RESTRICTED

TM 9-1727

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

# GUIBERSON ENGINE, MODEL T-1020

APRIL 8, 1942

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TECHNICAL MANUAL No. 9-1727.

WAR DEPARTMENT,
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## ORDNANCE MAINTENANCE
# GUIBERSON ENGINE, MODEL T-1020

Prepared under the direction of the Chief of Ordnance

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## SECTION I

# INTRODUCTION



1. **Purpose.**—This manual is published for the information and guidance of all personnel charged with the maintenance and overhaul of the Guiberson T-1020 tank engine used on light tanks.

2. **Scope.**—This manual contains information on the detailed construction of the unit, disassembly, and assembly procedure, inspection, maintenance, and repair supplementary to those covered in TM 9-727.

3. **References.**—Section XVI lists all Technical Manuals, Standard Nomenclature Lists, and other publications relative to the material described herein.

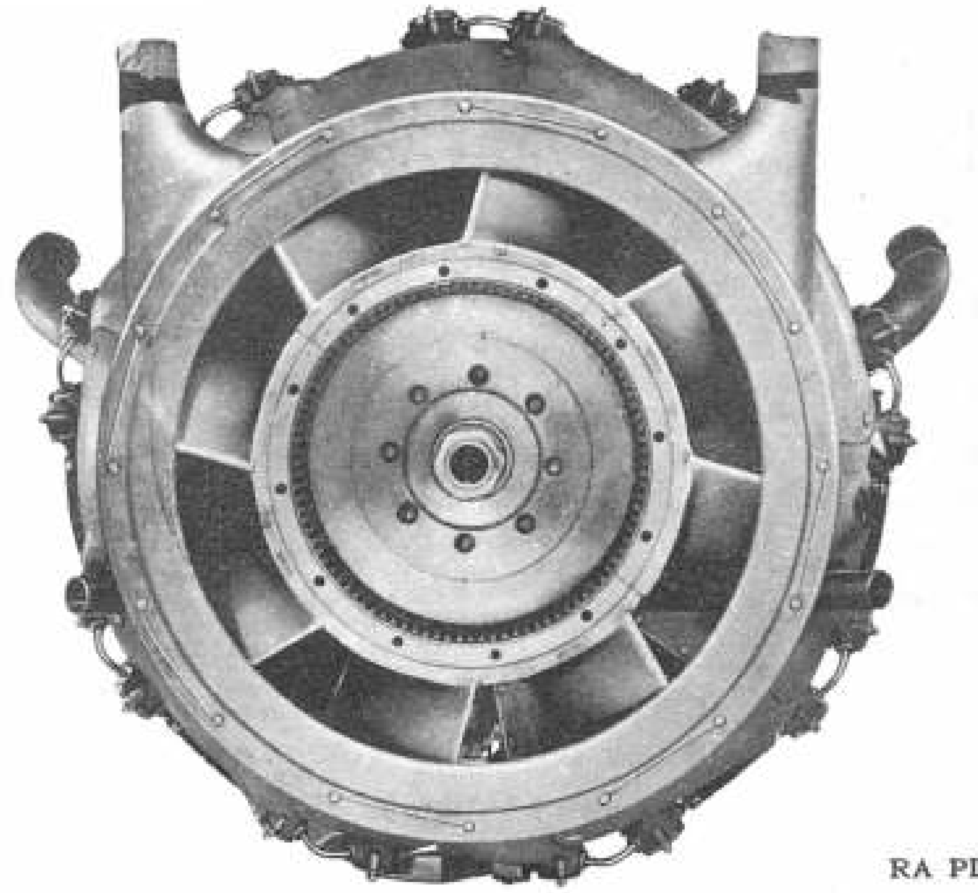

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FIGURE 1—Front view of engine.

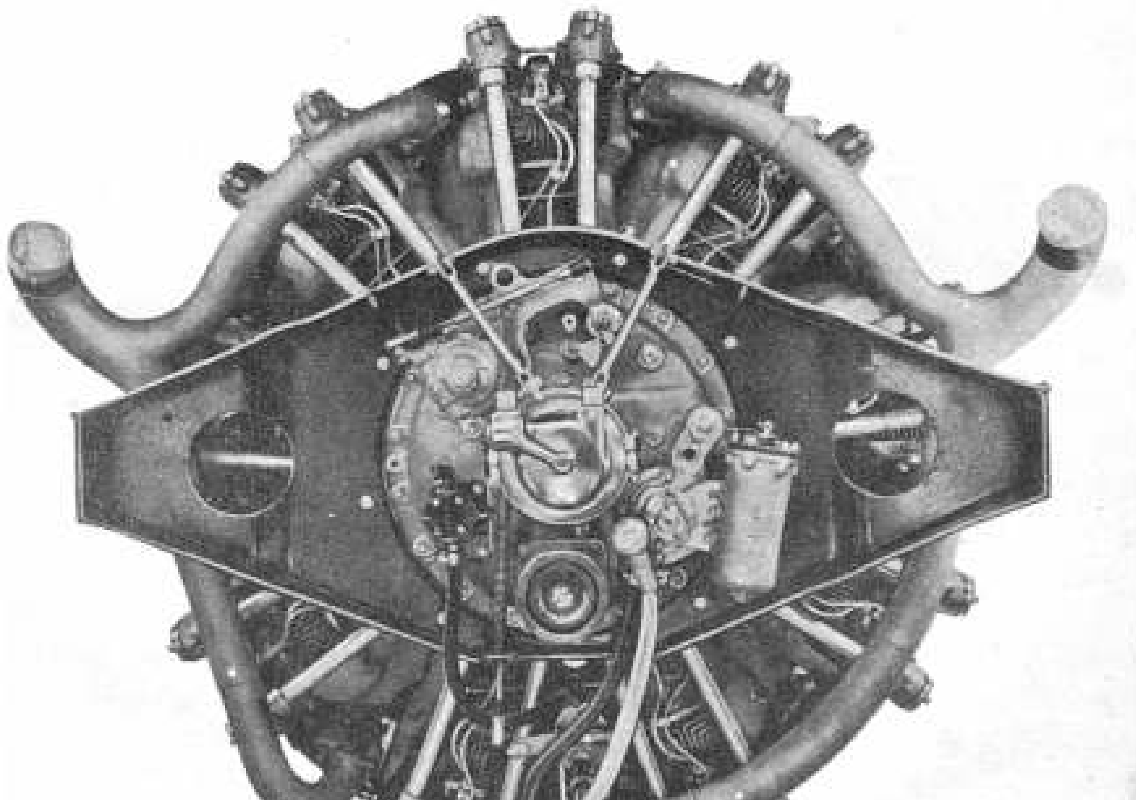

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FIGURE 2—Rear view of engine.

## SECTION II

# DESCRIPTION AND TABULATED DATA



4. **General description.**—*a.* The Guiberson Diesel Engine, Model T-1020, is a nine-cylinder radial engine, air-cooled, and using fuel oil for fuel. Cooling fins around the cylinder heads and barrels are provided for heat radiation, and baffles direct the flow of air to the cylinders.

*b.* The engine is mounted vertically in the tank with the intake manifold and shroud facing the front of the tank; therefore the intake manifold side of the engine is referred to as the front of the engine and the exhaust manifold side of the engine is referred to as the rear.

*c.* The cylinders fire anticlockwise, facing the front of the engine, the firing order being 1-3-5-7-9-2-4-6-8. Number one cylinder is at the top of the engine.

*d.* Air is drawn into the intake manifold through a vertical air horn and air cleaner at each side of the engine. The air is compressed in the combustion chamber to a ratio of 14.5 to 1. This compression raises the temperature of the air sufficiently to ignite the fuel oil which is injected at the proper time.

*e.* Fuel is pumped to a drilled passage in the crankcase by the fuel supply pump, and thence to each of the individual injection pumps. Individual injection pumps at each cylinder build up the fuel pressure so that the fuel can be injected into the highly compressed air. The injection pump also measures the correct amount of fuel for each injection. The injection of the fuel into the combustion chamber is controlled by a fuel injector at each cylinder.

*f. (fig. 4)* The action of the fuel injection pumps is controlled by a fuel control plate assembly on the crankshaft. The injection pump plungers ride on levers of the fuel control plate assembly. These levers move up and down, actuated by the lobes of the fuel cam ring over which they operate, to move the injection pump plungers up and down. The position of the plunger on the lever is controlled by the throttle and determines the length of stroke, and amount of fuel injected.

*g. (fig. 5)* Valve tappets operate on the valve cam. Both the intake and exhaust valve tappets operate over the same cam.

*h. (fig. 4)* A decompression plate and ring are also parts of the valve cam and fuel control plate assembly. When the throttle is pulled beyond the shut-off position, the exhaust valve tappets rest on the lobes of the decompression ring, and the exhaust valves are held open. The engine is then on decompression. This permits the exhausting of unburned fuel, especially the lubricant.

*i.* Lubrication of moving parts of the engine is done by oil forced through drilled passages. Oil is drawn from an external tank and circulated through the engine. Before it is returned to the tank, it is passed through filters to remove impurities and through oil coolers to reduce the temperature.

5. **Engine characteristics.**—a. General specifications.—

| | |
|---|---|
| Bore | 5⅛" |
| Stroke | 5½" |
| No. Cylinders | 9 |
| Cylinder Arrangement | Radial |
| Total Piston Displacement | 1021 cu. in. |
| Rated Crankshaft rpm | 2200 |
| Cooling Media | Air |
| Cycle | 4 stroke |
| Compression Ratio | 14.5 to 1 |
| Fuel Injection | Solid |
| Rotation (Facing front) | Anticlockwise |

*b. Performance.*—

| | |
|---|---|
| Maximum rpm | 2250 |
| Rated BHP at 2200 rpm | 250 |

*c. Fuel consumption with specified fuel:* (lbs per BHP per hour). —

| | |
|---|---|
| at 2200 rpm — Full Power | .415 |
| at 1870 rpm — Full Power | .395 |
| at 1320 rpm — Full Power | .415 |

*d. Lubricating oil consumption:* (lbs per BHP per hour). —

| | |
|---|---|
| at 2200 rpm — Rated Power | .021 |
| at 1870 rpm — Full Power | .023 |
| at 1320 rpm — Full Power | .020 |

*e. Temperatures.*—

| | |
|---|---|
| Exhaust flange temperature at the stud nearest the center of the head—Maximum | 500 F |
| Cylinder flange temperature—Maximum | 300 F |

*f. Dimensions* (overall).—

Overall diameter ........................................ 45-$\frac{7}{16}$"

Length with Coffman Starter ........................................ 36-$\frac{13}{16}$"

*g. Center of gravity.*—

Horizontal........................Forward of mounting ring by approximately 7".

Vertical........................................ Crankshaft center.

**6. Crankcase.**—The crankcase consists of two aluminum alloy castings bolted together on the center line of the cylinders. Hardened bearing liners are pressed into the front and rear portions of the case. Ball or roller bearings fit these liners and furnish support for the crankshaft. Valve tappet guides and the fuel injection pumps are located in the rear case which is provided with mounting bosses. The fuel channel is bored in the rear case between the fuel pump bosses.

**7. Cylinders.**—Heat-treated aluminum alloy cylinder heads are screwed and shrunk onto forged steel barrels. Cooling fins are provided on the barrels and cylinder heads to provide radiation surface. Cylinder bores are bored to mirror finish and held within extremely close limits. Valve seats made of special materials are shrunk in the cylinder heads. The rocker boxes are cast integral with the heads.

**8. Pistons.**—Heat-treated aluminum alloy pistons are provided with three compression rings and one oil ring above the piston pin, and one scraper ring in the skirt. The pistons are forged. The full-floating piston pins have aluminum alloy plugs for the piston pin retaining device.

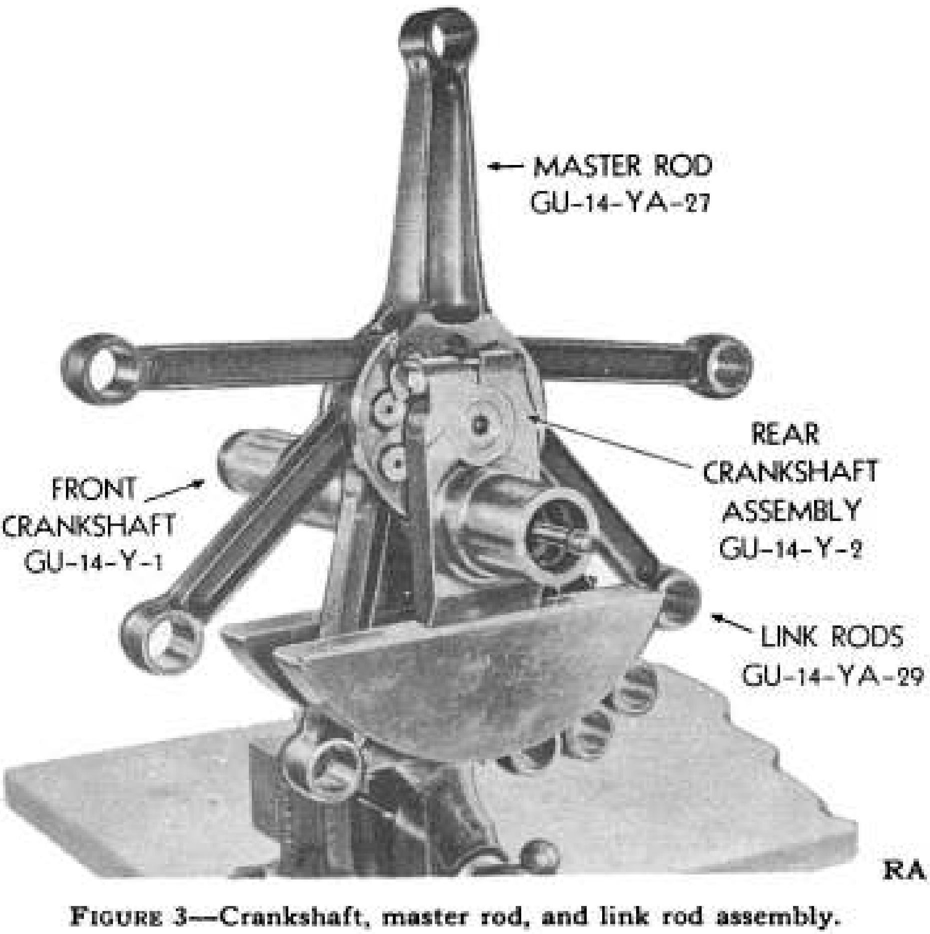


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FIGURE 3—Crankshaft, master rod, and link rod assembly.

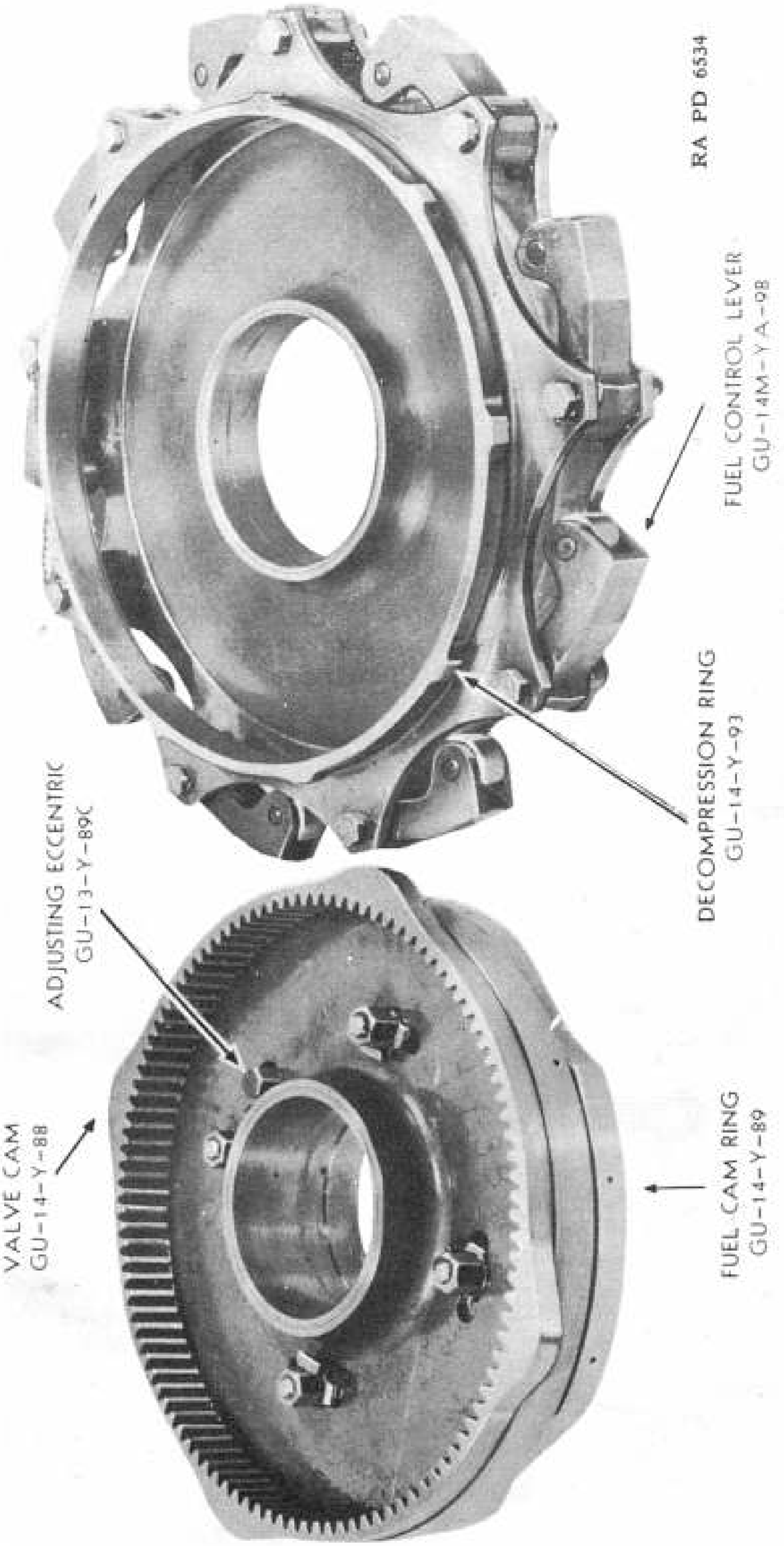


FIGURE 4—Valve cam and fuel control plate assembly.

**9. Master and articulated rod assembly.**—*a. Master rod.*—The master rod is an "H" section of forged steel, heat-treated, and machined. The crank pin bearing is an integral type, precision-bored, steel-backed, lead-bronze bushing. The link rods operate on knuckle pins secured in the master rod by retaining rings. The master rod is drilled to provide pressure lubrication to the knuckle pin bushings.

*b. Link rods.* — The link rod is an "H" section with machined ends. Knuckle pin bushings and piston pin bushings are pressed into the link rods. All bearings are jig-bored for alinement and center distance.

**10. Crankshaft.**—The crankshaft is a two-piece heat-treated steel forging drilled throughout for lightness and plugged to form oil passages. The shaft is of the one-throw design and is completely machined. The crankpin is carburized for hardness and is accurately ground to size. The crankpin step is accurately ground and fitted to a ground hole in the rear cheek where it is clamped in place. The shaft is supported by two roller bearings referred to as main bearings and one ball thrust bearing secured in place at the forward end against a spacer sleeve and lock nut. The flywheel end of the shaft is machined with a spline (aeronautic) modified in length for the flywheel hub.

**11. Valve cam and fuel control plate assembly.**—*a. Valve cam.*—*(fig. 4).* The valve cam is of forged steel, completely machined and hardened. The intake and exhaust lobes are unified so that one lobe operates both the intake and exhaust tappets per cylinder and is known as a monorail cam with four lobes. The valve cam is carried on a bronze bushing. The valve cam drive gear is integral with the cam, turning one-eighth engine speed in the direction opposite to the crankshaft rotation. The valve cam drive gear meshes with the pinion gear which is attached to the intermediate gear. The intermediate gear is driven by the starter jaw crankshaft gear.

*b. Fuel cam ring.*—*(fig. 4).* The fuel cam ring is of forged steel, heat-treated and machined all over. The fuel cam ring is secured to the valve cam by four mounting bolts. Slots in the valve cam permit the fuel cam ring to be turned relative to the valve cam for fuel-timing the engine. A fuel cam adjusting eccentric extends through the valve cam for adjusting the fuel cam ring when the securing nuts are loosened.

**12. Valve operating mechanism** *(fig. 5).*—*a.* The tappets, which operate the valves, have rollers which ride on the valve cam. The tappets fit into aluminum alloy guides which have threaded top sections. The push rod housing nut screws onto this threaded top section of the valve guide, keeps the push rod housing in alinement, and forms an oil-seal.

*b.* The push rods, which set on the valve tappets and operate the valve rocker arms, are made of light steel tubing with pressed-in ball ends, hardened and ground. The push rod is fully enclosed. The top end fits into an adjustable socket in the rear of the rocker arms. The inner end of the push rod is marked with an arrow. This indicates the end of the