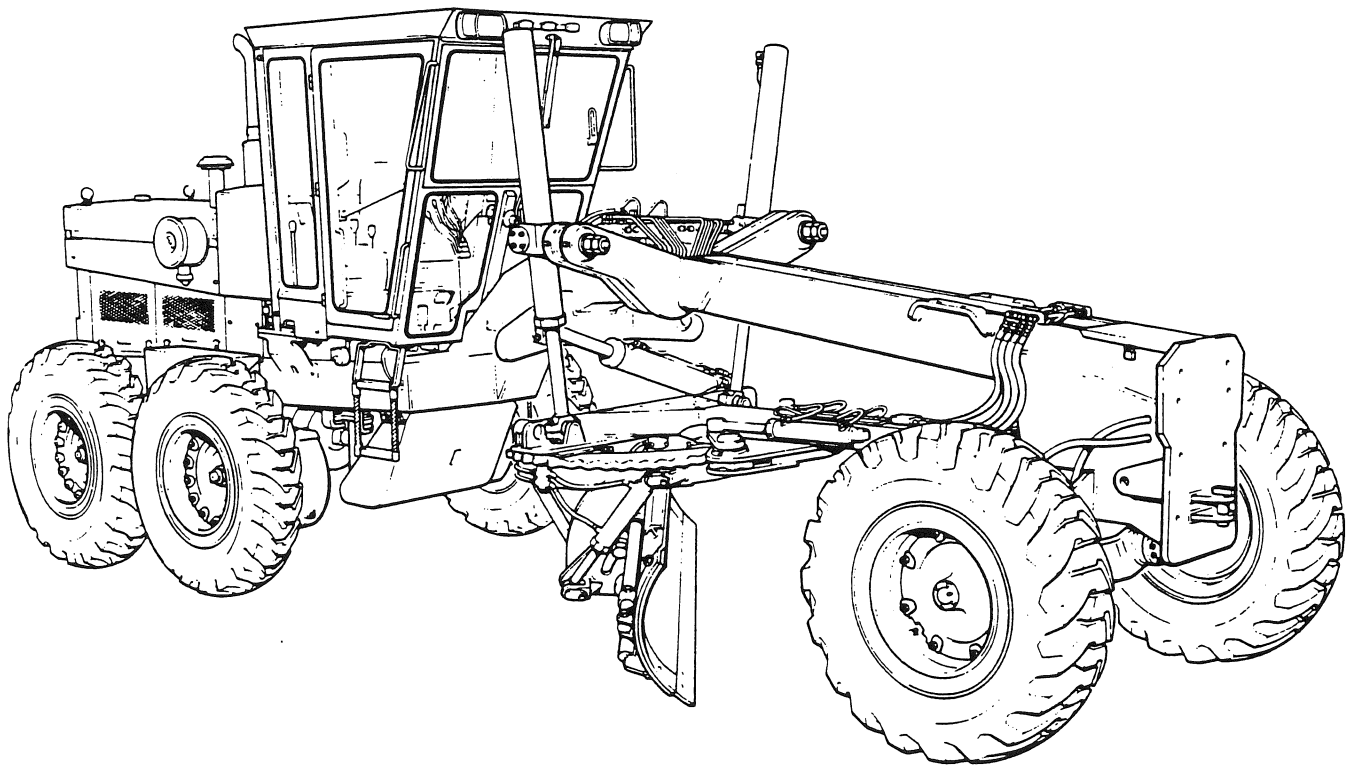


SECTION 14

ENGINE REMOVAL AND INSTALLATION



**700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION**

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Think Safety First!	1
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“USE AS A GUIDE ONLY”

700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION

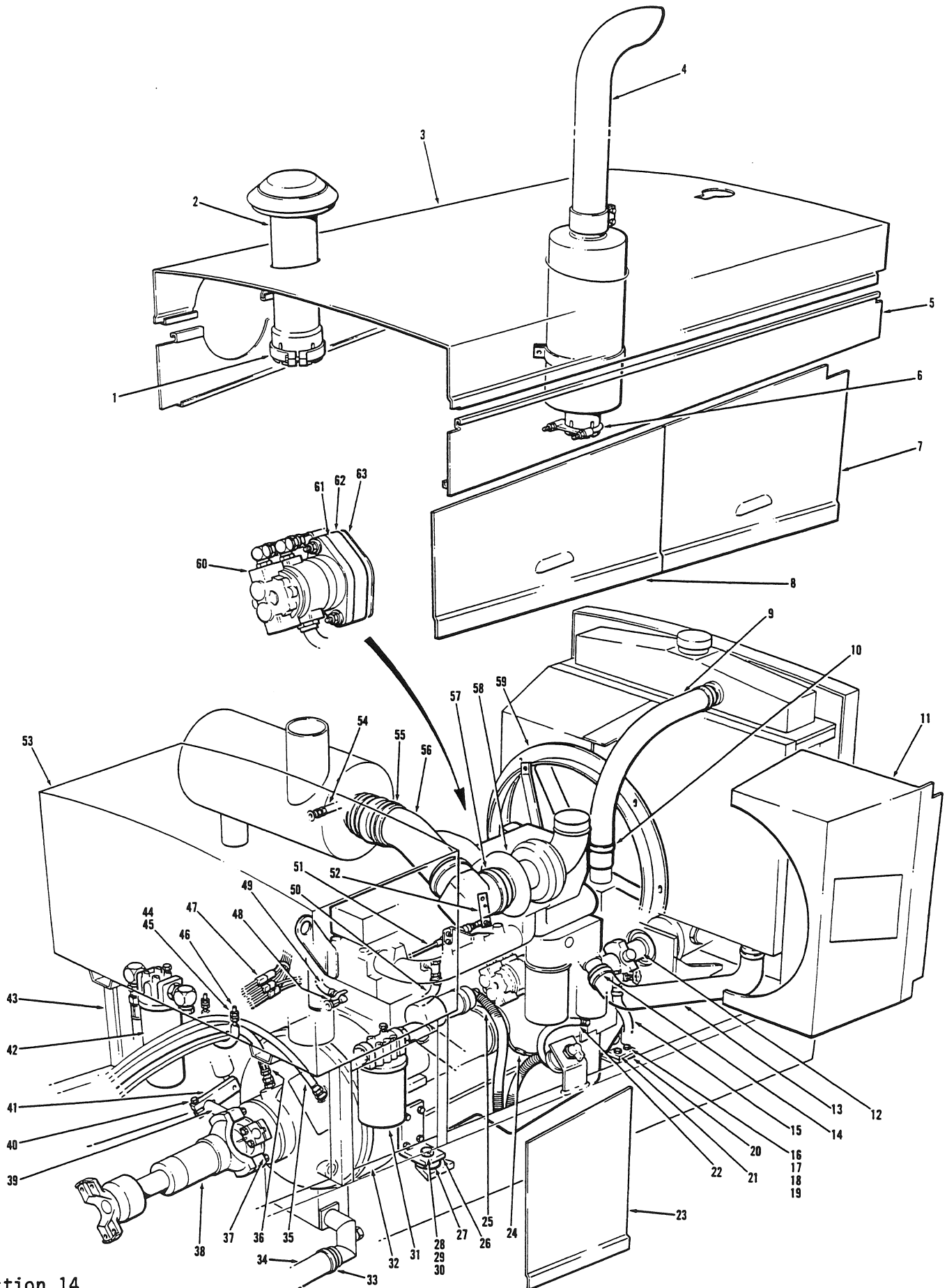


Fig. 1

700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION

Item	Description	Item	Description	Item	Description
1	Clamp	23	Panel	43	Stand
2	Air cleaner extension	24	Articulation solenoid wiring harness	44	Nuts
3	Engine hood	25	Positive cable	45	Lockwashers
4	Muffler/exhaust stack	26	Engine front support	46	U bolt
5	Intermediate panel	27	Rubber mount	47	Wiring harness con- nectors
6	Clamp	28	Locknuts	48	Fuel feed valve
7	Rear lower panel	29	Bolts	49	Fuel feed hose
8	Front lower panel	30	Plain washers	50	Heater hose
9	Upper radiator hose	31	Primary hydraulic oil filter	51	Accelerator cable
10	Clamp	32	Clutch housing	52	Engine governor arm
11	Left hand shroud	33	Clamp	53	Fuel tank
12	Transmission/steering hydraulic pump drive- shaft	34	Drain hose	54	Fuel return hose
13	Lower radiator hose	35	Breather hose	55	Clamp
14	Clamp	36	Lubrication pressure hose	56	Air cleaner duct
15	Heater hose	37	Bolts	57	Clamp
16	Nuts	38	Driveshaft	58	Engine
17	Bolts	39	Shaft	59	Shroud ring
18	Plain washers	40	Bolt	60	Primary hydraulic pump
19	Lockwashers	41	Arm	61	Gasket
20	Pads	42	Transmission hydraulic oil filter	62	Adapter
21	Engine rear support			63	Gasket
22	Ground strap				

Key to Fig. 1

700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION

General



A clean work area will reduce the chance of foreign matter entering the hydraulic system.

Make sure proper tools are available and in good working order. You will require a safe lifting device; blocks or proper stands and shop tools.

Refer to the 700 Series Parts Manual for spare parts information. Refer to the Lubrication Specifications in the front of this Shop Manual for lubricant information.



ALWAYS put the grader in the **SERVICE POSITION** before attempting any over-haul, maintenance or inspection procedure.

Refer to the **SERVICE POSITION** details on page (ii) in the front of this Shop Manual.

NOTE

Weights, measures and tolerances are in Metric (SI), Imperial and U.S. quantities. International standards specify the comma to represent the decimal point in all Metric measurements.

NOTE

The terms left hand side and right hand side indicate the directions when in the operator's cab looking toward the front of the grader.

Description

This Shop Manual Section describes how to remove and install the engine.

Depending on your engine model and grader options, you may or may not have to remove the fuel tank and fuel tank stand. Normally, the clutch housing should stay with the engine during this procedure.

**700 SERIES SHOP MANUAL
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Torque Guide

Fig. No.	Application	Torque Value		
		N.■	kgf.■	lbf.ft
Fig. No. 37	Engine rear support retaining nuts	47,5	4,8	35
Fig. No. 38	Engine front support retaining locknuts	379,6	38,7	280
Fig. No. 39	Transmission/steering hydraulic pump driveshaft bolts	31,2	3,2	23
Fig. No. 42	Primary hydraulic pump retaining nuts	77,3	7,9	57
Fig. No. 55	Slave cylinder bracket bolts	17,6	1,8	13
Fig. No. 57	Driveshaft bolts	31,2	3,2	23
Fig. No. 58	Transmission hydraulic oil filter bolts	31,2	3,2	23
Fig. No. 59	Primary hydraulic oil filter bolts	17,6	1,8	13

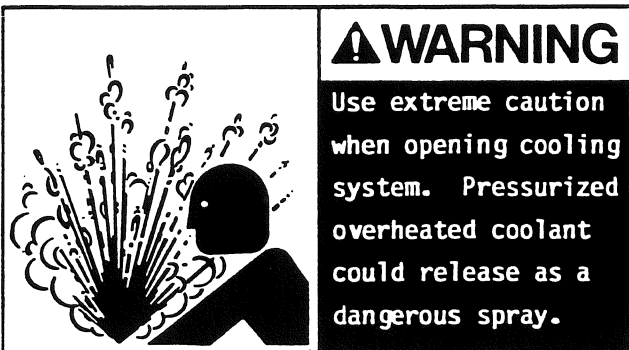
700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION

Engine Removal

Fig. 2

Park the grader on level ground. Place the transmission mode lever in **Neutral**. Lower the moldboard onto wooden blocks. Shut down the engine and place the machine in the **SERVICE POSITION**. Remove the panels (23) below the fuel tank (53). Remove the front (8) and rear (7) lower panels. Remove the intermediate panels (5).

Fig. 3



Turn off the heater hose valve on the right hand side of the engine (58). Disconnect the heater hose (50). Cap the open port and hose. Repeat this step for the left hand valve and heater hose (15).

Fig. 4

After disconnecting the left hand heater hose, open the valve and drain the coolant into a container (35 L [7.7 Imp. gal, 9.2 U.S. gal] capacity or more.

Fig. 5

Loosen the clamp (14) and disconnect the lower radiator hose (13). Drain the coolant into a container (35 L [7.7 Imp. gal, 9.2 U.S. gal]) capacity or more.

Fig. 6

Loosen the clamp (6) securing the muffler/exhaust stack (4) to the turbo-charger. Remove the nut, bolt and lockwasher retaining the clamp to the brace. Remove the muffler/exhaust stack and immediately cap the turbo-charger.

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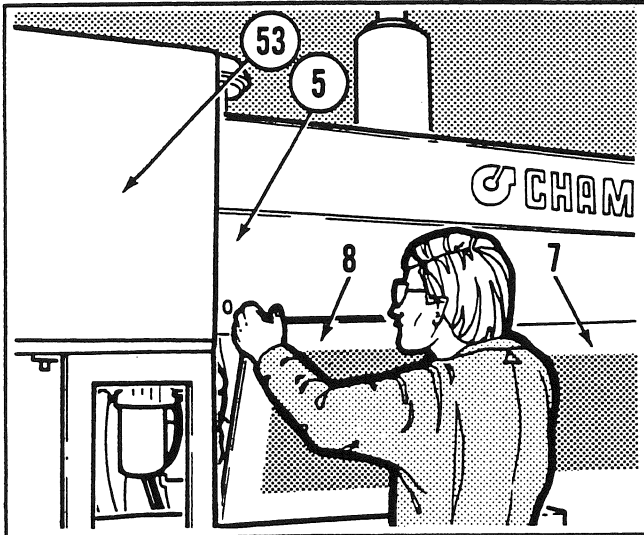


Fig. 2



Fig. 4

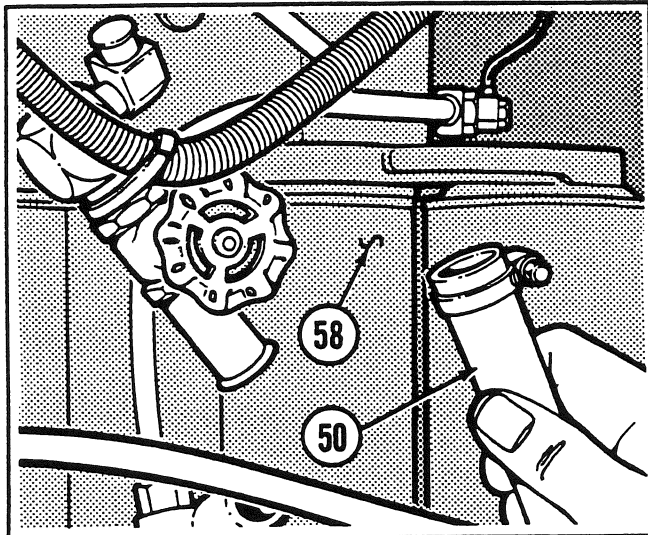


Fig. 3

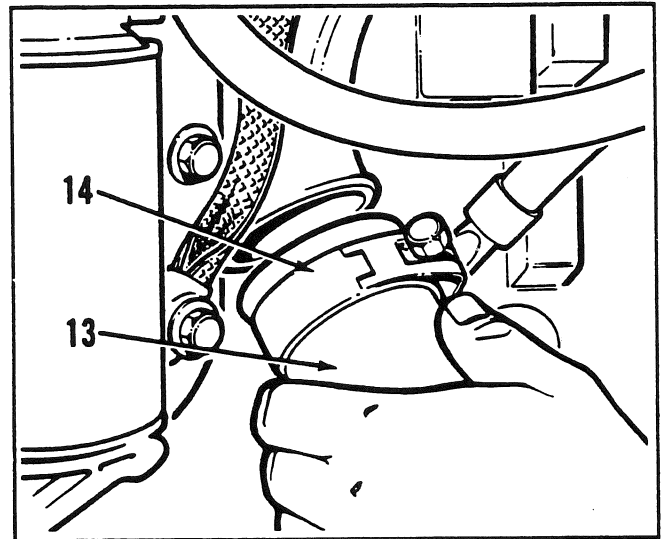


Fig. 5

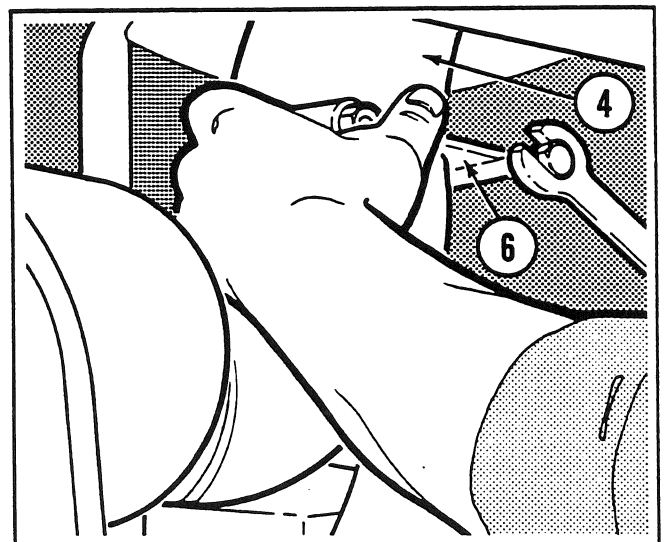


Fig. 6

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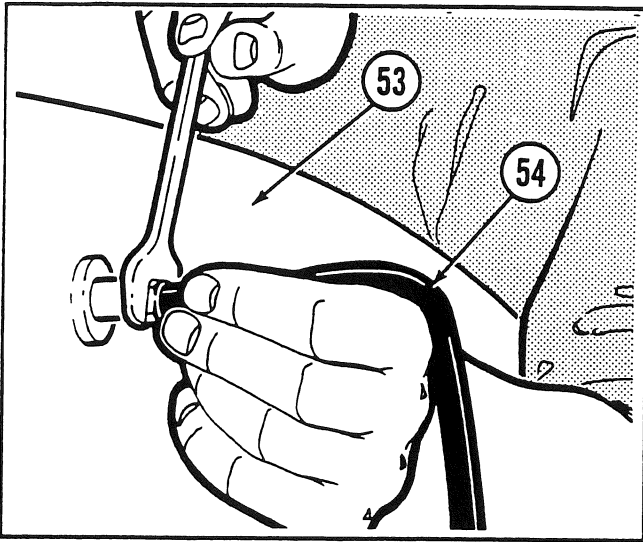


Fig. 7

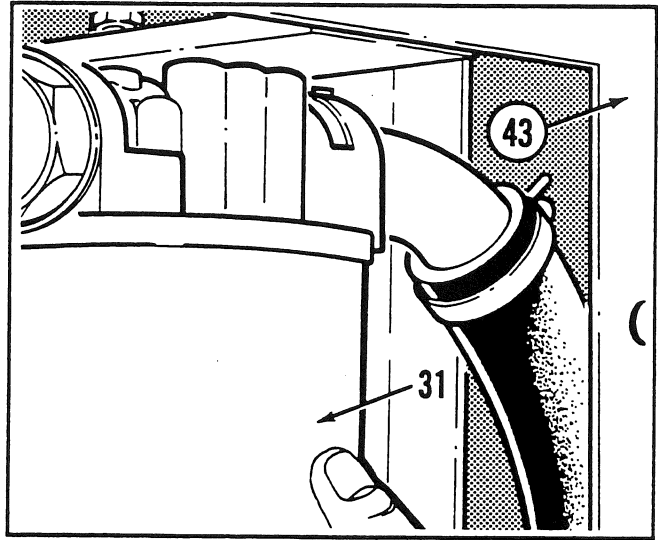


Fig. 10

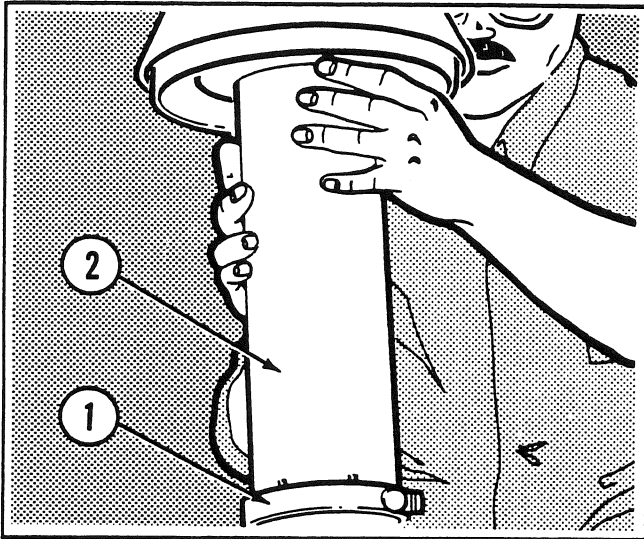


Fig. 8

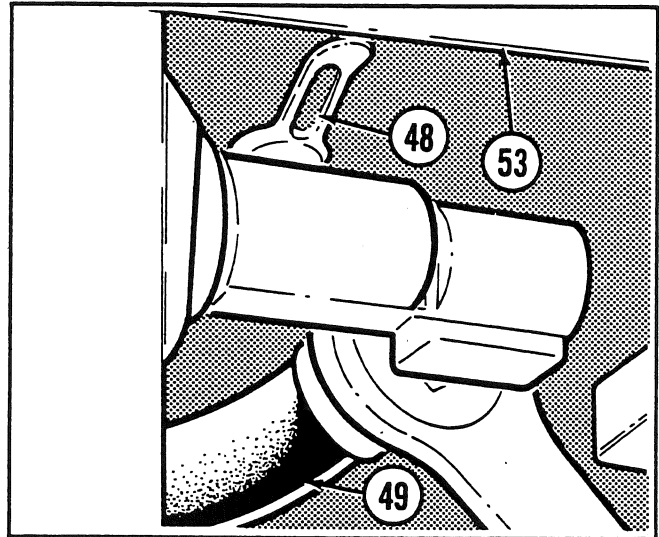


Fig. 11

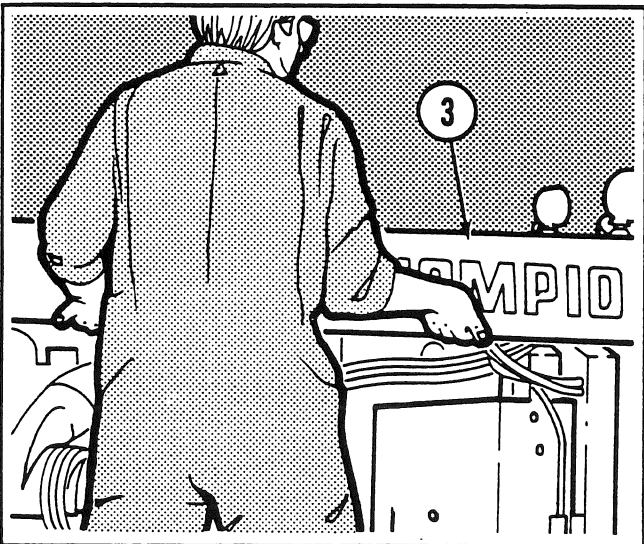


Fig. 9

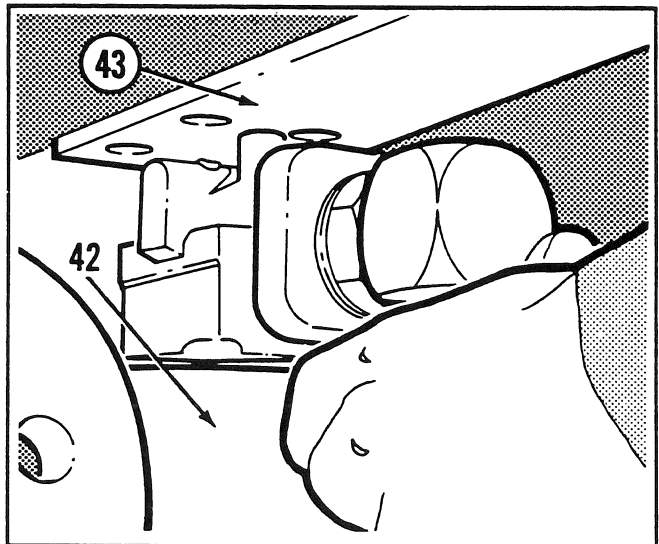


Fig. 12

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ENGINE REMOVAL AND INSTALLATION

Engine Removal (Continued)

Fig. 7

Disconnect the fuel return hose (54) from the fuel tank (53). Fuel will leak if the level is above the return port. Immediately cap the open port and hose fitting.

Fig. 8

Loosen the clamp (1) securing the air cleaner extension (2). Remove the extension and immediately cap the air cleaner intake tube.

Fig. 9

Remove the bolts, lockwashers and plain washers retaining the engine hood (3). Remove the hood.

Fig. 10

Remove and discard the plastic ties securing any hoses or wires to the stand (43). Remove the bolts and lockwashers retaining the primary hydraulic oil filter (31). Remove the filter. It is not necessary to disconnect the hoses from the filter.

Fig. 11

Close the fuel feed valve (48) below the fuel tank (53). Disconnect the fuel feed hose (49) and immediately cap the hose and port.

Fig. 12

Remove the bolts and lockwashers retaining the transmission hydraulic oil filter (42) to the stand (43). Remove the filter. It is not necessary to disconnect the hoses from the filter.

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ENGINE REMOVAL AND INSTALLATION

Engine Removal (Continued)

Fig. 13

Remove the bolts and lockwashers retaining the slave cylinder bracket to the clutch housing (32). Loosen the bolt (40) retaining the arm (41) on the shaft (39). Remove the slave cylinder and bracket. A Woodruff key prevents the arm turning on the shaft.

Fig. 14

Remove the clamp retaining the accelerator cable (51). Disconnect the accelerator cable from the engine governor arm (52).

Fig. 15

Remove the nuts and lockwashers retaining the primary hydraulic pump (60) and adapter (62). Remove the pump and adapter. Discard the two gaskets (61 and 63). It is not necessary to disconnect the hoses from the pump.

Fig. 16

Remove the nuts (44), lockwashers (45) and U bolt (46) retaining the hoses and wiring harnesses below the stand (43).

Fig. 17

Loosen the clamp (33) at the clutch housing drain manifold. Disconnect the drain hose (34). Immediately cap the hose and open port.

Fig. 18

Remove the bolts (37) and lockwashers from both ends of the driveshaft (38). Remove the driveshaft. Ensure that the universal joint bearings do not fall off during this procedure.

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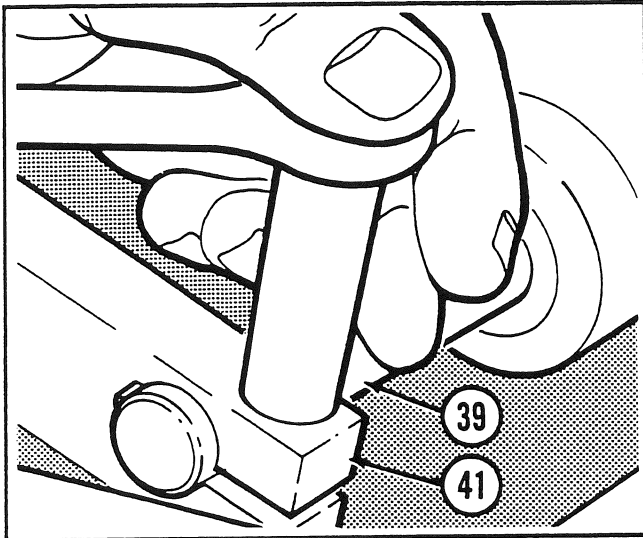


Fig. 13

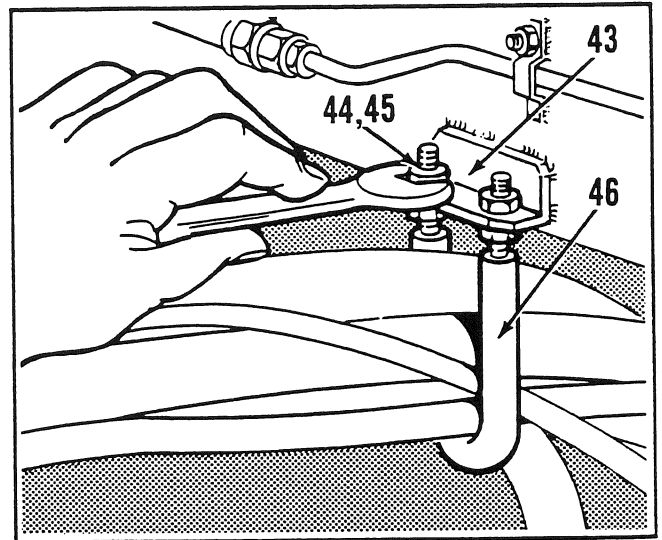


Fig. 16

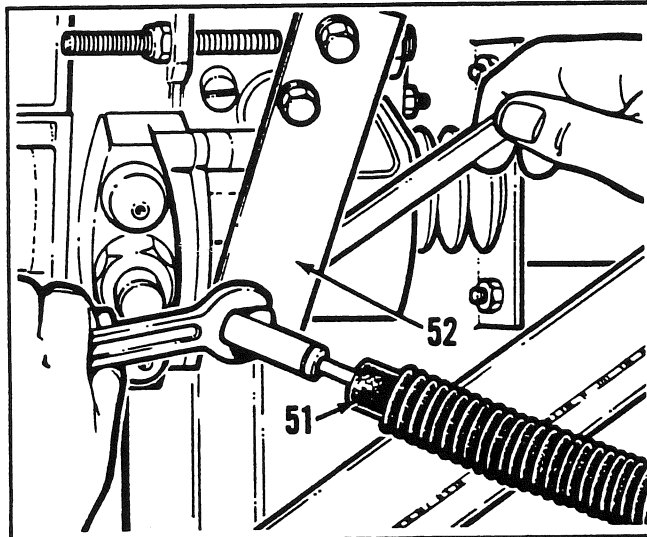


Fig. 14

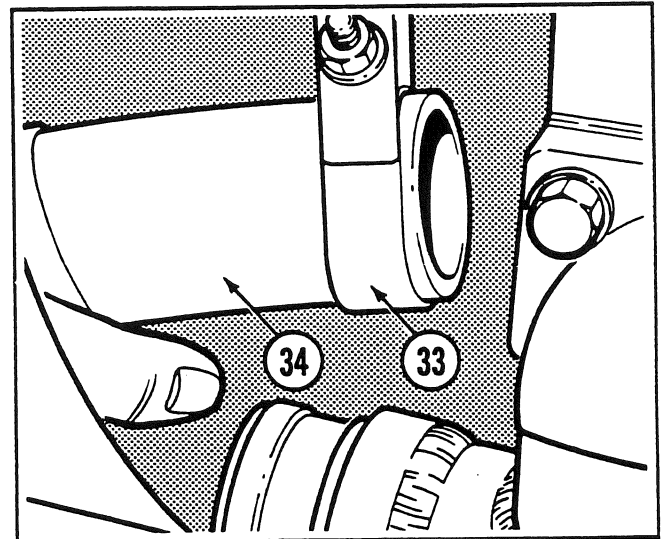


Fig. 17

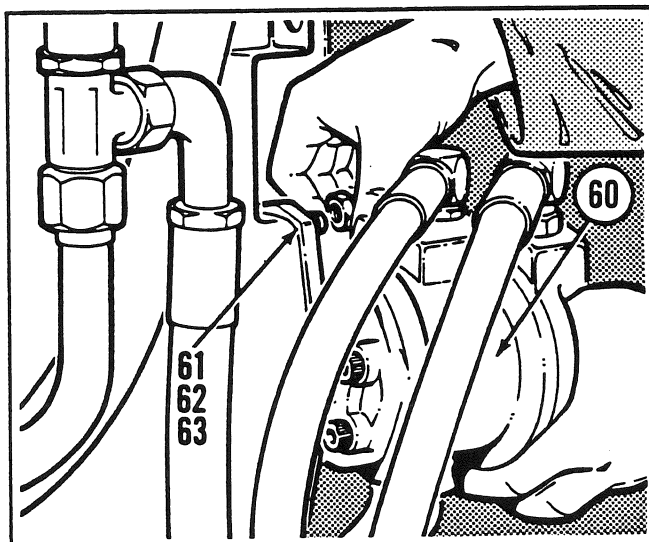


Fig. 15

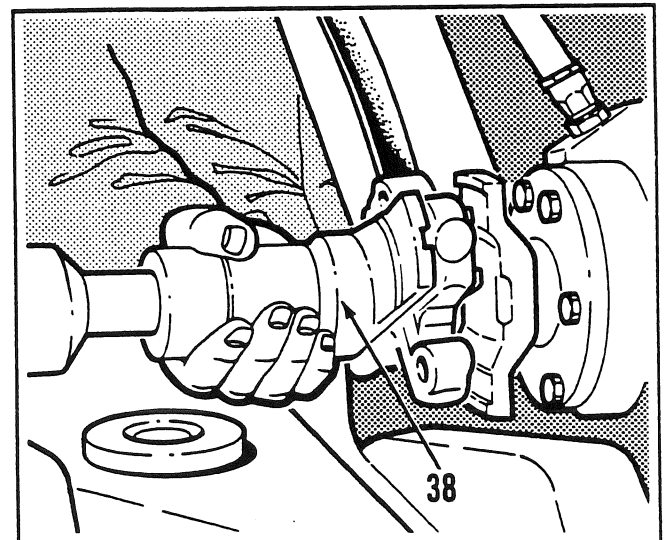


Fig. 18

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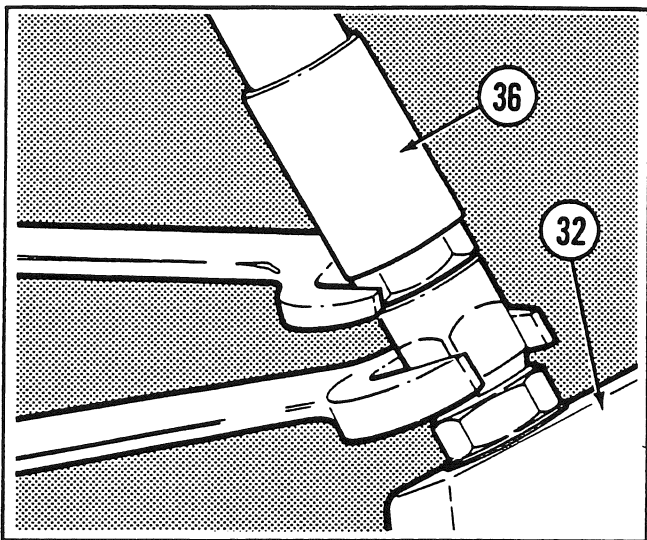


Fig. 19

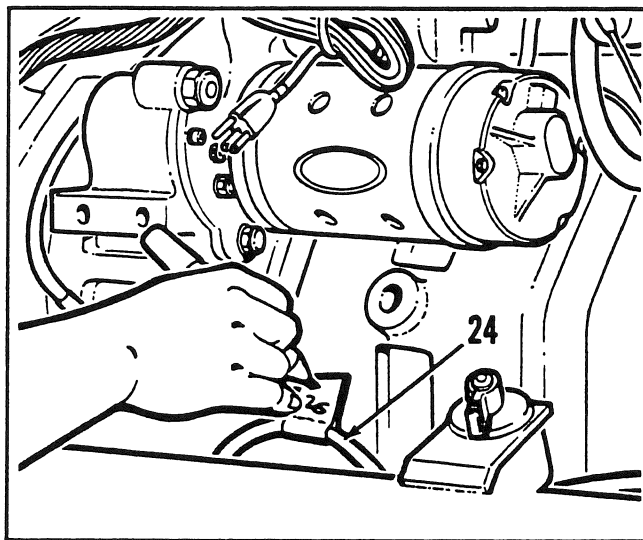


Fig. 22

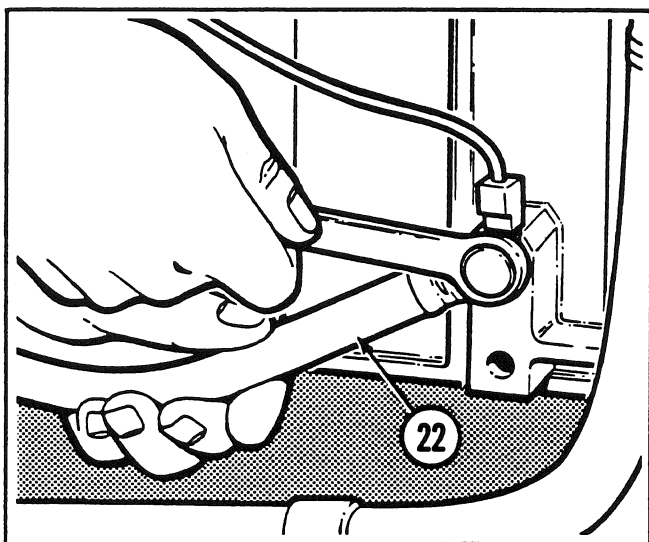


Fig. 20

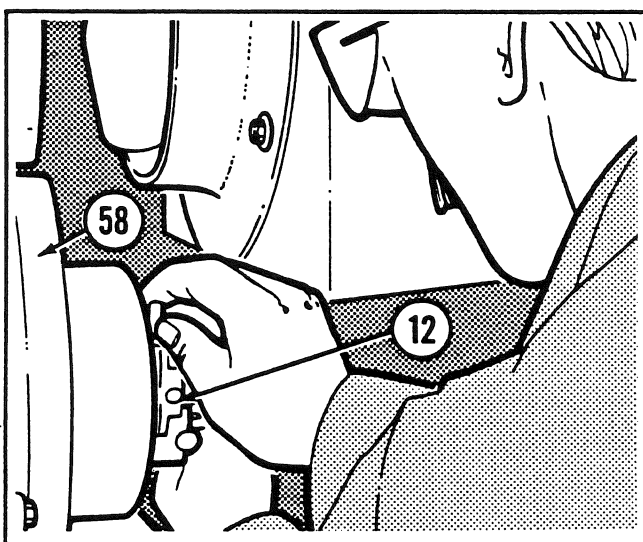


Fig. 23

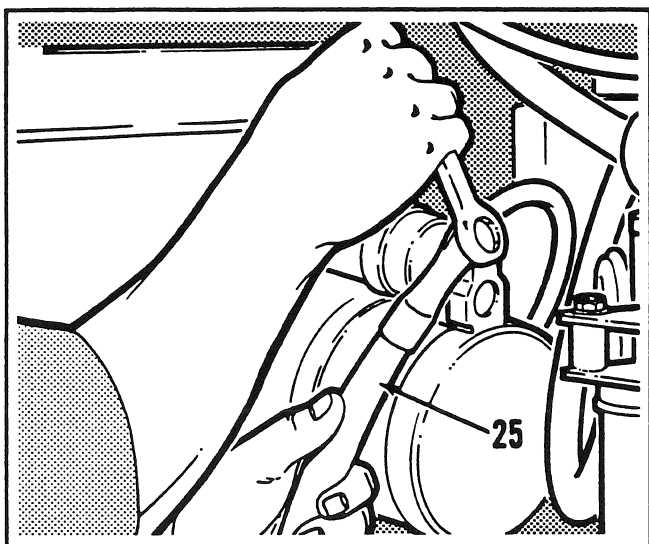


Fig. 21

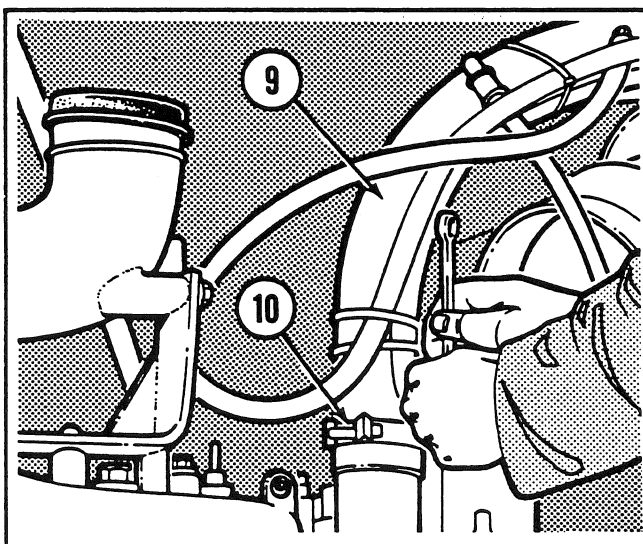


Fig. 24

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ENGINE REMOVAL AND INSTALLATION

Engine Removal (Continued)

Fig. 19

Use an appropriate method and identify the breather hose (35) and lubrication pressure hose (36) to prevent confusion during installation. Disconnect the hoses from the clutch housing (32). Immediately cap the open ports and fittings. Remove the heater hose clip from the clutch housing.

Fig. 20

Disconnect the ground strap (22) from the engine cylinder block.

Fig. 21

Disconnect the positive cable (25) from the starter motor.

Fig. 22

Use an appropriate method and identify the wiring harness connectors (47) under the fuel tank (53) to prevent confusion when connected. Disconnect the harnesses. For articulated frame graders, identify the articulation wiring harness (24). Disconnect the harness and remove it from behind the starter motor.

Fig. 23

Remove the bolts and lockwashers retaining the transmission/steering hydraulic pump driveshaft (12) to the pump drive adapter. Slide the driveshaft away from the engine (58).

Fig. 24

Loosen the clamp (10). Disconnect the upper radiator hose (9) from the engine thermostat outlet.

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ENGINE REMOVAL AND INSTALLATION

Engine Removal (Continued)

Fig. 25

Remove the bolts and plain washers retaining the shroud ring (59) to the radiator shroud. Remove the shroud ring. Remove only the bolts and plain washers retaining the left hand shroud (11). Remove the left hand shroud.

Fig. 26

Loosen the clamps (55 and 57). Remove the air cleaner duct (56) from the engine turbocharger and air cleaner tube. Immediately cap the open ports of the turbocharger, air cleaner tube and duct.

Fig. 27

Attach chains from a safe lifting device to the front and rear lifting eyes on the engine block. **Make sure** you keep the chains taut; remove any slackness in the links.

Fig. 28

Remove the nuts (16), bolts (17), plain washers (18) and lockwashers (19) securing the engine rear support (21) to the frame cross member.

Fig. 29

Remove the locknuts (28), bolts (29) and plain washers (30) securing the engine front supports (26) to the frame brackets. Inspect the locknuts for possible re-use. Locknuts can normally be re-used twice from new. If in doubt, discard the part.

Fig. 30

Raise the engine (58) a little distance using a safe lifting device. Move the engine toward the front of the grader sufficiently enough to remove the transmission/steering hydraulic pump driveshaft (12).

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ENGINE REMOVAL AND INSTALLATION

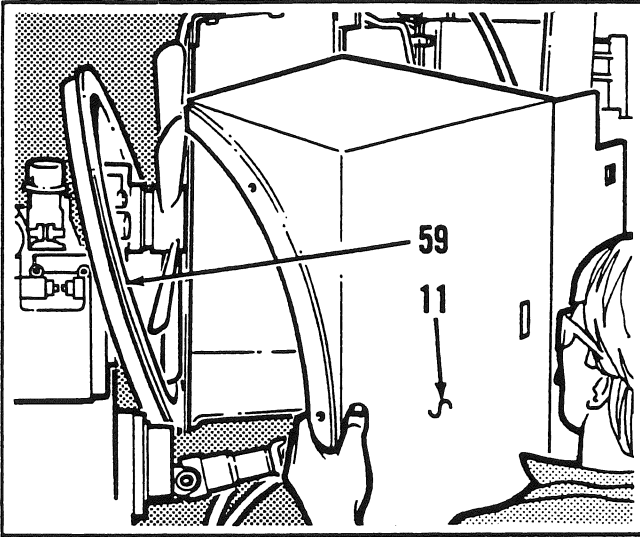


Fig. 25

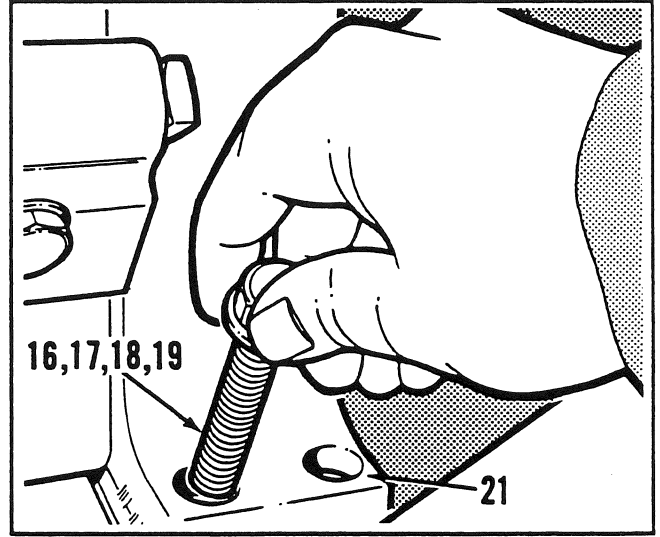


Fig. 28

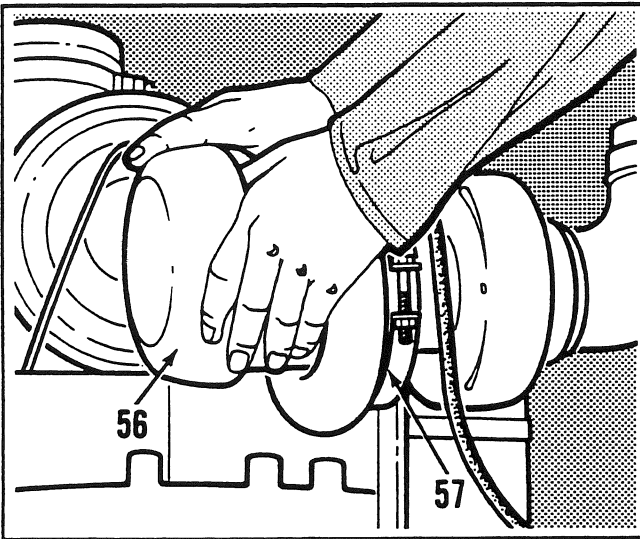


Fig. 26

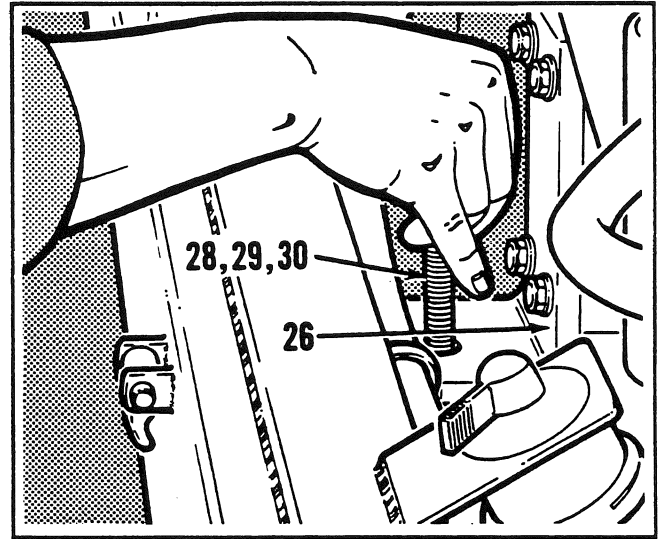


Fig. 29

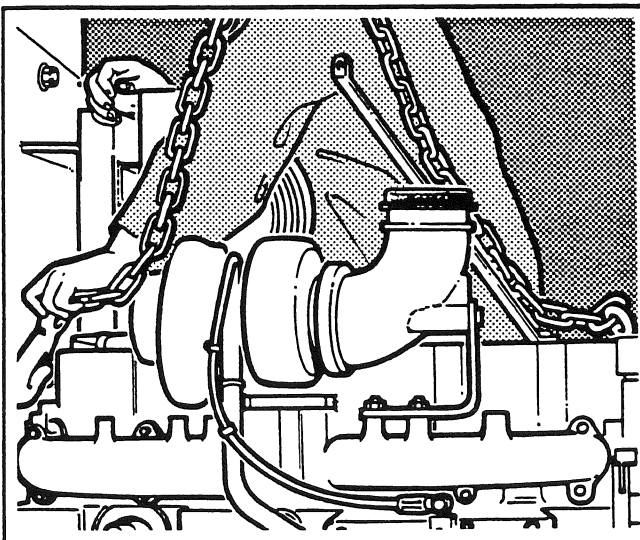


Fig. 27

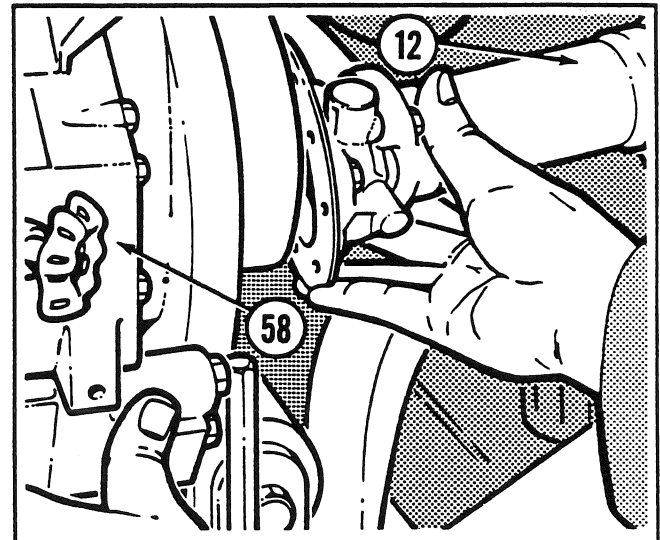


Fig. 30

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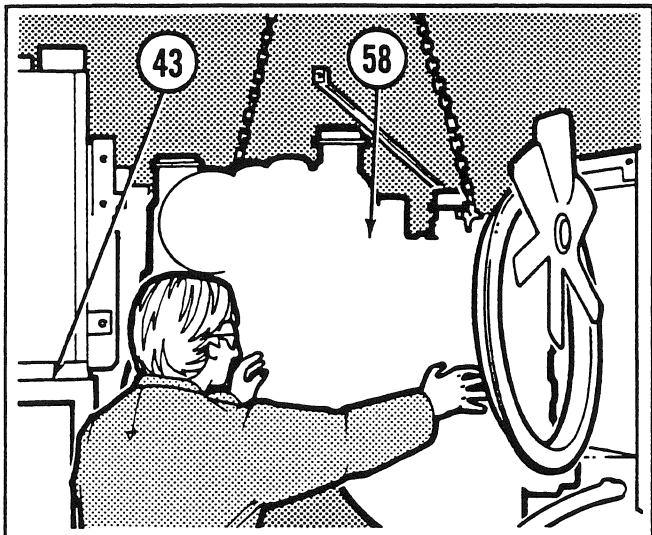


Fig. 31

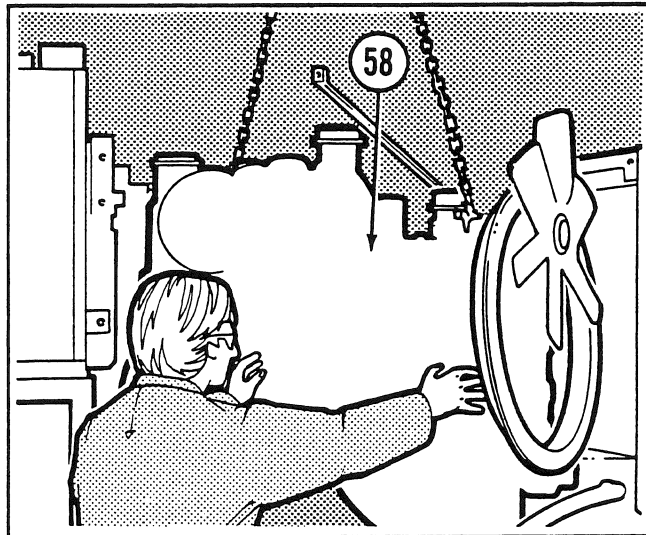


Fig. 33

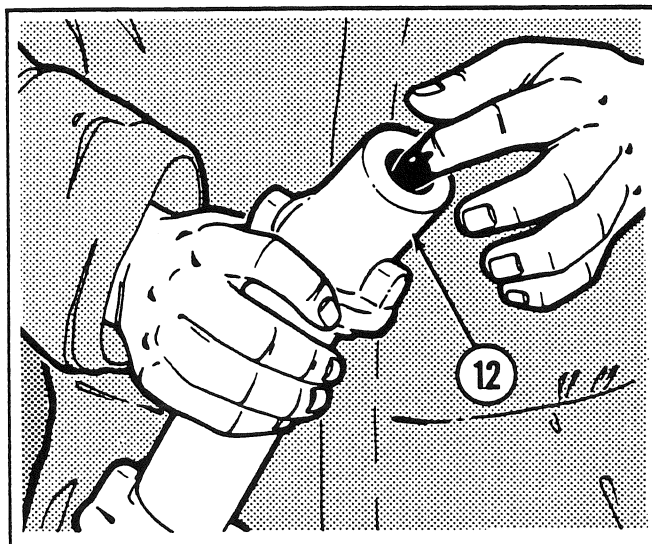


Fig. 32

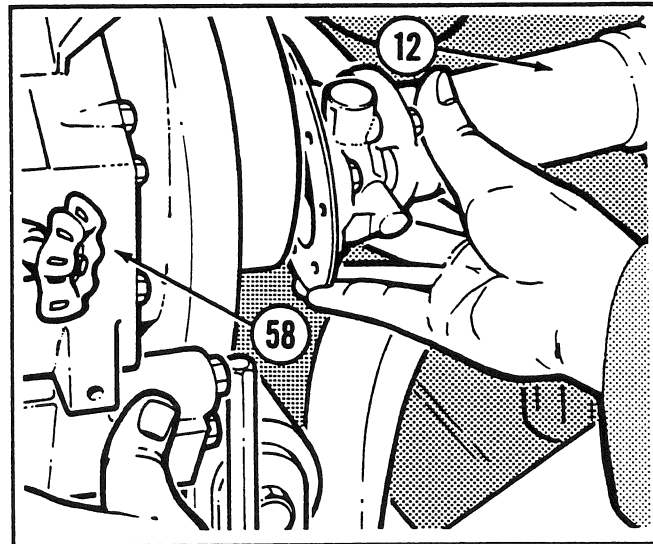


Fig. 34

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ENGINE REMOVAL AND INSTALLATION

Engine Removal (Continued)

Fig. 31



NOTE

MAKE SURE the fan does not strike the radiator or shroud; the valve cover does not strike the air cleaner and the engine rear supports do not damage any hoses.

Carefully lift the engine (58) using a safe lifting device. Move the engine backward to prevent the clutch housing (32) striking the stand (43). Slightly turn the engine to the right. Lift the engine. You may have to repeat these maneuvers. Remove the engine and lower onto a safe stand for servicing. **DO NOT** rest directly on the oil pan! Remove the plain washers (30).

Engine Installation

Fig. 32

Before installing the engine (58), inspect the universal joints and splined yoke on the transmission/steering hydraulic pump driveshaft (12). Apply anti-seize compound, Champion part number 30453, onto the slip yoke splines.

Fig. 33

NOTE

MAKE SURE the fan does not strike the radiator or shroud; the valve cover does not strike the air cleaner and the engine rear supports do not damage any hoses. When lowering the engine, **DO NOT** rest the oil pan on the cross member!

Inspect the condition of the rubber mounts (27) and pads (20). Replace parts where necessary. Lower the engine (58) into the grader using a safe lifting device. Position the engine so that the front (26) and rear (21) supports align with the pads and brackets on the frame.

Fig. 34

With the engine (58) suspended over the frame brackets and pads (20), install the transmission/steering hydraulic pump driveshaft (12) onto the pump input shaft splines.

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ENGINE REMOVAL AND INSTALLATION

Engine Installation (Continued)

Fig. 35

Align the bolt holes in the engine rear supports (21), pads (20) and frame cross member with an appropriate drift.

Fig. 36

Place a plain washer (30) on top of one rubber mount (27). Install the bolt (29) through the engine front support (26), washer and rubber mount. Repeat this procedure for the other front support.

Fig. 37

Just before resting the engine (58) on the rubber mounts (27) and pads (20), align the transmission/steering pump driveshaft (12) to the adapter flange. Fully lower the engine. Install the nuts (16), bolts (17), plain washers (18) and lockwashers (19) securing the engine rear support (21) to the frame cross member. Tighten the nuts to the specified torque.

Fig. 38

Install the locknuts (28) and plain washers (30) securing the engine front supports (26) to the frame brackets, refer to text for **Fig. 29**. Tighten the nuts to the specified torque.

Fig. 39

Retain the transmission/steering hydraulic pump driveshaft (12) to the adapter flange with the bolts and lockwashers. Tighten the bolts to the specified torque.

Fig. 40

Install the left hand radiator shroud (11). Retain with the bolts and plain washers. Install the shroud ring (59) onto the radiator shroud. Install the shroud ring bolts and plain washers. Tighten the bolts to finger tightness only.

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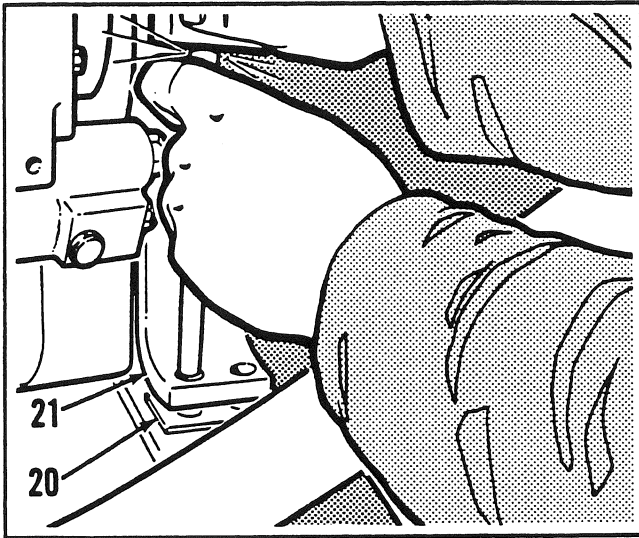


Fig. 35

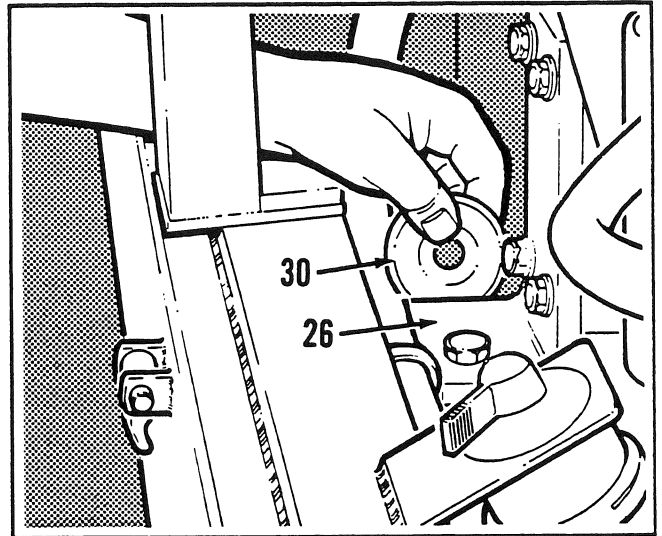


Fig. 38

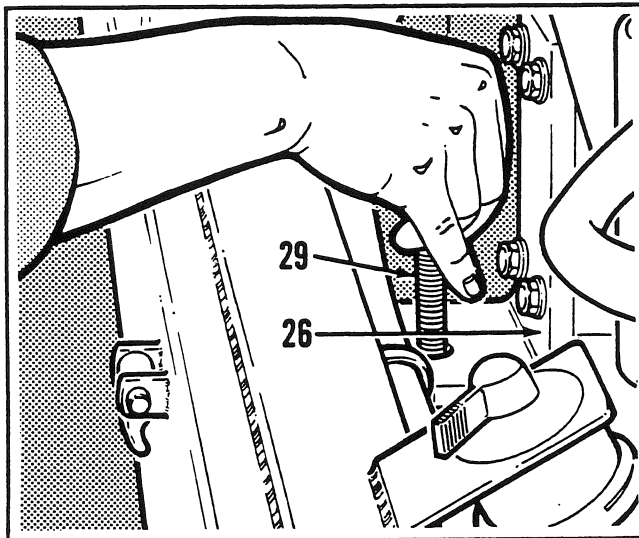


Fig. 36

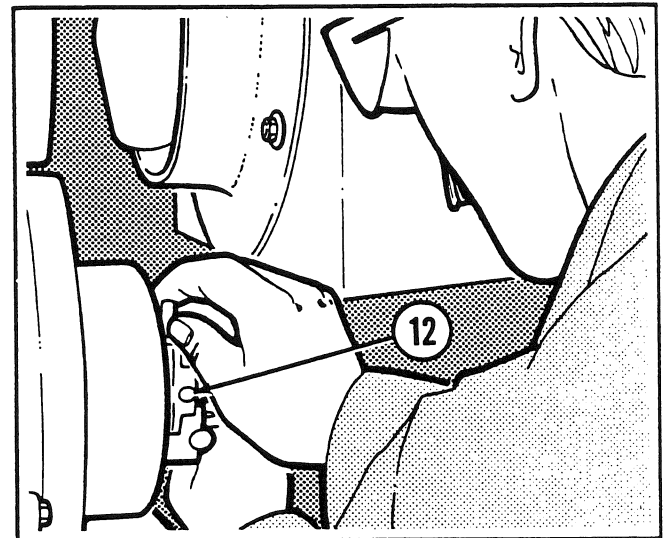


Fig. 39

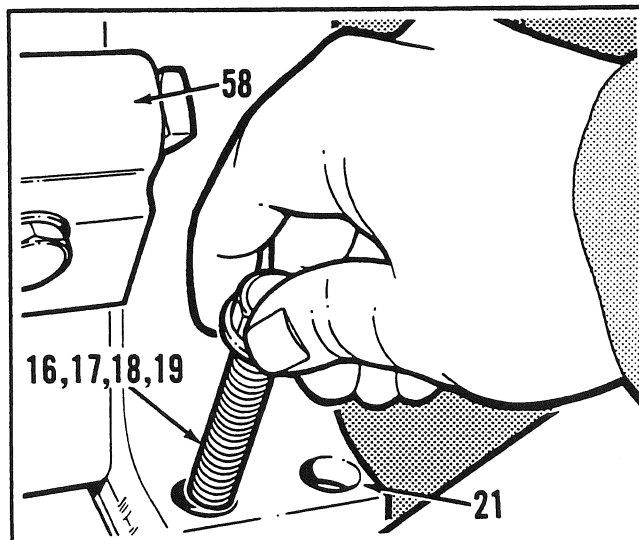


Fig. 37

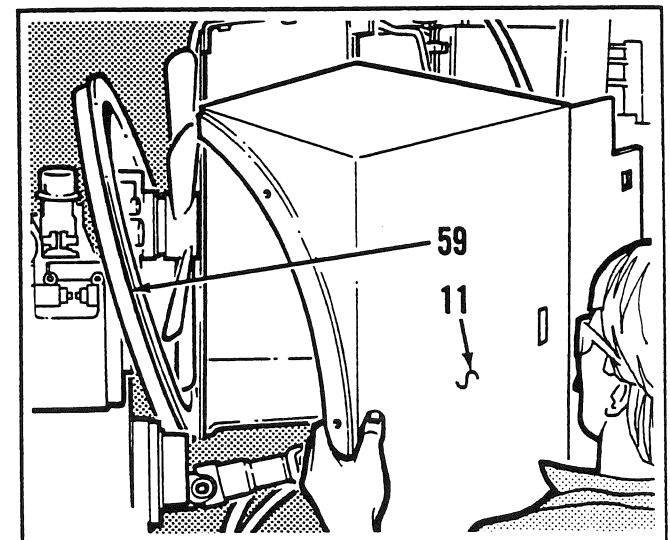


Fig. 40

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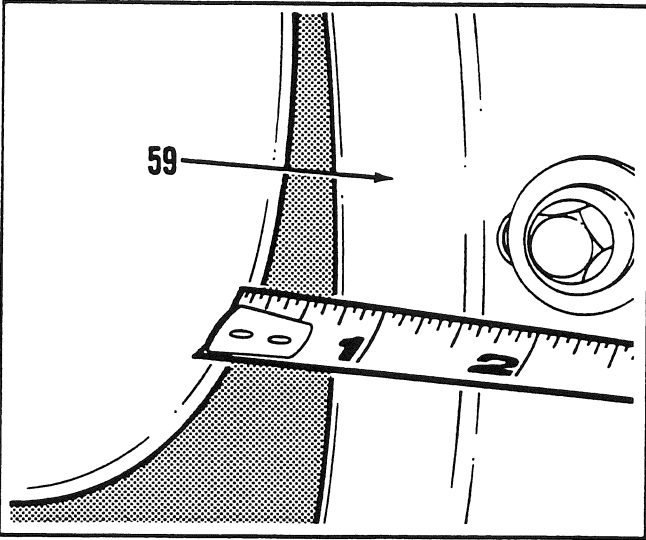


Fig. 41

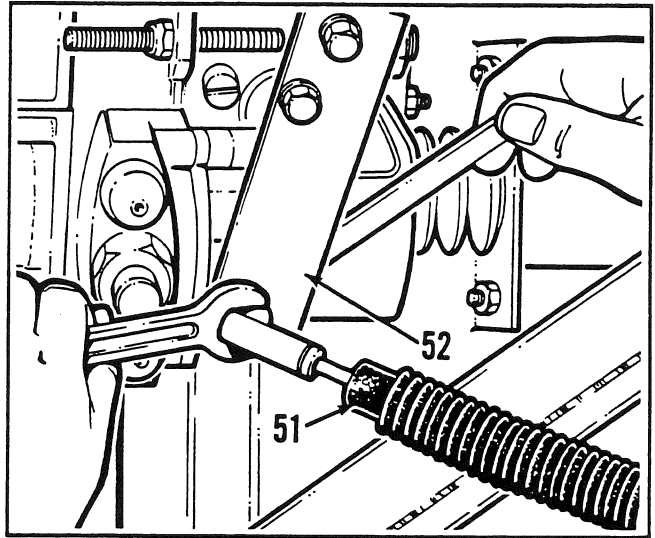


Fig. 44

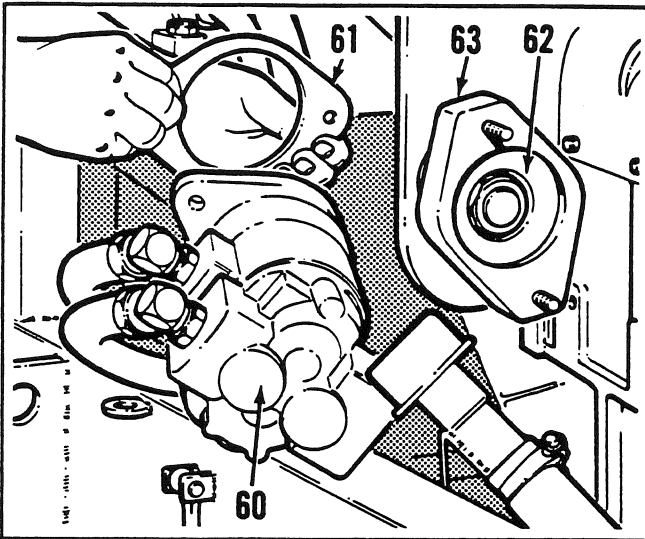


Fig. 42

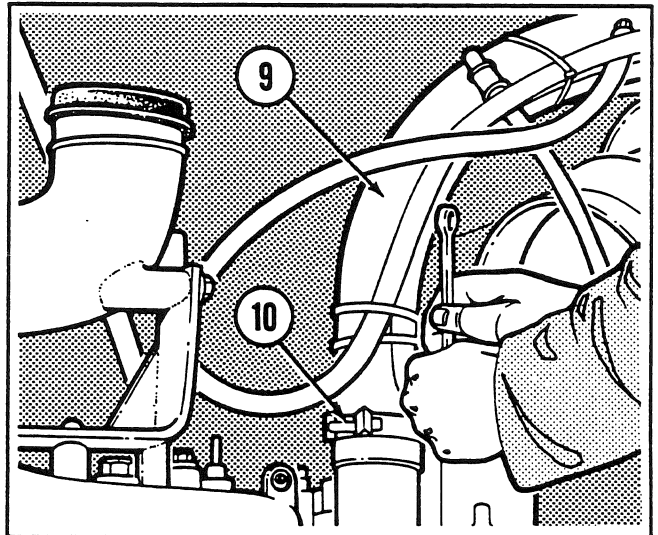


Fig. 45

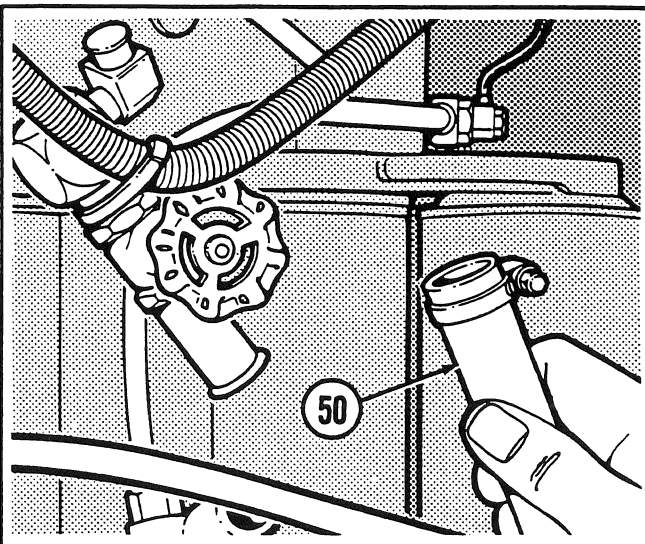


Fig. 43

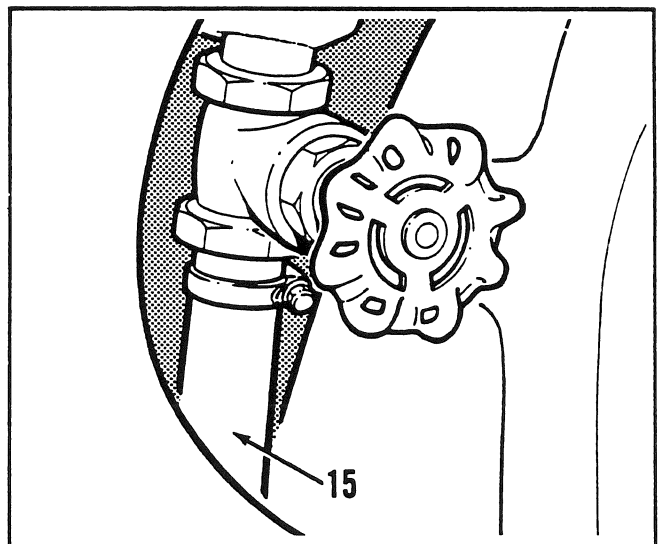


Fig. 46

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ENGINE REMOVAL AND INSTALLATION

Engine Installation (Continued)

Fig. 41

Center the shroud ring (59) on the radiator shroud by measuring the distance from the ring to the tip of the fan blades in four places. For maximum suction efficiency, ensure that one third of the fan blade width protrudes inside the shroud ring. When the shroud ring is centered, fully tighten the bolts. On blower fan installations ensure that the fan guard is installed.

Fig. 42

Before installing the primary hydraulic pump (60), install a new CUMMINS gasket (63) between the engine and the adapter (62). Install a new CHAMPION gasket (61) between the adapter and the pump. Install the pump. Make sure that the pump is seated properly. Secure with the nuts and lockwashers. **DO NOT** use the nuts to pull the pump onto the adapter. Tighten the nuts to the specified torque.

Fig. 43

Connect the heater hose (50) to the engine block and tighten the clamp. When the clamp is secure, open the valve.

Fig. 44

Connect the accelerator cable (51) onto the bracket. Tighten the clamp. Connect the linkage to the engine governor arm (52) and secure with the nut.

Fig. 45

Connect the upper radiator hose (9) to the engine thermostat housing and secure with the clamp (10).

Fig. 46

Connect the heater hose (15) to the water pump inlet and tighten the clamp. When the clamp is secure, open the valve.

700 SERIES SHOP MANUAL
ENGINE REMOVAL AND INSTALLATION

Engine Installation (Continued)

Fig. 47

Connect the lower radiator hose (13) and secure with the clamp (14).

Fig. 48

Connect the articulation solenoid wiring harness (24) if the grader is so equipped. Install the wiring harness behind the starter motor.

Fig. 49

Remove the caps and connect the drain hose (34) to the clutch housing drain manifold. Secure the hose with the clamp (33).

Fig. 50

Connect the positive cable (25) to the starter motor. Secure the cable terminal, but **DO NOT** over-tighten the nut!

Fig. 51

Connect the ground strap (22) to the engine block.

Fig. 52

Remove the caps from the turbocharger inlet, air cleaner tube and air cleaner duct (56). Install the duct and secure with the clamps (55 and 57). Ensure you make a tight and secure installation!

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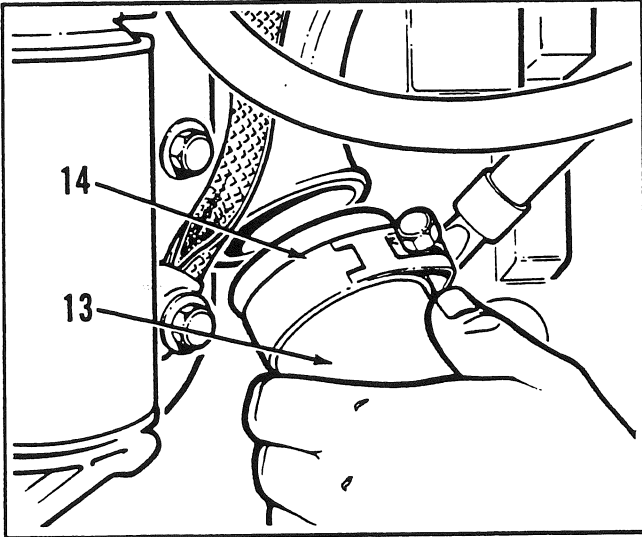


Fig. 47

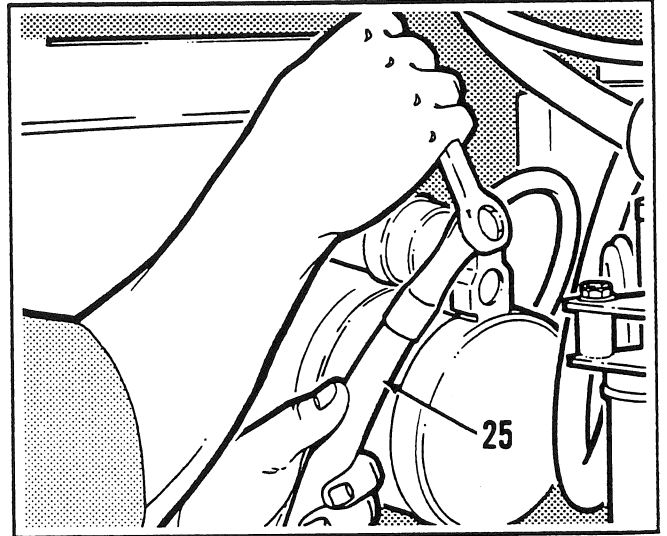


Fig. 50

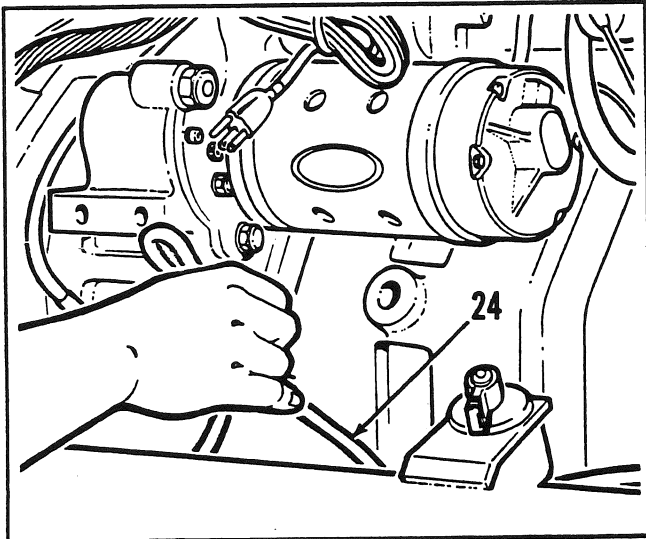


Fig. 48

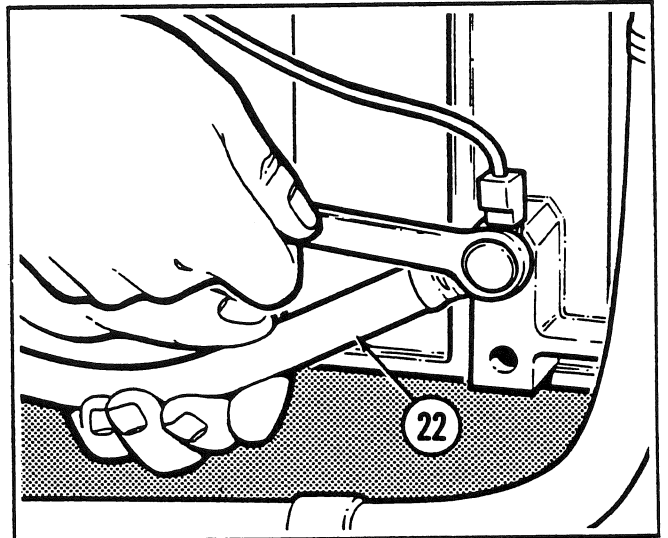


Fig. 51

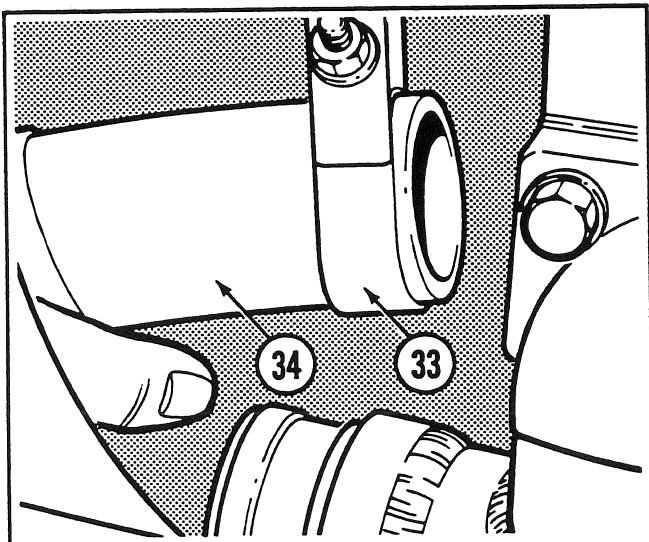


Fig. 49

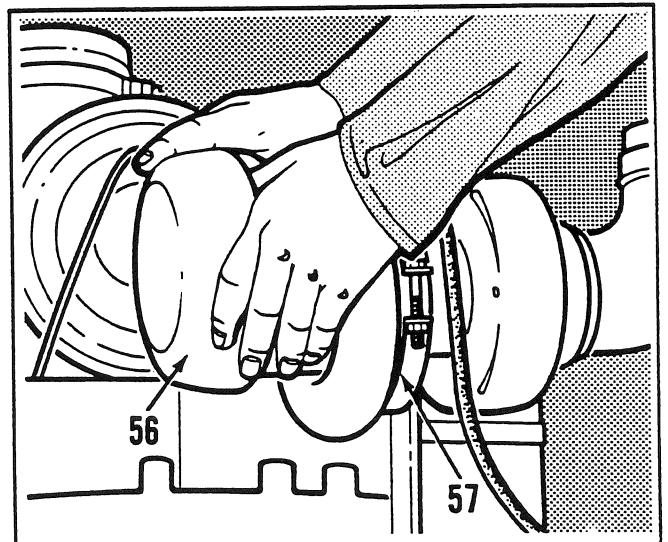


Fig. 52

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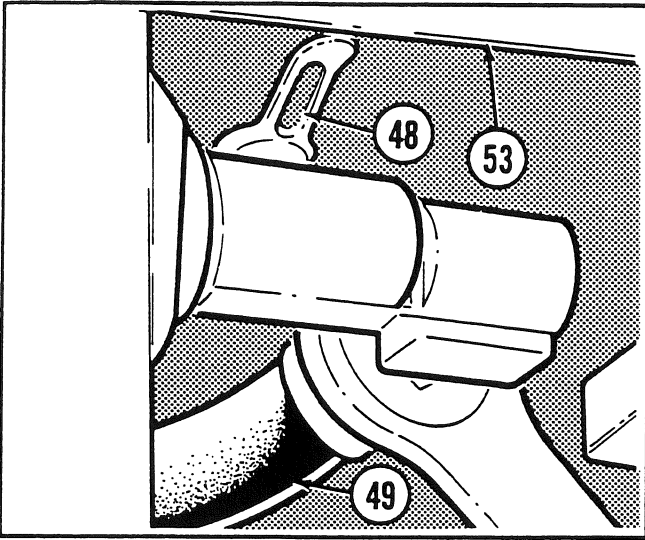


Fig. 53

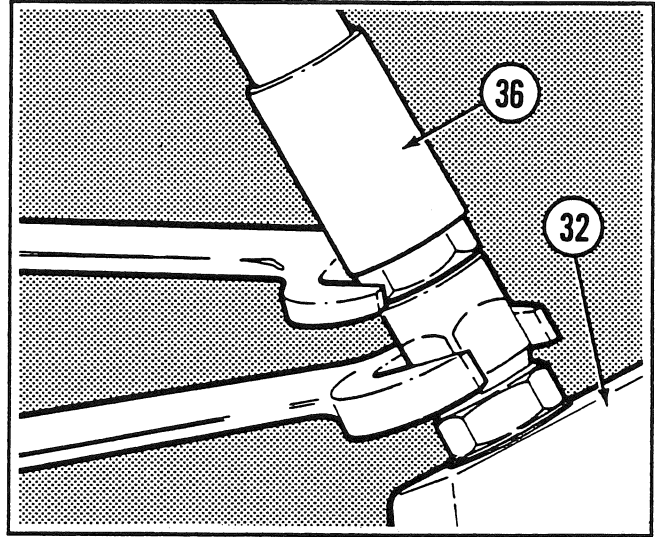


Fig. 56

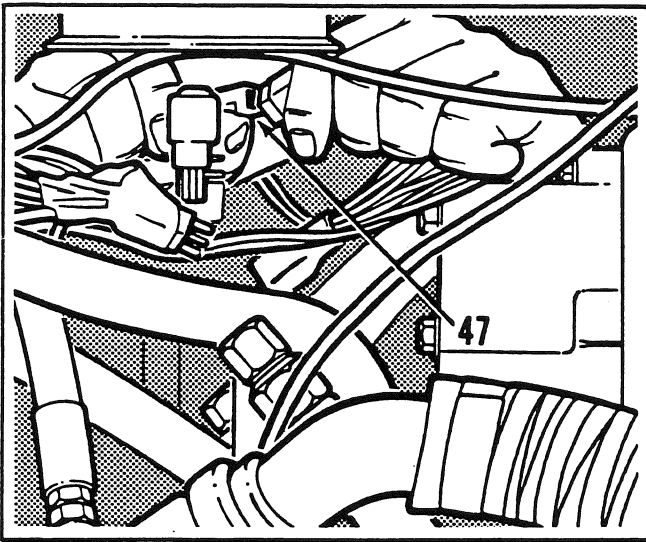


Fig. 54

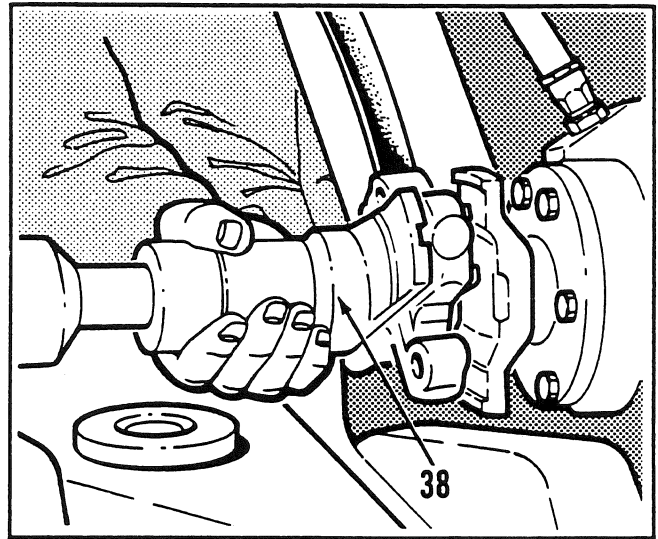


Fig. 57

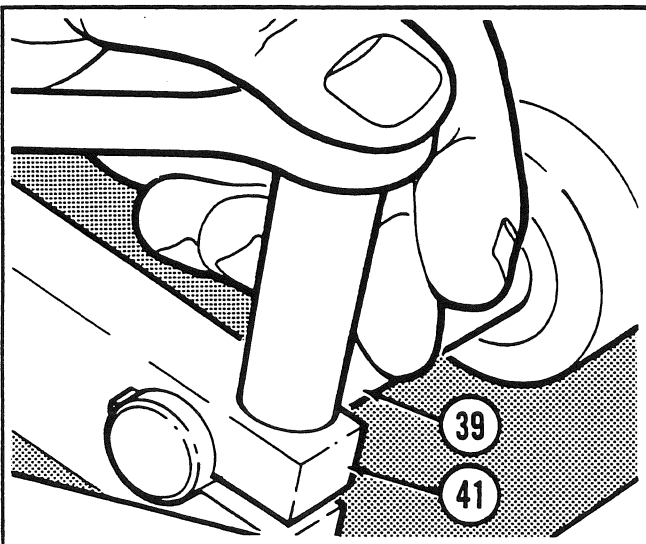


Fig. 55

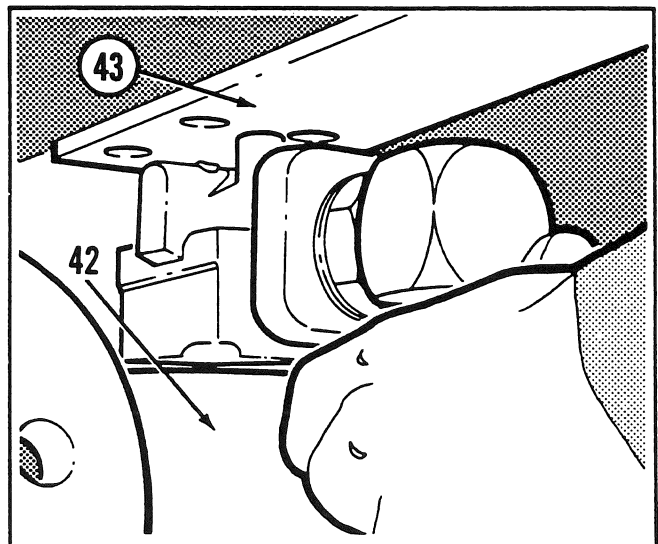


Fig. 58

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Engine Installation (Continued)

Fig. 53

Remove the caps and connect the fuel feed hose (49) to the fuel tank (53). Completely open the fuel feed valve (48). Wipe up any fuel that may have leaked or spilled when connecting the hose.

Fig. 54

Check the identification and connect the wiring harness connectors (47) below the fuel tank (53).

Fig. 55

Install the arm (41) on the shaft (39). Make sure that the Woodruff key engages with the key slot in the arm. Tighten the bolt (40) securing the arm on the shaft. Position the slave cylinder bracket on the clutch housing (32) and retain with the bolts and lockwashers. Tighten the bolts to the specified torque.

Fig. 56

On the left hand side of the machine, install the heater hose clip onto the clutch housing (32). Remove the caps and connect both the clutch housing breather hose (35) and the lubrication pressure hose (36). **Make sure** you check the hose identification for correct installation. Securely tighten all hydraulic hose fittings to avoid leakage.

Fig. 57

Before installing the driveshaft (38), inspect the universal joints and the slip joint. If binding occurs, service the driveshaft. Align the universal joints. Install the driveshaft and secure with the bolts (37) and lockwashers. Tighten the bolts to the specified torque.

Fig. 58

Install the transmission hydraulic oil filter (42) under the stand (43) and retain with the bolts and lockwashers. Tighten the bolts to the specified torque.

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Engine Installation (Continued)

Fig. 59

Install the primary hydraulic oil filter (31) under the opposite side of the stand (43) and retain with the bolts and lockwashers. Tighten the bolts to the specified torque.

Fig. 60

Install the U bolt (46) retaining the hoses and wiring harnesses below the stand (43). Secure with the nuts (44) and lockwashers (45).

Fig. 61

Place the engine hood (3) in position and lightly tap underneath to seat it properly on the grader. Retain the engine hood with the bolts, lockwashers and plain washers.

Fig. 62

Remove the caps and connect the fuel return hose (54) to the fuel tank (53).

Fig. 63

Remove the cap from the turbocharger port. Install the muffler/exhaust stack (4) and secure with the clamp (6). Tighten the clamp nuts evenly and check to see that the muffler is secure.

NOTE

Make sure that the muffler exhaust outlet points to the rear of the grader when installed.

Install the muffler clamp and secure to the brace.

Fig. 64

Remove the cap from the air cleaner inlet tube. Install the air cleaner extension (2) and secure with the clamp (1).

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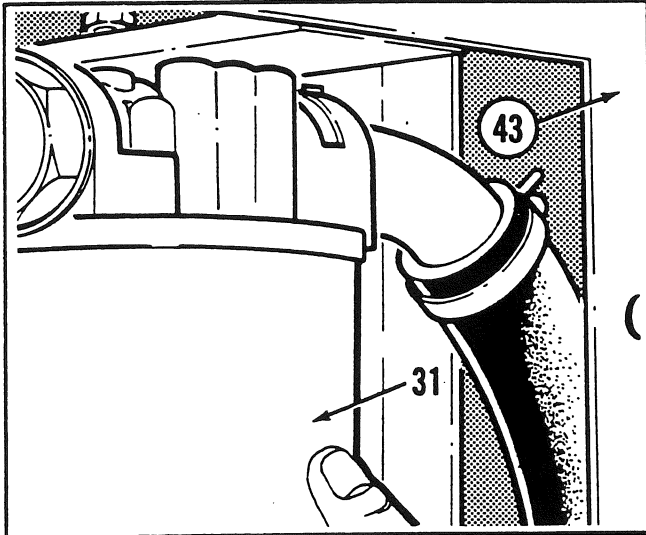


Fig. 59

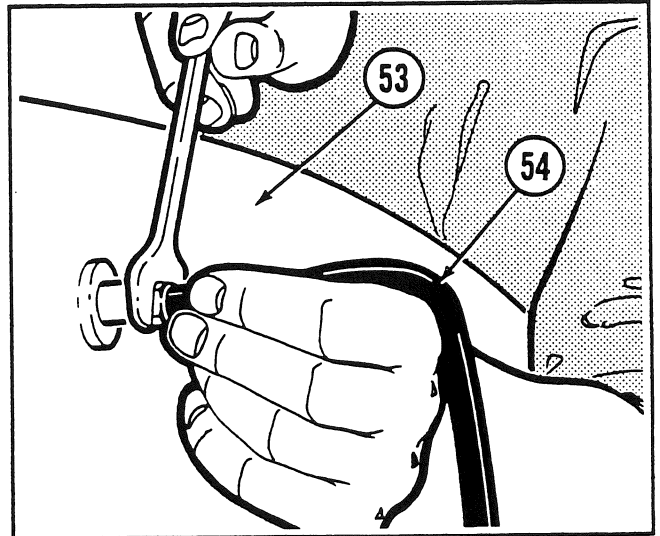


Fig. 62

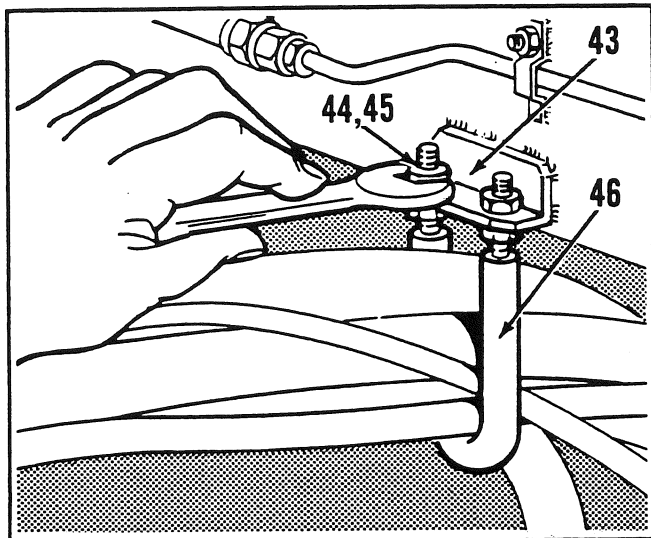


Fig. 60

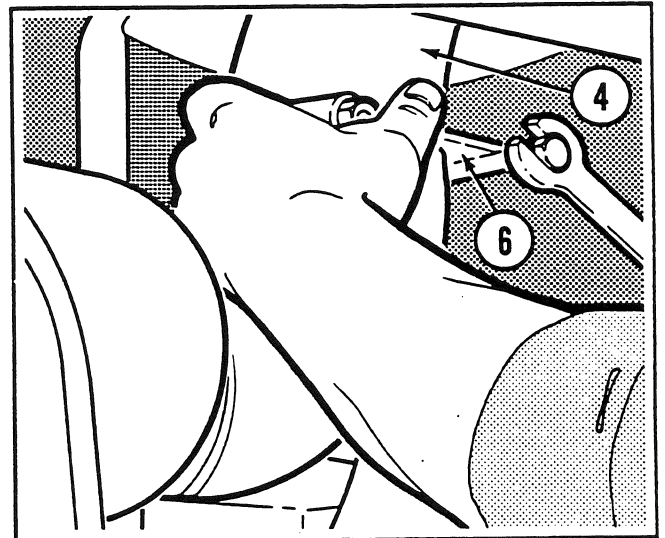


Fig. 63

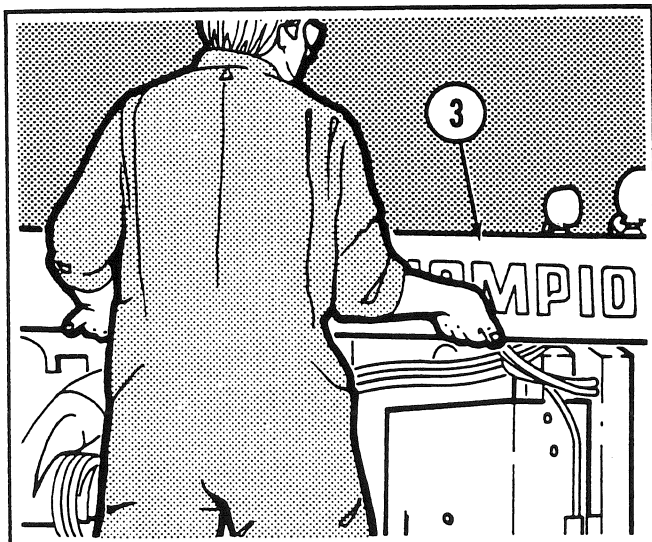


Fig. 61

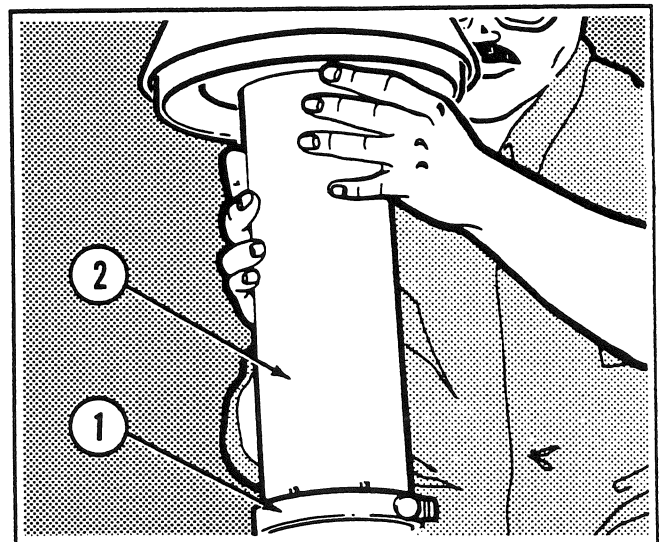


Fig. 64

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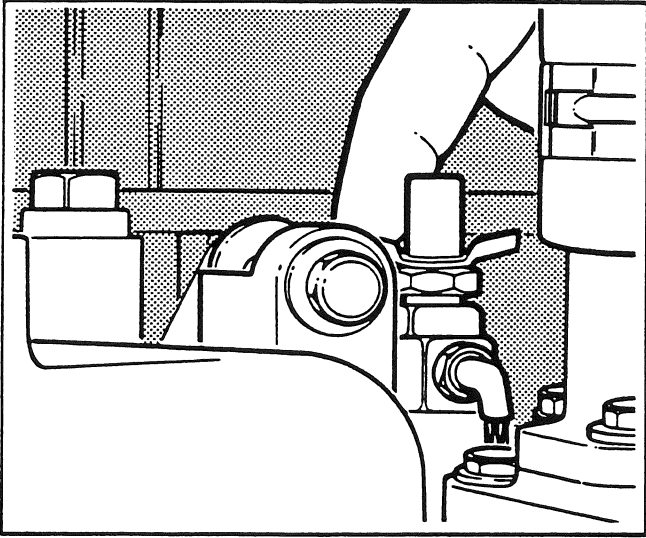


Fig. 65

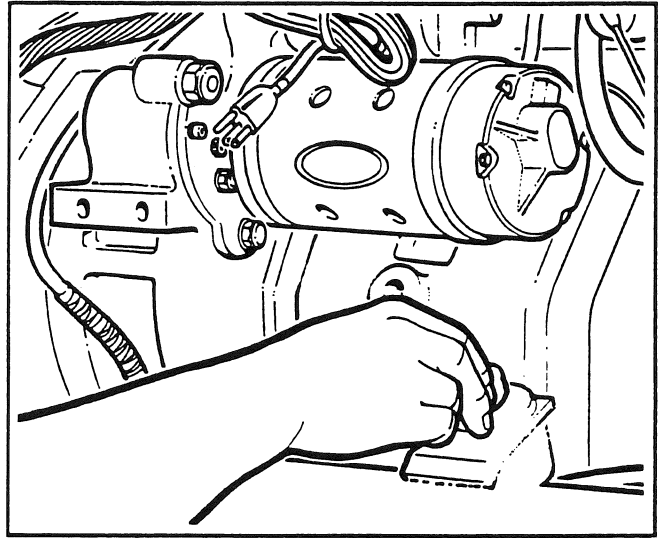


Fig. 68

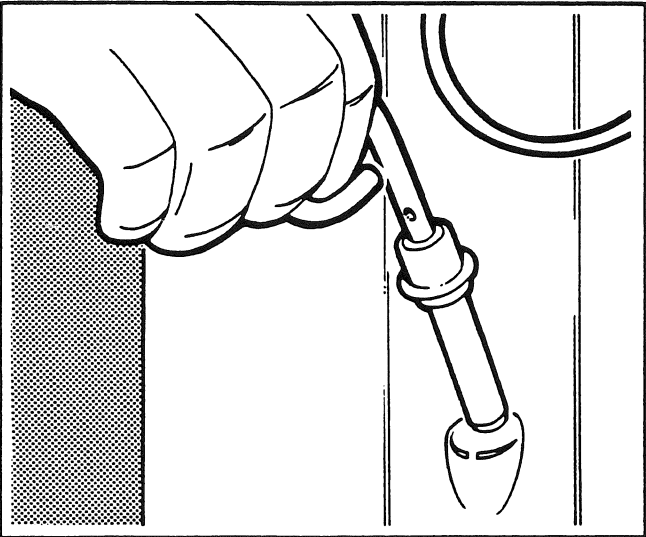


Fig. 66

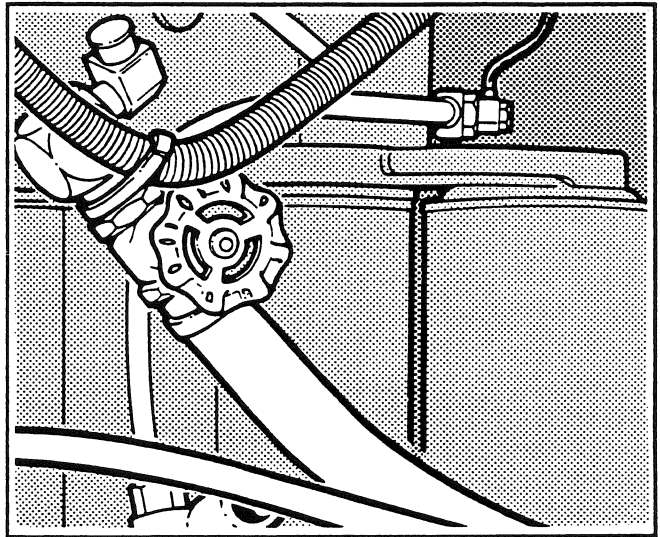


Fig. 69

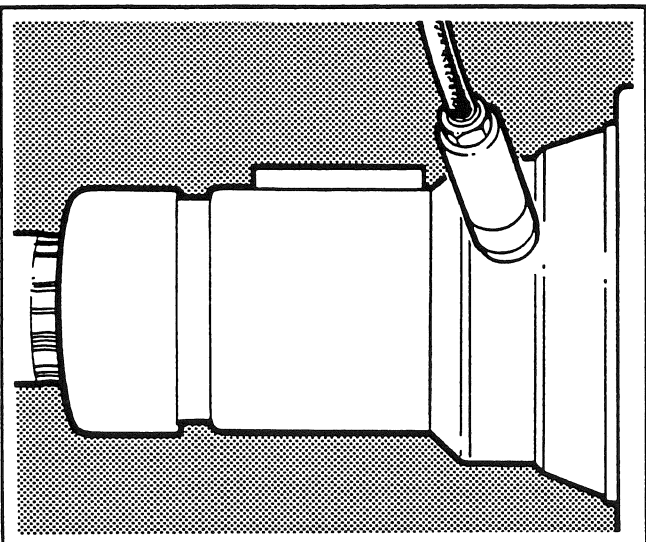


Fig. 67

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ENGINE REMOVAL AND INSTALLATION

Engine Installation (Continued)

Fig. 65

On CUMMINS models B and C Series engines, you must open the upper coolant bleed valve to vent air from the coolant passages. Fill the cooling system with fresh, clean coolant. Refer to your CUMMINS engine manual for coolant specifications. **Always** use a low-silica antifreeze containing less than 0.1% silica. When the coolant begins to flow through the bleeder valve, close the valve. Continue to fill the radiator to the "Full" level (refer to your 700 Series Operator's Manual) and install the pressure cap.

Fig. 66

Install a new engine oil filter. Change the engine oil with the type and quantity recommended in the CUMMINS engine manual. Check that the oil is at the correct level using the engine dipstick.

Fig. 67

Lubricate the steering/transmission and driveshaft universal and slip joints with grease recommended in the Lubrication Chart at the front of this Shop Manual.

Fig. 68

Secure all hoses and electrical wiring harnesses with plastic ties. Check that all hose clamps are tight. All hoses must be installed correctly to avoid bending or chafing. Check all electrical wiring harnesses and cable connections before turning the isolation switch "ON". Test the mechanical operation of the accelerator linkage. Refer to your CUMMINS engine manual for details of how to bleed air from the fuel system. Follow the instructions and bleed the fuel system.

Fig. 69

When all your pre-start checks are done, make sure it is safe to start the engine and signal your intention by sounding the horn. If a new or rebuilt engine has been installed, refer to your CUMMINS engine manual for the specific "break-in" procedure. With the engine running, check all hose connections for signs of leakage. When you are satisfied that the engine is running normally, test drive the grader until the engine coolant is at operating temperature. Turn the heater control in the cab to "Hot" during the test drive.

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Engine Installation (Continued)

Fig. 70

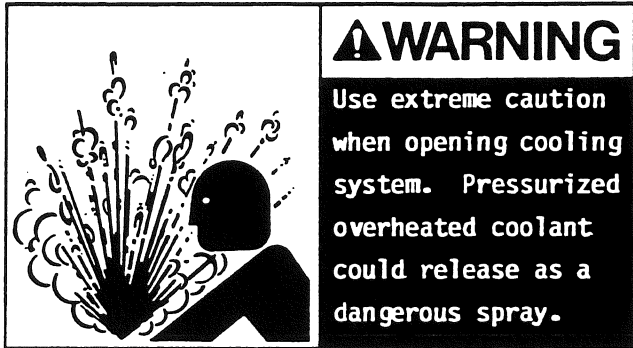


Fig. 71

Install the panels (23) below the fuel tank (53), intermediate panels (5) and front (8) and rear (7) lower panels.

After reaching operating temperature, shut down the engine and allow to cool. When the radiator has cooled, remove the pressure cap and check the level. Add coolant to the proper level. **DO NOT** add cold coolant to a hot engine!

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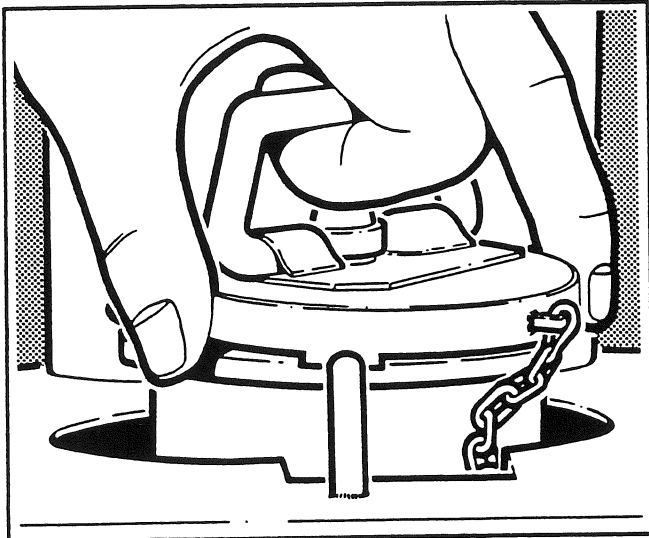


Fig. 70

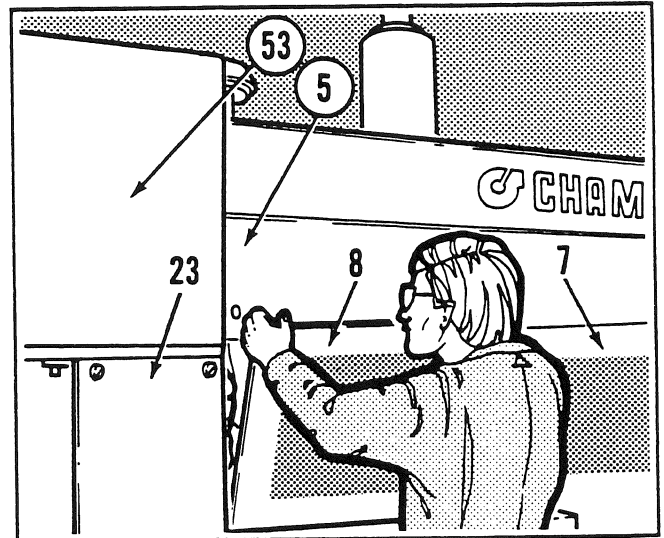


Fig. 71

