

**SERVICE MANUAL**

***VELVET DRIVE***<sup>®</sup>  
**HYDRAULIC TRANSMISSION**

**MODEL 73C**  
**DIRECT DRIVE and**  
**1.5:1, 2.0:1, 3.0:1**  
**REDUCTION RATIOS**

PRINTED IN U.S.A.

**WARNER GEAR**

marine  
transmissions



Muncie, Indiana • DIVISION OF BORG WARNER CORPORATION

# TABLE OF CONTENTS

|  |    |
|--|----|
| ASSEMBLY DRAWING.....  | 3  |
| DESCRIPTION.....   | 4  |
| INSTALLATION DRAWING.....  | 5  |
| PARTS DISPLAY AND PARTS LISTS.....                                 | 6  |
| HYDRAULIC CIRCUITS.....  | 10 |
| OPERATION.....   | 11 |
| INSTALLATION PRECAUTIONS.....                                      | 12 |
| DISASSEMBLY OF TRANSMISSION.....                                   | 13 |
| Procedure for All Models.....                                      | 13 |
| To Complete Disassembly of Direct Drive Transmissions.....         | 15 |
| Disassembly of Reduction Units.....                                | 17 |
| INSPECTION AND GENERAL INSTRUCTIONS.....                           | 19 |
| ASSEMBLY OF TRANSMISSION.....                                      | 20 |
| Procedure for All Models.....                                      | 20 |
| To complete Assembly of Forward and Reverse Transmission.....      | 21 |
| TO ASSEMBLE TRANSMISSION WITH REDUCTION UNIT.....                  | 26 |
| ASSEMBLING REDUCTION UNIT TO FORWARD AND REVERSE TRANSMISSION..... | 30 |
| SERVICE PRECAUTIONS AND INSTRUCTIONS.....                          | 31 |
| REPAIR KITS FOR MODEL 73C.....                                     | 32 |
| TROUBLE SHOOTING CHART.....  | 33 |
| PINION CAGE INSTRUCTION SHEETS.....                                | 34 |
| TORQUE SPECIFICATIONS.....   | 36 |
| GENERAL SPECIFICATIONS SUMMARY.....                                | 36 |

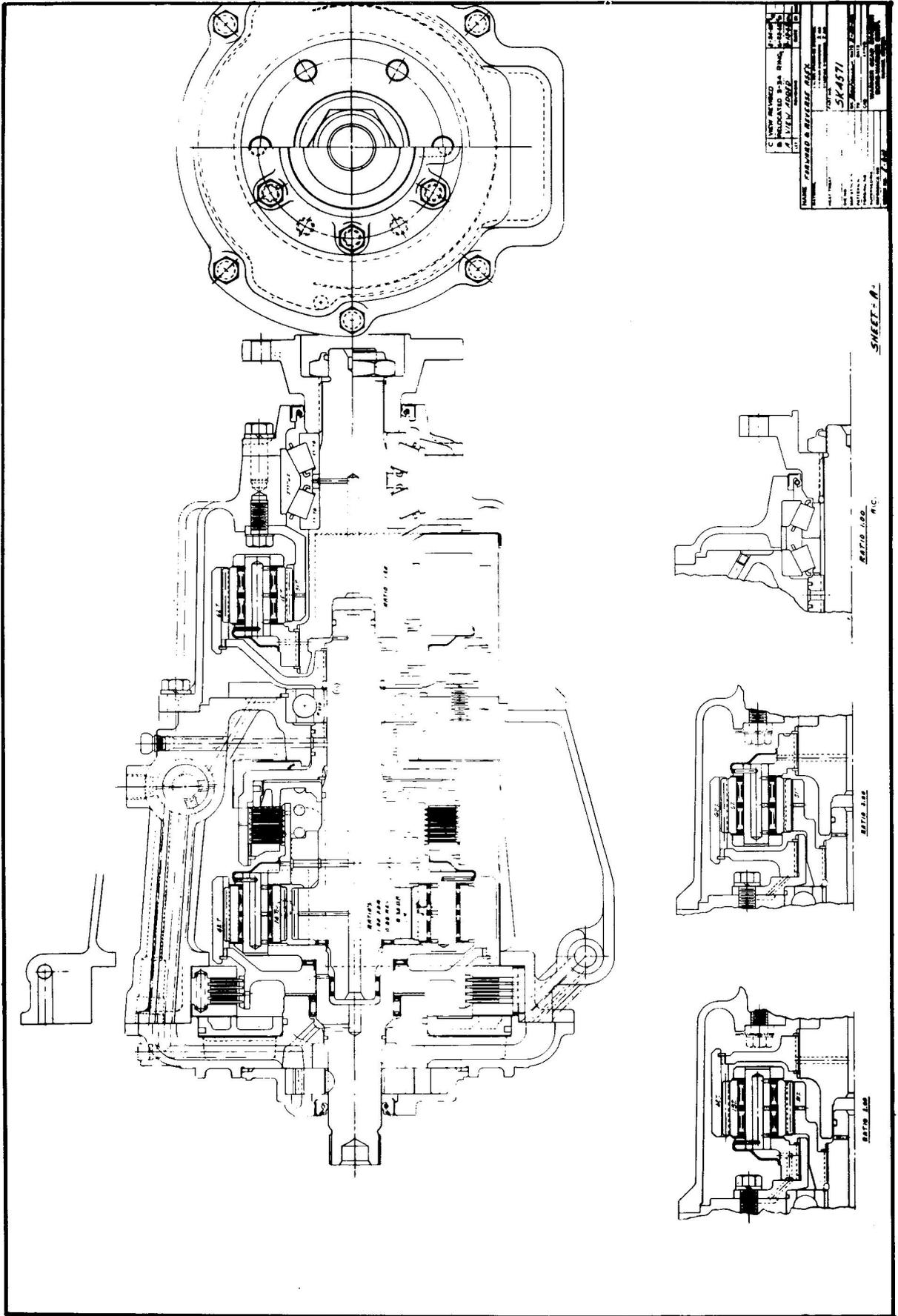


Fig. 1 Assembly Drawing Showing All Models

## DESCRIPTION

The model "73C" transmission described in this manual consists of a forward and reverse gear box, which may or may not have any one of three reduction ratios, contained in a separate housing and attached to the rear face of the transmission. Input and output shafts are all coaxial and splined at their outer ends.

The forward and reverse transmission consists of a planetary gearset, a forward clutch, a reverse clutch, an oil pump, and a pressure regulator and rotary control valve, all contained in a cast iron housing. The forward clutch locks the input to the output shaft for direct drive (1.00 to 1.00 ratio), when the selector valve is in the forward position. Reverse is obtained by placing selector valve in reverse position. The selector valve directs the hydraulic oil to the reverse clutch which causes a reverse ratio of .88 to 1.00 in a reverse rotation from input shaft.

A crescent type gear pump supplies oil from the sump to the pressure regulator valve which regulates the oil for clutch operation and the excess oil is dumped to supply oil for cooler and lubrication needs. Two ball check valves and springs

maintain cooler and lube pressure and the excess oil is returned to pump suction.

Three reduction ratios (3.00 to 1.00, 2.00 to 1.00 and 1.50 to 1.00) may be used in conjunction with the forward and reverse transmission. Reduction units are always engaged and have the same reduction in forward and reverse; however the over all reverse ratio is different from forward ratio due to the ratio difference of the forward and reverse transmission.

LOCATION OF SEVERAL TRANSMISSION DETAILS ARE SHOWN IN FIGURES 2 AND 3 AS FOLLOWS:

- A. Shift Lever
- B. Oil to Cooler
- C. Oil from Cooler
- D. Reverse Clutch Pressure Tap
- E. Mounting Pads and Bolt Holes
- F. Drain Plug
- G. Dipstick and Filler Hole Plug
- H. Forward Clutch Pressure Tap
- I. Breather
- J. Input Shaft
- K. Oil Pump
- L. Coupling
- M. Reduction Housing
- N. Adapter
- O. Lube Pressure Tap

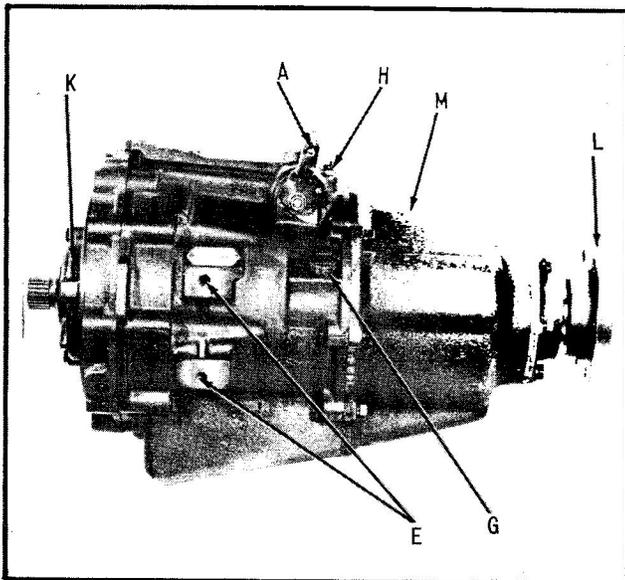


Fig. 2 Left Side View of Transmission

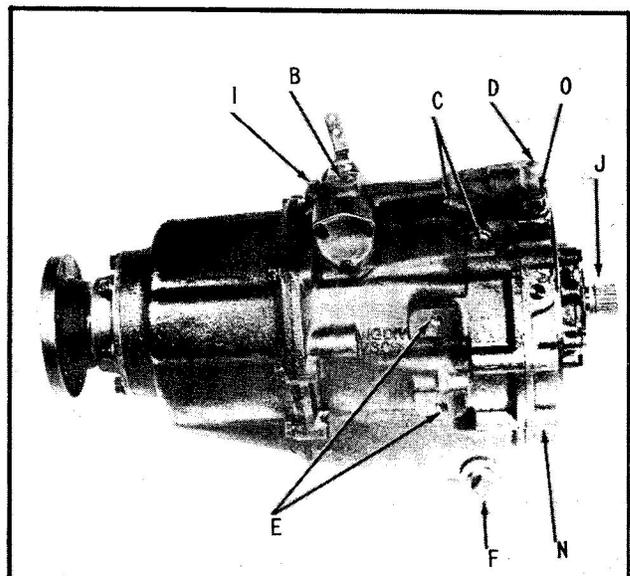


Fig. 3 Right Side View of Transmission



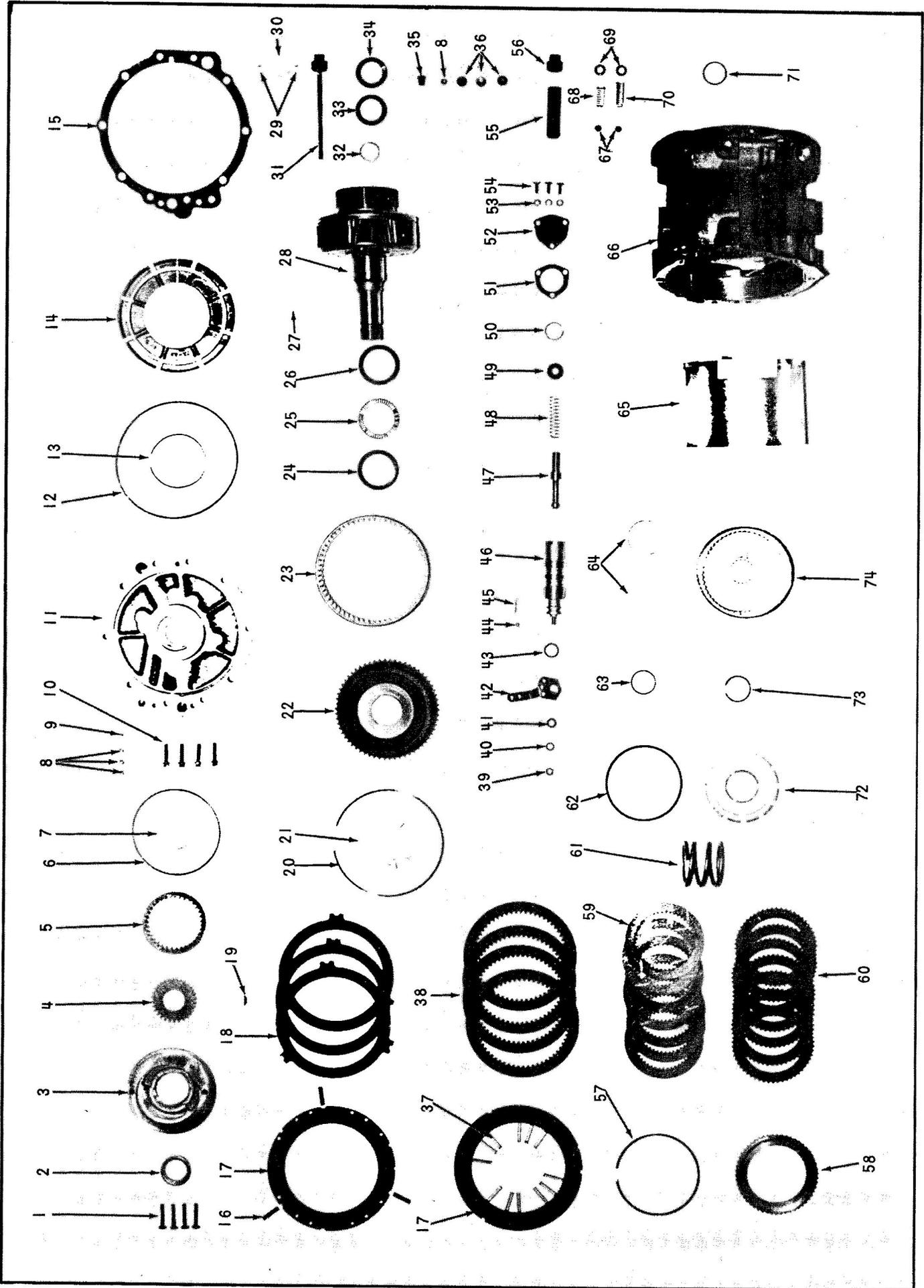


Fig. 5 Display of Parts used in Forward & Reverse Portion of All Model "73C" Transmissions

| INDEX NO. | PART NO. | PART NAME                          | NO. REQ'D | INDEX NO. | PART NO. | PART NAME                              | NO. REQ'D | INDEX NO. | PART NO. | PART NAME                             | NO. REQ'D |
|-----------|----------|------------------------------------|-----------|-----------|----------|--|-----------|-----------|----------|---------------------------------------|-----------|
| 1         | 179822   | 5/16-18x1-1/2 HEX HEAD BOLT        | 4         | 33        | 4832     | THRUST BEARING RACE                    | 1         | 66        | 73C-1    | FORWARD & REVERSE TRANS- MISSION CASE | 1         |
| 2         | 71C-62   | OIL SEAL ASSEMBLY                  | 1         | 34        | 4830C    | NEEDLE BEARING                         | 1         | 67        | 453595   | 7/16 STEEL BALL                       | 2         |
| 3         | 71C-60   | PUMP HOUSING                       | 1         | 35        | 4740A    | BREATHER ASSEMBLY                      | 3         | 68        | 68C-269  | CHECK VALVE SPRING                    | 1         |
| 4         | 71-64    | PUMP DRIVEN GEAR                   | 1         | 36        | 444864   | 3/8 PIPE PLUG                          | 12        | 69        | 68C-268  | CHECK VALVE SPRING RETAINER           | 2         |
| 5         | 3-63A    | PUMP DRIVEN GEAR                   | 1         | 37        | 71-97    | PRESSURE PLATE SPRING                  | 4         | 70        | 72M-273  | COOLER CHECK VALVE SPRING             | 1         |
| 6         | 3-61     | PUMP GASKET                        | 1         | 38        | 72-A668  | REVERSE CLUTCH INNER PLATE             | 1         | 71        | 3-34     | "0" RING                              | 1         |
| 7         | 4840T    | NEEDLE BEARING                     | 1         | 39        | 115729   | 5/16-24 HEX NUT                        | 1         | 72        | 6-A45    | CLUTCH PISTON                         | 1         |
| 8         | 444852   | 1/8 PIPE PLUG                      | 4         | 40        | 108579   | 5/16 LOCK WASHER                       | 1         | 73        | 4559A    | SNAP RING                             | 1         |
| 9         | 444858   | 1/4 PIPE PLUG                      | 1         | 41        | 103340   | CONTROL LEVER WASHER                   | 1         | 74        | 73C-50   | DIRECT CLUTCH CYLINDER                | 1         |
| 10        | 4911     | 3/8-16x1-1/4 CAPSCREW              | 4         | 42        | 68C-79   | FORWARD & REVERSE SHIFT LEVER          | 1         |           |          |                                       |           |
| 11        | 73C-8    | TRANSMISSION ADAPTER               | 1         | 43        | 4804H    | "0" RING                               | 1         |           |          |                                       |           |
| 12        | 4805A    | SEALING RING                       | 1         | 44        | 453632   | 5/16 STEEL BALL                        | 1         |           |          |                                       |           |
| 13        | 4804G    | SEALING RING                       | 1         | 45        | 71-42    | POPPET SPRING                          | 1         |           |          |                                       |           |
| 14        | 71-35    | REVERSE CLUTCH PISTON              | 1         | 46        | 68C-244  | FORWARD & REVERSE TRANS- MISSION VALVE | 1         |           |          |                                       |           |
| 15        | 73C-144  | CASE AND ADAPTER GASKET            | 1         | 47        | 68C-243  | REGULATOR VALVE                        | 1         |           |          |                                       |           |
| 16        | 4622F    | DOWEL PIN                          | 3         | 48        | 50-246   | VALVE SPRING                           | 1         |           |          |                                       |           |
| 17        | 71-71    | REVERSE CLUTCH PRESSURE PLATE      | 2         | 49        | 71-246   | VALVE SPRING RETAINER                  | 1         |           |          |                                       |           |
| 18        | 72-176   | REVERSE CLUTCH OUTER PLATE         | 3         | 50        | 4821     | SNAP RING                              | 1         |           |          |                                       |           |
| 19        | 4873     | PUMP DRIVE KEY                     | 1         | 51        | 71-14    | VALVE COVER GASKET                     | 1         |           |          |                                       |           |
| 20        | 4822A    | RING GEAR SNAP RING                | 1         | 52        | 71-4     | VALVE COVER                            | 1         |           |          |                                       |           |
| 21        | 73C-15   | RING GEAR HUB THRUST WASHER        | 1         | 53        | 103319   | 1/4 LOCK WASHER                        | 3         |           |          |                                       |           |
| 22        | 73C-106  | RING GEAR HUB-FRONT                | 1         | 54        | 179793   | 1/4-20x5/8 HEX HEAD BOLT               | 3         |           |          |                                       |           |
| 23        | 73C-6    | RING GEAR                          | 1         | 55        | 71C-A98A | OIL STRAINER ASSEMBLY                  | 1         |           |          |                                       |           |
| 24        | 4832B    | NEEDLE BEARING RACE- LIPPED        | 1         | 56        | 444592   | 3/4 PIPE PLUG                          | 1         |           |          |                                       |           |
| 25        | 4830D    | NEEDLE BEARING                     | 1         | 57        | 4751     | SNAP RING                              | 1         |           |          |                                       |           |
| 26        | 4832D    | NEEDLE BEARING RACE-FLAT           | 1         | 58        | 5L-67    | CLUTCH PRESSURE PLATE                  | 1         |           |          |                                       |           |
| 27        | 4806A    | SEALING RING                       | 1         | 59        | 5C-A66   | CLUTCH INNER PLATE ASSEMBLY            | 7         |           |          |                                       |           |
| 28        | 73C-1A16 | PINION CAGE & INPUT SHAFT ASSEMBLY | 1         | 60        | 3-176A   | CLUTCH PLATE                           | 7         |           |          |                                       |           |
| 29        | 145366   | DRIVE SCREW                        | 2         | 61        | 3-47A    | CLUTCH SPRING                          | 1         |           |          |                                       |           |
| 30        | 4636MT   | NAME PLATE                         | 1         | 62        | 3-46     | SEALING RING                           | 1         |           |          |                                       |           |
| 31        | 71-2A195 | DIPSTICK ASSEMBLY                  | 1         | 63        | 3-44     | SEALING RING                           | 1         |           |          |                                       |           |
| 32        | 4840R    | NEEDLE BEARING                     | 1         | 64        | 4806R    | SEALING RING                           | 2         |           |          |                                       |           |
|           |          |                                    | 1         | 65        | 73C-140  | OIL BAFFLE                             | 1         |           |          |                                       |           |

Parts Required for All Model "73C" Transmissions

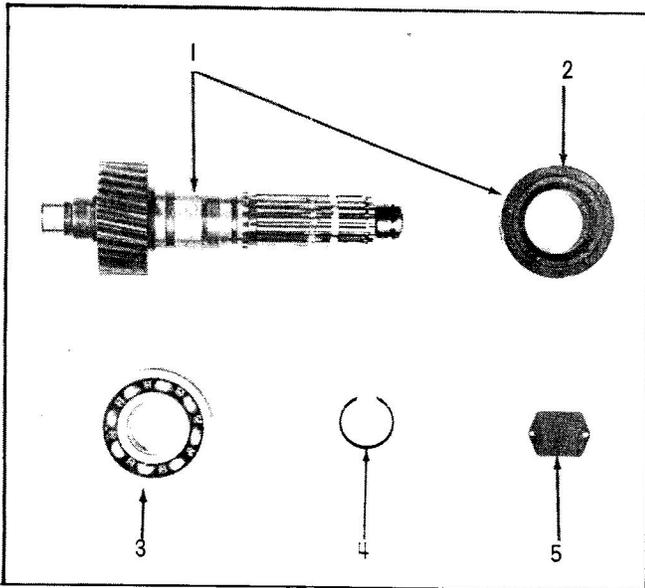


Fig. 6 Reduction Unit Parts

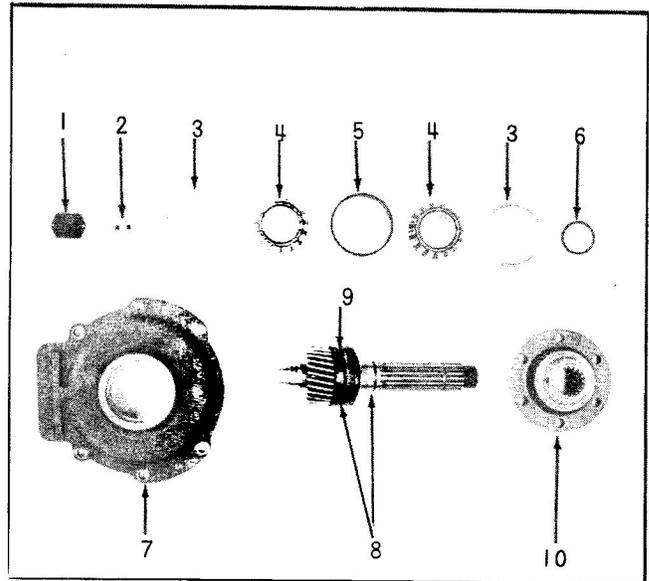


Fig. 6A Direct Drive Unit Parts

Figs. 6 and 6A show parts that are required to complete the forward and reverse transmission portion of the "Model 73C" transmissions.

| INDEX NO. | PART NO. | PART NAME                      | NO. REQ'D. | INDEX NO. | PART NO. | PART NAME                      | NO. REQ'D. |
|-----------|----------|--------------------------------|------------|-----------|----------|--------------------------------|------------|
| 1         | 73C-A2A  | OUTPUT SHAFT & SLEEVE ASSEMBLY | 1          | 1         | 4636MT   | NAME PLATE                     | 1          |
| 2         | 73C-12   | SUN GEAR BEARING SLEEVE (ONLY) | 1          | 2         | 4572N    | CUP PLUG                       | 2          |
| 3         | 4978AG   | BEARING                        | 1          | 3         | 4923G    | BEARING CUP                    | 2          |
| 4         | 4746     | SNAP RING                      | 1          | 4         | 4922G    | BEARING CONE                   | 2          |
| 5         | 4636MV   | NAME PLATE (3:1 RATIO)         | 1          | 5         | 73C-75   | BEARING SPACER                 | 1          |
|           | 4636MW   | NAME PLATE (2:1 RATIO)         |            | 6         | 4652KK   | BEARING SPACER                 | 1          |
|           | 4636MU   | NAME PLATE (1.5:1 RATIO)       |            | 7         | 73C-7    | BEARING RETAINER               | 1          |
|           |          |                                |            | 8         | 73C-A2B  | OUTPUT SHAFT & SLEEVE ASSEMBLY | 1          |
|           |          |                                |            | 9         | 73C-12   | SUNGEAR BEARING SLEEVE (ONLY)  | 1          |
|           |          |                                |            | 10        | 4914A    | COUPLING                       | 1          |

### ORDERING PARTS

Parts orders should include the part number and a description of each item. The transmission serial and model number should also be included so that in certain cases the correct part may be selected. When serial or model numbers can not be read from name plate, check your sales contract for such numbers. Your dealer may be able to help with the correct model number or sometimes pictures in service manuals will clearly show your model, if so, state the likeness and give all other information, which would help

identify your transmission. The engine behind which the transmission is installed will sometimes help determine size of transmission.

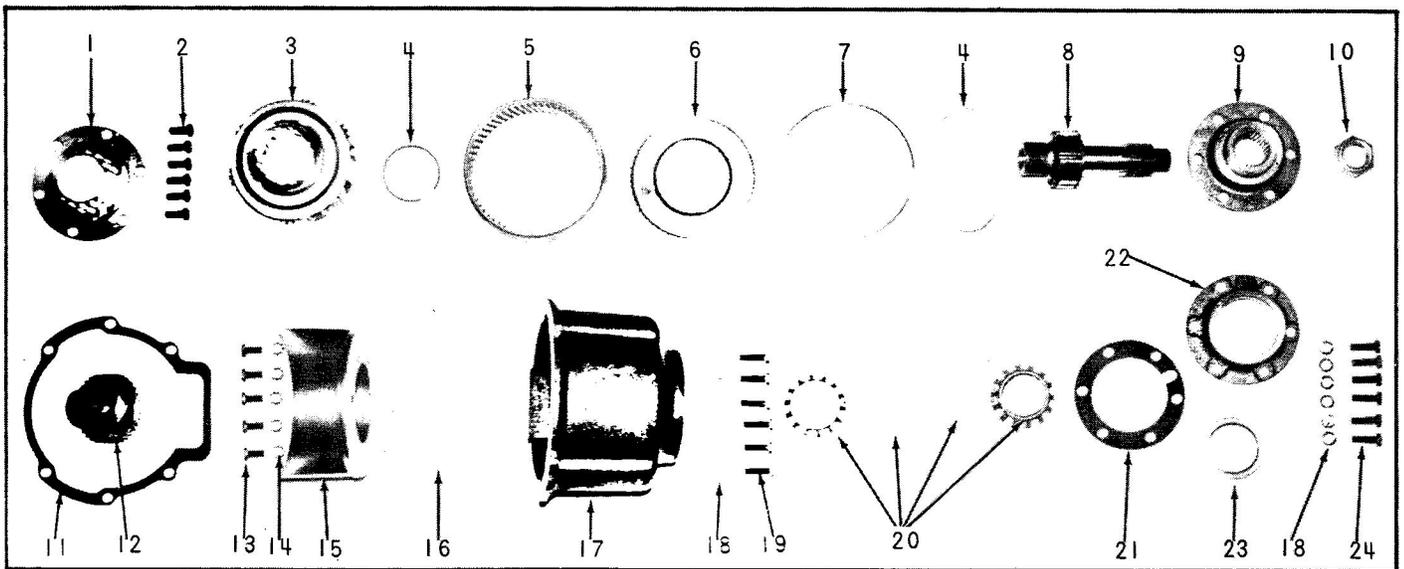


Fig. 7 Parts Display for 2.00 and 3.00 to 1.00 Reduction Units

| INDEX NO. | PART NO. | PART NAME               | NO. REQ'D. | INDEX NO. | PART NO. | PART NAME                   | NO. REQ'D. |
|-----------|----------|-------------------------|------------|-----------|----------|-----------------------------|------------|
| 1         | L17-8    | BEARING RETAINER-FRONT  | 1          | 13        | 179857   | 7/16-14x7/8 HEX HEAD BOLT   | 5          |
| 2         | 191641   | 7/16-14x1 LOCK BOLT     | 6          | 14        | 114607   | 7/16 LOCK WASHER            | 5          |
| 3         | L14-A150 | PINION CAGE ASSEMBLY    | 1          | 15        | L14-140  | REDUCTION OIL BAFFLE        | 1          |
| 4         | 4765B    | SNAP RING               | 3          | 16        | L17-141  | OIL BAFFLE SPACER           | 1          |
| 5         | 73C-6    | REDUCTION RING GEAR     | 1          | 17        | L14-1    | REDUCTION UNIT HOUSING      | 1          |
| 6         | L17-16   | REDUCTION RING GEAR HUB | 1          | 18        | 103322   | 7/16 LOCK WASHER            | 12         |
| 7         | 4822A    | RING GEAR SNAP RING     | 1          | 19        | 179861   | 7/16-14x1-3/8 HEX HEAD BOLT | 6          |
| 8         | L17-2    | REDUCTION OUTPUT SHAFT  | 1          | 20        | 4920B    | BEARING (COMPLETE)          | 1          |
| 9         | 4914     | COMPANION FLANGE        | 1          | 21        | 73C-147  | BEARING RETAINER GASKET     | 1          |
| 10        | 4775T    | MAINSHAFT NUT           | 1          | 22        | L14-7    | BEARING RETAINER-REAR       | 1          |
| 11        | 73C-146  | CASE GASKET REAR        | 1          | 23        | L14-110  | OIL SEAL                    | 1          |
| 12        | L17-4    | REDUCTION SUN GEAR      | 1          | 24        | 179860   | 7/16-14x1-1/4 HEX HEAD BOLT | 6          |

| INDEX NO. | PART NO. | PART NAME                 | NO. REQ'D. |
|-----------|----------|---------------------------|------------|
| 1         | 4745E    | SNAP RING                 | 1          |
| 2         | L14-8    | BEARING RETAINER-FRONT    | 1          |
| 3         | L14-16   | RING GEAR HUB             | 1          |
| 4         | L14-2    | REDUCTION OUTPUT SHAFT    | 1          |
| 5         | L14-4    | REDUCTION SUN GEAR        | 1          |
| 6         | 179857   | 7/16-14x7/8 HEX HEAD BOLT | 6          |
| 7         | 114607   | 7/16 LOCK WASHER          | 6          |
| 8         | 191641   | 7/16-14x1 LOCK BOLT       | 5          |

Fig. 8 illustrates parts of the 1.50 to 1.00 reduction unit, which are different from the 2.00 and 3.00 to 1.00 units. All parts not listed should be ordered from the 2.00 and 3.00 to 1.00 parts list. Items 6, 7, and 8 are used in all units but in different locations and differing numbers.

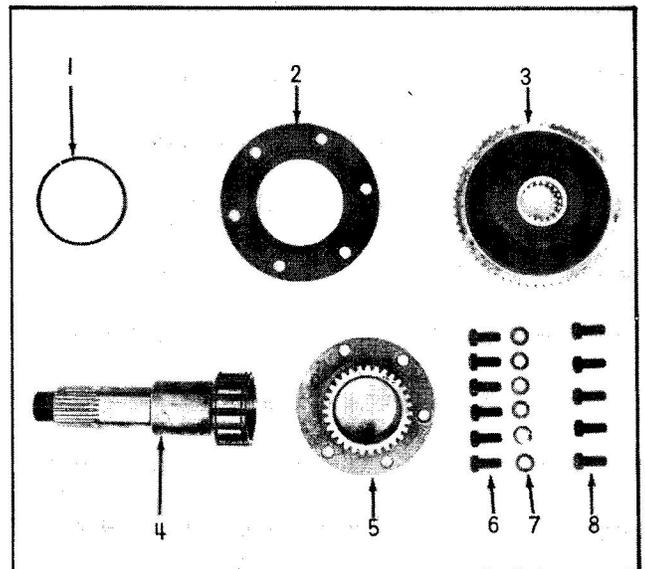


Fig. 8 Display for 1.5 to 1 Unit

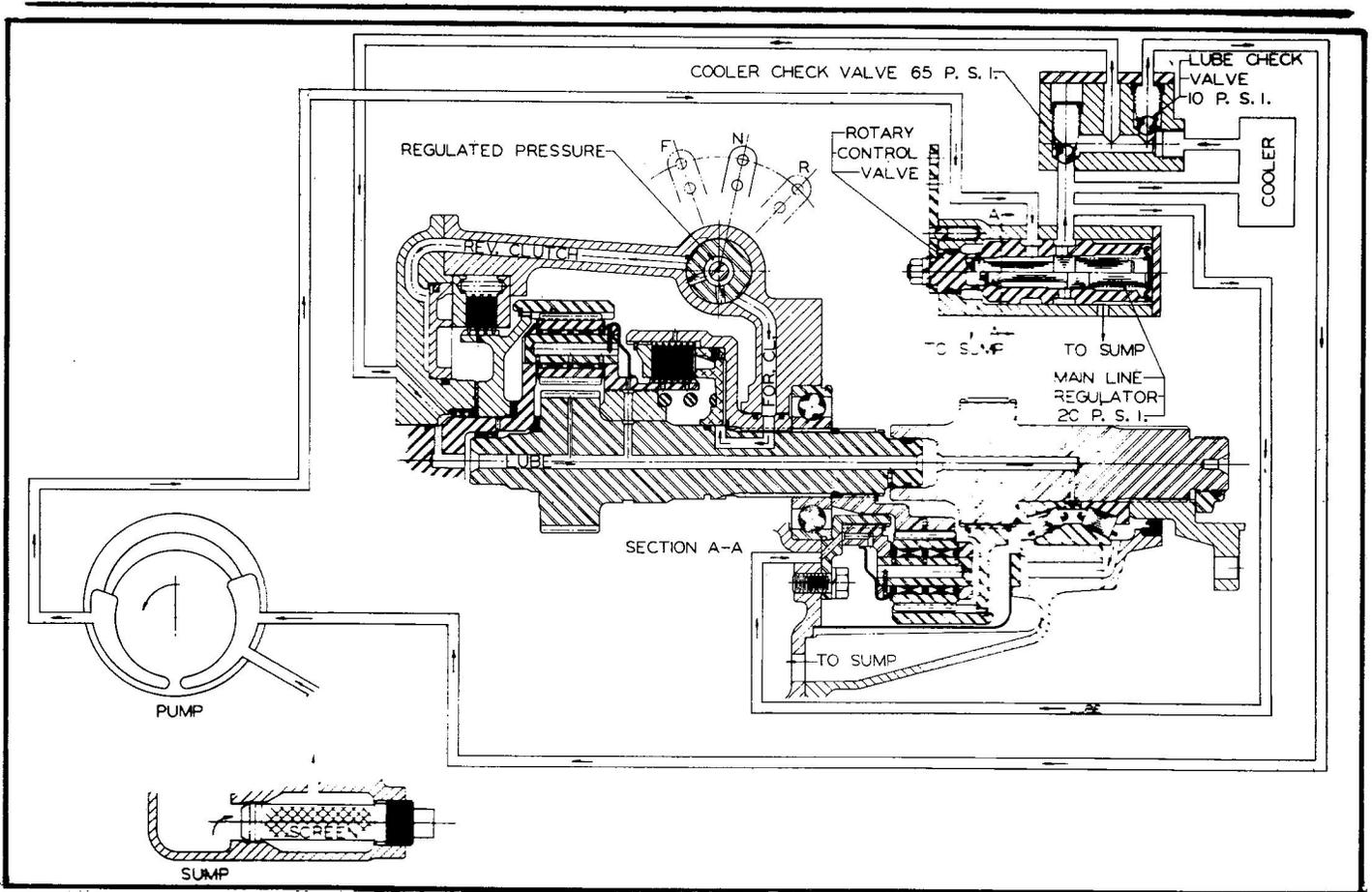


Fig. 9 AS7-73C Transmission Hydraulic Circuits

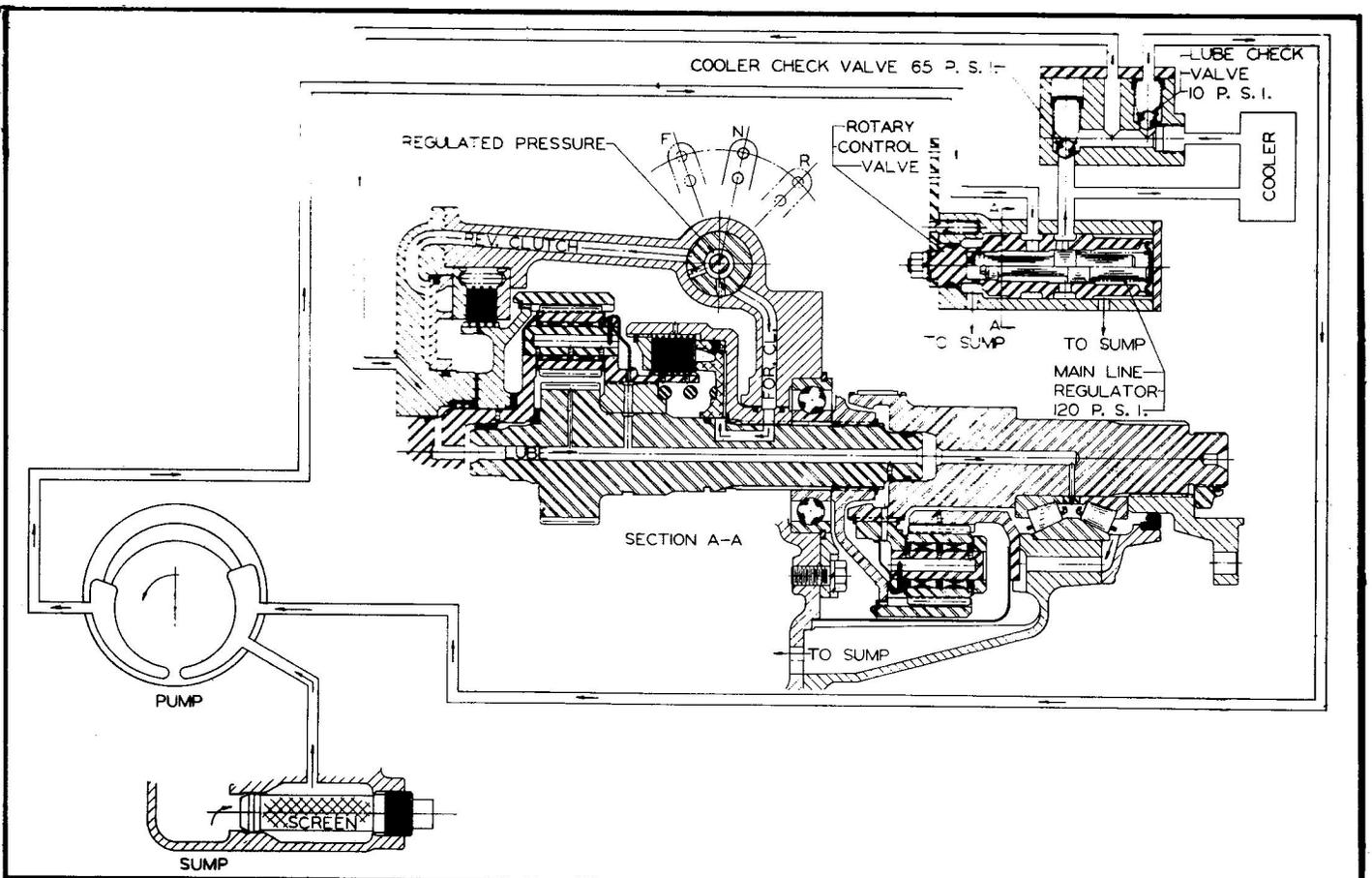


Fig. 10 AS2-73C Transmission Hydraulic Circuits

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# OPERATION

## STARTING ENGINE

Place transmission selector in neutral before starting engine. Shifts from any selector position to any other selector position may be made at any time and in any order if the engine speed is below 1000 RPM; however it is recommended that all shifts be made at the lowest feasible engine speed.

## NEUTRAL

Move the shift lever to the center position where the spring loaded ball enters the chamfered hole in the side of the shift lever and properly locates lever in neutral position, (Fig. 4). With shift lever so positioned, flow of oil to clutches is blocked at the control valve. The clutches are exhausted by a portion of the valve and complete interruption of power transmission is insured.

## FORWARD

Move the shift lever to the extreme forward position where the spring loaded ball enters the chamfered hole in the

side of the shift lever and properly locates lever in forward position, (Fig. 4). The input and output shafts are locked together by the forward clutch and 1.00 to 1.00 ratio is obtained for forward operation.

## REVERSE

Move transmission shift lever to the extreme rearward position where the spring loaded ball enters the chamfered hole in the side of the shift lever and properly locates it in the reverse position, (Fig. 4). Fluid directed by the shift valve applies the reverse clutch and causes the clutch plates to hold the ring gear. The planet carrier and input shaft, turning at engine speed, drives the pinion shafts and cause the pinions to rotate about the shafts inside the ring gear. As the pinions rotate they force the sun gear and output shaft to rotate in reverse rotation and at an input to output shaft ratio of .88 to 1.00.

# HYDRAULIC CIRCUITS

The transmission case is used as a sump for transmission fluid. Fluid leaving sump passes through an oil strainer and into case passages, which direct fluid to inlet side of pump. Fluid leaving pump under pressure goes directly to the rotary shift valve and regulator valve. The regulator valve, set to open at 120 PSI dumps excess fluid to maintain correct line pressure.

Fluid dumped by regulator valve, passes through case passages, flows from transmission through an externally mounted oil cooler and suitable connecting lines and is returned to transmission lube circuit. A ball check valve, ahead of cooler and set to open at 65 PSI, opens if pressure to cooler becomes excessive, and dumps excess fluid to the lube circuit without going through the cooler. The AS7-73C reduction carrier has cooler pressure feed to its lube circuit.

A ball check valve, set to open at 10 PSI, maintains correct lube pressure to

all transmission components, and returns excess fluid to suction side of pump.

Positioning the rotary shift valve in forward (F) position directs fluid from pump, through the valve and case passages through output shaft passage and into forward clutch cylinder behind clutch piston to apply against clutch plates.

Positioning the shift valve in reverse (R) position directs fluid from pump through the valve and case passages and into adapter passage into the clutch cylinder behind reverse clutch piston, forcing piston to apply against reverse clutch plates.

Fig. 9 illustrates hydraulic circuits of the AS7-73C transmission and shows cooler oil directed to lube the reduction carrier assembly. Fig. 10 illustrates hydraulic circuits of the AS2-73C transmission and is similar to circuits of the AS5 and AS1-73C transmissions.

# INSTALLATION PRECAUTIONS

## ENGINE

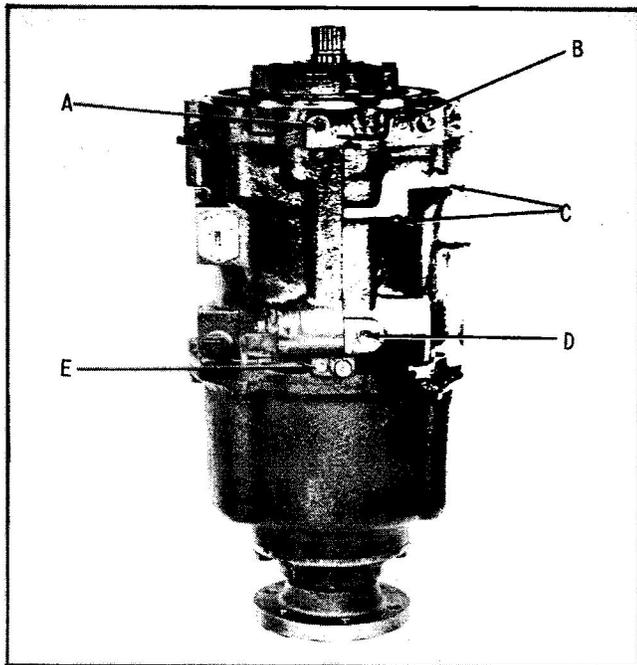
The Model "73C" transmission should not be installed on engines having a torque output in excess of 600 pounds feet. Warner Gear Sales Department recommendations should be obtained before making installations using gasoline engines with top ERPM in excess of 4800, diesel engines with a top ERPM in excess of 3500, or anytime there is a need to have installation questions answered.

## DAMPER ASSEMBLY

A suitable damper assembly should be installed between the engine and Velvet Drive<sup>®</sup> transmission. Assistance, for determining proper damper assembly, may be had by writing to Warner Gear Sales Department.

## ALIGNMENT

Bell housing bore and face total run-out with respect to crankshaft centerline should be a maximum of .010 inch. Propeller shaft alignment with respect to transmission coupling should be within .003 inch limit for bore and face.



A-REVERSE CLUTCH PRESSURE    D-OIL TO COOLER  
B-LUBE PRESSURE                    E-FORWARD CLUTCH  
C-RETURN OIL FROM COOLER        PRESSURE

Fig. 11 Transmission Pressure Outlets

## OIL COOLER

The Warner Gear 12 inch cooler or a cooler of similar size should maintain the desired 140 to 190 degrees F. sump temperature. Oil from fitting (D, Fig. 11) should be connected to the cooler inlet fitting and oil returning from cooler may be connected to either of the two cooler return fittings (C, Fig. 11). Maximum heat transfer will occur when water and oil flow in opposite directions through the cooler.

## PUMP ROTATION

Determine engine rotation and purchase a transmission having pump indexed to match engine rotation; however always check to make certain that pump is correctly indexed before making the installation. Pump can be indexed for opposite rotation by removing the four pump to adapter bolts and without removing pump from housing, tap pump with a soft hammer and rotate pump until the letters representing opposite hand rotation is rearest the top center position with the four bolt holes matching the holes in the adapter. Replace and re-torque the four pump bolts.

## CONTROL LEVER

Controls for shifting transmission should be designed to position the shift lever so that the ball poppet falls into shift lever holes. The Warranty is cancelled if the shift lever poppet spring and/or ball is permanently removed, or if the control lever is changed in any manner, or repositioned, or if linkage between remote control and transmission shift lever does not have sufficient travel in both directions.

## FREE WHEELING

Installations calling for freewheeling of propeller must have a means of stopping the output shaft from prolonged or continuous rotation with the engine stopped.

# DISASSEMBLY OF TRANSMISSION

## PROCEDURE FOR ALL MODELS

1. Tear down procedure should not begin until transmission exterior and work area have been thoroughly cleaned.
2. Remove all pipe plugs, all fittings, filler plug, drain plug and oil screen, (Fig. 12), and permit fluid to drain from transmission.
3. Place transmission upright on bench and remove the four pump to adapter bolts, (Fig. 13). Use a plastic hammer to free pump as it is pulled forward and off of input shaft.
4. Use a marking pencil to mark pump gears so that they may be replaced with both gears in same relative position as they were originally. Press seal from pump housing and discard seal and pump gasket.
5. Remove the four adapter to case bolts and pull adapter from transmission. A large plastic hammer may be needed to help free adapter from snap fit of transmission case. Catch and remove reverse clutch pressure plate as the adapter is removed, (Fig. 14).
6. Blow air into clutch feed hole to force clutch piston from adapter, (Fig. 15). Remove and discard adapter gasket and clutch sealing rings.
7. Remove the three dowel pins, which hold clutch outer plates from turning, and 12 clutch return springs.
8. Pull input shaft forward to remove ring gear, pinion cage assembly and remaining reverse clutch plates from transmission, (Fig. 16).
9. Remove reverse clutch plates from ring gear, thrust washer from ring gear hub, and remove ring gear and

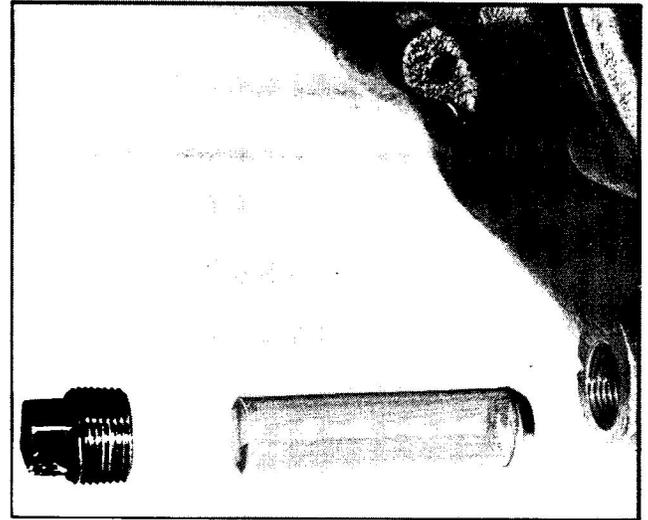


Fig. 12 Remove Drain Plug and Oil Screen

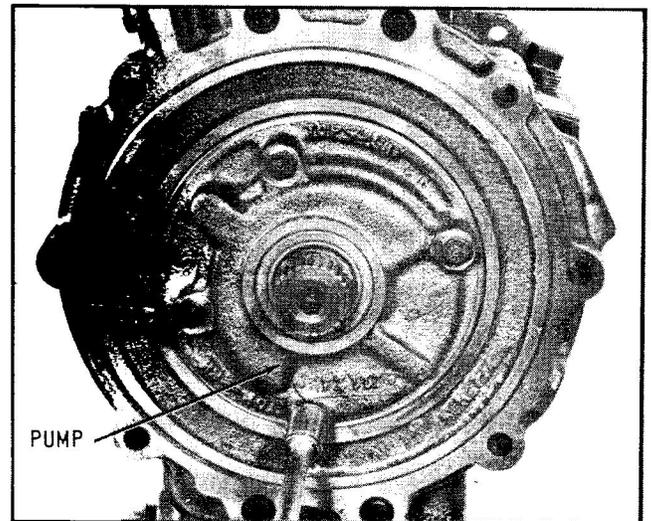


Fig. 13 Remove Pump Bolts

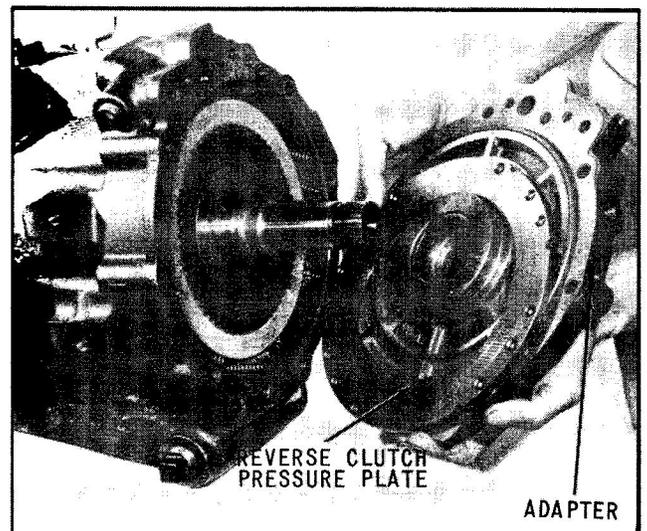


Fig. 14 Remove Adapter

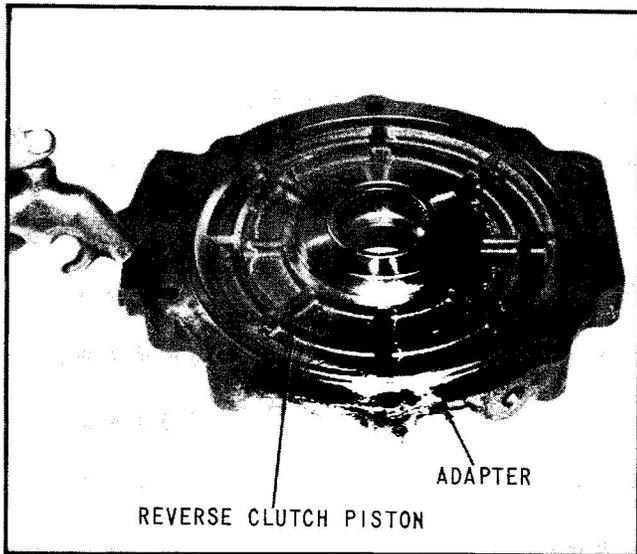


Fig. 15 Blowing Air into Clutch Hole

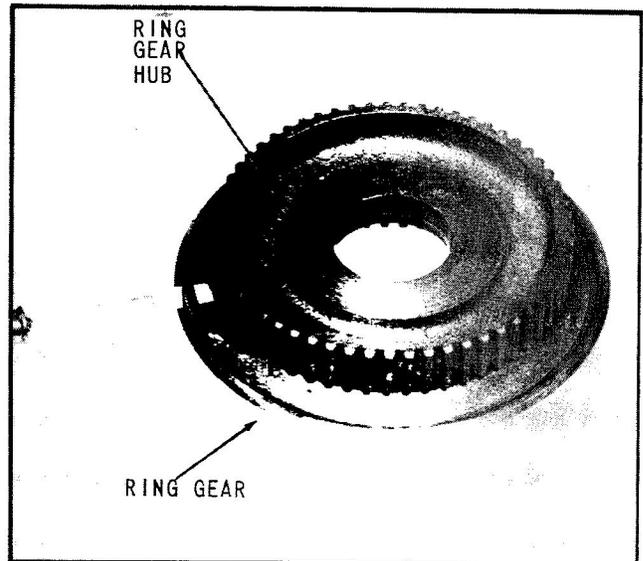


Fig. 17 Remove Ring Gear Snap Ring

ring gear hub from pinion cage assembly. Remove thrust needles and one thrust race remaining with pinion assembly and the other thrust race, which remains with ring gear hub, (Figs. 47 and 48).

10. Ring gear and ring gear hub may be separated by removing the snap ring from ring gear, (Fig. 17).
11. Remove needle thrust bearing from front face of sun gear. A thrust plate will be found inside the pinion cage assembly and it should be removed for inspection, (Fig. 45).

12. Remove nut, lock washer and flat washer from shift lever, then remove shift lever, (Fig. 18).
13. Remove valve cover bolts, lock washers, valve cover, and gasket, (Fig. 19). Valve assembly may be removed and disassembled by removing snap ring and spring retainer then spring and regulator valve can be removed from shift valve. Press on retainer, to prevent spring and parts from springing from the assembly, as snap ring is removed, (Fig. 33).
14. Go to section of instructions for transmission ratio being torn down.

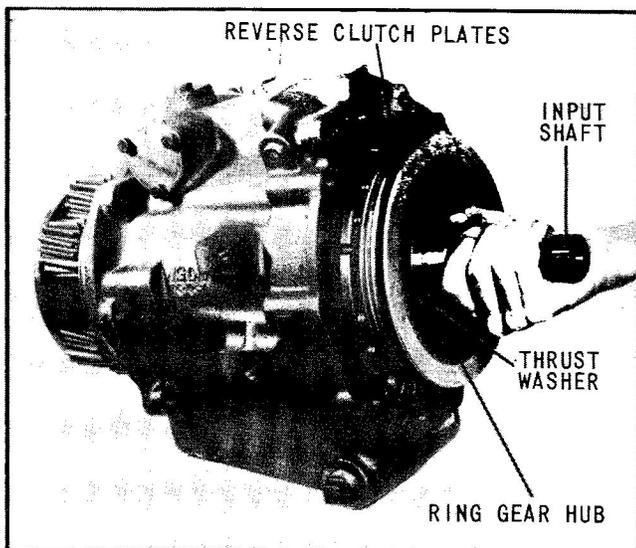


Fig. 16 Pull Input Shaft from Transmission

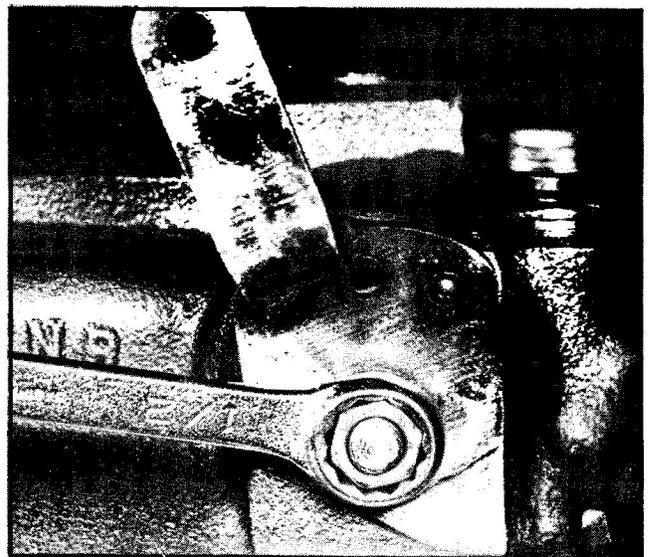


Fig. 18 Remove Shift Lever Nut

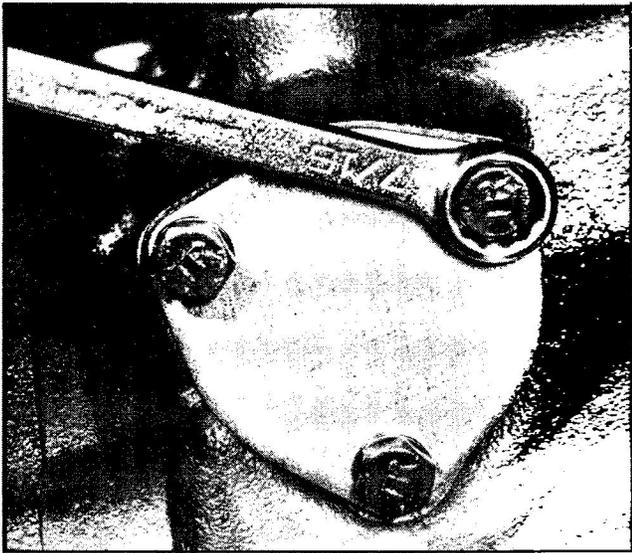


Fig. 19 Remove Valve Cover Bolts

### TO COMPLETE DISASSEMBLY OF DIRECT DRIVE TRANSMISSION (1 to 1 ratio)

NOTE: Following procedure to follow instructions given in section "Procedure for All Models!"

1. Use an arbor press or a tool similar to the tool shown in (Fig. 24) to press against the end of sun gear and output shaft, while completing steps 2 through 5 inclusive.
2. Remove output shaft nut and coupling from output shaft.
3. Remove bearing retainer to case bolts and lock washers. Pull bearing retainer rearward and tap re-

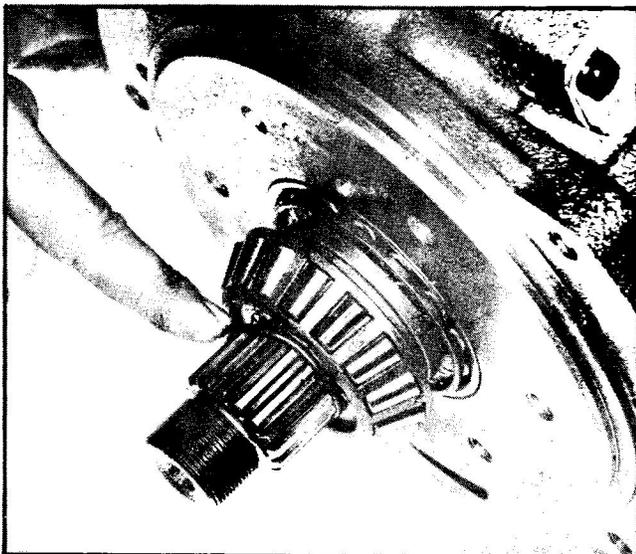


Fig. 20 Remove "O" Ring

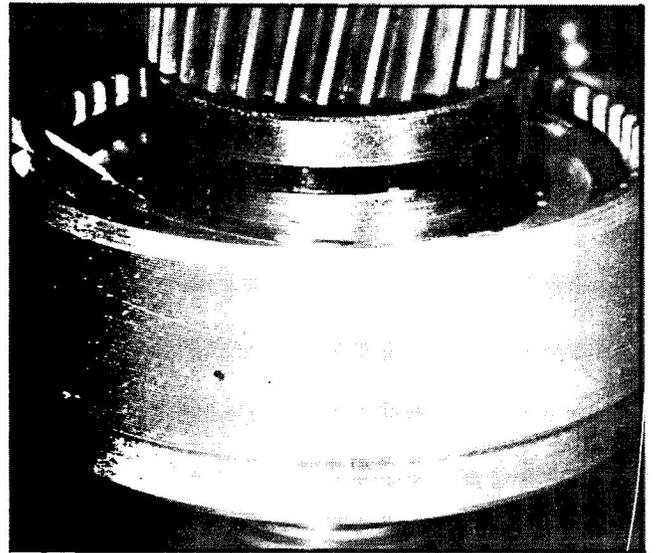


Fig. 21 Remove Snap Ring from Clutch

tainier with a large plastic hammer to remove from transmission case, (Fig. 43). Discard gasket. Bearing spacer will either remain with retainer or bearing and should be removed.

4. Remove the "O" ring from behind bearing cones, (Fig. 20).
5. Remove the two bearing inner races and cones from output shaft, (Fig. 20).
6. Pull output shaft and forward clutch assembly forward from case, (Fig. 41).
7. Remove snap ring from clutch cylinder, (Fig. 21).

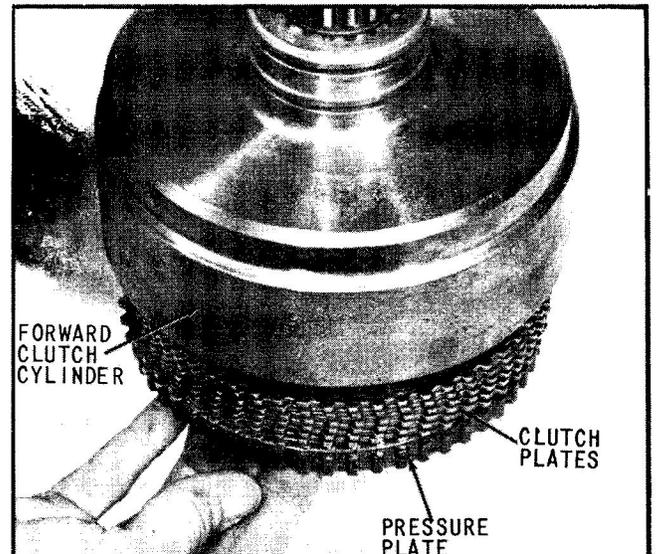


Fig. 22 Catching Clutch Plates

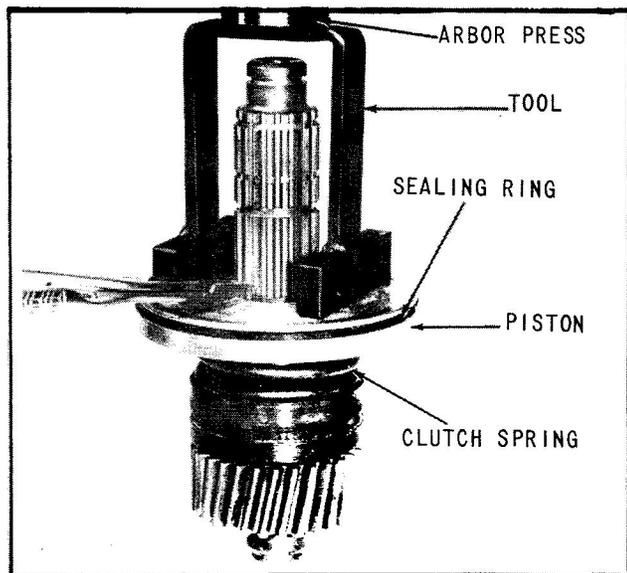


Fig. 23 Remove Snap Ring

8. Invert assembly and catch clutch plates as they slide from forward clutch cylinder. It is sometimes necessary to tap the parts to cause plates to slide from clutch cylinder, (Fig. 22).
9. Use both hands to press clutch cylinder, from shaft and piston.
10. Position remaining clutch parts, with a suitable tool placed against rear of clutch piston, on an arbor press and compress clutch return spring while snap ring, located just behind piston, is removed from shaft, (Fig. 23).

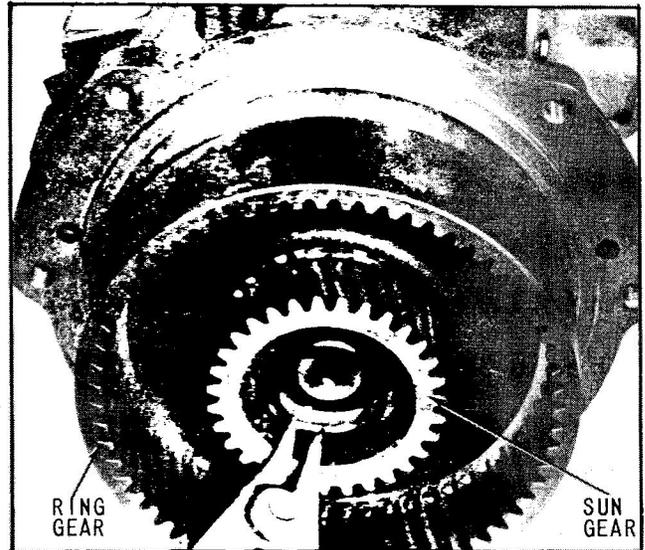


Fig. 25 Remove Snap Ring (3 to 1 Ratio)

11. Remove clutch piston, spring and sealing rings from clutch piston and output shaft, Fig. 24.
12. Remove two cast iron sealing rings from rear of clutch housing, (Fig. 39).
13. Inspect the bearing cups in transmission case and in bearing retainer. Remove only if it is necessary to replace cups.
14. Remove and discard oil seal from bearing retainer.

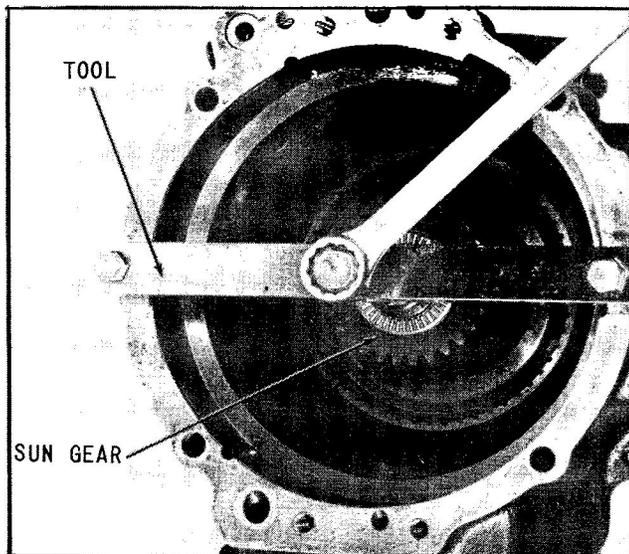


Fig. 24 Press Against Sun Gear Shaft

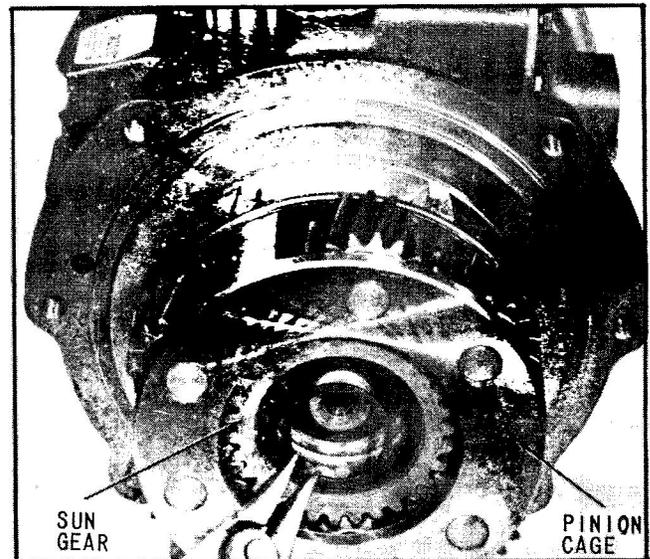


Fig. 26 Remove Snap Ring (2 to 1 Ratio)

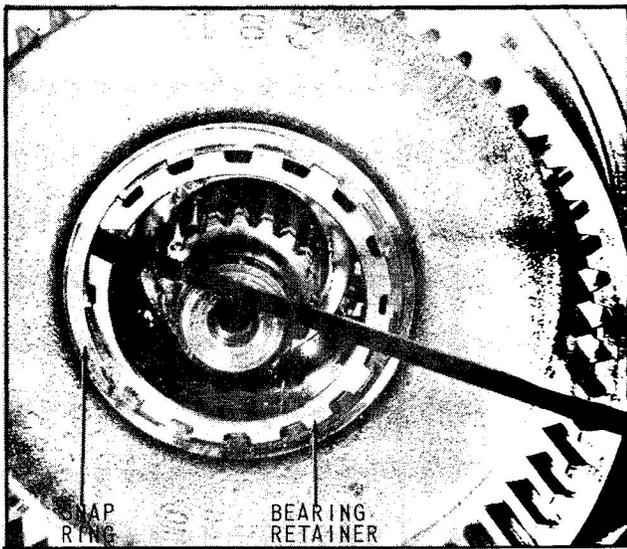


Fig. 27 Remove Ring Gear Hub Snap Ring (3 to 1 Ratio)

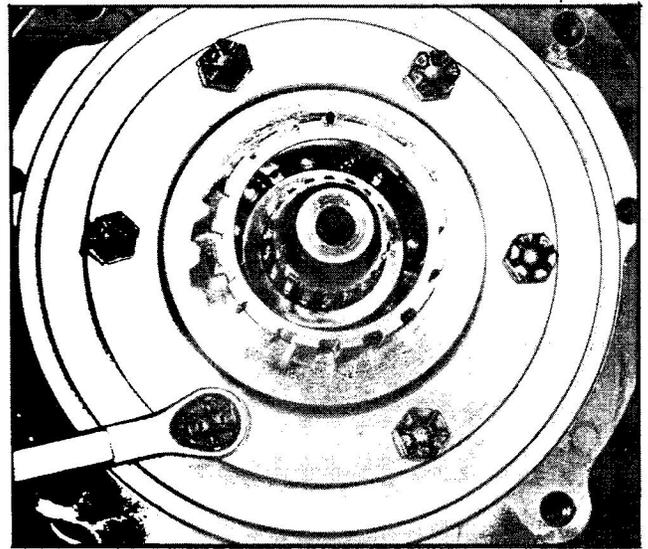


Fig. 29 Remove Bearing Retainer Bolts (2 and 3 to 1 Ratio)

## DISASSEMBLY OF REDUCTION UNITS

The following procedure to follow steps outlined in section "Procedure for All Models".

1. Remove six reduction housing to base bolts and slide reduction housing and all attached parts rearward from forward and reverse transmission. Use a large plastic hammer, if needed, to remove reduction housing from snap fit of transmission case. Discard gasket.
2. Use an arbor press or a tool similar to tool shown in (Fig. 24), to press

against end of sun gear and output shaft, while removing snap ring, which retains reduction unit gears to forward and reverse transmission output shaft, (Figs. 25 and 26). Slide reduction unit parts from shaft.

3. Remove tool from end of sun gear and complete steps 4, 5 and 7 through 12 inclusive of section "To Complete Disassembly of Direct Drive Transmission (1 to 1 Ratio)".
4. Remove snap ring from bearing retainer and remove ring gear and ring gear hub on 3 to 1 ratio units, (Fig. 27) or remove pinion cage assembly on 2 to 1 ratio units, (Fig. 28).

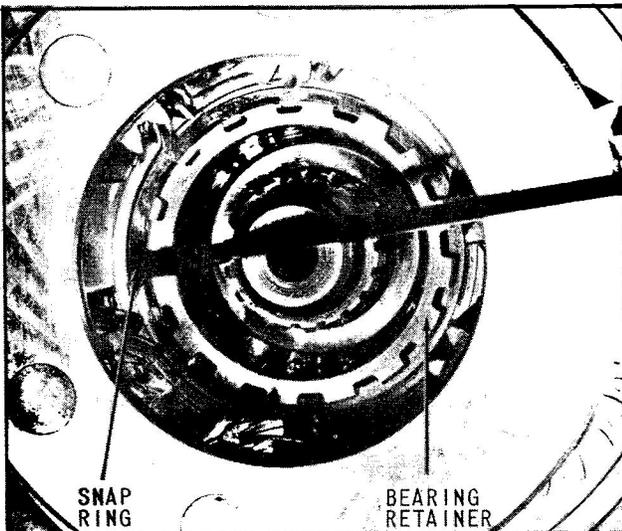


Fig. 28 Remove Pinion Cage Snap Ring (2 to 1 Ratio)

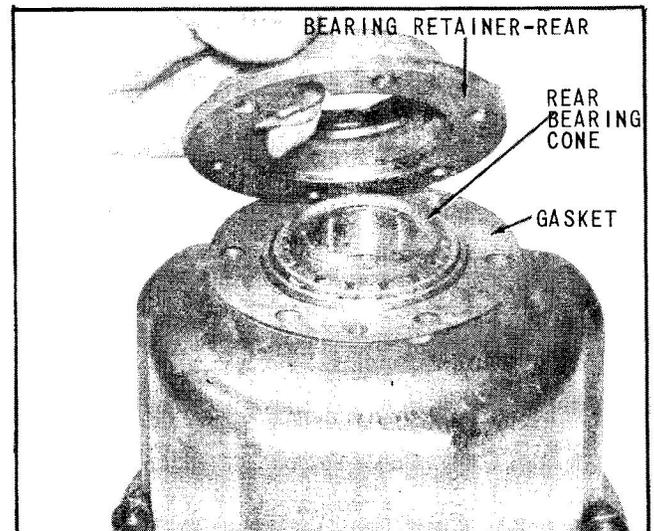


Fig. 30 Remove Bearing Retainer-Rear

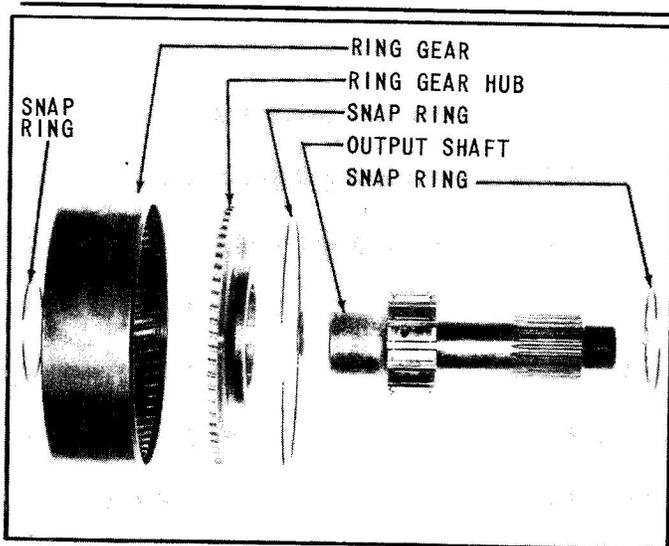


Fig. 31 Ring Gear and Output Shaft  
(2 to 1 Ratio)

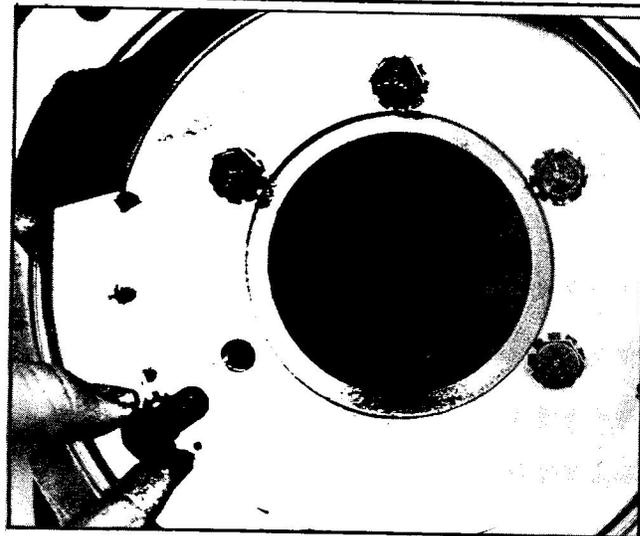


Fig. 32 Remove Oil Baffle Bolts

5. Remove bearing retainer to case bolts and bearing retainer, (Figs. 29 and 58).
6. Use a bearing puller to pull bearing from case, (Fig. 56).. It is necessary to remove bearing snap ring on 1.5 to 1 reduction units, so that puller may be installed in groove of bearing.
7. Remove output shaft nut and coupling from output shaft and remove output shaft and attached parts from reduction housing.
8. Remove bearing retainer to reduction housing bolts. Remove bearing retainer - rear, and rear bearing cone, (Fig. 30). Discard retainer gasket.
9. Remove and discard retainer oil seal.
10. Remaining bearing parts may be removed if necessary, after disassembly of reduction unit is completed, by pressing on forward face of front bearing cone with reduction housing on rear face on an arbor press.

TO COMPLETE DISASSEMBLY OF 1.50 to 1.00 RATIO REDUCTION UNIT\*

1. Remove the two snap rings from output shaft and slide pinion cage assembly from output shaft, (Fig. 67).
2. Remove sun gear to reduction housing bolts, then remove oil baffle and sun gear, (Fig. 66).

3. Ring gear may be removed from ring gear hub after snap ring is removed from ring gear.

TO COMPLETE DISASSEMBLY OF 2.00 to 1.00 RATIO REDUCTION UNIT\*

1. Remove the two snap rings from output shaft and slide ring gear hub from shaft, Fig. 31.
2. Ring gear may be separated from ring gear hub after removing snap ring from ring gear, Fig. 31).
3. Remove oil baffle to reduction housing bolts and remove oil baffle and spacer, (Fig. 32).

TO COMPLETE DISASSEMBLY OF 3.00 to 1.00 RATIO REDUCTION UNIT\*

1. Ring gear and hub may be separated after removing snap ring, (Fig. 62).
2. Remove two snap rings from output shaft and slide pinion cage from output shaft, (Fig. 73).
3. Remove oil baffle to reduction housing bolts and remove oil baffle and spacer from reduction housing, (Fig. 32).

\*The following procedure to follow steps outlined in section "To Complete Disassembly of Reduction Unit".