from both backing plates and the hydraulic brake lines from the axle housing. The backing plates and adjusting shims can then be removed and suspended from the frame. (Do not disconnect the hydraulic brake lines from the wheel cylinders.)

To complete the removal of the rear axle assembly, remove the universal joint U-bolts and nuts (use Universal Joint Clamp J-881-A to keep both bearings in position and free from foreign matter). Remove the rear spring U-bolts from the axle housing, and disconnect both lower shock absorber links.

Remove the rear axle assembly from the car and place it in a suitable stand for further disassembly and repair.

Rear Axle Disassembly

CHAMPION AND COMMANDER Remove the inspection cover, drain the lubricant, and remove both axle shafts with bearings and cups. Then clean the differential gears, the bearings, and other internal parts of the housing with a solvent.

Before proceeding any further with the rear axle disassembly, check the ring gear back face for runout with a dial test indicator (see Fig. 287). Runout in excess of .003" (0,076 mm.) indicates either a sprung differential case or loose differential bearings. A sprung differential case should be either replaced or trued.

Remove the differential caps and pry the differential assembly out of the housing. The differential housing gasket surface and the differential side bearing caps are marked in production (see Fig. 288). When reinstalling the bearing caps, be sure the positions of the numerals correspond.

Using Companion Flange Holding Tool J-2035, remove the companion flange nut, and using Rear Axle Universal Joint Flange Remover J-2046 in conjunction with the holding tool, remove the rear axle companion flange (see Fig. 289). Then drive the pinion out of the forward bearing with a brass drift placed on the forward end of the pinion shaft. The pinion, having been freed from the forward bearing, can now be pulled out of the axle housing.

NOTE.—Keep all shims intact.

Using Pinion Bearing Cup Remover J-1613, drive the front bearing cone and oil seal out of the front of the housing. If a damaged rear bearing cup is to be replaced or if the pinion setting is to be changed, the same remover set, J-1613, should be used for the removal of the pinion rear bearing cup. To press the rear bearing cone off the pinion, use an arbor press and Puller Plate J-1298-1 with Adapter Rings J-1298-4 (see Fig. 290).

Remove the ring gear from the differential case by bending down the locks and removing the mounting cap screws. Drive out the differential shaft lock pin and remove the shaft, differential gears, and thrust washers. To remove the differential side bearings, use Bearing Puller J-986-S (see Fig. 291).

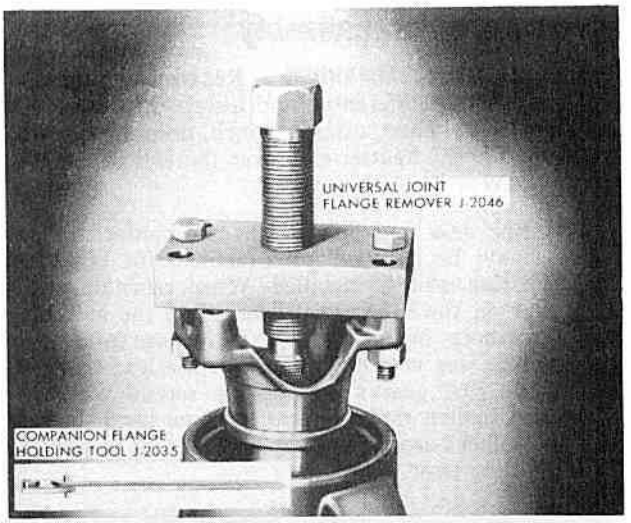


FIG. 289

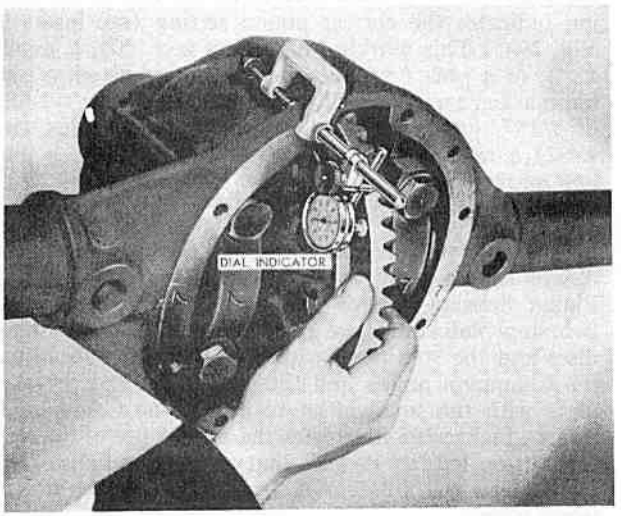


FIG. 287

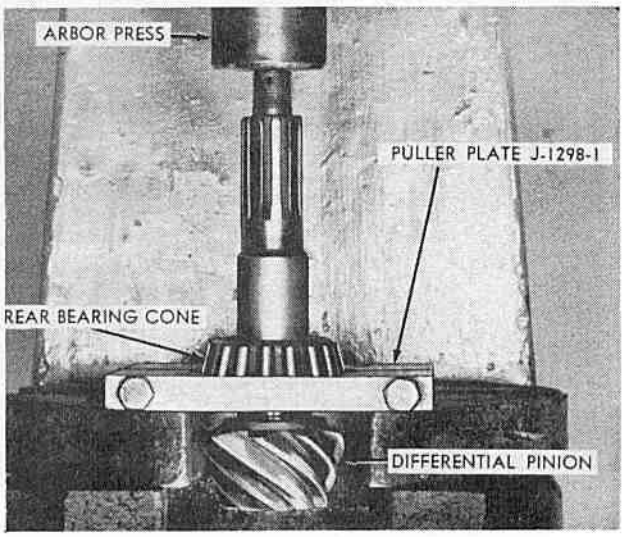


FIG. 290

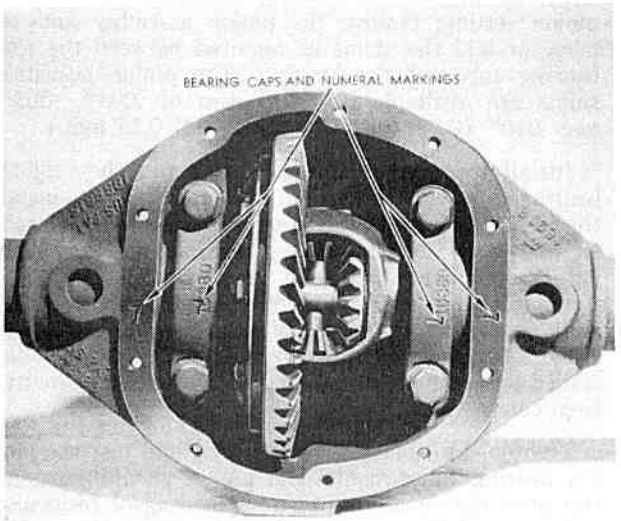


FIG. 288

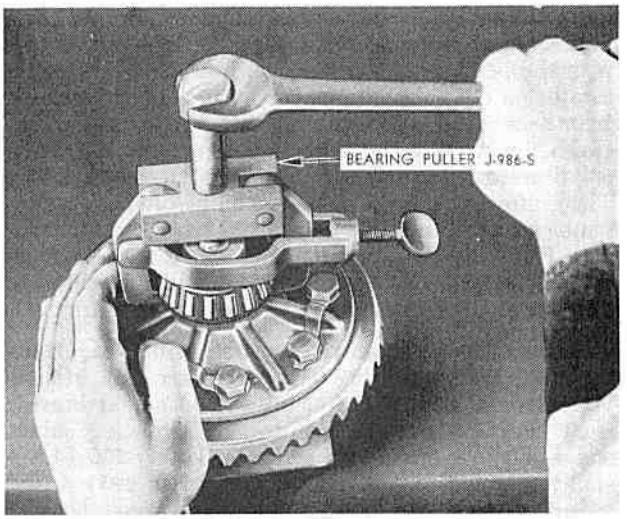


FIG. 291

Rear Axle Reassembly

CHAMPION AND COMMANDER Reassemble the internal parts of the differential and install the differential shaft lock pin. Then, using a punch, peen some of the metal of the differential case over the end of the lock pin to prevent its working loose.

The ring gear and differential case contacting surfaces should be cleaned and examined for burrs before the ring gear is installed. When reinstalling the ring gear on the differential case, align the attaching cap screw holes in the ring gear with those in the case and tap the ring gear on the case with a lead hammer. Insert the ring gear attaching cap screws with new locks and tighten them uniformly. Then bend the new cap screw locks around the cap screw heads to prevent their working loose.

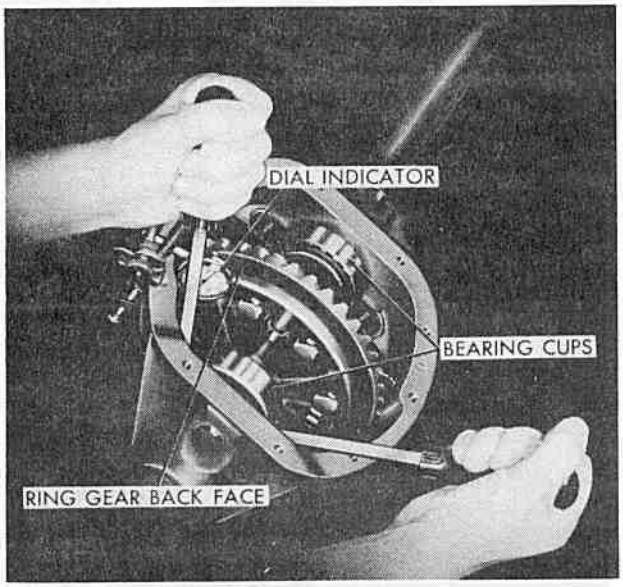


FIG. 292

Using Differential Side Carrier Bearing Replacer J-270-22 and an arbor press, install the differential side bearings without the shims on the differential case. Being sure that the bearing cones and cups and the housing seats are perfectly clean, place the differential case with the bearing cups in the housing. Install a dial indicator on the housing with the button against the ring gear back face, and inserting two screw drivers between the housing and a bearing cup, move the differential assembly to one side of the case (see Fig. 292). Then, after setting the indicator on zero, move the assembly to the other side and record the indicator reading. This reading plus an .008″ (0,20 mm.) recommended preload denotes the total quantity of shims to be used in the reinstallation of the carrier bearings.

Remove the differential assembly from the housing, and using Bearing Cup Replacer Set Handle J-270-1 with Disc J-270-6, install the pinion bearing front cup. Then install the original adjusting shims, and with the same handle and with Disc J-270-14, install the pinion bearing rear cup (see Fig. 293). Using an arbor press and a length of pipe, press the rear bearing cone on the pinion. The pipe must contact only the inner bearing race, not the retainer.

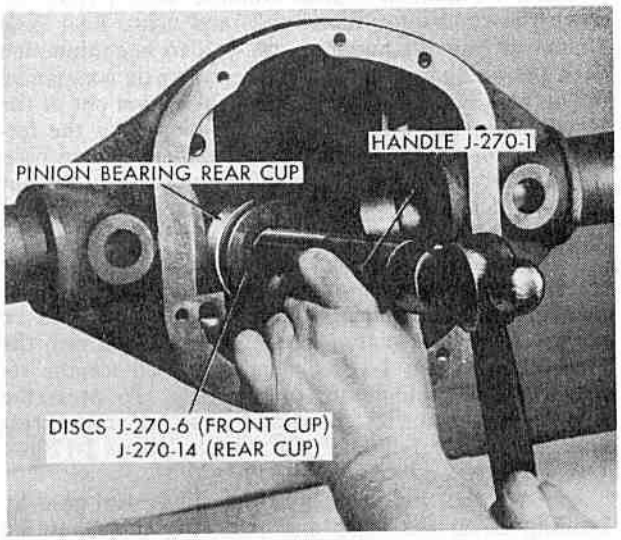


FIG. 293

The rear axle pinion should be adjusted properly before further rear axle reassembly is attempted. The marking on the ground surface at the end of the pinion indicates the correct pinion setting (see insert in Fig. 294). This marking may be a zero (0), a minus (−), or a plus (+). When properly adjusted, a pinion marked zero (0) will provide a micrometer reading of .719″ (18,262 mm.), a pinion marked plus two (+2) a reading of .717″ (18,2118 mm.), and a pinion marked minus four (−4) a reading of .723″ (18,3652 mm.). (See Fig. 294.)

Place the pinion with the rear bearing cone in the differential housing, and adjust the pinion, using Pinion Setting Fixture J-589-D. This tool includes two step plates and two pairs of discs. Use the small discs and the step plate with the large offset to adjust the Champion pinion and the large discs and the step plate with the small offset to adjust the Commander pinion. Figure 295 illustrates the correct use of the special setting fixture. Be sure that the setting fixture, the pinion, and the differential bearing cup seats are perfectly clean.

If the micrometer reading indicates an incorrect pinion setting, remove the pinion assembly and remove or add the shims as required between the rear bearing cup and the housing. The pinion adjusting shims are available in thicknesses of .003″, .005″, and .010″ (0,05 mm., 0,13 mm., and 0,25 mm.).

Install the pinion bearing spacer and the original bearing adjusting shims on the pinion. Then install the front pinion bearing cone, companion flange, washer, and nut. When installing the front bearing cone and the companion flange on the pinion, use Rear Axle Companion Flange and Pinion Bearing Pusher J-2204 and Companion Flange Holding Tool J-2035 (see Fig. 296). The pinion oil seal and slinger should not be installed until the pinion bearing adjusting procedure has been completed.

Tighten the companion flange nut and test the pinion bearing adjustment. The pinion should have no end play and should afford a slight drag or resistance to turning. Add or remove shims to obtain the proper pinion bearing adjustment.

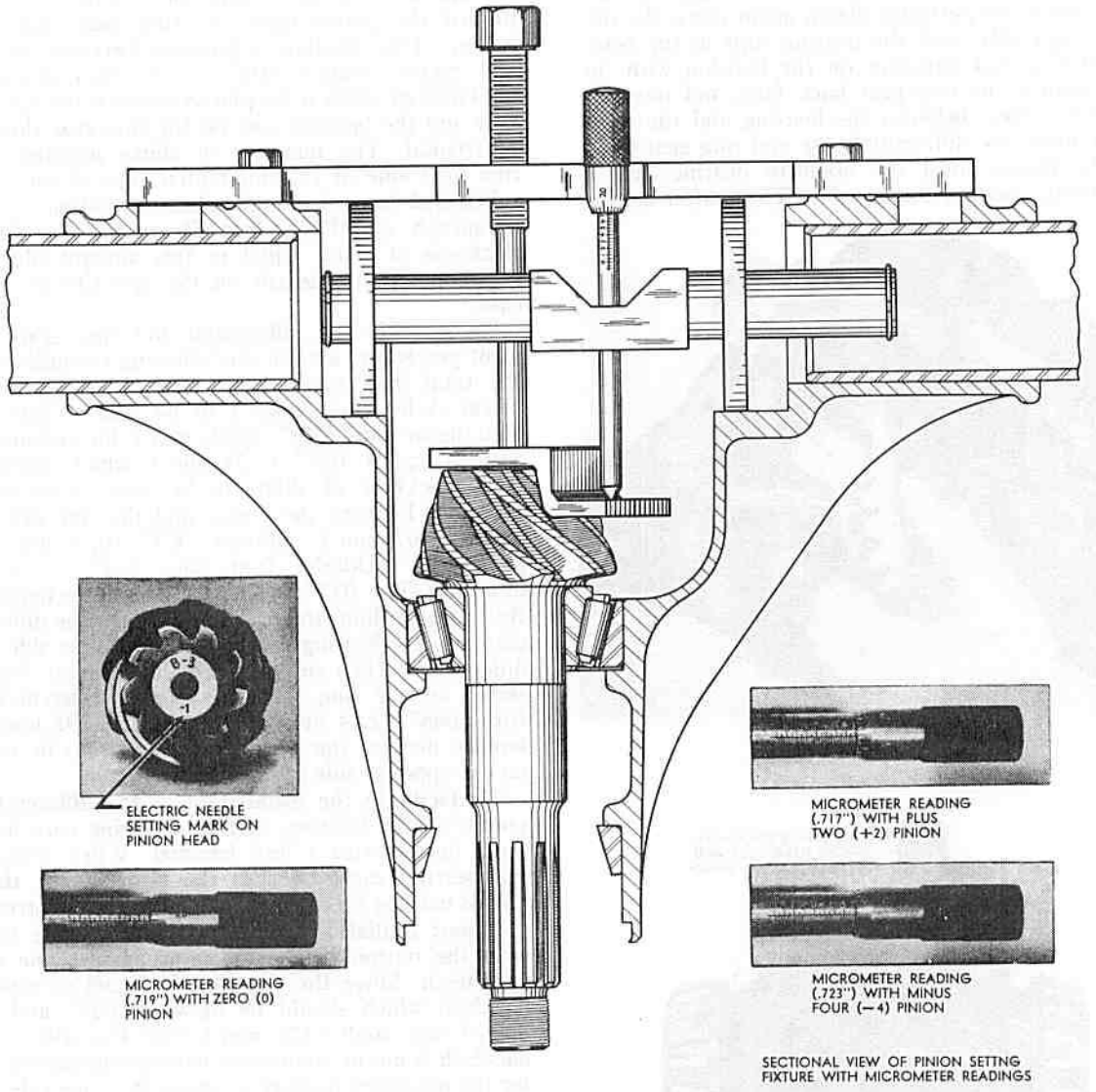


FIG. 294

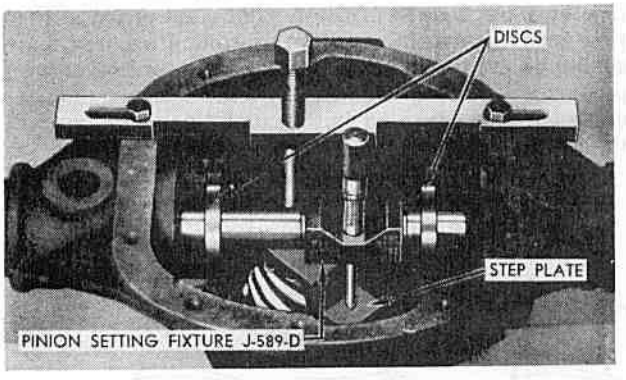


FIG. 295

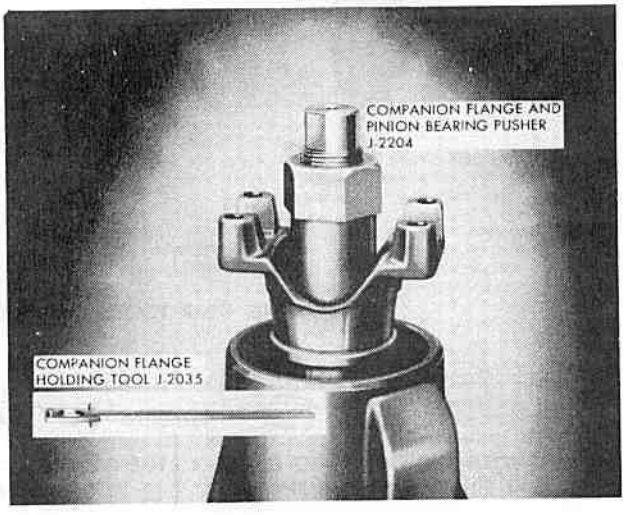


FIG. 296

Being sure that the bearing cones and cups and the housing seats are perfectly clean, again place the differential assembly with the bearing cups in the housing. Install a dial indicator on the housing with the button against the ring gear back face, and inserting two screw drivers between the housing and the bearing cup, move the differential case and ring gear away from the pinion until the opposite bearing cup is seated firmly against the housing. Then, after setting the indicator on zero, move the differential assembly toward the pinion until the ring gear contacts the pinion. This reading (clearance between ring gear and pinion) minus .005″ (0,13 mm.) denotes the thickness of shims to be placed between the differential case and the bearing cone on the ring gear side of the differential. The quantity of shims inserted on the ring gear side of the differential case should then be subtracted from the total indicator reading (see third paragraph of "Rear Axle Reassembly"). Insert a thickness of shims equal to this amount plus .008″ (0,20 mm.) for preload on the opposite side of the case.

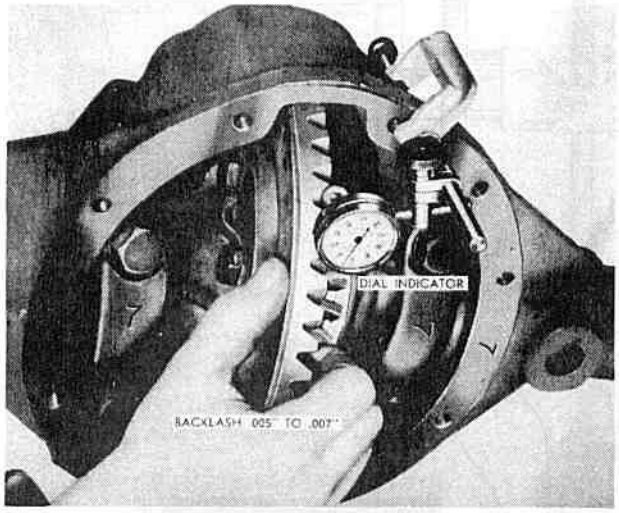


FIG. 297

To simplify the differential and ring gear adjustment procedure, we cite the following example. Assume the total indicator reading (see third paragraph of "Rear Axle Reassembly") to be .080″ (2,03 mm.). This figure plus .008″ (0,20 mm.) for recommended preload equals .088″ (2,23 mm.), which denotes the total thickness of shims to be used. Assuming the clearance between the pinion and the ring gear to be .042″ (1,07 mm.), subtract .005″ (0,13 mm.) (approximate backlash) from this .042″ (1,07 mm.) clearance. The .037″ (0,91 mm.) difference denotes the thickness of shims to be placed between the differential case and the bearing cone on the ring gear side of the differential. Then subtract the thickness of shims inserted on the ring gear side of the differential case from .088″ (2,24 mm.). The .051″ (1,295 mm.) difference denotes the thickness of shims to be inserted on the opposite side of the case.

To facilitate the installation of the differential assembly in the housing, cock the bearing cups and tap them lightly with a lead hammer. When reinstalling the bearing caps, be sure the positions of the numerals marked on the housing and the caps correspond.

Mount a dial indicator on the rear axle housing with the button of the indicator against one of the gear teeth. Move the ring gear by hand to check the backlash which should be between .005″ and .007″ (0,127 mm. and 0,178 mm.) (see Fig. 297). If the backlash is not in accordance with specifications, transfer the necessary number of shims from one side of the carrier to the other to obtain the desired setting (see Fig. 298). Backlash will be changed approximately 2/3 of the thickness of the shims transferred.

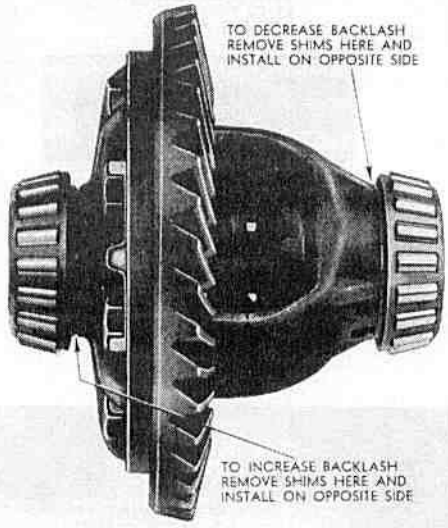


FIG. 298

After setting the backlash to comply with the specifications, use a small brush to paint eight or ten of the ring gear teeth with a mixture of ground red lead and engine oil. Move the painted ring gear teeth over the pinion until a good impression of the tooth contact is obtained. The resulting impressions should be similar to the first example illustrated in figure 299. Adjust

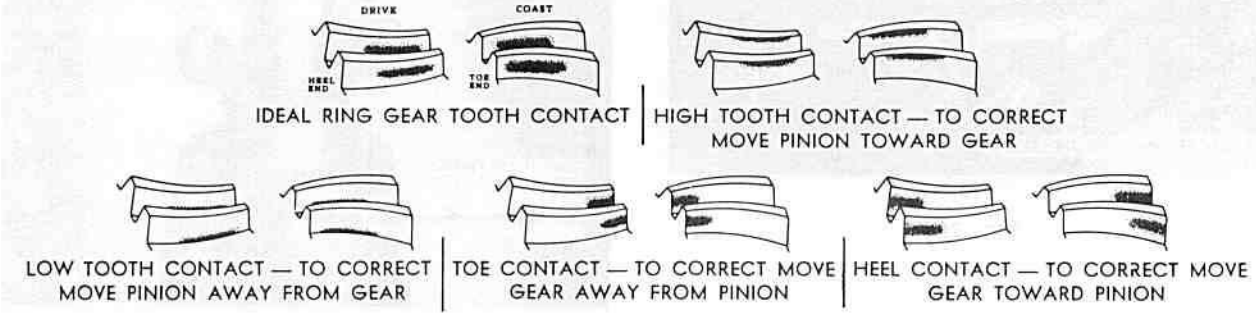


FIG. 299

either the ring gear or the pinion as required to obtain the proper tooth contact.

After removing the companion flange, install the oil slinger, and with Bearing Oil Seal Driver J-2037 and Handle J-270-1, install the new pinion oil seal (see Fig. 300). Tighten the companion flange and install both axle shafts, bearings, and cups. Then install the differential inspection cover (use a new gasket) and fill the differential with the correct amount of Studebaker Hypoid Lubricant or any S.A.E. 90 hypoid lubricant manufactured by a reputable oil company.

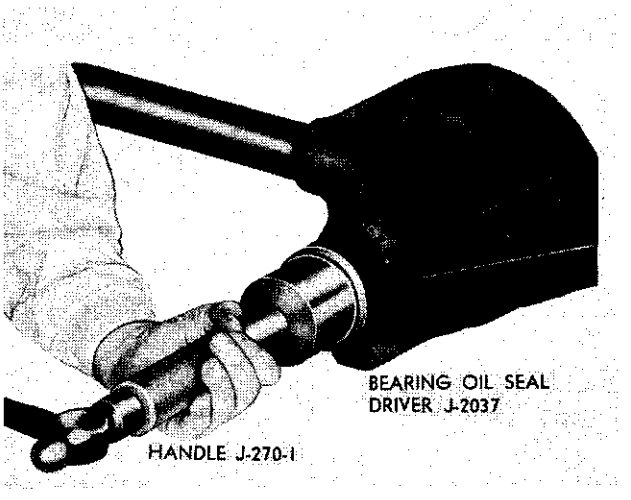


FIG. 300

Rear Axle Assembly Installation

CHAMPION AND COMMANDER Place the axle housing over the rear spring center bolts in the holes provided in the axle housing spring seats and install all spring to housing U-bolts, plates, lock washers, and nuts. Using a tension wrench, tighten the nuts to 47-50 foot-pounds (6,300-6,915 kilogram-meters) torque on the Champion and to 80-85 foot-pounds (11,064-11,756 kilogram-meters) torque on the Commander. Then connect both rear shock absorber links to the spring plates and the universal joint to the rear axle companion flange.

Using new grease retainers and the proper selection of adjusting shims, install both rear brake backing plates. The backing plate bolts should be tightened to 35-40 foot-pounds (4,841-5,532 kilogram-meters) torque. Then test the rear axle shaft end play with a dial indicator. (See "Rear Axle Shaft" in this section.)

Fasten the hydraulic brake line to the axle housing and connect the parking brake cable. Then install the hub and drum assemblies and the rear wheels.

Lower the car to the floor, tighten both rear axle nuts to 120-130 foot-pounds (16,596-17,979 kilogram-meters) torque, and install new cotter pins. Then tighten the rear wheel nuts and install the hub covers.

REAR AXLE DIAGNOSIS

REAR AXLE AND DIFFERENTIAL CARRIER ASSEMBLY NOISE

DESCRIPTION

Rear axle noise is usually apparent as a hum in moderated cases or as a growl in severe cases. Very often a rear axle which is noisy when the engine is driving the car will be quiet when the car is coasting, or vice versa.

Difficulties with rear wheel bearings, universal joints, muffler, or tire noise are often improperly diagnosed as rear axle and differential carrier noise. The possibility of an incorrect diagnosis of these difficulties is great and must not be disregarded.

CAUSES

1. Insufficient lubricant in housing.
2. Use of poor quality or incorrect grade of lubricant.
3. Rear wheel bearings scored or rough.
4. Ring gear and pinion not correctly adjusted to provide ideal tooth contact.
5. Ring gear and pinion not matched.
6. Ring gear or pinion teeth badly worn, scuffed, chipped, or improperly cut.
7. Excessive or insufficient ring gear backlash.
8. Loose pinion bearings.
9. Loose differential side bearings.
10. Pitted or broken pinion or differential bearings.
11. Ring gear does not run true (intermittent hum).
    - *a)* Loose or broken differential bearings.
    - *b)* Differential side gears tight in differential case.
    - *c)* Ring gear bolts drawn up unevenly.
    - *d)* Warped ring gear.
    - *e)* Foreign substance between ring gear and differential case.
12. Carrier assembly noisy on turns only, resulting from:
    - *a)* Differential pinion gears tight on cross or pinion shaft.
    - *b)* Differential side gears tight in differential case.
    - *c)* Differential pinion or side gears chipped, scuffed, or otherwise damaged.
    - *d)* Differential side gears or case thrust bearings rough, scored, or otherwise damaged.
    - *e)* Excessive backlash between differential gears and differential pinions.

RAPID REAR AXLE LUBRICANT LOSS

CAUSES

1. Loss at rear axle shafts.
    - *a)* Lubricant level too high in rear axle housing.
    - *b)* Incorrect grade or poor quality of lubricant.
    - *c)* Rear axle shaft grease retaining felts improperly installed or badly worn.
    - *d)* Rear wheel bearing retainer loose on end of housing.
    - *e)* Rear wheel bearing gasket damaged or improperly installed.
    - *f)* Cracked rear axle housing.

2. Loss at rear axle pinion shaft.
   a) Lubricant level too high in rear axle housing.
   b) Incorrect grade or poor quality of lubricant used.
   c) Pinion oil seal improperly installed or badly worn.
   d) Pinion oil seal retainer distorted, loose in housing, or improperly installed.
   e) Lubricant return passage in carrier housing restricted.
   f) Universal joint companion flange hub rough, scored, or out of round.
   g) Universal joint companion flange loose on pinion shaft.
   h) Forward end of pinion carrier tilted downward by use of wedges at spring seats.

PROPELLER SHAFT DOES NOT ROTATE — ENGINE RUNNING AND TRANSMISSION IN GEAR

CAUSES

1. Engine clutch slippage.
2. Overdrive cam and rollers slipping.
3. Transmission pinion or mainshaft broken.
4. Transmission gear teeth stripped.
5. Transmission main shaft flange key sheared.
6. Gear shift forks broken.

REAR WHEELS WILL NOT ROTATE — ENGINE RUNNING, TRANSMISSION IN GEAR, AND PROPELLER SHAFT ROTATING

CAUSES

1. Rear axle shaft key sheared.
2. Rear axle shaft broken.
3. Rear axle pinion flange key sheared.
4. Ring gear or pinion teeth stripped.
5. Differential side gear or differential pinion teeth stripped.
6. Differential pin or cross broken.
7. Propeller shaft rear yoke welds broken loose and yoke turning inside propeller shaft tubing.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

SPRINGS AND SHOCK ABSORBERS

The springs on the Champion and Commander models have tapered leaves which, being shot-peened on the tension side, reduce the stresses and increase the fatigue life. The front springs are equipped with four wood liners and the rear springs each have three wood liners. These liners are inserted between the longest leaves. If a spring is disassembled, all leaves and liners should be thoroughly cleaned and should be liberally coated on both sides with a graphite spring lubricant.

The procedure for the removal and installation of the front spring is included in the section, "Front Suspension and Steering System."

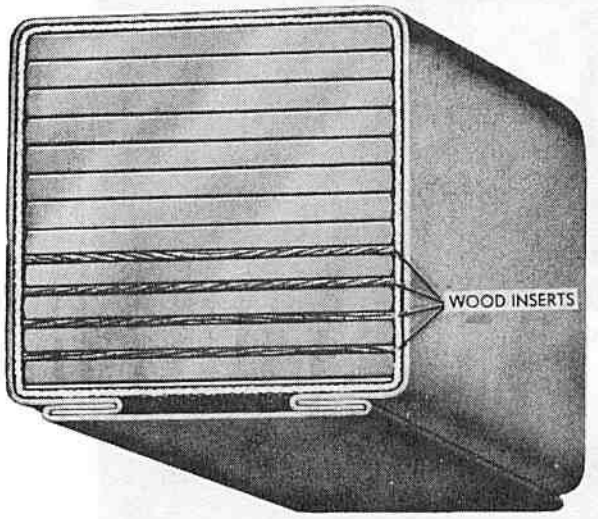


FIG. 301.—CONSTRUCTION OF THE FRONT SPRING

The Champion and Commander models are equipped with Houdaille shock absorbers, which control the spring action at both the front and rear springs. All shock absorbers on the Champion and the front absorbers on the Commander are manually adjustable. The rear shock absorbers on the Commander, being thermostatically controlled, equally restrict rebound at all temperatures. They can, however, be manually adjusted with Tool No. T-2860.

The valves in both the manually and thermostatically controlled shock absorbers are adjusted at the factory for average driving conditions, and it is recommended that these settings be maintained. If conditions, however, require increased or decreased shock absorber resistance, further adjustments can be made.

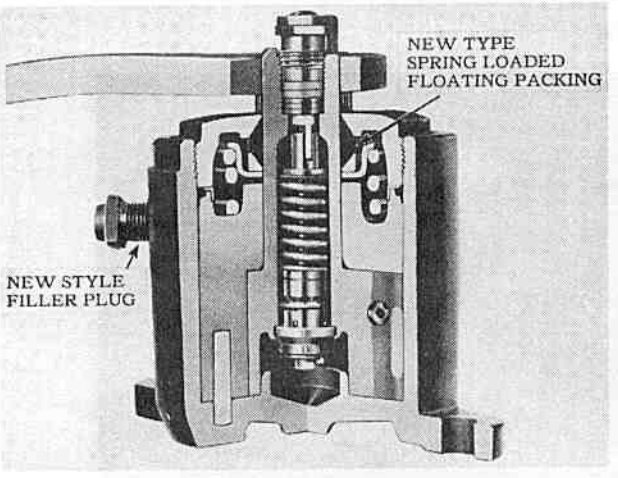


FIG. 302.—CONSTRUCTION OF THE CHAMPION REAR SHOCK ABSORBER

Rear Spring Removal

CHAMPION AND COMMANDER Raise the car and rest it on suitable stands placed under each side of the frame just ahead of the front of each rear spring. Use a hydraulic jack under the center of the axle housing to relieve the spring from the weight of the assembly.

Remove the shock absorber link, disconnect the spring at the front hanger and remove the spring from the axle housing U-bolts. Then disconnect the spring at the rear shackle.

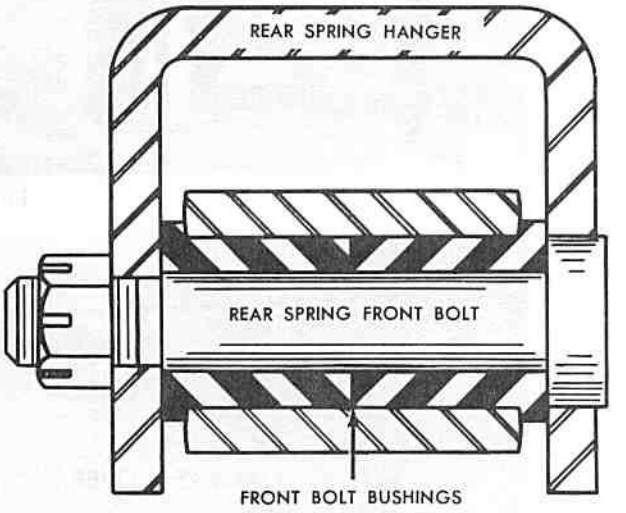


FIG. 303.—CONSTRUCTION OF THE HINGE END OF THE REAR SPRING

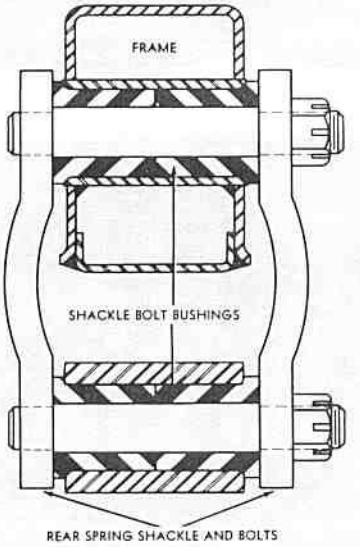


FIG. 304.—CONSTRUCTION OF THE REAR SPRING SHACKLE

Rear Spring Cover Installation

CHAMPION AND COMMANDER The replacement of metal spring covers can be easily accomplished by making an installation fixture similar to the one illustrated in figure 305. To obtain a satisfactory installation of the spring covers, remove the spring from the car, place it in the fixture, and perform the following operations.

Clean all the dirt and rust from the leaves and liberally coat them with Spring Packing Grease S-138 (2 lb. or 8 lb. [0,9072 kg. or 3,629 kg.] can) or S-312 (5 gal. [18,93 liter] can) or its equivalent (see Fig. 305). Do not discard the rebound clips when installing spring covers.

Soak the spring cover canvas in engine oil and wrap the canvas around the spring (see Fig. 306). Then place the lower section of the spring cover around the spring and compress the sides of the cover with wood blocks and a C-clamp.

Fit the closing strip over the lips of the covers, and using a wood block, hammer the strip down on the covers. (See Figs. 307 and 308.)

FIG. 305

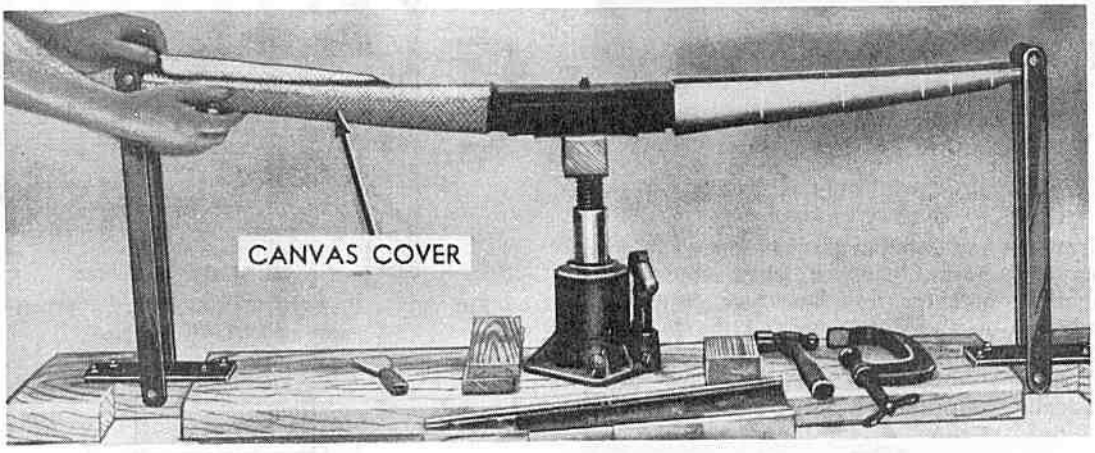


FIG. 306

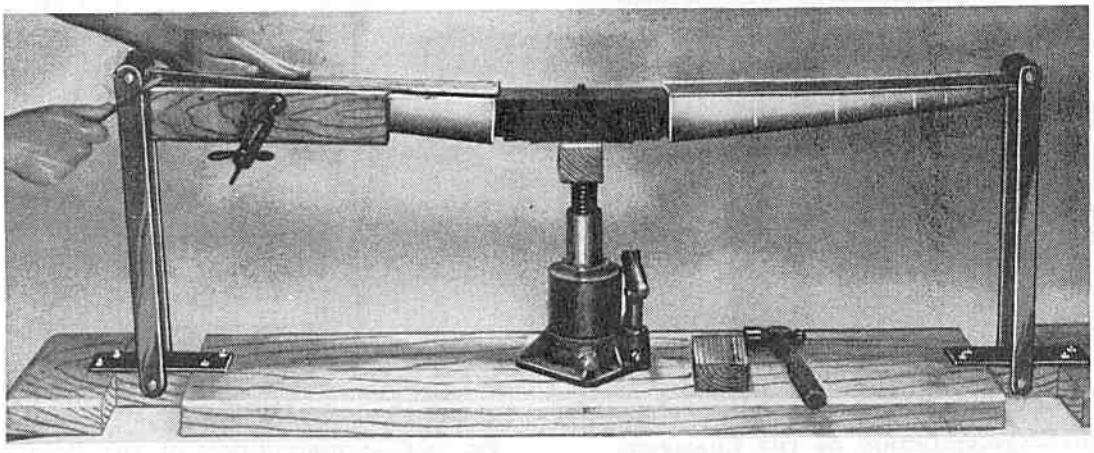


FIG. 307

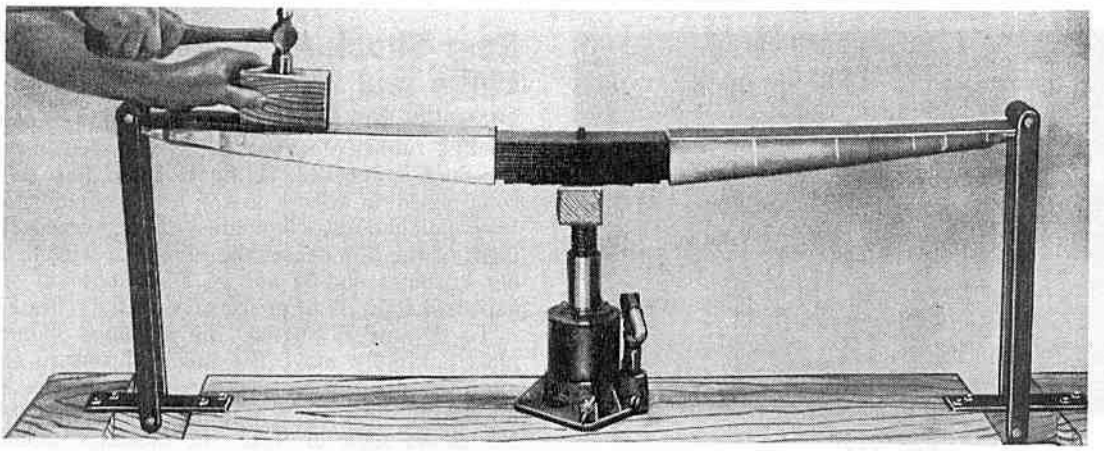


FIG. 308

Rear Spring Installation

CHAMPION AND COMMANDER Install the bushings in the spring eyes and attach the front of the spring to the hanger bracket. *The spring eye which is punch-marked must be installed toward the front of the car.* Then fasten the spring to the rear spring shackle.

Shift the axle housing assembly so that the spring center bolt head is properly centered in the axle housing spring seat. Fasten the spring to the axle housing and tighten the U-bolt nuts.

Connect the shock absorber link. Then remove the stands and lower the car to the floor.

Front Spring Cover Installation

CHAMPION AND COMMANDER Remove and install the front spring as outlined in the section, "Front Suspension and Steering System."

To facilitate the removal and installation of front spring covers, use an adapter, which may be fabricated locally (see Fig. 309), to hold the ends of the main spring leaf in the spring cover installation fixture.

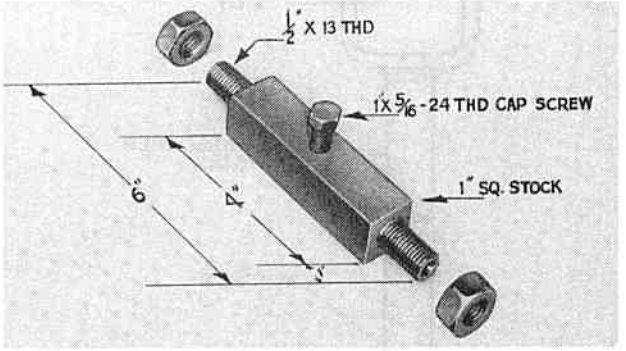


FIG. 309

Remove the bolt from each end of the main spring leaf and cover and bend the ends of the cover away from the spring. Then place the spring in the fixture, insert 5/16" (7,938 mm.) cap screws through the spring main leaf into the lower sides of each adapter, and install the spring cover following the procedure outlined for the rear spring cover installation. After completing the installation, reinstall the two spring cover and main leaf bolts and tighten the nuts securely.

Shock Absorber Adjustment

CHAMPION FRONT AND REAR — COMMANDER FRONT Unless the shock absorber has been previously adjusted, the adjustment pointer will be directly in line with the scribed mark which indicates the original factory setting (see Fig. 310). This mark is located between the two stops on the end of the shaft. Before adjusting the valve, determine whether the owner desires more control or a softer ride. The full range of adjustments lies between the two stops.

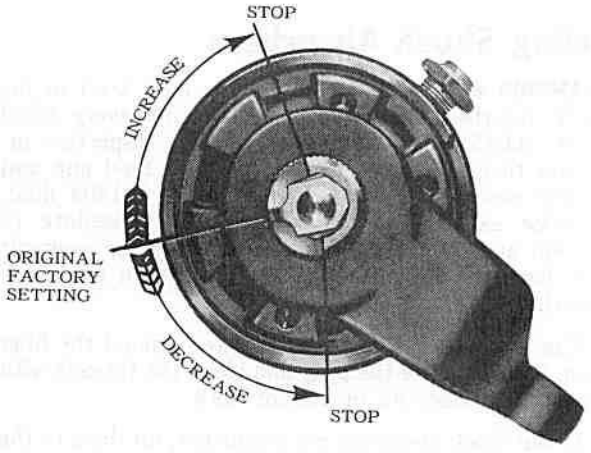


FIG. 310

Increase the resistance by turning the pointer clockwise and decrease it by turning the pointer counterclockwise. No more than a 1/32" (0,794 mm.) adjustment should be made between car tests.

COMMANDER REAR To adjust the thermostatically controlled rear shock absorber, remove the adjustment cover plug and insert Tool No. T-2860. This tool prevents damage to the valve. The adjustment range lies between the "O" (open) and "S" (shut) which are stamped on the machined surface of the shock ab-

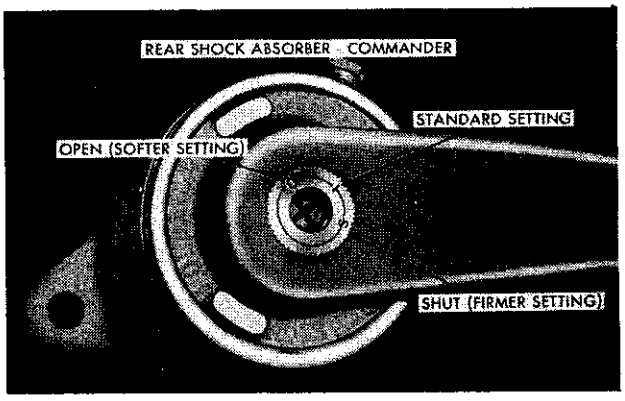


FIG. 311

sorbers. The scribed mark indicates the original factory setting (see Fig. 311). Turning the adjustment clockwise increases the resistance, and turning it counterclockwise decreases the resistance. Not more than a 1/32" (0,794 mm.) adjustment should be made between car tests.

Shock Absorber Fluid

CHAMPION AND COMMANDER Houdaille L-1404, a new type fluid which improves the cold weather performance of shock absorbers, is now used exclusively. This fluid may be used in previous model Houdaille shock absorbers, but the Houdaille 1400 fluid should never be used in the present type shock absorbers.

Filling Shock Absorbers

CHAMPION AND COMMANDER The fluid level in the shock absorbers should be inspected after every 5,000 miles (8.045 km.) of operation. If the inspection indicates that refilling is necessary, use a fluid gun and fill the shock absorbers with Houdaille L-1404 fluid. Exercise extreme caution during this procedure to prevent any foreign matter from entering the reservoir and damaging the internal working parts of the shock absorber.

Use a wire brush to clean the area around the filler plug. Then remove the plug and clean the threads with either compressed air or a clean cloth.

If the shock absorbers are on the car, fill them to the level of the filler plug hole. If the shock absorbers are to be filled off the car, use the following procedure.

Clamp the shock absorber in a vise so that it is in relatively the same position which it occupied on the car. Placing the shock absorber in this position (with filler plug hole at approximately a 45° angle from the vertical position) permits air to remain in the upper part of the shock absorber and prevents overfilling.

Fill the shock absorber with fluid until there is uniform resistance to lever movement and until the fluid flows from the filler hole. These indications show that all air has been expelled from the working chamber and that the shock absorber is full of fluid.

Insert the filler plug, install the shock absorber on the car, and reassemble the connecting links.

Rear Shock Absorber Connecting Links and Mounting Bolts

CHAMPION AND COMMANDER The one-piece connecting link rubber bushings should be inspected every time the fluid is checked. In this type of link the rubber, compressed to adhere to the lever and link or to the lower bolt and link, eliminates friction because the movement of the link causes the rubber to stretch. The rubber bushings should not be lubricated but should be kept free from oil or grease of any kind. (See Fig. 312.)

To determine whether the bushings should be replaced, rapidly move the link end toward the shock absorber and release it immediately. If the link does not spring back to its original position and if the rubber shows signs of wear, the bushings should be replaced. When installing new bushings, be sure that all parts are clean.

To facilitate assembly, dip the ends of the rubber bushings in gasoline (do not use grease, oil, or soapsuds) and spring the sides of the upper yoke approximately 1/8" (3,175 mm.). Insert the steel spacers in the rubber bushings, and after inserting the bushings and spacers in the eye of the lever and in the axle end of the link, attach the link to the shock absorber arm and to the spring plate with the link bolts. Then tighten the nuts until the parts seat firmly against the ends of the spacers. This will compress the rubber bushings into their proper positions.

The shock absorber mounting bolts and the connecting link bolts and nuts on the axle to spring plates should be kept tight at all times.

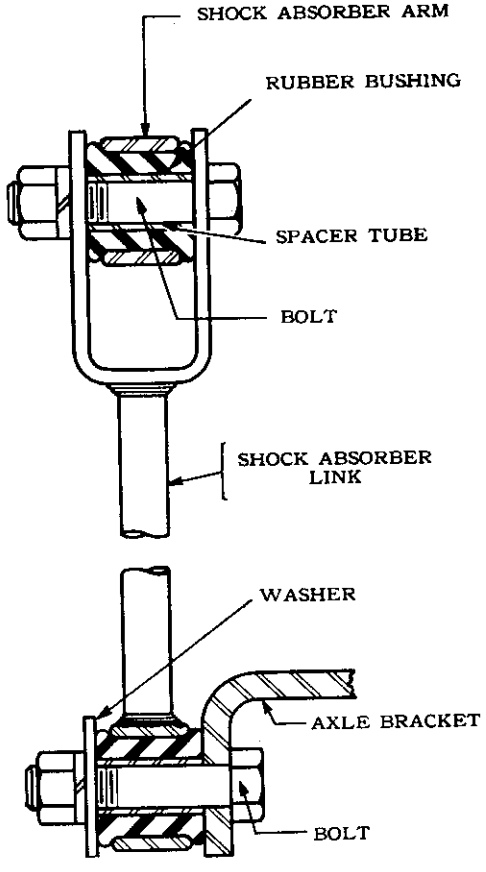


FIG. 312

Front Shock Absorber Grommets and Mounting Bolts

CHAMPION AND COMMANDER A visual inspection will determine the necessity for the replacement of the rubber grommets. Excessive wear is readily apparent. The shock absorber mounting bolts should be kept tight at all times.

Front Shock Absorber

Removal

CHAMPION AND COMMANDER To remove the front shock absorber from the car, raise the respective front side of the car and remove the front wheel. It is not necessary to compress the front spring for this operation.

Remove the nut, lock washer, flat washer, upper retainer, grommet, rebound bumper bolt, and spacer from the upper control arm. Then remove the two shock absorber to frame cap screws and lock washers and tip the shock absorber to remove the lower rubber grommet and retainer from the upper control arm.

Turn the shock absorber 1/2 turn counterclockwise and remove it from the upper control arm (see Fig. 313). It may be necessary in some cases to install a jack under the spring center plate and to remove the jack on the outer end. This allows the outer end of the control arm to drop and permits more clearance for the removal of the shock absorber assembly.

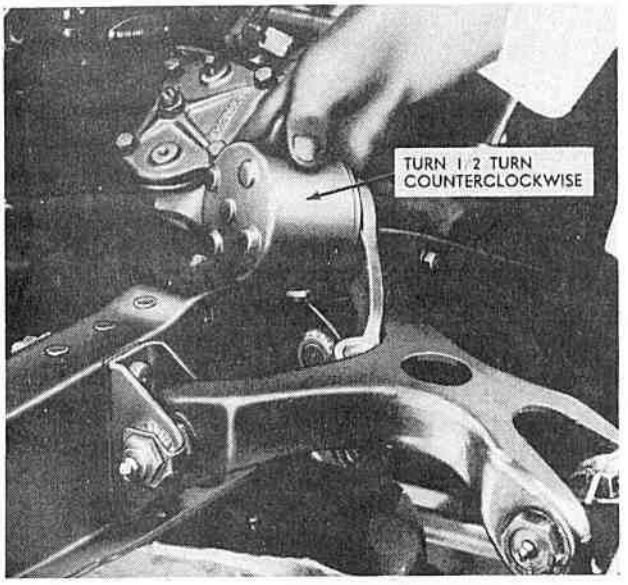


FIG. 313

Installation

CHAMPION AND COMMANDER Place the shock absorber in the position for assembly. Insert the upper control arm rebound bumper bolt, retainer, grommet, and spacer in the hole in the shock absorber arm and install the upper grommet, retainer, flat washer, lock washer, and nut (fasten the nut only fingertight). Then install the two shock absorber to frame cap screws and lock washers, securely tighten the bumper bolt nut, and install the front wheel.

Rear Shock Absorber

Removal

CHAMPION AND COMMANDER Raise the car to provide sufficient ground clearance and remove the top shock absorber link nut, lock washer, bolt, spacer, and rubber bushing. Then remove both shock absorber mounting nuts, lock washers, and bolts.

Installation

CHAMPION AND COMMANDER Install the shock absorber on the frame with both mounting bolts, lock washers, and nuts and insert the rubber bushing and spacer in the shock absorber arm. Then place the shock absorber link in position, insert the bolt through the link into the bushing and spacer assembly, and install the lock washer and nut. Tighten both mounting bolts and the shock absorber link bolt securely and lower the car to the floor.

SPRING AND SHOCK ABSORBER DIAGNOSIS

CHASSIS SPRINGS SAG OR BOTTOM

CAUSES

1. Unusually severe operation or excessive overloading.
2. Improperly functioning shock absorbers.
3. Spring leaves broken.

CHASSIS SPRING NOISES

CAUSES

1. Loose U-bolts permitting abnormal side movement of leaves and interference with metal covers.
2. Spring covers damaged, loose, or improperly installed.
3. Axle to frame bumper not of correct type or omitted.
4. Sprung frame or bent frame horn causing misalignment of springs.

ABNORMAL CHASSIS SPRING BREAKAGE

CAUSES

1. Unusually severe service or excessive overload.
2. Spring U-bolts loose (breakage near center bolt).
3. Spring center bolt loose (breakage at center bolt).
4. Improperly functioning shock absorbers (breakage of main leaf).

SPRING SHACKLE NOISES

CAUSES

1. Spring shackle pins or hinge pins loose in spring ends or in frame brackets.
2. Spring hangers loose on frame, bent, or broken.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

TRANSMISSION

Replacing the transmission assembly may sometimes be preferred to repairing the original one. We recommend that the following procedure be used:

1. A transmission on a 1947 model which is within the warranty period should be replaced with a new one obtained from the Parts and Accessories Division or from your Parts Depot. If replacement is not necessitated by abuse or neglect, the original transmission must be returned for credit, transportation charges prepaid, within thirty days from date of replacement. The unit must be tagged with a B866 Claim Parts Tag properly filled out, accompanied by a properly executed B865 Claim Form, and returned either to your nearest Parts Depot or to the Claims Division in South Bend.

2. Write the General Service Department describing any transmission difficulty encountered on a 1947 model which is beyond the warranty period. Instructions concerning repairs or replacement will be sent to you immediately.

3. Transmissions on the 1941 and 1942 models and on the 5G Skyway Champion should not be repaired in your service department unless your men are certain of their diagnosis and you are willing to guarantee their work to the customers. Ordinarily, if pertinent information is furnished, a special exchange price will be granted by the Claims Division.

Removal of Conventional and Overdrive Transmissions

CHAMPION AND COMMANDER For the removal or replacement of any of the internal parts, the transmission must be removed from the car.

After draining the transmission case, unfasten the parking brake cable and place it in an out-of-the-way position. Disconnect the universal joint from the transmission companion flange and detach the propeller shaft support assembly from the center frame cross member. Then move the front propeller shaft and support assembly rearward on the rear propeller shaft splines.

Disconnect the shift rods from the shift levers and detach the speedometer cable at the transmission case. Then remove the speedometer pinion. If the car is equipped with an overdrive transmission, detach the two wires from the overdrive solenoid, remove the wire from the lockout switch, and disconnect the control cable from the overdrive shift shaft lever and the conduit bracket. Remove the cap screws which hold the transmission case to the clutch housing. The transmission can then be easily removed.

Conventional Transmissions

● The conventional transmission used on the Champion and Commander models provides three speeds forward and one reverse. The helical type transmission gears insure quiet operation and long life, and a synchronizer assembly provides silent shifting into second and high speed gears. An interlock assembly determines the position of the shift levers and prevents the simultaneous shifting into two gears.

Gear ratios for the various speeds are listed in the section, "General Specifications."

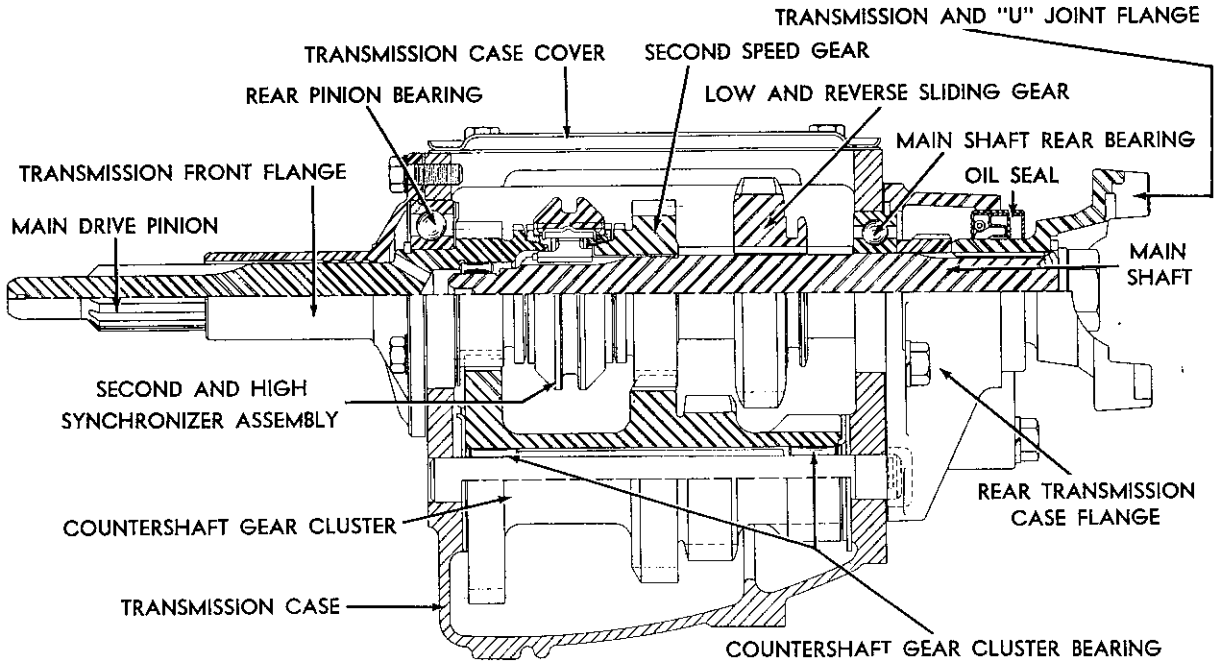


FIG. 314.—CONSTRUCTION OF THE CHAMPION COMMANDER CONVENTIONAL TRANSMISSION

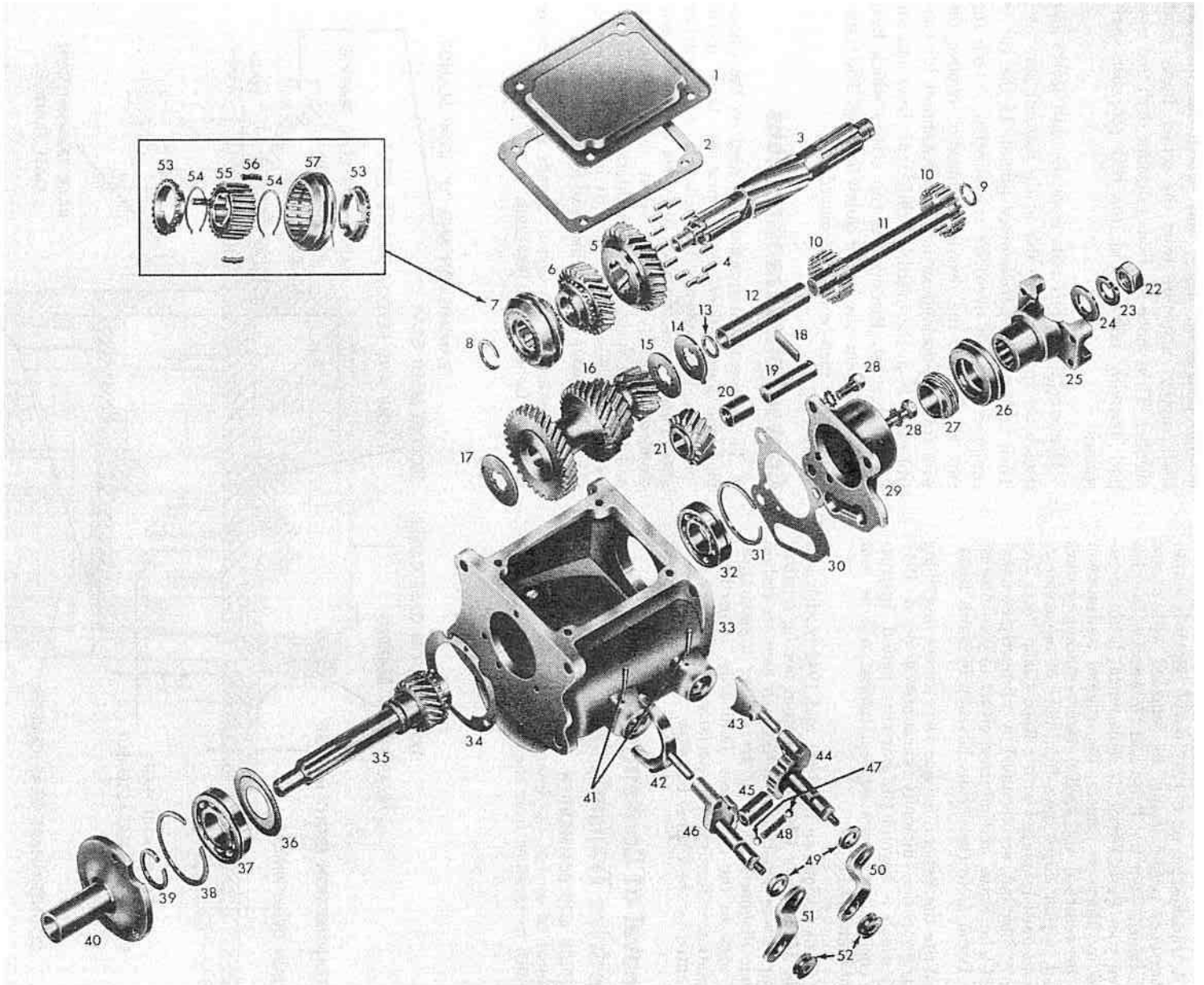


FIG. 315.—PARTS OF THE CHAMPION AND COMMANDER CONVENTIONAL TRANSMISSION

Disassembly

CHAMPION AND COMMANDER Remove the stamped transmission cover, the front flange, and the large snap ring from the pinion bearing. Then, using Snap Ring Removing Pliers No. 614, remove the small snap ring from the pinion bearing.

Remove the rear pinion bearing with Puller Plate J-1298 and Puller HM-925. Use the Transmission Synchronizer Ring Protector, J-2040 for the Champion and J-2039 for the Commander, to take up the thrust and prevent possible damage to the synchronizer (see Fig. 316). The rear pinion bearing oil slinger can then be easily removed.

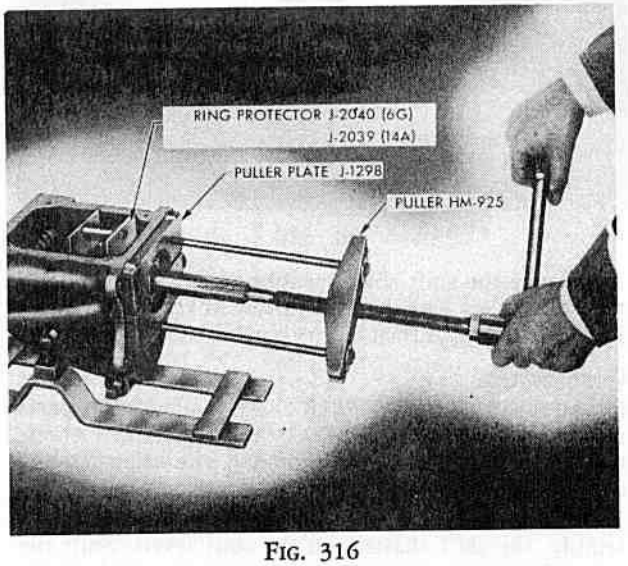


FIG. 316

Using Companion Flange Holding Tool J-2035 and Companion Flange Puller J-2046, remove the companion flange nut and the companion flange. Then remove the rear transmission flange from the main case (note position of long cap screw), remove the oil seal from the flange, and slide the speedometer drive gear off the shaft.

Mark the two synchronizer blocking rings, the synchronizer gear, and the synchronizer sleeve so that the parts of the synchronizer assembly may be reassembled in their original positions (see Fig. 317). Raise the pinion over the countershaft gear, pull the main shaft and bearing rearward, and remove the pinion from the

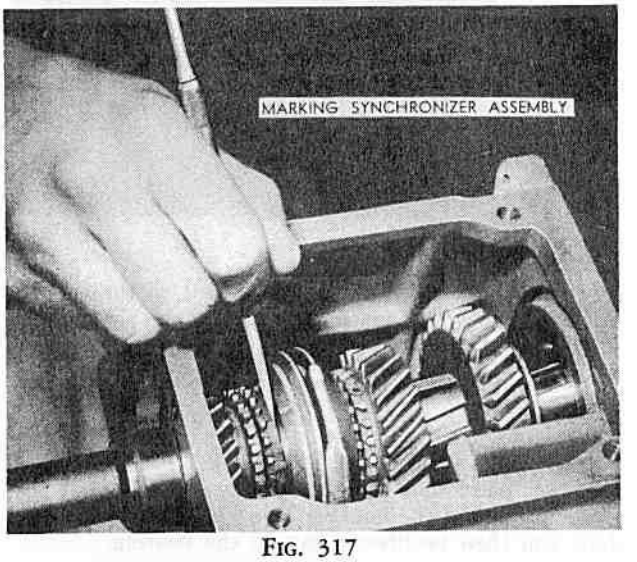


FIG. 317

KEY TO PARTS OF CONVENTIONAL TRANSMISSION IN FIGURE 315

1. TRANSMISSION CASE COVER
2. TRANSMISSION COVER GASKET
3. MAIN SHAFT
4. MAIN SHAFT FRONT BEARING ROLLERS
5. LOW AND REVERSE SLIDING GEAR
6. SECOND SPEED GEAR AND BUSHING
7. SYNCHRONIZER ASSEMBLY
8. SNAP RING
9. WASHER
10. COUNTERSHAFT CLUSTER BEARING ROLLERS
11. COUNTERSHAFT
12. TUBULAR SPACER
13. WASHER
14. THRUST WASHER, REAR OF REAR, GEAR CLUSTER
15. THRUST WASHER, FRONT OF REAR, GEAR CLUSTER
16. COUNTERSHAFT GEAR CLUSTER
17. THRUST WASHER, FRONT, COUNTERSHAFT GEAR CLUSTER
18. REVERSE IDLER AND COUNTERSHAFT LOCK PLATE
19. REVERSE IDLER GEAR SHAFT
20. REVERSE IDLER GEAR BUSHING
21. REVERSE IDLER GEAR
22. FLANGE NUT
23. LOCK WASHER
24. PLAIN WASHER
25. UNIVERSAL JOINT FLANGE
26. REAR FLANGE OIL SEAL
27. SPEEDOMETER GEAR
28. REAR FLANGE SCREW AND WASHER
29. REAR TRANSMISSION FLANGE
30. REAR TRANSMISSION FLANGE GASKET
31. SNAP RING, LARGE
32. MAIN SHAFT REAR BEARING
33. TRANSMISSION CASE
34. FRONT TRANSMISSION FLANGE GASKET
35. MAIN DRIVE PINION
36. REAR PINION BEARING OIL SLINGER
37. REAR PINION BEARING
38. SNAP RING, LARGE
39. SNAP RING, SMALL
40. FRONT TRANSMISSION CASE FLANGE
41. SHIFT SHAFT LOCATING PINS
42. SECOND AND HIGH GEARSHIFT FORK
43. LOW AND REVERSE GEARSHIFT FORK
44. LOW AND REVERSE SHIFT LEVER AND SHAFT
45. SHIFT LEVER INTERLOCK SLEEVE
46. SECOND AND HIGH SHIFT LEVER AND SHAFT
47. INTERLOCK BALL BEARING
48. INTERLOCK SPRING
49. INNER SHIFT LEVER SHAFT OIL SEAL
50. LOW AND REVERSE OUTER SHIFT LEVER
51. SECOND AND HIGH OUTER SHIFT LEVER
52. OUTER SHIFT LEVER INSULATOR
53. SECOND AND HIGH SYNCHRONIZER BLOCKING RING
54. SNAP RING
55. SECOND AND HIGH SYNCHRONIZER GEAR
56. SYNCHRONIZER SHIFTER PLATE
57. SECOND AND HIGH SYNCHRONIZER SLEEVE

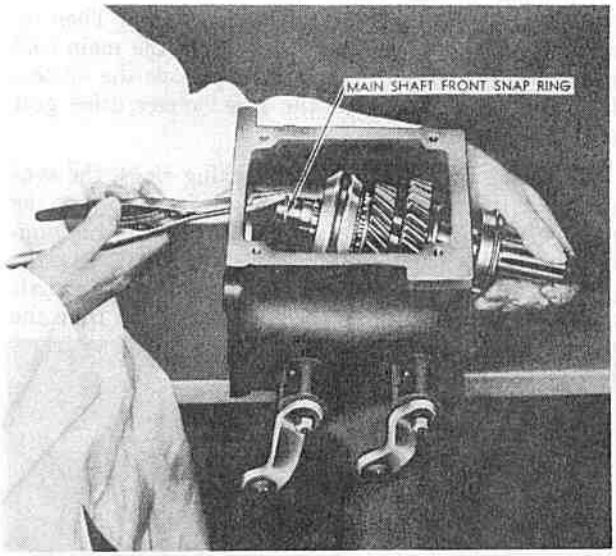


FIG. 318

case. Then, by cocking the main shaft to the side as far as possible, disengage and remove the shift forks.

Remove the main shaft front snap ring to permit the removal of the synchronizer assembly and the main shaft gears (see Fig. 318). Snap ring removing pliers are recommended for this operation. After removing the snap ring, support the synchronizer and main shaft gears by hand and pull the main shaft through the gears and out of the housing (see Fig. 319). The main shaft can then be pressed out of the bearing.

Remove the reverse idler and countershaft lock plate. To facilitate the reassembly of the needle bearings and cluster gear on the countershaft, drive the countershaft out of the rear of the case with a dummy shaft (see Fig. 320). Then remove the countershaft gear cluster and the three thrust washers. Carefully note the positions of these washers to avoid misplacement during reassembly. After removing the countershaft assembly, remove the reverse idler gear by driving the idler gear shaft out of the rear of the case.

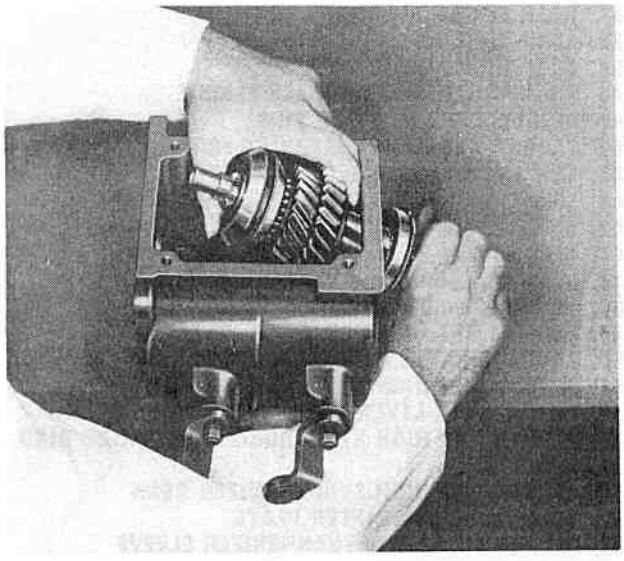


FIG. 319

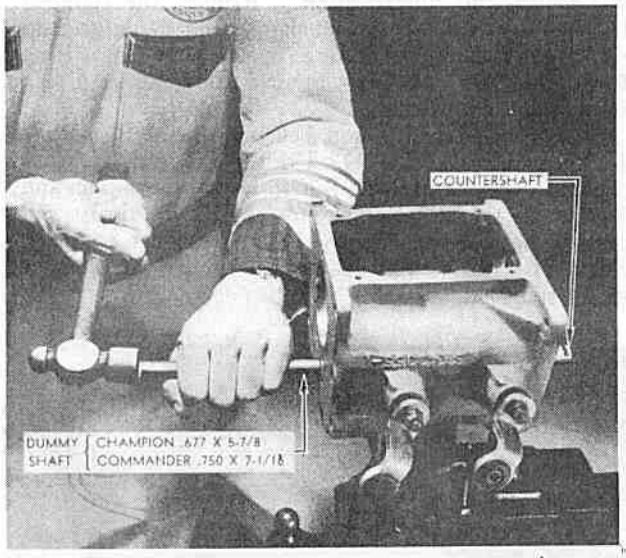


FIG. 320

Remove the shift shaft locating pins (see Fig. 321), the shift levers and shafts, and the oil seals. The interlock assembly can then be easily removed.

Reassembly

CHAMPION AND COMMANDER All transmission parts should be inspected for wear or damage and, if necessary, replaced. When reassembling the transmission, always install new gaskets and oil seals.

Install new shift shaft oil seals, the interlock assembly, the shift shafts, and the shift levers. Shift the transmission into any gear and, with one end of the interlock sleeve against a shift shaft cam, the clearance between the other end of the sleeve and the cam on the other shaft should be between .001″ and .005″ (0,025 mm. to 0,130 mm.). Interlock sleeves of different lengths are available at your nearest Parts Depot. After installing the correct interlock sleeve, lock the shift levers in place with the shift shaft locating pins.

To install the reverse idler gear, place the gear in position and drive in the idler shaft from the rear of the case.

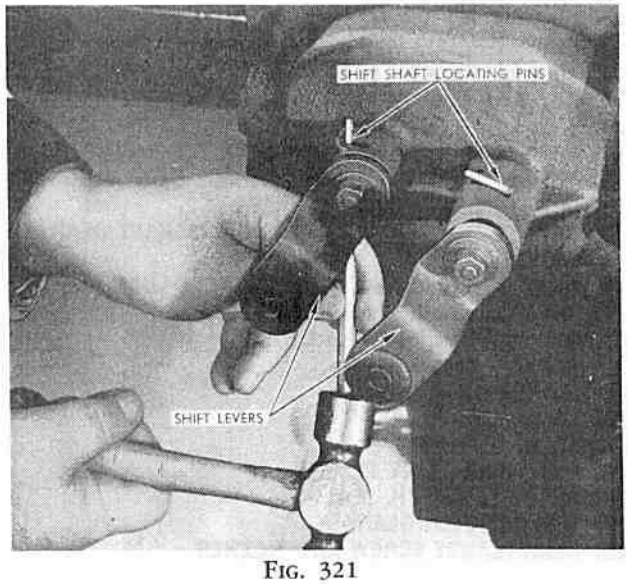


FIG. 321

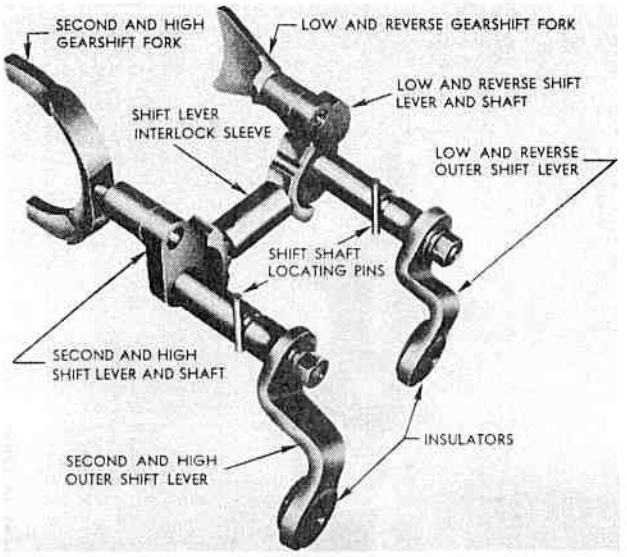


FIG. 322

Figure 322 shows the relative positions of the parts of the shifter mechanism when it is installed in the case.

Using a dummy shaft to hold the needle bearings, spacer, and thrust washers in place, install the countershaft gear assembly. The countershaft must be driven in from the rear of the case with a drift. Align the slots

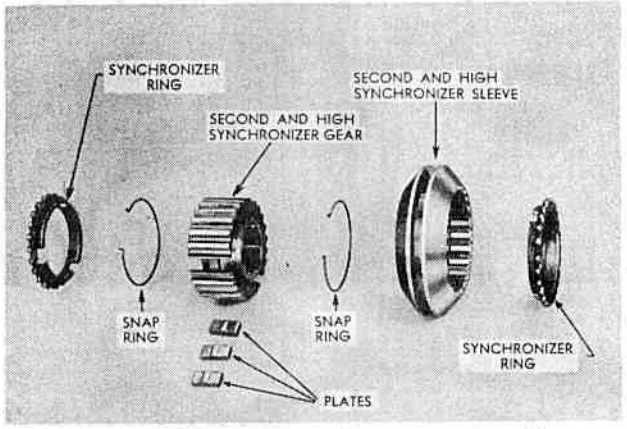


FIG. 323.—PARTS OF THE SYNCHRONIZER GEAR AND SLEEVE ASSEMBLY

in the countershaft and the idler gear shaft, and insert the reverse idler and countershaft lock plate.

Assemble the synchronizer gear and sleeve assembly, being sure that the gear and sleeve are in their original positions (observe marks made during disassembly). The identical ends of the two 2-3/16″ (55,56 mm.) snap rings should be hooked in the same detent plates.

Press the rear bearing on the main shaft and insert the main shaft through the opening in the rear of the case. Install the main shaft gears, the synchronizer assembly, and the main shaft front snap ring, and insert and engage the shift forks. Be sure that the synchronizer blocker rings, which were marked during disassembly, are installed in their original positions.

Insert the main shaft front bearing rollers in the pinion. A coat of Lubriplate will hold them in position. Then install the pinion on the main shaft.

Slide the speedometer drive gear on the main shaft. Using Transmission Rear Flange Oil Seal Driver J-2038, install a new oil seal in the rear flange (see Fig. 324).

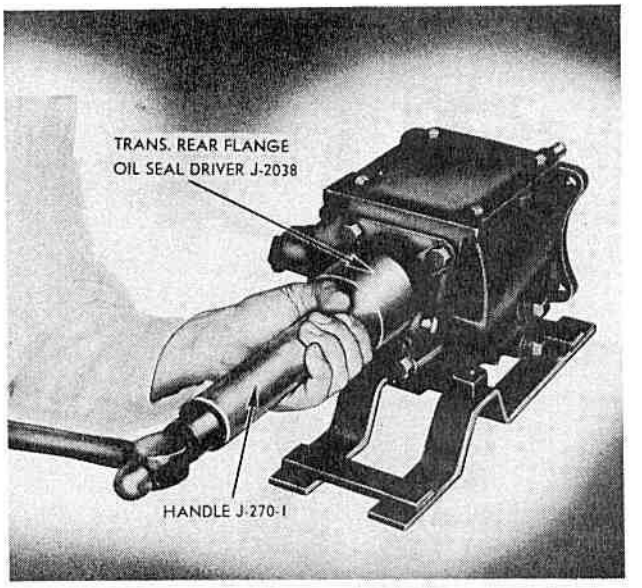


FIG. 324

NOTE.—The oil seal may also be installed with the rear flange on the transmission case. After replacing the oil seal, install the rear flange on the main case (long cap screw in lower right hole).

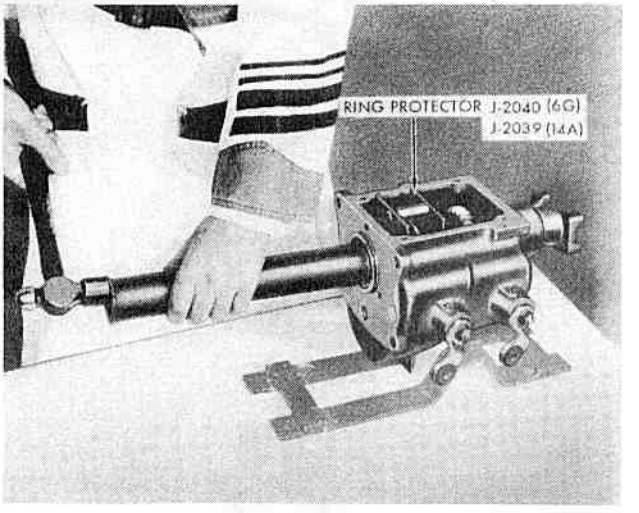


FIG. 325

Install the oil slinger on the pinion with the concave side facing the pinion gear. Fitting a section of pipe against the inner bearing race, drive the pinion bearing on the pinion and into the case (see Fig. 325). When installing the pinion bearing, use the Transmission Synchronizer Ring Protector, J-2040 for the Champion or J-2039 for the Commander, to take up the thrust and prevent possible damage to the synchronizer.

Install the small snap ring on the pinion bearing, using snap ring removing pliers. Then install the pinion bearing large snap ring, the front flange, and the transmission cover.

Fit the companion flange on the main shaft splines, install the companion flange washers and nut, and tighten the nut securely.

NOTE.—If the companion flange nut is not tightened sufficiently, the speedometer drive gear will rotate on the main shaft.

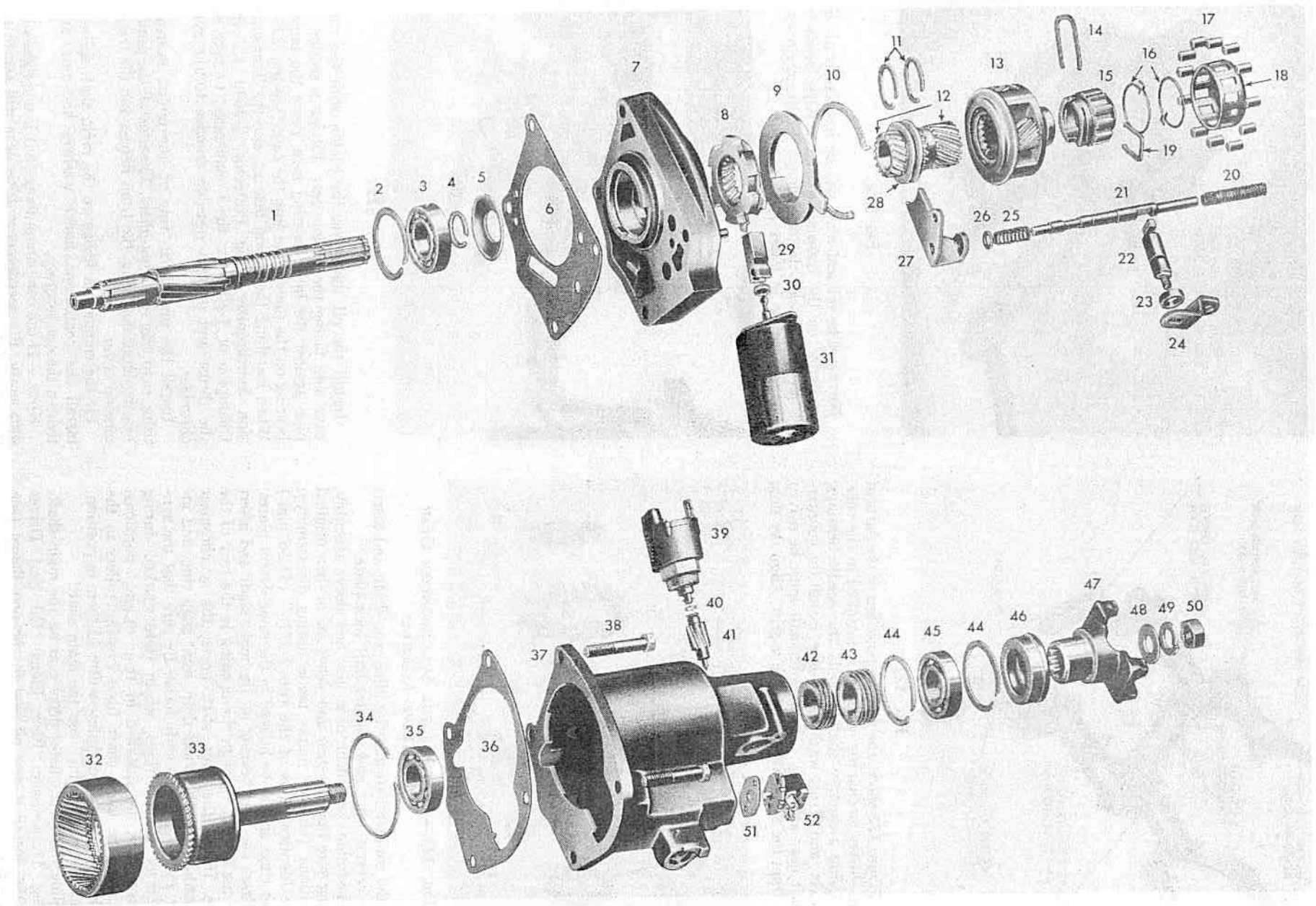


FIG. 326.—PARTS OF THE CHAMPION AND COMMANDER OVERDRIVE TRANSMISSION

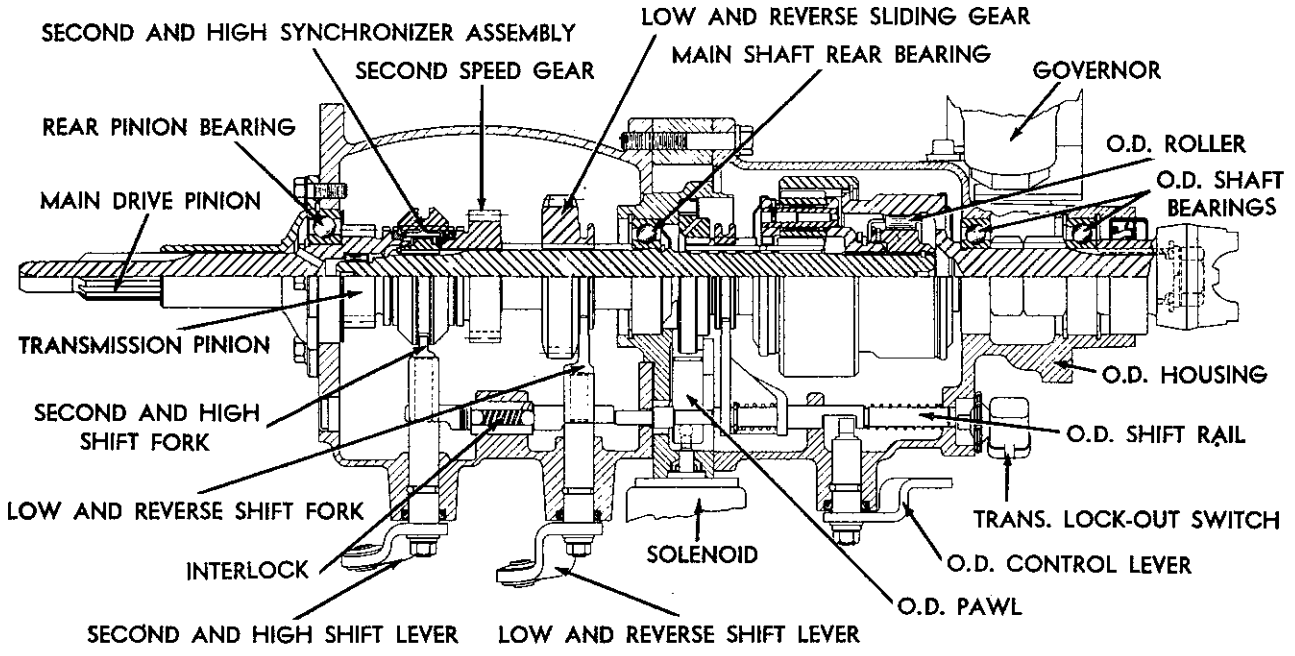


FIG. 327.—CONSTRUCTION OF THE CHAMPION AND COMMANDER OVERDRIVE TRANSMISSION

KEY TO PARTS OF OVERDRIVE TRANSMISSION IN FIGURE 326

1. TRANSMISSION MAIN SHAFT
2. SNAP RING, LARGE
3. MAIN SHAFT REAR BEARING
4. SNAP RING, SMALL
5. MAIN SHAFT OIL BAFFLE
6. ADAPTER PLATE GASKET
7. ADAPTER PLATE
8. PLATE AND BLOCKING RING
9. SUN GEAR COVER PLATE
10. ADAPTER SNAP RING
11. SNAP RING
12. SUN GEAR
13. OD. PINION CAGE
14. RETAINING CLIP
15. FW. CLUTCH CAM
16. CLUTCH ROLLER RETAINER SPRING
17. FW. CLUTCH CAM ROLLERS
18. FW. CLUTCH ROLLER RETAINER
19. RETAINING CLIP
20. OD. SHIFT RAIL REVERSE LOCKUP SPRING
21. OD. SHIFT RAIL
22. OD. SHIFT SHAFT
23. OD. SHIFT SHAFT OIL SEAL
24. OD. SHIFT SHAFT LEVER
25. OD. SHIFT RAIL SPRING
26. WASHER
27. OD. SHIFT FORK
28. SUN GEAR SHIFTING COLLAR
29. SOLENOID PAWL
30. OD. SOLENOID PAWL OPERATING ROD OIL SEAL
31. OD. SOLENOID
32. OD. SHAFT RING GEAR
33. OD. SHAFT
34. SNAP RING
35. OD. SHAFT BEARING
36. OD. HOUSING GASKET
37. OD. HOUSING
38. OD. TO TRANSMISSION CASE SCREW
39. OD. CONTROL GOVERNOR
40. GOVERNOR GEAR SNAP RING
41. OD. CONTROL GOVERNOR GEAR (ON GOVERNOR)
42. OD. CONTROL GOVERNOR GEAR (ON OD. SHAFT)
43. SPEEDOMETER GEAR
44. SNAP RING
45. OD. SHAFT BEARING
46. OD. HOUSING REAR OIL SEAL
47. UNIVERSAL JOINT FLANGE
48. PLAIN WASHER
49. LOCK WASHER
50. NUT
51. OD. CONTROL LOCKOUT SWITCH GASKET
52. OD. CONTROL LOCKOUT SWITCH

Overdrive Transmission

● The purpose of the overdrive is to reduce the engine revolutions at high car speeds. When the overdrive cuts in, the engine speed is automatically reduced approximately 30 per cent.

The overdrive transmission is divided into two parts, the main case and the overdrive case. The internal parts of both the main case and the conventional transmission case are similar. The fundamental shifting into three speeds forward and one in reverse is accomplished in the main case.

When the transmission is in conventional drive, the governor circuit is open at the lockout switch and the solenoid pawl is locked in the released position. The drive is through the transmission main shaft, the pinion cage assembly, and the overdrive main shaft to the propeller shaft.

During conventional drive the sun gear, being locked in the pinion cage assembly, prevents the rotation of the pinion gears on the ring gear. The blocker plate rotates freely with the sun gear.

When the overdrive control button is fully depressed, the sun gear is moved forward, the pinion gears are unlocked, and the circuit through the lockout switch is closed. At a speed of approximately 31-1/2 miles (50,68 km.) per hour, the overdrive control governor completes the overdrive relay circuit and energizes the overdrive solenoid. When this occurs, the solenoid pawl is pushed against the blocker ring. The pawl, however, will not engage the blocker plate until the accelerator pedal is released. The torque change, which results when the accelerator is momentarily released, shifts the blocker ring and allows the pawl to engage the blocker plate.

During overdrive operation the drive is through the main shaft to the pinion cage assembly. The pinion gears rotate around the sun gear which is locked in position by the solenoid pawl. This action imparts approximately one-third higher speed to the overdrive main shaft ring gear.

When the car coasts down to speeds below approximately 25-1/2 miles (41,03 km.) per hour, the governor breaks the overdrive relay circuit and de-energizes the overdrive solenoid. This causes the overdrive to disengage and return to conventional gear ratio.

At any time during overdrive operation, conventional ratio may be obtained by pushing the accelerator pedal completely down (past the wide-open throttle position). This breaks the ignition circuit momentarily and the resultant change in torque allows the solenoid to disengage the pawl from the blocker plate.

If reverse gear is used while the overdrive control button is fully depressed, the reverse shift fork moves the overdrive shift rail to the rear, breaking the governor circuit at the lockout switch. The possibility of energizing the solenoid and engaging the overdrive is thus prevented.

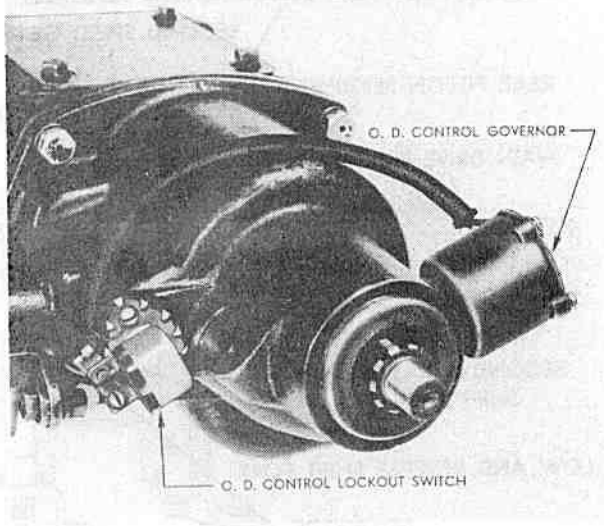


FIG. 328

Disassembly

CHAMPION AND COMMANDER Using Companion Flange Holding Tool J-2035 and Companion Flange Puller J-2046, remove the companion flange nut and the companion flange.

Remove the wire which connects the lockout switch to the governor (see Fig. 328). Then remove the lockout switch and unscrew the governor assembly from the overdrive housing.

Drive out the tapered pin which holds the overdrive shift shaft in the overdrive case (see Fig. 329). Pull out the shift shaft as far as possible to disengage the operating cam from the slotted shift rail.

Remove the four cap screws which hold the overdrive housing to the transmission case. While removing the overdrive housing, lightly tap the end of the overdrive shaft with a lead or rawhide mallet. Doing this prevents the shaft from coming off with the housing and spilling the free wheeling rollers.

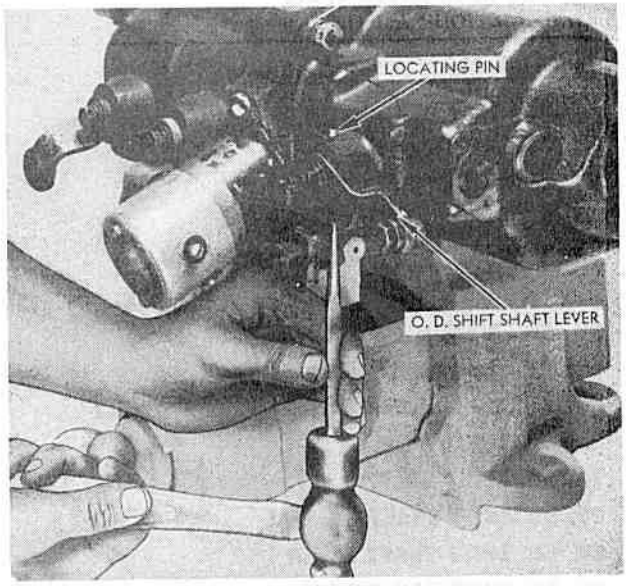


FIG. 329

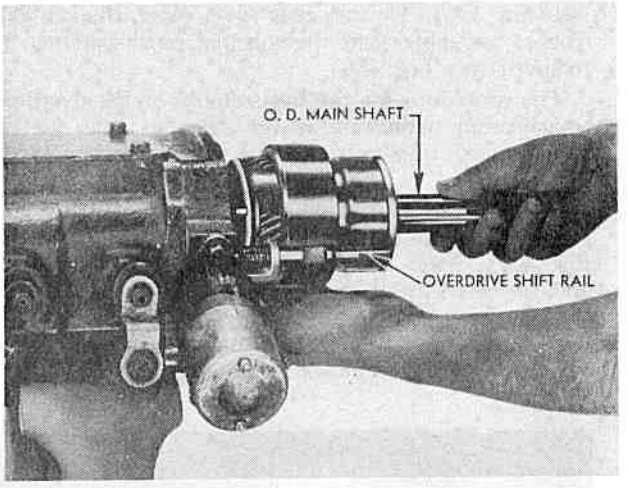


FIG. 330

Remove the reverse lockup spring from the housing, the shift shaft lever from the shift shaft, and the shift shaft from the inside of the case. The removal of the shift shaft oil seal is then easily accomplished.

Using a brass drift, drive the overdrive shaft front bearing out of the front of the housing and remove the governor and speedometer drive gears. Removing the rear flange oil seal then permits the removal of the two snap rings and the overdrive shaft rear bearing.

Install one cap screw to hold the adapter plate to the main case. Then remove the overdrive main shaft catching the free wheeling rollers in one hand (see Fig. 330). Removing the large snap ring will then permit the removal of the ring gear from the overdrive shaft.

Removing the retaining clip at the end of the free wheeling cam permits the removal of the free wheeling unit and the pinion cage assembly (see Fig. 331). To remove the free wheeling unit from the pinion cage assembly, remove the retaining clip which holds the two units together (see Fig. 332). Then remove the overdrive sun gear and shift rail assembly (see Fig. 333).

Remove the overdrive solenoid by taking off the cap screws and lock washers and turning the solenoid clockwise one-quarter turn (see Fig. 334).

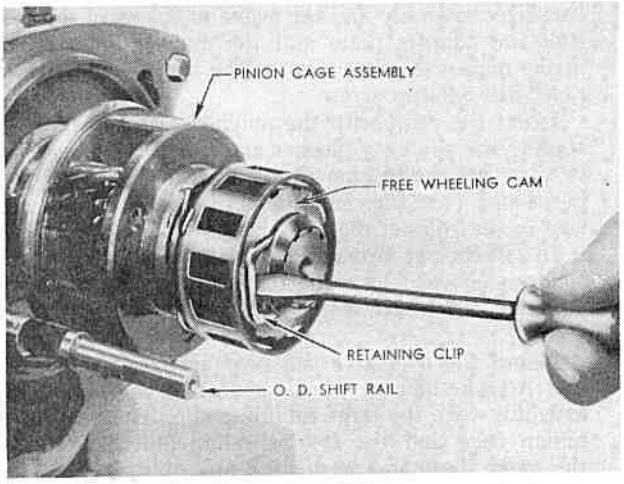


FIG. 331

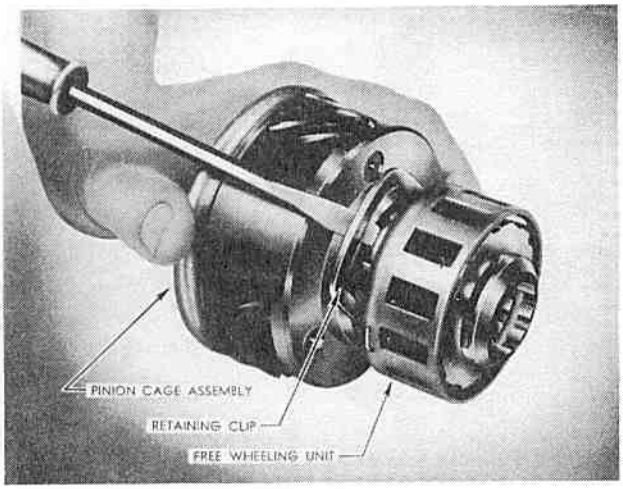


FIG. 332

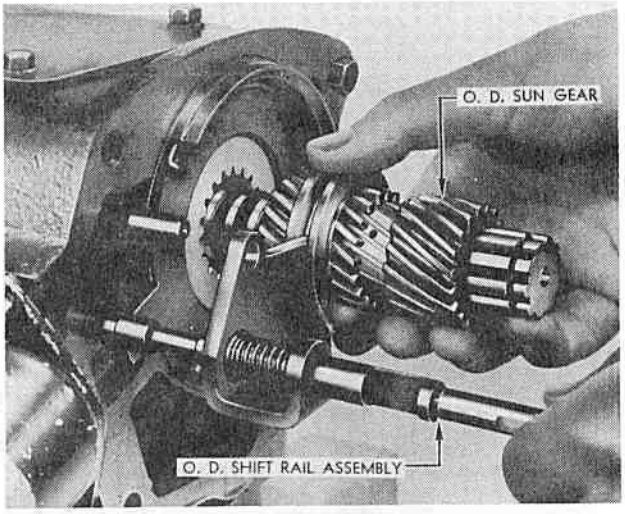


FIG. 333

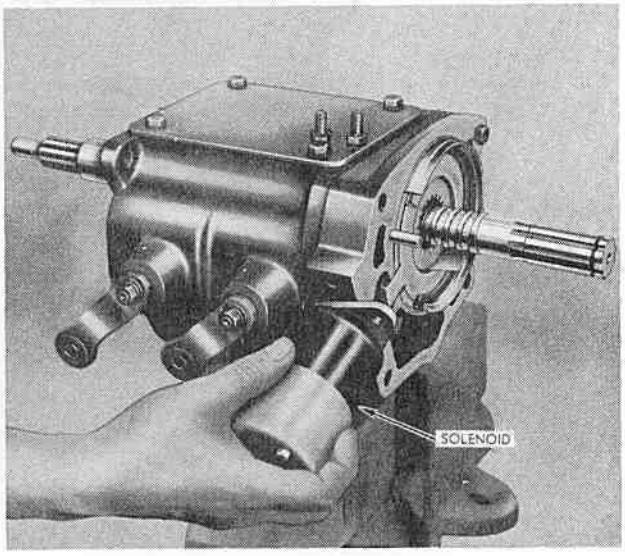


FIG. 334

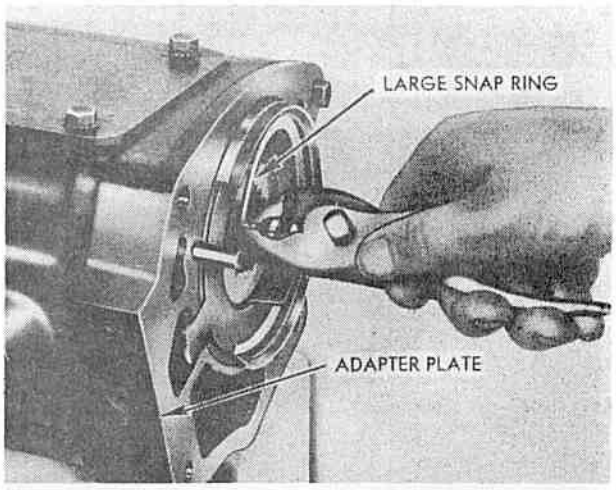


FIG. 335

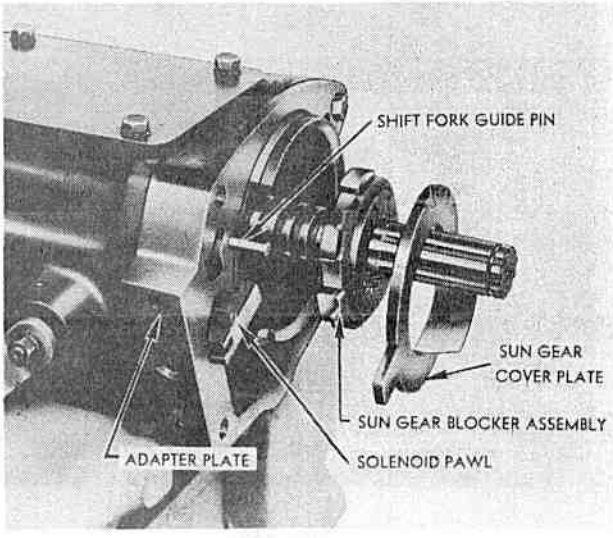


FIG. 336

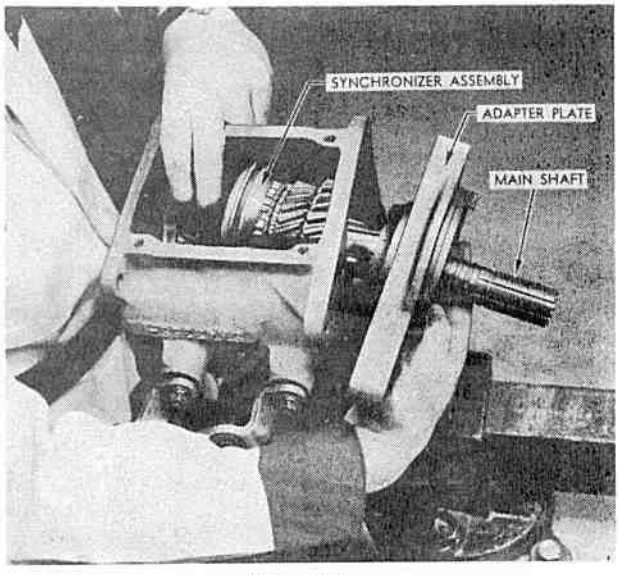


FIG. 337

Remove the large snap ring from the adapter plate (see Fig. 335). The sun gear cover plate, the sun gear blocker assembly, and the solenoid pawl can then be removed (see Fig. 336).

The procedure for the disassembly of the overdrive transmission main case is the same as that for the conventional transmission, with the following exceptions:

Remove the main shaft, adapter plate, gears, and synchronizer assembly from the case as a unit (see Fig. 337). After removing the synchronizer assembly and the gears from the main shaft, remove the main shaft rear bearing large snap ring (see Fig. 338). Then pull the adapter plate off the main shaft rear bearing and remove the oil slinger from the adapter plate.

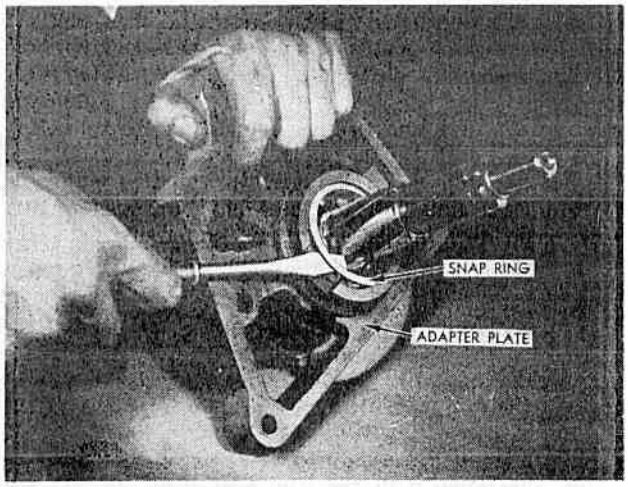


FIG. 338

Reassembly

CHAMPION AND COMMANDER All transmission parts should be inspected for wear or damage and, if necessary, replaced. When reassembling the overdrive transmission, always install new gaskets and oil seals.

The procedure for the reassembly of the overdrive transmission main case is the same as that for the conventional transmission, with the following exceptions:

Place the oil slinger in the adapter plate, insert the main shaft and rear bearing in the adapter plate, and install the large snap ring. After installing the synchronizer assembly and the gears on the main shaft, install the adapter plate and the main shaft assembly in the main case. Then fasten the adapter plate to the case with one cap screw.

Insert the pawl with the notched side up. When installing the sun gear blocker assembly and cover plate, be sure that the blocker ring and the pawl are properly positioned (see Fig. 339). Then install the large snap ring in the adapter plate.

Install the overdrive solenoid by turning the solenoid counterclockwise one-quarter turn and attach the solenoid to the case with the two lock washers and cap screws.

Install the overdrive sun gear and shift rail assembly. Attach the free wheeling unit to the pinion cage assembly with the large retaining clip. Then install the pinion cage and the free wheeling unit assembly on the main shaft and secure the assembly in place with the small retaining clip.

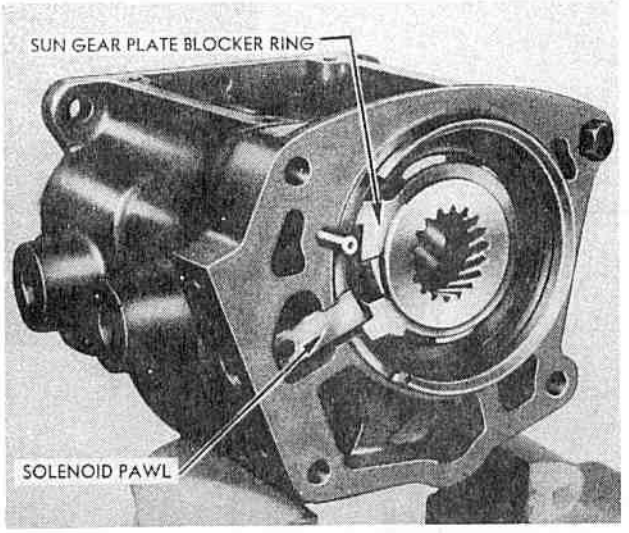


FIG. 339

Install the ring gear on the overdrive main shaft and lock it in place with the large snap ring. Insert the free wheeling rollers in the cage using heavy grease to hold them in position. Then, turning the cage and rollers counterclockwise until the rollers are in their low positions, install the overdrive main shaft and ring gear on the pinion cage and free wheeling unit assembly.

Install the overdrive shaft rear bearing with the two snap rings in the overdrive housing. After inserting the speedometer and governor drive gears, install the overdrive shaft front bearing in the housing. The oil seal should then be installed with Transmission Rear Flange Oil Seal Driver J-2038.

NOTE.—The oil seal may also be installed with the overdrive housing on the main case.

Install the overdrive shift shaft oil seal, shift shaft, shift shaft lever, and lockup spring in the housing. After removing the cap screw with which the adapter plate has been held on the transmission case, install the overdrive housing. Be sure the overdrive conduit bracket is attached to the housing by the lower left cap screw.

Push in the overdrive shift shaft to engage the operating cam with the slotted shift rail. Then drive in the tapered pin to retain the shift shaft in its proper position.

Install the lockout switch and the governor, and install the wire which connects the lockout switch and the governor. Fit the companion flange on the overdrive shaft splines, install the companion flange washers and nut, and tighten the nut securely.

NOTE.—If the companion flange nut is not tightened sufficiently, the speedometer and governor drive gears will rotate on the overdrive shaft.

Installation of Conventional and Overdrive Transmissions

CHAMPION AND COMMANDER Place the transmission case on the clutch housing and tighten the cap screws securely. Install the speedometer pinion. Then connect the shift rods to the shift levers and the speedometer cable to the transmission case. If the car is equipped with overdrive, connect the two wires to the overdrive solenoid, the one wire to the lockout switch, and the control cable to the overdrive shift shaft lever and conduit bracket.

Move the front propeller shaft and support assembly forward on the rear propeller shaft splines, and attach the propeller shaft support assembly to the center frame cross member. Fastening the universal joint to the transmission companion flange completes the installation procedure.

Fill the transmission to the level of the filler plug hole with the recommended lubricant. The overdrive housing on the overdrive transmission must also be filled to the level of the filler plug. For complete lubrication information, refer to the "Lubrication" section.

Gearshift Rod Adjustment

CHAMPION AND COMMANDER To adjust the steering post gearshift control, first disconnect the shift rods (note the position of each clevis) from the transmission levers. Then pry out the plug in the shift control box and install Transmission Shift Rod Adjusting Gage No. J-1308-B (see Fig. 340). This new tool may be

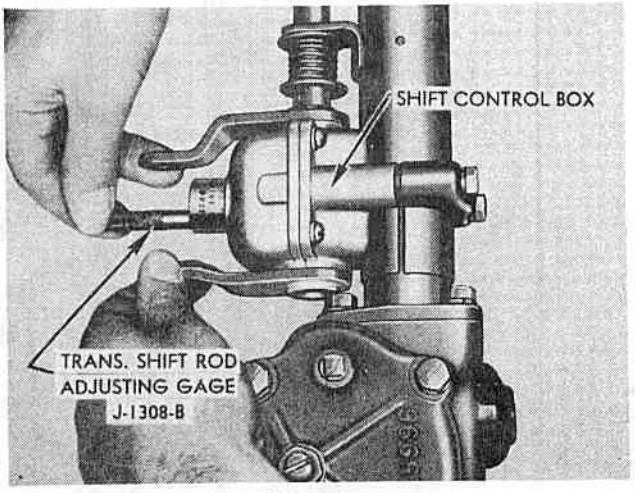


FIG. 340

ordered, or a section of the old tool (No. J-1308-A) may be milled or sawed out (see Fig. 341).

Check to see that the shift levers on the transmission are in the neutral position. This can be determined by the action of the interlock.

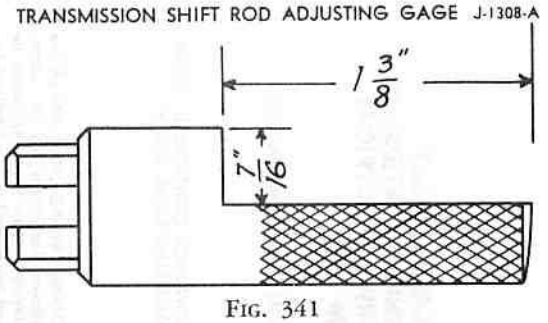


FIG. 341

By turning the threaded clevis (complete turns, not half turns, are necessary for adjustment because of the shape of the clevis), adjust the length of each shift rod so that the holes in the clevis and the shift lever are in perfect alignment. Then insert the clevis pin and secure the clevis in position with the lock nut. Repeat this procedure for the other shift rod. After adjusting both shift rods, remove the adjusting gage and reinstall the plug.

CHECK-OUT CHART GOVERNOR-CONTROLLED OVERDRIVE ELECTRICAL SYSTEM

CHAMPION AND COMMANDER

GOVERNOR-CONTROLLED OVERDRIVE ELECTRICAL SYSTEM

CHAMPION AND COMMANDER The following instructions and the accompanying diagram (figure342) should be used when checking the electrical system of the overdrive transmission. The following inspections should be made with the ignition switch on, the transmission in neutral, and the overdrive control button (on the dash) fully depressed:

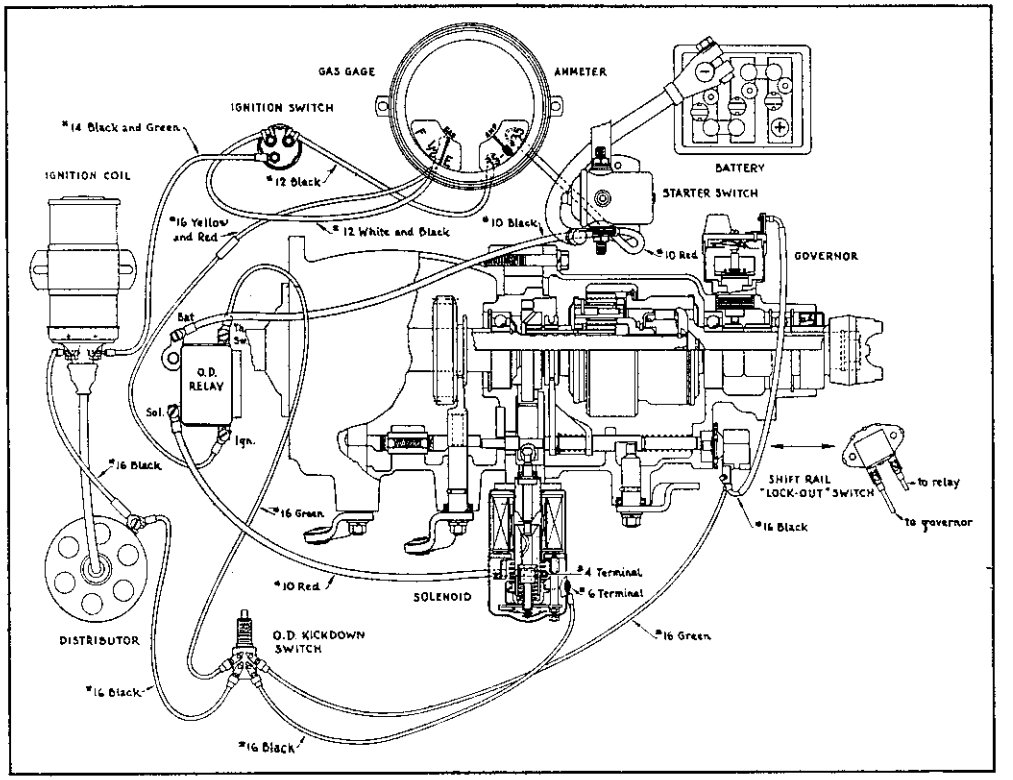
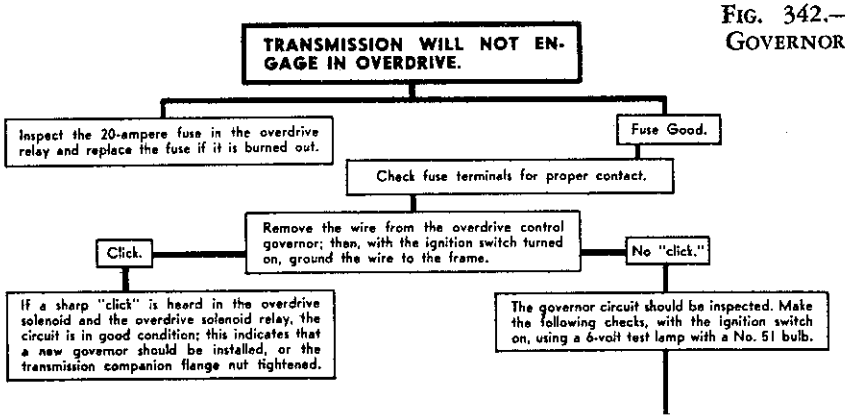
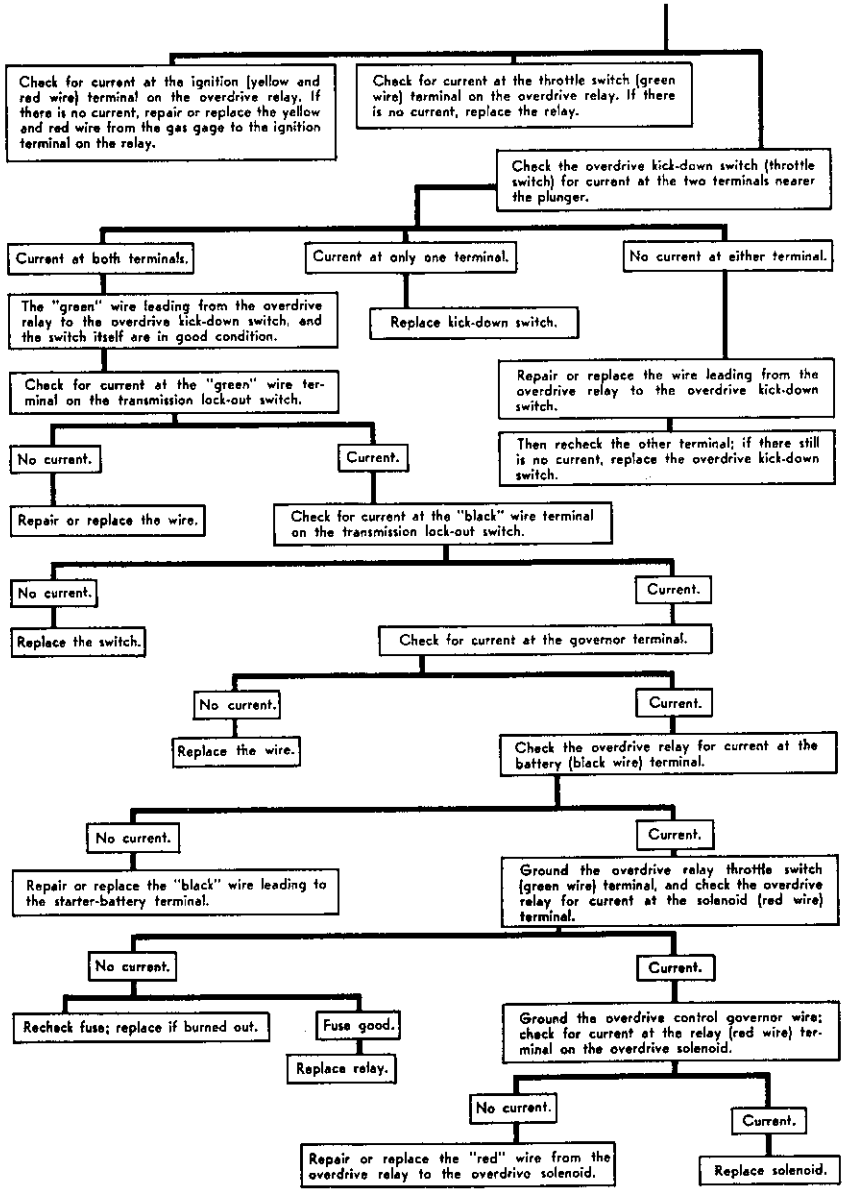
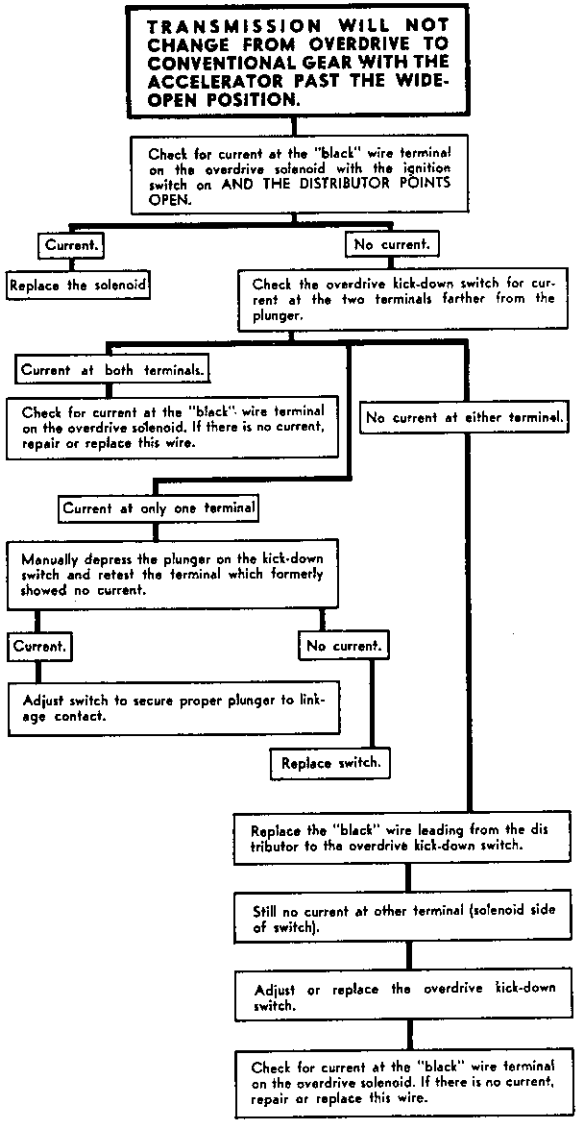


FIG. 342.—WIRING DIAGRAM OF THE GOVERNOR-CONTROLLED TRANSMISSION




Check for current at the ignition (yellow and red wire) terminal on the overdrive relay. If there is no current, repair or replace the yellow and red wire from the gas gage to the ignition terminal on the relay.
Check for current at the throttle switch (green wire) terminal on the overdrive relay. If there is no current, replace the relay.
Check the overdrive kick-down switch (throttle switch) for current at the two terminals nearer the plunger.
Current at both terminals.
Current at only one terminal.
No current at either terminal.
The "green" wire leading from the overdrive relay to the overdrive kick-down switch, and the switch itself are in good condition.
Replace kick-down switch.
Repair or replace the wire leading from the overdrive relay to the overdrive kick-down switch.
Then recheck the other terminal; if there still is no current, replace the overdrive kick-down switch.
Check for current at the "green" wire terminal on the transmission lock-out switch.
No current.
Current.
Repair or replace the wire.
Check for current at the "black" wire terminal on the transmission lock-out switch.
No current.
Current.
Replace the switch.
Check for current at the governor terminal.
No current.
Current.
Replace the wire.
Check the overdrive relay for current at the battery (black wire) terminal.
No current.
Current.
Repair or replace the "black" wire leading to the starter-battery terminal.
Ground the overdrive relay throttle switch (green wire) terminal, and check the overdrive relay for current at the solenoid (red wire) terminal.
No current.
Current.
Recheck fuse; replace if burned out.
Fuse good.
Replace relay.
Ground the overdrive control governor wire; check for current at the relay (red wire) terminal on the overdrive solenoid.
No current.
Current.
Repair or replace the "red" wire from the overdrive relay to the overdrivo solenoid.
Replace solenoid.


TRANSMISSION WILL NOT CHANGE FROM OVERDRIVE TO CONVENTIONAL GEAR WITH THE ACCELERATOR PAST THE WIDE-OPEN POSITION.
Check for current at the "black" wire terminal on the overdrive solenoid with the ignition switch on AND THE DISTRIBUTOR POINTS OPEN.
Current.
No current.
Replace the solenoid
Check the overdrive kick-down switch for current at the two terminals farther from the plunger.
Current at both terminals.
No current at either terminal.
Check for current at the "black" wire terminal on the overdrive solenoid. If there is no current, repair or replace this wire.
Current at only one terminal
Manually depress the plunger on the kick-down switch and retest the terminal which formerly showed no current.
Current.
No current.
Adjust switch to secure proper plunger to linkage contact.
Replace switch.
Replace the "black" wire leading from the distributor to the overdrive kick-down switch.
Still no current at other terminal (solenoid side of switch).
Adjust or replace the overdrive kick-down switch.
Check for current at the "black" wire terminal on the overdrive solenoid. If there is no current, repair or replace this wire.

SPEEDOMETER GEAR CHART

Transmission Type	Rear Axle Ratio	Tire Size	Drive Gear Teeth	Pinion Teeth	Part No. Drive Gear	Part No. Pinion
Champion Conventional	4.1	5.50x15	5	16	520082	520088
	4.1	6.00x15 (Special Order)	5	16	520082	520088
	4.1	5.50x16 (Special Order)	5	16	520082	520088
	4.56 (Special Order)	5.50x15	5	18	520082	520090
	4.56 (Special Order)	6.00x15 (Special Order)	5	17	520082	520089
	4.56 (Special Order)	5.50x16 (Special Order)	5	17	520082	520089
Champion Overdrive	4.56	5.50x15	5	18	520084	520090
	4.56	6.00x15 (Special Order)	5	17	520084	520089
	4.56	5.50x16 (Special Order)	5	17	520084	520089
Commander Conventional	4.09	6.50x15	5	15	520083	520087
	4.55 (Special Order)	6.50x15	5	17	520083	520089
Overdrive Commander	4.55	6.50x15	5	17	520084	520089
	4.09 (Special Order)	6.50x15	5	15	520084	520087

TRANSMISSION DIAGNOSIS

TRANSMISSION NOISY IN NEUTRAL

DESCRIPTION

Transmission noises in neutral, when the engine is idling, can generally be classified as a hiss or growl. Bearing difficulty is generally apparent as a hiss, although in severe cases a bump or thud will be heard. Rough, worn, chipped, or scuffed gears are apparent as an intermittent growl or hum. An out-of-alignment condition between the transmission and the engine assembly will cause a grind after the transmission has been in service for some time.

CAUSES

1. Misalignment of transmission with engine assembly.
2. Transmission pinion bearing worn, rough, or dirty.
3. Transmission constant mesh gears worn, scuffed, chipped, or burred.
4. Transmission countershaft bearings scored, worn, dirty, or rough.
5. Transmission second speed main shaft gear bushing rough, scored, or badly worn.
6. Transmission constant mesh gears not properly meshed or matched.
7. Replacement of only one constant mesh gear instead of the complete set.
8. Reverse idler gear shaft or bushing rough, scored, or worn.
9. Reverse idler gear worn, scuffed, chipped, or burred.
10. Eccentric countershaft gear assembly.
11. Countershaft sprung or badly worn.
12. Eccentric second speed constant mesh gear.
13. Too much lash in constant mesh gear train.
14. Abnormal end play of countershaft gear, reverse idler gear, or pinion.
15. Transmission main shaft pilot bearing badly worn or broken.
16. Insufficient lubricant in transmission.
17. Incorrect grade or poor quality of transmission lubricant.

TRANSMISSION NOISY IN GEAR — OVERDRIVE OR CONVENTIONAL

DESCRIPTION

Most transmission noises apparent in neutral will also be noticed in gear, although the frequency of the noise will increase. Transmission noises due to engine torsional periods occur at definite speeds and are not apparent throughout the entire speed range. Torsional transmission noises are usually a high-pitched, high frequency, metallic rattle.

CAUSES

1. Conditions causing noise in neutral — usually more pronounced at low road speeds.
2. Engine torsional periods being transmitted to transmission:
   a) Clutch plate mechanical damper inoperative or improperly adjusted.
   b) Clutch plate mechanical damper springs weak or broken.
3. Transmission main shaft rear bearing rough, worn, or dirty.
4. Transmission sliding gear teeth rough, worn, burned, scuffed, pitted, chipped, or tapered.
5. Excessive clearance or end play of second speed main shaft gear on main shaft.
6. Noisy speedometer gears.

TRANSMISSION OIL LEAKS

CAUSES

1. Lubricant level too high in transmission case.
2. Damaged, improperly installed, or missing gaskets.
3. Damaged or improperly installed oil seals.
4. Damaged, improperly installed, or missing oil throw rings.
5. Transmission case plugs loose or threads damaged.
6. Transmission case bolts loose, missing, or threads stripped.
7. Sand hole or crack in transmission case or cover.
8. Use of a lubricant which foams excessively.

TRANSMISSION — DIFFICULT SHIFTING INTO GEAR

CAUSES

1. Failure to release clutch completely.
2. Engine clutch spinning or sticking on splined pinion shaft.
3. Sliding gear tight on main shaft splines.
4. Insufficient chamfer of sliding teeth.
5. Main shaft splines distorted, burred, or otherwise damaged.
6. Synchronizing unit outer sleeve fits too tightly on synchronizer hub.
7. Improper adjustment of the gearshift control rods.
8. Remote control shift mechanism out-of-line or in need of lubrication.

TRANSMISSION STICKING IN GEAR

CAUSES

1. Engine clutch not completely released.
2. Insufficient chamfer at edge of gearshift lever detent ball notches.
3. Sliding gear tight on main shaft splines.
4. Distorted, burred, or otherwise damaged main shaft splines.
5. Improper adjustment of the gearshift control rods.

TRANSMISSION SLIPPING OUT OF HIGH GEAR

CAUSES

1. Misalignment of transmission with engine assembly.
2. Transmission pinion gear teeth worn or tapered.
3. Insufficient shift lever interlock assembly spring tension.
4. Worn shift lever interlock assembly.
5. Improper adjustment of the gearshift control rods.

TRANSMISSION SLIPPING OUT OF SECOND GEAR

CAUSES

1. Abnormal clearance between second speed constant mesh gear and main shaft.
2. Abnormal end play of second speed constant mesh gear on main shaft.
3. Second speed clutch gear teeth worn, tapered, or distorted.
4. Insufficient shift lever interlock assembly spring tension.
5. Worn shift lever interlock assembly.
6. Insufficient gear mesh.
7. Improper adjustment of the gearshift control rods.

TRANSMISSION SLIPPING OUT OF FIRST OR REVERSE GEAR

CAUSES

1. First and reverse sliding gear loose on main shaft splines.
2. First and reverse sliding gear teeth worn or tapered.
3. Main shaft splines worn or distorted.
4. Countershaft first speed gear worn or tapered.
5. Excessive end play of countershaft in transmission.
6. Reverse idler gear teeth worn or tapered.
7. Excessive end play of reverse idler gear in transmission case.
8. Insufficient gear mesh.
9. Insufficient shift lever interlock spring tension.
10. Worn shift lever interlock assembly.
11. Improper adjustment of the gearshift control rods.
12. Worn or damaged countershaft or countershaft bearings.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

WHEELS AND TIRES

Drop center rim type wheels and synthetic tires are used on Champion and Commander models. Tire sizes, both standard and optional, are given in the Tire Pressure Chart.

An accredited wheel puller equipped with the correct attachments should be used whenever a rear wheel hub is removed. Equipment of this kind saves time and prevents damage to the parts involved. The factory should not be expected to consider claims for rear axle parts damaged by hammering or by incorrect use of a puller.

The composition of the tubes is such that *the repair procedure for natural rubber tubes may be used.* The general characteristics of synthetic rubber, however, differ considerably from those of natural rubber, and all dealers and service men should learn to recognize and accept these differences.

Synthetic rubber tire treads are not as resistant to cuts and tears as natural rubber, especially when the tread is hot. For this reason synthetic tires require more frequent inspections for cuts in order that repairs can be made before the casing is seriously damaged.

The temperature of a tire is affected by the load carried, the running speed, the pavement temperature, the atmospheric temperature, and the inflation pressure. Since extreme heat is particularly destructive to synthetic tires, overloading or excessive speeds should be avoided.

Carefully balanced, true running wheels are conducive to easy steering and maximum tire mileage. Any unbalanced condition of the wheel and tire assemblies may be both destructive and dangerous, reducing not only the life of tires but also the life of all suspension and steering parts. All four wheel and tire assemblies should, therefore, be periodically balanced both *statically* and *dynamically* on an accredited wheel balancer.

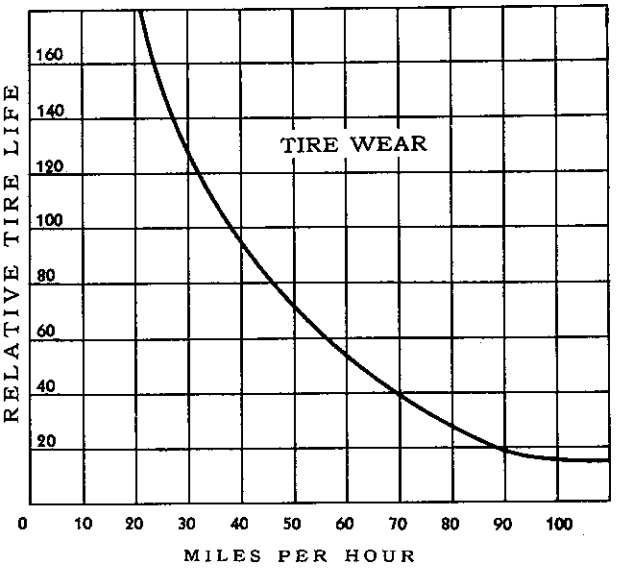


FIG. 343

Correct wheel alignment is dependent on proper toe-in, camber, caster, king pin inclination, and toe-out on turns. To correct misalignment, several adjustments may be necessary and should be made on an accredited wheel aligning machine. Before making these adjustments, however, check all tires for pressure and the wheel bearings for looseness.

Tire Pressure

CHAMPION AND COMMANDER The tires should be inflated when they are cool (air temperature approximately 70° F. [21° C.]), because heat developed by fast driving temporarily increases the air pressure. The accompanying chart lists the recommended tire pressures.

Tire Pressure Chart

MODELS	SIZE	PRESSURE (WITH TIRE COOL — 70°F. [21°C.])	
		FRONT	REAR
CHAMPION	5.50x15 Std.	28 lb. (1,96 kgs.)	26 lb. (1,82 kgs.)
	5.50x16 Opt.	28 lb. (1,96 kgs.)	26 lb. (1,82 kgs.)
	6.00x15 Opt.	26 lb. (1,82 kgs.)	24 lb. (1,68 kgs.)
CHAMPION STATION WAGON	6.00x15 Std.	26 lb. (1,82 kgs.)	28 lb. (1,96 kgs.)
COMMANDER	6.50x15 Std.	24 lb. (1,68 kgs.)	20 lb. (1,40 kgs.)

FIG. 344

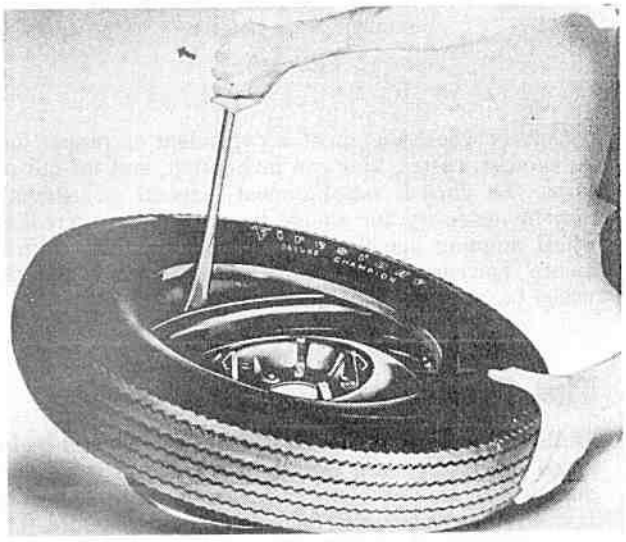


FIG. 345

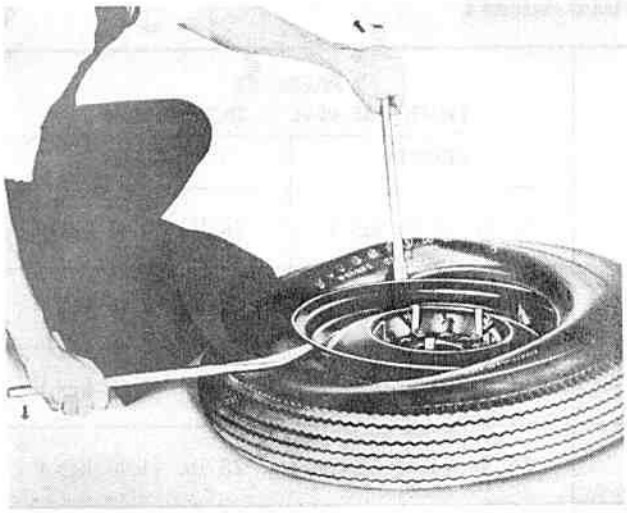


FIG. 346

Installation of Synthetic Tires and Tubes

CHAMPION AND COMMANDER Inspect the inside of the tire casing and remove any dirt or other foreign matter. Insert the deflated tube in the casing, placing the valve at the balance mark, and inflate just enough to round out the tube.

Use a tube mounting compound or other high grade soap worked into heavy suds. Dip a cloth or sponge in the suds and swab thoroughly all around the base of the tube, between the tube and beads of the tire casing, and on the face of the beads (see Fig. 344). The soap acts as a lubricant and reduces the friction as the inflated tube passes over the beads and down into the well of the wheel rim.

Place the wheel in a horizontal position with the valve hole up and start to mount the tire with the valve pointing toward the valve hole. Apply the first bead by pushing a portion of it into the well of the rim and working the remaining part over the flange with a tire tool (see Fig. 345). Then spread the tire and place the valve stem through the hole in the rim. The use of a valve fishing tool or a valve extension will aid in pulling the valve into position.

Apply the second bead by forcing the portion of the tire opposite the valve down into the well of the rim and, with tire tools, work the remainder of the bead over the flange, alternating from right to left to prevent the tire from creeping on the rim (see Fig. 346). Be sure that the beads are out of the well and properly seated against the flange; then pull the valve out so as to hold the base snugly against the rim.

While holding the valve in this position, inflate the tire until both beads are seated. The centering ribs (when marked on the tire) should show evenly above the rim flange. After the tire has been properly seated in the rim, deflate the tube completely to allow it to adjust its position in the tire and to prevent it from being pinched under the tire beads. Then reinflate the tube to the recommended pressure.

WHEELS AND TIRES DIAGNOSIS

FRONT TIRES WORN ABNORMALLY

CAUSES

1. Tires underinflated.
2. Incorrect front wheel toe-in.
3. Lateral tire run-out or wobble in excess of 1/8" due to:
   a) Tires improperly mounted.
   b) Wheel stud nuts drawn up unevenly.
   c) Sprung wheel.
4. Excessive front wheel camber.
5. Harsh or unnecessary use of brakes.
6. Improperly adjusted front wheel brakes (dragging).
7. Eccentric front wheel brake drums.
8. Tire eccentricity (in excess of 1/16").
9. Front wheel, hub, brake drum, and tire out of balance.

FRONT WHEEL NOISES

CAUSES

1. Wheel rattles resulting from:
   a) Loose bearings.
   b) Broken or pitted bearings.
   c) Brake drum loose on hub.
   d) Brake shoes or backing plate loose.
   e) Hub cap loose in wheel hub.
   f) Hub cover retaining spring broken and loose on wheel hub.
2. Wheel squeaks resulting from:
   a) Wheel stud nuts loose or unevenly drawn up.
   b) Slight movement of brake drums on hubs.
   c) Dust washer retainer sprung or broken.
   d) Lack of lubrication of front wheel bearings.
   e) Front wheel bearings adjusted too tightly.
   f) Front wheel bearings broken or pitted.
3. Variation in tire tread surface due to repaired section or broken place in casing.
4. Type or condition of tire tread (noise similar to a gear growl).
5. Underinflated tires (noise similar to a gear growl).
6. Foreign object imbedded in tire tread.

ABNORMAL HEATING OF FRONT WHEEL BEARINGS

DESCRIPTION

Front wheel bearings, when correctly adjusted and lubricated, will give off considerable heat after the car has been in operation for some time. The service man should not become alarmed if the wheel hubs are warm immediately after extended use of the car.

CAUSES

1. Insufficient lubricant.
2. Use of a poor quality or incorrect grade of lubricant.
3. Bearings adjusted too tightly.
4. Bearings broken or pitted.
5. Heat transfer from brake drums due to dragging brakes.
6. Foreign particles such as dirt and grit in bearings.
7. Dragging front wheel brakes or abnormal use of the brakes.
8. Steering knuckle spindle bent.
9. Eccentric front wheel hub.
10. Very tight felt lubricant seal.

REAR TIRES ABNORMALLY WORN

CAUSES

1. Tires underinflated.
2. Rear wheels out of alignment due to:
   a) Rear axle housing sprung or broken.
   b) Rear spring center bolt broken or sheared permitting rear axle housing to shift on rear spring.
   c) Broken rear spring main leaf.
   d) Use of incorrect rear spring or rear spring main leaf.
   e) Chassis frame bent or broken in rear.
3. Rear wheel run-out or wobble due to:
   a) Wheel stud nuts loose or drawn up unevenly.
   b) Wheel or rim distorted.
   c) Rear axle shaft bent or sprung.
   d) Rear wheel loose on axle shaft.
   e) Rear wheel hub does not fit shaft taper.
4. Harsh and unnecessary use of brakes.
5. Sustained high speed driving (especially on curves).
6. Tire tread not concentric with axle shaft center.
7. Wheel, hub, drum, and tire assembly out of balance.

REAR WHEEL AND REAR WHEEL BEARING NOISE

CAUSES

1. Rear wheel noise resulting from:
   a) Wheel loose on axle shaft taper (does not fit taper or loose shaft nut).
   b) Wheel key way or axle shaft badly worn.
   c) Wheel hub and drum stud nuts loose.
   d) Interference of brake drum with brake shoes.
   e) Interference of axle shaft with wheel bearing felt retainer.
   f) Brake backing plate loose.
2. Rear wheel bearing noise resulting from:
   a) Insufficient lubrication.
   b) Use of poor quality or incorrect grade of lubricant.
   c) Wheel bearing cup or cone rough, scored, or burned.
   d) Wheel bearing rollers chipped, cracked, or worn flat.
   e) Wheel bearing improperly adjusted (excessive axle shaft end play).
3. Type or condition of tire tread (noise similar to rear axle gear noise).

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

GENERAL SPECIFICATIONS

	CHAMPION	COMMANDER
Number of cylinders	6	6
Cylinder bore	3" (76,2 mm.)	3-5/16" (84,14 mm.)
Stroke	4" (101,6 mm.)	4-3/8" (111,13 mm.)
Piston displacement — cu. in.	170	226
Piston displacement — cu. cm.	2786	3704
Horsepower (N. A. C. C.)	21.6	26.35
Maximum horsepower at r. p. m.	80 @ 4000	94 @ 3600
Compression ratio — standard	6.5 to 1	6.5 to 1
Standard compression pressure at cranking speed	105 lb. at 150 r. p. m.	105 lb. at 150 r. p. m.

PISTONS AND RINGS

Piston material	Bearing Metal Plated Aluminum Alloy	Bearing Metal Plated Aluminum Alloy
Oil rings per piston	1	1
Width of oil ring	5/32" (3,97 mm.)	3/16" (4,763 mm.)
Oil ring gap	.007" to .017" (0,178 mm. to 0,432 mm.)	.009" to .014" (0,230 mm. to 0,355 mm.)
Compression rings per piston	2	2
Width of compression rings — top and middle	3/32" and 1/8" (2,380 mm. and 3,175 mm.)	3/32" (2,38 mm.)
Compression ring gap	.007" to .017" (0,178 mm. to 0,432 mm.)	.009" to .014" (0,230 mm. to 0,355 mm.)
Piston clearance	Selective Feeler Fit — See Text	Selective Feeler Fit — See Text

RODS AND PINS

Pin diameter	.7491" to .7495" (19,027 mm. to 19,037 mm.)	.8741" to .8745" (22,202 mm. to 22,212 mm.)
Pin locked or floating	Locked in Rod	Locked in Rod
Pin clearance	.0001" to .0003" (Selective Fit) (0,0025 mm. to 0,0076 mm.)	.0001" to .0003" (Selective Fit) (0,0025 mm. to 0,0076 mm.)
Crank pin journal — diameter	1.81175" to 1.81275" (46,02 mm. to 46,04 mm.)	2.18675" to 2.18775" (55,54 mm. to 55,57 mm.)
Crank pin journal — length	1.123" to 1.126" (28,52 mm. to 28,60 mm.)	1.373" to 1.376" (34,87 mm. to 34,95 mm.)
Connecting rod bearing — type	Interchangeable	Interchangeable
— material	Steel Back Microbabbitt Lined	Steel Back Microbabbitt Lined
Connecting rod bearing clearance	.0005" to .002" (0,0127 mm. to 0,0500 mm.)	.0005" to .002" (0,0127 mm. to 0,0500 mm.)
Connecting rod side clearance	.005" to .009" (0,127 mm. to 0,230 mm.)	.005" to .009" (0,127 mm. to 0,230 mm.)
Rods and pistons removed	From Top	From Top

CRANKSHAFT

Vibration damper type	Rubber	Rubber
End thrust carried on	Front Bearing	Front Bearing
Crankshaft end play	.003" to .006" (0,076 mm. to 0,152 mm.)	.003" to .006" (0,076 mm. to 0,152 mm.)
Main bearing — type	Interchangeable	Interchangeable
— material	Steel Back Microbabbitt Lined	Steel Back Microbabbitt Lined
Removable from below	Yes	Yes
Main bearing clearance	.0005" to .0025" (0,0127 mm. to 0,0640 mm.)	.0005" to .0025" (0,0127 mm. to 0,0640 mm.)
Main bearing journal — diameter	2.4370" to 2.4375" (61,90 mm. to 61,91 mm.)	2.4995" to 2.5000" (63,49 mm. to 63,50 mm.)
Main bearing journal length — No. 1	1-5/16" (33,34 mm.)	1-5/16" (33,34 mm.)
— No. 2	1-1/8" (28,58 mm.)	1-1/8" (28,58 mm.)
— No. 3	1-1/8" (28,58 mm.)	1-1/8" (28,58 mm.)
— No. 4	1-17/32" (38,90 mm.)	1-27/32" (46,83 mm.)
Crankshaft gear — material	Cast Iron	Cast Iron
— make	Own	Own

CAMSHAFT

Camshaft drive	Gear	Gear
Camshaft journal diameters — No. 1	1.7475" to 1.7480" (44,360 mm. to 44,372 mm.)	1.9975" to 1.9980" (50,737 mm. to 50,749 mm.)
— No. 2	1.7162" to 1.7170" (43,591 mm. to 43,612 mm.)	1.9662" to 1.9670" (49,541 mm. to 49,962 mm.)
— No. 3	1.6857" to 1.6865" (42,817 mm. to 42,837 mm.)	1.9357" to 1.9365" (49,167 mm. to 49,187 mm.)
— No. 4	1.6232" to 1.6240" (41,229 mm. to 41,250 mm.)	1.1232" to 1.1240" (28,529 mm. to 28,550 mm.)
Camshaft bushing clearances — No. 1	.0007" to .0022" (0,018 mm. to 0,056 mm.)	.0007" to .0022" (0,018 mm. to 0,056 mm.)
— No. 2	.0010" to .0027" (0,025 mm. to 0,069 mm.)	.0010" to .0027" (0,025 mm. to 0,069 mm.)
— No. 3	.0010" to .0027" (0,025 mm. to 0,069 mm.)	.0010" to .0027" (0,025 mm. to 0,069 mm.)
— No. 4	.0010" to .0027" (0,025 mm. to 0,069 mm.)	.0010" to .0027" (0,025 mm. to 0,069 mm.)

	CHAMPION	COMMANDER
LUBRICATION — ENGINE		
Capacity — oil pan	5 U.S. Qts. 4.14 Imp. Qts. 4,73 Liters	6 U.S. Qts. 5.00 Imp. Qts. 5,68 Liters
Oil pressure at 40 m.p.h. (64 km.p.h.)	20 lb. to 40 lb. (1,4 kgs. to 2,8 kgs.)	20 lb. to 40 lb. (1,4 kgs. to 2,8 kgs.)
External oil filter — make	Fram (Optional)	Fram
LUBRICATION — CHASSIS		
Chassis lubrication — make	Alemite	Alemite
COOLING		
Capacity	10 U.S. Qts. 8.35 Imp. Qts. 9,46 Liters	13 U.S. Qts. 10.82 Imp. Qts. 12,30 Liters
VALVES		
Valve stem diameter	5/16" (7,94 mm.)	11/32" (8,73 mm.)
Valve lift	5/16" (7,94 mm.)	11/32" (8,73 mm.)
Operating tappet clearance — intake	.016" (0,407 mm.) Cold	.016" (0,407 mm.) Cold
— exhaust	.016" (0,407 mm.) Cold	.016" (0,407 mm.) Cold
Valve seat angle	45°	45°
Narowing cutter angle — top	30°	30°
— bottom	70° to 75°	70° to 75°
Valve head diameter — inlet	1-11/32" (34,13 mm.)	1-15/32" (37,30 mm.)
— exhaust	1-9/32" (32,54 mm.)	1-9/32" (32,54 mm.)
Valve spring pressures — open	77 lb. to 85 lb. @ 1-7/16" (34,93 kgs. to 38,55 kgs. @ 36,51 mm.)	125 lb. to 135 lb. @ 1-3/4" (56,70 kgs. to 61,24 kgs. @ 44,45 mm.)
Tappet clearance for checking valve timing	.020" (0,508 mm.)	.020" (0,508 mm.)
Intake opens	15° before U.D.C.	15° before U.D.C.
Intake closes	49° after L.D.C.	49° after L.D.C.
Exhaust opens	54° before L.D.C.	54° before L.D.C.
Exhaust closes	10° after U.D.C.	10° after U.D.C.
FUEL		
Gasoline tank capacity	17 U.S. Gal. 14,166 Imp. Gal. 64,345 Liters	17 U.S. Gal. 14,166 Imp. Gal. 64,345 Liters
Fuel pump — make	AC	AC
— pressure	4 lb. to 5 lb. (0,2812 kgs. to 0,3515 kgs.)	4 lb. to 5 lb. (0,2812 kgs. to 0,3515 kgs.)
Carburetor — make	Carter	Stromberg
— model	WE-532 S	BXOV-26
— size	1-1/4" (31,75 mm.)	1-1/4" (31,75 mm.)
IGNITION		
Distributor — make	Auto-Lite	Auto-Lite
— model	IGC-4805	IGC-4802
Centrifugal advance — crankshaft degrees	14°	22°
Vacuum advance — crankshaft degrees	18°	12°
Spark timing	2° before U.D.C. Vibration Damper Flywheel	9/64" (3,57 mm.) before U.D.C. Vibration Damper Flywheel
Distributor point gap	.020" (0,51 mm.)	.020" (0,51 mm.)
Cam angle	35°	35°
Spark plug gap	.0225" to .0275" (0,57150 mm. to 0,69850 mm.)	.0225" to .0275" (0,57150 mm. to 0,69850 mm.)
Spark plug thread	14 mm.	14 mm.
Spark plug make	Champion	Champion
Spark plug model	J-7 or J-9	J-7 or J-9
Firing order	1-5-3-6-2-4	1-5-3-6-2-4
Distributor breaker arm tension	17 oz. to 20 oz. (482 gm. to 567 gm.)	17 oz. to 20 oz. (482 gm. to 567 gm.)
BATTERY		
Battery make	Willard	Willard
Battery number	HW-1-100	HW-1-100
Ampere hours	100	100
Number of plates per cell	15	15
Terminal grounded	Positive	Positive
STARTER		
Starter motor — make	Auto-Lite	Auto-Lite
— model	MZ-4136	MAW-4020A
Lock torque	11.8 ft.-lb. (1,63 kg.-m.)	18 ft.-lb. (2,49 kg.-m.)
Lock amperage	560	670
Lock voltage	4	4
Free running minimum speed	4300 r.p.m.	4900 r.p.m.
Free running amperage	70	65
Free running voltage	5.5	5.5
Flywheel teeth	Steel Ring	Steel Ring

GENERATOR

	CHAMPION	COMMANDER
Generator — make	Auto-Lite	Auto-Lite
Generator — model	GDZ-4804A	GDZ-4805A
Armature speed at cut-out closing	920	920
Voltage at cut-out closing	6.4 to 6.6	6.4 to 6.6
Car speed at cut-out closing	10.4 m. p. h. (16,73 km. p. h.)	10.4 m. p. h. (16,73 km. p. h.)
Cut-out opens	4 to 6 Amp. Discharge	4 to 6 Amp. Discharge
Maximum normal charging rate	35 Amps.	35 Amps.
Armature speed maximum (hot)	2250 r. p. m.	2250 r. p. m.
Car speed maximum charge (hot)	24 m. p. h. (38,6 km. p. h.)	25.8 m. p. h. (41,5 km. p. h.)

LAMPS

Head lamp bulb	40 Watts Driving — 30 Watts Passing	40 Watts Driving — 30 Watts Passing

TRANSMISSION

Gear ratio — high	1 to 1	1 to 1
— second	1.630 to 1	1.55 to 1
— low	2.605 to 1	2.57 to 1
— reverse	3.535 to 1	3.48 to 1
— overdrive	.700 to 1	.70 to 1
Synchro-mesh	Yes	Yes
Overdrive	Optional (Extra Cost)	Optional (Extra Cost)
Transmission oil capacity (conventional)	1.5 U. S. Pts. 1.2 Imp. Pts. 0,71 Liters	2.4 U. S. Pts. 2.0 Imp. Pts. 1,14 Liters
Transmission oil capacity (including overdrive)	2.4 U. S. Pts. 2.0 Imp. Pts. 1,14 Liters	3.2 U. S. Pts. 2.7 Imp. Pts. 1,51 Liters
Transmission lubricant (conventional and overdrive)	See Text	See Text

UNIVERSAL JOINTS

Make	Spicer	Spicer
Type	Needle Point	Needle Point
Number	3	3
Lubricated with	Chassis Lubricant (Light Weight)	Chassis Lubricant (Light Weight)

CLUTCH

Make	Borg & Beck	Borg & Beck
Vibration damper	Yes	Yes
Clutch driven discs	1	1
Clutch facing	Composition	Composition
Facing inside diameter	5-3/8" (136,525 mm.)	6" (152,4 mm.)
Facing outside diameter	8" (203,2 mm.)	9-1/4" (235,0 mm.)
Facing thickness	.125" (3,175 mm.)	.125" (3,175 mm.)
Facings required	2	2

REAR AXLE

Make	Spicer	Spicer
Type	Semi-floating	Semi-floating
Type of drive	Hypoid	Hypoid
Road clearance	7-1/2" (190,5 mm.)	7-1/2" (190,5 mm.)
Lubrication capacity	2.5 U. S. Pts. 2.08 Imp. Pts. 1,175 Liters	3 U. S. Pts. 2.50 Imp. Pts. 1,43 Liters
Lubrication — summer and winter	Hypoid Lubricant S. A. E. No. 90	Hypoid Lubricant S. A. E. No. 90
Type gear	Hypoid	Hypoid
Gear ratio — with conventional transmission	4.10 to 1	4.09 to 1
— with overdrive transmission	4.56 to 1	4.55 to 1
Blacklash — pinion and gear	.005" to .007" (0,127 mm. to 0,178 mm.)	.005" to .007" (0,127 mm. to 0,178 mm.)

TIRES

Size — standard	5.50x15	6.50x15
— optional	See Text	See Text
Number of plies — standard	4	4
Inflation pressure (cold, minimum)	28 lb. (1,96 kgs.) Front 26 lb. (1,82 kgs.) Rear	24 lb. (1,68 kgs.) Front 20 lb. (1,40 kgs.) Rear

SPRINGS AND SHOCK ABSORBERS	CHAMPION	COMMANDER
Front spring — type	Transverse	Transverse
— size	2-1/2" x 42" (63,5 mm. x 1.066,8 mm.)	2-1/2" x 40-1/2" (63,5 mm. x 1.028,7 mm.)
— standard number of leaves	10	13
Rear springs — size	1-3/4" x 50" (44,45 mm. x 1.270,00 mm.)	1-3/4" x 54" 44,45 mm. x 1.371,60 mm.)
— standard number of leaves	7	7
Spring leaf lubricant	Graphite Spring Lubricant	Graphite Spring Lubricant
Rear spring shackle type	Rubber Mounted	Rubber Mounted
Shackle or bolt lubricant — rear	None	None
Shock absorbers — make	Houde	Houde
— type	Two-Way with Lever	Two-Way with Lever

STEERING		
Type	Cam and Twin Lever	Cam and Twin Lever
Make	Ross	Ross
Ratio — straight ahead	12 to 1	15 to 1
— full turn	14 to 1	17 to 1
Lubricant	Quality Steering Gear Lubricant	Quality Steering Gear Lubricant
Front wheel toe-in	1/16" to 1/8" (1,589 mm. to 3,174 mm.)	1/16" to 1/8" (1,589 mm. to 3,174 mm.)
Caster angle	0° to +1°	0° to +1°
Front wheel camber angle	1/2° ± 1/4	1/2° ± 1/4
King pin inclination	5-1/2°	5-1/2°
Minimum road clearance	7-3/4" (166,85 mm.)	7-7/8" (170,025 mm.)

BRAKES		
Make	Lockheed	Lockheed
Type mechanism	Hydraulic	Hydraulic
Brake lining	Moulded	Moulded
Drum size	9" x 2" (228,6 mm. x 50,8 mm.)	11" x 2" (279,4 mm. x 50,8 mm.)
Lining length per wheel	18-1/2" (469,90 mm.)	22-1/4" (565,15 mm.)
Lining width	2" (50,8 mm.)	2" (50,8 mm.)
Lining thickness	3/16" (4,76 mm.)	3/16" (4,76 mm.)
Total braking area	148 sq. in. (954,896 sq. cm.)	178 sq. in. (1.148,456 sq. cm.)
Brake power — front wheels	57%	57%
— rear wheels	43%	43%
Hand lever operates on	Rear Service Brakes	Rear Service Brakes

GENERAL DATA		
Wheelbase	112" (284,8 mm.)	119" and 123" (3.022,6 mm. and 3.124,3 mm.)
Tread — front	56-1/4" (1.428,75 mm.)	55" (1.397,0 mm.)
— rear	54" (1.361,6 mm.)	54" (1.361,6 mm.)
Serial number location	Left Front Door Lock Pillar Post	Left Front Door Lock Pillar Post
Overall length of car with bumpers and bumper guards	192-3/4" (4.895,85 mm.)	204-3/8" and 208-3/8" (5.181,125 mm. and 5.292,725 mm.)
Overall width of car	69-3/4" (1.771,65 mm.)	69-3/4" (1.771,65 mm.)
Overall height — road to roof with load	60-3/4" (1.543,05 mm.)	61-1/4" (1.555,75 mm.)
— road to roof without load	62-1/2" (1.587,50 mm.)	63-1/2" (1.612,90 mm.)

TORQUE READINGS		
Cylinder head cap screw — size and thread	7/16" — 14	1/2" — 13
— torque required	550-600 in.-lb. 46-50 ft.-lb. (6,4-6,9 kg.-m.)	960-1,020 in.-lb. 80-85 ft.-lb. (11,1-11,8 kg.-m.)
Connecting rod cap nut — size and thread	11/32" — 24	3/8" — 24
— torque required	336-384 in.-lb. 28-32 ft.-lb. (3,9-4,4 kg.-m.)	624-648 in.-lb. 52-54 ft.-lb. (7,2-7,5 kg.-m.)
Crankshaft main bearing cap screw — size and thread	1/2" — 13	1/2" — 13
— torque required	1,050-1,115 in.-lb. 88-93 ft.-lb. (12,2-12,9 kg.-m.)	1,050-1,115 in.-lb. 88-93 ft.-lb. (12,2-12,9 kg.-m.)
Valve tappet adjusting screw — torque required (minimum)[1]	25 in.-lb. (0,29 kg.-m.)	
Piston pin clamp screw nut — size and thread	3/8" — 24	3/8" — 24
— torque required	240-300 in.-lb. 20-25 ft.-lb. (2,8-3,5 kg.-m.)	240-300 in.-lb. 20-25 ft.-lb. (2,8-3,5 kg.-m.)
Valve cover plate cap screw — size and thread	5/16" — 18	5/16" — 18
— torque required[2]	24-30 in.-lb. 2-2½ ft.-lb. (0,28-0,35 kg.-m.)	24-30 in.-lb. 2-2½ ft.-lb. (0,28-0,35 kg.-m.)

[1] These are self-locking screws and the specification is the minimum required drag. With less drag, the screw is considered to have doubtful locking.

[2] To obtain proper seal, tighten these screws to required torque three successive times.

	CHAMPION	COMMANDER
Oil filter cover screw — size and thread	7/16" — 20	7/16" — 20
— torque required	300-400 in.-lb. 25-33 ft.-lb. (3,5-4,6 kg.-m.)	300-400 in.-lb. 25-33 ft.-lb. (3,5-4,6 kg.-m.)
Crankshaft vibration damper nut (cap screw on the Champion) — size and thread	11/16" — 16	7/8" — 14
— torque required	1,560-1,680 in.-lb. 130-140 ft.-lb. (18,0-19,4 kg.-m.)	1,920-2,040 in.-lb. 160-170 ft.-lb. (22,1-23,5 kg.-m.)
Spark plug — thread	14 mm.	14 mm.
— torque required	300-360 in.-lb. 25-30 ft.-lb. (3,5-4,1 kg.-m.)	300-360 in.-lb. 25-30 ft.-lb. (3,5-4,1 kg.-m.)
Rear spring axle U-bolt nut — size and thread	3/8" — 24	1/2" — 20
— torque required	565-600 in.-lb. 47-50 ft.-lb. (6,5-6,9 kg.-m.)	900-960 in.-lb. 75-80 ft.-lb. (10,4-11,1 kg.-m.)
Front spring U-bolt nut — size and thread	1/2" — 20	9/16" — 18
— torque required	900-960 in.-lb. 75-80 ft.-lb. (10,4-11,1 kg.-m.)	960-1,020 in.-lb. 80-85 ft.-lb. (11,1-11,8 kg.-m.)
Rear axle shaft nut — size and thread	3/4" — 16	1" — 14
— torque required	1,440-1,560 in.-lb. 120-130 ft.-lb. (16,6-18,0 kg.-m.)	1,440-1,560 in.-lb. 120-130 ft.-lb. (16,6-18,0 kg.-m.)
Brake backing plate bolt nut — size and thread	3/8" — 24	3/8" — 24
— torque required	420-480 in.-lb. 35-40 ft-lb. (4,8-5,5 kg.-m.)	420-480 in.-lb. 35-40 ft.-lb. (4,8-5,5 kg.-m.)
Wheel mounting nut — size and thread	1/2" — 20	1/2" — 20
— torque required	900-1,000 in.-lb. 75-83 ft.-lb. (10,4-11,5 kg.-m.)	900-1,000 in.-lb. 75-83 ft.-lb. (10,4-11,5 kg.-m.)
Steering gear cam lever shaft nut — size and thread	5/8" — 18	3/4" — 16
— torque required [3]	960-1,680 in.-lb. 80-140 ft.-lb. (11,1-19,3 kg.-m.)	1,080-1,800 in.-lb. 90-150 ft.-lb. (12,4-20,7 kg.-m.)
Steering wheel nut — size and thread	13/16" — 20	13/16" — 20
— torque required	275-325 in.-lb. 23-27 ft.-lb. (3,2-3,7 kg.-m.)	275-325 in.-lb. 23-27 ft.-lb. (3,2-3,7 kg.-m.)
Auxiliary steering arm threaded bushing — size and thread	11/16" — 11	
— torque required	1,260-1,380 in.-lb. 105-115 ft.-lb. 14,5-15,9 kg.-m.)	
Front suspension control arm threaded bushing — torque required (minimum)	2040 in.-lb. 170 ft.-lb. (23,5 kg.-m.)	2040 in.-lb. 170 ft.-lb. (23,5 kg.-m.)
Propeller shaft bearing U-bolt nut — size and thread	5/16" — 24	5/16" — 24
— torque required	240-264 in.-lb. 20-22 ft.-lb. (2,8-3,0 kg.-m.)	240-264 in.-lb. 20-22 ft.-lb. (2,8-3,0 kg.-m.)
Flywheel bolt nut — size and thread	3/8" — 24	3/8" — 24
— torque required	396-420 in.-lb. 33-35 ft.-lb. (4,6-4,8 kg.-m.)	396-420 in.-lb. 33-35 ft.-lb. (4,6-4,8 kg.-m.)
Timing gear cover bolts and cap screws — size and thread	5/16" — 18	5/16" — 18
— torque required	156-204 in.-lb. 13-17 ft. lb. (1,8-2,4 kg.-m.)	156-204 in.-lb. 13-17 ft.-lb. (1,8-2,4 kg.-m.)
Oil pump body to block screw — size and thread	5/16" — 18	5/16" — 18
— torque required	156-180 in.-lb. 13-15 ft.-lb. (1,8-2,1 kg.-m.)	156-180 in.-lb. 13-15 ft.-lb. (1,8-2,1 kg.-m.)
Clutch cover to flywheel screw — size and thread	5/16" — 18	5/16" — 18
— torque required	156-180 in.-lb. 13-15 ft.-lb. (1,8-2,1 kg.-m.)	156-180 in.-lb. 13-15 ft.-lb. (1,8-2,1 kg.-m.)
Rear engine mounting bolt nut — size and thread	1/2" — 20	1/2" — 20
— torque required	300-360 in.-lb. 25-30 ft.-lb. (3,5-4,1 kg.-m.)	300-360 in.-lb. 25-30 ft.-lb. (3,5-4,1 kg.-m.)

[3] This torque is required to line up the cotter pin.

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ADDITIONAL NOTES

S T U D E B A K E R

Shop Manual

SUPPLEMENT

TO 1947 SHOP MANUAL

COVERING THE 1948 MODELS PLUS REVISIONS AND ADDITIONS TO THE 1947 STUDEBAKER SHOP MANUAL

Starting 1948 Passenger Car Serial Numbers:

South Bend	7G	G314501	Los Angeles	7G	G827301
	15A	4287001		15A	4820501

INDEX

THE STUDEBAKER CORPORATION
SOUTH BEND 27, INDIANA

Body

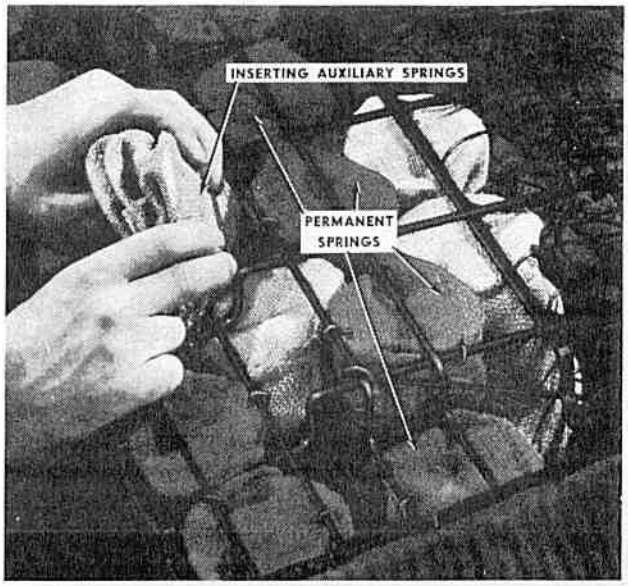


FIG. 347

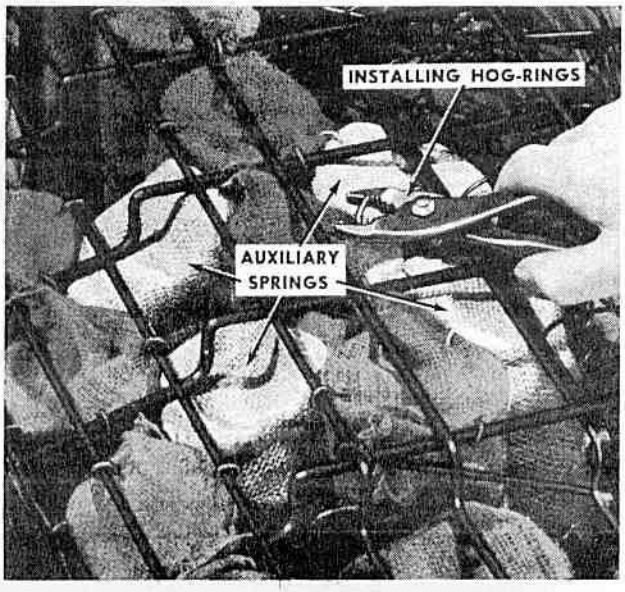


FIG. 348

Front Seat Cushions

CHAMPION AND COMMANDER All of the 1948 Studebaker passenger cars are equipped with Select-O-Seat front cushions. These cushions are so constructed that auxiliary coil springs may be inserted between the rows of permanent springs to obtain the degree of firmness desired by the owner. Auxiliary springs are available in kits containing four springs each.

To install the auxiliary springs, compress, insert, and position them between the permanent rows of springs as shown in Fig. 347. Then, using suitable pliers, fasten the auxiliary springs to the adjoining permanent springs with the "hog ring" fasteners provided in the Select-O-Seat kits as in Fig. 348.

Brake System

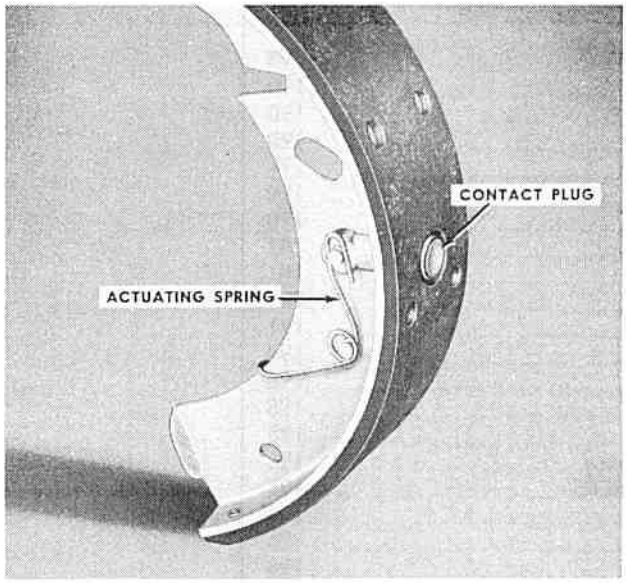


FIG. 349

Self-Adjusting Device — Service Brakes

CHAMPION AND COMMANDER Fig. 349 illustrates the new type contact plug actuating (pressure) spring as used on the front brake shoe assemblies of the 1948 models. This external spring replaces the small coil spring formerly used inside the contact plug. Operation and servicing instructions for this mechanism are the same as outlined on pp. 20-23 of this manual.

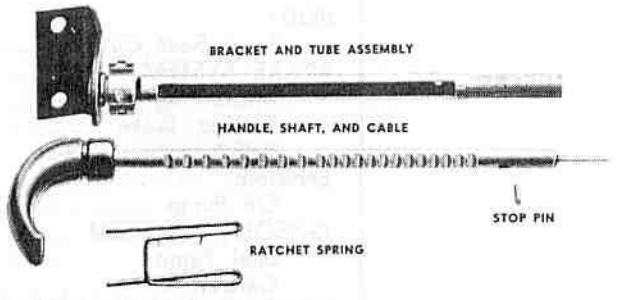


FIG. 350

Parking Brake

CHAMPION AND COMMANDER The parking brake assembly illustrated in Fig. 350 is used in the 1948 closed bodies. The handle, shaft, and cable assembly can be removed from the tube and bracket assembly by taking the stop pin out of the shaft. A hole for the punch is provided in the tube. The ratchet spring may also be slipped out of its retainer for replacement.

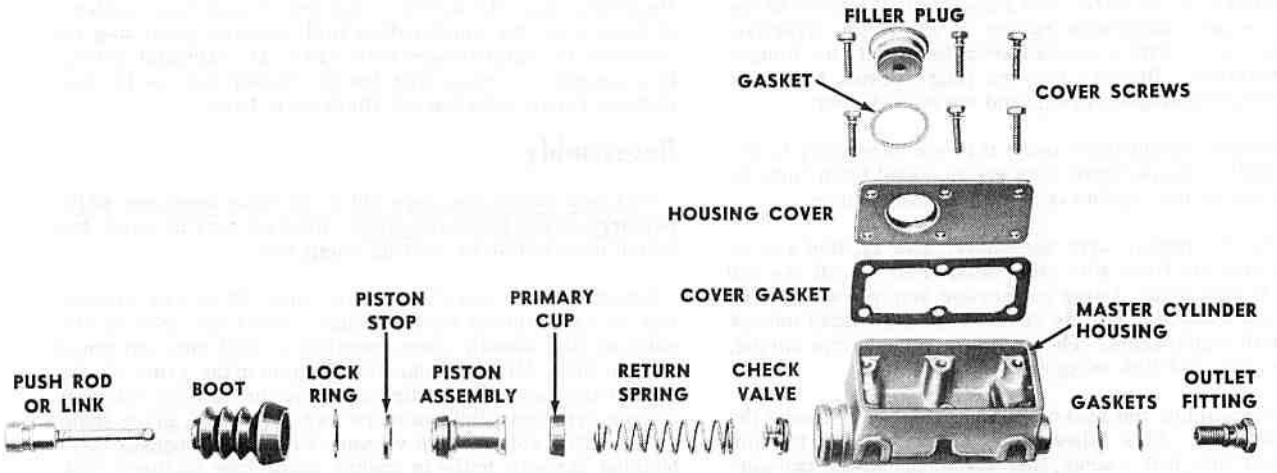


FIG. 351

Master Cylinder

CHAMPION AND COMMANDER The brake master cylinder used on the 1948 model cars is illustrated in Fig. 351. The cylinder housing is of the cast aluminum type. The cover and gasket assembly may be removed for inspection and cleaning of the housing interior. Servicing procedures for the master cylinder assembly are similar to those outlined on pp. 24 and 25 of this manual.

Engine

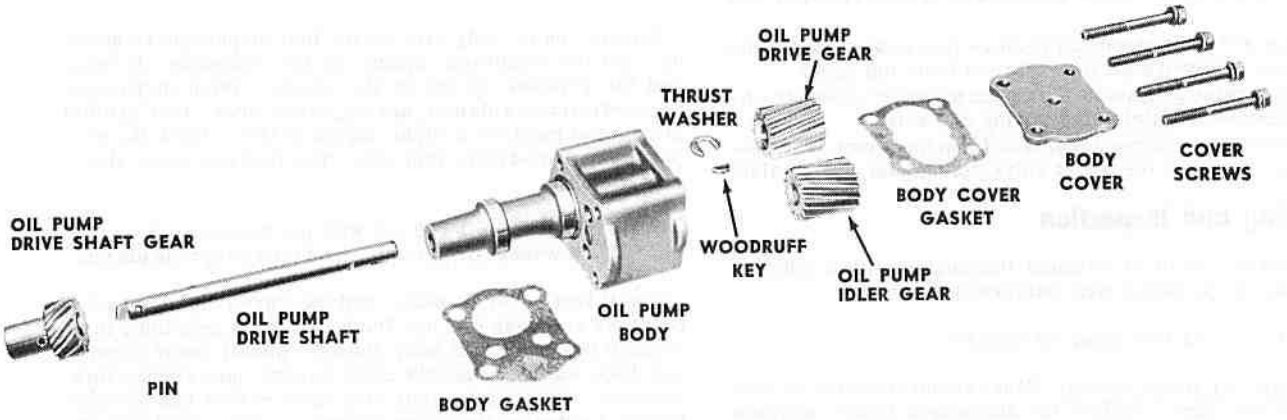


FIG. 352

Oil Pump

COMMANDER The oil pump on the 1948 Commander does not incorporate the windshield wiper vacuum booster. (See Fig. 352.) The vacuum booster unit is an integral part of the fuel pump assembly.

The removal and disassembly procedures for the Commander oil pump are the same as those outlined on pp. 67 and 68 of this manual with the exception of the information pertaining to the windshield wiper vacuum booster unit.

The reassembly and installation procedures for the 1948 Commander oil pump are the same as outlined on p. 68 of this manual.

Gasoline System

Fuel Pump

COMMANDER (Optional Equipment for Champion). An AC Series CB combination fuel-vacuum pump is used on the 1948 Commander. The vacuum section of this pump acts as a booster to the intake manifold suction thus providing uniform operation of the windshield wiper at all engine speeds and loads.

Disassembly (Complete Overhaul)

Wash the outside of the unit with cleaning solvent and blow off with compressed air to remove loose grit and grease.

Mark edges of fuel cover and body diaphragm flanges with a file. The parts may then be reassembled in the same relative positions. Note that the fuel diaphragm flange is symmetrical and the vacuum diaphragm flange has bulges where the screw holes occur.

Remove fuel section cover screws and lock washers. Separate cover from body by jarring cover loose with a screwdriver handle.

Remove only two cover screws from opposite sides of the vacuum section cover and substitute for them two No. 10 - 32 x 1-1/2-inch fillister head screws. Turn the two long screws all the way down and then remove the rest of the regular cover screws. Alternately back off the two

long screws, a few turns at a time, until the force of the heavy vacuum diaphragm spring is no longer effective. Rap the cover with a screwdriver handle if the flanges stick together. Remove the two long screws, the cover assembly, diaphragm spring, and spring retainer.

To remove diaphragms only, it is not necessary to remove links. Diaphragms may be unhooked from links by tipping end of pull rod away from mounting flange.

To remove rocker arm assembly, file riveted end of rocker arm pin flush with steel washer or cut off the end with 3/8-inch drill. Drive out rocker arm pin with a drift punch and hammer. Wiggle rocker arm until links unhook from both diaphragms. Then remove rocker arm spring, rocker arm, and link assembly.

To disassemble the rocker arm assembly, remove the steel bushing. This allows the removal of the vacuum links, fuel link, link spacer, link washers, and the two outer spacer washers.

Lift vacuum diaphragm straight out of body. Remove fuel diaphragm by lifting it straight out. Do not tilt diaphragms excessively or staked-in oil seals will be damaged. Lift the fuel diaphragm spring and spring retainer from the pump body.

Remove vacuum section valve and cage retainer screw and lift out retainer, two valve and cage assemblies, and two gaskets.

Remove vacuum section cover plate screw with gasket. Then remove cover plate, gasket, and screen retainer and screen.

Loosen bail-screw nut and remove fuel bowl, gasket, and bowl seat. Remove strainer screen from top cover.

Remove valve plug and gasket from top cover over strainer. Remove the inlet valve spring and valve.

Remove the air dome and gasket from top cover over diaphragm. Remove the outlet valve spring and outlet valve.

Cleaning and Inspection

All parts should be cleaned thoroughly with a solvent. Blow out all passages with compressed air.

Check parts of fuel pump as follows:

Top cover and pump body - Make visual check for cracks and breakage. Inspect for diaphragm flange warpage by testing on a smooth flat surface. Examine all of the threaded holes for stripped or crossed threads. Broken, damaged, or severely warped castings require replacement of complete pump.

Valve and cage assemblies, valves, and springs - Replace. Extent of wear cannot be determined visually.

Strainer Screen - Replace. Inspect new screen for damage or obstruction. Screen must fit snugly around inner edge.

Rocker Arm Pin and Washer - Replace with service type pin and washer.

Links - Replace fuel and vacuum links. Amount of wear cannot be determined visually.

Rocker Arm Spring - Replace. Spring may be weak from distortion or corrosion.

Diaphragm Spring - Replace. Spring may be weak from distortion or corrosion.

Diaphragm - Always replace.

Gaskets - Always replace gaskets to assure tight seals.

Oil Seals - If seals are rough or torn, replace pump.

Depending upon the extent of service required as a result of diagnosis, the combination fuel-vacuum pump may be serviced by replacement with a new AC exchange pump, by a general overhaul with the AC Repair Kit, or by diaphragm repair with the AC Diaphragm Kits.

Reassembly

Soak new diaphragm assemblies in clean kerosene while performing the following steps. Fuel oil may be used, but do not use shellac or sealing compound.

Assemble link spacer over fuel link. Place one vacuum link on each side of the fuel link. The hook ends of the vacuum link should come together so that they surround the fuel link. All link hooks should point in the same direction. Place assembly of links and spacer between lobes of rocker arm and if link washers were provided, place them on the outer side of each vacuum link. Slide rocker arm bushing through holes in rocker arm, link washers, link spacer, and links.

Stand the pump body on the bench, fuel flange down. Set rocker arm spring in position with one end over cone cast into the body. With the two outer spacer washers over the ends of the bushing, slide rocker arm and link assembly into body. Outer end of rocker arm spring slips over projection on link spacer. The open end of all link hooks must point toward vacuum flange. Temporarily retain rocker arm and link assembly with small diameter end of AC Tool No. PT-6.

Turn the pump body over so the fuel diaphragm flange is up. Set the diaphragm spring on the staked-in oil seal, and the retainer on top of the spring. Push diaphragm pull rod through retainer, spring, and oil seal. Flat section of pull rod must be at right angles to link. Hook the diaphragm pull rod to the fuel link. The fuel link is the short, center link.

Drive AC Tool No. PT-6 out with permanent rocker arm pin. Place washer over small end of pin and spread pin end.

Install fuel cover on body, making sure that file marks on cover and body line up. Push on rocker arm until diaphragm is flat across body flange. Install cover screws and lock washers loosely until screws just engage lock washers. Pump the rocker arm three or four full strokes before tightening the cover screws, or pump will deliver too much pressure.

Install new gaskets on fuel section valve plug and air dome.

Place a drop of light oil on outlet valve and install in chamber over diaphragm. Insert valve spring in air dome. Install dome assembly and gasket in top cover over diaphragm, holding pump on its side. Make sure that spring seats properly by observing through fuel outlet hole as air dome is tightened securely.

Place a drop of light oil on inlet valve and install in chamber over strainer. Insert spring in valve plug and install valve plug and gasket over strainer holding pump on its side as plug is tightened to be sure that spring seats properly.

Install strainer screen and new gasket in fuel cover. Install bowl seat on bowl screw. Assemble filter bowl, swing bail into position, and tighten bail nut securely.

Place two gaskets and two valve and cage assemblies in vacuum cover. Inlet valve must have 3-legged spider facing out of cover. Outlet valve must have 3-legged spider facing into cover. Secure valve and cages with retainer and screw.

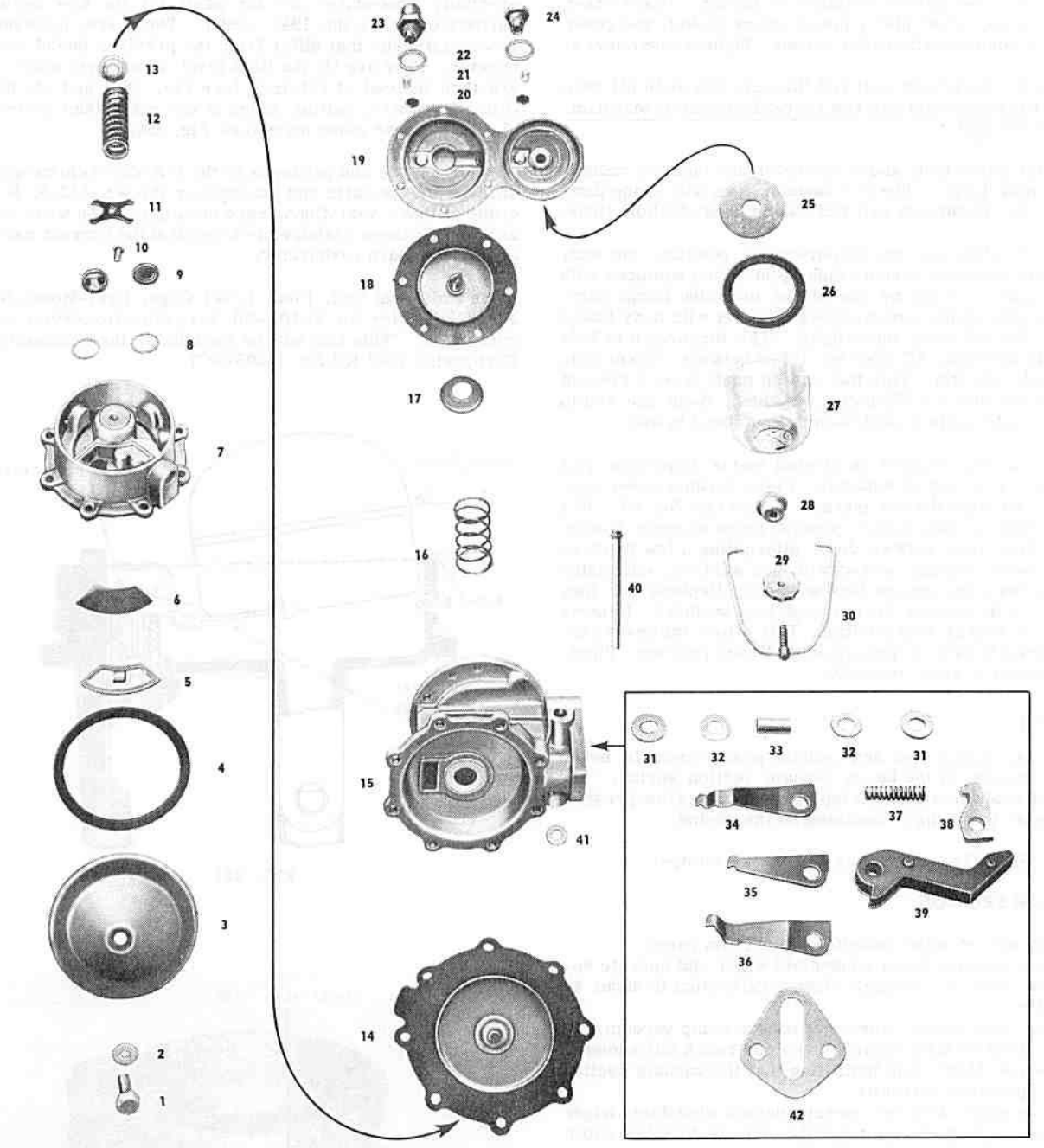


FIG. 353

1. COVER PLATE SCREW
2. COVER PLATE SCREW GASKET
3. COVER PLATE
4. COVER PLATE GASKET
5. SCREEN RETAINER
6. SCREEN
7. VACUUM COVER
8. VALVE AND CAGE ASSEMBLIES GASKETS
9. VALVE AND CAGE ASSEMBLIES
10. VALVE AND CAGE ASSEMBLIES RETAINER SCREW
11. VALVE AND CAGE ASSEMBLIES RETAINER
12. VACUUM DIAPHRAGM SPRING
13. VACUUM DIAPHRAGM SPRING RETAINER
14. VACUUM DIAPHRAGM
15. PUMP BODY
16. FUEL DIAPHRAGM SPRING
17. FUEL DIAPHRAGM SPRING RETAINER
18. FUEL DIAPHRAGM
19. FUEL COVER
20. FUEL INLET AND OUTLET VALVES
21. FUEL VALVE SPRINGS
22. AIR DOME AND VALVE PLUG GASKETS
23. AIR DOME
24. VALVE PLUG
25. FUEL STRAINER SCREEN
26. FUEL BOWL GASKET
27. FUEL BOWL
28. FUEL BOWL SEAT
29. BALL SCREW NUT
30. FUEL BOWL BAIL
31. OUTER SPACER WASHERS
32. LINK WASHERS
33. ROCKER ARM BUSHING
34. VACUUM LINK
35. FUEL LINK
36. VACUUM LINK
37. ROCKER ARM SPRING
38. LINK SPACER
39. ROCKER ARM
40. ROCKER ARM PIN
41. ROCKER ARM PIN WASHER
42. FUEL PUMP TO BLOCK GASKET

Turn vacuum section over and set screen in recess over valve hole. Set screen retainer on screen. Place cover plate gasket, cover plate, cover screw gasket, and cover screw in position in the order named. Tighten cover screw.

Push the diaphragm pull rod through staked-in oil seal. Do not tilt diaphragm pull rod excessively as this may damage the oil seal.

Lift the pump body above eye level and face the vacuum diaphragm flange. The two vacuum links will swing down so that the diaphragm pull rod can be hooked to both links.

While holding vacuum diaphragm in position, the body should be clamped vacuum side up in a vise equipped with brass jaws. Clamp by one of the mounting flange ears. The vacuum diaphragm must be held level with body flange during the following operations. The diaphragm is held level by inserting AC Tool No. PT-8 between rocker arm stop and body stop. This tool can be made from a piece of steel 3/16-inch x 3/32-inch x 8 inches. Bend one end to form a right angle hook 3/8-inch from bend to end.

Place spring retainer on riveted end of diaphragm pull rod and the spring on retainer. Place vacuum cover over spring and align the file marks. Insert two No. 10 - 32 x 1-1/2-inch screws in two opposite holes in cover flange. Turn these long screws down, alternating a few turns on each. Insert regular screws with lock washers, and tighten until screws just engage lock washers. Replace two long screws with regular screws and lock washers. Remove tool from rocker arm position. This allows the heavy vacuum spring to push diaphragm into a flexed position. Tighten all cover screws securely.

Testing

The combination fuel and vacuum pump cannot be bench tested because of the heavy vacuum section spring. The only adequate test for this type pump is with a low pressure gage when the pump is mounted on the engine.

FUEL SECTION -- See page 115, "Fuel Pumps".

VACUUM SECTION

1. Disconnect outlet (manifold) line from pump.
2. Open vacuum line to windshield wiper and operate engine from idle through slow acceleration to about 40 MPH.
3. The wiper should start operating on pump vacuum only at about 15 MPH engine speed and reach full speed at about 40 MPH, thus indicating that the vacuum section is operating correctly.
4. If the wiper does not operate, detach windshield wiper line at pump and joint it to the already detached outlet line with a piece of rubber hose.
5. SLOWLY operate engine from idle to about 25 MPH. The wiper should run at full speed operating on the engine vacuum only. If it does not, it can be assumed that the wiper motor or tubing is defective. The pump vacuum section is inoperative if the windshield wiper operates on engine vacuum but not on pump vacuum.

Carter Carburetor (Model WE-661-S)

CHAMPION Early production cars are equipped with the Carter Model WE-532-S carburetor. Later production cars are equipped with the Carter Model WE-661-S carburetor. The latest model carburetor improves the warm-up on cold starts and decreases the possibility of loading-up on hot starts. The new carburetor may be readily identified by inspection of the automatic choke heat tube. This tube is bare, not being covered by an asbestos loom as on the Model WE-532-S carburetor.

The disassembly, cleaning and inspecting, and the reassembly procedures are the same for the new series carburetor as for the 1947 model. There are, however, two adjustments that differ from the previous model carburetor. They are (1) the float level adjustment which is 3/8-inch instead of 1/4-inch (see Fig. 354) and (2) the Climatic control setting which is one notch lean instead of on the center index mark (see Fig. 355).

Various parts and passages in the WE-661-S carburetor differ from the parts and passages in the WE-532-S. Because of these variations, care should be taken when reassembling these carburetors to see that the correct parts are used in each carburetor.

One additional tool, Float Level Gage, Kent-Moore No. J-818-2 (Carter No. T-109-80), is required to service this carburetor. This tool will be included in the combination Carburetor Tool Kit No. J-505-SCT.

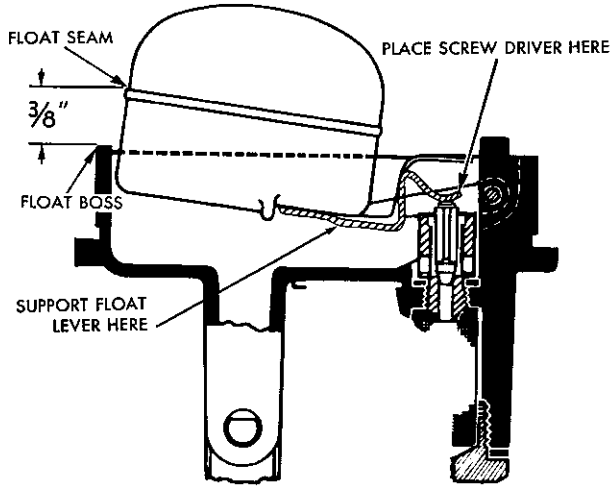


FIG. 354

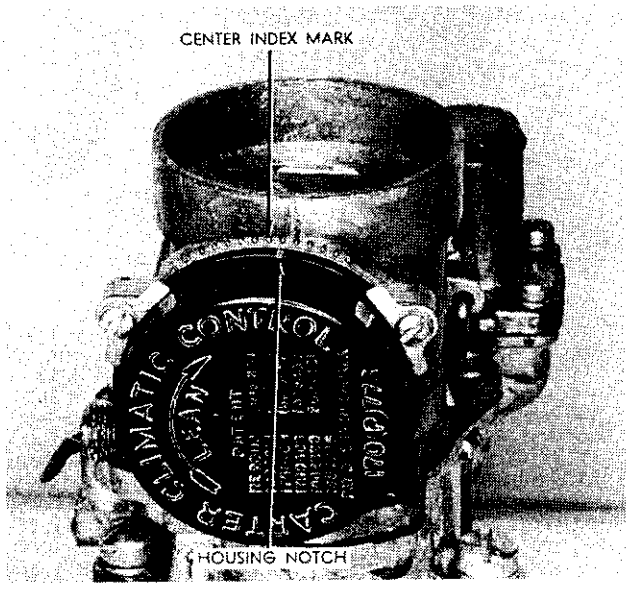


FIG. 355

Lubrication

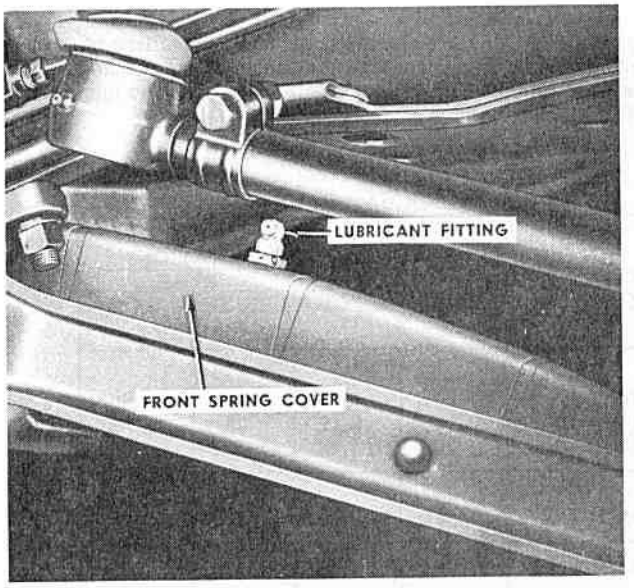


FIG. 356

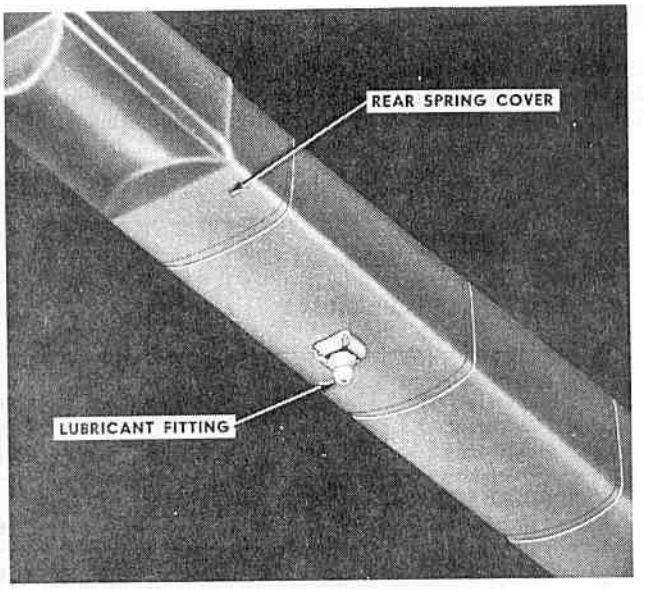


FIG. 357

Chassis Springs

CHAMPION AND COMMANDER Chassis springs equipped with lubrication fittings should be lubricated with a good grade of graphite spring lubricant at 1000 mile (1609 km.) intervals. Two 90° lubricant fittings are used on the top of the front spring covers and are lubricated from the front as shown in Fig. 356. Each rear spring is equipped with two 180° lubricant fittings located on the under side of the covers as illustrated in Fig. 357.

On early production cars not equipped with lubrication fittings, lubricate at least every 5000 miles (8046 km.) with a good grade of graphite spring lubricant using Lubroclamp equipment.

Clutch Operating Shaft Bearing

CHAMPION AND COMMANDER The clutch operating shaft bearing should be lubricated with engine oil at 1000 mile (1609 km.) intervals.

Springs and Shock Absorbers

Rear Shock Absorbers

COMMANDER The rear shock absorbers on the 15A Commander and Commander Land Cruiser are mounted at right angles to the frame, which allows the shock absorber links to extend from the shock absorber arms to the spring mounting plates at an angle of approximately 45° (see Fig. 358).

The servicing, filling, and adjustment procedures for these shock absorbers are the same as those given on pp. 159-161 of this manual for the rear shock absorbers on the 1947 Champion models.

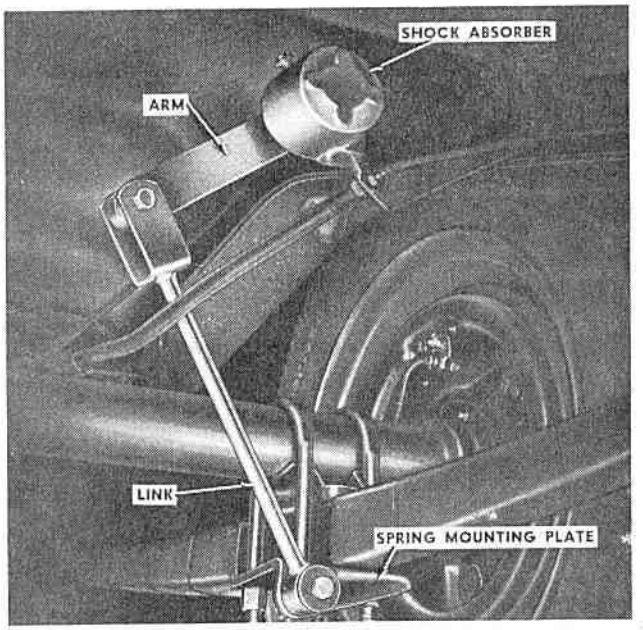


FIG. 358

Wheels and Tires

Tire Pressures

CHAMPION AND COMMANDER Tire pressures should be read and air added or withdrawn to obtain correct inflation only after the tires are cooled to prevailing temperatures. Never remove air from a heated tire because of excessive pressures; the tires and tubes are constructed with allowance for pressure build-up caused by hot roads and high speeds.

CAR MODEL AND TIRE EQUIPMENT	TIRE SIZE	RECOMMENDED INFLATION FRONT LBS/IN^2	FRONT KG/CM^2	REAR LBS/IN^2	REAR KG/CM^2
CHAMPION					
Standard	5.50x15	30	2,10	28	1,96
Optional	5.50x16	30	2,10	28	1,96
Optional	6.00x15	28	1,96	26	1,82
COMMANDER					
Standard	6.50x15	26	1,82	22	1,55
LAND CRUISER	6.50x15	26	1,82	22	1,55

General Specifications

1948 Model specifications are the same as those given for the 1947 Model except as designated below:

	CHAMPION	COMMANDER
FUEL		
Carburetor	Carter Model WE-661-S	
IGNITION		
Distributor Cam Angle	38°	38°
STARTER		
Make	Auto-Lite	Auto-Lite
Model	MZ-4151	MCH-4001
CLUTCH		
Pedal Free Travel	1/2 inch to 1 inch (12,7 to 25,4 mm.)	1/2 inch to 1 inch (12,7 to 25,4 mm.)
TIRES		
Inflation Pressure (cool, minimum)	30 lbs. (2,10 kgs.) Front 28 lbs. (1,96 kgs.) Rear	26 lbs. (1,81 kgs.) Front 22 lbs. (1,52 kgs.) Rear
Station Wagon	(28 lbs. (1,96 kgs.) Front (30 lbs. (2,10 kgs.) Rear	
	See Tire Pressure Chart for Optional Sizes	
STEERING		
Front Wheel Caster Angle (No load)		-2° to -3°
BRAKES		
Pedal Free Travel	1/8 inch to 1/4 inch (3,16 to 6,35 mm.)	1/8 inch to 1/4 inch (3,16 to 6,35 mm.)

Revisions and Additions to the 1947 Studebaker Shop Manual

IMPORTANT

FILE THIS PINK SECTION IMMEDIATELY AFTER PAGE 196 OF THE 1948 SUPPLEMENT. AS A PERMANENT REMINDER, ALSO PLACE CHECK MARKS IN THE 1947 SHOP MANUAL BESIDE THE PARAGRAPHS OR ILLUSTRATIONS ON THE PAGES DESIGNATED.

PAGE NO.	FIG. NO.	SHOP MANUAL SECTION	ADDITIONAL INFORMATION OR REVISIONS
7 & 8		BODY	REMOTE CONTROL ADJUSTMENT - - ADDITIONAL INFORMATION CHAMPION AND COMMANDER To adjust: Loosen the two remote control retaining screws and the link adjusting screw. Set remote control bell crank in a straight up and down position. Tighten retaining screws at the remote control. Adjust the length of the remote control link as required and tighten adjusting link screw. When properly adjusted, the rotary latch should turn freely with the inside door handle in its fully opened position. With inside door handle in locked position, the door cannot be opened from the outside.
24	55	BRAKE SYSTEM	BRAKE PEDAL FREE TRAVEL--REVISION CHAMPION AND COMMANDER The second sentence under "Brake Pedal and Master Cylinder Adjustment" should read as follows: Adjust brake pedal by loosening the lock nut on the piston rod and turning larger nut until not less than 1/8 inch (3,16mm.) and not more than 1/4 inch (6,350mm.) free pedal travel exists before the pressure stroke starts. This change also applies to the measurements given in Fig. 55.
42	85	COOLING SYSTEM	WATER PUMP SHAFT END PLAY--REVISION CHAMPION AND COMMANDER The last sentence in the second paragraph on page 42 should read as follows: Allow .015 inch to .031 inch (0,38 mm. to 0,79 mm.) clearance between impeller and the housing; rotate the shaft when checking clearance. This change also applies to the measurement given in Fig. 85.
38		CLUTCH	CLUTCH PEDAL FREE TRAVEL--REVISION CHAMPION AND COMMANDER The specifications given in the first paragraph under "Clutch Pedal Travel Adjustment" should be 1/2 inch to 1 inch (12,7 mm. to 25,40 mm.).
43	88	COOLING SYSTEM	DRAINING COOLING SYSTEM--REVISION CHAMPION AND COMMANDER Draining instructions in the drawing should read: "All five of these outlets must be opened when draining the cooling system. Remove both hoses from Climatizer heater core."
48	90	ELECTRICAL SYSTEM	WIRING DIAGRAM, CONVERTIBLE TOP--REVISION CHAMPION AND COMMANDER A revised drawing of the wiring diagram for the top control is shown on p. 18E.
53	98		STARTER MOTOR OILER--REVISION COMMANDER The oiler on the front end of the Com-

PAGE NO.	FIG. NO.	SHOP MANUAL SECTION	ADDITIONAL INFORMATION OR REVISIONS
			mander starter is the same as on the Champion starter. The "covered oil hole" type is used instead of the "cup" type that is shown in the drawing.
54	101		DISTRIBUTOR CAM ANGLE--REVISION CHAMPION AND COMMANDER The last sentence in the second paragraph under "Adjusting and Testing" should read as follows: The cam angle on both models is 38°. This change also applies to Fig. 101.
69		ENGINE	OIL PAN FILLER BLOCK--REVISION CHAMPION The note under "Engine Oil Pan Installation" should read as follows: If a new oil pan filler block is installed in a 1947 Champion, be sure that it is of the malleable iron type.
78			VALVE GUIDES--REVISION CHAMPION AND COMMANDER The second sentence under "Valve Guides" should read as follows: If they are worn so that the clearance exceeds .0035 inch (0,0889 mm.), they should be replaced using Valve Stem Guide Remover and Replacer J-2034.
78			VALVE SEAT RUNOUT--ADDITIONAL INFORMATION CHAMPION AND COMMANDER The maximum valve seat runout is .0025 inch (0,0640 mm.).
80			CYLINDER HEADS CHAMPION AND COMMANDER Fig. 173, page 80 of the Shop Manual shows the tightening sequence for the Champion cylinder head cap screws. Fig. 174 shows the tightening sequence for the Commander cylinder head cap screws. Complete information on cylinder head tightening procedure is given in Service Bulletin Nos. 187 and 197.
134 & 135	263 & 264	LUBRICATION	CHASSIS SPRINGS--REVISION CHAMPION AND COMMANDER Chassis springs should be lubricated with graphite spring lubricant at 5000 mile (8046 km.) intervals using Lubroclamp equipment.
134 & 135	263 & 264		CLUTCH OPERATING SHAFT BEARING--REVISION CHAMPION AND COMMANDER The clutch operating shaft bearing should be lubricated with engine oil at 1000 mile (1609 km.) intervals.
138	273		STARTER MOTOR OILER--REVISION COMMANDER The oiler on the Commander starter motor is the "covered oil hole" type, the same as for the Champion, instead of the "cup" type as shown in Fig. 273.
143		PROPELLER SHAFTS AND UNIVERSAL JOINTS	SLIP JOINT ALIGNMENT--ADDITIONAL INFORMATION CHAMPION AND COMMANDER When installing the slip joint on the rear propeller shaft it is important to

PAGE NO.	FIG. NO.	SHOP MANUAL SECTION	ADDITIONAL INFORMATION OR REVISIONS
			align the arrow on the slip joint with the arrow on the propeller shaft.
149	284	REAR AXLE	REAR AXLE PINION BEARING--REVISION CHAMPION AND COMMANDER The rear pinion bearing as shown in Fig. 284 is reversed. The smaller end of the bearing cone should face the bearing cup.
163	314	TRANSMISSION	TRANSMISSION DRAWING--REVISION CHAMPION The caption under the Transmission drawing should read as follows: Fig. 314.--Construction of the Champion Conventional Transmission.
164	315		TRANSMISSION ILLUSTRATION--REVISION CHAMPION The caption under the Transmission illustration should read as follows: Fig. 315.--Parts of the Champion Conventional Transmission. The low and reverse sliding gear (No. 5) in the illustration is inverted. The shift fork channel of the gear should face the main shaft rear bearing. (On the Commander transmission the shift fork channel should face the front transmission bearing.)
165	317		TRANSMISSION DISASSEMBLY--ADDITIONAL INFORMATION CHAMPION AND COMMANDER The first sentence in the last paragraph on page 165 should read as follows: Mark the two synchronizer blocking rings, the synchronizer gear, and the synchronizer sleeve with quick drying lacquer, so that the parts of the synchronizer assembly may be reassembled in their original positions (see Fig. 317). Figure 317 is an illustration of the Champion conventional transmission.
166	318		TRANSMISSION DISASSEMBLY--ADDITIONAL INFORMATION CHAMPION Fig. 318 is an illustration of a Champion conventional transmission.
166	319		TRANSMISSION DISASSEMBLY--ADDITIONAL INFORMATION CHAMPION Fig. 319 is an illustration of a Champion conventional transmission.
167	322		TRANSMISSION REASSEMBLY --ADDITIONAL INFORMATION CHAMPION AND COMMANDER Fig. 322 shows the relative positions of the parts of the shifter mechanism when it is installed in the Champion case. On the Commander transmission, the offset part of the low and reverse gearshift fork is toward the front.
167			TRANSMISSION REASSEMBLY--ADDITIONAL INFORMATION CHAMPION AND COMMANDER The first sentence of the second paragraph on page 167 should read as follows: Using a dummy shaft to hold the center spacer, needle bearings, washers (bearing rings), and thrust washers

PAGE NO.	FIG. NO.	SHOP MANUAL SECTION	ADDITIONAL INFORMATION OR REVISIONS
			in place, install the countershaft gear assembly.
169	327	TRANSMISSION (Cont'd.)	OVERDRIVE TRANSMISSION DRAWING--REVISION CHAMPION The caption under the transmission drawing should read as follows: Fig. 327.--Construction of the Champion Overdrive Transmission.
184		GENERAL SPECIFICATIONS	IGNITION, CAM ANGLE--REVISION CHAMPION AND COMMANDER The distributor cam angle is 38°.
184			STARTER, MODEL NO.--REVISION COMMANDER The starter motor model number is MCH-4001.
185			CLUTCH, PEDAL FREE TRAVEL--ADDITIONAL INFORMATION CHAMPION AND COMMANDER The clutch pedal free travel is 1/2 inch to 1 inch (12,7 mm. to 25,4 mm.).
186			STEERING, CASTER ANGLE--ADDITIONAL INFORMATION COMMANDER Beginning with the serial numbers listed below, the caster angle specification for the Commander is —2° to —3° with no load.

Model	South Bend Production	Los Angeles Production
14A	4276243	4819208
14AS	4276102	
14AY	4276053	4819188

Also Car Serial Numbers
4819196, 4819200, 4819201, 4819177, 4819180, and 4819185.

186			BRAKES, PEDAL FREE TRAVEL--ADDITIONAL INFORMATION CHAMPION AND COMMANDER The brake pedal free travel is 1/8 inch to 1/4 inch (3,16 mm. to 6,35 mm.) before the pressure stroke starts.
186			GENERAL DATA, WHEELBASE--REVISION CHAMPION The wheelbase of the Champion is 112 inches (2.844,8 mm.).

STUDEBAKER

SUPPLEMENT TO 1947 PASSENGER CAR SHOP MANUAL

COVERING 1949 MODELS

8G AND 16A

Starting 1949 Passenger Car Serial Numbers

8G CHAMPION	
South Bend	G-400501
Los Angeles	G-839701
Hamilton	G-703101
16A COMMANDER	
South Bend	4361001
Los Angeles	4832701

Starting Engine Numbers

8G CHAMPION	
South Bend and Los Angeles	441001
Hamilton	C-4101
16A COMMANDER	
South Bend and Los Angeles	H326001

THE STUDEBAKER EXPORT CORPORATION
SOUTH BEND 27, INDIANA, U. S. A.

INDEX

PACKAGE COMPARTMENT DOOR LOCK — All Models

The package compartment door lock is of the turn-knob type. To remove lock (1, Fig. 359) spring the ears of the retainer (2) outward and lift up over the projections on each side of the lock body.

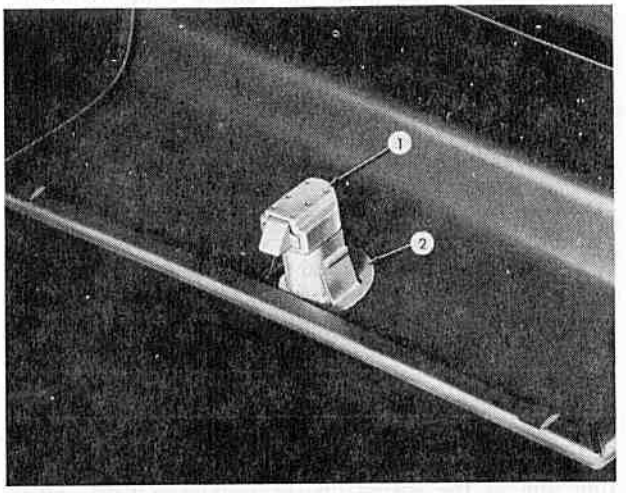


FIG. 359

1. Lock 2. Retainer

INSIDE DOOR AND WINDOW REGULATOR HANDLES — All Models

The inside door and window regulator handles have individual escutcheon plates. The individual plate eliminates the possibility of a bind on the shaft and insures free operation. To remove the window regulator handle, press in on the escutcheon plate far enough to expose the retaining pin. Push the pin out with a small drift and then remove the handle.

ARM REST — All Models

The arm rest is held on the trim panel by means of two screws (1, Fig. 360). The outer retaining plate (2) is provided with two holes which expose the attaching screws, therefore, it is not necessary to remove the plate before removing the arm rest.

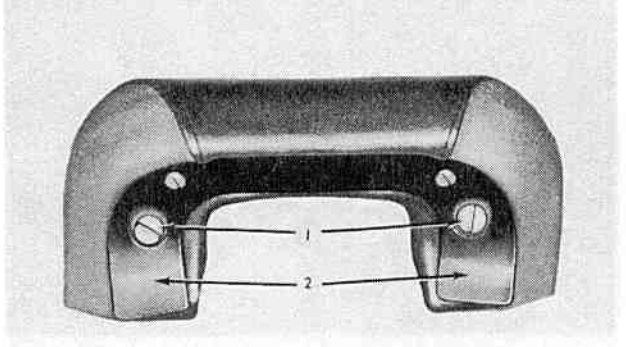


FIG. 360

1. Screw 2. Plate

DOOR WINDOW REGULATOR — All Models

The window regulator mechanism is of heavier construction and affords greater leverage. The servicing procedures are the same as outlined in the 1947 Passenger Car Shop Manual. Figs. 361 and 362 illustrate the front and rear window regulators.

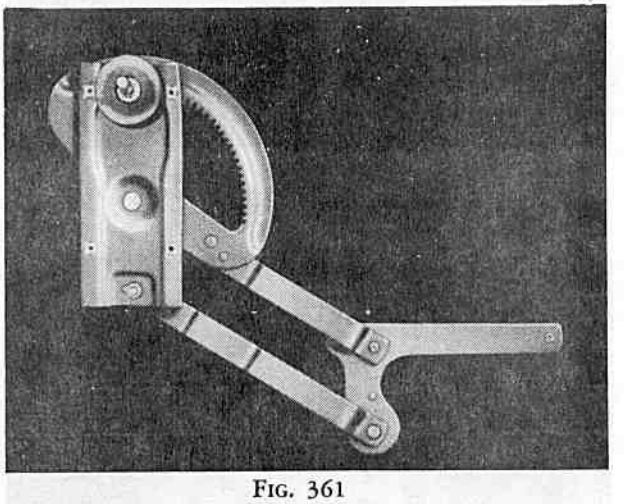


FIG. 361

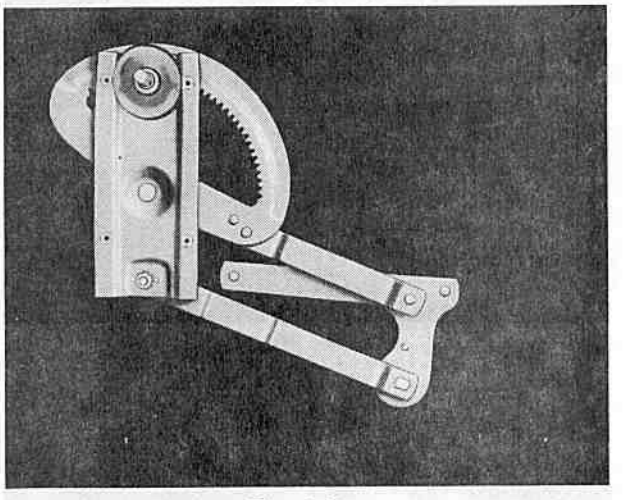


FIG. 362

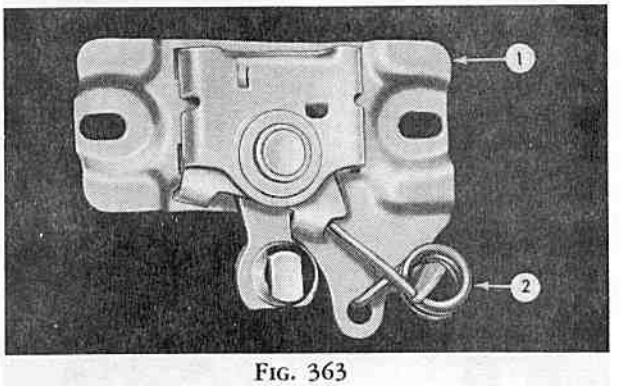


FIG. 363

1. Remote control 2. Spring

REMOTE CONTROL — FRONT — All Models

A spring (2, Fig. 363) has been added to the remote control assembly that will assure positive return of the remote control link to a neutral position.

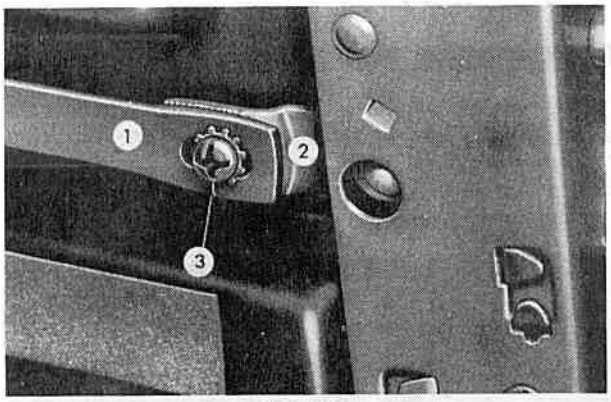


FIG. 364

1. Inner link
2. Outer link
3. Screw

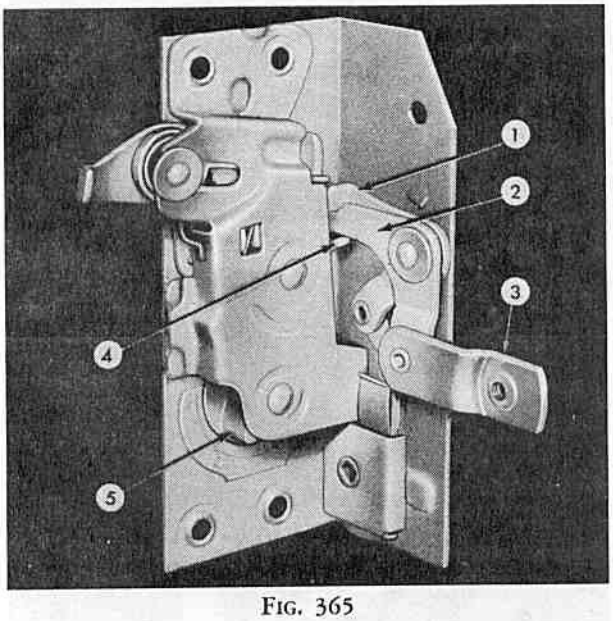


FIG. 365

1. Lock lever
2. Remote control lever
3. Control link
4. Latch lever
5. Latch

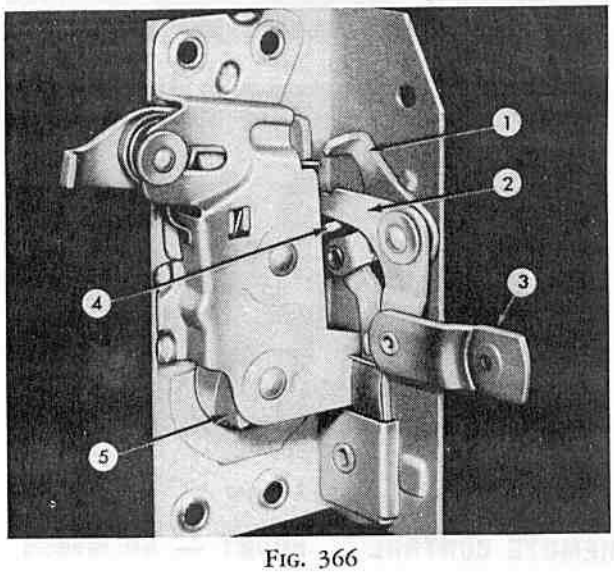


FIG. 366

1. Lock lever
2. Remote control lever
3. Control link
4. Latch lever
5. Latch

The length of the remote control link is adjustable. The elongated hole in the link (1, Fig. 364) permits shifting of the link so that the link assembly will properly trip the door latch. To make the adjustment, loosen the retaining screw, shift the link (2) toward the center of the door, and the link (1) toward the outside edge of the door just enough to take up the slack of the assemblies at each end. Then tighten the retaining screw. If properly adjusted, the latch will not be released or free until the remote control mechanism reaches its full open position. Serrations on both parts of the link prevent the loss of adjustment.

DOOR LOCK — All Models

The front door lock assembly has been redesigned so that either front door, if locked from the inside, can now be unlocked with a key from the outside. Fig. 365 illustrates the position of the levers in the unlocked position. In Fig. 366 the levers are in the locked position. The same lever is employed when the door is locked from either the inside or outside instead of the two locking levers which were used on former models.

When locked from the inside, the remote control lever (2, Fig. 366) pushes the lock lever (1) into the locked position and then returns to the neutral position due to the spring on the remote control. Then, when the door is unlocked from the outside the lock lever is pulled down out of the locked position without interference.

If the lock is put into the locked position while the door is open, closing of the door trips the latch (5) pulling the latch lever (4) down which in turn pushes the lock lever (1) into the unlocked position.

The lock shaft is not connected solidly to the lock cylinder but is turned by means of a pawl on the cylinder. Therefore, the shaft and lock assembly may operate independently of the lock cylinder when the assembly is operated from the inside.

Only a quarter of a turn of the key is necessary to lock or unlock the door.

VENTILATOR ASSEMBLY — All Models

Fig. 367 illustrates the type of pivot now used on all ventilator assemblies. The ventilator assembly adjustment is made by turning the nut (2) to increase or decrease the tension on the spring (1).

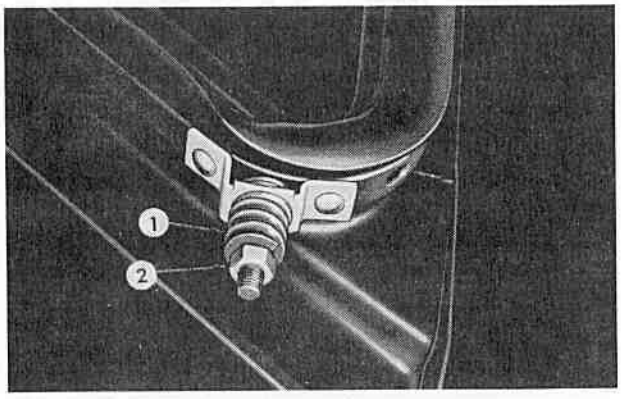


FIG. 367

1. Spring
2. Nut

FRONT SEAT CUSHIONS — All Models

All models are equipped with Select-O-Seat front cushions. These cushions are constructed so that auxiliary springs may be inserted between the rows of permanent springs to obtain the degree of firmness desired. Auxiliary springs are available in kits, each containing four springs.

To install the auxiliary springs, compress, insert, and position them between the rows of permanent springs (2) as shown in Fig. 368. Then using suitable pliers, fasten the auxiliary springs to the adjoining permanent springs with hog rings (1) as shown in Fig. 369. Installation of the hog rings will prevent shifting of the auxiliary springs.

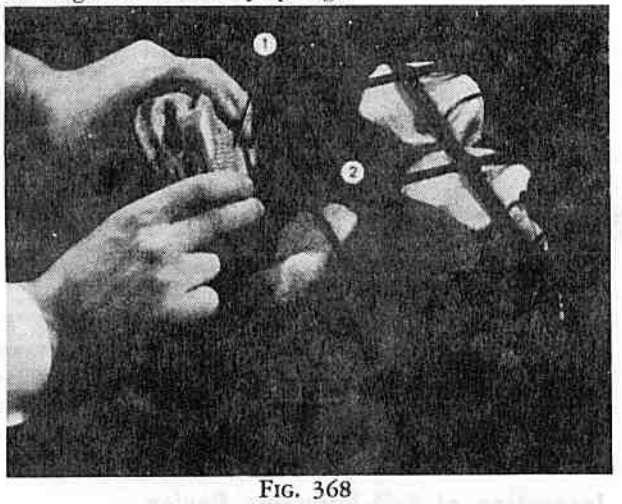


FIG. 368

1. Auxiliary spring
2. Permanent springs

TRUNK LID HANDLE LOCK CYLINDER

Removal and Installation — Champion

Insert the key in the lock and turn the key to the unlocked position. Insert a 3/32" (2,38 mm.) drill or a piece of wire of equivalent diameter in the hole located below the cylinder (see Fig. 370), push the retaining yoke of the cylinder with the wire, and pull the cylinder out of the handle.

To install the lock cylinder, insert the key in the cylinder, position the lock cylinder at the handle with retaining yoke down (unlocked position), depress the yoke, and insert the cylinder in the handle. After installation, make sure the yoke is seated and the cylinder is held securely in the handle.

Removal and Installation — Commander

Insert the key in the lock and turn the key to a position halfway between the locked and unlocked positions. Insert a 3/32" (2,38 mm.) drill or piece of wire of equivalent diameter in the hole located below the cylinder, push the locking plunger of the cylinder and pull the cylinder out of the handle.

To install the lock cylinder insert the key in the lock cylinder and turn the key so that the plunger can be pushed in. Align the cross groove of the locking shaft and the mating tongue of the lock cylinder, and with the milled side of the cylinder to the left, install the cylinder in the handle. Then turning the key pushes the plunger outward, seating it in the handle.

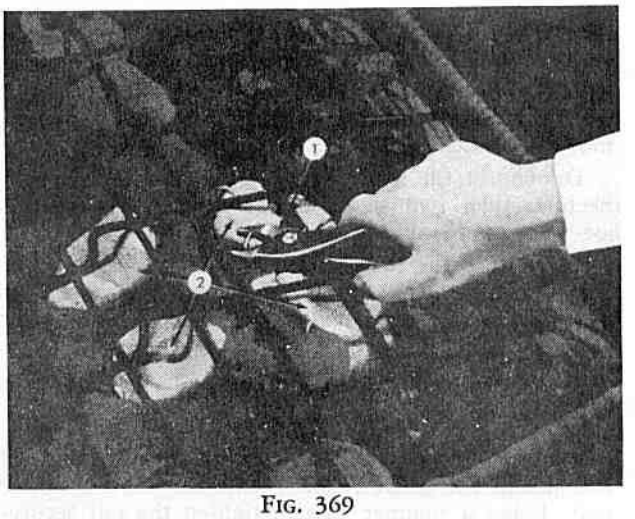


FIG. 369

1. Hog ring
2. Auxiliary springs

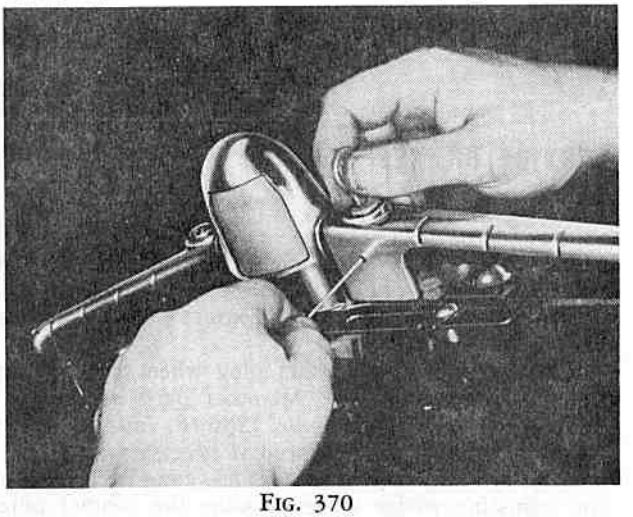


FIG. 370

WINDSHIELD WIPERS

Removal — All Models

Remove the control cable from the wiper motor. Remove the wiper motor from the auxiliary drive connector by removing the two attaching screws.

Relieve the tension on the drive cables by moving the spring (3, Fig. 371) away from the ratchet of the

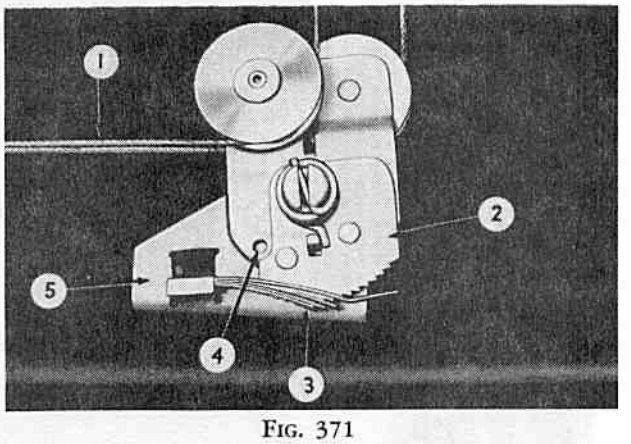


FIG. 371

1. Cable
2. Tensioner
3. Spring
4. Hole
5. Bracket

tensioner (2) and then push the tensioner assembly toward the center of the car. To hold the tensioner in this position, insert a small pin through the hole (4) in the tensioner and into a hole in the tensioner mounting bracket (5).

Disconnect the cables from the auxiliary drive connectors, then remove the auxiliary drive connectors assembly and cable tensioners from the cowl.

To remove the driver unit, remove the wiper arm, then using a spanner wrench remove the retaining nut which allows removal of the driver unit, spacer and gasket.

Installation — All Models

Insert the driver unit through the hole in the cowl and install the gasket, spacer, and nut on the driver unit. Using a spanner wrench tighten the nut securely. Install the wiper arm.

Install the cable tensioners and auxiliary drive connectors assembly on the cowl. The auxiliary drive connectors are formed in a slight V shape. Be sure the auxiliary drive connectors assembly is installed so that open part of V formed by the connector is down. Apply Lubriplate to the cables and install, being careful not to kink or fracture the cables. Be sure that the cables are riding the center of the pulleys and are not riding the edges.

Remove the small pins to allow the tensioners to return to their normal positions. The adjustment of the tensioners is automatic and manual adjustment is not usually required.

If it is found that the wipers react slowly, apparently due to the lack of proper tension on the cables, push the tensioners outward so that tensioner advances to the next notch. Thereafter, the adjustment is automatic.

Install the wiper motor and tighten attaching screws securely. Then connect the control cable to the wiper motor.

BRAKE SYSTEM

SERVICE BRAKES

Relining — All Models

Rivet the linings to the shoes being sure that there is approximately 1/16″ (1,58 mm.) clearance between the 3/4″ (19,05 mm.) contact plug lining hole and the contact plug.

Always use a new contact plug when reassembling the self-adjusting device. All other parts of the self-adjusting device should be cleaned, inspected for wear or damage, and replaced if necessary.

After relining the forward shoes, completely retract the adjusting wedge while pressing the contact plug. Clamp the shoe in a vise so that the jaws of the vise are directly beneath and bearing against the adjusting lever to prevent movement of the contact plug. Then file the contact plug flush with the lining surface.

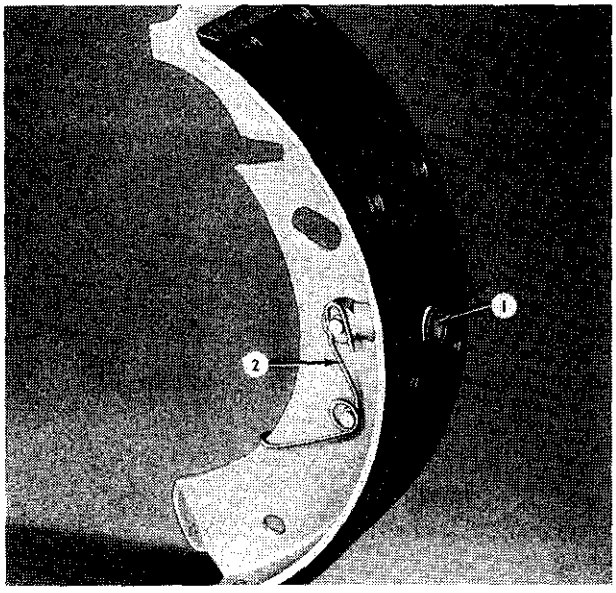


FIG. 372

1. Contact plug 2. Actuating spring

Self-Adjusting Device — All Models

The contact plug actuating (pressure) spring as used on the forward brake shoe assemblies is shown in Fig. 372. This external spring (2) replaces the small coil spring formerly used inside the contact plug (1) and also serves as a retainer to hold the adjusting lever in place on the brake shoe web.

Inspection of Self-Adjusting Device — All Models

To check the operation of the contact plug and plug actuating spring, completely depress the contact plug, fully retract the wedge, and hold it in a fully retracted position while pressing and releasing the contact plug. With the wedge still in the fully retracted position, release the contact plug, then release the wedge. To check the wedge action, manually depress the contact plug, noting if the wedge advances upward. To return the contact plug to its original position completely depress the plug, fully retract the spring and release the contact plug.

Both tests should reveal positive and free action of all parts. Worn parts should be replaced when either the contact plug actuating spring or the wedge tension spring fails to function properly.

When set in the proper position, the end of the contact plug must either be level with or not more than the equivalent of one adjusting notch below the lining surface. This should be checked after the shoes have been assembled on the brake backing plate and with the shoe return spring in place.

Reverse Shoe Adjustment — All Models

Reverse brake shoes are not equipped with a self-adjusting device. Wear of the shoe lining may under some conditions cause a pedal reserve loss which may be sufficient to require adjusting of the reverse shoes.

Before making the reverse shoe adjustment, check the pedal free travel and adjust if necessary. Then adjust each reverse shoe by turning the reverse shoe eccentric until the wheel drags and then back off the eccentric until the wheel just turns freely.

If this adjustment of the reverse shoe fails to pro-

vide adequate pedal reserve, check for the correct positioning of the forward shoes and the operation of the automatic self-adjusting device at each wheel.

Forward Shoe Adjustment — All Models

Remove the brake drum and inspect the brake lining. To check the self-adjusting device for free operation, first disconnect the shoe return spring and pull the shoe out just far enough so that the self-adjusting lever is off the eccentric. Then test the operation of the self-adjusting device as outlined in Inspection of Self-Adjusting Device.

Connect the shoe return spring and set the contact plug by depressing the plug until it is flush or one notch below the lining surface.

Install the brake drum. Position the forward shoe by turning the eccentric until the wheel drags and then back off the eccentric just enough to make sure there is no drag in the complete revolution of the wheel.

NOTE.—Under no circumstances adjust the forward shoes by means of the eccentric without pushing the contact plug either flush with or one notch below the lining surface because this may cause the brake to be overadjusted the first time the automatic adjustment is made.

MASTER CYLINDER

The master cylinder housing is of the cast aluminum type. The cover over the fluid reservoir as shown in Fig. 373 has been removed for illustration purposes only. It is usually not necessary to remove the cover during the disassembly and servicing procedures.

Disassembly — All Models

To disassemble the unit, slip the large end of the boot (2, Fig. 373) from the groove of the master cylinder barrel (9) and remove the boot and push rod (1) assembly. Disassemble the boot and push rod assembly by lifting the small end of the boot from the groove in the push rod and then pulling the push rod from the boot.

Remove the piston stop lock wire (3), and piston stop (4). The piston assembly (5), primary cup (6), return spring (7), and check valve (8) can then be removed. Remove the filler plug (16) and gasket (15). Then remove the outlet fitting bolt (12) and gaskets (10 and 11). If equipped with a hill holder, removal of the outlet fitting bolt will allow removal of the hill holder from the master cylinder.

Servicing — All Models

Inspect the condition of the master cylinder bore; if pitted or scratched, hone the cylinder wall to restore the highly polished surface necessary for efficient operation. Do not hone away any more than is required to remove pits and scratches, and smooth up the bore wall. After honing the cylinder use a No-go gage to check the diameter of the master cylinder bore and be sure the cylinder is within service limits. The master cylinder bore diameter is 1″ on all models. A burring tool should be used after the honing operation to remove the sharp edges on the by-pass port.

Before reassembly, make sure that the by-pass port hole is open; run a small wire through the hole to dislodge any foreign substance.

The cylinder and parts must be washed in clean alcohol or brake fluid (do not use gasoline, kerosene, or oil) and then dipped in Wagner Lockheed brake fluid before the unit is reassembled.

Reassembly — All Models

Install the check valve (8, Fig. 373) on the return spring (7), and install in the cylinder bore. Place the primary cup (6) and piston assembly (5) in the master cylinder bore and install the piston stop (4) and piston stop lock wire (3). Be sure that the lock wire is well seated in the groove. Install the boot (2) on the push rod (1) and install the assembly on the master cylinder. Install the filler plug (16) and gasket (15). Install the outlet fitting bolt (12) and gaskets (10 and 11), and if equipped with a hill holder, install the hill holder on the master cylinder.

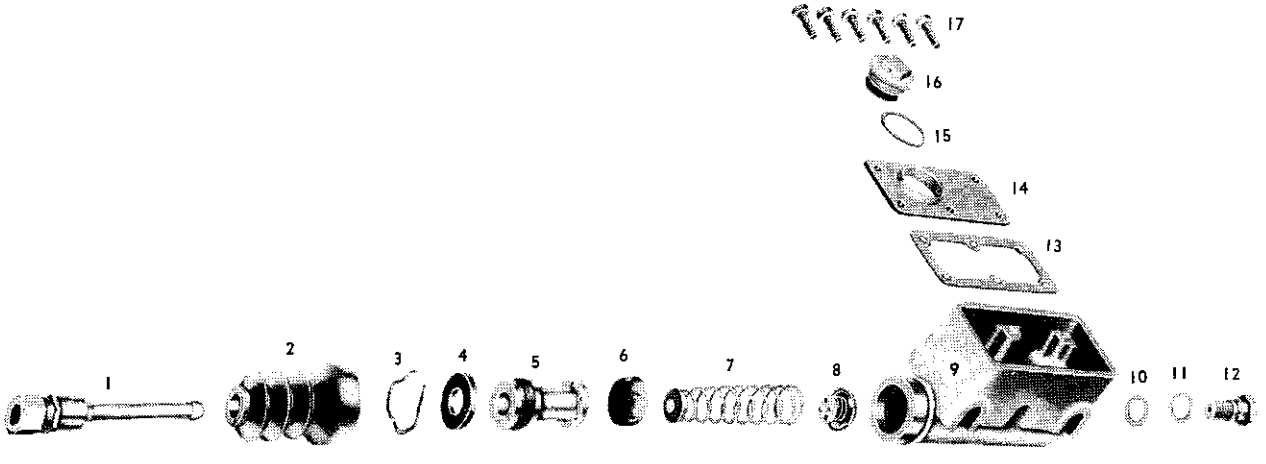


FIG. 373

1. Push rod
2. Rubber boot
3. Snap ring
4. Piston stop
5. Piston
6. Primary cup
7. Return spring
8. Check valve
9. Housing
10. Gasket
11. Gasket
12. Outlet fitting
13. Gasket
14. Cover
15. Gasket
16. Filler plug
17. Cover screws

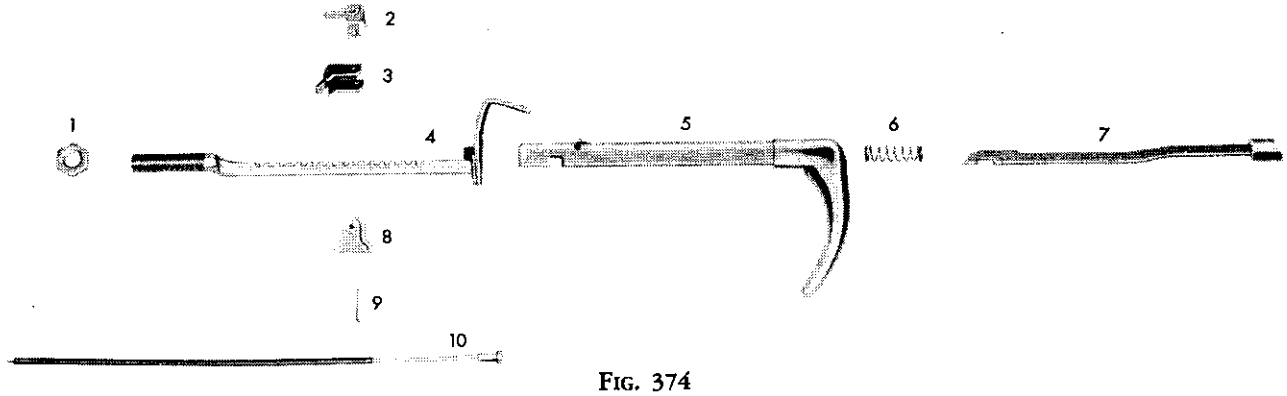


FIG. 374

1. Nut
2. Latch spring
3. Latch
4. Ratchet and handle guide assembly
5. Handle and plunger assembly
6. Spring
7. Release rod
8. Plunger stop
9. Rivet
10. Cable

PARKING BRAKE OPERATING HANDLE
Disassembly — All Models

File off the upset end of the rivet. Removal of the rivet (9, Fig. 374) then allows the removal of the plunger stop (8), latch spring (2), and latch (3). Withdraw the handle and plunger assembly and cable from the ratchet and handle guide assembly (4). Unhook the cable (10) from the plunger (5). Press the trigger release rod (7) slipping the end of the rod from the notch in the lower end of the plunger and remove the release rod and spring (6) from the handle.

Reassembly — All Models

Install the spring (6, Fig. 374) on the release rod (7) and install the rod in the handle (5) placing the notch of the release rod in the notch in the lower end of the plunger. Attach the cable (10) to the end of the plunger. Thread the cable through the ratchet and guide assembly (4) and install the handle and plunger assembly. Install the latch (3), latch spring (2), and plunger stop (8); align the holes of the three parts and the hole in the plunger and install a new retaining rivet (9). Peen the end of the rivet slightly.

CLIMATIZER

CLIMATIZER — All Models

The rectangular filter box formerly between the heater blower and the heater core is no longer used. Therefore, filters cannot be used on this model.

The heater core chamber has been redesigned to increase the flow of air through the core.

DEFROSTER — All Models

The built-in duct beneath the cowl and running the length of the cowl has been eliminated. A built-in outlet is now provided for each half of the windshield (see Fig. 375). Each outlet is connected to a sheet metal Y connection at the defroster motor by a flexible hose.

CLUTCH

CLUTCH RELEASE SHAFT — All Models

The clutch release shaft is lubricated by means of a Zerk fitting located at the left side of the clutch housing in the release shaft retainer. A pre-packed grease retainer is used on the right side. This grease retainer requires servicing only if the clutch release shaft is removed. Before installation of the shaft, fill the retainer approximately 1/3 full of Lubriplate.

NEW CLUTCH HOUSING
Installation — Commander

The aligning dowel which was formerly located at the top of the rear engine plate is no longer used.

Change the location of the dowel rings and align the clutch housing as described in the 1947 Passenger Car Shop Manual.

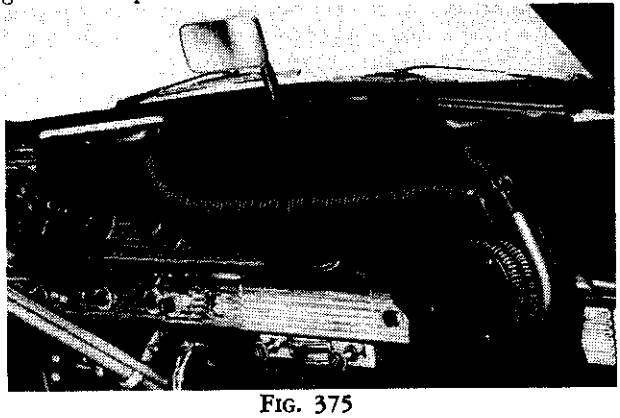


FIG. 375

COOLING SYSTEM

CAPACITY — Champion

A larger radiator core with four rows of tubes is used which increases the cooling system capacity to 11 quarts (9.15 Imp. quarts; 10,41 liters).

FAN — Champion and Commander

The fan speed is increased, the fan-to-engine ratio being 1.04 to 1 on all models.

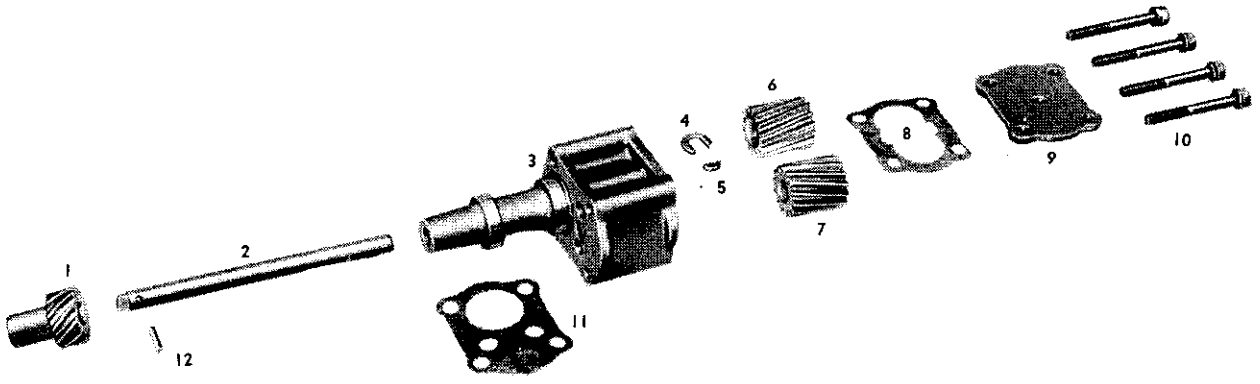


FIG. 376

1. Drive shaft gear
2. Drive shaft
3. Oil pump body
4. Thrust washer
5. Woodruff key
6. Drive gear
7. Idler gear
8. Cover gasket
9. Body cover
10. Cover screws
11. Body gasket
12. Pin

OIL PUMP

Removal and Disassembly — Commander

Disconnect the battery. Turn the crankshaft until No. 1 piston is on the compression stroke and the "UDC 1-6" mark on the vibration damper flywheel is directly under the timing pointer. Remove the starter mounting cap screws and, without disconnecting the wires tie the starter in an out-of-the-way position. Using a roller jack, raise the engine just enough to take the load off the rear engine mountings, then remove the support mountings from the crossmember. Remove the clutch operating shaft bracket-to-cross member bolts.

Place a small hydraulic jack between the right frame side member and the base of the engine block, with the base of the jack against the frame and the ram of the jack just rear of the breather tube. Operate the jack and move the rear of the engine about two inches to the left.

Disconnect the oil pressure gage pipe at the elbow at the oil pump cover. Remove the four cap screws (10, Fig. 376) which hold the pump body (3) to the block, then remove the body cover (9) and the oil pump.

To complete the disassembly, first remove the cover gasket (8) and the idler gear (7) then drive out the pin (12) which holds the oil pump drive shaft gear (1) to the drive shaft (2). With an arbor press, push the drive shaft (2) and drive gear (6) together out of the drive shaft gear and pump body. Press the shaft out of the drive gear, and remove the horseshoe thrust washer (4) and Woodruff key (5).

Reassembly and Installation — Commander

With the horseshoe-shaped thrust washer (4, Fig. 376) and the Woodruff key (5) in place, press the oil pump drive gear (6) on the drive shaft (2). After inserting the drive shaft in the oil pump body (3), press the drive shaft gear (1) on the shaft, being sure to align the holes in the gear and the shaft. Then lock the gear on the shaft with a new 3/16" (4,76 mm.) pin (12) and peen the pin securely in position.

To obtain proper end play when installing a new drive shaft and drive shaft gear, press the drive shaft gear on the shaft, placing a .003" (0,076 mm.) feeler gage between the faces of the gear and the pump body. Then, using the hole in the gear as a pilot, drill a hole in the shaft, ream it to 3/16" (4,76 mm.) and install a new pin.

Place a new body gasket (11) on the body. Before installing the oil pump, make sure No. 1 piston is at top dead center and the "UDC-1-6" mark on the vibration damper flywheel is directly under the timing pointer. With the keyway of the pump drive gear facing toward the rear of the car, start to engage the pump drive shaft gear with the camshaft gear. When full engagement has been obtained the keyway will point almost straight downward.

With the oil pump in the proper position, install a new cover gasket (8), the body cover (9) and cover screws (10).

After installing the pump, prime the pump with engine oil and connect the oil pressure gage pipe.

Remove the hydraulic jack and move the engine back into position. Install the rear engine support mountings. Install the clutch operating shaft bracket-to crossmember bolts. Install the starter motor, connect the battery and check the ignition timing.

VALVE CHAMBER BAFFLES

An oil baffle plate is provided on all models to prevent excessive oil splash in the valve spring chamber. One baffle is used in each half of the chamber. The baffle straddles the valve lifters and projects over the drain holes between the lifters. The baffles (1, Fig. 377) of the Champion engine are the same for both

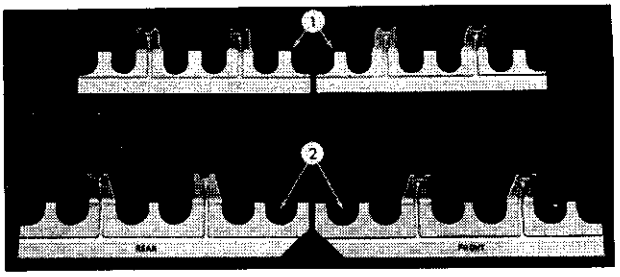


FIG. 377

1. Champion baffles
2. Commander baffles

halves of the chamber and are interchangeable. The baffles (2) of the Commander engine are marked front and rear and must be installed as marked.

Installation — All Models

Insert the baffle so that the curved portion is upward and the notch is aligned with the cover plate screw hole in the block. Then install the cover plate, making sure that the notches are straddling the cover plate screws. With the cover installed, the baffle is held tightly in place against the cover and cover plate screws.

CAMSHAFT — Champion

The lift of the Champion camshaft has been increased to 11/32" (8,73 mm.).

CAMSHAFT END PLAY — All Models

The camshaft end play is .003" to .006" (0,076 mm. to 0,15 mm.). The end play is the difference between the thickness of the thrust spacer and the thrust plate.

When installing the thrust plate, tighten the cap screws alternately a few turns at a time to prevent distortion of the plate.

PISTON — Commander

The piston (6, Fig. 378) of the Commander engine is provided with a groove (1) in the second land to reduce blow-by to a minimum in the higher speed operating range. It is important that the groove be cleaned whenever the pistons are removed. To clean the groove, apply coarse grinding compound to a piece of string, then run the string around through the groove until the groove is clean. After cleaning the groove thoroughly be sure to remove all grinding compound from the piston.

VALVE LIFTER — Commander

The adjusting screw of the lifter used in the Commander engine is self-locking (see Fig. 379). When an adjusting screw is replaced, the torque required to turn the screw should be at least 25 inch-pounds.

The valve lifter stem diameter is 0.624" (15,85 mm.).

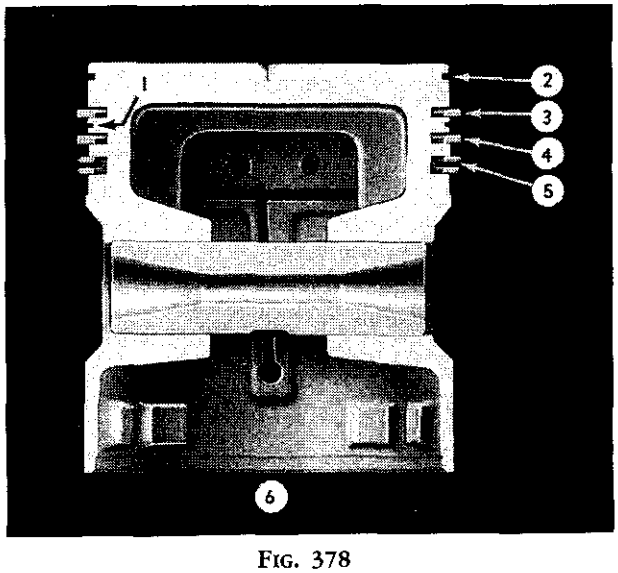


FIG. 378

1. Groove
2. Heat dam
3. Compression ring
4. Compression ring
5. Oil ring
6. Piston (Commander)

VALVE LIFTER SPRING — Commander

The valve lifter spring is the same as the spring used in the Champion engine.

CRANKSHAFT — Commander

The diameter of the main bearing journals of the Commander engine crankshaft is 2.8745" to 2.875" (72,01 mm. to 73,02 mm.).

The main bearing lengths are:

No. 1—1-3/32" (27,78 mm.)
No. 2—1-1/16" (27,0 mm.)
No. 3—1-1/16" (27,0 mm.)
No. 4—1-25/32" (45,24 mm.)

The main bearing clearance limits are .0006" to .0027" (0,015 mm. to 0,069 mm.).

CONNECTING RODS AND BEARINGS — Commander

The length of the connecting rod bearings of the Commander engine has been shortened from 1-3/16" to 1-5/32" (30,16 mm. to 29,37 mm.). The connecting rod length is 7-15/16" (201,61 mm.), the connecting rod having been shortened to allow the increase in the engine stroke without changing the position of the crankshaft in the block.

INLET AND EXHAUST MANIFOLD — Champion

The size of the riser of the Champion manifold has been increased from 1-7/16" to 1-9/16" (36,5 mm. to 39,7 mm.).

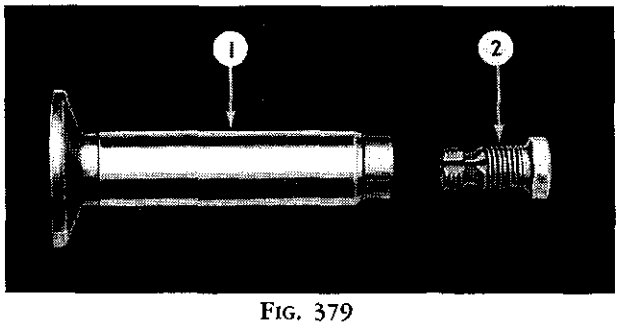


FIG. 379

1. Valve lifter
2. Adjusting screw

EXHAUST PIPE — Commander

A heat shield is provided on the exhaust pipe of the Commander model. It is clamped on the pipe opposite the rear engine support to deflect the heat of the exhaust from the support cushion.

CYLINDER BLOCK — Commander

The 3/16" (4,76 mm.) longer throw of the Commander engine crankshaft necessitates having the lower part of the block (case) larger just above the oil pan mounting flange.

OIL PAN — Commander

The Commander engine oil pan is deeper and of somewhat different contours but the width and length of the pan across the mounting flanges has not been changed. The increase in depth of the pan requires a longer dipstick although the capacity remains 6 quarts.

REAR BEARING OIL SEAL
Installation — All Models

Three oil seals are used at the rear main bearing. Wood filler blocks (3 and 4, Fig. 380) are used between the sides of the bearing cap and the cylinder block. Neoprene seals are used between the cap face and the block. The Brummer oil seal is installed around the crankshaft journal.

The engine rear plate must be removed before the Brummer oil seal installation is made.

The rear bearing cap and bearing as in all bearing installations must be cleaned thoroughly. Loosen the intermediate (Nos. 2 and 3) bearing cap screws ap-

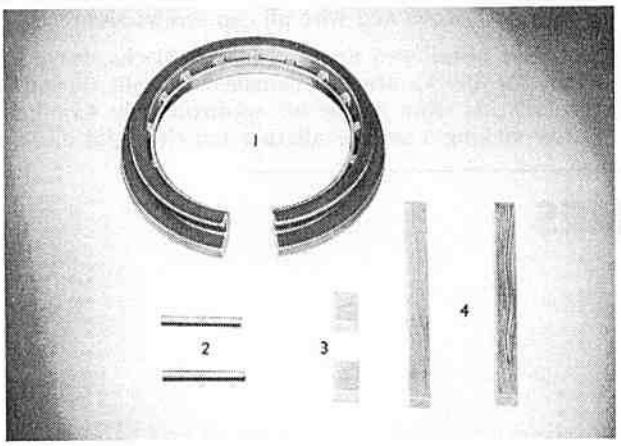


FIG. 380

1. Brummer oil seal
2. Neoprene seals
3. Wood filler blocks (Champion)
4. Wood filler blocks (Commander)

proximately two turns which will give additional clearance between the rear journal and the block.

Insert the Neoprene seals in the cross grooves of the rear bearing cap so that the inner end of each seal is inset 11/64″ ± 1/64″ (4.37 mm. ± 0.397 mm.) from the inner end of the groove. See Fig. 381. Press the seals uniformly and firmly into the grooves. Place the cap with the seals downward on a flat surface and, while pressing on the cap, use a sharp knife to cut the protruding ends of the seals flush with the side of the cap.

Using the flat side of a screw driver or a similar tool, blunt the sharp edge of the flange at the rear of the block on which the seal is to be mounted. The edge referred to is on the bottom face of the cylinder

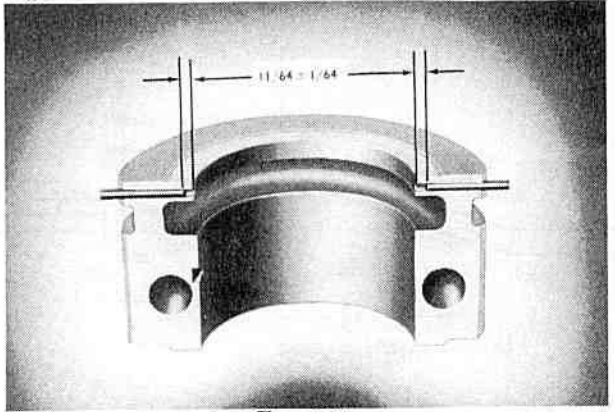


FIG. 381

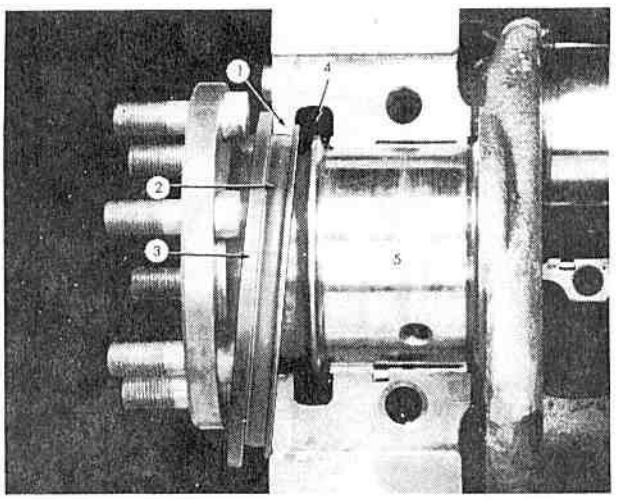


FIG 382

1. Rear flange
2. Sealing cushion
3. Brummer oil seal
4. Channel at rear of block
5. Rear bearing journal

block adjacent to the cap and is the one over which the Brummer seal is first pushed on each side. It is not necessary to remove any material from the edge but only to blunt it so that it does not scuff the soft center sealing cushion at the bottom of the groove since this cushion is as important a part of the seal as the compression flange which wipes the crankshaft.

Before installing the Brummer oil seal, thoroughly clean the channel just forward of the crankcase rear flange. This can be done by pulling a swab saturated with alcohol or a similar solvent through the channel several times, then drying the channel thoroughly.

Dip the ends of the seal in liquid soap and spread the liquid soap throughout the inside of the outer groove. Spread the seal (3, Fig. 382) just enough to permit aligning one end of it with the crankcase rear flange (1) and insert the seal as shown in the illustration. Carefully work the seal around the crankshaft until the end emerges on the opposite side. See Fig. 383. Now align the seal, reverse the direction of

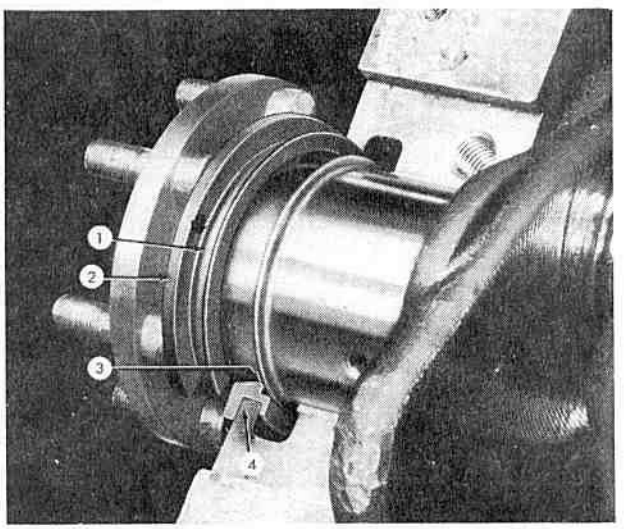


FIG. 383

1. Sealing cushion
2. Brummer oil seal
3. Compression flange
4. Rear flange

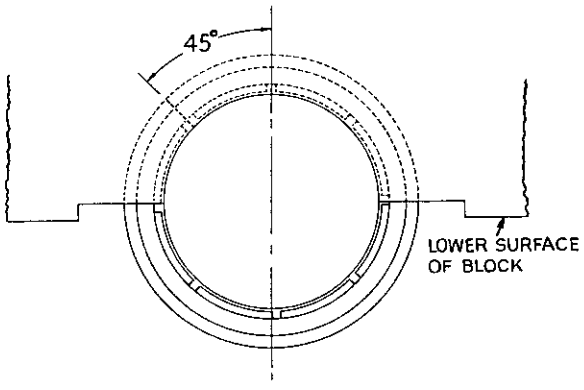


FIG. 384

rotation and insert the other end of the seal. Continue to turn the seal until the joint is approximately 45° from the lower surface of the block (see Fig. 384). During the installation procedure, great care must be used to avoid scuffing the soft center sealing cushion at the bottom of the groove of the seal.

Apply oil between the compression flange of the seal and crankshaft journal. Install the bearing cap and the two Neoprene seals. Be sure that the exposed half of the Brummer oil seal smoothly straddles the rear flange of the bearing cap and that the end edges of the flange have been blunted if required. Install the bearing cap bolts and tighten to specified torque. Tighten the intermediate (Nos. 2 and 3) bearing cap to proper torque and wire all cap screws securely.

Then install two new wood filler blocks, being sure that the blocks are not damaged or split during the installation. Run engine for approximately 45 minutes after making a seal installation and check for oil leaks.

FRAMES

Frame dimensions for the 8G Champion model are shown in Fig. 385 and for the 16A Commander model in Fig. 386.

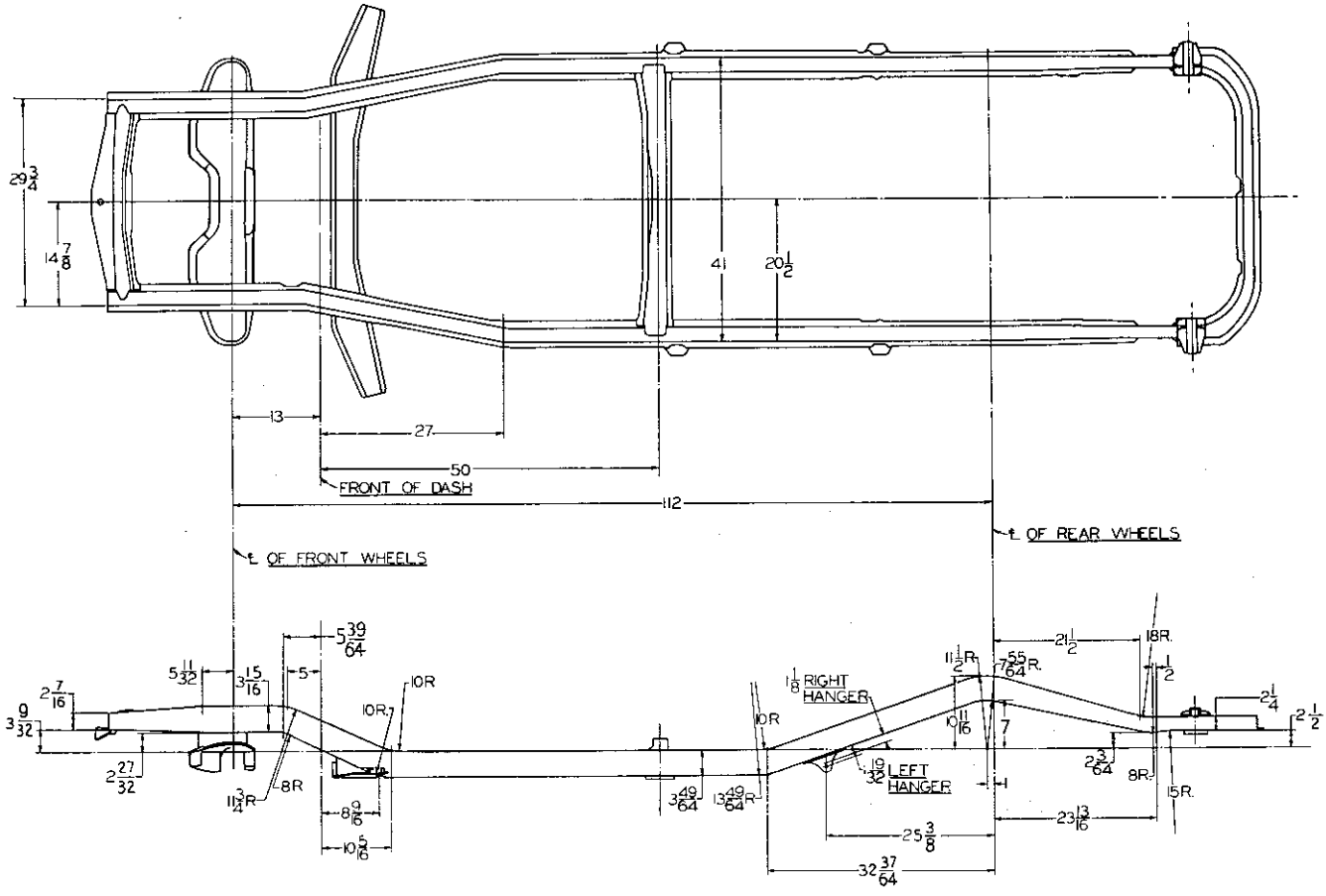


FIG. 385

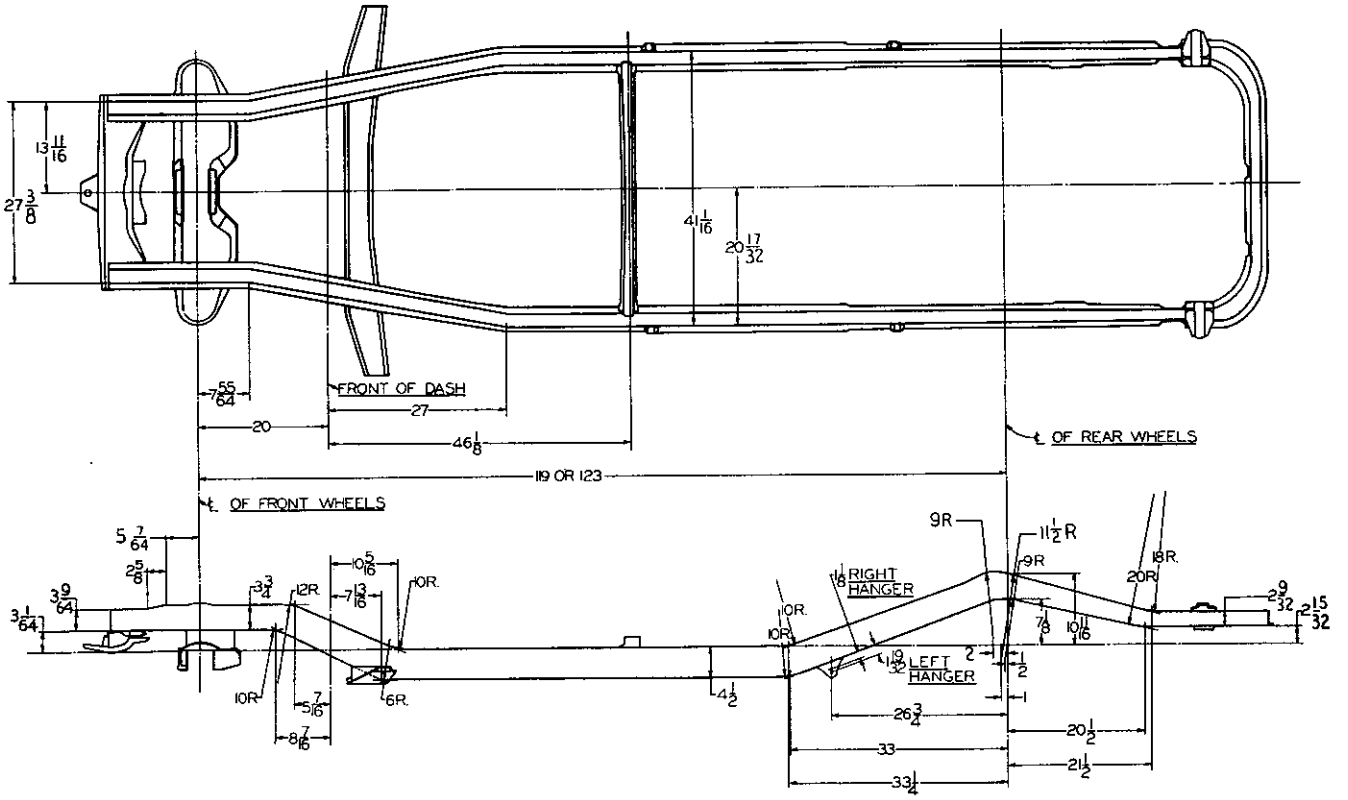


FIG. 386

FRONT SUSPENSION AND STEERING SYSTEM

STEERING GEAR ADJUSTMENT — All Models

Steering gear adjustments and linkage checks should be made with the load of the car off the front wheels, the front end supported at the outer ends of the lower control arms.

Two adjustments are provided for the steering gear assembly: the steering post end play and the cam lever shaft stud clearance. Before making the adjustment, disconnect the steering gear from the steering linkage and make sure the steering gear is filled with approved lubricant. The checks and adjustments should be made with the lubricant in the steering gear at room temperature.

Check the steering post end play first. Loosen the cam lever shaft adjusting screw lock nut and back off the adjusting screw. Using a spring scale that is calibrated in ounces, measure the amount of pull required to turn the steering wheel. The scale should be hooked to a light tag wire or string which is wrapped around the rim of the steering wheel at the spoke (see Fig. 387). A steady pull of 4 - 7 ounces, tangent to the rim of the wheel, should turn the steering gear smoothly. If the pull is not within the limits, remove the top cover cap screws, lift the top cover, and add or remove shims to secure the proper scale reading.

With the steering gear end play adjusted correctly,

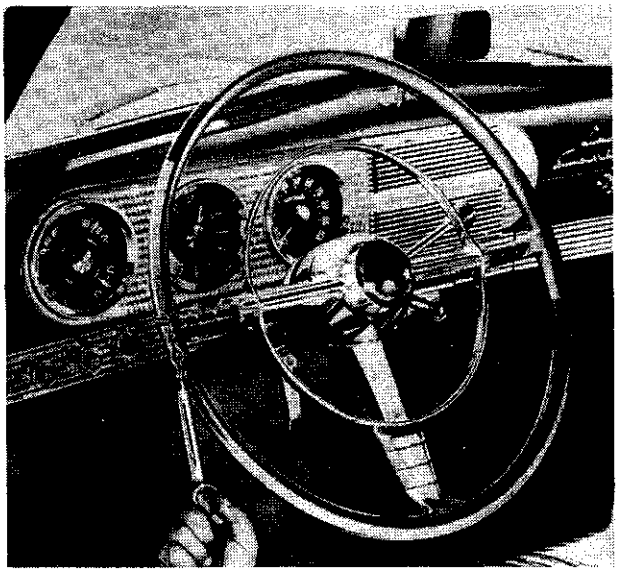


FIG. 387

locate the center of travel (high spot) of the steering gear. While turning the steering wheel back and forth over the high spot, turn the lever shaft adjusting screw, keeping the lock nut snug, until a slight drag is felt. Then tighten the lock nut. To check the adjustment, hook the spring scale to the rim of the steering wheel as outlined in the preceeding paragraph and check the amount of effort required to turn the wheel, either direction, through the high spot. The scale readings should be 16 - 24 ounces.

With the steering gear on the center of the high spot, the left front wheel should be in a straight ahead position with respect to the rest of the car. If not, adjust the left tie rod as outlined under Toe-In.

FRONT WHEEL ALIGNMENT

Camber — All Models

The camber limits are 0° to +1°, the adjustment procedure remains the same as outlined in the 1947 Passenger Car Shop Manual, but it is recommended that 1/2° more camber is maintained on the left wheel than on the right wheel.

When adding or removing shims, the same number and thickness of shim must be used at both front and rear brackets.

Caster — All Models

The caster limits are +1/2° to + 1-1/2° on the Champion and −2° to −3° on the Commander.

Toe-In — All Models

Set the steering gear on the center of the high spot. Reposition the steering wheel, if necessary, so that the spoke is straight across. The steering gear must be in this position during the adjustment procedure.

Following the procedure outlined in the 1947 Passenger Car Shop Manual, adjust the left tie rod, so the left front wheel is in a straight ahead position.

Measure the left tie rod and adjust the right tie rod to the same measurement. On the Champion, measure the length of the rod between the ball stud centers. On the Commander, measure the distance between the Zerk lubrication fittings of the rod. Set the toe-in to the correct specifications of 1/16" to 1/8" (1,58 mm. to 3,17 mm.) by adjusting the center (auxiliary) tie rod. If considerable change is necessary in this rod, check the steering gear arm, and on the Commander check the idler lever for proper position on the marked serrations.

CONTROL ARM STABILIZER

Removal — Commander

Remove the lock nut (18, Fig. 388) and inner nut (17), which allows the removal of the grommet retainer (16), grommet (15), and grommet seat (14). Remove the stabilizer link (5), grommet retainers (6, 9, and 11), grommets (7, 8, and 12), spacer (10), and grommet seat (13) from the end of the stabilizer shaft (2).

After disassembling both sides, remove the stabilizer shaft bushing retainer (4) from the shaft bracket (1) on both sides and remove the stabilizer shaft from the vehicle. Locate the split in the shaft bushing (3), spread, and remove it from the shaft.

Fig. 388 is an exploded view of the right side end of the stabilizer shaft, which is different from the left side in that it has an offset to avoid interference with the exhaust pipe.

The control arm stabilizer shaft bracket (19) is riveted to the control arm.

Installation — Commander

Spread the bushing (3, Fig. 388) and install on the stabilizer shaft (2). Install both bushings and place the bushing retainers (4) on the bushings. Position the stabilizer shaft at the shaft brackets (1), with the ends of the shaft above the control arm brackets, and install the bushing retainer on the shaft bracket on both sides.

Install the grommet retainer (6) and grommet (7) on the stabilizer link (5). Insert the stabilizer link through the eye at the end of the shaft, then install the grommet (8), grommet retainer (9), spacer (10), grommet retainer (11), grommet (12), and grommet seat (13) on the link. Insert the end of the link through the lower control arm bracket and install the grommet seat (14), grommet (15), grommet retainer (16), and inner nut (17) on the link. Thread the inner nut on the link to the end of the threads, then install the lock nut (18) securely.

Improper tightening of the link nuts will affect the stabilizer action due to improper compression of the rubber grommets.

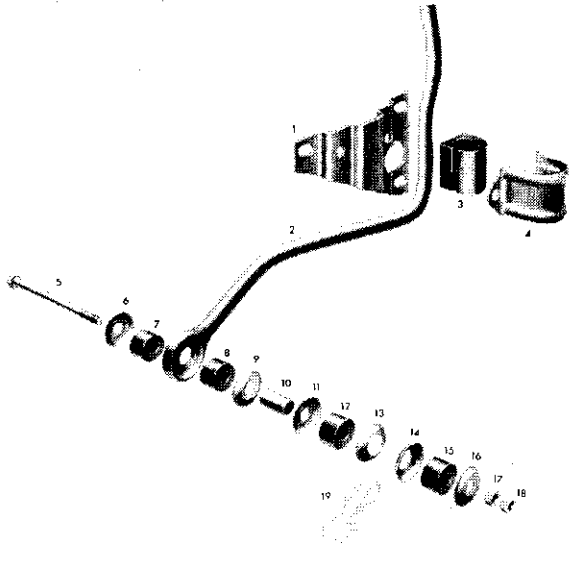


FIG. 388

1. Shaft bracket
2. Stabilizer shaft
3. Bushing
4. Retainer
5. Link
6. Retainer
7. Grommet
8. Grommet
9. Retainer
10. Spacer
11. Retainer
12. Grommet
13. Seat
14. Seat
15. Grommet
16. Retainer
17. Inner nut
18. Lock nut
19. Stabilizer shaft bracket

TANK — All Models

The tank capacity is 18 gals. (15 Imp. gals; 68,1 liters). The tank is supported by two mountings at the frame side rail on the left side and by a single mounting at the spare tire well on the right side. An air-vent tube extends from the top of the tank to the top of the filler pipe. The filler pipe is held securely by means of a clamp bracket which is attached to the body mounting bracket.

FUEL AND VACUUM PUMP

An AC Series CB combination fuel and vacuum pump is used on the 1949 Commander and Land Cruiser and is optional equipment for the Champion model. The vacuum section of this pump acts as a booster to the intake manifold suction thus providing operation of the windshield wiper at all engine speeds and loads.

Disassembly (Complete Overhaul) — All Models

Wash the outside of the unit with cleaning solvent and blow off with compressed air to remove loose grit and grease.

Mark the edges of fuel cover (1, Fig. 389), vacuum cover (3), and body (2) diaphragm flanges with a file so that the parts may be reassembled in their original positions. Note that the fuel diaphragm flange is symmetrical and the vacuum diaphragm flange has bulges where the screw holes occur.

Remove the fuel section cover screws and lock washers. Separate the cover from the body by jarring the cover loose with a screwdriver handle.

Remove only two cover screws from opposite sides of the vacuum section cover and substitute for them two No. 10 — 32 x 1/2-inch fillister head screws (1, Fig. 390). Turn the two long screws all the way down and then remove the rest of the regular cover screws (2). Alternately back off the two long screws, a few turns at a time, (rap the cover with a screwdriver handle if the flanges stick together) until the force of the heavy vacuum diaphgram spring is no longer effective. Remove the two long screws, the cover assembly, diapraghm spring and spring retainer. To remove the diaphragms only, it is not necessary to remove links. The diaphragms may be unhooked from the links by tipping the end of the pull rod away from the mounting flange.

To remove the rocker arm assembly, file the riveted end of rocker arm pin flush with the steel washer or cut off the end with 3/8-inch (9,5 mm.) drill. Drive out the rocker arm pin (1, Fig. 391) using AC tool PT 6, Kent-Moore tool No. KMO 707 (2). Wiggle the rocker arm until the links unhook from both diaphragms. Then remove the rocker arm spring, rocker arm, and link assembly.

To disassemble the rocker arm assembly, remove the steel bushing (16, Fig. 392). This allows the removal of the vacuum links (18 and 21), fuel link (19), link spacer (13), link washers (14), and the two outer spacer washers (15 and 20).

Lift vacuum diaphragm (35) straight out of the body (10). Remove the fuel diaphram (7) by lifting

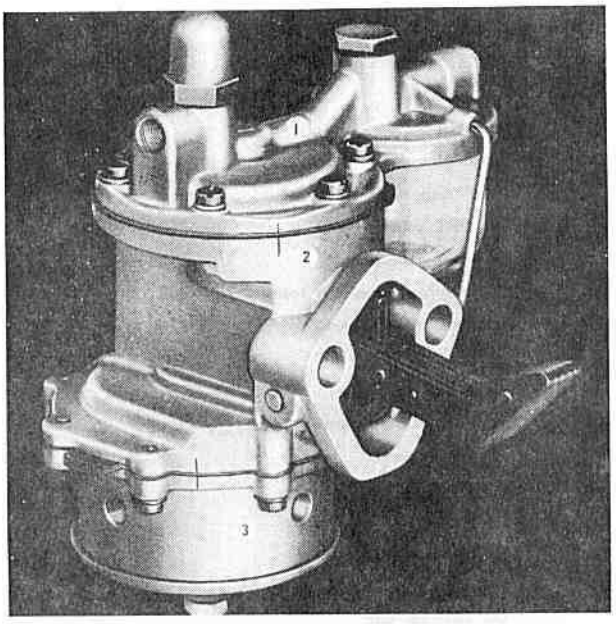


FIG. 389

1. Fuel cover
2. Body
3. Vacuum cover

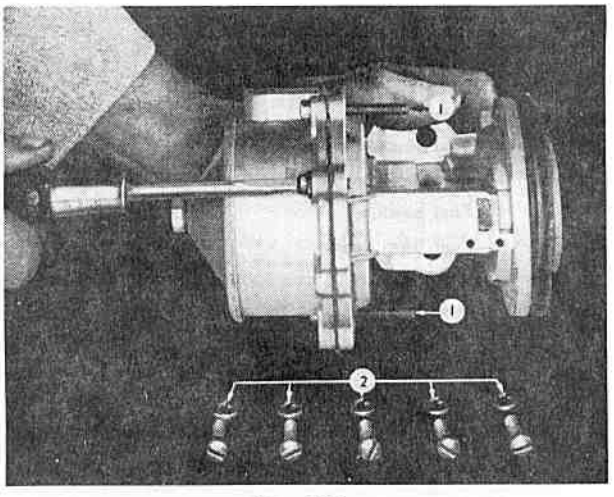


FIG. 390

1. No. 10-32x1-1/2 screws
2. Cover screws

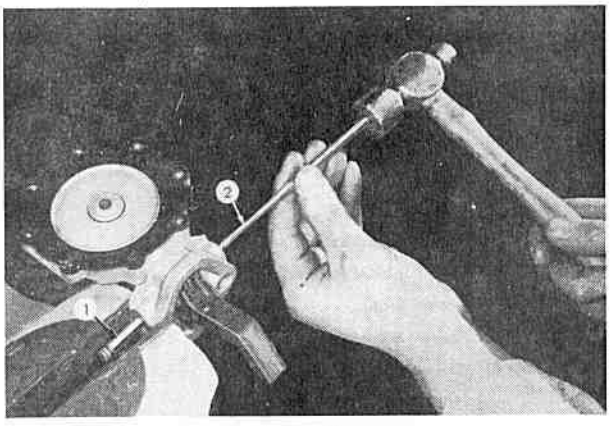


FIG. 391

1. Rocker arm pin
2. AC Tool No. PT-6

1. Air dome
2. Gasket
3. Fuel valve spring
4. Fuel outlet valve
5. Fitting
6. Fuel pump cover
7. Fuel diaphragm
8. Diaphragm spring retainer
9. Diaphragm spring
10. Pump body
11. Rocker arm pin
12. Rocker arm spring
13. Link spacer
14. Link washer
15. Outer spacer washer
16. Rocker arm bushing
17. Rocker arm
18. Vacuum link
19. Fuel link
20. Outer spacer washer
21. Vacuum link
22. Valve plug
23. Gasket
24. Fuel valve spring
25. Fuel inlet valve
26. Fitting
27. Fuel strainer screen
28. Fuel bowl gasket
29. Fuel bowl
30. Fuel bowl seat
31. Bail screw nut
32. Fuel bowl bail
33. Rocker arm pin washer
34. Fuel pump to block gasket
35. Vacuum diaphragm
36. Diaphragm spring retainer
37. Vacuum diaphragm spring
38. Retainer screw
39. Valve and cage retainer
40. Vacuum valve and cage
41. Vacuum valve gasket
42. Vacuum valve and cage
43. Vacuum valve gasket
44. Vacuum body
45. Fitting
46. Screen
47. Screen retainer
48. Cover plate gasket
49. Cover plate
50. Screw gasket
51. Cover plate screw

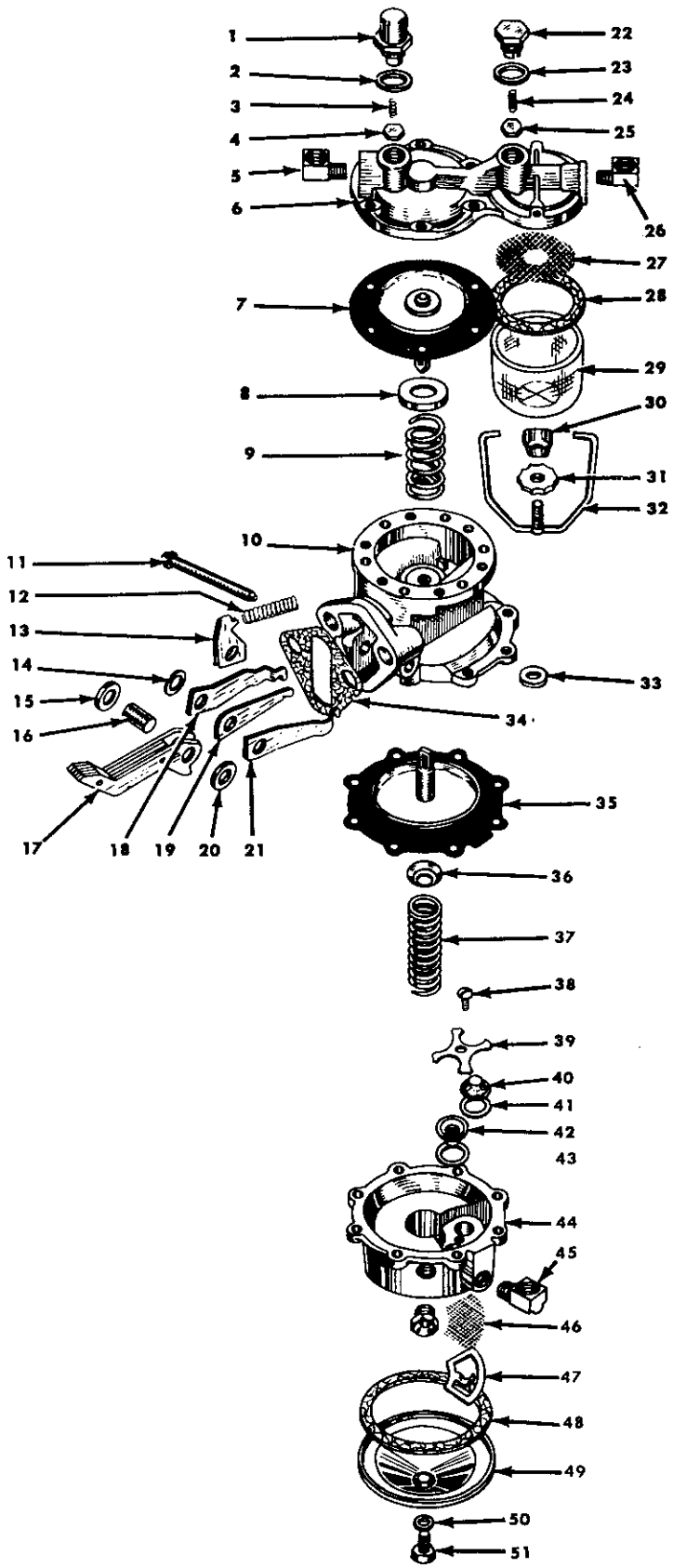


FIG. 392—PARTS OF THE FUEL AND VACUUM PUMP

it straight out. *Do not tilt diaphragm excessively or staked-in oil seals will be damaged.* Lift the fuel diaphragm spring (9) and spring retainer (8) from the pump body.

Remove the vacuum section valve and the cage retainer screw (1, Fig. 393) and lift out the retainer (2), and inlet (1), and outlet (4) valve and cage assemblies, and two gaskets.

Remove the vacuum section cover plate screw (51, Fig. 392) with gasket (50). Remove the cover plate (49), gasket (48), and screen retainer (47) and screen (46).

Loosen the bail-screw nut (31) and remove the fuel bowl (29), gasket (28), and bowl seat (30). Remove the strainer screen (27) from the top cover (6).

Remove the valve plug (22) and gasket (23) from top cover over the strainer. Remove the inlet valve spring (24) and valve (25).

Remove the air dome (1) and gasket (2) from top cover over the diaphragm. Remove the outlet valve spring (3) and outlet valve (4).

Cleaning and Inspection — All Models

All parts should be cleaned thoroughly with a solvent. Blow out all passages with compressed air.

Check parts of fuel pump as follows:

Top cover and pump body — Make visual check for cracks and breakage. Inspect for diaphragm flange warpage by testing on a smooth flat surface. Examine all of the threaded holes for stripped or crossed threads. Broken, damaged, or severly warped castings require replacement of the complete pump.

Valve and cage assemblies, valves, and spring — Replace. Extent of wear cannot be determined visually.

Strainer Screen — Replace. Inspect new screen for damage or obstruction. Screen must fit snugly around the inner edge.

Rocker Arm Pin and Washer — Replace with service type pin and washer.

Links — Replace fuel and vacuum links. Amount of wear cannot be determined visually.

Rocker Arm Spring — Replace. Spring may be weak from distortion or corrosion.

Diaphragm Spring—Replace. The spring may be weak from distortion or corrosion.

Diaphragm — Always replace.

Gaskets — Always replace the gaskets to assure tight seals.

Oil Seals — If seals are rough or torn, replace pump.

Depending upon the extent of service required as a result of diagnosis, the combination fuel-vacuum pump may be serviced by replacement with a new pump, by a general overhaul with a repair kit, or by diaphragm repair with a diaphragm kit.

Reassembly — All Models

Soak new diaphragm assemblies in clean kerosene while performing the following steps. Fuel oil may be used, but do not use shellac or sealing compound.

Assemble the link spacer (13, Fig. 392) over the fuel link (19). Place the vacuum links (18 and 21) on each side of the fuel link. The hooks ends of the vacuum links should come together so that they surround the fuel link and all link hooks should point in

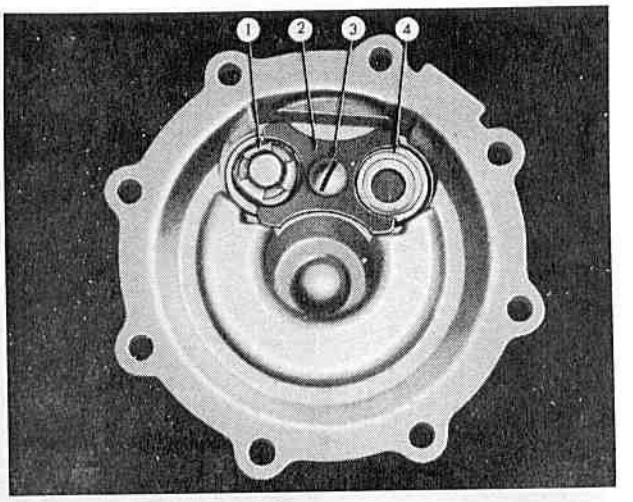


FIG. 393

1. Inlet valve
2. Retainer
3. Retainer screw
4. Outlet valve

the same direction. Place the assembly of links and link spacer between lobes of the rocker arm (17) and if link washers (14) were provided, place them on the outer side of each vacuum link. Slide the rocker arm bushing (16) through holes in the rocker arm, link washers, link spacer, and links.

Place the pump body in a vise with the fuel flange down. Set the rocker arm spring (6, Fig. 394) in position with one end over the cone cast in the body. With the two outer spacer washers (3) over the ends of the bushing (5), slide the rocker arm and link assembly (2) into the body. The outer end of the rocker arm spring slips over the projection on the link spacer (4). The open end of all link hooks must point toward the vacuum flange. Temporarily retain the rocker arm and link assembly with small diameter end of AC Tool No. PT-6, Kent-Moore Tool No. KMO-707 (1).

Set the diaphraghm spring on the staked-in oil seal, and the retainer on top of the spring. Push the diaphragm pull rod through the retainer, spring, and oil seal. Flat section of the pull rod must be at right angles to the link. Hook the diaphragm pull rod to the

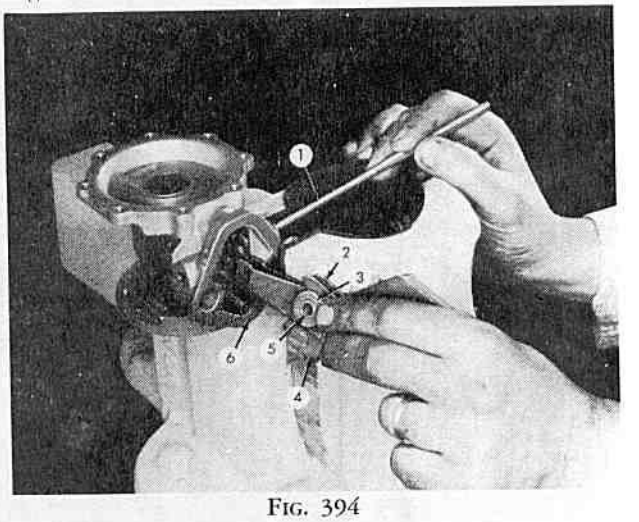


FIG. 394

1. AC Tool No. PT-6
2. Rocker arm and link assembly
3. Spacer washers
4. Link spacer
5. Bushing
6. Rocker arm spring

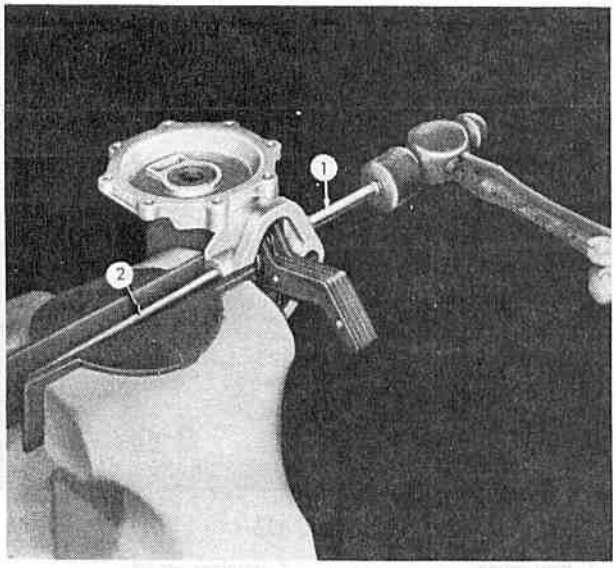


FIG. 395
1. Rocker arm pin 2. AC Tool No. PT-6

fuel link. The fuel link is the short, center link.

Drive in the permanent rocker arm pin (1, Fig. 395), pushing the tool PT-6, KMO-707 (2) ahead of it. Place the washer over the small end of the pin and spread the pin end.

Install the fuel cover on the body, making sure that the file marks on the cover and body line up. Push on the rocker arm until the diaphrgam is flat across the body flange. Install the cover screws and lock washers loosely until the screws just engage the lock washers. Pump the rocker arm three or four full strokes before tightening the cover screws, or the pump will deliver too much pressure.

Install new gaskets on fuel section valve plug and air dome.

Place a drop of light oil on outlet valve (4, Fig. 392) and install the valve in the chamber over the diaphragm. Insert the valve spring (3) in the air dome (1). Install the dome assembly and gasket (2)

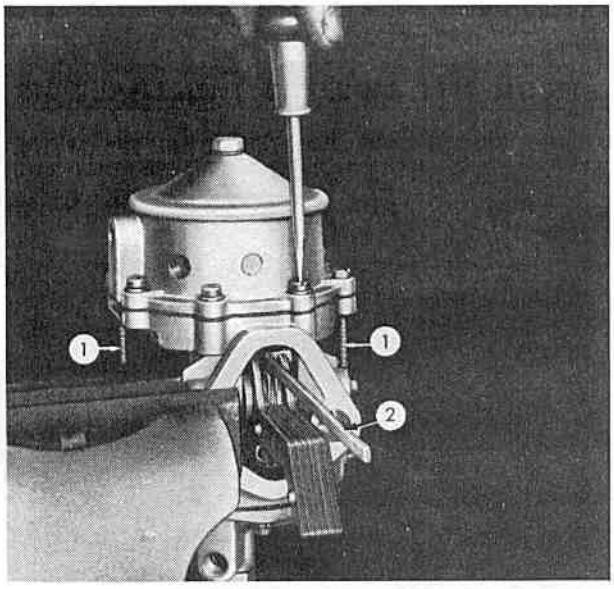


FIG. 396
1. No. 10-32x1-1/2 screws 2. AC Tool No. PT-8

in the top cover over the diaphragm, holding the pump on its side. Make sure that the spring seats properly by observing through the fuel outlet hole as the air dome is tightened securely.

Place a drop of light oil on the inlet valve (25) and install in the chamber over the strainer. Insert the spring (24) in the valve plug (22) and install the valve plug and gasket (23) over the strainer holding the pump on its side as the plug is tightened to be sure that the spring seats properly.

Install the strainer screen (27) and new gasket (28) in the fuel cover (6). Install the bowl seat (30) on the bowl screw. Assemble the filter bowl (29), swing the bail (32) into position, and tighten the bail nut (31) securely.

Place the two gaskets and the two valve and cage assemblies in the vacuum cover. The inlet valve (1, Fig. 393) must have the 3-legged spider facing out of the cover. The outlet valve (4) must have 3-legged spider facing into the cover. Secure the valve and cages with the retainer (2) and screw (3).

Turn the vacuum section over and set the screen (46, Fig. 392) in the recess over the valve hole. Set the screen retainer (47) on the screen. Place the cover plate gasket (48), cover plate (49), cover screw gasket (50), and cover screw (51) in position in the order named. Tighten the cover screw.

Push the diaphragm pull rod through the staked-in oil seal. *Do not tilt diaphragm pull rod excessively as this may damage the oil seal.*

Lift the pump body above eye level and face the vacuum diaphragm flange. The two vacuum links will swing down so that the diaphragm pull rod can be hooked to both links.

While holding vacuum diaphragm in position, the body should be clamped, vacuum side up, in a vise equipped with brass jaws. Clamp at one of the mounting flange ears. The vacuum diaphragm must be held level with body flange during the following operations. The diaphragm is held level by inserting AC Tool No. PT-8, KMO-613 (2, Fig. 396) between the rocker arm stop and the body stop. This tool can be made from a piece of steel 3/16-inch x 3/32-inch x 8 inches (4,76 mm. x 2,38 mm. x 203,2 mm.). Bend one end to form a right angle hook 3/8-inch (9,53 mm.) from bend to end.

Place the spring retainer on the riveted end of the diaphragm pull rod and the spring on the retainer. Place the vacuum cover over the spring and align the file marks. Insert two No. 10 — 32 x 1-1/2-inch screws in two opposite holes in the cover flange. Turn these long screws down, alternating a few turns on each. Insert the regular screws with lock washers, and tighten until screws just engage the lock washers. Replace the two long screws with regular screws and lock washers. Remove the special tool from the rocker arm position. This allows the heavy vacuum spring to push the diaphragm into a flexed position. Tighten all cover screws securely.

Testing — All Models

The combination fuel and vacuum pump cannot be bench tested because of the heavy vacuum section spring. The only adequate test for this type pump is with a low pressure gage when the pump is mounted on the engine.

Fuel Section

See Page 115 of the 1947 Passenger Car Shop Manual.

Vacuum Section

WITHOUT VACUUM GAUGE

1. Disconnect the outlet (manifold) line from the pump.
2. Turn on the windshield wipers and operate the engine from idle through slow acceleration to about 40 MPH (64,4 Km. PH.).
3. The wiper should start operating on pump vacuum only at about 15 MPH (24,14 Km. PH.) engine speed and reach full speed at about 40 MPH (64,4 Km. PH.), thus indicating that the vacuum section is operating correctly.
4. If the wiper does not operate, detach the windshield wiper line at the pump and connect it to the already detached outlet line with a piece of rubber hose.
5. SLOWLY operate engine from idle to about 25 MPH (40,23 Km. PH.). The wiper should run at full speed operating on the engine vacuum only. If it does not, it can be assumed that the wiper motor or tubing is defective. The pump vacuum section is inoperative if the windshield wiper operates on engine vacuum but not on pump vacuum.

WITH VACUUM GAUGE

1. Disconnect both inlet (wiper side) and outlet (manifold side) lines at the pump.
2. Connect the vacuum gauge to the vacuum section inlet (side attached to wiper line).
3. Operate the engine at a speed equivalent to 20 MPH road speed, the gauge should show 7 to 12 inches of vacuum.
4. If less than 7 inches of vacuum are produced, it can be assumed that the vacuum section of the pump is inoperative.
5. Always make this test of the vacuum pump with the outlet open because internal pressure due to closing the outlet will damage the mechanism.

CARBURETOR

The 1949 8G Champion uses Carter Carburetor, Model WE-715S. It provides for better high speed operation and idle adjustment. This carburetor differs in outward appearance from the previous model WE-532S and WE-661S in that the choke connector rod is a one-piece rod without an adjustment nut and lock nut.

Disassembly — Champion

Remove the dust cover (4, Fig. 398) from the bowl

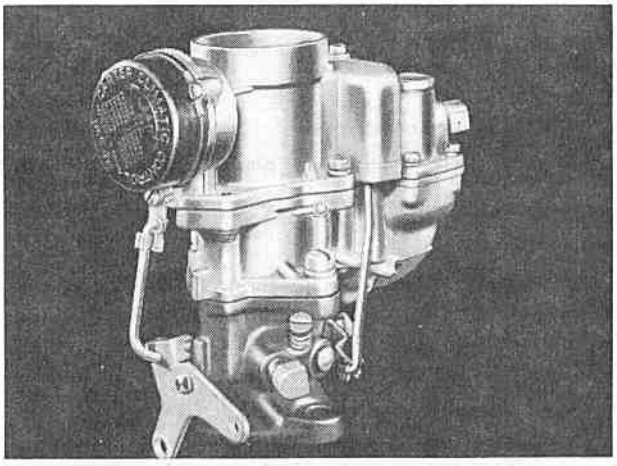


FIG. 397

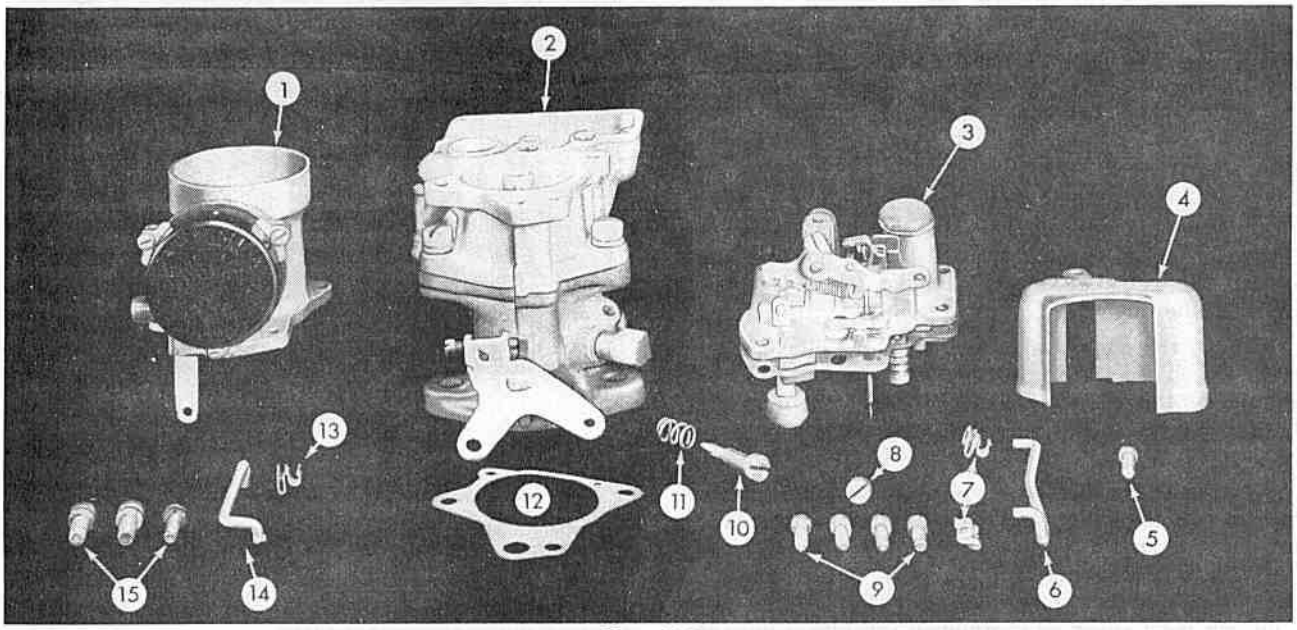


FIG. 398

1. Air horn and climatic control assembly
2. Main carburetor body
3. Bowl cover assembly
4. Dust cover
5. Dust cover screw
6. Throttle connector rod
7. Retainer clips
8. Idle passage plug
9. Bowl cover screws
10. Idle adjustment screw
11. Spring
12. Gasket
13. Retainer clip
14. Choke connecting rod
15. Air horn screws

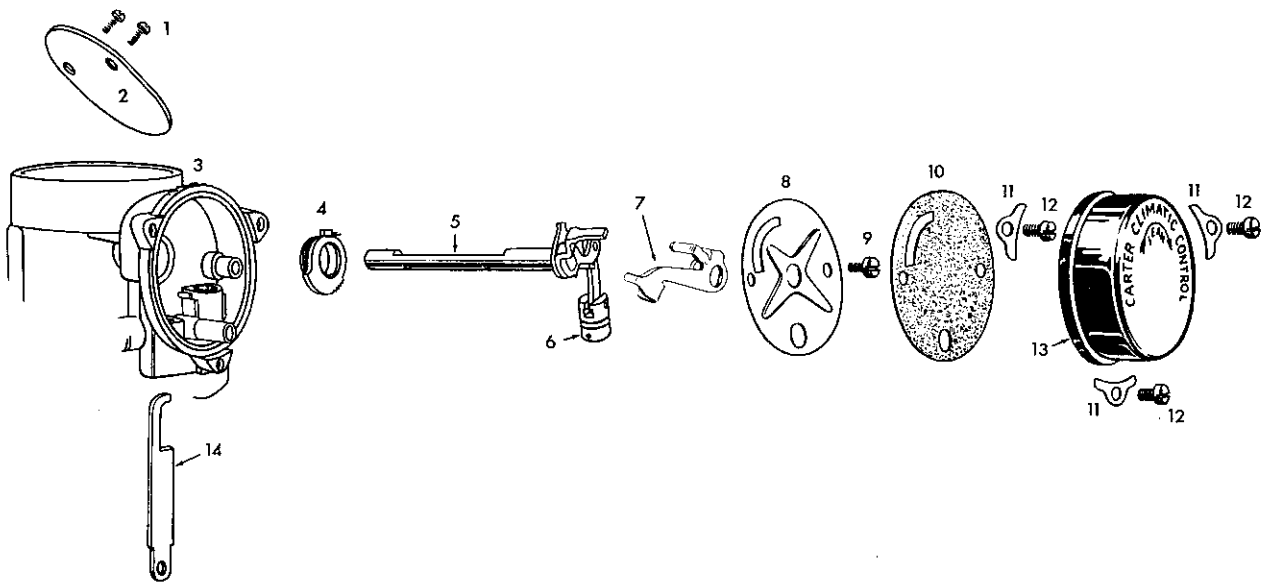


FIG. 399

1. Choke valve screws
2. Choke valve
3. Air horn and climatic control
4. Fast idle cam
5. Choke valve shaft w/lever
6. Choke piston
7. Choke trip lever
8. Baffle plate
9. Baffle plate screw
10. Gasket
11. Retainer clip
12. Screw
13. Climatic control housing
14. Fast idle link

cover assembly (3). Then disconnect the choke connector rod (14) from the fast idle link by unhooking the retainer clip, and remove the choke connector rod. Next remove the idle adjustment screw (10) and spring (11) from the throttle body. Remove the screws (15) holding the air horn and climatic control assembly (1) to the main body (2) and remove the assembly. Remove the air horn gasket (12).

To disconnect the throttle connector rod (6), unhook the retainer clips (7) at the upper and lower ends of the rod (hair pin clips used at upper end on later production models, then remove the connector rods and clips. Then take out the four bowl cover screws (9) and the idle passage screw plug and gasket (8). Remove the bowl cover assembly (3).

Remove the climatic control housing (13, Fig. 399) with thermostat and gasket (10). Remove the screw (9) which holds the baffle plate to the housing and remove the baffle plate (18), choke trip lever (7); and fast idle link (13).

Remove the choke valve (2) from the choke valve shaft (5). Turn the shaft and lever counterclockwise to remove the choke piston (6) from the cylinder. Then pull the shaft (5) out of the climatic control body and remove the fast idle cam (4) from the shaft.

To disassemble the bowl cover assembly, turn the vacuum piston (4, Fig. 400) 90° counterclockwise and unhook it from the vacuum piston link (3). Remove the vacuum piston link (5, Fig. 401) with metering rod spring and the metering rod (6) and disk (7) from the bowl cover (1). Remove the disk from the metering rod, unhook the metering spring, and remove the rod from the vacuum piston link. Then remove the strainer nut (4), gasket (3), and strainer (2). Then, remove the hair pin clip (12) and pump connector link (1), and remove the accelerating pump

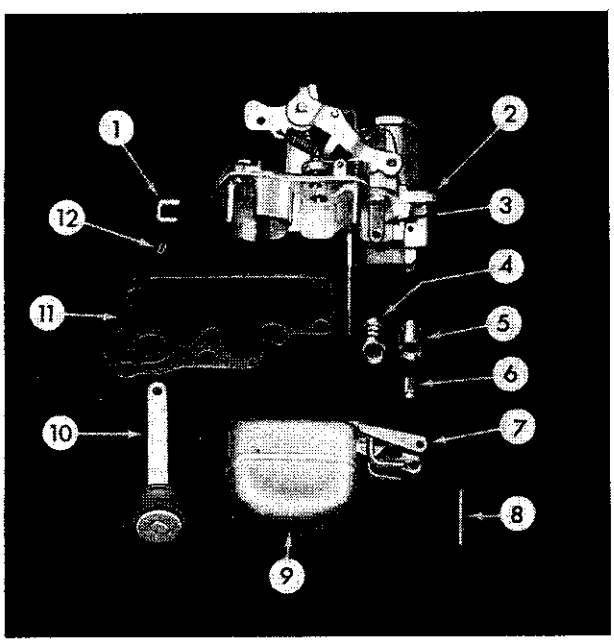


FIG. 400

1. Pump connector link
2. Bowl cover assembly
3. Vacuum piston link
4. Vacuum piston
5. Float needle seat
6. Float needle
7. Float lever
8. Float pin
9. Float
10. Plunger and rod
11. Gasket
12. Hair pin clip

plunger and rod assembly (10).

Remove the bowl cover gasket (11). Removing the float lever pin (8) will permit the removal of the float and lever assembly (9) and the float needle (6). Then, using Jet Wrench J-816-6, remove the float needle seat and gasket (5).

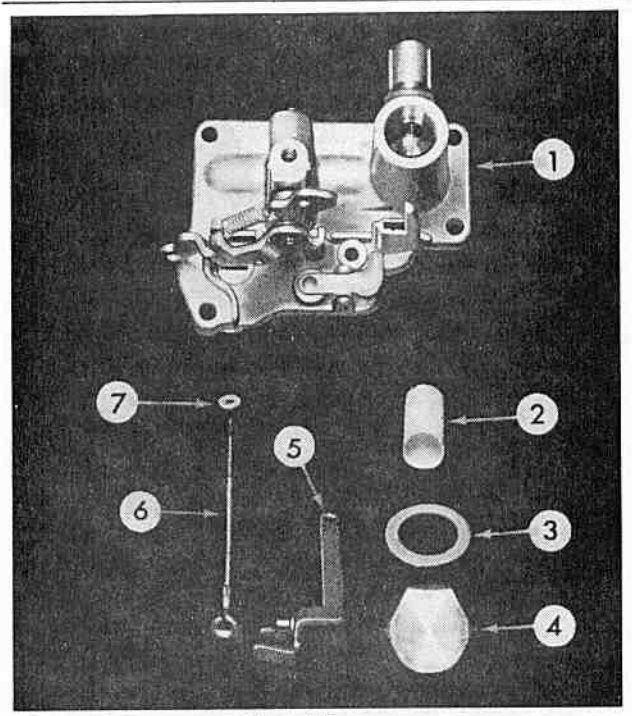


FIG. 401

1. Bowl cover
2. Strainer
3. Gasket
4. Strainer nut
5. Vacuum piston link
6. Metering rod
7. Metering rod disk

To disassemble the main carburetor body (1, Fig. 402), remove the vacuum piston spring (15) and accelerating pump spring (8). Then remove the accelerating pump strainer (9) and, using Retainer Ring Removing Tool T-109-56, remove the accelerating pump inlet check ball retainer ring (10). Turn the carburetor body upside down to remove the inlet check ball (11).

Using Jet Wrench J-816-1, remove the low speed jet (12). Then, using Jet Wrench J-816-6, remove the pump discharge jet passage plug (4) and gasket (3). Remove the pump discharge jet (2) using Jet Wrench J-816-2. Again using Jet Wrench J-816-6, remove the pump discharge check ball retainer screw plug (5) and gasket (6). Then tilt the body to remove the check ball (7). Next, using Jet Wrench J-816-6, remove the metering rod jet (14) and gasket (13).

Remove the two screws (7, Fig. 403) which hold the main carburetor body (2) to the throttle body (1) and separate the two pieces. Remove the throttle body gasket (8). Using Jet Wrench J-816-6, remove the main discharge nozzle passage plug (3). Remove the main discharge nozzle retainer plug (4) using Jet Wrench J-816-2. To remove the main discharge nozzle (5), use Jet Extractor J-508. Be sure to remove the small copper gasket (6) which fits around the seat of the nozzle.

Cleaning and Inspecting — Champion

All carburetor parts and passages should be cleaned thoroughly with Bendix Cleaner AC-1328 or equivalent rinsed with solvent, and blown out with compressed air before the carburetor is reassembled.

CAUTION. *When blowing out the climatic control housing with compressed air, support the thermostat coil with a thumb or finger to prevent the distortion of the thermostat.*

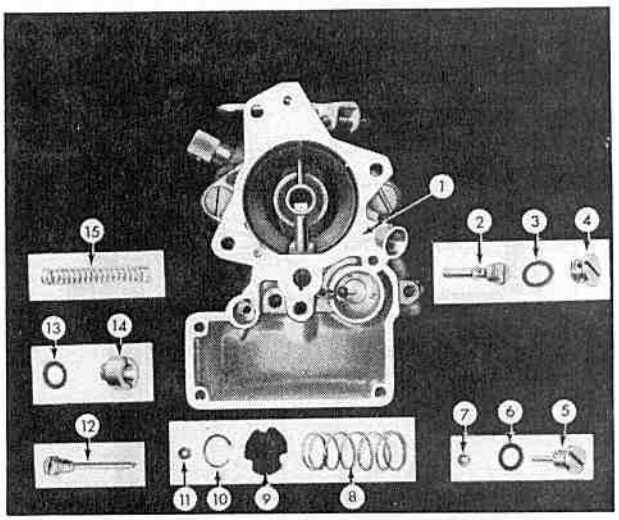


FIG. 402

1. Main body
2. Pump jet
3. Gasket
4. Passage plug
5. Plug and retainer
6. Gasket
7. Discharge check ball
8. Pump spring
9. Strainer
10. Retainer ring
11. Inlet check ball
12. Low speed jet
13. Gasket
14. Metering rod jet
15. Vacuum piston spring

Inspect all parts for wear or damage. When reassembling the carburetor, always replace all gaskets with new ones.

Reassembly and Adjustments — Champion

Place a new copper gasket (6, Fig. 403) on the main discharge nozzle (5) and install the nozzle with the flat at the end of the nozzle up. Using Jet Wrench J-816-2, install the main discharge retainer plug (4). The main discharge nozzle passage plug (3) can then be installed with Jet Wrench J-816-6. After installing a new gasket (8), attach the main carburetor body (2) to the throttle body (1) with the two screws

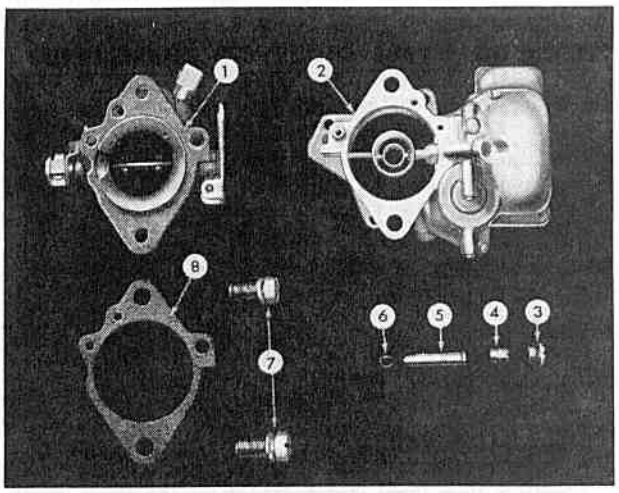


FIG. 403

1. Throttle body
2. Main body
3. Nozzle passage plug and gasket
4. Nozzle retainer plug
5. Discharge nozzle
6. Gasket
7. Screws
8. Gasket

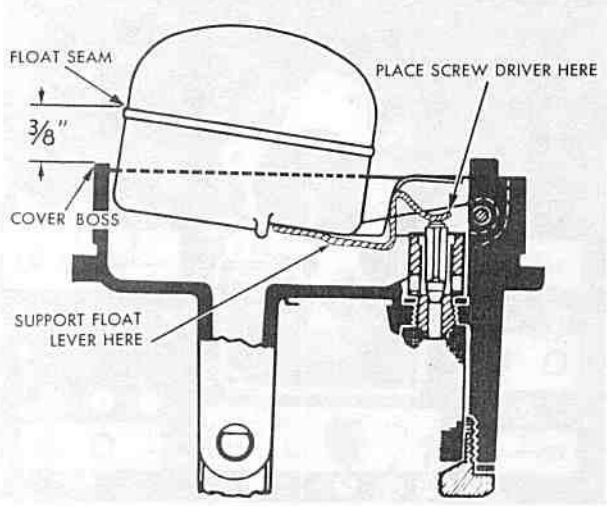


FIG. 404

and lock washers (7). Next install the idle adjustment screw and spring in the throttle body.

Using Jet Wrench J-816-6, install the metering rod jet (4, Fig. 402) and new gasket (13); and using Jet Wrench J-816-1, install the low speed jet (12).

Install the pump discharge check ball (7), and using Jet Wrench J-816-6, install the pump check ball retainer screw plug (5) and new gasket (6). With Jet Wrench J-816-2, install the pump jet (2); and again using Jet Wrench J-816-6, install the pump discharge jet passage plug (4) and new gasket (3).

Drop the accelerating pump inlet check ball (11) in place. Using Retainer Ring Installation Tool J-1407, install the check ball retainer ring (10). Then install the accelerating pump strainer (9) and spring (8). The vacuum piston spring (15) should also be placed in its well at this time.

Before reassembling the float bowl cover assembly, lubricate the pump operating countershaft with No. 3 graphite grease. Install the fuel bowl strainer, new gasket, and nut. Using Jet Wrench J-816-6, install the float needle seat (5) with new gasket. Then install the float needle (6), and holding the float and lever assembly (7) in position, insert the float lever pin (8).

The float maintains the proper level of the fuel in the bowl of the carburetor. To check the float level (see Fig. 404), turn the bowl cover upside down, allowing the weight of the float to be supported by the float arm lip resting on the needle valve. There should be 3/8" (9,53 mm.) between the boss on the bowl cover and the far edge of the float seam. Tool No. T24733 of the tool kit, which is 3/8" (9,53 mm.) wide, can be conveniently used as a gage to check the float level.

If an adjustment is necessary, support the float by placing a finger under the float lever; then, by exerting a slight pressure with a screw driver against the tip of the float lever lip, bend the lip as necessary to raise or lower the float level.

Install a new bowl cover gasket on the bowl cover. To install the accelerator pump plunger and rod assembly, insert the rod in its hole in the bowl cover and attach it to the pump arm with the connector link and hair pin spring. Then insert the vacuum piston link in the hole provided in the bowl cover and

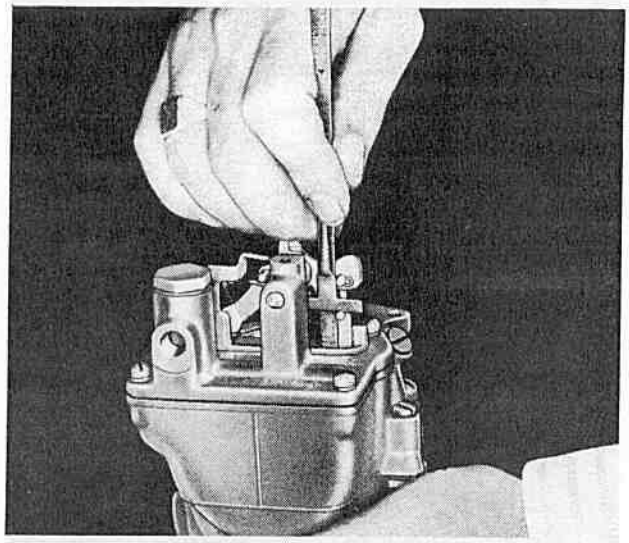


FIG. 405

install the vacuum piston on the link.

After assembling the bowl cover assembly, loosely attach the cover to the float bowl with the four screws and lock washers. Then install idle passage screw plug and new gasket and tighten all screws securely.

Install the retaining clips on the pump operating lever and the throttle valve shaft lever. Then install the throttle connector rod and hook the retaining clips (or hair pin) securely.

After the bowl cover assembly has been installed on the main carburetor body, the travel of the accelerating pump should be checked. Back off the idle speed adjusting screw to permit a fully closed throttle position. Set the throttle in the wide-open position and measure from the top of the lower end of the accelerating pump connector link to the top of the bowl cover. Then set the throttle in the fully closed position and repeat the measurement. The difference between the measurements, which should be 7/32" (5,56 mm.), is the travel of the accelerating pump plunger. (See Fig. 405).

If the travel of the accelerating pump plunger is incorrect, adjust the travel by bending the throttle connector rod (1) with Bending Tool J-1137 (2) at the point shown in Fig. 406. The rod must be discon-

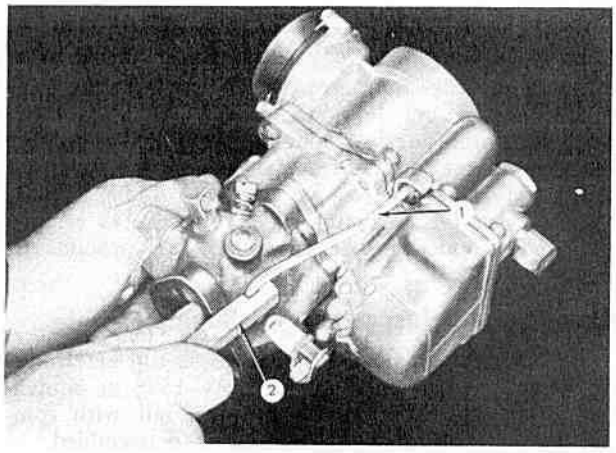


FIG. 406
1. Connector rod 2. Bending Tool J-1137

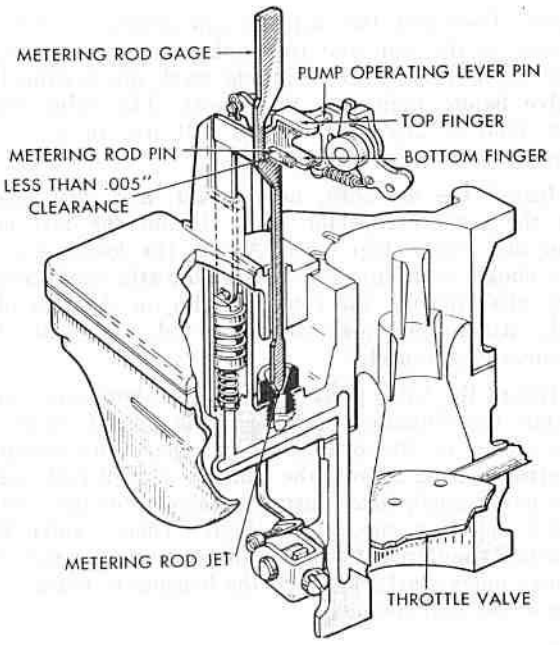


FIG. 407

nected from the throttle arm when making the adjustment.

Insert Metering Rod Gage T-109-102 in place of the metering rod (see Fig. 407), seating the tapered end of the gage in the metering rod jet. With the throttle valve closed (be sure the idle speed adjusting screw permits the throttle valve to close completely), press down lightly on the vacuum piston link. There should be less than .005" (0,13 mm.) clearance between the metering rod pin and the shoulder in the notch of the gage. The gage must not contact the pin.

If an adjustment is necessary, using Adjusting Tool T-109-105 (1, Fig. 408), bend the top finger of the vacuum piston link (2) to obtain the proper clearance.

After adjusting the top finger of the vacuum piston link, check the clearance between the bottom of the pump operating lever pin (1, Fig. 409) and the bottom finger of the vacuum piston link (2), using a 3/16" (4,763 mm.) gage (3) (Float Gage J-818-3). If an adjustment is necessary, using Adjusting Tool T-109-105, bend the lower finger of the vacuum piston link to obtain the proper clearance.

To check the seating of the anti-percolator cap (1, Fig. 410), insert a .030" (0,76 mm.) wire, Gage No. J-1633, in the throttle body opposite the idle port (see inset). With the throttle closed on the wire, there should be .025" (0,64 mm.) clearance between the anti-percolator rocker arm (2) and the pump operating lever (3). If an adjustment is necessary, bend the anti-percolator rocker arm to obtain the proper clearance.

Install the metering rod and disk, being sure that the metering rod spring is hooked around the rod. If it is not, movement of the metering rod in the jet may prevent the correct metering of fuel.

Slide the fast idle cam assembly on the choke shaft; insert the choke shaft in the air horn; and revolve the shaft, lever, and cam to slide the piston into the cyl-

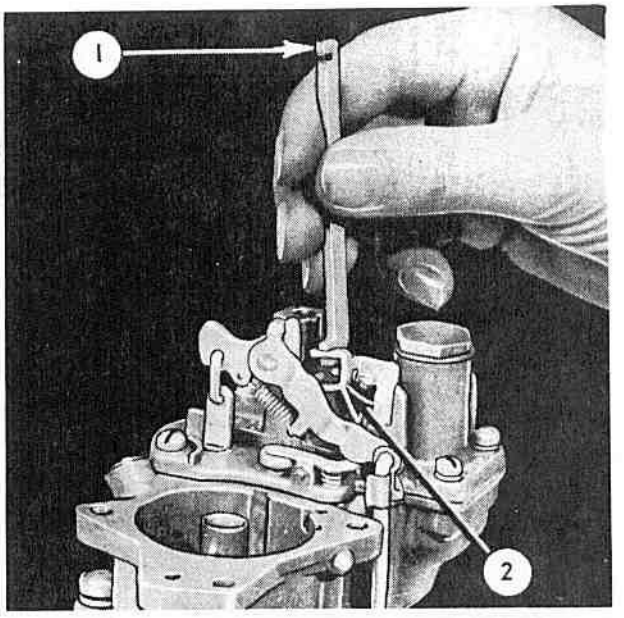


FIG. 408

1. Adjusting Tool T-109-105
2. Vacuum piston link

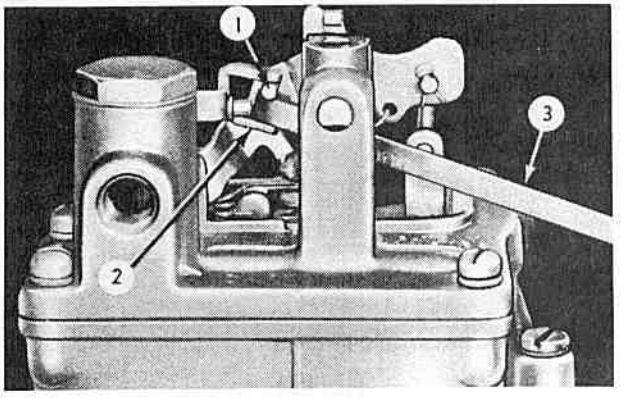


FIG. 409

1. Pump operating lever pin
2. Bottom finger
3. 3/16" gage (J-818-3)

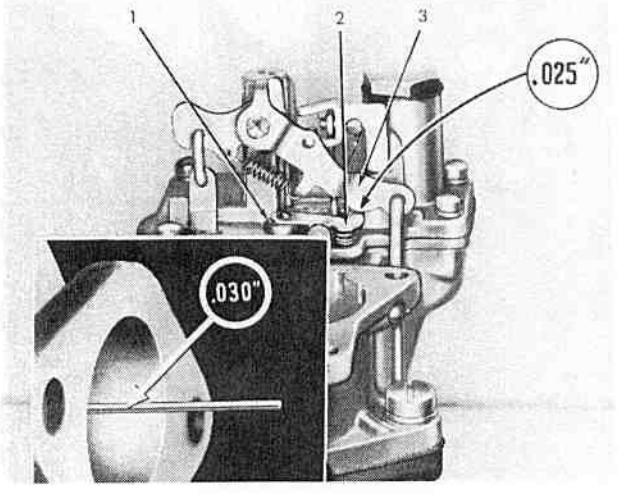


FIG. 410

1. Anti-percolator cap
2. Rocker arm
3. Pump operating lever

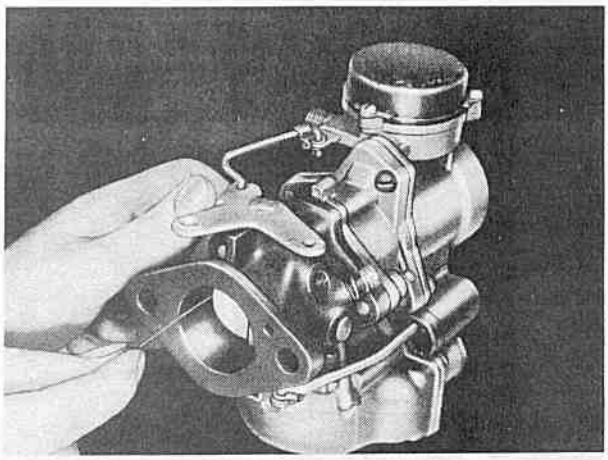


FIG. 411

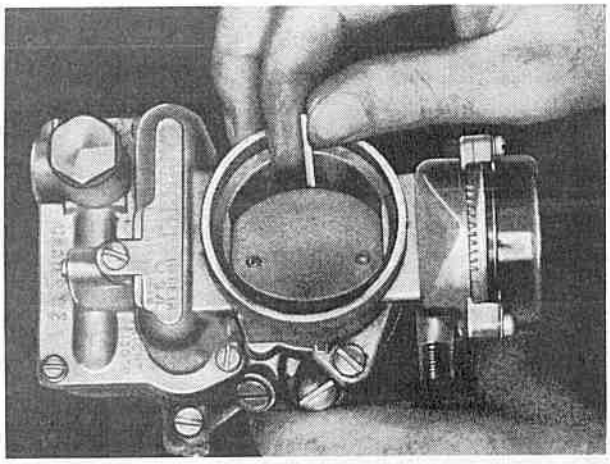


FIG. 412

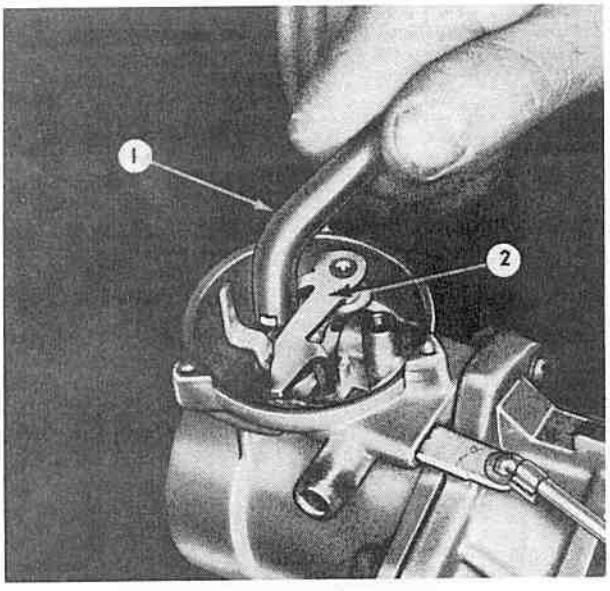


FIG. 413

1. Unloader Adjusting Tool T-109-187
2. Choke trip lever

inder. Then lock the fast idle cam spring around the bosses of the cam and the choke lever shaft. Install the choke valve with the trade mark up, seating the valve before tightening the screws. The valve must not bind in any position but fall free of its own weight.

Install the air horn, new gasket, and dust cover on the main carburetor body. Install the fast idle link and choke trip lever. Attach the lower end of the choke connector rod to the throttle shaft lever, and after placing the retaining clip on the fast idle link, attach the choke connector rod, and hook the retainer clip securely.

Install the baffle plate with the attaching screw and install the climatic control housing gasket. Holding the choke in the open position, place the climatic control housing against the climatic control body with the notch one-quarter turn clockwise from the center index mark on the control body. Then revolve the housing counterclockwise to align the notch and the center index mark, and lock the housing in place with the screws and retainers.

NOTE.—Be careful not to hook the thermostat spring on the hot air tube.

To check the fast idle adjustment, open the throttle and close the choke valve. Doing this permits the cam to drop into its fast idle position. Then, with the choke valve still closed, close the throttle so that the choke trip lever contacts the fast idle cam; and using the .045″ (1,143 mm.) Wire Gage T-109-158, check the clearance between the throttle valve and the bore on the side opposite the idle port. (See Fig. 411.)

If an adjustment is necessary, bend the choke connector rod using Bending Iron J-1137 or pliers at the lower end of rod. Adjust the rod to obtain the correct clearance of the throttle valve. The choke mechanism must not bind in any position.

To check the choke unloading mechanism, open the throttle wide and insert a 3/16″ (4,763 mm.) gage (Float Gage J-818-3) between the low side of the choke valve and the inside of the air horn. (See Fig. 412.)

If it is necessary to make an adjustment, remove the climatic control housing, gasket, and baffle plate. Then, using Unloader Adjusting Tool T-109-187 (1, Fig. 413), bend the upper finger on the choke trip lever (2) up or down as required until the correct clearance is obtained.

Before attempting an adjustment of the climatic control, it is important first to check thoroughly all other items that affect the warm-up period. In production the notch on the climatic control housing and the center index mark on the control body are in line (See Fig. 414). This setting should be satisfactory for average operating conditions. Under extreme weather conditions, however, or for use of fuels of other than standard octane ratings, change the adjustment by rotating the climatic control housing counterclockwise for a long warm-up period or clockwise for a short warm-up period. Do not move the housing more than one notch for each adjustment.

Adjust the idle mixture by turning the idle adjustment screw clockwise for a lean mixture or counterclockwise for a rich mixture. The correct adjustment

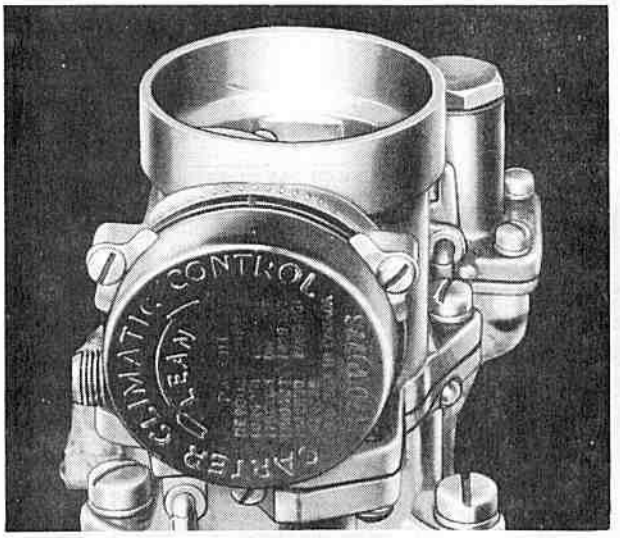


FIG. 414

should be between 1/2 and 1-1/2 turns. Idle adjustment should be made with the carburetor air cleaner installed and with the engine running at normal operating temperature. The idle speed of the engine should be set at a speed equivalent to 8 to 10 miles (12,9 to 16,1 km.) per hour in high gear (550 to 575 R.P.M.).

Metering Rods — Champion

Metering rods are available in several sizes to provide proper fuel-air ratio at different altitudes. The part number is stamped on the metering rod.

CARTER PART NO.	STUDEBAKER NO.	ALTITUDE
CAR-75-652	525832	Up to 4,000 ft. (up to 1.219 m.)
CAR-75-666	525833	4,000 to 8,000 ft. (1.219 to 2.438 m.)
CAR-75-667	525834	8,000 to 12,000 ft. (2.438 to 3.657 m.)
CAR-75-672	525835	Over 12,000 ft. (2.438 to 3.657 m.) (over 3.657 m.)

Carburetor Tools

The tools illustrated in Fig. 415 are required to service the Carter Model WE-715S Carburetor. These

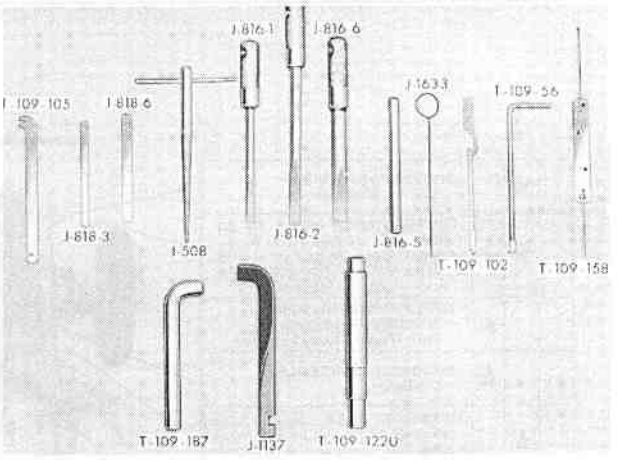


FIG. 415

T-109-105 Adjusting Tool
J-818-3 Float Level Gage
J-818-6 Float Level Gage
J-508 Jet Extractor
J-816-1 Jet Wrench
J-816-2 Jet Wrench
J-816-6 Jet Wrench
J-816-5 Wrench Handle
J-1633 Anti-percolator Gage
T-109-102 Metering Rod Gage
T-109-56 Retainer Ring Removing Tool
T-109-158—Wire Gage
T-109-187—Unloader Adjusting Tool
J-1137 Bending Iron
T-109-122U—Retainer Ring Installing Tool

tools are included in the Carburetor Tool Kit No. J-3261.

TOOL NO.	TOOL NAME
T-109-105	Adjusting Tool
J-818-3	Float Level Gage (3/16")
J-818-6	Float Level Gage (1/4")
J-508	Jet Extractor
J-816-1	Jet Wrench (Screw Driver Bit 3/16" Blade)
J-816-2	Jet Wrench (Screw Driver Bit 1/4" Blade)
J-816-6	Jet Wrench (Screw Driver Bit 5/16" Blade)
J-816-5	Jet Wrench Handle
J-1633	Anti-percolator Gage
T-109-102	Metering Rod Gage 2.468
T-109-56	Retainer Ring Remover
T-109-158	Wire Gage (.053"-.045")
T-109-187	Unloader Adjusting Tool
J-1137	Bending Iron
T-109-122U	Retainer Ring Installing Tool

LUBRICATION

Engine Oil — All Models

The oil viscosities for various temperatures are recommended as follows:

Lowest Anticipated Temperatures
−10° F. (−23,3° C.) — Use S.A.E. 10-10W or 10W
+10° F. (−6° C.) — Use S.A.E. 20
+32° F. (−0° C.) — Use S.A.E. 30

Some oils contain chemical detergents which hold extremely small particles of carbon or other foreign matter in suspension. Many of the particles are so small that they flow through the oil filter with the oil and remain in suspension. For this reason, oil which is perfectly good for lubrication purposes may be discolored when seen on the oil level gage. With such oils the need for an oil change should be governed by the mileage the oil has been used and the dust conditions prevalent during that mileage. As long as the oil retains a slick quality and good body, it is generally satisfactory.

Rear Axle — All Models

Check level at 1000 mile (16.090 Km.) intervals.

Transmission — All Models

Check level at 1000 mile (16.090 Km.) intervals.

Clutch Release Shaft — All Models

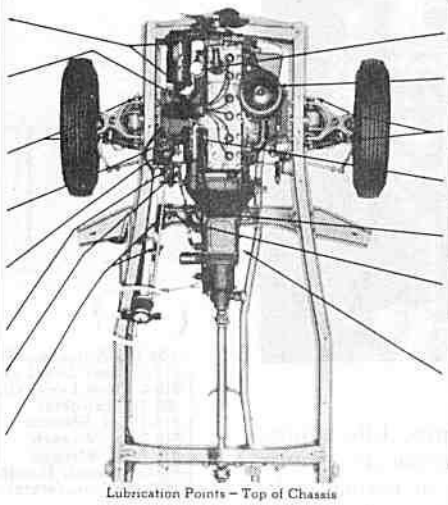
The clutch release shaft is lubricated by means of a Zerk fitting located at the left side of the clutch housing in the release shaft retainer. A pre-packed grease retainer is used on the right side.

Chassis Springs — All Models

Chassis springs are equipped with lubrication fittings and should be lubricated with graphite spring lubricant at 1000 mile (16.090 Km.) intervals with the springs unloaded.

Lubrication Points – Top of Chassis

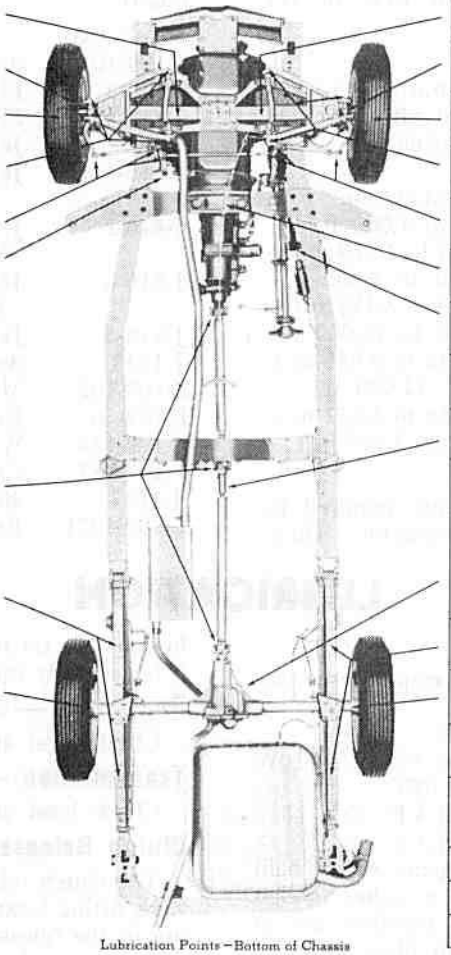
	★		GENERATOR – 2 Oilers – SAE No. 20 Engine Oil
	★		DISTRIBUTOR – S.A.E. No. 20 Engine Oil on Felt Under Rotor. Small Amount of Petroleum Jelly on Cam. Wheel Bearing Lubricant in Grease Cup.
		★	UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	THROTTLE CONTROLS – Engine Oil
	★		STEERING GEAR – Special Lubricant as Approved by Ross Gear and Tool Company of Lafayette, Indiana.
★			GEAR SHIFT CONTROL CASE – Remove Plug – Light Weight Chassis Lubricant
		★	GEAR SHIFT RODS – Engine Oil
		★	CLUTCH PEDAL LINKAGE – 2 Clevis Pins – Engine Oil



Lubrication Points – Top of Chassis

			ENGINE OIL PAN FILLER TUBE – Check Oil Level When Purchasing Gasoline
			CARBURETOR AIR CLEANER – Service according to Instructions in Text.
★			UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
	★		STARTER MOTOR – 1 Oiler – SAE No. 20 Engine Oil
★			CLUTCH RELEASE SHAFT – One Fitting – Chassis Lubricant.
★			CLUTCH OPERATING SHAFT BRACKET BEARING – Engine Oil
★		★	TRANSMISSION – Conventional and Overdrive CHECK LEVEL DRAIN AND FLUSH LUBRICANT – SAE No. 40 Engine Oil or a High Grade Mineral Oil Gear Lubricant of SAE No. 90 Viscosity for Both Summer and Winter. Gear Lubricants Containing Any Extreme Pressure Ingredients Such as Lead, Sulphur, or Chlorine Compounds Must Not Be Used.

		★	SPRING LEAVES – Graphite Spring Lubricant – 1 Fitting
		★	STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
★			FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
		★	LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
		★	AUXILIARY ARM BUSHING – 1 Fitting – Light Weight Chassis Lubricant
			CLUTCH RELEASE BEARING – No Lubricant Required
		★	UNIVERSAL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
		★	SPRING LEAVES – Graphite Spring Lubricant – 2 Fittings
★			REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)



Lubrication Points – Bottom of Chassis

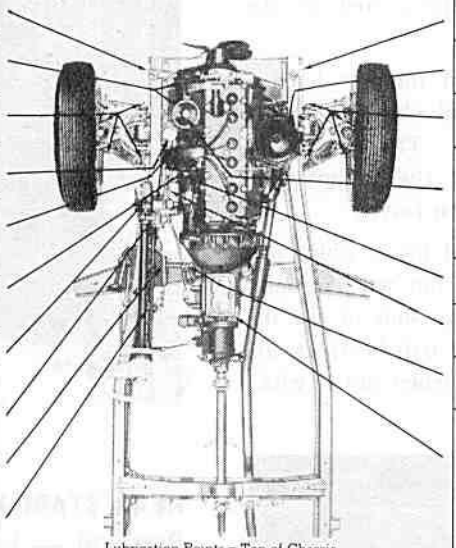
★			SPRING LEAVES – Graphite Spring Lubricant – 1 Fitting
★			STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
		★	FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
★			LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
★			TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			PARKING BRAKE LINKAGE – Spray – Engine Oil
★			CLUTCH AND BRAKE PEDALS – 1 Fitting – Light Weight Chassis Lubricant
★			PROPELLER SHAFT SPLINES – 1 Fitting – Light Weight Chassis Lubricant
★		★	REAR AXLE – CHECK LEVEL DRAIN AND FLUSH LUBRICANT – Use Studebaker Hypoid Lubricant or Any S.A.E. No. 90 Hypoid Lubricant Manufactured by a Reputable Oil Company. Do Not at Any Time Mix Various Brands of Hypoid Lubricants
★			SPRING LEAVES – Graphite Spring Lubricant – 2 Fittings
		★	REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)

The Lubrication Periods Established Are For Average Use and Should Be Changed to Suit Individual Operating Conditions.

FIG. 416

Lubrication Points – Top of Chassis

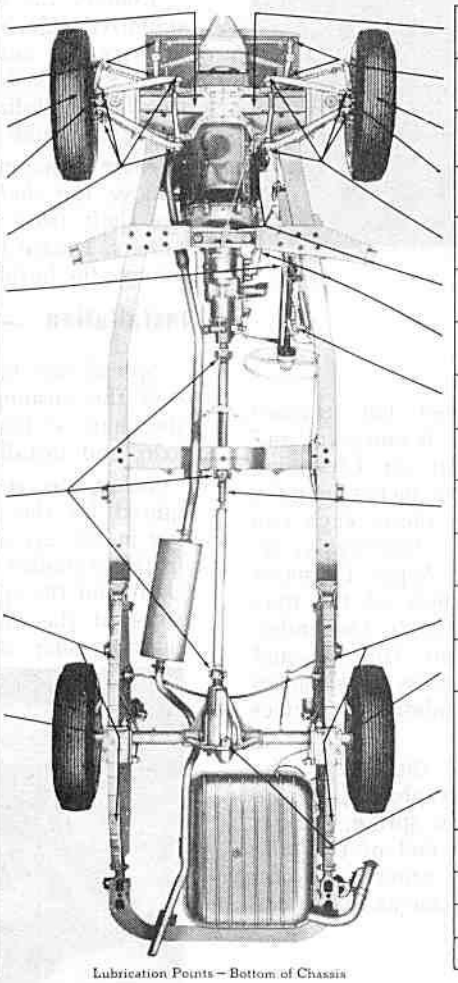
		★	STEERING BELL CRANK SHAFT – 1 Fitting – Light Weight Chassis Lubricant
	★		GENERATOR – 2 Oilers – SAE No. 20 Engine Oil
		★	UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
			ENGINE OIL PAN FILLER TUBE – Check Oil Level When Purchasing Gasoline
	★		DISTRIBUTOR – S.A.E. No. 20 Engine Oil on Felt Under Rotor. Small Amount of Petroleum Jelly on Cam. Wheel Bearing Lubricant in Grease Cup.
		★	THROTTLE CONTROLS – Engine Oil
	★		STEERING GEAR – Special Lubricant as Approved by Ross Gear and Tool Company of Lafayette, Indiana.
★			GEAR SHIFT CONTROL CASE – Remove Plug – Light Weight Chassis Lubricant
		★	CLUTCH OPERATING SHAFT BRACKET BEARING – Engine Oil
		★	CLUTCH AND BRAKE PEDALS – 1 Fitting – Light Weight Chassis Lubricant



Lubrication Points – Top of Chassis

★			STEERING BELL CRANK SHAFT – 1 Fitting – Light Weight Chassis Lubricant
			CARBURETOR AIR CLEANER – Service according to Instructions in Text.
★			UPPER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
			OIL FILTER – Under Normal Conditions, the Oil Filter Cartridge Should Be Replaced after Five to Six Thousand Miles of Operation. Where Severe Dust and Dirt Conditions Prevail, It Will Be Necessary to Replace the Oil Filter Cartridge at Correspondingly Lower Mileages.
	★		STARTER MOTOR – 1 Oiler – SAE No. 20 Engine Oil
★			STEERING REACH ROD – 2 Fittings – Light Weight Chassis Lubricant
★			CLUTCH RELEASE SHAFT – One Fitting – Chassis Lubricant.
★		★	TRANSMISSION – Conventional and Overdrive CHECK LEVEL — DRAIN AND FLUSH — LUBRICANT – SAE No. 40 Engine Oil or a High Grade Mineral Oil Gear Lubricant of SAE No. 90 Viscosity for Both Summer and Winter. Gear Lubricants Containing Any Extreme Pressure Ingredients, Such as Lead, Sulphur, or Chlorine Compounds Must Not Be Used.

		★	SPRING LEAVES – Graphite Spring Lubricant – 1 Fitting
		★	TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
★			FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
		★	STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
		★	LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
		★	CLUTCH PEDAL LINKAGE – 2 Clevis Pins – Engine Oil
			CLUTCH RELEASE BEARING – No Lubricant Required
		★	UNIVERSAL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
		★	SPRING LEAVES – Graphite Spring Lubricant – 2 Fittings
★			REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)



Lubrication Points – Bottom of Chassis

★			SPRING LEAVES – Graphite Spring Lubricant – 1 Fitting
★			TIE ROD BALL JOINTS – 3 Fittings – Light Weight Chassis Lubricant
		★	FRONT WHEEL BEARINGS – Wheel Bearing Lubricant
★			STEERING KNUCKLE – 1 Fitting – Light Weight Chassis Lubricant
★			LOWER CONTROL ARM BUSHINGS – 4 Fittings – Light Weight Chassis Lubricant
★			PARKING BRAKE LINKAGE – Spray – Engine Oil
★			GEAR SHIFT RODS – Engine Oil
★			HILL-HOLDER LINKAGE – Spray – Engine Oil
★			PROPELLER SHAFT SPLINES – 1 Fitting – Light Weight Chassis Lubricant
★			SPRING LEAVES – Graphite Spring Lubricant – 2 Fittings
		★	REAR AXLE SHAFT BEARING – Wheel Bearing Lubricant
★		★	REAR AXLE – CHECK LEVEL — DRAIN AND FLUSH — LUBRICANT – Use Studebaker Hypoid Lubricant or Any S.A.E. No. 90 Hypoid Lubricant Manufactured by a Reputable Oil Company. Do Not at Any Time Mix Various Brands of Hypoid Lubricants.
			1,000 Miles (1.609 Km.)
			5,000 Miles (8.046 Km.)
			10,000 Miles (16.090 Km.)

The Lubrication Periods Established Are for Average Use and Should Be Changed to Suit Individual Operating Conditions.

FIG. 417

SPRINGS AND SHOCK ABSORBERS

FRONT SPRING — All Models

The front spring is equipped with inserts, which consist of a 2-inch (50,8 mm.) tape coated on one side with hardened steel shot.

The inserts are installed between the five longest leaves of the Champion spring and the six longest leaves of the Commander spring. The Champion spring now has eleven leaves and the Commander spring remains the same with thirteen leaves.

The shot inserts replace the wood liners which are no longer used on the front spring but will continue to be used on the rear springs. The shot of the insert has an action similar to that of ball bearings, allowing the leaf tips to move freely when flexed without rubbing against each other.

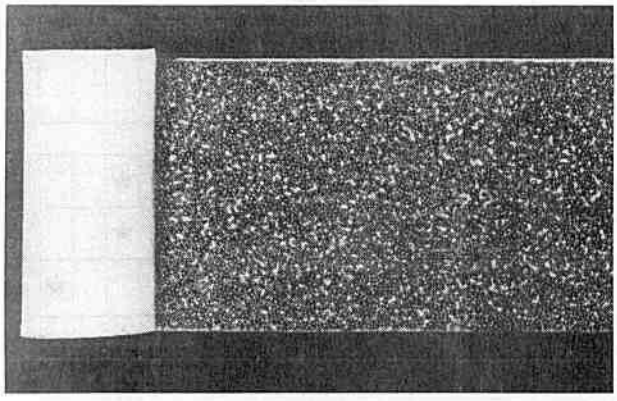


FIG. 418

Assembly — All Models

The insert liner tape with the steel shot attached (see Fig. 418), if purchased in a kit, is one piece and must be cut before installation. Cut the Champion liner tape into eight pieces, each two inches long, or the Commander liner tape into ten pieces each two inches long. Clean the spring leaves thoroughly, removing all galled or rusted spots. Apply Permatex No. 2 to the plain side of each piece of the liner tape, and cement a piece of the tape to the underneath surface of each end of the 2nd, 3rd, 4th, and 5th spring leaves. On the Commander, also cement a piece of the liner tape to the underneath surface of each end of the 6th spring leaf.

Thoroughly lubricate each leaf of the spring, (including the steel shot insert) with graphite spring lubricant (see Fig. 419). Assemble the spring, using a new center bolt and peen over the end of the bolt. Apply the spring lubricant liberally around the outside of the spring, then install the canvas and metal covers on the spring.

Lubrication — All Models

All springs are equipped with lubrication fittings and should be lubricated with graphite spring lubricant at 1000 mile (16.090 Km.) intervals with the springs unloaded.

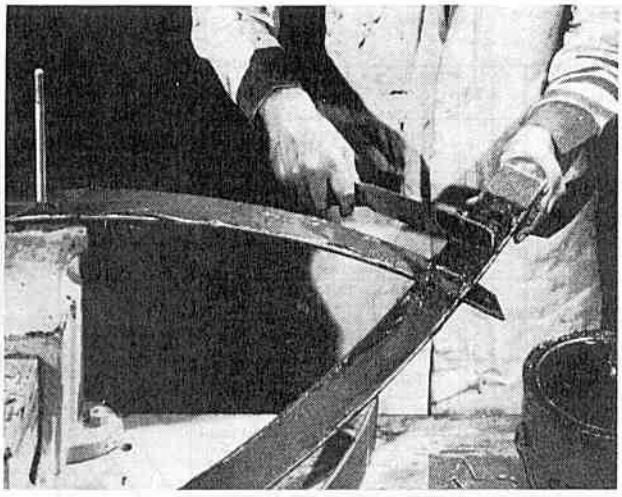


FIG. 419

REAR STABILIZER SHAFT

Removal — Land Cruiser and Convertible

Remove the lower link bolt which disconnects the stabilizer link from the spring plate (see Fig. 420). Remove the bushing and spacer tube from the link eye. Remove the upper link bolt and remove the link from the stabilizer shaft. Then remove the bushing and spacer tube from the stabilizer shaft.

After removing the stabilizer links at both sides, remove the shaft bushing retainer bolts and remove the shaft from the vehicle. Remove the bushing retainers. Locate the split in each bushing, spread, and remove the bushings from the shaft.

Installation — Land Cruiser and Convertible

Spread the bushings and install on the shaft. Install the bushing retainers on the bushings, position the shaft at the frame with the shaft ends over the axle, and install the bushing retainer bolts.

Insert the steel spacers in the four bushings required for the complete installation. Install a bushing in the eye of the shaft end and another bushing in the stabilizer link. Attach the link to the stabilizer shaft and the spring plate. Tighten the nuts until the sides of the yoke of the link at the top and the plain washer at the lower bolt are seated firmly

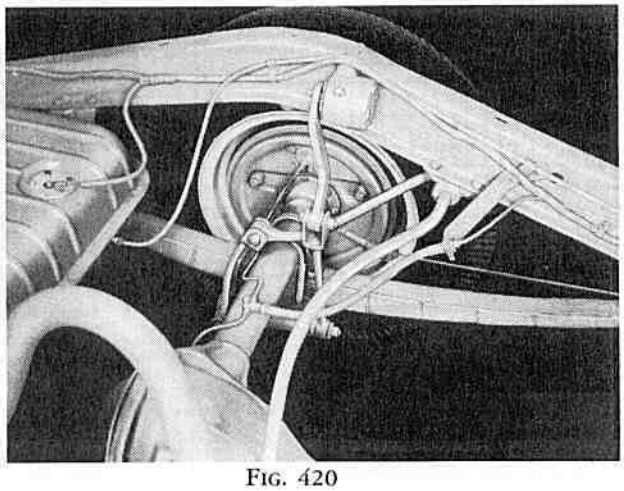


FIG. 420

against their respective spacer. This will compress the rubber bushings to their proper position. The installation procedure is the same for both sides.

The stabilizer shaft bushing retainer bolts and link bolts must be tight at all times for proper stabilizer action.

REAR SPRING FRONT CUSHION

The front end of the rear spring is mounted in a single bushing which consists of a rubber cushion between two steel sleeves and bonded to the sleeves (see Fig. 421).

The bushing is pressed into the spring eye, hence movement of the outer sleeve is eliminated. The inner sleeve, acting as a spacer, is held securely in the hanger by the bushing bolt. Therefore, all movement occurs in the rubber cushion.

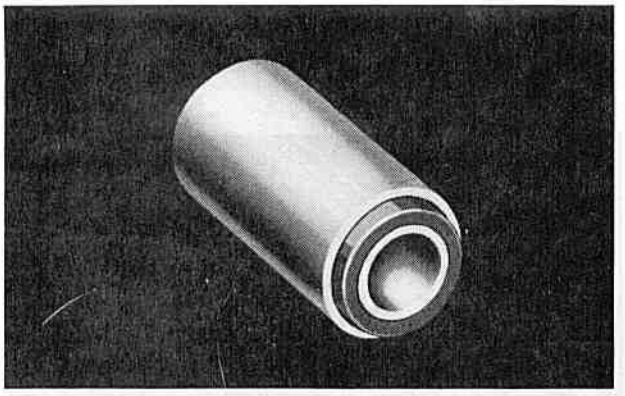


FIG. 421

Tool No. J-3225 (Fig. 422) is required to remove and install the bushing. The construction of the nut makes it adaptable for both the removal and installation. The nut is hollow (see inset) with internal threads on one end. When removing the bushing the nut (3) is installed on the screw (1) with the screw going through the hollow portion first. On the installation of the bushing, the position of the nut is reversed to obtain the maximum length of the screw.

Removal — All Models

Remove the spring bushing bolt and pull the end of the spring out of the hanger. Assemble the tool in the bushing (see Fig. 423) with the hollow portion of the nut adjacent to the spring eye. Then by turning the nut (1), the step washer (2) bearing against the outer sleeve of the bushing, will force the bushing out of the spring eye and into the hollow of the nut. Remove the tool from the bushing.

Installation — All Models

Coat the bushing lightly with white lead and insert it into the spring eye just enough to hold it in place. Place the step washer (3, Fig. 424) on the screw, insert the screw (4) through the bushing (2) and install the nut (1) on the screw. The threaded end of the nut should be adjacent to the spring eye. Make sure the bushing is aligned squarely with the spring eye, then turn the nut and press the bushing into the spring eye until the edge of the outer sleeve of the bushing is flush with the edge of the spring. Remove the tool from the bushing.

Align the spring end in the hanger, install the bushing bolt and tighten securely.

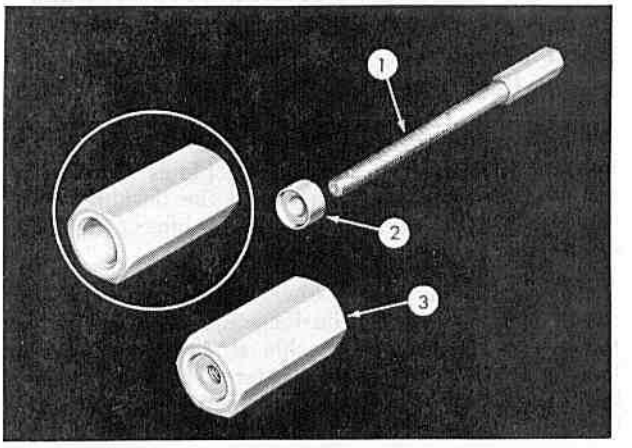


FIG. 422

1. Screw
2. Step washer
3. Nut

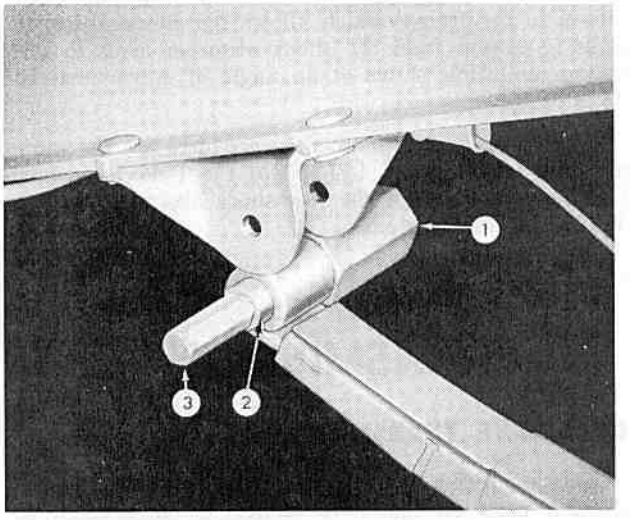


FIG. 423

1. Nut
2. Step washer
3. Screw

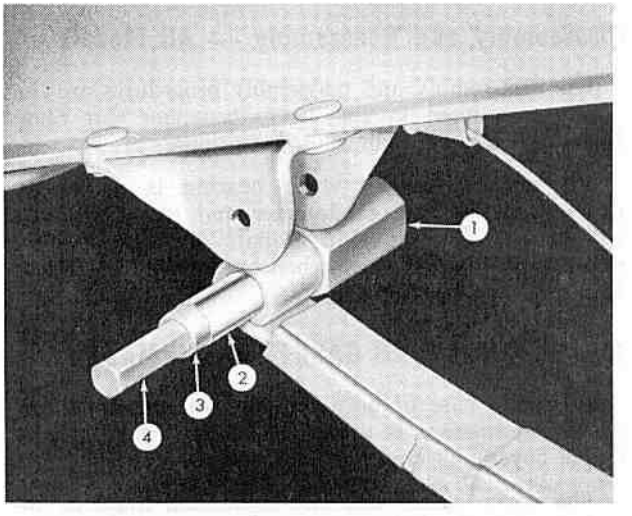


FIG. 424

1. Nut
2. Bushing
3. Step washer
4. Screw

REAR SHACKLE

Installation — All Models

The rear spring rear shackle bushing is of the mushroom-head type. The shackle plates are "dished out" at the point of contact with the bushing to receive the mushroom head of the bushings. (See Fig. 425.)

On installation as the shackles are tightened the contour of head of the bushing and plate forces the bushing in toward the shackle stud. This results in longer bushing life due to greater compression of the bushing on the stud, thus minimizing the movement between shackle stud and bushing.

SHOCK ABSORBERS — Commander and Land Cruiser

The rear shock absorbers are mounted at right angles to the frame, which allows the shock absorber links to extend from the shock absorber arms to the spring mounting plates at an angle of approximately 45°.

The filling and adjustment procedures are the same as those given on pp. 159-161 of the 1947 Passenger Car Shop Manual for the rear shock absorbers on the 1947 Commander Models.

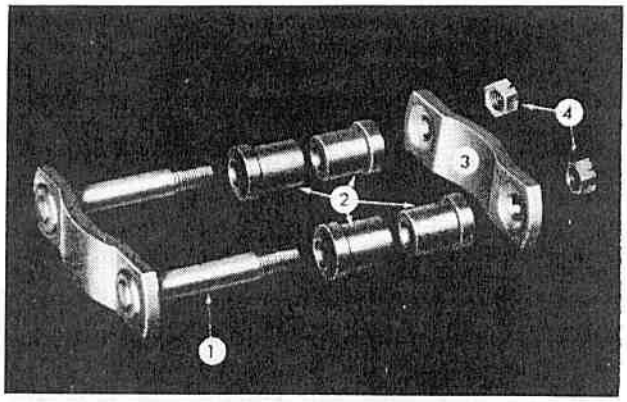


FIG. 425

1. Shackle and studs
2. Bushings
3. Shackle
4. Nut

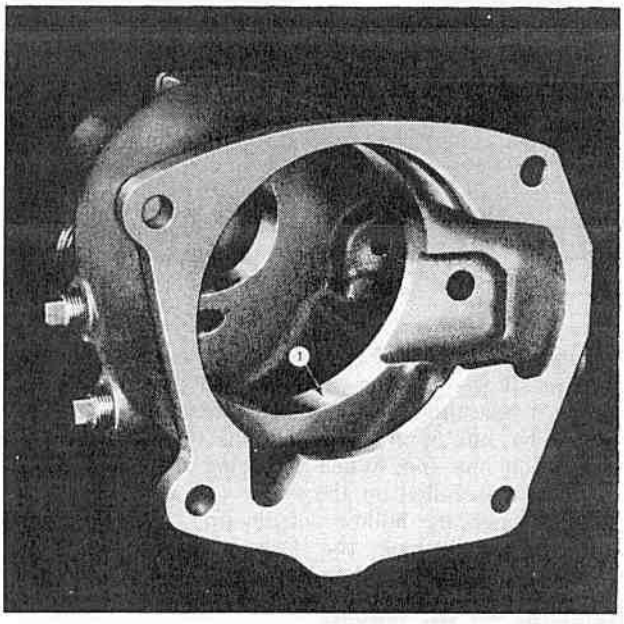


FIG. 426

1. Machined surface

TRANSMISSION

OVERDRIVE TRANSMISSION

The overdrive housing of the overdrive transmission used on the 1949 models is constructed so that the overdrive shaft is supported at the shaft ring gear by a machined flange which is cast integral with housing (see Fig. 426). One bearing instead of two bearings as on previous models supports the shaft at the rear of the housing.

Disassembly and Reassembly — All Models

The disassembly and reassembly procedures are the same as outlined in the 1947 Passenger Car Shop Manual, with the following exceptions:

The front overdrive shaft bearing is no longer used, therefore the speedometer and governor gears will remain on the overdrive shaft when the housing is removed. The gears can then be removed by sliding them off the overdrive shaft.

COVER AND COVER GASKET — All Models

The main case of both the conventional and overdrive transmission is vented by means of vent holes in the cover and cover gasket.

The cover gasket has two holes and must be installed with the holes toward the rear of the transmission.

The cover has a single hole and is installed with the hole at the front of the transmission.

WHEELS AND TIRES

6.40 x 15 low pressure 4-ply tires are standard equipment on all Champions.

TIRE PRESSURES

		FRONT	REAR
Champion	6.40 x 15	28	24
Commander	6.50 x 15	26	22
Land Cruiser	6.50 x 15	26	22

GENERAL SPECIFICATIONS

The 1949 Model specifications are the same as those given for the 1947 Model except as designated below:

	CHAMPION	COMMANDER
Stroke		4-3/4" (115,65 mm.)
Piston displacement — cu. in.		245.6
Piston displacement — cu. cm.		4025,4
Maximum horsepower at r.p.m.		100 @ 3400
Rods and Pins		
Connecting rod — center to center length		7-15/16" (101,6 mm.)
Crankshaft		
Main bearing clearance		.0006" to .0027" (0,015 mm. to 0,068 mm.)
Main bearing journal — Diameter		2.8745" to 2.8750" (72,01 mm. to 73,02 mm.)
Main bearing length — No. 1		1-3/32" (27,78 mm.)
No. 2		1-1/16" (26,98 mm.)
No. 3		1-1/16" (26,98 mm.)
No. 4		1-25/32" (45,24 mm.)
Cooling		
Capacity — U. S. Qts.	11.0	
Imp. Qts.	9.15	
Liters	10.3	
Valves		
Valve lift	11/32" (8,73 mm.)	
Valve spring pressures — open	93 lb. to 103 lb. @ 1-5/16" (42,18 kgs. to 46,72 kgs. @ 33,34 mm.)	125 lb. to 145 lb. @ 1-3/4" (56,7 kgs. to 65,77 kgs. @ 44,45 mm.)
Fuel		
Gasoline Tank Capacity — U. S. Gals.	18	18
Imp. Gals.	15	15
Liters	68,1	68,1
Carburetor — model	WE-715S	
Ignition		
Cam angle	38° — 40°	38° — 40°
Starter		
Starter motor — model	MZ 4151	MCH — 4001
Lamps		
Head lamp bulb	45 watts Driving 35 watts Passing	45 watts Driving 35 watts Passing
Clutch		
Pressure plate spring tension	195 lb. ± 6 lb. @ 1-1/2" Red Spring — (88,43 Kgs. ± 2,72 Kgs. @ 38,1 mm.) Orange Spring 170 lb. ± 5 lb. @ 1-1/2" (77,11 Kgs. ± 2,27 Kgs. @ 38,1 mm.)	Yellow Spring 140 lb. ± 5 lb. @ 1-1/2" (63,50 Kgs. ± 2,27 Kgs. @ 38,1 mm.)
Rear Axle		
Road clearance	8" (203,2 mm.)	
Backlash — pinion and gear	.003" to .006" (0,076 mm. to 0,15 m.)	.003" to .006" (0,076 mm. to 0,15 mm.)
Tires		
Size	6.40 x 15	6.50 x 15
Inflation pressure	28 lb. (1,96 kgs.) front	26 lb. (1,82 kgs.) front
(cold, minimum)	24 lb. (1,68 kgs.) rear	22 lb. (1,55 kgs.) rear
Springs and Shock Absorbers		
Front spring — size		2-1/2" x 40-1/4" (63,5 mm. x 1022,4 mm.)
— No. of leaves	11	
Steering		
Caster	+1/2° to +1-1/2°	−2° to −3°
Camber	0° to +1°	0° to +1°
Minimum road clearance	8-1/4" (209,55 mm.)	
General Data		
Overall length of car with bumpers and bumper guards	191-15/16" (4,875 m.)	205-7/16" (5,218 m.) 209-7/16" (5,319 m.)
Overall height — road to roof with load	61-1/4" (1,556 m.)	61-5/8" (1,565 m.)
Overall width	69-19/32" (1,768 m.)	69-19/32" (1,768 m.)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