SECTION 14 - CHARGING SYSTEM

GENERATOR

1. The generator (Fig 21(11)) is located in a cradle pivoted to a mounting bracket attached to the induction side of the engine crankcase, and is belt driven from the crankshaft by twin belts. The belts are tensioned by means of an adjuster attached to the generator cradle.

2. The generator has a maximum controlled output of 25A at 28v and incorporates inter-poles. It is driven through an integral two-speed gearbox which automatically changes the speed of the generator armature at 2,000 rev/min (generator pulley speed). With the driving pulley running at speeds below 2,000 rev/min, the armature runs at approximately four times the pulley speed and at speeds above 2,000 rev/min at approximately $1\frac{1}{2}$ times the pulley speed. The purpose of the two-speed gearbox is to increase the speed of the generator armature when the engine is running slowly in order to maintain a high charging rate at low engine speeds.

3. The two-speed gearbox houses two epicyclic trains and a clutch which is operated by a centrifugal device. At low engine speeds the clutch is engaged by springs, and the path of the drive is such that the armature is driven at high speed. As the generator pulley speed approaches 2,000 rev/min approximately, the centrifugal device opens the clutch, the path of drive through the gearbox changes, and the armature speed drops to approximately $1\frac{1}{2}$ times pulley speed.

4. The generator gearbox is connected by flexible pipes to the engine lubricating system. Oil from the main gallery enters the gearbox through an inlet pipe on top of the generator and after circulating around the gears, returns through an outlet pipe to the oil tank. Seals prevent oil reaching the electrical components of the generator. A filler plug is provided adjacent to the oil inlet block.

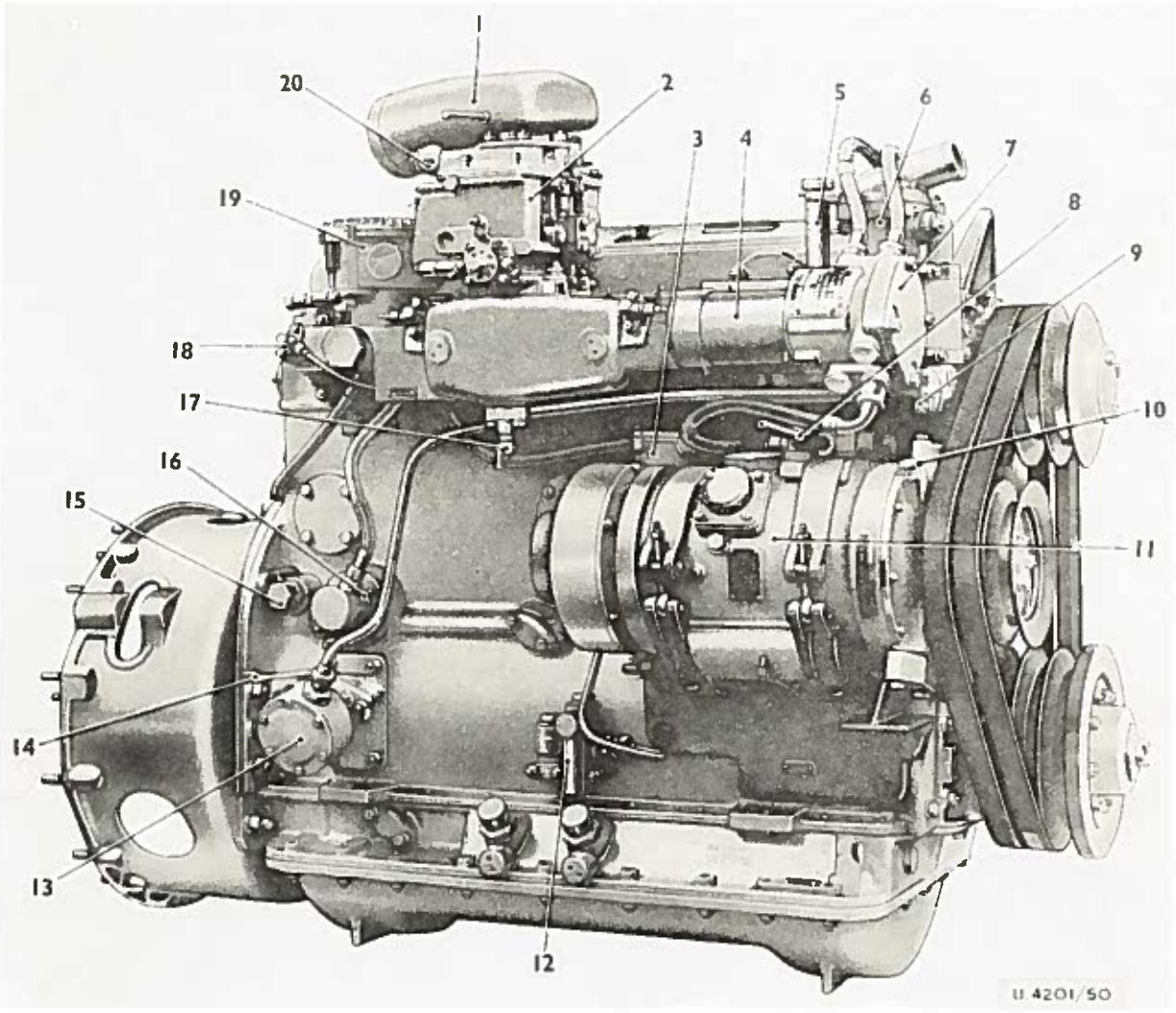
5. The generator is ventilated by a fan on the armature shaft which draws in air through a gauze in the commutator end cover. The air leaves the generator through a gauze in the top of the main casing.

6. The engine compartment is waterproofed during flotation operations; sealing of the generator air-inlet and outlet gauzes by the fording caps, para 8, is unnecessary.

GENERATOR PANEL

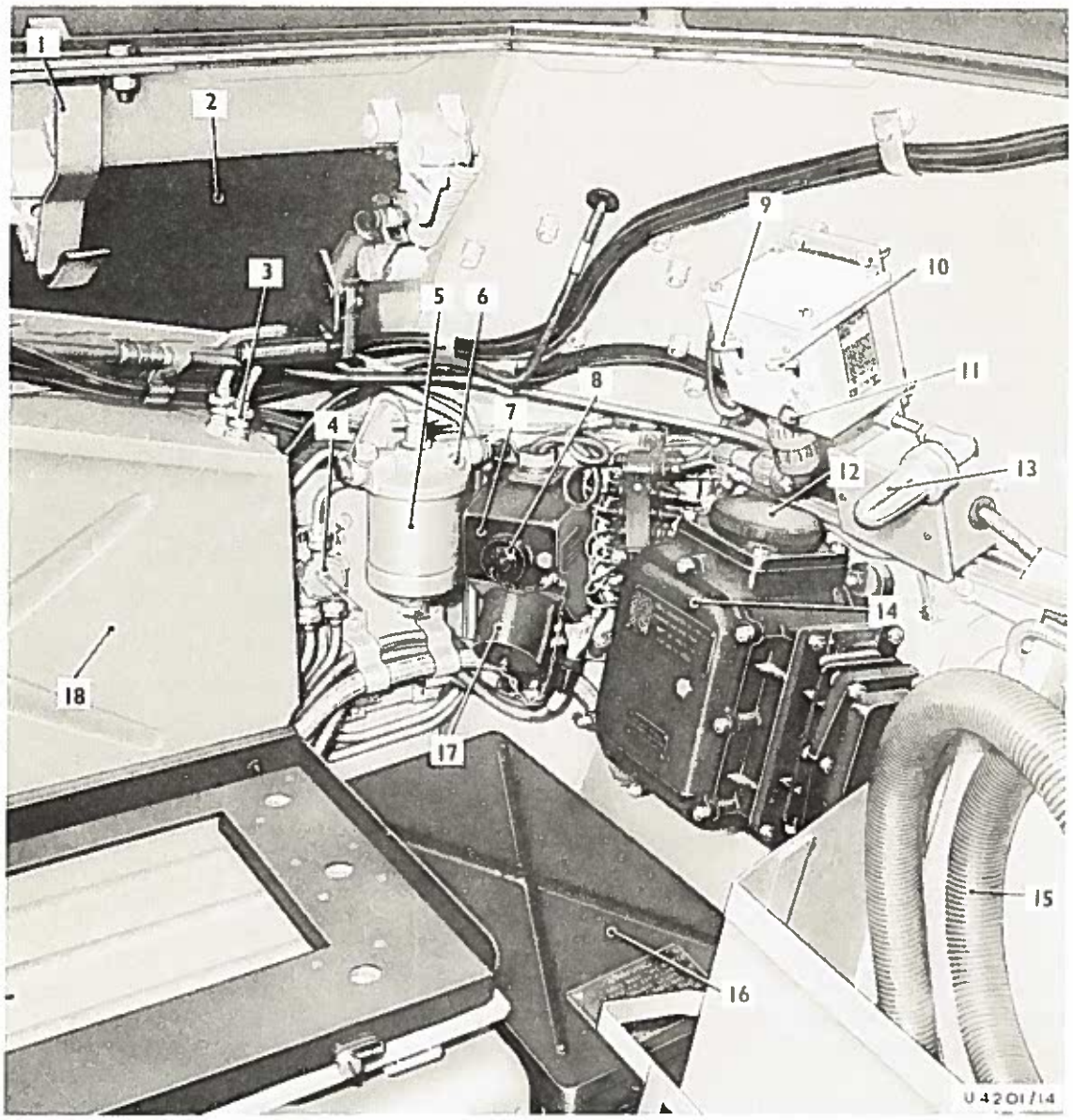
7. The generator panel (Fig 38(14)), which controls the output of the generator, is situated on the rear left wall of the fighting compartment. It is a tropicalized and waterproofed unit, and electrical connections are made via breeze type plugs and sockets. Either one of the two marks of panel may be fitted, ie, Panel Generator No.2, Mk 1 (Fig 40), or Panel Generator No.2, Mk 2/1 (Fig 41). The generator panels are interchangeable as complete Units.

2. The cylinder block, head, and induction manifold, are jacketed for the circulation of coolant. An additional tubular gallery is fitted in the right side of the cylinder block. The gallery is drilled so that a positive supply of coolant is directed around the exhaust valve ports. Short sleeves are



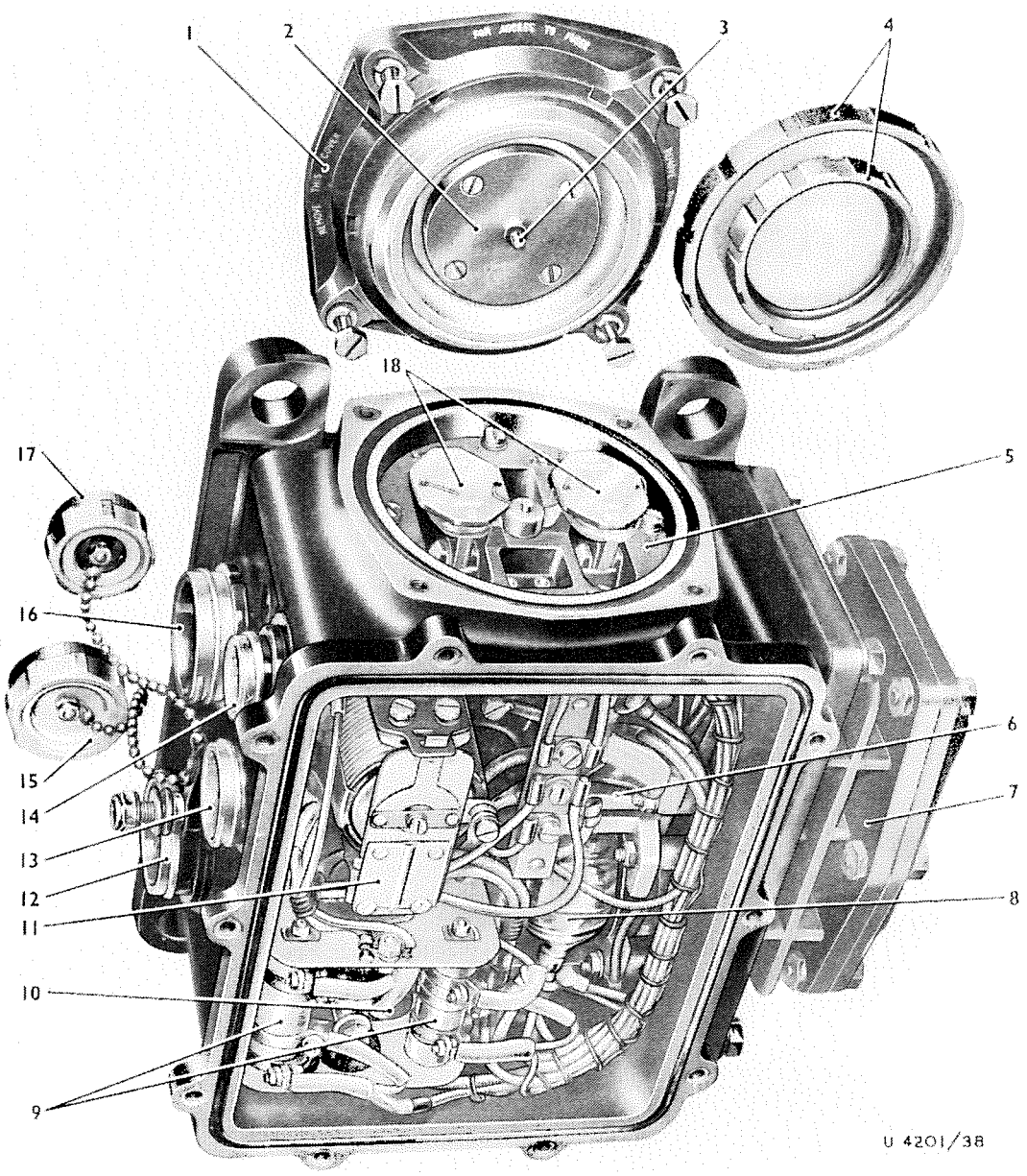
1 Air horn
2 Carburetter
3 Ignition filter unit
4 Ignition coil
5 Modification record sheet container
6 Thermostat
7 Terminal cover plate
8 Driving belts adjuster
9 Manifold jacket coolant pipe connection
10 Generator gearbox filler plug
11 Generator
12 Oil pressure relief valve
13 Fuel pump
14 Priming lever
15 Engine block coolant drain pipe adaptor
16 Oil pressure switch
17 Manifold jacket drain tap
18 Priming atomizer
19 Ignition junction box
20 Fuel feed pipe filter

Fig 21 Engine, left side



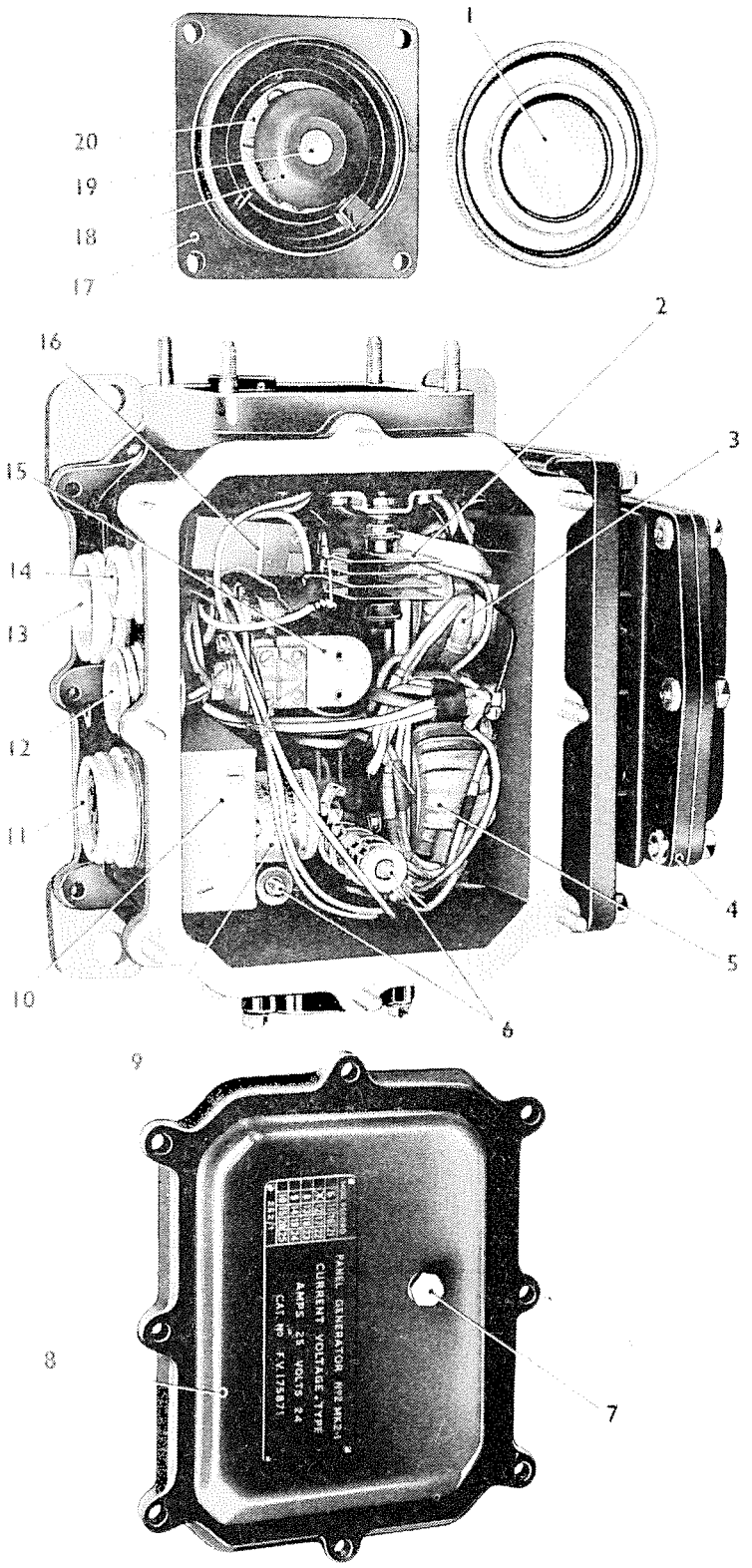
1 Stowage clip, machine gun
2 Rear vision visor
3 Fuel tank breather pipes
4 Fuel cock
5 Fuel filter
6 Air release plug
7 Distribution box
8 Inspection lamp socket
9 Turret isolating switch
10 Bilge pump switch
11 Bilge pump warning light
12 Fording caps
13 Fixed fire extinguisher discharge nozzle
14 Generator panel
15 Bilge pump discharge pipe
16 Battery box
17 Inter vehicle starting socket
18 Fuel tank

Fig 38 Fighting compartment, left rear (Mk 3, 4 and 5 vehicles)



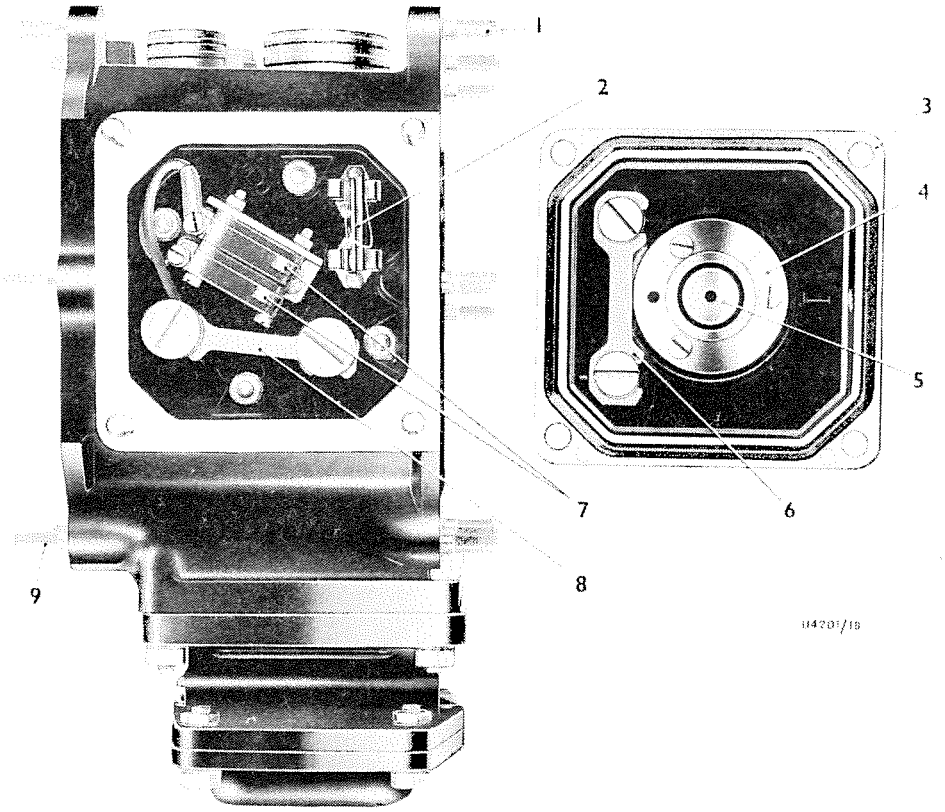
1	Fuse cover	10	Capacitor
2	Switch diaphragm	11	Cut-out
3	Operating plunger	12	Generator socket
4	Fording caps	13	Radio battery plug
5	Fuse compartment	14	Battery thermal switch plug
6	Current unit	15	Waterproof cap
7	Regulator assembly	16	Vehicle battery and ignition plug
8	Voltage unit	17	Waterproof cap
9	Resistors	18	Fuse holders

Fig 40 Generator panel No.2, Mk I



1 Fording caps
2 Rectifier
3 Current unit
4 Regulator assembly
5 Voltage unit
6 Resistors
7 Pressure test plug
8 Front cover
9 Capacitor
10 Screening box
11 Generator connection socket
12 Radio battery connection plug
13 Battery and ignition connection plug
14 Battery thermal switch connection socket
15 Cut-out
16 Relay
17 Fuse cover
18 Rubber moulding
19 Guide
20 Clamp plate

Fig 41 Generator panel No.2, Mk 2/1



1	Backplate stud	5	Plunger
2	Warning lamp fuse	6	Spare main fuse
3	Fuse cover	7	Micro switches
4	Retainer	8	Main fuse
		9	Front cover stud

Fig 42 Generator panel No.2, Mk 2/1 fuse and switch compartment

8. Housed in the panel are carbon pile regulators with trimmer resistances, a cut-out, relay and rectifier (ancillaries to the cut-out), two switches, two fuses, radio interference suppression capacitors, and fording caps for waterproofing the generator.

9. The fuses and switches are located on the same base which is attached to one end of the panel. A protecting cover encloses the assembly. The cover is engraved "FUSES UNDER HERE".

10. The fuses for the Mk 1 panel are 25 amp (No.23 SWG tinned copper) and 5 amp (No.35 SWG tinned copper). The 25 amp fuse is connected in the main charging circuit and the 5 amp fuse in the warning lamp circuit. In Mk 1 panels, not incorporating Mod No.5, the fuse wire gauge is No.21 and No.30 SWG respectively. Spare fuse wire is wrapped round each holder and the fuse rating is stamped on the holders and base to ensure that correct fuses are replaced.

11. The fuses for the Mk 2/1 panel are the main fuse (Fig 42(8)) and the warning light fuse (2). The main fuse (charging) is a special strip type

(50 amp) and the warning light fuse is 5 amp (No.30 SWG tinned copper). Three main fuses (6) are carried in the fuse cover and spare fuse wire is wound around the 5 amp fuse holder.

12. The two switches fitted to the Mk 1 panel are of the strip type, and are located on the underside of the fuse base. The Mk 2/1 panel switches (7) are of the micro type, and are located on the top of the fuse base. In both panels the switches are operated by spring loaded plungers. The smaller generator fording cap locates over the projecting end of the plunger, and the larger cap screws on the fuse cover to press the small cap against the plunger. The plunger, when compressed, opens the switches. Removal of the fording caps results in the switches closing.

13. The closing of one switch causes the regulator to limit the generator output to 6A and the closing of the other switch causes the warning light to glow, thus indicating that the generator is operating at reduced output.

14. In addition to the plug and socket provided for the vehicle battery and generator connections respectively, a four-pin plug and a two-pin socket are provided for connection to a radio battery and a battery thermal switch. These two items are not fitted in this installation, and waterproof sealing caps are fitted to the plug and socket.

15. The carbon pile regulator comprises two units, mounted on a common frame fitted to the side of the panel. One unit is for voltage control and the other for current limitation. The pile housing embodies fins for heat dissipation. The carbon pile regulators embody a stack of carbon washers located in a ceramic tube. The pile is held in compression by a leaf spring assembly carrying a solid armature acted upon by an electro-magnet.

> **Note:** *The engine must not be run without the vehicle batteries connected.*

OPERATION

16. When the generator is stationary the cut-out contacts are open and the positive connection between the generator and the battery is broken. As the generator commences to rotate, its voltage is applied to the cut-out coils. When the generator voltage exceeds that of the battery, current commences to flow through a further winding on the cut-out. The resultant magnetic flux is added to that of the other coil and assists in closing the cut-out at 26.5v to 27v.

17. When there is no current passing through the windings of the electro-magnet, the springs are exerting maximum pressure on the pile. The resistance of the pile is, therefore, at the minimum. Generator output will energize the windings, causing the armature attached to the springs to be attracted towards the core.

18. As the generator commences to rotate, its voltage builds up and the control current through the voltage windings approaches its pre-determined value. As this stage is reached, the solenoid commences to relieve pressure on the pile and there is a consequent increase in the resistance of the pile and a reduction in the generator field current and terminal voltage.

19. When the generator voltage is such that when the pre-determined control current is flowing, any further increase in generator speed and consequent terminal voltage and control current results in the regulator armature moving nearer the core. The movement further increases the generator field current resistance (due to the increased resistance of the pile) and reduces the field current and terminal voltage.

20. The lowering of terminal voltage will also reduce the effect of the solenoid, increasing the pressure on the pile and reducing its resistance to that of the generator field circuit. The generator then rises to its regulated value.

21. The current pile operates in a similar manner, but in this case the control current is the generator current and the regulator limits the output to 25 amps nominal, over armature speed range of 4,000-8,000 rev/min.

OPERATION OF CONTROLS

Fording caps

22. The fording caps are housed on the fuse cover of the generator panel (Fig 41(1)), the large cap fitting over the smaller. When the fording caps are removed from the generator panel, a pair of switches operate to reduce the maximum generator output to 6A, and to cause the ignition warning light to glow. In normal operation, the warning light should extinguish when the engine speed is above idling.

Battery charging

23. If it is necessary to run the engine for battery charging or to provide for a heavy electrical demand when the vehicle is stationary, the hand throttle should be set to give an engine speed of approximately 600 rev/min (tachometer). At this speed the main indicator lamp should extinguish and the generator will give its maximum output.

Two-speed gearbox

24. The operation of the two-speed gearbox can be checked by the change in note of the generator that takes place at approximately 1,600 rev/min (tachometer) on rising and falling speeds.

SERVICING

To adjust the driving belt tension

25. See Section 8, para 11.

To change the driving belts

26. See Section 8, para 12.

Lubrication

27. The oil feed to the generator gearbox does not operate until the engine has been started, and it takes a few minutes to fill the gearbox. Consequently, when starting from ccld, the gearbox may be noisy until filled with oil. To check that oil is flowing through the gear, the plug (Fig 21(10)) should be removed; with the engine running, oil should splash from the hole.

28. Periodically examine the air outlet gauze on the top of the generator for traces of oil. If oil is present, remove the gauze and examine the internal surfaces of the air outlet block. If more than a slight film of oil is present, a leaking oil seal must be suspected and the defect should be reported.

29. When a replacement generator is fitted, or if the vehicle has been standing idle for three weeks or more, a $\frac{1}{4}$ pint of engine oil should be poured into the generator gearbox filler plug (Fig 21(10)) before the engine is started. This is essential, to prevent failure of the generator bearings through lack of lubrication.

30. The generator, and oil feed pipes and unions, should be checked for security at the specified periods. The gearbox has a normal noise level when running and changing gear. If any unusual noise occurs, gearbox trouble is indicated and the engine must be stopped and the defect reported

To remove the generator warning light fuse

31. (1) Ensure engine is stopped.

(2) Remove the fuse cover (Fig 42(3)).

(3) Withdraw the fuse holder, remove all remains of the burnt fuse, fit a new piece of fuse wire. Ensure that the correct wire is used, spare wire is carried on the fuse. Replace the fuse holder.

(4) Replace the fuse cover. Check the circuit; if the fuse blows again, Report.

Note: *Spare fuse strips are fitted to the fuse cover. No other type of fuse should be used.*

To renew the main charging fuse, Panel No.2, Mk 2/I

32. (1) Proceed as in para 31(1) and (2).

(2) Slacken the screws securing the fuse.

(3) Remove the remains of the old fuse.

(4) Ensure that the terminals are clean.

(5) Place a new fuse in position and tighten screws.

(6) Replace the fuse cover. Check the circuit, if the fuse blows again, Report.

To renew the main charging fuse, Panel No.2, Mk I

33. (1) Proceed as in para 31(1) and (2).

(2) Withdraw the main fuse holder, clean off contacts, fit new piece of fuse wire (No.23 SWG tinned copper). Replace fuse holder.

(3) Replace the fuse cover, check the circuit. If fuse blows again, Report.