

BULLETIN NO. 125-E
INSTALLATION, CARE AND MAINTENANCE
of Twin Disc

MARINE GEARS

Price: \$1.00



TWIN DISC CLUTCH COMPANY • RACINE, WISCONSIN, U. S. A.

When the book is first received, it is recommended that the Marine Gear is promptly identified from the shipping tag information. A reprint of the shipping tag is herewith reproduced expressly for this purpose, and it is recommended that it be filled out to correspond with the information on the shipping tag. Each Marine Gear is built to conform with the power and speed of the engine to which it is applied. In order that we may service the Marine Gear quickly and correctly, it is imperative that the Twin Disc Clutch Company be given this information when either service or parts are requested.

Form 65 1M-7-39-S

TWIN DISC MARINE REVERSE GEAR MODEL _____

SPECIFICATION No. _____

UNIT & SERIAL No. _____

BUILT ON S. O. No. _____

CUSTOMER _____

SHIPPED TO _____

PURCHASE ORDER No. _____ SHIPPING DATE _____



**Instructions for Installation,
Care and Maintenance**
of
TWIN DISC
MARINE REVERSE GEARS

MODELS MG-55, MG-61, MG-165, MG-166,
MG-200 and MG-201



Before making installation of Marine Reverse Gear to engine follow instructions contained in chapter on "Installation" beginning on page 8 of this Care and Operation Booklet.

TWIN DISC CLUTCH COMPANY
RACINE, WISCONSIN, U. S. A.

Newark, New Jersey
New Orleans, Louisiana

Cleveland, Ohio
Seattle, Washington

Los Angeles, California
Dallas, Texas

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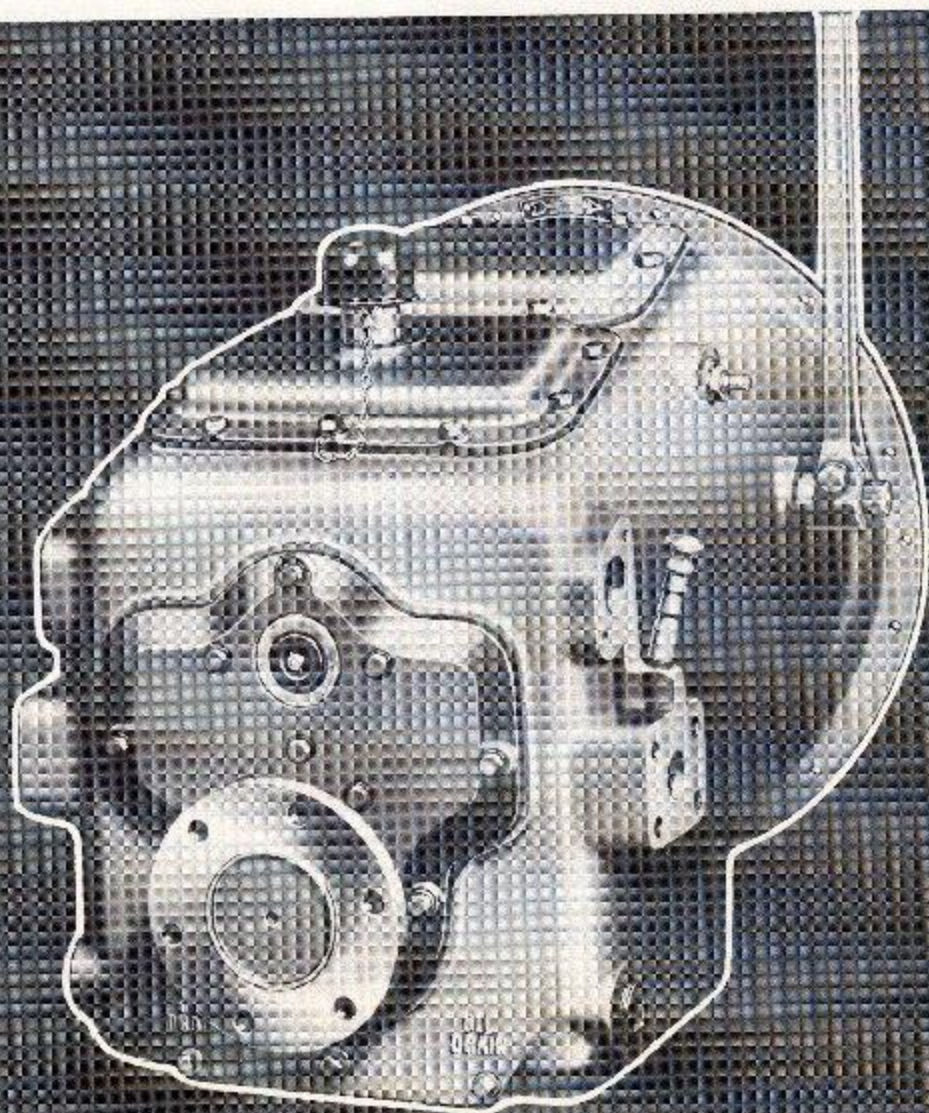
PREFACE

It is the purpose of this book to furnish the operator of the Twin Disc Marine Gear with the essential instructions for operating and repairing the Marine Gear.

This book is divided into two separate parts: General Operating and Installation Instructions and Dismantling and Repairing Instructions.

The first part of this book covering operating and installation instructions must be read very carefully by every operator and the instructions contained therein followed to obtain satisfactory operation of the Marine Gear.

The second part gives detailed instructions covering dismantling of the Marine Gear, and its assemblies for repairs, or the installation of new parts.



SERVICE

INSTRUCTIONS FOR ORDERING REPAIR PARTS -- Spare parts or replacement parts can be obtained from the Twin Disc Clutch Company, Racine, Wisconsin, or from any authorized Twin Disc Parts Station. See page 53.

Give description and quantity required when ordering parts and always specify the model, specification number and serial number of the Marine Gear, which will be found stamped on the name plate located on the clutch housing cover. Furnish the complete description and part number, when known, of the part or parts wanted. Do not use the word "complete", but state exactly each item that is wanted. Do not designate the quantity by "sets" but mention how many parts are required.

TELL HOW TO SHIP AND WHERE -- State whether the shipment is to be routed by freight, express, or parcel post. Furnish shipping point and post-office address. If shipping instructions are not specified on the order, we will use our judgment, taking into consideration time, as well as cost. We will not be responsible for any charges by our doing so.

TERMS ON REPAIRS -- To avoid delay, all repairs will be sent C.O.D. unless cash accompanies the order. All prices quoted are f.o.b. Racine, Wisconsin.

HOW TO RETURN PARTS FOR CREDIT -- When returning parts for inspection and credit, the model, serial and specification numbers, your order number and date of original purchase of the Marine Gear from which the parts were taken must be given and all transportation charges must be prepaid. Previous to the return of this material, it is necessary that you contact our service department for permission to return any parts for credit.

RETURN OF MARINE GEARS FOR OVERHAUL -- The Service Department of the Twin Disc Clutch Company offers to users of Twin Disc Marine Gears the same degree of manufacturing skill and precision for reconditioning of their Marine Gears that were used in building the same. Flat rates make this a simple, easy, safe and sure way of keeping a Marine Gear in good condition. Many users of Twin Disc Marine Gears have little use for them during the Fall and Winter months. They should anticipate their needs and send such Marine Gears, that they intend to have overhauled, at an early date, so that we may have plenty of time to overhaul and return them before the Spring rush season starts.

WARRANTY

A. The Twin Disc Clutch Company guarantees all assembled products and parts, except parts or equipment on which writ-

ten warranties by respective manufacturers thereof are furnished the original purchaser, against defective material or workmanship for a period of one year from date of original shipment, but not to exceed one hundred and eighty days of service.

- B. Complete units or parts returned* within this warranty period, transportation charges prepaid, which are found by the Twin Disc Clutch Company to be defective in material or workmanship shall at their option be repaired, replaced or credited. No claims will be allowed which in the opinion of the Twin Disc Clutch Company result from complete units or parts having been subjected to abuse or neglect or where failure has been caused by accident.
- C. Any warranty is void unless the buyer or his agent provides proper care and storage of complete units and parts from date of shipment to date placed in service and unless units are properly installed within rated capacity with installations properly engineered in accordance with the practices approved by the Twin Disc Clutch Company.
- D. The Twin Disc Clutch Company will accept no responsibility for contingent liability through the failure of any complete unit or part.
- E. No person except authorized factory representative may assume any liability or expense in the replacing of parts or servicing of units within the warranty period except when such expense is authorized in advance and in writing by the Twin Disc Clutch Company.
- F. The right is reserved to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture.

* All units and parts except hydraulic to be returned to the factory at Racine, Wisconsin. Hydraulic units and parts to be returned to the factory at Rockford, Illinois.

GENERAL CONSTRUCTION How they Operate

Twin Disc Marine Reverse Gears have been designed for Marine service of extreme diversity and where frequent and extended operation of the Reverse Gear is required. These units will operate in forward or reverse direction of rotation continuously. The principle feature in the construction of Twin Disc Marine Reverse Gears is the duplex clutches. Referring to Figure #1, the main clutch castings "A" and "B", are rigidly bolted to the engine flywheel.

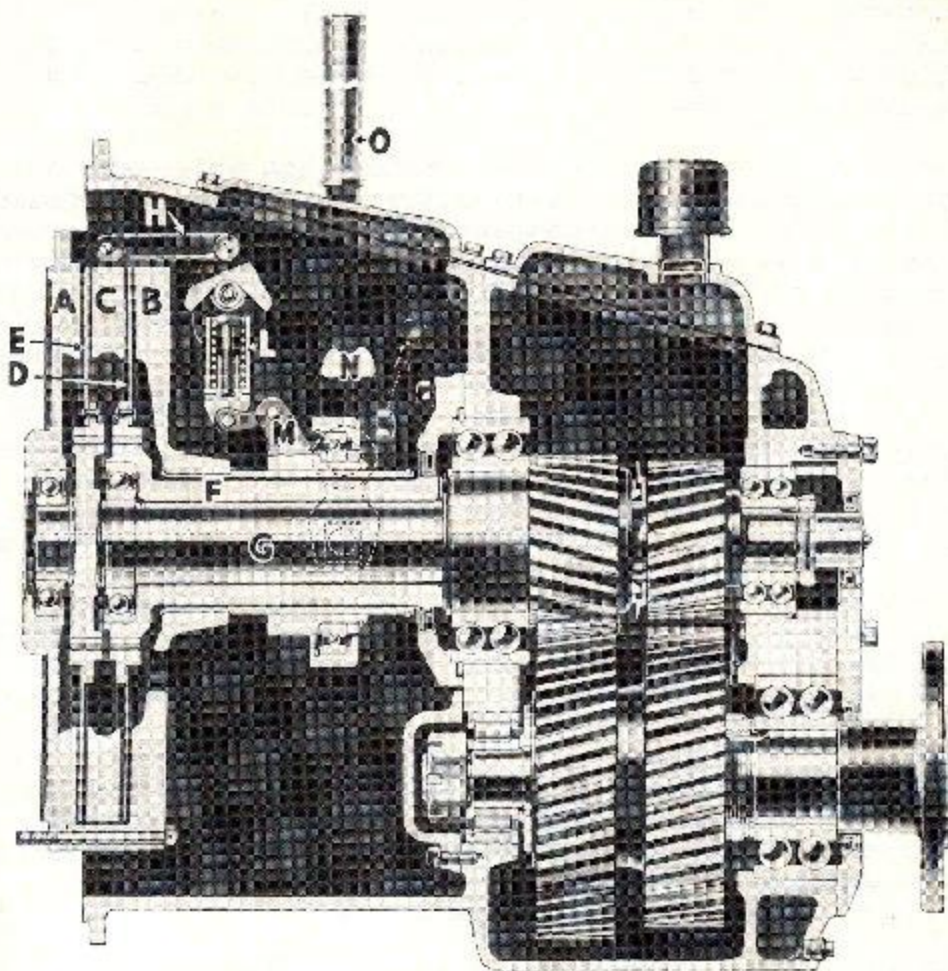


FIGURE 1

In forward direction, the movable floating plate "C" exerts pressure against the driving plate assembly "D", likewise on the driving plate "E" for reverse. These driving plates are attached to the respective shafts, "F" and "G", by means of gear teeth which provide for the necessary float of the driving plate to obtain proper release when the clutches are disengaged. The movement of floating plate "C", is obtained by the use of a specially designed duplex clutch operating mechanism. This exerts pressure to the floating plate through a series of pressure links "H".

The clutches are operated by shifting the sliding sleeve, "M", which is controlled by the throw-out fork "N", and a single hand lever, "O". By this construction, a duplex clutch is obtained, which can be operated by one common clutch operating mechanism.

The springs in the spring cup assembly "L", compensate for wear on the friction discs. The rollers in these assemblies are mounted on needle bearings to reduce friction losses to a minimum. Since the pressure is exerted to the cam lever by compressing these springs, the expansion of the springs automatically compensates for any wear on the driving plates.

RATIOS AND CAPACITIES

MODEL	DRAWING NUMBER	FORWARD RATIO	REVERSE RATIO	WEIGHT	CAPACITIES
MG-55**	X9267	1.62:1	1.60:1	300	20 hp @ 800
		2.36:1	2.36:1	305	47 hp @ 1500
		3.20:1	3.21:1	310	70 hp @ 2500*
MG-61	X8759A	1.96:1	2.00:1	435	40 hp @ 900
	X8839A	3.00:1	3.00:1	460	70 hp @ 1500 110 hp @ 2500*
MG-165	X9210	1.96:1	1.96:1	635	95 hp @ 900
	X9211	3.00:1	3.00:1	685	145 hp @ 1500 185 hp @ 2100*
MG-166	X9212	4.38:1	3.80:1	900	95 hp @ 900 152 hp @ 1500 195 hp @ 2100*
MG-200	X8761B	1.96:1	2.00:1	1370	90 hp @ 800
	X8841B	2.96:1	3.00:1	1590	165 hp @ 1000 225 hp @ 1500*
MG-201	X8761B	1.96:1	2.00:1	1370	120 hp @ 800
	X8841B	2.96:1	3.00:1	1590	150 hp @ 800 180 hp @ 1000*

All 1:1 and 1-1/2:1 ratios were removed from production 1/1/52.

* Speed indicated is maximum permissible safe operating speed.

** No longer in production.

By taking advantage of the centrifugal force, the spring pressure necessary has been greatly reduced. The centrifugal force acts on the roller pin assembly, which, at the higher engine speeds exerts considerable force in the same direction as the springs. Since reversing of the Marine Gears is usually done at reduced speeds, this feature is of obvious advantage, because the pressure necessary to shift the clutches at slower speeds is reduced considerably and the necessary spring pressure needed to hold the clutch when engaged is considerably less.

Note that the reverse direction of the propeller shaft is obtained through one operation - by shifting the duplex clutches. This eliminates any possibility for gear clashing and for the need of complicated synchronizing mechanism such as are sometimes used for timing the operation of the clutch with the shifting of the gears.

Forward direction is obtained by means of two helical gears which provide reduction ratio as required. Reverse direction is obtained by means of three helical gears, providing 100% of forward speed in reverse.

INSTALLATION

Assembly of a New Marine Gear to an Engine.

When installing a Marine Reverse Gear to an engine check the following points in the order named:

The size of the flywheel housing on the engine must check with the dimensions indicated in the following tabulation:

Marine Gear	Flywheel Housing Bore	Bolt Circle	No. Bolt	Diameter
MG-55	17.625 17.630	18-3/8	12	3/8
MG-61	17.625 17.630	18-3/8	12	3/8
MG-165	20.125 20.130	20-7/8	12	3/8
MG-166	20.125 20.130	20-7/8	12	3/8
MG-200	25.500 25.505	26-3/4	16	1/2
MG-201	25.500 25.505	26-3/4	16	1/2

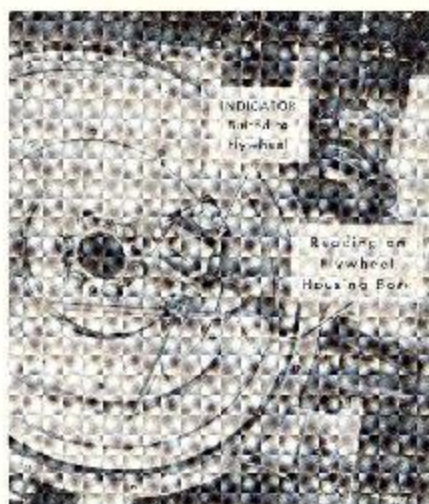


FIGURE 2 - METHOD OF INDICATING FLYWHEEL HOUSING



FIGURE 3 - METHOD OF MEASURING FLYWHEEL DIMENSIONS

The maximum eccentricity of the flywheel housing bore should not exceed .010" total indicator reading and the maximum deviation of the face of the flywheel housing flange should not exceed .006" total indicator reading. The most satisfactory method to make indicator readings on both the bore and the face of the flywheel housing is to clamp the indicator on a bolt screwed into the flywheel and to crank the engine over by hand as shown in Figure 2.

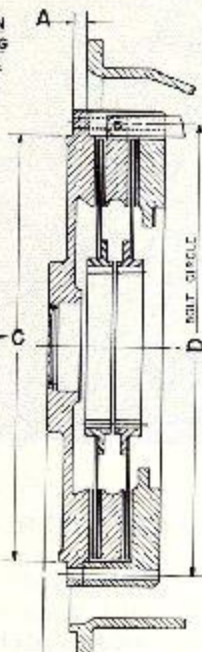
PRECAUTIONS — The most important precaution to insure the satisfactory operation of a Twin Disc Marine Reverse Gear is to make sure that closest possible alignment is provided between the Marine Gear and the engine. Improper alignment will result in undue wear due to excessive stressing of parts in both the clutch and the Reverse Gear mechanism.

The dimensions of the engine flywheel must conform closely with those specified for use with Twin Disc Marine Gears and which are indicated in Figures 4-A and 4-B. The most convenient way to check the dimensions of the flywheel is to place a two-foot steel scale edgewise across the face of the flywheel housing, as all dimensions are given in relation to this surface and to use a short scale or depth indicator in connection with this scale as shown in Figure 3. If the flywheel does not check with the dimensions shown in Figure 4-A or 4-B, it is recommended to get in touch with the manufacturer of the engine or his nearest authorized representative before taking further steps. It will generally be found that the engine manufacturer is in a better position to make suitable provisions to supply the correct flywheel for the Marine Gears referred to than can be made by re-machining an old flywheel locally.

ACCURATE DIMENSION
FROM FACE OF HOUSING
TO FACE OF FLYWHEEL
AND LIMITS TO WHICH
THIS MUST BE HELD

LIMITS OF PILOT
BORE IN FLYWHEEL

CLEARANCE → B



ASSEMBLY TO ENGINE

FIGURE 4-A

ACCURATE DIMENSION
FROM FACE OF HOUSING
TO FACE OF FLYWHEEL
AND LIMITS TO WHICH
THIS MUST BE HELD

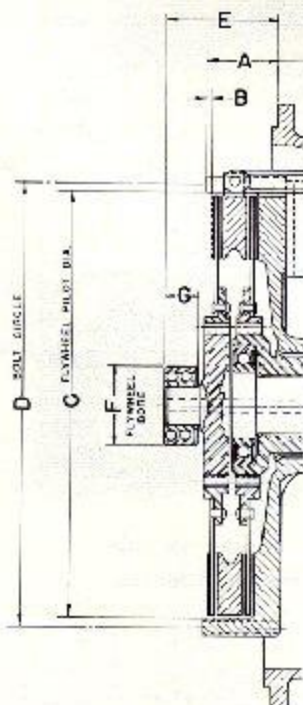


FIGURE 4-B

CHART FOR FIGURE 4-A

Model No.	A	B	C	D		
				B.C.	No. of Holes	Dia. of Holes
MG-61	1-3/16	2-9/32	14.247 14.250	15"	12	13/32
MG-165 MG-166	1-1/2	2-5/16	14.997 15.000	16"	12	13/32
MG-200 MG-201	1-7/16	2-7/8	21.000 20.997	22-1/8"	8	17/32

CHART FOR FIGURE 4-B

Model No.	A	B	C	D	Holes	E	F	G
MG-55	2-5/16	3/16	12.248 12.251	13	* 9	3-15/16	2.4407 2.4413	.875

* 9 holes used on 12 spacing — holes 30° apart - 3 not used.

ASSEMBLY TO ENGINE — The Marine Gear and clutch assembly are assembled to the engine as one unit and it is only necessary to remove the small cover plate on the top of the clutch housing for assembly purposes. With the Marine Gear in place against the flywheel housing of the engine, the bolts which attach the clutch to the flywheel should be assembled first. Care should be taken to pull these bolts up uniformly and to make sure that the pilot on the clutch plate has definitely entered into the flywheel, before any of these bolts are pulled up tight and securely locked by means of lock washers. It is advisable to insert two bolts in the flywheel housing and Marine Gear case which will serve to guide the pilot in the clutch housing to enter into the flywheel housing while the clutch bolts are being tightened up.

ASSEMBLY IN BOAT — Wherever possible it is recommended to assemble a new Marine Gear to the engine before it is installed in the boat. After the entire assembly has been set on the foundation provided for the same, it must be properly aligned with the propeller shaft. Care should be taken to make this alignment without pulling the support brackets on the Marine Gear out of their proper position, and for this reason it is recommended to provide clearance for shimming at this point, as indicated in Figure 5. It is advisable to recheck the alignment after the engine foundation bolts have been tightened and then to carefully shim

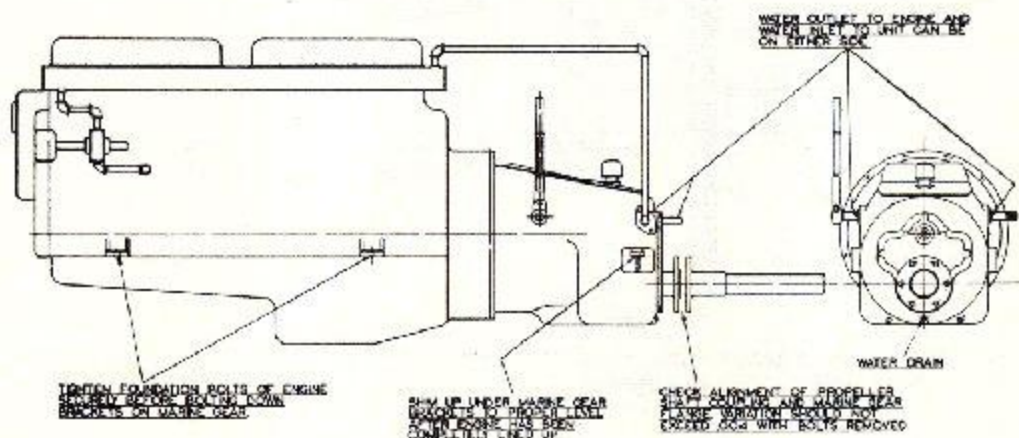


FIGURE 5

up under the Marine Gear support brackets. Experience has shown that the hull often changes its shape after the boat has been launched, and it is advisable to recheck and correct the alignment, if necessary, with the boat in the water. This can be accomplished by removing the bolts in the propeller shaft coupling and checking the spacing of the two flanges on the circumference. (Refer to Figure 5.) For satisfactory alignment, the variation should not exceed .004".

CONTROLS -

To prolong life of reversing clutches reduce engine speed when reversing direction of rotation of Marine Gear in normal operation.

Marine Gear should not be reversed at full engine speed except in emergency.

For either direct or pilot housing control, the mechanism must be such that the operating lever on the Marine Gear is moved toward the engine for operation in forward direction and away from the engine in reverse direction. (Refer to Figure 6.) The over-center action of the clutch mechanism requires a constant travel of the lever regardless of any wear of the clutch plates. To avoid undue wear on the throwout bearing, it is vitally important that no constant pressure on the linkage is applied when the clutch is in the engaged position, either forward or reverse, or when in neutral. The throwout bearing must float at all times. It is recommended to mark the neutral position definitely on the control quadrant. The travel of the clutch operating lever is as shown below.

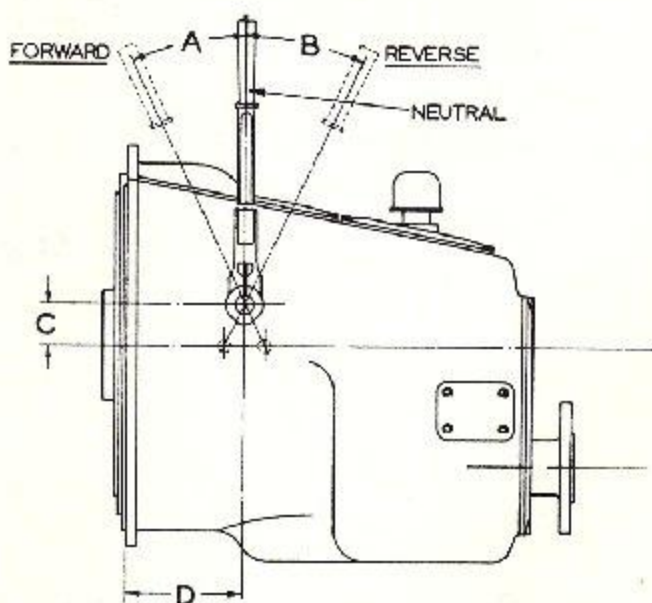
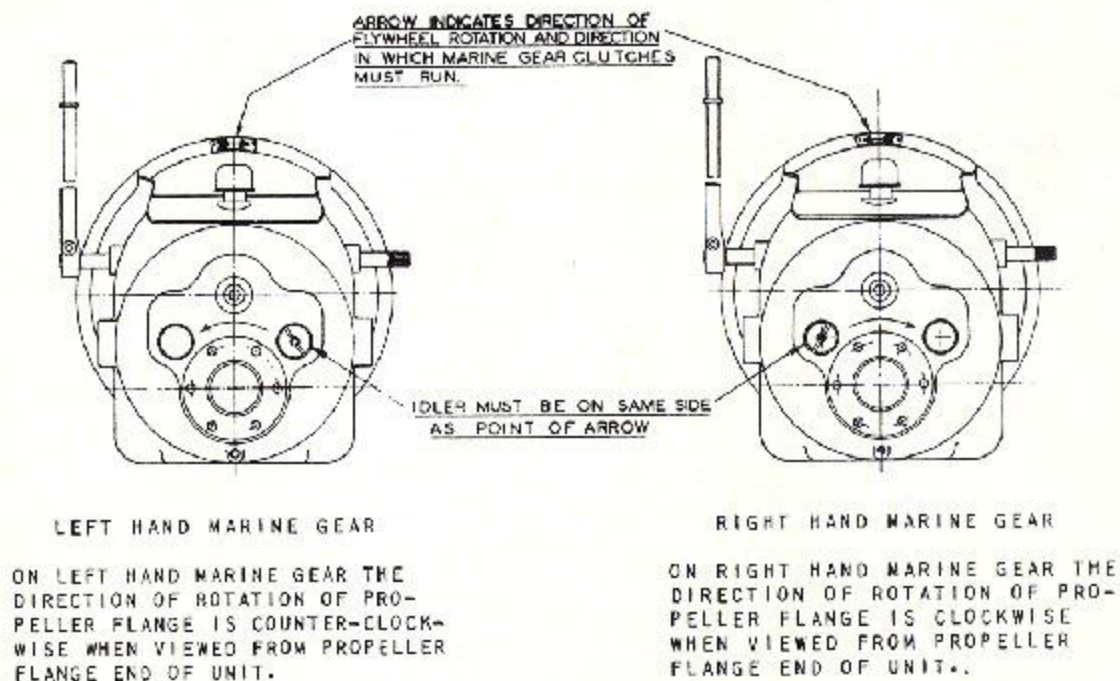


FIGURE 6

Model	In.Lb. Operating Shaft Torque Required			A Degrees	B Degrees	C In.	D In.
	0 RPM	1200 RPM	1800 RPM				
MG-55	750	825	900	23	23	2-1/2	4-17/32
MG-61	1310	1410	1535	23	23	2-1/2	4-17/32
MG-165	1500	1650	1800	24	24	2-1/4	6-5/8
MG-166	1500	1650	1800	24	24	2-1/4	6-5/8
MG-200	2420	3820	—	26	26	3-1/2	8-1/4
MG-201	2800	4460	—	26	26	3-1/2	8-1/4

COOLING WATER CONNECTIONS — After the Marine Gear has been assembled to the engine and the control mechanism has been hooked up, the only other outside connections that need to be made are those for the cooling water jacket. In the housing, a cooling water jacket is provided that should be hooked up with the cooling water system of the engine. It is recommended to arrange the piping, as shown on Fig. 5, in such a way that the cooling water is circulated through the water jacket of the Marine Gear before it reaches the jackets on the engine or the water-cooled exhaust manifold.

The water may be drained from the gear housing water jacket by removing the drain plug from the hole marked "water drain". This hole is located at the rear end of the gear housing directly beneath the propeller shaft.



THE ROTATION OF THE OUTPUT SHAFT WHEN THE HAND LEVER IS IN FORWARD POSITION IS THE OPPOSITE OF THE FLYWHEEL ROTATION.

FIGURE 7

CAUTION -- When operating marine units in waters infested with silt, provisions must be made to prevent an excessive amount of silt from collecting in the cooling water jackets. If necessary Marine Gear should be cooled by means of fresh water system.

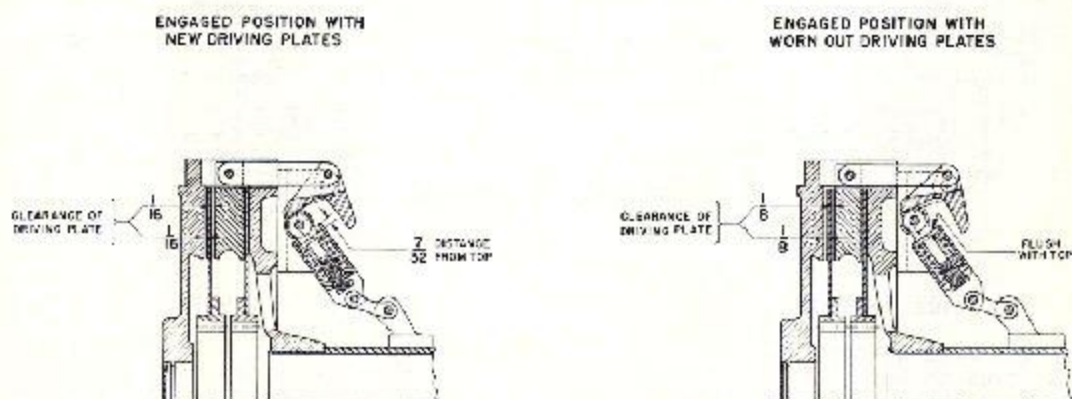
LUBRICANT -- Before starting up a new Marine Gear, make sure that it has been filled with the correct amount of lubricant to the specifications, covered under lubricating instructions on page 15.

DIRECTION OF ROTATION

Because of the idler mounting used in Twin Disc Marine Reverse Units, it is very important that units must be used only in connection with engines having the correct rotation of flywheel. Units can be furnished for either rotation of engine flywheel and are clearly marked on the rim of the clutch housing by means of a red arrow indicating the required direction of rotation. Certain models of our Marine Gears cannot be run continuously in reverse if long wear life is to be expected of the unit. If for any reason a Marine Gear should be required for installation on an engine having opposite rotation to the engine on which the unit was originally installed, an idler gear change-over will be required, and full information can be obtained from the Twin Disc Clutch Company upon request. As noted in our service warranty, the Twin Disc Clutch Company cannot be held responsible for the performance of any units which are not properly installed for the correct direction of engine rotation. See Figure #7 on previous page.

MAINTENANCE

ADJUSTMENT -- The heavy duty duplex springloaded over-center clutch is loaded by means of the spring pressure of the springs in each of the



SPRING LOADED CLUTCH
OPERATING MECHANISM

FIGURE 8

clutch action units. This springloaded mechanism is designed to follow up and to compensate for the wear on the friction surfaces thus requiring no adjustment. The operating mechanism is designed to allow 1/16" clearance on each side of one driving plate with the other clutch in the engaged position. This clearance will increase to a maximum of 1/8" in the worn-out position. The simplest means to check the relative wear of the friction surfaces and to determine when the driving plates need replacing is to check the position of the plunger in the engaging mechanism. (See Figure 8).

When the driving plates are new, the plunger comes within 7/32" of the top of the spring cup with the clutch engaged in either direction. When the plates are worn to a point where they need replacing, the plunger is flush with the top of the spring cup.

The gears are all mounted on ball bearings in permanently fixed centers and they do not require any adjustment whatsoever.

LUBRICATION -- In the gear housing use S.A.E. #40 Heavy Duty Oil or S.A.E. #80 Transmission Oil. Select an oil of the above type having good crankcase lubricating qualities. The oil level of the lubricant should be maintained to conform with markings on the bayonet gauge. If the oil level is carried too high -- it will work its way into the clutch assembly, and also will cause the gears to run hot. The lubricant in the gear housing should be drained and replaced with fresh oil every 500 hours of operation.

On marine gear models M. G. 200 and 201 periodically lubricate the propeller shaft seals with grease when the boat is docked. This operation will prevent water from entering the gear housing.

It is possible to remove the lubricant from the gear housing at two points: (1) By removing the pipe plug from the drain hole marked "oil drain", which is located at the rear end of the gear housing beneath the propeller shaft. (2) By removing the bayonet oil gauge and drawing the lubricant up through the oil gauge tube. This can be accomplished with the use of any suction pump, such as a bilge pump equipped with 5/8" I.D. rubber hose, which will fit tightly over the head of the oil gauge tubing and permit the removal of the oil from the bottom of the gear housing by means of suction.

The clutch throw-out bearing and pilot bearings should be lubricated every fifty hours of operation. For the clutch throw-out bearing and pilot bearings use only a high grade of ball and roller bearing grease having a minimum melting point of 300°F. Suitable greases may be obtained from any reputable grease manufacturer. A non-exclusive list of approved greases is available from the Twin Disc Service Department upon request. If a Marine Gear fails because of the use of some inferior type grease, the Twin Disc warranty is definitely void.

Do not use ordinary cup grease, since this type of grease is not suitable for high speed installations where relatively high engine temperatures are encountered.

LUBRICATION OF CLUTCH PARTS

To insure against binding of clutch action parts due to rust caused by moisture, remove cover plate from clutch housing and apply a few drops of light machine oil to all pivot pins, trunnion blocks on ball bearing throw-out collar, and sliding sleeve support every 50 hours of operation.

OIL TEMPERATURE — The normal oil temperature during continuous full load operation is 120° F. and a maximum temperature of 200° F. is permissible. In order to maintain the oil at moderate temperatures, a means to cool the oil in the form of a cooling water jacket is built integral with the rear end of housing. As indicated in the installation instructions and in Figure 5, piping for the cooling water circuit should be arranged so that the water circulates through the water jacket of the Marine Gear before it reaches the engine. In order to reduce the possibility of condensation forming in the Marine Gear, it is recommended to install a bypass in the cooling water circuit so that the cooling water jacket is not used and the water conducted directly to the engine whenever the operating temperature of the Marine Gear is 90° or less during continuous full load operation in winter time.

SUMMARY OF VITAL POINTS FOR BEST PERFORMANCE AND LONGER LIFE OF MARINE GEARS

- 1- Be sure transmitted power of engine does not exceed rated capacity of Marine Gear - see page 7.
- 2- Be sure Marine Gear and engine are in proper alignment - see pages 11 and 12.
- 3- Be sure proper dimensions were held between engine flywheel and housing - pages 9 and 10.
- 4- Be sure Marine Gear flange and propeller shaft coupling are properly aligned - see page 11.
- 5- Be sure Marine Gear is running the correct rotation in relation to engine - see page 14.
- 6- Do not cool Marine Gear with excessively silty water - see page 14.
- 7- Do not reverse Marine Gear rotation without reducing engine speed - see page 12.
- 8- Be sure proper oil level is registered on oil gage before running Marine Gear - see Page 15.
- 9- Be sure to drain gear case every 300 hours of operation and re-fill with S.A.E. 50 oil - see Page 15.
- 10- Be sure to lubricate clutch throw-out and pilot bearings every 25 hours of operation - see page 15.
- 11- Be sure oil temperature in Marine Gear is not excessively high - see page 16.

**PAGES PRECEDING THIS
SHEET ARE FOR
OPERATORS**



**PAGES FOLLOWING THIS
SHEET ARE FOR
REPAIR MEN**

REPAIRING

Instructions for dismantling and repairing the Twin Disc Marine Gear.

It is assumed that the repairing of the Marine Gear will be done by a man or men who have had experience in repairing Marine Gears.

We do not advise that an operator who has not had previous repairing experience, attempt to dismantle and reassemble the Marine Gear unless the work is supervised by a competent mechanic.

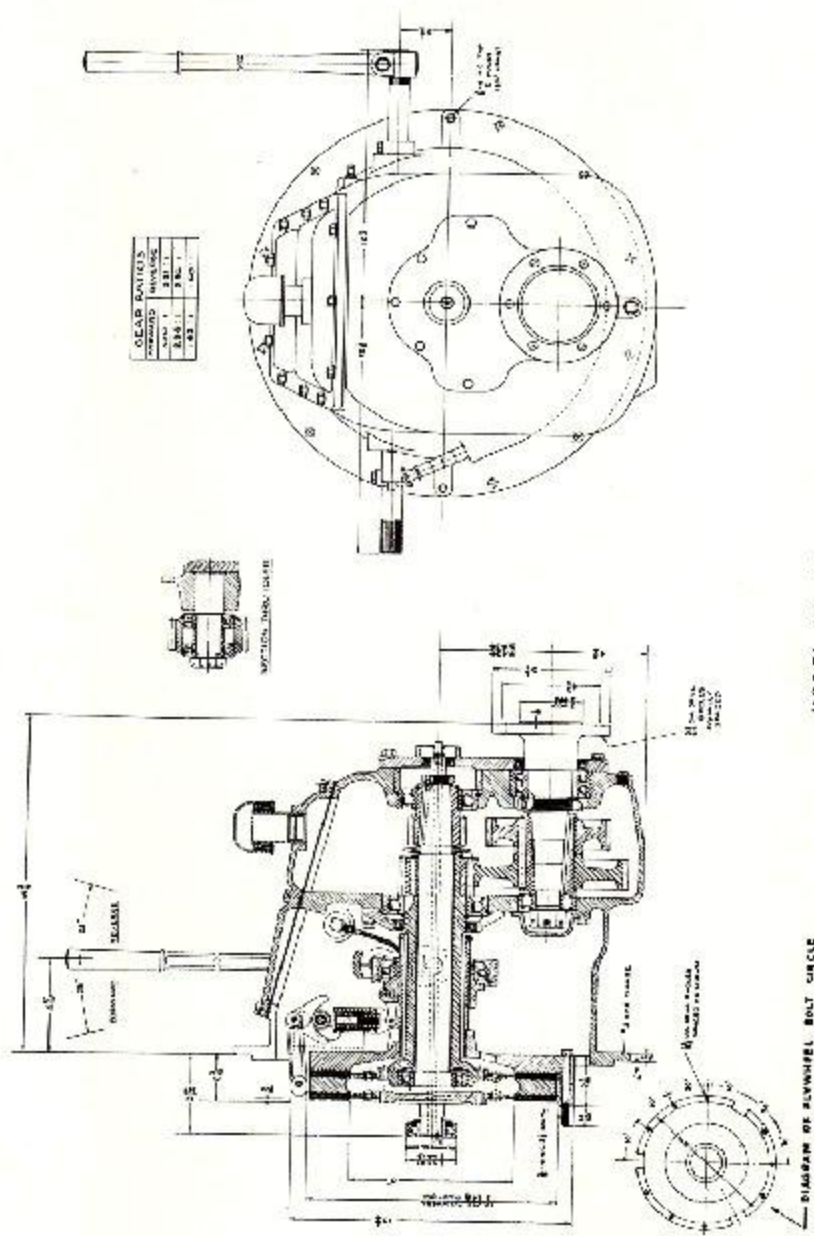
When repairing the Marine Gear, undoubtedly a shorter procedure for removing the various assemblies can be used by an experienced mechanic.

The procedure for repairing the Marine Gear given in the following pages can be done under ordinary conditions encountered in field repairing. The procedure for dismantling of each assembly is given in detail, and to reassemble, it is only necessary to reverse the procedure used in dismantling.

When making repairs be sure to replace all locks, cotter pins, lock washers and snap rings. It is always best to use new gaskets, cotter pins and oil seals when repairing the Marine Gear. By following these instructions a great deal of unnecessary work will be eliminated.

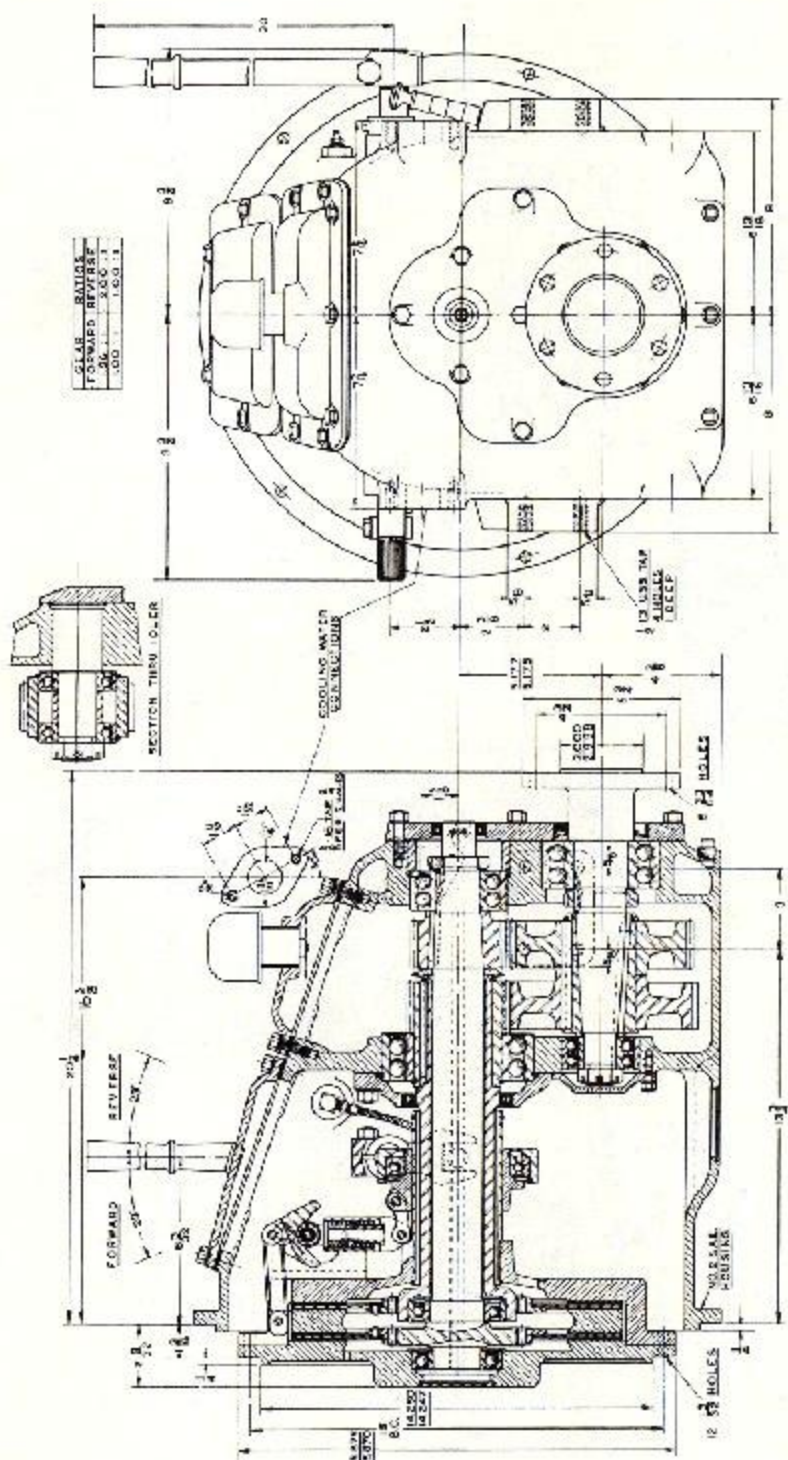
In order to facilitate the dismantling and rebuilding of Marine Gears, the Twin Disc Clutch Company has made available the following tools which can be purchased through the Service Department.

SPECIAL TOOLS FOR SERVICING TWIN DISC
MARINE GEARS ON PAGE 49



MODEL MG-55
DRAWING NO. X9267

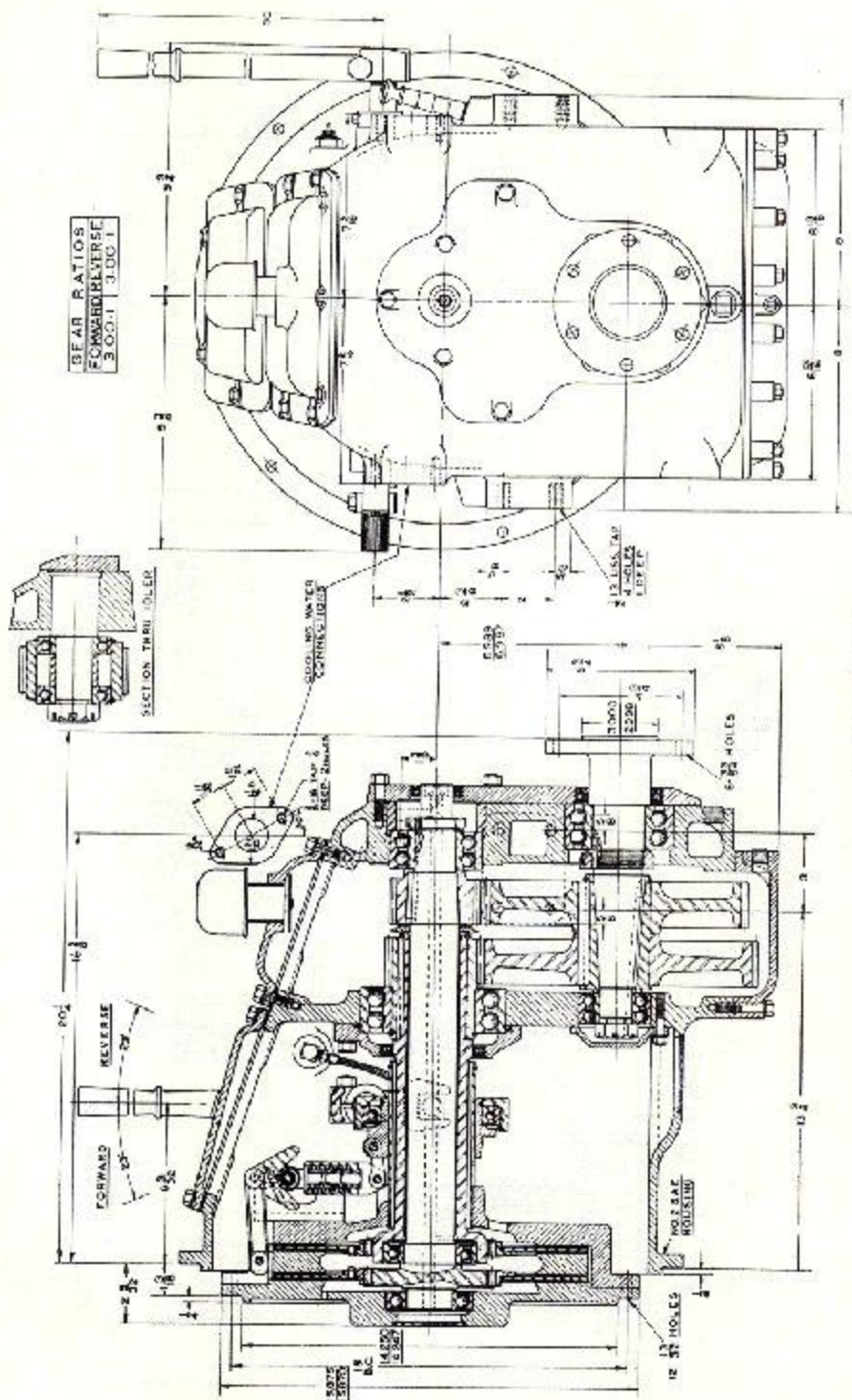
FIGURE 9



SCALE	REVISED
DATE	BY
1941	1941
00	100

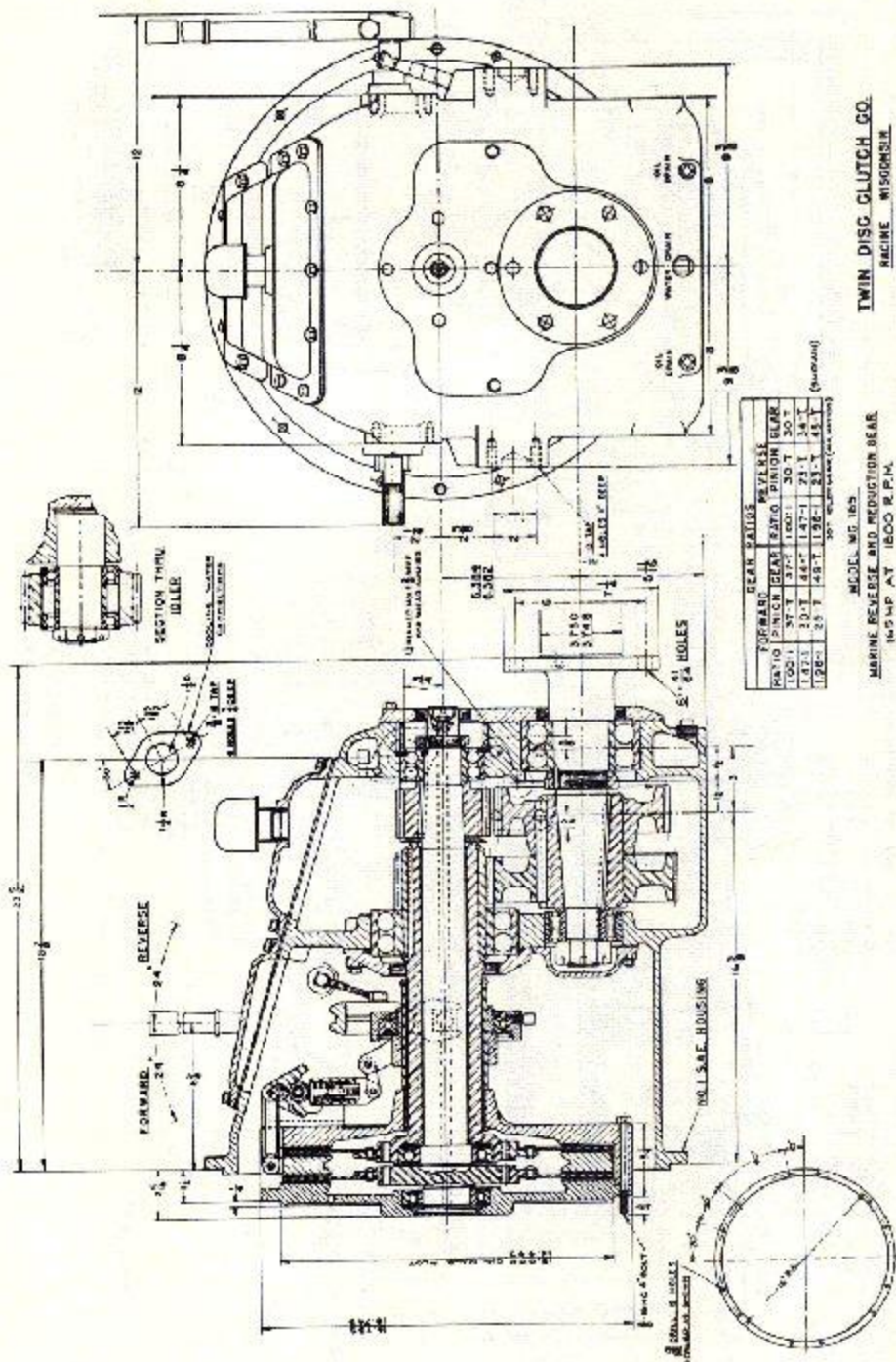
MODEL MG-61
DRAWING NO. X8759A

FIGURE 20



MODEL MG-61
DRAWING NO. XB839A

FIGURE 11



BEAR RATIO		PALLETS	
RATIO	SWITCH	RATIO	DIVISION GEAR
100:1	37-T	140:1	30-T
180:1	20-T	44-T	21-T
120:1	25-T	48-T	23-T

30° ROLLERS (SEE DRAWING)

TWIN DISC CLUTCH CO.
RACINE, WISCONSIN
S. 110, 108, 44, 45

MODEL MG-165
MARINE REVERSE AND REDUCTION GEAR
14.5HP AT 1800 R.P.M.

MODEL MG-165
DRAWING NO- X9210

ONLY FINISHED PARTS ARE TO BE SHOWN, CLUTCH GEAR

FIGURE 12

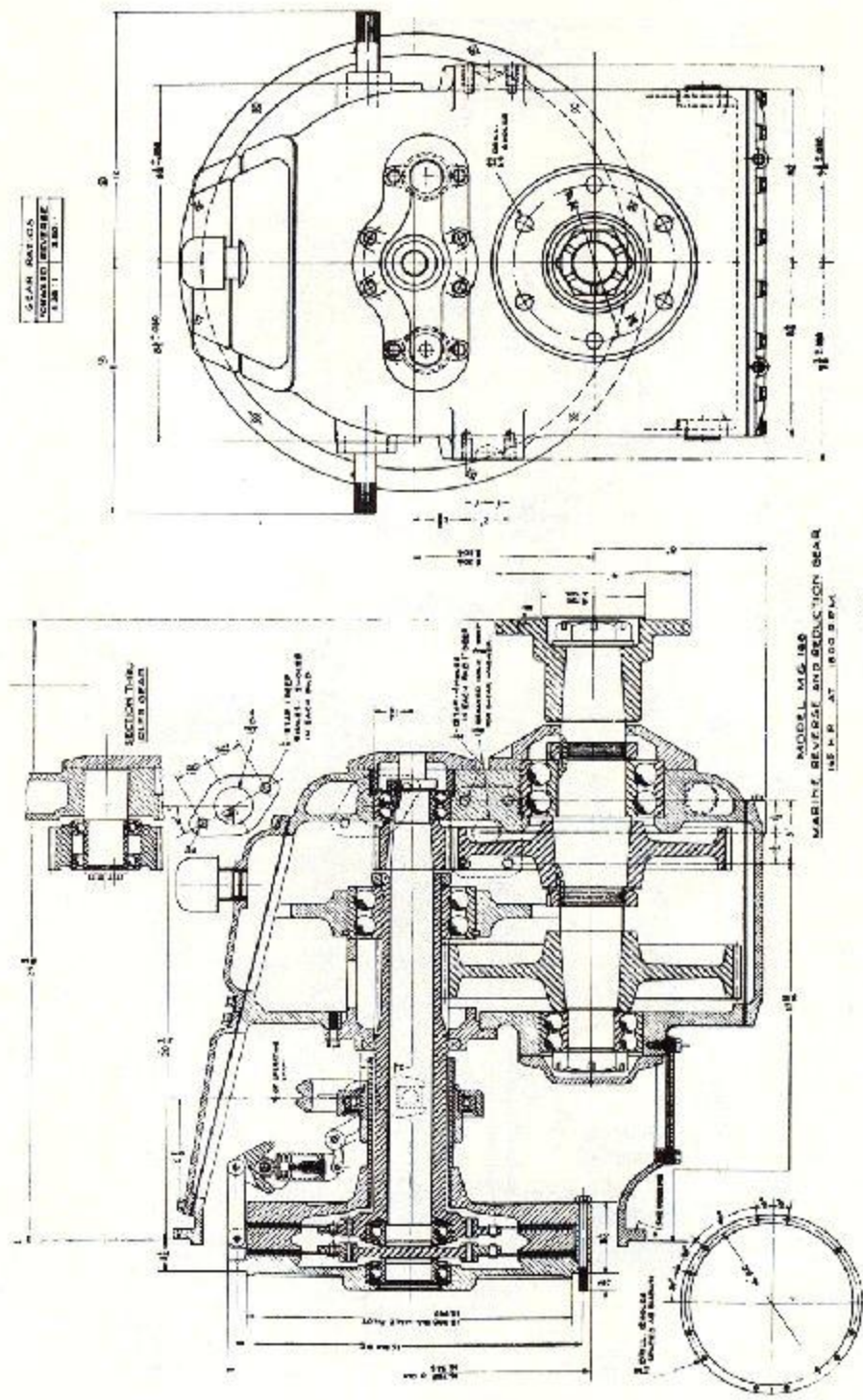
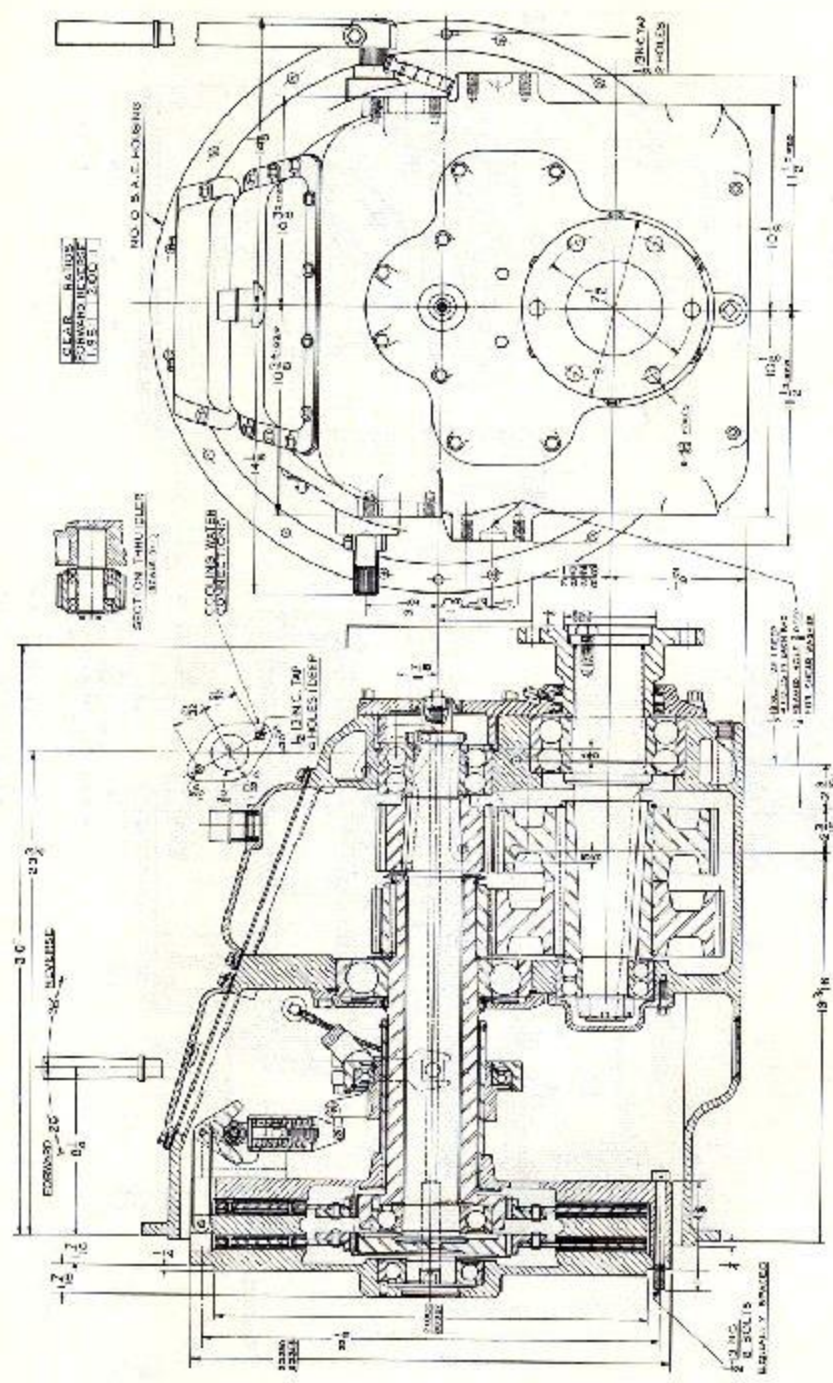


FIGURE 14



MODEL MG-200
 DRAWING NO. X876LB

FIGURE 15

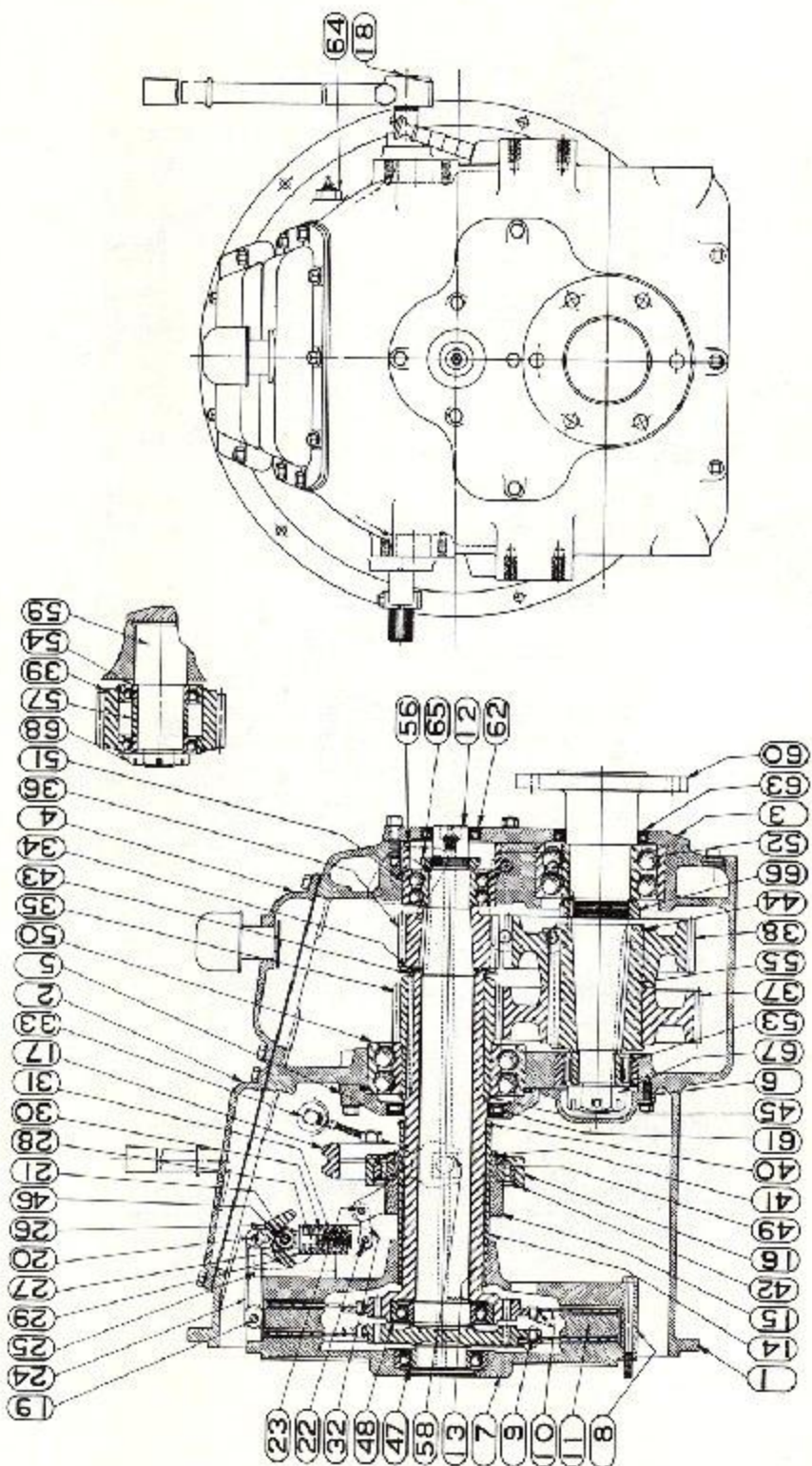


FIGURE 17

PARTS LIST

1-Clutch and Gear Housing	35-Forward Pinion
2-Front Cover Plate	36-Reverse Pinion
3-End Cover Plate	37-Forward Gear
4-Rear Cover Plate	38-Reverse Gear
5-Bearing Retainer	39-Idler Gear
6-Cover Plate	40-Snap Ring (Sleeve Support)
7-Back Plate	41-Snap Ring (Sliding Sleeve)
8-Front Plate	42-Snap Ring (Sleeve Collar)
9-Reverse Driving Plate Assembly	43-Snap Ring (Forward Sleeve)
10-Forward Driving Plate Assembly	44-Snap Ring (Countershaft Sleeve)
11-Floating Plate	45-Snap Ring (Forward Pinion)
12-Reverse Shaft	46-Needle Bushing (Lever Rollers)
13-Forward Sleeve	47-Ball Bearing (Front Pilot Bearing)
14-Sliding Sleeve Support	48-Ball Bearing (Rear Pilot Bearing)
15-Sliding Sleeve	49-Ball Bearing (Sleeve Collar)
16-Sleeve Collar	50-Ball Bearing (Forward Sleeve)
17-Throw-out Yoke	51-Ball Bearing (Reverse Shaft)
18-Operating Shaft	52-Ball Bearing (Counter Shaft)
19-Link Pins	53-Ball Bearing (Counter Shaft)
20-Link Pins	54-Ball Bearing (Idler Shaft)
21-Pins	55-Countershaft Sleeve
22-Link Pins	56-Spacer
23-Link Pins	57-Spacer (Idler Gear Assembly)
24-Engaging Links	58-Shifter Blocks
25-Lever Brackets	59-Idler Gear Shaft
26-Levers	60-Countershaft
27-Rollers	61-Oil Seal (Forward Sleeve)
28-Spring Pins	62-Oil Seal (Reverse Shaft)
29-Spring Cups	63-Oil Seal (Counter Shaft)
30-Springs	64-Jam Nut (Flexible Hose)
31-Spring Adjusting Nut	65-Lock Nut (Reverse Shaft)
32-Links	66-Nut (Counter Shaft)
33-Flexible Hose	67-Slotted Nut (Countershaft)
34-Oil Slinger	68-Slotted Nut (Idler Shaft)

NOTE: All numbered parts referred to in the following page will be found listed above and also in Figure #11. These numbers are reference numbers only and cannot be used as part numbers for ordering repair parts.

TOP VIEW OF MARINE GEAR, WITH COVERS REMOVED,
SHOWING INTERNAL MECHANISM

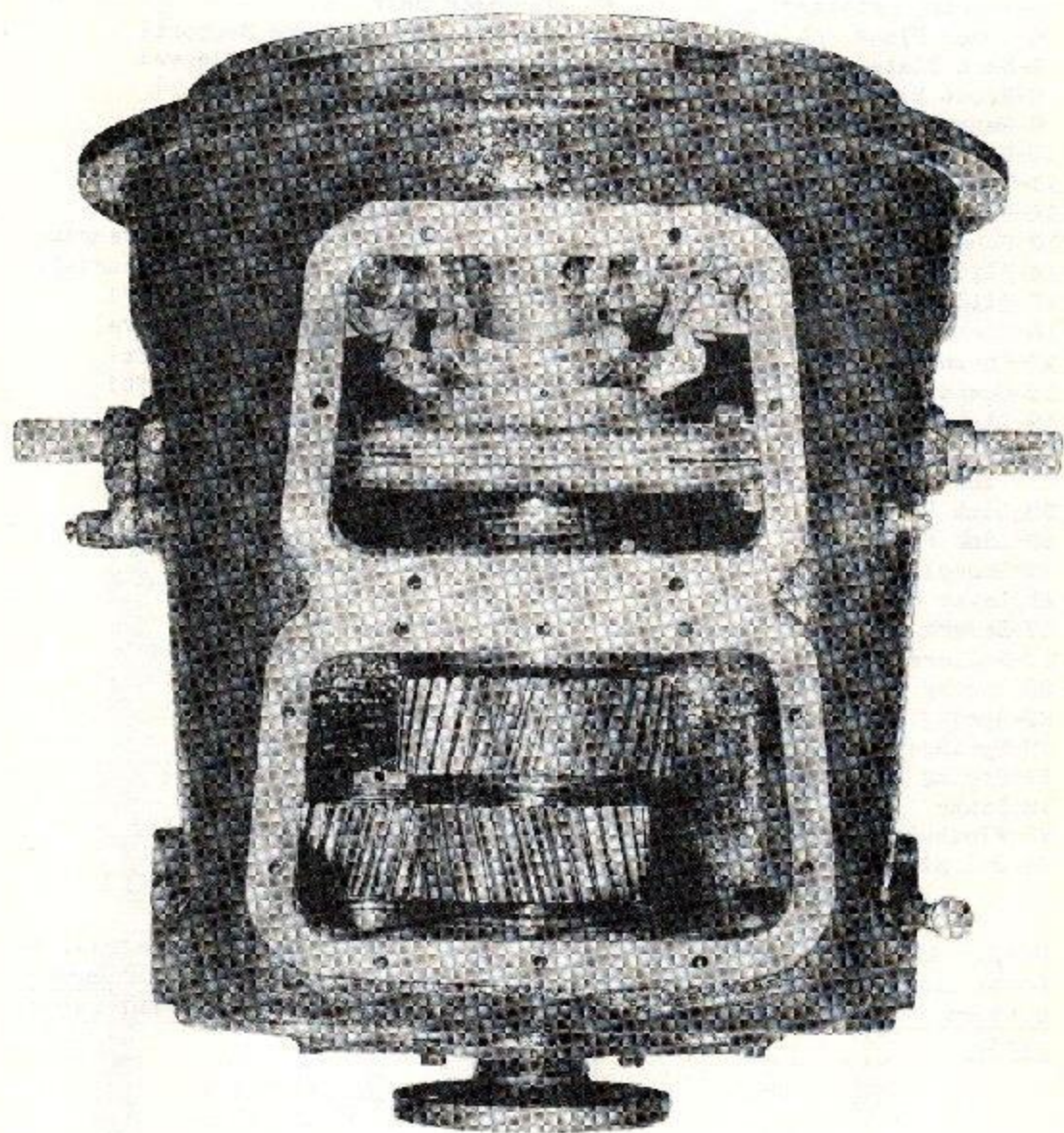


FIGURE 18

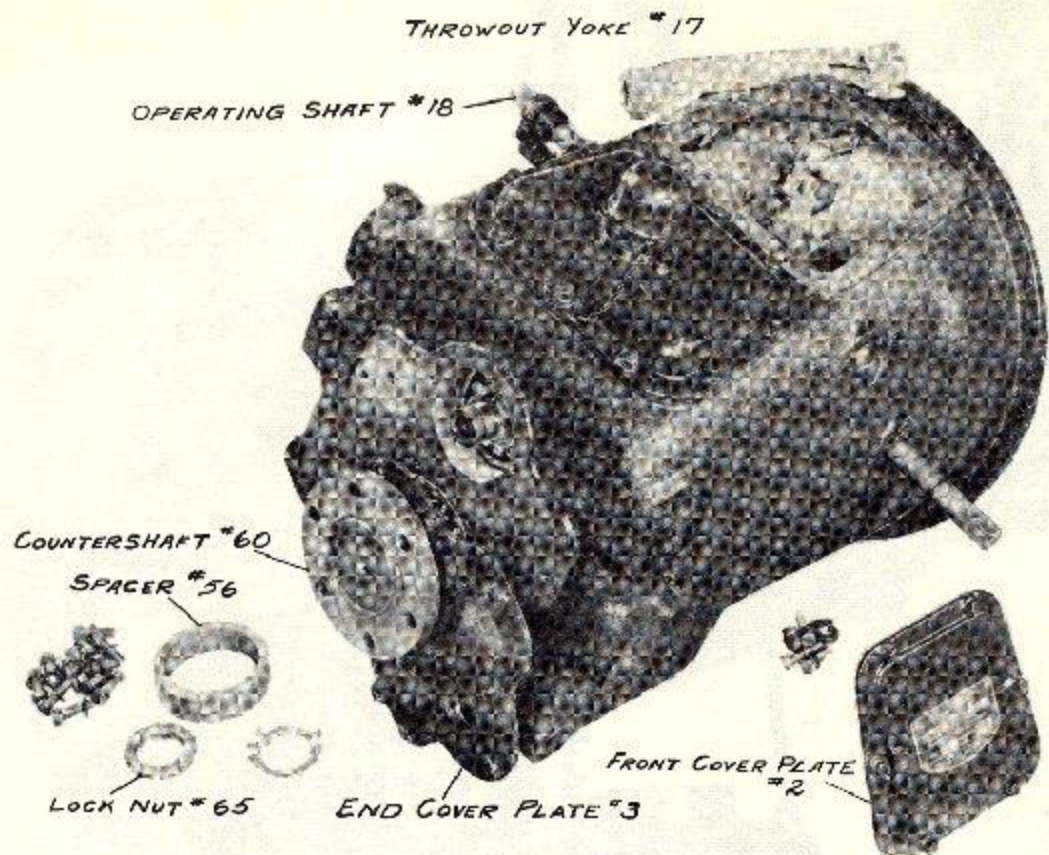


FIGURE 19

TO REMOVE CLUTCH ASSEMBLY

Remove cap screws from front cover plate #2 and remove plate.

Loosen the two cap screws holding operating shafts #18 and throw-out yoke #17 together and pull operating shafts out of throw-out yoke. Remove the throw-out yoke. Remove cap screws from bearing retainer #5.

WARNING: Care must be exercised so as not to injure the oil seal #61. Do not move the bearing retainer.

Remove jam nut #64 and loosen the flexible hose #33 from the housing #1.

Remove the cap screws from end cover plate #3 and revolve and cover plate about countershaft #60 to the position shown in Figure #13.

NOTE: Care must be exercised so as not to injure oil seal #63.

Remove the spacer #56.

Remove the Lock Nut #65.

Figure 19 shows the Marine Gear at this point of dismantling.

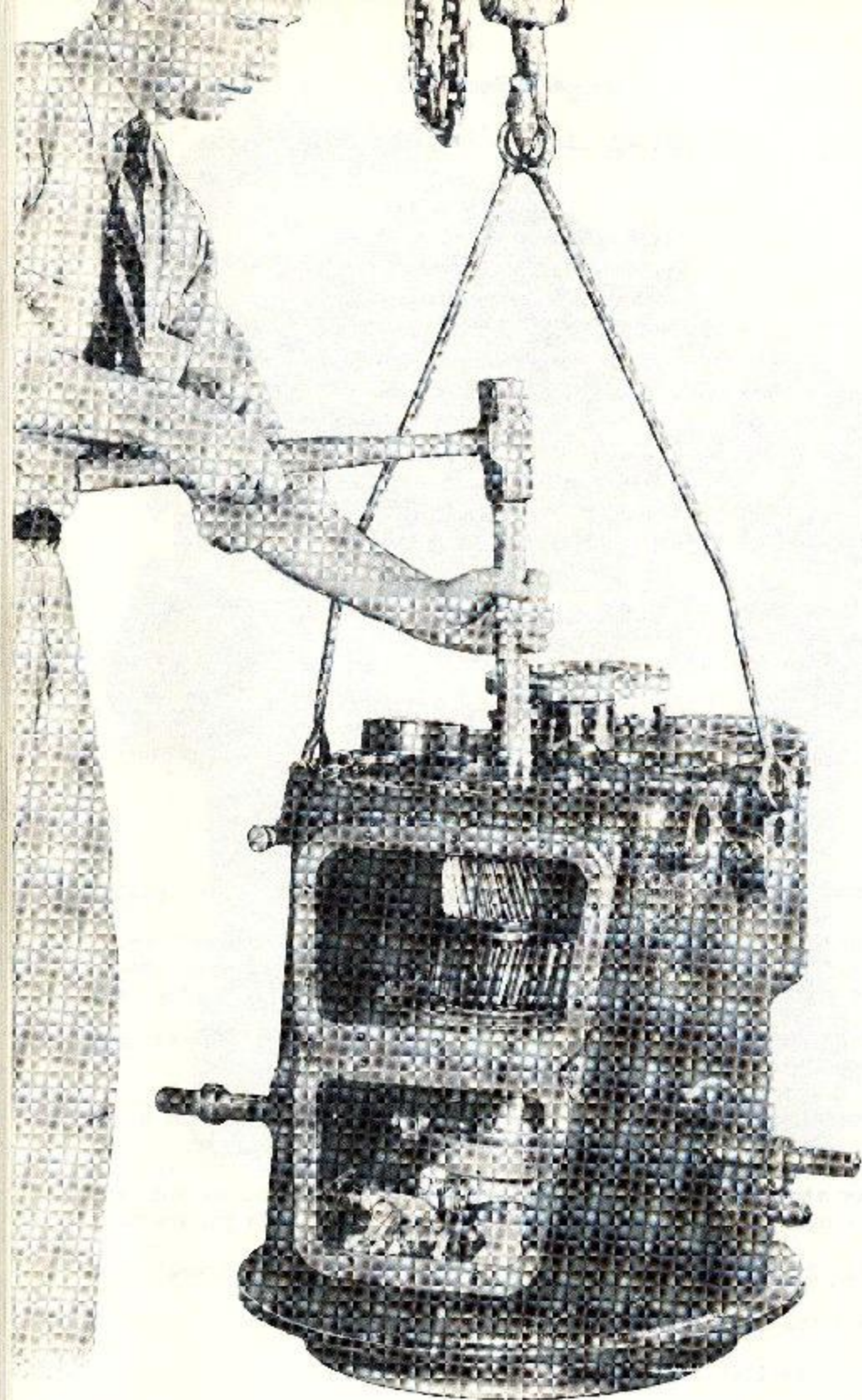


FIGURE 20

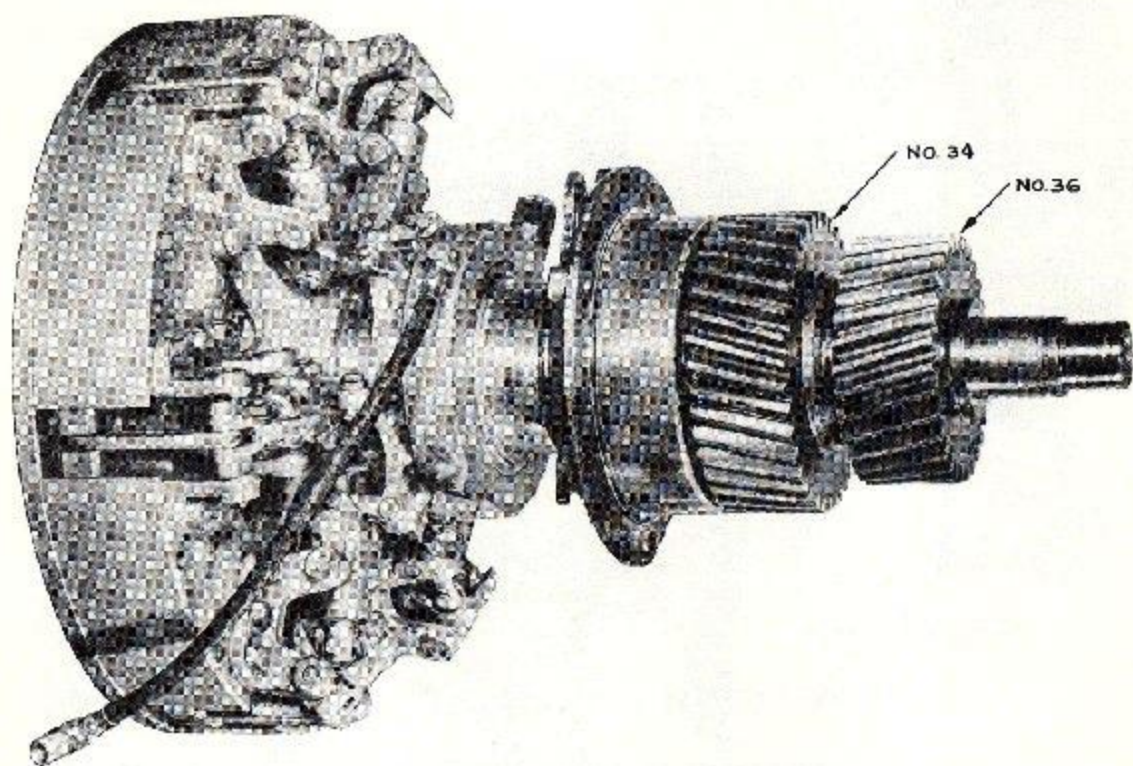


FIGURE 21

Stand Marine Gear on end and block under housing so that back plate clears floor approximately one inch. Drive the clutch assembly out of the housing by driving against the end of the reverse shaft as shown in Figure 20.

WARNING: A block of wood or bar of some soft metal such as brass must be placed against the end of the reverse shaft to prevent marring of the shaft.

When the clutch assembly breaks loose from the housing, the housing is lifted up and off the clutch assembly.

The clutch assembly and reverse pinion, which is removed from the Marine Gear housing as a unit, is shown in Figure 21.

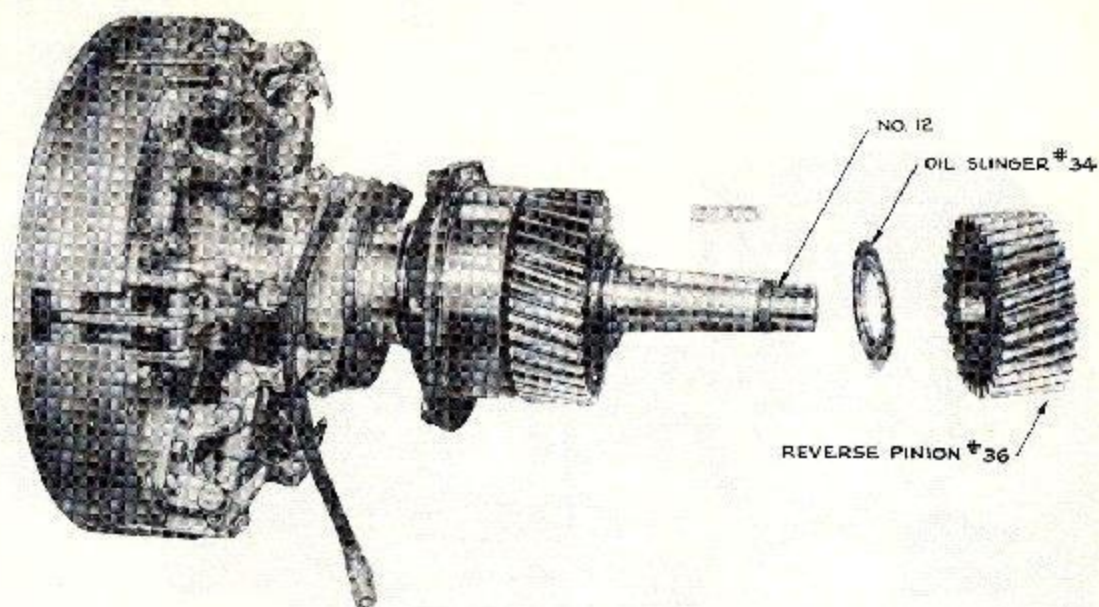


FIGURE 22

TO REMOVE REVERSE PINION AND OIL SLINGER

To remove the reverse pinion #36 and oil slinger #34 from the assembly shown in Figure 21 it is necessary to exert pressure against the pinion, tending to lift it off the shaft and at the same time strike the end of the shaft a sharp blow. This will break the pinion loose from the shaft and it can be lifted off. The oil slinger can then be lifted off. The clutch assembly with reverse pinion and oil slinger removed is shown in Figure 22.

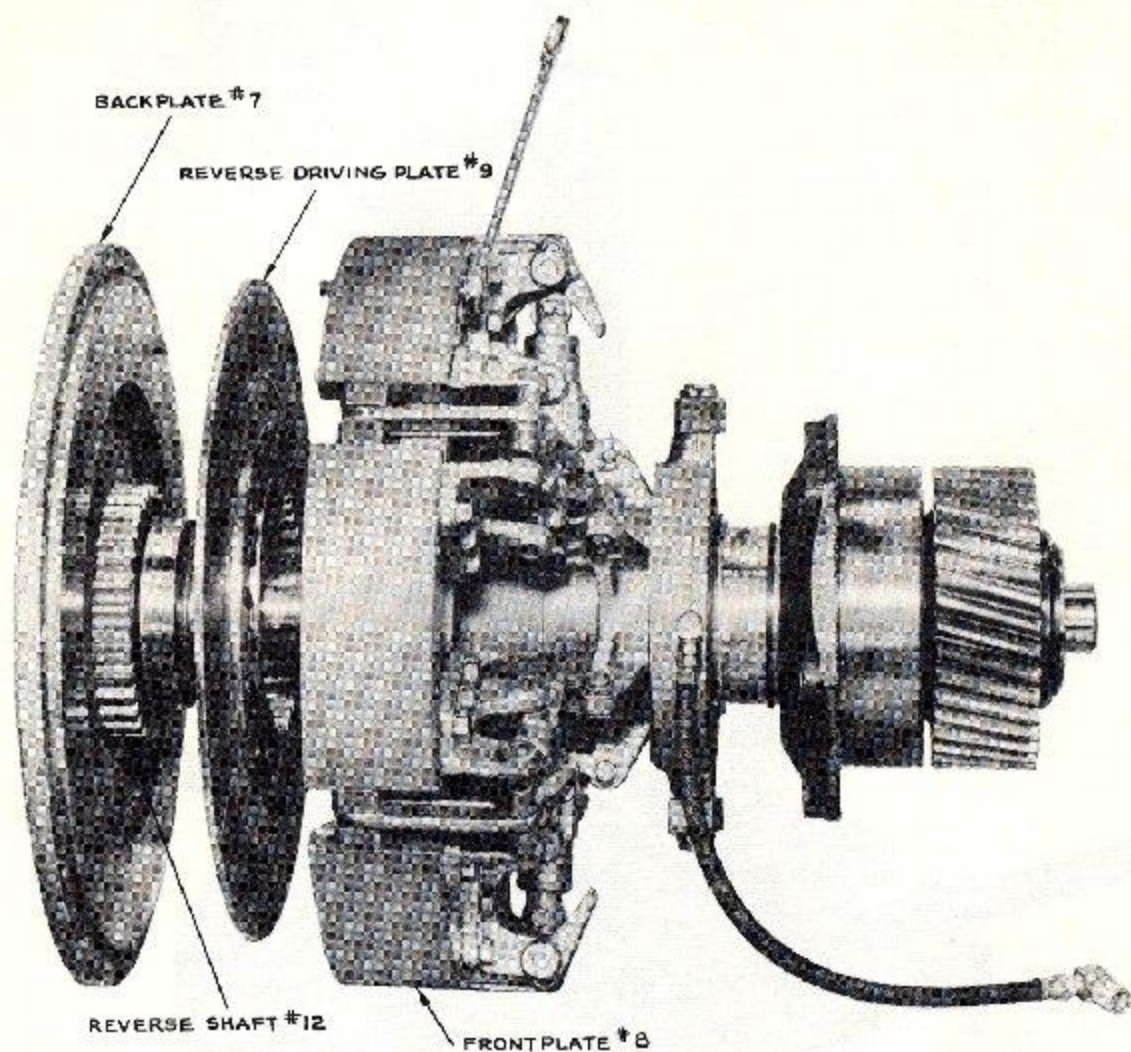


FIGURE 23

TO REMOVE THE REVERSE SHAFT AND REVERSE DRIVING PLATE

Remove the two cap screws, 180° apart, holding the front plate #8 and back plate #7 together. With the assembly in the position shown in Figure 22, drive the reverse shaft #12 through the forward sleeve #13. The back plate #7, reverse shaft #12, and reverse driving plate #9 may then be removed as shown in Figure 23. (The M.G. 55 has no back plate, see Figure 9, so that procedure referring to back plates is omitted when dismantling M.G. 55).

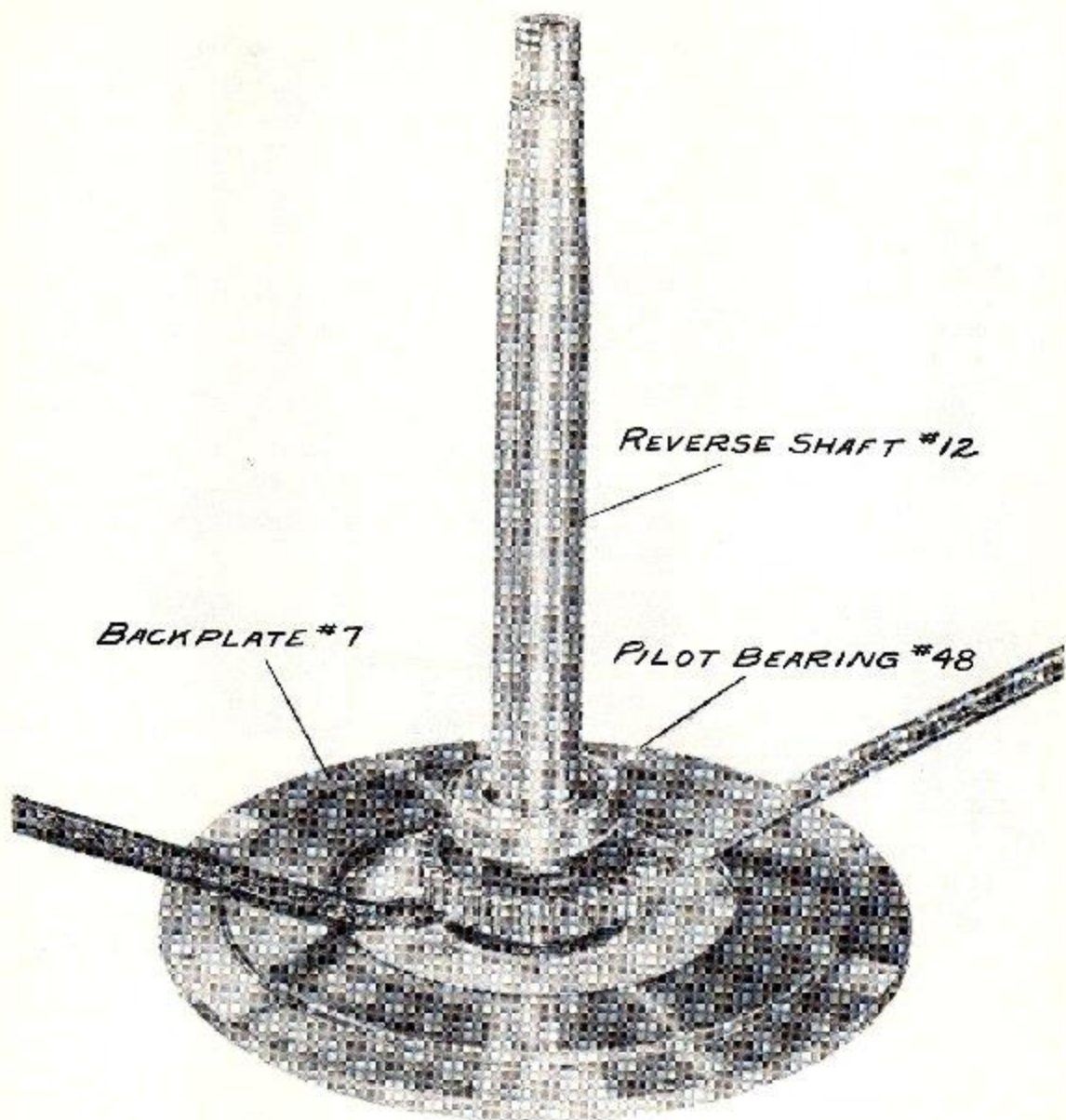


FIGURE 24

TO REMOVE THE BACK PLATE FROM THE REVERSE SHAFT

To remove the back plate #7 from the reverse shaft #12, place two bars under driving gears, which is integral with the reverse shaft, and lift pilot end of reverse shaft out of back plate as shown in Figure 24.

The pilot bearings #48 and #47 may then be removed from the shaft.

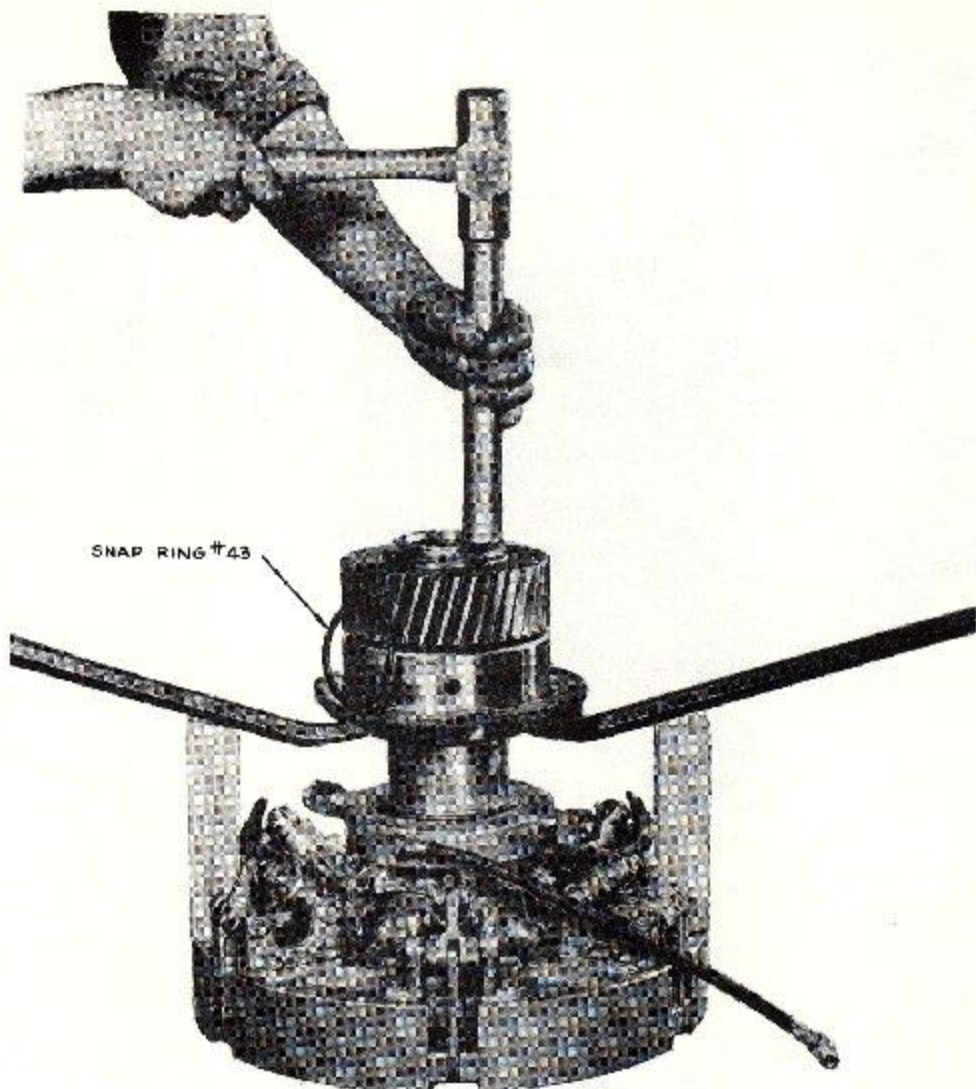


FIGURE 25

TO REMOVE FORWARD PINION, BALL BEARING, BEARING RETAINER AND OIL SEAL

To remove forward pinion #35, ball bearing #50, bearing retainer #5 and oil seal #61 from the forward sleeve #13, it is first necessary to remove snap ring #43 from the forward sleeve. Arrange two bars as prisms, and exert a force tending to lift the parts off the forward sleeve and at the same time using a soft bar as a drift, drive against the end of the forward sleeve as shown in Figure 25. Care must be exercised so as not to injure the oil seal #61 when prying against the bearing retainer. Figure 26 shows the forward pinion, ball bearing, bearing retainer and oil seal removed from the forward sleeve.

To remove the ball bearing #50 from the forward pinion #35 it is necessary to remove snap ring #45. The bearing can then be driven off the forward pinion.

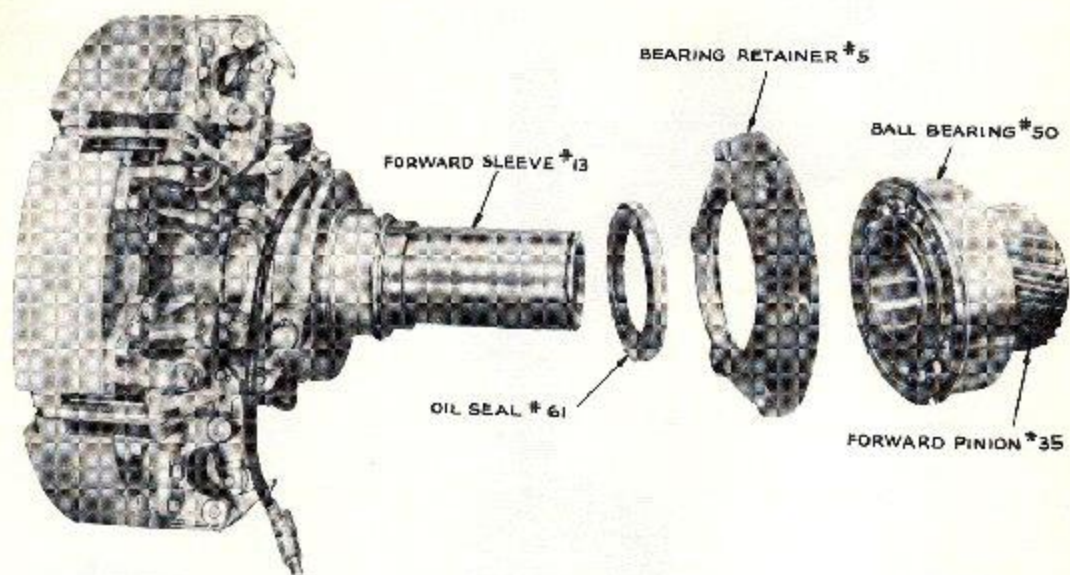


FIGURE 26

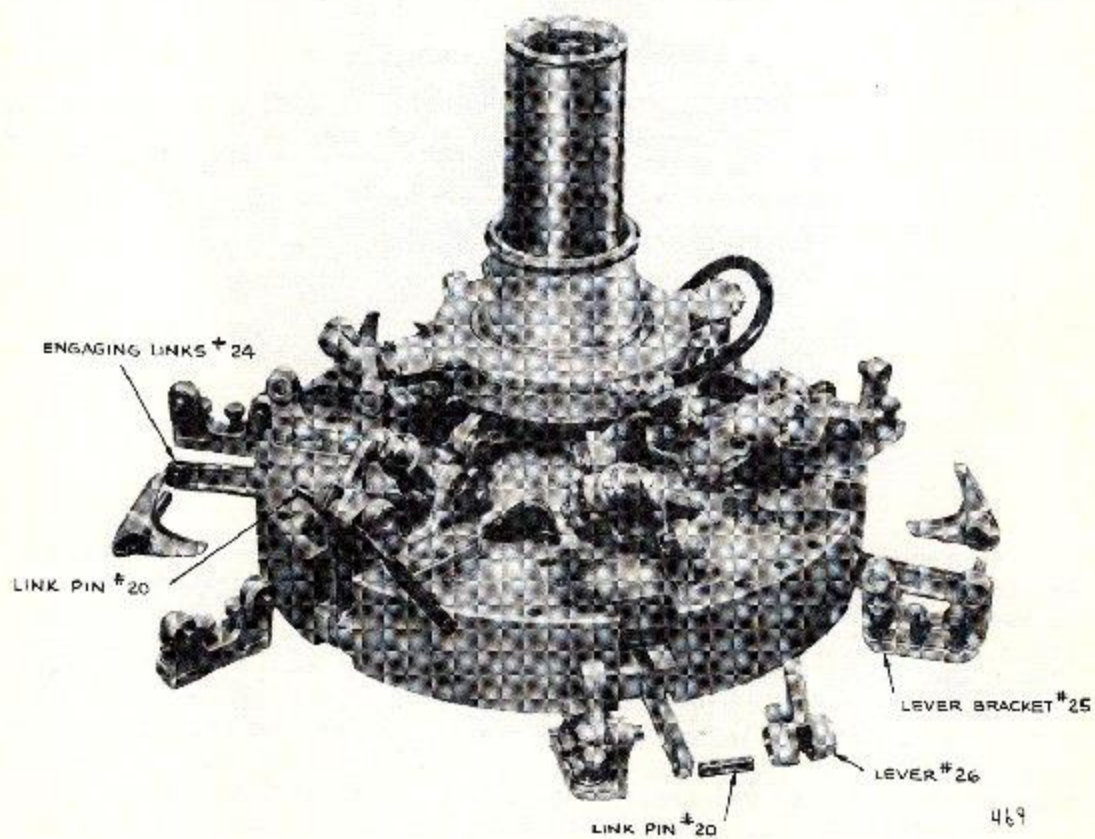


FIGURE 27

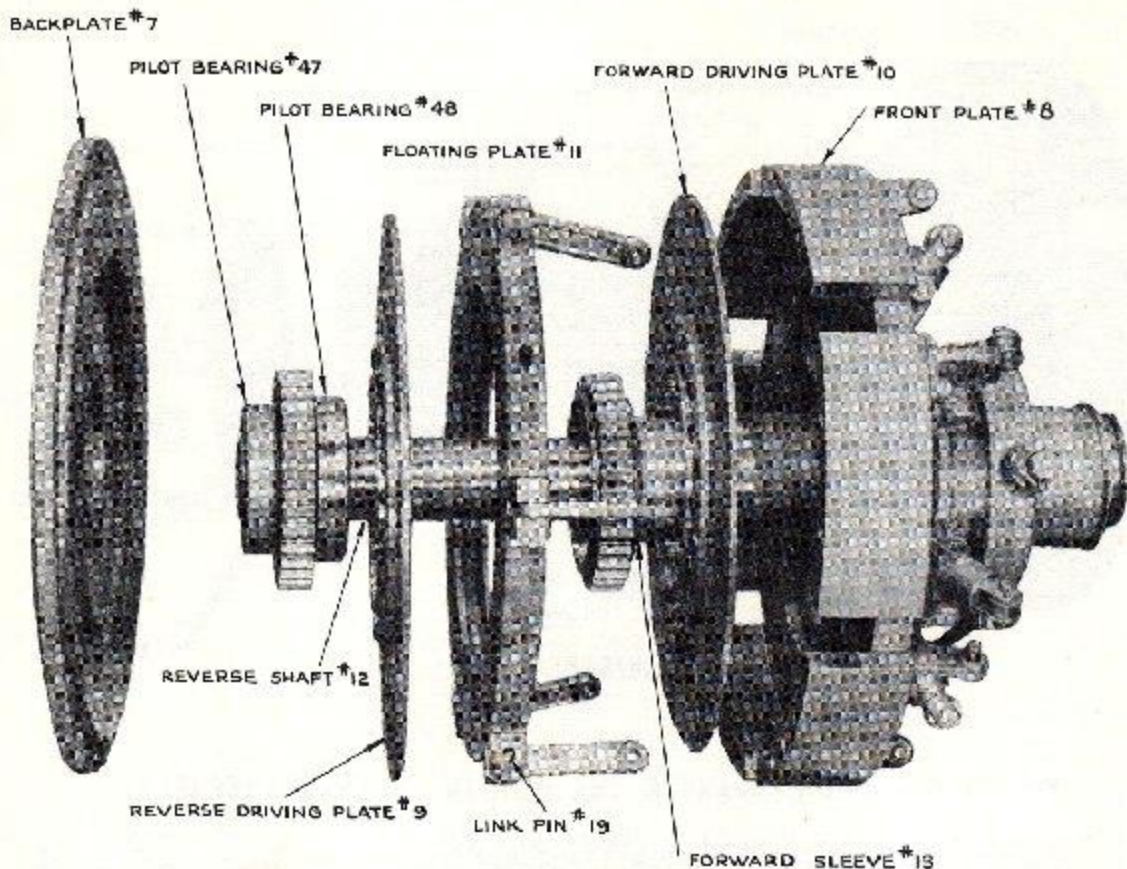


FIGURE 28

TO REMOVE THE FORWARD SLEEVE NO. 13, FORWARD DRIVING PLATE NO. 10 AND FLOATING PLATE NO. 11

Remove the cap screws holding alternate lever brackets #25 to the front plate #8 and remove the brackets.

Remove the link pins #20 and then remove the levers #26.

NOTE: Be sure the levers are replaced in the same position when reassembling unit. The side of the lever with the deep slot must be toward the front plate #8. Figure 27 shows the clutch unit at this stage of dismantling. It also shows method for removing link pin #20 from lever #26.

The floating plate #11, driving plate #10 and forward sleeve #13 may now be removed.

Figure 28 shows a spread view of the clutch parts.

IMPORTANT: When assembling unit the flanged side of the gear tooth rings of driving plates #9 and #10 must be toward the floating plate #11, that is, the flanges must face each other.

The engaging links #24 are removed from the floating plate by removing the link pins #19.

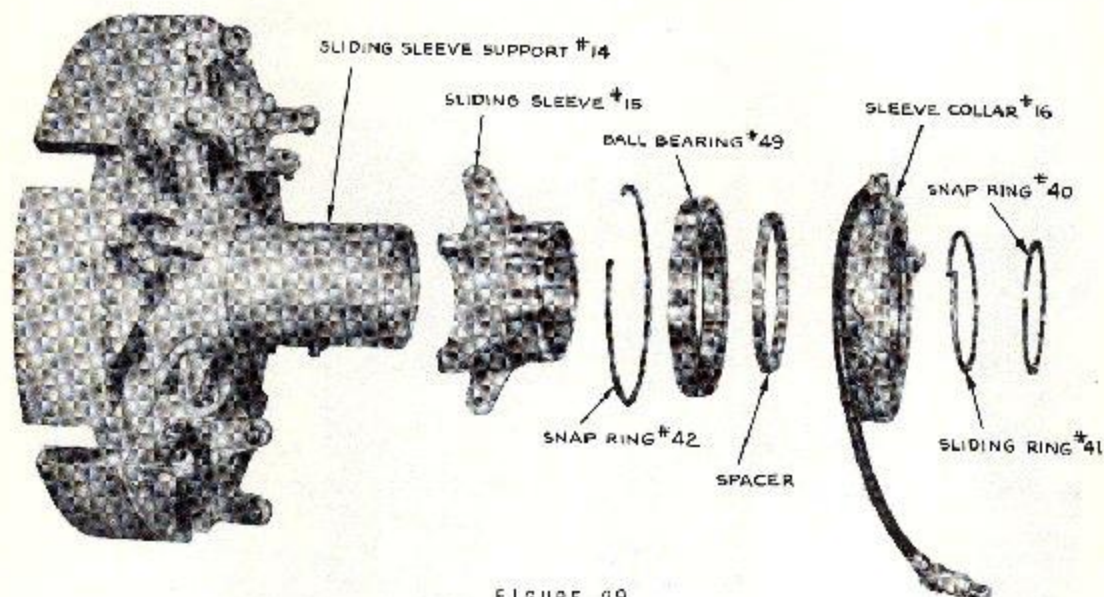


FIGURE 29

TO REMOVE AND DISMANTLE THE SLIDING SLEEVE ASSEMBLY

Remove snap ring #40 from sliding sleeve support #14. Remove cotter pins and link pins #23 which hold the links #32 together with sliding sleeve #15. The spring cup assemblies may now be removed. The sliding sleeve assembly is now removed from the sliding sleeve support. Remove snap ring #42 from sleeve collar #16. Drive the sleeve collar #16 off the ball bearing #49. Remove snap ring #41 from the sliding sleeve #15. Press the ball bearing #49 and spacer off the sliding sleeve. Figure 29 shows the sliding sleeve dismantled.

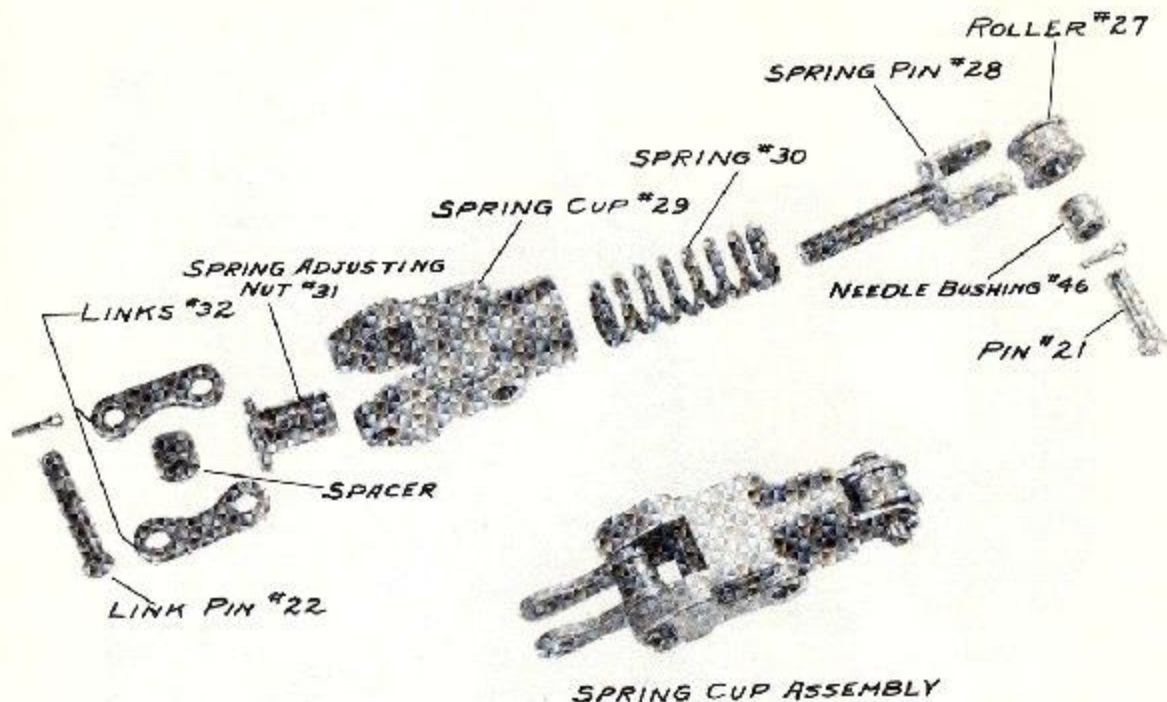


FIGURE 30

Figure 30 shows a spring cup assembly complete and also one spring cup assembly completely dismantled. These spring cup assemblies are the means by which the clutch is loaded. They are accurately adjusted at the factory and are so designed to take up any wear in the driving plates.

Under no circumstances except failure of the spring cup assembly itself, should this assembly be dismantled or the adjustment tampered with.

TO REMOVE THE IDLER GEAR SHAFT NO. 59, IDLER GEAR NO. 39, AND THE BALL BEARINGS NO. 54

Remove cap screws from rear top cover plate #4 and remove cover plate. Remove cotter pin and slotted nut #68 from the end of the idler gear shaft #59. By means of a puller remove the idler gear shaft. As the idler gear shaft is pulled from the housing #1 the idler gear and ball bearings will, automatically, be pressed off the shaft inside the gear case. The idler must be lifted off the idler shaft to prevent its falling into the bottom of the gear case and being damaged. Figure #25 shows the method used and the puller required to pull the idler shaft.

Figure 32 shows the idler shaft #59, idler gear #39, ball bearing #54, spacer #57 and slotted nut #68 after removal from the housing #1 and completely dismantled.

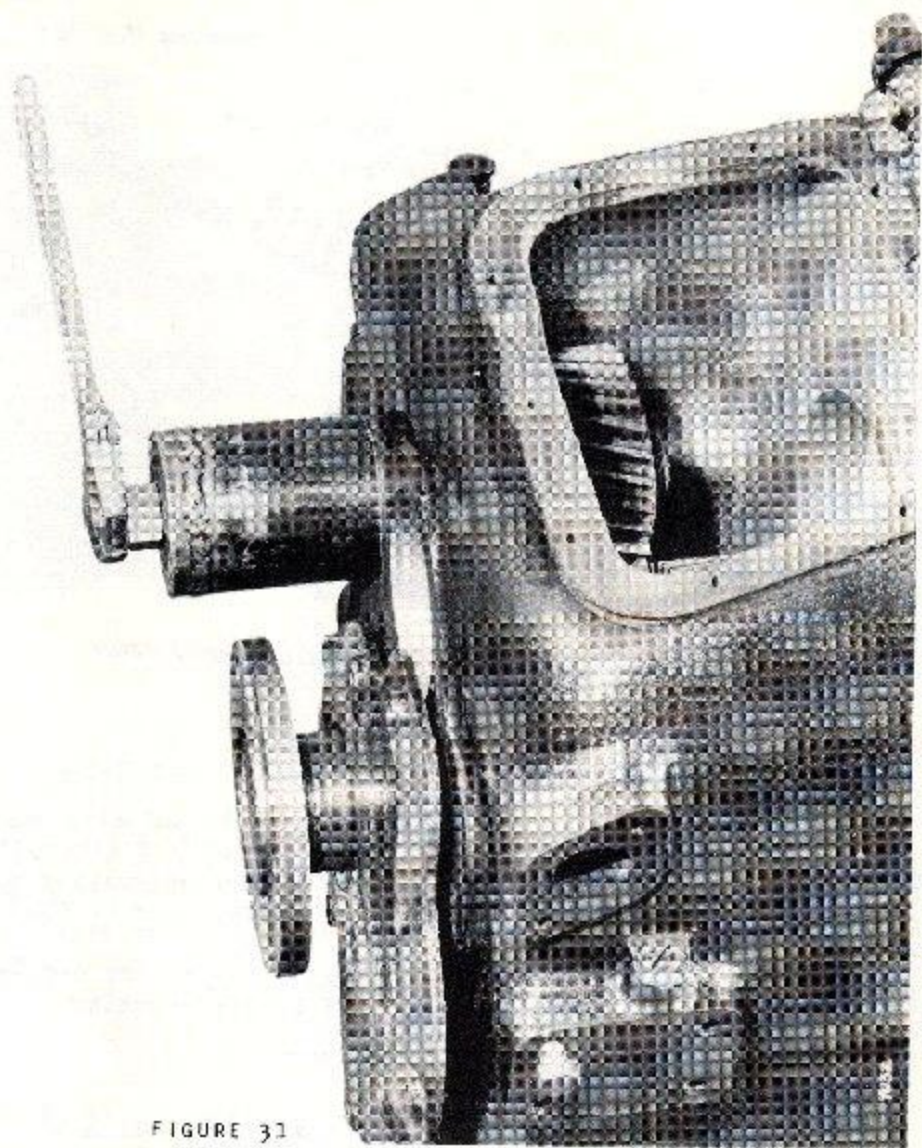


FIGURE 31

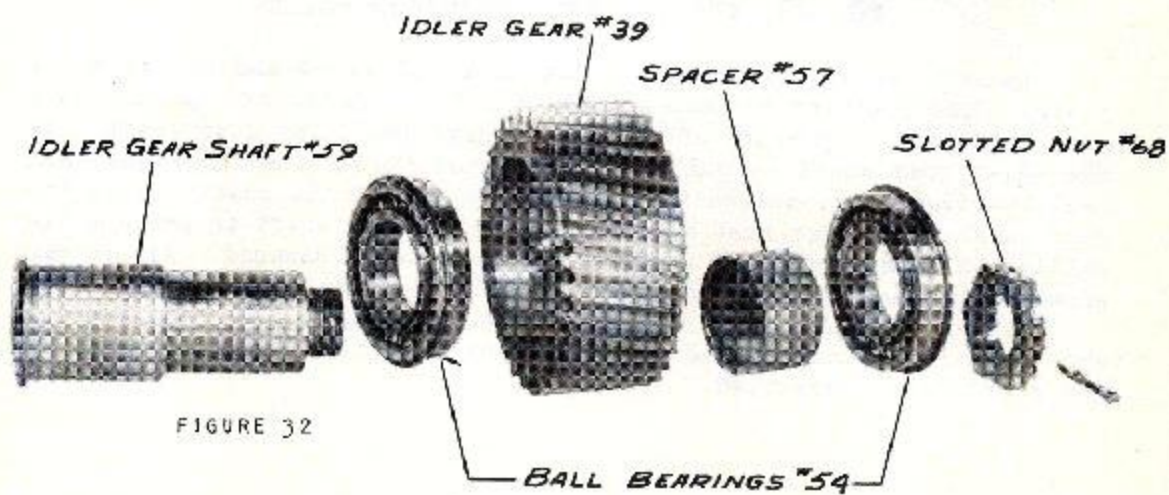


FIGURE 32

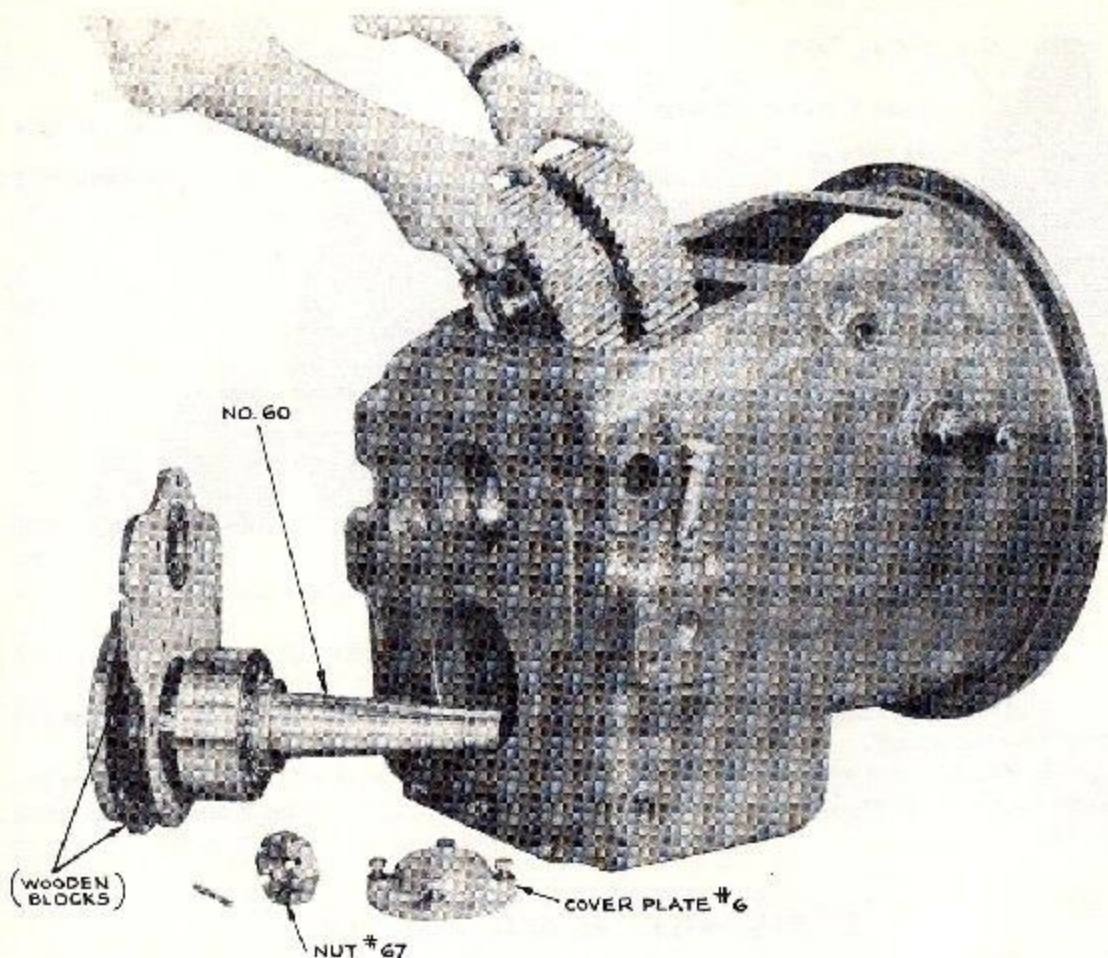


FIGURE 33

TO REMOVE COUNTERSHAFT NO. 60 AND GEAR ASSEMBLY

Remove cap screws from cover plate #6 and remove cover plate. Remove cotter pin and slotted nut #67 from front end of countershaft #60. Using a soft metal bar or block of wood against the threaded end of the countershaft, drive the countershaft #60, ball bearing #52 and the nut #66 out the rear of the gear housing. The gear assembly will come off the countershaft #60 and remain in the gear case. As observed in Figure 33, it is recommended to place two small blocks of wood between cover plate #6 and the flange of countershaft #60. By doing this the oil seal #63 will not be injured because the cover plate will be held vertical to the countershaft at all times. Figure 33 shows manner in which the countershaft is removed from the housing and the manner in which the gear assembly is removed from the housing of all Marine Gears except the following 3 to 1 ratio Gears: M.G. 61, M.G. 166, M.G. 200 and M.G. 201.

In the 3 to 1 ratio gears named above it is necessary to remove the cap screws from the bottom cover plate and remove the bottom cover plate. The 3 to 1 ratio gears are removed through the opening in the bottom of the gear case.

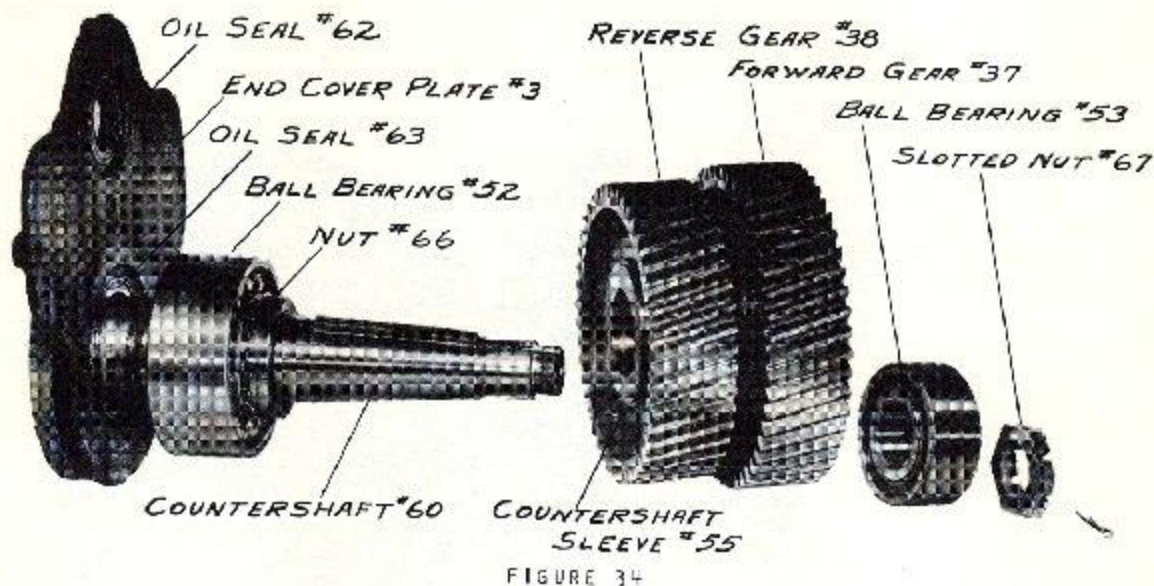


Figure 34 shows the countershaft and gear assembly after removal from the housing.

WARNING: When driving against the threaded end of the countershaft extreme care must be exercised so as not to injure the threads on the shaft.

TO DISMANTLE THE GEAR ASSEMBLY

Remove snap ring #44 from the countershaft sleeve #55. Press the reverse gear #38 and the forward gear #37 off the countershaft sleeve.

TO REMOVE THE BALL BEARING NO. 52 AND END COVER NO. 3 FROM COUNTERSHAFT NO. 60

Remove nut #66 from countershaft. Press ball bearing #52 off the countershaft. The end cover can then be slid off the countershaft.

PROCEDURE TO FOLLOW ON M.G. 166

Due to a variance in the construction of the forward sleeve oil seal retainer assembly, a slightly different routine must be followed during the tear down of this unit. (See Figure 14).

1. Loosen cap screws holding operating shaft #18 and throwout yoke #17 and pull operating shafts out of throwout yoke. Remove throwout yoke.
2. Remove jam nut #64 and loosen flexible hose #33 from housing #1.
3. Remove the upper end cover plate #3. (This is slightly different in constructions than the cover plate on other models).

NOTE: BE CAREFUL OF OIL SEAL IN COVER PLATE.

4. Remove spacer #56.
5. Remove lock nut #65 and lock washer.
6. Remove two cap screws holding back plate #7 to front plate #8.
7. Remove reverse shaft #12, back plate #7 and bearing #47 by tapping on back end at shaft with brass bar. This should also break loose the reverse pinion #36.
8. Pinion #36 can then be lifted through the top hand hole.
9. Stand unit on end and raise housing off the floor as is indicated in Figure 20, page 32.
10. Remove nut and washer from back end of forward sleeve.
11. Remove cap screws from bearing retainer #5.
12. By tapping the forward sleeve with a brass bar the complete balance of the clutch assembly and forward sleeve can be pushed down and out from the housing.

NOTE: BE CAREFUL OF THE FORWARD SLEEVE OIL SEAL IN THE RETAINER #5.

Rebuilding of this much of the Marine Gear can be done by reversing the above procedure. We caution you, however, that you must round off the corners of the gear part of the forward sleeve where it rests against the inner race of the ball bearing. This is done to protect the oil seal.

Because of the high reduction ratio in the M.G. 166 it is necessary to remove the bottom cover plate and pull the forward and reverse gears through the lower hand hole.

Steps involved are as follows:

1. Clutch and upper shafts must be removed from housing before any work can be done on the countershaft assembly.
2. Remove the cover plate #6.
3. Remove lower end cover plate #3.
4. Remove bottom hand hole plate.
5. Remove countershaft nut #67 and loosen slotted nut between the forward and reverse gears.
6. Using a brass bar on front end of countershaft -- drive shaft #60 out of gears, number 37 and 38 and bearing number 53. Gears should then be carefully brought through hand hole plate.

By reversing above steps the countershaft assembly can be reinstalled in unit. It is only necessary to hold gears in place as shaft is slid through. Reverse gear lock nut and washer must be slid on to shaft before inserting shaft into forward gears.

Keys must also be lined up during this process.

SUGGESTIONS FOR LOCATING AND CORRECTING DIFFICULTIES

THE CLUTCH PLATE MUST RUN DRY

IF THE CLUTCH SLIPS the reason is one of the following:
(It is assumed the correct size Marine Gear is being used)

1. Oil or grease on the driving plates.

To remove the oil or grease from the driving plates, the plate must be removed from the clutch and washed off with kerosene or gasoline. Be sure to remove any carbon that may be on the plate.

If oil or grease is on the plate, the source of this oil or grease should be found and corrected. The following are possible places from which the oil may have come:

A. Crankcase oil leaking through the rear main bearing or seal around the crankshaft into the flywheel housing of the engine.

B. A surplus of lubricant in the pilot bearing of the Marine Gear, the lubricant being thrown into the clutch plate by centrifugal force.

C. A surplus of lubricant in the sliding sleeve bearing and collar.

2. Driving plate may be worn out.

Check spring cup assembly as shown on page 14 to determine whether or not the plates are worn out.

To repair worn out driving plate the procedure is as follows:
(Numbers refer to sectional view Figure #17).

1. Remove front top cover plate #2 and remove Marine Gear from engine.

2. Remove the two cap screws holding back plate #7 and front plate #8 together and remove back plate. (On the M.G. 55, it will be noted, there is no back plate and this operation is omitted.)

3. Remove reverse driving plate #9.

4. Remove cap screws from alternate lever brackets #25 and remove the brackets.

5. Remove the link pins #20.

6. Remove floating plate #11.

7. Remove forward driving plate #10.

8. Replace worn out driving plate assemblies #9 and #10 with new driving plate assemblies and reverse the above procedure to assemble clutch.

WARNING: Be sure the flanged side of the gear tooth rings of the driving plate assemblies are to the inside, that is, facing each other as shown in Figure #23.

3. If the clutch cannot be shifted into forward or reverse.
(Referring to Figure #17) Bearing #47 or #48 may be broken.

PILOT BEARING FAILURES are caused by the following reasons:

1. Insufficient lubrication or using the wrong lubricant.
See page 15 for the correct lubrication and lubricant.
2. Misalignment between the Marine Gear and flywheel or flywheel housing of the engine.
See pages 9 and 10 for the allowable misalignment and how to check it.

THROW-OUT BEARING FAILURES are caused by the following reasons:

1. Insufficient lubrication or using the wrong lubricant.
See page 15 for the correct lubrication and lubricant.
2. Continuous thrust load on bearing due to the weight of the engaging linkage from the pilot house to Marine Gear.

The engaging linkage must be so designed that there will be no thrust on the engaging collar in either the forward or reverse position. It is impossible to give a set rule for eliminating this thrust as almost all installations are different. However, by the use of counterweights, correctly set for the individual installation, this thrust can be overcome.

POSSIBLE RESULTS OF EXCESSIVE MISALIGNMENT BETWEEN ENGINE AND MARINE GEAR

1. Failure of the pilot bearing. (See above)
2. Failure of the reverse shaft.
3. Overloading gears and pinions and causing uneven wear resulting in noisy gears and their failure.
4. Overloading ball bearings #50 and #51 resulting in the failure of the bearings.

POSSIBLE RESULTS OF EXCESSIVE MISALIGNMENT BETWEEN MARINE GEAR AND PROPELLER SHAFT

1. Failure of the countershaft.
2. Overloading bearings supporting countershaft resulting in their failure.
3. Overloading the gears and causing uneven wear resulting in noisy gears and their failure.

From the above the importance of correct alignment between the Marine Gear and engine and Marine Gear and propeller shaft can readily be seen. See pages 9, 10, 11 and 12 for allowable misalignment and method of checking.

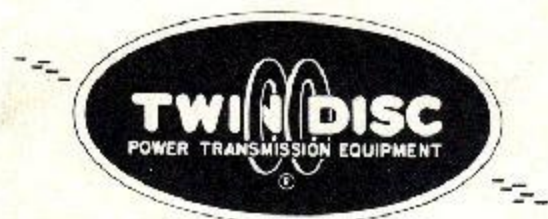
WARRANTY

- (a) The Twin Disc Clutch Company guarantees all assembled products and parts, except parts or equipment on which written warranties by respective manufacturers thereof are furnished the original purchaser, against defective material or workmanship for a period of twelve (12) months from the date of original shipment by the Twin Disc Clutch Company to its customer or two thousand (2,000) hours of service, whichever occurs first.
- (b) Complete units or parts returned* within this warranty period, transportation charges prepaid, which are found by the Twin Disc Clutch Company to be defective in material or workmanship shall at their option be repaired, replaced or credited. No claims will be allowed which in the opinion of the Twin Disc Clutch Company result from complete units or parts having been subjected to abuse or neglect or where failure has been caused by accident.
- (c) Any warranty is void unless the buyer or his agent provides proper care and storage of complete units and parts from date of shipment to date placed in service and unless units are properly installed within rated capacity with installations properly engineered in accordance with the practices approved by the Twin Disc Clutch Company.
- (d) The Twin Disc Clutch Company shall not be responsible for contingent liability or consequential damages of any sort arising through the failure of any complete unit or part.
- (e) No person except authorized factory representatives may assume any liability or expense in the replacing of parts or servicing of units within the warranty period except when such expense is authorized in advance and in writing by the Twin Disc Clutch Company.
- (f) The right is reserved to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture.

*All units and parts, except hydraulic, to be returned to the factory at Racine, Wisconsin. Hydraulic units and parts to be returned to the factory at Rockford, Illinois.



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TWIN DISC CLUTCH COMPANY

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