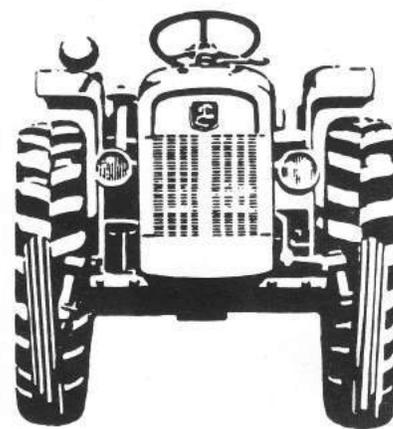


**SATOH  
TRACTOR  
S-650G  
REPAIR  
MANUAL**



**SATOH AGRICULTURAL MACHINE MFG. CO.,LTD.**

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**SATOH TRACTOR**

**MODEL S-650G**  
**REPAIR MANUAL**

**ENGINE SYSTEM**

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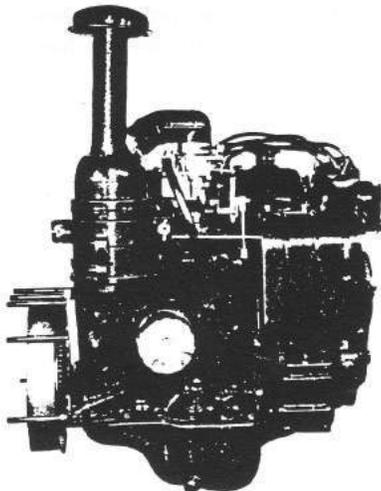
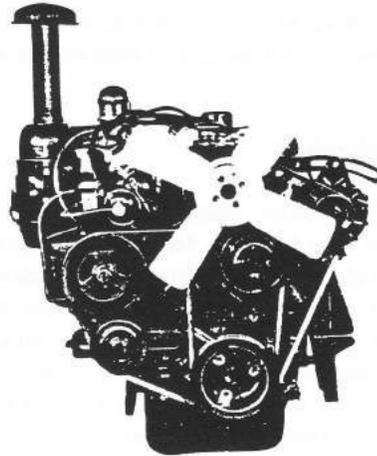
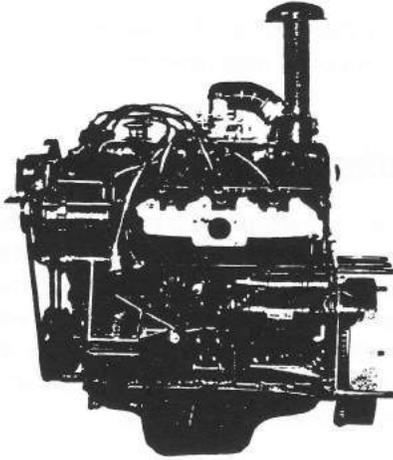
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## THE ENGINE-GENERAL

This PB engine is a high performance, water-cooled, 4-cylinder, in-line gasoline engine, employing the overhead valve and high cam shaft system. The cylinder bore and the piston stroke measure 2.6772 in. (68 mm) and 2.6772 in. (68 mm), respectively. In this sense, the cylinder is of a square type, having a total displacement of 60.2 cu. in. (987 cc) and a compression ratio of 8.6 to 1. The maximum output is 25 PS at 2,800 r.p.m. and the maximum torque 46.9 ft-lb/2,200 r.p.m. (6.5 kg-m/2,200 r.p.m.). The description of the engine is as follows:



## 1. Cylinder Head

Being made of a light alloy, the cylinder head is light in weight, providing excellent radiation efficiency. The dome-shaped combustion chamber is shrinkage-fitted with ductile cast iron valve seats. The intake and the exhaust valves are arranged opposite to each other the cylinder head; that is, the cross-flow design is employed for better combustion efficiency.

## 2. Cylinder Block

The cylinder block is precision-cast from a light alloy metal by means of pressure die casting. To support the crankshaft, five bearings of the deep skirt type are employed. The cylinder liners are made of special cast iron and replaceable. They are directly cooled by water and sealed with two "O" rings.

## 3. Pistons and Crankshaft

The pistons are of a conical ellipse type manufactured by LO-EX. The crankshaft is made of ductile cast iron superior in durability and wear-resistance, and supported by five main bearings. The main bearings are made of an aluminum alloyed with tin, which is also excellent in durability and wear-resistance.

## 4. Valve Mechanism

The high cam shaft design is employed, along with five special iron bearings, for increased rigidity. This permits high speed revolutions. The cam shaft is driven by a Renold-made chain, whose tension is adjustable by means of the chain adjuster and vibration damper. To reduce the chain noise, the contacting surfaces of the chain is finished with heat-proof and wear-proof rubber.

## 5. Intake and Exhaust Mechanism

The exhaust manifold is made of cast iron, and the intake manifold made of a light alloy metal. Both manifolds are of independent branch type. The hot spot is heated by warmed "cooling water". In the intake system, a Stromberg type carburetor, having a down-draft double-venturi is used.

## 6. Governor

The Governor is of fly weight type and controlled by means of all speed governor system.

## 7. Cooling System

Cooling system is the type of forced-circulation, and the pressure in the radiator is 9.954 lbs/sq. in. by which the high efficiency of heat radiation is secured. Their system is incorporated with the Wax type thermostat and the water pump is of the centrifugal type. The material of cooling fan is the synthetic resin, consisting of 4 wings,

## 8. Lubricating Mechanism

Total pressure lubrication is carried out by a trochoid gear oil pump, which is driven by the cam shaft drive gear. A cartridge type oil filter is employed.

## 9. Electrical System

Electrical component is of 12-volt capacity. The alternator is 16-amp. capacity, and the starter of 1.0-kW. As the battery, the N40L type is used, and the distributor is provided with a vacuum and centrifugal type automatical advancer.

# ENGINE

## 1. Disassembling Order

Note: Notes on Engine Disassembly

- Both engine and transmission are very heavy in weight. In addition, they must be kept in a horizontal position while being disassembled, and therefore, engine disassembly operations should be performed on solid floors.
- To keep the tractor in a horizontal position, place a wooden wedge between the front extension and the axle beam.
- Be sure that necessary wrenches, such as a special tool (No. N033S SOCKET WRENCH SET), special tool (No. BT-100 DOUBLE OFFSET BOX WRENCH SET), and (No. BT-9 OPEN-END WRENCH SET), and other special tools including a chain block are all available on hand.
- Put a mark on each engine component part such as a piston, piston ring, valve, valve spring, metal, tappet, push rod, etc. in order of the cylinders, so that you will not confuse about parts.
- Take special care not to damage the removed parts, and put them in order.

### 1-1. Removing the Engine

1. Remove the negative (-) corde from the battery.
2. Remove the wires from the alternator (A), starting motor (B) and head light (C).

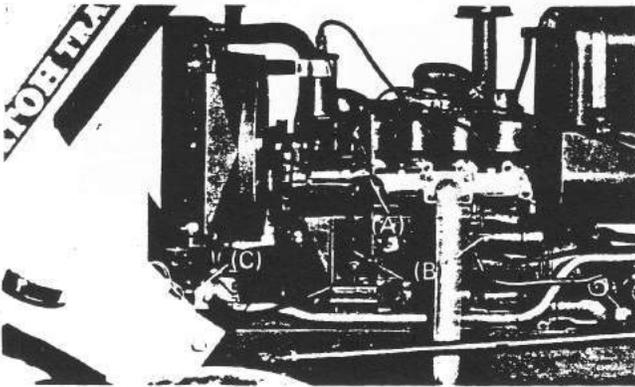


Fig. 1

3. Remove the bonnet.
4. Disconnect the wires from the oil pressure switch (A) and the water heat gauge (B).

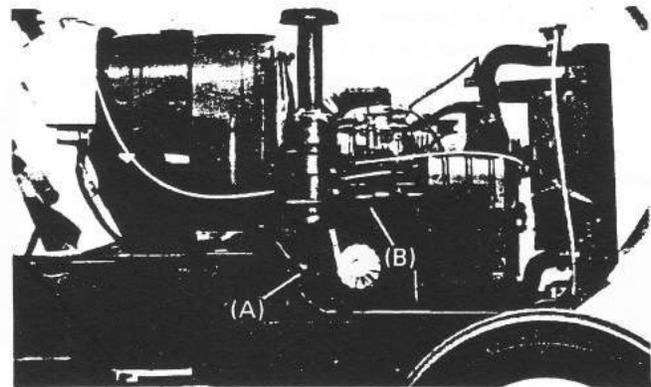


Fig. 2

### 5. Removing the radiator

Thoroughly drain off the cooling water from the radiator and cylinder block. Loose the water hose clip (A) and pull out the water hose from the radiator. Remove the radiator mounting bolts (B), (C), and fitting nut for radiator support (D), and remove the radiator.

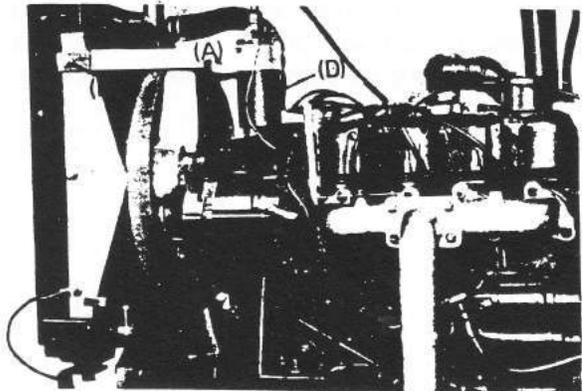


Fig. 3

6. Removing the tractor meter cable, throttle wire and choke wire

Remove the governor cover (A), and disconnect the tractor meter cable (B), throttle wire (C) and choke wire (D). Remove the governor cover.

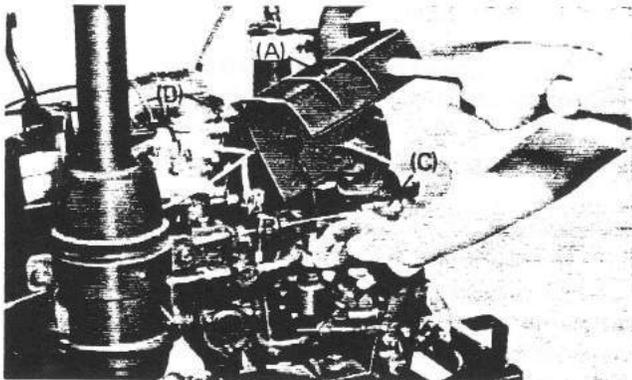


Fig. 4

7. Removing the fuel pipe

Remove the fuel pipe (A). To prevent dust from entering the fuel tank, cover it with a clean dry cloth.

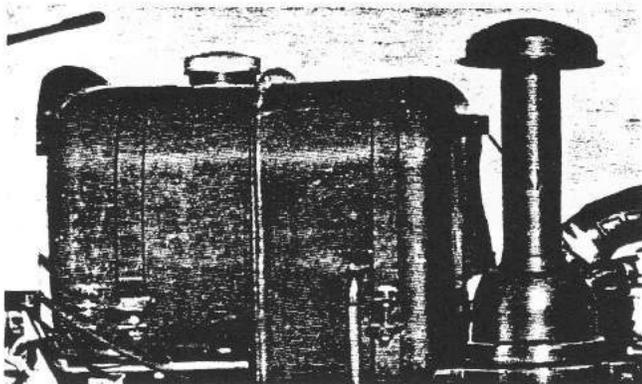


Fig. 5

8. Removing the drag link

Pull out the split pin from the ball socket connecting the Pitman arm and drag link, and remove the slotted nut (A). Remove the ball socket by using the special tool (No. TRH-12 TIE ROD END REMOVER)

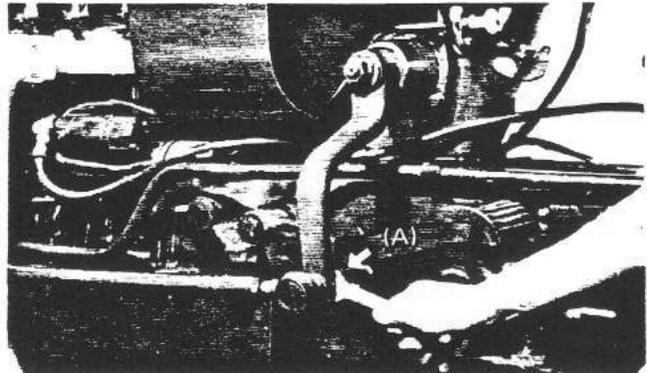
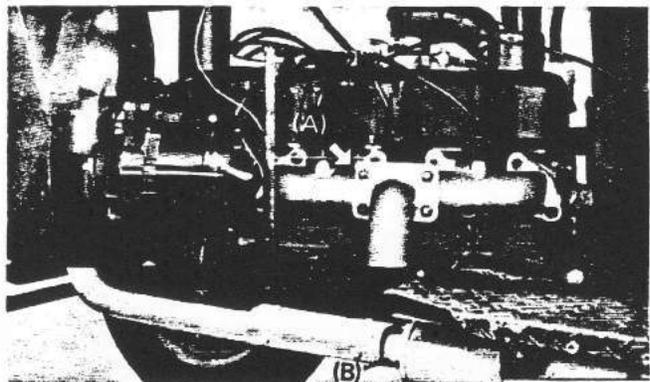


Fig. 6

9. Removing the silencer pipe

Remove the nut (A) mounting both exhaust manifold and silencer pipe, and remove the silencer mounting nut (B). Then remove the silencer pipe.



Figs. 7 and 8

10. Removing the hydraulic oil pipe

a. Remove the hydraulic oil pipe clamp (A).

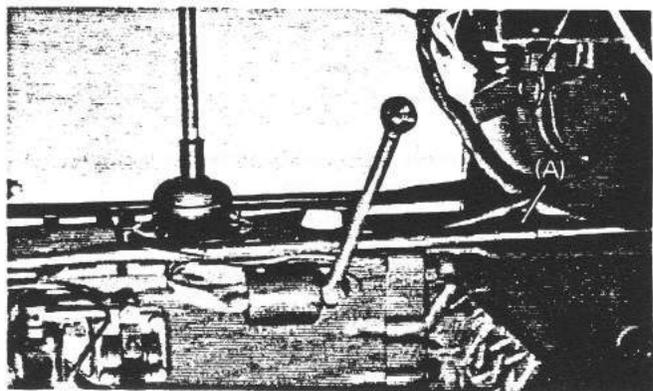


Fig. 9

- b. Remove the magnet plug (B), and drain off the hydraulic oil case. When reusing the oil, put it in a clean container while taking care not to allow dust to enter the oil.

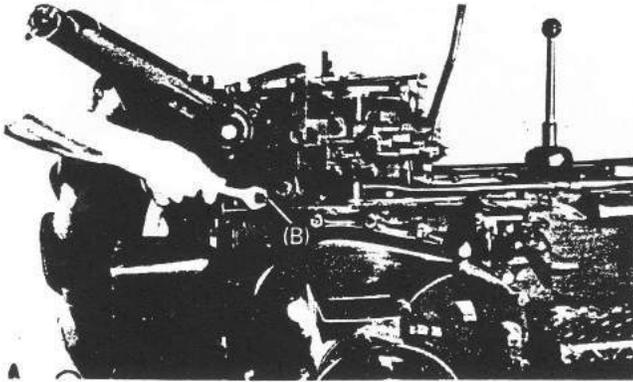


Fig. 10

- c. Remove the banjo bolt (C).

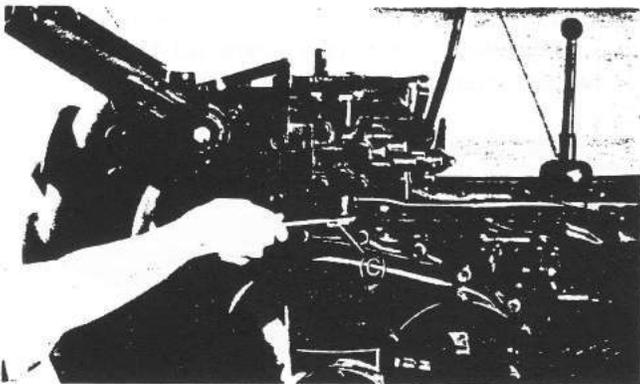


Fig. 11

- d. Loosen the strainer body (D), and take it out.

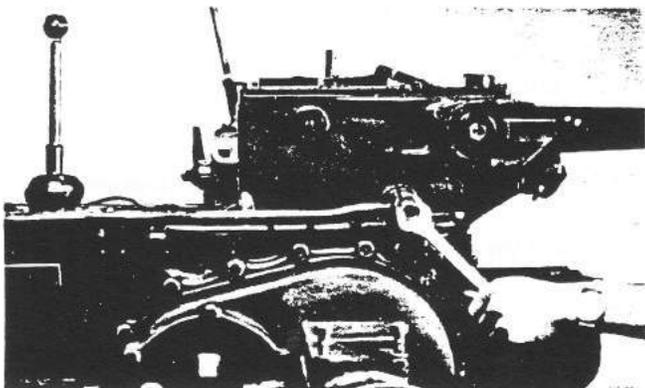


Fig. 12

- e. Remove the pump flange mounting bolt (E) from both inlet and outlet sides. Cover the ends of the pipe so that no dust will enter the pipe.

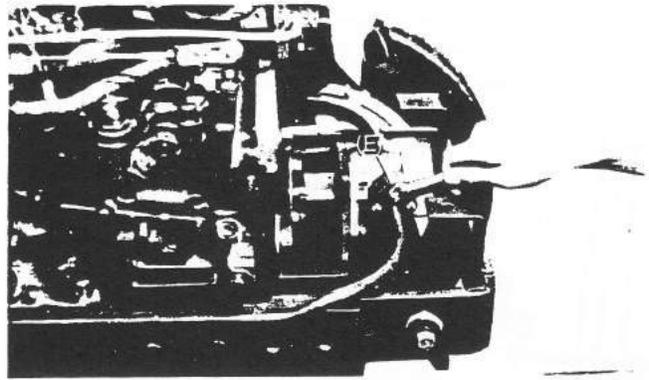


Fig. 13

11. Removing the hydraulic pump and pump bracket. Remove the four bolts setting the pump joint (A), and remove the pump joint. Remove the four nuts (B) from the pump (C). Remove the two screw (M8 x 25) and three bolts (M8 x 45) from the pump bracket, and remove the bracket (D).

Note: As alignment of the center line between crankshaft and the hydraulic oil pump had been correctly fixed at 0.001181 in. (0.03 mm) during factory assembly, do not attempt to remove the pump unless otherwise it is definitely necessary to work out its removal.

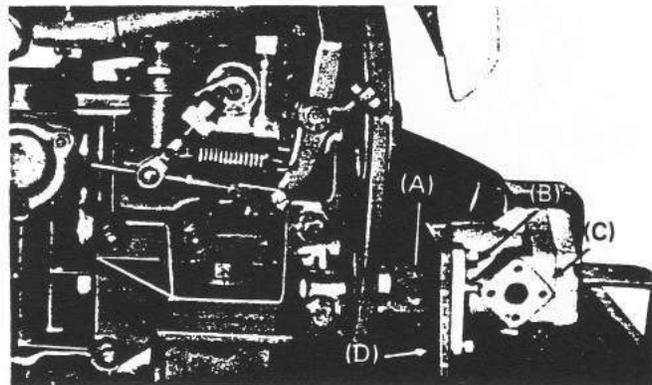


Fig. 14

12. Removing the flange coupling and CG-type rubber coupling

Remove the three bolts which fasten the CG-type rubber coupling to the crank pulley, and remove the flange coupling and CG-type rubber coupling.

13. Remove the engine mounting rubber mounting nut (A) on both right and left sides, and remove the engine support mounting bolt (B).

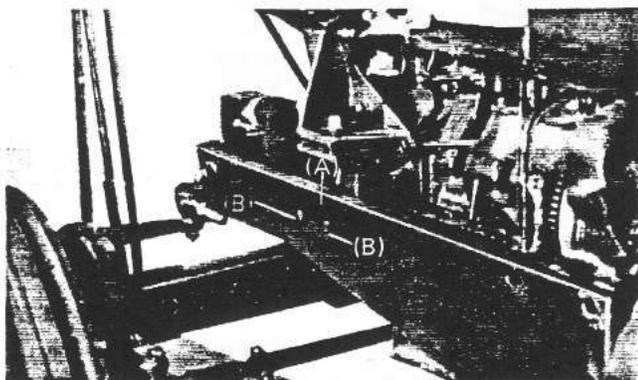


Fig. 15

14. Removing the alternator and V-belt
  - a. Remove the bolt as shown in Fig. 16, and remove the alternator strap (B) from the alternator (A).
  - b. Remove the alternator mounting nut and bolt, and remove the alternator and V-belt (C) from the alternator bracket.

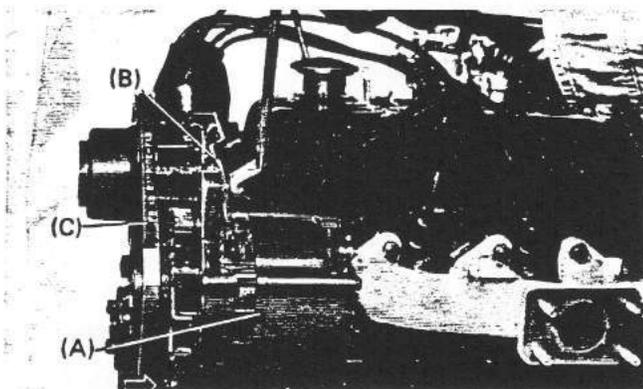


Fig. 16

15. Install the chain block on the engine hanger (A) on the manifold on both exhaust and intake sides. Do not hoist the engine, but pull the wire so that it becomes slightly tight.

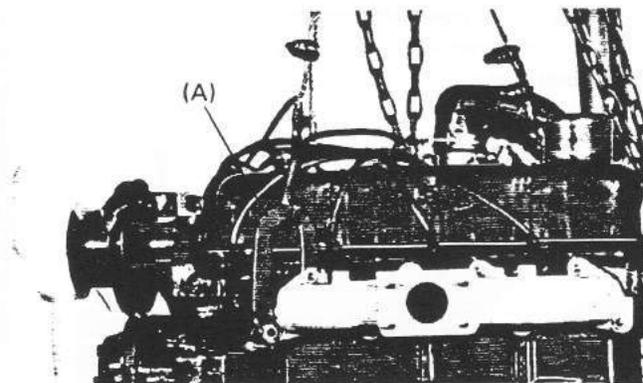


Fig. 17

16. Place a garage jack under the clutch housing. Do not jack up the tractor, just raise the jack so that it is just tightly locked under the tractor.
17. Remove the bolts (A), four each on both right and left sides, and the four bolts (B), also four each on both sides, which mounting the chassis and clutch housing. Remove the three screws (C) from the rear plate, and pull the rear plate downward.

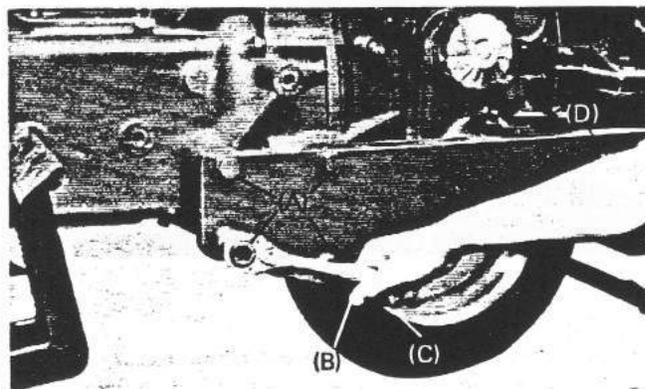


Fig. 18

18. Pull out the chassis and front axle toward the front.
19. Removing the engine mounting and alternator bracket
  - a. Remove the mounting nut, and remove the engine mounting (A) from the alternator bracket.

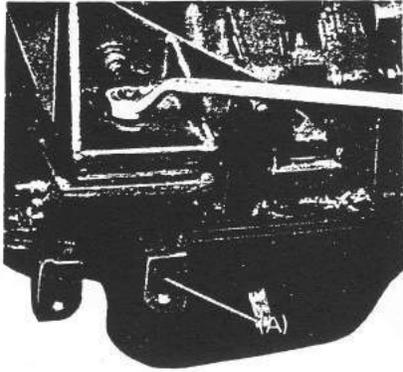


Fig. 19

- b. Remove the three mounting nuts, and remove the alternator bracket (B) from the cylinder block.

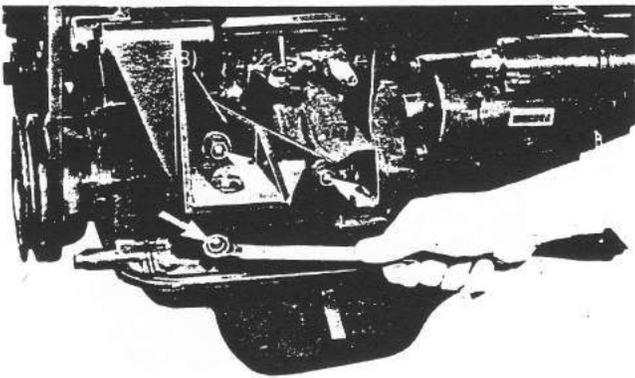


Fig. 20

20. Remove the starter mounting nut, and remove the starter.

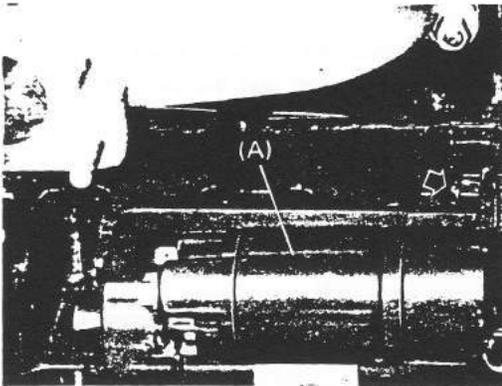


Fig. 21

21. Remove the four nuts (A) and nuts (B) (one each on both right and left sides), which mounting the engine and clutch housing. Next, adjust the chain block suspending the engine so that the stud bolt will not be under excessive load. Then pull the engine toward the front.

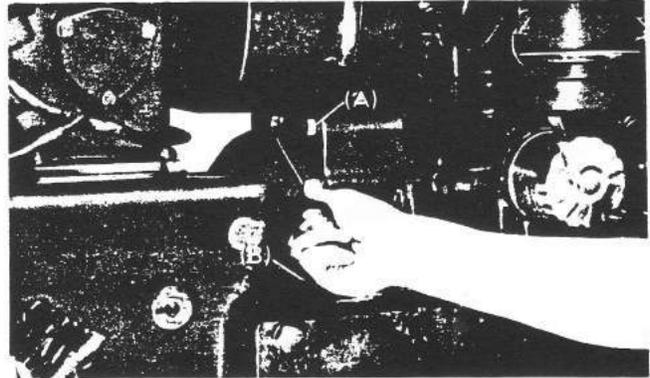


Fig. 22

## 1-2. Disassembling the Engine

1. Install the engine on the special tool (No. 0490010 ENGINE STAND) by means of one bolt and three nuts then removing the clutch unit.

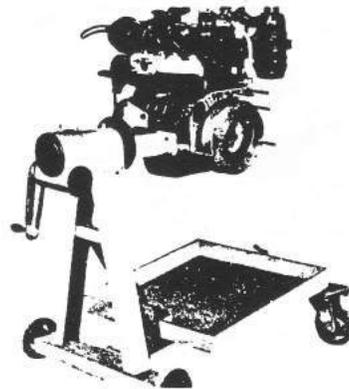


Fig. 23

2. Draining the engine lubricants  
Remove the drain plug and drain off the engine lubricants.

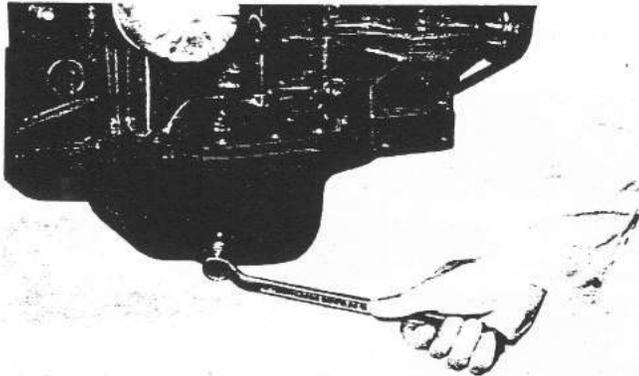


Fig. 24

3. Remove the clutch, flywheel and crank pulley
  - a. As shown in Fig. 25, remove 6 pcs. of screws and remove the clutch. Make sure that the removal order for screws should be diagonally done.

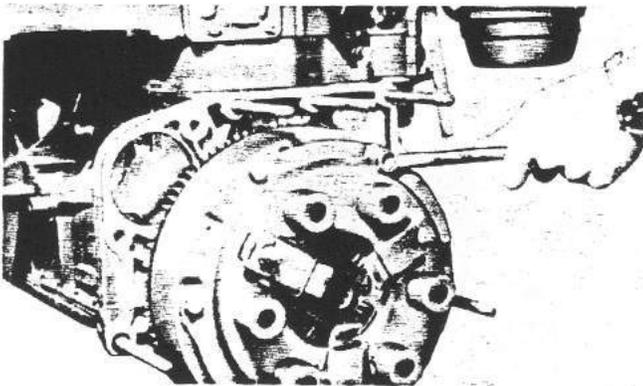


Fig. 25

- b. As shown in Fig. 26, raise up the lock washer of its bent portion.
- c. As shown in Fig. 26, install the special tool (No. 0490100 RING GEAR BRAKE) so that the crankshaft and flywheel cannot be rotated.
- d. Remove 6 pcs. of the lock bolts and remove the flywheel (A) from the crankshaft.

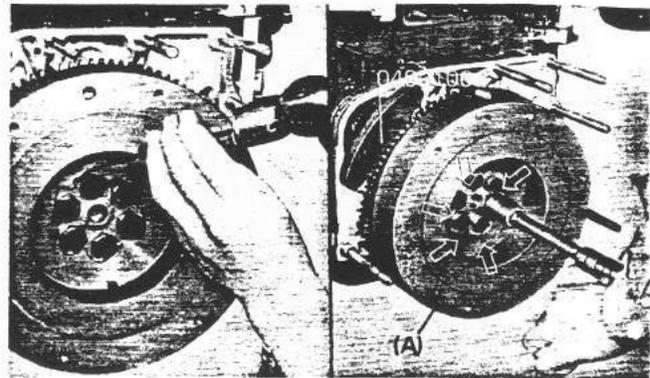


Fig. 26

- e. Remove lock bolt from the crank pulley (A) at the front of the engine.

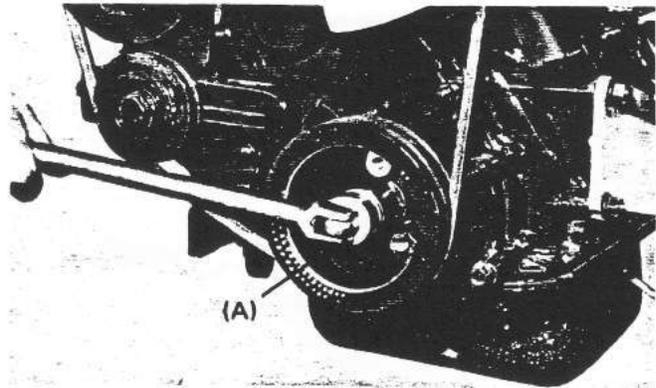


Fig. 27

- f. Remove the special tool (No. 0490100 RING GEAR BRAKE).

4. Removing the air cleaner

- a. Loosen two hose bands, and remove the hot air hose (A) from the air cleaner and the carburetor.

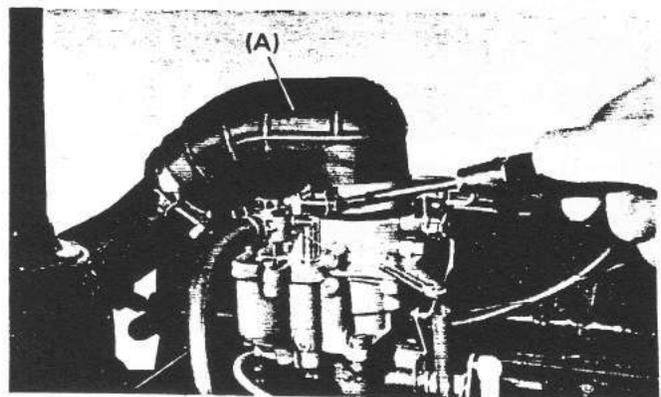


Fig. 28

- b. Loosen two wing nuts, and raise the clamp (B). Remove the air cleaner bands (C) and remove the air cleaner.