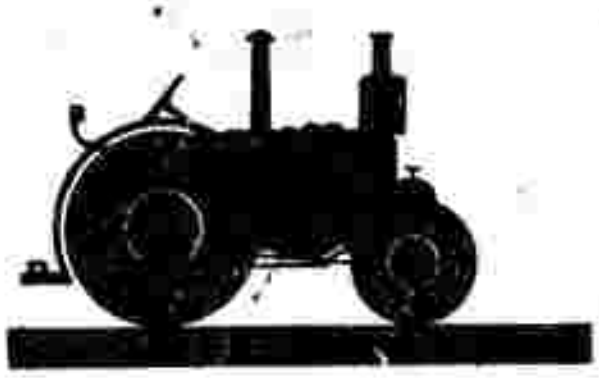
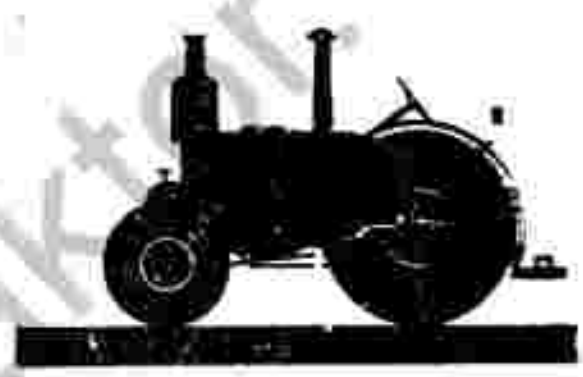
K.L. TRACTORS

LIMITED





INSTRUCTIONS FOR
OPERATING & MAINTAINING

THE

K. L. BULLDOG

CRUDE OIL TRACTOR

INSTRUCTION BOOK

for

K. L. BULLDOG

CRUDE OIL TRACTOR

The strict observance of the contents of this instruction book will assure the owner of long and satisfactory service from the K. L. Bulldog Tractor.

It is therefore imperative that the tractor owner or operator should become thoroughly acquainted with the construction, operation and maintenance of the tractor by carefully following these instructions and recommendations.

ISSUED BY

K.L. TRACTORS LTD.
SPRINGVALE
VICTORIA, AUSTRALIA

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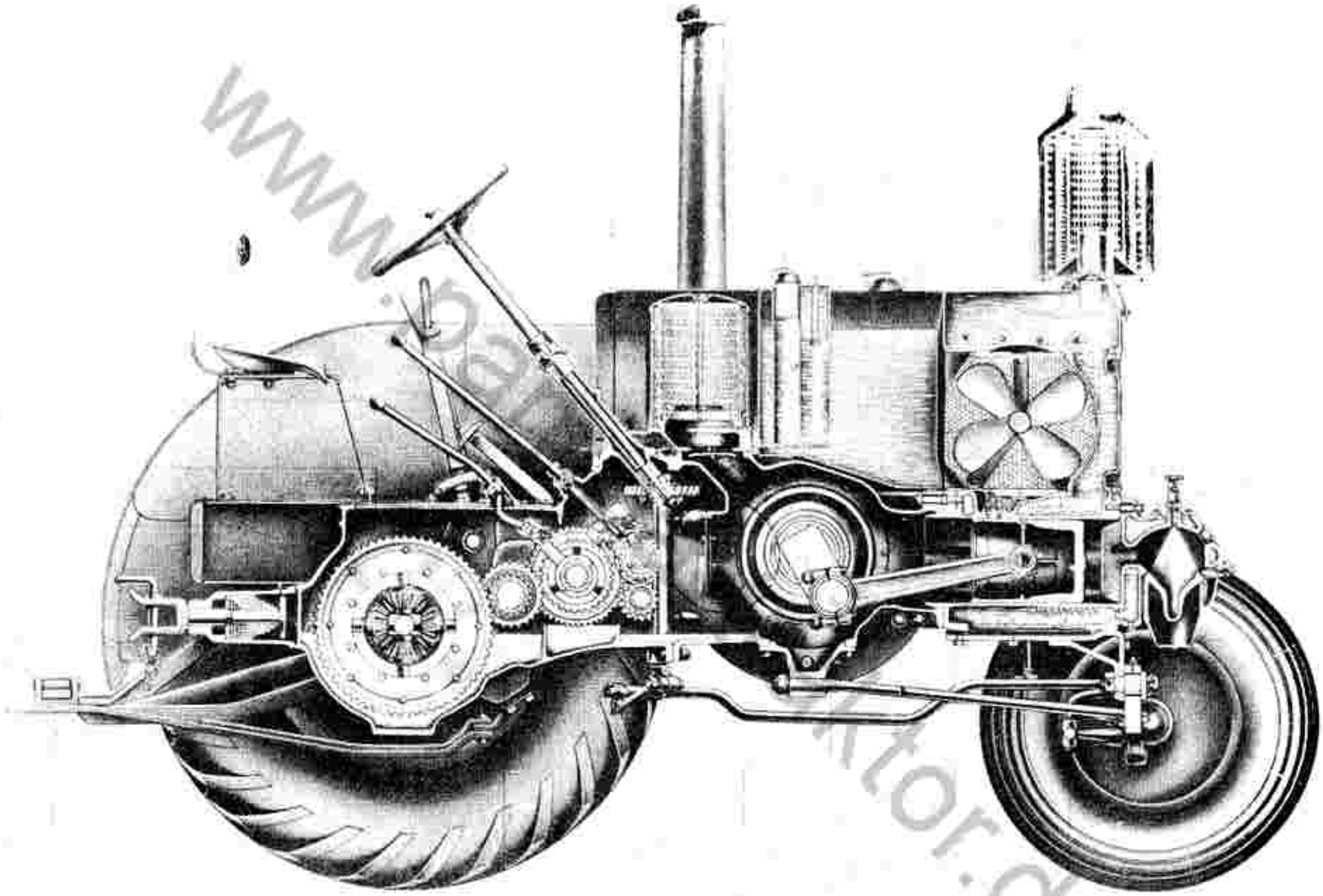

Fig. 1.

(1) Sprung haulage hitch.
(2) Tool box.
(3) Inspection plate.
(4) Secondary gear lever.
(5) Primary gear lever.
(6) Brake lever.
(7) Clutch pedal.
(8) Air cleaner.
(9) Oil container.
(10) Return oil filter.
(11) Fuel tank.
(12) Silencer.
(13) Cooling water header tank.
(14) Radiator units.
(15) Cylinder head.
(16) Atomizer.
(17) Safety plug.
(18) Hot bulb.
(19) Front axle beam.
(20) Engine motor.
(21) Crank shaft.
(22) Transmission gear box.
(23) Swinging chain bar.

SECTION I.

DESCRIPTION & ACTION OF ENGINE

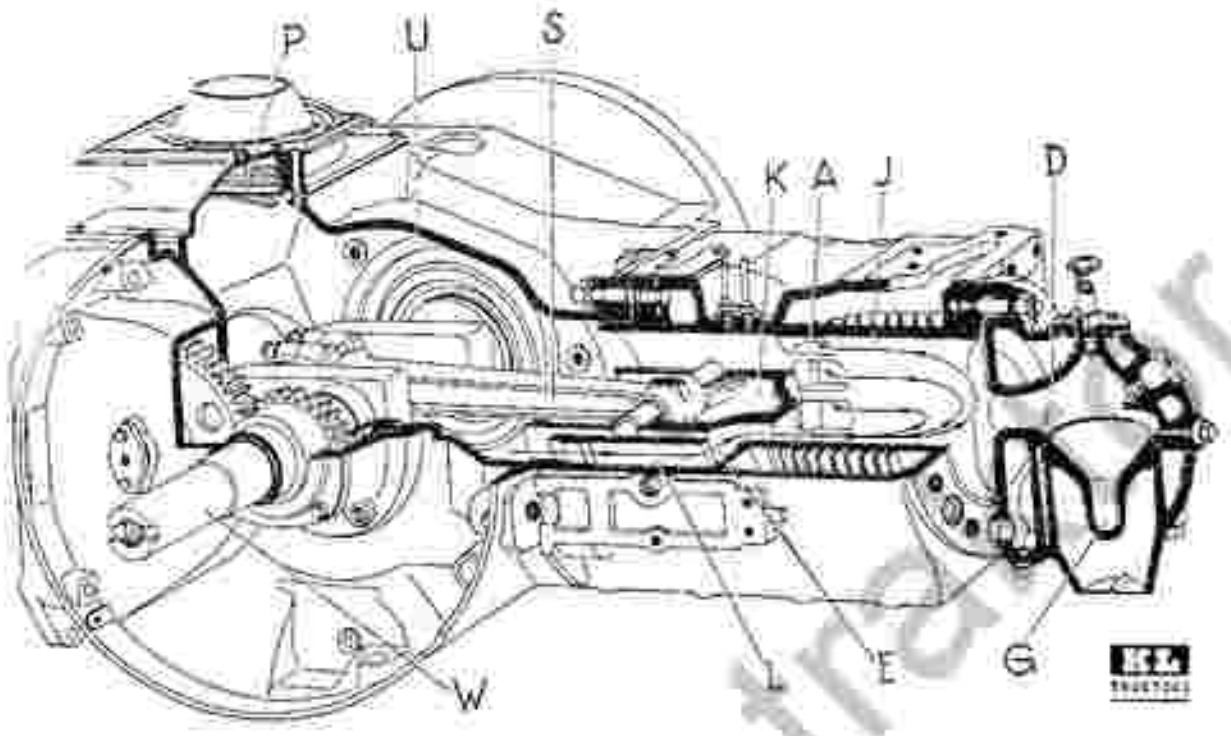

Fig. 2. Sectional view of the engine.

A Exhaust ports
D Cylinder head
E Air intake ports
G Hot bulb
J Cylinder
K Piston
L Air channel
P Air valve flaps
S Governing rod
[illegible]

The engine is of the horizontal, single cylinder, 2-cycle, hot bulb type with crankcase compression to take care of induction and scavenging. In the 2-cycle type of engine the piston not only performs its conventional duty in the cylinder, but also creates crankcase compression.

FIRST CYCLE - During the power stroke the air in the crankcase "U", Fig. 2, is compressed by the backward movement of the piston. Just before the termination of the power stroke the piston uncovers the exhaust ports "A" on the near, and, a little later, the air intakes ports "E" on the off-side of the cylinder. Air under pressure from the crankcase rushes through the channel "L" and intake ports "E" and, guided by the deflector type piston head, fills the cylinder with pure air.

SECOND CYCLE - The piston moves forward, sucking air into the crankcase through the air cleaner, and at the same time, compressing the fresh air in the cylinder, while fuel in a finely atomized spray, is injected through the atomizer by the fuel pump into the combustion chamber. The charge is not exploded, but by a combined action of the hot bulb and the subsequent compression a gradual combustion takes place, resulting in smooth, consistent power very similar to that of the steam engine.

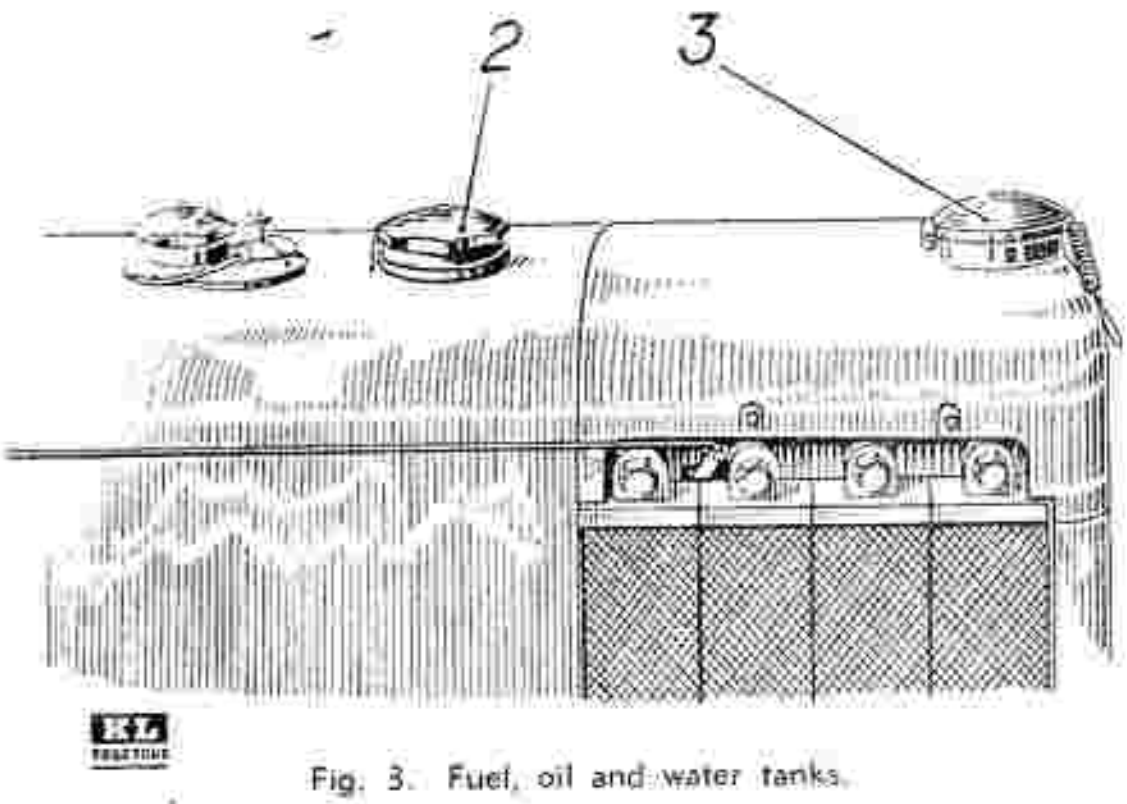

Fig. 3. Fuel, oil and water tanks.

1. Oil for lubricator.
2. Fuel.
3. Cooling water.

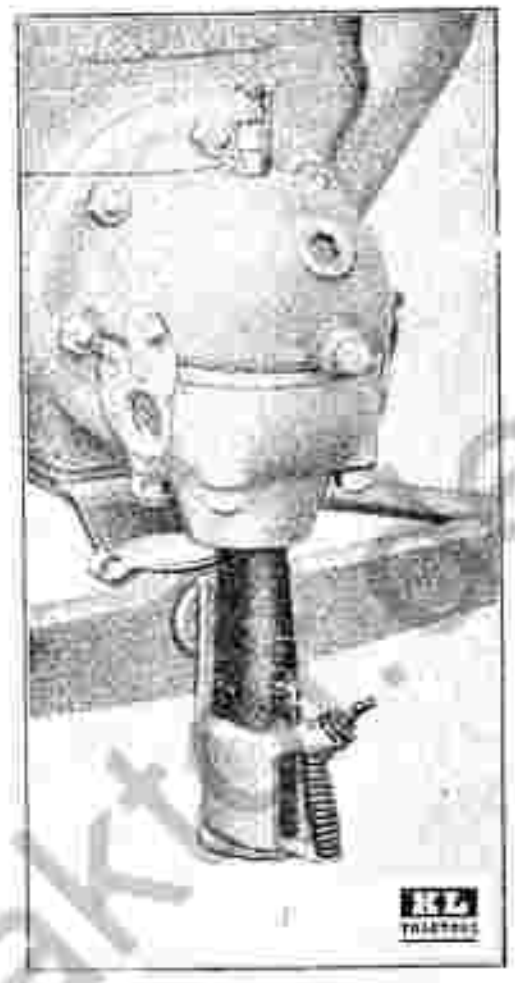

Fig. 4. Heating the bulb.

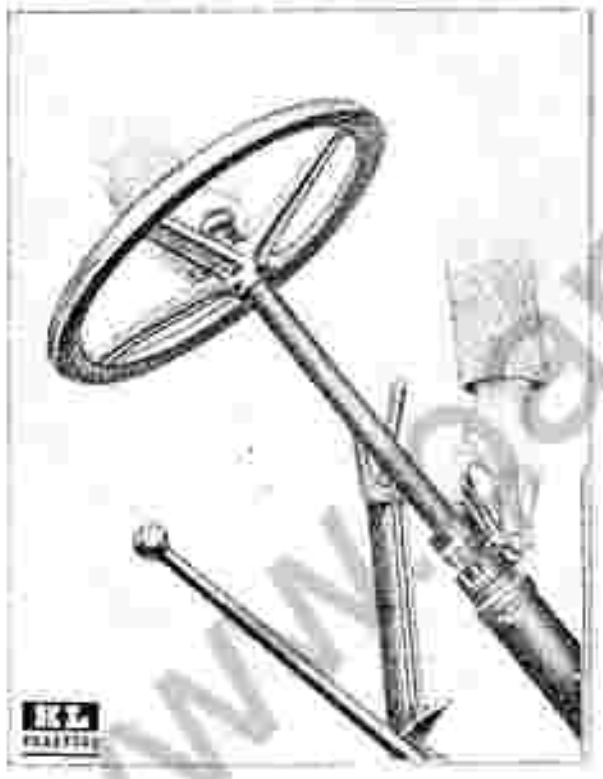

Fig. 5. Taking off steering wheel.

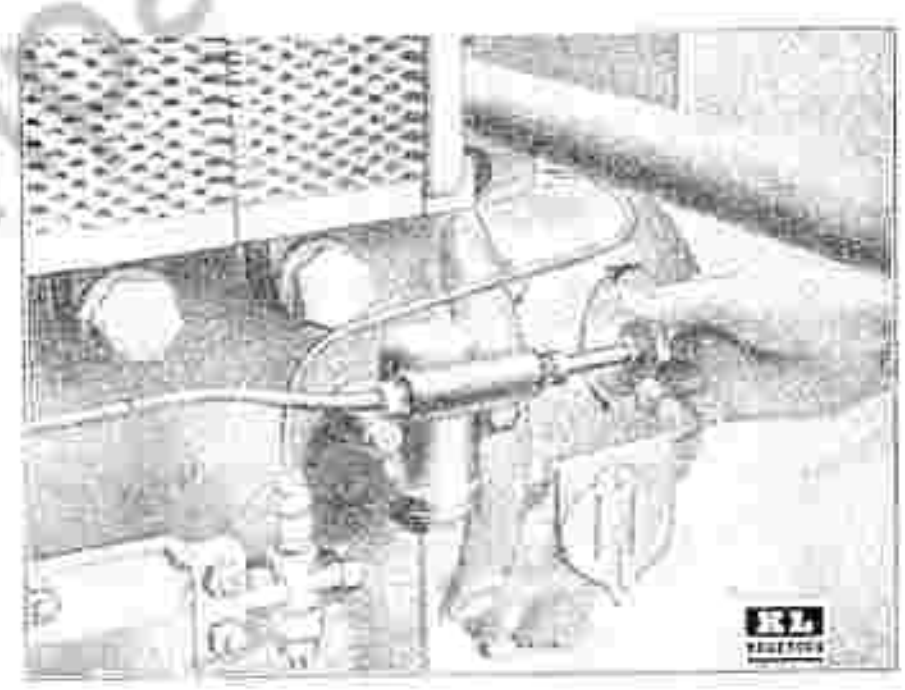

Fig. 6. Opening fuel stop valve.

STARTING THE ENGINE

The hot bulb is heated by the blow lamp for a few minutes, while the operator is greasing and tanking up. A few strokes are given to the fuel pump hand lever and a swing on the starting wheel starts the engine.

STARTING PROCEDURE - Fill radiator to one inch from top of gauze filter with soft water, preferably rain or boiled water, Fig.3 - 3.

Fill fuel tank, Fig. 3 - 2.

Fill fresh lubricating oil tank and continue to add oil until oil flows into return oil tank and reaches a level ½" from top of division, Fig. 3 - 1.

Three-quarters fill blow lamp with petrol and light. Fig. 90.

Place blow lamp under hot bulb, care being taken to open air flaps on hot bulb cover, Fig. 4.

Place fuel lever in fully forward position, Fig. 35. This ensures adequate supply of oil to piston and gudgeon pin when priming lubricator, Page 22, Fig. 23.

Remove steering wheel and place in crankshaft on right hand side, Fig. 5.

Place gears in neutral.

Turn crankshaft so that key is in rearmost position.

Place fuel lever in starting position, namely, 3 notches ahead of the idling position, Fig. 35.

Open fuel stop valve 4 full turns, Fig. 6.

Turn atomizer three full turns from right down position.

Prime fuel pump by giving priming handle three short, hard strokes. See Page 35.

Start engine by rocking the steering wheel sharply anti-clockwise Fig. 7.

Remove steering wheel with a short sharp pull, holding it by means of the loose knob, Fig. 8.

See that engine is running in the correct direction.

Remove and extinguish blow lamp.

Replace steering wheel.

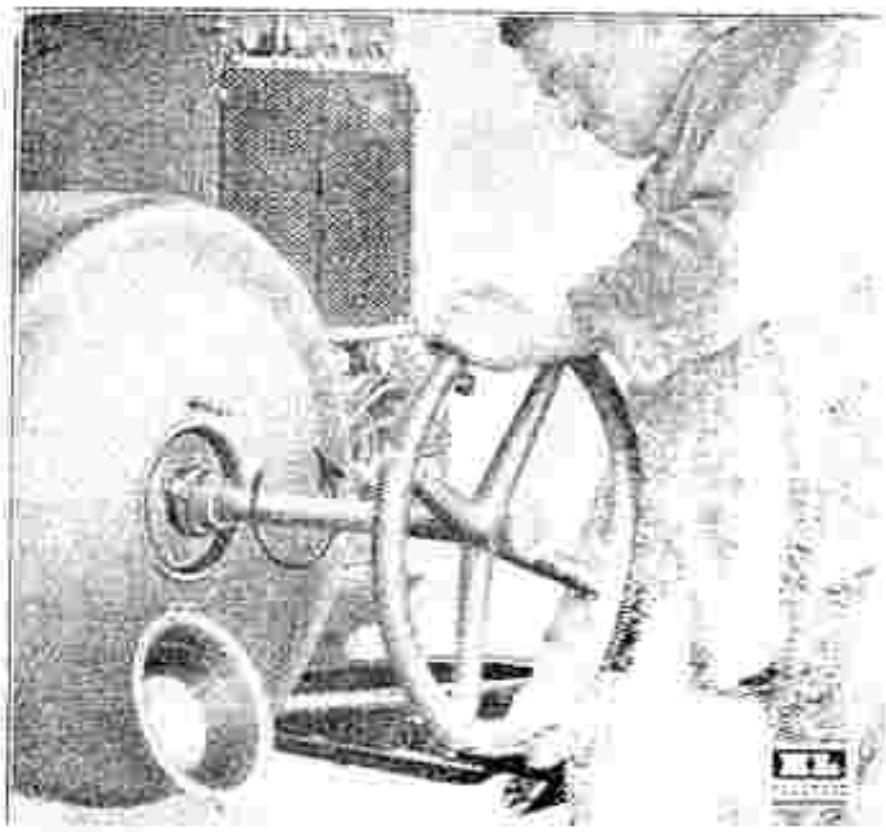

Fig. 7. [illegible]
[illegible]

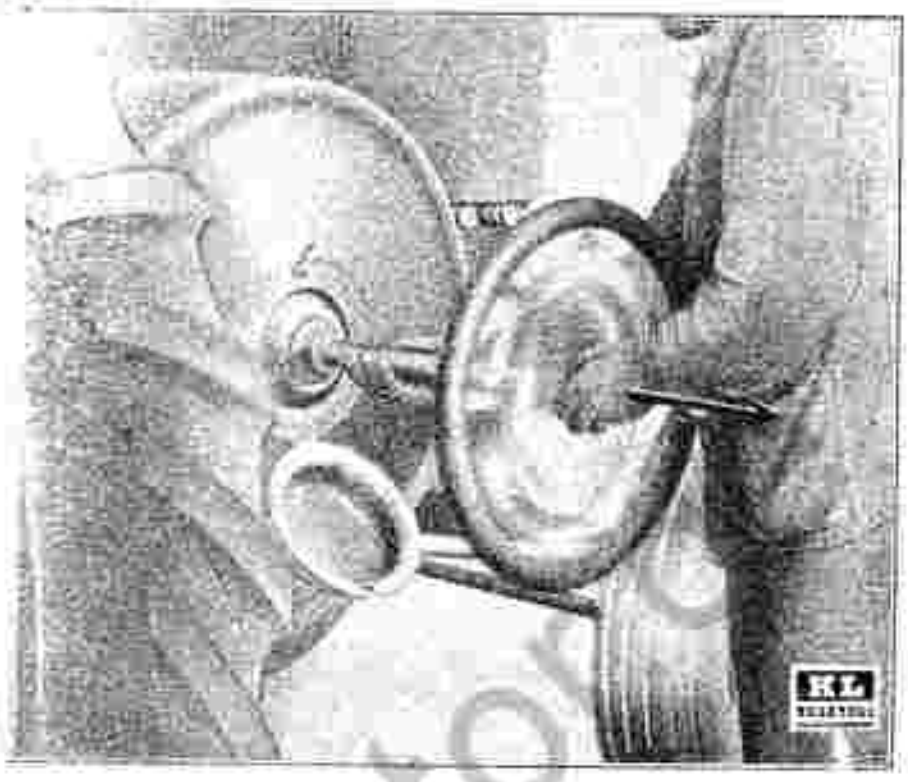

Fig. 8. Removing the steering wheel after engine starts.

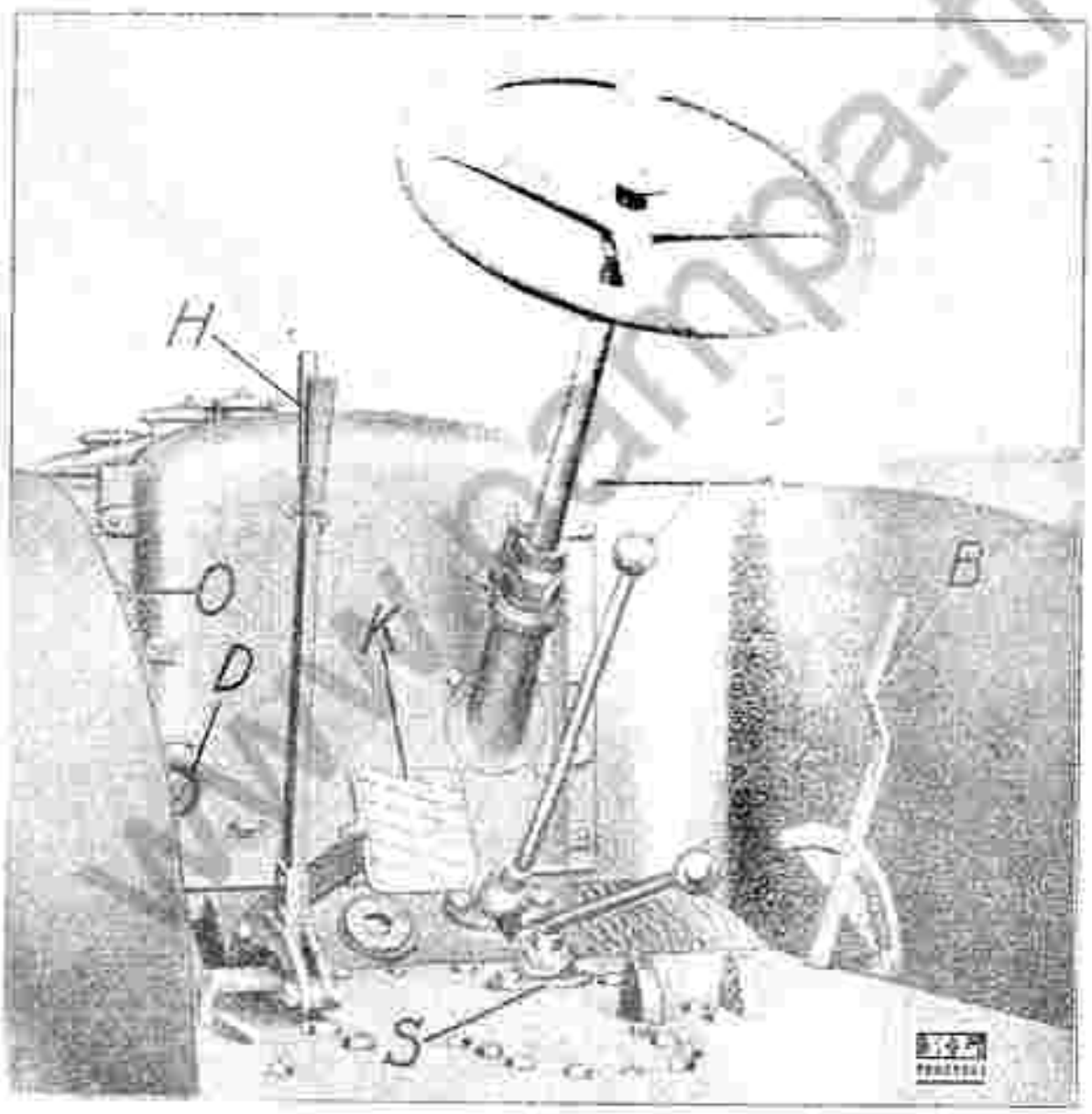

Fig. 9. Operating levers on K.L. Bulldog Tractor.

B. Fuel lever.
D. Engine direction indicator.
G. Primary gear change lever.
H. Hand brake lever.
K. Clutch pedal.
O. Plough line ring.
S. Secondary gear change lever.

IF ENGINE REFUSES TO START. A small quantity of fuel oil may have accumulated in the pocket of the hot bulb, due to excessive hand pumping and, when starting by blow lamp, this must be removed before the engine can be started.

Remove safety plug and heat up bulb thoroughly. Turn engine round a few times slowly with fuel lever in closed (rear) position. Turn flywheel into starting position, key in crankshaft upwards, replace safety plug, and attempt to start again.

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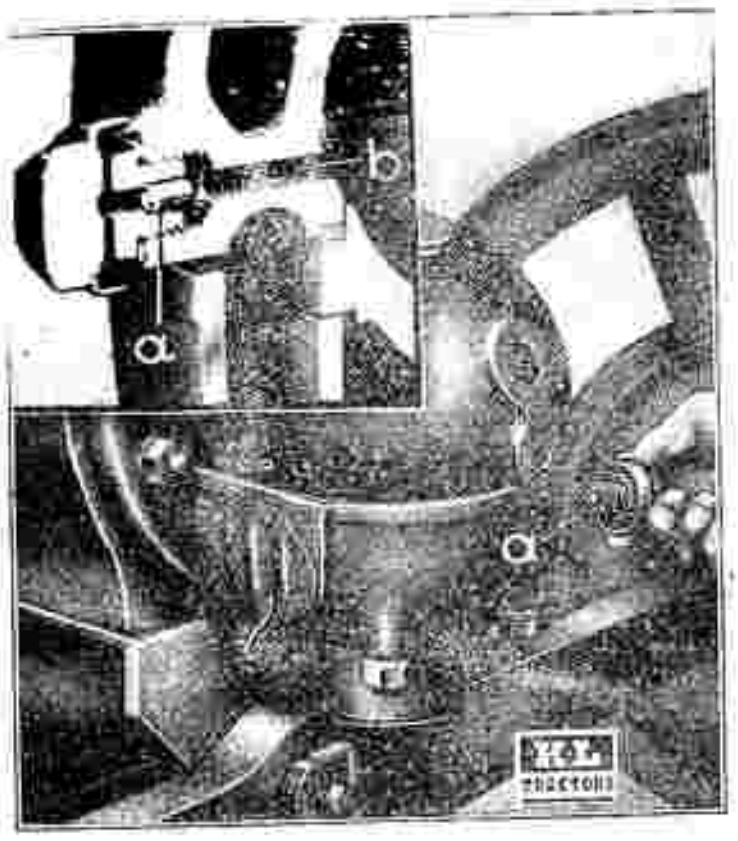

Fig. 10. Cylinder head with safety plug.

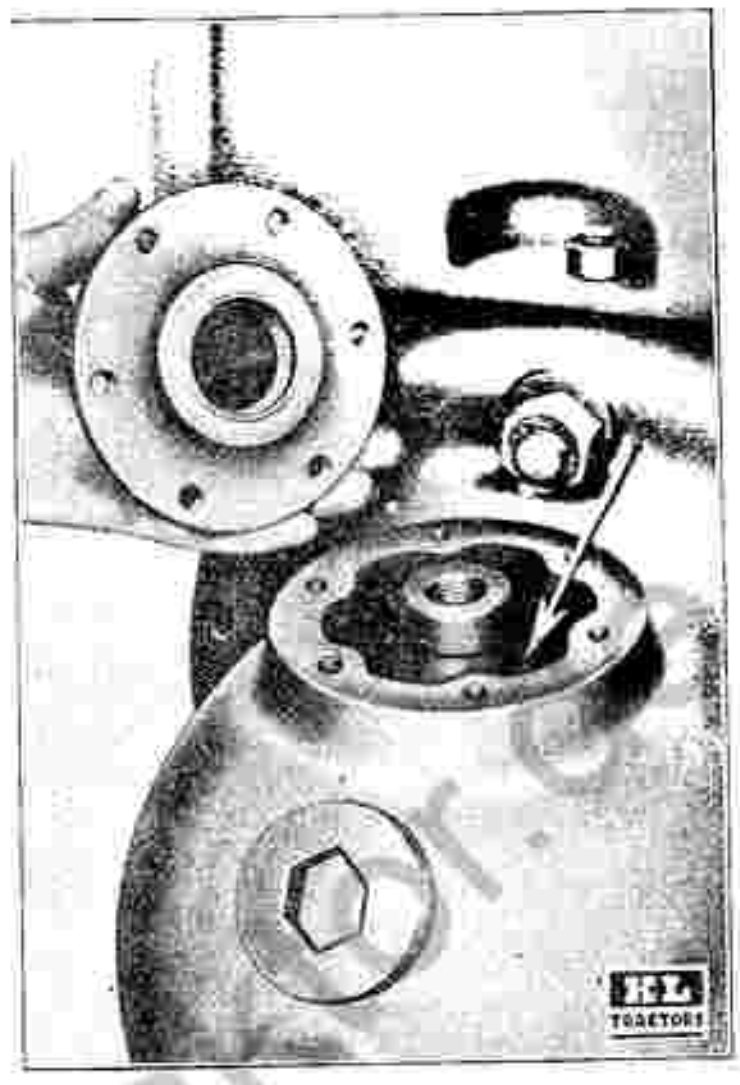

Fig. 11. Ring cover removed for inspection of cylinder head.

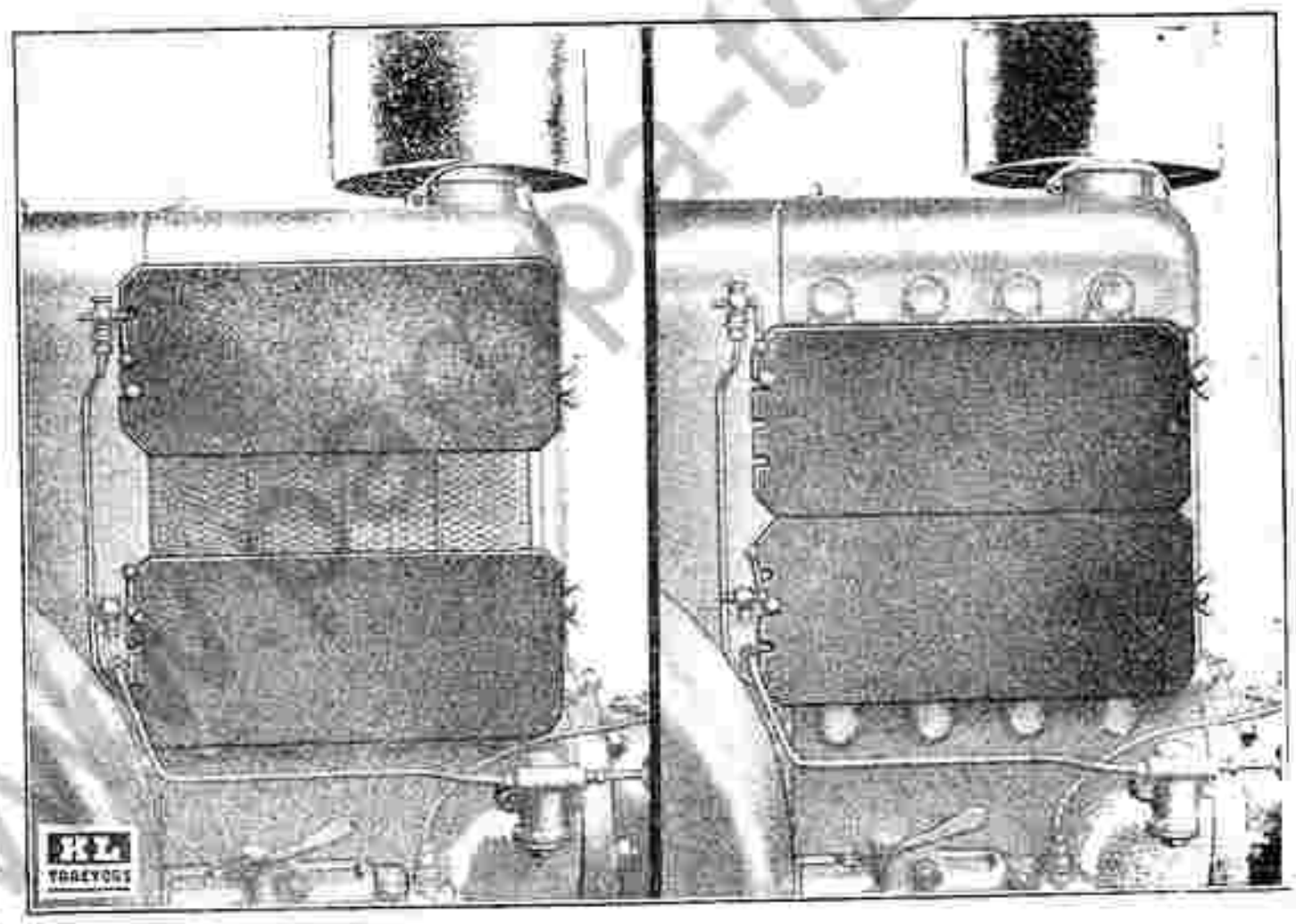

Fig. 12. Radiator shutters — open and closed positions

SECTION 2.

COOLING SYSTEM

The cooling is accomplished by a thermosyphon system assisted by a double radiator and fan. The water circulates by rising through the water riser and returning to the cylinder jacket and head through the radiator.

Keep tank filled within one inch of the top of the gauze filler with soft water, preferably rain or boiled water, free from impurities.

Water containing lime forms scale in the cooling system, thus reducing the cooling effect and causing overheating.

Inspect water level occasionally when working and replenish when necessary. Never remove gauze when filling. Never use oily vessels for filling up cooling water, because oil in connection with scale forms an effective heat insulating material.

REFILLING WHILE ENGINE HOT - Never pour cold water into an empty or nearly empty water system when engine is hot, otherwise the cylinder or head might be damaged. Wait until engine cools. Take care not to scald hands or face by steam or hot water when opening filler cap while engine is hot.

HOT WATER IN WINTER - In cold weather fill cooling system with hot water. This thins down the congealed oil between piston and cylinder and makes the engine easy to turn. A few turns, given to the flywheel will show if every thing moves freely. Any part stiffened by cold should be warmed slightly and carefully with the blow lamp.

DANGER FROM FROST - On no account must water be left in cooling system if there is the least sign of frost, otherwise serious damage might result by bursting of cylinder, head, radiator or tank. To drain water, open drain cock under engine, (handle in tool box), and drain plug on cylinder head and filler cap on water tank. Make sure that the drain cock is clear by passing a wire through it. Leave cock open. Re-use drained water.

SAFETY PLUG - As a precaution against overheating caused by lack of water, scale etc., a safety plug, Fig. 10, is fitted in the cylinder head. The core of this is filled with a melting fuse (a) consisting of a fusible alloy, which melts at a certain temperature. Never use lead or iron as a substitute.

Keep a number of spare fuses on hand, obtainable from our Agents. These are knocked in with a hammer. The hole, Fig.10 (b) and the thread for the safety plug must be often cleaned. After replacing a fuse due to overheating prime with oil.

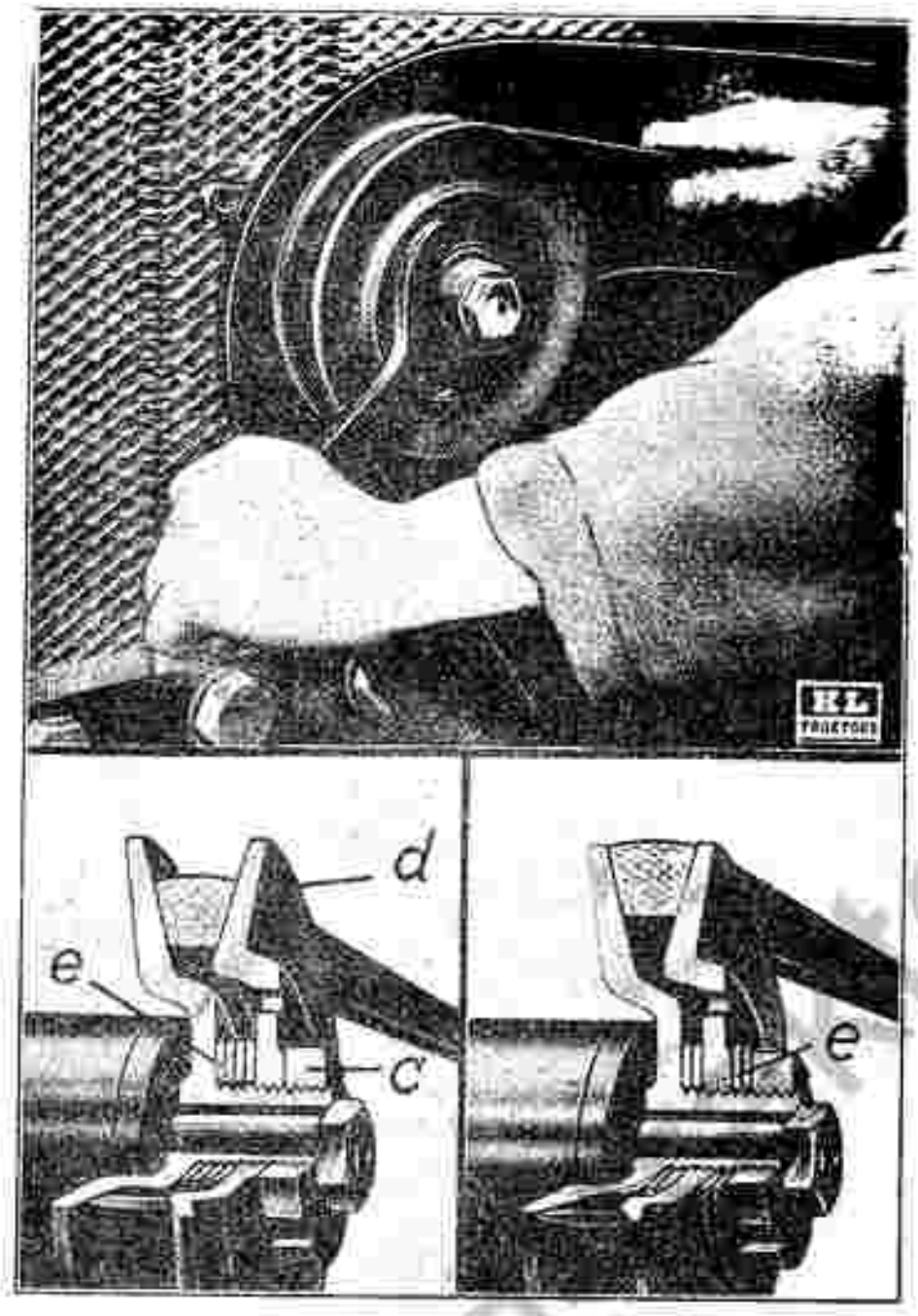

Fig. 13. Tightening of fan belt.

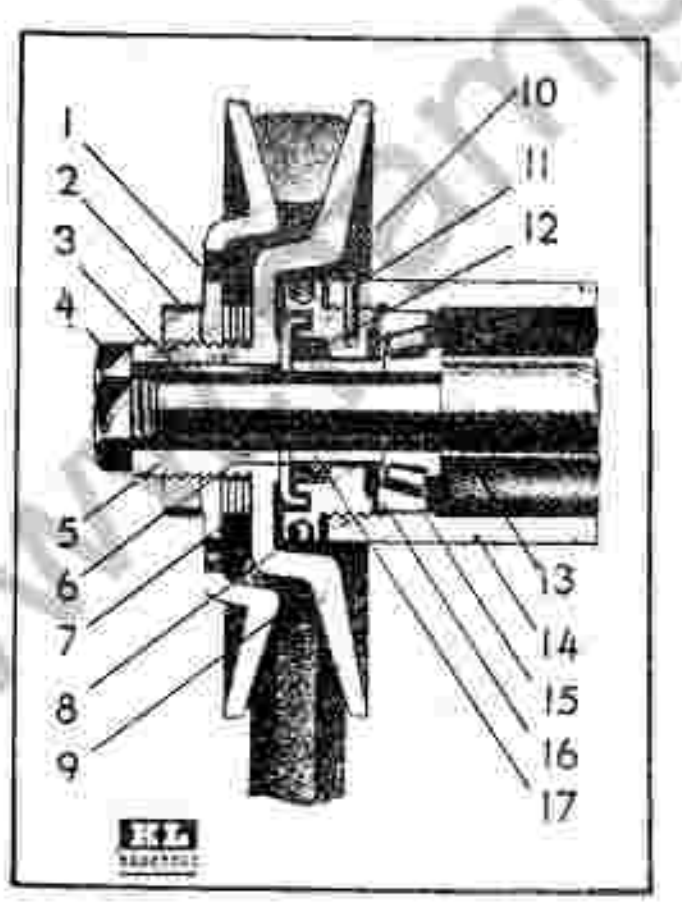

Fig. 14. Section of fan pulley.

1 Outer pulley plate
2 Ring nut
3 Key
4 Nut
5 Inner pulley plate with hub
6 Felt holder
7 Spring washer for belt adjustment
8 Ring nut
9 Fan belt
10 Packing ring
11 Lock pin
12 Felt ring
13 Fan shaft
14 Fan shaft housing
15 Tapered roller bearing
16 Shim
17 Spacer

Oil must be pumped through the oil pipes until lubricating points are amply supplied. In order that the oil should reach the gudgeon pin and big end bearing during hand priming, set fuel lever in foremost position and turn the flywheel by cranking wheel, so that key, Fig. 22 (s), in crankshaft shows to the rear.

To ensure engine remaining in this position remove safety plug. Then fit crank supplied to the pumpshaft, Fig. 18(21), press into the lubricator and turn in a clockwise direction for 180 turns, at a speed not exceeding 60 turns a minute, Fig. 23. Then turn twice in an anticlockwise direction to disengage dog clutch and withdraw.

This priming is necessary before starting the engine and after a fuse has been replaced, due to overheating.

RADIATOR SHUTTER - For reducing the cooling effect of the radiator, shutters are provided on the off-side of the tractor, Fig. 12. Keep shutters closed until cooling water temperature is near boiling point, which is necessary in order to obtain good combustion and smokeless exhaust. In very cold weather cover the header tank and radiators with a blanket or hessian.

REMOVING SCALE - From time to time remove ring cover, Fig. [illegible], on cylinder head and ascertain whether any scale has formed. If this is so it must be removed in the following way: drain water, take out the atomizer and safety plug and remove cylinder head. Then remove water jacket base plate, chip and scrape scale as far as possible from cylinder and from cylinder head after removing the ring cover.

To remove scale from parts not accessible to hand tools, replace the base plate and plug water holes in cylinder, remove radiator units and water tank. Then fill up with commercial hydrochloric acid and let stand for 4 to 6 hours, when scale will have dissolved. Now drain off the sludge, assisting by stirring up with a wire, and flush several times with hot water. The cylinder head is to be treated in the same way.

CARE MUST BE TAKEN TO PREVENT ACID GETTING INTO THE CYLINDER, ON THE PISTON, ON HANDS OR ON CLOTHES.

Having removed the scale from the cylinder, head, riser and header tank, the radiator units must be attended to. Assemble cooling system. Fill with soft water, in which 5 lbs. of soda have been dissolved. Run engine for half an hour to cause circulation. Stop engine for an hour, then run it again for an hour. When cold, drain and flush until all sludge is removed. To make sure that all scale is removed, repeat the whole procedure after 20 working hours.

As a substitute for a scale preventative, a few handfuls of caustic soda should be added to the cooling water.

In order to maintain the efficiency of the radiator, the outside of the radiator block must be kept free from dirt and oil and must not be painted as this will retard the cooling effect. If dirty, wash with a water jet, if oily remove the oil with hot water and soda or paraffin.

FAN BELT ADJUSTMENT - The fan belt must be correctly tensioned. If too tight, bearings will overheat and wear out quickly. If it slips by being too loose, the water will overheat, causing steam to issue from the filler cap. To tighten belt, remove a spacing washer Fig. 12 (e), from between the inner and outer pulley plate and place it between the latter and ring nut (c). If the belt is still insufficiently tightened, shift another washer from inside to outside (C spanner in tool kit). KEEP THE BELT FREE FROM OIL AND GREASE.

FAN SHAFT BEARING ADJUSTMENT - The fan shaft is running on tapered roller bearings. Increased humming of the fan usually indicates that adjustment of the bearing is needed. It is adjusted by shims, Fig.14(16) between bearing cup and ring nut (8) which is removed after removing nut (4), pulling off the complete pulley with belt, when key (3) will fall out, and removing lock pin (11).

At the same time inspect the felt ring (12) and that on the opposite shaft end, for which purpose the R.H. radiator and fan must be taken down.

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SECTION 3.

LUBRICATION

OIL - The life and efficient working of the tractor depend on proper lubrication: neglect in this direction will cause serious trouble, excessive wear and breakdown.

Only high grade mineral oil should be used, i.e., an odorless oil, free from water, acid and other impurities. It should not, after exposure in thin films to the atmosphere, become resinous or dry up to a varnish-like layer.

HANDLING OIL - When handling oil scrupulous cleanliness is absolutely essential. Prior to opening the oil drum, dust and dirt must be removed from its cover. No open can should be used for storage, and the oil should preferably be poured into the oil tank straight from the drum, in which it is purchased. Under no circumstances must the strainer be removed during filling. Thick oil should be thinned down by warming.

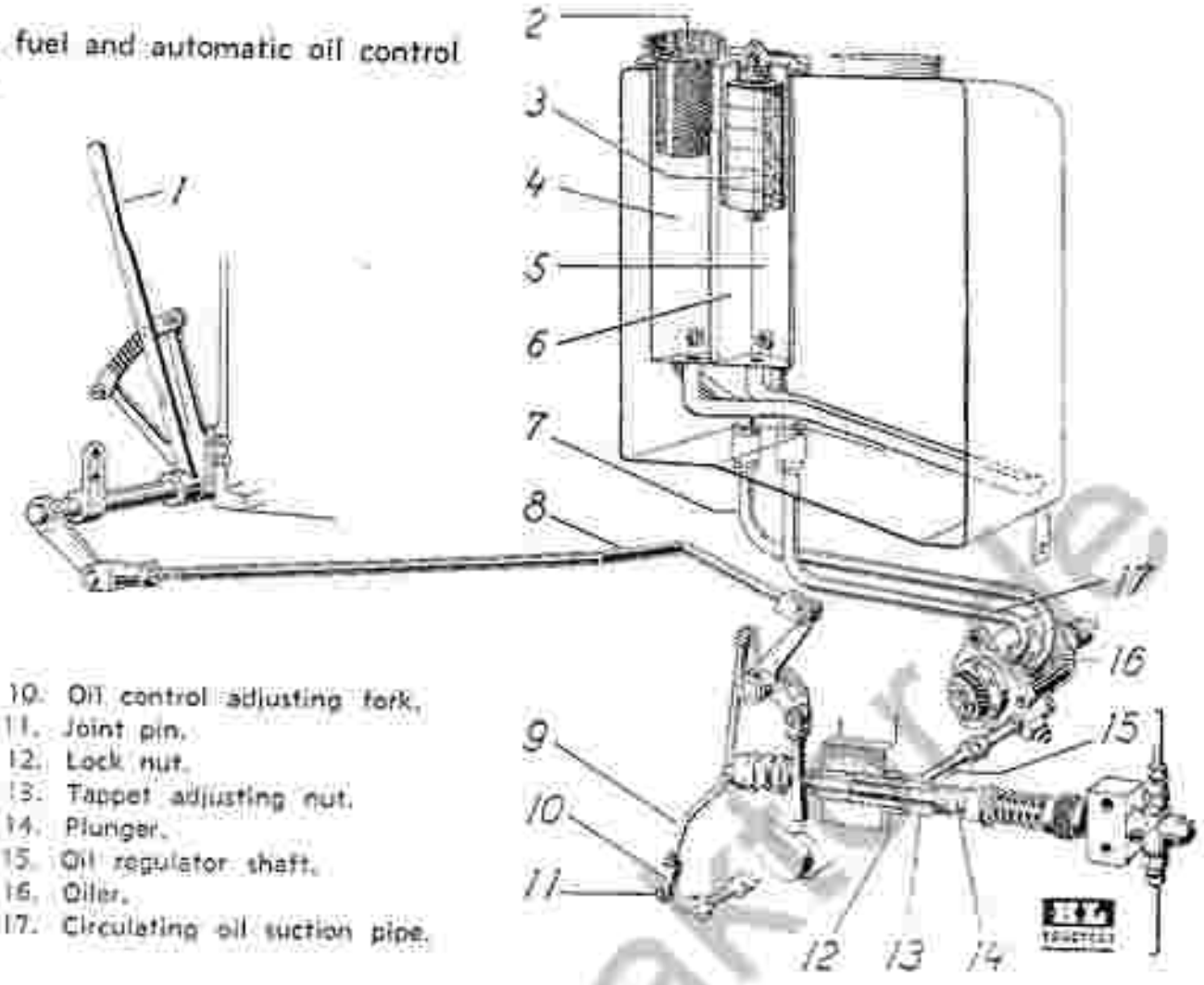
OIL TANK - The oil tank, Fig. 15, is divided by a partition wall (6) into two compartments: (5) for return and (4) for fresh oil, which is filled daily by filler (2). When compartment (4) is filled up to the top of partition (6) the fresh oil [illegible] compartment (5) where it mixes with the return oil. [illegible] the oil level exceeds the partition wall (6) by not more than [illegible] to avoid overflowing and spilling when it enters the engine. The oil accumulated in the crankcase is [illegible] returned to the container. The fresh oil compartment (4) is connected by suction pipe (7) to the pump units for lubricating the crank pin and main bearings, while compartment (5) is connected to the piston lubricating pump by suction pipe (17).

The level in the two compartments should be checked at least twice a day by the dip rods, screwed into each compartment, Fig. 16, and replenished with fresh oil if it is getting low.

POINTS OF LUBRICATION

Points of Lubrication	Served with	Served by
Crank pin and main bearings	Fresh Oil	Mechanical
Piston, cylinder and gudgeon pin	Circulating Oil	Oiler
Transmission and rear axle housing	Gear Oil	Oil Bath
All points of lubrication enumerated in lubricating chart	Grease	Grease Gun and Oil Can

...ing system, fuel and automatic oil control ...ing fuel lever.



1. Fuel lever.
2. Oil filler screen.
3. Return oil filter.
4. Fresh oil container.
5. Circulating oil container.
6. Partition wall.
7. Fresh oil suction pipe.
8. Fuel operating rod.
9. Oil operating rod.
10. Oil control adjusting fork.
11. Joint pin.
12. Lock nut.
13. Tappet adjusting nut.
14. Plunger.
15. Oil regulator shaft.
16. Oiler.
17. Circulating oil suction pipe.

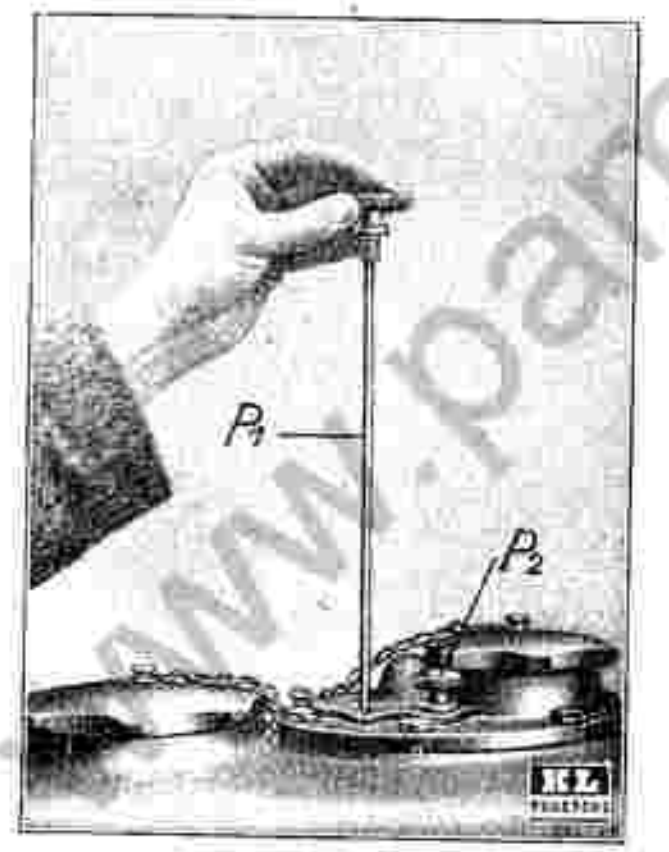


Fig. 16. One dip rod for each compartment.

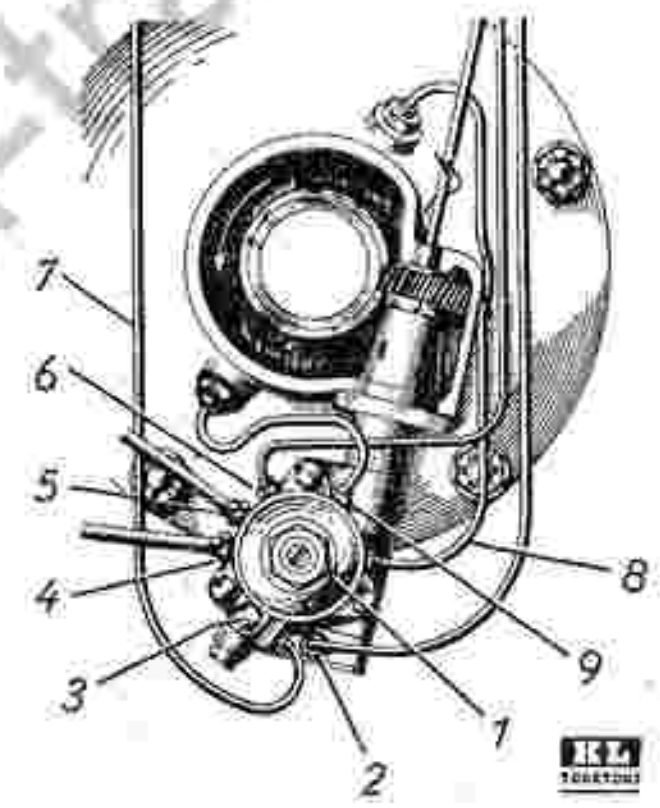


Fig. 17. Mechanical lubricator and pipes

1 Mechanical lubricator
2 Return pump (gear type)
3 Regulator shaft for piston lubrication
4 Fresh oil suction pipe
5 Circulating oil suction pipe
6, 7, 8, 9 Delivery pipe to: R.H. main bearing; piston, cylinder, and gudgeon pin; L.H. main bearing; crank pin

OILER - Main bearings, big end and piston including gudgeon pin and cylinder walls are served by the mechanical oiler, which is fitted to the main bearing cover behind the left flywheel and driven from the crankshaft by a skew gear and shaft as shown in Fig. 17. The oiler consists of 4 plunger pumps, the barrels of which are bored into the pump body, Fig. 18 (6). A separate oil pump is provided for each point, requiring lubrication, and the action is as follows:-

The pump plunger, Fig. 18 (4) is actuated by the rotation of the swash plate (17), rigidly fixed to the driving spindle (25), whilst at the same time the oil suction and delivery conduits are alternately connected with the pump chamber by apertures, provided in the rotating spindle (15). If the pump plunger (4) is raised by the swash plate (17), a connection between the pump chamber and the suction opening is established by a bore in spindle (15). The oil is thus drawn in by the upward stroke of the pump plunger. As the plunger descends, the spindle (15) rotates and establishes a connection by means of a channel between the pump barrel and the delivery pipe.

ADJUSTING LUBRICATOR PUMPS - The lubricating pump units must be checked for correct adjustment, since faulty adjustment will lead to serious damage or heavy oil consumption. Each pump has an individual adjusting screw, Fig. 18 (3), adjusting the length of the plunger stroke and consequently the quantity of lubricating oil, supplied to each point. This screw has a left hand thread. Turning to the left increases, to the right decreases the oil supply. To check or adjust the pump units, unscrew the lubricator cap as shown in Fig. 19, and turn the aforementioned adjusting screw, Fig. 18 (3) to "No Stroke" position by turning it to the right as far as it will go. Then turn to the left for the number of quarter turns given below.

Quarter turns to adjusting screw, Fig.20 (3) of the pump	Number of quarter turns
Fig. 17 (7) for cylinder lubrication	2
Fig. 17 (8) for L.H. main bearing	8
Fig. 17 (6) for R.H. main bearing	8
Fig. 17 (9) for crank pin lubrication	16

Note that the adjusting screws (3) and (22), Fig. 18, (4) in Fig. 20, are rather hard to turn, because each quarter turn is arrested by a catch.

The lubricator cap (20) Fig. 18, contains a check (2) preventing the pump plunger being pushed beyond the maximum stroke by oil pressure.

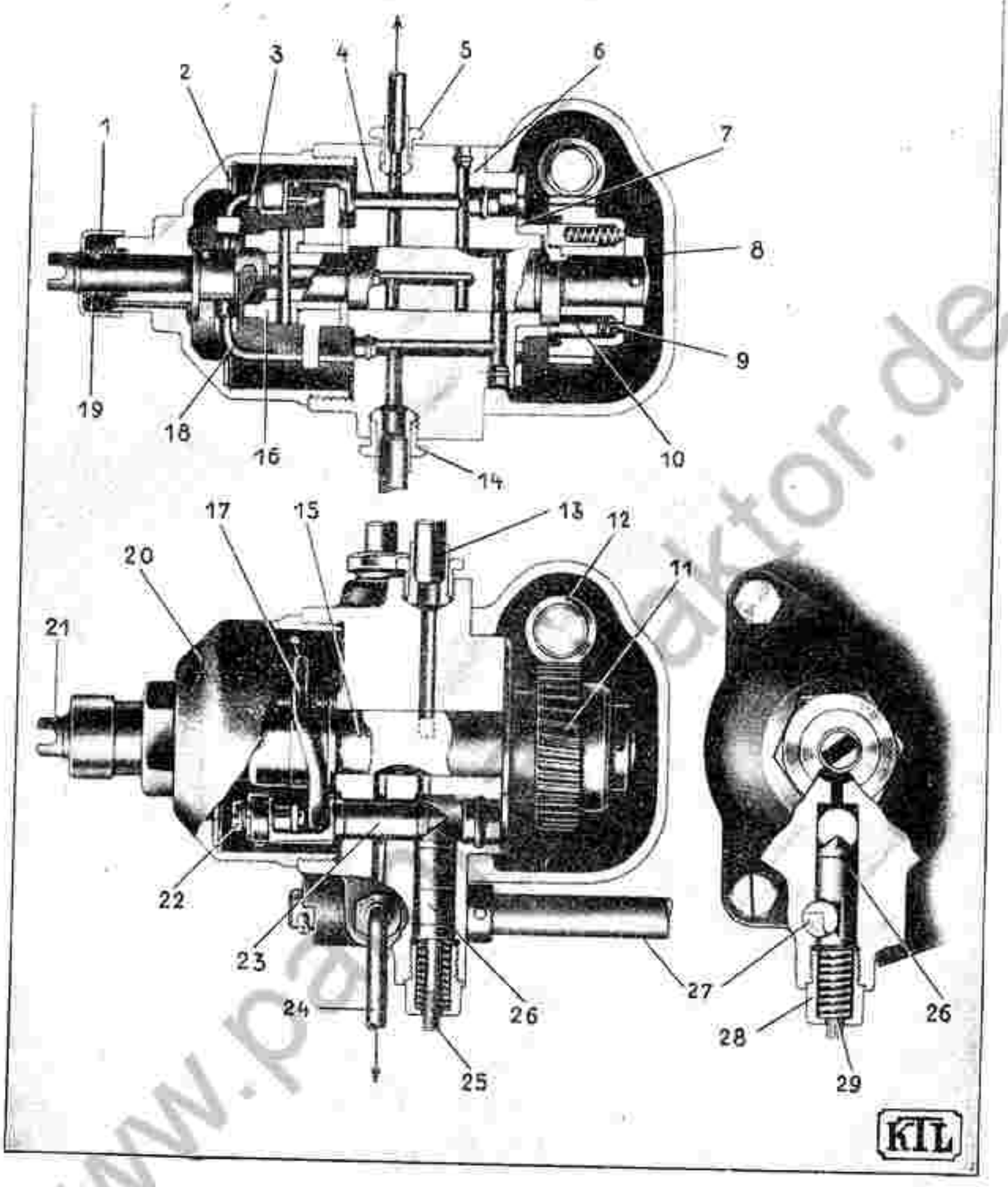


Fig. 18 Sectional views of the mechanical lubricator. Upper view shows a pump unit for big end and main bearings, lower views show the pump unit and compensating plunger for cylinder lubrication

1 Spring cover
2 Plunger check ring
3 Plunger adjusting screw
4 Pump plunger
5 Fresh oil delivery pipe
6 Pump body
7 Disengager
8 Lubricator drive housing
9 Spring for disengager pin
10 Disengager pin
11 Worm gear
12 Worm
13 Mixed oil suction pipe
14 Fresh oil suction pipe
15 Driving spindle
16 Dog clutch
17 Plunger swash plate
18 Disengaging fork
19 Clutch spring
20 Screw cap
21 Clutch connecting shaft
22 Plunger stroke adjusting screw to piston lubrication
23 Pump plunger
24 Mixed oil delivery pipe
25 Threaded stud for putting compensating plunger out of action
26 Compensation plunger of automatic cylinder oil regulator
27 Regulator shaft
28 Regulator spring housing
29 Regulator spring

Therefore, THE SCREW CAP MUST BE TIGHTLY SCREWED UP AND SECURED BY A WIRE.

The oiler pump (23), Fig. 18, for supplying lubricating oil to piston and cylinder is also actuated by [illegible] plate (17) and adjusted by its adjusting screw (22) in a similar way to the other three pumps by their adjusting screws (3). It differs, however, from these pumps in so far as it is primarily adjusted at the Works to supply a quantity of oil equal to twelve quarter turns of the adjusting screw (22), which quantity cannot be reduced by adjusting screw (22). For this purpose this pump is provided with a two-way adjustment illustrated in Fig. 21, i.e., the primary adjustment by sleeve (2). Adjusting sleeve (2) is secured against turning by circlip (3) and should not be touched by any unauthorized person, since its readjustment requires expert knowledge.

Although adjustment by setting adjusting screw (4), Fig. 20, does not permit cutting down the oil supply below the setting of the primary adjustment sleeve (2), the oil supply is, in fact, cut down automatically by the setting of the fuel lever when the tractor is idling or operating on a light load, in order to minimize the consumption and to prevent overoiling and smoky exhaust.

This is attained by [illegible] the compensating plunger through the medium of the [illegible]

The compensating plunger in the pump is actuated by the regulating shaft [illegible] and (9) in Fig. 18 and [illegible]

The compensating plunger in Fig. 18 and the regulating shaft (27) are interlocked with each other by slots as shown. The pin, provided in the slot of the regulating shaft, limits the length of the stroke of the compensating plunger.

When the fuel lever is set for full load, the compensating plunger (26) is drawn back into the barrel, so that it does not interfere with the pump chamber and the maximum quantity of oil, to which the pump is primarily adjusted is delivered to the pistons. When the fuel lever is set for lighter loads, the compensating plunger is proportionately released by the movement of the fuel lever, i.e., by the changed position of the cam on the regulating shaft and is pushed by the coil spring (29) into the pump chamber thus reducing its capacity.

As shown in Fig. 18, the heads of the two plungers are slanted so that the compensating plunger (26) is pushed back into its barrel by the delivery stroke of the pump plunger. During the suction stroke the pump plunger (23) the compensating plunger (26) is pushed again into the pump chamber by spring (29), thus closely following up the suction stroke of the pump plunger, partly compensating its stroke and consequently reducing the oil quantity in proportion to the load on the engine.

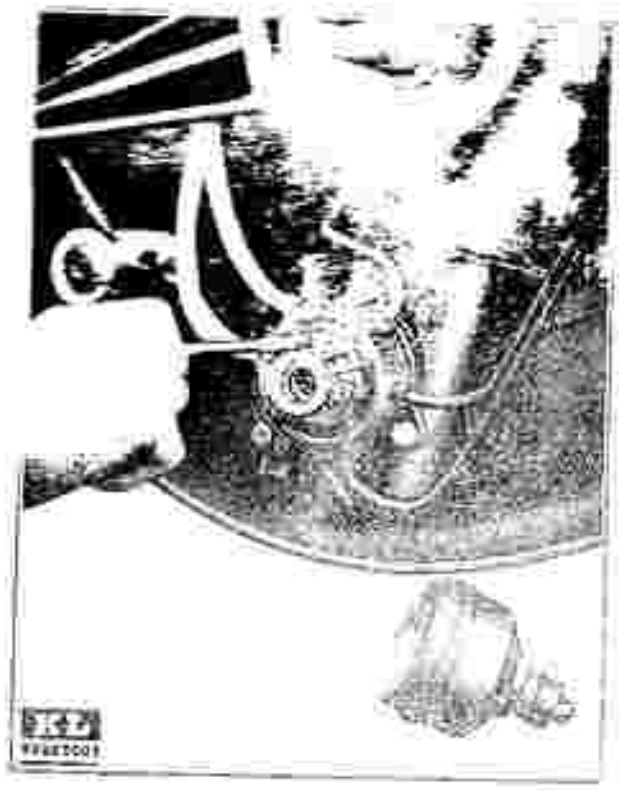


Fig. 19.
Adjustment of lubricator pumps.

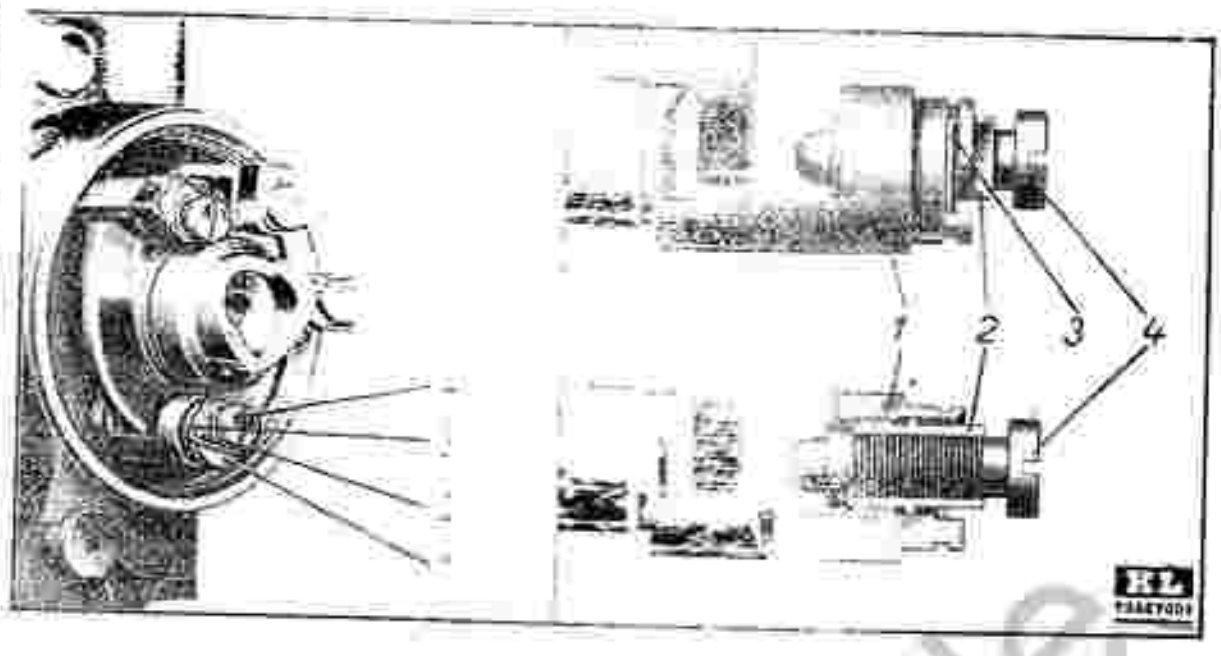


Fig. 20. Adjustment c[illegible] lubrication

1 Pump plunger head
2 Threaded adjusting sleeve for primary pump stroke adjustment in the Works

[illegible] the
[illegible]tting sleeve
[illegible] secondary
[illegible] pump stroke

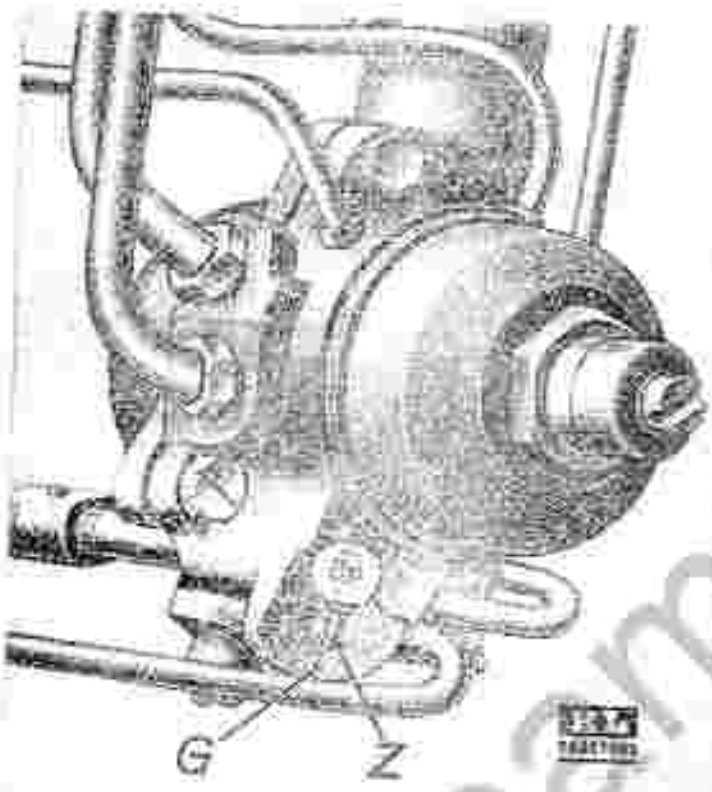


Fig. 21.
Adjustment of regulator shaft of piston lubrication
G: Mark on oilef housing
Z: Pointer on regulator shaft

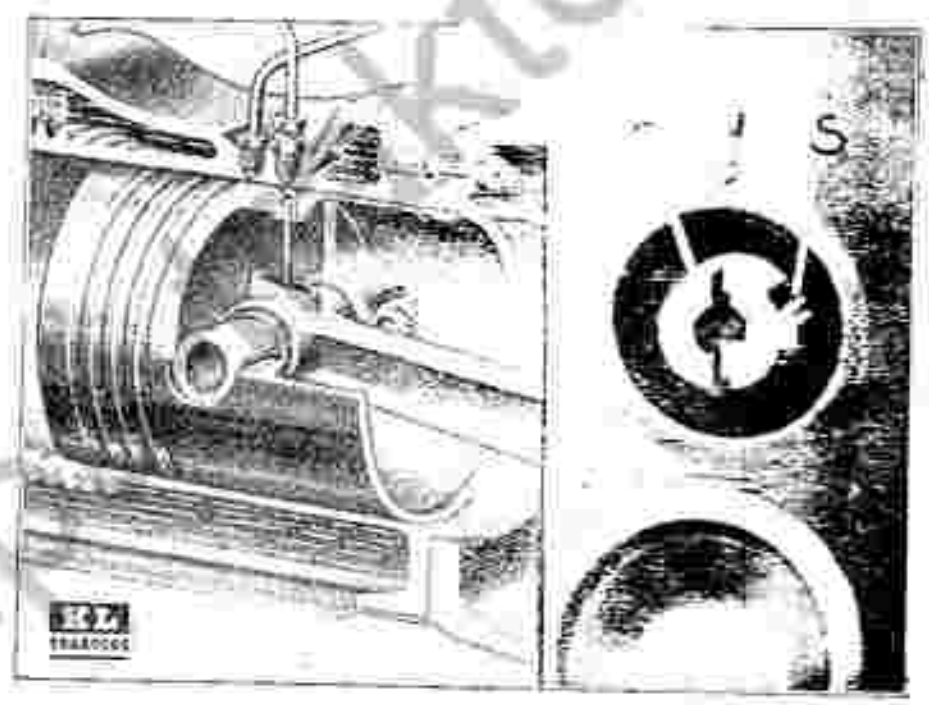


Fig. 22. Position of piston for [illegible]
Key in crankshaft showing [illegible]

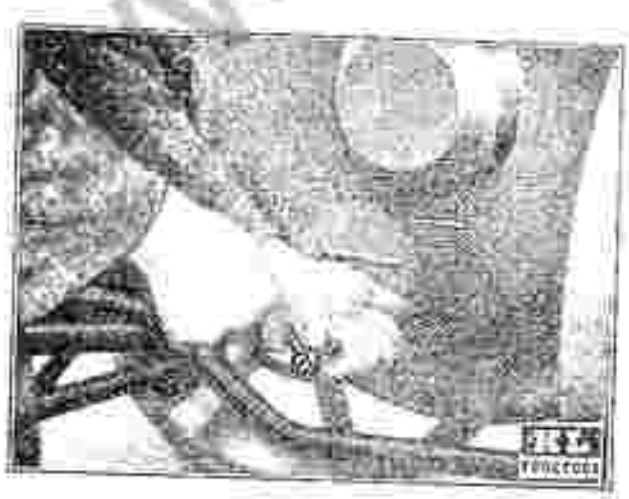


Fig. 23. Priming lubricating oil

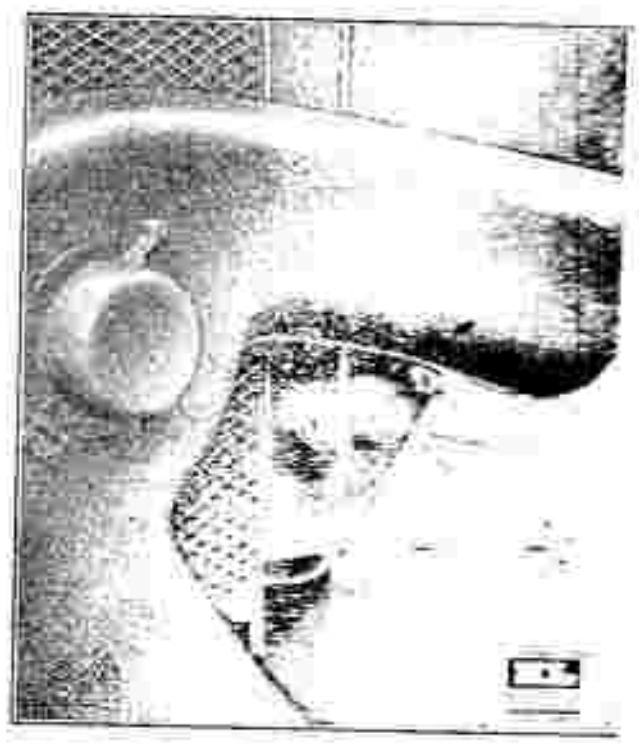


Fig. [illegible]

ADJUSTMENT OF THE REGULATOR SHAFT - With fuel lever set to mark (1) Fig. 35, the engine idling at 300 r.p.m., the pointer (Z) Fig. 21, on the regulator shaft must coincide with mark (G) on the oiler housing. Adjustment is effected by fork (10), Fig. 15, on link (9). This adjustment is always necessary when the fuel pump tappet has been readjusted.

The automatic lubricating oil supply (i.e. cutting down when idling), controlled by the fuel lever, can be put out of action by placing a nut on the threaded stud (25), Fig. 18, fixed to the compensating plunger (26) and by tightening the nut to prevent the compensating plunger being pushed into the pump barrel by spring (29) when released by the regulating rod.

PRIMING WITH OIL - Oil must be pumped through the oil pipes until lubricating points are amply supplied. In order that the oil should reach the gudgeon pin and big end bearing during hand priming, set fuel lever in foremost position and turn the flywheel by cranking wheel, so that key (s), Fig. 22, in crankshaft shows to the rear. To ensure engine remaining in this position remove safety plug. Then fit crank, supplied to the pump shaft (21), Fig. 18, press into the lubricator and turn in a clockwise direction for 180 turns, at a speed not exceeding 60 turns a minute Fig. 23. Then turn twice in an anti-clockwise direction to disengage dog clutch and withdraw.

This priming is necessary before starting the engine and after a fuse has been replaced, due to overheating.

RENEWAL OF OIL AND CLEANING LUBRICATING SYSTEM - After the first 100, and subsequently every 300 working hours the oil must be drained from the oil tanks by the drain plugs (A1) and (A2), Fig. 24, and replenished with fresh oil after carefully mopping up all sediments from the containers.

The lubricating system should be cleaned every 1600 working hours at the same time as removing the tanks for cleaning the fuel tank. To do this, drain oil from tanks when level is low by unscrewing the drain plugs, Fig. 24.

Remove oil tank cover with filter attached to it and wash both compartments (4) and (5), Fig. 15, with kerosene, remove all sediments by mopping with a lintless cloth (not cotton waste) and re-connect suction pipes.

Then unscrew cap (20), Fig. 18, from lubricator and wash thoroughly both cap and oiler with kerosene without taking the latter down from the tractor. Clean the inside mechanism and pumps by pumping kerosene through the lubricator by means of the crank handle.

For this purpose disconnect oil delivery pipes at their

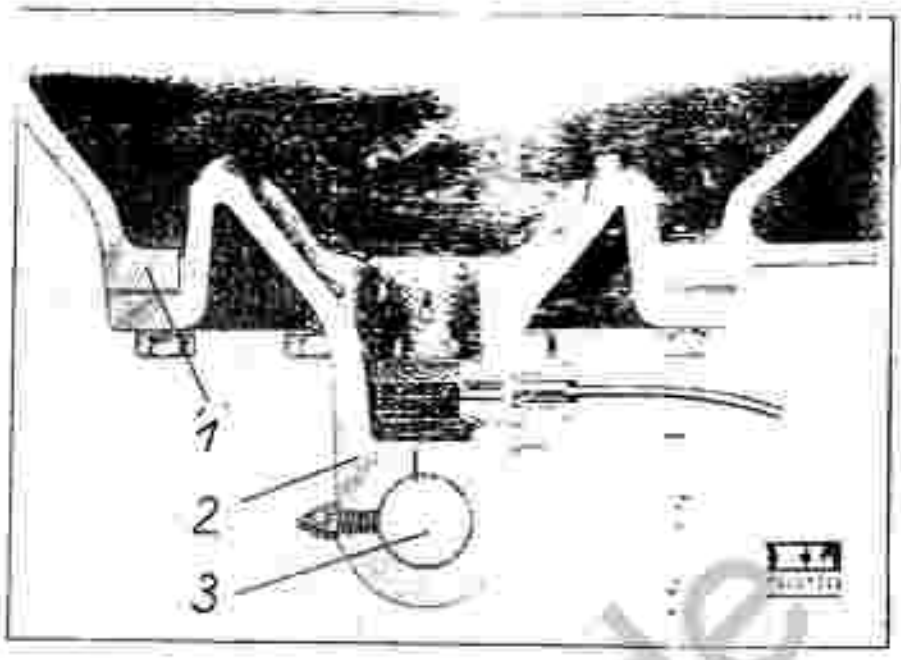


Fig. 25. Front view of gauze strainer in crankcase base plate.

1 Crank case
2 Crank case base plate
3 Radius rod
4 Return oil pipe
5 Pipe union screw
6 Gauze strainer

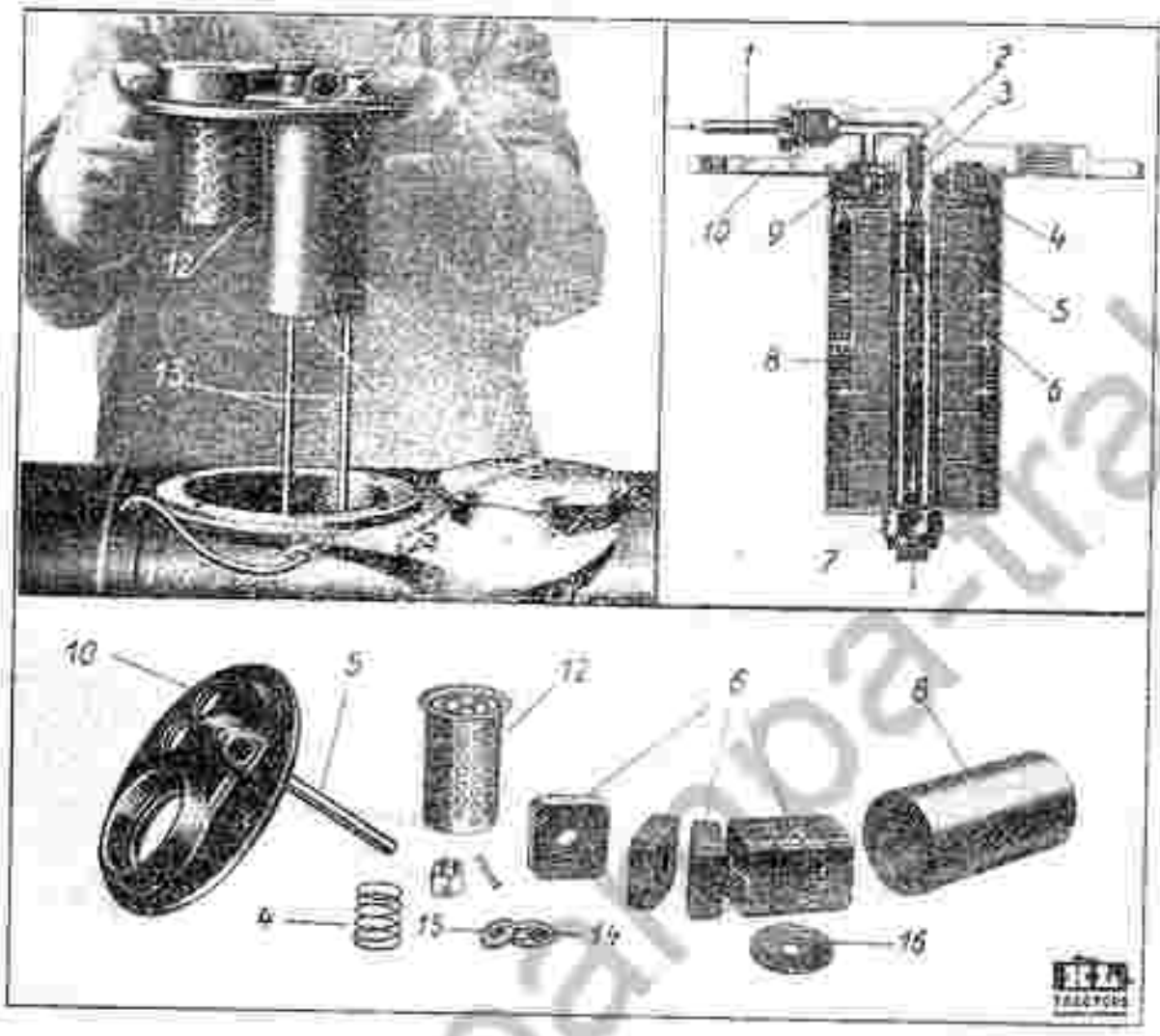


Fig. 26. Oil cleaner for engine oil.

1 Return pipe from cleaner
2 Overflow valve ball
3 Overflow valve spring
4 Felt ring holding spring
5 Centre tube
6 Filter felts
7 Nut
8 Filter housing
9 Return oil conduit
10 Oil tank cover
12 Gauze strainer
13 Dip rods
14 Spring seat
15 Felt ring
16 Washer

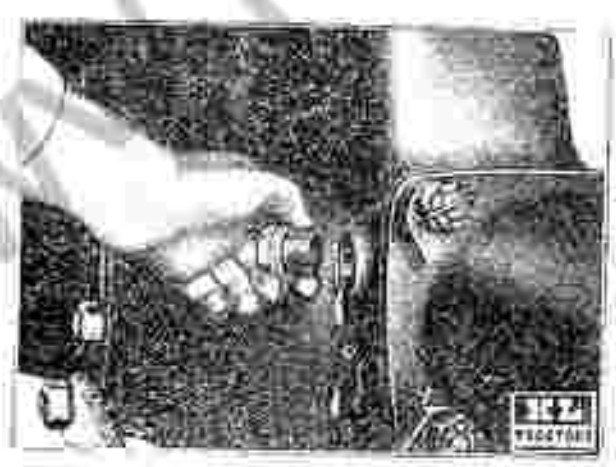


Fig. 27. Gear oil level control plug.

Fig. 28. Filler plug for gear oil.

lubrication points after marking them with tags. Pour a little kerosene into each compartment of the oil container and turn crank handle until no more kerosene comes out of any of the delivery pipes. Wipe the oil container carefully out with a dry lintless cloth and fill with fresh oil. Then continue pumping by crank handle until clean oil comes from all delivery pipes without air bubbles.

If, after turning the crank handle about 100 times and no oil comes out, this is a sign that air is contained in the suction line, which must be removed by temporarily increasing the pump plunger stroke by several quarter turns by turning adjusting screw (3), Fig. 18, to the left. Then continue hand pumping. After all air has been removed, readjust pump plunger. Then reassemble and do not omit to secure the tightly screwed up lubricating cap by wire. The oil chamber containing the skew gear drive of the filter, must be drained every 1000 working hours by drain plug, Fig. 17, on the left main bearing cover and refilled with half a pint of lubricating oil through the hole of the oil pipe reduction socket on top of the main bearing cover after removing the oil pipe and the said socket.

OIL RETURN PUMP - The geared type oil return pump (2), Fig. 17, returns the oil accumulating in the crankcase by pipe (I), Fig. 26, to the circulating oil compartment (3), Fig. 15.

GAUZE STRAINER FOR RETURN OIL - During its circulation, the oil is cleaned first from coarser impurities by the gauze strainer, built into the crankcase base plate, and then thoroughly by the oil cleaner attached to the underside of the oil tank cover.

The gauze strainer, Fig. 25, must be cleaned weekly, or every 50 hours: Remove sludge from crankcase, using a brush, and flush with kerosene. Replace gauze screen if damaged. Make sure that return pipe (4), Fig. 25, is clear, otherwise take down and blow through with an air pump.

RETURN OIL CLEANER - After passing through the gauze strainer, the return oil enters through pipe (I) and conduit (9), Fig. 26, into the chamber between filter housing (8) and filter felts. It is pressed through the felts (6), in which all impurities are retained, into the compartment, encircling the perforated centre tube, through which it flows down into the return oil compartment (5), Fig. 15.

Should felts become choked through want of cleaning, the oil passes unfiltered from pipe (I) through valve (2) Fig. 26, direct into the centre tube.

CARE OF THE RETURN OIL CLEANER - The cleaner must be cleaned at the same time when renewing the oil, i.e., after the first 100, and subsequently every 300 working hours in the following way:

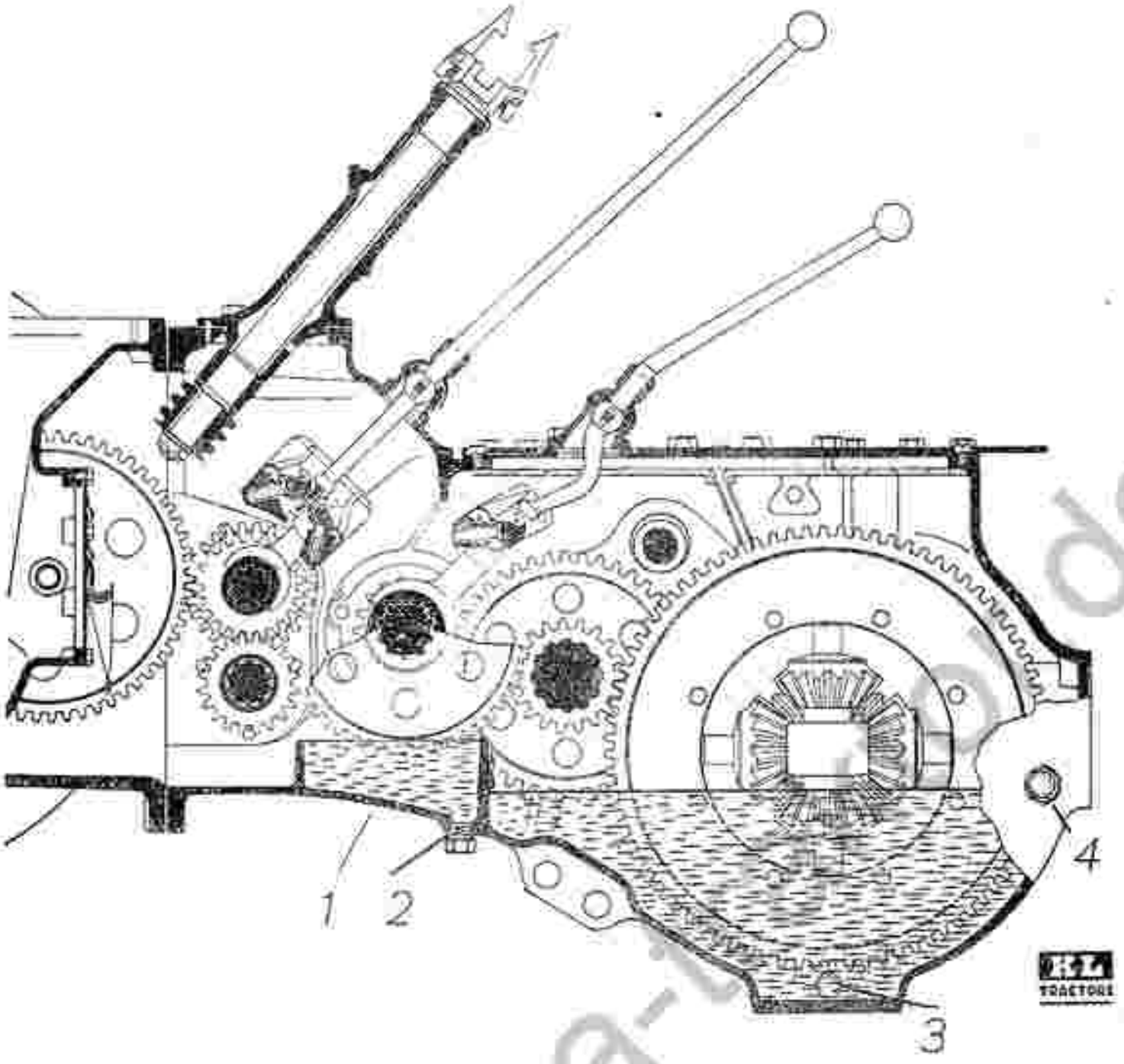


Fig. 29. Sectional view of transmission.

1 Upper oil bath compartment
2 Drain plug for 1
3 Drain plug of lower oil bath compartment
4 Oil level control plug

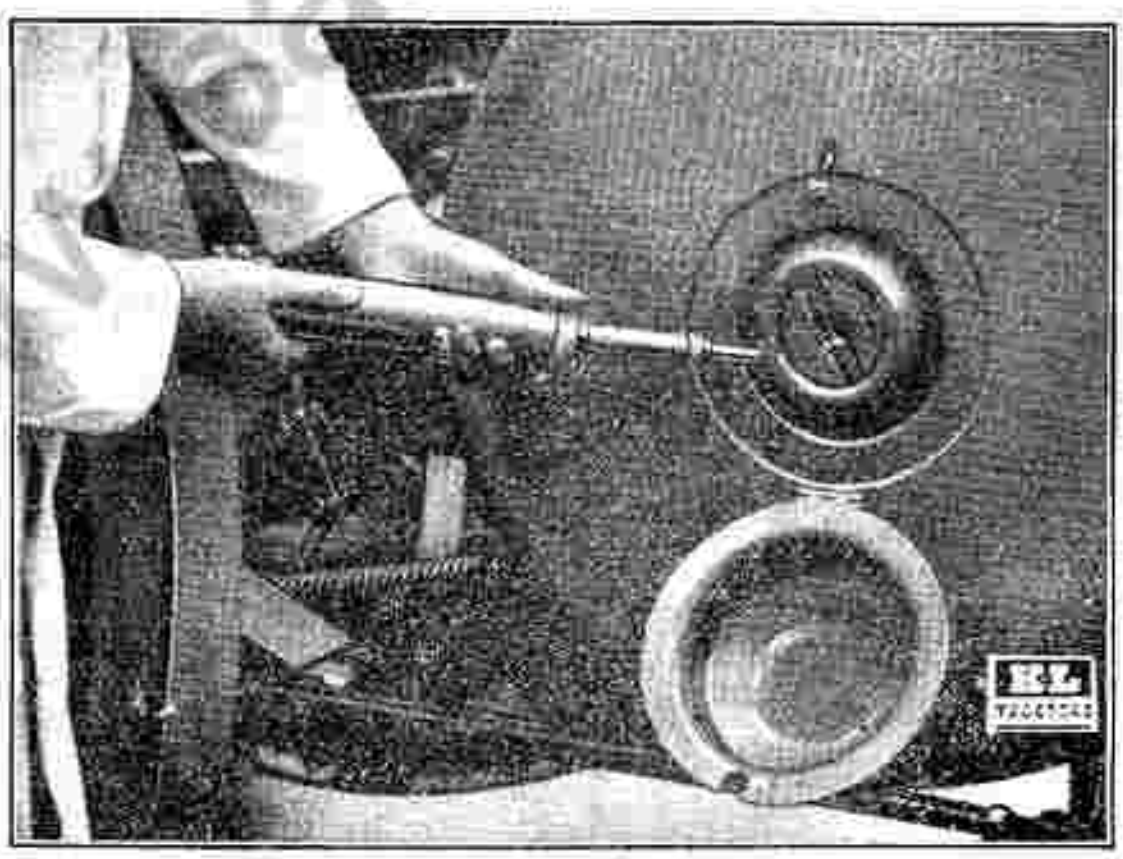


Fig. 30. Lubricating with grease gun.

Unscrew the oil tank cover holding screws and remove with the cleaner attached to it. Then remove the filter (7) Fig. 26. Wash the belts, all filter parts as well as the interior of the oil tank and strainer 3 and (1) thoroughly with kerosene, and re-assemble after the belts have thoroughly dried.

Do not use belts other than those supplied from the K.L. Traktor works. Keep spare belts on hand.

Take care not to lose the ball valve (2), which is apt to jump out when plug 3 is being unscrewed from oil tank cover (10) for the purpose of cleaning the oil passages.

GEAR LUBRICATION

The gear case of the tractor is provided with a filler hole, Fig. 28, and oil lever control plug, Fig. 27, and (4), Fig. 29, and 2 drain plugs (2) and (3), Fig. 29. After the first 100 working hours the gear oil must be drained and removed. Drain the oil immediately after stopping the tractor, while the engine is still warm and the oil in liquid state, by removing plugs (2) and (3), Fig. 29. Replenish, taking care that the oil level in the housing is not higher than up to the control plug (4), Fig. 27, otherwise it might leak out and damage the rubber tyres.

Therefore, before filling gear oil through the filler hole, remove the oil level control plug and all gummy oil sediments by which the oil level control hole may be choked.

When filling the gear case the oil must flow, directed by means of a funnel, into the smaller upper compartment (1), Fig. 29, arranged sideways within the gear box so that the compartment is filled to capacity before the oil flows into the lower main compartment.

Subsequently, the gear oil is to be renewed every 1,500 working hours.

GREASE

All points, provided with nipples are lubricated as indicated in the lubricating chart, Fig. 31, by the grease gun supplied with tractor. The grease lubrication is of as much importance as the oil lubrication. A very soft, high grade grease of mineral base is to be used, free from water, acid and other impurities, as well as not being resinous nor rancid.

... gun, place it on nipple and push barrel towards
... to slide back, and repeat several times until a
... grease oozes from the bearing joints. When the large
... thereby into the barrel the grease gun is empty. If grease
... between nipple and nozzle, renew grease gun nozzle and/or nipple.
... escaping from the joints must be removed, otherwise it would collect
... and dust.

When greasing fan spindle, care must be taken not to over-grease as excess grease is thrown by the fan into the radiator cores causing overheating. Two or three strokes of the grease gun daily should be sufficient.

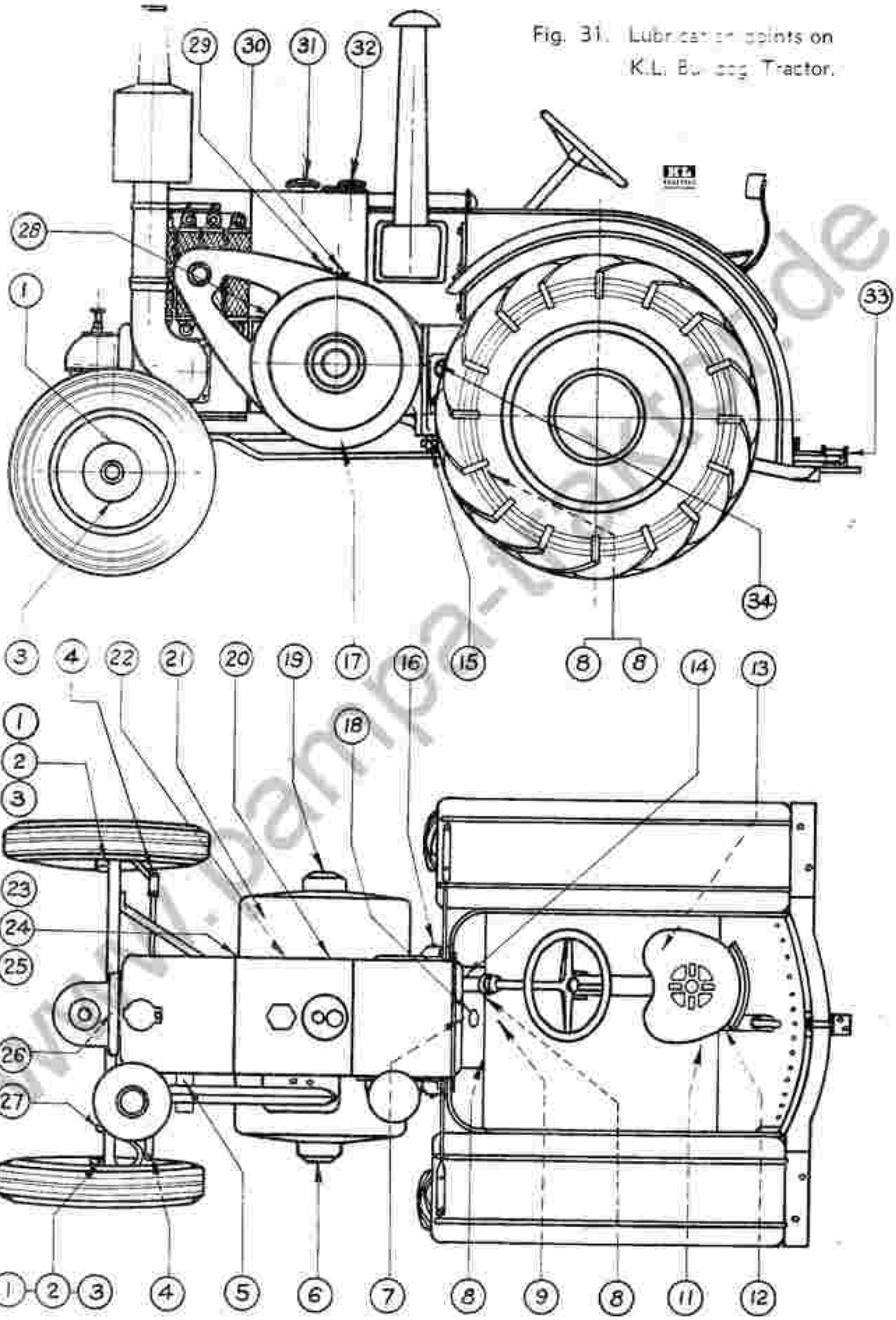
---oOo---

LUBRICATING CHART FOR

K.L. BULLDOG

CRUDE OIL TRACTOR

Fig. 31. Lubrication points on K.L. Bulldog Tractor.



[illegible] FOR M.F. BULLDOG TRACKTORS

[illegible]	KEY NO. ON CHART	NUMBER OF NIPPLES	QUANTITY
TWICE DAILY:			
SERVE [illegible]			
Clutch sleeve under R.H. flywheel cover flap.	19	1	6 - 8 strokes
SERVE WITH LUBRICATING OIL			
Mechanical force feed lubricator	32		Fill as directed in text.
Eccentric strap and lubricator drive - use oil can	29 30		Approx. 6 squirts with can.
ONCE DAILY:			
SERVE WITH GREASE GUN			
Wrist pin bearings L.H. & R.H.	[illegible]	[illegible]	2 - 3 strokes
Front wheel bearings L.H. & R.H.	2	2	2 - 3 "
Track rod bushes	4	2	1 - 2 "
Eccentric sheave (under L.H. flywheel cover flap)	6	1	2 - 3 "
Steering sector shaft	7	1	2 - 3 "
Pivot pin, swinging draw bar	9	1	2 - 3 "
Rear bearing, power take-off	13	1	1 - 2 "
Steering column	14	1	1 - 2 "
Side rod of steering gear (front and rear)	15, 27	2	1 - 2 "
1st. gear shaft bearings	16, 34	2	2 - 3 "
Stay rod pivot bearing	17	1	1 - 2 "
Clutch sliding collar	20	1	2 - 3 "
Clutch operating shaft (lower end)	22	1	1 - 2 "
Idler gear	23	1	2 - 3 "
Rocker shaft	24, 28	2	1 - 2 "
Fuel pump tappet	25	1	1 - 2 "
King pin, centre of front axle	26	1	1 - 2 "
Roller pin of swinging draw bar	33	1	2 - 3 "
ONCE WEEKLY:			
SERVE WITH GREASE GUN			
Fan bearings	5	1	3 - 4 strokes
Clutch pedal cross shaft bearings	8	2	2 - 3 "
Spring hitch	11, 12	2	3 - 4 "
Clutch shoe pivots (under R.H. flywheel cover)	21	3	2 - 3 "
ONCE MONTHLY:			
Gear oil-replenish to correct level (see Instruction Text)	18	-	As required

ALL JOINTS NOT PROVIDED WITH NIPPLES MUST BE SERVED [illegible] OIL CAN AFTER THOROUGH CLEANING

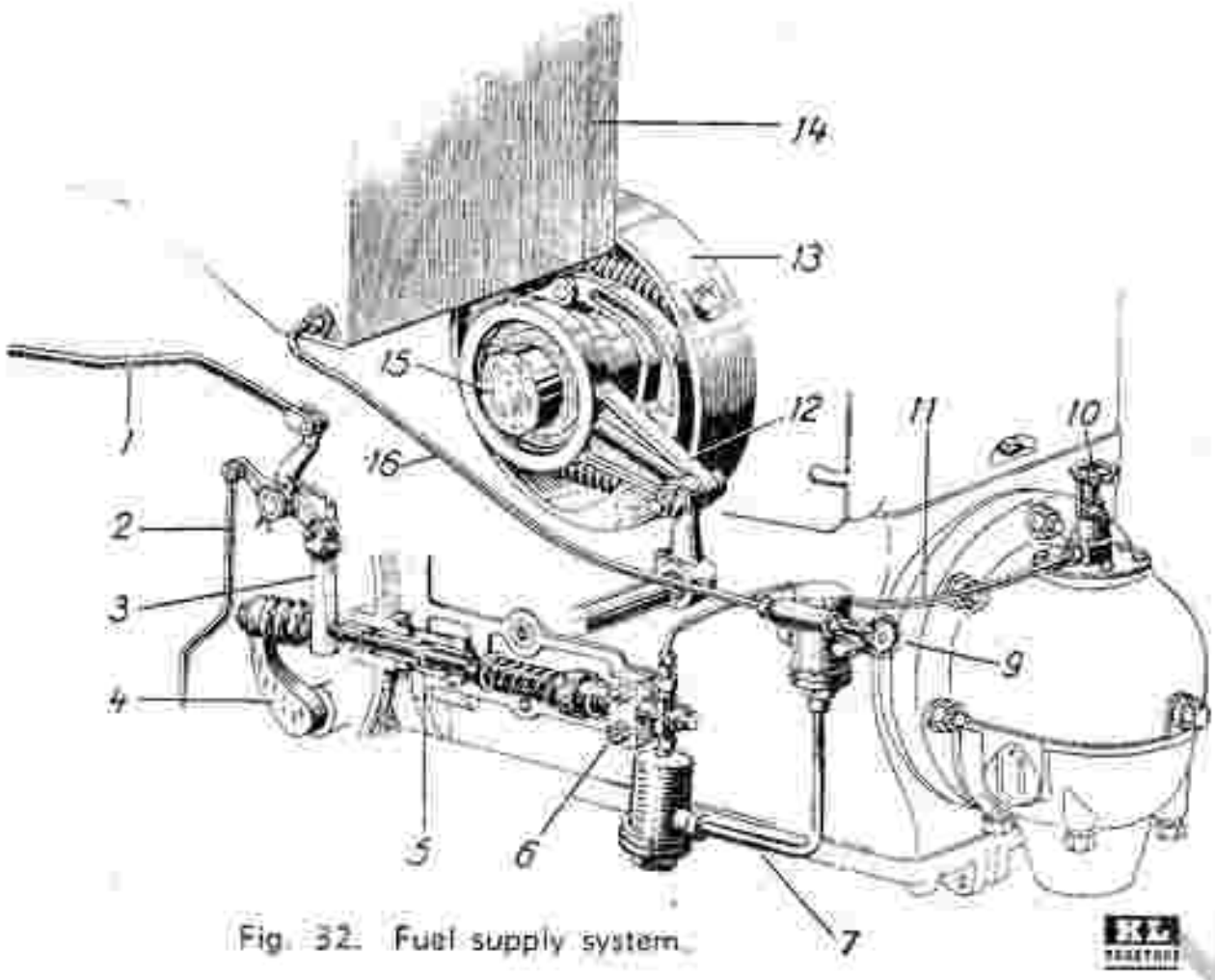


Fig. 32. Fuel supply system.

1. Fuel control rod.
2. Oil control rod.
3. Fuel supply regulating wedge.
4. Governor rocker arm shaft.
5. Pump tappet.
6. Fuel pump.
7. Fuel suction pipe.
8. Fuel strainer.
9. Fuel stop valve.
10. Atomizer.
11. Fuel delivery pipe.
12. Eccentric strap.
13. Engine rotation governor.
14. Fuel tank.
15. Crank shaft.
16. Fuel pipe to strainer.

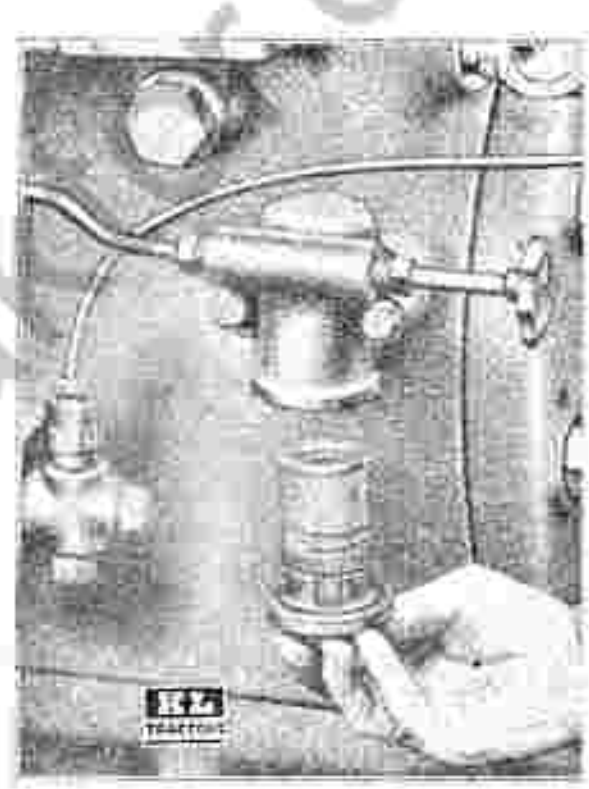


Fig. 33. Fuel strainer and stop valve.

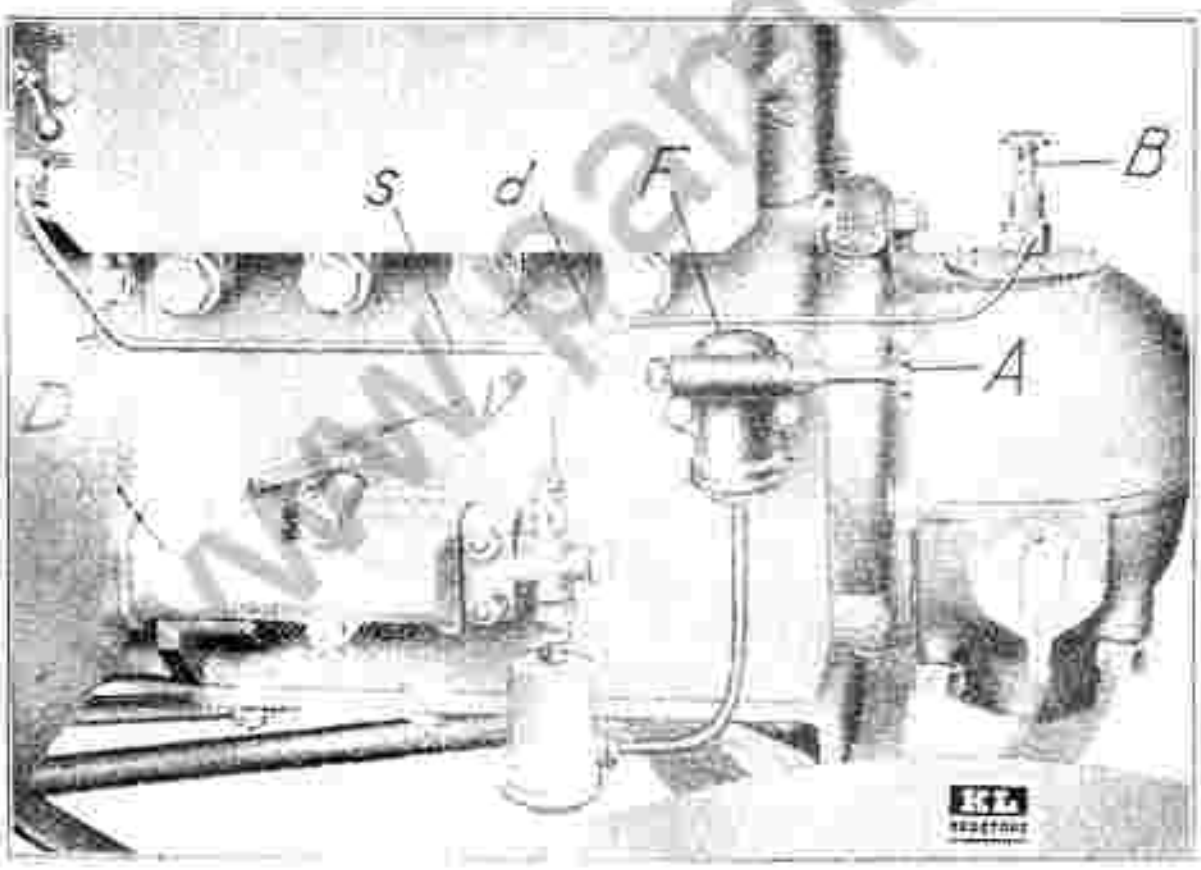


Fig. 34. Outside view of fuel supply.

A Fuel stop valve
B Atomizer
F Fuel strainer
D Pump casing
P Fuel pump
V Fuel pump roller
d Fuel delivery pipe
s Fuel suction pipe

Fig. 35. Fuel lever setting.

SECTION 4.

FUEL SYSTEM

FILLING UP FUEL - When filling with fuel filler (2), Fig. 5, the gauze strainer [illegible] be removed, and careful attention should be paid to cleanliness as engine stoppages are often caused by dirty fuel. Do not use the drips of storage tanks, as they contain sediment.

CLEANING FUEL TANK - The fuel tank should be completely drained and cleaned every 600 working hours. To drain the tank, unscrew the plug at the bottom of the fuel strainer, Fig. 33, and open stop valve, and remove the air cleaner cowling, disconnect the tank fastening screws and all pipes in the tank including the oil suction pipes (7) and (17), Fig. 15, remove the tank and wash thoroughly with kerosene.

This opportunity should be taken to clean the lubricating system.

STOP VALVE AND FUEL STRAINER - The fuel strainer (F) Fig. 34, is placed in the pipe line (16) and (7), Fig. 32, between the tank and pump. This is provided with a stop valve (A), Fig. 34, which is opened 4 turns. The strainer should be cleaned every 100 working hours by unscrewing the plug at the bottom, as shown in Fig. 33.

Take care that the inlet and outlet openings and fuel pipes are perfectly clear.

Clean the fuel filler gauze at the same time.

FUEL LEVER - The operator controls the fuel supply to the engine by setting the fuel lever Fig. 35. If the engine load is increased, the supply of fuel to the engine must be increased by moving the lever forward, if the load is decreased, the fuel supply must be decreased by moving the lever backwards.

FUEL LEVER SETTING FOR IDLING - The engine commences to knock when the temporary permissible peak load is reached. There is no danger in temporary knocking of the engine but continuous knocking must be avoided.

For idling, set the fuel lever on mark 1, when the engine will idle at 350 r.p.m. Do not put the lever below this mark to idle, or insufficient lubricating oil will be supplied to the piston and cylinder.

Do not alter the lever operating rods, for dismantling withdraw only the pins from the joints.

GOVERNOR & FUEL LEVER SETTINGS - The two speed governor, Fig. 36, acting with the fuel lever settings, is mounted on the left hand flywheel and crankshaft, and keeps the two engine speeds, i.e., the idling speed

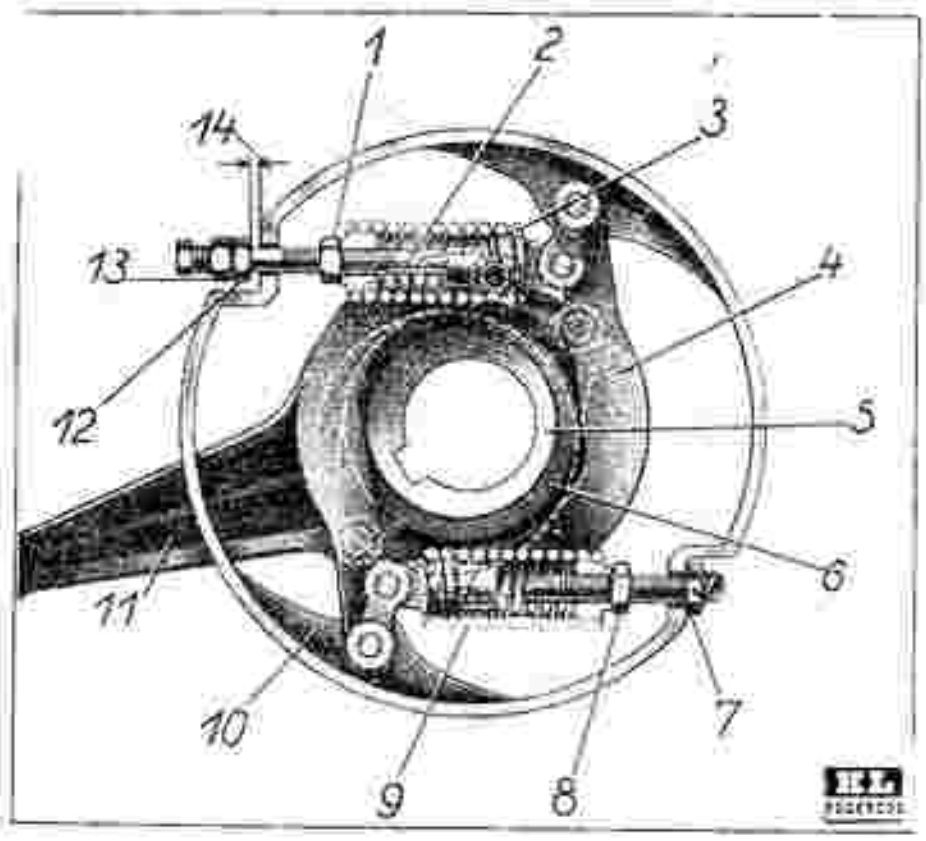


Fig. 36. Governor.

1. Lock nut.
2. Adjusting screw for [illegible] speed.
3. Governor spring for high speed.
4. Fly weight.
5. Inner (fast) eccentric.
6. Outer (loose) eccentric.
7. Adjusting screw for minimum speed.
8. Lock nut.
9. Governor spring for low speed.
10. Governor housing.
11. Eccentric strap.
12. Adjusting nut.
13. Lock nut.
14. Dead play before action of governor.

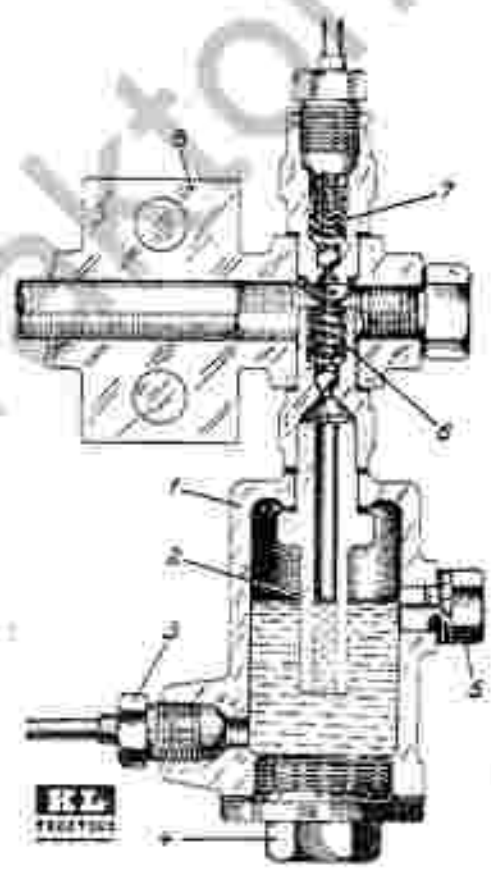


Fig. 37. Air pocket trap.

1 Air chamber
2 Center tube
3 Pipe Union
4 Accessibility plug
5 Air discharge plug
6 Suction valve
7 Delivery valve
8 Pump body

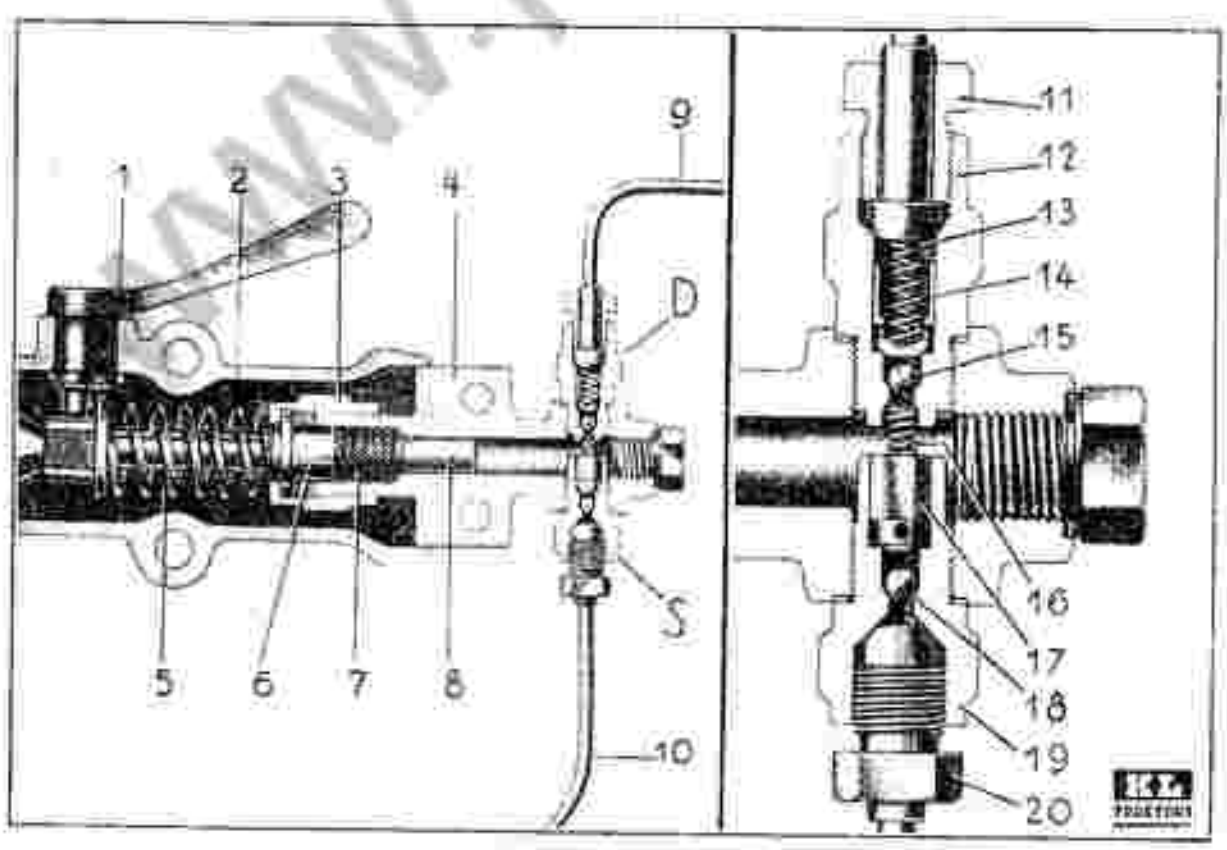


Fig. 38. Sectional view of fuel pump valves. D Delivery valve; S Suction valve.

1 Fuel priming handle
2 Pump casing
3 Gland adjusting nut
4 Pump body
5 Pump plunger spring
6 Gland distance piece
7 Gland packing
8 Pump plunger
9 Fuel delivery pipe
10 Fuel suction pipe
11 Delivery pipe union screw
12 Delivery valve housing
13 Delivery valve spring
14 Delivery valve
15 Delivery valve ball
16 Suction valve spring
17 Suction valve
18 Suction valve ball
19 Suction valve housing
20 Suction pipe union screw

of 350 r.p.m. and the normal speed of 600 r.p.m., approximately, constant under all normal load conditions, providing the fuel lever is correctly set. With fuel lever on mark (1), Fig. 35, only spring (9) Fig. 36, is active, and the speed is limited to 350 r.p.m. When the fuel lever is advanced beyond mark (2), spring (3) is brought into action, and the combined action of both springs keeps the engine speed nearly constant at 600 r.p.m.

The governor is correctly adjusted at the works and neither the adjusting nuts 1, 8, 12 and 13, nor the centre bolt (2) for pre-compression of spring (3) should be altered.

The dead play at (14) before the governor begins to act at normal speed is necessary.

PRIMING WITH FUEL - On the pump casing (2) Fig. 38, a handle (1), is fitted, by which the hot bulb is primed with fuel for starting. Open the fuel stop valve 4 turns, and push priming lever to the left until the resistance of the pump plunger spring is felt, then give priming lever 2 to 3 short hard strokes. Do not overprime, otherwise the engine will refuse to start. After priming is finished be sure to push lever back until it engages with the catch.

REMOVING AIR FROM PIPE LINE - Before first starting the engine, and after the fuel strainer, pipes, or atomizer have been removed, or the engine has stopped due to want of fuel, the air pockets in the pipe line must be removed.

Open the fuel stop valve 4 turns, loosen pipe union on delivery valve, disconnect fuel pipe at the atomizer and unscrew plug (5) Fig. 37, until air is expelled and fuel flows freely from the plug, tighten plug (5) and operate the pump with the priming lever until fuel flows freely, without air bubbles, from the end of the delivery pipe.

Make sure that fuel line unions, such as gland nuts, valve housings and pipe unions are tight to avoid sucking of air, and retighten if necessary.

TESTING VALVES - In order to test the efficiency of valves, disconnect suction and delivery pipes and unscrew valve housings. Examine valve with balls removed to see if their cones fit tightly in their seatings by pouring a little gasolene into the housings, and this should not seep through. If it does, the valves must be ground in, as follows:

Place the valve housing in a vice, apply a very fine grinding compound to the valve cone and place it in the valve seating. By means of a small stick turn the valve by quarter turns alternately to the

right and left in the seating applying a little pressure, lifting the cone occasionally to let the grinding compound get between the cone and the seat. Continue in this manner until the surface of the seat and cone show an even surface all the way round. If the valve seating is badly worn, it must be milled before reseating the valve or a new one must be fitted.

It is advisable to keep a set of spare valves on hand.

Whilst the suction and delivery pipes are off, make sure that the ball valves seat tightly by inserting the balls and testing. Should the seatings be leaky, place a brass drift on the ball in the housing and give a few light taps with the hammer. Damaged or rusty balls must be replaced.

When re-assembling be careful to fit the proper valves and springs. Each valve goes with the housing, into the seating of which it has been ground. The stronger spring belongs to the delivery valve. The springs must be correctly fitted and air pockets removed from pipes etc. before tightening the pipe unions.

FUEL PUMP - The plunger type fuel pump (6), Fig. 35, is operated by an eccentric strap through governor rocker arm (4), pump tappet (5) and and pump plunger. Between rocker arm (4) and tappet (5) the regulating wedge (3) is interposed, and this is operated by the fuel lever, thus varying the stroke and consequently the amount of fuel delivered to the engine.

In order to avoid over-heating of the engine by overcharging it with fuel and consequently giving a smoky exhaust, caused by the inertia of the governor fly-weights in case of sudden changes of load, the stroke of the fuel pump is limited and the excess movement caused by action of the fly-weights cancelled out in the following way:

The movement of the collar, integral with the tappet (7), Fig. 40, is limited on one (minimum) side by the inner shoulder of the adjustable tappet guide (9), and on the other (maximum) side by the adjustable, slotted tappet check screw (14), screwed into the tappet guide. Thus the movement of the tappet and the stroke of the plunger are limited. The excess movement of the rocker arm (2), governed by the governor strap, in case of sudden changes of load is taken up by the buffer (4) and its spring (3), for which purpose the anchorage stud of the buffer is carried in the bore of the rocker arm in a sliding fit with a certain amount of axial play under the control of the buffer spring (3).

CHECKING AND ADJUSTMENT OF PUMP STROKE - With the fuel lever set to mark (1), Fig. 35, the engine must idle at 350 r.p.m. checked with a revolution counter. If this is not so, adjust the engine speed to this number of revolutions by screwing the tappet guide (9), Fig. 40, in or out while engine is running after loosening the lock nut (8). After adjustment, tighten the lock nut but not to such an extent that the tappet will stick. Then check the minimum idling speed once more. Then check the pump stroke which must be 2.0 mm.

To do this, proceed as follows:

FIG.38 Stop engine, remove pump casing, Fig. 39, set fuel lever on mark (3) for maximum load and remove safety plug to facilitate turning of flywheel. When turning the flywheel slowly, the tappet (7), Fig. 39, will be moved in forward direction, and after it has come to a standstill in foremost position, measure the distance (e) as shown in Fig. 39, with a calliper. Then turn the flywheel half a revolution until the backward movement of the tappet comes to a standstill and measure the distance (e) again. The difference between the two measurements indicates the maximum tappet (or pump) stroke, which must be as stated above. The maximum limitation of the pump stroke is adjusted by screwing the tappet check screw (14, Fig. 40, in (for decreasing the pump stroke) or out (for increasing it) after loosening tab washer (13) and lock nut (10) until the difference of the measurements (e) is not more or less than started above. A greater stroke would cause overheating of the engine and smoke. Then draw lock nut tight and check the stroke once more. Secure by bending one tab of the lock washer (13) over the tappet check screw and the other over the lock nut.

Note that the checking and adjustment of the minimum limitation is with engine running and fuel lever on mark (1) Fig. 35, and that of the maximum limitation with engine at rest and fuel lever on mark (3).

DO NOT ADJUST PUMP STROKE SO THAT ENGINE IDLES WITH FUEL LEVER PLACED LOWER THAN MARK (1) ON FUEL QUADRANT AS LUBRICATING OIL SUPPLY TO CYLINDER IS THEN ELIMINATED.

GLAND PACKING - Should fuel leak from the gland, Fig. 38, while the engine is running, slightly tighten gland nut (3), but not to such an extent that the pump plunger sticks. If this tightening of the nut (3) is not sufficient to stop leakage of fuel, then a new gland packing is required and should be inserted as follows:

Remove fuel pipes from the pump, also the valves and valve housings, take off the pump by removing the two nuts and levering the plunger past the tappet.

With the pump removed, withdraw the plunger and remove the spring, when the gland nut can be taken off and the old packing removed.

Thoroughly clean all parts in kerosene, then place the pump body lightly in a vice, with stuffing box uppermost. Insert the pump plunger with gland nut and gland in their correct positions on it, hold the nut and gland up and place one round of graphited string (previously cut to correct length) round the pump plunger. Push this round home into the stuffing box by means of the gland and repeat this operation with other rounds of packing until the stuffing box is filled to within about $\frac{1}{8}$" of the top.

In putting the rounds in, keep the gaps of adjacent ones diametrically opposite.

Carefully remove the plunger, oil well and the spring, then insert plunger with spring gland and gland nut on it into the pump body.

Particles of packing which may have become detached should be carefully removed from the pump body.

Replace pump on the cylinder block and adjust gland nut so that it contacts gland but does not cause plunger to stick.

Reassemble valve housings, valves and pipes to the pump body, replace pump cover and then proceed to remove air from pump and fuel lines as previously instructed.

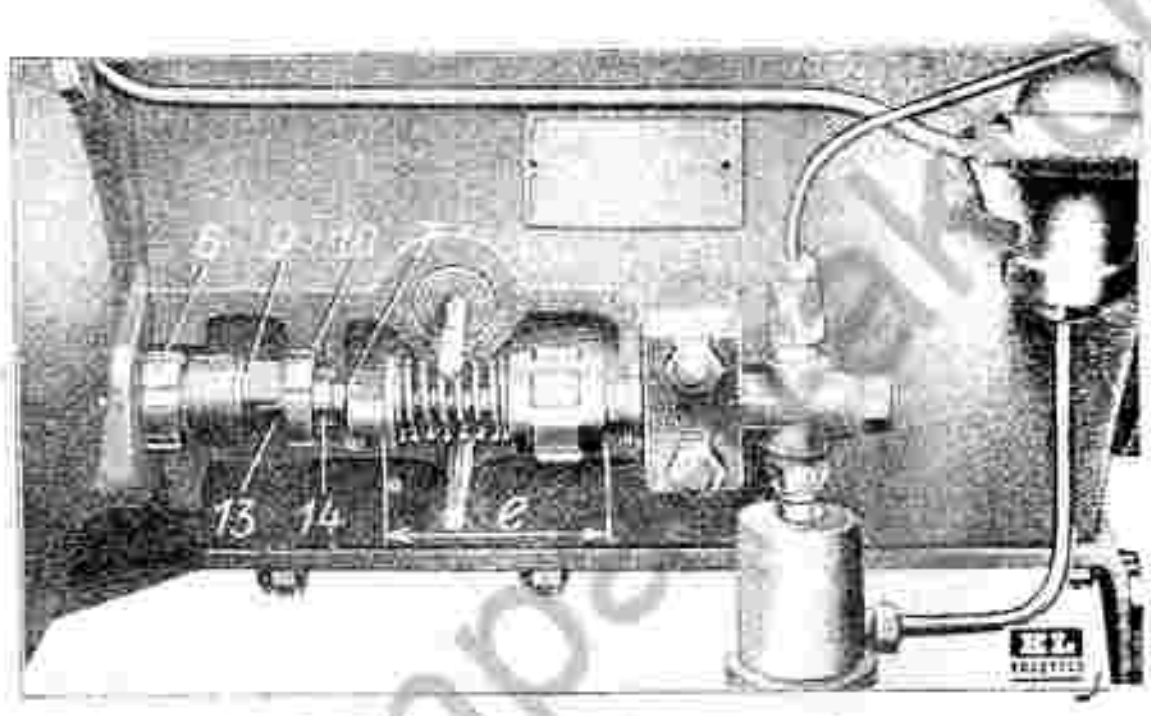


Fig. 39. Measuring the pump stroke.

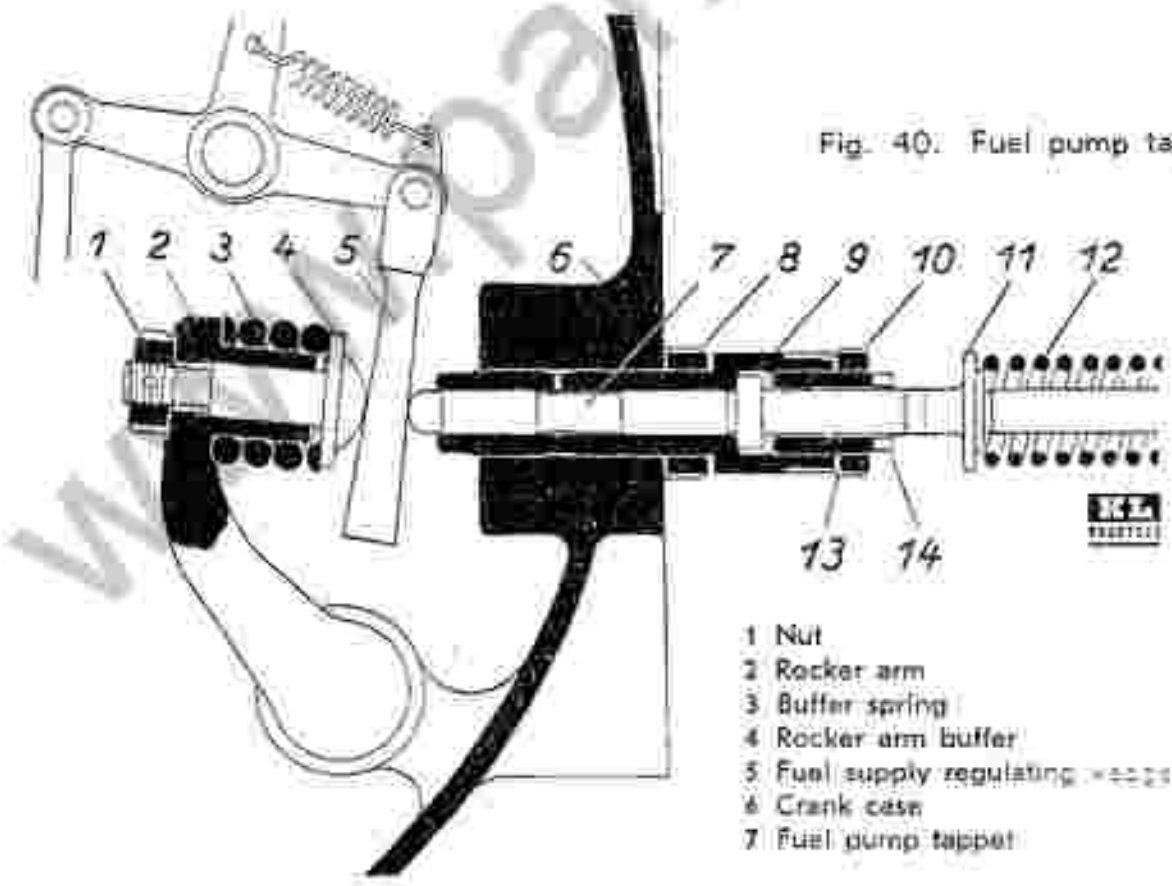


Fig. 40. Fuel pump tappet adjustment

1 Nut
2 Rocker arm
3 Buffer spring
4 Rocker arm buffer
5 Fuel supply regulating
6 Crank case
7 Fuel pump tappet

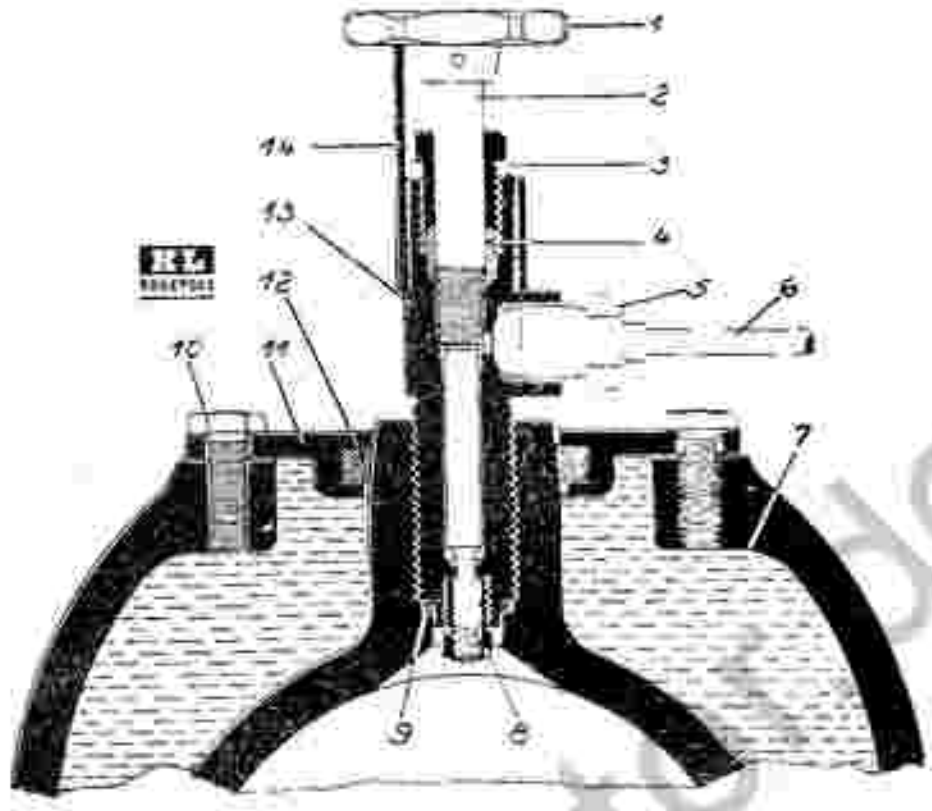


Fig. 41. Atomizer.

1 Hand wheel
2 Spindle
3 Gland screw
4 Gland packing string
5 Fuel pipe union screw
6 Fuel pipe
7 Water jacket
8 Nozzle
9 Copper washer
10 Ring cover screw
11 Ring cover
12 Rubber packing ring for ring cover
13 Atomizer body
14 Spindle stop

ATOMIZER

The Atomizer, Fig. 41, must be handled carefully, special attention being paid to nozzle (8), and grooves at the end of spindle (2) which are carefully ground at the factory. The fuel spray for various loads is regulated by screwing the spindle up or down, Fig. 42, according to requirements, but this adjustment does not alter the quantity of fuel injected, only increasing or decreasing the degree and angle of atomization, with which the fuel is sprayed on the heating plate or into the pocket of the bulb, Fig. 45.

SETTING ATOMIZER

When the estimated load . . .

is over 12 H.P. (full load) . . . close the spindle - Fig. 43.
is 6 - 12 H.P. . . . $1\frac{1}{8}$ turns open, (to the left).
is 0 - 6 H.P., and when starting . . . 3 turns up - Fig. 43.

When spindle is screwed right down, Fig. 41, to stop (14), this is full load position, and "turns up" are counted from this position, Fig. 42. Above settings are only approximate. Do not apply force when screwing spindle down for full load and return slightly when it reaches the bottom. Adjustment should be carried out immediately after stopping the tractor or any change of load. If the atomizer spindle is unscrewed too far on a heavy load, the bulb will become over heated, and irregular running will result, the engine will knock and pull badly. If it is screwed in too far on a light load, misfiring and smoking from the exhaust will result and perhaps ignition will cease altogether.

TESTING OF ATOMIZER - For testing unscrew the atomizer from cylinder head and connect it up to delivery pipe, leaving the unions loose. Now pump by priming handle, Fig. 44, in order to expel all air from pipe; when fuel flows freely, tighten the union nut and pump again. The correct shape of the spray is tested in the following way:

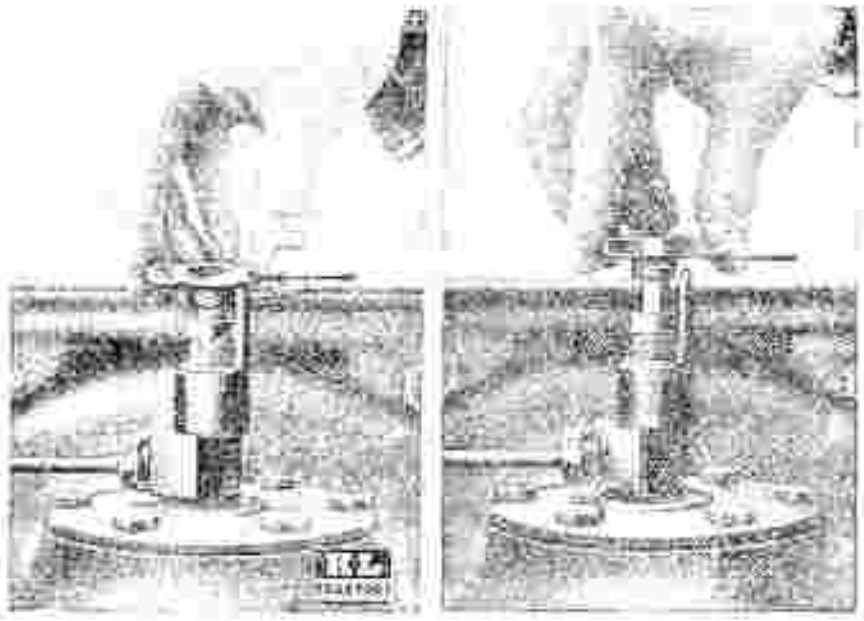


Fig. 42. Position of spindle.
V, at full load. L, when idling.

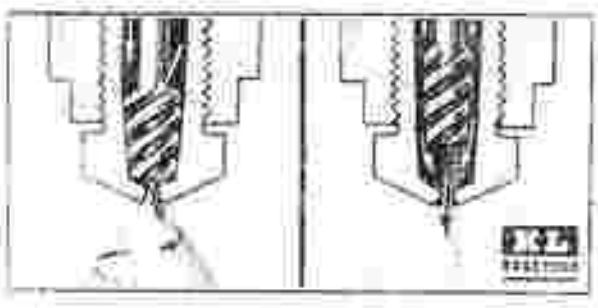


Fig. 43. Action of atomizer.
V, at full load. L, when idling.

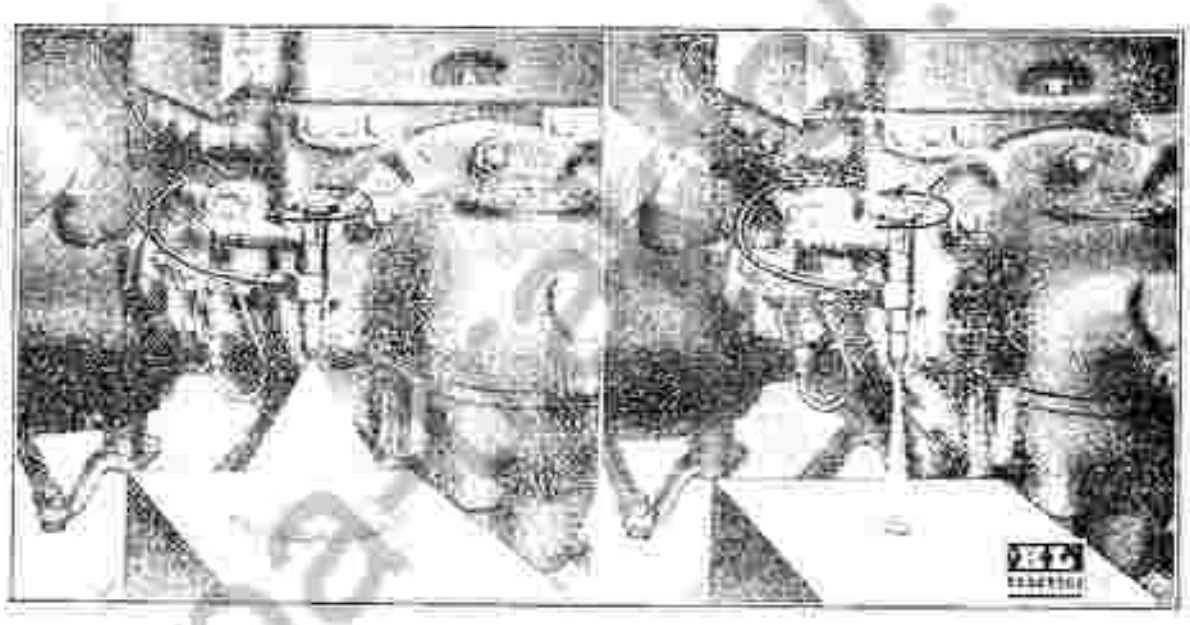


Fig. 44. Fuel spray.
V, at full load. L, when idling.

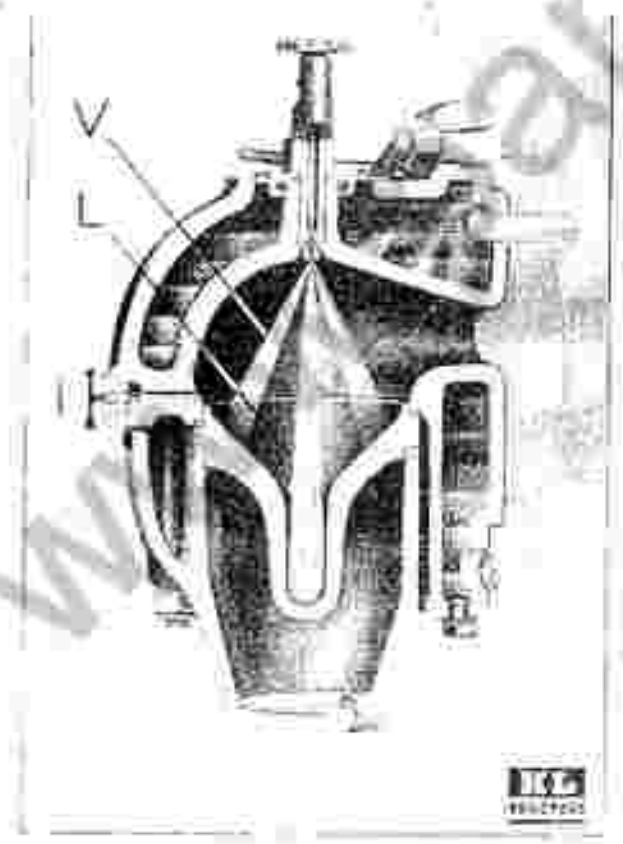


Fig. 45. Fuel spray.
V, at full load. L, when idling.

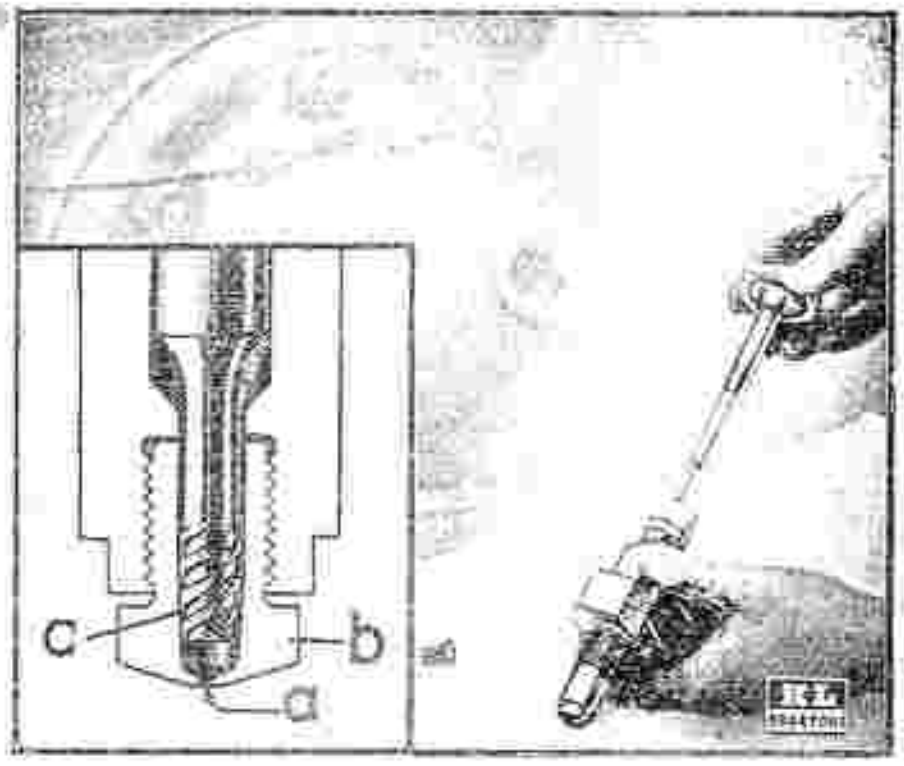


Fig. 46. Dismantling atomizer.
a. Nozzle nut.
b. Needle.
c. Groove in spindle.

A piece of paper is held horizontally underneath the atomizer at a distance of [illegible] from the end of the nozzle, and one or two short hard strokes are given to the priming handle. If the spindle is screwed right down, the spray will show in a perfect circle of 4¾" diameter, Fig. 44. If unscrewed 7 turns (no load), it will show a practically straight spray.

If fuel leaves in blobs, air is present in the pipe or nozzle and must be expelled by further pumping. Replace atomizer in cylinder head and fit delivery pipe loosely so that the air may be pumped out, and then tighten up.

Perfect atomization is of special importance for efficient tractor operation under light loads, therefore, satisfy yourself that at atomizer settings for half load and idling (spindle screwed 1½ and 3 turns up) the atomization is perfect, although the spray crown diameter is smaller. When testing the spray, the hits on the priming handle must be as sharp and short as possible in order to establish natural working conditions.

CARE OF ATOMIZER - Under correct conditions, the nozzle remains clean for weeks, but it may become choked by badly filtered fuel.

If the atomizer nozzle requires cleaning, one, or a combination of the following faults, will ensue:

Lack of power, smoky exhaust, bulb incandescent on one side, pump stiff to operate by priming handle, engine steps, spray incorrect or one-sided.

Remove nozzle (b), Fig. 46, unscrew spindle and clean the grooves (c) carefully, using a chip of wood. Clean the inside of the nozzle, being careful not to enlarge the hole (a).

When fitting atomizer, do not use unnecessary force to tighten and do not attempt to keep it tight in the cylinder head by using any other packing than copper washers (9), Fig. 41, which can be had in different thicknesses to assure correct position of the atomizer for connecting to fuel pipe. Use only one washer of proper thickness.

Efficient operation of the K.L. Bulldog Tractor depends on correct atomization of the fuel. It is of primary importance to keep the atomizer in perfect condition. First of all, it is necessary to re-condition end, if necessary, to renew the nozzle, because its jet hole may be worn by rapid passage of the ejaculated fuel. A defective atomizer must be sent for repair to the Works or Agents and replaced by a new atomizer which should always be kept in stock for such a case.

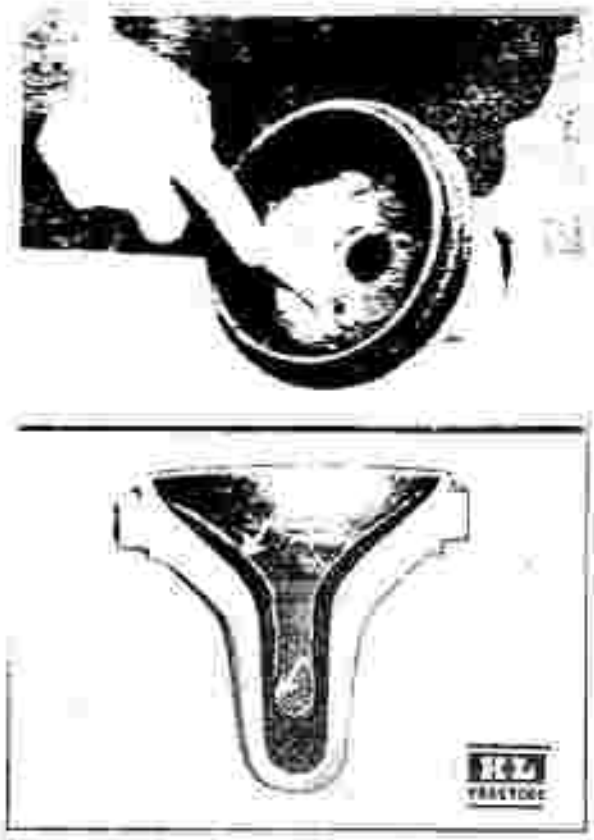


Fig. 47. Cleaning the hot bulb.

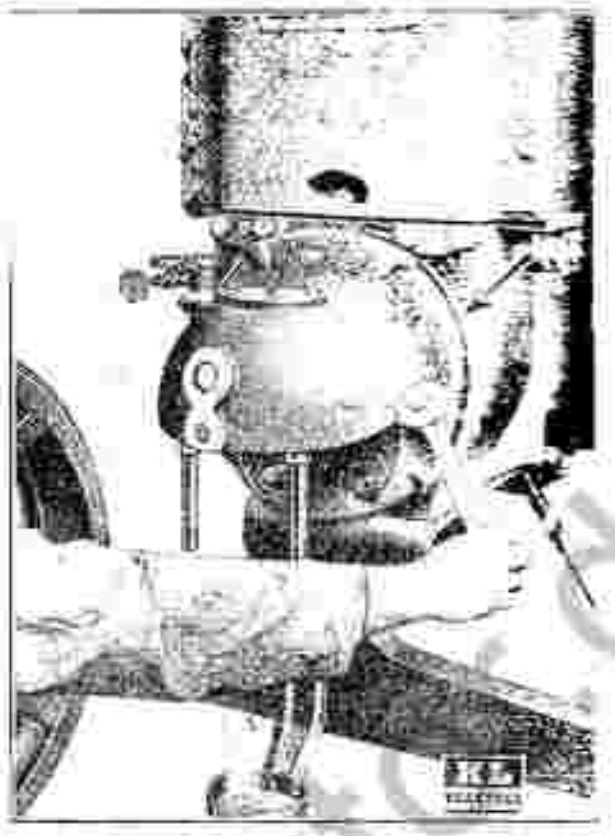


Fig. 48. Drawing off the cylinder head.

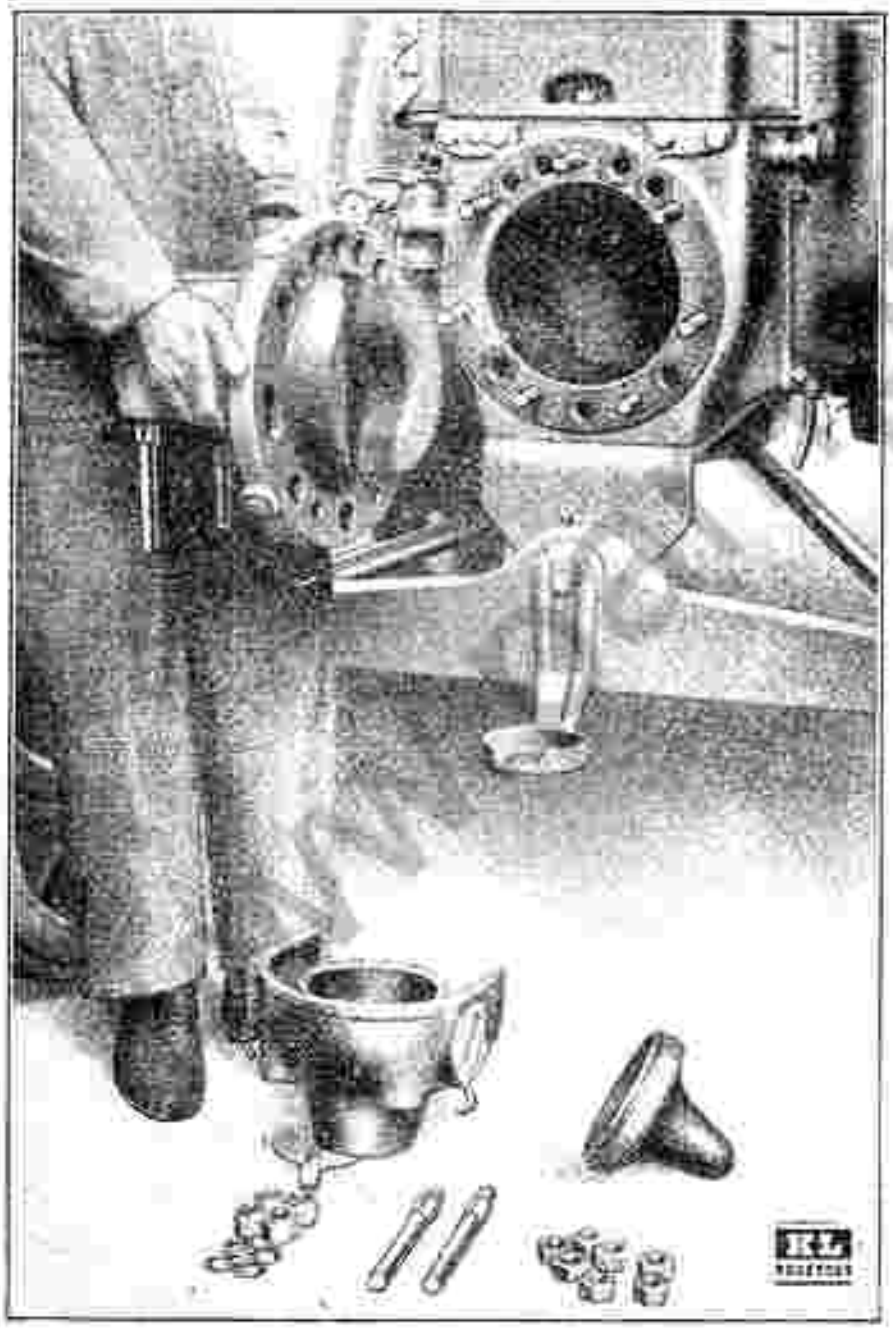


Fig. 49. Cylinder head removed.

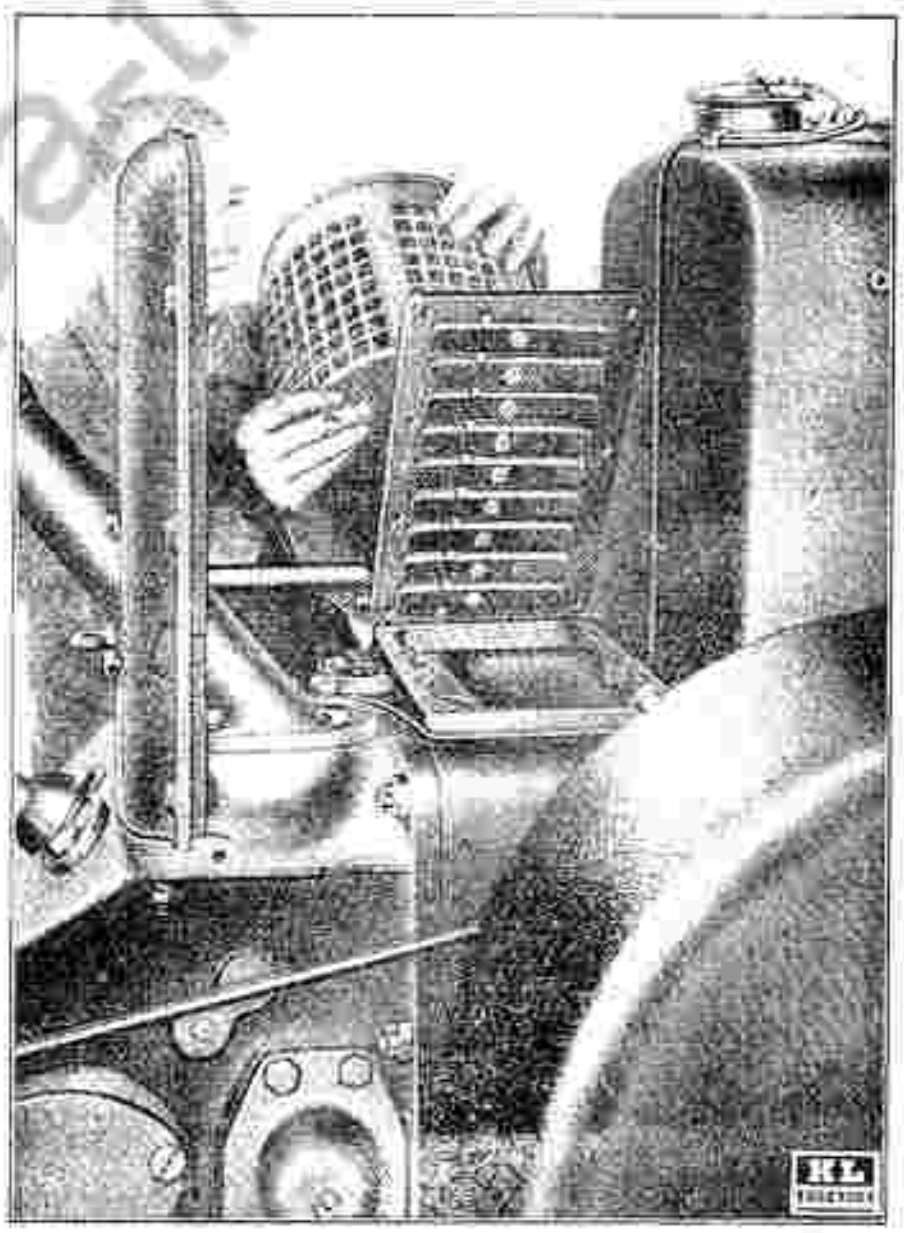


Fig. 50. Removing air cleaner base.

SECTION 5.

ENGINE

HOT BULB - The hot bulb must be clean, since accumulation of carbon impairs combustion, and when in the pocket, prevents the engine running properly without load. If the engine has been running for some time, with the nozzle dirty or the atomizer spindle wrongly adjusted, carbon may have accumulated in the bulb and pocket, and this must be removed. Mineral ingredients, contained in many kinds of fuel oils, are deposited in the bulb in the form of yellow ash, which must be scraped off, Fig. 47.

Before removing the bulb, its position, as well as that of the copper ring and bulb cover with reference to the cylinder head, should be marked so that these parts can be put back in exactly the same position.

The threads of the studs in the cylinder head should be brushed over with graphite supplied to prevent the nuts burning on during working, and thus tearing the thread when next loosened. The nuts must be evenly and firmly tightened a little after the engine is warm. If the leakage continues due to the copper ring having become hard, it must be annealed by heating to cherry red and quenching in water.

CLEANING COMBUSTION CHAMBER - The combustion chamber must be cleaned from time to time as follows:

Remove bulb cover and bulb, remove atomizer, the two bulb cover holding studs at rear and unscrew cylinder head fastening nuts; draw cylinder head off by means of draw bolts as shown in Fig. 48. Scrape deposits from cylinder head without injuring copper ring seat. Then remove carbon also from the cylinder walls and wash with kerosene.

When replacing cylinder head, see that it is perfectly tight by fitting it evenly. If the copper ring joint is renewed, all rubber packing rings must be renewed at the same time.

CLEANING ENGINE - The engine should be cleaned periodically according to the amount of work done. Particular care must be taken to thoroughly remove all carbon deposits from the outside and inside of the piston. Carbon, being an efficient insulating material, is apt to cause overheating of the engine if permitted to accumulate in the skirt or on the head of the piston. Remove cylinder head. Then remove air cleaner and air cleaner base thus giving access to the crankcase. The [illegible] nuts are unscrewed, Fig. 51, and bearing cap taken off. Remove rods taking care to replace in same position when reassembling. The [illegible]

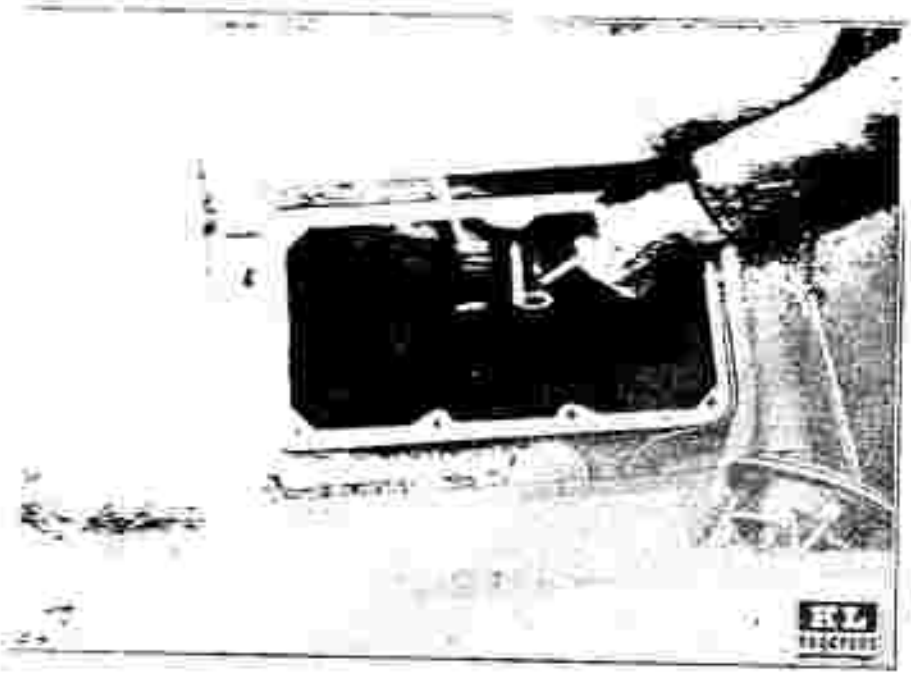


Fig. 51.- Unscrewing big end nuts.

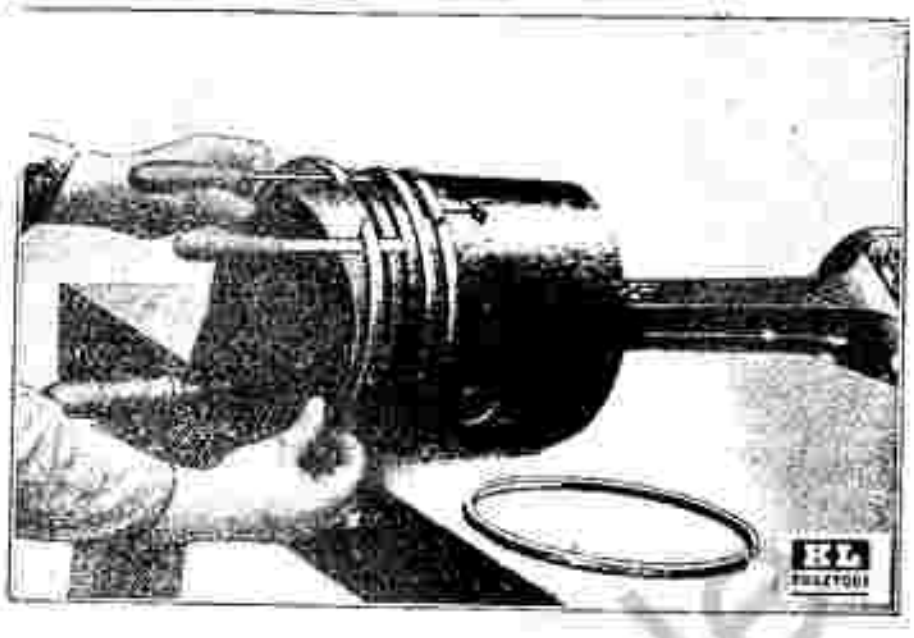


Fig. 52. Removing p[illegible]

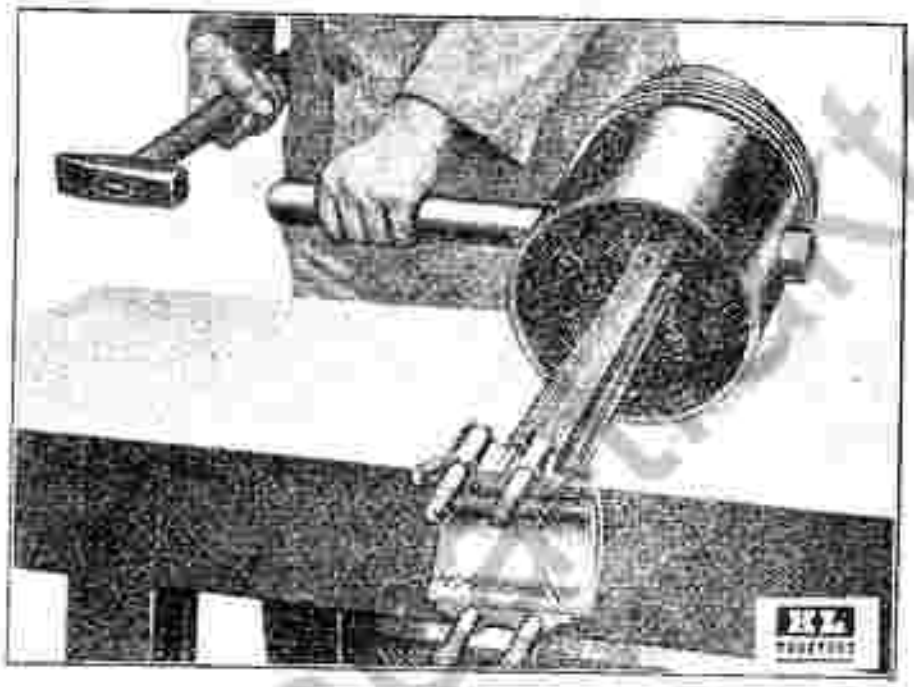


Fig. 53. Removing gudgeon ring from piston.

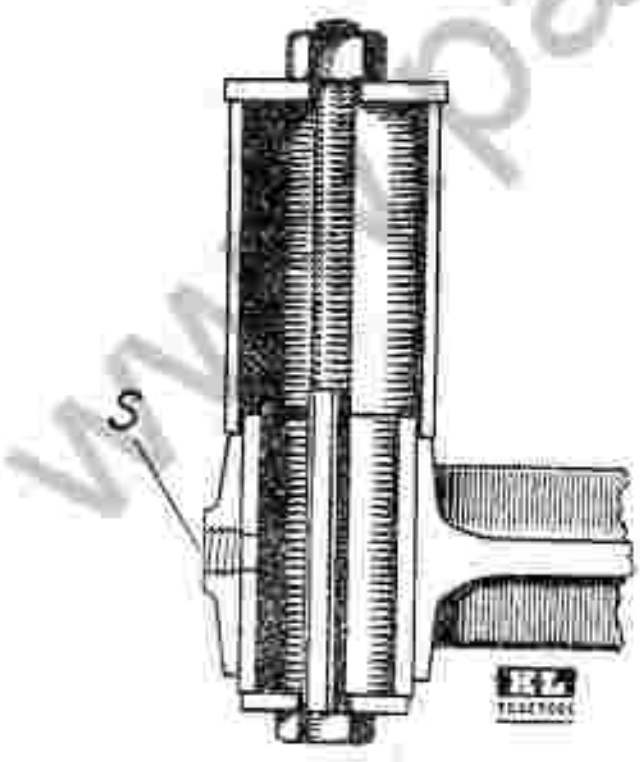


Fig. 54. Drawing bush from connecting rod.

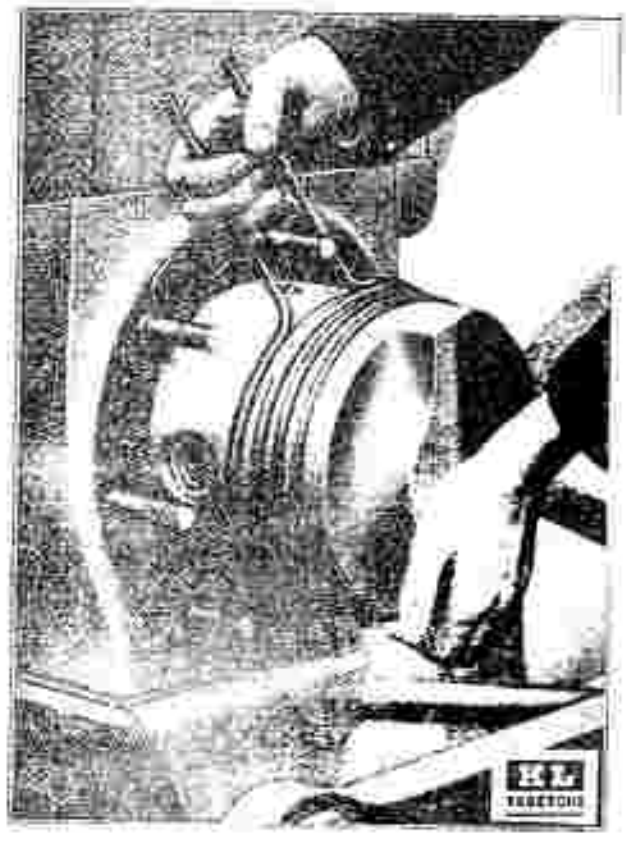


Fig. 55. Inserting piston into cylinder.

connecting rod are then carefully removed by pushing them towards the cylinder head, taking care that the crank pin and the cylinder walls do not get damaged and that the connecting rod does not knock against the edge of the piston skirt. A piece of copper or rubber tubing placed on the big end bolts, safeguards the crankpin and the cylinder from scores. All parts must be thoroughly cleaned with kerosene, using clean cloth and not cotton waste, which is apt to choke lubricating lines.

PISTON RINGS - Piston rings should fit loosely in the grooves, and if a ring is bedded in, it must be carefully loosened by tapping gently all round with a mallet, or the whole piston placed for one hour in kerosene. The piston rings being very fragile, should be handled carefully. For removing them, use 3 thin strips (use discarded air flaps), Fig. 52, and mark the rings to ensure their reinsertion in same order and groove.

GUDGEON PIN - To remove gudgeon pin: Remove the lock wire from the lock screw head. Then unscrew the lock screw taking care not to lose the spring washer under its head. The gudgeon pin end, away from the lock screw, being slightly bigger in diameter than the other end, must be driven out from the lock screw side as shown in Fig. 53. If the gudgeon pin be worn on one side only, it may be re-used after turning it by half a turn, and if badly worn it must be replaced by a new one. When re-assembling the gudgeon pin, take care that the holes for the lock screw are in exact alignment, otherwise it would be impossible to fit the screw. Do not omit to place the spring washer under the lock screw head and secure the head with the lock wire.

GUDGEON BUSH - To remove gudgeon bush from connecting rod, first remove the locking grub screw (8), Fig. 54. Use a press or a simple withdrawing tool, as shown in Fig. 54. When fitting new bush do not omit fitting the locking grub screw.

CLEANING OIL CONDUITS IN CRANKSHAFT - At the opportunity of removing the piston and connecting rod, the crankshaft and crankcase should be cleaned out, for which purpose the radius rods (3) and crankcase base plate (2), Fig. 25, must be removed. The banjo ring taking care of crank pin lubrication and now accessible through the hole of the removed air cleaner base, must be thoroughly cleaned and freed from the gummy oil sediments by alternately squirting kerosene into their grooves and turning the crankshaft with the starting wheel.

The lubricating hole in the crankshaft is first cleaned with a wire as far as accessible and then blown through with an air pump, or cleansing oil is pumped through by means of the grease gun. Turn the crank pin to its lowest position so that the kerosene drains out and leaves the oil hole perfectly clear. Then wash the inside of the crankcase.

Fig. 56. Big end bearing shims.

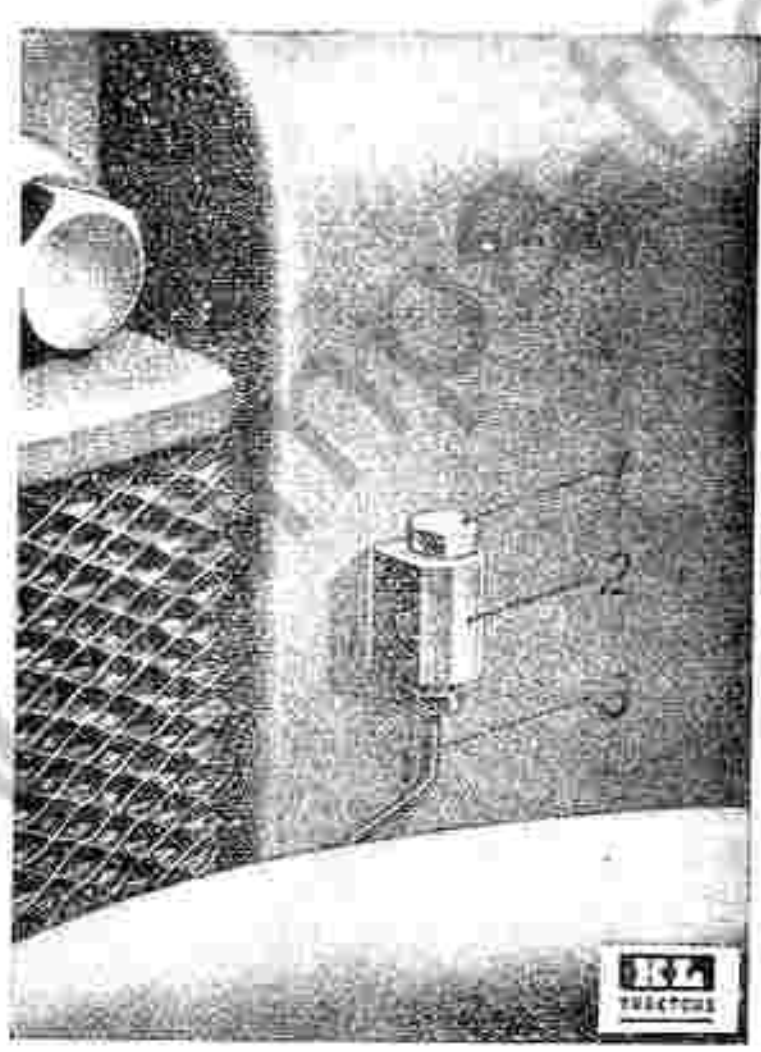


Fig. 57. Socket for flushing the cylinder with kerosene.

WHEN CLEANING THE INTERIOR OF THE ENGINE NEVER USE COTTON WASTE, ONLY FIRM CLEANING CLOTH.

REPLACING PISTON - When replacing the piston, it must be well lubricated and the same care must be taken as when dismantling. Push each ring into the same groove from which it was taken and the piston, carefully, without force, into the cylinder. Do not use a hammer. To facilitate the work, a piston ring clamp should be used, consisting of a wire ring, the ends of which are bent to form a handle. This is first placed round the back piston ring, Fig. 55, the latter being pressed into its groove by tightening the clamp.

The part of the piston containing the ring can then be pushed into the cylinder, the ring clamp sliding automatically to the next ring. This is repeated with the second, third and fourth ring.

BIG END BEARING - The big end bearing cap and shims are then replaced and nuts tightened. If bearing is too loose, remove shims evenly from each side, Fig. 56, until clearance of 0.004" is obtained. To avoid confusion, the connecting rod, bolts and nuts are numbered. When bearing nuts are finally tightened and split pins securely fitted, make sure that crankshaft turns freely.

COMPRESSION - Before starting the engine, the flywheel should be moved to and fro by means of the starting wheel to ensure that all moving parts work freely and the engine has compression. If the engine can be turned beyond the dead centre more easily than usual the piston rings may be jammed or broken, cylinder head or hot bulb faulty, allowing the compression to escape. Cylinder head or bulb nuts to be tightened or the joint ring replaced.

FLUSHING SOCKET - Immediately after stopping the engine for night, place the piston in rear dead centre with key in crankshaft showing up, pour a little kerosene into the cylinder flushing socket (2), Fig. 57, after removing the plug, allow the kerosene to drew into the cylinder, then move piston backward and forward. This prevents the oil in the cylinder from congealing and makes the engine easy to turn when next required. Leave the crankshaft key showing up. Before restarting, prime with oil.

SEIZING OF PISTON - If the piston happens to seize due to gumminess, pour a little kerosene into the cylinder through the flushing socket, Fig. 57, then after a few minutes, it will be possible to move the flywheel, although with difficulty at first, until finally it moves freely. Just before restarting the engine, pump some lubricating oil by the mechanical lubricator to ensure the piston being amply lubricated from the start.

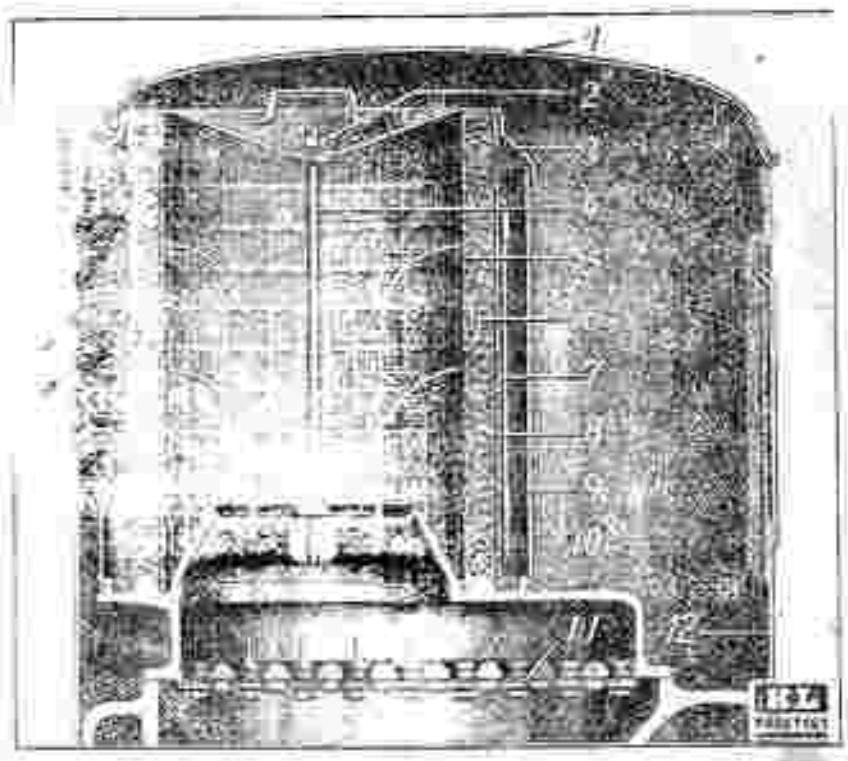


Fig. 58. Sectional view of air cleaner.

1 Cowling cover
2 Air cleaner fastening nut
3 Air cleaner cover
4 Air cleaner centre rod
5 Inner screen cylinder
6 Coir padding
7 Outer cage
8 Hinge pin
9 Air cleaner housing
10 Base with air flap valve
11 Air flaps
12 Cowling

Fig. 59. Removing the clogged fibre.

Fig. 60. By means of a narrow strip of wood, the fibre is pressed between the cage and the screen cylinder.

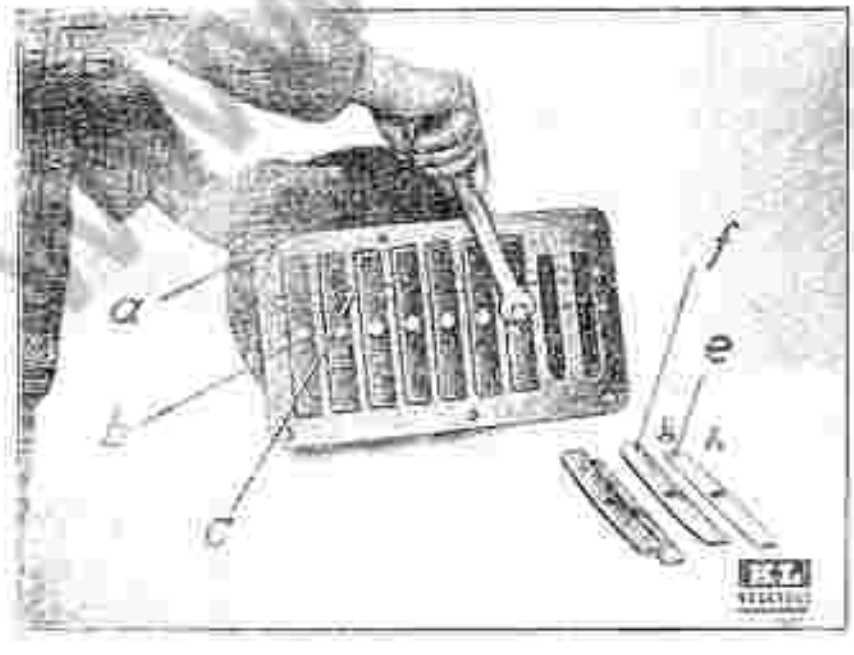


Fig. 61. Removal of air flaps.

a Air cleaner base
b Air flap fastening screw
c Air flap seat screw (square headed)
e Air flap
f Air flap check

AIR CLEANER - It is of primary importance that the air drawn in by the engine should be absolutely clean, as sand and dust, combined with lubricating oil set up friction in the engine and cause rapid wear. Therefore, an air cleaner is mounted under the cowling immediately above the air intake fitted on the crank case.

It consists of coir padding, moistened with oil and inserted between the inner screen cylinder (5), Fig. 58, and the outer cage (7), in which the dust is deposited.

CLEANING AIR CLEANER - The choking of the fibre padding in the cleaner depends on the amount of dust and air. When choked up, it must be cleaned or replaced. After the tractor has been out of use for some time, examine padding and moisten with oil, if necessary, by coating the outside of the filter with oil (about 1 pint), which by the action of the engine will be sucked into the fibre padding.

Do not open the filter while the engine is running.

To clean the air cleaner, open cowling cover (1), Fig. 58, unscrew air cleaner fastening nut (2) and lift the air cleaner out of its housing.

Thoroughly sluice the cleaner in a suitable conteiner, using power kerosene. (A 12-gallon drum with top removed and three quarters filled with kerosene is suitable).

Place two straps across the top of the container and support air cleaner on them after sluicing. Allow it to drain for several hours, then smear about 1 pint of engine oil over the outside of the cleaner and replace it on the engine.

When new fibre is being used to replace fibre which has become choked, it should be first washed with water to remove dust and other impurities. Then it is well loosened and spread out to dry. For one filling about 2 lbs. are required. By means of a narrow strip of wood the well dried fibre is then pressed between the cage and screen cylinder, and distributed evenly over the entire surface, Fig. 60. The fibre must not be packed too tightly, but on the other hand, no spaces must be left in the filling, through which air might pass unfiltered. It is essential that the cleaner be filled right to the top, as the fibre settles somewhat during running. Finally, smear about 1 pint of oil over the outside as outlined previously.

Under ordinary conditions it will suffice to clean the cleaner every 100 working hours, on the other hand, in very dusty districts, it will be necessary to clean it 2 or 3 times a day. Under such conditions it is advisable to keep one or two spare filters ready for use in order to avoid loss of time in cleaning.

The K.L. Bulldog Tractor coir padding air cleaner is very efficient and gives 100% clean air if properly attended to. It cannot be overemphasized to do so as the life of the tractor, especially the life of the cylinder and piston depends on it.

AIR FLAPS - If flaps of the air inlet valve under the air cleaner are bent or broken, not enough air is supplied for scavenging and filling the cylinder, resulting in loss of power of the engine.

After taking off the air cleaner, remove air cleaner base (10), Fig. 61, to which the flap valve is attached and replace damaged flaps by new ones. Take care that the flaps do not bear with a pressure upon their seating, but a clearance of about .5 mm is left between their free end and air cleaner base.

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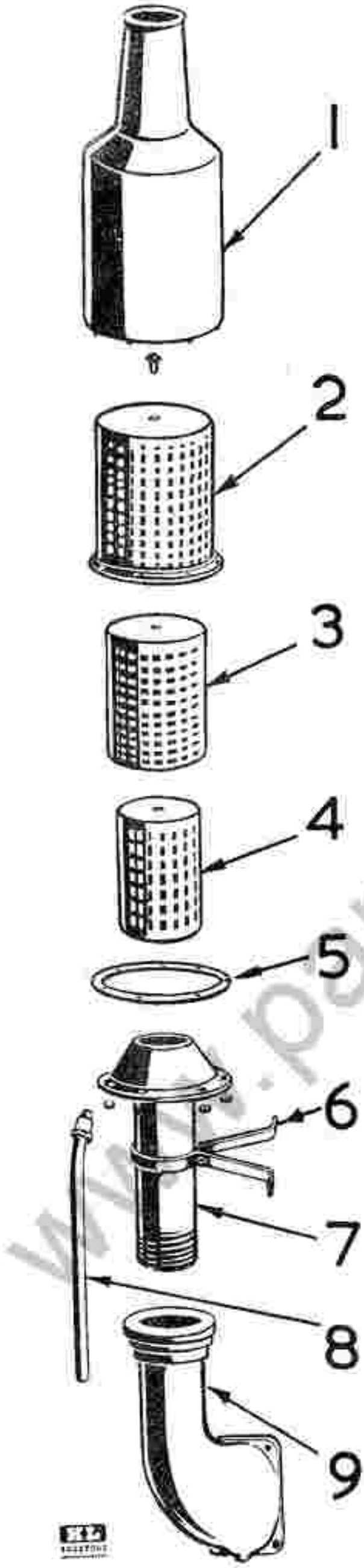

Fig. 62. Exhaust and spark arrester.

1 Bottle [illegible]
2 Outer baffle
3 Centre baffle
4 Inner baffle
5 Gasket
6 Pipe clip
7 Exhaust pipe
8 Drain plug
9 Exhaust bend

EXHAUST

To avoid loss of power, the exhaust should be kept free of carbon deposits, caused by over oiling and incomplete combustion. Therefore, it is of primary importance to keep the fuel lever as low as possible, consistent with the load, especially when idling.

The inside of the exhaust pipe must be cleaned thoroughly once a fortnight. The whole of the exhaust piping and the silencer must be taken to pieces and its parts cleaned with a scraper and steel brush. If, after a a long period of working, considerable carbon has been deposited, which cannot be removed with a scraper, the parts can be burned off over a light paper fire. This must be done with care to prevent the sheet metal being burnt by the high temperatures, produced by the deposits.

DURING HARVEST OR WHEN DANGER OF FIRE IS PRESENT, DO NOT OPERATE TRACTOR WITHOUT BAFFLE PLATES AND DO NOT OMIT THEM WHEN ASSEMBLING.

The exhaust ports in the cylinder must be cleaned out with a scraper and wiped out with a cloth moistened with kerosene. Close exhaust ports by turning piston to top dead centre so that no carbon gets into the cylinder. Tractors are equipped with an upright exhaust as shown in Fig. 62.

TROUBLE CHART

SYMPTOMS	CAUSE NOS. (See Opposite)
Engine will not start	1, 2, 3, 5, 16, 17, 19, 20, 21, 22.
Engine stops after starting	15, 17, 18, 19, 20, 21, 22.
Engine runs irregularly	15, 17, 19, 20, 22, 26, 28, 29, 30.
Engine stops while working	1, 4, 8, 11, 14, 17, 20, 22, 23, 24, 26, 27, 28, 29.
Engine stops while idling	1, 4, 5, 8, 14, 15, 16, 17, 18, 19, 20, 22, 25, 26, 27, 28, 29.
Engine knocks	4, 7, 8, 9, 11, 19, 20, 22, 23, 24, 28, 30.
Engine smokes	5, 12, 15, 19, 20, 22, 28, 30.
Engine pulls badly	5, 15, 17, 18, 19, 20, 22, 24, 25, 26, 28, 29, 30.

	FAULTS	REMEDIES
1.	Lack of fuel	Fill fuel tank.
2.	Fuel insufficiently heated	Heat by blow lamp.
3.	Fuel supply shut off	Open fuel stop valve 4 turns.
4.	Lack of water (fuse melted)	Fill up water, renew fuse.
5.	Water too cold	Use hot water, close radiator shutter.
6.	Congealed oil	Use hot water and warm up by blow lamp.
7.	Cooling system fouled	Clean cooling system.
8.	Scale (fuse melts)	Remove scale, renew fuse.
9.	Fan belt incorrectly tensioned	Adjust fan belt.
10.	Lubricator incorrectly adjusted	Adjust lubricator.
11.	Lack of oil	Replenish oil container.
12.	Return oil line choked	Clean return oil strainer and filter.
13.	Broken or blocked gears	Inspect gears.
14.	Fuel line choked	Clean fuel strainer.
15.	Fuel lever incorrectly set	Set the fuel lever correctly.
16.	Air in fuel line	Remove air and prime.
17.	Fuel pump fouled	Clean and test valves.
18.	Gland packing leaky	Renew gland packing.
19.	Atomizer incorrectly set	Set atomizer correctly.
20.	Atomizer dirty	Test spray and clean nozzle.
21.	Hot bulb flooded	Remove excess fuel.
22.	Hot bulb dirty	Remove carbon from bulb.
23.	Water in cylinder	Remove packing between cylinder and head.
24.	Cylinder dirty	Clean cylinder.
25.	Piston rings jammed and broken	Inspect piston rings and test compression.
26.	Lack of compression	Test compression.
27.	Piston seized	Flush with kerosene.
28.	Air cleaner padding dirty or too tight	Clean air cleaner.
29.	Air flap bent or broken	Renew air flap.
30.	Exhaust or exhaust ports dirty	Clean exhaust.

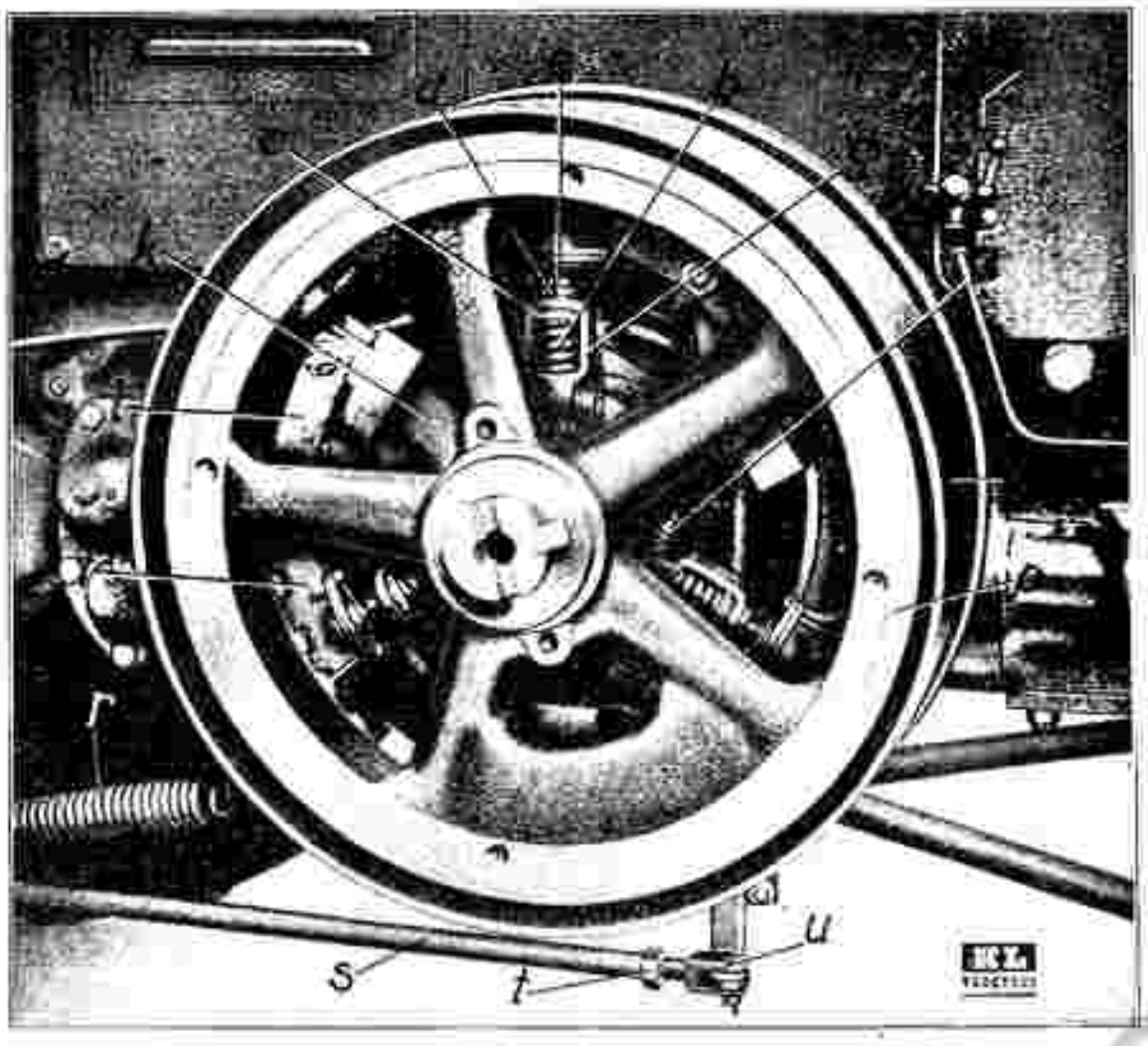

Fig. 63. Clutch assembly.

a Sliding collar
b Shoe pressure spring
c Floating spring seat
d Adjusting bolt lock nut
e Ball joint with adjusting bolt
f Clutch shoe
g Spring cage
k Spider
l Bracing plate
m Belt pulley on farm and dual purpose tractor
n Flywheel
r Engaging spring
s Clutch connecting rod
t Adjusting fork lock nut
u Adjusting nut

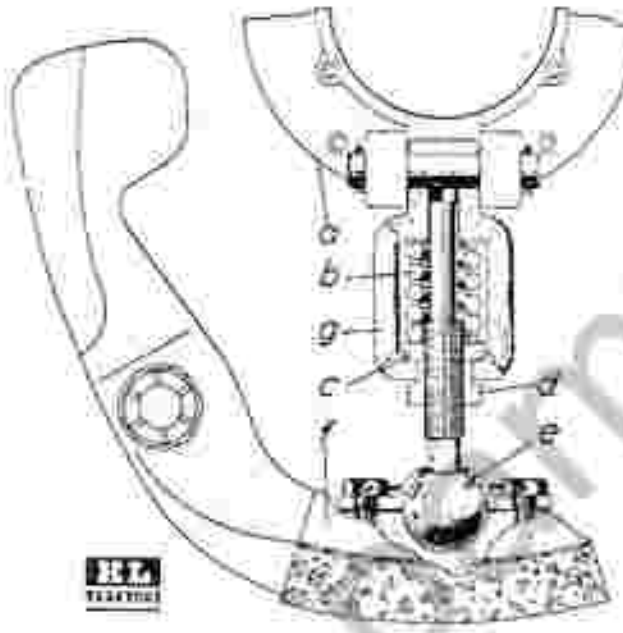

Fig. 64. Shoe expansion unit.

a. Sliding collar.
b. Shoepressure coil spring.
c. Floating spring seat.
d. Adjusting bolt lock nut.
e. Ball joint with adjusting bolt.
f. Clutch shoe.
g. Spring cage.

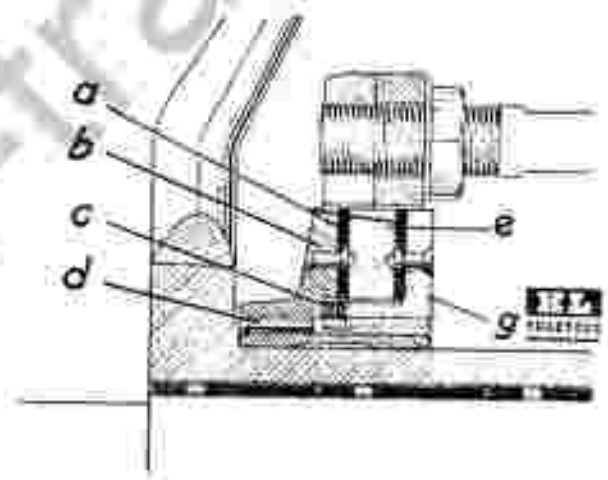

Fig. 65. Sliding collar assembly.

a Bronce thrust pads
b Outer sliding collar ring
c Spacers
d Ring locking rivet
e Ring with stubs
g Inner sliding collar ring

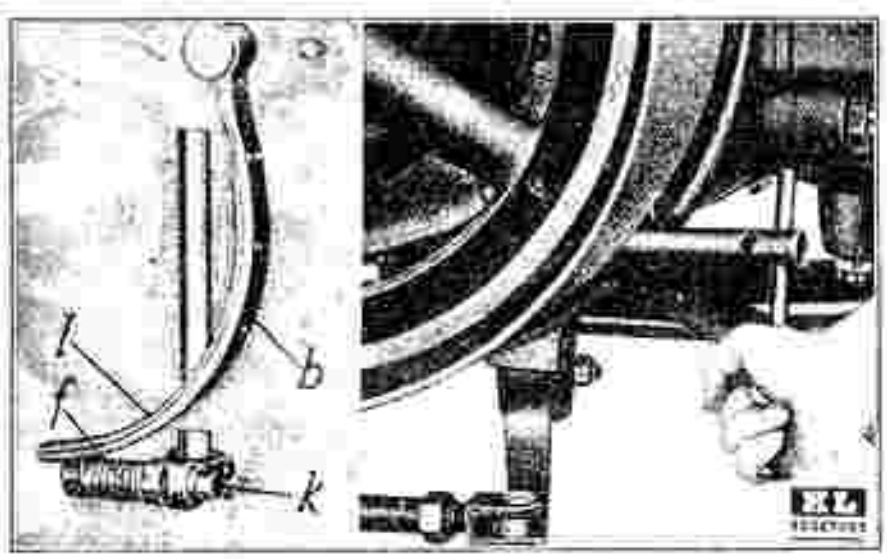

Fig. 66. Clutch brake adjustment.

SECTION 6.

CLUTCH

CLUTCH GENERAL - The clutch interposed between the engine and the transmission enables the operator to cut off the power flow from the engine to transmission at any moment when required, i.e. for gear changing, by depressing the clutch pedal (K) Fig. 9. A further downward pressure brakes the pulley, clutch and 1st gear shaft. When releasing the pressure on pedal, first the brake is released and then the clutch is engaged.

The clutch must engage smoothly, therefore, release the pressure on the clutch gradually. Never drive downhill with the clutch disengaged. Declutch immediately the engine tends to stop due to overload or want of fuel, otherwise engine will reverse. This is of greatest importance when driving uphill, in such case, disengage clutch and brake the tractor immediately, otherwise the tractor might be pulled backward by the weight of the trailer. Before re-engaging the clutch, control correct engine rotation by knob (D), Fig. 9. Avoid riding the foot on the clutch pedal, as even a slight pressure exerted on the pedal when the tractor is pulling will cause the clutch to slip, wearing out the clutch linings.

ACTION OF THE 3-SHOE CLUTCH - On K.L. Tractors the rotary motion of the crankshaft is transmitted to the driving wheels and driving pulley by an expanding 3-shoe clutch consisting of the spider, the clutch shoes with pressure unit and sliding collar, and the throw-out unit.

The spider hub is carried by the R.H. crankshaft extension on sleeves interposed between shaft and hub. On the inner end of the spider hub the ring gear is keyed on, transmitting the motion through the transmission to the driving wheels; on its outer end, it carries three spider arms, to which the driving pulley is bolted in such a manner that it embraces the flywheel, which is running inside the pulley rim.

The transmission of power is established and interrupted by the clutch shoes pressed into or lifted out of the groove provided on the inner circumference of the flywheel.

The 3-shoe clutch is actuated by the clutch pedal through the axial movements of the clutch sliding collar on the spider hub.

Each shoe (f), Fig. 34, is firstly pivoted on a pin passing through the web of the pulley bolted to the spider, and secondly, it is connected with the clutch sliding collar (a) by a pressure unit consisting of spring cage (g), coil spring (b), built into this cage with a certain amount of compression, and the adjusting bolt, connected with the shoe ball joint (e).

The ball headed adjusting bolt (e) is screwed into the floating spring seat (c) and locked from rotation by lock nut (d). When clutch

is "in" (engaged), the spring (b) thus exerts pressure on the clutch shoe through the floating seat and ball joint bolt. Due to its expansion being limited by the cage apex, it is most important to adjust the ball joint bolt (c) in the spring seat (c) so that - with clutch engaged - a clearance of not less than .5 and not more than 1. mm. which is guided by a hole in the cage apex.

ADJUSTMENT OF 3-SHOE CLUTCHES - It is of utmost importance that all three shoes engage simultaneously. To ascertain that this is so, depress clutch pedal until the shoes just begin to disengage. By now moving each shoe separately by hand, it can be easily felt, whether they engage simultaneously or not and re-adjust if necessary. Repeat this test twice more after turning every time the spider by one third of its circumference.

If, in spite of the fact that the engine is turning at normal speed, it no longer pulls properly, and if the clutch shoes drag, the clutch must be re-adjusted. When the tractor is new, the clutch shoes must be frequently re-adjusted, as, when new, the linings are settling down, so that the shoes are not sufficiently pressed into the flywheel groove.

To gain access to the clutch, remove the flywheel cover and the clutch guard plate on the off-side of the engine.

Unscrew lock nut (d), Fig. 63, on all three shoes by holding the ball joint bolt at its square section with another spanner. Disengage clutch and unscrew ball joint bolt on one shoe by one or two quarter turns, thus increasing the pressure of spring (b) and adjust the other two springs accordingly. Then tighten lock nuts (d) while holding the ball joint bolt with another spanner.

Note that the spring clearance being equal is no proof of correct adjustment, the clearance on the three springs may differ within the limits of .5 to 1. mm, although the shoes are correctly adjusted.

Should one of the springs become dead and no replacement spring be at hand, a washer must be inserted between the spring and adjusting nut (c) instead, unscrewing the ball joint bolt so far that the clearance amounts to more than 1 mm.

On release of the clutch pedal, the clutch must engage completely on its own accord. If it does not, the clutch springs are exerting too much power (i.e. the ball joint bolts having been unscrewed too far), or the clutch connecting rods require adjustment, due to being bent, or wear of the joint pins and/or sliding collar bronce thrust pad.

When the tractor is warm, the belt pulley should slowly run out after the clutch has been disengaged (without actuating the clutch brake). There should be a certain amount of movement on the clutch pedal between

disengagement and brake actuation. Should the pulley continue running after declutching, this is a sign that the ball joint bolt has been unscrewed too far. Grease and dirt, accumulating on the clutch shoes and in the groove, should occasionally be washed out with kerosene.

ADJUSTMENT OF CLUTCH SLIDING COLLAR - If the clutch pedal shows slackness before being depressed, and the stub ring (e), Fig. 65, shows side play, which can be ascertained after removing the clutch rod joint pin, this is a sign that the sliding collar needs adjustment due to wear of the bronce thrust pads (a). To do this the sliding collar must be taken down after taking down the complete clutch assembly and removing the clutch ring gear; Drive the ring locking rivet (d) out from the inside, insert pins of suitable size into the 2 holes, provided in the inner collar ring, and by means of these pins and a lever, screw the inner ring (g) down from the outer ring (b). Remove - in accordance with the play ascertained - one or more spacers (c) (which are obtainable in thicknesses of 0.015" and 0.030". After reassembling, the stub ring (e) must turn freely without showing any side play. Then secure ring (b) and (g) against turning by inserting rivet (d) from the outside through the apertures provided in the rings and spacers and secure it by riveting it in the inner countersink.

ADJUSTMENT OF LINKAGE OF 3-SHOE CLUTCHES - When adjusting 3-shoe clutch, do not alter setting of the linkage. Should it become necessary, for any reason, to remove the rod, withdraw the pins (u), Fig. 63, in the joints without removing the lock nuts and adjusting forks. The clutch linkage must be so adjusted that the clutch pedal is stopped by the platform when clutch is fully engaged, otherwise the clutch sliding collar will run hot.

The rod is too long if clutch is engaged before the pedal is stopped. It is too short if pedal is stopped before the clutch is engaged. Before altering the adjustment of the rod, ascertain if the clutch shoe adjustment is correct. For adjusting the length of the connecting rod, withdraw the pin (u) and then screw the fork in or out, as the case may be, to such an extent, that the joint pin is slack when clutch is fully engaged and the pedal lever firmly rests against the platform. Make sure that the joint pin is still slack when the end play (of 2 mm.) of the crankshaft is on the governor side. To do this, declutch, take the off-side flywheel arm by your hands and push the flywheel in the direction of the near side.

The clutch spring (r), Fig. 63, must have enough tension to engage clutch smoothly; adjustment is only necessary after dismantling.

ADJUSTMENT OF 3-SHOE CLUTCH BRAKE - For stopping the three-shoe clutch and pulley, clutch brakes (b), Fig. 66, is provided. If it fails

to act, it must be adjusted by means of the clutch brake adjusting screw (k), each half turn of which is arrested by a catch. Access to this screw is gained by turning the pulley on the off-side until the semi-circular indenture in the inner edge of the pulley rim coincides with that in the crankcase ledge.

Through the aperture formed thereby insert box spanner supplied and turn the adjusting screw one turn. After adjustment, the brake must be tested with the engine running. The brake must be so adjusted that after disengaging the clutch, there is a certain amount of play between declutching and braking to allow for clean changing of gears. The coil spring (f) on the brake hand serves only to actuate the catch of the brake adjusting screw. The brake itself is unsprung. Worn brake linings must be replaced.

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SECTION 7.

TRANSMISSION

TRANSMISSION GENERAL - The transmission consists of the clutch ring gear, the intermediate idler gear, the speed change and reduction gear, the differential with rear axle halves and with rear wheels rigidly fixed to them. The movement of the tractor is made possible by the grip of the rear or driving wheels on the ground, which, therefore, form part of the transmission.

The clutch hub interposed between the crankshaft and the ring gear, carried by it, enables it to establish a rigid connection between the crankshaft and ring gear or to interrupt it.

The transmission is of the sliding mesh type with spur gears, ball and roller bearings throughout. The gear box contains four gear shafts. The 1st and 3rd gear shafts carry each one sliding double pinion, controlled by the gear change levers through selector forks.

INTERMEDIATE IDLER GEAR - The intermediate idler gear Fig. 69, transmitting the engine effect from the ring gear to the transmission, is running on tapered roller bearings, which must be inspected should the overhauling of the clutch take place. For taking up end play, the lock wire must be removed from the adjusting screws (6), Fig. 69, and Fig. 70, and these screws alternately and evenly tightened.

GEAR SHIFTING GENERAL - The K.L. Tractor has six gears or travelling speeds. The various gear changes are effected by gear shift levers (1) Fig. 72 and (16) Fig. 72. All gear changes must be made with clutch disengaged. Rough handling when shifting gears will inevitably lead to damaged gears. Correct gear changing is silent. To avoid "crashing" adopt the following procedure:

TO CHANGE UP:

1. Declutch by slightly depressing the clutch pedal and slide lever to neutral.
2. Press clutch slightly harder to actuate brake.
3. Slide lever into higher gear.
4. Release clutch pedal.

TO CHANGE DOWN:

1. Declutch slide lever to neutral and release clutch pedal.
2. Wait until tractor is travelling at correct speed.
3. Declutch.

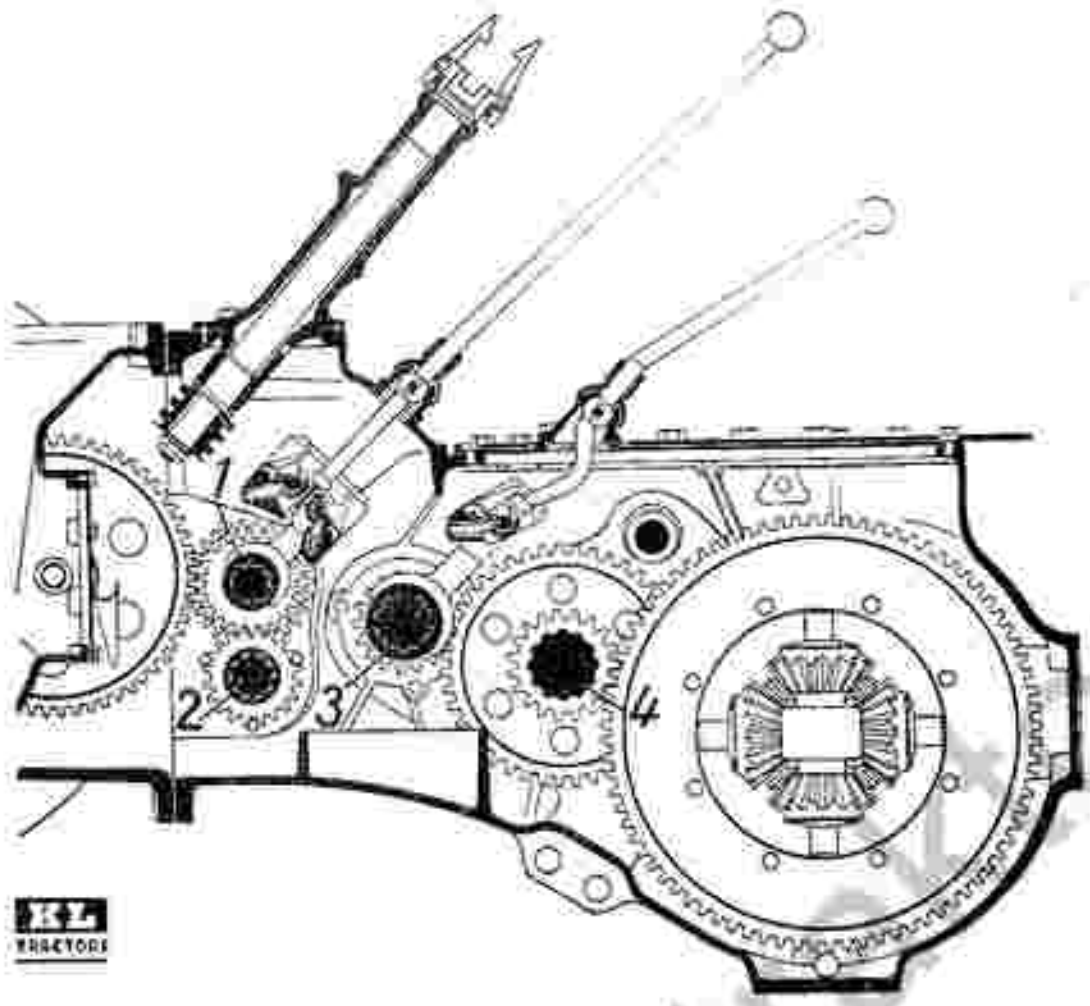


Fig. 67. Sectional view of transmission.

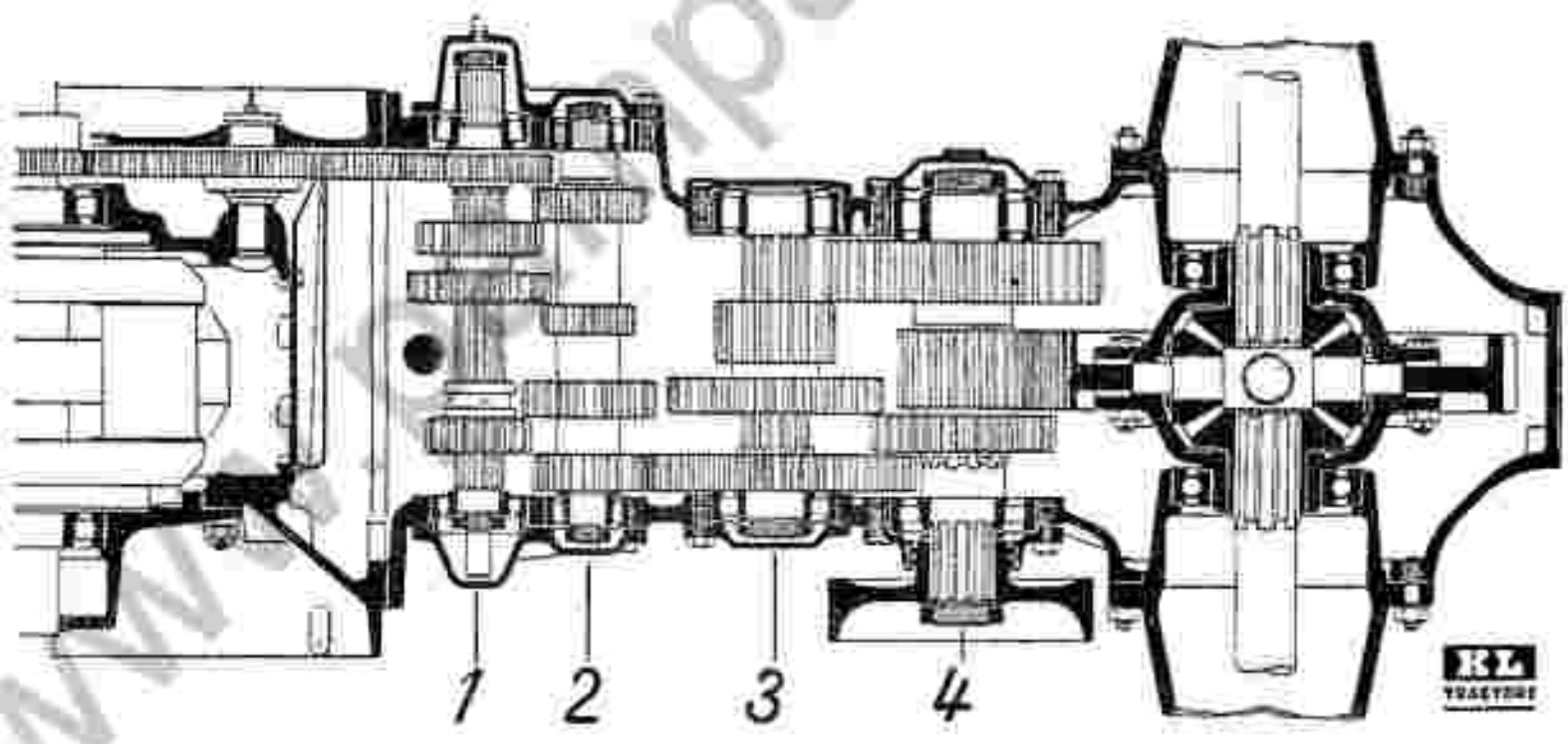


Fig. 68. Diagramatic section of transmission.

4. Slide to lower gear.

5. Release clutch pedal.

If the lever is slid across gently, and the change be misjudged, no damage will result when the teeth are felt rubbing each other. In such a case, and if difficulties are encountered in gear shifting on a downward grade, stop tractor and start in required gear. The gears must always be put in neutral immediately after stopping the tractor.

K.L. Tractors have two gear shift levers, the primary lever (1) and the secondary lever (16) Fig. 72. When changing gear, first set the secondary lever (16) movable in two directions, and then the primary lever (1) which can be placed in four different positions, as shown in Fig. 71. Looking forward, the secondary lever (16) is moved from neutral:

<u>to the left</u> for 1st, 2nd, 3rd speed forward
and 1st reverse,
<u>to the right</u> for 4th, 5th 6th speed forward and
2nd reverse.

Then set the primary lever from neutral position as follows:

For first and 4th speed forward - backward and to the left,
For 2nd and 5th speed forward - forward and to the left,
For 3rd and 6th speed forward - forward and to the right,
For 1st and 2nd speed reverse - backward and to the right.

In order to shift from 1st to 4th, from 2nd to 5th, from 3rd to 6th, and from 1st to 2nd reverse or vice versa, only the secondary gear shift lever need be pushed to the opposite side, but only when the tractor is stationary. When engaging 1st or 4th speed or reverse the primary lever will spring forward half an inch, thus automatically locking itself into position, therefore, MOVE THE LEVER in the direction indicated by the arrow, Fig. 71, UNTIL THE SNAPPING OF THE ANCHORAGE CLIP (10) OR (11) FIG. 72, IS DISTINCTLY FELT ON THE LEVER. Then let in the clutch. For disengaging, pull lever back, thus unlocking it and slide into neutral. In case of 2nd and 5th, 3rd and 6th gear, the locking action takes place when the primary lever springs backwards, therefore push forward to disengage. The secondary lever locks itself by springing forward and is disengaged by being pulled back. If, due to obstruction of the gear teeth, the primary lever cannot be shifted, place lever in neutral, disengage and engage clutch again, when the obstruction will be overcome. In case the secondary lever cannot be shifted, set primary lever first, disengage and engage clutch again, when it will be possible to shift the secondary lever.

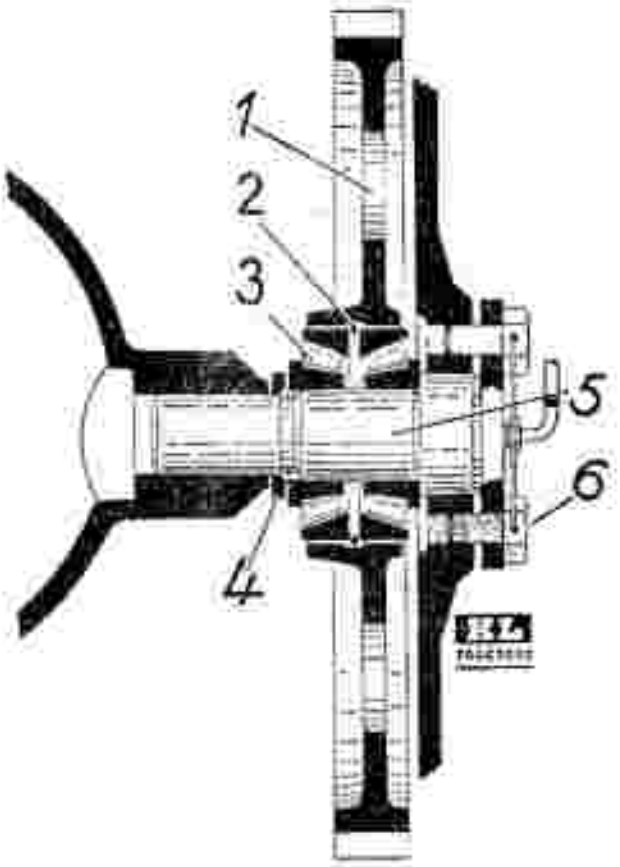


Fig. 69. Intermediate idler gear.

1 Intermediate idler gear between clutch ring gear and transmission
2 Lock ring
3 Tapered roller bearing
4 Distance piece
5 Stud shaft
6 Bearing adjusting screw

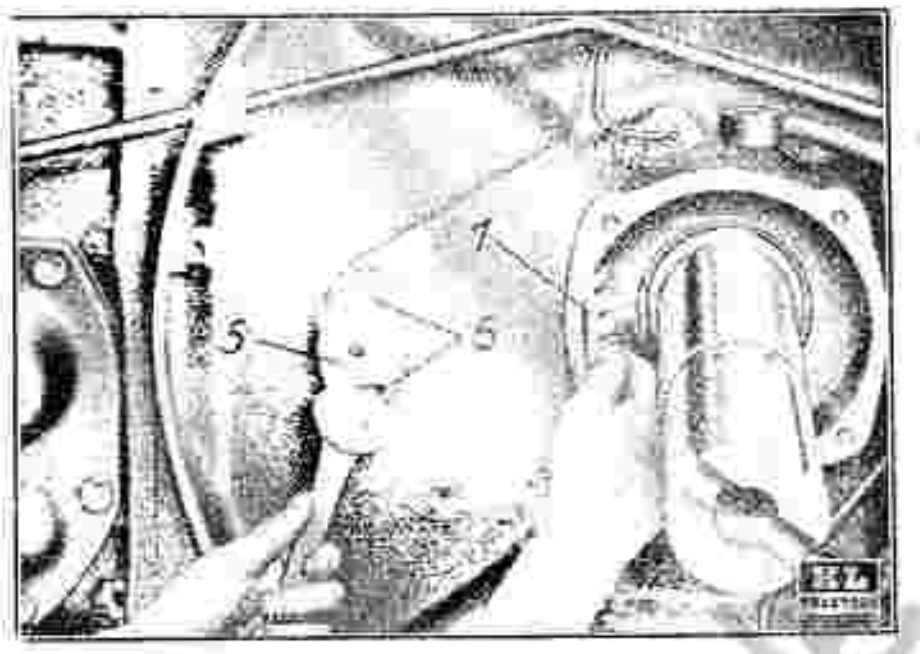


Fig. 70. Adjusting idler gear bearing.

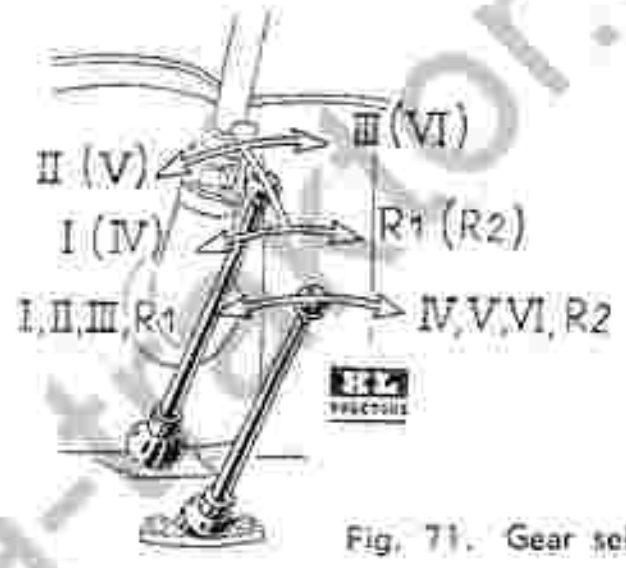


Fig. 71. Gear selection.

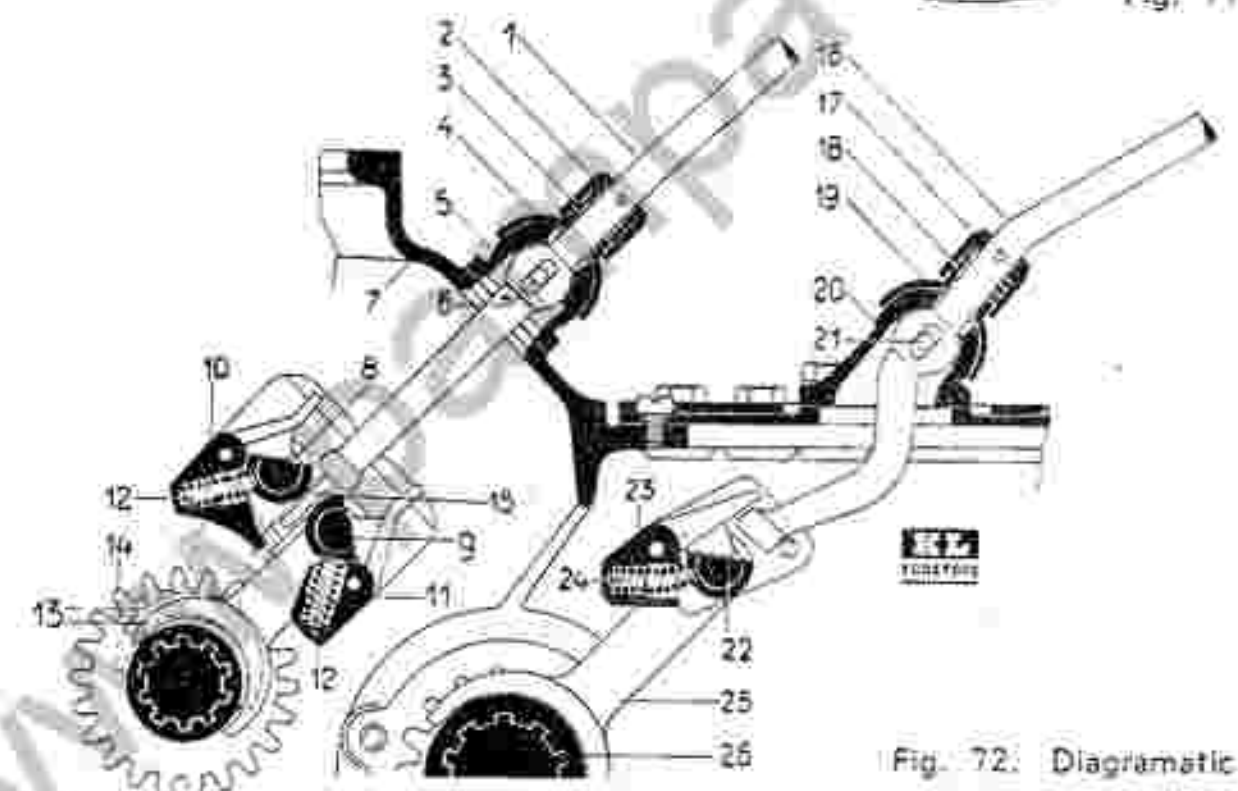


Fig. 72. Diagramatic gear selection.

1 Gear shift lever
2 Spring dust cover
3 Spring
4 Dust seal
5 Ball joint
6 Swivel pin
7 Gear case
8 Selector rod (1st & R)
9 Selector rod (2nd & 3rd)
10 Anchorage clip
11 Anchorage clip
12 Anchorage clip spring
13 Selector fork
14 Sliding mesh pinion
15 Gear locating plate
16 Secondary gear shift lever
17 Spring dust cover
18 Spring
19 Ball joint dust seal
20 Ball joint
21 Swivel pin
22 Secondary selector rod
23 Anchorage clip
24 Clip spring
25 Secondary selector rod
26 Secondary sliding mesh pinion

When driving on a downward grade use the same speed as would be required for driving on the same grade upwards; if difficulties in changing gear are encountered on a downward drive, the tractor must be stopped for changing the speed gears. The gears should always be put in neutral immediately after stopping the tractor.

CARE OF TRANSMISSION - Every six months (1500 working hours) the transmission must be cleaned and the gearing inspected. Drain the gear oil from gear case immediately after stopping the tractor while the engine is still warm and the oil in liquid state. Before removing the gear case inspection plate as shown in Fig. 73, its adjoining parts must be thoroughly cleaned and the platform with fenders must be removed before getting access to the inspection plate. Then carefully wash all shafts, gear wheels and bearings, remove sludge from gear case using a brush and flush with kerosene.

At this opportunity, the gear shaft bearings should be inspected and end play taken up. The 1st, 2nd, 3rd and 4th gear shafts are running on tapered, roller bearings. The end play is taken up by shims inserted between outside bearing race and gear shaft cover as illustrated in Fig. 74. These shims are found in part lists under Nos. 5121, 5122 and 5125.for 1st.gear shaft, under Nos. 5130, 5131 and 5132 for 2nd, under Nos. 5110, 5111, 5112, 5113 and 5114 for 3rd and under Nos. 5100, 5101, 5102 and 5103 for the 4th gear shaft.

Remove shims evenly from each side when adjusting to keep shaft in central position.

CARE OF DIFFERENTIAL AND REAR AXLE BEARING - For inspection and cleaning the differential and the rear axle bearings, proceed as follows:

1. Jack up tractor rear under differential.
2. Unscrew bolts and nuts holding the wheels to the rear axle flange (1) Fig. 76 and remove wheels.
3. Remove rear axle with bearing housing (9), Fig. 76, after unscrewing nut.
4. Remove brake band of gear brake.
5. Unscrew ring nut and drive the stay rod out to the left while holding the tubular space. When taking out this, attention must be paid to spacing shims or washers which may be inserted between the tubular spacer and the gear case web in order to replace them properly when re-assembling.
6. Draw off the gear brake drum by means of a puller.
7. Remove the 4th gear shaft which is to be driven out to the left.
8. Draw off the rear axle tubes by means of draw bolts supporting the differential to prevent it from falling down.

Now take out the differential from above. If bevel gears have more than .5 mm play, the bronce thrust pads (9) and (10), Fig. 75, must be renewed. Assemble the differential by the identification numbers stencilled on the respective parts.

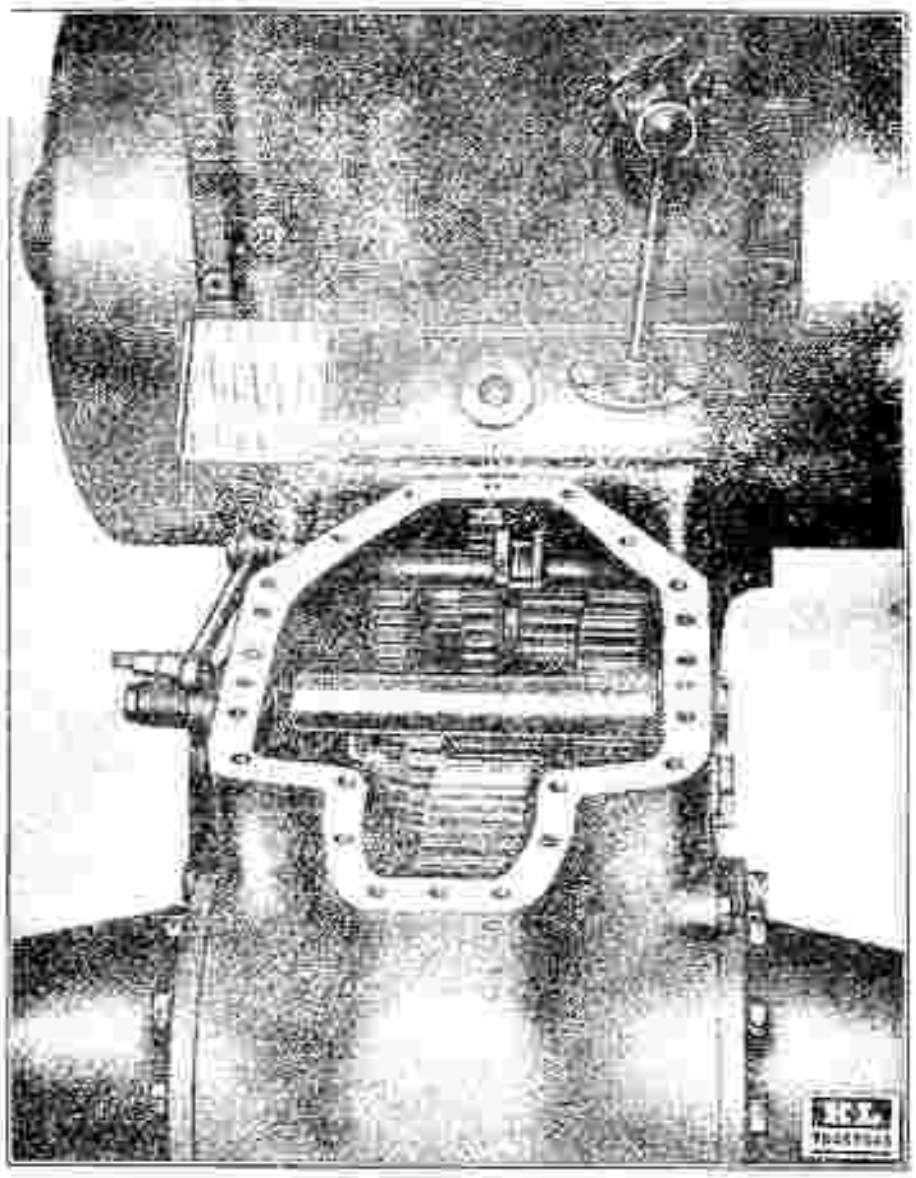


Fig. 73. Gear case with inspection plate removed.

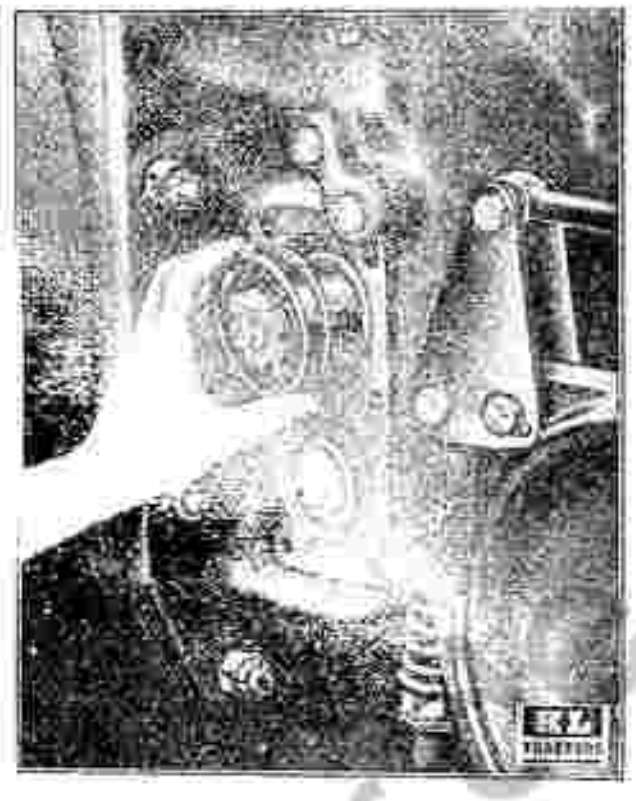
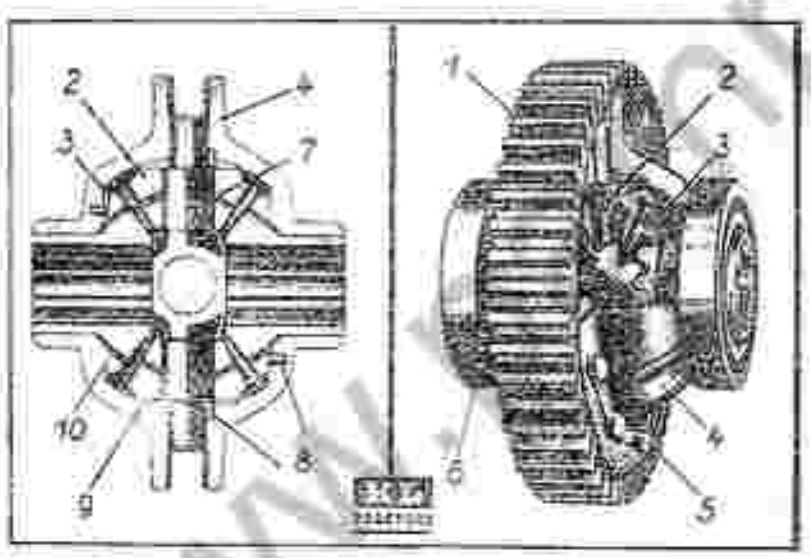


Fig. 74. Adjustment of gear shaft bearings by shims between outside of roller race and shaft cover.



A B

Fig. 75.

Differential spider shaft. Differential and ring gear.

1 Ring gear
2 Differential bevel gear
3 Rear axle bevel gear
4 Differential housing
5 Ground bolts with nut
6 Ball bearing
7 Bevel gear cross pin
8 Lock pin
9 Bronze washer
10 Bronze washer

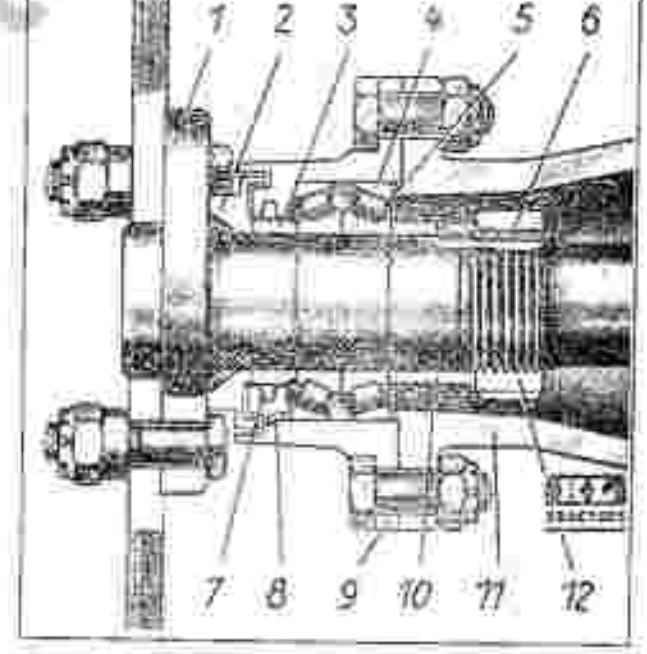


Fig. 76. Rear axle bearing.

1 Rear axle flange
2 Ring
3 Spacer
4 Tapered roller bearing
5 Shims
6 Lock key
7 Felt ring
8 Pin for driving out tapered roller bearing
9 Roller bearing housing
10 Bush
11 Axle tube
12 Nut

If there is any end play in the tapered roller bearings of the rear axle, this must be taken up as follows:

Place the rear axle vertically on two wooden blocks with the flange of the bearing housing (9), Fig. 76, resting upon these blocks and axle flange (1) hanging down and the inside roller bearing turned upward.

Now drive the outside ring (cup) of the inner tapered roller bearing (4), Fig. 76, down as far as it will go by lightly tapping with a hammer on the circumference of this race with a drift. When all play in the bearing has disappeared, ascertain the distance between the outer ring (cup) and the edge of the bearing housing, then measure also, the height of the collar on the axle tube going into this recess. The difference between the two measurements plus the thickness of paper gasket (12), Fig. 76, indicates the clearance which must be filled either by shims (5) inserted between axle tube and tapered roller bearing, or by gaskets between axle tube and roller bearing, which must turn freely without showing any end play.

ASSEMBLING TRANSMISSION - Before assembling lubricate all bearings. Renew stuffing box packing of steering spindle if necessary, using a length of 24 inch asbestos string of $\frac{1}{4}$ inch diameter.

When fitting the differential, care must be taken that the high rim of the ring gear is on the off side. Before replacing the inspection plate, cleansing oil trapped in wells and pockets of the transmission housing must be dried with a lintless cloth. Then re-install all parts in reverse order being sure that all gaskets are intact and all screws drawn tight and retightened after the engine is warm. Refill gear oil up to the control plug but not more.

Repeat test of rear axle bearing, for which purpose the gear shift lever must be placed in neutral. The rear wheel must still turn freely without showing end play. If it turns too stiffly, dismantle again and remove one shim.

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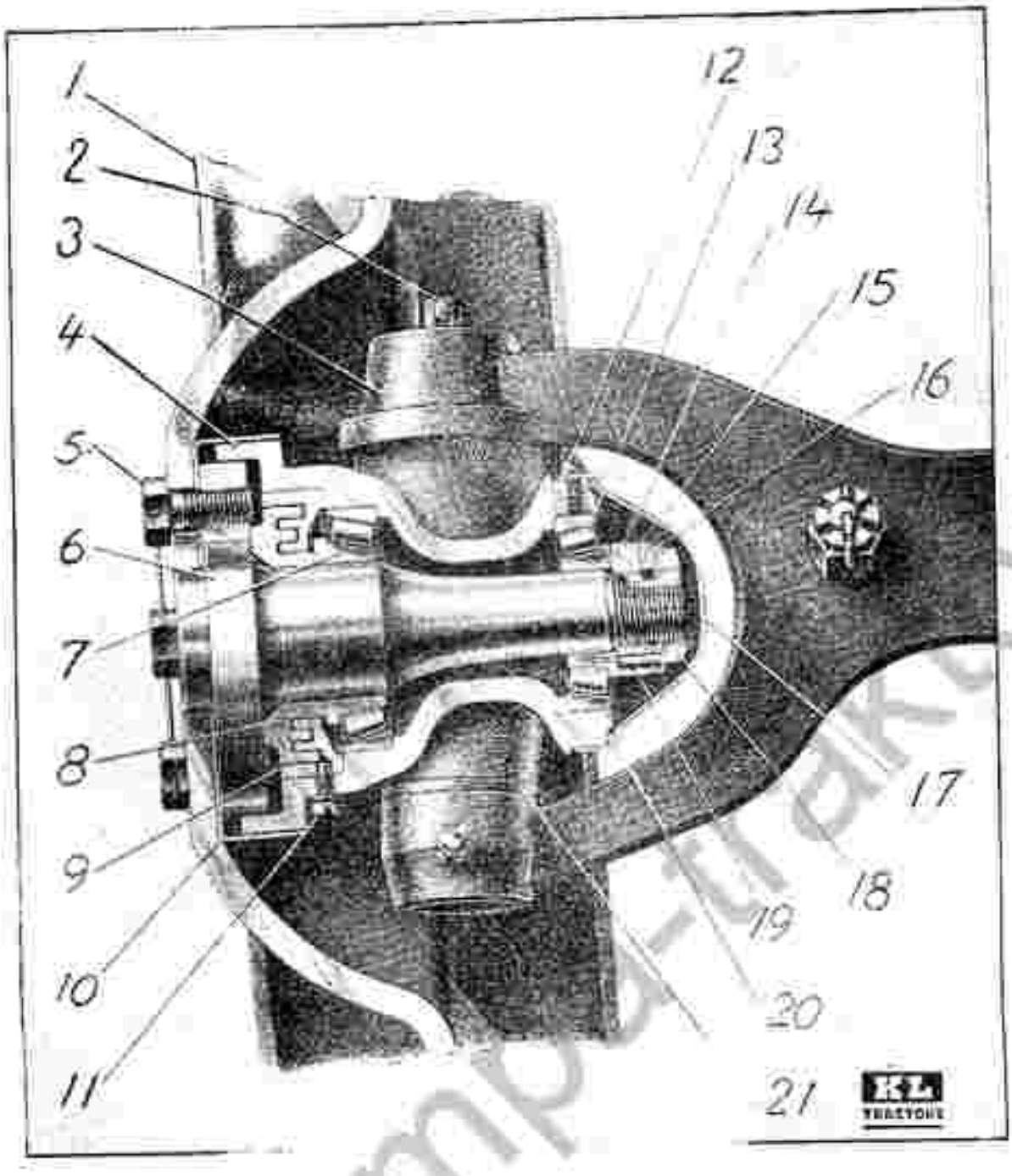


Fig. 77. Sectional view of steering knuckle assembly.

1 Front wheel
2 Grease nipple
3 Forked front axle beam
4 Axle housing
5 Front wheel fastening screws
6 Stub axle
7 Large tapered roller bearing
8 Inner labyrinth seal ring
9 Outer labyrinth seal ring
10 Axle bearing guard
11 Screw
12 Screw
13 Small tapered roller bearing
14 Adjusting ring nut with hole
15 Lock plate
16 Lock washer
17 Inside hub cap
18 Lock nut
19 Lock pin
20 Felt ring
21 Thrust washer

SECTION 8.

WHEEL & TYRE MAINTENANCE

While the rear wheels form part of the transmission, the front wheels are an independent unit. The heavy strains to which this unit is subject is apt to cause trouble and even break down if the bearings are not properly attended to and the position peculiar to the front wheels is neglected, because the front wheels are not parallel, but the extension of their horizontal and vertical diameters meet in front and underneath the tractor. The inclination to the front is called toe-in; that towards the ground, wheel camber.

If wheels wobble or difficulties in steering are encountered, these are signs that the front wheels and their steering linkage have not been properly cared for.

STEERING KNUCKLE - The steering knuckle bearing must be inspected frequently for end play by moving it axially to and fro after jacking it up. Slightest signs of end play must be teken up immediately by adjusting ring nut (14), Fig. 77, secured by lock plate (15) and lock pin (19). To get access to this nut, the front wheel must be jacked up and turned on full lock. Then remove hub cap (17), felt ring (20), lock nut (15), lock washer (16), lock plate (15), and lock pin (19).

For adjusting the bearing, lock the front wheel by tightening the adjusting nut (14). Then release this nut again by about one-sixth of a turn, but so that the hole in this nut for taking up the lock pin (19) is in alignment with one of the holes in lock plate (15), placed on top of ring nut (14). Then strike a short hard blow against the inner end of the stub axle, thus releasing the bearing cone and the wheel, which must turn freely without showing any end play. Re-assemble and repeat test after tightening lock nut (18).

Should, by neglect of attendance, the play has become .020 ins. or more, it is necessary to dismantle the whole assembly in order to replace any part which may have worn or been broken. Remove front wheel, unscrew the three screws (11) holding the outer labyrinth seal ring (10) to the hub casing and, by means of a drift, knock the stub axle from the inner race of the small roller bearing (13). Wash the roller bearings and all other parts with kerosene and replace any defective parts. Renew felt ring (20) if necessary. Fill the hub with grease and reassemble. By means of a socket of suitable size drive the cone of the small bearing on the stub axle. Then adjust the bearings as described.

The wheel fastening nuts must be re-tightened from time to time.

FRONT WHEEL TOE-IN - Before checking or adjusting the front wheel toe-in, make sure that the track rod joints are not worn out, otherwise the bushes in the track arms must be renewed.

The front wheels must be adjusted so that when the wheels are aiming straight ahead, the distance between the inner side of the wheel rims at axle height must measure from 2 to 4 mm (.08-.16" less at the front, than at the rear of the rims. This adjustment is effected by screwing the fork (g), Fig. 78, on track rod (s) out to obtain greater toe-in.

WHEEL CAMBER - The distance between the front wheel rims at their lowest points must be smaller than that at their opposite highest points. This inclination or camber of the front wheels is maintained by the wrist pin brushes, the wear of which is checked by jacking the front wheels up and lifting them slightly. If the wear is excessive the axle beam yokes must be rebushed, as this wear causes loss of wheel camber and therefore, difficult steering.

STEERING LINKAGE - Wear of tyres and difficult steering is further caused by wear in the drag link joints, which must be taken up by removing one or two shims (w) as shown in Fig. 79.

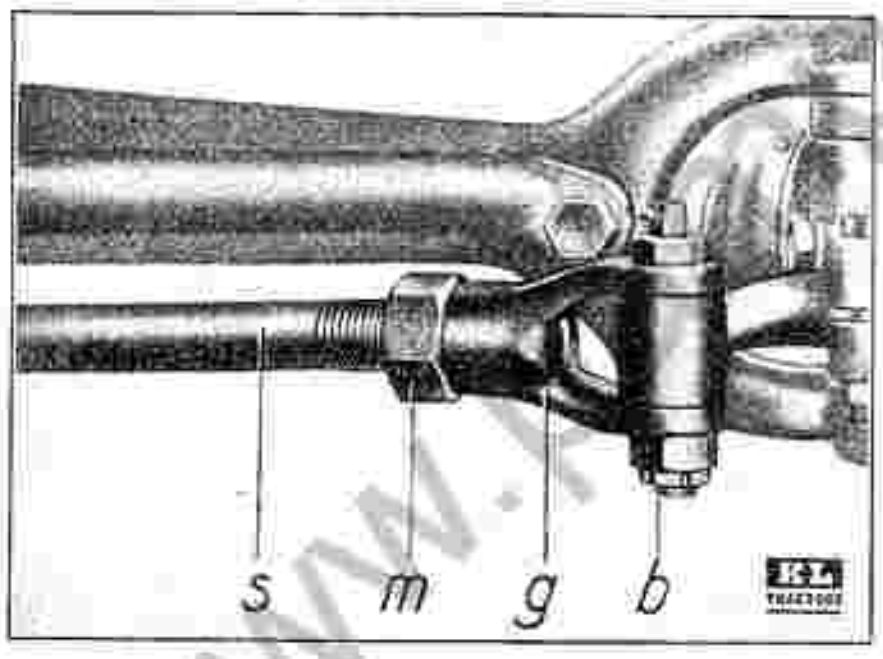


Fig. 78. Track rod adjustment.

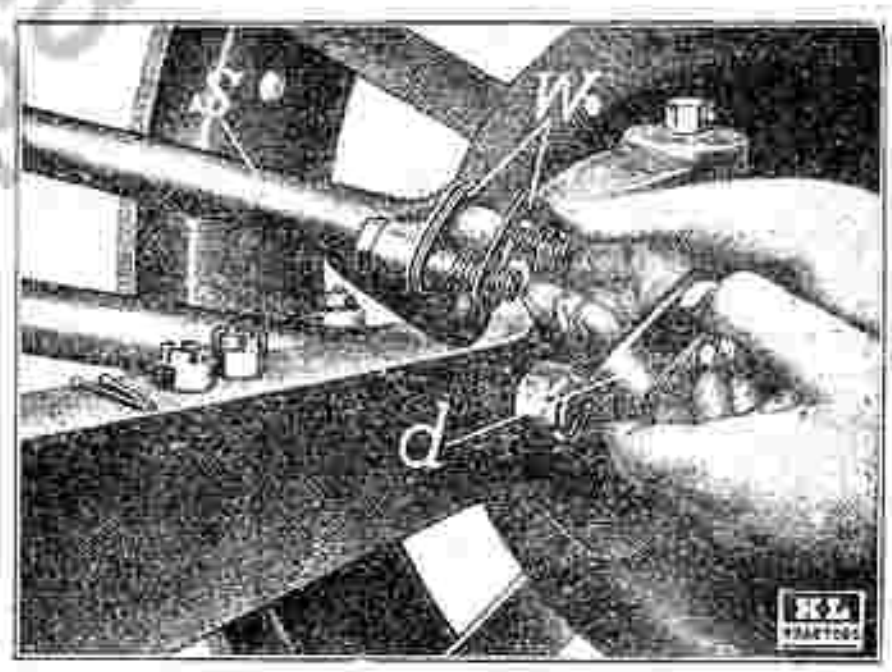


Fig. 79. Taking up wear in steering linkage.
s drag link d drag link ball joint cap
w shims in drag link ball joint

TYRE MAINTENANCE AND REPAIRS

The proper care of tractor tyres is essential resulting in longer life, better ground grip and economy. These instructions have been prepared to provide tractor owners with information so that they may receive all the service originally built into the tyres.

INFLATION - Use of proper air pressure is the most important factor in the satisfactory performance and maintenance of tractor tyres. Following are brief tables showing recommended pressures for all tractor tyres.

TRACTOR TYRE INFLATION

Front - All sizes.

1. 4 ply tyres . . . . . 28 lbs.
2. 6 ply tyres . . . . . 36 lbs.

Rear - All sizes.

3. Minimum inflation pressure. . . . 12 lbs.
4. When ploughing, increase pressure in tyre on furrow wheel by 4 lbs.
5. When special heavy wheels are used, or heavy loads are carried on the tractor, inflation pressure must be increased.

Both over-inflation and under-inflation are harmful. Under-inflation will damage the cord body of the tyre. It will cause a series of diagonal breaks in the cord fabric in the sidewall area. This usually occurs on the inner sidewall of the furrow wheel tyre. Under-inflations will result in repeated buckling of the sidewall and the constant buckling will break the cord fabric.

Inflation should always be high enough, especially in the furrow wheel tyre so that the tyre will not buckle. The buckling can be seen, especially on hard pulls, by the driver or someone who walks alongside of the tractor.

If the tyre buckles or wrinkles, the air pressure should be increased to the point where the sidewalls remain smooth while the tyre is pulling. Under-inflation may also allow the tyre to slip on the rim which in turn, will tear off the valve stem of the tube.

Over-inflation should also be avoided. It causes loss of traction which results in excessive slippage, causing tyres to wear more rapidly.

The inflation of tyres on new tractors should be watched carefully. Tractors are despatched from the factory with very high air pressure in order to prevent bouncing of the tractor during delivery. The air should be dropped to the recommended pressure before the tractor is put to work.

PROPER AIR PRESSURE FOR MOUNTING TYRES - After rear tyres are mounted on the rims, they should be inflated to 30 pounds air pressure in order to force the tyre beads firmly onto the rims. The rim and tyre are

tapered so this pressure is necessary in order to force the beads firmly into place.

The tyre should be inflated to 30 pounds air pressure every time the tyre bead is pushed away from the rim seat at any point. Then the air pressure should be dropped to the recommended pressures.

This practice should always be followed, as otherwise the tyre will slip on the rim and shear off the valve stem.

CHECK AIR PRESSURES FREQUENTLY - Air pressures should be checked every 2 to 3 weeks and should not be allowed to drop below the recommended levels. A low pressure gauge, with one pound graduations, is necessary in order to get accurate inflation.

If tyres are partly filled with water, see that valve in tube is in topmost position (12 o'clock) before testing pressure. Always use caps on the valves as this prevents loss of air.

CARE OF TYRES - Never leave your tractor standing idle in direct sunlight for any length of time. When not in use and not housed, cover the tyres with bags.

Do not allow tyres to come in contact with grease or oil as both destroy rubber.

REPAIRS - Proper attention to repairs prevents premature tyre failure. If the rubber on the sidewall or tread is cut through, exposing the fabric, it should be washed out with petrol and filled with Tread Cut Repair Gum to prevent dirt and moisture from working into and damaging the fabric.

When a puncture is made by a large nail or similar object, a rubber plug should be inserted from the inside.

If an injury results in the body fabric being broken for a space up to 2 inches, it can be repaired with a Cemented Cord Patch or a Quick Applying Criss Cross Patch. The injured area is cleaned with petrol and roughened up with a rasp for a space the size of the patch to be used. A heavy coat of Cold Patching Rubber Cement is applied and allowed to dry thoroughly.

The injury should be filled with Tread Cut Repair Gum from the inside, and the patch pressed down tightly over the injury. The outside of the injury should be filled in with Tread Cut Repair Gum to seal it against dirt and moisture.

Any injury to the fabric over 2 inches long requires a permanent vulcanized repair. The nearest tyre manufacturer will supply further information. After repairs, the instructions for remounting tyres should be strictly adhered to.

METHODS OF ADDING EXTRA WEIGHT - Addition of weight to the driving wheels may be provided by bolting weights to the wheels, but the use of water in the tyres for weight is less expensive and less difficult to handle. No objectionable operating effects are encountered when water weight is used at tractor speeds as high as 20 miles per hour.

From an operating standpoint, tests have shown no appreciable difference in the effect of solid or liquid weights.

AIR CUSHION TAKES SHOCK - K.L. Tractors Ltd. recommend 75 per cent water inflation, that is, the tyre should be inflated with water to three-quarters of its air capacity. The remaining 25 per cent or quarter will then act as an air cushion, having the effect of a spring. Water is not compressible, but air is! Therefore, the air left in the tyre -- 25 per cent or one-quarter of the normal air volume at correct pressure -- acts as a cushion, Fig. 80. When the tyre passes over a sudden projection in the ground, the indention causes the water to rise above its normal level in the tyre and compresses the volume of air in the "air chamber" or "air cushion". The air compresses -- it gives like a spring, and the tyre travels over the projection in the ground, unharmed. This "air cushion" takes the shock, acts as a spring-like shock absorber to local impact and - its most important function - prevents fracture or abnormal casing growth.

METHODS OF GETTING WATER INTO A TUBE (FIG.81) - There are three methods explained here by which water can be forced into the tubes.

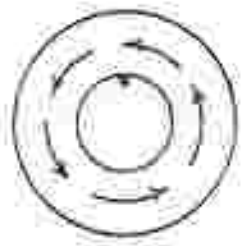
1. By line pressure
2. Gravity method
3. Hand force pump method

NOTE: Two types of tube valves and hose couplings are available at any tyre manufacturers for getting water into tubes.

TO WATER-INFLATE TYRES (FIG.82)

1. Jack the tyre to be water inflated clear of the ground.
2. Remove core from valve stem. In the case of Special Water Inflation Valve, unscrew and remove valve stems and allow air to completely expel itself from the tyre.
3. Revolve tractor wheel until tube valve is in the 12 o'clock position, that is, directly above the wheel hub.
4. Connect water hose to tyre valve with water valve coupling.
5. Fill the tyre with water up to the valve level while it is in the 12 o'clock position.
6. Remove water valve coupling from the tyre tube valve from time to time to "bleed" the remaining air in the tube, otherwise, this remaining air will act as back pressure and prevent the water from entering the tyre.

FIG. 80. ACTION OF AIR AS CUSHION AGAINST SHOCK.



Air Inflated Tyre

75% Water Inflation provides Air Cushion.

Air Cushion acts as shock absorber.

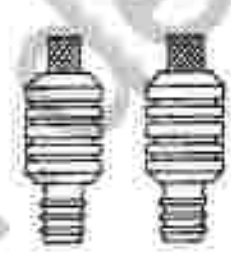
FIG. 81. WATER INFLATED TRACTOR TYRES TO 75% CAPACITY.

Main Water Line.

Filling from Tank.

Filling with Hand Pump.

(Left) Single Stem Valve.
(Right) Special Water-Inflation Valve.



Water Hose Valve Couplings

FIG. 82. INTRODUCING WATER INTO TYRES.

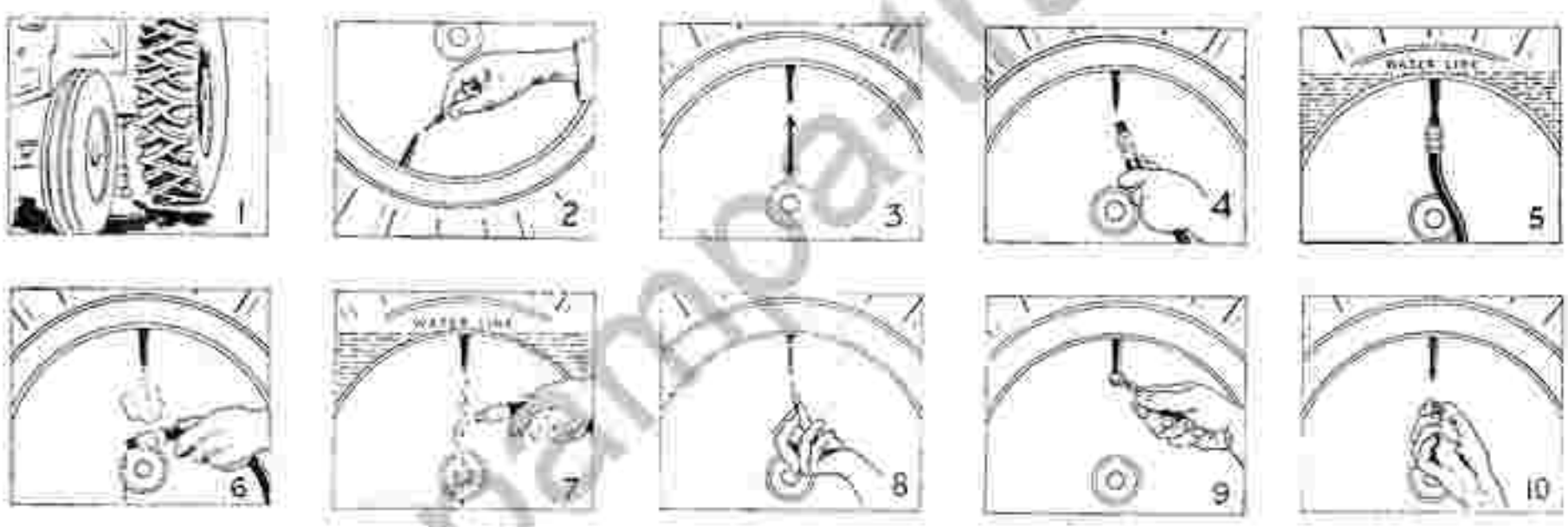


FIG. 83. REMOVING WATER FROM TYRES.

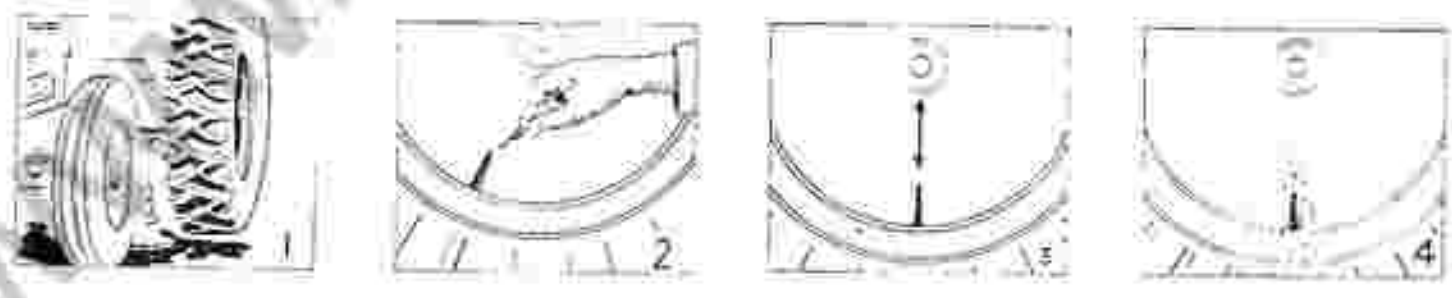
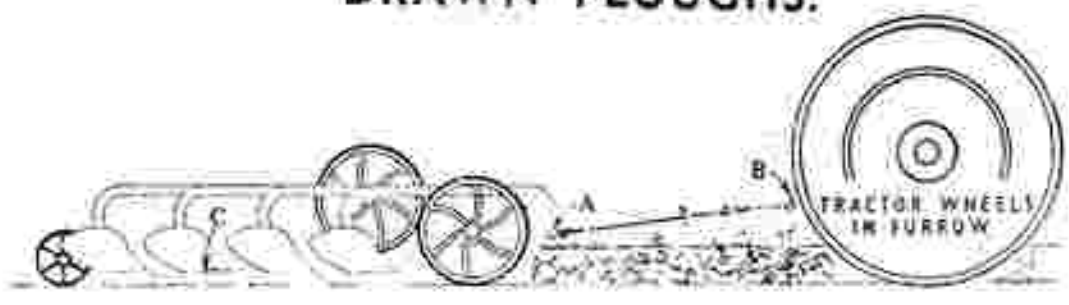


FIG. 84. CORRECT VERTICAL HITCH ADJUSTMENT FOR TRACTOR-DRAWN PLOUGHS.



7. To ensure that you have the correct amount of water inflation, continue to fill the tyre with water, with valve still in the 12 o'clock position, until water flows out of the valve. Allow the surplus water to drain off still keeping the valve in the 12 o'clock position.

8. When surplus water has ceased to flow from the valve, replace the valve core or insertion piece.

9. Now inflate the part water-inflated tyre with air to the correct pressure.

Minimum: Front tyres - 28 lbs.
Minimum: Rear tyres - 12 lbs.

10. Replace valve dust cover firmly and remove jack.

TO REMOVE WATER FROM TYRES (FIG.83)

1. Jack the tyre to be drained of water clear of the ground.

2. Remove core from valve stem. (With special water inflation valve, unscrew and remove insertion piece.)

3. Revolve tractor wheel until tube valve is in a 6 o'clock position, that is, directly below the wheel hub.

4. With valve in the 6 o'clock position, allow the water to drain.

WARNING: Do NOT, under any circumstances, run part water inflated tractor tyres before they have been inflated to correct air pressure recommended.

ANTI FREEZING PRECAUTIONS - In certain areas, in extremely cold weather, there is always the possibility of water in tractor tyres freezing. To prevent this, we recommend that 1 lb. of Calcium Chloride be added for each gallon of water. This will provide an efficient anti-freezing solution.

Tyre size:- 13.50 - 28. when 75 per cent. full of water contains 37 gals. of water - 370 lbs.
Tyre size:- 13.50 - 32. when 75 per cent. full of water contains 39 gals. of water - 390 lbs.

HITCHING TRACTOR PLOUGHS (FIG. 84) - Correct hitching of your plough to tractor is important. For best work and easiest handling, the correct hitch at "A" is the place where "A" is in a true line between point of hitch "B" and the centre of the load "C" on the plough.

TO FIND CENTRE OF LOAD - First, find total cut of plough. Half of total cut is centre of cut. Measure to the rear side of centre of cut, one quarter the width of cut of one bottom, to get centre of load.

WHEEL LOADING

When checking the wheel loading of tractor rear tyres, take the rear end weight of your tractor including wheels, divide this weight between the two rear tyres and you will obtain the gross weight carried by your tyres. Then, by compering this figure with the Tyre Load and Inflation Schedule below you will be able to ascertain if any more weight can be applied within the load carrying capacity of the tyres.

LOAD AND INFLATION TABLES

REAR TRACTOR TYRES
(Conventional Type)

Tyre Size	Ply Rating	Recommended Inflation Pressure (lbs.)				
		12	14	16	18	20
		Recommended Load per Tyre (lbs.)				
9.00-24	6	1520	1670	1820	1970	2120
9.00-36	6	1825	2000	2175	2330	2490
10.00-36	6	2120	2320	2510	2690	2860
10.50-20	6	1550	1700	1850	2000	2150
11.25-24	6	2000	2200	2375	2540	2710
11.25-28	6	2140	2340	2530	2710	2880
12.75-24	6	2620	2870	3100	3325	3540
12.75-28	6	2800	3060	3300	3540	3760
12.75-32	6	2960	3240	3510	3750	4000
13.50-24	6	2970	3250	3520	3760	4010
13.50-28	6	3170	3460	3740	4010	4275
13.50-32	6	3360	3660	3950	4250	4500

When mounted implements are used on tractors, loads may be increased up to 20% with no increase in air pressure.

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FIG. 85. METHOD OF CHANGING REAR TYRE.

CAUTION: The nuts at the inner circle shown at (5A) retain the wheels on the hubs. It is important that the nuts at (1B) in the outer circle are not loosened while any air pressure exists in the tyre. The wheel is in two sections which are bolted together by the nuts and bolts in the outer section.
Should these be loosened when air is retained under pressure in the tyre, injury to the operator is possible.

REMOVAL:

1. Place the wheel on the ground with the handles of the outer rim upwards and with the tool provided release the air pressure from the tube by the removal of the insert from the valve in the tube.
2. Remove all nuts from the bolts in the outer circle (1B).
3. Taking great care not to injure the beads of the tyre insert a tyre lever between the bead and rim (2), hammering the lever around the entire circumference of the rim thus freeing the bead from the tapered bead seat. Once the tyre is loosened removal is easy.
4. Turn the tyre over and repeat the previous levering and hammering operation.
5. Remove Tube (3).

TO REASSEMBLE:

1. Replace valve core and place tube inside tyre. Inflate tube with sufficient air to support the tube walls but not enough to stretch them.
2. With the studded portion of the wheel uppermost, lower the tyre over the wheel and work tyre down into position.
3. Standing inside, and holding the retaining rim by the handles (4) lower in position over the two sets of studs, making sure to face the valve stem which is pushed through the slotted portion of the upper rim.

Tighten nuts one turn at a time, working opposite nuts in succession until all nuts are pulled down tightly. Inflate to proper pressure and replace on Tractor.

FRONT WHEELS: Fitting is the same as normal well-base car or truck wheel procedure.

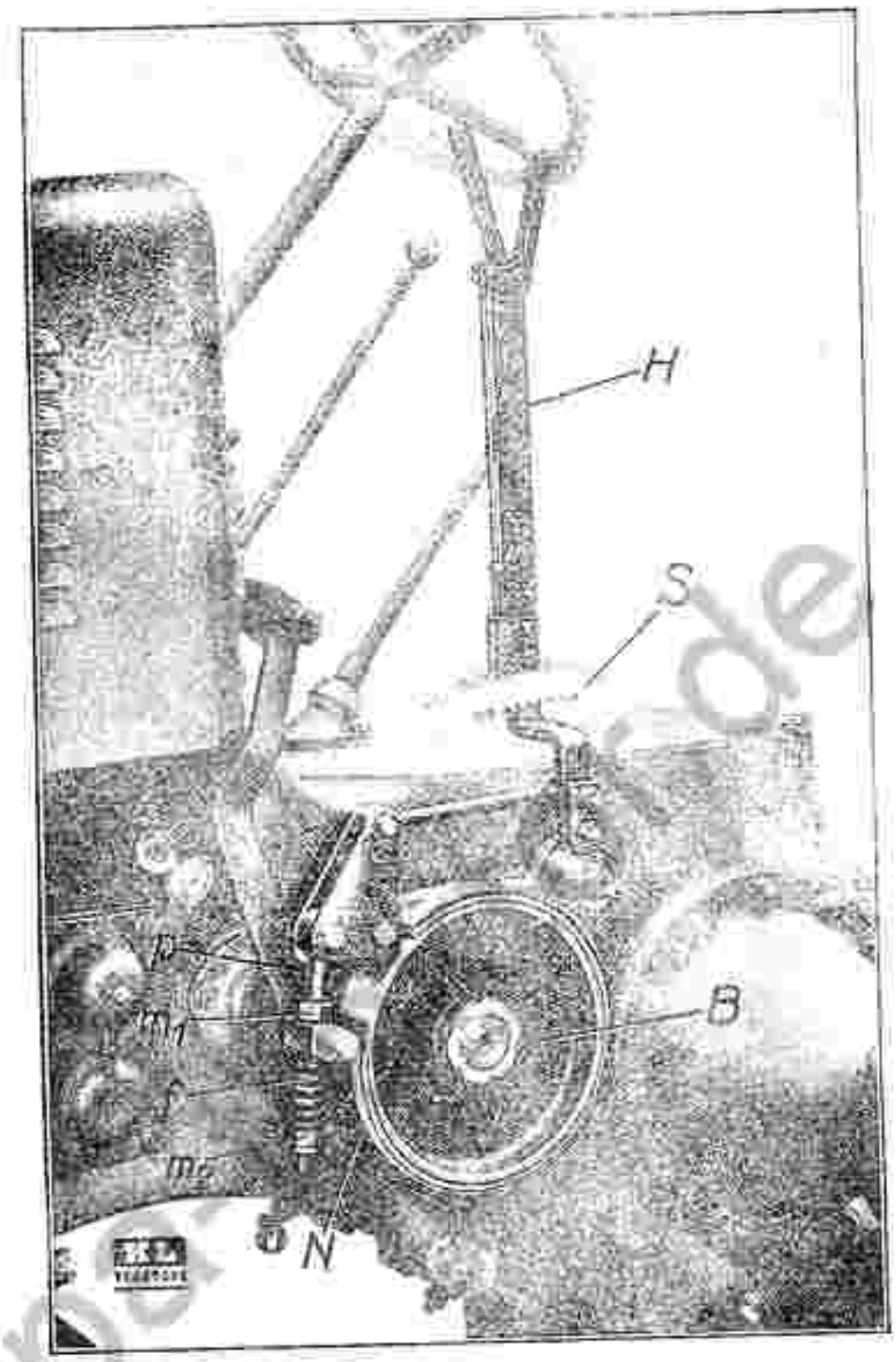

Fig. 86. Gear hand brake with ratchet.

B Brake drum
H Brake operating lever
S Ratchet
t Spring
m_1 Adjusting nut
m_2 Adjusting nut
p Tension bolt

SECTION 9.

BRAKES

TRANSMISSION BRAKE - The L.H. gear brake, Fig. 86, operated by hand lever (H) with ratchet is used for holding the tractor on inclines or for belt work. It is adjusted by loosening lock nut washers and screwing the adjusting nuts up to such an extent that the brake band holds the drum after three ratchet teeth, and the spring (f) is compressed to a length of $2\frac{1}{2}$" with lever in foremost position.

WHEN DRIVING DOWNHILL USE THE ENGINE AS A BRAKE BY SELECTING A LOW GEAR. This saves the brake, which is therefore, always ready for an emergency. A hot brake drum has not the efficiency of a cold one. IT GOES WITHOUT SAYING THAT TRAILERS MUST HAVE THEIR OWN INDIVIDUAL BRAKES, WHICH MUST BE APPLIED IMMEDIATELY WHEN DRIVING DOWN HILL, IT BEING IMPOSSIBLE TO HOLD UP THE WEIGHT OF TRAILERS BY BRAKING THE TRACTOR. TRAILERS WITHOUT BRAKES WOULD INVARIABLY LEAD TO ACCIDENTS.

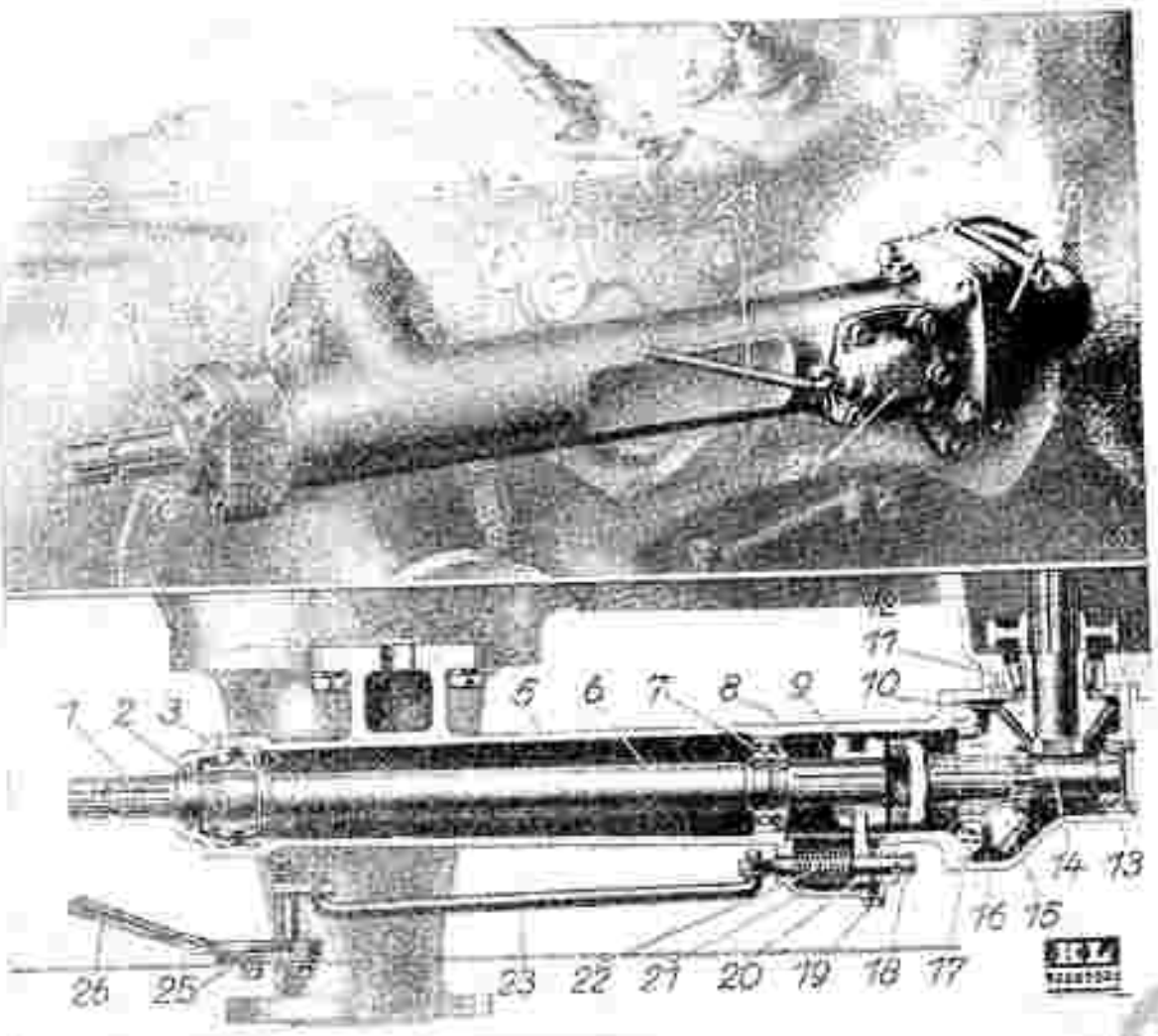

Fig. 87. Power take-off.

1 Splined shaft end
2 Felt ring
3 Rear cover
4 Grease nipple
5 Main casing
6 Power take off shaft
7 Tapered roller bearing
8 Nut
9 Dog clutch, loose
10 Bevel gear
11 Ring
12 1st gear shaft
13 Tapered roller bearing
14 Clutch shaft
15 Bevel gear
16 Drive casing
17 Tapered roller bearing
18 Operating lever pin
19 Accessibility screw
20 Operating fork
21 Cover
22 Spring
23 Operating lever rod
24 Grease nipple
25 Segment
26 Operating lever

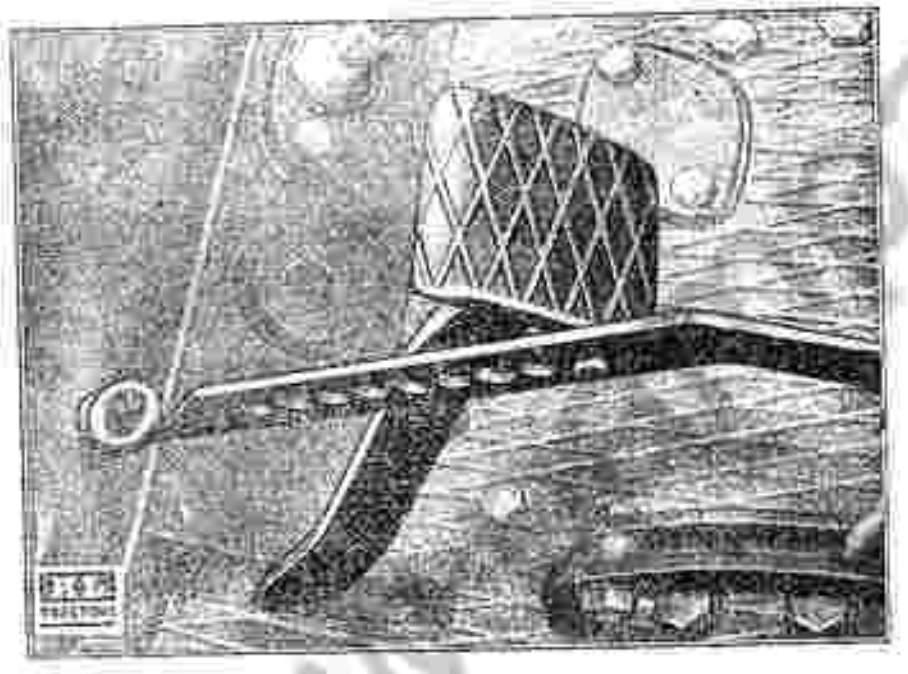

Fig. 88. Clutch locking bar.

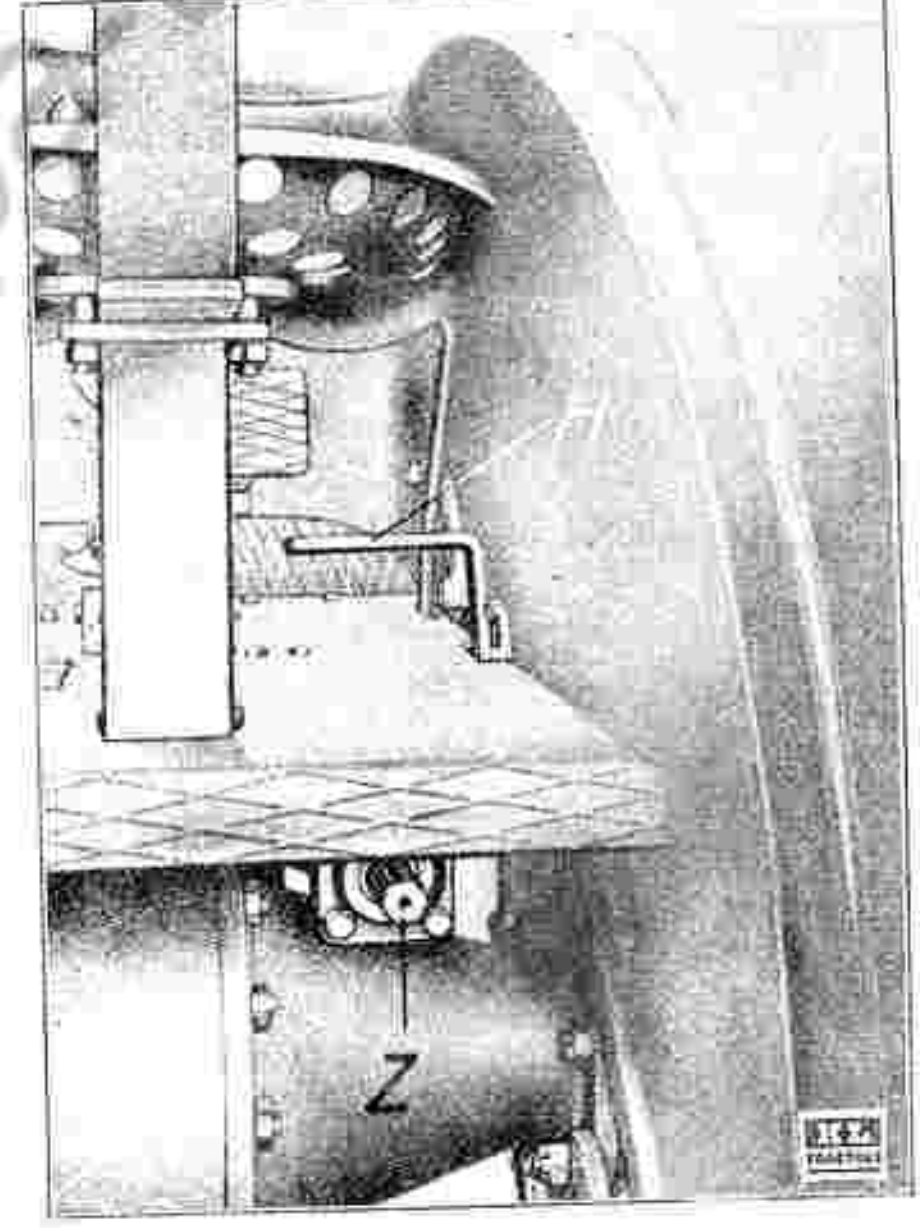

Fig. 89. Z, Rear shaft of power take-off.
H, Power take-off operating lever.

SECTION 10.

POWER TAKE-OFF

The power take-off, Fig. 87, consisting of a shaft running on two pairs of tapered roller bearings and fully protected from dust and dirt, is driven from the 1st gear shaft by bevel gears (10) and (15), which are therefore always running when the engine clutch is engaged. The power take-off is engaged or disengaged by means of lever H, Fig. 89, located within easy reach of the operator. This lever should only be operated with engine clutch disengaged.

The power take-off will transmit full engine power and runs at the same speed, regardless of the forward speed of the tractor.

BELT WORK - When it is desired to use the tractor for belt work, remove the off side flywheel cover, apply hand brake and chock the wheels. For putting on the belt while the engine is running, stop the pulley by depressing the clutch pedal and holding it in this position by hooking it to the dash by the clutch locking bar, supplied with the tools, Fig. 88.

DO NOT ALLOW THE ENGINE TO RUN FOR ANY LENGTH OF TIME WITH CLUTCH DISENGAGED IN ORDER TO PREVENT THE CRANKSHAFT RUNNING IDLE IN THE CLUTCH SLEEVES, UNDULY WEARING THEM.

Rubber tyred tractors must be earthed to avoid accumulation of static electricity caused by belt friction.

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SECTION II.

GENERAL INSTRUCTIONS

All tools, special spanners and pullers mentioned in this instruction book are standard equipment of the tractor and contained in the tool box.

When dismantling a unit the order of the component parts should be carefully noted to ensure correct assembly. Special attention should be paid to thin spacing washers, which, when stuck up by thick oil to one or the other adjoining parts, are easily overlooked and lost. These and similar small parts, such as washers, lock plates, wires, nuts and cotter pins though they may seem to be negligible must on no account be omitted, and if lost should be replaced by original M.L. Builder parts.

Before removing adjustable parts a note should be made with regard to their position which should also be marked with relative part. All removed parts should be cleaned immediately and carefully stored. When removing adjusting nuts of precompressed springs or adjusting screws the number of turns should be noted. As a rule the fitting or reassembly of a unit is not described in the instruction book because the procedure of dismantling, which, as stated above, should be carefully noted, is simply reversed.

When tightening nuts and bolts, their size must be taken into consideration and no excessive long spanner or spanners with defective jaws should be used.

Tools should only be used for their proper purpose. Mechined or ground parts or castings should only be struck with a copper, lead or wooden hammer or by inserting a piece of wood between them and the hammer. When applying a puller the draw bolts must be tightened gradually and alternately. When a unit is to be screwed on by several screws or nuts, these nuts or screws should be tightened gradually, evenly and alternately passing from one screw or nut to one on the opposite side. The nuts must be secured by cotter pins or lock wire.

Lubricating and fuel oil should be poured into the tractor tanks direct from the original containers, in which they are purchased. If that is impracticable, separate vessels should be used for oil and fuel as well as for cooling water and cleansing oil or kerosene. These vessels should be kept clean and never used for any other purpose nor interchanged with each other.

For cleaning the interior parts of the machine, use only a firm lintless cloth, never cotton waste, the fibres of which are apt to choke the pipes and cause trouble.

When removing adjustable connecting links, only remove the clevis pin from the joint without touching the adjusting fork and its lock nut.

When removing pipe lines a tag should be fixed to every end of the pipe marking its point of connection in order to avoid confusion when re-assembling. Before connecting an oil or fuel pipe, all air contained therein must be removed. Therefore, first connect the intake end of the pipe and let the fluid pass through until it leaves the other end without air bubbles. Then connect the delivery end, at first loosely so as to allow the air contained in the union to escape also.

Plain roller bearings must have a certain axial play, the limits of which are specified in each individual case. The axial play of the crankshaft (main) bearing must be about 2 mm. Excessive play is taken up by inserting shims between the outer race and the bearing cover.

Tapered roller bearings must turn freely, unless their free motion is somewhat retarded through a felt washer, without showing any perceptible axial play whatsoever when moved by hand. The slightest signs of axial play must be taken up immediately, therefore, tapered roller bearings should be inspected more or less frequently, according to the strain to which they are subjected. The adjustment is effected by shims or screw adjustment. When adjusting a roller tapered bearing, it is a good plan to tighten the bearing so that the wheel stops revolving and then to remove a .1 mm shim or to back off the adjusting nut by one-sixth of its circumference and to strike a short hard blow against the opposite shaft end to cause the bearing cup to take up the slack.

To adapt a felt ring: A well fitted felt ring will give a perfect seal after it has expanded through saturation of oil. If too loosely fitted, the sealing will be imperfect, and if too tightly seated, the washer will be damaged by excessive friction. Before inserting a new felt ring into its retainer flatten it a little with a hammer, then insert and drive it with light taps into its groove. Then insert a round piece of wood, i.e., a hammer handle into the hole of the felt and pass it under slight pressure along the inner circumference, thus enlarging the inner diameter of the felt ring and increasing its bearing face. Should a loose enough fit not be attained in this way, the inner circumference should be carefully worked with a rasp.

Labyrinth seals require no other attention then forcing grease through the grease nipple until the old grease oozes out of the joints of the labyrinth rings expelling all impurities.

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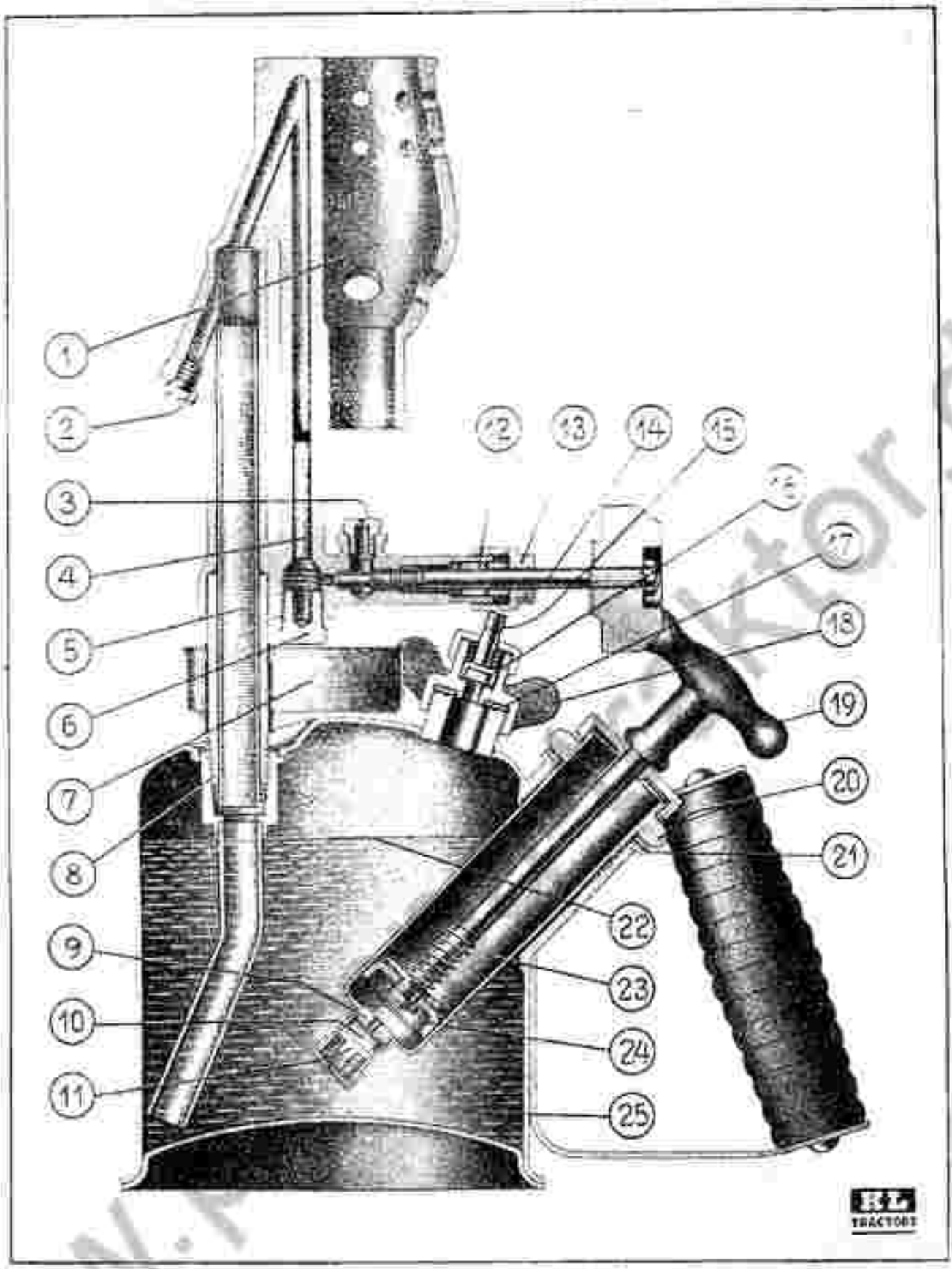

Fig. 90. Blow lamp (sectional view)

1. Burner
2. Screw plug
3. Nozzle
4. Wire coil
5. Vapouriser gauge
6. Closure screw
7. Heating tray
8. Vapouriser tube
9. Valve body
10. Valve cork
11. Valve cone
12. Stuffing box packing
13. Stuffing box nut
14. Regulating spindle
15. Safety valve
16. Valve cork
17. Packing
18. Filling cap
19. Air pump
20. Pump cap
21. Pump packing
22. Filling level
23. Pump barrel
24. Pump leather
25. Container

SECTION 12.

BLOW LAMP

This is an important accessory and must be handled carefully and kept ready for use. The arrangement and dimensions of the individual parts are such that the fuel in the container is completely vapourised and burns with an intense blue flame, with a greenish tint in the centre. A yellow flame, falling off or diminishing of the flame, or if the fuel comes out in sprays, indicates an irregularity, which must be remedied at once.

FUEL - Clean white spirit or benzole should be used.

FILLING - The container (25), Fig. 90, holds about one pint, but it should be filled only about once inch from the top.

HEATING - Close filling cap (18) and regulating spindle (14) and give pump two or three strokes. Fill heating tray with spirit, light and place wind screen on top of lamp.

LIGHTING - Open the spindle (14) slowly one or two turns shortly before the flame from the heating spirit dies down, and if the vapour coming through the burner does not ignite, it should be lit with a match at the top (1).

REGULATING - In a few minutes the burner will be sufficiently hot and a little more pressure can be applied, but only just sufficient to enable the pump to move with difficulty. Adjust flame by opening spindle. As the lamp burns, the pressure in the container will decrease, and must be raised by pumping.

EXTINGUISHING - Close regulating spindle (14) and release air from container by drawing the projecting valve rod (15) in filling cap (18) for a moment, Fig. 92.

WARNING - It is dangerous to expose the lamp to the heat of a coal fire or the container to a bare flame.

Fig. 91. Unscrewing the nozzle.

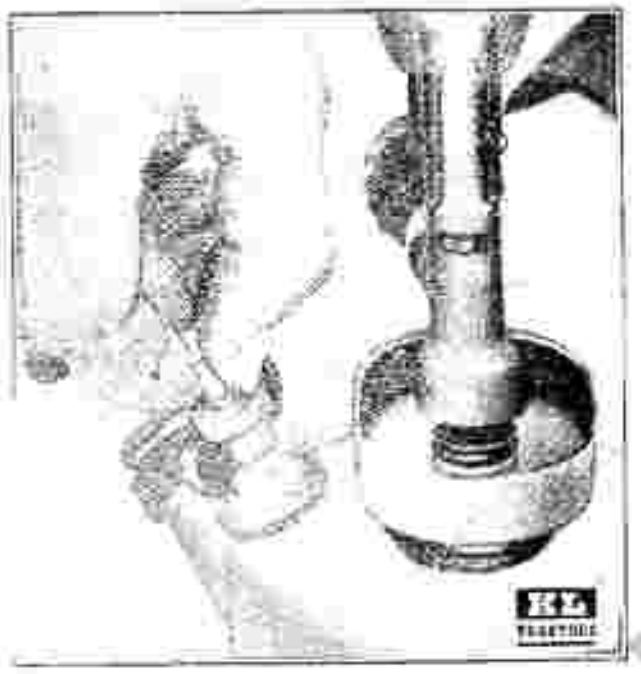

Fig. 92. Releasing air from container.

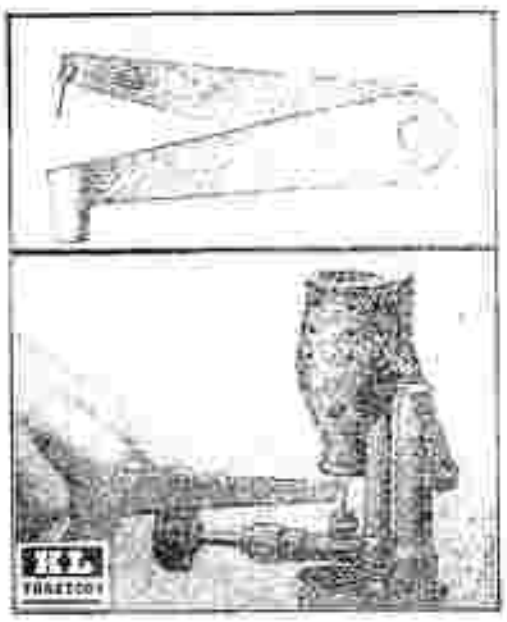

Fig. 93. Cleaning the nozzle.

Fig. 94. Cleaning the vapourized ducts.

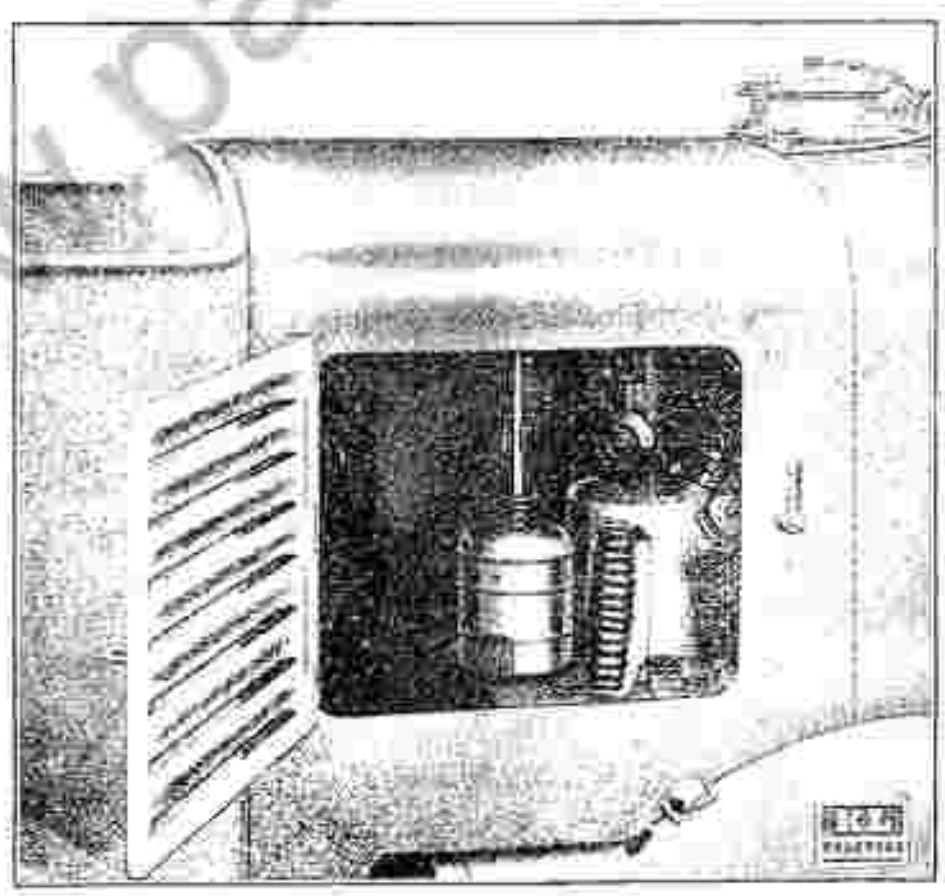

Fig. 95. Blow lamp stored under cowling.

TROUBLES	REMEDIES
Dirty or unsuitable spirit	Remove and refill with fresh spirit.
Unsufficient heat before starting	Increase supply of spirit in heating tray.
Nozzle (3), Fig. 90, choked up	Pass the cleaner through the hole in nozzle, taking care not to enlarge same, Fig. 93.
Filling cap (18) or pump cap (20) are not tight enough.	Tighten up.
Packing (17) in filling cap (18) or packing (21) in the pump cap (20) defective.	Renew.
Leaky stuffing box (13)	Tighten up slightly or renew asbestos packing (12). New packing should be coated with graphite.
Pump fails to work properly.	Plunger should be withdrawn, the leather cup (24) slightly opened out and coated with grease. The lamp must be extinguished at once or it will catch fire.
Should the plunger be forced out and fuel enters the pump barrel (23), valve (11) does not fit tightly.	Valve (11) must be cleaned and if necessary, renewed. Valve cone (11) is tightly fitted to the valve body (9) by means of a cork gasket (10).

After a long time in use, the burner part (1) and particularly the vapourizer gauze (5) may become choked up. It should be unscrewed from the container, the ducts cleaned out with a wire hook, and new gauze inserted, Fig. 94. Before refitting, the thread (8) should be coated with soft soap.

Safety valve may be leaky. If this is so, unscrew the cover on the filling cap and insert a new cork. If the spring of the safety valve is broken or slack, it should be replaced by one of the same thickness.

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