

April 18, 1941

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ELECTRO-MOTIVE CORP.

SUBSIDIARY OF GENERAL MOTORS

La Grange, Illinois

SERVICE MAINTENANCE BULLETIN

FOR

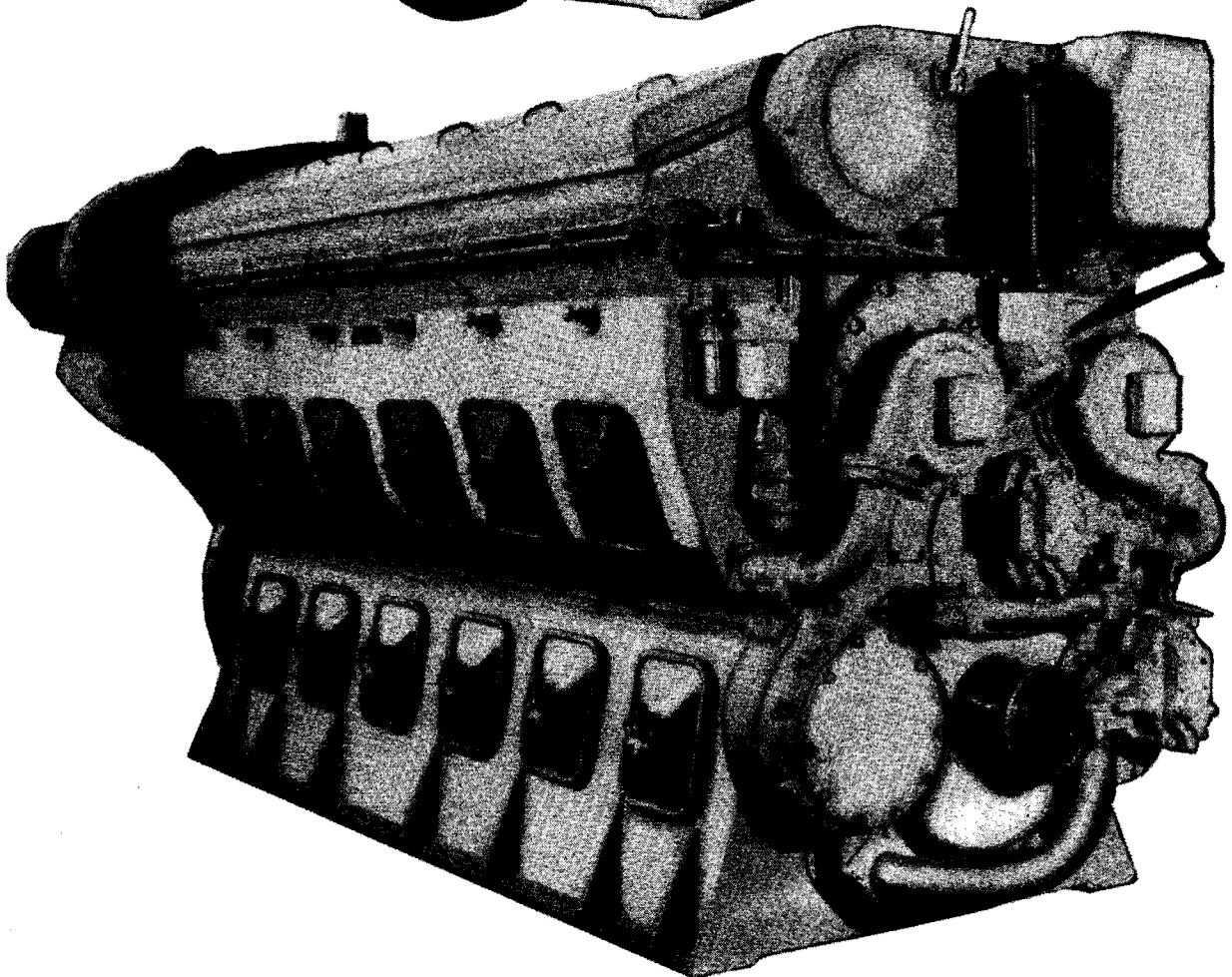
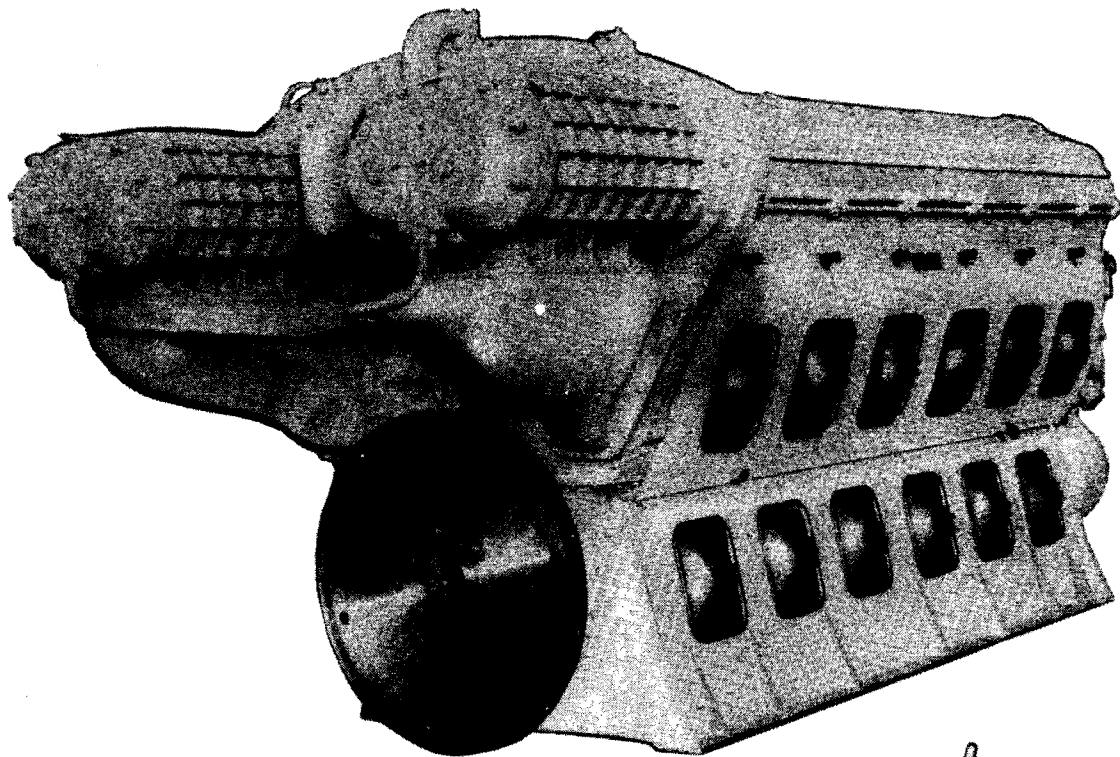
MODEL 567 ENGINES

for

RAILWAY EQUIPMENT

Diesel-Electric	{	Locomotives	}	Gas-Electric
		Motor Cars		
		Power Plants		

This bulletin supersedes all previous issues of Bulletin 150.



MODEL 12-567 ENGINE
PLATE 1941

E.M.CORP.
Apr. 18, 1941

SECTION O

F O R W A R D

This bulletin is a manual on the operation and maintenance of the model 567 Diesel engines. It is intended for the use of customers and service men who are already familiar with the fundamentals of internal combustion engines and repairing in general. It is not a text book for those who have had no mechanical experience and does not present instructions in elementary form. However, a reader with limited knowledge of Diesel engines will find neither confusing charts nor lengthy words, but clearly defined explanations.

The style in which the information is presented is a distinct departure from the usual book of this sort. Straight reading matter has been eliminated as far as possible and the facts and figures needed in servicing the engine are presented in concise paragraphs and specifications.

At the beginning of each section is a brief description, accompanied by service information in the form of notes. Following this is a specification table giving clearances, dimensions, and other facts important in servicing the engine. The rest of the information is in picture form.

Our Service Department invites correspondence with any maintenance or service men on all matters discussed in this bulletin.

For frequency of inspection, or inspection schedules, refer to Bulletin 1704.

For the illustration and part numbers of all tools mentioned in this bulletin see Bulletin 1702.5.

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OPERATING DESCRIPTION
(See plate 1325)

In a *two-cycle engine, a charge of fuel is burned on every down stroke of the piston, and consequently there is one power impulse per cylinder for each revolution of the crankshaft. In other words, a two-cycle engine with six cylinders has twice as many power impulses as a four-cycle engine with six cylinders operating at the same speed.

In a +four-cycle engine, four piston strokes are required to complete each power cycle. During the exhaust and intake strokes the piston functions as an air pump and this operation actually consumes power.

In a two-cycle engine, intake and exhaust take place simultaneously during part of the power and compression strokes. The two-cycle engine, therefore, does not have to function as an air pump during any part of the cycle, so an external means of supplying air is provided. A specially designed blower forces air under pressure into the cylinders in order to expel the exhaust gasses and fill the cylinders with fresh air for combustion, in the manner shown on Plate 1325.

FIGURE 1. A series of ports cut into the circumference of the cylinder wall above the piston in its lowest position admits the air from the blower into the cylinder as soon as the top face of the piston uncovers the ports. The uni-directional flow of air towards the exhaust valves produces complete scavenging, leaving the cylinders full of clean air when the piston again covers the inlet ports.

FIGURE 2. As the piston continues on the upward stroke, the exhaust valves close and the charge of air is compressed to about one-sixteenth of its initial volume, or about 600 lbs. per square inch. Air, when compressed to this extent increases in temperature to about 1000°F. Due to the fact that the air intake in a Diesel engine is never throttled, it maintains this high compression ratio at all loads and speeds.

FIGURE 3. Shortly before the piston reaches its highest position, fuel atomized by high pressure is introduced into the combustion chamber. It is ignited by the high temperature of the air and continues to burn as injection continues. The burning charge rapidly builds up a pressure to 1000 lbs. per square inch. This confined energy acts upon the piston, forcing it downward on the power stroke.

FIGURE 4. Upon the completion of the useful part of the power stroke the exhaust valves open, releasing the gases through the manifold to the atmosphere. The piston then uncovers the air inlet ports. By this time the exhaust gases have expanded so that the pressure is less in the cylinder than in the air chamber.

* Same as two-stroke cycle

+ Same as four-stroke cycle

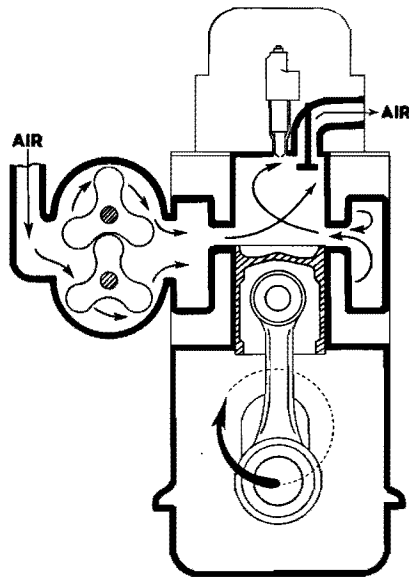


FIG. 1

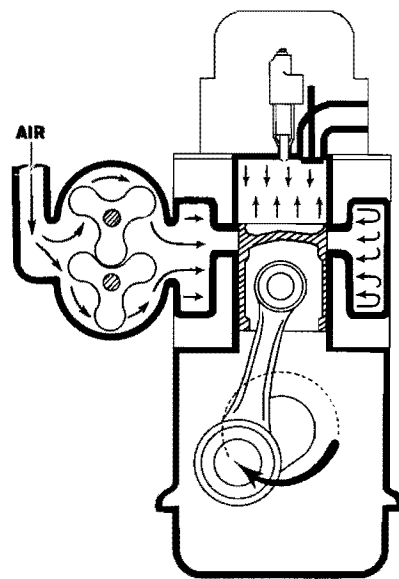


FIG. 2

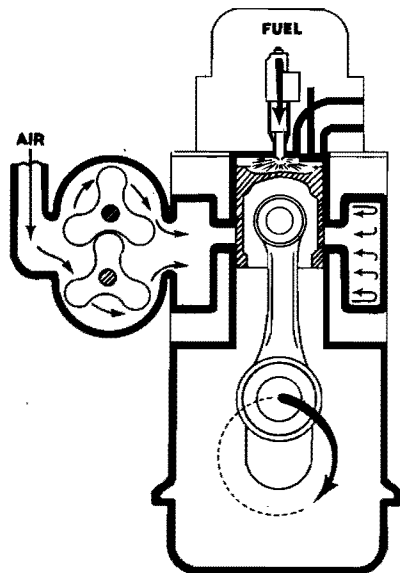


FIG. 3

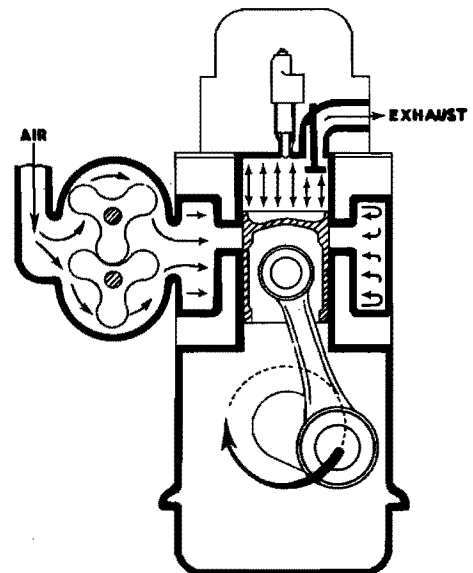


FIG. 4

FOUR-CYCLE

INTAKE STROKE	COMPRESSION STROKE	POWER STROKE	EXHAUST STROKE
------------------	-----------------------	-----------------	-------------------

TWO REVOLUTIONS OF THE CRANK SHAFT

INTAKE	COMPRESSION STROKE	POWER STROKE	EXHAUST	INTAKE	COMPRESSION STROKE	POWER STROKE	EXHAUST
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TWO-CYCLE

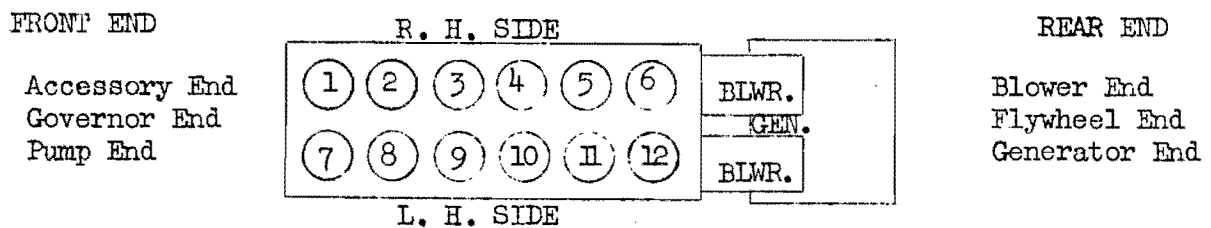
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GENERAL DESCRIPTION & DATA

The Model 567 Diesel engine is a "V" Type two cycle model incorporating the advantages of a relatively low weight per horse power, fully scavenging air system, solid unit injection, high compression, and full horse power development at a relatively low engine speed.

The two ends of an engine will be known as GENERATOR end, and ACCESSORY end, respectively. The RIGHT HAND side of an engine is determined by looking from the GENERATOR end toward the ACCESSORY end. Cylinder numbering begins with 1 on the RIGHT HAND side at the ACCESSORY end, runs consecutively down the RIGHT HAND side to the GENERATOR end, then continues from the ACCESSORY end down the LEFT HAND side.



GENERAL DATA

Bore	8-1/2"
Stroke	10"
Compression Ratio (Nominal)	16:1
Maximum Governed Speed	800 R.P.M.
Idling Speed	275 R.P.M.
Starting Speed	75 to 100 R.P.M.
Rotation - Rear End	Counter- Clockwise
Weight (Approx.)	15000 Lbs. (6-567), 17000 (8-567) 24000 Lbs. (12-567), 30000 (16-567)
Angle between Banks	45°
*Nominal Horse Power (At 800 R.P.M.)	600 (6-567), 720 (8-567), 1000 (12-567), 1350 (16-567)
Total Displacement - Cu. In.	3405 (6-567), 4540 (8-567), 6809 (12-567), 9079 (16-567)
Firing Order	1-4-3-6-2-5 (6-567) 1-5-3-7-2-6-4-8 (8-567) 1-12-7-4-3-10-9-5-2-11-8-6 (12-567) 1-8-9-16-3-6-11-14-4-5-12-13-2-7-10-15 (16-567)
Number Exhaust Valves per cyl.	4
Crankshaft Diameter	7-1/2"
Crankpin Diameter	6-1/2"
Number Main Bearings	4 (6-567), 5 (8-567), 7 (12-567), 10 (16-567)
Number Compression Rings	4
Number Oil Control Rings	2

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* For Industrial Engine ratings consult the Industrial Eng. Division.

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SECTION 1

S E C T I O N 1

CRANKCASE, OIL PANS, & CYLINDER LINERS

GENERAL DESCRIPTION

CRANKCASE AND OIL PAN

The crankcase and oil pan are entirely fabricated by electric weld. The oil pan serves as the base for the engine as well as an oil sump. The crankcase supports the cylinder liners and crankshaft, and acts as a reservoir for the scavenging air.

HAND HOLE COVERS

Hand hole covers along the sides of the crankcase and oil pan permit inspection of the bearings, pistons and liners. (See Plate 1710).

THE CYLINDER LINERS

The cylinder liners are a one piece casting with integral water passages and a row of ports for admitting the scavenging air.

SERVICE INFORMATION

1. REPLACING MOUNTING BOLTS

The engine hold-down bolts must be kept tight at all times. In case of breakage, replace only with bolts listed in parts catalog, as these bolts are heat treated for additional strength.

2. INSPECTION

All of the engine mounting bolts and dowels should be inspected every month.

The cylinder liners, pistons and piston rings should be inspected through the liner ports and through the crankcase hand hole covers every month. Look for scored cylinder liners or scored pistons. A dark color on the piston ring indicates blow-by and the piston should be examined for a sticking ring.

Every month the air box should be inspected and cleaned if necessary. See Paragraph 10 for details.

3. REMOVING A CYLINDER LINER

Drain the engine cooling system (See Section VIll). Unbolt the "P" pipe bracket from the liner. Remove the head (See Section ll), then remove the piston and connecting rod (See Section lll). Be sure to remove any cylinder liner ridge before removing the piston.

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Two methods of removing a liner are: A cylinder liner lifting plate with a lifting eye (See Bulletin 1702.5 for all tools) can be put down over the top of the liner studs and held in place with necessary nuts. A hoist fastened to the eye will then remove the liner. Another method is to put a wood block spacer between the crankshaft throw (bottom dead center) and the bottom of the skirt, and then bar the engine over a little by hand. This should be enough to break liner loose so it can be removed manually.

4. CLEANING CYLINDER LINERS

When a liner is removed it should be inspected for scale in the water jacket. If this is present, clean with scraping, followed by a pickling solution of 10% Hydrochloric acid, as follows:

- a. Cover bottom of liner water passages with some suitable water-tight cover. Stand liner in vertical position.
- b. Fill the liner water passages with above mentioned 10% Hydrochloric acid solution.
- c. Allow to stand a short time and then flush out well with water.
CAUTION! Do NOT get acid solution on honed liner surface.
Do not allow to stand any longer than necessary.
- d. If scale still exists, repeat step c .

Scale can be removed with other solutions such as Okite #32 etc.

To remove grease use any good grease remover as authorized in Bulletin 1706.

5. REPLACING A CYLINDER LINER

- a. Be sure sealing grooves in liners are clean.
- b. Use EMC recommended seal rings.
- c. Use care so as not to fracture the seal rings.
- d. Use care not to bump or nick the cylinder studs. A hard bump on the top of the stud might ruin the thread or crack the liner.

6. DRAINING THE AIR BOX

The valves in the air box drain lines should be left open at all times. On locomotives equipped with air box drain reservoirs, the drain valve should be closed except when locomotive is at maintenance point.

7. CLEANING THE SCREENS IN THE ENGINE OIL SUMP

The lubricating oil strainers in the engine oil sump should be cleaned at each oil change. To do this follow procedure outlined in Bulletin 1706.

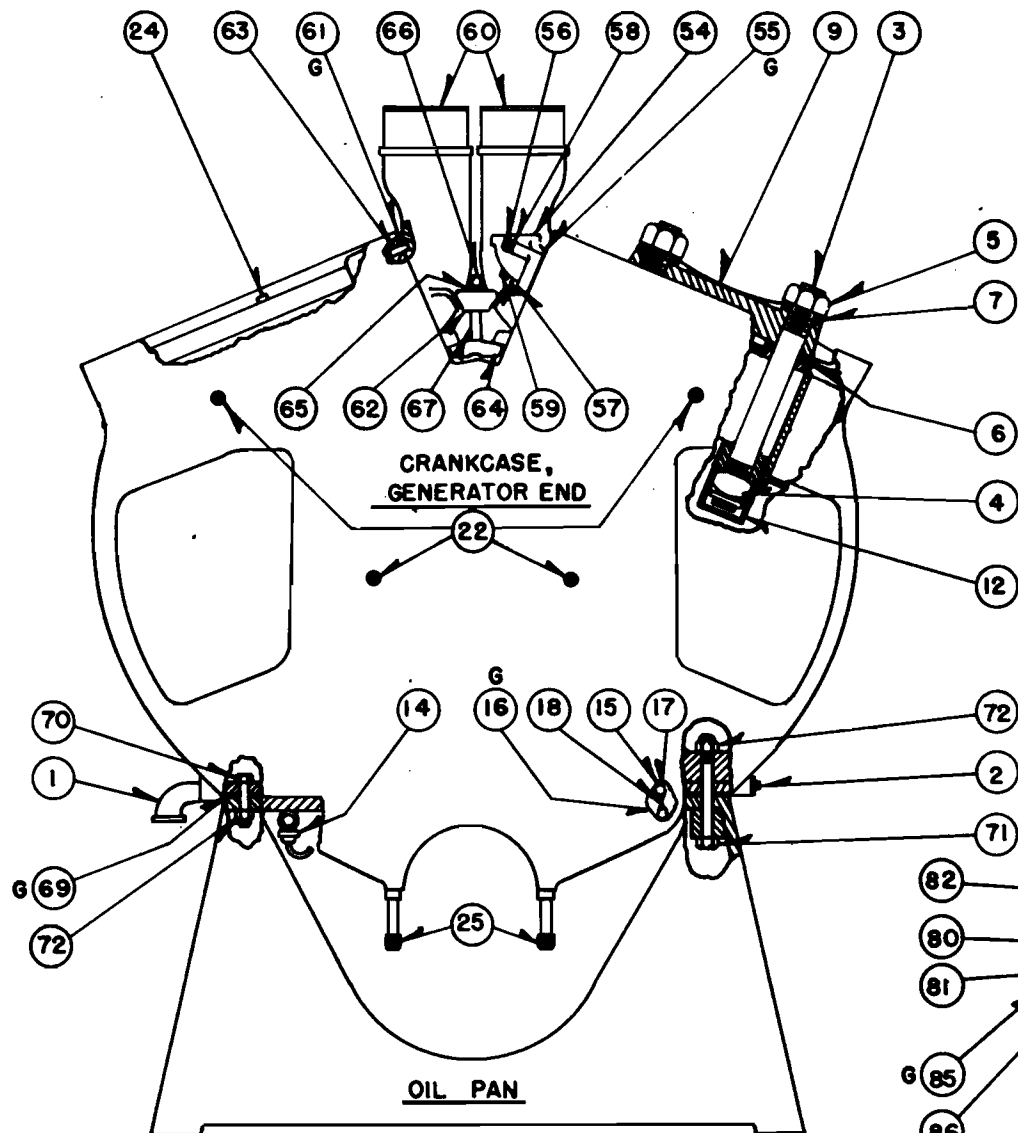
8. PAINTING INSTRUCTIONS

When the crankcase is being painted, use an E.M.C. recommended inside paint, and E.M.C. #8039242 Grey outside for a priming coat, or E.M.C. #8041106 Suede Grey as a finish coat. The liners should not be painted.

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MARCH 1941

Electro-Motive Corp.



CYLINDER TEST VALVE, HAND HOLE COVER,
OIL PAN SUMP AND CRANKCASE.

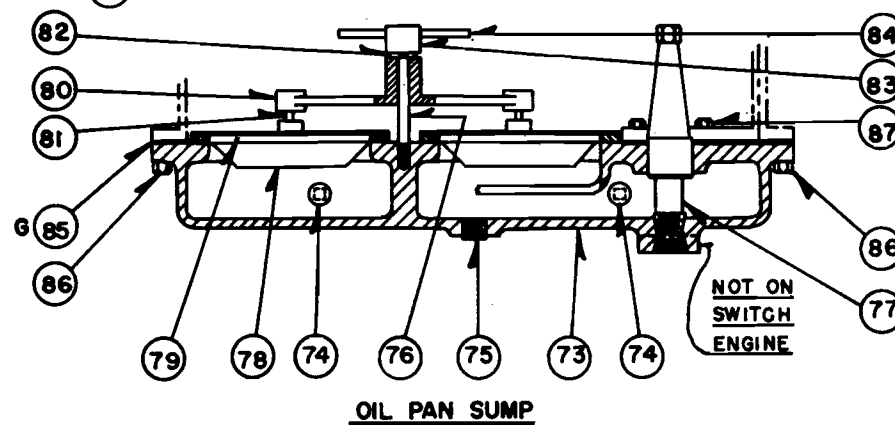
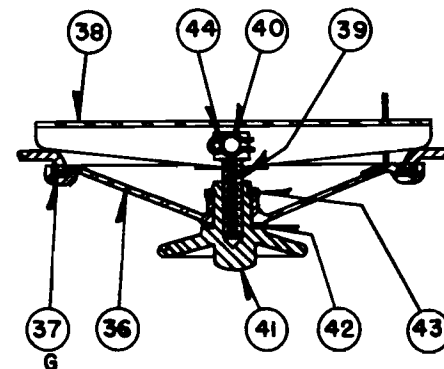
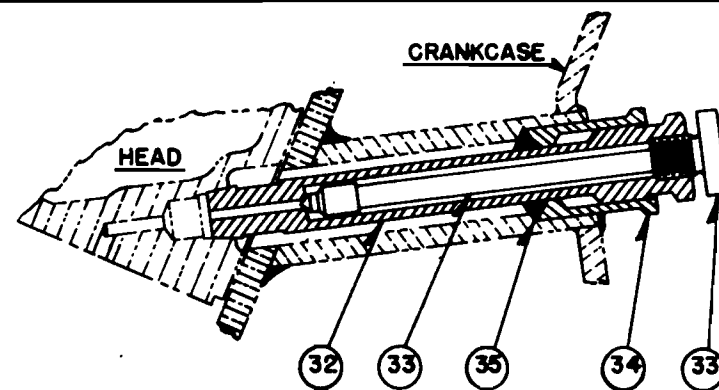


PLATE 1938

9. REMOVING CYLINDER LINER RIDGE

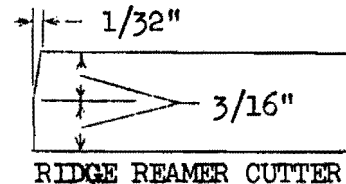
Before using ridge reamer, oil the cylinder wall just under the ridge. See that the cam handle is turned inward so that the cutter is drawn back away from the liner. Swing out the locking stop and lower the reamer into the liner until the stop rests lightly on the top of the liner, then turn the adjusting nut until the reamer assembly is anchored firmly in the liner. Now swing the locking stop back out of the way and then swing the cam handle to the release position, permitting the cutter to move outward against the ridge, then proceed to ream using a deep socket on the large anchor member, turning this with a speed wrench.

Continue turning until the cutter no longer cuts at any point. With the cutter exactly even with the stop pin there is no danger of cutting too deep.

Lock the cutter away from the liner before removing reamer assembly from the cylinder.

To reset cutter, loosen the cutter with screw until the cutting tool is free. Anchor the reamer assembly in a good liner and below any ridge that might be present. Release the cam so the stop pin is pressed tightly against the cylinder wall. Now push the cutter out against the cylinder wall and tighten the set screw.

If it becomes necessary to sharpen the cutter, do so with a very fine grained grinding wheel, using a tri-square to be sure that the ground surface is square. Bevel the upper end as per sketch.



10. CLEANING CRANKCASES AND AIR BOXES

Use a petroleum solvent with a high flash point. Kerosene or fuel oil is satisfactory. If the equipment near the engine is protected, the crankcase can be sprayed with an air hose syphon. Otherwise, the crankcase should be wiped out with rags saturated in petroleum solvent with high flash point. In either event, finish by wiping up all solvent trapped in corners and pockets.

The air box should not be sprayed. Wipe the air box with lintless rags soaked in a solvent. Do not wipe the cylinder liners. Keep dirt from entering cylinder liner ports.

The frequency must be determined by inspection.

11. REMOVING BROKEN MAIN BEARING STUDS

A stud extractor is available, 1-1/8" - 1-1/4" dia. used with 13/16" dia. drill. (E.M.C. No. 8044587)

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12. REMOVING BROKEN CRAB BOLTS

If the bolt breaks so that a portion of it is sticking above the top deck, a nut or rod may be welded to the broken section and turned out from the nut below. If the nut should break below the top deck, then it will be necessary to drill a hole and use a screw extractor. This same procedure could be used in the first case also. Most of the engines now in the field have elastic stop nuts, while present production engines are being equipped with castellated nuts. In the latter case, it would be necessary to remove the key before attempting to remove the crab bolt.

13. INSTALLING CYLINDER HEAD CRAB STUDS

Use a stud driver (E.M.C. No. 8042686) to install a cylinder head crab stud.

14. HONING CYLINDER LINERS

Honing cylinder liners is done to remove the glaze on the liner wall and to remove any slight irregularities. If the liner is scored, it should be returned to Electro-Motive Corporation for re-grinding.

Equipment:

- Hone kit complete
- 1/2" electric drill motor. The motor should operate at 300 to 500 R.P.M.
- Coil spring and arm for supporting weight of motor (optional).

Procedure:

Remove cylinder head and remove any ridge at top of liner with ridge reamer before removing the piston (See Paragraph 9).

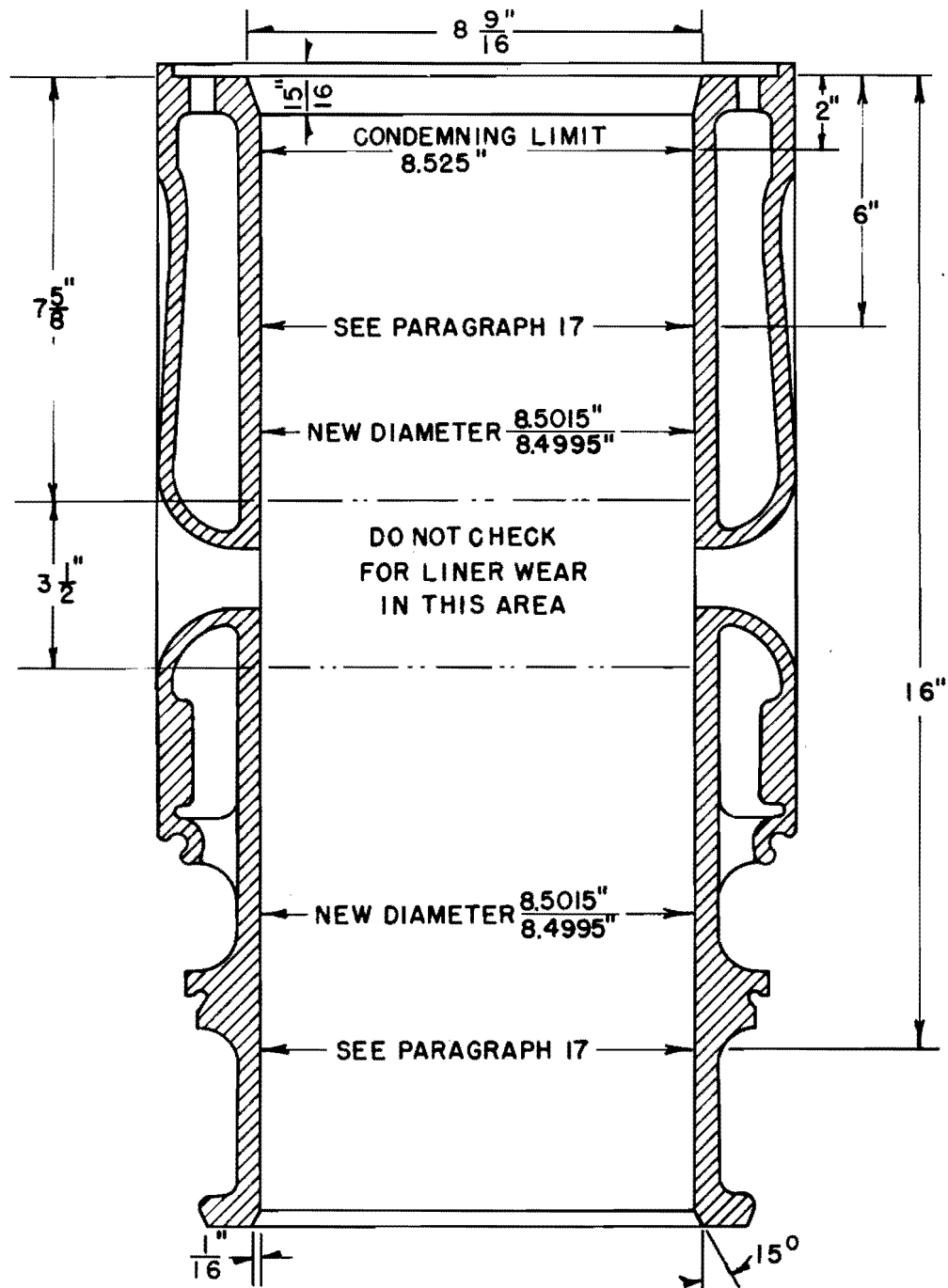
Remove liner from engine and clean thoroughly to remove oil and grease from liner wall.

Mount liner away from floor a few inches so stones can extend to lower edge of liner on downward stroke.

If drill and honing assemblies are too heavy to handle, hang them on a long coil spring to relieve their weight.

Mount the stones and guides in the hone. This is done by removing the center splined shaft and inserting the stones and guides in the holes marked "X". The two stones go on opposite sides. Place the stones and guides completely into the holders and insert the splined center shaft. Keep this shaft out 1/4 inch to prevent the adjustment gears at the top from meshing, and lower the hone into cylinder. Turn the adjustment to expand the hone to fit the cylinder. Mesh the gears together and turn the micrometer adjustment to give a snug fit.

Turn on the motor and raise and lower the hone in the liner so the stones pass completely from top to bottom. Do not let them extend outside liner as this may cause binding. Keep the hone moving. Lubricate the stones with kerosene. Do not file away the guides. Keep the hone snug in the liner. Do not remove any more metal than is necessary to obtain the desired finish. (See Plate 1775 for wear limits).



WEAR LIMITS OF CYLINDER LINERS
MODEL 567 ENGINES
PLATE 1775
REV. C

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SECTION 1

- Hone until the wall presents an even satin finish and until any out-of-roundness is removed.

The finishing stones are coarse and the polishing stones are fine. Use the finishing stones if any metal is to be removed. Use the polishing stones to give the satin finish.

15. ENGINE BREAK-IN

Due to the finish and clearances used in 567 engines, it is not necessary to subject the engine to prolonged "breaking-in" after installing new liners, pistons or other parts. It is only necessary to use reasonable precautions in checking and observing the performance of the engine during the first few hours.

Inasmuch as running the engine at idling speed even for long periods, would not materially affect the fitting of the new parts, it is recommended that the engine be run without load between 400 and 500 R.P.M. for a period of 1/2 to one hour, during which time it should be stopped once or twice and a visual inspection made.

After this preliminary running, the engine may be put into routine service.

16. CLEANING CRANKCASE BREATHER

Clean Crankcase Breather every three months on switchers, or every 25,000 miles on streamliners, or if locomotive is operated in location where air conditions are dirty, clean every month on switchers, or 10,000 miles on streamliners. Wash the element in a petroleum solvent and blow dry with compressed air. Dip in SAE 10 oil and allow to drain.

17. CHECKING CYLINDER LINER WEAR

New liners are finished 8.5015 to 8.4995 for the full length except for approximately 3-1/2" of relief at the intake ports. Liners will wear tapered with the larger diameter at the top. Liners should be condemned when the point of maximum wear at a point 2" from the top reaches 8.525. If they are allowed to exceed this dimension they cannot always be cleaned up for .030" oversize pistons and a third of the total wear life of the liner is lost.

In order to check a liner for clearance and wear below the maximum wear point, check the diameters at right angles at points 6" and 16" below the top of the liner. If the average of these four measurements exceeds the condemning limits as indicated in the next paragraph, the liner should be re-bored .030" oversize. Also if the liner is more than .005" out of round at the checking points 6" and 16" below the top of the liner, it should be re-bored and finished .030" oversize.

The maximum diametrical clearance between a piston and liner must not exceed .020" at the time of a service installation. This means that with a new piston 8.490 (which is the high limit) the liner may measure 8.510" diameter.

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If an old piston which has worn .003" below the lower new limit, which would be 8.485", is to be installed, the liner should not measure more than 8.505"

Both of the examples above give a clearance of .020", and if it is desired, pistons and liners may be so selected as to obtain additional wear life of either pistons or liners depending upon which may pre-dominate in stock.

SPECIFICATIONS

Subject and Remarks

CYLINDER LINERS

Data

Cylinder liner wear limits	See Plate 1775
Clearance crankcase to liner . . . . .	.0015" to .0045"
Bore	8-1/2"
Stroke	10"
Weight of liner with studs (Approx.)	150#

OVERSIZE LINERS

The dimensions of cylinder liners which are oversize are similar to those on Plate 1775 except that each figure shown indicating diameter is increased by .030" or .060" as the case may be. These are the two oversizes supplied. A standard liner which has worn beyond the limits prescribed on Plate 1775 can be returned to E.M.C. for refinishing to the next oversize.

When measuring the wear of oversize liners, simply add .030" or .060" to the figures given on Plate 1775.

S E C T I O N I I

CYLINDER HEAD, ROCKER ARMS, VALVES AND INJECTORS

• GENERAL DESCRIPTION

CYLINDER HEADS

The cylinder heads are made of alloy cast iron and are water cooled, their water openings matching those of the cylinder liner. The heads fit into wells counterbored in the top deck of the crankcase, and are located by indexing plates fastened to the head which fit dowels in the crankcase. Four replaceable exhaust valve guides are pressed into the head. The exhaust ports in the head line up with a water jacketed exhaust port in the crankcase.

ROCKER ARMS

Two rocker arms actuate the four exhaust valves and another rocker arm actuates the injector. All three are actuated directly by the camshaft. Each rocker arm has an adjusting screw which is used to compensate for variation in valve seat depth or for adjusting the injector stroke. The valve rocker arms operate valve bridges on each end of which are lash adjusters. The rocker arm bushings are bronze. See Plates 1703 & 1939.

EXHAUST VALVES

The exhaust valves and springs are fastened by spring retainers provided with a tapered hole into which two mating locks are inserted. A cap on top of each valve stem held by a snap ring holds the valve stem shims. These shims compensate for variation in valve stem height.

INJECTOR

The injector unit consists essentially of a low pressure fuel supply connection, high pressure pump, atomizing valve complete with needle valve and an atomizing tip, and a control mechanism for regulating the amount of fuel injected and the timing (See Plate 15-3). The injector unit is located centrally in the cylinder head, being securely fastened in a water-cooled boss by means of a crab, stud & nut.

The injector plunger is operated from the camshaft through a rocker arm, the plunger of the injector having a constant stroke. The effective stroke of the plunger, as well as the timing of the fuel injection, is controlled by means of a rack and pinion operated from a common control shaft which is regulated by the governor. Proper adjustments are provided in the linkage for accurate setting of the injector rack. See Plate 1321.

HYDRAULIC LASH ADJUSTER (See Plate 2300, Fig.1)

The hydraulic lash adjuster consists of a spring loaded piston and ball check valve operating under oil pressure flows through the drilled passage in the valve bridge to the top of the lash adjuster where it flows past the ball and fills the hollow piston. The oil pressure and a spring forces the piston down on the valve stem cap. When the rocker arm forces the valve bridge down, the oil in the lash adjuster is trapped by the ball check so the exhaust valve is opened.

As the valve and valve seat wear, or the valve heats up, the top of the valve stem cap gets higher. However, the lash adjuster does not keep the valve (exhaust) from seating, since the small leakage around the lash adjuster piston compensates for any increase in valve stem height.

SERVICE INFORMATION

1. REMOVING ROCKER ARMS AND VALVE BRIDGES

Remove lubricating oil lines. Remove the two nuts holding rocker arm bearings in place. Parts can then be removed easily.

2. REMOVING INJECTOR

Remove oil line from rocker armshaft and remove rocker arms. Remove fuel oil lines. Use prybar under edge of injector (See Plate 1336, Fig. 6) after removing injector crab and fuel lines. Handle the injector with care and put in a metal shipping container.

3. REMOVING ROCKER ARM ROLLERS

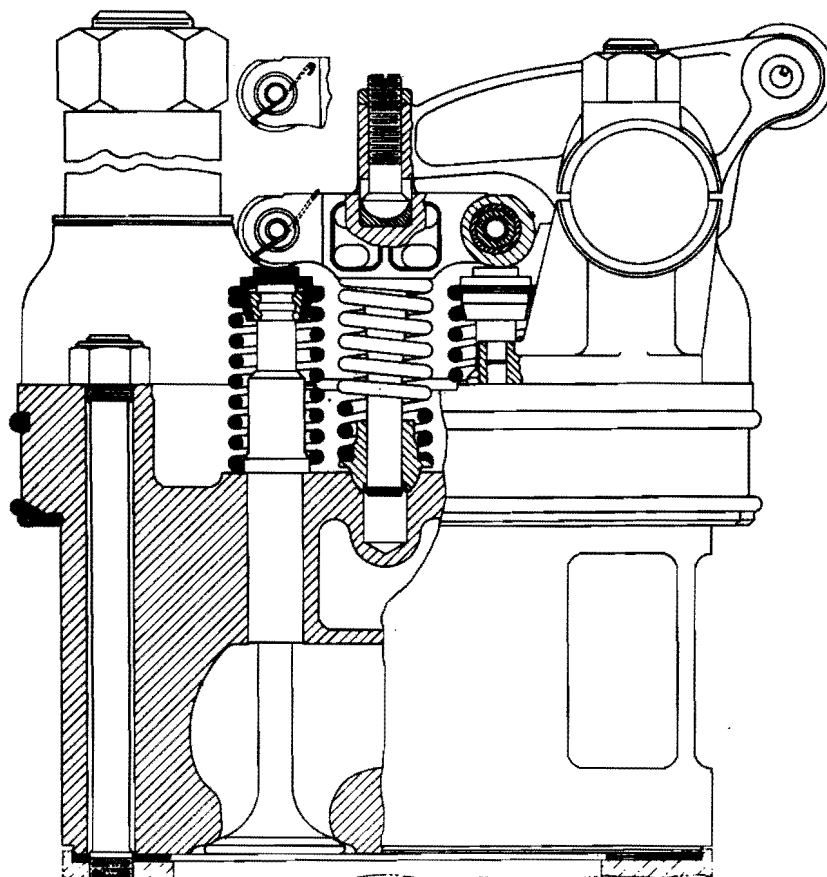
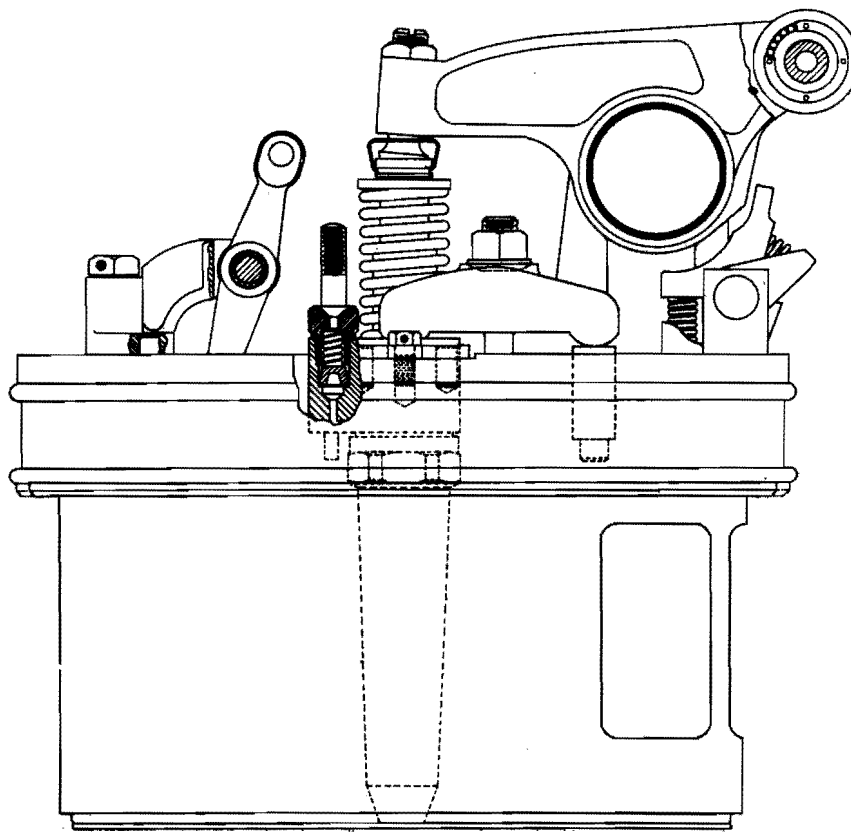
The bearing pins are press fitted. First drive through the holding pin and remove with cutting pliers. The bearing cannot be disassembled; replace as an assembly if worn.

4. REMOVING MECHANICAL LASH ADJUSTER

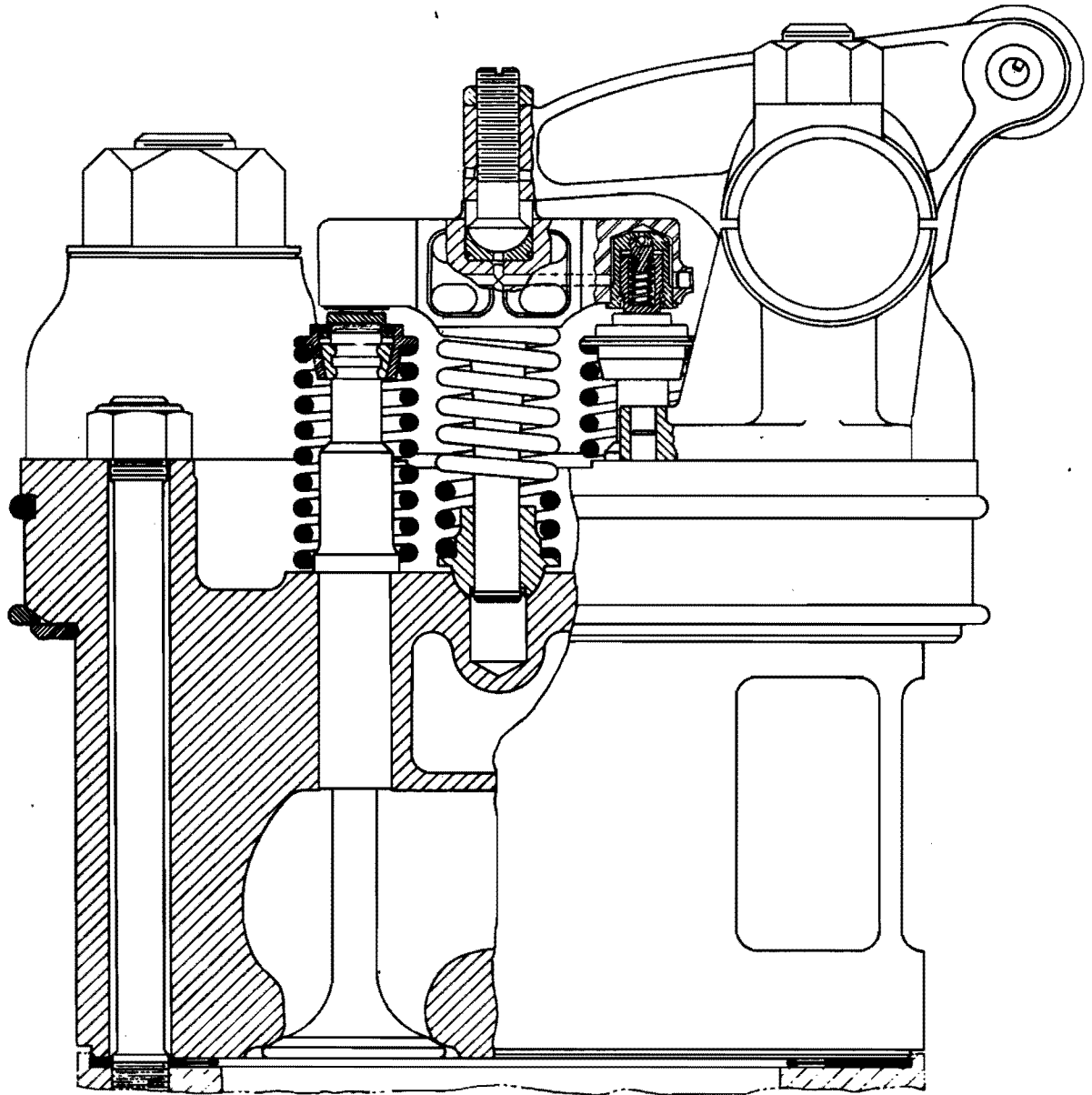
Unhook lash cam spring and remove. Press out pin. Cams should not be scratched or worn flat.

5. REMOVING CYLINDER HEAD

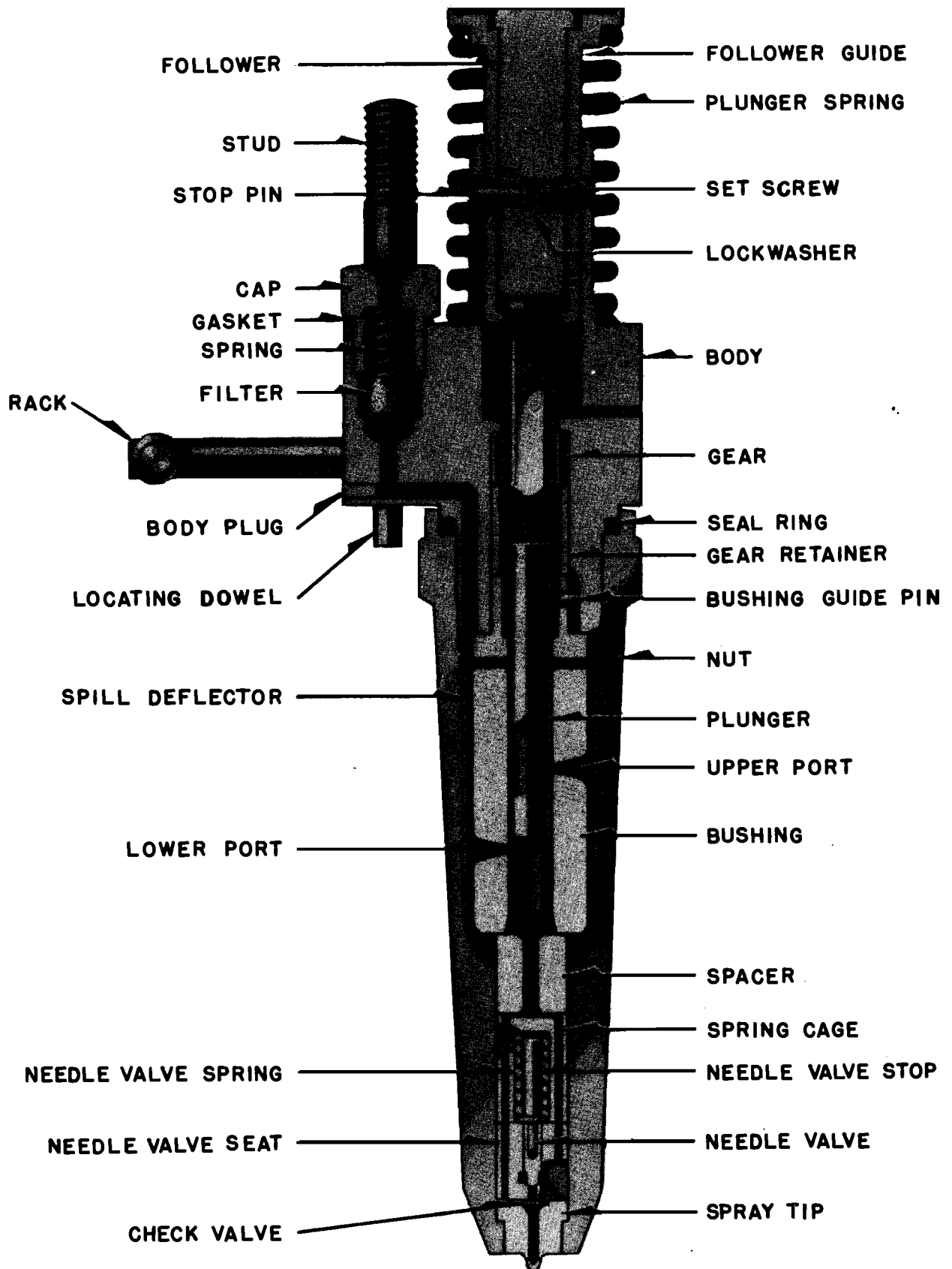
First remove injector (See Paragraph 13) and fuel lines. The engine cooling system must be drained. Clamp liner down with liner anchor tool (See Plate 1336, Fig. 1 & 2) before loosening any nuts. The liner must not be allowed to move when removing a head unless the liner is to be removed also. Otherwise, the liner seals may leak. Remove complete cylinder head test valve by using a wrench. Remove injector micrometer adjustment linkage clevis pins. Protect the crab stud threads with fibre cups. Apply head removing tool (See Plate 1336, Fig. 3). Tighten the nuts on this tool first; this separated head from liner. Remove head cautiously.



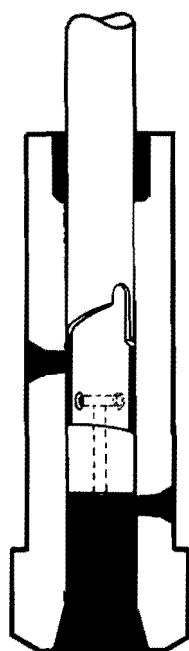
CYLINDER HEAD WITH MECHANICAL LASH ADJUSTER



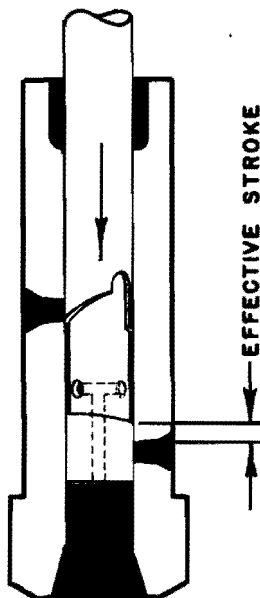
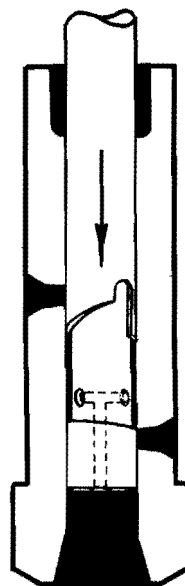
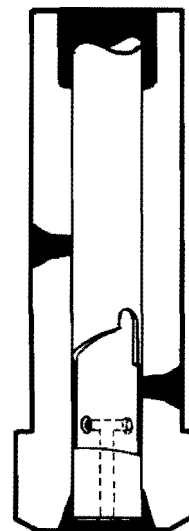
CYLINDER HEAD WITH HYDRAULIC LASH ADJUSTERS

**PLATE 1322**

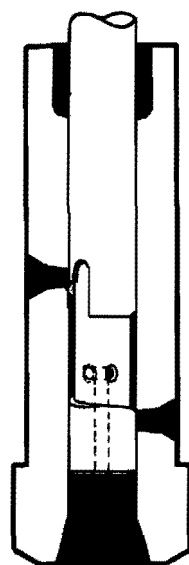
REV. B.



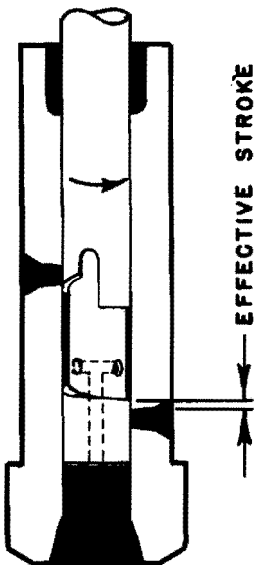
TOP OF STROKE

START OF
PUMPING STROKEEND OF
PUMPING STROKE

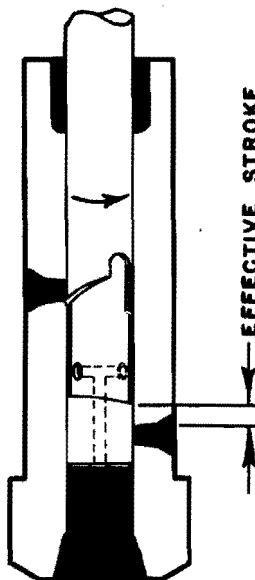
END OF STROKE



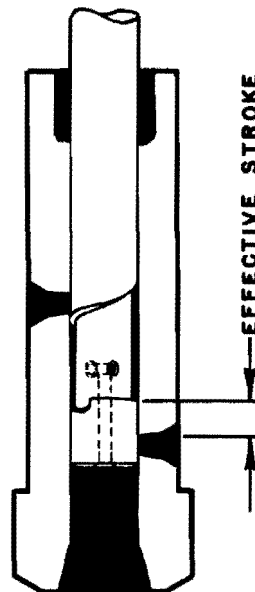
NO INJECTION



IDLING LOAD



HALF LOAD



FULL LOAD

INJECTOR PLUNGER POSITIONS PLATE 15-3

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SECTION 2

6. REMOVING EXHAUST VALVES

Remove valve cap locking ring with screwdriver or pincers. Depress spring, using tool (See Plate 1336, Fig. 4) screwed to head, until valve stem cap, shims, and tapered keys can be removed. Remove tool and springs. If head is in engine, place piston at upper position to prevent valve from falling.

7. CLEANING CYLINDER HEAD

a. To remove grease, submerge the head in Turco-Penetrol or other solvent. Leave for a few hours, then remove head and flush off with steam.

b. To remove scale, and rust from the water passages, place a clamp and gaskets around top water holes, turn head over and fill with a solution of 10% Hydrochloric Acid or Oakite 32 (10% solution). Be careful not to get any solution on the machined part of the head. Flush thoroughly after one hour with hot water and steam.

c. The top of the cylinder heads together with the valve mechanism should be washed down with petroleum solvent and a spray hose at each oil change. (This is to be done with the heads in the engine). See Plate 1081 in instruction bulletin 1706.

8. REMOVING VALVE STEM GUIDES

These guides are press fitted and can be removed by pressing out from the bottom side of the cylinder head. Use a brass pin with a shoulder on it to prevent damage to the valve guide. New guides must be pressed into head and reamed.

9. GRINDING VALVE SEATS

See Plate 2-3 for proper dimensions. See Plate 1468 for pictures of tools. See Bulletin 1703.5 for part numbers of valve seat grinding tools. Never use grinding compound. Proceed as follows:

- a. Clean valve guides with tool shown in Fig. 2 of Plate 1468.
- b. Clean the valve seat and dry to prevent oil or carbon from clogging the wheel. Use a piece of abrasive cloth under the wheel and turn several times by hand.
- c. Insert the proper tapered pilot in the valve guide. Use a pilot which will bring the shoulder on the pilot above guide.
- d. Use 45° cutter as in Fig. 1 to narrow seat to width shown on Plate 2-3; turn by hand, not by motor.
- e. Use 75°-90° cutter as in Fig. 2 of Plate 1468 to true edge of valve seat. Turn by hand, not by motor.
- f. If stone needs dressing, mount as in Fig. 3. Put a little oil on the pilot to prevent sticking and eliminate friction. The spiral sleeve which raises and lowers the grinding wheel is adjusted until the wheel just touches the diamond; holder

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and grinding wheel are then revolved with the high speed drive. Hold the driver as straight as possible. Take light cuts with the diamond and move the diamond steadily across the wheel. The Diamond Holder is threaded for light cut adjustment.

Grinding wheels should be kept properly dressed to obtain the best results for fast grinding, accuracy, and a mirror finish.

- g. Proceed to grind valve seat, using a roughing stone, only if the seat is badly pitted.

No pressure is required when grinding. Do not slow down the driver; let it run at high speed. (See Fig. 4 of Plate 1468).

- h. Test Seat after Grinding

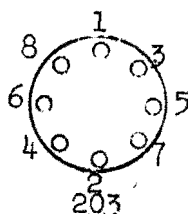
Using the same pilot that was used for grinding, adjust the indicator over the pilot so that hand of indicator is free to move in either direction. Plate 1468, Fig. 4. Set dial to zero and rotate. An attempt to get the valve seat perfect should be made, for the better the grind, the longer the valve seat life.

- i. After reconditioning valves the height of the valve caps above the cylinder head must be adjusted by adding or taking out shims under the valve caps to equalize both valves under the same valve bridge. This height should be the same within .010". A tool for checking valve height is available. Not more than .090" or six (6) shims, nor less than .030" or two (2) shims should be used between the end of valve stem and cap. Mechanical lash adjusters should be set so that the pin makes an angle of not less than 15°, and not more than 60° with the center line of the valve. Using .015" shims under valve caps, the setting of the lash adjusters should all check within 30° of each other. See Paragraph 22 for setting hydraulic lash adjuster.

10. INSTALLING CYLINDER HEAD

Clean head and liner seating surfaces thoroughly. Install gaskets. Line up indexing plate with dowel in crankcase. It is very important that the upper and lower seals at the water outlet ports in the cylinder head be properly seated into position in order to prevent leaks. (Ref. 23 & 24, Plate 1703). Apply cylinder head crab over studs. It is necessary to have the rocker arms removed in order to tighten all of the cylinder liner nuts. Tighten liner to head first (by hand), then tighten crab nuts (by hand). Repeat this procedure with a wrench taking up all nuts gradually. The crab studs and nuts are numbered; keep them matched. The crab stud washers are under the spacers, not under the nuts. When crab bolts are used, there are no spacers. On engines with no spacers, the washers are under the nuts.

The following method is suggested in tightening cylinder heads on 567 engines: the cylinder head is held to cylinder liner with 8 studs. After tightening the nuts by hand, they should be progressively tightened with the wrench, in the following order:



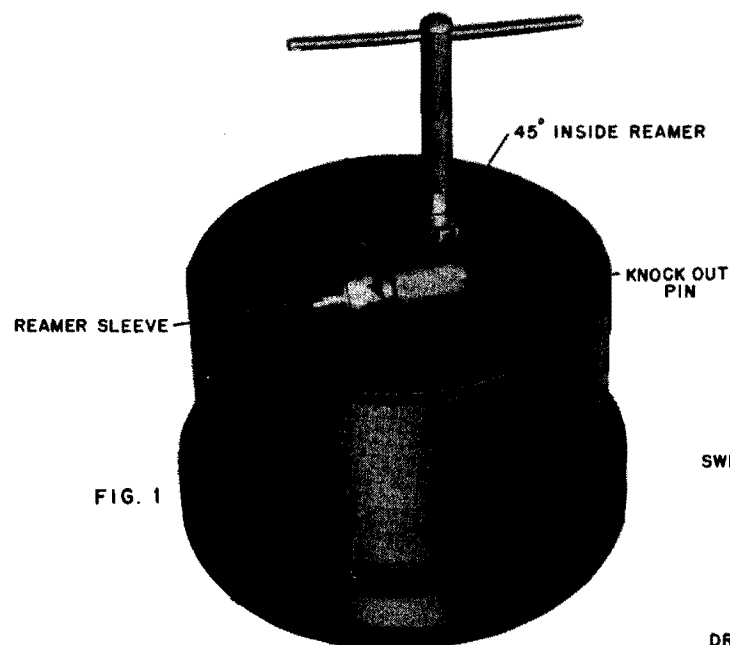


FIG. 1

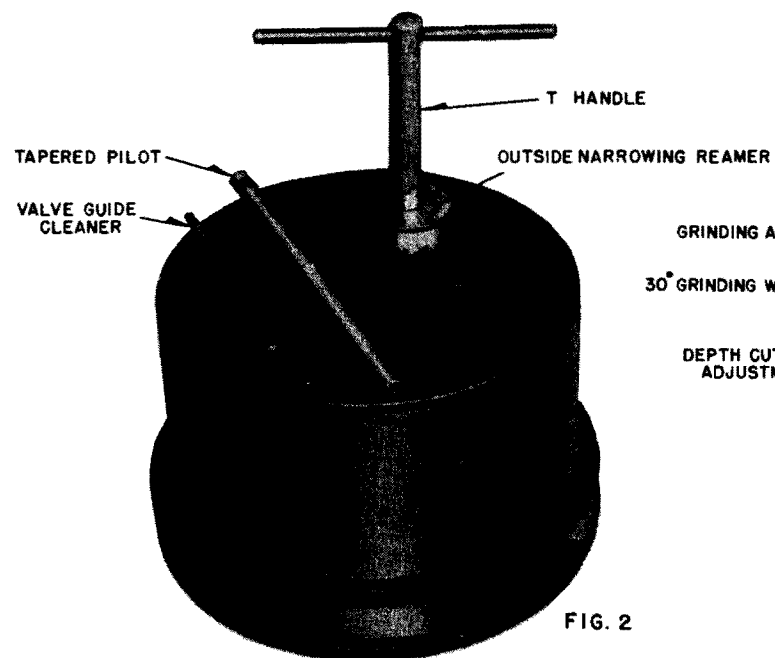


FIG. 2

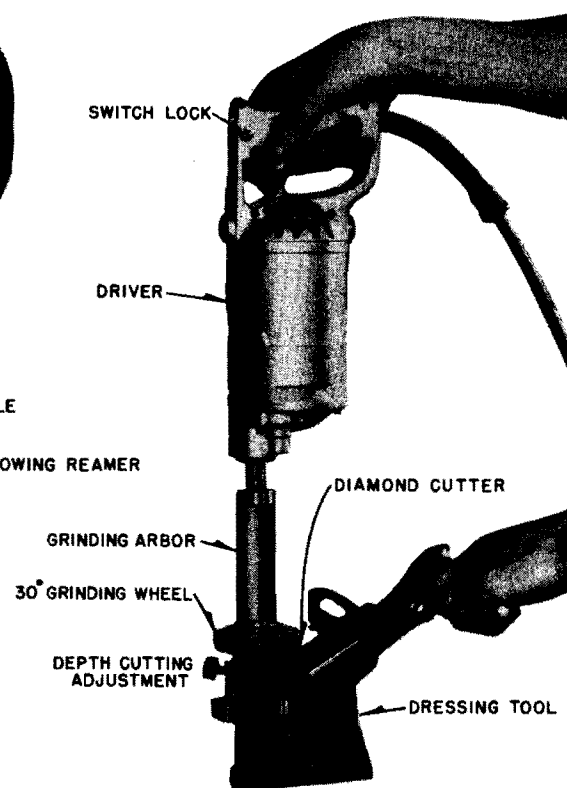


FIG. 3

567 ENGINE
VALVE SEAT TOOLS

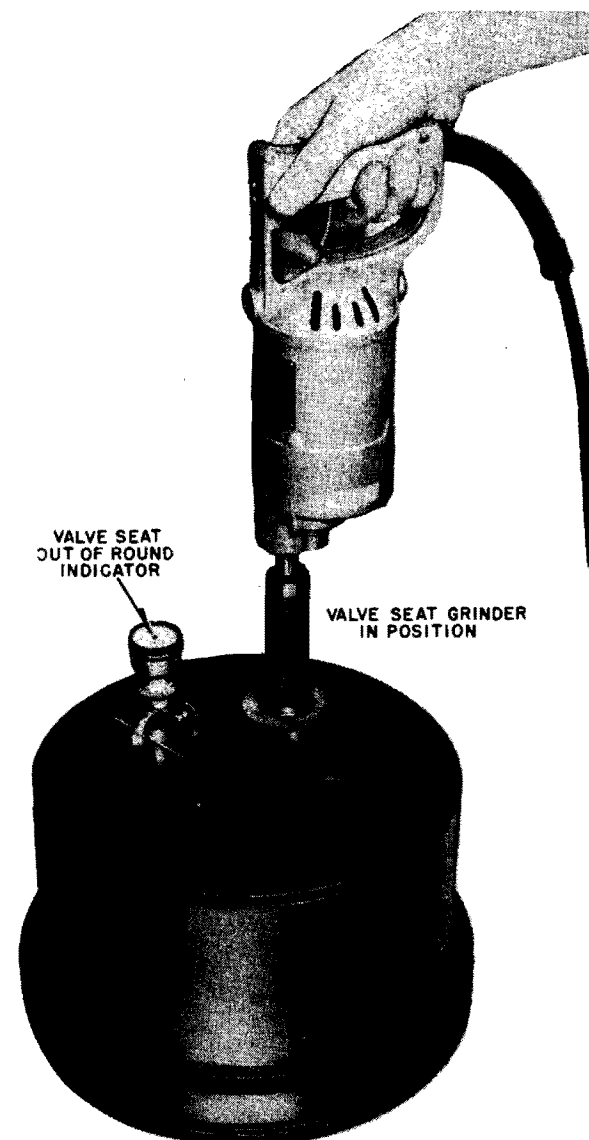
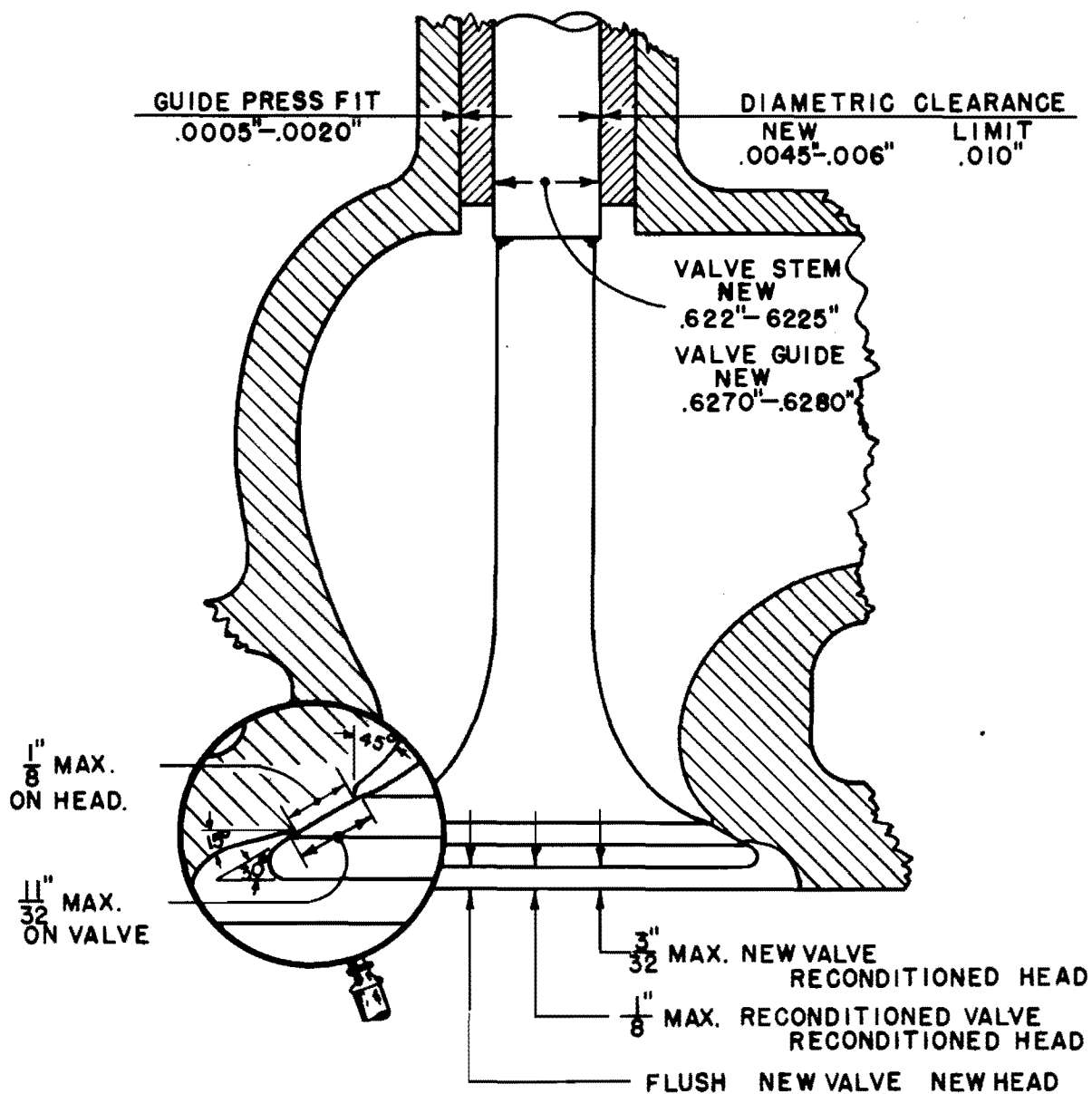


FIG. 4



VALVE CLEARANCES
567 ENGINE
PLATE 2-3
REV. B.

11. SETTING MECHANICAL LASH ADJUSTERS AND ROCKER ARM ADJUSTING SCREWS

See Plate 2-2. Be sure the tops of the valve stem caps (of any two valves under the same valve bridge) are the same height from the machined surface of the cylinder head, within .010". See Paragraph 9.

12. ADJUSTMENT OF HYDRAULIC LASH ADJUSTERS (See Plate 2300, Fig. 2)

On engines equipped with hydraulic lash adjusters, rocker arm adjustments are made while the engine is stopped and the temperature of the engine parts are equalized.

The height of the valve caps above the cylinder head must be adjusted by adding or taking out shims under the valve caps, so that the two valves under the same valve bridge are within .010". There should be not less than .030" nor more than .090" of shims under any one valve cap.

Valve feeler gauge 8058298 should be used for setting the rocker arm adjustment. This gauge is .150" thick and is made to gauge the distance between the lash adjuster body and the valve stem cap. On each bridge, the rocker arm should be adjusted so the gauge will fit on the valve having the least clearance. This adjustment is to be made with the valves closed.

In case a gauge is not available, the rocker arm adjustment is screwed in until one of the hydraulic lash adjusters just touches the valve cap, then turn the adjusting screw in one-half turn more and tighten the lock nut. One turn on the adjusting screw is equal to .056"

13. CYLINDER TEST VALVES

These valves are for the purpose of finding and removing fuel oil and water from the combustion chamber. Keep valves closed tightly when running engine. Leave valves open when leaving engine. Open v valves and turn engine over once by hand after engine has been setting idle. If any liquid is discharged, find the cause. To remove test valve stem, use valve stem removing tool. To remove test valve body, use a standard wrench.

14. CUTTING OUT A CYLINDER

Back off injector rocker arm adjusting screw (counter-clockwise) all the way. Place injector rocker arm hold down clip in position (See Plate 1336, Fig. 5) over adjusting screw on injector rocker arm. Bar injector down with a strong screwdriver placed in front of cam follower, and fasten clip in place; this will make injector inoperative. Be careful not to damage cam follower. The engine must be stopped and the injector rack must be at "no fuel" position, when prying down a rocker arm.

15. SERVICING THE INJECTOR

If the injector is proven to be defective, it should be returned to the Electro-Motive Corporation. Absolutely no attempt should be made to repair an injector. To determine that an injector is causing trouble, check the points covered in Paragraphs 15, 16, and 17.

In an emergency, the fuel filters of the injector can be replaced by removing the fuel lines to the injector, removing the caps and spring over the filters and lifting out the old filters with tweezers. Extreme care must be exercised not to let any dirt drop into the space below the filters. Insert a new filter with the large side down, and replace spring, cap, and cap gasket. Destroy the used filter.

16. OPERATION OF INJECTOR TEST RACK

If an injector is to be tested to determine if it is functioning properly, it should be placed in an injector test rack.

The injector test rack must be mounted securely in a position where the operator can bear down on the handle with considerable force. A fuel reservoir with properly filtered fuel should be located above the level of the injector and connected through a flexible line to a spout which fits the fuel openings in the injector. After the injector is placed in the stand, it should be filled with fuel and pumped up and down several times to remove air pockets. The injector plunger should then be depressed with a quick, even stroke. The fuel from the injector tip should be completely atomized in six sprays. If the fuel drips or runs in a stream from the injector tip, it is an indication of dirt under the valve seat. During the test, guard is to be placed around the injector so that no fuel will hit the operator as the force of the fuel leaving the injector tip is sufficient to penetrate the skin.

17. TRACING A MISSING CYLINDER

A cylinder which is not firing will have a colder exhaust stack when engine is idling compared to one which is firing properly. By touching each exhaust stack momentarily, the difference in temperatures is easily determined and the unloaded or missing cylinder located.

Causes may be:

1. Badly leaking exhaust valves.
2. Improperly operating injector.
3. Excessive ring blow-by.
4. Improperly timed injector.

To further determine which cylinder is not firing, first have engine running in idle position. Disconnect the injector linkage from the lay shaft arm, on one cylinder, then push the injector rack to OPEN, or full throttle position. If this cylinder is firing properly, there will be a pronounced laboring of the cylinder. Thus, one by one, each cylinder in the engine can be tested.

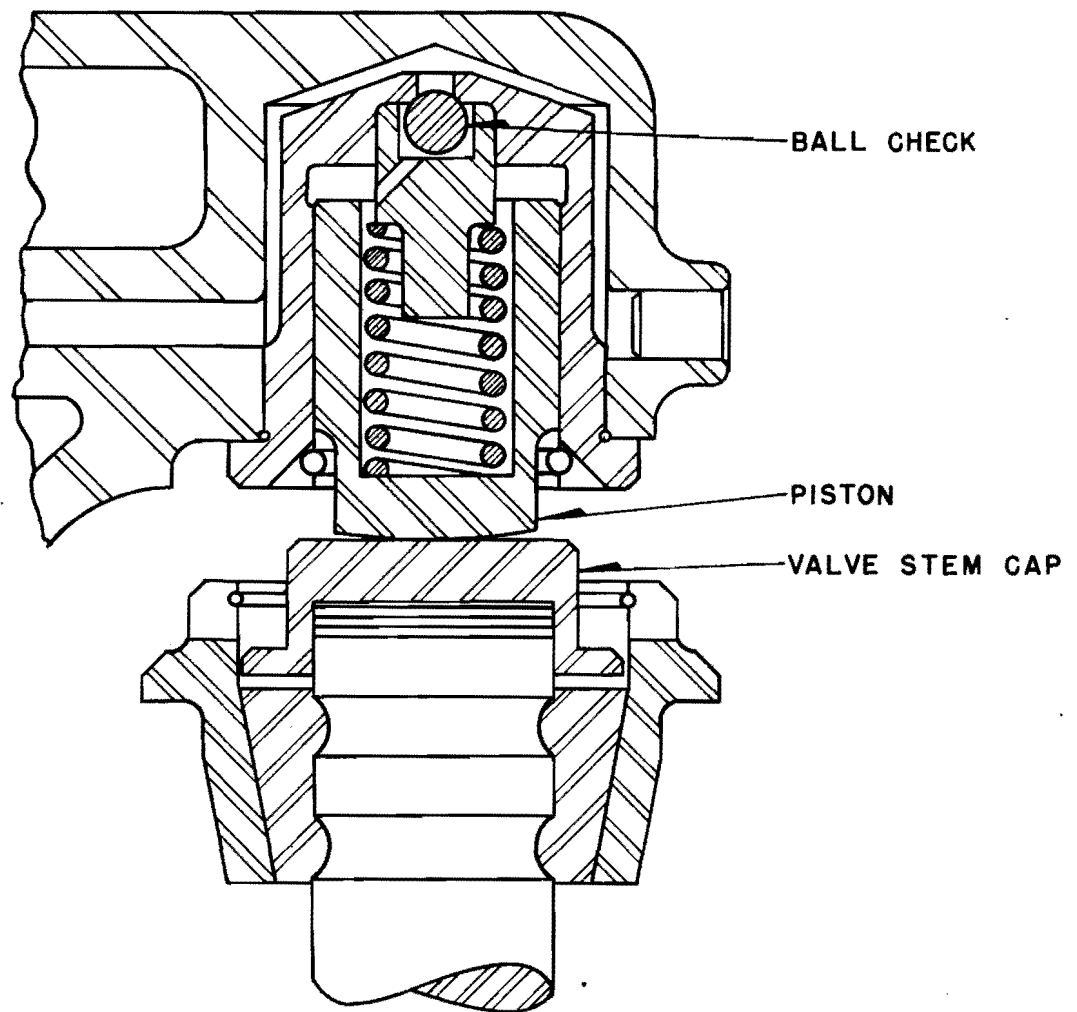


FIG. 1.

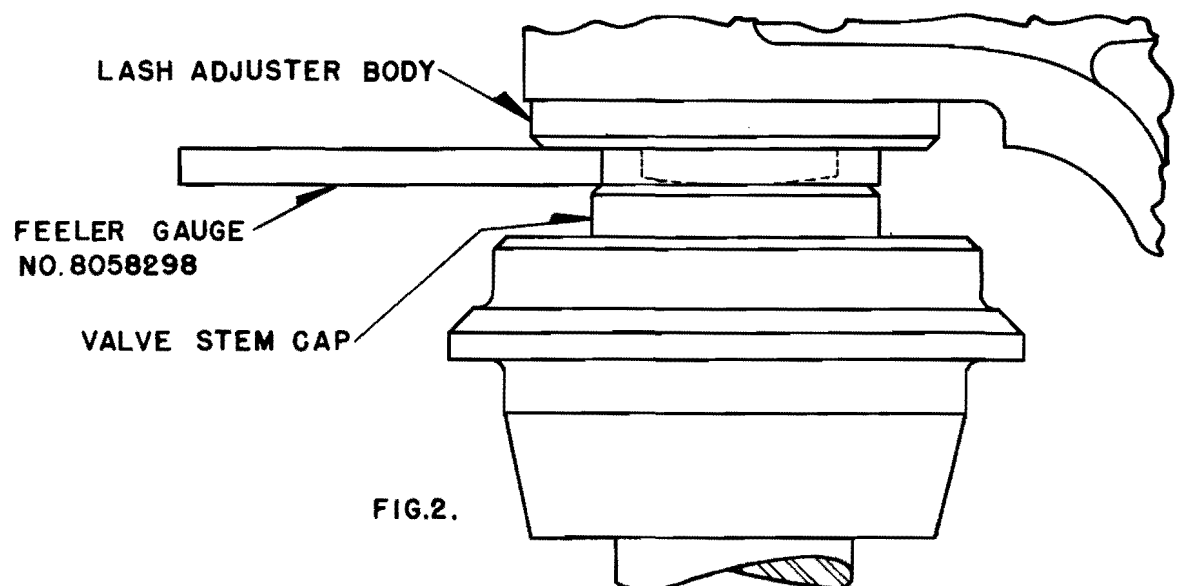
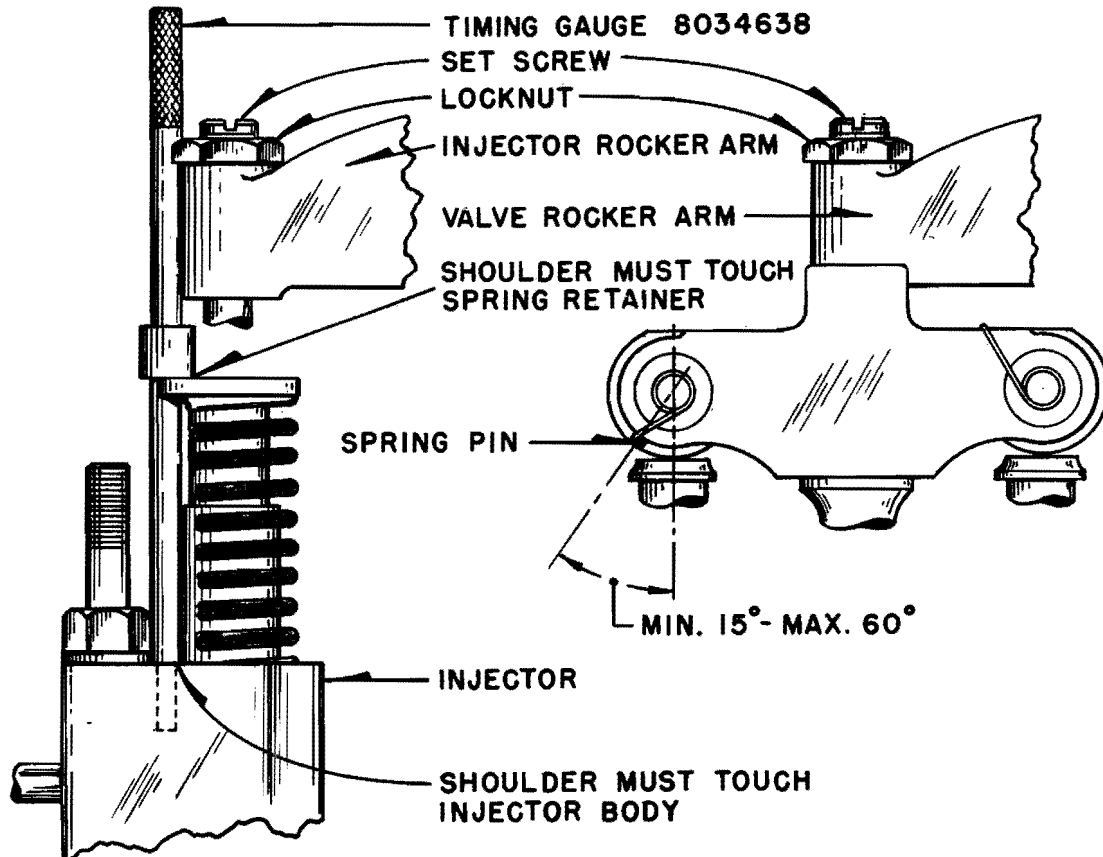


FIG. 2.

HYDRAULIC LASH ADJUSTER



INJECTOR SETTING: Set piston 2° before T.D.C. Insert gauge in 3/16" hole in injector. Turn set screw with a screw driver to bring shoulders of gauge as indicated. Tighten lock nut.

VALVE SETTING: Lash adjuster spring should be tightened 1/2 turn from unhooked position. Have valve rocker arm roller on low part of camshaft cam. Pull spring pins up to upper position and tighten set screw to hold them there. Then back off set screw until spring pin is in position shown. Tighten lock nut.

SETTING OF ROCKER ARM ADJUSTING SCREWS

MODEL 567 ENGINE

PLATE 2-2

REV. A

18. TRACING A NOISY CYLINDER

A broken or stuck lash adjuster, or broken lash spring, will cause considerable noise. By removing the cylinder head cover, one can determine which cylinder is causing the noise. If a pounding occurs, the engine should be stopped and inspected for a scored piston, bad bearing, or an injector out of time or stuck. A certain throb is common to all engines, especially where two engines are in a single locomotive. This is not to be confused with faulty operation. On engines equipped with lash cams, on the valve operating system, the cams will sometimes ROLL UNDER, causing the valves to be pushed down far enough to contact the top of the piston, causing a knock or pound.

19. CLEANING HYDRAULIC LASH ADJUSTER

The hydraulic lash adjuster 8054359 is the sub-assembly which presses into the valve bridge assembly. It is made up of a body which is the bushing, a spring, plunger, the ball check, ball check guide, and a snap ring which holds the plunger in the bushing.

With dirty lubricating oil there is a possibility of the small ball check getting dirt under its seat. If this occurs the adjuster will "swish" and the sound of noisy tappets will be heard. It is usually possible to cure this trouble by soaking the whole bridge in kerosene and working the small plunger by hand, and then blowing out with air, repeating this procedure if necessary. It is advisable to then fill the bridge with lube oil and work by hand until the plunger seats hard on the oil in its extended or nearly extended position.

If the above method does not cure the trouble it is possible to take out the nap lock ring which holds the plunger and carefully remove the parts. After washing the parts, re-assemble them as they were removed. Again fill with oil, and test by hand as mentioned in the preceding paragraph, referring to Plate 2300 for a sketch of proper assembly.

If there is gummy deposit on the plunger when it is taken apart, it can be cleaned with alcohol or lacquer thinner before re-assembly.

20. TO CHECK FOR EXHAUST VALVE BLOW

I. Valve blow can be determined by two methods while engine is running:

- (a) Black Smoke from exhaust when engine is under load.
- (b) Blowing noise from exhaust stack when engine is idling
(Engine must be warm, preferably after working hard.)

II. Valve blow can be determined by the following method to find the exact cylinder that is blowing: (Engine must be stopped).

- (a) Bar doubtful piston to top dead center and attach air pressure in the relief valve.

- (b) If valves are leaking, a blowing noise will be heard from the exhaust stack.

III. Valve blow may be caused by sticking valves. This can momentarily be corrected by applying kerosene or fuel oil to the valve stem, then working the valve by hand in a vertical motion.

IV. Repeat II. If valves still leak the head should be removed, cleaned and valve faces as well as valve seats in head reground.

V. When cylinder heads are removed for inspection or after valves and seats have been reconditioned the procedure, as explained below, should be followed to determine condition of seal between the valves and valve seats.

Place the cylinder head in an upright position on two blocks, far enough apart so the valves are not covered, and high enough so that the valve faces are visible. Squirt kerosene inside the exhaust passages around each valve. If the liquid is retained by the seal between the valve and valve seat they need not be refaced. If the liquid drips through between the valve and seat, they should be ground according to instructions contained in this bulletin.

If cylinder head is not scratched or marred, the seal can be checked by using a vacuum cup (Part No. 8060306). If vacuum cup holds to cylinder head over valve for at least one minute, the seal between valves and valve seat may be considered fit for further service. If it does not hold for one minute, the valves should be reconditioned.

21. REFACING VALVES

When refacing valves proceed as with similar automotive valves. Follow instructions supplied with valve grinding machine. Use a wet grinding attachment. See Bulletin 1703.5 for part numbers of valve grinding tools.

22. MACHINING CYLINDER HEAD SEATS

Refer to General Service Bulletin 200 for information on steel rings used under cylinder heads. Bulletin 2101 covers the operation of boring the crankcase for these rings.

23. INSPECTION

Inspection schedules are listed in Bulletin 1704.

24. HANDLING CYLINDER HEADS

Whenever the cylinder heads are removed it is of the utmost importance that no scratches or dents are put on the bottom side. In moving the heads, do not drag them over the floor or bench, as any marring of the gasket seat will cause leakage when the head is installed. A cylinder head carrying container is available to prevent any such damage. See Bulletin 1702.5 for illustration and part number.

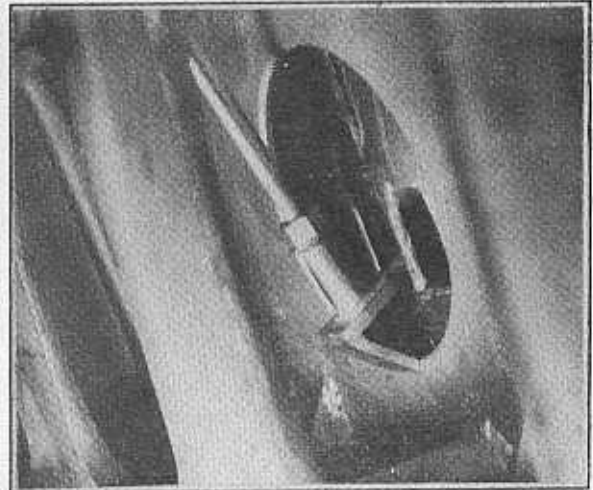
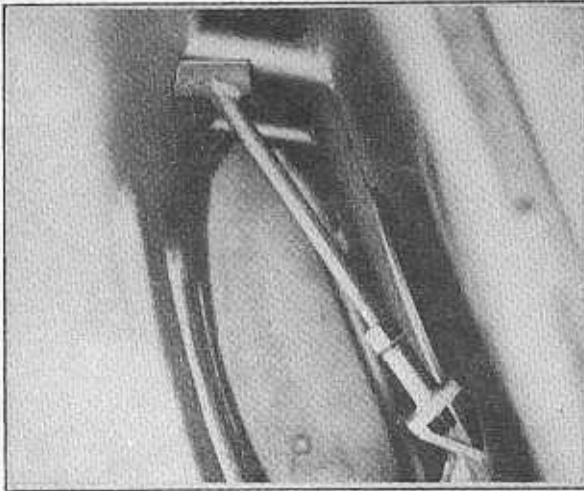


FIG. 1 CYLINDER LINER ANCHOR TOOL. **FIG. 2**
FOR ENGINES WITHOUT FABRICATED TOP DECK.

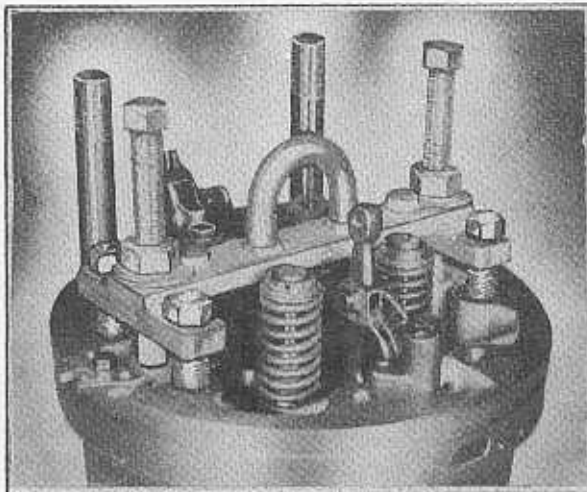


FIG. 3
CYLINDER HEAD REMOVING TOOL.

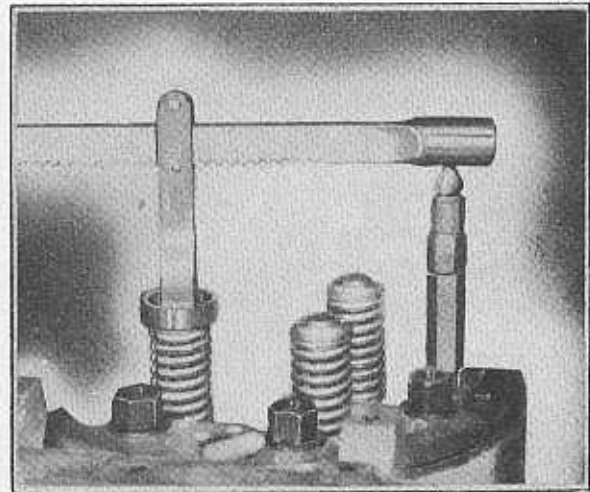


FIG. 4
VALVE SPRING COMPRESSION TOOL.

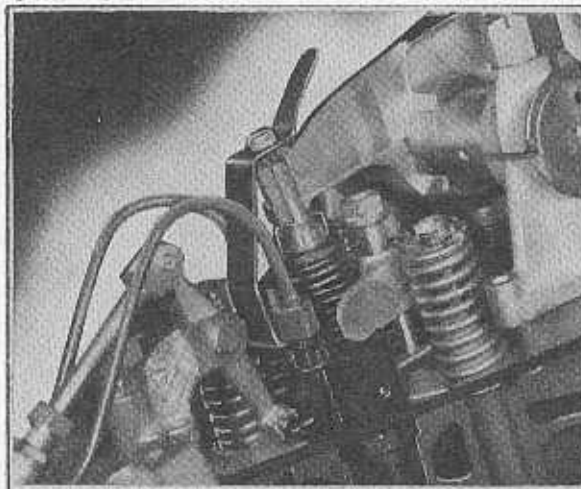


FIG. 5
INJECTOR HOLD-DOWN CLIP

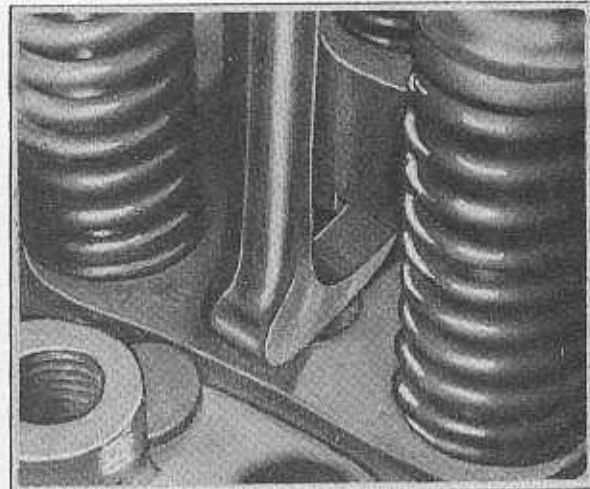


FIG. 6
INJECTOR PRYBAR.

SPECIFICATIONS

SUBJECT AND REMARKS	DATA
EXHAUST VALVES	
Wear Limits	See Plate 2-3
Diameter.	2-1/2"
Lift . . . . .	.686"
No. per Cylinder	4
Thickness of One Shim . . . . .	.015"
Minimum Number to be Used	2
Maximum Number to be Used	6
VALVE SPRINGS	
Free Length	4-1/8" (New)
Length - Valve Open	2-11/16"
Length - Valve Closed	3-3/8"
Pressure with Valve Open	213# to 225#
Spring must not show any set after being compressed with coils touching	
TIMING PROCEDURE	See Section IX
ROCKER ARM	
Clearance - Bushing to Shaft	New .002" - .004" Limit .008"
Press - Bushing to Rocker Arm0025" - .004"

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APR. 18, 1941

SECTION 3

S E C T I O N III

PISTON AND CONNECTING ROD

GENERAL DESCRIPTION

PISTONS

Pistons are pearlitic malleable iron with four compression rings above the wrist pin and two oil rings at the bottom. The head is recessed at the top to form part of the combustion chamber and help create turbulence during fuel injection, and is deeply ribbed on the underside for strength and to provide additional cooling, the space above the wrist pin is partitioned off for oil cooling. A jet at the bottom of each cylinder liner is supplied with oil from a separate oil pump to direct a stream of oil through a hole in the partition plate for piston cooling. The oil passing over the cooling fins is discharged through a hole on the opposite side.

WRIST PINS

Wrist pins are of ample size, case hardened steel, hollow bored, with outer surface ground for the needle bearing or the floating bronze bushing. The wrist pin is supported on bronze bushings in the piston.

CONNECTING RODS

The connecting rods are drop forgings of alloy steel of "I" section with rounded corners to reduce stress concentration in the section. Fork and blade rod construction eliminates cylinder offset and improves bearing conditions. Two-cycle operation permits simplicity in cap design, allowing removal through the cylinder liners of connecting rods with a large crankpin diameter.

FLOATING BUSHINGS

There are three types of floating wrist pin bushings in use at this time.

Part No. 8059069 is for service use for old rods that have had needle bearings which have been staked* so much that a retainer can no longer be used.

Part No. 8055658 is a two-piece bushing held in with retainers that are staked in the rods.

Part No. 8059506 bushing is the latest type, two-piece, being held in the eye of the rod with thin retainers and snap rings. This can be used in any standard rod but must have a baffle with a larger wrist pin hole (3-29/32"). It is permissible to use either the 8055658 or the 8059069 bushing with large or small hole baffle.

* This is the peening process which held the needle bearing retainer.

SECTION 3

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When floating bushings are applied to a rod which had needle bearings, the eye should be honed as outlined in paragraph 15.

SERVICE INFORMATION

1. PULLING A PISTON:

Remove a cylinder head (See Section 11). Remove hand hole covers and remove bearing straps. Before pulling a piston make absolutely sure that there is no ridge at the top of the cylinder liner. If the rings should strike this ridge the ring lands would be fractured. A ridge can be detected by feeling the cylinder wall. See Section 1 for removing a ridge. Turn crankshaft so piston is at top position. On pistons with a hole for pulling, use a $3/8$ " - 16 bolt with a rod through the bolt head or a piston pulling eye. The cylinder liner must be held tightly in place unless it is to be removed. Use the cylinder liner anchor tool, if liner is not to be removed.

If the rod is bumped hard against the inside of the piston skirt the piston at the lower ring section can very easily be swelled out a few thousandths of an inch. This is likely to start piston to scuff in the liner which eventually will cause piston and liner failures. Some form of boot, as described in paragraph 6, should be used.

Piston and rod assemblies must be handled very carefully either on the bench or when being installed in an engine.

2. REMOVING PISTON PIN:

Remove piston pin caps by inserting cap removing tool in hole provided. (Also see Paragraph 4). The pin is full floating and can be removed by hand. If it is desired to keep needle bearings (if used) in piston, slide needle bearing retainer tool in place of piston pin. Inspect the piston for cracks, loose baffle, excessive wear, etc.

3. PULLING PISTON BAFFLE:

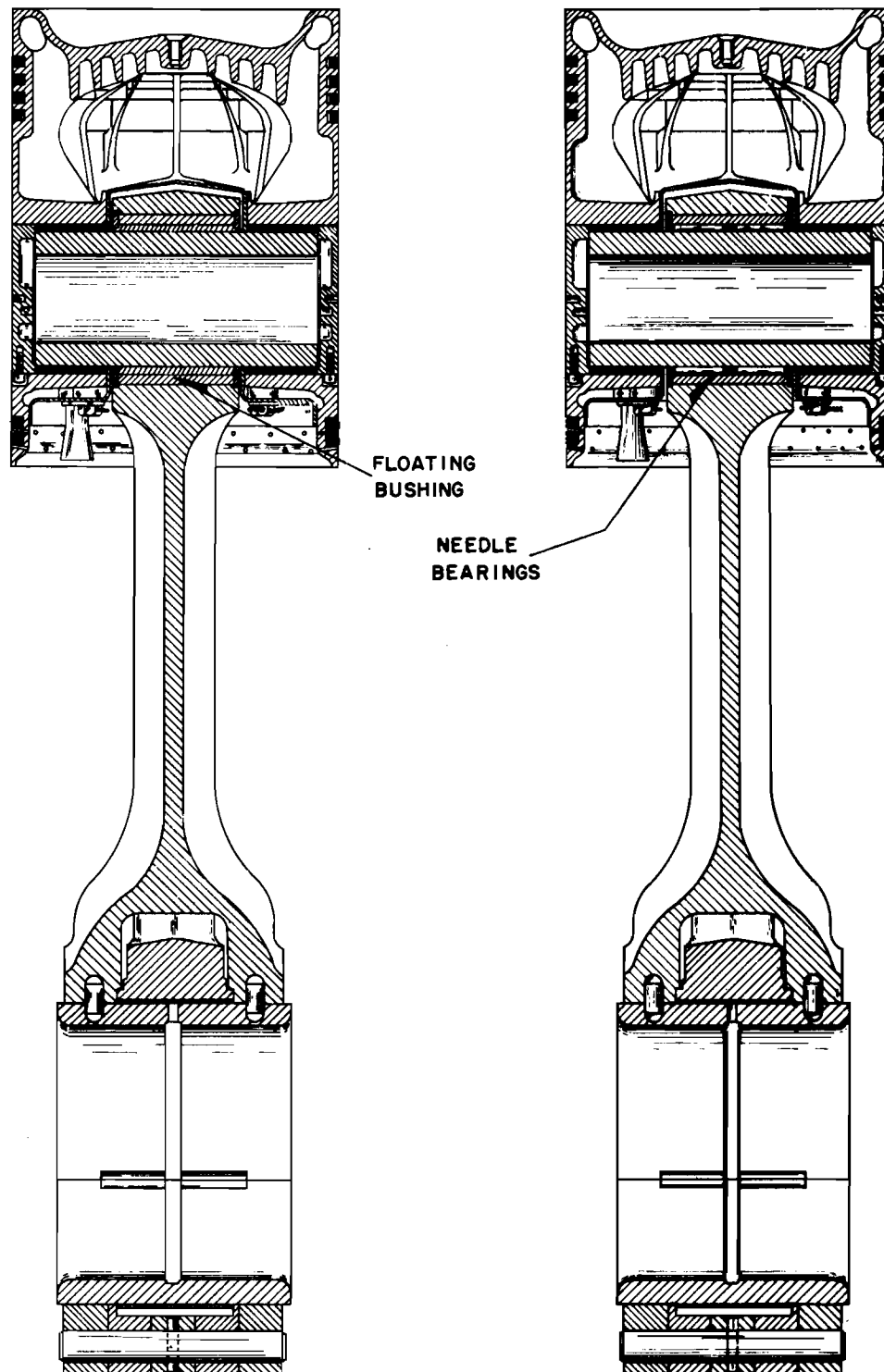
Remove connecting rod and wrist pin. Remove baffle bolts and apply piston baffle puller tool.

4. REPLACING PISTON PIN CAPS

Use piston pin guide to hold needle bearing rollers. This is unnecessary when floating bushings are used in place of needle bearing. (Note: All service replacements and new engines use floating bushing - See paragraph on Floating Bushings). If piston pin caps are loose they will leak oil or work out, causing a scored liner and piston. It is well to use new caps - or at least a very tight cap.

5. NEEDLE BEARING AND RETAINER REMOVAL:

After removing the piston pin the needles can be taken out by hand. The outer retainers are peened in and can be removed by prying



PISTON AND CONNECTING ROD

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lower half by one dowel. The oil holes must be on the same side as the blade rod. Definite alignment of the hinged cap is also obtained by a dowel. No adjustment of the connecting rod bearings is provided. When the bearings wear, replace with new bearings. Connecting rods are stamped FRONT. Bearing shells and straps are stamped "F". The following identification will eliminate any possibility of improperly installing rods.

The upper half of the bearing is is doweled on the same side of the forked rod assembly as the dowel locating the "backet" to the rod. The piston cooling funnel must be on the same side of the rod as these two dowels. This means that, regardless of whether the forked rod is in either right or left bank, the two dowels will always be toward the outside of the engine.

The new type blade connecting rod has what is known as a "long toe" on one side. In engines where these rods are applied it is essential that the rods be placed in the engine so that the blade connecting rod will be in the ~~left~~ bank with the "long toe" pointed to the center of the engine. ~~left~~ **right**

When a new blade and new connecting rod bearing are applied, it is not necessary that the fork rod be changed, as the new fork rods will be the same as the old, and are still identified as number 8029127.

11. BENT CONNECTING ROD:

A bent connecting rod can be detected by measuring the angularity between the axis of the wrist pin end, and the axis of the crank-pin bearing surface. These two surfaces should be parallel within .002" from one side of the wrist pin eye to the other. Place the connecting rod horizontally on a clean, flat surface and measure first one end, and then the other with a dial indicator.

12. ROD AND CAP ASSEMBLIES:

The fork connecting rod cap is serrated and machined to mate but one connecting rod, the one with which it was first assembled. Do not separate a cap from its rod. In the event either the rod or cap is damaged the complete assembly should be replaced.

13. INSTALLING FLOATING BUSHINGS

To install these new bushings it is necessary to remove all of the present style of wrist pin bearing assembly, which includes the needle bearings, spacers, retainers and outer race. The eye of the connecting rod should be honed out smooth and any burrs or rough edges or corners should be removed so that the bushing can float freely in the eye of the rod, as outlined in paragraph 15. The clearance between the bushing and the rod should not exceed .012. The clearance with new rod and bushing is .0065 to .0075.

upon the under edge near the place where the peening is the shallowest. The center spacer is floating. If any are defective the assembly should be replaced with a floating bushing.

6. REPLACING PISTON IN LINER:

Use piston ring guide to depress rings. Oil all parts well. A piece of automobile inner tube or some other soft material can be wrapped around the lower end of the rod when it is lowered into a cylinder liner. This is to prevent the rod from scratching the liner.

7. REMOVING OR INSTALLING PISTON RINGS:

Rings can easily be removed or installed on the piston by using a ring removing tool. If a ring is stuck soak the piston in Terco-Penetrol.

8. INSPECTING RINGS:

Air box inspection should include the three following important checks:

1. Inspect rings for blow-by. This can be done visually. Do not use a bar or piece of wood to see if the rings are free. There is too much danger of damaging the ring face or even breaking a ring, should someone start baring the engine over. Also, every time anything is placed through the ports a certain amount of dirt and grit is shoved in against the piston. A stuck ring will show blow-by and is easily observed. A ring in good condition (not sticking or broken) will be bright and free from vertical brown streaks.
2. With the piston at bottom dead-center, inspect the top of the piston for evidence of loose pieces of piston rings, ring groove lands, etc., which may happen to have broken off the back side of the piston and not observed under under above inspection.
3. Inspect air box for foreign materials.

9. CLEANING PISTON RING GROOVES:

Do not use a broken ring as a ring groove tool. A ring is not the same shape or size as a ring groove and will not clean the carbon but may even damage the groove. Details of cleaning procedure can be found in Bulletin 1706.

10. CONNECTING ROD AND BEARING INSTALLATION:

The connecting rod bearing is clamped in the forked rod by a hinged lower portion which is attached to the rod by serrated joints. The blade rod is held in the forked rod by a flanged portion which allows for relative movement between the two rods. The upper half of the bearing shell is located in the forked rod by two dowels, the

SECTION 3

E.M.CORP.
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lower half by one dowel. The oil holes must be on the same side as the blade rod. Definite alignment of the hinged cap is also obtained by a dowel. No adjustment of the connecting rod bearings is provided. When the bearings wear, replace with new bearings. Connecting rods are stamped FRONT. Bearing shells and straps are stamped "F". The following identification will eliminate any possibility of improperly installing rods.

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When a new blade and new connecting rod bearing are applied, it is not necessary that the fork rod be changed, as the new fork rods will be the same as the old, and are still identified as number 8029127.

11. BENT CONNECTING ROD:

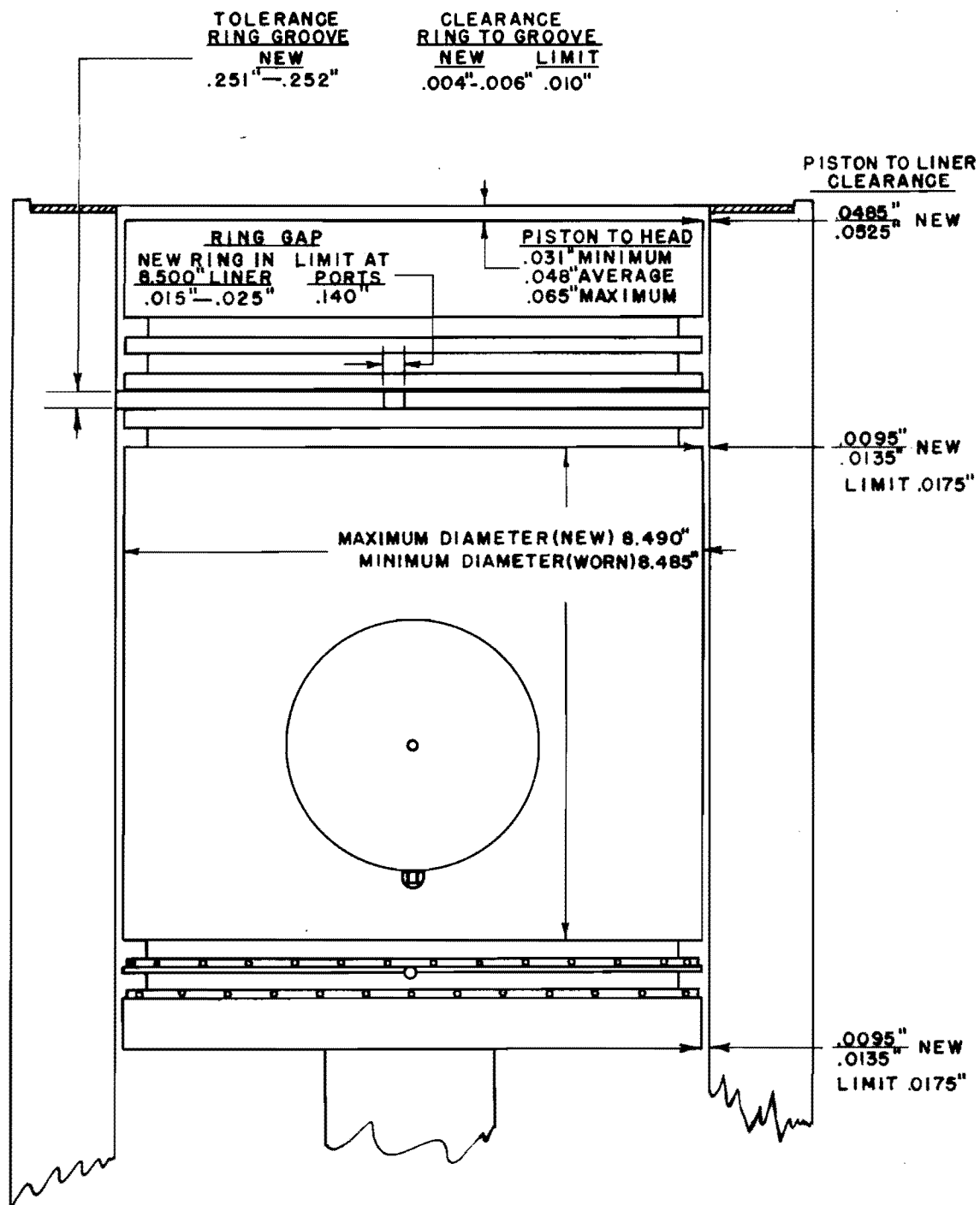
A bent connecting rod can be detected by measuring the angularity between the axis of the wrist pin end, and the axis of the crank-pin bearing surface. These two surfaces should be parallel within .002" from one side of the wrist pin eye to the other. Place the connecting rod horizontally on a clean, flat surface and measure first one end, and then the other with a dial indicator.

12. ROD AND CAP ASSEMBLIES:

The fork connecting rod cap is serrated and machined to mate but one connecting rod, the one with which it was first assembled. Do not separate a cap from its rod. In the event either the rod or cap is damaged the complete assembly should be replaced.

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To install these new bushings it is necessary to remove all of the present style of wrist pin bearing assembly, which includes the needle bearings, spacers, retainers and outer race. The eye of the connecting rod should be honed out smooth and any burrs or rough edges or corners should be removed so that the bushing can float freely in the eye of the rod, as outlined in paragraph 15. The clearance between the bushing and the rod should not exceed .012. The clearance with new rod and bushing is .0065 to .0075.



PISTON AND PISTON RING WEAR LIMITS

MODEL 567 ENGINE

PLATE 3-6

REV.D.

14. HONING CONNECTING ROD EYE

If installing a wrist pin bushing in place of needle bearings, the "I" of the rod should be honed when necessary. If the hole is not out of round more than .0005" and the finish is smooth and does not have scratches running with the length of the hole, it will not be necessary to use a hone. If honing should be necessary to remove small scratches or other irregularities, the maximum which should be honed would be .0005" over the average diameter of the bore. Smoothing up scratches lengthwise of the bore is more important than those extending around the circumference. In any event the hone would only be used to smooth up the bore and not used to entirely remove scratches and eroded spots.

In all cases new wrist pins should be used.

When honing the rod eye, proceed as follows:

1. Clamp the rod horizontally to a bench or table so there will be at least 3" clearance below the eye.
2. Using the finishing stones, adjust the hone so the stones are pressed firmly against the sides of the bore, but not so tight as to bind.
3. Apply kerosene to the bore and to the felt guides on the hone.
4. Using the special shank in either a drill press or 1/2" electric drill running at from 300 to 500 RPM, run the hone with finishing stones through the rod eye, raising and lowering it so that the lower part of the hone passes 1" out from the lower surface, at the bottom of the stroke and the top of the hone is lifted 1" above the upper surface of the rod at the top of the stroke. Run long enough to clean up all roughness, then remove hone and remove all surplus lubrication. Apply polishing stones 8051962 and run for about one minute in order to polish the bore, using very light tension on the stones.

15. PISTON AND RING INSPECTION

Due to the 2-cycle construction, rings and pistons can be periodically inspected visually through the intake ports without removing them from the engine. (See Paragraph 8). As long as the rings show no signs of blow-by and the ring gap is within limits, and the piston shows no excessive signs of scoring, pistons should not be removed for inspection except where needle bearing wrist pins are used and they are suspected of being in bad condition. By barring the engine back and forth a small distance each side of the 90-degree position past top dead center and feeling the connecting rod and piston at the same time, excessive wrist pin clearance can be felt.

SPECIFICATIONS

CONNECTING ROD

Shell inside diameter New 6.5075" - 6.5085"
Crankpin journal diameter New 6.4995" - 6.4985"
Crankpin bearing clearance New .008" - .010
Limit .015"
Clearance between rods on the same throw . New .008" - .015"

PISTON

No. of compression rings 4
No. of oil rings 2
Piston clearances and wear limits . . . See Plate 3-6
Press - bushing to piston004" - .007"

PISTON PIN

Diameter 3.4801" - 3.4796" (New)
Clearance - Pin to Bushing010" limit
Clearance - Rod to Bushing0065" - .0075 (New)
.012" limit
Clearance - Bushing to Sleeve on
Two-piece Bushing010" limit
(8055658 or 8059506)
Clearance - Pin to Piston003" - .0045"

NEEDLE BEARINGS (IF USED)

Overall clearance - Needle to outer
race and piston pin0011" - .00175" (New)
Scrap when pitted
Diameter - Needle Bearing Rollers2488" - .2490" (New)
Distance between connecting rod
and piston baffle (measured
along piston pin). 3/32" (Approx.)

FLOATING BUSHING

See Paragraph 13

S E C T I O N I V

CRANKSHAFT, HARMONIC BALANCER, FLYWHEEL FLEXIBLE COUPLINGS & MAIN BEARINGS

GENERAL DESCRIPTION

CRANKSHAFT

The carbon steel crankshaft is drop forged with good grain flow characteristics, with "electro-hardened" surfaces of the main and crankpin journals.

The crankshaft dimensions result in good strength factors, which, in conjunction with proper balance weights result in conservative bearing loads, torsional vibration stresses, and balance. Crankshaft is drilled to provide a continuous flow of oil to the connecting rod and main bearings (See Plate 1327, Fig. 5).

HARMONIC BALANCER (ON 12 & 16-567 ENGINES)

The harmonic balancer is located on the accessory drive end of the crankshaft. Consisting of a two-piece hub, laminated springs and a rim, it acts to dampen torsional vibrations inherent in crankshafts. There are approximately 84 leaves in each group of springs which are depressed $3/32$ " by the pivot pin (See Plate 4 - 3).

Model 6-567 engines are not equipped with a harmonic balancer. See Plate 4 - 4 (with straight stub shaft) and Plate 4 - 5 (with tapered stub shaft).

FLYWHEEL AND GENERATOR FLEXIBLE COUPLING (See Plate 18 - 2)

The term "flywheel" is applied to the thick front disc (Ref. 2) of the crankshaft to generator coupling and the rim (Ref. 1) which has the timing marks. The inertia necessary to keep the engine running smoothly is supplied by the combined weight of the flywheel, flexible coupling, and generator armature. The flexible coupling disc (Ref. 3) is bolted to the flywheel rim and to the generator armature shaft flange.

For information on aligning generator to engine See the Instruction Bulletin on the generator.

BEARINGS

The main bearings are steel shells in halves of ample thickness to prevent distortion, with well bonded lining. The bearings are precision made, eliminating hand scraping and are fitted without shims. Shells are provided with staggered tongs or projections used for locating the shells and preventing them from turning. The upper shell has only one projection, making it possible to rotate it out of position in case of replacement. (See Plate 1327.)

SERVICE INFORMATION

1. REMOVING AND REPLACING FLYWHEEL:

Due to an oversize hole in the flywheel, the flywheel rim can be installed in only one position. The flywheel disc and hub are stamped with an "O". These marks must be adjacent when assembling. (See Plate 1327, Fig.2).

2. REMOVING AND INSTALLING MAIN BEARINGS:

The main bearings are non-adjustable and no shims should ever be used. Whenever, therefore, the main bearing clearances become excessive, new bearing shells should be installed. When the crankshaft main bearing journals become worn to the point where the standard shells would provide excessive clearance the crankshaft must be replaced.

The main bearing shells can be removed by removing the bearing caps without removing the crankshaft (See Plate 1327, Fig. 1). Rotate the upper shell out of position. Main bearing and support is marked "front". This face must be installed toward the front of the engine. Main bearing caps are numbered on their right side, with serial number and location number. The "A" frame is also marked on the right side of the engine. Upper and lower shells of the same bearing are not interchangeable. When shells are removed, inspect for cracks or looseness of the shell in the bearing cap. If a bearing shell is loose, it should be replaced. Bearing caps are line bored and are not interchangeable.

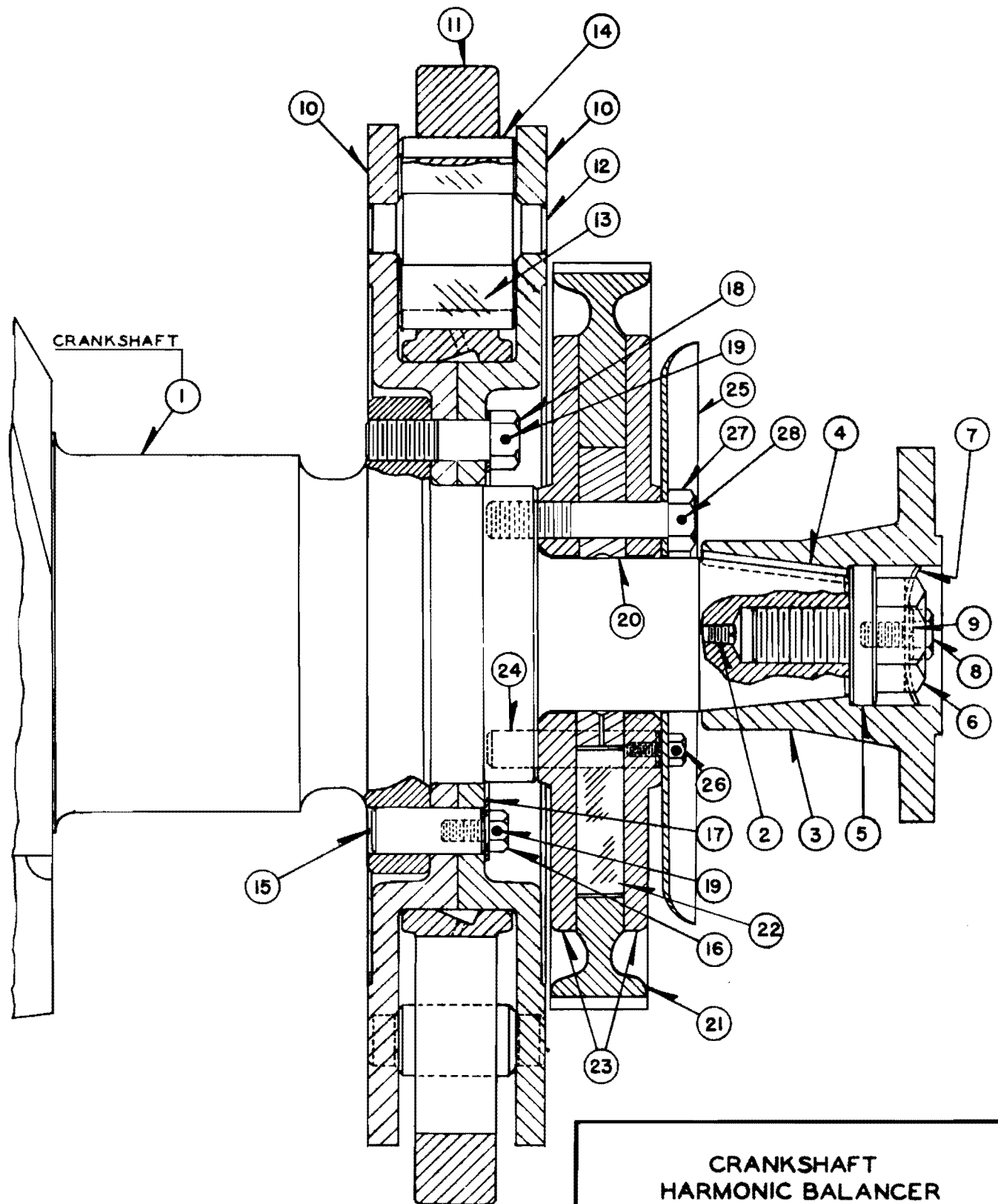
The upper shell has one tang and the lower one has two. All upper shells, except the center, are interchangeable. The center bearing assembly is shown on Plate 1327, Fig. 4. No shells can be put in backward because the tangs are offset. The center (thrust) and the rear lower shells (for rear bearing See Plate 1327, Fig. 3) are not like the other lower shells. The upper shells can be rotated out of position with the crankshaft in place.

3. INSPECTION

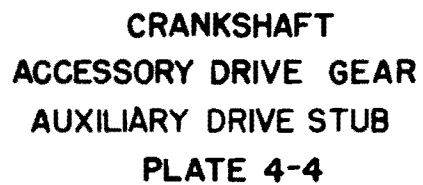
The main bearings should be removed for inspection annually on switching locomotives and every 100,000 miles on passenger locomotives. Measure all points of wear and look for looseness or cracks in the surface of the bearing. Examine the crankshaft at this time for scoring. If, at any time, bearing metal is found in the crankcase or filters, the bearings should be inspected.

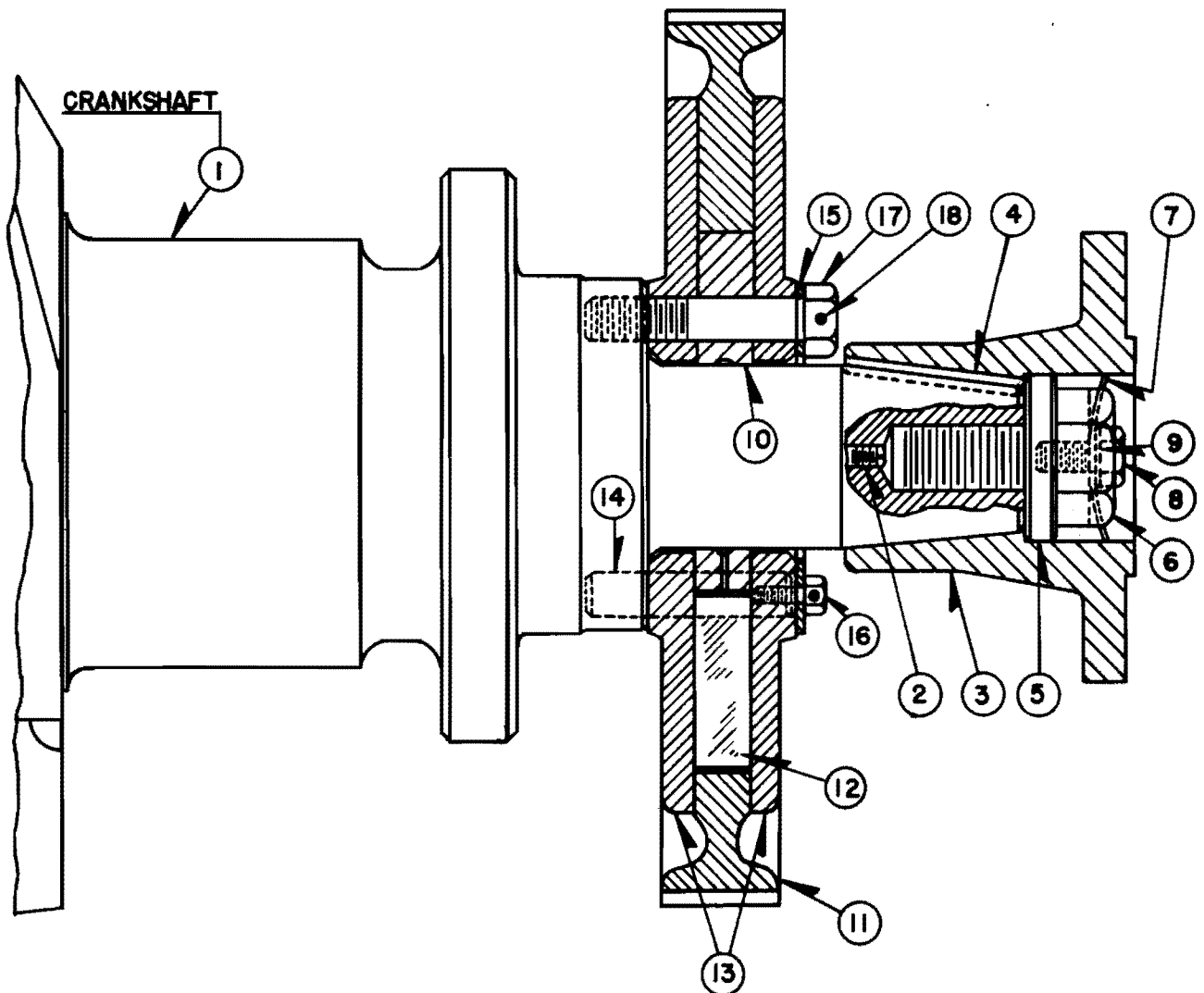
4. MOUNTING FLEXIBLE COUPLING:

The flexible coupling disc can be assembled in only one position on the flywheel rim due to an oversize bolt hole.



CRANKSHAFT
HARMONIC BALANCER
ACCESSORY GEAR
AUXILIARY DRIVE CONNECTION
PLATE 4-3
REV. A





CRANKSHAFT
ACCESSORY GEAR
AUXILIARY DRIVE CONNECTION
PLATE 4-5

5. HARMONIC BALANCER:

The rim of the harmonic balancer is marked "front". This side should be toward the front of the engine. The springs receive pressure lubrication from the engine through drilled passages in the balancer hub. These holes should be cleaned when the balancer is off the crankshaft. The main dowels between the groups of springs are press-fitted to the two flanges, thus in the event disassembly of the unit is necessary, a hydraulic press will be necessary to remove the dowels. The spring leaves are installed one at a time with the dowel in place, using a lead hammer.

6. SIX INCH MAIN BEARINGS

The 6" upper half bearing (8061232) includes a relief machined in the bearing to trap any foreign matter to prevent same from finding its way into the bearing.

In making replacements, the 6" upper half can be used with old style lower half No. 8042465. However, where it is necessary to apply new lower half No. 8061272, it is necessary that the upper half be changed to new style No. 8061232 at that time. The reason for this is to eliminate the possibility of oil spilling out of the bearing. If this precaution is not followed, it will result in bearing failure at that point.

SPECIFICATIONS

MAIN BEARING SHELLS

Diameter (Inside)	New 7.5065" - 7.5075"
Clearance - Shell to Crankshaft	New .007" - .009", Limit .015"
Total End Clearance (Thrust Brg.) . . .	New .010" - .015", Limit .030"
Number of Main Bearings	4(6-567) 5(8-567) 7(12-567) and 10(16-567)
Thrust Bearing Collar Thickness	New .369" - .370" (6, 8, & 16-567) .869" - .870"(12-567)

CRANKSHAFT

Diameter Main Bearings	New 7.4985" - 7.4995"
Crankpin Diameter	New 6.4985" - 6.4995"
Journals Out of Round Not Over . . . .	.006"

FLYWHEEL & FLEXIBLE COUPLING

Diameter	36"
Combined Weight of Flywheel, Rim, and Flexible Coupling	410#

FLYWHEEL TIMING MARKER

Number of Degrees to Left of Center Line of Crankshaft	51°
---	-----

INTERCHANGEABLE MAIN BEARING
SHELL CHART

3-1/16" LONG UPPER SHELLS - ALL INTERCHANGEABLE:

Nos. 5 & 6 (16-567)

3-1/16" LOWER SHELLS - ALL INTERCHANGEABLE:

Nos. 5 & 6 (16-567)

4-1/4" LONG UPPER SHELLS - ALL INTERCHANGEABLE:

Nos. 1-2-3 (6-567), 1-2-3-4 (8-567),
1-2-3-5-6 (12-567), 1-2-3-4-7-8-9 (16-567)

4-1/4" LONG LOWER SHELLS - ALL INTERCHANGEABLE:

Nos. 1-2-3 (6-567), 1-2-3-4 (8-567), 1-2-3-5-6
(12-567), 1-2-3-4-7-8-9 (16-567)

6" LONG UPPER SHELLS - ALL INTERCHANGEABLE:

Nos. 4 (6-567), 5 (8-567), 7 (12-567), 10 (16-567)

6" LONG LOWER SHELLS - ALL INTERCHANGEABLE:

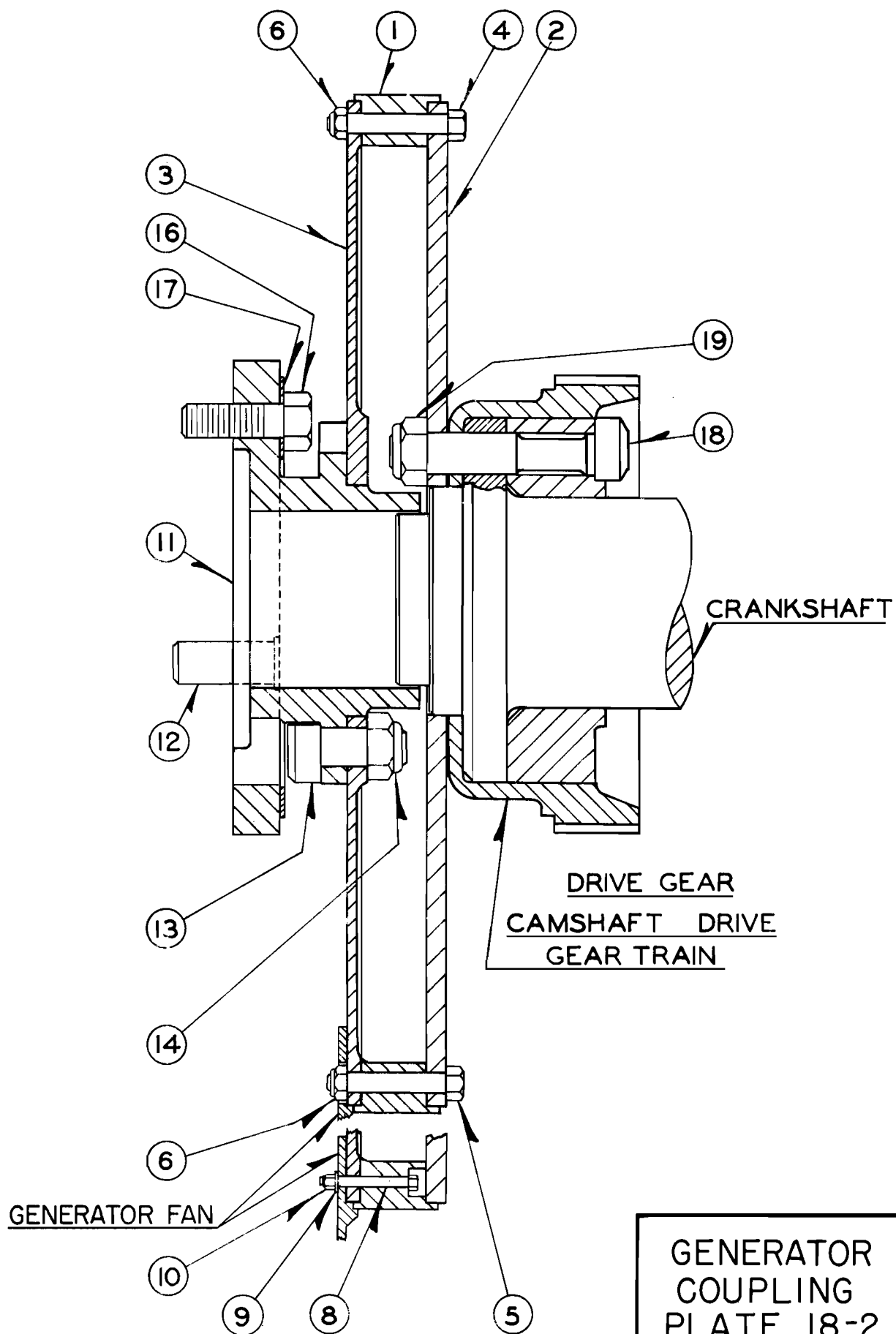
Nos. 4 (6-567), 5 (8-567), 7 (12-567), 10 (16-567)

5-1/4" LONG SHELLS:

No. 4 (12-567)

Upper and lower shells are not interchangeable.

Bearings numbered from front end of engine.



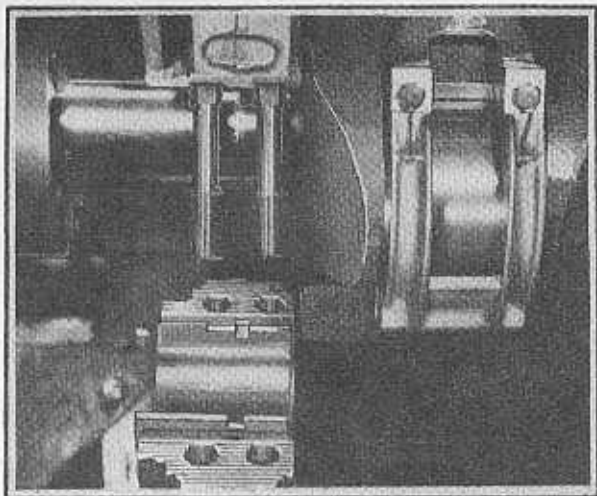


FIG. 1

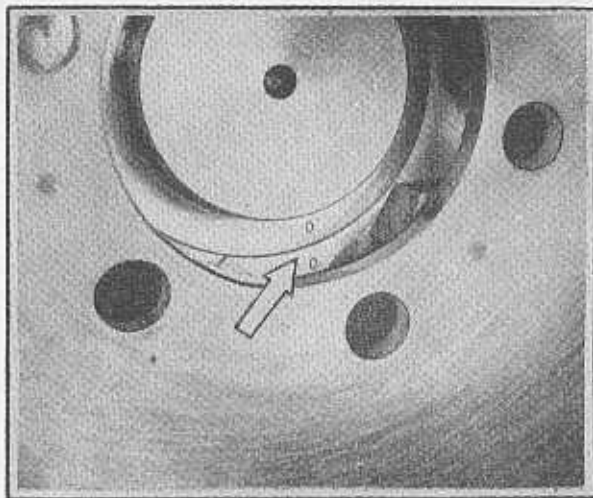


FIG. 2

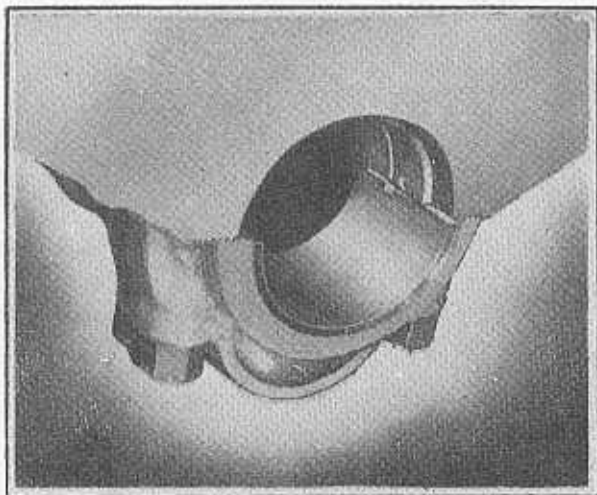


FIG. 3

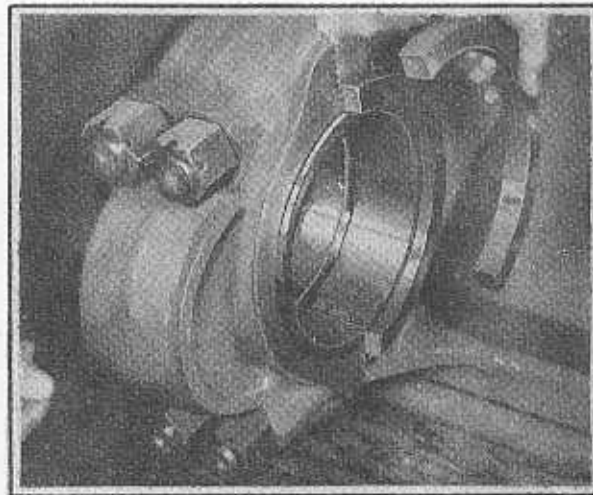


FIG. 4

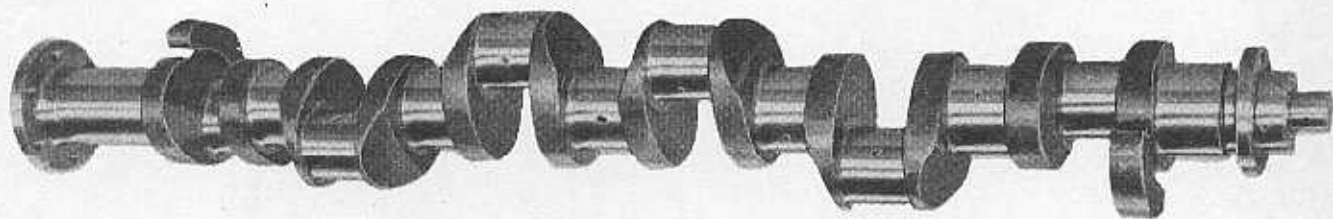


FIG. 5

S E C T I O N V

OIL PUMPS

GENERAL DESCRIPTION

The oil pumps are mounted on the front of the engine driven from the crankshaft through spur gears. The pump, located to the left of the crankshaft, is the scavenging oil pump, taking oil from the oil pan and sending it through an oil cooler, by-pass, and oil filter to the supply tank. (See Plates 1704, 1707, and 5 - 6).

The pump, located above the crankshaft, serves two purposes. One side supplies oil for cooling pistons; the other supplies oil for lubricating the entire engine. (See Plates 1708 and 5 - 6).

The rotors in each pump are a pair of steel gears fitted both laterally and radially to the housing. In the double purpose pumps the two sections are separated by a spacer. (See Plate 1708).

Plate 5 - shows typical pumps, there being several more sizes than are shown.

SERVICE INFORMATION

1. DISASSEMBLING OIL PUMPS:

Care should be taken not to damage the pump gears or to get any dirt on them.

2. MEASURING WEAR:

A lead ribbon can be used to measure pump clearances or thrusts.

3. REPLACING ROTOR GEARS:

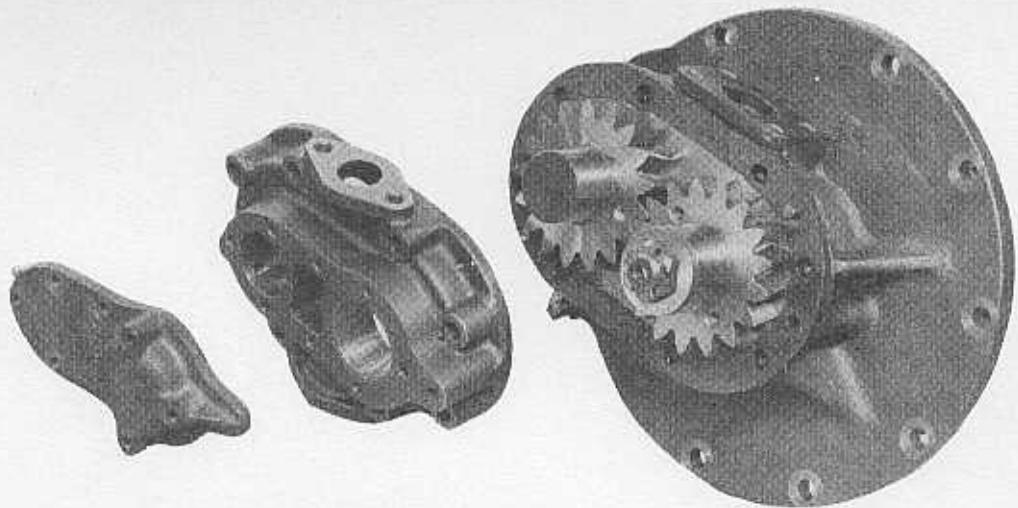
When replacing gears they are to be installed in matched pairs.

4. REPLACING OIL PUMPS:

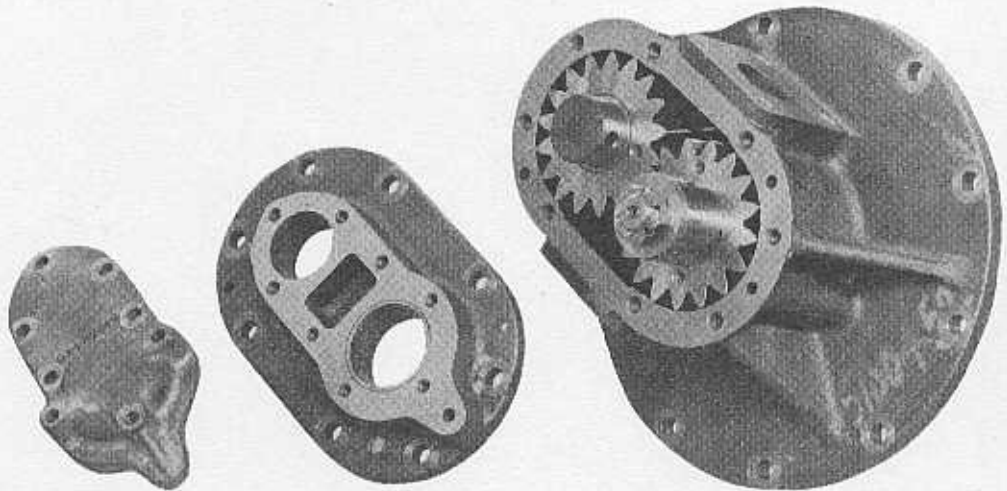
Before replacing an oil pump be sure it is filled with lubricating oil. This acts as a primer so that pressure will build up as soon as the engine starts.

5. CHECKING DRIVE DOWELS:

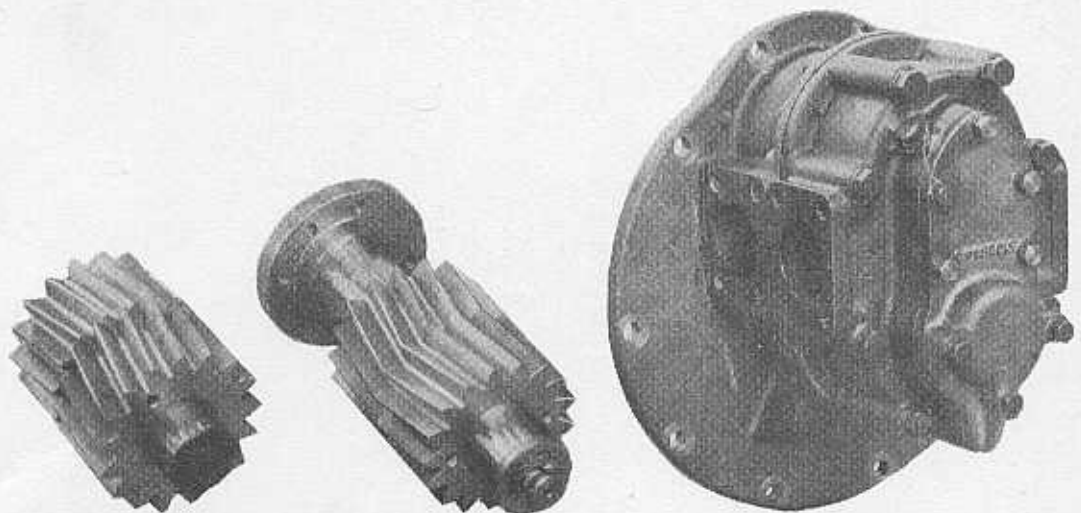
When servicing oil pumps the driving dowels between drive gear and drive shaft should be checked to make sure they are tight.



6, 8, 12, & 16-567 LUBRICATING &
PISTON COOLING PUMP



6 & 8-567 SCAVENGING PUMP



12 & 16-567 SCAVENGING PUMP

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In the event that they are loose they must be replaced by .015" oversize dowel (Part #8040414). The gear and shaft must be reamed together .5135" - .5140" using Reamer #8044484. It is desirable to have a tight fit of approximately .001".

6. OIL PUMP INSPECTION

Due to the construction of the oil pumps, very little wear occurs and as long as they maintain proper pressures, inspection for wear would be of little value. If the normal pressure drops the viscosity of the oil should be checked first, then check for leaks or broken oil lines, or stuck relief valves. If none of the above causes are found, remove pump and install a new pump, or if time permits, inspect and test old pump.

SPECIFICATIONS

LUBRICATING AND PISTON COOLING PUMP

Speed at 800 R.P.M. of engine	1130 R.P.M.
Displacement Gallons per Minute (full speed)	
Lubricating Pump	53(6-567) 53(8-567) 80(12-567) 107(16-567)
Piston Cooling Pump	27(6-567) 27(8-567) 37(12-567) 53(16-567)

NEW	COND. LIMIT
-----	----------------

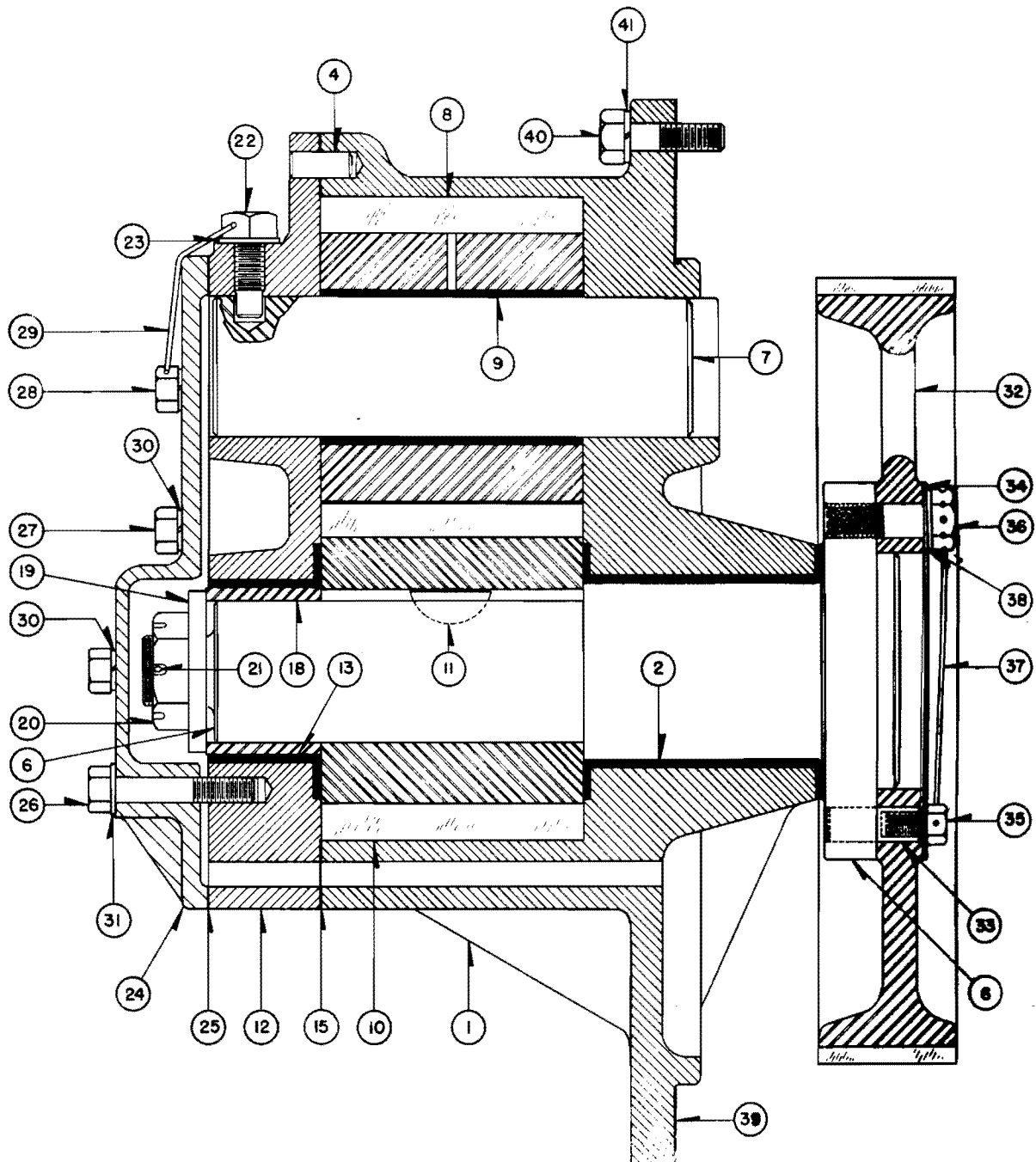
Clearance - Bushing to Drive Shaft . . . . .	.0015 - .0035	.007
Clearance - Idler Gear Bushing to Shaft . . . . .	.0015 - .0035	.007
Backlash of Gears . . . . .	.012 - .016	.030
Clearance - Gear to Pump Separator . . . . .	.009 - .010	.020
Clearance - Gear to Housing - Endwise . . . . .	.007 - .010	.020
Thrust Clearance Gear to Thrust Washer . . . . .	.001 - .006	.012
Backlash of Drive Gear . . . . .	.010 - .014	.030

SCAVENGING PUMP

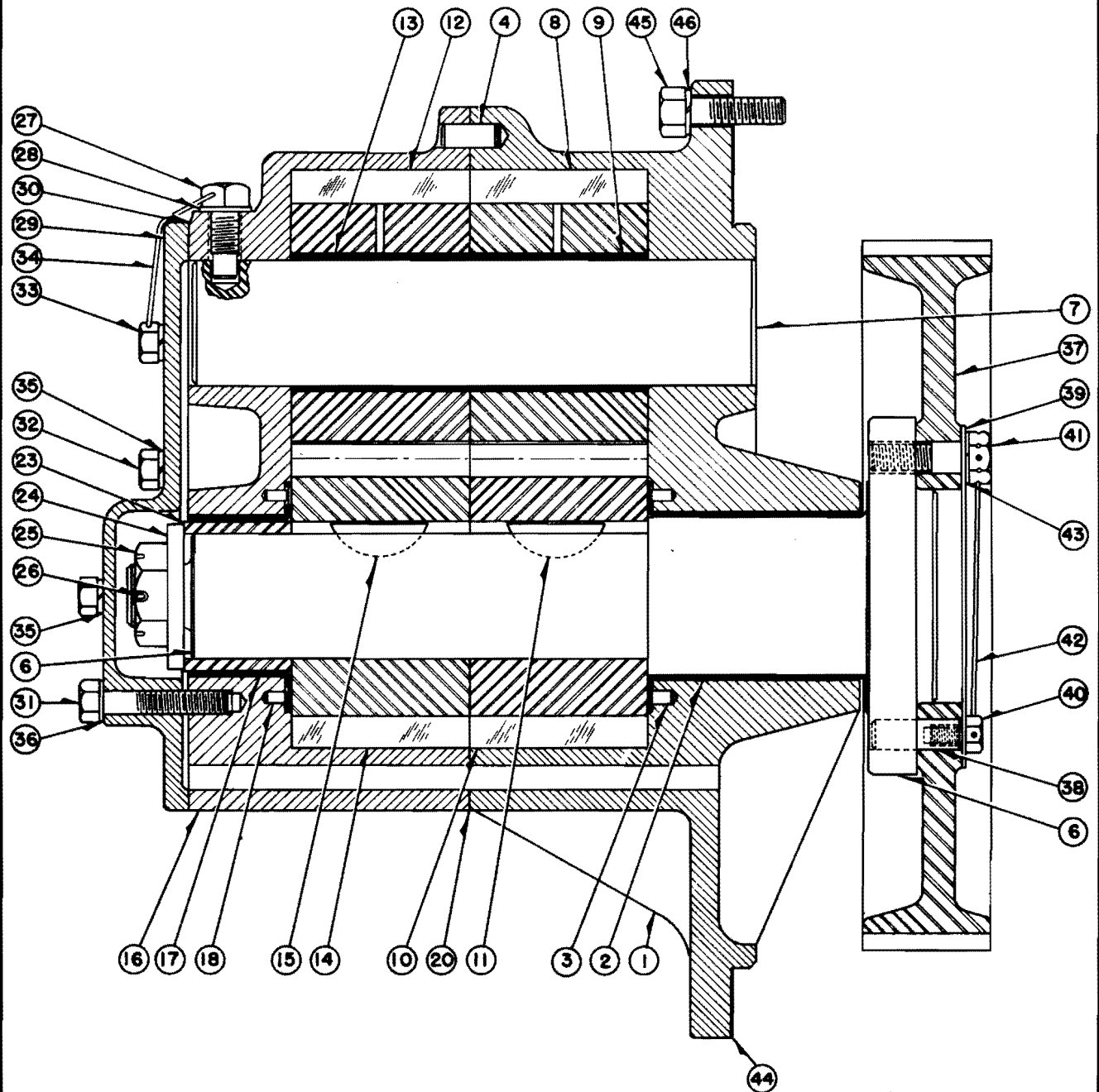
Speed at 800 R.P.M. of engine	1130 R.P.M.
Displacement Gallons per Minute	107(6-567) 107(8-567) 160(12-567) 210(16-567)

NEW	COND. LIMIT
-----	----------------

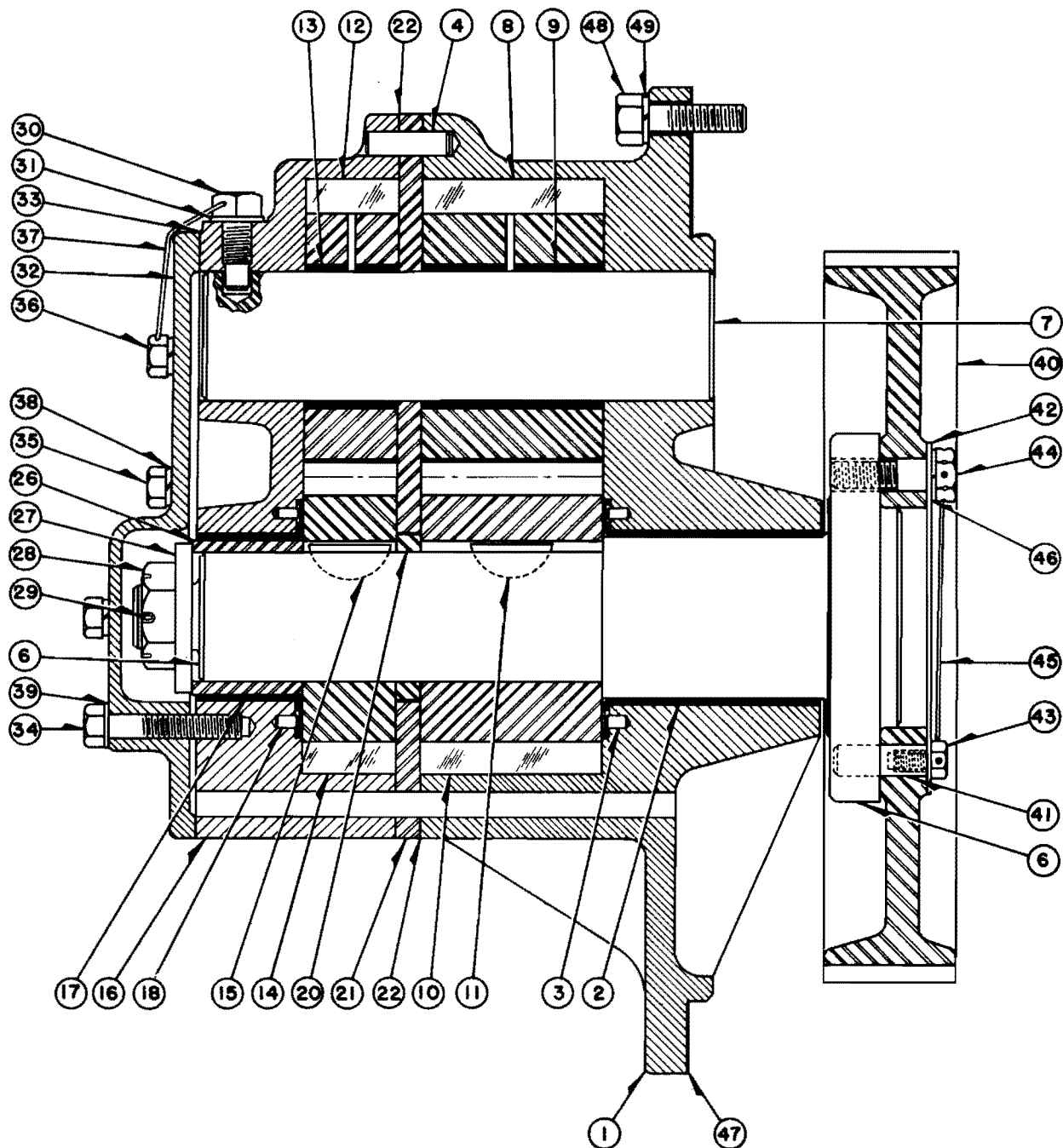
Clearance - Bushing to Drive Shaft . . . . .	.0015 - .0035	.007
Clearance - Idler Gear Bushing to Shaft . . . . .	.0015 - .0035	.007
Backlash of Gears . . . . .	.012 - .016	.030
Clearance - Gear to Housing - Endwise . . . . .	.007 - .010	.020
Thrust Clearance - Gear to Thrust Washer . . . . .	.001 - .005	.012
Backlash of Drive Gear . . . . .	.010 - .014	.030



SCAVENGING OIL PUMP
SINGLE SECTION
PLATE 1704



SCAVENGING OIL PUMP
DOUBLE SECTION
PLATE 1707



LUBRICATING AND PISTON COOLING
OIL PUMP
PLATE 1708

S E C T I O N VI

LUBRICATING OIL SYSTEM

GENERAL DESCRIPTION

ENGINE OIL SYSTEM (See Plate 1335)

The engine oil system consists of three parts: 1, the lubricating oil pump, oil switch, and relief valve; 2, the piston cooling oil pump, "P" pipes and oil switch; and 3, the scavenger oil pump and oil separator.

For details of the locomotive lubricating oil equipment (such as the cooler, filters, etc.) see the locomotive instructive bulletin.

No relief valve is used in the piston cooling oil system. The pressure here varies according to the temperature and viscosity of the oil, and the speed of the engine.

The oil separator is a twin unit mounted over the main generator. Air is drawn through this from the crankcase to the blower intake. The metal screen condenses any oil from vapor which is taken from the crankcase.

The low oil switches open at 100 to 125 R.P.M. (hot oil) and much lower than this when starting a cold engine. This is the equivalent to 2 - 3 lbs. For wiring diagram see Locomotive Instruction Bulletin.

SERVICE INFORMATION

1. SETTING RELIEF VALVE:

The lubricating oil relief valve can be adjusted while the engine is running by removing the cover from the valve and using a wrench on the flat portion of the exposed stud (R.H. thread). (See Plate 1343, Fig. 1).

2. LIMITS IN LUBRICATING OIL PRESSURE:

If oil pressure drops below 20# (at 800 R.P.M. - hot oil), stop the engine and investigate possible causes. Look for a stuck relief valve, leaks, or broken oil lines, low oil viscosity, or worn oil pump.

3. LIMITS IN PISTON COOLING OIL PRESSURE:

If pressure drops below 15# (at 800 R.P.M. - hot oil), stop the engine and investigate possible causes.

4. LOW OIL SHUTDOWN SWITCH:

These switches consist of a spring loaded piston actuating a pair of electrical contacts (See Plate 1343, Fig. 2). By artificially opening or closing this circuit, as the case may be, one can test the operation of the switch when the engine is out of service for inspection. The 16-567 switch is not shown, but is similar to Fig. 2 except for a spacer between the two housings. Test these switches every month.

5. LUBRICATING NEW ASSEMBLIES:

When any new assemblies are installed in the engine they should be oiled well so that before lubricating oil reaches them they will not be running dry.

6. ENGINE STORAGE:

If the engine has been shut down for two weeks or more, about a table-spoonful of lube oil should be sprayed through the cylinder ports so the cylinders will be lubricated during the first revolution of the engine, which should be made with the test valves open using the engine turning bar.

7. OIL SEPARATOR (See Plate 1343, Fig. 3):

This should be cleaned twice annually, or as inspection indicates, by washing the screen element in a petroleum solvent and blowing it dry with compressed air.

8. CHANGING THE OIL:

The oil should be changed every 25,000 miles on passenger locomotives and every three months on switching locomotives. For the proper procedure to drain the lubricating oil system, see the locomotive instruction bulletin.

9.. PISTON COOLING "P" PIPES:

This nozzle assembly directs the piston cooling oil into the funnel on the piston. Because the "P" pipe cools the piston and lubricates the wrist pin it is imperative that the pipe be adjusted so that the oil stream will enter the piston funnel. To check this, connect an oil pump to the piston cooling oil manifold and place a hose in the oil pan as a supply. Due to the volume of oil required to operate all the "P" pipes it may be necessary to place blind copper gaskets over the flanges to all "P" pipes except the one being tested. By holding a mirror under the lines to be examined one can observe through the hand hole whether or not the oil stream is properly directed. If it is not, tap the upper end of the pipe gently, until the stream hits the center of the piston funnel. Due to the

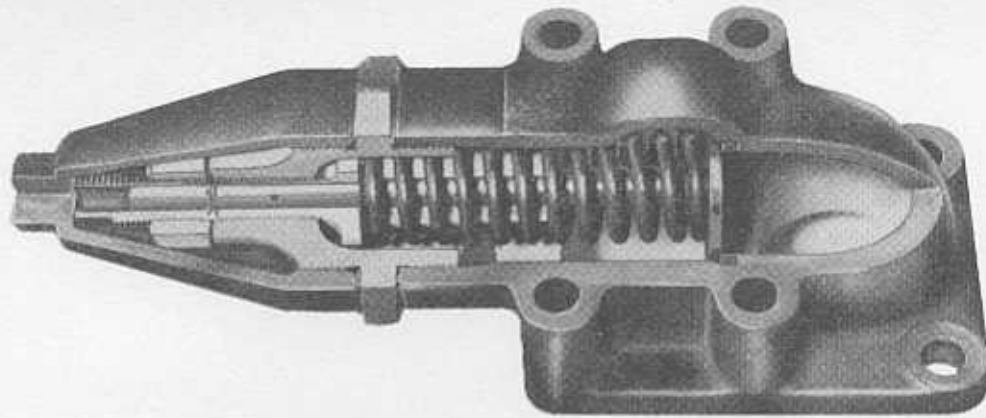


FIG. 1

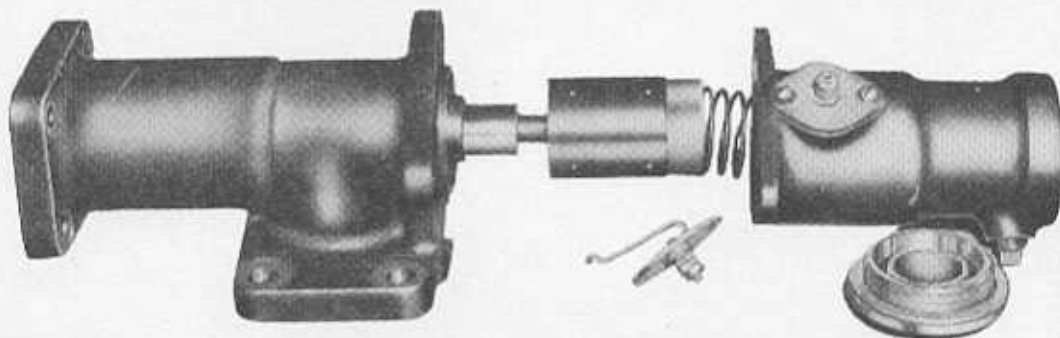


FIG. 2

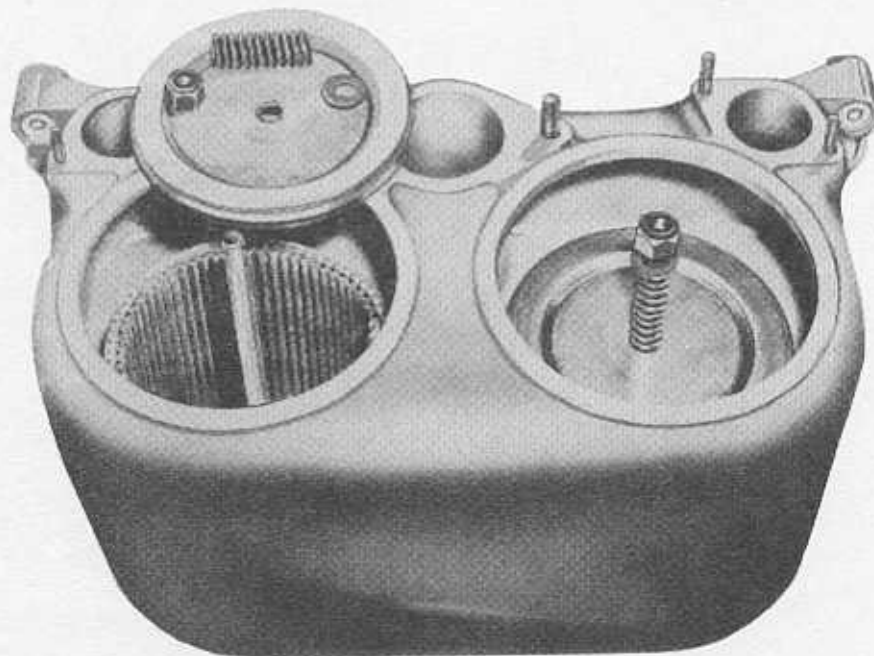
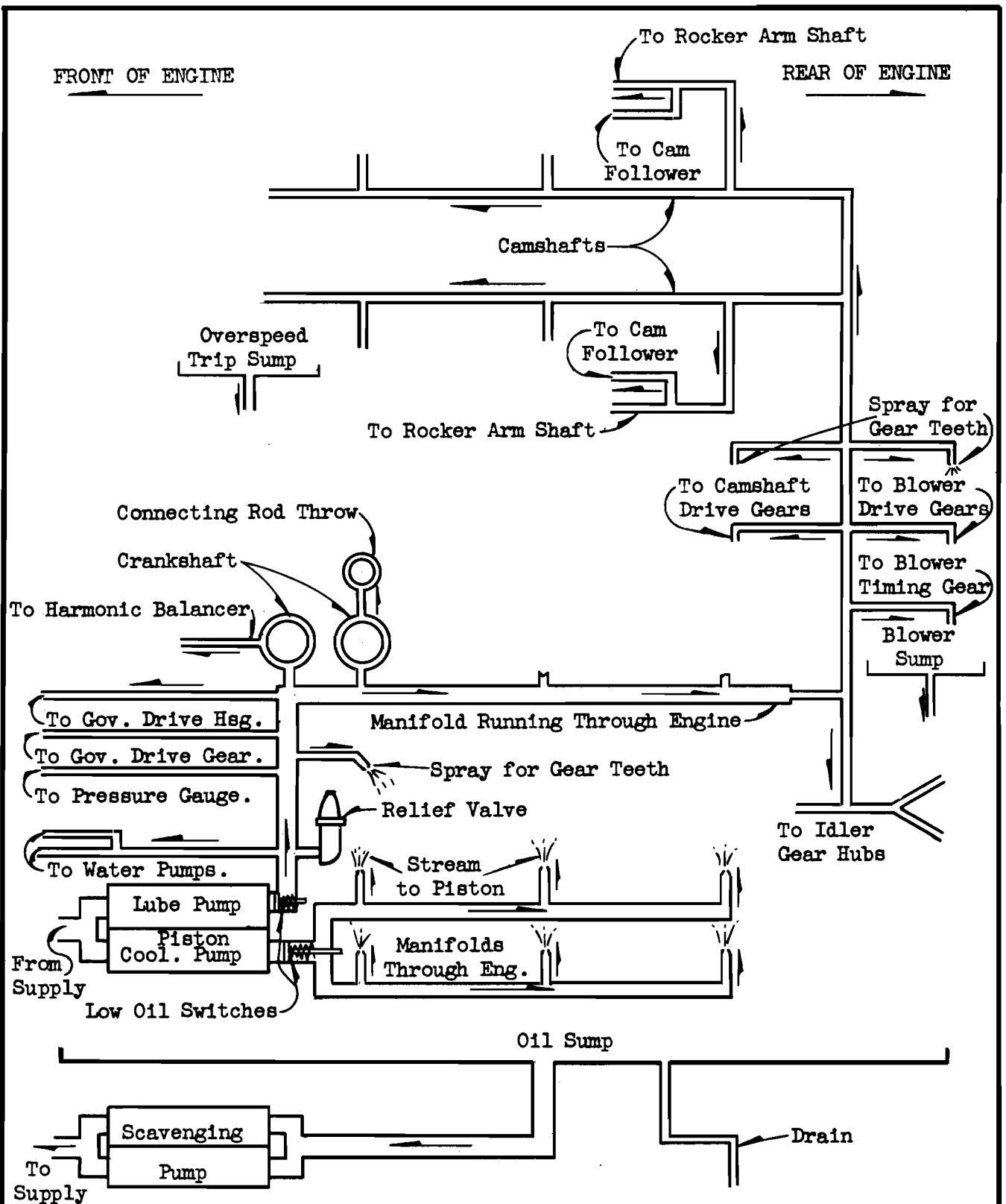


FIG. 3



LUBRICATING OIL DIAGRAM
MODEL 567 ENGINE
PLATE 1335 REV. A

E.M.CORP.
APR. 18, 1941

SECTION 6

rigidity of these "P" pipes it should not be necessary to adjust them unless they have been bent. Therefore, care should be exercised when removing the pipes or liners not to bend them.

Maintenance forces should be cautioned about the necessity of careful handling of the piston cooling jets when they are out of the engine, for a slight burr or nick on the orifice will cause the oil to spray on the bottom of the piston rather than enter the piston in a solid stream.

The above method of checking the jets by use of the auxiliary pump will definitely show any defects on the orifice of the jets. Use this check if piston scores or cracks occur.

11. CLEANING LUBRICATING OIL SYSTEM ON 567 ENGINES:

In order to prevent a progressive accumulation of sludge and abrasive material from collecting in the lubricating system and eventually getting into the bearings and other parts it is recommended that the system be cleaned out when necessary. If oil filters and air filters are changed and cleaned at proper intervals, the above will not be necessary very often..

The procedure in cleaning the lubricating system is as follows:

- a. Remove the 3/8" plug at the bottom of the blower and connect flushing line to this point. On blowers recently manufactured, the bottom plug has been discontinued. In this case, the top plug is removed for the application of flushing. See Plate 2340. On twelve and sixteen cylinder engines, connect flushing lines to both blowers at the same time, or to each blower alternately.
- b. Remove both of the 1-1/2" pipe plugs at the sides of the accessory drive housing at the front of the engine and attach pipe for drain. On engines manufactured more recently, a flange has been substituted for the 1-1/2" pipe plug. In this case, remove the flange and use drain pipe.
- c. Force either SAE-10 or flushing oil through the engine oil lines until clean oil appears. Do this operation with a separately driven oil pump.
- d. Replace the pipe plugs or flanges.

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SPECIFICATIONS

Lubricating Oil Specifications

LUBRICATING OIL SHOULD BE OBTAINED FROM REPUTABLE OIL COMPANIES TO MEET THE FOLLOWING SPECIFICATIONS FOR DIESEL ENGINE LUBRICATION:

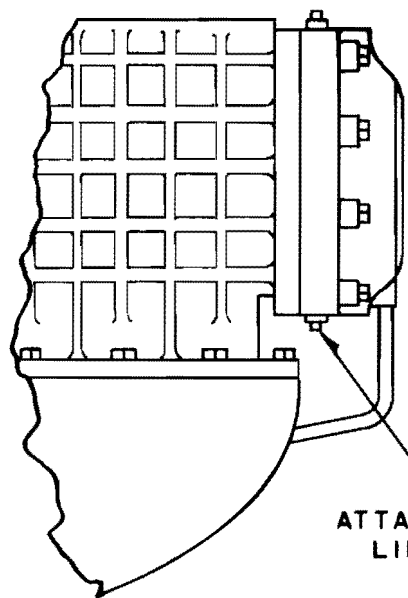
Saybolt Viscosity at 100° F.	1000 sec. Maximum* (See Note)
Saybolt Viscosity at 210° F.	65 sec. Minimum to 90 sec. Max.
Flash	420° F. Minimum
Fire	475° F. Minimum
Pour	40° F. Maximum
Carbon Residue	1.1% Maximum

It will be noted that the above specification covers a wide range of oil viscosity and it may be necessary to use an oil having a body toward the upper limit of this specification in heavy duty road work where the load of the main and connecting rod bearings is a limiting factor, and an oil of light body toward the lower end of the specification in switching service.

* NOTE: The requirement of 1000 seconds maximum at 100° F. is included in this specification to insure that the oil will not be too thick at low temperatures. In services where low temperatures are not encountered this requirement is not essential. However, the viscosity of the oil at starting temperature should never exceed 30,000 seconds Saybolt.

OIL PRESSURES:

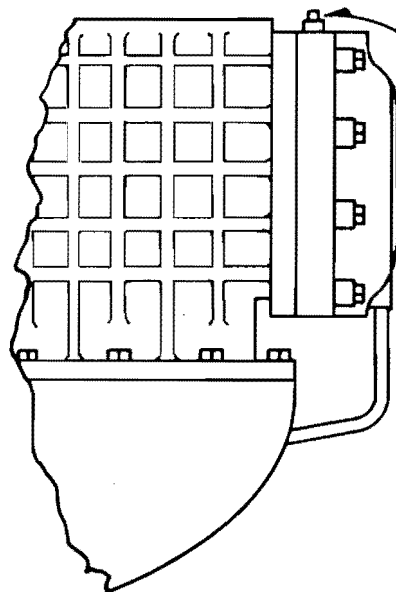
Tube Oil pressure at 800 R.P.M. (hot oil)	35 - 45#
Piston cooling pressure at 800 R.P.M. (hot oil) .	25# (approx.) low 15#
Piston cooling pressure at idling (hot oil) . . .	3 lbs. Minimum
Capacity of Lube Oil System:	See Locomotive Instruction Bulletin



ATTACH FLUSHING
LINES HERE

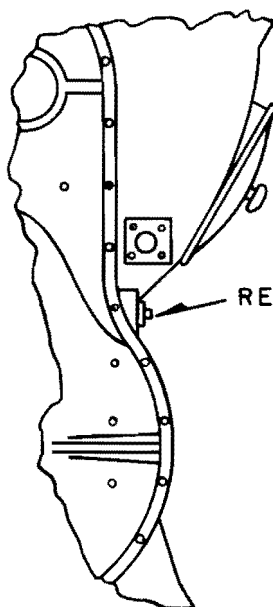
SEE DRAWING
#49658

OLD STYLE BLOWER



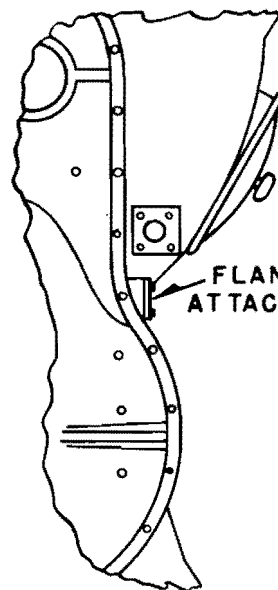
ATTACH
FLUSHING
LINES
HERE

NEW STYLE BLOWER



REMOVE PLUG AND
ATTACH DRAIN PIPE

ACCESSORY DRIVE HOUSING
WITH 1 1/2" PIPE PLUG



REMOVE
FLANGE AND
ATTACH DRAIN PIPE

ACCESSORY DRIVE HOUSING
WITH FLANGE

S E C T I O N VII

WATER PUMP

GENERAL DESCRIPTION

The water pumps are mounted on the front of the engine. They rotate in the same direction, counter-clockwise when facing them, at approximately three times crankshaft speed. (The 6-567 Engine has but one water pump).

SERVICE INFORMATION

1. REMOVAL OF PUMP:

Drain cooling system and remove piping to pump. Be sure hoses are perfectly solid before using them over. If in doubt replace them with new hose.

2. PUMP PRESSURES:

The pressure gauge on the outlet side of the water pump indicates whether or not the pump is running satisfactorily. By marking on the glass or face of the gauge the position of the hand at maximum R.P.M. when the equipment is new one can determine whether or not the engine cooling system is filling with scale, lime, rust, or sludge. An increase in pressure of five pounds would warrant flushing the cooling system. The actual pressure at the outlet of the pump will vary with the equipment.

3. LUBRICATION

The water pump should be lubricated every month on switching locomotives and every 10,000 miles on passenger locomotives by filling the oil cup with S.A.E. 30 oil.

4. INSPECTION

The water pumps should be inspected every year and any worn parts renewed.

5. INTERCHANGING WATER PUMPS

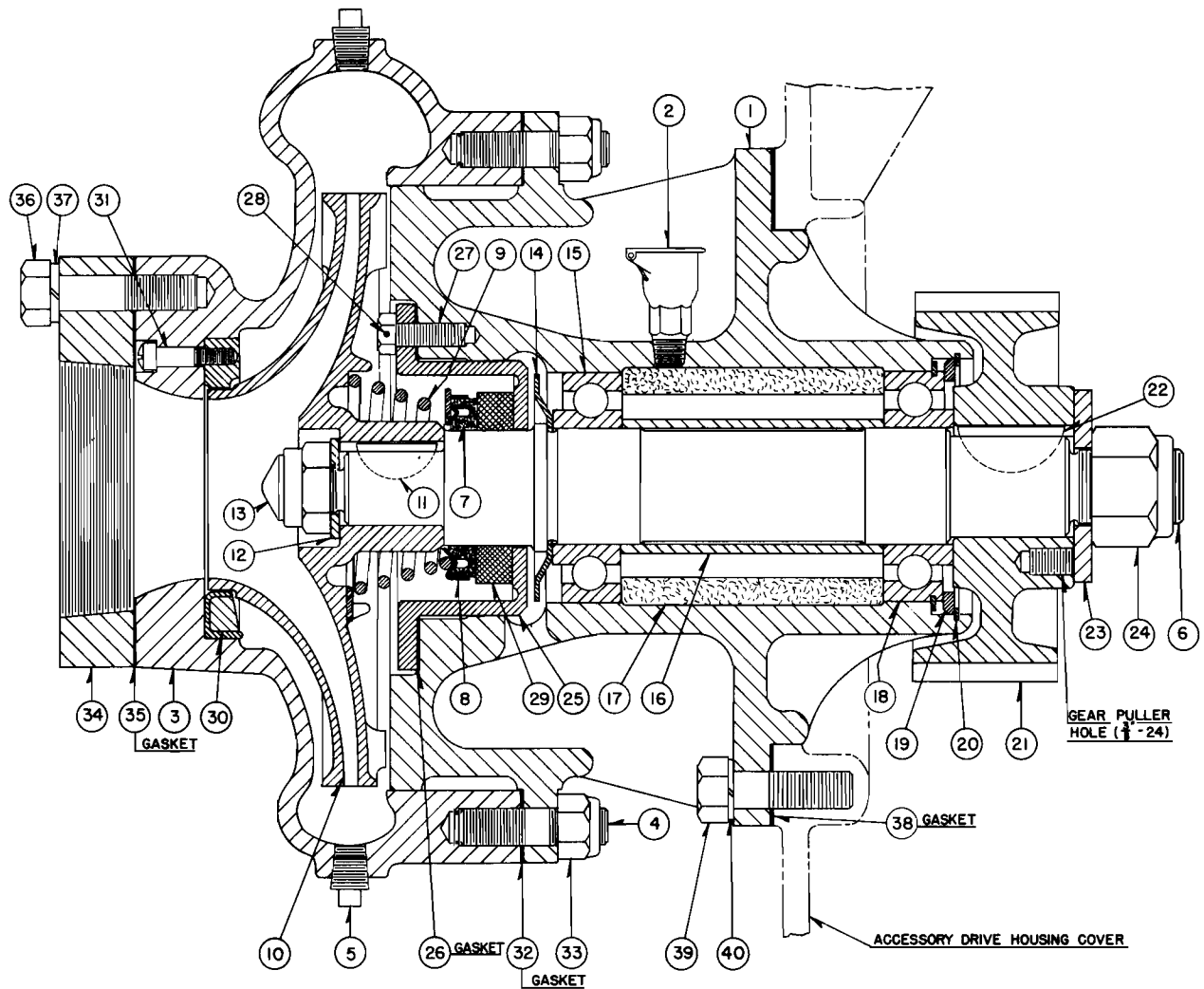
The only difference between a right hand and a left hand pump is the position of the impeller housing in relation to the rest of the pump. Therefore, if it is necessary to use one pump in place of another, simply rotate the impeller housing to bring the water outlets to match the water piping on the engine. As a guide to installing the pump on the engine, the oil cup on both pumps is located approximately 40° to the right of the vertical center line of the pump.

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SPECIFICATIONS

WATER PUMP

Speed at 800 R.P.M. of engine	2440 R.P.M.
Capacity at 800 R.P.M. of engine	225 Gal. per Min.
Backlash of Drive Gear	New .010 - .014, limit .030



S E C T I O N VIII

COOLING SYSTEM

GENERAL DESCRIPTION

The water pump draws the water from the tank and discharges it into the lower part of the cylinder liner. It passes up to the cylinder head through the outlet manifold to the radiator and then through the oil cooler back to the tank. The engine cooling system includes only the water pump and engine water passages.

NOTE: For service information on the locomotive cooling system see the Locomotive Instruction Bulletin.

SERVICE INFORMATION

1. FLUSHING ENGINE COOLING SYSTEM:

The engine cooling system is best cleaned by flushing the entire locomotive cooling system. Complete details of this can be found in either the Locomotive Instruction Bulletin or Bulletin 1706.

2. COOLING MEDIUM:

Distilled water is recommended but filtered rain water may be used. Do not use hard water or a water softener.

3. DRAINING THE COOLING SYSTEM:

See the Locomotive Instruction Bulletin for details.

SPECIFICATIONS

APPROX. WATER CAPACITY (Engine Only)	38 gals. (6-567)
	45 gals. (8-567)
	58 gals. (12-567)
	78 gals. (16-567)

(For water capacity of complete cooling system

see

Locomotive Instruction Bulletin)

OPERATING TEMPERATURES 165° F. ± 15°

S E C T I O N I X

BLOWER DRIVE, CAMSHAFT DRIVE & CAMSHAFT TIMING

GENERAL DESCRIPTION

The blowers and camshafts are driven through a helical gear train located at the rear end of the engine (See Plate 1705). The camshaft gears are counterweighted and slotted for adjusting the timing. Balance weights at each end of the camshafts, supplementing the crankshaft balance weights, insure smooth operation.

The camshaft is made from carbon steel with "electric-hardened" cam profiles and journals. The shaft is made in unit sections (there being one per cylinder) bolted together.

SERVICE INFORMATION

1. REPLACING BEARINGS:

All of the camshaft intermediate bushings are interchangeable. Thrust is taken on the rear stub shaft bearings. The stub shaft bushings are not interchangeable with the intermediate bushings. Lubricate all parts when replacing. Aluminum caps are used for the top bushings on earlier engines. Later engines have cast-iron caps.

2. ASSEMBLING CAMSHAFT:

In the event a camshaft section is damaged it is not necessary to replace the entire camshaft, but the damaged section can be replaced. Extreme care should be taken to line up the camshaft sections when assembling them so that no binding will occur between the camshaft and its bearings. After assembly, check the alignment of the camshaft sections with an indicator.

3. CAMSHAFT COUNTERWEIGHT TIMING: (See Plate 1344).

4. CHANGING 6-567 CAMSHAFT BALANCING WEIGHTS

It is recommended that the heavy counterweights be replaced with the light weight type whenever an engine is dismantled for repairs. The balancing weights at both ends (timing gear end and overspeed trip end) MUST BE changed out as a COMPLETE SET.

5. CAMSHAFT TIMING:

See Plate 9-4 for camshafts other than "4-4".

See Plate 2353 for "4-4" camshafts. (The "4-4" camshaft is a later design; it opens the exhaust valves four degrees earlier and closes them four degrees later than the former camshaft). Each camshaft section is marked with the part number and "4-4" on the bolting flange.

Individual copies of pages 901 or 902 with the associated plates can be had upon request. 900

LOCATING TOP DEAD CENTER

In the event it becomes necessary to check the flywheel marks to see that they correspond to cylinder #1, place a plunger and bushing, E.M #8039139, in the injector hole of cylinder #1 with the dial indicator resting on the plunger. When the dial indicator is approximately .060" to .090" before top dead center, set the dial indicator to zero and mark the flywheel. Turn past top dead center and back up the flywheel until zero again appears on the dial indicator and mark the flywheel again. Divide the distance between these two marks in half. This point will be top dead center for #1 cylinder and should coincide with zero, or 360° mark on the flywheel rim.

TO CHECK TIMING OF THE EXHAUST VALVES

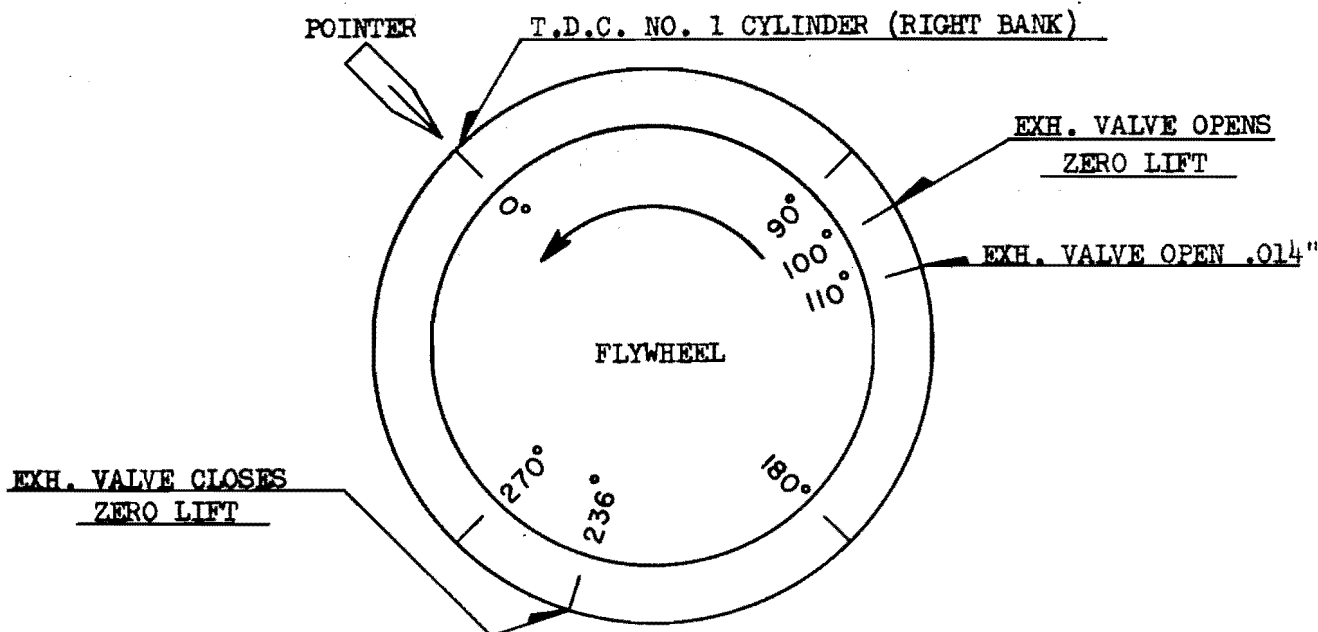
1. During the timing of the exhaust valves the engine should be barred only in a counter-clockwise direction when looking at the flywheel (its natural direction of rotation) due to the possibility of slack in the gear train.
2. Install a rocker arm assembly on the #1 cylinder.
3. Attach a dial indicator so it will rest on the valve bridge. Press the indicator down 100 thousandths and adjust the dial to read zero. The rocker arm should be all the way up (the exhaust valves closed). This should be with #1 cylinder at top dead center, or zero on the flywheel.
4. Bar the engine over to 112° after top center, if timing the right bank, or to 157° after top center if timing left bank. The timing is correct if the exhaust valves open .014" at 110° to 112° when timing the right bank, and .014" at 155° to 157° when timing the left bank, first cylinder. (This is #4 cylinder on the 6-cylinder engine, #7 cylinder on the 12-cylinder engine, and #9 cylinder on the 16-cylinder engine). If timing is not correct, proceed as follows:

TO CORRECT TIMING

1. Remove the dowel pins and bolts from camshaft drive gear. By attaching a suitable handle to the overspeed end of the camshaft, the shaft can be rotated without moving the drive gear. Looking at the camshaft from the accessory drive end, rotate the shaft in a counter-clockwise direction until the dial indicator is released .014" or the dial reading is 86.
2. If the bolt holes in the camshaft do not show through the slotted openings in the camshaft drive gear, remove the gear and replace so that the bolts may be applied to secure the setting of the camshaft. Tighten these bolts.
3. Before the camshaft can again be dowelled to the gear, there is one more step; the gear play should be checked by barring the engine over counter-clockwise until exhaust valve lift is .014" checked against the flywheel position (110° for #1 cylinder). The bolts holding the drive gear to the camshaft will permit moving the shaft through small degrees of rotation by tapping on the handle at the overspeed trip end of the camshaft. By trial, tap the camshaft until the 110° flywheel mark coincides with the .014" valve lift.

When timing checks satisfactorily, drive gear should be dowelled to camshaft.

As noted on page 903 the timing tolerance is 2° early and 0° late; therefore when retiming an engine, time it at the early setting as mentioned in Paragraph 3 under "To Correct Timing". 901

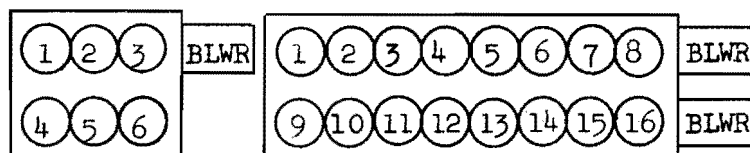
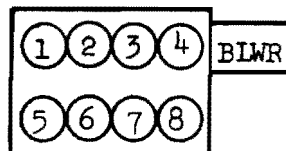


FLYWHEEL MARKING TOP DEAD CENTER

CYL. NO.	6-567	8-567	12-567	16-567
1	0°	0°	0°	0°
2	240°	180°	240°	270°
3	120°	90°	120°	90°
4	45°	270°	94°	180°
5	285°	45°	214°	202½°
6	165°	225°	334°	112½°
7		135°	45°	292½°
8		315°	285°	22½°
9			165°	45°
10			139°	315°
11			259°	135°
12			19°	225°
13				247½°
14				157½°
15				337½°
16				67½°

FIRING ORDER CLOCKWISE LOOKING AT FRONT END

6-567	1-4-3-6-2-5
8-567	1-5-3-7-2-6-4-8
12-567	1-12-7-4-3-10-9-5-2-11-8-6
16-567	1-8-9-16-3-6-11-14- 4-5-12-13-2-7-10-15



567 ENGINE
TIMING DIAGRAM FOR CAMSHAFTS OTHER THAN TYPE "4-4"
PLATE 9-4 REV.E

E.M.CORP.
APR. 18, 1941

TIMING EXHAUST VALVES
567 ENGINES
WITH "4-4" CAMSHAFT
PLATE 2353

SECTION 9

LOCATING TOP DEAD CENTER

In the event it becomes necessary to check the flywheel marks to see that they correspond to cylinder #1, place a plunger and bushing, EMC #8039139, in the injector hole of cylinder #1, with the dial indicator resting on the plunger. When the dial indicator is approximately .120" to .190" before top dead center, set the dial indicator to zero and mark the flywheel. Turn past top dead center until zero again appears on the dial indicator and mark the flywheel again. Divide the distance between these two marks. This point will be top dead center for #1 cylinder and should coincide with zero, or 360° mark on the flywheel rim.

TO CHECK THE TIMING OF THE EXHAUST VALVES

1. During the timing of the exhaust valves, the engine should be barred only in a counter-clockwise direction when looking at the flywheel (its natural direction of rotation) due to the possibility of slack in the gear train.
2. Install a rocker arm assembly on the #1 cylinder.
3. Attach a dial indicator so it will rest on the valve bridge. Press the indicator down 100 thousandths and adjust the dial to read zero. The rocker arm should be all the way up (the exhaust valves closed). This should be with #1 cylinder at top dead center, or zero on the flywheel.
4. Bar the engine over to 108° after top center, if timing the right bank, or to 153° after top center if timing left bank. The timing is correct if the exhaust valves open .014" at 106° to 108° when timing the right bank, and .014" at 151° to 153° when timing the left bank, first cylinder. (This is #4 cylinder on the 6-cylinder engine, #7 cylinder on the 12-cylinder engine, and #9 cylinder on the 16-cylinder engine). If timing is not correct, proceed as follows:

TO CORRECT TIMING

1. Remove the dowel pins and bolts from the camshaft drive gear. By attaching a suitable handle to the overspeed end of the camshaft, the shaft can be rotated without moving the drive gear. Looking at the camshaft from the accessory drive end, rotate the shaft in a counter-clockwise direction until the dial indicator is released .014" or the dial reading is 86.
2. If the bolt holes in the camshaft do not show through the slotted openings in the camshaft drive gear, remove the gear and replace so that the bolts may be applied to secure the setting of the camshaft. Tighten these bolts.
3. There is one more step before the camshaft can again be dowelled to the gear: the gear play should be checked by barring the engine over counter-clockwise until the exhaust valve lift is .014" checked against the flywheel position (106° for #1 cylinder). The bolts holding the drive gear to the camshaft will permit moving the shaft through small degrees of rotation by tapping on the handle at the overspeed trip end of the camshaft. By trial, tap the camshaft until the 106° flywheel mark coincides with .014" valve lift.

When the timing checks satisfactorily, the drive gear should be dowelled to the camshaft. As noted on page 903, the timing tolerance is 2° early and 0° late. Therefore when retiming an engine, time it at the early setting as mentioned in Paragraph 3 under "To Correct Timing".

SECTION 9

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APR. 18, 1941

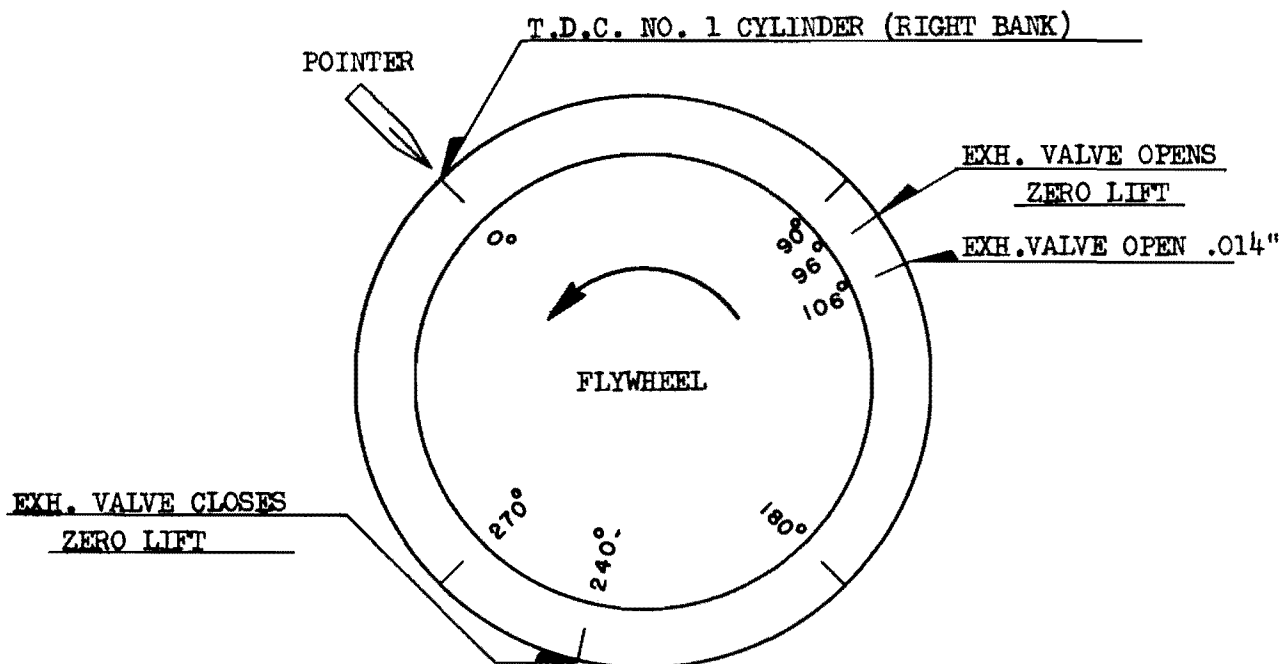
SPECIFICATIONS

Limit of lag of Camshaft behind Crankshaft due
to worn gears 2° Max. (or 108° on
"4-4" camshafts; 112°
on camshafts other than
"4-4" at .014" lift)

CAMSHAFT DRIVE	NEW	CON. LIMIT
Radial Clearance - Idler Gear Bushing to Stubshaft . . . . .	.003 - .005	.010
Thrust Clearance - Idler Gear . . . . .	.006 - .013	.025
Radial Clearance - Blower Drive Bushing to Stubshaft . . . . .	.003 - .005	.010
Thrust Clearance - Blower Drive Gear . . . . .	.004 - .011	.025
Backlash - For all Gears . . . . .	.012 - .024	.050

CAMSHAFT AND STUBSHAFT

Camshaft Diameter	2.497 - 2.498	
Radial Clearance . . . . .	.002 - .005	.010
Stubshaft Diameter	2.497 - 2.498	.010
Radial Clearance . . . . .	.002 - .005	.010
Thrust Clearance . . . . .	.004 - .012	.025



FLYWHEEL MARKING
TOP DEAD CENTER

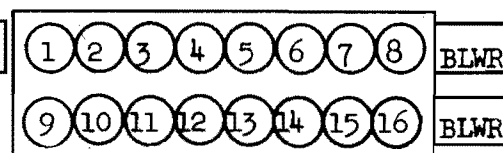
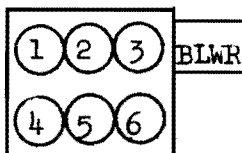
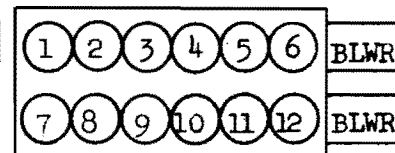
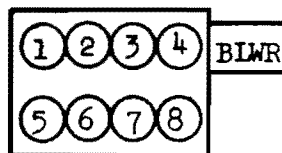
FIRING ORDER
CLOCKWISE LOOKING AT FRONT END

CYL.

NO.

	6-567	8-567	12-567	16-567
1	0°	0°	0°	0°
2	240°	180°	240°	270°
3	120°	90°	120°	90°
4	45°	270°	94°	180°
5	285°	45°	214°	202½°
6	165°	225°	334°	112½°
7		135°	45°	292½°
8		315°	285°	22½°
9			165°	45°
10			139°	315°
11			259°	135°
12			19°	225°
13				247½°
14				157½°
15				337½°
16				67½°

6-567	1-4-3-6-2-5
8-567	1-5-3-7-2-6-4-8
12-567	1-12-7-4-3-10-9-5-2-11-8-6
16-567	1-8-9-16-3-6-11-14-4-5-12-13-2-7-10-15



567 ENGINE
TIMING DIAGRAM FOR "4-4" CAMSHAFTS
PLATE 2353 REV.B

E.M.CORP.
APR. 18, 1941

SECTION 9

GEAR TEETH AND SPEED RATIOS

BLOWER DRIVE & CAMSHAFT DRIVE - 567 ENGINES

6 - 567

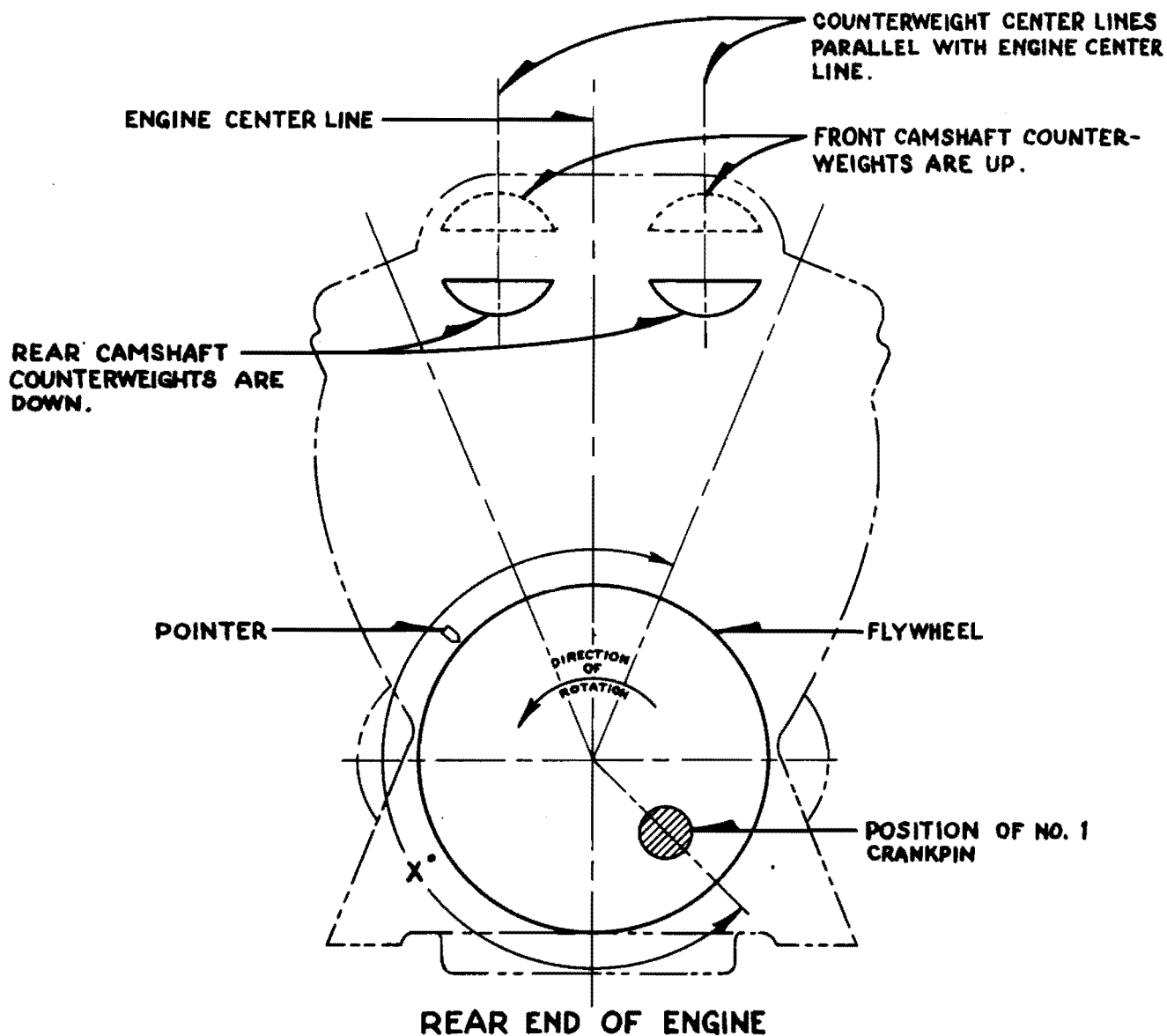
8 - 567

CAMSHAFT AND BLOWER DRIVE	NO. TEETH	RATIO TO CRANK:	NO. TEETH	RATIO TO CRANK:
Crankshaft	71	1	71	1
#1 Idler	56	1.27:1	56	1.27:1
#2 Idler	56	1.27:1	56	1.27:1
#3 Idler	37	1.92:1	37	1.92:1
L. Camshaft	71	1:1	71	1:1
R. Blower	38	1.87:1	28	2.54:1
#4 Idler	37	1.92:1	37	1.92:1
L. Blower	-	-	-	-
R. Camshaft	71	1:1	71	1:1

12 - 567

16 - 567

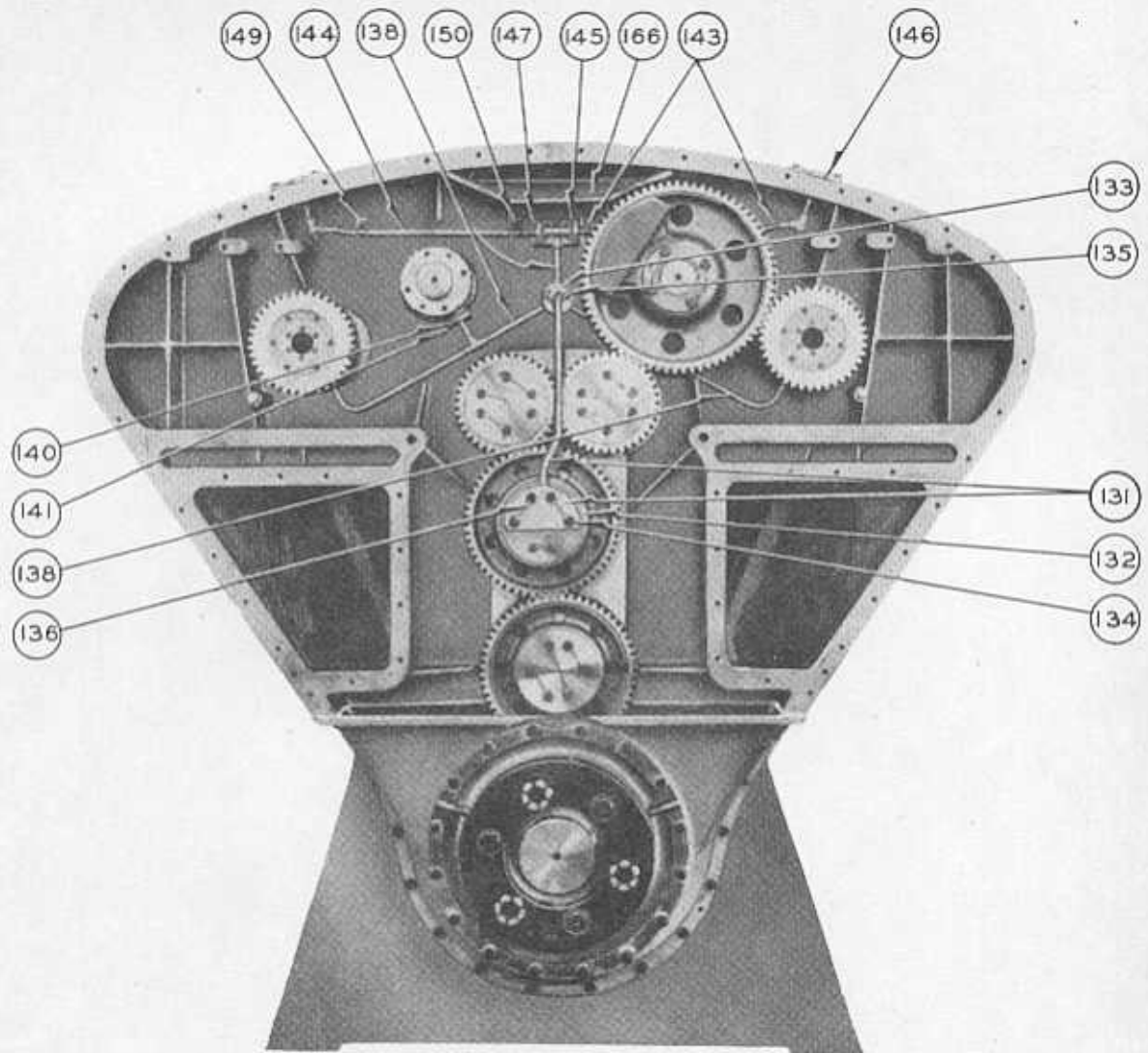
Crankshaft	71	1	71	1
#1 Idler	56	1.27:1	56	1.27:1
#2 Idler	56	1.27:1	56	1.27:1
#3 Idler	37	1.92:1	37	1.92:1
L. Camshaft	71	1:1	71	1:1
R. Blower	38	1.87:1	28	2.54:1
#4 Idler	37	1.92:1	37	1.92:1
R. Camshaft	71	1:1	71	1:1
L. Blower	38	1.87:1	28	2.54:1



X = DEGREES AFTER T.D.C. OF NO. 1 CYLINDER.
TO GET THE CRANKSHAFT IN THIS POSITION, TURN THE
FLYWHEEL UNTIL THIS NUMBER IS AT THE POINTER.

ENGINE MODEL	X EQUALS
6 - 567	172 1/2°
8 - 567	247 1/2°
12 - 567	249 1/2°
16 - 567	105°

COUNTERWEIGHT TIMING
PLATE 1344
REV. A



CAMSHAFT AND BLOWER
DRIVE GEARS
PLATE 1705

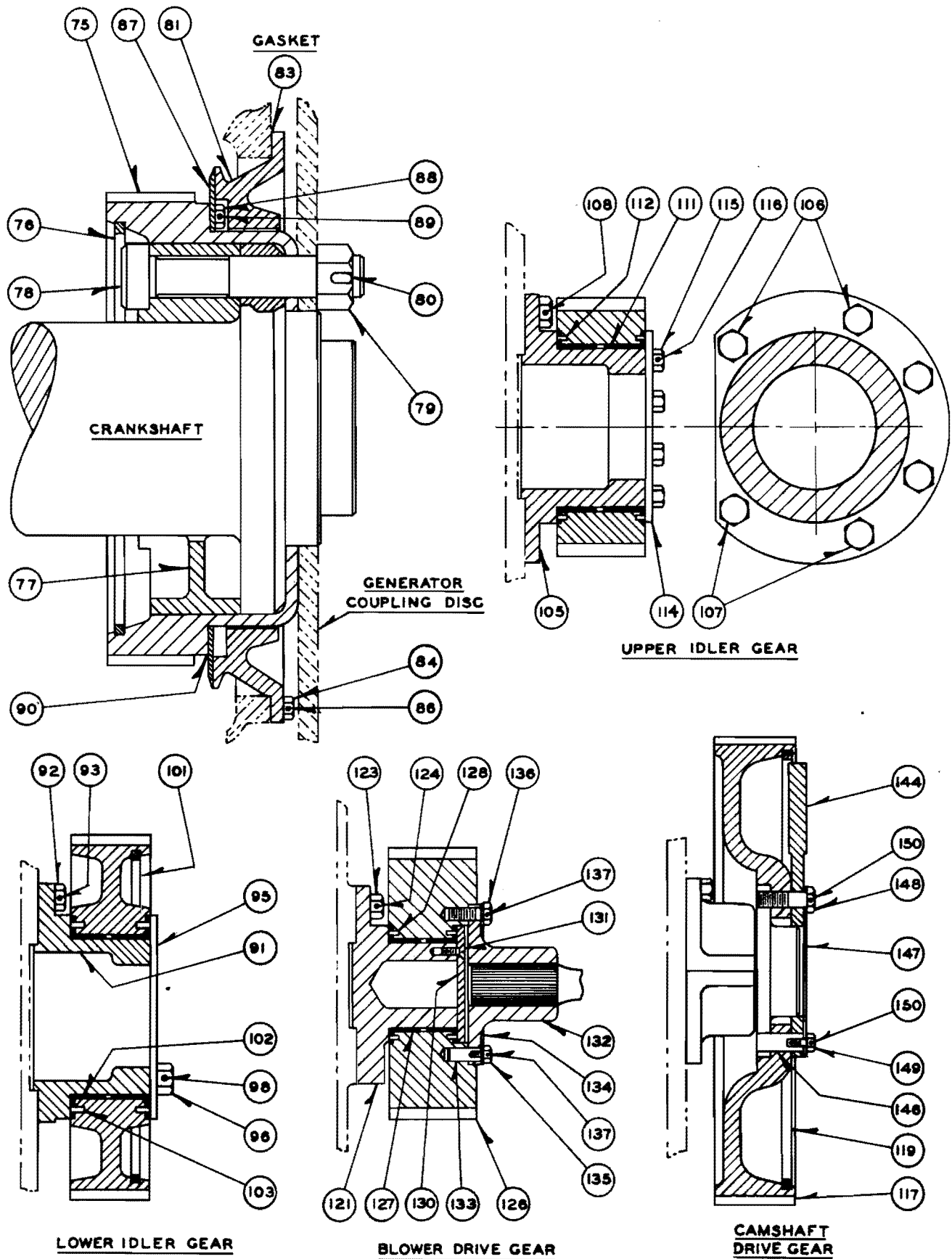


PLATE 1706

E.M.CORP.
APR. 18, 1941

SECTION 10

S E C T I O N X

GOVERNOR, GOVERNOR DRIVE, AND OVERSPEED TRIP

GENERAL DESCRIPTION

GOVERNOR (See Plate 12-8)

The governor is driven from the front of the engine through a 90° gear drive. It is the centrifugal hydraulic type allowing very close speed regulation. The main throttle, the movement of which sets the governor, is not connected to the injector linkage. The work of moving the injector racks is performed by a hydraulic piston in the governor known as the servo-motor.

GOVERNOR DRIVE

See Plate 1712. This is the 90° gear drive which operates the governor. It is lubricated under pressure through drilled passages. The horizontal extension on the driving shaft operates a tachometer.

OVERSPEED TRIP

See Plate 1709. The overspeed trip mechanism is entirely independent of the governor. An overspeed weight at the front end of the camshaft actuates a trip which permits pawls to act on the fuel injector rocker arms, keeping them clear of the camshaft and causing immediate stoppage of the fuel injection. This makes it impossible to run the engine over the speed at which this mechanism is set, which is approximately 880 R.P.M.

SERVICE INFORMATION

1. THE GOVERNOR:

Except for lubrication or an emergency adjustment as shown on Plate 1472 it is recommended that the governor be returned to Electro-Motive Corporation for repairs. Change the governor oil semi-annually on switching locomotives and every 50,000 miles on passenger locomotives. Use the same grade of oil as for the engine. Fill to the level mark on the glass sight gauge.

2. OVERSPEED TRIP ADJUSTMENT AND RESETTNG:

To reset the overspeed trip turn the reset lever counter-clockwise. Plate 1709 shows the trip in its normal position. Tighten the nuts on the end of the trip weight spring to increase the setting at which the trip will operate.

SECTION 10

E.M.CORP.
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3. FLUSHING THE GOVERNOR:

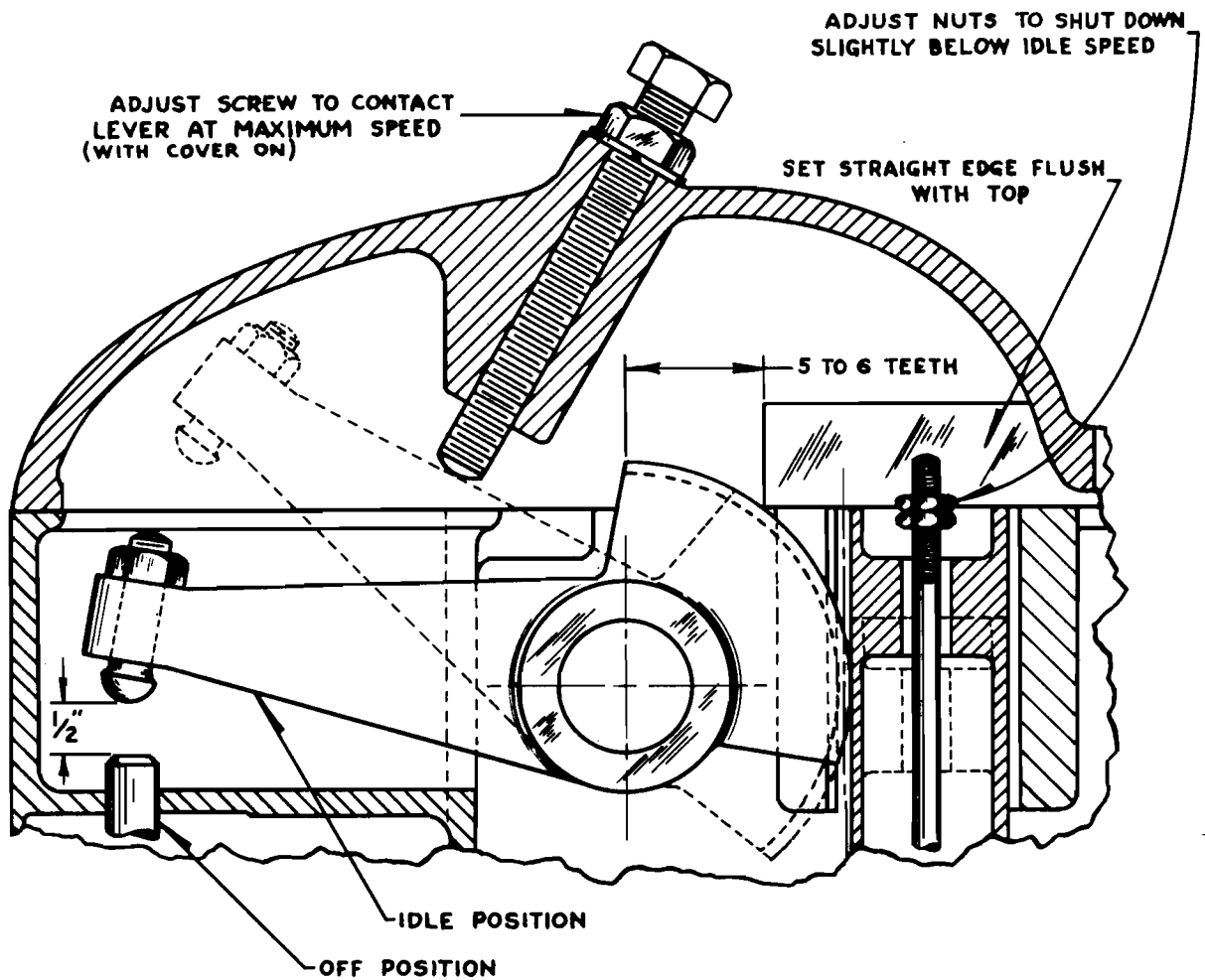
There is a certain amount of tar and gum which settles in the governor causing faulty operation. It is therefore recommended that the governor be flushed every year as follows: Connect a line from the drain plug on the governor housing to a catch pail. This line should have a shutoff valve. Disconnect the servo-motor clevis from the injector linkage. During the flushing process the throttle should be moved back and forth one notch. This will cause the servo-motor piston to fill and discharge oil. Start the engine idling and pour filtered kerosene into the governor filler cap. At the same open the drain valve and allow the oil to run out. Pour the kerosene in at the same rate as it comes out until no sign of dirt is noticeable in the oil coming out. A gallon of kerosene should suffice. Stop the engine, allow all the kerosene to run out of the governor, and refill with new oil. Do not run the governor without oil. Make sure all kerosene is removed from governor by filling the governor with oil once, and running it and draining the oil before the final filling.

4. INSPECTION

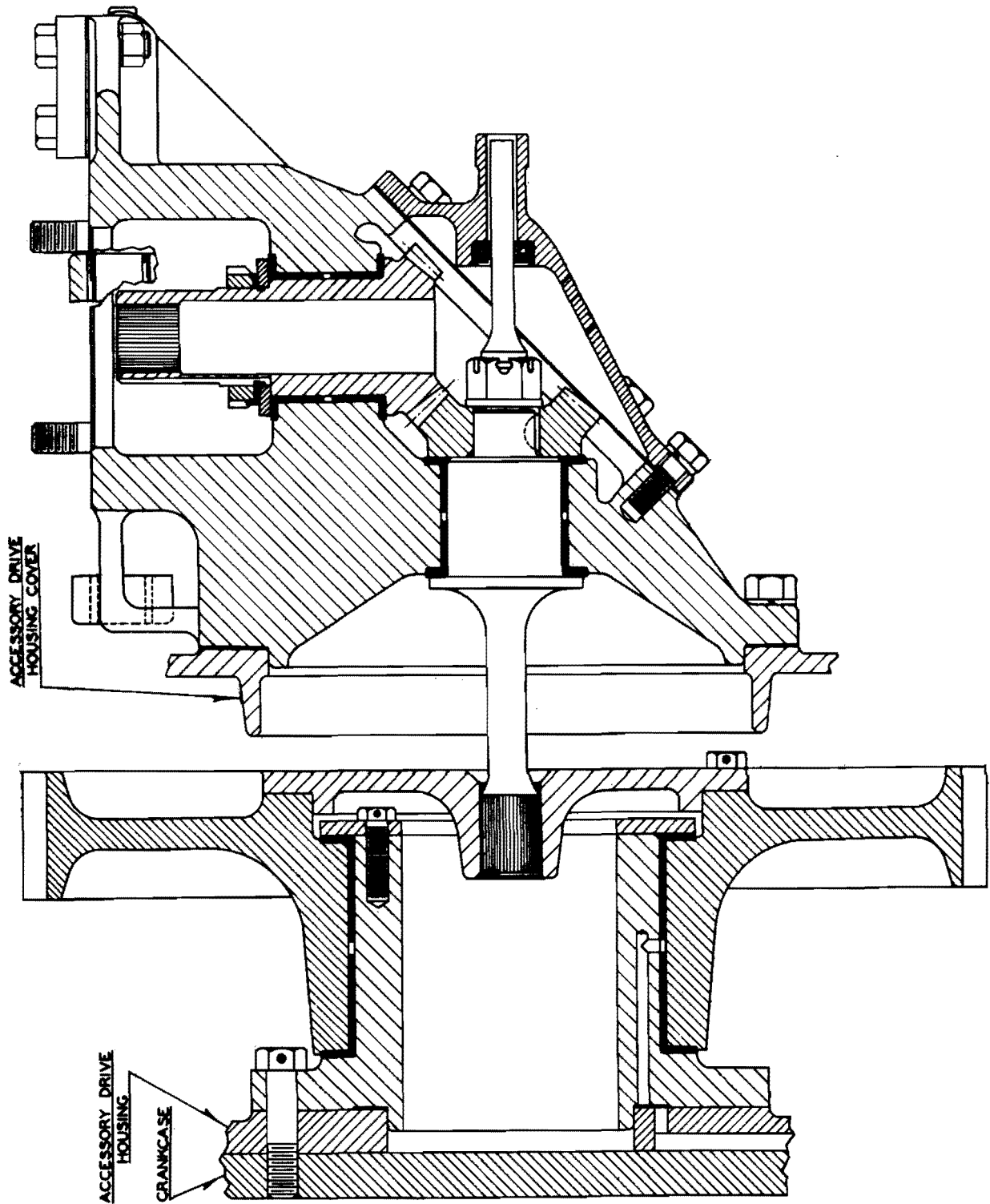
The pilot valve should be cleaned and inspected every three months on switching locomotives and every 25,000 miles on passenger locomotives. The operation of the over-speed trip should be checked periodically to determine that it is operating properly.

SPECIFICATIONS

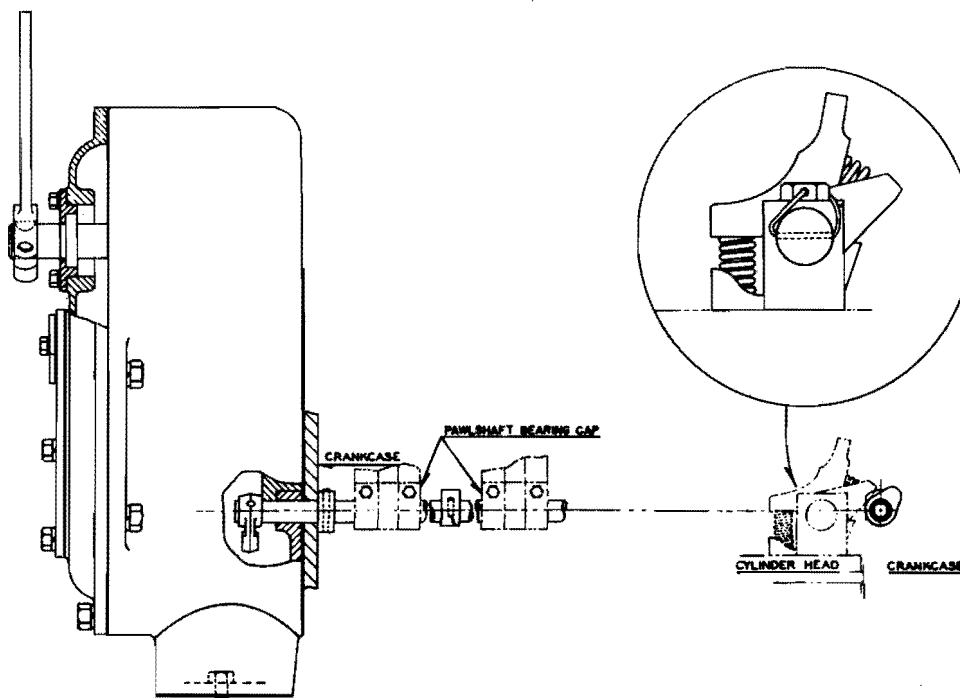
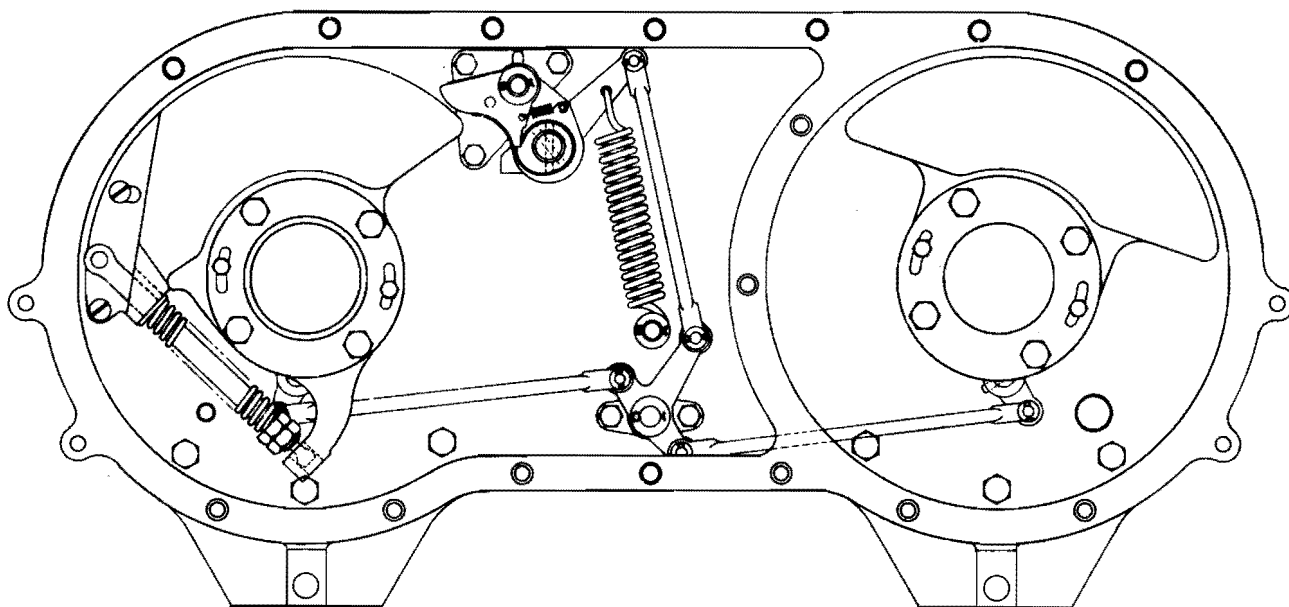
GOVERNOR DRIVE	NEW	COND. LIMIT
Radial Clearance - Dr. Gear Bushing to Stub-shaft . . . . .	.003 - .005	.010
Thrust Clearance - Drive Gear . . . . .	.004 - .011	.020
Backlash in Bevel Gears . . . . .	.004 - .006	.012
Backlash for Drive Gear . . . . .	.010 - .014	.030
Governor speed at 800 R.P.M. of engine. (when Tachometer is driven from governor drive gear)	872 R.P.M. 1 to 1	
GOVERNOR		
Oil Capacity	3 Pints	
Lubricant	Engine Oil	
OVERSPEED TRIP		
Clearance Flyweight to trip latch . . .	.025" \pm .005"	
Trip Speed	880 \pm 10 R.P.M. of engine	
OVERSPEED TRIP SPRING ON WEIGHT		
Free Length	5-11/16" \pm 1/32" Use until Broken	
Load	159# to 169# at 4-1/2"	



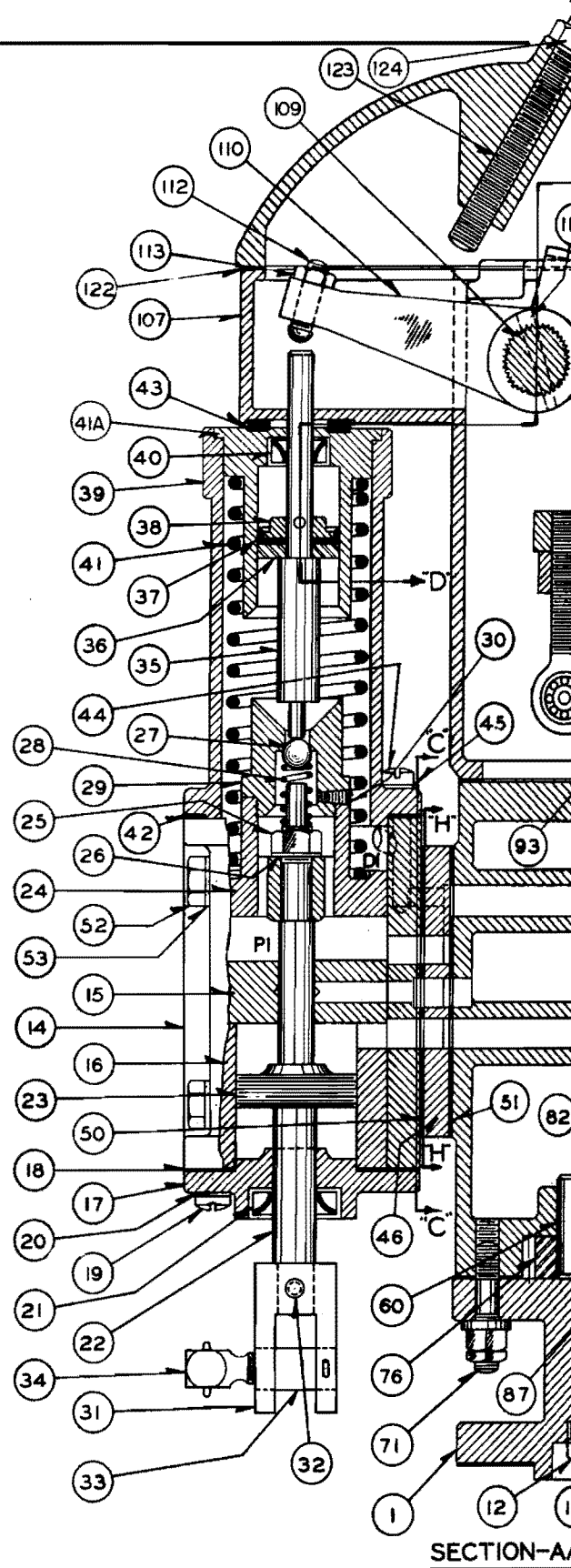
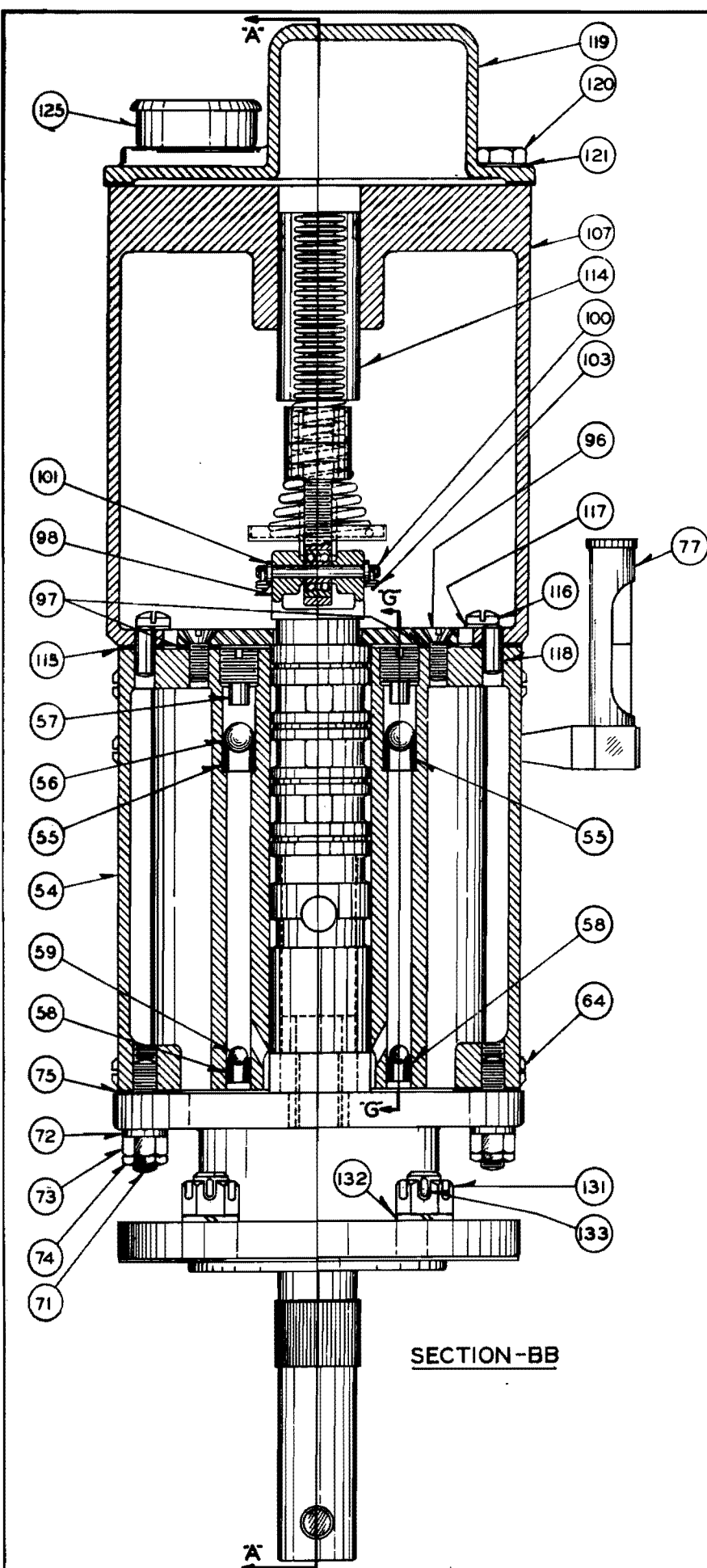
CHECKING GOVERNOR SETTING
PLATE 1472
REV.A.

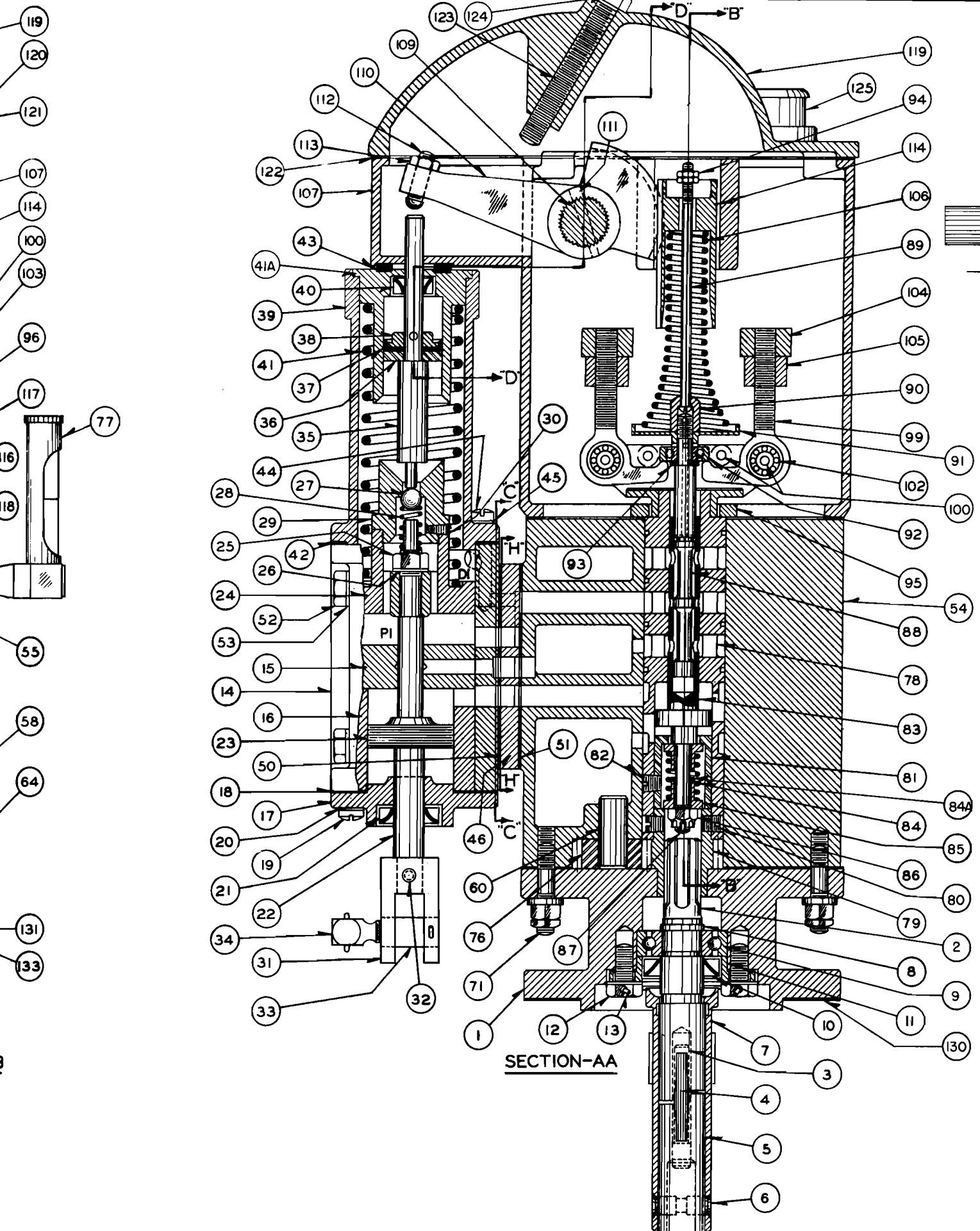


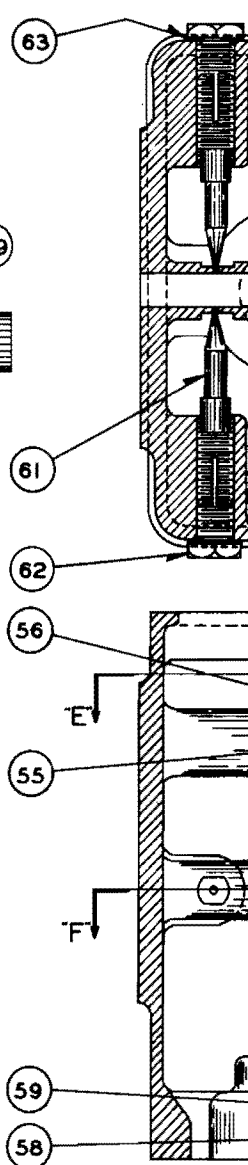
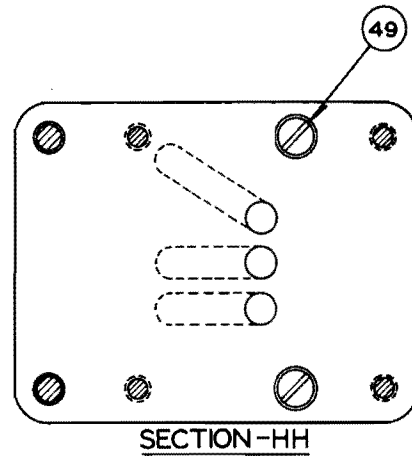
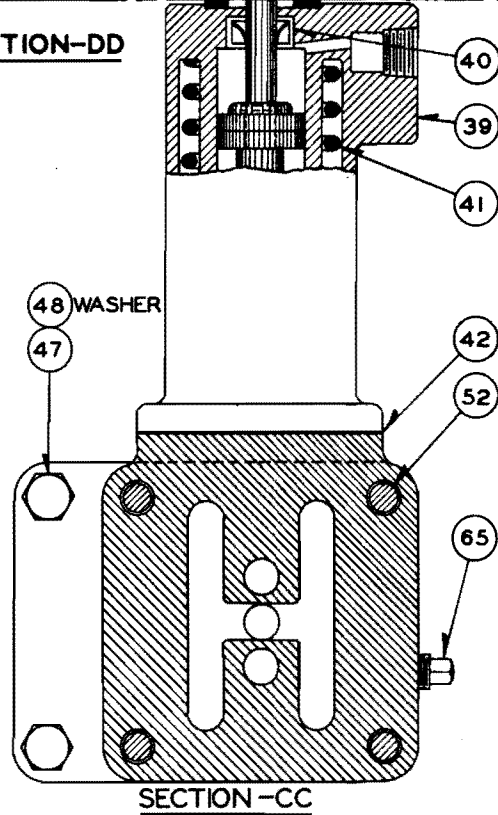
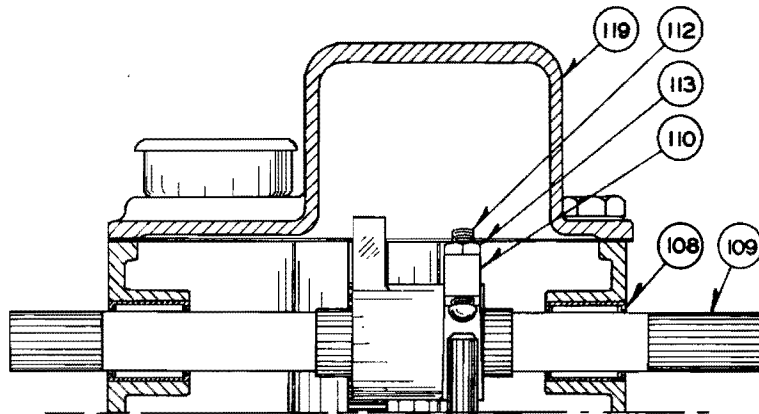
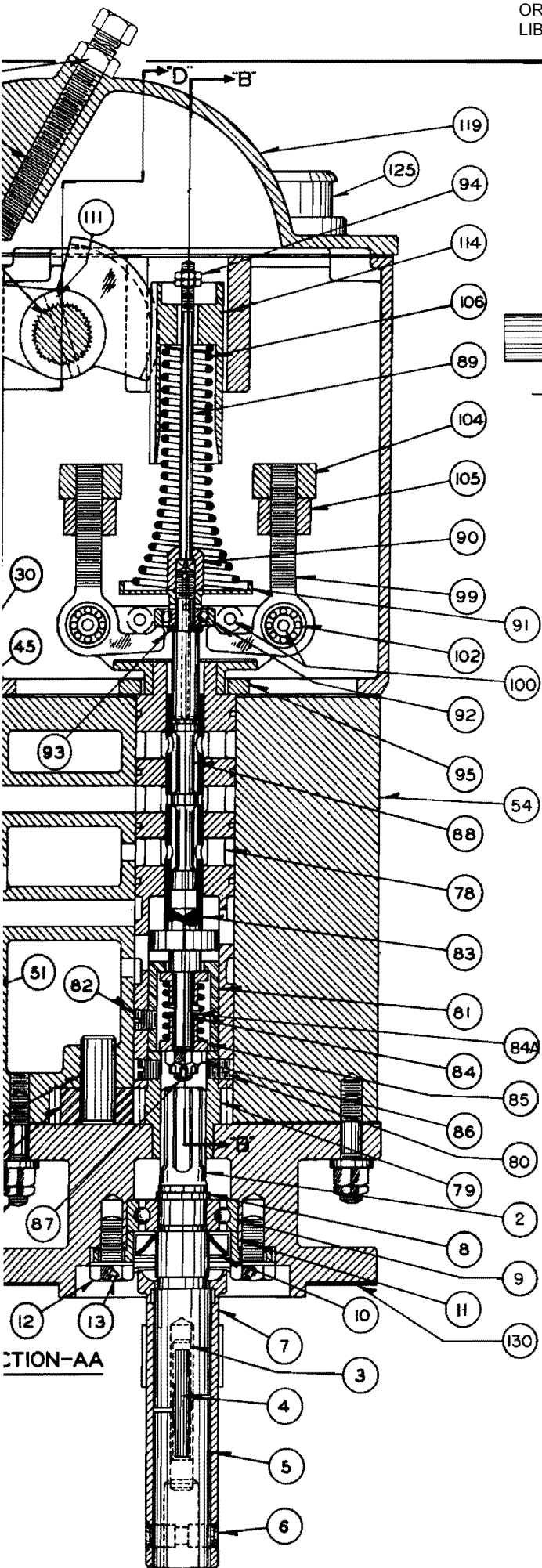
GOVERNOR DRIVE
PLATE 1712
REV. A.

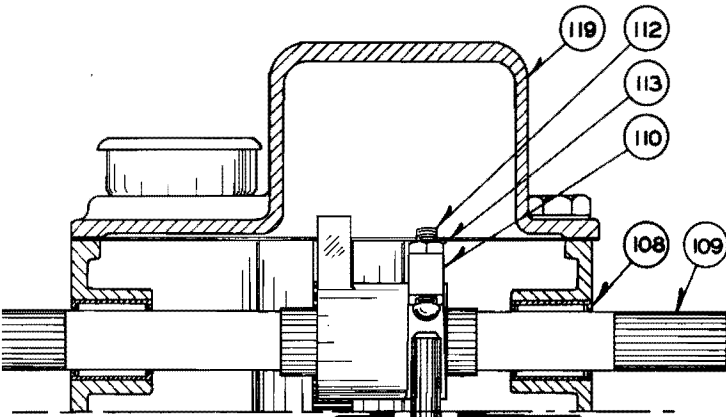


OVERSPEED TRIP

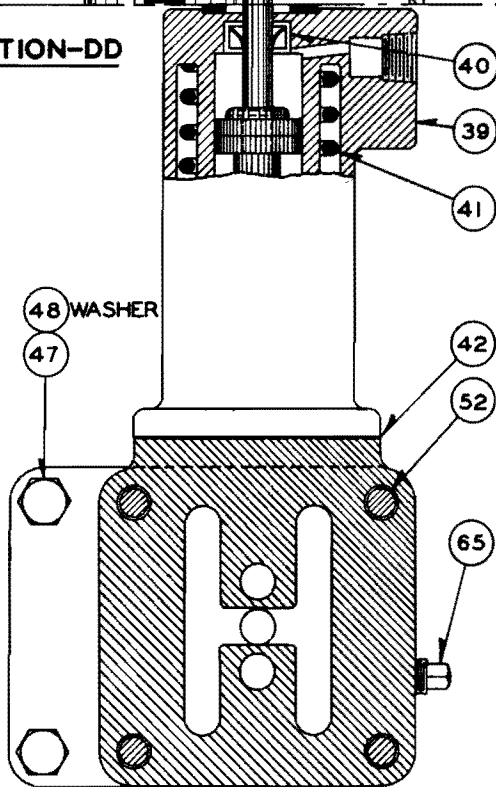




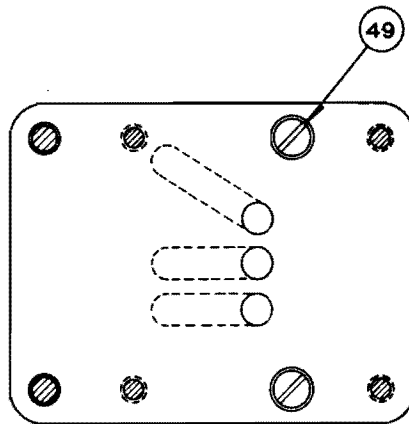




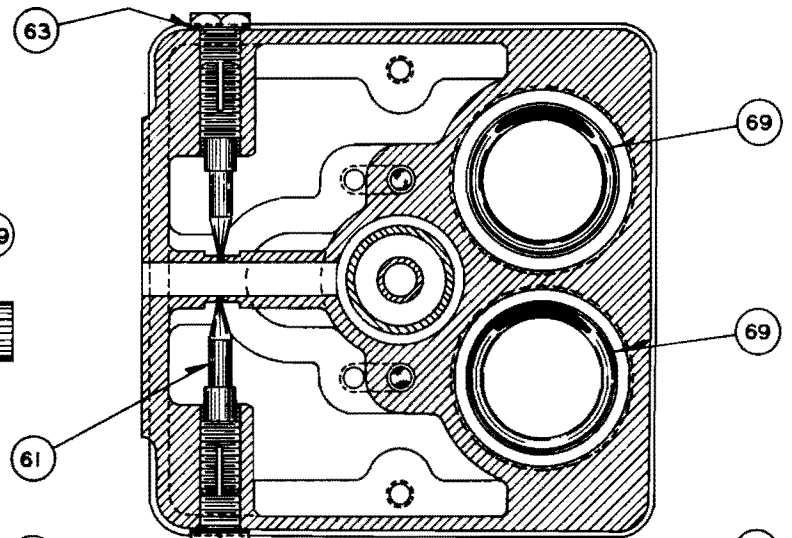
SECTION-DD



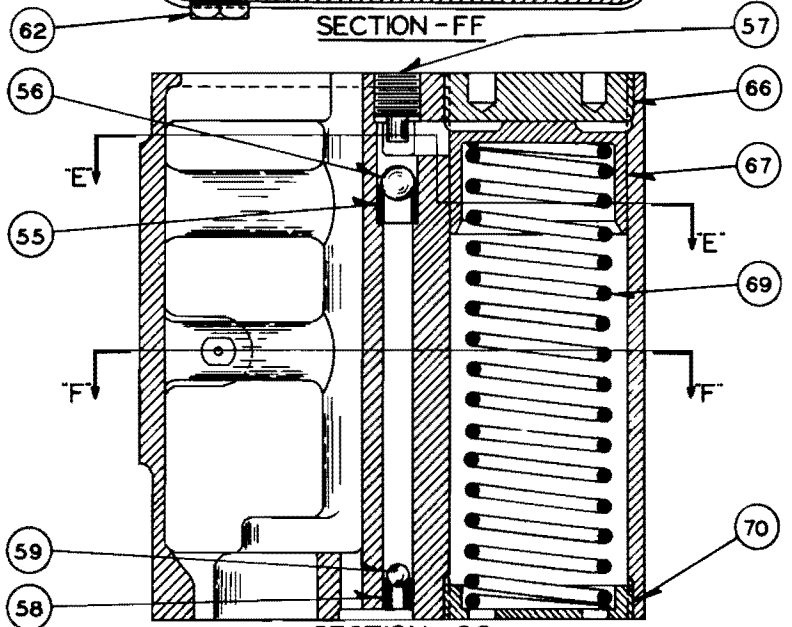
SECTION-CC



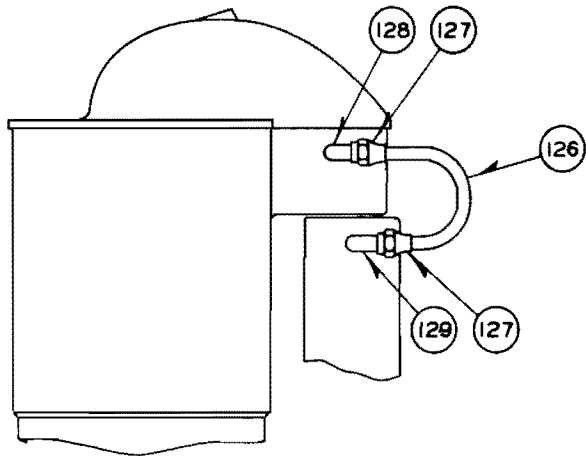
SECTION-HH



SECTION-FF



SECTION-GG



**TYPE S.I. GOVERNOR
PLATE 12-8**

E.M.CORP.
APR. 18, 1941

SECTION 11

S E C T I O N XI

ELECTRO-PNEUMATIC GOVERNOR CONTROL

GENERAL DESCRIPTION

To control the speed of an engine electrically, rather than be direct mechanical connection, the electro-pneumatic governor control is used. This device, sometimes called the "grasshopper", consists of four air operated pistons, each controlled by a magnet valve, and connected in such a way that by energizing different combinations of these magnet valves, eight different engine speeds are available. In this way any number of engines can be controlled from one controller. Plate 11-1 shows this equipment with the cover removed.

SERVICE INFORMATION

For maintenance of magnet valves in this equipment see Bulletin 604.

1. LUBRICATION:

The air piston leathers should be softened with Gulf Eskiro "B" oil - E.M.C. #8047697. Soak the leathers in oil every time the air pistons are taken apart for inspection.

The linkage with bushings is lubricated by a drip from oilers above the case. Moisten the felt in the oiler reservoir with engine oil every 25,000 miles. Keep all internal parts clean. The linkage with needle bearing needs lubricating much less often.

The magnet valves receive no lubrication.

2. LINKAGE ADJUSTMENT:

The adjustable turnbuckle at the upper R.H. corner (See Plate 11-1) should be set so that the top horizontal lever does not strike the case at its extreme position. The approximate length of this rod between centers is 10-11/16". Increasing this distance decreases engine speed and vice versa.

For adjustments of the linkage between the governor control and the engine, see Section XII, Plate 1337.

3. PARTS REPLACEMENT:

The linkage pivot bushings are pressed in place. The air piston springs are removed by removing the head on the cylinder blocks and removing nut 57, Plate 1713.

SECTION 11

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Renew piston leathers, if worn, by removing head piston assembly. To insert pistons with leathers in place, lubricate the leather with air cylinder oil and take care not to cut the leather on the edge of the casting.

4. INSPECTION

The electro-pneumatic governor control should be cleaned and inspected every six months on switching locomotives and every 50,000 miles on passenger locomotives. At this times, soften the leathers if necessary with "air engine" oil and clean and test the magnet valve.

SPECIFICATIONS

Magnet Valve Data See Bulletin 604
Radial Clearance - Link Bushing to Pin Now .0005 - .0025,
Limit .010

PLUNGER SPRING

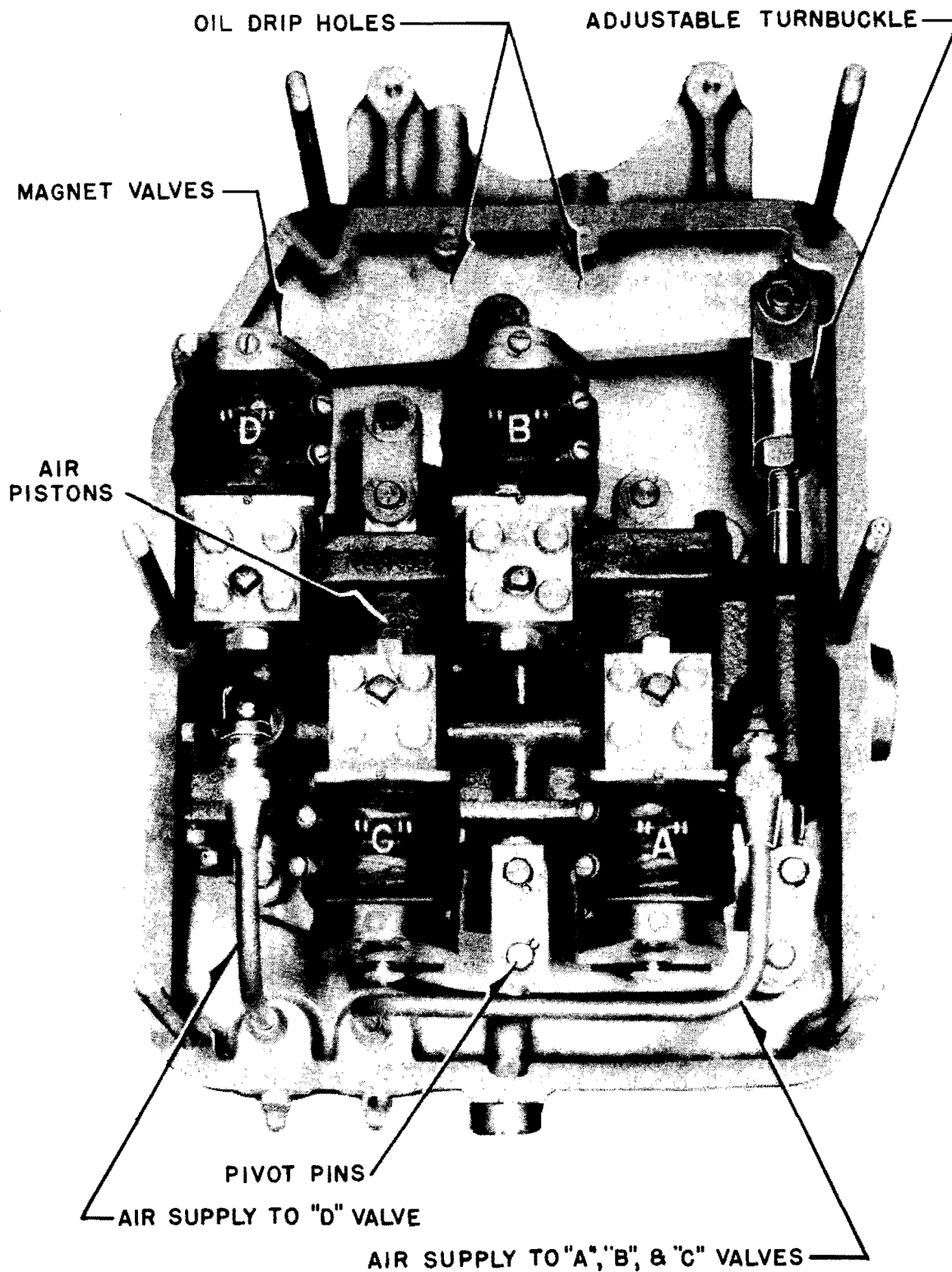
Free Length 4-9/16" \pm 1/16"
Load 56# to 62# at 3-1/8"

PISTON TRAVEL

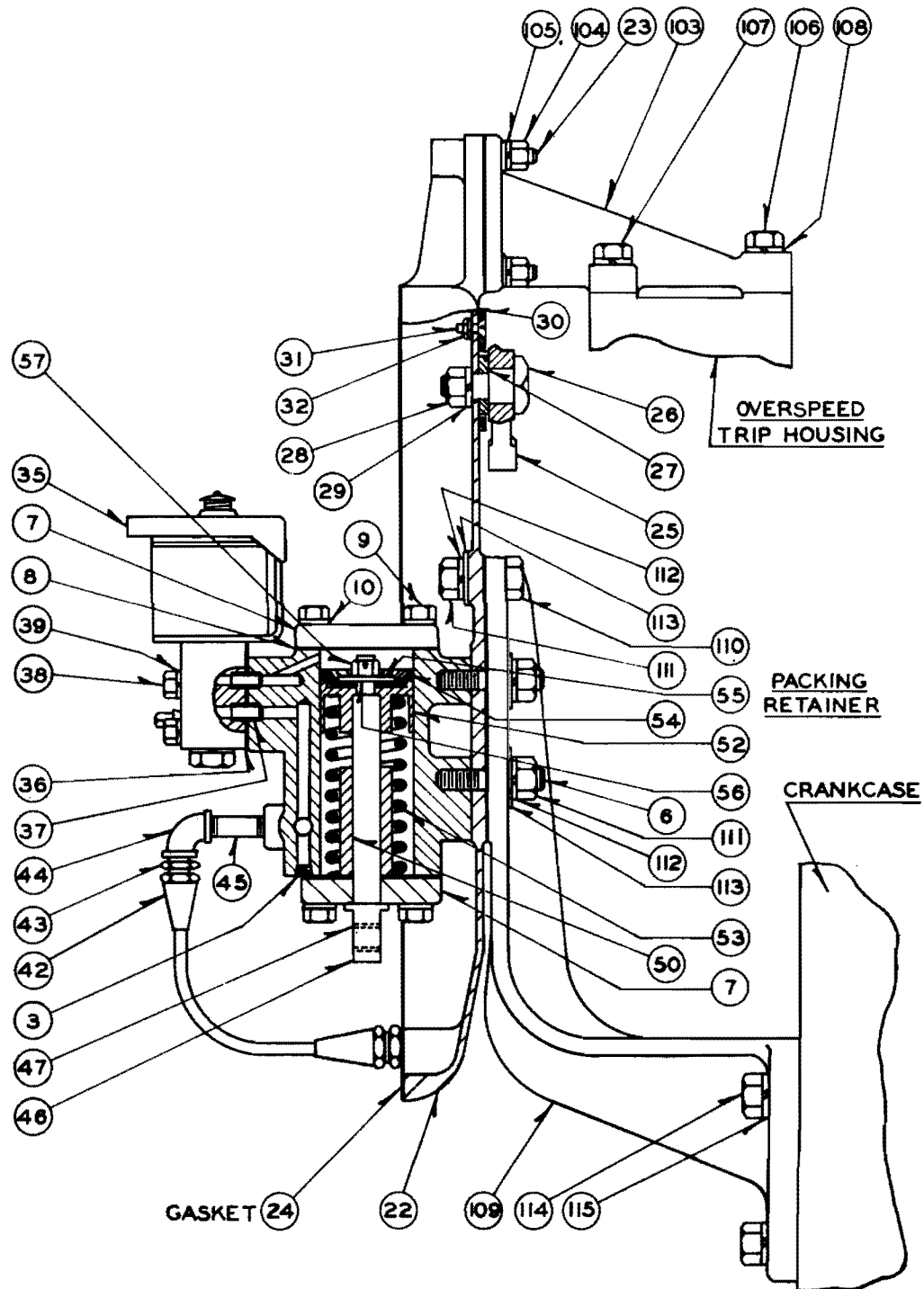
Lower Pistons 7/16"
Upper Pistons 1/2"

THROTTLE POSITION	MAGNET VALVES				ENGINE SPEED R.P.M.
	ENERGIZED				
	A	B	C	D	
OFF				*	0
IDLE					275
1					275
2	*				350
3			*		425
4	*		*		500
5		*	*	*	575
6	*	*	*	*	650
7		*	*		725
8	*	*	*		800

ENGINE
SPEED
CHART



ELECTRO-PNEUMATIC GOVERNOR CONTROL
PLATE II-1



ELECTRO-PNEUMATIC GOVERNOR CONTROL

PLATE 1713

E.M.CORP.
APR. 18, 1941

SECTION 12

S E C T I O N XII

GOVERNOR LINKAGE, PILOT VALVE LINKAGE, INJECTOR LINKAGE,& PILOT VALVE

GENERAL DESCRIPTION

GOVERNOR LINKAGE (See Plate 1337, Fig. 1)

This title in this bulletin applies to the turnbuckle and adjustable bar which connects the Electro-Pneumatic Governor Control to the Governor. (Not used on mechanical throttles).

PILOT VALVE LINKAGE

This is the linkage on the governor which actuates the pilot valve (See Section X for operation of pilot valve).

INJECTOR LINKAGE (See Plate 1321)

This term in this bulletin covers all the linkage which moves the fuel racks in the injectors. This linkage is powered by the governor servo-motor.

PILOT VALVE

The load regulator pilot valve is covered in the load regulator instruction bulletin.

SERVICE INFORMATION

1. SETTING GOVERNOR LINKAGE:

If the pointers do not line up with the marks on the indicator plates, check all possible causes. (See Plate 1337).

2. SETTING INJECTOR LINKAGE: (See Plate 1321)

A special tool for measuring injector rack setting is available (See Bulletin 1702.5). This tool is constructed in such a way that the dimension "Y" on plate 1321 can be measured.

TO SET INJECTOR LINKAGE:

- a. Back off on all injector racks by changing the micrometer adjustment so that when the servo-motor is brought up to the top of its travel, the injector racks will not be jammed.
- b. Raise the servo-motor to the top of its travel which is approximately $5/32$ " gap between top of clevis and the boss on the servo-motor. Use a governor jack.

- c. Adjust the injector racks to $5/8$ " between the injector body and the end of the rack.
- d. Servo-motor piston travel should be one inch.

3. LUBRICATING LINKAGE

Use a ball bearing grease. Lubricate the linkage monthly.

4. INDICATOR PLATES:

There are two indicator plates on electro-pneumatically controlled engines, one mounted on top the governor, or behind the "grass-hopper" (See Plate 1337, Fig. 2) and the other mounted at the base of the governor (See Plate 1337, Fig. 3). Both are graduated with a "STOP" position, and "IDLE" position, and seven additional graduations. The first mentioned dial (not used on locomotives with direct throttle to governor linkage) is an indication of what position the throttle is in. The second mentioned dial is an indication of the injector rack setting. Reference to these dials will show the relationship between the throttle position and the injector rack setting. This factor is dependent upon the load the locomotive is pulling. Stuck injector linkage, a faulty governor, improper linkage settings, etc., can be discovered by becoming familiar with these dial settings. Hand operate the linkage to check for binding.

5. INSPECTION

Every month check the setting of the governor linkage, pilot valve linkage, and injector linkage as outlined in this section.

6. SETTING LOAD REGULATOR PILOT VALVE LINKAGE (See Plate 2230)

In order to set the pilot valve linkage, the balanced position of the pilot valve must be known. This is the position which causes no movement of the load regulator. A figure is stamped on the top of the packing box (Ref. 72, Plate 13-13), which is the distance in 64ths of an inch from the top of the packing box to the bottom of the clevis - i.e., the figure being 56 means the distance is $56/64$ ". This is the dimension "Y" when the valve is balanced.

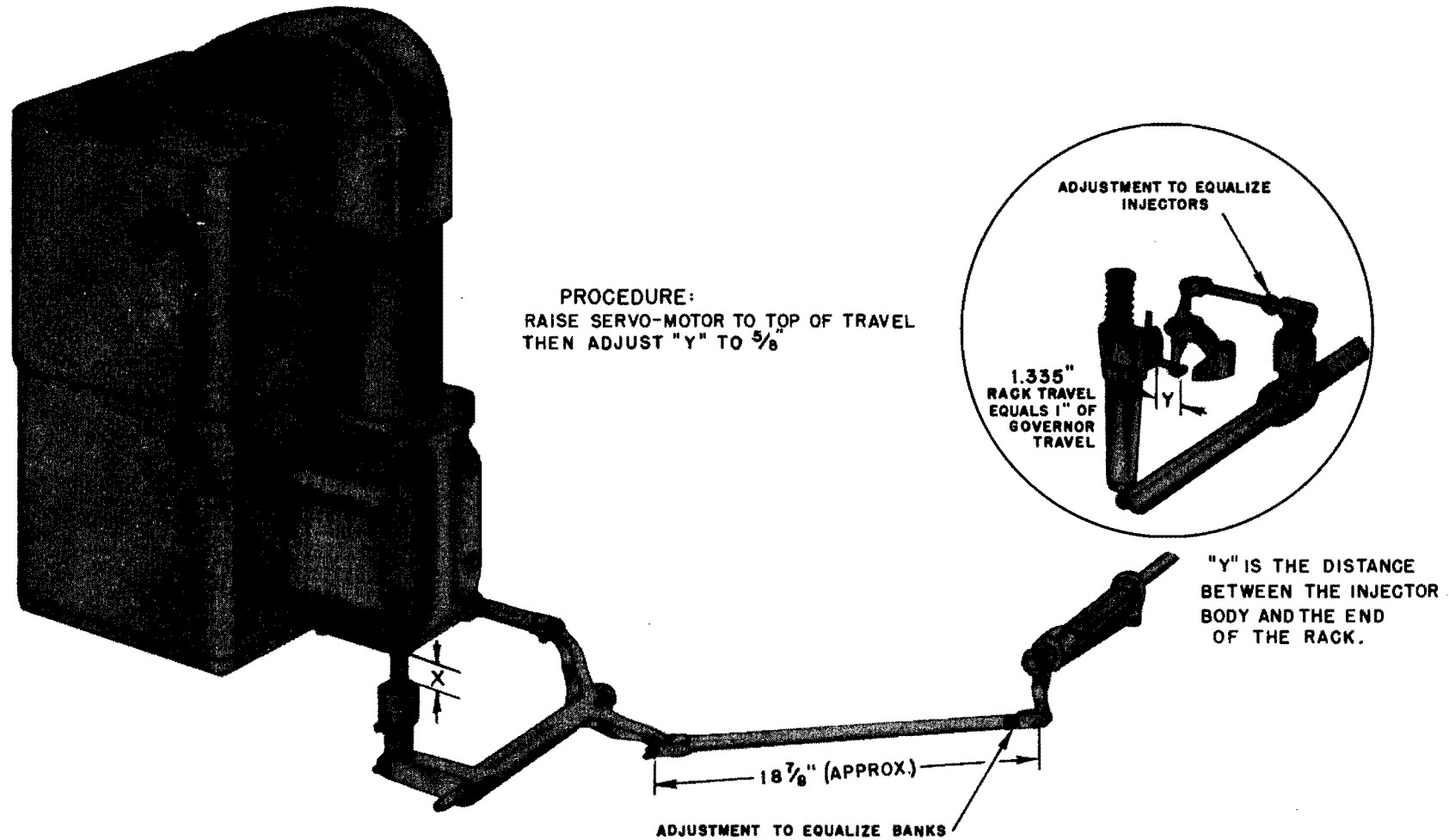
This pilot valve linkage has only two adjustments, i.e., the angular position of the governor arm and the length of the governor arm. Changing the length of the governor arm changes the total travel of the pilot valve plunger and changing the angular position of the governor arm raises or lowers the pilot valve plunger.

The injector linkage must be set according to paragraph 2.

With the engine shut down:

- a. With the throttle at idle position and Servo-Motor piston held so that "X" is $1-1/32$ ", set the governor arm to the approximate dimensions shown in table.

MARCH 1941



INJECTOR LINKAGE
PLATE 1321
REV. B

Electro-Motive Corp.

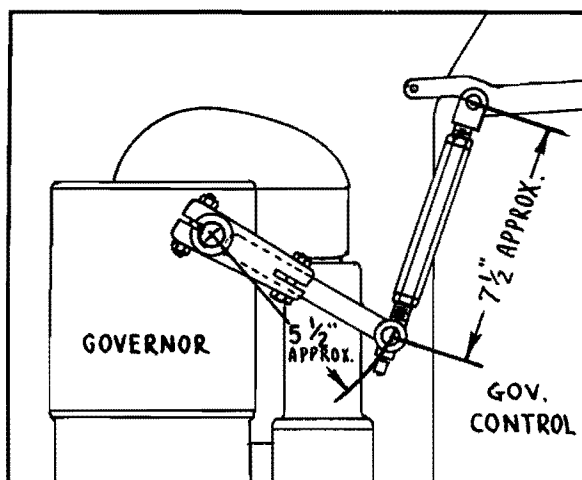


FIG. 1

INCREASE SLIDE TO DECREASE
DIFFERENTIAL & VICE VERSA.

INCREASE TURNBUCKLE TO
DECREASE ENGINE SPEED & VICE
VERSA.

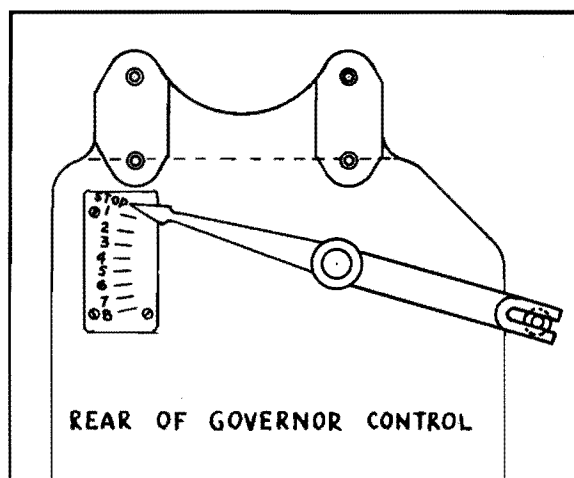


FIG. 2

DIAL SHOWING POSITION OF
GOVERNOR CONTROL.



FIG. 3

DIAL SHOWING POSITION OF
INJECTOR LINKAGE.



FIG. 4

TOOL FOR OPERATING INJECTOR
LINKAGE MANUALLY.

GOVERNOR LINKAGE

PLATE 1337

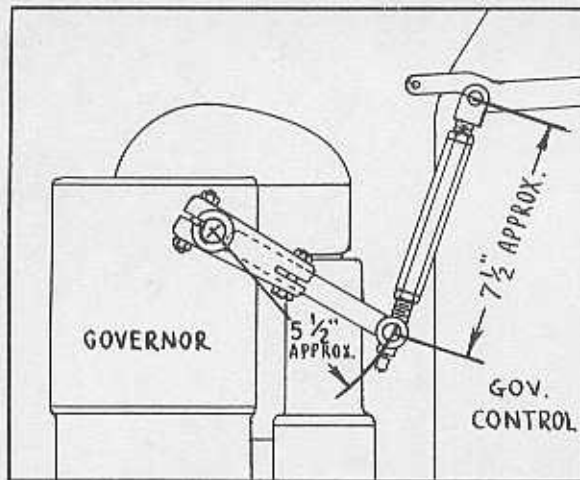


FIG. 1

INCREASE SLIDE TO DECREASE
DIFFERENTIAL & VICE VERSA.

INCREASE TURNBUCKLE TO
DECREASE ENGINE SPEED & VICE
VERSA.

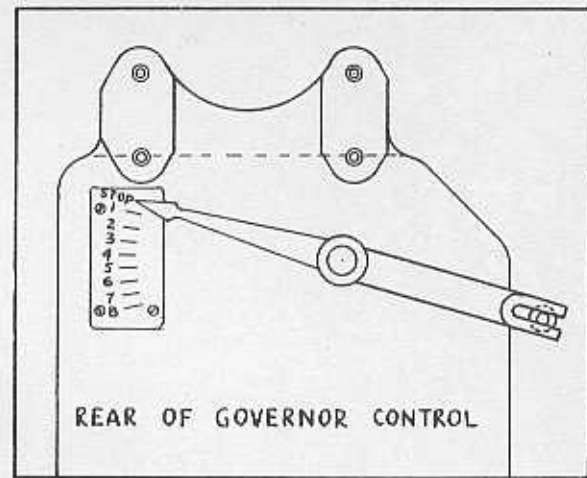


FIG. 2

DIAL SHOWING POSITION OF
GOVERNOR CONTROL.

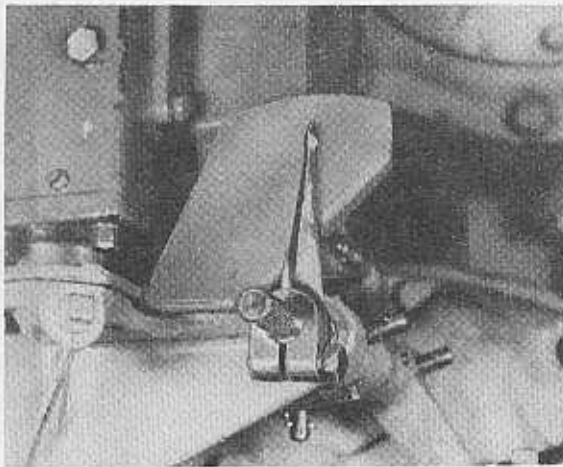


FIG. 3

DIAL SHOWING POSITION OF
INJECTOR LINKAGE.

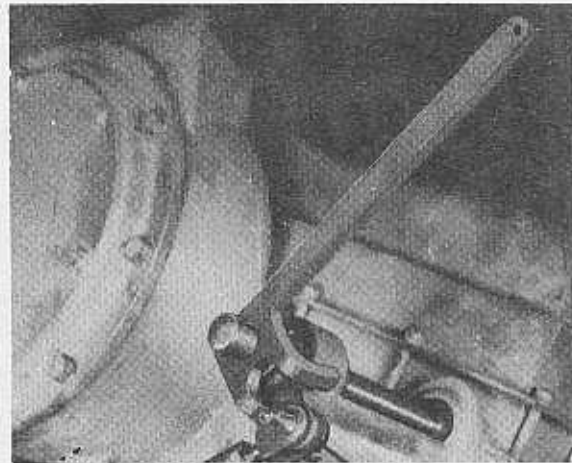


FIG. 4

TOOL FOR OPERATING INJECTOR
LINKAGE MANUALLY.

GOVERNOR LINKAGE

PLATE 1337

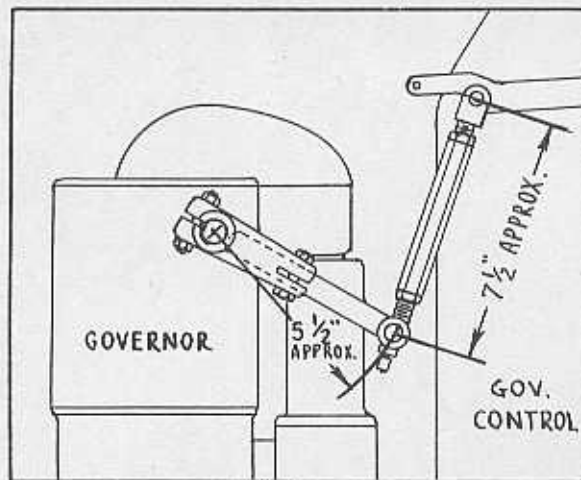


FIG. 1

INCREASE SLIDE TO DECREASE
DIFFERENTIAL & VICE VERSA.

INCREASE TURNBUCKLE TO
DECREASE ENGINE SPEED & VICE
VERSA.

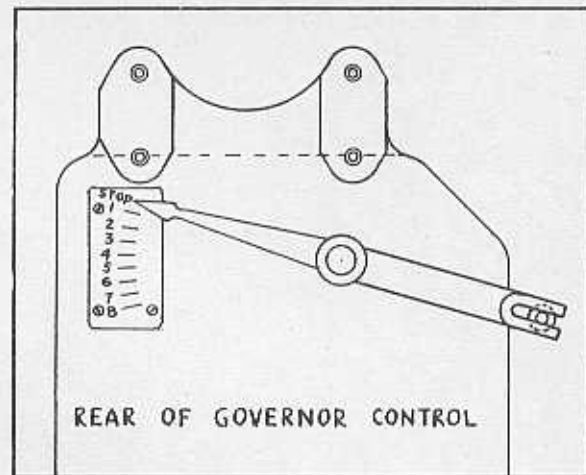


FIG. 2

DIAL SHOWING POSITION OF
GOVERNOR CONTROL.

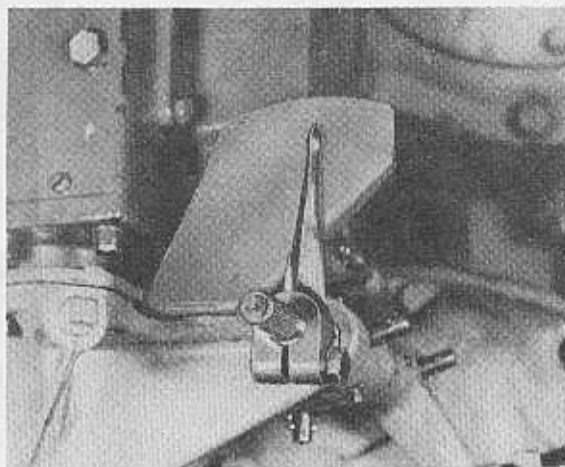


FIG. 3

DIAL SHOWING POSITION OF
INJECTOR LINKAGE.

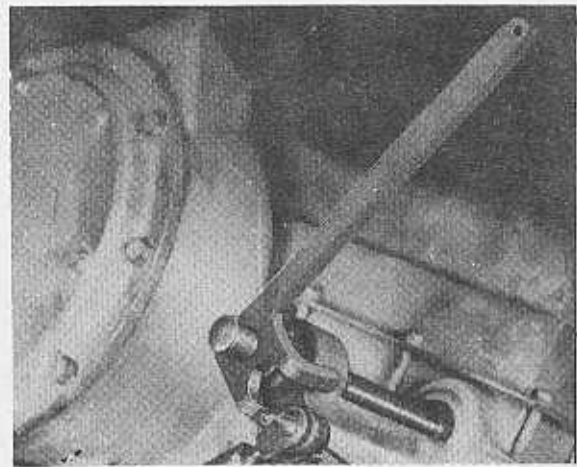


FIG. 4

TOOL FOR OPERATING INJECTOR
LINKAGE MANUALLY.

GOVERNOR LINKAGE

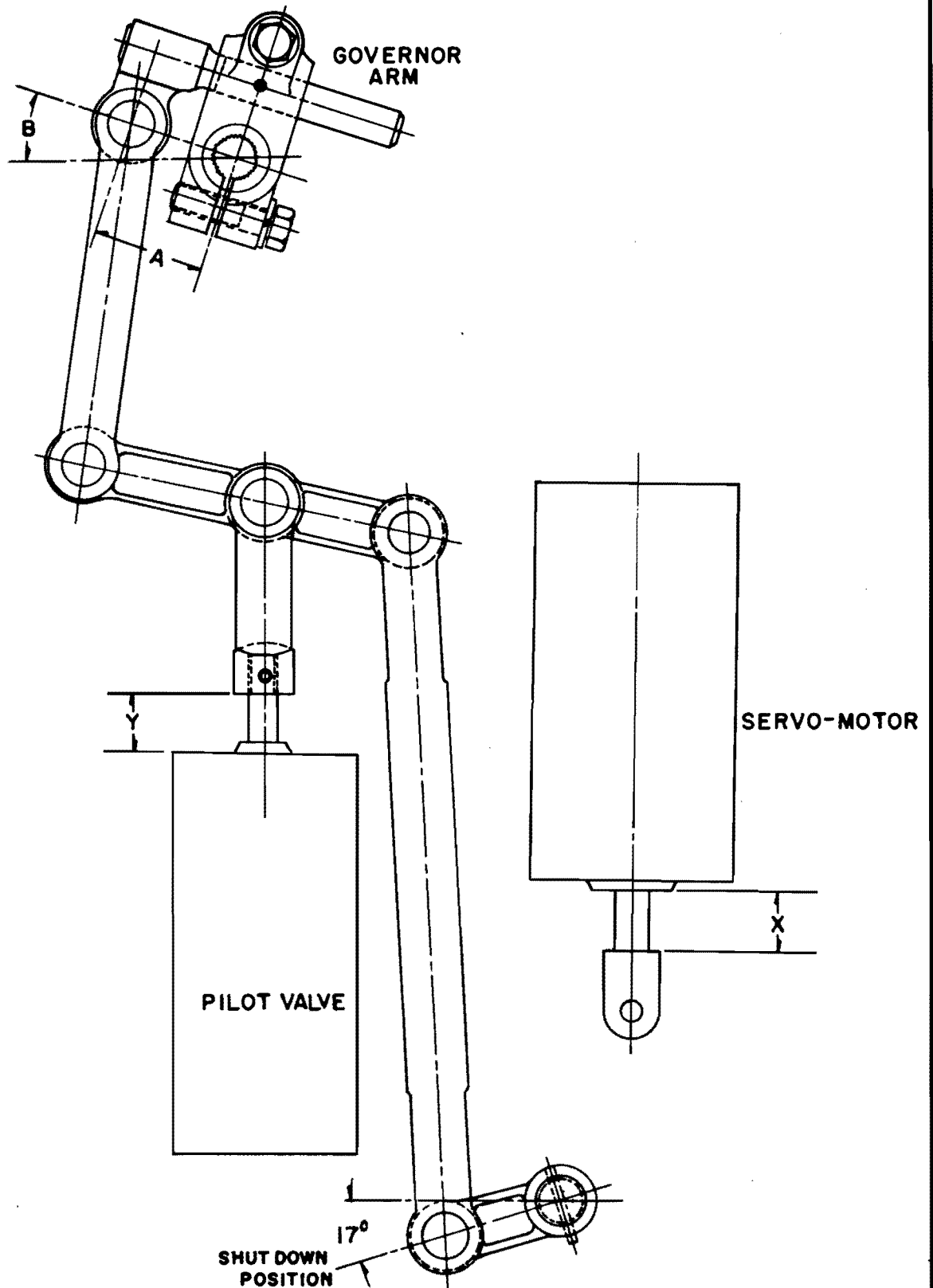
PLATE 1337

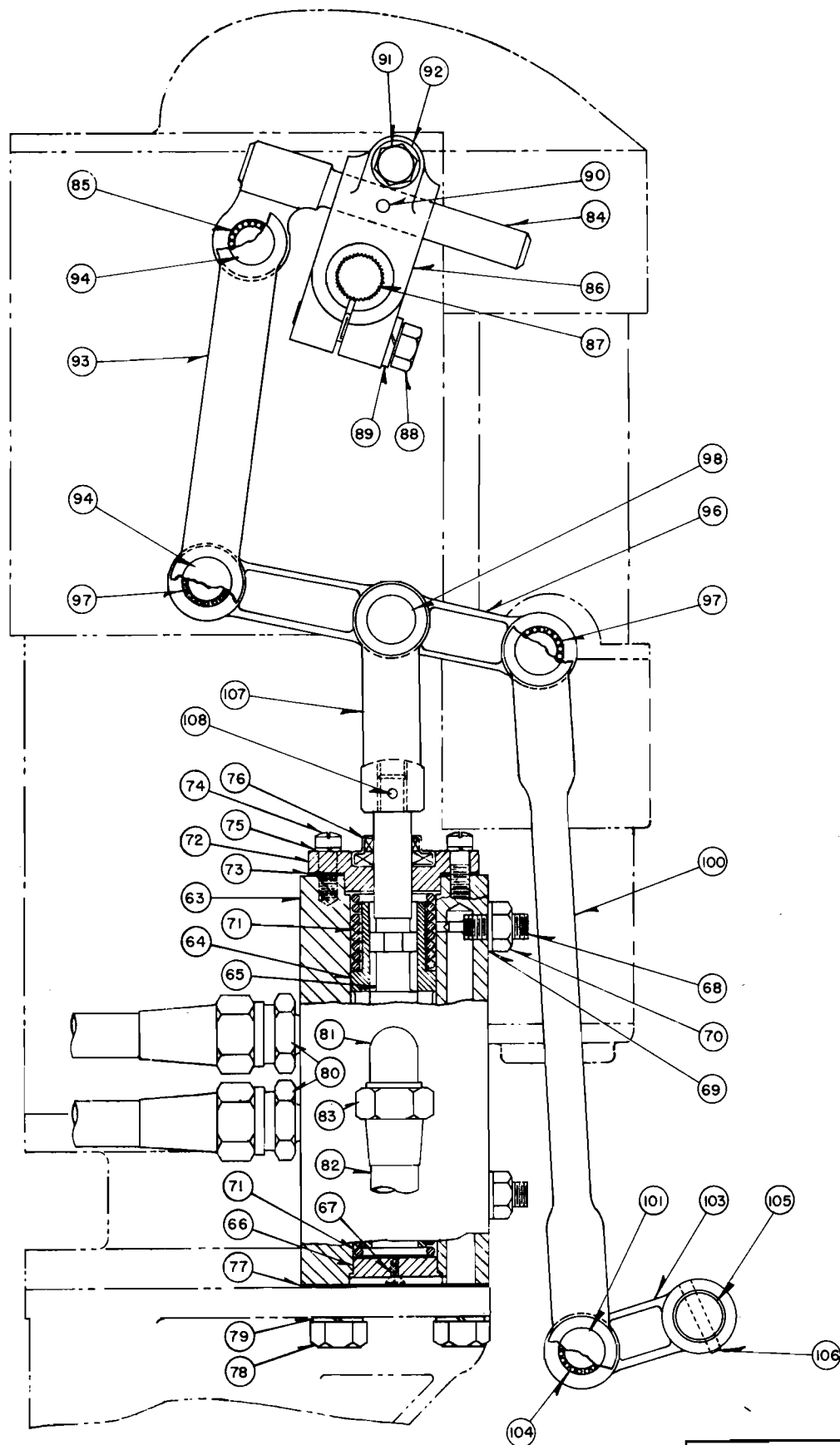
E.M.CORP.
APR. 18, 1941

SECTION 12

- b. With throttle at full speed position and Servo-Motor piston held to the dimension "X" as given in table for the particular engine being set, the pilot valve should be balanced. The governor arm may be lowered or raised to give this position, which is important and MUST be held.
- c. Return throttle to idle position and hold Servo-Motor piston so "X" is $1-1/32$ "; pilot valve plunger should now be in position so that "Y" is in position shown in table.
- d. If pilot valve is low the governor arm is too long. If pilot valve is high, the governor arm is too short.
- e. Repeat steps 2 and 3 until proper conditions are met for both idle and full speed conditions.

<u>TYPE OF LOCOMOTIVE</u>	<u>"Y" FOR THROTTLE IN IDLE POSITION</u>	<u>"X" FOR FULL THROTTLE POSITION</u>	<u>"A"</u>	<u>"B"</u>
600 H.P. Switcher (Max. Starting Field)	"Y" at balance less $1/32$ to $3/64$ "	5/16	2" Approx.	8° Approx.
200 H.P. Passenger 1000 H.P. Switcher (Max. Starting field)	"Y" at balance less $1/32$ to $3/64$ "	7/16	1-11/16" Approx.	9° Approx.
Freight 1350 HP Engine (Min. starting field)	"Y" at balance plus $1/32$ to $3/64$ "	7/16	2-1/4" Approx.	13° Approx.
2000 H.P. Passenger (Min. starting field)	Settings same as Freight			





PILOT VALVE AND LINKAGE
PLATE 13-13

S E C T I O N XIII

FUEL OIL SYSTEM

GENERAL DESCRIPTION

Fuel is pumped from the fuel tank through the fuel filters to the fuel manifold on the side of each bank of the engine. After passing through the injector where a portion is used the fuel flows to the crossflow manifold which conveys it back to the tank.

The engine fuel oil system consists of the fuel manifolds, filters, and the injector.

SERVICE INFORMATION

NOTE: For service information in the Locomotive Fuel System, see the Locomotive Instruction Bulletin.

1. CLEANING FINGER STRAINERS AND INJECTOR FILTERS:

A monthly inspection and cleaning of the strainers and lines will eliminate the possibility of dirt reaching the injector. Clean the finger strainers by washing in a petroleum solvent and blowing dry with compressed air. The cindered bronze injector filters should be thrown away when dirty, and replaced with new ones. For cleaning procedure of Duplex bronze filter see paragraph 3.

2. AIR LEAKS:

Air entering the fuel system will cause the engine to missfire or even stop. If a cylinder fails, then starts firing again, it is an indication of an air leak. Inspect the suction lines periodically for air leaks.

3. CLEANING SINTERED BRONZE (Duplex) FUEL FILTER ELEMENTS

Steam: Dry steam from a suitable nozzle at fairly high pressure directed first on the inside of the filter, then on the outside and finally on the inside, will remove the dirt and will do a good job of cleaning. A suitable fixture for holding the filter element would be of considerable help. The jet of steam should be directed at the inside surface perpendicular to the surface, in order to force the dirt from the inside toward the outside. Then if the steam jet is directed at an angle to the surface on the outside, most of the dirt will be blown off and very little forced back through the filter. A final cleaning from the inside will leave the filter element in a clean condition. The filter must be free from moisture before putting it back in service. Dip in alcohol and blow dry with clean dry air.

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APR. 18, 1941

Alcohol: Soak the filter element in alcohol for 5 to 10 minutes with the open top resting on a rack, so that additional dirt will not get on the inside of the filter. In some cases after cleaning once or twice by blowing air from the inside to the outside, it may be necessary to blow air from the outside to the inside to remove accumulations from the inside of the filter.

Lacquer Thinner: Use same as alcohol

It may be desirable, especially with certain fuels, to soak the filter in either alcohol or lacquer thinner, depending on which works better for the particular fuel used, before cleaning with steam. The suggested soaking time when using either alcohol or lacquer thinner alone may also be increased if necessary.

Any of the above operations should be repeated when an increase in pressure on the fuel gauges indicates that the element is clogged.

4. TURNING DUPLEX SINTERED BRONZE FILTER HANDLE

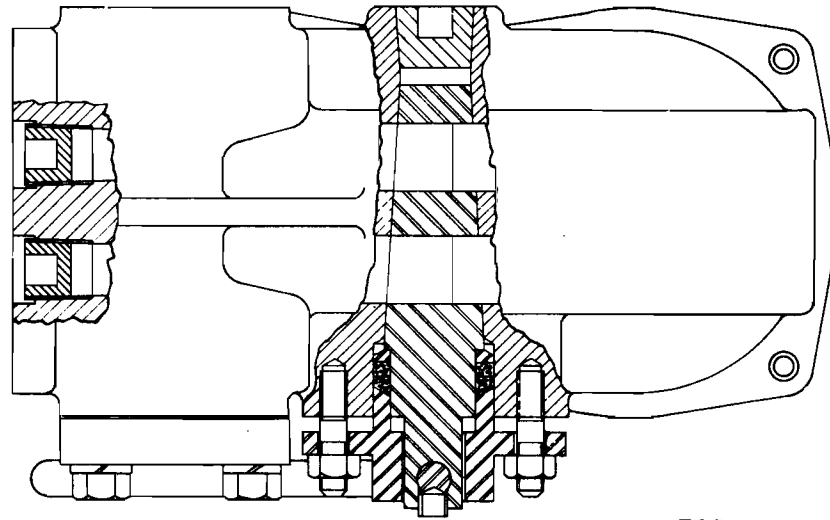
The handle on the side of the filter controls the flow of fuel through the filter elements. The handle should be either to the left or right so that only one filter is in operation at a time. By observing the condition of the elements when they are removed for cleaning, a definite schedule can be set up so that at regular intervals the handle is turned and the element cleaned.

SPECIFICATIONS

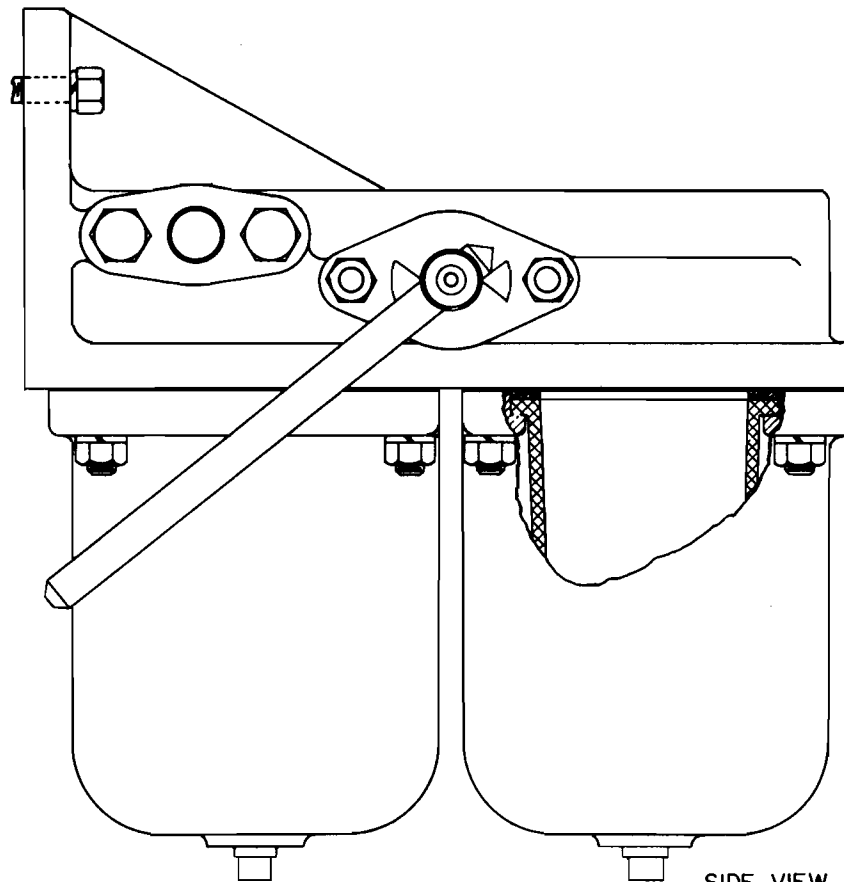
FUEL OIL SPECIFICATION

Flash (Min.)	150° F.
Viscosity (S.S.U.) at 100° F.	35-70
Viscosity (S.S.U.) at 32° F. (Max.)	100
Conradson Carbon (Max.) . . . . .	.5
Pour Point in degrees F. (Max.)	0
Water and Sediment (Max.) . . . . .	.1%
Ash (Max.) . . . . .	.02%
Sulphur (Max.) . . . . .	.5%
Cetane Number (Min.)	50

NOTE: It is desired that the fuel be free from any acid which, in contact with any metal, will form soap in sufficient quantities to plug up the fuel filters.



TOP VIEW



SIDE VIEW

DUPLEX FUEL OIL FILTER

S E C T I O N X I V

BLOWER AND AIR INTAKE SILENCER

GENERAL DESCRIPTION

In the scavenging process employed in these two-cycle engines air forced into the cylinders by the blower (See Plate 1328) thoroughly sweeps out all of the burned gases through the exhaust valves, and effectively cools the internal engine parts.

The blower supplies the fresh air needed for combustion and scavenging. Two hollow aluminum rotors, each with three lobes, revolve with very close clearances in an aluminum housing bolted to the rear end of the engine. To provide continuous and uniform displacement of the air the rotor lobes are made with a twisted or helical form. Three lobes are provided because this is the smallest number that will give a continuous air flow.

The air entering the blower inlet from the air cleaner is picked up by the lobes and carried to the discharge side of the blower. The continuous discharge of fresh air from the blower creates an air pressure of about three to five pounds per square inch in the air chamber of the crankcase. This pre-compressed air sweeps through the belt of intake ports as soon as the piston uncovers these openings.

As the intake air enters the cylinder it is given a rotational motion by the angle of the intake ports, insuring the expulsion of all traces of burned gas. This rotation continues throughout the compression stroke and improves the combustion.

The front rotor shaft bearings locate the rotors endwise and maintain a clearance between the rotors and the housing. The rotor lobes do not touch but roll together through a set of closely fitted timing gears. All bearings receive pressure lubrication from the engine oil system.

On Plate 1700, Fig. 1 shows a cross section of a blower; Fig. 2 shows the air cleaner; and Fig. 3 shows a cross section of the tachometer drive portion of a blower.

SERVICE INFORMATION

1. SERVICING BLOWER:

Blowers should be returned to Electro-Motive Corporation for repair.

2. CLEANING AND LUBRICATING BLOWER INTAKE CLEANER:

This operation is of great importance and should be done thoroughly and frequently. Remove the element and wash it in an air-agitated tank of petroleum solvent, carbon tetrachloride, Oakite, or any cleaner which cuts all the dirt and oil film from the filter. Dry the element with compressed air and dip it in clean, warm engine oil for a few minutes. Allow the element to drain for at least 12 hours in a warm room. This procedure should be repeated on an average of once a week, depending on operating condition. A drawing of a tank for cleaning air filters will be sent upon request.

It is very important that the filter housing be thoroughly wiped out and cleaned each time the element is removed for cleaning or any other reason.

3. BLOWER INSPECTION

It is recommended that blowers be allowed to run four years or one million miles in road locomotive service. (This will include passenger, freight and transfer locomotives). It is recommended that blowers be run for six years in switching service. At this time the blowers can be sent in to EMC for rebuilding on a unit exchange basis.

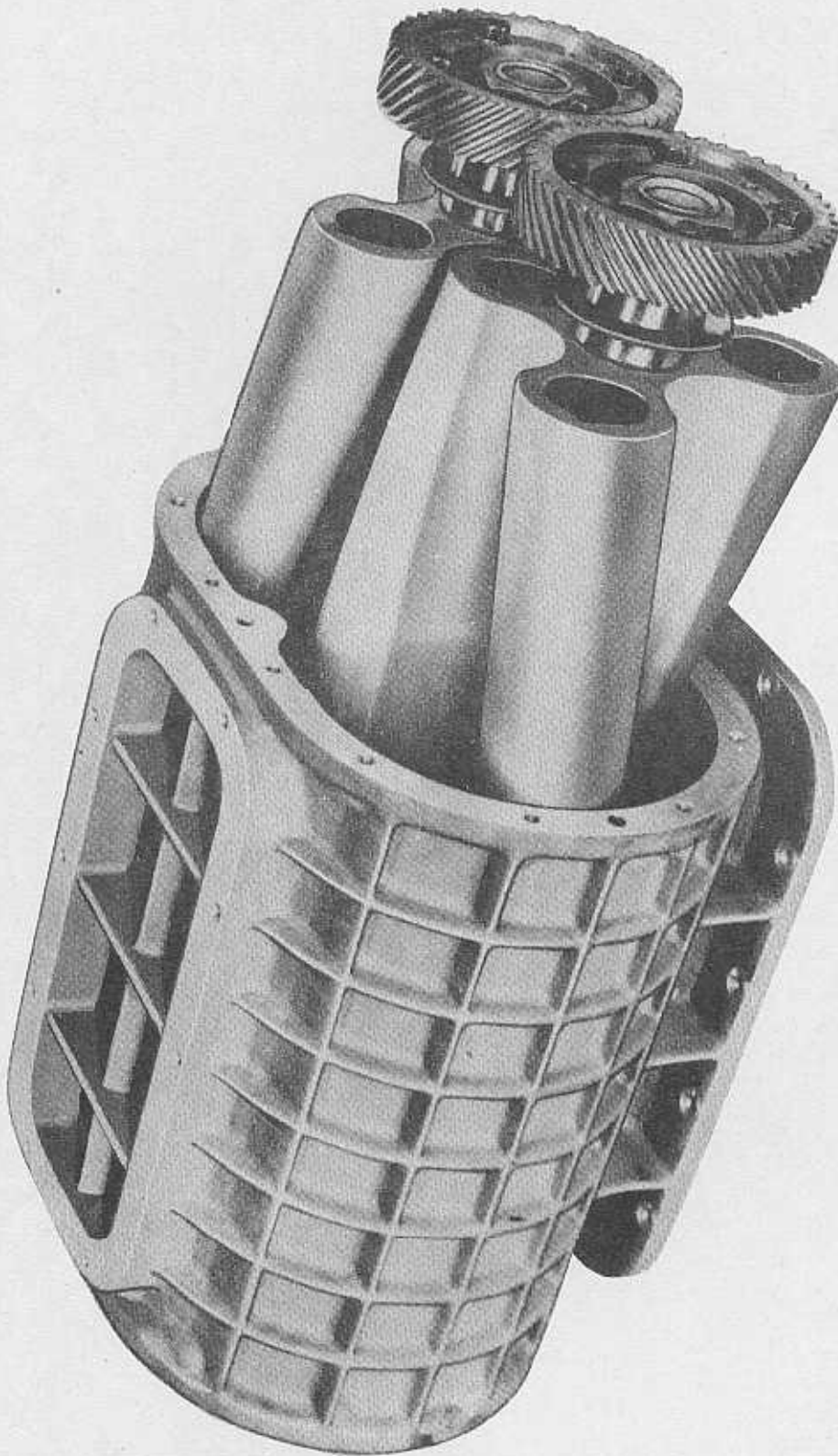
If bearing wear on blowers becomes great enough for actual rotor interference, maintainers will be quickly warned by an actual clicking noise of the blower rotors. Also there will be definite chowing of aluminum dust in the blower support housing and in the air box. Such a blower should be removed at once.

If blower oil seals are badly worn, an excessive amount of lubricating oil will be found running down the blower support housing into the air box.

SPECIFICATIONS

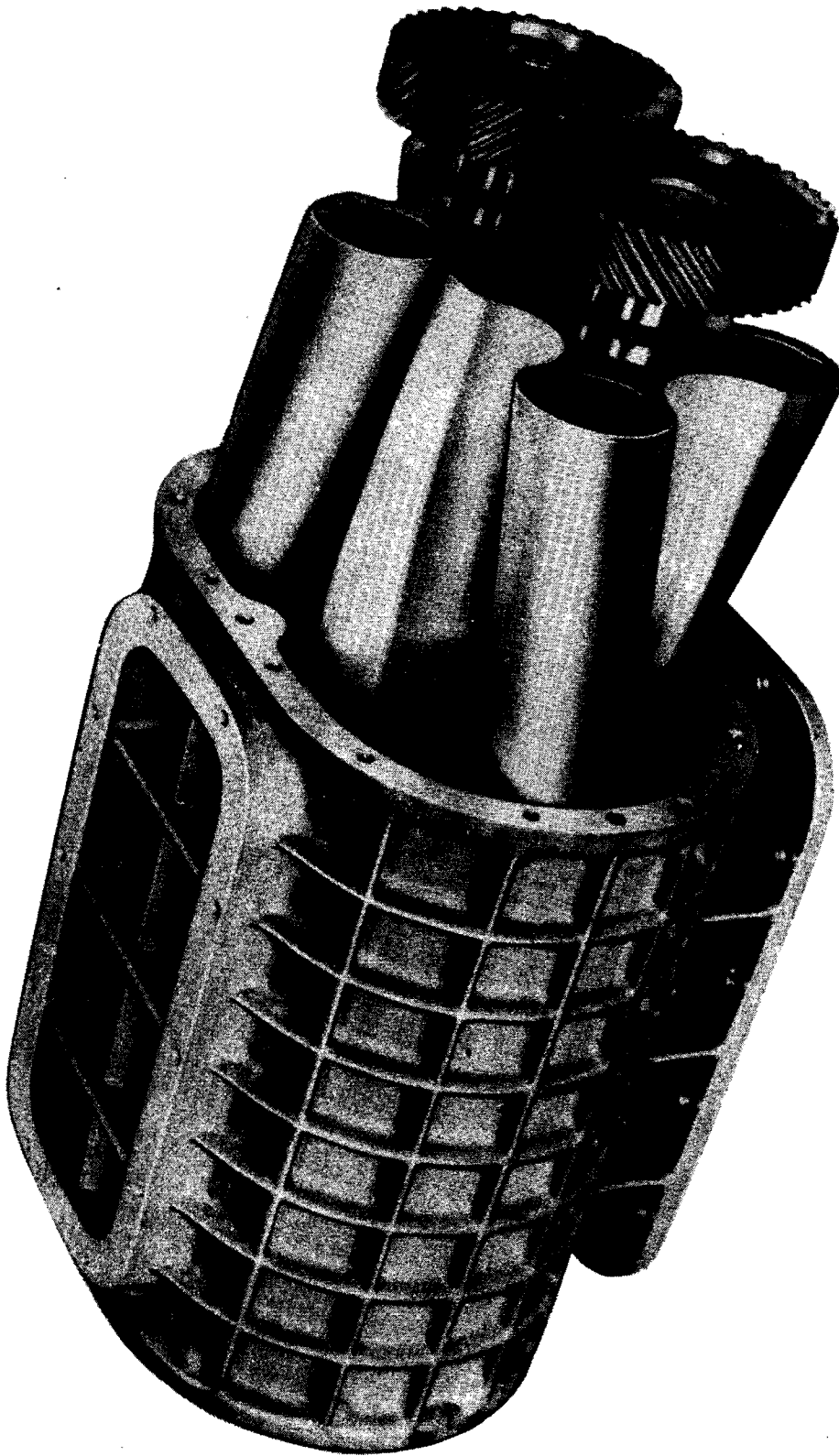
	6 & 12 CYL.	16 CYL.
Blower speed (At 800 R.P.M. of engine) . . .	1490 R.P.M.	2030 R.P.M.
Tachometer speed at blower (if mounted here)	1490 R.P.M.	2030 R.P.M.
Blower capacity (per blower)	2100 C.F.M.	2860 C.F.M.
Blower head at 800 R.P.M. of Engine (Approx)	6-8" of Mercury	
	NEW	COND. LIMIT
Clearance - Rotor to Rear End Plate . . . .	.012" - .023"	
Clearance - Rotor to Front End Plate . . . .	.0085" - .0165	
Clearance - Housing to Rotor . . . . .	.008" - .012"	
Clearance - Rotor to Rotor . . . . .	.008" - .012"	
Radial Clearance - Rotor Shaft Brg. . . . .	.003" - .0045"	.008"
Thrust Clearance - Rotor Bearing . . . . .	.002" - .005"	.010"
Backlash - Synchronizing Gears . . . . .	.0015" - .0025"	.006"

JANUARY 1941



BLOWER
PLATE 1328

JANUARY 1941



BLOWER
PLATE 1328

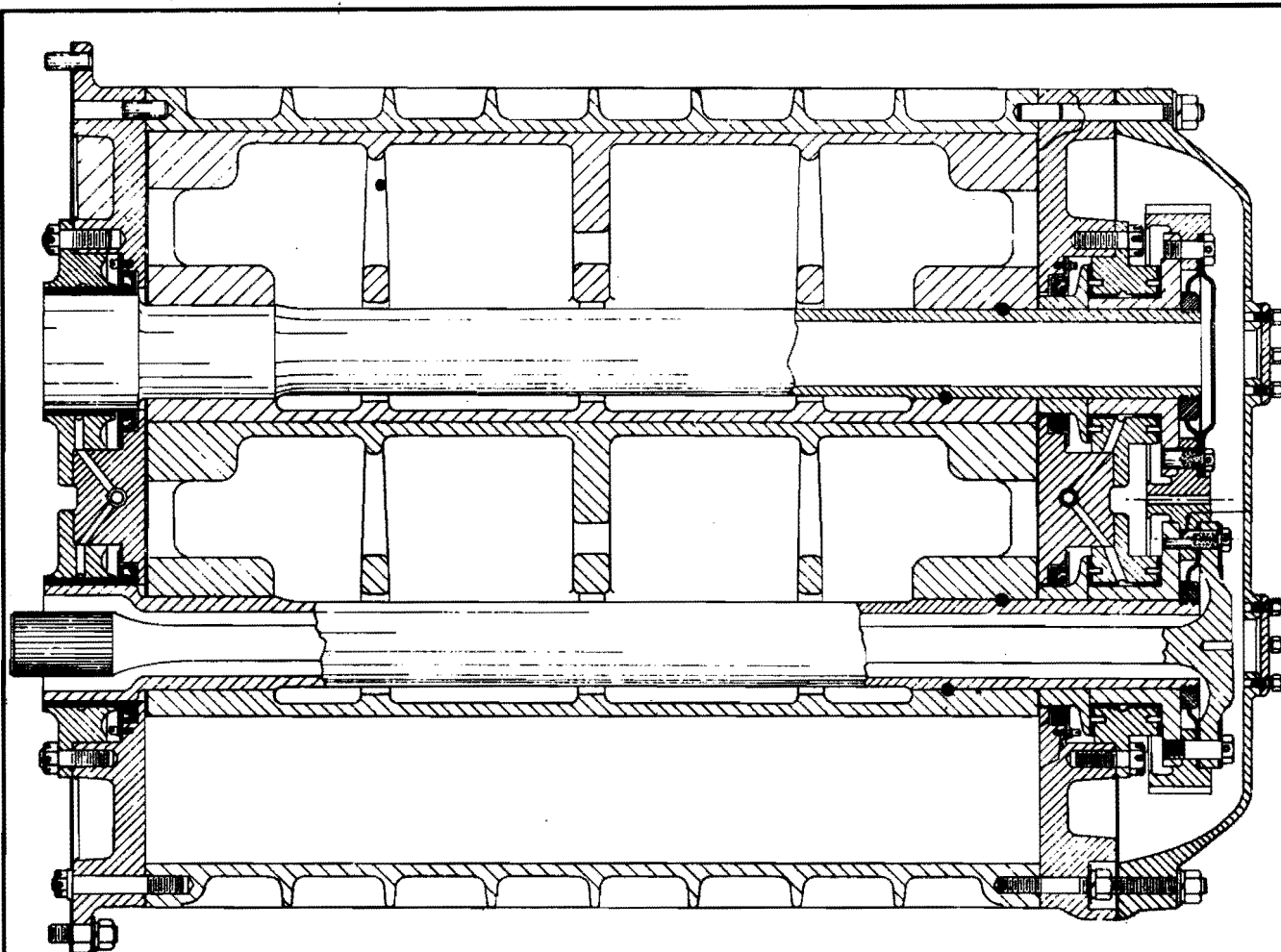


FIG. 1

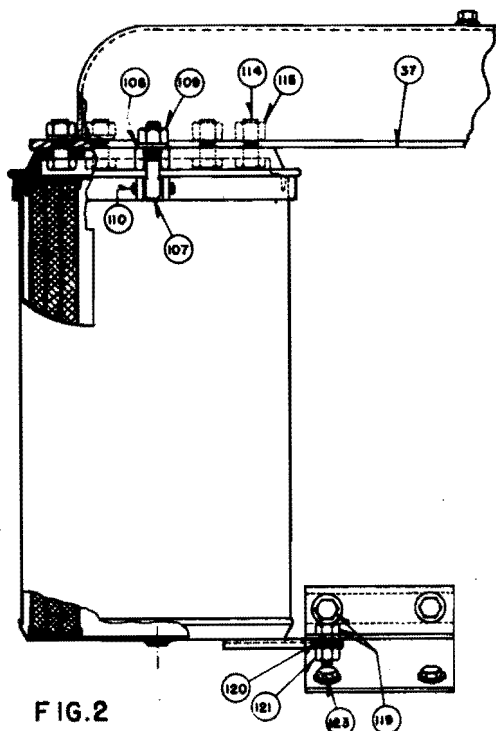


FIG. 2

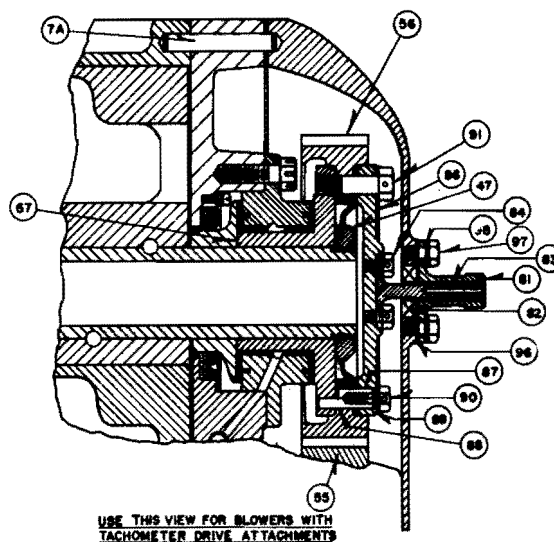


FIG. 3

BLOWER AND AIR CLEANER

E.M.CORP.
APR. 18, 1941

SECTION 15

S E C T I O N XV

ACCESSORY DRIVES

GENERAL DESCRIPTION

ACCESSORY DRIVES

The oil pumps, water pumps, and governor are driven from a spur gear train located at the front of the engine.

On the top of the accessory drive housing is a breather of the copper wool type. This accessory drive housing also contains the harmonic balancer on the crankshaft. (Not on all engines.)

SERVICE INFORMATION

1. REMOVING ACCESSORY DRIVE HOUSING COVER:

First remove all piping and linkage, then remove oil and water pumps, governor, and governor drive. Pull the cover away from the engine (with the weight completely taken by jacks or a crane) until all studs are clear. Care must be taken not to put any weight on the studs.

2. CLEANING BREATHER:

Wash in a petroleum solvent, (not gasoline) and dry. Dip in #10 oil and let drain before replacing.

3. ACCESSORY DRIVE GEAR

The accessory drive gear (mounted on the crankshaft) is of two sections, an inner and outer. Power is transmitted from one to the other through leaf springs, lubricated from the engine oil system. The inner and outer portion of this gear should not be binding. The gear should be inspected for broken springs whenever work is being done to this part of the engine. This gear is shown on Plate 4-3, 4-4, 4-5 and 17-11.

SECTION 15

E.M.CORP.
APR. 18, 1941

SPECIFICATIONS

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ACCESSORY DRIVE	NO. TEETH	RATIO TO CRANK.
Crankshaft	113	1
Scav. Oil	80	1.41:1
Press. Oil	80	1.41:1
Gov. Drive	113	1:1
R. Water Pump	37	3.05:1
L. Water Pump	-	-

8 - 567

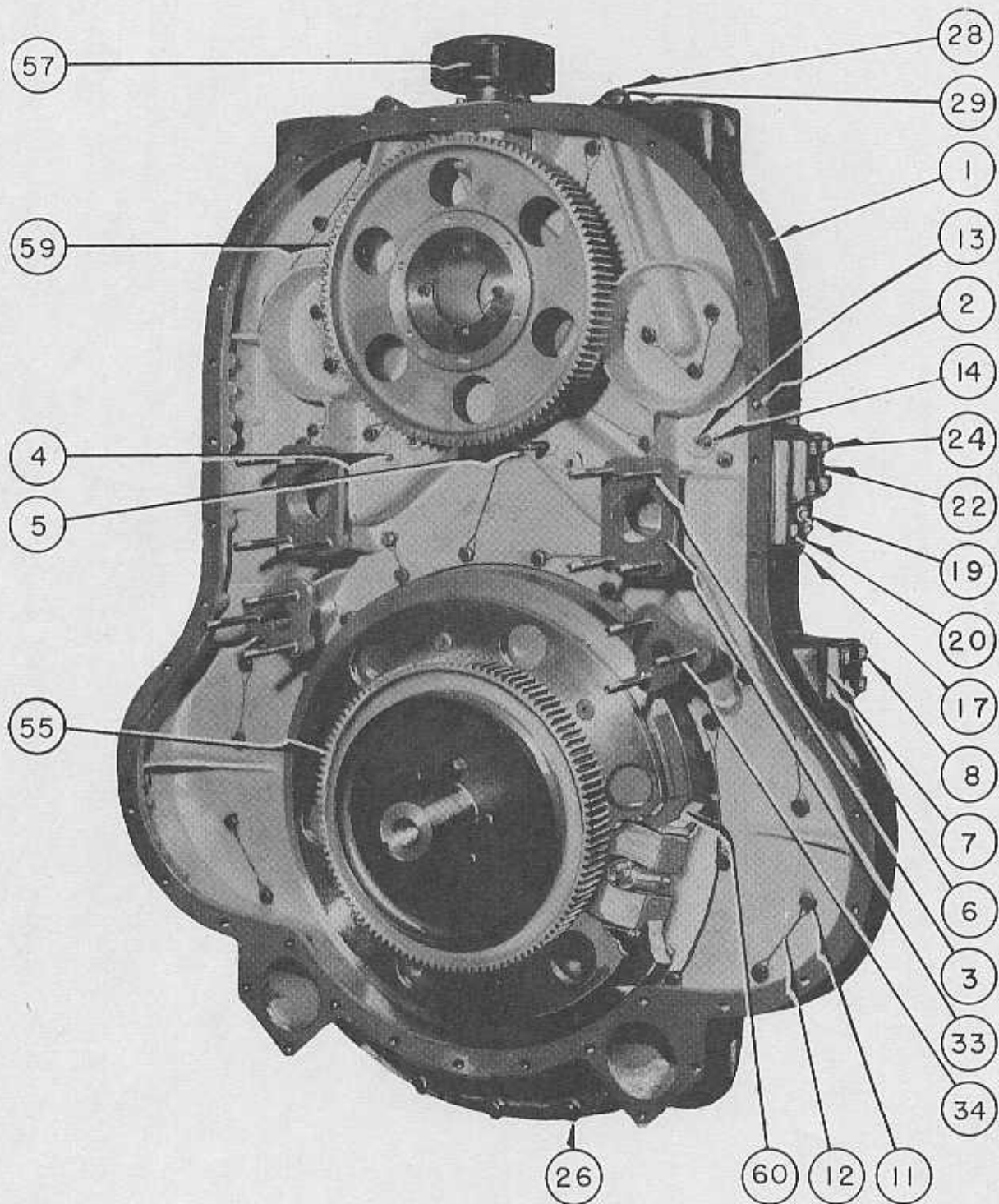
NO. TEETH	RATIO TO CRANK.
113	1
80	1.41:1
80	1.41:1
113	1:1
37	3.05:1
-	-

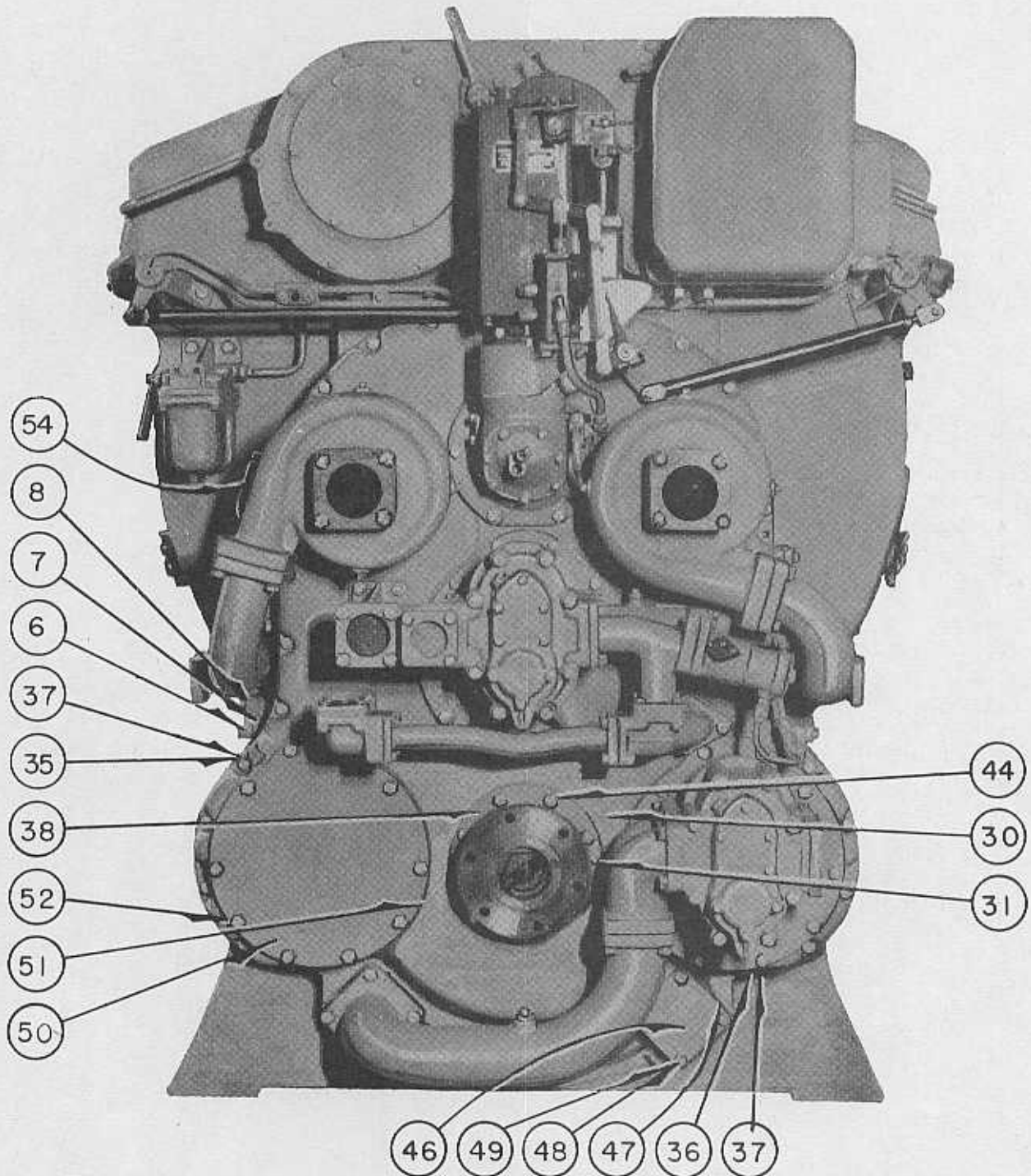
12 - 567

Crankshaft	113	1
Scav. Oil	80	1.41:1
Press. Oil	80	1.41:1
Gov. Drive	113	1:1
R. Water Pump	37	3.05:1
L. Water Pump	37	3.05:1

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113	1
80	1.41:1
80	1.41:1
113	1:1
37	3.05:1
37	3.05:1





ACCESSORY DRIVE HOUSING
PLATE 17-II

E.M.CORP.
9-12-41

150 Rev.C.

ELECTRO-MOTIVE CORPORATION
OPERATING AND MAINTENANCE BULLETIN 150
MODEL 567 ENGINE

CHANGE NOTICE NO. 1

- 1.- Insert plate 1775 Rev. C. in place of plate 1775 Rev. B.
- 2.- Add the following paragraph to page 105.

OVERSIZE LINERS

The dimensions of cylinder liners which are oversize are similar to those on Plate 1775 except that each figure shown indicating diameter is increased by .030" or .060" as the case may be. These are the two oversizes supplied. A standard liner which has worn beyond the limits prescribed on Plate 1775 can be returned to E.M.C. for refinishing to the next oversize.

When measuring the wear of oversize liners, simply add .030" or .060" to the figures given on Plate 1775.

- 3.- On page 303, third paragraph from top, change to read "The blade connecting rod will be in the right bank."
- 4.- On page 1202, add to the last line "2000 H.P. Passenger Locomotives with minimum start field." The setting for this is the same as for the Freight Locomotive.

Attached - Plate 1775 Rev. C.

Changed By : R. L. Eby
Date: Sept. 12, 1941

H. B. Ellis,
Service Manager

