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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

S-E-C-R-E-T

50X1-HUM

COUNTRY Hungary

REPORT

SUBJECT The Csepel Machine Factory

DATE DISTR. 30 December 1955

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DATE OF INFO.

PLACE ACQUIRED

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ENTATIVE.

1. The Raba-Botond machine factory was destroyed during World War II and was never rebuilt for production. The Mavag-Mercedes factory, partially destroyed during the War, managed to produce approximately 20 vehicles from the end of the War until it was dismantled in 1948. These 20 vehicles were shipped to Poland.

2. After the nationalization of 1948, the Csepel machine factory became the exclusive manufacturer of Hungarian trucks. The 3½-ton truck manufactured by Csepel for both export and national military purposes, was modified slightly in approximately 1951 or 1952. The new Csepel trucks intended for export (Csepel D-350) are Diesel-type, while those retained in Hungary for military purposes are gasoline-type. Except for this difference in engines, the export and military trucks are identical. See Attachment 1 for photographs of the Csepel export truck and a manual entitled Drivers Handbook for the CSEPEL D-350 Diesel Truck, issued by Mogurt in Budapest. The Csepel factory also recently began manufacturing 4.2- and 7-ton trucks.

3. The Csepel factory also produces fuel tank trucks, fire trucks and ambulances, which are almost exclusively for military purposes (see Attachment 2, four photographs). Except for certain modifications in body design, the characteristics of these vehicles are the same as the Csepel D-350 trucks. The Csepel factory currently manufactures special military transport vehicles, which are identical with the Ikarus 60/601 bus (see Attachment 3), except that they have gasoline engines and have 3-axle construction.

4. Several years ago the Csepel factory attempted the construction for military use of a 1½-ton "Dodge" weapon carrier (4 cylinders). However, in 1954 the Csepel factory ceased work on these vehicles, since they were heavier than Hungarian Army specifications. The two engineers responsible for the construction of the vehicles were imprisoned and are believed to be still in prison.

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STATE	X	ARMY	X	NAVY	X	AIR	X					

(Note: Washington distribution indicated by "X"; Field distribution by "#".)

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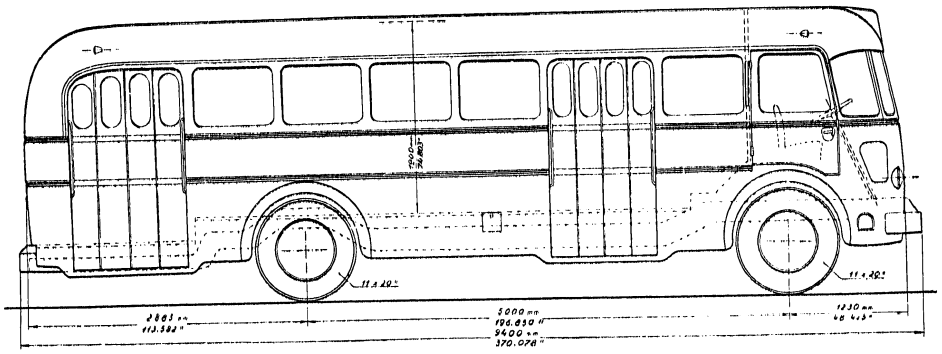
INFORMATION REPORT

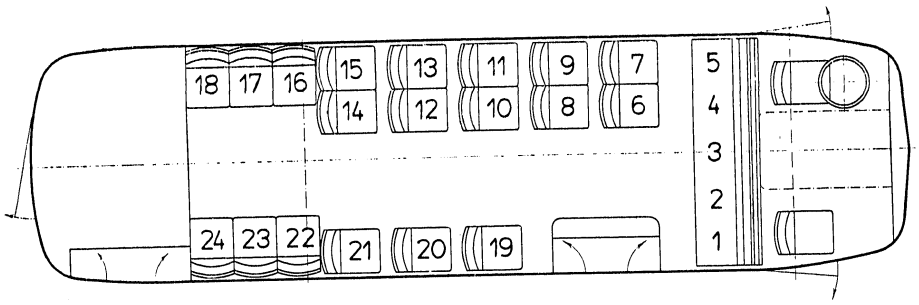
ATTACHMENT 3

MOGÜRT

IKARUS 60/601

AUTOBUS FÜR STADT- UND ÜBERLANDVERKEHR





MOTOR

6-Zylinder-Viertakt-Diesel, Typ Csepel D 613

Bohrung 110 mm

Hub 140 mm

Zylinderinhalt 7983 cm^3

Verdichtungsverhältnis 21 : 1

Drehzahl 2200 U/min

Höchstleistung 125 PS bei 2200 U/min

Grösster Drehmoment 48,7 mkg bei 1600 U/min

Druckschmierung mit Zahnradpumpe, Wasserkühlung mit Zentrifugalpumpe und sechsflügeligem Ventilator. Nasse Zylinderbüchsen aus legiertem Gusseisen. Einzelstehende, getrennte gusseiserne Zylinderköpfe für jeden Zylinder.

KUPPLUNG Einscheiben-Trockenkupplung für 60 mkg Drehmoment

GETRIEBE Vom Motor getrennt angebracht, 5 Vorwärts- und 1 Rückwärtsgang, mit Fernschaltung. Der erste und der Rückwärtsgang sind mit Schubzahnrädern geschaltet, die Zahnräder der anderen Gänge sind schräg verzahnt und dauernd in Eingriff

KARDANWELLENANTRIEB Rohrkardanwelle mit sechs Nadel-Rollenlagern vom Typ Mechanics

HINTERACHSE Aus Stahl, im Gesenk geschmiedete volle Achse. Hinterachsantrieb mit Doppelübersetzung. Erste Übersetzungsstufe mit Kegel- und Tellerradantrieb, die zweite als Stirnradantrieb in die beiden Radnaben eingebaut. Differentialsperre

FEDERUNG Halbelliptische Längsfedern, rückwärtige Federn progressiv wirkend. Zweifach wirkende hydraulische Stossdämpfer zwischen Vorderfeder und Fahrgestellrahmen

VORDERACHSE Im Gesenk geschmiedete "I" Profil Faustachse aus Edelstahl. Die Radnaben laufen auf Kegelrollenlagern

LENKUNG Die Doppelrolle auf der Lenkstockwelle wird durch die auf der Lenksäule befestigte Globoidschnecke bewegt. Lenkung leicht nachstellbar

FAHRGESTELLRAHMEN Zwei aus 6 mm Stahlblech gepresste Längsträger mit 7 Queträgern. Motor und Kühler sind auf einem mit Rollen versehenem Hilfsrahmen angeordnet und können nach vorn leicht herausgezogen werden

BREMSEN Fussbetätigte 4-Rad Druckluftbremse mit eigenem Bremszylinder für jedes Rad. Mechanisch wirkende Hinterrad-Handbremse mit automatischer Nachstellvorrichtung

RÄDER UND REIFEN 7.33 V × 20" Trilexräder
11.00 × 20" Reifen, hinten Doppelreifen

KRAFTSTOFFBEHÄLTER Inhalt 170 Liter

HAUPTABMESSUNGEN UND GEWICHTE

Gesamtlänge mit Stossstangen	9400 mm
Gesamtbreite	2500 mm
Grösste Höhe (belastet)	2850 mm
Fahrgastraumhöhe	1900 mm
Achsenabstand	5000 mm
Radstand, vorn	1855 mm
Radstand, rückwärts	1815 mm
Bodenfreiheit	344 mm
Wendekreisdurchmesser	19 m
Gewicht des Fahrgestells	4,700 kg
Gewicht der kompletten Karosserie	3,050 kg
Gewicht des leeren Wagens	7,750 kg
Nutzlast (60 Pers. à 75 kg)	4,500 kg
Zugelassenes Höchstgewicht	12,250 kg

ÜBERSETZUNGEN UND ENTSPRECHENDE HÖCHSTGESCHWINDIGKEITEN

Bei 2200 U/min Motordrehzahl, 8,35 : 1 Hinterachsübersetzung und 11.00 × 20" Reifen

Gänge	Übersetzung im Getriebe	Gesamtübersetzung	Geschwindigkeit (km/st)
1. Gang	7.22	60.34	7.15
2. Gang	4.03	33.73	12. 8
3. Gang	2.35	19.70	21. 9
4. Gang	1.43	12.02	35. 9
5. Gang	1.00	8.35	51. 7
R. Gang	7.22	60.34	7.15

STEIGVERMÖGEN

Mit Vollast im 1. Gang mit 5.2 km/st Geschwindigkeit, auf trockener Betonstrasse 34,5%

KAROSSERIE

Ganzmetall Karosserierahmen aus kaltgepresstem Profilstahl mit elektrisch geschweisstem Querträger. Innen- und Aussenverkleidung aus zusammengeschweisstem und an das Gerippe genietetem Aluminiumblech. Knotenfreier Tannenholz-Bodenbelag. Zwei Fahrgasttüren mit je vier Türflügeln, luftdruckbetätigt. An beiden Seiten je eine Einsteigetür für Wagenführer und -begleiter. Rückwand-Nottür auf Wunsch. Alle Fenster aus splitterfreiem Sicherheitsglas. Zweiteilige Windschutzscheibe. 24—42 Fahrgastsitze mit Stahlrohrrahmen, Sitze und Lehnen mit Schaumgummi gepolstert. Verstellbarer Fahrersitz. Fahrerhaus vom Fahrgastraum durch Scheidewand separiert. Auf Überlandwagen Vorhänge, Gepäcknetze und Dach-Gepäckträger. Staubdichte Kasten für Batterien, Ersatzrad und Werkzeug

AUSRÜSTUNG UND ZUBEHÖR

Lichtmaschine 300 Watt/12 Volt, Anlasser 6 PS/24 Volt, Glühkerzen, 2 Batterien von je 150 A/st-12 Volt, vollständige innere und äussere Belichtung, Reserverad, Werkzeug, Abschleppvorrichtung

Alle Angaben verstehen sich mit den üblichen Toleranzen. Konstruktions- und Ausführungsänderungen vorbehalten

MOGÜRT

MOGÜRT, UNGARISCHES AUSSENHANDELSUNTERNEHMEN FÜR KRAFTFAHRZEUGE
BUDAPEST 62, POSTFACH 249 - UNGARN

Verantw.: E. Polgár - 24887/LD05 - Réval, Budapest (Verantw.: D. Nyáry)

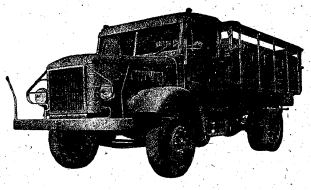
ATTACHMENT 1

DRIVER'S HANDBOOK

FOR THE *CSEPEL D-350*

DIESEL TRUCK

DESCRIPTION, OPERATING AND MAINTENANCE INSTRUCTIONS



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Budapest 62, P. O. B. 249
Hungary

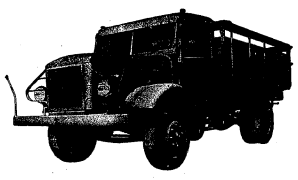
TEXT

FIGURES

DRIVER'S HANDBOOK

FOR THE *CSEPEL D-350* DIESEL TRUCK

DESCRIPTION, OPERATING AND MAINTENANCE INSTRUCTIONS



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Hungary

LIST OF ILLUSTRATIONS

F. k.: Pelgár E.

22070/LD05 - Révai, Budapest

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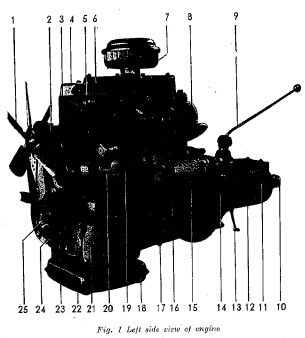


Fig. 1 Left side view of engine

1. Fan
2. V-belt
3. Cylinder head
4. Cylinder head cover
5. Water outlet pipe
6. Inlet collector
7. Air cleaner
8. Exhaust manifold
9. Gear change lever
10. Coupling flange
11. Gearbox
12. Speedometer drive
13. Clutch lever
14. Rear engine mounting
15. Starter motor
16. Crankcase
17. Sump-bolt
18. Sump
19. Water pump
20. Dynamo with control box
21. Oil filler housing
22. Oil drain plug
23. Front engine support
24. V-belt pulley on crankshaft
25. Cranking dog

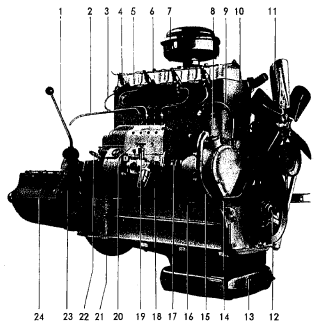


Fig. 2 Right side view of engine

1. Gear change lever
2. Heater plug cable
3. Fuel inlet pipe
4. Injector
5. Cylinder head cover
6. Lead-off pipe
7. Air cleaner
8. Oil filler
9. Earth cable for heater plugs
10. Cylinder head
11. Fan
12. Cranking dog
13. Sump
14. Front engine support
15. Breather
16. Oil dipstick
17. Injection pump coupling
18. Pre-filter and drain-tap of fuel feed pump
19. Hand primer of feed pump
20. Fuel injection pump
21. Flywheel housing
22. Gas control lever
23. Rear engine mounting
24. Gearbox

PREFACE

In manufacturing the Csepel D 350 truck, all the latest achievements of modern engineering science have been applied. The four-cylinder 85 HP diesel engine weighs only 375 kg (800 lbs) although all parts have been dimensioned to withstand the heaviest wear.

The 5 forward gears of the gearbox are easy to operate, ensuring the highest permissible cruising speeds on all gradients and fully utilizing engine performance.

Steering, brakes and wheelbase have been designed and weight distributed with an eye to swift and yet safe driving even on bad terrain.

The welded chassis and the amply dimensioned transmission are designed to ensure maximum service life. Driver's cab is properly equipped and comfortable. The diesel engine runs so smoothly, the centrally arranged control levers and steering wheel are so easy to operate that the driver will have maximum comfort and will be able to accomplish long-distance travels with minimum fatigue.

All parts requiring maintenance are easy of access.

Spacious platform, maximum tractive power, economic fuel consumption, high cruising speed, robust construction are other highlights of the truck. The Csepel D 350 can rightly be called a worthy representative of present day motor industry.

Not even the best motor vehicle can keep up its good performance without proper handling and careful maintenance. It goes without saying that it is of the utmost importance for the driver to become fully acquainted with the constructional features of the vehicle and strictly to observe the instructions contained in this booklet.

The numbers in brackets refer to the respective illustrations, e. g. (2/10) refers to Item No. 10. of Fig. 2.

"Right" and "left" always indicate the right and left hand sides of the vehicle as seen from the driver's position.

Permissible gross laden weight (including crew, pay-load, full fuel tank, oil, water and special equipments, e. g. loading plank) must not exceed 7200 kg (142 cwt.)

On no account should this maximum load be exceeded!

GENERAL HINTS

1. During the running-in period — the first 1000 kilometres (600 miles) — operate vehicle and especially the engine with great care and do not exceed the following speed limits:

1st gear	6.5 kmph	3.1 mph
2nd gear	12.0 kmph	7.5 mph
3rd gear	21.0 kmph	13 mph
4th gear	37.0 kmph	23 mph
Top gear	50.0 kmph	31 mph

2. Change oil at regular intervals. Do not overdo lubricant economy for it is liable to entail much greater repair costs. Observe all operating and maintenance instructions carefully
3. Use approved lubricants only
4. Always use clean fuel. When filling the tank, in addition to a wire-gauze funnel, employ a fine-mesh cloth as well. When tanking from a barrel, do not stir up the sediment from the bottom and do not fill it in
5. Clean fuel filter at short intervals
6. Drain sludge from oil filter regularly
7. Frequently clean air cleaner, especially when travelling on dusty roads
8. Check oil level in crankcase every day
9. Check oil level in gearbox and rear-axle housing according to prescriptions
10. Check valve clearance (between valve-stem and rocker) at regular intervals
11. Fuel tank should never be drained to the extent of the suction-pipe drawing air
12. Always keep cooling water at correct temperature. In frosty weather — unless an anti-freeze solution is used — drain the cooling system completely
13. Use anti-freeze compounds of well-known quality only
14. Check tyre-pressure regularly
15. Check tightness of wheel-nuts from time to time
16. Check brakes daily.

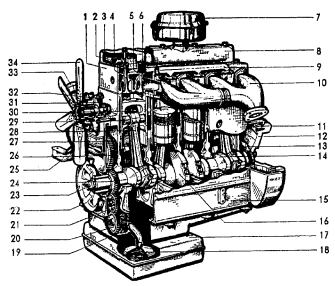


Fig. 3 Engine, longitudinal section

1. Cylinder head
2. Rocker
3. Cylinder head cover
4. Inlet valve
5. Valve guide of exhaust valve
6. Valve spring
7. Air cleaner
8. Inlet manifold
9. Water duct
10. Exhaust manifold
11. Starter ring gear (on flywheel)
12. Flywheel
13. Rear lid of crankcase
14. Crankshaft
15. Crankcase
16. Balance weight on crankshaft
17. Sump
18. Oil pump suction funnel
19. Oil pump
20. Oil pump drive gear
21. Intermediate gear
22. V-belt pulley on crankshaft
23. Crankfist dog
24. Timing gear on crankshaft
25. Front engine support
26. Timing gear on camshaft
27. Injection pump driving gear (intermediate)
28. Connecting rod
29. Gudgeon pin
30. Piston
31. Belt adjusting screw
32. Fan pulley
33. Oil filter
34. Fan

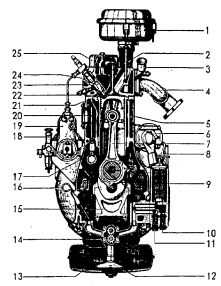


Fig 4 Engine, cross section

1. Air cleaner
2. Inlet manifold
3. Water duct
4. Exhaust manifold
5. Crankcase
6. Water pump
7. Connecting rod
8. Starter motor
9. Oil filter
10. Oil relief valve
11. Oil by-pass valve
12. Oil pump suction funnel
13. Sump
14. Oil pump
15. Main bearing cap
16. Oil dipstick
17. Valve tappet
18. Hand primer for fuel feed pump
19. Injection pump
20. Valve push-rod
21. Two-hole burner
22. Heater plug
23. Precombustion chamber
24. Injector
25. Cylinder head cover

Specifications

Engine. Four-stroke water-cooled diesel engine

Number of cylinders	4
Bore	110 mm (4.331 in.)
Stroke	149 mm (5.511 in.)
Swept volume	5322 c. c. (325 cu. in.)
Compression ratio	21 to 1
Max. brake horse power	80 HP at 2200 rpm
Firing order	1—3—4—2
Lubrication	Force feed, by spur gear type oil pump
Oil capacity of crankcase	14 litres (24 ½ pints)
Oil pressure	3—5 kg per sq. cm (43—70 lbs p. sq. in.)
Cylinder liners	Wet type, cast iron
Pistons	Aluminium alloy, with 4 compression and 2 oil control rings
Valves	Overhead valves
Valve clearance	0.2 mm (0.008 in.) with cold engine
Valve timing	Inlet opens 10° before T.D.C. Inlet closes 40° after B.D.C. Exhaust opens 40° before B.D.C. Exhaust closes 10° after T.D.C.
Injection pump	Bosch PE 4 B 80 D 410 S 275 with mechanical governor (idling 400—500 rpm, max. speed 2000 rpm) or P.A.L.
Injection pressure	120 atm (1836 lbs per sq. in.)
Injection timing	21° before T.D.C. (Bosch) 28° before T.D.C. (P.A.L.)
Injection nozzle	Bosch DNO SD 21, or C.A.V. BDO SD 21, or P.A.L. DCR OS 610
Fuel tank capacity	Approx. 120 litres (28 ½ gals)
Cooling system	Water cooling, with impeller type pump

Electrical equipment

Dynamo	300-Watt, 12-Volt, four-brush-type
Starter motor	4 HP, 24-Volt, axial type
Heater plugs	Bosch GS 2 D 30, or P.A.L. VSL 3, or BERU 293 G
Heating switch	Bosch SH/GH 1/2
Starter switch	Bosch SSH 13/3 Z
Lighting switch	With 0—1—2—3 positions
Starter battery	Two 12-Volt, 90 Amp-h. DIN 7231

Chassis

Clutch	Single dry-plate, 11 in. dia
Gearbox	5 gears forward, 1 reverse
Transmission ratios in gearbox	Bottom 1 : 8.71 Second 1 : 4.74 Third 1 : 2.71 Fourth 1 : 1.59 Top 1 : 1 Reverse 1 : 8.71

Rear axle ratio	1 : 5.14
Overall gear ratios (rear wheel to engine speed)	Bottom 1 : 44.7 Second 1 : 24.3 Third 1 : 13.9 Fourth 1 : 8.17 Top 1 : 5.14 Reverse 1 : 44.7
Maximum speeds in gears at 2200 RPM	Bottom 8.6 kmph (5.33 mph) Second 15.7 kmph (9.75 mph) Third 27.5 kmph (17.05 mph) Fourth 46.8 kmph (29.10 mph) Top 74.5 kmph (46.20 mph) Reverse 8.6 kmph (5.33 mph)

Wheels and Tyres

Tyre	8.25 × 20
Rim contour and diameter	5.00 S 20 (7.00—20)
Tyre Pressure	4 atm. (57 lbs/sq. in.)
Front wheel toe-in (measured on outer rim of brake drums)	2—4 millimetres (0.08—0.16 in.)
Front wheel camber	0°
Castor angle	3°30'
Front axle	Flat type, I-section beam
Rear axle	Rigid housing, with fully floating axle shafts
Final drive	Spiral bevel crown wheel and pinion, with differential lock
Front and rear springs	Longitudinal, semi-elliptic leaf springs
Shock absorbers	Two double acting hydraulic shock absorbers

Brakes

Foot Brake	Hydraulic servo-assisted four-wheel brake with internal shoes
Hand Brake	Acting on rear wheels, servo-assisted mechanical, with internal shoes
Steering	Left hand side, cam and roller type

Main Dimensions

Overall length	6735 mm (265 in.)
Overall width	2260 mm (89 in.)
Overall height	2749 mm (108 in.)
Wheelbase	3710 mm (146 in.)
Track front	1740 mm (68 ½ in.)
Track rear	1650 mm (65 ½ in.)
Ground clearance (under rear axle)	255 mm (10 in.)
Turning circle diameter (on outer front wheel spur)	16.8 m (55 ft.)
Platform area	8.2 sq. m (88 ½ sq. ft.)
Platform length	3920 mm (154⅜ in.)
Platform width	2160 mm (85⅛ in.)

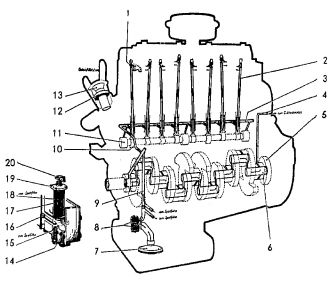


Fig. 5 Engine lubrication

1. Valve rocker
2. Valve push-rod
3. Oil distribution channel
4. Oil duct to gauge
5. Crankshaft
6. Oil channel in crankshaft
7. Oil pump suction funnel
8. Oil pump
9. Main oil channel
10. Oil pipe to oil distribution channel
11. Camshaft
12. Air cleaner
13. Oil filler
14. Oil relief valve
15. Oil by-pass valve
16. Plug
17. Laminated filter element
18. Dirt cleaning rack
19. Oil filter cover
20. Retainer

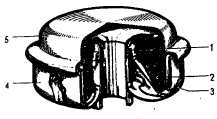


Fig. 6 Air cleaner

1. Seal ring
2. Filter
3. Oil level mark
4. Air cleaner, lower part
5. Air cleaner, upper part

Trailer draw-hook	With bumper spring
Loading capacity	3600 kg (7720 lbs)
Permissible gross laden weight	7200 kg (141½ cwt)

Load distribution

Front axle	2400 kg (47½ cwt)
Rear axle	4800 kg (94½ cwt)
Fuel consumption, on road	16 to 20 litres per 100 km (14 to 17 mpg)
Oil	0.3 litres per 100 km (940 mpg)
Hill climbing ability at 7200 kg gross weight on dry road surface	32 per cent (1 in 3.2)

Description

1. ENGINE

Four-cylinder water-cooled four-stroke oil (diesel) engine with a maximum output of 85 b. h. p. at 2200 r. p. m.

2. CRANKCASE (1/16 and 3/15)

integral with the cylinder-block it is an improved light-metal alloy (Silumin) casting. In the centre line of each main bearing there is a vertical partition extending to the uppermost part of the cylinder-block. Side walls are reinforced by webs. For maximum rigidity the joint face of the crankcase is deep below the crankshaft axis. The rigid construction of the crankcase combined with an amply dimensioned crankshaft, ensure long service life for all bearings under the most adverse conditions.

3. CRANKSHAFT (3/14)

is a heat-treated high-grade alloy steel forging, with journals of ample diameter and sturdy crank-webs. Corners between journals and crank-webs are well rounded. Journal dia. is 85 mm (3 11/32 in.), that of the crankpins 75 mm (2 15/16 in.). Bearing surfaces are flame-hardened and highly polished. The five journals are mounted in steel-backed lead-bronze shells. High-pressure lubrication of all bearings is effected by means of a drilled oil-channel along the entire length of the crankshaft. (Fig. 5) Case-hardened helical timing gear (3/24) is mounted at the front end of the crankshaft.

4. CAMSHAFT (5/11)

has flame-hardened and polished cams and bearing surfaces. Valves are actuated by tappets (4/17) having chill-cast, glass-hard lower ends, by steel tube push-rods (4/20), and by forged-steel rockers (3/2). Valves are closed by concentric twin coil-springs (3/6). Lubricating oil gets to the rockers through drilled tappets and tubular push-rods.

5. VALVES (3/4 and 3/5)

are of overhead layout. Inlet valves (3/4) are of manganese-silicon steel, the exhaust valves (3/5) of chromium-silicon steel. Valve diameters: inlet 52 mm (2 3/64 in.), exhaust 48 mm (1 57/64 in.). Lift of both valves is 11.5 mm (29/64 in.), valve clearence 0.2 mm (0.008 in.) with cold engine. Valves are slightly inclined to fore and aft. By this arrangement a very favourable cylinder head design could be obtained.

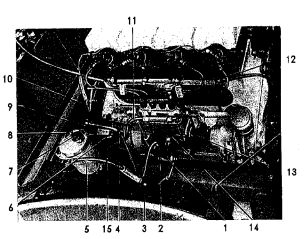
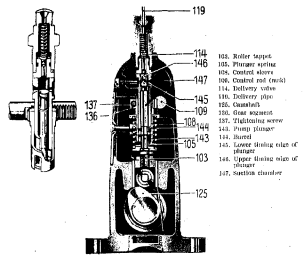
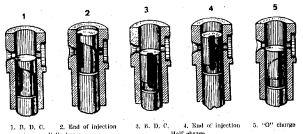


Fig. 7 Fuel line layout

1. Pre-filter of fuel feed-pump
2. Hand primer for fuel feed-pump
3. Fuel line from tank to feed-pump
4. Overflow pipe from filter to tank
5. Fuel filter
6. Throttle control rod
7. Fuel filter filling screw
8. Fuel filter bleeding screw
9. Fuel overflow valve
10. Leak-off pipe
11. Fuel line from filter to injection pump
12. Fuel inlet pipe
13. Coupling for injection pump drive
14. Injection pump
15. Fuel line from feed-pump to fuel main filter



103. Roller tappet
105. Plunger spring
108. Control sleeve
108. Control rod (rack)
114. Delivery valve
119. Delivery pipe
125. Camshaft
135. Gear segment
137. Tightening screw
143. Pump plunger
144. Barrel
145. Lower timing edge of plunger
146. Upper timing edge of plunger
147. Suction chamber



1. B. D. C. 2. End of injection Full charge 3. B. D. C. 4. End of injection Half charge 5. "O" charge

Cross-section of the barrel at different charges

Fig. 7/a Injection pump, cross-section

8. CONNECTING RODS (3/28)

are sections of heat-treated alloy-steel. Big end is split at an angle of 45°, permitting of easy removal of connecting rod and piston assembly through the cylinder liners after uncoupling big-end bearing-cap.

7. PISTONS (3/30)

are of light-metal alloy, fitted with four compression and two oil-control rings. Gudgeon pins (3/29) are fully floating and located by circlips.

8. CYLINDER LINERS

made of cast-iron alloy, are detachable wet liners with highly polished bores. They are shoulder-located and easily removable. Bottom end of the liners is fitted with synthetic rubber gaskets to separate water circuit from crankcase.

9. CYLINDER HEADS (2/10)

separate for each cylinder, are made of cast-iron alloy. The sealing surface sunk into the circular groove of the liners protects the gasket against burning or blowing out.

10. FLYWHEEL (3/12)

mounted at the rear end of the crankshaft, is manufactured of cast-iron and weighs 38.8 kg (85 1/2 lbs). The hardened starter ring gear is screwed-on.

11. FUEL INJECTION PUMP (3/29)

mounted on the right hand side of the engine, is easily accessible. It is driven from the camshaft by a pair of helical spur gears (3/27). The pump delivers fuel to the injectors through relatively short delivery pipes of equal length. It has to provide each cylinder with minutely exact quantities of fuel on injection.

Operation (7/a). Cam (7a/125) lifts plunger (7a/143) by means of roller-tappet (7a/103), and at the same time compresses spring (7a/105). As the cam turns on, the spring pushes the plunger back which, travelling downwards, draws the fuel from suction chamber (7a/147) into the barrel above the plunger. As the plunger rises again, it first presses some fuel back into the suction chamber, but as soon as its top edge closes the port, this backflow ceases. Then the fuel is forced by the plunger past delivery valve (7a/114) and delivery pipe (7a/119) into the injector, until lower spiral timing edge (7a/145) of the plunger uncovers the port mentioned above (Cut-off). During the further

rise of the plunger, fuel will return through the vertical groove of the plunger and the port into the suction chamber. It follows from the above process that the supplied quantity of fuel is determined by varying the distance of both timing edges (7a/145 and 7a/146) of the plunger. This quantity can be controlled by rotating the plunger, as its lower timing-edge is helically shaped. Hence the rotary motion of the plunger alters the vertical distance of the edges when measured in the line of the port hole. Rotation of the plunger is brought about by shifting control-rod (7a/109), which turns sleeve (7a/108) and, by means of the two lugs held in a slot of the sleeve, the plunger itself. By moving the control rod towards the flywheel-end of the engine the supplied fuel quantity is diminished and engine-speed reduced. On the other hand, moving the control-rod in an opposite sense increases the quantity of fuel delivered and the engine gains speed and performance. Control rod can be operated either with the pedal (accelerator) or with the hand control lever, and is also influenced by the automatic governor. These two controls are so connected that the foot-pedal does not take along the hand control lever. Having released the pedal it is returned by a spring to its original position, limited by the hand control lever. Maximum delivery, which still gives smoke-free exhaust, is limited by adjustable stops, the original adjustment of which should not be disturbed.

12. AUTOMATIC GOVERNOR

assembled with the fuel injection pump at its rear end, automatically ensures a steady idling speed and limits the maximum permissible speed of the engine. (Detailed description on (p. 25.)

13. FUEL INJECTORS (10/a)

are mounted diagonally into each cylinder-head. Delivery pipe (10a/15) of the fuel injection pump is mounted at the side of the injector with the leak-off pipe connecting all four injectors at their upper end. This pipe conducts the small quantities of fuel, which by-pass the nozzle-spindle, back to the fuel tank. The fuel passes through the connecting channel of the injector into collecting chamber (10a/17), round the lower end of the nozzle. To ensure uniform working of each cylinder, every injector must work with the same pressure i. e. 130 atm. (1890 lbs. p. sq. in.). Uniform pressure is ensured by adjustable injector valve spring (10a/3) which holds the needle-valve of the nozzle on its seat by means of nozzle spindle (10a/2). As fuel pressure in annular chamber (10a/17) reaches 130 atm., it lifts the needle-valve against the tension of the spring and the fuel is injected with great velocity in the form of a very fine spray into the pre-combustion chamber.

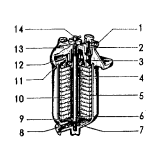


Fig. 8 Main fuel filter

1. Overflow union
2. Overflow valve
3. Gasket
4. Central tube
5. Filter bowl
6. Felt seal
7. Spring
8. Drain plug
9. Spring plate
10. Felt ring (filter element)
11. Filter head sekot
12. Fuel inlet
13. Filter head
14. Bleeding screw

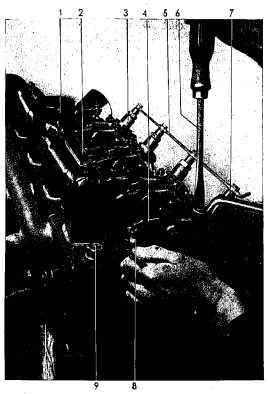


Fig. 9 Adjusting the valve clearance

1. Air cleaner flame
2. Inlet manifold
3. Injector
4. Valve rocker
5. Leak-off pipe
6. Screwdriver
7. Ring spanner
8. Feeler gauge
9. Cylinder head stud

14. PRECOMBUSTION CHAMBER (10/3)

Here the fuel is mixed with a small quantity of hot air and, on being ignited, its pressure increases and the burning fuel passes through *two-hole burner cell* (10/4) into the combustion chamber of the cylinder. Here the swirling fuel, becoming thoroughly mixed with air, burns perfectly and the pressure thus resulting turns the crankshaft through the piston and the connecting rod.

15. COOLING SYSTEM

The engine is cooled by water which is held in circulation by a centrifugal pump. The engine should run at idling speed until water temperature reaches 70° C (160° F).

16. WATER PUMP (Fig. 20)

is driven together with the dynamo by the fan belt.

17. SIX-BLADE FAN (2/11)

mounted on the fan belt is driven off the crankshaft by a triangular V-belt, common with the dynamo.

18. RADIATOR BLIND

for regulating cooling according to engine load or weather conditions, is made of canvas. Water temperature should be kept constantly between 75° and 85° C (162° to 180° F) When laying up the vehicle for a longer period, especially in frosty weather, all water must be drained through the drain-plug mounted on the lowest part of the water inlet pipe.

19. CLUTCH (11)

of the single-disc dry-plate type, is amply dimensioned for taking heavy stresses. Steel clutch plate (11/32) is provided on both sides with friction linings, and is pressed by 9 coil springs (11/21) and the pressure-plate against flywheel friction face (11/4). In this position the engine is connected with the gearbox. When depressing clutch pedal (11/9), release fork and release levers (11/10) hinged to the pressure plate, make the pressure plate move away from the flywheel, thus interrupting the drive from the engine to the gearbox.

20. GEARBOX (12)

provides 5 forward speeds and one reverse. Drive-shaft spigot end (11/28) rotates in the rear end of crankshaft (11/26) on a needle-roller bearing (11/29). Layshaft (12/14) is parallel with mainshaft (12/28) and is constantly driven by the drive shaft through a pair of constant-mesh gears (12/3). Gear change lever (12/9) is mounted

in the gearbox cover by means of ball joint (12/10) and is guided by guide-plate (12/7).
Change of speeds is accomplished as follows:

1st speed: By means of selector shaft (12/22) and shifting fork (12/25), the gear change lever pushes twin gearwheel (12/31) rearward on the mainshaft. In this position the bigger twin-gear meshes with gear (12/19) on the layshaft.

2nd speed: On pushing selector shaft (12/22) forward, the small twin-gear is meshed with gear (12/15) on the layshaft.

3rd speed: On moving selector shaft (12/21) rearward it connects layshaft and constant-mesh idling gear (12/13) by means of dog-clutch (12/12) and thus gear (12/13) drives the mainshaft by means of gear (12/33).

4th speed: On moving selector shaft (12/21) forward, dog-clutch (12/12) connects idler gear (12/6) to the layshaft which in its turn drives the mainshaft be means of gear (12/35).

5th speed: By pushing selector shaft (12/20) and shifting fork (12/24) rearward, sliding-sleeve (12/36) engages the drive-shaft and the mainshaft, providing the direct drive.

Reverse: Broad reverse gear (12/16) sliding on reverse gear-shaft (12/17), is in constant mesh with bigger twin-gear (12/31) on the mainshaft. When pushing the reverse gear by means of selector-shaft (12/23) and shifting-fork (12/24) rearwards, gears (12/19) and (12/31) come into mesh and the mainshaft rotates with the layshaft in the same sense.

21. PROPELLER SHAFT (13)

Driven by the mainshaft through a needle-roller type universal joint, it consists of two halves and is supported at its middle by flexibly mounted ball bearing (13/12). The two halves of the propeller shaft are also connected to each other by another universal joint, enabling the rear-half of the propeller shaft to move transversally. Its longitudinal movement is made possible by splined shaft-end (13/4) and sleeve (13/5). The third universal joint connects the rear shaft to the rear axle driving pinion.

22. REAR AXLE AND FINAL DRIVE (14)

On passing a curve, the outer wheel running on the wider circle has to make more revolutions than the wheel running on the inner circle, as the former has to cover a longer distance at the same time. In other words, the two wheels rotate differently in relation to each other. This relative movement is made possible by the differential

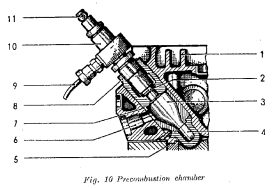
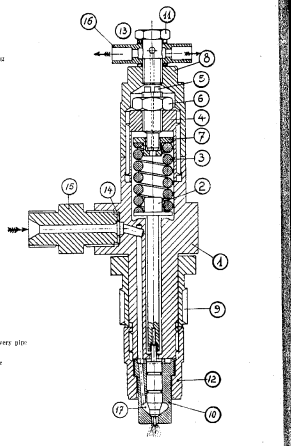


Fig. 10 Precombustion chamber

1. Cylinder head
2. Injection nozzle
3. Precombustion chamber
4. Two-hole burner cell
5. Cylinder head gasket
6. Heater plug socket
7. Copper gasket
8. Threaded sleeve
9. Delivery pipe
10. Injector
11. Fuel leak-off pipe



1. Injector body
2. Nozzle spindle
3. Injector valve spring
4. Spring cap nut
5. Adjusting screw
6. Lock nut
7. Spring cushion
8. Closing cap

9. Fixing sleeve
10. Injection nozzle
11. Holder bolt
12. Nozzle cap nut
13. Gasket
14. Gasket
15. Union nut of delivery pipe
16. Leak-off pipe
17. Collecting chamber

Fig. 10/a Fuel injector

gear in the following manner: the two sun wheels (14/12), mounted on the inner ends of the rear axle driving-shafts, mesh with planet pinions (14/19) and, through the pinion-spider, are connected with differential cage and crown wheel (14/3) mounted thereon. The spiral bevel crown wheel is driven by the driving-pinion which is connected by a universal joint to the rear end of the propeller shaft. At both ends of the pressed-steel axle casing the rear-wheel hubs rotate on tapered roller bearings (14/28 and 14/30).

23. DIFFERENTIAL LOCK

When moving sleeve (14/22) inwards on the splines of the left hand side rear driving shaft (14/1) by means of pull-rod (14/2), the two shafts will be positively connected. In this position both rear shafts and both rear wheels can only rotate with the same speed. The differential lock is required should one of the rear wheels start spinning on a wet, muddy or icy road. In such cases the spinning wheel remains stationary, with the other wheel standing still and thus the vehicle is unable to start. By engaging the differential lock, the vehicle can easily be set in motion, without employing any other means. The differential lock should not be kept engaged longer than absolutely necessary for starting the vehicle. Releasing the control lever of the differential lock, it disengages automatically.

24. FRONT AXLE (Fig. 15)

The I-section front beam axle is made of drop-forged alloy steel. The stub axles turn around king-pin (15/5). Front wheel hubs (15/20) run on tapered roller bearings mounted on the stub axles. The front axle is fitted at the front springs with double-acting hydraulic shock absorbers.

25. STEERING GEAR (Fig. 16)

Globoid cam (16/11) mounted at the end of steering shaft (16/2), turns in two tapered roller bearings. The cam is in mesh with the double roller fixed in rocker-shaft (16/8). On turning the cam, steering fork swings out and drop-arm (16/9) conveys the movement to the front wheels.

26. ENGINE LUBRICATION SYSTEM (5)

is of the force-feed circulation type. Oil is drawn by the gear pump through a wire-gauze strainer from the sump, and is forced through full-flow oil-filter (5/17). The thoroughly filtered oil passes through main oil-channel (5/9) along the drilled crankshaft and lubricates all main bearings and big-end bearings. From the rear main bearing oil flows to oil-pressure gauge (5/4). The oil-duct, branching off main oil-channel (5/9), delivers oil to the camshaft bearings and — via drilled tappets, pushrods and rockers — to the rocker shafts. The casing of the full-flow oil-filter is bolted to the crankcase and incorporates the relief and by-pass valves. Relief valve (5/14) opens whenever oil pressure exceeds the permissible maximum, but the by-pass valve only opens when the oil-filter becomes clocked by dirt or sludge and impedes oil circulation. Though in such cases oil is delivered unfiltered into the main oil-channel, lubrication is still maintained. Cleaning rack (5/18) of the oil-filter is turned slightly on by means of a rod and lever at each clutch release.

27. CHASSIS FRAME

The channel section side-members are pressed of steel-plates and adequately braced by cross-members. Joints are welded. The rear cross-member is fitted with a draw-hook, the front one with a pivot for towing purposes.

28. SPRINGS

Both front and rear axles are supported by semi-elliptic spring-assemblies of wide leaves.

29. WHEELS

are made of pressed sheet-steel. The twin rear wheels are suitable for applying double snow-chains. Tyre size 8.25 × 20 in., rim contour and diameter 5.00 S 20 (7.00—20).

30. BRAKES (Fig. 17)

A servo-assisted hydraulic brake, operated by brake pedal (17/13), acts on all four wheels. The rod of the brake pedal pushes piston (18a/12) of the master cylinder rearward and the piston expels the brake fluid through pipe-lines into front (17/14) and rear (17/10) wheel brake cylinders. The pistons in the wheel brake cylinders are forced apart thus pressing the brake shoes against the inner surface of the brake drums. The brake system must be bled whenever the brake becomes soft. Hand-brake lever (17/3) operates the brake shoes of the rear wheels by means of brake rods and cables (17/7).

31. BODY

The spacious driver's cab provides comfortable accommodation for 3 persons. Instrument panel (Fig. 19) is easily accessible and comprehensive. By loosening two bolts it can be readily removed, allowing the wiring of the electrical instruments to be handled. The body is supported by a pressed steel framework and has dropsides on both its sides and at the rear. Starting battery is mounted on the dashboard in front of the driver's cab, the spare-wheel is accommodated on two ledges under the body. The toolbox is placed beneath the driver's seat.

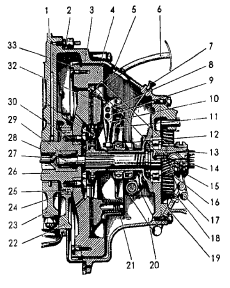


Fig. 11 Clutch

1. Crankcase
2. Union to oil pressure gauge
3. Clutch housing
4. Flywheel
5. Inspection hole
6. Clutch pedal
7. Lubricator
8. Needle roller bearing
9. Clutch release lever bearing
10. Release lever
11. Clutch cover
12. Adjusting screw for release lever
13. Release hub with release roller bearing
14. Needle roller bearing
15. Dog clutch sleeve to 5th speed
16. Helical gear on mainshaft
17. Lever on pedal shaft
18. Helical gear on layshaft
19. Release rod
20. Release arm
21. Clutch spring
22. Rear cover of crankcase
23. Cap of main bearing
24. Ring of cover
25. Ring oil seal
26. Crankshaft
27. Socket sleeve
28. Clutch drive shaft
29. Needle roller bearing
30. Splined hub
32. Clutch plate
33. Starter ring gear

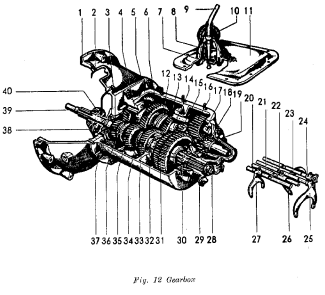


Fig. 12 Gearbox

1. Clutch housing
2. Timing index
3. Lubricator for release bearing
4. Gearbox housing
5. Constant mesh helical gears
6. 4th speed layshaft gear
7. Guide plate
8. Stop spring
9. Gear change lever
10. Ball joint
11. Gearbox cover
12. Dog clutch sleeve, 3rd and 4th speeds
13. 3rd speed layshaft gear
14. Layshaft
15. 2nd speed layshaft gear
16. Reverse gear with roller bearings
17. Reverse gear shaft
18. Ball bearing on layshaft
19. Gear of 1st speed
20. Selector shafts of 4th speed
21. Selector shaft of 3rd and 4th speeds
22. Selector shaft of 1st and 2nd speeds
23. Selector shaft of reverse gear
24. Shifting fork of reverse gear
25. Shifting fork of 1st and 2nd speeds
26. Shifting fork of 3rd and 4th speeds
27. Shifting fork of 5th speed
28. Mainshaft
29. Flange hub
30. Rear ball bearing on mainshaft
31. Twin slide gear of 1st and 2nd speed
32. Middle bearing of mainshaft
33. Mainshaft gear of 3rd speed
34. Speedometer drive gear
35. Mainshaft gear of 4th speed
36. 5th speed dog clutch sleeve
37. Ball bearing on drive shaft
38. Clutch release fork
39. Drive shaft
40. Clutch release sleeve

How to Operate the Truck

A) PREPARATIONS FOR STARTING

Prior to starting the engine, always check :

1. Fuel level in the fuel tank
2. Water level in the radiator
3. Oil level in the crankcase
4. Tyre pressure
5. Lighting system and signals
6. Hand and foot brakes
7. When hauling a trailer, the latter's drawing hook, brakes and lighting.

B) STARTING THE ENGINE

In warm weather

1. Put gear lever into neutral
2. Push key into switch-box (19/15) and turn it to the right, red control lamp (19/13) will light
3. Move hand-controlled gas lever (19/25) to full charge
4. Turn on heater plug switch (19/14) and let the plugs glow for approx. a minute (pilot plug on the instrument panel will emit a cherry-red glow)
5. Depress clutch pedal
6. Depress foot button of starter switch. Should engine not start within 3—4 seconds, release starting pedal and repeat heating. A warm engine will start without heating
7. Having started the engine, shift hand-controlled gas lever to idling and let the engine run until it warms sufficiently.

In cold weather

Heat precombustion chambers for 1½—2 minutes. Should engine fail to start within 3—4 seconds, don't strain the starter motor further but heat again. Warming the cooling water and — in very cold weather — the engine oil as well, is recommended. Should the vehicle park outdoors in very cold weather (below —15° C or 5° F) for a long time, take the batteries into a heated room and drain cooling water to prevent its freezing, unless an anti-freeze solution has been used. When travelling, check radiator shutter occasionally to keep water temperature between 70° and 80° C (158° and 176° F).

C) STOPPING THE ENGINE

1. Put gear change lever into neutral
2. Engage hand brake
3. Cut off fuel delivery by moving hand-controlled gas lever upwards
4. Pull key out of switch box.

D) HOW TO DRIVE

1. *For changing speed* use the gear change lever, having previously disengaged the clutch. Double declutching is required. To this end, disengage clutch, put gear change lever into neutral, re-engage clutch for an instant and — having disengaged it again — put gear lever into the next speed. When changing to a lower gear, first engage clutch and then slightly accelerate motor rpm by stepping on the gas control pedal. Skilful changing of gears is a matter of practice, the important thing is to secure a nearly equal rpm of engine and gearbox mainshaft at the moment of changing. Smooth changing of gears is essential to obviate premature wear of the transmission. When declutching, fully depress clutch pedal. Before engaging reverse, bring the vehicle to a complete stop. Prior to climbing a hill, change to a lower gear. Keep the same gear engaged downhill, as would be necessary for climbing the same gradient. Never disengage clutch or gear downhill ! With pay-load less than 3 tons on level ground, the vehicle can be started using the second speed. When fully loaded or hauling a trailer, always change to bottom gear on starting.

2. *Braking.* When cruising use the foot-brake only. Avoid excessive braking, for the truck is apt to skid with wheels blocked. Use the hand brake for securing the vehicle in stationary position. Should you have to use it in an emergency, apply it with great care to prevent skidding.

3. *Differential lock.* As already mentioned, the differential lock should only be used in an emergency and for as short a time as possible. Do not engage the differential lock when passing a curve for it is impossible to stear the vehicle with the differential lock engaged and serious damage of the differential gears may result.

4. *Protection against skidding.* On snowy, icy or muddy roads apply snow-chains on the wheels. The chains must be loose enough to find their proper place on the tyres without difficulty.

5. *Hauling a trailer.* Remember that a double load almost doubles the required stopping distance. Trailer brakes must be in faultless condition.

6. *Haulage.* A spring-buffered draw-hook is fitted on the rear cross-member of the frame for hauling purposes. To haul another car or truck, attach a drawbar to the front of the vehicle. For hauling always use a drawbar, never a rope.

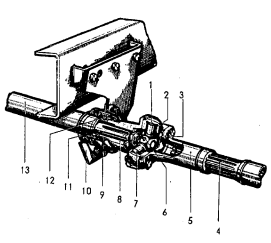


Fig. 13 Propeller shaft suspension

1. Universal joint
2. Needle rollers
3. Grease nipple
4. Rear half of propeller shaft
5. Splined sleeve
6. Grease nipple
7. Joint cross
8. Sleeve hub
9. Oil seal ring
10. Suspension plate
11. Bearing housing
12. Ball bearing
13. Front half of propeller shaft

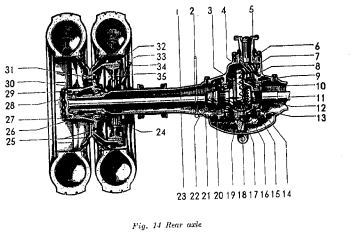


Fig. 14 Rear axle

1. Rear axle driving shaft (left)
2. Pull rod to differential lock
3. Crown wheel
4. Rear axle housing
5. Flanged hub
6. Ball bearing
7. Driving pinion
8. Roller bearing
9. Adjusting nut
10. Tapered roller bearing
11. Rear axle driving shaft (left)
12. Differential sun wheel
13. Bearing sleeve
14. Bearing support
15. Differential gear, bearing
16. Thrust washer
17. Pinion spider
18. Oil filler plug
19. Differential planet pinion
20. Operating fork to differential lock
21. Operating lever to differential lock
22. Clutch sleeve of differential lock
23. Rear axle tube
24. Flanged ring
25. Rear wheels
26. Spacer
27. Rear wheel bolt
28. Outer tapered roller bearing
29. Driving shaft bolt
30. Inner tapered roller bearing
31. Wheel nut
32. Brake drum
33. Brake shield
34. Hand brake cable
35. Brake shoe

A) IN GENERAL

Careful maintenance and regular attention will ensure long and satisfactory service. All tools and accessories required for routine maintenance and smaller repair are supplied by the manufacturer. Excepting the maintenance operations marked for execution by special repair shops, all maintenance work can be performed by the driver himself. During the first 1000 km (600 miles) exercise special care, especially with the engine. Do not run it at too high speeds.

Speed limits are as follows:

bottom	gear.... 6.5 kmph	4	mph
second	gear.... 12.0 kmph	7.5	mph
third	gear.... 21.0 kmph	13	mph
fourth	gear.... 37.0 kmph	23	mph
top	gear.... 60.0 kmph	37	mph

After every 5000 km (3000 miles) have the vehicle checked at a repair shop. Once every year thorough cleaning is necessary, on this occasion have the paint mended, remove all rust from the wheel-rims and paint the latter with a rust-proof coating. Observe the lubrication chart strictly (Fig. 37).

B) ENGINE

With the dipstick check oil-level in the crankcase daily or before every longer run. To obtain true reading the vehicle must be on level ground. Wipe the dipstick thoroughly with clean, non-fluffy cloth. Oil-level must reach the lower end of the dipstick but should not overtop the dipstick marking. Change oil at least every 4000 km (2500 miles), but more frequently when using oil of inferior quality. With a new engine or after a major overhaul change oil

after the first 500 km (300 miles)
after the first 1500 km (1000 miles)
after the first 3000 km (2000 miles)
after the first 6000 km (4000 miles)

Change oil with the engine still hot, preferably after a long run. The oil-drain plug is at the lowest point of sump (4/13), the oil-filler is located on the right hand side at the front of the engine. After every 15,000 km (10,000 miles) remove the sump and clean it thoroughly, together with the oil-strainer of the oil-pump suction funnel (4/12).

C) VALVE CLEARENCE

Valve clearance, i. e. the clearance between valve-stem and rocker arm pad has to be checked at intervals. The correct clearance is 0.2 mm (0.008 in) for both inlet and exhaust valves with the engine cold. Measure clearance with the feeler-gauge, placed in the toolkit. Adjust clearance as follows (fig. 9):

Having dismantled the cylinder-head, remove heater plugs to facilitate the turning of the crankshaft. Bring the piston to its top dead centre so that both inlet and exhaust valves are closed and the tappets are free. Having released the locknut of the rocker adjusting screw, turn the adjusting screw with a screwdriver until the feeler gauge enters with a sliding fit between valve-stem and rocker. Now hold the adjusting screw with the screwdriver in position and tighten the locknut.

D) MAIN FUEL FILTER (Fig. 8)

Fuel is delivered to the main filter by the fuel feed pump mounted on the injection pump. In case of insufficient fuel delivery clean the main filter in the following manner: Drain fuel from the filter by removing drain plug (8/8) at the lower end of the filter-casing. Unscrew locknut at centre top of filter head, let bowl down and take out filter element assembly. Flush out the bowl with clean fuel and dismantle filter element. Immerse felt rings in clean fuel for a couple of minutes and keep wringing felt-rings, changing the fuel used for washing several times until the dripping fuel is free of sludge. Wash out filter central tube and the fine-mash filter cloth on it. Reassemble filter element and wash it in clean fuel once more. Mind to clean all felt rings! Damaged felt rings or filter-cloth must be replaced immediately. When reassembling filter element, mind that the gasket fits well into the filter head recess. Bleed the main filter from time to time by loosening the bleeding screw on the filter head, letting air to vent until fuel flows without air bubbles, indicating that the filter is properly bleeded. Then tighten bleeding screw.

E) AIR CLEANER (Fig. 6)

To obtain long service life, the air admitted into the cylinders must be entirely free from dust. The air entering the air cleaner undergoes an abrupt change of direction over an oil-surface, the bigger particles of dust being thereby hurled into the oil. From here the air passes through an oil-covered wire-gauze filter and is freed even from the tiniest particles of dust. Mind that there is always oil in the cleaner up to the level mark. Remove filter element from time to time and wash it in clean fuel oil.

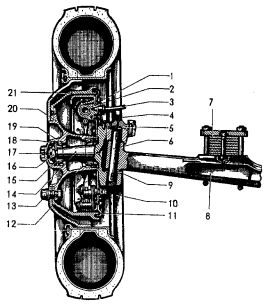


Fig. 15 Front axle

1. Bleeding screw
2. Wheel brake cylinder
3. Brake flexible hose
4. Grease nipple
5. Steering arm
6. King pin
7. Front spring
8. Front axle beam
9. Thrust washers
10. Brake adjuster eccentric
11. Brake shield
12. Disc wheel
13. Wheel nut
14. Stub axle
15. Washer
16. Flat slotted nut
17. Grease nipple
18. Hub cap
19. Tapered roller bearing
20. Front wheel hub
21. Brake drum

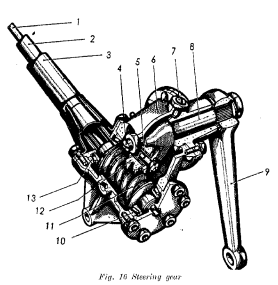


Fig. 16 Steering gear

1. Inner tube
2. Steering wheel shaft
3. Steering wheel support tube
4. Adjusting screw
5. Needle roller bearing
6. Steering gear housing
7. Adjusting screw
8. Rocker shaft
9. Drop arm
10. Tapered roller bearing
11. Cam
12. Double roller
13. Tapered roller bearing

F) INJECTION PUMP AND INJECTORS

No special maintenance is required, only check oil level in the pump with the dipstick daily and top up if necessary. All repairs must be undertaken at the service.
Faulty injectors may cause constant overloading of the engine. A sticking injector valve causes untimely ignition, knocking and excessive smoking. Since most injection troubles arise from contaminated fuel, take special care in using perfectly clean fuel only.

How to detect a faulty injector?

The injectors give a long period of trouble-free service provided that the fuel filters receive regular and careful attention. Nevertheless if at times injector troubles occur, these will be apparent from the following symptoms:

a) extraordinary knocks in the engine
b) misfiring and lack of performance
c) black exhaust smoke
d) fuel consumption increase.

The location of the faulty injector can be carried out as follows: Slacken the fuel pipe union nut of each injector one after the other when the engine is running. After two or three turns oil leaks through and so the respective cylinder is cut out. If this procedure causes a change in the running of the engine, the injector is in order. The faulty injector which causes no change in the erratic running of the engine when cut out, must be removed for inspection and repair.

Governor (Fig. 31). Check oil level at every 2000 kilometres (1200 miles) by removing the plug (31/110 ab). Top up with special oil or thin engine oil through oiler opening on top of governor housing (31/110 c) until level reaches opening of checking plug (110 ab), then replace and tighten plug.

Tanking

1. Should fuel storage container (barrel, etc.) have been stirred, wait until dirt and sludge settle down. Settling is even more important than filtering.
2. When taking fuel by means of a pump, take care not to stir the sediment. Never pump fuel from the bottom of the container.
3. The sediment of the storage tank should never be used in the engine.
4. Keep all implements used for tanking (vessels, cans, funnels, etc.) always clean, never put them on the ground.
5. When tanking, put a fine-mesh wire-gauze strainer, a non-fluffy piece of linen or chamois leather into the funnel.

G) RADIATOR

For perfect cooling, the radiator must be clean outside and inside. It must not be painted or covered with dust or oily dirt either. A dusty radiator must be blown out with compressed air or cleaned with a strong water-jet. If the radiator is oily on the outside, wash it with a warm solution of soda and water and then flush it with clean water. Use only clean soft water for the cooling system. Rain water is best for this purpose, as hard water containing lime may cause scaling which considerably lessens cooling efficiency.
To remove scale, flush radiator with a warm solution of soda and water (0.5 kg sodium hydroxide to 10 litres of water, i. e. 1 pound to 2 gallons). Having drained the cooling system, pour this solution into empty radiator and use the truck for 1—2 days like that. Then, drain the solution and flush the radiator with pure water until the water flowing out is entirely clean. Scale deposits in the cylinder-block and cylinder heads should be removed at the service only. Do not attempt to remove scale with diluted hydrochloric acid, owing to the thinness of the radiator tubes.
Check tightness of pump-driving fan-belt weekly and adjust, if required, by means of the adjusting screws on top of the fan mounting. Should V-belt become distended so that it cannot be re-tightened, it must be replaced.

H) ELECTRICAL EQUIPMENT

The dynamo and starter-motor require no special attention, only the grease in the bearings must be re-filled every six months. At the same time, have dynamo and starter-motor brushes and commutators cleaned by the service. Battery maintenance requires special care. Check them every fortnight and make sure that the electrolyte level overtops the cell-plates by 15 mm (5/8 in.). If not, top up cells with distilled water. Keep positive terminals (marked) well smeared with acid-proof grease or vaseline to prevent corrosion. Keep all terminals spanner-tight to ensure good electrical connection. Should the battery not be required for several months, hand it over to the service for storage. Discharging of the battery reduces acid density and the electrolyte will freeze more easily. In winter, therefore, always keep your batteries in fully charged condition. Don't put any metal part or tool on the battery, lest it short-circuits. Check grade of charging and specific gravity on the electrolyte frequently. Should electrolyte be leaking from the battery, have it checked at the service, to prevent corrosion of the battery-box. Prior to doing any work on the electrical equipment, disconnect the positive terminal to avoid short circuiting.

Plugs (Fig. 4/22) are fitted to each cylinder. The glowing-head of the heater plugs penetrates into the precombustion swirl-chamber. The

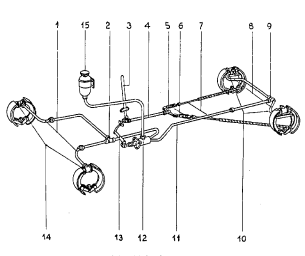


Fig. 17 Brake system

1. Flexible hose to front brakes
2. Distributor to front brakes
3. Hand brake lever
4. Connecting rod
5. Balance lever
6., Adjusting screws
7. Steel cable with flexible tube to rear brakes
8. Brake hoses to rear brakes
9. Distributor to rear brakes
10. Rear wheel brake cylinders
11. Brake pipe to rear brakes
12. Main brake cylinder
13. Brake pedal
14. Front wheel brake cylinders
15. Brake fluid reservoir

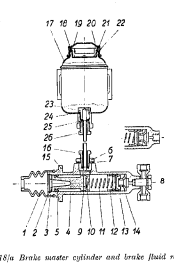


Fig. 18/a Brake master cylinder and brake fluid reservoir

1. Rubber gaiter
2. Lid of cylinder
3. Locking ring
4. Piston body
5. Rubber sleeve
6. Union nut
7. Packing
8. Rubber piston
9. Spring cushion
11. Spring
12. Auxiliary piston
13. Rubber sleeve
14. Stop
15. Cylinder body
16. Union screw
17. Brake fluid reservoir
18. Filter
19. Packing
20. Air filter
21. Packing
22. Cover
23. Union screw
24. Packing
25. Union
26. Union screw

four heater plugs are connected in series so that if one plug is burnt out, the current-circuit is interrupted and the plugs do not function at all. In such cases we must first ascertain if the tell-tale plug on the dashboard is in good order. If it is, then we must be sure that the earthing-cable is not broken. If not, then take a screwdriver and beginning at the fourth cylinder (i. e. at the fan end of the engine): short-circuit one plug after the other by placing the screwdriver on the plug-screw and contacting the end of the screwdriver to the cylinder head. Naturally heater current must be switched on. Some other person should attend to the tell-tale plug on the dashboard and if that heater plug is defective as its short-circuiting, the tell-tale plug will begin to glow. The defective plug must be replaced by a new one. It is advisable to have one or two spare plugs in the tool kit.

I) CLUTCH (Fig. 11)

Lubricate release-sleeve and its ball-bearing with a few drops of oil every 1000 kilometres (600 miles) through the nipple of the pipe protruding from the clutch housing. The clutch needs no further attention or adjustment unless the clutch-linings become worn. To eliminate this readjust rod (11/19). The foot-pedal must have a free travel of at least 20 millimetres (3/4 in.) before releasing the clutch. Lack of this free play indicates that the linings are worn and must be replaced.

J) GEARBOX (Fig. 12)

Change oil every 10,000 kilometres (6000 miles), preferably after a longer run when oil is still warm. The oil capacity of the gearbox is approx. 4 litres (7 pints). Check oil level every 3000 kilometres (1800 miles) with the dipstick built into the filler plug. With a new vehicle change oil after the first 1000 kilometres (1000 miles), and subsequently after 6000 kilometres (3600 miles).

K) PROPELLER SHAFT (Fig. 13)

Lubricate universal joints every 6000 kilometres (3600 miles), suspension ball-bearing and spline shaft every 3000 kilometres (1800 miles) with heavy gearbox-oil. Should the protecting cover of the propeller shaft (13/4) become damaged, have it repaired or replaced without delay.

L) REAR AXLE (Fig. 14)

Change oil in the differential every 10,000 kilometres (6000 miles). See that oil level is at the height of oil-filler plug (14/18). For refilling approx. 8 litres (14 pints) of oil are needed. Check oil level every 3000 kilometres (1800 miles) and refill, if necessary.

M) SPRINGS

Lubricate the spring pins and shackle pins of both front and rear springs every 1000 kilometres (600 miles) with heavy gearbox oil. When lubricating unload the springs by jacking up the frame. Every 12,000 kilometres (7500 miles) put graphite grease into the space between the spring leaves, having previously unloaded the springs.

N) WHEEL HUBS (Figs. 14 and 15)

Grease front wheel hubs with wheel-hub grease (lime-soda soap grease) every 6000 kilometres (3600 miles). Rear wheel hubs, being lubricated with oil from the differential gear, need no further attention.

O) STEERING-GEAR (Fig. 16)

Fill up every 3000 kilometres (1800 miles) with gearbox winter oil. Grease the steering linkage with gearbox oil every 1000 kilometres (600 miles). Free-play, measured on the steering-wheel rim, must not exceed 20 millimetres (3/4 in).

P) FOOT BRAKE (Figs. 17, 18a, 18b)

Replenish brake fluid in reservoir (17/15) every 3000 kilometres (1800 miles). Keep fluid level 10 millimetres (3/8 in.) below the upper edge of the filling orifice. After filling tighten cap thoroughly. Sometimes a soft, "spongy" reaction makes itself felt on applying the brake pedal indicating the presence of air in the hydraulic system. In such cases, the brake system must be bled as follows:

1. Fill up brake fluid reservoir preferably with same make of brake fluid as used previously.
2. Attach one end of bleeding-pipe (24/2) to the bleeding screw and immerse the other end into a bottle containing some brake fluid. Open bleeding screw by 1—2 turns.
3. Depress brake pedal quickly and let it back slowly. Continue this operation until the fluid flowing into the bottle is entirely free of bubbles.
4. Depress pedal once more and, holding it depressed, tighten bleeding screw firmly.
5. Remove bleeding pipe.

Repeat this procedure with all four wheels, always making sure that the brake fluid reservoir is filled to capacity. Adjust brake pedal and its linkage so that the piston is forced by the spring to its left dead centre leaving the connecting hole free. For this, a free play of 3—5 mm (1/8—3/16 in.) is required between the piston and push rod. When performing any work on the braking system take care not to distort the brake pipes.

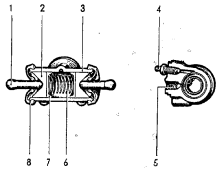


Fig. 18/b Wheel brake cylinder

1. Push rod
2. Piston
3. Wheel brake cylinder
4. Bleeding screw
5. Union
6. Spring
7. Piston sleeve
8. Rubber cup

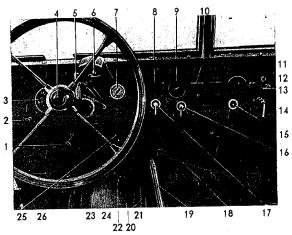


Fig. 19 Instrument panel

1. Starter push-button
2. Panel lighting switch
3. Speedometer
4. Push-button of horn
5. Panel lighting
6. Switch of windscreen-wiper motor
7. Oil pressure gauge
8. Heater pilot ring
9. Water temperature gauge
10. Fuse boxes
11. Socket for hand lamp plug
12. Switch of driver's cab lighting
13. Battery charge control lamp
14. Heater plug switch
15. Switch box
16. Trafficator switch
17. Lighting switch
18. Gear change lever
19. Hand brake lever
20. Accelerator pedal
21. Differential lock lever
22. Foot brake pedal
23. Clutch pedal
24. Dip switch
25. Gas hand-control lever

R) HAND BRAKE

After adjusting the foot brake, the hand brake should be adjusted also, as follows :

1. Jack up rear wheels.
2. Pull on and release hand brake lever several times and make sure that cables are free in their conduits. The spot where the cables enter the conduit must be cleaned and greased thoroughly. If the cable is jammed in the conduit, the whole unit should be dismantled in specialist's workshop and repaired or replaced by a new one.
3. Pull on hand brake lever into third ratchet.
4. If in this position the jacked-up rear wheels cannot be moved by hand, the brakes are in good order and need no adjustment.
5. If the wheels can be rotated by hand, the length of the cables must be adjusted by the buckle adjusters inserted into both cables, as follows :
   Slacken lock nuts at both ends of buckles and turn adjusters, inserting a screwdriver until brake drag is perceptible at the rear wheels. The buckle adjusters must be driven in such a way that the balance lever should be rectangular with the pull-rod.
6. When releasing the hand brake lever, the wheels must rotate freely without the slightest drag when being turned by hand.
7. Tighten locknuts of the buckle adjusters.
8. Try brakes on the road.

Remember to keep a sharp lookout behind, before applying the brakes !

S) TYRES

Inflate both front and rear tyres wheels to 4 atm (56 lbs. p. sq. in) pressure. In warm weather slightly less tyre-pressure is required. With a view to the long service life of your tyres, take care that garage floor is free of fuel, oil or grease spots because rubber coming into contact with oil deteriorates rapidly.

T) BODY AND DRIVER'S CAB

Grease door-locks and hinges once monthly. Once a year dismantle door panel, and clean and lubricate the window-raising mechanism. Tighten all bolts, nuts and screws every 10,000 kilometres (6000 miles).

Remember that proper maintenance pays !

Idling and Maximum Speed Governor

The diesel engine draws pure air only into the cylinders during the suction stroke and fuel is injected into the highly compressed (and consequently hot) air in the combustion chamber at the end of the compression stroke. Assuming equal engine temperatures, the engine draws equal quantities of air at each suction stroke. This amount of air is independent of the quantity of fuel injected and is more than required for the combustion of fuel. Fuel oil being liable to produce soot and carbon deposits if not burnt perfectly, there must be a surplus of air even at full load. At partial load or idling this can rise to the multiple of the theoretically needed air quantity. Contrary to the petrol engine, the quantity of air drawn into the diesel engine does not influence the performance of the latter.
The rpm of the diesel engine is changed by increasing or diminishing the injected quantity of fuel.
The quantity of fuel injected at one stroke being exceedingly small (a few cu. mm only when idling), and there being a constant abundance of air in the cylinder, performance may rise or fall to an undesirable degree at the smallest alteration of load. That is why the engine is apt to stalling or racing when idling.
The automatic governor ensures a steady idling speed and limits adjusted maximum speed automatically. In the speed range between idling speed and maximum rpm the governor does not operate, and speed is altered by means of the control rod actuated by the throttle pedal (accelerator).

HOW THE AUTOMATIC GOVERNOR WORKS (Figs. 26-32)

The automatic governor is of the mechanical flyweight type and is built integrally with the injection pump for the simplest conveyance of the regulating force to the control rod.
The hub of the governor is keyed on the fuel injection pump camshaft and has two flyweights (110h). As the engine gains speed, the increased centrifugal force compels the flyweights to move outwards against the resistance of governor springs (110d). Governor springs are of two different strengths according to the range of speed to be controlled. The outward movement of the flyweights is transferred to control rod (107d) by the intermediary of the two cranked levers (110g) and operating lever (110r), making the control rod move in the "Stop" direction. This in turn reduces fuel supply, and engine rpm falls.
When engine rpm falls, the centrifugal force of the flyweights also decreases and the latter move towards the axis obeying the pressure of the governor springs. When shifting the control rod in the opposite

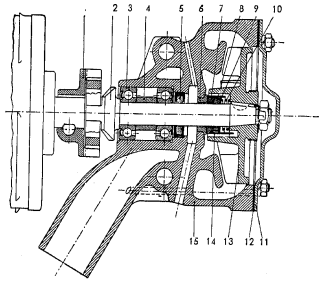


Fig. 29 Water Pump

1. Coupling jaw on dynamo shaft
2. Impeller axle
3. Ball bearing
4. Spacer
5. Felt packing ring
6. Bush in the pump housing
7. Slide ring
8. Rubber gasket
9. Spring cushion
11. Pump housing cover
12. Cover gasket
13. Impeller
14. Driving sleeve
15. Pump housing

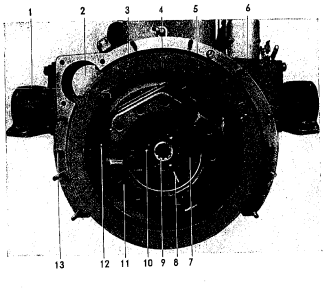


Fig. 21 Flywheel and clutch

1. Rear engine suspension
2. Starter motor bonfire
3. Mark of beginning of injection
5. Flywheel
6. Crankcase
7. Clutch disc
8. Clutch release lever
9. Splined hub
10. Adjuster screw for clutch release lever
11. Clutch cover
12. Balance weight
13. Dowel for gearbox

direction, fuel delivery increases and engine rpm rises. Since the automatic governor regulates both the idling and maximum speeds of the engine, each flyweight has two springs of different tensions. Within both speed-ranges the delivered quantity of fuel is regulated automatically by means of control lever (110p) turning on excentric (110 I) as centre (Fig. 26).

Fig. 27 shows the arrangement of the two concentric governor springs in the flyweights. Idling speed is determined by outer weaker spring (110d), while for regulating maximum speed, inner stronger spring (110f) comes into action. In the idling-speed range only outer spring (110d) acts against the centrifugal force of the flyweights. As soon as gas control pedal is depressed, engine speed increases above idling speed, the flyweight yields to the increased centrifugal force and bears against retainer (110w) of inner spring (110f). The flyweights remain in this position as long as the resistance of springs (110f) outweighs the centrifugal force of the flyweights. With the injected quantity of fuel becoming more than required for the momentary engine load, or with engine load decreasing, engine speed increases and the augmented centrifugal force of the flyweights compresses inner spring (110f) too. The flyweights move outwards and the above described process is repeated. The movement of the flyweights is transmitted to the delivery control rod and the latter moves in the "Stop" direction until the injected quantity of fuel has been reduced to that corresponding to the maximum permissible speed.

In the interval between idling and maximum speeds, the governor is inoperative, the centrifugal force of the flyweights having already overcome the resistance of the weak springs but not yet being sufficient to compress the stronger springs. In this interval injected fuel quantity is regulated by the driver through the gas control pedal. The gas control pedal moves operating lever (110r) and control rod (107d) by means of control lever (110p) and excentric (110 I) mounted on eccentric shaft (110m).

In such a case the flyweights bear against the retainer of the inner spring without moving, joint pivot (110y) becomes a fix centre and eccentric (110 I) turns operating lever (110r) around pivot (110y) and shifts control rod (107d). In this way control rod can be brought to every position between "Stop" and "full charge".

ADJUSTING THE INJECTION PUMP

The quantity of fuel delivered per stroke depends on the position of control rod (107d) the movement of which is limited by two stops, stop screw (110ma, Fig 31), and adjuster screw (101n, Fig. 30). These have been adjusted on the test bed at the factory and must not be touched.

Adjust idling speed stop (the extreme outer position of the gas control pedal, Figs 26 and 28) so that on letting the pedal back from its full charge position (Fig. 32, III) engine speed falls rapidly, but engine does not stall. The engine must be running smoothly at the idling position (II) of the foot pedal.

On withdrawing the idling stop, gas control pedal must be returned so that stop lever (110 mb) bears against the stop for "O" delivery (110mc, Fig. 31).

STOPPING THE ENGINE

To stop the engine, control lever (110p) has to travel in the "Stop" direction until it rests against the stop for "O" delivery. To this effect, withdraw idling hand lever, whereupon the retracting spring of the linkage pulls control lever (110p) back into "Stop" position (Fig. 31, I).

LUBRICATION

When putting the governor into operation, approx. 150 cc (9 cu. in.) good quality thin engine oil must be filled in through oil filler cap (110c, Fig. 31). Top this up every 2000 kilometres (1200 miles) with approx. 40 cc (2½ cu. in.) of the same oil. For checking oil level, remove screw (110 ab.)

REPLACING GOVERNOR SPRINGS

Remove adjuster nut (110k, Fig. 29) entirely. When adjusting a new spring assembly take care that the springs of both flyweights have equal tension, i. e. adjuster nuts are in the same position on the threaded bolts.

As shown in Fig. 29, control lever (110r) is joined to control rod (107d) by means of an adjustable connecting rod. Do not detach this connection, to avoid disturbing the correct adjustment of the governor.

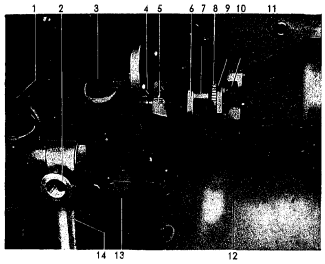


Fig. 22 Adjusting the fuel injection pump

1. Hand primer of fuel feed-pump
2. Inlet pipe union
3. Injection pump fixing bolt
4. Mark on injection pump housing
5. Mark on fuel coupling half
6. Mark on 1st fuel coupling half
7. Coupling flange
8. Mark on adjuster disc
9. Mark on adjustable coupling half
10. Fixing bolt of adjuster disc
11. Bearing housing of injection pump drive
12. Fixing bolt of drive flange
13. Crankcase
14. Primary fuel filter

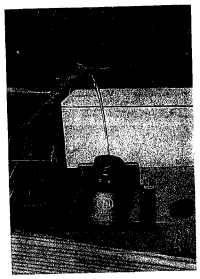


Fig. 23 Filling up the brake fluid reservoir

Trouble-tracing Chart

With careful driving very few troubles will occur. Should, however, any trouble of unknown cause arise, trace the source first to find adequate means for eliminating the trouble and for preventing more serious damage. Spare parts, packings, gaskets and tools must always be in good order and near at hand. Think before dismantling or repairing any part; work done in a hurry often brings about greater damage.

Kind of Trouble	Possible Cause and Remedy
Engine fails to start	See Item No. 1 to 7
Engine stops	,, ,, ,, 8 to 9
Engine lacks power	,, ,, ,, 10 to 11
Engine exhaust smoky	,, ,, ,, 12 to 15
Engine runs irregularly	,, ,, ,, 16 to 18
No oil pressure	,, ,, ,, 20 to 24
Water is boiling	,, ,, ,, 25 to 28
Insufficient braking	,, ,, ,, 29 to 34

No.	Trouble	Remedy
	Engine does not crank	
1.	*a)* Discharged battery	Replace or recharge battery
	b) Loose or dirty main-cable contacts	Clean and tighten cable ends and shoes
	c) If both mentioned are in full order :	Check starter switch
	d) defective starter motor	To be repaired by specialist
	Engine cranks but will not start	
1/a.	Heater plugs do not function, control plug is not glowing	
	a) broken cable	Replace or repair cable
	b) burnt-out heater plug or control plug	Replace faulty plug
2.	Pilot plug is only dark glowing :	
	a) discharged battery	Recharge or replace battery
	b) loose cable contacts	Check cable contacts according to wiring diagram, tighten contact nuts

No.	Trouble	Remedy
3.	Pilot plug glows white instantly	Switch out heater plugs immediately
	a) short circuit in wiring	Check and insulate cables
	b) pilot plug circuit earthed	Check insulation, if necessary replace control plug
4.	Lack of fuel	
	a) no fuel in tank	Fill up tank and bleed fuel system
	b) air in fuel system	Bleed system
	c) fuel filter choked up	Dismantle and clean filter
5.	Fuel injection pump does not function	To be repaired at the service
6.	Injector nozzles choked up	Fit new injectors, have defective ones repaired at the service
7.	Lack of compression in engine	
	a) valves not tight	Grind-in valves
	b) too little valve clearance	Adjust valve clearance (Fig. 9)
	c) pistons not tight	Replace piston rings or cylinder liners
	d) cylinder head gasket not tight	Fit new gasket
	Engine stops	
8.	Gradually (dies out) : lack of fuel	See 4a, b, c and 6
9.	Abrupty (stalls) : jammed-in piston	Tow vehicle to service
	Engine lacks power	
10.	One or more cylinders set out	
	a) fuel delivery pipe broken	Fit new pipe
	b) fuel delivery pipe union slackened	Tighten
	c) injector nozzle sticking	See 6.
	d) low compression	See 7.
11.	Injection pump setting misplaced	Check and re-set at service

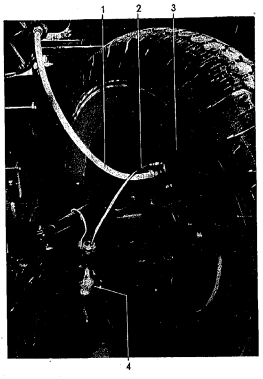


Fig. 24 Bleeding the brake cylinders

1. Brake hose
2. Bleeding pipe
3. Front wheel
4. Bottle with brake fluid

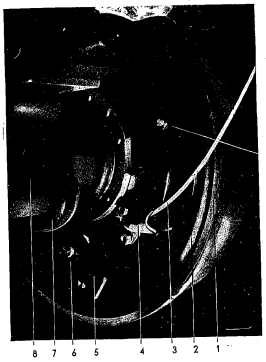


Fig. 25 Readjusting the brake-shoes

1. Brake drum
2. Brake shoe plate
3. Hand brake cable
4. Brake cable cable
5. Eccentric lever
6. Fixing nut
7. Spring clamp
8. Rear axle housing

No.	Trouble	Remedy
	Engine exhaust smoky	
12.	Lubricating oil working up cylinder bores, oil control rings worn	Replace oil control rings
13.	Injector nozzle-valve sticking	See 6.
14.	Cylinder liners or pistons worn or piston rings stuck-in	Engine to be overhauled
15.	Low-grade fuel being used	Fill up tank with good quality fuel
	Engine runs irregularly	In case of hard knocking stop engine immediately, tow vehicle to repair-workshop
16.	Injector nozzle-valve stuck	See 6.
17.	Injection pump timing amiss	See 11.
18.	Worn crankshaft main or big-end bearings, slack-ened bearing bolts	Stop engine immediately and have it overhauled
19.	Heavy smoke at crankcase oil-filler necks	See 14.
	No oil pressure	
20.	Faulty oil pressure gauge	Replace or repair gauge
21.	Oil pressure pipe broken	Fit new pipe or solder defect one
22.	Oil filter relief valve (Fig. 5/14) jammed	Clean valve
23.	Relief valve-spring broken	Renew valve-spring
24.	Leak of oil in crankcase	Fill up sump, check oil-level daily
	Cooling water boils	
25.	Radiator shutter closed	Open shutter

No.	Trouble	Remedy
26.	Lack of water in cooling system	Top up water level of radiator (if engine overheated, fill up water gradually with engine running)
27.	Radiator clogged	Clean radiator inside and outside
28.	Fan V-belt slipping	Readjust fan-belt tension
	Inadequate or uneven braking	
29.	Brake linings oiled	Clean or burn lining surface or renew linings
30.	Brake adjustment faulty	Readjust brakes (see "Maintenance Instructions")
31.	Air in brake system	Bleed brake system
32.	Lack of brake fluid in main brake cylinder	Top up brake fluid level and bleed brake system
33.	Brake pipes not tight	To be repaired at the service
34.	Wet brake linings	Drive vehicle with slightly applied brakes until moisture evaporates (Take care when washing vehicle)

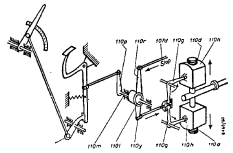


Fig. 26 Governor delivery control

107 d Delivery control rod
110 d Governor spring
110 g Crankcd lever
110 h Flyweight
110 l Eccentric
110 m Eccentric shaft
110 p Control lever
110 r Operating lever
110 y Joint pivot

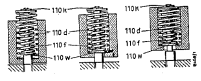


Fig. 27 Arrangement of governor springs

110 d Weaker governor spring
110 f Stronger governor spring
110 k Adjuster nut
110 w Spring retainer

Lubrication Chart

Numbers refer to diagram shown in Fig. 37.

Ref. No.	Point of lubrication	Kilometres (Miles)	Lubricant
1.	R. H. Front Spring Front Pin	1000 (600)	Thick gearbox oil
2.	Engine Crankcase		Check oil level daily and before every trip, top up with engine oil if necessary. Change oil after the first 500 km (300 miles), 3000 km (1800 miles) and 6000 km (3600 miles), and subsequently at every 4000 km (2500 miles). (More frequently if a lower-grade oil is used)
3.	R. H. Shock Absorber	3000 (1800)	Shock absorber oil, fill up wholly
4.	Injection Pump and Governor	3000 (1800)	Refill with engine oil, lubricate governor housing daily with a few drops of oil
5.	R. H. Front Axle King Pin	1000 (600)	Thick gearbox oil
6.	R. H. Front Wheel Hub	6000 (3600)	Wheel hub grease
7.	R. H. Track Rod Ball Joint	1000 (600)	Thick gearbox oil
8.	Clutch Release Bearing	1000 (600)	A few drops of engine oil
9.	R. H. Front Spring Shackle	1000 (600)	Thick gearbox oil
10.	R. H. Front Spring Pin	1000 (600)	Thick gearbox oil
11.	Universal Joint, Front	6000 (3600)	Thick gearbox oil
12.	Universal Joint, Middle	6000 (3600)	Thick gearbox oil

Ref. No.	Point of lubrication	Kilometres (Miles)	Lubricant
13.	Propeller Shaft Suspension	3000 (1800)	Thick gearbox oil
14.	Propeller Shaft Splined End	3000 (1800)	Thick gearbox oil
15.	R. H. Rear Spring Front Pin	1000 (600)	Thick gearbox oil
16.	R. H. Brake Cable Tube	3000 (1800)	Thick gearbox oil
17.	Universal Joint, Rear	3000 (1800)	Thick gearbox oil
18.	Rear Axle Housing	3000 (1800)	Fill up with gearbox oil, change oil after the first 1200 and 6000 km (1000 and 3600 miles), and subsequently after every 10,000 km (6000 miles)
19.	R. H. Rear Spring Sliding Shoe	1000 (600)	Grease, possibly graphited
20. 21. 22.	Trailer Draw-hook	3000 (1800)	Grease
23.	L. H. Rear Spring Sliding Shoe	1000 (600)	Grease, possibly graphited
24.	L. H. Brake Cable Tube	3000 (1800)	Thick gearbox oil
25.	L. H. Rear Spring Front Pin	1000 (600)	Thick gearbox oil
26.	Brake Fluid Tank	3000 (1800)	Top up brake fluid (not oil) to 1 cm (1/2 in.) below upper edge
27.	Hand Brake and Differential Lock Lever	6000 (3600)	Engine oil, with oil can
28.	L. H. Front Spring Rear Pin	1000 (600)	Thick gearbox oil
29.	L. H. Front Spring Shackle	1000 (600)	Thick gearbox oil

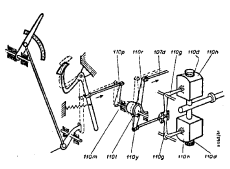


Fig. 28 Gas control pedal delivery control

107 d Delivery control rod
110 d Governor spring
110 g Cranked lever
110 h Flyweight
110 i Eccentric
110 m Eccentric shaft
110 r Control lever
110 s Operating lever
110 y Joint pivot

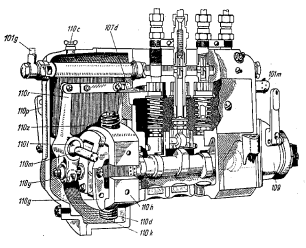


Fig. 29 Injection pump cross section

107 g Fuel pipe
107 m Control rod stop
107 d Control rod
100 Adjuster of injection start
110 c Oiler cap
110 d Governor spring
110 g Cranked lever
110 h Flyweight
110 k Adjuster nut
110 i Eccentric
110 m Eccentric shaft
110 r Control lever
110 s Operating lever
110 y Joint pivot
110 z Cooling screw

Ref. No.	Point of lubrication	Kilometres (Miles)	Lubricant
30.	Gearbox	3000 (1800)	Fill up with gearbox oil, change oil after the first 1500 and 6000 km (1000 and 3600 miles), and subsequently after every 10,000 km (6000 miles)
31.	Clutch Release Shaft	3000 (1800)	Thick gearbox oil
32.	Starter Motor	1000 (600)	Engine oil, witch oilcan
33.	Air Cleaner	1000 (600)	Top up with engine oil to mark
34.	Steering Tie Rod Ball Joint	1000 (600)	Thick gearbox oil
35.	Foot Brake Pedal Shaft	3000 (1800)	Engine oil with oilcan
36.	L. H. Track Rod Ball Joint	1000 (600)	Thick gearbox oil
37.	L. H. Front Wheel Hub	6000 (3600)	Wheel hub grease
38.	L. H. Front Axle King Pin	1000 (600)	Thick gearbox oil
39.	L. H. Shock Absorber	3000 (1800)	Shock absorber fluid, fill up wholly
40.	Water Pump	3000 (1800)	Water pump grease
41.	Dynamo	6000 (3600)	Engine oil, with oilcan, if lubricating point provided
42.	Steering Gear	3000 (1800)	Fill up with thick gearbox oil
43.	Steering Drop Arm Ball Joint	1000 (600)	Thick gearbox oil
44.	L. H. Front Spring Front Pin	1000 (600)	Thick gearbox oil

Routine Maintenance

No.	Task	Checking period during running-in: daily	100 (60)	1500 (1000)	3000 (1800)	4500 (2800)	after running-in: 3000 (1800)	6000 (3600)
		kilometres (miles)						
1.	Check valve clearance and adjust if necessary (0.2 millimetres = 0.008 in. with engine cold), check lubrication of rockers and valve-guides		*	*	*			*
2.	Check fan-belt tension and readjust if necessary (total play of belt pressed by thumb midway between crankshaft pulley and dynamo should not be more than 10 millimetres = 3/8 in.)	*						
3.	Examine tightness of nuts and bolts: engine mounting, dynamo, air cleaner, radiator brackets, fan-shaft end, exhaust pipe, fuel injection pump coupling (the latter should not be loosened, mind timing marks)		*		*		*	
4.	Inspect tightness of fuel lines, tighten unions if necessary		*	*	*		*	
5.	Tighten threaded sleeves (10/8), injectors and heater plugs with engine warm		*		*		*	
6.	Check water pump gland		*				*	
7.	Drain oil filter		*				at every oil change	
8.	Bleed fuel main filter			*			*	
9.	Clean fuel main filter (more frequently if fuel delivery insufficient)				*			
10.	Check oil level in air cleaner	*						
11.	Clean and refill air cleaner						*	
12.	Check level and specific gravity of electrolyte in batteries, top up with distilled water, if necessary, clean contacts and grease terminals, recharge battery, if necessary					*	*	

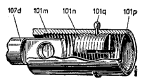


Fig. 30 Adjusting the control rod stop

101 m Threaded sleeve
101 n Adjuster screw
101 p Closing disc
101 q Split pin
107 d Control rod

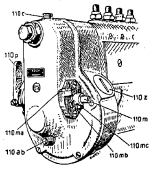


Fig. 31 Adjusting the injection pump

110 ab Oil level checking plug
110 c Filler cap
110 m Eccentric shaft
110 ma Stop screw
110mb Stop lever
110 mc Stop at "O" delivery
110 g Control lever
110 z Closing screw

No.	Task	Checking period during running-in				after running-in			
		kilometres (miles)							
		daily	500 (300)	1000 (600)	1500 (900)	2000 (1200)	2500 (1500)	3000 (1800)	4000 (2400)
13.	Check free travel of clutch pedal (20—30 millimetres, ¾—1¼ in.)			*				*	
14.	Check electrical equipment (head lamps and dipping, side lamps, tail lamp, battery charging control lamp, etc.)	*							
15.	Inspect efficiency of foot and hand brake, readjust and bleed, if necessary	*							
16.	Check tyre pressures (should be 4 atm = = 56 lbs per sq. in, front and rear)	*							
17.	Check and tighten wheel nuts	*							
18.	Tighten spring shackle nuts		*		*		*		*
19.	Check free motion of steering (approx. 2 cm = ¾ in. on steering wheel rim) and effortless steering when driving		*		*		*		*
20.	Inspect steering, rods, tighten nuts, ball joints and locks		*		*		*		*
21.	Check clearance of wheel hub bearings, readjust if necessary		*				*		*
22.	Top up brake fluid reservoir					*		*	
23.	Clean heater plugs and threads								*
24.	Lubricate door, hinges, windscreen wipers, pedal shafts and clutch release bearing			*				*	

Frost and Corrosion Precautions

Anti-freeze Compounds

In frosty weather — when temperature sinks below freezing point — precautions must be taken to prevent cooling water from freezing, for this might cause cracking of engine parts or radiator.

The addition of an anti-freeze solution to the water is the best safeguard, obviating the inconvenience of draining the cooling water.

Only good quality anti-freeze solutions should be used complying with the following requirements:

1. Liquid state at all temperatures
2. Physical properties (specific heat, heat and electric conductivity, viscosity at medium temperatures) similar to those of water
3. Permanent chemical and physical properties
4. Harmless to metal or rubber components
5. No salt deposits or scaling in radiator or engine
6. Minimum froth formation
7. Should not be easily inflammable, or develop poisonous gases or disagreeable fumes

The most frequently used anti-freeze is alcohol (methanol). For an anti-freeze effect down to —15° C (5° F) it is sufficient to mix to the water a quantity amounting to 20 per cent of the total cooling system capacity. Its drawbacks are: low boiling point of 64.5° C (150° F) which in practice means vast vaporization of the anti-freeze as soon as the temperature of the coolant exceeds this figure. Thus the anti-freeze content of the coolant diminishes with a corresponding rise in the freezing point.

Another widely used anti-freeze is ethylene glycol. Having a boiling point higher than water no vaporization losses or weakening of the mixture can occur. Its disadvantage is a tendency to form froth (losses by overflow) and the fact that 30.5 per cent has to be mixed to the cooling water to reach a freezing point of —15° C.

Anti-corrosive compounds

Radiator and engine interior being inaccessible, corrosion of the metal components can only be prevented by the addition of anti-corrosives to the cooling water.

In winter, when anti-freeze solutions are used, add anti-corrosives to the mixture.

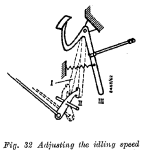


Fig. 32 Adjusting the idling speed

I. Stop II. Idling speed III. Full load

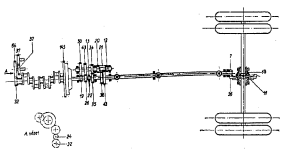


Fig. 33 Number of teeth of gear wheels

"A" view

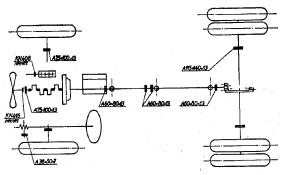


Fig. 34 Oil seal rings of the vehicle

The most frequently used anti-corrosives are :

1. *Mixture of sodium chromate and potassium silicate (water glass)*
This is the most effective anti-corrosive which does not attack ferrous metals or light metal alloys. Copper and tin are attacked only slightly. Add 10 grammes to one litre water (½ oz to 2½ pints).

2. *Borax (sodium borate)*
Does not attack ferrous metals and copper, slightly attacks light metals and tin. Add 10 grammes to one litre water (½ oz to 2½ pints).

3. *Drilling oil*
Does not attack ferrous metals, slightly attacks copper and tin. Add 20 cc to one litre water (1 cu. in. to 1½ pints).

In winter when mixed with anti-freeze solutions

Mix water glass with ethylene-glycol A, only.
Borax and drilling oil can be used either with methanol or with ethylene-glycol.

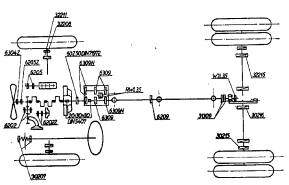


Fig. 35 Ball and roller bearings of the vehicle

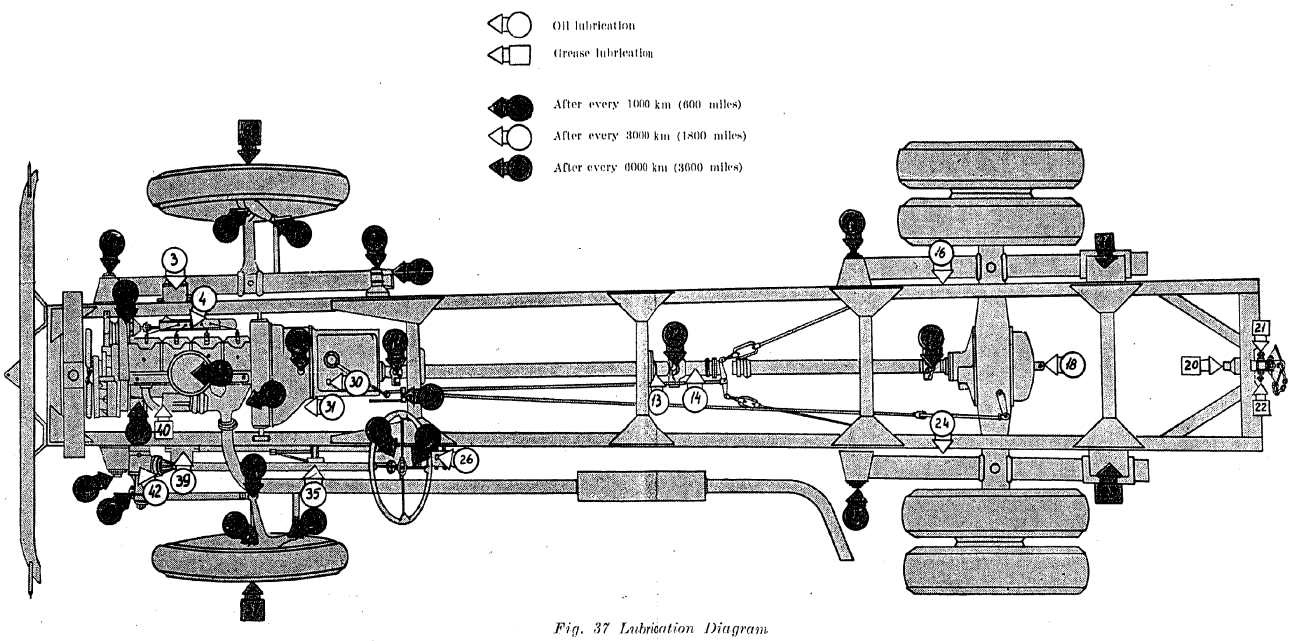


Fig. 37 Lubrication Diagram

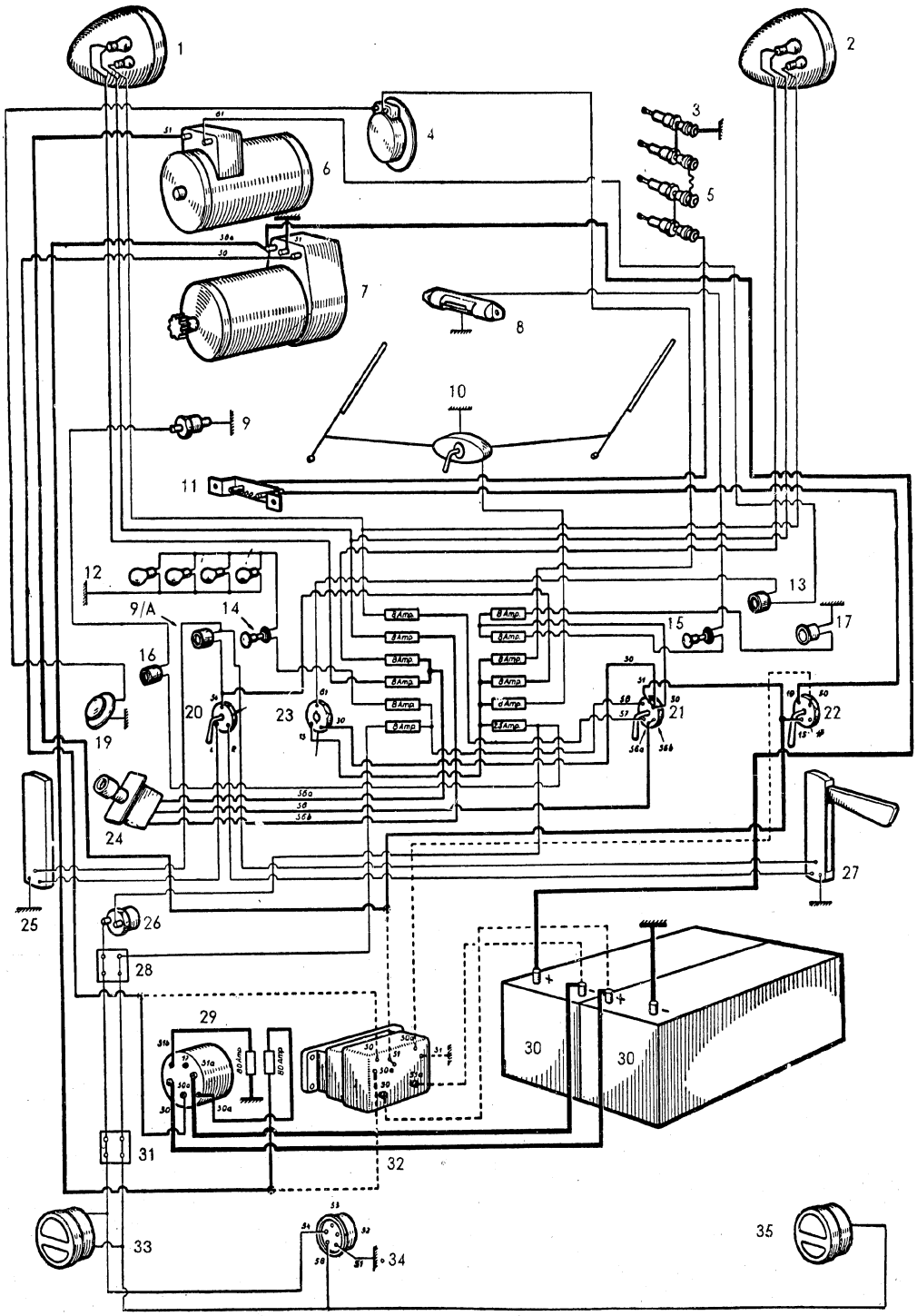


Fig. 36 Electrical Wiring Diagram

1. L. H. head lamp
2. R. H. head lamp
3. Heater plugs
4. Horn
5. Heating resistance
6. Dynamo
7. Starter motor
8. Interior lighting
9. Oil pressure gauge switch
9/A Trafficator control lamp
10. Windscreen wiper
11. Heater pilot plug
12. Panel lighting
13. Battery charge control lamp
14. Panel lighting switch
15. Interior lighting switch
16. Oil pressure gauge
17. Socket for hand-lamp plug
19. Horn push-button
20. Trafficator switch
21. Main lighting switch
22. Heater plug switch
23. Ignition switch
24. Dipper switch
25. Trafficator, left
26. Tail lamp switch
27. Trafficator, right
28. Junction box I
29. Battery changeover switch
30. Batteries
31. Junction box II
32. Battery changeover (Alternative)
33. Stop and tail lamp
34. 5-way socket
35. Tail lamp