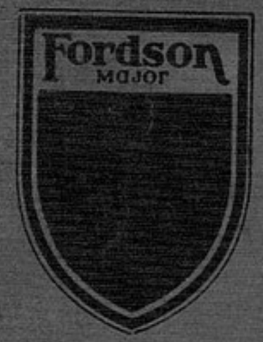
Fordson
MAJOR
TRACTOR

AGRICULTURAL · ROW CROP
LAND UTILITY · INDUSTRIAL

INSTRUCTION MANUAL

PRICE 2/- POST FREE

FORD MOTOR COMPANY LTD
DAGENHAM



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INSTRUCTION MANUAL

OF THE

Fordson MAJOR TRACTOR

STANDARD
AGRICULTURAL
●
ROW CROP
●
LAND UTILITY
●
INDUSTRIAL

By Appointment — Motor Vehicle Manufacturers

FORD MOTOR COMPANY LIMITED
DAGENHAM, ESSEX - - - - - - - - ENGLAND

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FOREWORD

The Fordson Major Tractor is simple to operate and maintain, reliable in operation, and, provided it is properly looked after, will give years of good service. In order to utilise the tractor to the best advantage, some knowledge of how it works and an understanding of the maintenance needed is essential.

This book has been prepared to enable the operator to keep the tractor in good condition, and to avoid those abuses likely to cause damage. It deals primarily with the Agricultural Model, though all the information given applies equally to the Row Crop, Industrial and Land Utility Tractors, with a few exceptions which are dealt with in the appropriate place in the book.

The method of carrying out certain repairs is described, and while, in general, it is safe for an experienced mechanic to carry out this work, it is strongly recommended that the operations described in the repair section of this book should be carried out only by an authorised Fordson dealer. They are described for the benefit of those operators who are situated at a distance from their dealer.

Before using the tractor, read the Operation and Maintenance sections of this book through carefully, and be quite sure that you are thoroughly familiar with the contents. If there are any points on which you are not clear, your local Fordson dealer will be pleased to help you in every way.

When reference is made in the text to "right-hand side" or "left-hand side" this is to be interpreted as viewed from the operator's position.

Specification

AGRICULTURAL TRACTOR

(Row Crop, Industrial or Land Utility Tractors similar except where noted).

Engine.—Four cylinder, four-stroke, cylinders cast *en bloc*. Cylinder bore 4⅛ in. (104.8 mm.). Piston stroke 5 in. (127.0 mm.). Cubic capacity 267 cu. in. (4380 c.c.). Firing order 1, 2, 4, 3. Special cast alloy crankshaft, statically and dynamically balanced, carried on 3 main bearings, 2 in. (50.8 mm.) diam. by 3¼ in. (82.55 mm.) long. Big end bearings, 2 in. (50.8 mm.) diam. by 2¼ in. (57.15 mm.) long. Cast-iron pistons, with 3 compression and 1 oil control piston rings fitted above the piston pin. Side by side valves of special steel alloy. Industrial Tractor has high compression cylinder head for running on petrol. Low compression cylinder head for running on vapourizing oil.

Lubrication by splash system with oil circulation maintained by oil thrown off flywheel by centrifugal action. Ducts lead oil to main bearings and timing gears. Oil capacity 2¼ imperial gallons (19.33 litres).

Use a good quality oil of S.A.E. 30 viscosity in Winter and S.A.E. 40 viscosity in Summer. For climates having a temperature above 90°F. use an oil of S.A.E. 50 viscosity, for climates with a severe Winter temperature below 20°F. use an oil of S.A.E. 20 or 20W viscosity.

Engines operating exclusively on petrol can use an engine oil one grade lighter in each case.

Cooling System.—Thermo-syphon, impeller assisted. Efficient cooling ensured by vertical tube type radiator with very large reinforced tanks, in conjunction with ample water jackets round cylinder block and cylinder head, and four-bladed fan which draws 1,700 cu. ft. (48.14 cu. m.) of air per minute through the radiator. Water capacity, 10 gallons (45½ litres). A radiator blind is fitted at the bottom of the core so that a greater or lesser area is exposed. This permits a satisfactory operating temperature being attained and should be suitably adjusted to compensate for varying load conditions which may be encountered.

Water temperature gauge, mounted on the radiator, is visible to the operator and indicates the cooling water temperature.

Ignition System.—High tension magneto with impulse coupling for easy starting, driven by a helical gear from camshaft gear. Manual advance and retard controlled by lever on dash.

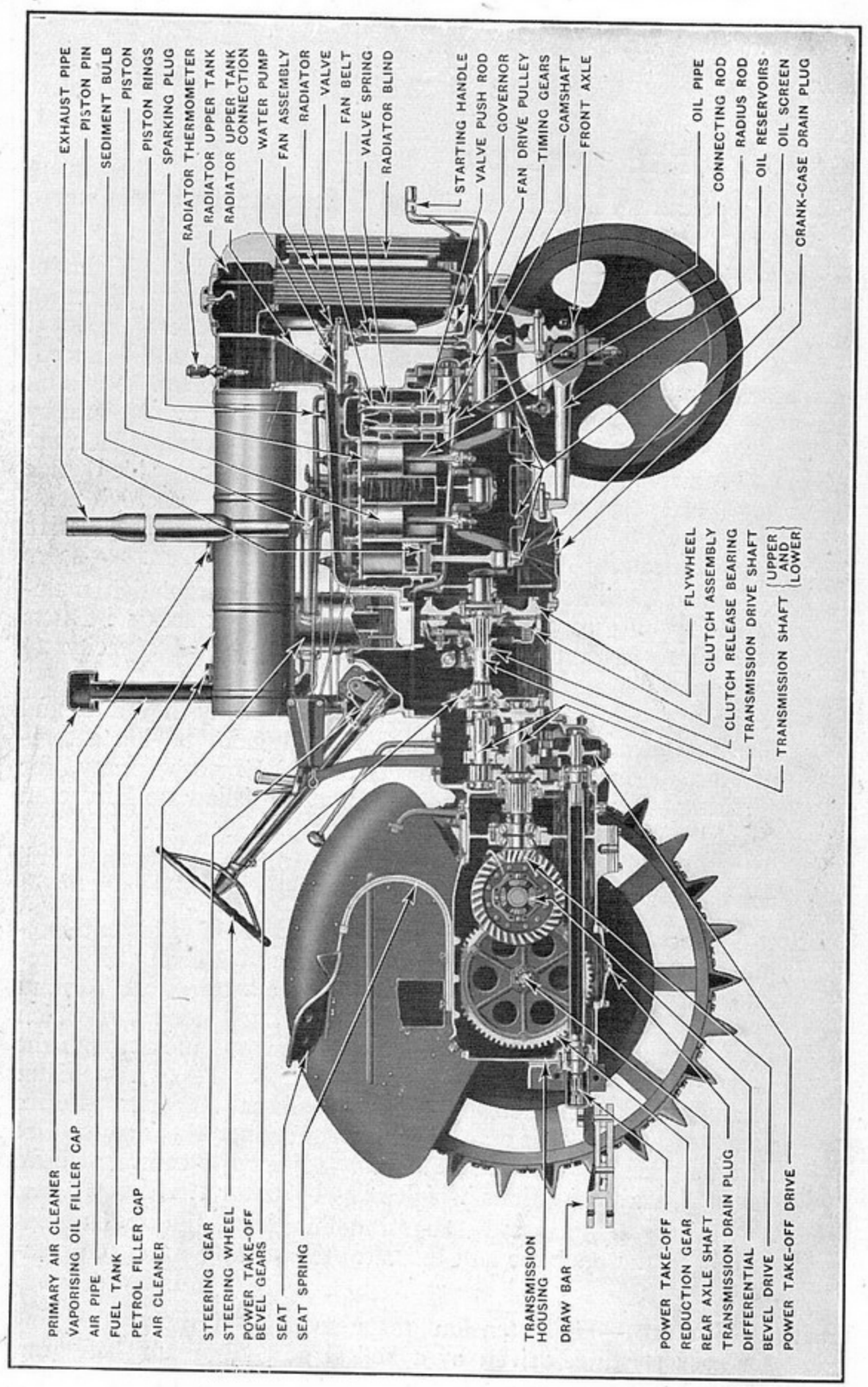


Figure 1
Section of Tractor

Governor.—Centrifugal type, adjustable to maintain any desired engine speed from 400–1,450 r.p.m. Controlled from dash. Optional on Industrial Tractor, which normally has throttle lever beneath steering wheel, directly connected to carburettor.

Fuel System.—Gravity feed from 17½ imperial gallon (79.55 litres) overhead tank, through a sediment bulb which filters all fuel before it reaches the vapourizer or carburettor. Tractors equipped to run on vapourizing oil have a one gallon (4.55 litres) auxiliary petrol tank inside the main one.

Vapourizer.—Tractor fitted with low compression cylinder head for running on vapourizing oil has a special vapourizer with an adjustable mixture control and an exhaust heated plate to ensure economy and proper vapourization of fuel.

Carburettor.—Tractor fitted with high compression cylinder head for running on petrol has special down draught carburettor.

Air Intake System.—A primary air cleaner at the top of the vertical air inlet pipe, and an oil bath air cleaner ensure that all air used by the engine is thoroughly clean, thus minimising wear on all engine parts. A gauze type of filter may be used when operating on petrol only.

Steering System.—Worm and nut (steel sector and worm on early tractors). Ratio 17 to 1. All steering arms and rods are of heavy construction. Easily replaceable bushes are fitted to steering shaft and spindle bodies.

Front Axle.—Heavy cast steel axle, heat treated to provide maximum strength. It is mounted at the centre of the front of the engine on a trunnion. Heavy radius rods are fitted to take up thrust.

Front Axle, Row Crop.—Adjustable for width by means of extensible ends which can be altered to give track widths from 48 ins to 72 ins. (121.92 cm. to 182.88 cm.) for cast-iron wheels, 49¾ ins. to 73¾ ins. (126.36 cm. to 187.32 cm.) when pneumatic tyres are fitted, without affecting the radius rods or drag link.

Gearbox.—Constant mesh sliding selective type with three speeds forward and reverse. All shafts run on ball or roller bearings. Single plate clutch mounted on flywheel and operating in oil. Oil capacity approximately 2¾ imperial gallons (12.5 litres). Use a good grade of gear oil of S.A.E. 90 viscosity for both Winter and Summer. For hot climates with temperatures above 90°F. use a gear oil of S.A.E. 140 viscosity, for climates having Winter temperatures below 10°F. use a gear oil of S.A.E. 80 viscosity.

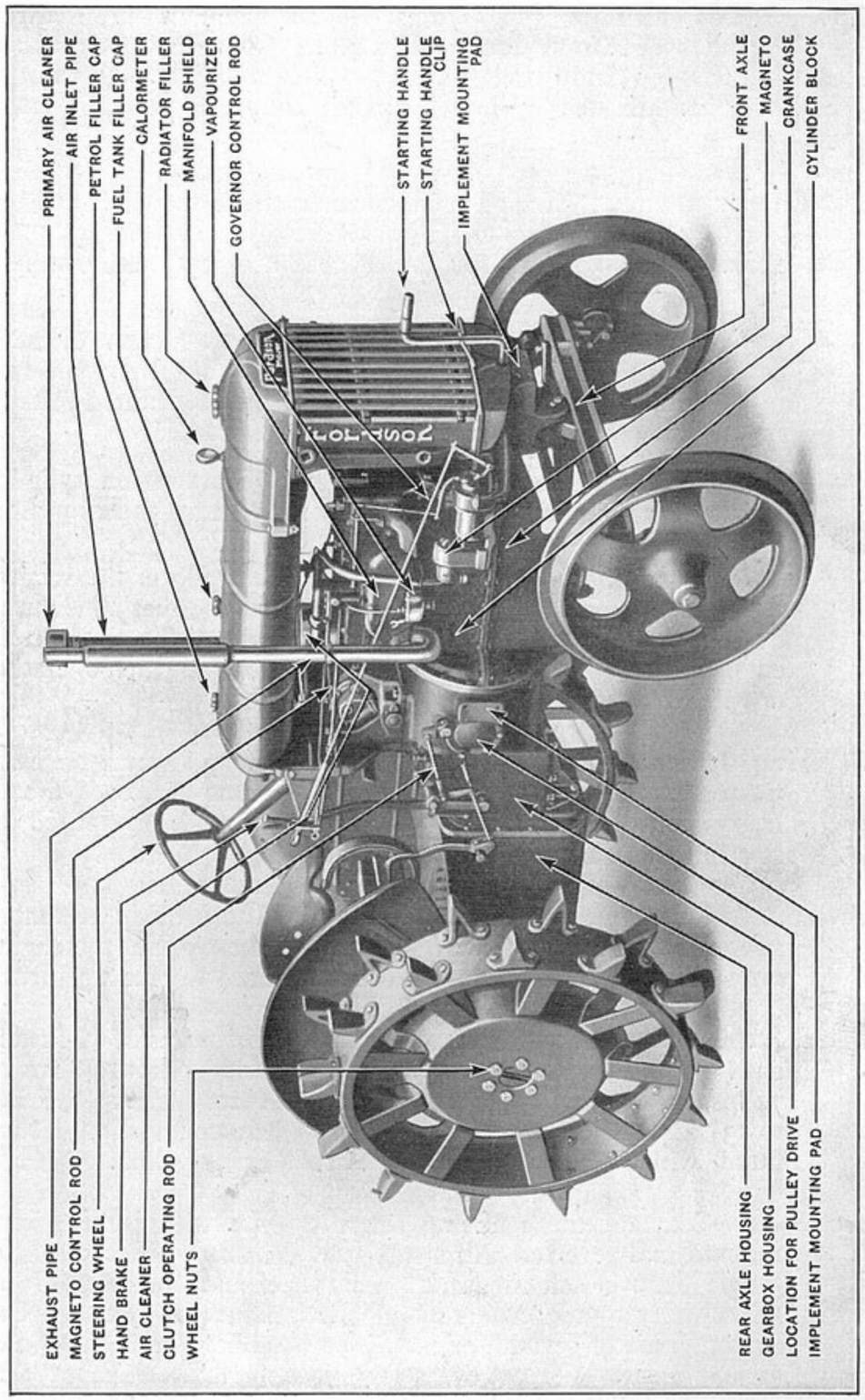


Figure 2
Vapourizer Side of Tractor

Gear Ratios (Based on an engine speed of 1,200 R.P.M.)

Type 4.3 (Low Speed Top Gear)

Standard Ratio (Intermediate Gears)

Gear	Final Ratio	M.p.h. †	M.p.h. *	K.p.h. †	K.p.h. *	‖ Identification
First	73.6 :1	2.18	2.54	3.51	4.09	S.T.D. 43 (Green Spot)
Second	48.6 :1	3.31	3.85	5.33	6.20	
Top	34.84:1	4.61	5.37	7.42	8.64	
Reverse	85.9 :1	1.88	2.18	3.03	3.51	

Special Ratio (Intermediate Gears)

Gear	Final Ratio	M.p.h. †	M.p.h. *	K.p.h. †	K.p.h. *	‖ Identification
First	92.9 :1	1.72	2.02	2.77	3.24	S.R. 43 (Red Spot)
Second	61.32:1	2.62	3.06	3.32	4.92	
Top	34.84:1	4.61	5.37	7.42	8.64	
Reverse	108.2:1	1.48	1.72	2.38	2.77	

Type 7.7 (High Speed Top Gear)

Standard Ratio (Intermediate Gears)

Gear	Final Ratio	M.p.h. †	M.p.h. *	K.p.h. †	K.p.h. *	‖ Identification
First	68.5 :1	2.35	2.73	3.78	4.39	S.T.D. 77 (Green Spot)
Second	48.6 :1	3.31	3.85	5.33	6.20	
Top	19.4 :1	8.30	9.65	13.36	15.53	
Reverse	50.6 :1	3.18	4.04	5.12	6.50	

Special Ratio (Intermediate Gears)

Gear	Final Ratio	M.p.h. †	M.p.h. *	K.p.h. †	K.p.h. *	‖ Identification
First	86.5 :1	1.86	2.16	2.99	3.48	S.R. 77 (Red Spot)
Second	61.4 :1	2.62	3.06	3.32	4.92	
Top	19.4 :1	8.30	9.65	13.36	15.53	
Reverse	63.9 :1	2.48	2.93	3.99	4.72	

INDUSTRIAL TRACTOR, WITH PNEUMATIC TYRES

Type 7.7 (High Speed Top Gear)

Standard Ratio (Intermediate Gears)

† With Steel Wheels. * With Pneumatic Tyres.

‖ Stamped on R.H. flange of gearbox housing towards the top where this mates with the flywheel housing.

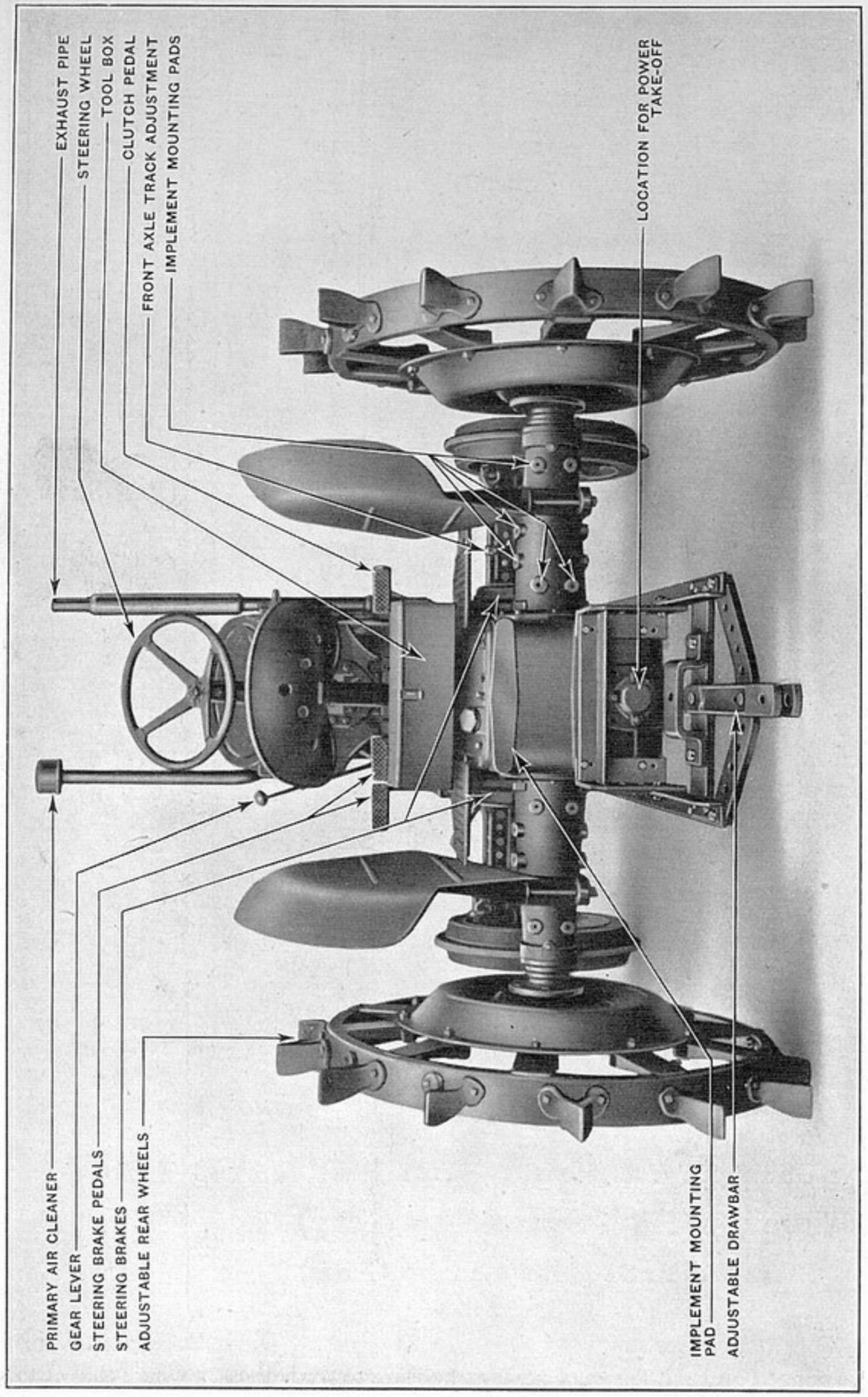


Figure 3
Rear View of Row Crop Tractor

Handbrake.—Multi-plate disc, running in oil, operated by hand brake lever, acting on transmission.

Foot Brake (optional equipment).—External brake drums fitted to countershaft at each side with internal expanding self energising dual shoes. Foot pedals in duplicate, side by side on left hand of tractor, enabling brake on either side, or both, to be operated.

Foot Brake.—Industrial Tractor. Brake drums fitted to rear wheels, brake back plates carried on axle housings. Brake shoes of internal expanding type, non-servo, with simple adjustment for lining wear.

Rear Axle.—Semi-floating, four-pinion differential, running on roller bearings.

Crown and pinion spiral bevel reduction of 3.5 : 1 to countershaft. Spur gear reduction from countershaft to rear axle shafts 5.308 : 1. Oil capacity, 10 imperial gallons (45.46 litres) approximately. Use a good grade of gear oil of S.A.E. 90 viscosity for both Summer and Winter. For hot climates with temperatures above 90°F. use a gear oil of S.A.E. 140 viscosity, for climates having Winter temperatures below 10°F. use a gear oil of S.A.E. 80 viscosity.

Wheels—Front.—Heavy cast-iron, mounted on adjustable roller bearings.

Rear.—Have spokes welded to the rim, which is punched to allow spade lugs to be fitted. Wheels adjustable to vary width of track on Row Crop from 48 ins. to 72 ins. (121.92 cm. to 182.88 cm.) minimum width with pneumatics 52 ins. (132.08 cm.).

Wheels—Front.—Land Utility and Industrial. Heavy cast-iron, similar to agricultural, mounting pneumatic tyres, 6.00–19 in. Tyre pressure 25 lbs. per sq. in. (1.758 kg. per sq. cm.)

Rear.—Land Utility. Steel wheel, with welded spokes, mounting pneumatic tyres, 11.00–36 in. Tyre pressures: Land work—min. 11 lbs. per sq. in. (0.773 kg. per sq. cm.); Road use—14 lbs. per sq. in. (0.984 kg. per sq. cm.)

Adjustable Drawbar.—A drawbar, adjustable for height and hinged to provide lateral movement if required, is mounted accessibly behind the rear axle housing at the centre.

Rear Towing Attachment.—Industrial Tractor. Automatic coupling mounted on laminated transverse leaf spring, carried on channel iron frame.

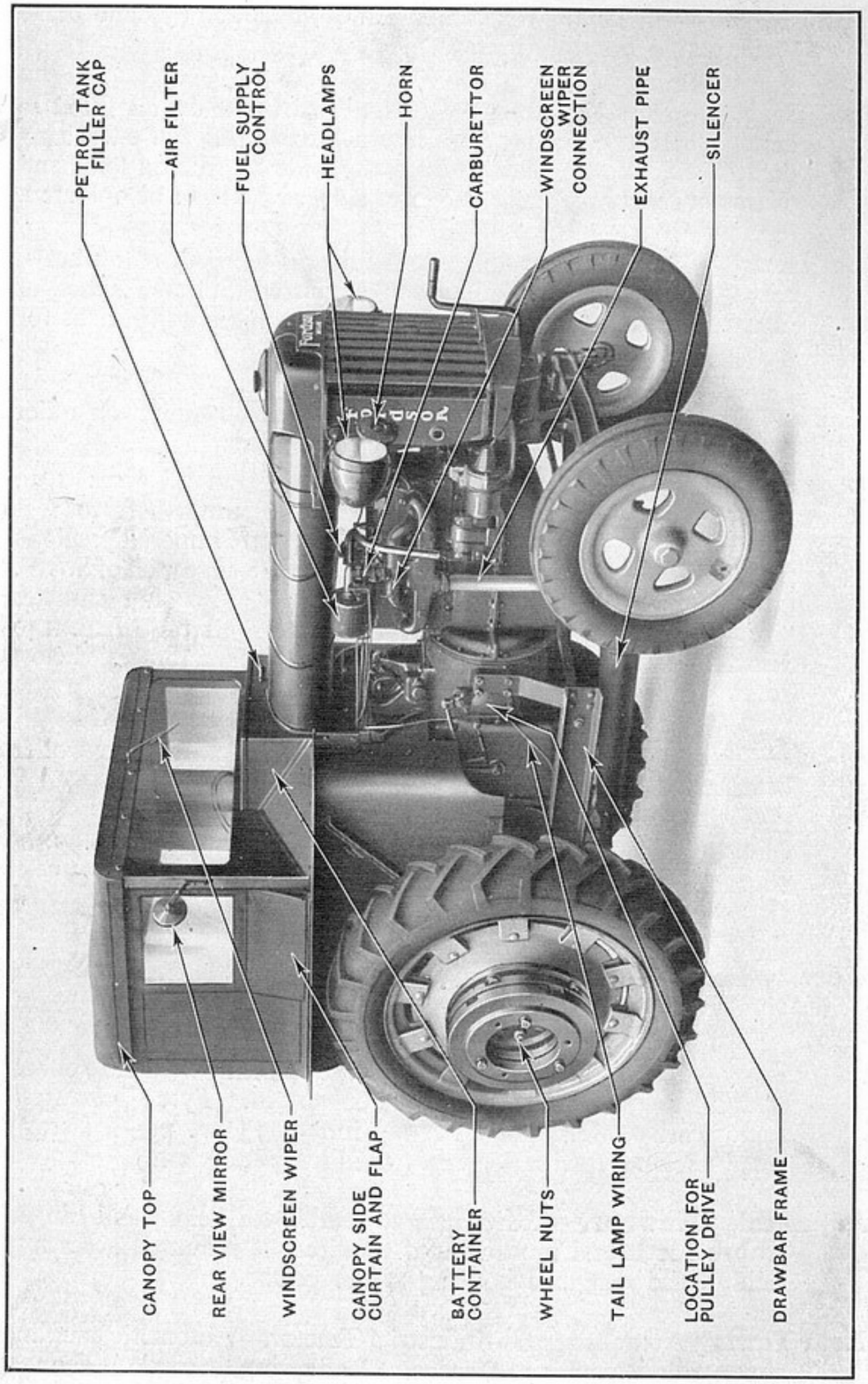


Figure 4
Industrial Tractor

Belt Pulley Drive, having either a fixed drive or a control lever, permitting the drive to the pulley to be disconnected at will, may be fitted. Diameter of pulley 9½ in. (24.13 cm.) fabric type, or 9¾ in. (24.76 cm.) cast-iron type, operating at engine speed, giving belt speed of 2,984 ft. (604.7 m.) per minute for each type.

Power Take-off Shaft above draw-bar at rear centre of axle operates at 574 r.p.m. for 1,200 r.p.m. of engine, clockwise rotation, 6 splines, 1⅜ in. (34.92 mm.) dia. (optional equipment: not available for Industrial Tractor).

Hydraulic Power Lift.—Power take-off from top of gearbox, driving self-contained pump unit and lift, hand lever control (extra equipment. Not fitted to Industrial Tractors).

Electrical System (Extra equipment: standard on Industrial Tractor).—12 volt, two-brush generator, belt-driven from crankshaft pulley, with automatic current control by regulator unit. Battery mounted on dash panel above gearbox, starter fitted on left-hand side of engine with solenoid switch controlled from dash or starter, lamps and horn.

Weight.—Agricultural Tractor, with spade lugs, 4340 lbs. (1968 kg.) approx.

Land Utility Tractor, 4214 lbs. (1911 kg.) approx.

†Row Crop Tractor, with spade lugs, 4368 lbs. (1981 kg.) approx.

Above weights are less driver, but with water and oil.

Weight.—Industrial Tractor, less driver, water, oil and fuel, but including tools, wheel weights and ballast, 2 tons, 13 cwts. 3 qrs. (2730 kg.) approx.

Weight for Taxation.—Over 2 tons. (2032 kg.)

Dimensions.—Wheelbase, 77 ins. (195.58 cm.); diameter of front wheel, 30 ins. (762 cm.); width of rear rims, 9 ins. (22.86 cm.) (Row Crop 4½ ins.) (11.43 cm.); width of extension rim 4½ ins. (11.43 cm.); diameter of rear rim 45 ins. (114.3 cm.) (spade lugs additional). Overall length of tractor 133 ins. (337.8 cm.), overall width 65 ins. (165.1 cm.), 77½ ins. (196.85 cm.) with extension rims less spade lugs, overall height, 82 ins. (208.28 cm.). Ground clearance at front axle, 17½ ins. (44.45 cm.), pneumatics, 16⅜ ins. (41.59 cm.), steel wheels. Ground clearance at engine, 19 ins. (48.26 cm.) steel wheels, or 22 11/16 ins. (57.63 cm.) on pneumatics. Height of drawbar from ground, steel wheels 11½ ins. (29.21 cm.) minimum, 14⅞ ins. (37.78 cm.) maximum; pneumatic tyres, 16¼ ins. (41.28 cm.) minimum, 19 9/16 ins. (49.8 cm.) maximum. Turning circle 26 ft. (7.92 m.) 21 ft. (6.4 m.)—with brakes in operation.

† With Pneumatics 4062 lbs. (1842 kg.).

Dimensions—Industrial Tractor.—Overall length, 10 ft. 8½ ins. (326.4 cm.); overall width, 5 ft. 6 ins. (167.6 cm.); overall height, 7 ft. 4 ins. (223.5 cm.). Ground clearance at silencer, 12 ins. (30.4 cm.) approx. Height at coupling, 18½ ins. (47 cm.) approx. Turning circle, 26 ft. (7.92 m.)

Toolbox.—Beneath seat with full equipment of tools. On left side of engine when Hydraulic Power Lift is fitted and on Industrial Tractor.

Location of Engine Number.—Front end of cylinder block on o/s between No. 1 cylinder exhaust port and inlet port.

Important Instructions for Operators

1. The importance of adequate and correct lubrication cannot be too strongly impressed on tractor drivers. The correct grades of oil must be used in the engine and transmission. The oil should be maintained at the proper level at all times and changed frequently. Keep the strainers in the oil filler and bottom of the crankcase clean and in good condition. Clean oil will protect the engine bearings, minimise wear on all engine parts, and cut down sparking plug trouble.

2. The worst abuse that can be given the tractor is racing the engine. Drivers must avoid this at all times. The proper speed to run the engine is 1,200 revolutions per minute. The tractor is equipped with a governor which can be set to give the correct speed to suit operating conditions. The manual control permits the speed to be adjusted by the operator to the desired figure immediately. A throttle control is fitted beneath the steering wheel on Industrial Tractors and acts directly on the carburettor, without any governor device. When the engine is idling cut the speed down as low as possible and retard ignition (ignition lever up). When starting do not race the engine to heat up the manifold quickly. This is destructive to the tractor and will not accomplish your purpose.

3. Do not allow the engine to labour, but change to a lower gear immediately it shows signs of doing so.

4. It is very important that the correct oil level is maintained in the air cleaner of the oil bath type. If it is not kept cleaned and filled to the oil level mark with engine oil, dirt and grit will be drawn into the cylinders, resulting in premature wear of pistons, rings and cylinders and loss of power. Never operate this type of air cleaner with the oil container empty.

The dry, gauze type air filter should be cleaned approximately every three months, see page 69.

5. The Drawbar or coupling is provided for your convenience in hitching. Always hitch to this and do not hitch a chain or rope round the rear axle housing under any circumstances. When pulling a heavy load, or when the tractor is travelling on very soft ground where there may be a tendency for the wheels to sink and dig in, be sure to keep your foot adjacent to the clutch pedal. If the tractor should become bogged, always pull out in first gear. Do not attempt to pull tree stumps out of the ground or do any similar work which may bring the tractor to a sudden stop.

6. Do not race the engine and let the clutch in suddenly, as this may lift the front end of the tractor off the ground. Should this happen, release the clutch immediately—this will bring the front wheels back to the ground at once.

The clutch pedal should always be depressed when using the starter motor. Not only does this reduce the oil drag from the gearbox, but it also isolates any of the various drives such as the pulley drive, power take-off shaft or hydraulic lift drive should these not have been returned to the neutral position.

7. Do not attempt to engage or disengage gears until the clutch pedal has been pushed down far enough to release the clutch fully. Always allow the clutch pedal to engage gradually, so taking up the drive smoothly. Do not, however, " slip " the clutch when the tractor is in motion, as this damages the clutch disc and clutch as a whole. When changing gear, if the clutch is not properly disengaged, the teeth on the gears will not mesh readily, and there is danger of breaking off the edges of the teeth so that in time they will not remain in mesh. Always reduce the speed of the engine when changing gear.

8. Do not run the tractor downhill with the gears in neutral or with the clutch released. Engage either first or second gear and use the governor or throttle lever to control the speed of the engine. To bring the tractor to a complete stop, declutch and apply the hand brake. It is good practice to lift the pawl from the ratchet when pulling " on " the handbrake as this saves wear on these parts. When the footbrake pedals are fitted the tractor wheels may be locked by first engaging the latch which locks both pedals together and then pressing down the pedals to apply the brakes. When firmly applied, engage the pawl which will then enter one of the serrations of the sector (see also page 20 and Fig. 8).

9. Remember that a new tractor requires more careful attention during the first few days it is being driven, than after the parts have become thoroughly " run in." The tractor which is driven carefully when new gives the most satisfactory service in the end. See that the

tractor has plenty of oil and water before starting work. If the tractor is left in the open overnight, see that it is properly covered and drain the radiator if there is any likelihood of frost. The radiator drain tap is beneath the radiator, to the left-hand side. See Fig. 9. When the tap is opened to drain the radiator, it is good practice to probe the passage when the flow of water ceases as sediment or some foreign matter may cause a blockage, thus it may appear that the system is empty when in fact water may be trapped. Nothing will shorten the life of the tractor more than being left exposed to the weather. INSPECT THE TRACTOR DAILY AND SEE THAT ALL BOLTS AND NUTS ARE TIGHT AND THAT THERE ARE NO OIL LEAKS. Make a practice of taking care of each repair and adjustment as soon as its necessity is discovered; this attention requires but little time and may avoid delay or accident. When the tractor is delivered it is in proper mechanical adjustment. After it has been worked it is plainly the duty of the owner to see that it is kept in that condition.

10. If a noise develops in the engine or transmission, it is important that the cause be investigated at once and corrected. If not corrected it may become more pronounced, thereby causing lack of power and tending to shorten the life of the tractor. Do not continue to operate the tractor when the engine fires only on two or three cylinders. This, besides causing loss of power and wasting fuel, will allow unburnt fuel to get into the crankcase, thinning the lubricating oil, and accelerating wear.

11. Full use should be made of the radiator blind. When starting the tractor pull the blind up to the fullest extent and on no account should vapourizing oil be admitted until the engine is hot enough to vapourize the fuel completely.

12. The blind should be adjusted during work so that the cooling water is at least 80°C. or 176°F., preferably just below boiling point.

The calormeter fitted to the radiator indicates the temperature of the cooling water by means of an indicator needle. For efficient operation, keep the blind so adjusted that the needle of the circular-type calormeter is within the white-coloured sector, and with the pillar-type calormeter the red and white sections must be centrally positioned in the aperture.

13. Do not run with the mixture richer than necessary. A rich mixture wastes fuel, forms carbon, dilutes the lubricating oil and gives inferior results.

14. When electrical equipment is fitted there is the possibility that the battery may freeze in extremely severe conditions of frost,

particularly if it is not fully charged or the electrolyte specific gravity is not correct. Suitable precautions must be taken to obviate damage by such freezing which can result in a cracked container and if the Tractor has to be out of use under conditions of severe frost for some time, the battery should be removed for proper storage.

15. **Do restrict the speed of the tractor when implements are in the fully raised position,** with hydraulic equipment. Severe shock loading can be imposed on the hydraulic pump and lift mechanism, possibly causing damage, if implements, when raised, are subjected to bumps caused by driving too fast over uneven surfaces.

IN CASE OF DIFFICULTY CONSULT YOUR FORDSON DEALER.

Controls

The Choke Control is located on the extreme right of the dash. It is pulled out to enrich the mixture when starting.

The Governor Control is placed immediately above the choke control and controls the speed of the engine. It may be set in any desired position by means of a ratchet. To increase the engine speed, pull the control out.

The Throttle Lever on Industrial Tractors is on the right-hand side underneath the steering wheel. To open the throttle, move the lever downwards, i.e., towards the driver.

The Ignition Control Lever which is located to the left of the governor control serves two purposes :—

1. To advance and retard the timing of the spark which ignites the combustible mixture in the cylinders.
2. To stop the engine by earthing the primary current of the magneto.

When the tractor is running, the ignition control lever should be moved down to the stop, which is the fully advanced position. Whenever heavy pulling causes the engine to " pink " the ignition should be

TWICE DAILY IN THE MORNING AND AFTER DINNER

(A) FILL WITH FRESH CLEAN WATER

(B) FILL TO F MARK ON DIPSTICK WITH OIL OF CORRECT GRADE

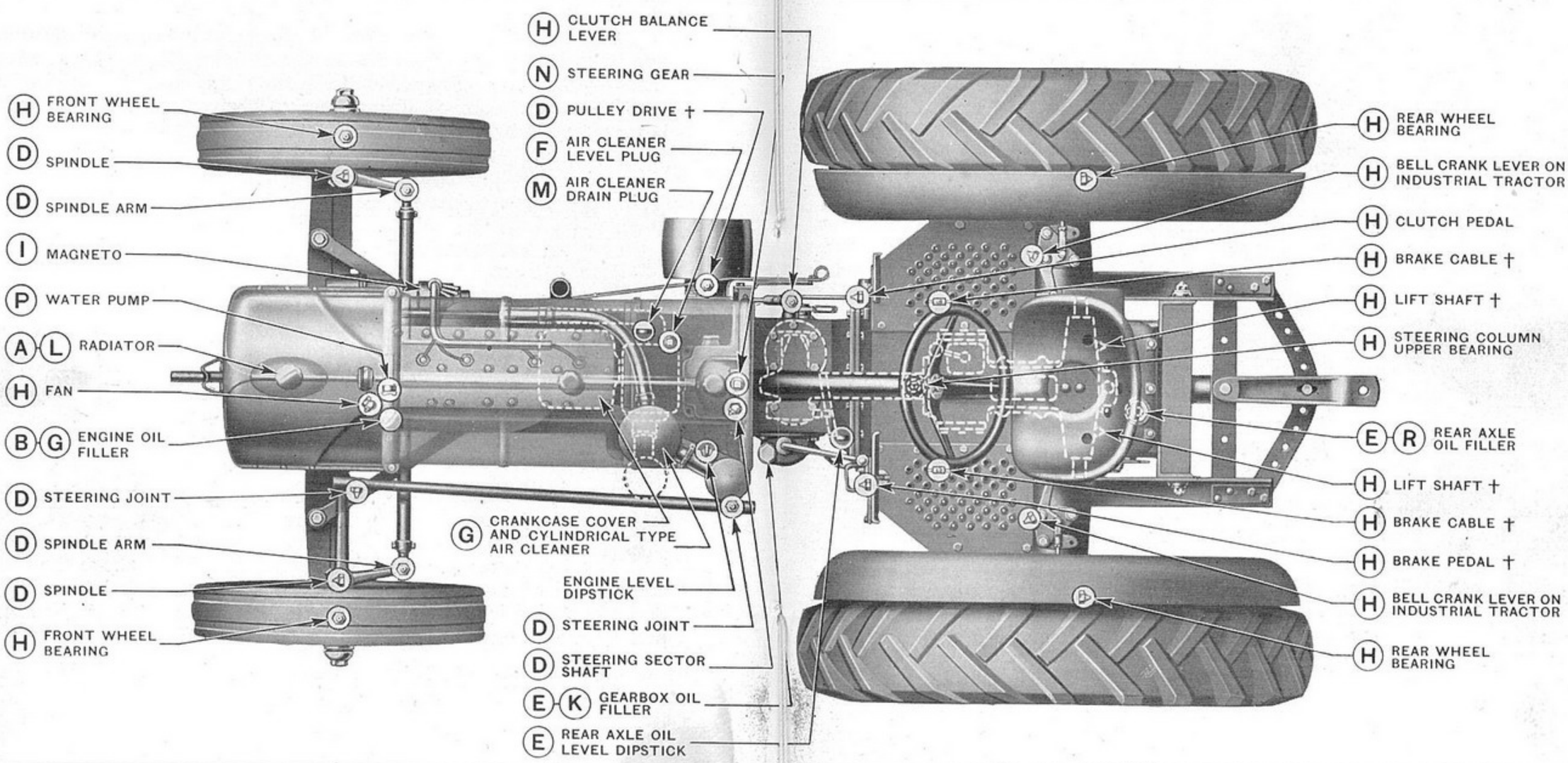
(P) USE SUITABLE WATER PUMP GREASE AS REQUIRED

EVERY NIGHT

(D) GREASE WITH GREASE GUN

(E) CHECK OIL LEVEL AND ADD GEAR OIL IF NECESSARY

(F) CHECK OIL LEVEL AND ADD CLEAN ENGINE OIL IF NECESSARY. COVER TRACTOR TO PROTECT IT FROM THE WEATHER



AFTER EVERY 50 HOURS (100 HOURS WHEN USING PETROL ONLY)

(G) CHANGE ENGINE OIL, REMOVE CRANKCASE COVER, CLEAN COVER AND SCREEN IN PETROL, RE-ASSEMBLE AND REFILL WITH OIL OF CORRECT GRADE. WASH OIL FILLER CAP IN PETROL AND RE-OIL FILTER. CYLINDRICAL TYPE AIR CLEANER, CHANGE OIL, CLEAN OUT SEDIMENT

(H) GREASE WITH GREASE GUN

(I) APPLY 2 OR 3 DROPS OF OIL

AFTER EVERY 6 MONTHS OPERATION

(K) DRAIN, FLUSH WITH ENGINE OIL AND REFILL WITH CORRECT GRADE OF GEAR OIL

AFTER EVERY 200 HOURS

(L) DRAIN AND FLUSH UNTIL WATER COMES OUT CLEAN

(M) DRAIN SQUARE TYPE AIR CLEANER AND REFILL WITH ENGINE OIL (WHEN FITTED)

(N) FILL TO LEVEL OF FILLER HOLE WITH GEAR OIL OF CORRECT GRADE

AFTER EVERY 12 MONTHS OPERATION

(R) DRAIN AND REFILL WITH CORRECT GRADE OF GEAR OIL

†WHEN FITTED.

Figure 5 **Lubrication and Maintenance Chart**

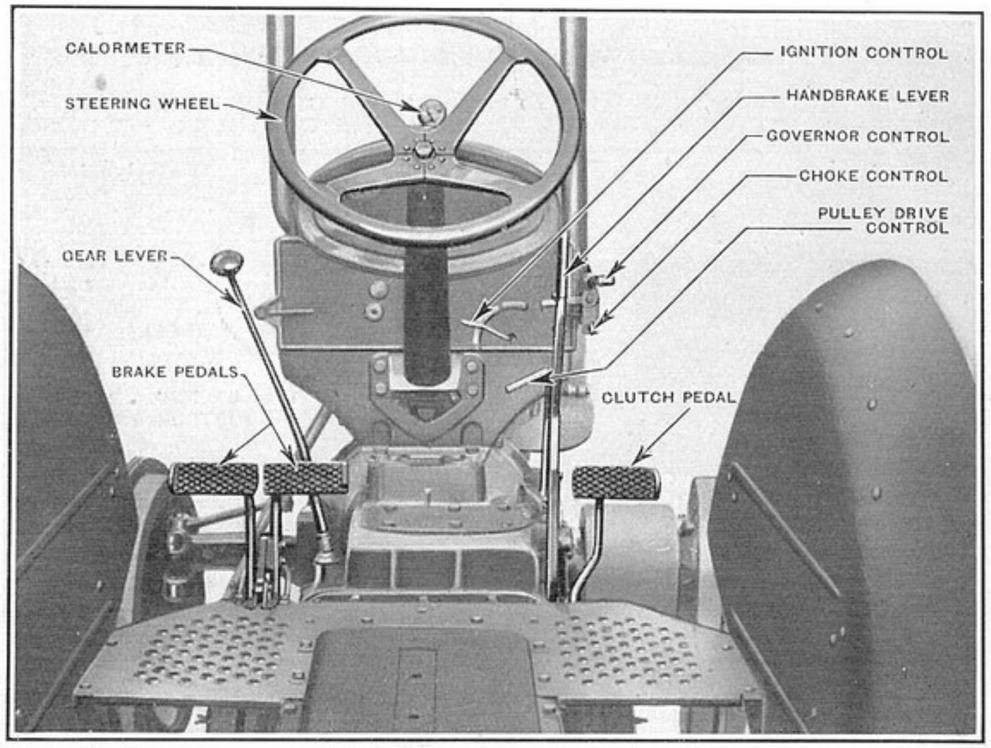


Figure 6
View of Controls

retarded by raising the handle just sufficiently to stop the pinking. Driving with the ignition too far retarded is conducive to overheating, high fuel consumption and loss of power.

When the ignition handle is in the " fully retarded " position, it drops into a small notch cast in the dash. If the handle is moved to the right beyond this notch it closes the earth contact on the magneto housing and so stops the engine.

The Vapourizer Needle Control (on tractors equipped with vapourizers) controls the proportion of fuel and air supplied to the engine. It is located on top of the float chamber on the right-hand side of the tractor. To enrich the mixture, turn the needle in an anti-clockwise direction. The best setting is approximately two and one quarter turns open.

The Carburettor Main Jet Adjusting Needle controls the amount of petrol issuing from the jet. To enrich the mixture, turn the needle anti-clockwise. The setting is approximately 1 to 1½ turns open, with the engine warm.

The Fuel Supply Control, located beneath the fuel tank, has a tap which is turned anti-clockwise to release fuel. Tractors having

vapourizers have an additional fuel valve tap to control fuel from the auxiliary petrol tank when this type of fuel tank is fitted. **Operators must never have both valves open together,** otherwise vapourizing oil and petrol will mix, with consequent difficulty in starting from cold.

On earlier tractors the fuel supply control valve position was similar, but a two-way valve was used for tractors operating on vapourizing oil without an independent control valve for the auxiliary petrol tank. Turning the handle clockwise changes over the fuel supply from petrol to vapourizing oil. When the handle is vertical the fuel supply is cut off (see also page 58 and Figs. 27 and 28).

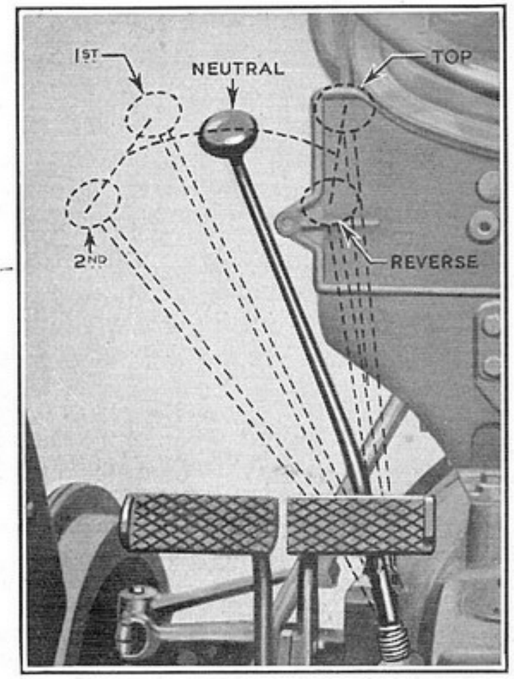


Figure 7
Gear Lever Positions

The Gear Change Lever is located on the left-hand side of the tractor and engages the gears as required by the driver.

The five positions of the gear lever are as follows (see Fig. 7) :—

Neutral.—The central position in which the gear lever can be moved freely from side to side.

First.—Move the lever outwards to the left and push forward.

Second.—Move the lever outwards to the left and pull backwards.

Top.—Move the lever inwards to the right and push forward.

Reverse.—Move the lever inwards to the right and pull backwards.

Always press down the clutch pedal before engaging or disengaging gears.

Practise changing gear and get accustomed to the various positions of the gear lever before you attempt to start the engine, or drive the tractor.

The Handbrake Lever to the right-hand side of the tractor applies the transmission brake when pulled back, so locking both rear wheels. A safety catch is connected to the balance lever of the clutch pedal so that the handbrake cannot be applied unless the clutch pedal has first been depressed. See Fig. 39.

The Clutch Pedal is situated on the right-hand side of the tractor behind the hand-brake lever mounting. It is used to engage and disengage the clutch, to start and stop the tractor and when changing gears. When pressed downwards it releases the clutch, thus disconnecting the engine from the transmission gears.

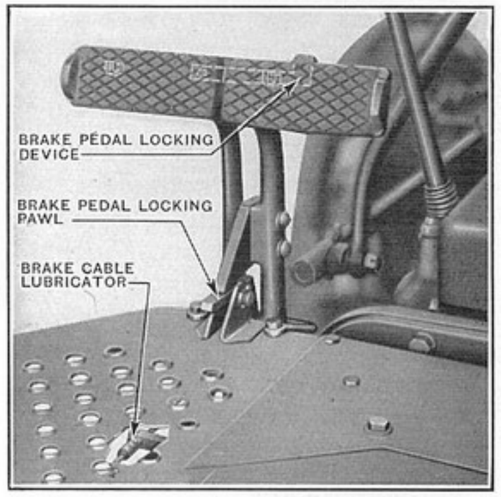


Figure 8
Footbrake Pedals

Always allow the clutch pedal to return slowly and smoothly. Sudden engagement of the clutch imposes excessive strain on all parts and may stall the engine.

Footbrake Pedals (extra equipment only and for Row Crop Tractors) when fitted, are to the operator's left. They may be used independently to assist in making a short turn, or by engaging the latch behind they may be locked together, when both brakes will be applied at once. To hold the brakes on, depress the pedals and then lock the pawl by pressing it down to engage the sector. To release, press down the pedals firmly, when the pawl will drop out of engagement due to its weighted end. The pawl will only engage the sector when manually operated.

On Industrial Tractors, there is only one footbrake pedal and this has no pawl or sector.

The Starting Handle is fitted in front of the engine, and, when not in use, is held out of the way by means of a clip. To crank the engine, disengage the clip, clasp the handle, turn it to the bottom of the stroke and push it firmly towards the engine until you feel the pin engage with the crank ratchet. Then lift the crank upwards with a quick swing. Never attempt to start the engine by pushing downwards on the crank handle.

Starter Switch, with electric equipment only, operates the starter motor and so starts the engine. Release the switch directly the engine starts. An additional control is at the commutator end of the starter motor. To operate, press the rubber-covered knob.

A Speedometer is fitted to Industrial Tractors and indicates speed and also distance travelled.

Lighting Switch, with electrical equipment only, controls the various lamps and is at the left of the dash panel. There are four positions for the switch handle :—

1. " Off "—straight down.
2. To the right for side lights and rear light.
3. To the left for headlights " dipped," side lights and rear light.
4. As for 3 except headlights are normal beam.

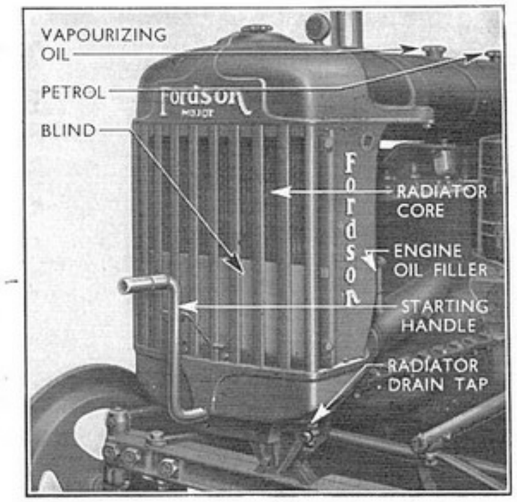


Figure 9
Radiator Blind

Radiator Blind, fitted in front of the radiator core, assists in keeping the cooling water at the most efficient temperature. Adjust by pressing the ends of the upper supporting bar inwards so allowing it to be moved up or down between the radiator side members as required.

Windscreen Wiper Control, on Industrial Tractors, is pulled out to set the vacuum type wiper motor in operation. It will only work when the engine is running.

Power Take-off Control Lever, when fitted, engages the drive at the take-off shaft at the rear of the tractor. Moving the lever forwards engages the drive. Declutch before meshing the gears.

Pulley Drive Clutch Lever, to the operator's right side, engages the dog clutch so that the pulley may be operated by the engine. Depress the clutch pedal, turn the handle clockwise to mesh the dogs and slowly release the clutch pedal. The pulley drive can be supplied without this clutch lever. (Extra equipment only.)

Hydraulic Power Lift Drive Control, when fitted, enables the drive to the pump unit to be engaged by moving the P.T.O. lever forwards. Disengage the clutch when meshing the P.T.O. gears.

Two types of pump unit may be fitted, having a single or double lever control. For instructions, see page 94.

Rear Towing Attachment on Industrial Tractors consists of an automatic coupling mounted on a transverse spring leaf. To free the

towed vehicle, pull back the catch and on driving forward the jaw will turn, releasing the tow bar. To couple up, enter the tow bar in the open jaw and back the tractor slightly, when the jaw will move forward, securing the tow bar and the catch will lock it in place.

Running-in the Tractor

For a tractor to give its best service, it should be carefully run-in and the extra attention given to it during its first few weeks of use will be repaid handsomely during its subsequent life.

During the first 50 working hours, especial care should be taken to see that the engine, transmission and oil bath type air cleaner have the proper quantity of oil of the correct grades and that the radiator is full of water. These points should be checked several times daily.

Half a pint ($\frac{1}{16}$ litre) of engine oil should be mixed with each gallon (litre) of **petrol** put into the fuel tank, to provide an additional lubricant for the valves, pistons, etc., when first started up and before the oil has time to circulate fully.

The engine should not be run at high speed or be allowed to " labour." It is advisable to run the engine slowly at first and gradually increase its speed as it becomes run-in.

After 25 working hours, the engine oil should be changed (see page 31), the rear wheel nuts tightened, the cylinder head screws tightened and all nuts, bolts, screws, etc., checked and tightened if necessary.

Where the belt pulley is fitted, the hexagon nut securing the pulley to the shaft should be tightened after it has been used for a short period, this will prevent any tendency for it to work loose subsequently.

Operating the Tractor

TWICE DAILY BEFORE STARTING THE TRACTOR

In the morning and after dinner the following operations must be carried out, with the engine stopped and the tractor standing level (full details of each of these operations will be found under its proper section) :—

1. See that the radiator is full of soft clean water.
2. See that the engine is filled to the F mark on the dipstick. If it is necessary to add oil use a good grade of S.A.E. 30 viscosity in Winter and S.A.E. 40 viscosity in Summer. See page 3 for oil to be used in climates having extremely hot or cold temperatures.

EACH NIGHT

1. See that the gear box is filled to the " FULL " mark of the filler with oil of the correct grade and quality and the rear axle oil level is between the marks on the dipstick, see Figs. 13 and 14.
2. See that the square type air cleaner on earlier tractors has clean engine oil to the level of the filler plug. See Fig. 16, also page 67.
3. See that the fuel tanks, situated immediately above the engine, have ample fuel. Always use a fine mesh filter.

TO START THE ENGINE

Tractors equipped with Vapourizer

When the tractor is fitted with a starter motor, the clutch pedal must be depressed, when starting from cold, to reduce the drag caused by the stiff oil. The engine should also be turned over by hand a few times to reduce the severe loading that would otherwise be imposed on the starter motor and battery. The ignition may be left " on " when using the starter motor.

1. When starting from cold, pull up the radiator blind fully.
2. **See that the gear lever is in neutral,** i.e., the position in which it can be freely moved from side to side. Power take-off drive, pulley or hydraulic lift drive, when fitted, should be in neutral position.

3. Move the ignition lever on the dash to the upper end of the quadrant (past the notch on the dash) to switch off the ignition. See note on Ignition Control Lever, page 15.

4. Pull out the governor control lever to the fifth notch.

5. Choke the engine by pulling the choke control, on the right-hand side of the dash, to the rear.

6. With the fuel supply " off," drain the float chamber if vapourizing oil is present, otherwise turn on the tap marked " GAS " on earlier tractors with the two-way tap, move the upper end of the lever finger to " G."

7. Set the vapourizer needle approximately $2\frac{1}{4}$ turns open.

8. Prime the engine by pulling up the starting handle four times. Have the clutch pedal depressed to eliminate the drag from the oil in the gearbox.

9. Push choke control in half-way.

10. Switch " on " the ignition.

11. Start the engine by pulling the starting handle up sharply until the ratchet of the impulse coupling releases and the engine fires. It is not necessary to " swing " the engine.

    If the starter motor is fitted, press the switch, releasing it directly the engine starts. An alternative switch is fitted on the motor itself, a rubber-covered knob at the commutator end.

12. When the engine starts, move the governor control back to the slow running position. Release the choke control fully. **Gently release the clutch pedal immediately the engine starts should it have been held out of engagement.** If the engine will not start readily, ensure the manifold drain valves, see Fig. 29 and page 62, are not allowing air to enter, due to incorrect operation. Test by sealing both valves with the fingers and then having the engine cranked. Should this prove air is leaking, have the valves removed for attention.

13. When the vapourizer is thoroughly warmed up (usually ten to fifteen minutes in cold weather) close the petrol tap of the auxiliary petrol tank and then open the tap marked T.V.O. **Both taps must never be open together.** On earlier tractors, change over the fuel supply by turning the tap so that the upper end of the lever points to " K."

14. The blind should be adjusted during work so that the cooling water is at least 80°C. or 176°F. The most efficient temperature is just below boiling point. When the calormeter, or water temperature indicator, is fitted the indicator needle should be within the white coloured sector.

Tractors equipped with Petrol Carburettor

When starting from cold and the tractor has a starter motor fitted, hold down the clutch pedal to minimise the drag caused by the oil in the gearbox. Leave the ignition " on " when using the starter motor with the choke closed, otherwise the engine may be choked with an over-rich mixture.

1. **If the engine is cold,** pull the choke rod on the dash to the rear. Turn on the petrol. Pull up the blind fully.

2. Prime the engine by pulling up four times **only** on the starting handle with the ignition switched off. See note on Ignition Control Lever on page 15. If the engine is cranked more than this with the choke closed, an excess of petrol will be drawn into the inlet manifold and cylinders. If this occurs the engine will not start (even though hot) until the excess fuel is pumped out of the cylinders by considerable cranking with the choke released. See note 12 on page 24 *re* Manifold Drain Valves.

3. Push choke half-way in and move ignition lever half-way down the quadrant to switch on the ignition.

4. Pull governor control out to the tenth notch, or where the hand throttle lever is fitted beneath the steering wheel move this downwards slightly to open the throttle.

5. Start the engine by pulling up the starting handle sharply, move the governor control to the slow running position and open the choke fully as the engine warms up. When the starter motor is fitted, press the starter switch on the dash panel, releasing it directly the engine starts. There is also a hand-controlled switch on the starter motor itself, at the commutator end.

6. If the engine is warm, pull out the governor control about two notches, **but do not choke.**

7. Then switch on the ignition and start the engine in the manner detailed on page 23.

TO START THE TRACTOR

To ensure the operator's position relative to the controls is most convenient, the seat may be adjusted to bring it nearer to or away from them by slackening off the two seat securing bolts, so allowing it to be moved along the slots provided in the seat spring. Tighten these bolts securely after adjustment.

After the engine has been started proceed as follows :—

1. Push the clutch pedal down with the foot. This releases the clutch.

2. Move the gear lever to the desired position, and so engage the gear in which it is proposed to start the tractor.

If the gears are in such a position that they will not slip into mesh readily, return the gear lever to neutral position, raise the foot, allowing the clutch to be engaged for an instant, then disengage the clutch by pushing the clutch pedal down and re-engage the gears as directed above.

3. Release the handbrake and if the Row-Crop type footbrake pedals (when fitted) are also applied, these must be released by freeing the pawl.

4. Pull the governor control rod out slightly (or move the throttle lever towards the rear on Industrial Tractors) and as the speed of the engine increases, allow the clutch pedal to return slowly by gradually raising the foot. As the clutch engages, it transmits the driving effort to the rear axle and sets the tractor in motion.

TO CONTROL THE SPEED OF THE TRACTOR

The best method of controlling the speed of the tractor is by selecting the correct gear ratio to suit the load conditions. Always use the highest gear ratio on which the tractor will give the necessary pull. A little experience will soon teach the proper gear to engage and the best speed at which to run the engine. Don't permit the engine to " labour " in top gear. The speed of the engine is controlled by means of the governor control rod (see page 15) or throttle lever and should be kept nearly constant at all working speeds of the tractor.

The engine is designed to run at 1,200 revolutions per minute and this speed should not be exceeded for any length of time.

TO STOP THE TRACTOR

1. Return the governor control rod or throttle lever to the closed position, thus slowing up the engine.

2. Release the clutch by pushing the clutch pedal downwards.

3. Apply the handbrake lever by raising the pawl and pulling the lever rearwards : release the pawl. Note that this brake cannot be applied unless the clutch pedal is depressed.

4. Move the gear change lever into the neutral position, disengaging the gears.

5. Allow the clutch to re-engage by releasing the clutch pedal.

TO STOP THE ENGINE

When running on vapourizing oil, turn the fuel off at the fuel control and allow the engine to run slowly until it almost stops for want of fuel. Change to petrol for two minutes, then turn off.

The above procedure is necessary to obviate difficulty in starting the tractor, as the heat stored in the manifold continues to vapourize fuel after the engine is stopped, thus flooding the passage with too rich a mixture ; also it drains all vapourizing oil from the vapourizer, making it ready for the petrol to be used to start the engine.

When running on petrol, turn off the petrol supply, slow the engine down and allow it to idle for two or three minutes to let the valves cool off (this will materially lengthen their life) and then switch off the ignition by moving the ignition control lever to its uppermost position. See note on Ignition Control Lever, page 15.

Lubrication and Maintenance

The importance of correct lubrication, and periodic inspection and adjustment cannot be over-emphasised. On it will depend, to a very large extent, the service which the tractor will give.

Regular attention to the points mentioned below will be amply repaid in long life, freedom from repair, and reliability.

The lubrication and maintenance work may be divided into various groups which require attention after the following periods of use :—

1. Twice daily.
2. Every night.
3. Every 50 hours of use.
4. Every 200 hours of use.

The lubrication chart on pages 16 and 17 gives full information as to the points requiring attention, and the location of grease gun lubricator fittings.

FOLLOW THE CHART CAREFULLY.

1. TWICE DAILY

Engine.—Check level and replenish if necessary to the mark " F " on the dipstick with oil of S.A.E. 30 viscosity in Winter and S.A.E. 40 viscosity in Summer. See page 3 for oils for use in extremes of climate.

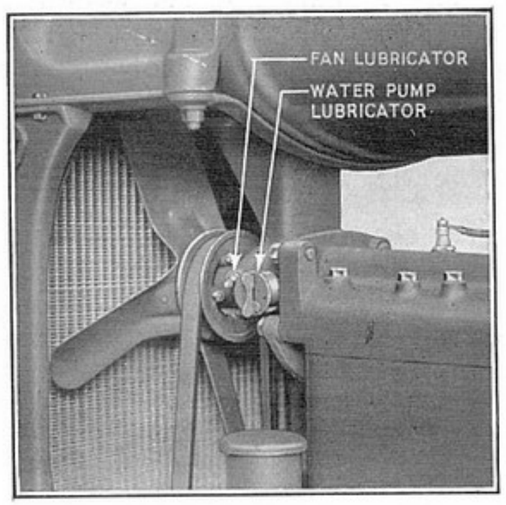


Figure 10
Water Pump Lubricator

Radiator.—Fill with fresh, clean water if the level is low.

Water Pump.—Give the grease cup cap half a turn or more during operation as may be necessary. Refill the cup when it is empty with special high temperature water-resisting grease.

2. EVERY NIGHT

Gearbox.—Check and refill if necessary to the " Full " mark at the filler hole with oil of the correct grade (see page 32).

Rear Axle.—Check and refill if necessary to the high mark on the dipstick at the left-hand rear side with oil of the correct grade (see page 33 and Fig. 14).

Spindles, Spindle Arms, Steering Joints and Sector Shaft.—Grease with grease gun. (Regular greasing at these points will prevent the ingress of dirt and water and prolong the life of the joints.)

Air Cleaner, Square Type.—Check oil level and add clean engine oil if necessary. For detailed instructions, see page 69. For circular type, see under " Every 50 hours."

Protection.—Cover tractor after use to protect from weather.

If the manifold and vapourizer are excessively hot, they should be allowed to cool before putting on the cover as otherwise it may be scorched or even catch fire.

Belt Pulley Drive (when fitted).—When the belt pulley drive is in continuous use, lubricate this with the grease gun through the lubricator provided, **once daily.**

3. EVERY 50 HOURS OF RUNNING

Engine.—When operating wholly on petrol as in the case of the Industrial Tractor, drain the engine oil after each 100 hours of use. If the engine is operated on vapourizing oil, drain off engine oil, remove crankcase cover, clean cover and screen in petrol, reassemble, and refill with an approved grade of oil of S.A.E. 30 viscosity for winter and S.A.E. 40 viscosity for summer. For oils to be used under extremes of climate, see page 3. (The oil will drain off more easily, and completely, when the engine is warm.) DO NOT FLUSH THE ENGINE OUT WITH PARAFFIN. Wash the oil filler cap in petrol, to remove any dirt which may have accumulated in the air filter portion, and pour a little engine oil into the felt.

Fan ***Front Wheel Bearings** **Clutch Balance Lever** **Clutch Pedal** **Rear Wheel Bearings** **Steering Gear Bearing** **Brake Pedal** (when fitted) **Brake Cables** (when fitted) **Lift Shaft** (when fitted) **Brake Bell Crank Levers** (Industrial Tractor only)	Grease with grease gun. * Also check wheel bearing adjustment and re-adjust if necessary. See page 151.

Magneto.—Lubricate with two or three drops of light oil. (No more than two or three drops of oil should be applied, as excessive oil may leak into the body of the magneto and interfere with its satisfactory operation.)

Raise the spring-loaded cover at the top of the magneto adjacent to the distributor and add the oil to the centre of the two holes which appear. The one towards the side is an air vent and oil must not be added at this point.

For magnetos having the stationary type contact breaker, the lubricator position differs somewhat, being nearer the distributor cap. To add oil move the trigger sideways, when the oil hole is disclosed and two or three drops of light oil may then be added. This magneto is illustrated in Fig. 24.

Air Cleaner, Cylindrical Type.—On later tractors having the cylindrical type air cleaner, release the three clips, remove the cleaner base and clean both inner and outer caps. Add clean engine oil to the level mark, see Fig. 15. If used in very dusty conditions, clean at more frequent intervals. Periodically attend to the Primary Air Cleaner, see page 33.

Battery.—When the battery is fitted, top up with distilled water as instructed in the electrical system.

4. EVERY 200 HOURS OF RUNNING

Radiator.—Drain, and flush out with clean water, until water runs out clear.

Steering Box.—Examine the oil level and, if necessary, add sufficient gear oil of similar grade to that used in the gearbox, to bring the level to the bottom of the filler plug orifice.

Air Cleaner, Square Type.—Drain, clean out sediment, refill with engine oil to the correct level. See page 34 and Fig. 16. Very dusty conditions may necessitate more frequent cleaning.

5. EVERY 3 MONTHS

Air Cleaner on Industrial Tractor.—Clean the gauze type air cleaner at this period or more often if operated under very dusty conditions, see also page 69.

6. EVERY 6 MONTHS

Gearbox.—Drain the gearbox, flush out with engine oil, and refill with an approved gear oil of S.A.E. 90 viscosity. (Oil will drain more readily if it is warm, immediately after the tractor has been used for a few hours.) Under no circumstances must grease be used in the tractor transmission. See page 32.

For oils to be used in extremes of climate, see page 5.

Generator.—When the generator is fitted, add a good grade of petroleum jelly, if required, to the wick in the lubricator at the rear bearing, every six months. The front bearing is packed and requires attention only at overhaul periods.

7. EVERY 12 MONTHS

Drain the rear axle lubricant every 12 months, the drain plug is at the bottom of the housing at the centre. Refill with clean, fresh gear oil of an approved grade of S.A.E. 90 viscosity. For oils to be used in extremes of climate, see page 9. See also page 33.

LUBRICATING THE ENGINE

Under no circumstances must the oil in the engine be allowed to get below the mark " L " on the dipstick, which is located on the left-hand side of the tractor about six inches in front of the bottom of the gear change lever. The correct way to ascertain the oil level is as follows: With the tractor standing level and the engine stopped, pull out the dipstick, wipe it with a clean rag, re-insert fully and again remove it, when the mark made by the oil indicates its level. See Fig. 11.

Figure 11
Engine Oil Level Dipstick

The oil filler is located on the left-hand side, to the front of the engine, see Fig. 9. The capacity of the engine oiling system is about 2¼ imperial gallons (19.33 litres).

A new tractor must have the engine oil changed at the end of 25 working hours and thereafter every 50 working hours, approximately, except when operating solely on petrol, as in the case of the Industrial Tractor, when it should be changed every 100

hours. To do this, remove the large plug underneath the crankcase in the centre. When the oil has drained off, it is absolutely essential to remove the crankcase cover, see Fig. 12, and clean the oil screen and cover thoroughly with petrol, after which they should be reassembled, and the engine filled with oil. Do not flush out the engine with paraffin.

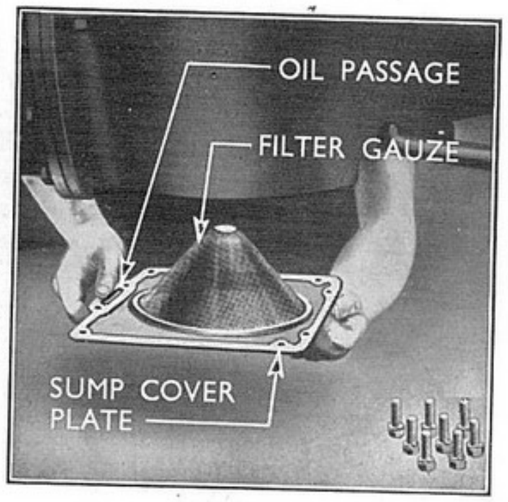


Figure 12
Engine Oil Filter

Your local Fordson dealer will be pleased to advise you as to the various grades and brands of oil which have been approved for use in the engine. On page 3 are given details as to the suitable viscosity figures for engine oil for use under various climatic conditions.

THE GEARBOX.—The only attention needed is to see that it is kept filled with oil to the " Full " mark on the filler. Use gear oil of S.A.E. 90 viscosity for summer and winter. If used in extremes of climate, see page 5. See also page 31 and Fig. 13.

The filler hole is located just below, and to the side of the gear change lever. Before removing the filler cap, wipe off all dirt on, or around, the cap so that none gets into the gearbox housing, see Fig. 13. Pour in the oil until it reaches the " FULL " mark on the filler, allowing plenty of time for it to reach all parts. If this is done when the tractor is warm, the heat will make the oil flow more readily and so save time. Change the oil after every six months operation. To do this, remove the drain plug underneath the housing, preferably while the oil is warm. When all the oil has drained out, flush out the housing with a quart or so of engine oil. Replace the plug and refill with gear oil. The capacity is $2\frac{3}{4}$ imperial gallons (12.5 litres).

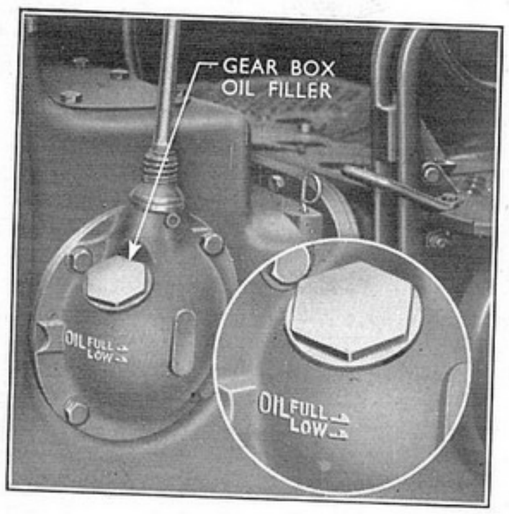


Figure 13
Gear Box Oil Filler

Should the oil be left unchanged too long, or if too light an oil be used, the transmission housing may overheat when the tractor is operated. This condition must be remedied immediately or excessive wear could be caused.

THE REAR AXLE

The oil in the rear axle should give adequate service for one year, provided the oil level is kept at the " High " mark on the dipstick; the dipstick is in the left-hand side of the housing at the top, as shown in Fig. 14. Use a good grade of gear oil of S.A.E. 90 viscosity in summer and winter. For extremes of climate use the grades given on page 9.

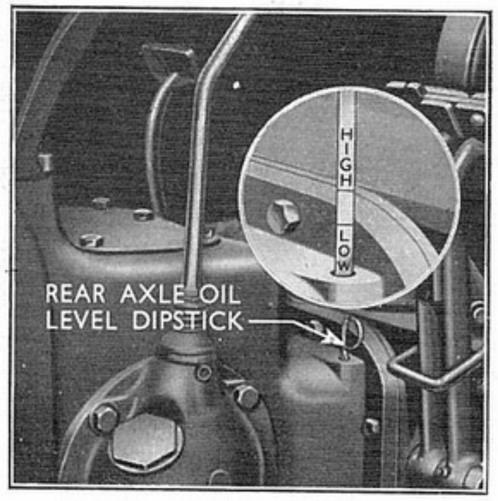


Figure 14
Rear Axle Oil Level Dipstick

Drain the rear axle every year and refill with clean oil to the " High " mark on the dipstick. On later Tractors the filler plug has a small air release hole drilled in it. Ensure that this is not fitted in the drain plug location when the axle is drained. When the tractor has pneumatic tyres fitted, the dipstick must bear the part No. E27N-4334-B and this measures approximately $9\frac{5}{16}$ in. (23.65 cm.) from the " High " mark to the bottom of the handle loop.

AIR CLEANER, CYLINDRICAL TYPE

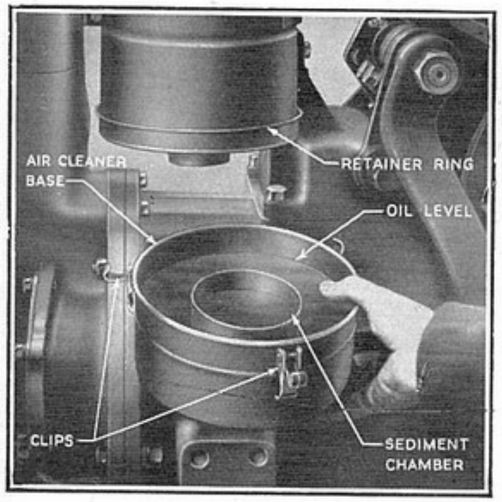


Figure 15
Cylindrical Type Air Cleaner

Every 50 hours, or more often, if necessary in very dusty conditions, release the three clips and lower the base of the air cleaner, when the dirty oil can be discarded and the sediment washed out of the inner and outer cups.

Refill with clean engine oil to the level mark at the side of the base and secure with the three clips.

The primary air cleaner is similar to that used with the square type air cleaner and should be cleaned periodically as described on page 34.

AIR CLEANER, SQUARE TYPE (on earlier Tractors)

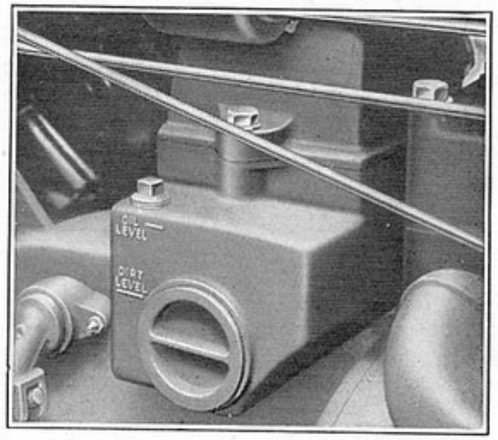


Figure 16
Square Type Air Cleaner

Use engine oil for the air cleaner and check the level nightly.

Fill to the level mark.

Every 200 hours drain off the oil and clean out any sediment: this is best done when the tractor is warm. Make sure that there is no leak from the dirt trap cover when the cleaner is refilled.

The primary air cleaner, mounted at the top of the vertical air inlet pipe, should be examined occasionally to ensure that the air vanes beneath the cleaner are free and unobstructed by foreign matter. At the same time the four scoops provided at the top of the cleaner to permit the escape of larger fragments of dust should be examined and cleared if necessary. Failure to maintain the primary air cleaner free from obstruction will cause a relatively greater proportion of partially cleaned air to enter the oil bath and in addition engine performance may be affected.

GREASE GUN LUBRICATOR FITTINGS

In order properly to force lubricant to all parts equipped with the conical-shaped lubricator fittings, a high-pressure grease gun is employed. With this gun, the lubricant can be forced in under a pressure of 2,000 pounds or more per square inch (140 kg. per sq. cm.), thus ensuring a more thorough and positive lubrication than can be accomplished any other way.

To fill the grease gun, unscrew the cap and then draw the nozzle end outwards as far as possible, which will cause the piston to move to the bottom of the barrel. Using a good grade of grease gun lubricant, pack the gun solidly with grease, avoiding air pockets. Replace the cap securely: do not lose the leather washer which seals the joint at this point, see Fig. 17.

On earlier tractors a slightly different grease gun was used, and to fill this unscrew the bottom cap and nozzle, disclosing the piston in the barrel. Push the piston fully along the barrel, towards the handle end. Fill the barrel as described above, then replace the bottom cap and nozzle.

OPERATING THE GREASE GUN

When the grease gun is pressed against the conical-shaped lubricator fittings, the nozzle moves inwards, forcing the lubricant in the nozzle directly through the fitting into the bearing under an extremely high pressure.

On releasing the hand pressure the internal spring returns the nozzle to its fully extended position, charging it with lubricant ready for the next forward thrust.

The operation of the earlier type grease gun is similar except that the nozzle does not move as it is rigidly secured to the bottom cap. Grease is injected in the usual way and hand pressure applied to the grease gun causes the plunger to move forward, forcing lubricant through the nozzle.

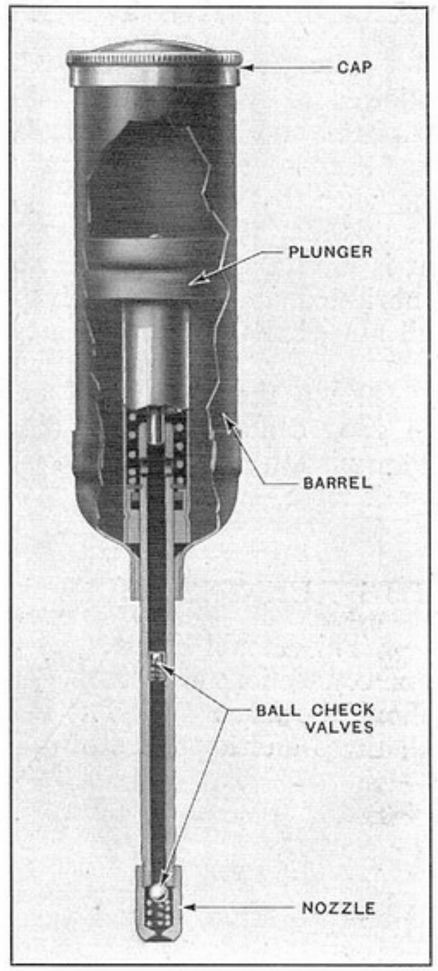


Figure 17
Grease Gun

LOCATION OF FITTINGS

A list of points at which lubricator fittings are located is given on page 29.

The lubrication and maintenance chart on pages 16 and 17 also shows the location of these fittings on your tractor.

RADIATOR

The radiator should be kept filled at all times, and should be checked several times daily if the tractor is in continuous use in hot weather. **Clean water only must be used.** The capacity of the cooling system is 10 gallons (45½ litres). Flush every 200 working hours (see page 46). **If overheated allow to cool down before adding water** (see page 42).

CLEANING THE TRACTOR

The tractor should be kept free from rust or dirt. If this is allowed to accumulate, it may in time get carried into the bearing surfaces and cause unnecessary wear. Wash the tractor frequently and keep it well painted to prevent rusting. When washing, care should be taken that no water reaches the wiring, magneto, or sparking plugs, as this may result in a short circuit and failure of the ignition system. It is most important to see that the tractor is properly and efficiently lubricated and cleaned. Inspect the tractor frequently and see that all nuts, bolts and screws are tight.

Keep the rear wheel bearings and felt washers and dust caps in good condition, as oil may leak out and dirt may work into the transmission through the rear axle if these bearings are allowed to work loose.

THE RUNNING GEAR

This should be carefully gone over every week to see that all bolts and connections are secure, and any looseness in the steering joints, etc., should be taken up. The working parts should be well lubricated at all times and kept free of dust and mud.

The Engine

The engine is of the four-cylinder, four-stroke, internal combustion type in which petrol or vapourizing oil is supplied to the carburettor or vapourizer, where it is mixed with a certain proportion of air and forms a mixture which is highly inflammable when compressed.

As the crankshaft revolves the pistons, which are connected to the cranks by the connecting rods, move up and down in the cylinders. The travel of the piston from the top to the bottom of the cylinder (and vice versa) is called a " stroke."

The camshaft is geared to the crankshaft and revolves at half the speed of the latter ; it is so arranged that the cams lift each push rod and so open each valve at the correct time—once every two revolutions of the crankshaft. The valves are closed by the valve springs.

The magneto supplies a high tension current to the sparking plugs, causing a spark to jump the gap between the points and so ignite the mixture when compressed in the cylinders.

THE CYCLE OF OPERATION IN ONE CYLINDER

The Induction Stroke.—With the exhaust valve closed and the inlet valve open, the piston moves downwards drawing the mixture from the carburettor or vapourizer into the cylinder.

The Compression Stroke.—At the bottom of the induction stroke the inlet valve closes and the piston moves upwards, compressing the mixture in the cylinder head.

The Power Stroke.—When the piston reaches the top of its travel, a spark is produced at the sparking plug points which ignites the compressed mixture, causing it to expand and drive the piston downwards, imparting a power impulse to the crankshaft and so producing the power to drive the tractor.

The Exhaust Stroke.—At the bottom of the power stroke, the exhaust valve opens and allows the upward movement of the piston to expel the burnt gases through the exhaust pipe.

This cycle of operation is repeated in turn in each cylinder and each cylinder " fires " once for two revolutions of the crankshaft. The order in which the cylinders fire is 1–2–4–3 (counting from the front of the engine).

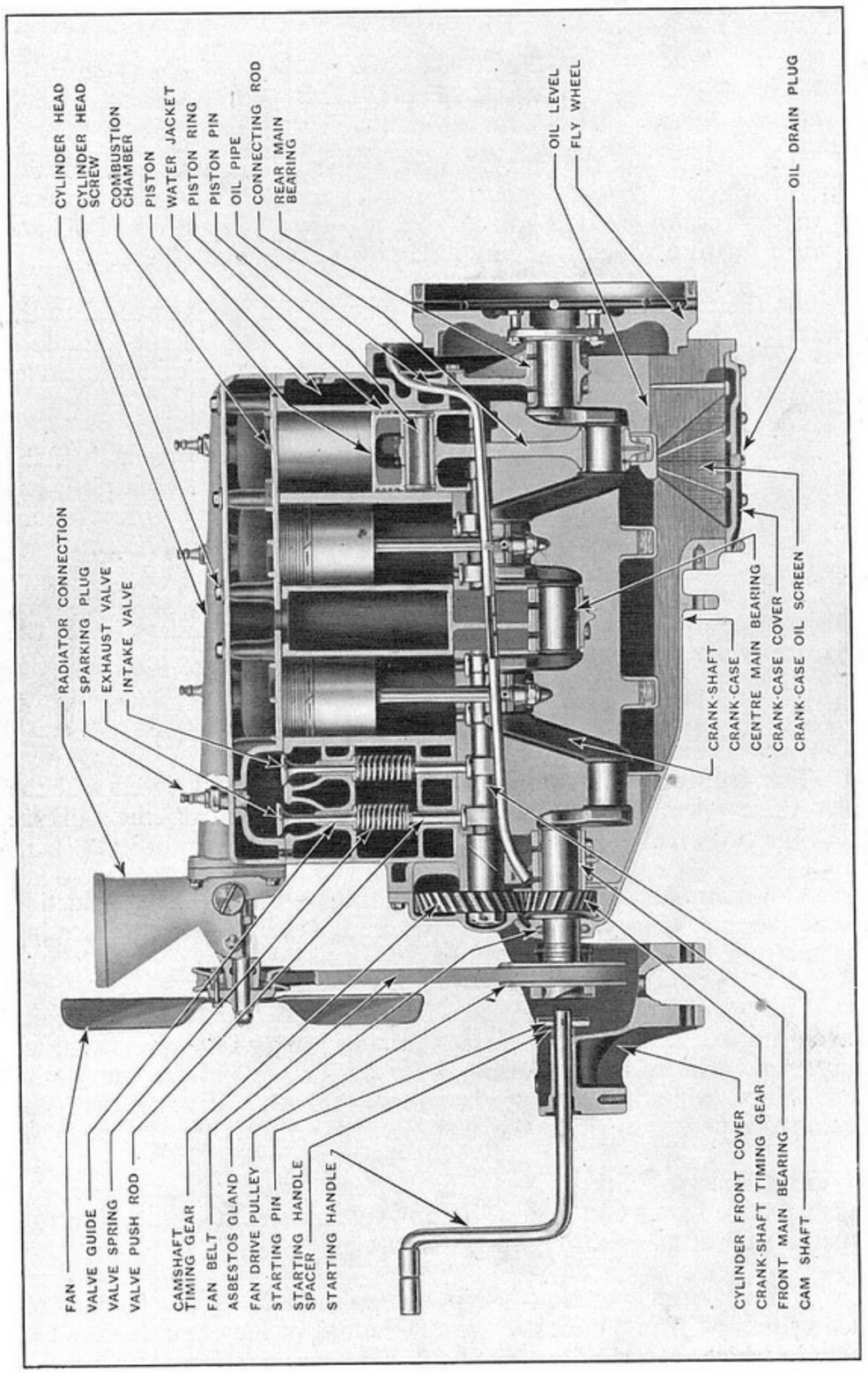


Figure 18
Sectional View of Engine

ENGINE LUBRICATION

The engine lubrication is entirely automatic and requires no attention from the operator, except to see that the oil is up to the " F " mark on the dipstick and that it is changed every 50 working hours, or 100 working hours when working solely on petrol (see pages 29 and 31).

Oil is thrown by the flywheel into a scoop formed at the end of a pipe running downwards to the front of the engine. The oil flows from holes in the side of this pipe through holes drilled in the upper half of the centre main bearing, lubricating it.

This pipe also feeds oil to the front main bearing and the timing wheels at the front of the engine.

The rear crankshaft bearing is lubricated by oil from the flywheel which reaches the bearing surfaces via holes drilled in the upper half of the bearing, so assuring ample lubrication.

The excess oil then flows into troughs in the crankcase where it is picked up by dippers on the big end caps to lubricate the big end bearings and create an oil mist for the cylinder walls and small end bearings.

A dam at the rear of the crankcase prevents the oil from returning direct to the flywheel for re-circulation and forces it first to pass through a large fine mesh gauze screen which removes the particles of dirt and hard carbon which cause most wear.

If the screen is left uncleaned for a very long time and becomes so choked with dirt that oil cannot pass through it, the oil builds up against the dam till it overflows into the flywheel compartment and is so re-circulated.

The dam is low enough to allow the oil to overflow before the level in the flywheel compartment drops to such an extent as to diminish the quantity of oil in circulation at all seriously, though as this oil is unfiltered, it naturally causes much more wear than if the crankcase screen had been properly cleaned.

Full instructions for cleaning the screen are given on page 32.

Engine Components and their Functions

THE PISTON AND PISTON PIN

The Piston moves up and down in the cylinder, drawing the combustible mixture from the vapourizer and compressing it. It then receives the force of the expansion, being driven downward and transmitting the power through the piston pin and connecting rod to the crankshaft, after which it expels the burnt gases.

The Piston Pin holds the piston and connecting rod together and allows them to move in relation to each other ; it is held in position by spring retaining rings in the piston pin bosses.

THE CONNECTING ROD

This is used to transmit the power from the piston and, in conjunction with the crankshaft, to transform the reciprocal motion of the piston into the rotary motion which drives the tractor. The small end (piston pin) bearing has a bronze bushing ; the big end (crankshaft) bearing is of babbitt metal, and shims are provided to allow it to be adjusted to compensate for wear.

PISTON RINGS

In order to prevent any of the charge under compression escaping past the piston, three compression piston rings are fitted in grooves in each piston. The " spring " of these rings keeps them always in contact with the cylinder walls and provides an efficient seal. Below these is an oil control ring which has slots cut in it to allow excess oil to flow through it, and thence through small holes in the ring groove of the piston back into the crankcase. This effectively prevents oil working its way up to the cylinder head, where it would tend to oil up the sparking plug, gum up the valves, and leave an excessive carbon deposit on the piston top and cylinder head.

THE CRANKSHAFT

This is carried on three main bearings, with two cranks between each pair. As this shaft rotates, the cranks revolve, and, being connected to the connecting rods and pistons, cause the latter to move up and down in the cylinders. The main bearings are lined with babbitt metal and may be adjusted to compensate for wear.

THE FLYWHEEL

A heavy flywheel is provided to ensure smooth running at all speeds and steady pulling at low speeds.

VALVES, CAMSHAFT AND PUSH RODS

In order to allow the piston to draw the fuel-air mixture from the vapourizer into the cylinder and to expel the burnt gases after they have done their work, an inlet and exhaust valve are provided for each cylinder.

The camshaft is geared to the crankshaft and rotates at half the speed of the latter shaft. The cams lift the push rods which transmit this movement to the valves, causing them to open. A spring surrounds each valve stem and one end is attached to the valve by the valve spring seat and valve spring seat retainers, and the other abuts against the cylinder block. This spring closes the valve as soon as the cam has turned sufficiently to allow the push rod to fall. The cams are so arranged that, as long as the gaps between the push rods and valves are accurate, the valves open and close at the proper time for the engine to work at its maximum efficiency.

VALVE TIMING

Inlet valve opens 10° past top dead centre.

Inlet valve closes 40° past bottom dead centre.

Exhaust valve opens 30° before bottom dead centre.

Exhaust valve closes at top dead centre.

Lift of valve $\frac{5}{16}$ in. (7.94 mm.).

Clearance between valve and push rod .020 in. to .024 in. (.508 mm. to .61 mm.).

For repairs to Engine see page 114.

The Cooling System

The engine is cooled by the circulation of water in the jackets round the cylinders. The heated water flows by thermo-syphonic action, assisted by a pump at the front of the cylinder head, to the radiator and, as it flows downwards through the radiator tubes, it is cooled by the stream of air induced by the fan placed behind the radiator. A radiator calormeter, or temperature indicator, is fitted to the radiator and enables the operator to see at a glance if the cooling water is at the correct temperature (see page 44).

REFILLING THE RADIATOR

The **radiator should be kept filled at all times,** and should be checked several times daily if the tractor is in continuous use in hot weather, or whenever the cooling water boils.

If **clean** rainwater is obtainable, its use is advisable as it is free from salts, etc., which tend to clog the water passages. Only clean water should be used.

It is advisable to see that the radiator is full before starting, and it should be topped up at least twice daily, or whenever the tractor is stopped for refilling with fuel or oil.

To remove the radiator cover, unscrew the nut on top two or three turns and push the cover off the filler (see Fig. 19).

The capacity of the cooling system is 10 gallons (45½ litres).

IF THE RADIATOR OVERHEATS

Always allow the engine to cool down till the back of the hand can be held against the cylinder head without discomfort before refilling with water.

If there is water in the radiator top tank, the radiator may safely be refilled.

Don't be alarmed if the tractor boils occasionally, especially if it is working on heavy ground in hot weather, because the engine is most efficient at a temperature just below that of boiling water. Should the tractor consistently overheat, however, it is advisable to investigate the cause and remedy it.

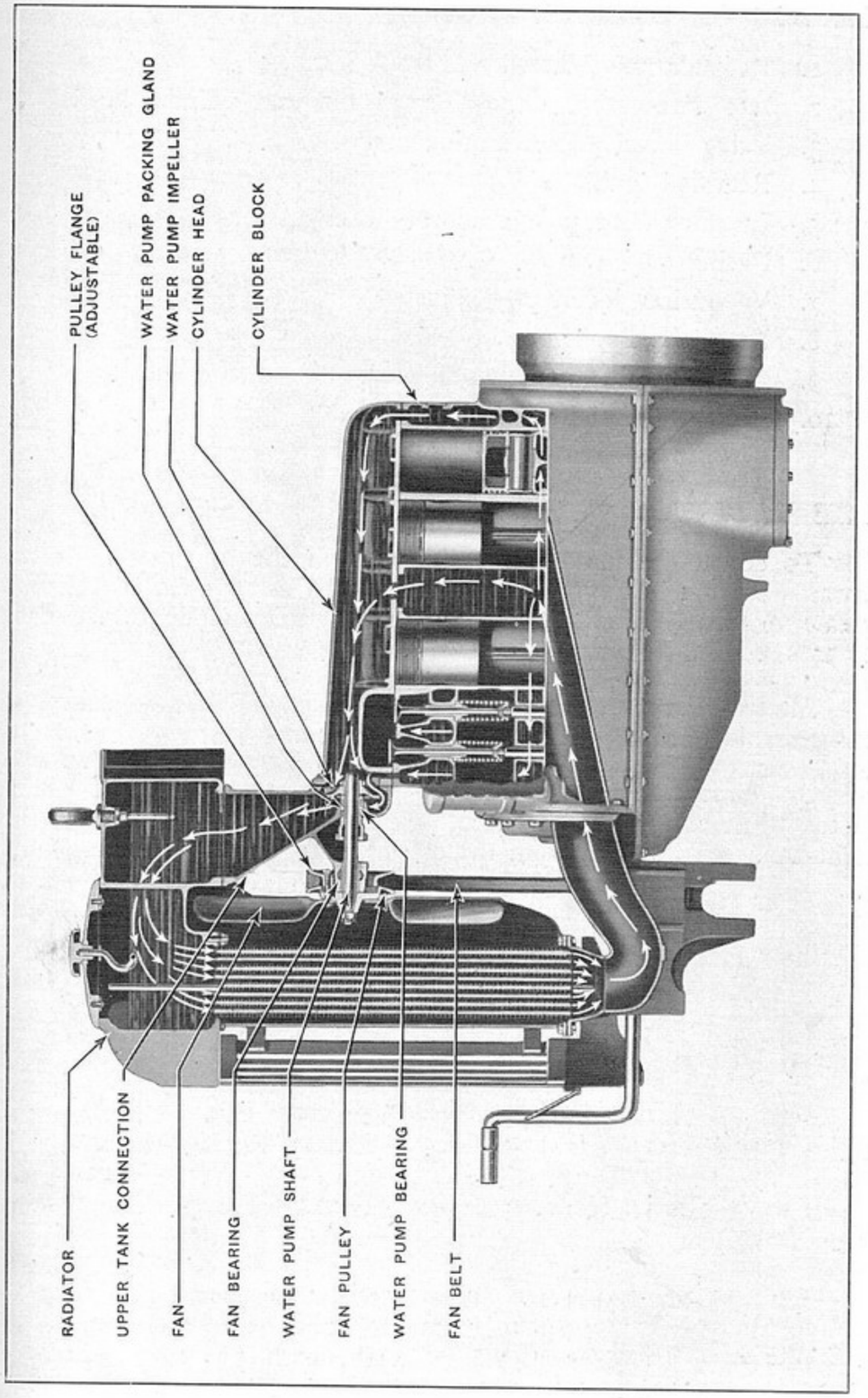


Figure 19
The Cooling System

CAUSES OF OVERHEATING

1. Radiator not full.
2. Excessive carbon deposit on pistons and cylinder head.
3. Valve or valves not seating properly.
4. Retarded ignition.
5. Insufficient or poor grade oil in engine.
6. Racing engine.
7. Vapourizer incorrectly adjusted.
8. Fan belt slipping or broken.
9. Radiator tubes and fins clogged.
10. Radiator blind incorrectly adjusted.

THE RADIATOR BLIND

To adjust the blind, press the ends of the upper support bar inwards so that it may be raised or lowered as required, covering a greater or lesser area of the radiator. Keep water temperature at 80°C. or 176°F. See Fig. 9.

Always raise the blind fully when the engine is first started to ensure rapid warming-up and put it to work at once.

On tractors having the circular type calormeter, keep the needle in the white sector: if the needle moves off the white sector to the right-hand side, viewed from the driver's seat, the cooling system is too hot and boiling may occur. If the needle is to the left-hand side the cooling system temperature is too low and the radiator blind should be raised as necessary.

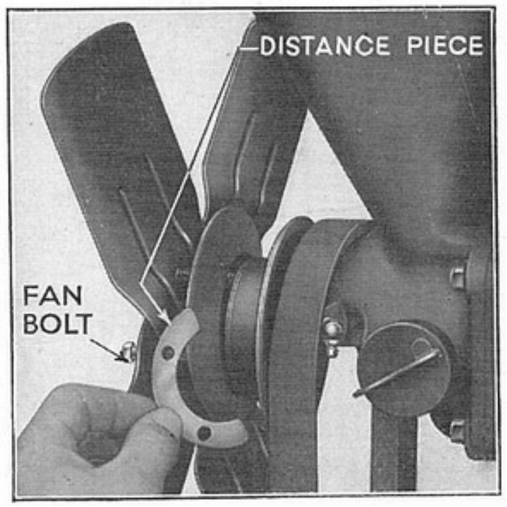


Figure 20
Fan Belt Adjustment

On tractors having the pillar type calormeter, keep the red and white segments centrally positioned in the aperture. If the cooling system overheats the indicator will rotate further, bringing into view diagonal red lines against a white background. Should the cooling system be too cold, the white segment only, with possibly a part of the red sector, will be visible in the aperture.

TO ADJUST THE FAN BELT

Any slackness that may develop in the fan belt after extended use may be readily adjusted, suitable provision having been made for this by means of spacers between the divided type fan pulley boss. The view of the fan pulley, Fig. 20, will make the adjustment an easy matter to carry out when the construction is understood.

Remove the four nuts of the bolts holding together the two halves of the fan pulley. The two halves of the pulley may then be separated and the distance pieces removed or added to as necessary. In adjusting for a slack fan belt, remove some distance pieces, but if a new belt is to be fitted and which will appear shorter than that which it replaces, then distance pieces must be added. There must be 2 in. (50 mm.) of side movement on the free side of the belt when pushed and pulled, see Fig. 21.

Retain any distance pieces you may have to remove, as these may be required when a new belt is fitted.

The number of split distance pieces must be the same on each pair of opposite bolts.

The belt must not be allowed to become so slack that it rides on the bottom of the V in the pulley; the drive is transmitted by the grip of the sides of the pulley and the belt will be ruined quickly if allowed to slip due to bottoming.

When the generator is fitted, this is mounted on the right-hand side of the engine and driven by the belt which passes over both fan and generator pulleys. To adjust the fan belt in such cases, loosen the generator mounting bolts and remove the adjusting bolt at the top of the generator.

Move the generator outwards, secure it temporarily with the adjusting bolt inserted in one of the adjustment arm holes and test the fan belt tension at the mid point between the pulleys, see Fig. 21.

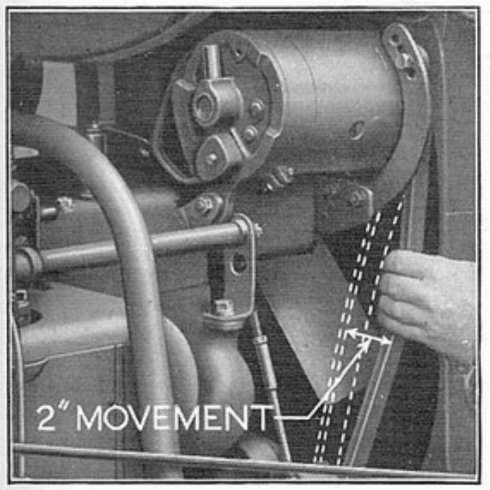


Figure 21
Fan Belt Adjustment with Generator Fitted

If correct, there will be approx. 2 in. (50 mm.) movement—1 in. (25 mm.) movement only when six-bladed fan is fitted—at this point, when the three bolts should be finally tightened.

When a new belt is fitted this should be inspected after a few hours operation to ascertain if any initial slackness has developed. Should this be so, then re-adjust as described above.

ANTI-FREEZING MIXTURE IN WINTER

The tractor should be properly housed when not in actual use, and so protected from severe weather conditions.

In winter, it is advisable to use an anti-freezing mixture in the cooling system, as the cylinder block, cylinder head, etc., may be cracked if the water freezes.

Before putting the mixture into the radiator, the cylinder head bolts should be tightened down to prevent the possibility of any getting into the cylinders, where it will cause serious damage.

When obtainable, a good proprietary brand of anti-freezing solution may be used to obviate freezing in winter. A 60 per cent. concentrated solution of glycerine, if available, may be used advantageously.

A table showing the degree of protection afforded against freezing for various strengths of solution is given below :—

Radiator Glycerine in Solution.	*Freezing point.*
20%	26° F.
30%	22° F.
50%	12° F.

A good mixture is 60% water, 10% glycerine, and 30% alcohol.

It freezes at 8° F.

Fresh alcohol must be added frequently to make up for loss due to evaporation.

If an anti-freezing mixture is not being used in frosty weather, it is essential that the radiator be drained if the tractor is left out overnight, and refilled next morning.

Top up with an anti-freeze solution when the engine is hot : this will prevent loss of the solution via the overflow pipe as would occur when the radiator is filled and the engine is cold.

CLEANING AND DRAINING THE RADIATOR

Every 200 working hours the entire water circulating system should be flushed out thoroughly. All that is necessary is to open the drain cock in front of the engine, just under the radiator, and pour water into the top tank until such time as the water which comes out of the drain cock is quite clear. Should the tubes become clogged inside, and water not remove the obstruction, they can be cleaned by

means of a thin strip of copper wire or cane, inserted through the filler hole. When the fins and tubes become clogged outside with chaff, seed, dust, etc., they should be cleaned, as otherwise the air circulation is retarded.

REPAIRING LEAKS IN RADIATOR TUBES

A small leak may be repaired temporarily by applying brown soap or white lead, but the repair should be made permanent with solder as soon afterwards as possible. A choked radiator tube is a more serious affair. Whilst the stopping of one tube does not seriously interfere with the water circulation, it is bound to cause trouble sooner or later, and the tube may freeze in cold weather.

For repairs to Cooling System see page 129.

The Ignition System

The magneto is driven by a gear from the camshaft through an impulse coupling which provides an intense spark when the engine is cranked. It generates the high tension electric current which is conducted through the high tension leads to each sparking plug in turn, where, in jumping the gap between the points, it produces the spark which ignites the compressed mixture in the combustion chamber.

To obtain the best results under varying operating conditions, the timing of the spark is adjustable and is controlled by the ignition control lever on the dash.

When this lever is at the bottom of its quadrant, the ignition is fully advanced. When the lever is moved upward to the indentation in the dash the ignition is fully retarded. When the lever is moved beyond the indentation the primary circuit of the magneto is earthed and the ignition is switched off. See note on Ignition Control Lever, page 15.

THE IMPULSE COUPLING

A pawl carriage, on which two weighted pawls are pivoted, is keyed to the magneto armature shaft and held in position by a nut which is retained by a snap ring in the central boss of the pawl carriage, so that, when the nut is unscrewed from the armature shaft, it pulls off the whole coupling. A hub carrying two cams fits round the boss and is retained by another snap ring.

OPERATION OF IMPULSE COUPLING

When the engine is being cranked by hand or by the starter when fitted, the magneto shaft is turned slowly, and, at a certain point, one of the pawls engages a stop on the magneto body. This holds the pawl carriage and magneto shaft stationary while the hub continues to rotate and winds up the torsion spring. When a piston reaches its firing point one of the cams on the hub lifts the pawl clear of the stop, allowing the torsion spring to " flick " the magneto shaft sharply over the firing point of the magneto, which so generates a far more powerful electrical impulse than it would if rotated slowly over its firing point.

When the engine starts, the centrifugal force of the weights on the pawls causes them to move outwards, clearing the stop on the magneto body, throwing the impulse coupling out of action, and thus allowing the magneto to operate in the normal manner.

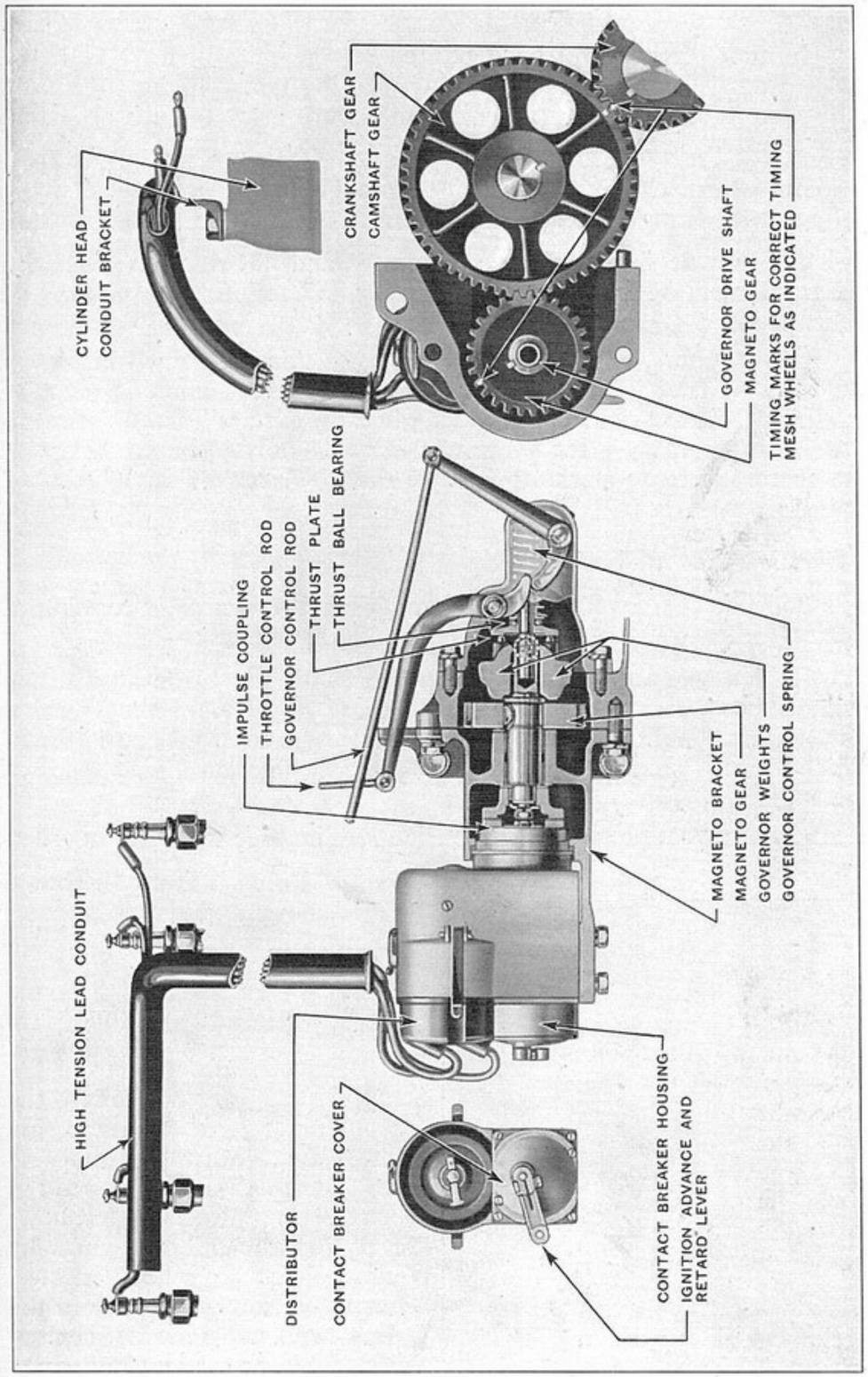


Figure 22
The Ignition System and Governor

TROUBLE

In time, carbon will be deposited on the plug points and if not cleaned off will short circuit the plug, causing that cylinder to misfire. Also after prolonged use, the points may burn away to such an extent as to interfere with the regular firing of the plug.

An irregularity in the exhaust note indicates that one or more cylinders are firing intermittently or not at all.

The trouble should at once be located and put right, as otherwise the tractor will not develop its full power and serious damage may be done.

Condensators, which take the form of a thimble-shaped insulator, are fitted on later tractors over the upper end of the sparking plugs to minimise the effect of moisture which can cause surface leakage. Ensure they fit squarely over the plug insulator and only make contact with the centre electrode at the top where the H.T. cable is attached.

TO LOCATE MISFIRING

Pull out the governor control rod until the engine is running at a fair speed and " short circuit " each plug as follows :—

Hold a wooden-handled screwdriver with the blade against the cylinder head, and the shank about $\frac{1}{64}$ in. ($\frac{1}{2}$ mm.) from the sparking plug terminal nut. Check each plug in this manner till one is found which when " shorted " makes no difference to the running speed of the engine.

Examine that plug and high tension lead and see that all is in order.

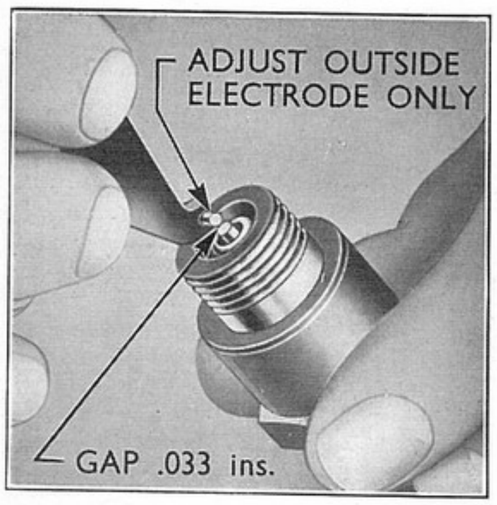


Figure 23
Adjusting Plug Points

If a plug is faulty, it should be removed, and cleaned or changed if necessary.

If it is necessary to clean the plugs, proceed as follows :—

Remove the plugs from the engine (take care not to lose the condensators, when these are fitted) and clean the points with an old toothbrush dipped in petrol. It is always better, however, to dismantle the plugs by securing the large hexagon steel nut in the hexagonal hole in the right-hand radiator side member and loosening the lock nut which holds the porcelain insulator in

place. The carbon deposit can then be easily removed from the porcelain and body with a small knife. Care should be taken not to scrape the glazed surface off the porcelain as this will cause rapid carbonization of the plug. The insulator should be carefully inspected for breakage. In reassembling the plug, care should be taken that the lock nut is not tightened so much that it cracks the porcelain. Do not omit the gasket which is fitted in the shell between the centre electrode and the body. Another gasket must always be fitted between the plug and the cylinder head seating.

The correct gap between the sparking plug points is .030"—.033". (.76 mm.—.84 mm.).

When adjusting plug points, always do so by bending the outside electrode as if the central one is bent it may crack the porcelain.

Dirty plugs are usually the result of worn piston rings, pistons or cylinder bores, excessive oil in the crankcase, or of using too rich a mixture.

If all the plugs are satisfactory, the trouble may be that a valve is not seating properly (see page 41), that the high tension lead insulation is faulty allowing the high tension to short circuit to earth, or that the contact breaker mechanism needs cleaning or is incorrectly adjusted.

TO ADJUST THE CONTACT BREAKER POINTS

(Stationary type Contact-Breaker.)

Magnetos having the stationary type contact breaker may be identified by the rectangular contact breaker cover, held in position by two screws.

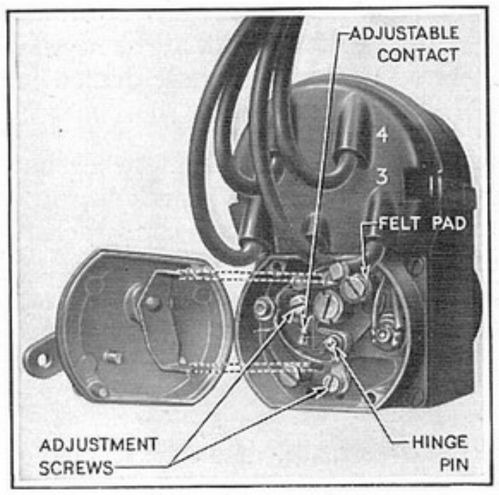


Figure 24
Stationary Type Contact Breaker Adjustment

To adjust the contact breaker gap, disconnect the vertical operating control from the lever on the cover. Then unscrew the two cover screws, noting they are retained in the cover when fully unscrewed from the body.

Removing the cover discloses the contact breaker points, see Fig. 24 and on loosening the two adjustment screws the adjustable contact may be set to give the proper clearance, which is .012 in. (.3mm.) when the cam has

fully opened the points. After adjustment, tighten the two adjustment screws and recheck to ensure the gap has not been altered.

If it is found necessary to face the contact breaker points, first withdraw the split pin, plain washer and fibre washer from the hinge pin which passes through the fibre mounted contact point. Then unscrew the nut which secures the condenser lead, also the other end of the contact breaker spring. Remove the shakeproof washer and plain washer fitted beneath this nut, which will permit the shouldered fibre washer to be withdrawn and frees the condenser lead. The contact breaker point and spring can then be detached.

To remove the adjustable contact breaker, unscrew both adjustment screws and remove them, after which the contact can be lifted off clear of its mounting pin.

Do **not** use an ordinary file when dressing the contacts : use a special contact breaker file and take care the points are quite square when finished so that correct assembly will be achieved.

When replacing the adjustable contact point, install it so that the centre hole fits over the shoulder of the hinge pin. Secure it by the two adjustment screws, noting the spring washers must be fitted against the underside of the screwhead and the plain washers next to them.

Before refitting the contact breaker spring and contact, first fit the insulated washer on the hinge pin, touching the adjustable contact plate. Next, fit the shouldered fibre washer on the outer mounting spring pin, with the shoulder outwards. Over this shoulder fit the plain steel washer.

Then install the contact and spring, lightly oiling the hinge pin and bush. On the hinge pin, install a fibre washer followed by a steel washer and secure with a split pin inserted through the hole drilled for the purpose.

Secure the outer end of the spring against the steel washer and fibre shoulder of the parts already assembled. Enter the condenser lead terminal tag over the shoulder of the remaining fibre bush and then fit this so the shouldered end is the outer end of the spring eye. Fit the plain steel washer, shakeproof washer and nut in that order. When tightening the nut ensure the lead from the condenser is not strained or distorted. Check the contact breaker gap as previously described and correct if necessary.

When refitting the contact breaker cover plate, take care to ensure the two fingers of the advance control register correctly with their respective locations. The upper finger must enter the U-shaped register, whilst the lower finger must enter the rectangular location provided for it just beneath the contact breaker spring. Do not attempt

to tighten up the cover screws until both fingers are correctly engaged, when the cover will fit flush against its flange.

TO ADJUST CONTACT BREAKER POINTS

(Rotating Contact Breaker type Magneto.)

Remove contact breaker cover.

Rotate crankshaft until the fibre block on the end of the breaker arm is at the high point of the contact breaker cam ring.

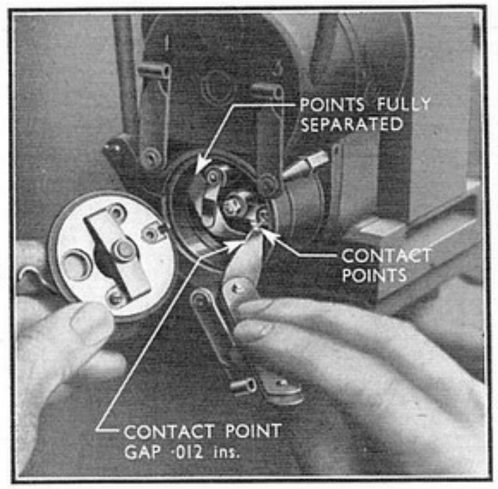


Figure 25
Adjusting the Rotating Type Contact Breaker

When the crankshaft is being turned, it will be found that at a certain point the magneto armature and the contact breaker stop revolving, then, when the impulse coupling releases, they spring round past the firing point of the magneto and the fibre block may pass the high point of the cam.

If this occurs, moving the ignition control lever on the dash may rotate the cam ring sufficiently to bring the fibre block back on to the high point of the cam.

Loosen contact breaker point lock nut and adjust the gap to .012 in. (.3 mm.).

Tighten the lock nut and replace the contact breaker cover, noting that the lug of the cover must enter correctly the location provided for it in the cam ring. If this is not done the earthing connection may be rendered inoperative.

Should it be found necessary, however, to reface the points due to pitting, first remove the contact breaker from the armature by unscrewing the central hexagon screw.

Release the spring from the rocker arm, noting that reinforcement springs are fitted, gently prise the flat spring sideways and ease the arm from the pin. Do not lose the fibre washer between the flat spring and the shoulder of the rocker arm bush.

Each contact face may then be dressed with a special contact-breaker file (do **not** use an ordinary file) taking care that they meet absolutely squarely when reassembled. If the fixed contact is removed by unscrewing the securing screw, be careful not to lose the insulating washers which must be correctly replaced.

Reassembly may be made in the reverse order, but when reinstalling the contact breaker take care that the key engages correctly with the keyway in the armature and that the carbon earthing brush is not displaced. Adjust the points as described above.

REPAIRS TO MAGNETO

IN CASE OF FAILURE OF THE MAGNETO IT IS ESSENTIAL TO CONSULT AN AUTHORISED FORDSON DEALER, AS INEXPERT REPAIRING OF MAGNETOS IS ALWAYS UNSATISFACTORY.

For repairs to Ignition System see page 133.

The Governor

The speed of the engine is regulated by a centrifugal governor which is controlled by the governor control rod from the dash.

On Industrial Tractors, however, there is a throttle lever fitted beneath the steering wheel and this operates directly on the carburettor and a governor is not fitted as standard equipment.

A short shaft is fitted into a hollow forward extension of the magneto driving shaft and is secured by a pin which projects through this extension and acts as a pivot for two governor weights. A thrust plate, ball thrust bearing and grooved sleeve fit, in this order, on to this shaft, and are free to move along it. See Fig. 22.

One end of the governor spring goes over the end of the grooved sleeve, and as this spring is slightly compressed it holds the thrust plate, thrust bearing and grooved sleeve against each other with the thrust plate pressing against hardened steel pegs in the governor weights. These weights are so shaped and pivoted that when they revolve and centrifugal force causes them to move outwards, they push the thrust plate, thrust bearing, and grooved sleeve, forward against the governor spring till the force exerted by the revolving governor weights is balanced by the force of the spring.

A fork fits into the groove in the sleeve and is connected through the throttle control arm and rods to the throttle valve in the vapourizer or carburettor and it is so arranged that when the sleeve moves forward against the spring the throttle is closed and, when it moves back, the throttle is opened.

A small actuating arm operates a plunger into which the other end of the governor spring enters and when the arm is moved the pressure on the spring may be varied, so regulating the engine speed to a predetermined figure. This lever arm is connected to the governor control rod.

OPERATION OF THE GOVERNOR

When the engine is stationary the governor weights are lying at their innermost position allowing the spring to push the grooved sleeve into its rearmost position, the linkage thus opening the throttle. When the engine is started the open throttle allows it to speed up, causing the revolving governor weights to move outwards, pushing the grooved sleeve forward against the spring, closing the throttle, until the force of the spring balances the forward thrust of the governor weights. Should

the speed increase above the set figure, the weights move further out, overcoming the resistance of the spring, pushing the grooved sleeve forward and closing the throttle. Should the speed decrease, the weights move inwards allowing the spring to push the sleeve back and open the throttle, thus correcting any variation in engine speed.

Extensions are provided on the throttle and governor control arms which provide a positive closing action to the throttle valve when the governor control is pushed right in.

For repairs to Governor see page 138.

The Fuel System

The fuel system on tractors using vapourizing oil consists of a tank with two sections—a main tank for vapourizing oil and a small one, built inside it, for petrol for starting the engine—also a fuel supply control which permits either petrol or vapourizing oil to be used as fuel. In some cases gas oil may be used and where it is intended the tractor shall operate on such fuel a bronze plate is fitted between the exhaust manifold and the vapourizer plate as described on page 62. On tractors designed to run on petrol, however, there is only one large tank. The tanks may be drained by removing the sediment bulb or, on early tractors, by unscrewing the drain plug at the base of the sediment bulb.

Tractors running on vapourizing oil or gas oil are equipped with a vapourizer, those running on petrol with a special down-draught carburettor and a cylinder head giving a higher compression ratio.

Under no circumstances should vapourizing oil or gas oil be used as fuel in a tractor equipped with a high compression cylinder head. Petrol may be used in emergency in tractors equipped with a vapourizer, but if it is intended to use this fuel regularly, a petrol carburettor and high compression head should be installed.

CARE

All fuel should be carefully strained to prevent water or other foreign matter getting into the tanks, and the vent holes in the filler caps should be kept free of obstruction.

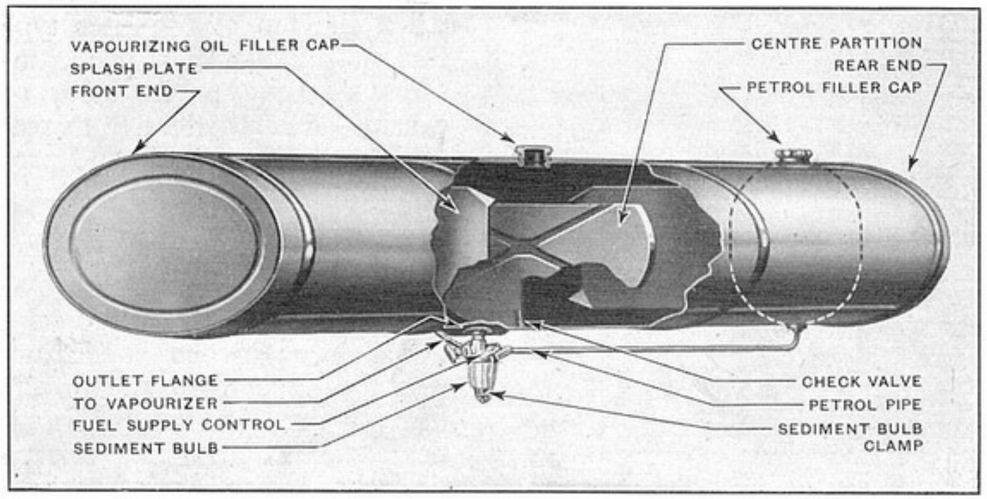


Figure 26
The Fuel Tank

As Tractors frequently have to be refilled at a distance from bulk supplies of fuel, great care should be taken to ensure that the containers used are clean and free from sediment. They should also be so marked as to obviate the tank compartments being replenished with the incorrect type of fuel.

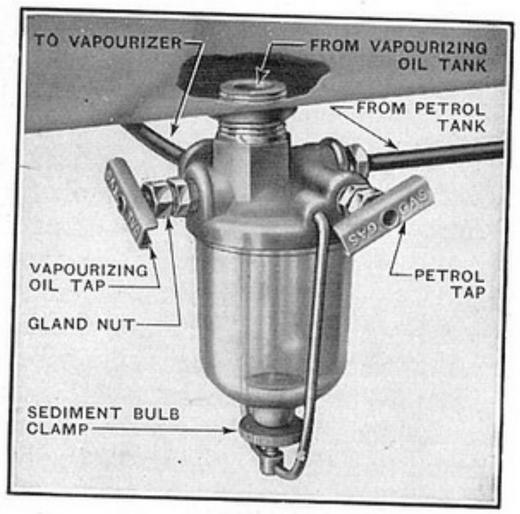


Figure 27
Fuel Supply Control (Later Type)

Any accumulation of water or foreign matter should be removed and its presence is visible as the sediment bulb is of glass : unscrew the clamp at the base, move the retainer aside and lower the sediment chamber for cleaning, see Fig. 27. On earlier tractors unscrew the drain valve (Fig. 28) at the bottom of the bulb, allowing any dirt, etc. to run away. It is not necesary to unscrew this drain valve fully. The sediment bulb tends to prevent any foreign matter getting to the carburettor or vapourizer.

In cold weather, if any water in the sediment bulb or vapourizer freezes, causing a blockage, clear it by wrapping round it a cloth saturated with hot water until the ice melts and the water can be drained away.

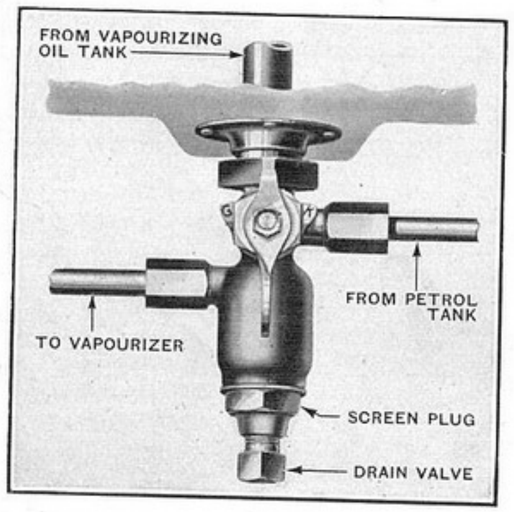


Figure 28
Fuel Supply Control (Original Type)

To obviate gland leakage when the tap of the later type fuel supply control is open, unscrew it fully to its stop, so causing an internal valve to seat against the gland body and providing a seal.

If leakage of fuel takes place at the tap shaft this may be cured by tightening the gland nut slightly ; if necessary for any reason to repack this gland, fully unscrew the gland nut and install new packing, arranging this so that the coil nearer the gland nut is pointing in a clockwise direction.

TO CLEAN THE FILTER SCREEN

After removing the sediment chamber as described on page 58, the filter screen is disclosed just below the tap. If necessary to remove it for cleaning, carefully withdraw the cork gasket, when the gauze filter screen may be drawn downwards for further attention. The cork gasket must be in good condition, otherwise there may be fuel leakage at this point.

On earlier tractors, remove the filter screen by unscrewing the screen plug (see Fig. 28), which will allow the filter to be withdrawn for cleaning. Replace with the shouldered part uppermost.

THE VAPOURIZER

The vapourizer is used to mix the liquid fuel with air and so form a combustible mixture which is drawn into the cylinder by the pistons and ignited by an electric spark at the plug points.

The vapourizer is illustrated in Fig. 29. When using petrol for starting, turn off the fuel control tap and open the petrol tap. (On earlier models, turn the two-way valve to " G.")

After the engine has been running for ten to fifteen minutes, change the fuel used from petrol to vapourizing oil or gas oil. The paths of the air, fuel, mixtures, and exhaust gases are indicated by arrows, as explained by the key on the diagram (Fig. 29). The volume of gas mixture entering the cylinders is regulated by the governor through the throttle valve.

To stop the engine when running on vapourizing oil or gas oil, change over to petrol for two minutes before turning off the fuel.

OPERATION OF THE VAPOURIZER

Fuel flows through the fuel regulator valve into the float chamber where its level is regulated by the float. It then passes through the adjustable needle valve to a jet at the rear of the float chamber, where it is met by a small stream of air supplied through a by-pass from the choke valve.

The fuel and air mixture is then sucked through the passage in the vapourizer hot plate where the heat of the exhaust gases is used to ensure complete vapourization of the mixture, then up a short pipe, over the

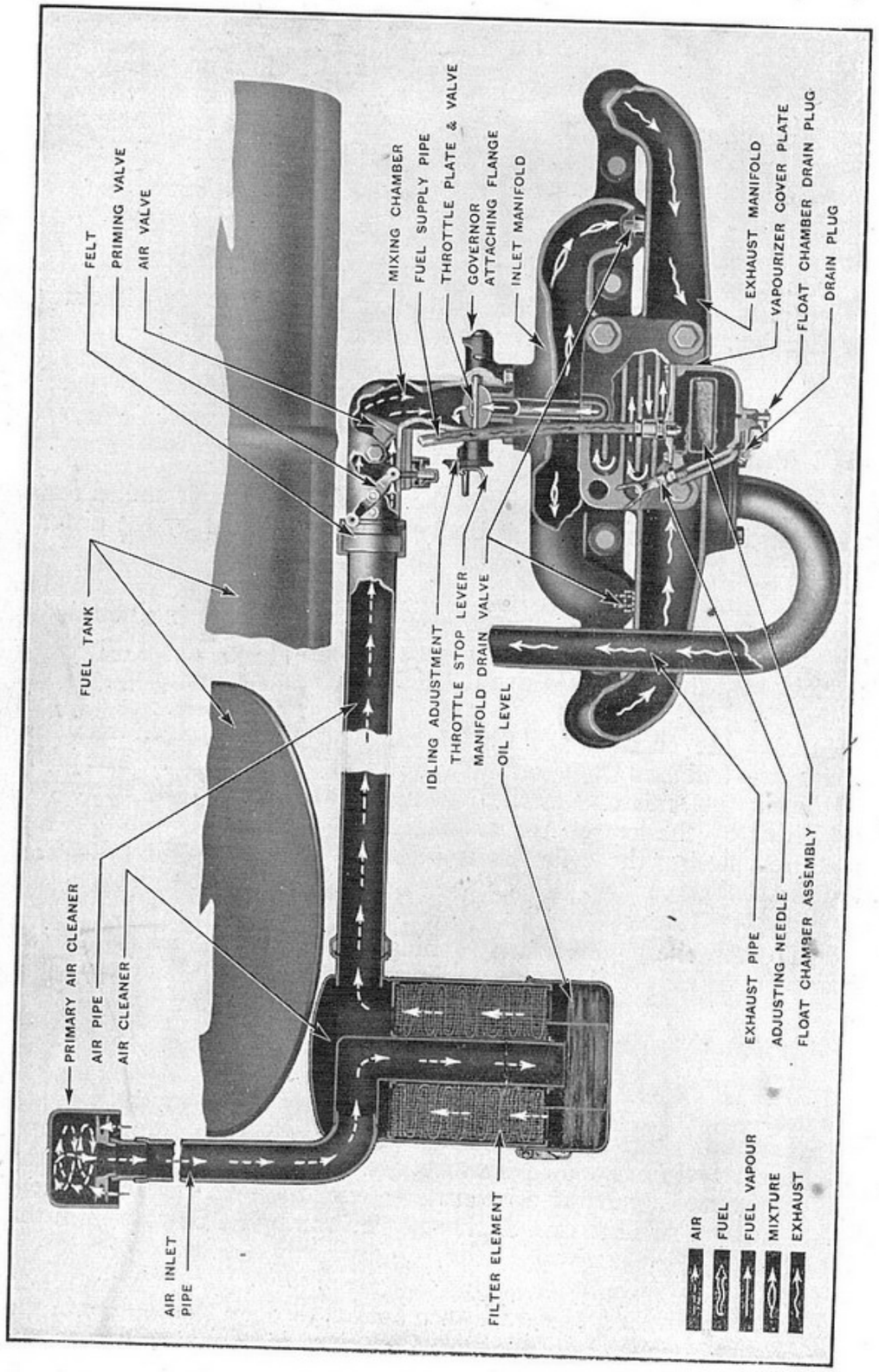


Figure 29
Vapourizer and Fuel System

throttle valve plate where it mixes with the main air supply from the air cleaner, and downwards through the inlet manifold into the cylinders.

For the mixture to ignite easily, the proportion of fuel and air must be correct, and on tractors having vapourizers this is effected by the vapourizer needle control. If the mixture is too rich (too much fuel and insufficient air) it increases carbon deposit in the cylinders, heads, pistons, valves, and valve ports, the engine tends to overheat, fuel is wasted, and the engine will misfire at low speeds. Too rich a mixture is shown by excessive exhaust smoke, and too weak a mixture by backfiring in the vapourizer, while with the correct mixture there is very little smoke or odour.

As a rich mixture is needed for easy starting from cold, a dash controlled choke is provided and this may be used to restrict the flow of air to the vapourizer, so causing the engine to draw a larger proportion of fuel into the cylinders. **The choke control must not be pulled out when the engine is warm.**

A spring-loaded diaphragm type, vacuum operated, economy device is fitted adjacent to the choke lever to allow an increased supply of air to the mixture at light loads. As the throttle is opened from its closed position, the depression in the manifold draws the spring-loaded valve in the economiser off its seat, permitting an additional supply of air to reach the vapourizer fuel. As, however, the throttle is opened more, according to the load on the engine, so will the depression be reduced until finally there is insufficient suction to draw the valve from its seat and thus the air supply at this point is cut off.

This device is entirely automatic and there is no provision for any adjustment since the device, once set correctly at assembly, should operate indefinitely without further attention.

VAPOURIZER NEEDLE ADJUSTMENT

The external adjusting needle controls the admission of fuel to the main jet and this provides the operator with a ready means of adjusting the fuel supply for any particular operating condition. The best setting is approx. $2\frac{1}{4}$ turns open but on light loads it may be found advantageous to screw this down a little, which, besides effecting economy in fuel, will ensure that the mixture is not too rich.

If there is any considerable discharge of black smoke from the exhaust this is usually an indication of an over-rich mixture, but may also mean that the vapourizer plate is either too cool or fouled with carbon. To clean the vapourizer plate see page 62.

SLOW-RUNNING ADJUSTMENT

Unscrew the nut and remove the cover as shown in Fig. 30, turn the throttle stop screw clockwise about 1 to 1½ turns after the screw just touches the throttle stop, for normal slow-running, turn further to increase slow-running speed.

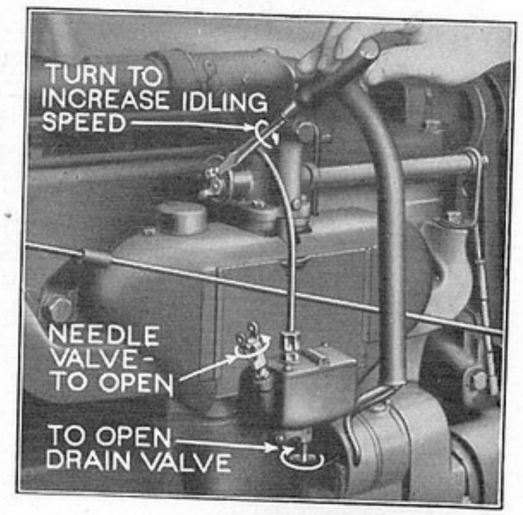


Figure 30
Slow Running Adjustment

TO CLEAN VAPOURIZER PLATE

The vapourizer plate should be cleaned occasionally to remove any carbon which may accumulate. Disconnect the fuel feed pipe. Remove the manifold shield panel and remove the four manifold cover studs; take off the vapourizer plate. The plate may then be cleaned with a wire brush and reassembled.

The vapourizer plate for use with gas oil differs somewhat from that used for vapourizing oil in that it is of bronze and the exhaust manifold is cut away so that the exhaust gases impinge directly on it. It is advisable to clean out the vertical passages as well as the horizontal fuel passages to ensure the proper degree of heat is transferred to the fuel mixture. When refitting the bronze plate take care to install it with the horizontal passages outwards, i.e., towards the float chamber.

TO CLEAN JET

Should the jet become choked with dirt or water, it may be cleared by running the engine fairly fast, opening the vapourizer needle valve and pulling out the choke control and returning it quickly. This has the effect of creating a high suction on the jet and may suck the obstructing matter through. The choke control must not be held out for any length of time as the engine may choke and stop, in which case starting will be difficult.

MANIFOLD DRAIN VALVES

Two manifold drain valves are fitted, one at each end of the inlet manifold, at the bottom, so that any excess petrol or fuel drawn into the system may escape when the engine is stopped. Each has a small valve which is normally open; when the engine is running, however, the valves are drawn onto their seats by suction and so prevent any air leak, see Fig. 29.

If these valves tend to remain open they will contribute to difficult starting and so should be checked occasionally. See also page 24. They are fitted to tractors operating on petrol, vapourizing oil or gas oil.

CARBURETTOR

On tractors designed to run on petrol, in addition to a high compression head, a special downdraught carburettor which has been designed to meet the particular requirements of the Fordson Major Tractor is fitted.

Fuel flows from the petrol tank to the carburettor float chamber and fills it to a predetermined level which is controlled by a float and a fuel regulating valve.

From the float chamber the petrol flows through calibrated jets, receiving a small quantity of air through the high-speed air bleed which atomises the fuel, and then enters the air stream from the air cleaner through a discharge nozzle into the secondary venturi. The mixture then goes past the throttle valve, which controls the amount of mixture supplied to the engine, and into the inlet manifold and so to the cylinders.

Any water or dirt which may have collected in the float chamber may be drained away by unscrewing the gland which carries the main jet adjusting screw.

To prevent any possibility of the taper needle being forced into the jet orifice when refitting the gland, slacken back the adjusting needle, re-adjusting when the gland is tightened.

A choke valve controlled from the dash is also provided and this may be used to restrict the air supply from the air cleaner to the carburettor, thus enriching the mixture to facilitate starting when the engine is cold. If the choke control is held out too long, liquid petrol may be drawn into the intake manifold, causing the mixture drawn into the cylinders to become too rich for easy starting. The choke must not be used when the engine is warm, or it will act in the same way and may stop the engine. To minimise this effect, two small valves are fitted to the intake manifold and these allow any liquid petrol which may accumulate in the manifold to drain off. As soon as the engine starts these valves close and prevent any air leaking in through them.

Provided the carburettor is maintained in correct adjustment trouble with this component is most unlikely, but cleanliness of the jets is best assured by straining all fuel when filling the tanks.

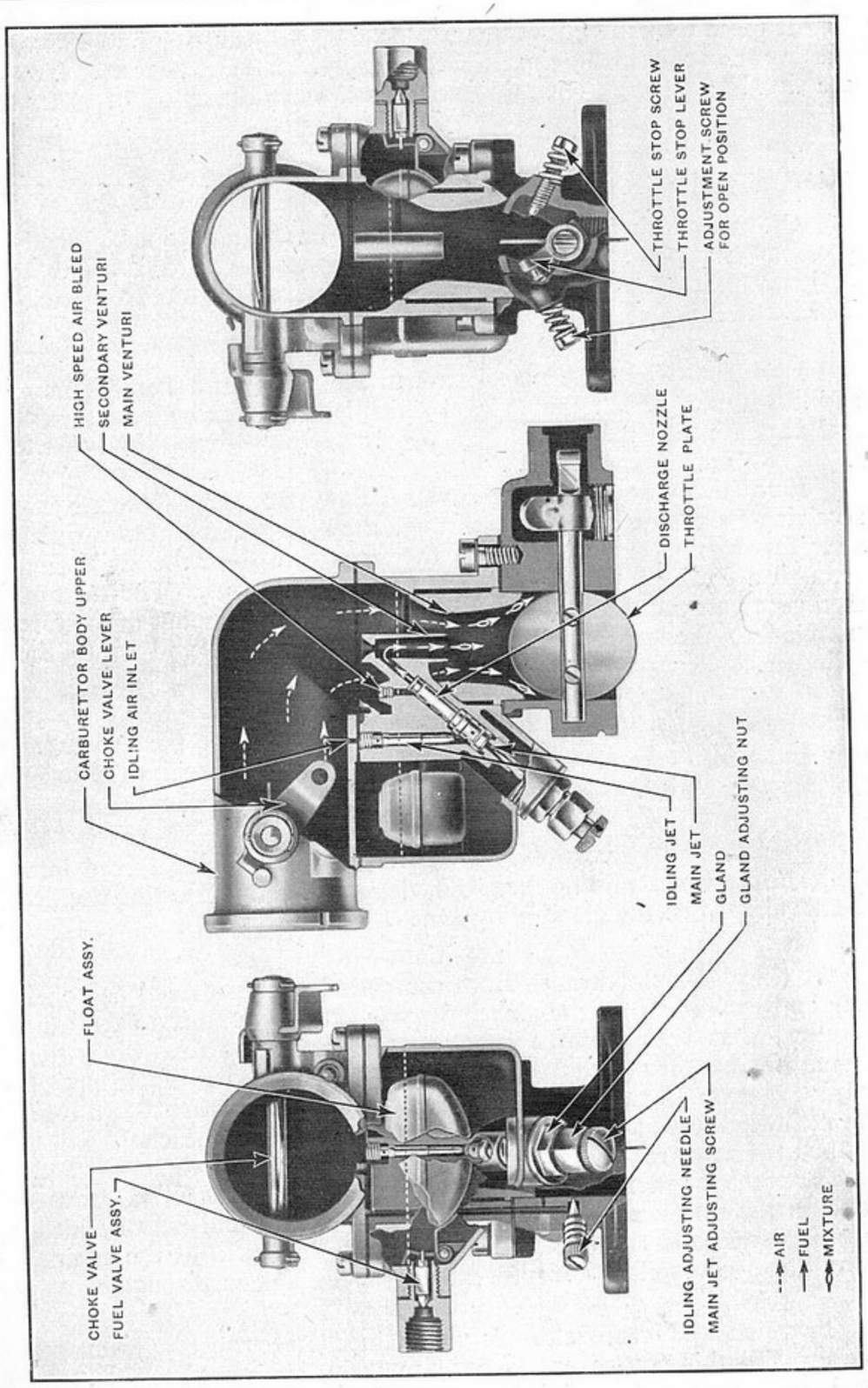


Figure 31
The Carburettor

Should the jet become choked it may be cleared by running the engine at a fair speed, pulling out the choke and returning it quickly, taking care not to hold out the choke control for any length of time, as this may stop the engine and make it difficult to start again.

Slow-Running Adjustment.—The only adjustments required are to the idling adjusting needle and to the throttle stop screw (see Fig. 31). An approximate setting for the idling adjusting needle would be ½ to 1 turn open from the fully closed position.

To obtain the exact setting for the individual engine proceed as follows :—

When the engine is warm, turn the throttle stop screw so that the engine will run sufficiently fast to prevent stalling. The idling adjusting needle should then be screwed in or out until the engine runs evenly ; the throttle stop screw may now be readjusted if the engine is running too fast, followed by a further readjustment of the idling adjusting needle. These operations should be repeated until the idling speed is satisfactory.

The screw opposite the throttle stop screw controls the fully open position of the throttle plate and should not be altered.

Main Jet Adjustment.—The approximate setting for the main jet adjusting screw is 1 to 1½ turns open for maximum power.

Should this needle be open too far a rich mixture will be caused, which may result in a black exhaust, fouled sparking plugs, and loss of power, in addition to heavy fuel consumption. A mixture which is too weak, due to the needle being screwed in too far, may cause overheating, " pinking," and loss of power.

Approximate settings are :—

Idling Adjusting Needle—½ to 1 turn open.

Throttle Stop Screw—Screwed in about 1 to 1½ turns after the screw just touches the throttle stop. (See Fig. 31.)

Do not expect a new engine which is stiff to idle properly at low speed or to " rock " on compression when stopped.

FLOODING CARBURETTOR AND VAPOURIZER

Should petrol flow from the float chamber, it may be due to the fuel regulating valve not seating properly, or to the float being punctured.

Turn off the fuel at the sediment bulb.

Unscrew the union nut, when the adaptor can be unscrewed and removed. This may then be cleaned and examined for particles of grit or other foreign matter, whilst the needle valve will be exposed to view. When refitting the adaptor, ensure its gasket is in position and in good condition : take care the needle valve enters the drilled passage in the adaptor before screwing it into place in the float chamber.

If, after reconnecting the petrol pipe and testing, the carburettor still floods, it will be necessary to undo the six screws holding on the float chamber cover, when the internal parts may be inspected and replaced, if necessary.

The Air Intake System

On the Standard Agricultural, Land Utility, or Row Crop Tractor, air is drawn through a number of vanes at the base of the primary air cleaner, and these impart a rotary motion to the incoming air, causing the larger particles of dirt, chaff, etc., to fly outwards and upwards against the top of the cleaner, thence through four small scoops to the atmosphere.

The partially cleaned air then flows down the vertical air inlet pipe and enters the air cleaner at the left-hand side of the tractor.

A suitably shaped deflector is fixed inside the air cleaner and the level of oil contained in the base of the cleaner is such that the air has to pass across the oil bath before it can enter the engine. Owing to the internal construction, together with its speed, impurities in the air are deposited in the oil in the base of the cleaner.

Before leaving the cleaner the air passes through a final filter of wire mesh type which besides preventing any chance of oil being carried through with the air stream, tends to impregnate the cleaned air with a finely divided oil-mist.

A small release valve is fitted beneath the outlet elbow of the square type cleaner so that any fuel or oil which may find its way to this point may escape. This valve opens when the engine is at rest and it should occasionally be inspected to ensure that it is free and unobstructed.

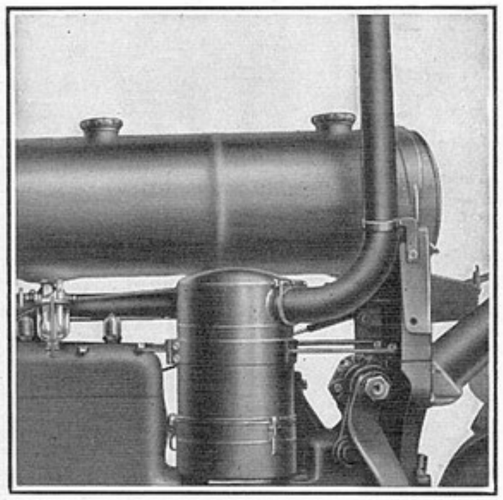


Figure 32
The Cylindrical Type Air Cleaner

The **square type air cleaner** is mounted on the housing, immediately behind the cylinder block and is secured by three bolts, two at the bottom and the third at the apex of the mounting bracket. These bolts should be inspected periodically to ensure that they are quite tight.

The **cylindrical type air cleaner** is mounted to the left-hand side, between the cylinder block and dash panel.

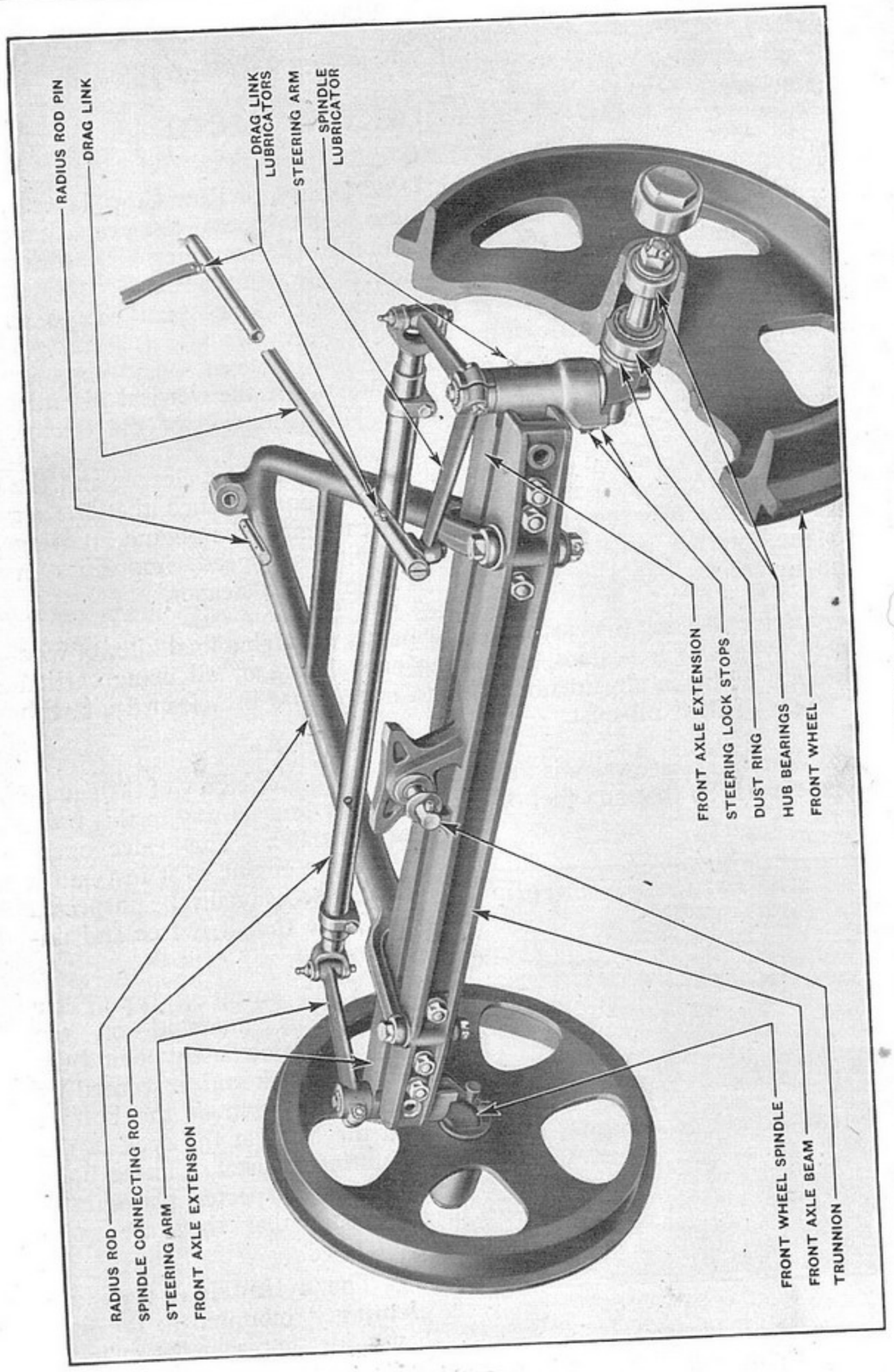


Figure 33
Row Crop Front Axle

There is a short connecting pipe from the air outlet elbow direct to the vapourizer, or carburettor as the case may be, through which the cleaned air is drawn into the engine.

CARE

The cleaner depends for efficient operation on a supply of clean engine oil which is contained in a suitable reservoir in the base and across which all the air is drawn.

On the **cylindrical type air cleaner** sediment may be cleaned out and the oil changed every 50 hours by releasing the three clips and lowering the base. Use engine oil and fill to the level mark shown in Fig. 15: the oil capacity is approximately $2\frac{1}{4}$ pints ($1\frac{1}{4}$ litres).

For the **square type air cleaner** a detachable dirt trap cover is provided and the oil should be changed at intervals of 200 hours operation. If the oil be drained when warm, after the engine is stopped, the operation is rendered easier as the oil flows readily and sediment is more easily removed.

The dirt trap cover is screwed into the base and when this is removed all sediment may be cleaned out through the hand-hole. When replacing the cover plate care must be taken that it is tight since any leak at this point will permit oil to escape and render the cleaner less efficient.

Check the release valve beneath the outlet elbow periodically to ensure that it is operating freely.

The capacity of the cleaner is approximately 5 pints (2.84 litres). The clean engine oil should be inserted through the filler to the correct oil level. The filler cap should be screwed home and the drain plug and gasket checked for oil leaks. Never run the tractor with the oil container empty, or the filler plug missing.

THE AIR CLEANER (for Tractors operating on petrol)

A gauze type air cleaner may be fitted and needs little attention except to clean the gauze.

Every three months, unscrew the wing nut at the centre of the air cleaner cover, remove the cover, withdraw and clean the gauze, after which the air cleaner should be reassembled.

If the air cleaner is left uncleaned too long, it will become choked with dirt which will restrict the air supply to the carburettor, causing the mixture to become too rich for satisfactory running and cause excessive fuel consumption.

For repairs to Air Intake System see page 141.

The Steering Gear and Front Axle

The Steering Gear is of the worm and nut type, on earlier tractors of the hour-glass worm and sector type, mounted on the housing at the base of the dash panel.

The steering-box has a filler plug for replenishment and gear oil should be used, filling to the orifice, Fig. 36.

A lubricator is provided on the housing to enable grease to be injected from the grease gun for lubricating the sector shaft bearings. Another lubricator is fitted at the upper end of the column for lubricating the steering column shaft.

The steering connections are of heavy construction with lubricator fittings wherever necessary. They should be greased daily with the grease gun as these parts are usually covered with mud or dirt, which may work its way into some bearing surface and cause undue wear.

The front axle is mounted in the cylinder front cover and is located by a trunnion. Heavy radius rods are bolted to the ends of the axle to take up thrust and preserve alignment.

ROW CROP FRONT AXLE

To facilitate cultivation, the front axle of Row Crop models has

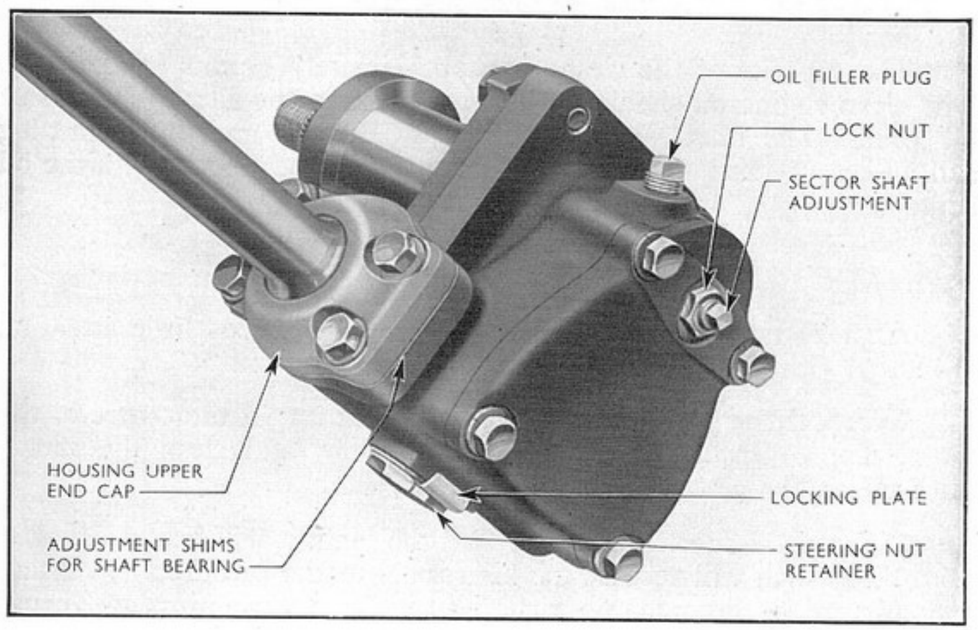


Figure 34
Worm and Nut Steering Gear

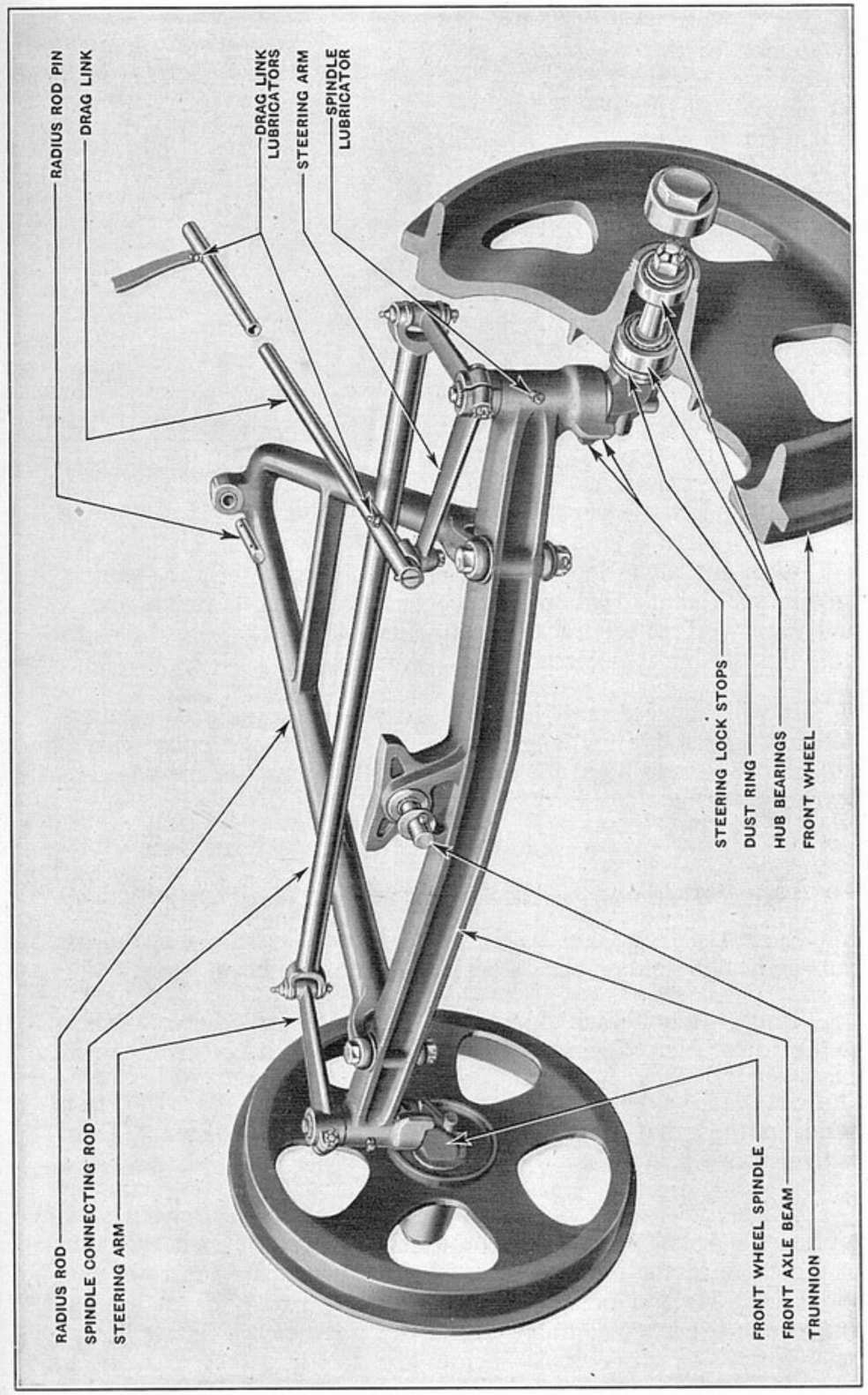


Figure 35
Agricultural Front Axle

extensions which may be adjusted in relation to the axle beam, so permitting the wheel track to be set between widths of 48″ to 72″ (121.9 cm. to 182.9 cm.) with iron wheels. When pneumatic tyres are fitted the wheel track may be adjusted between the widths of 49¾ ins. and 73¾ ins. (126.4 cm. to 187.3 cm.).

The radius rod is bolted to the axle beam itself in such a way that it is unaffected by any alteration to the wheel track adjustment since the forward ends of it permit the extensions to slide readily through the jaws.

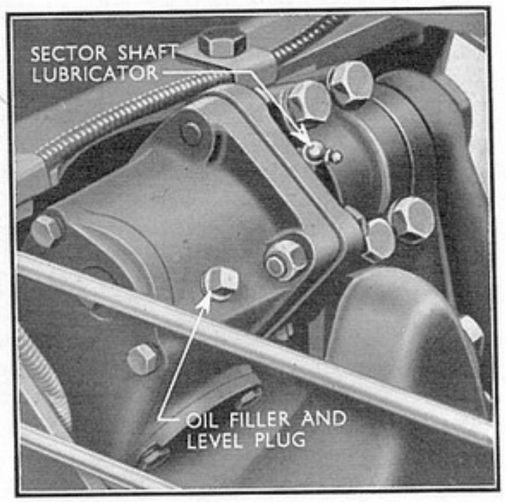


Figure 36
Steering Gear Lubrication

With any alteration in track width the layout of the steering drag link is such that it will permit correct operation between the widest and narrowest wheel track adjustments and so no adjustment for the drag link setting is necessary or is provided.

It will be necessary, however, to set the spindle connecting rod, which is adjustable for length, according to the particular wheel track setting which is selected for the work in hand, so that the wheels are in correct track.

To Adjust the Row Crop Front Axle

Raise the front end of the tractor and unscrew and remove the nuts and bolts holding the extensions to the axle beam.

Undo the bolt each side which clamps the spindle connecting rod to the adjustable yoke and completely remove each bolt from the clamp.

Set each side to give the correct distance for the work in hand, noting that each side must be an equal distance from the centre, see Fig. 37.

When the correct adjustment of the extensions has been obtained, replace the bolts, noting that the innermost bolt at each side must be in that hole in the axle beam which is between the centre of the axle and the radius rod bolt. Of the remaining two bolts each side, one must be at the extreme outer end of the axle beam. These bolts must be tightened up very firmly before the tractor is set to work and it is good practice to check them again after a short period of operation.

Next, line up the front wheels each in the straight-ahead position, so that the bolts may be inserted through the clamps, passing also through the spindle connecting rod. Note that the appropriate slots are machined on the adjustable yoke ends to provide positive locking in definite stages according to the particular wheel track adjustment.

When finally adjusted, the spindle connecting rod must be equally centred between its adjustable yoke ends, after which the nuts must be split pinned when they have been tightened.

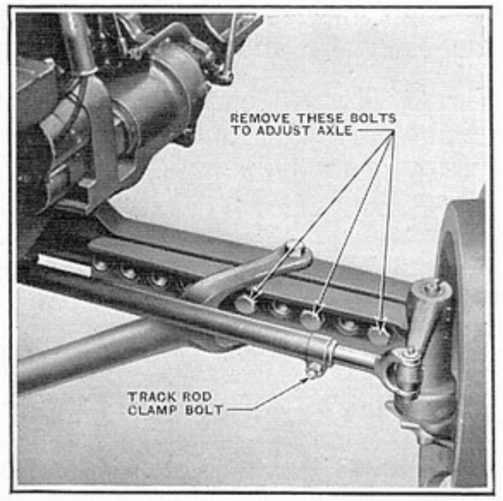


Figure 37
Row Crop Front Axle Adjustment

The rear wheels on row crop tractors may also be adjusted for track width, details concerning these being given on page 81.

Foot Brake Operation—Row Crop Tractors

When the foot-brakes are fitted these assist in row crop operation, notably in assisting in obtaining short turns, by applying the brake shoes on that side of the tractor towards which the turn is to be made.

For further details, see pages 20 and 182.

For Pneumatic Tyre Fitting Instructions, see page 83.

For repairs to Steering Gear and Front Axle, see page 143.

The Transmission

The transmission consists of a clutch, gearbox, hand operated transmission brake and rear axle, and is used to transmit the engine power to the rear wheels and so drive the tractor.

CARE

The clutch is lubricated by the oil in the engine crankcase and needs no attention in normal running. The gearbox and rear axle components are enclosed in separate compartments, each having their own

oil supply which, provided it is kept up to the correct level, assures adequate lubrication for all working parts.

As all shafts and gears are of specially hardened steel with a large number of heavy duty ball or roller bearings, wear is reduced to a minimum and no attention is needed except to see that the transmission is kept full of gear oil of S.A.E. 90 viscosity (S.A.E. 140 viscosity in hot climates having temperatures above 90°F. or S.A.E. 80 viscosity in climates having severe temperatures below 20°F.), and that the oil is changed at the recommended periods, for which see the sub-headings for the components affected.

The Clutch

To enable the power of the engine to be taken up smoothly and to facilitate engagement and changing the gears, a clutch is provided. It is the means by which this power is supplied to, or cut off from, the gearbox and rear axle.

The drive is effected by means of a clutch of the single plate type, operating in oil. A clutch disc, having suitable friction linings rivetted to each side of it, is mounted on the splined end of the main drive gear and is free to slide along it. It is pressed against the machined face of the flywheel by the clutch pressure plate, which is spring loaded, and the clutch disc is firmly held between these two faces, transmitting the drive to the gearbox.

To release the clutch and so disconnect the drive from the engine to the transmission, the clutch pedal is pressed down, operating the linkage which moves the thrust face and hub forwards. This in turn presses the inner ends of the clutch fingers towards the flywheel, the pressure plate is drawn back due to the hinged mounting of the fingers on the cover and so the disc is free to turn or remain stationary between the thrust faces on the flywheel and clutch pressure plate.

When the engine is running, with the clutch released, it will be seen that the disc, no longer pressed between the flywheel and the pressure plate, will be stationary on the main drive gear splined end, which is supported by the bearing in the flywheel.

As the clutch pedal is released, the pressure plate forces the disc into contact with the flywheel thrust face and the drive is taken up gradually until the full pressure of the springs is applied, when the drive is transmitted without slip.

The outer end of the clutch fingers incorporates a needle roller bearing assembly which will operate indefinitely without attention, as will the single roller bearing where this lever is hinged to the cover.

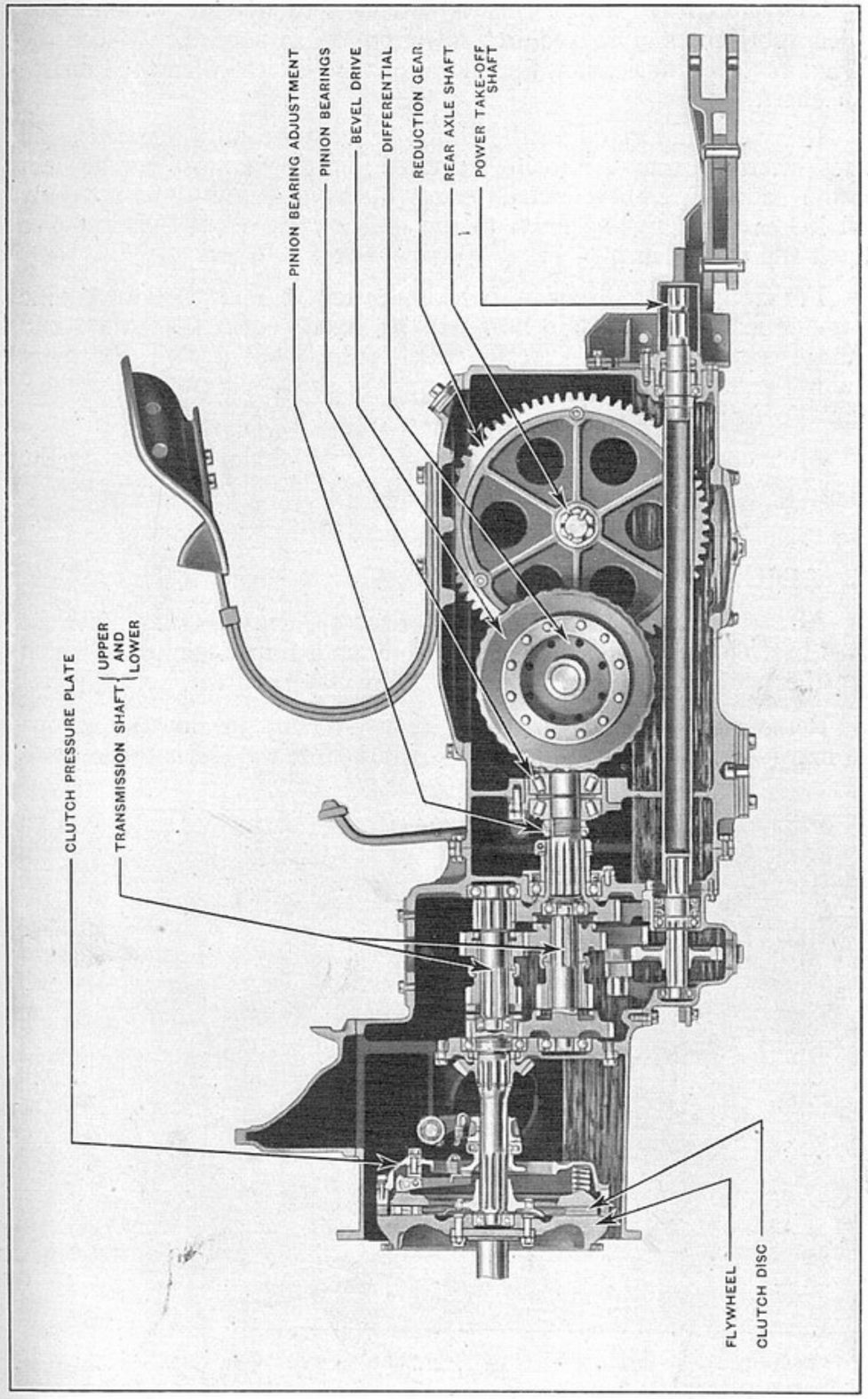


Figure 38
The Gearbox and Rear Axle

The clutch release bearing is intended to operate without any added lubricant and so requires no attention in service. Where the linkage requires lubrication, these locations are indicated on the lubrication chart.

It is very important for the clutch pedal to be fully released at all times when the tractor is being operated: the foot must not be kept on the pedal once the clutch is engaged, for if this is done not only will increased wear be caused to the clutch release bearing, but also clutch slip may occur.

For clutch slip to occur in such circumstances, i.e., when the engine is under load, considerable heat will be generated at the clutch and damage or distortion may occur which subsequent pedal adjustment may not rectify. If it becomes necessary to adjust the pedal clearance, see " To Adjust the Clutch Pedal."

After engaging gear, always release the pedal slowly, allowing the drive to be taken up smoothly and without stalling the engine.

TO ADJUST THE CLUTCH PEDAL

After the tractor has been in use for some time, wear may cause the pedal to strike the floor-plate before the clutch is fully engaged, in which case the pedal should be adjusted or slip may occur.

Remove the cotter pin from the clevis pin (Fig. 39), loosen the lock nut and then pull out the pin, which will enable the clevis to be freed

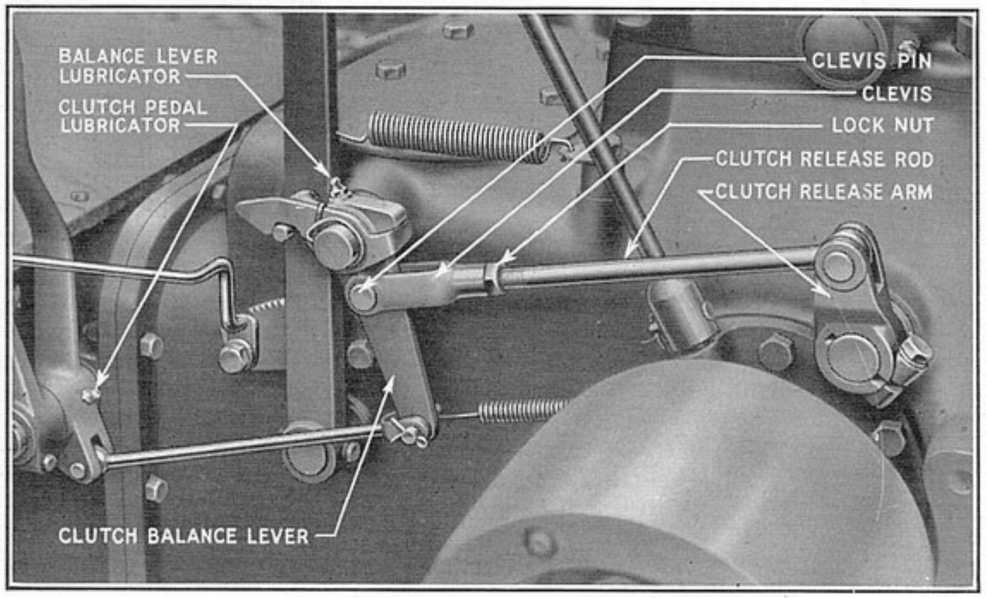


Figure 39
Clutch Pedal Adjustment

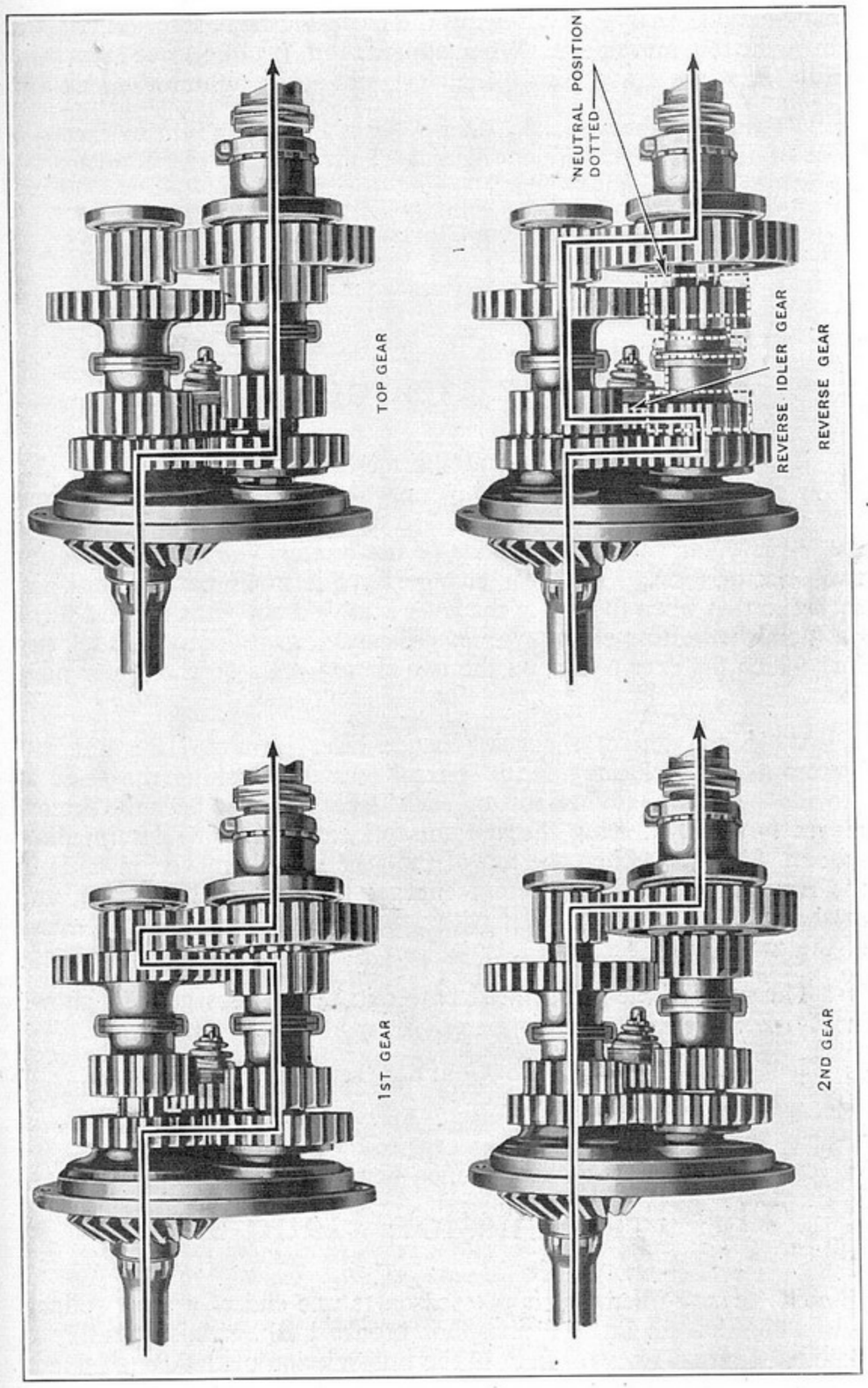


Figure 40
Meshing of Gears and Path of Transmitted Power in Various Gears

from the balance lever. Screwing the clevis further on to the rod will reduce the free movement. When approx. ½ in. (13 mm.) free movement exists, fit a new cotter pin in the clevis pin and retighten the lock nut.

Resting the foot on the clutch pedal is likely to result in excessive wear of the clutch release mechanism, and the necessity for frequent adjustment of the clutch pedal.

For repairs to Clutch see page 160.

The Gearbox

The gearbox is of the constant mesh selective type, fitted with heavy ball or roller bearings wherever necessary. Three forward speeds and one reverse are provided and are engaged by means of the gear change lever on the left-hand side of the tractor which works through two selector forks. The gear change lever is mounted in a ball and socket so that when the top of the lever is moved outwards in the neutral position, the bottom end moves inwards and engages the upper selector fork which fits over collars on the two sliding gears on the upper main shaft.

When the top of the gear change lever is moved forward, the bottom moves back carrying the selector fork and meshing the gears to provide low speed. When the top of the lever is moved back the bottom moves forward, carrying the selector fork, and engaging intermediate speed. Similarly, when the top of the gear lever is moved inwards in the neutral position, the bottom engages the lower selector fork and meshes high or reverse speeds with a forward or backward movement of the gear change lever.

The path of the transmitted power in the various gears is shown in Fig. 40.

For repairs to Gearbox see page 156.

The Transmission Hand Brake

The reverse idler gear is pressed on to one end of a short splined hub, which has an internal phosphor bronze bush. This assembly is mounted on a hollow steel shaft in the transmission plate through which the brake shaft passes, while a stationary brake plate is fitted between

the reverse idler gear and the transmission plate to act as a thrust washer.

Five steel plates are mounted on the splines on the reverse idler hub and revolve with it. Interleaved with these plates are six plates which are held in position and stationary by two pins in the transmission plate. A conical coil spring surrounds the brake shaft and holds a retaining plate against a shoulder on the brake shaft. The spring is held in compression by a nut at the end of the brake shaft.

When the hand brake is applied it partly rotates the shaft on which it is mounted and so brings the lobe of the cam on the shaft into contact with the conical nut on the brake shaft, presses the plates into contact and so applies the braking effort. A safety catch is fitted so that the hand brake lever cannot be applied unless the clutch pedal is depressed. (See Fig. 39.)

As the reverse idler gear is constantly in mesh and the five revolving brake plates revolve with it, the friction brought about by forcing them and the stationary plates together is very great and provides a brake which may be relied upon to operate under the severest conditions.

For repairs or adjustment to Brake, see page 166.

Industrial Tractor Foot Brake Adjustment

To allow for wear at the brake shoe linings, there is a simple external adjustment which permits the shoes to be expanded within their brake drums, see Fig. 77.

Using the brake adjusting tool provided with the tractor, enter this on the squared shank of the brake adjusting wedge. Turn this in a clockwise direction, when it will move in the series of " clicks." Adjust until it is felt that the shoes are pressed against the brake drum : then slacken off in the reverse direction until the brake drum, when lightly tapped, emits a clear ringing sound, indicating that the shoes have sufficient clearance.

Treat each adjusting wedge in a similar manner, testing the brake pedal to ensure it has no undue movement before the brakes are applied.

Do not attempt to adjust the brakes by altering the brake rod setting.

For repairs to the Braking System, see page 187.

Rear Axle

The power of the engine is delivered through the clutch and gearbox to the rear axle and thence to the rear wheels.

The drive from the gearbox is transmitted to each pinion shaft by means of a crown wheel and bevel pinion, the latter being directly connected to the gearbox and meshing with the crown wheel. A differential of the four pinion type with a four armed spider is bolted to the crown wheel and provides a balanced drive to each pinion shaft. Each pinion shaft has a small spur gear on it which meshes with a larger ring gear on the rear axle half-shaft. See Fig. 69.

On Row-crop tractors a brake drum is fitted at each side of the pinion shaft and brake pedals are connected so that either or both rear wheels may be braked. See also page 20 for further details.

The rear axle shafts are of the semi-floating type and the drive to these is transmitted by the large reduction gears which mesh with the smaller gears of the pinion shafts.

Each rear axle shaft is mounted on taper roller bearings, the outer one being lubricated through an external lubricator by the grease gun, the inner one being lubricated in the normal way from the oil contained in the axle housing. See Fig. 41. On Industrial Tractors, the rear axle shaft bearing lubricator at the outer end is in front of the housing, mounted on the brake plate, on the left-hand side and behind it, in a corresponding position, on the right-hand side. The rear axle filler plug is beneath the seat, to the left side of the cover plate.

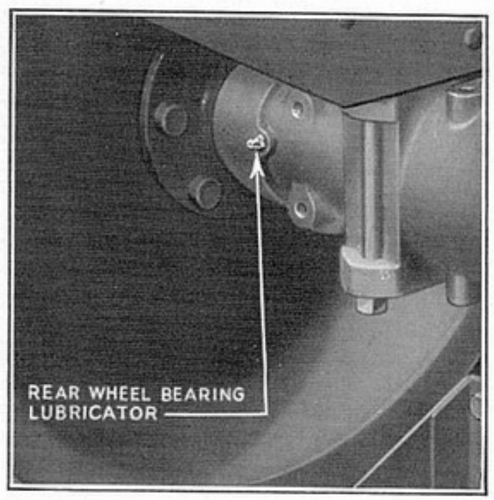


Figure 41
Rear Wheel Bearing Lubricators

A flange formed integral with the shaft, provides the mounting for the rear wheel.

Rear Wheels. Agricultural Type

The rear wheels are bolted directly to the axle shaft flanges by studs and nuts. Earlier tractors had *left-hand threaded studs and nuts* on the *left-hand side* of the tractor. Right-hand nuts are stamped R and left-hand nuts are stamped L, on one of the hexagons.

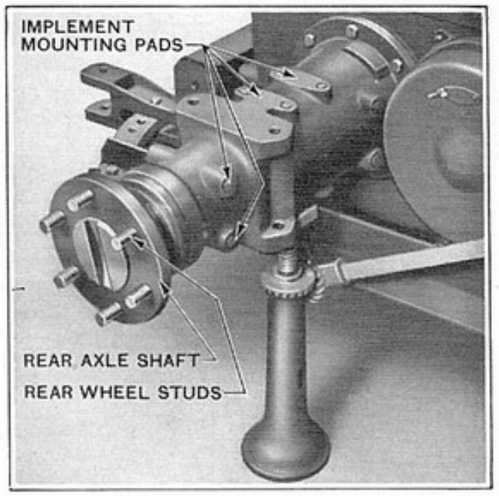


Figure 42
Rear Axle Shaft

To remove the rear wheel, apply the handbrake, place the jack in position beneath the rear axle housing, see Fig. 42, but before raising the wheel fully from the ground, loosen the six wheel nuts with the spanner provided in the tool kit. Raise the wheel fully and then unscrew the nuts when the wheel can be removed from the studs. Take care not to damage the threads by allowing the weight of the wheel to be taken on the studs.

To replace the rear wheel, ensure that the flange of the axle shaft and the mating flange of the wheel are clean. Then place the wheel in position so that the register on the flange of the shaft enters the counterbore, with the dished side of the wheel centre towards the tractor. Take care not to damage the wheel stud threads when mounting the wheel in position. Install the washers on the studs, tapers to the wheel.

Refit the nuts, *which are not interchangeable from side to side on earlier tractors due to their being right-hand threaded for the right-hand side and left-hand threaded on the left-hand side.* The letter R or L, stamped on the hexagon, provides a means of identification. Apply a little grease to the threads of the nuts before these are finally tightened. Do not tighten these nuts consecutively round the circle, but pull them up, a little at a time, diagonally, i.e., across the circle. This will ensure that the wheel is correctly seated and will minimise any tendency for the nuts to work loose when the tractor is working.

Lower the jack and remove it, again giving the nuts a final tighten after the tractor has been in use for a short time.

Rear Wheels. Row Crop Type

The width between the wheels may be altered in stages of 4 in. due to the fact that the wheel disc is offset with respect to the axle shaft

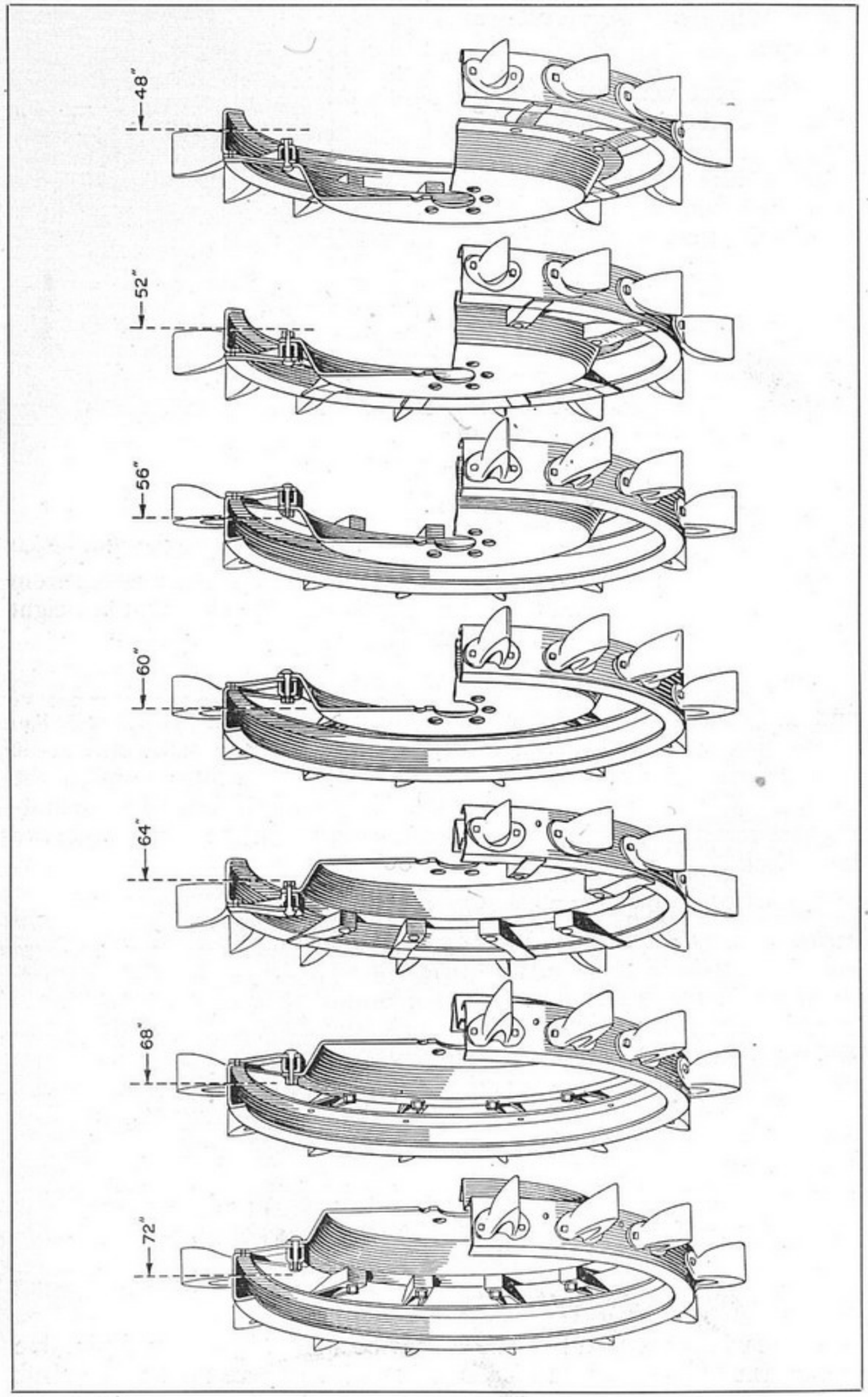


Figure 43 Adjustment for Row Crop Rear Steel Wheels

flange and may be reversed, in conjunction with the wheel rim which has spoke mountings, also offset in relation to the wheel centre. Thus track widths of 48″ (121.9 cm.), 52″ (132 cm.), 56″ (142.2 cm.), 60″ (152.4 cm.), 64″ (162.6 cm.), 68″ (172.7 cm.) and 72″ (182.9 cm.) may be obtained by suitably mounting the wheels and wheel discs as illustrated in Fig. 43.

When pneumatics are fitted the minimum width obtainable is 52 ins. (132 cm.), not 48 ins. (121.9 cm.).

For track widths of 48″ (121.9 cm.), 52″ (132 cm.), 56″ (142.2 cm.) and 60″ (152.4 cm.) the *wheel disc* has the dished part *towards* the tractor whilst for track widths of 64″ (162.6 cm.), 68″ (172.7 cm.) and 72″ (182.9 cm.) the dish is *outwards* or away from the tractor. The wheel itself may be reversed and bolted to the outer or inner face of the wheel disc as shown in Fig. 43 for the various combinations. For instructions on fitting extension rims see Page 102.

WHEELS WITH PNEUMATIC TYRES—TYRE REMOVAL

Tractors fitted with pneumatic tyres have wheels of the well-base type which renders tyre removal or replacement, if required, a straightforward operation if the following instructions are followed.

Completely deflate the tyre and place the wheel flat on the ground. Unscrew the valve lock nut on rear wheels and then press the tyre bead into the well-base opposite the tyre valve for as great a circumferential distance as possible.

Use a tyre lever adjacent to the tyre valve to lift the tyre bead over the edge of the rim. The inner tube may then be removed when the tyre valve has been withdrawn from its location in the wheel rim.

To remove the tyre completely, work the other bead into the well-base and then similarly lever it over the rim edge.

TYRE REPLACEMENT

The use of soap on the beads of the tyre greatly facilitates replacement. In cases where there is an arrow moulded on the tyre wall, replace the cover and wheel so that it revolves in the direction indicated.

Should the tyre have been removed completely, place the wheel on the ground and work one side of the tyre bead over the rim, into the well-base.

When the majority of the tyre has thus been installed a lever may be used to complete the operation and, provided the bead is kept correctly in the well-base, no undue force should be required.

Prepare the cover by lightly dusting the inside with French chalk. Inflate the tube until it begins to round out and lubricate the base half of the tube, also the inside and outside of the beads of the tyre with a frothy solution of soap and water or French chalk, before inserting the tube in the cover.

Insert the tube, pass the valve through the hole drilled to receive it and secure it temporarily with the nut. Install the tube in the tyre.

Press the tyre into the well-base opposite the tyre valve and lever the bead over the rim edge, taking care not to nip the tube.

Before inflating, make sure the tyre beads are on the rim seat and then inflate until the beads are fully seated. Then remove the valve core and so deflate the tube completely; on again inflating the tyre the tube will have been permitted to take up its position so there is no undesirable local stretching present. This is most important with tubes of synthetic rubber. Tighten the valve lock nut when the tyre is fully inflated.

TYRE PRESSURES

On new tractors, tyre pressures may be above normal. This is to avoid undesirable deflation in storage and pressures should be corrected before the tractor is put into use, see below :—

Industrial and Land Utility Tractor—Front tyre size 6.00–19. Tyre pressure 25 lbs. per sq. in. (1.758 kg. per sq. cm.).

Industrial and Land Utility Tractor—Rear tyre size 11.00–36. Tyre pressure for land work, min. 11 lbs. per sq. in. (0.733 kg. per sq. cm.); for road use 14 lbs. per sq. in. (0.984 kg. per sq. cm.).

Tyres, 11–36 size, marked " Replaces 9.00–36 " must not be paired with 9.00–36 on the same tractor; either two tyres 11–36 or two 9.00–36 must be fitted, and not one of each.

WATER BALLAST FOR REAR WHEELS

If it is found necessary to increase adhesion on the rear wheels where extra draw-bar pull is required on tractors having pneumatic tyres, water may be pumped into the inner tubes to provide additional weight.

To provide protection against frost a suitable anti-freeze solution must be used, otherwise ice may form inside the tube, become broken up when the tractor is used and so cut the tyre or tube, rendering them unfit for further use.

A suitable anti-freeze solution, which will not affect the valve core, inner tube or outer casing, is water mixed with calcium chloride ($Ca\ Cl_2$). 2 lbs. (.2 kg.) of *commercial* calcium chloride should be dissolved in each gallon (litre) of water, increasing the quantity of calcium chloride proportionately if considerable frost is anticipated.

Mix the solution, *adding calcium chloride to the water first,* in a wooden barrel or container for preference. Allow to cool before pumping the solution into the tyre.

Common salt may be used as a substitute for calcium chloride and should be used in the proportion of 2 lbs. per gallon (.2 kg. per litre) of water.

Radiator anti-freeze solutions must not be used in tyres or calcium chloride solution used in the radiator.

The solution may be put into the tyre either by gravitational methods with a tank 6 to 8 feet (1.8 to 2.5 m.) above the tyre or by means of an ordinary hand pump in conjunction with one of the special adaptors.

Adaptor N–1726–A can be identified by means of the deflator valve button on the side of the adaptor. Adaptor N–1726–B can be distinguished by means of a thin metal tube, one end of which passes through the side of the adaptor, the other end projecting through the valve screw end. A plastic tube is supplied with this adaptor and should be placed over the metal tube projecting from the screw end of the adaptor. The length of tubing supplied is for use with 11.00 × 36 tyres and approximately 2 inches (5 cm.) must be cut off the end if 9.00 × 36 tyres are to be filled. In any case, ensure that the tube does not foul the crown of the inner tube.

Proceed as follows :—

1. Jack up the rear of the tractor, turn the wheel to bring the valve to the top with the deflator valve button type or the bottom of the wheel with the plastic tube type adaptor.
2. Secure the tyre valve with a piece of wire to prevent it slipping inside the rim, then unscrew the valve core, so releasing all pressure in the tube.
3. Connect up the adaptor to the valve, passing the plastic tube through into the crown of the tyre when using the latest type adaptor. Do not place the tube in position until the valve is to the wheel top. Connect up the solution line from the pump or other container used.
4. Pump in the solution or allow it to enter from the gravitational tank if this method is used. When using the deflator valve type adaptor, the solution should be periodically shut off and the deflator button located on the adaptor pressed to release any trapped air from the inner tube. The tube is filled to the correct level when the deflator button is pressed and the solution issues from it in a stream. With the plastic tube type adaptor gradually turn the valve round while the liquid is flowing into the inner tube until the valve is at the top, so that the air can escape. When water issues from the small pipe in the side of the adaptor with the valve in the top position the tyre is full.

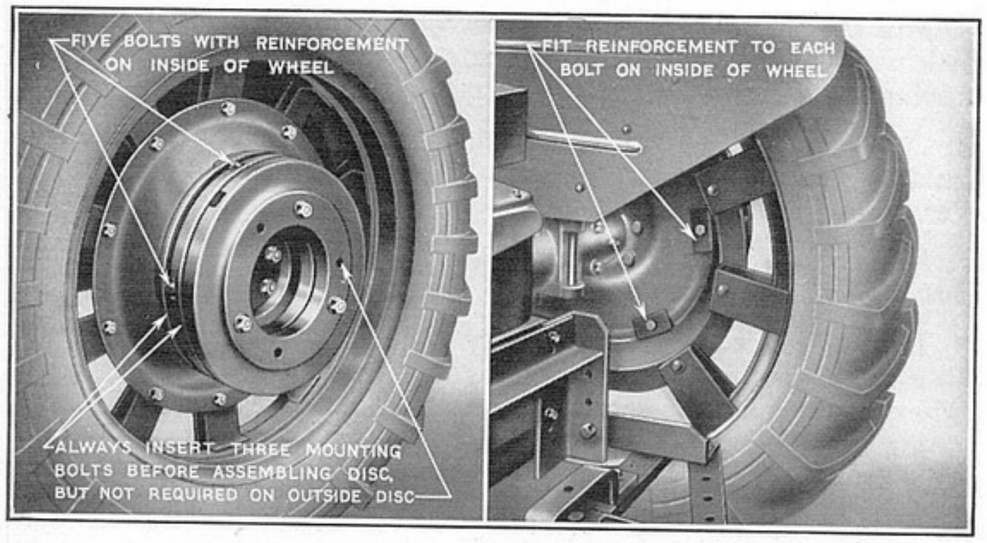


Figure 44
Rear Wheel Weights

5. Remove the adaptor quickly, replace the valve core and inflate the tyre to about 30 lbs. per sq. in. (2.11 kg. per sq. cm.) to seat the cover beads correctly. Then reduce the pressure to 2 lbs. per sq. in. (.14 kg. per sq. cm.) above the normal working pressure to allow for the added weight. For tyre pressures see Page 84.

REAR WHEEL WEIGHTS

To increase rear wheel adhesion, wheel weights may be fitted and used either in conjunction with water ballast or not as required. Each weight is of cast-iron and weighs approximately 100 lbs. (45.36 kg.), and normally 300 lbs. (136 kg.) on each rear wheel will be found suitable for most conditions. They should be equally distributed on each wheel and may be obtained in sets, comprising weights, bolts, nuts, etc., through your authorised Fordson dealer.

Note that the weight (E27N-1065) which is to be bolted directly to the wheel disc differs slightly from the auxiliary weight (E27N-1076) as the former has five mounting holes drilled in the periphery of the weight and the latter five recesses at this point.

Fit the weights as follows :—

Assemble the five reinforcement discs (E27N-1077) on the bolts (21198-S) and insert the bolts from the *inside* of the wheel disc. If the wheel weight only is to be used, secure it to the wheel disc by the five bolts, nuts and washers.

Should, however, auxiliary weights be required, it will be necessary to fit the three mounting bolts (23103-S) with the head in the recessed hole provided **before** securing the weight to the rear wheel disc.

Assemble the auxiliary weight to these three bolts, using the nuts and washers provided and if further additional weight is desired, adopt the same procedure, making certain that the three bolts are assembled to the preceding weight **before** securing it to the wheel disc or auxiliary weight.

On Tractors having undrilled wheel discs, mark off five points at a diameter of 20.19 ins. (50.85 cm.), each being spaced 72° apart, and drill $\frac{11}{16}$ in. diameter holes in the disc. The weight (E27N-1065) may also be used as a template for drilling but if this method is adopted the holes must be concentric with respect to the wheel disc.

On Industrial Tractors a rectangular section weight is bolted in the angle of the sub-frame beneath each rear wheel, each weight being 100 lbs. (45.36 kg.).

ADJUSTABLE DRAWBARS AND IMPLEMENT PADS

The forward end of the drawbar is mounted beneath the rear axle housing at the front end on early tractors and is free to move sideways at the rear end either side of the centre line across a rack to which it may be locked in any one of thirteen positions.

On later tractors the drawbar is adjustable for sideways travel, nine positions are provided and may also be adjusted for height by removing one bolt each side of the longitudinals and raising or lowering the drawbar as required. There are three alternative positions for height adjustment and one for the rear cross bracket.

Beyond ensuring that the bolts at the front and rear end are always kept tight (Fig. 45) no further attention is required. Since the drawbar is designed to transmit the pulling effort of the tractor no attempt is to be made to attach implements by bolting attachments to the power take-off shaft flange which is not intended for such a purpose.

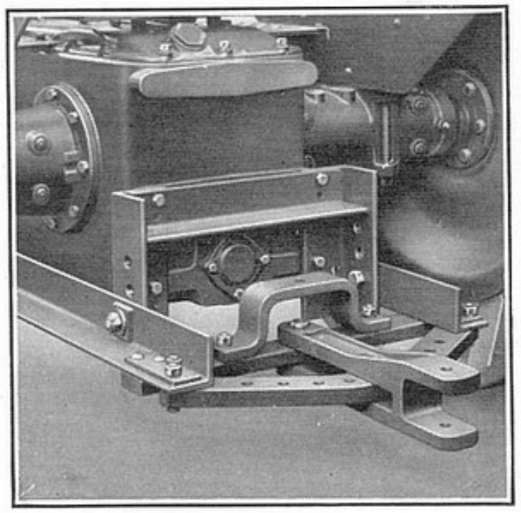


Figure 45
Drawbar Mounting

Implement pads are provided on the tractor as under :—

(*a*) Rear axle housings. See Fig. 42.

(*b*) The right and left-hand side of the transmission housing. See Fig. 2.

(*c*) Cylinder front cover beneath radiator.

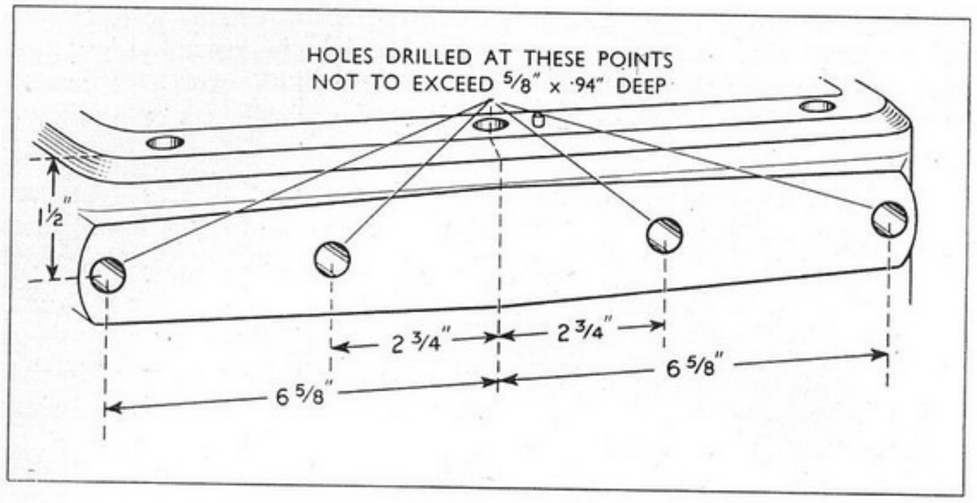


Figure 46
Rear Implement Mounting Pad

(*d*) Top rear face of the rear axle housing. No holes are drilled and if it is necessary for implements to be attached at this point the holes must be drilled in accordance with Figs.3 and 46.

Power Take-off Attachment

A power take-off, independent of the belt pulley attachment, may be fitted to Fordson Major tractors having Type 4.3 (low speed top gear) or Type 7.7 (high speed top gear) transmission, standard or special ratio (intermediate gears) : the drive is taken from the gearbox by replacing the cover plate below the gear box with the take-off unit and the drive is led to the rear of the tractor, the shaft being splined for the attachment of suitable fitments.

Due to the differing gears for the Type 7.7 (high speed top gear) and Type 4.3 (low speed top gear) ratios it will be necessary for the power take-off installation to be correctly mated with the existing gears both of the tractor gearbox and the power take-off unit.

The ratios fitted to the tractor when produced are indicated by a series of numbers stamped on the right-hand flange of the gearbox housing towards the top where this mates with the flywheel housing.

The identification numerals are tabulated on page 7.

The power take-off for fitting on the Type 4.3 (low speed top gear) transmission differs from that for the Type 7.7 (high speed top gear) as shown in the following tabulation, irrespective of standard or special ratio (intermediate gears).

TRACTOR GEAR BOX

Ratio.	No. of Teeth on Low Transmission Pinion.
Type 7.7 (High speed top gear)	20
Type 4.3 (Low speed top gear)	26/20

POWER TAKE-OFF UNIT

Ratio.	Type of Idler Gear.
Type 7.7 (High speed top gear)	Double Idler Gear
Type 4.3 (Low speed top gear)	Single Idler Gear

The direction of rotation of the power take-off shaft viewed at its splined driving end at the rear of the tractor is *clockwise*.

To fit the power take-off unit it will be necessary to drain off the oil from the gearbox and also the rear axle.

Unscrew the seven bolts from the horizontal flange of the bottom cover and five bolts from the vertical flange and remove the cover. Re-use the gaskets only if undamaged, otherwise fit new ones, holding them in position with a film of grease at the crankcase joints. See Fig. 71.

For the **vertical** flange two gaskets of different thickness have been used, .006 in. (.152 mm.) and .012 in. (.3 mm.) : if only the former are available, use two together. Gaskets at this point must not overlap the chamfer and reach the horizontal flange or an oil leak may result ; cut back the gasket, if necessary, to suit.

Bolt the power take-off unit in position and tighten the bolts a little at a time so that it fits firmly against the right-angled faces of the gearbox. Check the drain plug in the housing ; a gasket is used at this point and must be in place before the plug is finally tightened.

To install the power take-off shaft remove the four bolts securing the cover plate to the rear axle housing at the centre just above the draw-bar platform. If the gasket is damaged, clean off all traces from the housing face.

With the outer bearing and spacer pressed on to the shaft, insert it in the housing, so that the internally splined end may be engaged with the splined shaft of the power take-off unit. This can be located and the splines engaged before the ball bearing assembly at the rear enters the location of the axle housing.

Then press the shaft and its bearing into the housing ; position a new gasket on the housing flange and ensure that the oil seal is correctly installed in the retainer. The sharp edge of the seal must be fitted so that it is towards the bearing. Bolt the bearing retainer in position, taking care not to damage the oil seal when inserting this over the splined end of the shaft or to disturb the gasket. Tighten the four bolts securely, then test the shaft for freeness by turning it by hand when in the neutral position, i.e., with the slotted end of the shifter shaft in its outermost position.

Connect up the control lever so that the offset handle is towards the left-hand side, to clear the tool box. The mounting for this lever is at the left-hand side of the housing, to the rear of the axle flange.

The control rod lever is fitted so that the end having the greater distance from the slotted hole at the centre is to connect up with the control rod. Bolt the other end to the housing with the special bolt supplied, using a flat washer and spring washer. Test for free operation before installing the cotter through the yoke end of the shifter shaft and the slotted end of the lever. Secure the cotter with the cotter pin, the legs of which must be well opened to prevent it working out in use.

Connect up the control rod to the lever and note that at the rear a castellated nut and bolt is used to secure the rod to the operating lever. Check the lever to ensure that it operates the mechanism correctly before filling the gearbox and rear axle housings with oil. If that oil which was drained out is to be re-used it must be carefully filtered to remove any foreign matter which might be present.

Inspect the drain plugs and other joints to ensure that there is no oil leakage. (See note on Page 33 re Rear Axle Drain and Level Plugs.)

When out of use the shaft may be protected by the cover which is secured by two bolts.

To engage the Power Take-off drive when the engine is running, hold out the clutch by pressing down the clutch pedal and move the control lever forwards to mesh the gears. If the control lever cannot be moved forward to the full extent of its travel due to the gears not sliding readily into mesh, release the clutch pedal momentarily which will alter their relative positions and allow them to be then meshed easily. When the power take-off shaft is coupled up and the tractor is stationary, allow the clutch pedal to be released slowly to take up the drive gradually, without imposing strain on the various parts of the drive.

The Hydraulic Power Lift Attachment

General

Provision is made on all Fordson Major Tractors for a Power Lift attachment for " Unit " equipment. This is optional equipment which may be already fitted or may be installed by the owner.

The lift drive is installed in place of the cover plate on top of the gearbox and takes its drive from the low transmission gear on the upper transmission shaft. The pump and lift assembly is mounted on the rear axle housing top cover.

Two types of lift drive gears are available to suit tractors with either Type 7.7 (high speed top gear) or Type 4.3 (low speed top gear) ratios.

The top gear ratio fitted to the tractor when produced is indicated by numbers stamped on the front right-hand flange of the gearbox housing towards the top, these numerals being indicated on page 7. Should there be any doubt, since these might have been altered in service and the numbers on the flange left as originally marked, the following will assist in positive identification.

GEARBOX		LIFT DRIVE ASSEMBLY			
Gear	Identification Markings	No. of teeth on Transmission Low Gear	No. of teeth on Idler Gear	No. of teeth on Drive Gear	Length of Drive Shaft
Type 4.3 (low speed top) Standard ratio (intermediate gears) Special ratio (intermediate gears)	S.T.D. 43 (Green Spot) SR 43 (Red Spot)	21	26	29	13 27/32 * or 18 7/16 †
Type 7.7 (high speed top) Standard ratio (intermediate gears) Special ratio (intermediate gears)	S.T.D. 75 (Green Spot) SR 75 (Red Spot)	27	23	29	13 27/32 * or 18 7/16 †

* Single-lever type lift. † Two-lever type lift.

The direction of rotation of the lift drive shaft viewed from the rear of the tractor is anti-clockwise.

Installation

Remove the gearbox top cover plate. It should be noted that the bolt nearest the hand brake lever is of a smaller diameter than the remaining bolts. Remove the seat and spring from the rear axle housing top cover and detach the seat from the spring. Remove the tool box.

Place the lift drive assembly in position on the top of the gearbox, using a new gasket if the old one has been broken or torn, and fit the bolts and lockwashers. Ensure that the smaller diameter bolt is toward the hand brake lever and that the bolts are tightened evenly.

Slide the pump shaft (drilled) coupling onto the pump shaft and then ream out the pump shaft hole to $\frac{3}{16}$ in. diameter for the pin. Pin the coupling to the shaft, and then locate the lift drive shaft (tongued) coupling on the lift drive shaft. Line up the two couplings so that they engage easily when the pump is slid into position.

Slide the hydraulic power lift pump assembly into position on the rear axle housing top cover, ensuring that the two couplings are fully engaged, and bolt the pump assembly to the cover. Place the two halves of the pump drive shaft guard round the drive shaft and tighten the cover clips so that it is firmly held on the pump and pump drive housings.

Fit the lift arms (E27N-994620, Right-hand side and E27N-994621, Left-hand side) with the offset outwards and nearly horizontal when in the lowered position.

Attach the seat to the new spring (supplied with the kit) and then bolt the spring and seat assembly to the top of the hydraulic pump housing.

Relocate the tool box on the L.H. side of the engine, using two supports and longer cylinder head studs. It will be necessary to drill two more holes in the tool box, in line with the existing two holes in the bottom of the tool box, to fasten it to the support with the nuts and bolts provided. The large hole in the base of the tool box should then be blocked up to prevent any tools being lost.

Fill the hydraulic pump housing with the correct quantity of oil of the correct grade, see page 94 under " Maintenance."

There are two different types of hydraulic pump and lift assemblies, one having a single control lever mounted on top of the pump casing and the other has two control levers, one at each side of the pump

casing. The Single lever type has an oil capacity of 2 gallons and the Two lever type has an oil capacity of 7 pints. There is no separate oil level plug fitted on either type of pump assembly, the correct oil level is when the oil is just below the filler plug orifice.

Maintenance

No provision is made for the lubrication of the pump drive assembly as this is lubricated by oil splashed up from the gearbox.

The hydraulic pump and lift assembly operates in its own independent filtered oil supply. It should only be necessary to change the oil when the pump is removed for dismantling. The oil capacity of the Single lever type hydraulic lift is 2 gallons (9.09 litres) and of the Two lever type hydraulic lift 7 pints (4 litres). Use an approved grade of winter engine oil (S.A.E. 20) for the lift of the Single lever type. For the Two lever type use oil supplied under Part No. M100502-C, available from your Fordson Dealer.

The oil filler plug is at the top of the pump casing at the rear. The oil drain plug for the Single lever type hydraulic lift is the lower bolt holding the rear cover in position and on the Two lever type hydraulic lift it is located on the left-hand side of the pump casing. There is no separate oil level plug fitted : the correct level of the oil is just below the filler plug orifice, or up to the level marked on the dip-stick on later type Two lever hydraulic lifts.

Should the lift have been out of use for some time, before it is used for normal lifting purposes, it should be allowed to operate light for a short period to ensure the oil has circulated to all the working parts.

Periodically lubricate the lift arm cross shafts by forcing a good quality soft grease through each of the two lubricators.

Operating Instructions

Hydraulic Power Lift Drive.—The hydraulic power lift drive is easily engaged by declutching and moving the control lever forwards when the drive will operate all the time the engine is running, and the clutch pedal is released. The drive is disengaged by pushing the lever rearwards.

Always disengage the power lift drive when the hydraulic lift is out of use to eliminate unnecessary wear.

Single Lever Type Hydraulic Lift.—The " up " and " down " positions of the control lever are marked on the casting. There is a neutral position to which the handle is automatically returned on completion of the lift.

(1) *To attach the implement*

Move the lift control lever to the " down " position when the lift arms will be lowered and the implement may then be attached.

(2) *To raise the implement*

After ensuring that the power lift drive is engaged, move the lift control lever smartly to the " up " position and release the lever. When the implement is fully raised, the control lever will automatically return to the neutral position.

If the lever is restrained from returning to the neutral position, the pump will operate unnecessarily, although a relief valve will come into operation to prevent excessive pressures being built up in the hydraulic system. As soon as the control lever is released it will return to the neutral position.

(3) *To lower the implement*

Move the lift control lever smartly over to the " down " position when the oil will be released from the hydraulic system and the implement will be lowered. At the completion of the drop the control lever will not return to the neutral position.

The rate at which the implement is lowered is fixed by an external screw adjustment adjacent to the control lever. On manufacture the rate of fall is set at 2 to 4 secs. To **increase** the rate, slacken off the locknut and **tighten up** the adjuster ; to **decrease** the rate, slacken off the locknut and **unscrew** the adjuster. Always tighten the locknut after adjusting the rate of lowering.

(4) *External Hydraulic Tapping*

An external high pressure oil feed, tapped $\frac{1}{2}$ in. B.S.P., is provided on the left-hand side of the pump body for actuating external jacks when required.

If the external high pressure tapping only is in use, the pump control lever should be moved to the " up " position when the lift arms will be raised before actuation of the external jacks begins and they will remain up during successive operations.

Two Lever Type Hydraulic Lift.—There are two control levers :—the right-hand control lever controls the lift arms and the left-hand control lever controls the supply of oil to external hydraulic jacks when these are to be used. The " up " and " down " positions of the lift control lever are **not** marked on the casting. There is **no** neutral position of the lift control lever. A stop is provided across the jack lever gate on later units to prevent this lever being accidentally moved into the operating position.

(1) *To attach the implement*

Pull the **right-hand** lift control lever **upwards** as far as possible when the lift arms will be lowered and the implement may then be attached.

(2) *To raise the implement*

After ensuring that the power lift drive is engaged. Push the **right-hand** lift control lever **down** as far as possible, and release the lever, when the implement will be raised.

(3) *To lower the implement*

Pull the **right-hand** lift control lever **upward** as far as possible when the oil will be released from the hydraulic system and the implement will be lowered. No external provision is made for the adjustment of the rate of lowering of the implement.

(4) *External Hydraulic Tapping*

An external high pressure oil feed, tapped $\frac{1}{2}$ in. B.S.P., is provided on the left-hand side of the pump body for the actuation of external jacks. If the high pressure tapping only is in use, the **left-hand** or shorter jack control lever should be pushed **downward** as far as possible and held there to extend the jacks and pulled upward as far as possible and held there to release the jacks.

As soon as the jacks are at the extended position the lever should be released, when it will be pulled back to the centre position by the centralizing spring. The pump will be loaded unnecessarily if the lever is held in the downward position after the jacks are extended.

Replace the stop across the jack lever gate on later units to prevent the jack lever being accidentally moved into its operating position.

Hydraulic Lift Linkage

Before attempting to attach any implement to the hydraulic lift linkage, it is essential to ensure that the linkage is properly assembled.

Check that the lift arms are fitted in their correct position. For rear mounted implements, the arms should make an angle of approximately 39° below the horizontal (the eye of the lift arm should be approximately $\frac{1}{8}$ in. (3 mm.) above the base of the pump). If this condition is not obtained, *i.e.*, the arms make an angle of 14° approximately

to the horizontal (the eye of the lift arm is approximately $4\frac{1}{2}$ ins. above the base of the pump), then the lift arms are fitted on the wrong side of the pump and should be transposed.

Where the lift arms are stamped with the letter " R " or " L," the one stamped " R " is fitted to the right-hand or furrow-side and the one stamped " L " is fitted to the left-hand or land-side of the pump.

Ensure that the lifting rods are assembled correctly for the type of work to be undertaken.

The lifting rods comprise a clevis end for connecting to the lower link and an inner sleeve, tapped at the upper end to accommodate a screw from the levelling box on the furrow side or from the lift arm on the land side.

The lower hole in the clevis is connected to the lower link for tractors with pneumatic tyres and the upper hole for steel-wheeled tractors (see Figs. 47 and 48).

The inner sleeve has two holes drilled in the lower end at right-angles and $1\frac{1}{4}$ in. (32 mm.) apart. The pin retaining the sleeve to the clevis is located through the hole at the rear of the clevis and the lower hole of the sleeve when ploughing and, in the case of the land-side lifting rod, the length of the rod should be adjusted so that the distance from the upper hole of the clevis to the knuckle eye at the lift arm end is 21 in. (53.3 cm.) as shown in Fig. 47 and the locknut tightened up in this position.

When using the plough or an implement with not more than one depth adjusting wheel, it is essential that lifting rods are fitted and that the locating pin is fitted in the lower hole (see Fig. 47) so that the lifting

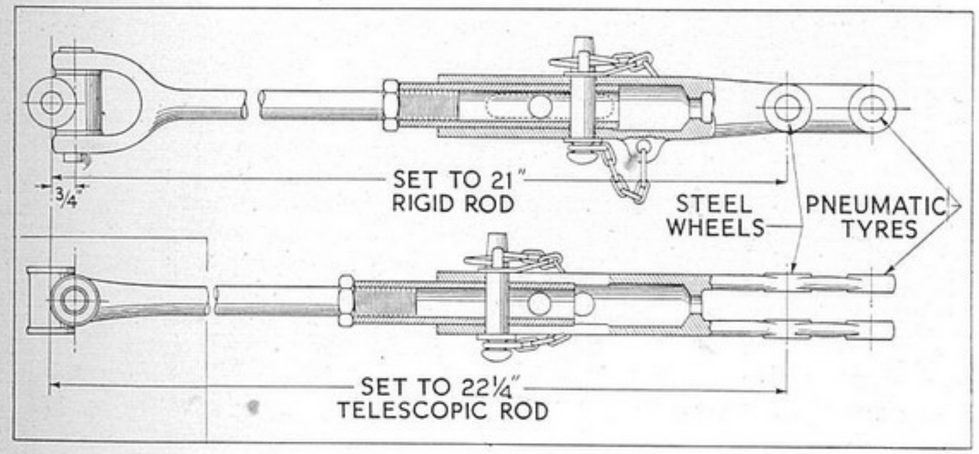


Figure 47
Lifting Rod

rod is rigid. If it is attempted to plough with the locating pin in the slot, the rod is then telescopic, and it will be impossible to control the depth of ploughing on the depth wheel. Levelling of the implement is then controlled by the levelling lever on the furrow-side lifting rod.

When using a toolbar, or implement with more than one depth adjusting wheel, the locating pin is fitted in the slot in the clevis and the upper hole in the inner sleeve, as shown in Fig. 47, so that the rod is telescopic and will not interfere with the depth control wheels on the implement.

When the lower links are attached to brackets welded on the drawbar frame the drawbar position should be adjusted according to the tractor wheel equipment as shown in Fig. 47, *i.e.*, in the lower hole for pneumatics or the second for steel wheels.

Where continuous ploughing at shallow depths is undertaken, it may be advisable to adjust the drawbar position one hole higher than that shown in Fig. 48, so that the load on the tractor is reduced and the lower links are brought into the line of draught.

The check chain position should then be adjusted according to the location of the drawbar as shown in Fig. 48. When the check chain has been fitted correctly, its length should be adjusted by rotating the turnbuckle, so that it is as slack as possible when the plough is at work and at the same time short enough to prevent the plough or lower links fouling the tractor wheels or the drawbar in the lifted position.

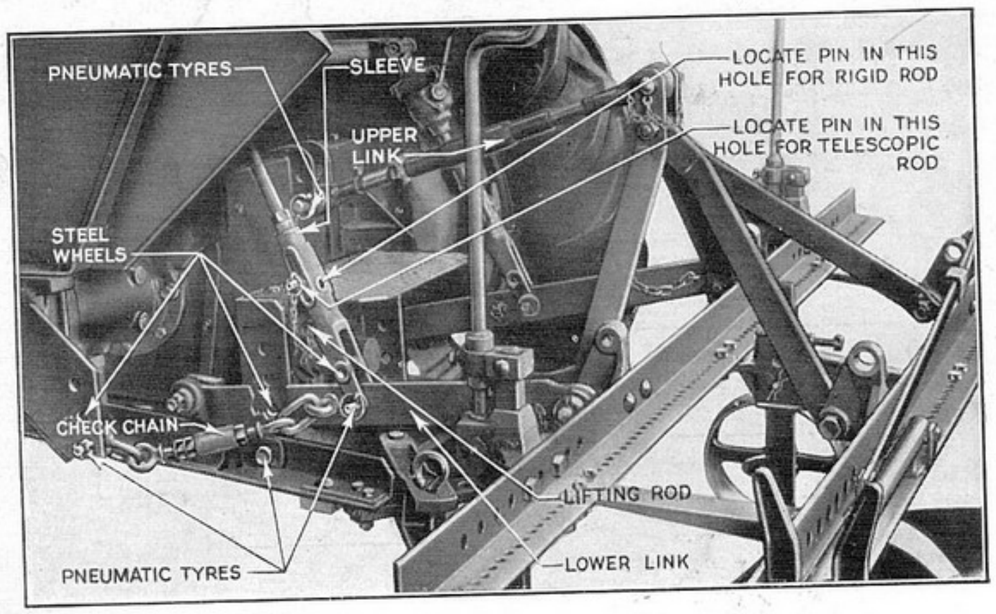


Figure 48
Hydraulic Lift Linkage

Belt Pulley Attachment

A pulley attachment is available as special equipment, obtainable, if not already fitted to the tractor, through your nearest authorised Fordson Tractor dealer. This attachment is driven from the bevel gear on the transmission drive shaft between the engine flywheel and the gearbox and runs at the same speed as the engine.

The pulley, which has a diameter of 9½ in. (24.13 cm.)—cast iron type pulley 9¾ in. (24.76 cm.)—rotates clockwise when looking at the outer face; the attachment can be supplied with or without the clutch lever illustrated in Fig. 49, the purpose of which is to put the drive in or out of gear.

To Fit the Attachment

Remove the plate on the right-hand side of the housing beneath the steering gear. Take care not to lose the retraction spring, with a distance piece, of the clutch balance lever which is secured to the adjacent bolt by a small bracket, when these six bolts are removed.

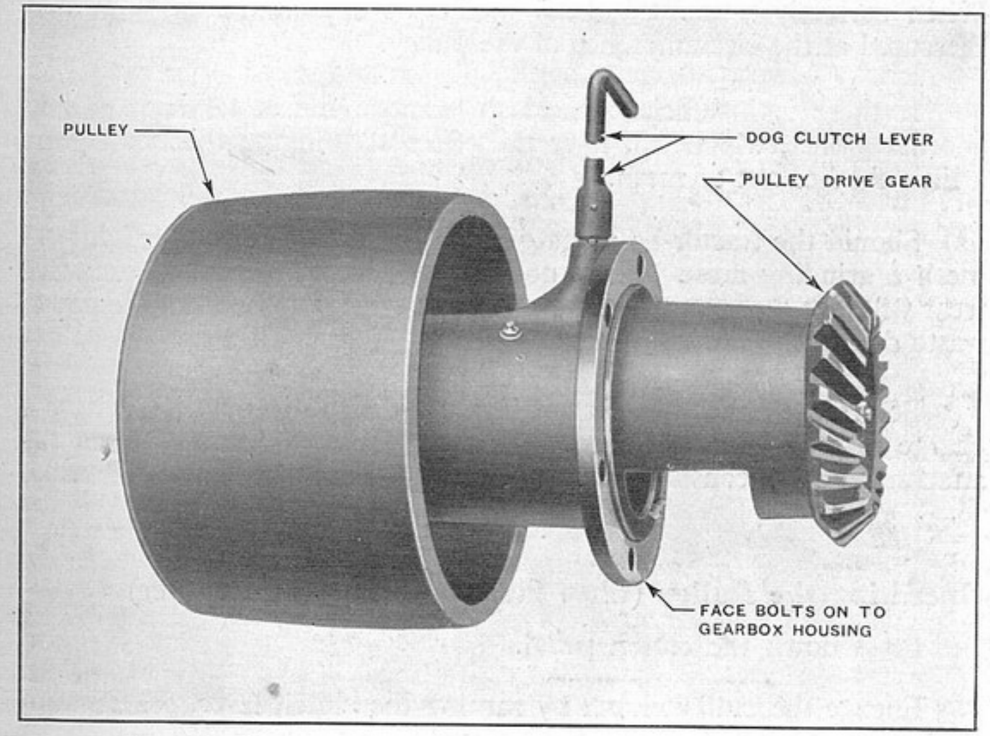


Figure 49
Belt Pulley Attachment

Ensure that the flange of the pulley attachment is clean and also the corresponding flange on the housing has the gasket undamaged. An imperfect seal at this point would permit the loss of engine oil whenever the engine is being operated.

Place the paper gaskets supplied with the attachment in position round the flange : they can most easily be kept in position with a little grease.

Install the pulley attachment with the bevel gear meshing with the bevel on the transmission shaft of the tractor. When the clutch lever is fitted to the pulley attachment this must be so arranged as to bring the handle adjacent to the hand-brake lever. Do not fit the attachment with the cut-away part of the housing uppermost or oil may work its way along the shaft in sufficient quantity to pass the oil retainer at the outer end.

Replace the bolts previously removed, the upper left-hand bolt must have the retraction spring and distance piece attached to it in the same manner as originally.

Engage the pulley attachment clutch and, holding the pulley between the hands, rock it backwards and forwards to test the backlash. When correctly assembled there should be approximately $\frac{1}{8}$ in. rock measured at the circumference of the pulley.

If there is insufficient backlash, remove the attachment and fit another gasket, which will have the effect of bringing the bevel gears a little further out of mesh.

Should the tractor be operated with the pulley gears too tightly in mesh a grinding noise will be noticed and, if not remedied, excessive wear will take place on the gears and ball bearings apart from the power waste due to the misadjustment.

Before the attachment is put into use the lubricator should have a charge of grease injected through it from the grease gun. When the attachment is in constant use the bearings should be lubricated daily.

Operating the Pulley (when fitted with hand clutch lever)

Press down the clutch pedal.

Engage the pulley clutch by turning the clutch lever, see Fig. 49, clockwise. If the drive cannot be meshed readily, allow the clutch pedal to rise sufficiently for the relative positioning of the dog clutches to alter, when the lever can be turned the full amount, which is $\frac{1}{2}$ turn.

Let the clutch pedal return slowly when the drive will be gradually taken up.

When the pulley is in continuous use, it should be lubricated daily with the grease gun. This applies to pulley attachments with or without the clutch lever.

The surface of the pulley on which the belt operates is curved, the highest part being at the centre : this assists in ensuring that the belt runs truly in the centre since it tends to run to the highest part of the rim.

It is important to line up the tractor accurately so that the belt runs squarely with both the driving and driven pulleys, seating for its full width on both pulley surfaces. No oil or grease must be permitted to reach the working surfaces of the belt or pulleys or slip may be caused and an attempt to tension the belt to prevent such slipping will impose additional unnecessary loading on the belt as well as the pulley bearings.

Take care not to permit the edge of the belt to come in contact with any part of the tractor other than the pulley such as the radiator side member or the top of the front axle beam.

Two types of pulley may be fitted, the compressed fabric type, having a diameter of $9\frac{1}{2}$ ins. (24.13 cm.), or the cast iron type which has a thinner rim, illustrated in Fig. 49, with an outside diameter of $9\frac{3}{4}$ ins. (24.76 cm.).

Rear Wheels and Extension Rims

For Row Crop tractors having steel wheels, these are 4½ inches (11.43 cm.) wide, but an extension rim, also having a width of 4½ inches (11.43 cm.) may be bolted on to it, so giving an effective width of 9 ins. (22.86 cm.). Keep the nuts and bolts, which hold them together, tight at all times and these bolts should be checked periodically, particularly just after the rims have been installed.

A set of extension rims consists of two rims with all parts necessary for installation.

Price can be obtained from your nearest Fordson dealer.

Eighteen spade lugs in two rows of nine are fitted to each rear steel wheel of Row Crop tractors, these being equally spaced around the periphery of the wheel rim to which they are secured by nuts and bolts so that the lugs are all towards the centre of the tread.

In some cases the Row Crop rear wheels were drilled to take 26 spade lugs in two rows of 13 each: on such wheels the lugs must be bolted to the wheel so that all face away from the centre of the tread.

The extension rims in all cases are drilled to take 13 spade lugs, equally spaced round the periphery of the rim. Each flange is drilled and has ten holes on one side and five on the other to enable road bands to be used to avoid damaging the surface when the tractor is taken on the road.

When fitting extension rims, that side having **ten holes in the flange** must be bolted to the rear wheel, whilst the spade lugs of the extension rim are to be offset outwards. Always bolt the extension rim to the rear wheel so that the spokes are between the wheel and rim.

If a rear wheel having 26 spade lugs is used with an extension rim, under certain circumstances it may be advisable to remove the middle row of 13 spade lugs. Should the extension rim, however, be removed at any time the 13 lugs must be correctly refitted to the wheel to obviate excessive vibration.

Any adhering, caked mud should be removed before bolting on the extension rim otherwise there will be difficulty in obtaining good metallic contact and slackness may develop in use.

The Electrical System

The tractor may be fitted with an electrical system as extra equipment comprising some or all the following :—

Battery.	Lighting switch.	Generator.
Lamps.	Horn and switch.	Ammeter.
	Starter motor and switch.	Cut-out and regulator unit.

THE BATTERY

This is a twelve-volt unit of 57 ampere-hour capacity. It is placed at the rear end of the fuel tank on a suitable mounting bracket.

CARE OF THE BATTERY

Every two weeks, check the electrolyte in the battery to see that it is at the proper level, i.e., ⅜ in. to ½ in. (9.5 mm. to 12.7 mm.) above the top of the plates. If below this point, add distilled water until the electrolyte reaches the proper level. Water for battery use should be kept in clean, covered vessels of glass, china, rubber or lead. In cold weather, add water only immediately before running the engine, so that the charging will mix the water and electrolyte and prevent freezing.

If the battery is allowed to stand in frosty weather in an unduly discharged condition there is the possibility that it may freeze, so causing damage to the container. Take care, therefore, always to keep the battery as fully charged as possible (*i.e.*, 1.270 to 1.290) since then it is unlikely to be affected by frost. A battery which is ¾ charged (sp. gr. approx. 1.245) will not freeze until a temperature of nearly — 50°F. has been reached, whilst when fully discharged it will freeze at 16°F. (16° below freezing point).

The battery should not be allowed to become unduly discharged, or to stand in a run-down condition as this will materially affect its life.

Loose or corroded battery connections increase the line resistance, and may cause the voltage of the generator to rise, possibly leading to bulb failure should the lamps be switched on at the time.

Keep the battery filling plugs and connections tight, and the top of the battery clean. Wiping the battery with a rag moistened with ammonia will counteract the effect of any of the solution which may be on the outside of the battery. Coating of a good grade of petroleum jelly will protect the terminals from corrosion. It is of vital importance that the battery is firmly secured.

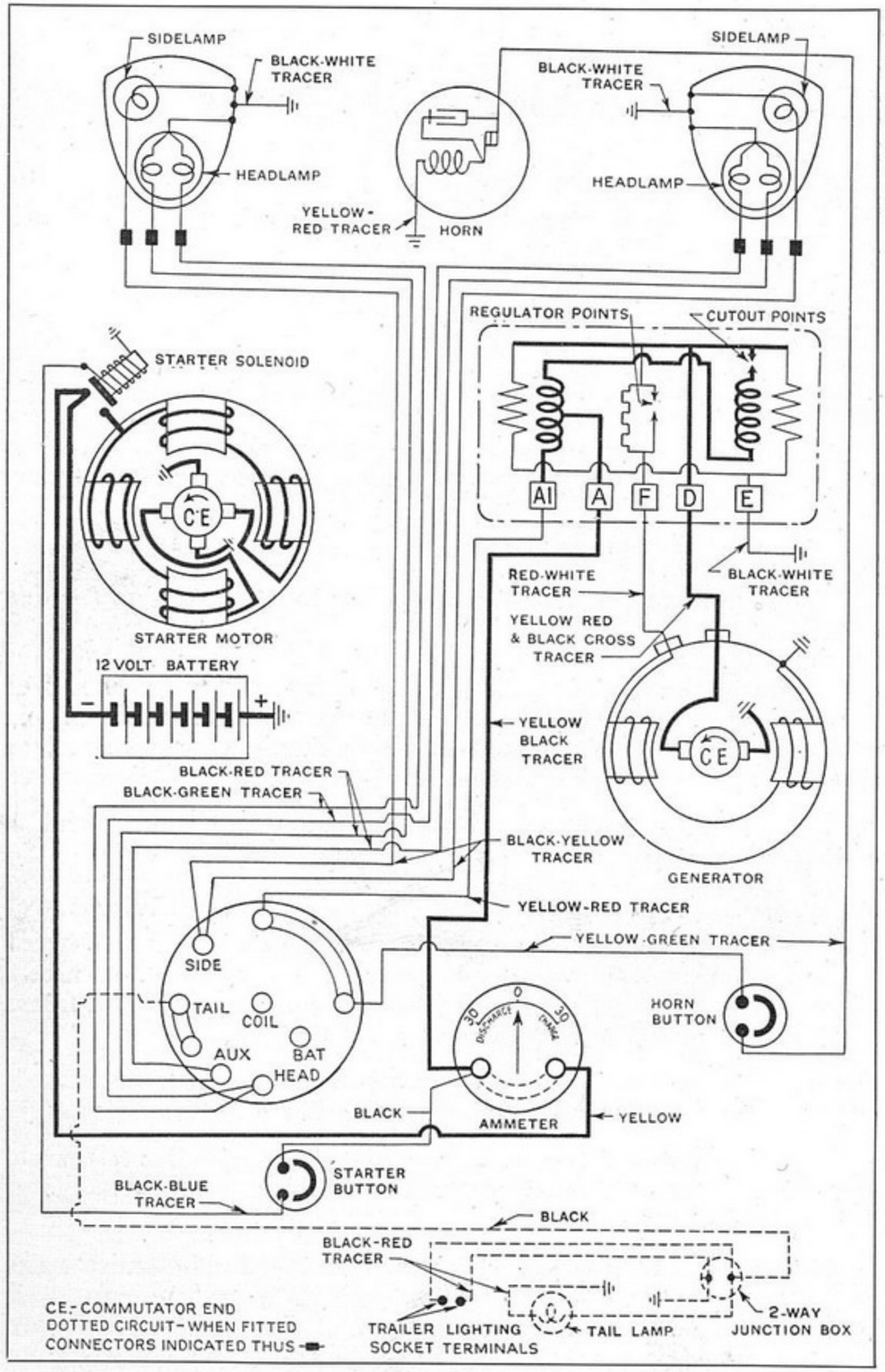


Figure 50
Wiring Diagram

When repairs are necessary, or if the tractor is to be laid up for the winter, take the battery to an authorised Fordson dealer for proper attention and storage. Do not entrust your battery to inexperienced or unskilled hands.

To remove the battery from the tractor, take off the lid, remove terminal leads, undo the securing nuts, and lift off the battery. When replacing the battery, be sure to install it with the POSITIVE TERMINAL EARTHED.

LIGHTING SWITCH

This is located on the left-hand side of the dash panel on the steering column. It has four positions :—

Lever straight down	" Off."
To right	" Side lights."
To left	" Headlamps normal."
Second position to left	" Headlamps dipped."

and is so arranged that the generator charges the battery in any position of the switch, but the charging rate is automatically controlled by the regulator.

A trailer connection for the rear light is provided on the Industrial Tractor. The connection is to the right of the tail lamp on the rear axle : a plug is inserted in it to keep out dust, etc., and is secured by a small chain to the bracket.

GENERATOR

This is mounted on a bracket to the right of the cylinder head at the front and is driven from the crankshaft by the fan belt.

The generator charging rate is adjusted automatically by the regulator to provide sufficient electric current to keep the battery fully charged.

ATTENTION NEEDED BY THE GENERATOR

No lubricator is provided at the pulley bearing as it is packed at assembly and only the lubricator at the commutator end will require attention.

At intervals of approximately six months the felt pad in this lubricator should be moistened with a good grade of petroleum jelly. See Fig. 21.

Every six months, clean the commutator by holding a strip of very fine glass paper against it (not emery cloth) with a small piece of wood whilst the engine is idling. Then blow out any carbon dust

that may have accumulated and examine the brushes for excessive wear. Replace any that have worn to such an extent that there is a possibility of the brush lead fastenings fouling the commutator, or at which excessive sparking occurs. See that all connections are clean and tight.

THE CUT-OUT AND VOLTAGE REGULATOR

The cut-out and regulator is a self-contained unit which automatically connects the generator to the battery when the output has risen sufficiently and also prevents the battery discharging itself when for any reason the charging rate falls below a minimum value as, for instance, when the engine is idling or stopped.

There is also provision for automatic regulation of the current supplied by the generator so that if the battery is considerably discharged the charging rate increases. When the battery is fully charged the charging rate will decrease and so there is no provision for any external adjustment on the generator or regulator unit.

HEADLAMPS

The headlamps are properly aligned and focussed when the tractor is delivered and should not be interfered with in the ordinary way. Should the headlamps get out of focus or alignment they may be quite easily corrected.

TO FOCUS HEADLAMPS

Loosen the headlamp rim clamp screw and push it downwards free of the clamp. The rim, headlamp glass and reflector may then be removed as a unit. Loosen the clamp behind the headlamp, when the bulb and its carrier may be moved nearer to or away from the reflector as necessary. Tighten the clamp when the bulb is correctly focussed and, when refitting the headlamp rim, insert the tongue in the corresponding slot at the top of the headlamp body first.

The headlamp rim may then be pressed into position so that the slotted clamp is accurately lined up with the clamp screw which must then be moved into position and tightened up.

TO ALIGN THE HEADLAMPS

Loosen the nut holding the headlamp to its bracket and move the lamp as desired.

REPLACING HEADLIGHT OR SIDELIGHT BULBS

Remove the headlamp rim and reflector unit as described in " To Focus Headlamps."

The sidelight bulb may be removed by carefully grasping the holder, which is retained by friction grip in the reflector, and pulling it out of its location. The bulb is secured in a bayonet type holder and may be replaced as required. Do not pull the holder out by dragging on the sidelight cable.

To remove the headlamp bulb, turn its holder anti-clockwise sufficiently to free the retaining lugs when it may be drawn out of its mounting in the reflector. The bulb is held in a bayonet type holder.

When replacing burnt-out bulbs be sure that you get genuine Ford bulbs, as satisfactory results cannot be obtained from the many inferior bulbs on the market. Genuine Ford bulbs have the name " FORD " marked on the base. When replacing headlamp bulbs, make sure that the word " top," which will be found stamped on the base, is uppermost as otherwise it will not be possible to focus the lamps properly.

Note that the holder lugs are of unequal width, so assuring its correct replacement in the reflector to bring the TOP marking of the bulb uppermost.

REPLACING THE HEADLAMP GLASS

Free the reflector by releasing and removing the six spring clips round the edge of the rim : the glass front may then be detached when the reflector is separated from the rim.

When fitting the new glass to the reflector, with the cork gasket between, ensure the indented part of the glass and reflector are correctly registered.

Install the other cork gasket on the outside shoulder of the glass and then fit the rim so the indentation of the reflector is adjacent to the internal rim tongue which locates it.

Secure the reflector and glass in place in the rim with the six clips.

THE HORN

This is located just below the right-hand headlamp and is operated by pressing the button on the dash. A high frequency type horn is used.

TO ADJUST THE NOTE OF THE HORN

Press the horn button on the dash.

A countersunk screw is fitted adjacent to the mounting bracket at the rear of the horn. Turn this screw to adjust the note of the horn.

Storing the Tractor

If the tractor is to be stored for any length of time :—

Drain the dirty engine oil, clean the crankcase cover and screen, and refill with fresh oil.

Run the engine for a minute or two to allow the clean oil to cover all parts of the engine.

Drain off all water from radiator and flush out.

Drain off all petrol and vapourizing oil from fuel tanks.

Grease all points fitted with lubricator fittings.

Cover the tractor and store in a dry place.

Every month, the sparking plugs should be removed, a spoonful of engine oil poured into the cylinders and the engine cranked a few times.

Remove battery and send it to an authorised Fordson dealer for proper attention and storage, if fitted.

Jack up tractor to take the weight if rubber tyres are fitted.

If the tractor is to be stored for a long time it is advisable to remove rubber tyres, if fitted, and wrap them in an airtight package.

Repair Section

GENERAL ADVICE ON REPAIRS

Full instructions for dismantling are given ; to reassemble it is only necessary to reverse the order of operations, paying attention to any points which may be specially mentioned.

Before dismantling any part, examine its general arrangement, details of fitting and, if necessary, mark adjacent parts, so that when the part is reassembled, it is replaced exactly as it was in the first place.

If care is taken to keep all nuts and bolts tight by periodically checking the various parts likely to be affected by vibration, etc., any need for adjustment will be minimised.

Should any small adjustment be required, this should be attended to without delay, otherwise it may lead to expensive repairs as a result of such neglect.

When electrical equipment is fitted take care there is no possibility of a short circuit or other electrical derangement occurring. Preferably, disconnect the battery cables to isolate the system. The generator must not be driven by the engine unless the battery is correctly connected up, i.e., **positive earthed.**

Always make sure **all** nuts, bolts, screws, etc., are undone before attempting to remove any part.

Always keep the valves and push rods in the correct order, so that they may be replaced in their correct position.

When reassembling, see that **all** locking devices are correctly installed, as serious damage may occur if this is neglected :—

Always wire the main bearing screwheads.

Always wire the transmission plate screwheads.

Always put cotter pins in the big end bearing nuts, and any other places where castellated nuts are fitted.

Always open both legs of cotter pins.

Always replace spring washers.

Each connecting rod and its big end cap is numbered. Always keep them together and when reassembling fit the cap to the rod with the numbers together and see that the slot in the dipper is toward the valve side of the engine.

ALWAYS KEEP DISMANTLED PARTS FREE FROM GRIT AND DIRT, AND CLEAN THEM THOROUGHLY BEFORE REPLACING.

Gaskets are fitted between many parts which do not move in relation to each other—always see that they are in good condition and correctly replaced.

Always oil bearing surfaces during reassembly. This includes such points as valve stems, piston pins, pistons, main and big end bearings, ball and roller bearings, gear shaft bearings, camshaft bearings, clutch and transmission brake plate surfaces, etc.

Always remove sharp edges, or burrs from ground bearing surfaces with an oil stone.

Before starting the engine after carrying out any repair, always see that the radiator is full, that the oil levels in the engine, air cleaner, gearbox and rear axle are correct, and that any part which has been dismantled is properly greased through the lubricator fittings, where provided.

It is strongly advised that the operations described in the repair section marked with an asterisk (*) in this book be carried out, should they become necessary, by an authorised Fordson dealer. The fact that he has been officially appointed is proof that he has ample stocks of spare parts, as well as mechanics who are familiar with the tractor, and may be relied upon to carry out all repairs and adjustments quickly and economically.

Engine Trouble Chart

A—ENGINE FAILS TO START

1. Fuel System.

Fuel supply turned off.
Trying to start on vapourizing oil.
Mixture too lean, possibly due to air leaks at manifold drain valves.
Mixture too rich.
Sediment bulb choked or blocked with ice.
Fuel pipe choked.
Water or dirt in vapourizer or jets.
Jets choked.

2. Ignition System.

Ignition switched off.
Short circuit in earth clip.
Incorrect contact breaker point gap.
Plug point gap incorrect.
Water on high tension leads or plug insulators.
Water or moisture in magneto.
Contact breaker point stuck open.
Impulse coupling failed.
Magneto failed.

B—ENGINE LACKS POWER OR RUNS IRREGULARLY

1. Fuel System.

Mixture too lean.
Mixture too rich.
Choked sediment bulb.
Partially choked fuel pipe.
Partially choked jets.
Punctured float, or fuel regulator valve stuck open causing flooding and producing too rich a mixture.
Air leak in intake manifold.
Manifold drain valves leaking.
Excessive carbon on vapourizer plate.

2. Ignition System.

Plugs dirty.
Plug point gap incorrect.
Magneto contact breaker points dirty or incorrectly adjusted.
Sparking plug gaskets leaking.
Incorrect type of plugs fitted.
Advance or retard not working.
Carbon brush broken or missing in magneto.
Oil in interior of magneto.

3. Mechanical Faults.

Valve spring weak or broken.
Cylinder head gasket leaking.
Valve stuck open.
Valve badly burnt.
Valve clearance incorrect.
Broken piston rings.
Badly worn piston rings and/or cylinder bores.
Badly worn valve stems and/or guides.

C—ENGINE STOPS SUDDENLY

1. Fuel System.

Fuel tank empty.
Water in fuel.
Dirt in vapourizer or fuel pipe.
Mixture too lean.
Overheated owing to lack of oil and water.

2. Ignition System.

Contact breaker points stuck open.
Magneto shorted or earthed.
Magneto failed.

D—ENGINE OVERHEATS

Incorrect mixture.
Ignition retarded too far.
Dirty or incorrect sparking plugs.
Racing engine.
Lack of water in radiator.
Insufficient or poor grade of oil.
Clogged radiator tubes.
Fan belt slipping or broken.
Excessive carbon on pistons and cylinder head.
Valve not seating properly.
Radiator blind incorrectly adjusted.

Knocks

Should a knock develop in the engine or transmission, the cause should be investigated and a remedy effected, as otherwise serious damage may occur. As a general rule, only an experienced mechanic can locate the exact cause of any particular knock, and in consequence it is advisable to consult an authorised Fordson dealer if one becomes apparent.

The most usual knocks are given below, with an indication of how to diagnose and cure them.

Ignition Knock.—This caused by running with the ignition lever too far advanced for the particular conditions under which the tractor is working. The cure is to retard the ignition just enough to stop the knock.

It sounds very like a carbon knock but it may be distinguished from it by retarding the ignition when an ignition knock will vanish though a carbon knock will persist.

Knock due to using the wrong type of plug.—This is easily avoided by obtaining replacements only from an authorised Fordson dealer.

Knock due to using wrong type of fuel.—A sound, resembling a carbon knock, may be noticed and this may still persist even when the ignition is retarded. It may be found also that there is some tendency for the engine to overheat and in such cases the quality of the fuel should be checked.

The characteristics of certain " lamp " oils render them unsuitable for use in tractors and operators should have their attention drawn to the necessity for using only good quality vapourizing oils.

Carbon Knock.—This only occurs after the tractor has been in service for a considerable time. It is noticeable when the engine is hot and pulling hard. Running with the ignition retarded tends to cause overheating and may cause the valves to burn. Always run with the ignition as far advanced as possible.

The cure is to decarbonise the engine (see page 116).

Piston Slap.—This is due to wear in the pistons and cylinders. It is most noticeable when the engine is cold, and diminishes as the engine warms up.

It is usually due to the tractor air cleaner allowing uncleaned air to enter, due to shortage of oil or excess of dirt in the sediment trap, or with unsuitable or inferior oil in the engine. It also occurs after prolonged service, owing to normal wear. The cure is to have the cylinders rebored and oversize pistons fitted, but this is an operation which can only be satisfactorily carried out by an authorised Fordson dealer.

Small End Knock.—This is due to undue play between the piston, piston pin and connecting rod small end bearing. It is most noticeable when the throttle is suddenly closed and the engine is slowing down, when it appears as a rattle in the engine. The cure is to replace or correct the faulty part or parts (see page 124).

Big End Knock.—This occurs when the babbitt metal in the big end bearings has worn so that there is play between the bearing and crankpin. It is noticeable when the engine is pulling hard. It may be cured by adjusting the big end (see page 122).

Main Bearing Knock.—Wear in the babbitt metal of the main bearings will in time give rise to a knock which will be heard as a rumble if the engine is speeded up and then suddenly slowed down. It may be cured by adjusting the bearing (see page 123).

Transmission Knocks.—These are due to a variety of causes, such as end play in the shafts, chipped gear teeth, worn bushes, damaged bearings, etc. Provided, however, that the transmission is kept full of oil of the correct grade, and no dirt is allowed to work into it, it is unlikely that any trouble will arise in this connection.

Repairs to the Engine

*TO REMOVE THE FUEL TANK

Turn off the fuel at the control valve.

Disconnect the sediment bulb to vapourizer fuel pipe at the sediment bulb.

When the generator is fitted, disconnect the cables which pass through the conduit at the bottom of the tank. See the " Wiring Diagram," Fig. 50, also page 138 for cable connections.

Undo the nuts on the fabric lined metal straps at each end of the tank (four in all) and the tank may be lifted off.

It will help if the primary air cleaner pipe is removed as this will allow the tank to be drawn out sideways. Loosen the clamp bolt sufficiently to permit the pipe to be withdrawn, but if the clamp bolt of the square type air cleaner is taken out do not lose the two clamps which are located in the pipe housing.

It is not necessary to empty the tank, though this may be done to enable it to be lifted more easily.

* See pages 109 and 110.

*TO REMOVE THE CYLINDER HEAD

Drain all the water from the cooling system by opening the drain cock in front of the engine under the radiator.

Remove the fuel tank. See note *re* cables above.

Disconnect the sparking plug leads and take out the sparking plugs.

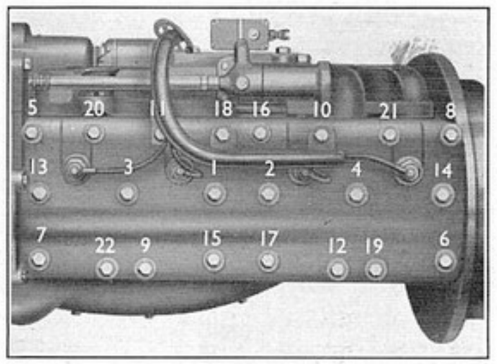


Figure 51
Tightening Cylinder Head Nuts

Undo the water pump to cylinder head screws (4).

When the generator is fitted the two right-hand bolts of the water pump housing hold the generator front bracket, whilst the rear bracket is secured to the cylinder head.

When the battery is fitted, this should be disconnected.

Undo the cylinder head to cylinder block screws (22).

Lift off cylinder head.

When replacing the head, see that no water or foreign matter is in the cylinder head screw holes in the top of the cylinder block, as if any is present, it will prevent the screw being tightened down properly.

New copper asbestos gaskets of the correct type should be fitted between the cylinder head and cylinder block, and between the cylinder head and water pump. Make sure that they, the support for the ignition control rod, the brackets for the high tension lead conduit and the generator bracket when fitted are all properly replaced. The cylinder head gasket should be fitted with the name " Fordson " uppermost.

When tightening down the cylinder head screws, tighten the screw in the centre of the head first, then one each side front and rear. Tighten up a little at a time, working outwards. The reason for doing them up in this order is to make quite sure that the cylinder head sits absolutely square on the cylinder block. See Fig. 51.

The cylinder head screws should be tightened again after the engine has been run for some time and is still hot. Always use the spanner provided in the tool kit as this is the correct size and will not damage the heads of the screws.

* See pages 109 and 110.

*TO DECARBONISE THE ENGINE

Remove the cylinder head.

Place some grease around the tops of cylinders 1 and 4, then rotate the engine until these pistons are at top dead centre. It will be noticed that the grease fills the small gap between the piston and cylinder walls, thus preventing carbon working its way into the piston rings.

Cover the valve ports and fill the remaining bores with clean rag as a precaution against carbon chips. Remove the carbon by scraping inwards from the edges of the piston towards the centre, taking care not to score the piston crown in the process.

When both pistons have been cleaned, bring the other two pistons to the top of their travel, similarly applying grease around the bores, at the top of the cylinders : wipe all traces of carbon from the cylinder bores of the two pistons which are now at the bottom centre position and protect them from any further chips of carbon by inserting clean rag as previously.

Remove any carbon from the valve ports and valves : if there is any possibility of leakage past the valves or seats, these must be reground, see " To Grind the Valves."

When decarbonising the cylinder head, remove the sparking plugs, otherwise particles of carbon may lodge in the body and cause electrical leakage. It is good practice to clean the sparking plugs and to test them under pressure after the engine has been decarbonised and the valves ground in.

Scrape all the carbon from the cylinder block, cylinder head, piston tops and valve heads with a screwdriver or similar tool. Take care that no carbon is allowed to fall down the valve stems, or to lodge between the valves and their seats.

Wipe all the carbon off carefully, particularly round the valves, and replace the cylinder head.

It is advisable to remove and examine the valves when decarbonising.

*TO REMOVE MANIFOLD

Disconnect control rods.

Disconnect air pipe to carburettor or vapourizer at air cleaner

Disconnect fuel pipe at vapourizer or carburettor.

Disconnect exhaust pipe.

* See pages 109 and 110.

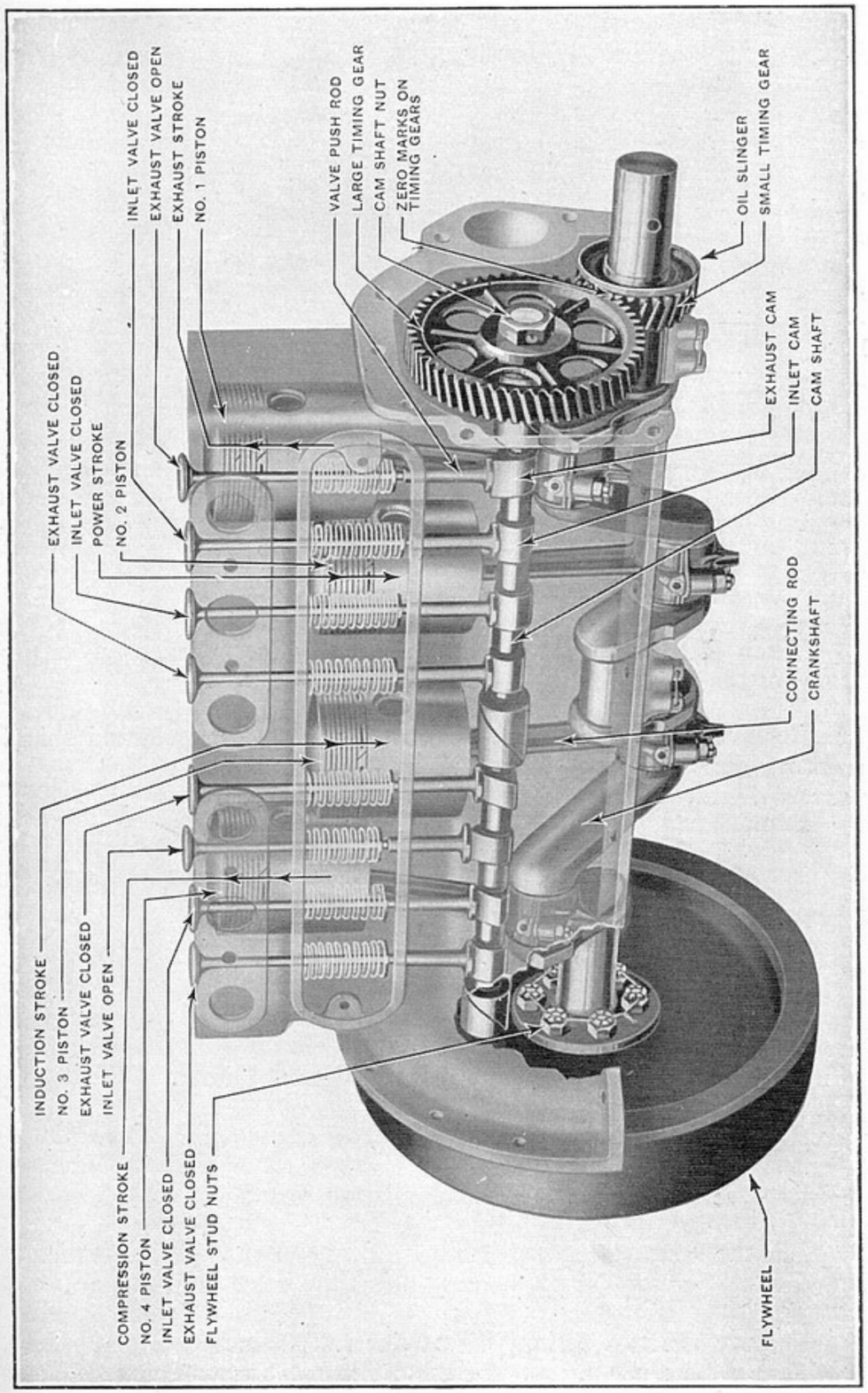


Figure 52
Cylinder Assembly

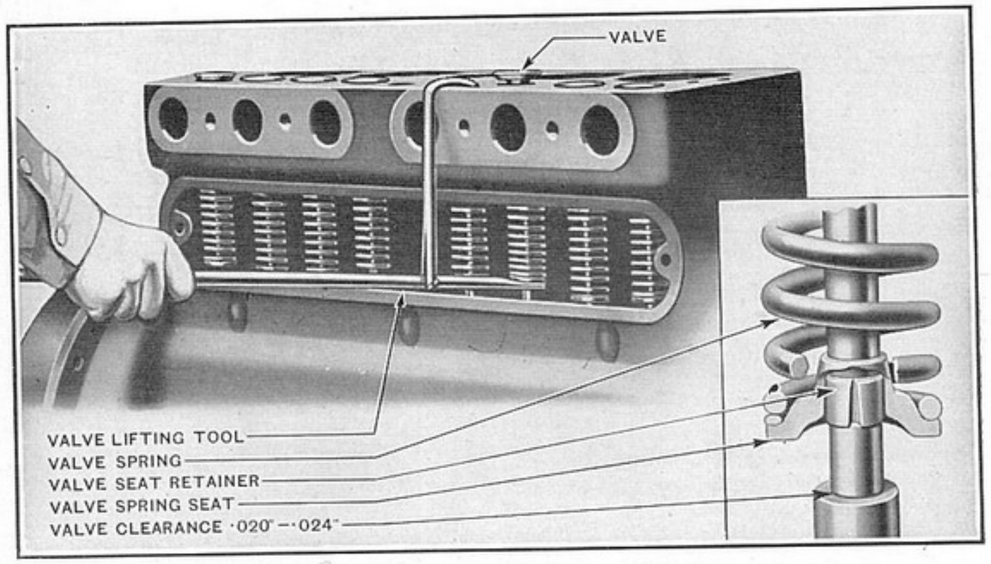


Figure 53
Lifting the Valve Spring

When fitted, disconnect the windscreen wiper connection at the centre of the manifold.

Remove 2 outer manifold securing nuts, remove manifold shield and then undo the two inner manifold securing nuts.

Remove manifold.

*TO REMOVE THE VALVES

Disconnect control rods.

Remove cylinder head (see page 115).

Disconnect the exhaust pipe at the exhaust manifold.

Remove the manifold and vapourizer or carburettor.

Remove valve cover, held by one bolt at each end.

Lift the valve spring and spring seat on one of the valves which is closed as shown in Fig. 53, holding down the valve onto its seat.

Remove the two spring seat retainers. As these are very small, care should be taken to prevent them getting lost, or being dropped into the engine.

* See pages 109 and 110.

The valve may now be drawn out from the top and the spring removed. If the valve which is to be removed is opened, it is advisable to rotate the crankshaft till the valve closes.

During reassembly, the spring seat retainers will remain in place better, and so facilitate their reinstallation, if a little grease is put on them. The flat end of the retainer must be downwards.

*TO REMOVE VALVE GUIDES

This can only be done when the cylinder head is removed.

Remove valve and spring.

The valve guide may now be dipped downward into the valve chamber. If it does not come out freely, it may be tapped gently from the top with a piece of soft wood.

*REPLACING VALVES AND PUSH RODS, VALVE GUIDES, VALVE SPRINGS

A valve should be replaced by a new one if :—

The head is so badly worn or pitted that it will not make an efficient gastight seal.

If a ridge is present on the stem diameter at the end of the portion worn by the movement of the valve through its guide.

If the base of the stem has worn to such an extent that it is impossible to obtain the correct clearance between the valve and a new push rod, due to excessive clearance.

A new valve should always be ground in, though if the seat is in good condition very little grinding should be needed.

A push rod should be replaced by a new one if it is worn to such an extent that it is impossible to obtain the correct clearance between it and a new valve, i.e., excessive clearance.

A valve guide should be replaced by a new one if it is worn to such an extent that the stem of a new valve fits " sloppily " in it.

A valve spring should be replaced by a new one if it is broken, or so weak that when compressed to a length of $2\frac{7}{8}$ ins. (73 mm.) it exerts a pressure of less than 30 lbs. (13.6 kg.).

* See pages 109 and 110.

*TO GRIND THE VALVES

Clean the valve and seat.

Remove valve and inspect.

If the valve or valve seat is pitted, apply a little coarse valve grinding paste to the valve seat. Replace the valve. See that the valve stem is not touching the push rod, and rotate the valve backwards and forwards (about a quarter of a turn) a few times by means of a valve grinding tool (see Fig. 54). Then lift the valve just clear of its seat and turn it through a quarter of a turn, and rotate as before. Continue until the pits are ground almost out.

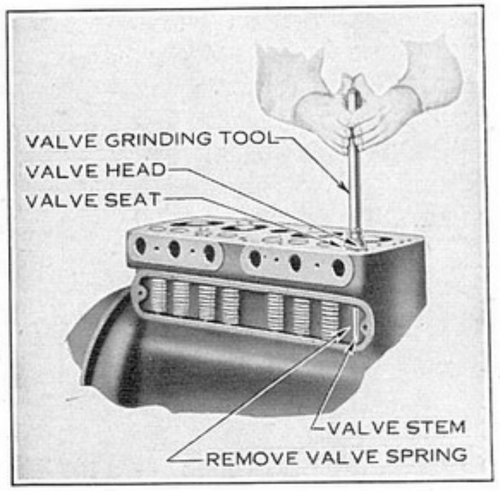


Figure 54
Grinding the Valves

Wipe off the coarse paste and apply a little fine grinding paste and continue to grind as above till the valve is seating properly all round.

This is when the greyish grinding marks form a thin continuous line round the valve and seat.

If the valve or seat is not badly pitted, use a fine grinding compound.

When the valve is seating satisfactorily, remove the valve, wash thoroughly in paraffin, clean the valve seat and make absolutely sure that none of the abrasive compound remains in the valve guides, valve ports or cylinders. This is best assured by putting only the minimum amount of paste on the valve seat.

*TO REFACE THE VALVE SEATS

Should the valve seat be so badly pitted that coarse grinding paste will not remove the pits, it will be necessary to cut a fresh seat with a valve reseating tool.

To do this remove the valve.

Push the guide rod of the reseating tool through the valve guide.

Lower the cutter gently on to the valve seat, and rotate it in a clockwise direction, maintaining a steady downward pressure. Remove only sufficient metal to eliminate the pits.

Clean the valve seat.

Grind in the valve.

* See pages 109 and 110.

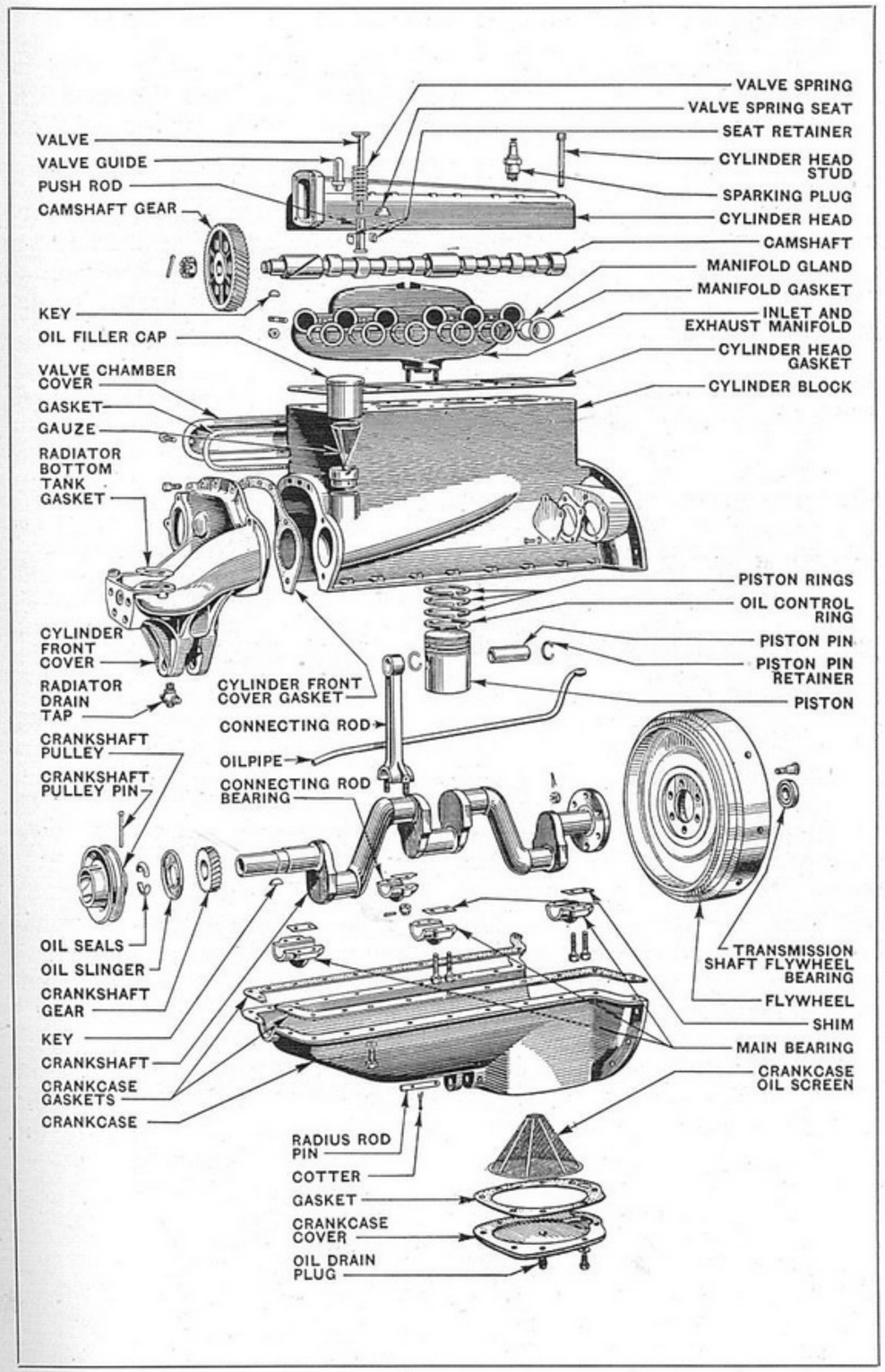


Figure 55
Exploded View of the Engine

*TO ADJUST THE VALVE CLEARANCE

The clearance between the valve stem and the push rod may be checked by means of standard feeler gauges and when the push rod is on the heel of the cam it should be between .020 in. and .024 in. (.508 mm. and .61 mm.).

If it is less than .020 in. (.508 mm.) the stem of the valve may be filed to give the correct clearance. Great care must be taken to see that the end is filed absolutely square. It is preferable, however, to have the work carried out by a Fordson dealer, who has proper equipment for grinding the valve to the correct length.

If the clearance is more than .024 in. (.61 mm.) either the valve, or rod, or both, should be replaced, and the clearance checked.

*TO REMOVE THE CRANKCASE

Drain oil from engine by removing crankcase drain plug.

Withdraw radius rod retaining pin at rear end of radius rods.

Undo radius rod to front axle nuts and withdraw bolts (2).

Remove radius rod.

Undo the crankcase to gearbox housing bolts and nuts (8).

Undo the crankcase to cylinder block screws (22).

It is advisable to support the crankcase before undoing the final screws.

When replacing the crankcase, it is advisable to fit new crankcase to cylinder block gaskets and to see that the crankcase to gearbox gasket and the packing gland surrounding the crankshaft at the front of the crankcase are in good condition and correctly replaced.

Put in two screws at diagonally opposite corners, then two in the middle of the sides and then the others. Note that the four holes having larger diameter heads and threads are fitted at the front of the sump. Make sure the crankcase is up tight and absolutely square.

*TO ADJUST BIG END BEARINGS

Remove crankcase.

Remove cotter pins and undo the nuts (2) holding on the cap of No. 1 big end. Between the cap and the connecting rod will be found a number of shims of .002 in. (.051 mm.) thickness.

* See pages 109 and 110.

The crank pin should be measured with a micrometer gauge to be sure that is has not worn oval, as it is impossible to obtain a satisfactory bearing with an oval crank pin.

Take off shims of equal thickness from each side—.0025 in. (.063 mm.) each side should be tried first.

Replace the cap, making sure that it is on the correct way round (i.e., with the slot in the oil dipper on the cap facing towards the valve side of the engine and the punch marks on the connecting rod and the cap together) and tighten the nuts fully.

Test tightness of bearing by turning crankshaft with the starting handle. The correct adjustment is when the " drag " of the bearing can just be felt. If tapped lightly with a hammer, the bearing should move from side to side of the crank pin. It may be necessary to take the cap off several times and remove or add shims as required.

When this bearing is correctly adjusted, loosen the nuts and proceed to adjust each of the others in the same way.

When all have been done satisfactorily, take off each cap in turn, oil the bearing surface, replace the caps, tighten the nuts up, insert the cotter pins and see that the bearings are not so tight that it is impossible to turn the crankshaft when they are all tightened.

Replace crankcase and radius rod. Refill with new oil of the correct grade.

After adjusting the big end bearings it is advisable to run the engine light for some little time, keeping it well supplied with water and oil before running it under load.

*TO ADJUST MAIN BEARINGS

Should this adjustment in time become necessary, the big end bearings will probably also need adjustment and if the two jobs are done together much time can be saved.

Remove crankcase.

Remove wire through the front main bearing screwheads.

Undo the screws (4).

Remove the cap.

Examine the bearing cap babbitt metal to be sure that the bearing is making perfect contact over all its area.

* See pages 109 and 110.

If the babbitt metal is cracked or damaged do not attempt to adjust, but let your dealer know so that he may do any necessary re-metalling.

A number of shims, .005 in. (.127 mm.) and .0025 in. (.063 mm.) thick, will be found between the bearing cap and the cylinder block.

Remove shims of equal thickness from each side of the crankshaft—try .005 in. (.127 mm.) each side first.

Replace the cap, do up the screws and test the crankshaft for tightness by turning it with the starting handle. The " drag " of the bearing should be just felt. It may be necessary to undo the bearing cap and add or remove shims several times before the adjustment is correct, though it is impossible to obtain a satisfactory bearing if the crankshaft journal has worn oval.

When the front main bearing is correctly adjusted, undo the bolts and adjust the centre and then the rear main bearing in the same way.

The rear main bearing cap cannot be removed completely with the flywheel bolts in place, but the shims may be removed for any necessary adjustments assuming the condition of Nos. 1 and 2 caps is satisfactory.

When all these are satisfactorily adjusted, do all the screws up tightly and re-wire their heads. Then make sure that the bearings are not so tight that it is impossible to turn the crankshaft with the handle.

The crankshaft must have end float of between .002 in. (.051 mm.) to .006 in. (.152 mm.) when finally adjusted.

If the big end bearings are adjusted at the same time, see that when all bearings are tightened, it is possible to turn the crankshaft with the handle.

Replace the crankcase and radius rod. Refill with clean oil.

After adjusting the main bearings it is advisable to run the engine light for some little time, keeping it well supplied with water and oil before running it under load.

*TO REMOVE PISTON AND CONNECTING ROD

Remove cylinder head.

Remove crankcase.

Remove cotter pins from, and undo, the big end nuts.

Remove big end cap.

* See pages 109 and 110.

Push the piston and connecting rod out through the top of the cylinder.

*TO REMOVE PISTON PIN

Remove piston and connecting rod.

Remove the retainer circlips from the piston pin bosses.

Support the piston in a semi-circular block with a hole through which the piston pin can pass.

Push out the piston pin with a drift of the same diameter as the piston pin ($1\frac{3}{8}$ in. or 39.4 mm.).

The connecting rod may then be withdrawn from the piston.

After replacing the piston pin be careful to fit the retainer circlips firmly in their grooves in the piston pin bosses.

*TO REPLACE CONNECTING ROD OR PISTON

Remove piston and connecting rod.

Remove the piston pin.

The connecting rod may then be withdrawn from the piston.

If there is appreciable play between the piston and connecting rod, the parts should be carefully inspected to see if the wear has occurred in the small end bearing of the connecting rod or in the piston pin bores in the piston.

If the wear is in the connecting rod, the connecting rod should be replaced by a new one, as also it should be if the babbitt metal in the big end is worn to such an extent that the bearing is loose when all the shims under the bearing caps are removed and nuts are done up tightly.

If the wear is in the piston, a piston pin .002 in. (.051 mm.) or .010 in. (.254 mm.) over size may be obtained, though to fit it, it may be necessary to reamer out the small end bushing and the piston pin bores in the piston, after which the piston pin must be replaced, the circlips fitted and the piston and connecting rod reassembled.

*TO REMOVE PISTON RINGS

Remove piston and connecting rod.

* See pages 109 and 110.

The piston rings may then be removed by slipping the blade of a penknife under one end of the ring and working it gradually off over the top of the piston.

*TO REPLACE PISTON RINGS

The piston rings should be replaced by new ones when the compression in a cylinder is poor, or when excess oil is working past the piston into the combustion chamber.

First clean the ring grooves in the piston thoroughly, then check that they have not worn so as to allow a new piston ring to move vertically in the groove. If there is any wear in the groove, the piston should be replaced with a new one. There should be from .0005 in. (.012 mm.) to .002 in. (.051 mm.) vertical clearance when the ring is fitted in the groove. The easiest way to fit a piston ring is to use three strips of thin metal (old hacksaw blades are suitable) as " skids " and, placing the strips at right angles to the ring grooves and equally spaced round the diameter of the piston, ease the ring over the top of the piston to its appropriate groove. Always fit the rings with the word " Top " towards the top of the piston. When fitted in the cylinder, the top ring should have a gap of .009 in. (.229 mm.) to .013 in. (.33 mm.), the middle two, .006 in. (.152 mm.) to .011 in. (.28 mm.) and the oil control ring .006 in. (.152 mm.) to .013 in. (·33 mm.).

*TO REPLACE PISTON AND CONNECTING ROD IN CYLINDER

Set the gaps in the piston rings so that no two are directly in line. It is best to have the gaps equally spaced round the circumference of the piston. Remove the big end cap from the connecting rod.

Clean the crank pin and big end bearing surfaces.

Insert the connecting rod and piston in the cylinder, making sure that the assembly is the correct way round (when the big end cap is replaced the punch marks on the cap and rod should be together and the orifice in the dipper should be towards the valve side of the engine).

Compress the piston rings with a piston ring compressor and tap the piston into the cylinder with the ball of the hand.

Replace the big end on the crankshaft and adjust this bearing as described on page 122.

*TO REMOVE MAGNETO AND MAGNETO BRACKET

Remove the distributor cover with high tension leads from the magneto.

Disconnect the ignition control rod.

Undo magneto bracket to cylinder block screws (2).

Undo magneto bracket to cylinder front cover screws (2).

The magneto may be removed from the bracket by removing the magneto bracket to magneto screws (4).

To time the magneto see page 133.

*TO REMOVE THE GOVERNOR

Disconnect the governor control rod.

Disconnect governor to throttle control rod.

Undo the governor to cylinder front cover screws (4).

Slide the governor casing forward.

Remove the governor weights securing pin.

To dismantle the Governor, see page 138.

*TO REMOVE STARTING HANDLE

Remove cotter pin securing starting pin.

Withdraw starting pin.

Withdraw starting handle.

*TO REMOVE CRANKSHAFT PULLEY

Remove starting handle.

Remove cotter and securing pins from pulley. This may be done through the hole in the cylinder front cover, just behind the pulley.

Two tapped holes are provided in the pulley to enable a puller to be used to remove it.

*TO REMOVE THE CYLINDER FRONT COVER

Remove fuel tank. (See note *re* cables on page 114.)

Remove radiator.

Remove magneto bracket.

Remove governor.

Remove the crankshaft pulley.

Raise the front end of the tractor slightly.

Withdraw the radius rod retaining pin from the rear of the crankcase.

Place a support underneath the flange at the front of the gearbox housing.

Remove the cotter pin from the front axle trunnion and withdraw the trunnion.

Remove the front axle.

Undo crankcase to cylinder front cover screws (4).

Undo the cylinder front cover to cylinder block screws (4).

Slide the cylinder cover forward and off.

*TO REMOVE CAMSHAFT

Remove manifold (see page 116).

Remove valve cover.

A hole is drilled in each valve push rod, and when the valve is lifted the push rod may be raised till this hole is uncovered, when a cotter pin can be inserted which will prevent the push rod falling into the crankcase.

When all the push rods are pinned up, remove the cylinder front cover and the camshaft may be withdrawn.

*TO REMOVE PUSH RODS

Remove manifold.

Remove valve cover, lift valve springs, remove spring seat retainers and take out the valves.

Remove cylinder front cover.

Remove crankcase.

Insert cotter pins in holes in push rods.

Withdraw camshaft.

Remove cotter pins.

The push rods can then be withdrawn downwards.

* See pages 109 and 110.

*TO DISMANTLE CAMSHAFT TIMING WHEEL

Remove camshaft.

Remove cotter pin from nut holding timing wheel on camshaft.

Remove nut.

The timing wheel may then be pulled off the camshaft.

When being reassembled, the timing wheel must engage the key fitted to the camshaft, and have the timing mark on the same side of the wheel as the securing nut.

*TO REPLACE CAMSHAFT

When replacing the camshaft, the marked tooth on the crankshaft gear must come between the two teeth on the camshaft timing wheel at zero mark, and when the shafts are revolved the marked tooth on the magneto wheel must also come between these two teeth at the zero mark on the camshaft timing wheel.

The backlash between the camshaft and crankshaft timing gears should be tested with standard thickness gauges, and if it exceeds .0065 inch the gears should be replaced, as otherwise the gears may prove noisy in operation.

Cooling System

*TO REMOVE THE RADIATOR

Drain off water by opening the cock under the left-hand side of the radiator.

Loosen front fuel tank strap by undoing the nuts on radiator tank (2). Temporarily support tank by suitable packing.

Remove the screws (3) holding the radiator to the cylinder front cover.

Remove the screws (4) under the top tank holding the radiator to the water pump.

When fitted, disconnect the headlamp and horn cables: for the connections, see Wiring Diagram, page 104.

* See pages 109 and 110.

Lift off radiator, taking care not to damage the gaskets used to keep the connections watertight.

When reassembling, see that the water pump to radiator and cylinder front cover to radiator gaskets are in good condition, and correctly placed, and do not forget the washer that goes between the radiator and the cylinder front cover on the right-hand side.

*TO REMOVE THE RADIATOR CORE

Remove radiator. Unscrew the bolts (4) holding the grille to the side members.

Undo the radiator core to radiator upper tank screws (13), nuts and bolts (10).

Undo the radiator core to radiator lower tank bolts (24).

Any faulty tube or the entire core may now be replaced.

TO ADJUST THE FAN BELT

Remove the nuts on the bolts (4) holding together the two portions of the fan pulley. The rear portion of the pulley may then be slipped back and split distance pieces removed or added as required. To tighten the belt, remove distance pieces. See also page 45.

*TO ADJUST WATER PUMP PACKING GLAND

Should any water be seen leaking from the water pump round the pump shaft, it can probably be stopped by tightening the water pump packing gland nut (clockwise) with a screw-driver. If tightening this does not stop the leak, a new gland ring should be fitted and if this is not satisfactory the whole gland should be repacked.

*TO REPLACE THE WATER PUMP PACKING GLAND

Drain the radiator.

Undo the brass water pump packing gland nut and withdraw the old gland.

Split or the spiral type of glands are supplied for replacement.

Slip one gland ring over the water pump shaft, straighten it and push it back into its recess. Screw up the packing gland nut, so positioning the gland ring, then unscrew the nut, put on a further ring and screw up the nut again.

Fit as many rings as necessary in this manner.

* See pages 109 and 110.

When using the spiral type of gland packing this should be inserted in the gland so that the coil *nearest the radiator* is pointing in the same direction as the shaft rotates, i.e., clockwise when viewed looking from the front towards the engine. See Fig. 56.

Grease the gland by means of the lubricator before tightening the gland nut.

Tighten the gland nut only enough to prevent water leaking.

It will probably be necessary to tighten the gland nut once or twice after the engine has run for awhile.

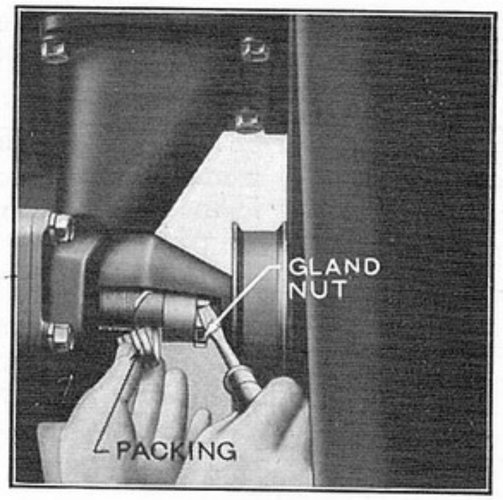


Figure 56
Packing the Water Pump Gland

*TO REMOVE WATER PUMP

Drain the radiator.

Undo the water pump to cylinder head screws (4).

Undo the water pump to radiator upper tank screws (4).

Withdraw the water pump.

*TO DISMANTLE THE WATER PUMP

Remove the water pump.

Withdraw the cotter pin securing the castellated nut which holds the fan assembly on to the water pump shaft and remove the nut, washer and key.

Withdraw the fan assembly from the shaft.

Undo the water pump packing gland nut.

The water pump shaft and impeller may then be withdrawn and any parts necessary may be renewed.

The bronze fan bearing bush and the brass water pump bearing bush may then be withdrawn.

* See pages 109 and 110.

It is inadvisable to remove the brass water pump bush if it can be avoided, as if it is incorrectly replaced water will leak between it and the water pump casing.

If, however, it is necessary to fit a new rear bushing, this must be inserted in such a manner as to ensure that one of the four holes for lubricant drilled in the annular groove comes into line with the grease cup communicating passage shown in Fig. 57.

A new front bushing may be installed after pressing out the old one, but line up the hole in the bush with the passage in the housing leading from the lubricator. If necessary, drill a $\frac{3}{16}$ in. (4.76 mm.) hole in the bush, removing the lubricator and using the passage as a guide.

Line ream both bushes after installation to .8127 in.–.8147 in. (20.638 mm.—20.689 mm.). Remove all swarf and replace the lubricators.

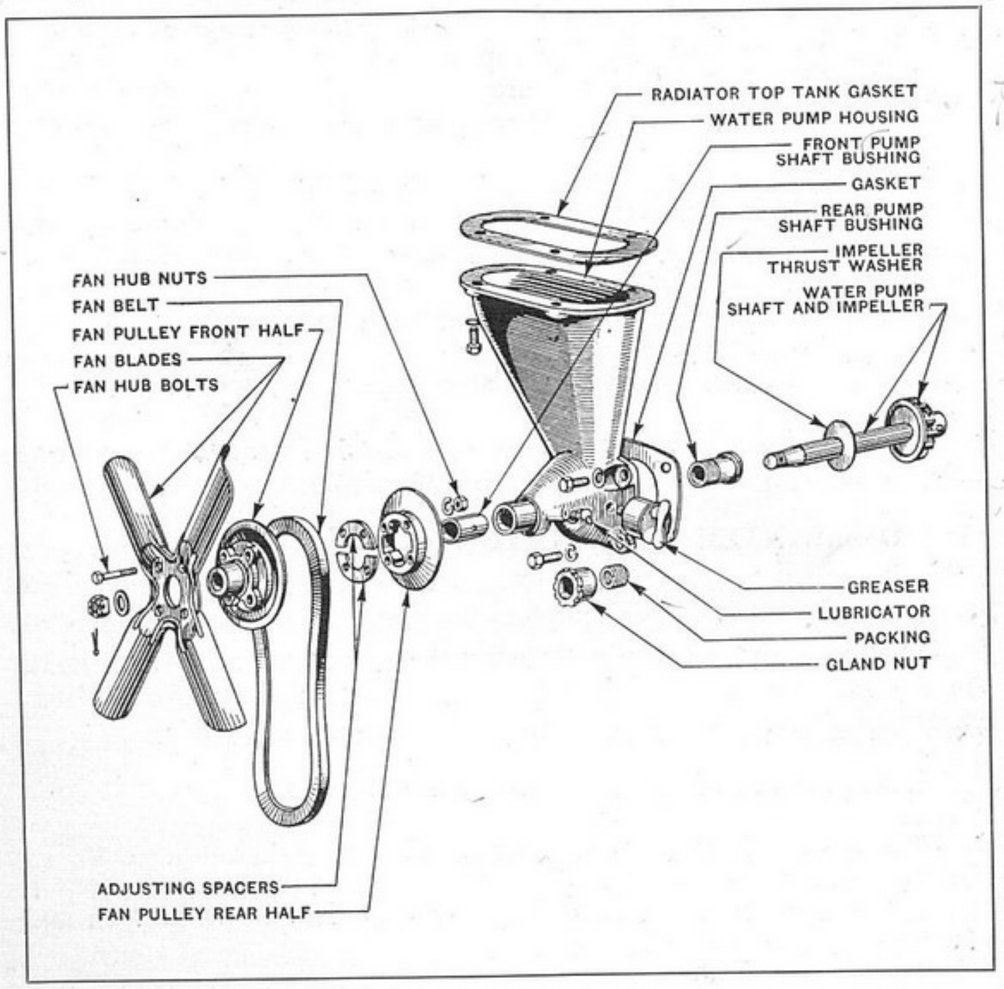


Figure 57
Exploded View of the Water Pump

When reassembled, the thrust washer must seat properly in the recess in the impeller, the bearing bush and gland must be greased before assembly, and also afterwards by means of the lubricator. Use a suitable water pump grease in the grease cup for lubricating the gland.

Ignition System

*TO TIME THE MAGNETO

Rotate the crankshaft by means of the starting handle till No. 1 cylinder is at firing point. This is when the piston is at top dead centre with both valves closed. The easiest way to find this is to remove the valve cover and No. 1 sparking plug, insert a piece of wire down the sparking plug hole on to the top of the piston and rotate the crankshaft until both valve springs are fully extended showing that both valves are shut, and the upward movement of the wire stops, showing that the piston is at top dead centre.

Remove the distributor cover from the magneto, see page 49, and rotate the magneto impulse coupling anti-clockwise until the rotor arm is pointing towards that segment of the distributor numbered 1 and to which the H.T. lead from No. 1 sparking plug should be connected. Turn the armature so that the points are just about to open with the rotor arm in the above position.

The lugs on the magneto coupling will be approximately horizontal and the lugs on the driving shaft will be vertical.

Install the fibre coupling and slide the magneto forward on its bracket, insert the four magneto securing screws and tighten these securely. Replace the distributor cover and reconnect the H.T. leads if they have been disconnected.

*TO DISMANTLE THE IMPULSE COUPLING

Remove magneto from tractor (see page 126).

Unscrew the nut in the centre of the impulse coupling holding it to the magneto armature shaft. This nut is secured in the impulse coupling by a spring retaining ring, so that when the nut is unscrewed, it acts as a puller, and draws the coupling off the armature shaft.

Remove the outer snap ring which secures the inner member to the outer case.

* See pages 109 and 110.

Withdraw the inner member, at the same time releasing the spring so that it is retained in the outer case.

Remove each snap ring and washer so that the pawls may be detached.

The spring may be removed from the outer case but take care to release the tension gently.

The impulse coupling securing nut is fixed in the same manner as the inner member, i.e., by a snap ring.

*TO REASSEMBLE IMPULSE COUPLING

Grease the torsion spring and fibre strip which is interleaved with it and engage the inner ends in the slot machined upon the boss of the inner member so that it is wound in a clockwise direction. Do not permit this fibre strip, however, to extend into the hooked outer end of the spring otherwise difficulty may subsequently be experienced in engaging the lug of the inner member.

Wind up the spring so that it just enters the outer case but ensure that the outer hooked end does not stand so proud of the remaining coils that it cannot be pushed into position afterwards.

Next, hold the inner member with the pawl pivot pins towards the operator and horizontal. Place the upper pawl on the left-hand pivot pin with the trailing part towards the right. Secure it with a flat washer and circlip.

Install the lower pawl on the right-hand pivot pin with the trailing part towards the left-hand side and similarly secure it with a flat washer and circlip.

It is essential that each pawl is free to move within its limits of travel as the member is rotated : any stiffness in action may prevent the impulse coupling from operating correctly.

Place the large boss of the inner member in the bore of the outer case so that the single protruding lug may be inserted in the hooked end of the spring.

Do not fully enter the inner member until the spring has been given approximately a quarter turn, when the stops of the inner member will register with the spaces of the outer case. Press the inner member into position and secure it with the circlip.

If the nut and washer have been removed from the centre these should be replaced, first installing the spring washer, followed by the nut and securing them with the circlip.

* See pages 109 and 110.

*TO REPLACE THE MAGNETO SHAFT OR GEAR

If it is necessary to replace the magneto gear shaft, first remove the magneto, see page 126. Unscrew the coupling bolt, retaining the lockwasher and thrust washer for re-use. Press the shaft forwards out of the coupling and magneto bracket bush, bringing with it the gear which is keyed to the shaft. Press the shaft out of the gear by applying pressure to the shouldered end having the keyway.

The position of the gear relative to the shaft is reversible as the keyways and timing marks are duplicated for either side. When viewed from the counterbored end the shaft key must engage the keyway nearer the mark " O." Press the gear right home to its shoulder when the key is correctly entered.

Make sure the key is entered at the coupling end before refitting the shaft in its bush. Fit the coupling after ensuring the marks on the camshaft and magneto gears are correctly meshed. To time the magneto, see page 133.

Electrical System

TO REMOVE THE STARTER MOTOR

First disconnect the three wires at the starter motor and then remove the three bolts holding the motor to the cylinder block. The starter motor can then be lifted away from the cylinder block.

TO FIT NEW BRUSHES OR CLEAN THE COMMUTATOR

Straighten the tabs of the lock plates on the four small screws on the brush end plate and remove the screws. The armature shaft end cover and the solenoid switch can then be removed from the end plate. Remove the brass nut now exposed.

Remove the cover band, lift up the springs on the brushes (a piece of bent wire is useful for this) and then draw the brushes out of the brush holders.

Unscrew the two through bolts and draw the brush end plate off the armature shaft. Do not lose the insulator bush and washer on the connector to the field coils.

Draw the starter drive support off the drive end of the armature shaft and then pull the armature and drive end plate out of the starter body.

* See pages 109 and 110.

Carefully inspect the commutator and if it is dirty or pitted, it should be cleaned up with **glass paper,** not emery paper.

If the brushes are badly worn or the brush pigtail is showing on the brush face, the brushes should be renewed. The brush leads are sweated into their terminals. Every care should be taken to ensure that the surrounding insulator in the starter body is not damaged.

After fitting the brushes, place the insulator washer and bush on the connector from the field coils and then refit the armature and drive end plate. Locate the brush end plate in position so that the dowel locates in the slot and the connector from the field coils passes through the hole in the end plate. The brass nut should then be fitted to the connector from the field coil.

Lift up the brush springs, insert the brushes in the holders and place the ends of the springs on top of the brushes. Pull the brush leads lightly to ensure that the brushes are free to work in the holders. The brushes with the braided leads, from the field coils, should be fitted in the insulated brush holders.

Refit the starter drive support, so that the dowel in the support locates in the slot in the end plate and starter body. Care should be taken to ensure that the lip of the oil seal in the support does not become damaged or trapped. Refit the two through bolts to retain the support in position.

Refit the starter solenoid switch, ensuring that the rubber insulator is located round the copper terminal, and refit the retaining screws and armature shaft end cover. Bend one tab of the lock plate up against the side of the screw head and bend the other tab down against the side of the solenoid switch mounting.

Refit the cover band.

TO REPLACE THE STARTER MOTOR

Replace the starter motor to mounting flange gasket if there is any possibility of an oil leak at this point.

Enter the starter motor in its location and refit the three retaining screws and lockwashers.

Connect the thick cable from the battery negative terminal post and the yellow cable to the copper terminal on the end plate. Connect the black cable with blue tracer to the insulated terminal on the side of the solenoid switch.

TO FIT A NEW STARTER DRIVE

First remove the starter and then remove the two through bolts. The starter drive support can then be removed.

Scribe a line across the end of the shaft and nut to assist in lining up the nut and shaft when reassembling. Drive out the pin in the shaft nut.

Unscrew the nut, when the individual parts are free and can be removed.

Replace the large spring on the shaft and reassemble the remaining parts. Ensure that the thin washer is located in the outer end of the pinion so that the anti-drift spring cannot work its way down inside the pinion.

Replace the retainer nut and tighten it up until the end of the shaft is approximately in line with the end of the shaft and the lines previously made on the nut and shaft are together and the pin can be fitted. Refit the pin, the ends of which must be peened over to secure it in place. Replace the starter drive support, taking care not to damage the oil seal and then refit the starter to the engine.

TO REMOVE THE GENERATOR

Remove the generator terminal box cover and disconnect the cables from the terminals.

Remove the three bolts holding the generator in position (one to the front and one to the rear mounting bracket, and one to the adjustment quadrant). Support the generator and then slip the fan belt off the generator pulley, when the generator can be lifted away.

TO FIT NEW BRUSHES OR CLEAN THE COMMUTATOR

Slacken off the cover band screw and remove the cover band.

If the commutator is dirty or blackened, it may be cleaned with a petrol-moistened, non-fluffy cloth held against the commutator while the armature is rotated. **Do not use emery cloth** to clean up the commutator as the dust may get between the commutator segments and cause them to be short-circuited. If the commutator is excessively scored, the generator should be dismantled so that the commutator can be cleaned up properly.

Pull the brush leads lightly. If the brushes are tight or sticking in the holders, they should be removed and the sides of the brushes

cleaned and eased. Raise the brush spring and lift the brush out of the holder. If the brushes are excessively worn or the brush leads are showing on the working face of the brush they should be renewed. The brush leads are held to their twin terminal by a screw and lock-washers. When refitting the brushes, the brush leads should be near to the end plate and the springs on top of the brushes.

Slide the cover band back into position and tighten up the screw.

TO REPLACE THE GENERATOR

Place the generator in position and fit the front and rear mounting bolts. Slip the fan belt into position in the generator pulley and adjust the fan belt tension as described on page 45. Refit the adjustment lock screw and washer.

Connect the red cable with white tracer to the inner terminal, the yellow cable with red and black tracer in the outer terminal and refit the dynamo terminal box cover.

Governor

*TO DISMANTLE THE GOVERNOR

When removed from the engine, the internal parts such as the spring and thrust bearing may easily be removed. To proceed further, punch out the pin securing the manual operating lever and the shaft can then be removed. The governor cam can be withdrawn when the seal has been removed.

Disengage the stop ring from its groove and the plunger can be removed. The fork can be released by punching out the pin and the governor operating lever is also pinned to the shaft.

When reassembling, note that when new levers or shafts are used accurate location of the holes for their securing pins is important. Each lever has the hole for the pin drilled in one side of the boss. This will serve as a lead for drilling the shaft and Fig. 60 shows the correct position of the lever.

The fork must be so fitted on the shaft that the longer arm is to that side where the lever is mounted. Secure the fork with a new pin and, before reassembling the governor operating lever, fit the oil seal in the location adjacent to this lever.

* See pages 109 and 110.

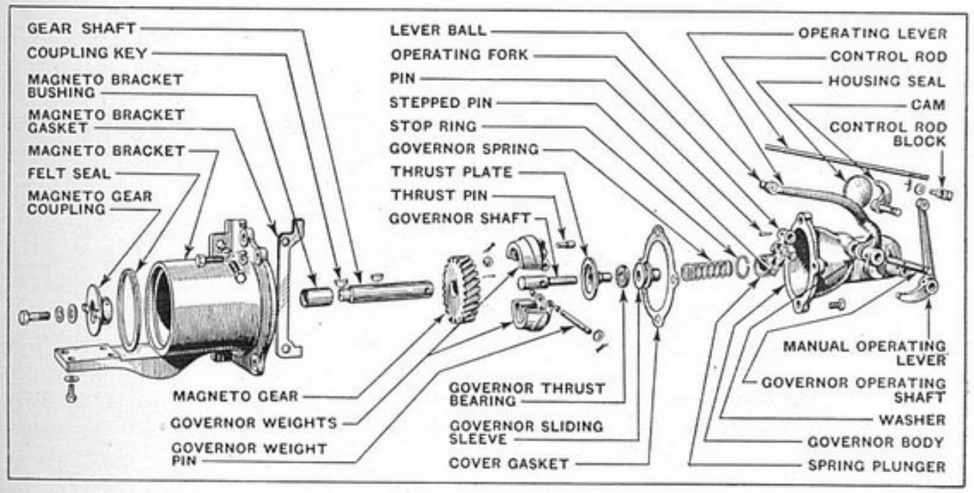


Figure 58
Exploded View of the Governor

Fit the housing oil seal after the cam has been replaced and the manual operating lever pinned to the shaft.

Install the plunger, open end towards the fork, and insert the stop ring in its groove.

Before replacing the governor spring this should be tested : it should exert a pressure of 90 lbs. (40.82 kg.) when compressed to $1\frac{3}{8}$ ins. (34.92 mm.).

Install the spring in the plunger and the shouldered end of the sliding sleeve in the spring : position the fork so that the stepped pins enter the annular groove of the sleeve and take care that when the thrust plate and bearing have been inserted the parts do not move out of position.

It is advisable to inspect the governor weights before reassembling the cover. Pull out the cotter pin, retaining the washer and extract the weight pin which holds the weights to the shaft and also the shaft to the magneto gear shaft.

Remove the weight pin and shaft if any wear present warrants this action. The weights are bushed and, if worn, the bearings may be extracted and new ones pressed in squarely in line with each hole. After insertion the bushes must be line reamed to .252 in./.253 in. (6.401 mm./6.426 mm.) diameter.

New weight thrust pins may be fitted if the heads have any signs of undue wear : these are pressed into the governor weight body.

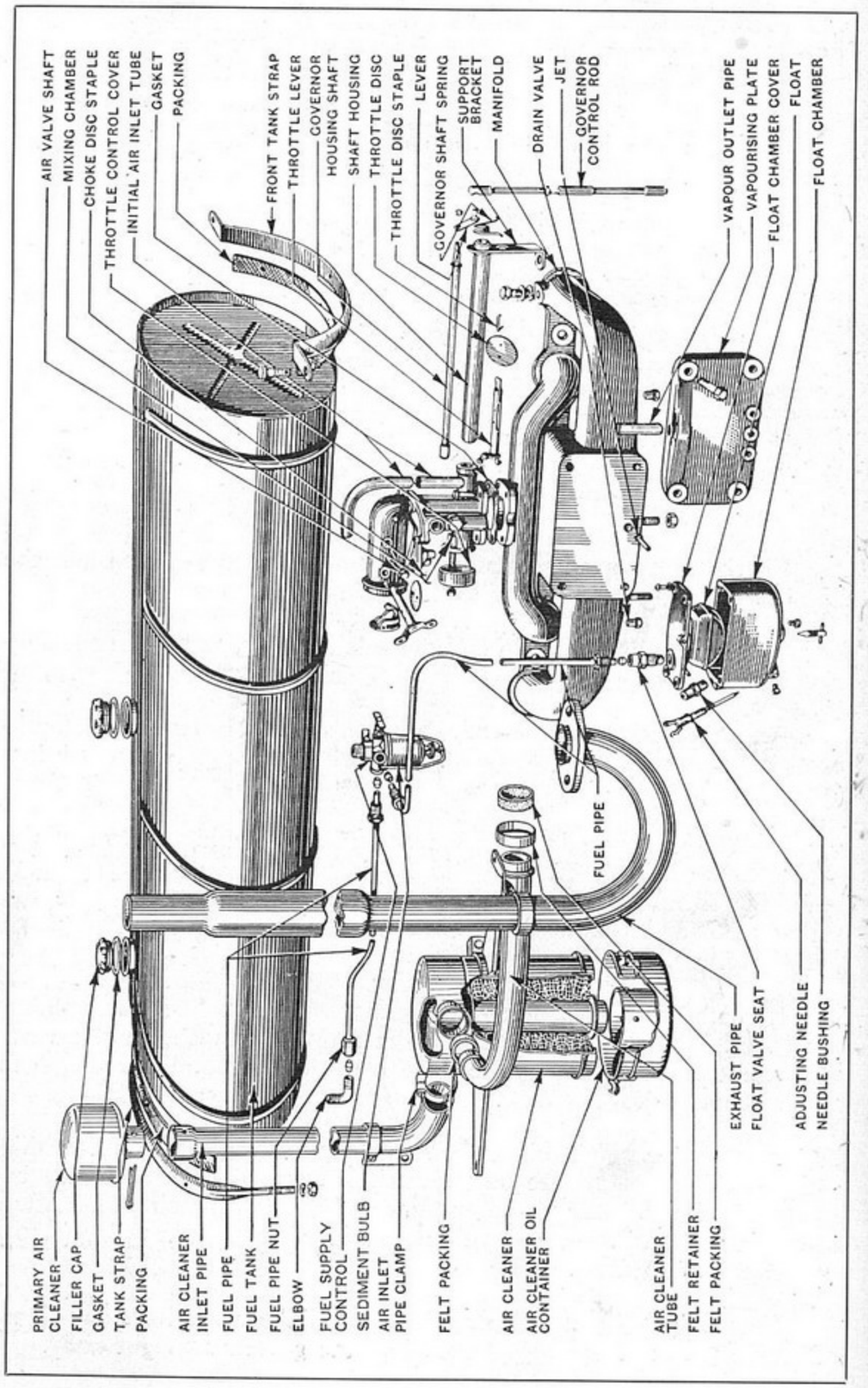


Figure 59
Fuel System

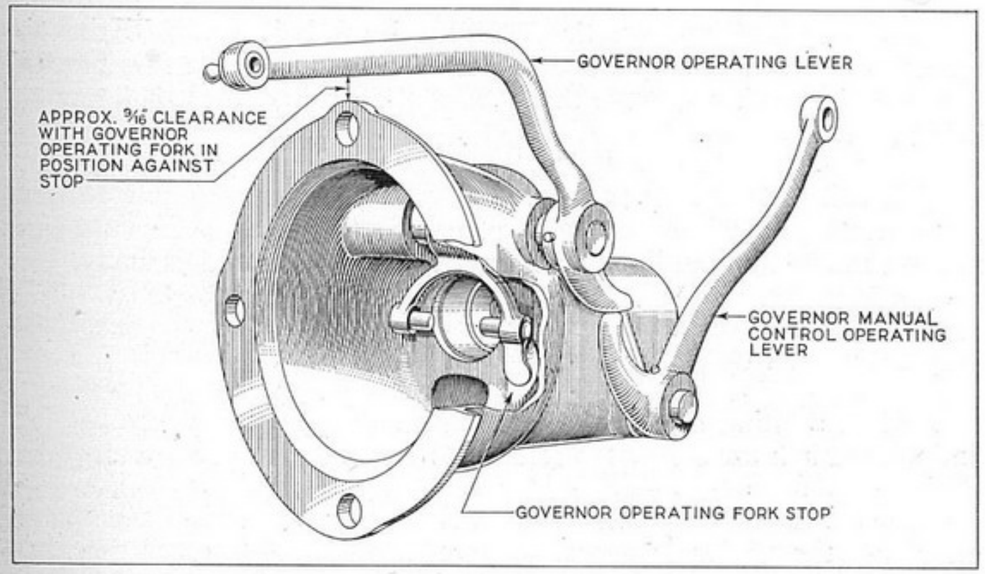


Figure 60
Control Rod Adjustment

*TO ADJUST THE CONTROL RODS

Turn the short lever on the throttle control assembly to its uppermost position.

With the governor assembled on the tractor, move the throttle control arm (the longer arm on the governor housing) to its uppermost position.

Set the adjustment at the middle of the rod connecting this arm to the throttle control assembly, so that the rod has to be pulled down $\frac{1}{64}$ inch ($\frac{1}{2}$ m.m.) to go into the hole in the arm, and connect the control rod to the inner side of the control arm. This is necessary to prevent the load from the governor spring being transferred to the throttle stop on the vapourizer.

When the adjustment is correct, a piece of paper may be slipped between the stop lever and its stud.

Air Cleaner

TO REMOVE THE CYLINDRICAL OIL BATH AIR CLEANER

Remove the bolt securing the vertical air inlet pipe bracket to the dash. Loosen the clamp bolt on the air cleaner body where this pipe enters the stub, when the air pipe may be withdrawn.

* See pages 109 and 110.

Unscrew and remove the cylinder head bolt securing the air cleaner bracket to the head and also the bolt securing the rear bracket to the dash panel. Remove the base of the cleaner to obviate any oil being spilt.

The air cleaner may then be removed, at the same time freeing it from the air pipe which conducts cleaned air to the engine. Take care not to damage the fuel line which passes near the air cleaner body.

The filter element cannot be removed, but if any dirt is present it may be cleaned by swilling out with a little petrol.

When refitting the air cleaner connecting pipe, make sure the felt and felt retainer are correctly positioned at each end to prevent air leaks.

Make sure the base is refilled to the level mark with clean engine oil before the engine is restarted, otherwise dust may enter the filter element and tend to choke this, instead of being trapped in the base. See Fig. 15.

TO REMOVE SQUARE TYPE OIL BATH AIR CLEANER ASSEMBLY

Remove the vertical air pipe which is attached to the air inlet port on the left-hand side of the tractor by withdrawing the draw-bolt which secures it. Do not lose the two clamps in the housing.

Unscrew the two bolts securing the air cleaner to the bracket: then unscrew the uppermost bolt which passes through the top of the steering gear housing bracket. The air cleaner may then be removed from the left-hand side of the tractor taking care that the fuel line is not damaged when passing the cleaner beneath it.

TO DISMANTLE THE SQUARE TYPE AIR CLEANER

This must be done when the air cleaner is removed from the tractor as owing to its construction the top portion has to be lifted approximately $3\frac{1}{2}$ in. (89 mm.) vertically before it may be removed and insufficient clearance exists if this be attempted in place.

Take care that the small release valve beneath the outlet elbow is not damaged: the valve must be free to move and close the outlet when the engine is running.

Unscrew the two bolts when the assembly may be parted and thorough examination of the interior provided. The copper wool assembly is designed to operate for a considerable period without attention and no attempt should be made to remove this. The dirt trap hand-hole provides access to enable all sediment to be removed and no useful purpose is effected by dismantling the cleaner.

When reassembling the upper and lower parts of the cleaner the cork gasket should be in good condition and mounted correctly in register with the air passage formed in the air cleaner.

On replacing the air cleaner on the Tractor, ensure that the top bolt is correctly refitted at the apex of the bracket.

Refill with engine oil to the level plug. See page 34.

TO REMOVE THE GAUZE-TYPE AIR FILTER

This air filter is fitted to the carburettor on Industrial Tractors and is held in place by a clamp which secures it to the carburettor air inlet stub.

It may, however, be cleaned by unscrewing the butterfly nut, when the end plate, the filter element and its internal spring may be withdrawn for attention.

When reassembling, make sure the perforated metal guard correctly enters the flange of each end plate.

Do not moisten the filter element with oil as it is intended to operate in a dry condition.

Steering Gear and Front Axle

TO REMOVE THE STEERING GEAR

Remove rear fuel tank strap nuts (2) supporting fuel tank with suitable packing when the dash is removed.

Undo steering wheel nut and remove steering wheel and washer.

Undo the four bolts securing the steering column to the dash and remove the column by passing it upwards along the shaft.

Disconnect the dash controls and remove the four bolts securing the upper part of the dash to the steering gear housing bracket.

Unscrew the drop arm nut and remove the drop arm.

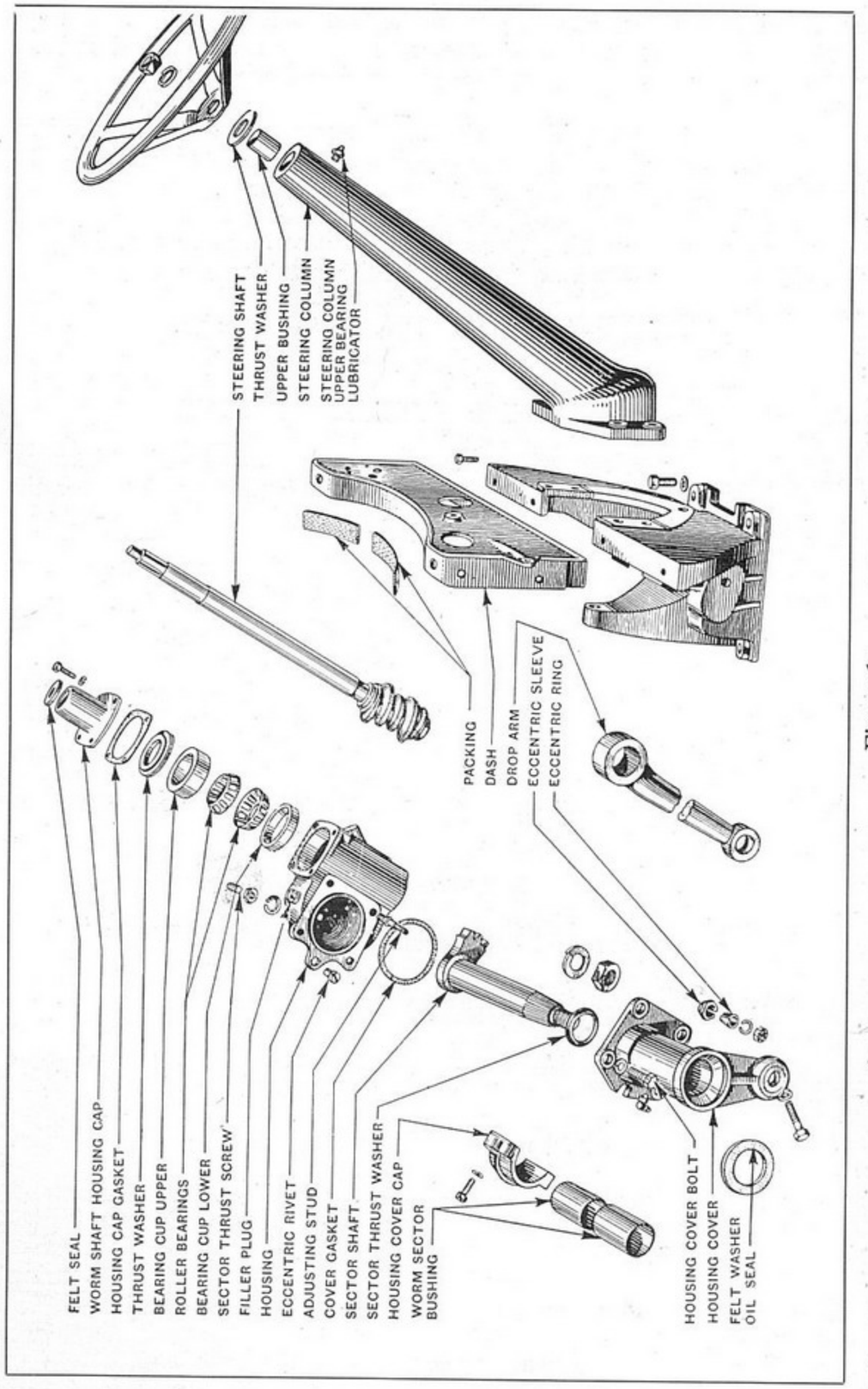


Figure 61
Exploded View of the Worm and Sector Type Steering Gear

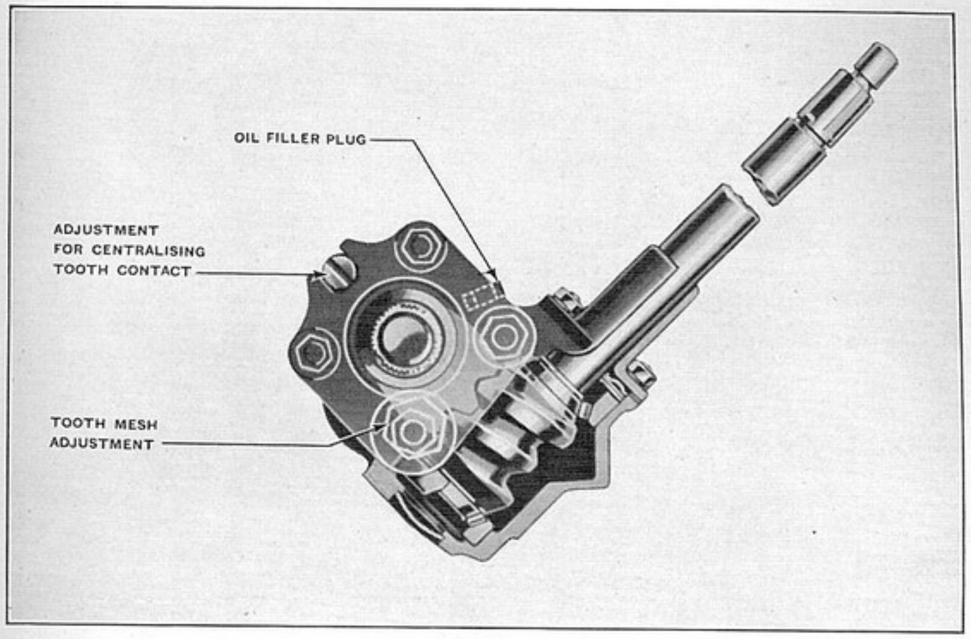


Figure 62
Worm and Sector Type Steering Gear Adjustments

Remove the single bolt at the side of the steering box and the four bolts securing the cap, when the steering gear can be removed from the tractor. When the cylindrical type air cleaner is fitted this must be removed to provide sufficient clearance to allow the steering gear to be withdrawn.

*TO ADJUST THE STEERING GEAR (Worm and Sector Type)

If wear develops after service, provision is made to take up slackness in the steering-box and four adjustments are provided for this purpose. To ensure satisfactory operation it is advised that they be carried out in the order given below as this will ensure that each individual adjustment is completed and does not subsequently have to be altered to permit additional adjustments to be made. Adjust only when removed from the tractor.

***End Play Adjustment in Sector Shaft.**—If end play exists in the sector shaft, with the housing bolts securely tightened, this may be taken up by releasing the lock-nut and screwing in the sector thrust adjusting screw until all end-play is just taken up. After this adjustment, tighten the lock-nut and retest for end-play, at the same time checking to ensure that the shaft is free at all positions.

* See pages 109 and 110.

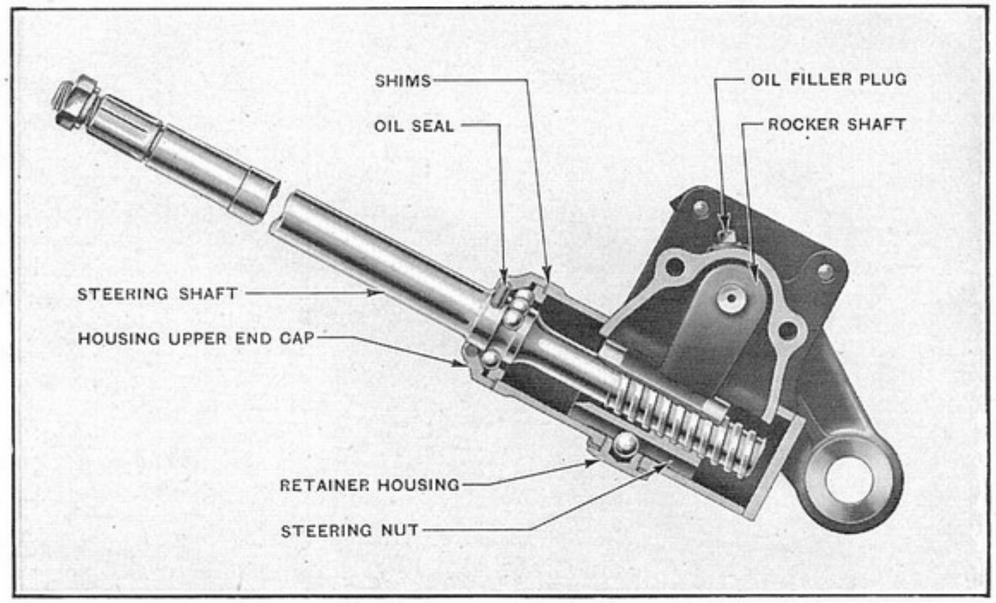


Figure 63
Worm and Nut Type Steering Gear

***Adjustment for Correct Mesh of Sector Teeth.**—With the drag-link disconnected and the steering in the straight ahead position, gauge the lost-motion present by movement of the sector shaft, grasping the drop arm will enable this to be felt.

Loosen the three nuts securing the housing one-quarter turn each and the mesh adjustment lock-nut one-half a turn.

Turn the eccentric adjusting sleeve clockwise very gradually, checking at each movement the amount of lost-motion still existing at the drop arm.

Do not adjust more than is necessary to eliminate all back-lash, **being sure to finish the movement of the sleeve in a clockwise direction.**

If this stiffens up the steering unduly, free the adjustment by turning the eccentric adjusting sleeve in an anti-clockwise direction and then readjust as described above, more carefully.

After adjustment, first tighten the mesh adjustment lock-nut, then the housing cover nuts.

It should be noted that the worm is so constructed that close mesh with the sector teeth is provided when the steering is in the central position.

* See pages 109 and 110.

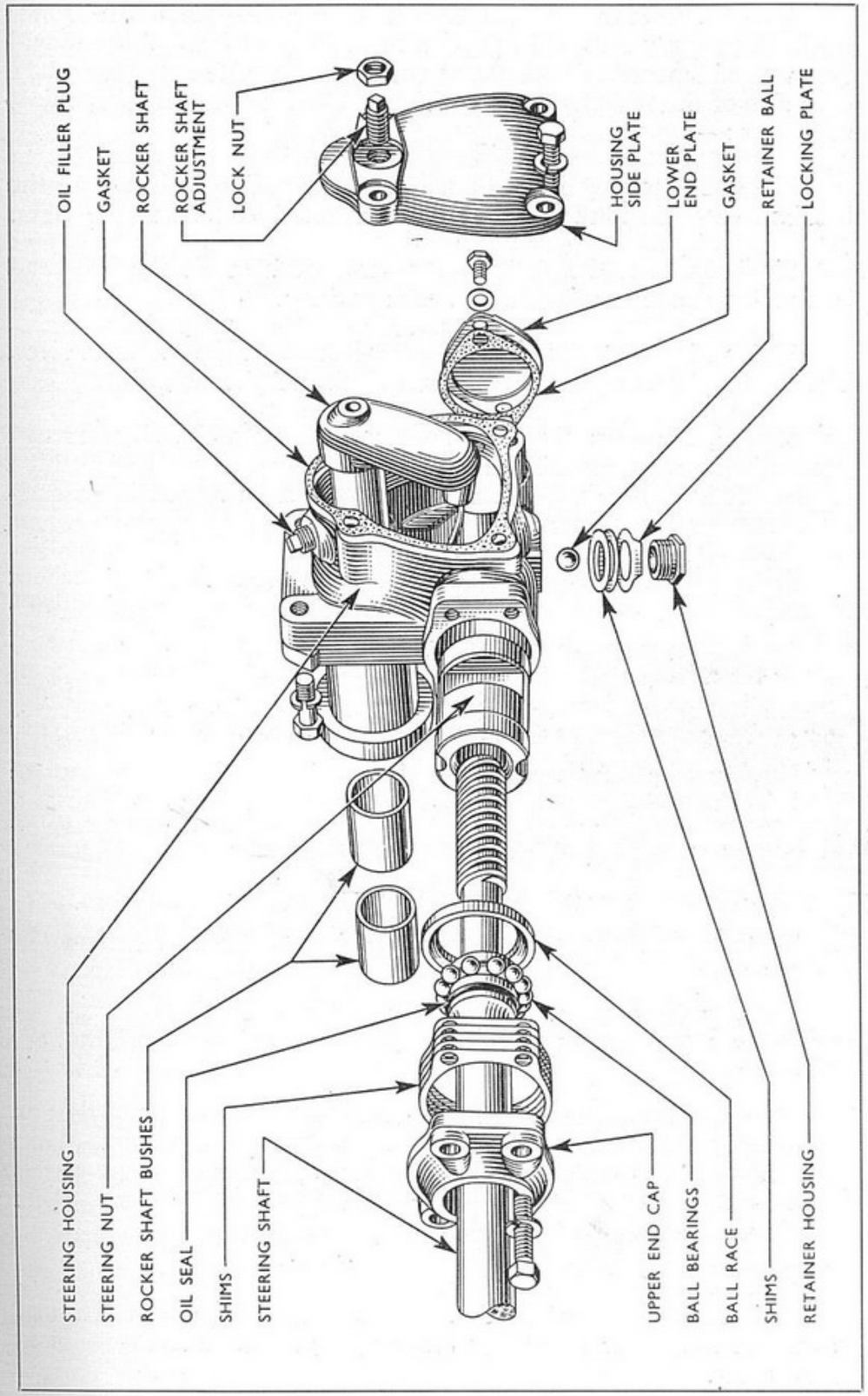


Figure 64
Exploded View of Worm and Nut Steering Gear

*__Centralisation of the Tooth Contact.__—When the sector teeth are properly centred in relation to the worm thread, there should be an equal amount of backlash at one-half turn of the steering wheel each side of the straight ahead position. If this is not the case, adjust as follows :—

Place the steering in the straight ahead position, then note the backlash obtained if the wheel be turned one-half turn to the right.

Similarly, turn the shaft to the same position on the left-hand lock and compare the backlash in each position.

If there is **less** backlash on the left-hand lock the eccentric rivet, Fig. 62, should be turned slightly in a clockwise direction.

Should, however, there be less backlash with the shaft turned one-half turn on the right-hand lock than on the corresponding position on the left lock, then the eccentric rivet should be turned in an anti-clockwise direction to correct this.

When correctly set, with backlash equal on both sides, recheck for correct mesh of teeth with the worm, remembering that after adjustment the mesh adjustment lock nut must be tightened first.

TO ADJUST THE STEERING GEAR (Worm and Nut Type)

Rocker Shaft Adjustment.—First ensure the bolts securing the housing side plates are tight—if not, tighten them securely and re-test. Should there still be end-play at the rocker shaft, adjust by first loosening the lock-nut, when the adjusting screw should be carefully tightened until all end-play has been removed. See Fig. 64.

Test the steering gear, at various positions between its extremes of travel, to ensure the shaft is quite free to rotate and that there is no undue lost motion at the rocker shaft. Tighten the locknut securely and again test to make certain that the adjustment has not been disturbed.

To Adjust the Steering Shaft Ball Bearing.—Any end float on the steering shaft will be due to slackness at the ball bearing at the upper housing end plate and provision for adjustment is made at this point. First ascertain, however, that the securing bolts are tight: if so, proceed as follows :—

Remove the four bolts from the upper end plate, which may then be moved upwards, along the shaft. As this will permit the ball bearings to fall out of their races, ensure that none are lost. Eleven are fitted at this point.

* See pages 109 and 110.

By removing shims fitted between the end plate and steering box, the races may be brought closer together, so adjusting the bearing. Carefully inspect the cups and ball bearings for any traces of wear and renew if necessary.

The balls may be assembled by applying grease to the cup in the steering box, when they will be held in position as the upper end plate and bearing are re-filled. Remove shims one at a time, all that is necessary being to remove any slackness : this ball bearing must not be adjusted tightly, otherwise the bearing cups and balls may be damaged.

Test the steering gear in all positions of its travel to make sure it is quite free to rotate.

Means are provided to prevent the steering nut, which engages the steering shaft, from rotating. This adjustment is set when the box is assembled and should rarely require attention. If it is found necessary to dismantle the assembly, however, note that the nut which secures the steel locking ball in place is prevented from turning by a tongued washer, one lip being in contact with one of its hexagons, whilst the nut itself is provided with a *left-hand thread*.

If the steering nut is removed from the box at any time, take care that this steel ball is not lost, whilst its adjustment should be such that it is held in engagement with the longitudinal slot in the steering nut sufficiently to prevent rotation yet without causing the steering nut to move stiffly.

TO REPLACE THE STEERING GEAR

Install the steering gear so that the cap may be replaced with the four bolts loosely in position. Place the washer on the single bolt which secures the arm of the housing to the bracket and loosely enter this bolt also.

Fit the steering column over the shaft and install the four bolts at the base, but do not tighten these at this stage.

Next tighten the single bolt at the side sufficiently to bring the lug into contact with its abutment flange, then tighten the four cap bolts. Pull up the four bolts at the base of the steering column and then test the steering gear by replacing the wheel and by turning this from lock to lock, ensure that it turns freely. If it appears stiff, loosen off the bolts and allow the column to re-align itself to the steering shaft.

When the four steering column bolts, the four cap bolts and the bolt in the lug have all been tightened up, make a final check to see that the steering shaft is still free to rotate easily.

Reassemble in the reverse manner as for dismantling and make sure that the steering gear box is filled to the level of the filler plug with gear oil of an approved grade.

When the cylindrical type air cleaner is fitted this must be replaced and the oil level checked and refilled if necessary. See Fig. 15 and page 33.

*TO REMOVE FRONT WHEELS

Take off hub cap, jack up front of tractor, take out cotter pin and unscrew nut from end of wheel spindle. The wheel can then be drawn off along with the outer roller bearing. The dust excluder can then be removed, allowing the inner roller bearing to be taken off. **Before replacing the wheel,** clean hub and spindle thoroughly with paraffin, and then fill up the hub and cap with fresh grease. Be careful in replacing roller bearings that the stamped faces of the outer rings face each other.

*FIT OF CONES AND CUPS

The cups should be a good press fit in hubs, and seated firmly against the shoulder in the hub. The cones should be a close push fit on the spindle with no play in the bearing. In no case, however, should wheel cones fit tightly on the spindle.

*TO ASSEMBLE AND LUBRICATE

Fill the hub between the cups, and pack the inner cone with a good quality medium body grease, being sure that the space between the rollers is filled with grease.

On later tractors a modified dust ring is used and may be identified by the inner flange, which is parallel with the outer flange. With this is used a felt grease retainer ring and it is important to replace these parts correctly as under :—

After installing the inner cup and roller bearing, press in the dust ring, flanges away from the roller bearing. Fit the felt grease retainer ring in the channel formed in the dust ring so that when installed, the grease retainer ring is pressed into contact with the face of the spindle body. This felt grease retainer ring is to be fitted dry. Do not soak it in oil when fitting it and it should be replaced at intervals of one year's service.

* See pages 109 and 110.

In the case of earlier tractors the dust ring is pressed into the hub, *flanges towards the bearing* and no grease retainer ring was used with it.

Fit the wheel on the spindle.

Pack the outer cone with grease and place it on the outer end of spindle. Re-install tongued thrust washer and adjusting nut.

*ADJUSTMENT

These bearings should be tested for correct adjustment every 50 hours and re-adjusted if necessary. (See page 29.)

Screw adjusting nut home but do not force it so tight that the wheel will bind, as this will damage the bearing immediately.

Revolve wheel to ensure all working surfaces coming in contact.

Loosen the adjusting nut $\frac{1}{3}$ to $\frac{2}{3}$ turn, enough to allow wheel to rotate freely but with no end play, then lock the adjusting nut in this position with a cotter pin.

Put on hub cap filled with grease.

*CAUTION

Care should be taken that no dirt or water gets on the bearings or in the hubs when the wheels are being readjusted and lubricated. When adjusting the front wheel bearings, do not mistake loose steering spindle bodies or bushes for end play in wheel bearings.

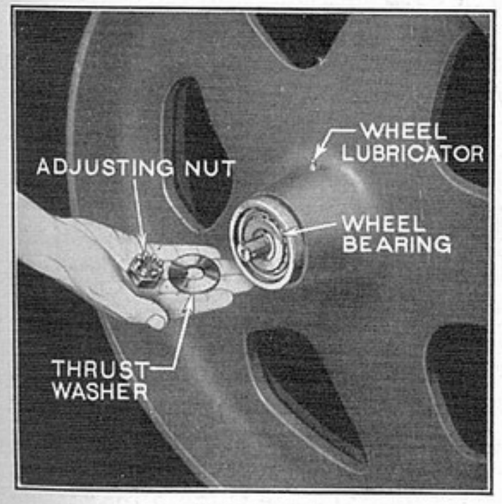


Figure 65
Adjusting the Front Wheel Bearings

*TO REMOVE THE FRONT AXLE

Jack up the front of the tractor and remove the wheels.

Disconnect the steering drag link from the steering arm.

Withdraw the radius rod retaining pin from the crankcase.

Support the front axle.

* See pages 109 and 110.

Remove the cotter pin from the front axle trunnion, withdraw the trunnion, and remove the axle.

When replacing the axle note that a washer is fitted on the trunnion pin between the cotter pin and the bracket, at both front and rear of the bracket.

Before reconnecting the drag-link ensure that the grease retainer cap is installed on the ball stud and that the grease retainer which fits into the cap is in good condition. The drag link spring must also be in good order and correctly installed in the drag link.

To adjust the ball plug, fully tighten it, then unscrew it from ½ to 1 turn: it must not be slacked back more than 1 turn from the fully tight position.

*TO DISMANTLE THE FRONT AXLE

Remove the cotter pins from the nuts of the radius rod bolts, undo the nuts and withdraw the bolts. Detach the radius rod.

Withdraw the cotter pins from the yoke pins and press these upwards out of the yoke ends, so freeing the spindle connecting rod.

After removing the split pin at each steering arm, unscrew the nut, remove the bolt and draw each steering arm off the splined shaft of the spindle body.

Each spindle body assembly may then be removed from the axle housing. Note that a thrust bearing is fitted at the lower end of each spindle to carry the upward thrust at this point.

On Row crop tractors having the adjustable axle, remove the three nuts and bolts at each side which will allow the extension bodies to be removed from the axle beam.

*TO REASSEMBLE THE FRONT AXLE

New bushes can be pressed into the axle knuckle if wear is present: the upper bush must have the **blind end** of the oil groove at the top and the open end downwards. A bush having **both ends** of the oil groove open must be fitted at the lower end of the knuckle. Broach the bushes to 1.5005 in. (38.112 mm.) when pressed into the axles, clean out the swarf and the lubricator passages.

Install the thrust washer on the shoulder of the spindle by passing it into position over the splined end. The shrouded part when installed must be towards the splined end.

* See pages 109 and 110.

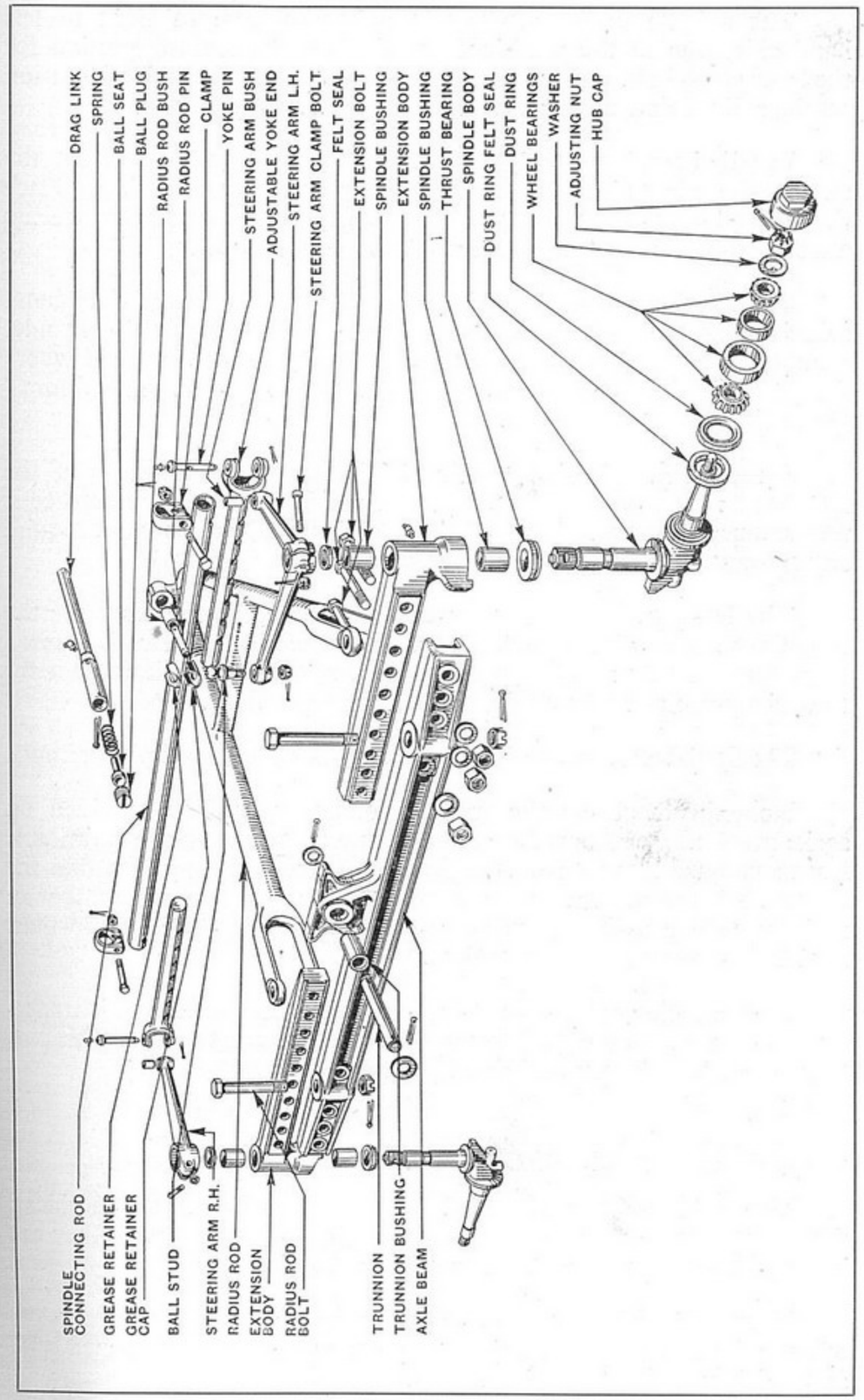


Figure 66 **Exploded View of Row Crop Front Axle**

The spindle bodies are not interchangeable from right to left hand side, due to the machined location on the splined portion for the lever pinch bolt. When offered up into place, this machined location on the splined end must be towards the *front* of the tractor.

Install the spindle body and thrust bearing, taking care that the stop on the spindle is to the rear of the stop on the axle housing. Place the felt seal over the splined end of the spindle and then fit the steering arms so that the register accommodates the felt seal.

The steering arms are not interchangeable, that for the right-hand side having no arm for the drag link as is the case on the left-hand side. Renewable bushes are fitted to each steering arm at the rear end where the yoke pin fits. These must be broached to .5630 in. (14.296 mm.) after being pressed into place.

A removable trunnion bushing is also fitted at the centre of the axle beam: test the fit of the trunnion pin in the bush and replace if undue wear is present. The bush is pre-lubricated and does not require any lubrication during service.

The left-hand steering arm must be fitted with the lever for the drag link parallel with the axle beam. The hole in this lever is tapered to fit the ball stud: the other lever having the parallel hole in it for the yoke pin, must be towards the rear of the tractor.

Firmly tighten the steering arm clamp bolts and split pin the nuts.

No adjustment for the spindle connecting rod is provided on agricultural models, but for row crop tractors having the adjustable front axle, take care to assemble the spindle connecting rod so that the clamp bolts are in corresponding slots each side, i.e., the number of registers visible each side must be the same. Tighten up the bolts after adjustment and pin the nuts.

Fit the radius rod so that the rear radius rod ball location is uppermost and firmly secure the bolts at the front, locking the nuts with pins to prevent them loosening in use.

*STRAIGHTENING FRONT AXLE

Should the front axle or spindle become bent owing to an accident, the parts must be sent to an authorised Fordson dealer where they can be straightened in fixtures designed for the purpose.

In case of emergency, when it is impossible to obtain the services of an authorised Fordson dealer, the parts should be straightened cold, as heating them will affect the steel.

* See pages 109 and 110.

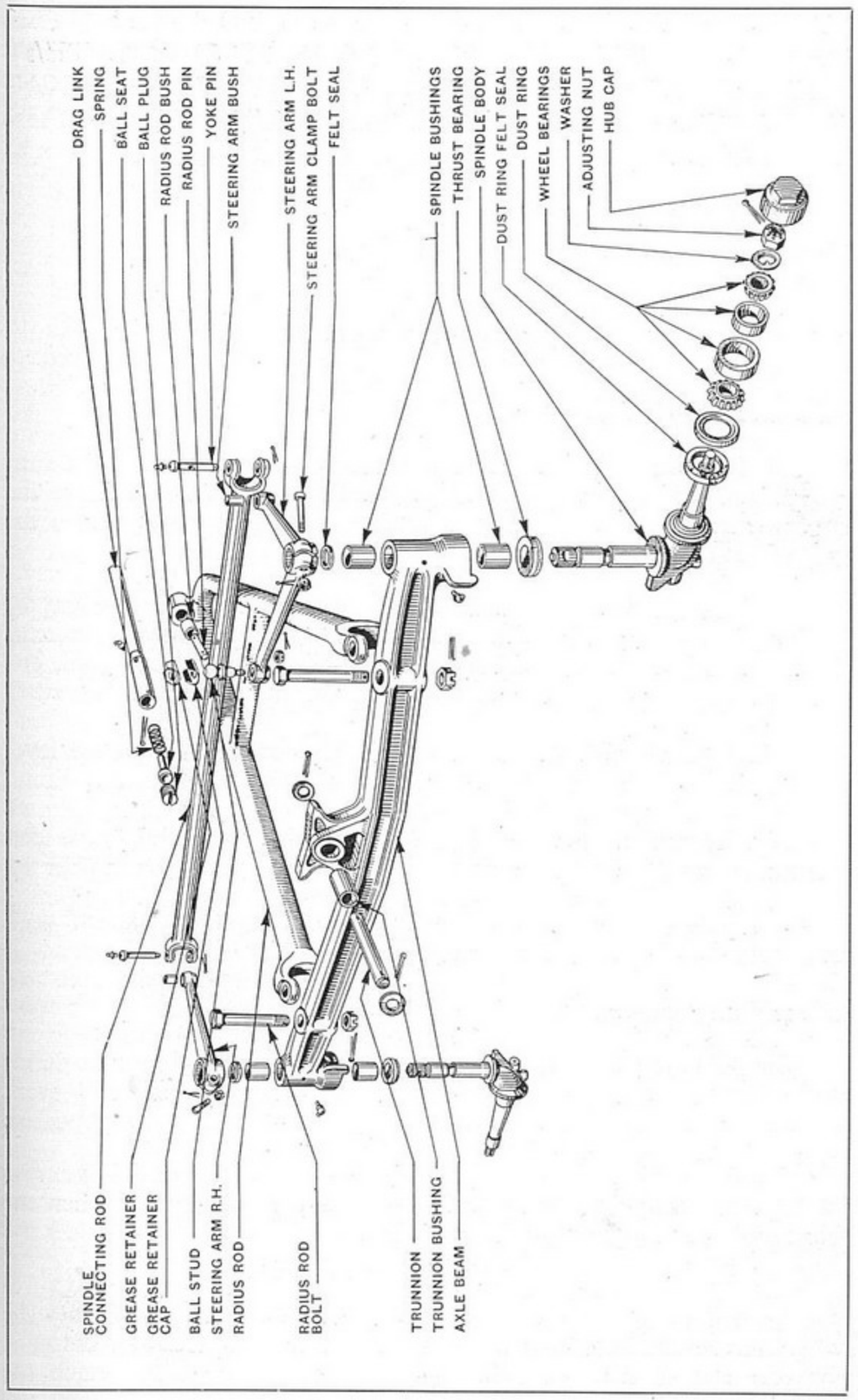


Figure 67
Exploded View of the Agricultural Front Axle

VERY GREAT CARE MUST BE TAKEN TO STRAIGHTEN THE PARTS ACCURATELY AS IT IS ESSENTIAL THAT THE WHEELS LINE UP PROPERLY. IMPROPER ALIGNMENT WILL CAUSE DEFECTIVE STEERING AND STRAIN THE PARTS.

Transmission

*TO REMOVE THE GEARBOX

On Industrial Tractors it will be necessary to disconnect the sub-frame, which is bolted to the rear axle and gearbox, and remove the superstructure together with speedometer drive cable, etc., before the gearbox can be removed.

Drain the oil from the engine, gearbox and rear axle : this may be retained in clean containers if it is satisfactory for re-use after normal filtration. If, however, there is a likelihood of powdered metal, etc. being present the oil from the component affected should be discarded.

Disconnect the clutch control rods from pedal to balance lever and the power take-off control lever rod if this component is fitted.

If a hydraulic power lift is fitted the drive shaft should be disconnected and the lift drive unit removed from the gearbox, see page 89.

It is advisable to undo the rear end of the power take-off shaft and pull this rearwards, free of the splines at the gearbox end, otherwise the shaft may be bent if undue weight is thrown upon it when the rear axle is pulled backwards.

Support the engine beneath the rear of the sump and insert suitable wedges each side of the trunnion mounting of the front axle to prevent the engine moving over sideways when the rear end is disconnected.

Another support for the front end of the rear axle housing will also be required and provision made for lifting away the gearbox when the front and rear flange bolts have been unscrewed.

Undo the bolts around the rear axle and gearbox flanges and carefully pull the axle away from the housing : take care to support the weight to prevent damage to the splined end of the pinion shaft. Support the rear end of the fuel tank under the mounting clip, detach the

* See pages 109 and 110.

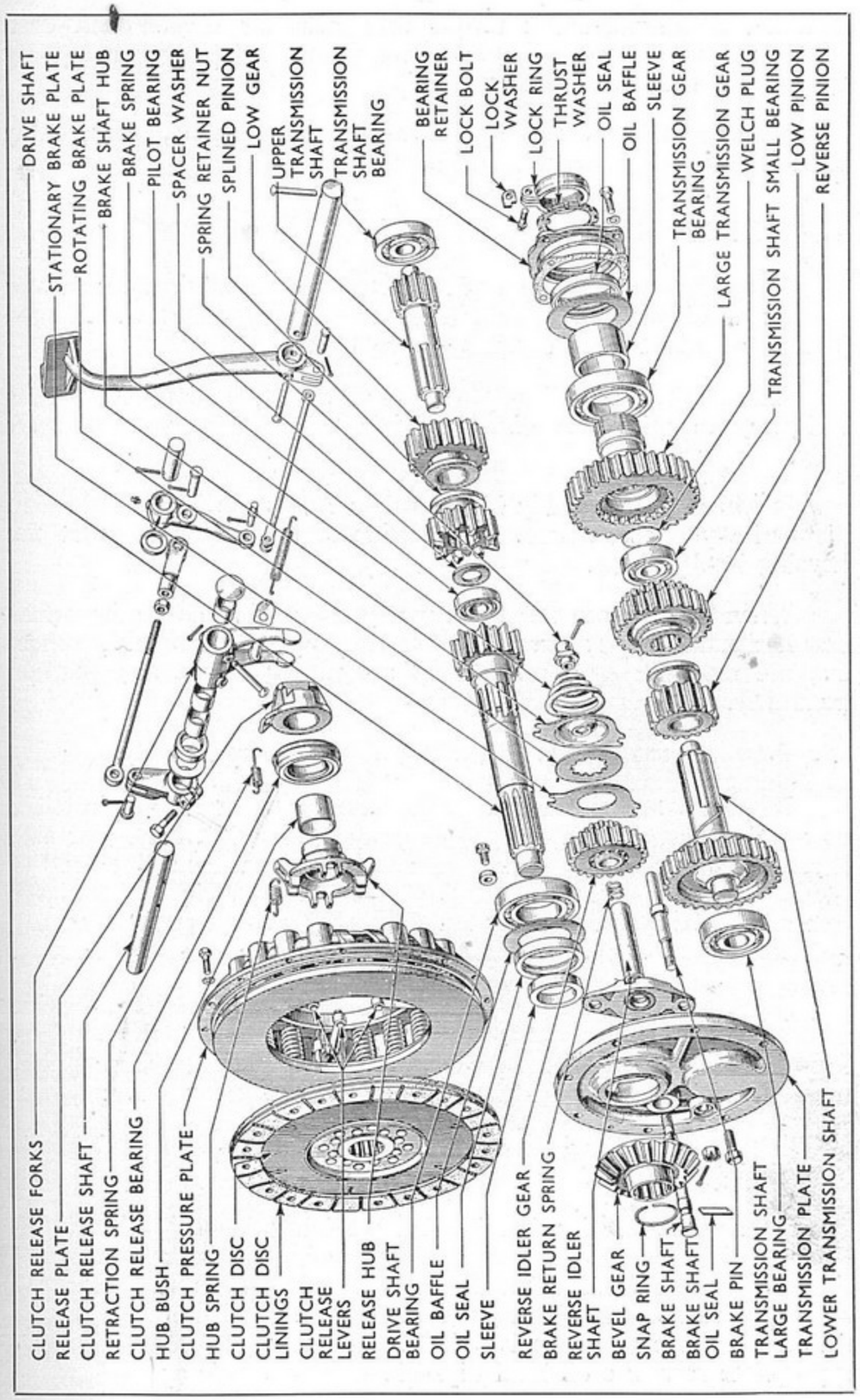


Figure 68
Exploded View of the Clutch and Gear Box

controls, steering gearbox torque arm bolt, air cleaner and dash so that the four bolts may be unscrewed from the steering gear housing bracket and the assembly removed.

Remove the bolts securing the gearbox to the engine, and carefully slide it rearwards, free of the splined drive shaft.

WHEN REASSEMBLING

Clean the mating flanges of the gearbox and engine and fit a new gasket : this is most easily held in place by a smear of grease. A good joint is essential to retain engine oil.

Line up the clutch disc splines so that they are concentric with the ball-race, otherwise the splined end of the drive shaft will not enter fully.

It will help reassembly if two suitable rods are inserted through diametrically opposite holes at each side of the engine to guide the housing into position.

When located, insert first one bolt each side, just above the crank-case horizontal flange : these two bolt holes are smaller than the others and are reamered so as to line up the tractor engine and gearbox accurately.

Once all the bolts are entered, tighten them up securely.

When reassembling the rear axle to the gearbox install a new gasket between the rear flange of the gearbox and the rear axle housing flange : line up the two components so that the splined end of the bevel pinion shaft will enter the corresponding splines of the large transmission gear and carefully draw the two flanges together. It may be necessary to turn the shaft to ensure the splines enter correctly.

Note that the two diagonally opposite holes are reamered to provide accurate alignment and the correct bolts must be used at these points. Viewed from the rear of the tractor, one is at the top left-hand corner, the other at the bottom right-hand corner of the gearbox mating flange.

Bolt the flanges together and refit the power take-off shaft if this has been withdrawn.

Replace the steering housing bracket (note that a bolt having a larger head acts as a breather and must be refitted in the rear left-hand side corner of this bracket) and fuel tank and all controls. Refill the engine, gearbox and rear axle (see note on Page 33 *re* drain plug) with the correct grade of an approved oil. See page 33 for notes on the appropriate rear axle oil level dipstick.

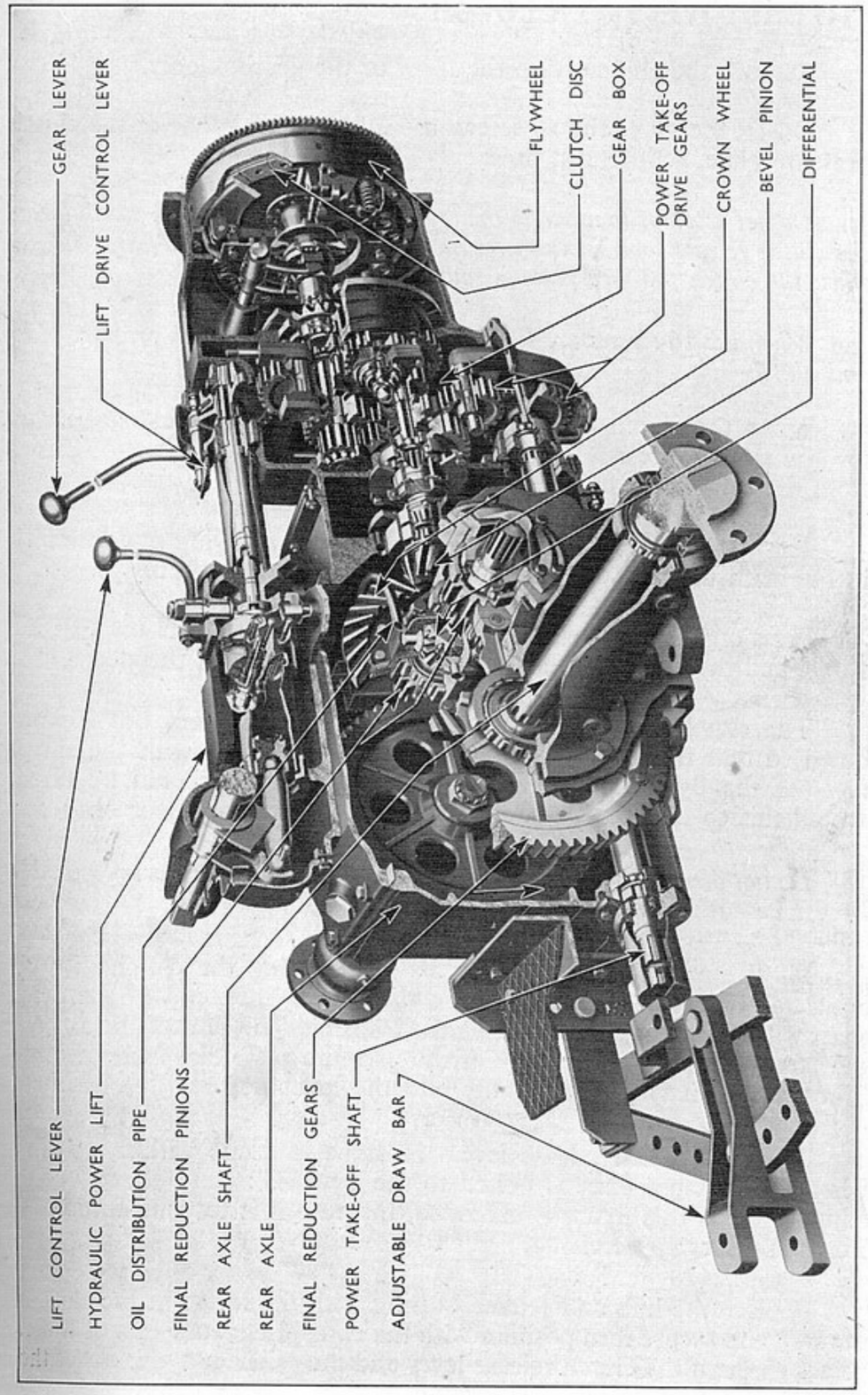


Figure 69 **Cut-away View of the Gearbox and Rear Axle**

*TO REMOVE THE CLUTCH

Remove the engine from the front of the gearbox only.

Unscrew each of the 16 screws around the rear flange of the clutch pressure plate, a little at a time.

Do not attempt to unscrew the four bolts nearer the centre which locate the clutch release levers, otherwise the spring pressure will be fully released when the clutch pressure plate is undone.

When the 16 screws are fully released, remove the clutch pressure plate and clutch disc.

When the clutch is dismantled, inspect the clutch release bearing for any trace of wear. To replace the bearing, detach the two springs from the ears of the hub and remove the unit from the pressure plate.

Support the bearing and press out the hub, applying pressure to it in line with the axis of the bore to avoid distortion or damage.

Press on the new bearing so that the shrouded face is towards the flange and the ground face is to the rear, just proud of the sleeve.

The clutch disc linings must be in good condition, but if worn down so that the rivets are likely to come in contact with the thrust faces of the flywheel or pressure plate, a new disc should be fitted. Install this so that the short shouldered boss is to the flywheel.

Do not dismantle the pressure plate as its subsequent correct reassembly cannot be effected without the proper equipment.

Fit the pressure plate to the flywheel, lining the clutch disc up accurately with the pilot bearing so that the splined end of the drive shaft will enter readily on refitting the transmission. Enter and tighten the 16 screws around the edge of the pressure plate diagonally, a little at a time, so it is pulled equally into the machined register.

The four clutch release levers must be in plane within .020 in., when the pressure plate is bolted to the flywheel: do not attempt to adjust these if this figure is exceeded, but return it to your authorised Fordson dealer for servicing.

Replace the hub and release bearing with the levers in the slots of the hub and secure it in position with the two springs, one end of which passes through the clutch release lever and the other over the ear of the hub.

* See pages 109 and 110.

If the release plate has been removed, refit this so the ear and drilled oil passage is uppermost, i.e., towards the release shaft and secure it against the fork arms by means of the retracting spring.

Refit the gearbox to the engine and replace all controls, etc. Refill with engine oil of an approved grade.

*TO DISMANTLE THE GEARBOX

Separate the engine and gearbox as described on page 156.

Remove the selector housing cover by unscrewing the four bolts which hold it to the gearbox housing on the left-hand side.

Remove the pulley attachment, if fitted, from the right-hand side of the housing by unscrewing the six bolts which hold it in position.

By removing the top cover or the lift drive when fitted, held by seven bolts, the internal parts of the gearbox may be seen and dismantling and reassembly thereby facilitated.

Disconnect the retraction spring from the release plate and slide this off the drive shaft. Remove the cotter and clevis pin from the clutch release lever on the right-hand side of the housing so that the forks may be swung forwards to clear the transmission plate.

Remove the seven bolts holding the transmission plate to the internal flange in the gearbox housing: pull the drive shaft, when the plate, together with the lower transmission shaft, can be removed in one unit, see Fig. 72, after turning the plate *so that the drive shaft is at the bottom.* This will enable it to be removed without taking out the clutch release shaft and fork.

The upper transmission shaft, after the two sliding gears have been pulled off it, may be eased out of the rear ball-race housing.

When a speedometer is fitted, the drive is by skew gears, one formed on the large transmission gear bearing sleeve, the other mounted in a bracket bolted to the rear face of the bearing retainer. The drive may be disconnected by unscrewing the two bottom bolts in the bearing retainer, when the speedometer bracket may be moved aside to allow the gearbox to be further dismantled. Note paragraph below, however.

The Speedometer Drive may be further dismantled if necessary, and it is more convenient to leave the bracket bolted in position at first.

Unscrew the bolt and remove the cable support. See Fig. 70.

* See pages 109 and 110.

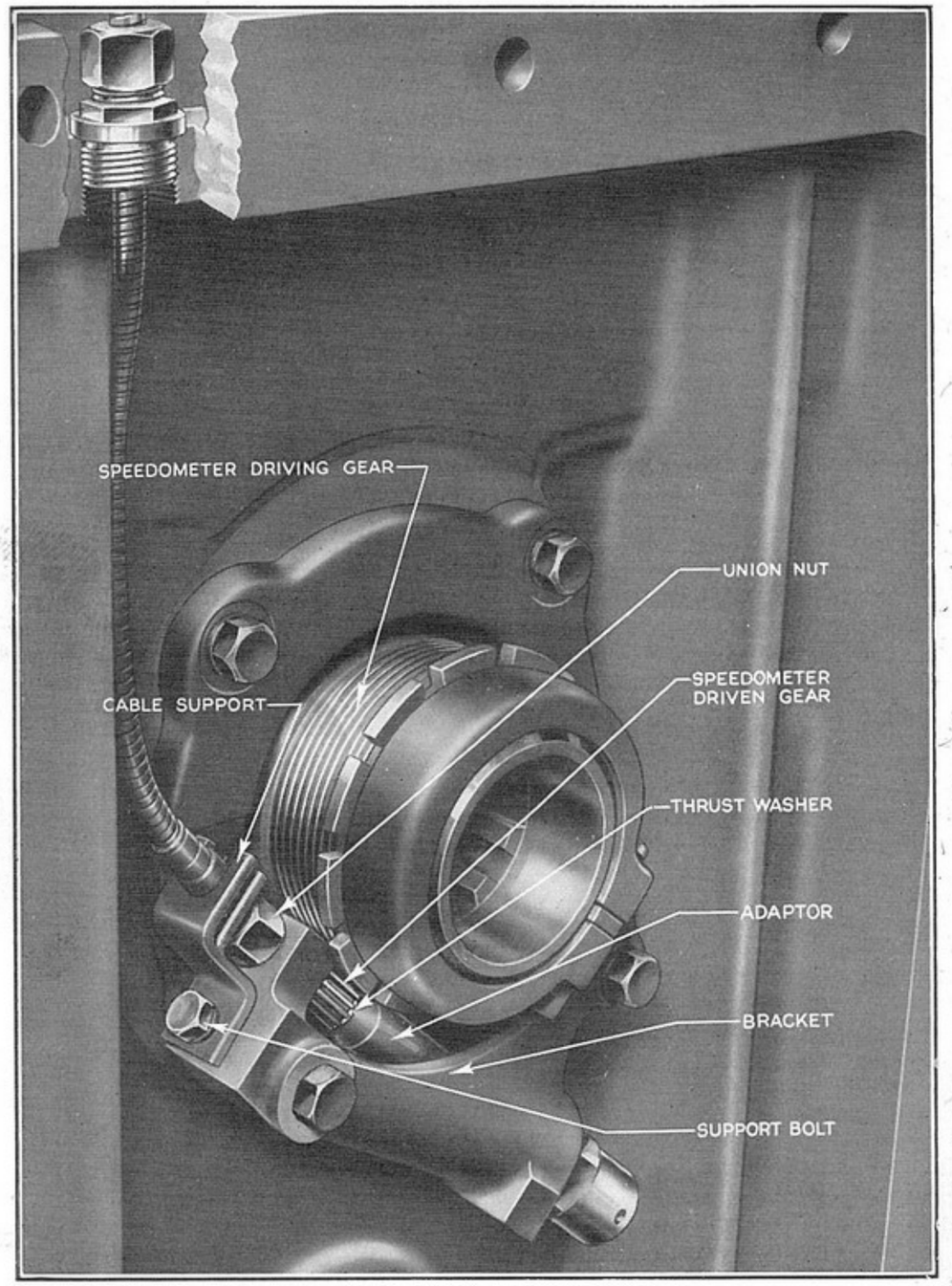


Figure 70

Speedometer Drive Gears

Fully unscrew the union nut which secures the speedometer inner cable to the driven gear and then pull out the cable from the driven shaft. By unscrewing the adaptor from the bracket the driven gear and its shaft can be removed. Do not lose the thin steel thrust washer which is fitted between the lower face of the driven gear and the upper end of the adaptor.

The driving gear is a press fit on its shaft and may be pressed off if necessary. Note that there is a bush in the upper end of the bracket and this forms the bearing for the shaft.

Unscrew the two bolts holding the bracket to the bearing retainer and it is then free to be removed.

The cable can be disconnected by first unscrewing the union nut after which the adaptor nut can be unscrewed from its location at the top left-hand corner of the gearbox housing. The rest of the speedometer cable may then be drawn out of the tapped hole without difficulty.

To remove the large transmission gear remove the split pin and bolt of the locknut and unscrew this from the threaded hub of the large transmission gear. The washer and sleeve may then be removed and the gear pressed forwards out of the bearing housing to facilitate removal of the upper shaft.

Unscrew the four bolts around the bearing retainer flange and after this has been withdrawn rearwards the large transmission gear may be pressed forwards out of its location.

The oil seal is located in the bearing retainer into which it is pressed, whilst an oil baffle is fitted between this seal and the bearing. Take care to keep it in its correct position.

Note that a welch plug is pressed into the large transmission gear location at the boss adjacent to the splines and this must not be removed or damaged as it prevents oil leakage along the shaft splines.

The bearings may be removed from their housings, washed and checked for any trace of wear or the presence of grit or chips of metal which will cause subsequent damage.

Clean out the inside of the gearbox housing and all the internal parts.

Examine the bushes in those gear wheels fitted with them and if they are worn the wheels should be sent to an authorised Fordson dealer who has the special equipment necessary to rebush them correctly.

If the gear teeth are chipped, great care must be taken to remove all loose particles of steel, as these will cause serious damage to the gearbox generally if they are allowed to remain.

When reassembling, if the large transmission gear has been removed, insert a new welch plug if necessary as the gear is below normal oil level at this point and no leakage must occur.

Press the small transmission shaft bearing into the location provided for it in the large transmission gear. After pressing the large bearing for this gear into position from the rear of the gearbox so that it abuts the end face of its housing, insert also the oil baffle, which will be pressed against the bearing by the retainer when replaced.

If a new oil seal is to be used in the bearing retainer, press this into place with the sharp lip of the seal pointing away from the flange of the retainer. Take care when pressing in the oil seal that it is not damaged or distorted, so affecting its oil sealing qualities, and ensure that it is right home in its housing. Then install the retainer, bolting it into position securely.

Push the sleeve into the bearing retainer oil seal so that it is held by the spring-loaded lip of the seal and enters the oil baffle. Hold it in position, at the same time inserting the transmission gear in its bearing from inside the gear box. If a speedometer is fitted, a special sleeve is used, this having skew gear teeth cut on its periphery to impart the drive to the corresponding gear meshing with it. The bearing retainer used in conjunction with it has one bolt hole of larger diameter than the others and this must be positioned so that it is to the bottom and to the left-hand side.

Fit the thrust washer over the threaded end of the gear, engaging its internal tongue with the machined slot and then install and tighten the lock nut until the gear is firmly held in place against the bearing. Lock the ring with the washer which must engage one of the slots of thrust washer, tighten the bolt and lock it with a new cotter pin.

Should the speedometer drive have been dismantled, proceed as follows: install the bracket so that the bushing enters the larger bolt hole in the bearing retainer and also in the bracket. Secure with the bolts originally used.

If the driven gear has been removed from its shaft, first fit the thrust washer on the shouldered end of the shaft and then press on the gear fully, taking care not to nip the washer between shoulder and gear. Install the shaft and gear in the adaptor and lubricate the working surfaces, particularly the threaded end which protrudes above the gear.

Screw the adaptor into the bracket until the shoulder abuts the base of the bracket. Make sure the driven gear meshes correctly with the driving gear when tightening the adaptor.

If the cable has been removed from the gearbox, first insert that end having the brass hexagonal union nut through the tapped hole in the gearbox housing, adjacent to the dipstick location. Then enter and tighten firmly the adaptor nut. After ensuring that there is a felt packing between the union nut and the adaptor, enter the nut on the threads a few turns, at the same time pulling the cable outwards until the stop is felt to abut the adaptor. Tighten the union nut sufficiently to prevent oil leakage past the cable.

Engage the inner cable end with the shaft of the driven gear, enter the nut on the threaded end and tighten it up firmly. Before proceeding further, test the inner cable by twisting the upper end to make sure it is firmly secured to the driven shaft. Assuming this to be in order, fit the cable support bracket so that the large flange on the outer cable, just above the hexagon nut enters the slot between the two parallel forks. Secure the support bracket, cranked end towards the drive gears, with the bolt and lock washer, checking the inner cable afterwards to ensure it is properly aligned with the driven gear shaft.

***To dismantle the transmission plate,** first remove the bevel gear snap ring and remove this gear from the shaft. When the Type 4.3 (Low Speed Top Gear) transmission is used the drive shaft bearing is located by four bolts and washers which hold the outer bearing race in place, these are not used on the Type 7.7 (High Speed Top Gear) transmission and no holes are therefore provided, but it must be clearly understood that these retaining bolts are to be used on the Type 4.3 (Low Speed Top Gear) transmission plate. Remove the transmission brake next, see below.

Undo the locking wire, unscrew the bolts and remove the washers, when fitted: if not already withdrawn, take out the lower transmission shaft.

Place the transmission plate beneath a suitable press and carefully press out the shaft, bringing with it the bearing and sleeve. The oil seal should always be renewed when overhauling the transmission plate and must be pressed out of its location in the housing of the plate.

To remove the shaft bearing and sleeve, support the shaft beneath a press, resting on the bearing as close to the boss of the gear as possible, then apply pressure to the splined end, so pressing this shaft through the bearing and sleeve.

* See pages 109 and 110.

To dismantle the transmission brake (when transmission plate is removed).

Remove the cotter pin from the spring retainer nut and unscrew this nut fully, so freeing the spring, which must be removed together with the brake shaft hub, stationary and revolving plates and return spring. The reverse gear may then be pulled off the shaft, between the gear and the plate being interposed another stationary brake plate.

The brake shaft is a sliding fit in the reverse idler shaft and may be pulled out ; note that an oil seal is fitted on the annular groove of the brake shaft. On the Type 4.3 (Low Speed Top Gear) transmission the idler shaft is machined with a relief to clear the mating gear but no such relief is required on the Type 7.7 (High Speed Top Gear) shaft. Each brake pin used on the Type 4.3 (Low Speed Top Gear) transmission is of different length and is secured by a castellated nut, unlike those of the Type 7.7 (High Speed Top Gear) transmission, both of which are the same length, but these are pressed into the plate without any nuts to locate them.

A distance piece is fitted on the machined boss of the idler shaft mounting pad on Type 4.3 (Low Speed Top Gear) transmissions only.

Examine the brake pins for any ridging and the shaft for wear, replacing if required by pressing them out of the plate.

When reassembling the transmission brake press in the idler shaft, noting that on the Type 4.3 (Low Speed Top Gear) transmission the flat on the shaft must be positioned to clear the teeth of the mating gear. If the pins have been removed, ensure the spacer used with the Type 4.3 (Low Speed Top Gear) transmission is placed on the mounting pad and press in the brake pins.

On the Type 7.7 (High Speed Top Gear) transmission both pins are the same length—press these into position ; on the Type 4.3 (Low Speed Top Gear) transmission install the shorter pin on the drive shaft side and the longer one opposite, using the castellated nuts to secure them, with a new cotter pin to prevent any loosening in service. Replace the reverse gear on the shaft.

Fit a stationary brake plate over the pins to abut the side of the gear and follow this with a revolving plate which must engage the splines of the year. Five revolving plates and seven stationary plates are to be fitted (one stationary plate is fitted, as previously described, between the gear and transmission plate housing or distance piece on Type 4.3 (Low Speed Top Gear)) so that the revolving plates are between the stationary ones.

Fit the oil seal in the annular groove of the brake shaft and install this in the idler shaft : the return spring must be entered on the brake

shaft and the shaft hub pushed on to the squared end, where it will be held by the brake spring and nut. Do not tighten this nut fully at this stage as it must be adjusted when the gearbox is reassembled relative to the hand brake operating cam.

Test the brake by turning the reverse gear : this must be free to turn, rotating with it the brake plates mounted on its hub. Press the brake shaft to test that the brake plates can be brought into contact with one another and that when released the brake shaft returns fully under the action of the return spring to the limit of its travel. This latter point is important as not only must the plates separate fully to avoid undue friction when in the released position, but the shaft must return to the full extent as the handbrake setting is based on this relative position.

Reassembling the Transmission Plate

Press in the oil seal with the sharp lip to the bearing housing and place the shims or oil shields, according to the type of transmission (Type 4.3 (Low Speed Top Gear) or Type 7.7 (High Speed Top Gear)) in the bearing housing.

Make sure the outer race of the pilot bearing is pressed into the drive shaft, then press the shaft bearing into position against its shoulder on the shaft.

Insert the shaft through the transmission plate and press it into place, the bearing being finally positioned against the shims in the bearing housing. On the Type 4.3 (Low Speed Top Gear) transmission, lock the outer race in position with the four bolts and washers, wiring the heads. No bolts are used at this location on the Type 7.7 (High Speed Top Gear) transmission.

Support the plate on the gear end of the shaft and then press the sleeve on to the shaft, so that it enters the oil seal and abuts the bearing. Fit the bevel gear and secure it with a new snap ring. Test the shaft by turning it by hand to ensure it turns freely.

Ensure the face joint is clean, both on the gearbox and the transmission plate, as no leakage must occur at this point when reassembly is completed.

End float of the shafts, both upper and lower, is necessary otherwise when the tractor warms up, due to expansion, undesirable loading may be placed on the bearings.

Shims are used between the bearing and the housing to control end-float of the upper shaft. On Type 4.3 (Low Speed Top Gear) transmissions the width of face is approximately $\frac{3}{4}$ in. (19 mm.) whereas on Type 7.7 (High Speed Top Gear) transmissions the corresponding width is $\frac{7}{16}$ in. (11 mm.).

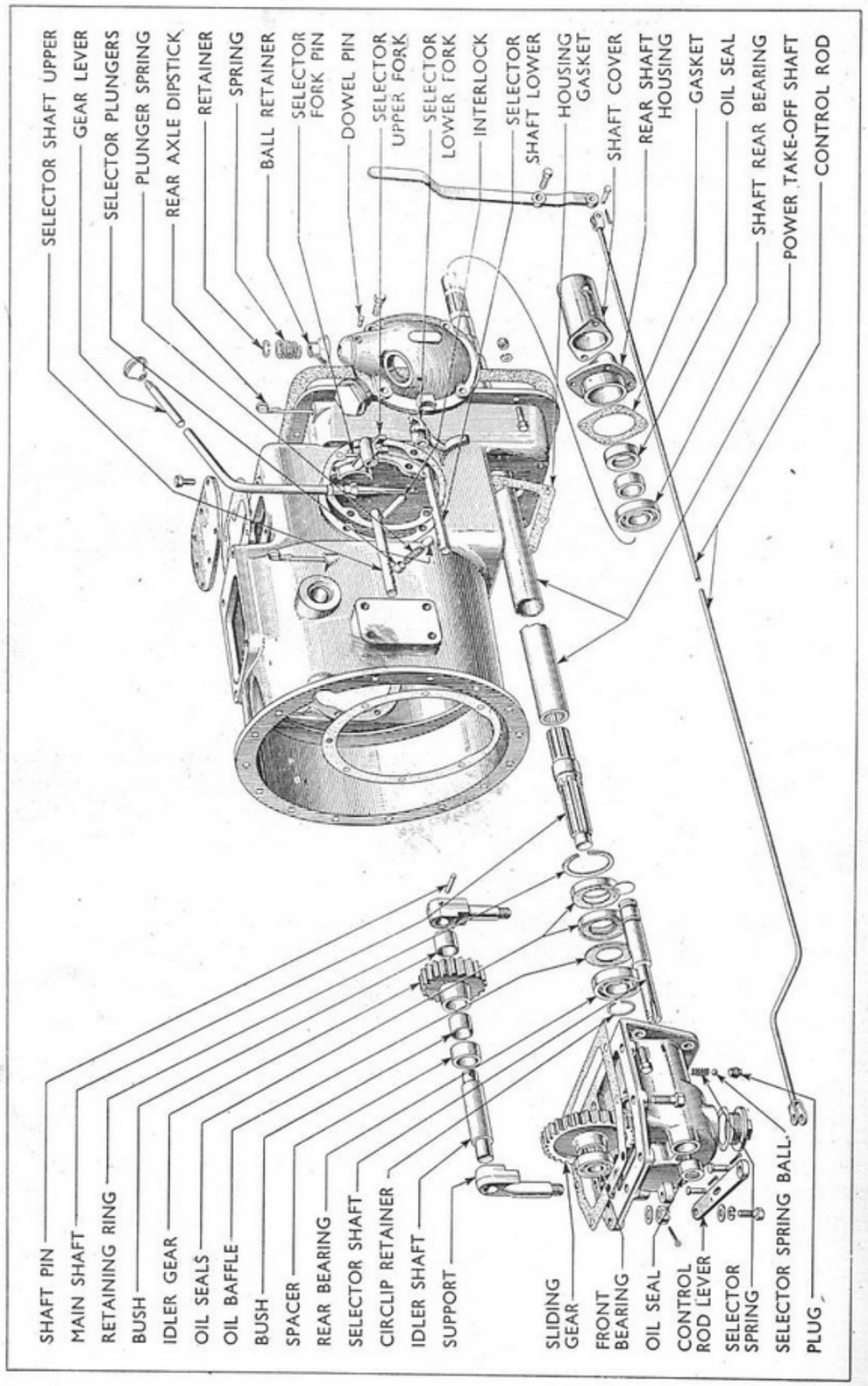


Figure 71
View of Gearbox and Power Take-off

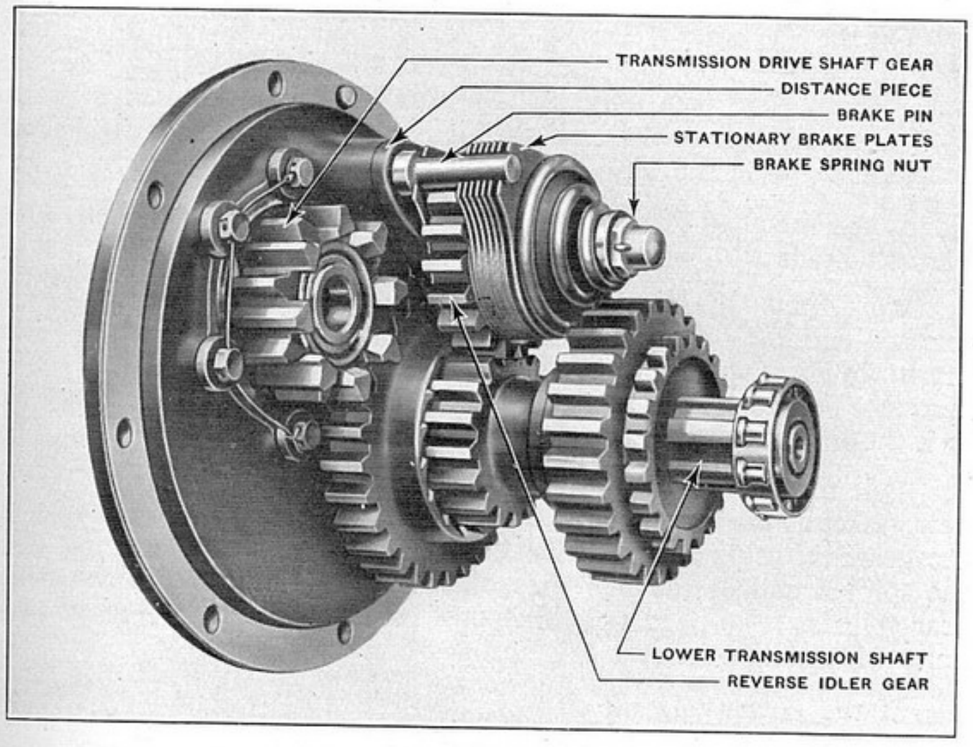


Figure 72
The Transmission Brake

On both Type 4.3 (Low Speed Top Gear) and Type 7.7 (High Speed Top Gear) transmissions the lower shaft must have end-float between .020 in. (.508 mm.) and .055 in. (1.397 mm.). If the minimum float of .020 in. (.508 mm.) does not exist it may be that the bearings have not been pressed fully home in their housings.

When refitting the transmission plate assembly the spacer washer must be fitted on the spigotted end of the upper shaft on the Type 4.3 (Low Speed Top Gear) transmission only. Press the pilot bearing on to the spigotted end of the main shaft, if it has been removed. Note that when the bearing assembly having stepped rollers is fitted the stepped end must be to the mainshaft splines, otherwise it will not enter fully the bearing cup when the transmission plate is refitted.

Bolt up the plate, which must have a gasket fitted to the face joint, and test the end float of the upper shaft. This must be within the following limits :—

.015 in. to .050 in. (.381 mm. to 1.27 mm.) for the Type 4.3 (Low Speed Top Gear) transmission.

.017 in. to .027 in. (.432 mm. to .686 mm.) for the Type 7.7 (High Speed Top Gear) transmission.

On the Type 7.7 (High Speed Top Gear) transmission, if the end float is less than .017 in. (.432 mm.) add a gasket as required at the transmission plate face joint. If the end float is more than .027 in. (.686 mm.) add one or more oil shields between the main shaft bearing and its housing in the transmission plate.

When the shaft adjustment is correct and the bolts are tight, lock the bolt heads with wire to prevent any loosening in service.

***To adjust the hand brake,** ensure the hand brake lever is fully released and the brake shaft is in its fully rearwards position. Turn the brake shaft spring nut as required, to give .010 in. (.254 mm.) clearance between the end and the operating cam finger. When correct, lock the nut with a new cotter pin.

Bolt the gearbox to the engine as described on page 158, using a new gasket at the flange joint. Reassemble the rear axle to the rear of the gearbox, using a new gasket also at this point and ensuring that the splined end of the rear axle pinion enters the large transmission gear splines. See page 158 for details regarding the two reamed bolt holes which align the rear axle and gearbox flanges.

If the power take-off shaft is fitted it will be found of help to remove the rear end first, so that when the rear axle has been reconnected the power take-off shaft may be entered on the splines at the gearbox end. Reconnect the control rod at the front end and refit the rear of the shaft.

When refitting the selector housing, make sure that both gears, on upper and lower shafts, are pressed together so that each selector fork engages the annular groove of both gears.

*TO DISMANTLE THE SELECTOR HOUSING

Punch out the pin in each selector fork, when the shafts are free to be pressed out of the housing. Take care not to lose the plungers, springs or interlock. See Fig. 71.

Remove the gear lever knob by unscrewing it and also remove the retainer at the bottom of the lever, so freeing the spring and ball retainer. The gear lever may then be withdrawn through the housing.

When reassembling, first install the gear lever, ensuring that the dowel pin engages the slot of the ball to prevent the gear lever from turning round.

Place the ball retainer over the top of the lever, followed by the spring which must press it on to the ball face when the retainer is installed in its groove. Refit the knob on the upper end of the gear lever.

* See pages 109 and 110.

When installing the selectors and shafts, assemble the lower one first. The selector ball locations in both shafts must be facing each other, i.e., upwards on the lower selector and downwards on the upper selector. The interlock is fitted at the rear and the two plungers and compression spring at the front end. Secure the selectors with new pins and test the lever before finally rivetting the pins to make sure it will engage correctly either selector and that each will move forwards and backwards, with the plungers engaging the machined locations in the shafts. The interlock device is to prevent both selectors being moved together and consequently engaging two gears.

*TO OVERHAUL THE POWER TAKE-OFF

This is bolted to the bottom of the gearbox and can be dismantled without removing the gearbox, but it will be necessary to drain the oil from both the gearbox and rear axle as the shaft will have to be removed to allow the unit to be detached.

Then unscrew the bolts of the power take-off shaft housing and pull the shaft rearwards clear of the splines. Disconnect the control rod from the lever and undo the bolts (5) in the vertical flange and 7 in the horizontal flange, when the power take-off unit may be withdrawn from the gearbox. See Fig. 71.

To remove the main shaft, detach the retaining ring from its groove in the housing : the end of the shaft is tapped to permit a stud and nut to be used, in conjunction with a suitable sleeve to fit over the bearing housing so that the shaft and its bearing may be extracted. Take care that the sliding gear does not foul the front bearing when this comes out of the housing. Remove it from the shouldered end of the shaft.

With the sliding gear removed from the shaft and the shaft extracted from the power take-off housing, dismantle further as follows :—

Remove the circlip retainer from the shaft which must then be mounted suitably on a press table, testing on the oil seal ; apply pressure to the longer splined end of the shaft which will then be forced out of the bearing, so freeing the seals and oil baffle.

The selector shaft may be removed after unscrewing the plug and so releasing the spring and ball when the shaft is withdrawn.

Disconnect the operating lever clevis and when the welch plug at the rear end has been removed the shaft may be withdrawn rearwards. An oil seal is fitted at the front end of the selector housing.

The idler gear and shaft can be dismantled by removing the nuts from the supports and the supports from the shaft.

* See pages 109 and 110.

When reassembling, note that the idler gear must be free to rotate on its shaft and the shaft supports correctly tightened up : the rear support is drilled for the pin which locates the shaft from endwise movement. The idler gear must be assembled with the longer shoulder towards the front and smaller gear towards the front. On the power take-off used with the Type 4.3 (Low Speed Top Gear) transmission there is a spacer which must be fitted between the idler gear and the front support to take up the end float that would otherwise exist with the single idler gear, see also Page 89. Tighten the support nuts after installing the washers and lock with new split pins.

If the selector shaft has been withdrawn, remove the oil seal as it is liable to damage if any attempt is made to replace the shaft with the seal in place. A new seal should be fitted as there must be no oil leakage at this point. Turn the housing upside down and install the selector spring on the drilled location, followed by the ball. Enter the shaft with the relieved slot in which the gear engages towards the main shaft : press it into position, ensuring that the spring-loaded ball enters its location.

Carefully enter the oil seal on the front end of the shaft so that the sharp, spring-loaded edge is towards the shaft : ensure the slotted end does not damage the seal as it is pushed along the shaft to its location. When driving the seal into position in the housing, use a suitable tool which must bear equally around the outer edge. Attempts to drive in the oil seal with a flat-ended punch will damage the seal and impair its oil-sealing properties.

Fit a new welch plug at the rear end of the housing : it will ensure an oil tight joint if a smear of shellac is applied to the plug and around its location before it is expanded into place.

Replace the square headed plug in the drilled passage for the selector spring and ball.

If the front shaft bearing has been removed, refit the outer race with the flanged end to the blind end of the housing, otherwise the inner bearing will not enter the race.

Press the rear bearing on to the shaft and secure it with a new circlip retainer.

After inserting the front bearing in its bearing cup, insert the shaft in the housing so that the sliding gear may be entered on the splines. Fit the gear so that the wider boss is to the front and then press the shaft into position, guiding the spigot into its bearing and taking care that the sliding gear enters the machined location on the selector shaft. Test the selector mechanism which should move in each direction when the selector ball should be felt to enter the annular groove : the sliding gear must also be carried along the splined shaft by the selector.

When the shaft and bearing are pressed home into the rear housing, install the oil baffle, followed by one oil seal, the spring loaded lip of which must be towards the bearing. Press in the other oil seal with the corresponding lip facing the other way, i.e., towards the short splined end of the shaft. Fit the circlip retainer in the groove adjacent to the oil seal.

Reconnect the operating lever to the selector shaft and, after ensuring the mating faces of the joint flange are clean and a new gasket has been fitted, bolt the power take-off to the gearbox, tightening the bolts equally so that both faces make a good joint. Ensure the gaskets do not overlap the chamfer and so prevent an oil tight joint being made at this point. Gaskets .012 in. (.3 mm.) thick should be used at this point. See also page 90.

Reconnect the control lever.

Replace the power take-off shaft, tighten up the rear bearing housing and refill the gearbox and rear axle with the correct grade of gear oil.

The Rear Axle

To Remove the Rear Wheel.—Apply the handbrake and loosen the nuts with the spanner provided. The nuts are right-hand threaded both sides but on earlier tractors those on the left-hand side have *left-hand threads and must be unscrewed in a clockwise direction.* The nuts are stamped R or L on one hexagon, those marked R unscrewing anti-clockwise and vice versa.

Jack up the axle as shown in Fig. 42, fully unscrew the nuts and carefully withdraw the wheel. Do not let the weight of the wheel rest on the threads of the wheel studs or burrs may be caused, which may make it difficult to retighten the nuts subsequently. Do not lose the coned washers which are fitted between the nuts and the wheel boss.

When replacing the wheel the axle flange and corresponding flange of the wheel must be cleaned to remove any dirt or grit which may be present and, if allowed to remain, might contribute to the wheel loosening under operating conditions.

Install the wheel, suitably positioning it and adjusting the height of the axle so that any possibility of damaging the threads of the wheel studs is removed as the wheel is being positioned.

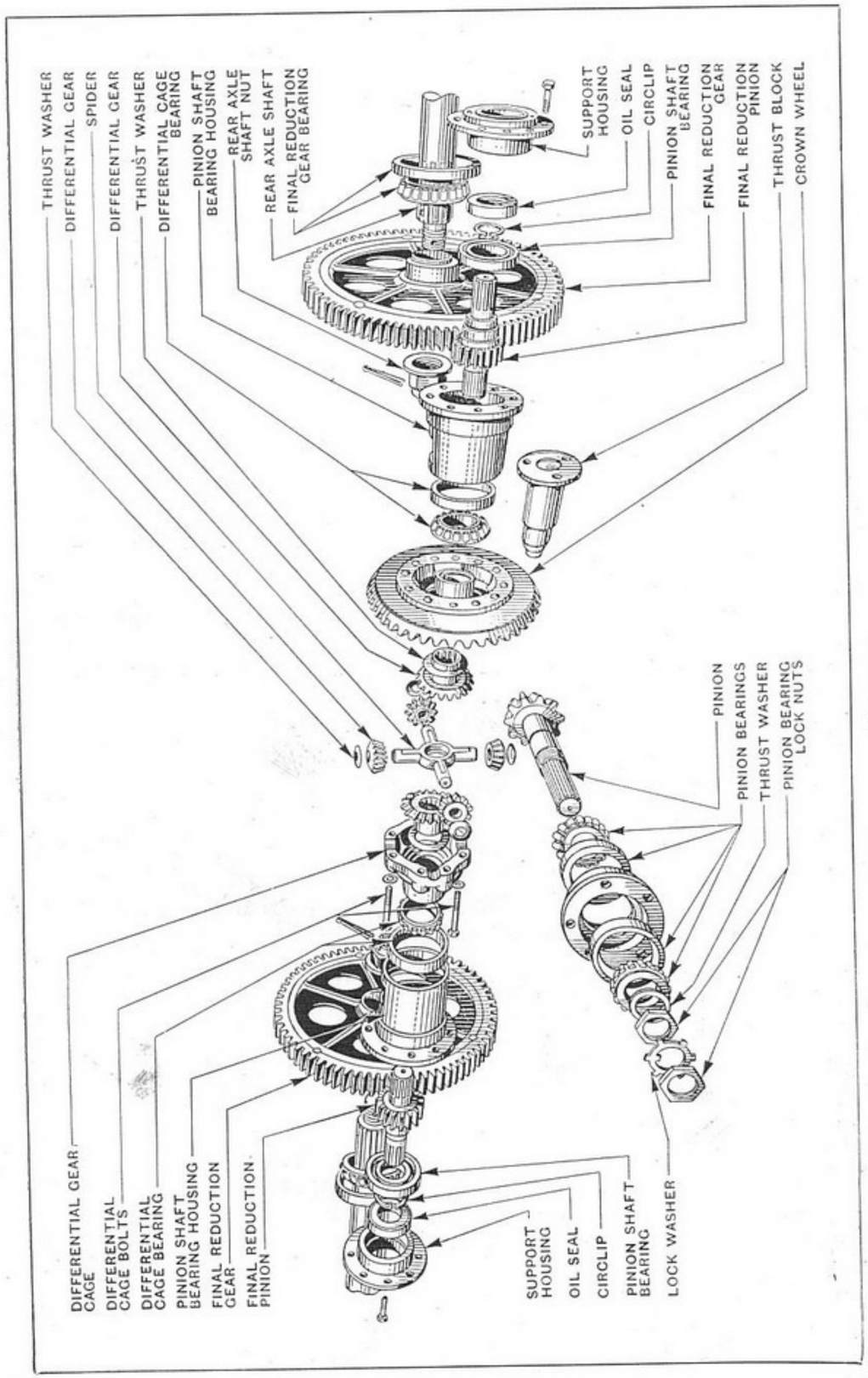


Figure 73
Rear Axle, Exploded View

Place the washers over the studs so that the tapered part enters the countersink of the wheel and then tighten up the wheel nuts diagonally, a little at a time, to ensure the wheel is correctly seated against the axle flange.

*TO FIT A NEW AXLE SHAFT, OIL SEAL, BEARINGS OR GEAR

Jack up the rear axle on the side affected and remove the rear wheel. Remove the top cover of the rear axle housing to which the seat is bolted after carefully cleaning off the dust which might otherwise fall into the housing and cause damage. Drain the oil from the rear axle.

Take out the split pin at the centre of the large reduction gear on the side affected and unscrew the axle shaft nut. The threads are *left-handed* on both sides.

Next prise up the axle shaft outer oil seal at the three points where it has been staked to the groove in the housing and drive it off the housing as far as possible.

The shaft will then be free and may be pulled out of the housing, leaving the large final reduction gear in place. As the inner end of the shaft is splined no undue force should be required to withdraw it provided the outer oil seal has been freed from the housing, but if it cannot readily be removed, careful pressure against the inner ends of both shafts will assist in starting the one from which the nut has been unscrewed.

When the shaft is withdrawn from the axle housing the outer roller bearing must be pulled off the shaft before the oil seal can be removed.

On earlier Tractors note that the inner end of the axle shaft has a threaded stud which may be renewed if necessary since it is not an integral part of the shaft. Punch out the pin, the head of which will be found in the root of one of the splines: the stud can then be unscrewed by using a spanner to engage on the two flats machined on the threaded part near the shaft end. These threads are right-handed in the shaft.

Wheel studs may be replaced with the shaft in position. Left-handed wheel nuts were fitted to the left-hand side and right-hand nuts on the right-hand side of earlier tractors, but current tractors have right-hand nuts on both sides: when installing these take care the cutaway part of the head is towards the machined location which prevents the stud from turning and drive each fully home.

When reassembling the rear axle shaft first enter the oil seal over the splined end of the shaft, the smaller end first, followed by the

* See pages 109 and 110.

flat cork seal. Press on the outer roller bearing, with the taper towards the splined end and ensure that it is right home against the shoulder.

Inspect the outer bearing cup for any signs of wear—it may be withdrawn from the housing in which it is a press fit. If a new cup is to be fitted the taper must be towards the outer end of the housing and it must be pressed in square with the housing, right home to the shoulder it abuts.

The outer cup of the inner bearing adjacent to the large final reduction gear is also pressed into position : if this has to be removed, it must be replaced with the taper towards the reduction gear. Both inner and outer bearing cups must be replaced so they abut the shoulder of their housings.

If the shaft has the detachable stud make sure it is fitted to the inner end of the axle shaft and that the pin which locates it is inserted so that it does not stand proud of the spline on either side, which would prevent the final reduction gear being entered fully on the shaft.

Apply some grease to the bearing, enter the splined end in the housing and position the large reduction gear and shaft so that with the gear and its bearing in the inner housing cup, the shaft splines enter the corresponding splines of the gear hub.

Drive the oil seal fully onto the axle housing with the flat cork gasket pressed firmly into position, so ensuring a good joint. Stake it at three equidistant points around the circumference by driving a tongue of metal into the annular groove of the housing.

Tighten up the nut at the inner end of the shaft to take up all play in the bearings then slack it back approximately one-sixth of a turn. The effort required to rotate the shaft must be measured by means of a torque gauge when the pinion has been withdrawn and the shaft is free to rotate. To remove the pinion, withdraw the oil seal support housing as described below, when the pinion and shaft may be extracted : the end of the shaft is tapped so that a bolt may be used to withdraw it, in conjunction with a suitable sleeve.

With the shaft pulled out sufficiently to permit the large reduction gear to be rotated freely, test the torque required and this should be between the limits of 40 in. lbs. to 45 in. lbs. (46 cm. kg. to 51.75 cm. kg.). When the nut has been tightened to give this figure, secure it with a new cotter pin and replace the pinion shaft and housing.

When the adjustment has been carried out, lock the nut with a new split pin.

Replace the top cover and complete the reassembly, refilling with gear oil to the "High" mark on the dipstick. (See note on page 33 *re* drain plug and level plug.) Lubricate the rear axle bearing through the lubricator by means of the grease gun.

Refit the rear wheel and remove the jack. It is good practice to check the rear wheel nuts after the tractor has been used, after which they should keep tight indefinitely.

*TO REPLACE THE REDUCTION PINION OIL SEAL

If no brakes are fitted, undo the four bolts of the metal cover plate and remove it : if brakes are fitted, first undo the three screws around the edge of the brake drum cover and pull this off. Unscrew fully the bolt in the end of the shaft, retaining the thrust washer and then pull the brake drum off the splined end of the shaft. Unscrew the four bolts which hold the brake plate to the flange, disconnect the brake cable and swing the plate clear of the end of the shaft, so exposing the heads of the six bolts in the oil seal retainer housing. From this point dismantling will be the same irrespective of whether the tractor has brakes or not.

Unscrew these six bolts around the flange and use two longer bolts in diagonally opposite tapped holes to draw the flanges apart. Tighten the two bolts up together so that the housing is extracted equally and does not tend to jam.

The housing will bring with it the oil seal which may then be renewed as required : carefully press in the new seal, so that the spring loaded, sharp edge is nearer the shouldered end which abuts the ball-bearing of the shaft.

An oil baffle is fitted, on later Tractors between the ball bearing and the housing, which has the effect of limiting the oil reaching the spring loaded oil seal. If not already fitted an oil baffle may be installed at this point.

Remove the two bolts which were used to withdraw the flange, clean the faces and replace the housing, taking care that the spring loaded lip of the seal is guided into position. If this is not done, as the housing is bolted up the lip of the seal will foul the shoulder of the shaft and be damaged.

On tractors having brakes, refit the brake plate and reconnect the cable. Place the brake drum on the splines of the shaft and secure it by the bolt and washer at the centre. Adjust the brakes if necessary, see page 182. Replace the brake drum cover and locate it by the three bolts around its circumference.

For tractors without brakes bolt the metal cover to the housing by the four bolts.

* See pages 109 and 110.

*TO DISMANTLE THE REAR AXLE

Drain the oil into a suitable container by unscrewing the drain plug Fig. 69. Raise the rear of the tractor and insert packing beneath the gearbox so that the rear axle housing may be disconnected from the gearbox after the bolts (14) have been removed and the clutch rod disconnected. If the power take-off shaft is fitted, withdraw this from the rear end.

Remove the wheels and axle shafts as described on page 173, lift out the large reduction gears: remove the axle shaft housings if necessary, by unscrewing the eight bolts each side, freeing the mudguards by undoing the two bolts each side.

Take off the two oil seal support housings as described in " To Replace the Reduction Pinion Oil Seal." Remove the oil distributor which is bolted to the left-hand side pinion bearing housing. The pipe bracket is bolted to the right-hand housing with one bolt. Support the differential and draw out each pinion bearing housing by inserting two bolts in the tapped holes provided and screwing these in together, taking care to tighten them equally to obviate any tendency for the housing to jam.

Pull out of its housing each pinion shaft when the crown wheel and differential may be removed as a unit from the axle case.

If shims are fitted between the pinion housings and the axle case, note the quantity each side as a guide when reassembling.

Remove the three screws holding the thrust block to the axle housing on the nearside: note the number of shims fitted between the thrust block flange and the housing.

***To remove the bevel pinion,** this may be withdrawn as a unit, after removing the clutch pedal cross shaft, by unscrewing the six bolts which secure it to the front face of the housing.

***To dismantle the bevel pinion** further, undo the lock nut after the ears of the lock-washer have been bent back and remove the lock nut, lock-washer, adjusting nut, thrust washer and bearing. The bearing is then free to be removed, after which the bevel pinion may be pressed out of the remaining bearing.

The outer bearing cups of the bevel pinion are pressed into their housing and if it is necessary to replace them, they must be extracted from the bevel pinion housing.

***To dismantle the differential,** cut the locking wire and unscrew the six bolts. Before separating the differential cage, make sure the

* See pages 109 and 110.

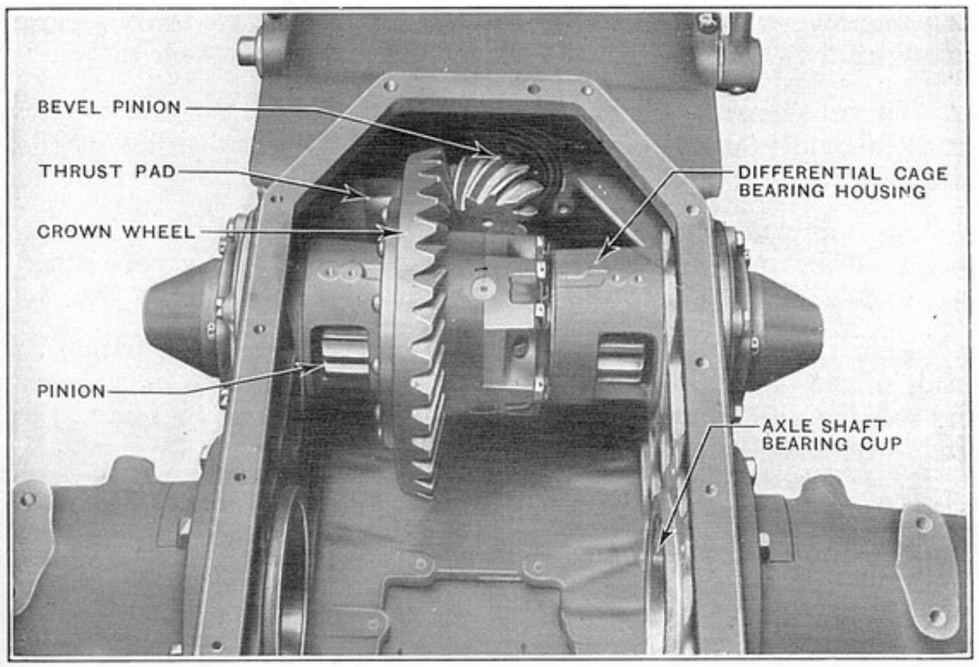


Figure 74
Rear Axle Bevel Gear Drive

two halves are marked—if not, suitably stamp them to ensure correct replacement.

On separating the cage, all parts are available for cleaning and inspection.

Each roller bearing is a press fit on the cage and must be drawn off if renewal is indicated.

The crown wheel is rivetted to the left-hand side differential cage and no attempt should be made to separate these parts.

Thoroughly clean all parts, including the inside of the axle housing. Flush out the oil channel in the front of the housing which feeds oil to the bevel pinion bearings and also the oil distributor, with its feed pipes.

Examine all bearings for signs of wear and clean all flanges so that there is no burr or grit which would prevent a proper joint being made on reassembly.

Early production tractors have a two-piece design large reduction gear and later tractors a single-piece design gear. Attempts should not be made to press the ring gear off the hub on the two-piece gear, as the ring is a shrink fit and the gear is serviced as a complete assembly.

The roller bearings on both type gears are, however, readily replaceable since they are a press fit on the hub.

To reassemble the differential, first enter the thrust washers on the shoulders of the differential gears, which must then be installed in the bearing location in each half of the cage.

Assemble the differential gear pinions on the spider, with their thrust washers on the conical faces and install them in the cage, ensuring that each half of the cage is correctly refitted with the marks together.

Refit the six bolts and tighten them securely : before wiring the heads of the bolts, insert a pinion in the splined location of each gear and test the differential for correct operation. It must be free to turn readily by hand : if correct, wire the bolt heads.

To reassemble the bevel pinion, first press on the bearing of the pinion, noting that the larger side must be to the pinion. Press the outer bearings into the bearing housing so that the wider face of each is to the centre : inspect the hole between these bearings to ensure it is clear. The bearings must be right home against their shoulders or the adjustment will be altered when the tractor is operated.

Fit the bearing housing over the bevel pinion shaft so that the shoulder is to the gear : then fit the remaining bearing over the shaft with the narrower side towards the bearing housing.

Assemble the thrust washer next, followed by the adjusting nut, which should be tightened just enough to draw the bearings together. Install a new lockwasher, with the tongue in the slot and screw on the lock nut.

Adjust the bearings so that an initial loading is placed upon them : this will ensure a rigid assembly and preclude any subsequent loosening up in service.

Test the effort required to rotate the bevel pinion shaft : this must be between 12–16 in. lbs. (13.83—18.45 cm. kg.) when the lock nut is tight.

Replace the bevel pinion bearing housing in the axle, so that the oil passage lines up with that in the axle housing. The uppermost hole is of a smaller diameter than the other five to ensure correct replacement.

Firmly tighten the lock nut and before securing the nuts with the lockwasher, make sure the adjustment has not been altered.

Replacing the crown wheel and differential. If the differential cage bearings have been removed, press on the inner bearings with the wider side towards the cage. The outer bearing cups must be pressed into their housings with the wider side towards the flange.

It is important to ensure that these inner and outer bearings are pressed right home to their shoulders otherwise undue loading will be caused when reassembly is completed.

Replace the crown wheel in the axle case, support it in place temporarily whilst the pinion bearing housings are fitted : when these are pushed home the differential unit will be carried on the outer bearings which are pressed on to the inner end of these housings.

Note that these housings are not interchangeable from side to side. The two small tapped holes in the shoulder must be uppermost and the cut away part to the rear so that the large reduction gears, when replaced, can mesh with the smaller pinions.

Shims of .003 in. (.076 mm.), .005 in. (.127 mm.) and .008 in. (.203 mm.) are fitted between these housings and the axle housing faces, usually .008 in. (.203 mm.) each side. Refit as originally installed, when the crown-wheel and pinion back-lash should be .004 in. to .018 in. (.102 mm. to .457 mm.). If necessary, change shims from one side to the other to obtain this back-lash figure but the **total** shim thickness **at both sides** must not be more than .016 in. (.406 mm.) or less than .013 in. (.33 mm.) if refitting the original bearings.

Install the thrust block and test the clearance between the end pad and the side of the crown wheel. The clearance at this point should not be less than .004 in. (.102 mm.) or more than .014 in. (.356 mm.).

Adjustment may be effected by adding or removing shims between the mating flange faces.

The bronze pad may be removed if required : extract the welch plug and then, by suitably supporting the thrust pad, the securing rivet may be driven out by passing a suitable punch through the body of the block to bear against the rivet.

When a new pad has been inserted and secured with a rivet, carefully fit a new welch plug so that no oil leakage can occur at this point.

Refit the oil distributor which is held on the left-hand side pinion shaft housing by two bolts and on the right-hand housing by one bolt. Ensure that the oil feed pipes have not been displaced. An oil feed is supplied by the pipes to the differential, left-hand side differential bearing and the trough which supplies the bevel pinion bearings. Adjust the oil deflector so that it is just clear of the side of the crown wheel.

To reassemble the pinion shafts, first press on the bearing, if this has been removed, making sure it is fitted to that side of the pinion shaft which has the circlip retainer groove machined in it.

Install the circlip retainer when the bearing has been fitted and place the shorter, splined end in the housing, pressing it in carefully so that

the bearing enters the housing and the splines enter the differential gear.

Refit the oil seal housing and baffle as described on page 177.

If the bearing has been removed from the boss of the large reduction gear, press on the bearing with the wider side to the gear, and then fit the gear in the housing so that the teeth mesh with those of the small pinion and the bearing enters the outer bearing which is pressed into the axle shaft housing.

If the axle shaft housings have been removed make sure these are replaced with the lubricator for the rear wheel bearing facing horizontally to the rear as illustrated in Fig. 41.

The axle shaft bearing cups are pressed into the axle housing and if these are replaced they must be fitted so that the wider sides of the bearings are towards each other.

A gasket is used each side between the axle shaft housing flange and the rear axle housing.

Adjust the axle shaft bearing preload as described on page 176, locking the nut when the correct adjustment has been obtained.

Complete the reassembly and make sure that the axle housing is filled with oil of the correct grade to the HIGH mark on the dipstick.

Row Crop Brake Adjustment

Adjustment for brake shoe lining wear is provided and any adjustment required can readily be made.

Loosen the fly-nut, see Fig. 75, and raise the hinged brake adjustment cover which discloses the expander inside the drum. It may be necessary to turn the brake drum to bring the aperture in its side into register with the cover plate before the expander will be visible. This expander is interposed between the brake shoe ends and by means of right and left-hand threaded studs expands the shoes when rotated.

It is provided with horizontal projections and these permit a screwdriver to be used to turn it by resting the blade on the bottom of the aperture in the drum, pressing the end of the blade against the projections and moving the handle downwards. The expander will move in a series of " clicks." Moving the projections upwards expands the shoes and so allows normal lining wear to be taken up without any dismantling.

Rotate the expander until the shoes touch the brake drum, then release them until they are just free of the drum by moving the expander in the opposite direction, i.e., downwards for approximately 8 " clicks." Test for free operation in the released position before closing the cover.

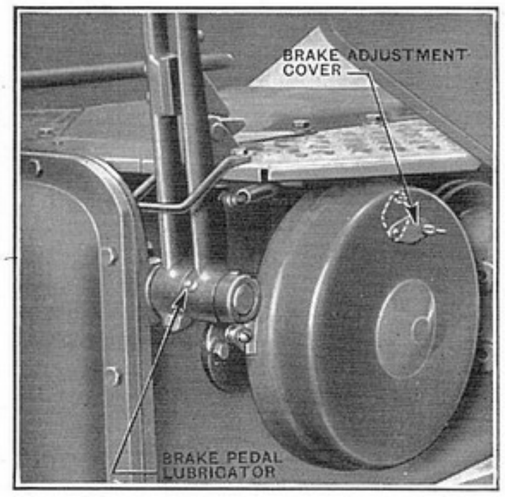


Figure 75
Brake Drum Cover Plate

After approximately every fourth adjustment for normal lining wear, loosen the centraliser nut to ensure that it can take up its normal position in the elongated hole in the brake plate. Tighten the nut after the shoes have been correctly adjusted. This nut is on the back of the brake plate behind the centraliser spring, see Fig. 76.

The centralizer nut and spring are not fitted on later Tractors.

Rotate the expander until the shoes touch the brake drum, then release them until they are just free of the drum by moving the expander in the opposite direction, i.e., downwards for approximately 8 " clicks." Test for free operation in the released position before closing the cover.

***To dismantle the brake shoes** remove the three screws at the circumference of the brake drum cover and withdraw the cover.

Undo the screw at the centre of the brake drum, retaining the thrust washer beneath its head and pull the drum off the splined end of the pinion shaft.

Disconnect the brake shoe retraction springs, when the shoes may be removed after the steady springs at the middle of the shoes have been released. Do not lose the spring caps fitted to the other end of these springs behind the brake plate.

When reassembling, each shoe is interchangeable, but the pull-off springs are not, and the satisfactory operation of the brakes depends on their correct replacement. Note that there are four different springs, apart from the two steady springs, as below :—

1. Operating lever return spring, which is black and of less tension than the others.
2. Primary shoe spring, black.
3. Secondary shoe spring, red.
4. Retraction spring for adjusting screw end. This is red also but has double cranked ends.

* See pages 109 and 110.

The table below gives the essential details concerning these springs and will be of help in cases where there is doubt as to their condition, since they may have become distorted or weakened in use.

Type of Spring.	Overall free length.		Retraction Tension in position.	
	ins.	mm.	lbs.	kg.
Red spring for Secondary Shoe.	4	101.6	50–56	22.68–25.4
Black spring for Primary Shoe	$2\frac{31}{32}$	75.4	22–28	9.98–12.7
Retraction spring for Adjusting Screw End.	$3\frac{15}{64}$	94	14–18	6.35–8.17

Before replacing the brake shoes ensure that the centraliser spring, fitted on earlier Tractors, is free to move when the nut is released: this centraliser spring slot in the housing plate is approximately parallel with the expander. The anchor pin must similarly be free to move in its slot when the nut is loosened, the slot in the housing plate in this case being approximately at right angles to the expander, at the bottom of the plate.

Apply a spot of grease to the three raised projections on which each shoe rests: check the expander for correct operation, screwing in each expander adjusting screw an equal amount. Test the cam lever and cam operating lever for free operation and apply a small quantity of oil to their working surfaces.

Fit the cam operating lever with the hooked end to the same side as the cable location so that the cable will run directly to it.

The return spring lever arm must be fitted over the cam operating lever so that the hooked end is opposite: the lug must be resting on the upper face of the cam operating lever. Note that in replacing the anchor pin the longer flanges adjacent to the brake shoes must be horizontal and between the operating cam fingers. Locate the anchor pin temporarily by the plain thrust washer, lockwasher and nut.

Assemble the shoes on the brake plate: if the expander has been removed make sure that the adjusting studs are equally screwed into it and that each engages that end of the brake shoe having the corresponding register. The semi-circular register fits around the anchor pin.

Position the expander so that the flange is between the centraliser spring ends.

Fit the shoe hold-down spring at the centre of the shoe, taking care not to lose the retainer caps fitted behind the plate.

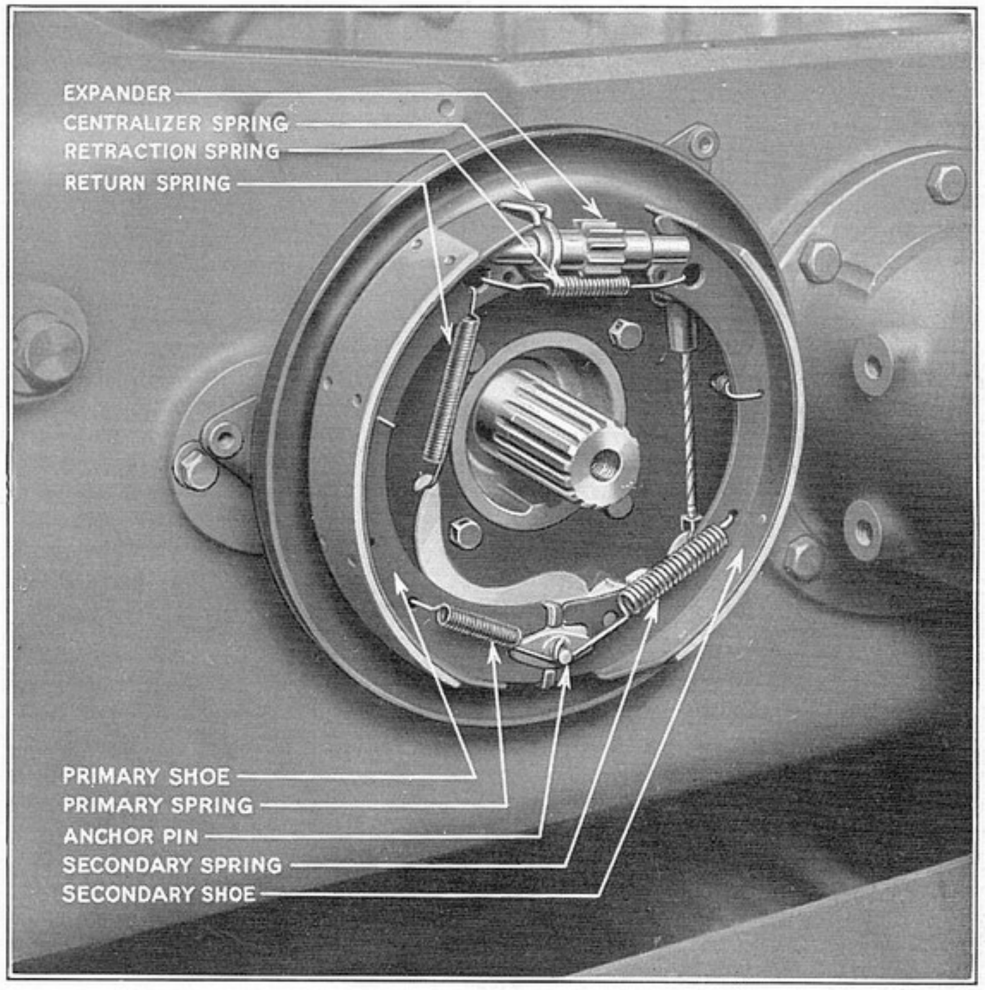


Figure 76
Brake Shoes and Plate

Hook the red retraction spring having the cranked ends across the brake shoes at the expander end: the spring abuts the serrations of the expander to prevent it loosening in service.

The black primary spring is fitted to the front brake shoe on both left and right-hand sides of the tractor. Fit this spring with the shorter end in the middle hole of the three holes in the brake shoe and the longer end on the anchor pin.

The red, secondary spring must be fitted to the other shoe, with the shorter end in the third of the three holes, nearest the centre. Hook the longer end of the spring on the anchor pin.

Reconnect the operating lever return spring: one end engages the hooked end of the lever, the other fits in the hole at the expander end of the brake shoe.

Reconnect the brake operating cable and test by operating the brake pedal to ensure that the shoes are working correctly.

Examine for any traces of oil leakage and, if it is necessary to do so, a new oil seal and baffle may be fitted to the pinion shaft housing as described on page 177.

Refit the brake drum and cover, adjusting as described on page 182.

To adjust the anchor pin and centralizer spring (centralizer spring not fitted to later production tractors), expand the shoes tightly in the drum, loosen the anchor pin nut and centralizer spring nut which are behind the brake plate at the bottom and top respectively.

This should permit them to take up the positions on the brake housing plate in their working position. If necessary, tap them to assist them moving into place.

Firmly tighten the anchor pin nut—the centralizer spring nut being of much smaller diameter must not be overtightened.

Slacken off the expander and check the shoe to brake drum clearance at each end of the secondary shoe. A slot is provided in the drum to permit a feeler gauge to be inserted. A feeler gauge of .008 in. (.203 mm.) thickness should enter at the expander end and at the anchor pin end. The clearance should be the same, i.e., .008 in. (.203 mm.) at the centre of the primary shoe.

***To adjust the cables or fit new cables,** remove the clevis pin from the brake pedal lever and remove the clevis and locknut.

Loosen the clamp bolt from the cable abutment bracket above the brake drum.

Remove the brake drum as described on page 183, then unscrew the four bolts shown in Fig. 76 which will allow the brake plate to be removed. Remove the bolt from the cable conduit bracket on the brake plate, unhook the cable from the operating lever, when the cable may be pulled out from the brake plate and also the bracket abutment.

Fit a new cable in the reverse order to that described above, but ensure that, at this stage, the cable conduit bracket is correctly seated in the brake plate and that the bolt is entered *but not tightened.* Do not replace the brake plate till the cable has been tensioned.

Refit the brake plate, locking the four securing bolts with wire when tightened.

Fit the cable at the abutment bracket, with the lubricator uppermost, leaving the clamp bolt loose and expand the shoes in the drum so they are tightly pressed against it. Apply a tension to the end, when

* See pages 109 and 110.

the locknut and clevis have been fitted, of 200 lbs. (90.75 kg.) This pull is to be applied *three times* so that the conduit will be seated correctly in its abutment brackets.

Tighten the bolt at the brake plate and the clamp bolt of the abutment bracket when this pull is placed on the cable.

Reconnect the clevis to the brake pedal when the shoes have been expanded in the drum, applying a tension of 25 lbs. (11.34 kg.) to the cable end and adjust the clevis so that the hole is opposite that in the end of the brake lever when it is in its fully released position.

The final adjustment of the cable to the brake lever must be made when the pedal is right back against the floor plate. If the plate has been removed, replace it and tighten it down otherwise there may be either lost motion or, on the other hand, the brakes may not be fully released if the floor plate is refitted after the cables have been adjusted.

Insert the clevis pin, insert a new split pin and tighten the locknuts: release the expander approximately eight " clicks " to ensure there is sufficient clearance between shoes and drum. Refit the retraction springs on the clevis pins each side, a small annular groove being provided on the extension of the pin so the spring may be correctly secured.

The Industrial Tractor Braking System

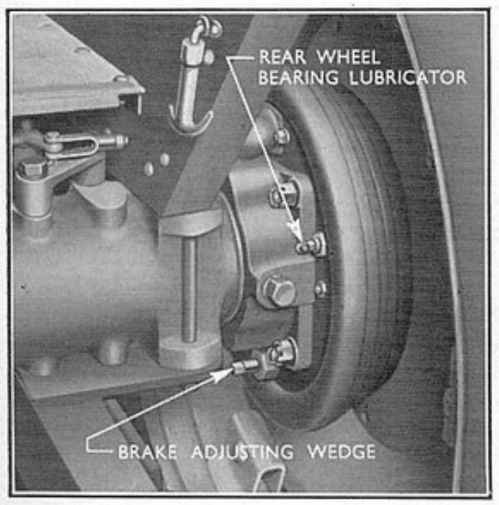


Figure 77
Industrial Tractor Brake Adjustment

The foot brake pedal operates internal expanding brake shoes within a 14 inch drum mounted on each rear axle shaft, whilst the hand brake is of the multi-plate type, running in oil and driven by the reverse idler gear.

Hand brake lever adjustment should seldom be required, as there is a catch to prevent it from being applied except when the clutch pedal is depressed, whilst the plates operate in oil and so should give long service. See page 170 for instructions as to adjustment.

To adjust the foot brake for lining wear turn the adjusting wedge, see Fig. 77, in a clockwise direction, at the same time tapping the drum with a small spanner. As the shoes are expanded and touch the drum it will no longer emit a clear ringing sound; unscrew the adjuster carefully until the shoes are just clear of the drum and which, when tapped, gives a clear ring. Set each brake drum as above, testing the pedal travel to ensure it is not excessive.

To adjust the foot brake pedal linkage.

Undue pedal travel, assuming the brake shoes are correctly adjusted, may be caused by incorrect adjustment of the operating rods, and the linkage should be set as follows: fully expand the shoes in their drums by means of the adjusting wedge and leave each adjusting wedge on the " high spot " i.e., between the positions where the wedge is felt to enter one of a series of notches in its circumference.

With the foot brake lever in the fully released position, touching the front edge of the floor plate, and with the bell crank lever to foot brake rod disconnected, check the alignment of the holes in the clevis with the hole in the bell crank lever, applying sufficient tension to the brake operating rod to take up lost motion. If they are not in line, adjust the clevis until it lines up correctly and the pin can be inserted. Fit a new cotter and tighten up the lock nut at each side of the tractor securely after the adjustment has been completed. Release the brake adjusting wedge, adjusting as described above.

To remove the brake drum, jack up the rear wheel clear of the ground, undo the nuts as described on page 81. When the wheel is removed, six nuts will be found adjacent to the rear axle flange and on unscrewing these the brake drum may be pulled off the shaft.

When replacing the brake drum, carefully clean the mounting flange and studs at the axle shaft and the mating flange in the brake drum. Any foreign matter or grit, etc., could throw the drum out of truth and so contribute to uneven braking.

Fit the spring washers and nuts to the studs holding the brake drum in position and tighten them a little at a time and diagonally across the drum, to ensure it seats correctly.

To replace the brake shoes, remove the brake drum as described above and draw each shoe out of its mounting, top and bottom. By allowing the shoes then to take up a position between the drum flange and the brake plate, the spring tension will be released sufficiently to enable each spring to be detached, so freeing the shoes.

When the shoes have been removed, note that the upper expander links cannot move out of position because a cotter pin limits their travel. The lower adjuster links are not interchangeable from front to rear shoe and must, if they have been removed, be fitted so that when the slot into which the brake shoe fits is held vertical, the bevelled edge must be in line with the corresponding grooves of the adjusting wedge.

Refit the brake shoes, noting that the retraction springs at the top and bottom must be between the brake shoe web and back plate. If fitted on the other side, i.e., between the brake shoe and drum flange, interference with the back of this flange will result.

After assembling the brake shoes so that they engage the slots of the links, making sure the springs are properly positioned, refit the brake drum.

Whenever new shoes or linings are fitted, the abutment stops should be set. The abutment stops are screwed into the brake plate, with a locknut to prevent the adjustment from altering and are so positioned that the end bears against the centre of the shoe web and acts as a steady rest. Adjust by fully expanding the shoes in the drum, loosen the locknut and screw in the abutment stop unit until it is felt to touch the shoe web. If it is already abutting the shoe, unscrew it, release the brakes and then apply them again. This will allow them to take up their normal position in the drum. When the abutment stop has been set as described above, tighten the locknut securely.

Hydraulic Power Lift Attachment

Provided that the hydraulic power lift is kept topped up with clean oil of the correct grade then it will give long service without attention.

In the event of the lift being sluggish in operation it may be due either to the use of an incorrect grade of oil or choked filters.

To Clean the Oil Filter

Single lever type.

To drain the oil, remove the bottom screw holding the rear cover in position.

Remove the screws holding the left-hand cover in position and remove the cover. The filter can then be drawn away from the impeller housing and washed in petrol or paraffin.

Refit the filter, side cover and drain plug.

Clean round the filler plug on the top of the rear cover and remove it. Refill to the level of the filler plug orifice with fresh winter grade (S.A.E. 20) engine oil using a No. 60 mesh filter to prevent any foreign matter entering the casing. The oil capacity is 2 gallons (9.09 litres).

Two lever type.

To drain the oil, remove the drain plug on the right-hand side of the lift casing.

Remove the screws holding the rear cover in position when the oil filter, situated below the ram cylinder can be removed.

Clean the filter in paraffin or petrol.

Replace the filter, ensuring that it is properly connected to the suction pipe.

Refit the rear cover plate and replace the drain plug.

Clean round the oil filler plug on top of the lift casing and remove it. Refill the lift casing to the level of the filler plug orifice or up to the level mark on the dipstick on later units with fresh oil of the correct grade, which is available from your dealer under Part Number M–100502–C, see page 94, using a No. 60 mesh filter to prevent any foreign matter entering the casing. The oil capacity is 7 pints (4 litres).

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