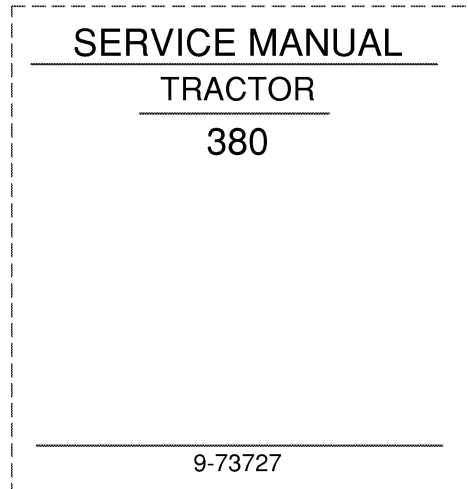


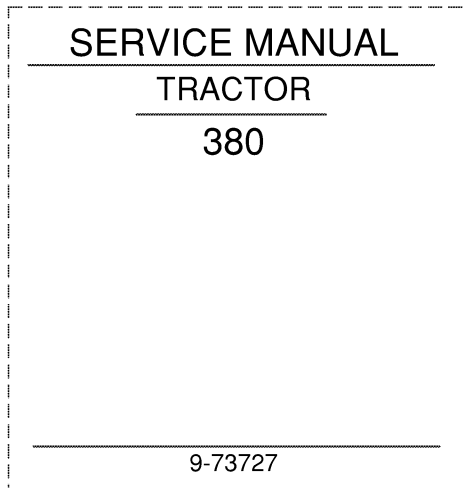
1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



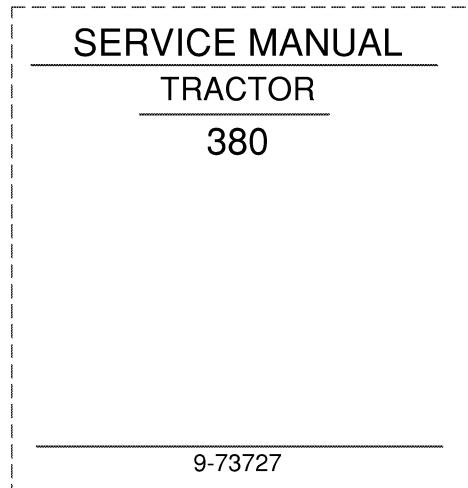
1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

380 Gen Tractor
Service Manual
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Reprinted

Section

2001

ENGINE DIAGNOSIS

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<https://www.ebooklibonline.com>

GENERAL INFORMATION

Before making any repairs or adjustments on an engine, the mechanic must properly diagnose the trouble.

Locating the trouble and repairing it is only part of the job, a mechanic must find and eliminate the cause of the trouble as well. Too many repairs are made with no thought to removing the causes that made the repair necessary.

For the engine to start and perform properly, three main requirements must be present:

1. Fuel
2. Air.
3. Compression - Ignition

When any of these requirements are not present or limited for some reason, the engine will not start or will fail to operate properly throughout the power range.

Fuel

Fuel system problems can be present anywhere from the fuel tank, through the filters and injection pump as well as the injectors. Correct injection pump timing is important in the overall fuel system performance.

Air

Air in an engine is related to the breathing of the engine; the intake of air into the engine and the expulsion of exhaust. Proper air flow is affected by the air cleaner condition, muffler restriction, valve condition, and adjustment, cylinder head gaskets, condition of cylinder walls, rings, pistons, camshaft and crankshaft timing.

Compression - Ignition

Ignition is the result of adequate compression of the intake air in the cylinder to provide enough heat to fire the fuel being injected into the engine cylinder. Proper spray pattern and atomization of the fuel by the injector is very important. Timing the fuel injection pump to the engine is a vital requirement for proper ignition.

ENGINE HARD TO START OR WILL NOT START

No Smoke From Exhaust

1. **Fuel Shut-Off Not Open Completely:**
Improper cable adjustment, damaged cable, cable slipping in clamps will not allow the fuel shut-off to open completely. Check lever to be sure it is opening completely. Adjust cable.
2. **Air Filter Plugged:**
A dirty filter will cause rich fuel mixture and low engine power. Service air filter if required.
3. **Slow Cranking Speed:**
Starter must crank engine 200 to 300 rpm (r/min) in order to ignite the diesel fuel. Check engine speed while cranking. If cranking is slow, check starter amperage draw to help determine the following defective areas: batteries, cables, solenoid and starting motor.

Slow cranking speed can be caused by the following internal and external engine defects: scuffing and scoring of pistons and cylinder walls, improper crankshaft or camshaft end play, defective rod or crank bearings, oil pump, water pump and hydraulic pump.
4. **Fuel Supply Shut-Off or No Fuel:**
Check that the fuel tank to fuel pump tube is open. Check fuel supply in tank.
5. **Air In Fuel System:**
Bleed fuel system until fuel flows steadily with no bubbles. Check for air leaks at fittings between tank and fuel pump.
6. **Camshaft Damaged:**
A sheared key in the cam drive gear or a broken camshaft will throw valve and injection pump timing out of sequence affecting engine operation. Check valve timing.
7. **Fuel Injection Nozzle Not Seated In Head:**
A nozzle that is not seated in the cylinder head will leak air and not allow enough compression to fire the injected fuel. Check for damaged nozzle gasket or seals, loose nozzle, or broken stud.
8. **Fuel Line Plugged:**
A fuel line plugged with dirt will not let fuel through to the injection pump. Remove line at fuel filters and check for fuel flow through line.
9. **Clogged Fuel Filter:**
Check and service fuel filters.
10. **Wrong Fuel or Contaminated Fuel:**
Wrong fuel or contaminated fuel can cause the engine not to run or to have pre-combustion, causing serious damage to the engine. Drain fuel tank and refill with correct fuel.
11. **Piston Rings Worn:**
As piston rings become worn, they lose tension and ability to seal and wipe lubrication oil off cylinder walls. Take a compression test to determine piston ring condition. If readings are low, squirt a small amount of oil into the cylinder and retest. If compression comes up because the oil helps the rings seal, it will be necessary to install new piston rings and possibly new pistons.
12. **Injection Pump Malfunction:**
A malfunctioning injection pump will usually under-fuel the engine. Adjust or replace the injection pump.

Section 2015

CYLINDER HEAD AND VALVES

ENGINE DISASSEMBLY

Injection Pump Removal

1. Put the engine in a suitable engine stand, Figure 5.

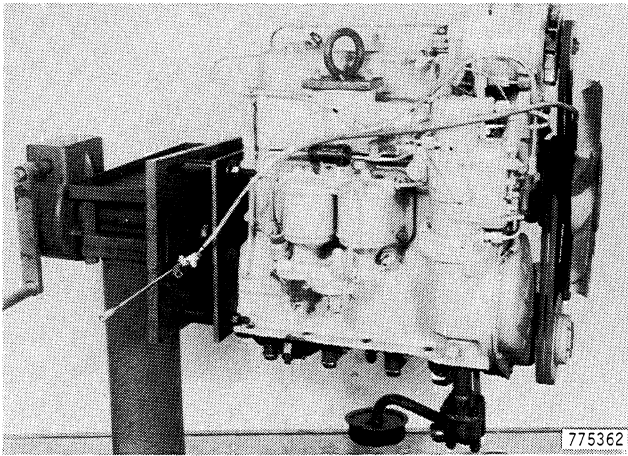


Figure 5

2. Disconnect the tube from the injection pump to number 1 cylinder, Figure 6.

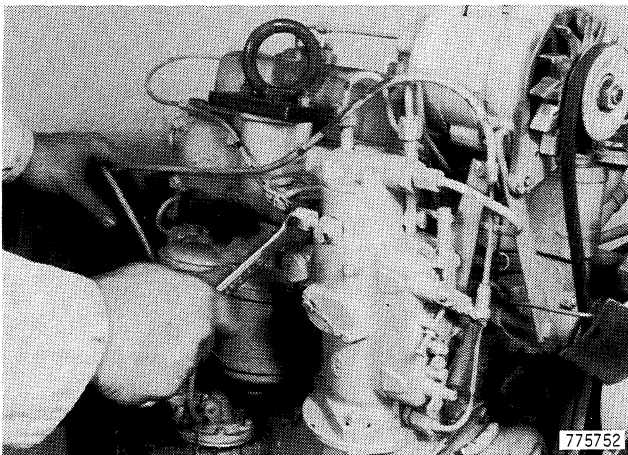


Figure 6

3. Disconnect the two tubes on top of the injection pump going to number 2 and 3 cylinder, Figure 7.

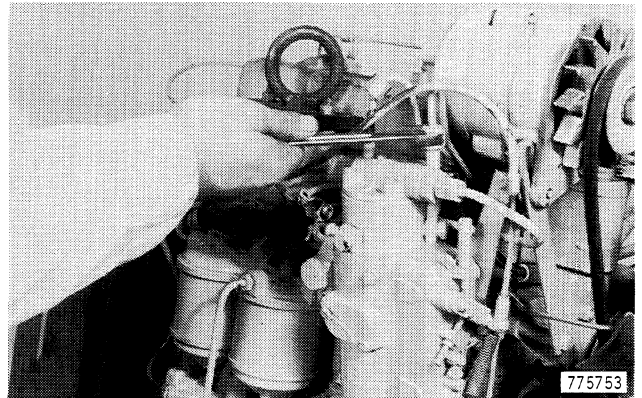


Figure 7

4. Disconnect the fuel supply tube at the injection pump, Figure 8.

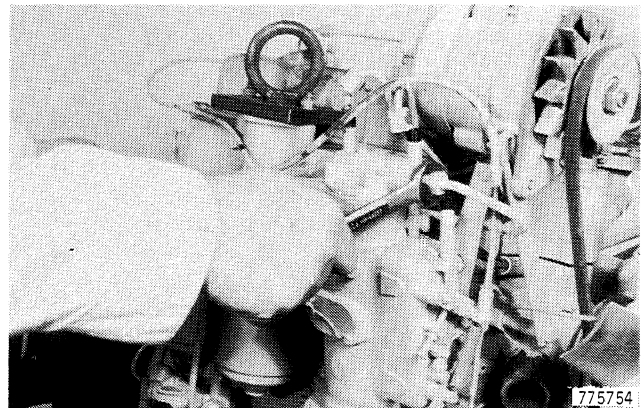


Figure 8

5. Disconnect the injector return tube at the injector pump, Figure 9.

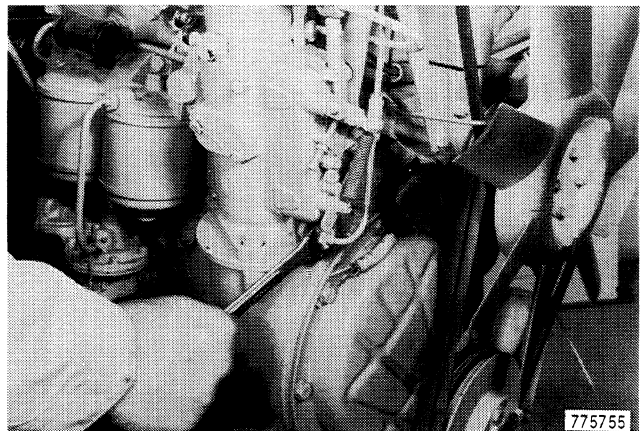


Figure 9

6. Remove the screw from the throttle cable clamp, Figure 10.

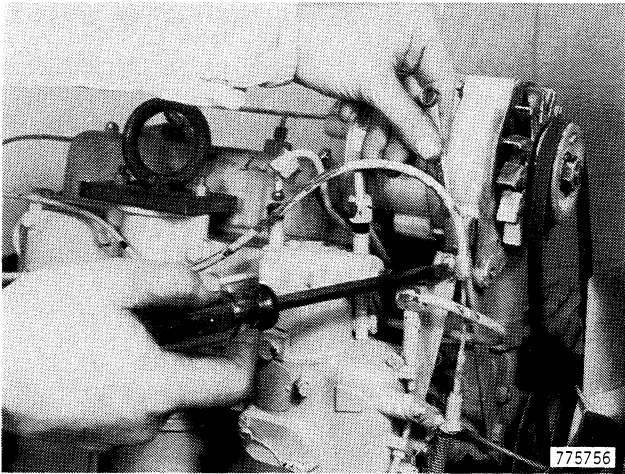


Figure 10

7. Disconnect the throttle cable at the injection pump, Figure 11. Remove the throttle cable.

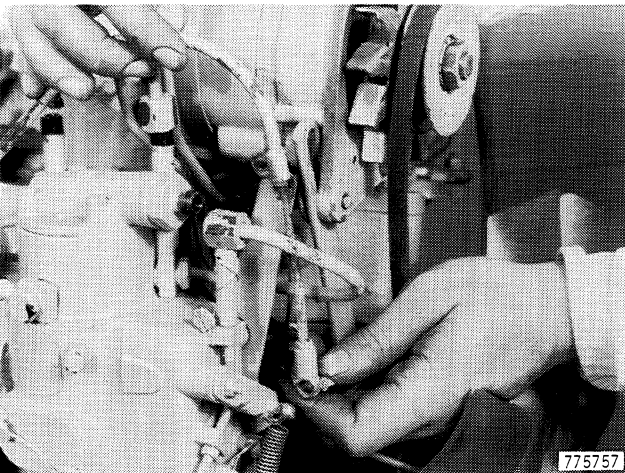
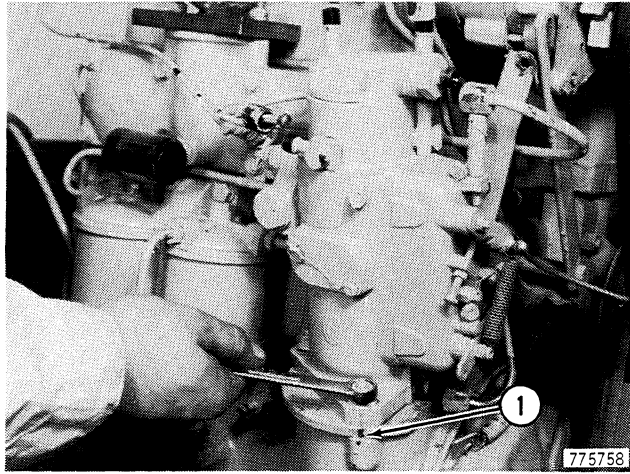


Figure 11

8. Check to see that there is a mark on the mounting flange of the injection pump corresponding to the one on the injection pump.

9. Remove the nuts, lock washers and flat washers from the studs on the injection pump, Figure 12.



1. Alignment Marks

Figure 12

10. Remove the injection pump from the engine, Figure 13.

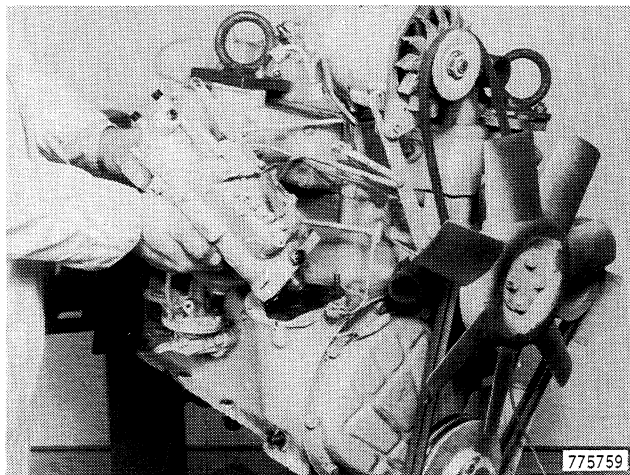


Figure 13

Fuel Feed Pump Removal

1. Disconnect the tube at the fuel feed pump, Figure 14.

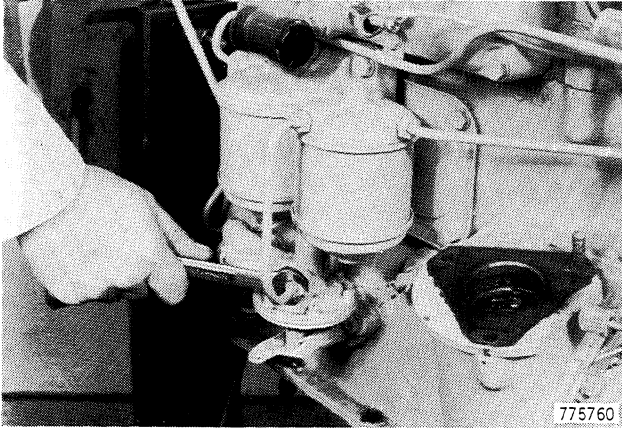


Figure 14

2. Disconnect the tube at the fuel filters, Figure 15.

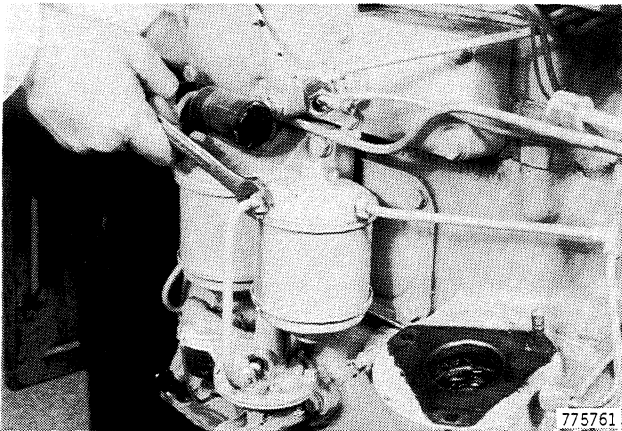


Figure 15

3. Remove the tube between the fuel feed pump and the fuel filters, Figure 16.

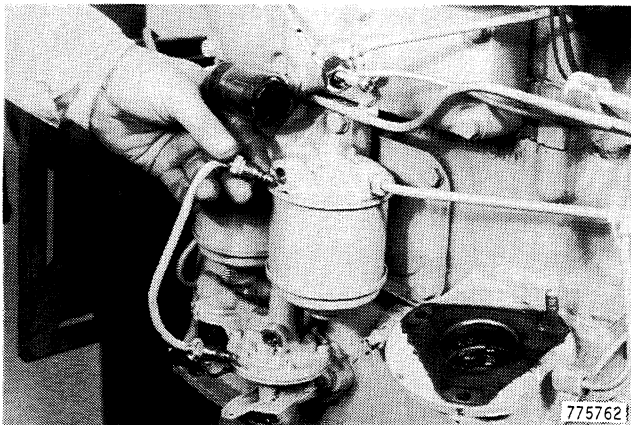


Figure 16

4. Remove the cap screws and lock washers from the fuel feed pump, Figure 17.

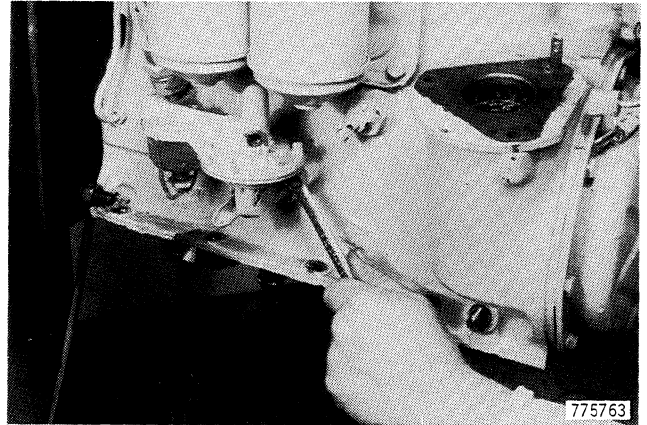


Figure 17

5. Remove the fuel feed pump, Figure 18.

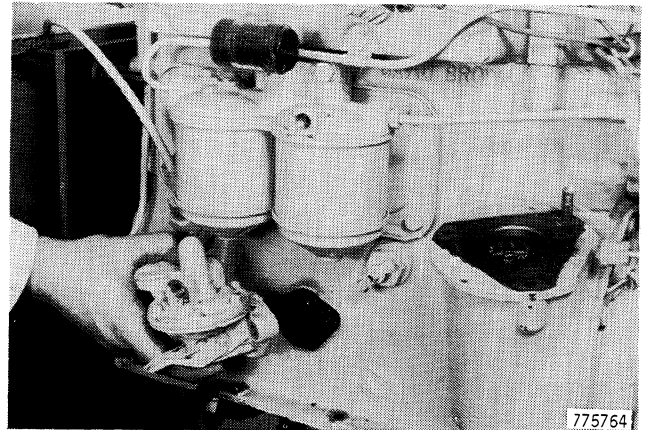


Figure 18

6. Pull the fuel feed pump drive shaft from the engine block, Figure 19.

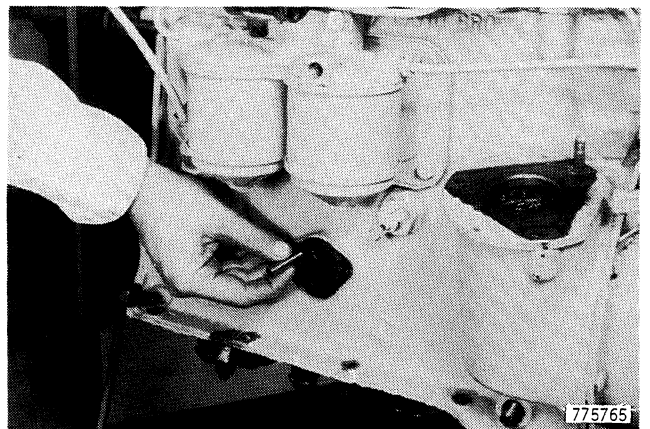


Figure 19

Fuel Filter Removal

1. Disconnect the injector return tube from the fuel filter, Figure 20.

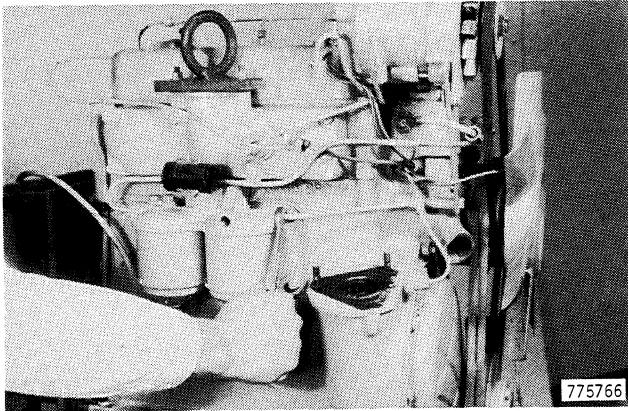


Figure 20

2. Disconnect the tube out of the fuel filter, Figure 21.

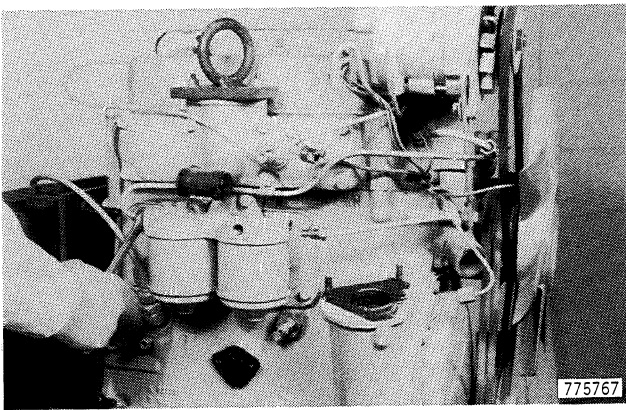


Figure 21

3. Remove the cap screw that holds the clamp on the fuel supply tube, Figure 22.

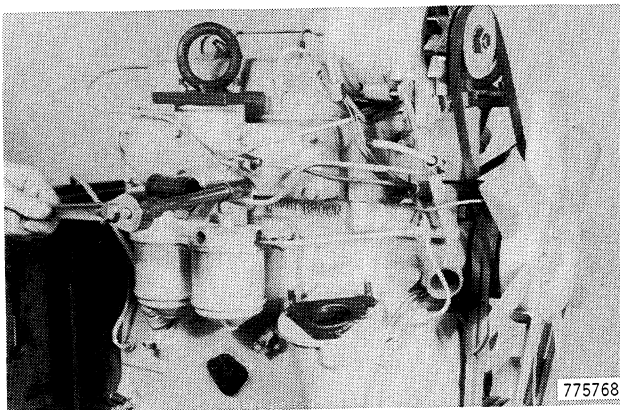


Figure 22

4. Remove the fuel supply tube, Figure 23.

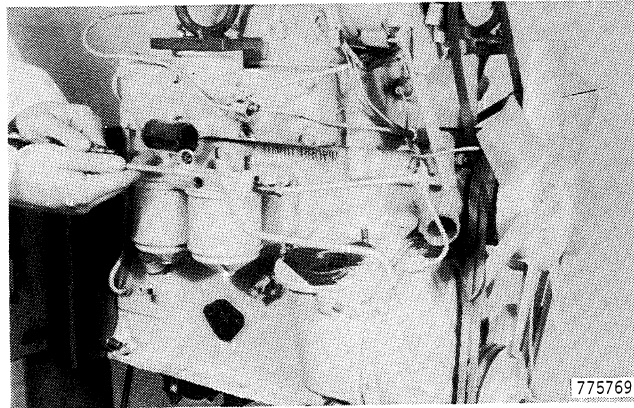


Figure 23

5. Remove the cap screws from the fuel filter, Figure 24.

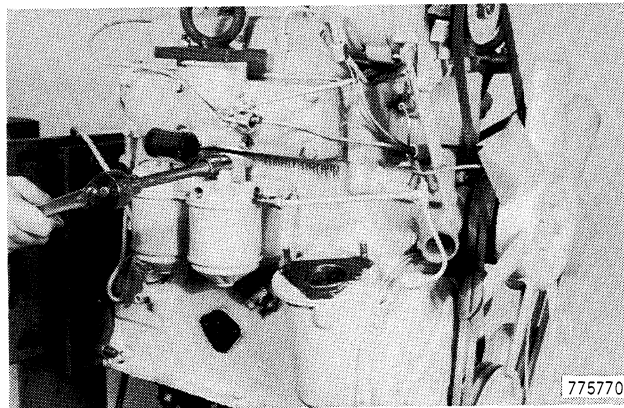


Figure 24

6. Remove the fuel filter, Figure 25. Do not lose the spacers behind the filter.

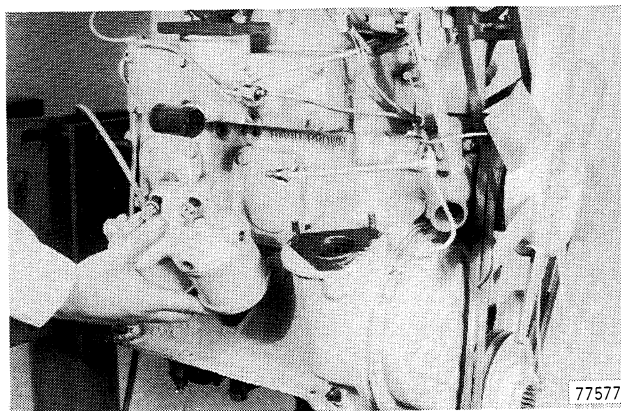


Figure 25

Cylinder Head Removal

1. Loosen the lock nut on the retaining screw for the tachometer drive, Figure 26.

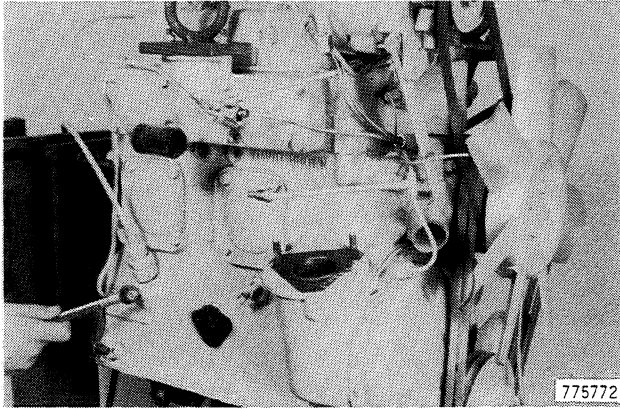


Figure 26

2. Loosen the retaining screw for the tachometer drive, Figure 27.

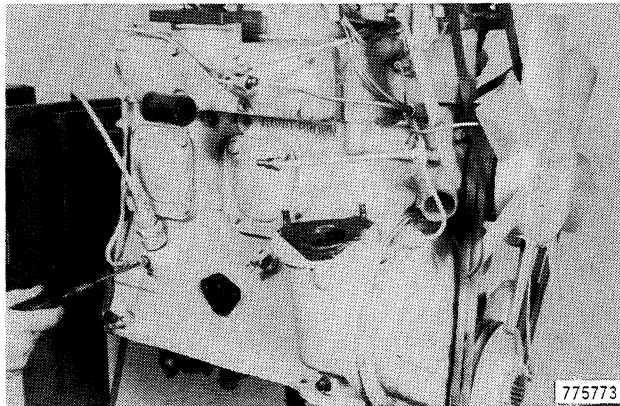


Figure 27

3. Pull the tachometer drive and cable from the engine block, Figure 28.

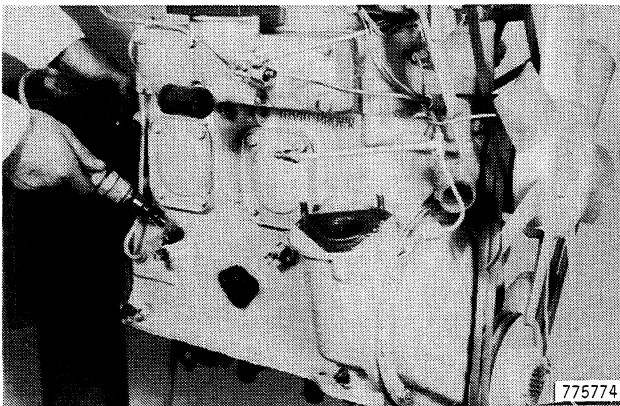


Figure 28

4. Disconnect the wire from the thermostart unit, Figure 29.

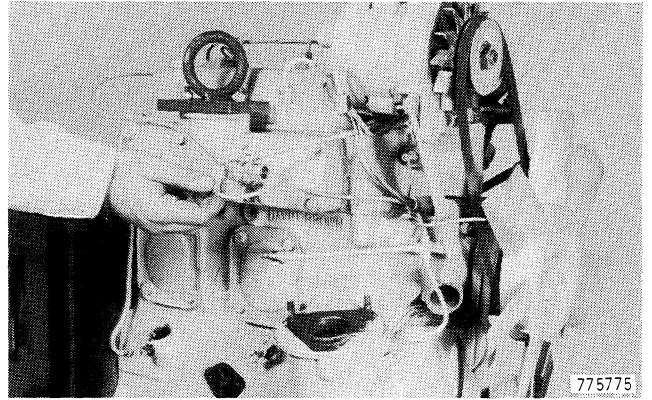


Figure 29

5. Disconnect the thermostart tube from the thermostart unit, Figure 30.

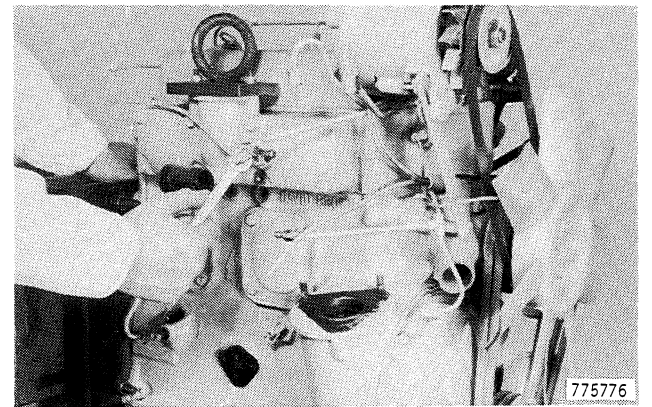


Figure 30

6. Remove the cap screw from the thermostart tube clamp, Figure 31.

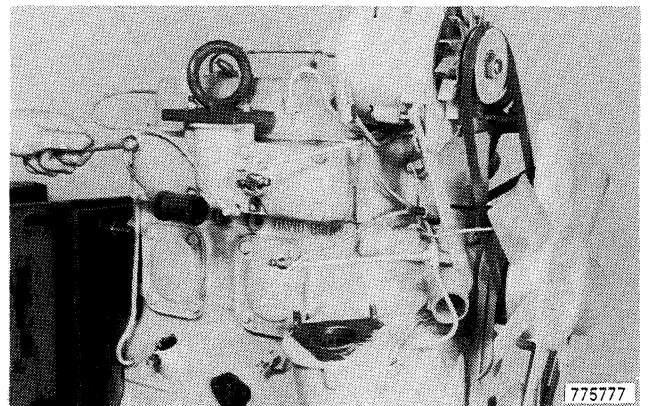


Figure 31

7. Remove the cap screws from the intake manifold, Figure 32.

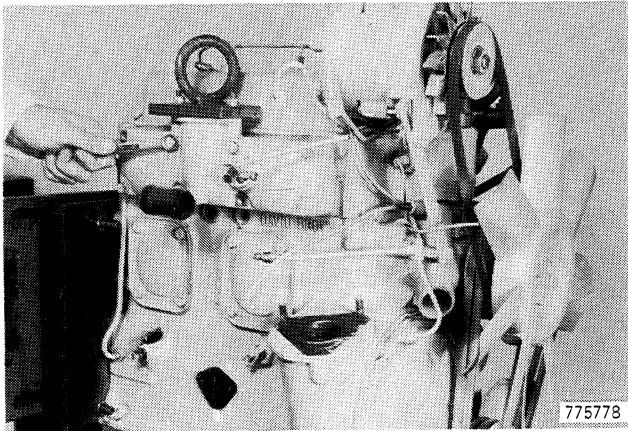


Figure 32

8. Remove the intake manifold, Figure 33.

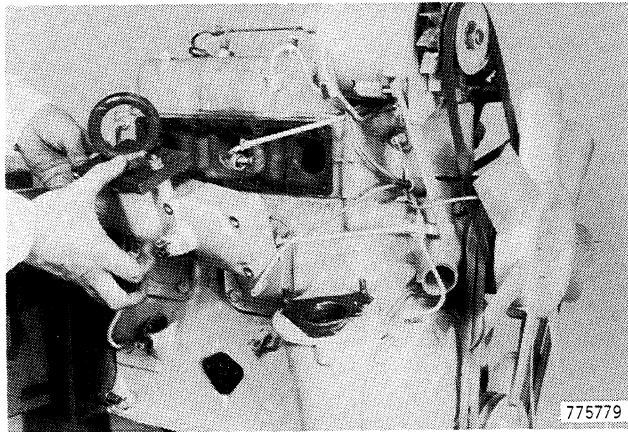


Figure 33

9. Remove the oil return tube, Figure 34.

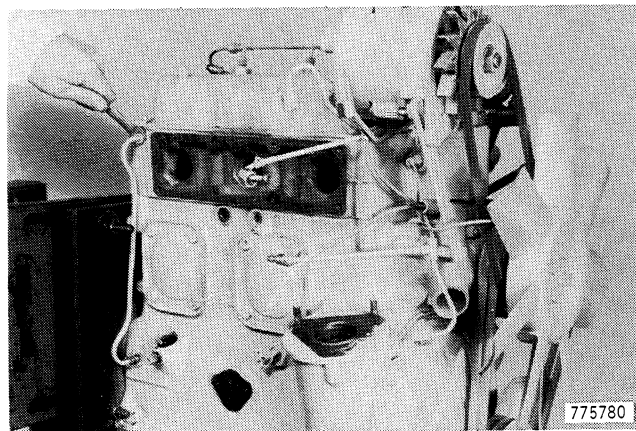


Figure 34

10. Disconnect the clip that holds the alternator electrical connecting plug, Figure 35.

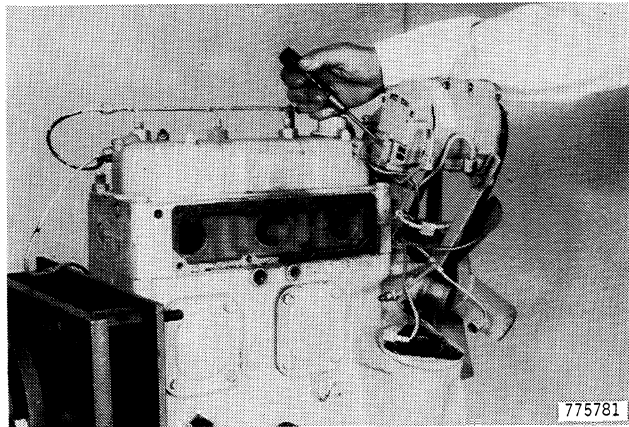


Figure 35

11. Pull the alternator connecting plug from the alternator, Figure 36.

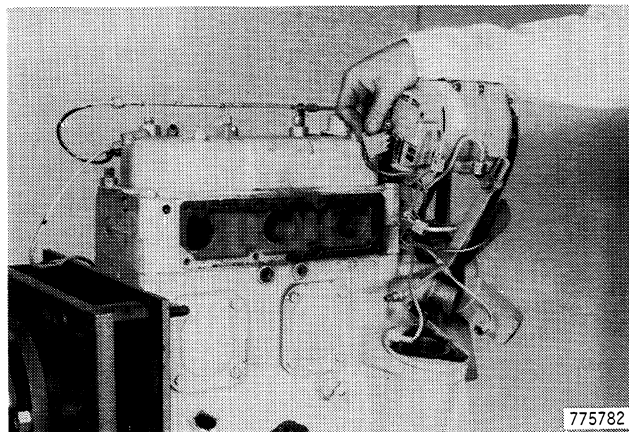


Figure 36

12. Remove the cap screw from the alternator adjusting strap, Figure 37.

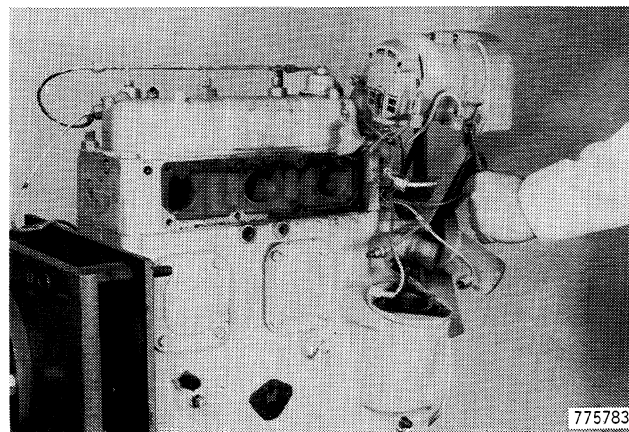


Figure 37

- 13. Remove the nut and lock washer from the stud that mounts the alternator, Figure 38.

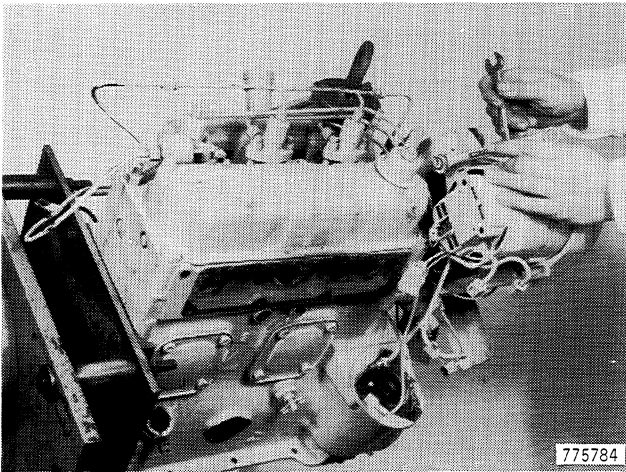


Figure 38

- 16. Remove the nuts from the studs that hold the exhaust manifold, Figure 41.

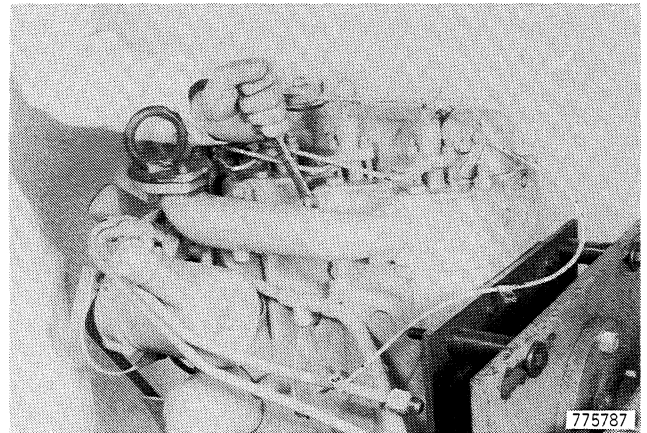


Figure 41

- 14. Remove the alternator mounting stud, alternator guard and the alternator, Figure 39.

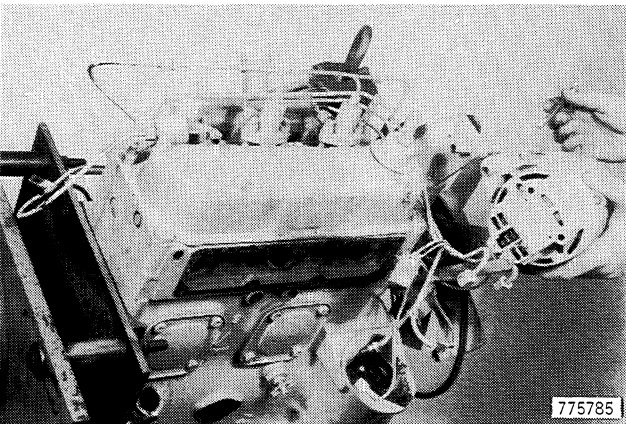


Figure 39

- 17. Remove the exhaust manifold, Figure 42.

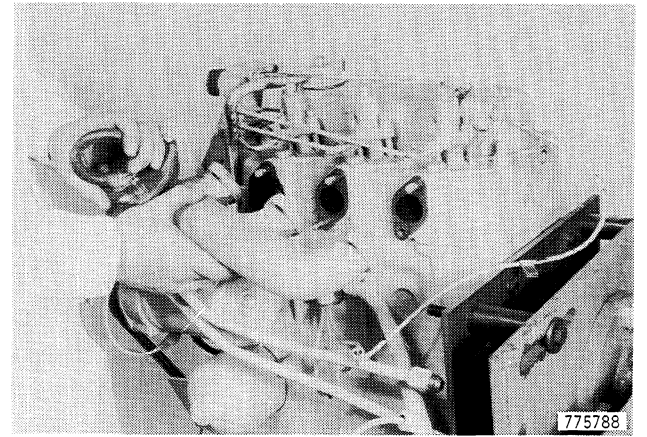


Figure 42

- 15. Remove the tube from the exhaust manifold, Figure 40.

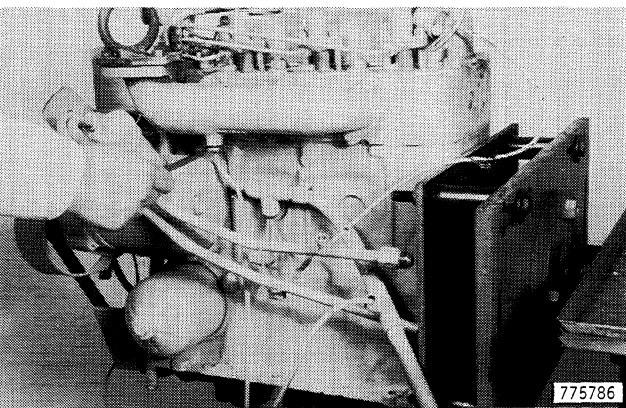


Figure 40

- 18. Disconnect the injector return tube at the front of the engine, Figure 43.

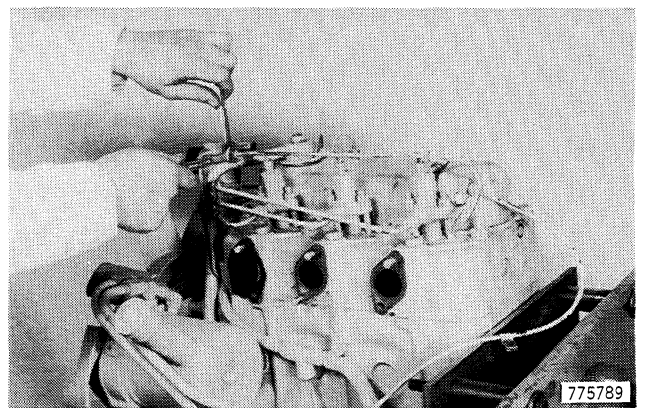


Figure 43

19. Disconnect the thermostart tube, Figure 44.

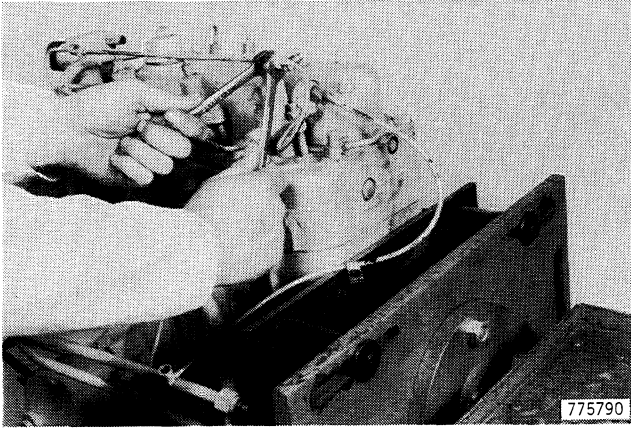


Figure 44

20. Remove the thermostart unit and tubing, Figure 45.

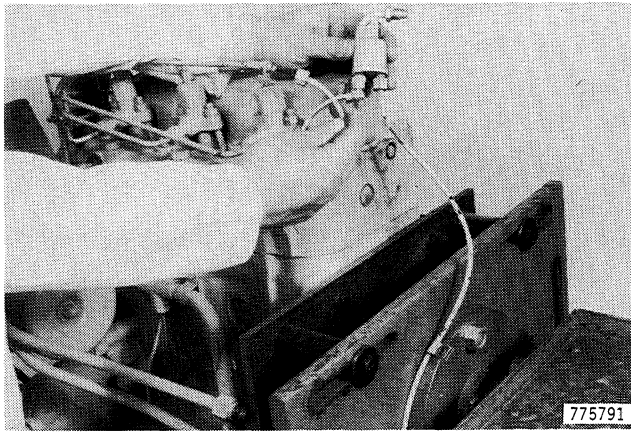


Figure 45

21. Remove the nut from the vent tube, Figure 46.

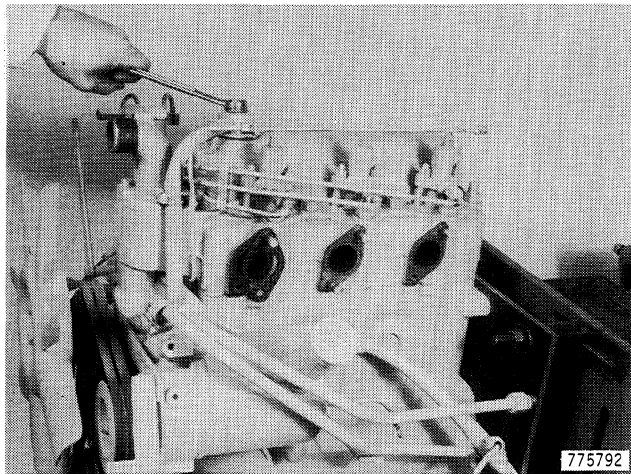


Figure 46

22. Remove the vent tube, spacer and gasket from the valve cover, Figure 47.

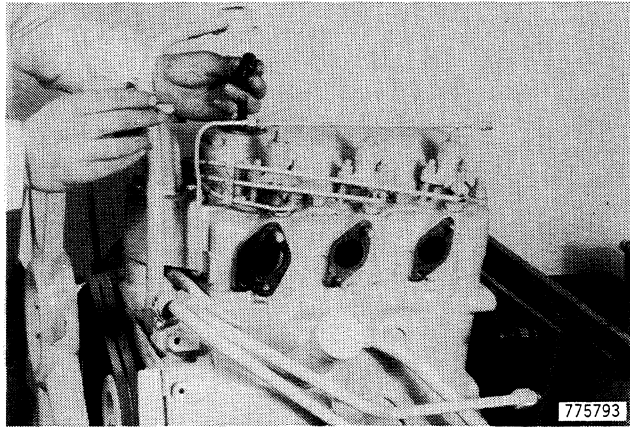


Figure 47

23. Remove the cap screw that holds the injector return tube clamp, Figure 48.

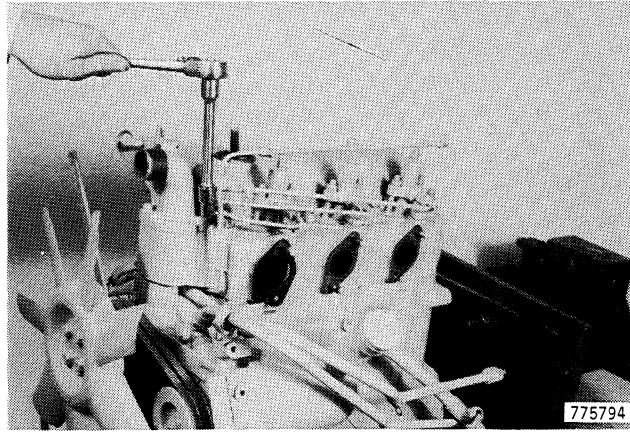


Figure 48

24. Remove the domed nuts and copper washers from the valve cover, Figure 49.

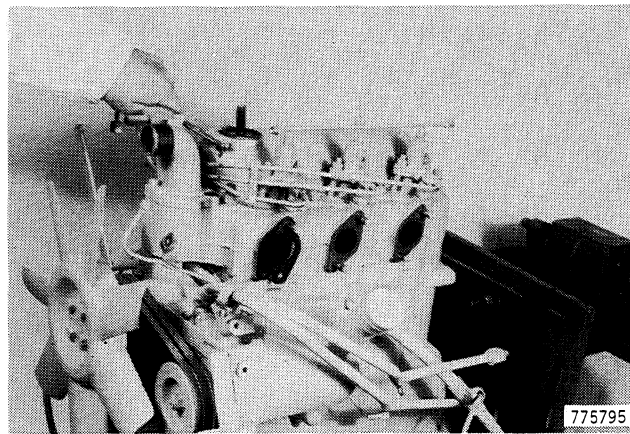


Figure 49

25. Remove the valve cover, Figure 50.

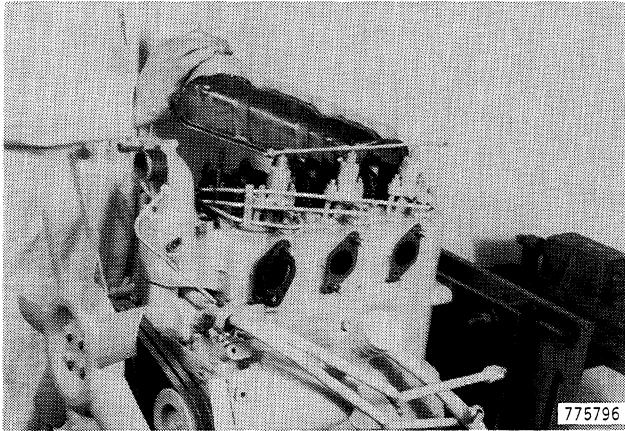


Figure 50

26. Remove the cap screws that mount the rocker arm assembly, Figure 51.

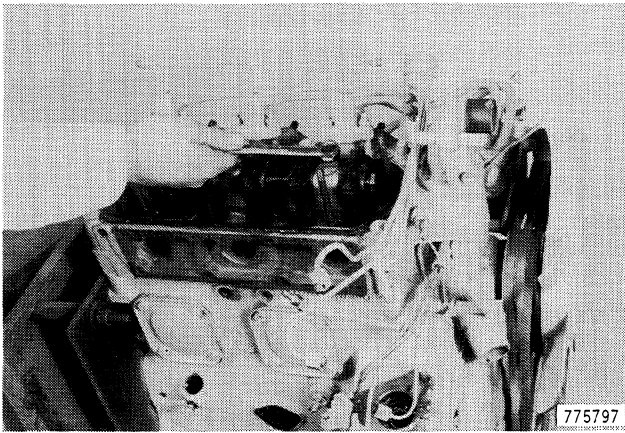


Figure 51

27. Remove the rocker arm assembly, Figure 52.

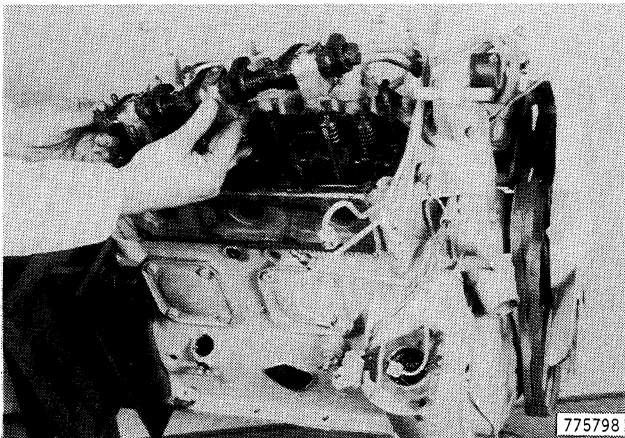


Figure 52

28. Remove the cap screws and nuts from the cylinder head, Figure 53.

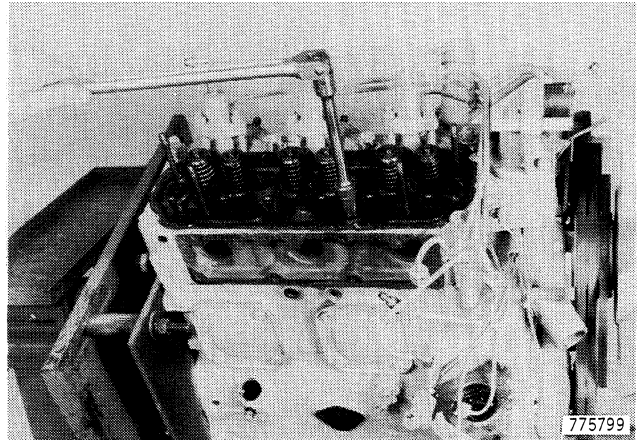


Figure 53

29. Disconnect the wire from the engine temperature sending unit, Figure 54.

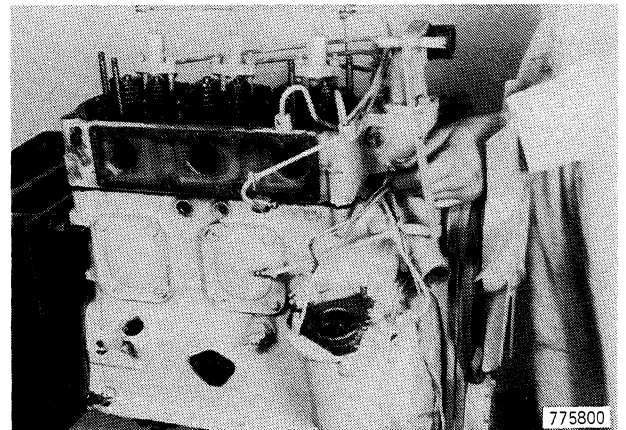


Figure 54

30. Lift the cylinder head from the engine, Figure 55.

NOTE: Do not damage fuel injector nozzle tips when head is placed on floor or bench.

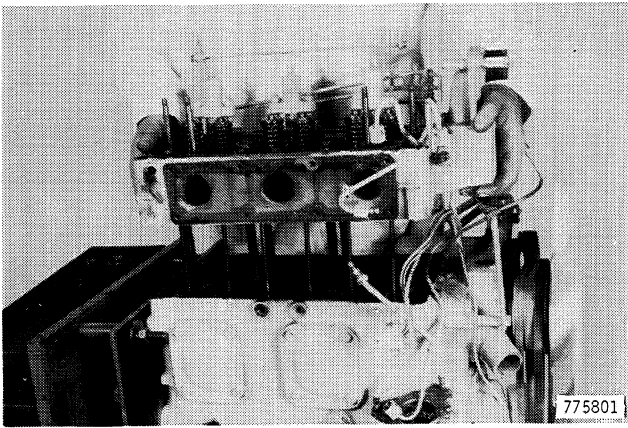


Figure 55

31. Lift the push rods from the engine, Figure 56. Keep the push rods in order so they may be replaced in the same location.

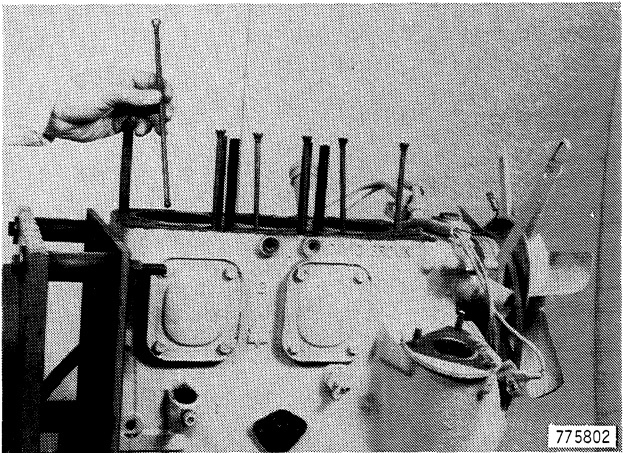


Figure 56

Water Pump Removal

1. Remove the cap screws from the fan, Figure 57.

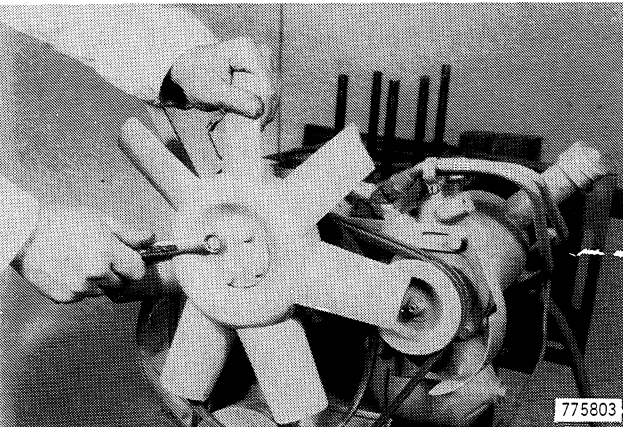


Figure 57

2. Remove the fan, Figure 58.

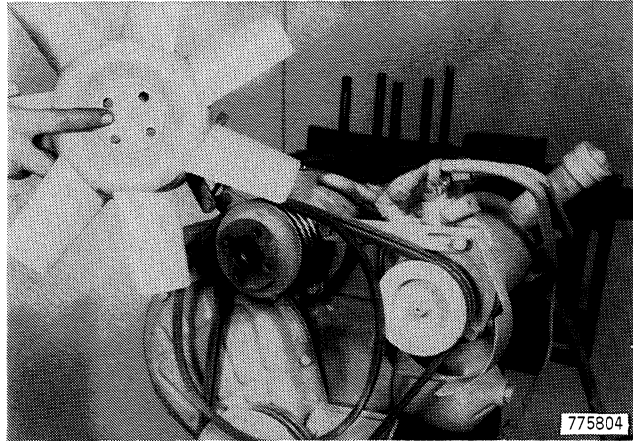


Figure 58

3. Loosen the cap screw in the steering pump adjusting strap, Figure 59.

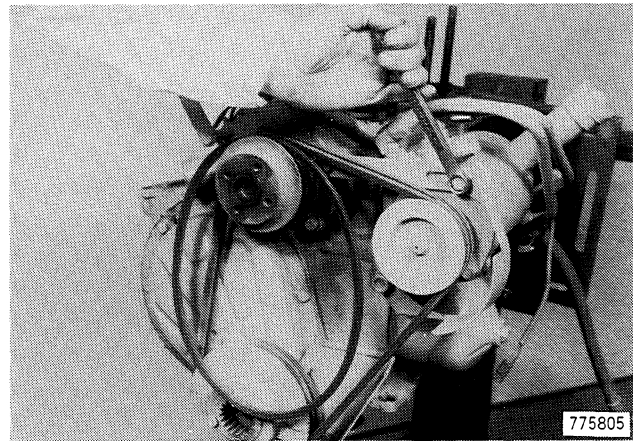


Figure 59

4. Loosen the nut on the steering pump mounting stud, Figure 60.

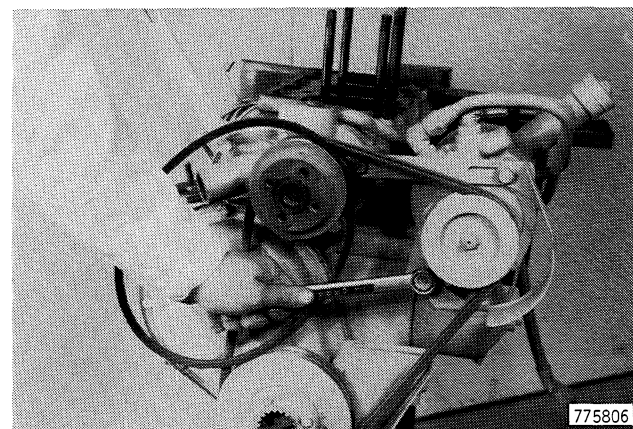


Figure 60

5. Push the steering pump up and remove the belts from the engine, Figure 61.

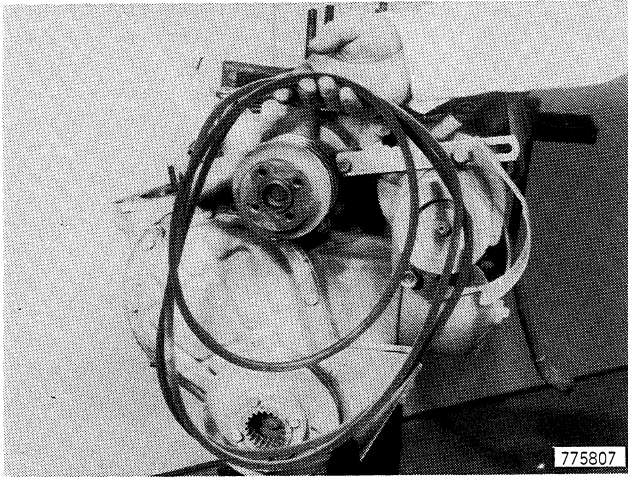


Figure 61

6. Remove the cap screw from the strap that adjusts the steering pump belt, Figure 62.

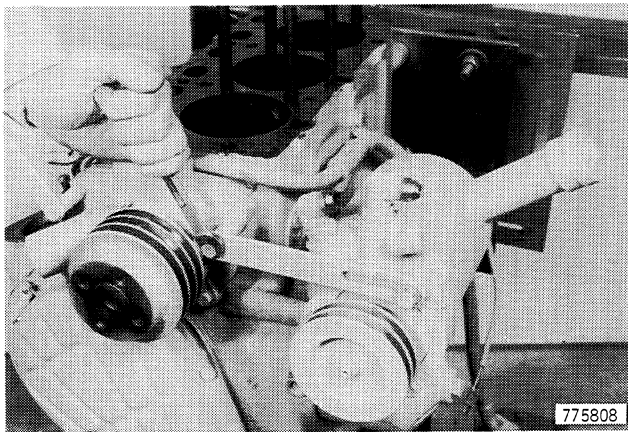


Figure 62

7. Remove the nut, lock washer and flat washer from the stud that mounts the steering pump, Figure 63. Remove the steering pump.

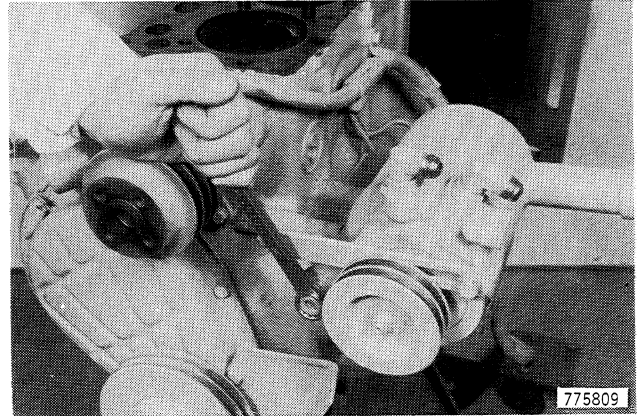


Figure 63

8. Remove the nuts, lock washers and cap screws from the water pump, Figure 64.

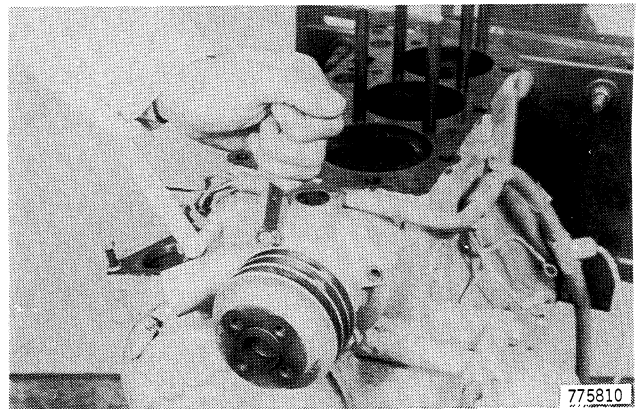


Figure 64

9. Remove the water pump, Figure 65.

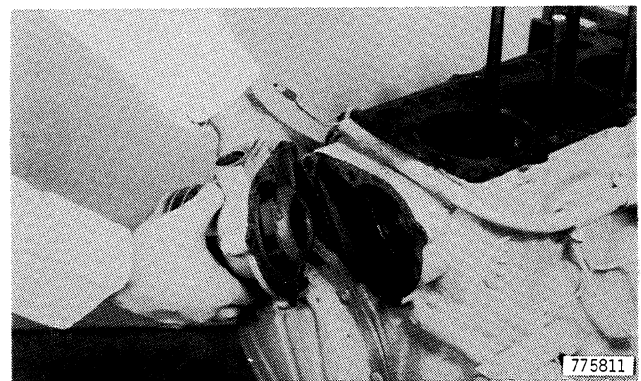


Figure 65

Camshaft Removal

1. Block the crankshaft so it will not turn and remove the cap screw that holds the crankshaft pulley, Figure 66.

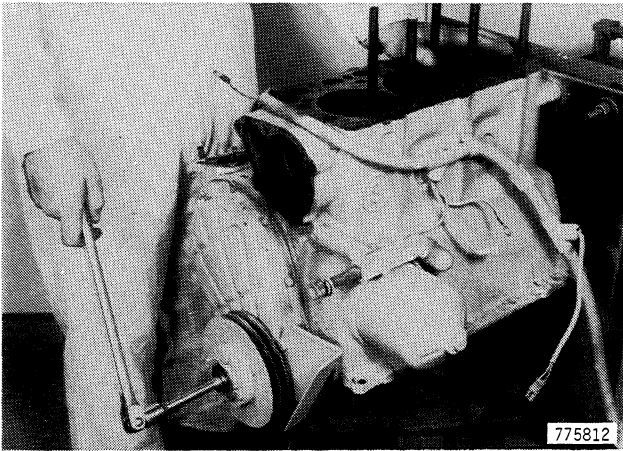


Figure 66

2. Remove the crankshaft pulley, Figure 67.

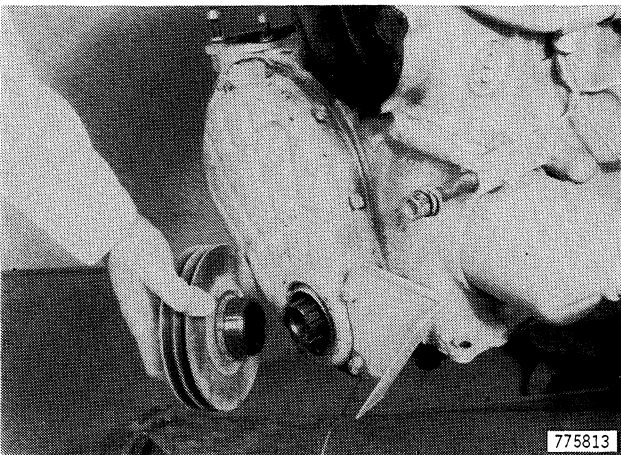


Figure 67

3. Remove the cap screws from the camshaft cover, Figure 68.

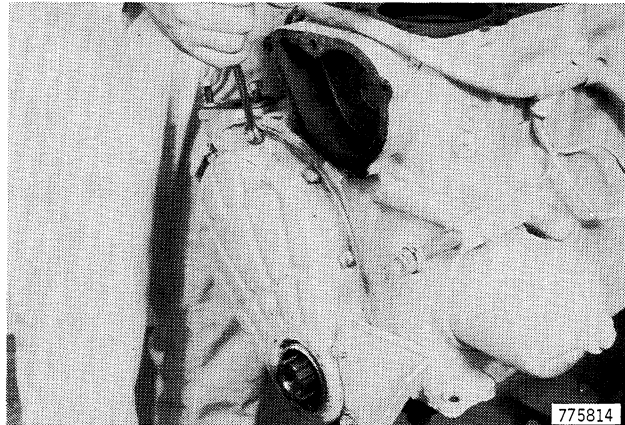


Figure 68

4. Remove the camshaft cover, Figure 69.

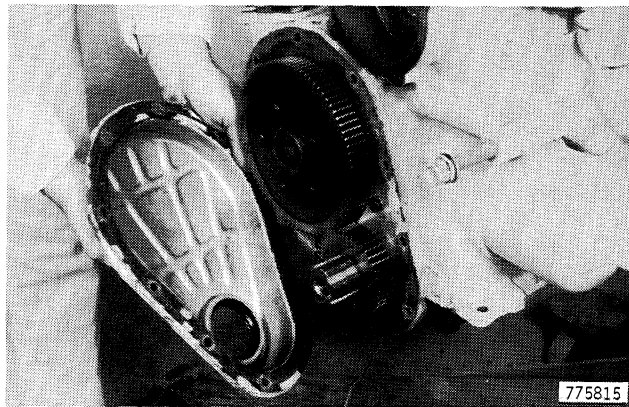


Figure 69

5. Cut the lock wire on the cap screw on the gear on the camshaft, Figure 70.

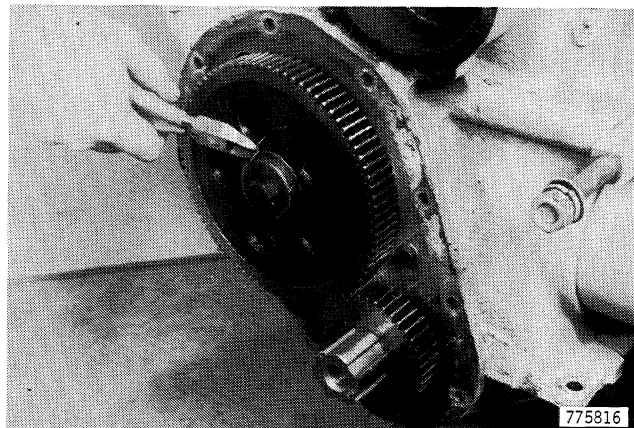


Figure 70

- 6. Remove the cap screw from the gear on the camshaft, Figure 71.

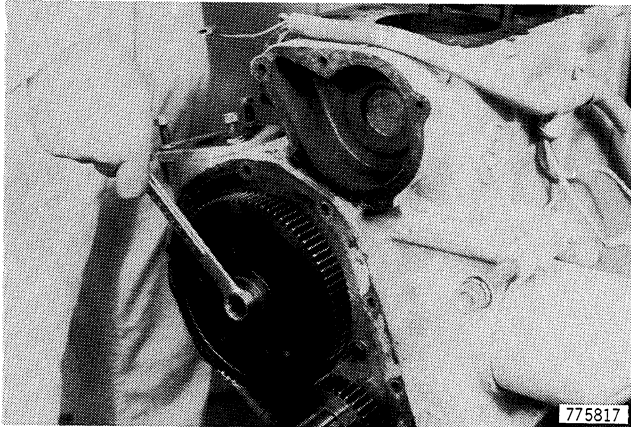


Figure 71

- 9. Remove the locating plate for the camshaft, Figure 74.

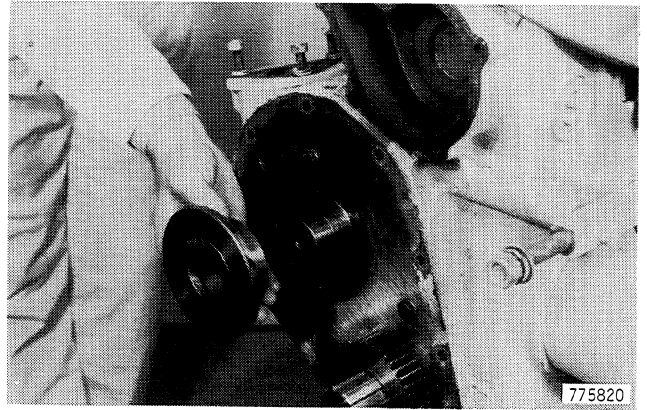


Figure 74

- 7. Pull the gear from the camshaft, Figure 72.

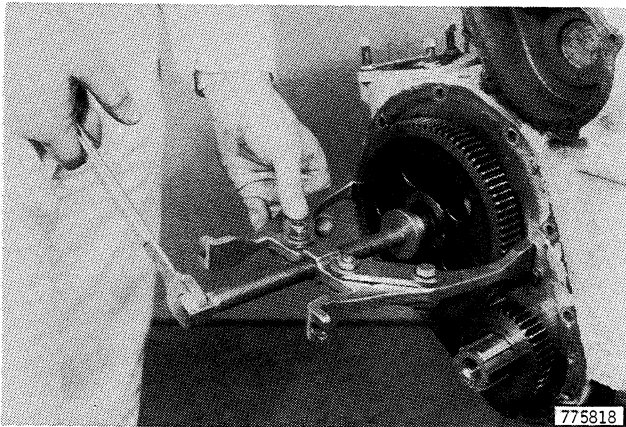


Figure 72

- 10. Remove the cap screws from the lifter cover plates, Figure 75.

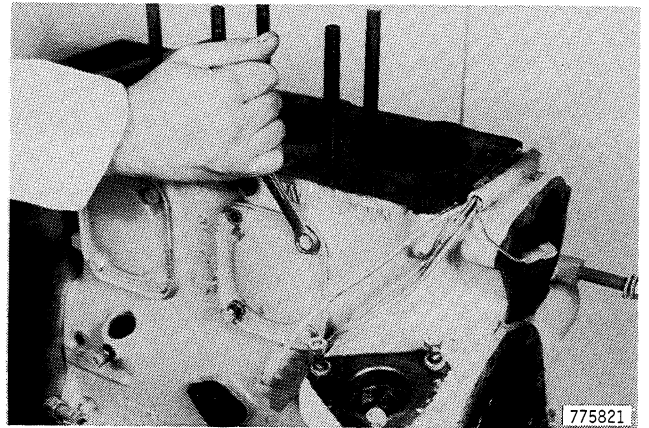


Figure 75

- 8. Remove the cap screws from the locating plate for the camshaft, Figure 73.

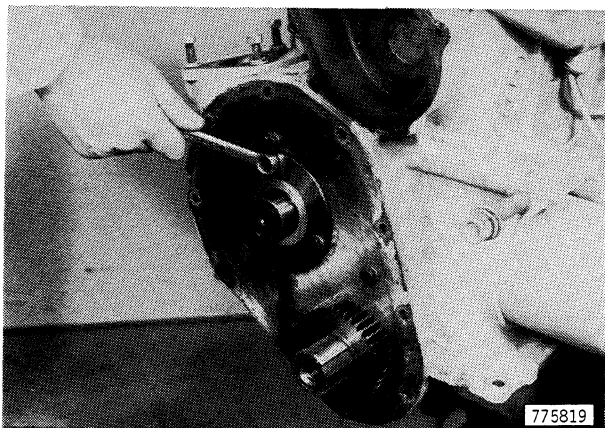


Figure 73

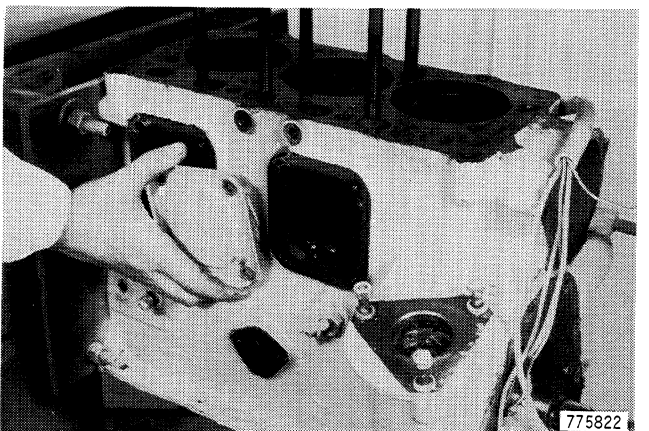
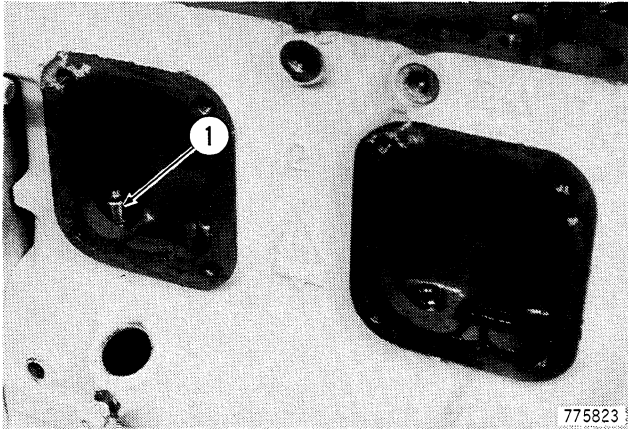


Figure 76

- 11. Remove the lifter cover plates, Figure 76.

12. Lift lifters up and put a 1/2" (12 mm) diameter O-ring over tappets to hold them up, Figure 77.



1. O-ring

Figure 77

13. Pull cam shaft from cylinder block, Figure 78.

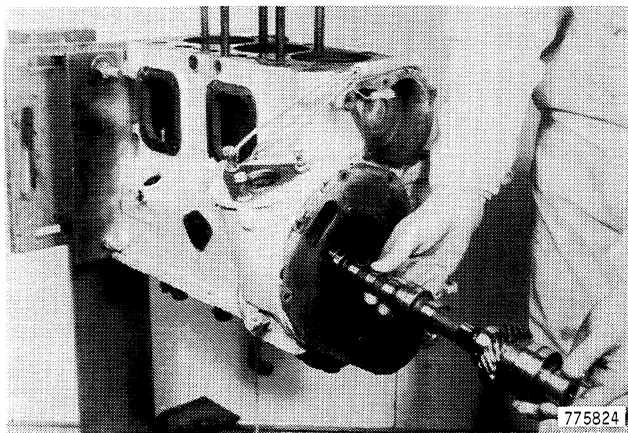


Figure 78

Oil Pump and Fuel Injection Pump Drive

Removal

1. Pull oil pump and fuel injection pump drive from the engine block, Figure 79.

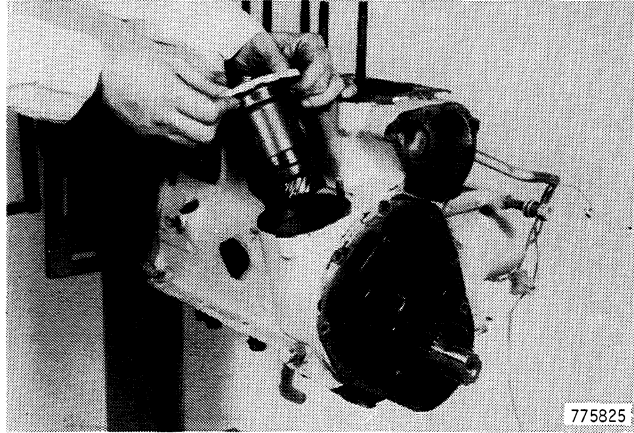


Figure 79

Disassembly and Assembly

1. Remove the snap ring from the drive gear, Figure 80.

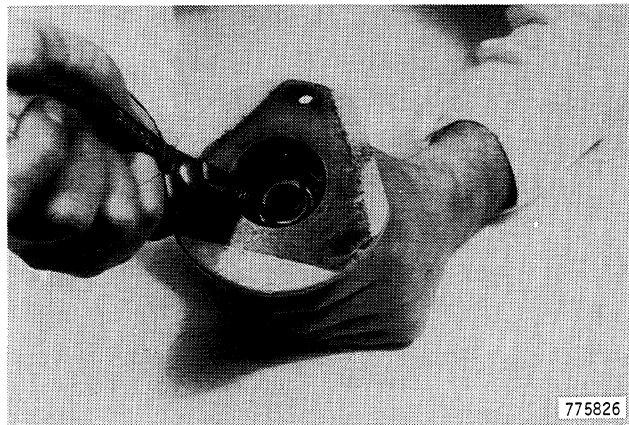


Figure 80

2. Pull the drive gear from the housing, Figure 81.

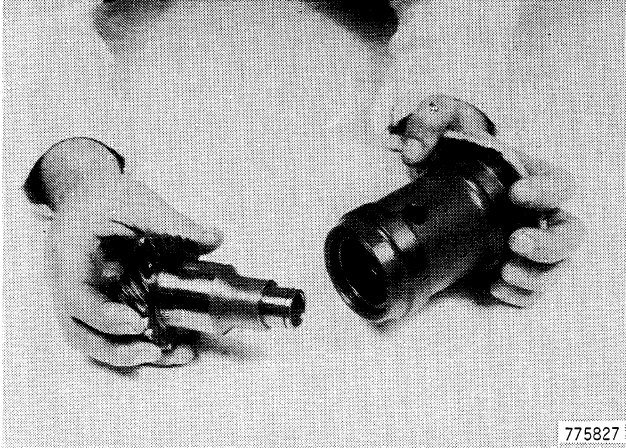


Figure 81

7. Install the snap ring in the drive gear, Figure 83.

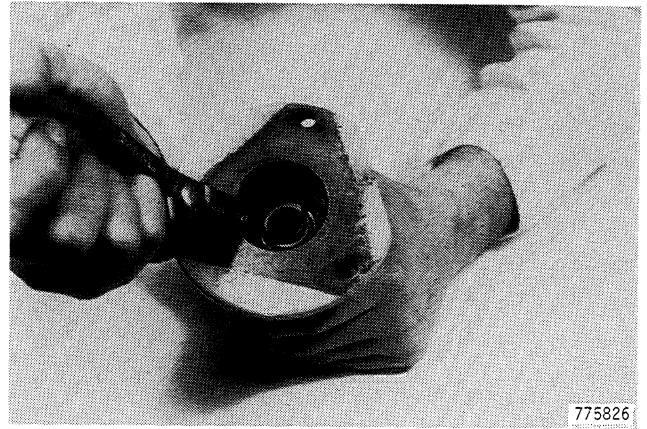


Figure 83

3. If the bearings are to be replaced, remove the lower needle roller bearing and discard. The needle roller bearing must not be used again once it has been removed. Remove the lower snap ring from the ball bearing and remove the ball bearing.
4. Install a new ball bearing into the housing. Install the snap ring.
5. See page 2015-4 and use the special bearing tool to install the new needle roller bearing. **DO NOT** drive the needle roller bearing into the housing. The needle roller bearing must be pressed into the housing using the special tool.
6. Install the drive gear in the housing, Figure 82.



Figure 82

Rocker Arm Disassembly

1. Put rocker arm in vise and remove plug from front end of shaft, Figure 84.

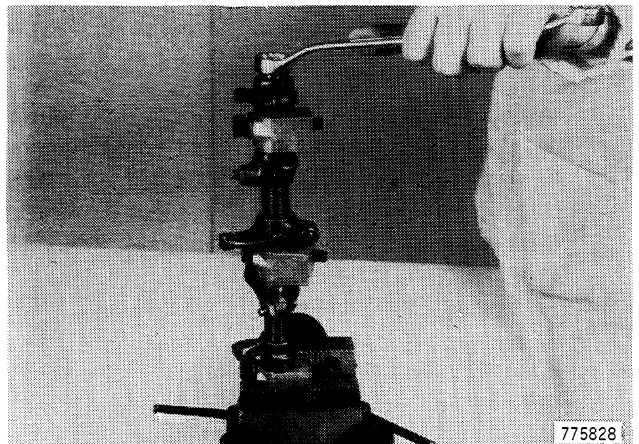


Figure 84

2. Slide parts off the shaft. Put the parts on a bench in the order of removal, Figure 85. Red bracket is retained by a set screw.

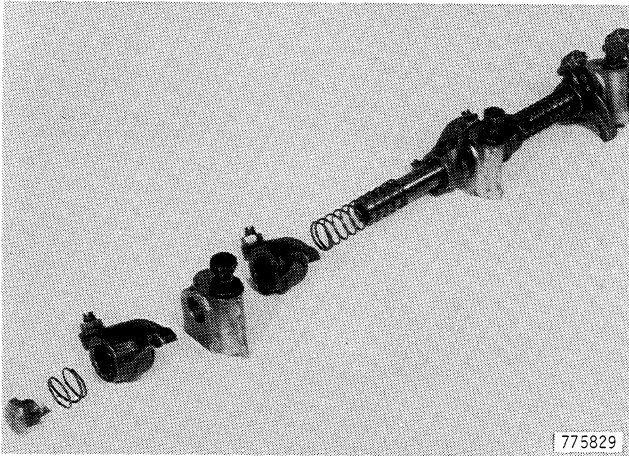


Figure 85

3. Inspect the bushings in the rocker arms. Press out worn bushings. Press new bushings into bore; make sure the oil holes in the bushing and rocker arm are lined up. Hone or ream the bushing until the rocker arm slides freely on the shaft. See specification on page 2015-3.
4. If the ends of the rocker arm are worn, grind the worn surface lightly with a smooth grindstone. Do not remove more metal than necessary. Grind only until the wear mark is almost, but not completely, removed.

Rocker Arm Assembly

1. Assemble the rocker arms, springs, and brackets onto the shaft. Install set screw into rear bracket, noting that the shaft is positioned with oil feed holes toward the bottom. Peen the bracket over the screw hole to retain the set screw.
2. When parts on shaft are fully assembled, install plug and spring on end of shaft. Tighten plug securely, Figure 86.



Figure 86

Injector Removal

1. Place blocks of wood under head to prevent damage to the fuel injection nozzles. Disconnect tube at the fuel inlet of the injector, Figure 87.

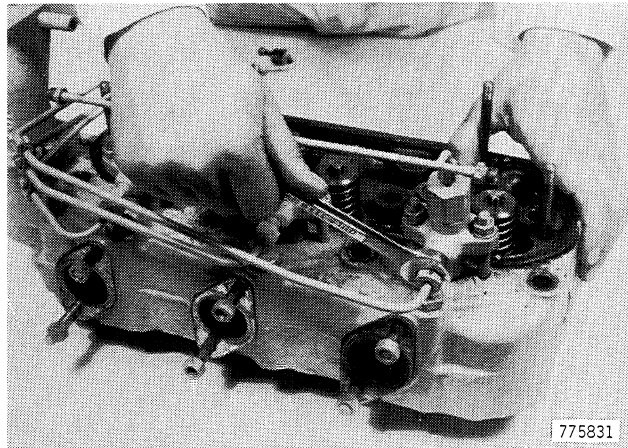


Figure 87

2. Disconnect the tube at the return of the injector, Figure 88.

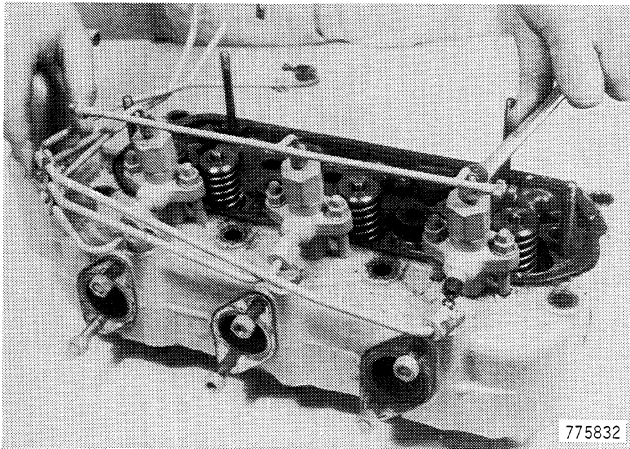


Figure 88

3. Remove the return tube, Figure 89.

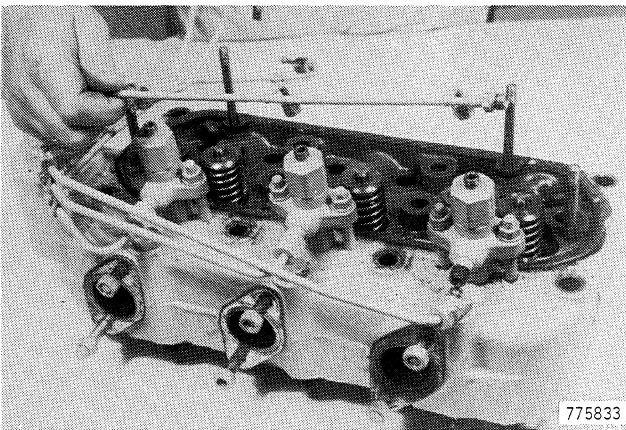


Figure 89

4. Loosen the nuts and lock washers from the studs on the injectors, Figure 90. The studs can come out instead of the nuts coming off.

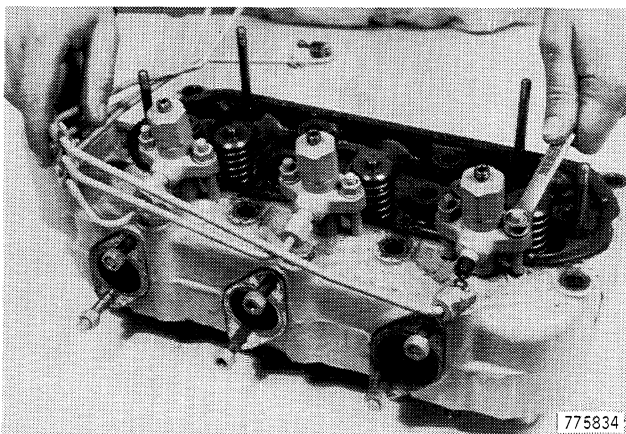


Figure 90

5. Remove the nuts, lock washers, and studs, Figure 91.

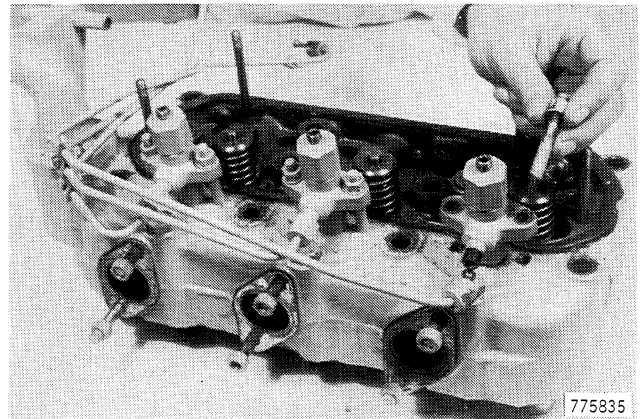


Figure 91

6. Pull the injector from the head, Figure 92.

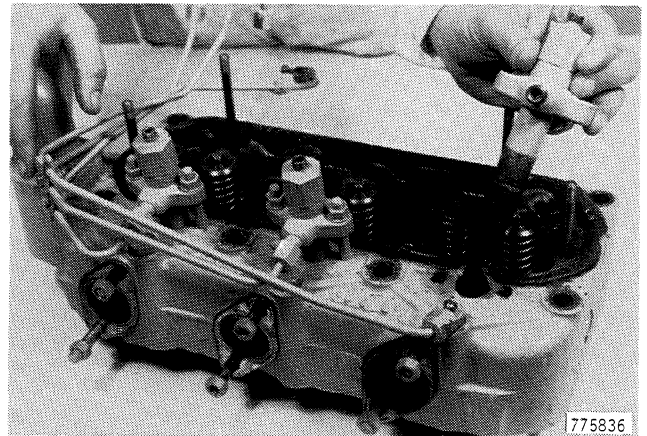


Figure 92

7. Remove the copper sealing washer from the head, Figure 93. The copper sealing washers can be retained by carbon and be hard to remove. Be sure the copper sealing washers are removed.

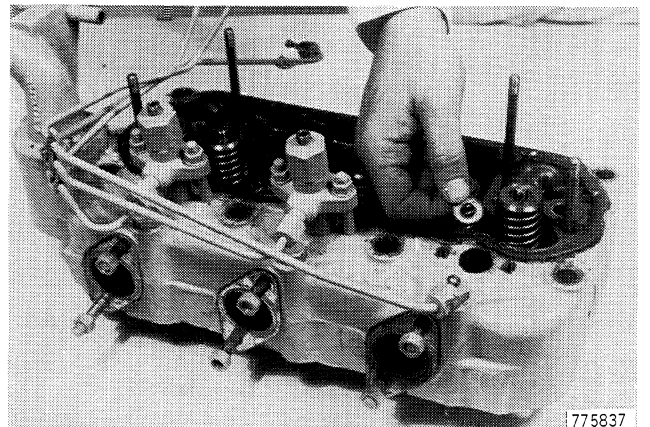


Figure 93



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Injector Installation

1. Install copper sealing washer in head, Figure 94.

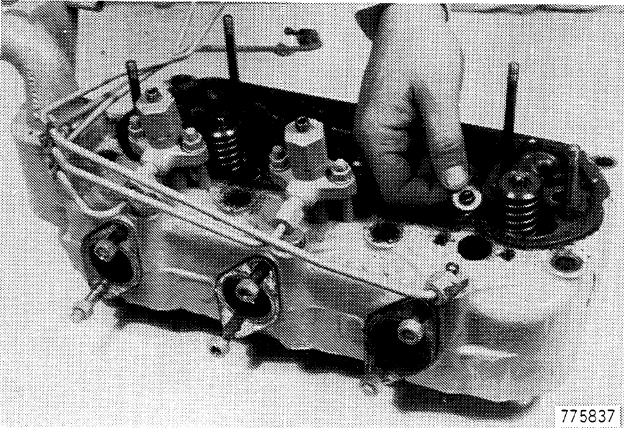


Figure 94

2. Install the injector in the head, Figure 95.

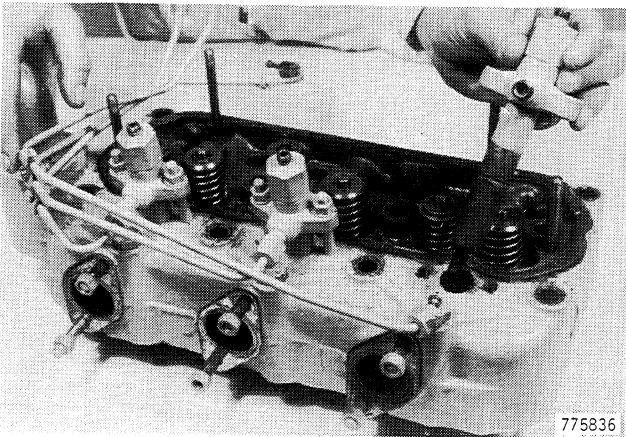


Figure 95

3. Install two studs with nuts and lock washers, Figure 96.

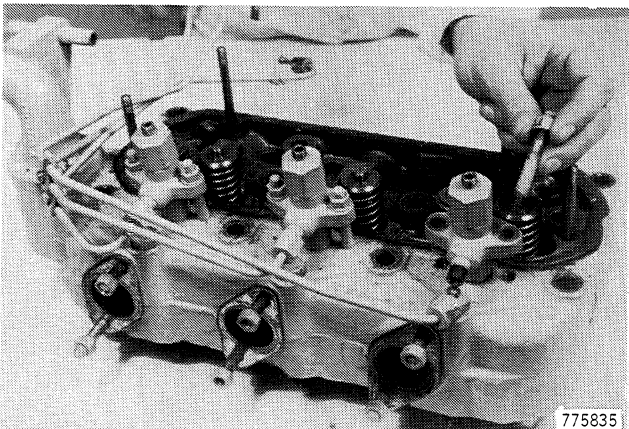


Figure 96

4. Tighten nuts evenly to 15 foot-pounds (20 N m), Figure 97.

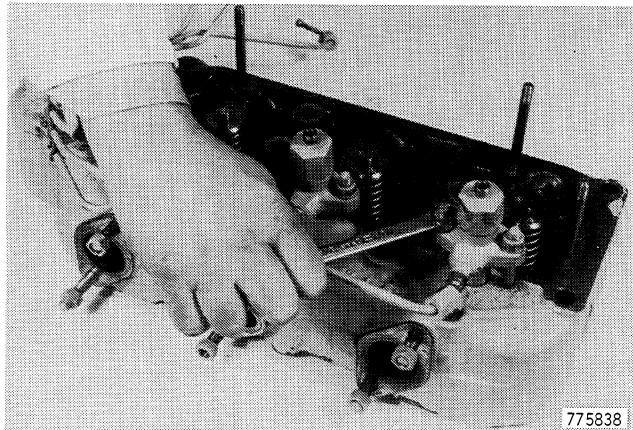


Figure 97

5. Install return tube, Figure 98.

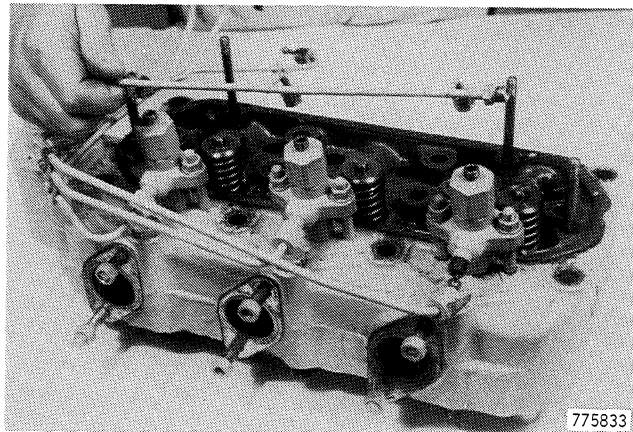


Figure 98

6. Tighten three nuts to secure return tube, Figure 99.

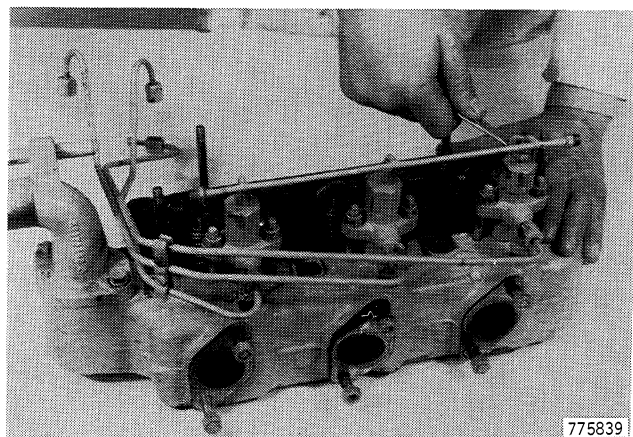


Figure 99

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