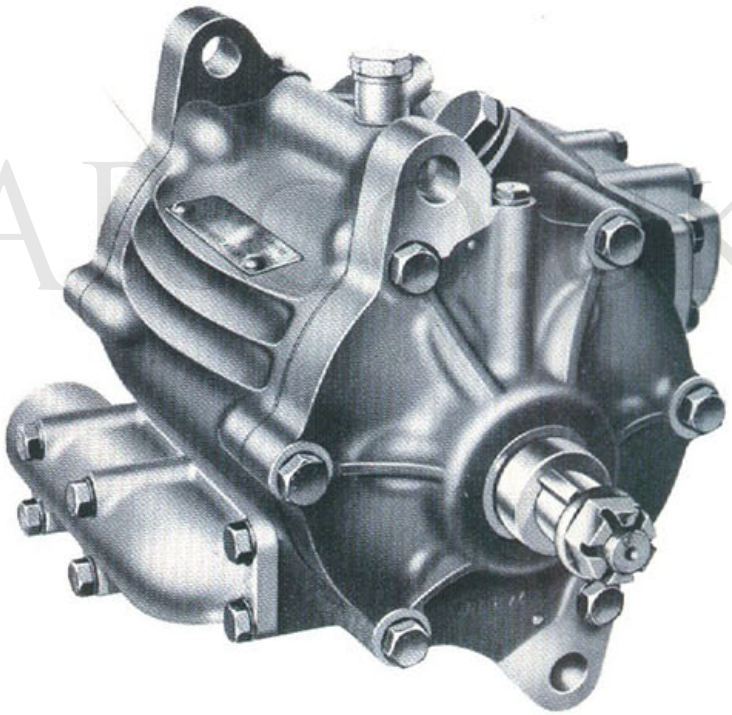
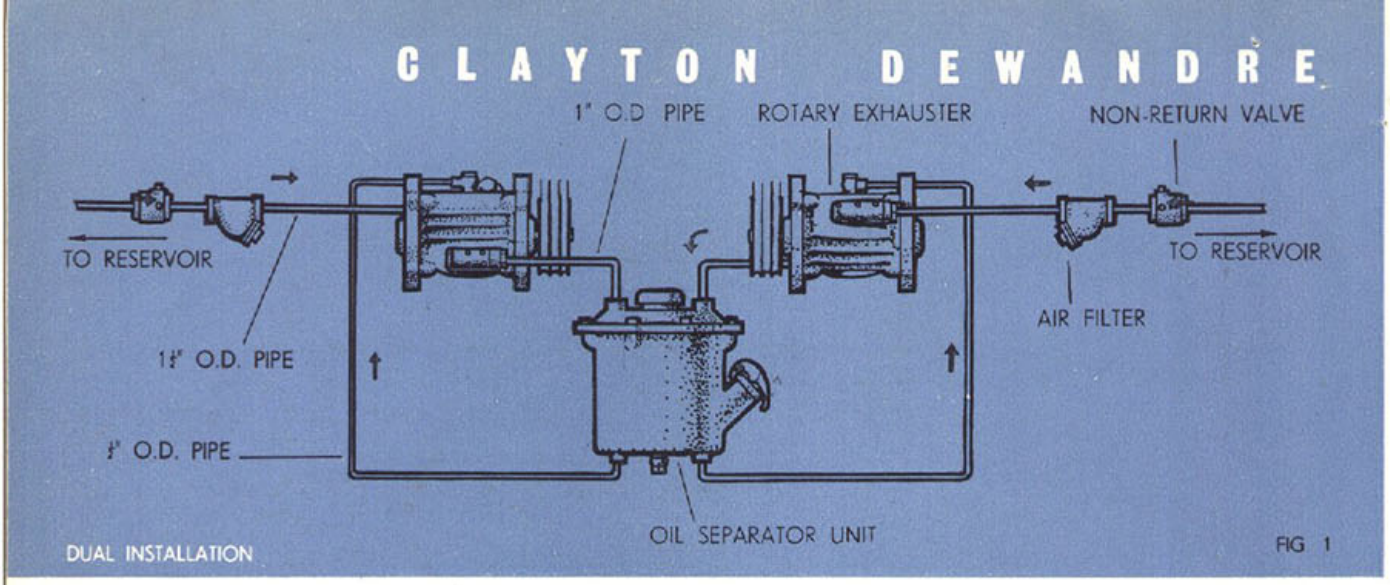
ROTARY EXHAUSTER

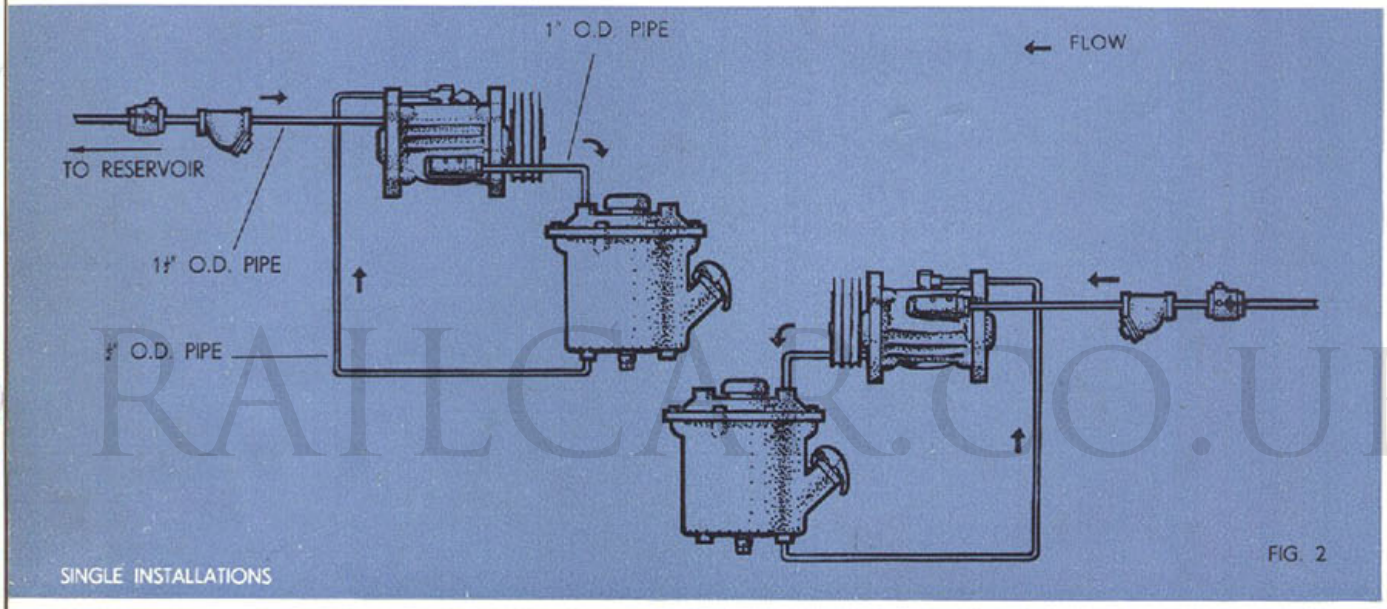
FOR RAILCARS

REGA 242-I



CLAYTON DEWANDRE · LINCOLN · ENGLAND





INTRODUCTION

The Clayton Dewandre rotary exhauster has been designed to provide vacuum on diesel engine railcars for the operation of the vacuum power brake. The railcars are fitted with the Gresham and Craven Quick Release Brake System incorporating a feed valve, which eliminates the necessity for a snifter valve in the exhauster itself. Generally two exhausters, belt driven from the engines, are fitted to each power car and these work in conjunction with a self-contained lubricating system, both exhausters drawing oil from the common Oil Separator and Container Unit. In other installations where the exhausters are at too great a distance from each other, two separators are necessary.

INSTALLATION

A non-return valve is fitted between the exhauster and the brake pipe, to prevent loss of vacuum from the system when the exhauster is stationary. It is also essential that a filter should be positioned between the exhauster and non-return valve to prevent any dirt from the brake system being drawn into the exhauster. The exhauster should be mounted to permit a flow of air over the body, which is finned to provide efficient cooling when operating for long continuous periods. The pulley is usually arranged for triple V drive belts and the lug mountings allow for belt adjustment.

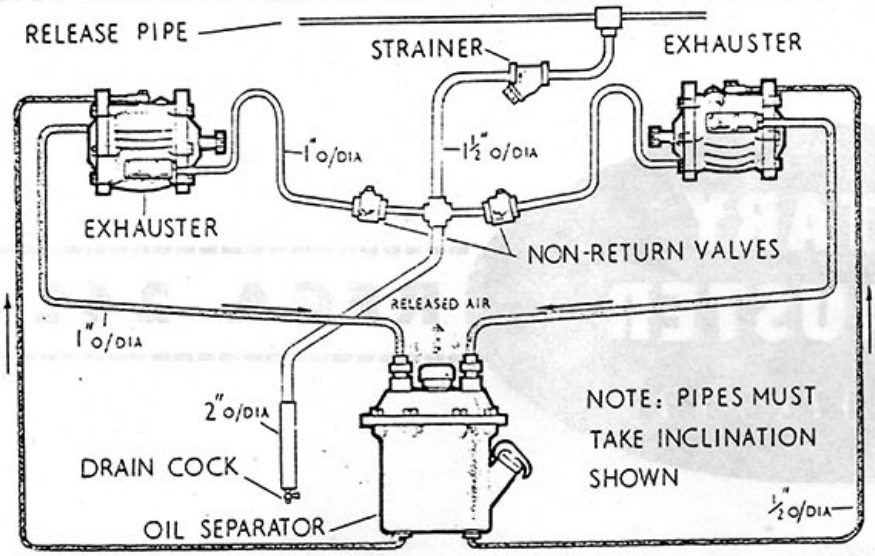
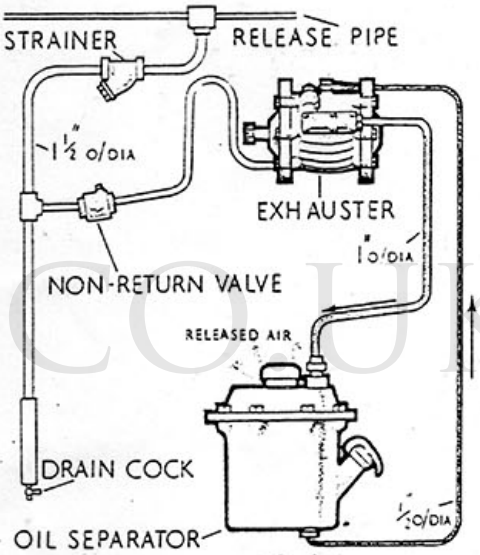


FIG. 1

DUAL EXHAUSTER INSTALLATION

VACUUM
AIR AND OIL
OIL



SINGLE EXHAUSTER INSTALLATION

FIG. 2

INTRODUCTION

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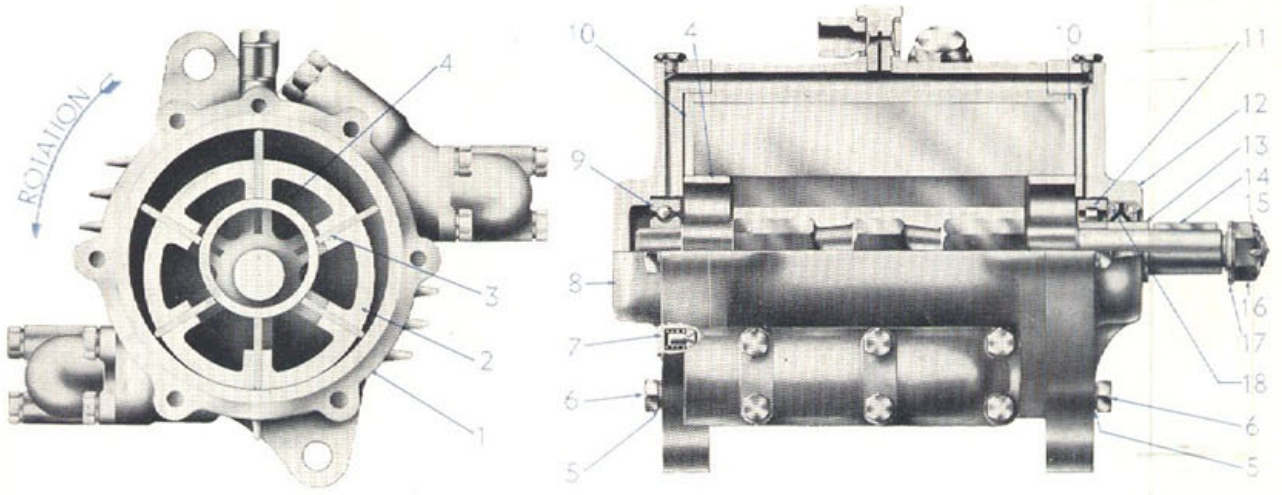


FIG. 3

DESCRIPTION and OPERATION

The exhauster is a rotary sliding vane type pump. The main parts are the body (1), the rotor (2), the heavy duty bearings (9) and (11) and the spring loaded sealing plates (10). The rotor carries six blades (3) and rotates about the axis which is eccentric to the bore of the body. The volume of the spaces between the blades, rotor and body thus increases and decreases as rotation occurs. The inlet port connected to the vacuum reservoir is situated on the side where the spaces are increasing and the exhaust or outlet port on the side where they are decreasing, so that air is drawn in at a low pressure and expelled at a higher (atmospheric) pressure.

To permit expansion, the body is .0005"/.002" longer than the rotor which in turn is slightly longer than the rotor blades. The ends of the body are sealed off by the sealing plates (10) loaded axially by means of 6 small springs (7) housed in pockets in the end covers (8) and (12). The clearances between the rotor, blades and sealing plate are sealed off by the lubricating oil film. The sealing plates are located in recesses in the end covers and a peg riveted to the plate fits into one of the spring pockets to prevent the sealing plates turning with the rotor.

Although the exhauster is designed to run at between 400 and 1000 r.p.m. it is still efficient at engine 'tick-over' speed. At normal speeds the blades (3) are kept in contact with the body bore by centrifugal force but at low speeds, particularly when the oil is cold, the blades have insufficient centrifugal force to keep them in their true motion. This is overcome by the action of cam rings (4) at each end of the rotor, which contact the inside edges of the blades and force them to move out radially in their grooves to maintain contact with the bore of the body. The cam rings are a 'push' fit in the sealing plates (10).

The clearance between the outer edges of the blades and the bore is sealed by the lubricating oil drawn in through the end covers. The rotor shaft is mounted on a roller race (11) at the drive end and a ball race (9) at the rear end, these being located in the end covers. The roller race takes the drive loading and is held in position by a hardened steel collar (13). The direction of rotation is anti-clockwise looking at the drive end.

During operation, the pressure inside the end covers of the machine is below atmospheric, since the mean pressure of the working spaces is below atmospheric. On the other hand, on starting with the vacuum system at atmospheric pressure, the delivery or exhaust pressure is above atmospheric and for a few seconds until a sufficient vacuum is generated there is a tendency to blow oil out at the shaft end. For this reason a double seal (18) is fitted, which runs on the hardened shaft collar (13).

THE LUBRICATING SYSTEM

Efficient operation of the exhauster is dependent upon sufficient oil being supplied to the two bearings, and also into the exhauster to provide an effective seal between the blades and the bore of the body. The oil inlet connection is situated at the top of the exhauster body and communicates by a cross drilling to the end covers. The vacuum created in the end covers is utilised to pull oil into the exhauster from the oil separator unit and the recommended installation is to pipe up the exhauster oil inlet connection direct to one of the two connections beneath the oil separator unit, using 1/2" o/d piping and ensuring that the oil level of the oil separator unit is between 0" to 12" below the outlet port of the exhauster. The oil is discharged together with the air evacuated from the brake system from the exhauster outlet port through 1" o/d pipe to the separator unit, which retains the oil and permits the air to pass to atmosphere. It is essential that a 'fall' is maintained in both oil feed and return pipes between the exhauster and oil separator unit to prevent 'locking' in the pipes.

THE OIL SEPARATOR UNIT

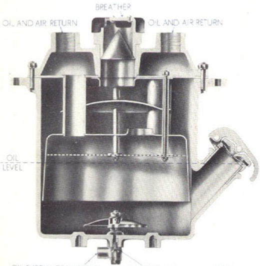


FIG. 4

Drg No. GA. 4407 (1+2)

The oil separator combines the oil reservoir and filters. Providing the correct level is maintained in the oil container, that is, up to the filler plug on the side, no maintenance other than periodic cleaning of the filters should be necessary.

The lubrication system is entirely self-contained, suction created by the exhauster drawing oil from one of the bottom outlet connections through the lower filter in the container. The oil passes into the exhauster to lubricate all parts and is ejected together with the air evacuated from the brake system and returned to the separator unit through one of the large pipe connections in the top cover. A series of baffle plates and the top filter separate the oil from the air, the oil falling to the reservoir to complete the circulation, and the air passing to atmosphere to relieve the pressure in the system, through the breather on top of the separator unit.

To carry out the periodic cleaning, it is necessary to remove the unit from its mounting. To withdraw the filters :—

1. Unscrew the eight nuts securing the top plate.
2. Remove the top plate.
3. Withdraw the filter and baffle plate assembly complete.
4. If necessary, the two filters in the base of the container can be dismantled by unscrewing the nuts and withdrawing the plates.

SERVICING

Weekly or every 1,000 miles, make a check at all joints, unions etc. for leakage or looseness and rectify where necessary. This is particularly important with regard to the 1/2" o/d supply pipe from the oil separator since an air lock will cause intermittent or possible failure of the exhauster lubrication system.

Top up the oil separator container, using clean engine oil. (S.A.E. 30, *e.g.* Castrol XL).

Every 5,000 miles, repeat the pipe inspection as already described.

Remove the plug in the base of the oil container and drain off the oil in the lubricating system. Replenish with clean engine oil. Check the drive belts for tightness. If they need tightening, loosen the mounting bolts and move the exhauster to take up the slack, then lock up the bolts again. When the belts are correctly adjusted it should be possible to depress them about 1/2".

Every 20,000 miles, repeat the 5,000 miles inspection but remove the separator filters for cleaning and at the same time clean out the container. (See notes on Oil Separator Unit).

Every 50,000 miles, remove the exhauster for dismantling and detailed examination of all component parts.

DISMANTLING OF EXHAUSTER

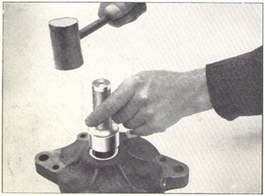


FIG. 5. Removing the roller race outer ring and the oil seal from the drive end cover.

1. Remove split pin, shaft nut and washer (15), (16) and (17) and withdraw the drive pulley. Remove the drive key (14).

2. Remove the end cover bolts (6) and washers (5). Ease off the end covers. The oil seal (18), the outer ring of the roller race (11) and the springs (7) are removed with the end covers.

3. To prevent damaging when removing the seal and outer race from the drive end cover, a special punch tool must be used. The operation is illustrated in Fig. 5.

4. Remove the sealing plates (10).

DISMANTLING OF EXHAUSTER (cont.)

5. Withdraw the rotor (2) together with the cam rings, bearings, blades and shaft collar in one assembly from the body.
6. Remove the blades (3) from the rotor.
7. Further dismantling of the rotor assembly should only be carried out if it is found necessary to replace any of the items. To remove the races, cam rings and shaft collar, the special extractor tool is required. The operation is illustrated in Fig. 6. The claws of the extractor should be inserted between the bearing and cam ring. On screwing the bolt up against the rotor shaft end, the race and shaft collar will be extracted together. The cam rings can then be removed from the rotor.
8. All component parts should be thoroughly cleaned in a paraffin bath.

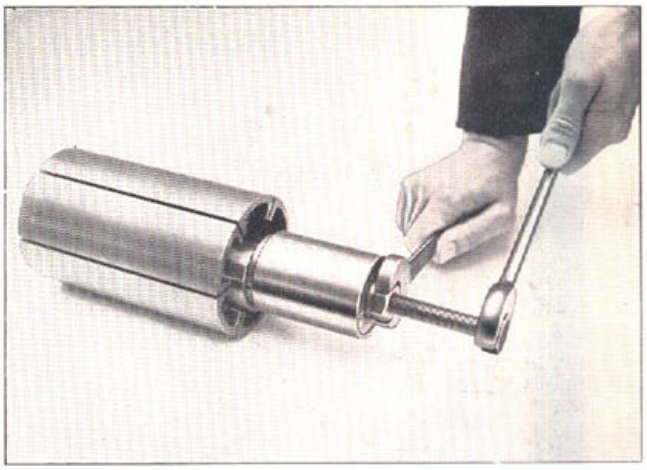


FIG. 6. Withdrawing the rear ball race

INSPECTION OF DISMANTLED PARTS

1. **Body.**
After a long period in service, the bore of the body may show markings in the form of lines or ripples running longitudinally and coinciding with the ends of the port openings. This is usual and if of only slight extent the body can be used for further service. If the ripples are pronounced and extend for most of the circumference, the body should be replaced. This condition can usually be attributed to the exhauster being operated without an adequate oil supply.
2. **Bearings.**
Worn bearings should be replaced.
3. **Rotor Blades.**
The blades wear on the outer edge, but a certain amount of wear is permissible. However, if the inner edges are appreciably "stepped" where they contact the cam rings the blades should be replaced.
4. **Sealing Plates.**
If the facing of the sealing plates becomes scored after a long period of service, they should be renewed.
5. **Oil Seal.**
The oil seal is adversely affected by dirty oil and dirty conditions generally, as the particles of grit cause wear. A doubtful seal should always be replaced.
6. **Joints.**
It is advisable to fit new joints whenever the exhauster is dismantled to obviate the risk of leakage.

ASSEMBLY OF EXHAUSTER

Reassemble to the following sequence after lubricating all internal parts with clean engine oil.

1. Place the cam rings in position on the rotor.
2. Replace the ball race on the rear end shaft using the special assembly tool illustrated in Fig. 7 making sure that the race butts against the shoulder on the rotor shaft.
3. Reverse the rotor and assemble the inner ring of the roller race to the drive end shaft again using the special tool. Then with the same tool drive on the shaft collar up to the bearing. See Fig. 8.
4. Check the bearings for tightness.

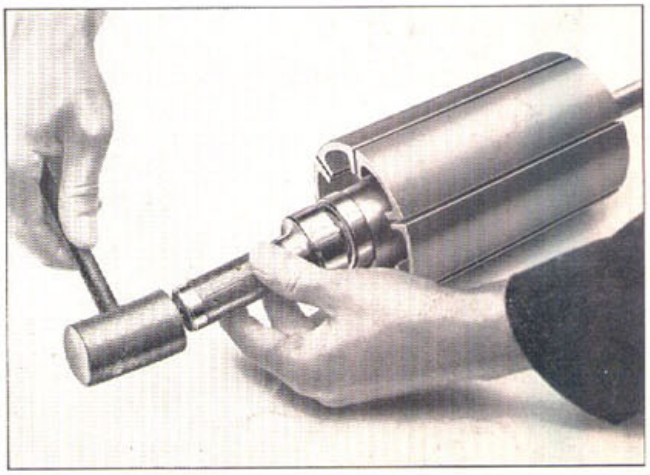


FIG. 7. Fitting the rear ball race on shaft

ASSEMBLY OF EXHAUSTER (cont.)

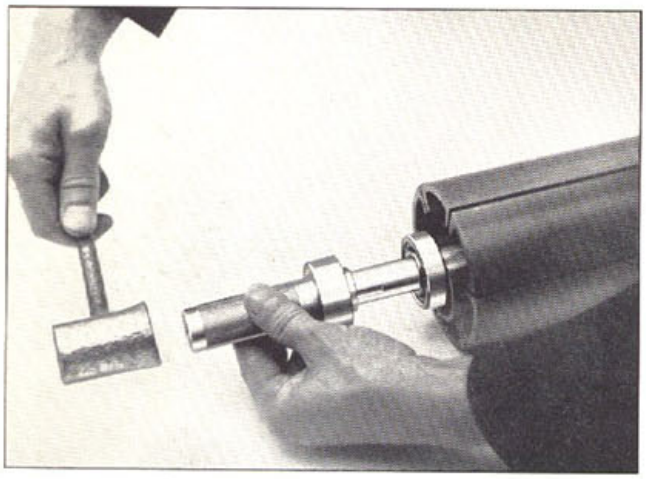


FIG. 8. Assembly of the shaft collar.

5. Slide the rotor assembly into the body.
6. To fit the seal in the drive end cover, the special assembly tool illustrated in Fig. 9 must be used. Insert the guide sleeve, place the seal in position in the guide sleeve and drive it into its housing. Withdraw the guide sleeve, and using the special tool drive the outer ring of the roller race into position behind the oil seal.
7. Smear the end cover joints with grease and place them on the covers in their correct position.
8. Replace the sealing plate springs in the pockets of the end covers.
9. Fit the sealing plates in the end cover recesses, taking care that the sealing plate peg is located within one of the sealing plate springs.
10. Refit the rear end cover to the body.
11. With the exhauster standing on its rear cover insert the rotor blades in their slots.
12. Refit the drive end cover to the body ; the special protective tapered seal guide should be fitted over the drive shaft to prevent damage to the edges of the seal by the shaft collar. The operation is illustrated in Fig. 10.
13. Replace the end cover bolts and washers. Drive in the end cover locating pegs and then tighten down the end cover bolts. Check the rotor to ensure free rotation.
14. Replace the drive key and pulley.

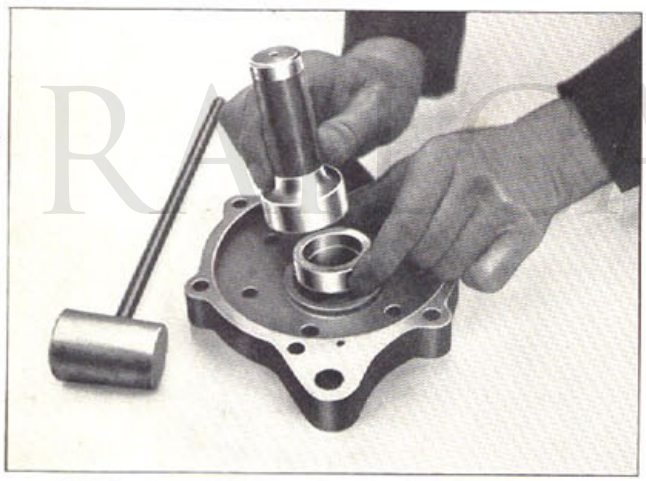


FIG. 9. Assembly of the oil seal in the drive end cover.

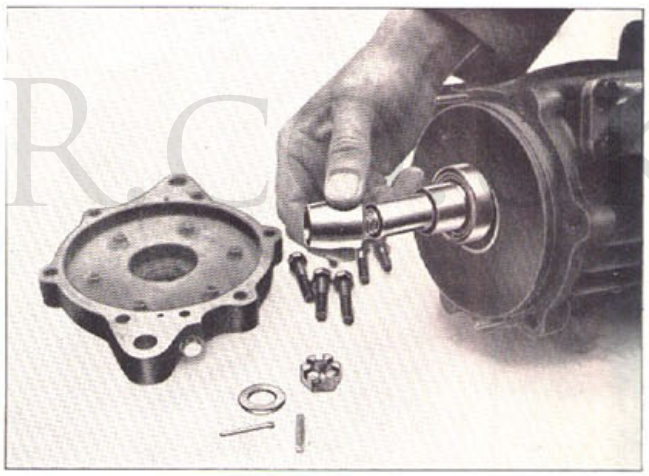


FIG. 10. Placing the seal guide in position, prior to assembly of the drive end cover.

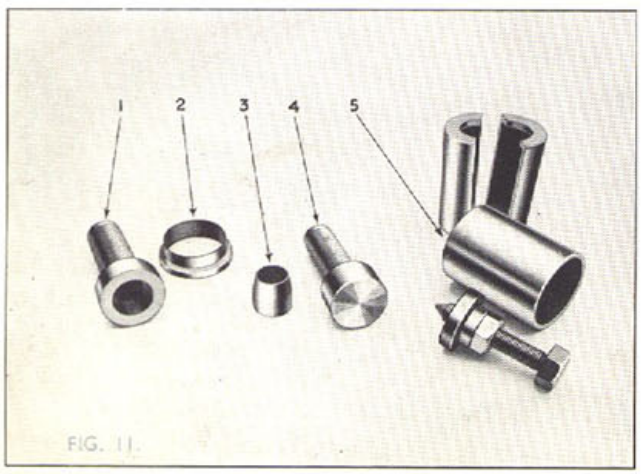


FIG. 11.

SPECIAL TOOLS

1. Assembly Tool TZ. 5297.
2. Guide Sleeve for Oil Seal TZ. 5298.
3. Seal Guide TZ. 5299.
4. Punch for Removing Seal TZ. 5300.
5. Bearings and Sleeve Extractor TZ. 5301.

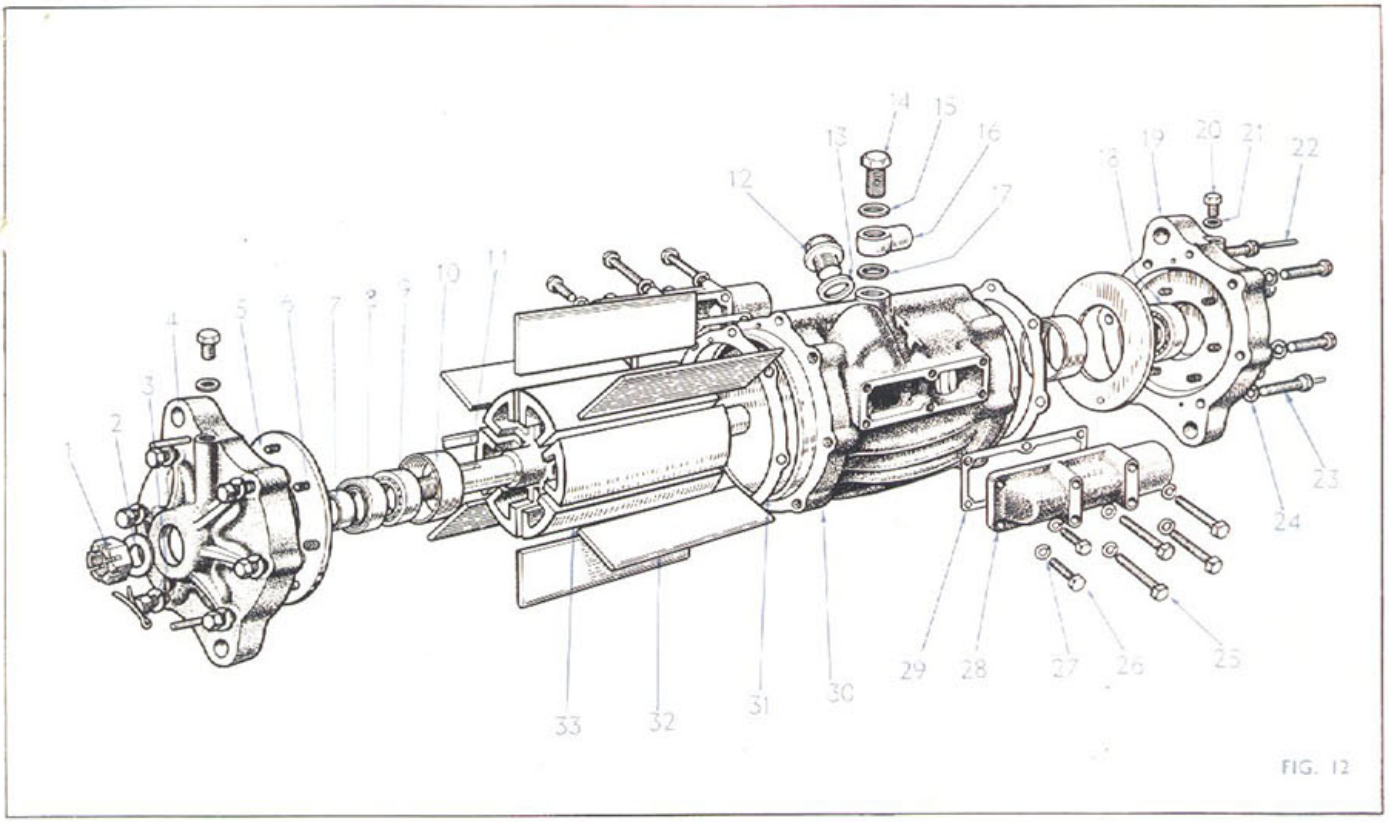


FIG. 12

SPARE PARTS LIST FOR ROTARY EXHAUSTER RE.GA. 242-1

No.	Part No.	Qty.	Description	Class				No.	Part No.	Qty.	Description	Class			
1	SF. 1–25	1	Shaft Nut 5/8″ BSF				D	18	157–513	1	Ball Race			C	
2	SF. 3–8	1	Washer				D	19	RE. 273–3	1	Rear End Cover				D
3	SF. 4–7	1	Split Pin	A				20	SF. 16–41	2	Plug 1/4″ BSF				D
4	RE. 274–3	1	Drive End Cover				D	21	SF. 240–9	2	Soft Copper Washer			C	
5	SA. 933	2	Sealing Plate with Peg			C		22	RE. 753	4	End Cover Locating Peg				D
6	RE. 801–1	12	Sealing Plate Spring			C		23	SF. 47–24	12	Setscrew 3/8″ BSF				D
7	RE. 658	1	Shaft Collar		B			24	307–303	12	Shakeproof Washer			C	
8	SF. 310–6	1	Metal Insert Seal		B			25	SF. 46–108	8	Setscrew 5/16″ BSF				D
9	157–508	1	Roller Race			C		26	SF. 46–3	4	Setscrew 5/16″ BSF				D
10	RE. 910	2	Floating Ring			C		27	SF. 60–3	12	Spring Washer			C	
11	117–11	1	Drive Key		B			28	RE.1002	2	Manifold				D
12	SF. 16–167	1	Plug 1/2″ BSF				D	29	RE. 952	2	Joint for Manifold		A		
13	SF. 240–4	1	Soft Copper Washer			C		30	RE. 23–1	1	Exhauster Body 14/A1376			C	IN STORE
14	S. 2047–1	1	Pipe Fastener				D	31	RE. 961	2	Joint for End Cover		A		
15	SF. 240–29	1	Soft Copper Washer			C		32	RE. 513–2	6	Rotor Blade 14/A0176			C	
16	S. 1951–1	1	Pipe Connection				D	33	RE. 169–1	1	Rotor and Shaft			C	
17	SF. 240–2	1	Soft Copper Washer			C									

CLASSIFICATION OF SPARE PARTS

As a recommendation to facilitate the stocking of spare parts, each of the above items is placed under one of four categories, identified by letters, A, B, C or D.

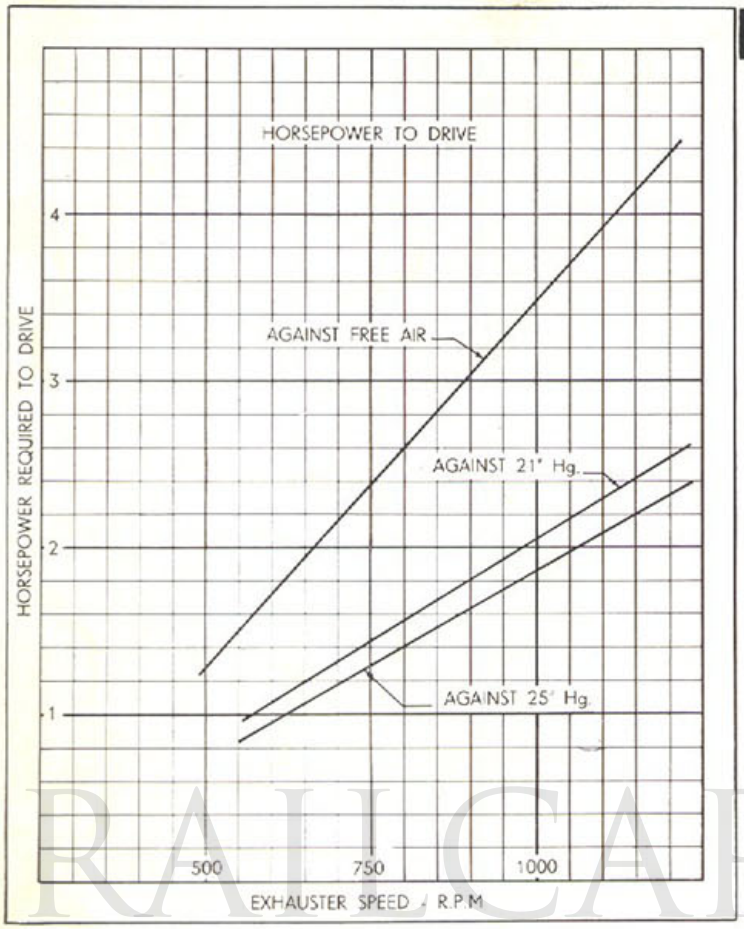
Class A : Fast moving spares which will be required during the first overhaul period up to 50,000 miles.

Class B : Parts in moderate demand, which may be required during the second overhaul period.

Class C : Slow moving spares which, although subject to wear and tear, would not require to be changed until the exhauster had been in service for a very long period.

Class D : Parts seldom required. These would only be replaced if the part had suffered external damage or had been damaged during maintenance.

ROTARY EXHAUSTER FOR RAILCARS



REGA 242-1

NORMAL WORKING RANGE
400-1000 R.P.M.

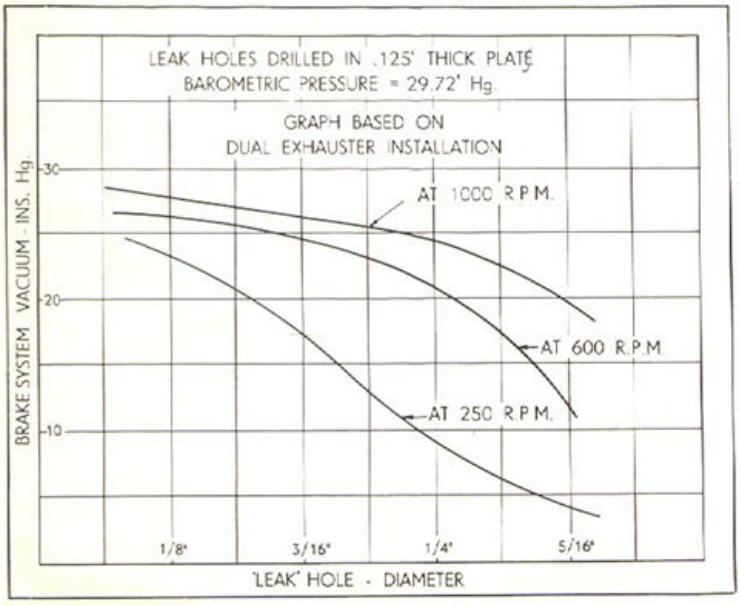
MAXIMUM SPEED
1200 R.P.M.

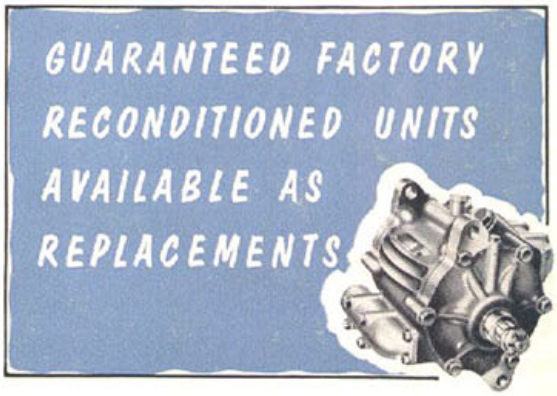
WEIGHT 48 LBS.

EXHAUSTER PIPE CONNS.
VACUUM AND DISCHARGE 1" O.D. PIPE
OIL CONNECTION 1/2" O.D. PIPE

OIL SEPARATOR
CAPACITY 11 PINTS

BELT DRIVEN ★
LUG MOUNTED. ★
AIR COOLED ★
SELF LUBRICATED ★





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