REVERSING GEAR No. 3UC / 12258

REDUCING GEAR No. 3UC / 12259

ENGINE No. 6L3 / 123256

3 U.C. TYPE

IMPORTANT

In any enquiry, or order for parts, the number of the Reversing Gear must be stated in order to ensure prompt attention.

WORKING INSTRUCTIONS

for the

GARDNER

3 U.C. TYPE REVERSING & REDUCING GEAR

NORRIS, HENTY & GARDNERS, LTD.
(Proprietors: L. Gardner & Sons, Ltd.)

Head Office and Works:
BARTON HALL ENGINE WORKS, PATRICROFT, MANCHESTER.

Telegrams: "Theorem Patricroft Eccles" Telephone: Eccles 2201 (8 lines)

LONDON OFFICE: ABFORD HOUSE, WILTON ROAD, S.W. 1.

Telegrams: "Nornodeste Sowest London" Telephone: Tate Gallery 3315 & 3316.

WORKING INSTRUCTIONS

for the

GARDNER

3 U. C. TYPE REVERSING & REDUCING GEAR.

It is very important that this book should be in the possession of the Person who is responsible for the operation of the Reversing Gear.

RD 134·1

N° 3 U.C. TYPE REVERSING & REDUCING GEAR.

LUBRICATION.

REVERSING GEAR. – Use the same grade of oil as that recommended for the lubrication of the engine. For this refer to the engine Instruction Book.

REDUCING GEAR. – Use an extreme pressure heavy gear oil of mineral base to the following specification. Drain and replenish with new oil every four months. Observe by dip-stick that oil remains fluid. Do not mix one make of oil with another. If there is any possibility that water has entered the gear box immediately drain and replenish with new oil.

Viscosity Redwood No.1
- at 100°F. not greater than 3500 secs.
- at 140°F. not less than 700 "
- at 200°F. not less than 160 "

Specific gravity about ·910 at 60°F.
Pour point not above 25°F.
Flash point (closed) not below 450°F.

QUANTITY OF LUBRICANT REQUIRED FOR INITIAL FILLING (approx).

Reverse Gear	Reduction Gear	
Quantity	Ratio	Quantity
14 pints	2/1	6 pints
	3/1	7½ pints

MAXIMUM & MINIMUM OIL LEVEL.

REVERSING GEAR. – See para. 2 to 7.

REDUCING GEAR. – Maintain the level between the Max. & Min. marks shown on the dip-stick. Test for this before running when the gear is cold.

Do not overfill, this will cause overheating and loss of power.

1 pint = ca 568 cm³
= 0,568 ltr.
14 x 0,568 ⇒ 7,9 ltr
6 x 0,568 ⇒ 3,4 ltr

N° 3 U.C. TYPE REVERSING & REDUCING GEAR.

1. LUBRICATION SYSTEM. – Refer to Fig. 1.
At the aft end of the hollow main shaft of the reversing gear, is mounted a ram pump, that is submerged in the oil sump. This pump delivers oil to the hollow shaft, and from thence, by means of small radial holes in this shaft, delivers oil to all the bearings and other working parts of the reversing gear.

The oil, after passing through these parts, is thrown into the gear case, and from thence drains into the flywheel sump, and the dirt sump. The revolving flywheel then carries the oil (by centrifugal force) from the flywheel sump, to a trough which returns the oil to the main oil sump. This oil flow may be seen through the filling hole.

2. SUMP FILLING INSTRUCTIONS. – Refer to Fig. 1.
Before filling the oil sump for the first time, the three drain plugs must be removed, to ensure that the three sumps are quite empty.

After replacing the three plugs, pour through the filling hole the correct amount required by the gear box. The oil level will now be well above the upper mark on the dip-stick. This level will fall after the engine has been run, because part of the oil will have been transferred to the flywheel and to the dirt sump, as explained in para. 1.

3. FIRST RUN OF ENGINE. – Next run the engine at about 500 R.P.M. for two or three minutes with the ahead or astern clutch engaged, otherwise, the oil pump will not be working. This will distribute the oil, and give an initial oiling to the working parts of the gear. Whilst the engine is still running, the oil level will be found to be between the upper and lower marks on the dip-stick. After this, the engine and gear may be put to work.

4. MAINTAINING OIL LEVEL. – With this lubricating system where the flywheel returns the oil to the main sump, it is not possible to give a definite oil level mark on the dip-stick, because the oil level in main sump varies according to the R.P.M. of the engine, and to the oil temperature in the gear box.

There are two lines on the dip-stick, upper and lower, and if the gear case has been filled in accordance with para. 2, the oil level should be about $\frac{3}{8}$" below the upper line with the engine running at about 900 R.P.M. and the gear box about 90°F.

5. MINIMUM OIL LEVEL. – If the oil level falls below the lower mark or minimum level, with the engine running at 900 R.P.M. as above,

N°. 3 U.C. TYPE REVERSING & REDUCING GEAR.

oil should be added to the gear case to bring the level up to about half-way between the level marks.

6. EXCESS OIL LEVEL. - If, when running, as para. 5, and due to over filling, the oil level reading is more than $\frac{7}{8}$" above the upper mark on the dip-stick, the surplus oil should be drained from the sump.

NOTE:- That it is undesirable to overfill, as the churning of this excess oil absorbs a little power.

7. MAXIMUM & MINIMUM OIL LEVEL. - Finally, it may be said, that if the oil at any engine R.P.M. does not fall below the lower mark on the dip-stick, there is sufficient oil in the gear box. Also if the oil, at any engine R.P.M. does not rise more than $\frac{7}{8}$" above the upper mark, there is not an excess of oil in the gear box.

8. LUBRICATING PUMP. - Refer to Figs. 1 & 2.
To check the working of this pump, it is advisable from time to time, to see that the oil is flowing along the return trough from the flywheel. This flow can be seen through the filling hole.

As the pump is submerged in the oil sump, it is extremely improbable that it will fail. Nevertheless it is prudent to check its action at intervals, by observation of the return oil flow.

The pump has two rams or plungers, the lower being the pump ram, and the upper being a balancing ram, which also serves as a pressure relief valve. The ball suction valve is carried at the lower end of the pump body, and the ball delivery valve is carried in the upper end of the pump ram. Flats are provided on the pump ram so that it can be held in a vice or spanner, when removing the screwed valve seat, with the special screwdriver that is provided.

9. REMOVAL OF OIL PUMP. - Refer to Figs. 1 & 2.
If the pump should fail, it must be removed from its shaft to find the cause of failure, and to do this, proceed as follows:-

Take off the cover of the gear case, having first put the gear in "neutral", next take out the cam plate shaft. To do this, release the setscrew in cam plate and slide the cam towards the crank as far as possible. The cam will now be clear of the bowl on the lower shaft, and after removing the two shaft pivot screws in the gear case, the cam and its shaft can be lifted out.

N^{o} 3 U.C. TYPE REVERSING & REDUCING GEAR.

Next, remove the two cap bolts of the pump, and take off the cap. Just above the gauze strainer will be found a knurled collar. If this is lifted upwards against the action of the spring and held upwards, the pump body can be lowered or disengaged from its shaft. When in this position, the pump can be moved sideways to clear the gear shaft, whilst lifting it from the gear case. The pump can of course be replaced by reversing the foregoing sequence of operations.

10. CAM PLATE BOWL. - Refer to Fig. 2.
Make sure that the bowl is in place on the lower shaft, before sliding the cam plate into its working position.

11. DIRT & FLYWHEEL SUMP. - Refer to Fig. 1.
This dirt sump is provided to trap any dirt particles that may collect from the wear of the clutch surfaces etc. It is therefore advisable to drain this, and the flywheel sump, at intervals of say 200 hours, in order to remove any dirt that may have collected therein. The oil removed may be re-used after filtering. When draining this sump, take note of the oil quantity removed, and afterwards restore a similar quantity through the filling hole. At intervals of about 1,000 hours working, the gear case should be completely drained and the oil renewed.

12. AHEAD CLUTCH. - Refer to Fig. 2.
This clutch is of the plate type, having alternate bronze and steel plates, that are loaded by the four clutch levers, each having an adjusting screw that transmits the pressure to the clutch plates by means of the clutch springs.

It is very important that the adjustment of these is such, that the load is shared equally between the four levers, and also that they must not be adjusted tighter than mentioned below and thus overstress the mechanism.

13. ADJUSTMENT OF AHEAD CLUTCH. - Refer to Fig. 2.
Move the clutch collar so that the lever rollers are resting on its smaller diameter. Unscrew the adjusting screw so that they do not project beyond the inside face of the levers. Move the clutch collar to bring the rollers in contact with its larger diameter. Taking each screw in turn, and holding the screw between the thumb and finger, turn the screw until it exerts a little but definite pressure on its clutch spring, then lightly lock the screw with its nut, taking care not to turn the screw when doing so. After

N° 3 U.C. TYPE REVERSING & REDUCING GEAR.

this, move the clutch collar to bring the rollers on to the smaller diameter. Again taking each adjusting screw in turn, unscrew the lock nut without allowing the screw to turn, and then tighten up the screw $1\frac{3}{4}$ turns, estimating this by the screwdriver slot in the screw and firmly lock its nut, again taking care not to turn the screw when doing so.

If this procedure has been carefully followed, the levers will be adjusted equally. Do not adjust more than the $1\frac{3}{4}$ turns, and when so adjusted, it should require a pull of 95 to 100 lb. at 2 ft. radius of the operating hand lever, to engage the clutch. This pull can be read by means of a spring balance and a cord.

13.1 When the reversing gear is fitted with wheel control proceed as directed in paragraphs 12 & 13. When so adjusted it should require a pull of 68 to 72 lb. at the 5" radius of the hole in the operating hand wheel, to engage the clutch. This pull can be read by means of a spring balance and a cord from the hole in the hand wheel rim.

14. ASTERN CLUTCH OR BRAKE. – Refer to Figs. 2 & 3.
This clutch takes the form of a brake, having a pair of alloy brake shoes, lined with friction fabric, the shoe hinge being anchored to the bottom of the gear box, whilst the upper ends of the shoes are contracted by means of a right and left hand screw shaft, which is in turn held endwise in the upper part of the gear box. It will be seen, that if the two adjusting nuts are equally adjusted, no disturbance of alignment of the rotating gear case and its shaft can take place. For this reason it is very important to adjust the two nuts so that the brake shoes when closing make contact with the drum at the same time.

15. ADJUSTMENT OF ASTERN CLUTCH OR BRAKE. – Refer to Figs. 2 & 3.
Remove the gear case cover having previously put the gear into "reverse". Next unscrew the bolts of the two locking clips, and turn both the adjusting nuts away from the shoes. The small bolt that is provided, must now be placed in the slots at the top of the brake shoes. Tighten this bolt, but not too much, and thus clamp the shoes on to the drum. After this, turn one adjusting nut until it is in contact with the shoe washer, hold it in this position with the fingers whilst the locking collar nut is tightened. Repeat this operation on the other adjusting nut.

The two adjusting nuts will now be adjusted equally, but there will not be sufficient load on the brake shoes, consequently, further and final adjustment is necessary.

N° 3 U.C. TYPE REVERSING & REDUCING GEAR.

16. FINAL ADJUSTMENT OF ASTERN CLUTCH. – Refer to Figs. 2 & 3.
For this, remove the bolt from the brake shoe slots, and turn the cam plate, until the astern clutch lever is in its highest position.

On the locking clips will be found a line, and below this line a dot, and the distance between these, defines the necessary adjustment to load the brake shoes. Make a mark with a scriber on both adjusting nuts, that will coincide with the DOT on the collar. Do this carefully. After this, unscrew one locking clip nut, just sufficiently to enable the adjusting nut to be prised round. With the screwdriver end in one of the slots, and using the brake shoe as a fulcrum, prise the nut round, until the scribed mark, that has just been made on the nut, coincides with the LINE on the locking clip. The locking clip must now be well tightened up. Repeat the operation on the other adjusting nut. This completes the astern clutch or brake adjustment.

Do not exceed the above adjustment, which should require a pull of 85 to 90 lb. at 2 ft. radius of the operating hand lever to engage this clutch, when the reversing gear is cold.

When the gear is warm (about 110°F.) the above pull will be a little less, owing to the expansion of the brake shoes, but the clutch or brake will still carry its load.

16.1 When the reversing gear is fitted with wheel control proceed as directed in paragraphs 14, 15 & 16. When so adjusted it should require a pull of 62 to 66 lb. at the 5" radius of the hole in the hand wheel rim to engage the clutch, when the reversing gear is cold.

17. CLUTCH MECHANISM. – Refer to Figs. 1, 2 & 3.
The three shafts of this mechanism, i.e. the astern clutch screw shaft, the cam plate crank or shaft, and the ahead clutch shaft, are carried by adjustable pivot screws. To locate their endwise position all the three shafts are made to fit endwise between their bosses. To adjust these shaft pivots, proceed as follows:–

Unscrew the lock nuts, then using the fingers only, tighten one screw sufficiently to push the shaft end into contact with the inside face of the boss that is on the other side of the case. Again using the fingers, tighten the other end pivot screw. The shaft

will now be a little stiff on its pivots, but the act of locking the nuts, will withdraw the screw pivots a little, and thus free the shaft. Hold the pivot screws with a spanner so that they cannot turn when locking the nuts.

NOTE:- It is important, that these shafts are closely adjusted, and at the same time, are free on their pivots. If not, the clutch collar shoes will continue to rub on the collar face, after the ahead clutch is engaged.

18. LEVER CONTROL TRAVEL. - This is correctly adjusted before leaving the works and should not require attention, unless the original adjustment is disturbed during internal inspection of the gear, involving removal of the top cover.

19. MESHING OF INTERNAL OPERATING QUADRANT. - It is important that the quadrant on the handlever cross-shaft be meshed correctly with the pinion on the cam cross-shaft, so that the quadrant abuts up to the stops, situated in the cover, in both ahead and astern positions. If the meshing is not correct either the ahead or astern clutch will not be fully engaged, in addition, the stopping of the lever or remote control mechanism (if fitted), will be transferred to the internal operating mechanism, which is not capable of withstanding the shock loads.

To ensure correct meshing of the quadrant, set the internal mechanism in the neutral position, with the line through the conical recess on the cam body coinciding with the line on the top face of the casing. Before placing the cover in position, set the hand lever so that the line on the lever socket coincides with the line on the extended boss of the cover.

Check the meshing by noting that these latter lines are coinciding exactly when the neutral locating plunger is fully engaged.

20. REMOTE CONTROL. (if fitted). - When making the initial adjustment to the remote control, it is essential that, when the control is placed in the neutral position, the timing line on the reversing gear cover coincides with that on the lever socket, as in para. 19.

Nº. 3 U.C. TYPE REVERSING & REDUCING GEAR.

21. LOAD REQUIRED TO ENGAGE AHEAD OR ASTERN CLUTCHES. – Do not adjust the clutches so that loads in excess of the figures mentioned in paragraphs 13, 13·1, 16 & 16·1 are obtained, it is unnecessary and might damage the mechanism.

22. REDUCTION GEAR GLAND.– The Reduction gear shaft is provided with a packed gland to prevent rapid entry of bilge water in an emergency. Follow up gland nuts regularly but do not tighten sufficiently to generate heat. Use gland grease cup daily using a water insoluble mineral base grease.

23. ALIGNMENT WITH TAIL SHAFT. – It is of the utmost importance that the reverse gear or reduction gear is maintained in perfect alignment with the tail shaft. Malalignment may cause failure of shafts, couplings, bearings, gears, etc. Inspect at regular intervals when craft is fully seasoned and frequently with an installation until "settled".
Please see table of Alignment Shims, Leaflet Nº. 51, attached.

24. DISMANTLING OF REVERSE GEAR. – Should this be required at any time the main shaft and rotating gear assembly can be withdrawn by removal of the following:–

1. Reduction gear and case (if of this type)
2. Ahead and astern clutch operating gear (cross shafts etc.)
3. All nuts and upper three bolts from main ball bearing housing at aft end
4. Upper half reverse gear case
5. Astern brake shoes
6. Castle nuts and bushes from main drive spider
7. Lubricating oil pump. See paragraph 9. (This is facilitated if eccentric is set with its throw upwards)
(MAINSHAFT ASSEMBLY MUST NOW BE PUSHED AFT ABOUT 1").
8. Six castle nuts which hold spigot sleeve to flywheel. These nuts can be seen between the aft face of the flywheel and the main spider. This spigot sleeve should now be levered aft out of engagement with the flywheel. For this purpose the outer diameter of this spigot sleeve is provided with relief to receive a large screwdriver or equivalent tool.

N°. 3 U.C. TYPE REVERSING & REDUCING GEAR

Before the mainshaft has been pushed aft sufficiently to withdraw aft ball race from its housing and the forward end spigot sleeve from engagement with the flywheel, the shaft and running gear assembly must be chocked or slung to take its weight, otherwise damage would occur when it loses its register at either end.

When drawing the running gear away from the engine it will be found necessary to slightly lift the aft end of the shaft so that the clutch case passes the forward wall of the oil sump.

It is to be noted that the large diameter internally screwed collar fitted to the mainshaft immediately forward of and in contact with the aft ball bearing should, if removed for any purpose, be refitted in its precise original position. For the older type collar, this can be determined by the pointed setscrew countersinks. On later type collars of the split type, the collar must be set to its original position by measuring its distance from the oil pump eccentric before dismantling.

The basic setting position of this collar is such that the main drive spider has $\frac{1}{8}$" clearance from the aft face of the flywheel.

In the split design of collar the correct tightening torque for the high tensile steel clamping setscrew is 1200 lb.in. for the No. 3 U.C. (L3) gear. Note: This entails considerably more pressure than would normally be applied to a spanner of this hexagon size ($\frac{3}{8}$" No. 3 U.C.)

GARDNER

LW & L3 MARINE ENGINES

Engine and Propeller Shaft Alignment Shims

for

fitting between Engine and Bearers.

NORRIS, HENTY, & GARDNERS, LTD.
(Proprietors: L. Gardner & Sons, Ltd.)

Head Office and Works:

BARTON HALL ENGINE WORKS, PATRICROFT,

MANCHESTER.

Telegrams: "Theorem Patricroft, Eccles." Telephone: Eccles 2201 (8 lines)

London Office: ABFORD HOUSE, WILTON ROAD, LONDON, S.W.I.

Telegrams: "Nornodeste Sowest London." Telephone: TATE Gallery 3315 & 3316.

GARDNER

To obtain alignment within •003" and to obtain a total thickness of shims between •003" and $\frac{1}{16}$" with steps not greater than •003", it is necessary to have available shims of the thickness and quantity quoted below for each individual foot on the Engine Reverse Gear Unit.

4 off shims	•003"	thick
3 " "	•007"	"
2 " "	•032"	"

With these shims it is possible to obtain a total thickness as per the table below.

TOTAL THICKNESS OF SHIMS	QUAN. OF SHIMS TO BE USED			TOTAL THICKNESS OF SHIMS	QUAN. OF SHIMS TO BE USED		
	•003"	•007"	•032"		•003"	•007"	•032"
•003"	1	—	—	•035"	1	—	1
•006"	2	—	—	•038"	2	—	1
•007"	—	1	—	•039"	—	1	1
•009"	3	—	—	•041"	3	—	1
•010"	1	1	—	•042"	1	1	1
•012"	4	—	—	•044"	4	—	1
•013"	2	1	—	•045"	2	1	1
•014"	—	2	—	•046"	—	2	1
•016"	3	1	—	•048"	3	1	1
•017"	1	2	—	•049"	1	2	1
•019"	4	1	—	•051"	4	1	1
•020"	2	2	—	•052"	2	2	1
•021"	—	3	—	•053"	—	3	1
•023"	3	2	—	•055"	3	2	1
•024"	1	3	—	•056"	1	3	1
•026"	4	2	—	•058"	4	2	1
•027"	2	3	—	•059"	2	3	1
•030"	3	3	—	•062"	3	3	1
•032"	—	—	1	•064"	—	—	2
•033"	4	3	—				

GARDNER

LW ENGINE

Location of Shims	Dimensions of Shim	Dwg. No.	Number of Supporting Feet	Total number of Shims to be supplied per each Engine Reversing Gear Unit.				
				2LW	3LW	4LW	5LW	6LW
Eng. Side Supporting Feet	4" X 2⅛" X .003"	J7253	2			8	8	8
	" X .007"	J7254				6	6	6
	" X .032"	J7255				4	4	4
	3¼" X 2¼" X .003"	J7259	2	8	8			
	" X .007"	J7260		6	6			
	" X .032"	J7261		4	4			
Reversing Gear Supporting Feet	5⅞" X 2" X .003"	J7256	2	8	8	8	8	8
	" X .007"	J7257		6	6	6	6	6
	" X .032"	J7258			4	4	4	4

L3 ENGINE

Location of Shims	Dimensions of Shim	Dwg. No.	Number of Supporting Feet	Total number of Shims to be supplied per each Engine Reversing Gear Unit.				
				3L3	4L3	5L3	6L3	8L3
Engine Supporting Feet	9½" X 2⅝" X .003"	J7247	None for 3L3, 4L3 & 5L3				16	16
	" X .007"	J7248					12	12
	" X .032"	J7249	Four for 6L3 & 8L3				8	8
	8" X 2⅝" X .003"	J7244	4 for 3L3, 4L3 & 5L3	16	16	16		8
	" X .007"	J7245	None for 6L3	12	12	12		6
	" X .032"	J7246	2 for 8L3	8	8	8		4
Reversing Gear Supporting Feet	3 15/16" X 2¾" X .003"	J7250	2	8	8	8	8	8
	" X .007"	J7251		6	6	6	6	6
	" X .032"	J7252		4	4	4	4	4

GARDNER U.C. TYPE REVERSE GEAR

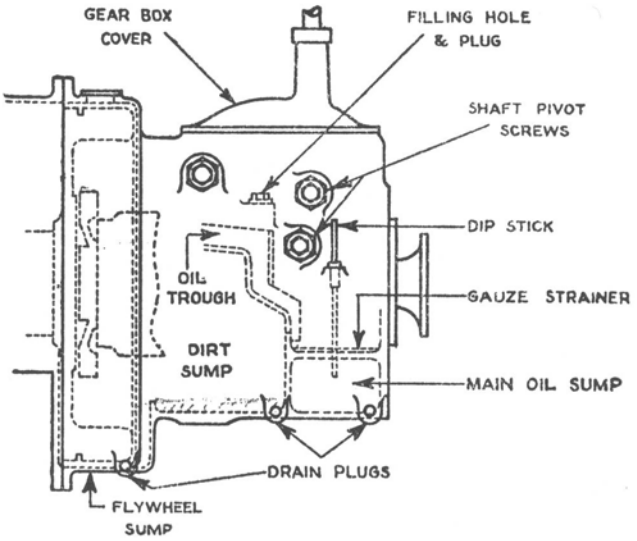


FIG. 1

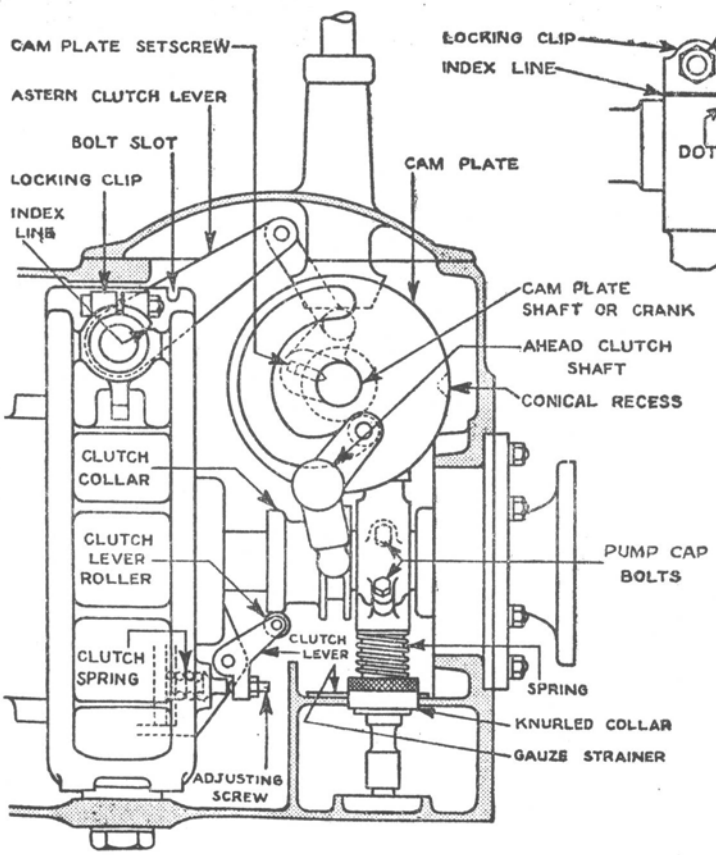


FIG. 2

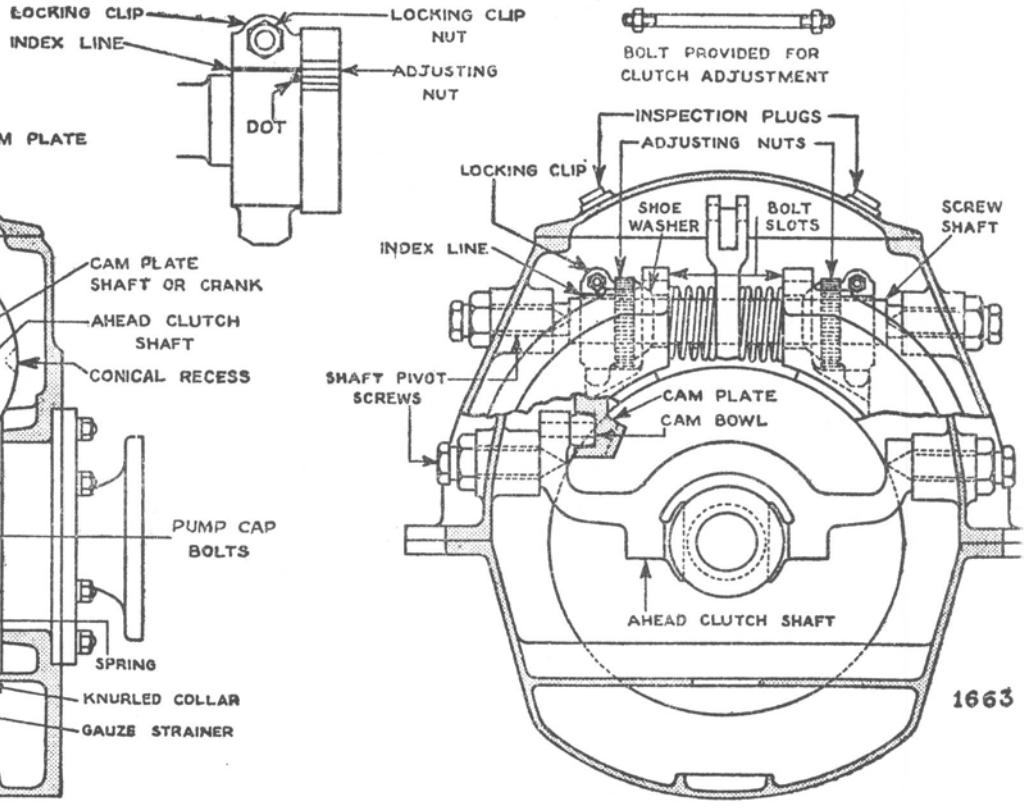
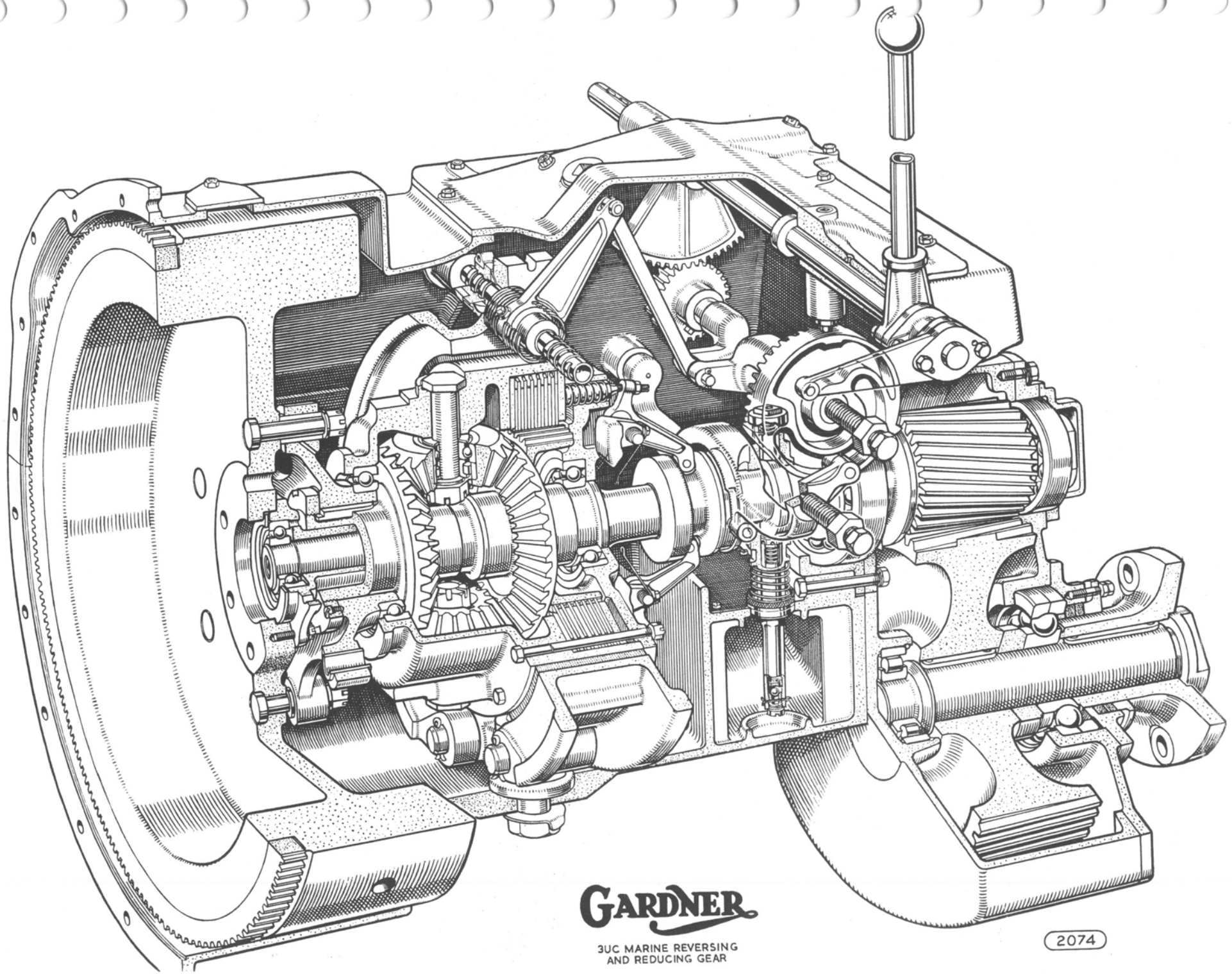


FIG. 3



GARDNER

3UC MARINE REVERSING
AND REDUCING GEAR

2074