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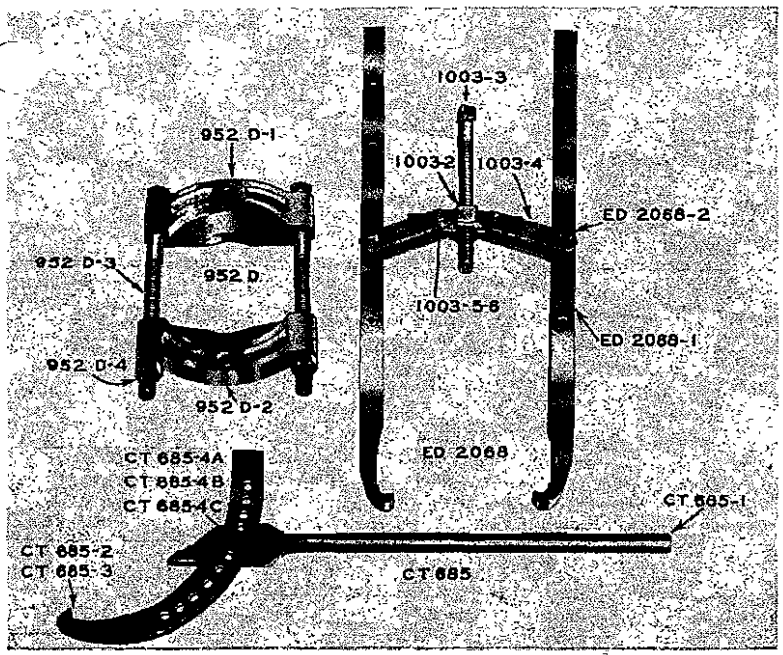


ADAMS TRANSMISSION

Factory Approved

The tools illustrated at the left were developed for servicing the Adams Transmission. They have been selected and designed by the Adams Division, LeTourneau-Westinghouse Co., and can be purchased from: Indiana Bearings, Inc., 801 North Capitol Ave., Indianapolis, Indiana.

With these tools it is possible to remove the bearings, gears and bearing inner races, etc. from the Adams Transmission and does these jobs at a substantial saving of time and labor and without damage to costly parts. They will also make your customers more satisfied with your service work.

O. T. C. TOOL NO.

ED-2068 Grip-O-matic puller complete (Includes the following):

2 - ED-2068-1	Jaws	1 - 1003-3	Forcing Screw
2 - ED-2068-2	Special Pins	4 - 1003-4	Straps
1 - 1003-2	Forged Head	2 - 1003-5-6	Cap Screws & Nuts

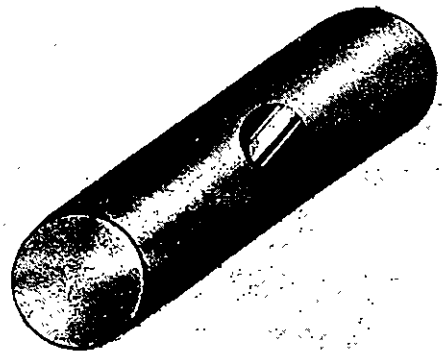
952D Bearing puller attachment complete (Includes the following):

1 - 952D-1	Block (top)	2 - 952D-3	Bolts
1 - 952D-2	Block (bottom)	2 - 952D-4	Nuts

CT685 Adjustable spanner wrench complete (Includes the following):

1 - CT685-1	Handle	1 - CT685-4A	Pivot Pin Bolt
1 - CT685-2	3/8" Thick Jaw	1 - CT685-4B	Pivot Pin Screw
1 - CT685-3	3/4" Thick Jaw	1 - CT685-4C	Pivot Pin Washer

Shown in illustration at right, is the pinion setting gage designed for use in adjusting the pinion and ring gear in the Adams Transmission. Order from Adams Division, LeTourneau-Westinghouse Co., Indianapolis 6, Indiana, under part number 723017 - gage.



POWER BOX

[illegible] pinion setting gage is designed for use in adjusting the power box drive pinion. This gage must be used to obtain correct pinion setting when new drive gears are installed. Order from Indiana Bearing Co., Inc., 801 North Capitol Ave., Indianapolis, Indiana.

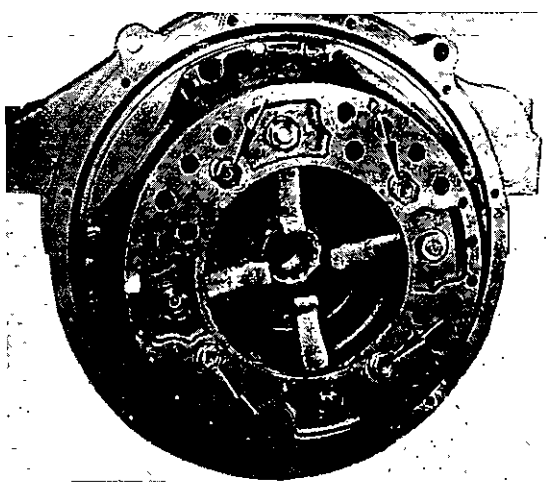
O. T. C. Tool No. LW-16.

— NOTES —

CLUTCH
(Models 550 and 660 Motor Graders)

Manufacturer	Rockford
Size	16"
Type - Model 660	Double Disc, Spring Loaded
Type - Model 550	Single Disc, Spring Loaded
Number of Springs - Model 660	20
Number of Springs - Model 550	24
Throwout Bearing Type	Ball
Pilot Bearing Type	Ball

After considerable service, or if the clutch has been subjected to intense heat, causing pressure springs to discolor due to the clutch slipping, the pressure plate should be taken apart and the tension of the springs checked. It is necessary to remove the engine from the grader in order to replace the clutch. To remove engine, see "Removal" section.



Illust. 1

NOTE: Before removing the pressure plate from the flywheel, four (4) hold down set screws (3/8" x 4") with jam nuts and washers must be installed in the tapped holes in the inner spring circle (Illust. 1). The purpose of these set screws is to relieve the pressure on the clutch assembly so it may be removed.

After removal of the clutch pressure plate assembly, the face of the pressure plate should be checked for cracks, scores and warpage. Heat cracks and scores can be detected by visual inspection. Warping can be checked by running a straight edge across the face of the plate. A badly scored, cracked or warped pressure plate will wear facings quickly and should be replaced with a new one.

Clutch pressure springs which have lost their tension will not exert sufficient pressure on the clutch pressure plate to prevent slippage and accompanying wear to the clutch facings. Therefore, clutch pressure springs should be checked before reassembling the clutch. Springs which have been used will often take a set and will, therefore, not return to their original free length but will still develop sufficient pressure to be usable. Therefore, the springs should not be discarded unless they do not meet the minimum allowable spring pressure.

If the springs do not meet the test specifications shown in the table on the next page, they should be replaced.

Diameter of Clutch	Back Plate Material	No. of Springs	Spring Free Length	Test Springs at Length	Lbs. Pressure
Model 660 16"	Cast Iron	20	3-5/16"	2-1/8"	130 - 140
Model 550 16"	Cast Iron	24	3-5/16"	2-1/8"	130 - 140

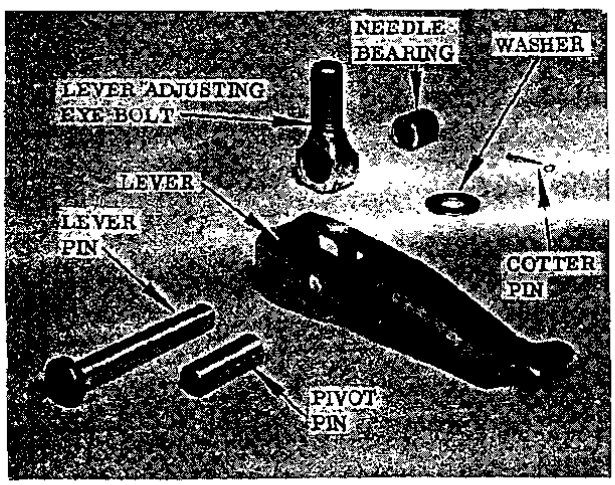
ASSEMBLY

The clutch assembly procedures are identical for Models 550 and 660 Motor Graders.

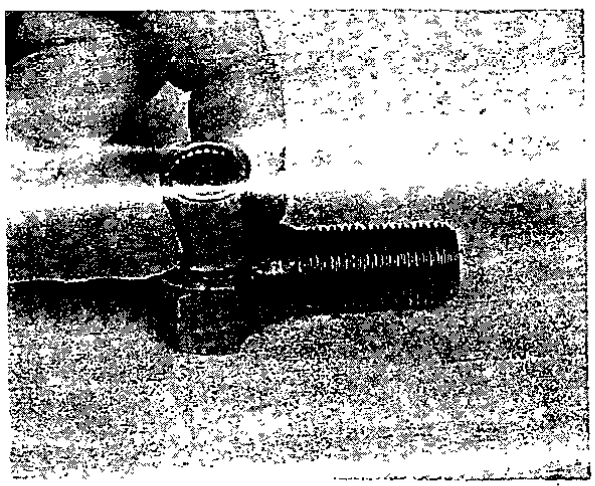
Illustrations 1 thru 15 refer to the Model 550 Motor Grader, using a single disc clutch.

Illustrations 1 thru 22, excluding Illustration 16, refer to the Model 660 Motor Grader, using a double disc clutch.

Illust. 2 is an exploded view of the release lever assembly.



Illust. 2

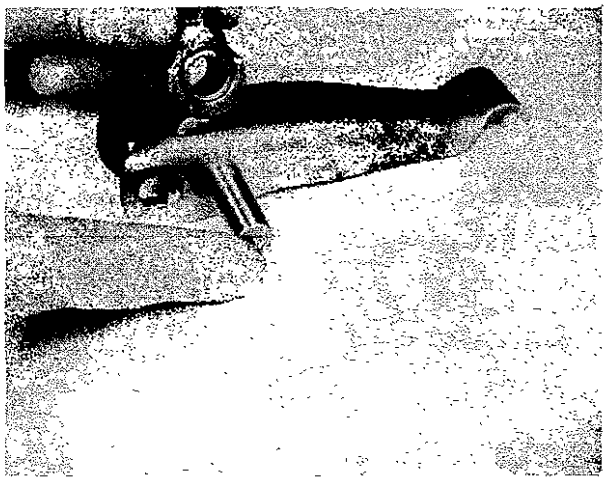


Illust. 3

Press needle bearing into eye bolt (Illust. 3).

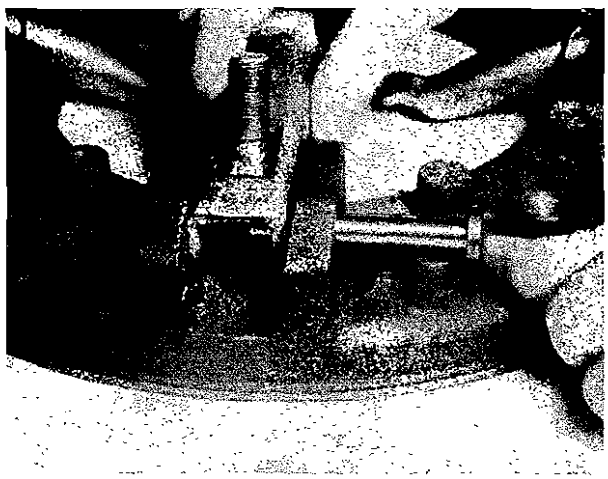
Install eye bolt into release lever (Illust. 4). Next, insert pin into lever and through lever needle bearing. NOTE: Lubricate bearing before inserting pin.

Press bearings into pressure plate (Illust. 5).

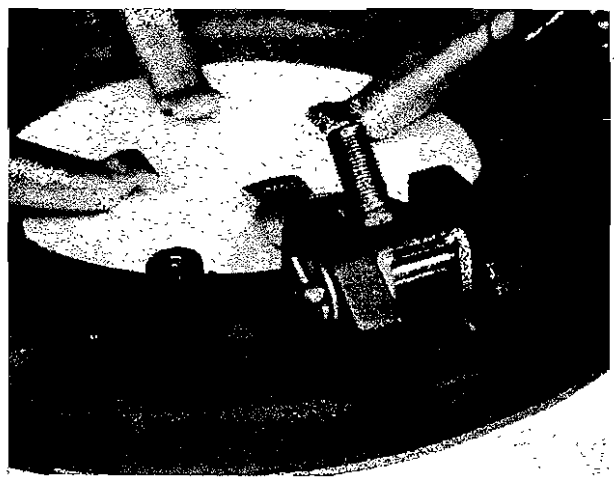


Illust. 4

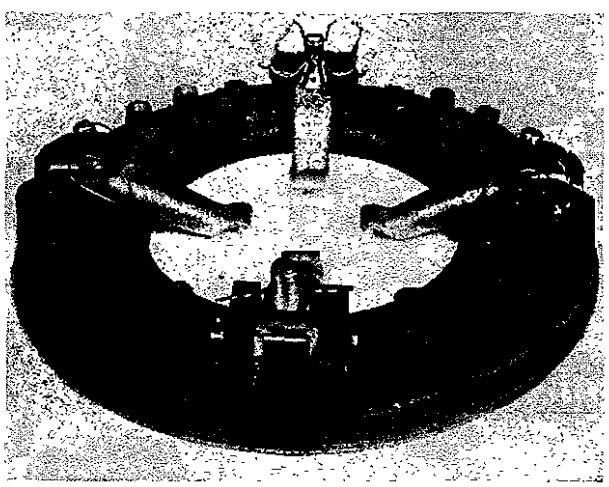
Illust. 5



Illust. 6



Illust. 7



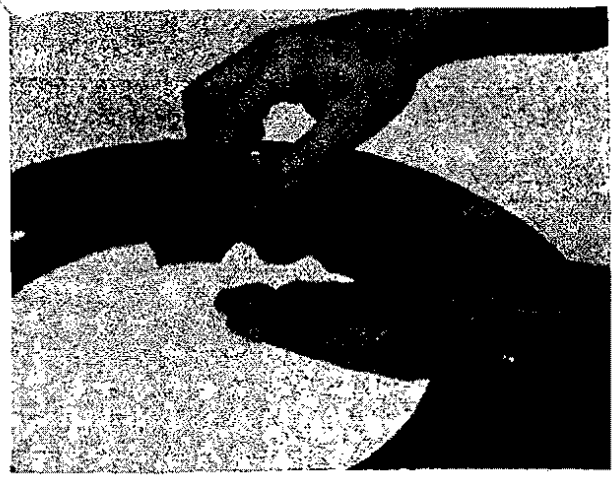
Illust. 8

Install release lever between brackets of pressure plate and insert pin (Illust. 6). NOTE: Head of pin to be against thrust of pressure plate. Lubricate bearings before inserting pin.

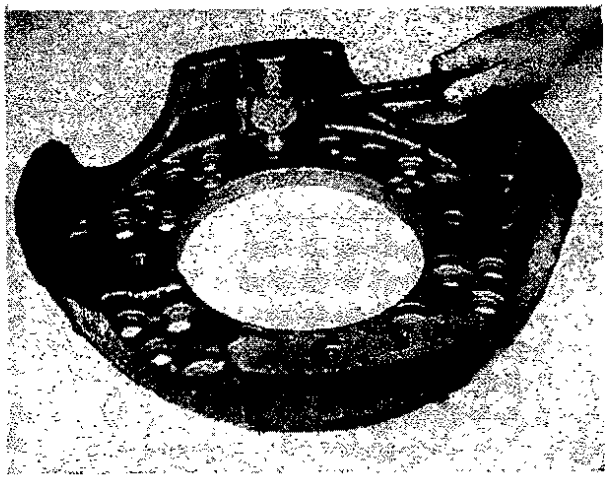
Install cut washer and cotter pin. Spread cotter pin (Illust. 7).

Install anti-rattle spring (Illust. 8). Prongs of spring toward long end of lever.

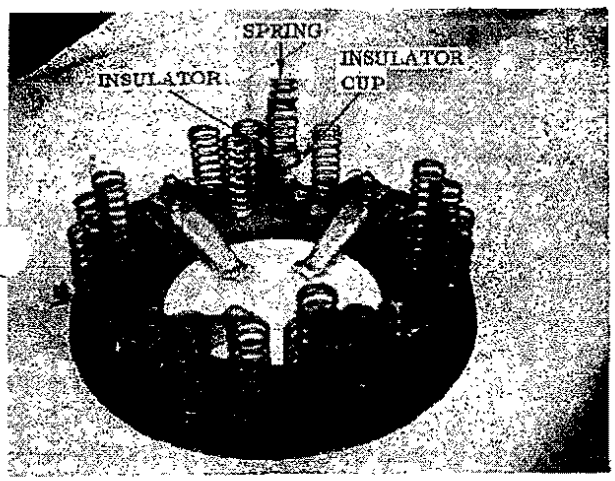
Insert adjusting nut through back plate (Illust. 9) Install washer onto end of adjusting nut. Cup of washer away from back plate.



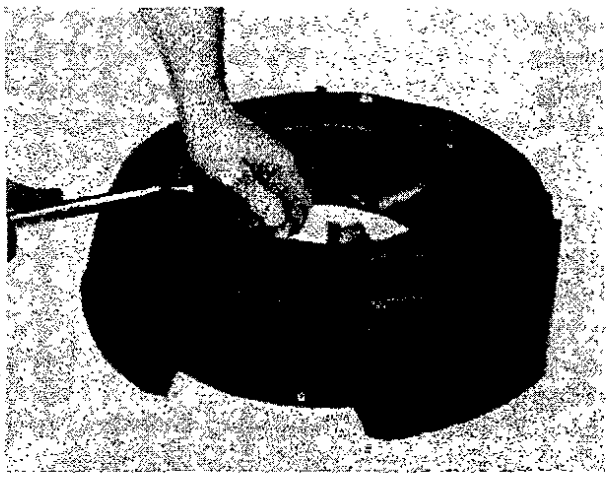
Illust. 9



Illust. 10



Illust. 11

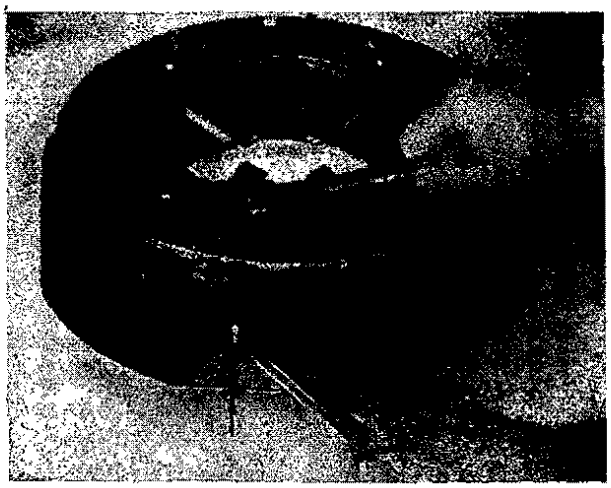


Illust. 12

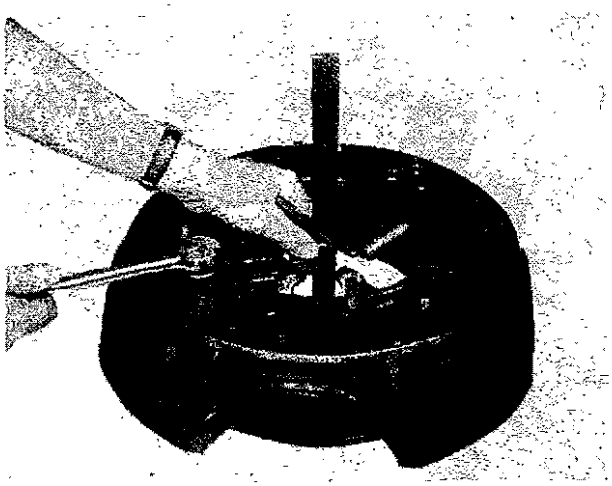
Using a ball peen hammer (Illust. 10) flare end of adjusting nut.

Install insulator cups, insulators and springs onto pressure plate (Illust. 11). NOTE: Model 550 clutch has twenty-four (24) cups, insulators and springs. Model 660 clutch has twenty (20) cups, insulators and springs.

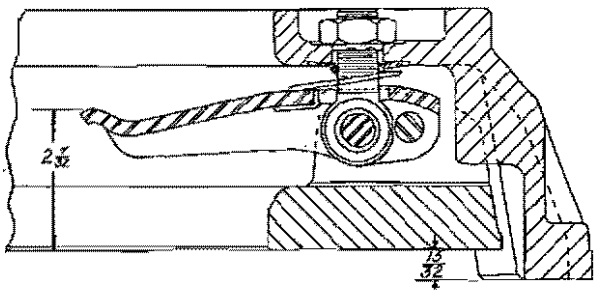
Install backing plate onto pressure plate. Install hold down set screws, jam nuts and cut washers (Illust. 12). Tighten hold down set screws until lever eye bolts touch adjusting nuts. Raise the levers and align eye bolts with adjusting nuts. Tighten adjusting nuts onto eye bolts until the



Illust. 13



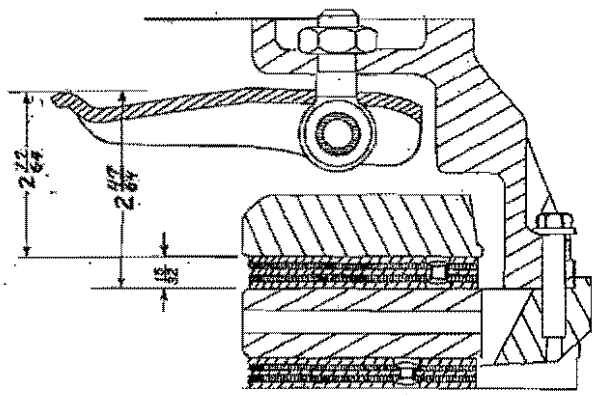
Illust. 14



MODEL 550 - SINGLE DISC

Illust. 15

levers raise and touch the back plate. Retighten hold down set screws until pressure plate raises 15/32" from a flat surface (Illust. 13). Next, adjust levers to 2-7/32" for Model 550 - single disc clutch. For Model 660 - double disc clutch, adjust levers to 2-17/64" (Illust. 14).



MODEL 660 - DOUBLE DISC

Illust. 16

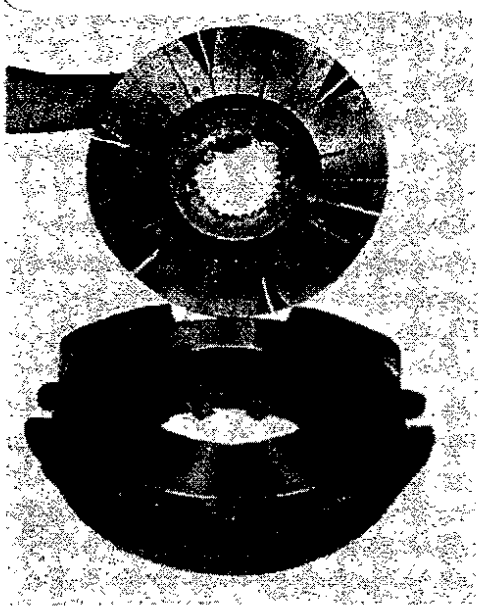
Illusts. 15 (Model 550) and 16 (Model 660), show cross section views of the clutch assemblies. The illustrations also show the dimensions necessary for adjusting the clutch release levers. These adjustments can best be made on a regular clutch locating fixture, although it is possible to make the adjustments with a straight edge or ruler. NOTE: The 15/32 of an inch dimension, shown in Illusts. 15 and 16 is for clutches with new discs. To adjust clutch levers in a clutch with worn discs, use a block 15/32 of an inch thick (Illust. 13). Tighten hold down set screws until pressure plate raises 15/32 of an inch from a flat surface. Then continue the adjustment of the clutch levers as specified in Illusts. 15 or 16.

The Model 550 - single disc clutch is now ready to be installed onto flywheel.

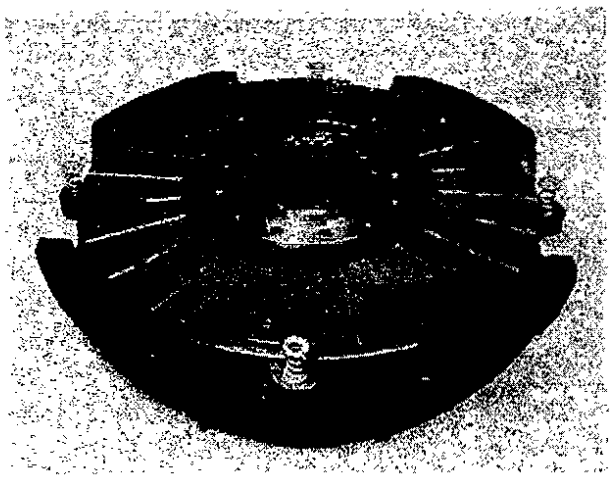
NOTE: Illusts. 17 through 22 is the continuation of the Model 660 - double disc clutch assembly.

Install disc (Illust. 17) onto pressure plate with the slinger on disc toward the levers.

Install the four (4) washers, heavy springs and second washer onto pressure plate (Illust. 18).



Illust. 17

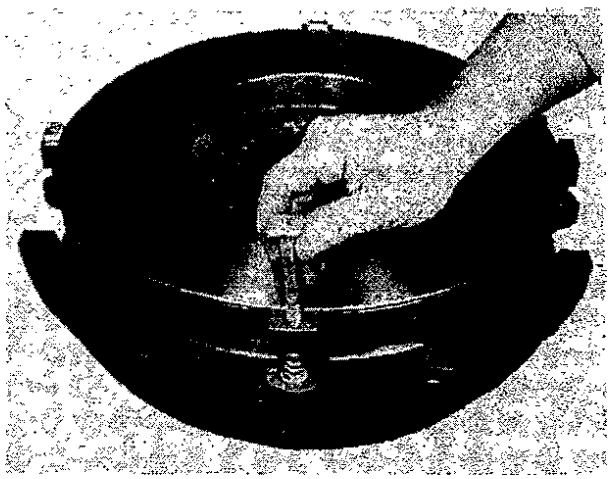


Illust. 18

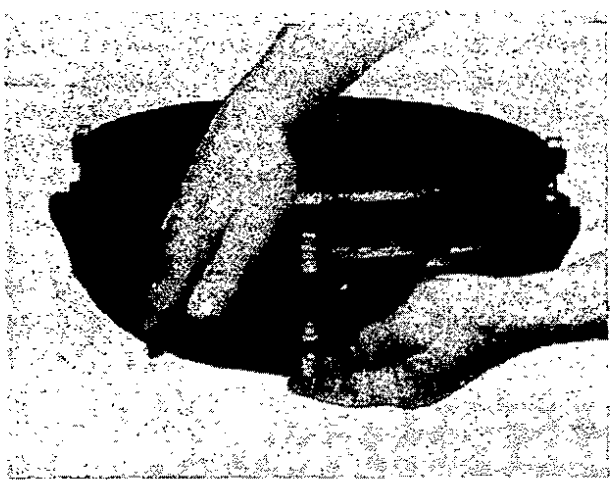
As shown in Illust. 19, install center plate over heavy springs and washers and onto disc. Insert center plate return screws through center plate, washers, springs and pressure plate.

Install light springs, return screw bushings and locking nuts (Illust. 20).

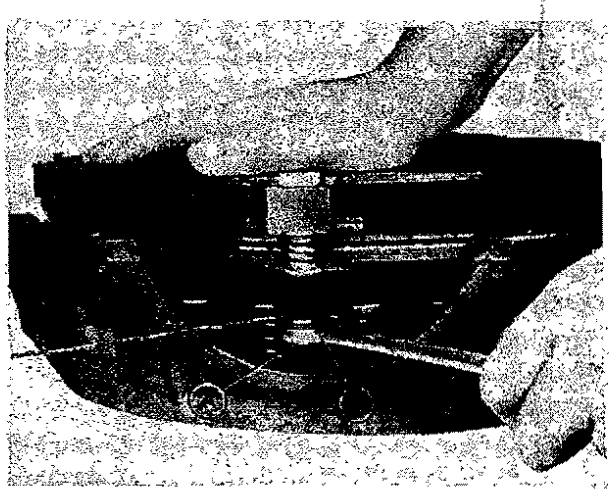
Hold center plate down against driven member and tighten locking nuts until a gap of 1/16" is obtained between the flange of the return screw



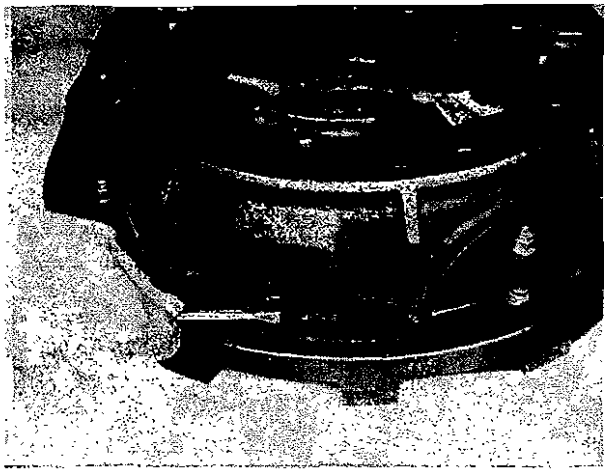
Illust. 19



Illust. 20



Illust. 21



Illust. 22

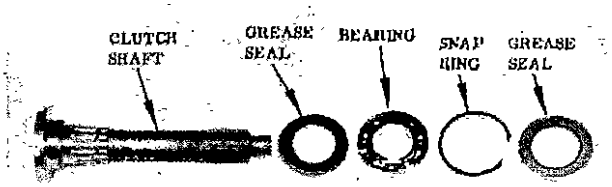
bushing and the pressure plate (Illust. 21). NOTE: Use a piece of wire 1/16" thick as a gauge.

Install clutch adapter onto backing plate. Install the four (4) cap screws and tighten securely (Illust. 22).

CLUTCH RELEASE AND BRAKE HOUSING (Models 550 and 660 Motor Graders)

DISASSEMBLY

The engine must be removed to repair or replace any parts of the clutch release brake housing assembly. To remove engine, see "Removal" section.



Illust. 1

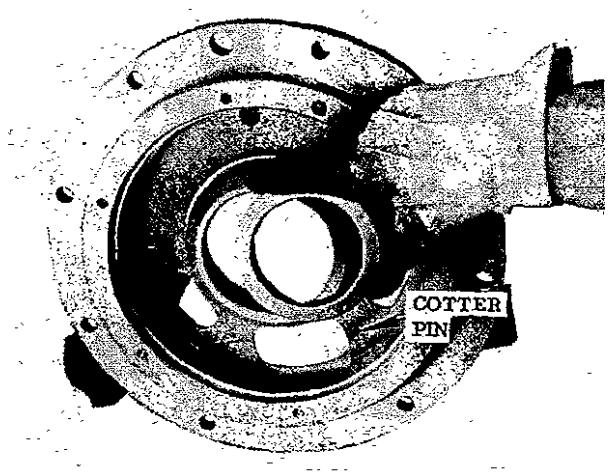
INSPECTION

Inspect all parts for excessive wear or damage.

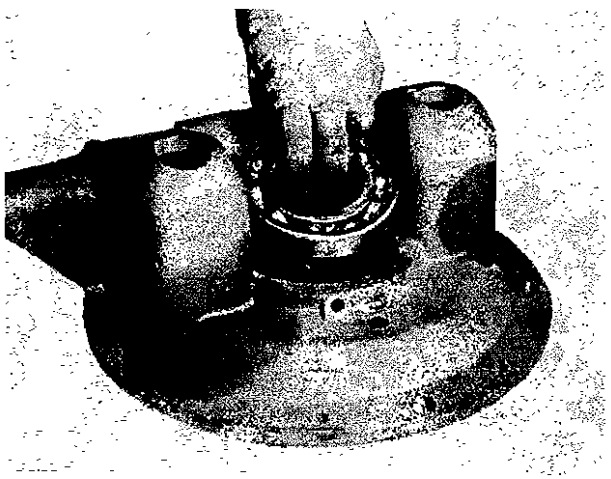
REASSEMBLY

Illust. 1 is an exploded view of the clutch shaft assembly.

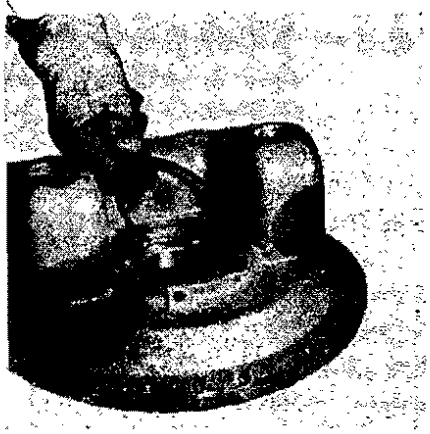
Press grease seal into clutch release brake housing (Illust. 2). Lip of seal toward inside of housing. Next, install cotter pin and spread.



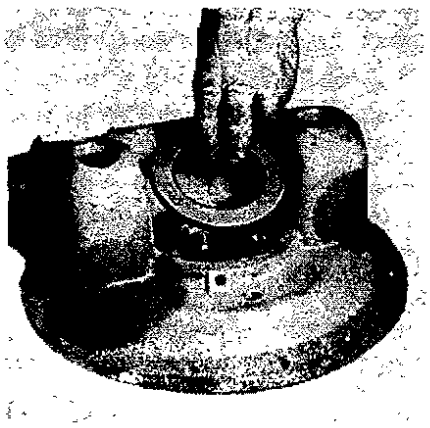
Illust. 2



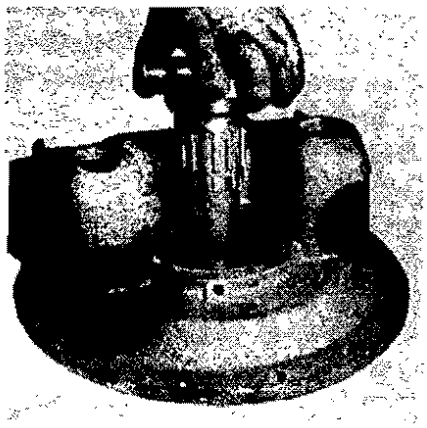
Illust. 3



Illust. 4



Illust. 5



Illust. 6

Press or drive bearing into housing (Illust. 3).

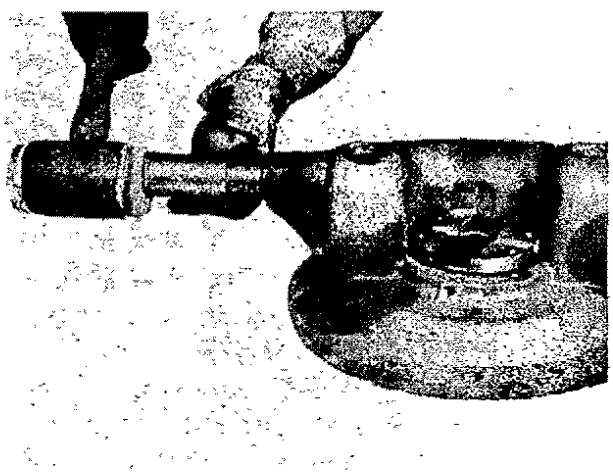
Install snap ring into groove of housing (Illust. 4).

Press or drive grease seal (used as a dust seal) into housing (Illust. 5). Lip of seal away from bearing.

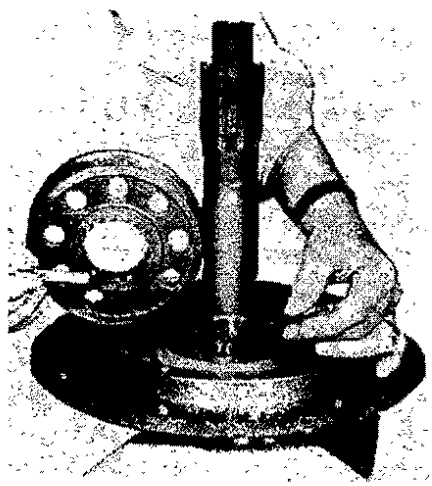
Insert clutch shaft into housing with the splined end toward inside of housing (Illust. 6). Using a rawhide mallet, drive clutch shaft into bearing.

Illust. 7

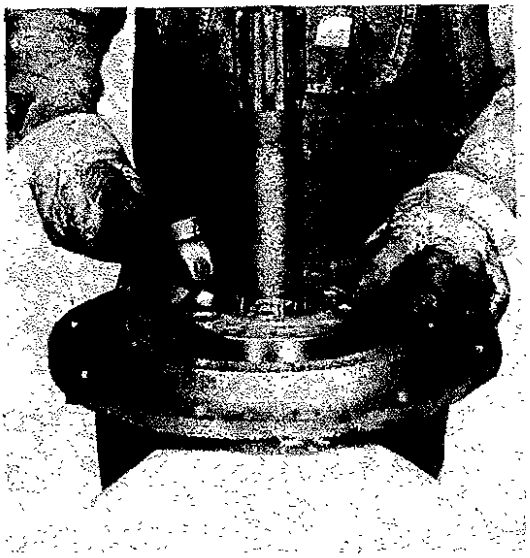
Install bushings (Illust. 7) into housing. Using a rawhide mallet and bronze drift pin, drive bushings



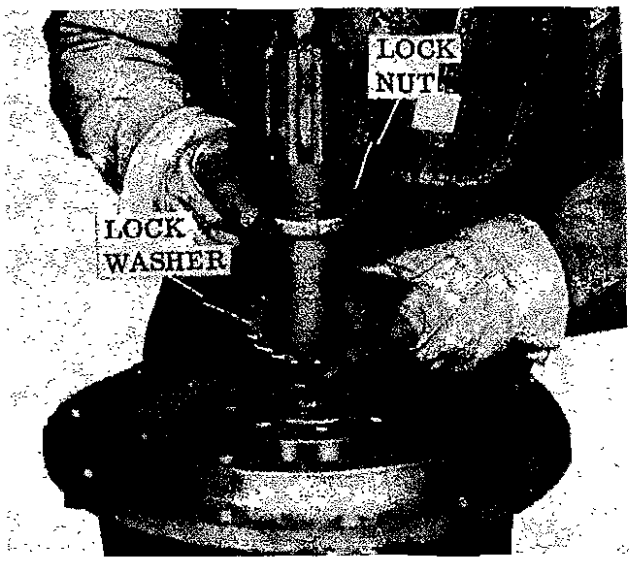
Illust. 8



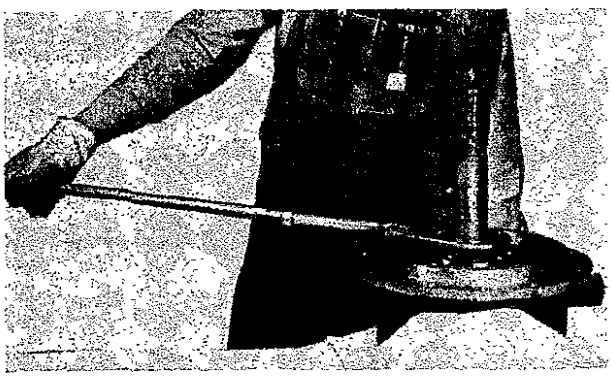
Illust. 9



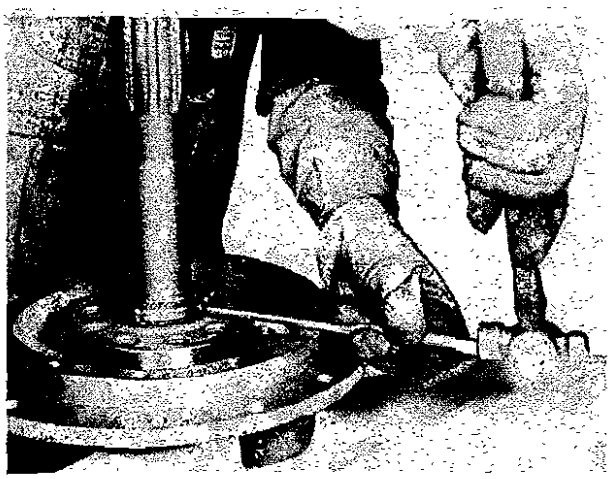
Illust. 10



Illust. 11



Illust. 12



Illust. 13

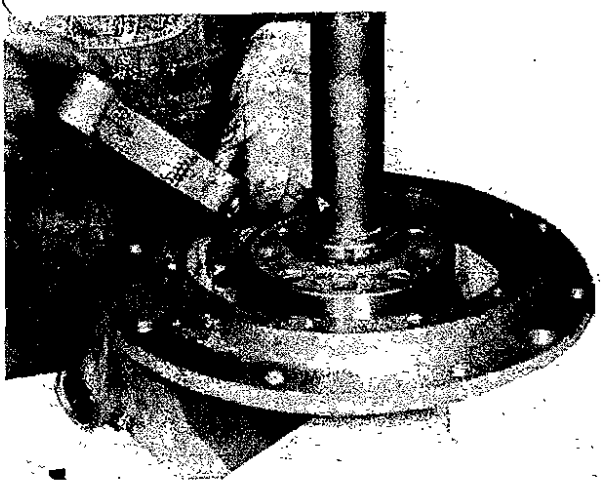
into place (Illust. 8).

Install brake drum onto clutch shaft. Long end of hub fitting into grease seal. The short spline of brake drum over wide slot of spline on shaft, as indicated with the pencils in Illust. 9. Tap drum down over splines with a rawhide mallet (Illust. 10).

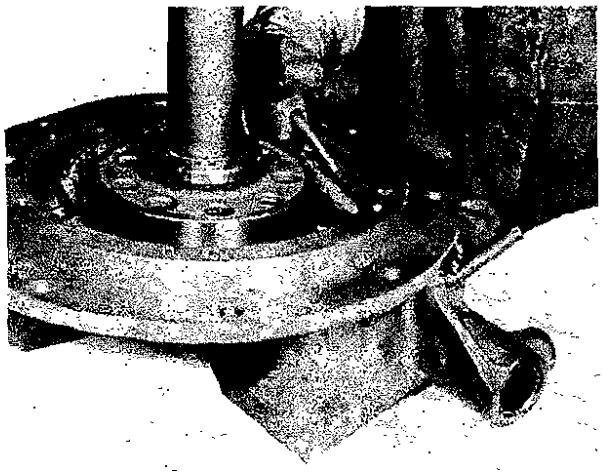
Install lock washer and lock nut onto clutch shaft (Illust. 11). Ears of lock washer in an upward position. Lock on inside diameter of lock washer to fit in wide slot of spline on shaft. Tighten nut securely with a spanner wrench (Illust. 12). Using a drift pin and hammer, lock ears of lock washer in as many slots of lock nut as possible (Illust. 13).

Install clutch brake band and spring (Illust. 14). Hook one end of spring into hole in brake band and the other end into cotter pin head.

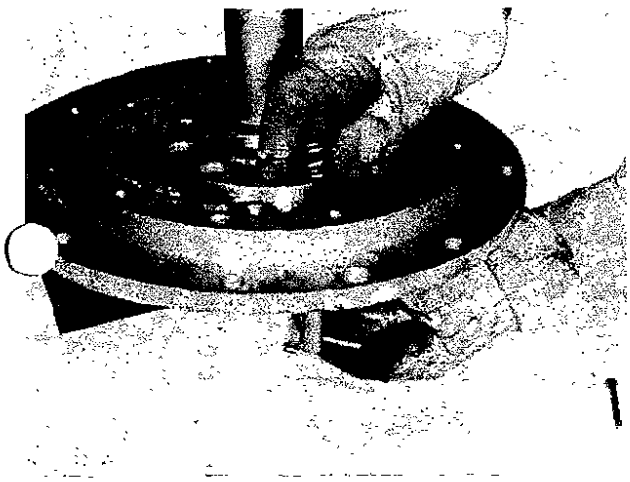
Insert clutch brake pull rod through housing and into clutch brake band. Next, install slotted nut and cotter pin (Illust. 15). Spread cotter pin.



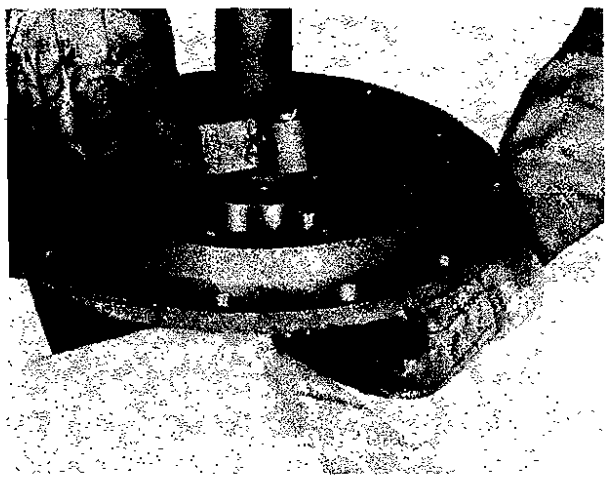
Illust. 14



Illust. 15



Illust. 16



Illust. 17

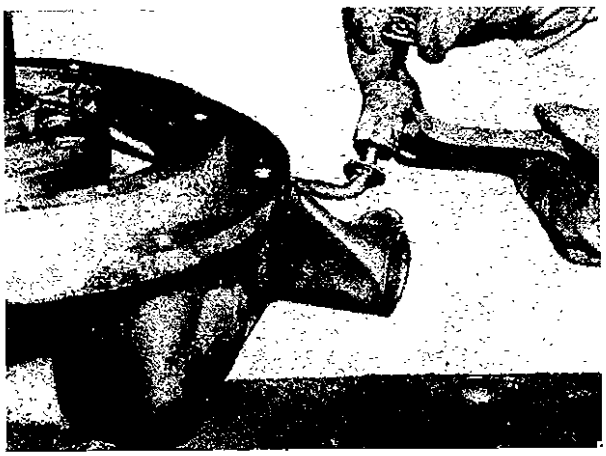
As shown in Illust. 16, insert cotter pin into pin. Spread cotter pin. Insert pin with cotter pin through housing. Next, install spring onto pin.

Install brake band onto pin with spring (Illust. 17).

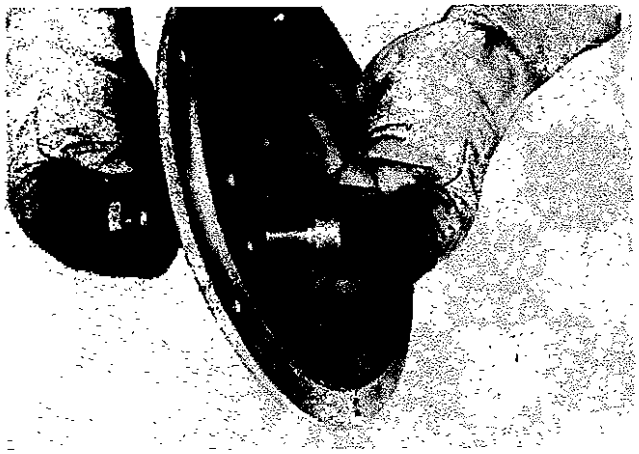
As shown in Illust. 18, install stud.

Install cotter pin into clutch brake pull rod. Next, install cut washer onto pull rod. (Illust. 19). Install operating lever onto clutch brake pull rod and onto stud. Install cut washer and cotter pin. Spread cotter pin. Install nut on

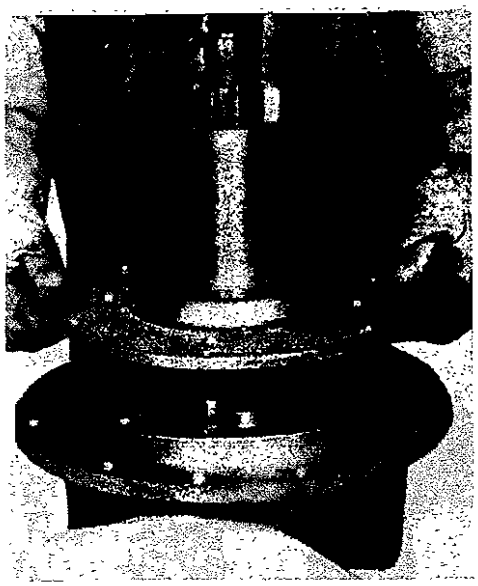
Illust. 18



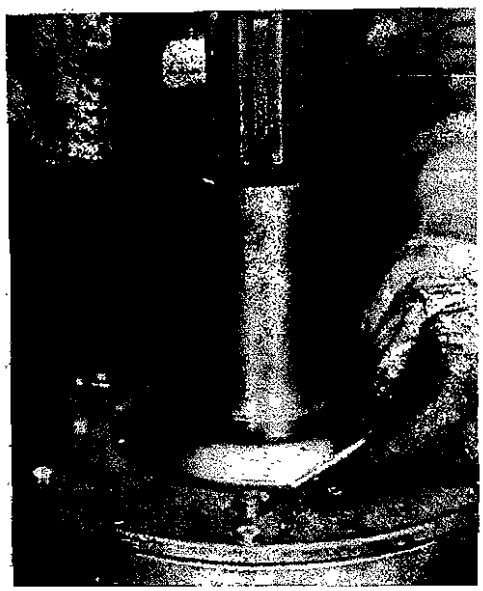
Illust. 19



Illust. 20



Illust. 21



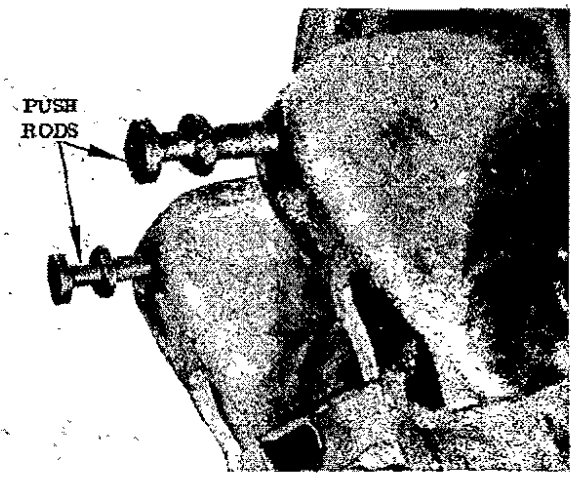
Illust. 22

stud and tighten only enough to allow free movement in operating lever.

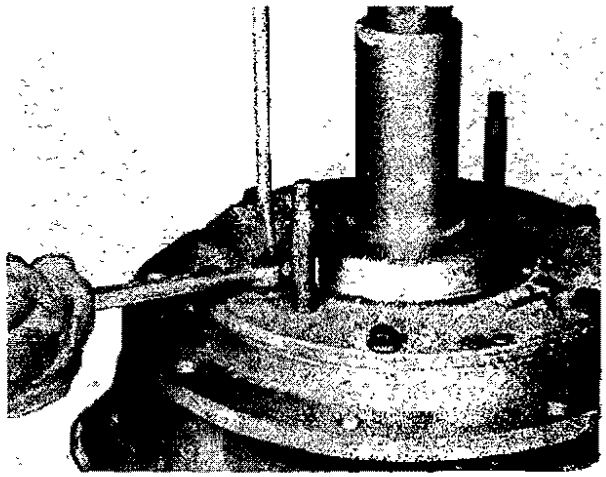
(Illust. 20). Insert lock cam through clutch release bearing sleeve support with flat side of cam head against brake band. Next, install lock washer and nut onto cam. Do not tighten nut.

(Illust. 21). Install clutch release bearing sleeve onto clutch shaft. Align dowel pin holes in clutch release bearing sleeve with those in clutch release bearing housing. Tap sleeve with a rawhide mallet to allow sleeve to go over clutch brake band pin.

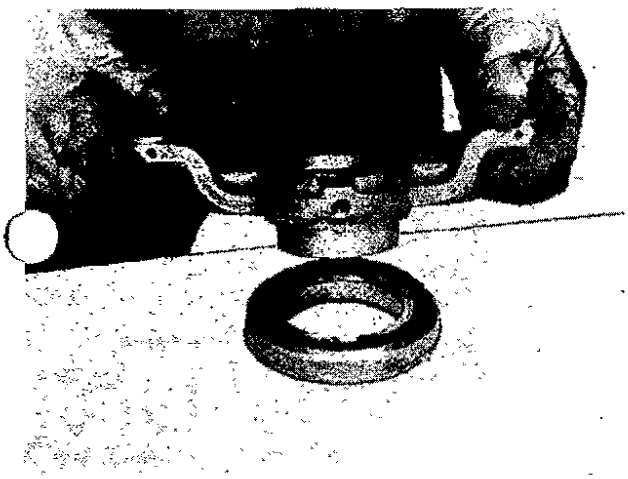
(Illust. 22). Next, install dowel pin and cotter pin. Spread cotter pin. Install and tighten cap screws.



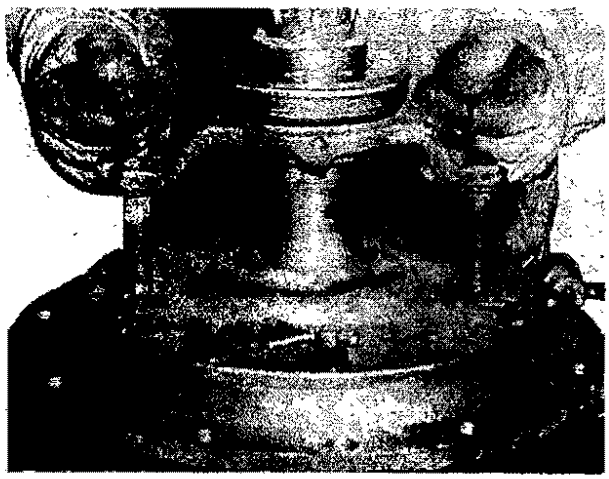
Illust. 23



Illust. 24



Illust. 25

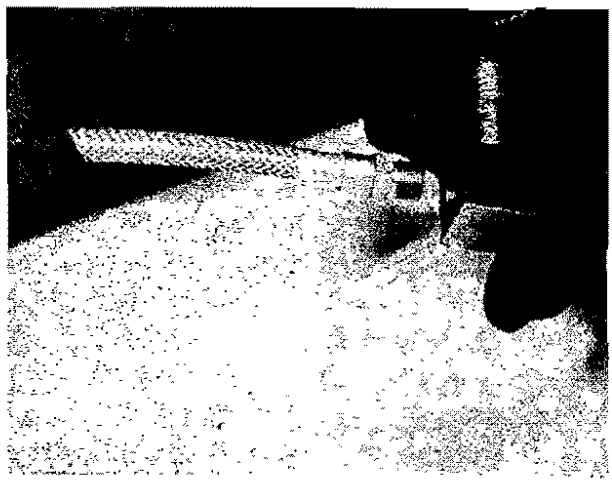


Illust. 26

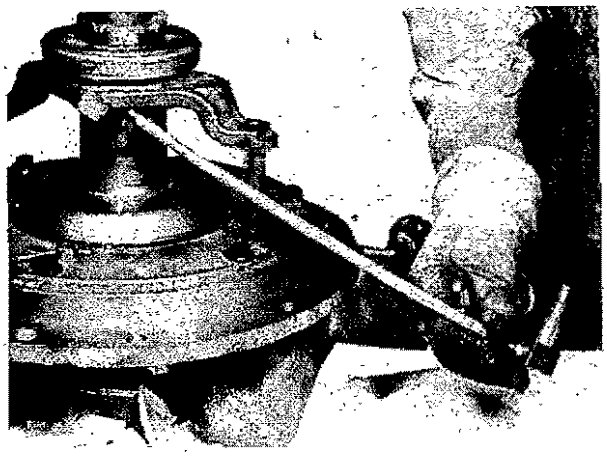
Install push rods (Illust. 23). Heads of push rods toward the rear of housing, with the tapered portion of head downward. NOTE: Apply grease to push rods before assembling.

Turn cam with screw driver until tight against brake band. Back off cam either clockwise or counter clockwise until there is freeness in push rods, then tighten jam nut (Illust. 24).

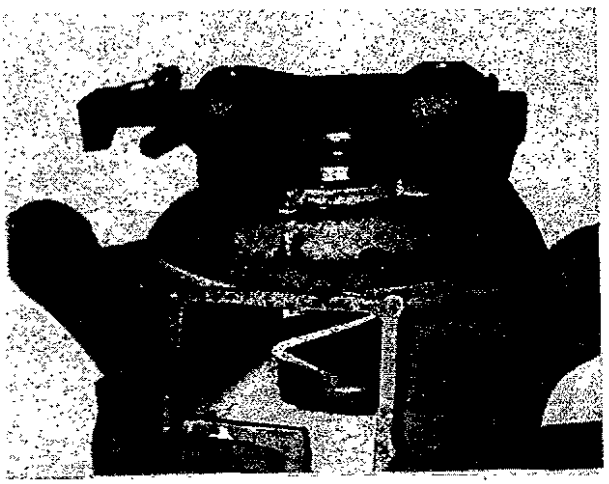
Press or drive bearing onto clutch release bearing sleeve (Illust. 25). Align grease hole in sleeve with grease hole in bearing. Fill bearing sleeve with grease.



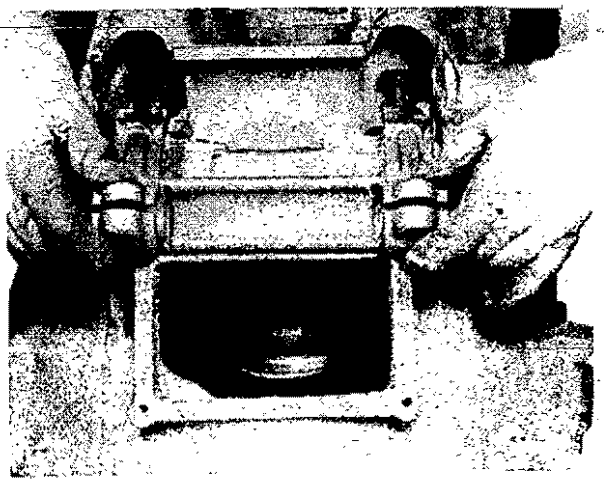
Illust. 27



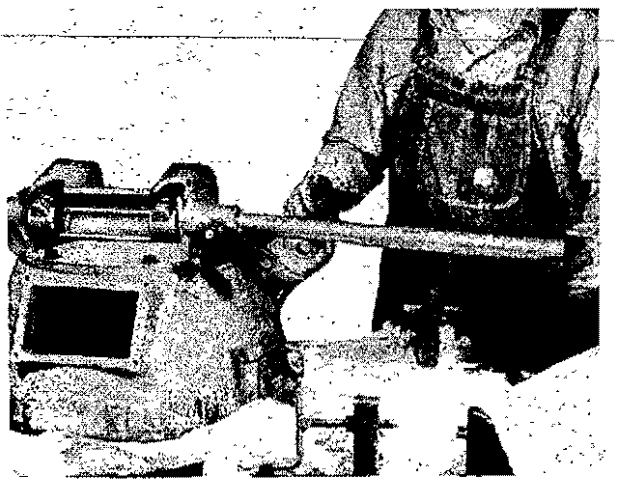
Illust. 28



Illust. 29



Illust. 30



Illust. 31

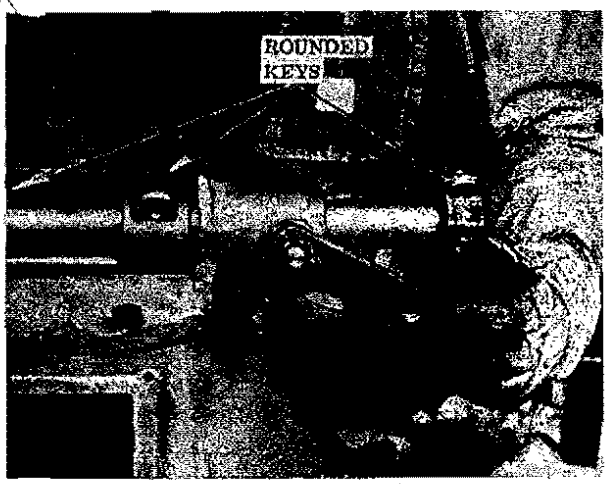
Install clutch release bearing sleeve onto sleeve support and onto push rods (Illust. 26). Next, insert cotter pins and spread.

Install lubrication tube into block head fitting and tighten (Illust. 27).

Install lube fitting elbow into clutch release bearing sleeve. Next, install and tighten lubrication tube with block head into clutch release bearing sleeve lube fitting elbow (Illust. 28). NOTE: Lubrication tube to clear the clutch release bearing sleeve support.

(Illust. 29). Install clutch release and brake assembly housing onto clutch housing. Install bolts and lock washers. Install block head through clutch housing and clutch release and brake housing. Install lock washer and nut. Tighten nut securely. Install lube fitting and tighten. Tighten bolts.

(Illust. 30). Install fork onto clutch housing. Forked ends between heads of push rods.



Illust. 32

Illust. 33

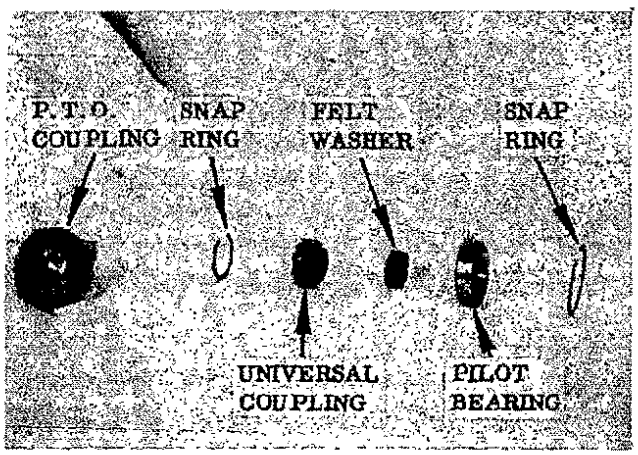
Insert clutch throw-out shaft (Illust. 31) through clutch housing and fork. Keyways in shaft in line with slots in fork.

Insert rounded keys into slots of fork (Illust. 32). Tap keys down into keyways of shaft. Next, install fork cap screws with lock washers and tighten securely.

Install clutch lever onto end of clutch shaft (Illust. 32). Long end of lever pointing toward bottom of clutch housing, also, hub of lever toward the fork. Install rounded key in slot of lever. Tap key down into keyway of shaft. Next, install lever cap screw, lock washers and nut. Tighten nut securely.

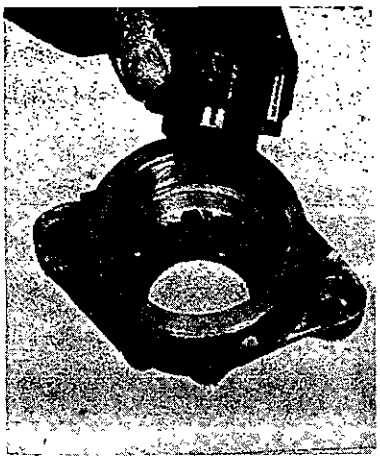
(Illust. 33). Install the ball socket to clutch lever. Install cut washer and slotted nut. Tighten nut securely and insert cotter pin and spread.

POWER TAKE-OFF BEARING CAGE (CUMMINS ENGINE ONLY)
(Models 550 and 660 Motor Graders)

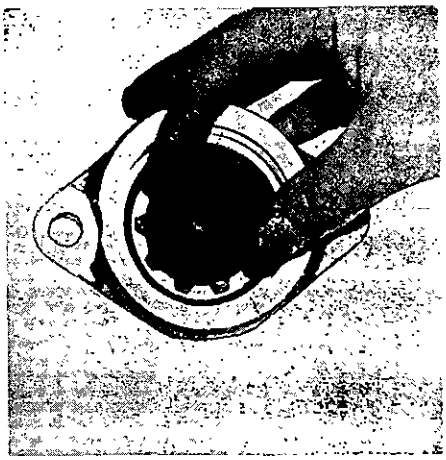


Illust. 1

Illust. 2

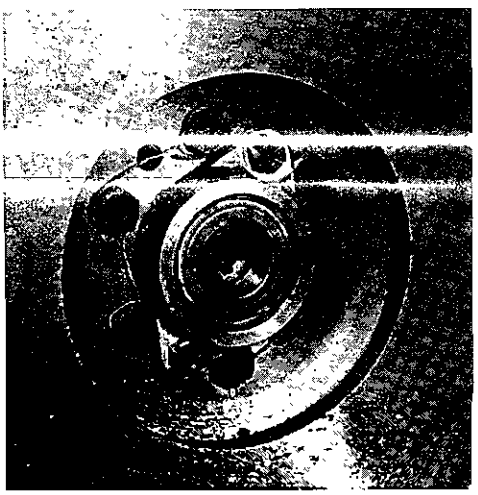


Illust. 3



Illust. 4

Illust. 5



Illust. 6

Illust. 1 is an exploded view of the P.T.O. coupling used on the Cummins Engine only.

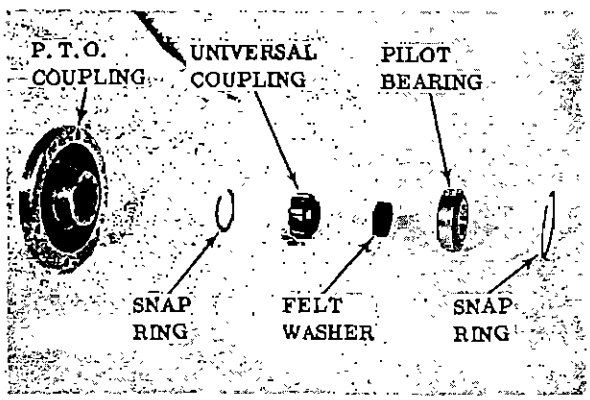
(Illust. 2). Insert small snap ring into groove of P.T.O. coupling.

Apply grease to inside of P.T.O. coupling and insert splined coupling (Illust. 3). Insert long hub of splined coupling into large bore of P.T.O. coupling.

Install felt washer into P.T.O. coupling and onto splined coupling (Illust. 4).

Press or drive bearing into P.T.O. coupling. Next, insert large snap ring into groove of P.T.O. coupling (Illust. 5).

Install P.T.O. coupling onto flywheel (Illust. 6). Long hub of P.T.O. coupling going into flywheel. Install coupling bolts and tighten securely.



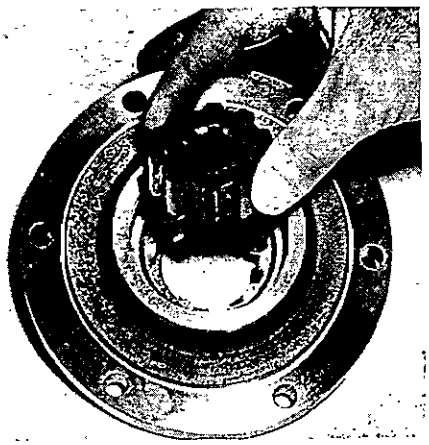
Illust. 1

POWER TAKE-OFF BEARING CAGE
(GENERAL MOTORS ENGINE ONLY)
(Models 550 and 660 Motor Graders)

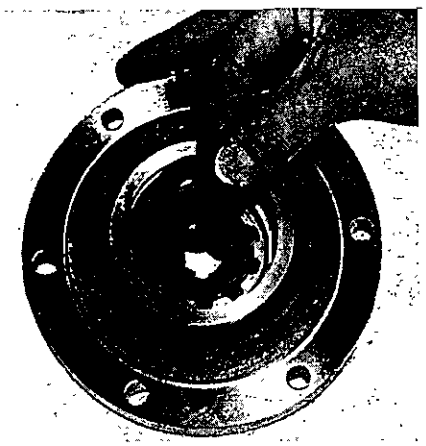
Illust. 1 is an exploded view of the P.T.O. coupling used on the General Motors engine only.

Insert small snap ring into groove of P.T.O. coupling (Illust. 2).

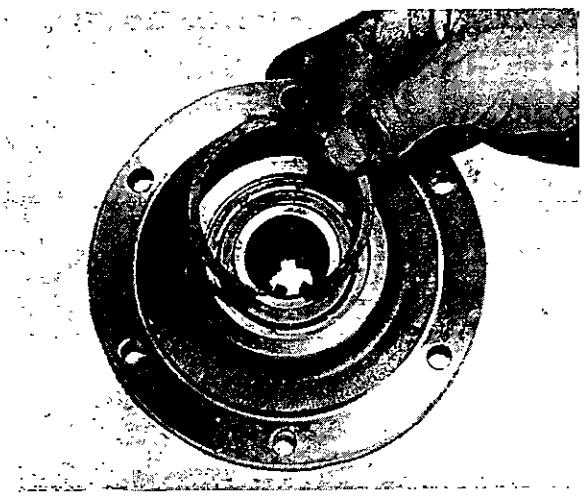
Illust. 2



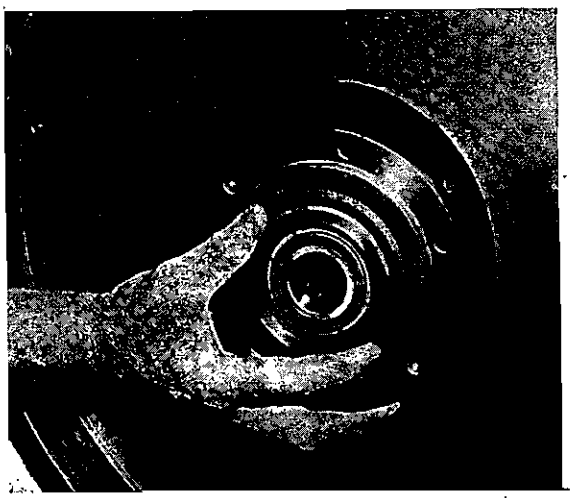
Illust. 3



Illust. 4



Illust. 5



Illust. 6

Apply grease to inside of P.T.O. coupling and insert splined coupling (Illust. 3). Insert long hub of splined coupling into large bore of P.T.O. coupling.

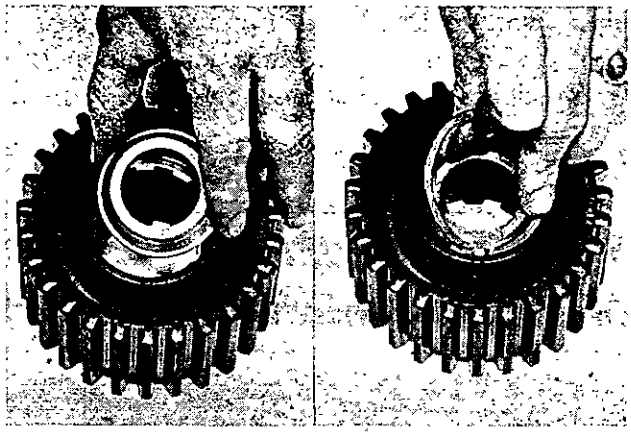
Install felt washer into P.T.O. coupling and onto splined coupling (Illust. 4).

Press or drive bearing into P.T.O. coupling. Next, insert large snap ring into groove of P.T.O. coupling (Illust. 5).

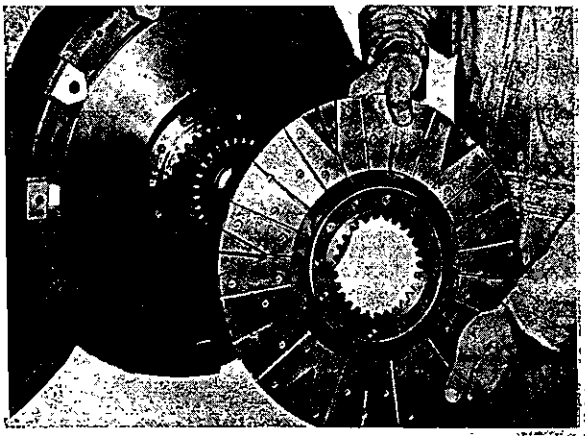
Install P.T.O. coupling assembly onto flywheel (Illust. 6). Long hub of P.T.O. coupling going into flywheel. Install lock washers and coupling bolts and tighten securely.

MODEL 550 MOTOR GRADERS ONLY: The clutch release and brake housing is ready to be assembled to the flywheel housing. For assembly procedure, see Illusts. 9, 10 and 11.

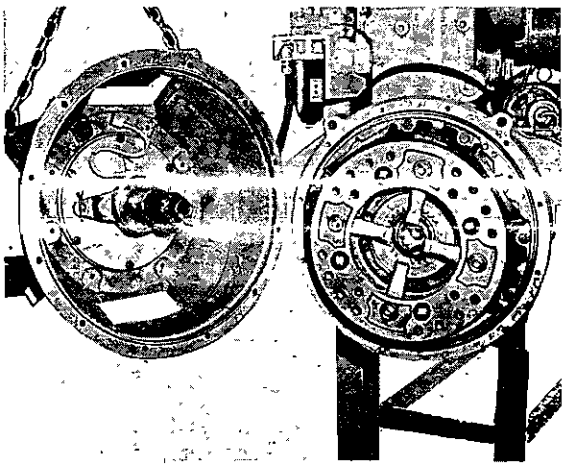
The same clutch gear (Illust. 7) is used in Model 660 Motor Graders with Cummins and



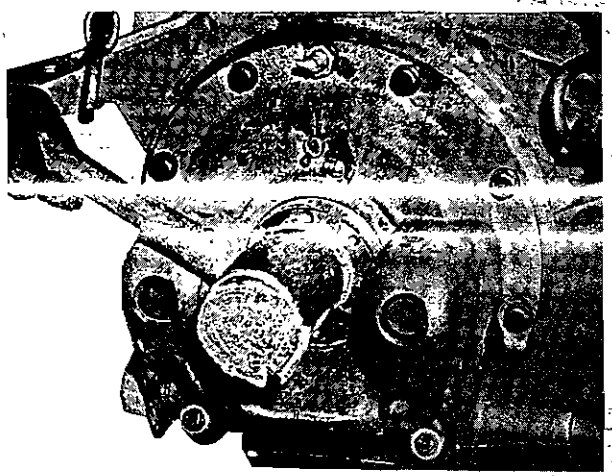
Illust. 7



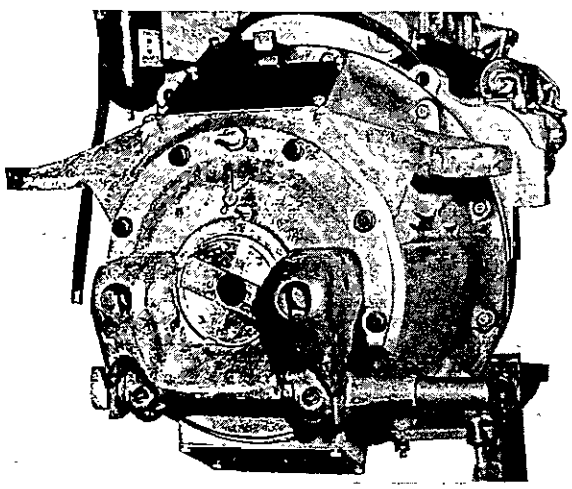
Illust. 8



Illust. 9



Illust. 10



Illust. 11

General Motors engines.

Install spacer into clutch gear (Illust. 7). Tapered end of spacer toward outside of gear. Next, insert snap ring into groove of clutch gear.

Install clutch gear into driven member. Spacer end of clutch gear toward the flywheel. Next, install second disc onto clutch gear. Oil slinger of disc toward flywheel (Illust. 8).

(Illust. 9). Install clutch assembly onto flywheel. Install cap screws with lock washers. Tighten cap screws securely. Tighten four (4) hold down set screws so driven members are free to shift when installing clutch shaft into bearing.

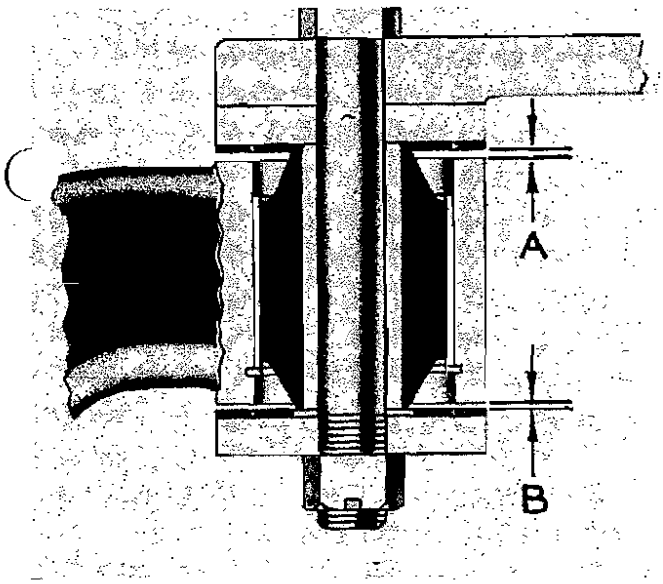
Install clutch release and brake housing assembly. Insert splined end of clutch shaft into clutch gear splines. NOTE: Grease splined end of clutch shaft before inserting into clutch gear. Use a rawhide mallet to tap outside end of clutch shaft to seat shaft into gear (Illust. 10).

Illust. 11 shows the clutch release and brake housing installed to the flywheel housing. Install lock washers and cap screws. Tighten cap screws securely. NOTE: Remove the four (4) clutch hold down set screws. Check to determine if all clutch levers have uniform pressure against release bearing. Install covers with gaskets. Install lock washers and cap screws. Tighten cap screws securely.

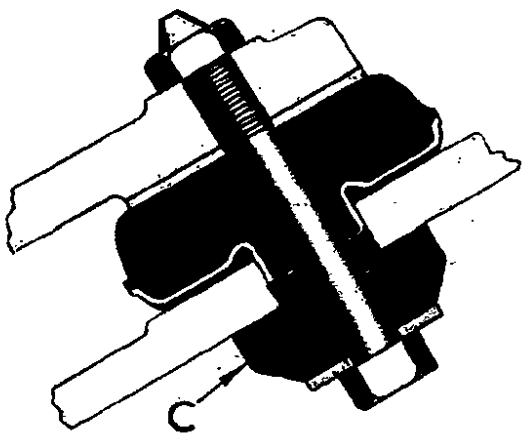
The engine is now ready to be reassembled to the grader.

MOTOR MOUNT GAP
(Models 550 and 660 Motor Graders)

When installing an engine, the rear mounts are to be tightened first.



Illust. 1



Illust. 2

If new mounts are installed, clearance (A) and (B) (Illust. 1) are as follows:

A	B
.120 to .140	.000 to .020

If motor mounts are re-used, clearance (A) and (B) (Illust. 1) are as follows:

A	B
.060 MIN.	.1875 MAX.

Proper gap at (A) and (B) can be maintained by removing shims at gap (B) and reinstalling

shims at gap (A) as the mount settles over a period of time. However, if the proper gap clearance cannot be maintained by the use of shims, install new mounts.

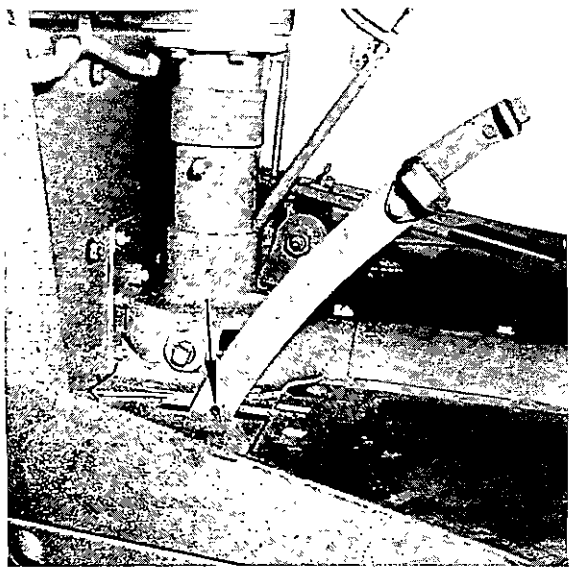
Front engine mounts are adjusted by tightening cap screw until biscuit (C) (Illust. 2) can be turned with effort by hand, then tighten cap screw one (1) more turn.

CLUTCH PEDAL ADJUSTMENT
(Model 550 Motor Grader - Serial No. 9500 and Later)
(Model 660 Motor Grader - Serial No. 4000 and Later)

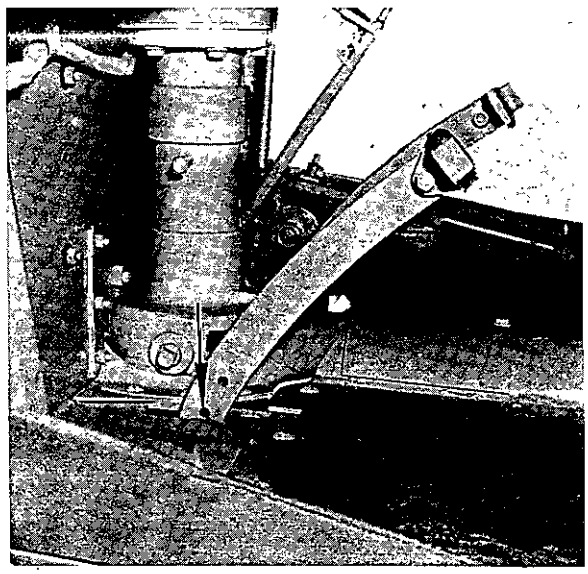
MAXIMUM TRAVEL: Adjust the maximum free pedal movement so upper hole in lever (Illust. 1) is flush with the floor board when the pedal is depressed.

As the clutch discs wear, the free pedal movement decreases and an adjustment is necessary.

MINIMUM TRAVEL: When the lower hole in lever appears flush with floor board (Illust. 2) with the clutch pedal depressed, adjustment should be made before serious damage occurs to the clutch disc.



Illust. 1



Illust. 2

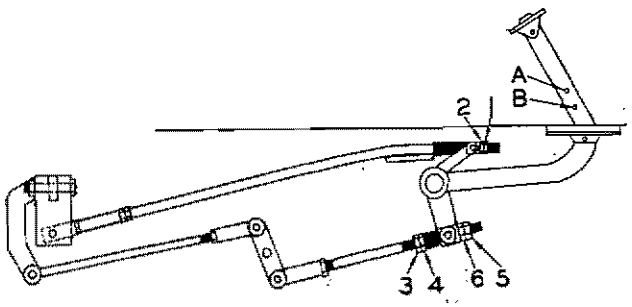
To adjust the free pedal travel, loosen jam nut (1) (Illust. 3). Tighten or loosen nut (2) at swivel block until the upper hole (Illust. 1) in lever is flush with cab floor, when pedal is depressed. After completing this adjustment, tighten jam nut (1) (Illust. 3).

CLUTCH BRAKE ADJUSTMENT

To adjust clutch brake, loosen jam nut (3) (Illust. 3). Tighten or loosen nut (4) until spring can be compressed 1/8" when clutch pedal is depressed all the way to the floor of the cab.

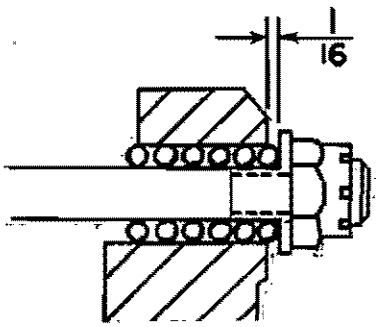
Retighten jam nut (3). Loosen jam nut (5). Tighten front nut (6) against swivel finger to prevent rattle or obvious looseness. Retighten jam nut (5).

With engine running at full throttle, brake should stop clutch in not less than 3 seconds and not more than 4 seconds after pedal is depressed to cab floor.



Illust. 3

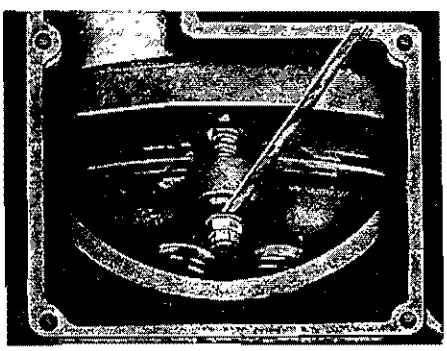
MODEL 660 MOTOR GRADER ONLY: Adjust center plate after every clutch pedal adjustment. The measurement should be 1/16 inch between flange of the return screw bushing and center plate (Illust. 4)



Illust. 4

To adjust the center plate, remove top clutch housing inspection cover. Turn engine over until center plate return screw is centered in opening. Loosen or tighten lock nut until a 1/16 inch gauge fits snug in gap between center plate and flange of return screw bushing (Illust. 5). After the adjustment is made on one (1) return screw, adjust the other three (3) in the same manner. Work through opening in side of fuel tank support.

OPERATION OF THE CLUTCH BRAKE



Illust. 5

This machine is equipped with a clutch brake which will stop the clutch from spinning when the clutch pedal is depressed all the way to the floor. The clutch pedal has approximately 2" of free pedal movement at the beginning of its stroke. From that point on down to a point approximately 2" to 3" from the floor plate, the clutch is released but the clutch brake is not applied. In the last 2" to 3" of clutch pedal travel at the bottom of the stroke, the clutch brake is applied.

It is necessary for the operator to get the "feel" of the brake operation after which shifting of gears under various operating conditions is made easier. Generally speaking, the clutch brake is used (the pedal is depressed all the way to the floor board) only when the machine is standing still and the operator is shifting from neutral into one of the gears. If the gears are being shifted while the machine is rolling, the brake may be used to slow the driving gears down slightly in order to synchronize the speed of the gears for shifting. However, under some operating conditions, it may be necessary to "double" clutch the grader, in order to increase the speed of the driving gears to match the speed of the driven gears. A

brief period of practice will provide the average operator with sufficient skill to handle the clutch brake quite adequately.

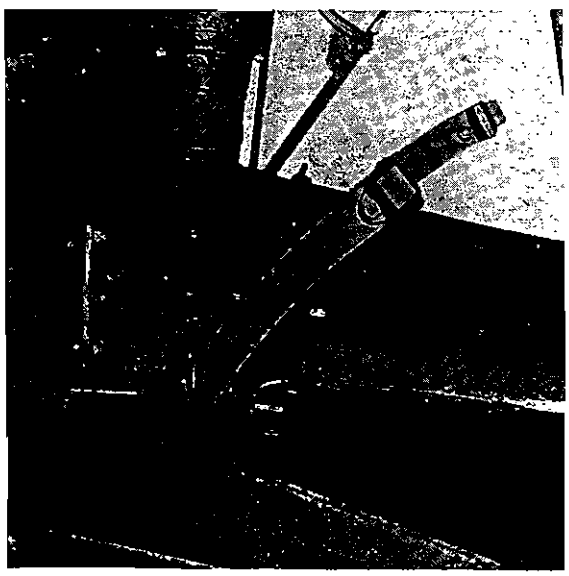
CLUTCH PEDAL ADJUSTMENT
(Model 550 Motor Grader - Serial No. 3000 thru 9499)
(Model 660 Motor Grader - Serial No. 1700 thru 3999)

MAXIMUM TRAVEL: Adjust the maximum free pedal movement so upper hole in lever (Illust. 1) is flush with the floor board when the pedal is depressed.

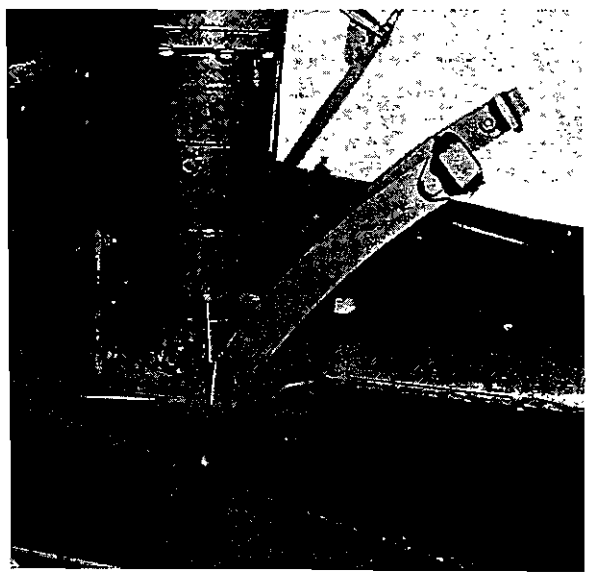
As the clutch disc wears, the free pedal movement decreases and an adjustment is necessary.

MINIMUM TRAVEL: When the lower hole in lever appears flush with floor board (Illust. 2) with the clutch pedal depressed, adjustment should be made before serious damage occurs to the clutch disc.

When adjustment is necessary, it can be accomplished by loosening the lock nuts (1) and (2) (Illust. 3). Turn coupling (3) to lengthen pull rod to obtain the free pedal travel. After adjustment has been made, tighten lock nuts (1) and (2) securely. There is no other adjustment to compensate for wear in the clutch.



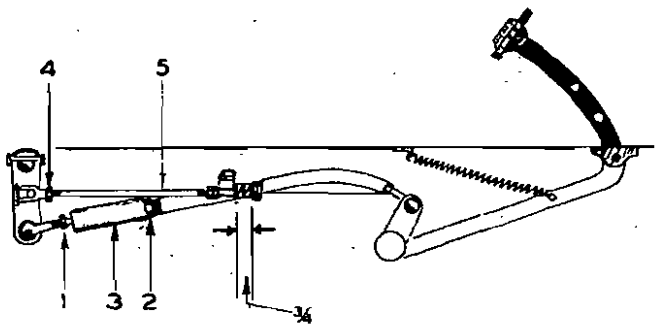
Illust. 1



Illust. 2

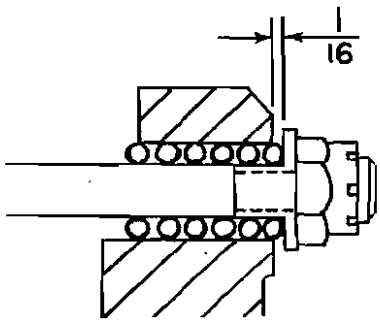
The spring on the front end of the clutch brake pull rod should be adjusted with the hex nut to a length of 3/4", as shown in the illustration. To adjust the clutch brake, loosen the lock nut (4) and turn the pull rod (5) to shorten the pull rod until, with the clutch pedal held against the floor plate of the cab, the pull rod spring will be compressed 1/8" (i.e., the spring will be compressed to 5/8" length instead of the normal 3/4" length). After completing the adjustment, tighten the lock nut (4) securely.

MODEL 660 MOTOR GRADER ONLY: Adjust center plate after every clutch pedal adjustment. The measurement should be 1/16 inch between flange of the return scre bushing and center plate (Illust. 4).



Illust. 3

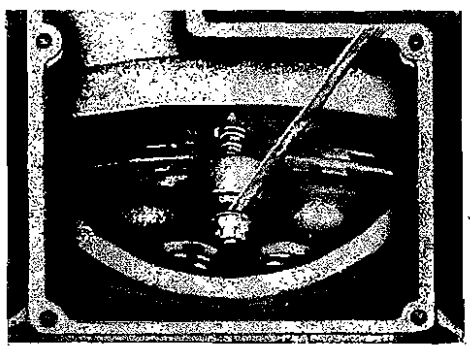
To adjust the center plate, remove top clutch housing inspection cover. Turn engine over until center plate return screw is centered in opening. Loosen or tighten loc nut until a 1/16 inch gauge fits snug in gap between center plate and flange of return screw bushing (Illust. 5). After the adjustment is made on one (1) return screw, adjust the other three (3) in the same manner. Work through opening in side of fuel tank support.



Illust. 4

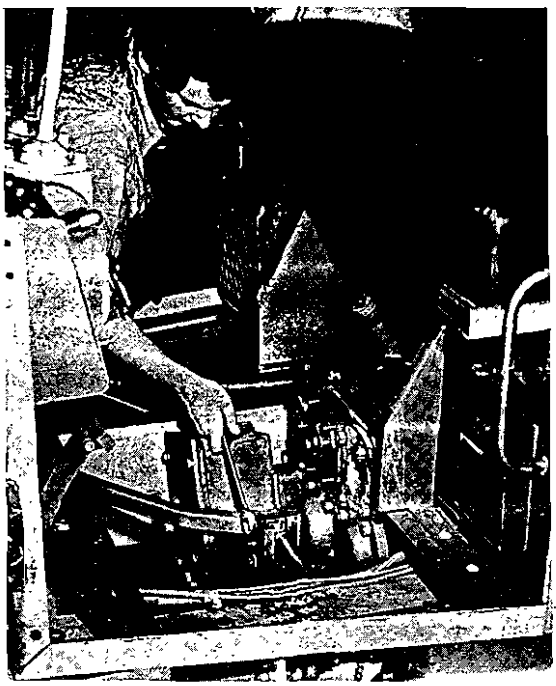
OPERATION OF THE CLUTCH BRAKE

This machine is equipped with a clutch brake which will stop the clutch from spinning when the clutch pedal is depressed all the way to the floor. The clutch pedal has approximately 2" of free pedal movement at the beginning of its stroke. From that point on down to a point approximately 2" to 3" from the floor plate, the clutch is released but the clutch brake is not applied. In the last 2" to 3" of clutch pedal travel at the bottom of the stroke, the clutch brake is applied.



Illust. 5

It is necessary for the operator to get the "feel" of the brake operation after which shifting of gears under various operating conditions is made easier. Generally speaking, the clutch brake is used (the pedal is depressed all the way to the floor board) only when the machine is standing still and the operator is shifting from neutral into one of the gears. If the gears are being shifted while the machine is rolling, the brake may be used to slow the driving gears down slightly in order to synchronize the speed of the gears for shifting. However, under some operating conditions it may be necessary to "double" clutch the grader, in order to increase the speed of the driving gear to match the speed of the driven gears. A brief period of practice will provide the average operator with sufficient skill to handle the clutch brake quite adequately.



Illust. 1

TRANSMISSION

The upper transmission can be serviced in the machine. (Illust. 1).

The creeper gears can also be installed with the transmission under the machine.

The balance of this section is written on a basis that the transmission is removed from the grader.

As you will note throughout this section, certain parts must be heated sufficiently in oil before assembling. The oil should be heated to a temperature of approximately 350° F.

FINAL DRIVE

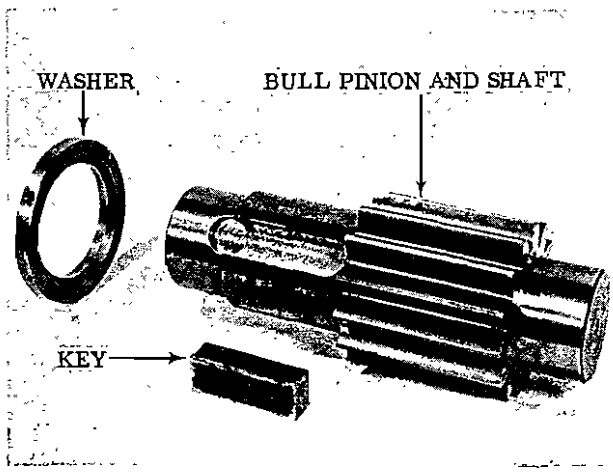
Illust. 2 is an exploded view of the bull pinion and shaft.

(Illust. 3). Heat washer in oil and press onto bull pinion shaft, inside chamfered edge of washer against pinion. Next, insert key in keyway.

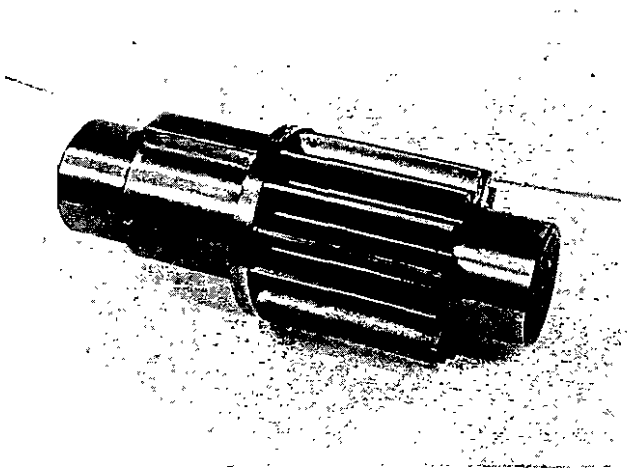
Heat spiral bevel gear in oil. Press bull pinion shaft through spiral bevel gear (Illust. 4). Hold in press until gear is set. NOTE: Be sure the gear is tight against the washer.

To remove spiral bevel gear from bull pinion and shaft, use a 100 ton press.

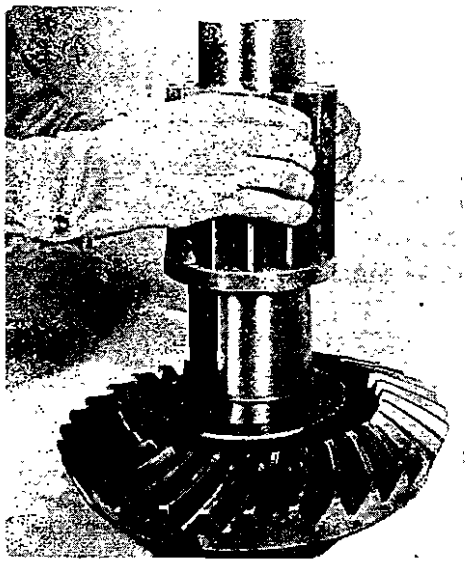
(Illust. 5). Heat bearings in oil and press onto bull pinion and shaft. Hold bearings until set.



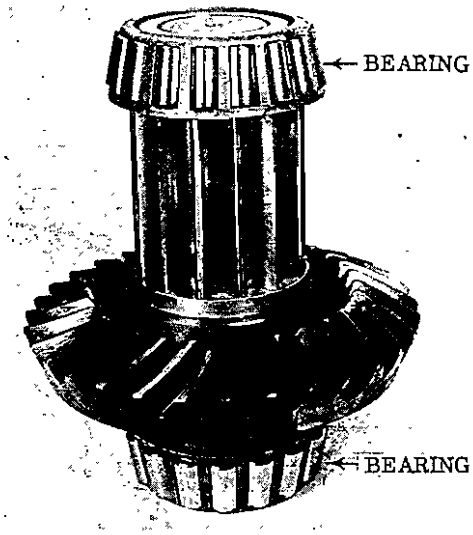
Illust. 2



Illust. 3



Illust. 4

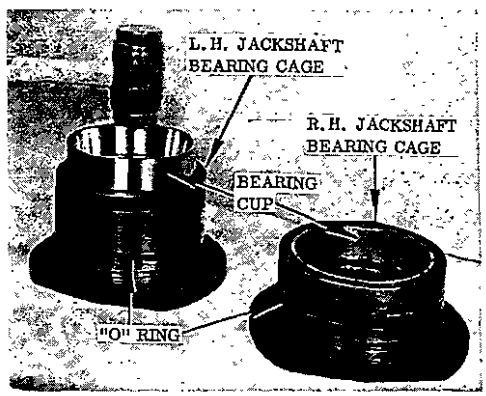


Illust. 5

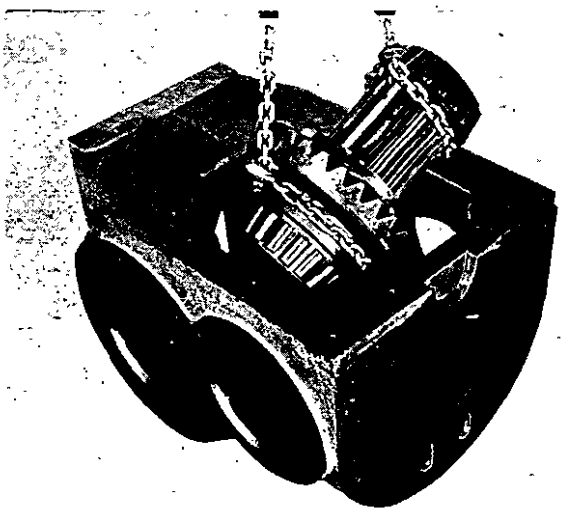
Drive bearing cups into L.H. and R.H. jackshaft bearing cages (Illust. 6). Next, install "O" rings in grooves of jackshaft bearing cages.

Install bull pinion and shaft assembly into the final drive housing (Illust. 7).

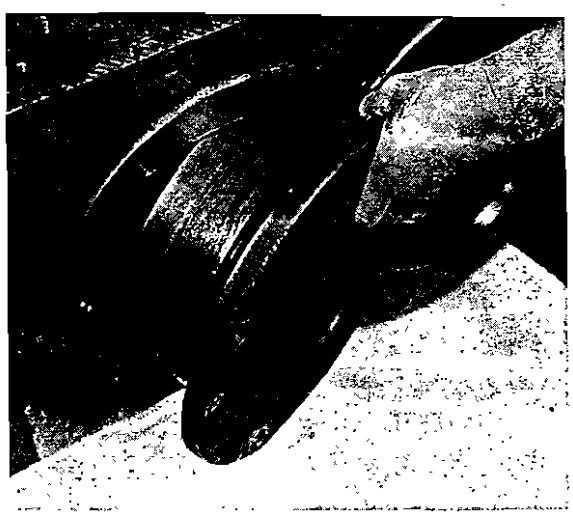
Insert left hand jackshaft bearing cage, less shims, (bearing cage with long hub) onto left side of final drive and over bearing of bull pinion and shaft (Illust. 8). To determine the left and right side of the final drive, stand in rear of machine and look toward the front of the



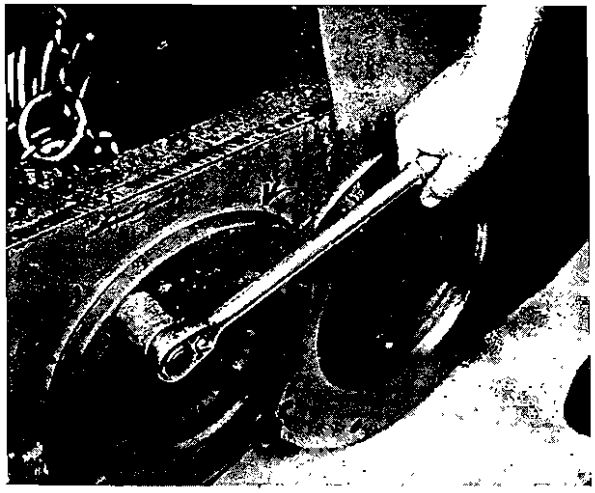
Illust. 6



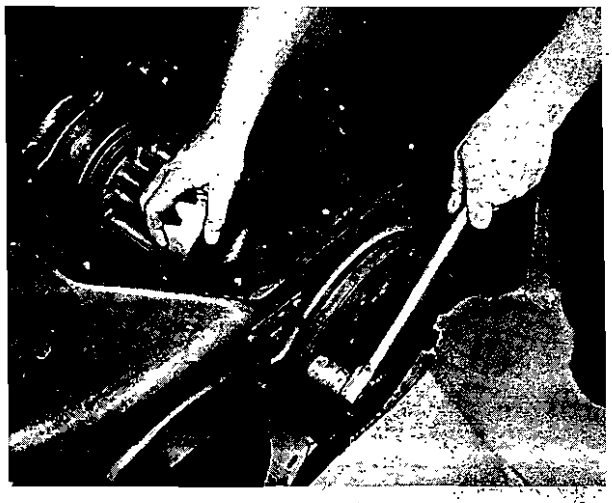
Illust. 7



Illust. 8



Illust. 9

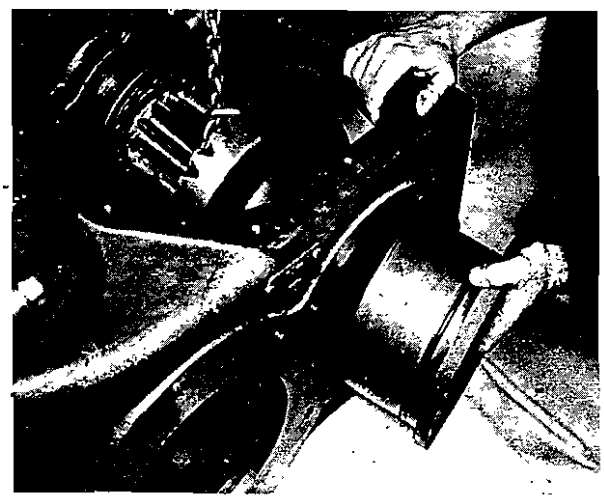


Illust. 10

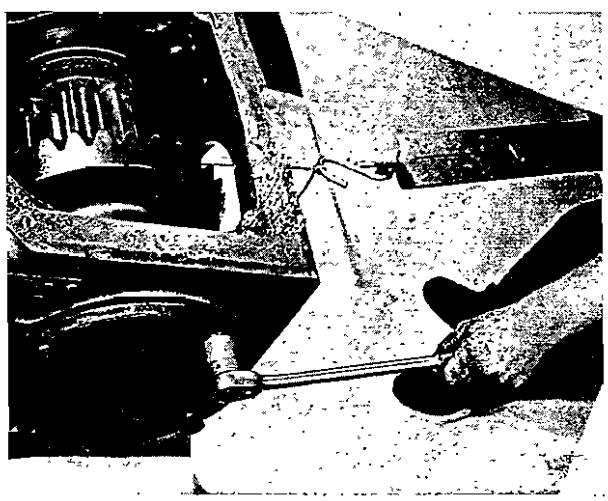
machine. Next, install the cap screws and lock washers. Tighten cap screws (Illust. 9).

Insert right hand jackshaft bearing cage, less shims (bearing cage with short hub) onto right side of final drive and over bearing of bull pinion and shaft (Illust. 10). Install cap screws and lock washers. While tightening cap screws, rotate bevel gear (Illust. 11). This will seat the bearings in the bearing cups. Continue tightening the cap screws until a slight drag is noted on the pinion and shaft assembly.

To pre-load the bearings, use a piece of rope and a fish scale. Wrap one end of the rope around the pinion teeth. Attach a fish scale to the other end of the rope. Pull on the fish scale (Illust. 12) and at the same time, tighten jackshaft bearing cage cap screws until a reading of 14-1/2 to 18 pull pounds is obtained. After this reading is obtained, use a feeler gauge (Illust. 13) to determine the amount of shims needed between the jackshaft bearing cage and the final drive housing.

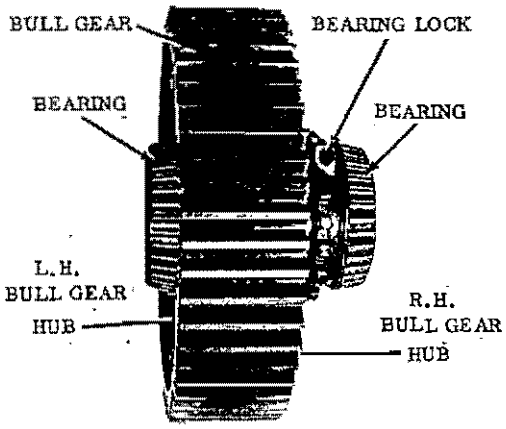


Illust. 11



Illust. 12

Illust. 13



Illust. 14

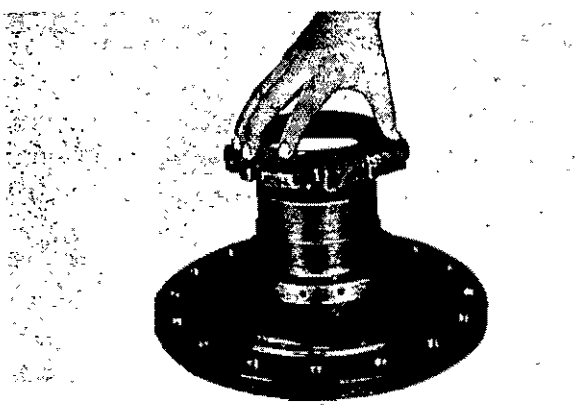
Next, install the correct amount of shims needed. Retighten the cap screws, then recheck the pull poundage. NOTE: Loosen jackshaft bearing cage to check pre-load of bull gear.

Illust. 14 is an assembly view of the bull gear.

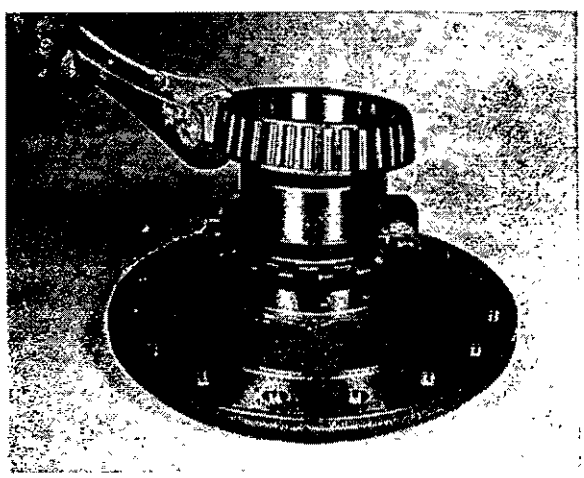
(Illust. 15). Install the bearing lock to the right hand bull gear hub. Screw the bearing lock on hub until the lock has passed the bearing seat. Heat bearing in oil and press onto bull gear hub (Illust. 16). Hold bearing until set.

Heat bearing in oil and press onto left hand bull gear hub (Illust. 17).

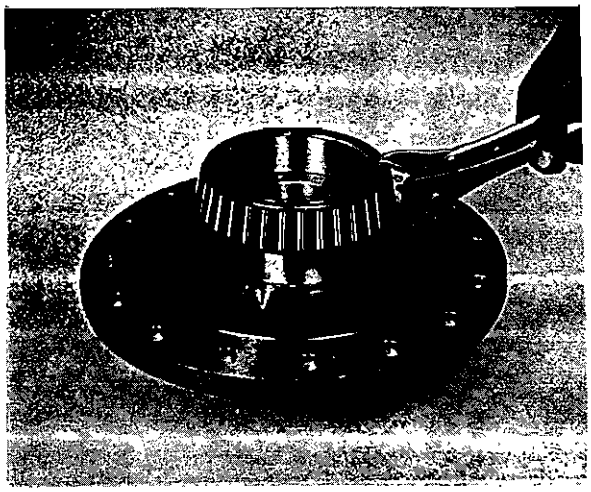
Install left and right hand hub assemblies to bull gear. Insert heat treated cap screws through right hand hub, bull gear and through left hand hub. Coat threads of cap screws with white lead or a sulfur based oil to prevent galling of the locking nuts. Install self-lock-



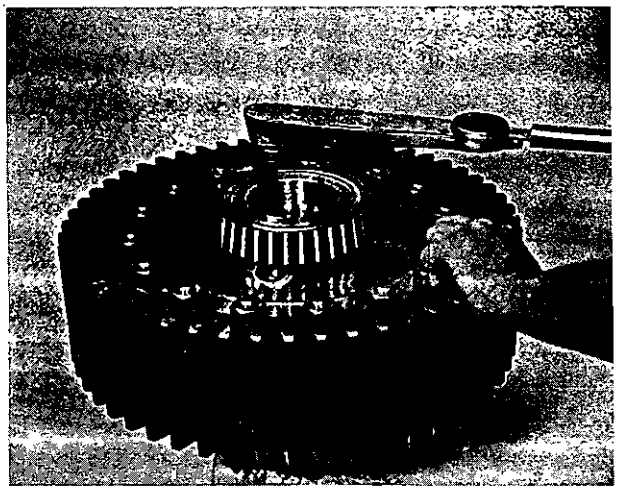
Illust. 15



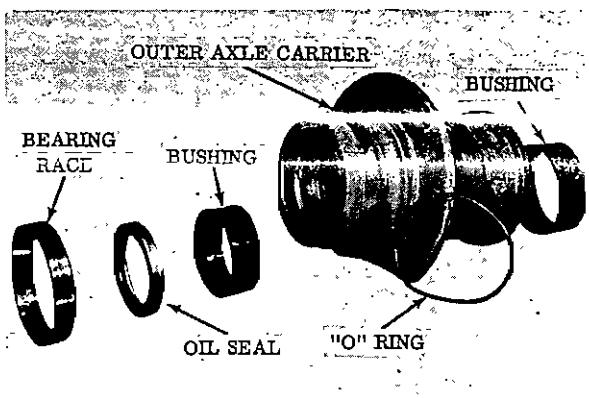
Illust. 16



Illust. 17



Illust. 18

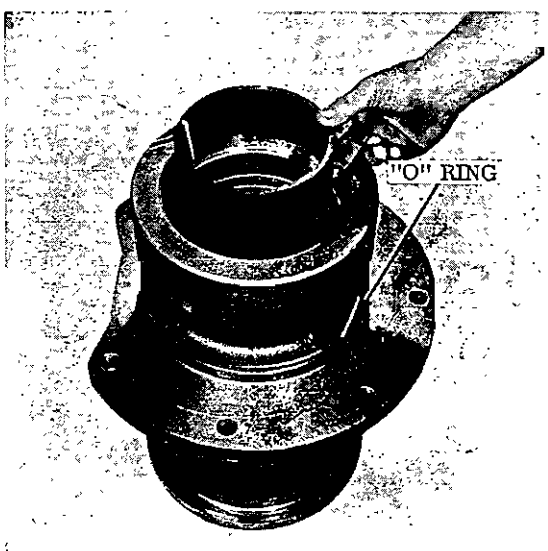


Illust. 19

ing nuts and tighten nuts to a torque reading of 265 foot pounds (Illust. 18).

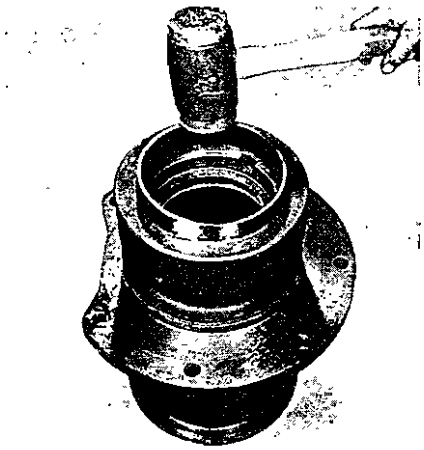
Illust. 19 is an exploded view of the outer axle carrier.

Press or drive large bushings into left and right hand outer axle carriers. Groove in I.D. of bushing to align with groove in axle carriers (Illust. 20). Lubricate bushings before pressing or driving into axle carriers. Next, install "O" rings in groove of outer axle carriers. Using a soft drift pin and hammer (Illust. 21), drive

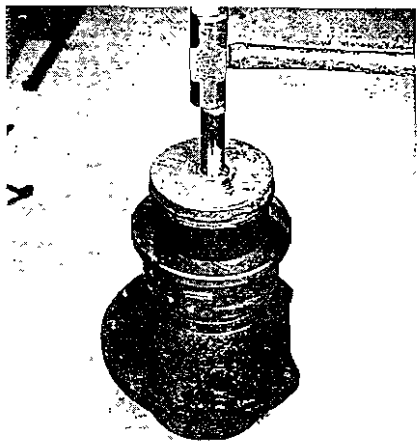


Illust. 20

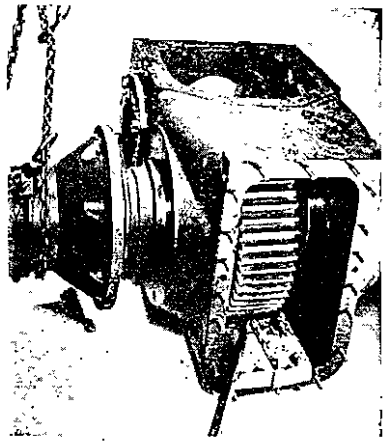
Illust. 21



Illust. 22



Illust. 23



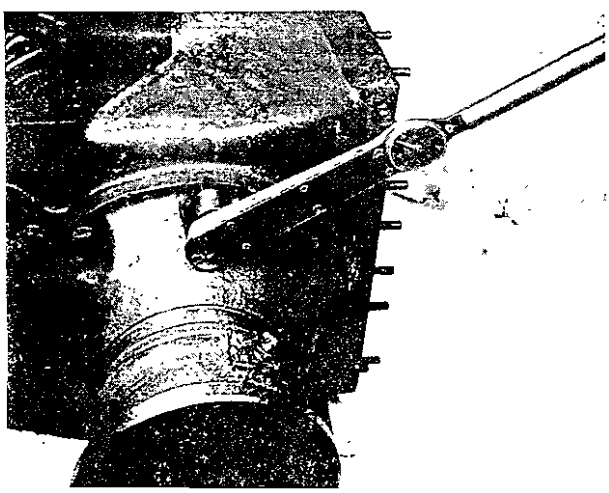
Illust. 24

grease seal into outer axle carrier, lip of grease seal away from bushing. NOTE: Be careful not to damage seal while driving into position.

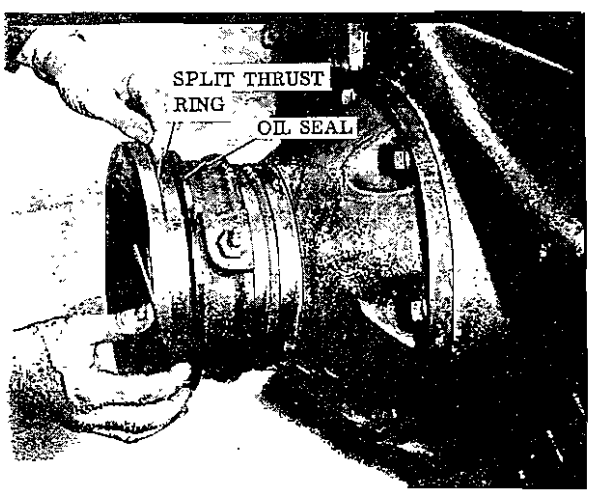
Press or drive bearing cups into left and right hand outer axle carriers. Use a mallet to drive cups (Illust. 22).

Turn the axle carriers over and press or drive small diameter bushings into left and right hand outer axle carriers flush with inside shoulder of carrier (Illust. 23). Lubricate bushings before driving or pressing bushings into outer axle carriers.

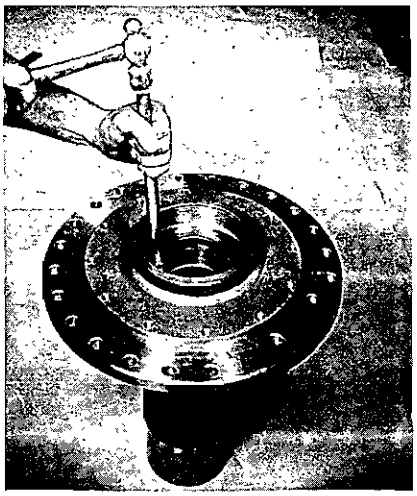
Roll bull gear assembly into position in the final drive housing with the bearing lock to the right. Use blocks to align bull gear assembly with axle carriers. Install the left hand outer axle carrier to the final drive housing (Illust. 24). Install lock washers and cap screws and tighten cap screws to a torque reading of 275 foot pounds (Illust. 25). Install right hand outer



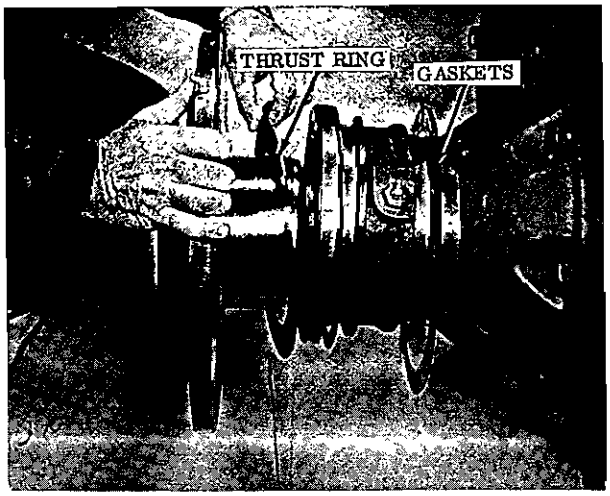
Illust. 25



Illust. 26



Illust. 27



Illust. 28

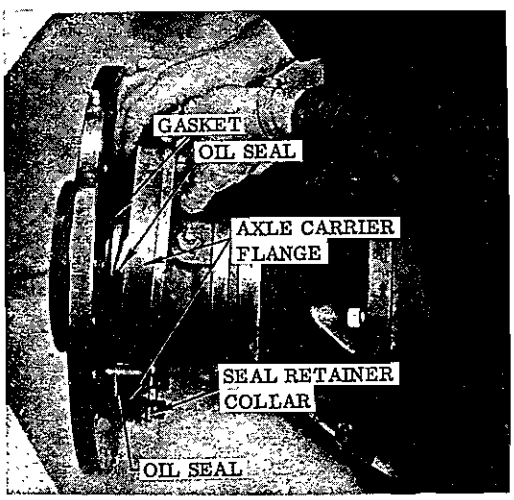
axle carrier in the same manner.

Install oil seal and split thrust ring on outer axle carriers (Illust. 26).

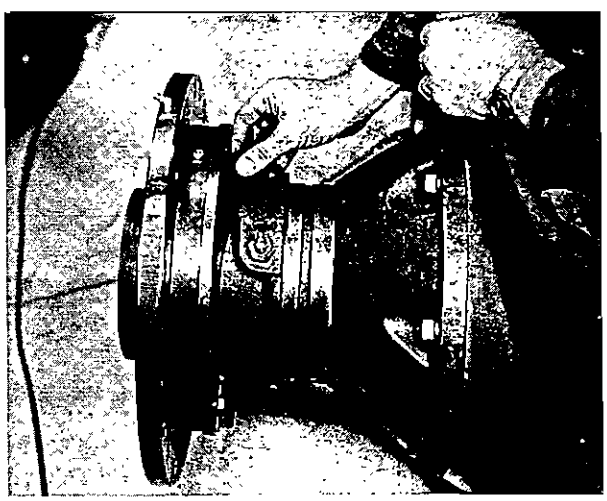
Press or drive oil seal into left and right hand inner axle carriers (Illust. 27), lip of seals toward long hub of carrier. To insert the seal by driving, use a soft drift pin and hammer. Tap seal into place, using care not to damage seal.

Install gaskets on left and right outer axle carriers. Next, install thrust ring on inner axle carriers (Illust. 28). Insert inner axle carriers in outer axle carriers.

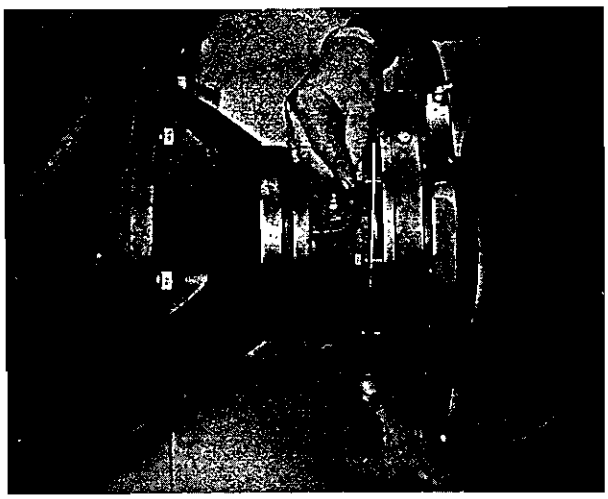
Install lower half of axle carrier flange and one section of seal retainer collar on axle carriers and over oil seals (Illust. 29), oil seal to fit in groove of lower flange. Install cap screws with lock washers through retainer collar, through ends of flange and into inner axle



Illust. 29

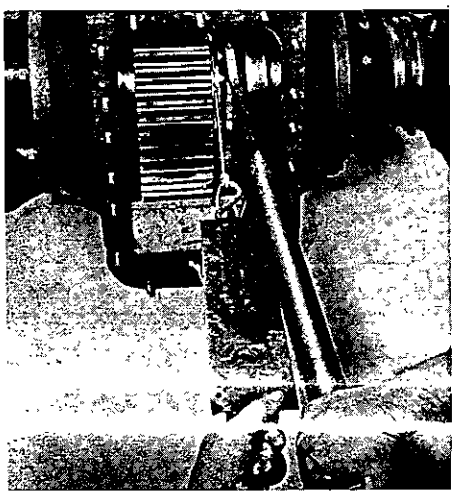


Illust. 30

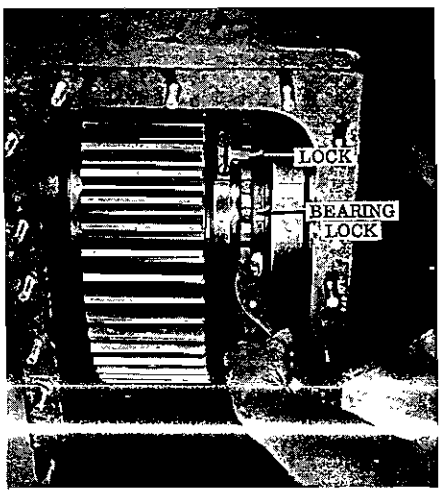


Illust. 31

Illust. 32



Illust. 33



Illust. 34

carrier. This will hold lower flange and seal retainer collar in place. Install the two small oil seals, one on each end of lower flange.

(Illust. 30). Install the upper flange to outer axle carrier and over oil seals, oil seals to fit in groove of upper flange. Next, install the other two oil seal retainers. Insert cap screws with lock washers through retainers, flange and into inner axle carriers (Illust. 31). Tighten all cap screws securely.

Rotate inner axle carrier and check for drag and end play in carrier. If inner axle carrier is not free to rotate, add sufficient amount of shims between the upper and lower flange and inner axle carrier. If inner axle carrier has end play, replace the thrust ring.

(Illust. 32). Tighten bearing lock cap screw. After the cap screw is tightened, loosen cap screw 1-1/2 rounds. Next, pre-load the bull gear by first wrapping one end of a piece of rope around bull gear hub (Illust. 33). Attach the other end of rope to a fish scale. Now, by

use of a spanner wrench, tighten the bearing lock until a rolling torque reading of 19-1/2 to 25 pounds is obtained. After the pull poundage is obtained, install lock and lock cap screws. Tighten cap screws securely (Illust. 34). Lock cap screws with wire. Next, tighten bearing lock cap screw securely. Insert a piece of wire through head of bearing lock cap screw and bearing lock. Lock wire securely, as illustrated.

LOWER TRANSMISSION

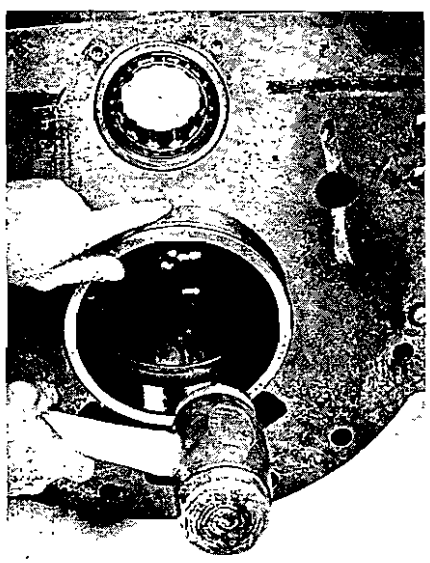
Illust. 1

Install snap rings into the two bored holes in the back of lower transmission housing (Illust. 1). Press or drive the bearing into the small bore (Illust. 2). NOTE: This bearing may extend slightly over the face of the housing. Press or drive bearing race into large bore, as shown in the illustration. NOTE: This race must be flush or under flush with face of housing.

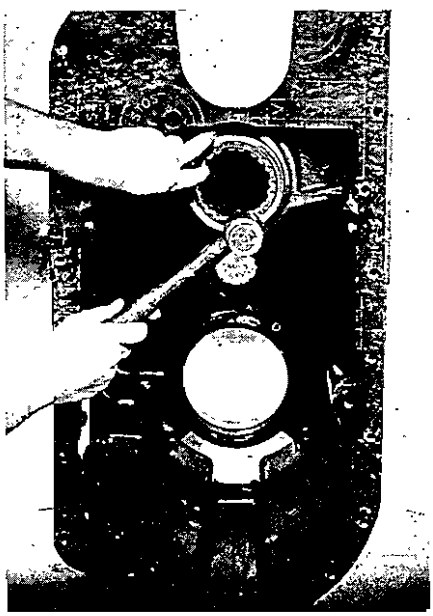
NOTE: Illusts. 3, 4 and 5 are used only in 660 Motor Grader transmissions.

Press or drive upper shaft bearing into lower transmission housing (Illust. 3). Next, install one or more gaskets and washer (Illust. 4). Install snap ring (Illust. 5).

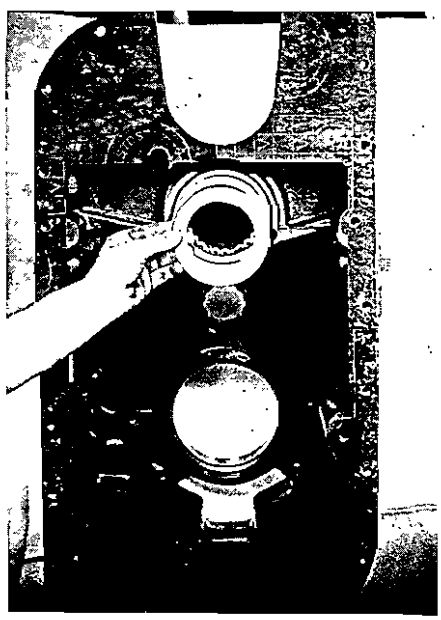
Insert dowel pin in lower transmission housing (Illust. 6).



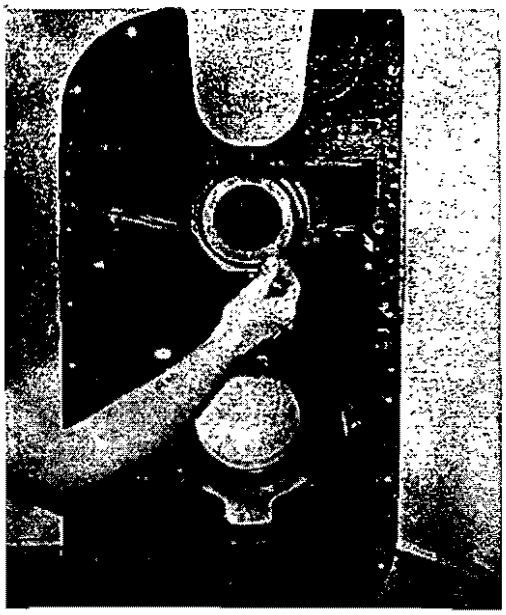
Illust. 2



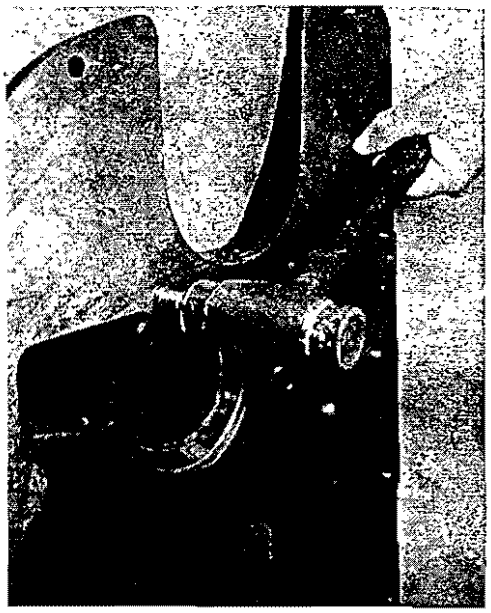
Illust. 3



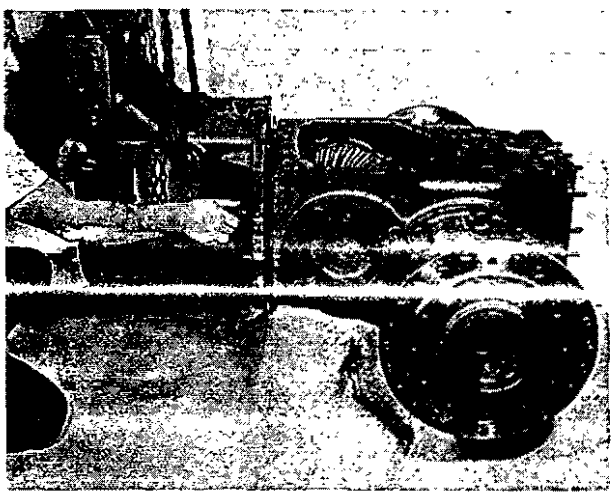
Illust. 4



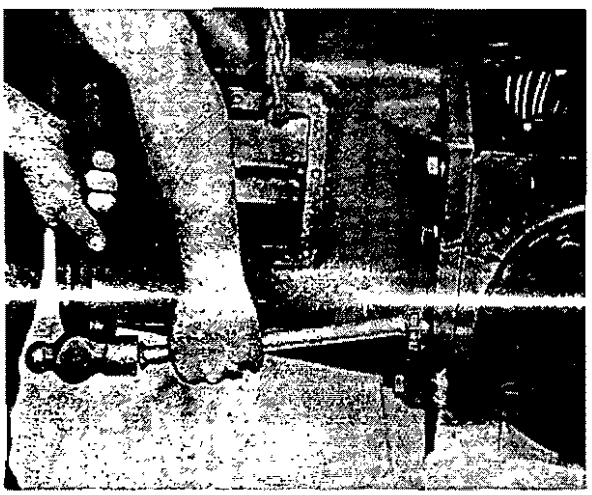
Illust. 5



Illust. 6



Illust. 7



Illust. 8

Shellac the gasket surface of the final drive housing and install the gasket.

Insert dowel pins into lower transmission housing. Do not drive dowel pins through housing. Install lower transmission housing to final drive housing. Insert cap screws with lock washers (Illust. 7). Snug cap screws.

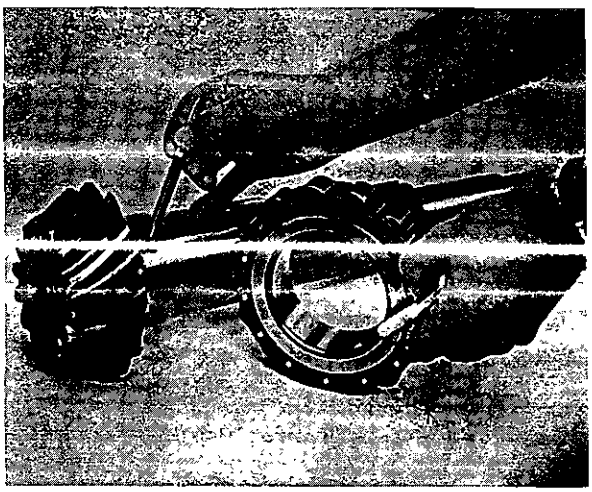
To prevent damage to dowel pin threads, install nut on threaded end of dowel pins. Drive dowel pins through lower transmission housing and into final drive housing (Illust. 8). Use a soft drift pin and hammer or mallet to drive dowel pins. After dowel pins have been driven into final drive housing, remove nut from dowel pins. Tighten cap screws to a torque reading of 190 foot pounds.

SPIRAL PINION SHAFT (Lower Transmission)

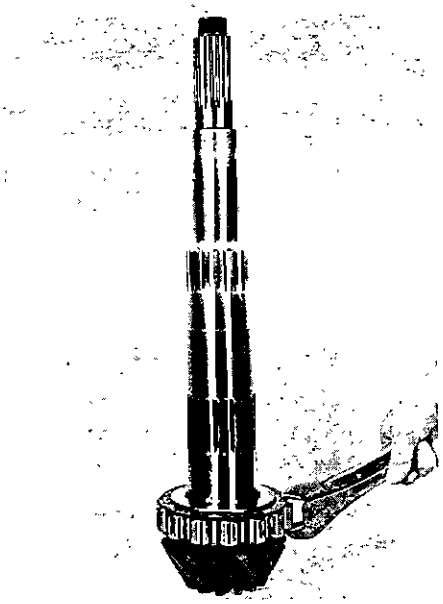
Heat spiral pinion shaft bearing in oil. Press bearing onto shaft with the radius of bearing against spiral pinion (Illust. 1). Hold bearing against pinion until set (Illust. 2).

Insert pin, as illustrated with finger in Illust. 3, into spiral pinion shaft. Next, install spacer. Slot in spacer, as illustrated by pencil, over head of pin and against bearing.

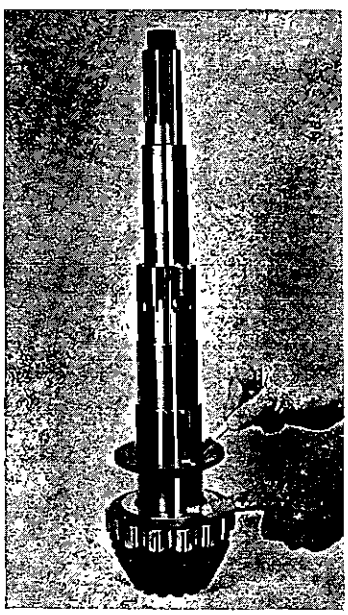
Heat inner race in oil and install onto spiral pinion shaft (Illust. 4). Hold inner race until set.



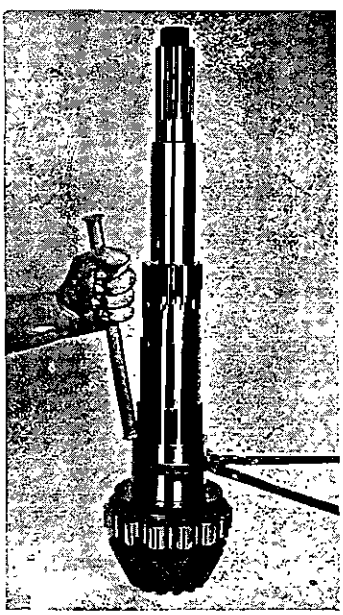
Illust. 1



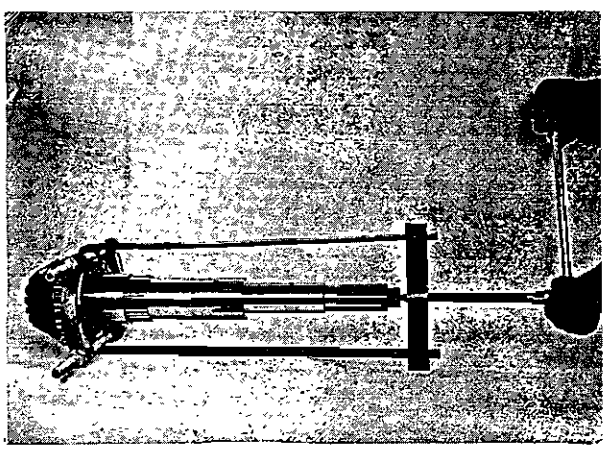
Illust. 2



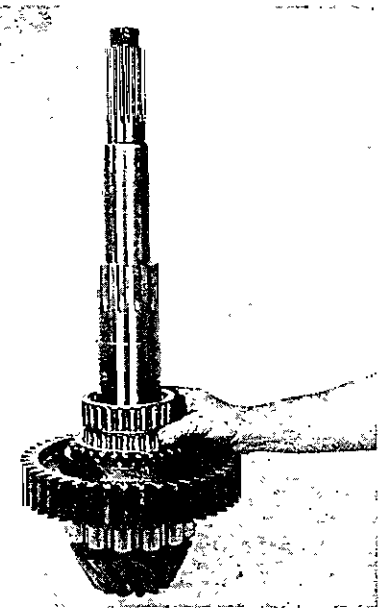
Illust. 3



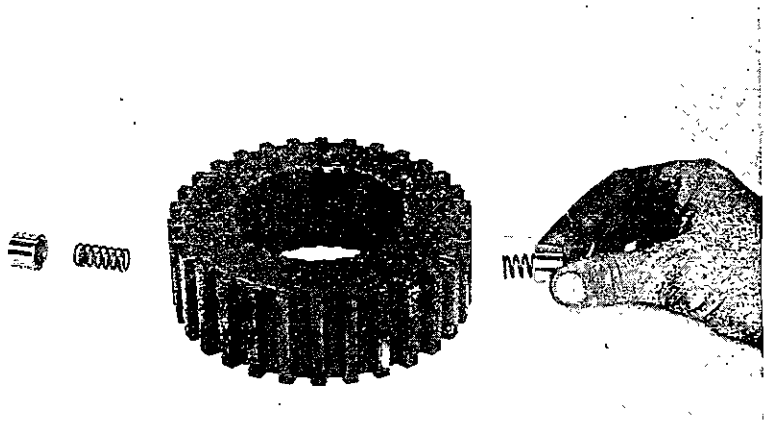
Illust. 4



Illust. 5



Illust. 6



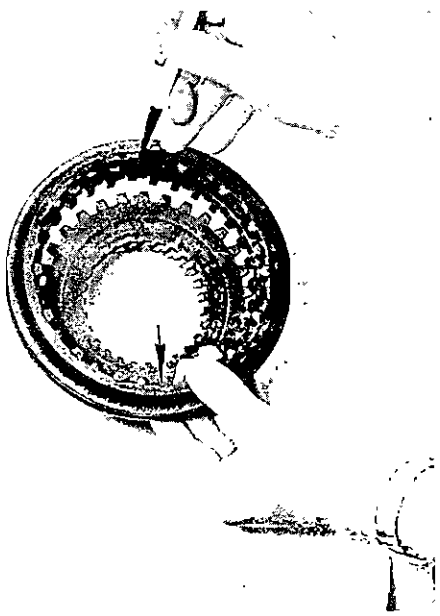
Illust. 7

To prevent breakage of pin, use a gear puller to remove spacer and bearings (Illust. 5).

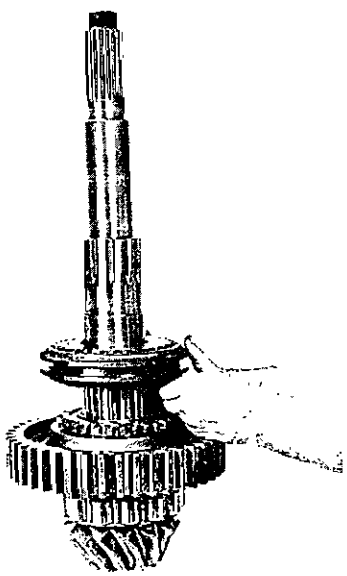
Install the 44 tooth gear (1st gear) onto spiral pinion shaft with the chamfered end of gear hub against spacer (Illust. 6). Next, insert the two roller bearings into the gear as illustrated.

(Illust. 7). Insert poppet springs and poppets into shifter gear.

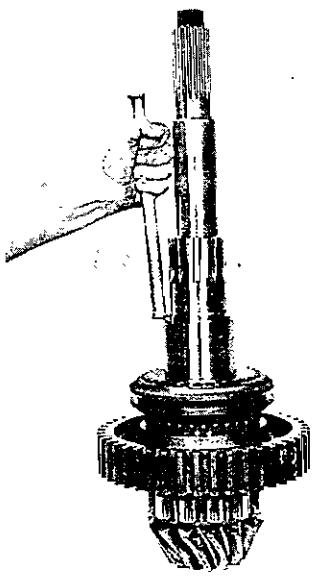
Install shifter collar over poppets and onto shifter gear. As you will note, the shifter collar (Illust. 8) has four tapered teeth; two teeth on each side of collar. Install collar so two tapered teeth slide over poppets and poppets fall in the groove of collar.



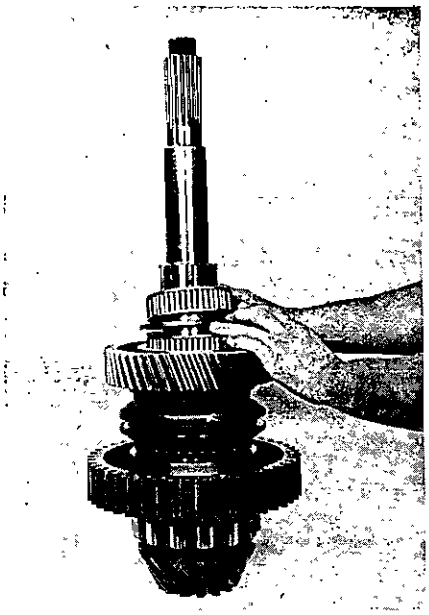
Illust. 8



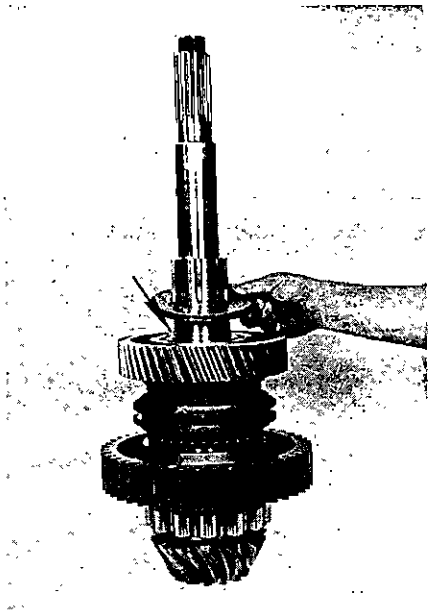
Illust. 9



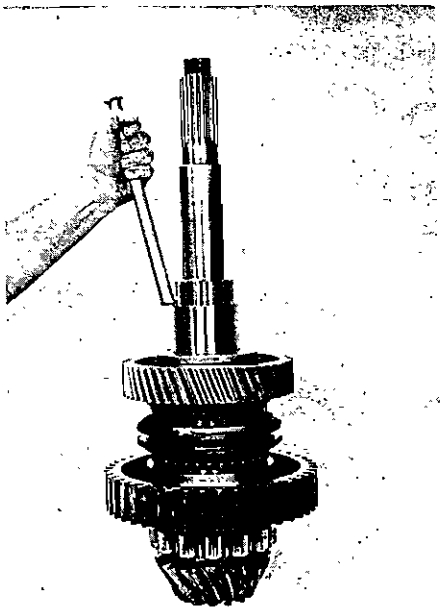
Illust. 10



Illust. 11



Illust. 12



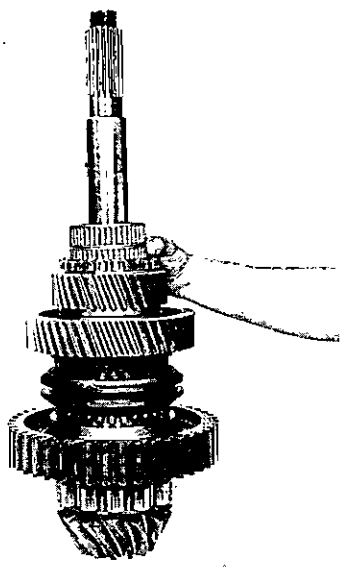
Illust. 13

Install shifter gear with collar onto spiral pinion shaft (Illust. 9).

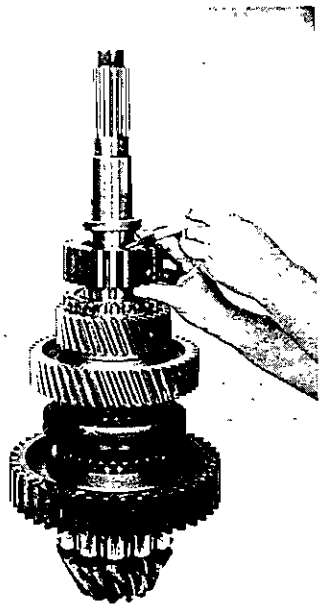
Heat inner race in oil and install on spiral pinion shaft. Hold race until set (Illust. 10).

Install 49 tooth gear (2nd gear) onto spiral pinion shaft. Insert roller bearing, spacer and second roller bearing into gear (Illust. 11).

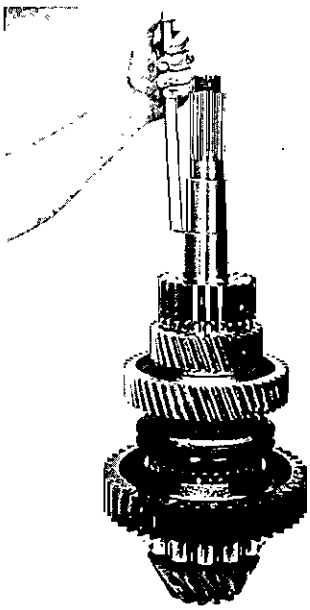
Insert pin in spiral pinion shaft. Next, install spacer. Slot in spacer over head of pin (Illust. 12).



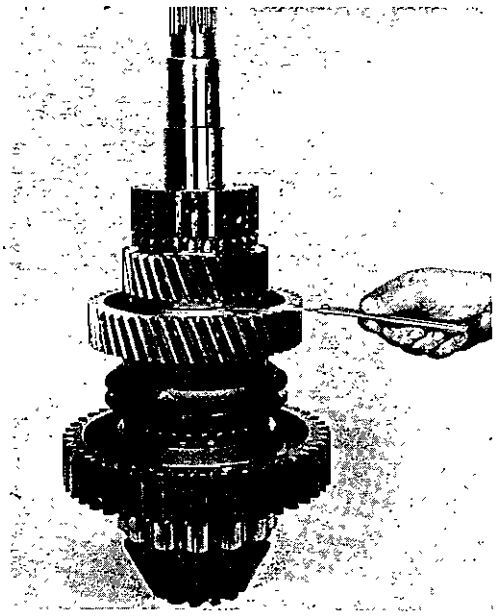
Illust. 14



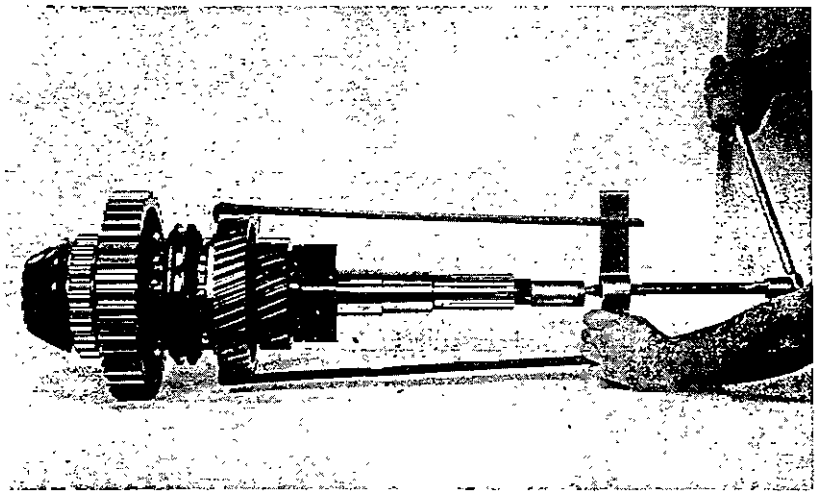
Illust. 15



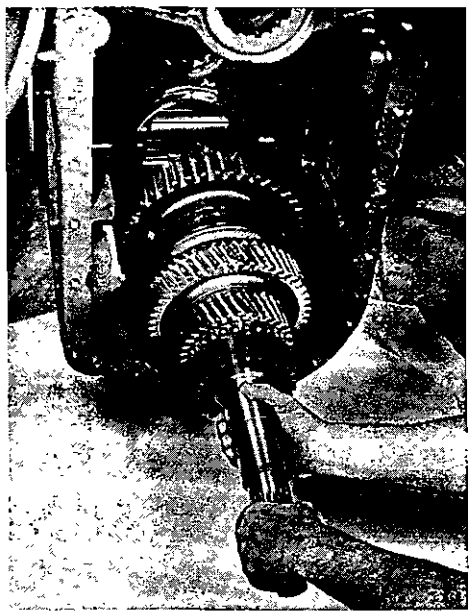
Illust. 16



Illust. 17



Illust. 18



Illust. 19

Heat bearing race in oil and install race on spiral pinion shaft. Hold race until set (Illust. 13).

Install the 33 tooth gear (3rd gear) onto spiral pinion shaft. Insert two roller bearings into gear (Illust. 14).

Install the 26 tooth shifter gear onto spiral pinion shaft. Counter bore in gear, as illustrated by pencil in Illust. 15, away from 33 tooth gear. Next, insert the spacer into the sliding gear, chamfered edge of spacer next to counter bore of gear. NOTE: This gear does not have poppets.

(Illust. 16). Heat inner race in oil and install race onto spiral pinion shaft. Hold race until set.

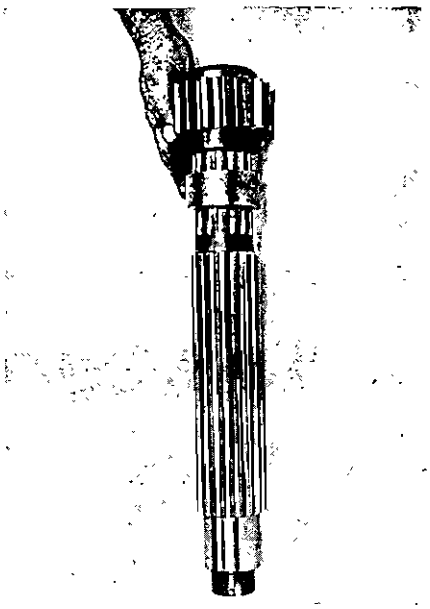
Check the clearance between the gears with a feeler gauge (Illust. 17). The clearance should read between .005 and .025.

To prevent breakage of pin, use a gear puller to remove gears and races (Illust. 18).

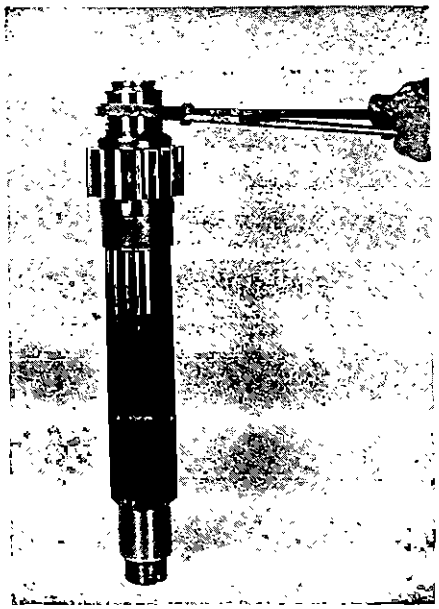
Insert spiral pinion shaft assembly into lower bore of transmission housing (Illust. 19). NOTE: The pinion is to be matched with the spiral bevel gear by number.

UPPER SHAFT (Lower Transmission)

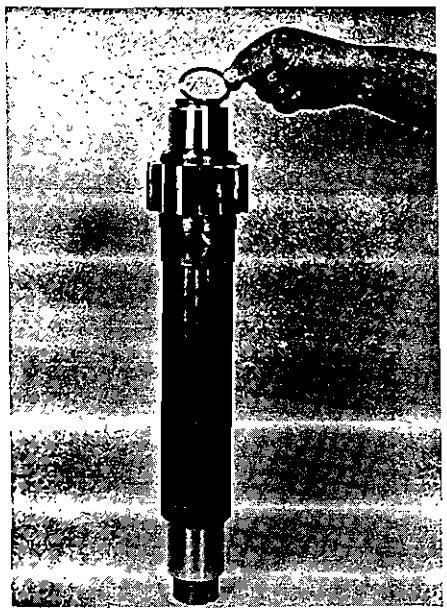
Insert spacer and 15 tooth gear (1st gear) onto upper shaft of lower transmission (Illust. 1).



Illust. 1



Illust. 2



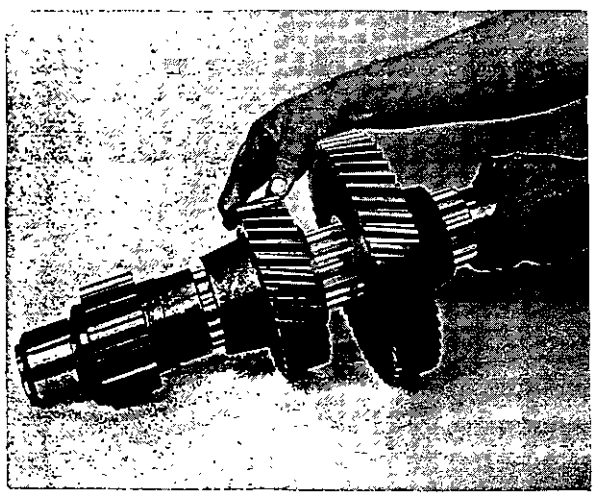
Illust. 3

Chamfered end of gear away from threaded end of shaft.

Heat inner bearing race in oil and install race onto shaft. Inside chamfer of race toward gear. Hold race until set (Illust. 2). Next, install snap ring in groove in shaft (Illust. 3).

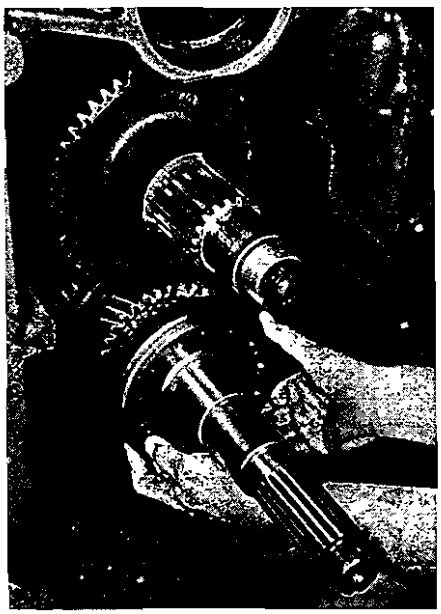
Install 34 tooth gear (2nd gear) onto shaft, long end of hub toward spacer. Next, install 50 tooth gear (3rd gear) onto shaft, long end of hub toward threaded end of shaft (Illust. 4).

Insert upper shaft assembly into lower transmission (Illust. 5).

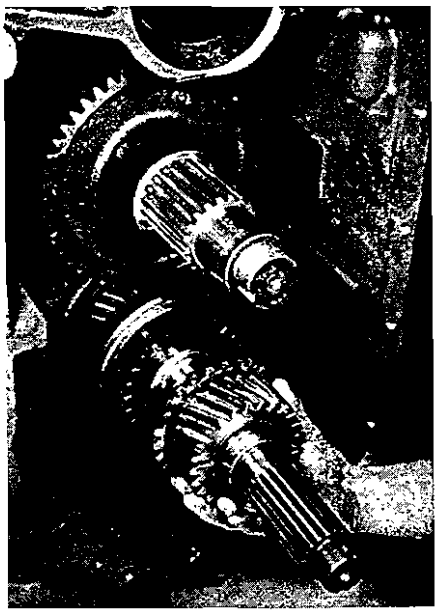


Illust. 4

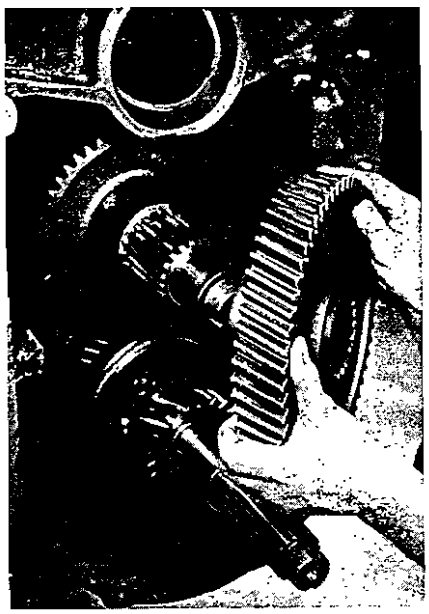
Illust. 5



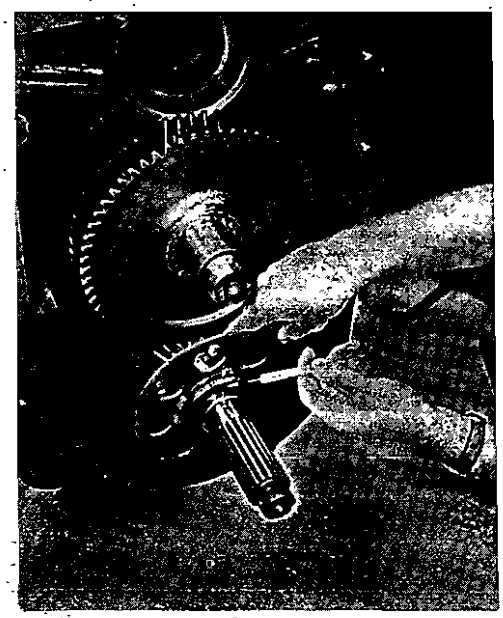
Illust. 6



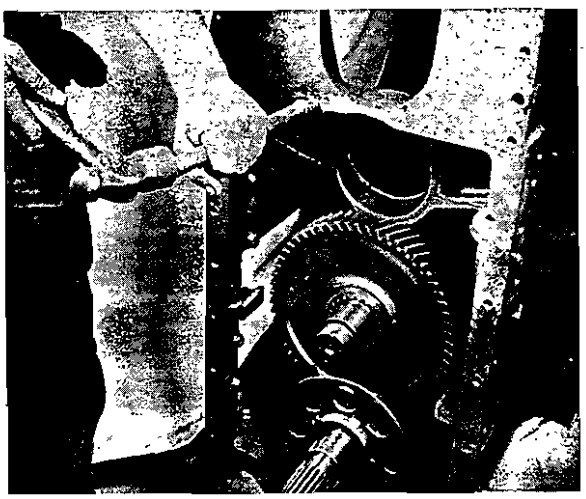
Illust. 7



Illust. 8



Illust. 9



Illust. 10

Install shifter collar over 26 tooth sliding gear on spiral pinion shaft (Illust. 6). Next, install 24 tooth (4th gear) onto spiral pinion shaft (Illust. 7).

Install 59 tooth all speed gear onto upper shaft of lower transmission (Illust. 8). Long hub of gear away from threaded end of shaft.

Insert pin into lower shaft (Illust. 9). Next, install slinger. Square notch in slinger over head of pin.

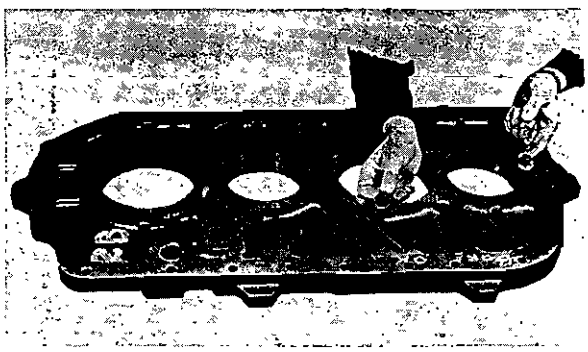
Install the shouldered dowel pin into the lower transmission housing (Illust. 10). Long end

of dowel pin going into lower transmission. Use a soft drift pin and hammer or mallet to drive dowel pin.

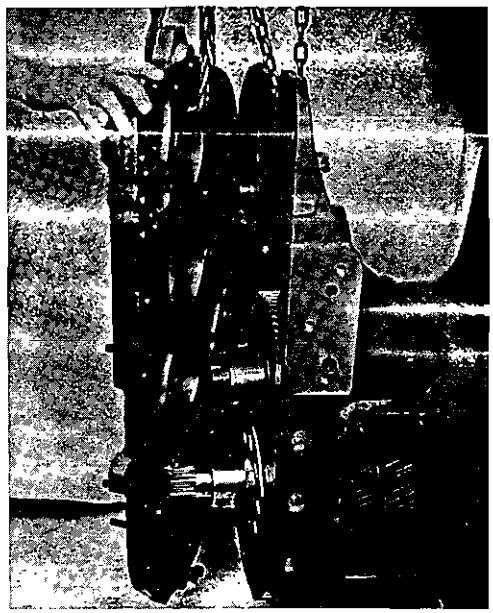
INTERMEDIATE PLATE

Install the two bearing locks on both the upper shaft bores of intermediate plate (Illust. 1). Drive dowel pin into lower dowel pin hole of intermediate plate. NOTE: Do not drive dowel pin through intermediate plate.

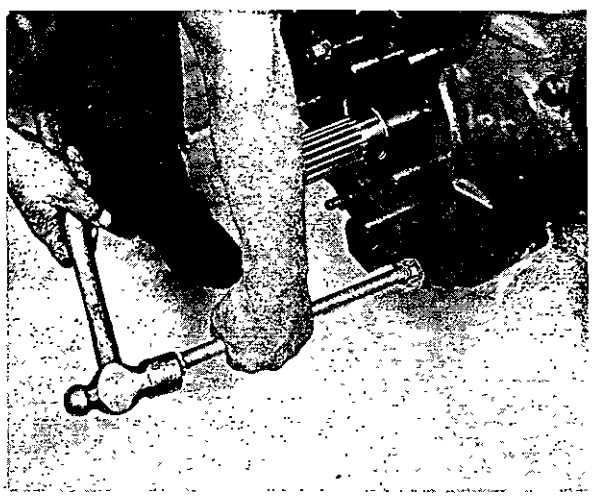
Shellac gasket onto front of lower transmission housing. Align dowel pin hole in intermediate plate with dowel pin in lower transmission housing. Install intermediate plate (Illust. 2). Install cap screws with lock washers. Do not tighten cap screws. Next, install nut on lower intermediate plate dowel pin to prevent damage to threads. Drive dowel pin through intermediate plate and into lower transmission (Illust. 3). Use a soft drift pin and hammer or mallet to drive dowel pin.



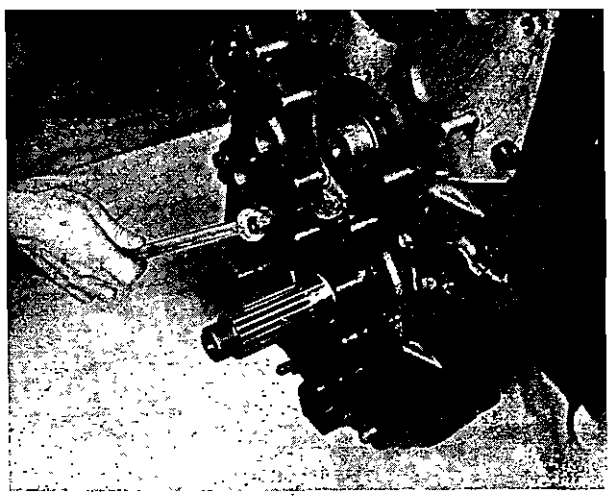
Illust. 1



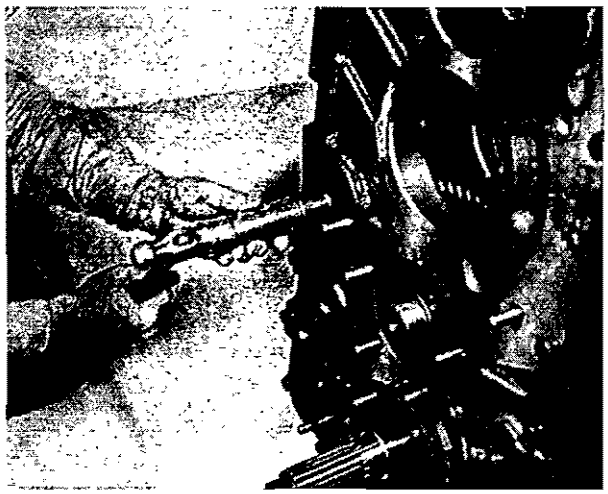
Illust. 2



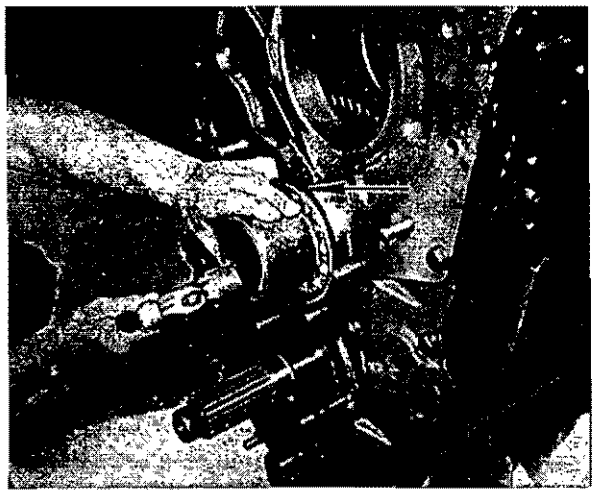
Illust. 3



Illust. 4



Illust. 5



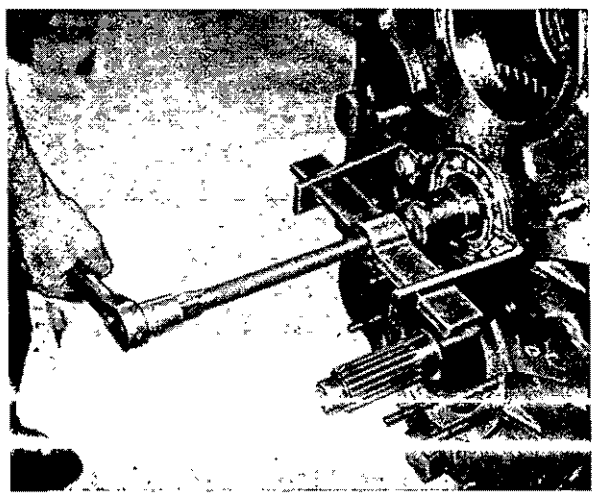
Illust. 6

When dowel pin is seated, remove nut from dowel pin. Tighten cap screws to a torque reading of 190 foot pounds.

Install studs into intermediate plate (Illust. 4). Tighten studs into intermediate plate, using two nuts locked together on studs.

Drive bushing, using a hammer and a piece of pipe or similar tool, into rocker shaft bore of intermediate plate (Illust. 5).

Drive bearing over upper shaft of lower transmission and into intermediate plate (Illust. 6). NOTE: Open ends of snap ring to be in line with oil hole in intermediate plate, as illustrated by arrows in the illustration.

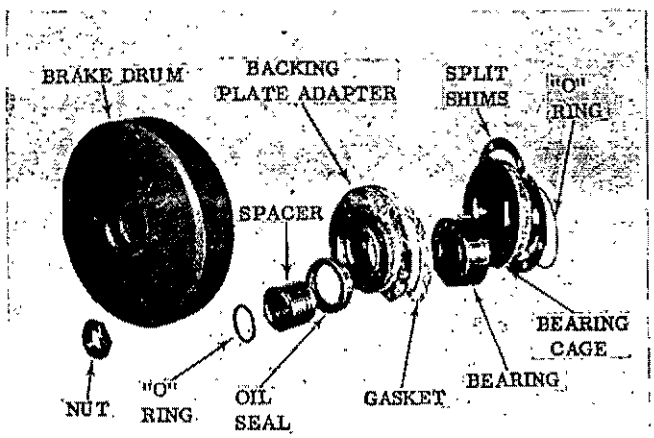


Illust. 7

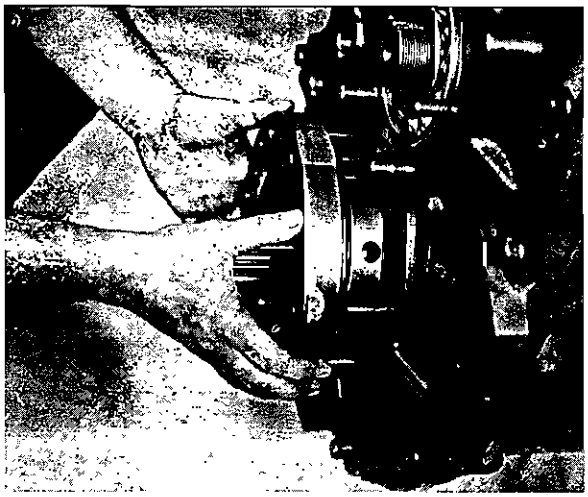
To remove intermediate plate from lower transmission, remove cap screws. Next, install two stud nuts on studs; one nut on each side of bearing. Then, by use of a puller (Illust. 7), pull intermediate plate with bearing from lower transmission.

BEARING CAGE AND ADAPTER ASSEMBLY

Illust. 1 is an exploded view of the bearing cage and adapter assembly.



Illust. 1

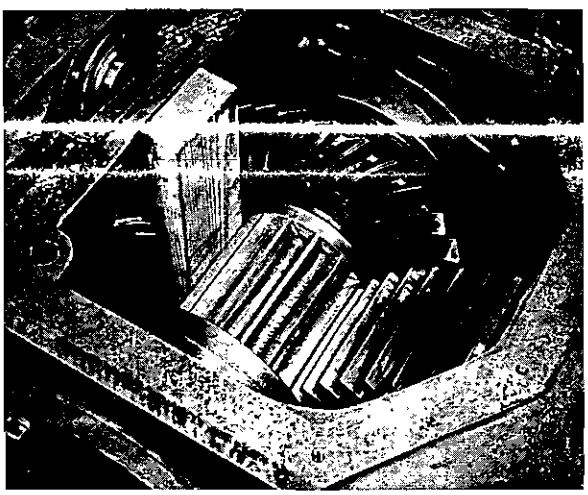


Illust. 2

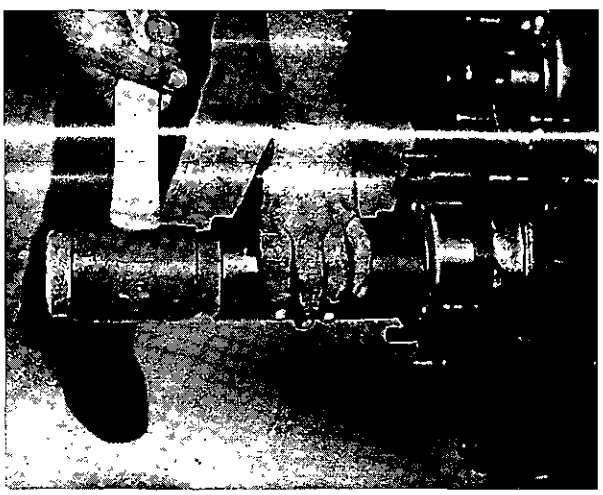
Install "O" ring on bearing cage and insert bearing cage into intermediate plate (Illust. 2). Apply white lead to "O" ring to prevent damage before inserting bearing cage into intermediate plate.

(Illust. 3). Place a block of wood between spiral pinion and spiral bevel gear in final drive housing. Block of wood will prevent lower shaft assembly from being driven back into the spiral bevel gear when bearing is driven into bearing cage (Illust. 4).

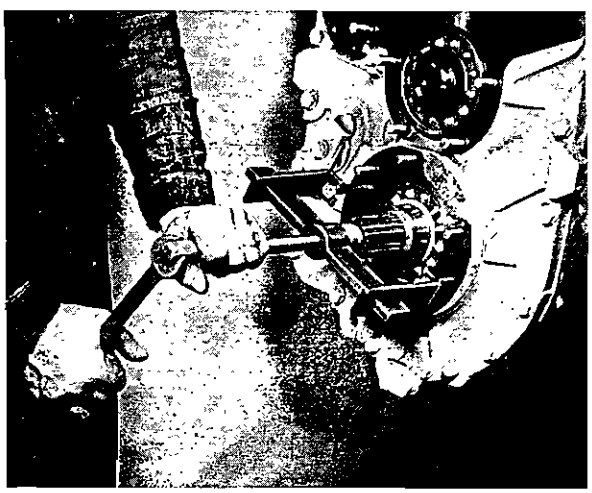
To remove bearing cage, install two cap screws in pull holes in bearing cage. Use a puller (Illust. 5) to remove bearing cage.



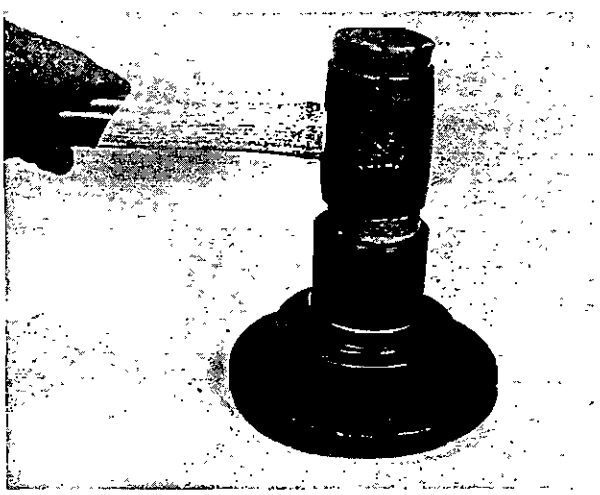
Illust. 3



Illust. 4



Illust. 5

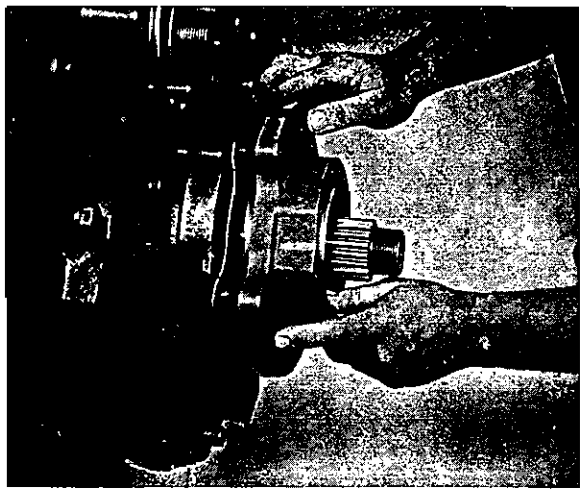


Illust. 6

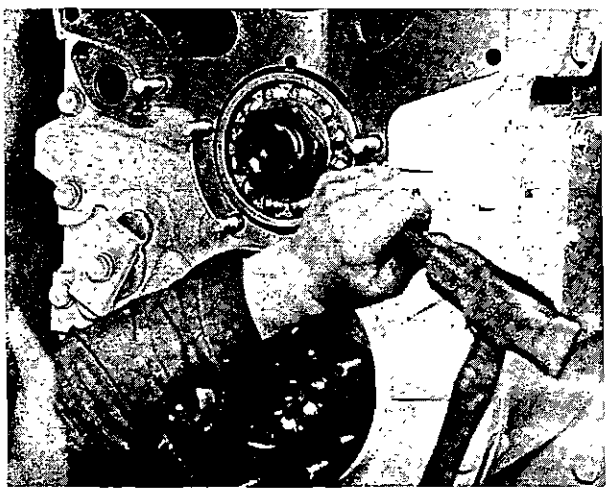
Press or drive oil seal into backing plate adapter (Illust. 6). Lip of seal away from hub of adapter.

Install backing plate adapter gasket and backing plate adapter (Illust. 7) over studs and against bearing cage. Install stud nuts with lock washers. Tighten stud nuts securely.

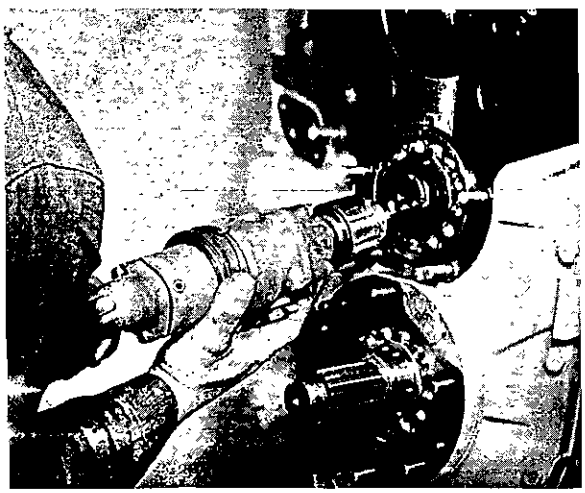
Install nut to upper shaft of lower transmission. Shift transmission into two (2) gears and tighten nut to a torque reading of 600 foot pounds. After nut has been tightened, stake nut (Illust. 8) using a drift pin and hammer.



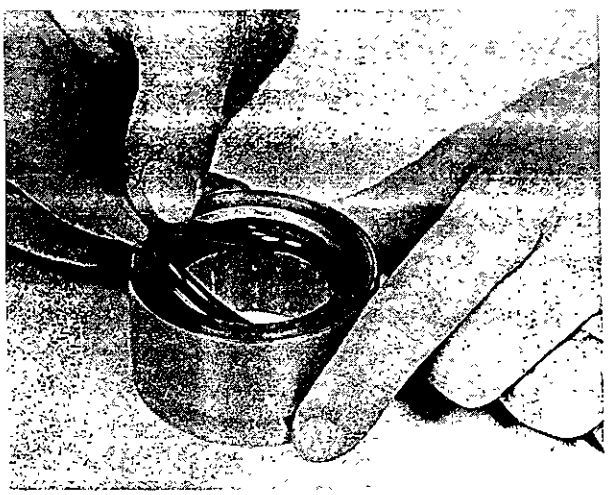
Illust. 7



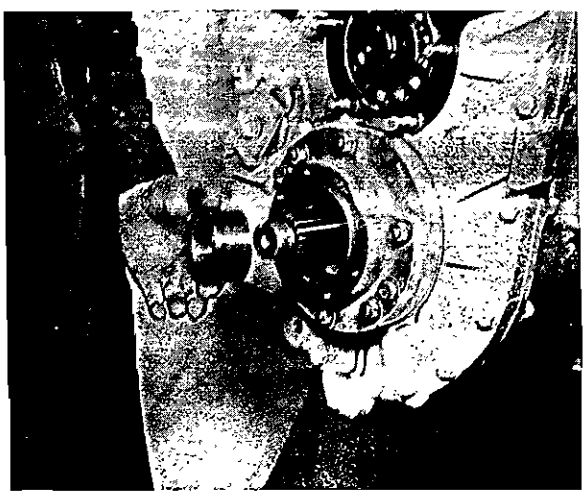
Illust. 8



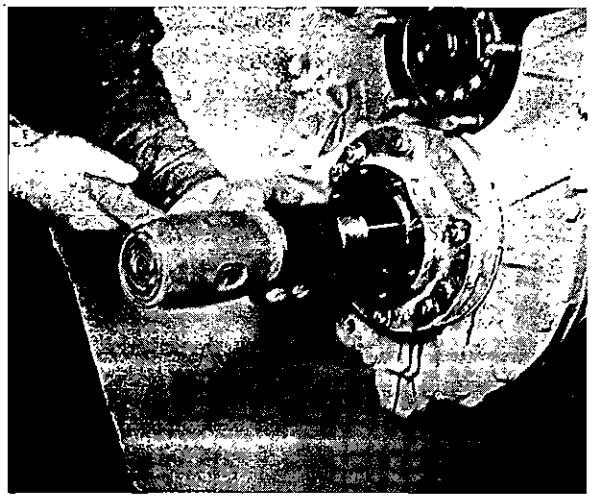
Illust. 9



Illust. 10



Illust. 11

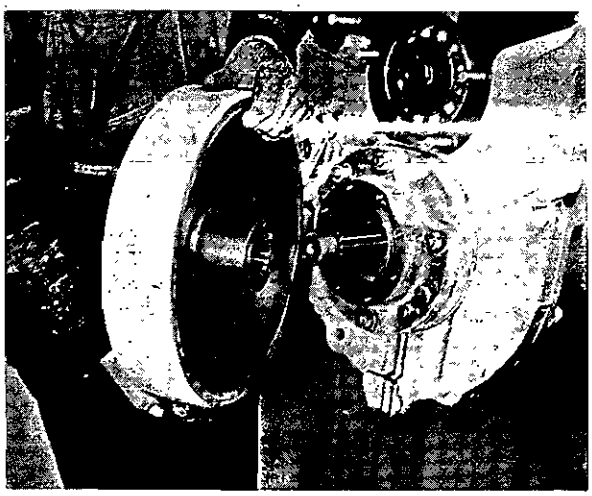


Illust. 12

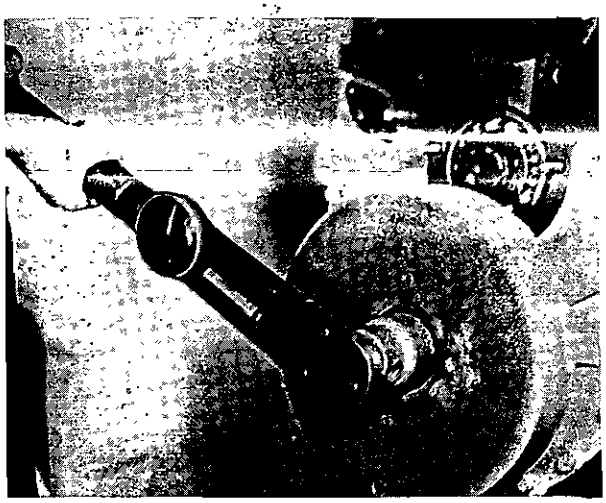
To remove staked nut from upper shaft, use a drill (Illust. 9).

Install "O" ring in groove of spacer (Illust. 10). Apply white lead to "O" ring and install onto lower shaft (Illust. 11). White lead will prevent damage to "O" ring. Next, drive spacer onto lower shaft and into adapter (Illust. 12) end of spacer with "O" ring against bearing.

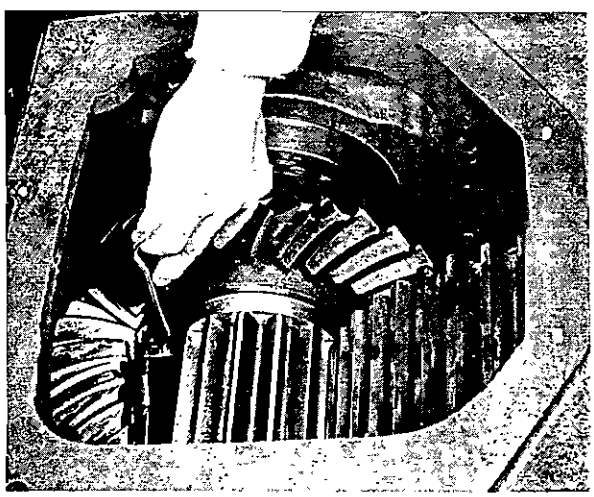
In order to obtain the pinion depth setting, install brake drum (Illust. 13). Next, install nut and tighten to a torque reading of 600 foot pounds (Illust. 14).



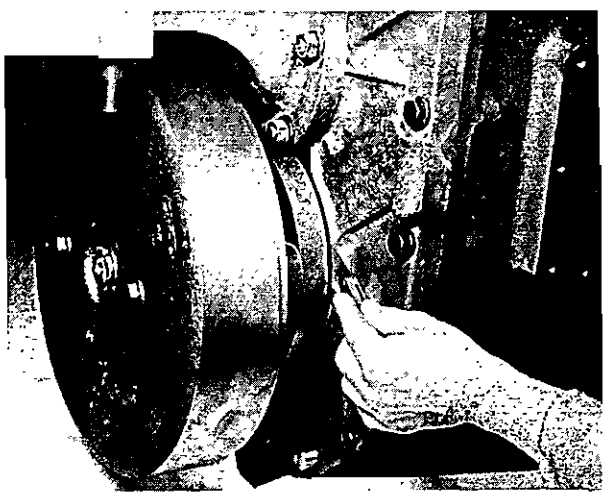
Illust. 13



Illust. 14



Illust. 15

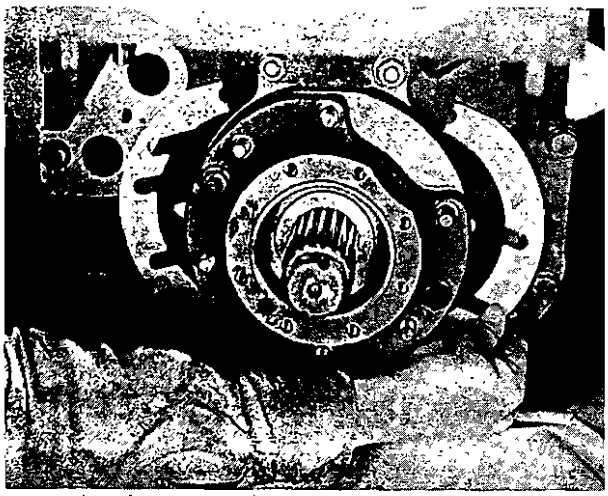


Illust. 16

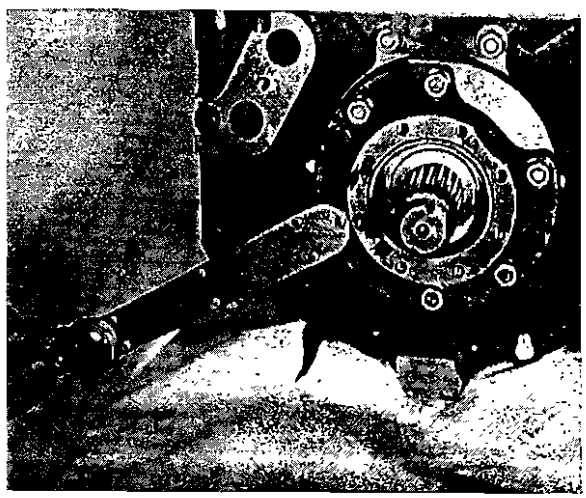
A special gauge block, Adams No. 723017, is required to obtain the correct pinion setting. Insert this gauge between the spiral gear setting disc and pinion (Illust. 15). Bump pinion shaft assembly back towards setting disc until a reading of 1.325 (gauge block length) to 1.330 is obtained.

When pinion depth setting is obtained, use a feeler gauge and measure the gap between bearing cage and intermediate plate (Illust. 16). Next, remove brake drum. Insert correct amount of split shims required to fill gap (Illust. 17). Install bearing cage stud nuts with lock washers and tighten to a torque reading of 65 foot pounds (Illust. 18). Recheck pinion depth setting. If the required setting is not correct, repeat the operation, adding or removing split shims. When setting is correct, shift gears into neutral.

To adjust the backlash between the spiral bevel gear and pinion, use a dial indicator (Illust. 19). To obtain the backlash, remove shims as needed, from right hand jackshaft bearing

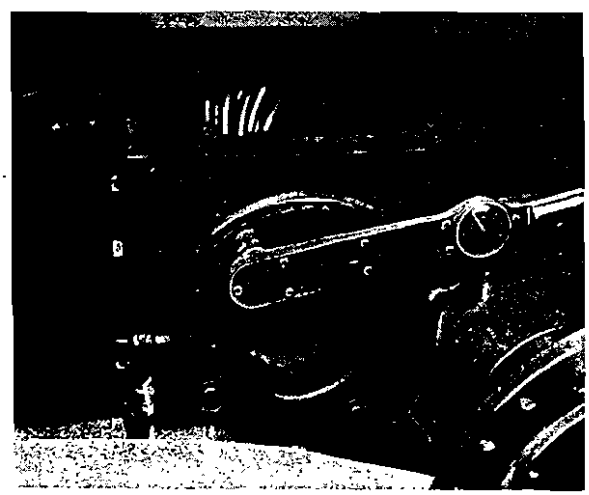


Illust. 17



Illust. 18

Illust. 19

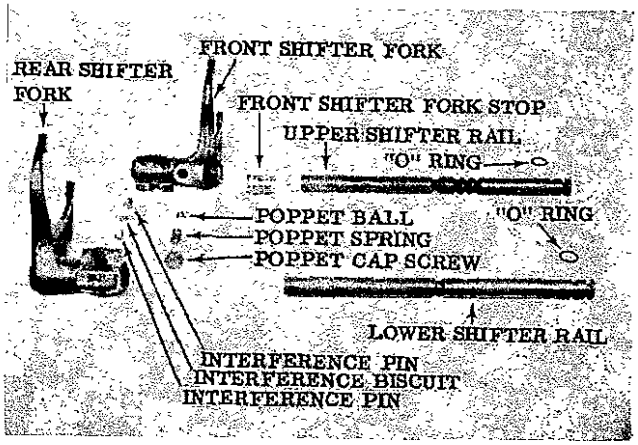


Illust. 20

Illust. 21

cage and install to left hand jackshaft bearing cage until a reading of between .010 to .014 is obtained on dial indicator. To assure accuracy, the reading should be taken from three (3) or more positions on the bevel gear. After the correct reading is obtained, tighten jackshaft bearing cages cap screws to a torque reading of 275 foot pounds (Illust. 20).

Shellac around top opening of final drive housing and opening in rear of lower transmission housing. Next, install closure cap gasket and cap. Install cap screws with lock washers and tighten securely (Illust. 21).

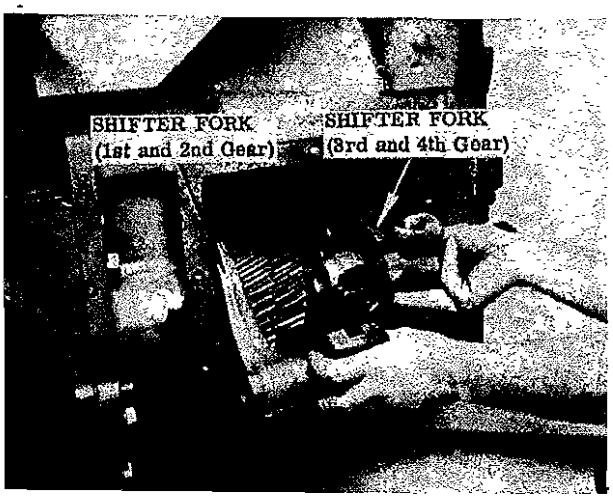


Illust. 1

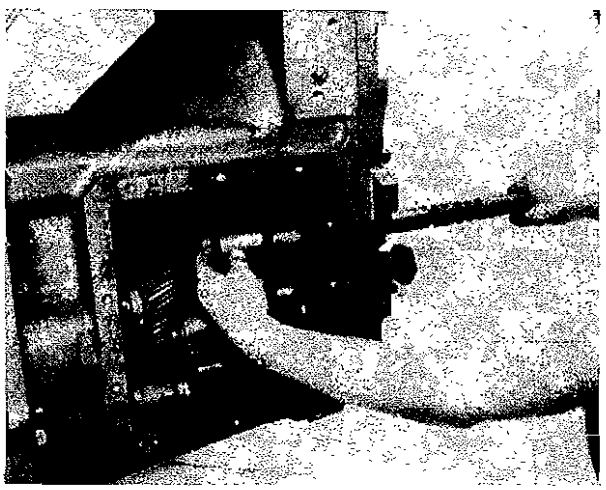
SHIFTER RAILS AND FORKS

Illust. 1 is an exploded view of shifter rails and forks.

Insert shifter forks into lower transmission and over shifter collars (Illust. 2). Next, insert upper shifter rail through intermediate plate and through stop (Illust. 3). Insert upper shifter rail into 3rd and 4th gear shifter fork enough to hold fork upward (Illust. 4). Next, insert lower shifter rail through intermediate plate and 1st and 2nd gear shifter fork, as shown in illustration.



Illust. 2

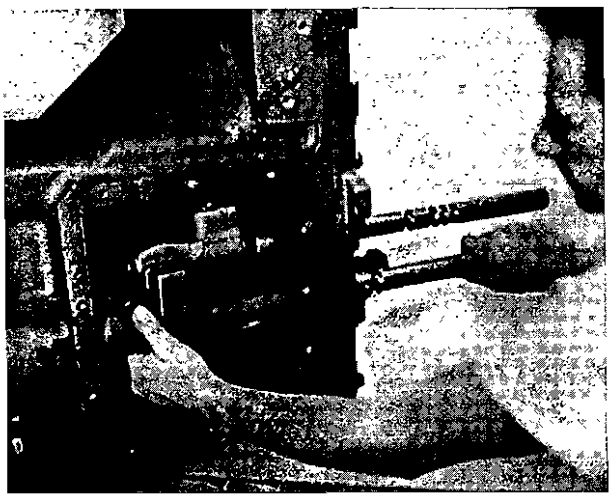


Illust. 3

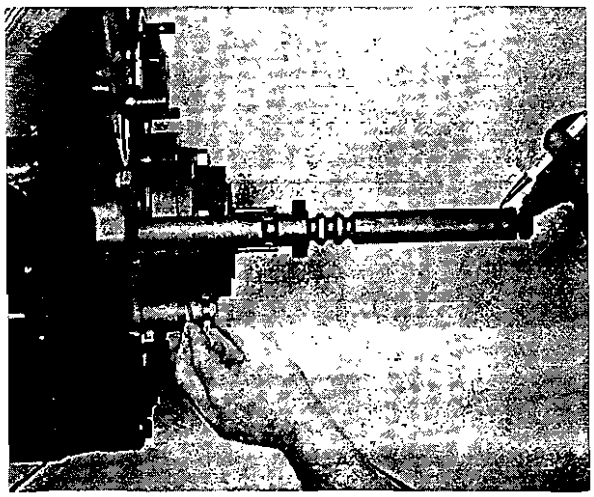
Install "O" rings in groove of upper and lower shifter rails (Illust. 5).

Pull top rail out of front fork only enough to allow front fork to be raised. Now, insert interference pin into hole of 1st and 2nd gear shifter fork, round head of pin toward lower rail (Illust. 6). Push lower shifter rail through fork and into lower transmission housing until interference pin seats itself in groove of shifter rail. Next, insert interference biscuit into hole of shifter fork (Illust. 7). Insert second interference pin into hole of shifter fork (Illust. 8). Round head of interference pin in an upward position. Use grease on each part before installing into shifter fork to hold parts in place. To protect "O" rings from damage, use white lead.

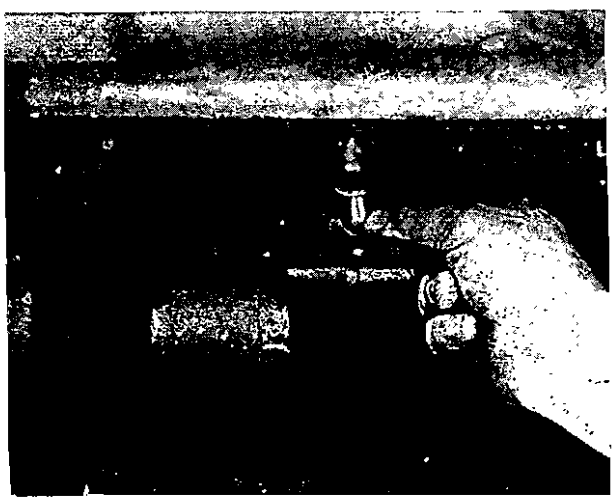
Insert upper shifter rail through 3rd and 4th gear shifter fork and into lower transmission. Next, insert locking disc into grooves of upper and lower shifter rails. Install clamp bar with cap screw and lock washer (Illust. 9). Tighten cap screw securely.



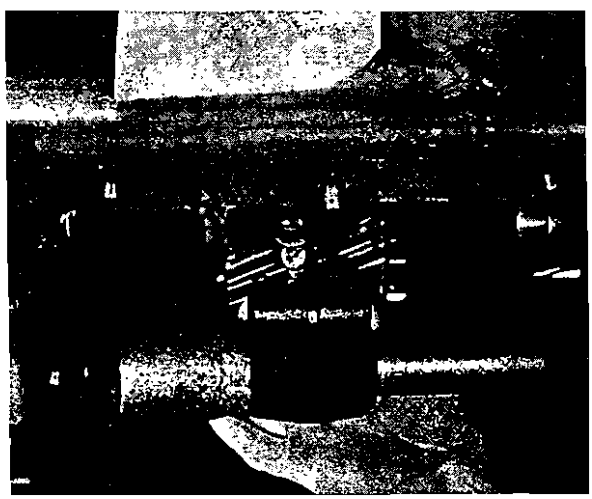
Illust. 4



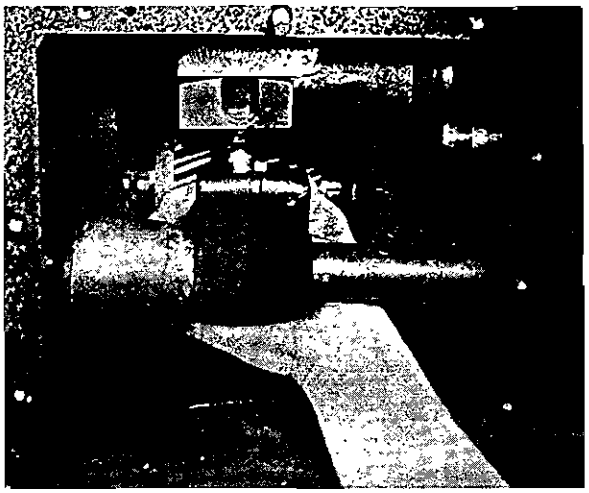
Illust. 5



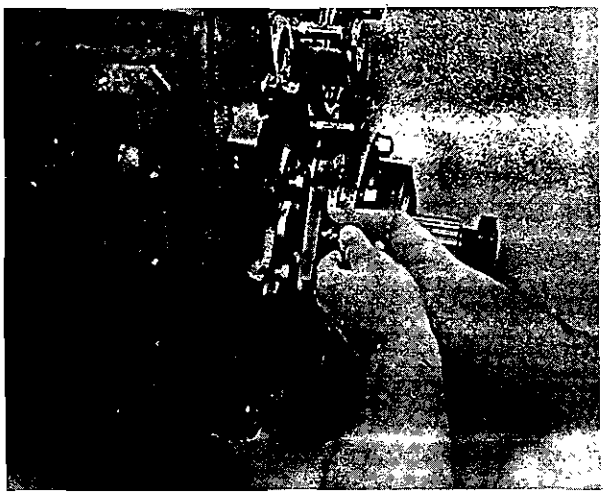
Illust. 6



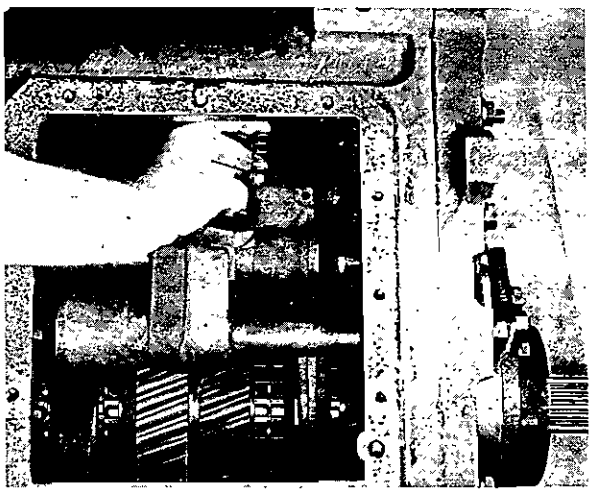
Illust. 7



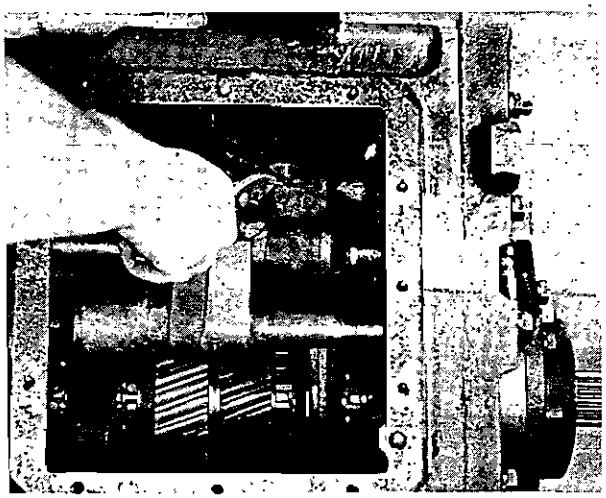
Illust. 8



Illust. 9



Illust. 10



Illust. 11

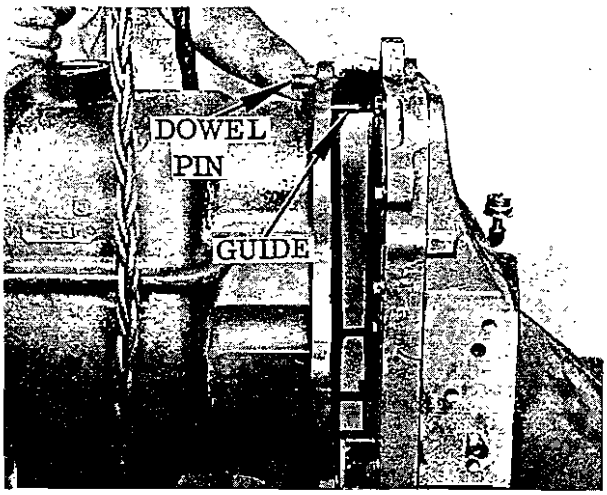
Install poppet ball and spring into 3rd and 4th gear shifter fork (Illust. 10). Next, install poppet cap screw and tighten securely. Insert a piece of wire through head of cap screw and through hole of shifter fork (Illust. 11). Lock wire by twisting.

Before installing upper transmission housing to intermediate plate, punch mark intermediate plate at lower and upper shaft bores, in line with bearing locks. These punch marks will aid when installing upper and lower shaft assemblies.

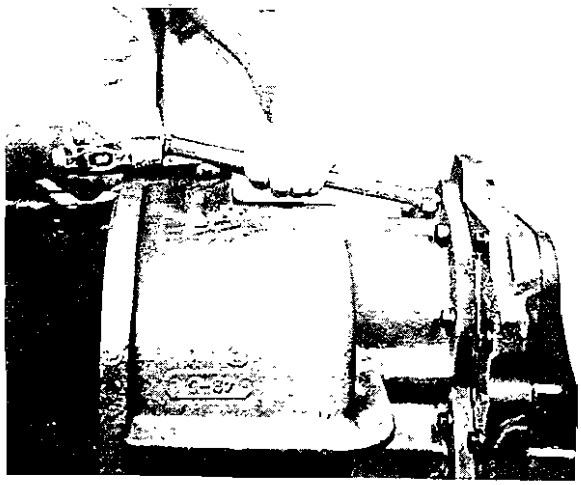
Install a guide in upper cap screw hole to guide upper transmission housing into place (Illust. 12).

Shellac intermediate plate and install upper transmission housing gasket.

Install dowel pin (Illust. 12) into upper transmission housing. Do not drive dowel pin through



Illust. 12



Illust. 13

housing. To prevent damage to threads of dowel pin, use a nut on threads (Illust. 13).

Install upper transmission housing onto guide and against intermediate plate (Illust. 12). Next, install cap screws with lock washers. Remove guide. Snug cap screws until dowel pin (Illust. 13) is driven into intermediate plate, then tighten cap screws securely.

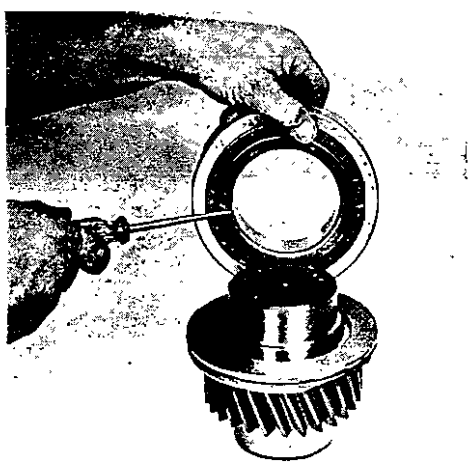
Remove nut from dowel pin.

UPPER TRANSMISSION LOWER SHAFT

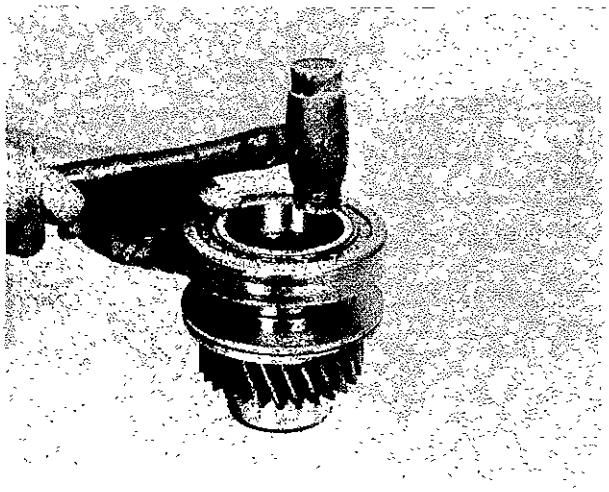
Press or drive oil seal into seal retainer (Illust. 1). Lip of oil seal away from milled surface of retainer. Next, install "O" ring (indicated by arrow) into groove of seal retainer.

Install seal retainer onto hub of 28 tooth (high range) gear (Illust. 2). Milled surface of seal

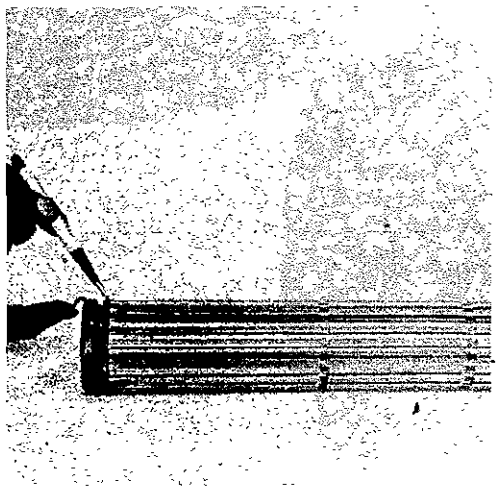
Illust. 1



Illust. 2



Illust. 3



Illust. 4

retainer toward teeth of gear.

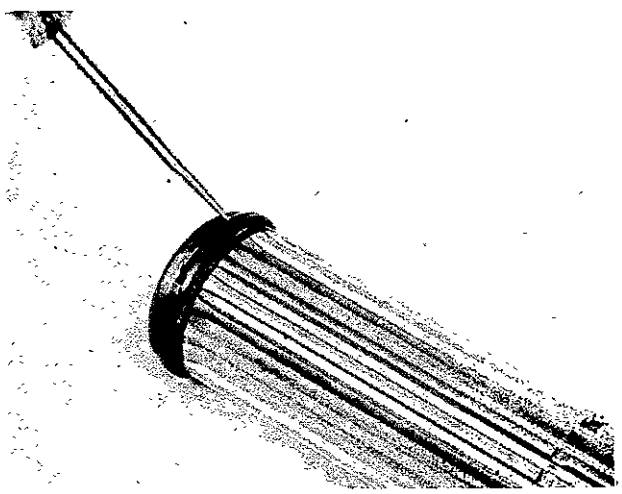
Press or drive bearing onto hub and down to shoulder of gear (Illust. 3). Radius of bearing, as indicated by screw driver in Illust. 2, toward the retainer.

Install "O" ring (indicated by pencil) and "O" ring retainer into groove of lower shaft (Illust. 4). Next, install snap ring into groove (Illust. 5).

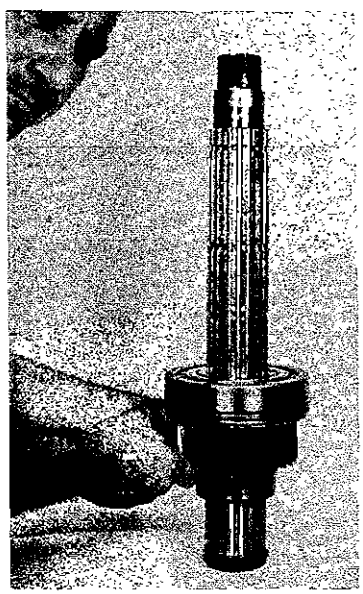
Install 28 tooth (high range) gear with retainer onto shaft (Illust. 6).

Install spacer onto shaft and against bearing (Illust. 7).

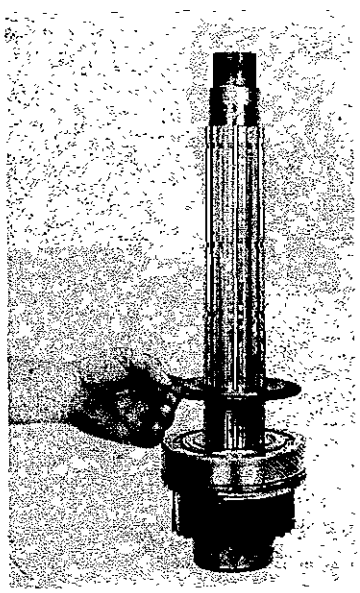
Heat bearing race in oil and install onto shaft and against spacer. Hold race un-



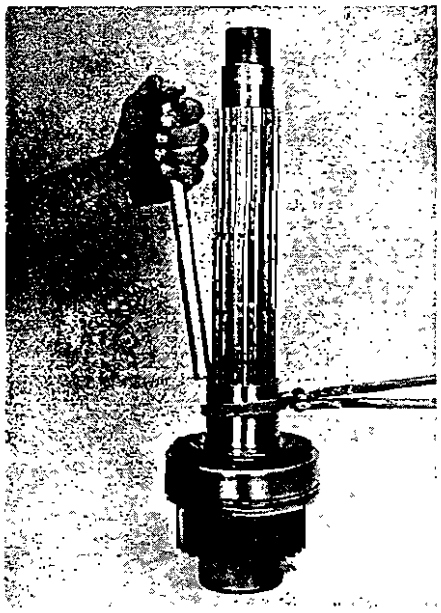
Illust. 5



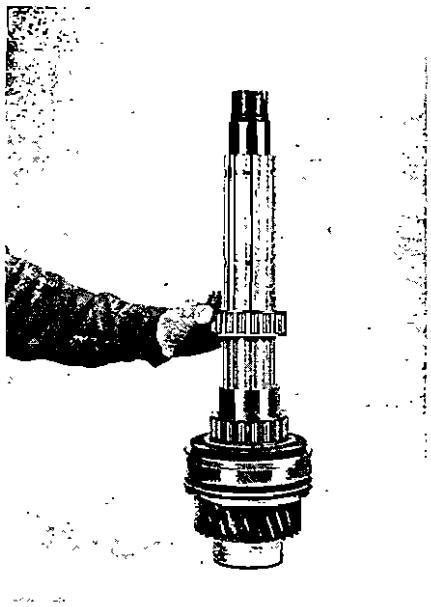
Illust. 6



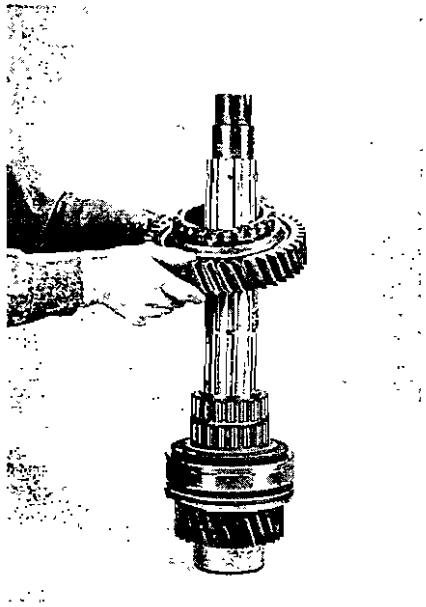
Illust. 7



Illust. 8



Illust. 9



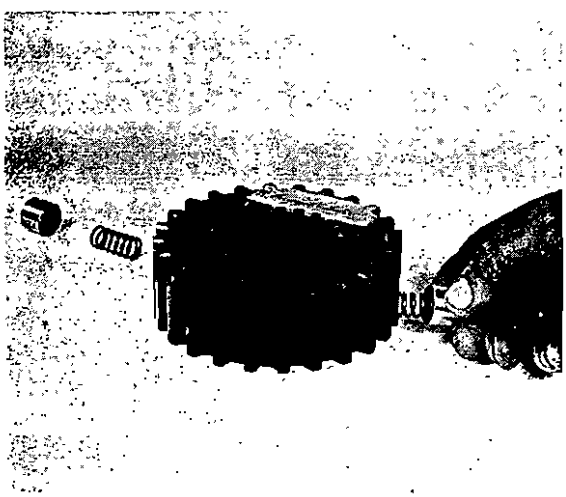
Illust. 10

til set (Illust. 8).

Install bearings onto bearing race (Illust. 9).

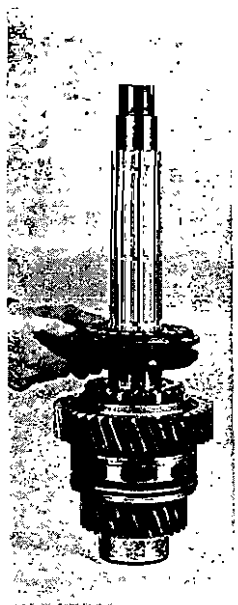
Install 42 tooth gear onto shaft and over bearings (Illust. 10).

Insert springs and poppets into shifter gear (Illust. 11). Next, install shifter collar over shifter gear and poppets. NOTE: Shifter collar has 4 tapered teeth (Illust. 12). Install collar so tapered teeth will slide over poppets. Poppets will fall into space between the teeth of collar.

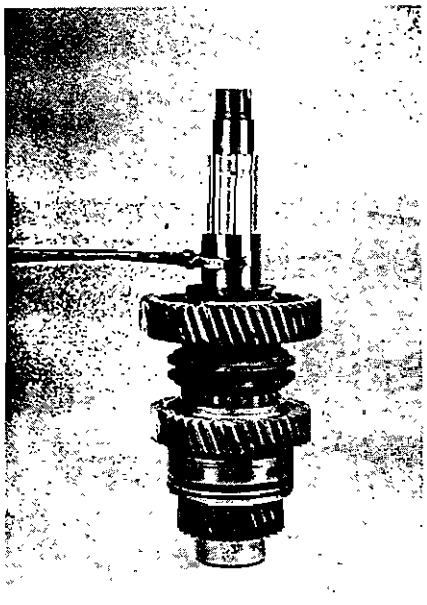


Illust. 11

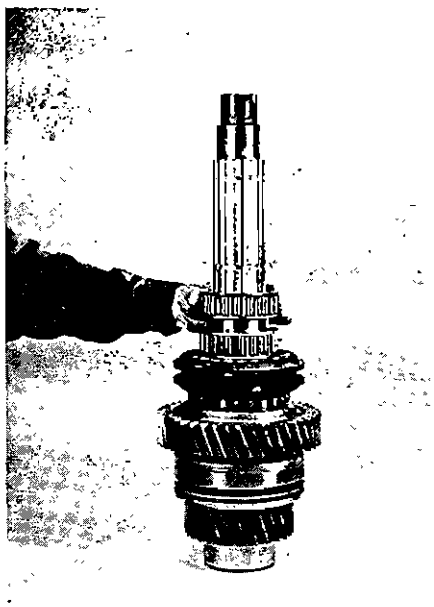
Illust. 12



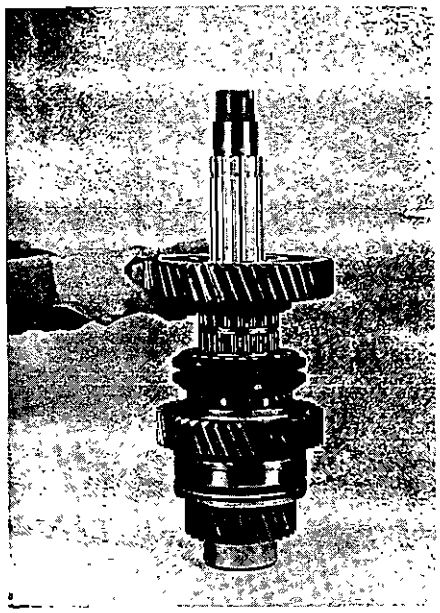
Illust. 13



Illust. 14



Illust. 15



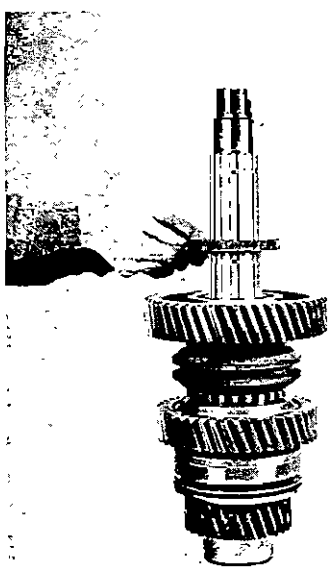
Illust. 16

Install shifter gear onto shaft (Illust. 13).

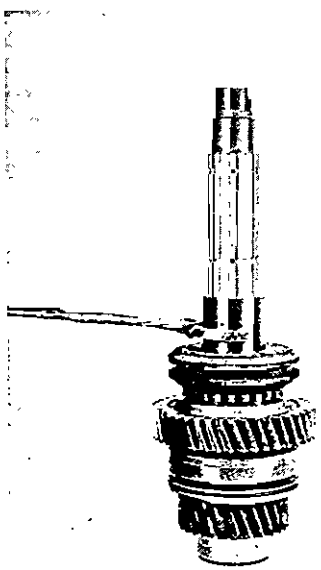
Heat bearing race in oil and install on shaft. Hold race until set (Illust. 14).

Install bearings onto race (Illust. 15). Next, install 48 tooth (low range) gear onto bearings (Illust. 16).

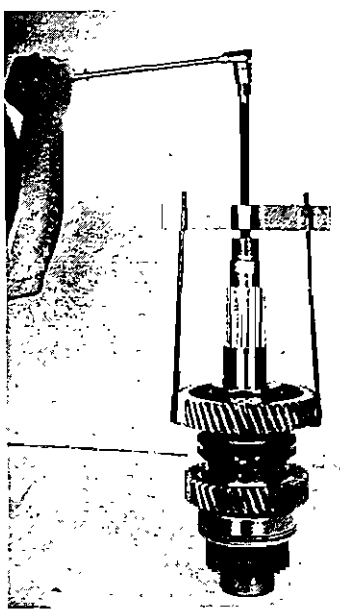
Install spacer onto shaft (Illust. 17).



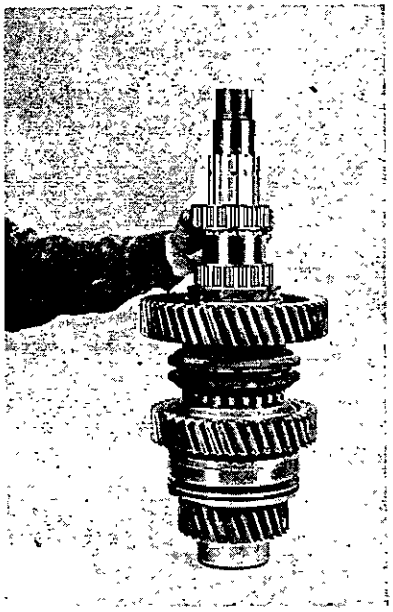
Illust. 17



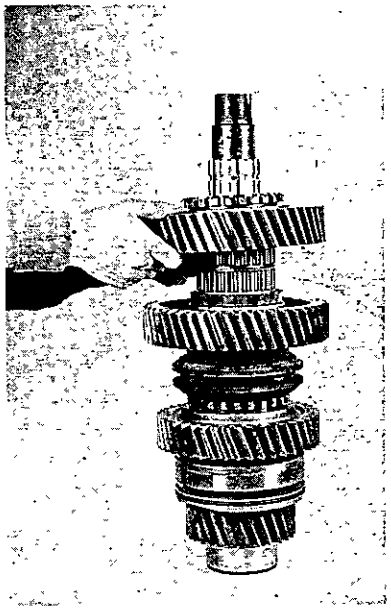
Illust. 18



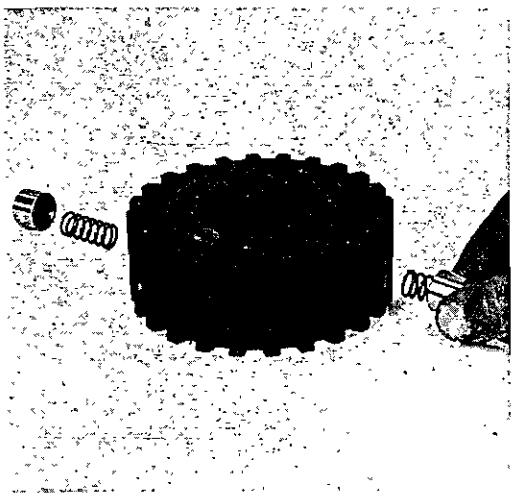
Illust. 19



Illust. 20



Illust. 21



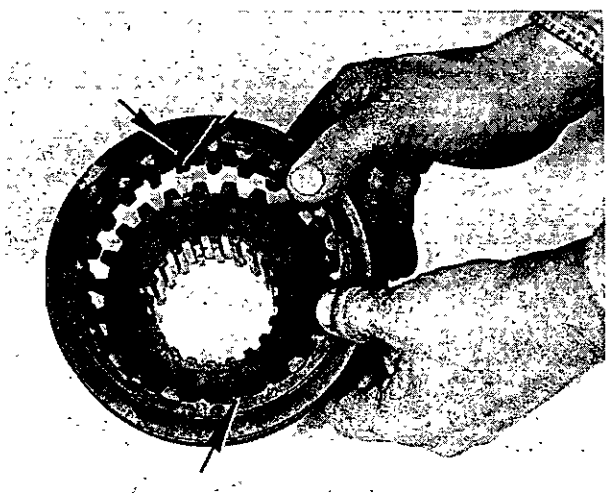
Illust. 22

Heat bearing race in oil and install onto shaft. Hold race until set (Illust. 18).

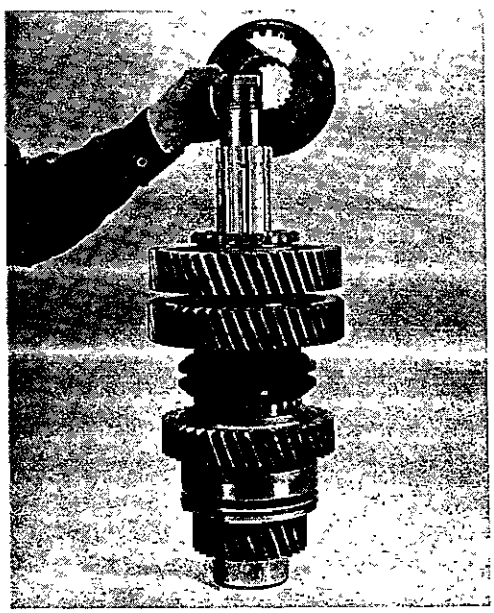
To remove gears from shaft, use a gear puller (Illust. 19).

Install bearings onto bearing race (Illust. 20). Next, install 47 tooth gear onto shaft and over bearings (Illust. 21).

Insert springs and poppets into second shifter gear (Illust. 22). Next, install shifter collar over shifter gear and poppets. NOTE: Shifter collar has 4 tapered teeth (as indicated with arrows). Install collar so tapered teeth will slide



Illust. 23



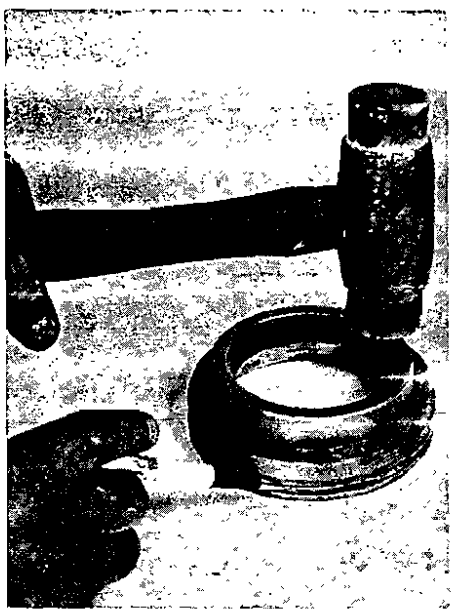
Illust. 24

over poppets (Illust. 23). Poppets will fall in space between the teeth of collar.

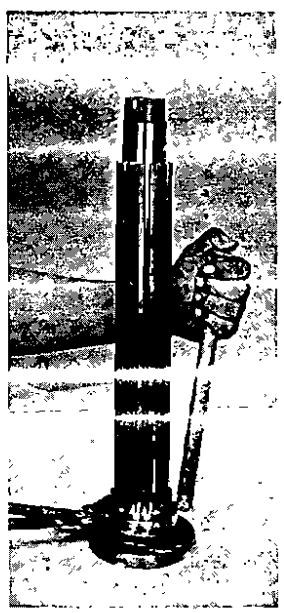
Install shifter gear onto shaft (Illust. 24). NOTE: Shifter gear is marked "Engine Side". Install gear so marking is toward engine, as illustrated. Next, install spacer. NOTE: This spacer is used only in the absence of creeper gears.

UPPER SHAFT

Press or drive oil seal into retainer (Illust. 1). Lip of oil seal away from milled surface of retainer. Next, install "O" ring (indicated by pencil) into groove of retainer.



Illust. 1

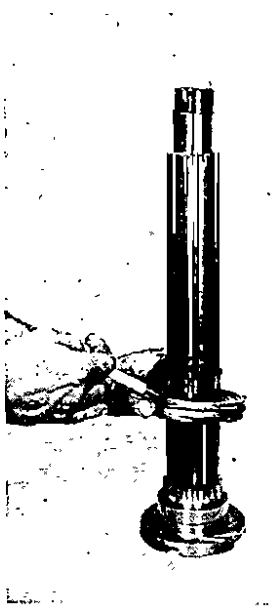


Illust. 2

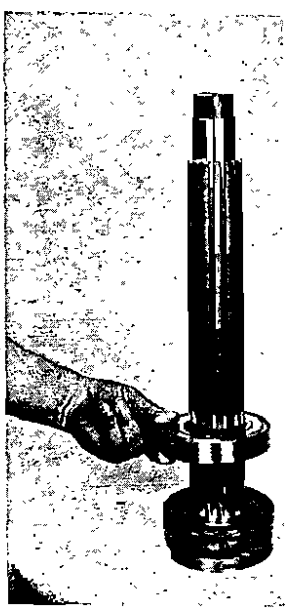
Heat spacer in oil and install onto upper shaft. Chamfered edge of spacer toward engine. Hold spacer until set (Illust. 2).

Install oil seal retainer onto shaft (Illust. 3). Lip of seal away from spacer.

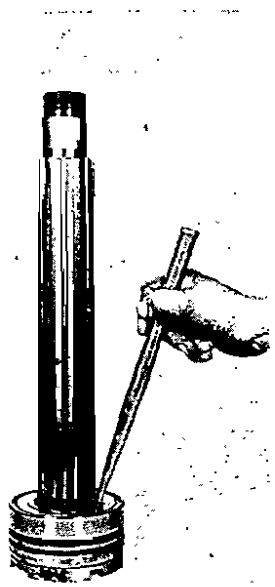
Heat bearing in oil and install onto upper shaft (Illust. 4). Sleeve of bearing away from retainer. Hold bearing until set (Illust. 5).



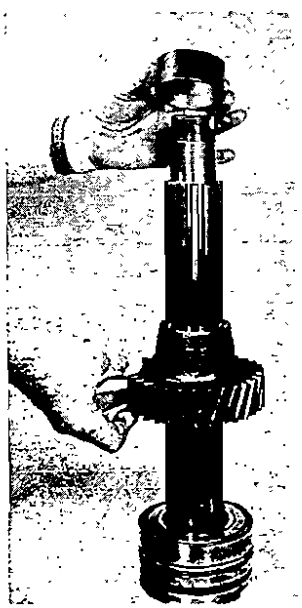
Illust. 3



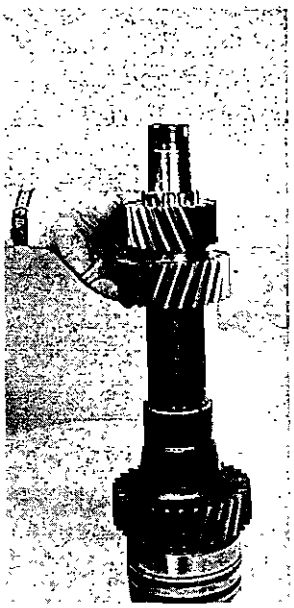
Illust. 4



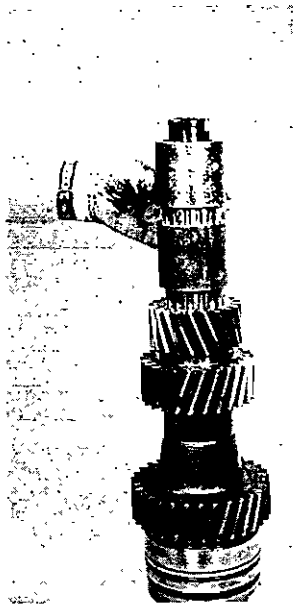
Illust. 5



Illust. 6



Illust. 7



Illust. 8

Install 31 tooth gear onto upper shaft (Illust. 6). Hub of gear toward threaded end of shaft. Next, install spacer.

Install sliding gear onto shaft (Illust. 7).

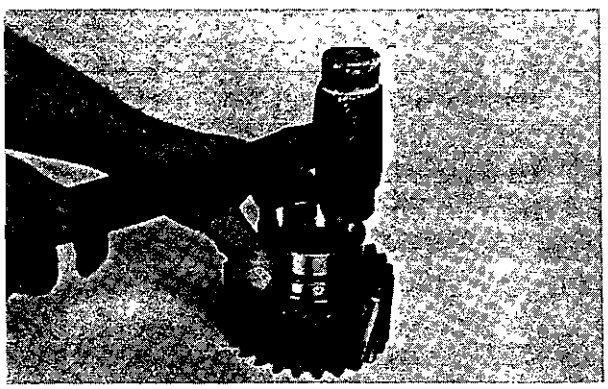
Install two spacers onto shaft (Illust. 8).

INSTALLATION OF LOWER, UPPER AND IDLER SHAFTS

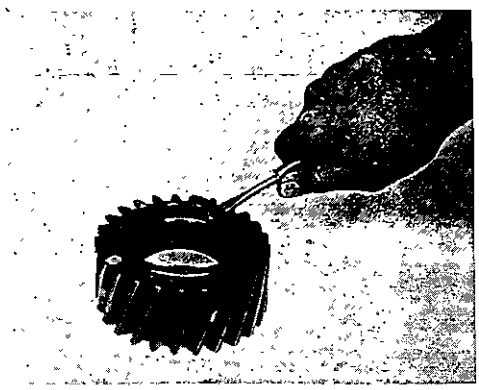
Press or drive cup into idler gear (Illust. 1).

Install snap ring into groove of idler gear (Illust. 2).

Install idler gear shaft into housing (Illust. 3).

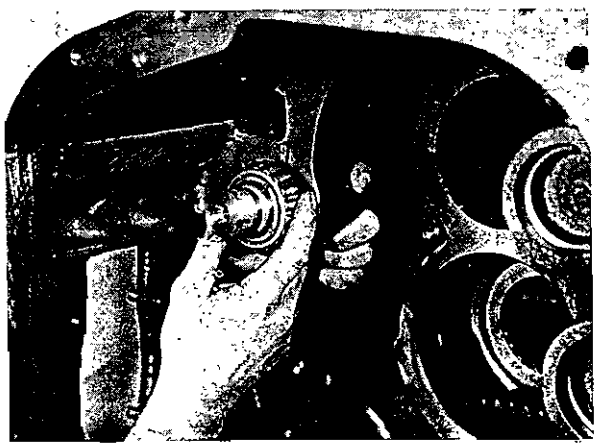


Illust. 1



Illust. 2

Illust. 3



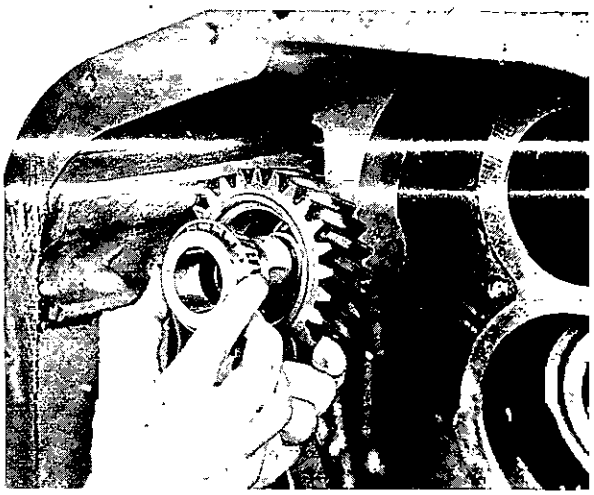
Illust. 4

Install bearing cone onto idler shaft (Illust. 4).

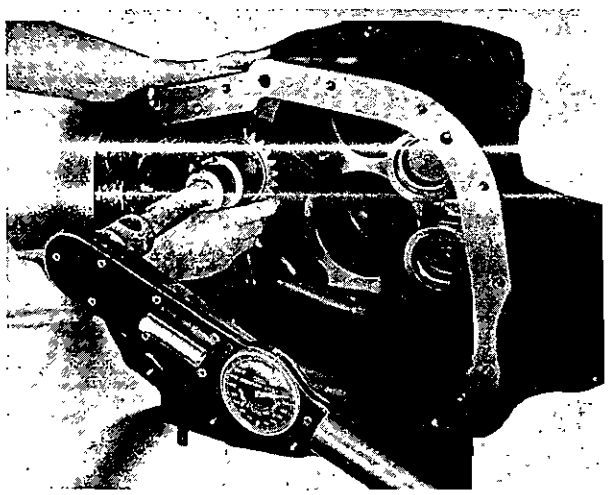
Install idler gear and second bearing cone onto idler shaft (Illust. 5). IMPORTANT: Etched number and letter on edge of bearing cup to correspond with number and letter etched on bearing cones.

Install locking nut onto shaft. Tighten nut to a torque reading of 600 foot pounds (Illust. 6). NOTE: While nut is being tightened, rotate gear to center bearings in cup. After torque reading is obtained remove torque wrench and check for binding. If binding occurs, remove bearings and inspect for defective bearings and cup. Foreign matter in bearings will also cause binding.

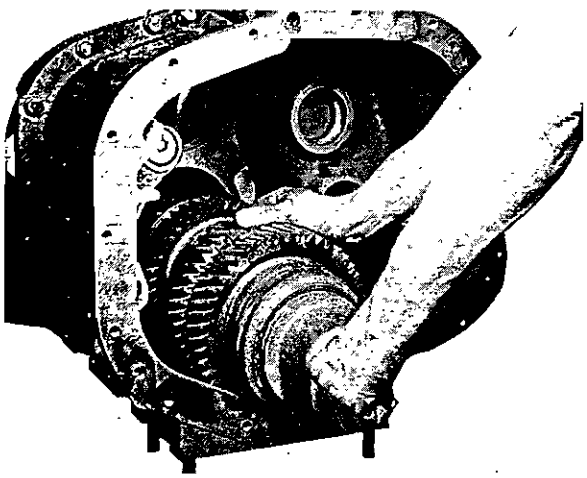
Remove locking nut from idler shaft. Next, remove bearing cone, idler gear and second bearing cone from idler shaft.



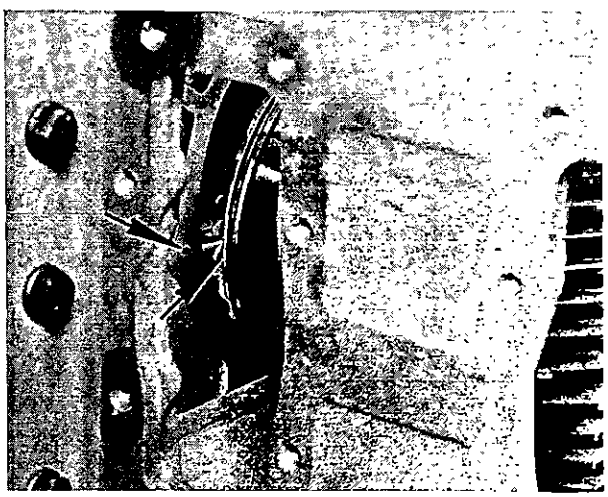
Illust. 5



Illust. 6



Illust. 7

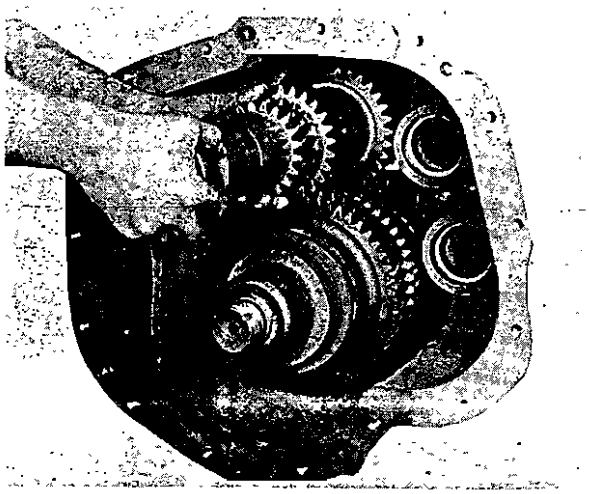


Illust. 8

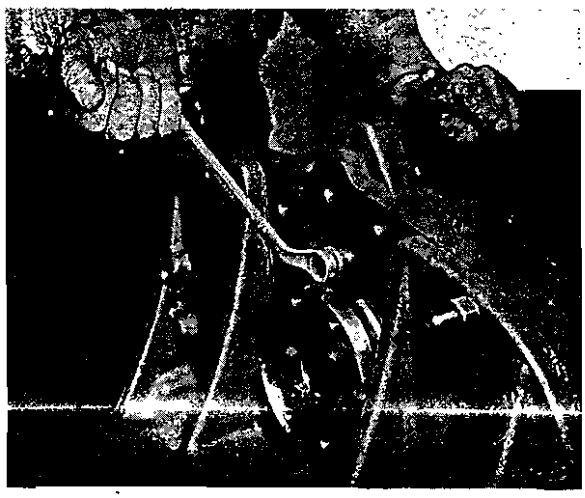
Insert lower shaft assembly into upper transmission housing (Illust. 7). NOTE: Align milled surface of retainer with punch mark in intermediate plate (Illust. 8). Bump end of shaft, using a rawhide mallet, until milled surface of retainer is flush with lock in intermediate plate.

Insert upper shaft assembly into upper transmission housing (Illust. 9). NOTE: Milled surface of retainer in an upward position. Bump end of shaft, using a rawhide mallet until surface is flush with engine side of intermediate plate. Next, install lock and cap screw to intermediate plate (Illust. 10). Insert locking portion of lock in hole in intermediate plate. Tighten cap screw securely. The lock will prevent retainer from rotating as shaft rotates, preventing wear to "O" ring.

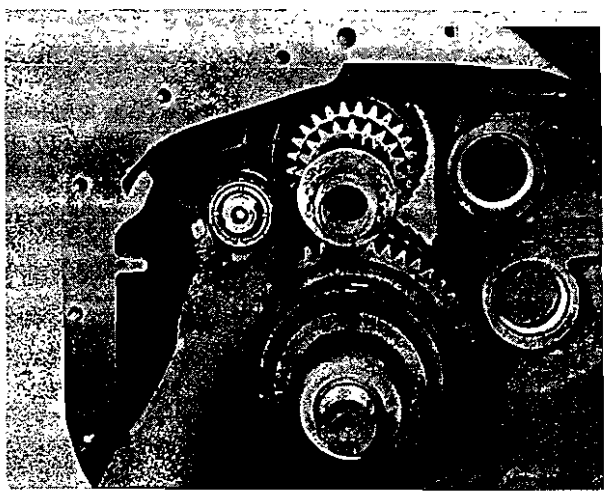
Install idler bearing cone onto idler shaft (Illust. 11).



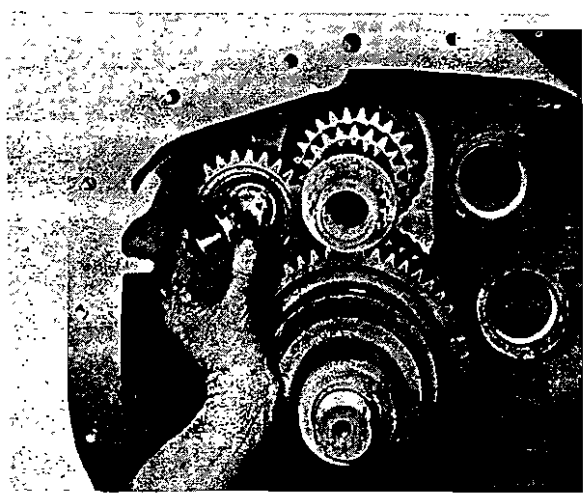
Illust. 9



Illust. 10



Illust. 11



Illust. 12

Install idler gear and second bearing cone onto shaft (Illust. 12). NOTE: Etched number and letter on edge of bearing cup to correspond with number and letter etched on bearing cones.

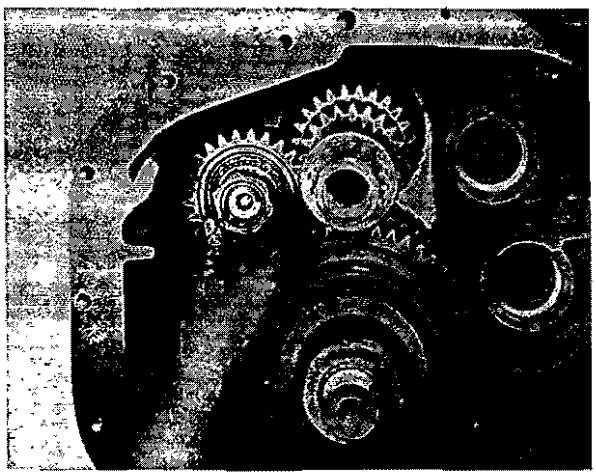
Install locking nut to idler shaft (Illust. 13).

Tighten nut to a torque reading of 600 foot pounds (Illust. 14).

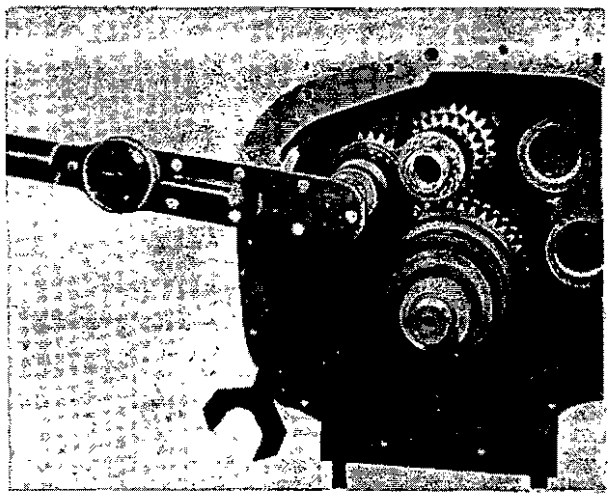
Stake locking nut, using a hammer and drift pin (Illust. 15).

To remove stake from locking nut, use a drill (Illust. 16).

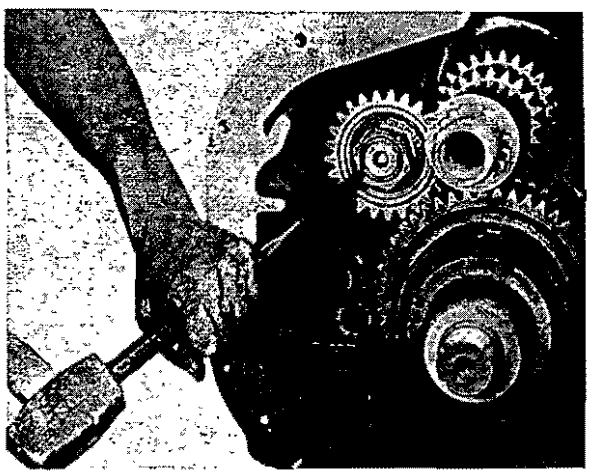
Install studs into upper transmission cover (Illust. 17). Install dowel pins, using a rawhide mallet. Do not drive dowel pins through cover.



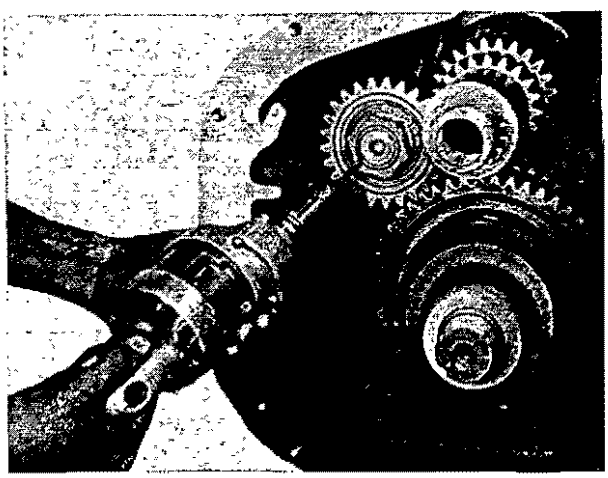
Illust. 13



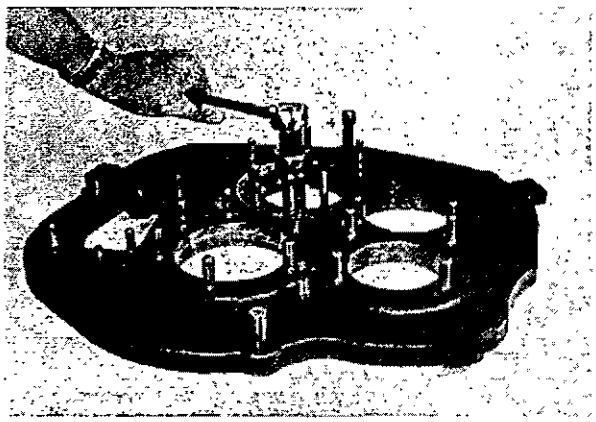
Illust. 14



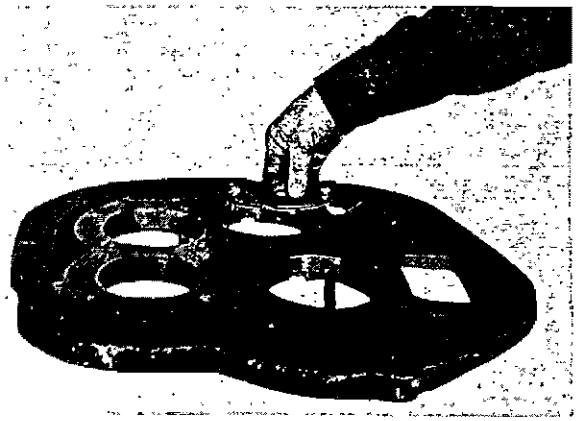
Illust. 15



Illust. 16



Illust. 17



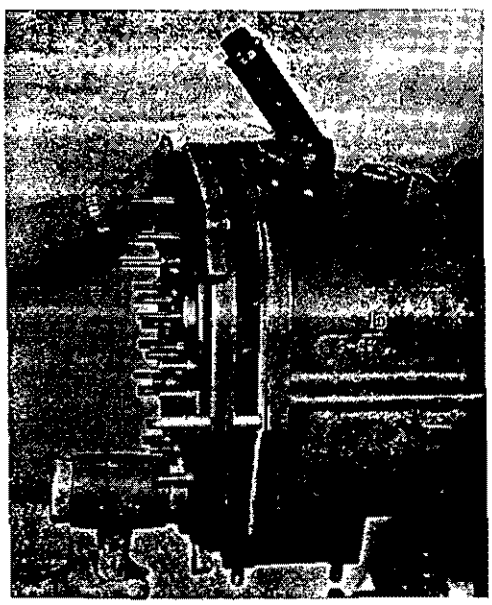
Illust. 18

Turn upper transmission cover over and install baffle and gasket (Illust. 18), long side of baffle toward gear box. Install cap screws with lock washers. Tighten cap screws securely (Illust. 19).

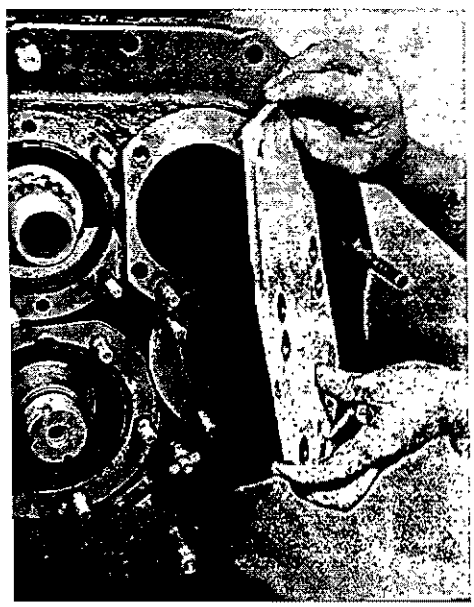
Shellac gasket to upper transmission. Install two or more guides in upper transmission cap screw holes.

Install cover onto guides. Bump cover, using a rawhide mallet, until cover is against gasket (Illust. 20).

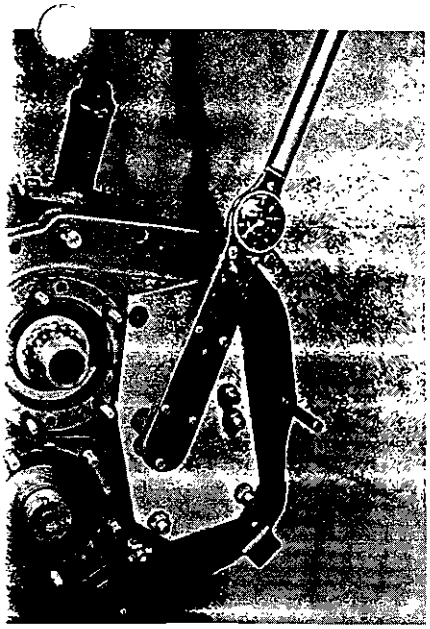
Illust. 19



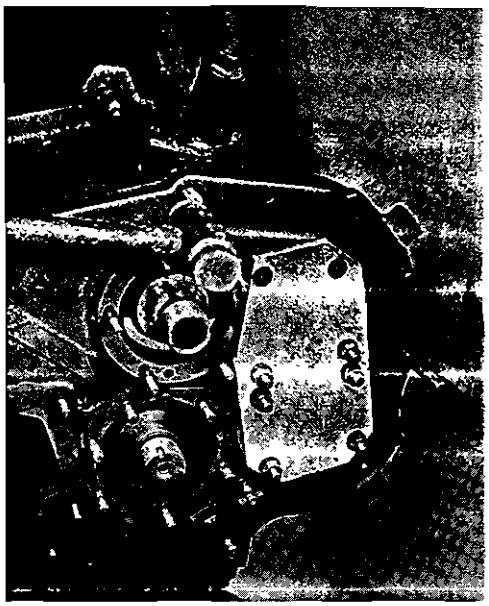
Illust. 20



Illust. 21



Illust. 22

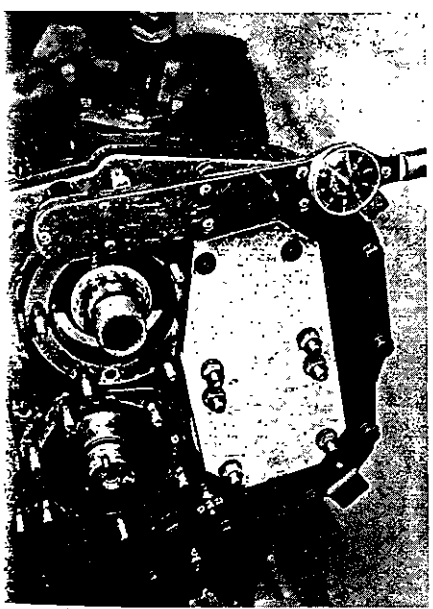


Illust. 23

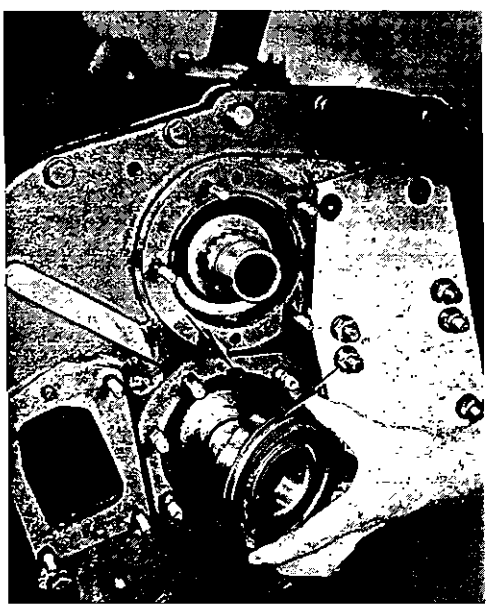
ellac cover plate gaskets to upper transmission cover. Next, install cover plate (Illust.).

sta wo Allen head cap screws with copper washers. Next, install lock washers and stud uts. Tighten cap screws and nuts to a torque reading of 65 foot pounds (Illust. 22).

stall four upper transmission cover plate cap screws with lock washers (two on each side cover). Snug cap screws. Next, using a rawhide mallet, drive dowel pins through cover

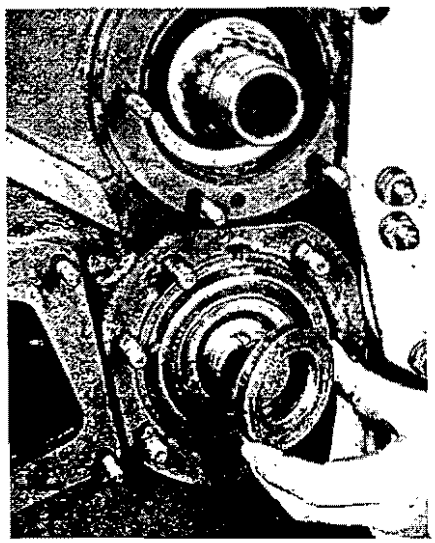


Illust. 24

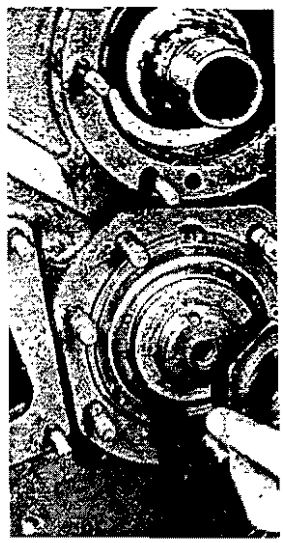


Illust. 25

Illust. 26



Illust. 27



Illust. 2

and into upper transmission (Illust. 23).

Remove guides from upper transmission and install the remaining cover cap screws with lock washers. Tighten cap screws to a torque reading of 65 foot pounds (Illust. 24).

Install bearing with snap ring onto lower shaft and into cover (Illust. 25). Slot in snap ring to be in line with oil hole in cover. Using a driver and hammer, drive bearing into bore of housing until snap ring is against cover (Illust. 26).

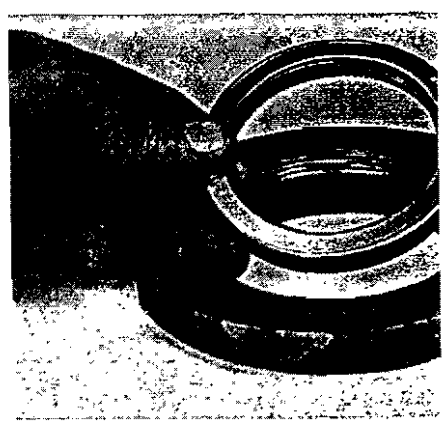
Install spacer onto lower shaft and against bearing (Illust. 27).

Illust. 29

Install locking nut onto lower shaft (Illust. 28).

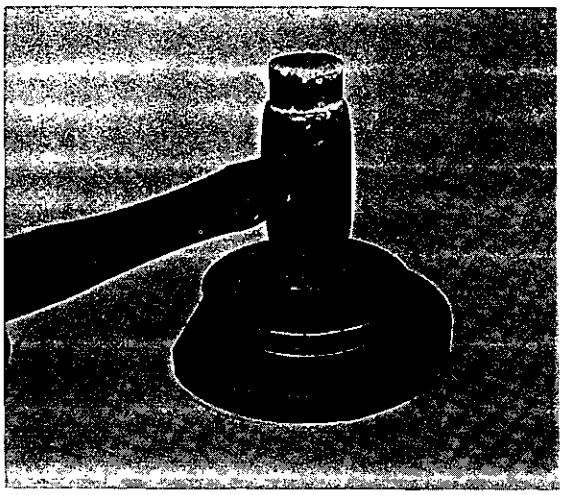
Install bearing onto shaft and into cover (Illust. 29). Using a hammer and driver, drive bearing into bore of housing until snap ring is against cover.

Install oil seal into oil seal retainer (Illust. 30). Lip of seal toward bearing. Using a hammer and driver, drive oil seal into retainer to pilot (Illust. 31).

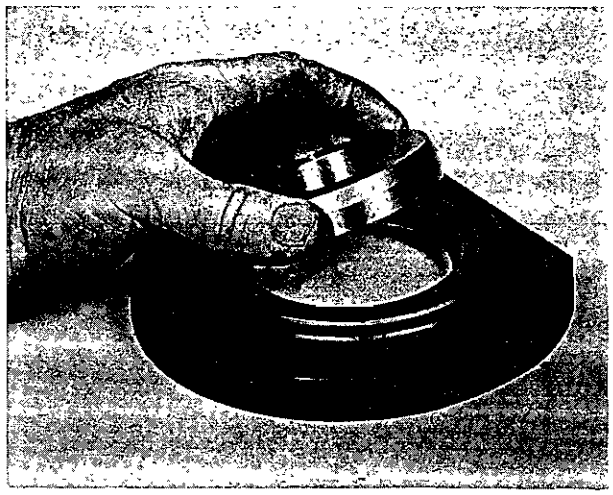


Illust. 30

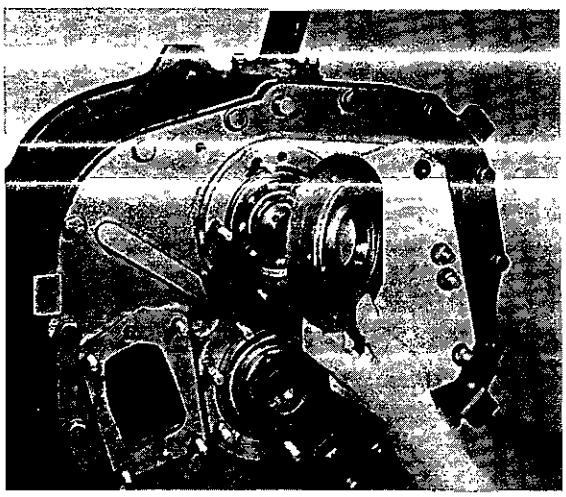
Insert chamfered spacer into oil seal (Illust. 32).



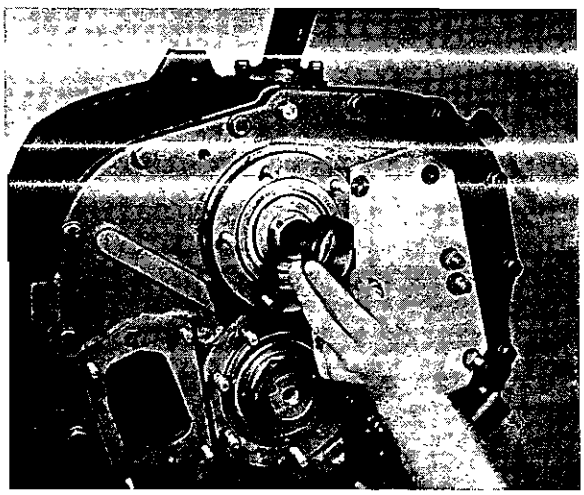
Illust. 31



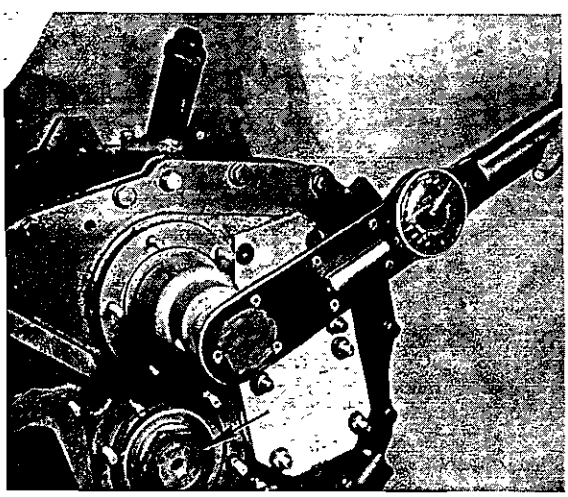
Illust. 32



Illust. 33



Illust. 34



Illust. 35

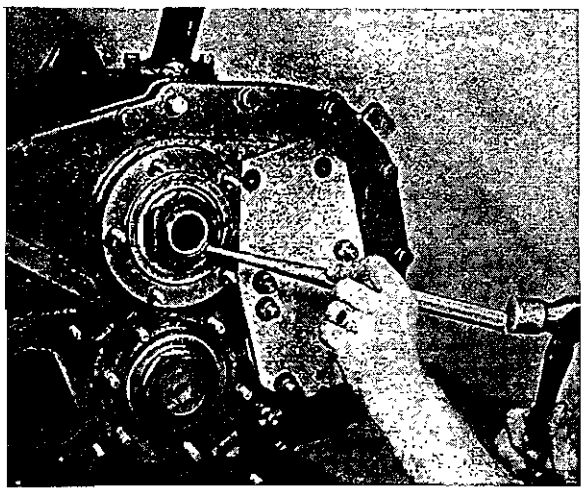
Chamfered end of spacer away from lip of seal.

Install retainer gasket and retainer over studs of upper shaft bore of cover (Illust. 33).

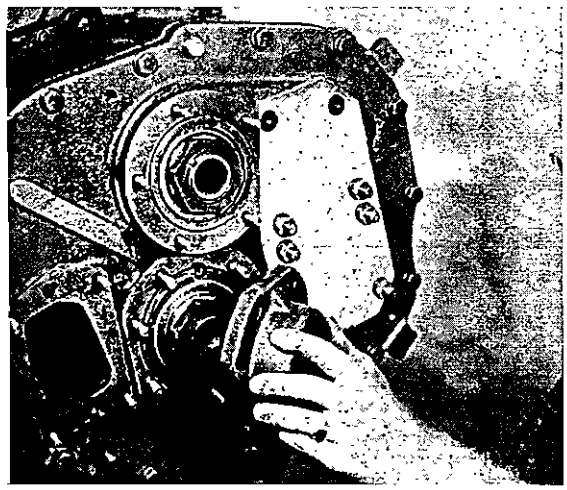
Install lock nut onto upper shaft (Illust. 34). Tighten nut to a torque reading of 750 foot pounds (Illust. 35). Stake lock nut, using a drift pin and hammer (Illust. 36).

Tighten lower shaft nut, as indicated by arrow (Illust. 35) to a torque reading of 750 foot pounds. Stake lock nut, using a drift pin and hammer.

To remove stake from both upper and lower shafts,



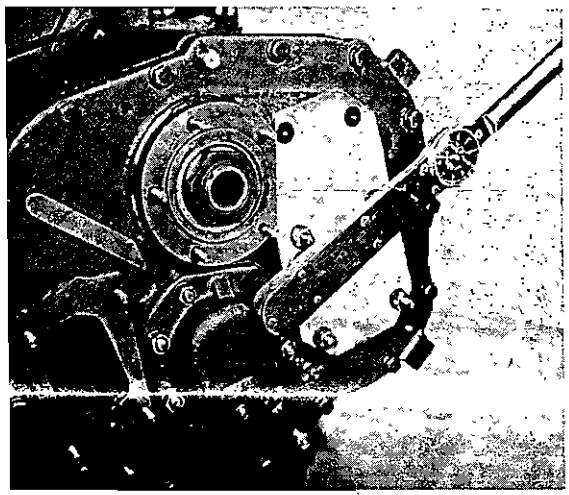
Illust. 36



Illust. 37

use a drill and drill out stakes. Use care not to damage threads of shafts.

Install lower shaft bearing cap and gasket (Illust. 37). Install stud nuts and lock washers. Tighten stud nuts to a torque reading of 65 foot pounds (Illust. 38).

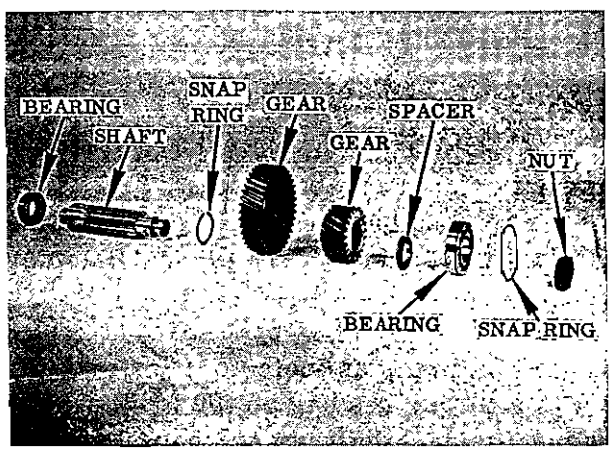


Illust. 38

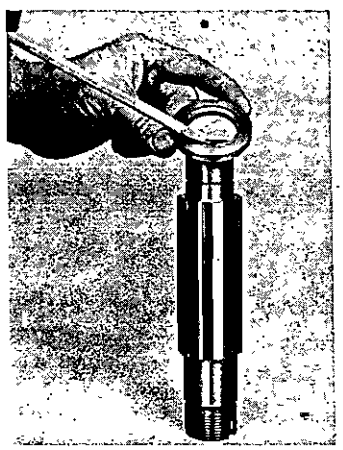
UPPER CREEPER GEARS

Illust. 1 is an exploded view of the upper creeper gears.

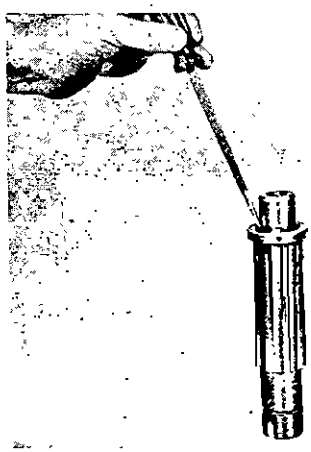
Install spacer onto shaft (Illust. 2). Tapered end of spacer away from splines of shaft.



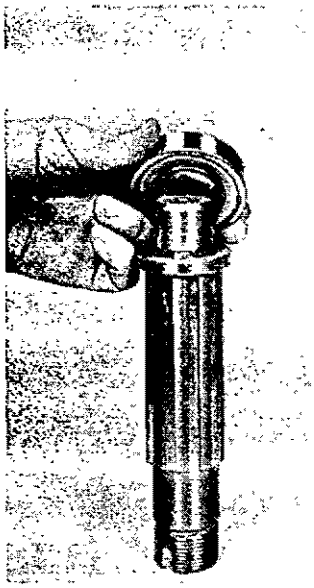
Illust. 1



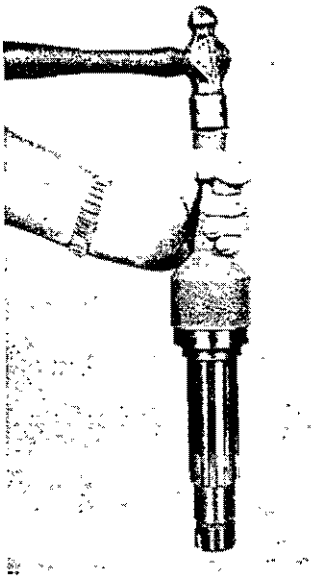
Illust. 2



Illust. 3

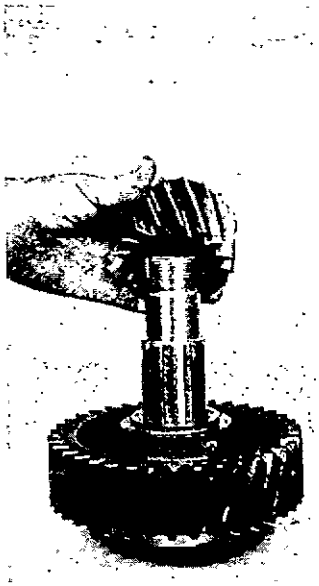


Illust. 4



Illust. 5

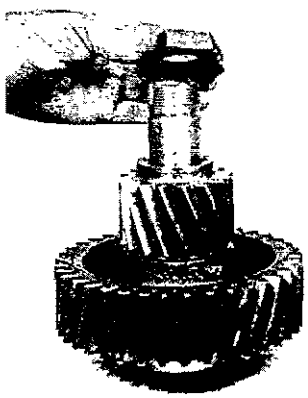
Illust. 6



Illust. 7

Install snap ring into groove of shaft (Illust. 3).

Install bearing onto shaft (Illust. 4). Shielded side of bearing toward snap ring. Press or drive bearing onto shaft and down to snap ring (Illust. 5).



Illust. 8

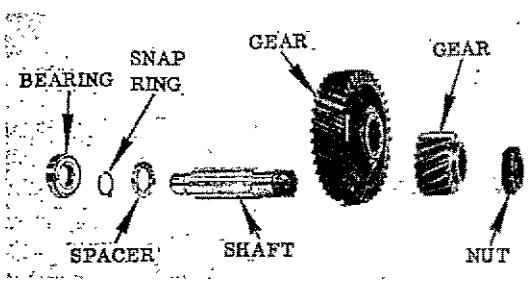
Install 38 tooth gear onto shaft and down to spacer (Illust. 6). Long hub of gear toward threaded end of shaft.

Install 16 tooth gear onto shaft and down to 38 tooth gear (Illust. 7). Long hub of gear toward threaded end of shaft.

Install nut onto shaft (Illust. 8). Do not tighten nut.

LOWER CREEPER GEARS

Illust. 1 is an exploded view of the lower creeper gears.

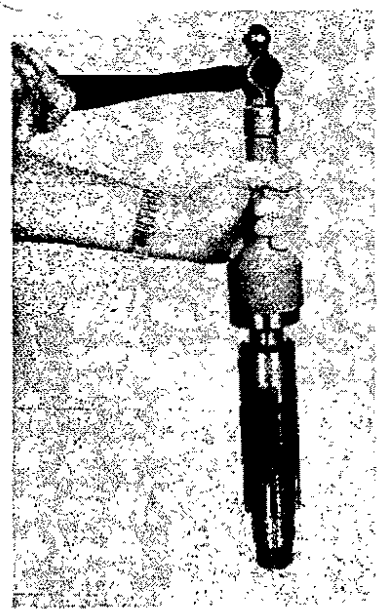


Illust. 1

Press or drive small bearing onto shaft (Illust. 2). Shielded side of bearing toward threaded end of shaft.

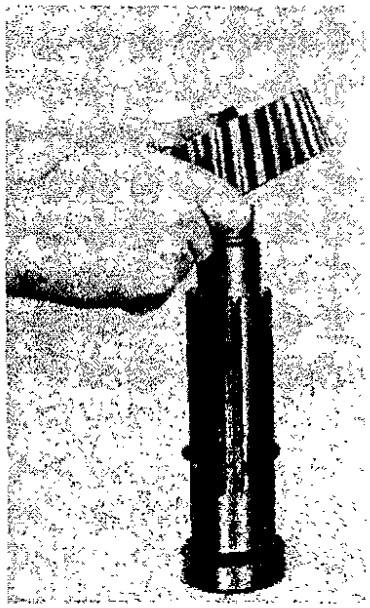
Install snap ring into groove of shaft (Illust. 3).

Install 38 tooth gear onto shaft (Illust. 4). Long hub of gear away from snap ring.



Illust. 2

Illust. 3

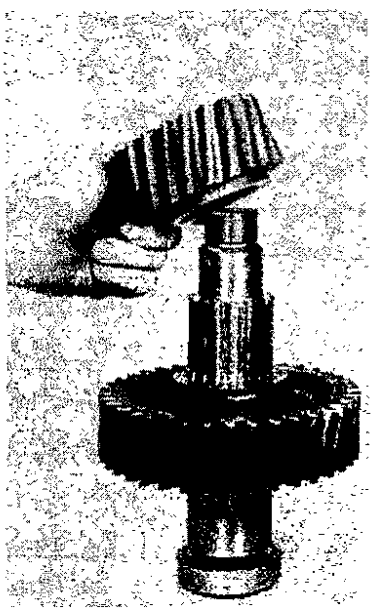


Illust. 4

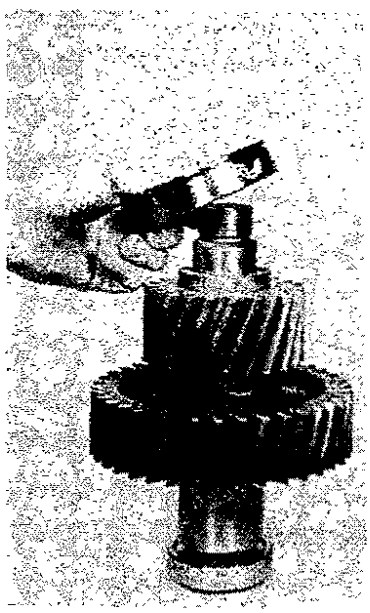
Install 22 tooth gear onto shaft (Illust. 5). Smooth side of gear away from 38 tooth gear.

Install spacer onto shaft. Chamfered edge of spacer toward 22 tooth gear. Next, install bearing onto shaft (Illust. 6). Press or drive bearing (Illust. 7). Snap ring groove in bearing toward threaded end of shaft.

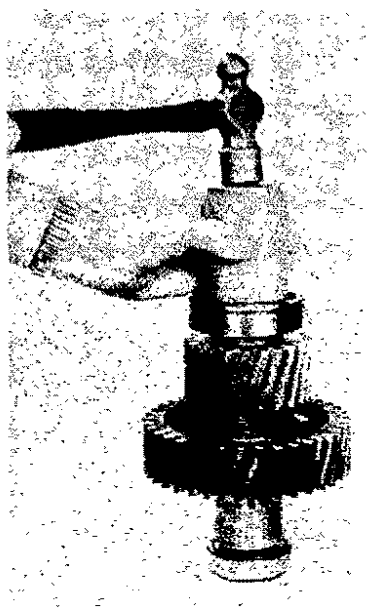
Install locking nut onto shaft (Illust. 8).



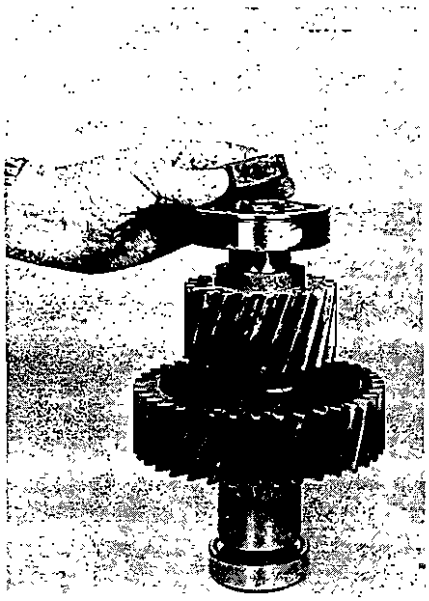
Illust. 5



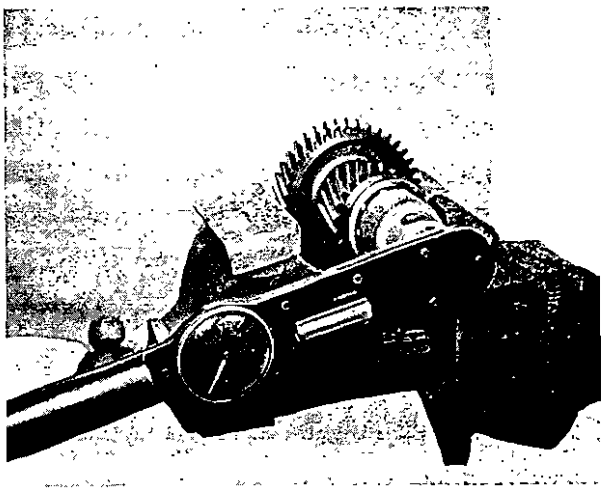
Illust. 6



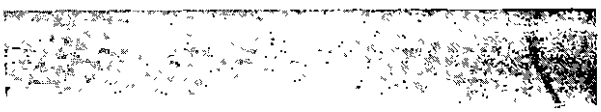
Illust. 7

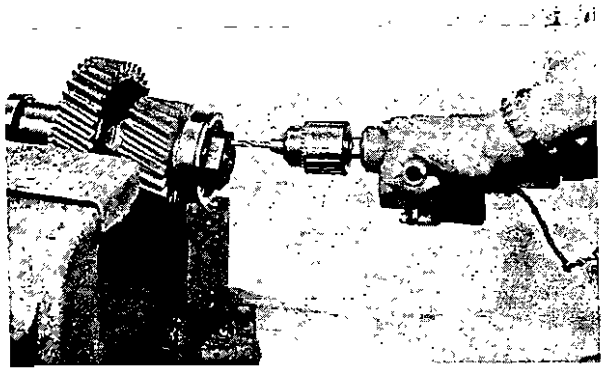


Illust. 8

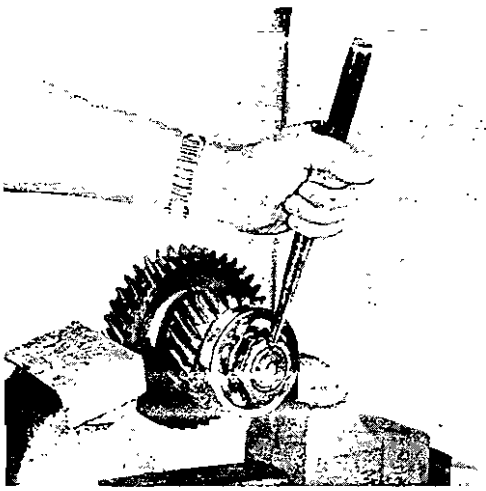


Illust. 9





Illust. 11



Illust. 10

Place lower creeper gear assembly into a vise. Use a soft metal over vise jaws to prevent damage to gear teeth. Tighten locking nut to a torque reading of 600 foot pounds (Illust. 9).

After torque reading is obtained, stake locking nut, using a drift pin and hammer (Illust. 10).

To remove stake from locking nut, use a drill (Illust. 11). Use care in drilling out stake to prevent damage to threads of shaft.

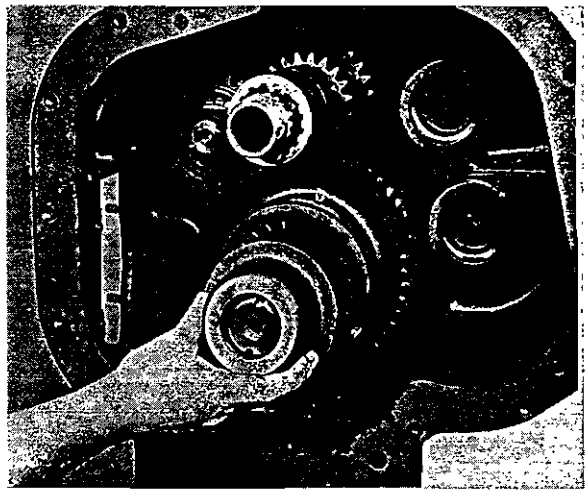
INSTALLATION OF CREEPER GEARS

When installing creeper gears for the first time, the spacer (Illust. 1) must be removed from the lower shaft. Another gear must be added in its place.

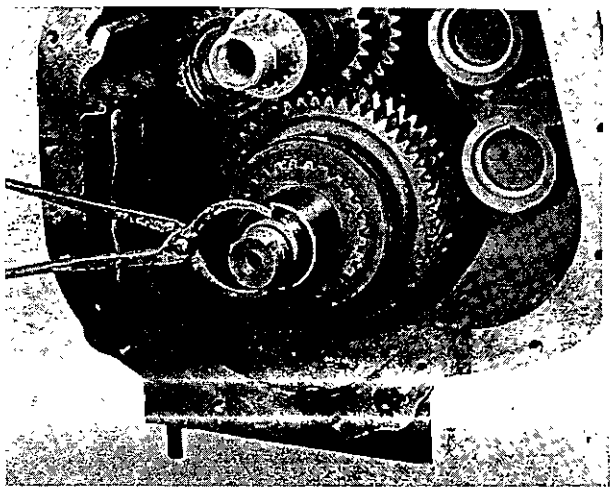
Heat bearing race in oil and install to lower shaft (Illust. 2). Race to be against shifter gear. Hold race until set.

Install both upper and lower creeper gear assemblies into upper transmission at the same time (Illusts. 3 and 4). Using a rawhide mallet, bump both shafts until seated in housing (Illusts. 5 and 6). Remove locking nut from upper creeper shaft.

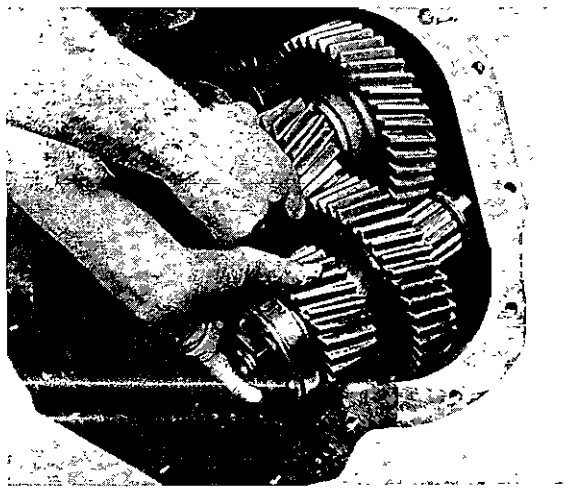
Remove snap ring from bearing of lower creeper shaft (Illust. 7).



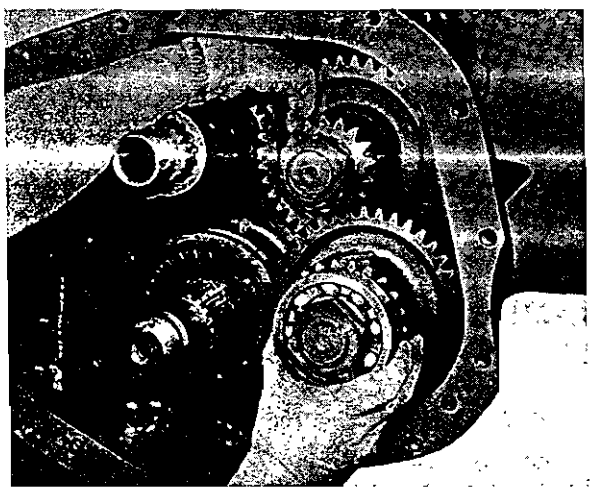
Illust. 1



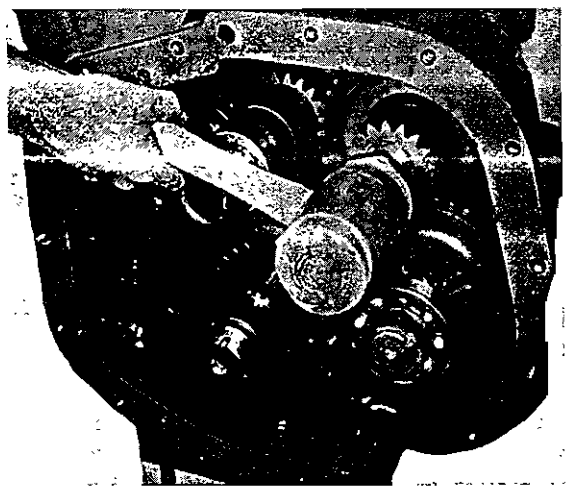
Illust. 2



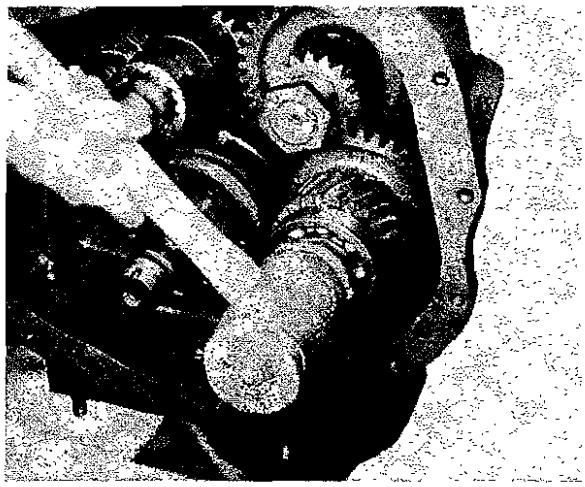
Illust. 3



Illust. 4



Illust. 5



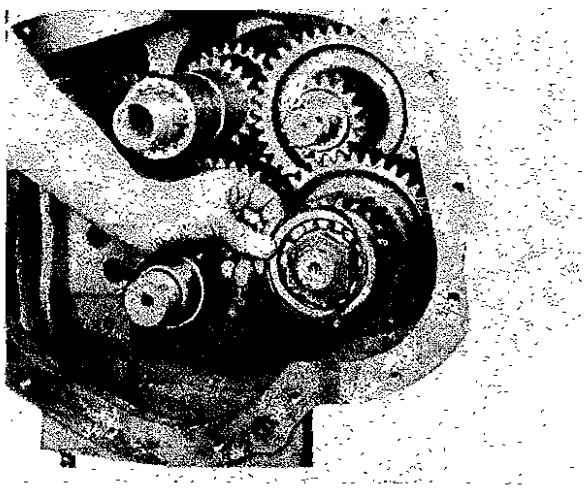
Illust. 6

Install 53 tooth gear onto lower shaft. Next, insert bearings into gear and onto bearing race (Illust. 8).

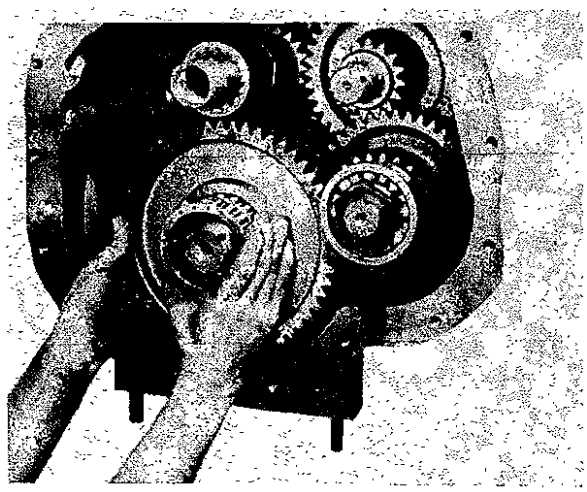
Install spacer onto lower shaft (Illust. 9). Flat side of spacer toward gear.

Install studs into upper transmission cover (Illust. 10). Install dowel pins, using a rawhide mallet. Do not drive dowel pins through cover.

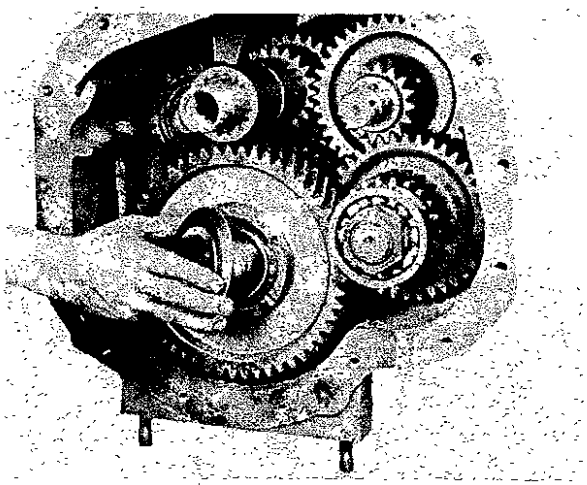
Turn upper transmission cover over and install baffle and gasket (Illust. 11), long side of baffle toward gear box. Install cap screws and lock washers. Tighten cap screws securely (Illust. 12).



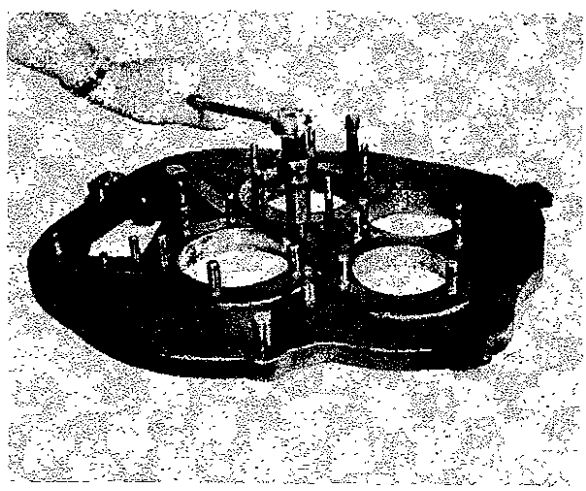
Illust. 7



Illust. 8



Illust. 9



Illust. 10

Shellac gasket to upper transmission. Install two or more guides into upper transmission cap screw holes.

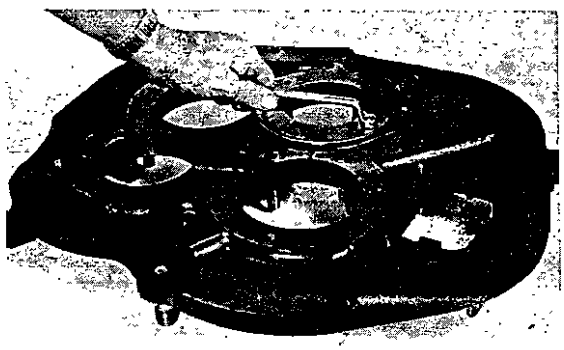
Install cover onto guides. Bump cover, using a rawhide mallet, until cover is against gasket (Illust. 13).

Install snap ring into groove of lower creeper shaft bearing (Illust. 14). Using a rawhide mallet, bump shaft back into upper transmission housing until snap ring in bearing is against cover (Illust. 15).

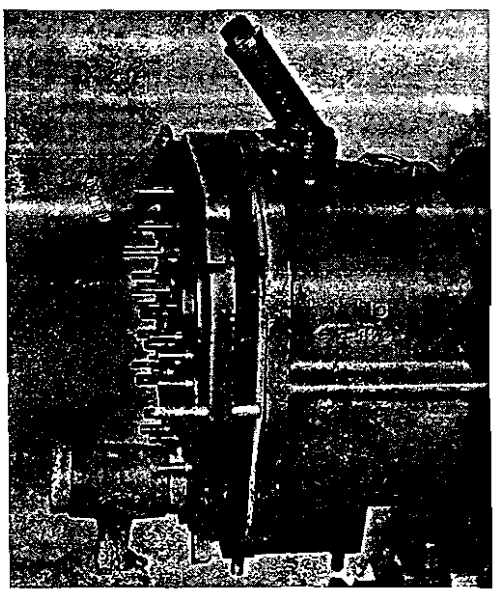
Install four upper transmission cover cap screws with lock washers. Do not tighten cap screws. Next, remove guides. Drive dowel pins through cover and into housing, using a rawhide mallet (Illust. 16).

Install the remaining cover cap screws with lock washers. Tighten cap screws to a torque reading of 65 foot pounds (Illust. 17).

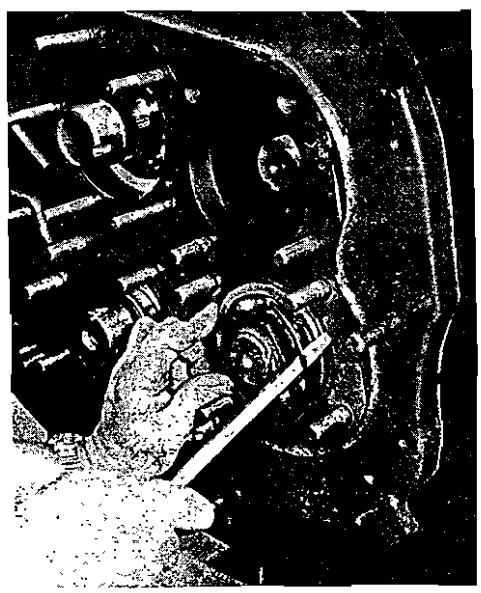
Illust. 11



Illust. 12



Illust. 13

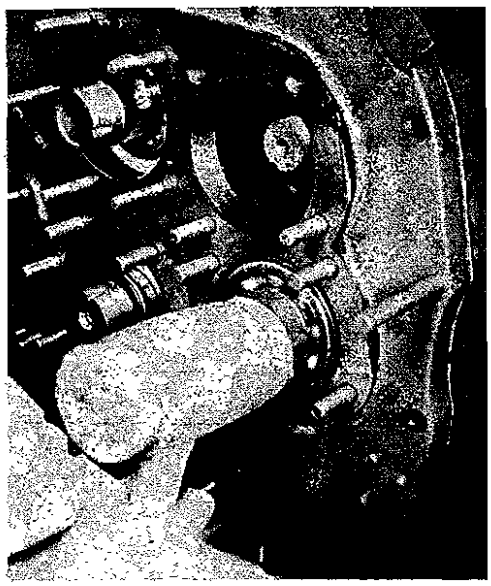


Illust. 14

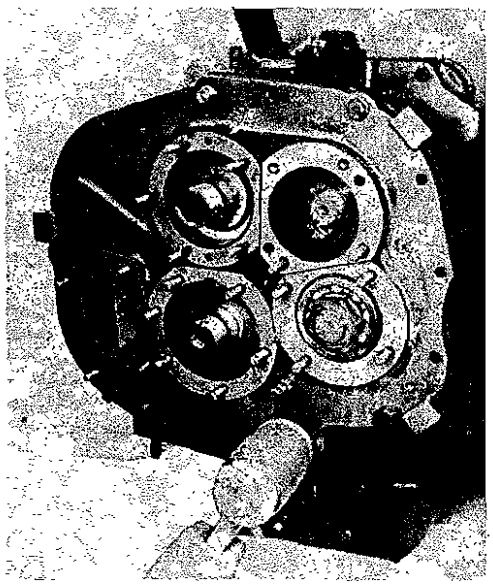
Press or drive bearing into bearing cage (Illust. 18). Next, install snap ring in groove of bearing cage (Illust. 19).

Shellac bearing cage gasket and lower creeper shaft cover gasket to upper transmission cover.

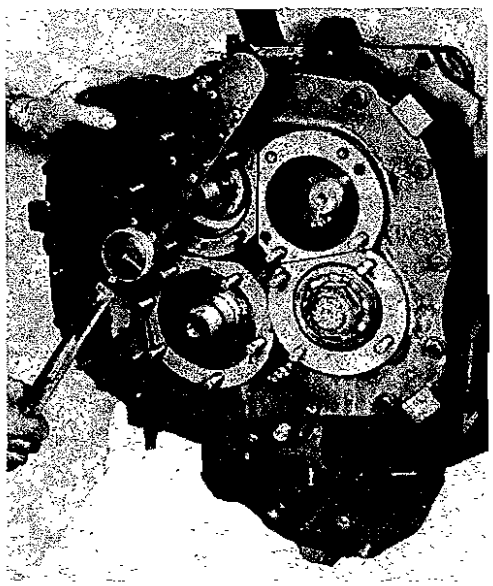
Install bearing cage with bearing into cover (Illust. 20). Using a rawhide mallet and driver, drive bearing onto upper creeper shaft (Illust. 21).



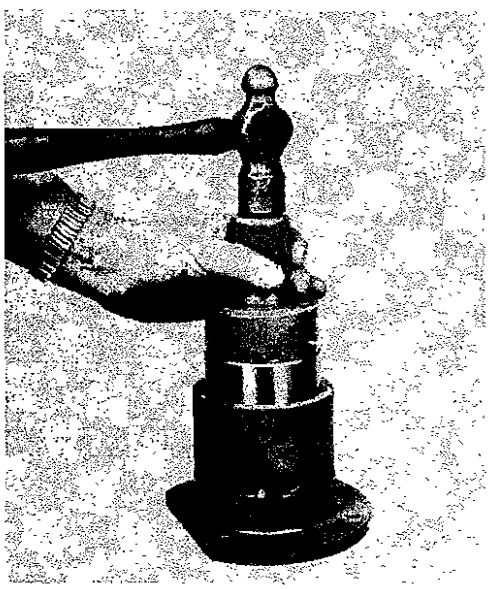
Illust. 15



Illust. 16



Illust. 17

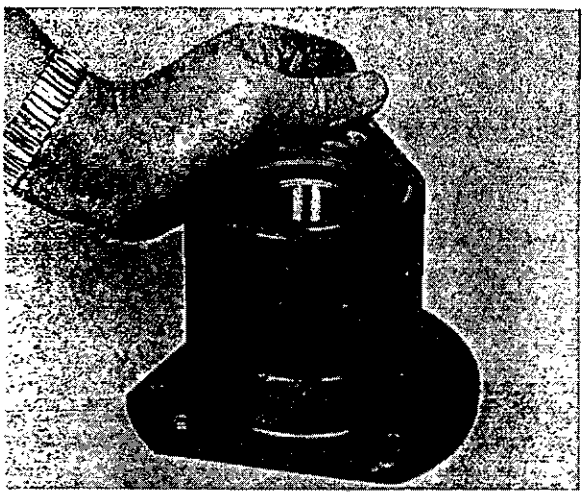


Illust. 18

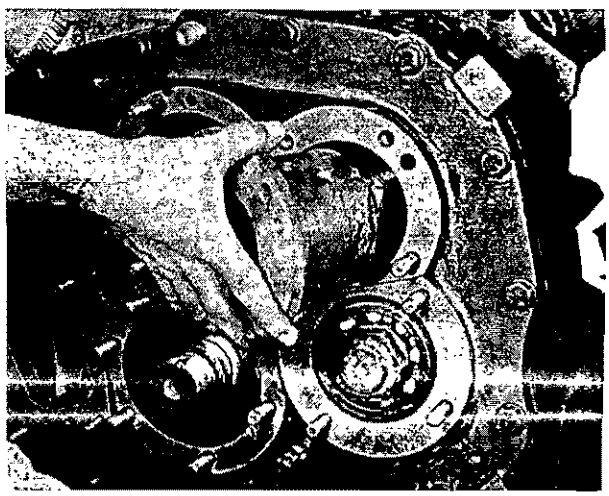
To remove cage with bearing, install two set screws into cap screw holes (Illust. 22). By tightening set screws, cage will be forced from cover.

Install nut to upper creeper shaft (Illust. 23).

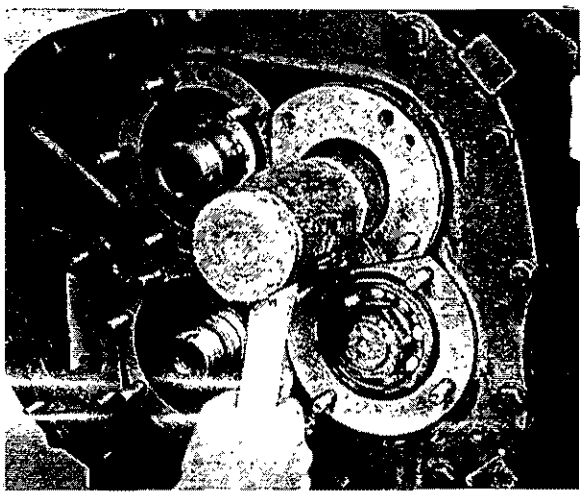
Install bearing with snap ring onto lower shaft of upper transmission (Illust. 24). Using a rawhide mallet and driver, drive bearing over shaft and into cover (Illust. 25). Snap ring to be against cover. NOTE: Slot in snap ring to be in line with oil hole in cover.



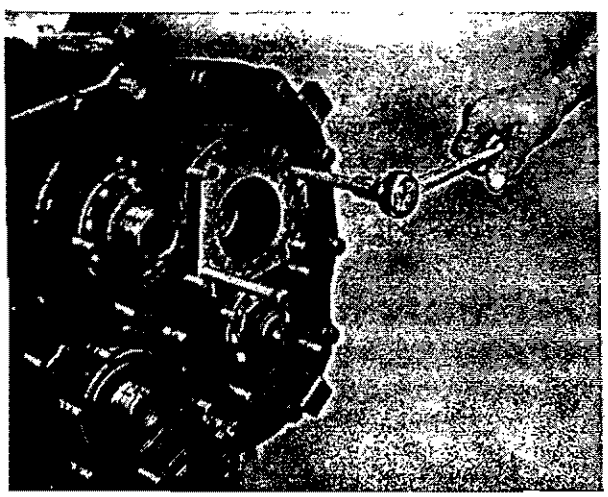
Illust. 19



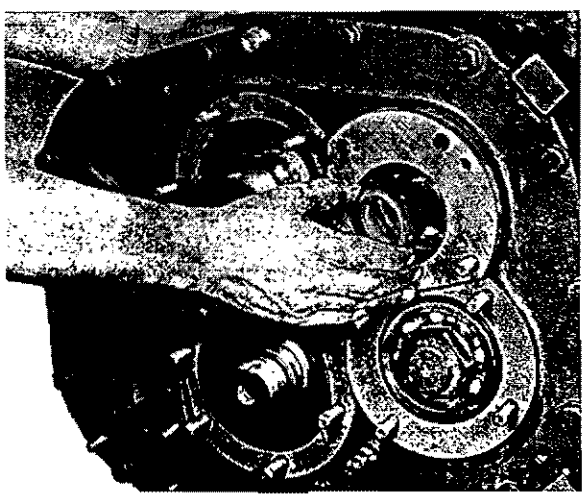
Illust. 20



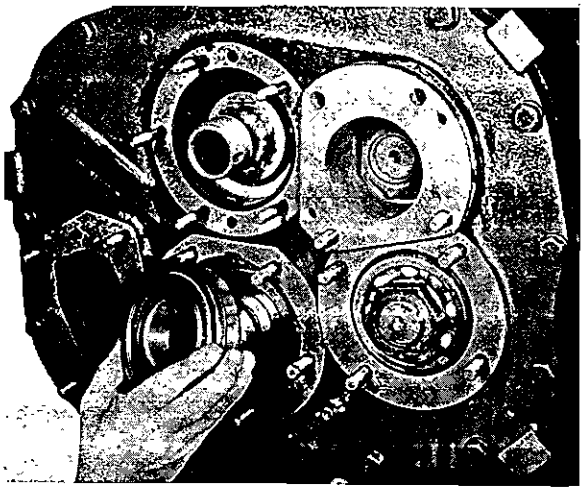
Illust. 21



Illust. 22



Illust. 23



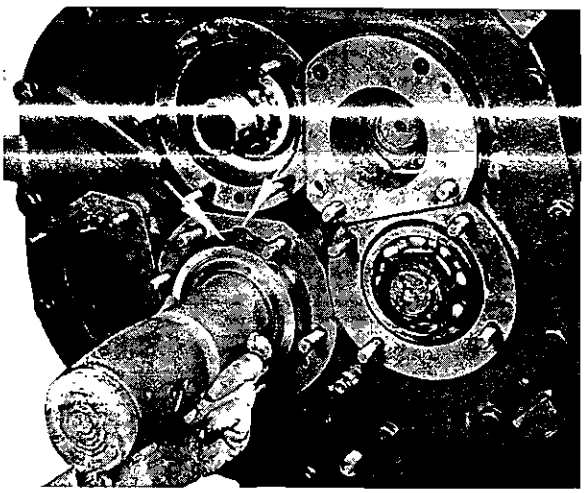
Illust. 24

Install spacer onto lower shaft (Illust. 26).

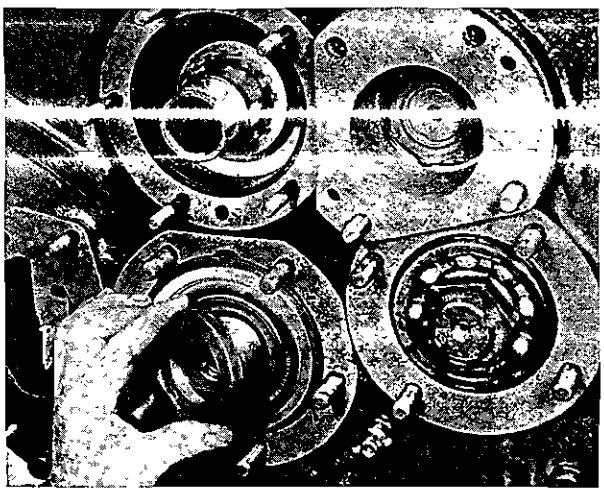
Install locking nut onto lower shaft (Illust. 27).

Install bearing with snap ring onto upper shaft (Illust. 28). Using a hammer and driver (Illust. 29), drive bearing onto shaft and into upper transmission cover. NOTE: Hold a block of wood against flanged end of shaft to avoid driving upper shaft through rear bearing and retainer.

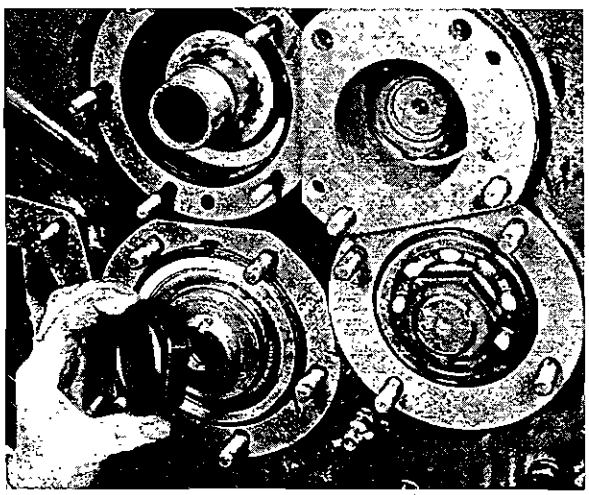
Tighten lower shaft locking nut to a torque reading of 750 foot pounds (Illust. 30). Stake nut,



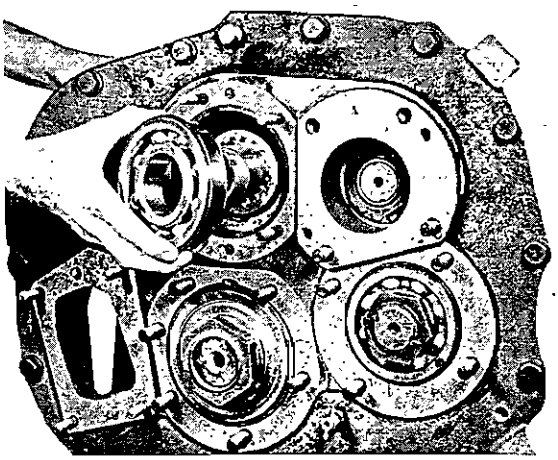
Illust. 25



Illust. 26



Illust. 27



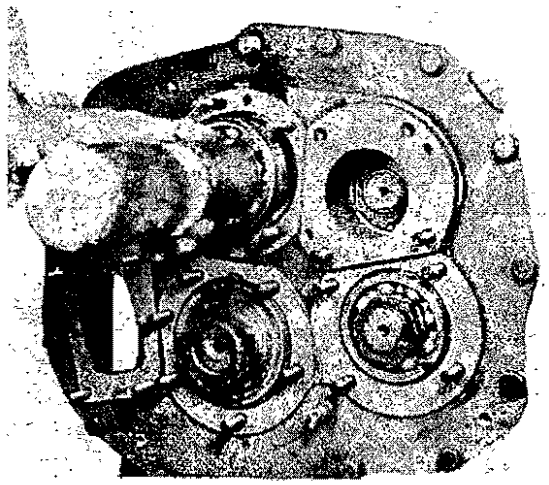
Illust. 28

using a hammer and drift pin (Illust. 31).

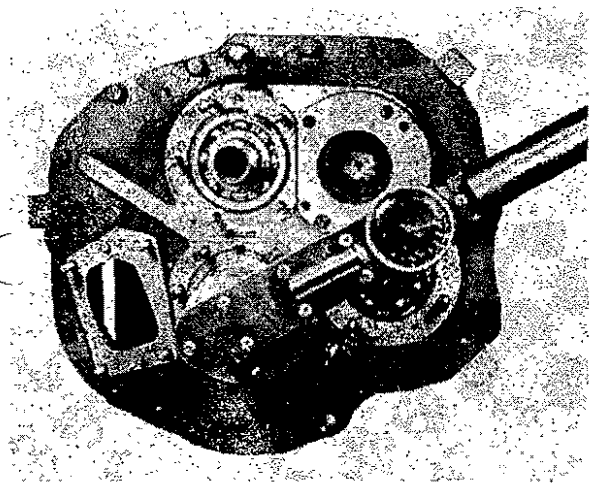
To remove stake from locking nut, use a drill (Illust. 32). Avoid damaging threads of shaft when drilling out stake.

Tighten upper creeper shaft locking nut to a torque reading of 600 foot pounds (Illust. 33). Stake locking nut, using a blunt chisel and hammer (Illust. 34).

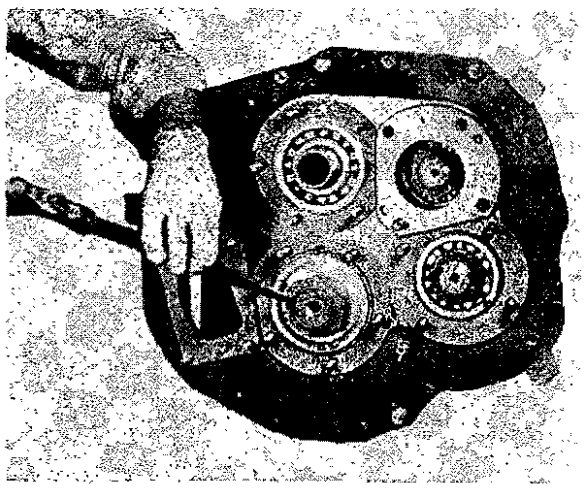
To remove stake from locking nut, use a drill (Illust. 35). Avoid damaging threads of shaft when drilling out stake.



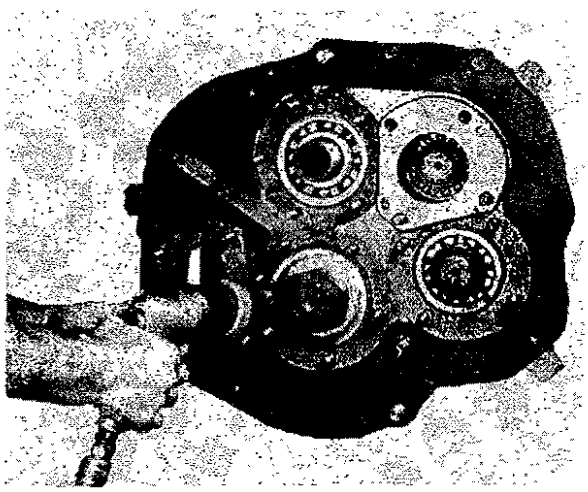
Illust. 29



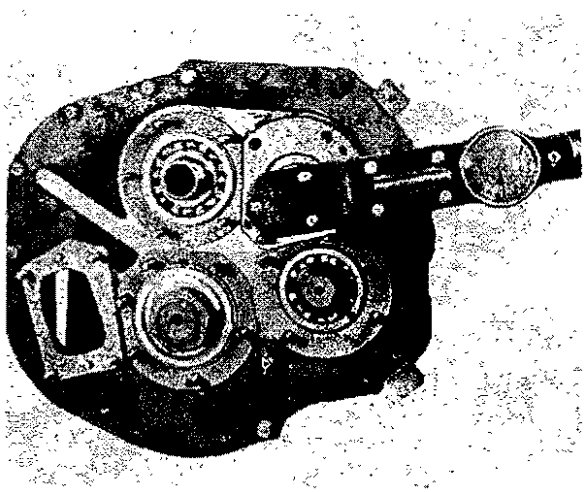
Illust. 30



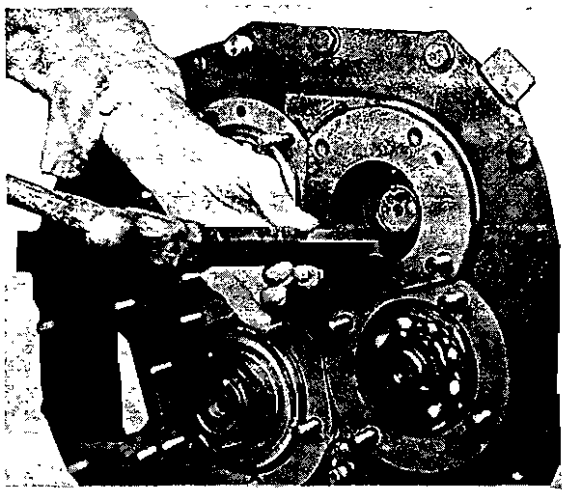
Illust. 31



Illust. 32



Illust. 33

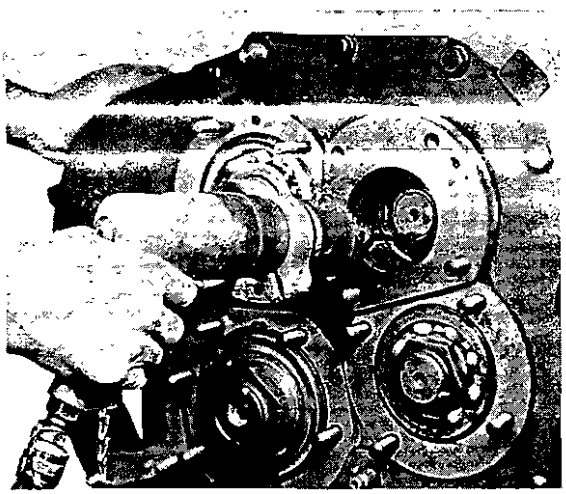


Illust. 34

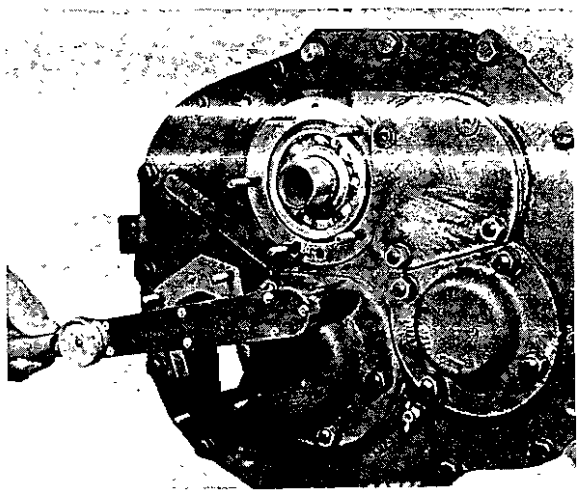
Install gasket and upper creeper cover over studs and onto upper transmission cover. Install two Allen head cap screws with copper washers. Next, install stud nuts with lock washers. Tighten Allen head cap screws and stud nuts to a torque reading of 65 foot pounds (Illust. 36).

Install gasket and lower creeper cover over studs and onto upper transmission cover. Next, install lock washers and stud nuts. Tighten stud nuts to a torque reading of 65 foot pounds (Illust. 37).

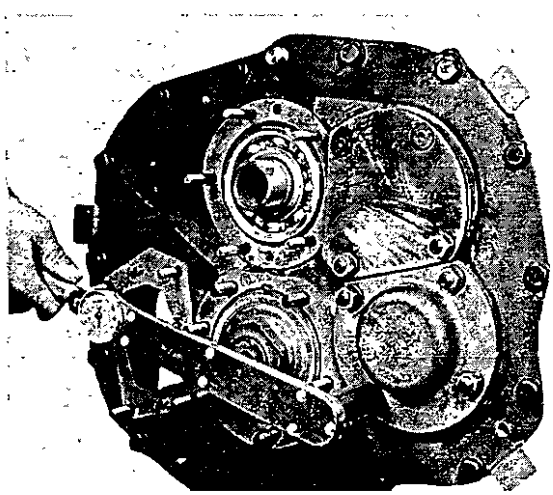
Install gasket and lower shaft cover over studs and onto upper transmission cover. Install lock wash-



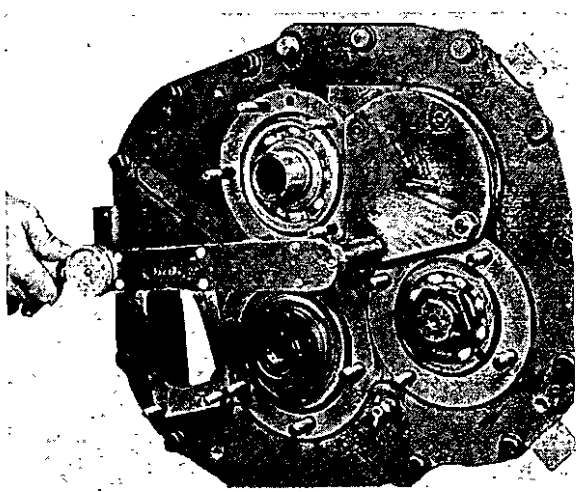
Illust. 35



Illust. 36



Illust. 37



Illust. 38

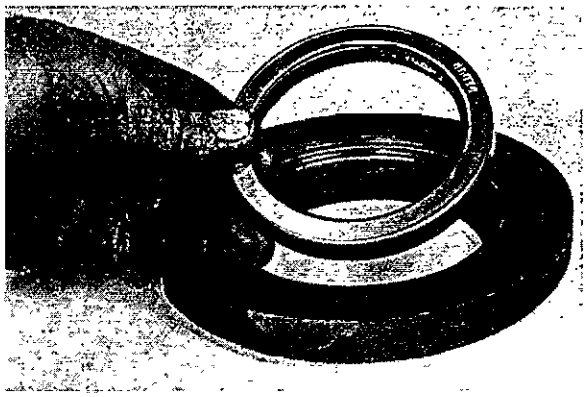
ers and stud nuts. Tighten stud nuts to a torque reading of 65 foot pounds (Illust. 38).

Install oil seal into retainer (Illust. 39). Lip of seal toward bearing. Using a driver and hammer, drive oil seal to pilot (Illust. 40).
NOTE: Use shellac to seal around oil seal.

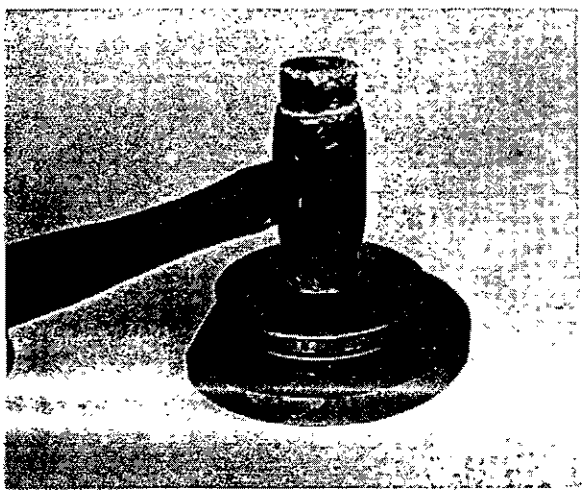
Insert spacer into oil seal (Illust. 41). Chamfered end of spacer away from lip of oil seal.

Install gasket and seal retainer over upper shaft and onto cover (Illust. 42). Using a hammer and driver, drive spacer onto shaft (Illust. 43).

Install lock nut onto upper shaft (Illust. 44).



Illust. 39



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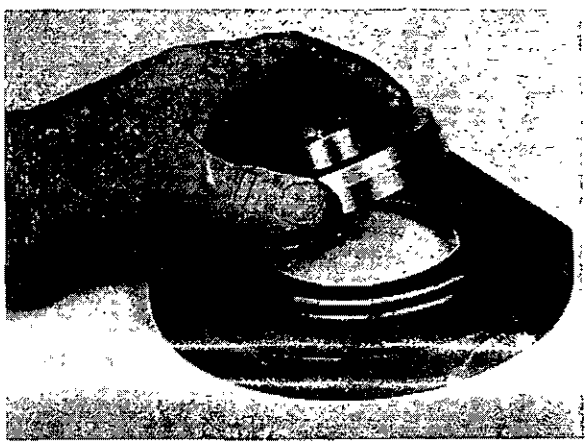

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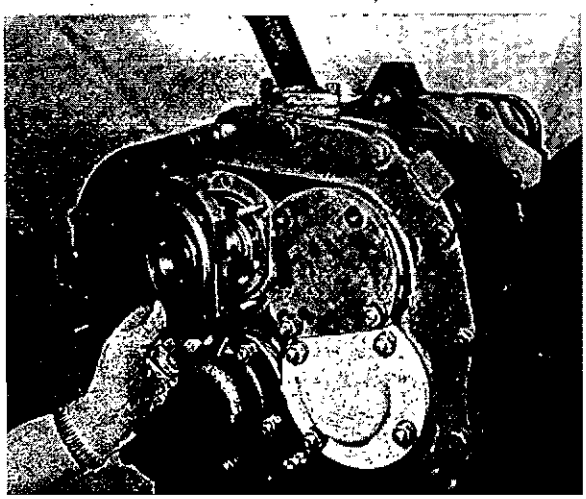

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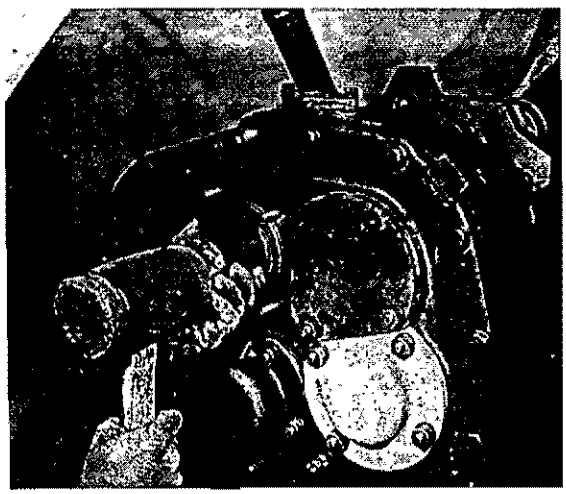

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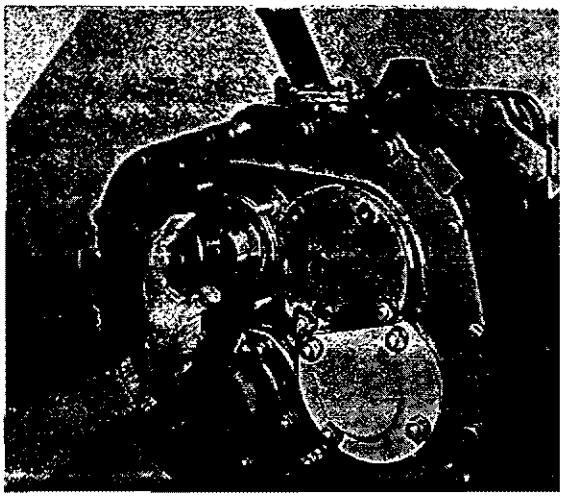
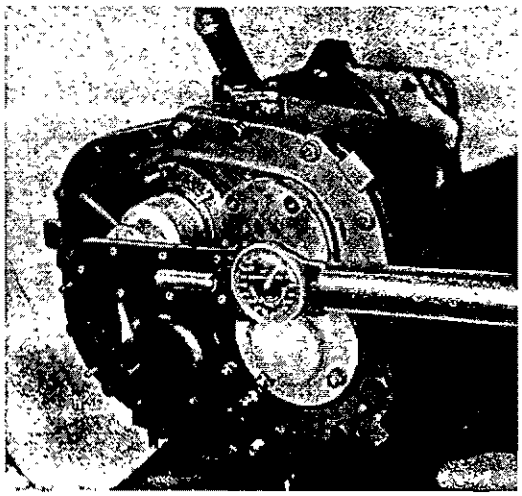
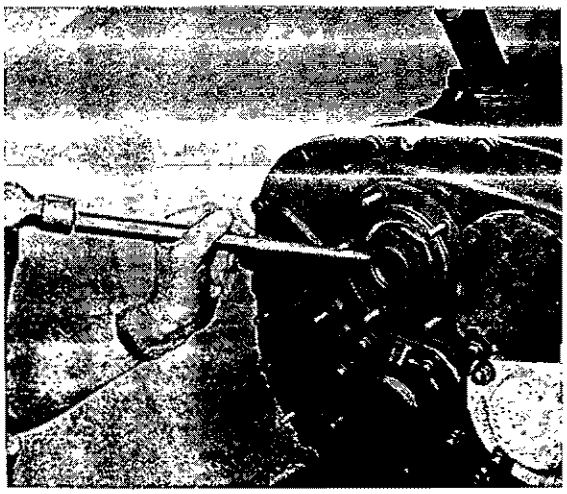


Illust. 44



Illust. 45



Illust. 46

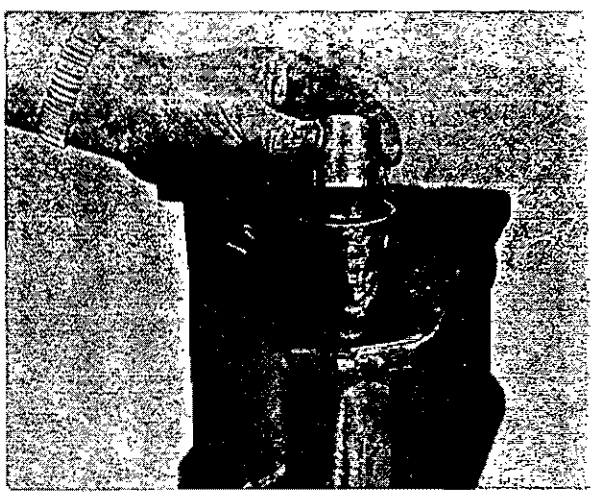
Tighten nut to a torque reading of 750 foot pounds (Illust. 45).

Stake locking nut, using a drift pin and hammer (Illust. 46).

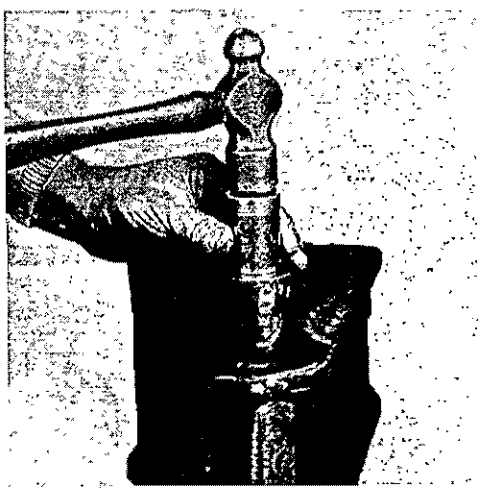
To remove stake from locking nut, use a drill. Avoid damaging threads of shaft, when drilling out stake.

SHIFTER MECHANISM

Insert bushing into shifter housing (Illust. 1). Using a hammer and driver, drive bushing into



Illust. 1



Illust. 2

housing (Illust. 2).

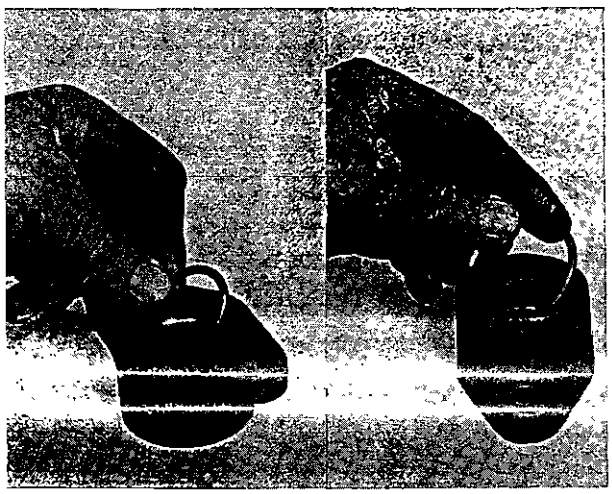
Install "O" ring into groove of shifter housing (Illust. 3).

Insert small "O" ring into groove of rocker shaft end. Turn rocker shaft end over and insert large "O" ring (Illust. 4).

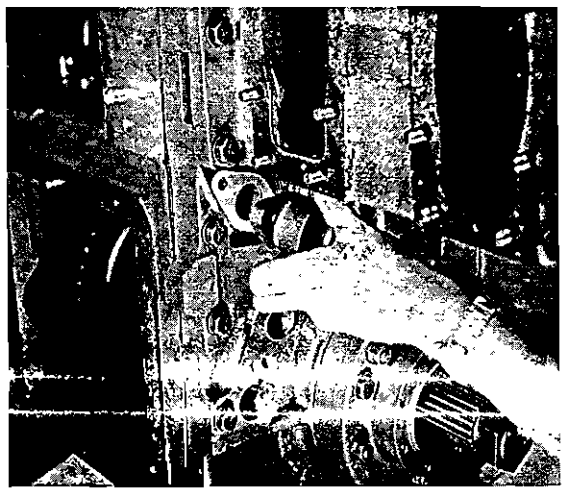
Install rocker shaft end with gasket to intermediate plate (Illust. 5). Install cap screws with lock washers, but do not tighten.

Insert rocker shaft tube into rocker shaft end (Illust. 6). NOTE: To protect "O" ring from damage, use white lead.

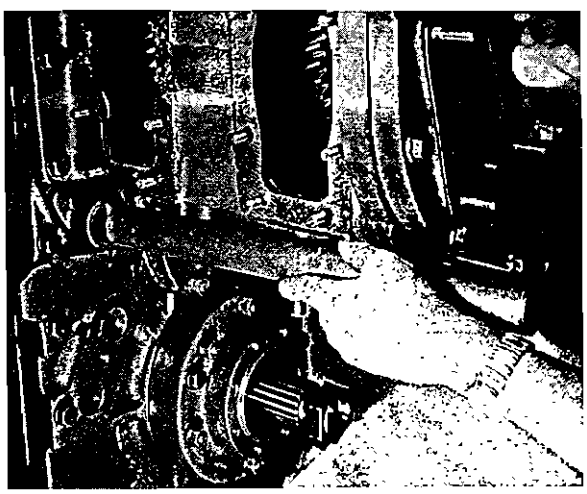
Illust. 3



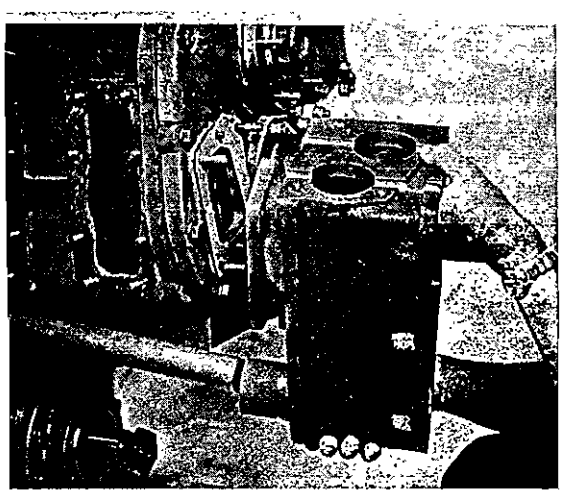
Illust. 4



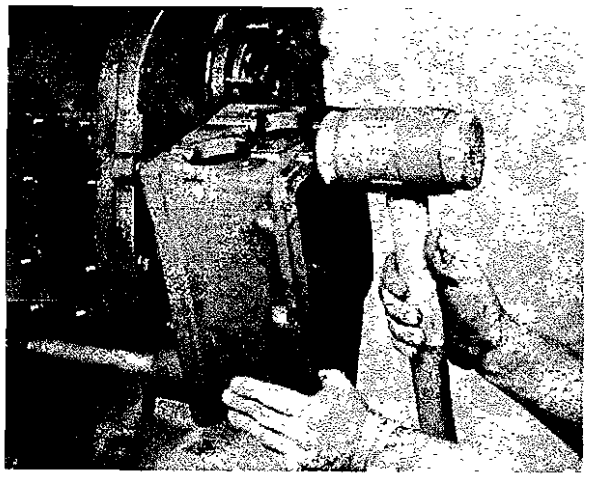
Illust. 5



Illust. 6



Illust. 7



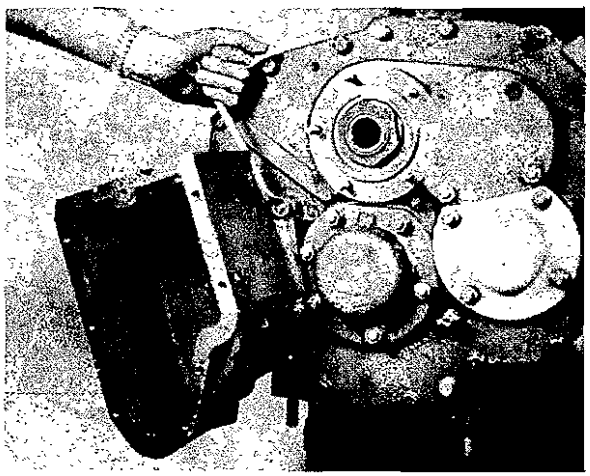
Illust. 8

Shellac shifter housing gasket to upper transmission cover. Next, install shifter housing onto studs and at the same time, insert rocker shaft tube into shifter housing (Illust. 7). NOTE: To protect "O" ring from damage, use white lead.

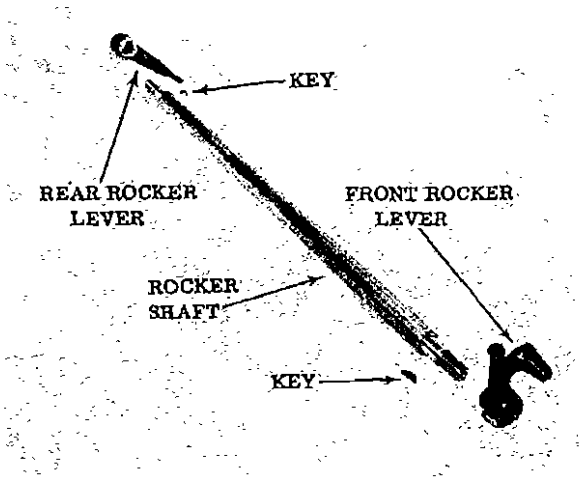
Using a rawhide mallet, bump shifter housing onto dowels (Illust. 8).

Install stud nuts with lock washers. Tighten nuts securely (Illust. 9).

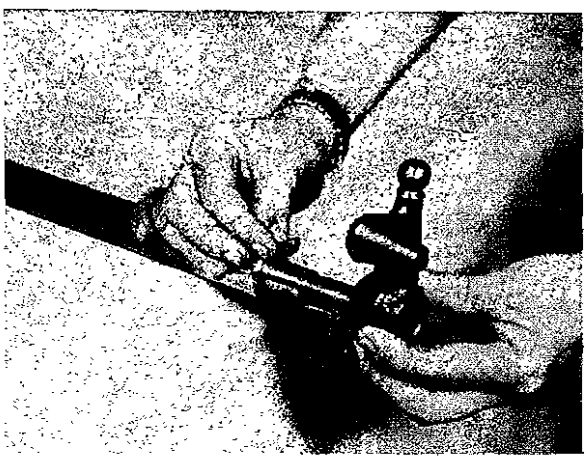
Illust. 10 is an exploded view of the rocker shaft.



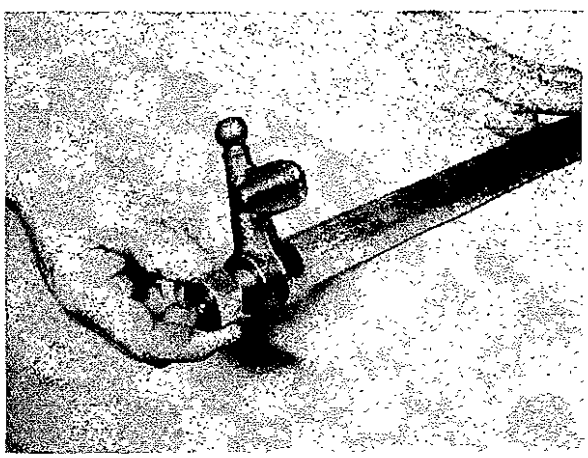
Illust. 9



Illust. 10



Illust. 11



Illust. 12

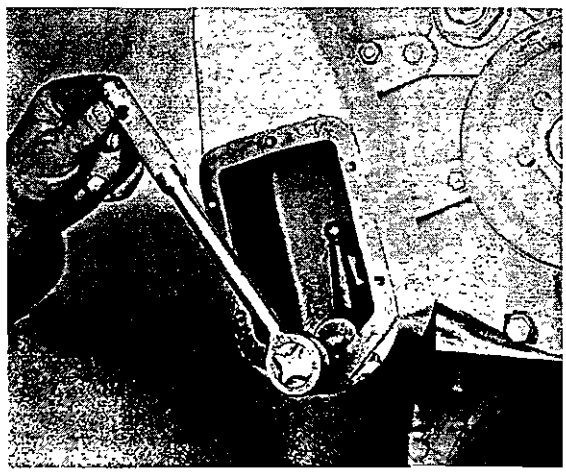
Insert key in keyway of rocker shaft. Next, insert front rocker lever onto shaft and over key (Illust. 11).

Install nut onto shaft (Illust. 12).

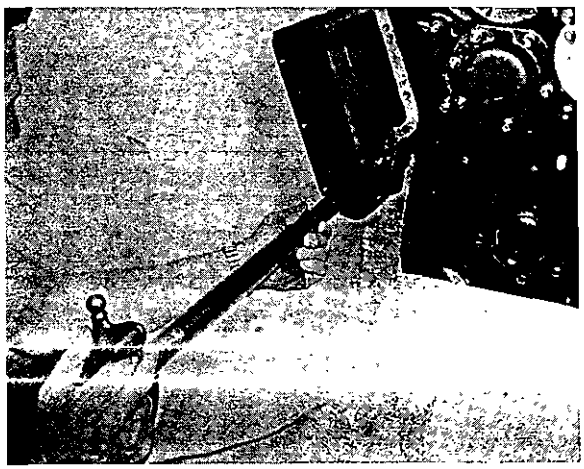
Insert second key in keyway of rocker shaft (Illust. 13).

Insert rocker shaft into shifter housing, through rocker shaft tube and into lower transmission (Illust. 14). NOTE: Key in rocker shaft toward gears in lower transmission.

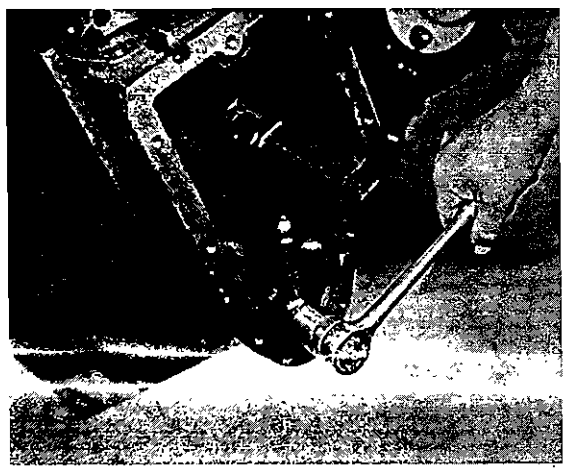
Install front nut to rocker shaft. Tighten nut securely (Illust. 15). Next, install cotter pin and spread (Illust. 16).



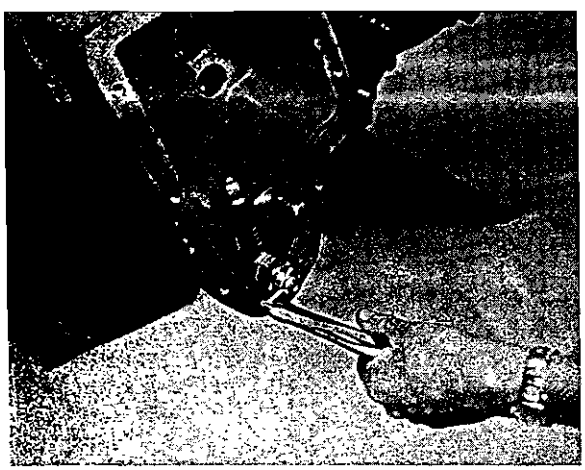
Illust. 13



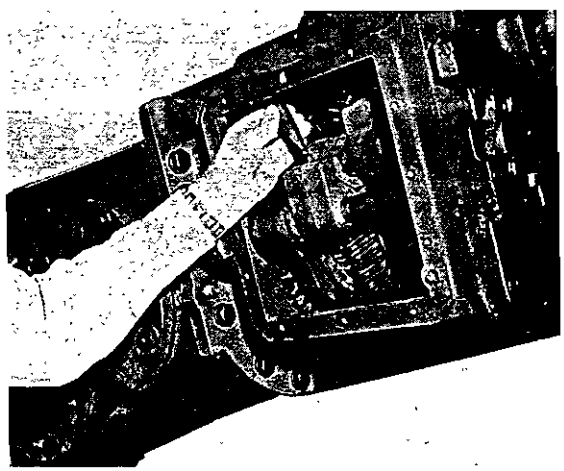
Illust. 14



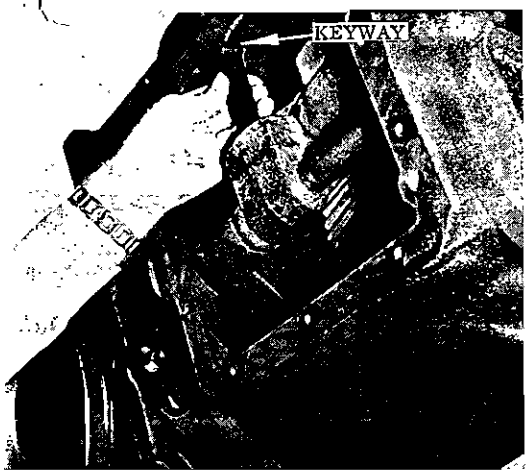
Illust. 15



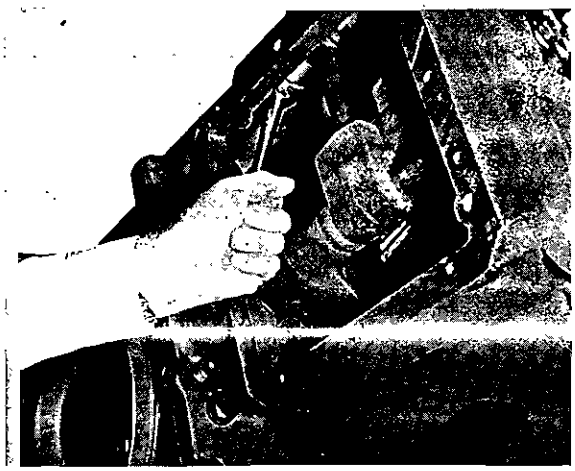
Illust. 16



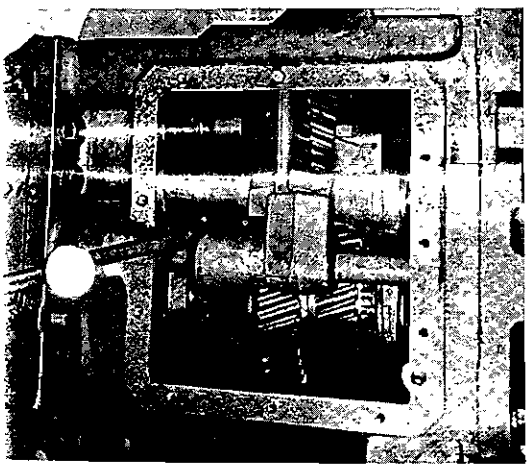
Illust. 17



Illust. 18

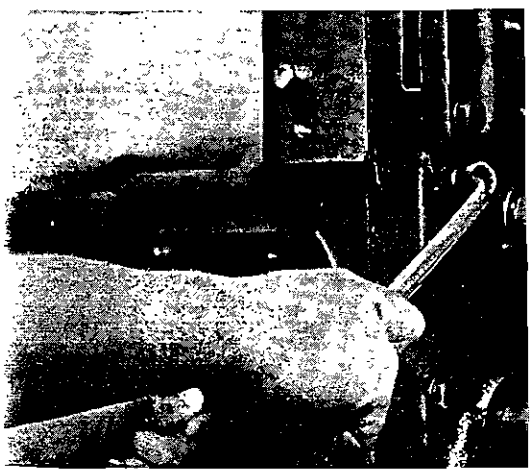


Illust. 19



Illust. 20

Illust. 21



Illust. 22

To install rear rocker shaft lever, insert knob of lever into slots of shifter forks (Illust. 17). Next, install lever onto rocker shaft and over key (Illust. 18). NOTE: Keyway in lever toward gears in lower transmission.

Install rear nut to rocker shaft (Illust. 19). Tighten nut securely. NOTE: It is necessary to shift lower fork forward (Illust. 20), to allow sufficient space for wrench.

Install cotter pin in rocker shaft and spread (Illust. 21).

igh(rocker shaft tube end cap screws and at the same time check for bindness of shifter

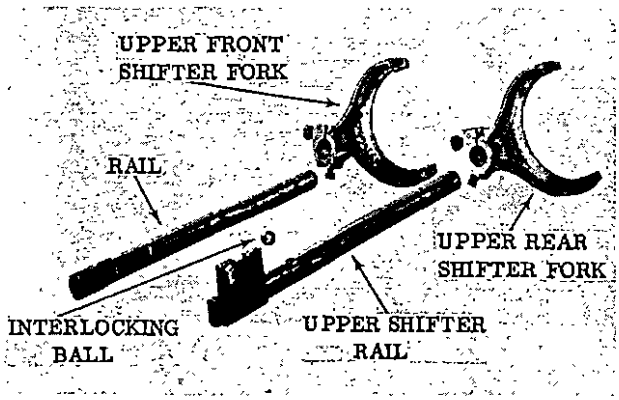
shaft (Illust. 22). If bindness is noted, loosen rocker shaft tube end cap screws and tap tube end with a mallet. When binding is eliminated, retighten cap screws.

UPPER SHIFTER RAILS

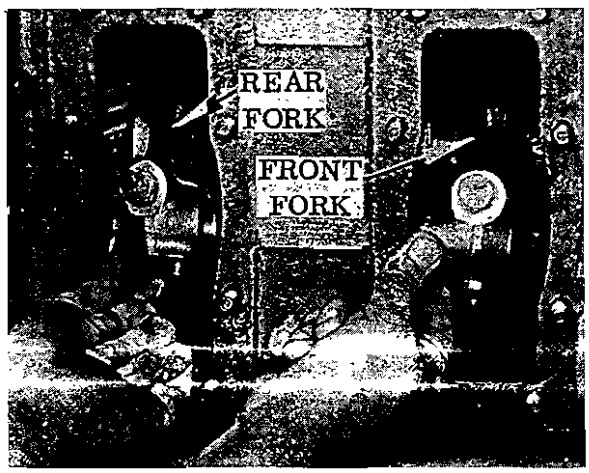
Illust. 1 is an exploded view of the upper shifter rails.

Insert the two forks into upper transmission and over shifter collars (Illust. 2). Long hub of forks facing each other.

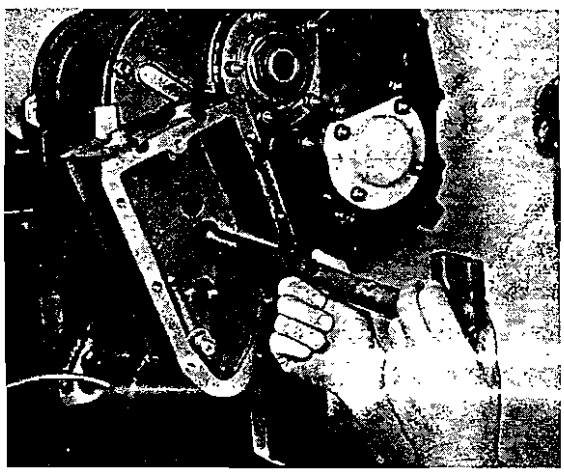
Insert lower shifter rail into lower hole of shifter housing (Illust. 3). NOTE: Shifter rail to be inserted under front shifter fork and into rear shifter fork.



Illust. 1

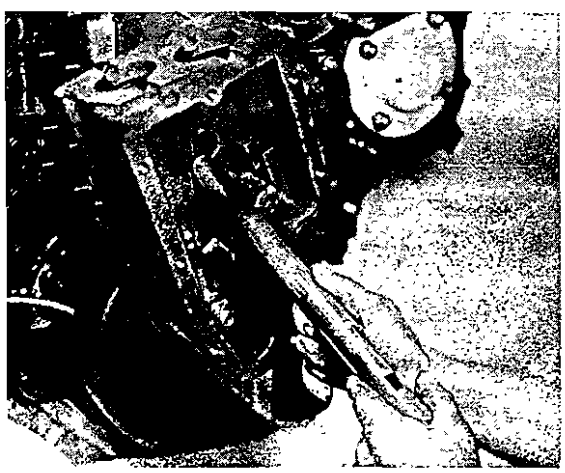


Illust. 2

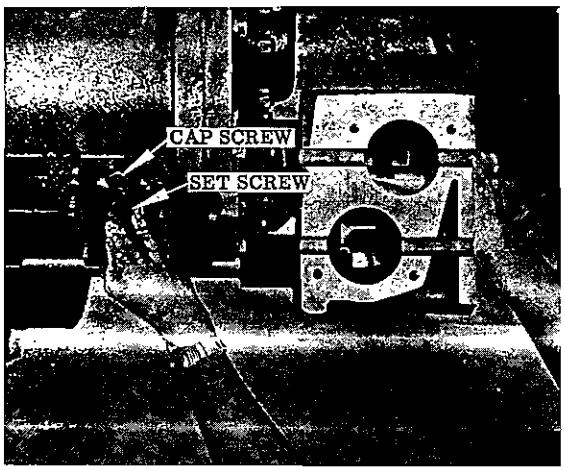


Illust. 3

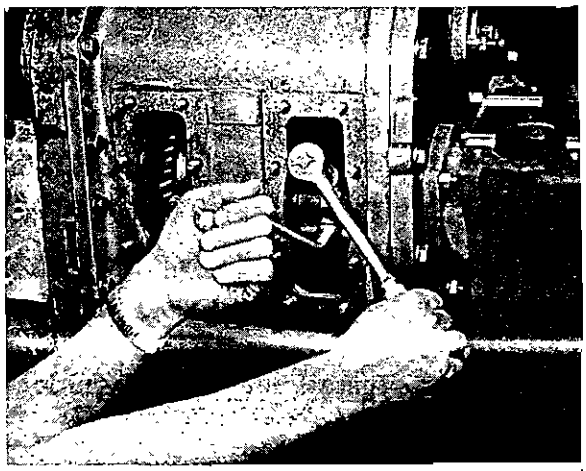
Illust. 4



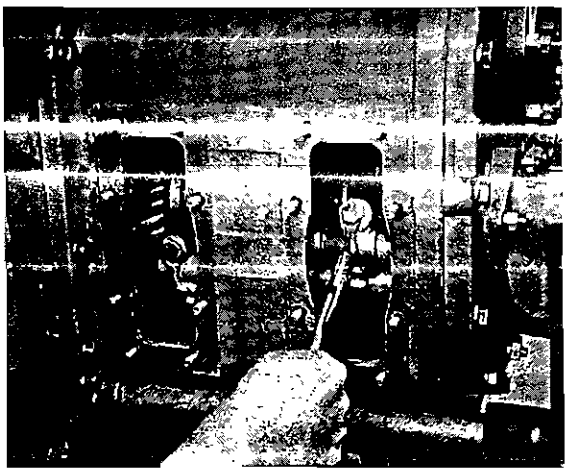
Illust. 5



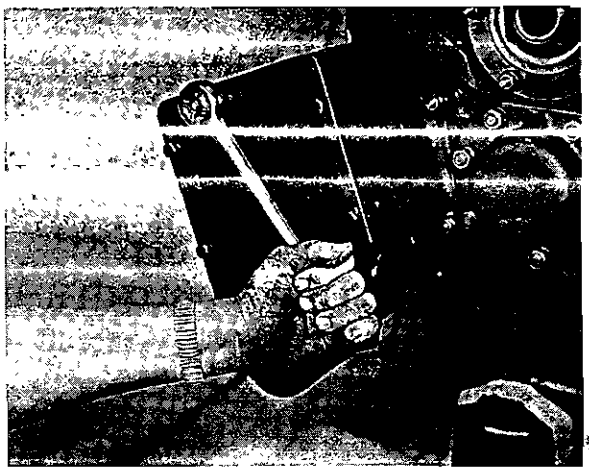
Illust. 6



Illust. 7



Illust. 8



Illust. 9

Insert interlocking ball into vertical hole of upper rail hole in shifter housing (Illust. 4). NOTE: Be sure ball is in groove of lower shifter rail.

Insert upper shifter rail into upper hole of shifter housing (Illust. 5). NOTE: Shifter rail to be inserted into front shifter fork.

Install cap screws and tapered end set screws into both front and rear shifter forks (Illust. 6). NOTE: Turn upper and lower shafts until hole in shafts align with set screws.

Tighten set screws securely, back off one-fourth of a turn, then tighten cap screws securely (Illust. 7). Re-tighten set screws to a torque reading of 65 foot pounds.

Lock cap screws and set screws securely with wire (Illust. 8).

Install gasket and cover to shifter housing (Illust. 9). Next, install cap screws and lock

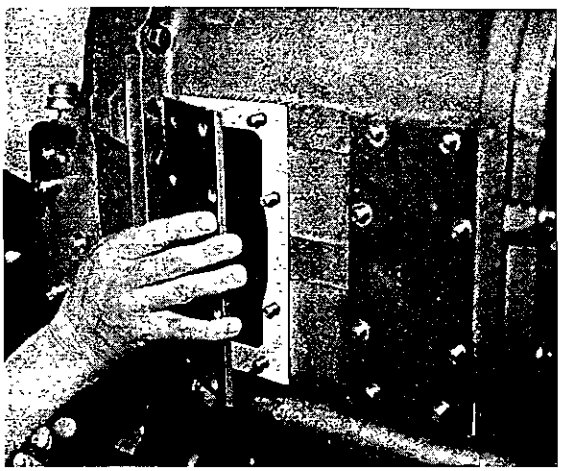
washers. Tighten cap screws securely.

Install cork gaskets to upper transmission. Install covers (Illust. 10). NOTE: Cover with magnet over front opening. Install stud nuts and lock washers. Tighten nuts securely.

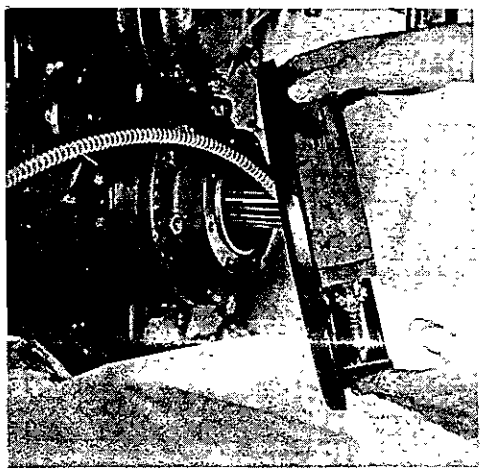
PARKING BRAKE

Install brake backing plate onto adapter plate (Illust. 1). Install cap screws and lock washers. Tighten cap screws securely (Illust. 2).

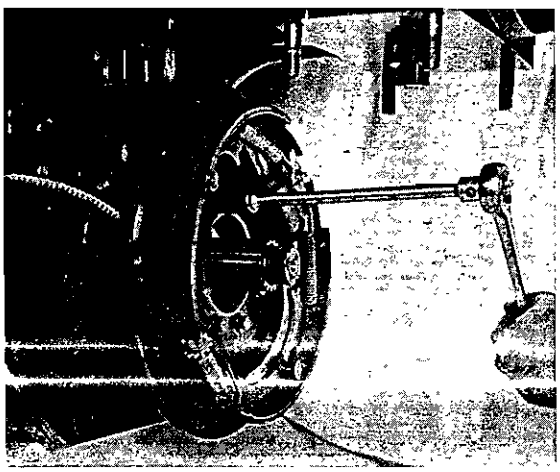
Install strut and springs (Illust. 3). NOTE: Use a screw driver to expand shoes to install strut and springs.



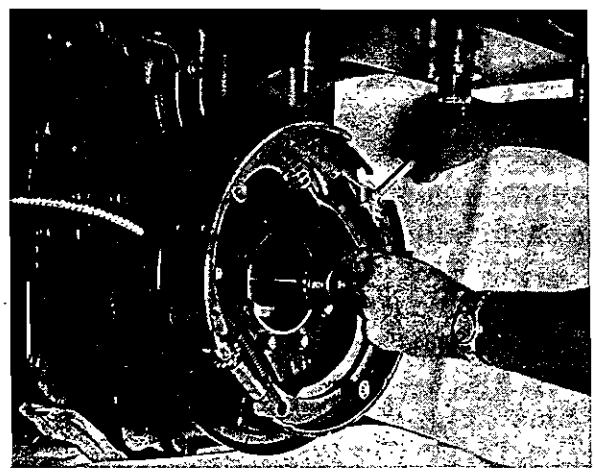
Illust. 10



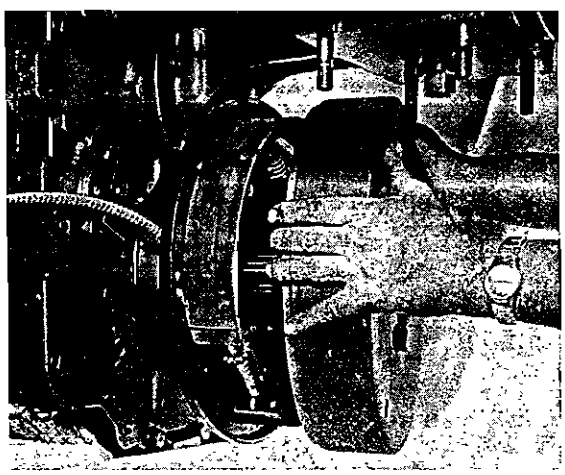
Illust. 1



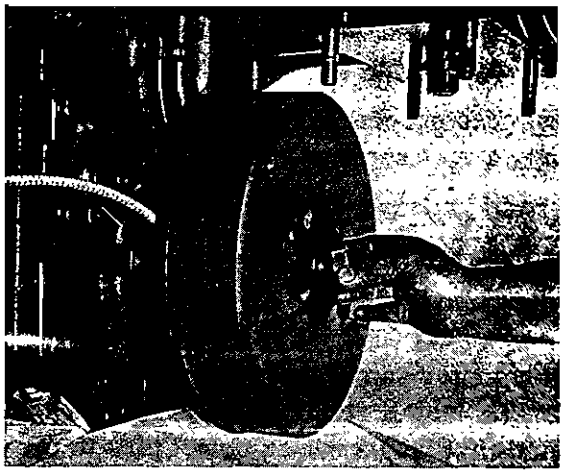
Illust. 2



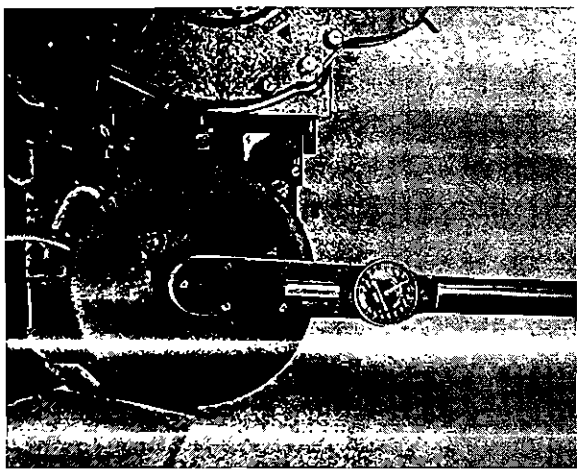
Illust. 3



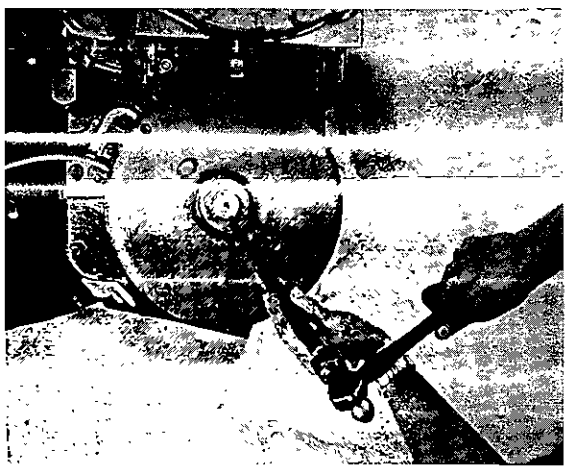
Illust. 4



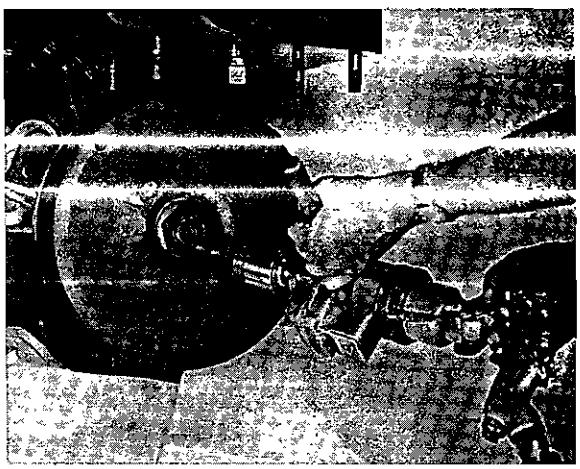
Illust. 5



Illust. 6



Illust. 7



Illust. 8

Install brake drum onto shaft and over brake shoes (Illust. 4).

Install lock nut (Illust. 5). Tighten nut to a torque reading of 600 foot pounds (Illust. 6). NOTE: To tighten nut, shift upper and lower transmission into gear.

Stake lock nut, using a drift pin and hammer (Illust. 7).

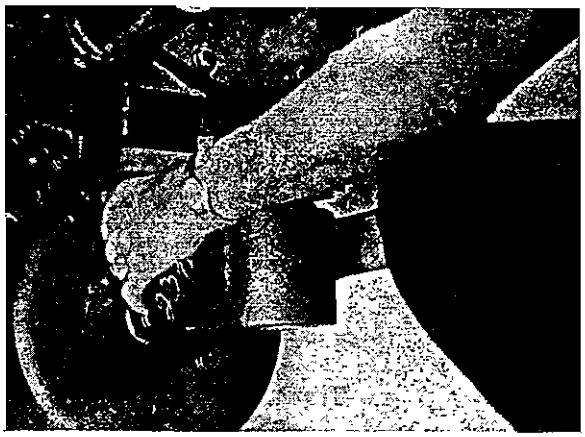
To remove stake from lock nut, drill out stake in line with slot in transmission shaft (Illust. 8).

Shift upper and lower transmission into neutral gear.

SUPPORT BRACKET, COVERS, MOUNTING BRACKETS AND MOTOR SUPPORT

Install transmission support bracket (Illust. 1). Install stud nuts and lock washers. Tighten nuts securely.

Install right lower transmission side cover and cork gasket (Illust. 2). NOTE: Magnets on cover to be toward bottom of transmission.

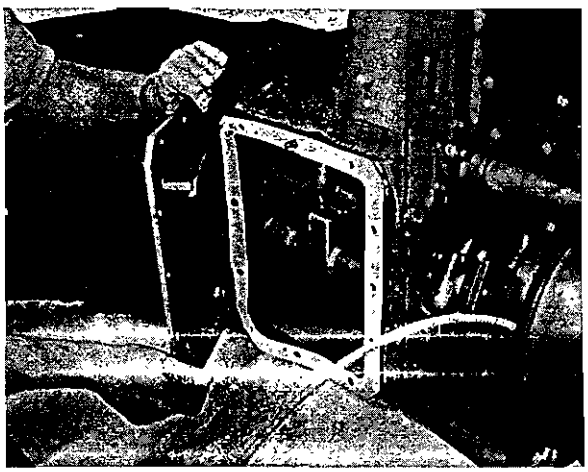


Illust. 1

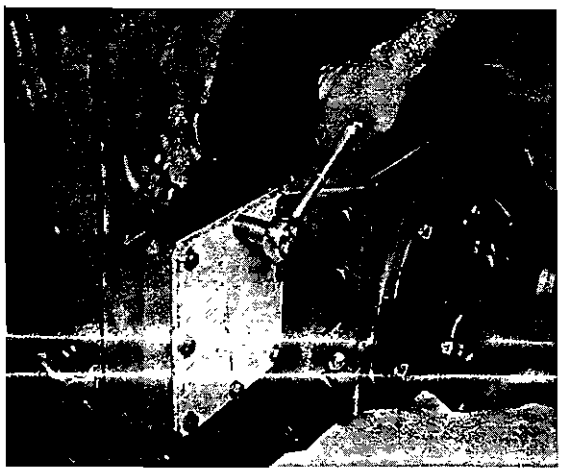
Install cover cap screws with lock washers. Tighten cap screws securely.

Install left lower transmission cover and gasket. Install cap screws and lock washers. Tighten cap screws securely (Illust. 3).

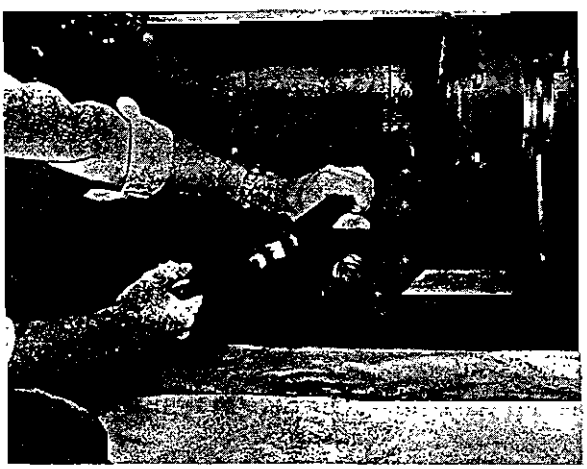
Install lower motor support and gasket to final drive housing. Install stud nuts and lock washers. Snug stud nuts. Place a nut on dowel pins to protect dowel pin threads. Drive dowel pins through motor support and into final drive housing (Illust. 4).



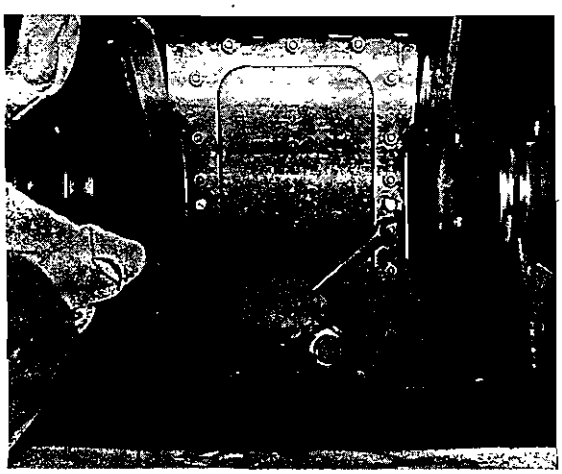
Illust. 2



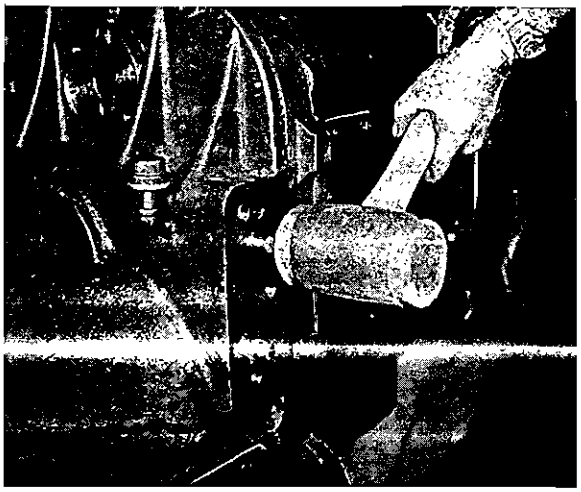
Illust. 3



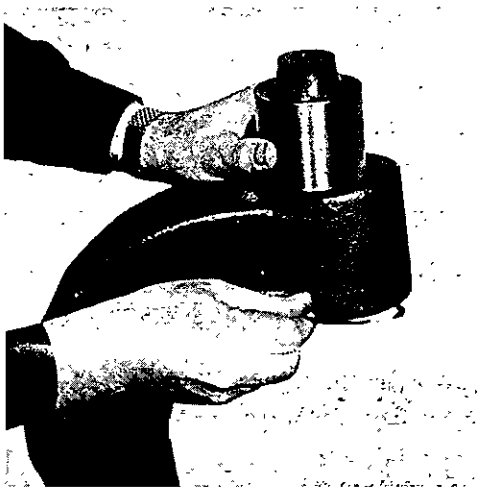
Illust. 4



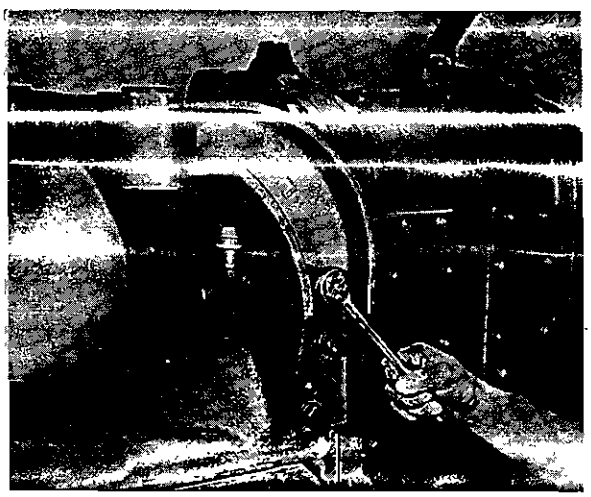
Illust. 5



Illust. 6



Illust. 7



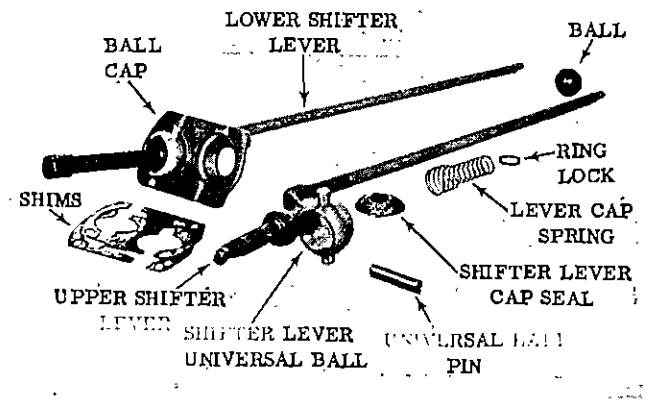
Illust. 8

When dowel pins have been seated, tighten stud nuts securely (Illust. 5). Remove nuts on dowel pins.

Install dowel pins in both sides of lower transmission housing (Illust. 6).

(Illust. 7). Install snap ring into bottom groove in both left and right flywheel motor mounts. Next, press tubular motor supports into mounts.

Install left and right flywheel motor mounts onto dowel pins. Bump mounts with mallet until flush against housing. Install cap screws with lock washers. Tighten cap screws securely (Illust. 8).



Illust. 1

SHIFTER LEVERS

Illust. 1 is an exploded view of the shifter levers.

Install shifter lever universal ball onto shifter lever. Align hole in shifter ball with hole in lever. Apply white lead on universal ball pin and press pin through shifter until top of pin is flush with universal ball (Illust. 2). NOTE: To prevent universal ball from becoming elongated, place ball on a block with a radius the same as that of ball.

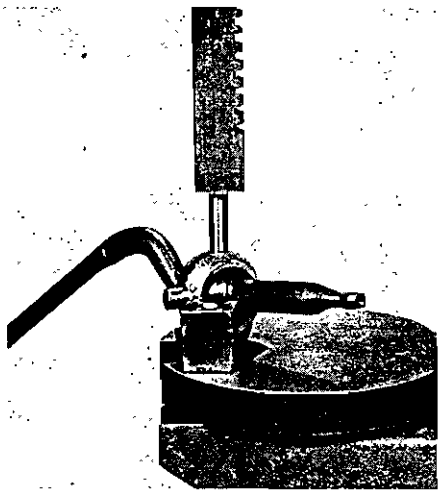
After pin has been pressed into ball and lever, check ball for freeness. If unable to move ball by hand, tap ball with a rawhide mallet.

Install the second universal ball to the other shifter lever in the same manner.

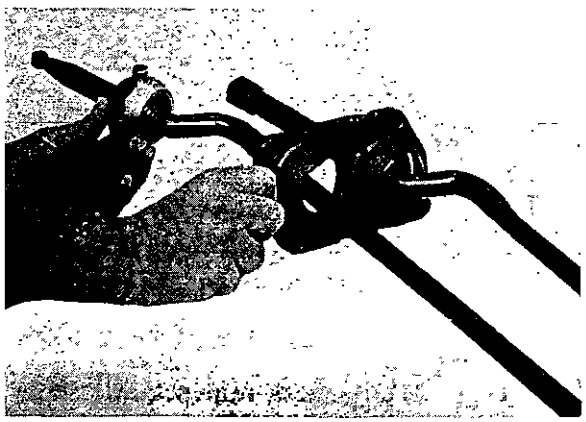
Install ball cap onto shifter levers (Illust. 3). IMPORTANT: Install cap so rounded portion of holes in cap are away from bend in levers.

Install shifter lever cap seals onto shifter levers (Illust. 4). Long rounded side of cap seals away from bend in levers.

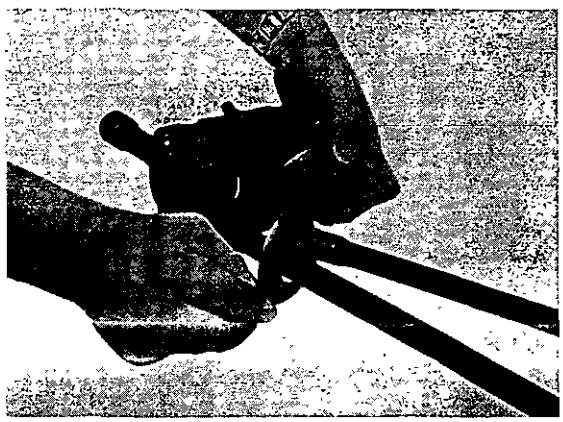
Install rubber cover over shifter levers and down on ball cap (Illust. 5). Long portion of cover away from bend in levers.



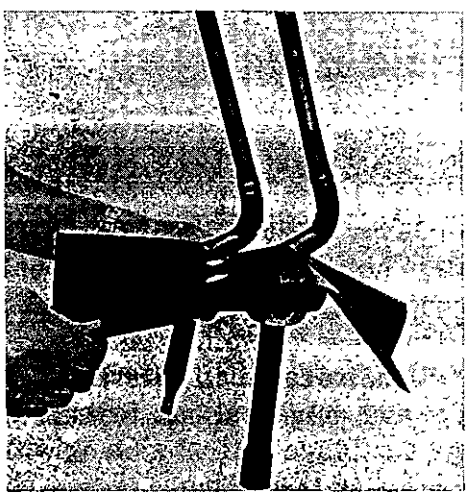
Illust. 2



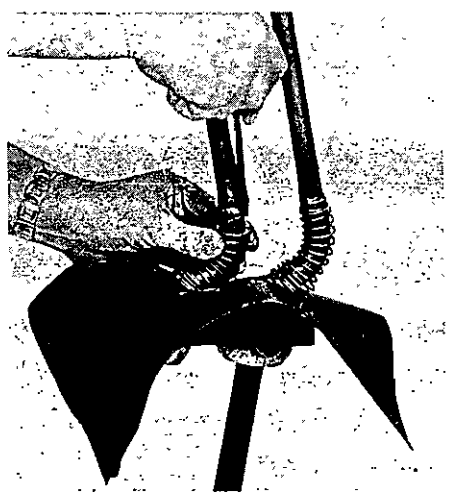
Illust. 3



Illust. 4



Illust. 5



Illust. 6

Install lever cap springs onto levers (Illust. 6). Next, install snap rings onto levers. Press down on springs until snap rings can be installed into groove of levers.

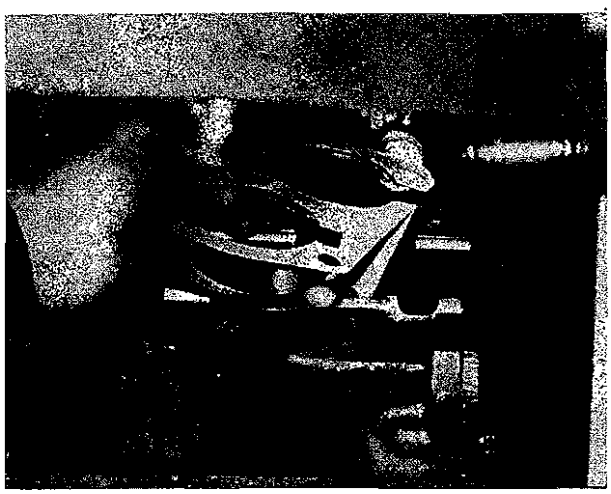
INSTALLATION OF SHIFTER LEVERS

Install two (2) or more shims onto shifter housing (Illust. 1).

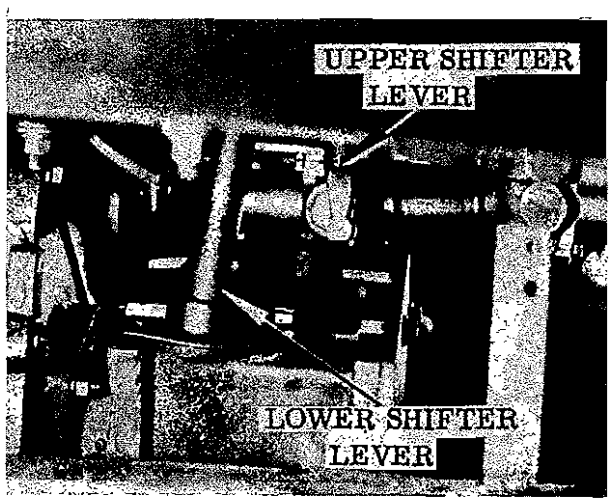
Install shifter levers through cab floor opening and into shifter housing (Illust. 2). NOTE: Ball end of upper shifter lever to fit into slots of upper transmission shifter rails. Socket end of lower shifter lever to fit over front rocker lever ball.

Install ball cap cap screws and tighten securely (Illust. 3).

Check shifter levers for freeness. Levers should be snug enough to allow easy shifting of



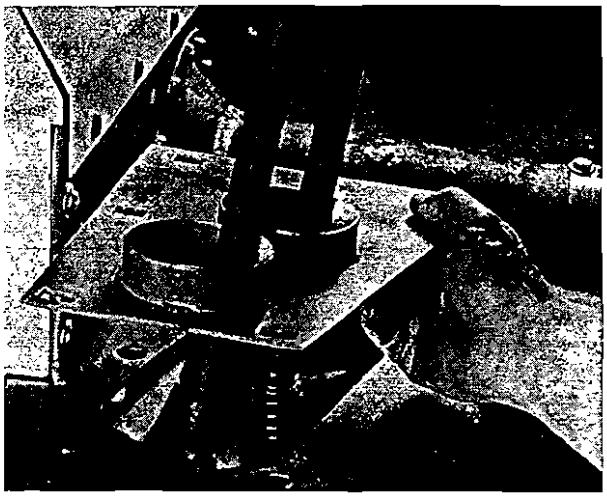
Illust. 1



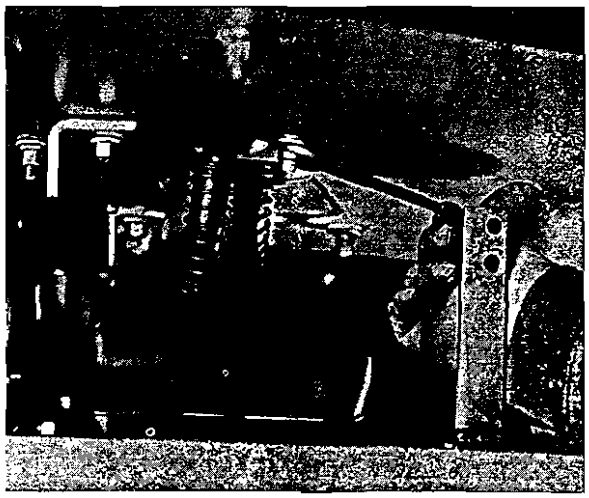
Illust. 2

Illust. 3

Illust. 4



Illust. 5

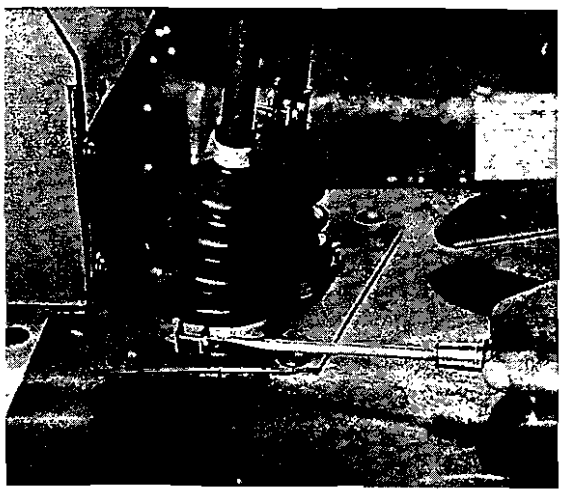


Illust. 6

levers. If levers are either too loose or tight, remove ball cap and add or remove shims as needed.

Fold rubber cover around shifter housing. Next, apply a piece of wire around cover and twist until tight (Illust. 4). On later machines, install clamp around shifter housing cover and tighten securely.

Install shifter hole cover plate (Illust. 5). Next, install carriage bolts, lock washers and nuts. Snug but do not tighten nuts. IMPORTANT: Adjust cover plate so levers, when in any shifting position, will not strike any portion of holes in cover.



Illust. 7

When this has been accomplished, tighten carriage bolt nuts securely (Illust. 6).

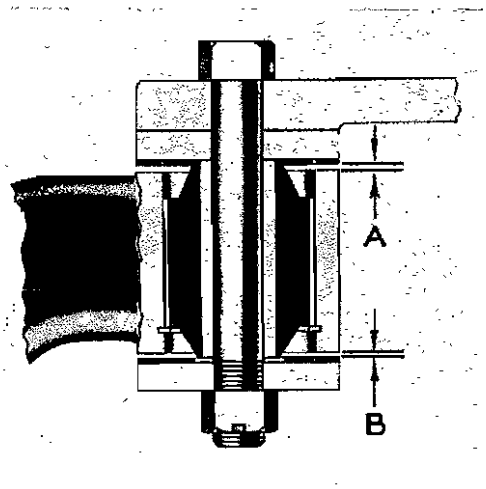
Install boots over shifter levers and down over holes in cover plate. Next, install boot clamps and tighten clamps securely (Illust. 7).

MOTOR MOUNT GAP

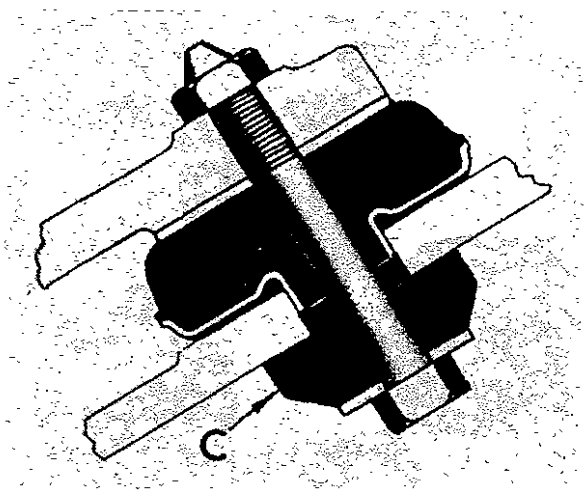
When installing transmission into the frame, the rear mounts are to be tightened first.

If new mounts are installed, clearances (A) and (B) (Illust. 1), are as follows:

A	B
.120 to .140	.000 to .020



Illust. 1



Illust. 2

If mounts are reused, clearance (A) and (B) are as follows:

A	B
060 Min.	.1875 Max.

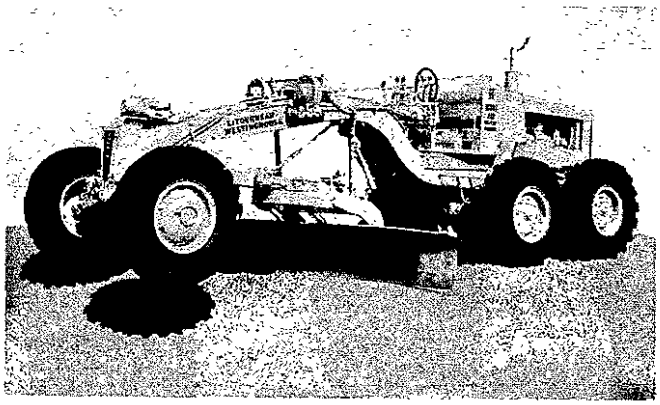
Proper gap at (A) and (B) can be maintained by removing shims at gap (B) and reinstalling shims at gap (A), as the mounts settle over a period of time. However, if the proper gap clearances cannot be maintained by the use of shims, install new mounts.

Front engine mounts are adjusted by tightening cap screw until biscuit (C) (Illust. 2) can be turned, with effort, by hand. Tighten cap screw one more turn.

—NOTES—

COMPLETE DRIVE UNIT

The complete transmission and tandem assemblies must be removed whenever transmission repairs become necessary.



Illust. 1

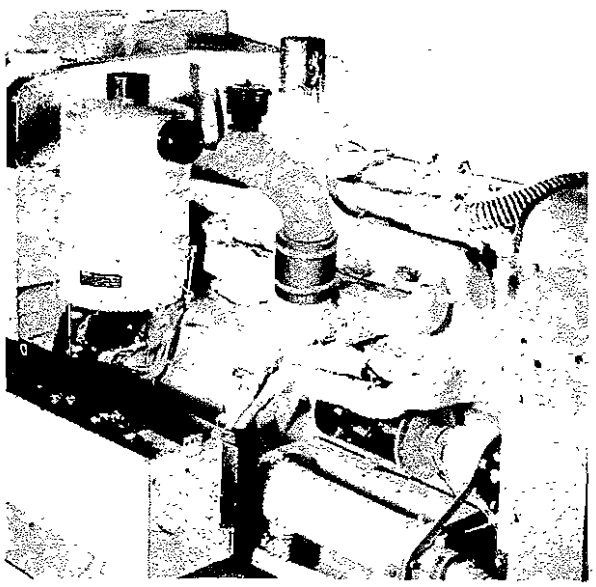
(Illust. 1). Turn moldboard of grader crosswise to the center line of the frame and lower it to the ground. Raise front end of grader until front wheels are approximately 10 inches above the ground.

(Illust. 2). Remove muffler, air cleaner cap or air pre-cleaner, hood and lower hood sides. Next, remove air cleaner hose between elbow and air cleaner.

(Illust. 3). Drain hydraulic reservoir by installing a suitable length of hose onto drain cock. Open drain cock and allow oil to drain in a container. When reservoir is empty, close drain cock and remove hose. Next, shut fuel off at fuel shut-off valve. Disconnect fuel outlet and return lines from tank. Disconnect vent pipe from top of tank.

Remove reducer from top of fuel tank and install a lift eye (Illust. 4).

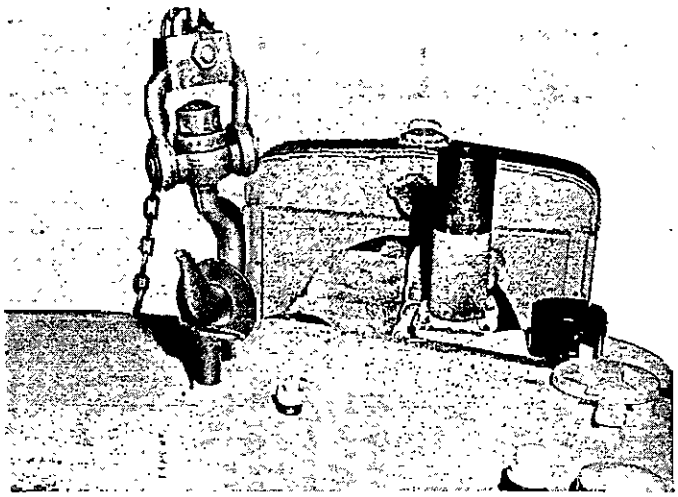
Disconnect battery cables at engine. Remove wiring from voltage regulator and clamps from fire wall.



Illust. 2

Illust. 3

Remove fuel tank support anchor cap screws, nuts and lock washers. Lift fuel tank from frame using a chain hoise (Illust (Illust. 4).



Illust. 4

Disconnect wiring from cranking motor and generator. Remove wiring clamps from engine.

Disconnect engine solenoid switch cable on Cummins engine and engine shut down cable on General Motors engine.

Disconnect hour meter cable from switch on engine.

Remove heat indicator cable from engine.

Disconnect heater hoses from engine and lower radiator pipe, if so equipped. Remove heater hose clamps on clutch housing.

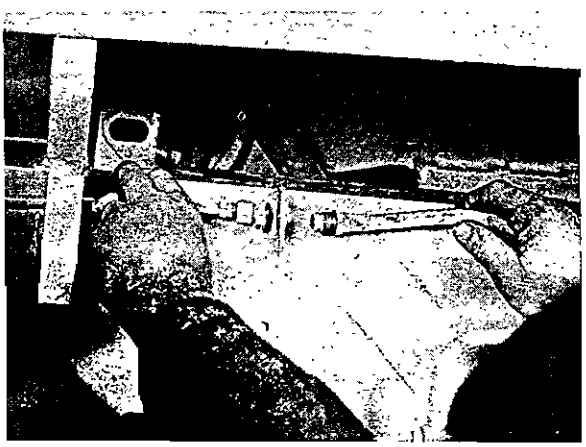
Disconnect ether starting aid cable at engine, if so equipped.

Disconnect radiator shutter cable at radiator, if so equipped.

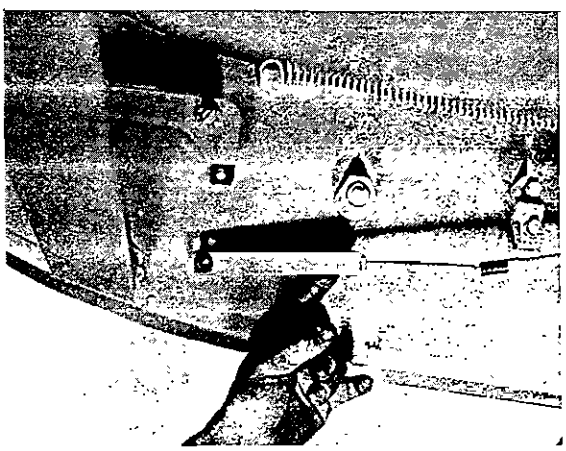
Disconnect oil line at engine.

Disconnect air cleaner tubing at air cleaner.

Disconnect brake hoses from tubing (Illust. 5).



Illust. 5



Illust. 6

Disconnect clutch pedal linkage under cab.

Disconnect hand brake cable under cab (Illust. 6).

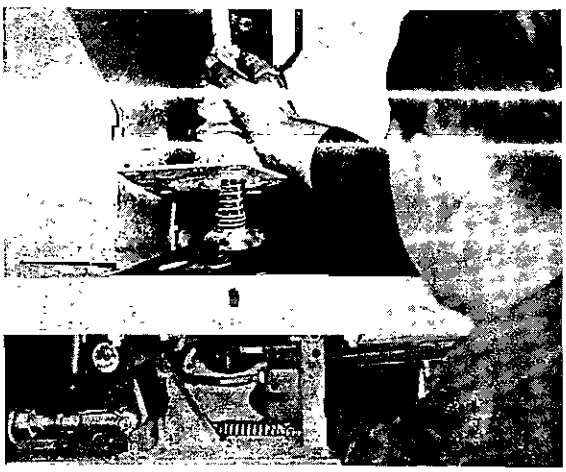
Disconnect throttle cable.

Disconnect propeller drive shaft coupling at shear pin under cab.

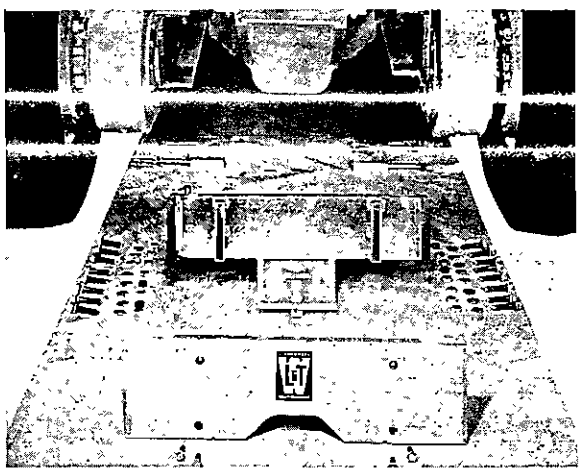
Disconnect parking brake hydraulic tubing behind parking brake backing plate.

Remove shifter lever floor plate cap screws. Loosen upper boot clamps and slide floor plate up on shifter levers. Remove rubber cover clamp and cover. Next, remove ball cap cap screws. Lift shifter levers and shims from shifter housing (Illust. 7).

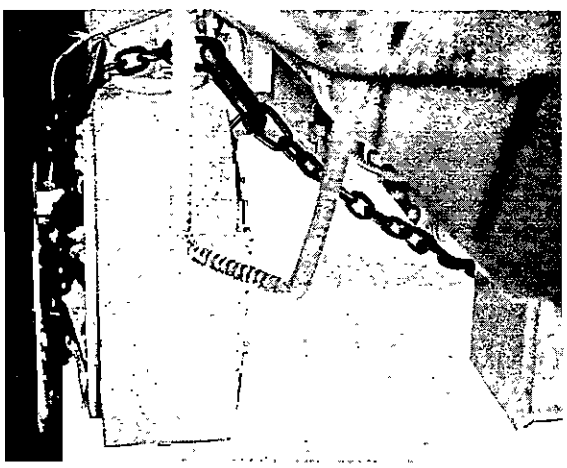
(Illust. 8). Remove rear closure plate cap screws and rear closure plate from rear cross member. Next, remove rear cross member cap screws from frame and slide rear cross



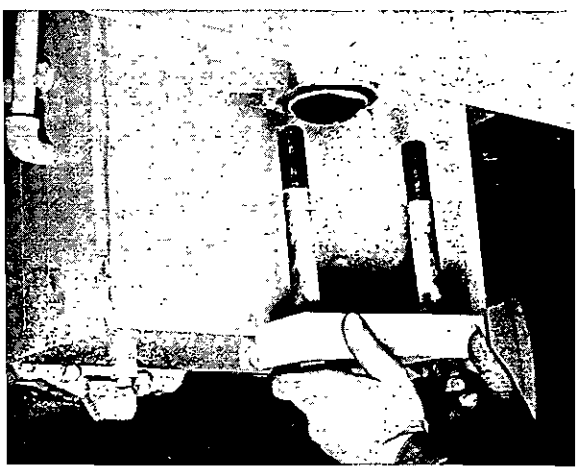
Illust. 7



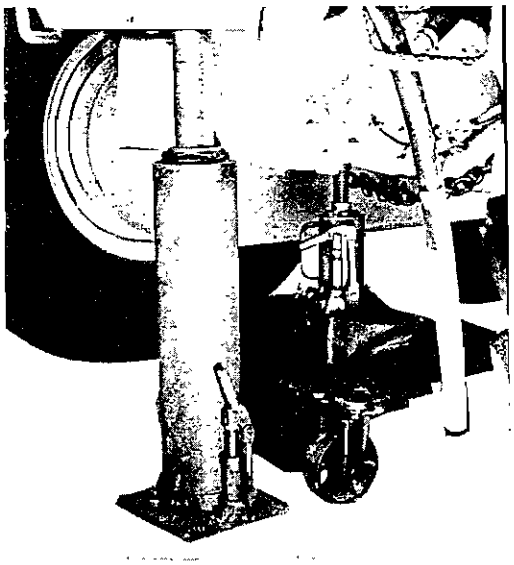
Illust. 8



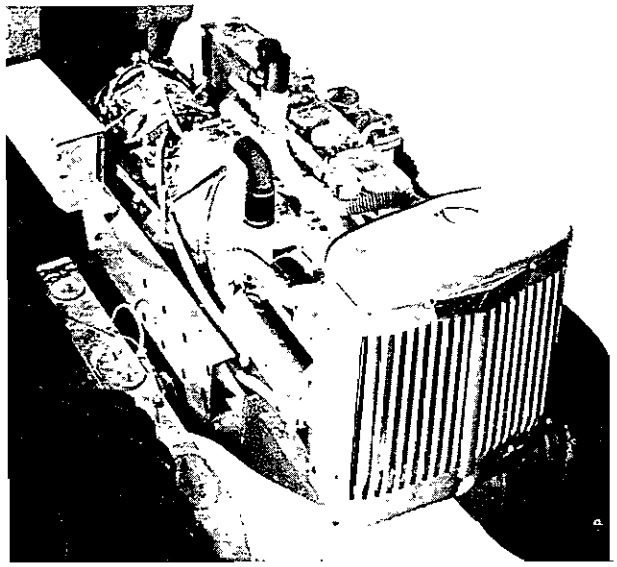
Illust. 9



Illust. 10



Illust. 11



Illust. 12

member from frame. Remove rear axle cap screws and caps.

Attach a chain around front portion of each tandem, using care to prevent crushing of brake lines. Bring chain under front end of transmission (Illust. 9). The chain will act as a safety measure preventing the unit from pivoting forward as unit is rolled from frame.

(Illust. 10). Remove transmission support bar. IMPORTANT: When reassembling support bar and new support biscuits are used, tighten bolts until a 1/8" clearance is obtained between clamp bar and support bracket; 1/16" clearance if biscuits are reused.

(Illust. 11). Use two hydraulic jacks, one on a dolly under front end of transmission and the other jack under moldboard stop angle. Alternate the raising of frame and front of transmission until there is clearance between shifter housing and moldboard stop angle, axle carriers and frame. When clearance is obtained at these points, roll unit from frame (Illust. 12).

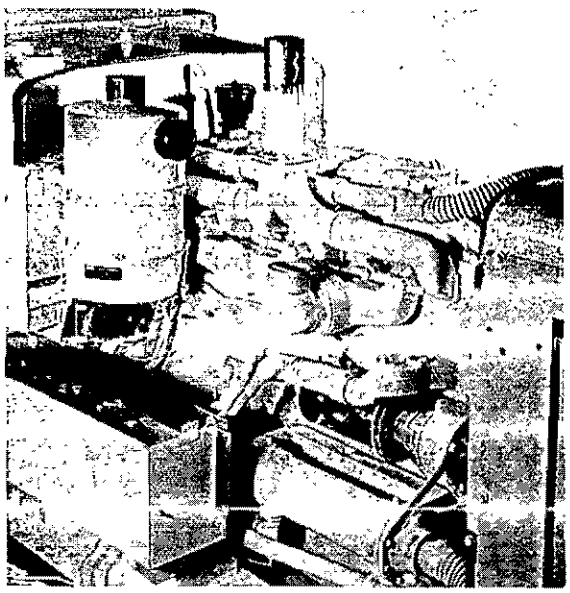
To install unit into frame, reverse removal procedure.

ENGINE REMOVAL

When major repairs to the engine are necessary, the engine must be removed from the frame. Since the removal of Cummins and General Motors engines are similar, the following instructions and illustrations will aid in the removal of either engine.

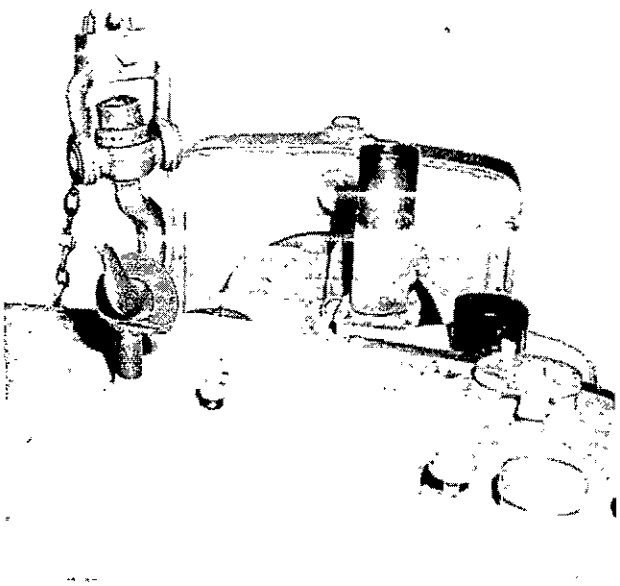
(Illust. 1). Remove air cleaner cap or air pre-cleaner, muffler, hood, lower hood sides and air cleaner hose with elbow.

(Illust. 2). Drain hydraulic reservoir by installing a suitable length of hose onto drain cock. Open drain cock and allow oil to drain in a container. When reservoir is empty, close drain

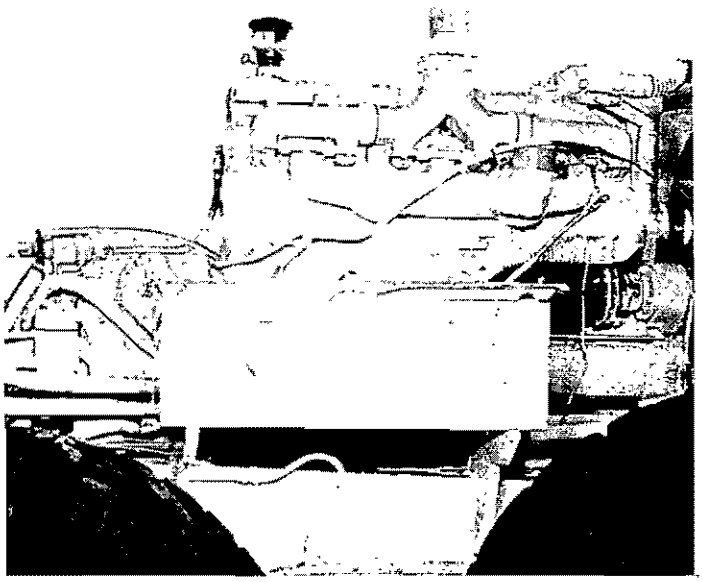


Illust. 1

Illust. 2



Illust. 3



Illust. 4

cock and remove hose. Next, shut fuel off at fuel shut-off valve. Disconnect fuel outlet and return lines from tank. Disconnect vent pipe from top of tank.

Remove reducer from top of fuel tank and install a lift eye (Illust. 3).

Disconnect battery cables from engine. Remove wiring from voltage regulator and clamps from fire wall.

Remove fuel tank support anchor caps screws, nuts and locks washers. Lift fuel tank from

frame, using a chain hoise (Illust. 3).

Disconnect wiring from cranking motor and generator. Remove all wiring harness clamps from engine (Illust. 4).

Disconnect engine solenoid switch cable on Cummins engine and engine shut down cable on General Motors engine.

Disconnect hour meter cable from switch on engine.

Remove heat indicator cable from engine.

Disconnect heater hoses from engine and lower radiator pipe, if so equipped. Remove heater hose clamp on clutch housing.

Disconnect ether starting aid cable at engine, if so equipped.

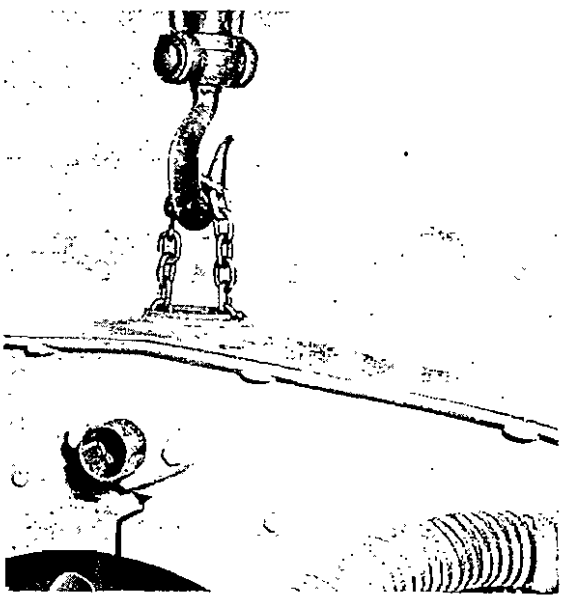
Disconnect radiator shutter cable at radiator, if so equipped.

Disconnect oil line at engine.

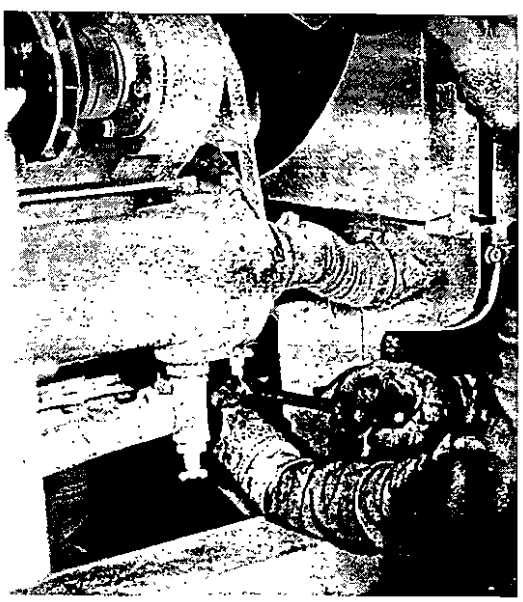
Disconnect clutch pedal linkage at engine.

Disconnect throttle cable at engine.

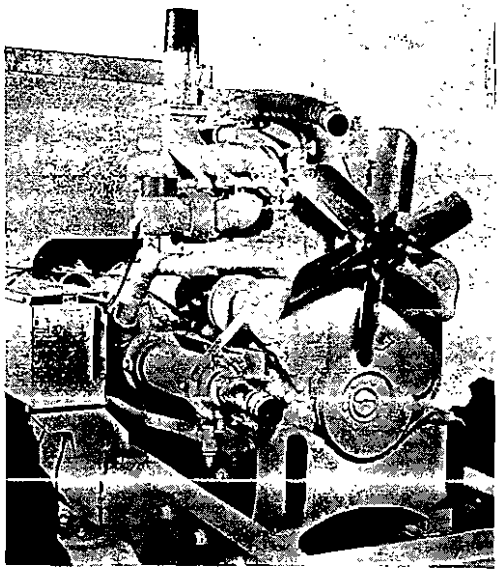
Remove propeller drive shaft under cab. Remove P. T. O. bearing cage cap screws and slide bearing cage with P. T. O. shaft from upper transmission. NOTE: Cab must be raised to accomplish this step.



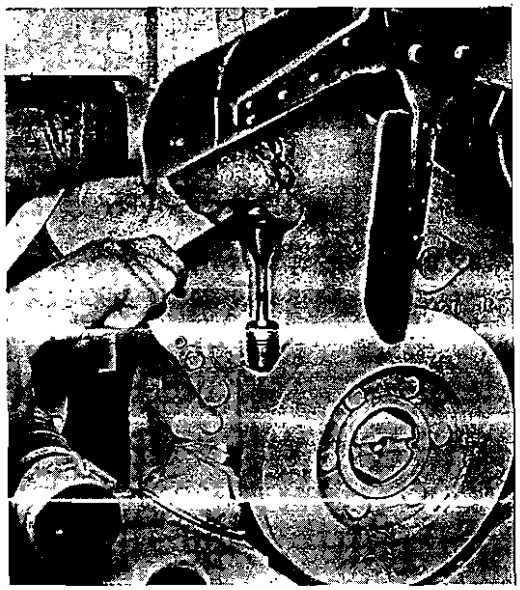
Illust. 5



Illust. 6

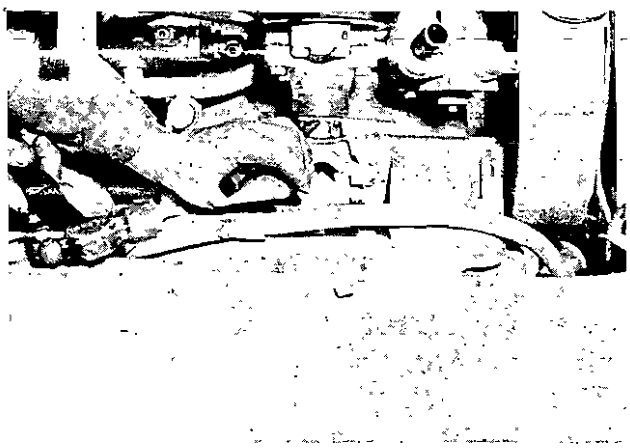


Illust. 7



Illust. 8

Illust. 9



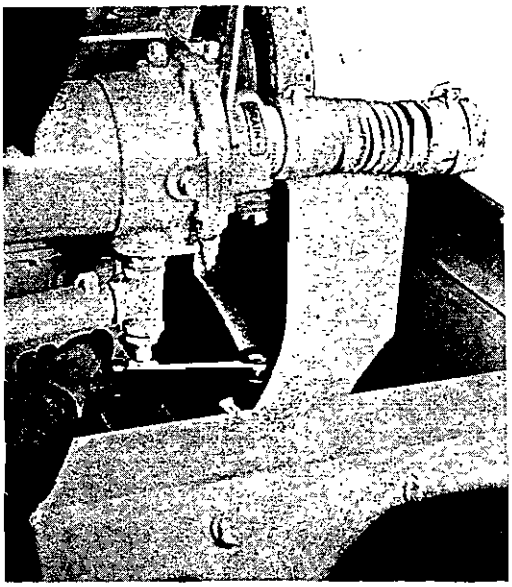
Illust. 10

To raise cab, remove stay bars from cab and control shaft knuckles from power box. Next, remove pedal springs from floor board. Disconnect throttle linkage and hand brake cable under cab. If necessary, remove pedal pads. Remove cab hold down cap screws. Raise cab approximately 8 inches above frame.

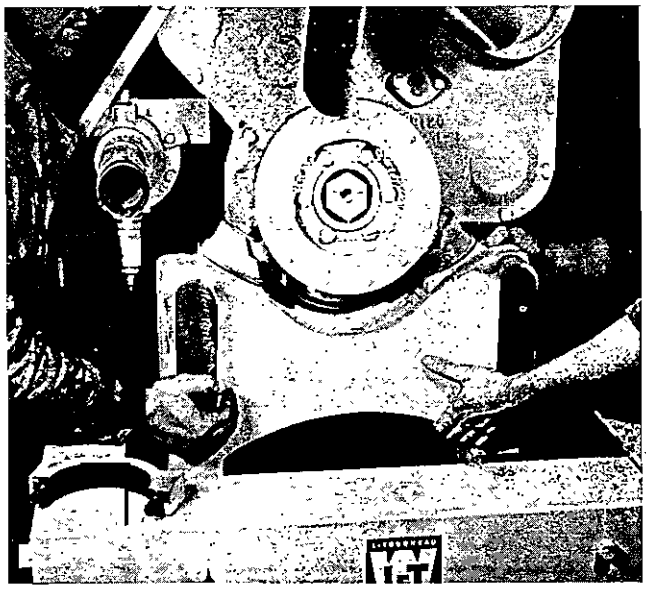
Drain radiator and disconnect both radiator connections. Next, remove radiator cap and insert a tool (Illust. 5). Using a chain hoise, apply enough pressure to radiator to prevent radiator from falling when mounting bolts are removed.

Remove radiator mounting bolts (Illust. 6) and radiator (Illust. 7).

Loosen trunnion cap screws (Illust. 8).



Illust. 11

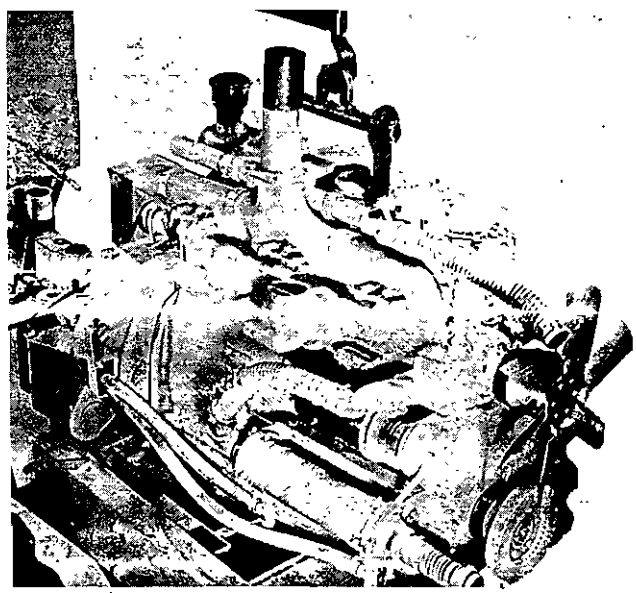


Illust. 12

Remove rear engine mount cap screws (Illust. 9). When removing the cap screws and rubber bonded washers, it is important to note the amount of shims removed from top and bottom of rubber bonded washers. Apply the same amount of shims to each washer when reassembling engine.

Mark yoke fitting of universal joint and also yoke stud with a center punch (Illust. 10). This is important when reassembling engine for proper alignment of yoke stud and yoke fitting splines. If yoke stud and yoke fitting are not aligned properly, undue vibration will occur.

Remove trunnion cap. Next, remove engine support cap screws (Illust. 11).



Illust. 13

Using a chain hoist, raise engine until there is enough elearance to remove engine support (Illust. 12).

Remove engine from frame (Illust. 13).

To reassemble engine, reverse removal procedure.

MOTOR MOUNT GAP

When installing an engine, the rear mounts are to be tightened first.

If new motor mounts are installed, clearance (A) and (B) (Illust. 1) are as follows:

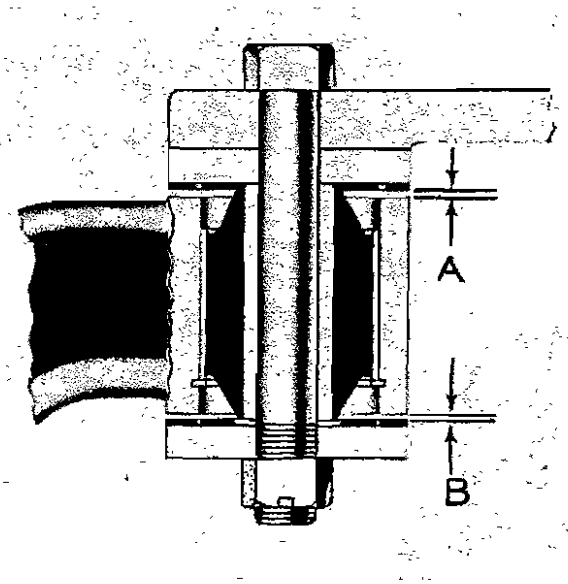
A	B
.120 to .140	.000 to .020

If motor mounts are reused, clearance (A) and (B) (Illust. 1) are as follows:

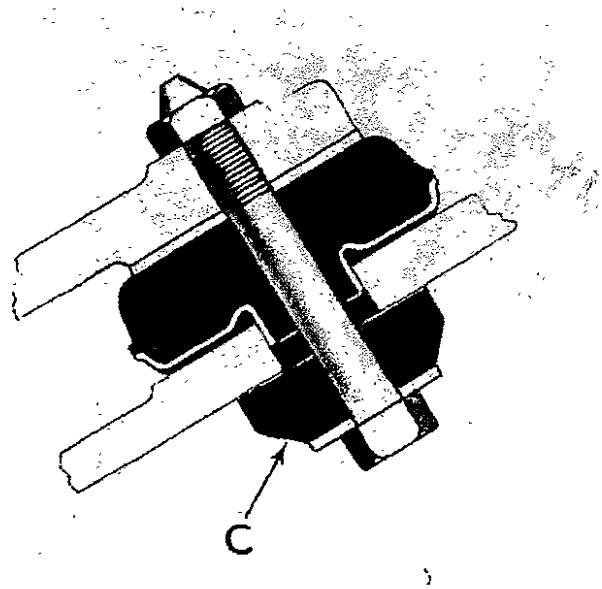
A	B
.060 MIN.	.1875 MAX.

Proper gap at (A) and (B) can be maintained by removing shims from gap (B) and reinstalling shims at gap (A), as the mount settles over a period of time. However, if the proper gap clearance cannot be maintained by use of shims, install new rubber mounts.

Front engine mounts are adjusted and tightened until biscuit "C" (Illust. 2) can be turned with effort by hand, then tighten cap screw one (1) more round.



Illust. 1



Illust. 2

— NOTES —

TANDEM DRIVE

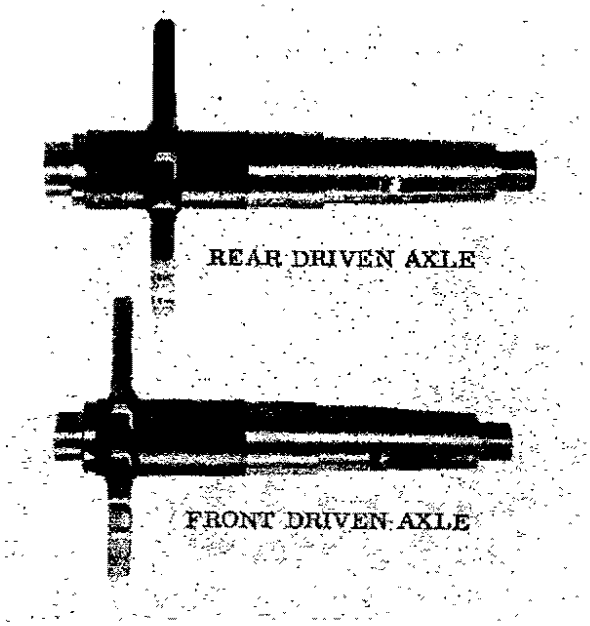
The following illustrations and description instructions are given for assembly of the left hand tandem drive. However, the assembly of the right hand tandem drive is exactly the same with the exception that each part is assembled on the opposite side from which it is shown in the illustrations.

Although in the following illustrations, the tandem drive assembly is shown being repaired while it is removed from the grader; most repairs can be made without removing the tandem from the grader. Either front or rear axle assembly can be removed, disassembled, inspected, repaired and reassembled without removing the tandem drive from the grader. Even the driving axle can be removed (Illust. 5) without the removal of the tandem assembly.

DISASSEMBLY

Due to the fact that during the reassembly operation all adjustment and settings must be accomplished, a detailed description is given under that heading. The disassembly procedure is merely the reverse of the reassembly and therefore, no detailed description is necessary. If the tandem assembly is not completely disassembled as shown, only that portion of the instructions which apply need be carried out.

However, before disassembling the tandem, the reassembly instructions should be read in order to determine any points which should be watched. Naturally, such settings as shim adjustments, etc., should be noted during the disassembly procedure as this will materially help during the reassembly operation.



Illust. 1

INSPECTION

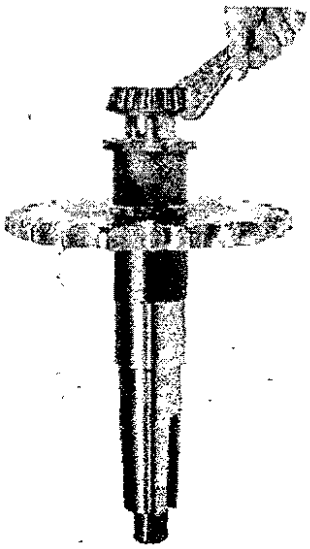
Inspect all parts for excessive wear or other damage. Bearings, shafts, etc., will sometimes seize and score due to insufficient lubricant or improper lubricant being used. Any parts which are defective should be repaired or replaced. Replace all gaskets and grease seals when reassembling.

REASSEMBLY

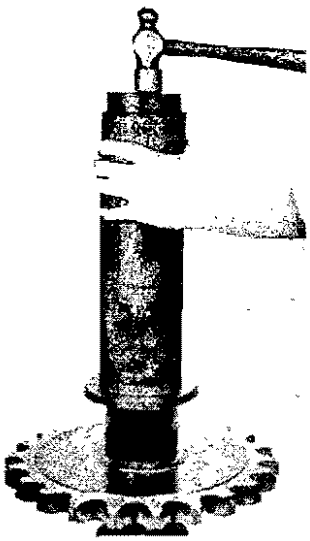
Illust. 1 is a view of the driven axles used in both tandems. NOTE: Parts being assembled to the driven axles are identical.

Press or drive seal onto hub of driven axle (Illust. 2). Groove in seal toward sprocket. Seal to fit snug against shoulder of axle.

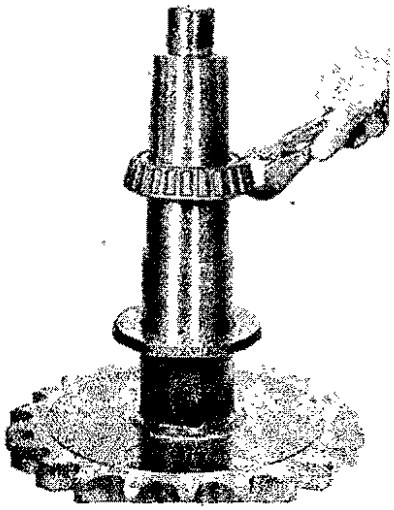
Illust. 2



Illust. 3



Illust. 4



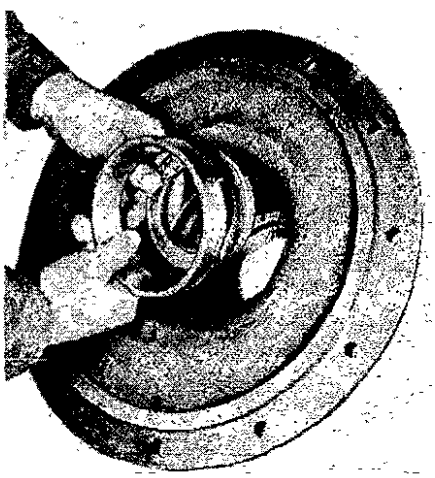
Illust. 5

Heat bearing in oil (350° F.) until bearing has expanded sufficiently, then install onto hub of axle (Illust. 3). Bearing to fit against shoulder of axle. NOTE: Hold bearing until set.

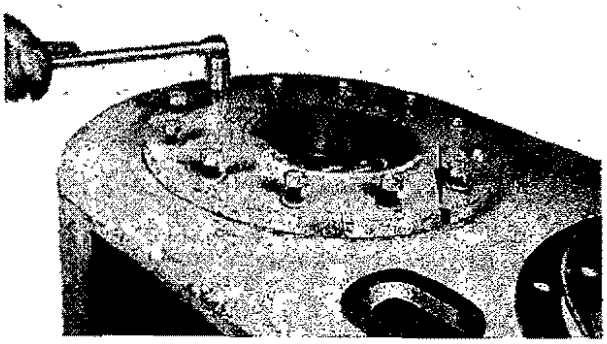
Press or drive seal onto driven axle (Illust. 4). Groove in seal toward sprocket. Seal to fit snug against shoulder of axle.

Heat bearing in oil (350° F.) until bearing has expanded sufficiently, then install onto driven axle (Illust. 5). Bearing to fit against shoulder of axle. NOTE: Hold bearing until set.

Press or drive grease seal and bearing cup into outer eccentric housing (Illust. 6). Lip of seal toward inside of tandem.

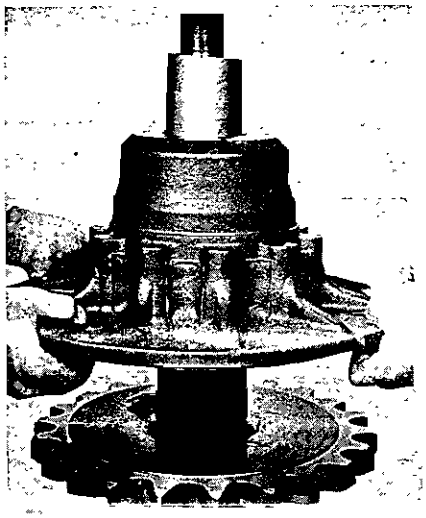


Illust. 6

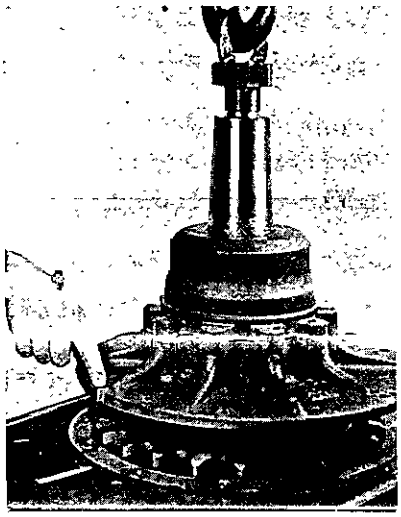


Illust. 7

Illust. 8



Illust. 9

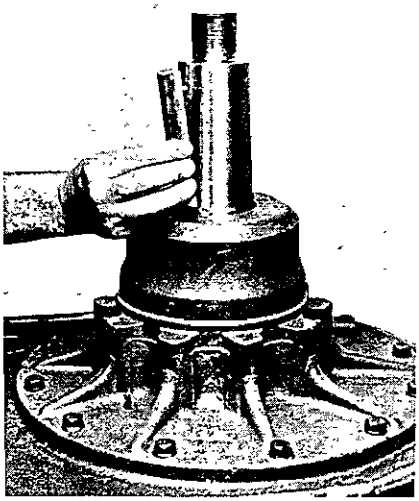


Illust. 10

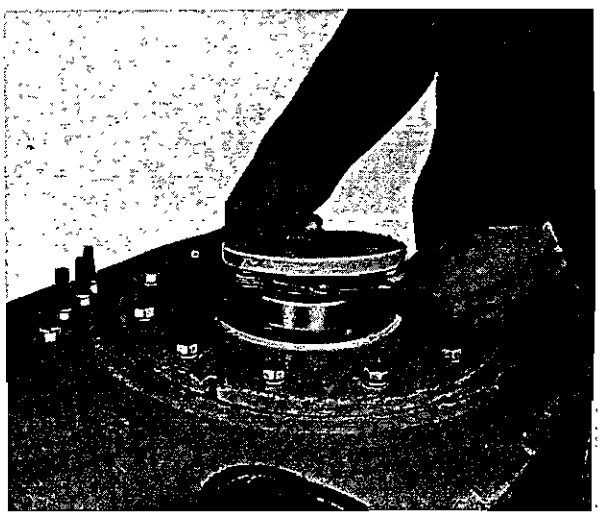
Install the inner eccentric housings (Illusts. 7 and 8). NOTE: When installing these housings, be sure the notch in the edge of the housings are turned toward the center of the tandem housing. (Notches indicate the short side of the eccentric). This will position the driven axle assemblies as close to the driving axle assembly as possible, thereby, allowing the maximum amount of adjustment on the chains.

Install outer eccentric housing onto driven axle (Illust. 9). NOTE: To prevent damage to seal, use a piece of shim stock over axle.

Shellac gasket to tandem then install driven axle with eccentric housing to tandem (Illust. 10). NOTE: Be sure notch in the edge of the outer eccentric housings are turned toward the center of the tandem. (Notches indicate the short side of the eccentric). Next, install cap screws with lock washers. Tighten cap screws securely.



Illust. 11



Illust. 12

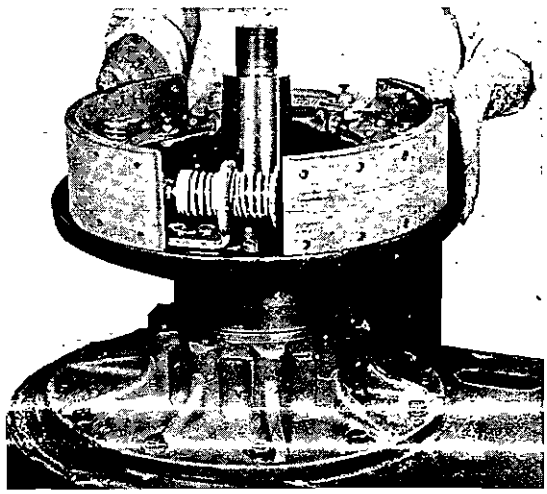
Tap rolled pin into key. Next, insert key into keyway of axle (Illust. 11). Rolled pin in key to fit in pin hole in axle.

Illust. 12. Using a soft hammer, drive inner bearing cup into inner eccentric housing. The next step is to pre-load the bearings. NOTE: Bearings should be free of dirt and oil before pre-loading.

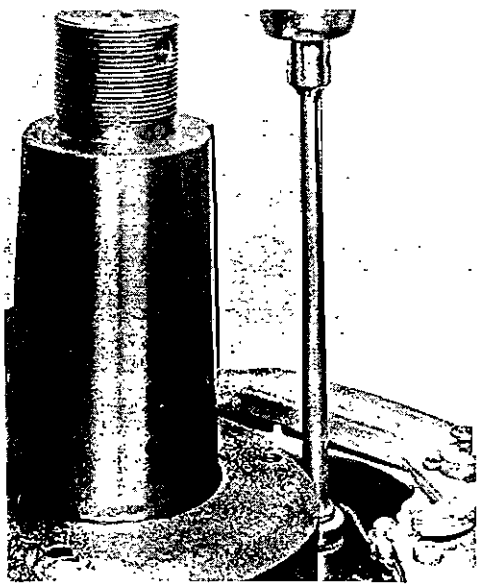
To pre-load the bearings, install hub cap less shims. Install cap screws and tighten until a slight drag is placed on the bearings. (Check by rotating sprocket by hand). NOTE: Be sure hub cap is drawn down evenly. Measure the gap between the cap and inner eccentric housing, using either a feeler gauge or shims, to determine the amount of shims to be installed. With new bearings a .005" to .010" pre-load will exist and with used bearings a snug fit will exist. Remove hub cap and install the correct amount of shims required to fill the gap (Illust. 12). Install hub cap, shims and cap screws with lock washers. Tighten cap screws securely. Recheck pre-load, by rotating sprocket by hand. Repeat this operation on the other driven axle assembly.

Install wheel brake onto outer eccentric housing (Illust. 13). Adjusting wheel toward bottom of tandem. NOTE: The letter "R" (right) or "L" (left) stamped after the number on back of backing plate will aid in identifing which side of machine the wheel brake is to be installed.

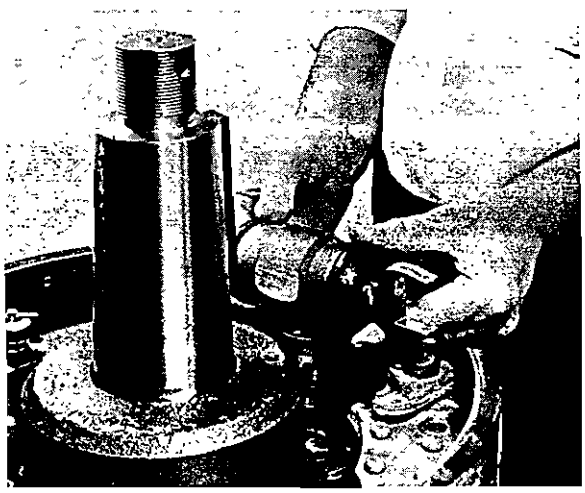
Install cap screws with lock washers. Tighten cap screws securely (Illust. 14).



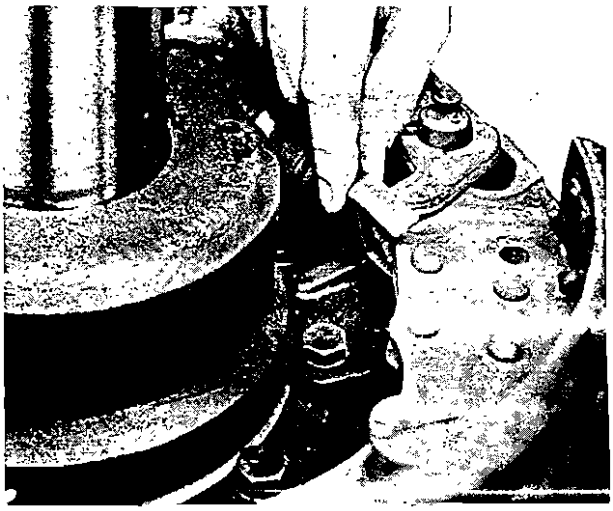
Illust. 13



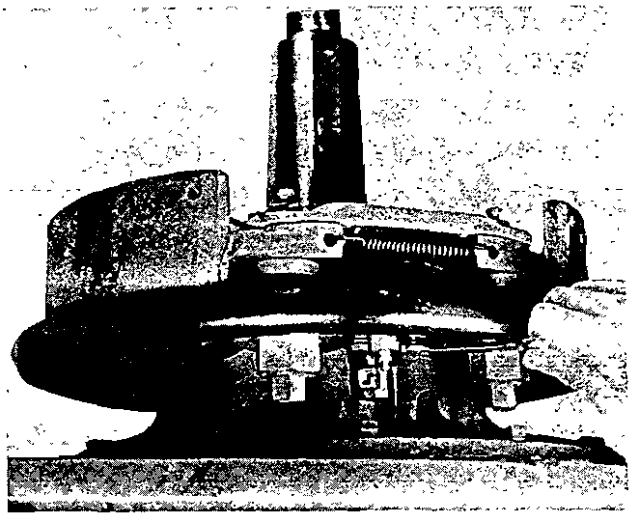
Illust. 14



Illust. 15



Illust. 16



Illust. 17

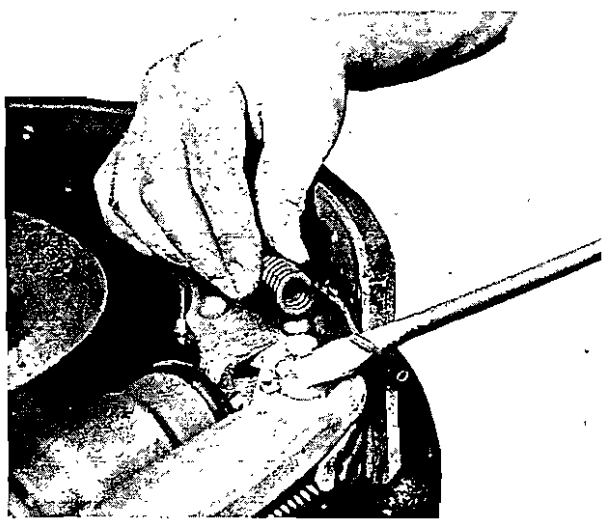
Install wheel cylinder into wheel brake (Illust. 15). Connecting links to fit over knobs and into slots in brake shoes (Illust. 16).

Install wheel cylinder cap screws. Tighten cap screws securely (Illust. 17).

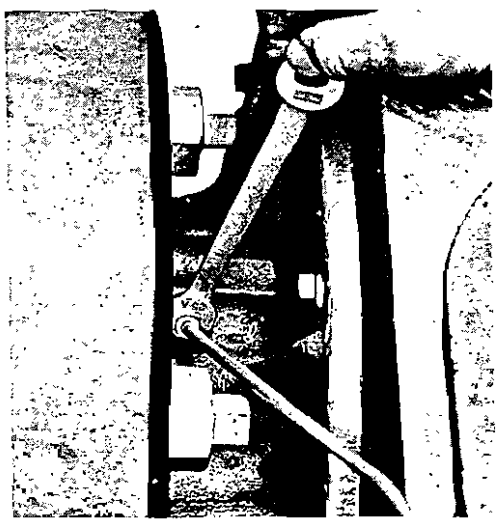
To install springs, hook short ends of springs into holes in brake shoes. Using a screw driver or a similar tool, bring long end of springs over anchor pins (Illust. 18).

Install and tighten brake line to wheel cylinder connection (Illust. 19). NOTE: Use care when tightening brake line fitting to prevent damaging threads of fittings.

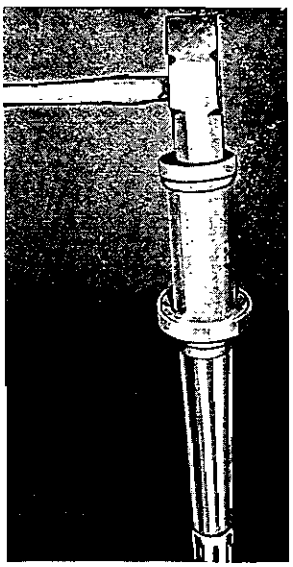
Press or drive ball bearing onto outer end of driving axle. Shielded side of bearing toward



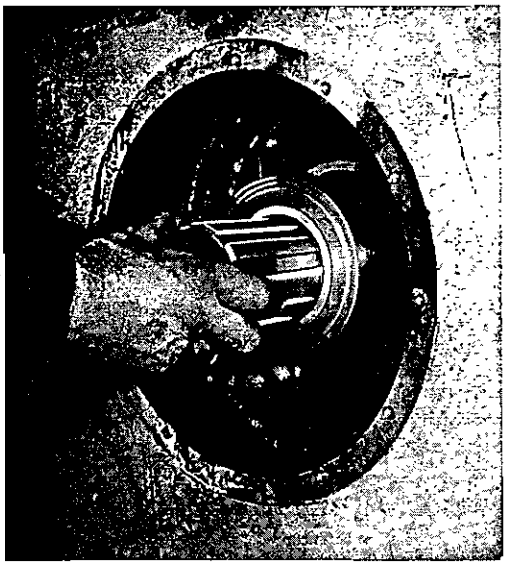
Illust. 18



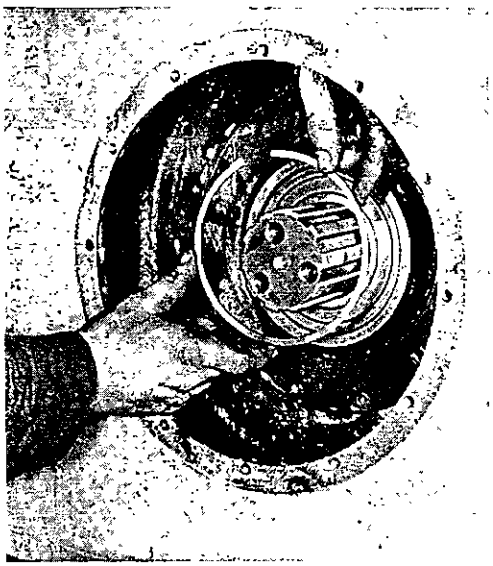
Illust. 19



Illust. 20



Illust. 21



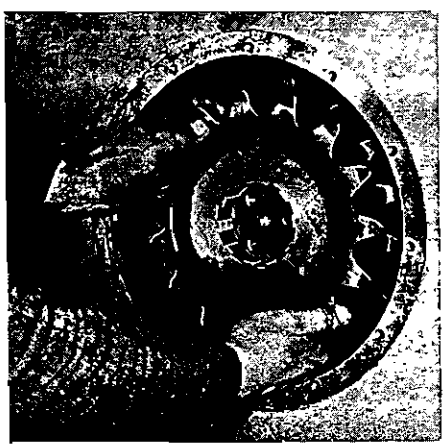
Illust. 22

outer end of axle (Illust. 20). Bearing to be tight against shoulder of axle. NOTE: When pressing or driving bearing into place, a piece of pipe or similar tool should be used so that the driving force is transmitted only to the inner race of the bearing.

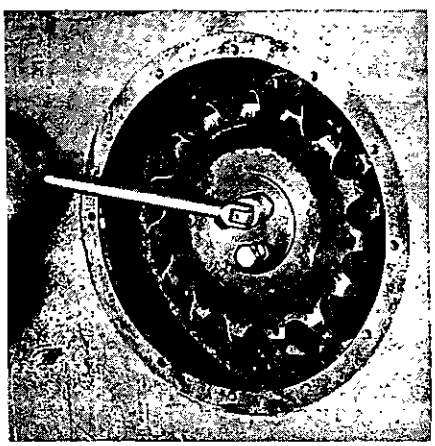
Insert axle with bearing into inner axle carrier (Illust. 21) using care to prevent damaging leather in grease seal. Next, install snap ring in the inner axle carrier (Illust. 22).

Install driving sprocket onto axle (Illust. 23). Long hub of sprocket towards transmission. Next, install axle bolting plate. Install bolting plate drilled cap screws and tighten securely (Illust. 24).

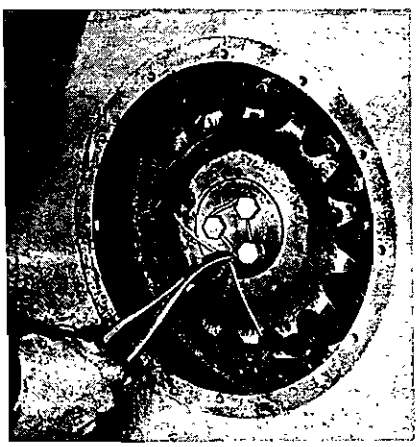
Insert a piece of wire through drilled heads of cap screws (Illust. 25) and lock securely by twisting ends of wire.



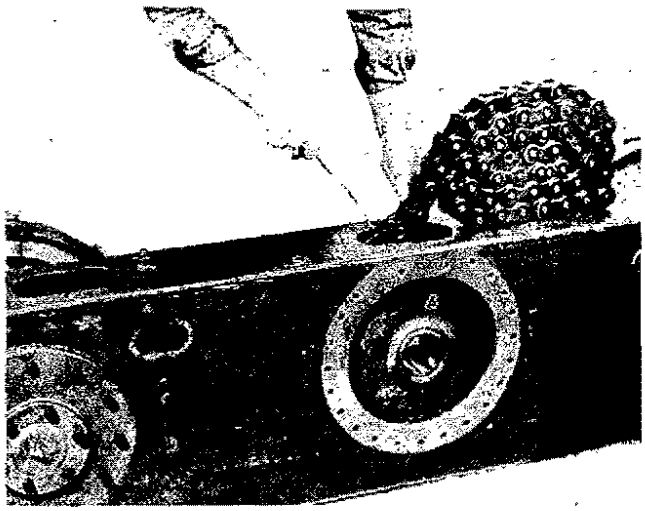
Illust. 23



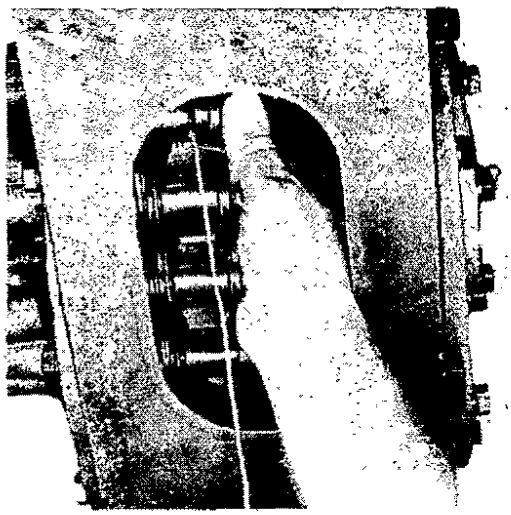
Illust. 24



Illust. 25



Illust. 26

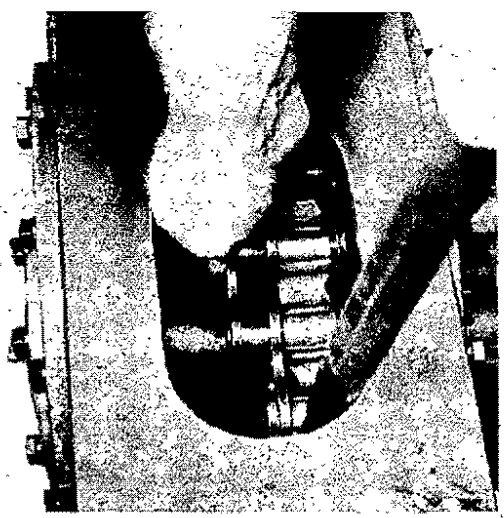


Illust. 27

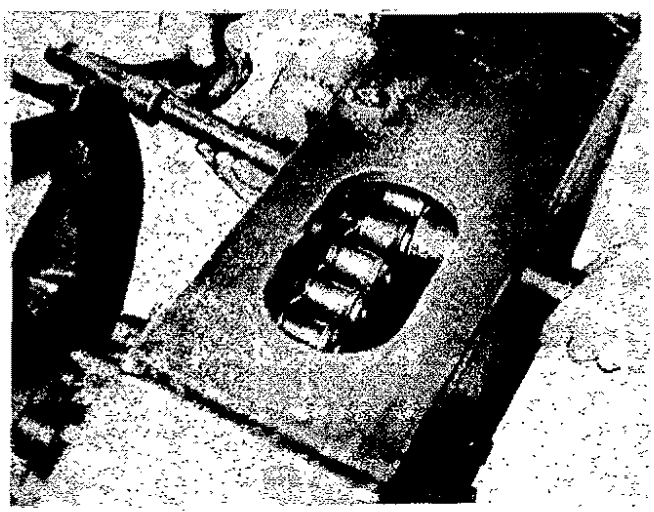
To install the drive chains, first coil chain on top of tandem housing (Illust. 26). Next, connect a soft wire to the end link of chain. Run the wire down through the center port hole of tandem, through the upper inside of tandem, around driven axle, through the lower inside of tandem, around driving sprocket and out the center port hole (Illust. 26).

Pull on wire and at the same time guide chain over teeth in driven axle. Continue pulling chain until chain is over teeth of driving sprocket. Bring loose end of wire through upper inside of tandem and out end port hole in tandem. Continue pulling on wire until end links of chain are near center of sprocket, (Illust. 27). NOTE: Manual turning of axle will also aid in the chain installation.

Pull the chain up tight, using the wire or a pry bar. Insert the coupler link into end links of chain, (Illust. 28). Remove wire from link. NOTE: When installing the drive chains,



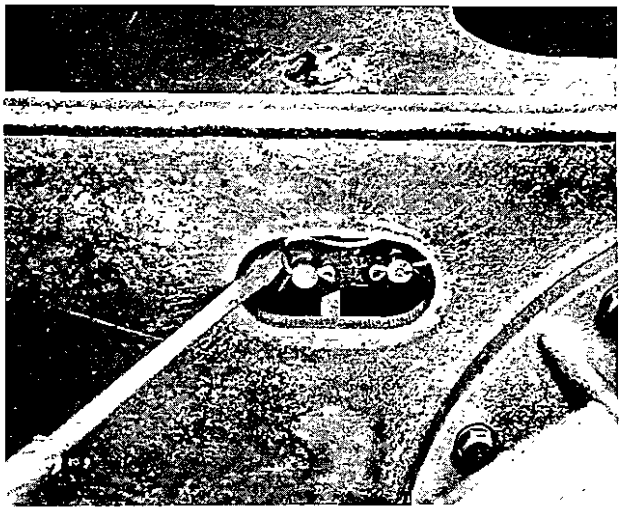
Illust. 28



Illust. 29

be sure to install them so the inside chain has the cotter pin side turned toward the center of the grader and the outside chain has the cotter pin side turned toward the outside of the grader. In other words, install the chains so that they pass over the driving sprockets, the cotter pin sides of the chain will be opposite each other.

Back up the chain until coupler link appears centered in the side port hole of tandem. Install connecting bar and drive bar onto coupler link (Illust. 29).



Illust. 30

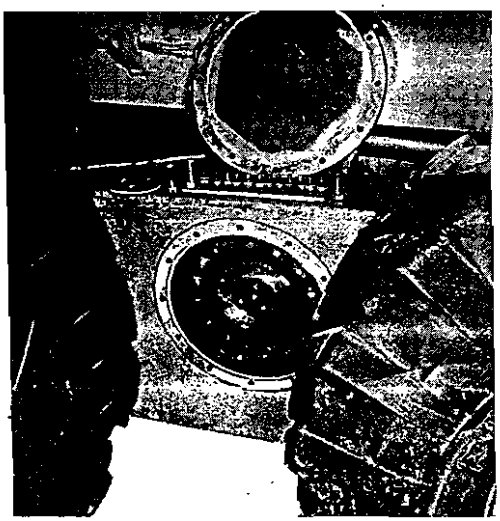
Install cotter pins into coupler link and spread (Illust. 30).

Install tandem to inner axle carrier. Install cap screws with lock washers. Tighten cap screws securely. NOTE: Do not use a gasket between the axle carrier and tandem. Coat the surfaces with a gasket shellac or similar compound.

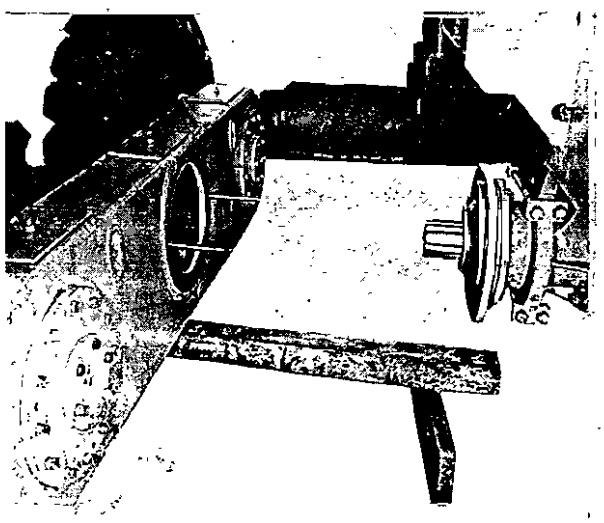
Install tandem top and side port hole covers and side cover plate to tandems. Lubricate tandems as described in the Lubrication section of this manual.

TANDEM REMOVAL

There are three basic types of removal in connection with the tandem drive assembly. The choice between these three types of removal depends entirely upon the work to be done.



Illust. 1



Illust. 2

These three types of removal can be classified as follows:

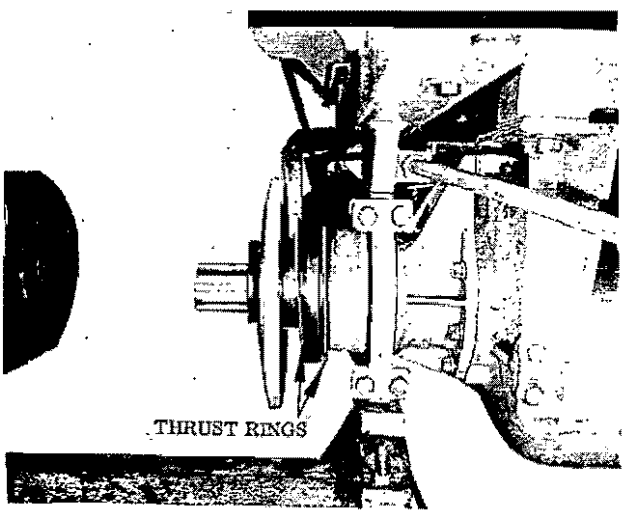
1. Removal of the tandem housing assembly leaving the driving axle and inner axle carrier on the machine.
2. Removal of the complete tandem assembly with driving axle and inner axle carrier.
3. Removal of the driving axle without the removal of the tandem or inner axle carrier.

These three types of removal will be discussed in the order listed.

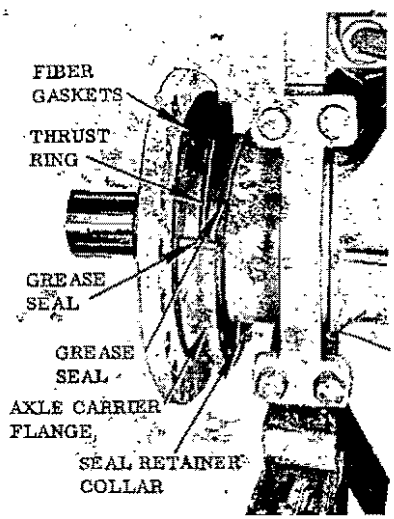
The first type of removal is shown in Illusts. 1 and 2. The first step to be taken in this type of removal is to remove the center cover plate and axle bolting plate (Illust. 1). Next, start the engine and rotate the moldboard until the point of the moldboard points toward the tandem to be removed, lower the moldboard to the ground and continue to lower until the weight of the grader is removed from the tandem assembly. If jacks and blocking are available, the grader can be raised and blocked in a similar manner. Remove the cap screws which hold the inner axle carrier to the tandem housing, disconnect the hydraulic brake hose, install two studs to aid in guiding the tandem housing assembly as it is removed, place a long beam under the center of the tandem housing and slide the complete assembly out (Illust. 2). The tandem assembly is replaced by reversing the above outlined procedure.

The second type of tandem removal, that of removing the tandem assembly with driving axle assembly and inner axle carrier, becomes necessary when the inner axle carrier or the bushings between the inner axle carrier and the outer axle carrier are to be replaced. This type of removal is also necessary when rebuilding the transmission assembly. However, when the transmission and tandem drive assemblies are removed from the grader as a unit and the tandems are then removed from the transmission assembly.

In either of these cases, it is only necessary to disconnect the hydraulic brake hose leading from the main frame of the grader to the tandem assembly and remove the three seal retainer collars and two axle carrier flanges. The complete assembly then can be slid out



Illust. 3



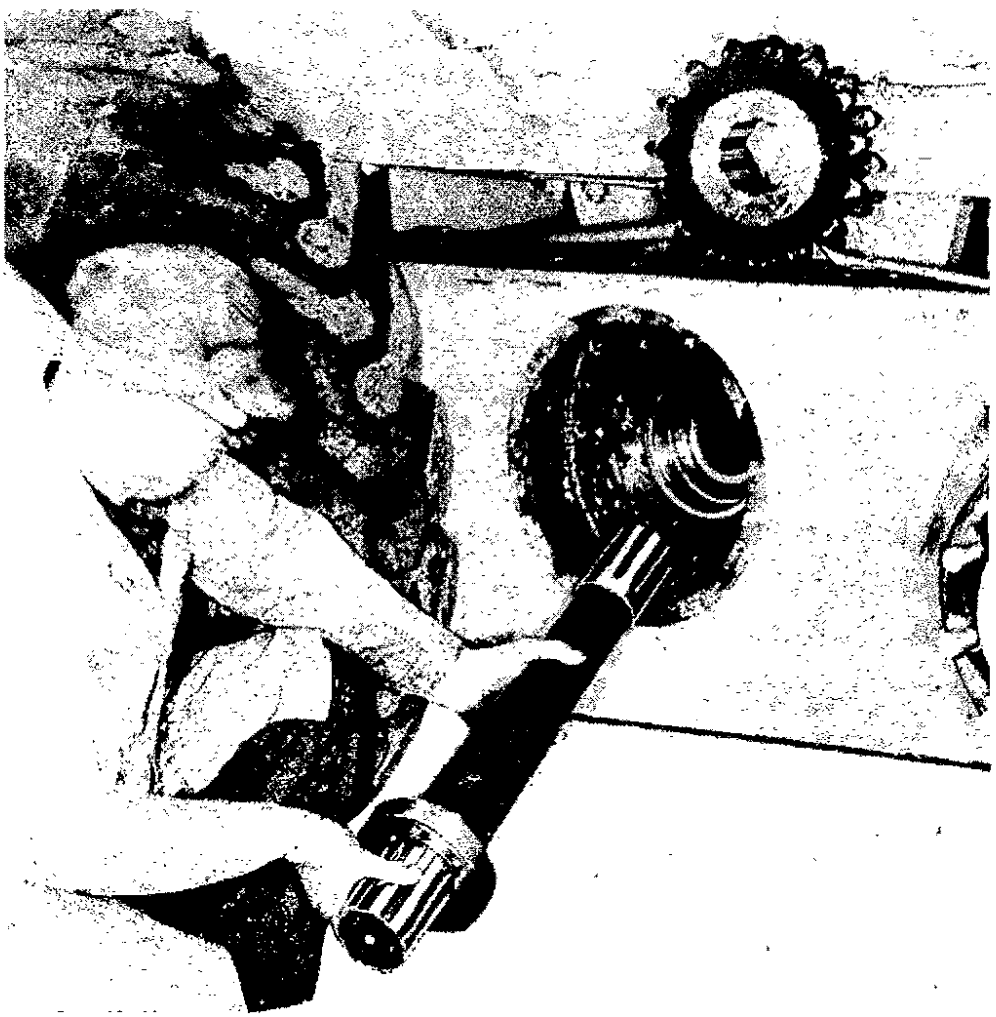
Illust. 4

rrom the outer axle carrier and disassembled separately.

The weight of the rear end of the grader can be supported in the same manner as that described for the first type of removal. When replacing the assembly, be sure to install the thrust rings pointed out in Illust. 3. Install the grease seals (Illust. 3). The fiber gaskets pointed out in the illustration are split to provide easy removal and installation when adjusting the running clearance at this point. Sufficient fiber gaskets should be installed or removed as needed to provide the minimum amount of clearance and yet eliminate all binding. The inner axle carrier should oscillate freely.

Although Illusts. 3 and 4, show the tandem housing assembly removed from the inner axle carrier previous to its removal from the machine, this is not necessary since the complete unit can be removed as one assembly.

The third type of removal is shown in Illust. 5. This illustration shows the method of re-



Illust. 5

moving the driving axle assembly while the tandem housing remains assembled to the grader. The weight of the grader is relieved from the tandem assembly in the same manner as that outlined for the first and second types of removal. The first step to be taken in this type of removal is to remove the center cover plate and axle bolting plate. Next, uncouple both front and rear drive chains and fold them back into the tandem housing out of the way. Next, remove the driving sprockets and the snap ring which hold the driving axle bearing into the inner axle carrier. The driving axle with bearing may then be withdrawn, as shown in the illustration.

NOTE: It is necessary to remove the front wheel from the tandem assembly in order to provide clearance for backing up the tandem drive chain to install coupler link, connecting bar and cotter pins.

The three types of removals outlined will cover any and all cases. The type of removal which should be used in any particular case depends entirely upon the work to be done. As outlined previously, it is not necessary to remove the tandem assembly in order to rebuild either front or rear driven axle assembly. This work can be done with the tandem assembly mounted on the grader.

— NOTES —

FOOT BRAKES

The brake assemblies are of the two shoe, internal expansion type with primary and secondary shoes. Both primary and secondary shoes should be equipped with molded linings.

DISASSEMBLY

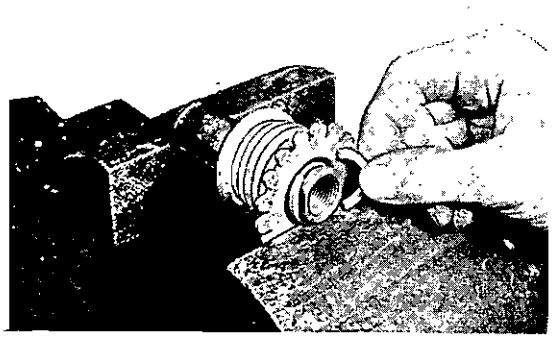
Detailed instructions on disassembly are not necessary due to the simple design of the brakes. Therefore, the only instructions given here is for reassembly. If difficulty is experienced in disassembling, read the reassembly instructions and reverse the procedure outlined.

INSPECTION

Inspect all parts carefully for excessive wear and scoring. Replace or repair all badly worn or damaged parts.

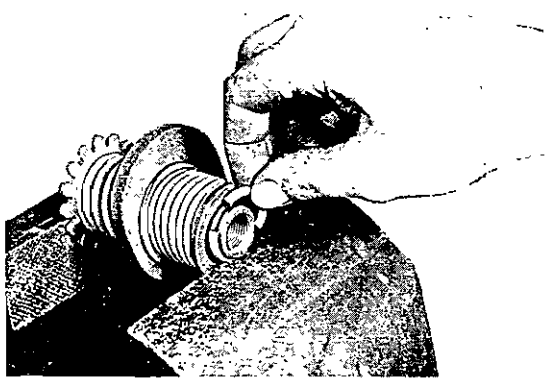
REASSEMBLY

The first step of reassembly is to install inner centralizer spring retainer onto adjusting nut. NOTE: Be sure to install retainer over end of adjusting nut which has the two flat sides. Countersunk portion of retainer against shoulder in center of adjusting nut. Next, install centralizer spring and adjusting nut wheel onto adjusting nut. Hub of wheel to fit into spring. After compressing spring sufficiently, install the two centralizer spring retainer locks in groove of adjusting nut (Illust. 1).

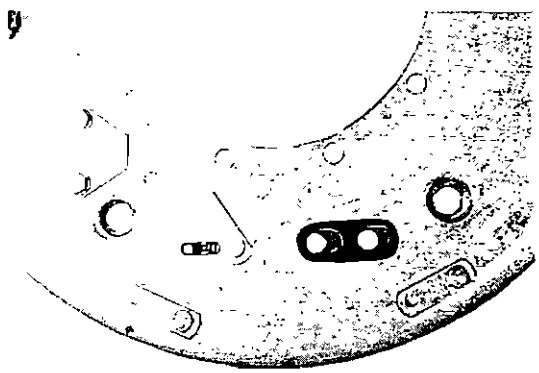


Illust. 1

Install centralizer bracket onto adjusting nut. Studded end of bracket away from adjusting nut



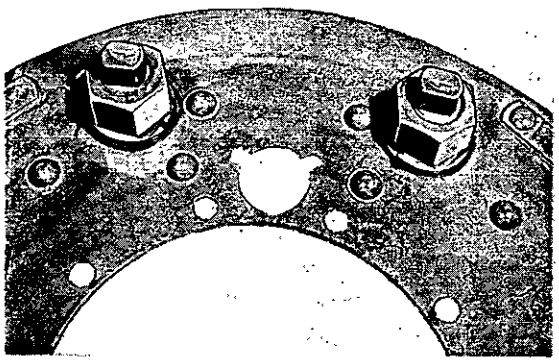
Illust. 2



Illust. 3

wheel. Install the second inner centralizer spring retainer. Countersunk portion of retainer against shoulder in center of adjusting nut. Next, install spring and outer centralizer spring retainer onto nut. When spring has been compressed sufficiently, install the remaining two centralizer spring retainer locks in groove of adjusting nut (Illust. 2).

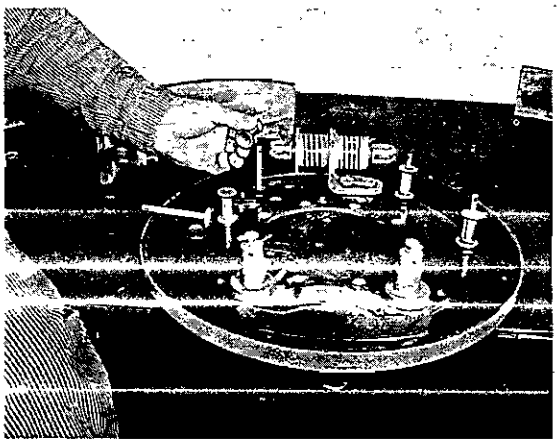
Install the right and left hand adjusting screws in the centralizer assembly. The adjusting screws should be turned back into the adjusting nut as far as possible. NOTE: Be sure that both adjusting screws are turned into the adjusting nut an equal amount.



Illust. 4

The centralizer assembly is now ready for installation onto backing plate. Install the assembly (Illust. 3) with the two studs through the slotted holes in the backing plate. Install the centralizer plate, two lock washers, and two nuts. Do not tighten nuts.

Install the two anchor pins in the backing plate. Next, install lock washers and hex nuts. Do not tighten nuts. Turn the anchor pins so arrows on outside ends of anchor pins point directly toward each other (Illust. 4). The anchor pins are made eccentric and by positioning them in this manner, the brake adjustment is slacked off to its minimum, therefore, giving the minimum circumference around the brake shoes.

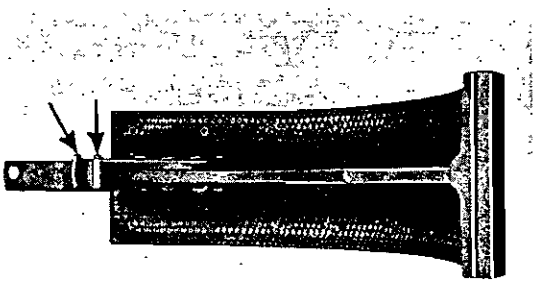


Illust. 5

Install four shoe hold down pins and shoe spacers (Illust. 5). The shoe spacers are slightly smaller on one end than on the other. The large end is machined out concave to fit onto the convex shape of the backing plate around each of the shoe hold down pins. Be sure that each of the shoe spacers are mounted with the concave end against the backing plate.

If the linings show excessive wear, they should be replaced. There are several fundamentals necessary in properly relining brake shoes.

1. Snug fit between liners and shoes. 2. Selection of proper rivets. 3. Removal of high spots on lining.



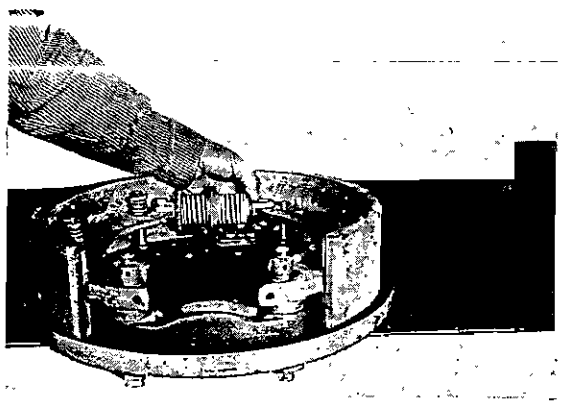
Illust. 6

Snug fit is absolutely necessary between liners and shoes if maximum efficiency is expected. Loosely applied liners contact only a small part of their area due to the humps between rivets.

There are several lining stretchers on the market that pull the liners tightly to the shoe before riveting. Stretchers are not necessary if care is used and the center rivets are set first. The operator then works toward both ends of the lining.

Proper selection of rivets is necessary to insure a close fit between rivet shank and drilled hole in liner and shoe. Rivets with small shank permit the liner to shift on shoe under pressure. This shifting gradually loosens liners and sometimes shears all rivets. The rivet should be long enough to properly upset the end, securely binding the lining. Should the rivet shank be too long, the upset end will split, materially weakening the job. Aluminum rivets should not be used.

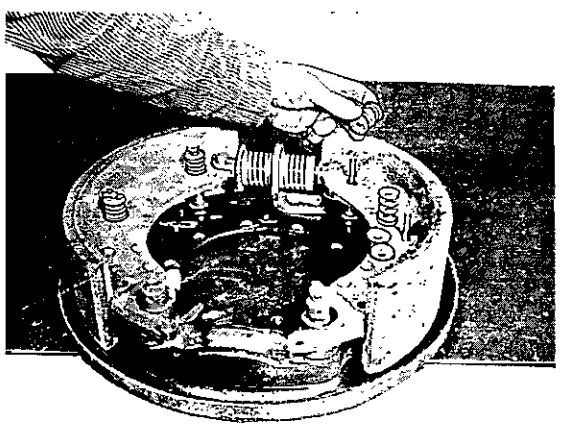
If the brake drum is scored or out of round, it should be turned on a lathe. Do not remove any more metal from the drum than necessary to "true" it.



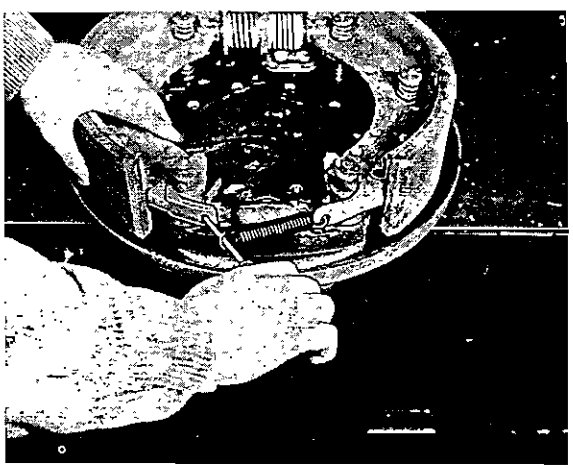
Illust. 7

When installing the brake shoe assemblies on the backing plate, be sure to mount each shoe with the projecting fingers (see arrows Illust. 6) turned toward the backing plate. This is extremely important as the brake shoes will not operate satisfactorily if it is mounted in a reverse manner.

Install the brake shoes with the primary shoe on the side of the backing plate which will be toward the front of the machine, and the secondary shoe on the rear side of the plate. The shoe assemblies shown installed (Illust. 7) are for the right hand



Illust. 8

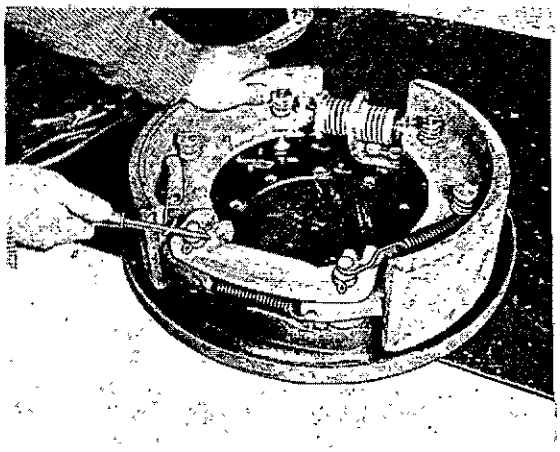


Illust. 9

side and therefore, the primary shoe is mounted to the left in the illustration, and the secondary shoe is mounted to the right. Be sure that all shoe hold down pins enter the brake shoes properly and install the brake shoe pivot pin from the inside out as shown in illustration. Install and spread 5/32" x 1-1/8" cotter pin through the end of the pivot pin. NOTE: The only obvious difference will be the shape of the shoes and the location of the projecting finger (Illust. 6).

Install the four shoe hold down spring cups, four shoe hold down springs and four shoe hold down spring cups, compress the springs sufficiently to install a 5/32" x 5/8" cotter key through the end of the shoe hold down pins (Illust. 8). Spread the cotter keys sufficiently to prevent their falling out during operation.

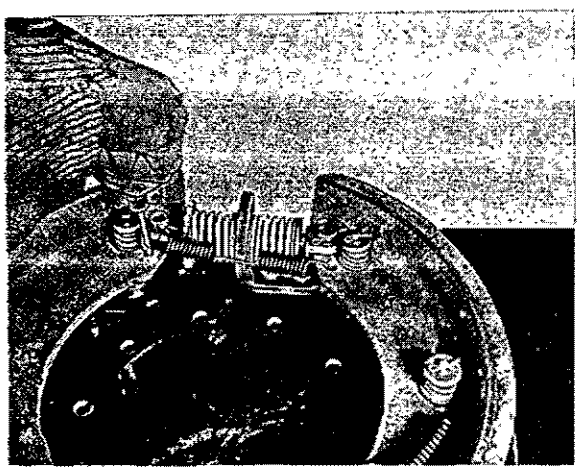
Install the primary to secondary shoe spring (Illust. 9). Be sure that the ends of the spring are hooked securely in the holes in the ends of the primary and secondary shoes. Install the anchor pin reinforcement plate and install and spread a 3/16" x 1-1/8" cotter pin in each anchor pin.



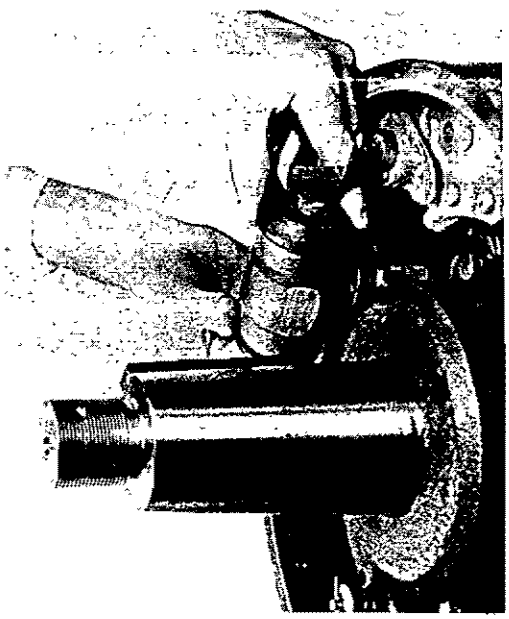
Illust. 10

Install the primary and secondary anchor to shoe springs (Illust. 10). The front or primary shoe spring is lighter than the rear or secondary shoe spring. Be sure they are installed with the light spring on the front shoe.

Install the adjusting screw spring (Illust. 11). This spring is made with two coils and a straight section which is in the middle. Make sure that the spring is installed with the straight center section



Illust. 11

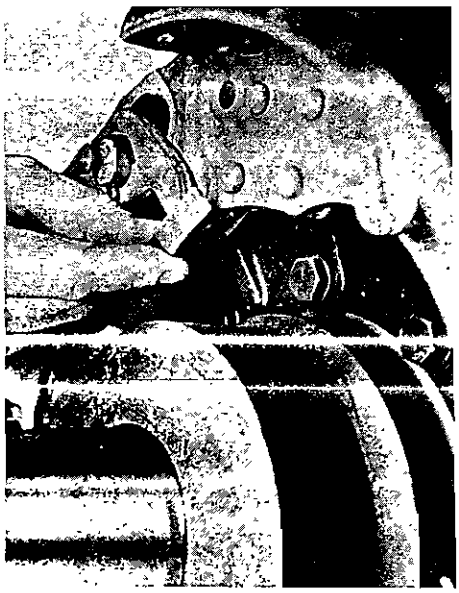


Illust. 12

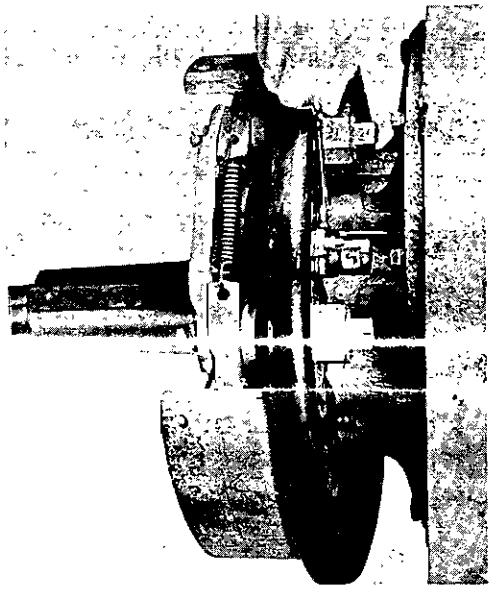
clearing the centralizer bracket. If this spring is installed backward, it will rub on the centralizer bracket thus causing the spring to bind and therefore, work improperly. The coils of the spring act as an adjustment lock by riding down against the adjusting nut wheel.

The brake shoe assembly is now ready for installation on the tandem housing.

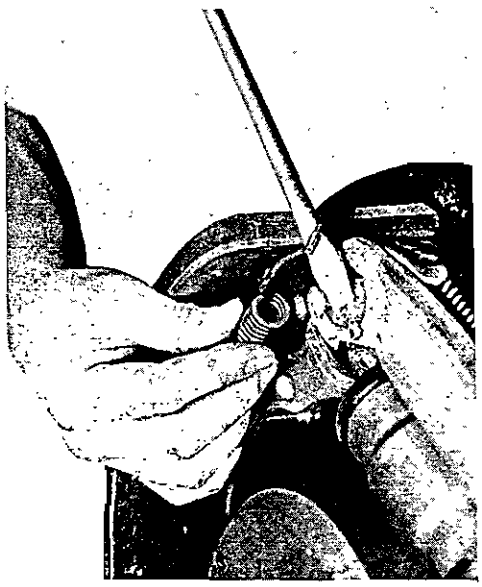
Install the assembly so that it is at a slight angle toward the front from vertical, the exact position can be determined by locating the brake cylinder in relation to the end of the hydralic brake tubing on top of the tandem housing. The four cap screws which hold the brake



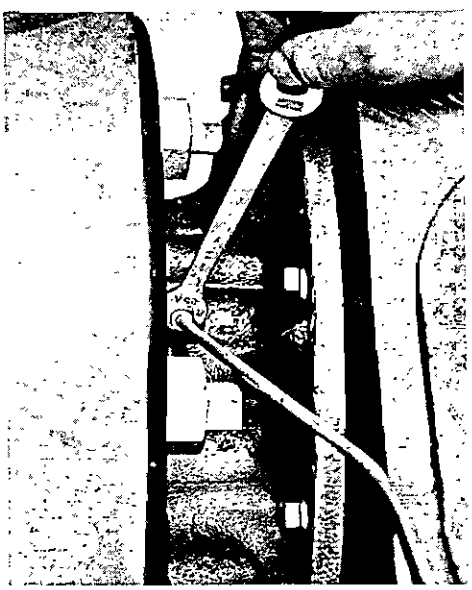
Illust. 13



Illust. 14



Illust. 15



Illust. 16

shoe backing plate to the eccentric housing are of the type which have a very thin head while the remainder are of the standard type. The reason for the thin heads is to provide clearance. Install cap screws and lock washers. Tighten cap screws securely.

Install wheel brake cylinder to backing plate (Illust. 12). Connecting links to fit over knobs and into slots in brake shoes (Illust. 13).

Install wheel brake cylinder cap screws and lock washers. Tighten cap screws securely (Illust. 14).

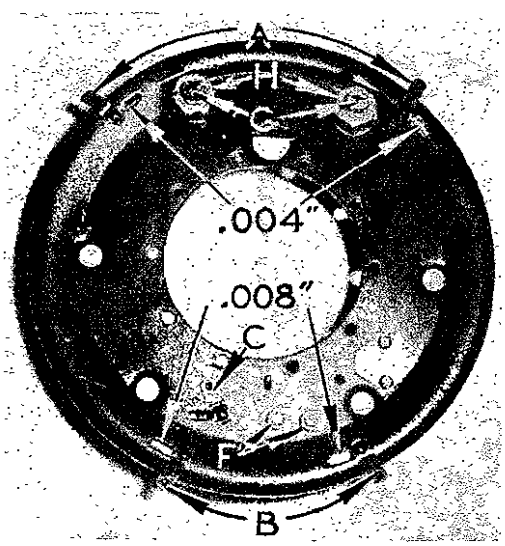
To install springs, hook short end of springs into holes in brake shoes. Using a screw driver or similar tool, bring long end of springs over anchor pins (Illust. 15).

Install and tighten brake line to wheel cylinder connection (Illust. 16). NOTE: Use care when tightening brake line fitting to prevent damaging threads of fittings.

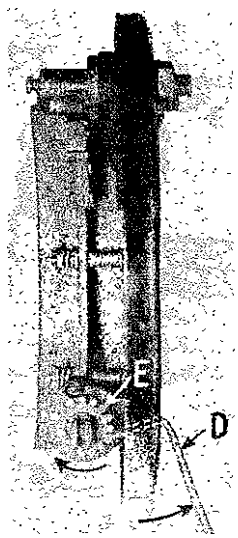
ADJUSTMENT

Never attempt to adjust the brake shoes with the wheel raised clear of the ground. The full weight of the machine should be supported on the wheels in order to assure proper centering of the brake drum around the brake shoe assemblies. Be sure that all adjustments, locks and nuts are loose. Brakes and brake drums should be approximately room temperature when making adjustments. If brakes are adjusted when drums are hot and expanded, the shoes may drag when the drums cool and contract. Turn the spring clips (A), (B) and (C) off from the holes in the backing plate (Illust. 17). Insert the adjusting tool (D) (Illust. 18) and turn the adjusting wheel (E) in the direction shown by arrow until the lower end of both brake shoes are expanded tightly against the drum. Tap the backing plate near the centralizer with a light hammer to insure centralizer taking correct position between shoe ends. Tighten the two nuts (F) securely.

The centralizer assembly is now properly located in the slotted holes in the backing plate which was shown in Illust. 3. Loosen the wheel centralizer adjustment by turning the wheel (E) (Illust. 18) in the opposite direction. Insert a .008" feeler gauge through each of the slots in the backing plate at (B) (Illust. 17). Insert a .004" feeler gauge through each one of the slots (A). Be sure that the feeler gauges have entered between the brake lining and the drum at all four points. Turn the anchor pins (G) in the direction of the arrows until a slight perceptible drag is felt on each of the feeler gauges inserted through the slots (A).



Illust. 17



Illust. 18

Turn the adjusting wheel (E) with the adjusting tool (D) (Illust. 18) in the direction of the arrow until a slight perceptible drag is felt on the feeler gauges inserted through the slots (B) (Illust. 17). Check all four feeler gauges at (A) and (B) to be sure that none are too tight. Hold the anchor pins (G) in their positions and tighten the lock nuts (H) securely. Check the feeler gauges again to see if the adjustments have changed. Due to the possibility of having drum distorted slightly or off center, it is best to revolve the wheel 180° and check all clearances again. This is especially true if drums have not been trued on a lathe. If any clearances have changed, adjust the shoes to a minimum of .004" and .008" as described above. Remove all four feeler gauges and turn all spring covers over the slots (A), (B) and (C).

Road test the grader. The brakes either may or may not be "run-in" depending on the desired results. If it is necessary to meet certain braking requirements which necessitate a 100% brake lining contact with the drum, then it will be necessary to "run-in" the brakes. However, if this is not necessary, it is better to allow the brakes to wear in normally and readjust them after they have become seated to the drums.

If it is decided to run in the brakes, run them in as follows: With the grader operating at half throttle in low gear, apply the brakes firmly for 10 second intervals releasing them completely for 15 seconds between each application. Apply the brakes 25 or 30 times. If the brakes tend to overheat; increase the time between applications to 20 or 30 seconds. Readjust the brakes after running them in and allowing them to cool.

HYDRAULIC BRAKE SYSTEM

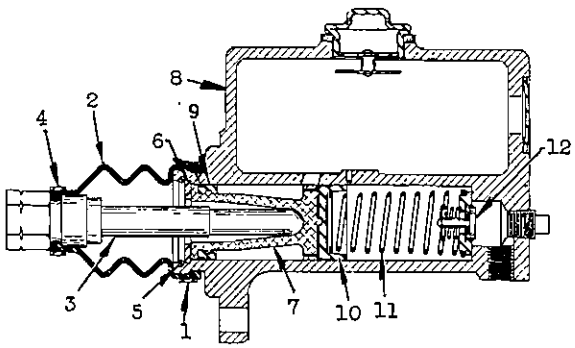
The hydraulic system used to actuate the brake mechanism consists of a compensating type master cylinder in which the hydraulic pressure is originated; individual wheel cylinders in which the hydraulic pressure is applied, which serve to actuate the brake shoes against the brake drum of each wheel; and the "line" consisting of steel tubing, flexible hose, brackets and unions, interconnecting the master cylinder and wheel cylinders. The master cylinder and wheel cylinders are fitted with pistons, all of which are provided with cup packing which act as a seal to maintain pressure and prevent loss of brake fluids. Depressing the brake pedal moves the piston within the master cylinder, thus displacing the brake fluid from the master cylinder through its outlet orifices, tubing and flexible hose connections into wheel cylinders. The brake fluid being non-compressible, enters each of the wheel cylinders, causing the cylinder pistons to move outward and actuate the brake shoes. As pressure on the pedal is increased, greater hydraulic pressure is built up within the wheel cylinders, and consequently greater force is exerted against the shoes.

When the pressure on the pedal is released, the brake shoe retracting springs return the brake shoes to their normal or released position. The return movement of the brake shoes, in turn, causes movement of the wheel cylinder pistons toward their released position, thus forcing the fluid back through the tubing into the master cylinder.

Always use hydraulic brake fluid in the hydraulic brake system. The introduction of mineral

based oil into the system will cause rubber parts to swell and become inoperative.

MASTER CYLINDER



Illust. 19

The combination type master cylinder (Illust. 19) consists of a barrel and tank casting (8), double check valve (12), piston cup return spring (11), primary piston cup (10), secondary piston cup (9), piston (7), piston stop (6), piston stop wire (5), boot (2) and connecting link (3). The boot straps (1) and (4) hold the boot in place on the barrel and tank casting (8) and the connecting link (3). The fluid reservoir or supply tank is cast integral over the master cylinder barrel. A combination filler and breather plug permits atmospheric pressure on the reserve fluid at all times.

Depression of the pedal causes piston (7) and cups (9) and (10) to move forward in the cylinder barrel. A very small forward movement of the cup (10) closes the by-pass port above the cup and pressure stroke commences. Actual pressure is not built up until the fluid displaced has caused all shoes to go into contact with their drums. Additional pressure on the pedal produces hydraulic pressure within the brake system.

Removal of the operator's foot from the brake pedal after each brake application permits the brake pedal and push rod (3) to return independently to their off position.

The return of piston (7) and cups (9) and (10) is accomplished by the piston return spring (11). The piston for this type of unit is designed to carry a primary cup (10) and a secondary cup (9). The construction of the piston is such that reserve fluid from the tank passes through the vent between cups (9) and (10) into the recessed area in the piston (8). Thus, we have fluid on both sides of the primary cup. The secondary cup (9) is merely a seal to prevent loss of reserve fluid into the boot (2).

The combination type master cylinder is also known as a compensating type. Its primary compensating function is to maintain a constant volume of fluid in the system at all times, regardless of expansion (heat) or contraction (cold). The secondary compensating function is the replacement of additional fluid into the system to counter-balance any loss due to gravity.

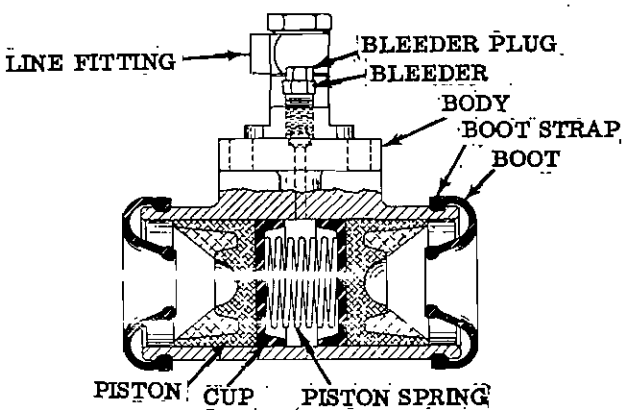
The return to off position of piston (7) and cup (10) is much faster in displacing volume than the return of the fluid through the "line" into the master cylinder. A momentary vacuum is created in the cylinder barrel and additional fluid is drawn into the system through the drilled holes in piston (7) and past the lip of cup (10). The operating fluid returns more slowly from the wheel cylinders and lines back into the master cylinder barrel. Any excess is by-passed by the port ahead of the primary cup into the reservoir. Thus, we have a cylinder full of fluid for the next brake application.

ADJUSTMENT

When the brake control system is in release position, the push rod (3) (Illust. 19) should travel approximately 1/32" before moving the piston (7). This free travel is required to prevent blocking of the by-pass port in the master cylinder. The brakes will drag if the by-pass port becomes blocked due to pressure building up in the system. Should all brakes drag, pressure may be relieved by screwing the push rod (3) back onto the yoke on the brake pedal linkage.

WHEEL CYLINDERS

Illust. 20 is a view of the wheel cylinder. This unit changes the applied hydraulic pressure into mechanical force to actuate the brake shoes.



Illust. 20

It is possible to rehone the majority of wheel cylinders when they become worn and place them in good working condition; however, this requires the use of up-to-date honing equipment and plug gauges. If this equipment is not available, the cylinders may be taken to the nearest Wagner service branch or authorized service station for repairing. Cylinders and the parts must not be washed in gasoline, kerosene or oil. Use high grade denatured alchol for all cleaning.

Keep all lubricant and brake fluid away from the brake linings. Do not allow any mineral based oil to come in contact with any of the hydraulic brake parts.

BLEEDING

Any air inside the hydraulic system must be removed. Whenever a line has been disconnected at master cylinder, the entire system must be bled at both wheels until all air is completely expelled. When a line has been disconnected at any wheel or if the hose leading to the tandem assembly has been disconnected, the cylinder on that side must be bled. Air in the system will cause a springy, rubbery action of the brake pedal. Should a sufficient quantity be introduced into the system, the brake pedal will go to the floor board under normal pressure.

Fill the master cylinder supply reservoir with brake fluid and see that it is kept at least half full during entire bleeding operation.

Remove the bleeder plug from the end of the bleeder (Illust. 20) and attach the bleeder tube. Allow the tube to hang into a clean container, such as a glass jar. Unscrew the bleeder connection 3/4 of a turn and depress the brake pedal, using half strokes, close bleeder

connection on return stroke. Pumping brake pedal forces fluid out into the glass jar and carries with it any air which might be present in the system. Watch flow of fluid from tube, the end of which should be kept below surface of fluid in glass jar and when all air bubbles cease to appear or when stream is a solid fluid mass, close bleeder connection. Remove bleeder tube and install bleeder plug.

Fluid withdrawn in bleeding operation should not be used again unless absolutely certain that it does not contain impurities. Fluid of which cleanliness is questionable should never be used. Fluid should be replenished in supply reservoir after each cylinder is bled. Should supply reservoir be drained during bleeding operation, air will enter the system and re-bleeding will then be necessary.

PARKING BRAKE

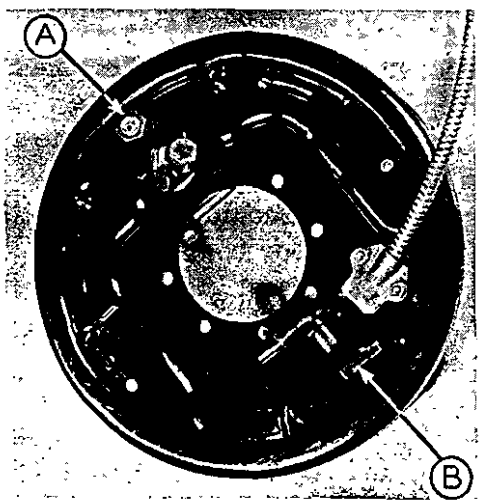
The parking brake is operated by a hand lever at the operator's right. It is an internal band expanding type brake. It operates in a drum mounted on the lower shaft of the transmission.

The brake has both mechanical and hydraulic action. It is activated mechanically by use of the hand brake lever. It is hydraulically activated by use of the foot brake. This helps slow down the machine by braking the transmission simultaneously with the wheels when the foot brake is depressed.

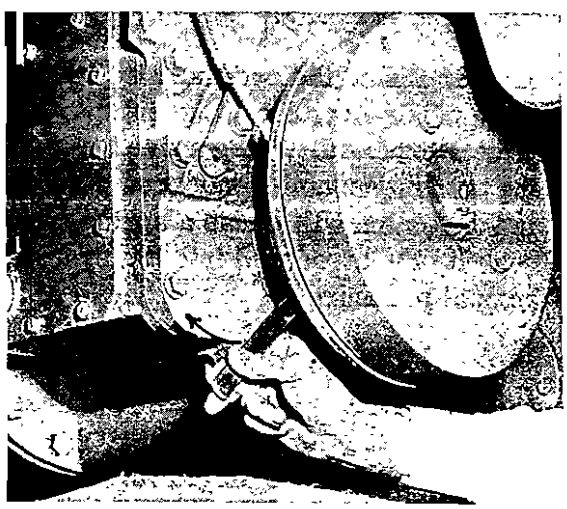
ADJUSTMENT

When brake adjustment becomes necessary, always adjust shoe contact to drum first before attempting to adjust cable length.

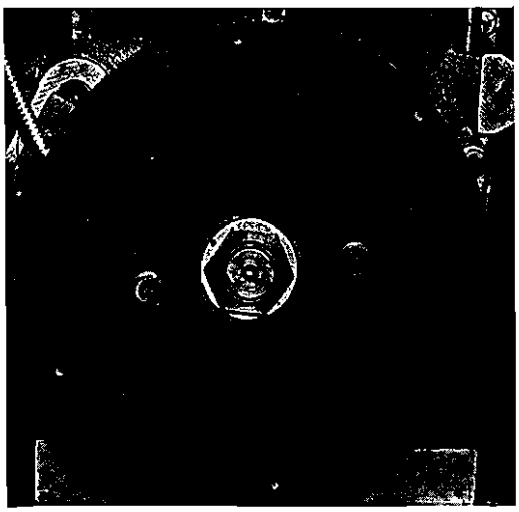
To adjust shoe contact, loosen lock nut on anchor pin (A) (Illust. 1). Remove clip (B) and insert brake adjusting tool in slot until it makes contact with the adjusting wheel.



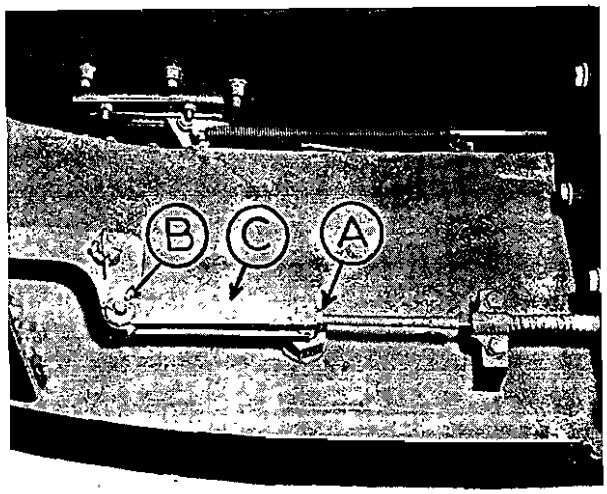
Illust. 1



Illust. 2



Illust. 3



Illust. 4

Move tool in direction of arrow (Illust. 2) to move brake shoes toward the drum. Move shoes out as far as possible. With a hammer, tap around the outer edge of brake drum to centralize brake shoes.

Tighten lock nut on anchor pin (A) (Illust. 1). Rotate adjusting wheel in the opposite direction approximately eight (8) notches.

Remove the socket head plug from the brake drum. Rotate brake drum until the hole is in position (A) (Illust. 3). The clearance at this point and point (B) should be .004". If this clearance is less than .004", loosen anchor pin lock nut. With a hammer, tap anchor pin down until a .004" clearance is obtained at point (A) and (B). Tighten lock nut. Rotate brake drum around to point (C) (Illust. 3).

Insert an .008" feeler gauge at this point. Adjust brake shoes until the .008" feeler gauge is a snug fit at point (C) and (D).

To adjust the parking brake cable, remove cotter key and pin (B) (Illust. 4). Loosen lock nut (A), turn yoke (C) clockwise to shorten. By exerting a normal pull, the brake shoes should make holding contact with the drum before the parking brake lever is half out of its holder.

— NOTES —

POWER CONTROLS

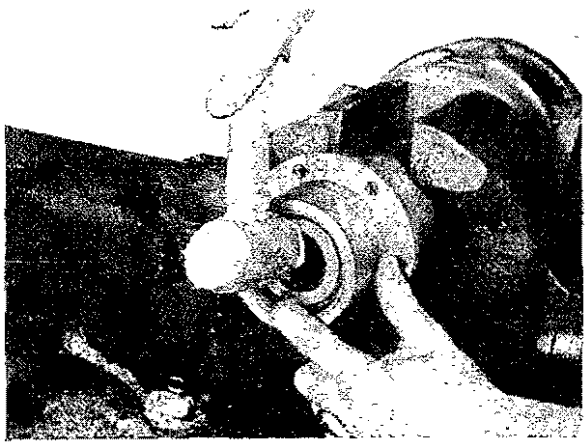
POWER BOX REDUCTION DRIVE

It is seldom necessary to completely overhaul the power control box. Usually it is only necessary to repair an individual unit in the box. If a complete overhaul is to be attempted, the procedure outlined below should be followed. Due to the fact that during the reassembly operation all adjustments and settings must be established, a detailed discussion is given only of the reassembly operation.

The following description and illustrations are with complete power control box removed from the grader.

REASSEMBLY

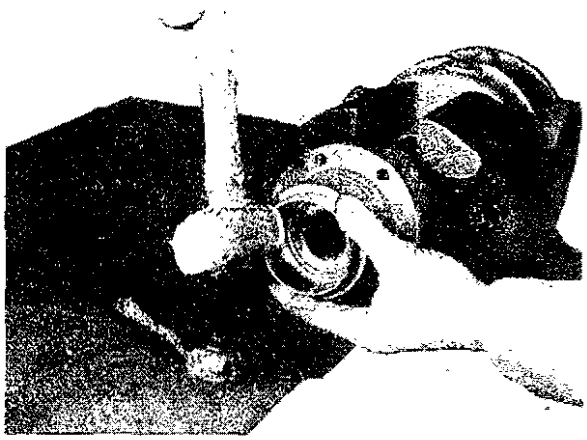
The first step in reassembly after all parts are cleaned and ready for installation, is to install leather grease seal in top end of power box drive housing (Illust. 1). Install seal with sharp edge toward top of housing, install as a grease seal. Drive seal into housing as far as it will go, using a soft hammer. Lubricate leather in seal with machine oil before installing.



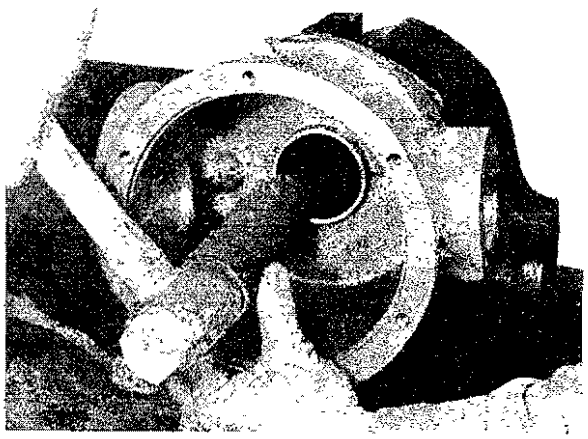
Illust. 1

Install bearing cup into top end of power box drive housing, making sure that small end of taper goes to the inside. Use a soft hammer and drive cup in as far as it will go (Illust. 2).

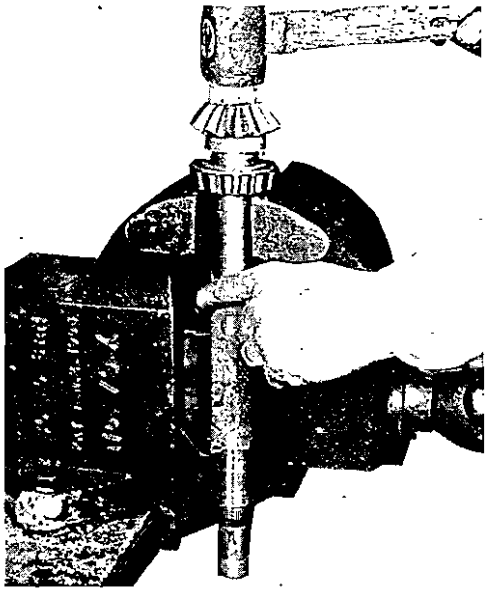
Install bearing cup into bottom end of power box drive housing, making sure that small end of taper goes to the inside. Use a soft hammer and drive cup in as far as it will go (Illust. 3).



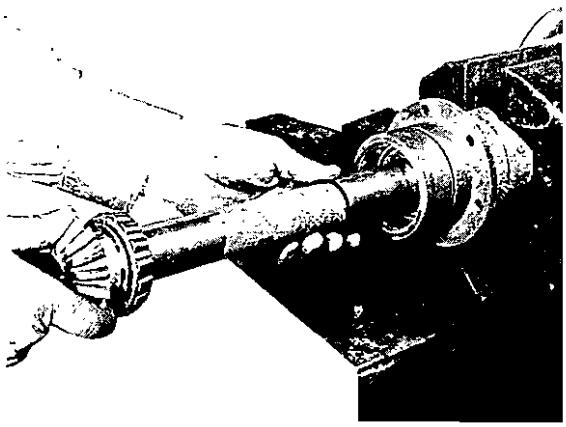
Illust. 2



Illust. 3

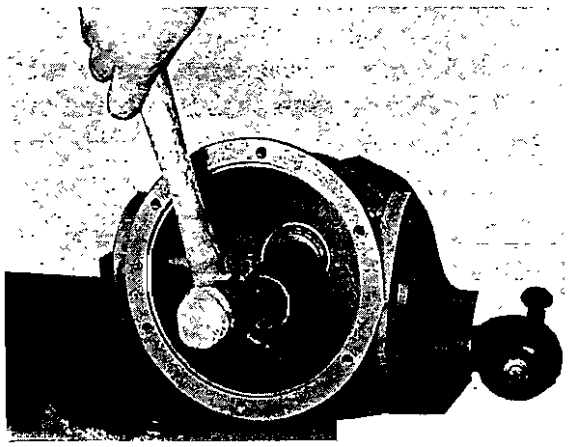


Illust. 4



Illust. 5

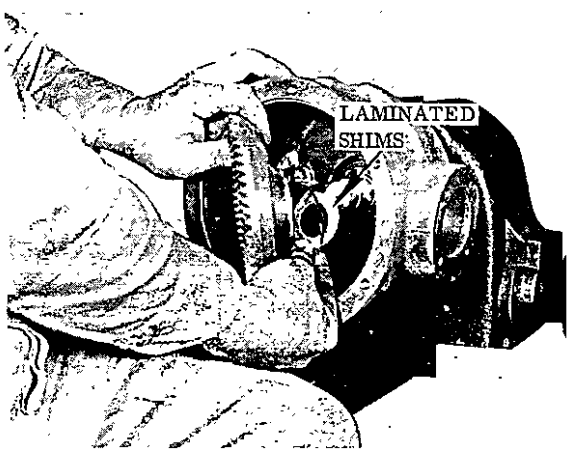
Install tapered roller bearing on vertical drive shaft (Illust. 4). Be sure that the large diameter of the bearing is driven up against the shoulder behind the bevel drive gear. All bearings should be lubricated with machine oil before installing.



Illust. 6

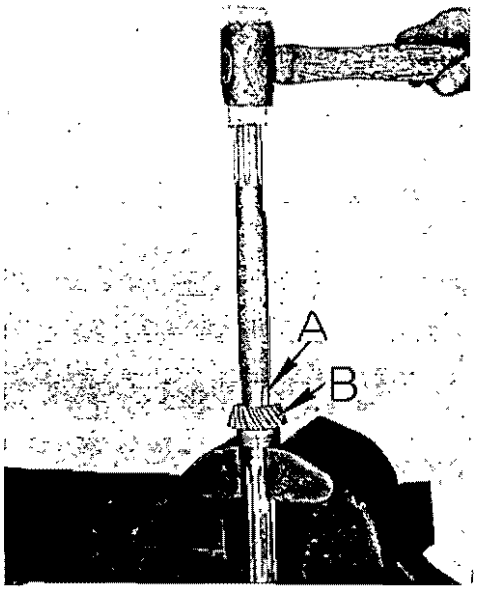
The vertical drive shaft with bearing may now be installed into housing. When inserting shaft through leather seal in top end of housing, be sure not to damage seal. One way of expanding leather seal over shoulder of shaft is by wrapping a strip of thin shim stock around shaft in a funnel shape. Illust. 5 is the installation of drive shaft through seal with the use of shim stock.

Press or drive lower bearing on shaft (Illust. 6). When pressing or driving bearing into place, use a piece of pipe or similar driver which will fit against the inner race of bearing.



Illust. 7

Install the two (2) laminated spiral gear shims (Illust. 7). Next, install spiral bevel gear. Install hex slotted nut and tighten securely. Back hex slotted nut off one (1) slot. Install and spread cotter pin. Using a block of wood or a soft drift, bump the shaft sharply. The bearings should now be pre-loaded. The specifications on the pre-load of these bearings are 4-8 inch pounds. If it should be necessary to remove the bevel gear for any reason, the re-



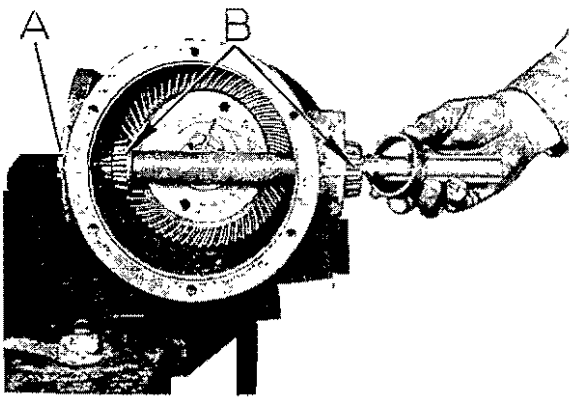
Illust. 8

assembly would be the same as the above mentioned procedure.

Install Woodruff key "A" (Illust. 8) into keyway of spiral pinion drive shaft. Install spiral pinion "B" onto shaft (Illust. 8) with hub of gear toward the long splined end of shaft. Use a soft hammer or piece of pipe to drive the gear to shoulder of shaft.

Install bearing cup into pump opening housing "A" (Illust. 9) using a soft hammer or piece of pipe. Assemble bearing cones "B", on spiral pinion drive shaft, small tapered ends of cones facing ends of shaft. Insert spiral pinion drive shaft, with the short splined end of shaft first (Illust. 9). Install bearing cup "A" (Illust. 10) using a soft hammer or piece of pipe.

Spiral pinion gear and bevel pinion gear to run hush at toe end of gears.

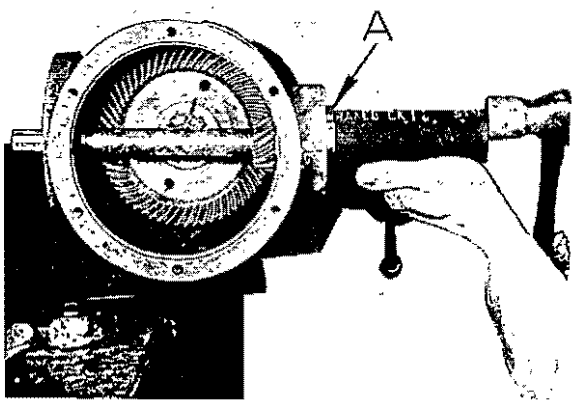


Illust. 9

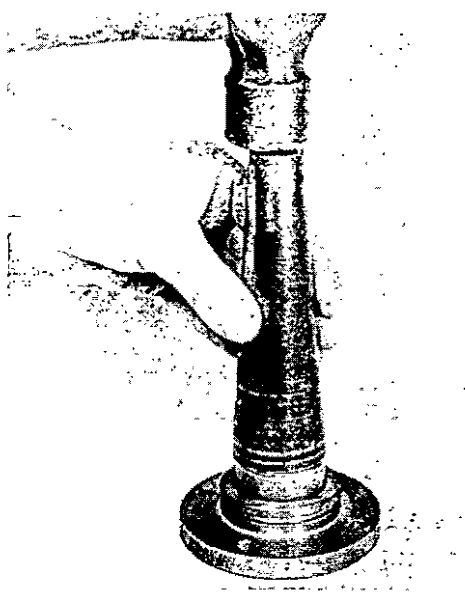
Press or drive oil seal into seal cap (Illust. 11). Lip of seal toward vertical drive housing.

Install "O" ring in groove of seal cap (Illust. 12).

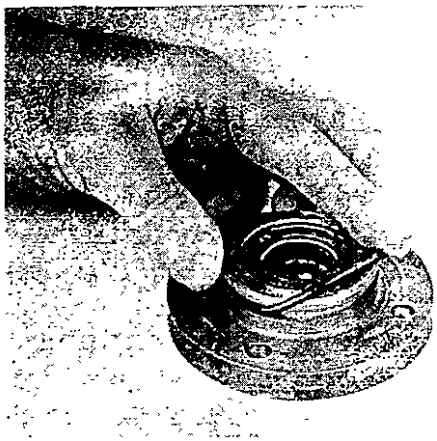
Install shims onto hub of seal cap. Next, install seal cap onto long splined end of spiral pinion



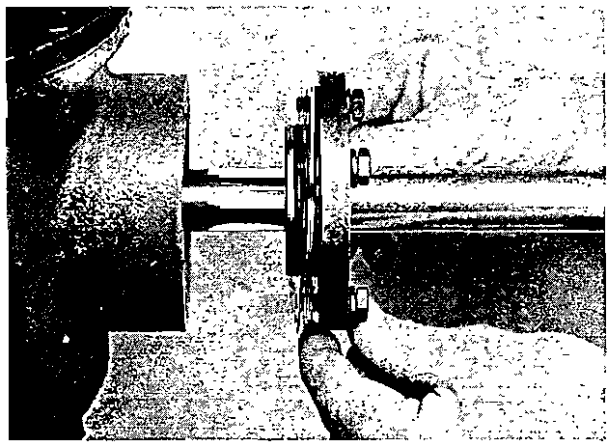
Illust. 10



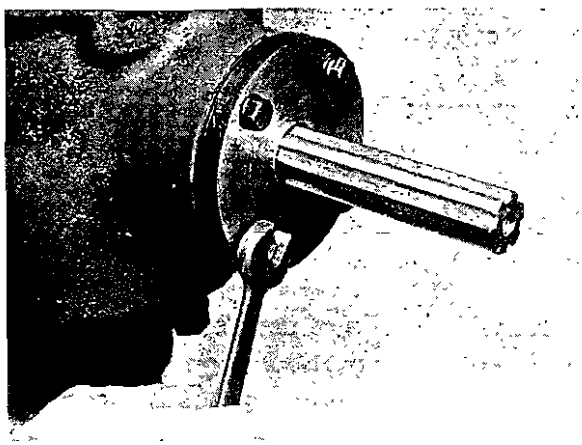
Illust. 11



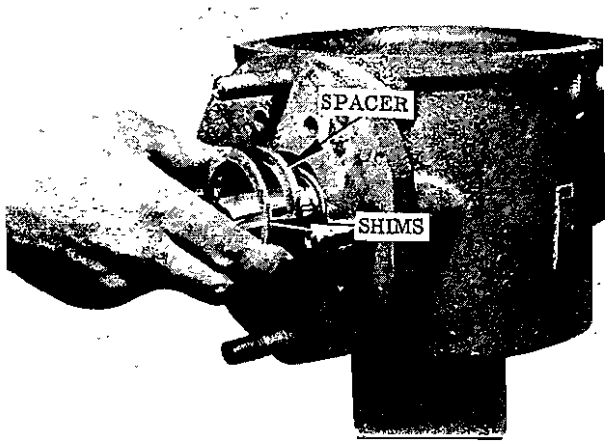
Illust. 12



Illust. 13



Illust. 14

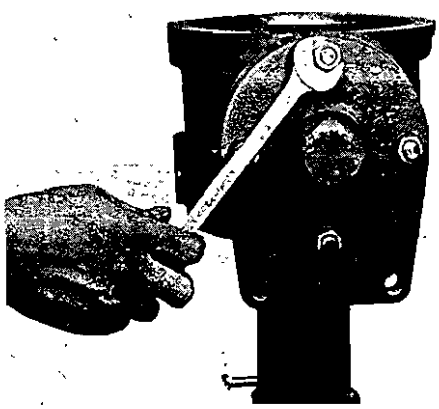


Illust. 15

drive shaft (Illust. 13). NOTE: To protect oil seal leather from damage, wrap a thin piece of shim stock over splines of shaft; also, use white lead on "O" ring to prevent damaging "O" ring when hub of seal cap is inserted into vertical drive housing.

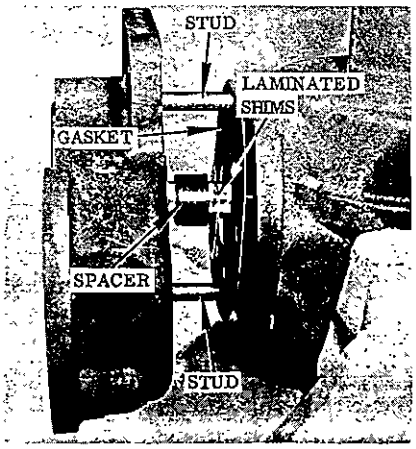
Install cap screws and lock washers. Tighten cap screws securely (Illust. 14).

Install spacer and shims onto short splined end of spiral pinion drive shaft (Illust. 15).

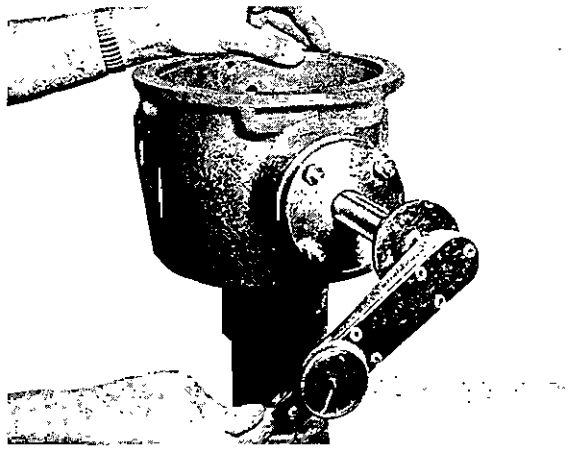


Illust. 16

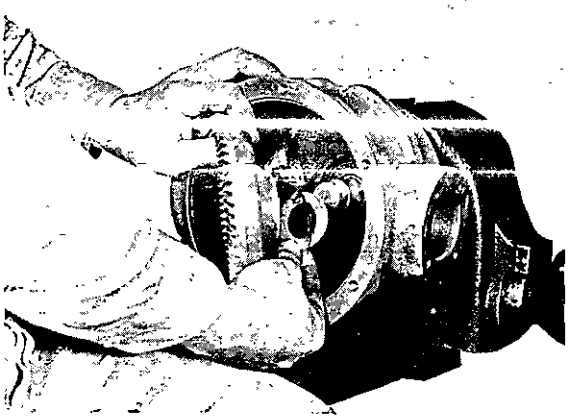
Install pump opening cover less gasket (Illust. 16). Install stud nuts and lock washers. Tighten nuts. NOTE: Pump opening cover is used on Model 550 motor graders only, when equipped with manual steering.



Illust. 17



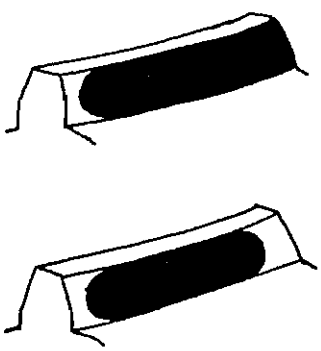
Illust. 18



Illust. 19

For Models 550 and 660 motor graders with power equipment, such as power steering, power shift moldboard, etc., install shims, spacer and pump mounting gear housing, less gasket (Illust. 17) onto vertical drive housing. Install cap screws with lock washers. Tighten cap screws securely.

Pre-load the bearings to a torque reading of 4-8 inch pounds (Illust. 18). To obtain this reading, remove or add shims at seal cap as necessary. If reading still cannot be obtained, remove or add shims at pump opening cover (Model 550 motor grader with manual steering) or pump mounting gear housing (Models 550 and 660 motor graders with power accessories).



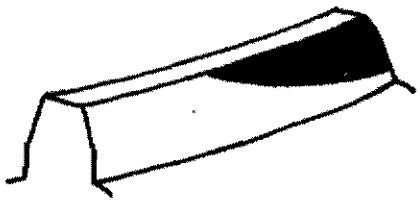
ACCEPTABLE TOOTH PATTERN

Illust. 20

To obtain the pinion depth setting, set toe end of spiral gear flush with toe end of bevel gear, remove shims as necessary from one side of vertical drive housing and add the same amount of shims to the opposite side (Illusts. 22 and 23).

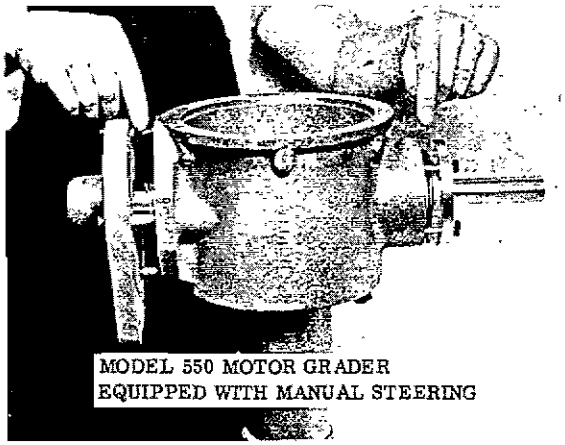
To obtain the backlash between spiral pinion gear and bevel gear, use a dial indicator. Remove or add shims under bevel gear (Illust. 19) until a reading of .004" to .012" is obtained. Backlash should be measured at the tightest point.

In order to be sure that the spiral pinion and spiral bevel gears are in proper mesh, it is necessary to make a surface pattern check. This may be done by mixing powered red lead with any light machine oil and spreading it over the



Illust. 21

working surfaces of the teeth with a brush to show clearly the tooth contact obtained. Prussian blue may also be used. NOTE: Gears are to be clean and free from oil.

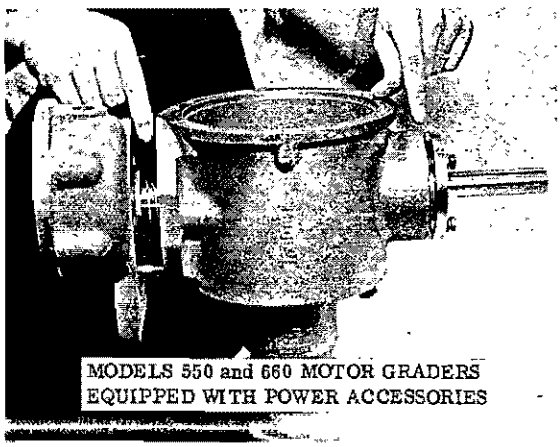


MODEL 550 MOTOR GRADER
EQUIPPED WITH MANUAL STEERING

Illust. 22

Revolve the gears several revolutions in the forward speed direction. Inspect the teeth of the gears for portions where the paint has been removed by the contact of the two (2) gears. Compare the results with the surface patterns shown in Illust. 20.

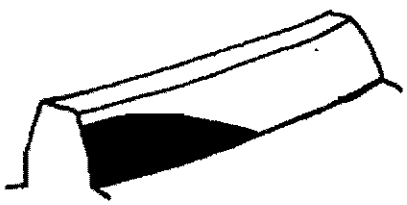
When you have a tooth pattern as in Illust. 21, it is necessary to remove shims from the seal cap side of vertical drive housing and add the same amount of shims to the pump opening side (Model 550 motor graders equipped with manual steering only) (Illust. 22) or pump mounting gear housing side (Models 550 and 660 motor graders equipped with power accessories) (Illust. 23) of vertical drive housing.



MODELS 550 and 660 MOTOR GRADERS
EQUIPPED WITH POWER ACCESSORIES

Illust. 23

When you have a tooth pattern as in Illust. 24, it is necessary to remove shims from the pump opening side (Model 550 motor graders with manual steering only) (Illust. 22) or pump mounting gear housing side (Models 550 and 660 motor graders with power accessories) (Illust. 23) of vertical drive housing and add the same amount of shims to the seal cap side of vertical drive housing.

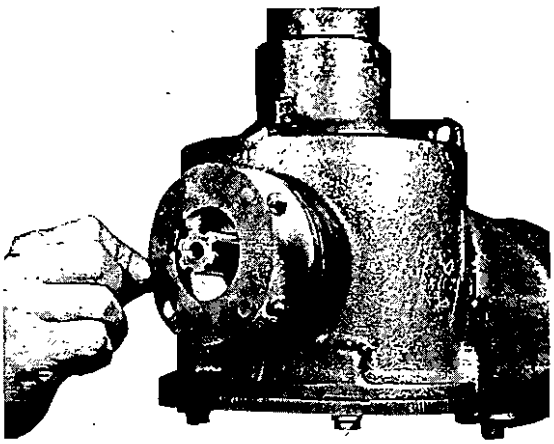


Illust. 24

After the pre-loading of bearings, pinion depth setting, backlash of gears and tooth pattern is obtained, remove pump opening cover from vertical drive housing. Shellac gasket (Illust. 25) to vertical drive housing.

Install cover onto vertical drive housing (Illust. 26). Install lock washers and nuts onto studs. Tighten nuts securely. Next, tighten seal cap cap screws securely.

Shellac bottom cover plate gasket to vertical drive housing and install cover plate. Install cap screws and lock washers. Tighten cap screws securely.

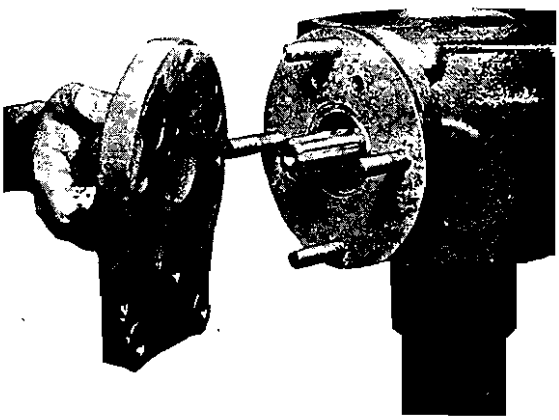


Illust. 25

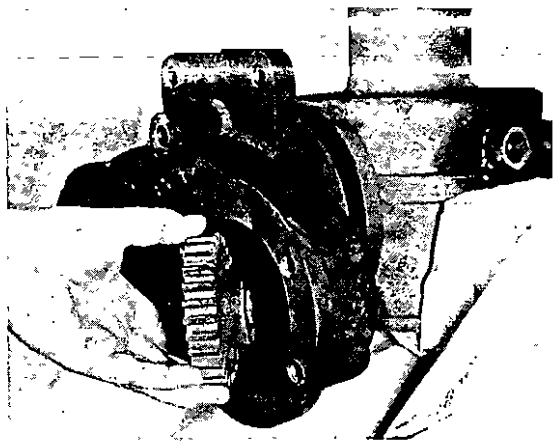
The vertical drive housing used on Model 550 motor graders with manual steering is complete and ready for installation to power box.

To complete the vertical drive housing used on Models 550 and 660 motor graders with power accessories, remove pump mounting gear housing from vertical drive housing. Shellac gasket to vertical drive housing and install pump mounting gear housing on studs just enough to hold housing into position.

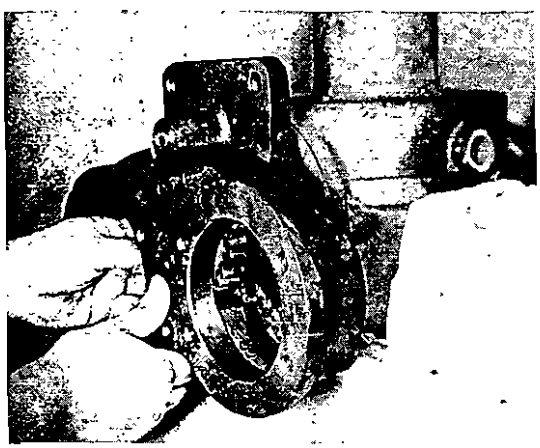
Insert pump drive gear into pump mounting gear housing and on to splined end of vertical drive shaft (Illust. 27).



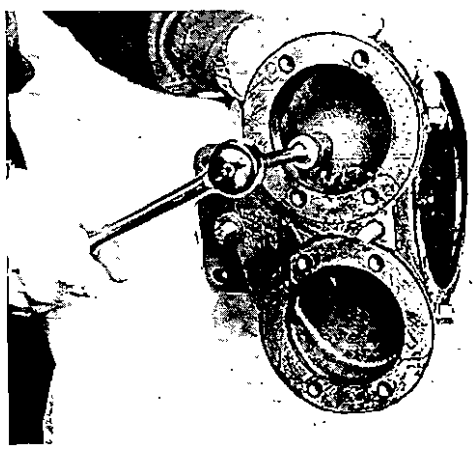
Illust. 26



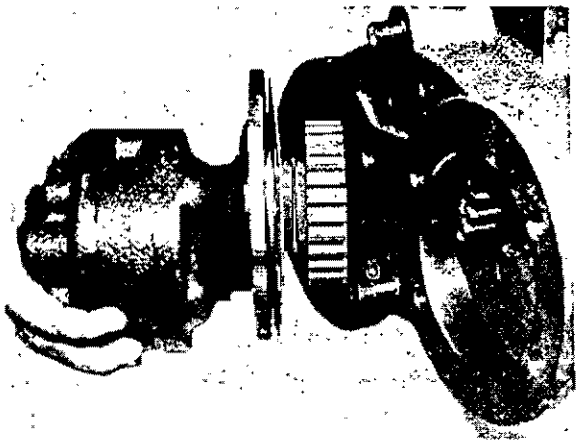
Illust. 27



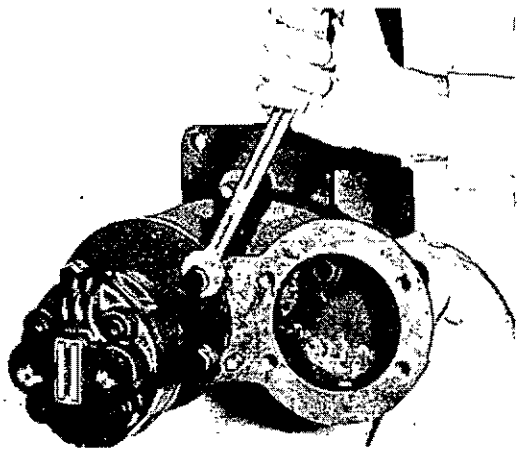
Illust. 28



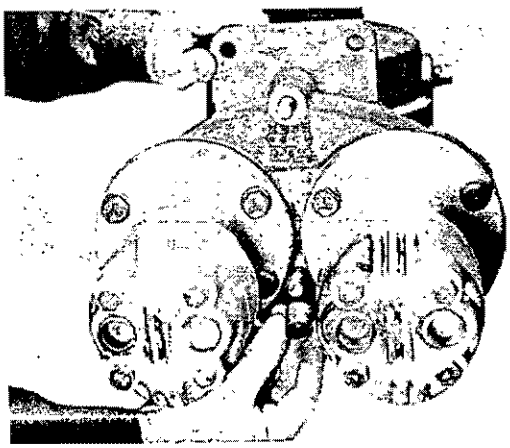
Illust. 29



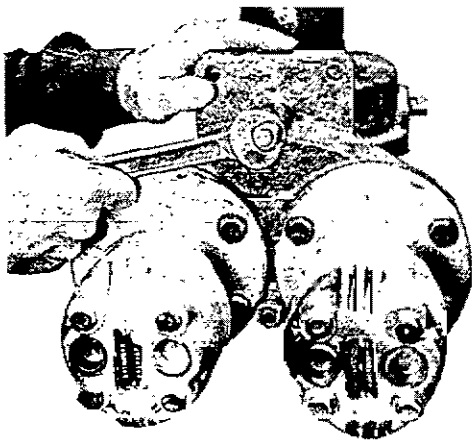
Illust. 30



Illust. 31



Illust. 32



Illust. 33

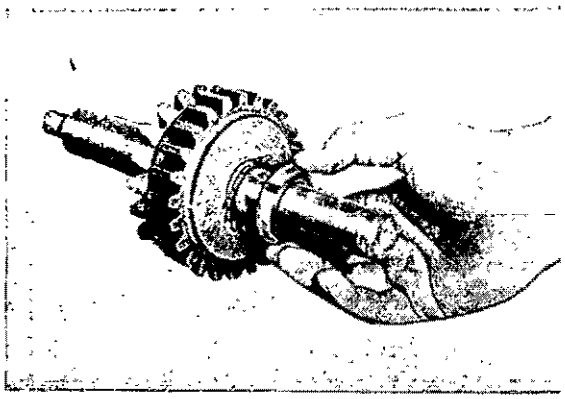
After gear is started on the splined shaft, slide gear and housing simultaneously until housing is against vertical drive housing (Illust. 28).

Install cap screws and lock washers. Tighten cap screws securely (Illust. 29).

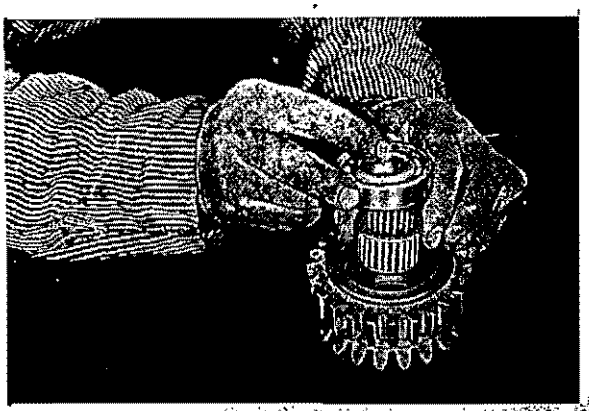
Next, install pump to housing (Illust. 30). Install cap screws and lock washers. Tighten cap screws securely (Illust. 31).

Install spacer onto stud (Illust. 32) and stud nuts and lock washers. Tighten stud nuts securely (Illust. 33).

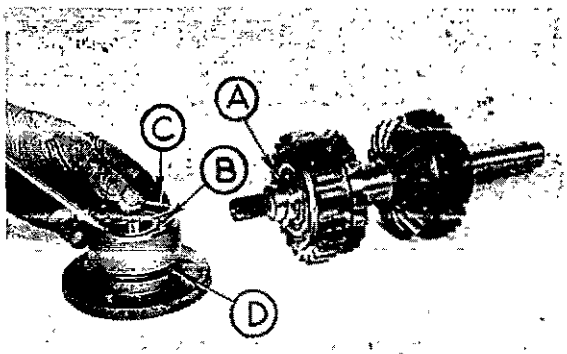
Shellac bottom cover plate gasket to vertical drive housing and install cover plate. Install cap screws and lock washers. Tighten cap screws securely.



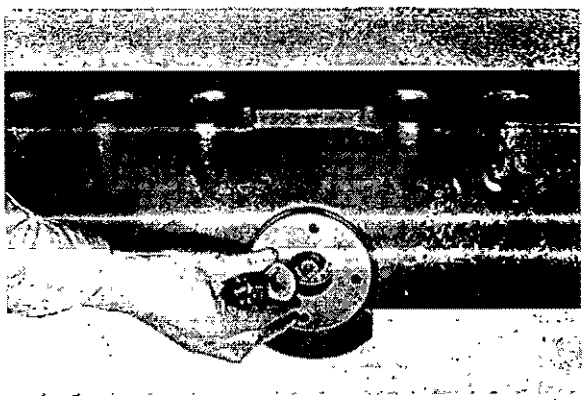
Illust. 1



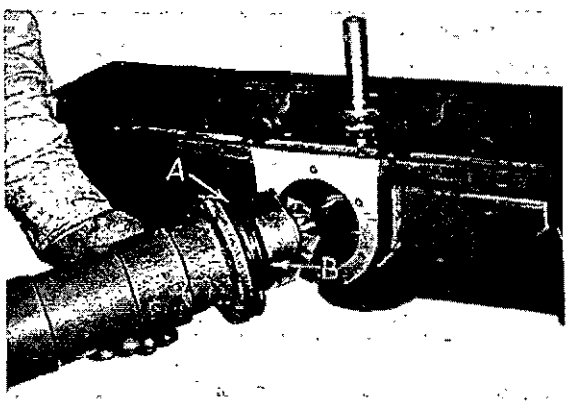
Illust. 2



Illust. 3



Illust. 4



Illust. 5

POWER BOX

Install the Woodruff key in the center shaft and install the front bevel gear by supporting the gear in a press and pressing on the shaft. Install the lock washer, being sure that the inside lip of the lock washer enters the keyway in the shaft. Install lock nut (Illust. 1) and tighten securely. Bend ears into slots of lock nut.

Install a roller bearing and ball bearing in the rear bevel drive gear and assemble it on the opposite end of the center drive shaft. The proper assembly of the bearings in the rear bevel drive gear is shown in Illust. 2.

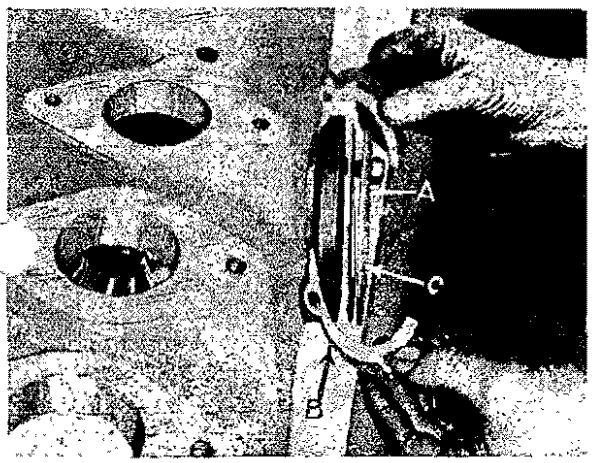
Install the spacer "A" on the shaft and install the ball bearing "B" in the rear bearing carrier. Install the snap ring "C" and "O" ring "D" in the rear bearing carrier (Illust. 3).

Assemble the rear bearing cage with "O" ring (Illust. 4) into the power box. Be sure and

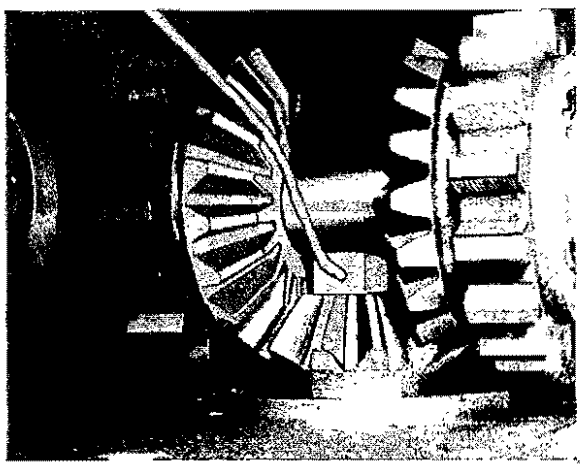
apply white lead to the "O" ring. This will help prevent damage to the "O" ring when installing the cage to the housing. Slide the threaded end of the center shaft into the bearing in the rear bearing cage. Install spacer and hex slotted nut (Illust. 4). Tighten hex slotted nut securely, being sure the ball bearing is pressed securely against the shoulder on the center shaft.

In order to properly adjust bevel gear and drive pinion, it will be necessary to assemble the bearings and gears on the center shaft and install in power box with cover in place. This will hold the center shaft in operating position while the gears are being adjusted.

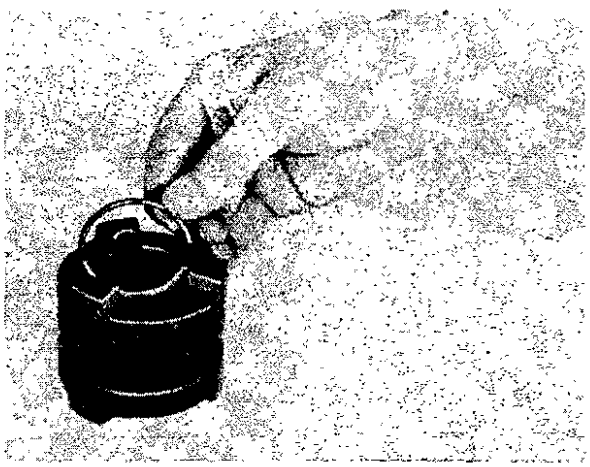
Install drive housing in power box. Maneuver gauge (.500 + .005") into power box through lever hole on right of center shaft. Place in position between center shaft and drive pinion gear (Illust. 7). Push drive housing into power box until gear and gauge are tight against center shaft. Use feeler gauge to measure clearance between bottom of power box and drive housing bolting flange. The reading obtained is the amount of shims required. Insert shims "A" and



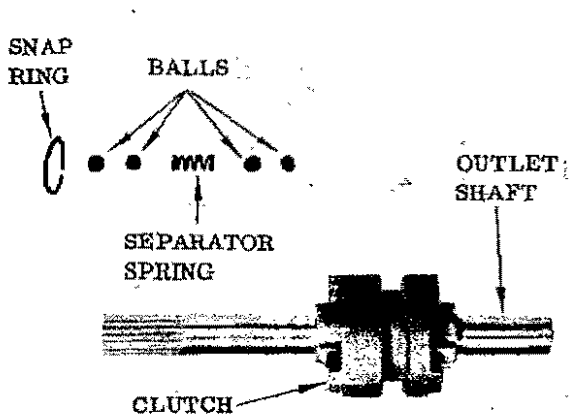
Illust. 6



Illust. 7



Illust. 8

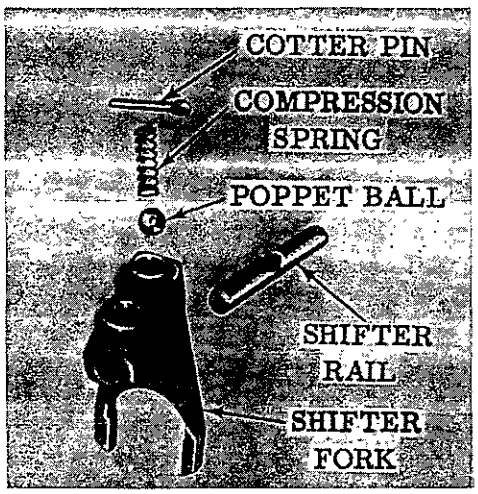


Illust. 9

"O" ring "B" (Illust. 5) in groove at top of housing and assemble to power box. Tighten securely. NOTE: Apply white lead to "O" ring to prevent damage.

Adjust bevel gears by tightening nut "A" (Illust. 6) until there is no backlash in either gear. Use feeler gauge to measure clearance between bearing cage "B" (Illust. 6) and power box body. Back-off nut "A" two (2) constellations plus whatever is necessary to align pin hole in shaft with nut. Install cotter pin. Add .010 to feeler gauge reading taken above and install the equivalent in shims (Illust. 6). Now, install cover "C" (Illust. 6) making sure all cap screws have lock washers. Tighten cap screws securely. Backlash will now be approximately .008 to .010.

Install the notched end of the snap ring in the groove at the base of the clutch jaws (Illust. 8). NOTE: The ring is to be hooked on the clutch jaws to prevent rotating.

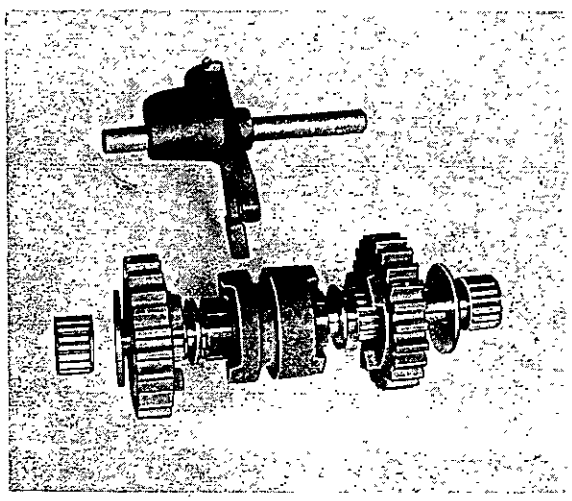


Illust. 10

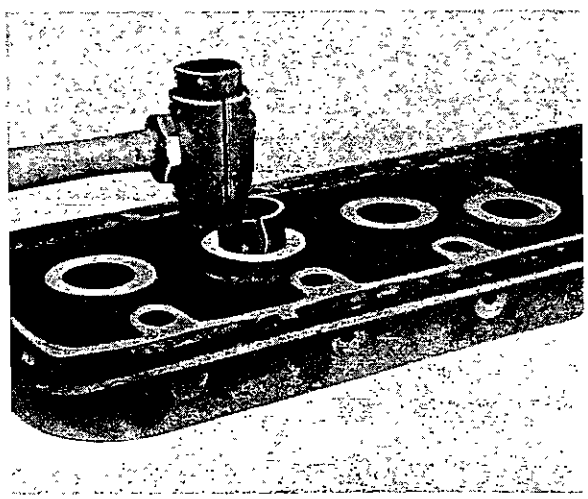
Place the clutch on the clutch shaft, with the broad side of the clutch facing the long end of the clutch shaft (Illusts. 9 and 11).

Before installing the second snap ring, place 4 steel balls and one separator spring in each of the 3 designated spots in the clutch spline. Then install the second snap ring (Illust. 9). However, the second control from the right, used to control the front leaning wheel housing, will be assembled with 15 balls, 5 balls and no springs in each of the 3 grooves.

In installing the shifter fork, place the countersunk end of the shifter rail extending out from the flat side of the shifter fork. Align the poppet seats in the shifter rail,



Illust. 11



Illust. 12

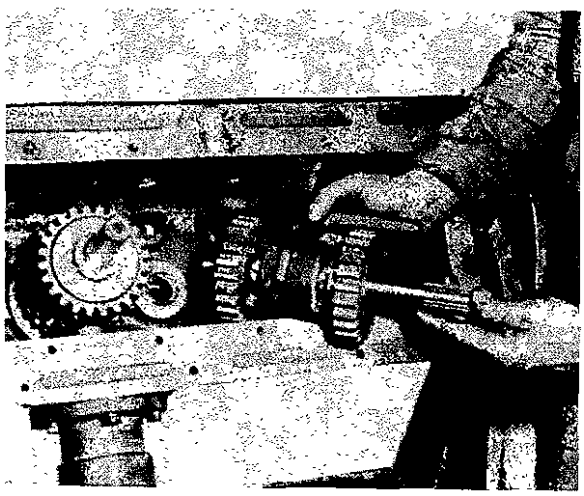
with the poppet, compression spring and cotter pin. See Illusts. 10 and 11.

To assemble the clutch shaft, start at each end of the splined shoulder by placing one small beveled thrust washer, one roller bearing, one clutch gear, one large thrust washer and one roller bearing. NOTE: Be sure to place the beveled side of the small thrust washer against the spline shoulder. Note assembly in Illust. 11.

Install the roller bearing outer races in the power box housing and power box housing cover (Illust. 12). These races should be driven into the housing and cover so the edge of the race is flush with the inside surface of the housing. Thrust washers are installed before the bearing race is driven into the housing. No thrust washers are used in the cover.

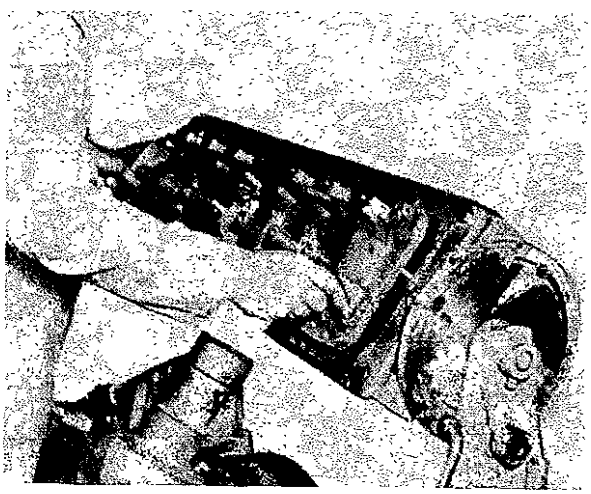
In installing the clutch shaft and shifter fork, start from the center shaft first and work toward the ends of the power control box.

Install with the long end of the shaft extending out from the open side of the housing. Illust. 13 shows this and also shows the complete unit of the clutch shaft and shifter fork being installed in the housing. (The roller bearing, large thrust washer and clutch gear can be left off all six clutch shafts. This allows less weight to handle, more visibility in lining the clutch shaft and shifter fork shaft in their bosses and less chance to have slippage between the clutch and spline shaft which often causes loss of steel balls).

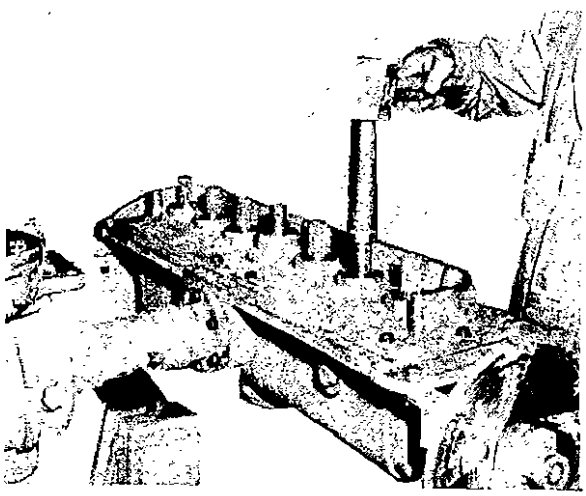


Illust. 13

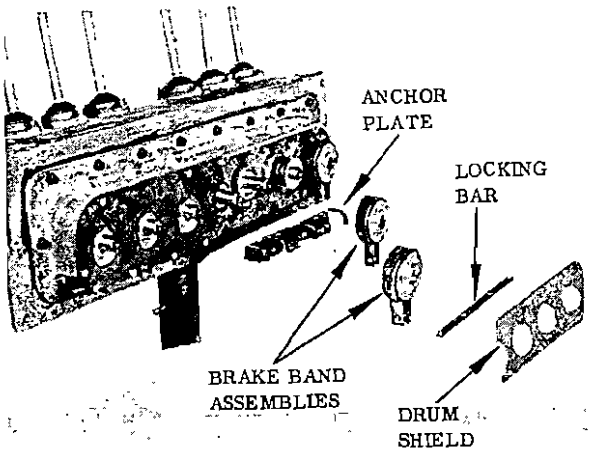
When installing the housing cover, be sure that the gasket is held firmly in position and that the cover fits over the two dowel pins in the housing.



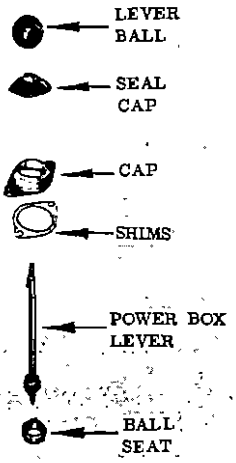
Illust. 14



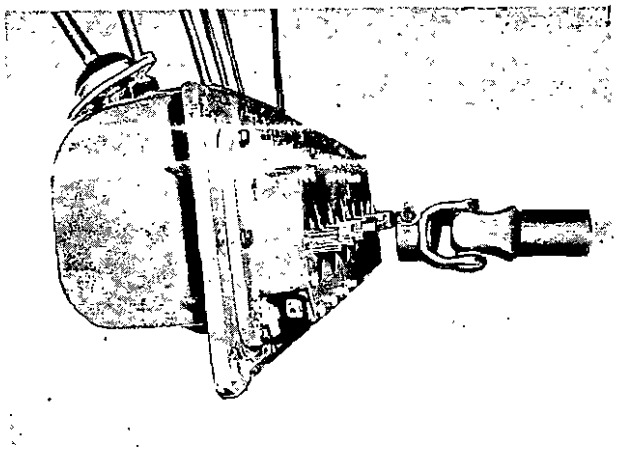
Illust. 15



Illust. 16



Illust. 17



Illust. 18

(Illust. 14). Install and tighten the cap screws in the housing cover.

Install the grease seals on the clutch shaft with the sharp edge of the leather seal pointing toward the inside of the housing, i.e., install as a grease seal. Expand the seal over the end of the shaft by wrapping the shaft with a piece of thin shim stock shaped like a funnel (Illust. 15). CAUTION: Be sure the edge of the seal does not drop into the pin hole in the shaft, thus damaging the seal. Drive the seal in with a piece of pipe that will fit the seal.

After installing the housing cover, adjust the shifter fork assembly by sliding the shifter fork rail back and forth until the countersunk end of the shifter fork rail indexes with the hole in the housing cover.

NOTE: Install the cone point set screw first, followed by the cup point set screw.

Install the brake assembly (Illust. 16). First, install the anchor plate. Then, install the brake drum and brake band assemblies as shown. Install the drum shield. Installing the locking bar, place the bar back of the fingers on the anchor plate, then align the holes of the locking bar with the holes in the anchor plate and the drum shield.

To install the control levers that have been disassembled, reassemble them by installing the ball seat, power box lever arms, laminated shims, power box lever caps, lever seal caps and lever balls (Illust. 17). NOTE: Apply the amount of shims necessary so there will be a maximum of 1/32" vertical free movement on the lever arm assemblies. The

lever seal cap is pressed on the lever arm. Illust. 18 shows the lever arm assembly being installed.

Install universal joints on splines of power control outlet shafts (Illust. 18). NOTE: End of outlet shaft to be flush with inside surface of universal joint yoke. Tighten universal joint clamp cap screw securely.

POWER CONTROL BOX REMOVAL

To remove power control box from cab, remove bearing cap from bracket which supports steering shaft. Swing steering shaft with steering wheel to one side. (Roadster Cab). Steering wheel and shaft must be removed on machines equipped with canopy top and enclosure.

Remove control shafts leading from power control box.

Remove both power control box stay rods which lead from front cab sheet to main frame.

Remove instrument box from each side of power control box and lay on cab floor.

Remove emergency brake from power control box.

Disconnect propeller shaft under cab by removing shear pin from discs.

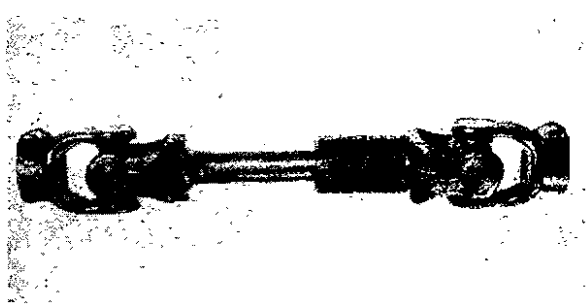
To further simplify removing power control box, disconnect vertical drive housing from power control box. Lower vertical drive housing enough to allow clearance for removing power control box. To lower vertical drive housing, use blocks or hydraulic jack.

By using a chain hoist to hold power control box from falling, remove the anchor bolts from front sheet. Next, remove power control box from cab.

The vertical drive housing may also be removed.

POWER CONTROL SHAFTS

The power control shafts should be maintained in good condition at all times. A close inspection of all universal joints should be made occasionally to determine if any of the joints are worn to the point where efficiency of the controls is impaired. Any universal joints found to be badly worn at the bearings or on the ends, should be immediately replaced.



Illust. 1

Inspect all telescopic shafts for excessive wear or other damage. When assembling the square shaft into the hollow square on the telescopic unit,

be sure to assemble it so fingers of the universal joint lie in the same relative plane. The proper assembling of the square shaft into the hollow square is shown in Illust. 1, with exception of front tilt square shaft and universal. If the shafts are assembled otherwise, it may cause sxcessive vibration of the control rods, thus causing difficult operation.

The universal joint yokes, used on the power control box outlet shafts, are of a splined yoke, clamp type while the control shaft ends of the universal joints, used for both lift control shaft, lateral control shaft and scarifier control shaft, are of a slip type.

When installing the splined end of universal joint yoke onto a power box outlet shaft, be sure the end of outlet shaft is flush with the inside surface of yoke, then tighten clamp cap screw securely.

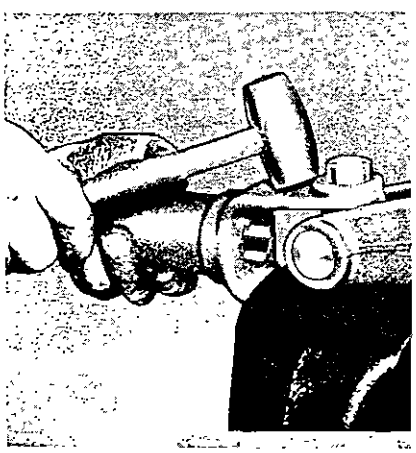
The control shaft end of the universal joint yoke is keyed to the control shaft. When inserting the keyed control shaft into keyway of yoke, be sure key is free to move lengthwise in yoke.

All other universal joint yokes are either welded or keyed to the control shafts. When inserting the key end of control shaft into keyway of yoke, be sure the end of control shaft is flush with the inside surface of yoke, then tighten clamp cap screw.

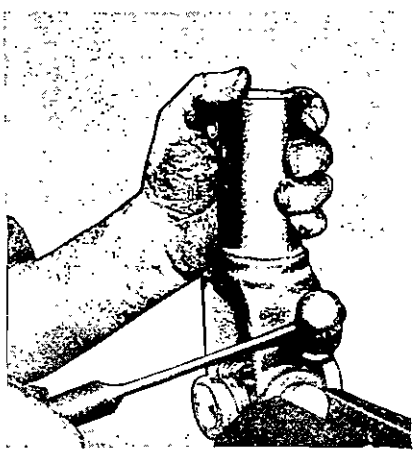
UNIVERSAL JOINT

The universal joints now employed on the present control rods and shafts of the Model 550 and 660 motor graders are of the roller bearing, anti-friction design. The roller bearing type of joint has many advantages over the old type joints. Some of the advantages are; each bearing is individually sealed against loss of grease or the entrance of dirt or moisture; the bearings are lubricated for life; the joints are smaller in size, lighter in weight compared to their torque capacity; component parts of the roller bearing joints may be ordered for repairs which in most cases will eliminate replacement of a complete joint.

Illust. 2

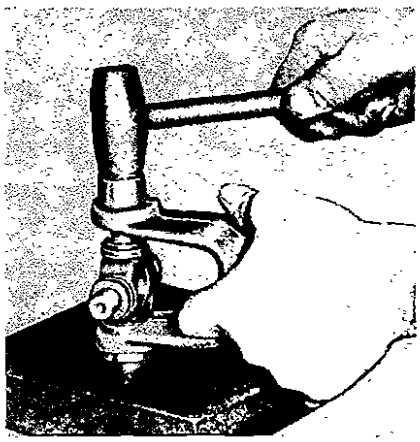


Illust. 3

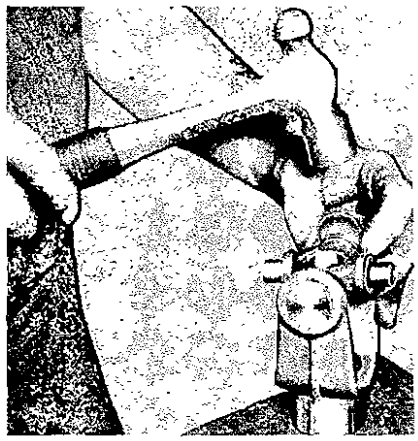


Illust. 4

Illust. 5



Illust. 6



Illust. 7

No special tools being required, a hammer, punch, screw driver and a vice with brass jaw protectors are all that are needed for the disassembly and assembly of this roller bearing joint.

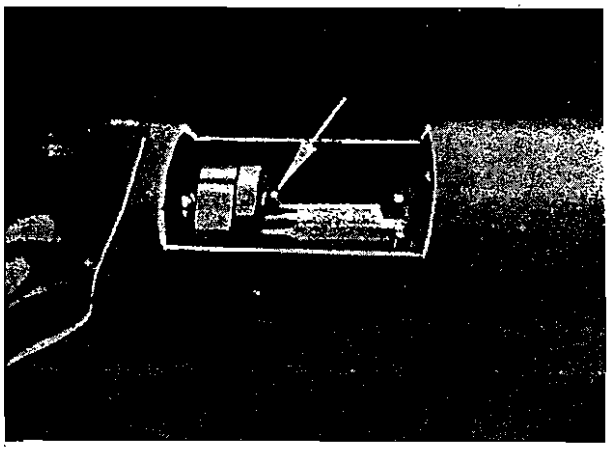
The following procedure can be followed in the disassembly of the joint. Remove the four snap rings (Illust. 2) by means of a punch placed against an end of the snap ring loop and then tapping the end of the punch with a hammer until the ring comes off. After removal of the snap rings, the assembly can be placed in the vice (Illust. 3). By striking the suspended yoke (Illust. 3) the yoke member will be driven down until it comes in contact with the cross. When one bearing has been partly removed, clamp the protruding end of the bearing in the vice (Illust. 4) and remove the bearing completely by driving against the yoke.

Next, turn the assembly over and remove the opposite bearing. The yoke member can be removed from the cross. Proceed to remove the other bearings, placing the assembly in the vice (Illust. 5).

The disassembled parts should be inspected and any worn working parts should be replaced by a new cross and 4 new complete bearing assemblies. Care should be taken to see that the trunnions are clean and that each bearing contains lubricant. It is advisable to replace the cork sealing washers on each trunnion to prevent ingress of dirt and to retain the lubricant in the bearings.

The following procedure can be followed for the assembly of the joint. Rest one of the yoke forks on a flat piece of iron, leaving fork member freely suspended below. Drive one of the bearings in, stopping when the open end comes flush with the inside of the fork member. Insert the cross through the opposite hole without the bearing and swing into place and down into the partially assembled bearing. Next, turn the assembly over, resting the above partially assembled bearing on the flat surface and drive in other bearing. (Illust. 6).

It is possible there will be some off center condition between cross and yoke after bearings are driven flush with outside of yokes, however, you will find this an advantage to the ex-



Illust. 1

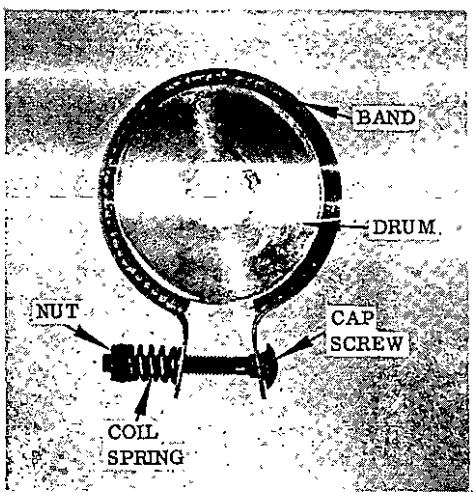
tent that it permits driving in snap ring on side that gives the most clearance (Illust. 7).

PROPELLER DRIVE SHAFT

The power box has a shear pin in the power box drive line (Illust. 1) making it possible to use the positive connection between outlet shaft and "U" joint. This shear pin "A" may be replaced through the opening in cab floor (Illust. 1) or may be replaced from under the cab.

POWER BOX ANTI-COAST BRAKE

The anti-coast brake (Illust. 1) is furnished on all motor graders.

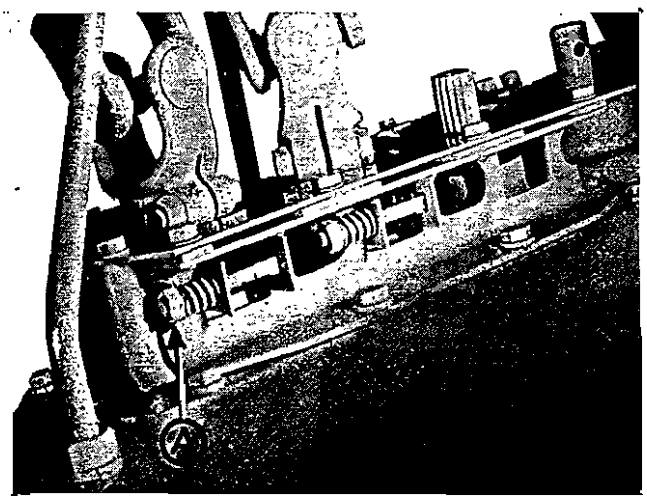


Illust. 1

The anti-coast brake band should be removed periodically to remove any dust or foreign matter that may have accumulated on the lining. The first step of reassembly should be to install band onto drum.

Install bolt through band as illustrated. Install coil spring and nut. Tighten nut until proper adjustment is obtained.

NOTE: The thrust bearings on the gear housings must be properly adjusted before anti-coast brakes are adjusted in order to insure the maximum efficiency of the two adjustments in controlling coasting.



Illust. 2

ADJUSTMENT

When adjusting the brakes, the adjusting nut "A" (Illust. 2) should be tightened until a 12 foot pound pull is necessary to turn the drum within the band. There may be some instances when it will be necessary to vary the adjustments to obtain the desired results.

If the band is too tight, the lever may not work smoothly, there may be an excessive amount

of chatter in the lever and the lining will wear excessively.

If the band is too loose, the brake will not be effective, therefore, it will not serve its purpose in eliminating coasting.

You will note that in the installation of the drum shields and locking bars, the holes in the locking bars are tapped. The locking bars, mounted behind the anchor plates, serve as the locking agent for the cap screws used in securing the drum shields, anchor plates and lock-bar assemblies.

MOLDBOARD LIFTS AND LATERAL HOUSINGS

The moldboard lift housings and lateral shift housing are so much alike, it is not necessary to describe the repair of all three. Instructions and illustrations in this section are for the repair of the right hand lift housing.

To repair the left hand lift housing, it must be remembered when following the illustrations, that the worm shaft is inserted into the lift housing from the left side, also, the spiral gear housing and its component parts are assembled on the left side of lift gear housing.

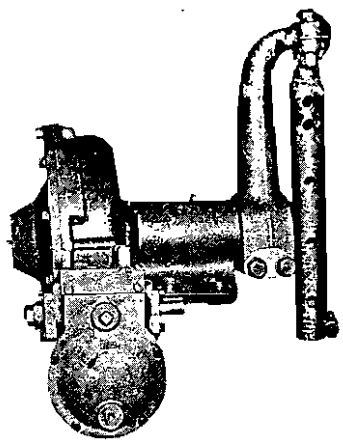
The lateral shift housing is assembled in a similar manner as the right hand lift housing.

The extent of this assembly depends on the work to be done. If a complete disassembly is necessary, it is best to remove the complete unit from the frame of the grader and disassemble it on a bench. Due to the fact that during the reassembly operation all adjustments and settings must be established, a detailed description is given here for the reassembly operations only.

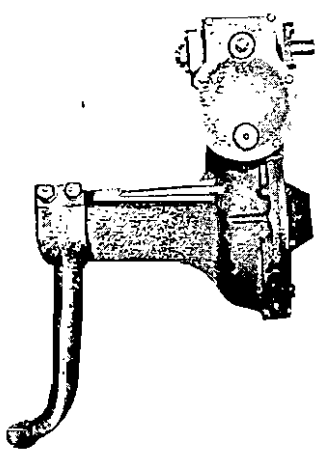
Inspect all parts for excessive wear, breakage or other damage. Gears, bearings and shafts will sometime score due to insufficient lubricant or improper lubricant being used. Parts which are damaged should be replaced. Inspect "O" rings for mars and cuts and replace with new ones if damaged. If any of the bushings are being replaced, they should be installed by supporting a housing in a press and pressing in the bushings. No reaming is necessary on any of the bushing before installation.

Illust. 1 is a view of right hand lift housing.

Illust. 2 is a view of the lateral shift housing. Note the positioning of the reduction gear housing compared with the reduction gear housing in Illust. 1.



Illust. 1

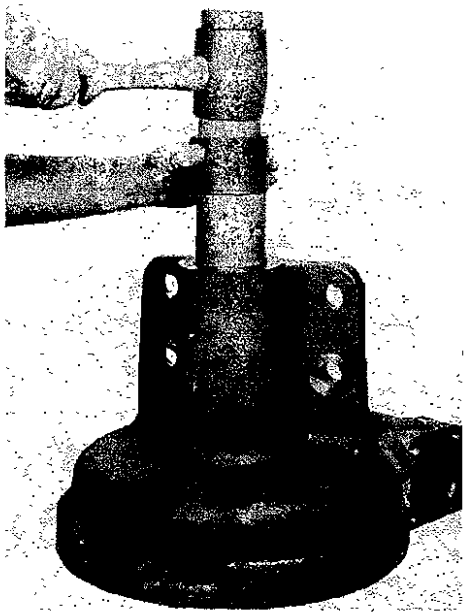


Illust. 2

Press or drive bushing into housing (Illust. 3). Bushing to be flush with outside bore of housing.

Press or drive bushing into worm thrust bearing (Illust. 4).

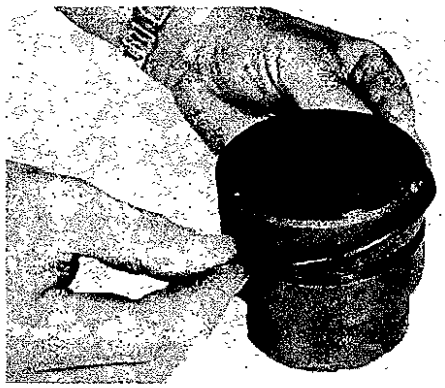
Install "O" ring in groove of thrust bearing (Illust. 5).



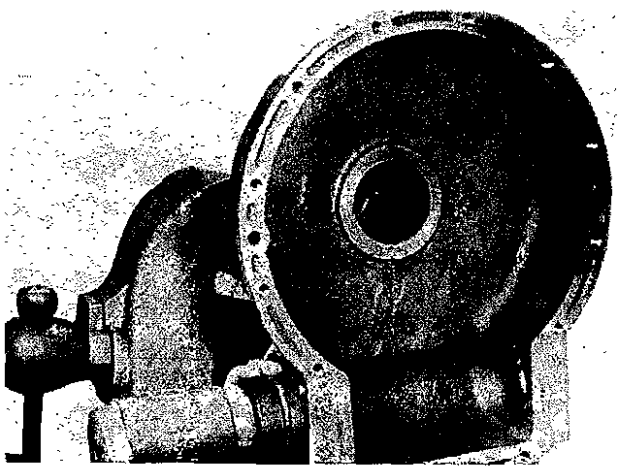
Illust. 3

Illust. 4

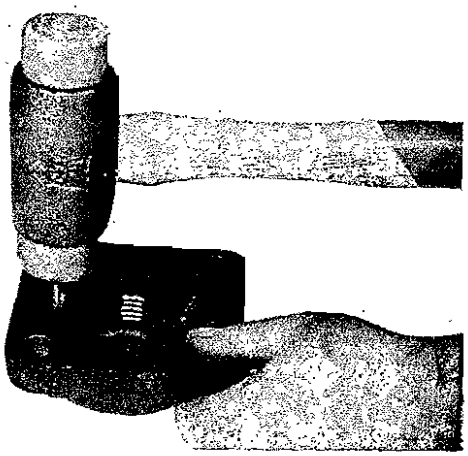
Install thrust bearing into housing (Illust. 6). Dowel pin hole toward top of housing. NOTE: Apply white lead to "O" ring to prevent damage.



Illust. 5



Illust. 6



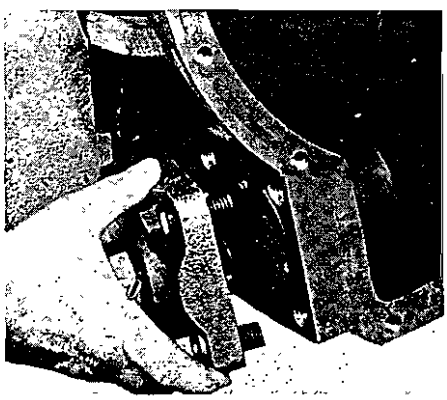
Illust. 7

Drive dowel pin into bearing cap (Illust. 7). Next, install an adjusting set screw and jam nut. Do not tighten set screw or jam nut.

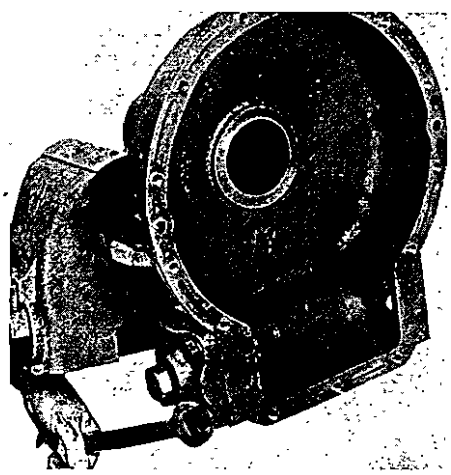
Install bearing cap with cap screws and lock washers onto housing (Illust. 8). Dowel pin in cap to align with dowel pin hole in thrust bearing. NOTE: No gasket is required. Next, tighten cap screws securely (Illust. 9).

Press worm gear on shaft. Long hub of gear toward end of shaft. Hub of gear to be 2 1/8" from end of shaft (Illust. 10).

Install shaft and gear into housing (Illust. 11).

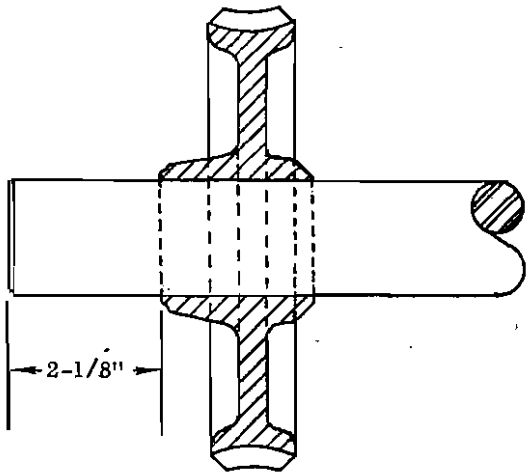


Illust. 8

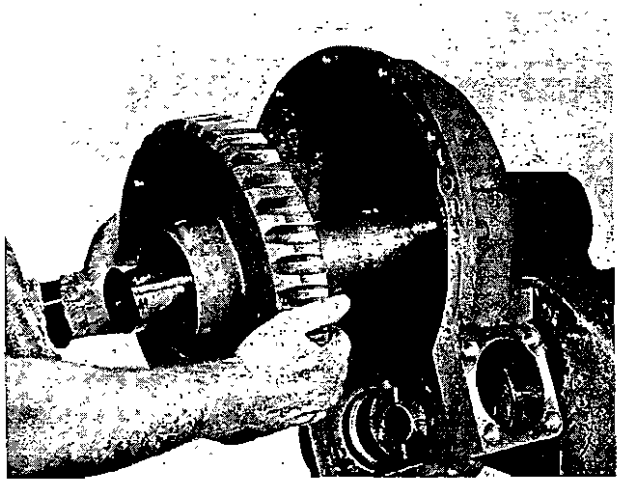


Illust. 9

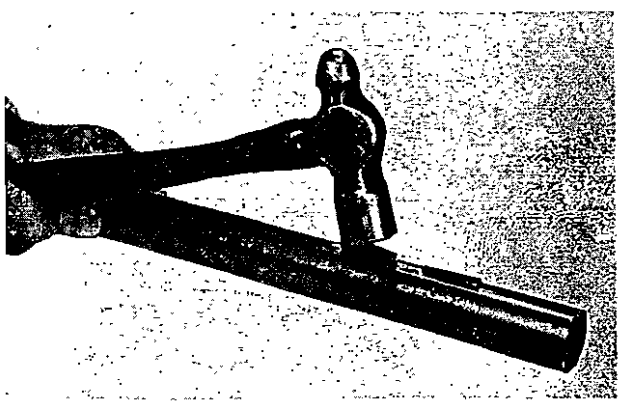
Drive keys in keyways of worm shaft (Illust. 12).



Illust. 10



Illust. 11



Illust. 12

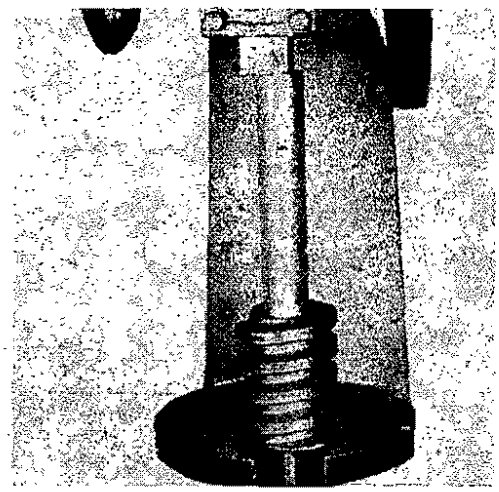
Align keys in shaft with keyway in worm, then press shaft into worm until keyed end of shaft extends 2 1/32" out of worm (Illust. 13).

Install worm and shaft into housing (Illust. 14). Rotate shaft until end of shaft is well seated into thrust bearings.

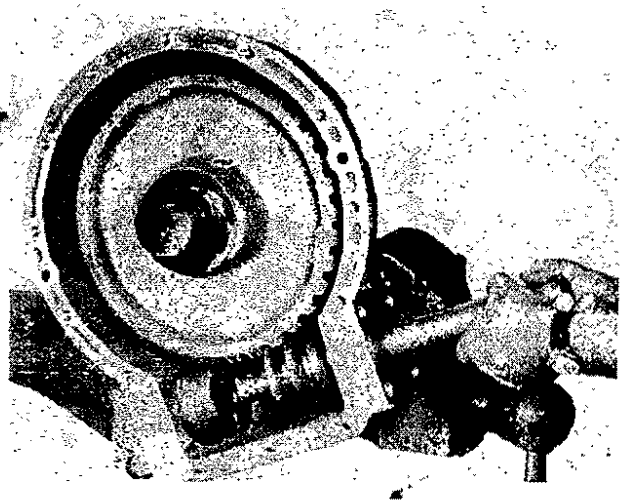
Install worm thrust bearing onto shaft and into housing (Illust. 15). Notch and thrust bearing should be in an upward position.

Install and tighten studs into the lift housing. If unable to use stud driver, use two (2) nuts locked together on studs (Illust. 16). Tighten studs to a torque reading of 100 foot pounds (Illust. 17).

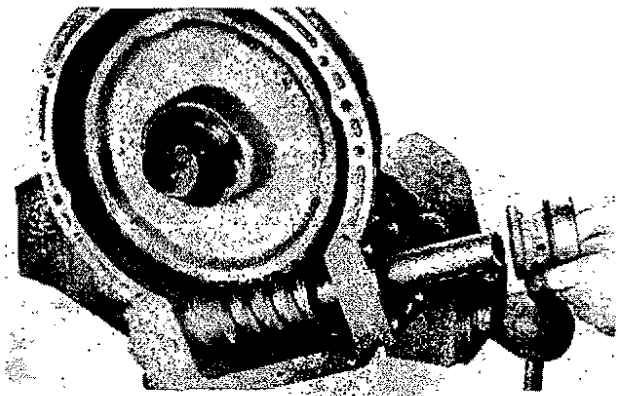
Install snap ring into reduction hous-



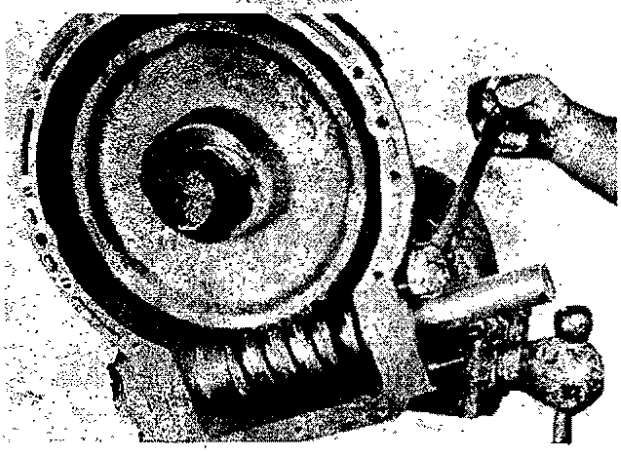
Illust. 13



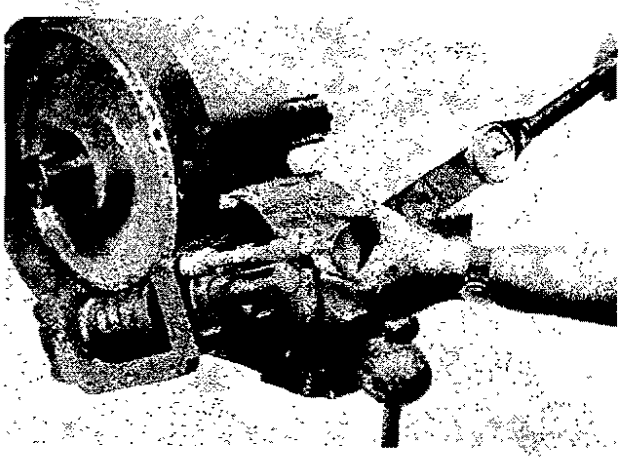
Illust. 14



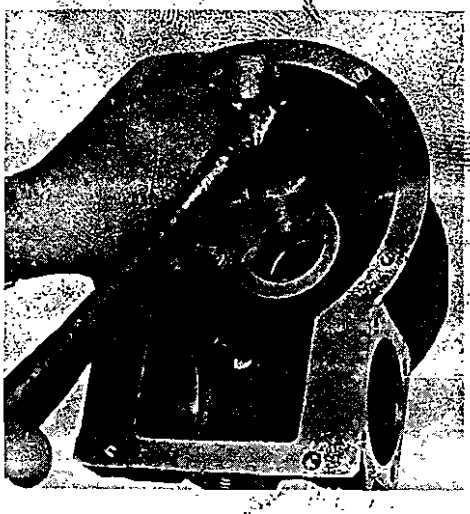
Illust. 15



Illust. 16



Illust. 17



Illust. 18

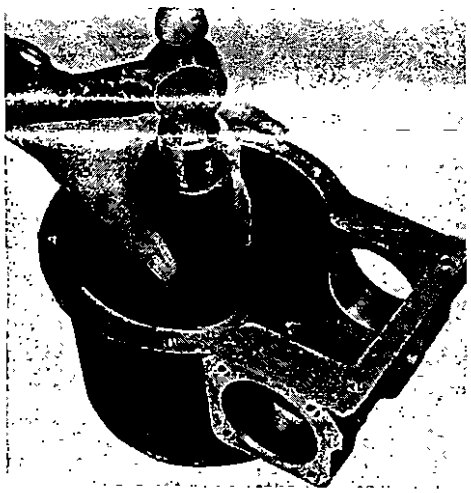
ing. NOTE: For easy installation, start snap ring into bore of housing in a vertical position (Illust. 18).

Drive snap ring into groove of housing (Illust. 19).

Press or drive bushing into housing until bushing is down on snap ring (Illust. 20).

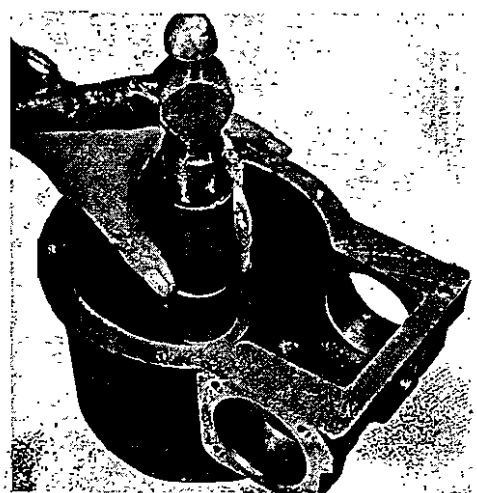
Install "O" ring into groove of housing (Illust. 21).

Install key in keyway of thrust bearing. Next, install gasket onto hous-

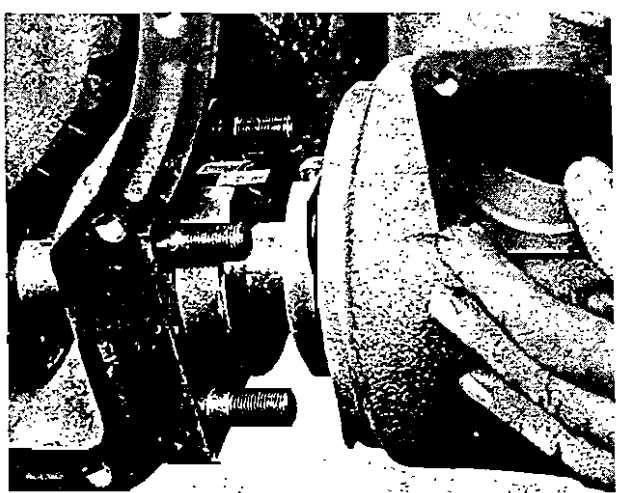


Illust. 19

Illust. 21



Illust. 20



Illust. 22

ng. Install housing onto shaft and onto studs (Illust. 22). Key in thrust bearing to fit into slot of housing.

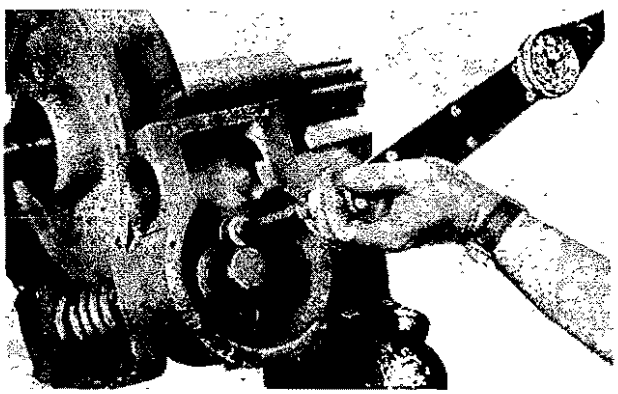
Install stud nuts and tighten to a torque reading of 135 foot pounds (Illust. 23).

Install spiral gear onto shaft (Illust. 24). Long hub of gear toward outside of housing. Key and gear align with keyway in shaft.

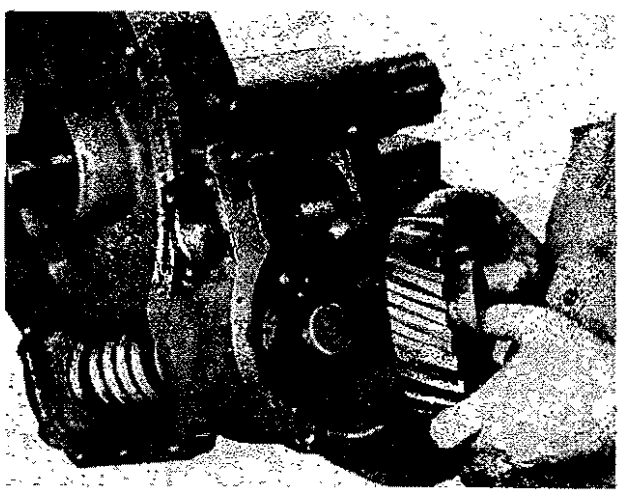
Drive key in keyway of gear and shaft (Illust. 25).

To remove gear from shaft, use a gear puller (Illust. 26).

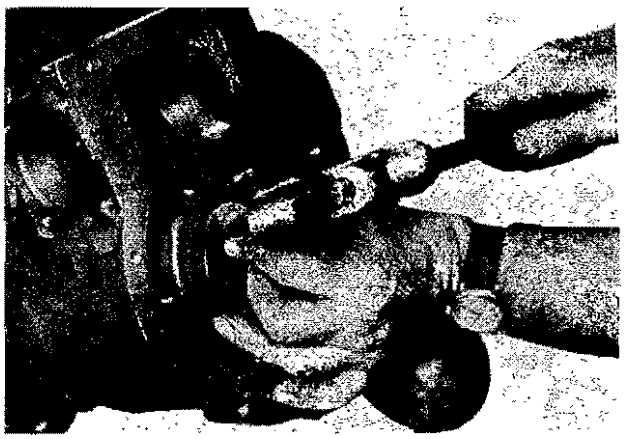
Press or drive bushing into reduction



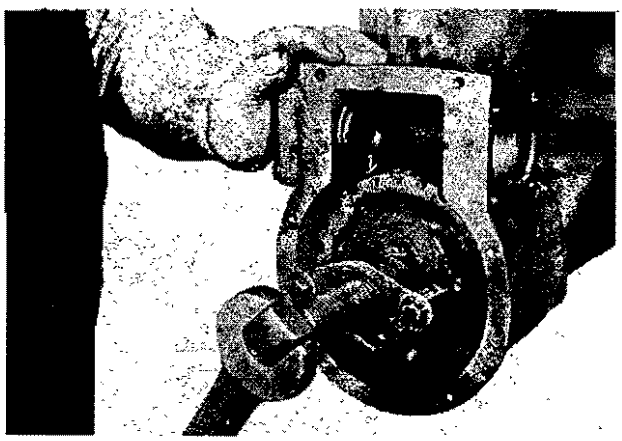
Illust. 23



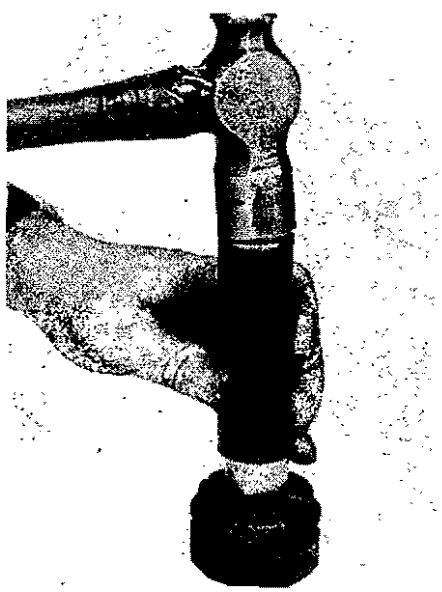
Illust. 24



Illust. 25



Illust. 26



Illust. 27

housing thrust bearing (Illust. 27).

Install "O" ring into groove of thrust bearing (Illust. 28).

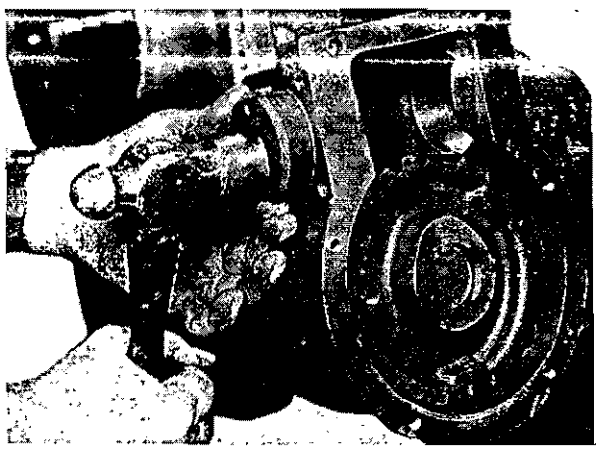
Illust. 28

Install thrust bearing into housing (Illust. 29). NOTE: Dowel pin hole in thrust bearing in an upward position. To prevent damaging "O" ring, use white lead.

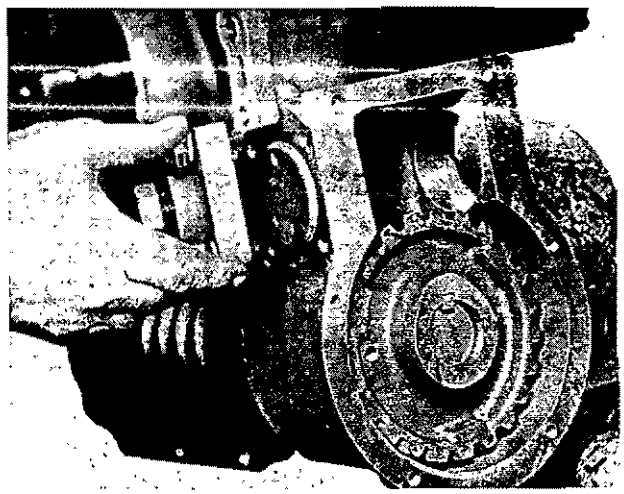
Drive roll pin into bearing cap (Illust. 30). Next, install adjusting set screw and jam nut. Do not tighten jam nut.

Install bearing cap with cap screws and lock washers onto reduction housing (Illust. 31). Roll pin in cap to align with pin hole in thrust bearing.

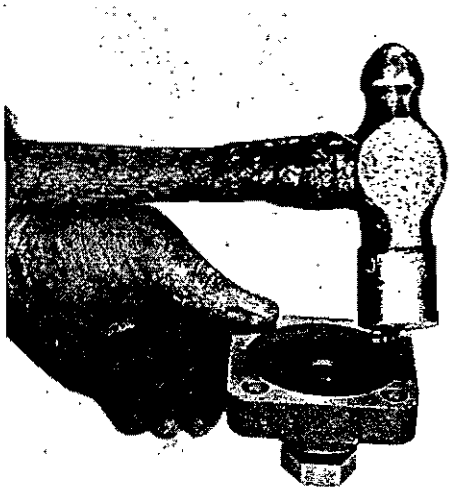
Tighten cap screws securely (Illust.



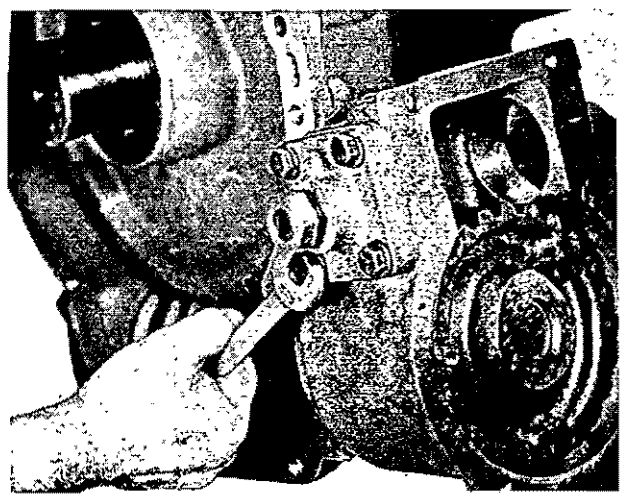
Illust. 29



Illust. 31



Illust. 30



Illust. 32

32).

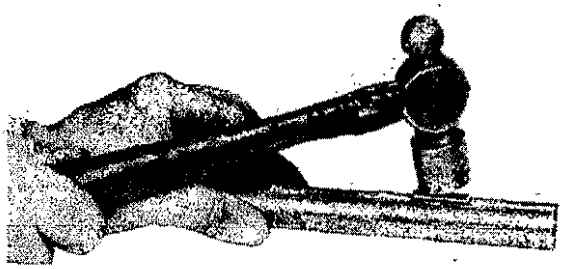
Install key in keyway of pinion shaft (Illust. 33).

Align key in shaft with keyway and spiral pinion. Press shaft into spiral pinion until shaft extends 1" out of pinion (Illust. 34).

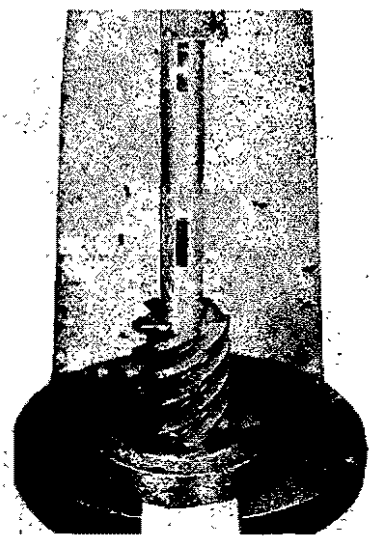
Install pinion shaft into reduction housing (Illust. 35). Rotate shaft until end of shaft is seated into thrust bearing.

Install "O" ring in groove of bearing cap (Illust. 36).

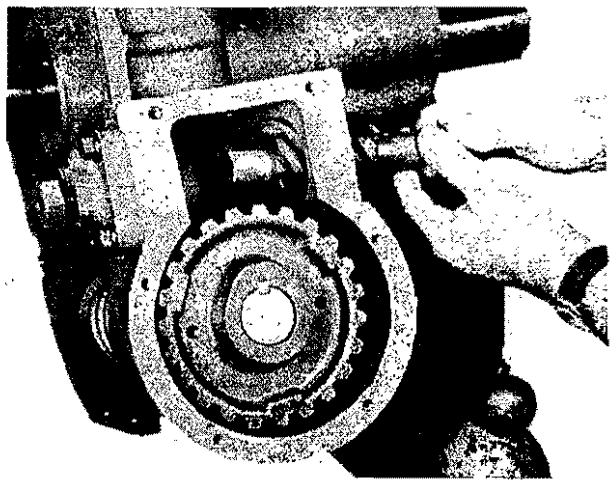
Install bearing cap with cap screws and lock washers onto reduction hous-



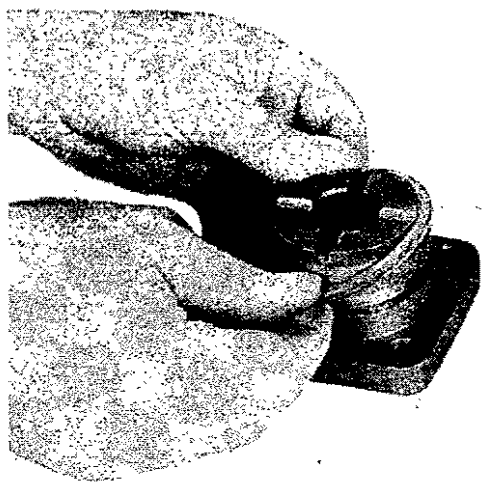
Illust. 33



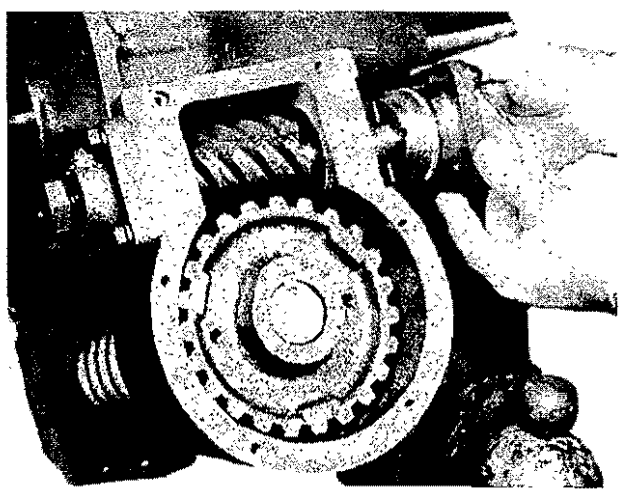
Illust. 34



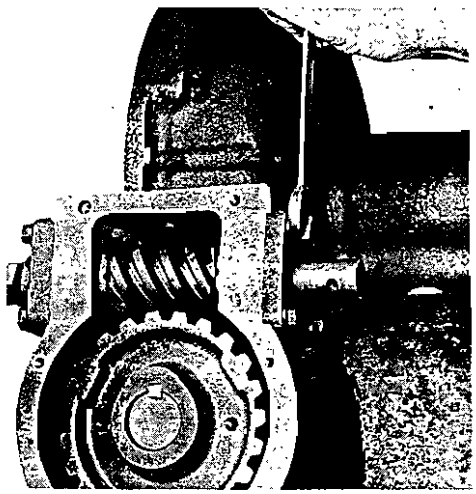
Illust. 35



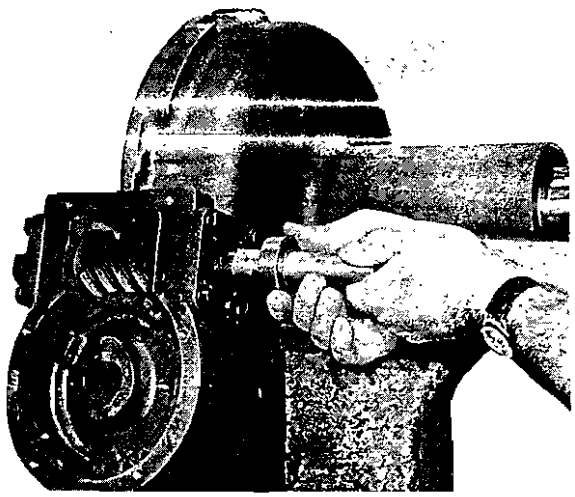
Illust. 36



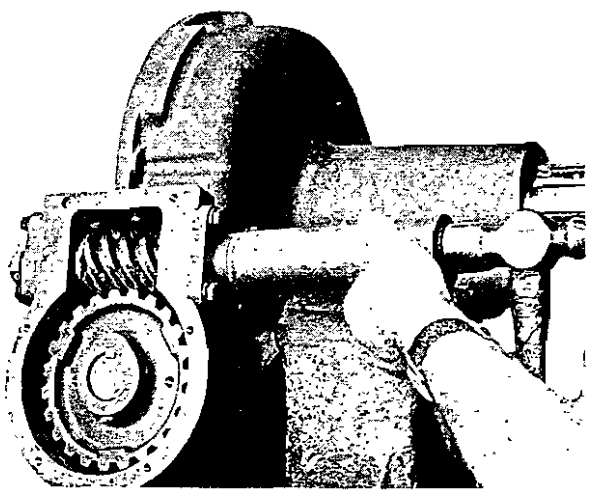
Illust. 37



Illust. 38



Illust. 39



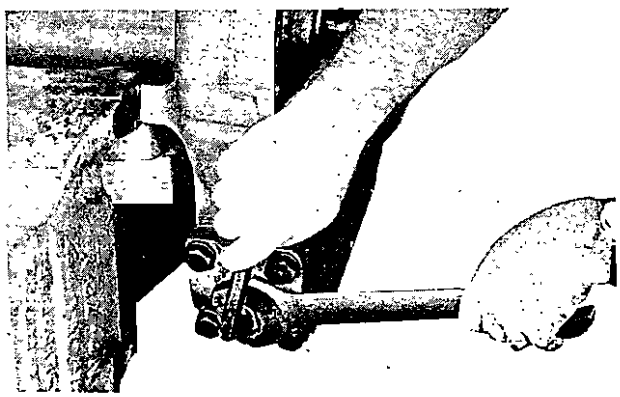
Illust. 40

ing (Illust. 37). NOTE: Apply white lead to "O" ring to prevent damage.

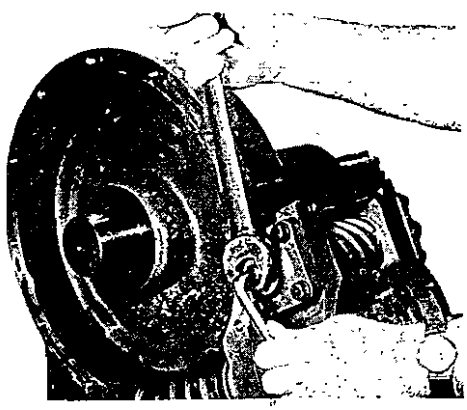
Tighten cap screws securely (Illust. 38).

Install grease seal into bearing cap (Illust. 39). Lip of seal toward inside of housing. NOTE: To install seal over shaft, use a piece of shim stock shaped like a funnel. Next, drive seal into cap (Illust. 40).

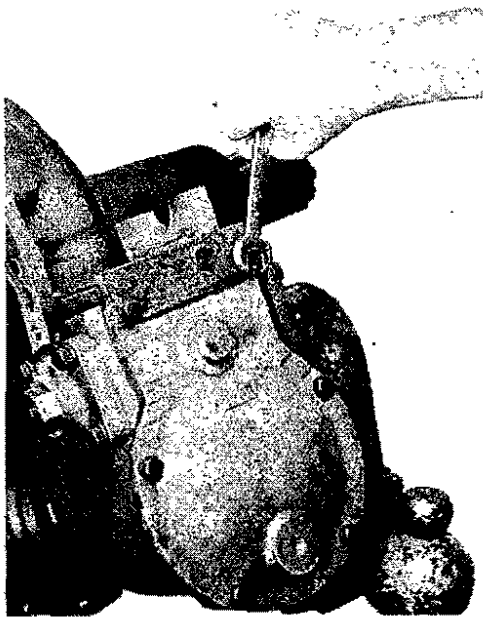
To adjust the thrust bearings, it is important that the main thrust bearing be adjusted first. To adjust the main thrust bearing, tighten adjusting set screw until a noticeable drag is felt while rotating worm shaft. Loosen set screw slightly until drag is eliminated. Holding set screw in



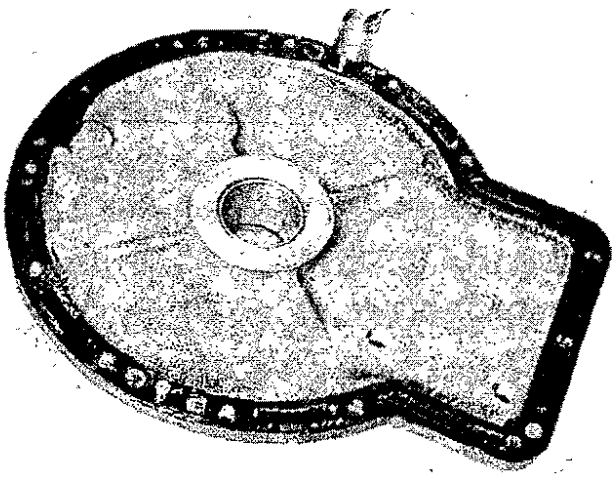
Illust. 41



Illust. 42



Illust. 43

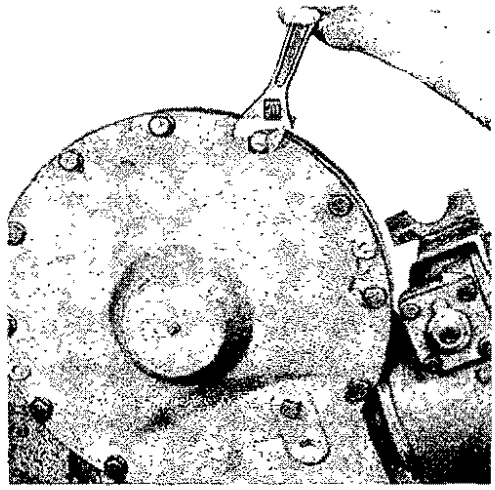


Illust. 44

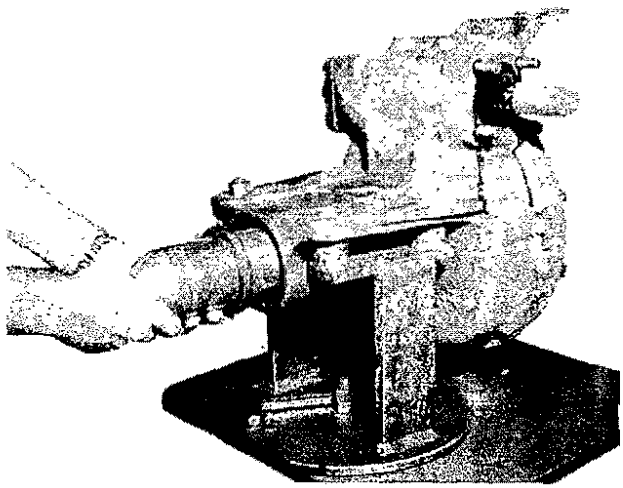
this position, tighten jam nut securely (Illust. 41).

Adjust the thrust bearings in the reduction housing in the same manner. When adjustment has been made, hold set screw in position and tighten jam nut securely (Illust. 42).

Shellac gasket to reduction housing cover. Install cover onto reduction housing. Install cap screws with lock washers. Tighten cap screws se-



Illust. 45



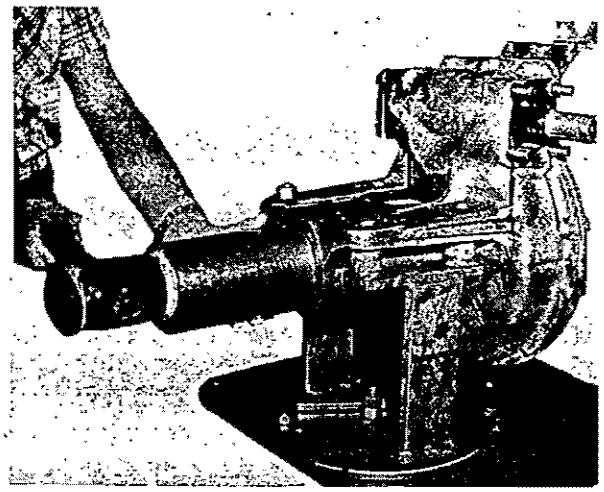
Illust. 46

curely (Illust. 43).

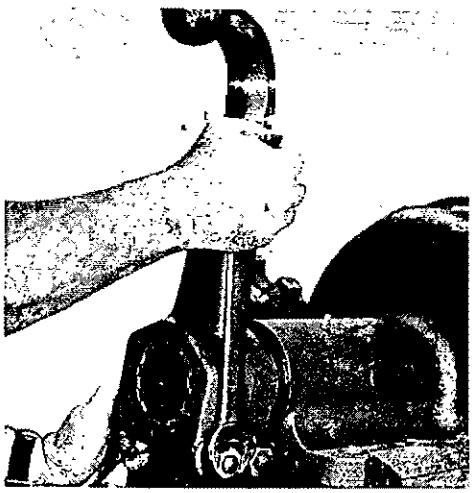
Drive dowel pins into lift housing cover (Illust. 44). Next, shellac gasket to lift housing. Install cover onto housing. NOTE: For easy installation, use two (2) pilots in housing. Install cover over pilots and onto housing. Bump cover with a mallet to seat dowel pins in housing. Remove pilots.

Install cap screws and lock washers. Tighten cap screws securely (Illust. 45).

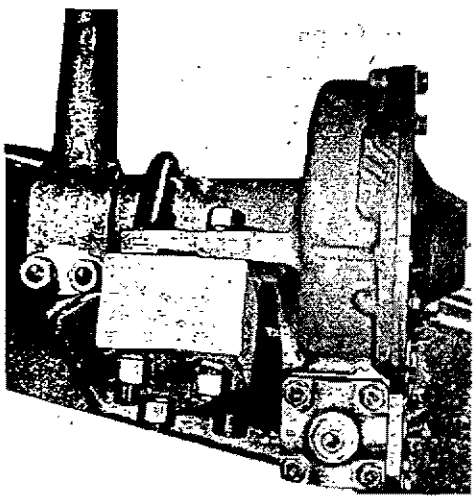
Illusts. 46 and 47 refer to the lateral



Illust. 47



Illust. 48



Illust. 49

shift housing only.

Install oil seal onto shaft, using a piece of shim stock over splines of shaft to prevent damage to seal (Illust. 46).

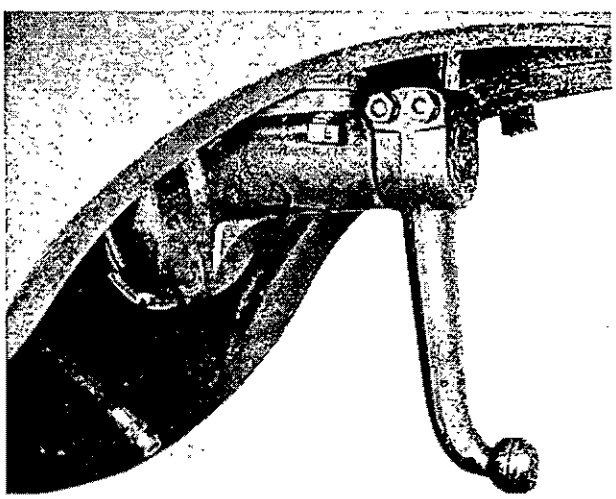
Drive seal into housing (Illust. 47). Remove shim stock.

Install arm onto spline shaft. NOTE: To install arm onto splines of shaft, drive a coal chisel into slot of arm. Align splines in arm with those on shaft. Using a mallet, tap arm on shaft until arm is a minimum of 1/32" away from housing.

Install bolts with lock washers and nuts. Tighten nuts securely (Illust. 48). NOTE: Heads of bolts toward main frame.

Install lift housing to lift beam. Install bolts and "U" bolt, lock washers and nuts (Illust. 49). Tighten all nuts securely.

Install lateral housing to cross beam. Install bolts, lock washers and nuts (Illust. 50). Tighten nuts securely.

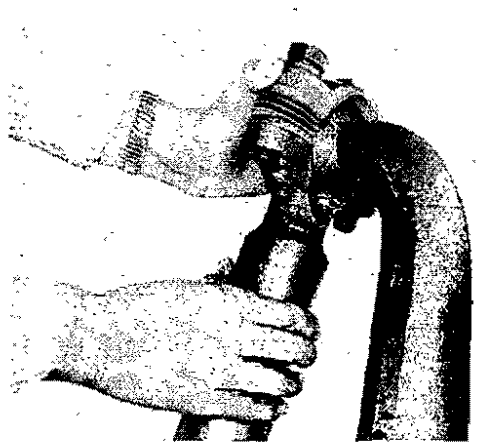


Illust. 50

ADJUSTABLE BALL AND SOCKET

(Illust. 1) The ball and socket joints on the lift links and lateral shift links are adjustable for wear. The laminated shims take care of the wear at these points. In order to make this adjustment the two clamp cap screws and caps should be removed as shown.

The laminated shims under the cap can be removed from the clamp cap screws and layers of shims peeled off with a knife.

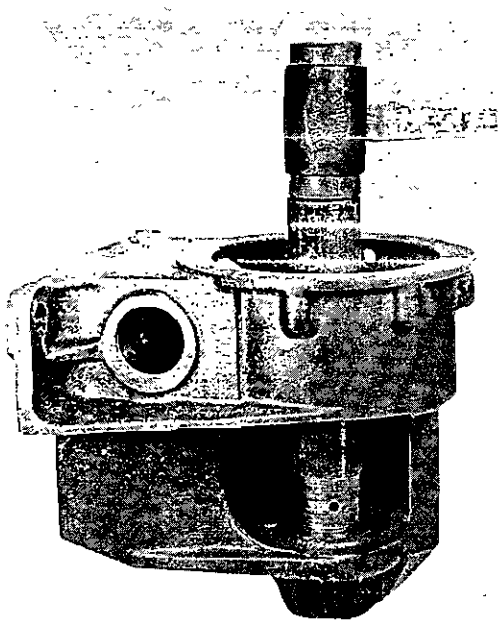


Illust. 1

Do not remove any more shims than necessary to remove the free play in the joint. The joint should never bind and should always work freely. It will be found that these joints wear egg-shaped. Therefore, they should be adjusted in the position in which they will operate.

CIRCLE REVERSE MECHANISM

The circle reverse mechanism is contained in two separate housings consisting of the circle reverse housing and transfer housing. Either of these housings should be removed from circle drawbar when major repairs are necessary. Minor repairs may be made to either assembly without removal from the drawbar.



Illust. 1

Illust. 2

The extent to which the circle reverse housing is disassembled depends upon the work to be done. In the disassembly of the worm thrust bearing and pinion gear shaft assembly, care should be taken not to distort or damage the "O" rings.

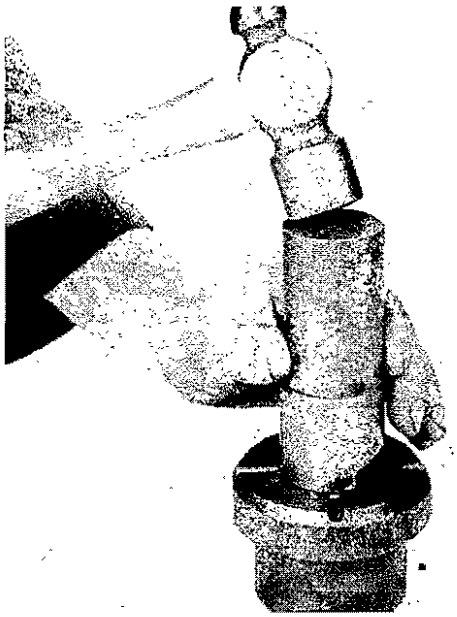
Inspect all parts for excessive wear or damage. Bearings, gears and shafts will sometimes score due to insufficient lubricant or improper lubricant being used. Parts that are damaged in this manner should be replaced with new ones. All gaskets, seals and "O" rings should be replaced when reassembling the housing. When installing the bushings, care should be taken to prevent distortion or damaging during assembly. They should be installed with a press or wood block and hammer. Care should be taken that bushings enter the bore squarely.

Press or drive bushing into circle reverse housing (Illust. 1). Bushing to be flush with bottom of chamfer in housing.

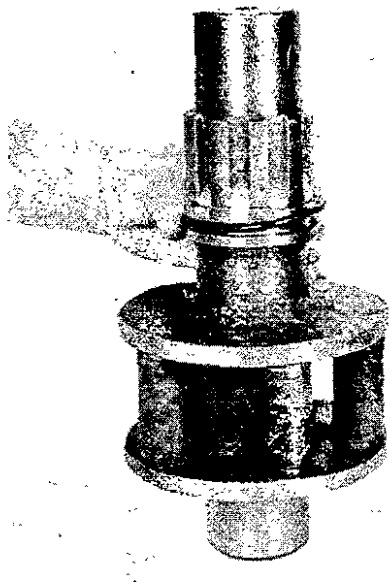
Press or drive dowel pin into shouldered worm bearing (Illust. 2).

Press or drive bushing into shouldered worm bearing (Illust. 3). Bushings to be flush with bottom of chamfer.

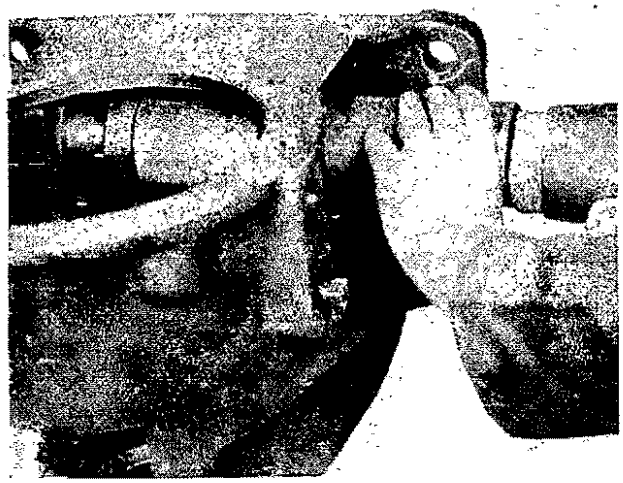
Align dowel pin in shouldered worm



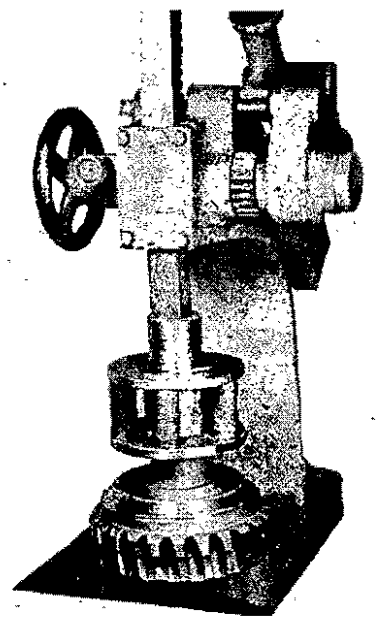
Illust. 3



Illust. 5



Illust. 4



Illust. 6

bearing with dowel pin hole in housing, then drive bearing into housing (Illust. 4).

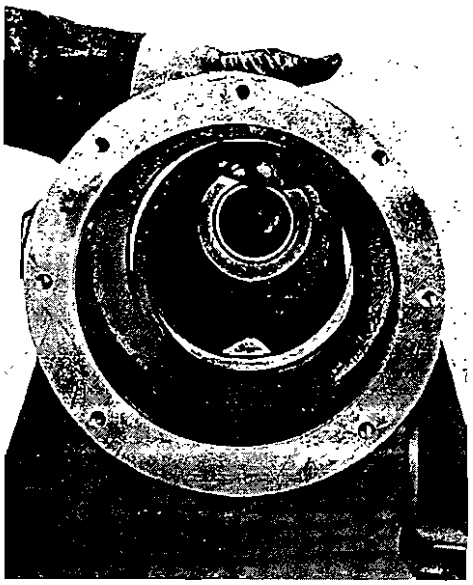
Install "O" ring in groove of pinion shaft (Illust. 5).

Apply white lead to "O" ring. Press pinion shaft into circle reverse gear (Illust. 6). Flange side of gear toward pinion.

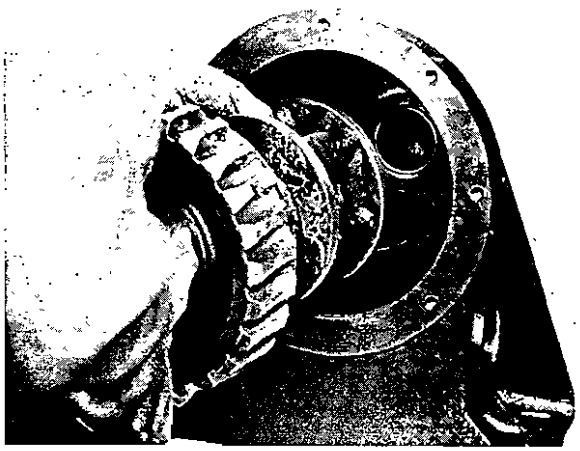
Install oil seal into groove in housing (Illust. 7).

Install gear with pinion into housing (Illust. 8). NOTE: Lubricate oil seal thoroughly before installing gear with pinion.

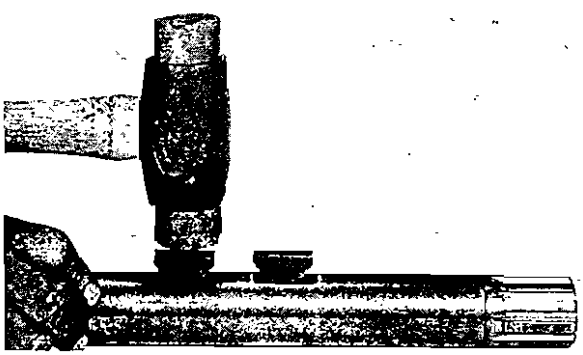
Drive two keys in keyways of worm



Illust. 7



Illust. 8



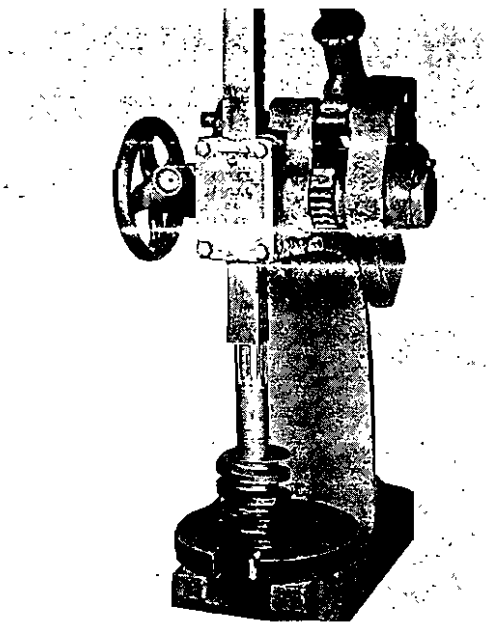
Illust. 9

shaft (Illust. 9).

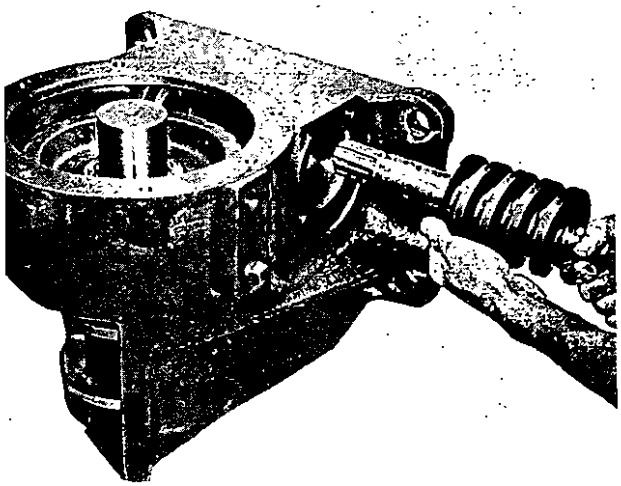
Align keys in shaft with keyway in worm and press shaft into worm until splined end of shaft extends 5-13/32" from face of worm (Illust. 10).

Install worm shaft into circle reverse housing (Illust. 11).

Rotate shaft until face of worm is approximately 1/16" away from face of



Illust. 10



Illust. 11

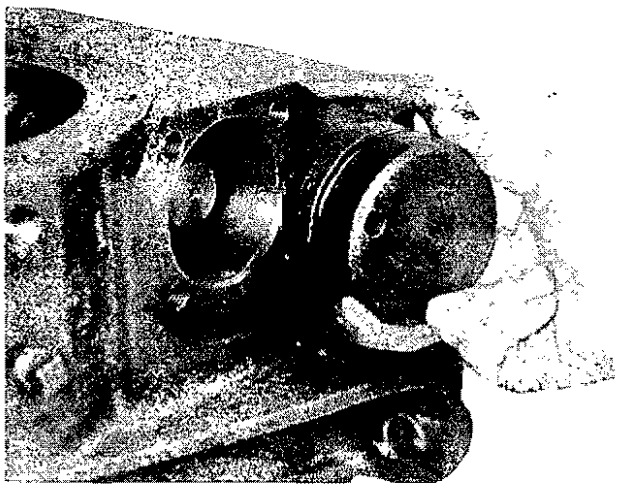
worm bearing.

Press or drive bushing into worm thrust bearing (Illust. 12).

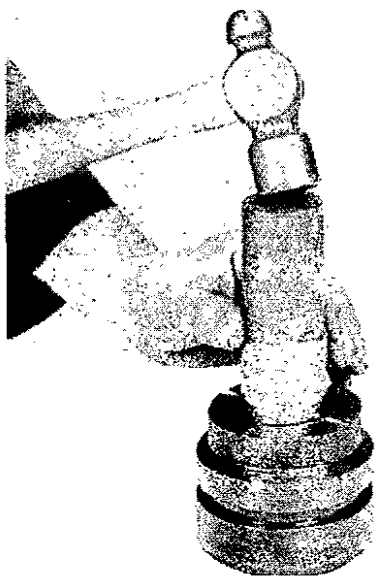
Install "O" ring into groove of worm thrust bearing (Illust. 13).

Apply white lead to "O" ring. Install worm thrust bearing into housing and over shaft (Illust. 14).

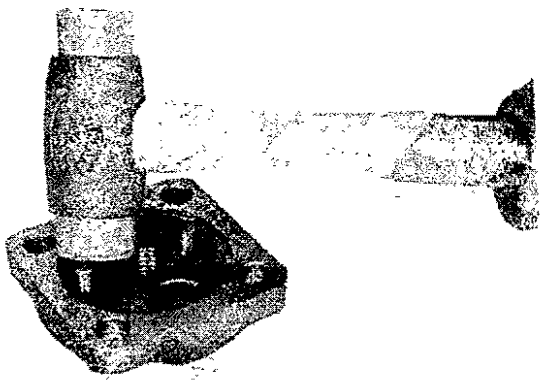
Drive dowel pin into bearing cap (Il-



Illust. 14

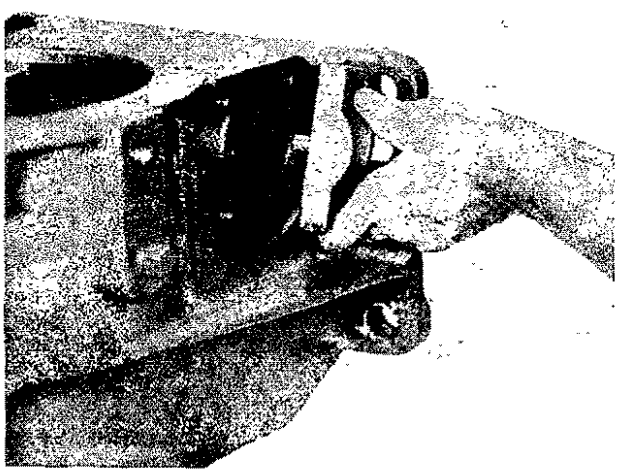


Illust. 12

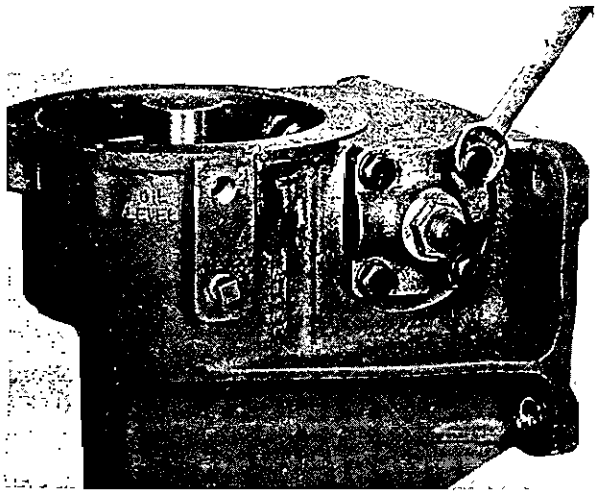


Illust. 15

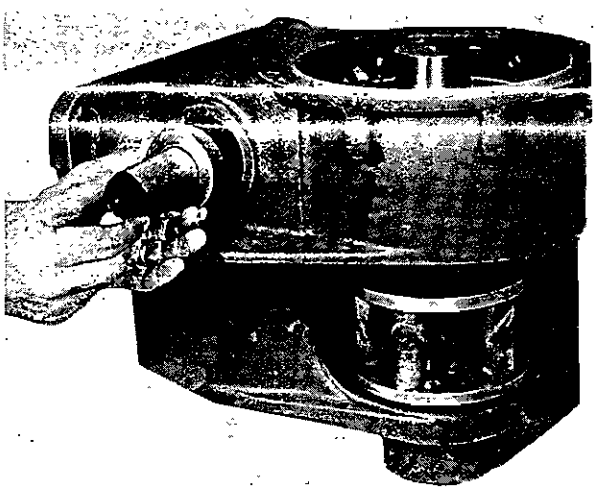
Illust. 13



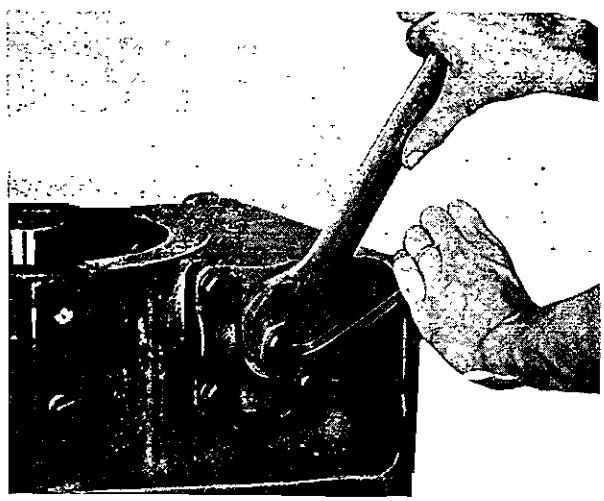
Illust. 16



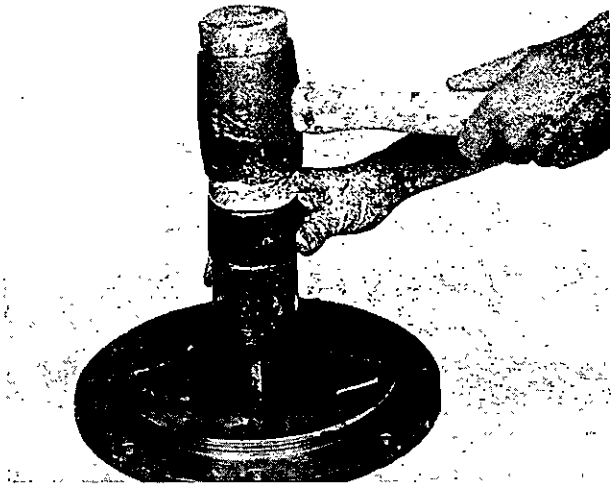
Illust. 17



Illust. 18



Illust. 19



Illust. 20

lust. 15). Next, install adjusting set screw and jam nut. Do not tighten jam nut.

Align dowel pin in cap with dowel pin hole in worm thrust bearing. Install cap to housing (Illust. 16). Next install cap screws with washers. Tighten cap screws securely (Illust. 17).

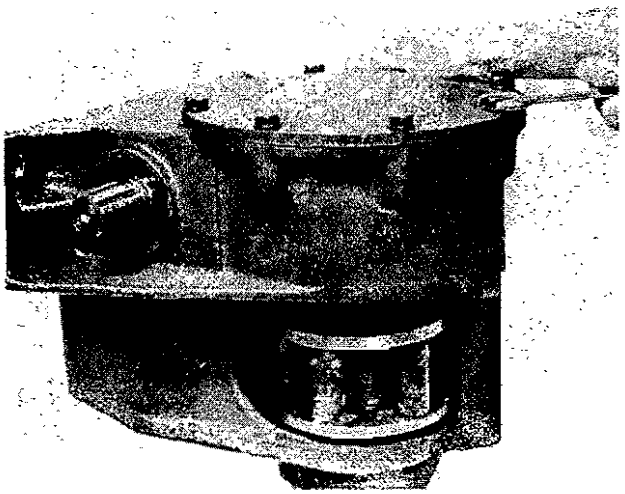
Install oil seal over shaft and into housing. Lip of seal toward inside of housing. NOTE: Use a piece of shim stock over splines of shaft to prevent damage to leather of oil seal (Illust. 18). Drive seal into housing.

To adjust thrust bearings, tighten adjusting screw while at the same time rotating shaft until a noticeable drag is obtained. Loosen set screw until drag is eliminated. Holding set screw in this position, tighten jam nut securely (Illust. 19).

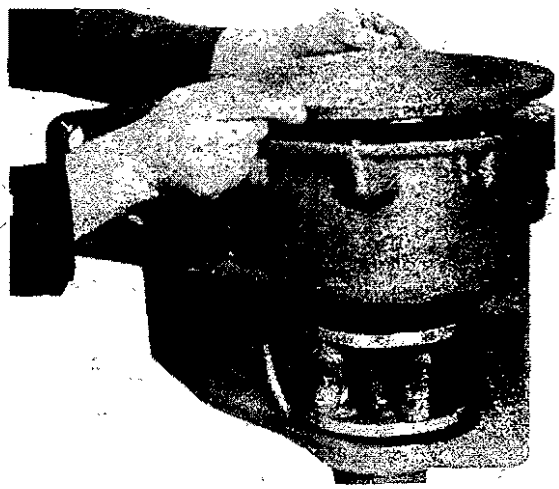
Press or drive bushing into circle housing cover (Illust. 20). Bushing to be flush with bottom of chamfer in cover.

Install "O" ring in groove of cover (Illust. 21).

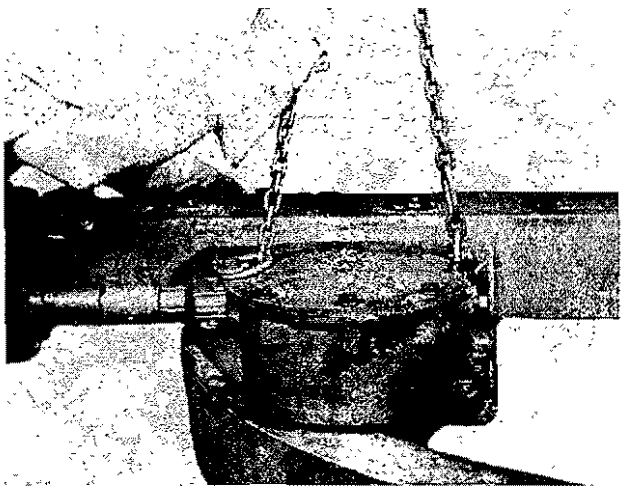
Illust. 21



Illust. 23



Illust. 22

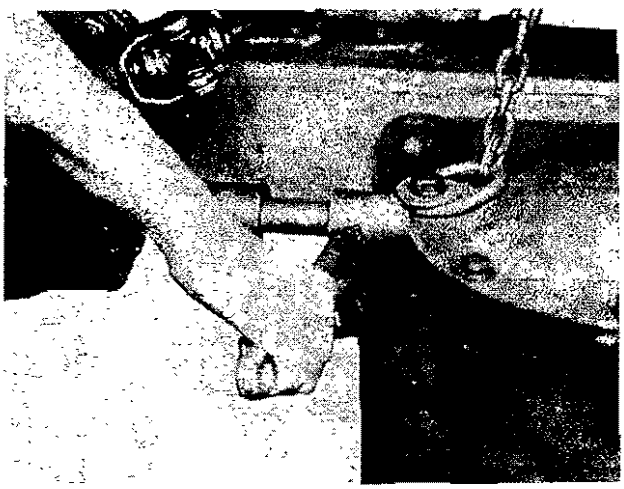


Illust. 24

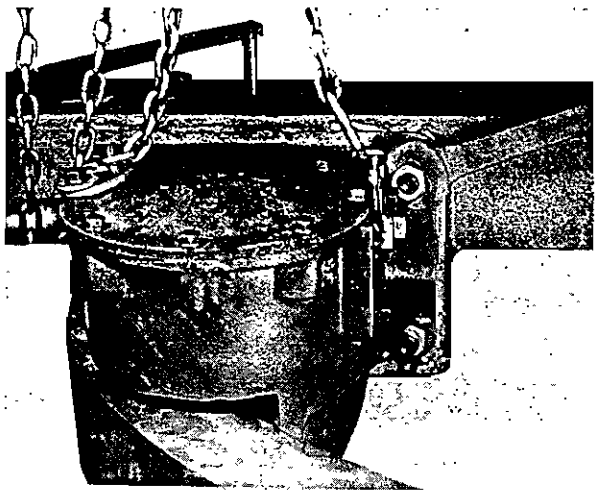
Apply white lead to "O" ring. Install cover onto housing (Illust. 22). Install cap screws with lock washers. Tighten cap screws securely (Illust. 23).

Install sleeve on splines of shaft.

To install circle reverse housing to drawbar, mesh teeth in pinion gear with teeth in rack of circle (Illust. 24). Rotate sleeve (using a pipe wrench) counterclockwise until housing is flush with circle drawbar (Illust. 25). Insert the two long bolts (upper bolts) through drawbar and through circle



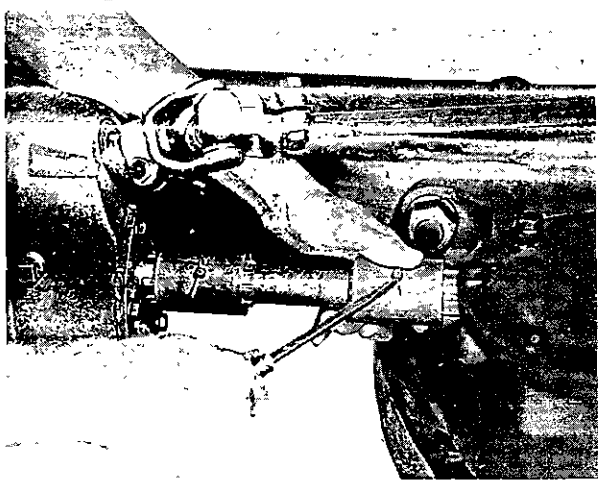
Illust. 25



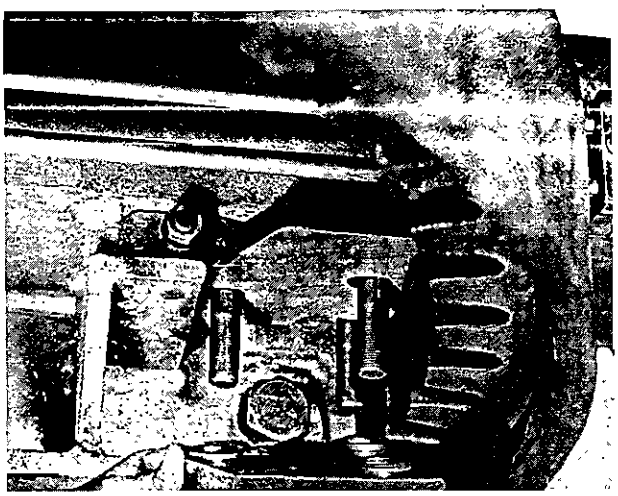
Illust. 26

housing just enough to hold circle housing in place. Insert lower bolts (short bolts) through drawbar and circle housing. Install lock washers and nuts. Tighten nuts securely (Illust. 26). IMPORTANT: Be sure all four circle housing pads are flush against drawbar. Should there be shims between circle reverse housing and drawbar, it is important that the shims be replaced in their original position.

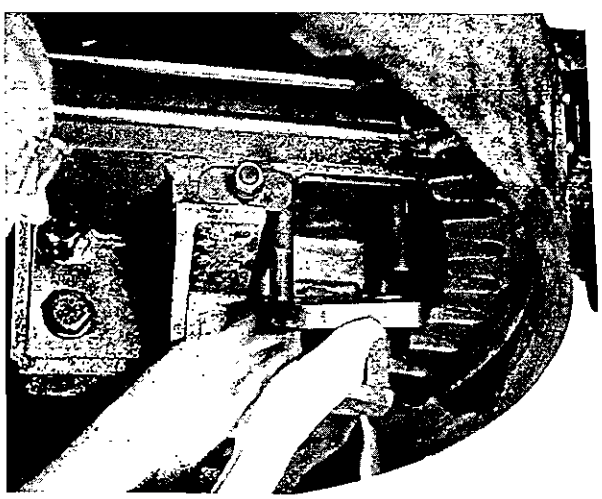
Install splined sleeve onto spline shaft. Install pins and cotter pins. Spread cotter pin (Illust. 27). NOTE: Sleeve should be free on spline shaft at all



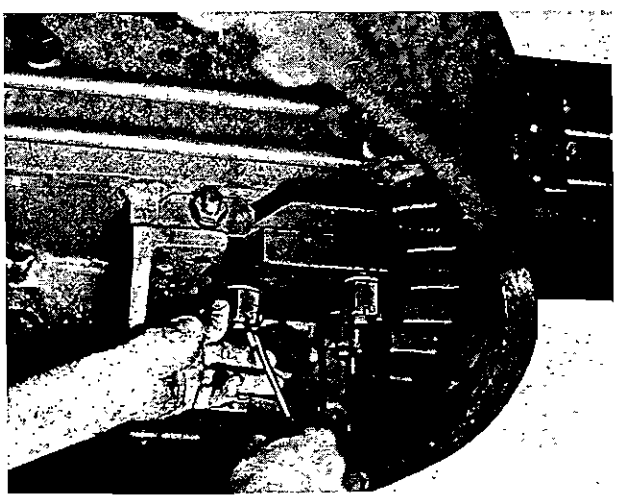
Illust. 27



Illust. 29



Illust. 28



Illust. 30

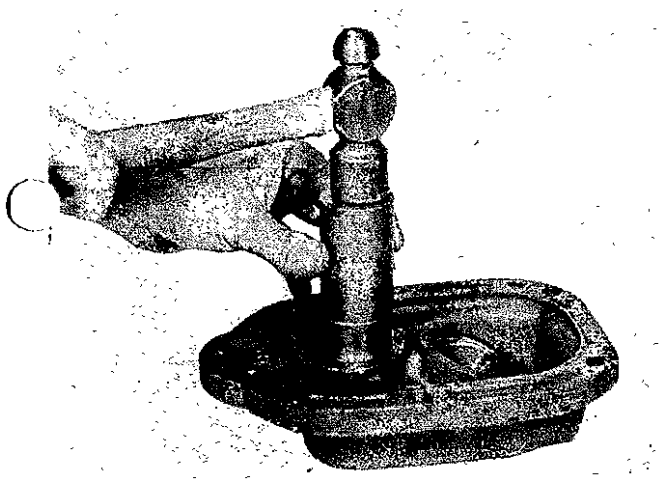
times.

Install adjusting plate onto drawbar bolts (Illust. 28). Cut away edge toward circle housing.

Install retaining plate with shims on bolts (Illust. 29). NOTE: When removing retaining plate, note the amount of shims taken from each bolt.

Install washers and slotted nuts onto bolts and tighten securely. Next, install cotter pin and spread (Illust. 30). Tighten wedge nut securely.

TRANSFER HOUSING



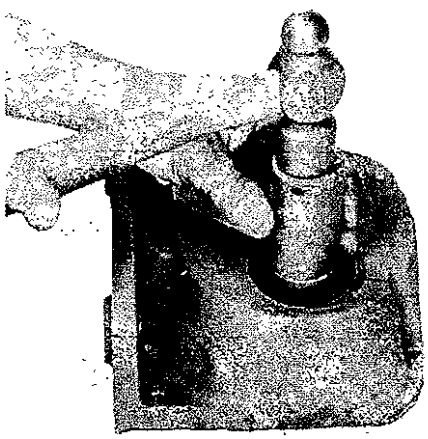
Illust. 1

Press or drive bushings into transfer housing cover (Illust. 1). Bushings to be flush with bottom of chamfer in housing.

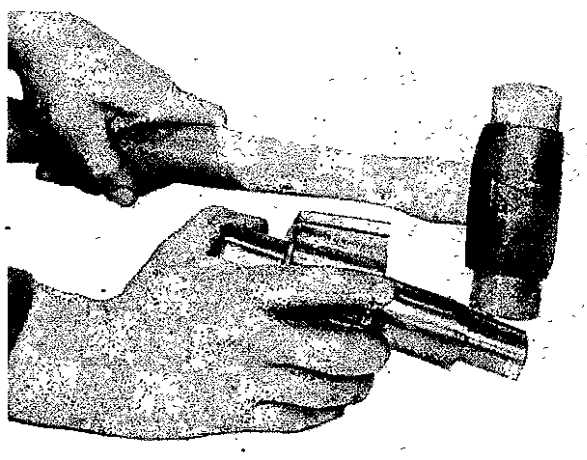
Press or drive bushing into transfer housing (Illust. 2). Bushing to be flush with bottom of chamfer in housing.

Drive key into keyway of upper pinion with shaft (Illust. 3).

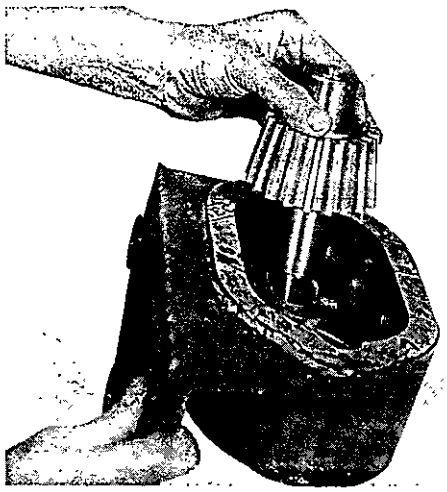
Shellac gasket to transfer housing. Next, install upper pinion shaft into housing (Illust. 4).



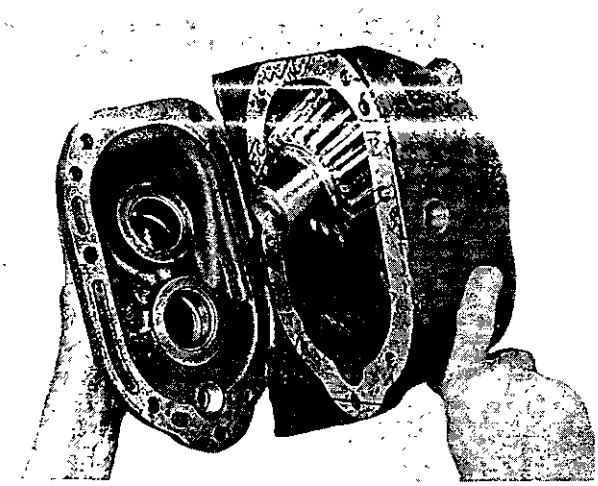
Illust. 2



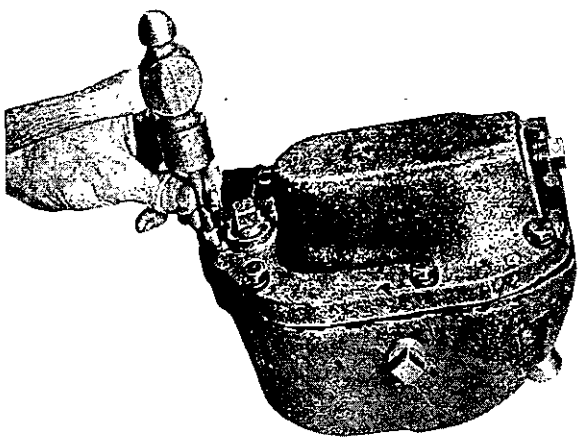
Illust. 3



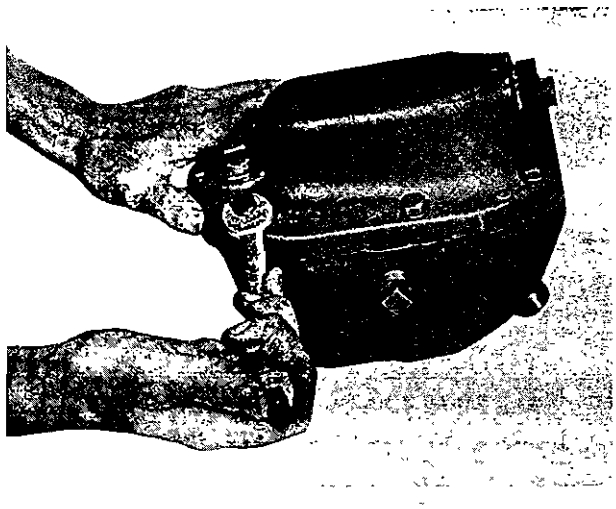
Illust. 4



Illust. 5



Illust. 6



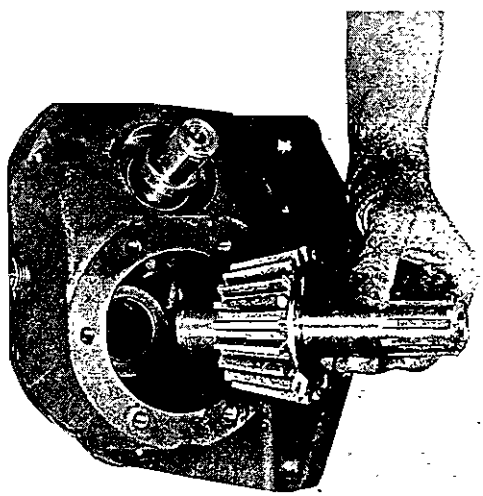
Illust. 7

Install cover to transfer housing (Illust. 5). Next, install cap screws with lock washers. Do not tighten cap screws.

Drive dowel pins through cover and into housing (Illust. 6). Dowel pins to be flush with cover.

To remove cover from transfer housing, it is necessary to drive dowel pins out of their holes in housing.

Tighten cover cap screws securely (Illust. 7).



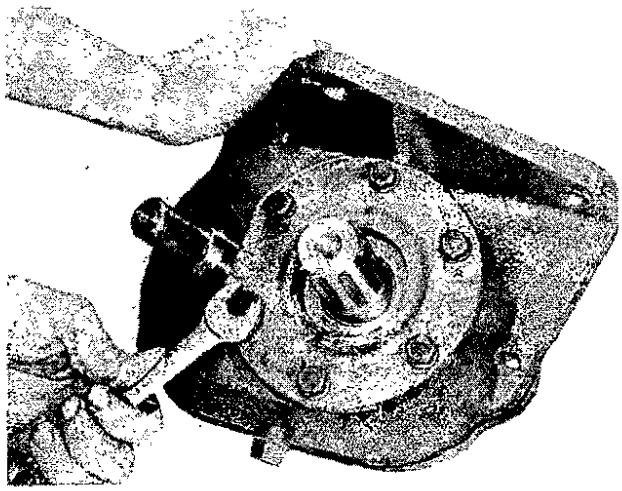
Illust. 8

Install lower pinion shaft into housing (Illust. 8).

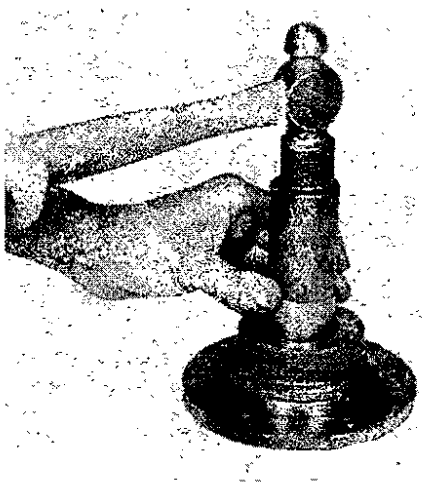
Install bushing into gear cover (Illust. 9).

Shellac gasket to cover and install cover onto transfer housing (Illust. 10). Install cap screws with lock washers and tighten securely (Illust. 11).

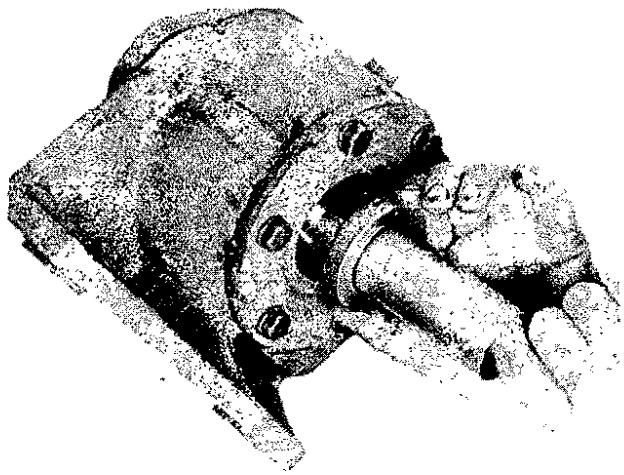
Install grease seals onto upper and lower pinion shafts. Lips of seals toward inside of housing. NOTE: Use shim stock around shafts to prevent leather in oil seals from damage (Illust. 12).



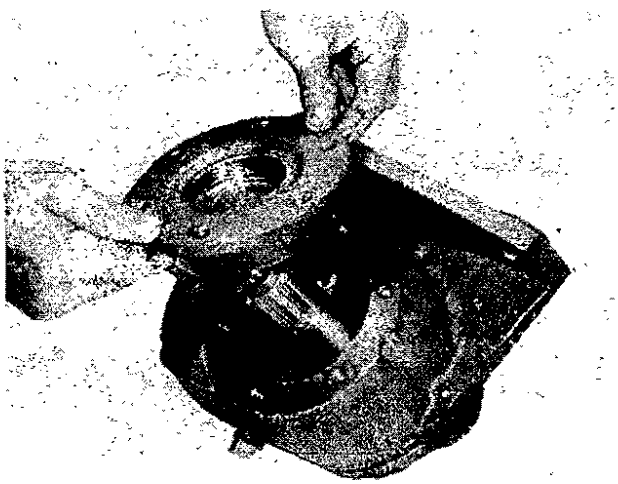
Illust. 11



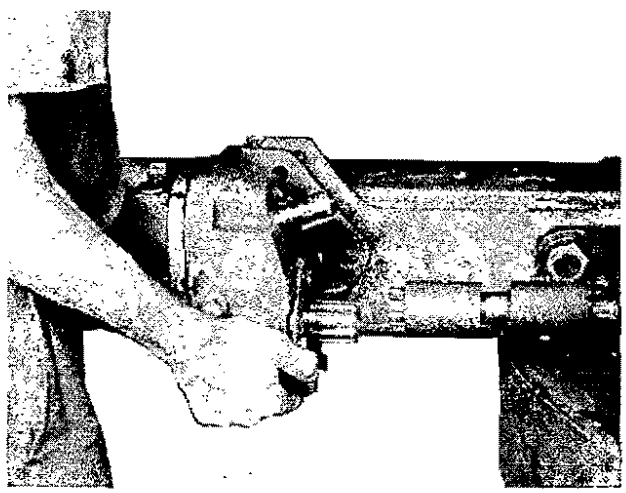
Illust. 9



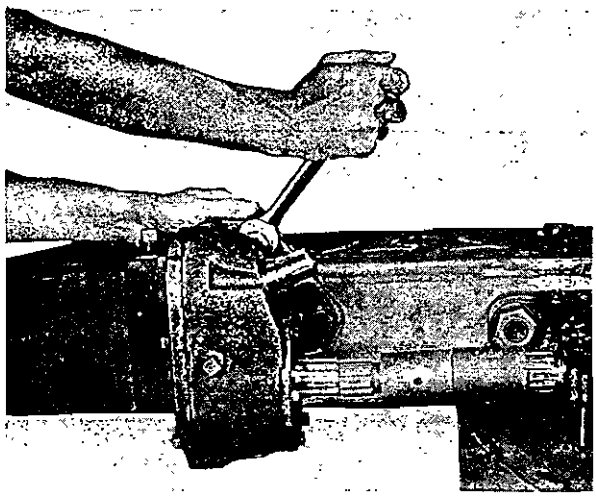
Illust. 12



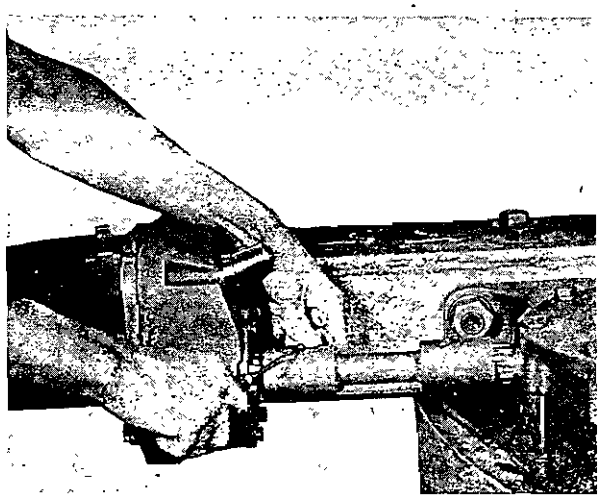
Illust. 10



Illust. 13



Illust. 14

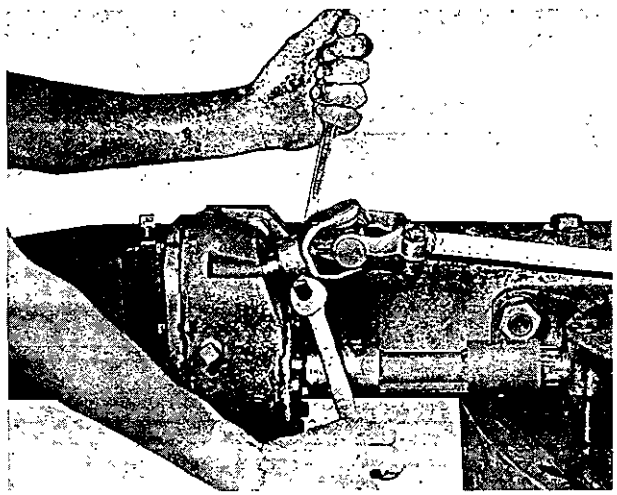


Illust. 15

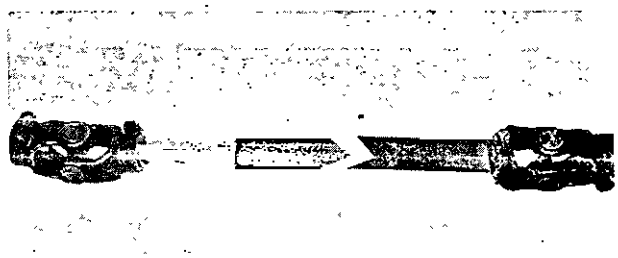
Drive seals into housing, using a piece of pipe and hammer.

Install transfer housing onto circle drawbar (Illust. 13). Next, install bolts, lock washers and nuts. Tighten nuts securely (Illust. 14).

Install couplings and shaft. NOTE: To install the couplings and shaft, slide couplings toward center of shaft. Insert shaft between transfer and circle reverse housings. Slide couplings onto the mating shafts until the drilled pins can be inserted through couplings. Install and spread cotter pins (Illust. 15). The shaft should have a small amount of end clearance at all times.



Illust. 16



Illust. 17

Install circle control square shaft universal joint onto upper pinion shaft. Tighten clamp cap screw securely (Illust. 16). NOTE: Be sure the universal joints on square and hollow shafts lie in the same relative plane (Illust. 17).

— NOTES —

FRONT AXLE

In order to better understand the problems involved in maintaining the front axle of a motor grader and proper wheel alignment, it is well to have a thorough understanding of the alignment angles involved. The most important and better known alignment angles are:

1. TOE-IN OF THE WHEELS.
2. CASTOR OF THE AXLE.
3. CAMBER OF THE WHEELS.

A brief description and discussion of the purposes of each of these angles should prove of assistance in properly servicing the axle.

1. TOE-IN OF THE WHEELS: Toe-in is the setting of the front wheels closer together at the front of the axle than at the rear. The purpose of toe-in is to offset the effect of wheel camber and the resultant tire wear due to lateral slippage.

2. FRONT AXLE CASTOR: Castor is the inclination of the spindle fork toward the rear or toward the front of the grader. Positive castor is an inclination of the top of the spindle toward the rear; negative or reverse castor is an inclination of the top of the spindle fork toward the front of the grader. The purpose of castor is to provide stability in steering.

3. WHEEL CAMBER: Camber is the inclination of the wheel from a vertical plane. The primary object of camber is to offset the wear of spindle bearings and bushings and wheel bearings and the deflection or sagging of front axle parts, thereby preventing the wheel from going into a reverse camber position after long mileage. Positive camber is an outward inclination of the wheel at the top. Negative or reverse camber is an inclination of the top of the wheel toward the center of the axle.

The factors effecting steering are so closely related and interdependent that any specific complaint may be caused by a number of different items. It will usually be found that not one but several factors are out of line and so all must be corrected before the motor grader can be expected to operate satisfactorily.

In regard to castor, there is no adjustment. The castor is a fixed dimension maintained by the axle pivot pin in relation to the front bolster. Should the machine be worn at this point, no serious damage to the tires can result. Improper castor has no serious effects on the wear of front tires on units of this type when traveling at their governed speed. However, bushings are provided at these points in the axle which are replaceable when wear becomes excessive.

Therefore, the only two dimensions which need to be checked are camber and toe-in. Before attempting to correct improper camber or toe-in, by adjustment, always check the spindle and spindle fork to determine if excessive wear has occured on the bearings and bushings in these parts. If excessive wear has occured, they should be adjusted or removed and new parts installed.

DISASSEMBLY

The extent to which the front axle assembly is disassembled depends upon the parts which must be repaired or replaced and therefore, the work to be done. All points of wear are equipped with replaceable bushings which require no reaming after installation. A detailed description is given here only of the reassembly operation since it is at this time that all adjustments must be established. The disassembly is merely the reverse of the assembly procedure and is so simple that it requires no detailed explanation.

INSPECTION

Inspect all parts for excessive wear, breakage or other damage. A close inspection should be made of the holes in the ends of the vibrating link to determine if they have become elongated. Occasionally, after long usage or severe operating conditions, these holes will become elongated thus allowing the front wheels to go into a reverse camber position. If this occurs, the complete vibrating link must be either repaired or replaced before reinstalling it on the machine.

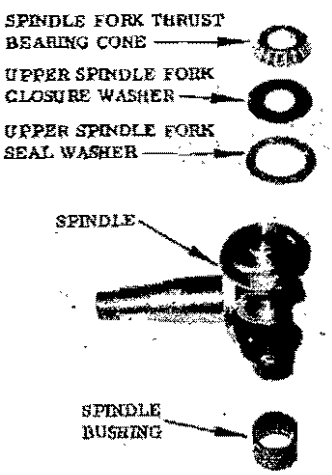
REASSEMBLY

Illust. 1 is a view of the spindle and component parts.

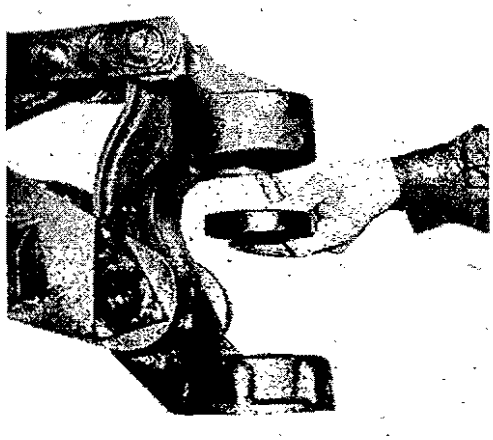
The first step is to install upper spindle fork seal washer onto spindle. Next, install upper spindle fork closure washer.

Heat spindle fork bearing cone in oil (350° F.) and install onto spindle. Hold bearing cone until set.

Heat spindle bushing in oil (350° F.) and install onto the lower end of spindle.

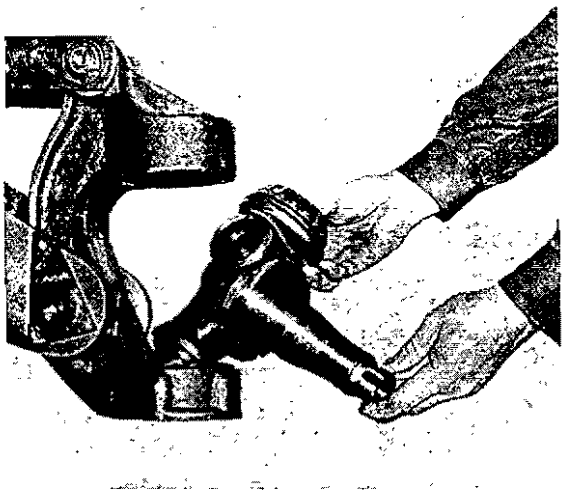


Illust. 1

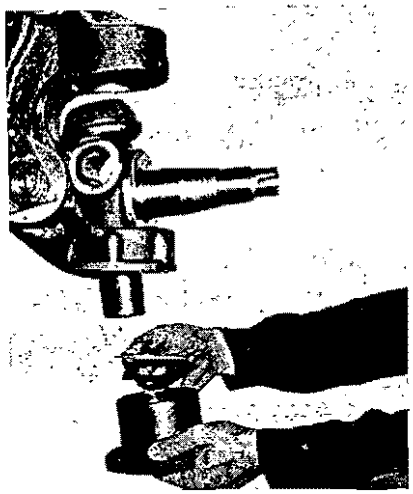


Illust. 2

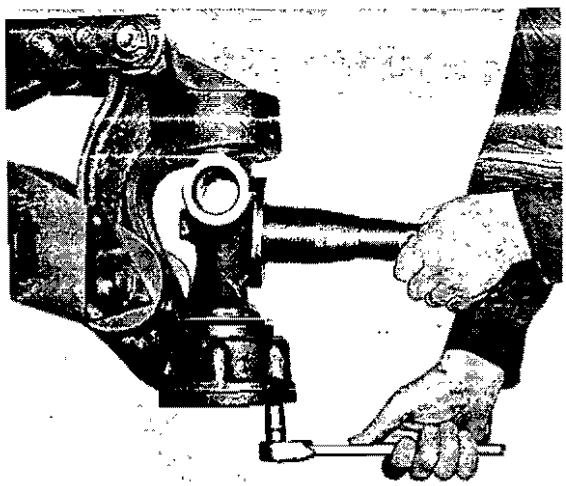
Illust. 3



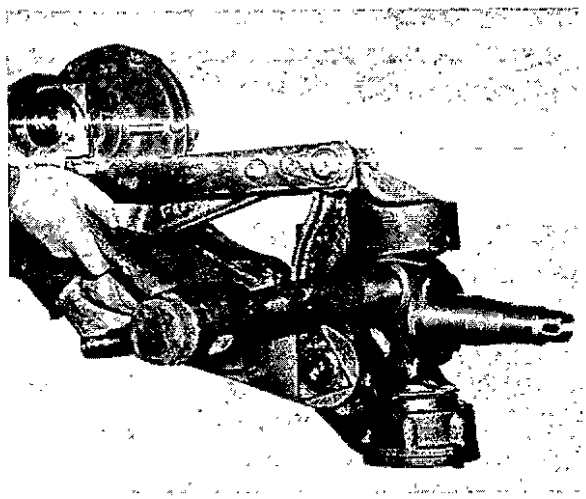
Illust. 4



Illust. 5



Illust. 6



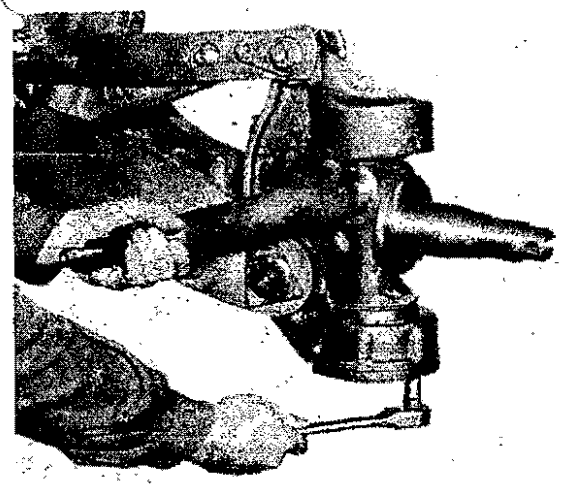
Illust. 7

Press or drive spindle fork bearing cup into spindle fork (Illust. 2).

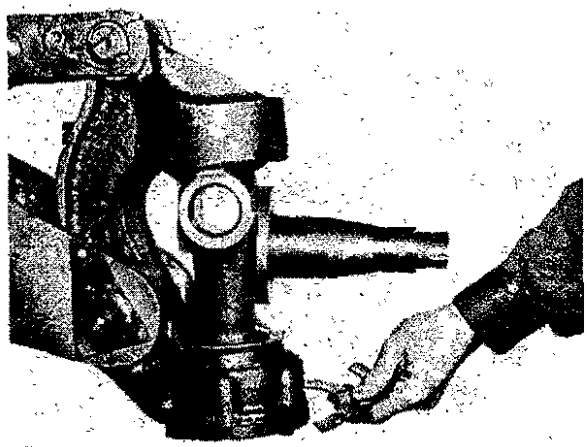
Install spindle fork into front axle (Illust. 3). Next, insert spindle fork and vibrating bar pins. Align tilt pin ear hole with hole in axle and install machine bolt with lock washer. Install lock washer and nut. Tighten nut securely. Align vibrating bar pin ear hole with hole in vibrating bar and install machine bolt with lock washer. Install lock washer and nut. Tighten nut securely.

Install hex slotted nuts and washers to vibrating bar and tilt pin. Tighten nuts securely, then install cotter pins and spread.

Install spindle assembly in spindle fork (Illust. 4). Next, install spindle lower seal washer, closure washer and lower spindle fork bearing less shims (Illust. 5). NOTE: It is extremely important that the lug on the closure washer engage properly on the flat side of spindle.



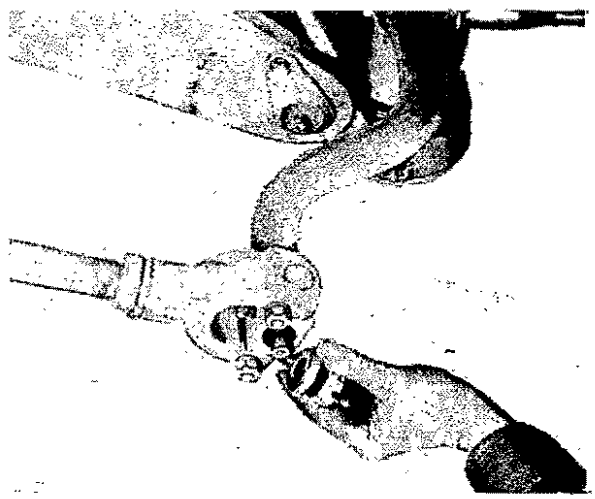
Illust. 8



Illust. 9

Component parts will not fit properly if closure washer is assembled any other way.

Install six (6) lower spindle fork bearing cap screws (Illust. 6). Install key in keyway of steering arm. Align key in arm with keyway in spindle and drive arm into spindle (Illust. 7). Install and tighten hex slotted nut securely. Next, install and spread cotter pin.



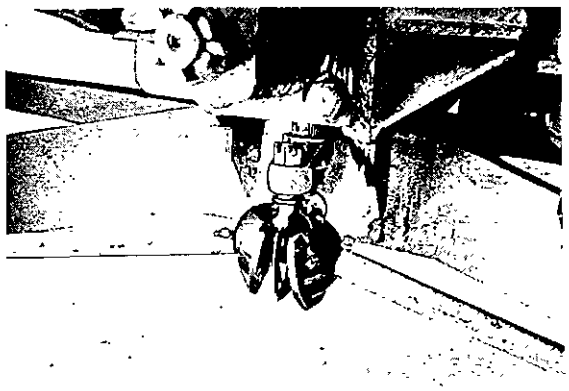
Illust. 10

Pre-load bearings by tightening lower spindle fork bearing cap screws (Illust. 8) until the spindle cannot be turned by pulling on the steering arm. Measure the gap between lower spindle fork bearing and spindle fork (Illust. 9). Remove the bearing and install the required amount of shims needed to fill the gap. Reinstall spindle bearing, lock washers and cap screws. Tighten cap screws securely. Hook a spring scale into the cotter pin hole in steering arm. Pull the scale at right angles to the steering arm and in a plane at right angles to the vertical center line of spindle. Tap spindle with a rawhide mallet until a pull of 4 to 8 pounds is obtained.

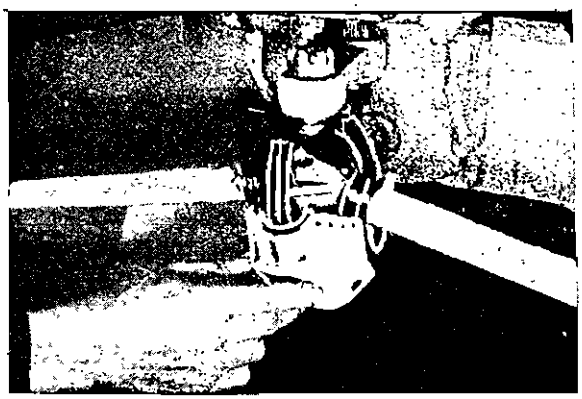
It is not necessary to remove the steering arm from the spindle to remove spindle from spindle fork.

After bearings have been pre-loaded, install tie rod yoke assembly onto steering arm (Illust. 10). Lubrication fitting to be toward inside of yoke. Next, install washer and hex slotted nut. Tighten nut securely, then install cotter pin and spread.

If the front axle tie rods have been disconnected from the steering ball, bring sockets over steering ball (Illust. 11) install shims, cap screws, lock washers and nuts. Tighten nuts



Illust. 11



Illust. 12

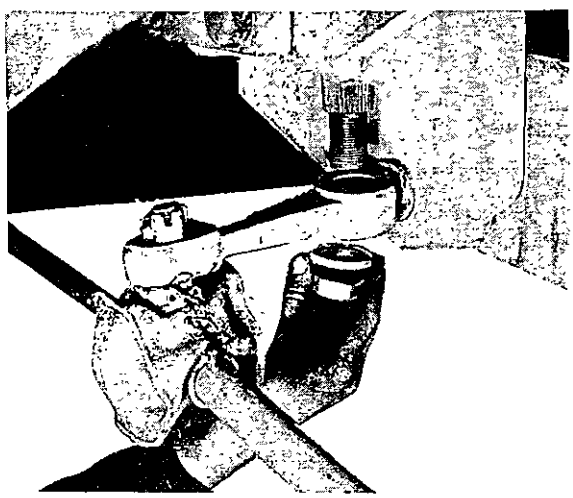
securely.

The ball and socket joint is equipped with shims to provide an accurate adjustment and also to take up any free play which may occur due to wear in the joints. The joint should never bind but should always work freely. Never remove any more shims than necessary to remove the free play in the joints.

After joint has been assembled, install steering ball boot and lace securely (Illust. 12).

Although the front axle assembly can be completely rebuilt while it is still attached to the grader, there are occasions when it is desirable to remove it as an assembly from the frame of the grader. An example of such removal would be the replacement of the bushings in the front axle assembly which fit around the bolster pin.

When such removal becomes necessary, the first step is to turn the moldboard crossways to the grader and lower it to the ground. Continue lowering on the moldboard until the front axle is raised slightly. Place blocks under the front axle to support its weight thereby preventing any danger of its turning over accidently during the removal procedure.

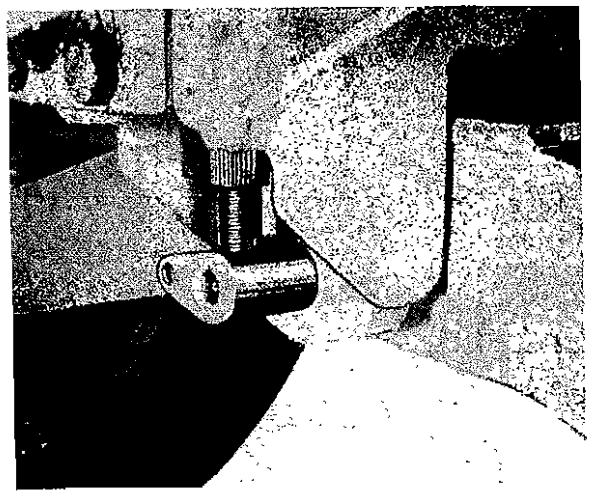


Illust. 13

Remove the nut and lock washer from the lower end of the steering gear and remove the steering arm (Illust. 13). If the steering arm does not slide off the tapered serrations easily, support the shaft and drive down on the arm using light hammer blows. Do not drive with excessive force on the steering arm as damage to the steering gear mechanism might result.

Remove the cap screw which holds the bolster pin in place and drive the pin out towards the rear

(Illust. 14). There are shims located between the axle and the front and rear front bolster plate which should be noted so they may be replaced in their original position.



Illust. 14

The frame of the grader can now be raised clear of the axle by continuing to lower the moldboard through the use of the power controls.

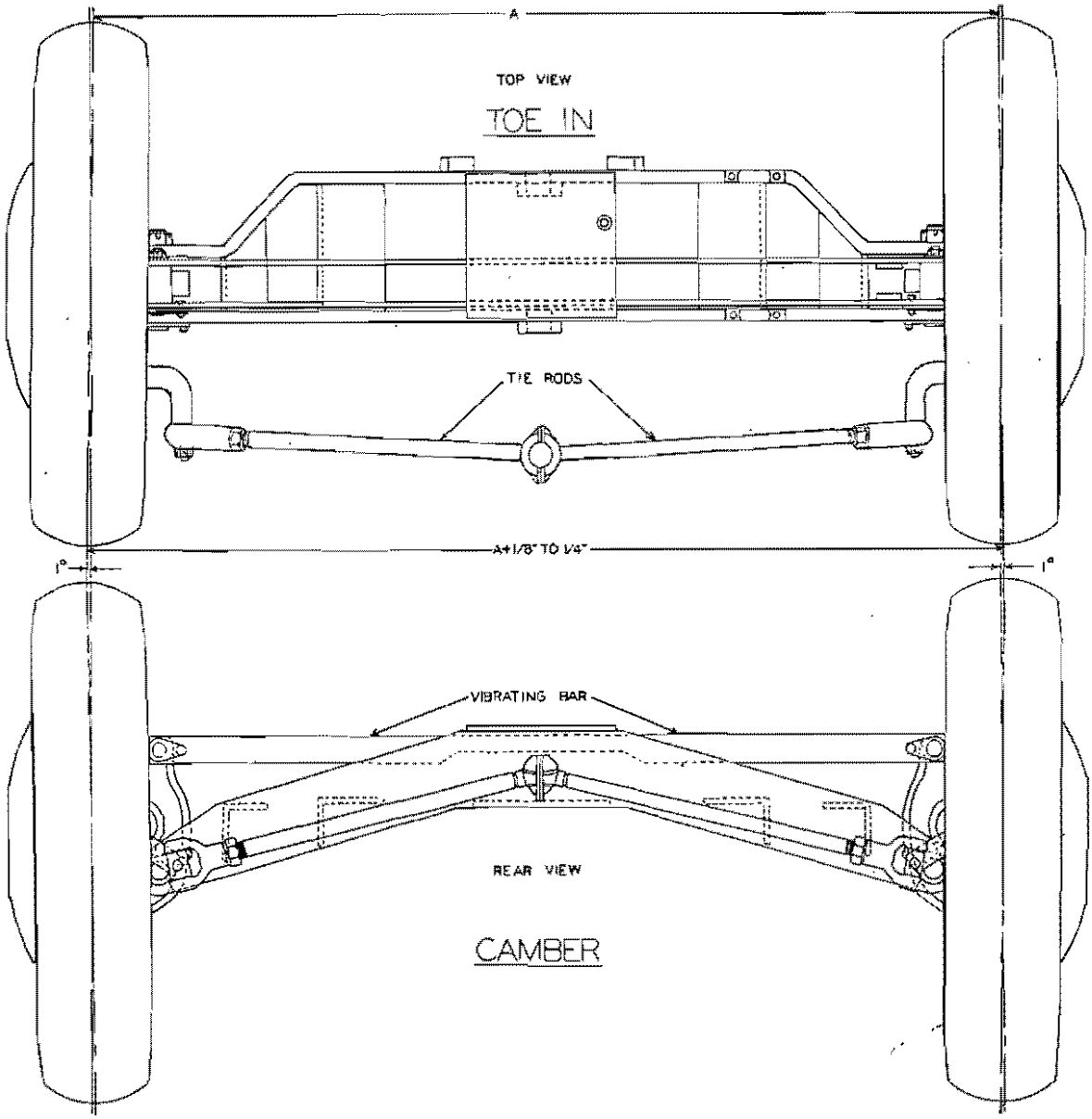
If it becomes necessary to replace the bushings around the bolster pin, they can be driven into place through the use of a wooden block. No reaming is necessary of the bushings after they have been replaced. When reinstalling the front axle assembly on the grader, install the shims on front or rear sides of the axle as needed to provide proper clearance for free oscillation of the axle in the front bolster assembly. Install sufficient shims to remove all free play between the axle and bolster. Be sure to install the sleeve over the bolster pin between the front and rear bars of the axle.

When reassembling the telescopic shaft on the front wheel lean housing, be sure to assemble it so the forks of the universal joints are in the same relative plane. Install the steering arm on the tapered splines of the steering gear shaft. Install lock washer and nut. Tighten nut securely.

ADJUSTMENT

Whenever the front axle is reconditioned as described above, the toe-in and the camber should be checked. If it becomes necessary to adjust the toe-in, the locking nuts on the ends of the tie rods should be loosened. The tie rods can then be turned in or out of the tie rod yokes to decrease or increase its total length, thereby changing the toe-in of the wheels. Both tie rods should be adjusted an equal amount in order to keep the steering ball centered.

Illust. 15 is a sketch of the front axle assembly with toe-in and camber dimensions. In order to properly measure toe-in, a line should be drawn down the center of each tire in order to compensate for any "run-out" of the tires. To do this, raise both front wheels clear of the ground and revolve each one rapidly by hand. As the wheel is revolved, hold a piece of chalk against the center of the tread and draw a true center line completely around each tire. Now lower the wheels to the ground so they support the full weight of the front end of the grader. Next, measure the distance between the lines at the front and at the rear of the axle. The distance between these lines should be from 1/8" to 1/4" greater at the rear than at the front; i.e., 1/8" to 1/4" toe-in. Both front wheels should have one degree positive camber (outward inclination of the wheel at the top). This dimension should not be confused with the front leaning wheel feature. It is suggested that to make sure of the dimensions, the front wheel control be operated until one of the front wheels assumes a one-degree lean toward the outside. Then check the opposite wheel which should also have a one-degree lean toward



Illust. 15

the outside. Incorrect camber may be due to worn bushings, bent spindle forks, bent front axle or elongated holes in the vibrating link. NOTE: It is important that the weight of the grader be supported by the front wheels when any measurements are taken so that the wheels will be in their normal operating position.

— NOTES —

FRONT LEANING WHEEL HOUSING

Aside from proper lubrication and occasional adjustment of the worm thrust bearings, the front leaning wheel gear assembly require very little attention.

The extent to which the front leaning wheel gear assembly is disassembled depends upon the work to be done. The disassembly operation is so simple that no detailed explanation is necessary. Should trouble be experienced, the mechanism can be disassembled by reversing the reassembly procedure. It is always necessary to completely remove the front leaning wheel gear assembly from the front axle when disassembly of the unit becomes necessary.
IMPORTANT: As a safety factor, tilt front wheels to the extreme right before attempting removal of tilt housing.

Inspect all parts for excessive wear or other damage. Bearings, gears and shafts will sometimes seize and score due to insufficient lubricant or improper lubricant being used. Parts damaged in this manner should be replaced. Apply oil to parts before installation.

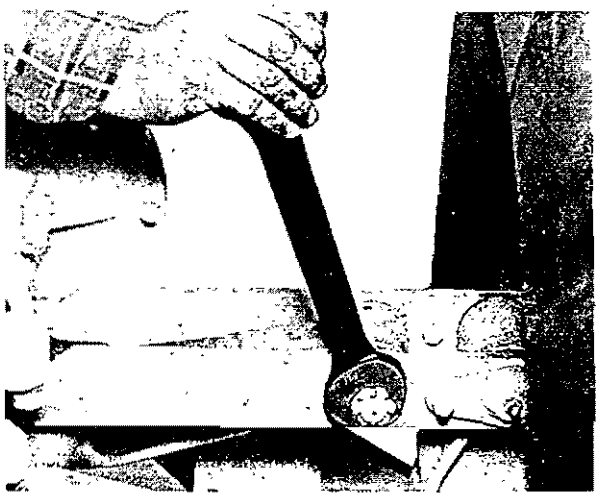
Illust. 1

REMOVAL

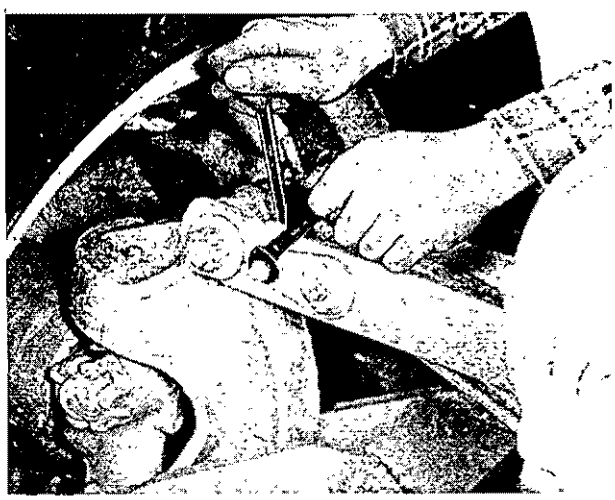
To remove the front leaning wheel gear assembly from the front axle, loosen universal joint yoke cap screw (Illust. 1). Bump yoke from key in worm shaft, using a rawhide mallet.

Remove cotter pin, hex nut and washer from vibrating bar pin (Illust. 2).

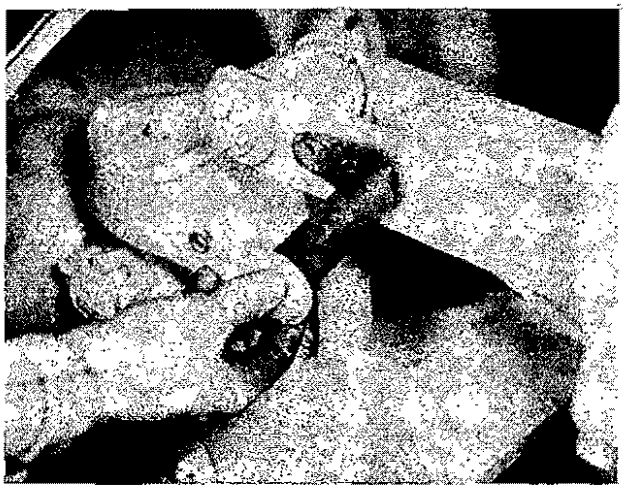
Remove machine bolt, nut and lock washers from vibrating bar pin (Illust. 3). Us-



Illust. 2



Illust. 3

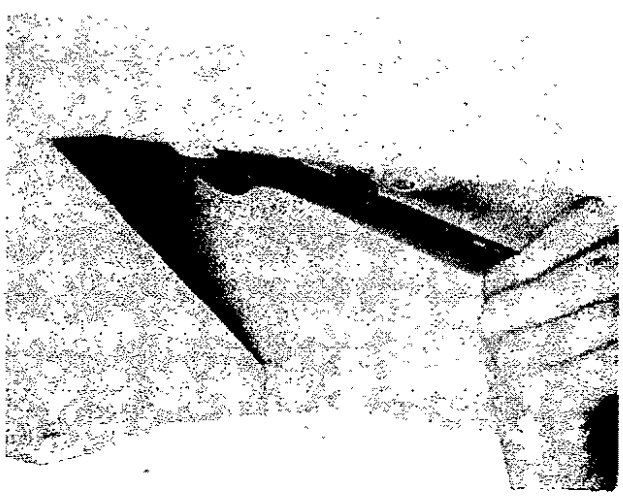


Illust. 4

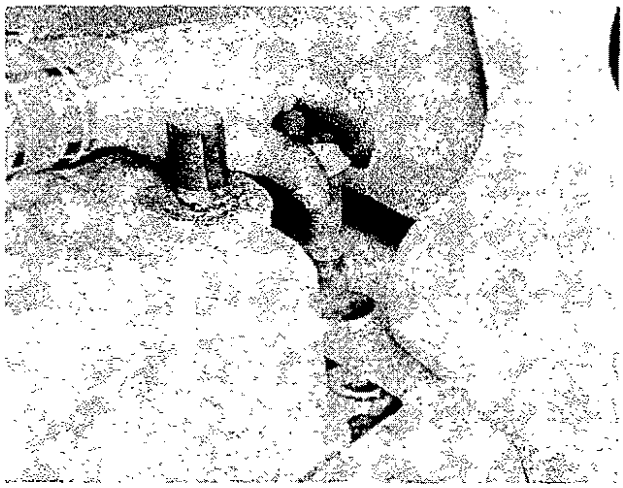
ing a rawhide mallet, bump pin from vibrating bar (Illust. 4).

Remove nut and lock washer from anchor plow bolt (Illust. 5). Next, remove spacer and plow bolt from front axle (Illust. 6).

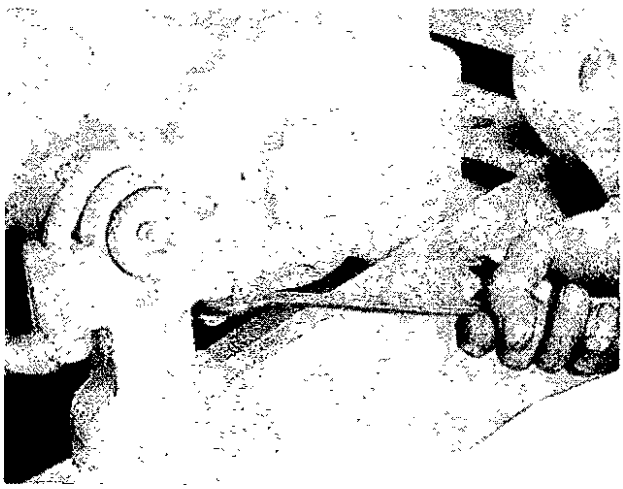
Remove "U" bolt nuts and lockwashers (Illust. 7). Remove "U" bolts (Illust. 8). IMPORTANT: It is important, in the reassembly procedure, that the "U" bolt nuts must be so tight that shaft is clamped in self-aligning bearing.



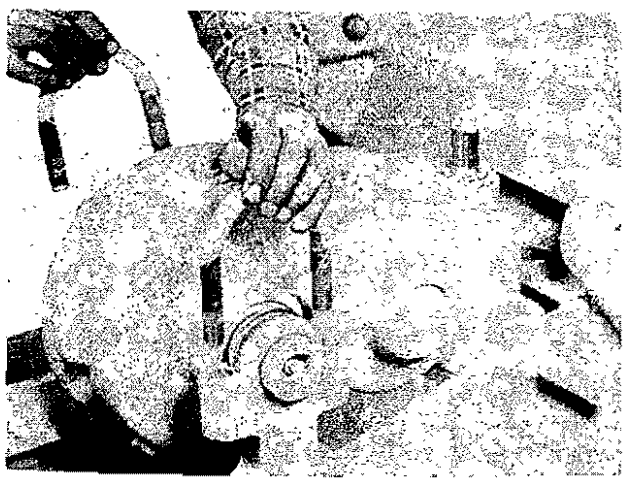
Illust. 5



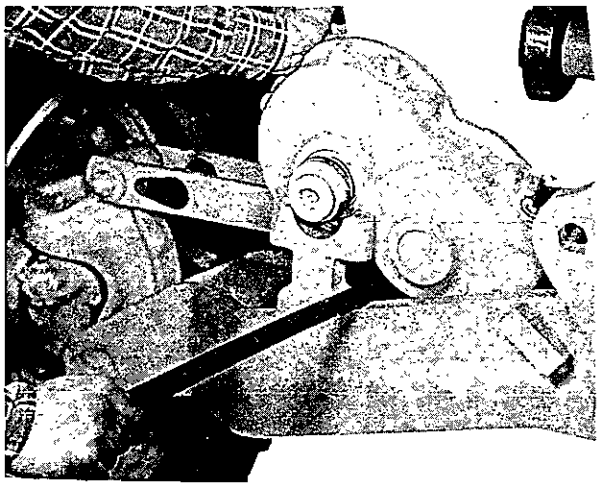
Illust. 6



Illust. 7



Illust. 8



Illust. 9

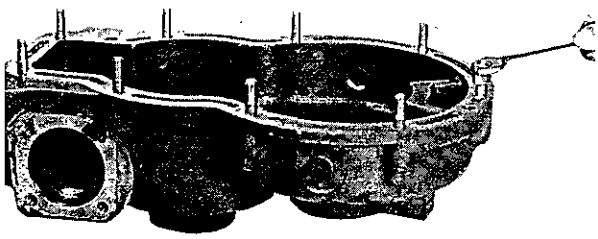
Using a pry bar, remove the assembly from front axle (Illust. 9).

REASSEMBLY

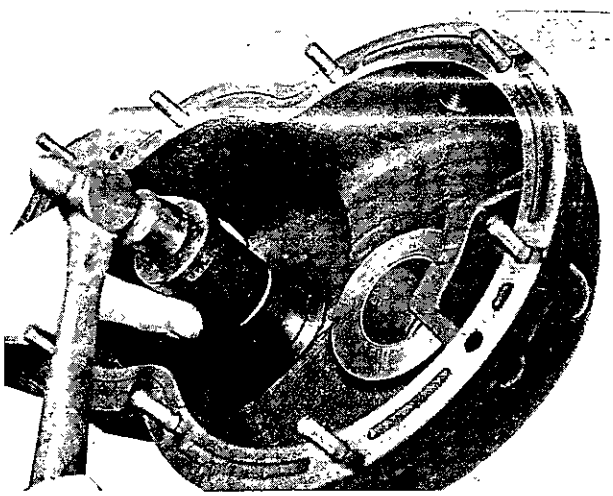
Install and tighten studs into housing, using two nuts locked together on studs (Illust. 1).

Press or drive bushings into housing (Illusts. 2 and 3). Bushings to be flush with surface of bore.

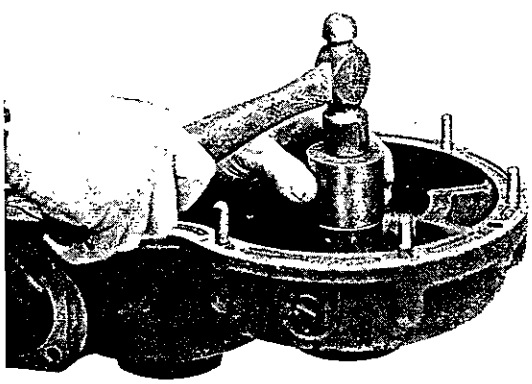
Press or drive small bushing into housing (Illust. 4). Bushing to be flush with inside shoulder of bore.



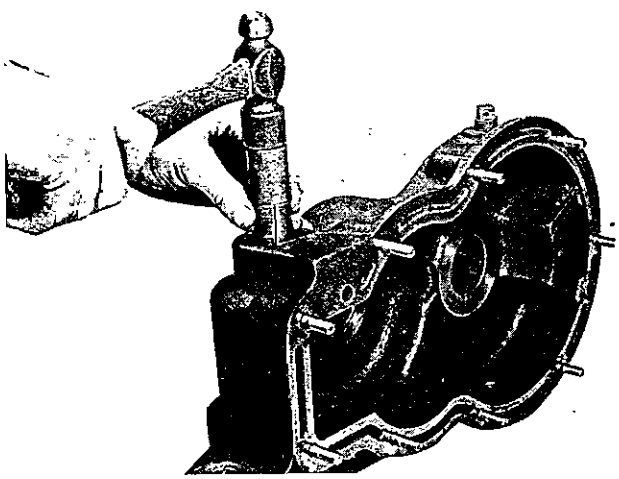
Illust. 1



Illust. 3



Illust. 2



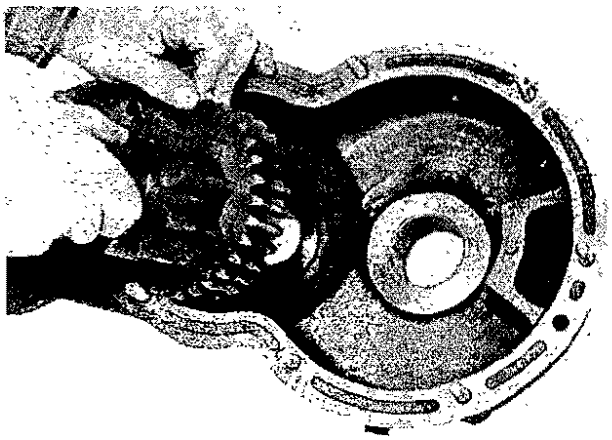
Illust. 4

Drive key in keyway of worm shaft (Illust. 5).

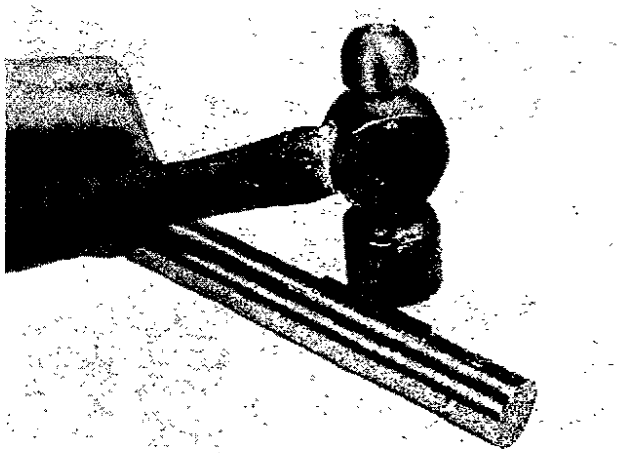
Align key in shaft with keyway in worm. Press shaft through worm until 1 inch of shaft extends from worm (Illust. 6).

Install worm gear and pinion into housing (Illust. 7).

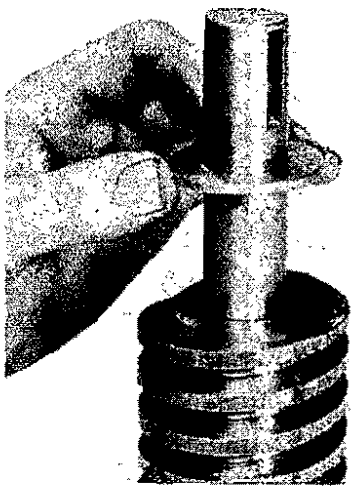
Install worm thrust washer onto worm shaft (Illust. 8).



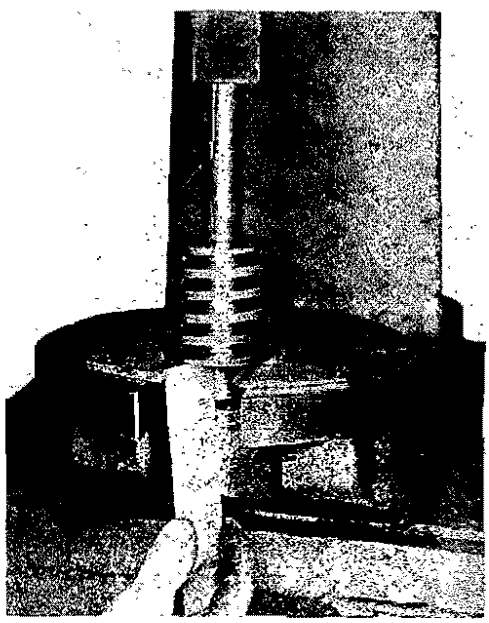
Illust. 7



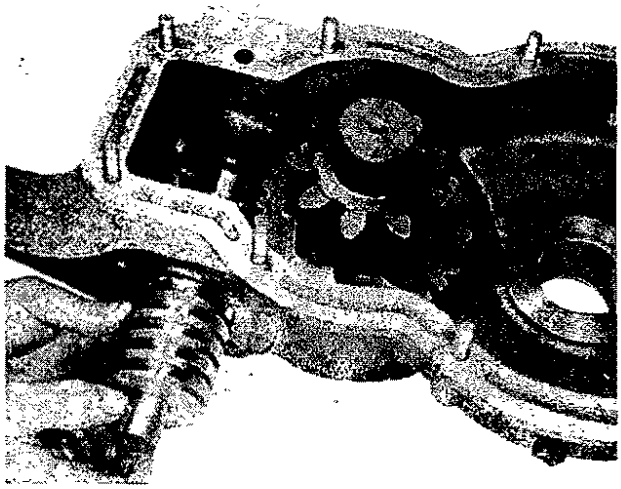
Illust. 5



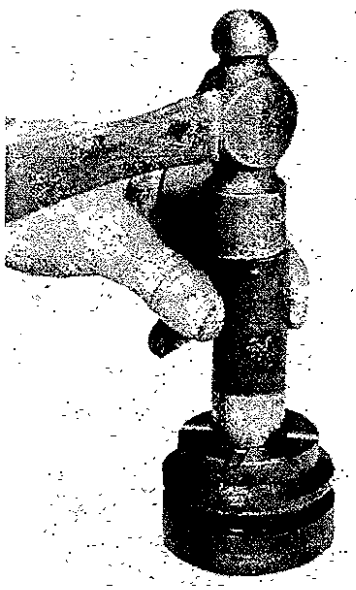
Illust. 8



Illust. 6



Illust. 9



Illust. 10

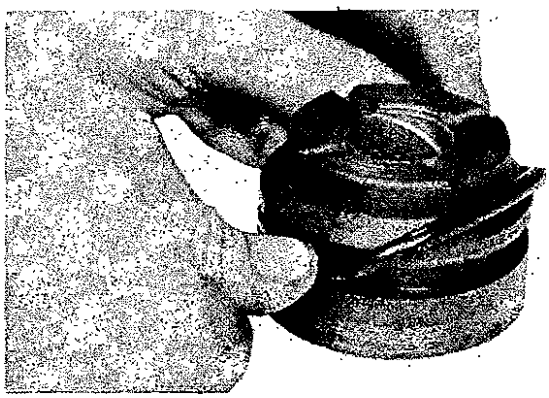
Insert worm shaft assembly into housing (Illust. 9). Rotate assembly until thrust washer is against smooth surface of housing.

Press or drive bushing into worm thrust bearing (Illust. 10). Bushing to be flush with bottom of chamfer.

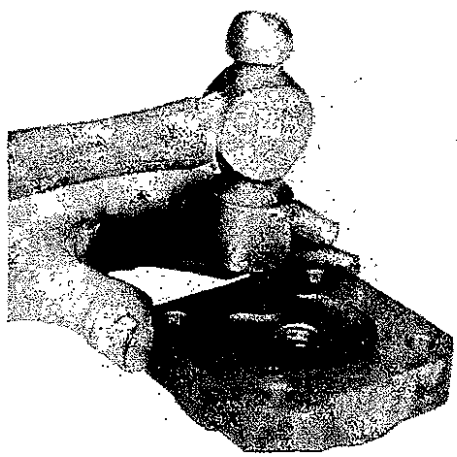
Install "O" ring in groove of thrust bearing (Illust. 11).

Insert thrust bearing into housing (Illust. 12).

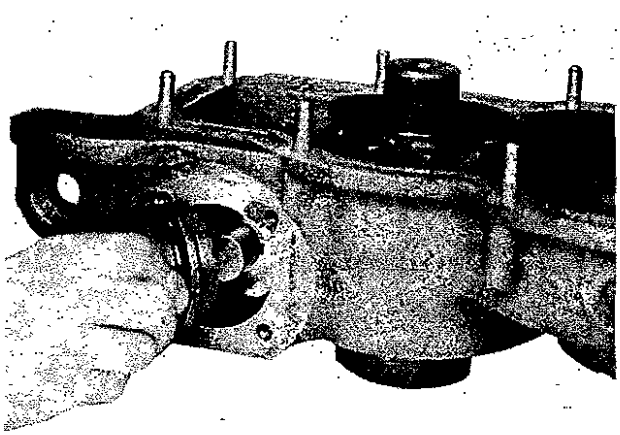
Press or drive rolled pin into bearing cap (Illust. 13). NOTE: Apply white lead to



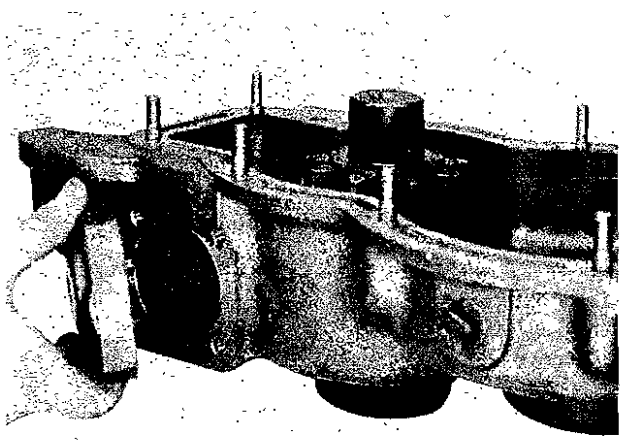
Illust. 11



Illust. 13



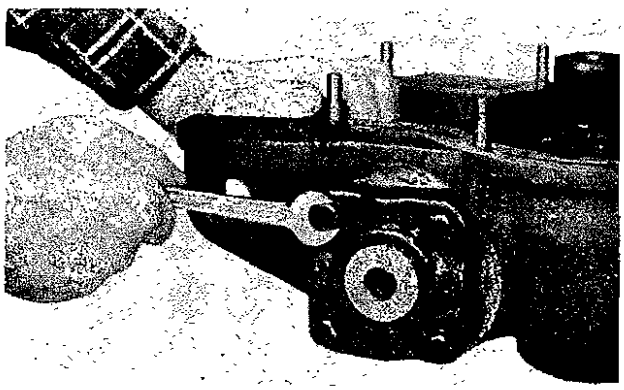
Illust. 12



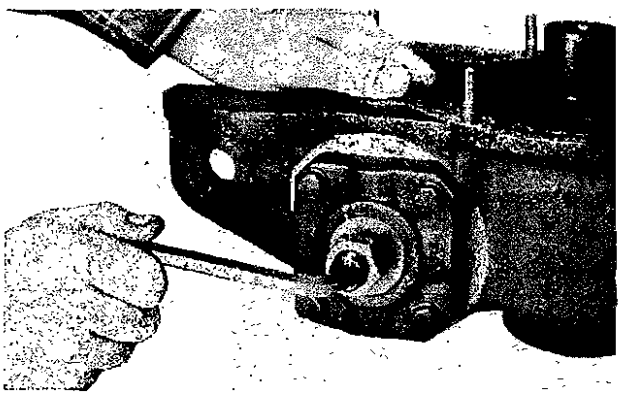
Illust. 14

"O" ring to prevent damaging.

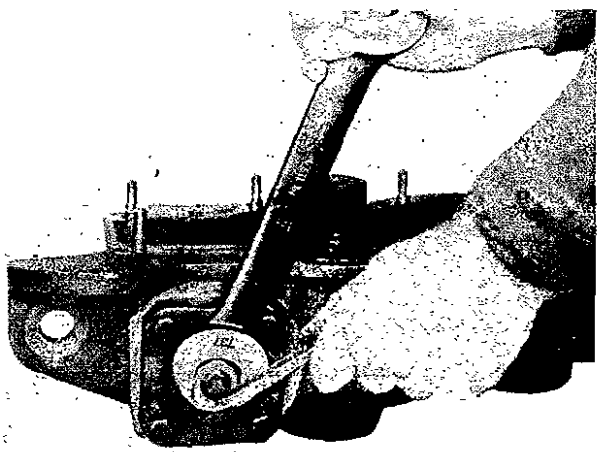
Install bearing cap onto housing (Illust. 14). Rolled pin to fit into bore of thrust bearing. NOTE: No gasket is required between bearing cap and housing.



Illust. 15



Illust. 16



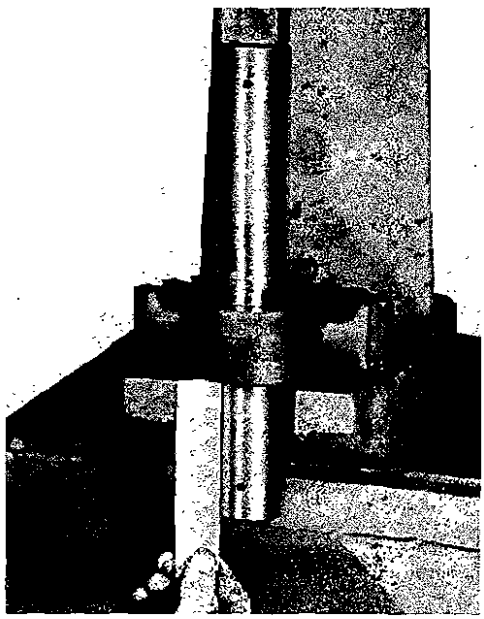
Illust. 17

Install and tighten cap screw with lock washers securely (Illust. 15).

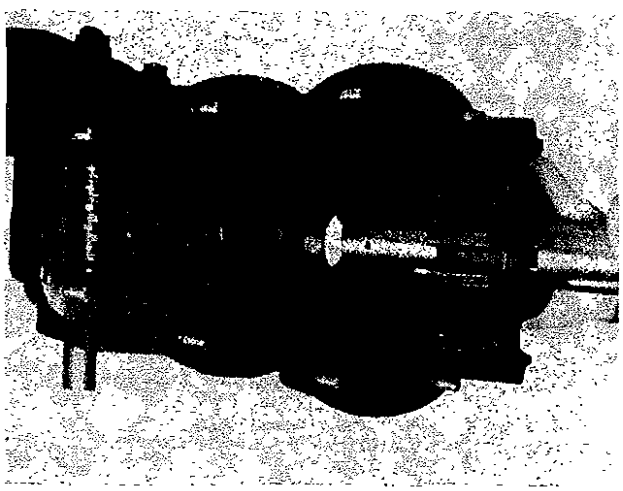
Install adjusting set screw and jam nut (Illust. 16), but do not tighten.

To adjust worm thrust bearing, tighten hex socket head set screw until a perceptible drag is obtained, then loosen set screw until drag is eliminated. Hold this position and tighten jam nut securely (Illust. 17).

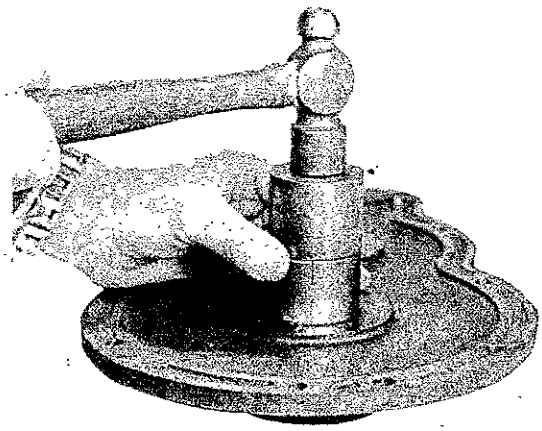
Press or drive key in keyway of tilting shaft. Next, align key in shaft with keyway



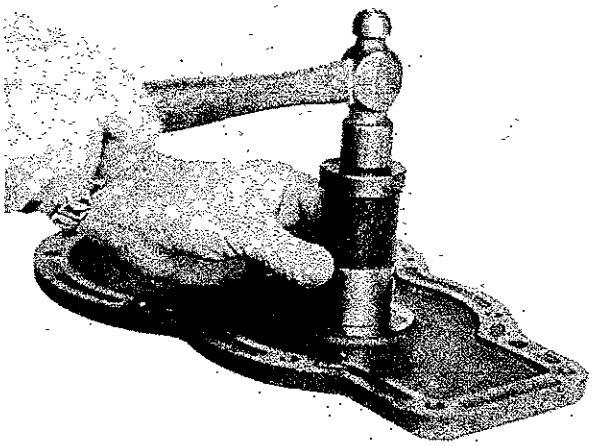
Illust. 18



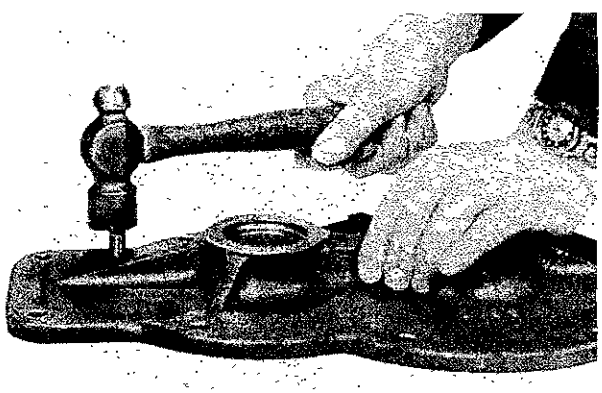
Illust. 19



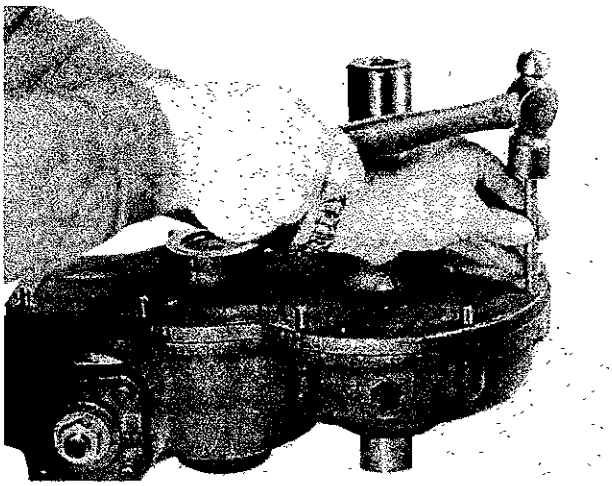
Illust. 20



Illust. 21



Illust. 22



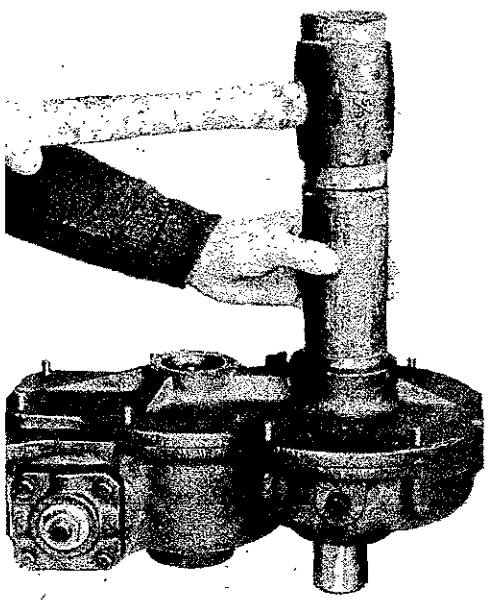
Illust. 23

in half gear. Press shaft through gear until shaft extends out of gear 4-5/16 inches from hub of gear (Illust. 18).

Insert half gear and shaft into housing (Illust. 19). Tooth in worm gear and pinion to center in half gear.

Press or drive bushings into bore of gear housing cover (Illusts. 20 and 21). Bushings to be flush with surface of bore.

Drive dowel pins into cover (Illust. 22). Do



Illust. 24

not drive dowel pins through cover.

Shellac gasket to gear housing and install cover. Drive dowel pins into housing (Illust. 23). Dowel pins to be flush with outside face of cover.

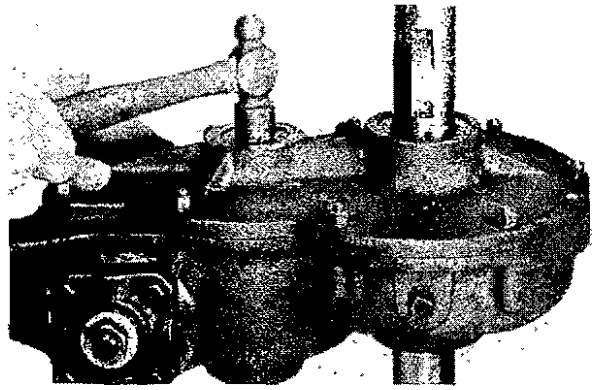
Press or drive oil seal into cover (Illust. 24). Lip of seal toward inside of housing. NOTE: To start oil seal over end of shaft, use a piece of thin shim stock or tool. This will prevent damage to seal leather.

Install stud nuts and lock washers. Tighten nuts securely (Illust. 25).

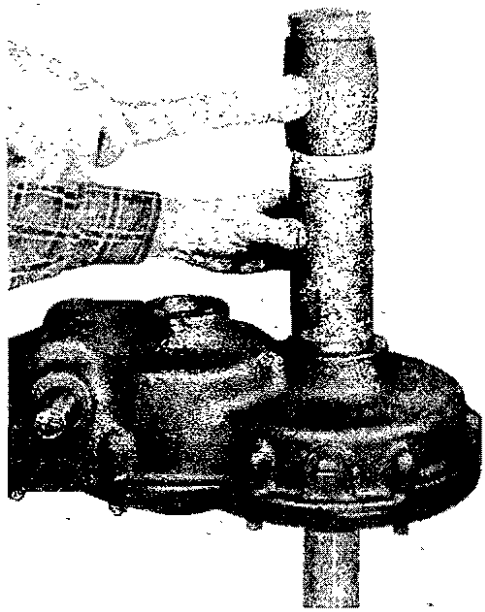
Install welsh plug into bore of cover. To set welsh plug, use a hammer. Strike concave of plug until flush with outside edge of plug (Illust. 26).

Press or drive oil seal into housing (Illust. 27). Lip of seal toward inside of housing. NOTE: To start oil seal over end of shaft, use a piece of thin shim stock or tool. This will prevent damage to seal leather.

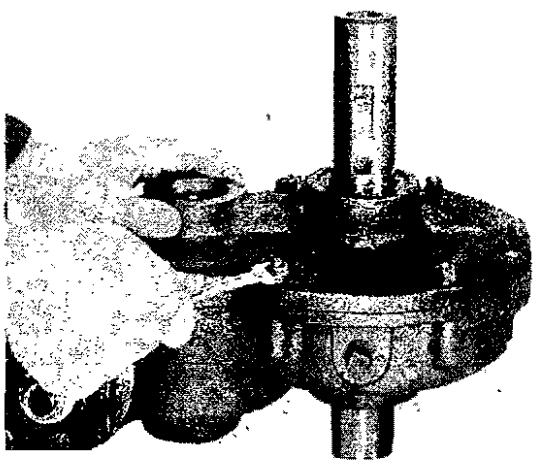
Install welsh plug into bore of housing. To set welsh plug, use a hammer, Strike concave of plug until flush with outside edge of plug (Illust. 28).



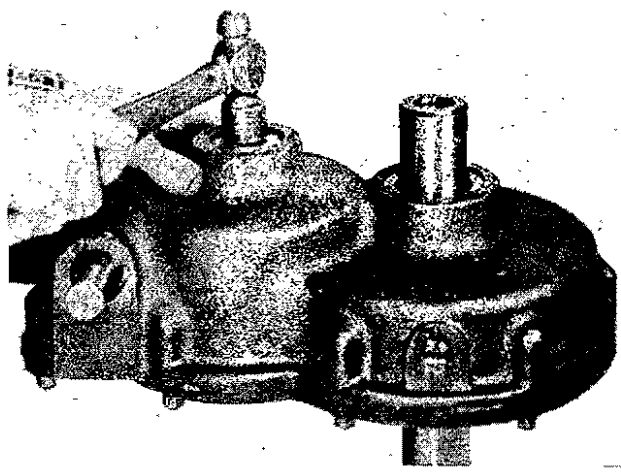
Illust. 26



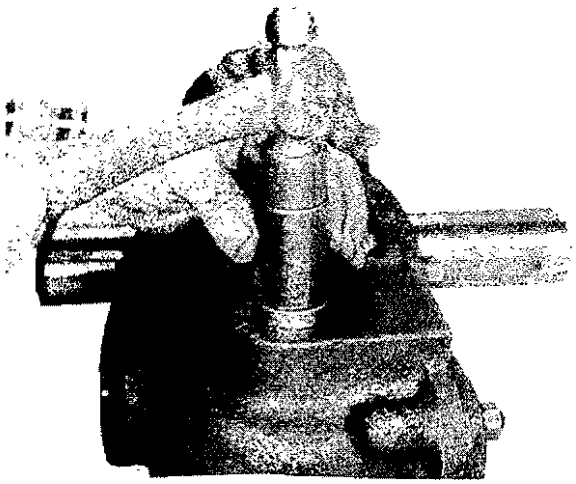
Illust. 27



Illust. 25



Illust. 28



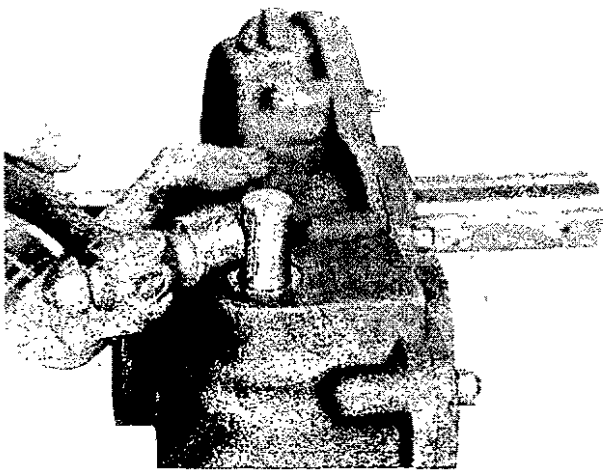
Illust. 29

Press or drive oil seal into top bore of housing (Illust. 29). Lip of seal toward inside of housing. NOTE: To start oil seal over end of shaft, use a piece of thin shim stock or tool. This will prevent damage to seal leather.

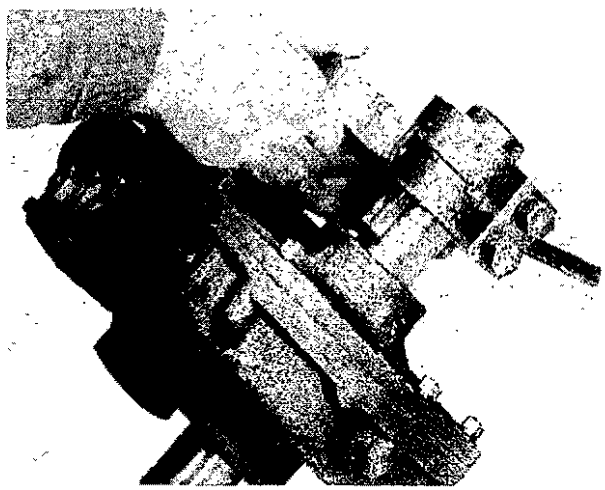
Drive key in keyway of worm shaft (Illust. 30).

Drive key in keyway of tilting shaft (Illust. 31).

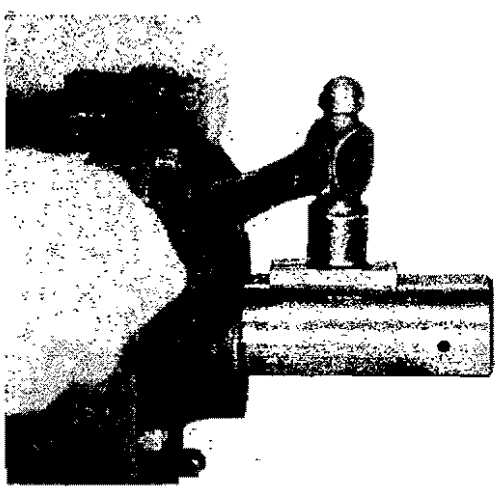
Align keyway in tilting crank with key in shaft, then install crank onto shaft (Illust. 32). Long end of crank toward anchor flange end of housing. NOTE: For easy installa-



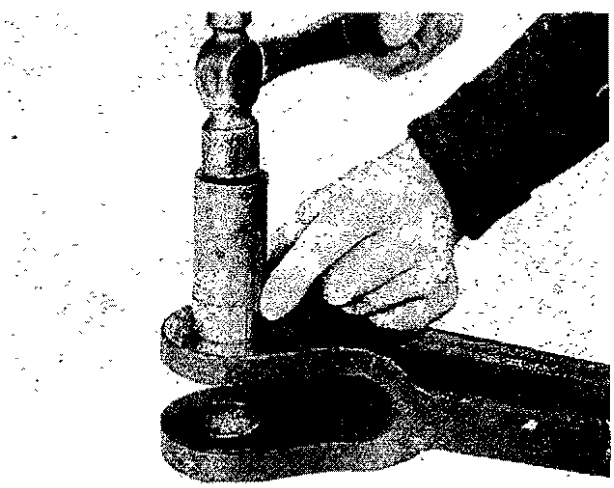
Illust. 30



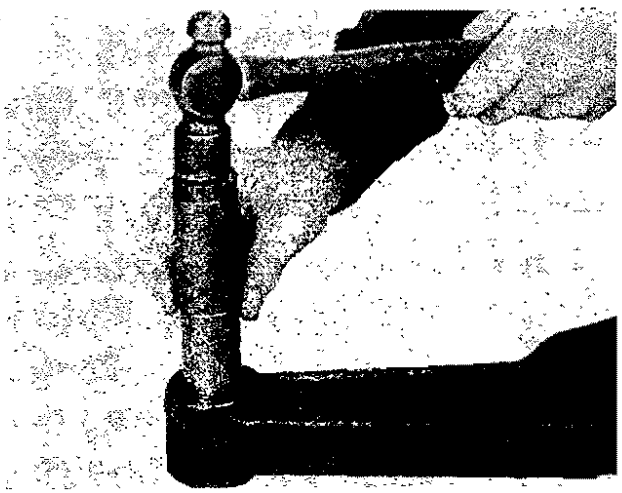
Illust. 32



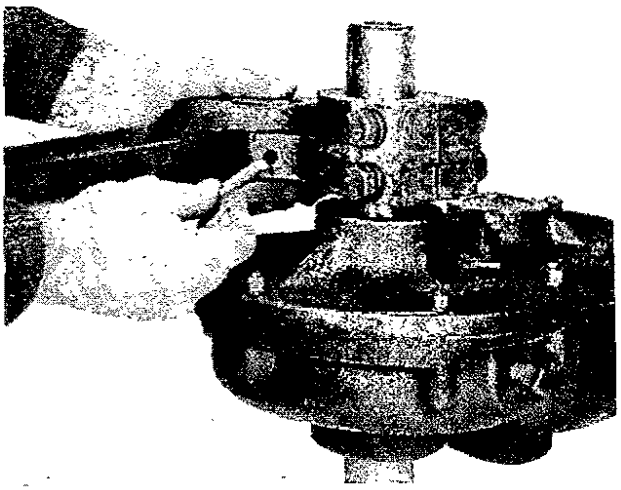
Illust. 31



Illust. 33



Illust. 34



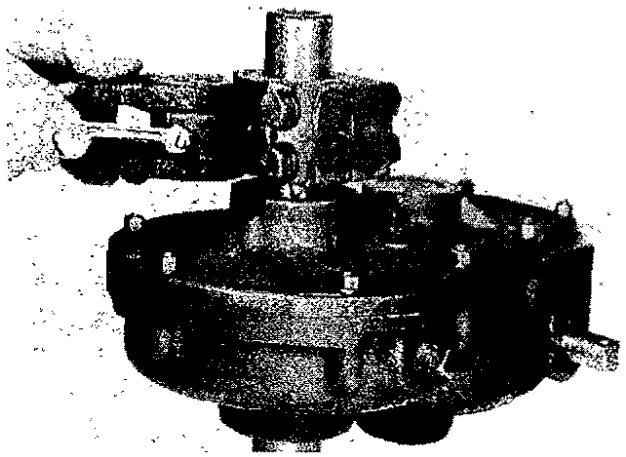
Illust. 36

tion drive a flat tool into slot of tilt crank. Next, install machine bolts, lock washers and nuts, but do not tighten.

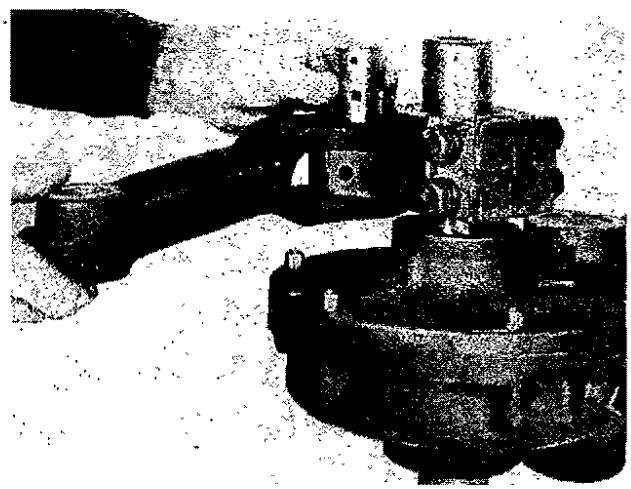
Press or drive bushings into tilting link (Illusts. 33 and 34).

Align tilt link pin bore with bore of tilt crank, then insert tilt link pin (Illust. 35). Threaded bore in pin to align with bore of crank. Insert lubrication fitting (Illust. 36) and tighten securely (Illust. 37).

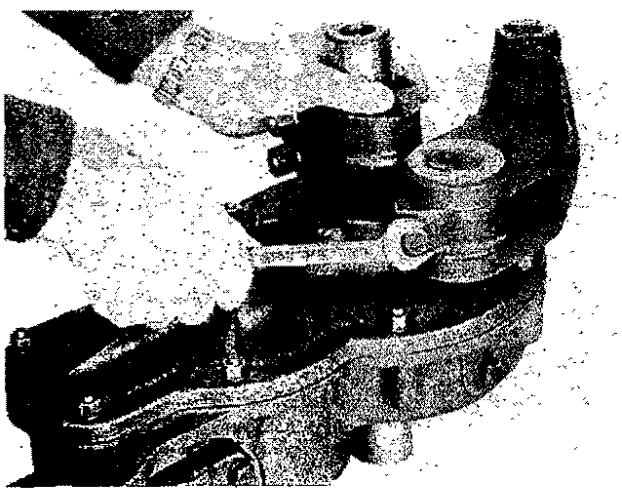
Install and tighten tilt crank cap screw with lock washer securely (Illust. 38).



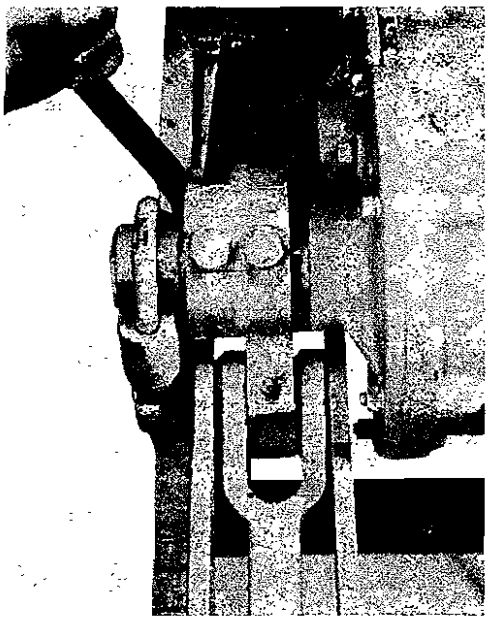
Illust. 37



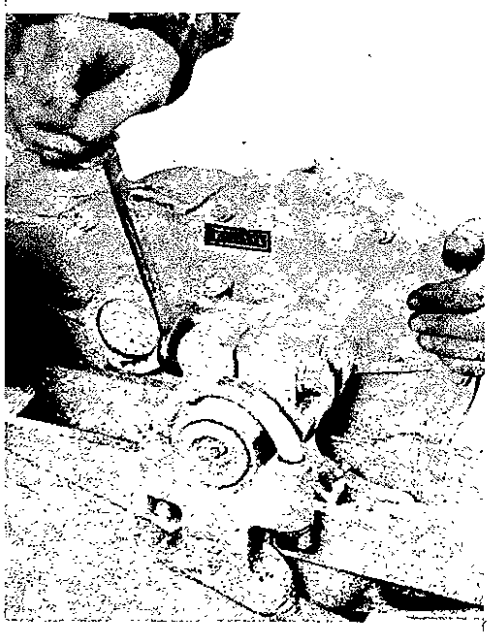
Illust. 35



Illust. 38



Illust. 39



Illust. 40

To install the gear housing assembly to front axle, reverse the removal procedure.

When gear housing has been installed to front axle, use a pry bar to center tilt link between vibrator bars (Illust. 39).
IMPORTANT: At no time should the tilt rub vibrating bars.

After the tilt link has been centered, remove flat tool from tilt crank slot and tighten machine bolts securely (Illust. 40).

See "Lubricating Instructions" for correct lubrication of gear housing.

— NOTES —

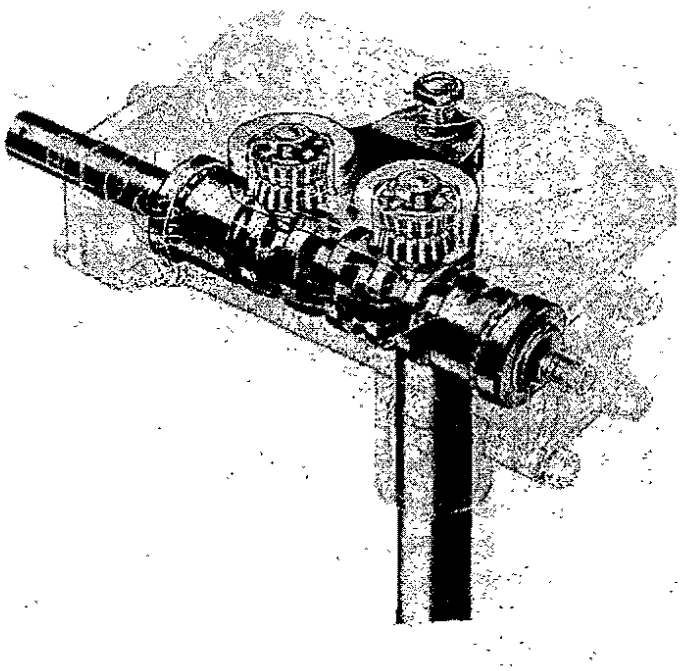
MANUAL STEERING

Illust. 1 is a phantom view of the manual steering gear assembly. This view shows all of the important parts and their relationship to each other.

All miner repairs and adjustments to the steering gear can be made without removing it from the grader. However, if it becomes necessary to remove the assembly, follow the procedure outlined below.

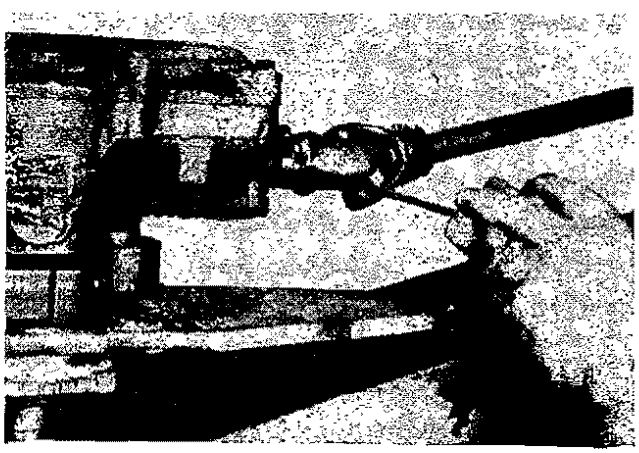
REMOVAL

The first step in the removal procedure is to remove nut and lock washer from end of shaft (Illust. 2). Next drive arm from serrations of shaft. NOTE: When driving the arm off, support end of shaft and use light hammer blows on the arm.

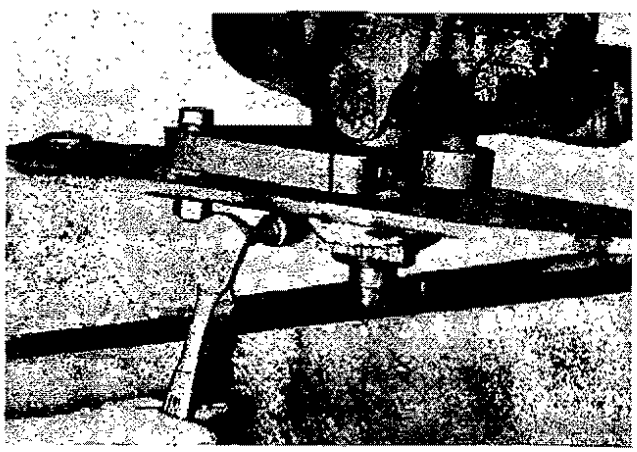


Illust. 1

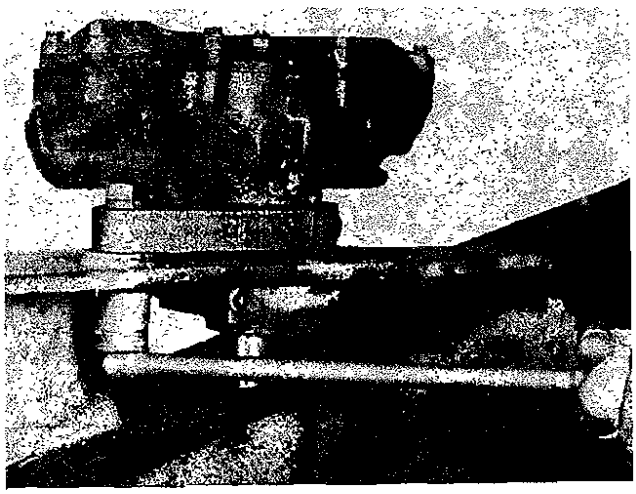
Illust. 2



Illust. 3



Illust. 4



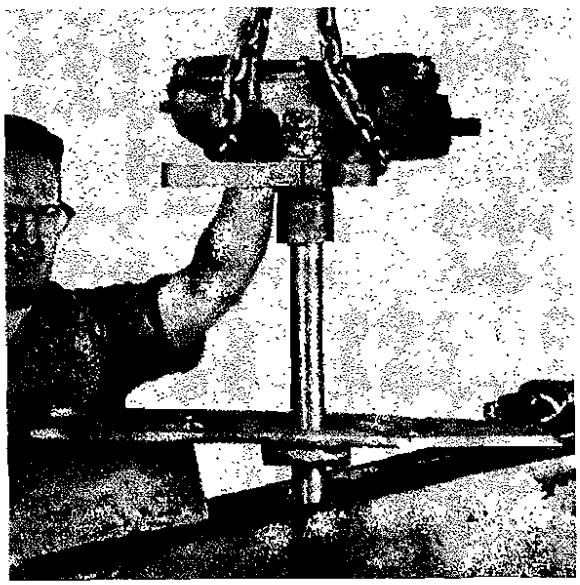
Illust. 5

Remove cotter pin from drilled pin (illust.3) Drive drilled pin from universal joint, then remove universal joint from steering camshaft.

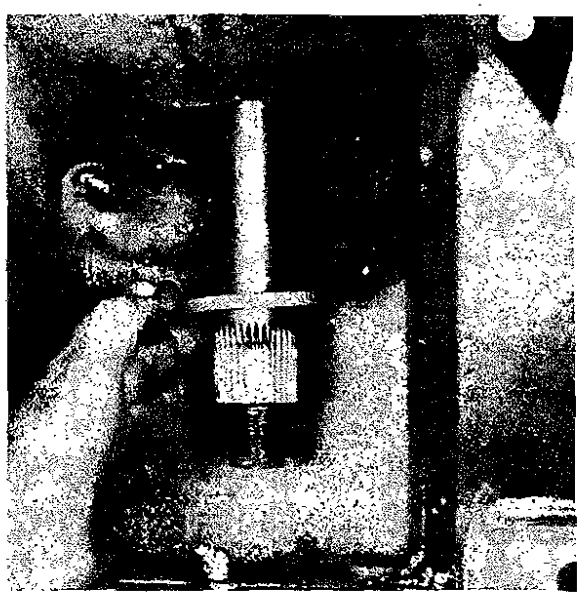
Loosen clamp bolt (Illust.4) and remove torque plate bolt (Illust.5).

Using a chain hoist, raise steering housing assembly (Illust. 6) from bolster until rubber washer can be removed from steering shaft (Illust.7), then remove steering assembly from frame.

Should it become necessary to disassemble the steering housing, reverse the reassembly procedure.



Illust. 6



Illust. 7

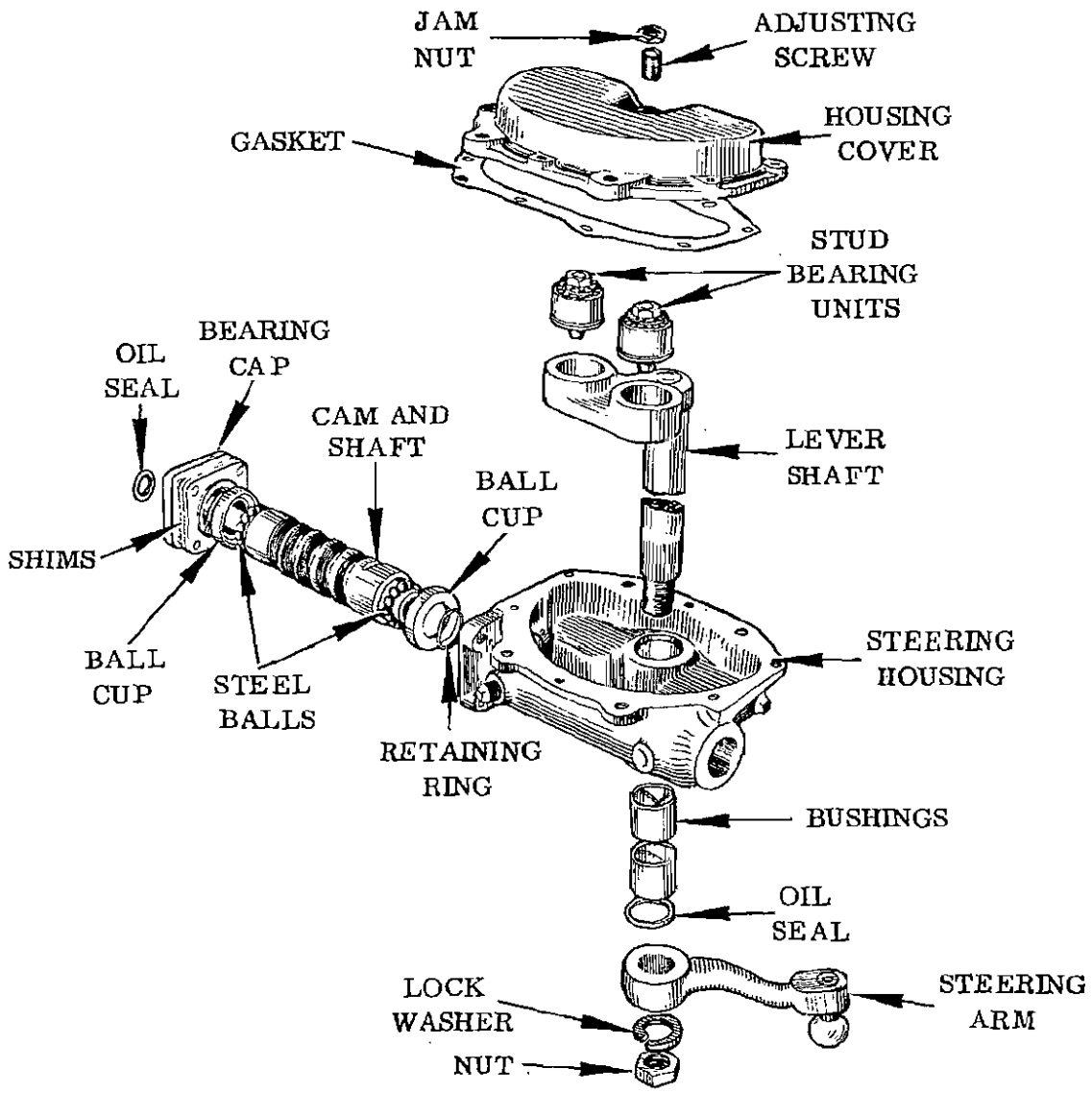
INSPECTION

Inspect all parts of the assembly for wear and damage. Replace defective parts.

REASSEMBLY

Illust.1 is an exploded view of the steering housing assembly. Press or drive bushing into bore of steering housing (Illust. 2) until bushing is approximately 1/8 inch under flush with top of bore. NOTE: Use a pilot tool for pressing or driving bushing into place. This will prevent bushing from becoming out of round.

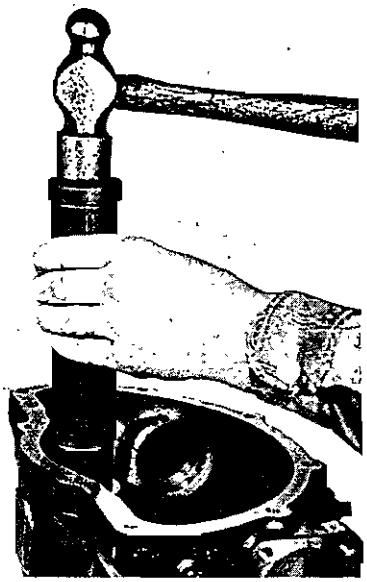
Install welsh plug into bore of steering housing. Welsh plug to fit against shoulder of housing. NOTE: Apply a sealing compound around edge of plug.



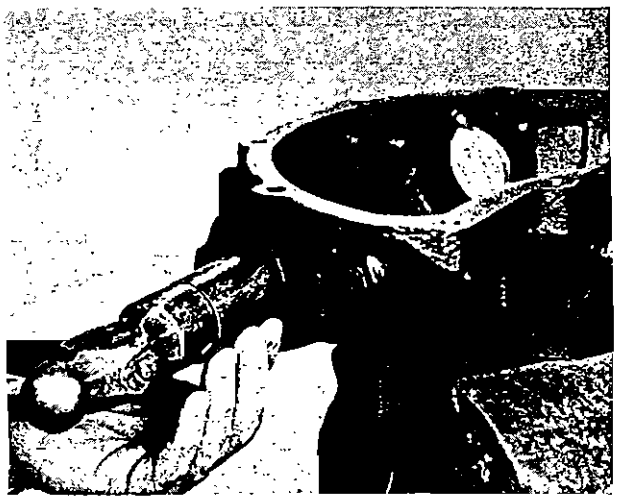
Illust. 1

To set or expand welsh plug in housing use a piece of steel bar the same diameter as bore. Place flat surface of bar against concave of welsh plug. Strike bar with a hammer, (Illust. 3) until concave is flush with outside edge of welsh plug.

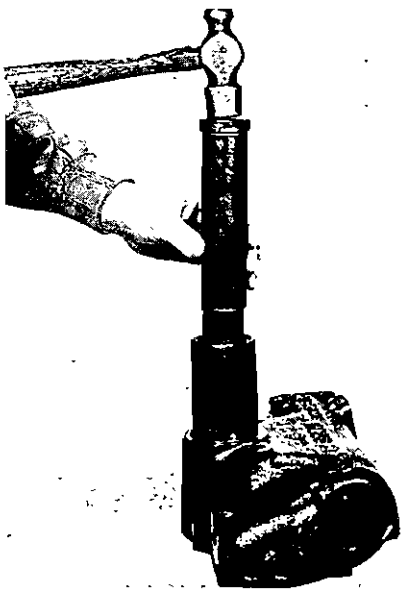
Turn steering housing over and press or drive second bushing into bore of housing (Illust. 4) until bushing is approximately 1/8 inch under flush with top of bore. NOTE: Use a pilot tool for pressing or driving bushing into place. This will prevent bushing from becoming out of round.



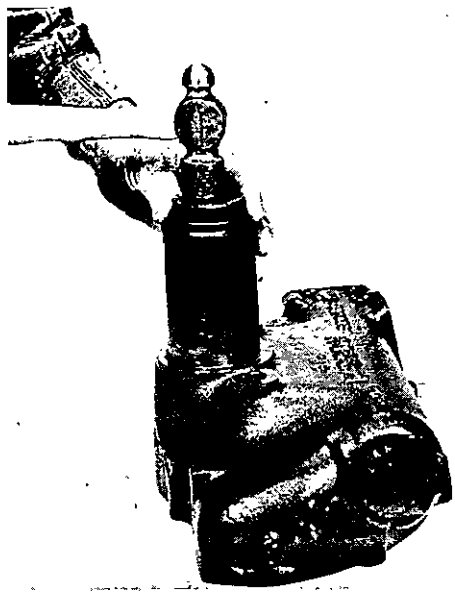
Illust. 2



Illust. 3



Illust. 4



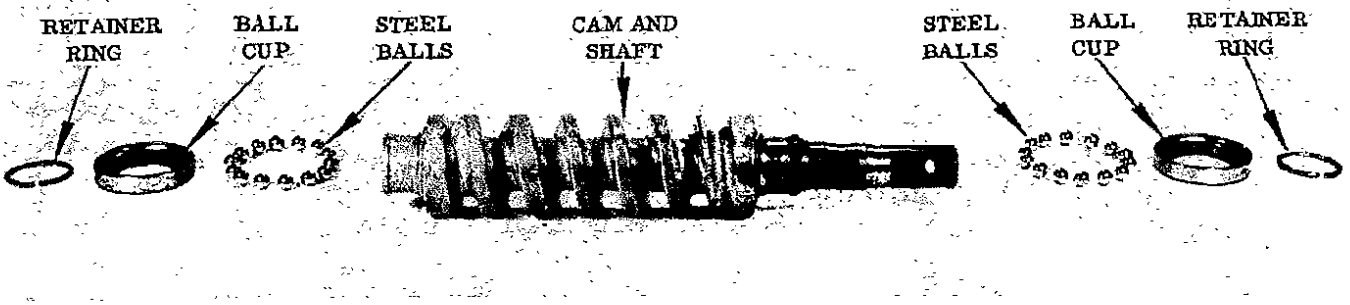
Illust. 5

Press or drive oil seal into bore of steering housing (Illust. 5). Lip of seal toward bushing.

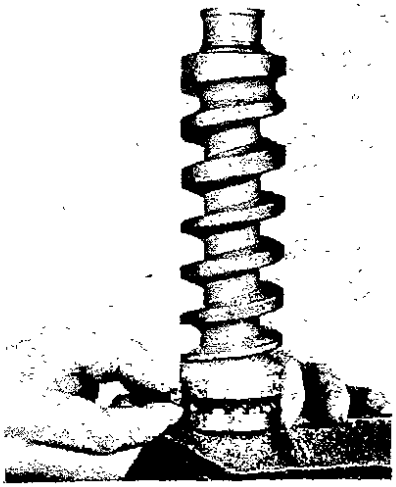
CAM AND SHAFT

Illust. 1 is an exploded view of the cam and shaft assembly.

Install ball cup onto cam and shaft. Smooth side of cup toward long end of shaft. Install long end of cam and shaft into a vice with brass jaw protectors. Allow enough space between cup and cam to insert the 14 balls.

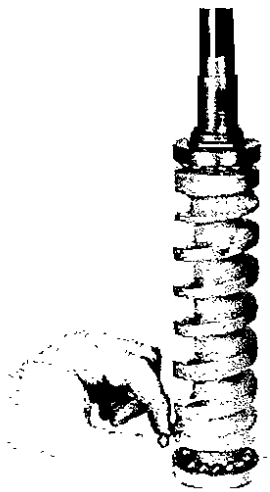


Illust. 1

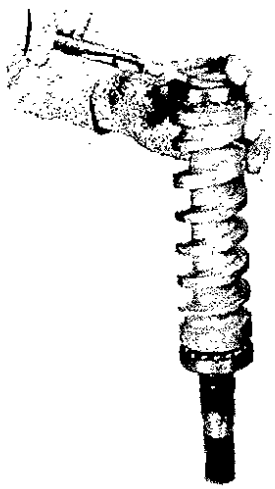


Illust. 2

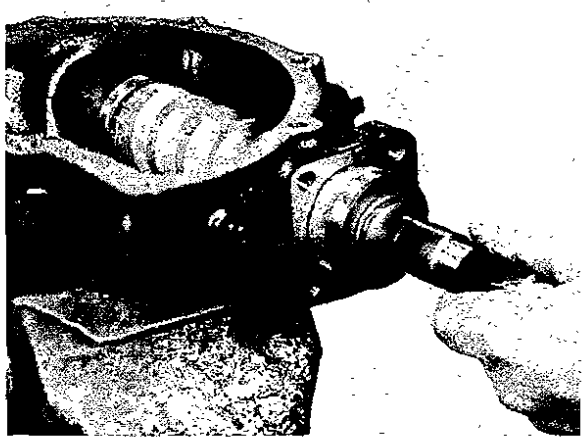
Illust. 3



Illust. 4



Illust. 5



Illust. 6

Insert 14 balls into cup (Illust. 2) NOTE: Apply grease to cup and balls to hold balls in place.

Remove cam and shaft from vice. Install retainer ring in groove of cam and shaft (Illust. 3).

Install second bearing cups onto cam and shaft. Smooth side of cup towards short end of shaft. Allow enough space between cup and shaft to insert the 14 balls.

Insert 14 balls into cup, (Illust. 4). NOTE: Apply grease to cup and balls to hold balls in place.

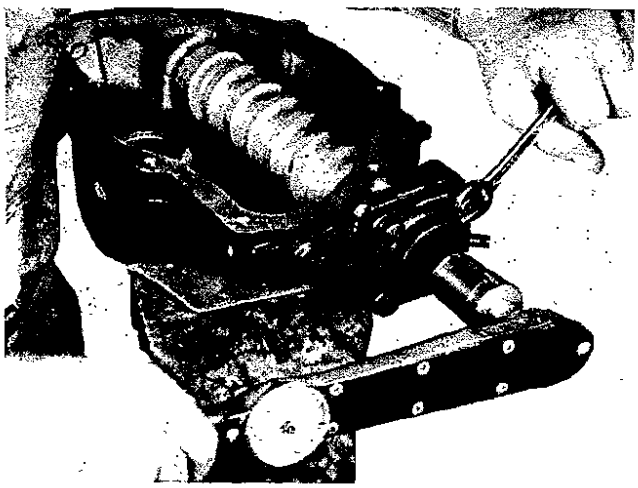
Install snap ring in groove of cam and shaft (Illust. 5).

Install cam and shaft into housing (Illust. 6).

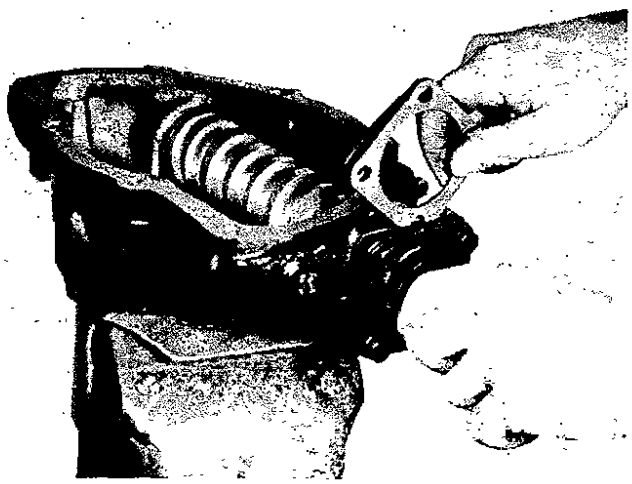
To pre-load the bearings, install bearing cap less shims. Install cap screws. Tighten cap screws (Illust. 7) until a torque reading of 20 inch pounds is obtained. NOTE: Rotate shaft while tightening cap screws.

Measure gap between bearing cap and housing, using shims or feeler gauge (Illust. 8).

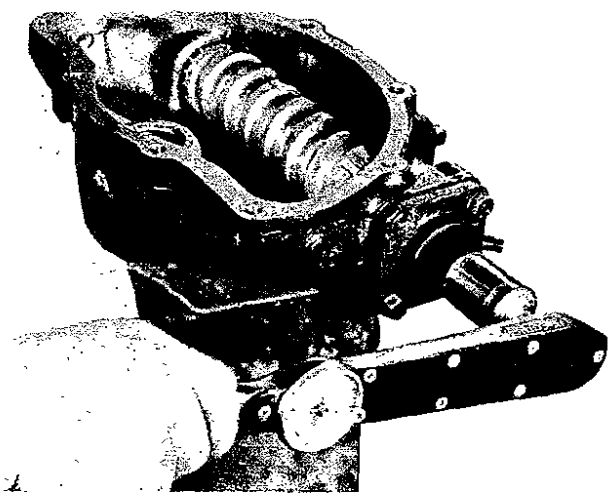
Remove bearing cap and install the required amount of shims to fill gap. Install bearing cap with shims onto housing. Install cap screws with lock washers. Tighten cap screws securely. Recheck bearing pre-load (Illust. 9).



Illust. 7

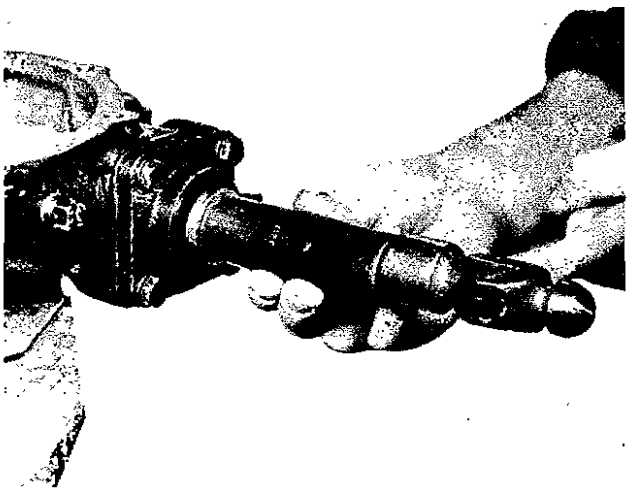


Illust. 8



Illust. 9

Illust. 10



Illust. 11

Install oil seal onto shaft, using a piece of shim stock over shaft to prevent damage to seal (Illust. 10). Lip of seal towards inside of bearing cap. When oil seal is on shaft, remove shim stock and drive seal into bearing cap (Illust. 11).

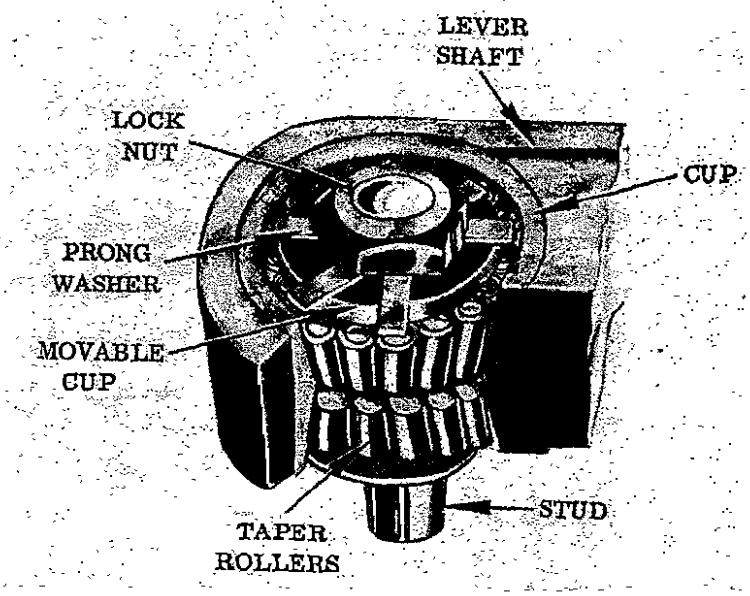
STUD ROLLER BEARING UNITS

Illust. 1 is a cut away view of the stud roller bearing unit.

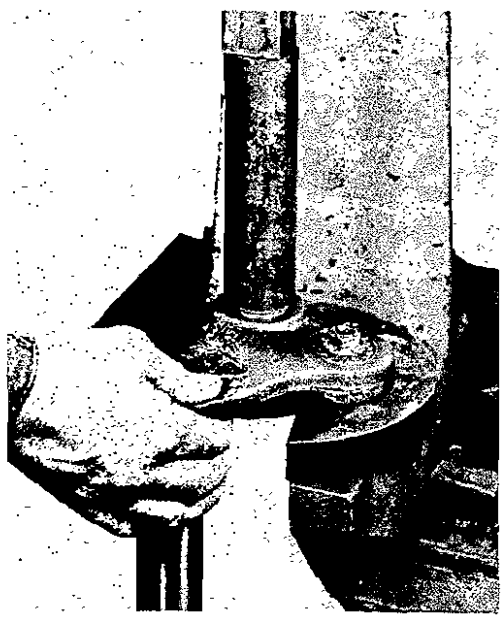
To remove either stud roller bearing unit from lever shaft, use a piece of pipe the same diameter as bearing cup. Press or drive unit from shaft, (Illust. 2). NOTE: When removing stud bearing unit from lever shaft, be sure lever shaft is in a downward position as illustrated.

Press or drive stud bearing unit into lever shaft, (Illust. 3), until shoulder of unit is flush against lever shaft.

To pre-load the bearings, clamp stud with a pair of pliers using care not to burr or nick stud. Tighten nut (Illust. 4) until a noticable drag is obtained. Rotate unit, using a torque wrench (Illust. 5). Torque reading should be minimum three inch pounds, never below. If reading is below three inch pounds, tighten nut still tighter. NOTE: Pre-load both stud roller bearing units exactly the same.



Illust. 1



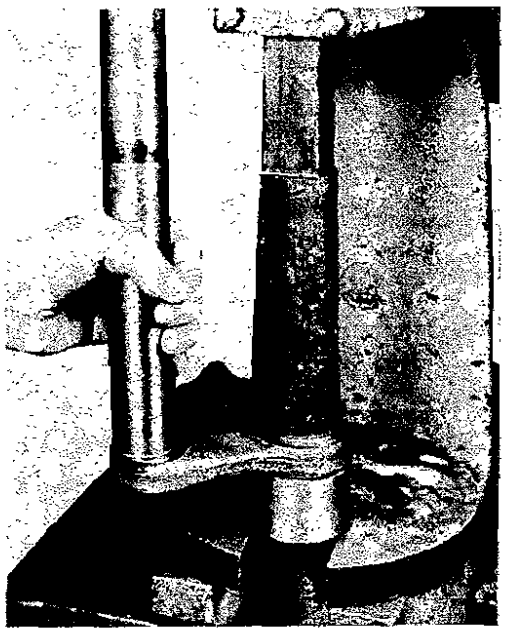
Illust. 2

Lock the nut by bending a prong of washer against a side of the nut (Illust. 6). NOTE: Bend a prong that is at right angles to a side of the nut. If old pronged washer is used, break off bent prong to prevent reusing.

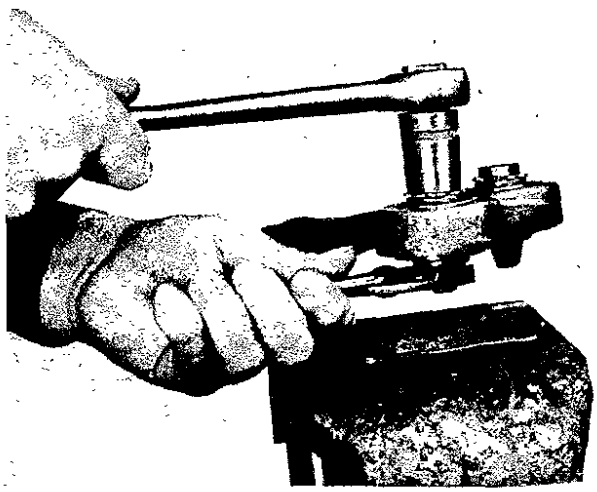
Install lever shaft into steering housing (Illust. 7). IMPORTANT: Center the shaft with stud bearing units in cam between lever stops in housing.

Install steering housing cover and gasket. Install cap screws with lock washers. Tighten cap screws securely (Illust. 8).

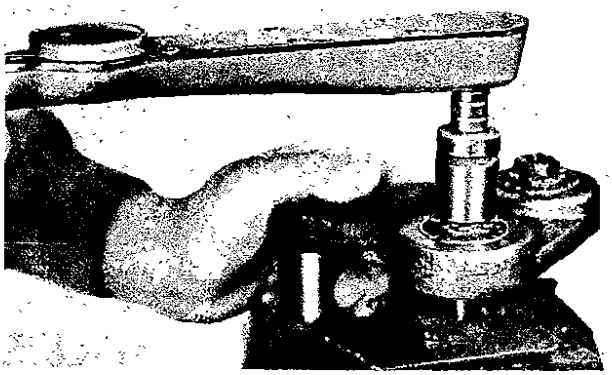
Install steering housing assembly into frame (Illust. 9).



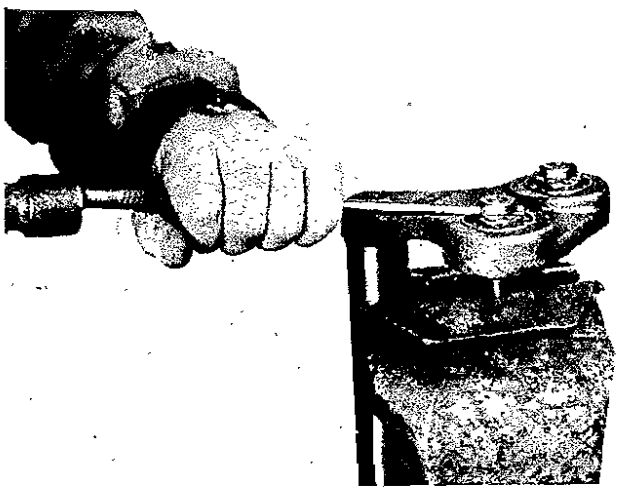
Illust. 3



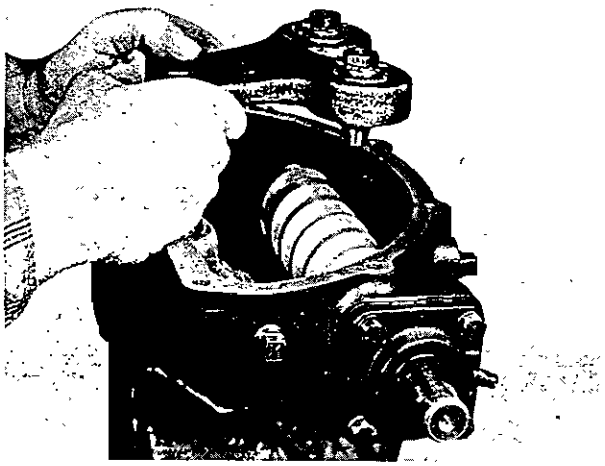
Illust. 4



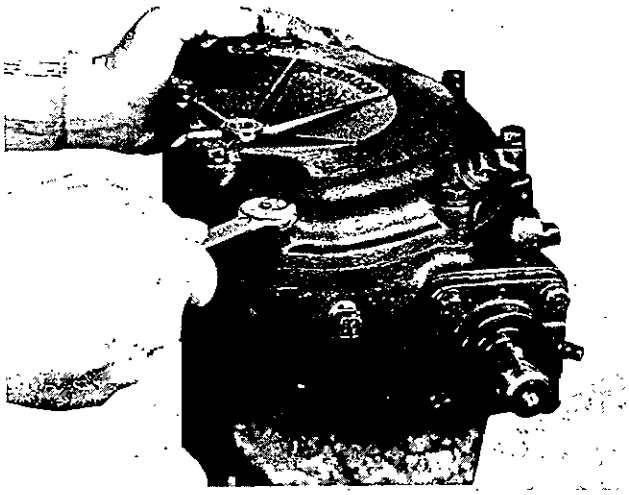
Illust. 5



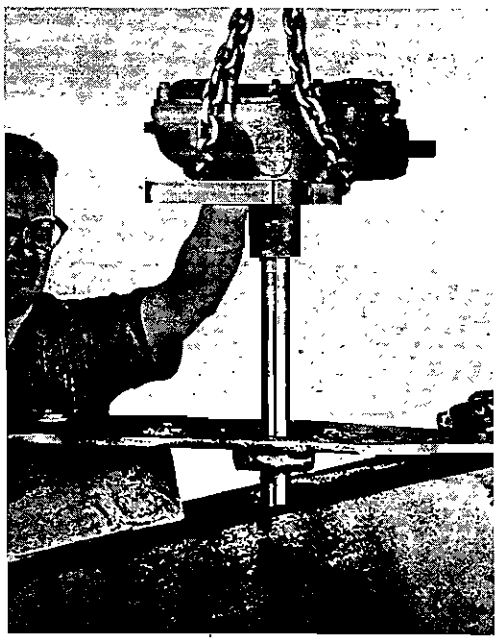
Illust. 6



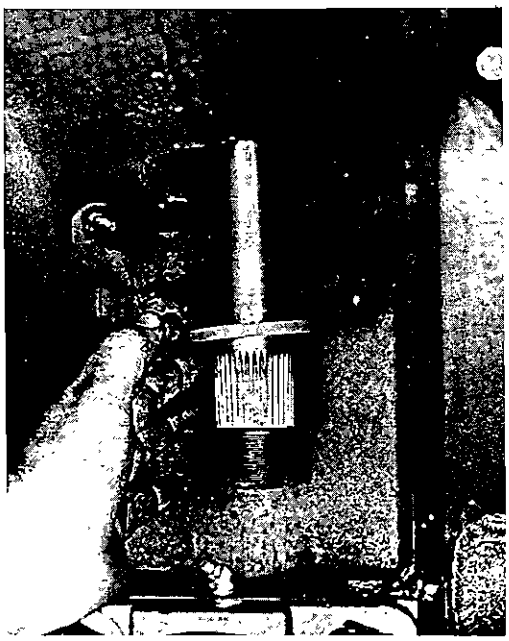
Illust. 7



Illust. 8



Illust. 9

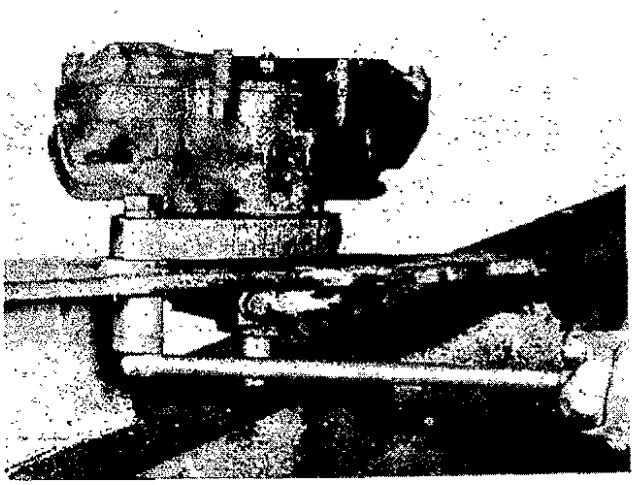


Illust. 10

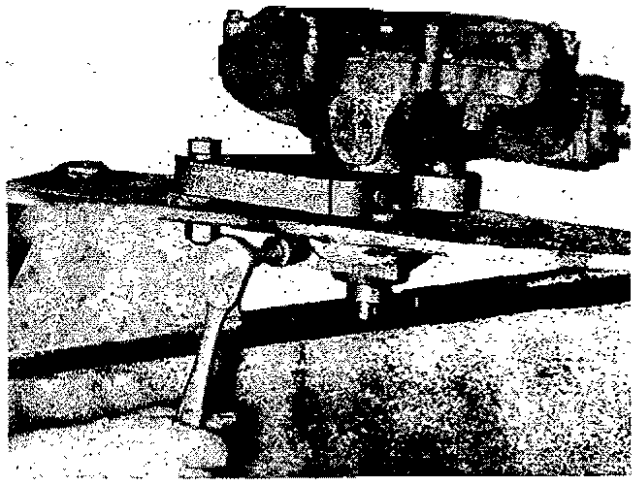
Lower steering housing through frame until end of shaft is well extended through bottom of frame, then install rubber washer.

(Illust. 10) Continue to lower steering housing until housing rests on bolster. Install torque plate bolt, lock washers and nut. Tighten nut securely (Illust. 11). Next, tighten steering gear clamp bolt securely. (Illust. 12).

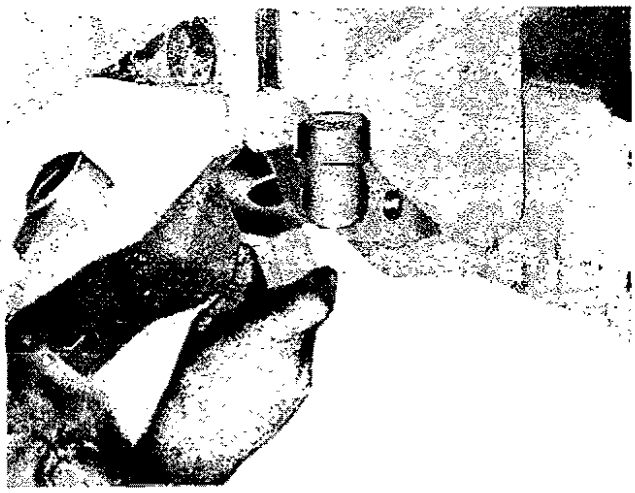
It is not necessary to remove the self-aligning bearing (Illust. 13) when removing the steering gear. However, if it is removed for any reason, be sure to reinstall the bearing with the longest end turned up. Install the grease fitting before tightening the cap screws in the bearing cap. The two lower cap screws in the drawbar bearing hold the self-aligning



Illust. 11



Illust. 12



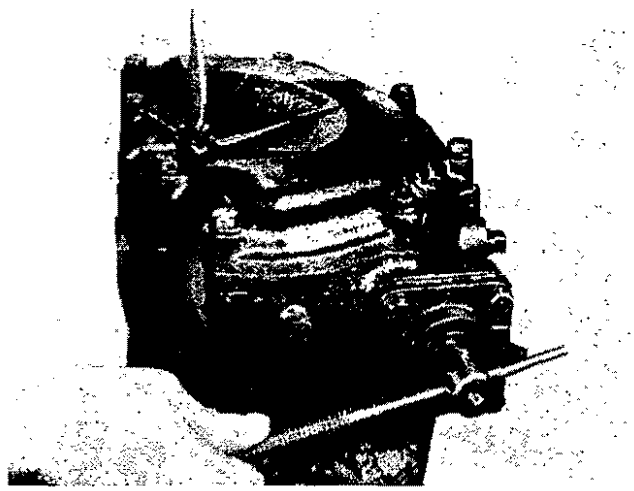
Illust. 13

Illust. 14

bearing in position.

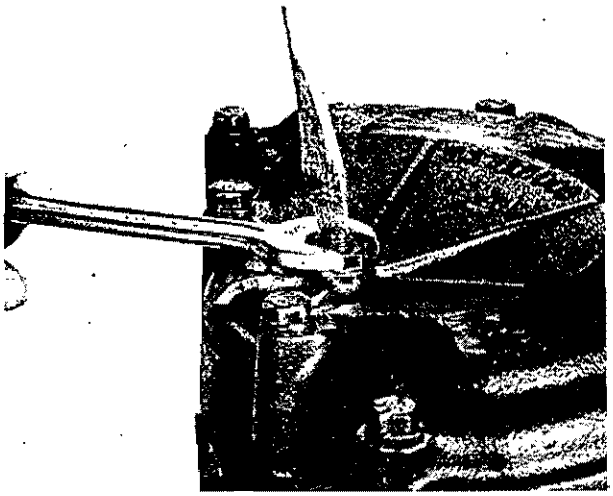
Install steering arm onto lever shaft (Illust. 14). IMPORTANT: Be sure to install steering arm onto shaft parallel with the center line of main frame.

To adjust backlash between stud bearing units and cam, tighten set screw while at the same time slightly turn shaft clockwise and counter-clockwise until a slight drag is obtained (Illust. 15). Tighten set screw jam nut securely (Illust. 16).

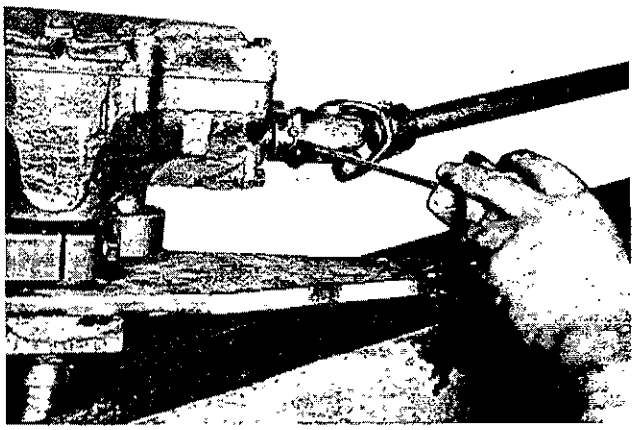


Illust. 15

Align pin hole in universal joint with pin hole



Illust. 16



Illust. 17

in cam shaft and install onto cam shaft. Install pin and cotter pin. Spread cotter pin (Illust. 17).

Should it become necessary to remove steering arm for repair, be sure before installing arm, center lever shaft in housing.

To center lever shaft in housing, count the number of turns required to turn the steering wheel from one extreme to the other. Turn steering wheel in the opposite direction one half the total number of turns. Install arm to lever shaft parallel with the center line of the main frame.

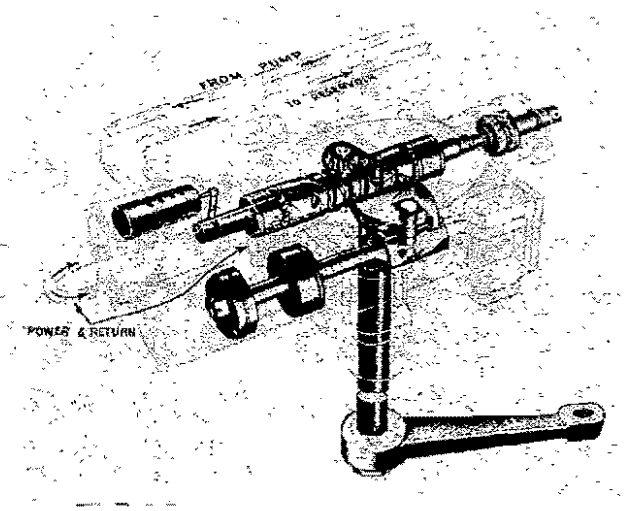
IMPORTANT: Be sure to fill manual steering housing with the correct lubricant. See "Lubricating Section."

POWER STEERING

STEERING GEAR

The power steering removal and assembly procedure described here refers to Models 550 Motor Graders - Serial Nos. 1780 thru 9832, Except 9680, 9695, 9701, 9710, 9713, 9716, 9785, 9809, 9812, 9824 and 9827.

Models 660 Motor Graders - Serial Nos. 1 thru 4425, Also 4525.



Illust. 1

Illust. 1 is a phantom view of the power steering gear assembly. This view shows all of the important parts and their relationship to each other.

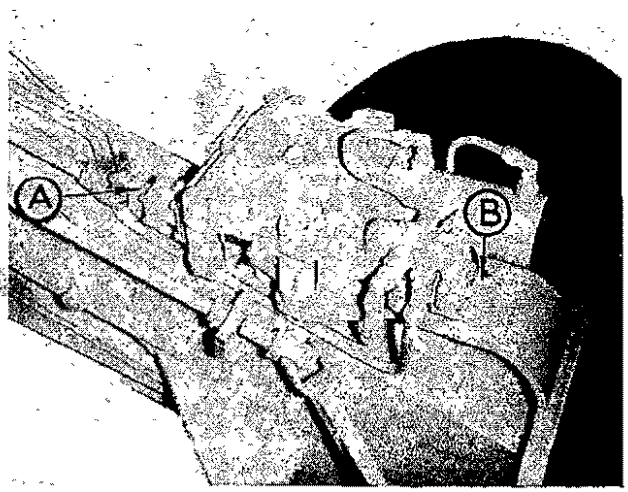
All minor repairs and adjustments to the steering gear can be made without removing it from the grader.

REMOVAL

(Illust. 2). Remove nut, lock washers and arm from end of shaft. IMPORTANT: When driving arm from shaft, the end of shaft must be supported or serious damage to the steering gear will result. Use light hammer blows to remove the arm.

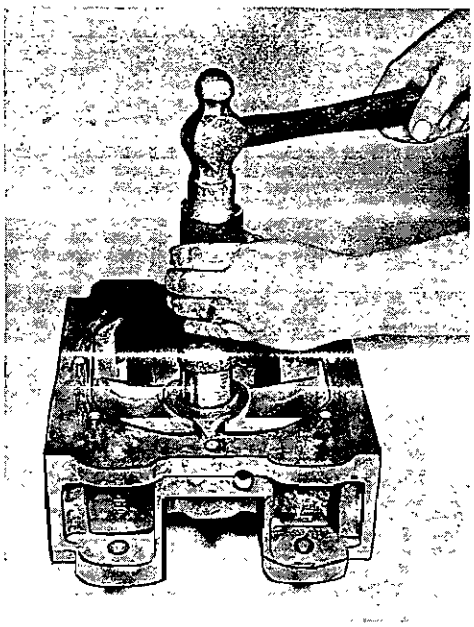
Remove pin "A" in universal joint (Illust. 3) and slide universal joint off shaft. Disconnect all hydraulic lines leading to steering gear. CAUTION: Extreme care must be used to keep all dirt and foreign material out of steering assembly, connections and

Illust. 2

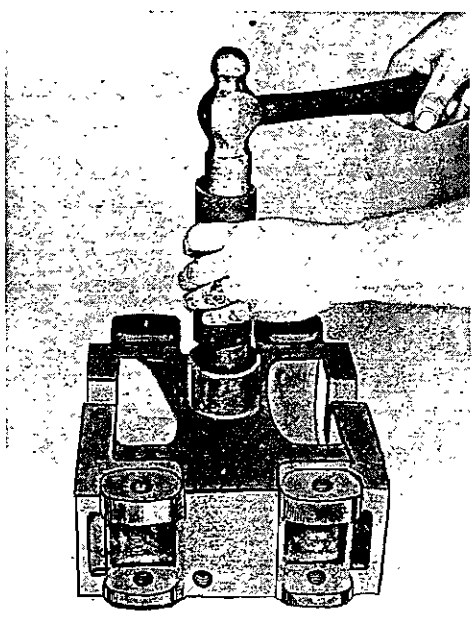


Illust. 3

internal parts. This will cause possible serious damage to the operation of the assembly. Plug all openings, both in the hydraulic lines which are disconnected and fittings in steering gear assembly. Remove torque bolt "B", then remove complete steering gear from grader.



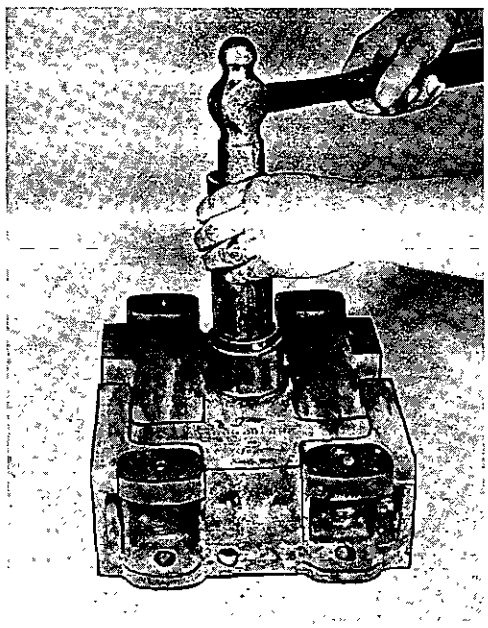
Illust. 4



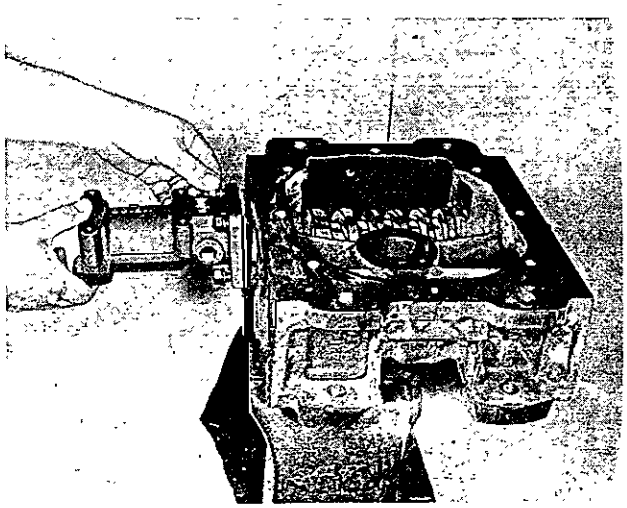
Illust. 5

The first step in reassembly is to install bushing into top of gear housing (Illust. 4). When driving bushing into place, use a piece of pipe or similar driver. Install bushing into the bottom of housing (Illust. 5). The grease seal (Illust. 6) should now be installed.

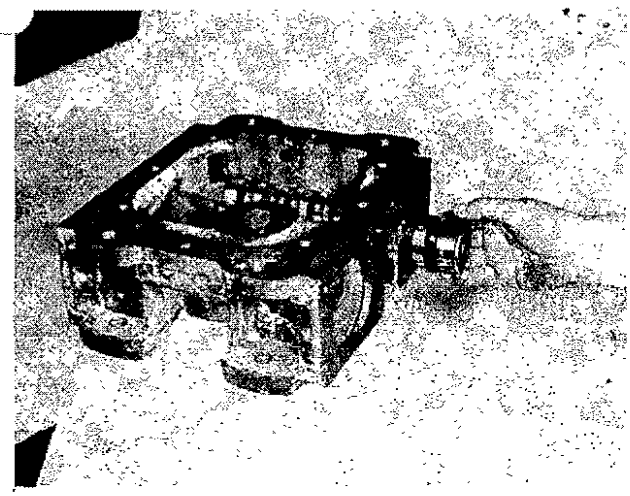
Install cam into gear housing. Assemble first thrust bearing and spring assembly on valve end of cam, small



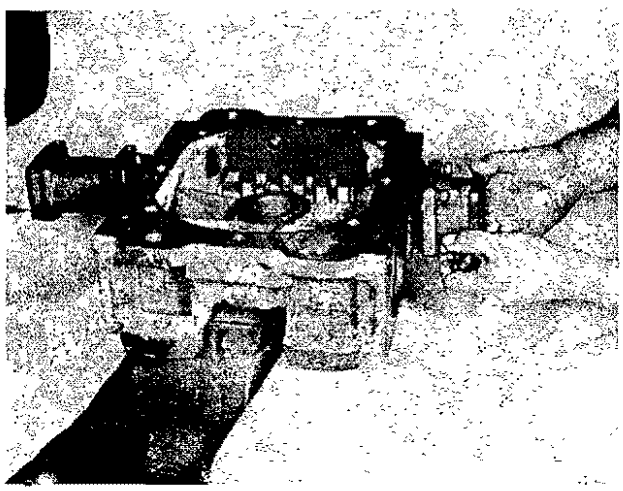
Illust. 6



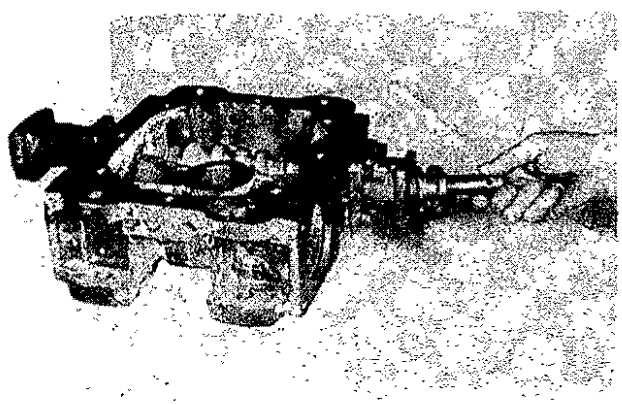
Illust. 7



Illust. 8



Illust. 9



Illust. 10

race of thrust bearing against shoulder of cam.

Assemble control housing and vellumoid gasket to housing (Illust. 7). Install cap screws and lock washers and tighten securely.

Assemble second thrust bearing and spring assembly. Install to the other end of cam (the splined end) (Illust. 8).

Install wheel tube bearing housing to gear housing less shims or gaskets.

Measure gap between gear housing and bearing housing with a feeler gauge or shims. This distance will be equal to the amount of shims necessary for proper adjustment. The metal shims are of .002", .003" and .010" thickness. The vellumoid gaskets are of .010" material but are only .006" when compressed. Therefore, they are to be figured at .006" when compressed. Remove the bearing housing and reinstall with the proper amount of shims and gaskets (Illust. 9). In doing this the metal shims are to go between the two vellumoid gaskets.

This will allow the vellumoid gaskets to seat the machine surfaces of the gear housing and bearing housing. Install cap screws and lock washers. Tighten securely.

You should be able to turn the cam freely with your fingers. If cam is hard to turn, not enough shims have been used. If it has end play, too many shims have been used.

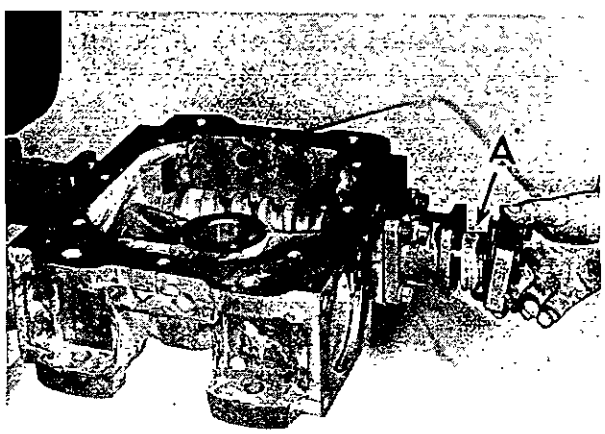
Install bearings to wheel tube and secure them with snap rings (Illust. 10). Coat end of shaft with a light grease and install assembly to splined end of shaft. Install spacer "A" (Illust.

11). Determine the amount of shims necessary to go between bearing housing and end cover by the same procedure as used between gear housing and bearing housing. Install shims and end cover with the metal shims between the vellumoid gaskets. Install lock washers and cap screws and tighten securely. Install grease seal around wheel tube, using care to prevent damaging seal. One way of expanding the leather seal over end of shaft is by wrapping a thin piece of shim stock around shaft in a funnel shape (Illust. 12).

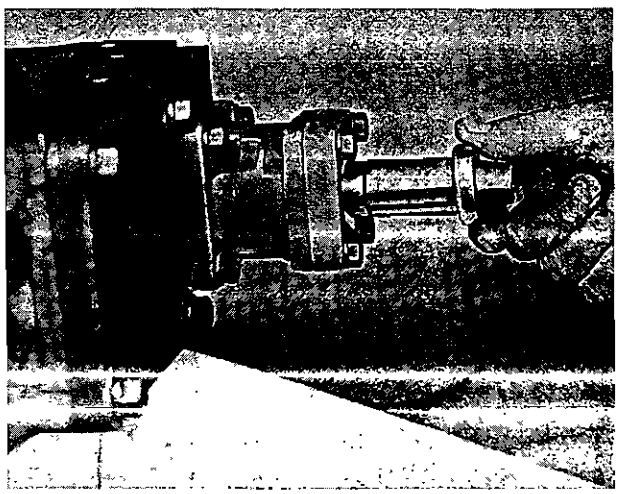
It should be noted that if either the valve body (Illust. 13), sleeve or spool should require replacement, the entire valve assembly must be replaced. The parts of the valve are not furnished individually for repair. The "O" rings between valve spool and sleeve, swivel rod bearing and nut and the valve spool cover "O" ring are the only internal parts of the valve that can be serviced.

Install "O" ring seal in groove on end of valve spool, opposite swivel bearing rod end (Illust. 13). Push spool through sleeve far enough to uncover second groove in swivel bearing rod end of spool (Illust. 14).

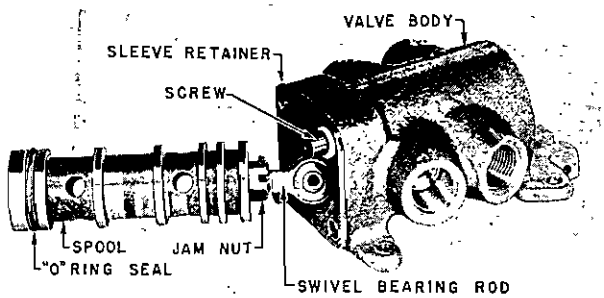
Install "O" ring seal in second groove (Illust. 14) and push this end of spool back into sleeve until "O" ring seal has just entered the sleeve. Install snap ring into first groove in spool



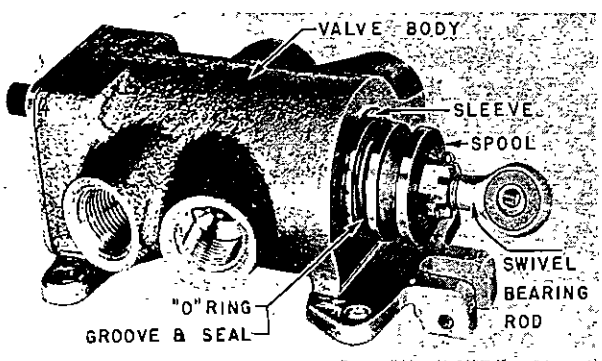
Illust. 11



Illust. 12



Illust. 13

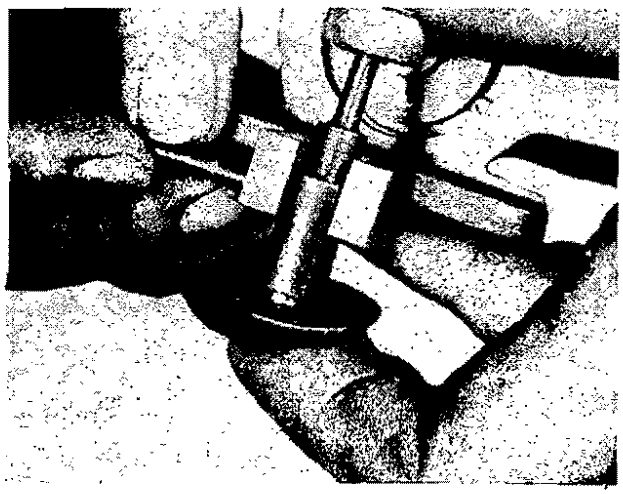


Illust. 14

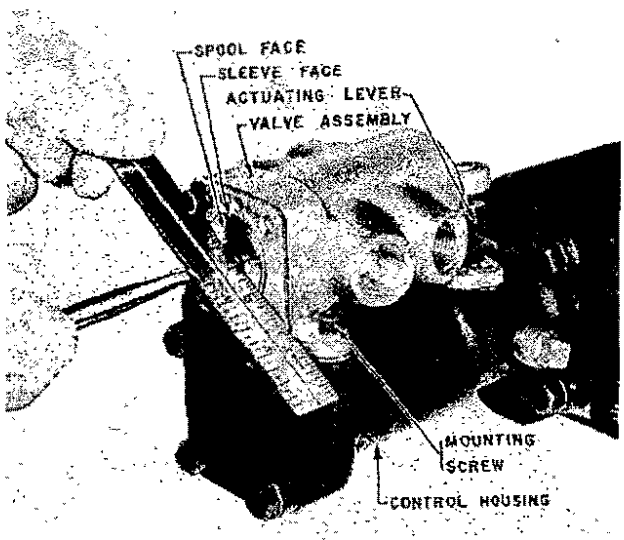
and push on spool at the same time, pressing snap ring into groove in valve body. Tighten the two screws holding the sleeve retainer (Illust. 13).

Install swivel bearing rod and jam nut to spool (Illust. 13). Insert actuating lever in swivel bearing, then insert pivot pin through valve body clevis and actuating lever (Illust. 15).

Install the steel washer, then rubber seal over rounded portion of actuating lever (Illust. 15).



Illust. 15



Illust. 16

Place valve assembly in position on control housing and start the four mounting screws, being sure rounded portion of valve actuating lever fits into its groove in steering gear cam. THIS IS IMPORTANT: If actuating lever has not entered the groove in the steering cam before the mounting screws are tightened, it will result in breaking the swivel bearing rod and lever brackets (Illust. 14). Make sure steel washer is centered over rubber washer (Illust. 15). Tighten mounting screws holding valve body to control housing. With jam nut loose, turn valve spool with screw driver until face of spool is flush with face of sleeve (Illust. 16).

Connect all power steering hydraulic lines and check oil level in power steering supply tank. Start engine and turn steering wheel to right and left several times. This will bleed the air from the hydraulic system and will determine if valve spool is properly adjusted. It may be necessary to change adjustment a little one way or the other to equalize the steering effort. Tighten the jam nut approximately 25 ft. lbs.

Assemble gasket and dust cover over

Illust. 17

swivel rod bearing and actuating lever. Install the valve spool cover and "O" ring and secure with Allen head screws and lock washers.

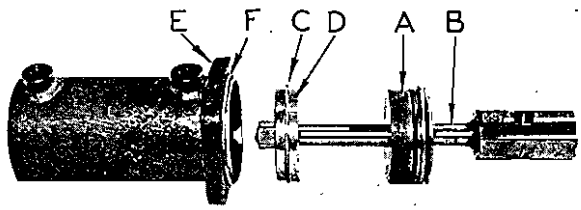
Install rubber seal, vellumoid gasket and steel washer in the order named, into adapter (Illust. 17). Be sure and place seal lip toward inside of adapter. Install snap ring "A" and "O" ring (Illust. 18).

Install adapter "A" (Illust. 19) to slide bar "B" with the end containing seal going on first. Install piston ring "C" to piston "D" and place piston on slide bar. Taper of piston mating with taper of rod. Place washer on threaded end of shaft.

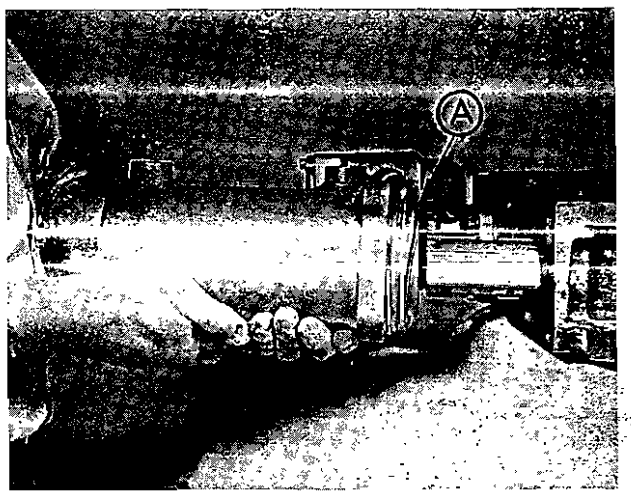
Install locking nut and tighten to a torque reading of 200 to 225 foot pounds.

Install cylinder adapter "E" and snap ring "F" to cylinder. Complete the assembly by placing piston and adapter in the cylinder. Use care while installing adapter into cylinder to prevent "O" ring from damage. Slide bar should move freely through cylinder and adapter.

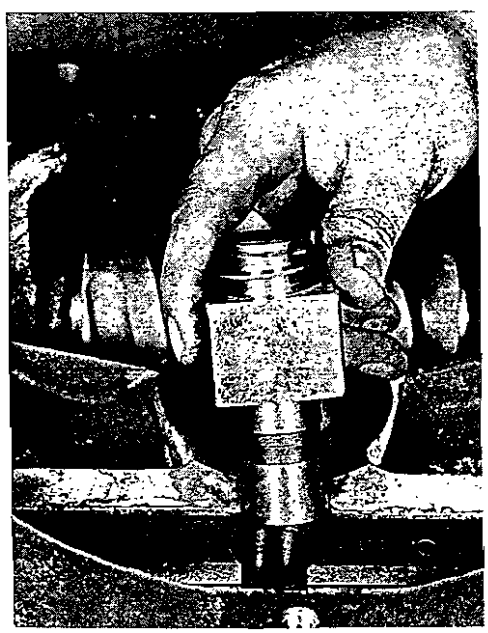
Illust. 18



Illust. 19



Illust. 20



Illust. 21

Install gasket "A" then install cylinder assembly to gear housing (Illust. 20). Install hex head cap screws and lock washers and tighten securely.

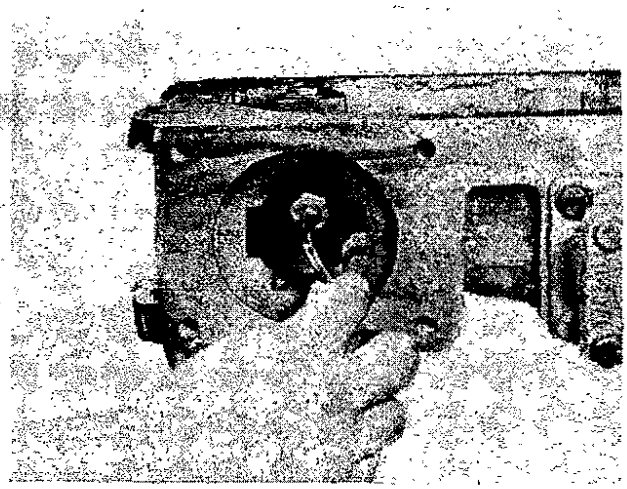
Install lever block pin, lever block, washer and snap ring (Illust. 21). Install them in slide bar.

(Illust. 22). Install set screw and lock nut in end of slide bar and tighten securely. Be sure lever block is free to rotate on pin and that slide bar and piston are free to move back and forth in housing and cylinder.

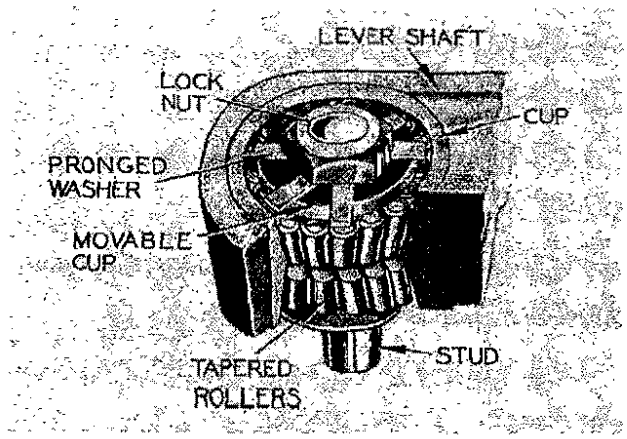
Install gasket "A" and cover "B" (Illust. 23). Install hex head cap screws and lock washers. Tighten securely.

Assemble stud roller bearing unit (Illust. 24), in lever shaft.

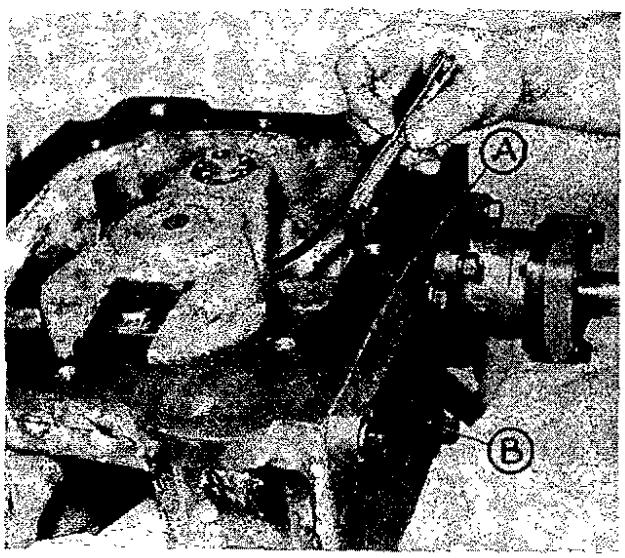
The roller bearing should be preloaded at all times. Adjust to a noticeable drag. NOTE: Operation of a correctly adjusted unit may feel rough to the hands but under steering



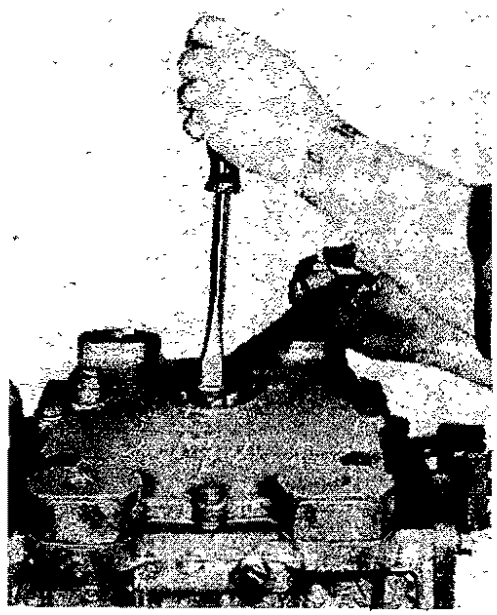
Illust. 22



Illust. 24



Illust. 23



Illust. 25

load it will operate smoothly and the load will be properly distributed. The unit should be adjusted to a minimum of three (3) inch lbs. of torque to revolve the stud, never below. Care should be taken not to burr surface of stud. Lock adjustment by bending the washer prong against a side of nut.

Omitting spacer washer, 3 spring washers and shims, install lever shaft in gear housing (Illust. 23). First, be sure there are no burrs on shaft that would damage bushing. With stud centered on cam, as shown in illustration, measure distance between face of lever and face of trunnion. Subtract .280" (which is the thickness of spacer and 3 spring washers in their compressed state) from measurement. If there is no difference, no shims are needed. If there is a difference, add the .010" shims as necessary. NOTE: Shims should be installed to the closest .010". For example, a difference of .024", you should add two shims and for a .026" difference, add three shims.

After the necessary shims have been determined, remove lever shaft from housing and install spring washer, spacer washer and shims, if necessary, to shaft and reinstall shaft to gear housing. Install cover, using a new gasket and fasten securely in place with lock washers and cap screws.

Install adjusting screw and jam nut (Illust. 25). NOTE: The backlash of the stud in the cam groove shows up as backlash at the steering wheel and at ball on steering arm.

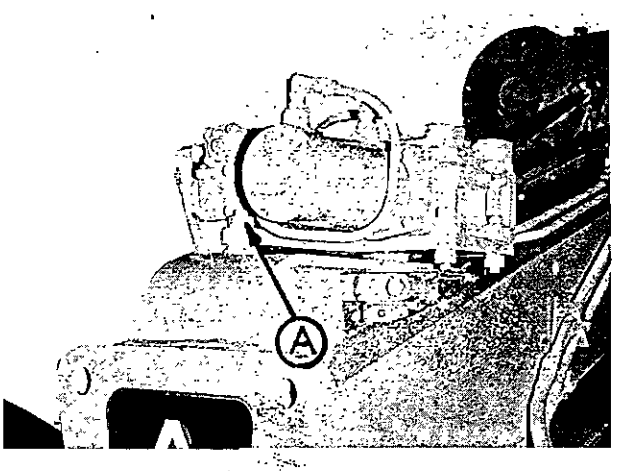
The groove in the cam is cut narrower in the mid-position range of stud travel to provide close adjustment where the straight ahead driving takes place.

Adjust through the mid-position. Do not adjust in the end positions. Backlash in the end positions is normal and not objectionable.

When making the adjustment, tighten adjusting screw until a slight drag is felt when turning gear through mid-position. While holding adjusting screw, tighten lock nut. Recheck drag at wheel through full travel of gear.

INSTALLATION

The main point to watch when the unit is being installed to the grader is that the vertical lever is not placed in a bind due to tightening down on the torque bolt. The spacer washer should be placed over the lever shaft before lowering the gear in position and then before tightening the torque stud "A" (Illust. 26), check the unit closely to be sure tightening the stud will not draw the plate down, thereby, placing the complete unit in a bind.



Illust. 26

If necessary use shims to prevent this condition.

When installing the steering arm on the serrations on the lower end of the lever shaft, it must be mounted so the front spindles will strike the stops before the steering gear reaches its maximum position. This is important as improper mounting of the steering arm may result in a broken steering gear. To determine the proper position for mounting the steering arm, turn the steering gear to the left as far as it will go. Then turn the front wheels to the left until they strike their stop. Turn the steering gear back to the right slowly until the first set of serrations on the lever shaft line up properly to allow the steering arm to become mounted. Install and tighten the lock washer and nut on the end of the lever shaft.

Install the grease tube and fitting for the lower bearing of lever shaft. Remove plugs and reconnect the hydraulic lines. Install universal joint and secure with pin and cotter pins. Lubricate steering gear as described under "Lubricating Instructions".

POWER STEERING

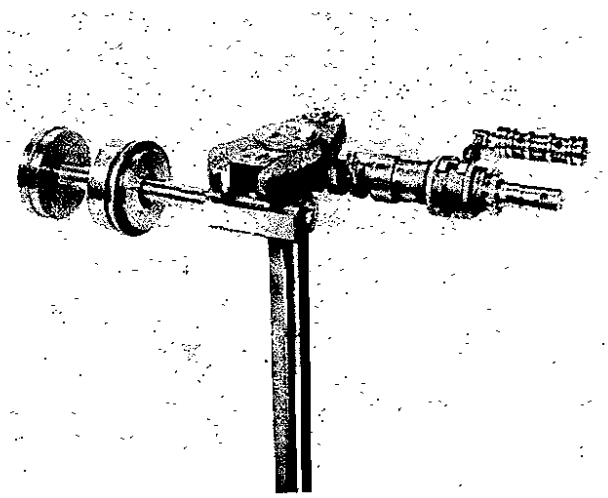
STEERING GEAR

The power steering removal and assembly procedure described here refers to Models 550 Motor Graders - Serial Nos. 9833 and Later, Also 9680, 9695, 9701, 9710, 9713, 9716, 9785, 9809, 9812, 9824 and 9827.

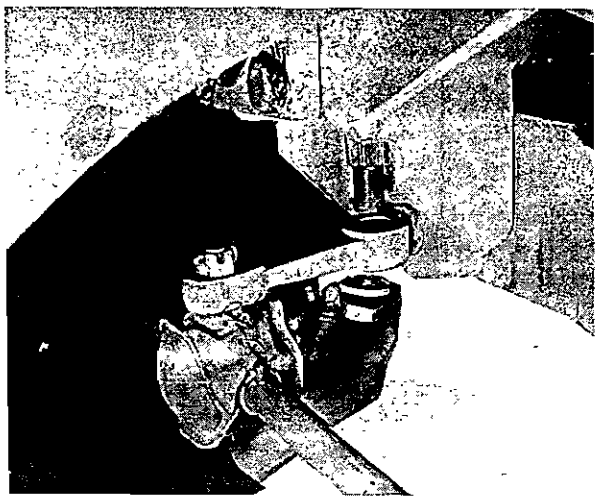
Models 660 Motor Graders - Serial Nos. 4426 and Later, Except 4525.

Illust. 1 is a view of the power steering gear assembly. This view shows all of the important parts and their relationship to each other.

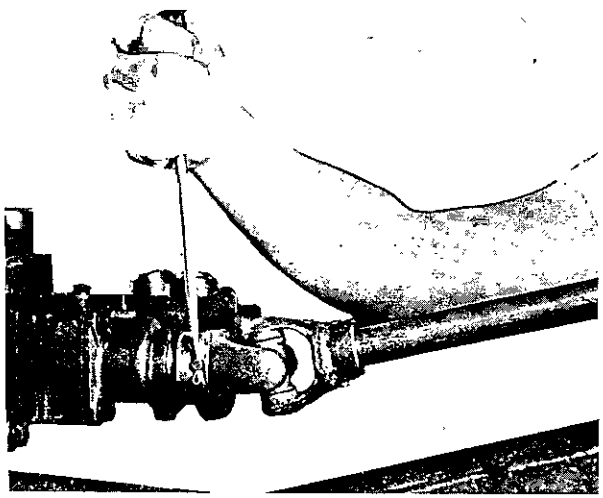
All minor repairs and adjustments to the steering gear may be made without removing it from the grader.



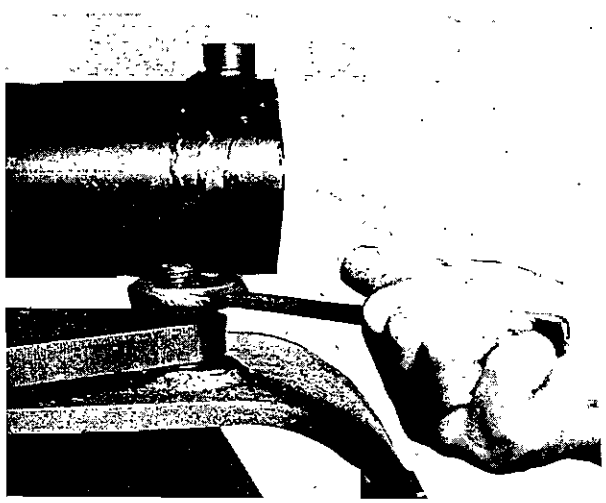
Illust. 1



Illust. 2



Illust. 3



Illust. 4

REMOVAL

The first step in the removal procedure is, disconnect hydraulic tubing from steering housing. CAUTION: Extreme care must be used to prevent dirt and foreign matter from steering assembly, connections and internal parts. Plug openings in hydraulic tubes and fittings in steering gear. Next, remove nut and lock washer from end of shaft (Illust. 2). Drive arm from serrations of shaft. IMPORTANT: When driving the arm from shaft, the end of shaft must be supported or serious damage to steering gear will result. Use light hammer blows to remove arm.

Remove cotter pin from drilled pin, then drive drilled pin from universal joint and shaft (Illust. 3). Remove universal joint from shaft.

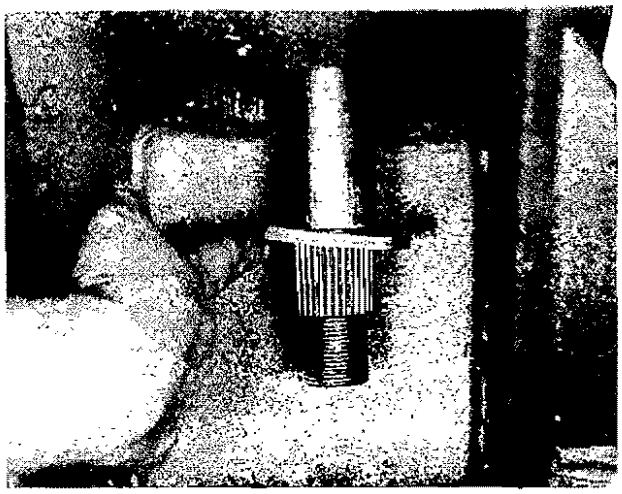
Loosen bearing cap bolts and remove torque plate bolt (Illust. 4).

With a chain hoist, raise steering housing assembly (Illust. 5) from

Illust. 5

bolster until rubber washer can be removed from steering shaft (Illust. 6), then remove steering assembly from frame.

To disassemble the steering housing, reverse the reassembly procedure.



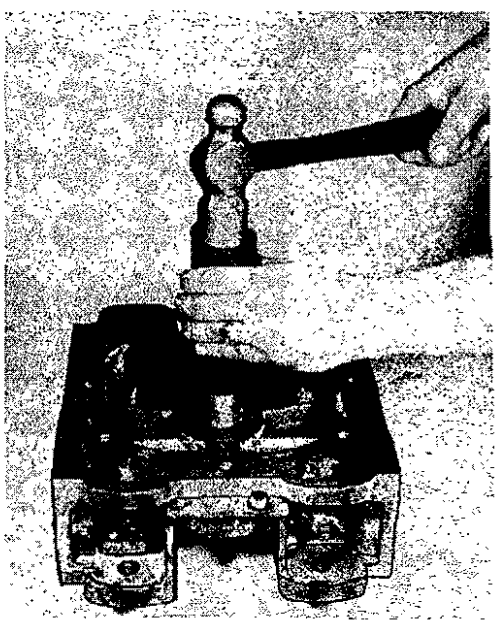
Illust. 6

REASSEMBLY

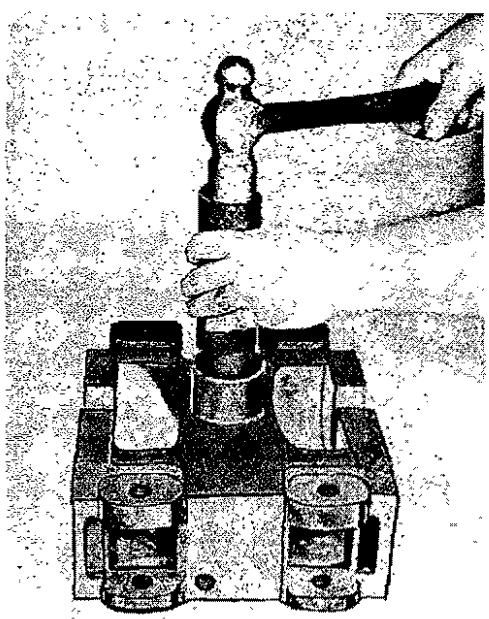
Inspect all parts of the assembly for wear and damage. Replace defective parts. Clean all parts before assembling. Apply oil to parts before installation.

The first step in reassembly is, install bushing into top of gear housing (Illust. 1). When driving bushing into place, use a piece of pipe or similar driver. Install bushing into bottom of housing (Illust. 2). The grease seal (Illust. 3) should now be installed.

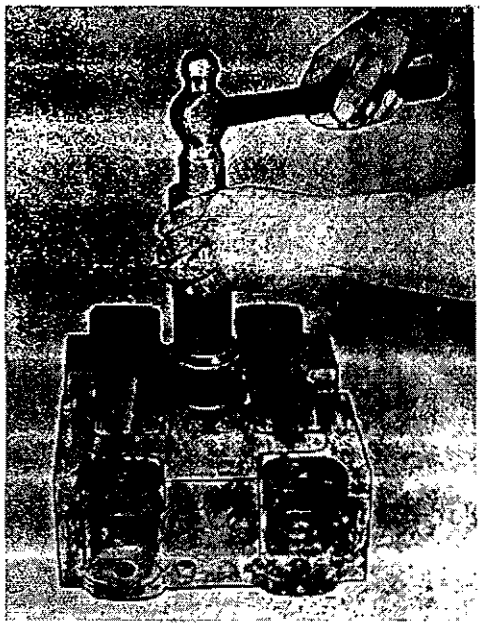
Install cam and shaft end cover and gasket on steering housing. Install cap screws and lock washers. Tighten cap screws securely (Illust. 4).



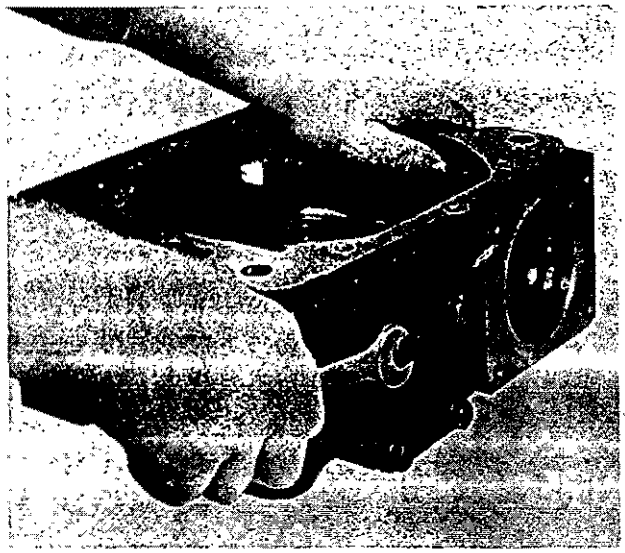
Illust. 1



Illust. 2



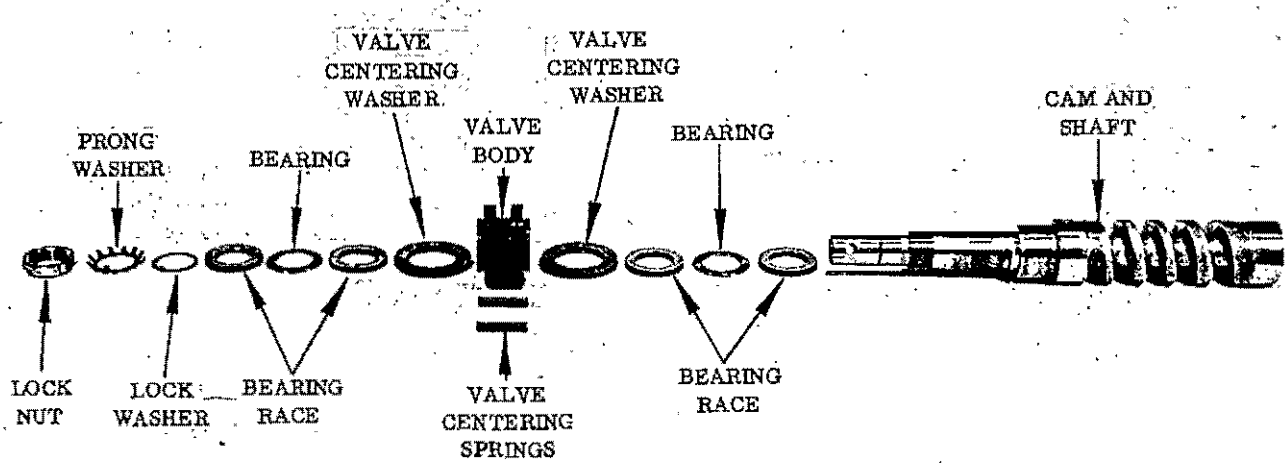
Illust. 3



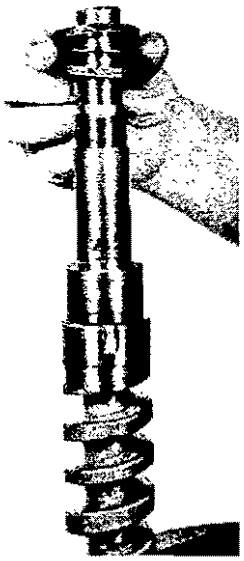
Illust. 4

CAM AND SHAFT

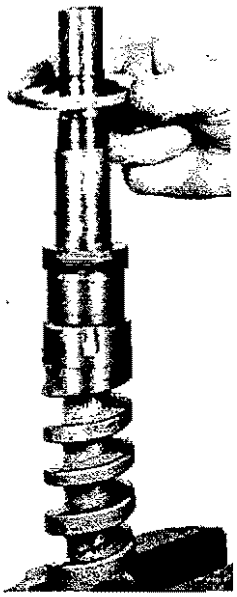
Illust. 1 is an exploded view of the cam and shaft.



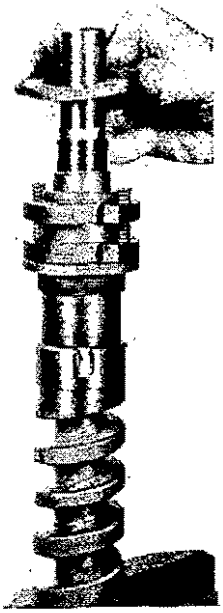
Illust. 1



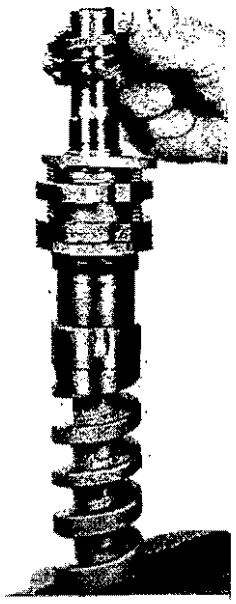
Illust. 2



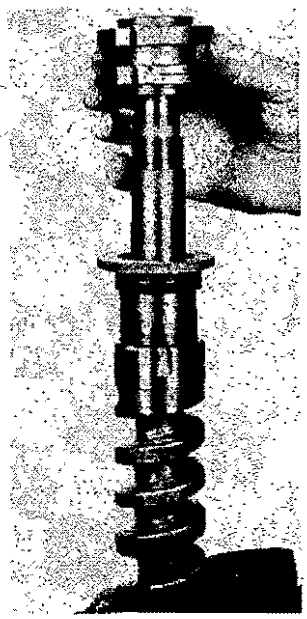
Illust. 3



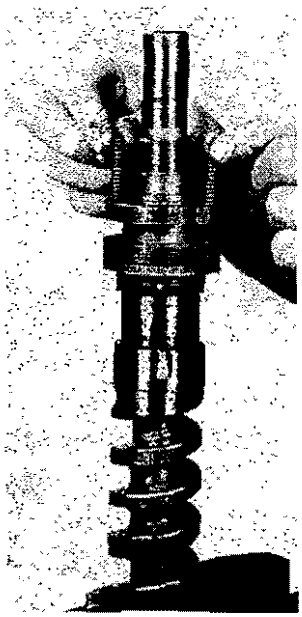
Illust. 6



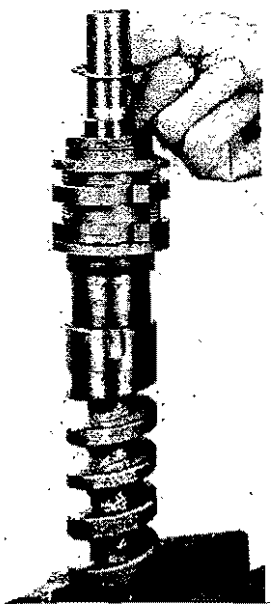
Illust. 7



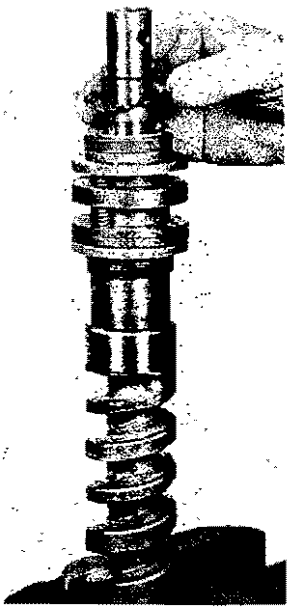
Illust. 4



Illust. 5



Illust. 8



Illust. 9

Clamp cam shaft into a vise with brass jaw protectors. Install bearing race, bearing and second bearing race onto cam shaft (Illust. 2). Next, install valve centering washer (Illust. 3).

Install valve body onto cam shaft (Illust. 4). Groove in valve body away from threaded end of cam shaft.

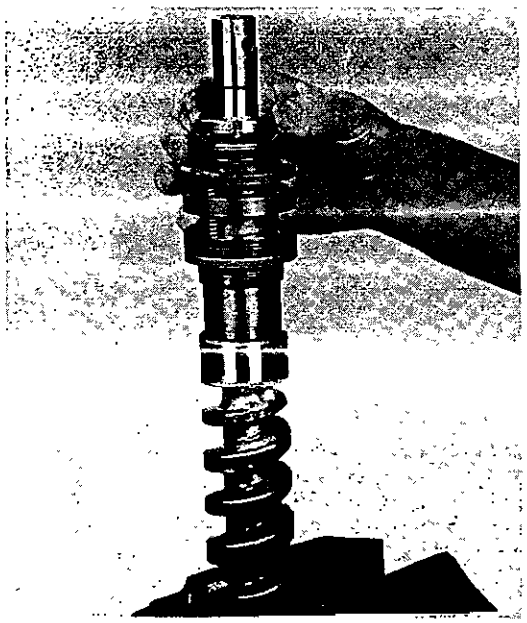
Install two valve centering springs into valve body (Illust. 5). Next, install second valve centering washer onto cam shaft and onto springs (Illust. 6).

Install bearing race, bearing and second bearing race onto cam shaft and down onto valve centering washer (Illust. 7).

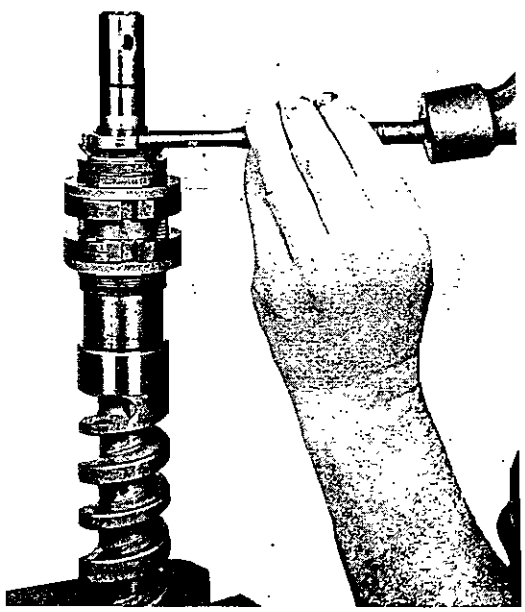
Install lock washer onto cam shaft (Illust. 8). Locking prong of washer to fit in slot of shaft.

Install prong washer onto cam shaft (Illust. 9). Prongs of washer away from valve body. Next, install lock nut (Illust. 10). Chamfered end of nut toward valve body.

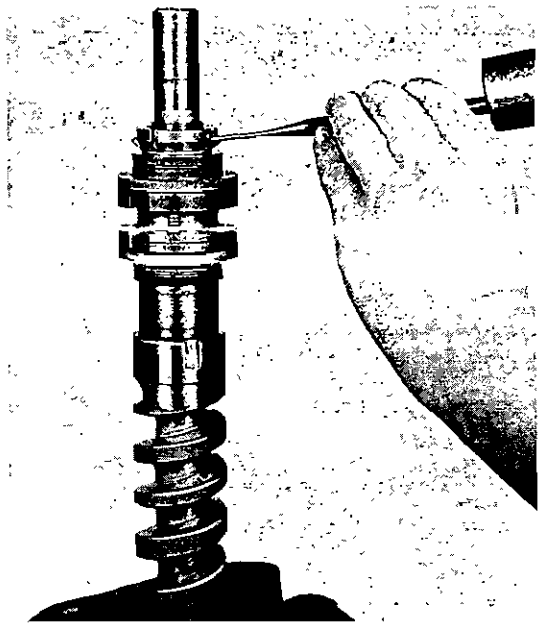
Tighten nut (Illust. 11) until a slight drag is obtained to rotate valve body, then, using a punch and hammer, bend a prong of washer into slot of nut (Illust. 12). NOTE: If washer is reused, break used prong from washer and lock the nut with an unused one.



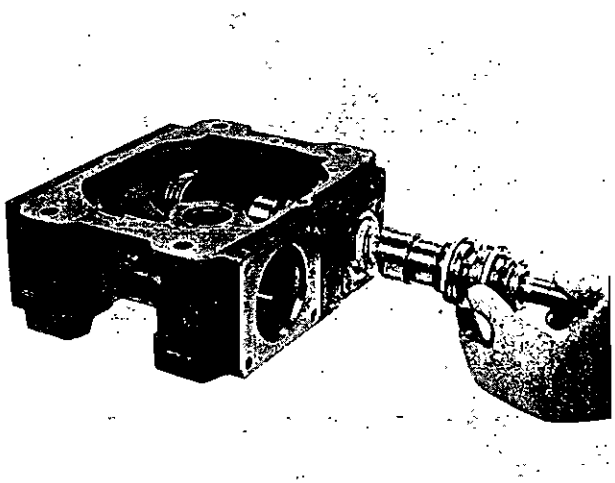
Illust. 10



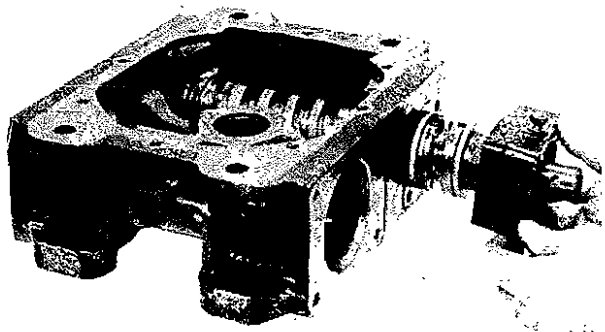
Illust. 11



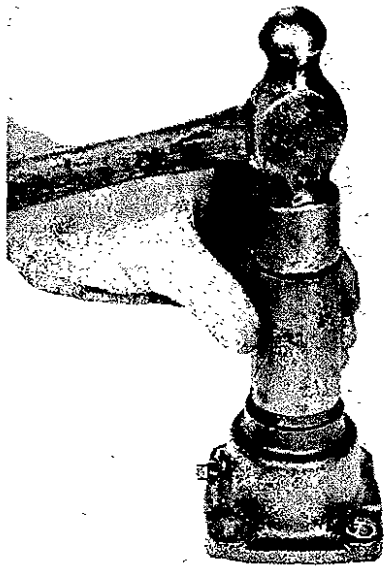
Illust. 12



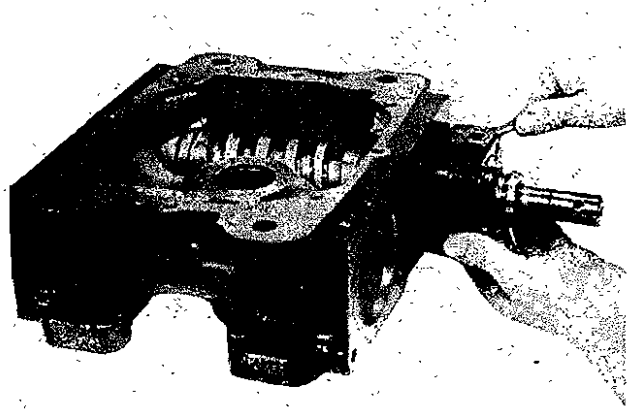
Illust. 13



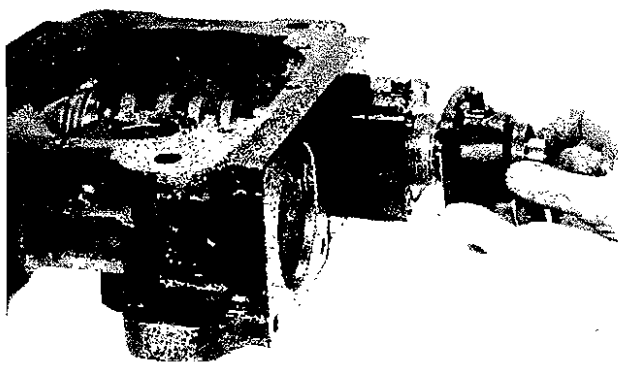
Illust. 14



Illust. 16



Illust. 15

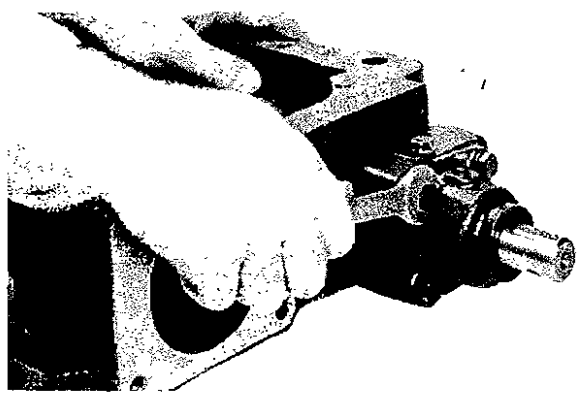


Illust. 17

Install cam shaft into housing (Illust. 13). Slots in valve body in an upward position.

Install actuator housing gasket and housing onto steering housing (Illust. 14). NOTE: Install actuator housing with set screw in an upward position and toward the universal joint end of cam shaft.

Tighten set screw into slot of valve body (Illust. 15).



Illust. 18

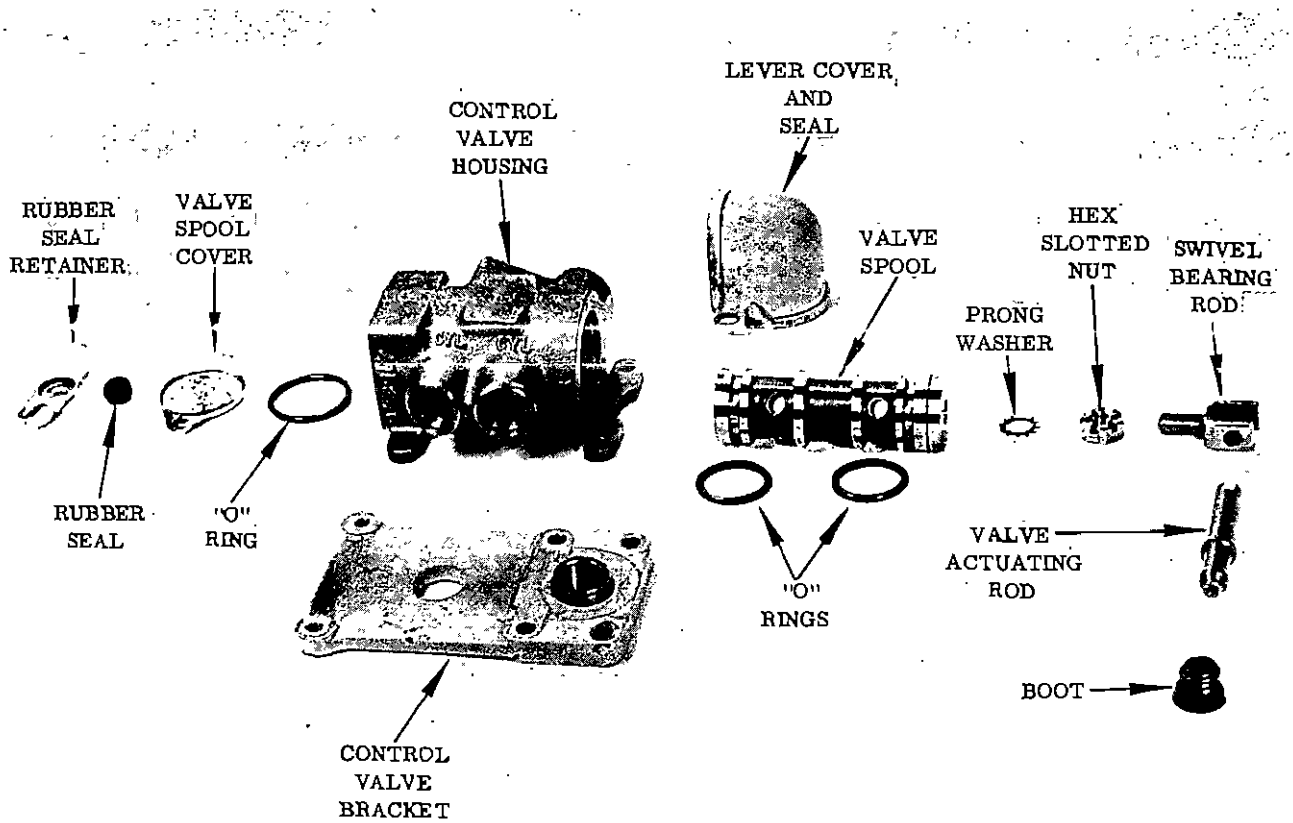
Press or drive oil seal into shaft hous-

ing (Illust. 16). Lip of oil seal toward inside of housing.

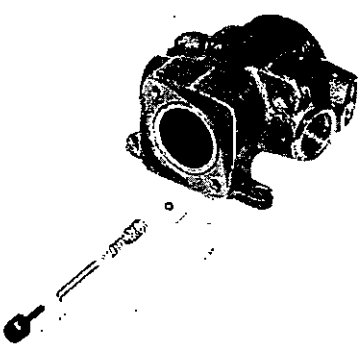
Install gasket and shaft housing onto cam shaft (Illust. 17) and against actuator housing. NOTE: Use a piece of shim stock over shaft to prevent damage to seal.

Install lock washers and cap screws. Tighten cap screws securely (Illust. 18).

CONTROL VALVE



Illust. 1



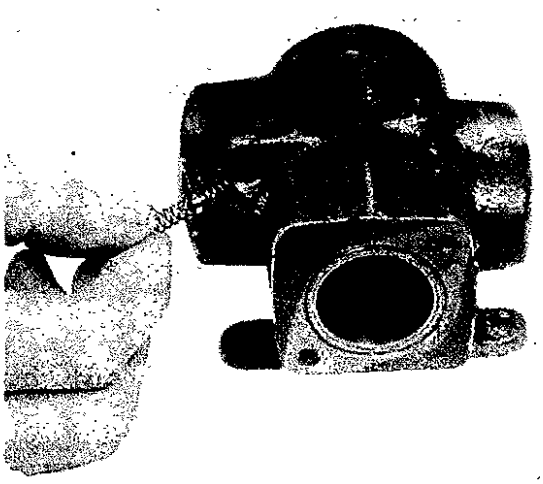
Illust. 2

Illust. 1 is an exploded view of the control valve assembly.

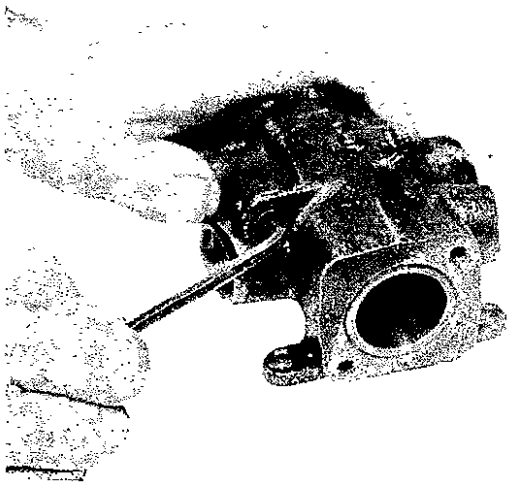
Illust. 2 is a view of the control valve springs and ball.

Insert ball into large end of tapered spring (Illust. 3) and insert into valve housing.

Insert straight spring onto pronged end of Allen head set screw. Now, insert



Illust. 3

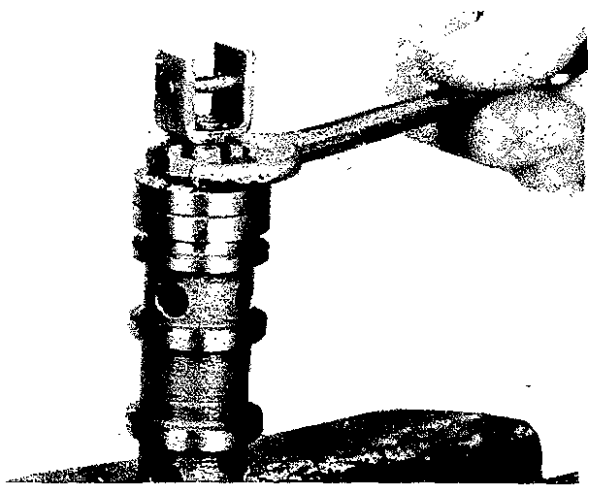


Illust. 5

spring into tapered spring (Illust. 4).

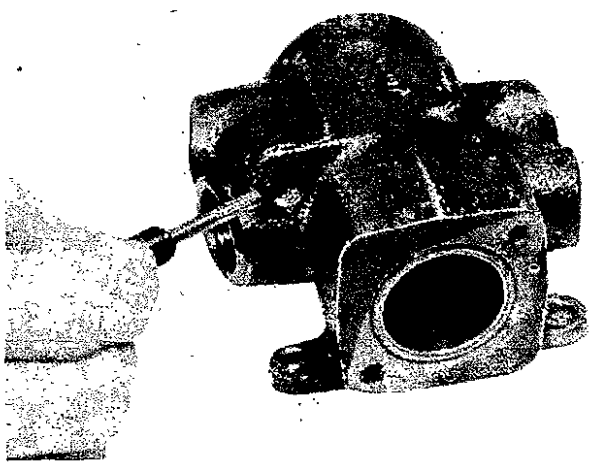
Tighten Allen head set screw securely (Illust. 5). Check to see that ball is properly seated.

Clamp valve spool in a vise with brass jaw protectors. Install slotted nut and Shakeproof lock washer onto swivel bearing rod. Slotted nut to be up to yoke in rod (Illust. 6). Do not tighten nut. Next, install swivel bearing rod into valve spool as illustrated.

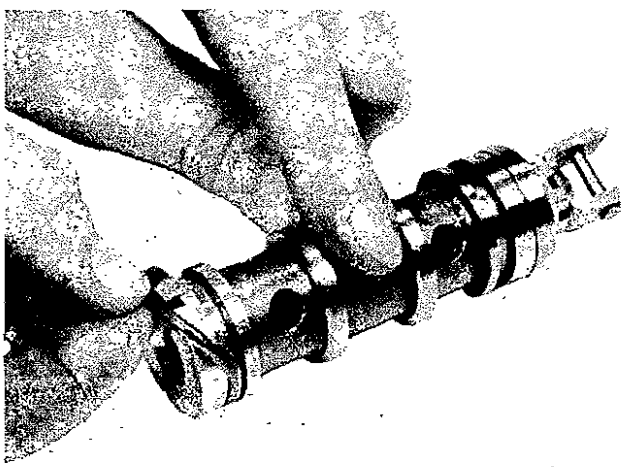


Illust. 6

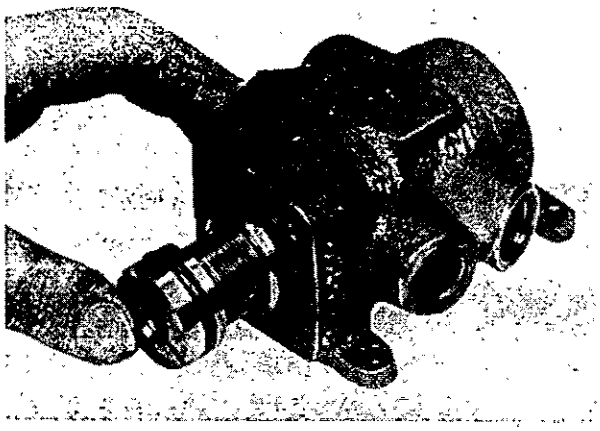
Install "O" ring into groove of valve spool (Illust. 7).



Illust. 4

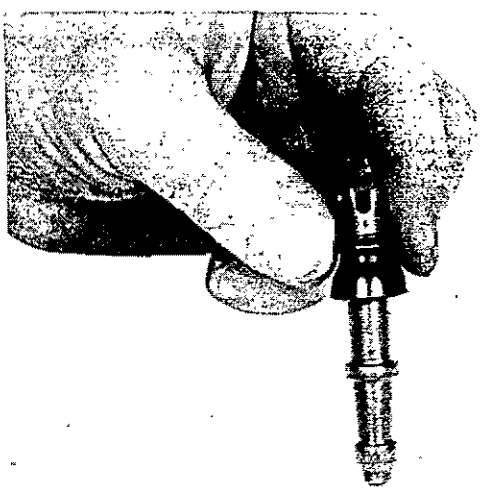


Illust. 7



Illust. 8

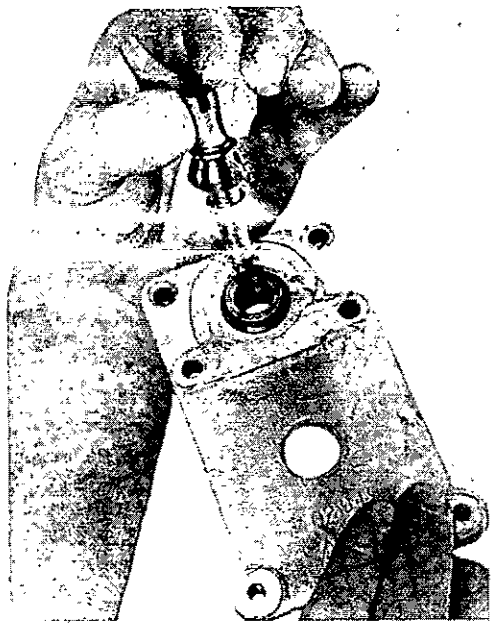
Illust. 9



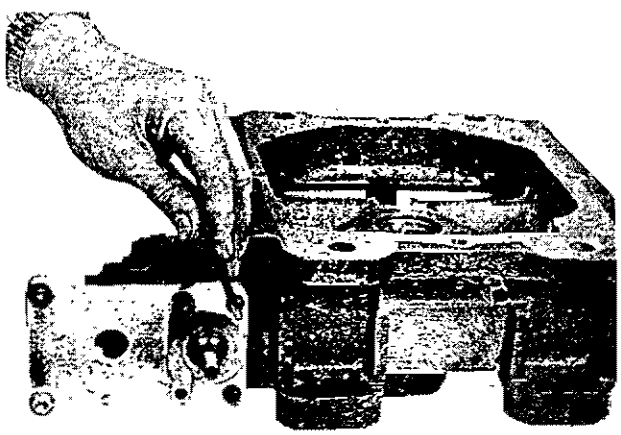
Illust. 10

Apply white lead to "O" ring. Insert valve spool into control valve housing (Illust. 8). Push spool through housing until groove nearest swivel bearing rod appears. Install second "O" ring in groove of spool (Illust. 9). Apply white lead to second "O" ring then push on swivel bearing rod until opposite end of spool is flush with end of control valve housing.

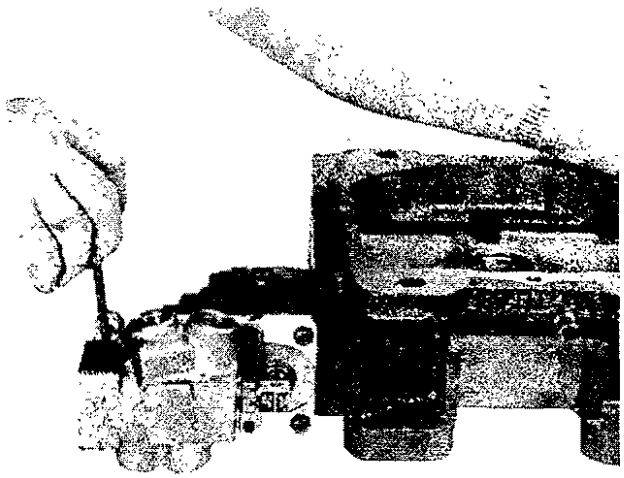
Install rubber boot onto slotted end of actuating rod (Illust. 10). Push boot



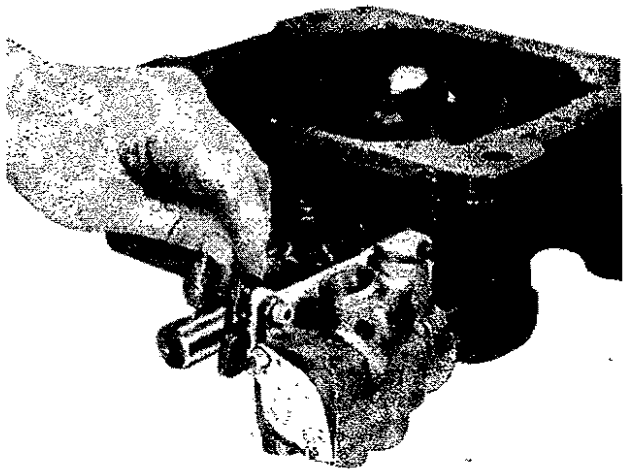
Illust. 11



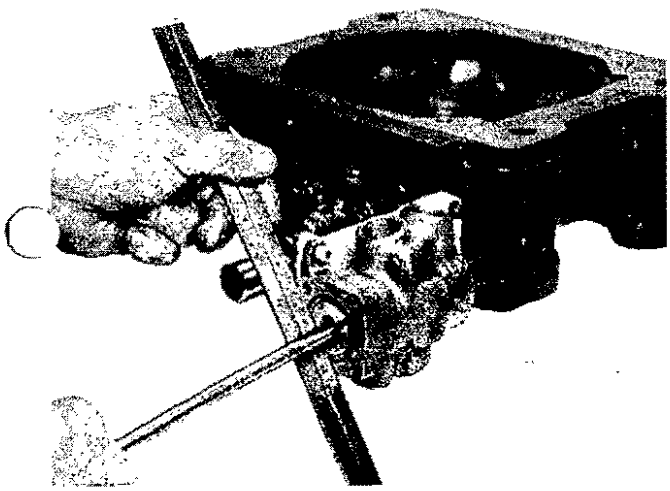
Illust. 12



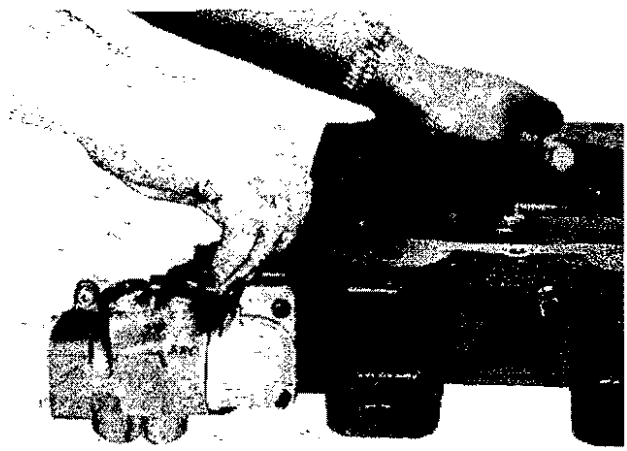
Illust. 13



Illust. 15



Illust. 14



Illust. 16

down to shoulder of rod.

Insert actuating rod into shouldered end of sleeve (Illust. 11).

Install control valve bracket onto steering housing (Illust. 12). Knob on end of actuating rod to fit in groove of cam shaft valve body. Install Allen head set screws with Shakeproof lock washers. Tighten set screws securely (Illust. 12).

Install control valve housing onto bracket (Illust. 13). Pin in swivel bearing rod to fit in slot of actuating rod. Next, install four Allen head set screws with shakeproof lock washers.

Tighten set screws securely.

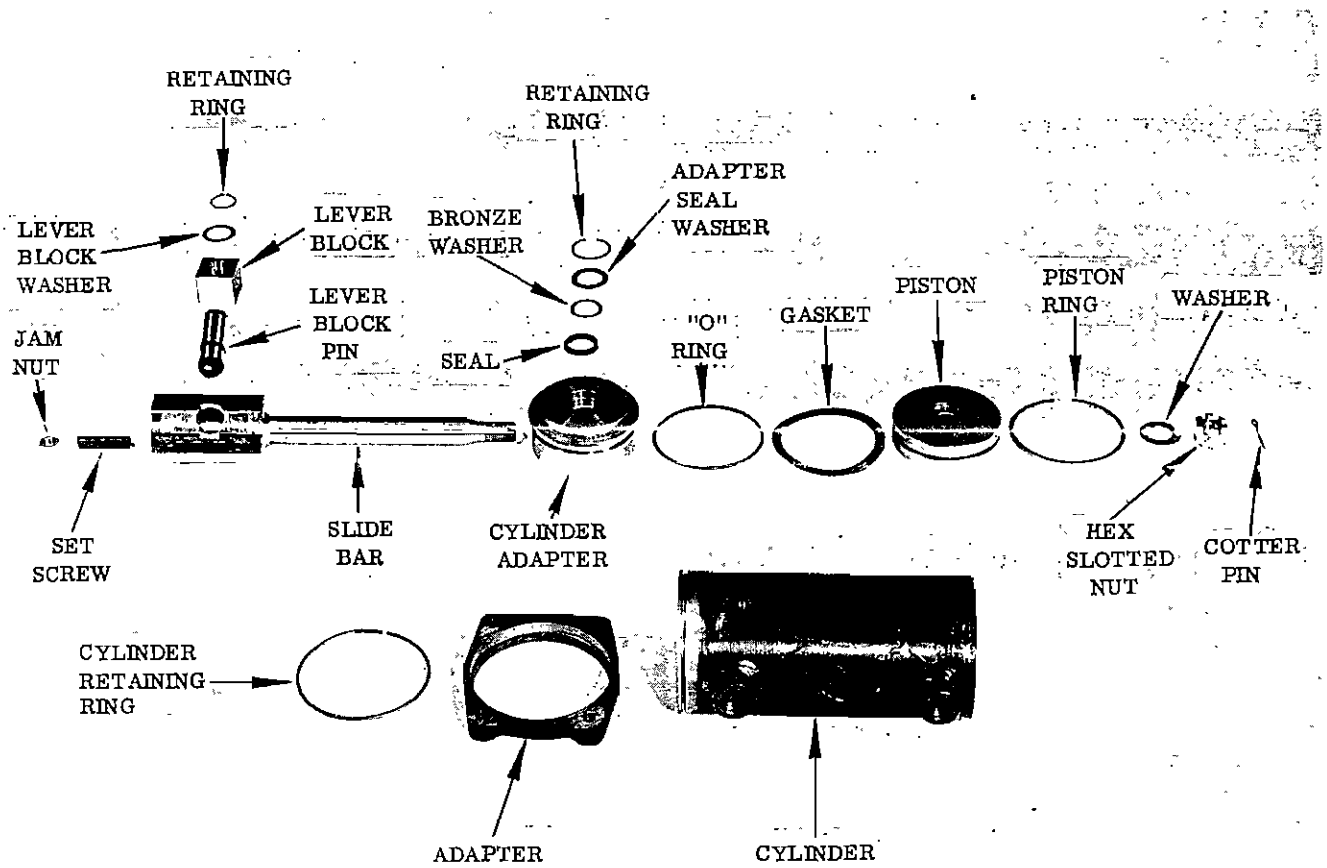
With the swivel bearing rod slotted nut loose, turn valve spool with a screw driver until face of spool is flush with face of control valve housing (Illust. 14). Next, tighten slotted nut.

Install valve spool cover, rubber seal and rubber seal retainer onto control valve housing (Illust. 15). Install Allen

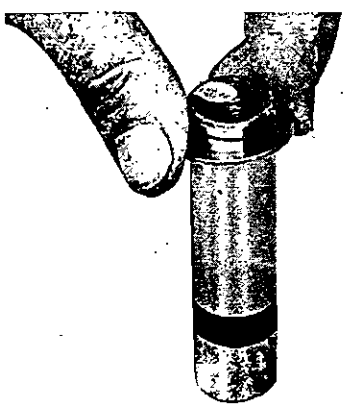
head set screws with Shakeproof lock washers and tighten securely.

Remove two Allen head set screws from the swivel bearing rod end of valve housing. Install lever cover and seal onto control valve housing (Illust. 16). Install Allen head set screws with Shakeproof lock washers and tighten securely.

CYLINDER



Illust. 1



Illust. 2

Illust. 1 is an exploded view of the cylinder.

Install lever block washer onto lever block pin (Illust. 2). Flat on washer to fit flat of pin.

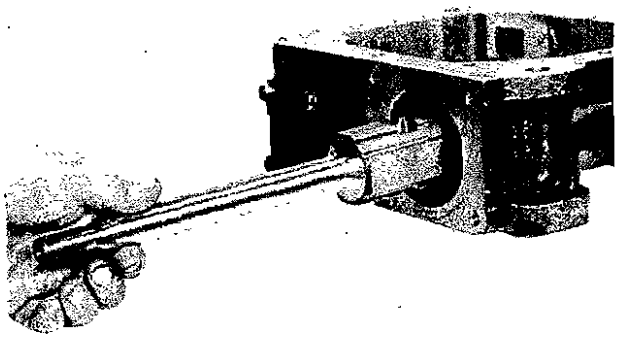
Install lever block retaining ring in groove of lever block pin (Illust. 3). Next, install lever block (Illust. 4).

Install slide bar into steering housing (Illust. 5).

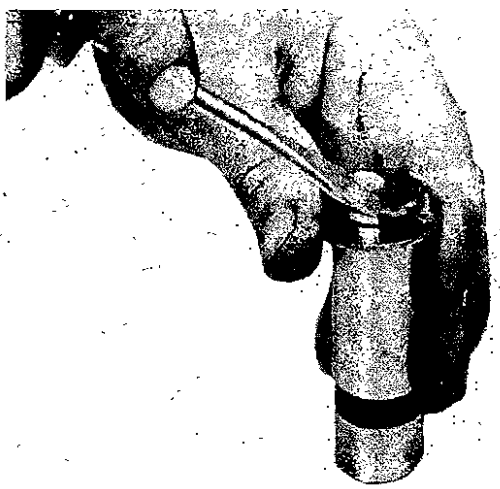
Install lever block pin assembly into bore of slide bar (Illust. 6).

Install set screw and jam nut in end of slide bar and tighten securely (Illust. 7). Be sure lever block is free to rotate on lever block pin and that slide bar is free to move back and forth in steering housing. Tighten jam nut securely (Illust. 8).

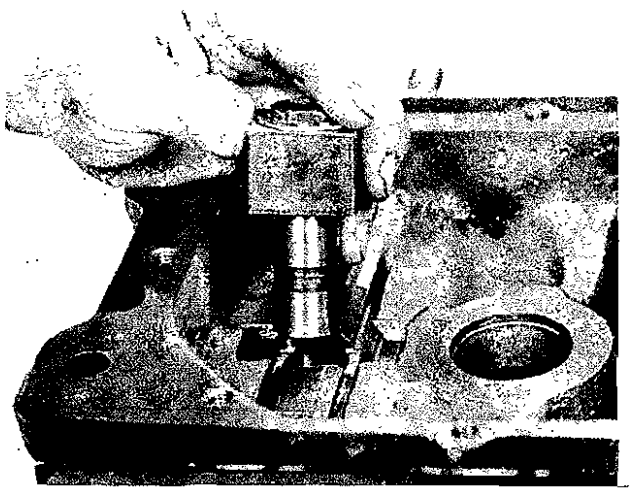
Install slide bar seal, bronze washer and adapter washer seal into cylinder



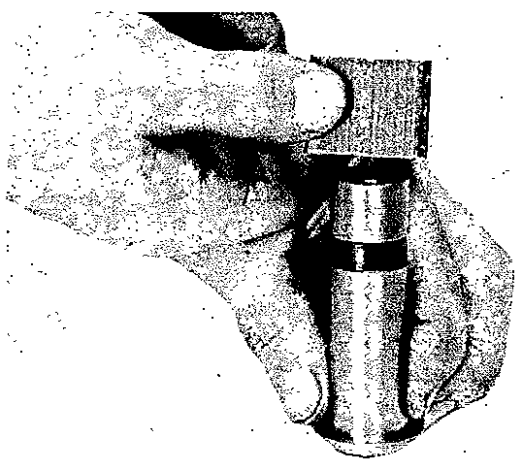
Illust. 5



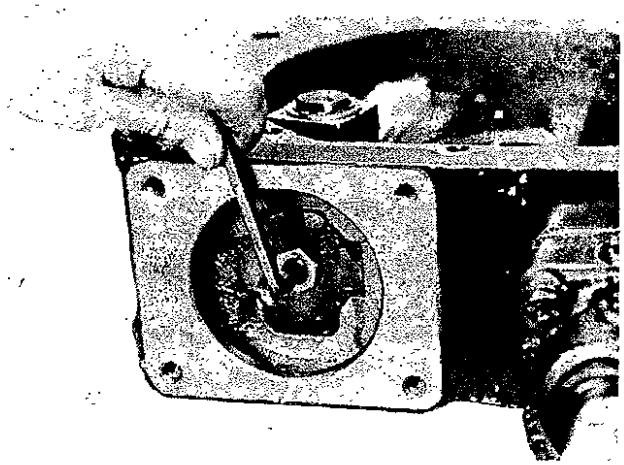
Illust. 3



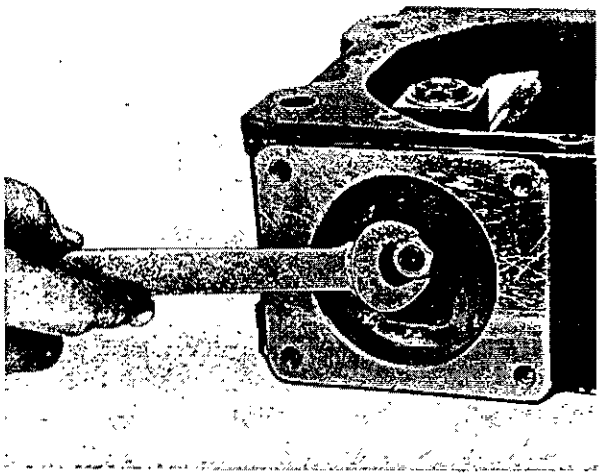
Illust. 6



Illust. 4



Illust. 7



Illust. 8

Illust. 9

Illust. 10

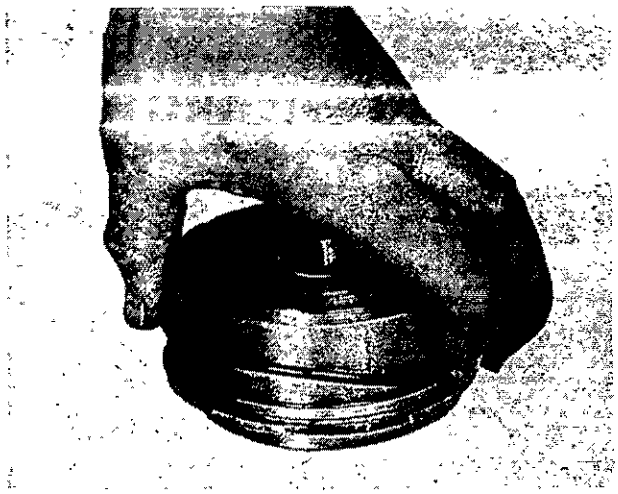
adapter in the order named (Illust. 9). Be sure to place lip of slide bar seal toward the inside of adapter.

Next, install retaining ring in groove of cylinder adapter (Illust. 10).

Install "O" ring into groove of cylinder adapter (Illust. 11).

Install gasket onto cylinder adapter (Illust. 12).

Install cylinder adapter onto slide bar (Illust. 13). End containing gasket and seal going on first.



Illust. 11

Illust. 12

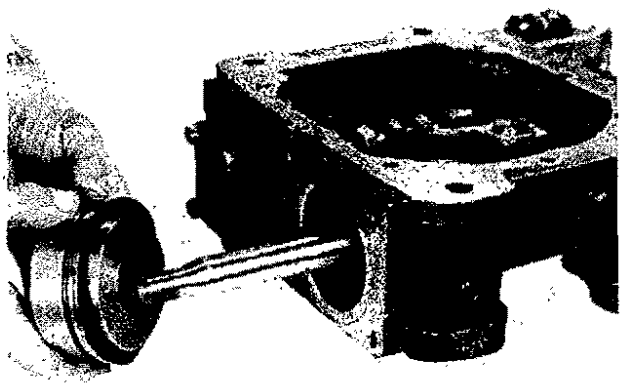
Install piston ring into groove of piston (Illust. 14).

Install piston onto slide bar (Illust. 15) with taper of bore in piston mating with taper of slide bar. Next, install washer and hex slotted nut (Illust. 16) onto slide bar.

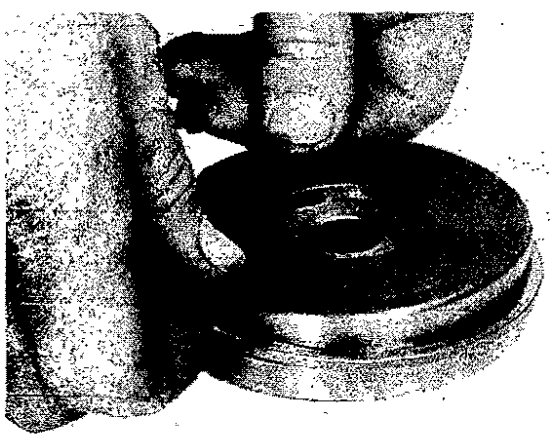
Tighten slotted nut to a torque reading of 200 to 225 foot pounds (Illust. 17).

Install cotter pin and spread (Illust 18).

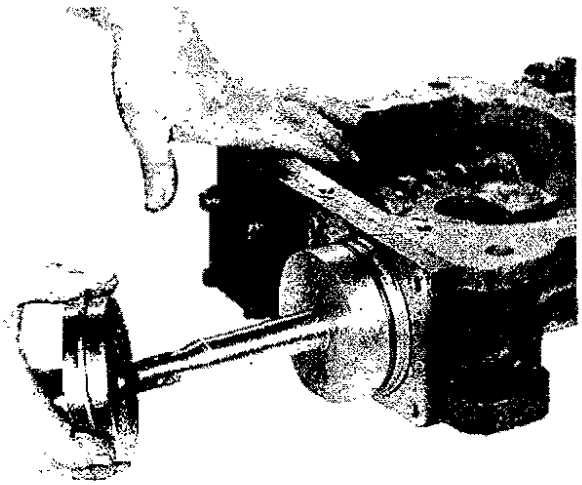
Install adapter onto cylinder (Illust. 19). Next, install cylinder retaining



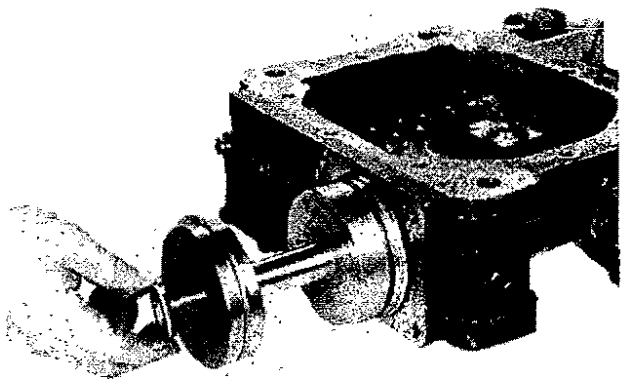
Illust. 13



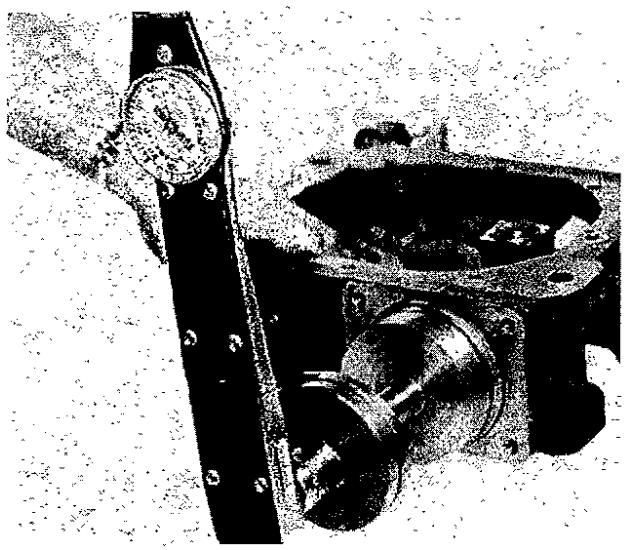
Illust. 14



Illust. 15



Illust. 16

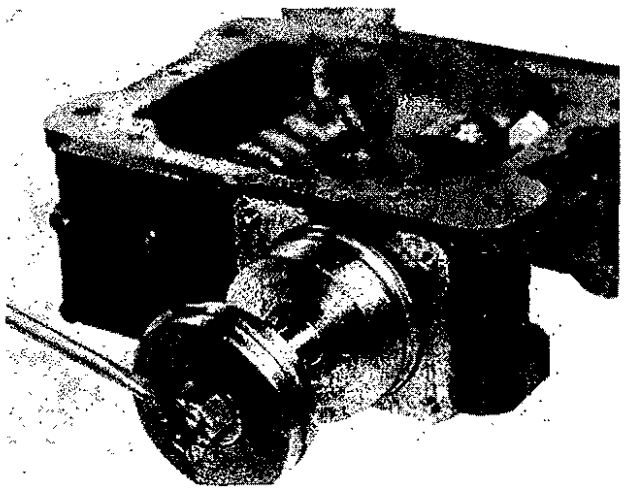


Illust. 17

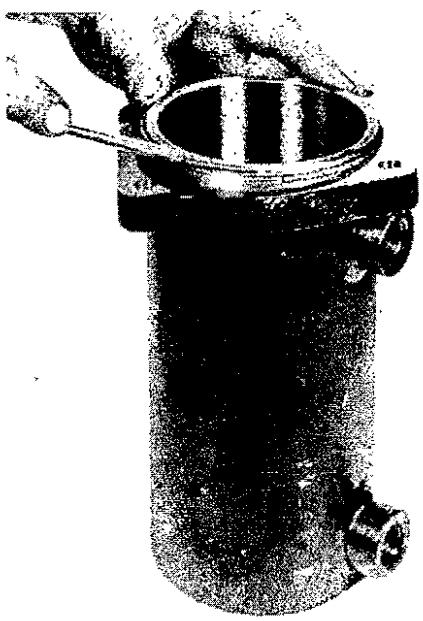
ring into groove of cylinder.

Compress piston ring, then slide cylinder over piston and cylinder adapter (Illust. 20). Cylinder to fit flush with shoulder of cylinder adapter. NOTE: Apply white lead to "O" ring to prevent damage.

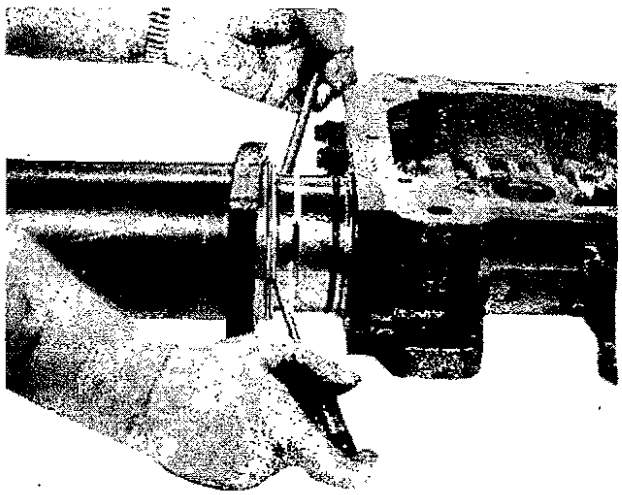
Install four adapter cap screws with lock washers. Tighten cap screws equal to prevent placing cylinder in a bind (Illust. 21). NOTE: Slide bar



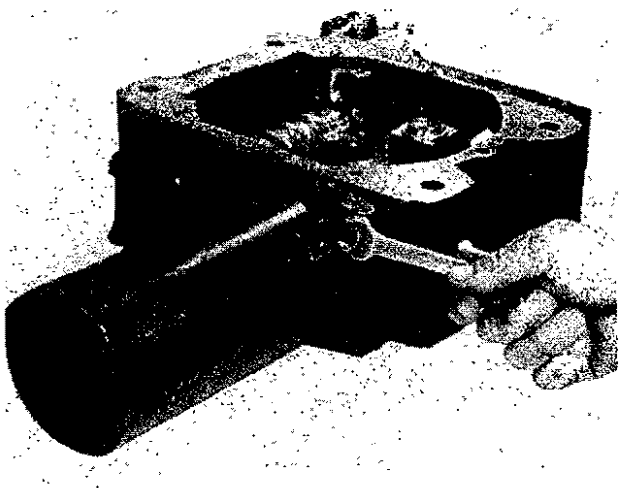
Illust. 18



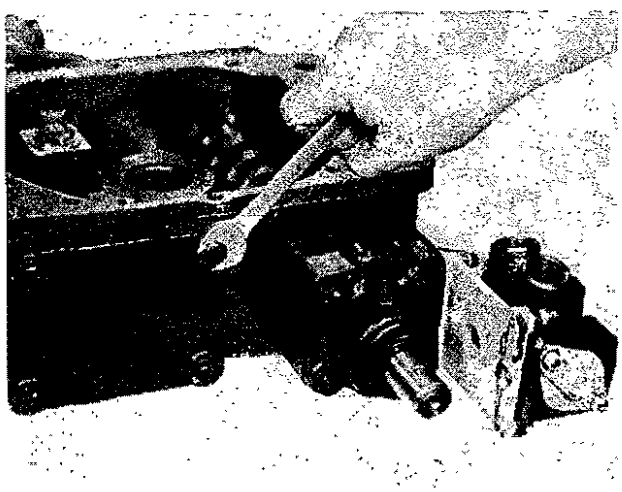
Illust. 19



Illust. 20



Illust. 21



Illust. 22

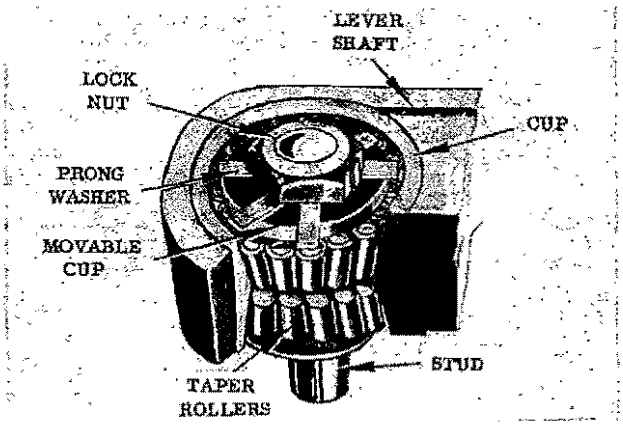
assembly should move freely through cylinder.

Install end cover and gasket. Install cap screws and lock washers. Tighten cap screws securely (Illust. 22).

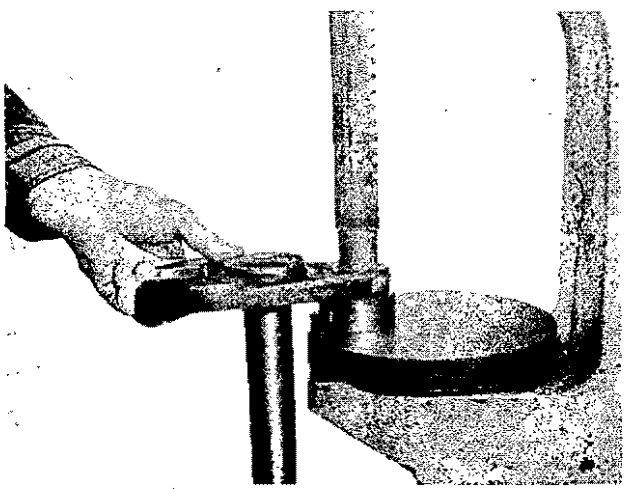
STUD ROLLER BEARING UNIT

Illust. 1 is a cut away view of the stud roller bearing unit.

To remove the stud roller bearing unit from the lever shaft, use a piece of pipe the same diameter as bearing cup. Press or drive unit from shaft (Illust. 2). NOTE: When removing stud bearing unit from lever shaft, be sure lever shaft is in a downward position as illustrated.



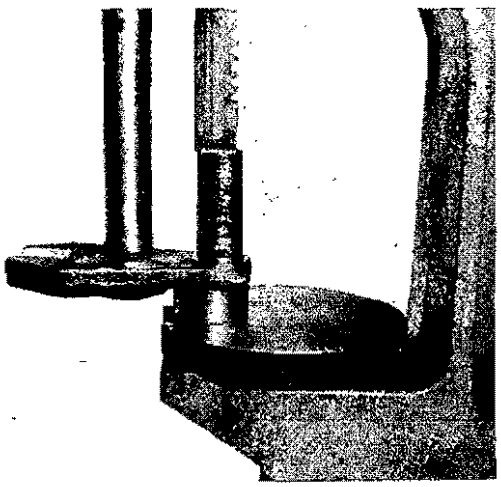
Illust. 1



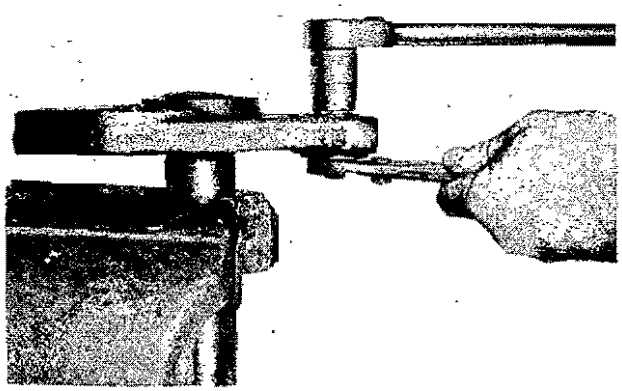
Illust. 2

Press or drive stud bearing unit into lever shaft (Illust. 3) until shoulder of unit is flush against lever shaft.

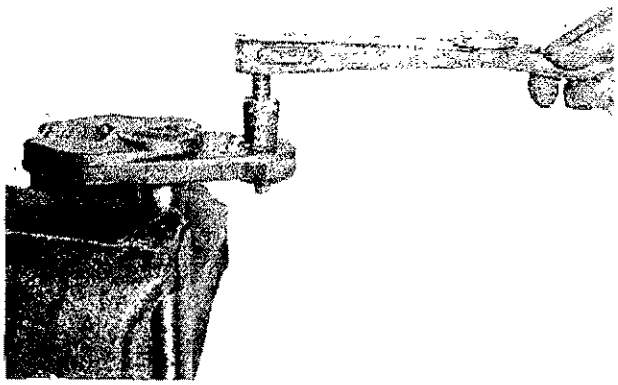
To pre-load the bearings, clamp stud with a pair of pliers, using care not to burr or nick stud. Tighten nut (Illust. 4) until a noticeable drag is obtained. Rotate unit, using a torque wrench (Illust. 5). Torque reading



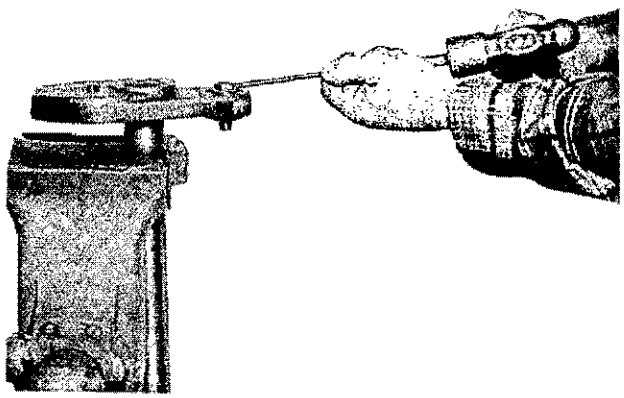
Illust. 3



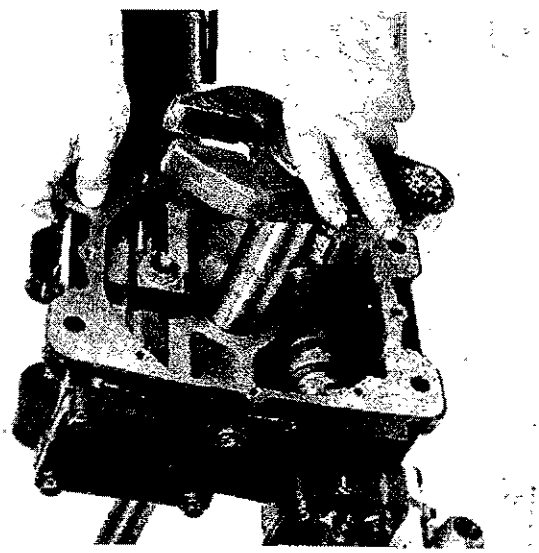
Illust. 4

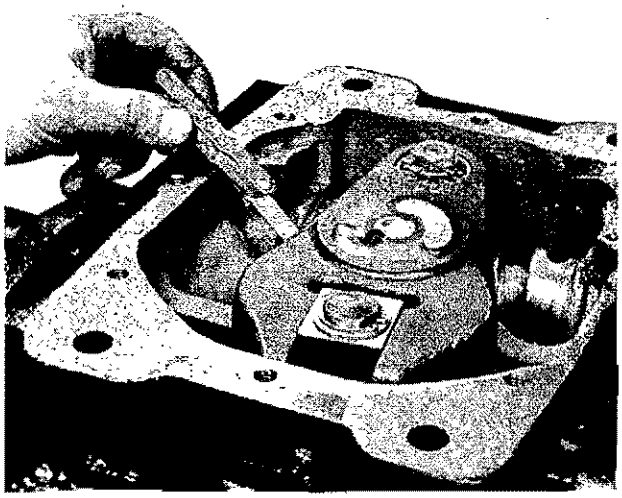


Illust. 5



Illust. 6





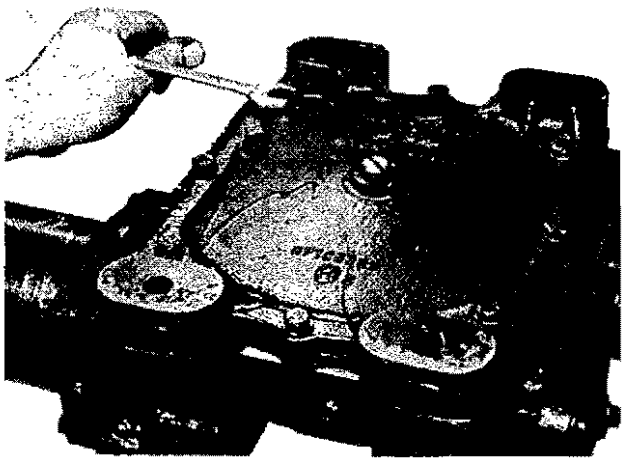
Illust. 8

should be minimum of three inch pounds, never below. If reading is below three inch pounds, tighten nut still tighter.

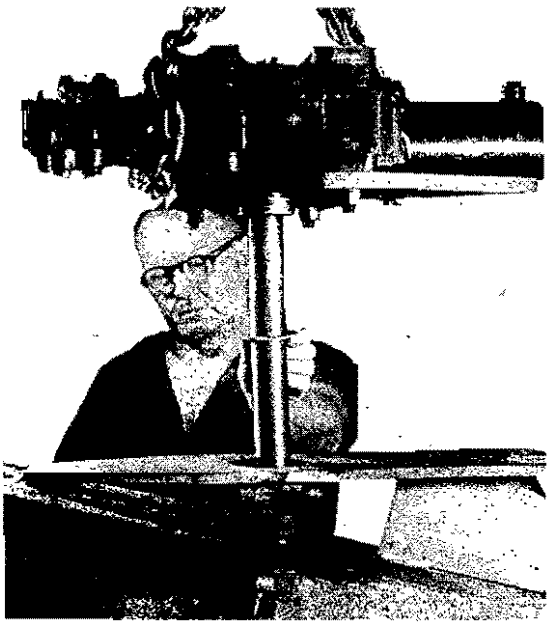
Lock the nut by bending a prong of washer against a side of the nut (Illust. 6). NOTE: Bend a prong that is at right angles to a side of nut. If old pronged washer is used, break off bent prong to prevent reusing.

Install lever shaft into steering housing, less shims (Illust. 7). With stud centered in cam shaft, measure distance between face of lever shaft and face of center bore of steering housing (Illust. 8). Subtract .280" (which is the thickness of support washer and 3 spring washers in its compressed state) from measurement.

If there is no difference, no shims are required. If there is a difference add .010 of an inch shims as necessary. NOTE: The shims should be installed to the closest .010 of an inch. For example, a difference of .024 of an inch, you should add two shims and for a .026 of an inch dif-



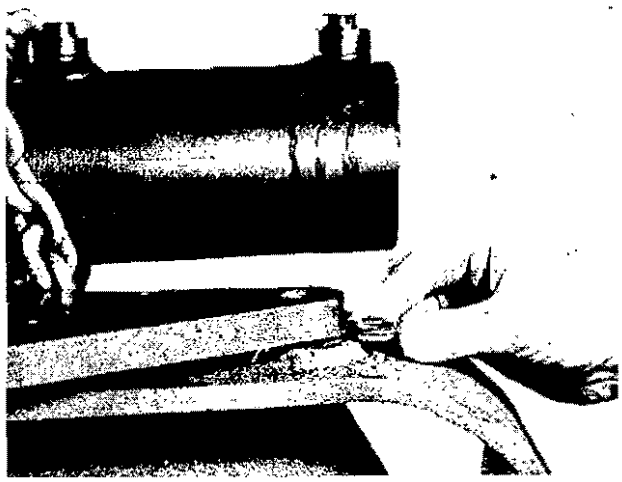
Illust. 9



Illust. 10

When required amount of shims has been determined, remove lever shaft from housing and install 3 spring washers, support washer and shims, if necessary, onto lever shaft. Rounded portion of spring washer toward forked end of lever shaft. Reinstall lever shaft into steering housing.
IMPORTANT: Center lever shaft with stud bearing unit in cam shaft between lever stops in housing.

Illust. 11



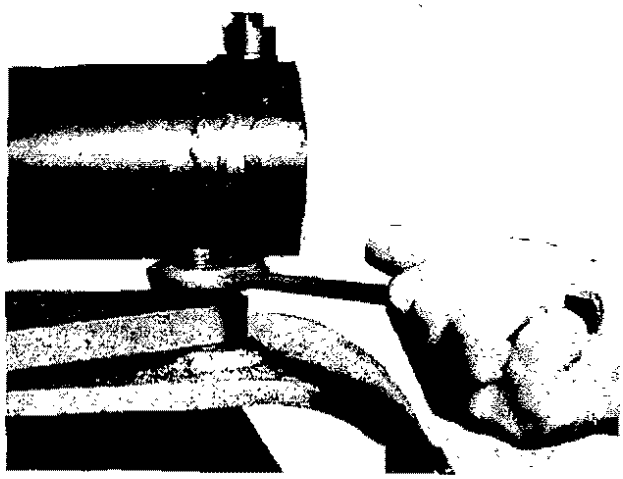
Illust. 12

cover and cap screws with lock washers. Tighten cap screws securely (Illust. 9).

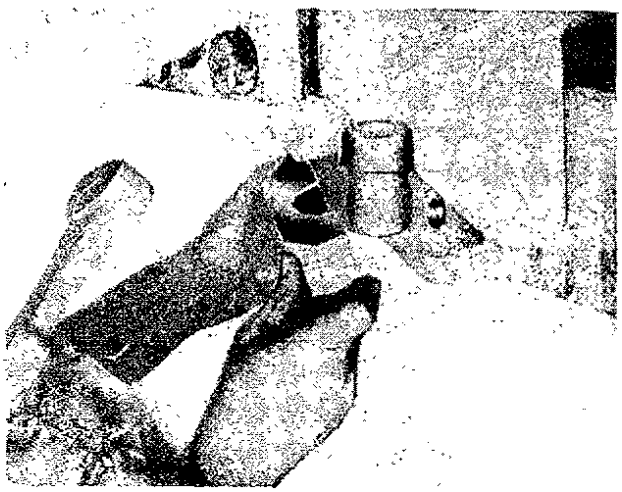
Install washer onto steering shaft and insert steering housing assembly into frame (Illust. 10).

Lower steering housing through frame until end of lever shaft is well extended through bottom of frame, then install rubber washer (Illust. 11).

11 (... housing cover gasket,

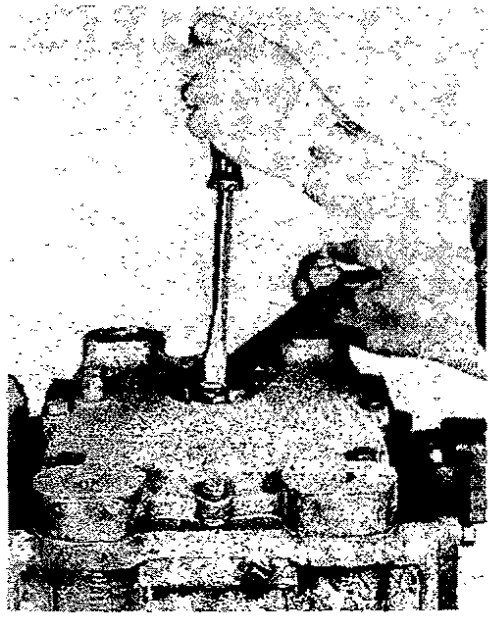


Illust. 13



Illust. 14

Illust. 15



Illust. 16

Continue lowering steering housing until housing rests on bolster. Measure the gap between torque plate and bolster and insert the required amount of shims (Illust. 12). Next, insert torque plate bolt through bolster and torque plate. Install lock washer and nut. Tighten nut securely (Illust. 13). Next, tighten self aligning bearing cap cap screws.

It is not necessary to remove the lower self-aligning bearing (Illust. 14) when removing the steering gear. However, if it is removed for any reason, be sure to reinstall the bearing with the longest end turned up. Install the grease fitting before tightening the cap screws in the bearing cap. The two lower cap screws in the drawbar bearing hold the self aligning bearing in position.

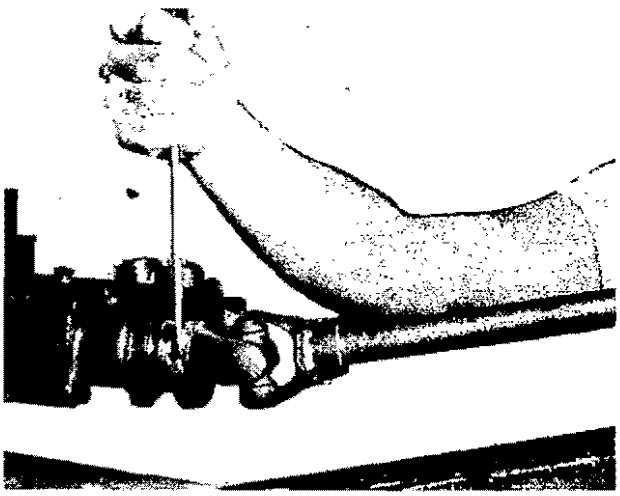
Install steering arm onto lever shaft (Illust. 15). IMPORTANT: Be sure to install steering arm onto shaft parallel with the center line of main frame.

To adjust backlash between stud bearing unit and cam, tighten set screw while at the same time slightly turn shaft clockwise and counterclockwise until a slight drag is obtained (Illust. 16). Tighten set screw jam nut securely.

Align pin hole in universal joint with pin hole in cam shaft. Install universal joint onto cam shaft. Install pin and cotter pin. Spread cotter pin (Illust. 17).

Should it become necessary to remove steering arm for repair, be sure before installing arm, center lever shaft in housing.

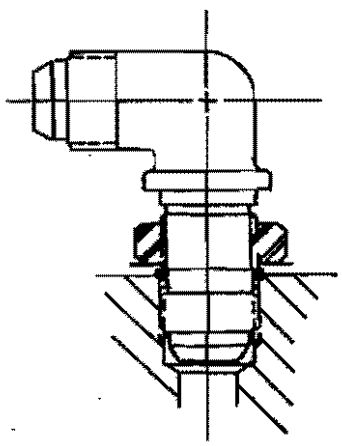
To center lever shaft in housing, count the number of turns required to turn steering wheel from one extreme to the other. Turn steering wheel in the opposite direction one half the total number of turns. Install arm to lever shaft parallel with the center line of the main frame. IMPORTANT: Fill steering housing with correct luhricant. See "Lubricating Instructions".



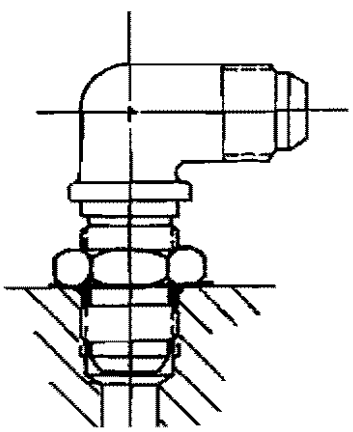
Illust. 17

INSTALLATION OF HYDRAULIC LINES

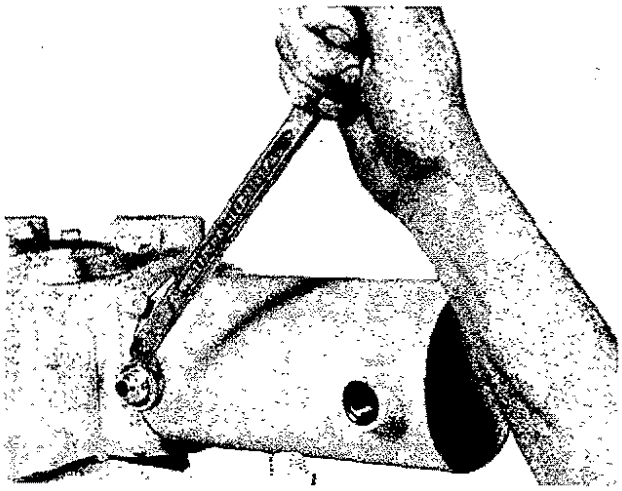
To install an elbow fitting, run nut and washer on fitting to clear gasket groove. Install gasket in groove, then screw fitting into boss until gasket contacts boss (Illust. 1). Unscrew fitting, not more than one turn, to desired position, then tighten lock nut (Illust. 2).



Illust. 1



Illust. 2



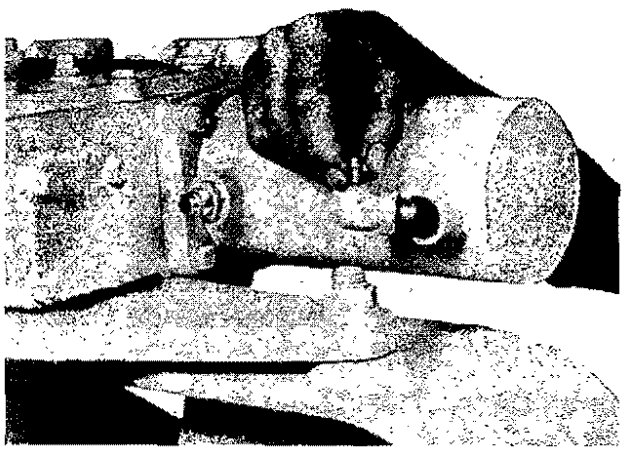
Illust. 3

Straight fittings do not require positioning. To install straight fitting, install gasket in groove. Screw fitting tight against boss.

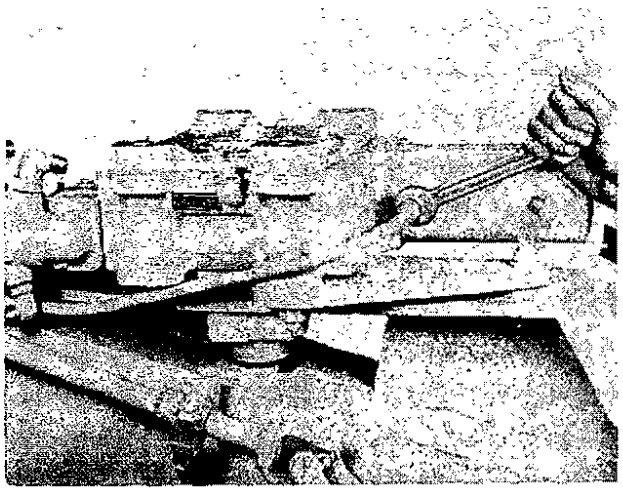
Install and tighten straight fitting into rear bore of cylinder (Illust. 3).

Install elbow fitting into front bore of cylinder (Illust. 4). NOTE Do not tighten nut until fitting is positioned.

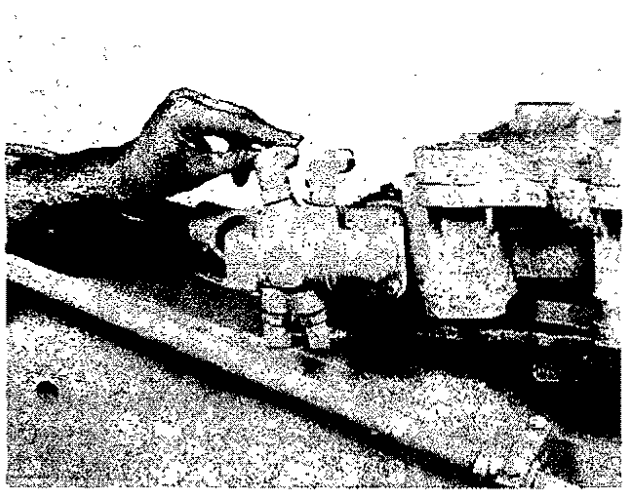
Install elbow fittings into control valve (Illust. 5). Large diameter fittings into top bores of valve housing. NOTE: Do not tighten nuts until



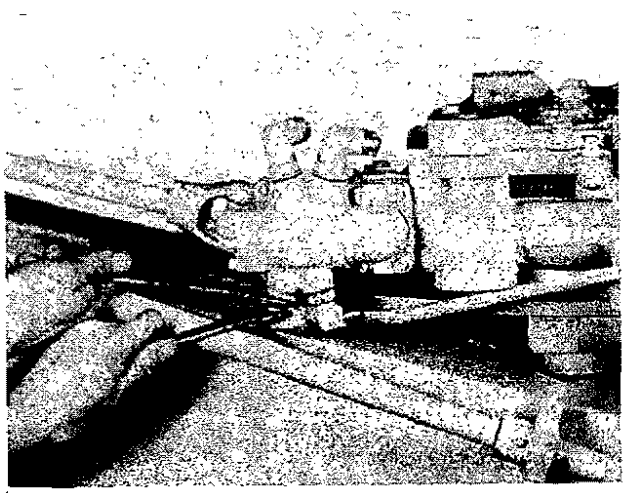
Illust. 4



Illust. 6



Illust. 5



Illust. 7

fittings are positioned.

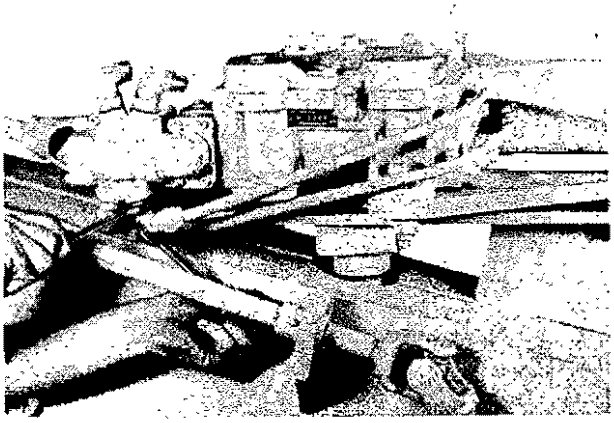
Install pressure line from straight fitting in cylinder to lower elbow in valve. Tighten line fittings securely (Illust. 6). Tighten elbow fitting nut securely (Illust. 7).

Install second pressure line from elbow fitting in cylinder to lower elbow fitting in control valve. Tighten line fittings securely (Illust. 8). Tighten both elbow fitting nuts securely (Illust. 9).

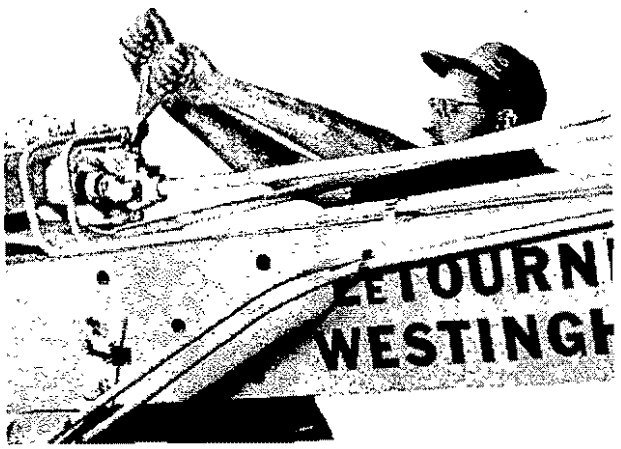
Install both return and pressure lines to elbow fittings in top of valve and tighten securely (Illust. 10). The short return line nearest the edge of frame. The long pressure line toward center of frame. Tighten elbow fitting nuts securely (Illust. 11).

Install both rear sections of return and pressure line. The long rear section (return) nearest the edge of frame. The short rear section (pressure)toward the center of frame. Screw both line fittings into straight fittings of front sections, but do not tighten.

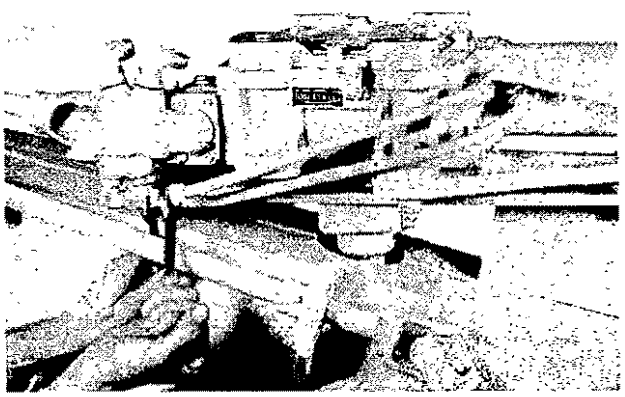
Install rear section of return line fit-



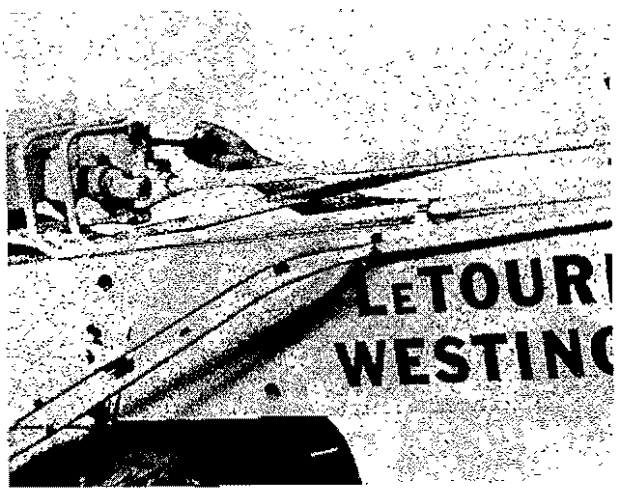
Illust. 9



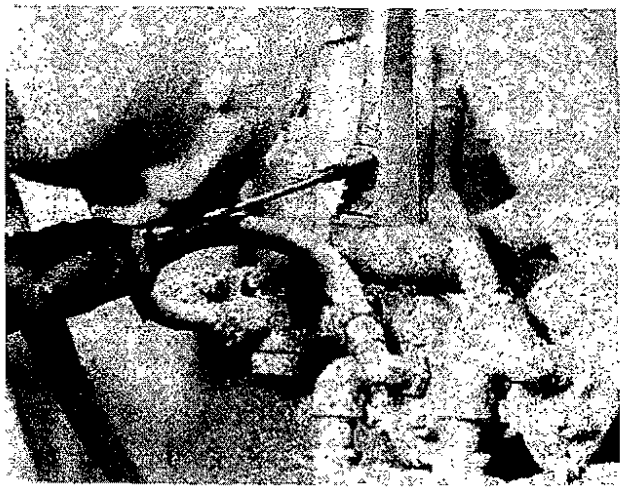
Illust. 10



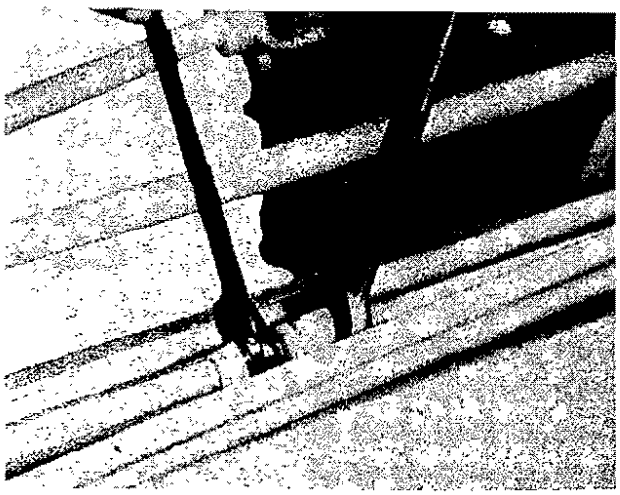
Illust. 8



Illust. 11



Illust. 12



Illust. 13

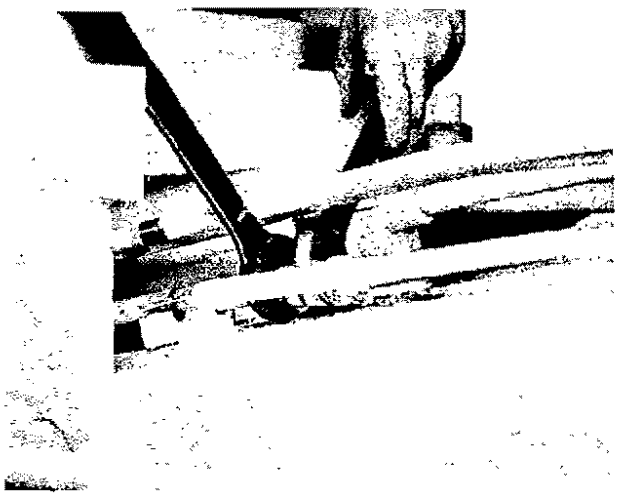
Illust. 14

ting to the straight fitting of tee at relief valve and tighten securely (Illust. 12). Now, tighten return line fittings on top of frame (Illust. 13).

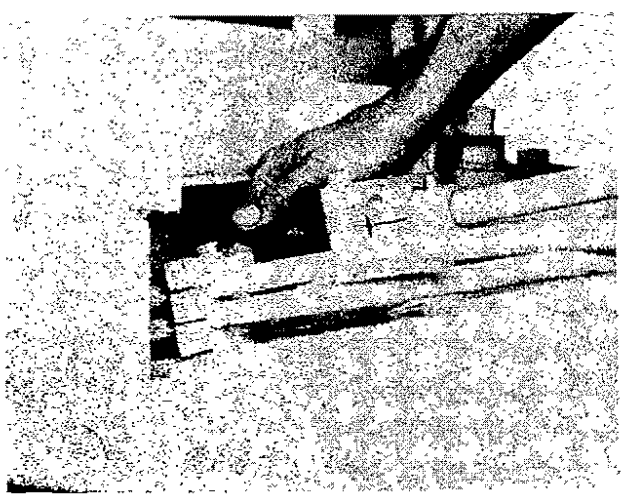
Install rear section of pressure line fitting to relief valve elbow and tighten securely (Illust. 14). Tighten pressure line fittings on top of frame (Illust. 15).

Install all hydraulic lines in clamp bases on frame. Install clamp, cap screws and lock washers. Tighten cap screws securely (Illust. 16).

NOTE: When installing hydraulic lines



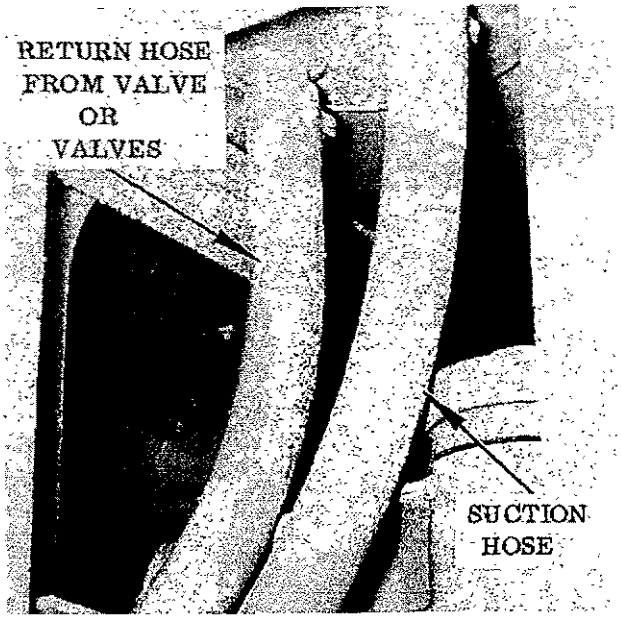
Illust. 15



Illust. 16

to fittings, be sure not to damage threads, also be sure lines are properly seated in clamps before tightening.

Illust. 17 is a view of the hydraulic hoses as they connect to the reservoir. This view will aid in the identification of the hoses. IMPORTANT: Fill reservoir with correct lubricant. See "Lubricating Instructions".



Illust. 17

HYDRAULIC PUMP

The hydraulic steering booster pump used with either power steering, power-shift moldboard or both, will give good service with the proper care.

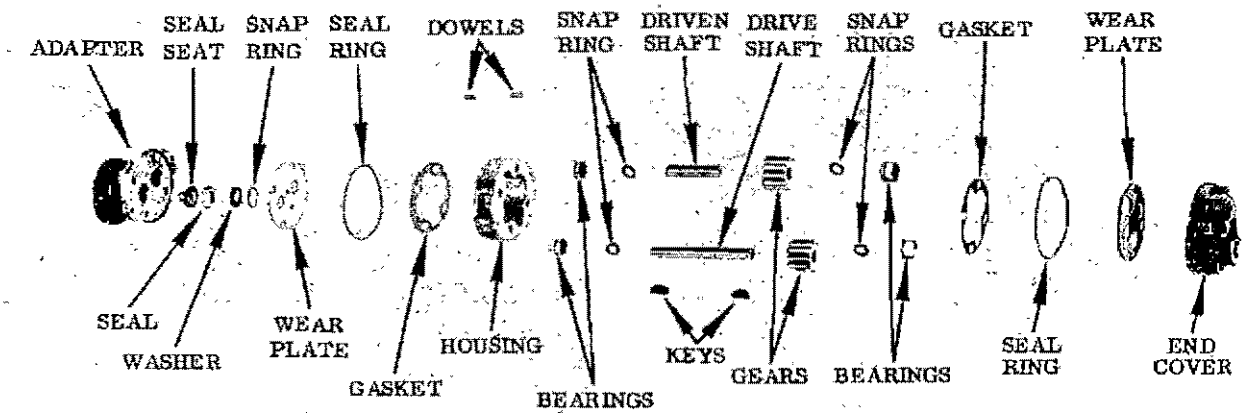
It is necessary to keep the whole system free from dirt. The oil used in the hydraulic system should be kept clean while in storage. The filter screen should be checked often. It is No. 200 wire mesh and should not be allowed to become clogged. Good oil should be used at all times. (Use a premium grade S.A.E. #10 in cold weather and S.A.E. #20 in warm weather.) Do not use hydraulic brake fluid, or low viscosity naphtha base motor oils. The hose and fittings should be checked daily for breakage or looseness.

REMOVAL

Clean outside of hydraulic pump with an oil solvent or similar fluid and dry thoroughly.

Drain hydraulic reservoir.

Remove hose connections from pump



Illust. 1

fittings.

Remove pump from pump adapter housing.

Before disassembling pump, mark sections of pump with a prick punch to insure proper reassembly. Remove sharp edges or burrs from shaft splines, drill point, keyway or shaft end. The pump may be disassembled by reversing the assembly procedure.

Clean parts with an oil solvent or similar fluid and dry thoroughly. Inspect parts and replace those that are worn or damaged. Apply a thin coating of oil to parts before assembling.

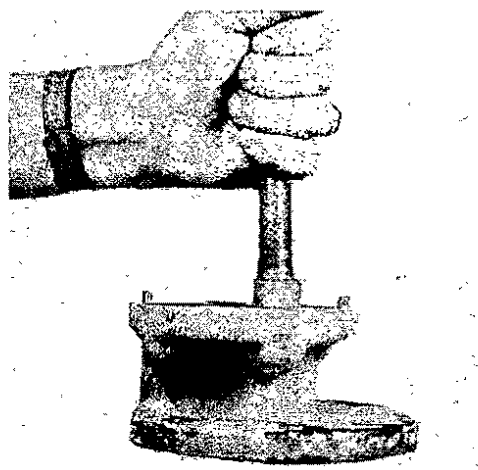
REASSEMBLY

Illust. 1 is an exploded view of the hydraulic pump used with either power steering or power-shift moldboard.

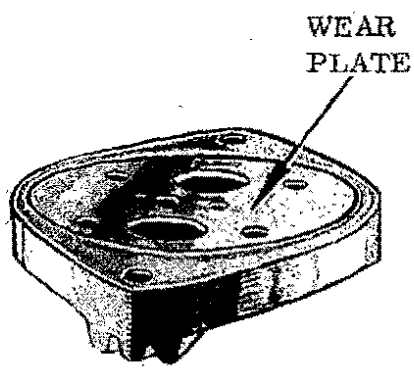
Before installing needle bearings into adapter and end cover, bearings should be checked fo. freeness of rollers and pitted, broken or excessively worn rollers. The bearing should be replaced if it is possible to insert a .020" feeler between the rollers. If it is necessary to replace bearings, do so only with the same make and type as were originally installed.

Install needle bearings into the end cover and adapter (Illusts. 2 and 3). Always apply pressure to lettered end of bearing. It is better to press them in if possible. If not, use a soft piece of tubing or drift pin, using care not to damage bearing. Bearings should be lubricated with a light grease.

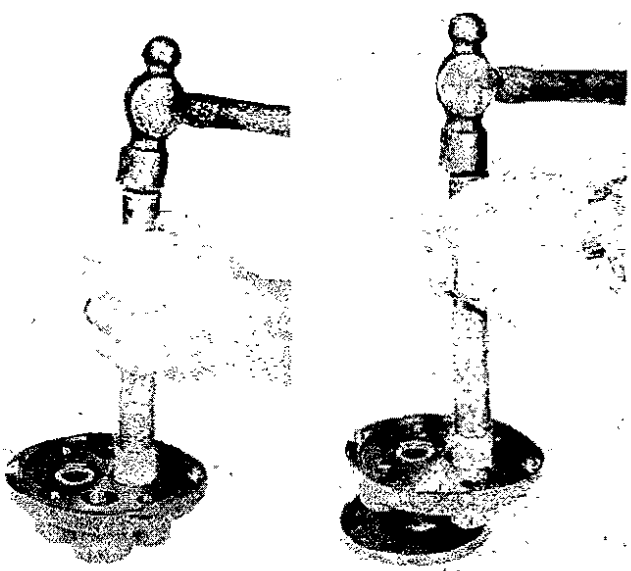
Press or drive seal into adapter and against shoulder of adapter (Illust. 4). When driving seal seat into adapter, use a soft drift pin as illustrated.



Illust. 4



Illust. 5



Illust. 2

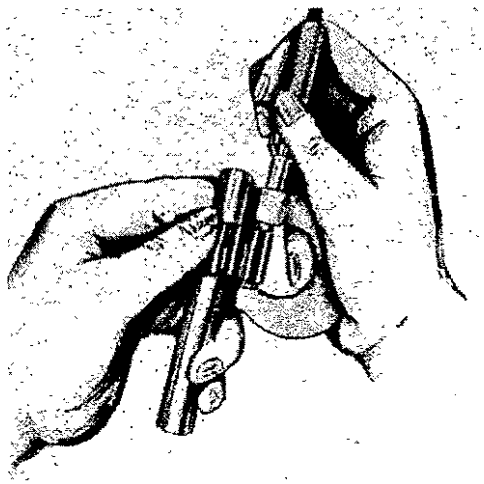
Illust. 3

Check wear plate (Illust. 5) for scoring or excessive wear. NOTE: Do not turn wear plate as the counter-bored relief pocket is on gear side only. If wear plate is steel backed, bronze side should be next to gears. Even though slight wear is shown on gear pattern, check for erosion path in vicinity of relief pocket and replace if in evidence. Also wear plate should be properly seated. If it has a slight rocking motion, check face of end cover or adapter for a burr. Be sure that the counter-bored relief pocket is up and in original position. Lubricate the contact surface of plate with light oil.

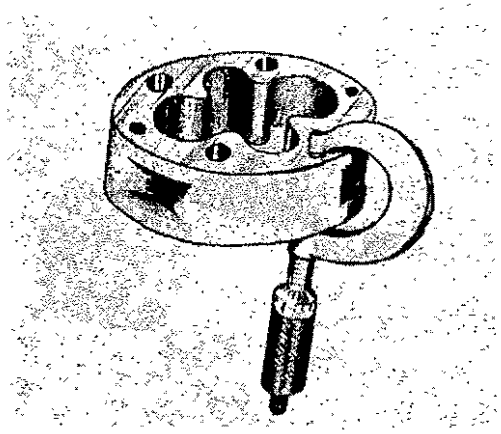
Proper clearance between the gear face and wear plate is provided by the plastic shim gasket between housing and adapter and housing and end cover. Using micrometers measure the width of the housing (Illust. 6) and width of gears (Illust. 7). If gear width is .002" greater than housing width, a red shim (.002") should be installed on adapter side and a red shim (.002") to end cover side. If gear width is .001" greater than housing, an amber shim (.001") should be installed on adapter side and a red shim (.002") to the end cover side. If housing and gears are the same width, an amber shim (.001") should be installed on adapter side and an amber shim (.001") to end cover side.

Press gear onto shaft. Center gear between the two (2) snap ring grooves in shaft. Next, install snap rings, one (1) on each end of gear. Install plate onto pump shaft. Next, install bearing (Illust. 8).

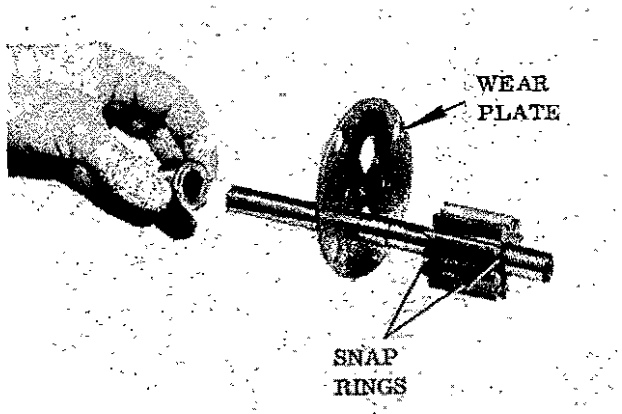
Install snap ring into groove on pump shaft (Illust. 9).



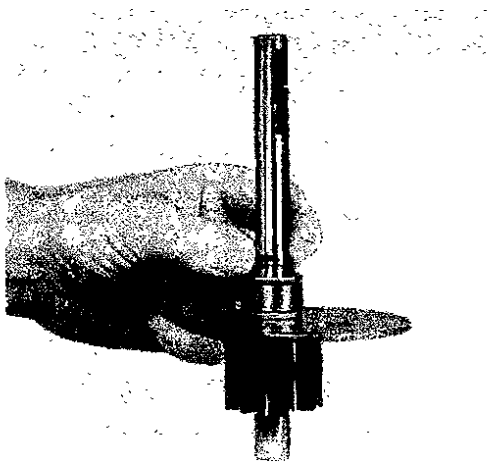
Illust. 7



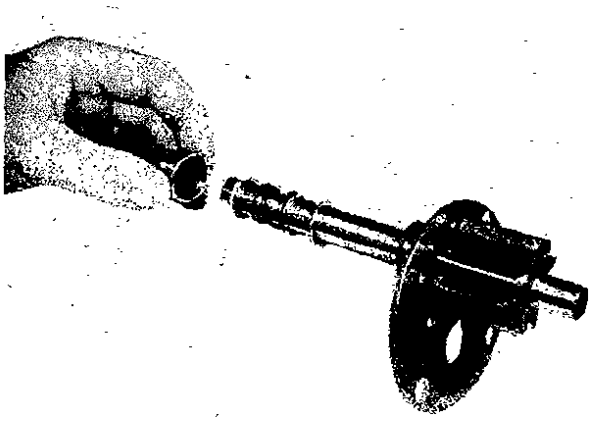
Illust. 6



Illust. 8



Illust. 9

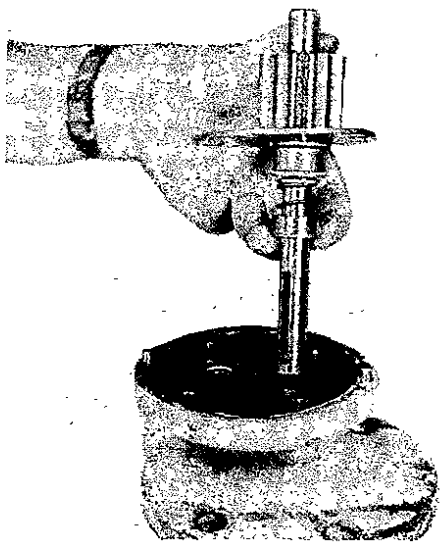


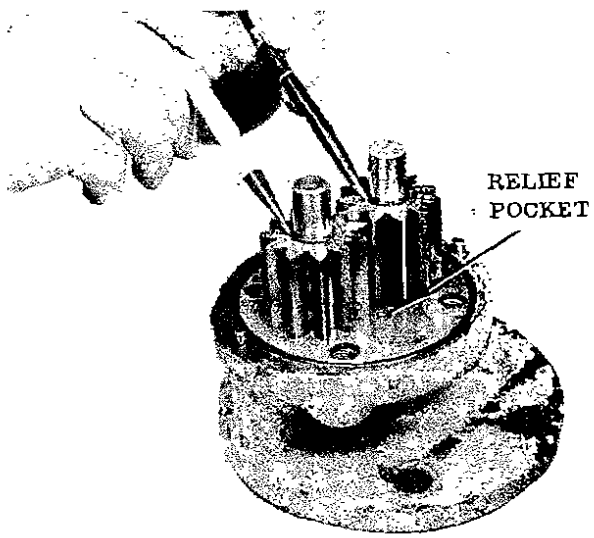
Illust. 10

Install washer, spring, 2nd washer and seal on shaft (Illust. 10). Next, insert shaft through adapter (Illust. 11).

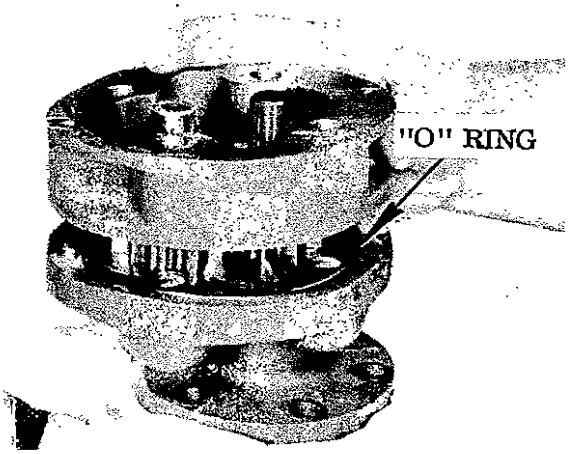
Install the gears (Illust. 12). Make sure that they are in their original position; that the relief pocket is in its original position, on the pressure side; and that edge of teeth and gear face are not scored. If new gears are installed, keep keyways 180° apart, as illustrated. Install "O" ring in groove outside of wear plate (Illust. 13). Install gasket shim, which was determined to be used, between adapter and housing. Align punch marks in housing with those in adapter then install housing over gears and gasket. Be sure dowels fit into holes in housing. Tap housing with fibre hammer to secure.

Install wearing plate to end cover, with relief pocket side toward gears, and on the same side of gears as relief pocket wear plate in the adapter. Be

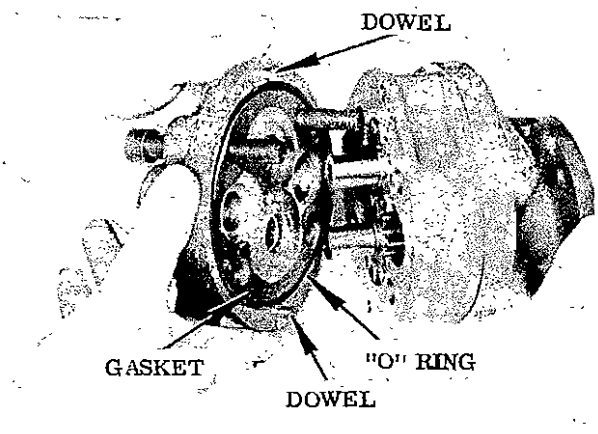




Illust. 12



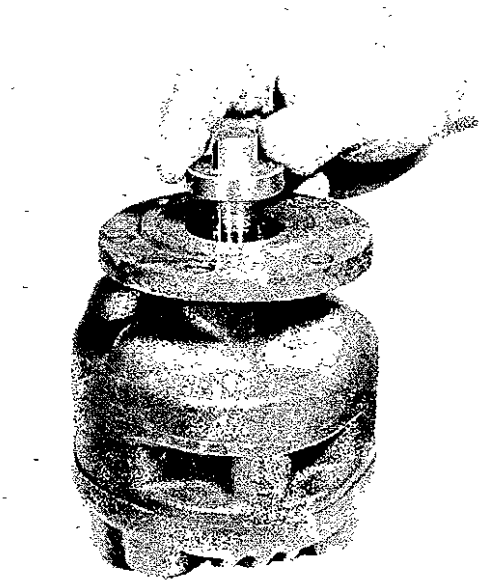
Illust. 13



Illust. 14

sure the bleed hole in wear plate is aligned with the corresponding size bleed hole in cover. Install "O" ring (Illust. 14) and proper gasket shim. Lubricate face of wear plate with clean oil. Install dowels in cover. Align punch marks previously made on housing and end cover. Install end cover to housing and tap with fibre hammer until cover is tight against housing. Be careful not to damage "O" ring. Check to make sure that bleed backhole in cover is on the intake side of pump.

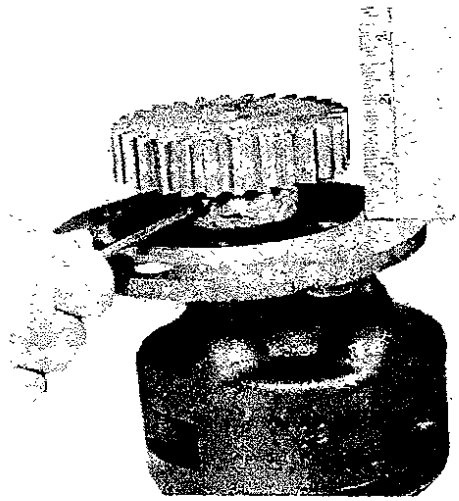
Install four Allenhead cap screws and



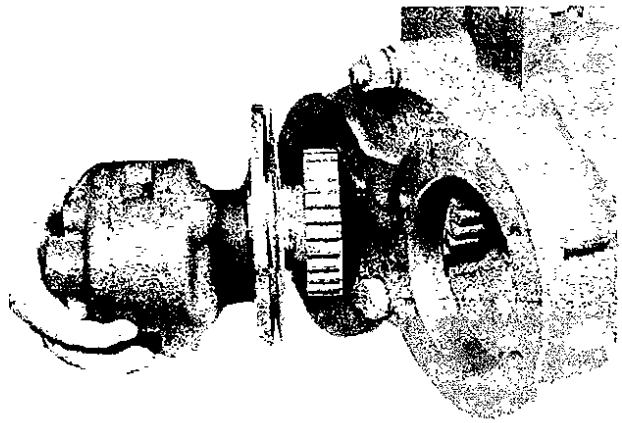
Illust. 15

Illust. 16

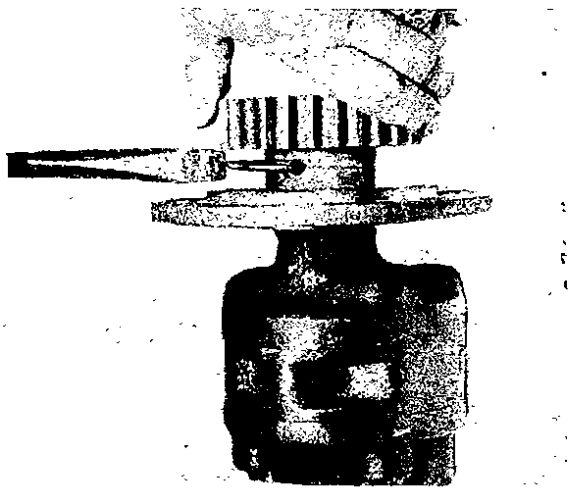
lock washers. Gradually tighten opposite cap screws. Tighten cap screws to a torque reading of 60 foot pounds. After the assembly has been completed, turn shaft with a six inch wrench. The shaft should turn with a slight drag. If shaft is too tight or too free, add or remove as many gasket shims as necessary for proper



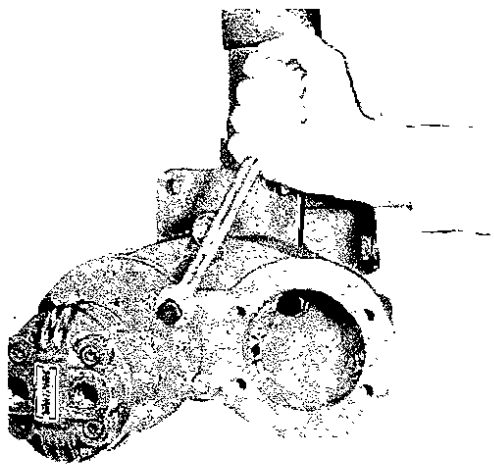
Illust. 17



Illust. 19



Illust. 18



Illust. 20

clearance.

Install bearing over drive shaft and down into housing (Illust. 15)then install snap ring into groove (Illust. 16).

Install key in keyway on pump shaft, then install driven gear (Illust. 17), using a fibre hammer or similar tool. The distance between flange of pump adapter to bottom edge of gear should be 15/16 of an inch. Install hex socket set screw and tighten securely.

Install snap ring (Illust. 18). End of snap ring to fit in set screw hole.

Using a new gasket, install hydraulic pump or pumps to pump adapter housing (Illust. 19). Install cap screws and lock washers (Illust. 20) and tighten securely.

Install pump opening cover (if only one (1) pump is used) and gasket. Secure with four cap screws and lock washers.

IMPORTANT: Fill reservoir with correct lubricant. See "Lubricating Instructions".

RELIEF VALVE

Illust. 1 is an exploded view of relief valve used on Model 550 Motor Graders Serial Nos. 4659 thru 9499, Also Model 660 Motor Graders - Serial Nos. 1 thru 3999.

REMOVAL

Clean outside of relief valve with an oil solvent or similar fluid and dry thoroughly.

Drain hydraulic reservoir.

Remove hoses and tubing from valve. IMPORTANT: Plug openings in hoses, tubing and fittings to prevent dirt or other foreign matter from entering system.

Remove relief valve from frame.

To disassemble relief valve, reverse the reassembly procedure.

REASSEMBLY

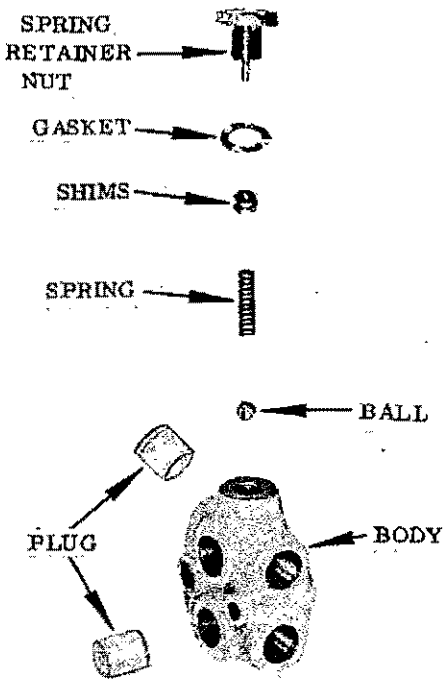
After the valve has been completely disassembled, parts should be washed in an oil solvent and dried thoroughly.

Inspect all parts for wear, pitting or corrosion.

Any parts showing wear should be replaced. If the spring should become weakened enough to effect the pressure, it should be replaced.

Should the ball seat inside valve body show wear the entire relief valve should be replaced.

Apply oil to parts before reassembling.



Illust. 1

When reassembling the valve, extreme care should be exercised to prevent dirt from entering the valve. Be sure nine (9) shims are used between spring and spring retainer nut. A new spring retainer nut gasket should be used.

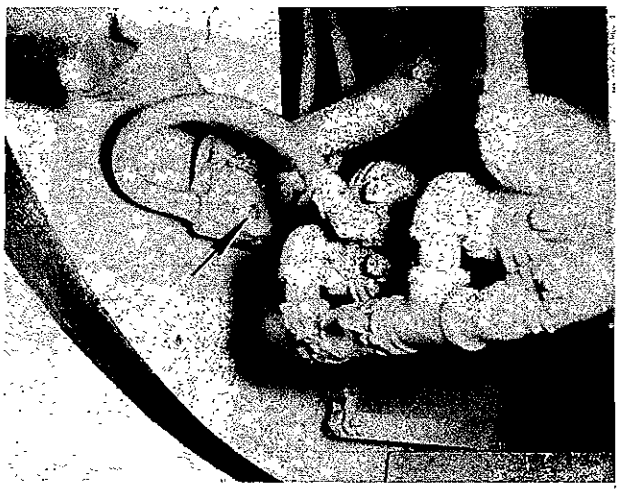
Install ball onto ball seat inside valve body. Next, install spring and nine (9) shims into body.

Install gasket onto spring retainer nut, then tighten nut into valve body (Illust. 1).

If pipe plugs have been removed, reinstall them into body.

Install relief valve onto frame. Install cap screws with lock washers and tighten securely.

Install hoses and tubing to relief valve. IMPORTANT: When reinstalling



Illust. 2

hoses and tubing, be sure plugs are removed from openings.

Refill reservoir with oil. See "Lubricating Instructions". Start engine and check for leaks.

ADJUSTMENT

To adjust the relief valve, remove pipe plug, designated by arrow in Illust. 2 and install a suitable pressure gauge.

Start engine. Pressure should read 1000 P.S.I. Should pressure be less than 1000 P.S.I., add shims under spring retainer nut.

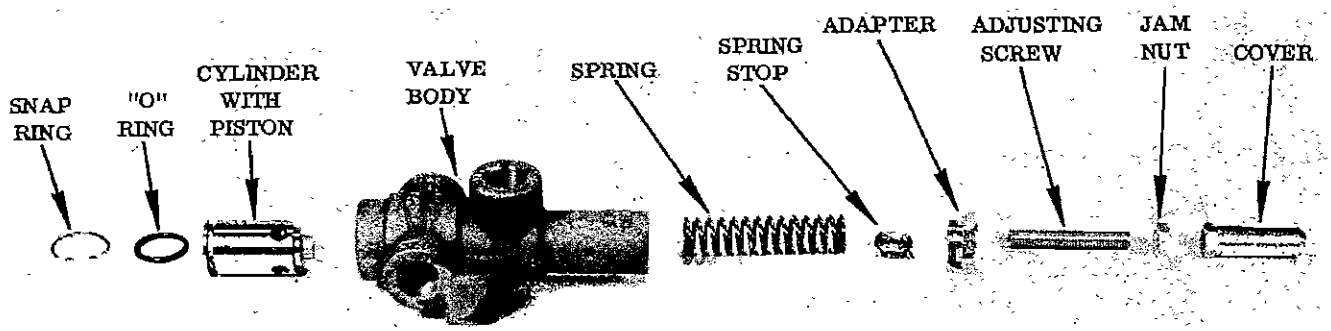
Should pressure be more than 1000 P.S.I., remove shims from under spring retainer nut.

RELIEF VALVE

Illust. 1 is an exploded view of relief valve used on Model 550 Motor Graders Serial Nos. 9500 and Later. Also Model 660 Motor Graders - Serial Nos. 4000 and Later.

REMOVAL

Clean outside of relief valve with an oil solvent or similar fluid and dry thoroughly.



Illust. 1

Drain hydraulic reservoir.

To remove the relief valve from motor grader, reverse the installation procedure.

IMPORTANT: When hoses and tubing are removed, plug openings in hoses, tubing and fittings to prevent dirt or other foreign matter from entering system.

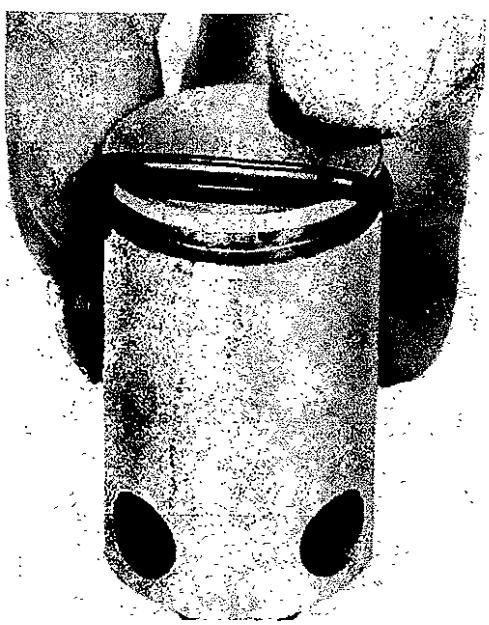
To disassemble valve, reverse reassembly procedure.

REASSEMBLY

After the valve has been completely disassembled, parts should be washed in an oil solvent and dried thoroughly.

Inspect all parts for wear, pitting or corrosion. Any parts showing wear should be replaced.

When reassembling the valve, apply oil to parts. Extreme care should be exercised to prevent dirt from entering valve.



Illust. 2

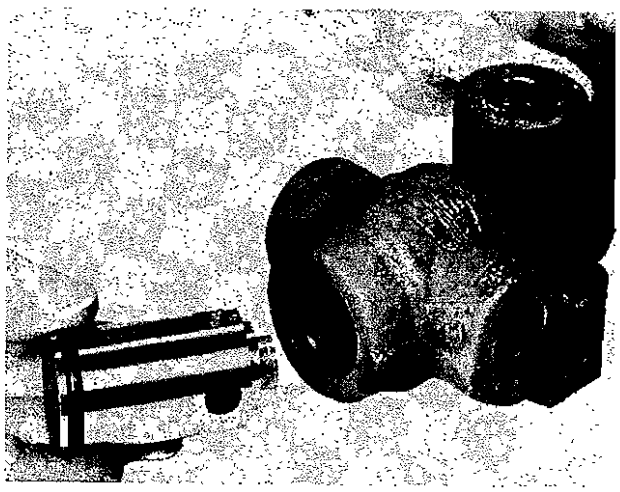
Install "O" ring in groove of cylinder with piston (Illust. 2).

Insert cylinder into valve body (Illust. 3). Push cylinder upward until bottom of cylinder is above snap ring groove. NOTE: Apply white lead to "O" ring to prevent damage.

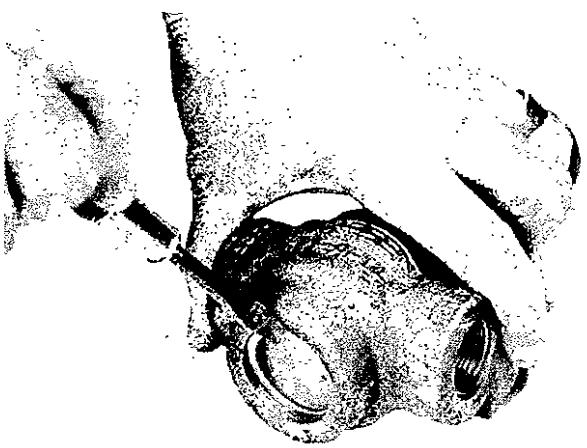
Insert snap ring into groove of valve body (Illust. 4).

Insert spring and spring stop into valve body (Illust. 5).

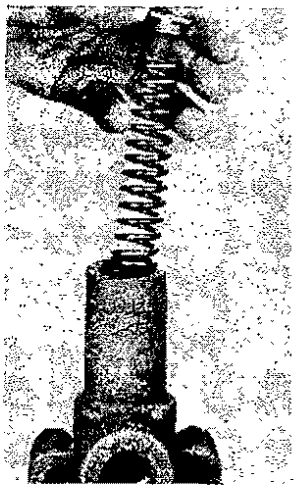
Install adapter onto adjusting screw. Next, install adapter into valve body



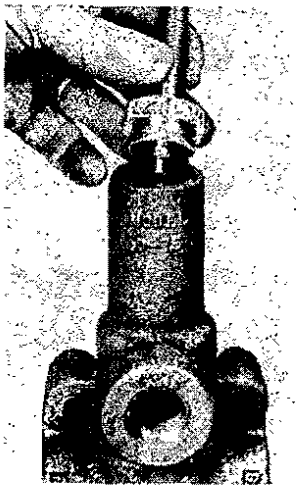
Illust. 3



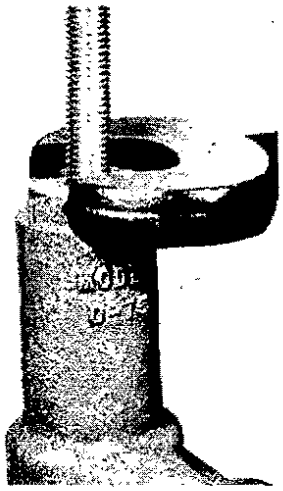
Illust. 4



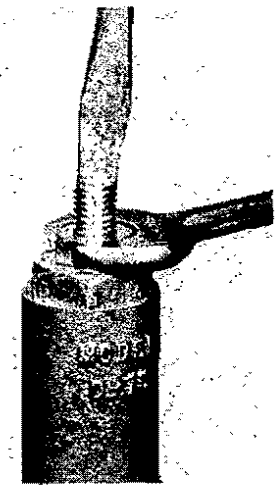
Illust. 5



Illust. 6



Illust. 7

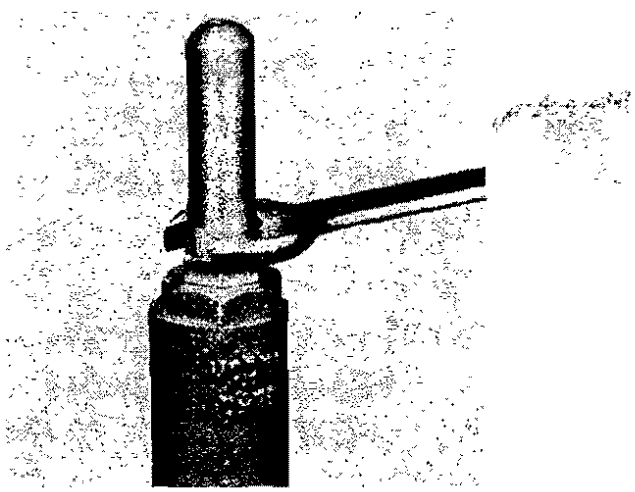


Illust. 8

(Illust. 6). Tighten adapter securely (Illust. 7). NOTE: Tip of adjusting screw to fit in hole of spring stop.

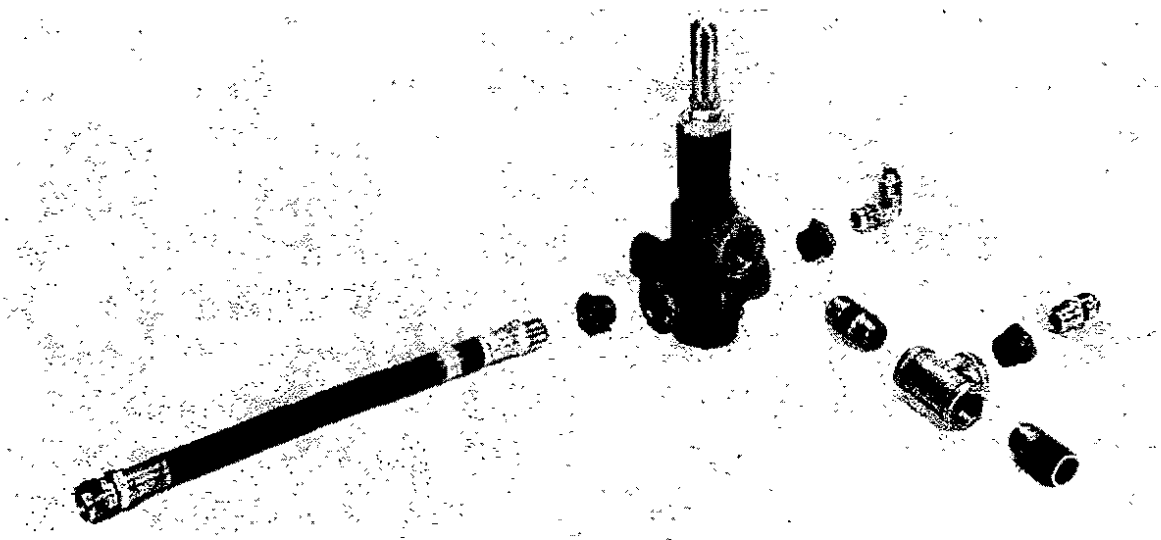
Install jam nut onto adjusting screw. NOTE: As a guide, tighten adjusting screw until bottom of slot is approximately 9/16 of an inch from top of jam nut then tighten jam nut securely (Illust. 8).

Install cover onto adjusting screw and tighten securely (Illust. 9).



Illust. 9

Illust. 10 is a view of the relief valve



Illust. 10

showing location of fittings. NOTE: Use a pipe sealing compound on fitting threads. Tighten fittings securely.

RELIEF VALVE INSTALLATION

Install relief valve onto frame. Next, install cap screws and lock washers. Tighten cap screws securely (Illust. 1).

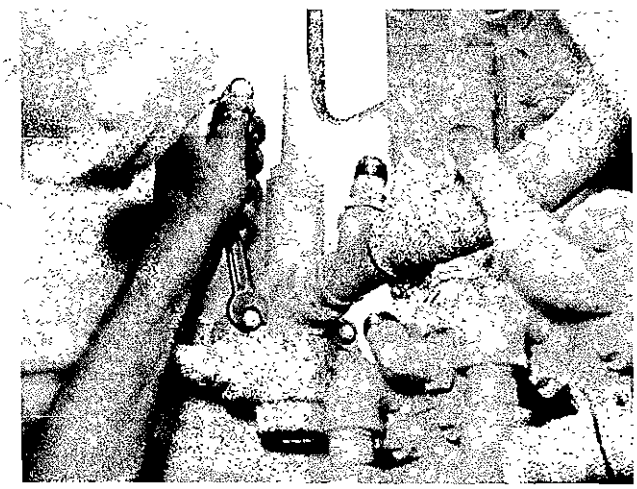
Install and tighten pressure hose to elbow fitting in pump (Illust. 2). NOTE: Do not twist hose while tightening.

Install return hose onto nipple of relief valve then tighten clamp securely (Illust. 3).

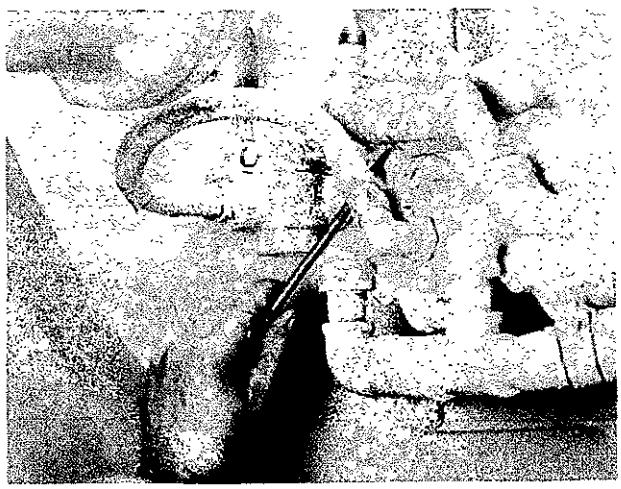
Install and tighten return line fitting to straight fitting of tee (Illust. 4).

Install and tighten pressure line fitting onto elbow in relief valve (Illust. 5).

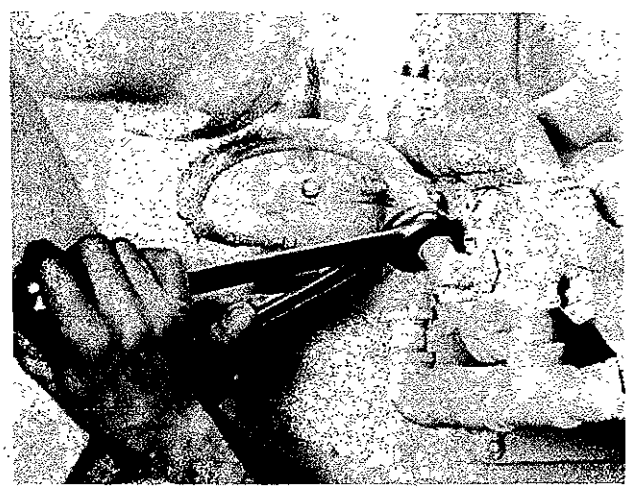
IMPORTANT: Fill hydraulic reservoir with correct lubricant. See "Lubricating Instructions".



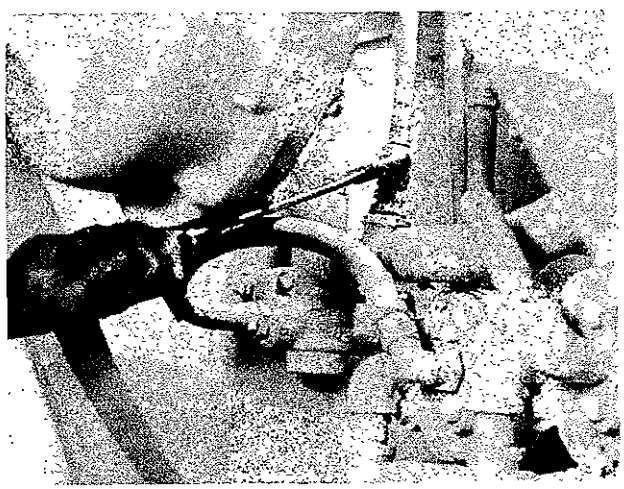
Illust. 1



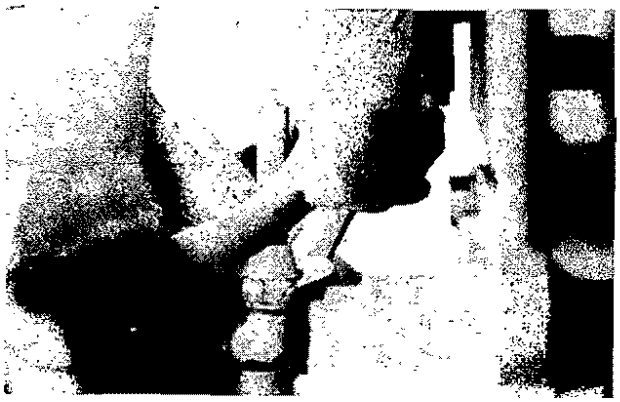
Illust. 3



Illust. 2

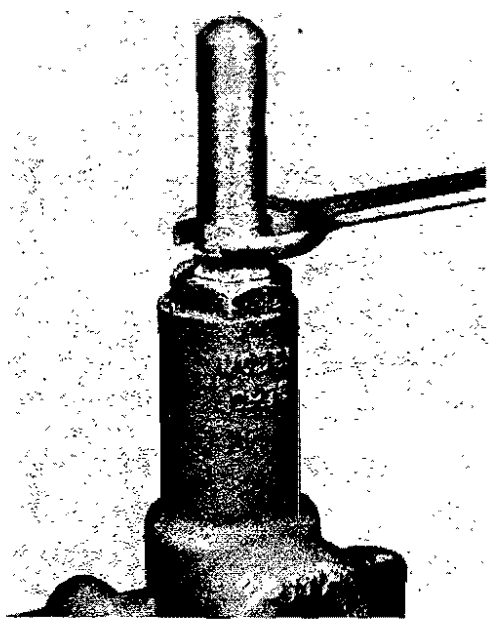


Illust. 4



Illust. 5

Illust. 1



Illust. 2

Start engine and check connections for leakage.

RELIEF VALVE ADJUSTMENT

To adjust the relief valve, remove pressure line from elbow in valve (Illust. 1). Next, remove elbow from valve body and install a pressure gauge.

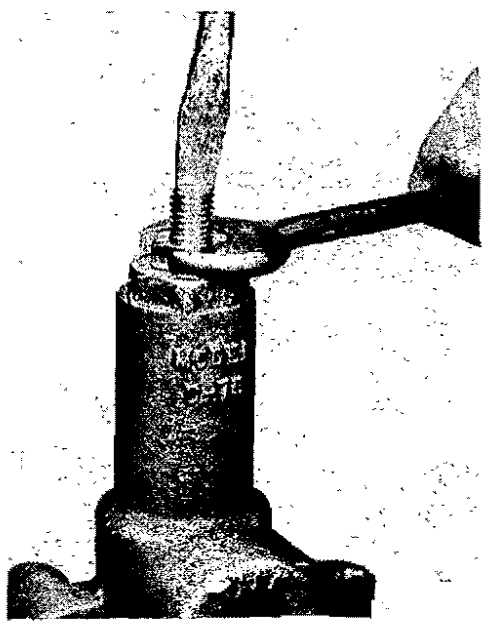
Remove cover from adjusting screw (Illust. 2).

Start engine and rev engine to maximum R.P.M. Loosen jam nut and with a screw driver turn adjusting screw until a reading of 1200 P.S.I. is obtained on the gauge (Illust. 3) then retighten jam nut while holding the screw driver in place.

Shut engine off and remove gauge.

Reinstall cover, elbow and pressure line.

Check oil level in reservoir and add oil if necessary. Restart engine and check for leaks.



Illust. 3

Drain hydraulic reservoir.

To remove the relief valve from motor grader, reverse the installation procedure.

IMPORTANT: When hoses and tubing are removed, plug openings in hoses, tubing and fittings to prevent dirt or other foreign matter from entering system.

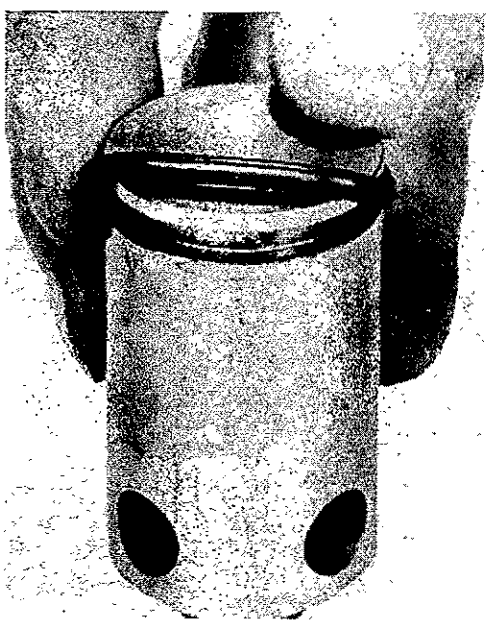
To disassemble valve, reverse reassembly procedure.

REASSEMBLY

After the valve has been completely disassembled, parts should be washed in an oil solvent and dried thoroughly.

Inspect all parts for wear, pitting or corrosion. Any parts showing wear should be replaced.

When reassembling the valve, apply oil to parts. Extreme care should be exercised to prevent dirt from entering valve.



Illust. 2

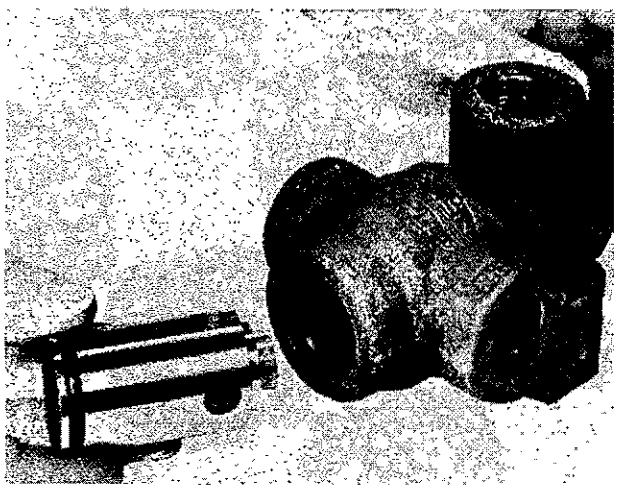
Install "O" ring in groove of cylinder with piston (Illust. 2).

Insert cylinder into valve body (Illust. 3). Push cylinder upward until bottom of cylinder is above snap ring groove. NOTE: Apply white lead to "O" ring to prevent damage.

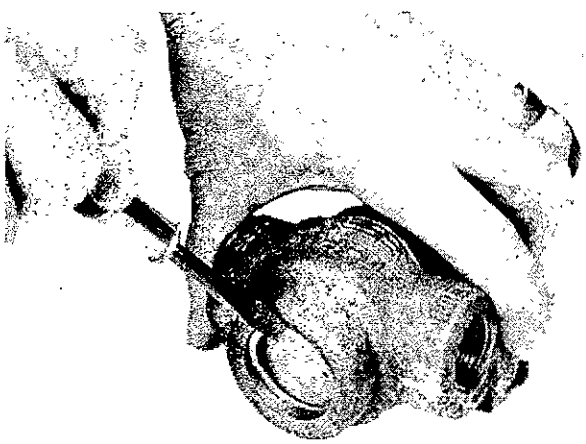
Insert snap ring into groove of valve body (Illust. 4).

Insert spring and spring stop into valve body (Illust. 5).

Install adapter onto adjusting screw. Next, install adapter into valve body



Illust. 3



Illust. 4

— NOTES —