LIST OF PARTS AND SECTIONS

Part	*Sections*
A	Specifications
B	A 4 . 107 Diesel Engine
C	Cooling System
D	Fuel Feed and Injection System
E	
F	Electrical Equipment (France)
G	Lighting
H	Clutch Housing and Clutch
I	Gearbox and Power Take-off
J	Rear Axle Shaft Housing and Differential
K	Hydraulic System
L	
M	Steering
N	Front Axle
O	Brakes
P	Front Wheels
Q	Seat Sheet Metal and Fenders

DESCRIPTION OF ENGINE

CYLINDER BLOCK: Cast Iron. As in all small diesel engines the top half of the crankcase and the cylinder block form one unit. The sump joint face is level with the crankshaft centre line. In the cylinder block are machined the bores for the cylinder liners, the seats for the upper halves of the main bearings and galleries carrying oil to the crankshaft main bearings and the camshaft bearings.

CYLINDER LINERS: Cast Iron. Being surrounded by cooling water, they are sealed at the bottom by two synthetic rubber rings and they are securely retained at the top by the cylinder head gasket.

CRANKSHAFT: Forged steel. The counterweights are formed integrally with the crank webs. The shaft is supported on three main bearings. The rear main bearing carries a thrust washer to control end-float and this also serves as an oil deflector. The rear main bearing journal carries a shallow oil return helix which prevents oil seeping out past the rear oil seal. Oil ways for lubrication of the connecting rod bearings are drilled through the crankshaft.

PISTONS: Cast in aluminium alloy, these are fitted with five piston rings:

1 tapered chromium plated compression ring. One face is marked "TOP".
2 tapered cast iron compression rings.
1 duaflex oil control ring with expanders.
1 drilled and grooved oil control ring situated below the gudgeon pin.

The gudgeon pins are fully floating and retained by circlips.

CONNECTING RODS: H section high tensile steel. The big-end bearing is cut at an angle of 45" to the cylinder centre line. The mating faces of the connecting rod and big-end bearing cap are grooved and the cap set screws carry locking washers. Steel backed, lead-bronze big-end bearings are used.

CYLINDER-HEAD: Cast iron. Attached by means of studs and nuts and sealed with a copper-asbestos-steel gasket. The valve seats are machined directly in the cylinder head but inserts may be fitted in service. There is a renewable pre-combustion chamber for each cylinder into which fuel is sprayed by the atomisers. There are two valves for each cylinder and the larger of these is the inlet valve. The valves are carried in cast iron valve guides pressed into the cylinder head. The cylinder head also carries the attachment studs for the rocker gear pedestals. A pressed steel rocker-cover protects the valve gear. The thermostat which regulates the temprature of the cooling water is fitted into the cylinder head at the forward end. A particular feature of this cylinder head is that it is arranged with the inlet valves at the extremeties.

CAMSHAFT: Special cast iron, carried in three bearings machined in the cylinder block casting and driving, apart from the valve gear, the lubricating oil pump and the fuel feed pump. End float is controlled by semi-circular thrust washers. Lubrication for the bearing is supplied under pressure while the cams are splash--lubricated.

VALVE GEAR: Movement of the tappets is transmitted to the valves by means of push rods and rockers.
The tappets are flat topped, are made of hardened cast iron and revolve automatically under the action of the cams.
The push-rods are forged steel with hardened ends.
The rockers are steel with a ratio between the arms of approximately 1: 1.5. Each is fitted with an adjusting screw and pivots on the shaft on a lead-bronze bush. They are lubricated under pressure but intermittently from the centre camshaft bearing. The quantity of lubricating oil supplied to the valve gear is therefore automatically limited.

VALVES: Chrome Steel. The inlet valve head is larger in diameter than the exhaust valve head. The valves are held closed by one concentric spring bearing against a cap located on the valve stem by two plit collets. A synthetic rubber "O" ring mounted on the stem of the inlet valve serve as an oil deflector. In addition a rubber cap covering the top of the valve guide has been fitted on each valve stem in order to avoid any flow of oil lubricating of rocker shaft assy. between valve and valve guide.

FUEL INJECTION EQUIPMENT: The fuel injection pump is of the rotating type. It is mechanically set to commence injection of fuel 18" before top dead centre. In addition an hydraulic device provides a few degrees extra advance at engine speeds higher than 1 600 r.p.m.

The atomisers which are of the pintle type, spray the fuel into the pre-combustion chambers.

FUEL FILTER: Situated in the fuel system between the feel pump and the fuel injection pump this contains a replaceable metal clad element packed with a paper filtration medium.

INLET MANIFOLD: On the right-hand side of the engine this is made of aluminium, is fitted with a cold-start device, and is connected directly to the rubber hose from the air filter.

EXHAUST MANIFOLD: Made of cast iron and located on the left-hand side of the engine. It bears an oval flange to which is attached the silencer unit.

COOLING SYSTEM: Cooling is affected by circulation of water by pump assisted thermosyphon. The radiator is pressurised and a thermostat situated between this and the engine maintains water temperature at 176° F (80° C). For further details please refer to Section C: Cooling System.

SUMP: Of cast iron and fulfilling two functions: Contains lubricating oil for the engine — forms part of the tractor chassis between the front axle support and the clutch housing to which it is joined by an adaptor plate.

ELECTRICAL EQUIPMENT: A 12 volt system is fitted. The dynamo, turning at twice engine speed provides an output of 120 watts at maximum speed.

Apart from charging the battery it supplies power for the electrical installation.

Starting is effected by a starter motor driving through a ring gear on the flywheel. A 12 volt, 85 amp/hour, battery supplies the necessary current for starting.

COLD STARTING: An electrical device facilitates starting in cold weather. Contrary to the method used for starting petrol engines this is only used before starting the engine.

TRACTORMETER: Good tractor operation requires that the driver should always know the speed at which his engine is running. On the right-hand side of this engine there is an attachment point for a tractormeter drive, for the fitting of a combined instrument which shows:—

- — Engine Speed.
- — P.T.O. Speed.
- — Counter for hours worked by engine.

GENERAL DATA

Type	Vertical 4-stroke Diesel engine
Bore	3.125" (79.33 mm)
Stroke	3.5" (88.9 mm)
Displacement	107 cu.m. (1.753 litres)
Compression ratio	22.5:1
Cylinder liners	Cast iron, wet, removable
Valves	Overhead with rocker drive
Rated engine speed (no load)	2 400 r.p.m.
Normal idling speed	550-600 r.p.m.
Firing order	1 - 3 - 4 - 2
Injection system	Rotary CAV Pump, type DPA 324
Combustion system	Swivel chambers in cylinder head
Fuel lift pump	A.C. membrane type with decantation bowl. Driven by cam shaft
Injectors	CAV BDN - SD - 6236
Injector holders	CAV type 35 S 5200
Injector code letter	M
Injector setting	135 Atmospheres (1984.5 p.s.i.)
Valve timing	Inlet: opens 13° before TDC closes 43° after BDC Exhaust: opens 46° before BDC closes 10° after TDC
Injection timing	18° before TDC
Injection pump timing letter	"C"
Pump outlet for No. 1. Cylinder	"W"
Lubrication	Pressure feed 25 to 70 p.s.i. (1.75 to 4.9 kg/cm²)
Timing drive	Gear drive
Valve tip clearance	.012" (0.30 mm) Cold
Inlet and Exhaust	.010" (0.25 mm) Hot
Oil filtration system	Full flow, renewable element
Oil capacity - Total	12.3 pints (5.82 l.)
Oil sump	11.1 pints (5.25 l.)
Oil filter	0.203 pints (0.43 l.)
Oil lines	0.066 pints (0.14 l.)
Cooling system	Pressurised, Pump assisted Thermo-syphon controlled by thermostat opening at 174.2° F (+37.4° F / —35.6° F) | 79° C (+3° C / —2° C)
Weight of engine with dynamo and starter	503 lbs (228 kg)
No. 1. Cylinder	In front, at water pump end
Max. rated engine speed under load	2 250 r.p.m.
Max. rated engine speed no load (1)	2 400 r.p.m.
Normal idling speed	550-600 r.p.m.
Maximum torque	76 ft/lbs (10.5 m/kg) at 1,200 r.p.m.
Maximum Gross B.H.P. (Bare Engine)	28.5 HP at 2 250 r.p.m.
Air filter	Oil bath type with removable wire mesh element

NOTE: "Right" or "Left" describes the position when viewed from the flywheel end of the engine.

(1) The foot accelerator gives a maximum speed of 16 m.p.h. (26.6 k.p.h.) (with 10x26 tyres) for an engine speed of 2 400 r.p.m.

TRACTOR SPECIFICATION

COOLING SYSTEM

Temperature of water controlled by thermostat	174° F (+5.4° F / —3.6° F) | 79° C (+3° C / —2° C)
Approximate speed of fan and water pump	Engine speed × 1.5
Water pressure in radiator	4 p.s.i. (280 gr/cm²) for a temperature of 221° F (105° C)

FUEL SUPPLY

Capacity of fuel tank	9,91 gallons (45 litres)
Fuel filter	Replaceable paper element.

ELECTRICAL EQUIPMENT

Battery	12 V - 85 Amp/hour
Starter motor with solenoid	Paris-Rhône : Type D 11 E 85 Ducellier : Type 6110 A Lucas : Type M 45 G C.A.V. : Type CA 45 D
Dynamo 12 volts	Paris-Rhône : Type G 10 R 29 Ducellier : Type 7249 A Lucas : Type C 40 A Réf. 22733
Voltage regulator	Paris-Rhône : Type YD 210 Ducellier : Type D 3 Lucas : Type RB 108
Ammeter	
Thermostart (cold starting)	
Start/Heat switch	

DYNAMO

Nominal voltage of battery	12 V
Nominal output	10 Amps at 1 600 r.p.m.
Pressure of brush springs	17.63 ozs (500 gr) approx.

VOLTAGE REGULATOR

It is a two coil type:
- — one coil to adjust the charging rate,
- — one coil to cut the battery in and out of circuit.

The voltage regulator should allow a maximum charge of 4 amps to an uncharged battery and 1.5 amps to a charged battery.
The voltage passing to the battery should be between 12.4 and 13.6 volts.

TRANSMISSION

Double clutch	Allows for disengagement of engine drive to traction wheels without disengaging P.T.O. drive Front discs 11" (280 mm) for traction Rear disc 9" (228 mm) for P.T.O. Fingers to be adjusted to a height of 5.695" to 5.785" (144.65 to 146.95 mm) with a tolerance of 0.015" (0.4 mm) between fingers, from the face of the adaptor plate (see Fig. 11, Chapter H) Clutch pedal free play 3/4" (19 mm)

Differential lock	Applied by foot pedal
Gear box	4 forward speeds and 1 reverse. An incorporated reduction gear increases the range to 8 forward and 2 reverse gears 3rd and 4th gears have syncromesh (similary 7th and 8th)
Final reduction gear	Epicyclic
Rear P.T.O.	Ration engine: P.T.O. 3.5:1 Standardized at 540 r.p.m. of P.T.O. for 1 890 r.p.m. of engine
Mid mounted P.T.O.	(For mower) 1 057 r.p.m. for 2 000 r.p.m. of engine
Capacity	Transmission 4 imp. gals (19 litres) Final reduction unit 0.6 pints (0,35 litres)

WEIGHTS AND DIMENSIONS

NORMAL WIDTH

Overall length	109" (2.76 m)
Overall width	63" (1.60 m)
Wheel base	72" (1.83 m)
Ground clearance	13" (0.34 m)
Weight in working order but excluding fuel	2 914 lbs (1,320 kg)

NARROW TRACTOR

Track width adjustable in	4" (10 cm) increments
Front: 5 settings from	42" to 58" (1.07 to 1.47 m)
Rear: 8 settings from	38" to 66" (0.96 to 1.68 m)
Overall length	114" (2.91 m)
Overall width	53" (1.35 m)
Wheel base	72" (1.83 m)
Ground clearance	13" (0.34 m)
Weight in working order but excluding fuel	2 803 lbs (1,270 kg)

VINEYARD TRACTOR

Overall length	107" (2.70 m)
Overall width	36" (0.92 m)
Wheel base	67" (1.70 m)
Ground clearance (under clutch housing)	12" (0.32 m)
Weigth in working order but excluding fuel	2 715 lbs (1,230 kg)

HIGH CLEARANCE TRACTOR

Ground clearance under front axle	24" (0.61 m)
Ground clear. under clutch housing	17" (0.44 m)
Ground clearance under rear axle	21" (0.54 m)
Overall height	59" (1.51 m)
Wheel base	33" (0.84 m
Weight in working order but excluding fuel	2 713 lbs (1,230 kg)

HYDRAULIC SYSTEM

Gear type pump	With automatic compensation for wear. Tudns at 2,420 r.p.m. for engine speed of 2 000 r.p.m.
Safety valve	Set at 2 000 p.s.i. (140 kg/cm²) giving maximum lifting capacity at end of lower links of 1 826 lbs (830 kg)

STEERING BOX

"Cam Gear" Worm type oil used SHELL DANTAX 80

FRONT AXLE

Angle of swing	11° minimum
Toe-in	5/8" ± 5/64" (16 mm ± 2 mm)
Camber angle	2°
Castor angle	4°

TRACK SETTING

Normal Width:

Front: 48 - 52 - 56 - 60 - 64 - 68 - 72"
(1.22 - 1.32 - 1.42 - 1.52 - 1.63 - 1.73 - 1.83 m)

Rear: 48 - 52 - 56 - 60 - 64 - 68 - 72 - 76"
(1.22 - 1.32 - 1.42 - 1.52 - 1.63 - 1.73 - 1.83 - 1.93 mm)

Narrow:

Front: 42 - 46 - 50 - 54 - 58"
(1.07 - 1.17 - 1.27 - 1.37 - 1.47 m)

Rear: 38 - 42 - 46 - 50 - 54 - 58 - 62 - 66"
(0.96 - 1.07 - 1.17 - 1.27 - 1.37 - 1.47 - 1.57 - 1.68 m)

Vineyard:

Front: 28 - 32 - 36 - 39 - 43 - 46 - 50"
(0.72 - 0.82 - 0.91 - 1,00 - 1,10 - 1,17 - 1.27 m)

Rear: 28 - 31 - 38 - 42 - 50 - 74"
(0.71 - 0.80 - 0.97 - 1.07 - 1.27 - 1.87 m)

High clearance:

Front: 48 - 52 - 56 - 60 - 64 - 68 - 72"
(1.22 - 1.32 - 1.42 - 1.52 - 1.63 - 1.73 - 1.83 m)

Rear: 48 - 52 - 56 - 60 - 64 - 68 - 72 - 76"
(1.22 - 1.32 - 1.42 - 1.52 - 1.63 - 1.73 - 1.83 - 1.93 mm)

BRAKES

Foot operated on rear wheels which can be actuated independantly.
Parking brake couplet to foot brake.
Girling type disc brakes incorporated in the trumpet housing (except on Vineyard model).

WHEELS

Normal width and Narrow:

Rear	10x28 or 11x28 Tyre pressure 15 p.s.i. (2 kg/cm²)
Front	400x15 Tyre pressure 6.5 p.s.i. (0.9 kg/cm²)

Vineyard:

Rear	10x24 - 9x24
Front	400x15

High clearance:

Rear	10x36 - 4 P.R.
Front	5,50x16

The length of the front axle spindles is 4.645" 11.8 cm) longer than on the normal width tractor. Camber angle: 3".
The tractor equipped with 10x36 tyres gives 1 turn of the Ground Speed P.T.O. for 22" (57 cm) of forKard travel.

A 4-107 DIESEL ENGINE

LIST OF OPERATIONS

FITS AND TOLERANCES

		Inches	Millimetres
1)	**Camshaft to Cylinder Block 1st Bearing**		
	Cylinder block bore	1.7940 - 1.7955	45.57 - 45.61
	Camshaft journal	1.791 - 1.792	45.49 - 45.52
	Clearance	0.002 - 0.0045	0.05 - 0.12
	2nd Bearing		
	Cylinder block bore	1.784 - 1.787	45.31 - 45.39
	Camshaft journal	1.781 - 1.782	45.24 - 45.26
	Clearance	0.002 - 0.006	0.05 - 0.15
	3rd Bearing		
	Cylinder block bore	1.776 - 1.778	45.11 - 45.16
	Camshaft journal	1.773 - 1.774	45.03 - 45.06
	Clearance	0.002 - 0.005	0.05 - 0.13
2)	**Crankshaft to Cylinder Block**		
	Main bearing housing bore diameter	2.395 - 2.3955	60.83 - 60.84
	Main bearing bore diameter (with caps tightened to specified torque)	2.2505 - 2.2515	57.16 - 57.19
	Cranshaft main bearing journal diameter	2.2480 - 2.2485	57.10 - 57.11
	Clearance	0.002 - 0.0035	0.05 - 0.09
	Thickness of thrust washers (standard)	0.091 - 0.093	2.31 - 2.36
	Thickness of thrust washers (oversize)	0.985 - 0.1051	2.50 - 2.67
	Crankshaft end float	0.003 - 0.009	0.08 - 0.23
3)	**Connecting Rod to Crankshaft**		
	Connecting rod parent bore - big end	2.1460 - 2.1465	54.51 - 54.52
	Connecting rod bearing bore diameter (big-end with cap tightened to specified torque)	2.0015 - 2.0025	50.84 - 50.86
	Crankshaft crankpin diameter	1.9995 - 2.0000	50.79 - 50.80
	Clearance	0.0015 - 0.003	0.04 - 0.07
	Connecting rod width	1.179 - 1.181	29.94 - 30.00
	Crankshaft - crankpin width	1.1875 - 1.1895	30.16 - 30.21
	Connecting rod side clearance	0.003 - 0.009	0.08 - 0.23
4)	**Connecting Rod to Piston**		
	Connecting rod bush bore diameter	0.93820 - 0.93875	23.83 - 23.84
	Gudgeon pin diameter	0.937 - 0.9377	23.81 - 23.82
	Clearance	0.0005 - 0.00125	0.01 - 0.03
	NOTE: Bushes are provided with a reaming allowance and should be reamed to fit individual pins.		
5)	**Piston to Cylinder Liner**		
	Cylinder liner bore diameter	3.125 - 3.126	79.37 - 79.40
	Diameter or piston (measured at the level of the gudgeon pi n and perpendicularly to it)	3.120 - 3.121	79.26 - 79.28
	Working clearance	0.0035 - 0.0055	0.09 - 0.14
	Height of piston crown at top dead centre above cylinder block face	0.0085 - 0.012	0.21 - 0.30
6)	**Piston Rings to Piston Grooves**		
a)	Top compressing ring		
	Width of groove in piston	0.0801 - 0.0811	2.03 - 2.06
	Width of ring	0.0771 - 0.0781	1.96 - 1.98
	Clearance	0.002 - 0.004	0.05 - 0.10
	Ring gaps (checked in standard bore)	0.012 - 0.017	0.30 - 0.43

		Inches	Millimetres
b)	2nd and 3rd (Tapered)		
	Compression rings width of groove in piston	0.0645 - 0.0655	1.64 - 1.66
	Width of ring	0.0615 - 0.0625	1.56 - 1.59
	Clearance	0.002 - 0.004	0.05 - 0.10
	Ring gap (checked in standard bore)	0.009 - 0.014	0.23 - 0.36
c)	4th Scraper ring - chrome plated DUAFLEX - spring fit		
d)	5th Oil Control ring		
	Width of groove in piston	0.190 - 0.191	4.83 - 4.85
	Width of ring	0.1865 - 0.1875	4.74 - 4.76
	Clearance	0.0025 - 0.0045	0.07 - 0.11
	Ring gap (checked in standard bore)	0.009 - 0.014	0.23 - 0.36
7)	**Gudgeon Pin to Piston**		
	Gudgeon pins and pistons are matched in manufacture and supplied in pairs. Any piston found in which the gudgeon pin will slide under finger pressure (when cold) must be discarded.		
8)	**Valve Guide to Cylinder Head**		
	Cylinder head bore for valve guide	0.4996 - 0.5004	12.69 - 12.71
	Outside diameter of valve guide	0.50125 - 0.50175	12.73 - 12.74
	Clearance	0.0015 - 0.004	0.02 - 0.05
	Valve guide protrusion above cyl. head top face	0.805 - 0.835	20.45 - 21.21
9)	**Valve to Valve Guide**		
	Valve Guide bore diameter	0.3140 - 0.3155	7.97 - 8.01
	Inlet valve stem diameter	0.312 - 0.313	7.92 - 7.96
	Exhaust valve stem	0.3115 - 0.3125	7.91 - 7.94
	Inlet valve clearance in guide	0.001 - 0.0035	0.01 - 0.09
	Exhaust valve clearance in guide	0.0015 - 0.004	0.03 - 0.10
10)	**Rocker Arms to Rocker Shaft**		
	Rocker arm bush bore (with bush)	0.62450 - 0.62575	15.86 - 15.89
	Shaft diameter	0.62225 - 0.62375	15.80 - 15.84
	Clearance	0.00075 - 0.0035	0.02 - 0.09
11)	**Working Clearances - Oil Pump**		
	Maximum clearance between rotor	0.006	0.15
	Maximum clearance rotor and pump body	0.010	0.25
	Rotor end float	0.003	0.08
	Tightening Torques	lb/ft	mm/kg
	Cylinder Head	40 - 42	5.5 - 6
	Connecting rod cap set screws	30 - 35	4.0 - 5
	Main bearing cap set screws	80 - 85	11 - 12
	Flywheel set screws	51	7
	Connecting Rod Weight Grades	lb oz	Grammes
	Code No. 9	1.10 - 1.11	737 - 766
	Code No. 10	1.11 - 1.12	767 - 795
	Code No. 11	1.12 - 1.13	796 - 823
	Code No. 12	1.13 - 1.14	824 - 851
	Code No. 13	1.14 - 1.15	852 - 879
	Code No. 14	1.15 - 2.0	880 - 908
	Code No. 15	2.0 - 2.1	909 - 936

The code No. is marked on the machined part of the connecting rod cap.

Preliminary Operations: D7 - Removal of injectors
B4 - Removal of valve rocker shaft

IMPORTANT: When undertaking work which requires the engine to be turned after removal of the cylinder head, it is recommended to fit liner retainers MIMO so that the liners do not lift out of the block when the crankshaft is turned (Fig. 1).

A — **Removal of cylinder head, with engine removed from tractor**

1) If necessary place the engine on a workshop engine stand (where this operation has to be followed by removal of crankshaft, etc).
2) Remove the injector pipes.
3) Remove the cylinder head nuts in the reverse order of that shown in Fig. 2.
4) Slacken the fan belt to free the water pump pulley.
5) Remove the cylinder head from the engine.
6) Remove the cylinder head gasket.
7) Remove the push rods. These can be easily removed except those for the admission valves (at the extremities of the block).
NOTE: These last mentioned push rods can only be removed after removal of the rocker shaft.

B — **Removal of cylinder head, engine not removed from tractor**

1) Carry out Operations:
Q3 - Removal of hood.
D1 - Removal of fuel tank.
2) Drain the cooling circuit.
3) Uncouple the throttle control rod (at the pump end).
4) Remove the injector pipes.
5) Uncouple the feed and return pipes to the injection pump and remove the clip fixing the return pipe to the water outlet.
6) Remove the exhaust pipe from the exhaust manifold.
7) Remove the water hose from the top of the radiator.
8) Remove the pipe to the oil pressure gauge.
9) Remove the feed and outlet fuel pipes to the filter.
10) Remove the flexible drive to the tractormeter.
11) Remove the ball joint on the accelerator pedal.
12) Remove the wires from:—
— the thermostart,
— the temperature gauge sending unit.
13) Remove the hose from the intake manifold.
14) Remove the two nuts holding the battery carrier to the adaptor plate.
15) Remove the four screws holding the steering box to the clutch housing.
16) Uncouple the drag link from the drop arm.
17) So that the rear end of the cylinder head is free to be lifted upwards, pull backwards the assembly:—
— steering box,
— instrument panel,
— battery carrier.
18) Uncouple the dynamo belt tensioner bracket from the cylinder head. Remove the belt from pulley.
19) Remove the breather and the cylinder head cover.
20) Remove the valve rockershaft, and the push rods.
21) Remove the cylinder head holding nuts in the reverse order shown in Fig. 2.
22) Remove the cylinder head.
23) Remove the cylinder head gasket.
24) Remove the cylinder head and the push rods. These are easily removable except those for the intake valves (at the extremities of the block).
NOTE: These last mentioned push rods can only be removed after removal of the valve rocker shaft.

OPERATION **B2** REMOVAL OF VALVES AND PRE-COMBUSTION CHAMBER CAPS

Preliminary Operations: D7 - Removal of injectors
B1 - Removal of cylinder head

1) With a valve removal tool compress the valve springs.
2) Remove the cotters.
3) Remove the cups, the springs and the valves.

NOTE: Put the valves, cups and springs in a suitable support in the order in which they have been removed.

IMPORTANT: The intake valves are equipped with rubber "O" rings.

4) If the cylinder head is to be replaced by a new one not equipped with pre-combustion chamber caps, these must be removed from the old part as follows:
Put a punch through the injector hole location and gently knock out the pre-combustion chamber cap.

OPERATION **B3** DE-CARBONISING

Preliminary Operations: B2 - Removal of valves and pre-combustion chamber caps

1) Remove:—
   — the exhaust manifold,
   — the intake manifold.
2) With the aid of a scraper made of brass or soft metal, scrape out the chambers in the cylinder head.
3) Clean and dry with compressed air.
4) Fit in place:—
   — the precombustion chamber caps,
   — the intake manifold having fitted a new joint smeared with a sealing compound.
5) Put No. 1 piston at BDC. Smear grease for about 1" (2.5 cm) around the top of the cylinder so as to avoid the introduction of carbon between the piston and the cylinder during the decarbonising of the head of the piston.
Repeat for piston No. 4.
Turn the crankshaft and bring pistonsNos 1 and 4 to TDC.
6) Plug Nos 2 and 3 cylinders and the water orifices with clean rag.
7) Scrape the carbon from the tops of the pistons, taking care not to scratch or mark them.
8) Slowly lower piston Nos 1 and 4, wipe off the grease and the carbon and lower them to BDC to clean the liners with a clean rag soaked in petrol or white spirit.
9) Repeat the same operations for cylinders Nos 2 and 3, having placed clean rag in the liners already decarbonised.
10) Clean the upper face of the cylinder block.
11) Oil the sides of the liners with clean engine oil.

ATTENTION: Never use abrasive paper.

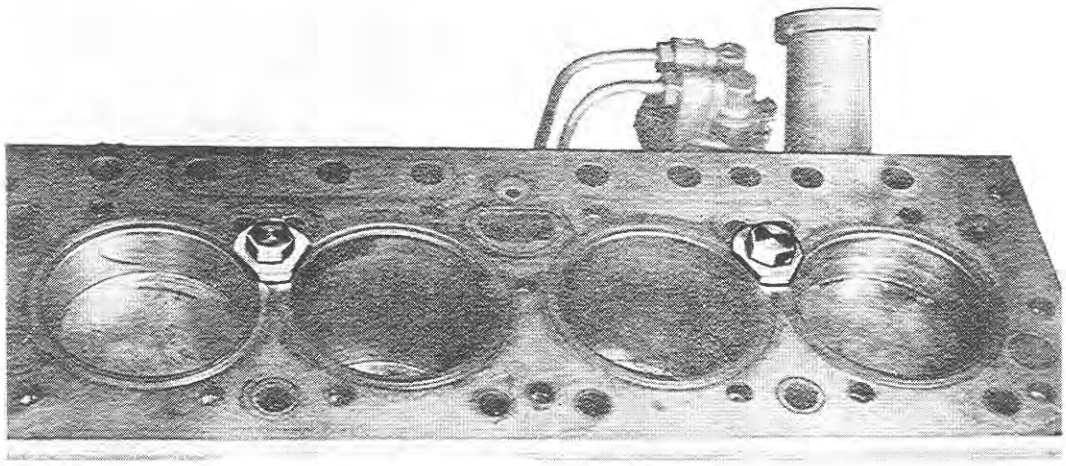


Fig. 1

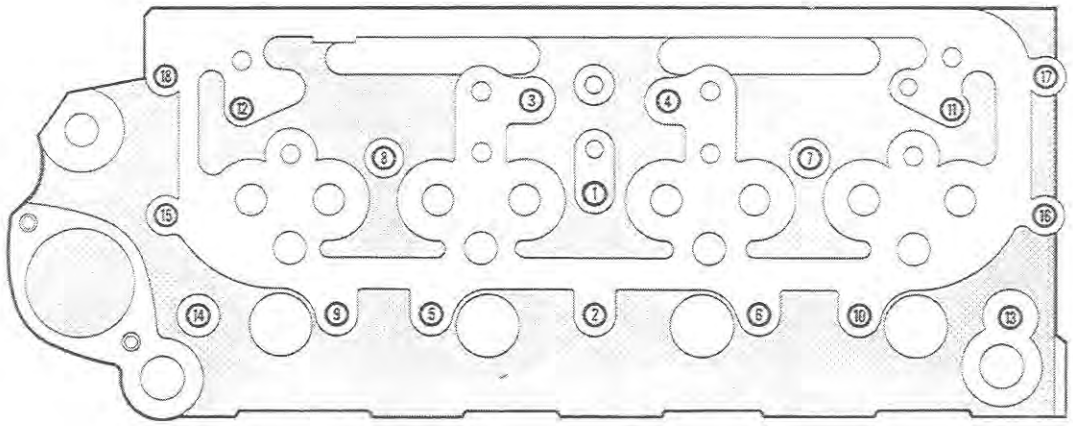


Fig. 2

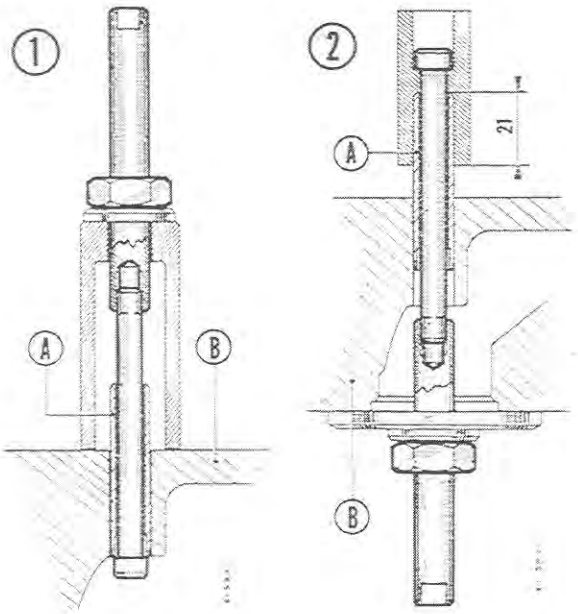


Fig. 3

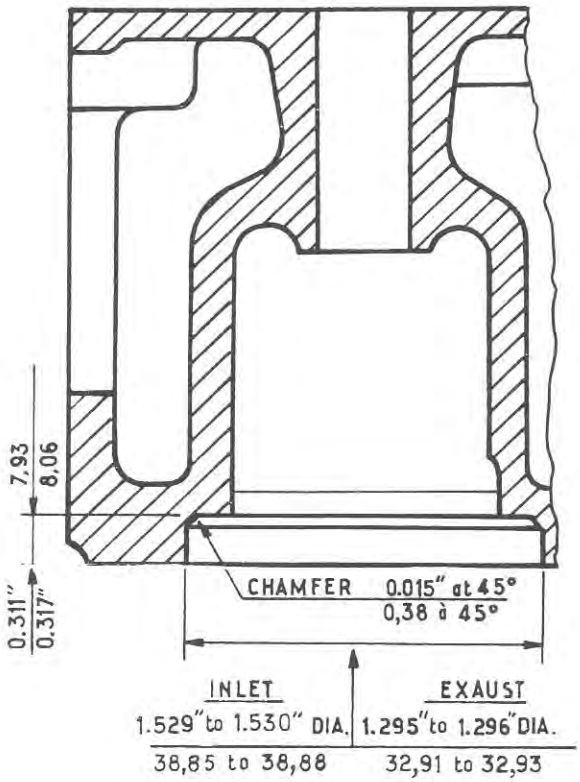


Fig. 4

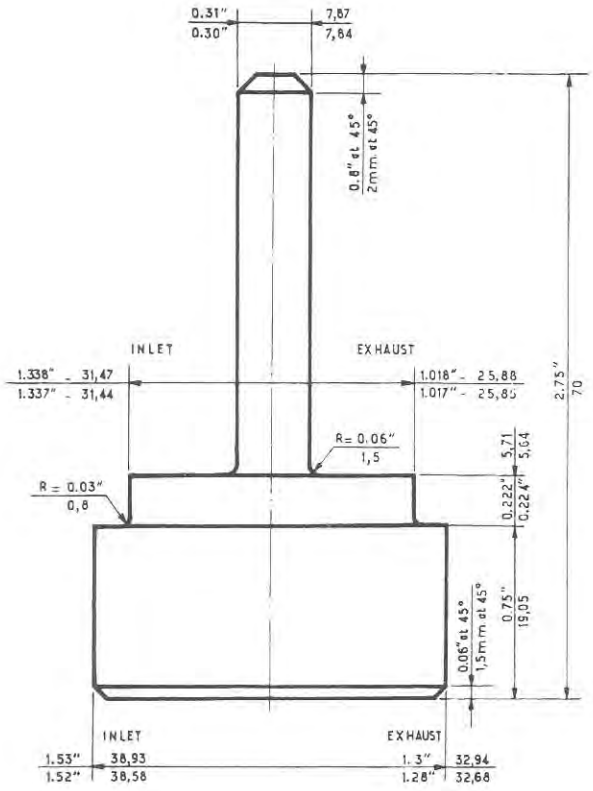


Fig. 5

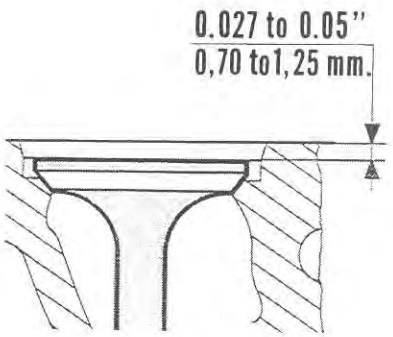


Fig. 6

OPERATION **B4** REMOVAL AND DISMANTLING VALVE ROCKER SHAFT

Preliminary Operations: Q3 - Removal of hood
D1 - Removal of fuel tank

1) Remove the cylinder head cover and the breather.
2) Remove the nuts holding the valve rocker shaft to the cylinder head.
3) Remove the valve rocker assembly.
4) Remove in this order:—
   - — the front circlip,
   - — a flat washer,
   - — a spring washer,
   - — a flat washer,
   - — No. 1 Rocker arm,
   - — No. 1 Support,
   - — No. 2 Rocker arm,
   - — a spring,
   - — No. 3 Rocker arm,
   - — No. 2 Support,
   - — No. 4 Rocker arm,
   - — a spring,
   - — the banjo oil union,
   - — No. 5 Rocker arm,
   - — No. 3 Support,
   - — No. 6 Rocker arm,
   - — a spring,
   - — No. 7 Rocker arm,
   - — No. 4 Support,
   - — No. 8 Rocker arm,
   - — a flat washer,
   - — a spring washer,
   - — a flat washer,
   - — the rear circlip.

OPERATION **B5** REMOVAL OF VALVE GUIDES

Preliminary Operations: B2 - Removal of valves
B3 - De carbonizing (optional)
Service Tools Required: MIMI-A

Remove the valve guides using the tool MIMI-A positioning it as indicated in Fig. 3.

1 = Remove A - Guide B - Cylinder head 2 = Replace

OPERATION **B6** FITTING NEW VALVE GUIDES

Preliminary Operations: B2 - Removal of valves
Service Tools Required: MIMI-A

1) Put the valve guides in place using the tool MIMI-A positioning it as shown in Fig. 3.

   NOTE: The intake valve guides are shorter by 0.31" (7.9 mm), but the height by which they protrude from the top of the cylinder head is the same for all, that is to say 0.80 to 0.82" (20.5 to 21 mm). The bush of the tool MIMI-A automatically gives the correct adjustment.
   To facilitate the fitting of the guides, the hole in the cylinder head should be cleaned of all metal projections and oiled.
2) Complete the following operations:
   B 9 - Grinding and fitting valves.
   B10 - Assembly and fitting of valve rocker assembly.
   B11 - Fitting the cylinder head - Adjusting valve clearance.
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

OPERATION **B7** FITTING VALVE SEATS

Preliminary Operations: B2 - Removal of valves
B3 - De carbonizing (optional)

1) Centering on the bores of the new valve guides, machine out a recess for the new valve seats following the measurements given in Fig. 4.
2) Remove rough edges and clean out the recess.
3) With a hydraulic press fit the new valve seats in the cylinder head using adaptors made to the measurements given in Fig. 5.
   NOTE: Never knock on the valve seats nor grease them.
4) Check that the insert is square with the bottom face of the cylinder head, and that it is pressed fully home.
5) Complete the following operations:
   B 8 - Recutting valve seat.
   B 9 - Grinding and fitting valves.
   B10 - Assembly and fitting of valve rocker assembly.
   B11 - Fitting the cylinder head - Adjusting valve clearance.
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

OPERATION **B8** RE-CUTTING VALVE SEATS

Preliminary Operations: B2 - Removal of valves
B3 - De carbonizing (optional)

1) Check the fit of the valves to their seat.
   This operation is recommended if the valve seat shows signs of pitting, burning or other evidence of gas leakage or if the valve seats have been changed.
2) Also ensure that the valve guides are in good condition.
3) Machine the valve seats if necessary, with a grinding machine with a stoned face to 44° or with a special tool, or where the tolerances exceed 0.05" (1.25 mm) (see Fig. 6).
   NOTE: The valves are ground on a machine with a cone angle of 90°. If a valve cutting tool is not available, fit new valves. Only remove the minimum of metal necessary so as not to increase unduly the contacting surfaces of valve and valve seat.
4) Complete the following operations:
   B 9 - Grinding and fitting valves.
   B10 - Assembly and fitting of valve rocker assembly.
   B11 - Fitting the cylinder head - Adjusting valve clearance.
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

OPERATION **B9** GRINDING AND FITTING VALVES

Preliminary Operations: B2 - Removal of valves
B3 - De carbonizing (optional)

1) With a metal brush and suitable soft metal scraper, remove the carbon from the valves taking care not to damage either the valve seat or the stem.
2) Clean and dry with compressed air.
3) Oil the stem of the valve and smear the face with grinding compound.
4) Put the valve in place and lap-in in the usual way.
5) Remove the valve and clean it and its valve seat and dry with compressed air.
6) Check both valve seat and contact surface of the valve and continue the operation if necessary until an even, clean, matt-gray finish has been effected. It is absolutely necessary to obtain this surface condition to guarantee correct sealing.
   NOTE: The contact surface obtained after grinding in should be between 1/16 to 3/32" (1.67 to 2.4 mm).

7) Refit the valves and springs in the inverse order of the removal operations shown in Operation B2. Do not forget the "O" ring for the intake valves.

Precombustion chamber caps

Fit the precombustion chamber caps in place ensuring that the injection orifice is correctly orientated.

Fit the holding plugs between the caps and the cylinder head and punch them lightly in the centre to hold them in place.

NOTE: The precombustion chamber caps can be fitted in any of the four cylinders, but the holding plug is fitted on the left or on the right according to the cylinder to which it is fitted.

8) Complete the following operations:
B10 - Assembly and fitting of valve rocker assembly.
B11 - Fitting the cylinder head - Adjusting valve clearance.
D17 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

OPERATION **B10** ASSEMBLY AND FITTING OF VALVE ROCKER ASSEMBLY

1) Fit the parts of the valve rocker assembly in the following order.
Place on the shaft (Fig. 7):—
— the rear circlip,
— a flat washer,
— a spring washer,
— a flat washer,
— No. 8 Rocker arm,
— No. 4 Support,
— No. 7 Rocker arm,
— a spring,
— No. 6 Rocker arm,
— No. 3 Support,
— No. 5 Rocker arm,
— the banjo union,
— a spring,
— No. 4 Rocker arm,
— No. 2 Support,
— No. 3 Rocker arm,
— a spring,
— No. 2 Rocker arm,
— No. 1 Support,
— No. 1 Rocker arm,
— a flat washer,
— a spring washer,
— a flat washer,
— the front circlip.

2) Fit the assembly to the cylinder head making sure that the oil line for lubricating the shaft is correctly engaged in the hole in the cylinder head.
3) Fit and tighten the valve rocker fixing nuts.
4) Complete the following operations:
B10 - Assembly and fitting of valve rocker assembly.
B11 - Fitting the cylinder head - Adjusting valve clearance.
D17 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

A — **With the engine removed from the tractor**

1) Remove the rags plugging the liners and the water orifices and lubricate slightly with the hand the top of cylinders.
2) Fit the push rods in place (inlet valves Nos 1 and 8).
3) Fit a new cylinder head gasket smeared with a sealing compound (it is only possible to fit the cylinder head gasket in one position).
4) Put in place the cylinder head on gasket and fit the 18 holding nuts (the nuts Nos 14, 9, 5, 6, 10 are special nuts). Tighten the nuts lightly to a torque of 14 to 22 ft/lb (2 to 3 m/kg) and in the order shown in Fig. 8.
5) Tighten the nuts to the final torque of 40 to 42 ft/lb (5.5 to 6 m/kg) and in the same order as above.
6) Fit the remaining rods in place.
7) If necessary, fit the exhaust manifold and the intake manifold having fitted new gaskets.
8) Operation B11-C - Adjusting valve clearance.

B — **Engine not removed from tractor**

1) Remove the rags from the liner bores and water orifices and lightly lubricate the tops of the cylinders.
2) Fit the push rods in place (inlet valves Nos 1 and 8).
3) Fit a new cylinder head gasket smeared with a sealing compound (it is only possible to fit the cylinder head gasket in one position).
4) Fit the 18 holding nuts (the nuts Nos 14, 9, 5, 6, 10 are special nuts) Tighten the nuts lightly to a torque of 14 to 22 ft/lb (2 to 3 m/kg) and in the order shown in Fig. 8.
5) Tighten the nuts to the final torque of 40 to 42 ft/lb (5.5 to 6 m/kg) and in the same order as above.
6) Fit the remaining rods in place.
7) Fit the exhaust manifold and the intake manifold having fitted new gaskets.
8) Adjust valve clearance.
9) Fit the cylinder head cover and the breather.
10) Fit the dynamo belt tensioner bracket - Fit and tension the belt.
11) Move forward the assembly:—
    — steering box,
    — instrument panel,
    — battery carrier,

    until they are correctly in place. Fix the steering box to the clutch housing with its four screws. These must be tightened to a torque of 50 to 55 ft/lb (6.9 to 7.6 m/kg).
12) Fit and tighten the two nuts holding the battery carrier to the adaptor plate.
13) Couple the feed and return fuel pipes to the injection pump.
14) Couple the feed and return fuel pipes to the filter (the return pipe must be fixed also to the water outlet with its clip).
15) Connect up the wires:—
    — to the thermostart,
    — to the temperature gauge plug.
16) Fit the upper water hose in place and fit its clip.
17) Fit the air hose and tighten its clip.
18) Fit the oil pressure pipe.
19) Fit the throttle control rod to the pump.
20) Fit the exhaust pipe.
21) Couple the drag link to the drop arm.

22) Fit the flexible drive for the tractormeter.
23) Fit the ball joint to the accelerator pedal.
24) Fill the cooling system.
25) Complete the following operations.
D11 - Fit the injectors.
D17 - Fitting the fuel tank.
D18 - Fill with fuel and bleed the fuel system.
Q16 - Fitting of hood.

C — **Adjusting valve clearance (Fig. 9)**

Preliminary Operations: Q3 - Removal of rood optional
D1 - Removal the fuel tank

1) Turn the crankshaft until the valves of No. 1 cylinder are "on the rock", that is to say the valves will be rocking up and down as a pair. Adjust the clearance of the valves of cylinder No. 4. A feeler gauge of 0.012" (0.30 mm) should pass with little resistance.
2) Turn the crankshaft untill the valves of cylinder No. 3 are "on the rock". Adjust the clearance of the valves of cylinder No. 2.
3) Turn the crankshaft untill the valves of cylinder No. 4 are "on the rock", and adjust the play of the valves of cylinder No. 1.
4) Continue to turn the crankshaft untill the valves of cylinder No. 2 are "on the rock", and adjust the clearance of the valves of cylinder No. 3.
5) Fit the rocker cover complete with a new cork joint smeared with a sealing compound. Do not damage the joint by excessive tightening.

OPERATION **B12** REMOVAL OF TIMING COVER

Preliminary Operations: N1 - Removal the front axle from engine

1) Remove the fan belt and remove the nut holding the crankshaft pulley.
2) Remove the pulley.
3) Remove the screws holding the cover to the dynamo holding bracket and the anchor plate for the spring for the injection pump throttle lever.
4) Remove the timing cover.
5) Remove the oil deflector.

OPERATION **B13** REMOVAL OF IDLER GEAR

Preliminary Operations: B12 - Removal of timing cover

1) Remove the two screws holding the idler gear.
2) Remove the idler gear.

OPERATION **B14** REMOVAL OF HUB AND INJECTION PUMP GEAR

Preliminary Operations: B12 - Removal of timing cover

A — **Removal of gear**
1) Remove the three screws and lock washers.
2) Remove the gear.

B — **Removal of hub**
1) Remove the injection pump (Operation D6).
2) Remove the gear.
3) Remove the inner circlip (Fig. 10).
4) Remove the hub.

OPERATION **B15** — REMOVAL OF CAMSHAFT GEAR

Preliminary Operations: B12 - Removal of timing cover

1) Remove the three screws and lock washers holding the gear to the camshaft
2) Remove the gear.

OPERATION **B16** — REMOVAL OF CAMSHAFT

Preliminary Operations: B13 - Removal of idler gear
B14 - Removal of hub and fuel pump gear
B24 - Removal of oil pump

1) Remove the four screws holding the front adaptor plate to the cylinder block.
2) If the cylinder head has not been removed, it is necessary to slacken off the nuts holding the valve rocker gear, and the tappet adjusting screws so that the push rods are no longer pushing on the camshaft.
3) Shut the fuel tap and remove the feed and return pipes to the fuel lift pump.
4) Remove the nuts holding the tappet cover.
5) Remove the tappet cover and the fuel lift pump.
6) Put suitable clips (clothes pegs for example) on the push rods so as to prevent them dropping down and to facilitate removal of the camshaft from the cylinder block.
7) Lift slightly the camshaft so as to release the two half thrust washers.
8) Remove the camshaft and eventually the front adaptor plate.

OPERATION **B17** — FITTING OF CAMSHAFT

1) Fit the push rods in place and maintain them with suitable clips (clothes pegs for instance) so as to prevent them dropping down.
2) Put the camshaft in the engine block without putting it in its final position.
3) Put the joint of the adaptor plate in place.
4) Fit the front adaptor plate.
5) Place the half thrust washers between the adaptor plate and the cylinder block. These must fit into the groove of the camshaft (Fig. 11 and 12).
6) Push the camshaft, the adaptor plate and the 1/2 thrust washers towards the cylinder block ensuring that the dowel in the thrust washer recess of the block enters into the hole of the adjacent half of the thrust washer.
7) Fit and tighten the four screws holding the adaptor plate to the cylinder block.
8) Put in place the fuel lift pump push rod.
9) Remove the clips which were holding the push rods in a raised position and fit the tappet cover.
10) Fit and tighten the nuts holding the tappet cover.
11) Fit the fuel lines to the fuel lift pump.
12) Complete the following operations:
    B27 - Fitting the oil pump.
    B28 - Fitting the engine sump.
    B19 - Fitting of injection pump gear.
    B20 - Fitting of idler gear.
    B21 - Aligning the timing marks.
    D13 - Fitting and timing of injection pump.
    B22 - Fitting of timing cover.
    B11/C - Adjusting valve clearance.
    N11 - Fitting the front axle.
    Q16 - Fitting of hood.

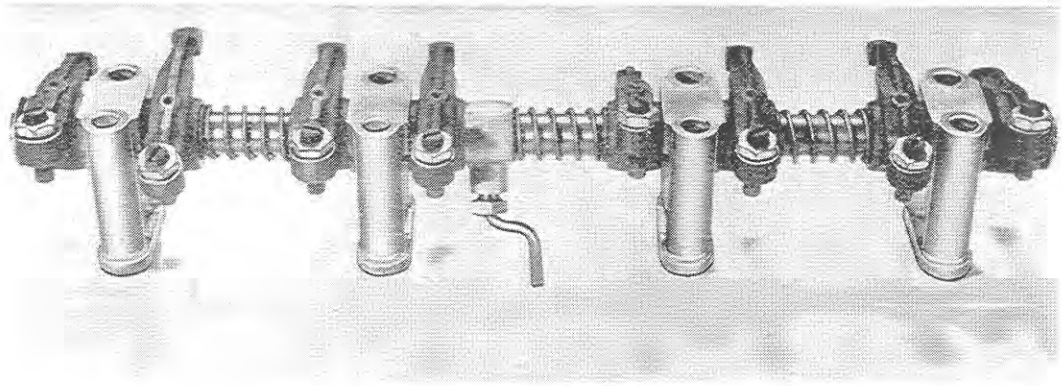


Fig. 7

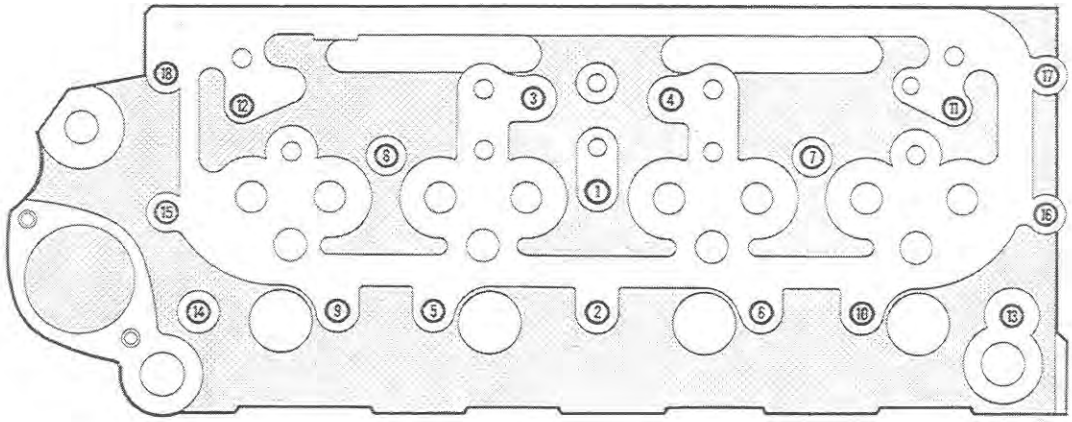


Fig. 8

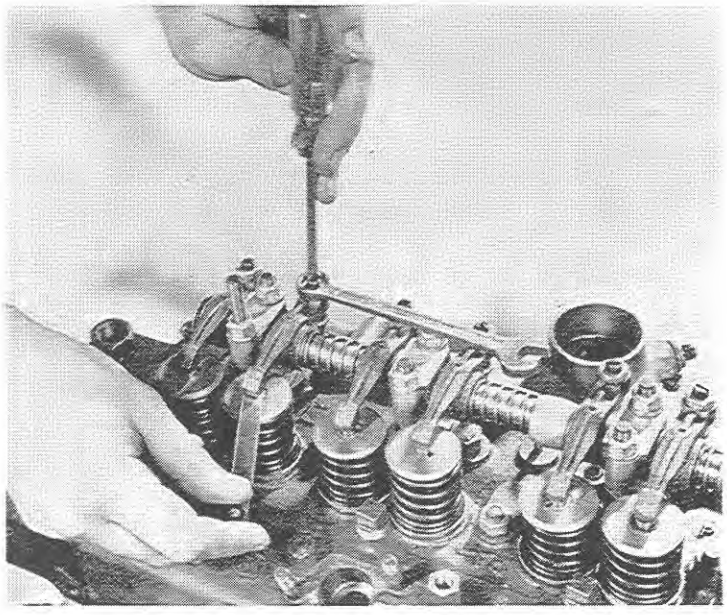


Fig. 9

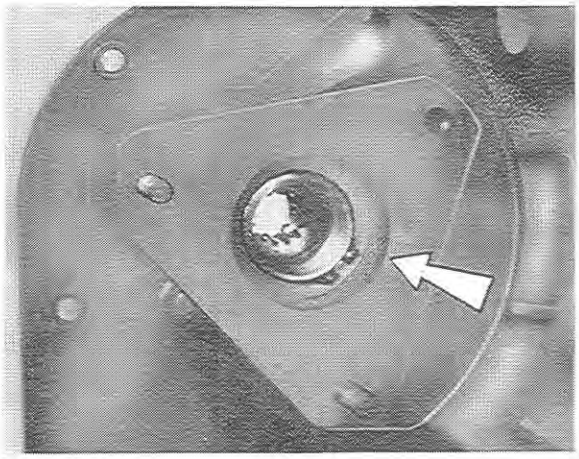


Fig. 10

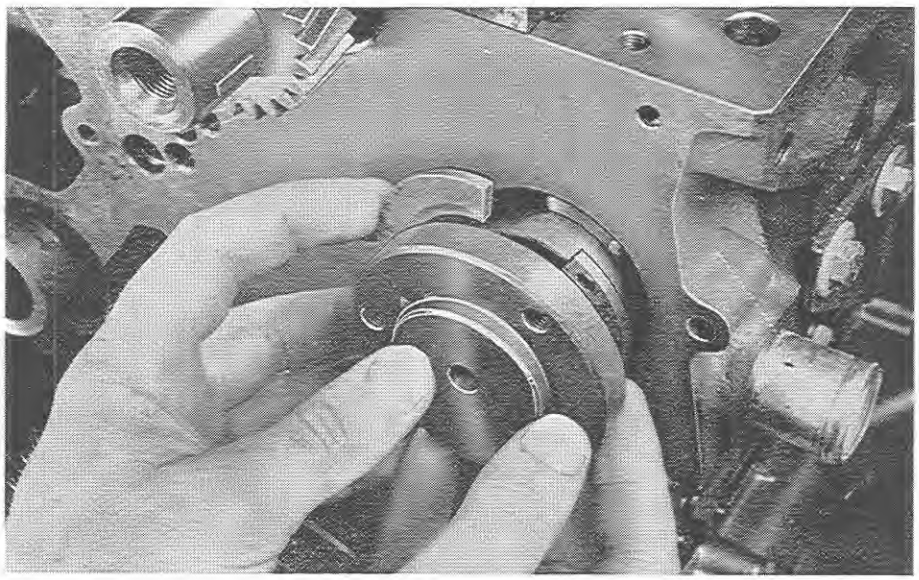


Fig. 11

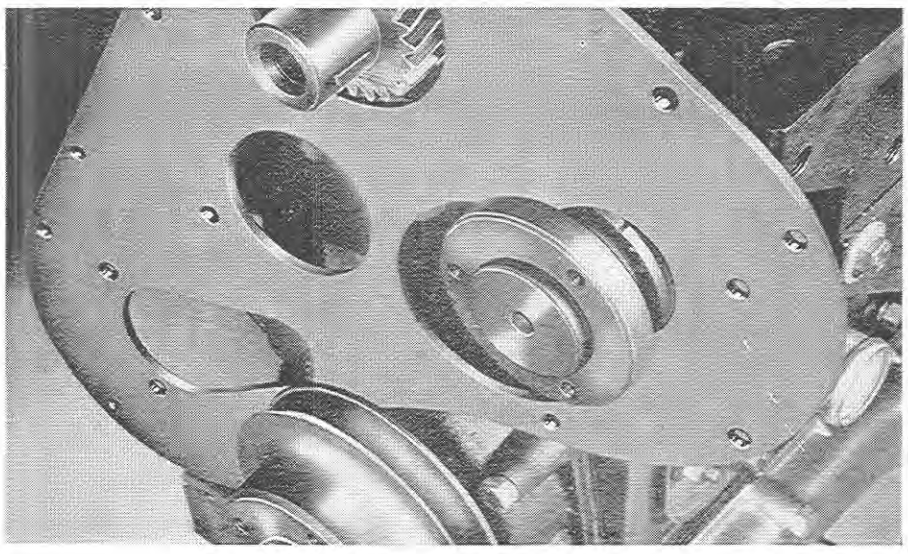


Fig. 12

OPERATION **B18** FITTING OF CAMSHAFT GEAR

Preliminary Operations: B15 - Removal of camshaft gear

1) Put the gear in place on the camshaft and fix it with its three screws having checked that the marks D on the two parts correspond (Fig. 13).
2) Also ensure that the marks on the camshaft gear and idler gear coincide (Fig. 14).

   NOTE: It is necessary to remove the idler pinion to obtain this.

   IMPORTANT: Under no circumstances must the slots be used for holding the gear to the camshaft.

3) Check the clearance between the gears (Fig. 15 and 16).
4) Complete the following operations:
   B21 - Aligning the timing gears.
   B22 - Fitting of timing cover.
   N11 - Fitting the front axle.
   Q16 - Fitting of hood.

OPERATION **B19** FITTING OF INJECTOR PUMP GEAR AND HUB

Preliminary Operations: B14 - Removal of hub and fuel pump gear

If it is necessary to change the bronze bush of the drive hub of the pump, this should be fitted by the front, taking care that the oil hole of the bush lines up with the oil hole in the cylinder block.

1) Fit the hub in the bush.
2) Fit the circlip to the front part of the hub (inside the fitting plate of the pump).
3) Fit the pump drive gear to the hub so that its mark lines up with that of the idler gear.
4) Check the clearance of the gear (Fig. 15 and 16).

   NOTE: It is necessary to remove the idler pinion to obtain correct line-up of the marks on all four gears (Fig. 14).

5) Complete the following operations:
   B21 - Aligning the timing marks.
   D13 - Fitting and timing of injection pump.
   B22 - Fitting of timing cover.
   N11 - Fitting the front axle.
   Q16 - Fitting of hood.

OPERATION **B20** FITTING OF IDLER GEAR

Preliminary Operations: B13 - Removal of idler gear

1) Fit the idler pinion making sure that its marks line-up with the marks on the other gears (Fig. 14).
2) Fit the two screws and new locking tabs and tighten these.
3) Check the clearance of the gears (Fig. 15 and 16).
4) Complete the following operations:
   B21 - Aligning the timing gears.
   B22 - Fitting of timing cover.
   N11 - Fitting the front axle.
   Q16 - Fitting of hood.

Preliminary Operations: B13 - Removal of idler gear (A)
D 1 - Removal of fuel tank (B)

A — Aligning the timing marks

1) Turn the crankshaft untill the keyway for the pinion is uppermost (pistons 1 and 4 at TDC).

2) Turn the camshaft by hand untill the valves of No. 4 cylinder are "on the rock".

3) Fit the idler gear in place so that its timing marks coincide with the crankshaft gear and the camshaft gear (Fig. 14).

   NOTE: If the gears are not marked (as in the case of new parts) engage the idler gear taking care not to change the positions of the camshaft and crankshaft gears.

4) Complete the following operations:
   B22 - Fitting of timing cover.
   N11 - Fitting the front axle.
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

B — Checking the timing

1) Removal of rocker cover.

2) Put No. 1 piston at TDC (end of exhaust/with No. 1 cylinder valves "on the rock").

3) Give a tappet clearance of 0.0366" (93/100) to No. 8 valve (No. 4 intake valve).

4) Put a 0.002" (5/100) shim between the valve stem and the rocker (No. 8 valve).

5) Eliminate this clearance by turning the flywheel; the 0.002 (5/100) shim should move with slight resistance.

6) In this position, the 0.25" (6 mm) holes in the flywheel and the engine mounting plate should coincide. Check this by means of a punch of 0.25" (6 mm) diameter (Fig. 17).

7) Refit the rocker cover complete with a new cork joint smeared with a smealing compound.

8) Complete the following operations:
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

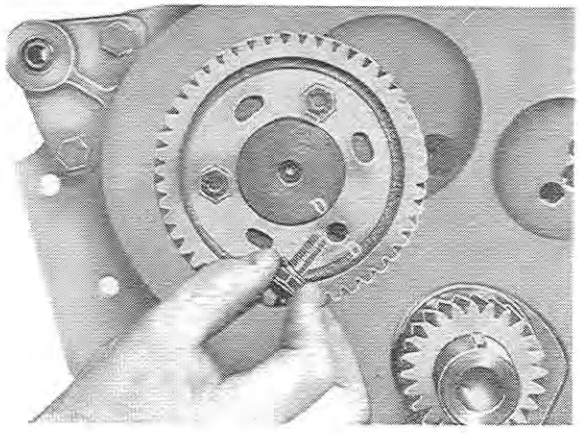


Fig. 13

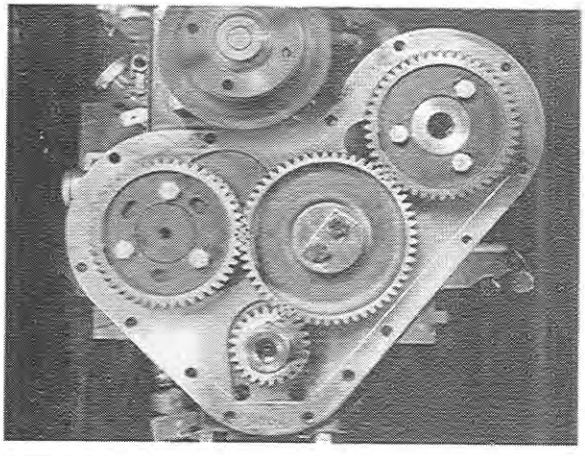


Fig. 14

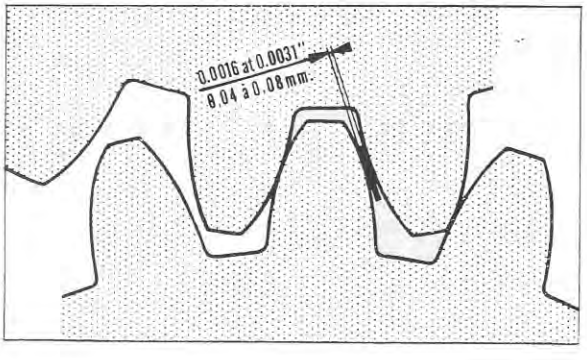


Fig. 15

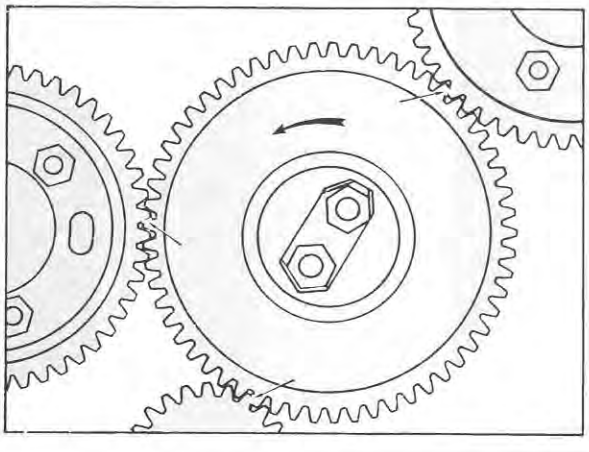
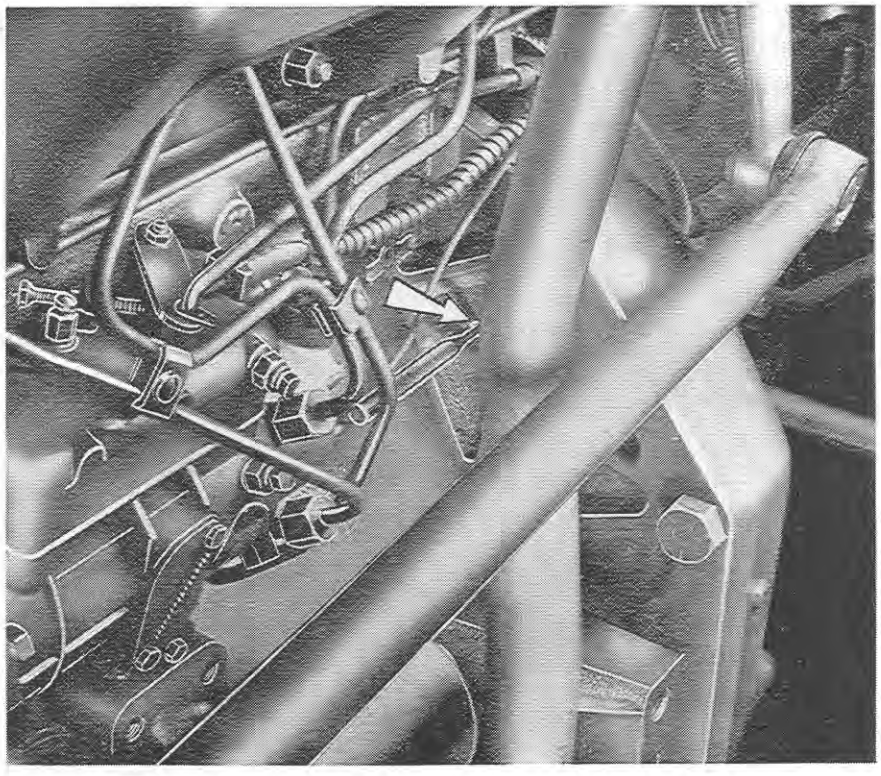


Fig. 16

Fig. 17



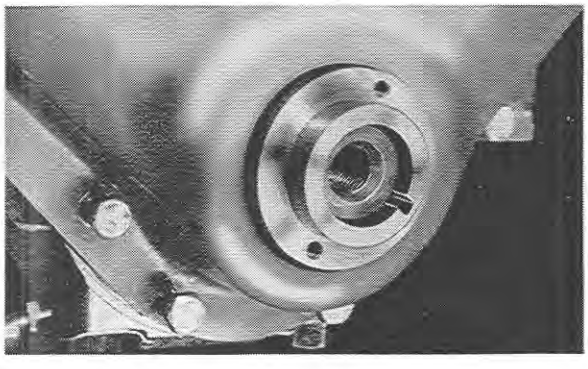
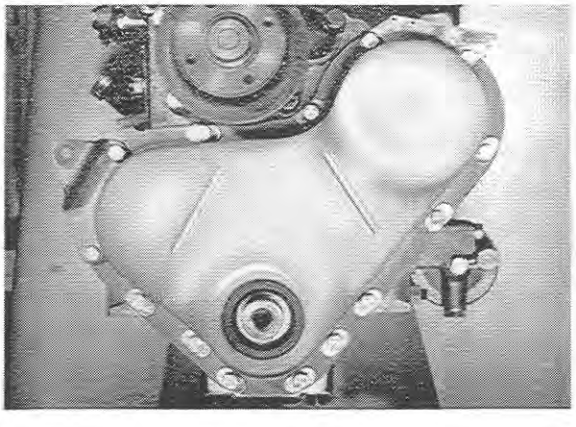


Fig. 18

Fig. 19



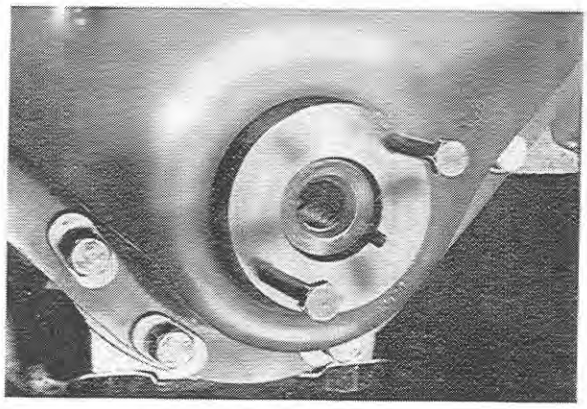


Fig. 20

Fig. 21

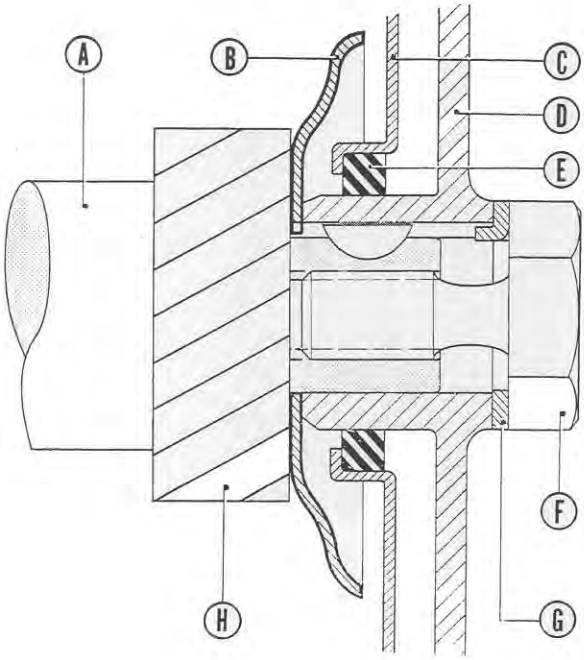


Fig. 22

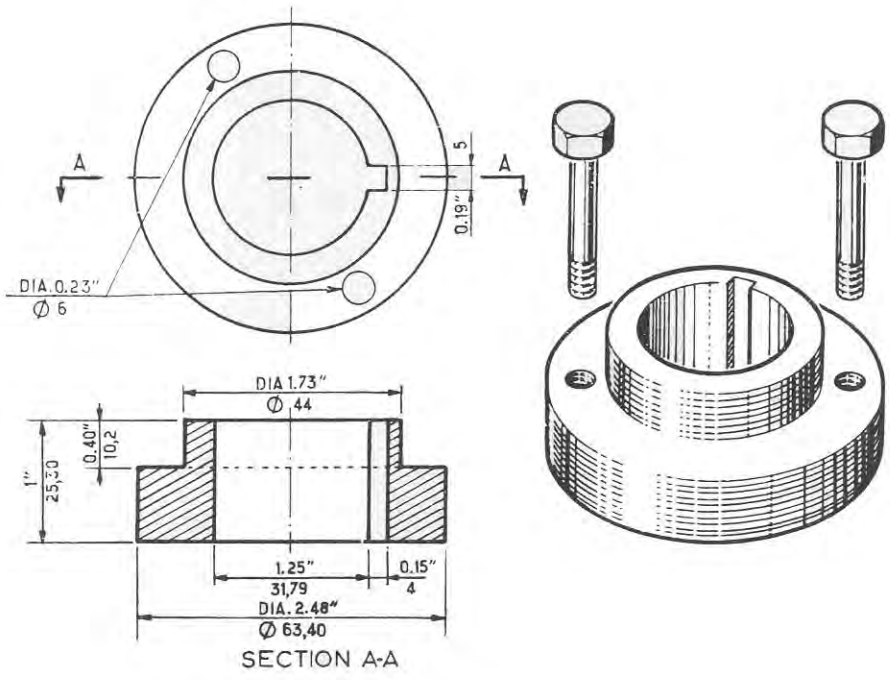

A
A
5
0.19"
DIA. 0.23"
Ø 6
DIA 1.73"
Ø ,44
0.40"
10,2
1"
25,30
1.25"
31,79
0.15"
4
DIA. 2.48"
Ø 63,40
SECTION A-A

Fig. 23

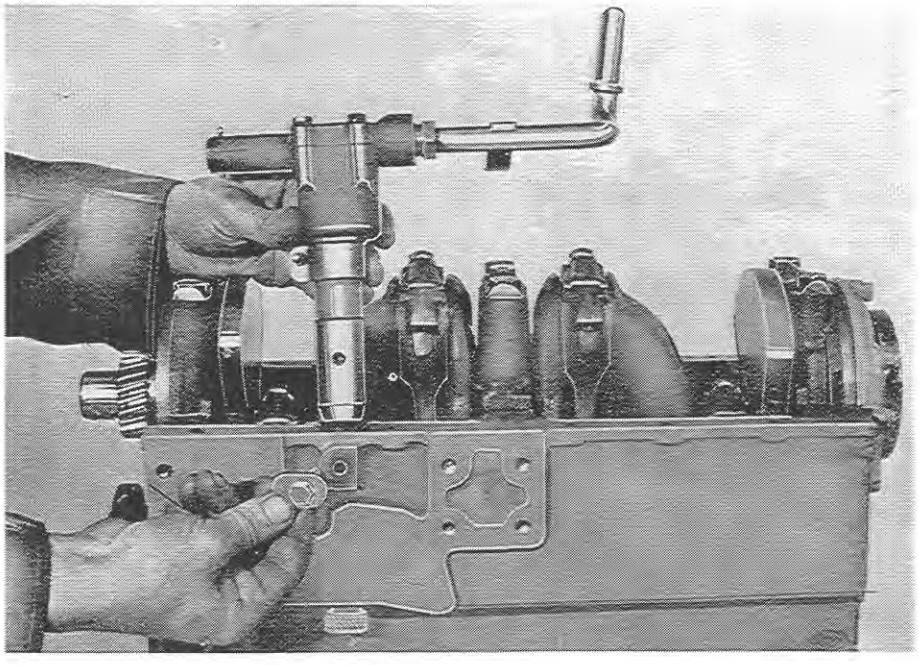


Fig. 24

See Figure 18 Service Tools Required: Centring Tool (See Fig. 23)

1) Fit the oil thrower on the crankshaft (Fig. 22 - Ref. B).
2) Ensure that the oil seal of the cover is in perfect condition and is correctly positioned in the cover.
3) If the oil seal has to be replaced, proceed as follows:
   a) Extra from the cover the oil seal which has to be changed taking care not to damage the recess from which it is removed.
   b) Slacken off the four bolts holding the front engine mouting plate.
   c) Fit the centring tool in the recess in the timing cover in which the new seal is to be located as shown in Fig. 18. Fit the timing cover to the engine **with the centring tool sliding on the crankshaft.**
   d) Fit five or six bolts spaced evenly round the cover making sure that they can be tightened up by hand. This will show that the front engine mounting plate is correctly positioned.

      IMPORTANT: If any difficulty is encountered in fitting the bolts due to the holes of the cover and mounting plate not lining up, it will be necessary to replace the cover.
   e) Gently remove the cover and the centring tool making sure that the engine mounting plate is not displaced.
   f) Tighten the four bolts holding the engine mounting plate.
   g) Refit the timing cover complete with centring tool and fit it with a new joint smeared with sealing compound. Fit and tighten the screws, not forgetting:
      — the plate for attaching the return spring of the throttle control rod,
      — the fitting plate for the dynamo (Fig. 19).
   h) Remove the centring tool by means of the two studs and then unscrew these studs (Fig. 20).
   i) Put the new seal on the centring tool (Fig. 21) and having smeared its exterior with sealing compound fit it in the timing cover. Slide the centring tool on the crankshaft thus putting the seal in place (Fig. 22).

TITLE (Fig. 22)

A - Crankshaft
B - Oil thrower
C - Timming cover
D - Pulley
E - Front oil seal
F - Washer
G - Screw
H - Crankshaft gear

   If necessary, the centring tool can be tapped with the soft mallette to get the seal completely in place.
   j) Remove the centring tool by means of the studs (Fig. 23).
4) Refit the pulley and washer and tighten up the nut to a torque of 108 ft/lb (15 m/kg).
5) Complete the following operations:
   N11 - Fitting the front axle
   Q16 - Fitting of hood.

TITLE (Fig. 25)

A - Pusher
B - Idler gear
C - Hub
D - Injection pump gear
E - Lubrication boom
F - By-pass
G - Oil sump
H - Bowl screen
I - Engine sump screen
J - Overflow valve
K - Engine sump

OPERATION **B23** — REMOVAL OF ENGINE SUMP

Preliminary Operations: N1 - Removal of front axle

1) Drain the engine sump.
2) Place a jack under the centre of the sump and a trolley jack under the transmission housing.
3) Remove the exhaust pipe and the silencer.

   NOTE: This operation is not necessary when the tractor is fitted with a vertical exhaust.
4) Remove the six screws holding the sump to the clutch housing.
5) Remove the two upper screws holding the adaptor plate, the one on the right also holds the starter motor.
6) Remove the screws holding the sump to the engine block leaving two in the centre.
7) Remove the two remaining screws and lower the jack. The sump should descend under its own weight.

OPERATION **B24** — REMOVAL OF OIL PUMP

Preliminary Operations: B23 - Removal of engine sump

1) Remove the sump strainer.
2) Remove the flexible drive to the tractormeter and remove the lower circlip.
3) Remove the screw holding the suction pipe to the centre main bearings.
4) Remove the two unions for the oil pipe.
5) Remove the screw holding the pump to the engine block.
6) Remove the pump from the engine block (Fig. 24).

   NOTE: As the pump is removed the intermediate shaft driving the tractormeter flexible drive will also fall out under its own weight.

OPERATION **B25** — DISMANTLING THE OIL PUMP

Preliminary Operations: B24 - Removal of oil pump

1) Remove the four screws and look washers holding the cover to which the safety valve is fitted.
2) Remove the cover.
3) Remove the exterior rotor (Fig. 26).
4) If necessary, remove the drive shaft.

OPERATION **B26** — CHECKING AND RE-ASSEMBLY OF THE OIL PUMP

Preliminary Operations: B25 - Dismantling the oil pump

1) Carefully clean all the parts, dry them with compressed air and examine for wear, or damage.
2) Refit the safety valve (Fig. 27).

TITLE (Fig. 27)

A - Spring seat
B - Spring
C - Overflow
D - Cotter pin
E - Valve body

3) Fit the exterior rotor with the chamfered edge entering the pump body first.
4) Fit the interior rotor.
5) Check:
   a) At several locations the clearance between the interior and exterior rotor (Fig. 28), this clearance must not exceed 0.006" (0.15 mm).

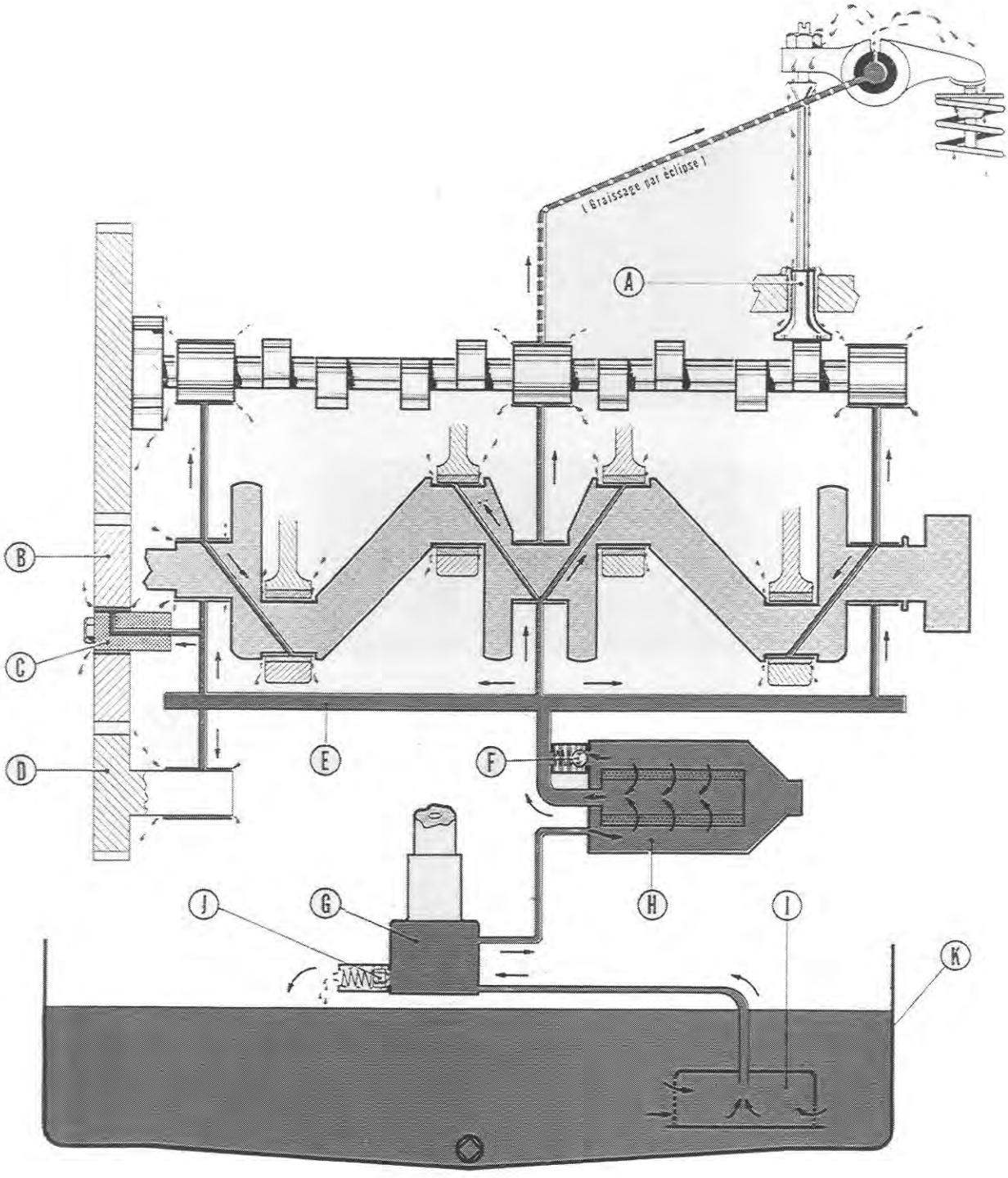


Fig. 25

Fig. 26

Fig. 27

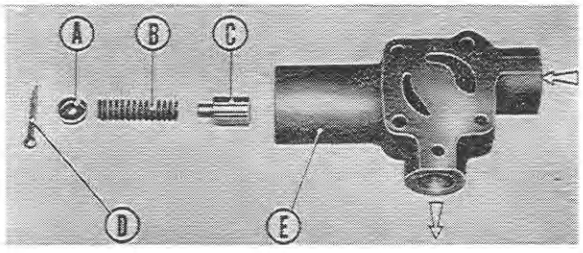
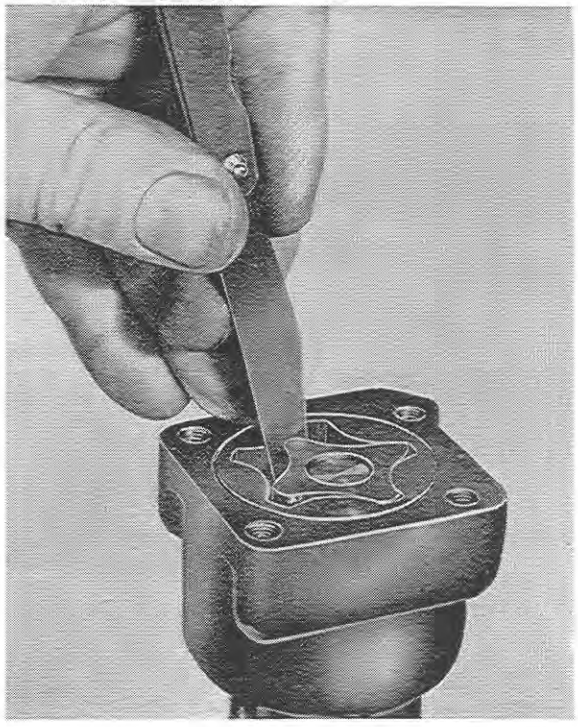


Fig. 28



b) The clearance between the external rotor and the pump body (Fig. 29). This clearance must not exceed 0.01" (0.25 mm).

c) The clearance between the top of the rotors and the surface of the pump body, this should be between 0.0016 and 0.0031" (0.04 to 0.08 mm) (Fig. 30).

NOTE: If any of these tolerances are exceeded or if the pump is considered in any way faulty, then it must be replaced by a complete unit as component parts are not available as spares.

6) Refit the cover to the pump—the central rotor on the shaft should be held in place by two pins placed perpendicularly.

7) If the drive gear of the pump has been removed, it must be refitted with the aid of a press, with the top already assembled; the shoulder of the drive gear should just touch the pump body.
After assembly the clearance between the gear and the pump body should be between 0.03 and 0.047" (0.8 and 1.2 mm).

8) Complete the following operations:
B27 - Fitting the oil pump.
B28 - Fitting the engine sump.
N11 - Fitting the front axle.
Q16 - Fitting of hood.

OPERATION **B27** FITTING THE OIL PUMP

Preliminary Operations: B24 - Removal the oil pump

1) Fix the pump in place on the engine block.
2) Place the fixing screw through the pump and tighten.
3) Place the oil tube and tighten the two unions.
4) Place the suction pipe and strainer on the pump—tighten the union.
5) Place the fixing screw for the suction pipe on the centre bearing.
6) Put in place the intermediate shaft for the flexible drive for the tractormeter, and its circlip.
7) Complete the following operations:
B28 - Fitting the engine sump.
N11 - Fitting the front axle.
Q16 - Fitting of hood.

OPERATION **B28** FITTING THE ENGINE SUMP

Preliminary Operations: B23 - Removal of engine sump

The easiest way to undertake this operation is to use a hydraulic jack which is placed beneath the engine sump. In this way, it can be lifted and put correctly in place.

1) Having cleaned the joint faces:—
   1. Fit two new cork joints smeared with sealing compound on the front and rear main bearing caps.
   2. Fit two new clingerite joints D and G smeared with sealing compound on the cylinder block faces.
2) Put the sump in place making sure that the strainer is positioned between the four studs in the bottom of the sump.
3) Fit the assembly screws holding the sump to the cylinder block.

NOTE: Fit the two long screws on the right side last.

4) Fit the six assembly screws holding the sump to the mounting plate.

NOTE: The two shortest screws are placed on the lower part of the sump. Tighten these six screws to a torque of 108 ft/lb (15 m/kg).

5) Fit the silencer and exhaust pipe.
6) Fill the engine sump with oil.
7) Complete the following operations:
N11 - Fitting the front axle.
Q16 - Fitting of hood.

OPERATION **B29** OIL FILTER

This is a "full flow" oil filter and filters the oil from the outside to the inside of the filter element. Should the element become clogged and the passage of oil severely restricted the pressure difference between the inlet port and outlet port will open the spring loaded ball valve in the by-pass connection permitting unfiltered oil to pass to the engine (Fig. 31).

The by-pass valve opens at a pressure difference of 13 to 17 p.s.i (0.900 to 1.200 kg/cm^2).

TITLE (Fig. 31)

A - Inlet port
B - Cover
C - Setscrew
D - By-pass (Ball valve)
E - Oil seal
F - Replaceable element
G - Bowl
H - Oil seal
I - Sheet-plate washer
J - Spring

OPERATION **B30** REMOVAL OF ENGINE

Preliminary Operations: N1 - Removal of front axle
D1 - Removal of fuel tank

1) Remove the exhaust pipe and silencer.
2) Remove the "stop" control from the injection pump.
3) Remove the throttle control rod between the injection pump and throttle lever.
4) Remove the pipe from the engine block to the oil pressure gauge.
5) Remove the wiring harness for the front lights from its protection tube.
6) Uncouple and remove the three fuel pipes between the fuel filter, fuel lift pump, and injection pump.
7) Remove the flexible drive to the tractormeter from the engine lock.
8) Disconnect:

On the starter motor
— the wire to the safety starter switch,
— the battery cable,
— the wire to the starter switch.

On the dynamo
— the two wires to the voltage regulator.

On the thermostart
— the wire.

On the thermometer plug in the block
— its wire.

9) Remove the two screws holding the battery carrier to the engine mounting plate.
10) Attach the motor to an overhead hoist.

NOTE: The form of the engine sump makes it difficult to place it on a trolley jack without risk.

11) Remove the two upper screws holding the engine to the clutch housing (the one on the right also holds the starter motor).
12) Remove the six screws holding the engine and its mounting plate to the clutch housing.
13) Dismantle the engine.
14) Complete the following operations:
H 4 - Removal of clutch.
B31 - Removal of flywheel.
15) Remove the mounting plate from the engine.

OPERATION **B31** REMOVAL OF FLYWHEEL

Preliminary Operations: H4 - Removal of clutch

1) Knock back the locking tab and remove the screws holding the flywheel to the crankshaft.
2) Remove the flywheel.
3) Extract the pilot bearing.

OPERATION **B32** REMOVAL OF STARTER RING GEAR

Preliminary Operations: B31 - Removal of flywheel

The starter ring gear is fitted when hot to the flywheel. To remove it from the flywheel it should be partially cut with a hacksaw taking care not to damage the flywheel. Finally knock off the ring gear with a cold chisel and a hammer if necessary.

OPERATION **B33** REMOVAL OF REAR MAIN BEARING SEAL

Preliminary Operations: B31 - Removal of flywheel

1) Remove the engine mounting plate.
2) Remove the two assembly bolts of the half shells and the six screws fixing it to the cylinder block.
3) Remove the half shells with the rope joints.

OPERATION **B34** REMOVAL OF PISTONS AND CONNECTING RODS

Preliminary Operations: B 1 - Removal of cylinder head
B23 - Removal of engine sump

1) Fix the engine to an engine stand if other work has to be carried out on the motor (e.g. crankshaft, rear bearing, etc...).
2) Remove carbon deposits from the tops of the liners.
3) Turn the engine horizontally.

4) Remove the pistons and conrods which are assembled together as follows:
   a) Bring the pistons to BDC.
   b) Unscrew the bolts from the conrods and remove the lower half of the bearing.
   c) Turn the crankshaft so that the conrods can easily be removed.
   d) Remove the piston and conrod and extract the other half bearing.
   e) Place the piston and conrod on the bench and mark as necessary to ensure that if the parts are to be replaced they will occupy the same position in the engine.

   NOTE: The conrods are marked "FRONT" to indicate that they must be positioned towards the front of the engine. It is recommended to replace provisionally the bearing caps to their respective conrods and to ensure that they are not damaged whilst other work is being carried out.

OPERATION **B35** REMOVAL OF CYLINDER LINERS

Preliminary Operations: B34 - Removal of pistons and connecting rods

1) Pull out the liners by hand from the engine block.
2) Remove the joints from the bottom of the liners.

OPERATION **B36** REMOVAL OF CRANKSHAFT

Preliminary Operations: B30 - Removal of engine (optional but recommended)
B12 - Removal of timing cover
B24 - Removal of oil pump
B33 - Removal or rear main bearing seal

1) Remove the nuts holding the connecting rod and bring the piston TDC.
2) Remove the bolts holding the main bearing caps.
3) Remove the screws holding the bearing caps.
4) Remove the bearing caps and their half shell bearings as well as the lower halves of the thrust washers.
5) Put the crankshaft webs in a horizontal position, raise the rear of crankshaft and draw out of cylinder block.
6) The crankshaft can now be removed. Remove it as well as the top half shell bearings and the upper halves of the thrust washers.

OPERATION **B37** DISMANTLING PISTONS AND PISTON RINGS

Preliminary Operations: B34 - Removal of pistons and connecting rods

1) Remove the gudgeon pin circlips.
2) To remove the gudgeon pins from their respective pistons, the assembly should be immersed in warm oil or water, remove gudgeon pin.
3) With the aid of a piston ring remover, remove the rings from their grooves.
4) If the pistons and piston rings are to be re-used, these must be cleaned free of carbon deposits.

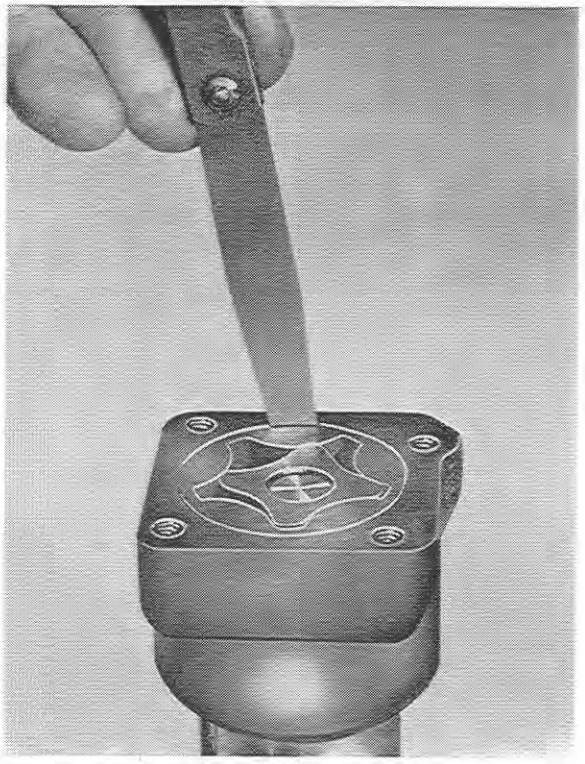
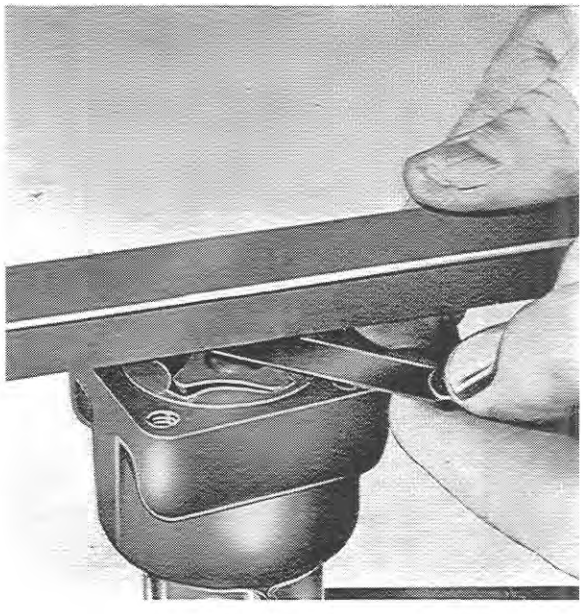


Fig. 29

Fig. 30



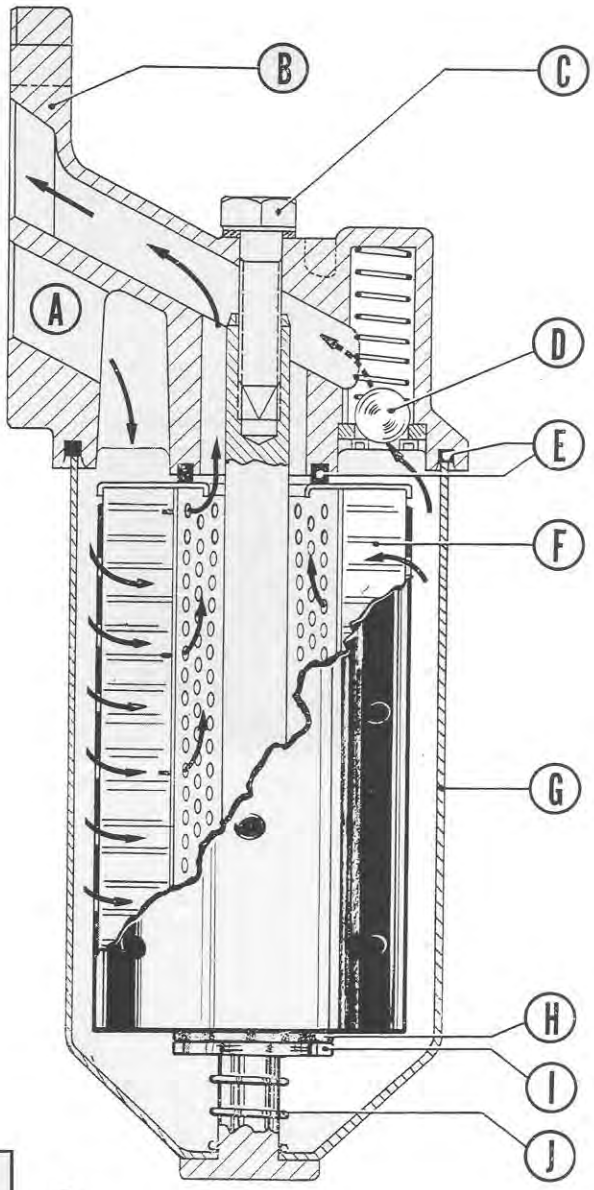


Fig. 31

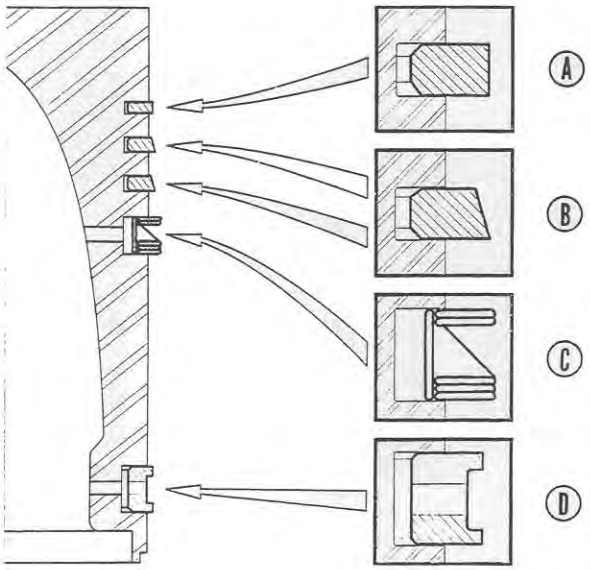


Fig. 32

OPERATION **B38** — REPLACEMENT OF GUDGEON PIN BUSH

Preliminary Operations: B37 - Dismantling pistons and piston rings.

1) Oil the outside of the new bush to be fitted.
2) Knock out the old bush from the conrod.
3) With a press push in the new bush. Take care to line up the oil hole of the bush with that of the connecting rod.
4) Ream out the inside of the new bush with an adjustable reamer to the size of 0.9374-0.9378 (23.81 mm $\binom{+\ 0.01}{-\ 0}$)
5) Complete the following operations:
   B39 - Assembling piston and piston rings.
   N42 - Fitting pistons and connecting rods.
   B28 - Fitting the engine sump.
   B11 - Fitting the cylinder head - Adjusting valve clearance.
   N11 - Fitting the front axle.
   D17 - Fitting of fuel tank.
   D18 - Bleeding the fuel system.
   Q16 - Fitting of hood.

OPERATION **B39** — ASSEMBLING PISTON AND PISTON RINGS

1) Clean the pistons and dry them with compressed air.
2) Fit in place one of the gudgeon pin retaining circlips.
3) Immerse the piston in hot oil for several minutes.
4) Fit the pistons on the connecting rods. If the original pistons are being used they must be fitted to the same original connecting rods and assembled in the same position, one to the other, as they were before dis-assembly.
5) Fit the second circlip in place.
6) Fit the piston rings to the piston (Fig. 32):
   a) **1st groove:** Compression ring (A).
      Parallel faces.
   b) **2nd and 3rd groove:** Compression rings (B).
   c) **4th groove:** Scraper ring (Expander - [C]).
   d) **5th groove:** Slotted scraper ring (D).

OIL CONSUMPTION

— Should oil consumption be excessive on the A 4-107 Engine it is recommended to replace the original piston rings by a "Welworthy" set (see Fig. 33).

— Before fitting pistons equipped with "Welworthy" rings it is necessary to deglaze the polished surface of the cylinder liner by several circular strokes with a fine emery paper.

   a) **1st groove:** Compression ring (a).
      Parallel faces—one face is marked "TOP" and must be placed upwards.

b) **2nd and 3rd groove:** Compression rings (b).
These are internally stepped rings.
The face opposite to the step in marked "BTM".
These rings must be fitted with the inscription "BTM" placed downwards i.e. to the bottom.

c) **4th groove:** "DUAFLEX" Scraper ring (c).
This ring is composed of:—
— 1 expander ring,
— 1 "Ondulex" ring,
— 4 parallel rings.
Put them in place in the following order:—
— 1 expander ring,
— 2 parallel rings,
— 1 "Ondulex" ring,
— 2 parallel rings.

d) **5th groove:** Slotted scraper ring (d).
This is symmetric and can be placed either way up.

Arrangement of piston ring gaps
The gaps must be at 30° to the right or left of the centre line of the gudgeon pin. At the same time the gaps on adjacent rings must be at 180° to each other i.e. on opposite sides of the piston (see Fig. 33).

NOTE: Usine a new connecting rod.
Before assembly it is necessary to verify the fit of the gudgeon pin in the connection rod bush. There should be no appreciable play.

The connecting rod to be used should bear the same weight grade number as the one discarded.

7) Complete the following operations:
B42 - Fitting pistons and connecting rods.
B28 - Fitting the engine sump.
B11 - Fitting the cylinder head - Adjusting valve clearance.
N11 - Fitting the front axle.
D17 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

OPERATION **B40** FITTING THE CRANKSHAFT

The engine should be carried either in the frame of the engine stand or placed on a bench, resting on the top face of the cylinder block i.e. upside down.

1) Clean the crankshaft and dry with compressed air.
NOTE: Take particular care to clean out the oil galleries in the crankshaft.

2) Place the upper main bearing shells into their locations.

3) Grease lightly, to hold them in place, the upper halves of the thrust washers; the vertical oil slots are to be placed next to the crankshaft and the bronze aluminium/tin, steel face next to the engine block.

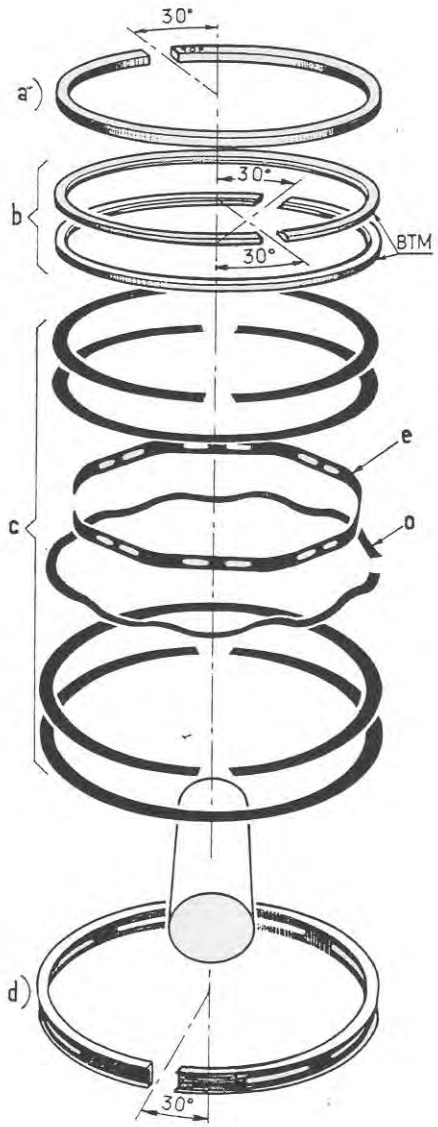


Fig. 33

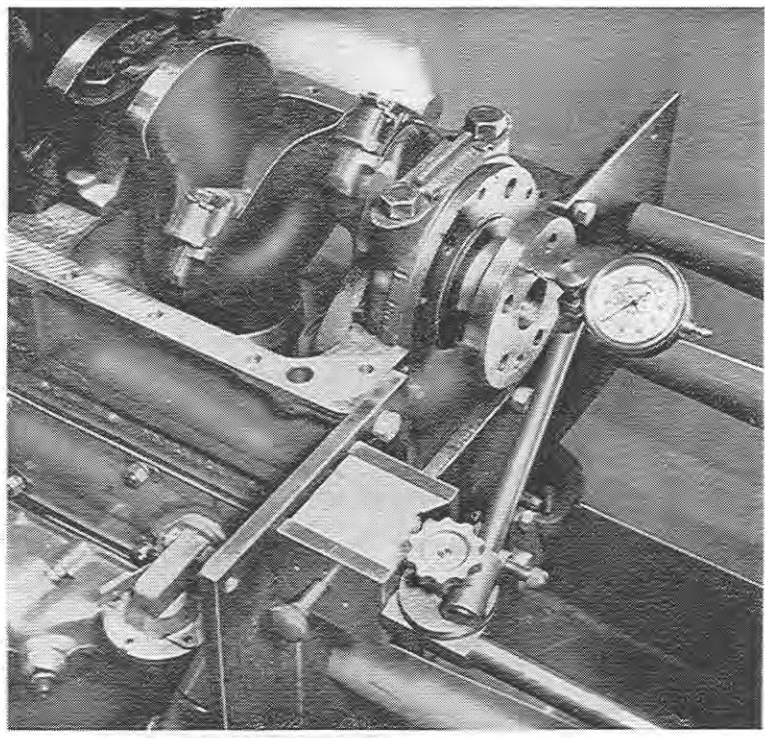


Fig. 34

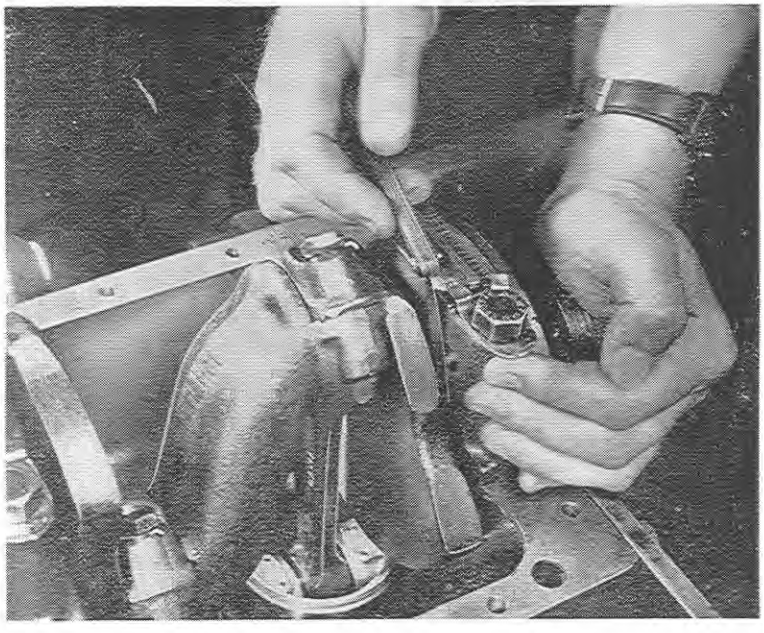


Fig. 35

4) Oil the bearing surfaces of the crankshaft. Fit the front of the crankshaft with the gear through the front mounting plate with the crankshaft webs horizontal. Place it carefully on the main bearings and ensure that the timing marks on the crankshaft timing gear and idler gear coincide.

5) Oil the lower bearing 1/2 shells and put them in place in the main bearing caps. When fitting the rear main bearing cap remove the half housing for the oil seal and ensure that the two lower half thrust washers are correctly fitted. The half washer with the tab is fitted on the flywheel side of the cap with its bronze face towards the flywheel.

6) Fit the main bearing caps in their respective places ensuring that the numbers marked on them correspond.

7) Fit the screws with new locking straps, tighten them progressively and alternately to a final torque of 80 to 85 ft/lb (11 to 12 m/kg) starting with the centre bearing.

8) Check the crankshaft end float which should be between .003" and .009" (0.08 and 0.23 mm) as follows:—
Push the crankshaft alternately forwards and backwards and measure the play on the crankshaft plate for the flywheel with a dial gauge, or feeler gauges (Fig. 34 and 35).
If the clearance is incorrect fit new thrust washers. Oversize washers are available if required.

9) Having checked the end float lock the bearing cap screws with the tab washers.

10) Assemble connecting rods to crankshaft and fit new lock nuts. Tighten these nuts to a torque of 32.5 to 36 ft/lb (4.5 and 5 m/kg).

11) Complete the following operations:
B23 - Fitting the rear crankshaft oil seal.
B27 - Fitting the oil pump.
B28 - Fitting the engine pump.
B45 - Fitting the flywheel.
H 7 - Fitting the cluch.
B22 - Fitting of timing cover.
B46 - Fitting the engine.
N17 - Fitting the front axle.
D17 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

OPERATION **B41** FITTING THE CYLINDER LINERS

Service Tools: MIMO

1) Verify that the grooves for the sealing rings are clean and that the vent holes between the extension of the block and the space between the sealing rings are clear. Verify that the recesses in the cylinder block top face are clean and free of any foreign matter which would prevent the liner flange from seating.

2) Fit the two new "O" rings in their grooves in the block. To facilitate the passage of the liner through them they should be lubricated with soft soap or soapy water.

3) Lubricate the lower point of the liner with tallow or soft soap. Insert the liner and press it into position with the fingers. To assure that it is fully seated it should be tapped with a mallet or copper hammer.
The upper face of the top shoulder should be between .001" (.025 mm) below and .003" (.076 mm) above the face of the cylinder block.
4) Fit liner retainers, MIMO, to hold the liners securely in position.
5) After fitting the liners the cylinder block, without the water pump, should be water tested to a pressure of 20 lbs.sq.in. (1.40 kg.sq.cm)

NOTE: A slight oil leak from the vent holes may be observed with a new or newly assembled engine; this is normal and should cease after a few days operation.
A slight seepage of water from the vent holes is permissible.

6) Complete the following operations:
B42 - Fitting pistons and connection rods.
B28 - Fitting the engine sump.
B11 - Fitting the cylinder head - Adjusting valve clearance.
N11 - Fitting the front axle.
D11 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

OPERATION **B42** FITTING PISTONS AND CONNECTING RODS

1) Clean the bore of the liner and cover with new engine oil.
2) Lubricate with new engine oil, the piston, the rings, the gudgeon pin, the connecting rod bearings and crankshaft journals.
3) Fit a piston ring clamp having checked the gap arrangement (Operation B39/6).
4) Turn the crankshaft so that the journal of the cylinder to which the piston is to be fitted is at BDC.
5) Slide the connecting rod and piston down the cylinder bore from the cylinder head end ensuring that the side of the connecting rod marked "FRONT" is towards the front of the engine (or that the number marking are on the injection pump side).
6) Push the piston into the cylinder ensuring at the same time that the connecting rod is correctly orientated.
7) Lubricate the journal, the upper shell bearing and fit this to the connecting rod. Push on the piston head to bring the bearing in contact with the crankshaft.
8) Fit the lower shell bearing in its cap and lubricate it.
9) Fit the bearing cap, the retaining bolts which must be new, and tighten to a torque of 32.5 to 36 ft/lb (4.5 to 5 m/kg).
10) Complete the following operations:
B28 - Fitting the engine sump.
B11 - Fitting the cylinder head - Adjusting valve clearance.
N11 - Fitting the front axle.
D17 - Fitting of fuel tank.
D18 - Bleeding the fuel system.
Q16 - Fitting of hood.

OPERATION **B43** FITTING THE REAR CRANKSHAFT OIL SEAL

1) Set up, in turn, each half housing in the vice with the seal recess upwards.
2) Settle approximately 1" of the rope sealing strip at each end into the ends of the groove, ensuring that the strip projects. 0.10 to 0.20" (0.25 to 0.50 mm) beyond the half bearing joint face. Allow the middle of the seal to bulge out of the groove during this operation (Fig. 34).
   IMPORTANT: Do not trim the ends of the seal.
3) With the thumb or finger press the remainder of the strip into the groove, working from the center. Using a suitable round bar further bed in the strip by rolling and pressing its inner diameter (Fig. 35).
4) Assemble the two half housings together and tighten the two securing bolts. Using a jointing compound place new joints on the back faces of the housings, ensuring that the butt faces of the joints meet and that all holes align. Allow a drying period.
5) Separate the half housings.
6) Lightly paint the butt faces of the housings with sealing compound.
7) Liberally oil the oil return groove on the rear end of the crankshaft.
8) Liberally oil the exposed inner diameter of the oil seal.
9) Assemble the half housings around the crankshaft over the oil return groove and tighten the two setscrews (fitted with locking washers).
10) Swivel the housing around the crankshaft to bed in the seals and ensure that the assembly turns easily on the shaft.
11) Secure the half housings to the cylinder block and rear main bearing cap with the six setscrews and spring washers, to torque of 7.2 ft/lb (1 m/kg).
12) Fit the engine mounting plate to the engine.
13) Complete the following operations:
    B45 - Fitting flywheel.
    H 7 - Fitting the clutch.
    H10 - Couple the engine to the clutch housing.

OPERATION **B44** FITTING STARTER RING GEAR

1) Carefully clean the flywheel where the ring has to be fitted.
2) Heat the new ring gear uniformly to a temperature of approximately 480" F (250" C).
3) Carefully put the ring gear in place on the flywheel having made sure that the chamfered side of the teeth is turned towards the engine.
4) Allow to cool down.
5) Complete the following operations:
   B45 - Fitting the flywheel.
   H 7 - Fitting the clutch.
   H10 - Couple the engine to the clutch housing.

OPERATION **B45** FITTING FLYWHEEL

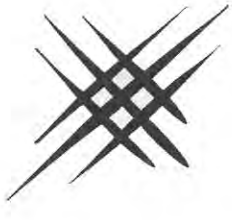
1) Check for cleanliness and condition the coupling plate of the crankshaft and the recess in the flywheel. The contacting faces should be free of all swarf or dirt to avoid an excessive run-out of the flywheel. (If necessary clean up with a fine stone.)
2) Put the flywheel in place so that the bolt holes line up with the threaded holes in the rear plate of the crankshaft.
3) Tigten up the screws to a torque of approximately 29 ft/lb (4 m/kg), then tighten up diagonally to a final torque of 50 ft/lb (7 m/kg).
4) Complete the following operations:
   H 7 - Fitting the clutch.
   H10 - Couple the engine to the clutch housing.

ADVICE: This operation can be made in two different ways: the first is to couple the engine suspended by a hoist to the clutch housing and then couple up the front axle support.

The second method, which is recommended, is firstly to join the engine to the front axle support (Operation N11) and then to couple up the engine and front axle assembly to the rear half of the tractor.

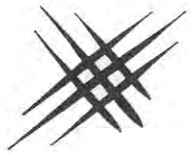
Only the second method is explained here as it is more practical to undertake particularly concerning the fitting of the primary shafts to the clutch.

1) Assemble the front axle to engine (Operation N11).
2) The gearbox or the clutch housing resting on the trolley jack advance the tractor and couple the engine to the clutch housing.
3) Fit and tighten the two nuts holding the battery support to the engine mounting plate.
4) Reconnect:
   — **to the dynamo:** the wire to the safety starter switch,
   the battery cable,
   the wire to the starter switch,
   — **to the dynamo:** the two wires to the voltage regulator,
   — **to the thermostart:** its wire,
   — **to the thermometer plug in the engine block:** its wire.
5) Fit the flexible tractormeter drive to the engine block.
6) Fit the three fuel lines between filter, lift pump and fuel injection pump.
7) Fit the wiring harness for the front lights in its tube.
8) Fit the tube between the engine block and oil gauge.
9) Fit the throttle control rod between the injection pump and throttle lever.
10) Fit the "stop" rod to the injection pump.
11) Fit the exhaust pipe and silencer.
12) Complete the following operations:
    D17 - Fitting the fuel tank.
    D18 - Bleeding the fuel system.
    Q16 - Fitting of hood.



COOLING SYSTEM

LIST OF OPERATIONS



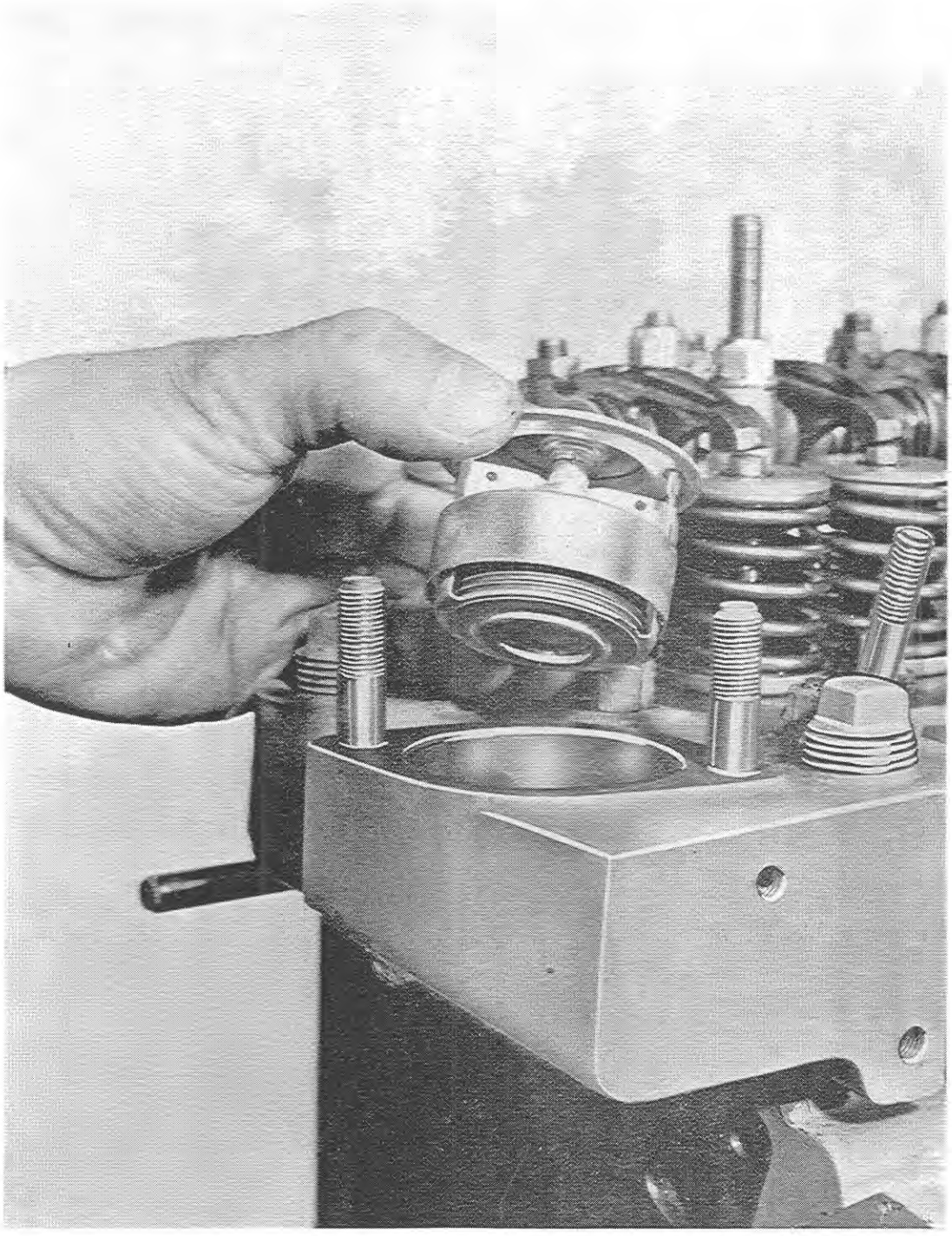


Fig. 1

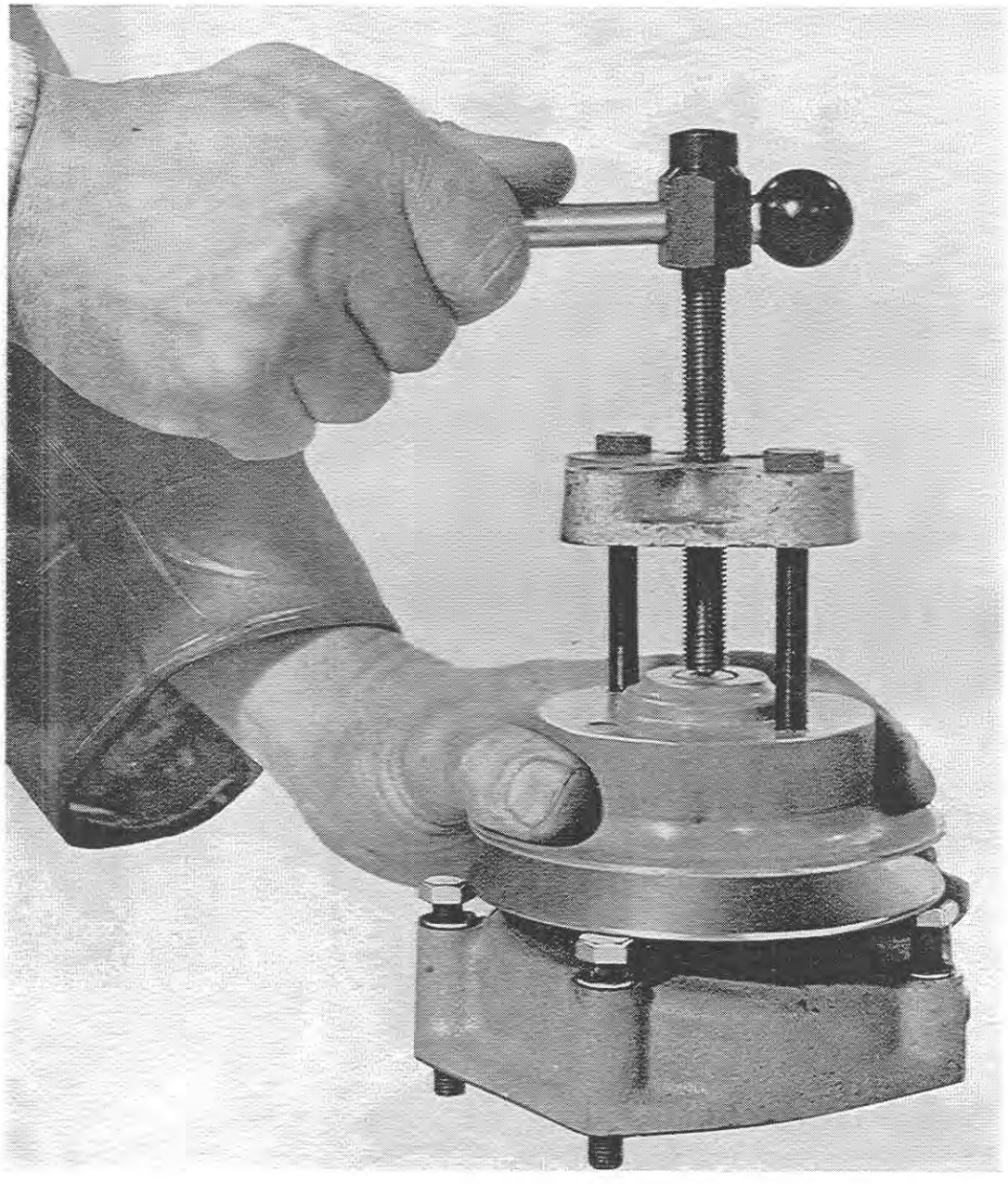


Fig. 2

OPERATION **C1** REMOVAL OF RADIATOR

Preliminary Operations: Q3 - Removal of hood
Q4 - Removal of radiator grille

1) Drain the engine and radiator by opening the taps in the engine block and the lower hose from block to radiator.
2) Disconnect the two unions to the oil cooler (for tractors fitted with this equipement).
3) Remove the two nuts holding the radiator to the front support.
4) Remove the radiator from the tractor.
5) Remove from the radiator:
   — The radiator cowl which is fixed by 6 "Parker" Screws.
   — The oil cooler (when fitted).

OPERATION **C2** REMOVAL OF THERMOSTAT

Preliminary Operations: D1 - Removal of fuel tank

1) Drain cooling system.
2) Remove the hose from the thermostat housing.
3) Unscrew the two nuts holding the thermostat housing to the cylinder head and remove.
4) Remove the thermostat (Fig. 1).

OPERATION **C3** VERIFICATION OF THERMOSTAT

Preliminary Operations: C2 - Removal of thermostat

1) Push between the valve and its seat a wire or feeler gauge of 0.002" (0.05 mm).
2) Immerse the thermostat in a vessel of water and hold it by the wire or feeler. Raise the temperature of the water progressively and check with a thermometer which reads up to 212°F (100°C).
3) When the thermostat opens it will be liberated from the wire or feeler gauge. The valve should open between 169°F and 179°F (76°C - 82°C).
4) If the thermostat does not function between these limits it should be discarded and a new one fitted.

OPERATION **C4** REMOVAL OF WATER PUMP

Preliminary Operations: Q3 - Removal of hood
N1 - Removal the front axle

1) Slacken the tension on the fan belt and remove.
2) Remove the 4 bolts holding the pump to the engine.
3) Remove the pump and the pulley.

OPERATION **C5** DISMANTLING OF WATER PUMP

Preliminary Operations: C4 - Removal of water pump

1) Remove the drive pulley with a hub puller (Fig. 2).
2) Remove the circlip from the shaft bearing cage (Fig. 3).
3) Remove the shaft and the impellor from the pump body.
4) With a press, remove the impellor from the shaft. This will enable the seal and the water deflector to be lifted off the shaft (Fig. 4).

OPERATION **C6** — CHECKING AND ASSEMBLY OF WATER PUMP

Preliminary Operations: C5 - Dismantling of water pump

1) Fit the pump shaft to the body, the shaft end towards the fan. Align the grooves in the bearing cage and pump body and insert the locating circlip.
2) Fit the water deflector, the disc forwards and then the seal, with its carbon face towards the impellor.
3) Press on the impellor until there is a clearance of: 0.007" to 0.023" (0.18 - 0.62 mm) between the impellor and pump body (Fig. 5).
4) Fix the two left hand and lower right hand pump attachment bolts in their holes and press the pulley on to the shaft until the front face of the pulley boss is flush with the end of the shaft (Fig. 4).
5) Re-fitting water pump (Operation C7).

Fig. 4

A - Pomp body
B - Pulley
C - Spacer
D - Fan-6 blade
E - Screw holding
F - Tab washer
G - Bearing shaft
H - Snap ring
I - Oil trower
J - Oil seal
K - Propeller

OPERATION **C7** — RE-FITTING WATER PUMP

Preliminary Operations: C6 - Checking and assembly of water pump

1) Fit a new joint smeared with sealing compound to the pump body.
2) Fit the pump to the engine and tighten the 4 fixing bolts.
3) Fit the belt and tension correctly.

OPERATION **C8** — RE-FITTING THE THERMOSTAT

Preliminary Operations: C3 - Verification of thermostat

1) Place the thermostat in place on the cylinder head.
2) Fit a new joint smeared with sealing compound.
3) Re-fit the thermostat housing, the two screws and tighten correctly.
4) Re-fit the water hose and tighten the clips.
5) Re-fill the cooling system and check for leaks.
6) Re-fit the fuel tank (D17).

OPERATION **C9** — RE-FITTING RADIATOR

Preliminary Operations: C1 - Removal of radiator

1) Put the radiator in place on the tractor and fit:
   — the radiator cowl by means of its 6 "Parker"screws,
   — the oil cooler (when supplied) by means of its 4 screws to the radiator.
2) Re-fit and tighten the two screws at the base of the radiator (the left screw also holds the lighting cable clip).
3) Re-fit the grille (operation Q15).
4) Fix the two support plates of the radiator to the fuel tank.

   IMPORTANT: Do not omit to place the vertical stud of the radiator in the hole of the right support plate.
5) Put the upper and lower water hoses in place and tighten the clips.
6) On tractors fitted with an oil cooler join up the two unions.
7) Shut the drain taps.
8) Re-fill the cooling system.
9) Run the engine for a few minutes, top up with water if necessary and check for leaks.
10) Re-fitting of hood (Q16).

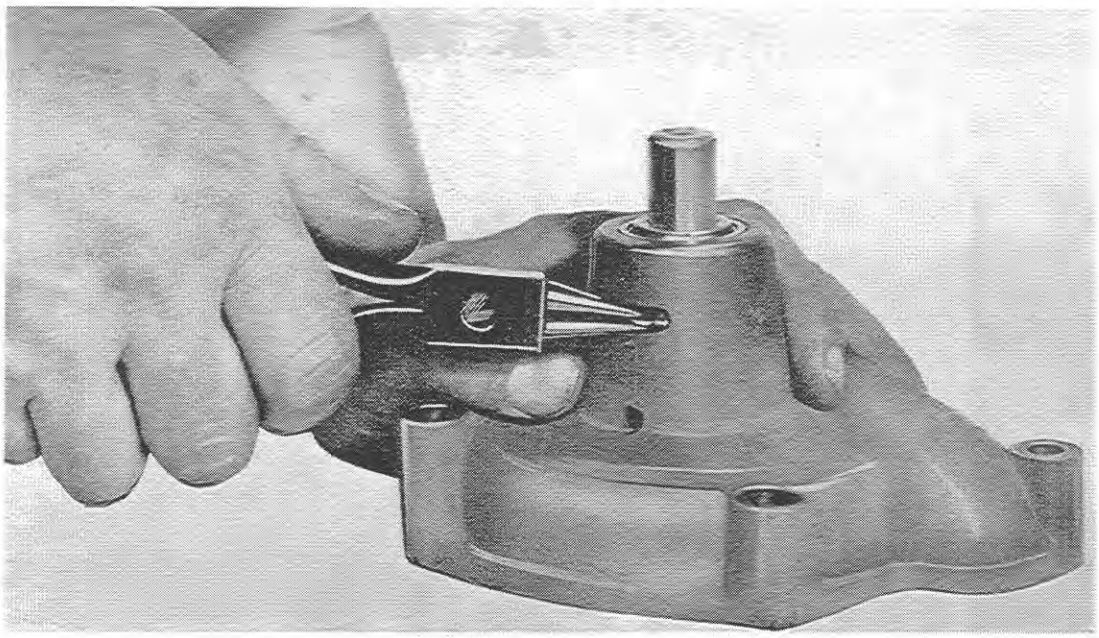


Fig. 3

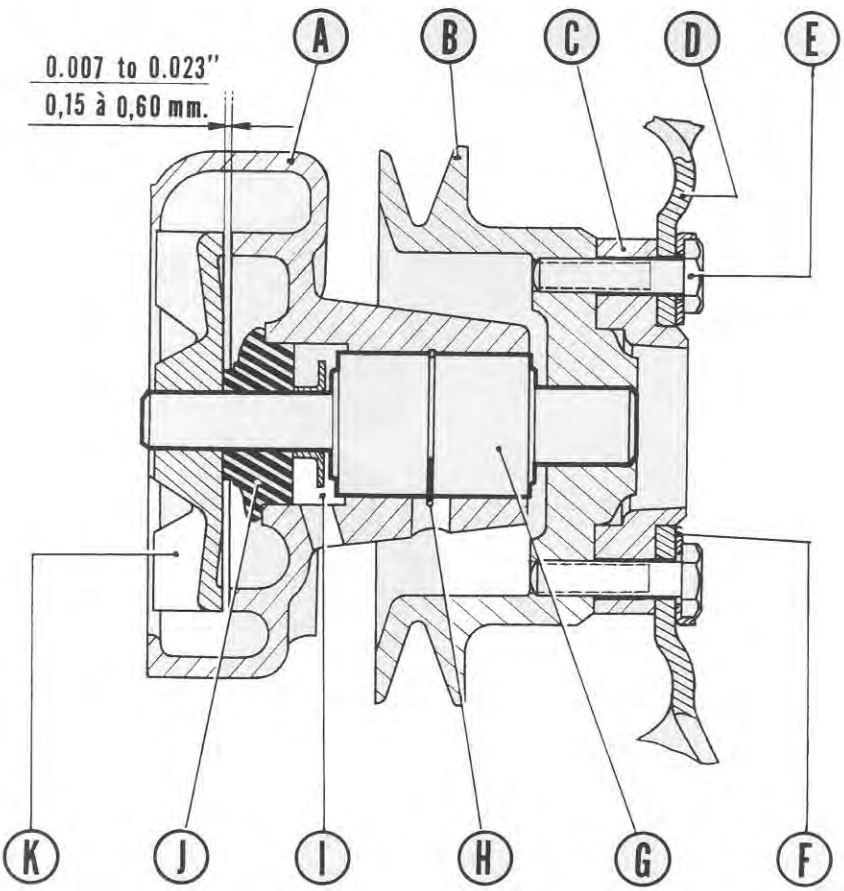


Fig. 4

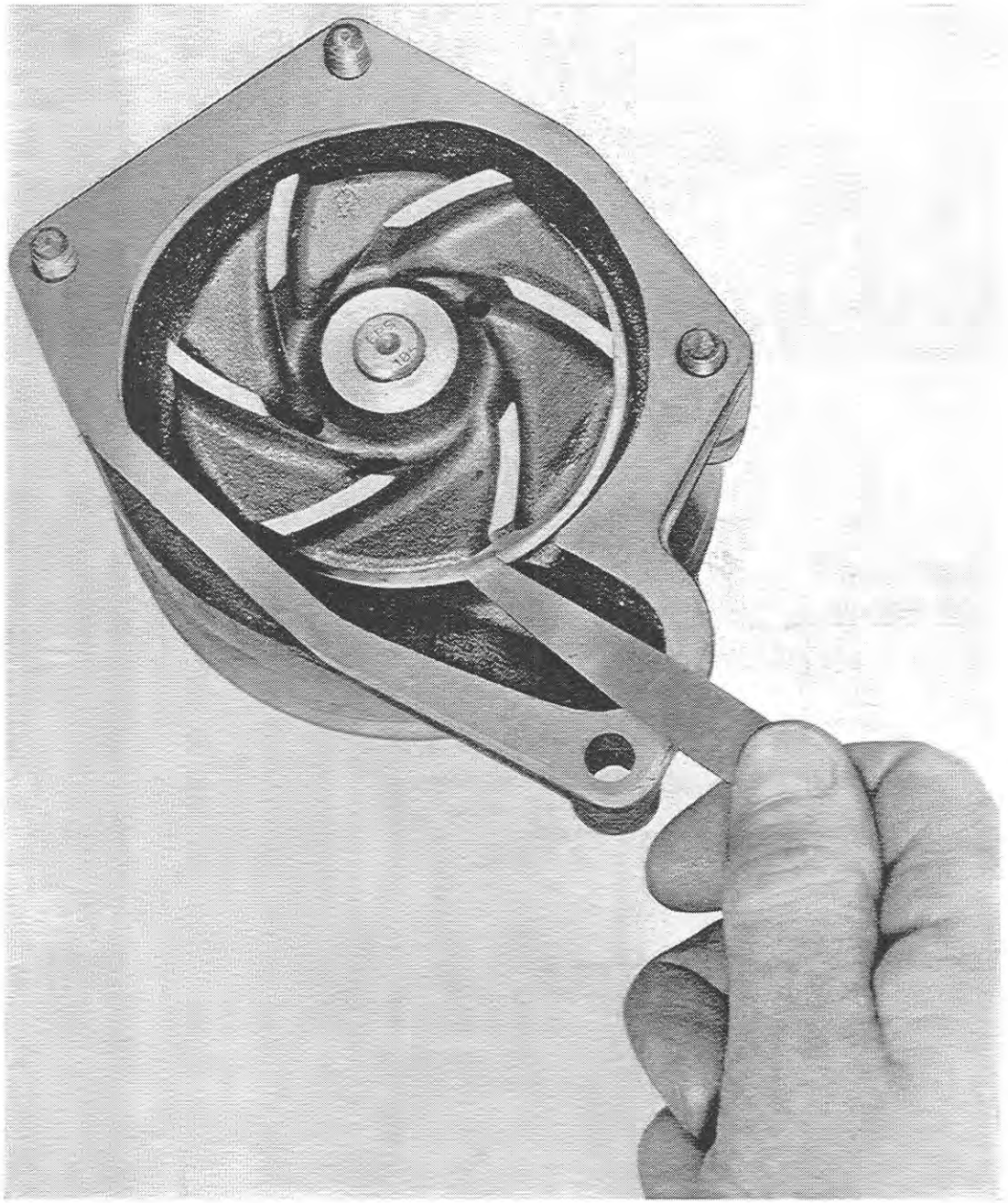


Fig. 5

FUEL FEED AND INJECTION SYSTEM

LIST OF OPERATIONS

DESCRIPTION

The circuit comprises essentially with the following elements: (Fig. 1 :—

TITLE (Fig. 1)

A - Fuel tank
B - Sediment bowl
C - Fuel litt pump
D - Filter
E - Injection pump
F - Injector
G - Auxiliary fuel tank
H - Bleed screw
I - Cover control
R - Tap

— a reservoir A of approximately 10 imp gallons (45 litres),
— a sediment bowl B to which is fitted a fuel tap R located at the tank outlet,
— a diaphragm type fuel lift pump C actuated by the cam shaft and fitted with a hand primer,
— a filter D equipped with a paper element,
— a rotary type injection pump E,
— 4 pintle type nozzle injectors F.

The fuel tank incorporates a special feature: its filler hole on the left side of the tank is inclined and has a collar.
If the tank is over filled this prevents fuel running over the surface of the tank.

OPERATION **D1** — REMOVAL OF FUEL TANK

1) Syphon out the fuel, or if there is only a little fuel in the tank, shut the fuel tap.
2) Remove the battery to facilitate removal of the tank .
3) Remove the two screws holding the tank to the battery support.
4) Remove the two screws to the front support (underneath the tank).

NOTE: To facilitate access to the right hand screw, it is recommended to pull back the air intake hose having slackened off the clip at one end.

5) Remove the 2 support plates holding the fuel tank to the upper plate of the grille.
6) Uncouple:—
   — on the T union, the pipe for tank to thermostart,
   — on the thermostart, the feed pipe,
   — on the sediment bowl, the pipe to the fuel lift pump,
   — on the injectors - the leak off pipes to thermostart reserve tank.
7) Remove the fuel tank.
8) When the fuel tank has to be replaced remove from the old one:—
   — the support plates and hood retaining strap,
   — the thermostart reserve tank and its 3 pipes,
   — the T union,
   — the sediment bowl and tap.

OPERATION **D2** — REMOVAL OF FUEL LIFT PUMP

1) Remove the starter motor.
2) Shut the fuel tap on the tank.
3) Uncouple from the fuel pump:—
   — the feed pipe from the sediment bowl,
   — the pipe to the filter.
4) Remove the two fixing screws and the pump.

NOTE: Cover the hole from wich the pump is removed by means of a piece of rag.

OPERATION **D3** — DISMANTLING THE FUEL LIFT PUMP

Preliminary Operations: D2 - Removal of fuel lift pump

TITLE (Fig. 2)

A - Rocker arm
B - Manual lever
C - Pump body assembly
D - Pump housing assembly
E - Valves inlet and outlet
F - Valve retainer
G - Lift pump diaphragm
H - Assembling screw

1) Plug the inlet and output holes and clean the exterior.
2) Remove the 5 assembly screws, and remove the cover from the pump body having marked it so that it can be replaced in the same position.
3) Push on the centre of the diaphram and turn it 90° in either direction to separate it from the body.

NOTE: The two valves are situated in the head and to remove them the centre screw must be taken out.

OPERATION **D4** — REMOVAL OF FILTER

1) Uncouple from the head of the filter:—
   — the intake pipe from the lift pump,
   — the output pipe to the injection pump,
   — the return pipe from the injection pump,
   — the return pipe from the fuel tank.
2) Remove the 2 screws holding the filter, and the filter.

OPERATION **D5** — DISMANTLING THE FILTER

Preliminary Operations: D4 - Removal of filter

Remove the central screw in the filter head to liberate the head and the filter element.

OPERATION **D6** — REMOVAL OF INJECTION PUMP

Service Tools Required: MIMU

1) Uncouple:—
   — the injector pipes,
   — the feed and return pipes. Plug all pipes and orifices.
2) Remove the control rods:—
   — throttle control,
   — stop control,
3) Remove the screws holding the pump to the engine. The allen headed screw behind the pump is removed with a special tool MIMU.
4) Remove the pump, the quill shaft remaining in place.

OPERATION **D7** — REMOVAL OF INJECTORS

Service Tools Required: MIPI

1) Remove the feed pipe to each injector.
2) Remove the leak-off pipes.
3) Remove the screws from the nozzle holder holding strap .
4) Remove:—
   — the holding straps,
   — the injection from the cylinder head.

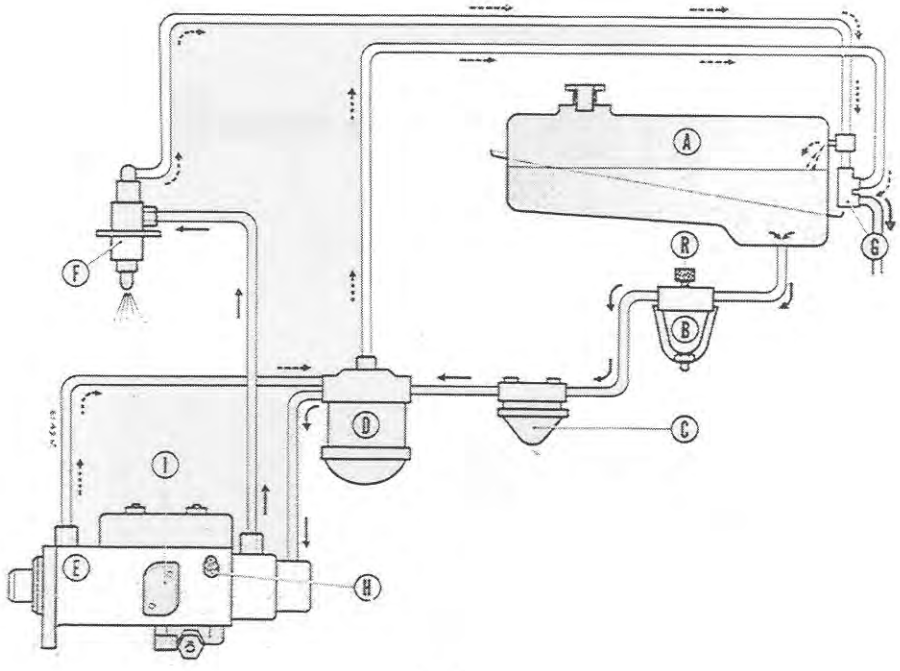


Fig. 1

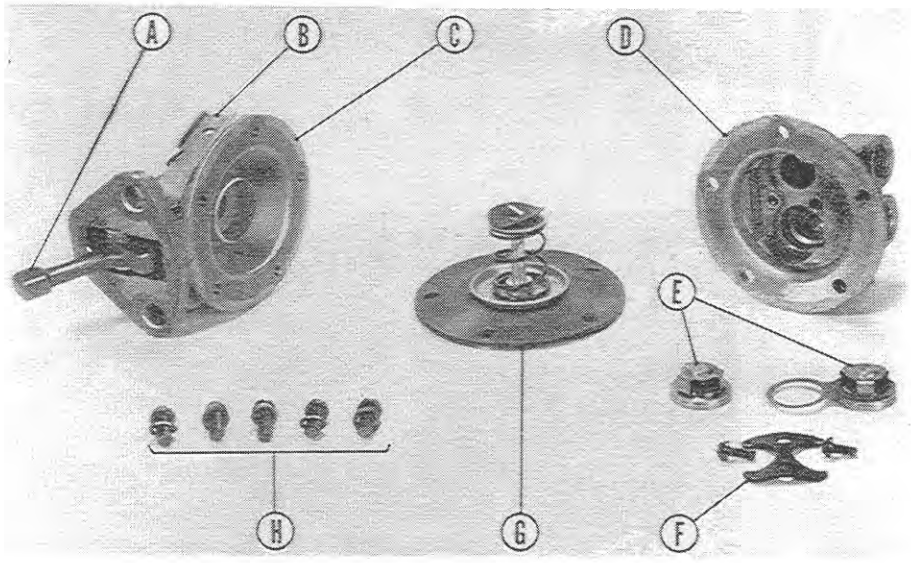


Fig. 2

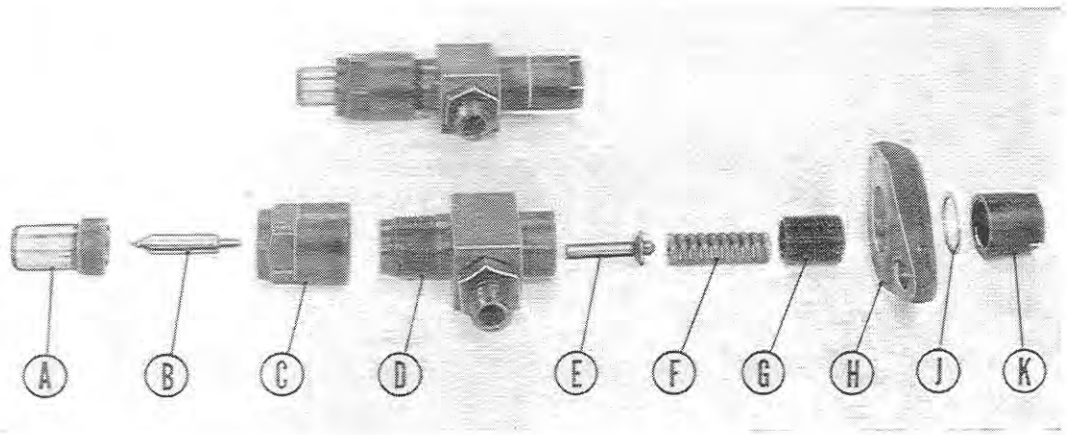


Fig. 3

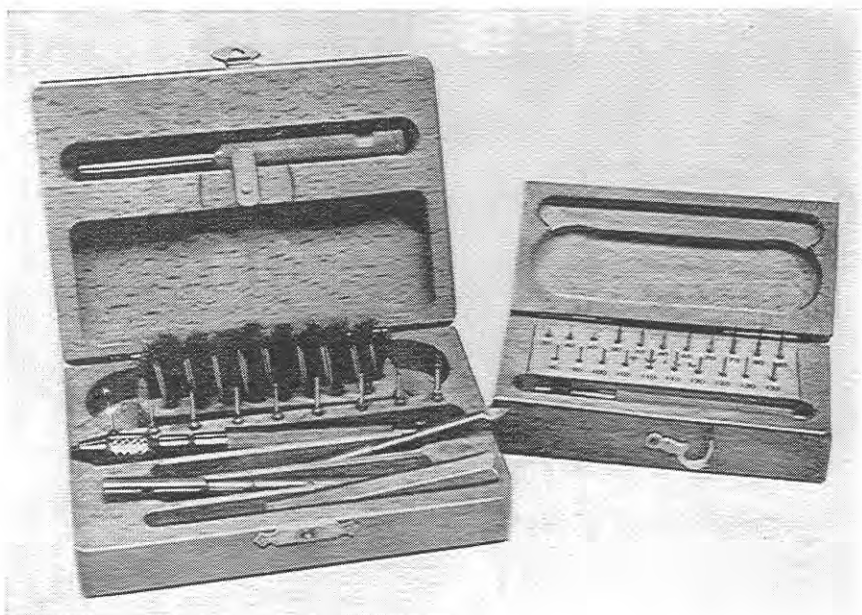


Fig. 4

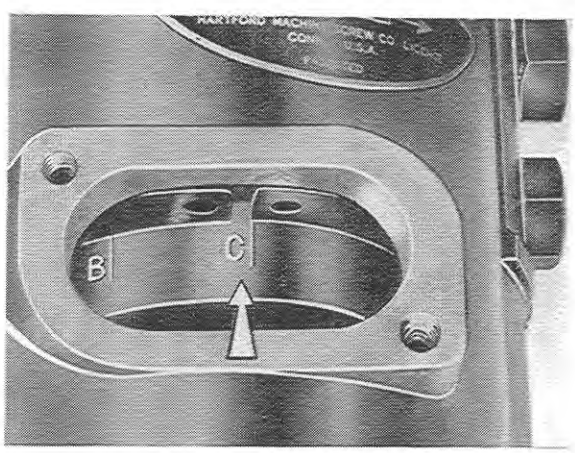


Fig. 5

OPERATION **D8** CHECKING AND SETTING THE INJECTORS

Preliminary Operations: D7 - Removal of injectors

See Fig. 3.

1) Remove the cap and slacken off the lock nut of the setting screw.
2) Fit the injector to an injector tester pump and pump at 20 to 40 strokes per minute.
3) Check the injection pressure and correct it if necessary.
4) Check the injector for leaks by holding for 10 seconds a pressure of 121 atmospheres (125 kg/cm²). This is 10 to 12 atmospheres (10 to 12 kg/cm²) below injection pressure. The injector nozzle should remain dry or only slightly wet.
5) Re-fit the cap.
6) Re-fitting injectors (op. D11).

OPERATION **D9** DISMANTLING AND CLEANING OF INJECTORS

Preliminary Operations: D7 - Removal of injectors

Dismantling

1) Having removed the injector from the engine:—
   - — remove the cap,
   - — remove the copper joint from the cap,
   - — remove the setting screw from the injector holder,
   - — remove the spring, valve and washer from the injector holder.

   NOTE: This operation is not necessary if it is only required to clean the nozzle.

2) Remove the nut holding the nozzle to the injector holders.
3) Check that the needle moves freely in the nozzle body.

   NOTE: The injectors must be replaced for any of the following reasons:—

   - — blueing due to overheating,
   - — deterioration (dulling or scoring) of the polished contact surfaces of the needle and nozzle holders,
   - — scoring or traces of seizure on the needle,
   - — deterioration of the needle valve seat.

Cleaning

1) Dip the injector in clean fuel oil to help release the carbon deposits. USE ONLY CLEANING TOOLS SUPPLIED SPECIALLY FOR NOZZLE CLEANING (Fig. 4).
2) Clean the outside of the nozzle with brass wire brush.
3) Clean the fuel delivery gallery with a wire of 0.0591 (1.7 m/m) diam.
4) Clean with the special scraper.
   a) the fuel gallery,
   b) the cavity at the extremity of the injector,
   c) the seat of the needle,
   d) the extremety of tye needle (with a brass wire brush).
5) Dip in clean fuel and dry with compressed air, particularly in the galleries so as to blow out all particles of carbon.

   NOTE: The injector and needle are matched. It is recommended to clean one injector at a time so as not to fit unmatched parts together.

TITLE (Fig. 3)

A - Injector
B - Needle
C - Screw
D - Injector holder
E - Spindle
F - Spring
G - Adjusting holder
H - Bridge
J - Washer
K - Lock-out

1) Assemble the needle and injector whilst submerged in fuel to avoid direct manual contact.
2) Assemble the injector and injector holder and tighten the screw.
3) Fit the spindle, the spring, the washer, the adjusting screw, the lock nut, without tightening.
4) Complete the following operations:
   D8/2-3-4 - Checking and setting the injectors.
   D11 - Re-fitting injectors.
   D18 - Bleeding the fuel system.

OPERATION **D11** RE-FITTING INJECTORS

1) Place the injectors in place in the cylinder head, either with a new copper washer or the old one re-tempered.
2) Place the holder strap or bridge on the injectors, the convex face towards the cylinder head. (Fig. 3 - Ref. H.)
3) Fit the holding nuts and tighten them to a torque of 10.1 to 12.3 ft/lbs (1.4 to 1.7 m/kg).
4) Fit the unions to:—
   — the leak-off pipes,
   — the feed pipes to the injectors.
5) Bleeding the fuel system (op. D18).

OPERATION **D12** CHECKING INTERNAL SETTING OF INJECTION PUMP

With the pump removed from the engine

1) Couple the outlet to No. 1 cylinder (marked W) to an injector tester pump.
2) Remove the inspection cover.
3) Pump to a pressure of 29 ats (30 kg/cm^2).
4) Turn the shaft of the pump by hand in the direction of the arrow on the plate. The pressure of fuel oil will make the rotor stop exactly at the point of injection. Check that the mark C and the mark on the circlip line up (Fig. 5). If necessary move the circlip with the aid of circlip pliers.
5) Complete the following operations:
   D13 - Re-fitting and timing the injection pump.
   D18 - Bleeding the fuel system.

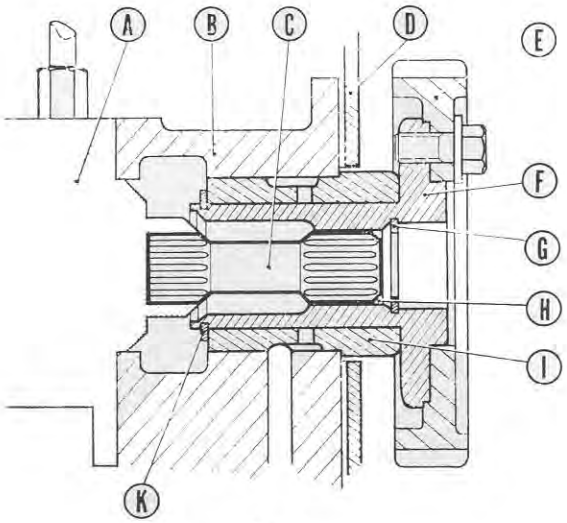


Fig. 6

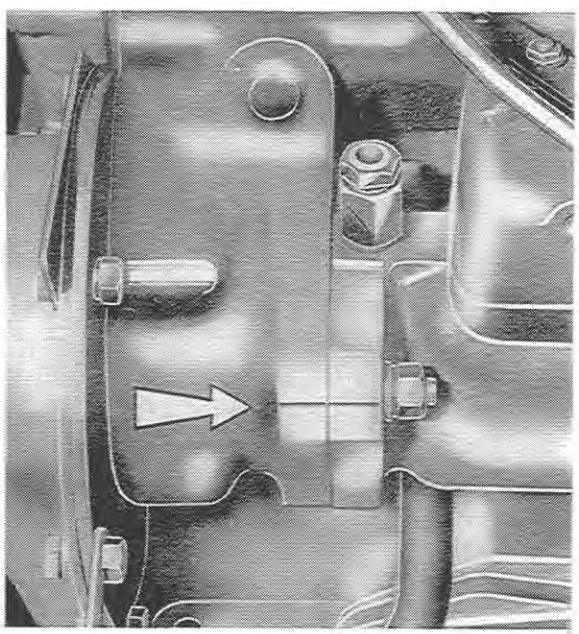


Fig. 7

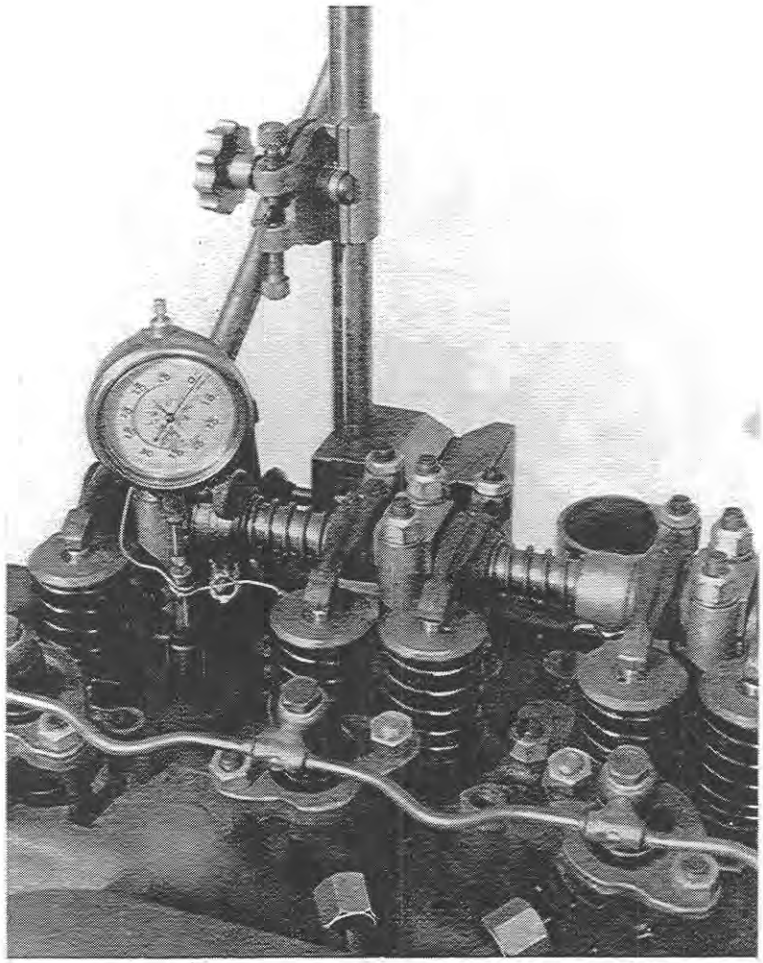


Fig. 8

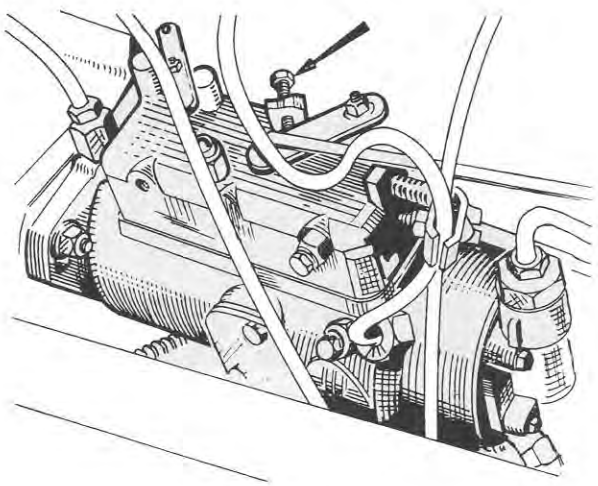


Fig. 9

Preliminary operations: D1 - Removal of fuel tank
Service tools required: MIMU

INJECTION PUMP TIMING

TITLE (Fig. 6)

A - Injection pump
B - Cylinder-block
C - Splined shaft
D - Timing plate
E - Pump driving gear
F - Hub
G - Circlip
H - Splined shaft chamfer
I - Bronze bush
K - Circlip

1st case:— The pump alone is removed from the engine.

1) Fit the splined shaft to the pump with the un-chamfered end inwards.
2) Position the master-spline on the chamfered end of the drive shaft so that when the pump is offered to the engine the studs on the cylinder block fall centrally in the slots on the pump body.
3) Insert the pump drive shaft in the drive hub splines and fit the attachments nuts. The assembly should conform to Fig. 6.
4) Align the timing marks on the cylinder block and pump mounting flange as in Fig. 7 and tighten the attachment nuts.

2nd case:— The timing have been dismantled and replaced maintaining the timing by means of the marks on the gears. Proceed as in the first case.

3rd case:— Parts of the timing gear been changed on re-assembly (drive gear or splined hub or both).

1) Remove the rocker cover and turn the engine until No. 4 cylinder valve rockers are both rocking.
2) Remove the spring and spring caps from the exhaust valve of No. 1 cylinder and attach a piece of wire to the valve stem to prevent it falling into the cylinder.
3) Mount a dial-gauge on the valve tip as shown in Fig. 8, ensuring meanwhile that the valve head is firmly seated on the piston crown.
4) Turn the crankshaft until No. 1 piston is exactly at the top dead centre and set the gauge to zero.
5) Turn the crankshaft anti-clockwise to lower No. 1 piston approximately 0.2" (4.5 m/m).
6) Raise the piston, turning the crankshaft clockwise, until it is exactly 0.107" (2.72 m/m) from top dead centre. This corresponds to an angle of 18° B.T.D.C. on the crankshaft.
7) Fit the pump as described in the first case above.
8) Remove the cover.
9) Remove the pump drive pinion and turn the drive hub until the C - mark on the rotor is aligned with the groove on the circlip as shown in Fig. 5.
10) Fit the drive gear to its hub and tighten the attachment screws.
11) To facilitate subsequent overhauls, mark the drive gear and the hub.
12) If the rotor marks move out of alignment when the drive gears are meshed, turn the pump bodily on its mounting face to re-align them.
If necessary remove the timing marks on pump flange or cylinder block with a file and make new marks.
13) Set the crankshaft at top dead centre.
14) Remove the dial gauge and fit the spring caps and springs to the No. 1 exhaust valve. Re-set the rocker clearance.

In the case of a new drive gear

1) Turn crankshaft until the timing marks on the crankshaft, camshaft and intermediate gear aligned and make a similar mark on the pump drive gear.
2) Fit the rocker cover, timing cover, pump inspection cover and crankshaft pulley.

4th case:— Fitting a new pump.

1) Position the piston as in the 3rd case at 0.107" (2.72 m/m) B.T.D.C.
2) Fit the pump as in the first case.
3) Verify the alignment of the timing marks. If necessary turn the pump body on its mounting face to ensure that the rotor marks are in line. Make a new mark on the pump flange, having effaced the original mark.
   Verification of injection pump timing should always be carried out as in the 4th case.
   D18 - Bleeding the fuel system.

SLOW RUNNING ADJUSTMENT

This operation should be carried out after a general overhaul, or if the injection pump has been changed. The correct slow running speed should be 550 - 600 R.P.M. with the engine at normal working temperature. (Oil and water at 17° F (80° C.) As indicated by the NORMAL marks on the temperature gauge on the tractor instrument panel. Fig. 9 shows (arrowed) the slow running adjustment screw.

OPERATION **D14** ASSEMBLY AND RE-FITTING OF FILTER

1) Assemble the head to the filter having first put in a new filter element and checked the sealing washers.
2) Fit the assembly to the battery support and connect up the fuel pipes.
3) D18 - Purge the fuel system.

OPERATION **D15** ASSEMBLY OF FUEL LIFT PUMP

1) Place the joint and the diaphram spring in the pump body.
2) Fit the diaphragm support in place, compress the spring and turn the support 90° so as to lock it in place.
3) Fit the cover, respecting the location mark which was made on dismantling, put the assembly screws in place without tightening them.
4) Actuate the priming lever several times to line up the components and then tighten the assembly screws.
5) Complete the following operations:
   D16 - Re-fitting of fuel lift pump.
   D18 - Bleeding the fuel system.

OPERATION **D16** RE-FITTING OF FUEL LIFT PUMP

Preliminary Operations: D15 (If necessary)

1) Check that the mating surfaces of the pump and engine block are not damaged.
2) Fit a new joint smeared with sealing compound and fit the pump.
3) Join up the fuel lines.
4) D18 - Bleeding the fuel system.

OPERATION **D17** — RE-FITTING THE FUEL TANK

1) The fuel tank being fitted with its support plates, sediment bowl, and thermostart tank, put in place making sure that the locating stud on the top right hand side of the radiator is correctly engaged in the right hand support plate.
2) Fit and tighten the two screws holding the tank to the front supports having put in place between the two, rubber and steel washers.
3) Fit and tighten the two screws holding the tank to the battery support.
4) Fit the support plates to the upper plate of the grille.
5) Fit the fuel pipes.
6) Connect the cables to the battery.
7) Fill the tank with fuel.
8) Open the fuel tap.

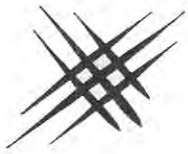
OPERATION **D18** — BLEEDING THE FUEL SYSTEM

1) Ensure that there is fuel in the tank and that all fuel lines are connected up.
2) The system must be bled until there is a continuous flow of fuel, free of all air bubbles.
Bleed in the following order:—

— at the return to the T union,
— at the injection pump body bleed screw,
— at the injection pump cover bleed screw,
— at the feed union on the plate behind the pump,
— at the feed unions to each injector.

NOTE: For this last operation, the engine must be rotated by using the starter motor.

It is recommanded to check fuel flow to thermostart, proceed as follow:
Slacken fuel pipe union, tighten union when fuel emerges. Should fuel not emerge, the auxiliary tank is empty. Fill up by actuating the feed pump lever, then tighten union when fuel emerges free of air bubbles.



ELECTRICAL EQUIPMENT

GENERAL DESCRIPTION

The electrical equipment can be separated into two distinct circuits:

a) Starting and charging circuit.
b) Lighting circuit (Section G).

The starting and charging circuit comprises (Fig. 1):

— Battery A, 12 volts, 80 to 85 amp/hr.
— Starter Motor B, with solenoid switch.
— Dynamo C, 12 volts.
— Voltage regulator and cut out controlling the charge of the dynamo to the battery.
— Ammeter E.
— Cold starting Aid F (Thermostart).
— Starter and Heater Switch G.
— Fuse.

DESCRIPTION AND MAINTENANCE OF ACCESSORIES

A — BATTERY

This is a lead-acid type battery of six elements in series.
The positive terminal, larger in diameter than the negative is surrounded by a red coloured disc. **The negative terminal is connected to earth.**
The battery at present fitted to the tractors has the two terminals at the same end, to facilitate the attachment of the cables. However, a conventional battery of the same capacity can also be fitted. **The bracket which holds the battery to the battery platform should only be moderately tightened to prevent damage to the battery case by vibrations of the engine.**

Battery Maintenance:

1) Every 100 hours of work the level of the electrolyte should be checked; top up as necessary with distilled water. The level should be about 1/2" (1 cm) above the serapator plates. **Never top up with electrolyte. Never add acid either to the battery or to water as this can cause dangerous spurting of the acid.**
2) If the terminals become sulphated or covered with deposits they should be cleaned with a dry brush. The deposits should then be neutralised by using water to which has been added an alkali (Sodium carbonate or bicarbonate).
   The terminals should then be rinsed with clean water. Dry and smear with vaseline. It is recommended to apply paint to parts which have been attacked by acid.
3) Check that the vent holes of the filler plug are clear for the evacuation of gasses.

4) If the tractor is to be immobilized for severalmonths the battery should be removed, charged fully, and stored in a dry place protected from the cold. A battery should never be stored where **the temperature will fall below 25° F (—4° C).**

Charging the battery.

The life of a battery depends not only on its maintenance but also on the method of charging. Rapid charging quickly deteriorates the plates. To avoid this, a charging time of 1/8 of the capacity with a charging rate of the same proportion should be used e.g. for an 80 amp/hour battery this gives maximum charge of 10 amps for 10 hours. Under no circumstances must this be exceeded.
If the battery is charged at 5 amps the maximum charging time is 20 hours. For 2.5 amps the maximum will be 40 hours.
The specific gravity of the electrolyte of a discharged battery is 1.14 to 1.16 S.G. (18 to 20 Baume) and a charged battery 1.24 to 1.26 S.G. (28 to 30 Baume).

Checking the battery.

Periodically it is necessary to check the state of the battery, cell by cell. The tension should be from 2.1 to 2.2 volts for a freshly charged battery and 1.7 to 1.8 volts for a discharged battery. A tension of less than 2 volts on a charged battery or 1.7 on a discharged battery indicates the beginning of a short circuit or the disintigration of the elements. This can only be remedied by changing the defective element or the whole battery.

Renovating the battery.

This operation can be carried out when the battery no longer holds its charge, and this is due to the elements being in short circuit.
The object of this renovation is to reduce the amount of sulphation of the accumulator plates and thus increase the capacity of the used battery for a certain time. Correct renovation can prolong the life of a battery for 6 to 12 months.

WIRING DIAGRAM (Fig. 1)

A - Battery.
B - Starter motor.
C - Dynamo.
D - Voltage régulateur.
E - Ammeter.
F - Cold starting device.
G - Starter and heater switch.
H - Safety starter switch.
I - Head lamps
J - Side lights.
K - Rear head-light.
L - Side and rear lamp.
M - Head-light switch.
N - Horn.
O - Fuse.
Q - Terminal relay
S - 1, **S - 2**, **S - 3** - Instrument panel bulb.
T - Plough lamps switch.
U - Temperature gauge.
V - Water temperature.
W - Towing receptacle.
Y - Relay number plate.

A high degree of sulphation is a battery of less than 2 years is generally due to the use of non-distilled water or abusive addition of electrolyte.

The procedure giving the best results is the following:—

a) With the battery discharged, to up with distilled water and charge at 4 to 5 amps until the electrolyte is at 1.24 to 1.26 S.G. (28° to 30° Baume).
b) Replace the electrolyte by distilled water and discharge by connecting to a lamp of 8 to 10 watts.
c) When the battery is discharged to 1.14 S.G. (18° Baume) approx. charge for 40 hours at 2.5 amps.
d) Empty out the electrolyte, replace by distilled water and discharge the battery again with the samp lamp.

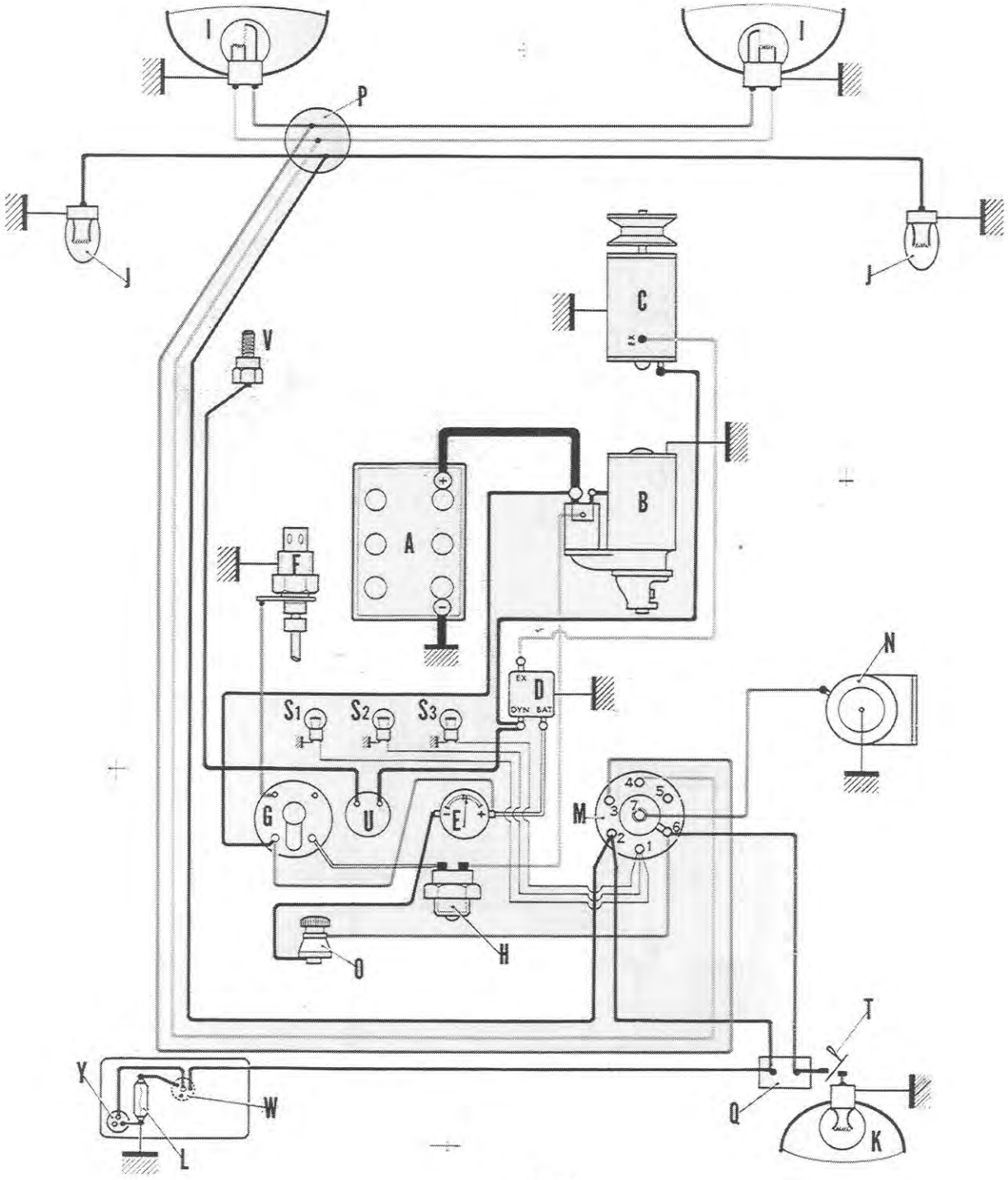


Fig. 1

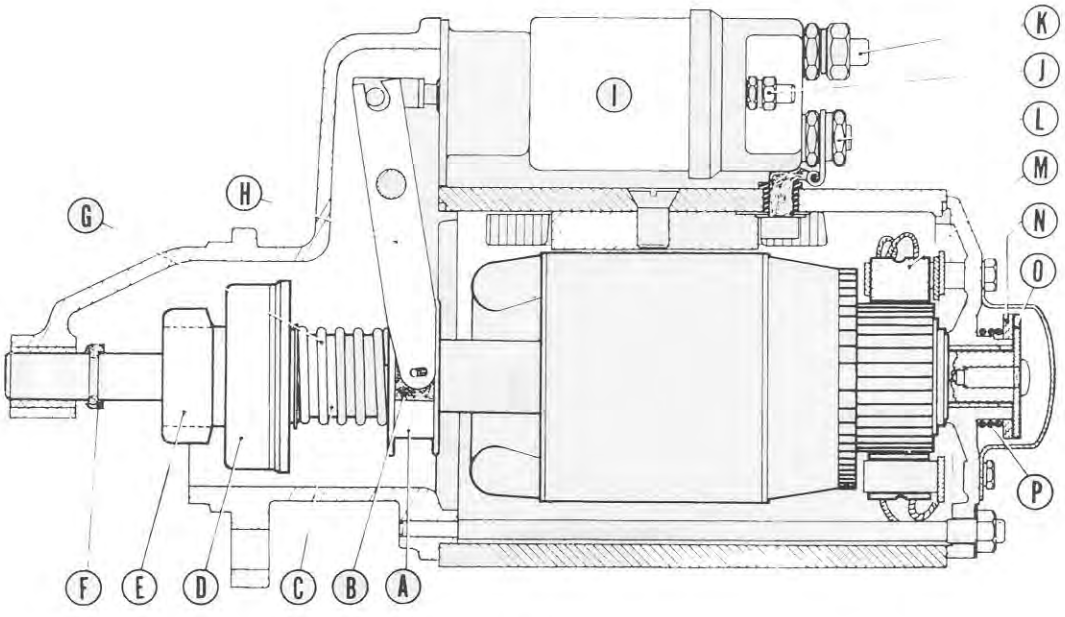


Fig. 2

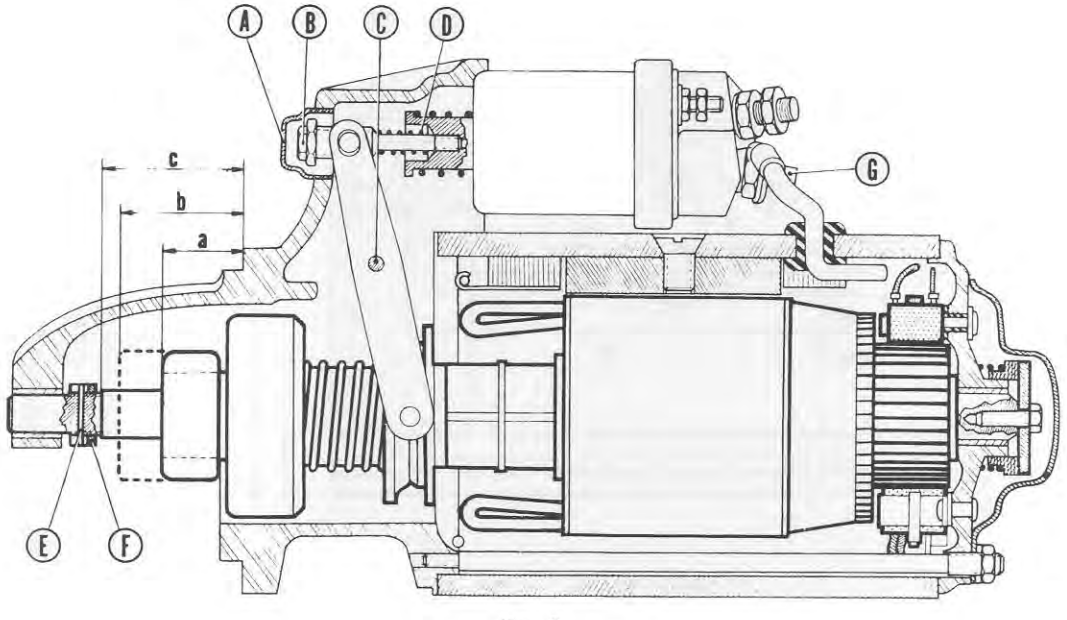


Fig. 3

e) Charge for 60 hours at 2 amps. When the battery is fully charged replace the electrolyte by fresh, having 1.24 to 1.26 S.G.

f) Charge for 25 hours at 4 amps. After this the battery can be used. All further charges should be for at least 20 hours at a maximum of 5 amps.

B — STARTER MOTOR

The MF 130 Tractor is fitted with starter motor, dynamo and voltage regulators of different makes, Paris-Rhône, Ducellier, Lucas and CAV.

PARIS-RHONE STARTER .	type D 11 E 85	(Fig. 2)
DUCELLIER STARTER	type 6 110 A	(Fig. 3)
LUCAS STARTER	type M 45 G	
CAV. STARTER	type CA 45 D	

These starter are four-pole with a force of 3 h.p. at 1,500 r.p.m.
The drive assembly clutch operates almost simultaneously with the rotation of the armature. These two operations are actioned by a solenoid which itself is controlled from the dash board by the starter and heater switch G. Both starters have an armature braking system to ensure rapid return to rest so that the starting cycle can be recommenced immediately. The starter has three distinct parts:—

— the solenoid unit,
— the engine itself,
— the drive assembly.

PARIS-RHONE STARTER-TITLE

A - Free pulley.
B - Synthetic resin shoe.
C - Sleeve.
D - Gear self locking device.
E - Gear.
F - Lever stop.
G - Spring.
H - Solenoïd lever.
I - Electro-magnetic switch.
J - Solenoïd excitation terminal.
K - Current imput terminal.
L - Motor current terminal.
M - Carbon brush.
N - Lock washer.
O - Stop plate.
P - Spring.

The Solenoid Unit (I - Fig. 2).

It consists of an electro magnet having two coils, the closing coil which is in series with the field coils of the starter and which is by-passed when the plunger is drawn fully home, and a hold-on coil to retain the plunger in the fully home position.

The Starter Motor (See Fig. 2).

This is a series type motor, four-pole, with the armature turning in two oil impregnated bronze bushes.

The shaft of the armature has at the front a helically splined sleeve for the engagement of the drive pinion. A thrust washer or nut limits the throw of the drive pinion. At the rear, a washer of synthetic resin, by the help of a spring, rubs on a disc which is part of the armature. This is the automatic braking system.

The Starter Drive Assembly (See Fig. 2).

It comprises:—

— A helically splined sleeve C imparts longitudinal movement to the pinion E on the armature shaft.
— A pinion E, has at its rear an automatic clutch D. This allows the pinion to free wheel when driven by the flywheel avoiding damage to the armature by rapid rotation.
— A free wheeling pulley, mounted on sleeve C is held at its rear by a circlip and at the front by a spring G. In the groove of the pulley A synthetic resin shoes B, transmit the movement of lever H to engaging mechanism.
— Spring G which holds the free wheeling pulley at the extremity of the engaging mechanism, cheks the movement of the solenoid on the engaging mechanism on the flywheel.

Starter faults.

Mechanical faults are limited to deterioration of the pinion of the engaging mechanism. If this occurs the engaging mechanism must be replaced.
Electrical faults due to the motor itself are rare. Trouble usually results from the solenoid. A short circuit of one of the coils is the most current fault. It shows up by bad engagement of the engaging mechanism or by immobilisation of the starter when in circuit. In both cases the solenoid must be changed.

Changing the engaging mechanism.

For this the armature of the starter motor must be removed (Fig. 4).

a) Paris-Rône Starter (Fig. 2):
   — Break off the stop ring, with a hacksaw or cold chisel, from the shaft of the armature (take care not to damage the shaft). Remove the engaging mechanism.
   — Cover sliding surfaces with grease and fit new engaging mechanism.
   — Fit a new stop ring and the two half circlips in the groove of the shaft. Respect the correct fitting sequence (see Fig. 2). (A new set comprising the stop ring and half circlips is obtainable under Paris-Rhône.
   — Fit the armature and engaging mechanism assembly to a fork shaped piece of metal to bend the lips of the stop ring over the half circlips.
   — Punch the lips of the stop ring in 3 or 4 places to lock it in place.

   NOTE: When assembling the starter, take care to fit the engagement lever the correct way round.

b) Ducellier Starter (Fig. 3).

DUCELLIER STARTER-TITLE

Plug (threading plug)	Tapper pin
Assembling screw	Nut
Pin	Current motor terminal
Pressure spring	

ADJUSTING

a. = 0.92 to 1.04" (23.5 to 26.5 mm)
b. = 1.55" minimum (39.5 mm minimum)
c. = 1.75 to 1.79" (44.5 to 45.5 mm)

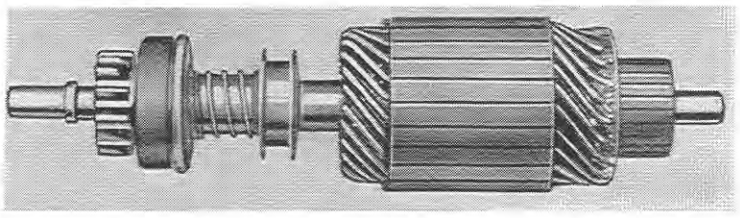


Fig. 4

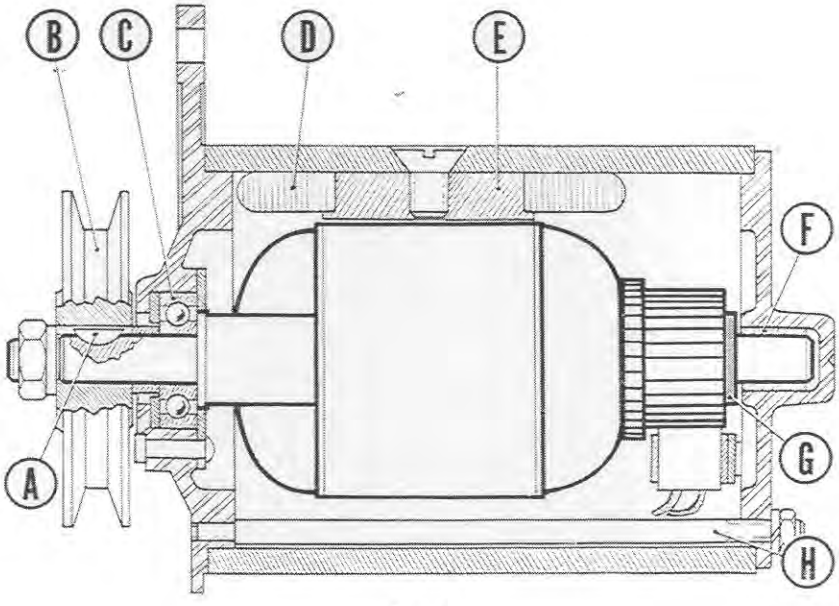


Fig. 5

— Having assembled the starter motor (but not screw cap A) remove the terminal to starter G and put the solenoid in circuit to check dimensions (b).

This check is advisable when changing the engaging mechanism, but is essential when changing the solenoid.

C — DYNAMO

PARIS-RHONE, reference G 10 R 19 (Fig. 5)
DUCELLIER . . reference 7249 A (225 J 2) (Fig. 5)
LUCAS . . . . . reference C 40 A (Réf. 22733)

DYNAMO-TITLE

A - « Woodruf » key
B - Pulley.
C - Ball bearing.
D - Pole shoe.
E - Field winding.
F - Oil impregnates bronze bushe.
G - Washer.
H - Assembling tie-rod.

It is a shunt wound dynamo turning at approximately twice the speed of the engine. The armature has a ball bearing at the front end and a self lubricating bronze bush at the rear. The Ducellier dynamo has no oil drilling for this rear bush.

The dynamo has two brushes; the negative brush is earthed to the conmutator end bracket. The positive brush is connected to the voltage regulator. The terminal for this brush is on the rear bracket. The terminal for the field coils is situated on the dynamo body. The dynamo is sealed against dust entry. The principal characteristics are as follows:—

— 12 volt.
— Nominal output (when hot); 10 amps at 1,600 r.p.m.
— Pressure of brush springs 1.1 lbs (500 grams) approx.

Routine dynamo maintenance.

Every 200 hours

— Put a few drops of engine oil in the oil way for the rear bearing (Paris-Rhône only).

Every 350 hours

— Check the condition of the brushes. The brushes should be changed when shorter than 3/10" (8 mm). Only use brushes made by the manufacturer of the dynamo.
— Clean the conmutator with fine emery paper, and brush it, wit a non-metallic brush to remove any dirt.

Every 700 hours

— Replenish the ball bearing at the front with high melting temperature grease. Ducellier and Paris-Rhône Dealers supply special grease for this purpose.

Dynamo faults.

Mechanical: This is limited to wear of the rear bush or the front ball bearing. In either case a short circuit may result.

Electrical: They are as follows :

— short circuit of the armature,
— short circuit of the field coil,
— short circuit of the conmutator,
— short circuit due to wear of armature bearings,
— dirt on conmutator,
— bad earth connection.

With the exception of the first two mentioned faults, repaire can be affected by Massey-Ferguson Dealers.

Advice:

1) When fitting a starter motor or dynamo ensure that the terminals and earth connections are clean. Make sure that they are correctly tightened to give good contact.
2) For field coil or armature troubles contact the Dealer for the electrical equipment manufacturer or a specialist in automobile electrical equipment.

D — VOLTAGE REGULATOR

PARIS-RHONE .... reference YD 210
DUCELLIER ..... reference RB 108
LUCAS ..... reference D 3 12 volts

It is a two coil type:—

— one coil to adjust the charging rate,
— one coil to cut the battery in and out of circuit.

All is covered by a metal hood which is rivetted in place and only accredited electrical Dealers are allowed to open the unit.
The voltage regulator should allow a maximum charge of 4 amps to an uncharged battery and 1.5 amps to a charged battery.
The voltage passing to the battery should be between 12.4 and 13.6 volts.

Fitting the voltage regulator.

When fitting the voltage regulator the following precautions must be taken:—

— Ensure that the terminal markings on the new regulators are the same as on the old.
— Ensure that the mounting bracket is correctly earthed.
— Check the wiring. If a wire is fitted to an incorrect terminal damage will result to both the voltage regulator and the dynamo. Refer to the wiring **diagram Fig.1.**

E — STARTER SWITCH

This is in one piece and is actioned by a key.
It has 4 terminals. Current arrives from the battery to the two terminals which are connected together (see Fig. 7). In case of faulty operation the switch must be replaced.

F — THERMOSTART

This incorporates a resistance that will absorb 17 amps at 12 volts.

G — AMMETER

This is fitted in the circuit between the voltage control box and the battery. It enables the charge of the battery to be checked and also serves to locate faults of the control box and dynamo.
The chart indicates the different faults that can be encountered and shows how these can be traced by the reading on the ammeter.

H — NEUTRAL GEAR SAFETY SWITCH

This is a spring loaded switch which is in the circuit between the starter switch and the starter motor. It is controlled by the high/low range gear selector lever and completes the circuit only when the lever is in the neutral position. Trouble with this switch is rare but in case of difficulty the switch should be replaced.

LIGHTING

LIGHTING SWITCH

From this bakelite switch, all the lights and the horn are controlled. There are six positions of the switch (Fig. 1) which correspond to the following:

Position I	Off.
Position II	Side and rear lamps and instrument panel.
Position III	Dipped head lamps, side and rear and with instrument panel.
Position IV	Head and rear lamps and with instrument panel.
Position V	Dipped head lamps and rear ploughing lamp (when fitted) and with instrument panel.
Position VI	Head lamps and rear ploughing lamp (when fitted) and with instrument panel.

The horn is operated by pushing on the knob of the lighting switch.

CONNECTIONS

To conform to these switch positions the wires must be connected as follows (see Fig. 2).

Terminal 1	Instrument panel light.
Terminal 2	Side and rear lamps.
Terminal 3	Head lamps (dip).
Terminal 4	Head lamps (full beam).
Terminal 5	Not used.
Terminal 6	Rear ploughing lamp (when fitted).
Terminal 7	Horn.

After connecting the wires, it is recommended to check with the wiring diagram (Fig. 1, Section F).

If the switch develops any faults it should be replaced.

NOTE: Removal and fitting of head-light is included in Section Q - Operation Q8 § A-B and Q11, § A-B.

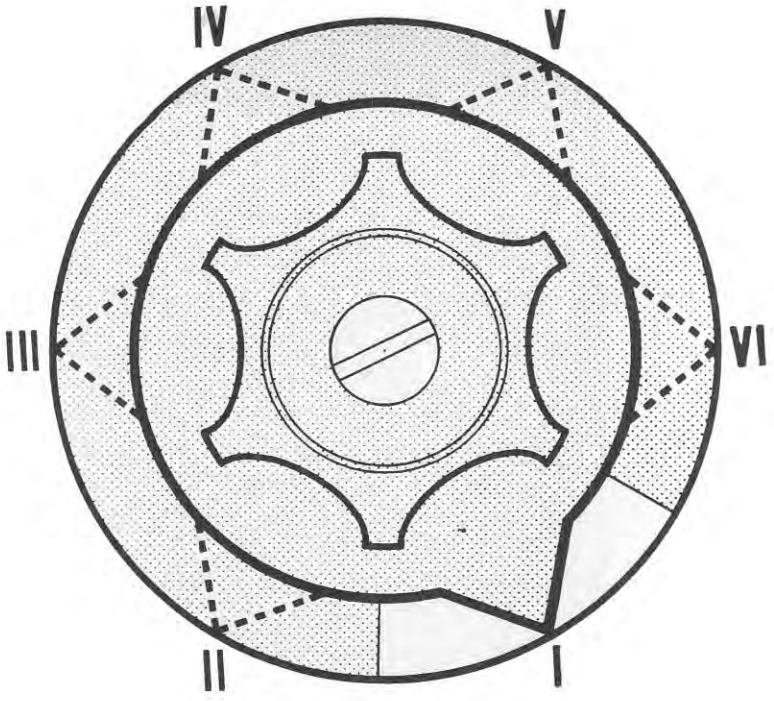


Fig. 1

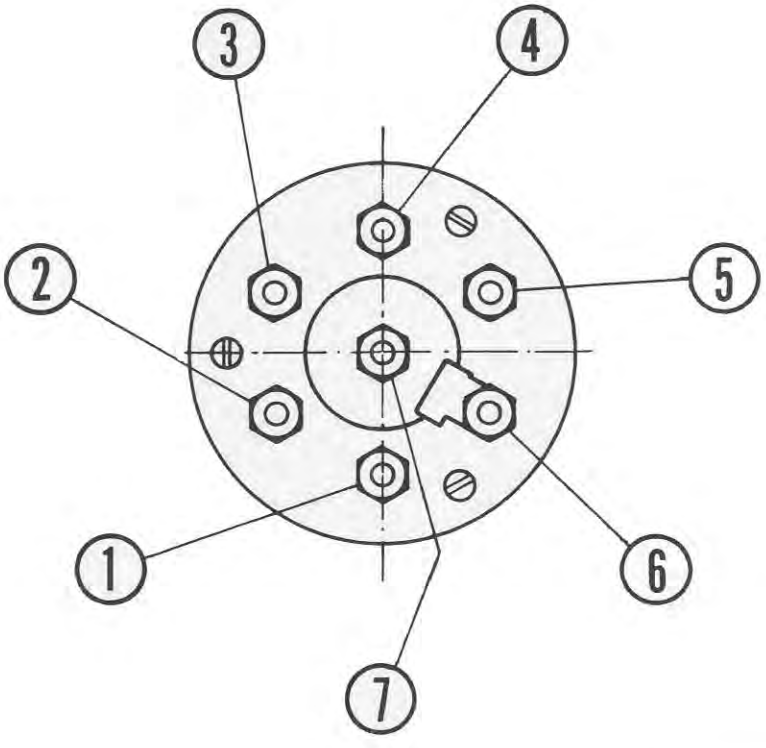


Fig. 2

CLUTCH HOUSING AND CLUTCH

LIST OF OPERATIONS

DOUBLE CLUTCH

DESCRIPTION

This is a dry clutch which allows the engine drive to be disengaged from the traction wheels without stopping the drive to the P.T.O.

It has two types of disc and a ball thrust race.

Assembly of the clutch, fitting to the flywheel and adjustement of the clutch fingers is done with the aid of a Special Tool MINA fitted with a new centring bush. This tool can also be used on the MF 25 and MF 30 Tractor.

OPERATION **H1** — DISCONNECTING THE CLUTCH HOUSING FROM THE ENGINE

1) Place trolley jacks under the engine sump and the clutch housing or transmission.
2) Disconnect the front light wiring harness from the two pole connector.
3) Separate the two screws holding the rear lighting wire conduits and pull out the tubes from the housing.
4) Remove the silencers and exhaust pipe to allow the removal of the bolts holding the engine to the clutch housing.
5) Remove the two screws holding the steering box to the left side of the clutch housing.
6) Unscrew the nut holding the left side of the battery carrier to the front face of the clutch housing.
7) Uncouple the accelerator rod from the ball joint of the foot pedal.
8) Disconnect the wires of the safety switch from:
   — the starter motor;
   — the starter switch.
9) Disconnect the two oil lines at the unions by the adaptor plate (only applicable to tractors fitted with an oil cooler).
10) Unscrew the nut holding the right side of the battery carrier to the front face of the clutch housing.
11) Remove the two screws holding the steering box to the right side of the clutch housing.
12) Lift up the steering box assembly together with the battery support and rear of the fuel tank and place a block of wood between the tank and the engine. This is to raise the level of the base of the steering box slightly above the upper lip of the clutch housing (Fig 1).
13) Remove on the right side: the four screws and one bolt holding the clutch housing to the adaptor plate.
    Remove on the left side: the four screws holding the clutch housing to the adaptor plate and the upper screw which assembles starter motor, clutch housing and adaptor plate.
14) Uncouple the assembly by rolling back the rear part of the tractor (Fig. 1).

OPERATION **H2** — DISCONNECTING THE CLUTCH HOUSING FROM THE TRANSMISSION HOUSING

Preliminary Operations: Q7 - Removal of foot rests

1) Place a trolley jacks under the transmission housing and block the rear wheels.
2) Remove the four screws and upper inspection cover.
3) Remove the two half shell couplings of the primary shafts.
4) Unscrews and remove by the upper inspection hole, the 5 screws and washers holding the clutch housing to the transmission housing, and then the two lower screws.
5) Gently roll back the rear of the tractor. Take care not to damage the two oil cooler pipes.
   — Remove the two 'O' rings of the oil pipes.
   — Do not lose the 'O' ring of the reductor shifter rail.

OPERATION **H3** — REMOVAL OF PARTS INSIDE THE CLUTCH HOUSING

Preliminary Operations: H1 - Disconnecting the clutch housing from the engine

A — **Removal of clutch thrust race**

1) Remove the engine and P.T.O. primary shafts.
2) Unhook the spring.
3) Remove the thrust race.

B — **Removal of clutch actuating fork**

1) Break the locking wire of the pointed locking screw of the clutch pedal shaft.
2) Remove the pointed locking screw.
3) Remove the pedal and its shaft.
4) Knock out the grooved pin holding the fork.
5) Knock out the shaft from the fork.

C — **Removal of cooler tubes and double unions**

1) Unscrew the unions inside the housing.
2) Remove the "O" rings from the tubes.
3) Remove the two tubes from the housing.
4) Unscrew and remove if necessary the two double unions.

D — **Changing the bushes of the fork and clutch pedal shaft**

Remove and replace these bushes with the aid of a Tool made to the dimensions given in Fig. 2.

E — **Changing the safety switch**

1) Remove the upper inspection cover.
2) Disconnect the two wires.
3) Remove the switch and fit a new one.
4) Reconnect the wires to the switch.
5) Replace the inspection cover and its 4 screws.

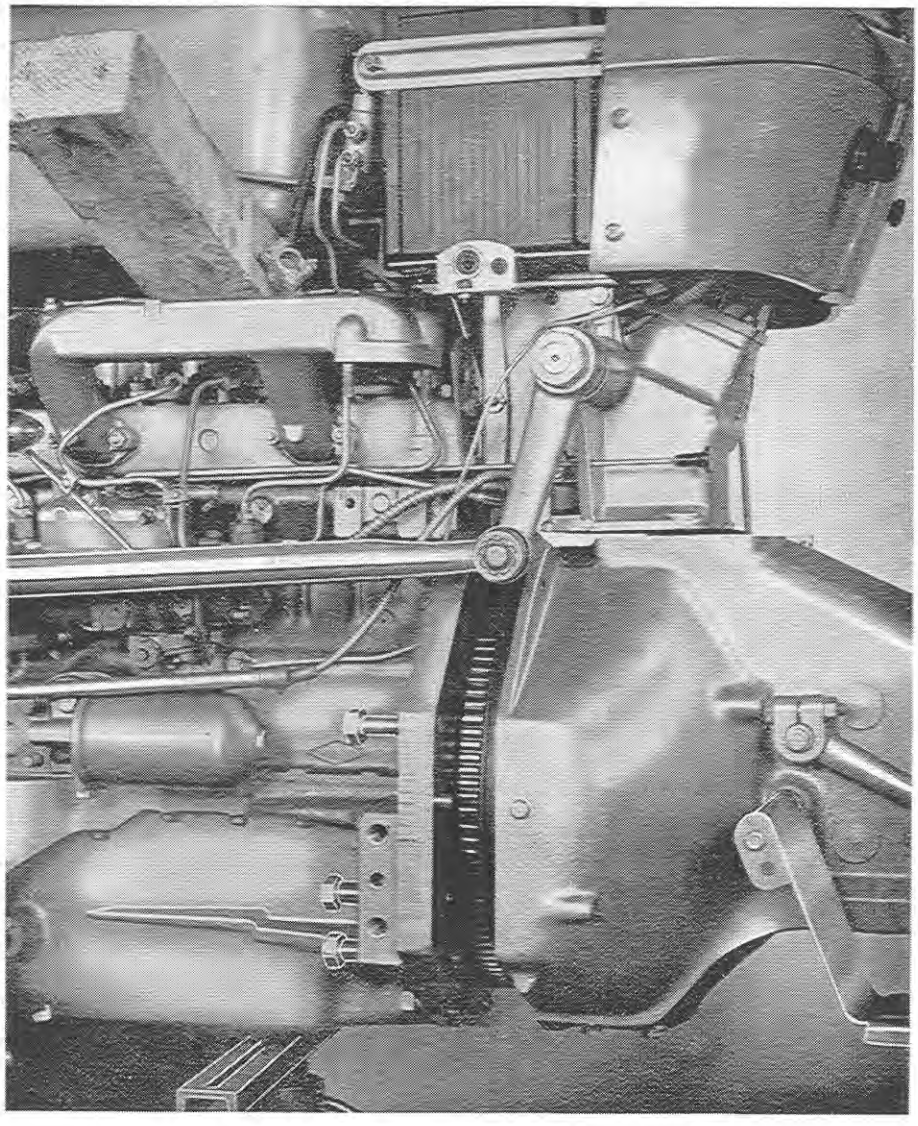


Fig. 1

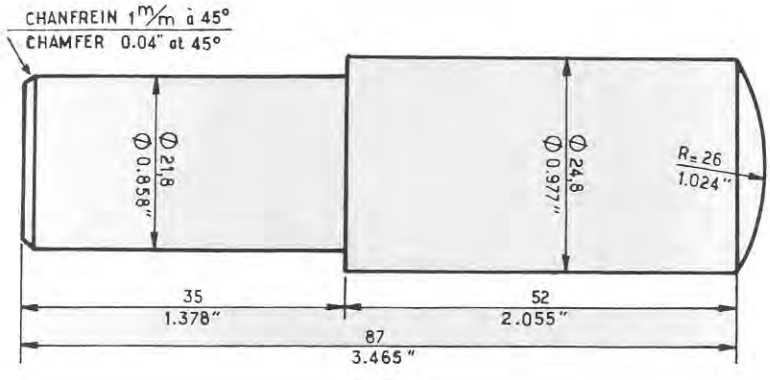

CHANFREIN 1 m/m à 45°
CHAMFER 0.04" at 45°
Ø 21,8
Ø 0.858"
Ø 24,8
Ø 0.977"
R= 26
1.024"
35
1.378"
52
2.055"
87
3.465"

Fig. 2

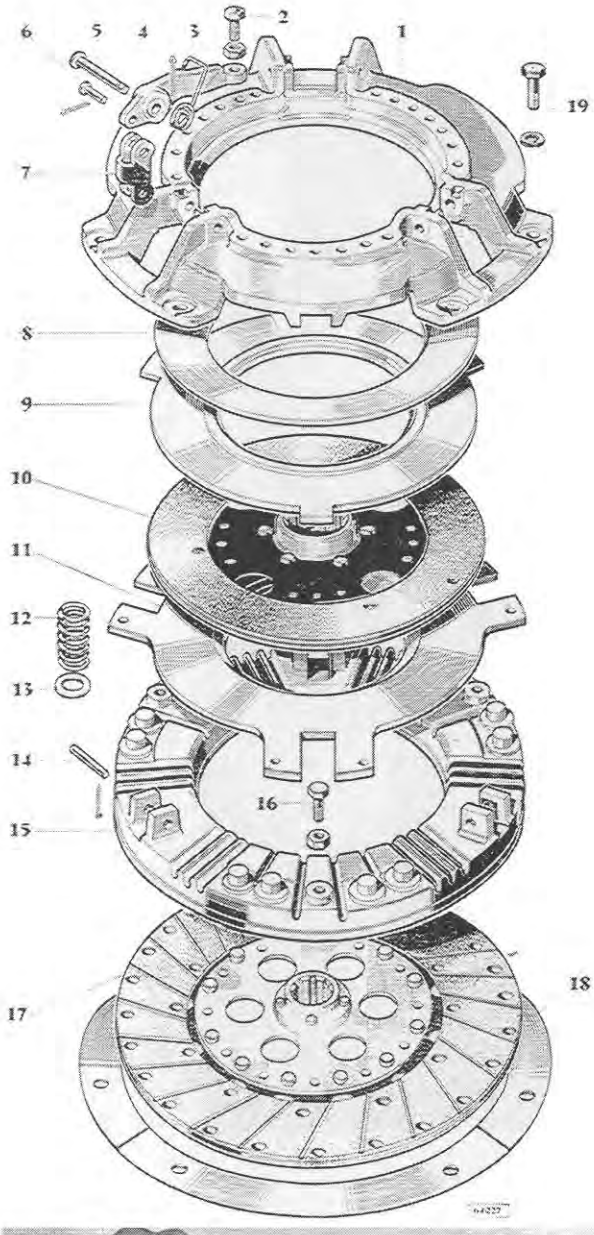


Fig. 3

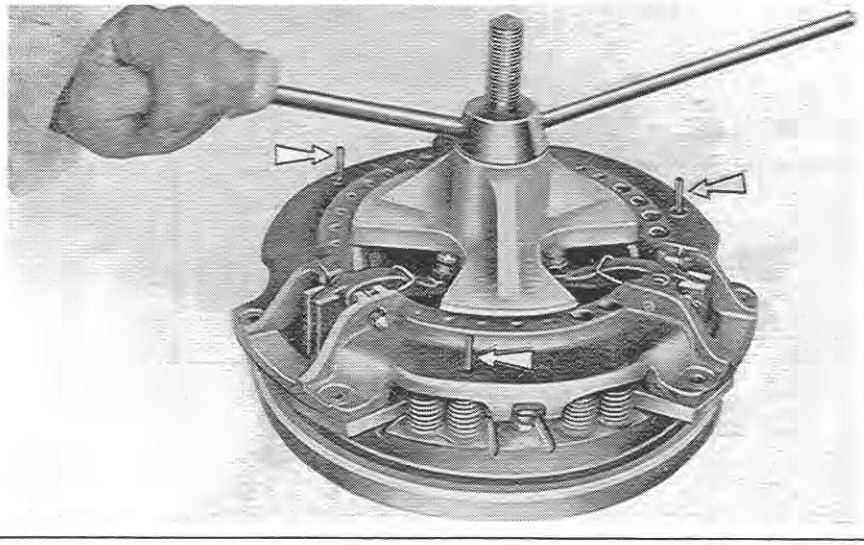


Fig. 4

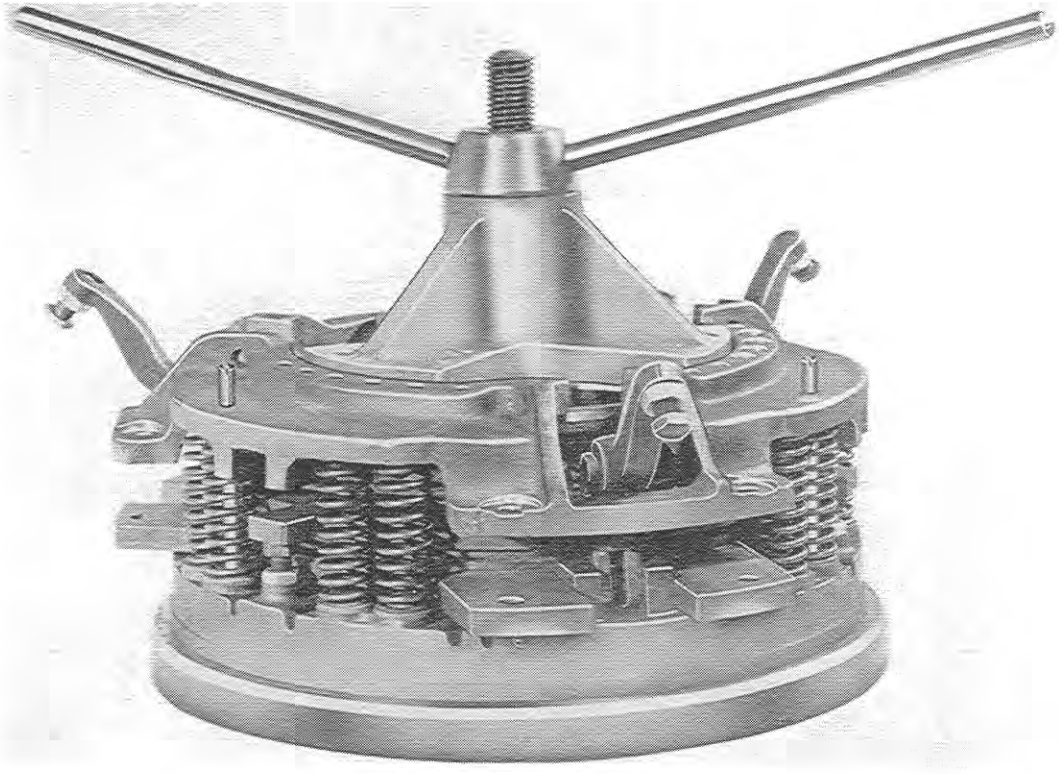


Fig. 5

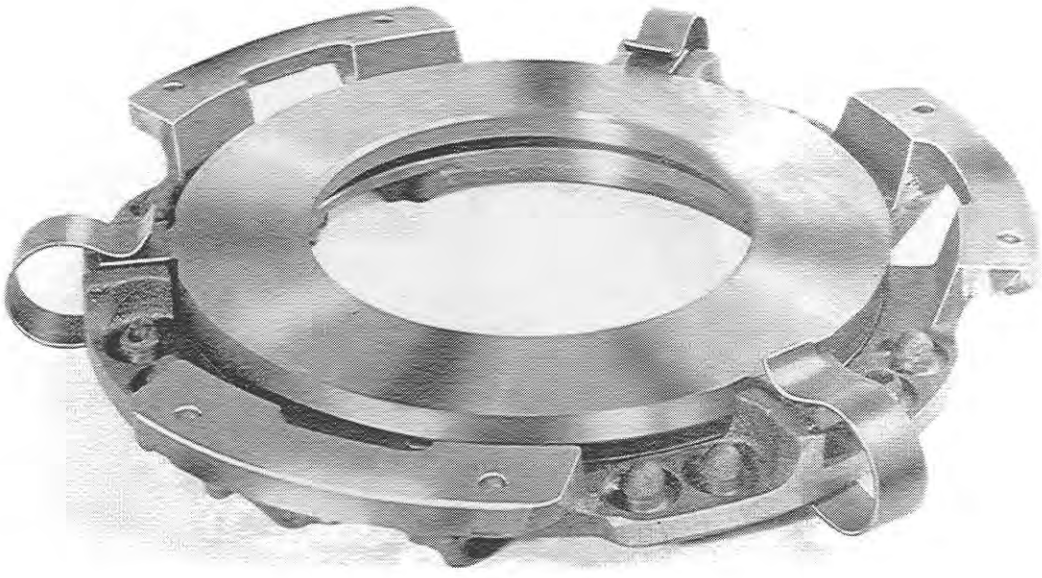


Fig. 6

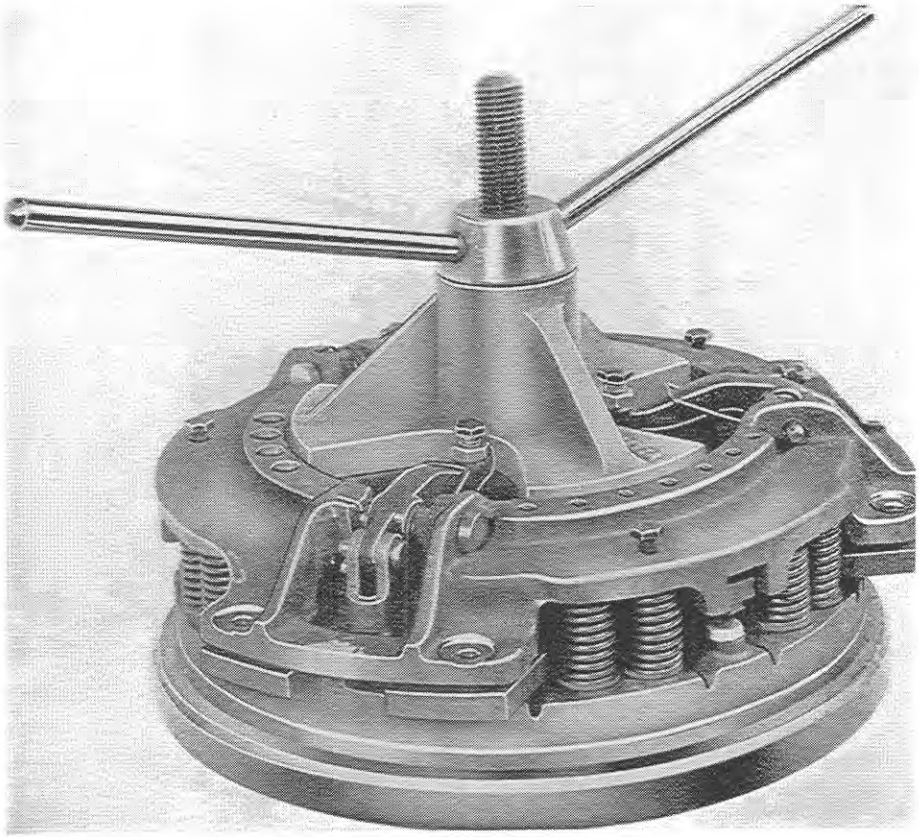


Fig. 7

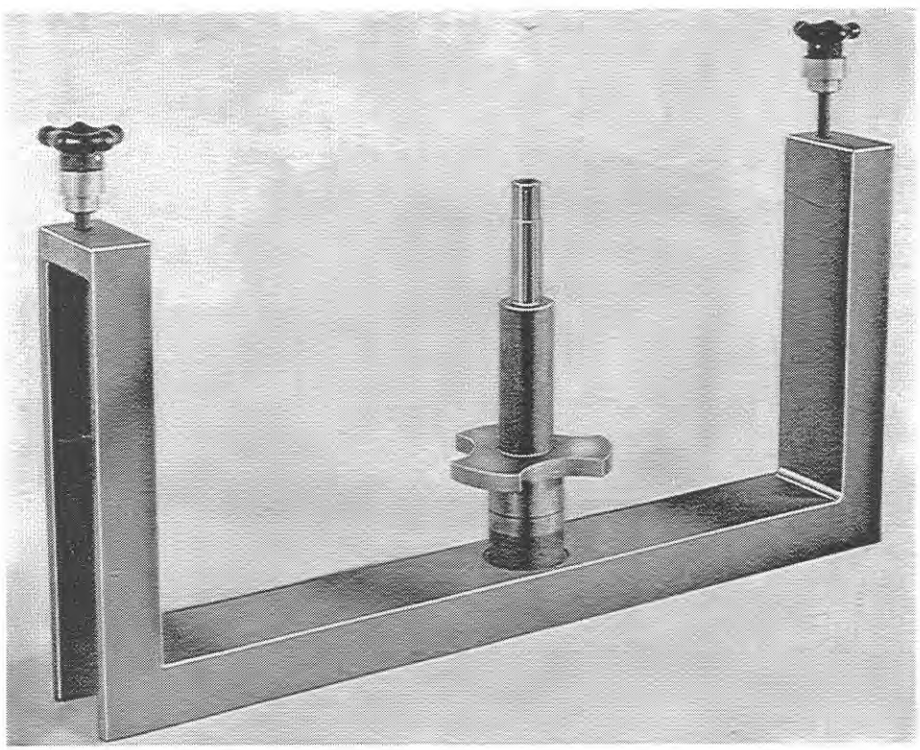


Fig. 8

OPERATION **H4** — REMOVAL OF CLUTCH

Preliminary Operations: H1 - Disconnecting the clutch housing from the engine

1) Firstly install three slave bolts (arrowed Fig. 7) to attach the clutch cover (1 - Fig. 3) to the pressure plate (15 - Fig. 3).
2) Mark the clutch components to enable re-assembly in the same relative positions.
3) Release progressively and diagonally the six screws (19 - Fig. 3) which attach the clutch mechanism to the flywheel.
4) Remove the three cooling deflector segments (18 - Fig. 3) from beneath the clutch cover and the flywheel.
5) Remove the clutch from the flywheel and lay it flat on a bench.

OPERATION **H5** — DISMANTLING OF CLUTCH

Preliminary Operations: H4 - Removal of clutch
Service Tools Required: MAMU

1) Lay the clutch mechanism flat on a bench.
2) Remove the lever pivot pin retainer (5 - Fig. 3).
3) Punch out the lever pivot pins and remove the return springs.
4) Set the levers in an upright position and put in place service tool MAMU.
5) Screw right down the compression nut and replace the three slave bolts (fitted paragraph 1 of Operation H4) by three threaded guide rods (Fig. 4).
6) Unscrew the service tool compression nut to release the pressure on the clutch springs (Fig. 5).
7) Gather all the clutch parts and arrange in the order shown on the exploded view (Fig. 3).

OPERATION **H6** — ASSEMBLY OF CLUTCH

Service Tools Required: MAMU

1) All parts should be examined and checked for wear before reassembly, particular attention being paid to springs and friction faces. Linings should be replaced if at all worn (using only genuine Massey-Ferguson replacements).
2) Invert the clutch cover (1 - Fig. 3) and place it flat on the bench. Place in it the Belleville spring (8 - Fig. 3) with its outside diameter centred in the cover, and on top of this place the secondary pressure plate (9 - Fig. 3).
3) Attach the secondary pressure plate to the cover with the three special assembly clips arranged as shown in Fig. 6.
4) Lay the primary pressure plate (15 - Fig. 3) on the Service Tool base plate and install on it the false flywheel (11 - Fig. 3) the secondary driven disc (10 - Fig. 3) the spring seat washers (13 - Fig. 3) the clutch springs, the three secondary clutch release screws (16 - Fig. 3) the three guide rods and finally the release levers (4 - Fig. 3) and their pivot links (6, 7, 14 - Fig. 3).
5) Mount the cover assembly together with the Belleville spring and secondary pressure plate on the Service Tool, guiding the release levers into their slots and put the compression plate in place.
6) Screw down the Service Tool compressor.
7) With the clutch springs fully compressed, remove the three guide rods and fit the three slave bolts (Fig. 7). Remove the assembly clips.
8) Fit the lever return springs, pivot pins and retaining clips.
9) Remove the Service Tool.
10) Complete the following operations:
    H 7 - Re-fitting and adjustment of clutch.
    H10 - Re-coupling the clutch housing to the engine.

Preliminary Operations: H6 - Assembly of clutch
Service Tools Required: MINA2

1) Pack the flywheel pilot bearing with grease (preferably a molybdenized type).
2) Put the clutch on to Service Tool MINA2 on which the spacer has already been adjusted for this tractor as shown in Fig. 8 (1), with its hub facing towards the clutch (Fig. 9).
3) Offer up the clutch assembly to the flywheel positioning the bridge MINA2 as shown in Fig. 10.
4) Fit, without tightening, the two assembly screws of MINA2 to the adaptor plate (the large screw to the right) then fit the three deflector plates between the clutch cover and the flywheel.
5) Tighten the screw of MINA2.
6) Fit and tighten the 6 clutch assembly screws (Fig. 10).
7) Remove the 3 slave bolts.
8) Position the three arms of MINA2 so that they are opposite the three adjusting screws of the clutch fingers.
9) After adjustment of clutch fingers, complete the following operations:
H10 - Re-coupling the clutch housing to engine.

ADJUSTMENT OF CLUTCH FINGERS

The heads of the adjusting screws of the clutch fingers should be adjusted to 5.74" (145.80 mm) above the rear face of the adaptor plate with a maximum tolerance of 0.015" (0.4 mm) between the screws (Fig. 11).
This check is made as shown in Fig. 12 by putting a feeler gauge of 0.015" (0.4 mm) between the arms of the Special Tool and the heads of the adjusting screws.
Adjust the three secondary clutch release screws to give a clearance of 0.086 to 0.094" (2.2 - 2.4 mm) from the secondary pressure plate (see Fig. 11).

The adjustment of the clutch of the MF 130 tractor is done with the spacer of bridge MINA2 placed below and NOT above (as on the MF 25 and MF 30 tractors).

A — **Fitting of cooler tubes and double unions**

1) Screw in place, on the clutch housing, the two double unions and tighten correctly.
2) Fit into the housing the two cooler tubes.
NOTE: The tubes to the upper union is bent in two planes.
3) Fit the tubes to the double unions.

B — **Fitting the clutch actuating fork**

1) Lightly smear the shaft with grease and introduce it into the housing and the fork by the right side.
NOTE: Line up the key groove correctly with the housing.
2) Fit the pedal and its shaft in the housing. Position it correctly and tighten the locating screw.
3) Fit a locking wire to the locating screw.
4) Knock in the key for the fork with a hammer.

C — **Fitting the clutch thrust race**

1) Orientate the bearing correctly and place it on its shaft.
2) Block the pedal in its uppermost position and fit the return spring.
3) Fit the primary transmission shaft(s).
4) H10 - Re-coupling the clutch housing to engine.

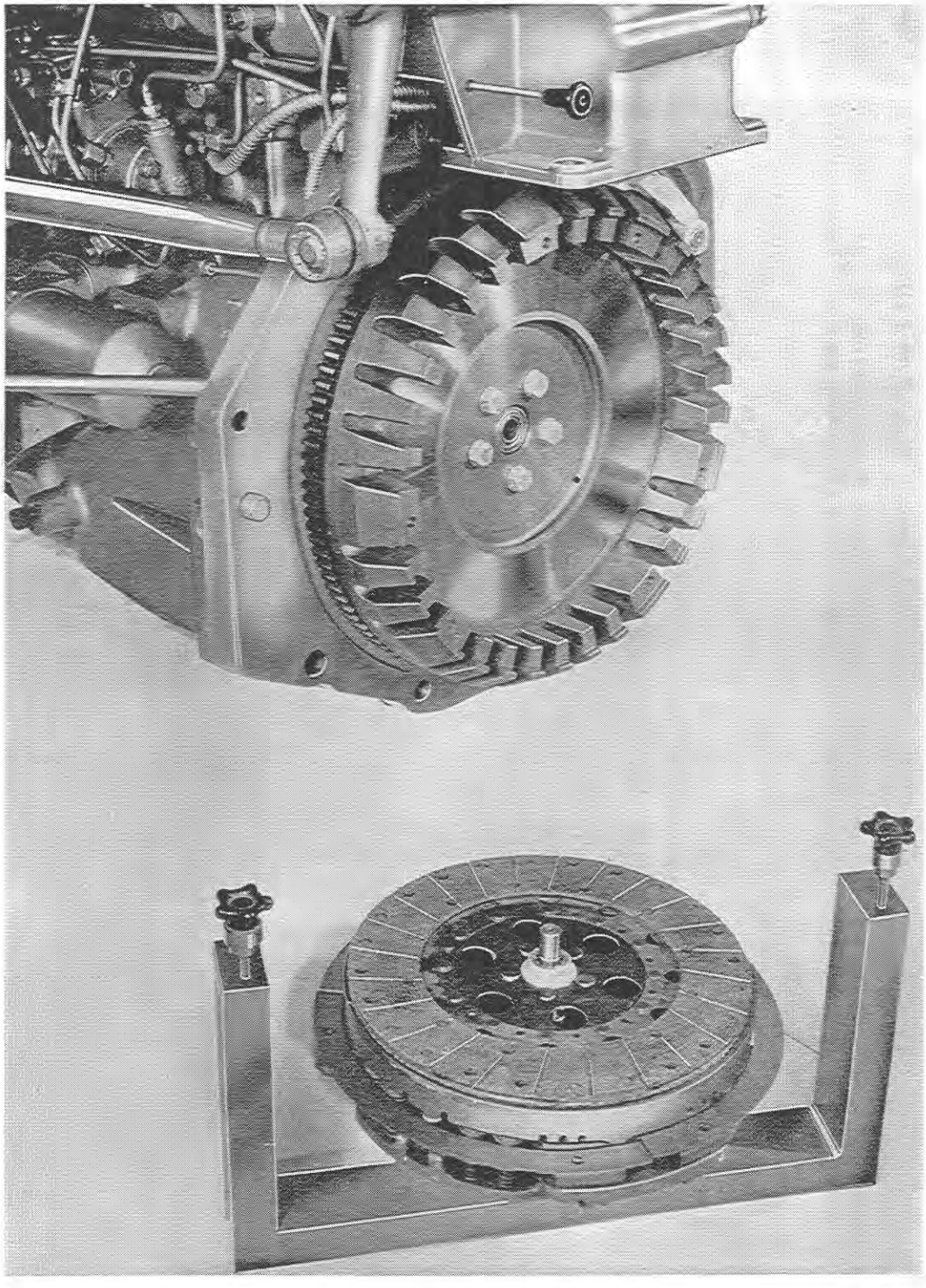


Fig. 9

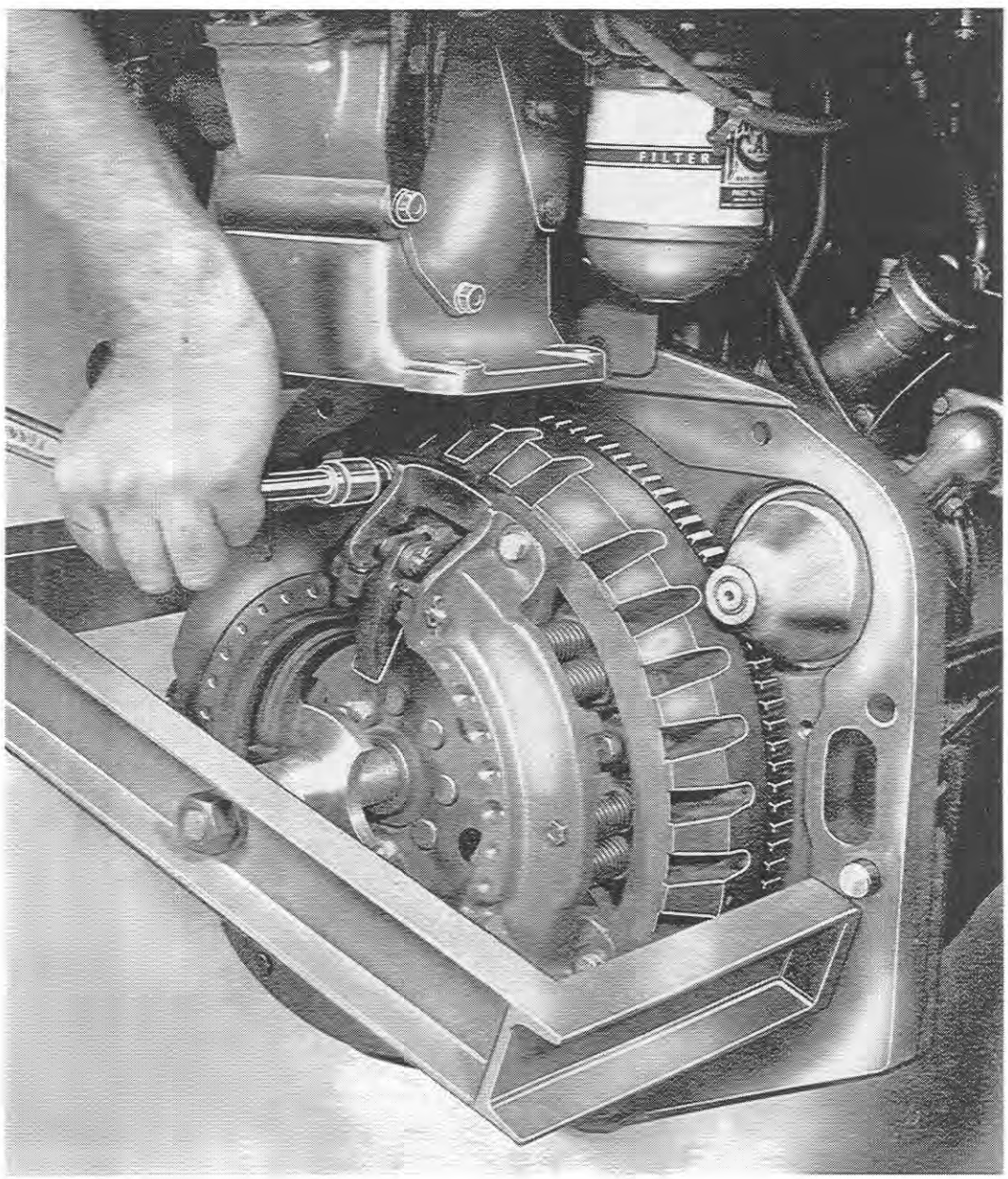


Fig. 10

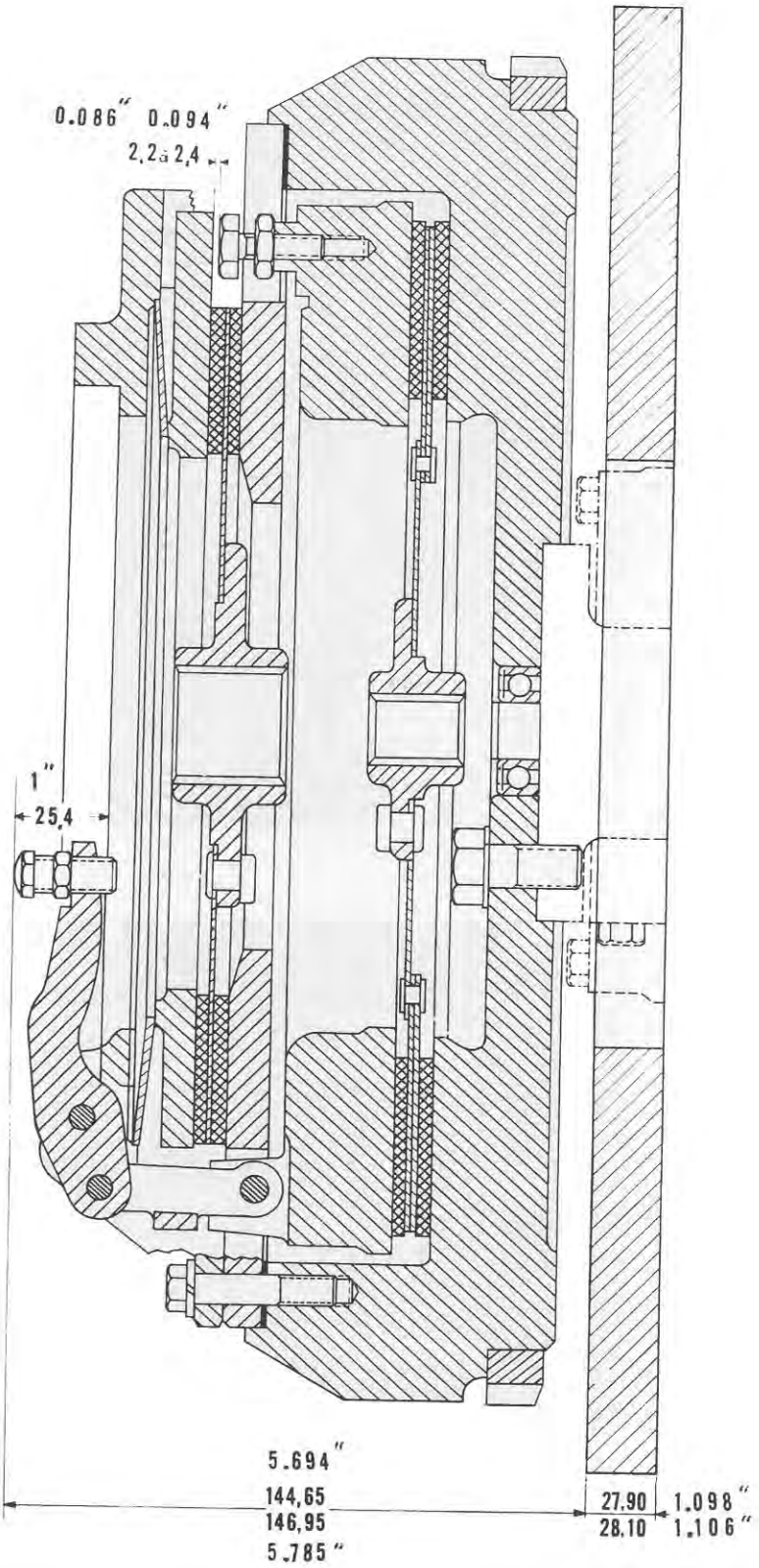

0.086" 0.094"
2,2 a 2,4
1"
25,4
5.694"
144,65
146,95
5.785"
27.90
28.10
1.098"
1.106"

Fig. 11

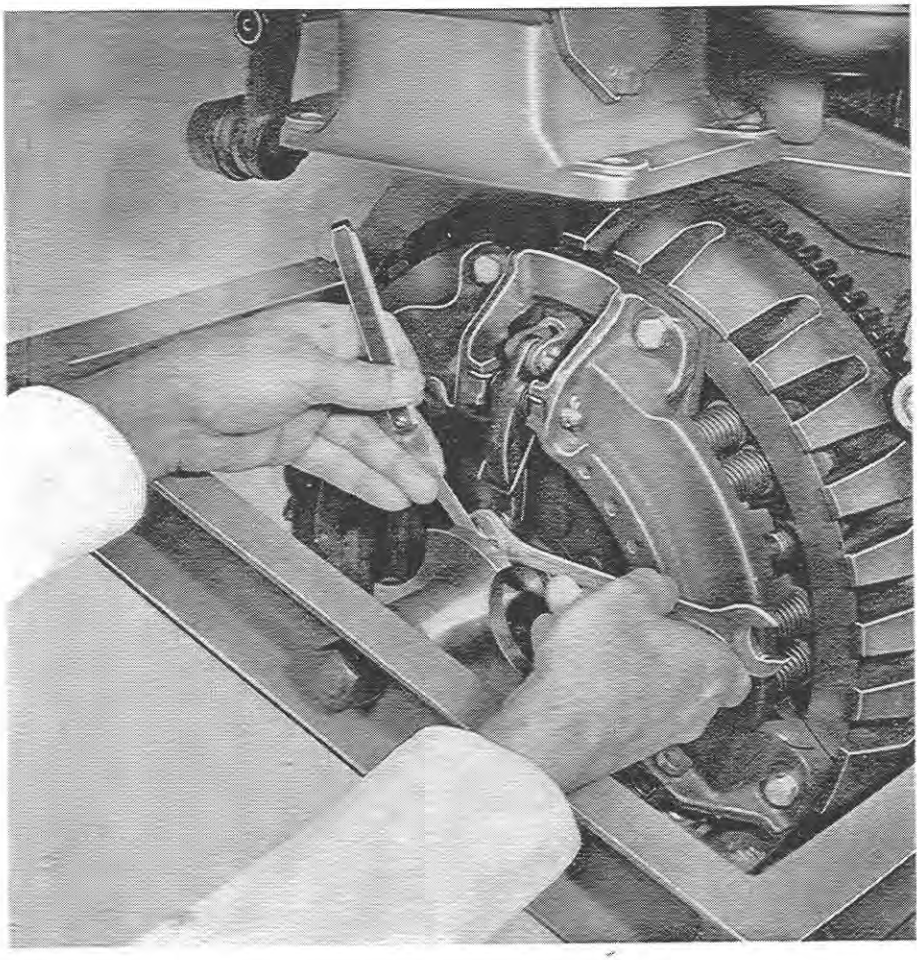


Fig. 12

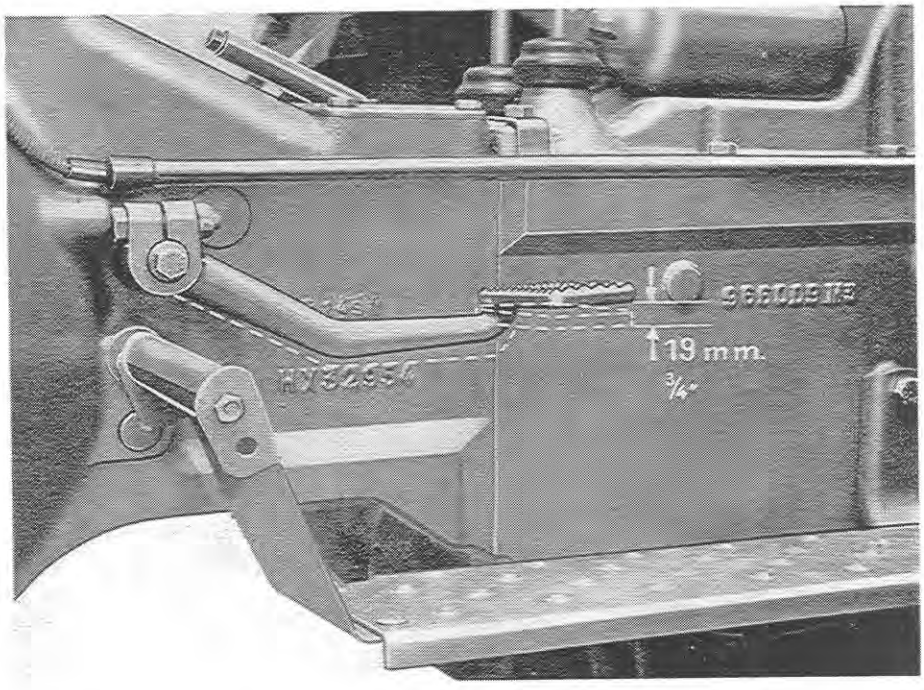


Fig. 13

OPERATION **H9** RE-COUPLING THE CLUTCH AND TRANSMISSION HOUSINGS

1) Put the two housings together making sure that the "O" rings for the oil cooler lines and the clutch actuating fork shaft are in good condition and correctly placed.
2) Put in place and tighten from inside the clutch housing the five assembly screws and their lock washers.
3) Put in place and tighten the two lower assembly screws and their lock washers.
4) Put the two shafts in position on the primary shafts protruding from the transmission.
5) Put the two half shell couplings in place and tighten the locking collars.
6) Fit the upper inspection cover and fix by means of its 4 screws.
7) Couple the clutch housing to the engine (Operation H10).
8) Lower the tractor and remove the adjustable support or jack.

OPERATION **H10** RE-COUPLING THE CLUTCH HOUSING TO THE ENGINE

Preliminary Operations: H7 - Refitting and adjustment of clutch
H8 - Assembly of parts inside clutch housing

1) The engine and the clutch housing being on their trolley jacks, and the front wheels blocked, push the two assemblies together.
2) Simultaneously, and with the aid of a screw driver engaged in the teeth of the starter ring drive on the flywheel, turn the flywheel so that the primary engine shaft engages into the clutch splines.
3) As soon as the primary shaft is engaged in the clutch, stop turning the engine. With the P.T.O. engaging lever in its rear position, turn the P.T.O. shaft by hand to line up the secondary shaft with its corresponding clutch plate.

   NOTE: Whilst undertaking this operation, care must be taken with the following:

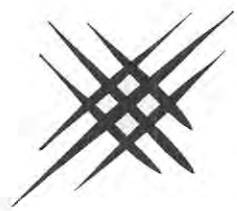
   a) The wiring conduits from the safety switch which slide into the clutch housing.
   b) The two locating studs of the adaptor plate which fit into locating holes on the face of the clutch housing (see Fig. 1).
4) The two housings being positioned together fit in place:
   — on the left side:
      — 3 large screws fixing the engine sump to the clutch housing,
      — 1 large screw fixing the adaptor plate to the clutch housing,
      — 1 small screw fixing the clutch housing to the adaptor plate;
   — on the right side:
      — 3 large screws fixing the engine sump to the clutch housing,
      — 1 large screw fixing the adaptor plate to the clutch housing,
      — 1 small screw fixing the starter motor to the adaptor plate and the clutch housing.
5) Tighten these screws to the following torques:

   Large screws ..... 130 ft/lbs (18 m/kg)
   Small screws ..... 79 ft/lbs (11 m/kg)
6) Fit the four bolt holding the steering box to the transmission and tighten to a torque of 50 to 55 ft/lbs (6.9 to 7.6 m/kg).
7) Connect up the wires for the safety starter switch wires.
8) Put in place the rigid tube for the rear lighting wires and fix its two supports to the transmission housing.
9) Connect the two wires to the two pole connector under the drivers seat.
10) Connect the accelerator rod to the ball joint of the foot pedal.

This adjustment is made by moving the foot pedal on its shaft. This operation is made from outside the tractor by adjusting simultaneously the screw on the end of the shaft and the pedal locking bolt.
The free play, measured at the free extremety of the foot pedal should be 3/4" (19 mm) (Fig. 13).

NOTE: After several successive adjustments, it is possible that due to wear of the friction linings, it will no longer be possible to get complete disengagement of the clutch, particularly the P.T.O. clutch. In this case check the clearance of the three clutch finger adjusting screws (OPERATION H7 - Fig. 11). It is not necessary to split the tractor as this operation can be done through the lower clutch housing inspection cover.

If the P.T.O. is in frequent use its clutch disc may tend to slip although the clutch free play has not changed. In this case too, check the clearance of the 3 clutch finger adjustment screws.



GEARBOX AND POWER TAKE-OFF

LIST OF OPERATIONS

OPERATION **I 1** REMOVAL OF DRIVE PINION

Preliminary Operations: K1 - Removal the hydraulic lift cover
J1 - Removal of axle shaft housing and differential

1) Place the auxiliary reduction gear in the "low" position.
2) Unlock the rear nut holding the tapered bearing.
3) Unscrew the nut.
4) Withdraw the drive pinion rearwards and take out the nut, the lock washer, the washer and the taper bearing.

OPERATION **I 2** REMOVAL OF THE AUXILIARY SLIDING GEAR SPLINED SLEEVE

Preliminary Operations: J1 Removal of drive pinion

1) Remove the sliding gear splined sleeve.
2) Place the reduction pinion and its selector in the "low" position.
3) Push the first and reverse gear selector rod towards the rear.
4) Disengage the auxiliary reduction sliding gear by means of the following simultaneous movements: —
   — with one hand hold the pinion against the rear face of the box and with the other hand lift and push forward the control lever so that the selector fork can pass through the teeth of the pinion (Fig. 2),
   — once the selector fork is disengaged from the pinion, withdraw the sliding pinion and thrust washer.

OPERATION **I 3** REMOVAL OF THE POWER TAKE-OFF SHAFT

1) Drain the oil from the gearbox.
2) Remove the cover plate from the rear of the housing and withdraw the spring. Remove the rubber plug and the strainer.
3) Place the power take-off control lever in the rear position (engine speed power take-off) to prevent the escape of the sliding gear sleeve which, if left in neutral position, will fall into the bottom of the gearbox and necessitate removal of the hydraulic cover for recovery.
4) Withdraw and remove the oil seal.
5) Remove the circlip which locates the bearing in the housing.
6) Withdraw the shaft and its bearing using an inertia extractor.

OPERATION **I 4** REMOVAL OF THE GROUND SPEED POWER TAKE-OFF DRIVE PINION AND SLIDING GEAR

Preliminary Operations: I2 - Removal of auxiliary sliding gear splined sleeve
I3 - Removal of power take-off shaft

1) Remove the circlip from the rear of the square sleeve and push the sleeve forward about 3/4" (2 cm) so that the forward circlip can be removed.
2) Remove the forward circlip.
3) Push the sleeve rearwards and withdraw the drive pinion from the top of the gearbox.
4) Withdraw the square sleeve and its bearing rearwards.
5) Remove the power take-off sliding pinion.

OPERATION **I 5** REMOVAL OF THE TRANSMISSION PRIMARY SHAFT AND GEARS

Preliminary Operations: H2 - Disconnecting the clutch housing from the transmission housing
I 1 - Removal of drive pinion
J 2 - Removal of final reduction units
I 3 - Removal of power take-off shaft
Service Tools Needed: MIFI

1) Remove the circlip which locates the synchromesh hub (Fig. 3).

2) Place the sleeve MIFI between the primary shafts.
3) Remove the circlip which locates the rear bearing in the housing.
4) Push the shaft towards the rear, sliding the circlip and thrust washer along the shaft (paying attention to the grooves) and simultaneously gather the first and second gear pinions and synchromesh assembly.
5) Withdraw the shaft through the rear power take-off orifice (Fig. 4).

Removal of the synchromesh assembly

This assembly is removed in two parts:—
— the 4th gear pinion and the cone,
— the hub, the ring and the third gear pinion.

NOTE: Before removing synchromesh components, check the play between them in order to determine whether the bronze cones should be replaced (see Fig. 5). The normal play should be 2.5 to 3 mm.

OPERATION **16** REMOVAL OF THE POWER TAKE-OFF PRIMARY SHAFT

Preliminary Operations: K1 - Removal the hydraulic lift cover
H2 - Disconnecting the clutch housing from the transmission housing

1) Withdraw the forward oil seal.
2) Remove the circlip which locates the forward ball bearing.
3) Knock out the power take-off primary shaft which will bring it with the bearing.

NOTE: If the shaft is difficult to withdraw, remove the drive pinion on the secondary power take-off shaft (Operation 17/A).

TITLE (Fig. 1)

A - Transmission housing.
B - Cover plate - central PTO.
C - Cover screw.
D - Circlip.
E - Driven gear - PTO.
F - Bleed plug.
G - Spacing sleeve.
H - Oil-seal.
J - Circlip.
K - Cover screw.
L - Front bearing - Lower shaft.
M - Circlip.
N - Driven gear - Reverse.
P - Driven gear - 1st.
Q - Driven gear - 2nd.
R - Driven gear - 4th.
S - Spacing sleeve.
T - Lower shaft.
U - Secondary shaft - PTO.
V - Driven gear - 3rd.
W - Driving gear - High speed.
X - Spacing sleeve.
Y - Driving gear - Low speed.
Z - Rear bearing - Lower shaft.
AA - Circlip.
AB - Circlip.
AC - Sliding gear - PTO.
AD - Bush PTO driven gear.
AE - Driven gear - PTO.
AY - Drive pinion.
AZ - Roller bearing.
BA - Bearing cup.
BB - Criclip.
BE - Bearing cup.
BF - Washer.
BG - Locking plate - Adjusting nut.
BH - Adjusting nut - Driving gear bearing.
BJ - Splined sleeve.
BK - Sliding gear - High and low speed.
BL - Thrust washer.
BM - Driving gear 3rd.
BN - Synchromesh cup.
BP - Synchromesh.
BQ - Washer.
BR - Circlip.
BS - Driving gear - 4th.
BT - Driving gear - 2nd.
BU - Driving gear - 1st and reverse.
BV - Locking ball.
BW - Locking spring.
BX - Driving pump - Gear.
CY - Oil-seal.
CZ - Primary shaft - PTO.
DA - Primary shaft - Véhicle.

D/S.

OPERATION **17** — REMOVAL OF THE POWER TAKE-OFF SECONDARY SHAFT AND ITS DRIVE PINION

Preliminary Operations: K1 - Removal the hydraulic lift cover
H2 - Disconnecting the clutch housing from the transmission housing
Service Tools Needed: MAPO (MF 135)

A — **Removal of the pinion**

1) Remove the cover plate from the central power take-off.
2) Remove the circlip which retains the pinion.
3) Disengage the pinion and withdraw it through the central power take-off orifice.

NOTE: If it is necessary only to remove the secondary shaft pinion, it is not essential to uncouple the tractor (Operation H2).

B — **Removal of the shaft**

1) Extract the expanded plug.
2) Remove the spacing sleeve.
3) Extract the oil seal.
4) Extract the circlip.
5) Remove the shaft with the aid of MAPO.

NOTE: Since the diameter of the bell of MAPO is somewhat small to push against the housing, it is necessary to place underneath it two tools (such as flat spanners or plates of the same thickness) (see Fig. 6).

OPERATION **18** — REMOVAL OF THE TRANSMISSION SECONDARY SHAFT AND PINION ASSEMBLY

Preliminary Operations: K1 - Removal the hydraulic lift cover
J1 - Removal of axle shaft housings and differential
I5 - Removal of transmission primary shaft and gears
I6 - Removal of power take-off primary shaft
I7 - Removal of power take-off secondary shaft and drive pinion

1) Remove the circlip at the rear extremity of the shaft.
2) Drive the shaft forwards (with a hammer and bronze drift).
3) Remove:—
   — the low gear pinion,
   — the spacer,
   — the high gear pinion.
4) Move the shaft forward so that the following can be removed in order:—
   — the third gear pinion,
   — the sleeve,
   — the fourth gear pinion,
   — the second gear pinion,
   — the first gear pinion,
   — the reverse pinion.
5) Withdraw the shaft through the front of the gearbox.

NOTE: It is not necessary to remove the circlip from the front of the shaft.

OPERATION **19** — REMOVAL OF THE SELECTOR RODS

Preliminary Operations: K1 - Removal the hydraulic lift cover
H2 - Disconnecting the clutch housing from the transmission housing

1) Drive out the pins which retain the forks and the selector cage on the sliding rods.
2) Withdraw the rods and their components from the gearbox.

NOTE: The selector rod for the third and fourth gear should be withdrawn through the forward orifice from the gearbox after removing the expanded plug.
The other rods can be withdrawn towards the rear.
The selector rod for the auxiliary reduction gear is withdrawn forwards.

OPERATION **I 10** — REMOVAL OF THE REVERSE GEAR PINION

Preliminary Operations: H2 - Disconnecting the clutch housing from the transmission housing
I 9 - Removal of the selector rods.

1) Unlock and remove the pointed set screw.
2) Remove:—
   — the reverse pinion shaft, either forwards or rearwards, driving it by means of MIDO (Fig. 7),
   — the reverse gear pinion,
   — the spacers,
   — lastly the locating washers for the needle bearing.

NOTE: Use the dummy shaft MIDO to prevent escape of the bearing needles in the gearbox housing.

OPERATION **I 11** — DISMANTLING THE GEARBOX

Preliminary Operations: All precedent operations
Service Tools Needed: MIDU

A — RIGID PIPES FOR THE OIL COOLER

1) **Oil return pipe**
   By means of a small pin punch and hammer, drive the collar on the pipe out of its location in the gearbox.

2) **Oil outlet pipe**
   Dismantle the two parts separately.
   a) Withdraw the horizontal pipe through the front of the box placing a spacer between the side of the gearbox and the pipe union and proceeding as for the return pipe.
   b) With the horizontal pipe removed withdraw the vertical pipe upwards.

B — VERTICAL OIL SUCTION PIPE

This is a drive fit in the gearbox and can be witdrawn with the aid of a pair of pliers.

C — POWER TAKE-OFF CONTROL LEVER

1) Drive out the transverse pin which retains the lever.
2) Remove the lever connecting the locking ball and its spring.
3) Push the power take-off control shaft into the gearbox and withdraw it.

D — TAPER BEARING CUPS

Withdraw the taper bearing cups from their locations by means of the special tool MIDU (Fig. 8 and 9).

OPERATION **I 12** — REASSEMBLY OF THE GEARBOX

Service Tools Needed: MIDU

A — RIGID OIL COOLER PIPES

1) Replace the pipes in the gearbox.

   NOTE: To fit the oil outlet pipe, first replace the vertical pipe and then the horizontal pipe.

2) Once the pipes are in place tap the collar to ensure that it is correctly located.

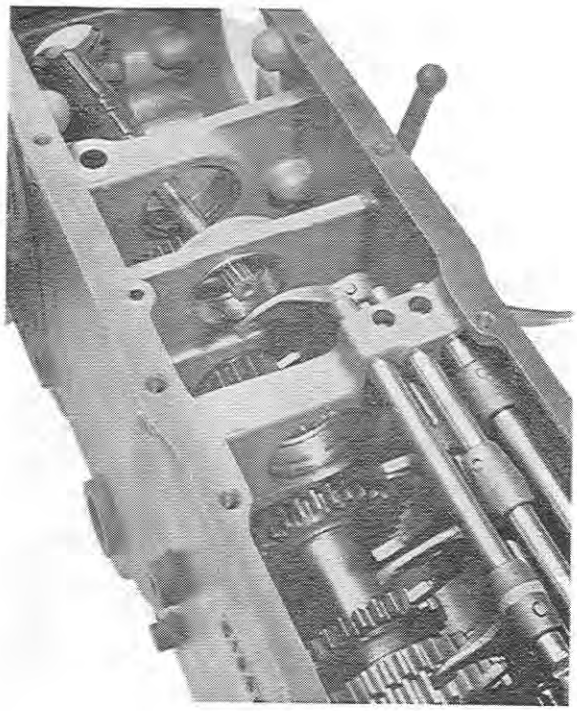


Fig. 4

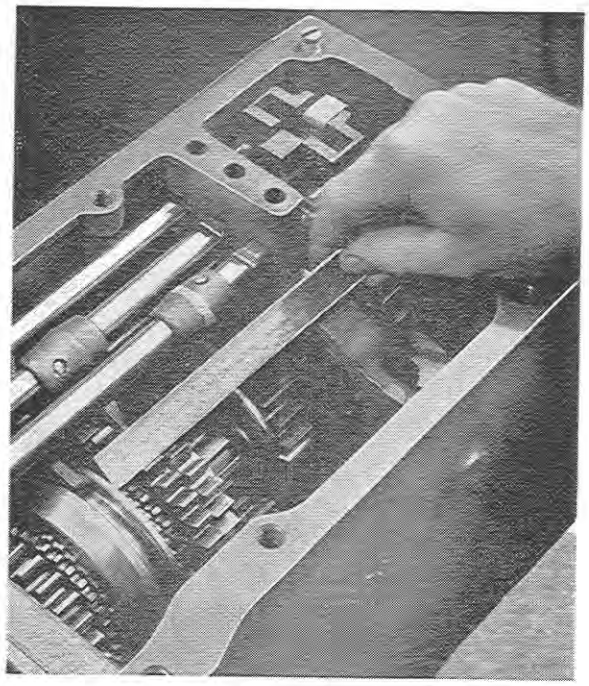


Fig. 5

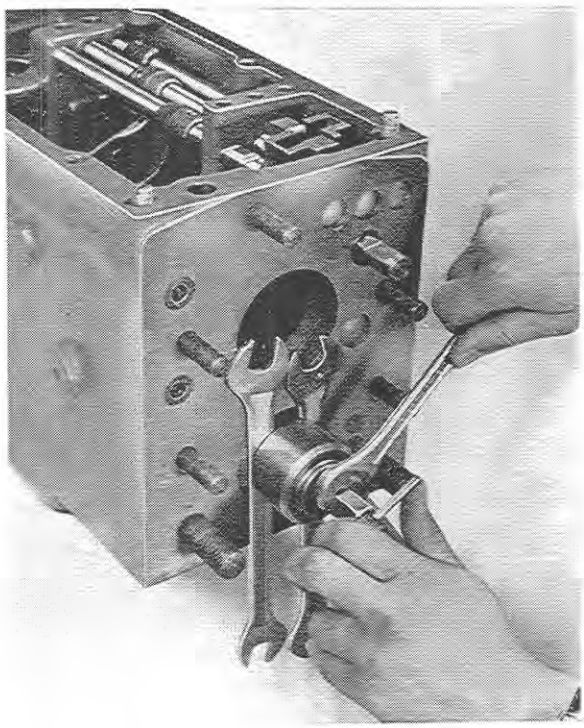


Fig. 6

Fig. 7

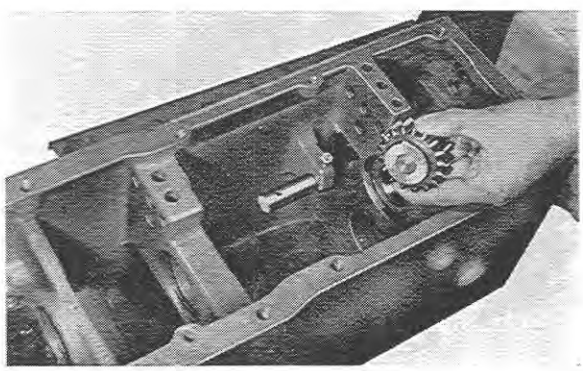
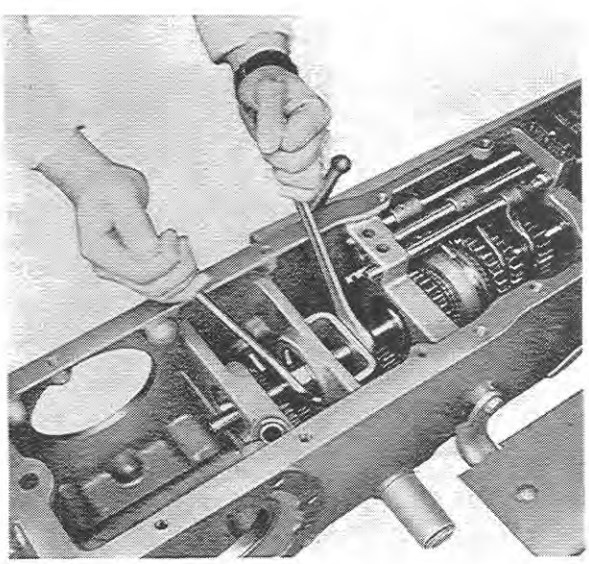


Fig. 8



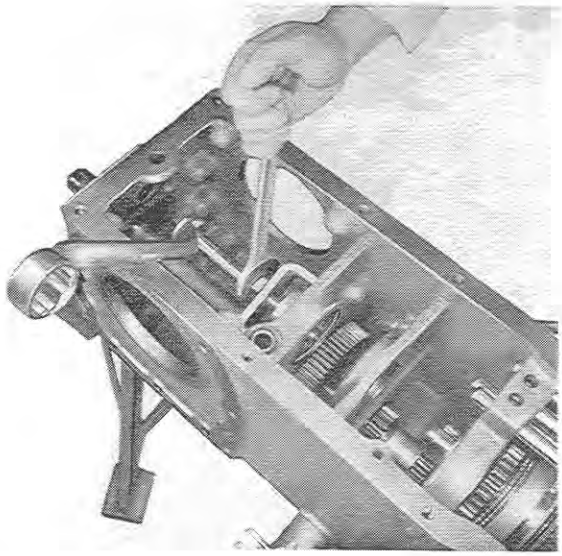


Fig. 9

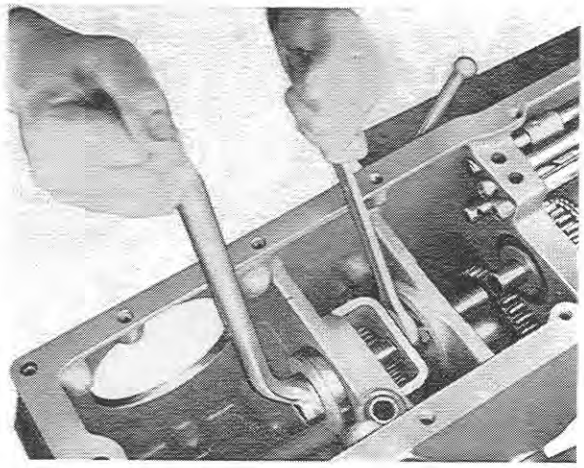


Fig. 10

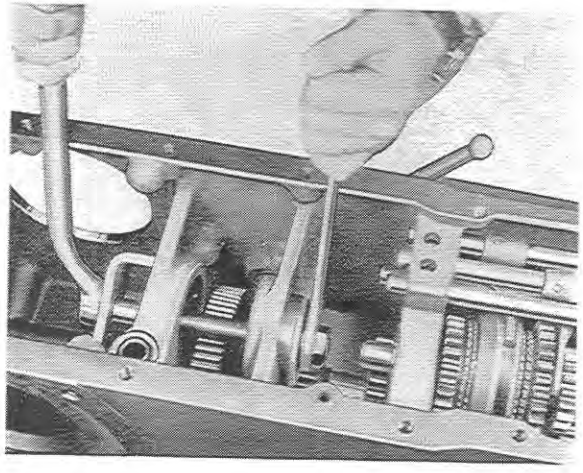


Fig. 11

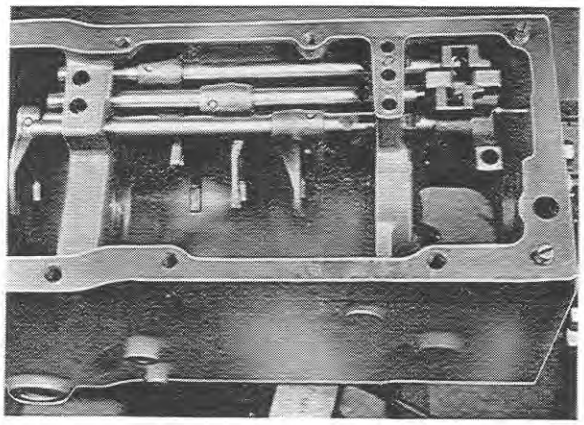


Fig. 12

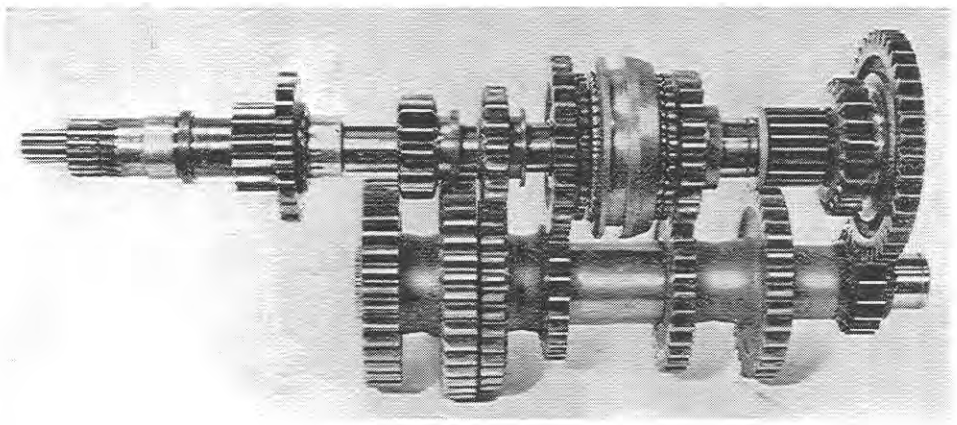


Fig. 13

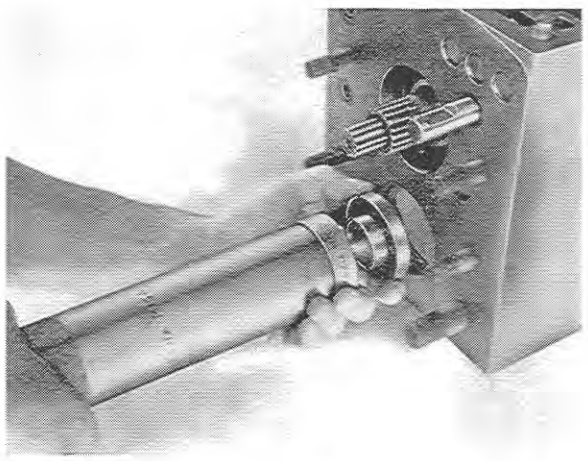


Fig. 14

B — **VERTICAL OIL SUCTION PIPE**

Fit a new "O" ring at base of the pipe and press the latter into the gearbox taking care not to damage it (it is a drive fit).

NOTE: The tube also has an "O" ring on its upper portion.

C — **POWER TAKE-OFF CONTROL LEVER**

1) Replace, from within the gearbox, the power take-off control shaft.
2) Fit the locking ball and spring in their location in the lever.
3) Place the lever on the shaft and retain it by means of the transverse pin.

D — **TAPER BEARING CUP**

Replace the bearing cups in their locations by means of special tool MIDU (Fig. 10 and 11).

OPERATION **I 13** FITTING THE REVERSE GEAR PINION

Service Tools Needed: MIDO

1) Refit the pinion and its shaft using the false shaft MIDO to permit the pinion and its two thrust washers to be mounted in their location without risking the escape of the bearing needles (46 in number) in the bottom of the gearbox (Fig. 7).
2) Fit and tighten the pointed screw which retains the shaft and lock it by means of an iron or brass wire.
3) I 14 - Fitting the selector rods.

OPERATION **I 14** FITTING THE SELECTOR RODS

1) Fit the rods and their components in the gearbox. Refer to Operation I 9 covering the removal of these rods.
2) Fit the forks on their respective rods using new pins.
3) Replace the expanding plug closing the orifice at the front of the third and fourth gear selector rod.

NOTE: Verify the correct location of the locking balls in the selector cage (see Fig. 12).

OPERATION **I 15** FITTING THE TRANSMISSION SECONDARY SHAFT AND PINION ASSEMBLY

1) Pass the hollow shaft through the front of the gear box, and fit on it in the following order, and referring to Fig. 13:—
   - — the reverse gear pinion,
   - — the first gear pinion,
   - — the second gear pinion,
   - — the fourth gear pinion,
   - — the spacing sleeve,
   - — the third gear pinion,
   - — the auxiliary reduction high range drive pinion,
   - — the spacer ring,
   - — the auxiliary reduction low range driving gear.

NOTE: The wide shoulders on the reverse gear and first gear pinions should be

fitted towards each other. The shoulders on the second and fourth gear pinions are towards each other. The shoulders on the third gear and low range driving pinion are towards ead other.
The large shoulder on the low gear driving pinion should face towards the sleeve.

2) Locate the shaft in its final position by knocking carefully on its forward end, by means of a hammer and a brass drift.
3) Complete the following operations:
   I 16 - Fitting the power take-off secondary shaft and drive pinion.
   I 17 - Fitting the power take-off primary shaft.
   I 18 - Fitting the transmission primary shaft and gears.
   J 10 - Fitting the differential and the axle shaft housings, and adjusting the mesh of the crown wheel and pinion.
   K20 - Fitting the hydraulic lift cover.

OPERATION **I 16** FITTING THE POWER TAKE-OFF SECONDARY SHAFT AND ITS DRIVE PINION

Service Tools Needed: MIGU, MIGA

1) Place the bearing and its retaining circlip on the shaft.
2) Fit the shaft through the front of the gearbox, so that it penetrates fully into the hollow shaft. Use a hammer and a bronze drift.
3) Fit the circlip at the front of the shaft against the bearing.
4) Fit the oil seal by means of the special tool MIGU and handle MIGA with its lips towards the rear, and at the same time fit the spacer which penetrates to the interior of the oil seal (Fig. 14).
5) Fit the secondary power take-off shaft pinion.
6) Push the shaft forwards to expose the forward circlip groove and fit the circlip.
7) Replace the expanding plug after smearing its contact surfaces with jointing compound (Part No. 969 673 M1).
8) Replace the central power take-off cover plate.
9) Complete the following operations:
   H 9 - Re-coupling the clutch and transmission housings.
   K20 - Fitting the hydraulic lift cover.

OPERATION **I 17** FITTING THE POWER TAKE-OFF PRIMARY SHAFT

Service Tools Needed: MIFI, Possibly MIFA, MIGO, MIGA

If it appears necessary to change the oil seal on the primary shaft, this operation should be carried out using the special tool MIFA (Fig. 15).

1) Fit the primary shaft through the front of the gearbox, and simultaneously into the hydraulic pump drive pinion, which should be correctly located (Fig. 1).
2) Fit the forward bearing.
3) Fit the circlip.

   NOTE: If the primary transmission shaft has not been dismantled, use the protecting sleeve MIFI to protect the oil seal (Fig. 16).
4) Fit the oil seal with its lips towards the rear, using special tools MIGO and the handle MIGA (Fig. 17).
5) Complete the following operations:
   H 9 - Re-coupling the clutch and transmission housings.
   K20 - Fitting the hydraulic lift cover.

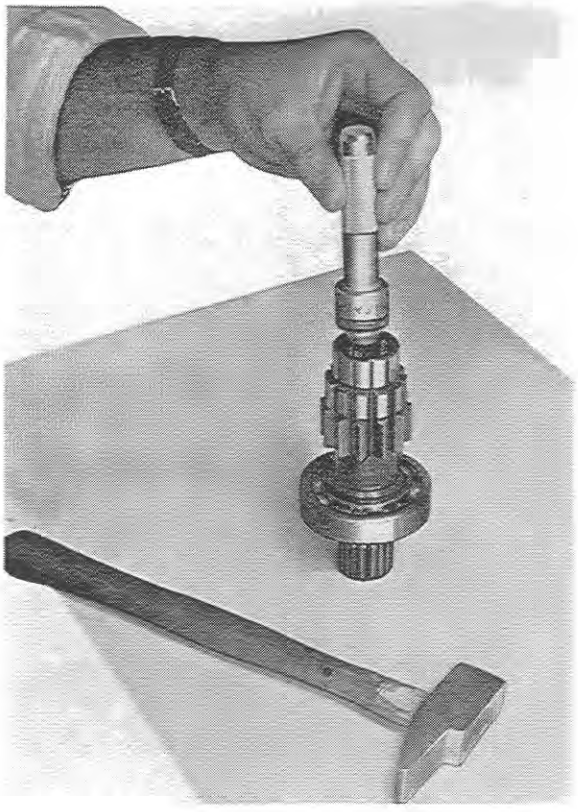


Fig. 15

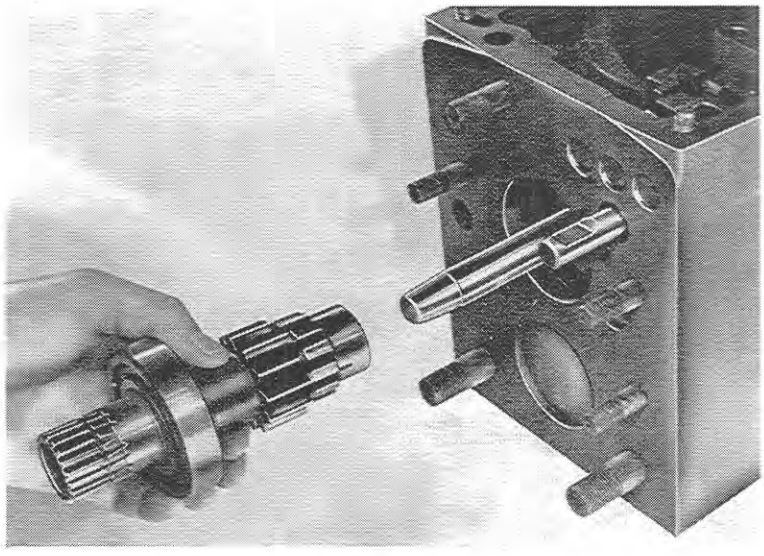


Fig. 16

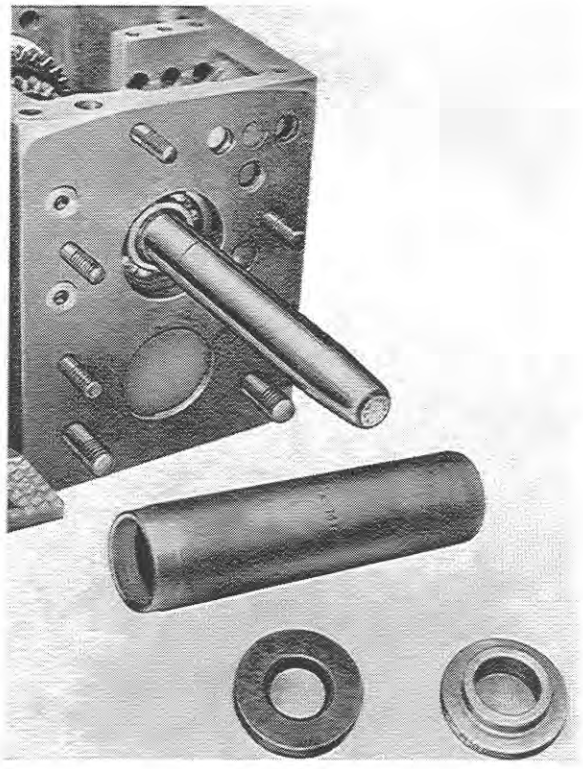


Fig. 17

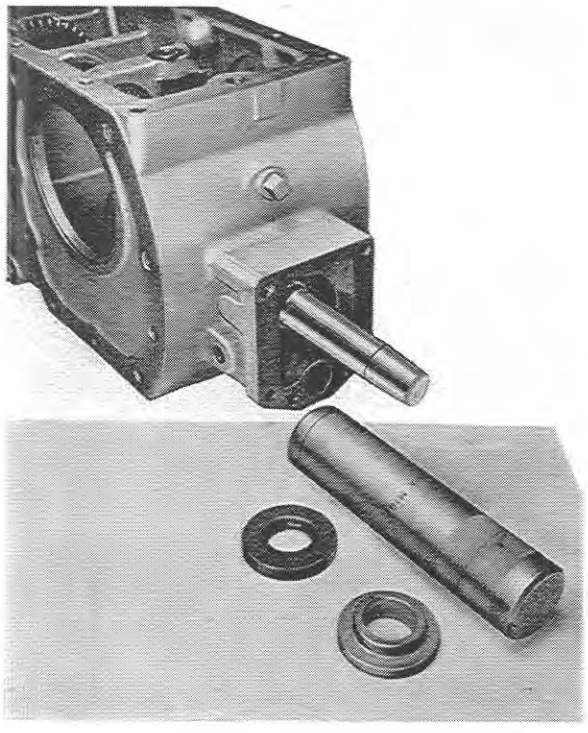


Fig. 18

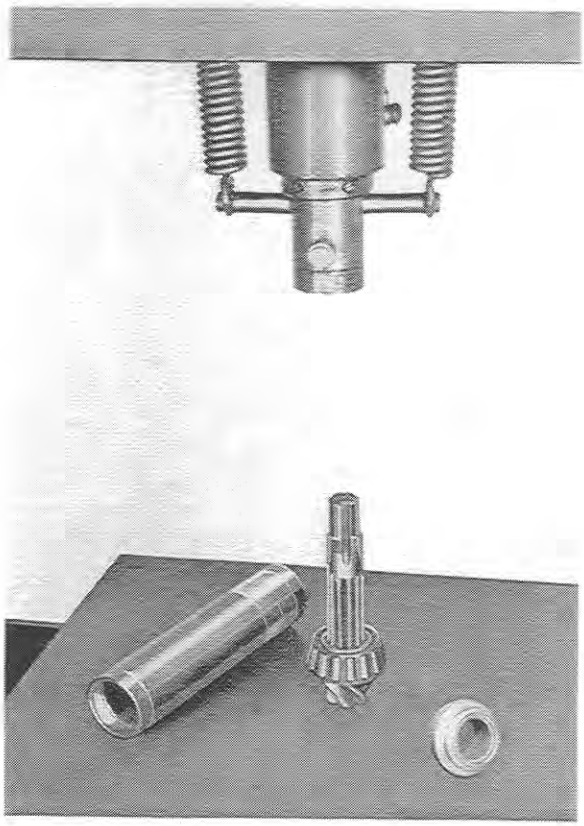


Fig. 19

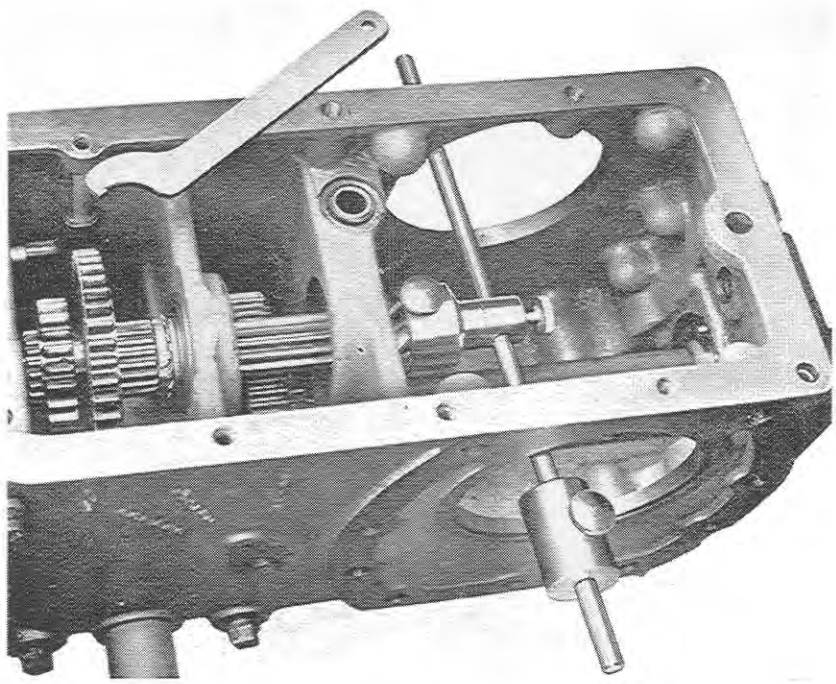


Fig. 20

OPERATION **I 18** FITTING THE TRANSMISSION PRIMARY SHAFT AND ITS GEARS

1) Fit the primary shaft into the gearbox from the rear (Fig. 4).
2) Fit the shaft into the synchromesh assembly.
   To do this properly it is advisable to fit the synchromesh assembly in two parts:
   a) Fit the third gear pinion on the shaft.
   b) Follow this by fitting the fourth gear pinion and synchromesh while engaging the selector fork in the exterior sleeve.
3) Fit the thrust washer and circlip.
4) Fit the second gear pinion simultaneously engaging it in its selector fork.
5) Fit the first gear and reverse pinion simultaneously engaging it in its selector fork.
6) Continue to move the shaft forward to its final position, sliding the thrust washer and the circlip long it.
7) Complete the following operations:
   I 20 - Fitting the power take-off shaft.
   I 22 - Fitting the drive pinion.
   J 10 - Fitting the differential and the axle shaft housings, and adjusting the mesh of the crown wheel and pinion.
   K20 - Fitting the hydraulic lift cover.

OPERATION **I 19** FITTING THE GROUND SPEED POWER TAKE-OFF PINION AND SLIDING GEAR

1) Fit the sliding gear on the shaft with the control lever pin engaged in its groove, and the coupling teeth towards the rear of the gearbox.
2) Introduce the square sleeve fitted into the gearbox, and slide it into the power take-off pinion simultaneously placed in the gearbox with its shoulder towards the rear.

   NOTE: The square sleeve should be fitted with its internal splines towards the front.

3) Push the square sleeve forward about 2 cm to expose the circlip groove. Fit the circlip.
4) Push the sleeve towards the rear, and fit the rear circlip.
5) Complete the following operations:
   I 20 - Fitting the power take-off shaft.
   I 21 - Fitting the auxiliary sliding gear spline sleeve.
   I 22 - Fitting the drive pinion.
   J 10 - Fitting the differential and the axle shaft housings, and adjusting the mesh of the crown wheel and pinion.
   K20 - Fitting the hydraulic lift cover.

OPERATION **I 20** FITTING THE POWER TAKE-OFF SHAFT

Service Tools Needed: MIGO, MIGA, MIGI

1) Pass the power take-off shaft fitted with its bearing through the rear of the gearbox.
2) Fit the rear locating circlip.
3) Fit a new oil seal using Service Tool MIGO equipped with its hollow handle MIGA and after placing on the shaft the protecting sleeve MIGI (Fig. 18).
4) Replace finally, the oil strainer, the rubber plug, the spring and the cover plate.
5) Fit and tighten the six screws holding the cover plate.

OPERATION **I 21** FITTING THE AUXILIARY SLIDING GEAR SPLINED SLEEVE

1) Place the thrust washer on the rear end of the primary transmission shaft.
2) Fit the sliding pinion in position on its selector fork. For this operation push the fork forward.
3) Engage the splined sleeve from the rear with its interior needle bearing towards the front.
4) Complete the following operations:
   I 22 - Fitting the drive pinion.
   J 10 - Fitting the differential and the axle shaft housings, and adjusting the mesh of the crown wheel and pinion.
   K20 - Fitting the hydraulic lift cover.

OPERATION **I 22** FITTING THE DRIVE PINION

Service Tools Needed: MILU, MINI, MIFO-A, MIGA

1) Place the complete forward taper bearing in its cup, and introduce the drive pinion fitted with its rear bearing.
   NOTE: The taper bearing cone on the drive pinion is fitted utilising Service Tool MIFO-A and the handle MIGA (Fig. 19).
2) Fit the washer and the lock washer and the castellated nut, and push the drive pinion forward.
3) Tighten the nut.
4) Using the spanner MINI and the pre-load gauge MILU adjust the pre-load on the drive pinion bearings (Fig. 20).
   With the drive pinion assembly fitted the spanner MINI will allow the castellated nut to be tightened or loosened while the pre-load is adjusted according to the gauge MILU.
   The torque exercised by the weight placed between the two limits on the arm of the tool should be sufficient to rotate the pinion slowly.
   Complete the following operations:
   J 10 - Fitting the differential and the axle shaft housings, and adjusting the mesh of the crown wheel and pinion.
   K20 - Fitting the hydraulic lift cover.

REAR AXLE SHAFT HOUSING AND DIFFERENTIAL

LIST OF OPERATIONS

OPERATION **J1** REMOVAL OF REAR AXLE SHAFT HOUSING AND DIFFERENTIAL

Preliminary Operations: Q2 - Removal of fenders
Q1 - Removal of brake assembly
Service Tools Needed: MIBA

A — **Right hand or left-hand axle shaft housing**

1) Partially drain the gearbox and remove the wheel.
2) Remove the hydraulic lift link from the axle shaft housing having removed the attachment nut.
3) Remove the 18 screws attaching the axle shaft housing to the gearbox using if necessary the spanner MIBA (Fig. 1).
4) Remove the axle shaft housing.

NOTE: It is advised at the same time to withdraw the strainer and thus to ensure the good condition of the square section sealing washer on which the end of the strainer is supported.

B — **Differential**

1) Remove the hydraulic lift cover (Operation K1).
2) Having removed the right and left-hand axle shaft housings, the differential may be withdrawn.

OPERATION **J2** REMOVAL OF FINAL REDUCTION UNITS

1) Remove the rear wheel.
2) Remove the eight bolts attaching the reduction housing to the axle shaft housing.
3) Separate the reduction unit cover from the axle shaft housing, using if necessary a screwdriver in the slot is provided for this purpose.
4) Separate the ring gear from the reduction unit if necessary after marking the relative positions of the cover and ring gear by means of a chisel or centre punch.

OPERATION **J3** DISMANTLING OF DIFFERENTIAL LOCK AND AXLE SHAFT HOUSING

Preliminary Operations: J1 - Removal of axle shaft housing and differential
J2 - Removal of final reduction units.
Service Tools Needed: MICI

A — **Differential lock**

1) Remove the screw which locates the actuating lever on the selector shaft and remove the pedal linkage assembly.
2) Remove the four attachment screws from the differential lock inspection cover.
3) Remove the inspection cover.
4) Unlock and remove the pointed screw from the differential lock selector fork, and withdraw the spindle from the fork.
5) Disengage the selector fork and withdraw the differential lock shoe having removed the clip and the return spring.

B — **Right or left-hand axle shaft housing**

1) Withdraw the half shaft from the reduction unit end having mounted on the differential end the protecting sleeve MICI so that the oil seal will not be damaged. Remove the brake disc.
2) Check the condition of the bearing cups and the oil seals in the axle shaft housing. Remove them if necessary.

OPERATION **J4** — DISMANTLING THE DIFFERENTIAL

Preliminary Operations: J1 - Removal of axle shaft housing and differential

1) Remove the locking tabs from the eight bolts attaching the crown wheel to the differential case.
2) Remove the bolts, the crown wheel and lastly the shim which is in two parts.
3) Unlock and remove the eight screws attaching the differential lock coupling to the case.
4) Remove the coupling and its taper bearing.
5) Withdraw the cylindrical pin which retains the differential pinion spindle.

   NOTE: The cylindrical pin will fall out by itself if the differential case is turned over after Operation No. 4.

6) Withdraw from the case the differential pinion spindle.
7) Turn the differential pinion assembly within the casing so that the pinions are opposite the holes in the casing.
8) Withdraw from the differential case:—

   — the pinions,
   — the concave bronze thrust washers,
   — the planetary gears,
   — the planetary gear bronze thrust washers.

9) Lastly remove the bearing cones from the differential case and the differential lock coupling.

OPERATION **J5** — DISMANTLING THE FINAL REDUCTION UNITS

Preliminary Operations: J2 - Removal of final reduction units
Service Tools Needed: MAPU

1) Using a hammer and a pinpunch, drive out the three grooved pins which retain the planetary gear spindles.
2) Withdraw the three planetary gear spindles.
3) Remove the planetary gears and the needle bearings.

   NOTE: Take care not to drop the needles into the bottom of the reduction housing during dismantling.

4) Remove the circlip which locates the wheel axle in the reduction housing by means of the circlip pliers MAPU (Fig. 2).
5) Separate the planetary carrier from the reduction housing using a three legged extractor with a capacity of up to 6 tons (Fig. 3).

   NOTE: This operation can be facilitated by placing a portable hydraulic ram between the wheel axle and the screw of the extractor.
   Under no circumstances should the wheel axle be forced out by hammer blows or with a press since these methods will damage the taper bearing on the rear axle.

6) Check the condition of the bearing cones in the reduction housing; the bearing cup and the oil seal in the reduction cover. Remove them if necessary.

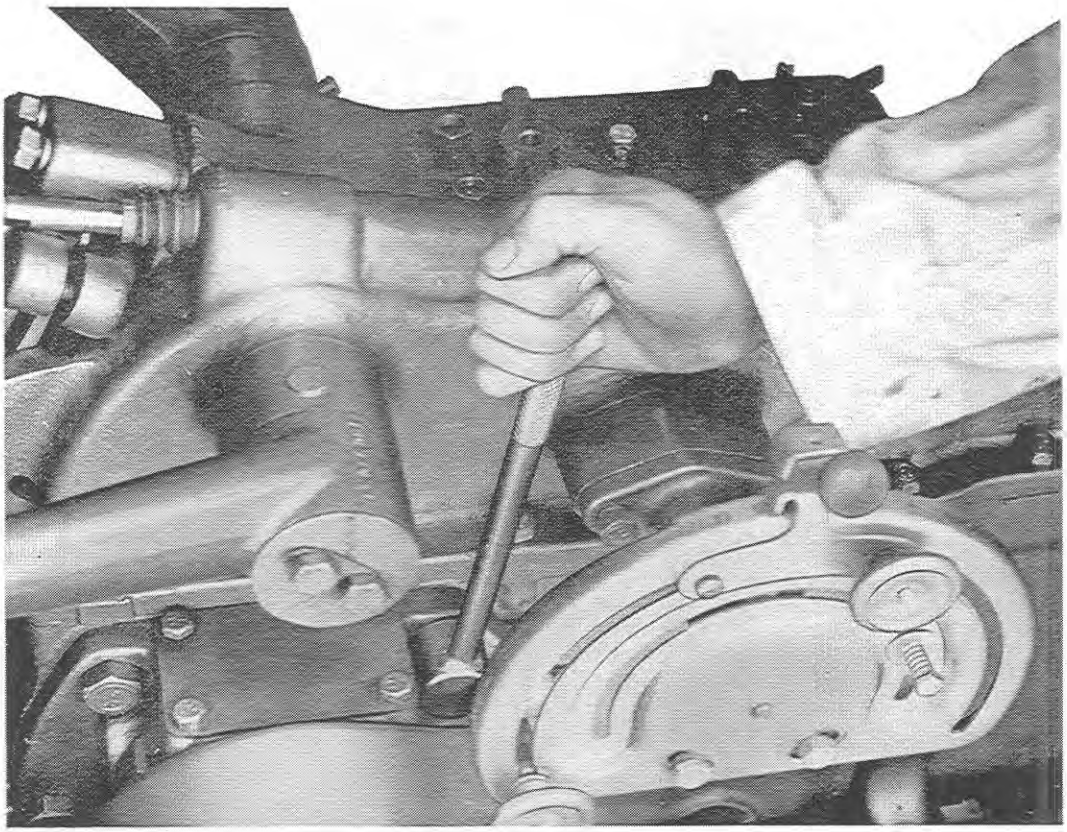


Fig. 1

Fig. 2

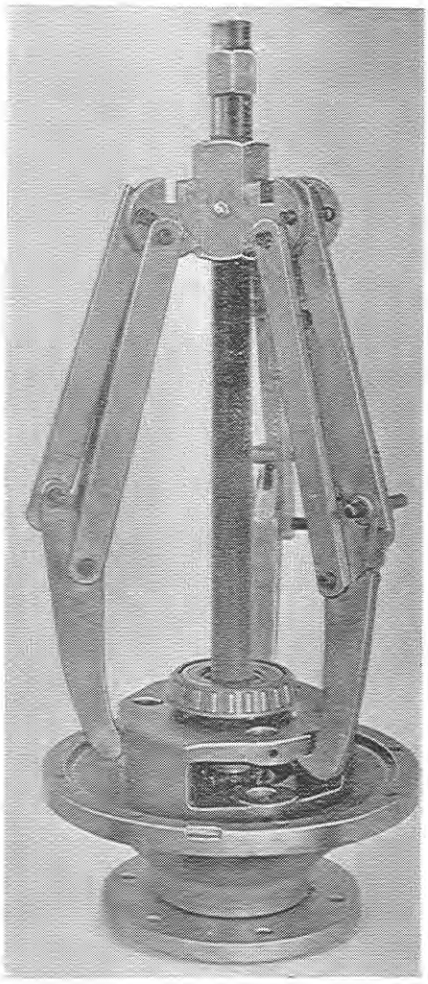


Fig. 3

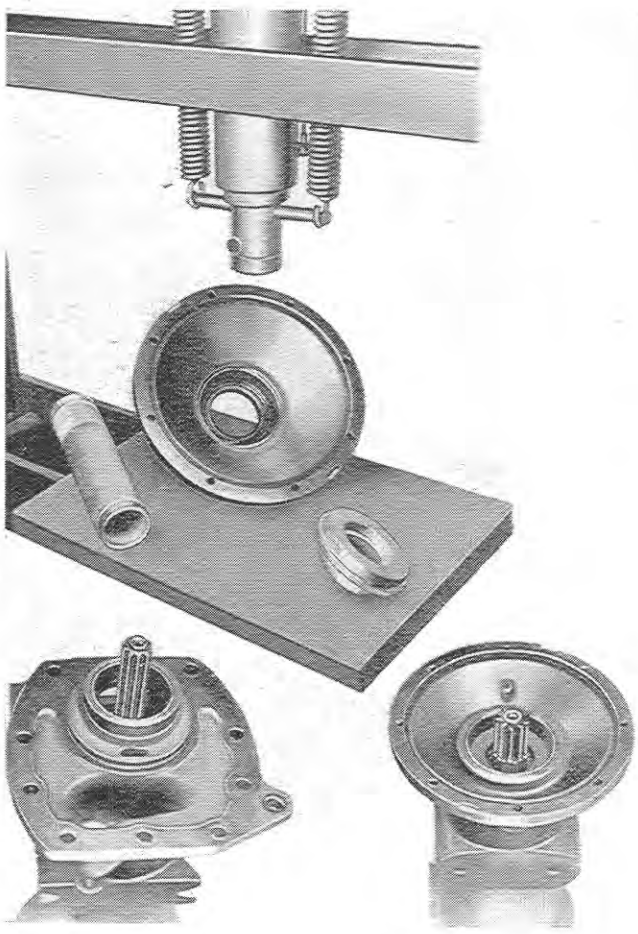


Fig. 4

Preliminary Operations: J3 - Removal of differential lock and axle shaft housing
Service Tools Needed: MICO-A, MIGA, MICI, MIBO, MIBU, MIFO-A

A — **Right or left-hand axle housing**

1) If necessary, fit the bearing cups in the axle housing by means of the special tool MICO-A and the hollow handle MIGA (Fig. 4).
2) Fit the half shaft into the axle housing from the reduction unit end, fitting the brake disc through the appropriate aperture. If the oil seals have not been removed, use the protecting sleeve MICI.
3) If necessary, fit the oil seals in the axle housing by means of the special tool MIBO, the hollow handle MIGA and the protecting sleeve MIBU for the reduction housing side (Fig. 5), and by means of the special tool MIFU-A, the hollow handle MIGA and the protecting sleeve MICI for the seal on the differential side (Fig. 6).

B — **Differential lock**

1) Fit the sliding shoe assembly on the half shaft followed by the return spring and the thrust washer.
2) Fit the circlip which retains the return spring.
3) Fit the selector fork through the inspection window.
4) Fit the selector fork spindle and tighten the screw to locate the spindle on the fork to a torque setting of 0.50 to 0.57 ft/lb (0.7 to 0.8 m/kg). Lock the screw.
5) Replace the inspection cover and its four attachment screws.
6) Fit the pedal and linkage to the selector fork spindle and partially tighten
7) Complete the following operations:
   J 9 - Fitting the final reduction units and adjusting the preload.
   J10 - Fitting the differential and the axle shaft housing, and adjusting the mesh of the crown wheel and pinion.
   J11 - Adjusting the differential lock.
   O 5 - Fitting of brake assembly.
   Q17 - Fitting of fenders.

NOTE: It is not possible to adjust the differential lock while the axle shaft housing is off the tractor.

OPERATION **J7** REASSEMBLING THE DIFFERENTIAL

Preliminary Operations: J4 - Dismantling the differential
Service Tools Needed: MILA

1) If necessary, fit the bearing cones on the differential case and the differential lock fixed shoe by means of special tool MILA and a hydraulic press (Fig. 7).
2) Fit a bronze thrust washer to each planetary gear.
3) Insert the planetary gears and the thrust washers in the differential housing through the openings.
4) By the same means insert the differential pinions and mesh them with the planetary gears.
5) Fit a bronze thrust washer on each planetary pinion and turn the assembly of gears pinions through 90° so that the pinion bores line-up with the bores in the differential case.
6) Fit the planetary pinion spindle.
7) Fit the cylindrical pin to retain the differential pinion spindle.
8) Fit the differential lock shoe on the case by means of the eigth screws complete with lock washers.

9) Tighten the eight screws to a torque setting of 23.9 ft/lb (3.3 m/kg) and lock.
10) If the crown wheel has been removed replace it complete with its attachment bolts and lock washers leaving out two bolts diametrically opposed. Do not tighten these bolts.
11) Between the crown wheel and the flange of the differential case, insert the shims so that the central hole in each corresponds to the holes where the assembly bolt as been left out (shown in No. 10).

NOTE: Where it appears necessary during dismantling to change components such as bearings, differential case, differential lock fixed shoe or crown wheel and pinion, it is necessary to assemble without the adjusting shims and to check the backlash between crown wheel and pinion to determine whether or not shims should be fitted.

12) Fit the two final bolts and tighten all to a torque setting of 23.9 to 26.7 ft/lb (3.3 to 3.7 m/kg).

OPERATION **J8** REASSEMBLING THE FINAL REDUCTION UNIT

Preliminary Operations: J5 - Dismantling the final reduction units
Service Tools Needed: MIDI-A, MICO-A, MIGA, MIBI, RASO

1) If necessary fit:—
   — the reduction housing, the bearing cones and the anti-noise ring by means of special tool MIDI-A (Fig. 8),
   — the reduction cover, the bearing cup by means of special tool MICO-A and the handle MIGA (Fig. 4) and the oil seal by means of special tool MIBI and the handle RASO (Fig. 9).
2) Degrease and clean the splines on the wheel axle and planetary carrier scrupulously with trichlorethylene.
3) Allow to dry then smear the edge of the splines of the planetary carrier with a few drops of "LOCTITE" grade A.V.
4) Fit the planetary carrier on the splines of the rear axle by means of a press as indicated in Fig. 10.

   NOTE: The pressure necessary for this latter operation will be between 32.286 to 36.126 p.s.i. (2.27 to 2.54 kg/cm²). If less than 31.290 p.s.i (2.200 kg/cm²) are needed the wheel axle or the planetary carrier or both must be changed.
5) Fit the circlip.
6) Smear new grease on the planetary gear bearing surface and fit the bearing needles (56 in each pinion).

   NOTE: Do not forget to fit the separating washer between the two sets of needles.
7) Replace the pinions in the planetary carrier between the thrust plates.
8) Fit three new grooved pins to retain the pinion spindles.
9) Reassemble the final reduction unit on the axle shaft housing.
10) Fitting the final reduction unit and adjusting preload (Operation J9).

OPERATION **J9** FITTING THE FINAL REDUCTION UNITS AND ADJUSTING THE PRELOAD

Preliminary Operations: J7 – Reassembling of the differential
Service Tools Needed: MATA

1) Place the ring gear on the final reduction unit, paying attention to the assembly marks (Operation J2 - No. 3) and fit the cork joints which should be either new or in perfect condition and smeared with grease or jointing compound Part No. 969 673 M1.
2) Place the final reduction unit against the flange on the axle shaft housing.

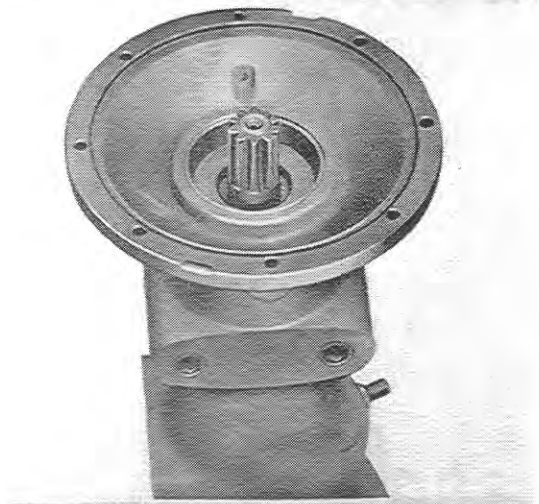
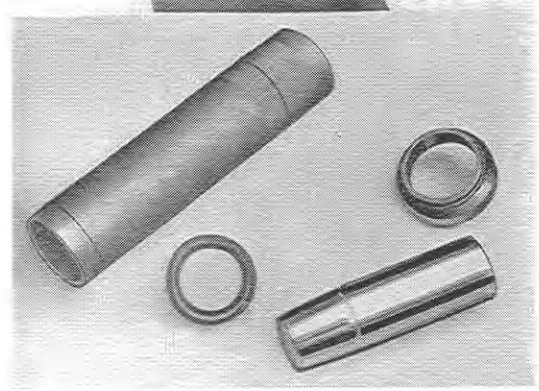
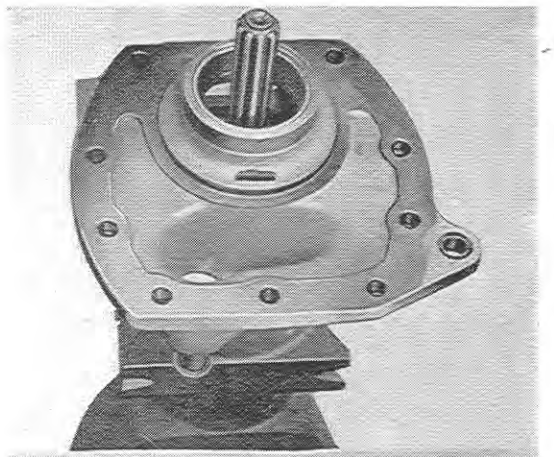


Fig. 5





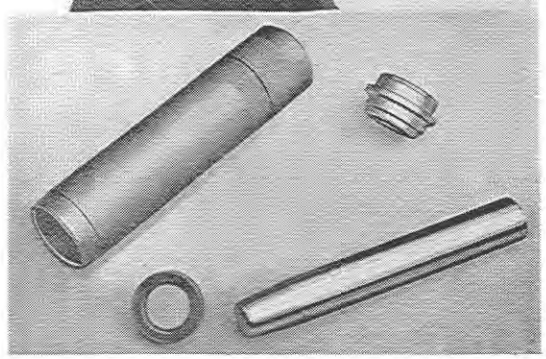


Fig. 6

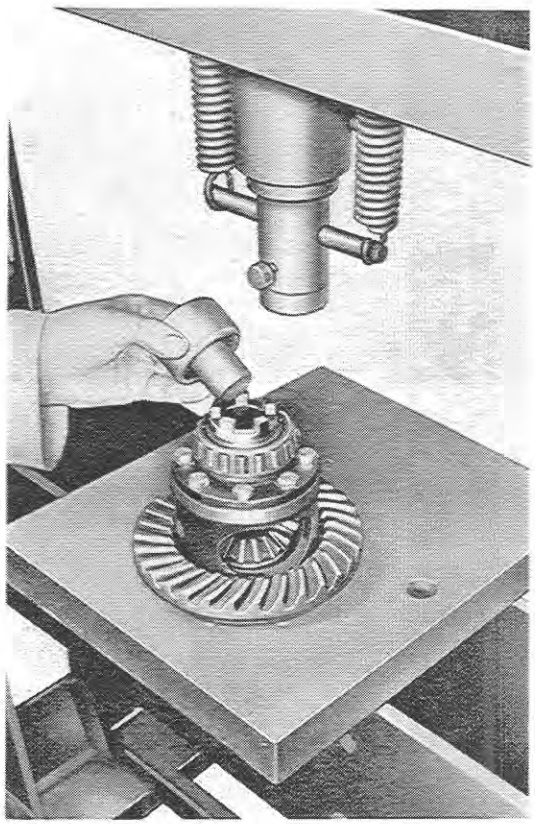


Fig. 7

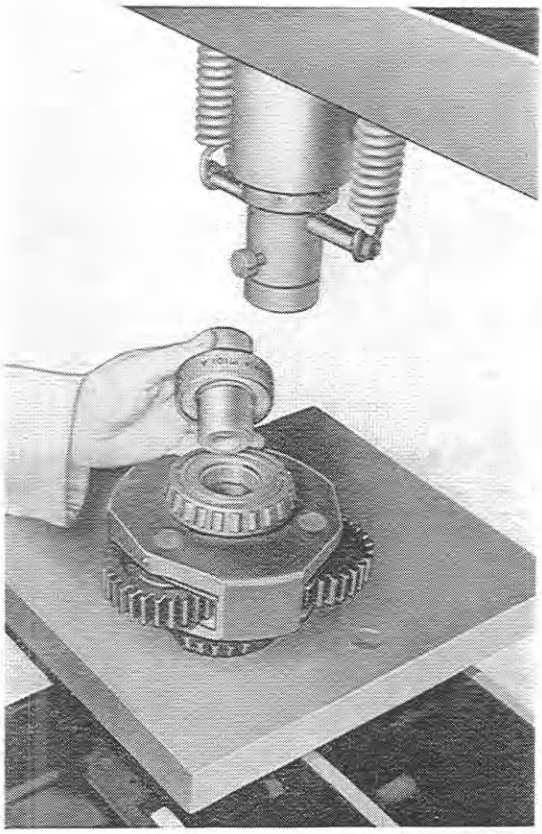


Fig. 8

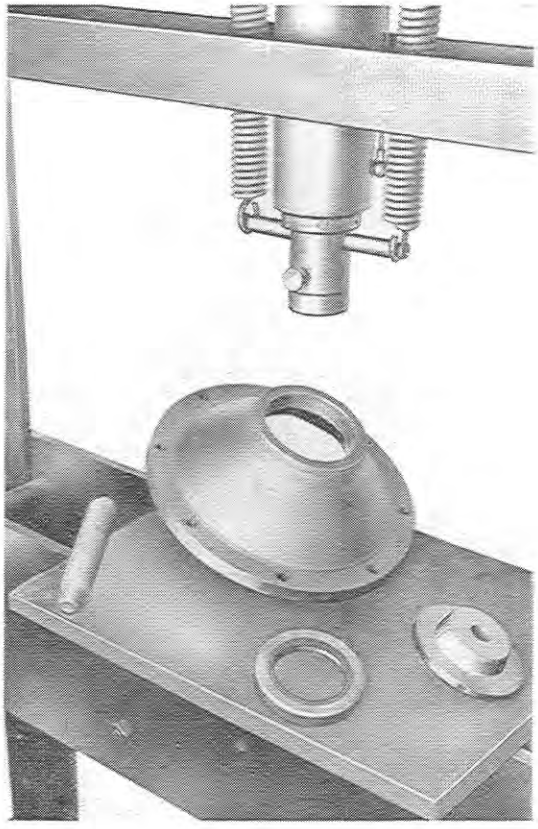


Fig. 9

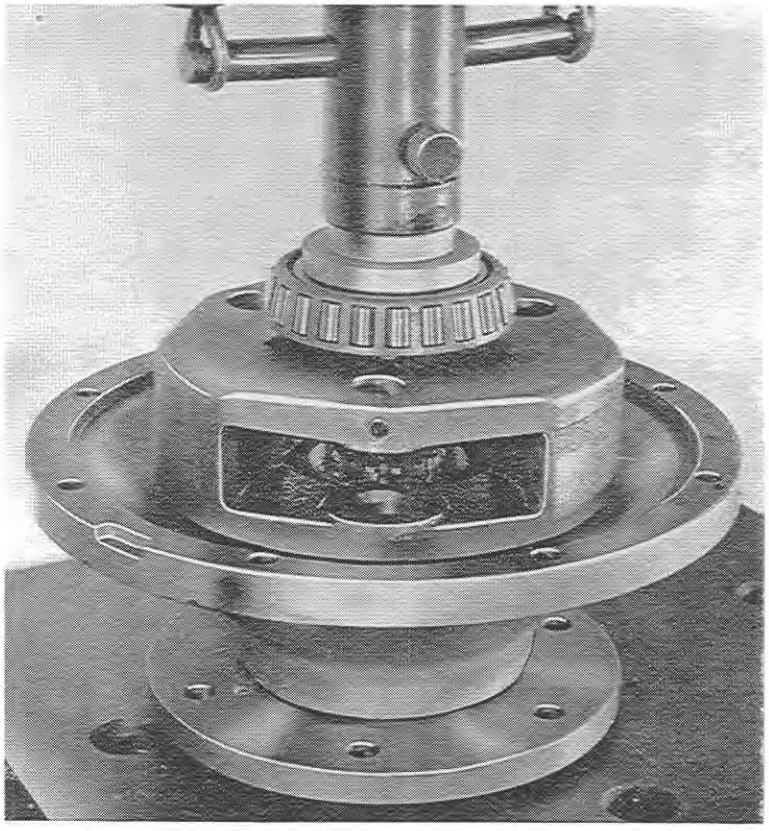


Fig. 10

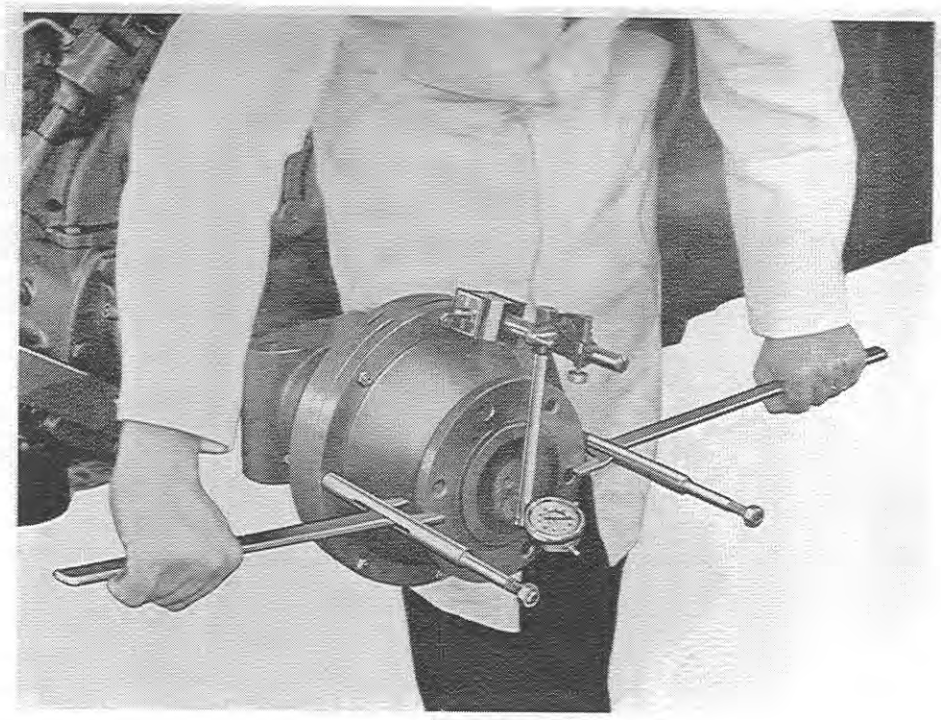


Fig. 11

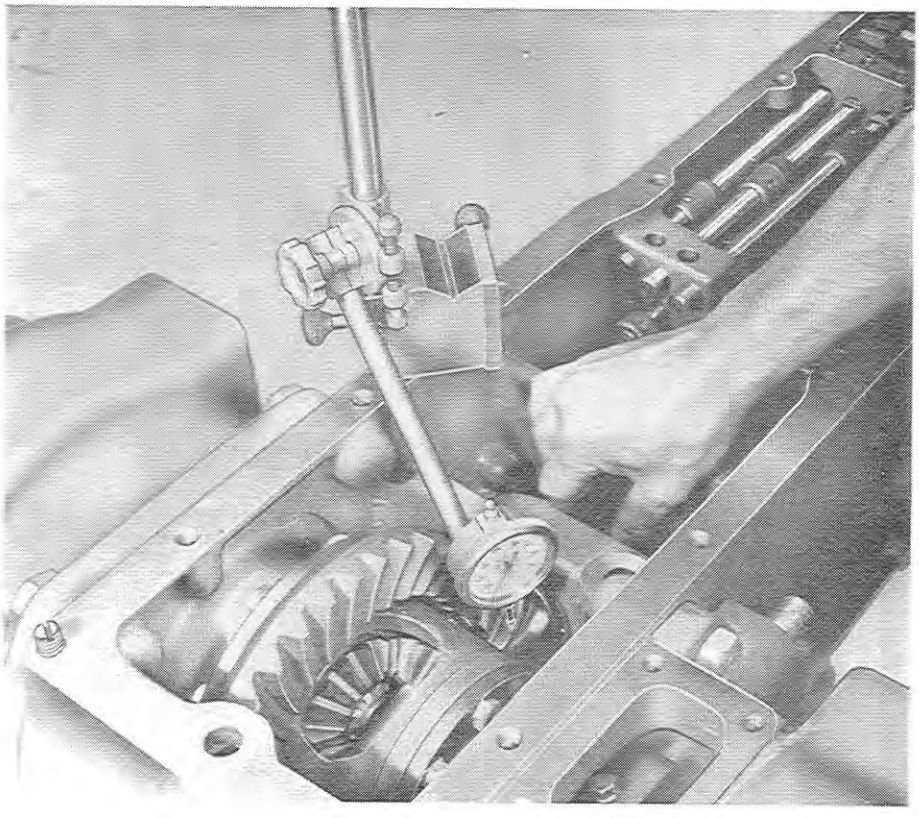


Fig. 12

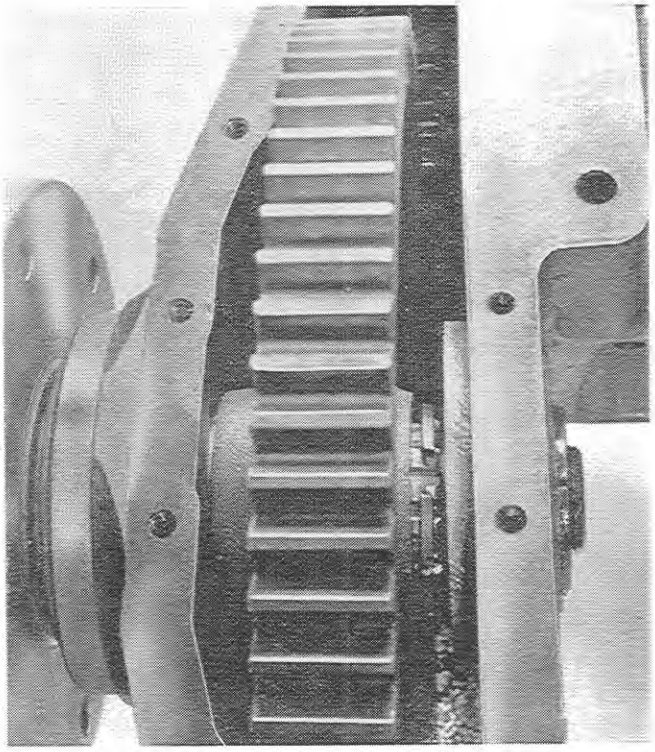


Fig 13

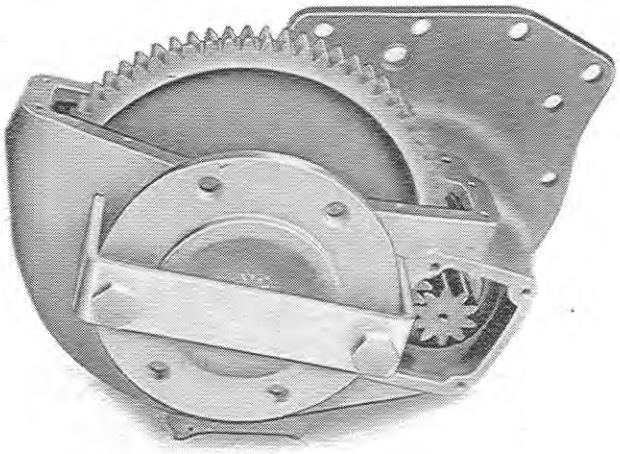


Fig 14

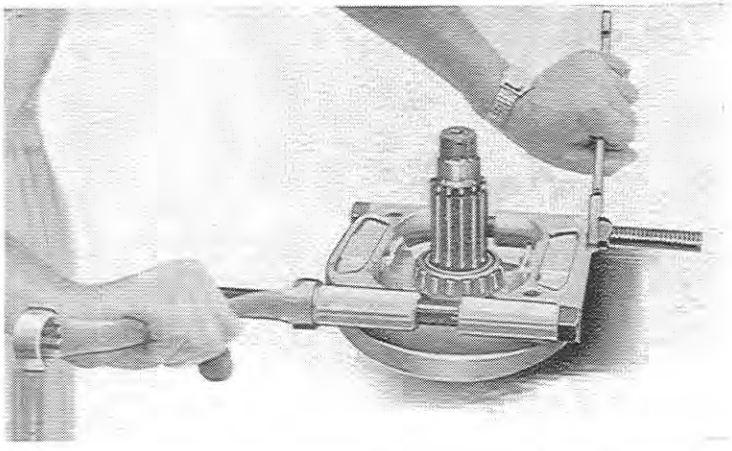


Fig 15

3) Fit the eight bolts and tighten to a torque setting of 18.8 to 21.7 ft/lb (2.6 to 3 m/kg).
4) **Adjusting the preload.**
Adjustment of preload of the final reduction bearings is determined by shims 0.002 and 0.005" (0.05 and 0.13 mm) thick placed between the interior bearing cup and the axle shaft housing.
The adjustment is made on first assembly by calibrating the planetary carrier (complete with shims and bearing) to 5.795 to 5.793" (147.19 to 147.14 mm). This provides a preload of 0.002 to 0.010" (0.05 to 0.25 mm).
Use for this operation the levers MATA and a dial test indicator with a magnetic base as indicated in Fig. 11.
NOTE: Place the dial test indicator in such a manner that the foot is in contact with the exterior face of the wheel axle. The amount of movement obtained by pressure on their levers MATA as indicated by the movement of the indicator needle.
5) Replace the rear wheel.

OPERATION **J10** — FITTING THE DIFFERENTIAL AND THE REAR AXLE SHAFT HOUSING AND ADJUSTING THE MESH OF THE CROWN WHEEL AND PINION

Preliminary Operations: J1 - Removal of axle shaft housing and differential
Service Tools Needed: MIBA

A — **Differential**
1) Place the differential in the housing.

B — **Right or left-hand axle shaft housing**
1) Where the attachment pins for the check chains have been removed these should be replaced before fitting the axle shaft housing.
2) Fit a new cork joint, fit the axle shaft housing and the 18 assembly screws, using if necessary the spanner MIBA.
3) Fit the hydraulic lift link on its spindle and tighten the nut.
4) Replace the rear wheel.

C — **Adjusting the mesh on crown wheel and pinion**
Place the dial test indicator as shown in Fig. 12, and move the drive pinion so that the backlash between it and the crown wheel can be read on the indicator. This should be between 0.004 and 0.013" (0.10 and 0.34 mm). If it is not between these two figures, it should be adjusted by means of shims between the crown wheel and differential case (see Operation J7). Do not fit more than one shim.
Shims are available in two thicknesses: 0.004 and 0.008" (0.10 and 0.20 mm).
Complete the following operations:
K 1 - Fitting the hydraulic lift cover.
O 5 - Fitting of brake assembly.
Q17 - Fitting of fenders.

OPERATION **J11** — ADJUSTING THE DIFFERENTIAL LOCK

1) Loosen the screw which retains the actuating lever on the selector fork spindle.
2) Position the pedal so that the differential lock shoes are fully engaged when the pedal is in contact with the foot step.
3) Tighten the screw retaining the actuating lever on the selector fork spindle.
4) Verify the effective action of the sliding shoe by viewing through the inspection cover.

OPERATION **J12** — REMOVAL OF REAR AXLE SHAFT HOUSING AND FINAL REDUCTION ASSEMBLIES AND THE DIFFERENTIAL

A — **Axle shaft housing**

1) Partially drain the gear box (5 litres) and completely drain the reduction housing to be removed. Remove the rear wheel.
2) Remove the two bolts which attach the mudguard to the reduction housing.
3) Remove the hydraulic lift linkage.
4) Uncouple the foot brake linkage and detach the return spring.
5) Loosen and remove the nuts and bolts attaching the reduction housing to the gearbox.
6) Place a trolley jacks or preferably a dismantling trolley below the reduction housing with the rails in the same direction as the plan of assembly of the reduction housing to the tractor.
7) Disengage the reduction housing.

B — **Differential**

Having removed the opposite axle shaft housing in a similar manner, remove the hydraulic lift cover (Operation K1) and withdraw the differential from above.

OPERATION **J13** — REMOVAL OF DIFFERENTIAL LOCK

This operation is identical to Operation J3 - A (Differential lock).

OPERATION **J14** — DISMANTLING THE FINAL REDUCTION UNITS

Preliminary Operations: O7 - Remove of brake assembly
J12 - Removal of rear axle shaft housing and final reduction assemblies and the differential
Service Tools Needed: MIRO, MIRA, MIDU, MICU

A — **Dismantling the wheel axle**

1) Remove the expanded plug by means of a wooden or plastic mallett.
2) Remove the split pin from the castellated nut and remove the nut.
3) Remove the circlip which retains the ring gear and place it on the splines (Fig. 13).
4) By means of the stirrup MIRO and two wheel bolts extract (Fig. 14):—
   - — the bearing,
   - — the ring gear,
   - — the circlip,
   - — the spacer.
5) Check the condition of the bearing cone and if necessary, remove it by means of a bearing puller and a press (Fig. 15 and 16). Extract the oil seal.

   NOTE: All the operations for dismantling concerning only the wheel axle can be done without removing the axle shaft housing.

B — **Dismantling the half shaft**

1) Remove the housing cover plate.
2) Remove the circlip retaining the half shaft bearing.
3) Withdraw the half shaft and its bearing through the ring gear housing.

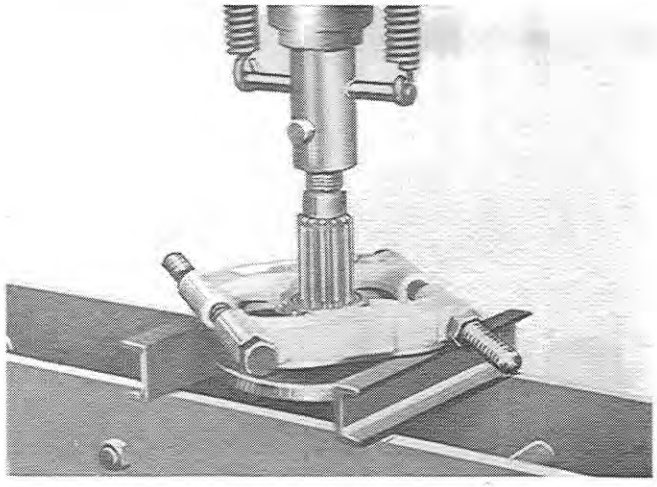


Fig. 16

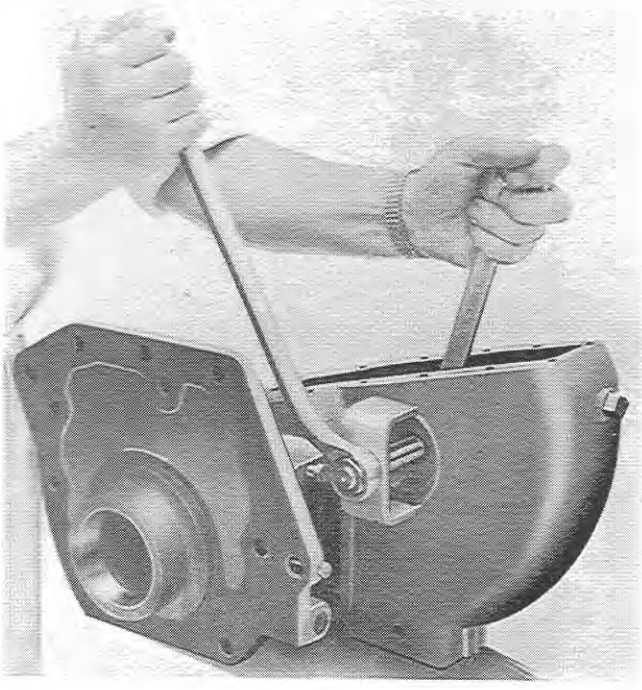


Fig. 17

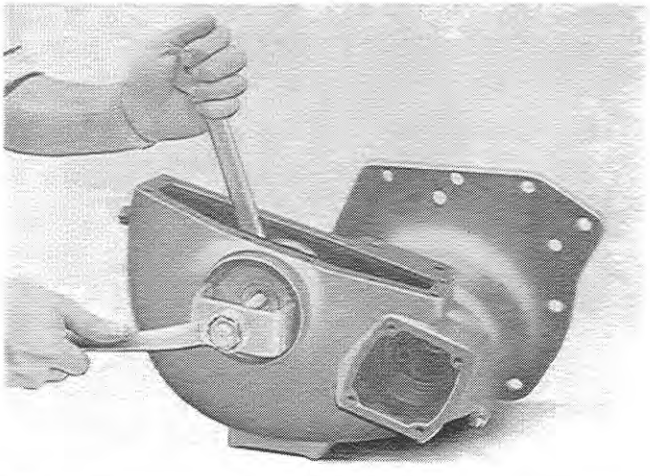


Fig. 18

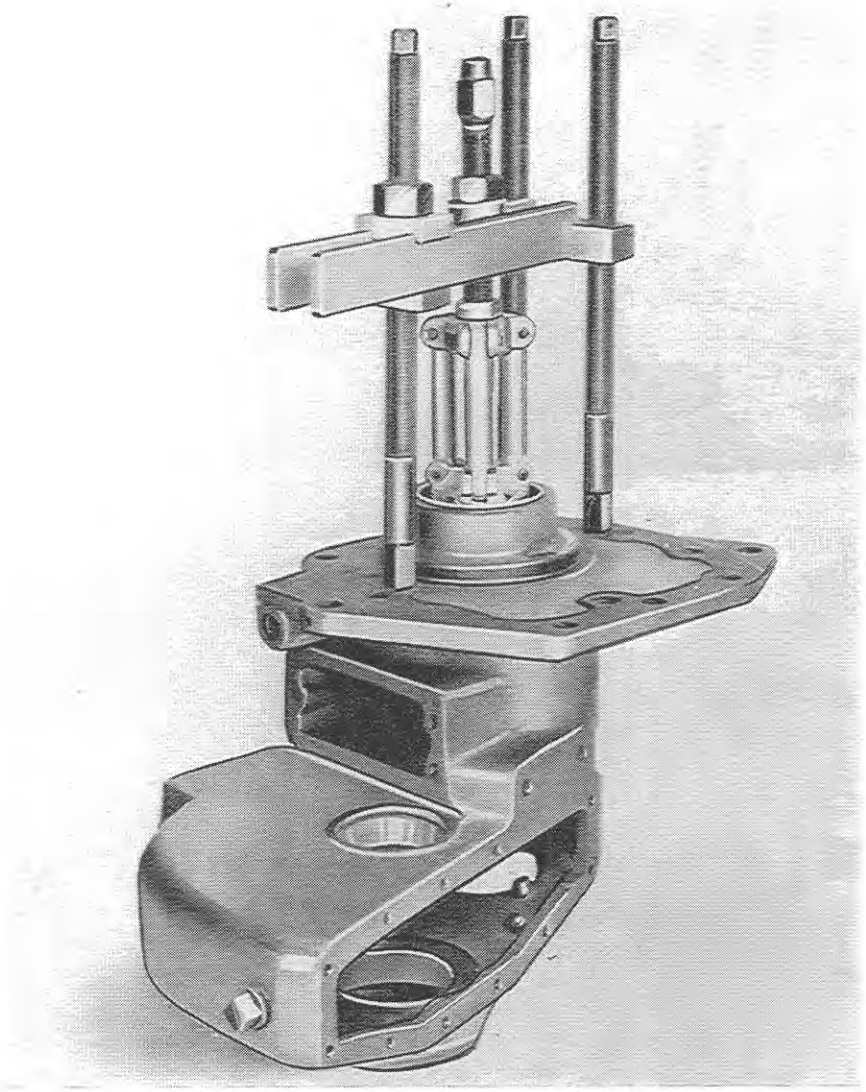
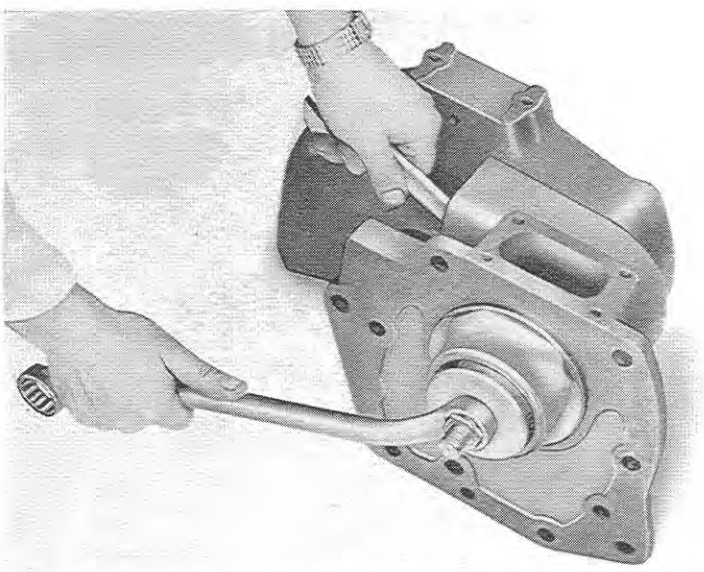


Fig. 19

Fig. 20



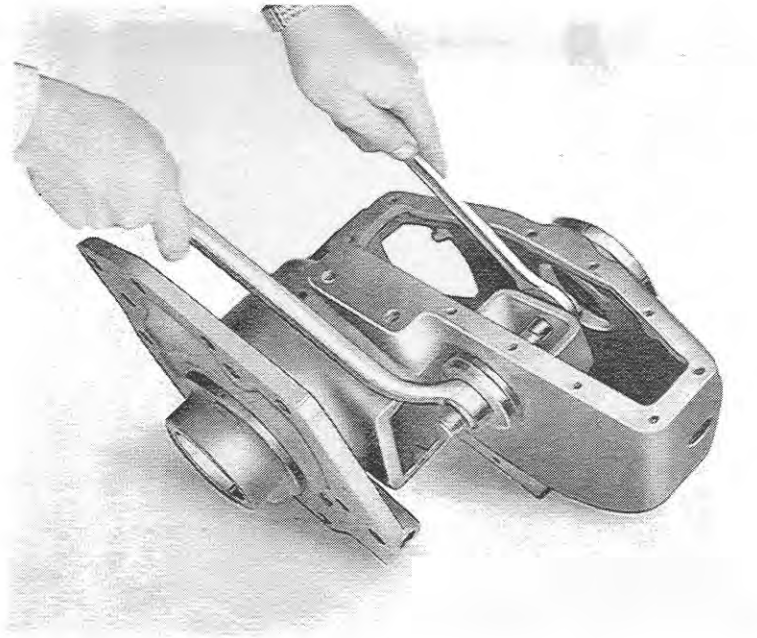


Fig. 21

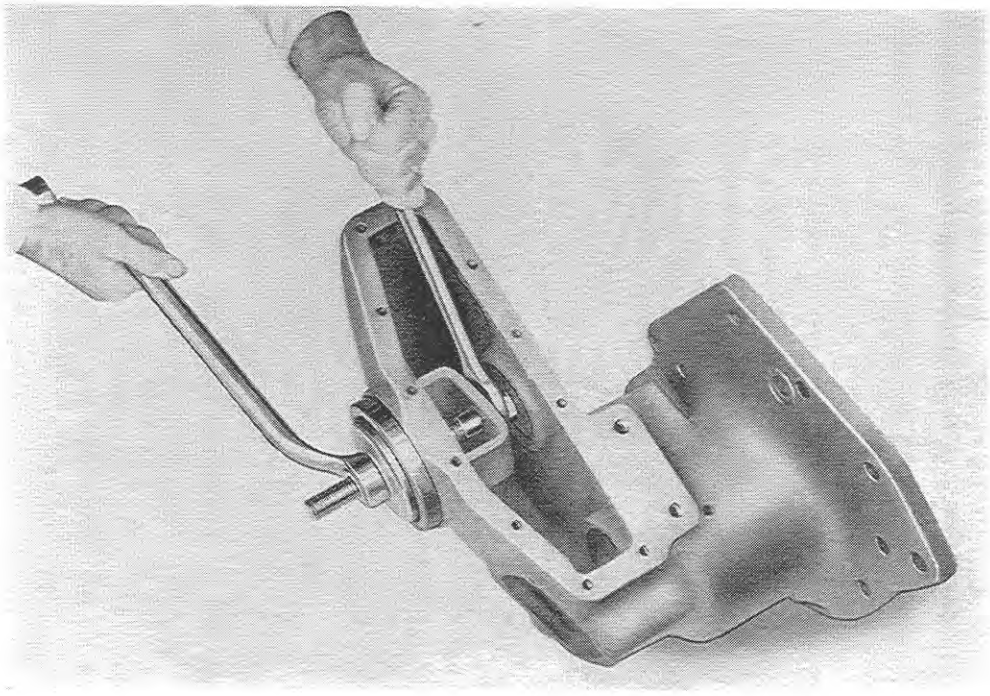


Fig. 22

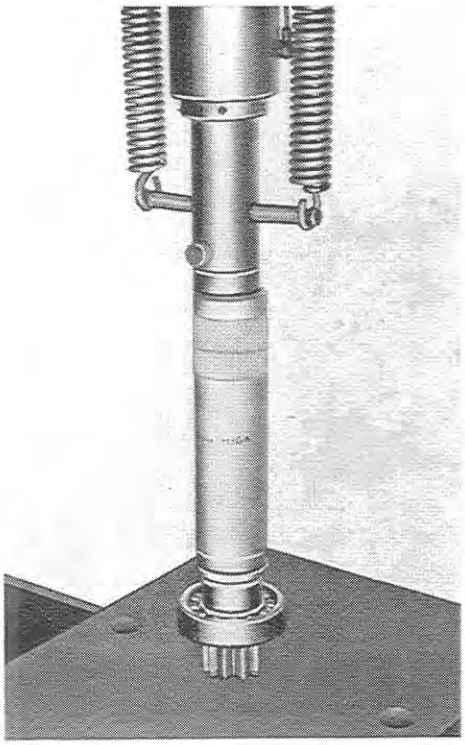


Fig. 23

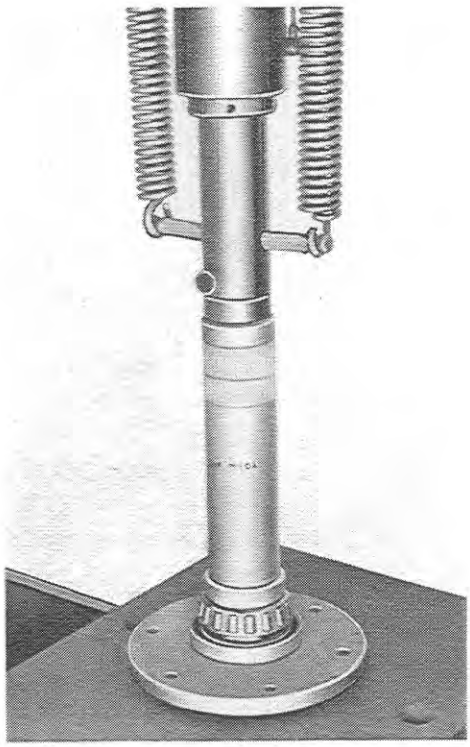


Fig. 24

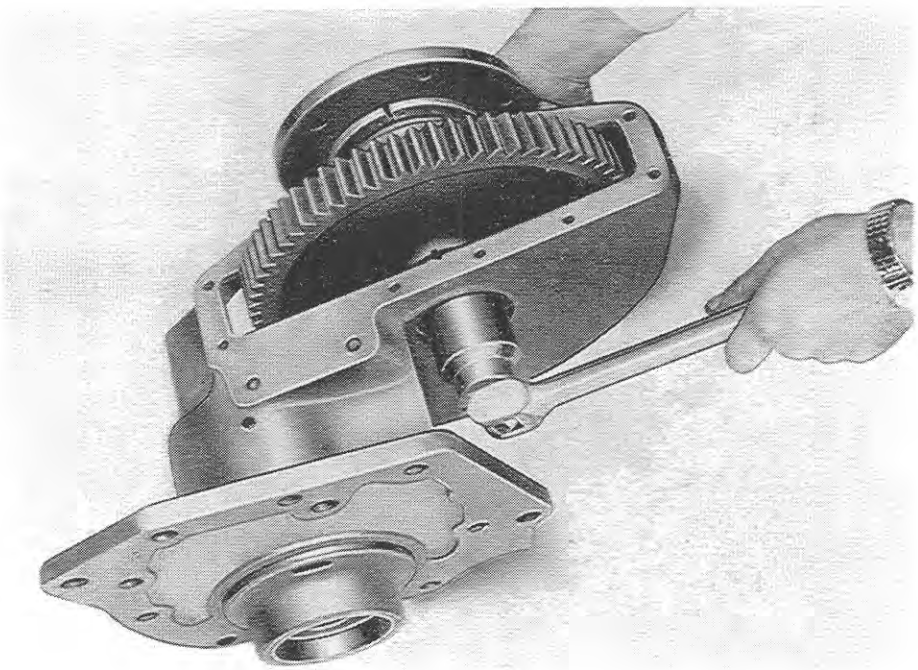


Fig. 25

4) Disengage the brake pulley.
5) Remove the circlip retaining the spacer ring and remove the latter.
6) Check the condition of the ball bearing on the shaft and if necessary remove it by means of a bronze drift.

C — **Dismantling the bearing cups and the oil seals**

Check their condition and if necessary:

1) Remove the wheel axle interior bearing cup by means of special tool MIRA and the stirrup MIDU (Fig. 17) having removed the circlip.
2) Remove the wheel axle outer bearing cup by means of a special tool MICU and the stirrup MIDU (Fig. 18) having removed the circlip.
3) Remove the differential bearing cup by means of a three-legged bearing puller (such as the FACOM LI 28) and a suitable bridge piece (Fig. 19).

OPERATION **J15** REASSEMBLING THE FINAL REDUCTION UNITS

Service Tools Needed: MICA, MICI, MIPO, MICU, MIRA, MIPU, MIRI, MISA, MISO

A — **Fitting the bearing cups and oil seals**

1) Fit the half shaft exterior oil seal (ring gear side) by means of a special tool MIPO fitted to handle MIGA.
2) Fit the half shaft interior oil seal (differential side) by means of special tool MICA fitted on hollow handle MIGA and the protection sleeve MICI. This operation should be carried out after fitting the half shaft.
3) Fit the differential bearing cup by means of special tool MICU and the stirrup MIDU (Fig. 20) after fitting the circlip.
4) Fit the interior taper bearing cup (housing side) by means of special tool MIDU (Fig. 21) and the stirrup after having fitted the circlip.
5) Fit the wheel axle outer bearing cup (wheel side) by means of special tool MICU and the stirrup MIDU (Fig. 22).

B — **Fitting the half shaft**

1) If necessary fit the bearing and the spacer on the shaft by means of a press and the special tool MIPU and the hollow handle MIGA (Fig. 23).
2) Fit the circlip.
3) Fit the half shaft into the housing, fitting at the same time the brake pulley. If the oil seal on the differential side has not been removed, use the protection sleeve MICI on the shaft.
4) Fit the circlip which retains the ball bearing on the half shaft.
5) Replace the cover plate and its four bolts.

C — **Reassembling the wheel axle**

1) If necessary fit the bearing cone on the shaft by means of a press, the socket MIRI and the handle MIGA (Fig. 24). Fit the spacer.
2) Fit the oil seal on the shaft and place the two half washers MISA between the seal and the flange on the shaft.
3) Introduce the rear axle into the housing, fitting the ring gear with its circlip.
4) Place the ring MISO in the interior bearing cup and tighten the shaft retaining nut, thus forcing the oil seal into its location.
5) Remove the half washers MISA and the ring MISO and fit the bearing cone.
6) Tighten the rear axle retaining nut until there is an end float of 0.0024" (0.06 mm) between the bearings.
7) Fit the split pin and the cap which should be smeared with jointing compound.

This operation is identical to Operation J6 - (Differential lock).

OPERATION **J17** FITTING THE AXLE SHAFT HOUSING AND FINAL REDUCTION ASSEMBLIES AND THE DIFFERENTIAL AND ADJUSTING THE MESH OF THE CROWN WHEEL AND PINION

A — **Differential**

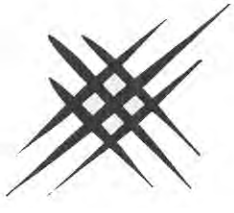
1) Place the differential in the housing.

B — **Left-hand or right-hand axle shaft housing**

1) If the check chain attachment pins have been removed, they should be replaced before fitting the axle shaft housing.
2) Fit a new cork joint, assemble the axle shaft housing on the tractor and fit the assembly bolts.
3) Fit the hydraulic linkage.
4) Couple the brake linkage and fit the return spring.
5) Fit the mudguard on the axle shaft housing by means of its two bolts.
6) Replace the wheel.

C — **Adjusting the mesh between crown wheel and pinion**

This operation is identical to Operation J10 - C (Adjusting the mesh on crown wheel and pinion).
Complete the following operation:
K20 - Replacement of hydraulic lift cover.



HYDRAULIC SYSTEM

LIST OF OPERATIONS

OPERATION **K1** — REMOVAL OF HYDRAULIC LIFT COVER

Preliminary Operations: Q1 - Removal of seat
Service Tools Required: MARU - MIRU

1) On the Vineyard Tractor only. Remove the 4 screws holding the remote control box to the cover. Remove the box and its shaft.
2) Remove the lighting cables from the 2 pole connector.
3) If the linkage is still attached, uncouple the lift rods from the lower links.
4) Lock the lift arms in their raised position.
5) Remove the screws holding the cover to the transmission housing.
6) Put tools MARU and MIRU in place as shown on Fig. 1.
7) Put the studs A and B in place as shown in Fig. 2 and lift the cover slightly and rest it on these studs.
8) Pull the lifting device sharply towards the rear; then tilt the assembly as shown in Fig. 3.

OPERATION **K2** — REMOVAL AND DISMANTLING OF OIL FILTER

1) Clean carefully the outside of the filter and the area around it.
2) Slacken off the cover (Fig. 4 - B).
3) Remove the cover A and its tube by removing the 2 fixing screws.
4) Remove the filter body.
5) Remove the cover B, the filter element and its spring.

OPERATION **K3** — DISMANTLING OF CONTROL SPRING

Preliminary Operations: K1 - Removal of hydraulic lift cover

1) On the high clearance tractor only, remove the two pins holding the control beam and remove it.
2) Uncouple the control rod (Fig. 5 - A) from the control beam by removing the screw.
3) Remove the stop bracket B by removing its two screws.
4) Unscrew the two allen screws from stirrup C and remove.
5) Knock out the pivot pin of the control beam.
6) Unscrew the two spring fastening nuts, remove the spring and holding plate.

OPERATION **K4** — DISMANTLING OF LIFT SHAFT AND TRANSPORT LOCK

Preliminary Operations: K1 - Removal of hydraulic lift cover

1) Uncouple the position control cam return spring.
2) Uncouple the auxillary valve control rod.
3) Slacken the screws holding the auxillary valve and position control cams to the lift shaft (Fig.6 - A and B).
4) At one end of the lift shaft remove the clamping bolts and washers.
5) Remove the lift arms.
6) Pull out the lift shaft.
7) Extract the two bushes and "O" ring which remain in the housing on the opposite side to the side from which the shaft was removed (on the side from which the shaft was removed, the two bushes and "O" ring come away with the shaft).
9) Knock out the groove pin D (Fig. 6) retaining the transport lock in the housing.
10) Take out the lock and remove the ball and its spring.

OPERATION **K5** REMOVAL OF PUMP

Preliminary Operations: K1 - Removal of hydraulic lift cover

1) Remove the control spring from the oil feed pipe.
2) Remove the oil feed pipe by withdrawing it towards the rear.
3) Take off the two bolts fastening the pump to the lift cover then withdraw the pump by pulling vertically.

NOTE: The pump should not be dismantled because internal components are matched and special precautions have to be taken during re-assembly. Internal parts are not supplied as serviceable parts.
Never apply force to the end of the pump shaft or the internal steel gears will damage the aluminium body.

OPERATION **K6** REMOVAL OF CONTROL VALVES AND CYLINDER ASSY.

Preliminary Operations: K1 - Removal of hydraulic lift cover

1) Unscrew the 2 screws holding the hand lever quadrant and remove.
2) Remove the 2 valve lever return springs.
3) Remove the screw holding the oil feed pipe and remove it by withdrawing it backwards.
4) Uncouple the secondary valve control rod.
5) Slacken off the clip (Fig. 7 - C) holding the transfer tube and pull it out rearwards from the cylinder assy.
(There may be clight resistance due to the "O" rings fitted to the tube inside the cylinder).
6) Remove the sensitivity adjustment lever (right side of transmission housing) by unscrewing the two allen screws, and then unscrewing the lever itself.
7) On tractors equipped with an oil cooler (hot climates only) unscrew plug A (Fig. 7) and remove the by-pass assembly.
8) Withdraw the "Response" adjustment lever assembly (on top of the transmission housing) by unscrewing the "Allen" screw and removing the retaining circlip.
9) Remove the oil suction pipe (fixed to the left side of the housing) by removing the 2 fixing screws.
10) Unscrew the nut from the rod (Fig. 5 - A) on the control beam, and pull the rod rearwards.
11) Slacken off the "stop" screw at the end of the cylinder (Fig. 7 - B).
12) Unscrew the 3 screws and remove the cylinder assembly from the hydraulic cover.
13) Remove the cams and valve control levers.

OPERATION **K7** DISMANTLING OF CONTROL VALVES AND CYLINDER ASSY.

Preliminary Operations: Q1 - Removal of seat
K6 - Removal of control valves and cylinder assembly

1) Remove the valve cover. Take care not to let the valves spring out.
2) Remove the primary and secondary valve and their springs.
3) Remove the plug and "O" ring to release the regulating valve assembly (Fig. 8).
4) Remove the needle valve of the sensitivity control as well as its spring and spring seat washer.
5) Remove the plug to release the non-return valve and spring. The ball must be extracted from the body of the cylinder.

NOTE: The non-return valve is situated between the two valves (on the cam side).

6) Remove the piston from the cylinder, using compressed air if necessary. Remove the seal from the piston.

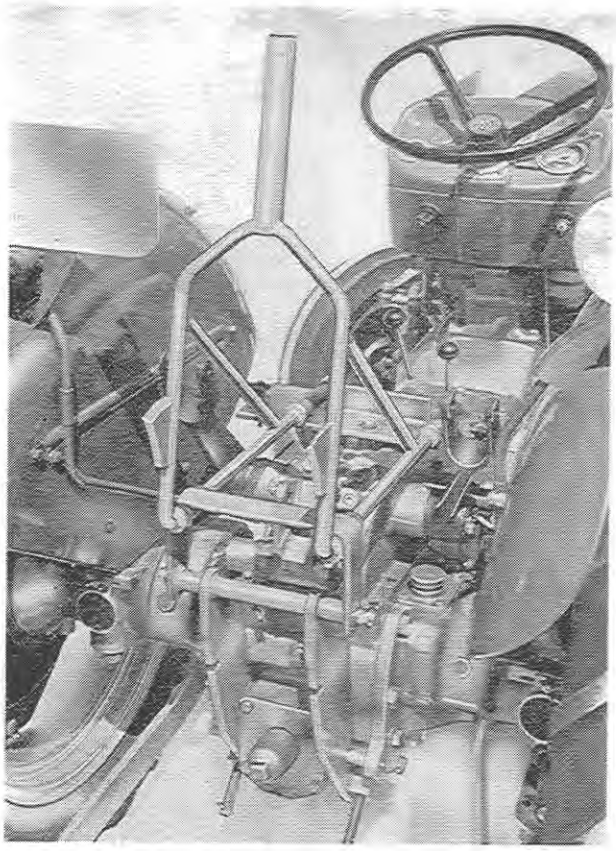
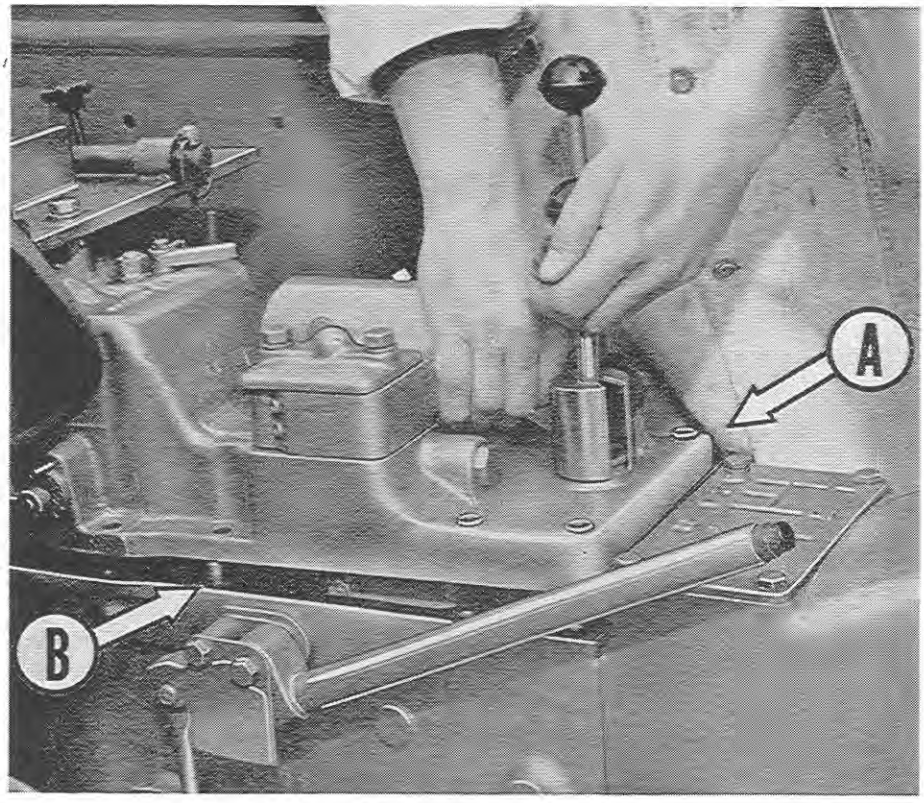


Fig. 1

Fig. 2



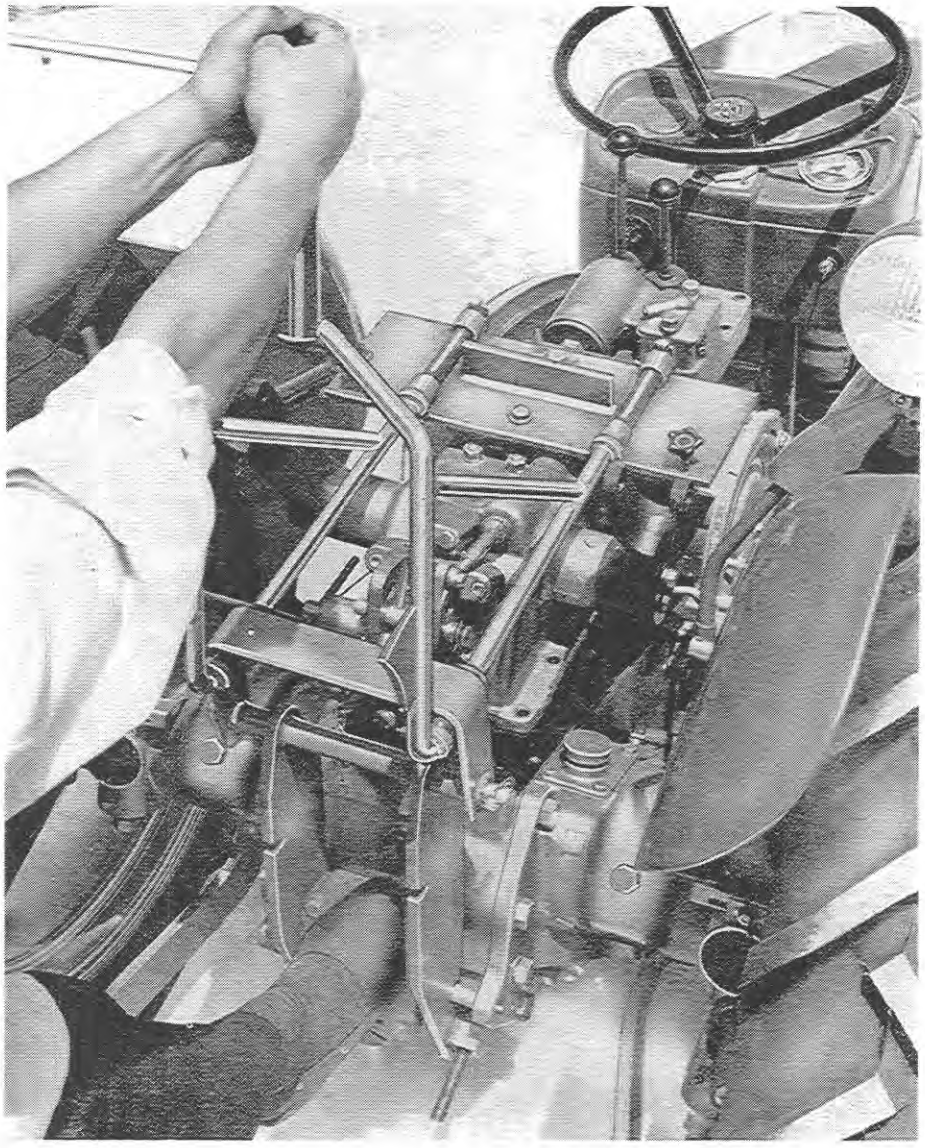


Fig. 3

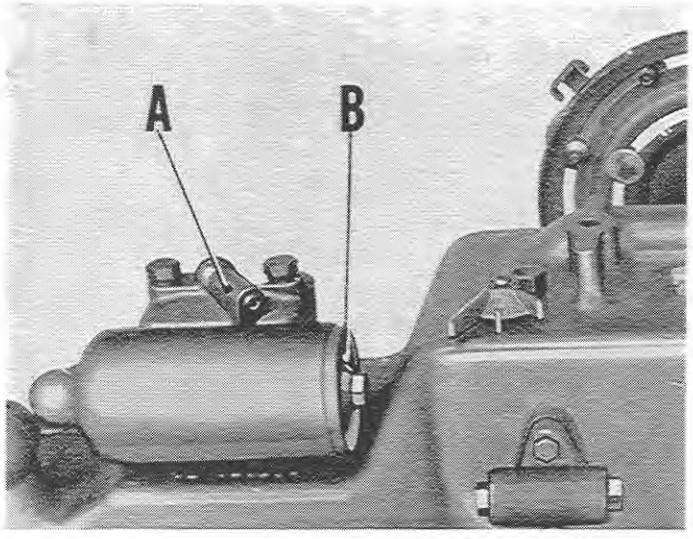


Fig. 4

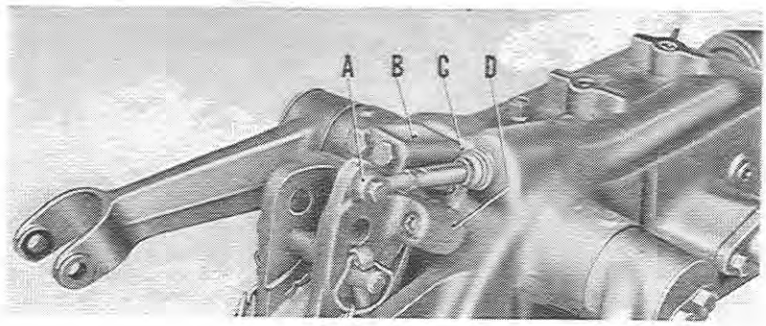


Fig. 5

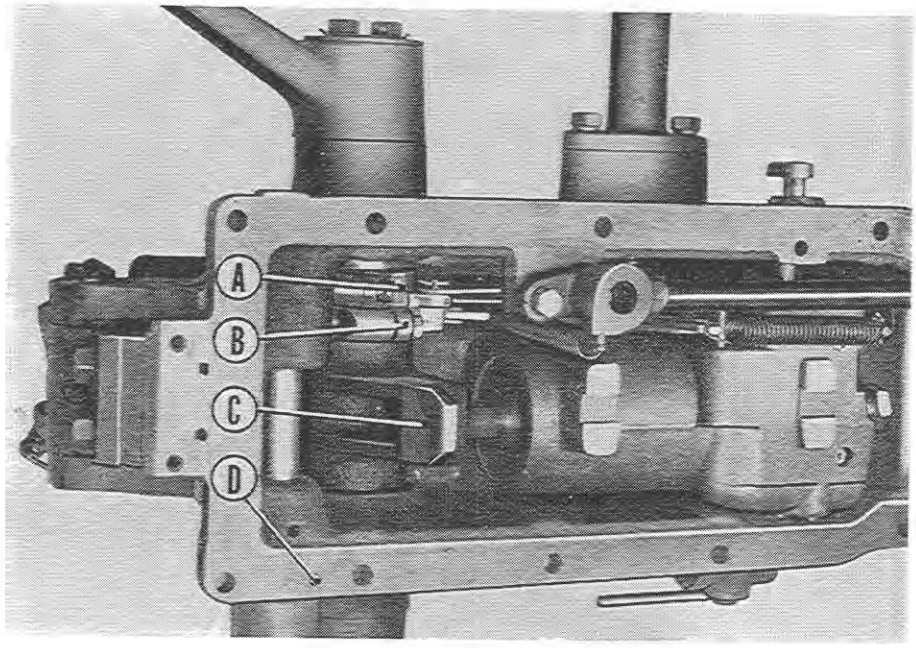


Fig. 6

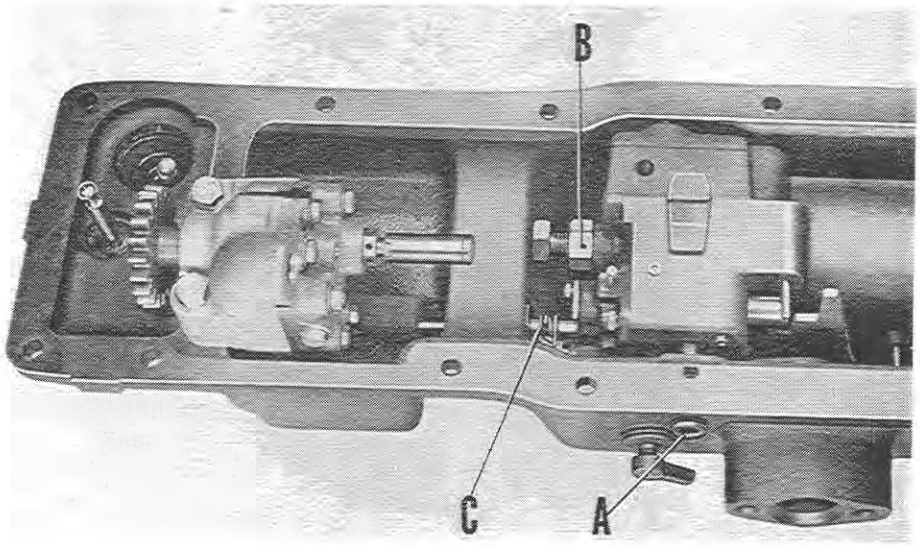


Fig. 7

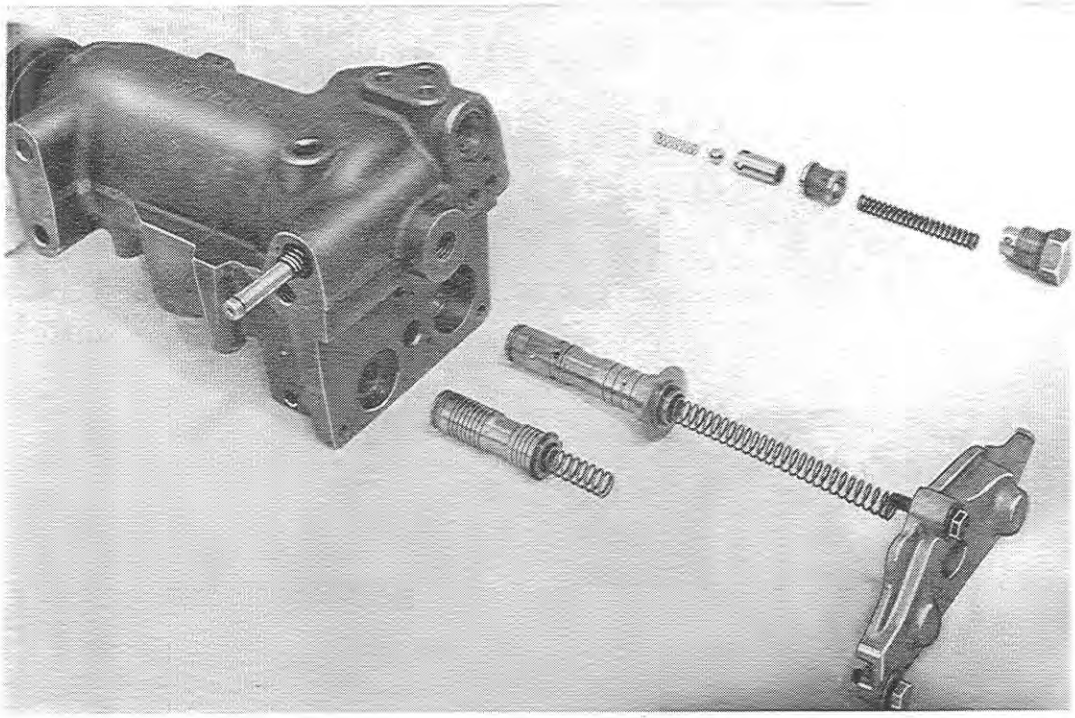


Fig. 8

Fig. 9

OPERATION **K8** RE-ASSEMBLY OF CONTROL VALVES AND CYLINDER ASSY

Special Tools Required: MINU - MINO

Before assembly clean all parts carefully in fresh oil, dry the cylinder assembly with compressed air.

1) Put a new joint in place on the piston using tool MINU.
   Take Care to position the joint correctly (Fig. 9).
2) Fit the piston into the cylinder assembly using tool MINO (Fig. 10).
3) Fit the non-return valve as follows:—
   — fit the ball in position,
   — the valve seat and its spring,
   — the plug fitted with a new "O" ring.
4) Fit the response adjustment lever, the rod of which must be fitted with two new "O" rings, the spring seat washer and the spring.
5) Re place the regulating valve assembly as follows (Fig. 8):
   — place the small spring in the bottom of the valve orifice,
   — place the ball,
   — place the valve and its liner referring to Fig. 8,
   — place the spring and the plug fitted with a new "O" ring.
6) Fit the primary and secondary valves in place, together with their respective springs (Fig. 8).
7) Refit the valve cover and tighten up the three assembly screws.
8) K9 - Replacement of control valves and cylinder assembly.

OPERATION **K9** REPLACEMENT OF CONTROL VALVES AND CYLINDER ASSY

1) Assemble the cams as shown in Fig. 11, and fit them to the cylinder (Fig. 12).
2) Position the cylinder in the hydraulic cover, with the cams positioned as shown in Fig. 13.
3) Couple the secondary valve control rod.
4) Put the hand control quadrant in place and fix it with its two screws.
5) Fit the control beam tube in its guide and fix it to the control beam with its screw.
6) Fix the cylinder assembly with its three nuts.
7) Block the cylinder assembly in place with the bolt and with the lock nut (Fig. 7 - B).
8) Put the oil suction pipe in place with new "O" rings on the transfer pipe and between the cylinder body and the cover. Tighten the two screws.
9) Fit in place the response control lever (on the top of the cover) and fix it by means of the pointed screw and circlip. To do this, it is necessary to push slightly on the valve rod from the cylinder side so as to have sufficient room on the hand lever side to place the circlip and the screw.
10) Put the sensitivity control lever in place (on the right side of the housing) and fix it with its two screws.
11) Where a tractor is equipped with an oil cooler (hot climat only). Put the by-pass assembly and plug in place (Fig. 14).
12) Fit in place the oil transfer pipe from the pump to the cylinder and tighten the collar.
13) Fit the oil suction pipe into the pump and fix it with its screw.
14) Put in place the two return springs for the valve control levers.
15) Complete the following operations:
    K14 - Adjustment of Control Quadrant.
    K15 - Adjustment of Position Control.
    K16 - Adjustment of Draft Control.
    K17 - Adjustment of Sensitivity Valve.
    K20 - Replacement of Hydraulic Lift Cover.
    Q18 or 20 - Refitting of Seat.

1) Check the condition of the drive gear, the key (it should be possible to fit the gear without effort), and the locating studs of the pump.
2) Check with an injector tester pump (Fig. 15), the safety valve (1,990 p.s.i - 140 kg/cm²) (Fig. 16 - A).
3) Fit a new "O" ring to the free end of the transfer tube B.
4) Put the pump in place and fix it with its two screws tightened to a torque of 50 ft/lb (7 m/kg).
5) Put the suction tube in place.
6) Fit the position control return spring to the suction tube.
7) Complete the following operations:
   K20 - Replacement of Hydraulic Lift Cover.
   Q17 or 20 - Refitting of Seat.

OPERATION **K11** REPLACEMENT OF LIFT SHAFT AND TRANSPORT LOCK

1) Put the transport lock in position taking care to position correctly the spring and the ball.
2) Fit the groove pin holding the transport lock in position.
3) Put the bushes in place, together with the "O" rings, one of which is placed between each pair of the bushes. Ensure that the "O" rings are in good condition.
4) Position the two cams and the ram arm in the housing, with their tightening bolts towards the rear (the cam with a fixing stud should be on the extreme right).
5) Fit the lift shaft to the housing, the ram arm and the two cams. (As the shaft has a double spline, there is no possibility of fitting it incorrectly.)
6) Fit the lift arms.
7) Put in place the washer and two screws with their locking plates on each lift arm.
8) On one arm only, tighten the two screws and lock them.
9) On the other arm, tighten the screws until both lift arms can still fall under their own weight.
10) Lock the screws.
11) Complete the followings operations:
    K15 - Adjustment of Position Control.
    K18 - Adjustment of Transport Lock.
    K20 - Replacement of Hydraulic Lift Cover.
    Q18 or 20 - Refitting of Seat.

OPERATION **K12** REPLACEMENT OF CONTROL SPRING

1) Put the leaf spring in place as well as its folding plate and fix with the two nuts.
2) Put the control beam in place and fit its articulating pin.
   NOTE: To obtain correct tightening, it is recommended to change this pin after the second disassembly.
3) Fit the stirrup C (Fig. 15), to the control beam by means of the two Allen screws.
4) Put the stop braket B in place.
5) Put the control rod in place and fix it to the control beam.
6) Carry out operations.
7) Complete the followings operations:
   K16 - Adjustement of Draft Control.
   K20 - Replacement of Hydraulic Lift Cover.
   Q18 or 20 - Refitting of seat.

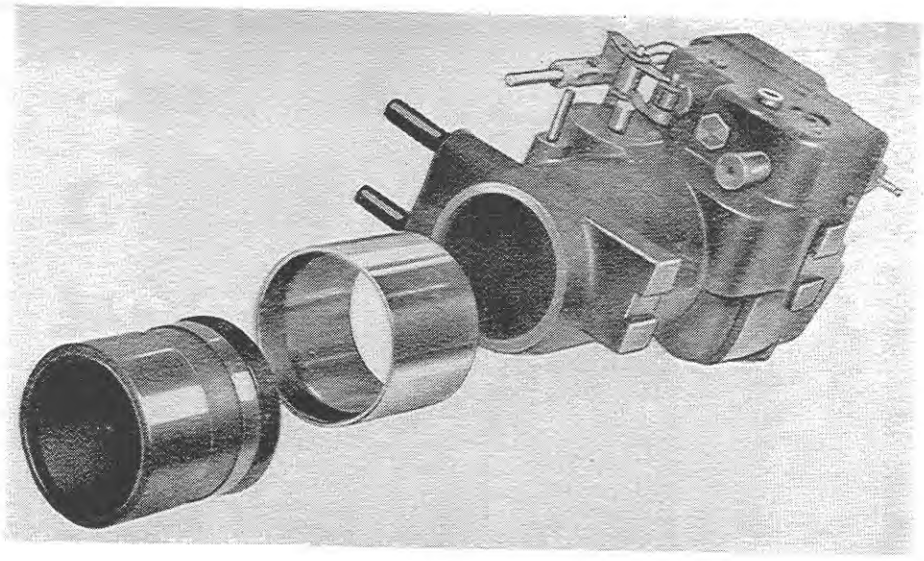


Fig. 10

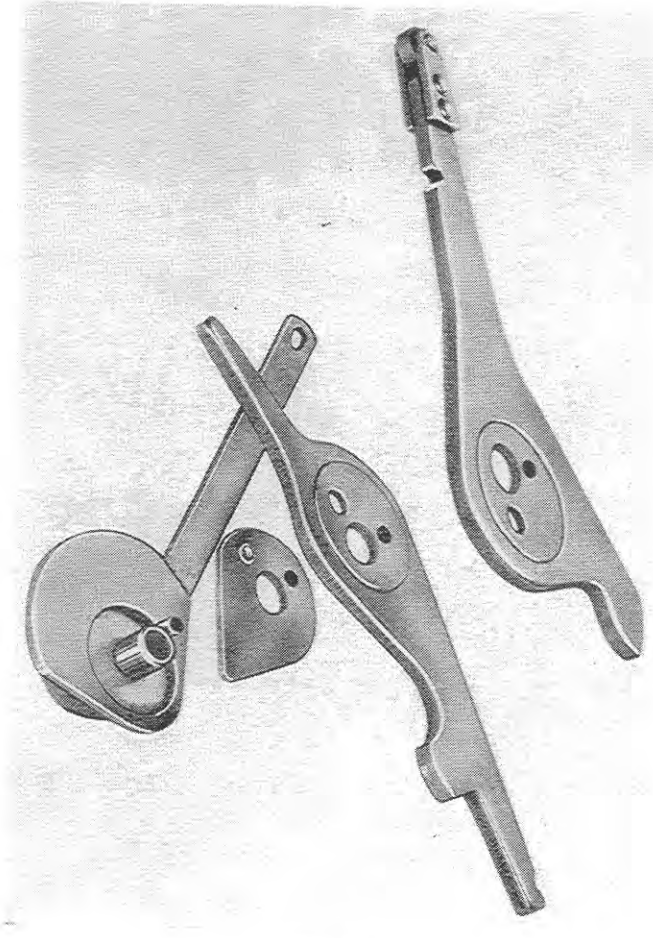


Fig. 11

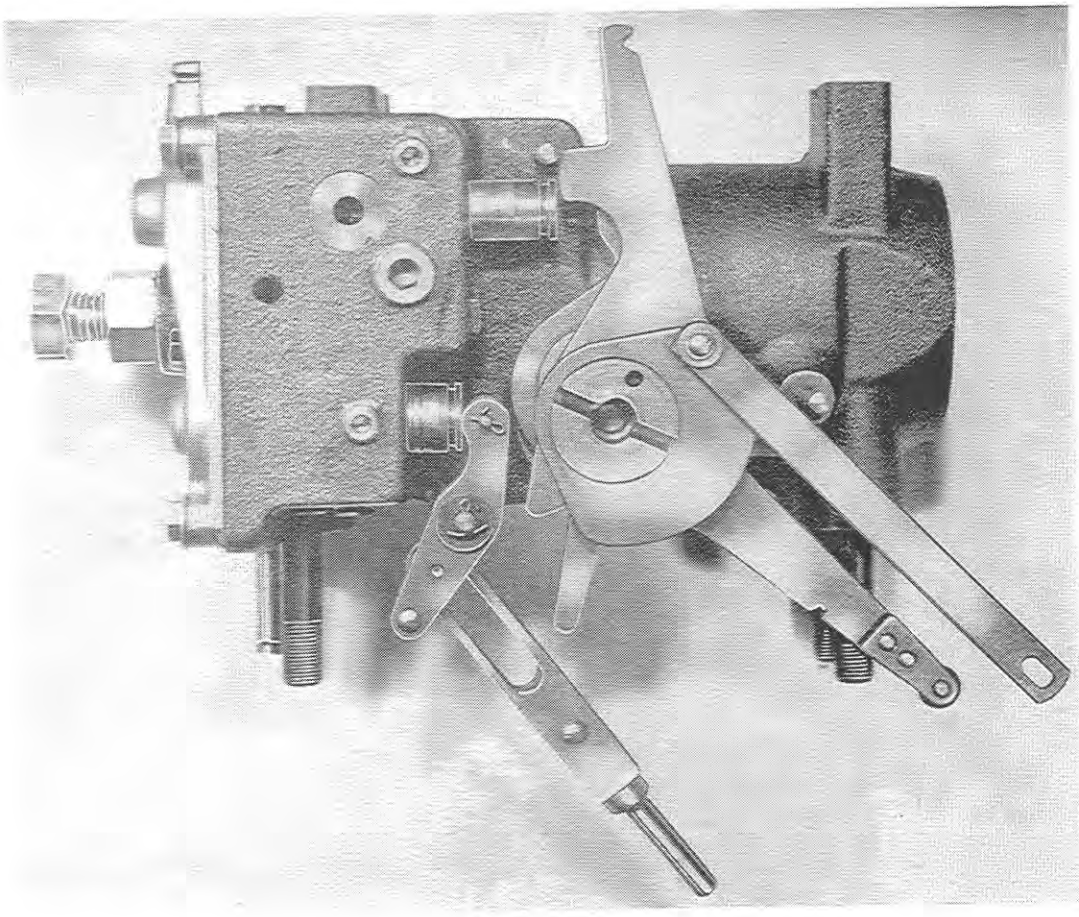


Fig. 12

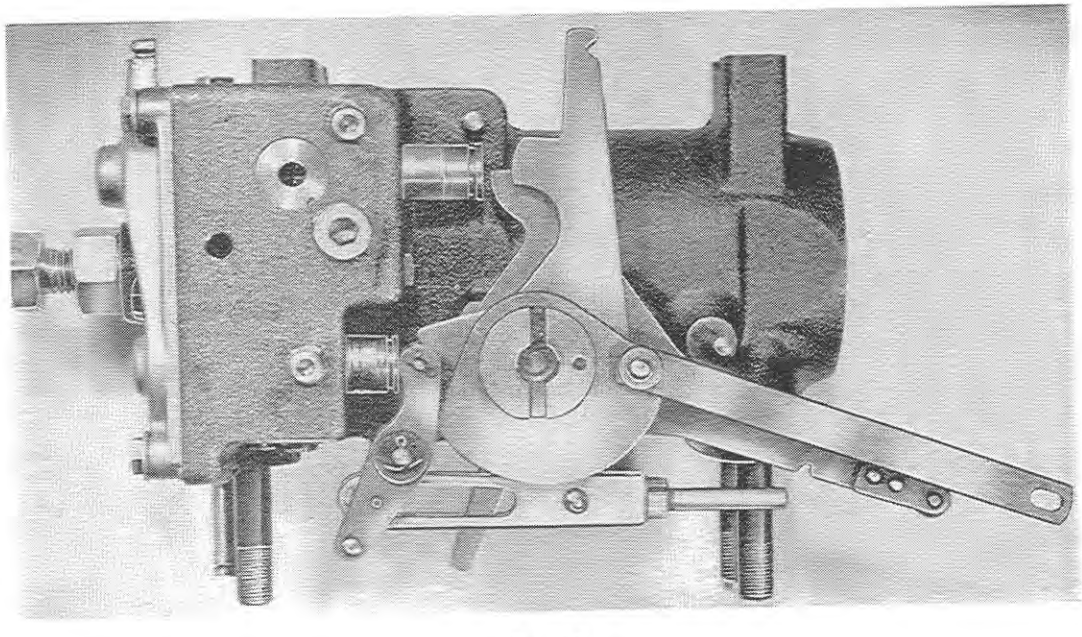


Fig. 13

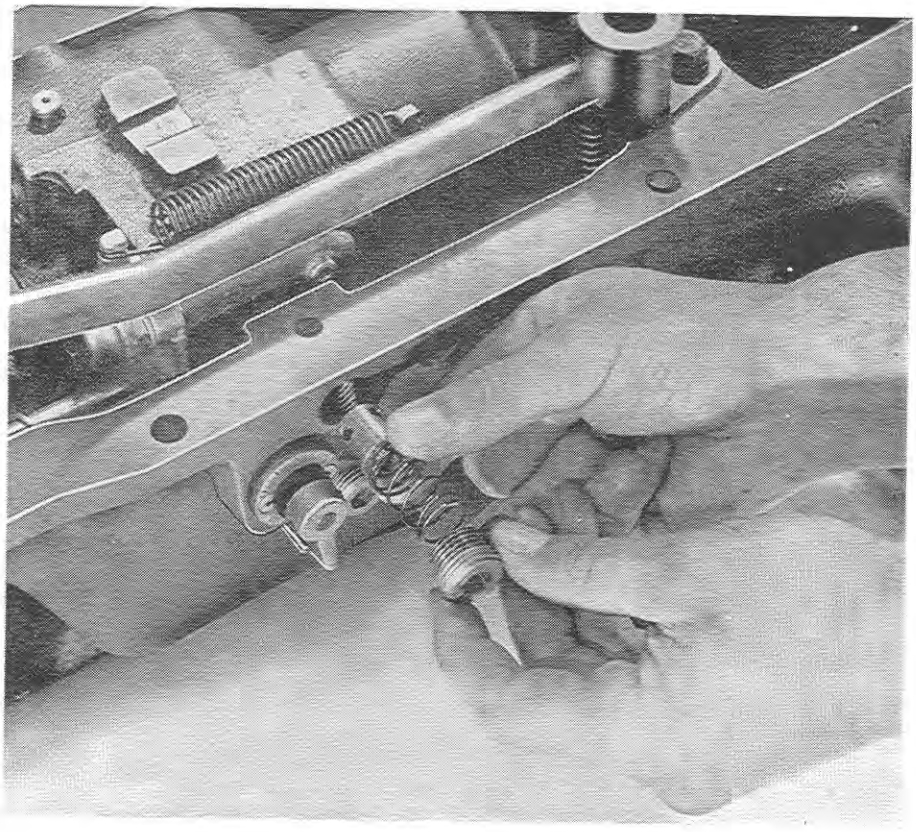


Fig. 14

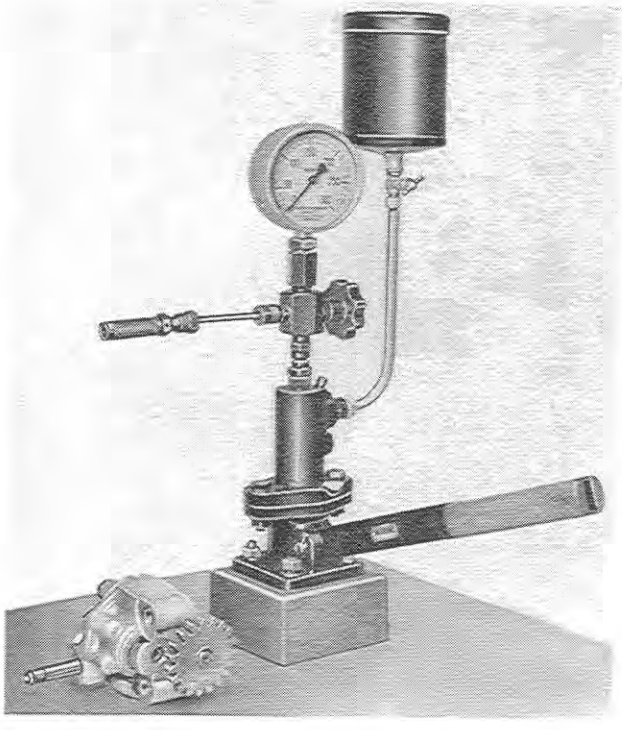


Fig. 15

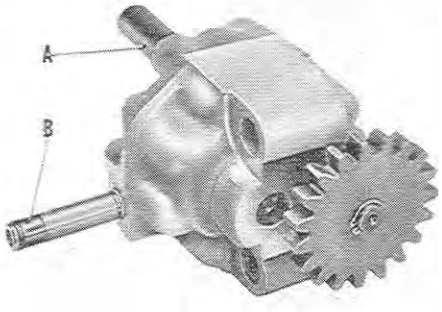


Fig. 16

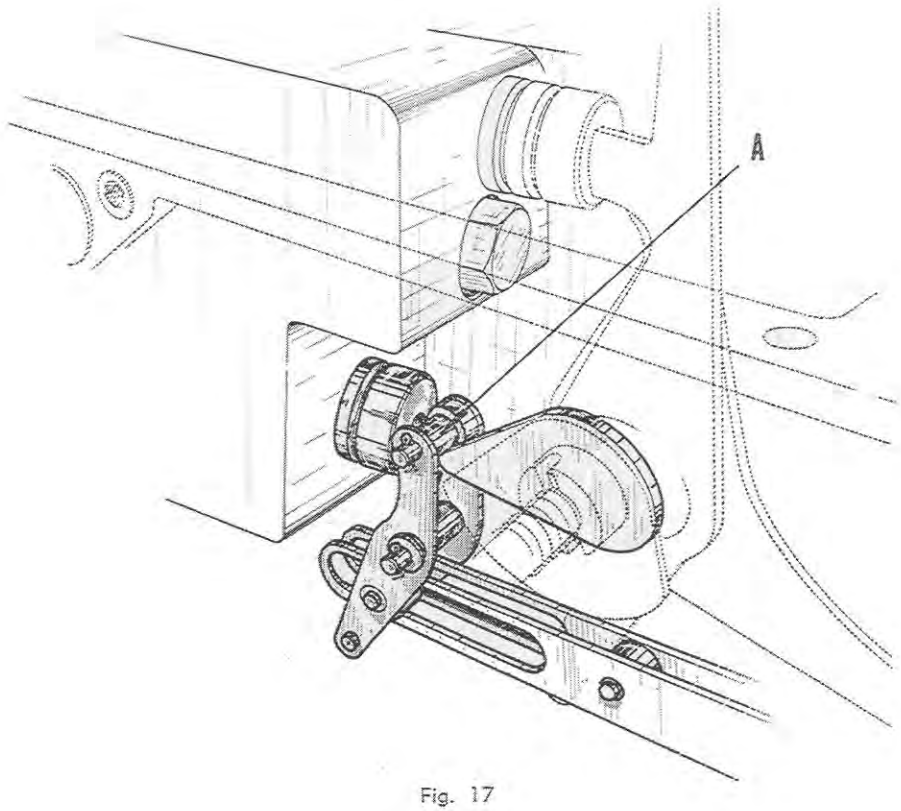


Fig. 17

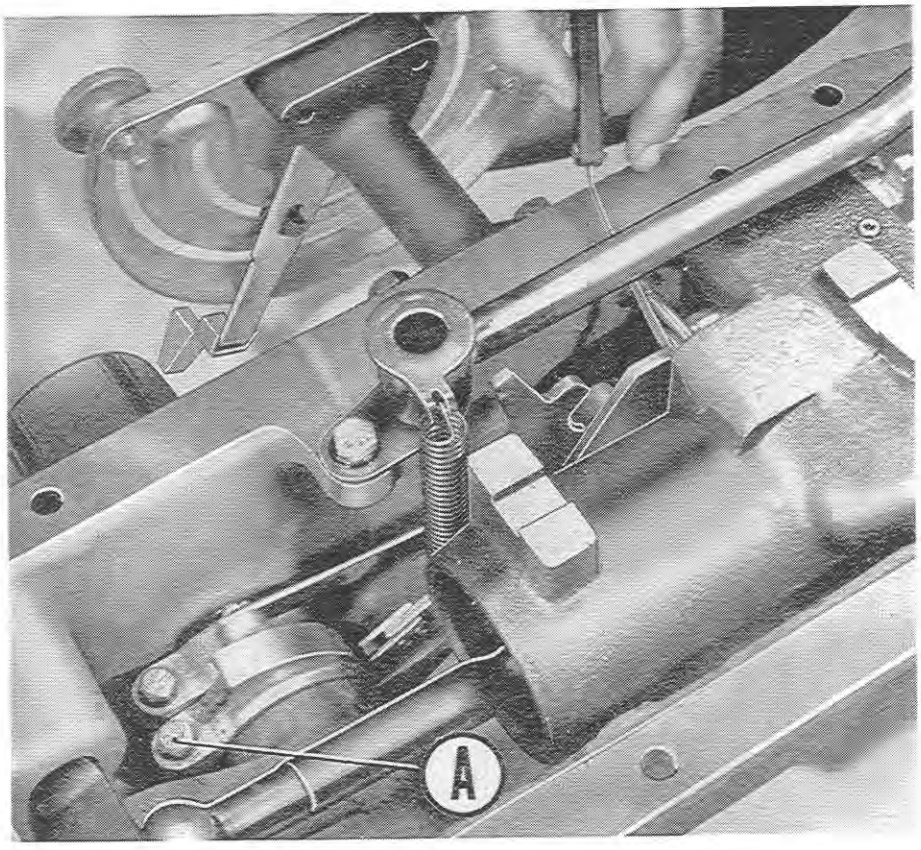


Fig. 18

OPERATION **K13** RE-ASSEMBLY AND REPLACEMENT OF OIL FILTER

1) Fit a new filter element and the spring in the filter body.
2) Check the condition of the "O" ring of the cover and screw this into thl filter body.
3) Fit a new "O" ring on the exposed extremity of the transfer tube.
4) Ensure that the contact surfaces of the filter body, the hydraulic cover and the transfer plate are undamaged and perfectly clean.
5) Fit a new "O" ring to the transfer plate in the orifice leading to the filter.
6) Put the filter body and the transfer plate fitted with its tube in place.
7) Tighten the filter body fixing screw to a torque of 50 ft/lb (7 m/kg).
8) Tighten the cover on the filter body.

OPERATION **K14** ADJUSTMENT OF CONTROL QUADRANT

Preliminary Operations: Q1 - Removal of seat
K1 - Removal of hydraulic lift cover

1) Place the hydraulic hand lever in the rear notch (raised position in the position control zone).
2) Ensure that the secondary valve slides easily.
3) Slacken off the two screws holding the quadrant to the support.
4) Turn the quadrant anti-clockwise until the acute angled cam comes in contact with the roller of the secondary valve. This should not move (Fig. 17).
5) Retighten the two quadrant fixing screws.
6) Check the adjustment by placing the hand control lever in the front notch (upper position of the depth control zone). The pointed cam should be in contact with the roller of the secondary valve, but on the other side.
7) Complete the followings operations:
   K20 - Replacement of Hydraulic Lift Cover.
   Q18 or 20 - Refitting of Seat.

   NOTE: For the vineyard tractor, the adjustments are the same, having fitted the remote control box.

OPERATION **K15** ADJUSTMENT OF POSITION CONTROL

Preliminary Operations: Q1 - Removal of seat
K1 - Removal of hydraulic lift cover

1) Place the hydraulic hand lever in the rear notch (raised position in the position control zone).
2) Put the lift arms in their maximum raised position (ram arm in contact with the housing).
3) Ensure that the primary valve slides freely.
4) Slacken off the tightening screw A (Fig. 18) of the cam, fitted on the left shaft.
5) Turn the cam one way or the other to obtain a clearance of 0.002 (5/100) between the lever and the primary valve (Fig. 18).
6) Tighten the fixing screw.
7) Complete the following operations:
   K20 - Replacement of hydraulic Lift Cover.
   Q18 or 20 - Refitting of Seat.

OPERATION **K16** — ADJUSTMENT OF DRAFT CONTROL

Preliminary Operations: Q1 - Removal of seat
K1 - Removal of hydraulic lift cover

1) Put the hand control lever in the front notch (upper position of draft control zone).
2) Bring the control spring into contact with the rear face of its stop bracket by means of a long screw replacing the Allen screw which attaches the stirrup (Fig. 19). Stop tightening as the spring is in contact.
3) Slacken off the lock nut B of the control rod A and lengthen or shorten it to obtain a clearance of 0.002" (5/100) between the depth control lever and the primary valve (Fig. 20).
4) Tighten the lock nut.
5) Complete the following operations:
   K20 - Replacement of Hydraulic Lift Cover.
   Q18 or 20 - Refitting of Seat.

OPERATION **K17** — ADJUSTEMENT OF SENSITIVITY VALVE

(Lever situated on the right side of the hydraulic lift cover)

1) Remove the hand lever from the rod by unscrewing the Allen screw.
2) By hand, screw in the rod as far as it will go.
3) Replace the hand lever on the rod placing it 0.11" (3 mm) from the rear face of the stop and tighten the Allen screw.

OPERATION **K18** — ADJUSTMENT OF TRANSPORT LOCK

Preliminary Operations: Q1 - Removal of seat
K1 - Removal of hydraulic lift cover

1) Place the lift arms in their maximum raised position with a shim or spacer of 0.09" (2.4 mm) fitted between the ram arm and the housing (Fig. 21).
2) Loosen the set screw clamping the secondary valve control collar mounted on the lift shaft (Fig. 22).
3) Turn the collar to push the valve into the distributor.
4) Turn the collar slowly backwards and stop just at the moment where the valve is released.
5) Tighten the locking screw.
   To check adjustment.
   — put the lift arms in their lowered position,
   — raise them slowly and stop at the moment the secondary valve is pushed out of the distributor by its spring. In this position the ram arm should touch the 0.09" (2.4 mm) shim and it should be possible to apply the transport lock.
6) Complete the following operations:
   K20 - Replacement of Hydraulic Lift Cover.
   Q18 or 20 - Refitting of Seat.

OPERATION **K19** — ADJUSTMENT OF CONTROL SPRING

This adjustment is made in the factory and should not be modified.

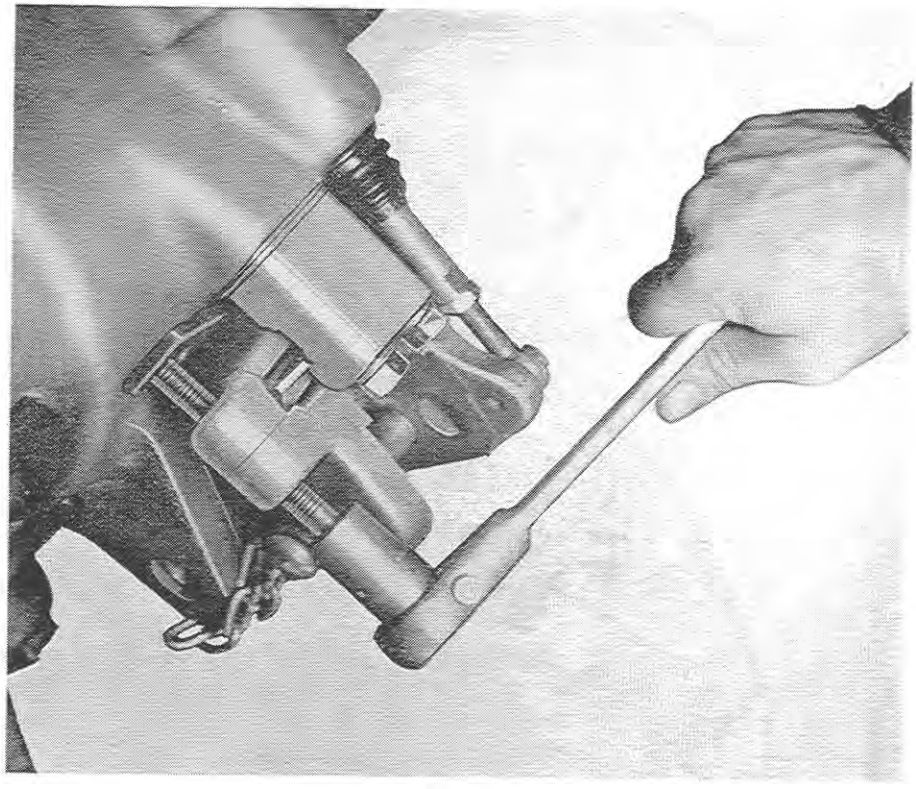


Fig. 19

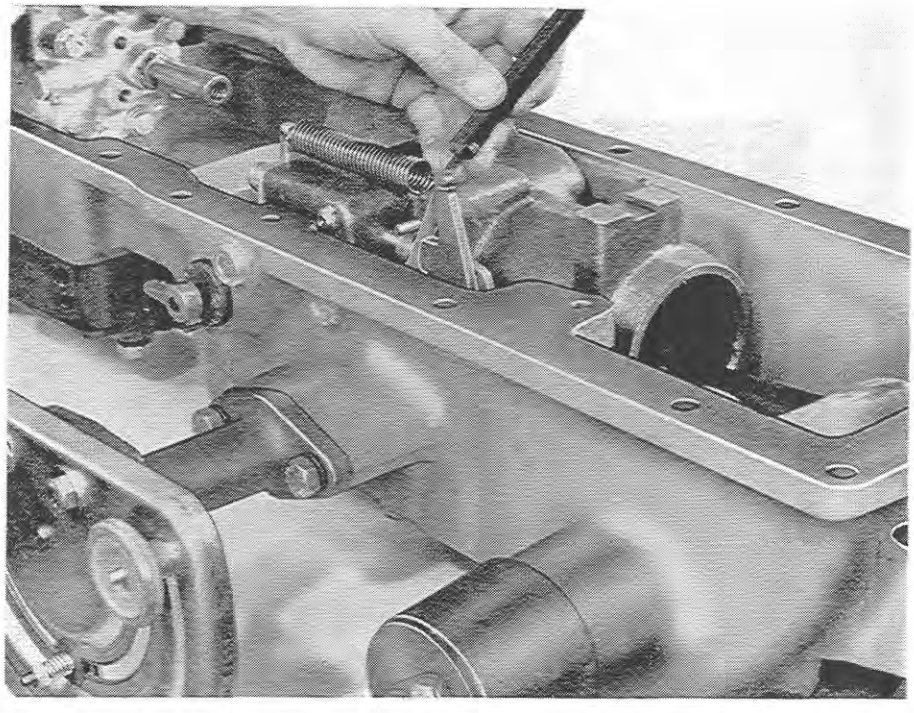


Fig. 20

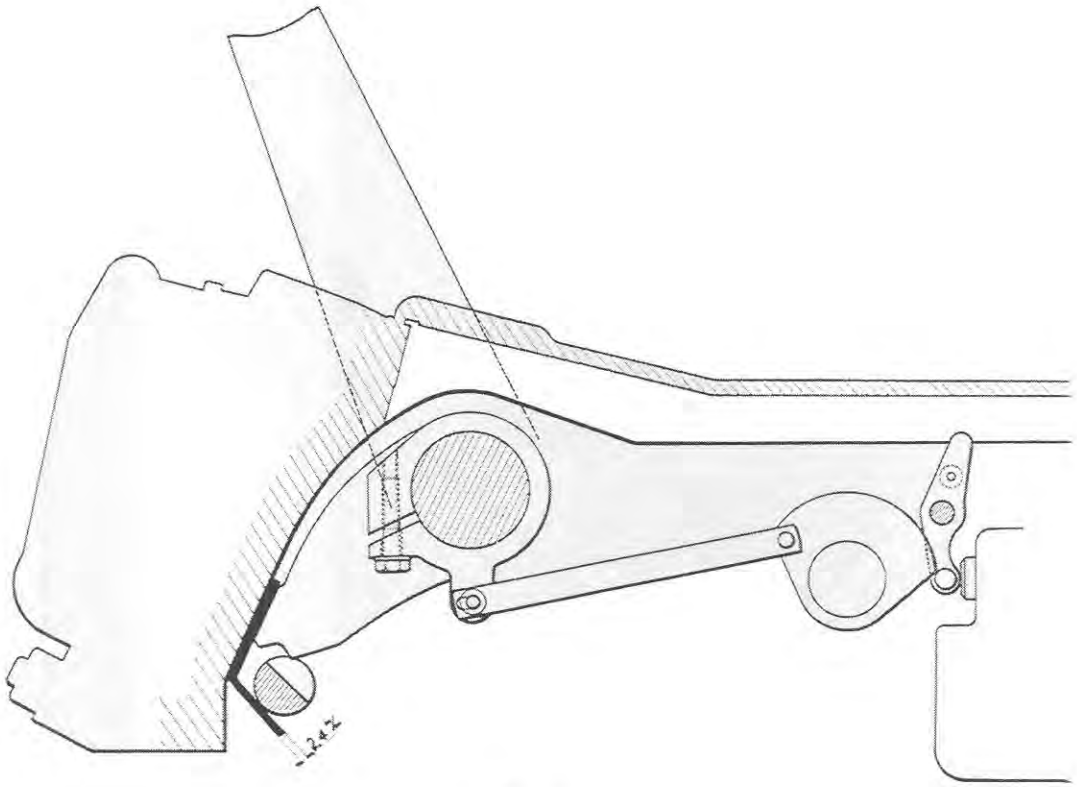


Fig. 21

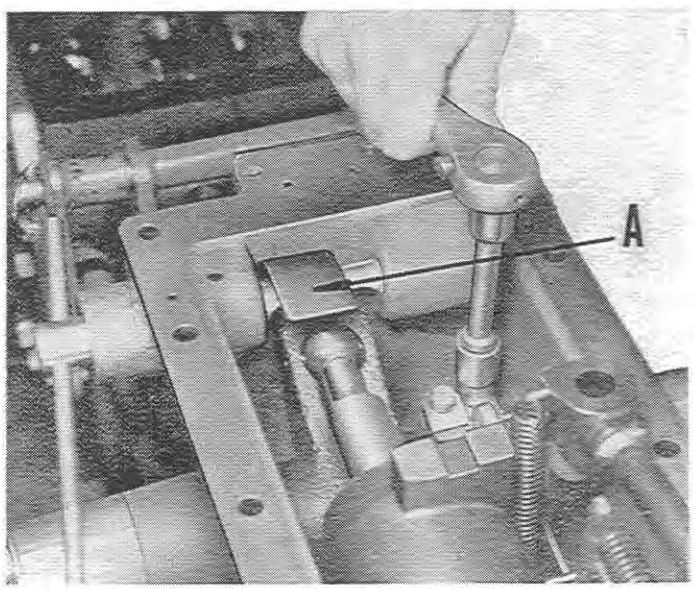


Fig. 22

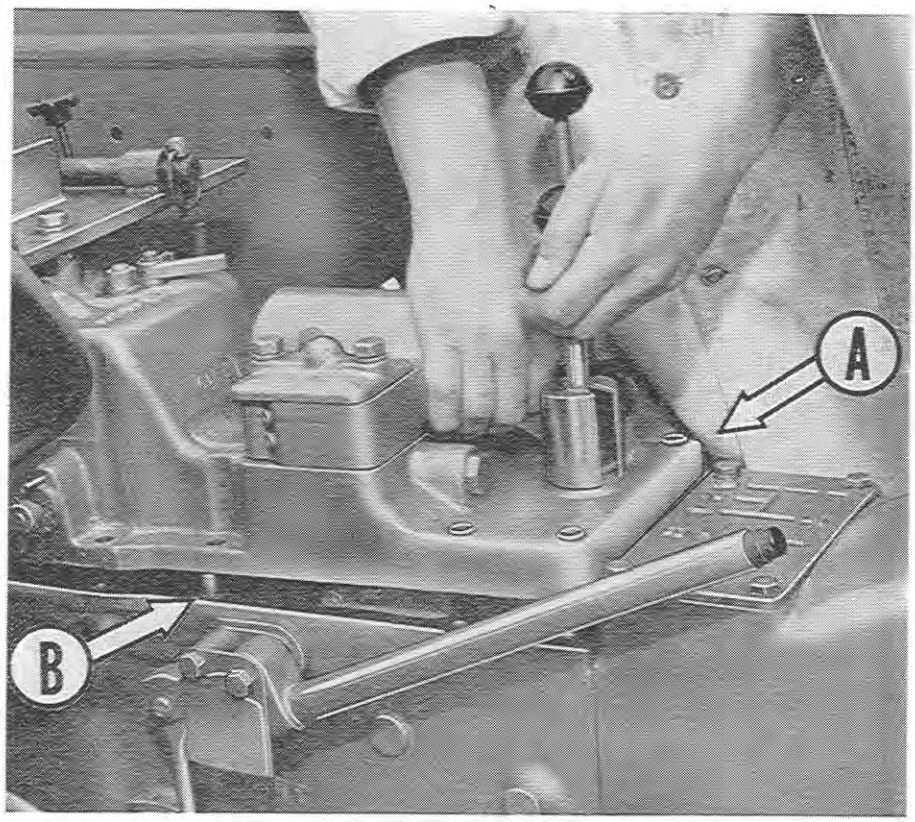
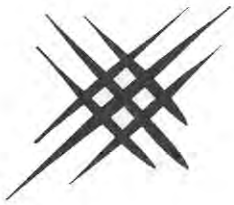


Fig. 23

Service Tools Required: MARU - MIRU

1) Fit a new joint which has been smeared with oil.
2) Fit in the rear extreme holes of the transmission housing, the two locating studs supplied with the hydraulic cover lifter. The purpose of these two locating studs is:
    a) to hold the joint in place,
    b) to hold the housing before it is finally tightened in place,
    c) to position the hydraulic lift cover correctly on the transmission housing.
3) Put over the high/low gear lever, the special cover as shown in Fig. 23.
4) Swing the cover over forwards making sure that it rests on the top of the two locating studs fitted to the transmission housing.
5) Ensure that the driven gear of the pump engages correctly with the drive gear of the gearbox, then lift the front of the hydraulic cover by means of the gear levers and then lower the cover gently in place on to the joint (Fig. 23).
6) Tighten all the cover fixing bolts correctly.
7) Remove the special tools MARU and MIRU.
8) Couple the lift arms to the lift rods.
9) Joint up the lighting cables to the two pole connector.
10) On the vineyard tractor only, fit the shaft and remote control box and fit in place with its four screws.
11) Q18 or 20 - Refitting the Seat.



HYDRAULIC LIFT TEST PROCEDURE

SPECIAL EQUIPMENT REQUIRED

— Churchill Pressure Gauge MF 148.
— Churchill Adaptor MF 148-8.
— 10 Rear Wheel Weights or equivalent 1100 lb (500 kg) weight.
— Stop Watch.

INTRODUCTION

— During the tests the temperature of the transmission oil must be between 140" to 176" F (60" to 80" C).
— The pressure gauge is fitted to the external oil circuit by replacing one of the plugs in the take off cap 967 198 M1 by adaptor MF 148-8.

I - CHECKING THE LINKAGE FOR FREE MOVEMENT

— With engine running at 2,000 r.pm. and using "POSITION" control section of the quadrant.
— Remove the multi-hole draw bar and raise the lower links by putting the hand control lever in the "UP" position.
— The linkage should drop under its own weight the hand lever is in the "DOWN" position.

Corrective Action

If the linkage does not drop check the following:—
— The cross shaft.
— The primary valve.
— The valve return springs.

II - CHECKING FOR LEAKS IN CYLINDER AND DISTRIBUTOR BLOCK

— Fit the pressure gauge.
— Fit the multi-hole draw bar and 10 wheel weights (1100 lbs - 500 kg) to give a pressure of 990 p.s.i. (70 kg/cm) when the lower lift arms are horizontal.
— Put the hand lever in transport position and stop the engine.
— The multi-hole draw bar should not drop more than 2 ¾" (7 cm) every 10 seconds.

Corrective Action

If the draw bar drop exceeds 2 ¾" per 10 seconds this can be due to :—
— Faulty relief valve.
— Leaking non-return valve.
— Leaking "U" joint on piston.
— Leaking "O" rings.

III - CHECKING THE RELIEF VALVE

— Run the engine at 2,000 r.p.m.
— Put the hand lever in the vertical position (external circuit).
— The gauge should register 2,060 to 2,275 p.s.i. (145-160 kg/cm).

Corrective Action

If this pressure is not obtained replace the relief valve.

IV - CHECKING THE PUMP

— With the engine running at 720 r.p.m. and using the "DRAFT" control section of the quadrant.
— Put the hand control lever in the lowest position of the "DRAFT" control.
— Bring the lever quickly to the transport position (the notch at the top of the draft control sector). As the lever is placed in the transport position set the stop watch in motion. The arms should be completely raised in 12 seconds maximum.

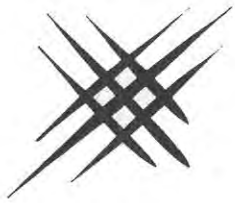
Corrective Action

If the arms take more than 12 seconds to lift:—
— Check that the strainer element is not clogged.
— If the strainer is not clogged then the pump is defective through low flow and must be replaced.

NOTE: When making the above test the speed of drop and response control levers must be set as follows:

— Speed of drop - This lever must be positioned at maximum speed of drop i.e. in the fast position which is obtained when the stop is opposite the + sign on the quadrant.
— Response control - This must be positioned in the fast position i.e. turned anti-clockwise to come in contact with the stop.

LIST OF OPERATIONS



DESCRIPTION

The steering is of the classic type usually used on tractors. The main components are :—

A — A worm type "Cam Gear" steering box which receives the movement of the steering wheel transmitted by the steering column.
The worm transmits fore and aft movement to a drop arm which in turn transmits movement to a drag link.

B — A double crank arm which pivots on a shaft on the front axle receives the movement of the drag link and transmits this to the tie-rods.

C — The tie rods action, the arms of the spindle which are integral with the wheel stub axles.
These last two sub assemblies are fitted to other assemblies which constitute the front axle assembly.

OPERATION **M1** — REMOVAL OF STEERING WHEEL

1) With a screw driver, remove the centre plug on the steering wheel.
2) Unscrew and remove the nut and washer.
3) Unscrew and remove the throttle lever from the collar so that a puller can be put on the steering wheel.
4) Put a puller, with protective covering on its arms, on the steering wheel and remove the steering wheel (Fig. 1).

OPERATION **M2** — REMOVAL OF STEERING BOX

Preliminary Operations: M1 - Removal of Steering Wheel
Q5 - Removal of Instrument Panel

1) Uncouple the drag link from the drop arm.
2) Uncouple the "Stop" wire from the lever of the injection pump (Spring and Flat washer).
Pull the rod rearwards and away from the steering box.
3) Uncouple the upper accelerator rod from the ball joint of the relay.
4) Remove the 2 left-hand screws holding the battery support to the steering box.
5) Remove the 2 left-hand screws holding the steering box to the clutch housing.
6) Uncouple the rod from the foot accelerator to the relay mechanism on the steering box.
7) Remove the 2 right-hand screws holding the battery support to the steering box.
NOTE: To facilitate removal of the lower screw fixing the battery support to the steering box it is recommended to slacken off the two screws holding the filter support to the battery support.
8) Remove the 2 right-hand screws holding the steering box to the clutch housing.
9) Pull the steering box rearwards inclining it to the right so that the play adjusting screw clears the hole in the right side of the battery support. Remove the steering box.

OPERATION **M3** — DISMANTLING OF STEERING BOX

Preliminary Operations: M2 - Removal of Steering Box

1) Drain the steering box, having removed the filler plug.
2) Uncouple the rod of the throttle relay from the ball joint of the collar to which the throttle lever is attached (Fig. 2 - Ref. A).
3) Remove the collar from the steering column (Fig. 2 - Ref. B).
4) Unscrew the fixing screws and remove the relay support from the cover.
5) Remove the locking nut and washer from the drop arm shaft.
6) With a two legged puller pull the drop arm off its shaft. Remove the anti-dust and soft rubber washers.
7) Remove the drop arm shaft from the steering box.
8) Unscrew the 4 fixing screws and remove the steering column tube from the steering column shaft.
9) Remove the shims and the paper joint.
10) Remove the special thrust washer on the bearing cap.
11) Pull upwards and remove the steering column.

IMPORTANT: Take care not to lose the ball bearings which are liberated during this last operation.

OPERATION **M4** — ASSEMBLY OF STEERING BOX

1) Smear the cup of the lower bearing with grease.
2) Fit 21 balls to the lower bearing cup.
3) Fit the column into the steering box so that the base of the worm rests on the ball bearings.
4) Smear the upper bearing surface of the worm with grease and place 21 balls on it.
5) Slide the upper bearing cup over the shaft of the steering column and fit in place on the steering box.
6) Fit the special thrust washer on the upper bearing cup.
7) Fit a new paper joint and the shims on the steering box.
8) Fit the steering column to the steering box and fit the 4 screws and lock washers. Tighten moderately so that the shaft has no play but can be turned without undue strain.
9) Fit the felt washer into the steering column.
10) Fit the drop arm shaft into the steering box, having first smeared it with oil.
11) Apply sealing compound to a new cover joint. Fit the cover and joint and fix with its two forward lower screws and lock washers.

NOTE: Do not fit the front intermediate and upper screws which also hold the battery support.

12) Place the foot accelerator relay support against the cover and fix it with two rear cover screws.
13) Fit the lower throttle control collar around the steering column.
14) Fit the rod from the throttle relay to the collar.
15) Place the drop arm on its shaft vertically downwards (or approximately) followed by the anti-dust and soft rubber washers.
16) By means of the adjusting screw situated on the cover, adjust to give free movement of the drop arm shaft without free play.
17) Fill the steering box with oil up to the level of the filler plug.
18) Complete the following operations:
    M 5 - Re-fitting of steering box.
    Q14 - Re-fitting of instrument panel.
    M 6 - Re-fitting steering wheel.

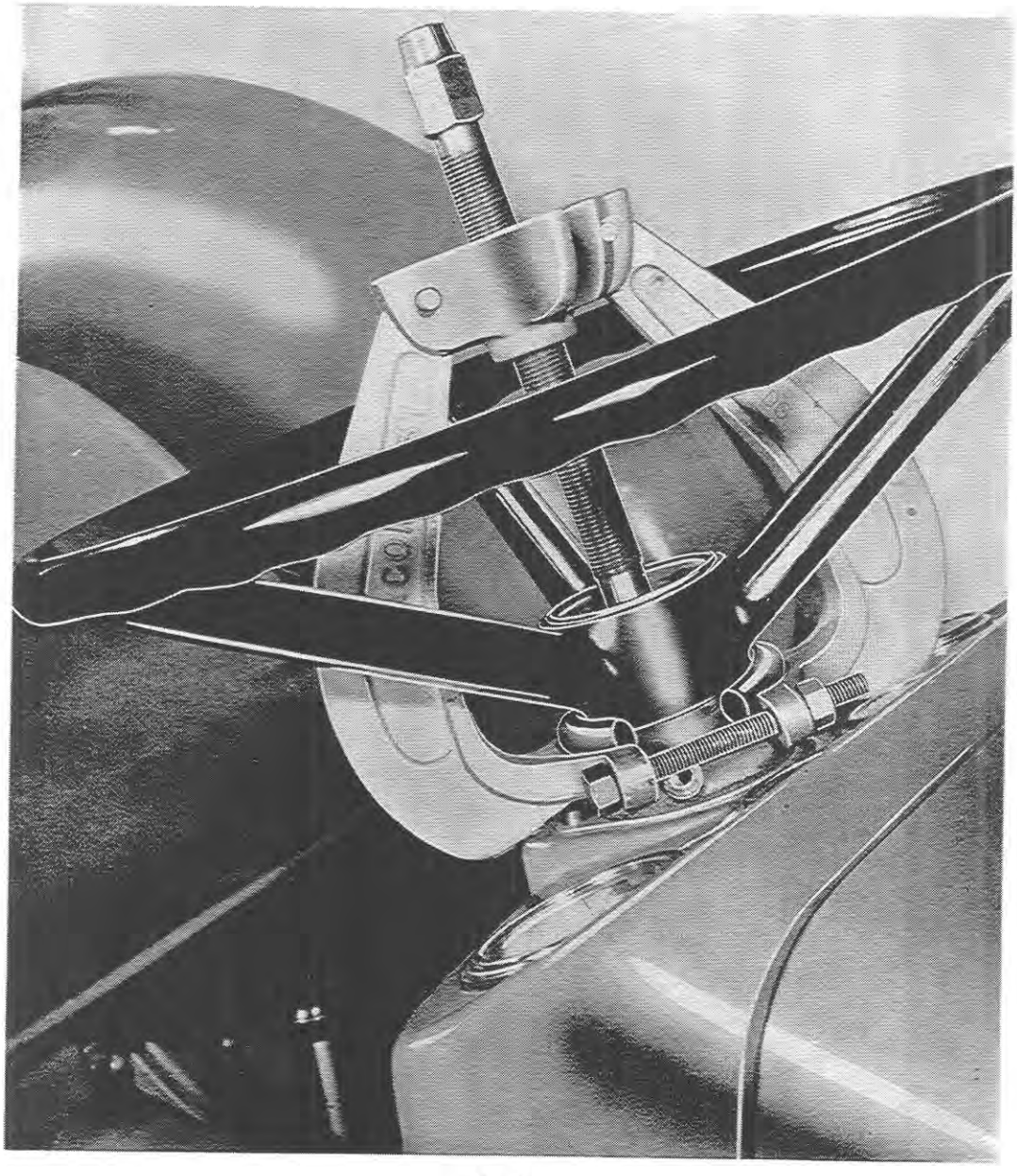


Fig. 1

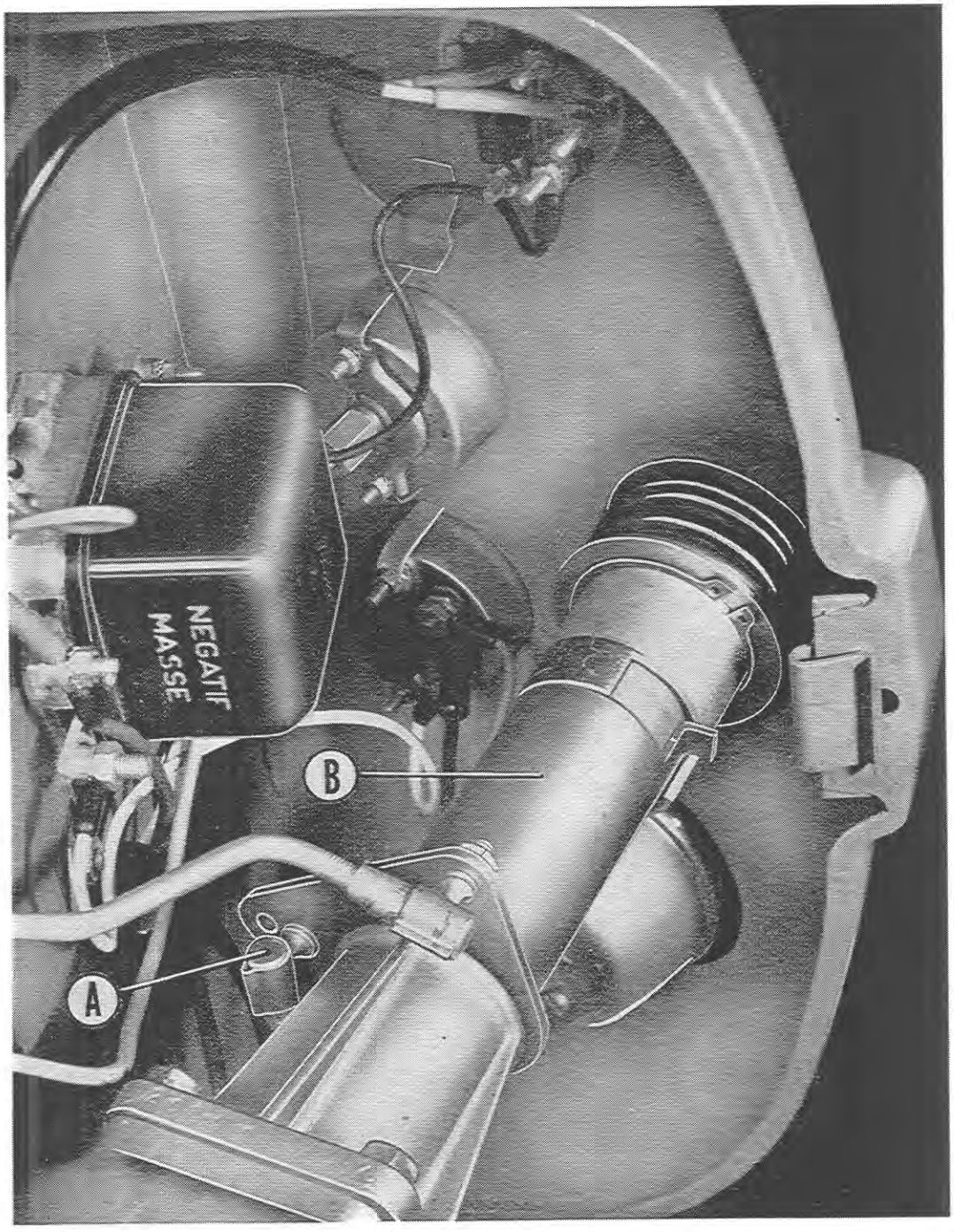


Fig. 2

OPERATION **M5** — RE-FITTING OF STEERING BOX

Preliminary Operations: M4 - Assembly of steering box

1) Place the steering box on the clutch housing and engage its right side in the right face of the battery carrier so that the adjusting screw is located in the hole in the battery carrier, also put the wiring harness inside the battery carrier.
2) Put in place but do not tighten the two left screws holding the steering box to the clutch housing.

   NOTE: The front screw holds the wiring harness clip.

3) Put in place but do not tighten the two left screws holding the battery support to the steering box.
4) Put in place but do not tighten the two right screws holding the battery carrier to the steering box.
5) Fit and tighten the two right screws holding the steering box to the clutch housing.
6) Tighten the screws indicated in 4, 3, and 2 above.
7) Tighten the two screws holding the fuel filter support to the battery carrier.
8) Fit the accelerator rod to the relay fixed to the steering box.
9) Fit the throttle control rod to the upper ball joint of the relay.
10) Fit in place the "Stop" control to the lever of the injection pump. Fit the washer and return spring.
11) Couple the drag link to the drop arm.
12) Complete the following operations:
    Q14 - Re-fitting of instrument panel.
    M 6 - Re-fitting of steering wheel.

OPERATION **M6** — RE-FITTING STEERING WHEEL

Preliminary Operations: M5 - Re-fitting of steering box
Q14 - Re-fitting of instrument panel

1) Fit the steering wheel to the steering column with the front wheels facing straight ahead.
2) Fit the washer and the nut to the steering column and tighten moderately.
3) Fit the centre plug in the steering wheel.

FRONT AXLE

LIST OF OPERATIONS

OPERATION **N1** — REMOVAL OF FRONT AXLE SUPPORT

Preliminary Operations: Q3 - Removal of hood

1) Drain the cooling system:—
   — at the tap on the cylinder block,
   — at the tap on the lower radiator to engine hose.
2) Place a jack under the engine sump and lift the tractor.
3) Place a trolley jack under the rear part of the front axle support.

   NOTE: To facilitate removal of the screws holding the support to the engine leave a space of about 2" (5 cm) between the heads of these screws and the jack.
4) Slacken off the upper clip on the air hose to intake manifold.
5) Slacken off the clip at the top of the radiator for the water hose.
6) Open the door of the grille and disconnect the lighting wire from the 3 pole connector.
   Disengage the wiring harness from the clip beneath the radiator.
7) On machines fitted with an oil cooler, disconnect the oil cooler pipes at the union by the engine adaptor plate.
8) Remove the lower screw holding the engine breather so that the oil cooler pipes can pass between the breather and the engine sump.
9) Disconnect the drag link from the drop arm.
10) Slacken off the clip at the bottom of the radiator for the water hose.
11) Remove the four bolts holding the support plates to the fuel tank.
12) Slacken off and remove the 6 screws holding the front axle support to the engine. For this operation, the trolley jack should be adjusted so that the front axle support and engine remain in alignment.
13) Remove the front axle support from the engine.

OPERATION **N2** — REMOVAL OF SPINDLE SUPPORT

Unless the spindle support has to be removed for the repair of its component parts it is not necessary to remove the front wheel.

1) Slacken the wheels bolts.
2) Lift the front axle with a jack or hoist.
3) Remove the hub cap, split pin and nut.
4) Remove the wheel.
5) Remove the two bolts holding the spindle support to the front axle.
6) Remove the spindle support from the front axle.

OPERATION **N3** — REMOVAL OF SPINDLE

Preliminary Operations: N2 - Removal of spindle support

1) Lift the front of the tractor with a jack or hoist and remove the front wheel.
2) Remove the track rod from the arm of the spindle.
3) Slacken off the nut holding the steering arm to the spindle.
4) Remove the steering arm from the spindle.
5) Remove the "Woodruff" key and the felt washers.
6) Draw out the spindle from its support.
7) Remove the thrust bearing.

   NOTE: If it is required to change the spindle bushes, the support must be removed from the tractor so that the support can be placed in a press for the fitting of the new bushes.

OPERATION **N4** — REMOVAL OF FRONT AXLE FROM ITS SUPPORT

Preliminary Operations: C1 - Removal of radiator

1) Remove the double crank arm and the track rods.
2) Remove the locking screws and lock nut which hold the pivot pin in place.
3) Knock out the pivot pin and if necessary make up a brass drift of diameter 14'' to 17'' (36 to 43 mm).
4) Remove one of the spindle supports (Operation N2) leaving the axle on a jack or stand.
5) Remove the axle from the axle support housing.

OPERATION **N5** — CHANGING THE SPINDLE BUSHES

Preliminary Operations: N2 - Removal of spindle support
N3 - Removal of spindle
Service Tools Required: MOTU

The spindle having been removed from the spindle support.

1) Put into the spindle support, tool MOTU (Fig. 1).
2) Fit to this assembly, the cover of MOTU (Fig. 2) and remove the bush.
3) Fit the new bushes, using the tool (see Fig. 3).
4) Ream the two bushes in line after assy. to 1.250—1.251 DIA. (31.75 $^{+\ 0}_{0,025}$ mm
5) Fitting the spindle (Operation N8).
6) Fitting the spindle support (Operation N10).

OPERATION **N6** — CHANGING THE DOUBLE CRANK LEVER BUSHES

Preliminary Operations: C1 - Removal of radiator
Service Tools Required: MIVA

1) Uncouple the track rods and drag link from the double crank lever.
2) Remove the holding screw, the friction washer and the double crank lever.
3) Extract, one at a time, the bushes from the double crank, using tool MIVA (Fig. 4 and 5).
4) Smear the outside of the new bushes with grease and fit them, one at a time, again using the tool MIVA.

   NOTE: Ensure that the bushes are fitted perpendicularly to the bore. On no account may the bushes be reamed after assembly.

   — The lower bush be recessed 0.0098'' (0.25 mm) from the face of the crank lever.
   — The upper bush must be recessed 0.06'' to 0.08'' (1.5 to 2 mm) from the face of the crank lever.

   It is advisable to check the alignment of the two bushes:—

   — a calibrated gauge of 1.501'' (38.100 mm) can pass,
   — a calibrated gauge of 1.503'' (38.152 mm) cannot pass.

   Before fitting the crank lever to its support on the axle, make sure that the surface of the pin on which it pivots is in perfect condition so that the anti-friction surface of the new bushes are not damaged.
5) Fit the crank lever, its washer and fixing screw.
6) Fit the track rods and drag link.
7) Complete the following operations :
   C 9 - Fitting of radiator.
   Q15 - Fitting of radiator grille.
   Q16 - Fitting of hood.

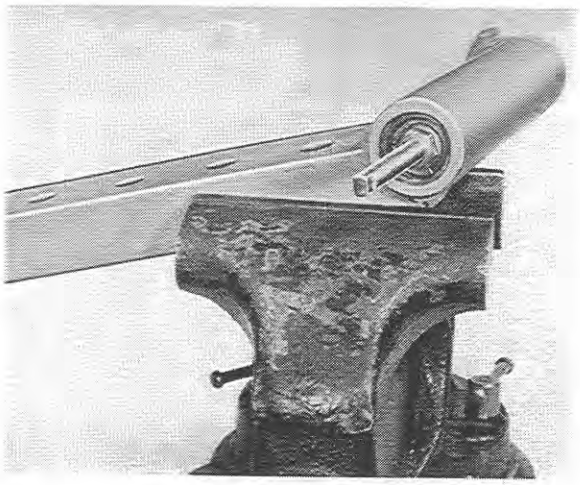


Fig. 1

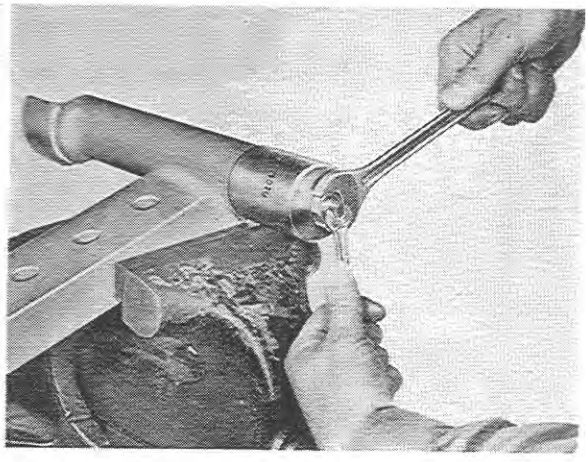


Fig. 2

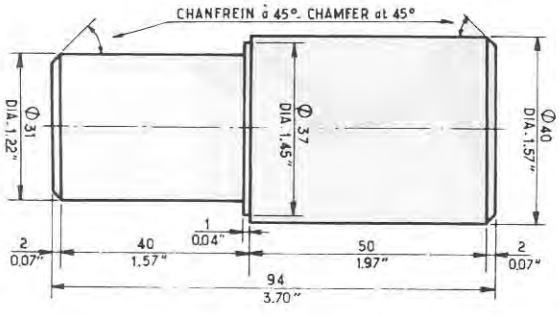


Fig. 3

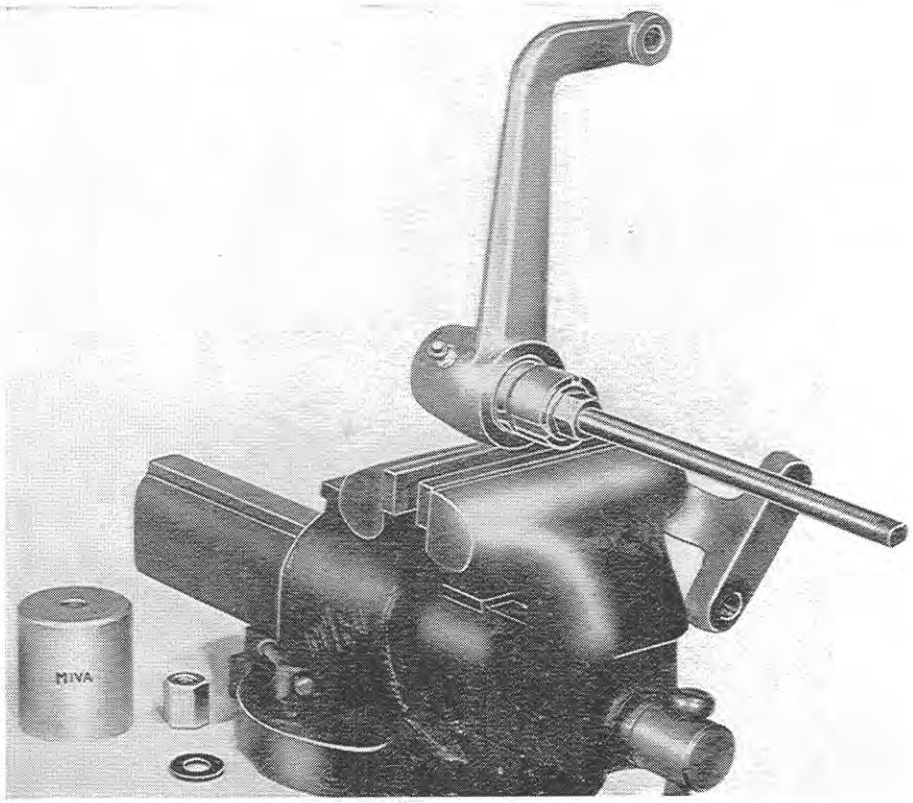


Fig. 4

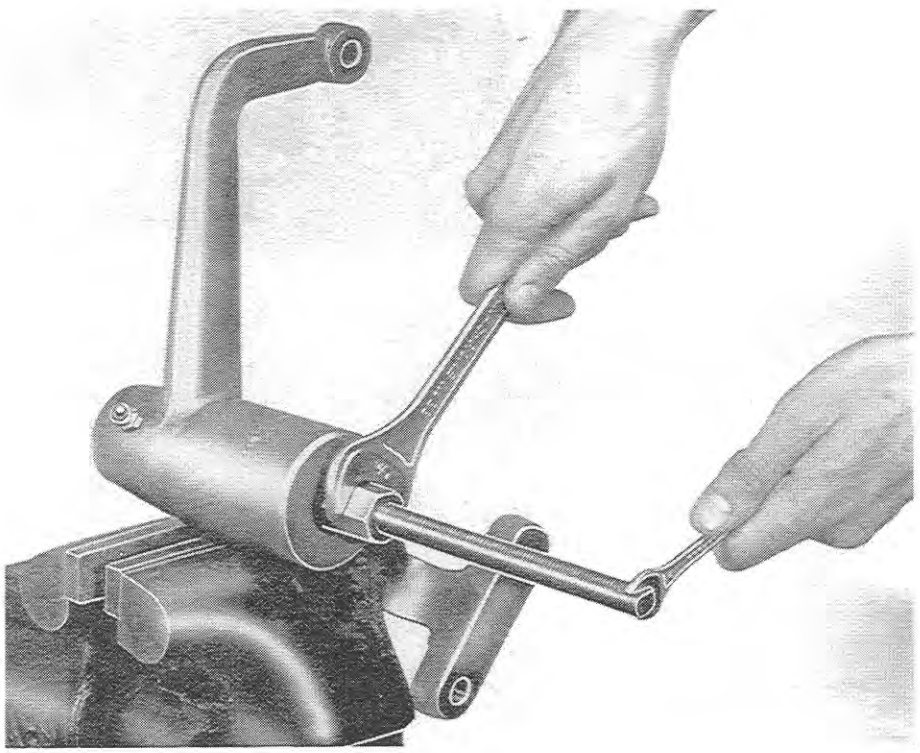


Fig. 5

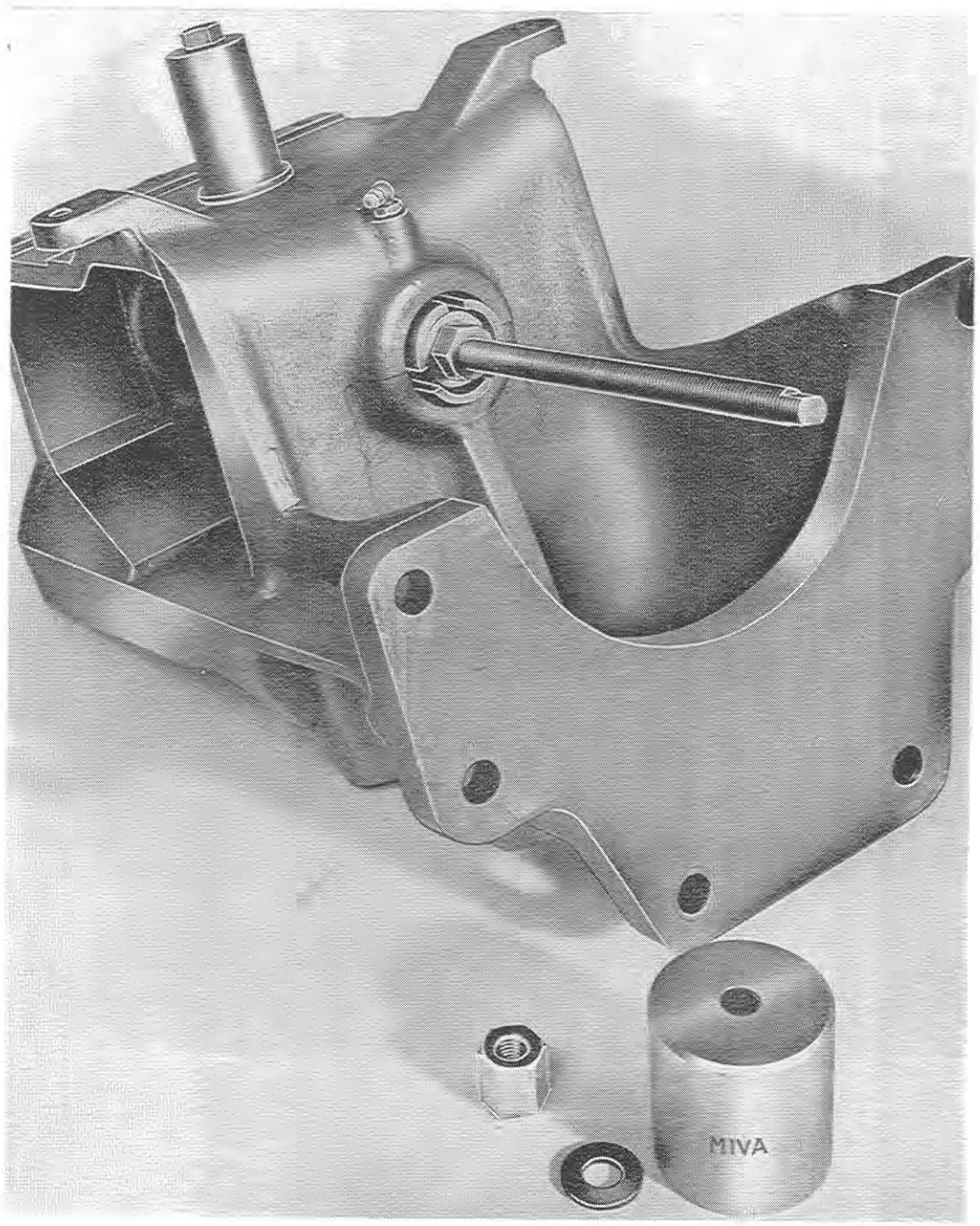


Fig. 6

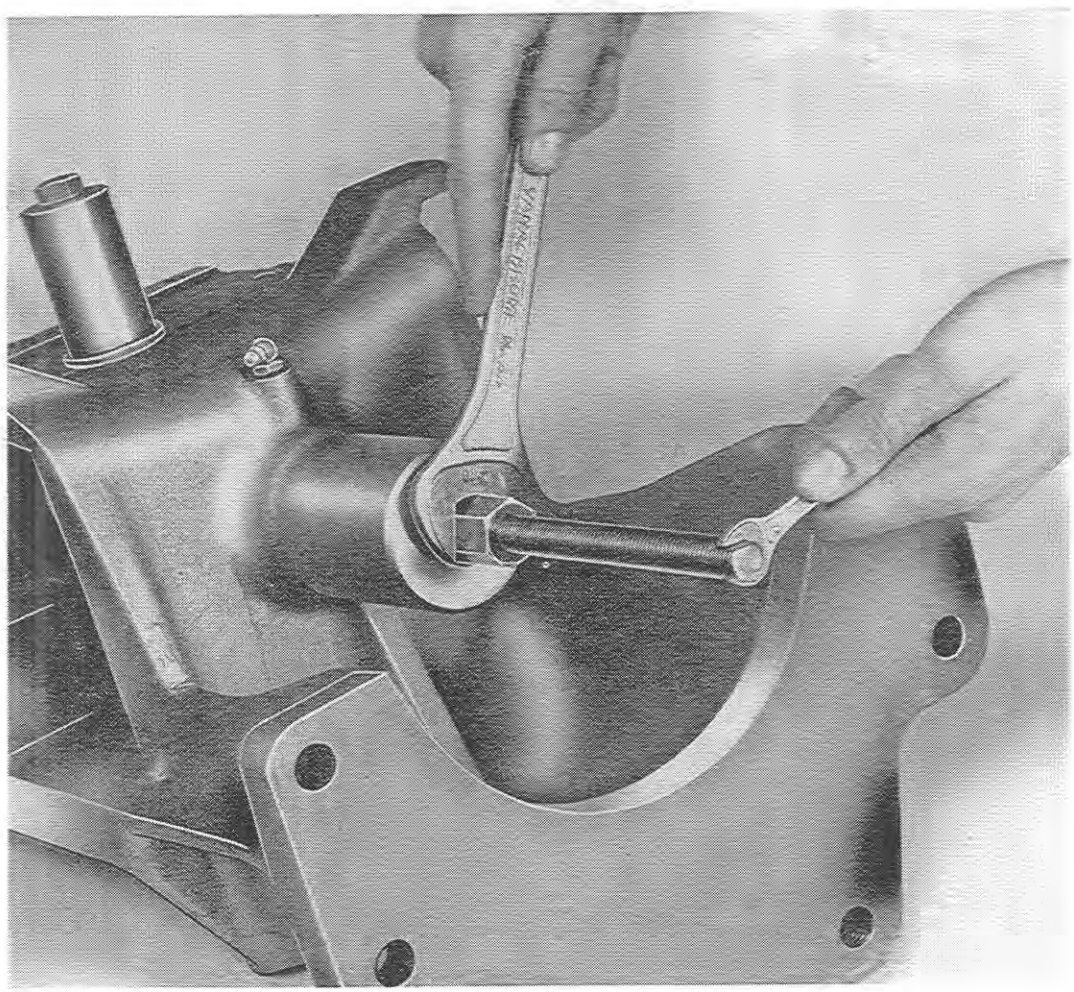


Fig. 7

OPERATION **N7** CHANGING THE AXLE PIVOT PIN BUSHES

Preliminary Operations: C1 - Removal of radiator
Service Tools Required: MIVA - MF 263 - 263-2 - 264 - 264-1

A — **Removal of the front bush**

1) Remove the circlip.
2) Remove the front bush with tool MIVA, the cover of the tool being in contact with the exterior face of the support (Fig. 6 and 7).

B — **Removal of the rear bush**

Repeat the same operation as for the front bush.

C — **Fitting front or rear bushes**

Suitably lubricate the exterior of the bush and insert it in the axle pivot with tool MIVA.

NOTE: Position the bush so that the grease hole lines up with the corresponding hole in the support. When the bush is in place, fit the circlip.

IMPORTANT: Ream the two bushes in line after assy. to 1.750-1.751" DIA. (44.55-44.52 mm).

OPERATION **N8** FITTING THE SPINDLE

1) Place the thrust race on the spindle.
2) Fit the spindle in the spindle support and fit the felt washer at the top.
3) Put the "Woodruff" key in place.
4) Put the steering arm on the spindle and orientate correctly.
5) Fit the tightening bolt for the steering arm and tighten the nut.
6) Fit the spindle support to the front axle.
7) Fit the track rod and tighten the nut to 39.8 ft/lbs (7.5 m/kg).
8) Fit the wheel.
9) Lower the tractor to the ground and tighten the wheel nuts.

OPERATION **N9** FITTING THE FRONT AXLE TO THE AXLE SUPPORT

1) Put the front axle in its place in the front axle support.
2) Put in the pivot pin from the front of the axle support.

NOTE:

a) The hole for the locking screw in the pin must be placed to the forward end of the tractor.
b) This hole must also line up with the threaded hole, for the same screw, in the support.

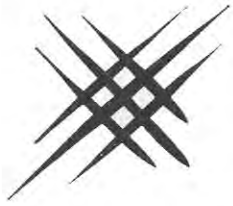
3) Push the pivot pin to its final position either with a press or a bronze drift and hammer.
4) Fit the locking screw making sure that it engages with the hole in the pivot pin. Tighten the screw and lock nut.
5) Complete the following operations:
   N10 - Fitting the spindle support.
   C 9 - Fitting of radiator.
   Q15 - Fitting of radiator grille.
   Q16 - Fitting of hood.

OPERATION **N10** FITTING THE SPINDLE SUPPORTS

1) Lift up the front axle with a jack or hoist.
2) Fit the spindle support to the front axle.
3) Adjust to the required track width, fit the assembly screws and tighten.
4) Adjust the track rods according to the width.
5) Fit the drag link.
6) Replace the wheel.

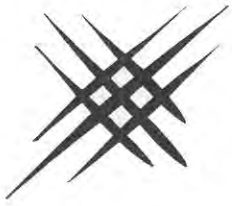
OPERATION **N11** FITTING OF AXLE SUPPORT TO THE ENGINE

1) Couple the support to the engine, simultaneously joining up the radiator hoses.
2) Fit the 6 assembly screws and tighten to 108.5 ft/lbs (15 m/kg).
3) Fit the 4 screws for the radiator supports on the fuel tank.
4) Fit the 2 oil cooler pipes to the unions by the adaptor plate (for tractors fitted with an oil cooler).
5) Fit and tighten the screw holding the breather tube to the engine.
6) Place the lower radiator hose correctly in place and tighten the clips.
7) Fit the air intake hose to the air filter and tighten the clip.
8) Fit the wiring harness in the clip on the left side of the radiator.
9) Connect the lighting wires to the 3 pole connector.
10) Fit the drag link.
11) Fitting of hood (Operation Q16).



BRAKES

LIST OF OPERATIONS



DESCRIPTION

The brakes of the normal width, narrow and high clearance tractors are of a mechanical disc type.

A steel disc, polished on both faces driven by each half shaft, turns between two jaws each one having a friction lining.

One of these plates which has the two faces of the friction lining parallel, remains fixed, the other with non-parallel faces, is actuated by a cam inside the brake housing.

This cam is actuated through a linkage mechanism by the foot pedals and the hand brake.

The linkage has a simple screw arrangement to set and adjust the brakes for wear.

OPERATION **01** REMOVAL OF BRAKE BLOCKS AND BRAKE LINKAGE

A — **RIGHT BRAKE** (Fig. 1)

1) Remove the return spring.
2) Uncouple the threaded brake adjuster by pulling out the split pin and then the small shaft.
3) Remove the two long lower screws and the short upper one from the brake housing.
4) Remove the brake housing.

B — **LEFT BRAKE** (Fig. 2)

1) Remove the return spring.
2) Uncouple the treaded brake adjuster by pulling out the split pin and then the small shaft.
3) Remove the two long lower screws and the short upper one from the brake housing.
4) Pull on the hand brake to facilitate the operation.
5) Remove the brake housing.

Preliminary Operations: 01 - Removal of brake blocks and brake linkage

A — REMOVING THE BRAKE BLOCKS

1) Remove the lock nut from the cam shaft.
2) Unscrew the jaw spindle and knock it out with a brass drift.
3) Remove the two jaws which are thus liberated together with their two springs.
4) Remove the cam lever having slackened off its holding bolt.
5) Remove the "Woodruff" key from the cam shaft.
6) Remove the screw holding the upper plug.
7) Push on the cam shaft to separate the plug and its 'O' ring from the brake housing.
8) Remove the cam shaft from the brake housing.

B — BRAKE LININGS (Fig. 3)

It is not necessary to remove the brake housing to dismantle the linkage. The replacement of one of the parts of the linkage is done as follows:

1) Remove the return spring.
2) Uncouple the threaded brake adjuster by removing the split pin and small shaft.
3) Screw out the brake adjuster from the cam lever.
4) Screw off the "lock" nut.

   NOTE: This "lock" nut has a nylon plug. This is to hold the adjuster screw in the required position. If the nylon plug loses its efficiency the lock nut must be replaced.

5) If the adjuster screw has to be changed proceed as in paragraphs 1, 2, 3, 4 and remove the roll pin from the adaptor knob with a 0.08" (2 mm) diameter punch.
6) Remove the adjuster knob from the adjuster screw.

   NOTE: These parts are cadmium plated and must not be lubricated.

Preliminary Operations: 01 - Removal of brake blocks

A — BRAKE DISC

Check the thickness of the disc with a pair of calipers. Initially the thickness is 0.37" (9.50 mm) but it must be replaced if it wears below 0.36" (9.30 mm).
NOTE: If the surface become scored or marked, the disc can be re-surfaced and polished to give a surface finish of not less than 32 micro/inches.

B — BRAKE LININGS (Fig. 3)

1) With a screw driver, prize off the two self locking washers which hold the linings.
2) Remove the worn lining and replace with a new part.
3) Replace on each stud of the lining a new self locking washer and press in place with a suitable tube. When the linings have been renewed replace the brake block (Operation 05).

   NOTE: The lining of the fixed brake block (A - Fig. 5) has its two faces parallel, and those of the movable one are triangular (see Fig. 5 - B). As the distance between their fixing studs is different it is not possible to fit them to the wrong block (see Fig. 3).

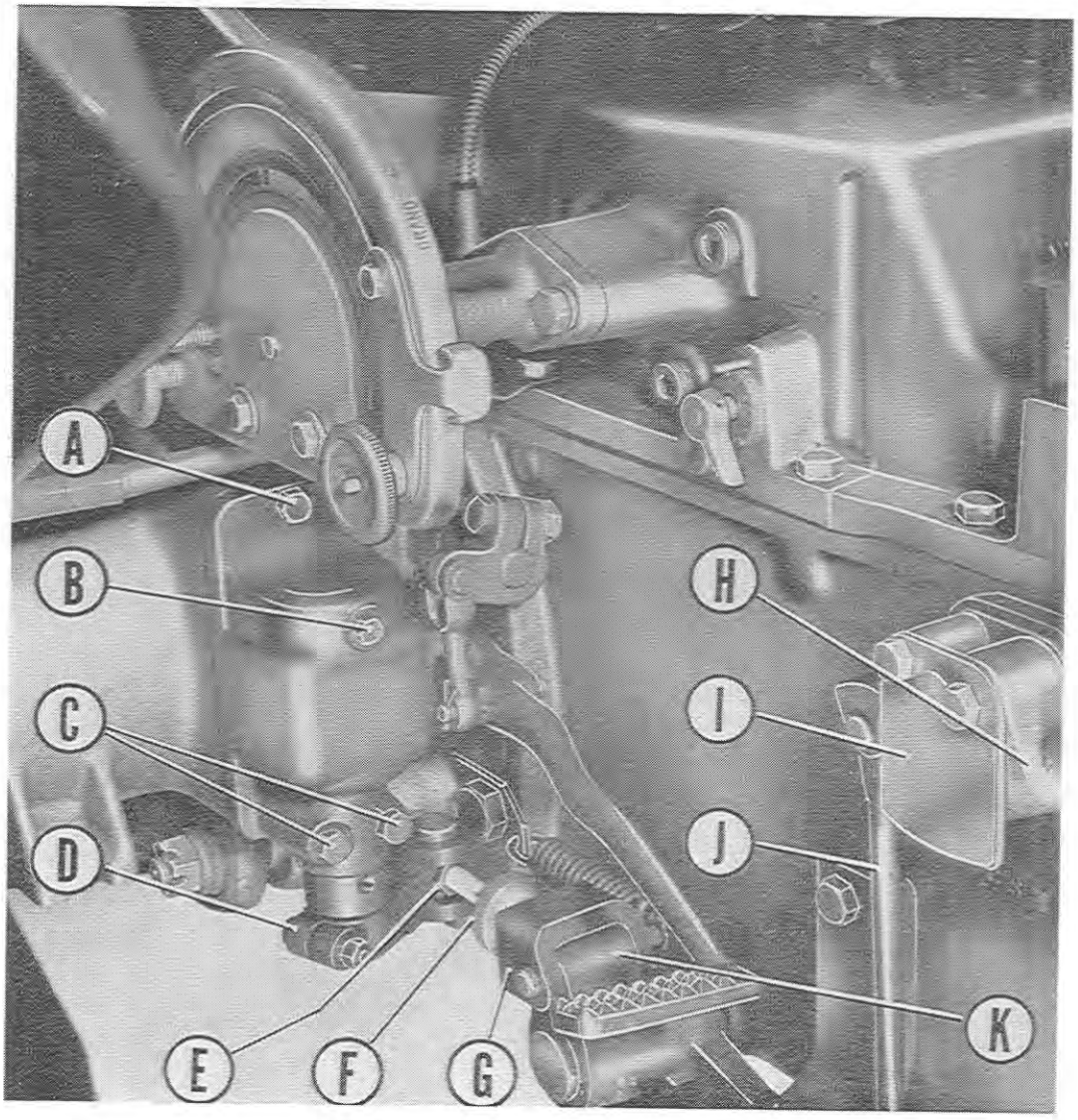


Fig. 1

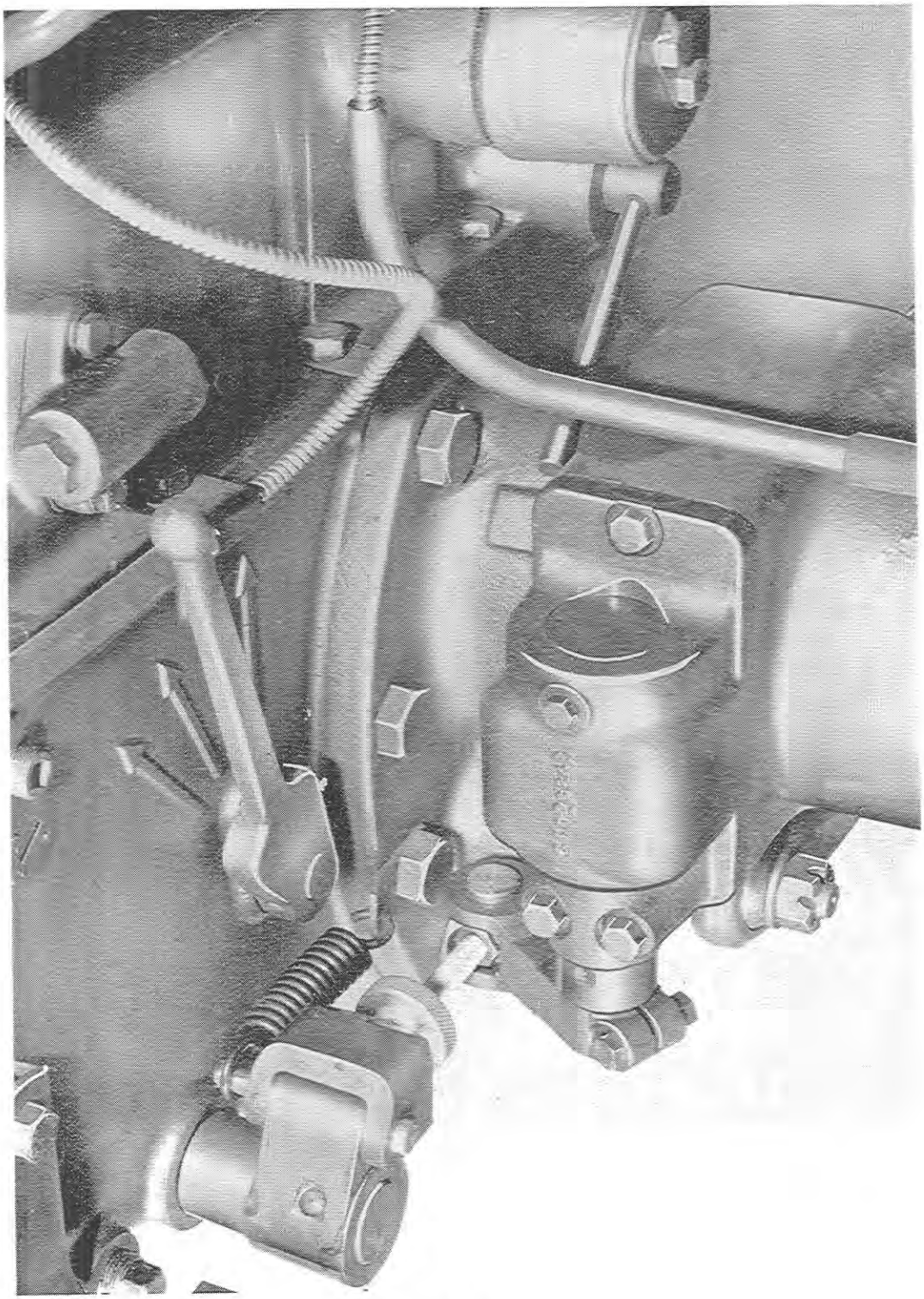


Fig. 2

Preliminary Operations: 02 - Dismantling the brake

A — ASSEMBLY OF THE BRAKE BLOCK (See Fig. 4)

1) Smear the cam shaft (F) with grease (preferably molybdenized or graphitized) and fit it into the brake housing, the small end first.
2) Put the upper plug (B) in place with its "O" ring (C). If the "O" ring is not in perfect condition it must be replaced.
3) Fit and tighten the plug locking screw (D).
4) Assemble the jaws (N and P) and their springs (Q) and put them into the brake housing (A) having positioned the cam shaft as follows: The "Woodruff" key (G) must be on the side of the transmission housing when the brake housing is fitted to the tractor and the movable (Fig. 4 - N) on the opposite side to the key.
5) Smear the jaw spindle (O) with molybdenized or graphitized grease and fit in place. Fit and tighten the lock nut.
6) Put the "Woodruff" key in its location and the cam shaft.
7) Fit the cam shaft lever (H) and tighten its locking bolt.

B — BRAKE LINKAGE

1) If the linkage has been completely dismantled, fit the adjuster screw into the clevis from the inside.
2) Re-fit the adjuster knob (K) to the screw and lock it in place with a roll pin.

   NOTE: The small diameter part of the adjuster knob which has the hole for the roll pin, must be placed touching the outside of the clevis.

3) Screw on to the adjuster screw a new "lock" nut (J) with a nylon plug.
4) Fit the adjuster screw into the threaded shaft (I) of the cam lever (H).
5) Fit the cam lever and tighten its lockings bolt.
6) Complete the following operations:
   O5 - Fitting of brakes and linkage.
   O6 - Adjustment of brake.

Preliminary Operations: 04 - Assembly of the brake

A — RIGHT BRAKE (Fig. 1)

1) Fit the brake assembly into the brake housing so that the disc is between the two jaws (Fig. 6).
2) Fix the brake assembly with:—
   — 1 short screw at the top,
   — 2 long screws at the bottom.
3) Fit the adjuster screw clevis to the right brake pedal, fit the small shaft and split pin.
4) Fit the return spring.

B — LEFT BRAKE (Fig. 2)

1) As for A1 and A2 above.
2) Fit the adjuster screw clevis to the transversal brake rod, fit the small shaft and split pin.
3) Fit the return spring.
4) Adjust the brakes (Operation O6).

1) Lift the rear of the tractor on a jack so that the wheels can be turned freely.
2) Put the hand brake in the first notch.
3) Turn the adjusting screw until the brake linings are just in contact with the disc, that is to say until a slight resistance is felt when turning the wheel.

NOTE: When the hand brake is returned to the fully off position the wheel should be absolutely free.

Do not grease the thread of the adjusting mechanism as it is protected against rust by cadmium plating. After a certain amount of use it will be necessary to adjust the brakes to take up play as in paragraphs 1, 2 and 3 above.

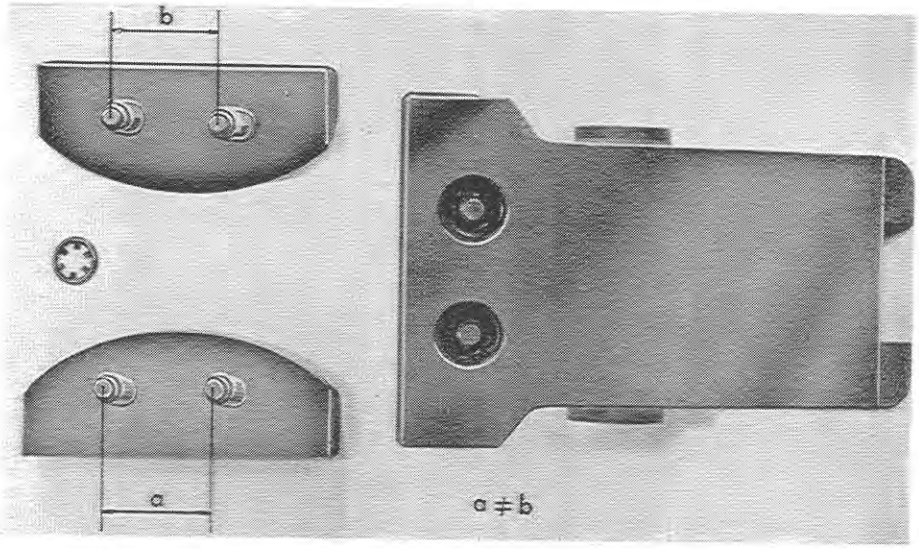


Fig. 3

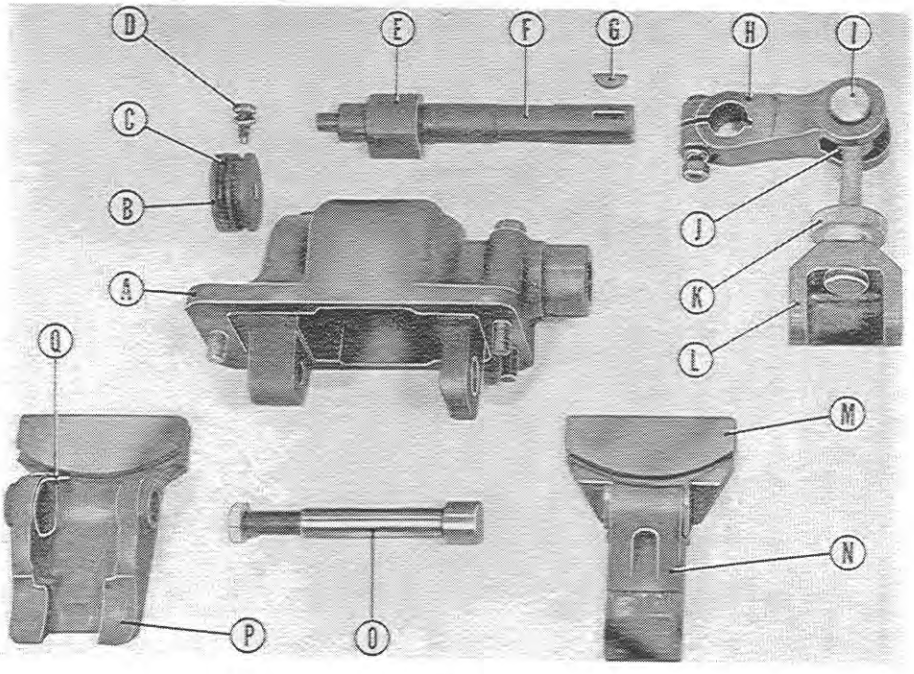


Fig. 4

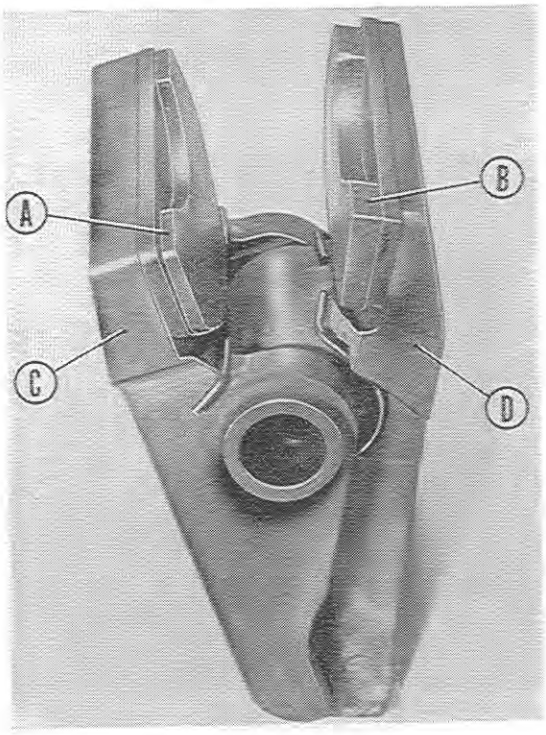
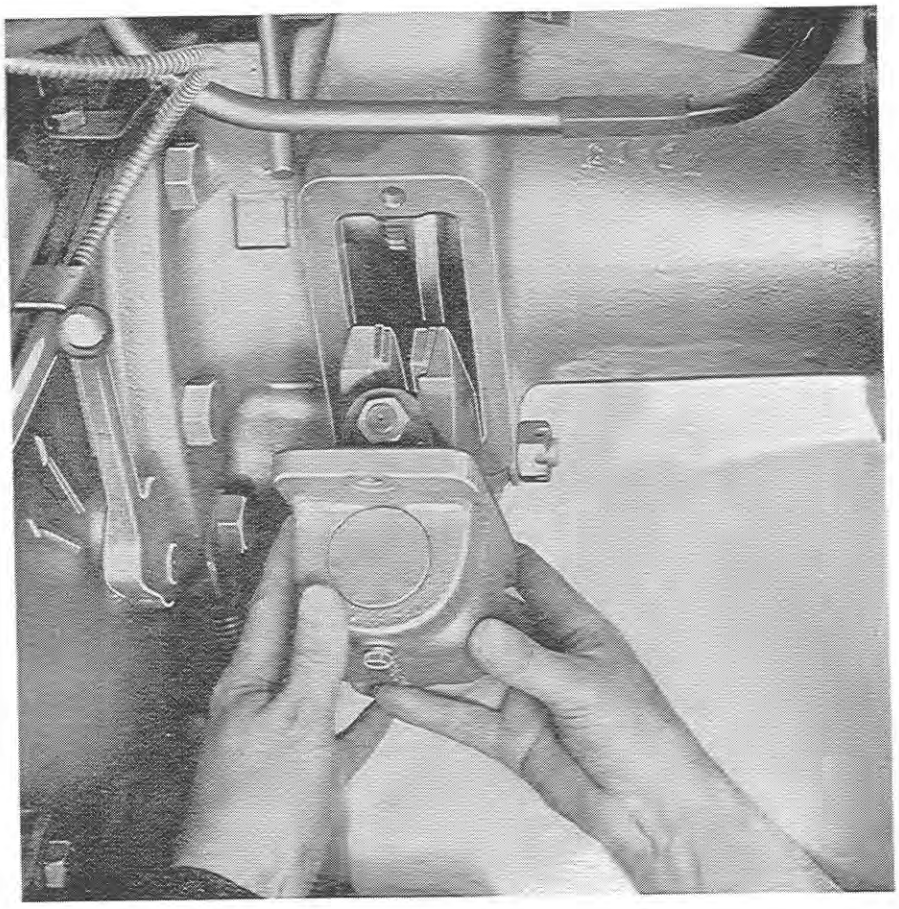


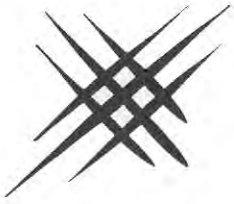
Fig. 5

Fig. 6



FRONT WHEELS

LIST OF OPERATIONS



OPERATION **P1** — REMOVAL OF FRONT WHEEL HUB

1) Slacken the wheel nuts.
2) Place a jack under the front axle support and raise until the wheel is off the ground.
3) Remove the wheel nuts.
4) Remove the hub cap.
5) Remove the split pin, remove the nut and washer.
   Remove the hub.

OPERATION **P2** — DISMANTLING OF FRONT WHEEL HUB

Preliminary Operations: P1 - Removal of front wheel hubs

1) With a 2 or 3 legged puller similar to that shown in Figures 1 remove the inner bearing and seal.
2) Remove the inner bearing cup (Fig. 2).
3) Remove the outer bearing cup (Fig. 3).

OPERATION **P3** — ASSEMBLY OF FRONT WHEEL HUB

Preliminary Operations: P2 - Dismantling of front wheel hub
Service Tools Required: MUTI, MUTO

1) Clean the hub with white spirit, parrafin or fuel oil and dry with compressed air.
2) Oil the bearing recesses.
3) With a press and a tool MUTI (Fig. 4) put the outer bearing cup in place.
4) Put the inner cup in place with the tool (Fig. 5) and a press.
5) Grease the inner bearing and cone and put in place.
5) Grease the inner bearing and cone put in place.
6) Put the seal in place with tool MUTO and a press (Fig. 6).
7) P4 - Re-fitting of front wheel hub.

OPERATION **P4** — RE-FITTING OF FRONT WHEEL HUB

1) Put grease inside the hub and put the hub in place on the stub axle.
2) Put the outside bearing cone in place.
3) Fit the washer and the nut.
4) Tighten the nut until the wheel can not be turned or to a torque of 33 to 36 ft/lbs (4.5 to 5 m/kg) and then slacken off about 1/6 of a turn, so that the wheel will turn freely but without play.
5) Fit a new split pin.
6) Fill the wheel hub with grease and fit in place.
7) Fit the wheel and put the nuts in place.
8) Lower the tractor to the ground and tighten the wheel nuts.

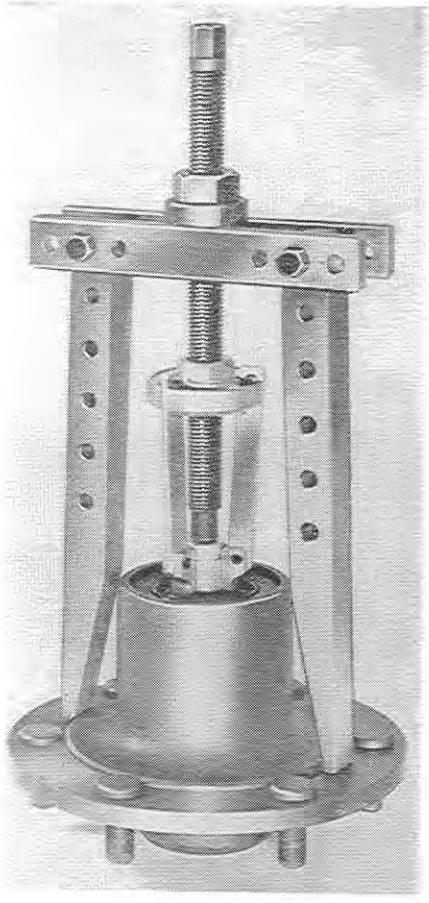


Fig. 1

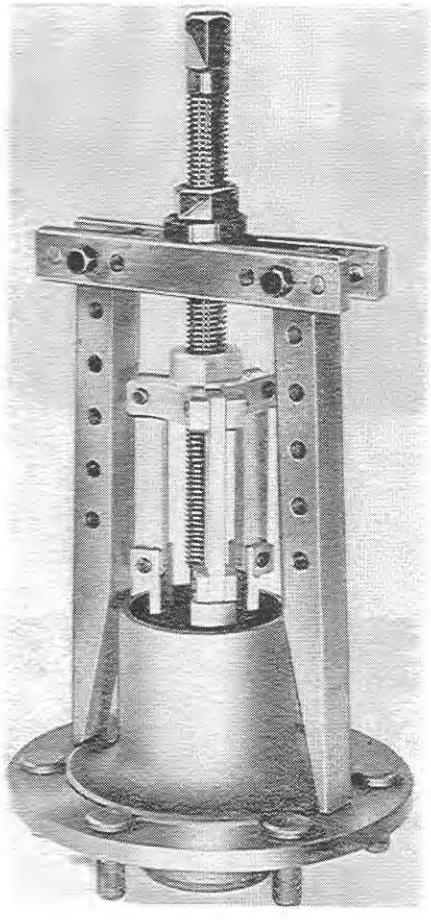


Fig. 2

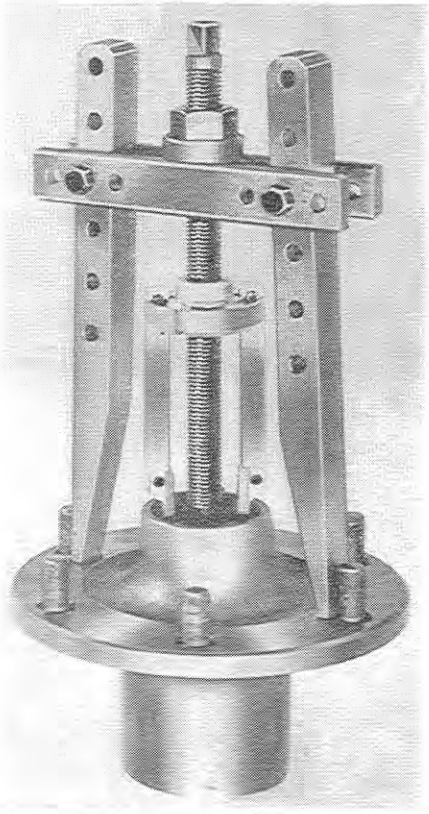


Fig. 3

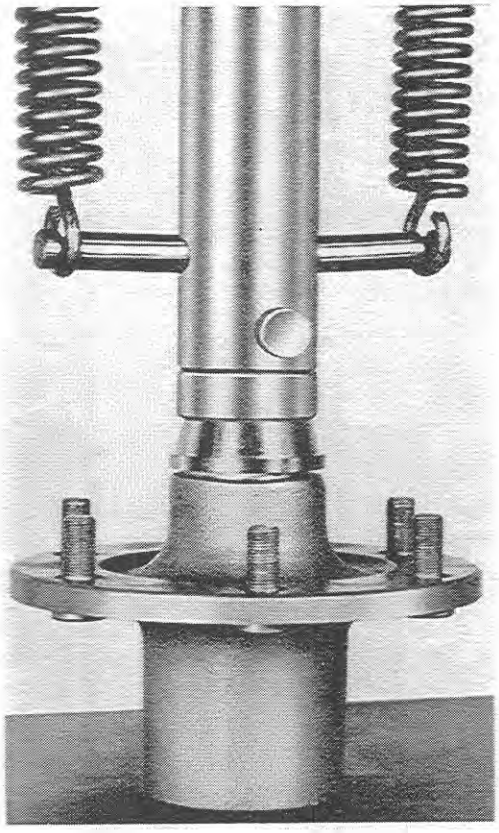


Fig. 4

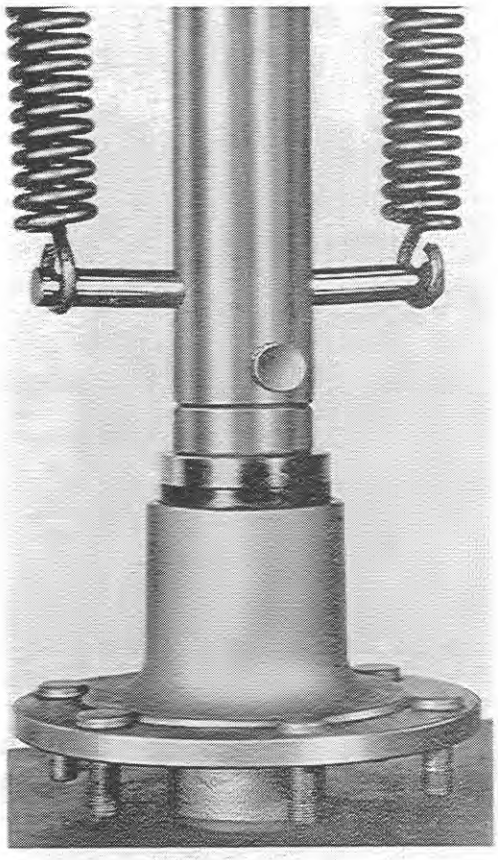


Fig. 6

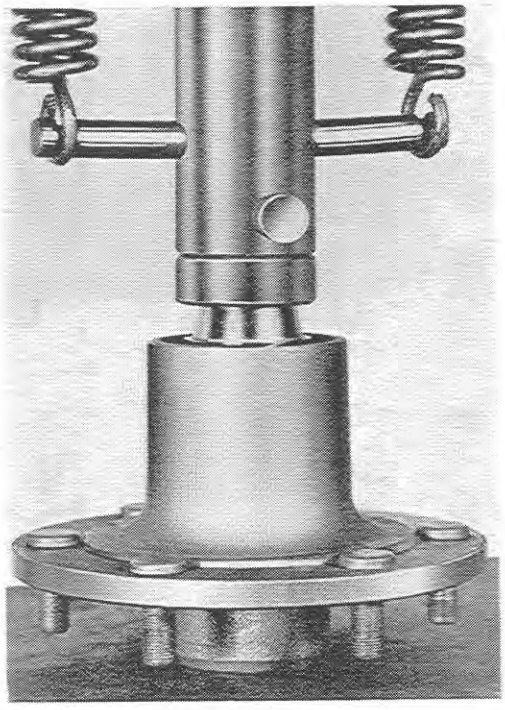


Fig. 5

SEAT SHEET METAL AND FENDERS

LIST OF OPERATIONS

DESCRIPTION

This chapter covers the following items, broken down into 18 operations.

- Seat
- Fenders
- Hood (Bonnet)
- Radiator Grille
- Instrument Panel
- Battery Carrier
- Foot Rests

On the No. 130 Tractor the Hood and Radiator Grille are of a new design.

The hood opens sideways giving good accessibility to the upper part of the engine. The radiator grille, the door of which opens with a simple catch, incorporates the head lamps which are held in place by a rubber ring and springs.

OPERATION **Q1** — REMOVAL OF SEAT

1) Tip the seat backwards
2) Remove the front fixing bolt
3) Remove the rear fixing bolt and the two pole electrical connector
4) Remove the seat

OPERATION **Q2** — REMOVAL OF FENDERS

A — **Right Fender**

1) Remove the bolt holding the cable
2) Remove the bolt holding the lamp support
3) Remove the two bolts holding the fender to the axle
4) Remove the fender from the tractor

B — **Left Fender**

1) Disconnect the wire from the connection to the number plate.
2) Remove the bolt holding the cable to the number plate.
3) Remove the two bolts holding the fender to the axle.
4) Remove the fender from the tractor.

OPERATION **Q3** — REMOVAL OF HOOD

1) Open the front and rear catches and swing over the hood.
2) Remove the cable from the battery.
3) Remove the two screws fixing the front end of the hood hinge to the radiator grille.
4) Remove the nut from the end of the rod, beneath the instrument panel.
5) Remove the split pin and pin fixing the holding cable to the hood
6) Move the hood forwards to clear the instrument panel.
7) Remove the Hood.

TRACTORS FITTED WITH DRIVERS CABIN

In its closed position, the rear of the hood is below the front of the cabin and it is not possible to open it in the normal way.

Before fitting a cabin the following modifications must be made so that the hood can be slid forward before opening (Fig. 2).

1) Unlock the catches and open the hood.
2) Remove the circlip at the front end of the hinge rod (Fig. 1 - B).
3) Remove the spacer (Fig. 1 - A).

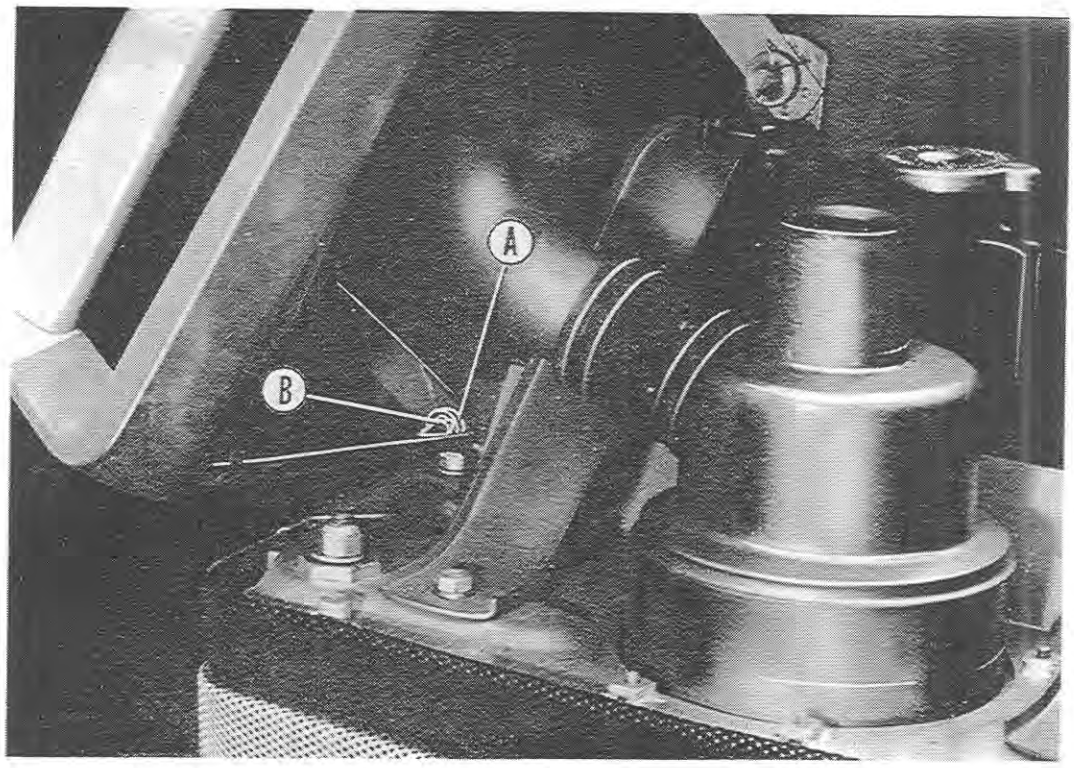


Fig. 1

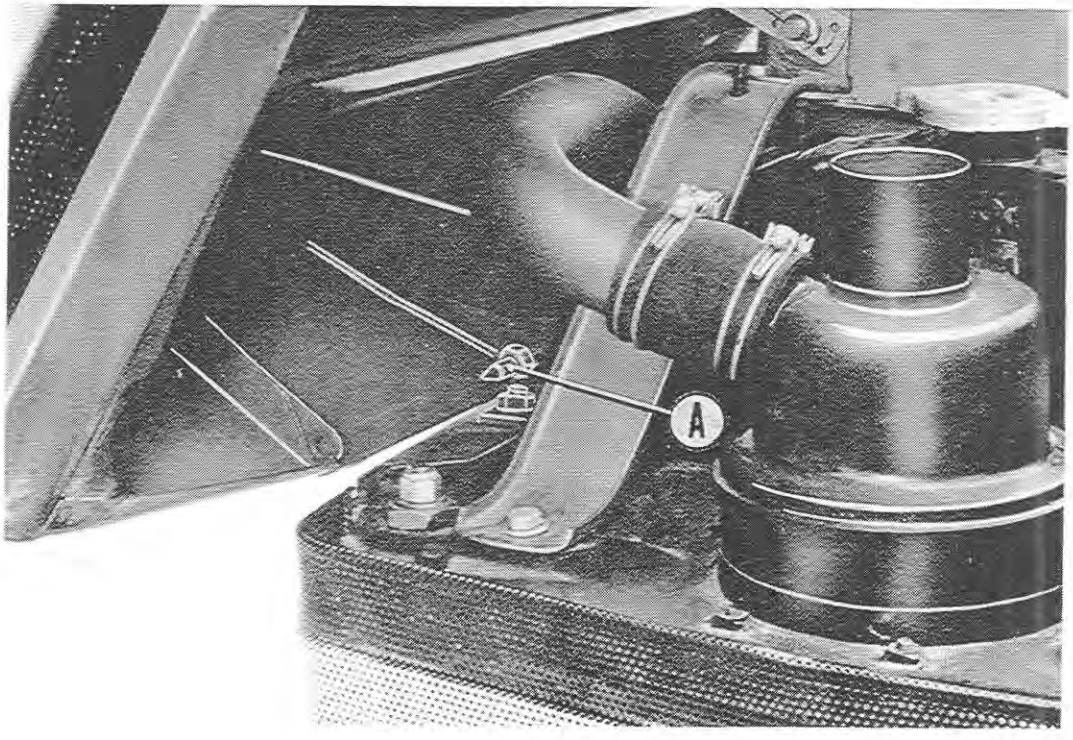


Fig. 2

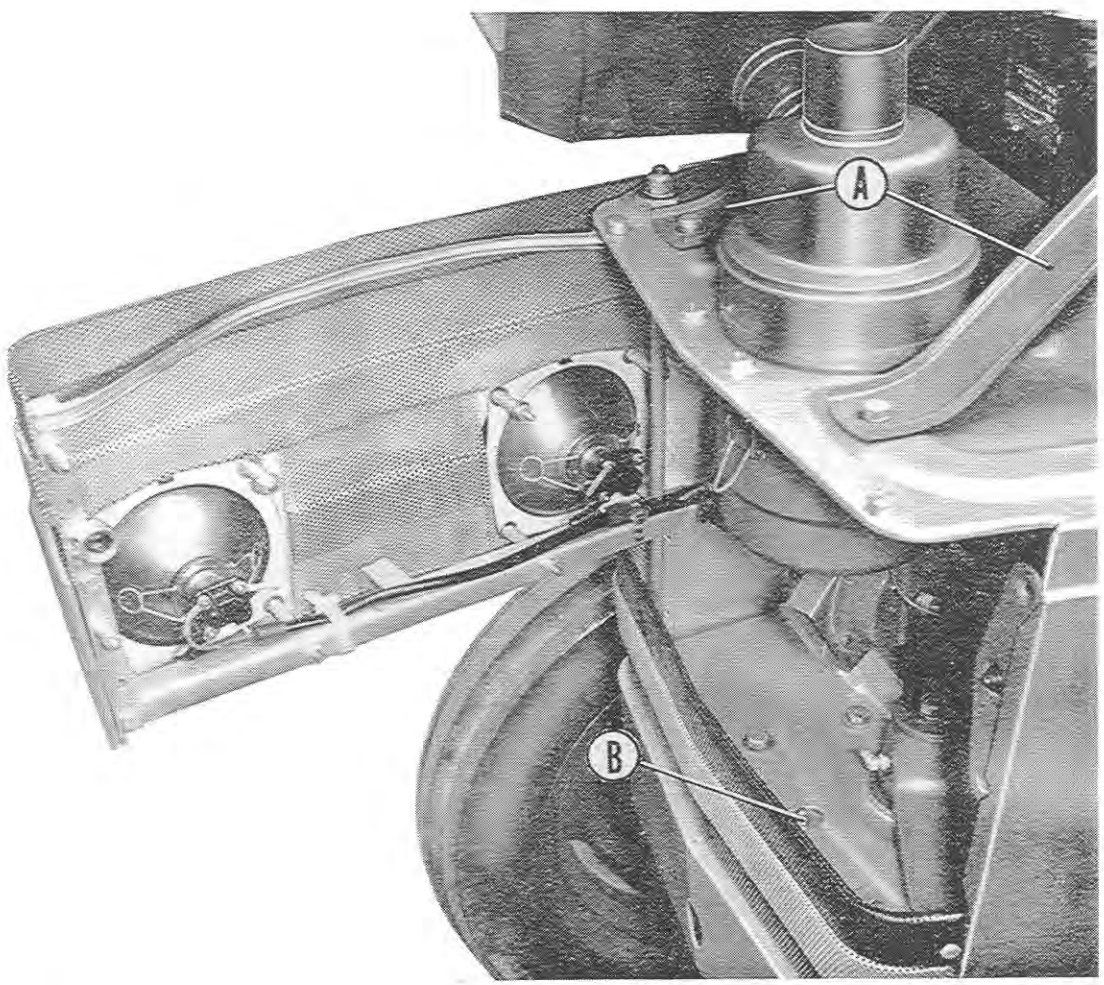


Fig. 3

1) Remove the side light wires from the three pole electrical connector and from the horn.
2) Uncouple the air intake hose from the filter outlet.
3) Remove the bolt holding the three pole electrical connector.
4) Remove the four bolts holding the lower support plate on the front axle support (The front right hand one holds the horn support).
5) Remove the grease nipple from the front axle pivot pin (Fig. 3 - B).
6) Remove the two bolts holding the upper support plate to the two front support plates of the fuel tank.

NOTE: Where removal of the grille is to be followed by the removal of the Radiator it is necessary to uncouple the support plates (Fig. 3 - A) from the fuel tank (4 bolts) and not as indicated in (6) above.

Preliminary Operations: Q3 - Removal of hood — M1 - Removal of steering wheel

— Remove the cables from the battery

A — **Removal of lower part of Instrument Panel**

1) Remove — The screw of the lighting switch
— The plastic knob
— The washer
— The spring
— The nut holding it to the panel
— The indicator plate
2) Remove — The nut holding the starter switch
— The indicator plate
3) Remove the switch.
4) Remove the four Philidas screws fixing the two halves of the instrument panel together.

B — **Removal of Main Instrument Panel**

1) Remove the battery.
2) Remove the circlip from the holding spring of the hand throttle lever (Fig. 4 - A).
3) Remove the hand throttle lever from the instrument panel (Fig. 4 - B).
4) Remove the tube from the oil pressure gauge.
5) Remove the drive cable from the Tractometer.

ATTENTION: Do not lose the copper washer in the cable connector.

6) Disconnect:
   a) On the Voltage Regulator
      — the field wire
      — the dynamo wire
   b) On the Thermometer
      — the wire to the sending unit
   c) On the sarter switch
      — the wire to the ammeter
   d) On the fuse
      — the wire to the switch
7) Remove the five bolts holding the instrument panel.
8) Remove the Instrument Panel from the tractor.

OPERATION **Q6** — REMOVAL OF BATTERY CARRIERS

Preliminary Operations: Q5 - Removal of instruments panel

1) Remove the tightening nut of the battery carrier to the left side of the clutch housing.
2) Uncouple the thermostart tube from the "T" union.
3) Remove the two bolts fixing the fuel tank to the battery support as well as the rubber pads and washers.
4) Uncouple the four tubes from the fuel filter.
5) Remove the fuel filter and its two fixing bolts.
6) Remove the tightening nut of the battery carrier to the right side of the clutch housing.
7) Remove the main wiring harness from its clip on the battery carrier
8) Remove the battery carrier.

OPERATION **Q7** — REMOVAL OF FOOTRESTS

A — LEFT FOOTREST

1) Remove the rear bolt of the footrest bracket from the transmission housing.
2) Remove the bolt holding the front of the footrest to the bar fixed to the clutch housing.
3) Remove the footrest.

B — RIGHT FOOTREST

a) **When splitting the tractor between the clutch transmission housings**

1) Uncouple the rod from the ball joint of the foot accelerator pedal.
2) Remove the two bolts fixing the footrest to the support bracket on the transmission housing.

NOTE: In this case it is not necessary to uncouple the footrest completely from the tractor; it remains fixed by the front bar and slides between the two ends of the brake pedals.

b) **When not splitting the tractor**

1) Remove the rear bolt fixing the support bracket to the transmission housing.
2) Remove the bolt holding the front of the footrest to the bar fixed to the clutch housing.
3) Remove the pin holding the rod joining the parking brake lever to the brake coupler.
4) Remove the rod mentioned above and remove the linkage; it will now be possible to lift the right pedal to its maximum and to remove the return spring.
5) Remove the circlip holding the R.H. pedal.
6) Remove the pin of the spindle joining the R.H. pedal to the coupler and remove the spindle.
7) Lift up the R.H. pedal to slacken off the return spring and remove the spring.
8) Pull the pedal off its shaft.
9) Remove the footrest.

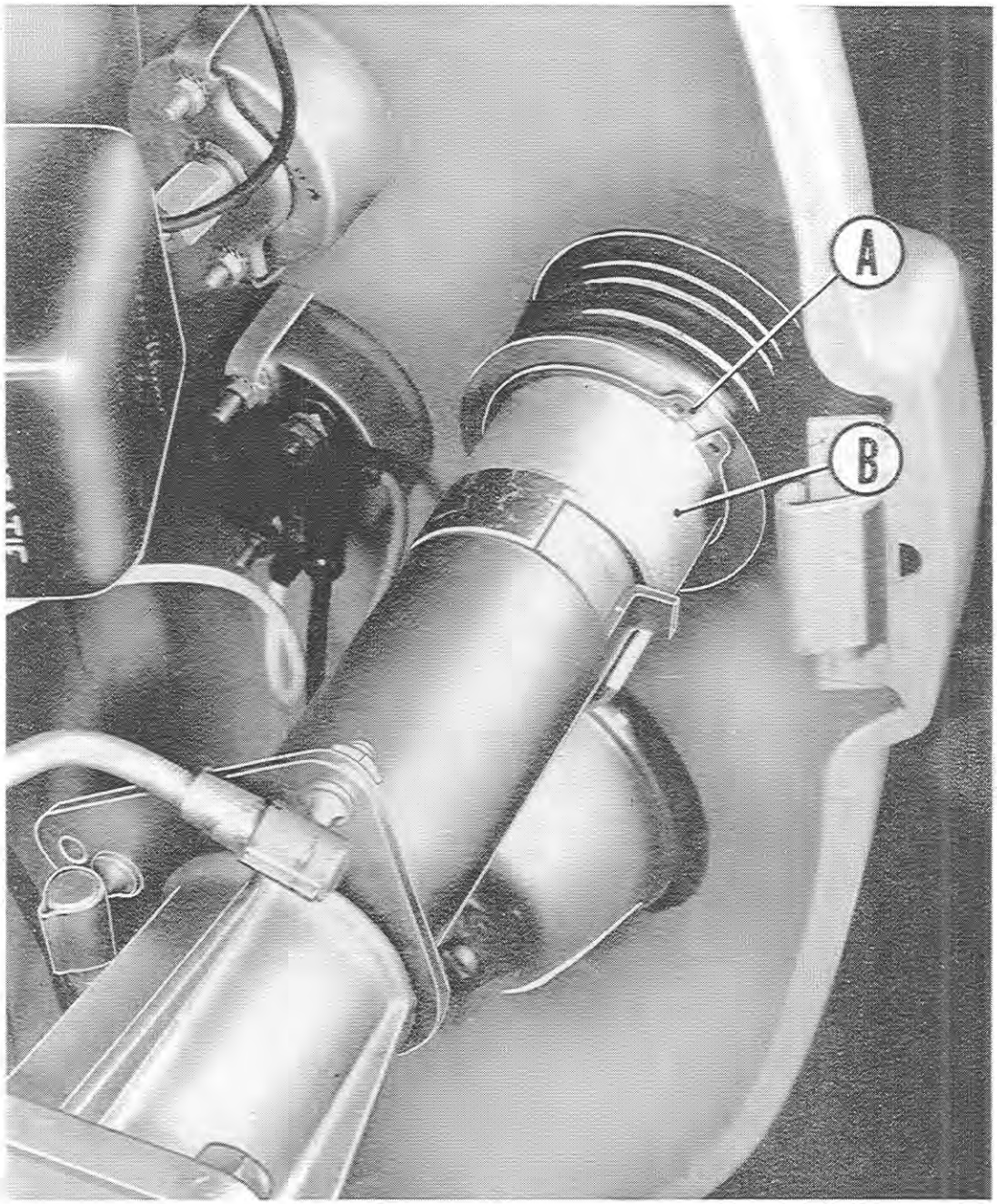


Fig. 4

OPERATION **Q8** — DISMANTLING THE RADIATOR GRILLE

A — **Removal of head-light supports from door of grille**
1) Remove the exterior assembly screws.
2) Remove the two nuts holding the head-light supports to the lower bar.
3) Separate the head-light supports from the grille frame.

B — **Removal of head-lights**
1) Remove the four nuts (on each head-light), washers and springs (the spring between two washers).
2) Separate the head-light support and the rear plate.
Finally remove the rubber ring around the glass.

C — **Uncouple the rear sealing plates of the grille**
1) Right plate: remove the three "Parker" screws and the plate.
2) Left plate: remove the three "Parker" screws, the rear screw of the locking plate and the plate.

D — **Separating the air filter from the grille**
Remove the screws fixing the air filter to the upper support plate and remove the air filter.

OPERATION **Q9** — DISMANTLING OF HOOD

Preliminary Operations: Q3 - Removal of hood

A — **Removal of the hinge pin**
1) With circlip pliers, remove the circlip at the front extremity of the pin.
2) Remove the spacer ring.
3) Slide the pin rearwards and remove the copper washer.
4) Unscrew the nut holding the hinge plate.
5) Remove the hinge plate.
6) Unscrew the lock nut.
7) Remove the hinge pin rearwards.

B — **Removal of rear hood locking catch**
1) Remove the groved pin.
2) Remove the catch handle, washer and spring.

C — **Removal of front grille**
1) Open the hood.
2) Remove the six nuts holding the grille to the hood.
3) Remove the grille and its Massey-Ferguson emblem.

OPERATION **Q10** — ASSEMBLY OF HOOD

A — **Assembling of hinge pin**
1) Fit the rod in the hinge from the rear
— the lock nut at the front
— the hinge plate
— the nut holding the hinge plate
2) Fit the rod in the location in the hood
— fit the spacer and the circlip

B — **Fitting the rear hood locking catch**
1) Fit in place, the catch handle, the flat washer and the lock
2) Fit the groved pin.

C — **Fitting the Front Grille**
1) Refit the grille and its Emblem and fix to the hood with the six nuts.
2) Shut the hood.

A — **Fitting of frame and head-lamp supports**

1) With the head-lamps placed with their glass downwards, put the frame in place.
2) Fit and tighten the four exterior assembly nuts.
3) Fit and tighten the two nuts holding the lamp supports to the lower bar (Fig. 5 - A).

B — **Fitting the head lamps**

Fit the rubber ring around the head-lamp glasses.

1) Assemble the head-lamp, its rear plate and support.
2) Place the spring between the two washers and then the nut on each of the four bolts of each lamp (Fig. 5 - B).

NOTE: The spring should be compressed to about 1" (25 mm).

C — **Fitting the rear sealing plates to the grille**

1) Right plate: Put the plate in place and fix with the three "Parker" screws.
2) Left Plate: Replace the hood locking catch.
   Position correctly the sealing plate against the grille frame and fix it with its three "Parker" screws.
3) Fit and tighten the rear screw fixing the locking catch plate.

D — **Fitting Air Filter to Grille**

Place the air filter inside the grille and fix it with its mounting screws.

A — **Left Footrest**

1) Fit the footrest over the front bar, and tighten the fixing bolt.
2) Fit the rear fixing bolt to the bracket on the transmission housing and tighten.

B — **Right Footrest**

a) **Fitting of footrest when joining up the clutch and transmission housing**
If this operation was rendered necessary for the splitting of the tractor between the clutch and transmission housings, the footrest remained attached at its front end to the clutch housing. (Operation Q7 - B - a). Consequently, when coupling up, slide the foot rest between the two brake pedals and fix it with the two bolts to the support fitted to the transmission housing.

b) **Fitting of footrest when clutch and transmission housings are already assembled together.**

1) Put the footrest in position without fixing it in place.
2) Put the R.H. brake pedal on its spindle.
3) Fit the circlip at the end of the spindle.
4) Put in place the pin joining the right pedal to the hand brake coupler.
5) Lift the L.H. pedal and attach the return spring.
6) Put in place the coupling rod between the parking brake and the foot brake.
7) Put the fixing pin of this rod in the parking brake and fit the split pin.
8) Fix the footrest to its front support bar and rear bracket.

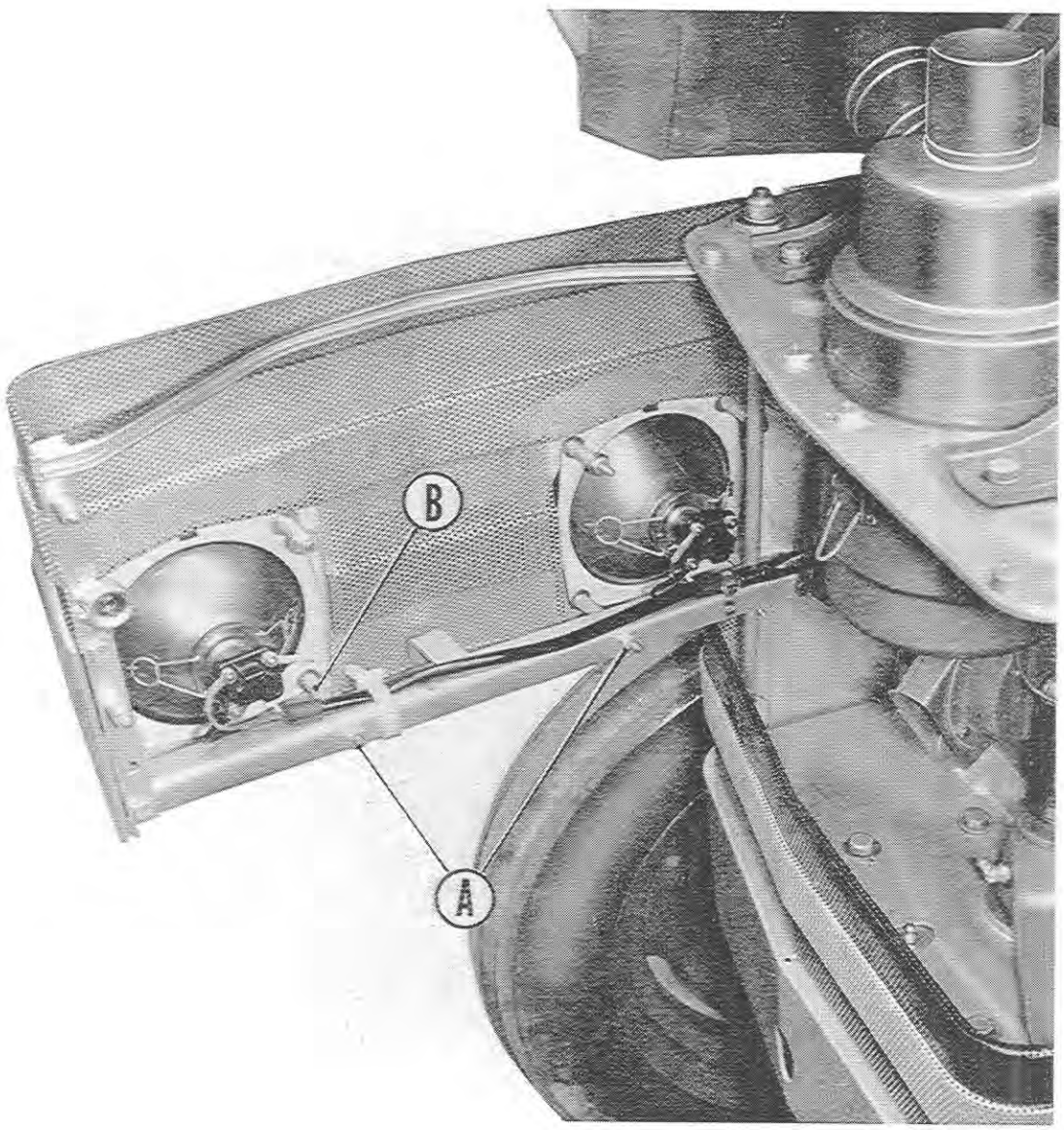


Fig. 5

ADVICE: The assembly of the steering box and battery carrier can be done on a bench but it is advisable to do this on the tractor, so as to accommodate the wiring harness and lighting switch (not disconnected in operation M2) between the steering box and the battery carrier ; the lighting switch will not pass between these two elements when they are assembled.

The battery support and steering box being on the tractor, fit one to the other by the right side, so that the play adjusting screw of the steering box and its lock nut, are positioned in the cut out portion of the battery carrier.

Simultaneously, pass the wiring harness and lighting switch between these two elements, as indicatld above, then engage the "stop" control wire in its sliding location on the steering box.

1) Place the two fixing screws of the battery carrier on the right face of the steering box. Tighten correctly.
2) Put the rubber pads between the battery and the fuel tank flange.
3) Assemble the fuel tank to the battery carrier by its two screws which fit on two other rubber pads.
4) Fit the thermostart tube to the "T" union.
5) Fit the steering box to the clutch housing by means of its four screws and flat washers, and place the main wiring harness in its clip.

   NOTE: The front left screw also holds the lighting wiring harness.

6) Fit and tighten the two nuts fixing the battery support against the upper lip of the adaptation plate.
7) Screw the plastic knob to the "stop" control wire.
8) Put in place the throttle relay lever, fit washer and split pin.
9) Place the two battery support assembly screws, on the L.H. side of the steering box.
10) Fit the throttle rods to the relay lever ball joints.
11) Fit the control rods to the relay mechanism of the foot accelerator fixed to the steering box. Tighten the lock nut after adjustment.
12) Place the fuel filter against the right face of the battery carrier and fix by its two screws.
13) Fit the four tubes to the fuel filter.

    ATTENTION: Do not omit the two copper washers when fitting the banjo union.

14) Fit the oil pressure gauge tube.
15) Fit the drop arm to the drag link.
16) Q14 - Refitting of instruments panel.

A — **Main Instrument Panel**

1) Fit around the steering column and fit to the hand throttle control (Fig. 6 - E)
   — the circlip (Fig. 6 - D)
   — the lower flat washer (Fig. 6 - C)
   — the coil spring (Fig. 6 - B)
   — the upper flat washer (Fig. 6 - A).
2) Put the instrument panel in place and fix to the battery carrier by its five bolts (the lower R.H. bolt also holds the fuse box bracket).
3) Fit the tube to the oil gauge.
4) Connect
   — on the switch, the wire to the ammeter
   — on the fuse, the wire to the lighting switch
   — on the temperature gauge, the wire to sending unit
   — on the voltage regulator, the wires to the dynamo (field and dynamo wire)
5) Place on the steernig column, the friction washer, which contacts the instrument panel, and the hand throttle lever which must be orientated on the quadrant.
6) Fit under the instrument panel the parts listed above in paragraph 1; compress them together and fit the circlip on the throttle lever sleeve.

B — **Lower Part of Instrument Panel**

1) Fit inside the panel
   — the starter switch
   — the lighting switch, assembling the various in reverse order to the dismantling procedure - see operation Q5 - A, 1 and 2.
2) Put the panel in place and fix it to the main panel with its four Philidas screws.
3) Re-connect the battery cables to the battery.
4) Shut the hood.

Complete the following operations:

M 6 - Refitting of steering wheel.
Q16 - Refitting of hood.

1) Put the grille in place; the two fuel tank support plates are placed on the upper plate of the grille.
2) Fit the two support plates to the upper plate with the two bolts.
3) Fit the four fixing screws of the lower support plate to the front axle support. (The front R.H. screw also holds the horn support).
4) Fit the three pole electrical connector beneath the upper support plate by means of the R.H. rear screw which also holds the air filter.
5) Connect to the three pole connector the wires for:
   — the horn
   — the side-lights
6) Fit the greaser for the front axle pivot pin.
7) Fit the air hose to the air filter and tighten the clip.

NOTE: It is preferable to fit the hood before fitting the head-light support door.

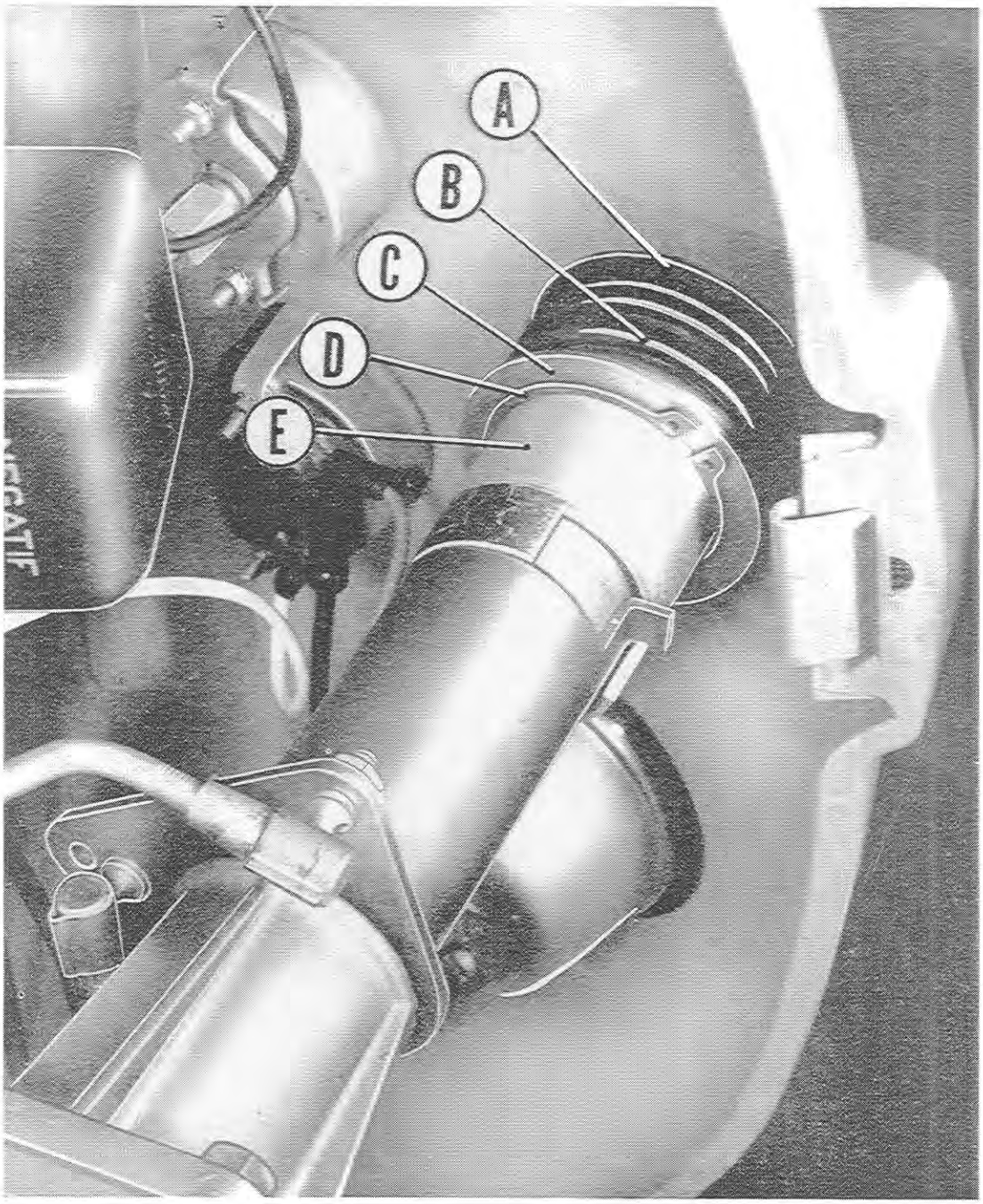


Fig. 6

1) Fit the hood to the tractor and fit the hinge rod in its location in the instrument panel.
2) Position suitably the hood holding cable and fix with split pin.
3) Place and tighten up the lock nut of the hinge rod under the instrument panel.
4) Fix the front hinge plate of the hood to the grille with two screws. Tighten these correctly.
5) Connect the cables to the battery.
6) Shut the hood and lock the front and rear catches.
   If necessary re-position the front catch support plate; this being positioned on the tractor, tighten the two fixing screws.

Right Fender

1) Put the fender in place on the tractor.
2) Fix the fender with the two bolts to the rear axle housing: tighten correctly.
3) Fit the lamp support.
4) Fix the cable in place.

Left Fender

1) Put the fender in place on the tractor.
2) Fix the fender with the two bolts to the rear axle housing: tighten correctly.
3) Fix the cable for the number plate in place.
4) Connect the cable to the connection for the number plate.

1) Put the seat in place.
2) Put the two pole electrical connector in place and the rear seat fixing bolt.
3) Fit and tighten the front seat fixing bolt.