The information in this booklet
must not be given to the public

British Rail Drivers Manual

Diesel Multiple Unit Trains
with mechanical transmission
excepting class 126

Driving instructions

This booklet
supersedes Issue 4.

BR 33056/2
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DRIVING INSTRUCTIONS FOR DIESEL MULTIPLE UNIT TRAINS WITH MECHANICAL TRANSMISSION, EXCEPTING CLASS 126 (WHITE CIRCLE) CARS.

1. DRIVING CONTROLS (See Figs. 1 and 2)

1.1 Control circuit key position. A control circuit key must be inserted into this position and then turned before the controls can be energised.

1.2 Reversing handle. A reversing handle must be inserted into the NEUTRAL position at the base of the gear selector. When moved to FORWARD or REVERSE, the gear selector handle can be moved away from the NEUTRAL position into the four gear-ratio positions. The AIR and AXLE and ENGINE indicators cannot be illuminated unless the reversing handle is moved away from the NEUTRAL position.

1.3 Power controller. This consists of a handle which must be depressed before the brake can be released. The handle can only be depressed when at the IDLING position. When the handle is depressed, the engine speed can be increased by moving it to the FULL POWER position. If the pressure on the handle is released when at a power position, it will rise due to spring pressure. It cannot be depressed again until the handle is moved to the IDLING position. Vacuum in the brake pipe will be destroyed 5–7 seconds after the release of the power controller handle.

1.4 Gear selector. This consists of a handle which has five positions i.e. NEUTRAL, 1, 2, 3 and 4. Gear ratios and neutral gear are directly selected by moving the handle to these positions.

1.5 Brake valve. This is marked OFF, LAP and ON. The handle of this valve can be detached when moved to the LAP position. Likewise it is refitted again with the brake valve still in this position. When the handle is at the OFF position, and the engines are running, a brake pipe vacuum of 21 in. Hg can be maintained. The vacuum is destroyed by moving the brake valve handle to the ON position. If a partial reduction in vacuum is required, the brake valve handle should be moved to the ON position until the required figure is obtained and then moved back to LAP. The vacuum can then be held at any desired figure.

2. INSTRUMENTS AND INDICATORS (See Figs. 1 and 2)

2.1 Duplex vacuum gauge. The left hand scale of this gauge indicates the Brake Pipe Vacuum and will normally read approximately 21 in. Hg. when running. The right hand scale indicated the vacuum in the release reservoir. This will normally read 28-30 in. Hg. although the reading will reduce when the brakes are applied. Additionally, on single unit power cars, a chamber side vacuum gauge is provided which must always read 21 in. Hg before moving.

2.2 Speedometer. This is scaled from 0 to 90 m.p.h., but the train speed must not exceed 70 m.p.h.

2.3 Engine tachometer. This is scaled from 0 to 1900 rpm and indicates the speed of either of the engines of the leading power car. A switch is operated in order to connect the tachometer to either the No.1 or No.2 engine. In addition to indicating the engine speeds, the tachometer face has two positions marked CHANGE UP and CHANGE DOWN and these are used to indicate when a change of gear ratio should be made.

2.4 AIR and AXLE indicator lights. These are situated to the left of the windscreen. Six indicator lights are provided and each represents a power car within the train formation. The indicator lights become illuminated provided:-

The air pressure in the main reservoir exceeds 60 psi.

Both final drive gearboxes of the appropriate power car are correctly engaged.

The reversing handle is moved to FORWARD or REVERSE.

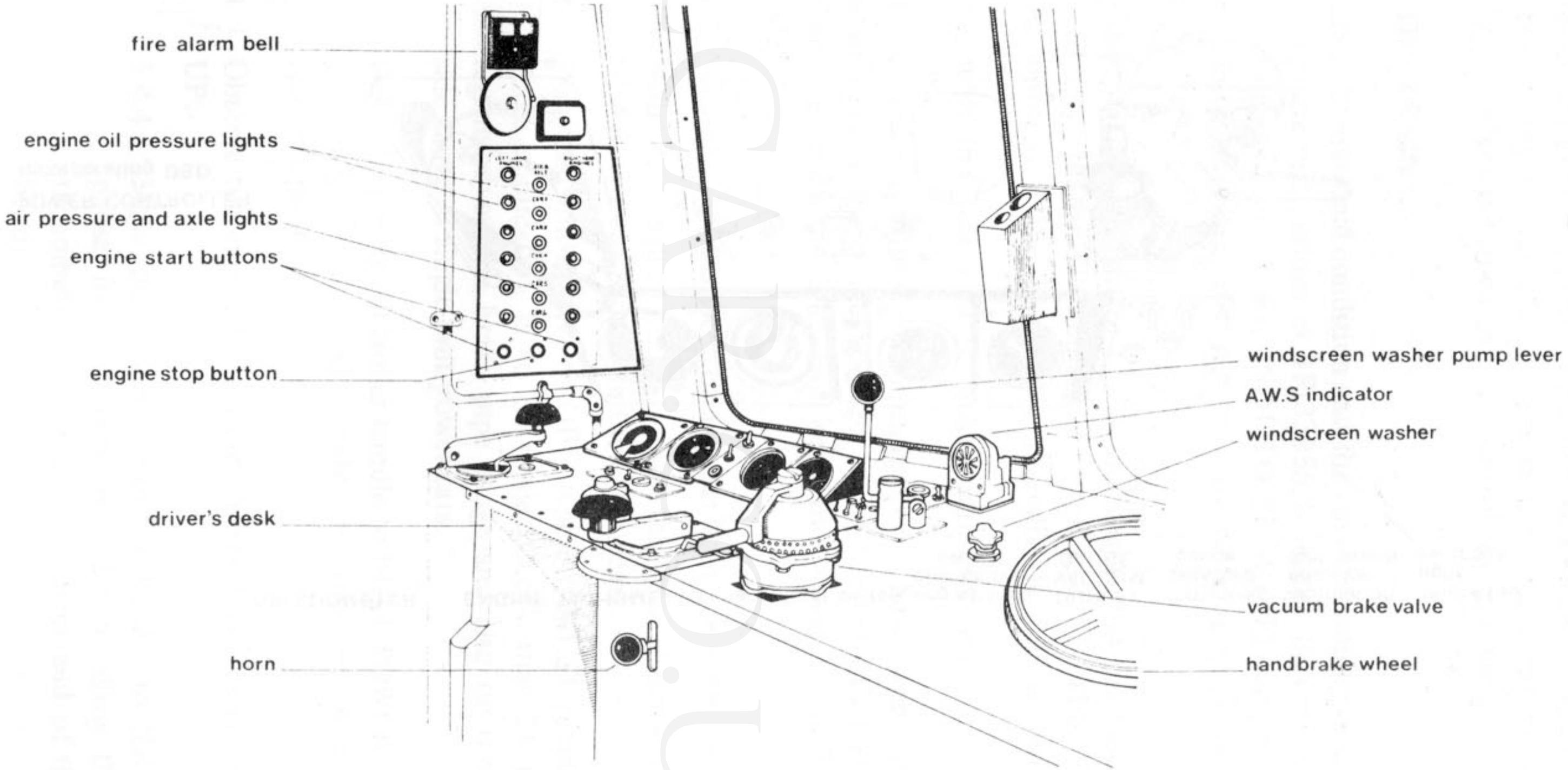
If the train has less than six power cars, the unused indicators remain extinguished.

2.5 Engine indicator lights. These indicators are provided in two columns. Those to the left of the AIR and AXLE indicators represent the left hand engines of the train and those to the right represent the right hand engines of the train. One indicator is therefore provided for each engine on the train, up to a maximum of 12. The indicators become illuminated if their associated engines are started. If the train has less than six power cars, the unused indicators remain extinguished.

driver's controls 1

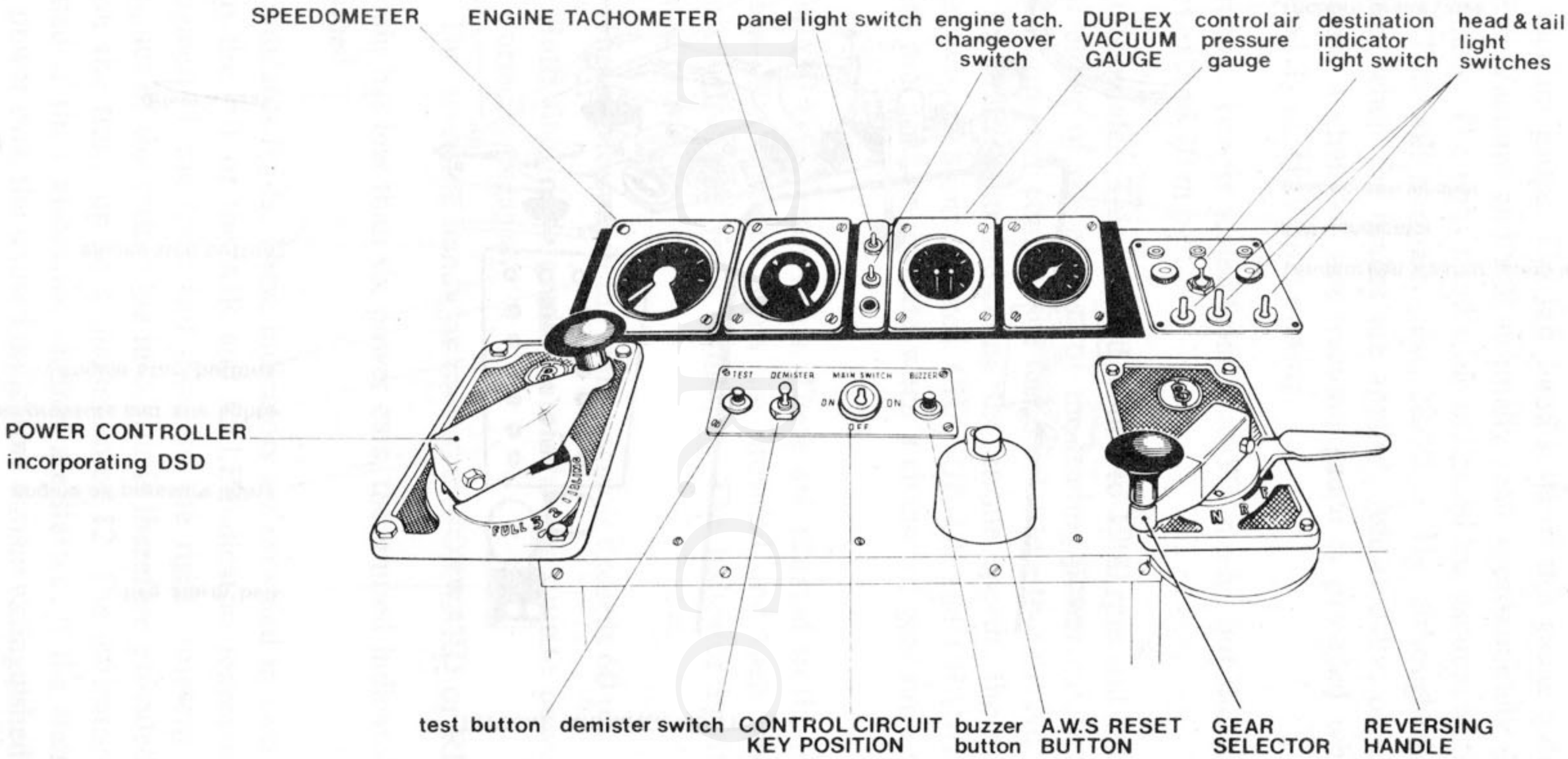
FIG.1

TYPICAL ARRANGEMENT



driver's controls 2

FIG. 2



2.6 Control circuit indicator light. This indicator becomes illuminated when a control supply is available to operate the equipment, i.e. when the control circuit key is turned and the control fuse is intact.

3. TO MOVE THE TRAIN

With the train in operational condition and the engines running in accordance with the appropriate instructions in BR.33056/9, ensure that no depot pipes or cables are connected and that no NOT TO BE MOVED targets, red flags etc. are attached. Ensure also that no staff are working on, adjacent to or underneath the train.

3.1 Move the brake valve handle to ON and check that the vacuum is reduced to zero, then move the handle back to OFF. This instruction may be omitted if the movement immediately follows preparation.

3.2 Arrange with the Guard for a brake continuity test, when required.

3.3 When the brake continuity test requirements have been carried out, and with the parking brake released, await the Guard's buzzer code, applying the brake in LAP and keep the power controller handle depressed.

3.4 When the Guard's signal is received and has been acknowledged.

3.4.1 With the engines idling, move the gear selector to FIRST GEAR without pausing in the other gears.

3.4.2 Move the brake valve to OFF, where it MUST remain until a brake application is to be made. Check that 21 in. Hg. is registered on the brake pipe gauge and also on the chamber side gauge of single unit power cars.

3.4.3 Move the power controller handle to FULL POWER smoothly, according to the rail conditions and ensure that speed restrictions are not exceeded.

3.4.4 Observe the engine tachometer. When this indicates CHANGE UP:-

3.4.4.1 Move the power controller handle to IDLING and pause for 4 seconds in order to allow the engine tachometer to indicate the lower end of the yellow band.

3.4.4.2 Select second gear.

3.4.4.3 Pause for two seconds, then move the power controller handle back to FULL POWER smoothly and according to speed restrictions.

3.4.5 When the engine tachometer again indicates CHANGE UP, repeat 3.4.4.1., select third gear and repeat 3.4.4.3. Repeat the procedure again for changing into fourth gear.

3.5 When the train is running in fourth gear the required speed should be maintained by moving the power controller handle as necessary. If the required speed of the train can be maintained without the use of the engine power, fourth gear must be selected and the power controller handle must be moved to idling. If the period of coasting is to be followed by a period of running under power, this must be resumed with the correct gear ratio selected. If the section requiring power to be used is approached at 41 mph or above, the gear selector should remain in fourth gear and the power controller handle should be moved to a power position as necessary.

3.6 When power is required after coasting and the speed is less than 41 mph the correct gear must be selected and after a pause of 2 seconds, the power controller handle must be moved smoothly towards the FULL POWER position. The correct gears in which to resume powered running after coasting are determined by the road speed at the time of power requirement. These are given in the following table:-

Speed Range in M.P.H.	Gear Ratio
0–15	1st
15–27	2nd
27–41	3rd
41–70	4th

3.7 When the train reaches a sharply rising gradient the full power will probably be required unless the ascent only covers a short distance and the speed of approach is high. If the gradient continues to rise sharply, the speed of the train will be reduced. The reduction in road speed will cause proportionate reduction in engine speed as will be seen by the

engine tachometer. If the speed falls to 41 mph a CHANGE DOWN indication will be given. When this occurs proceed as follows:-

3.7.1 Return the power controller handle to the IDLING position.

3.7.2 Without pausing, select the next lower gear.

3.7.3 Pause for 2 seconds and then move the power controller handle smoothly back to the FULL POWER position.

3.8 The selection of the lower gear may enable the train to be worked without further gear changing on the particular gradient, i.e. with the engine tachometer between the CHANGE UP and CHANGE DOWN positions.

3.9 If the gradient is of sufficient severity, the engine tachometer will again indicate CHANGE DOWN when the speed falls to 27 mph with full power being applied. When these circumstances occur, the procedure is 3.7.1 to 3.7.3 above must be repeated. The procedure must be repeated again if the engine tachometer gives a further CHANGE DOWN indication. This will occur if the speed falls to 15 mph with full power being applied.

3.10 When severe gradients are being ascended occasions can arise during which the road speed may remain constant with the engine tachometer indicating, or almost indicating CHANGE DOWN. On these occasions the next lower gear should be selected and there should be no attempt to remain in a higher gear for the longest possible period.

4. BRAKE APPLICATION

4.1 The brakes of DMU trains are of a "quick release" type, in which a high vacuum reservoir on each vehicle assists the exhausters to release the brakes. For a complete description of the brakes, see page 10.

4.2 To stop the train:

4.2.1 Return the power controller handle to IDLING and keep it depressed.

4.2.2 Move the brake valve handle smartly to ON without pausing in the LAP position and reduce the vacuum to 15 in. Hg or below. When the desired vacuum has been obtained, return the brake valve handle to LAP. A further reduction may be

required in some circumstances in which case the handle should be moved to ON and then back to LAP again when the desired vacuum has been obtained. If the train is running at or near to its maximum speed a reduction to 8 in. Hg or less may be necessary to give adequate braking.

When the train is running at slow speed, lighter applications should be made although the same basic technique should be used. When making a normal stop and the speed is reduced to below 25 mph, the vacuum should be increased slightly by moving the brake valve handle to OFF and then returning it to LAP.

4.2.3 When the speed of the train has dropped to between 10 and 15 mph move the gear selector handle to NEUTRAL.

4.2.4 When the train is about to come to a stand the brake valve handle should be moved to OFF. The brake should then be reapplied, as necessary, to secure the train and the brake valve handle should be moved to LAP.

4.2.5 THE BRAKE VALVE HANDLE MUST NOT BE ALLOWED TO REMAIN AT LAP, OTHER THAN WHEN BRAKING AND IT MUST NOT BE MOVED TO LAP IN READINESS FOR A BRAKE APPLICATION.

4.2.6 THE BRAKE VALVE HANDLE MUST NOT BE MOVED ALTERNATELY BETWEEN 'ON' AND 'OFF' WHEN MAKING A BRAKE APPLICATION.

4.2.7 If the train speed has been reduced by braking due to a signal check, permanent way slack etc., and power is again required, the correct gear must be selected before re-applying power as shown in 3.6.

5. REVERSING

5.1 When it is necessary to reverse a train without changing ends, proceed as follows:-

5.1.1 With the engines idling and the brake applied in LAP, move the reversing handle to the REVERSE position.

5.1.2 Check that the final drive indicator lights become momentarily extinguished and then re-illuminate.

5.1.3 When receiving the signal to move.

5.1.3.1 With the engines idling and the power controller handle depressed, move the gear selector to FIRST GEAR without pausing in any other gears.

5.1.3.2 Move the brake valve handle to OFF and check that 21 in. Hg is registered on the brake pipe gauge.

5.1.3.3 Move the power controller handle to a position sufficient to move the train at the required speed.

5.1.4 When receiving the STOP signal, move the power controller handle to IDLING, apply the brake and select NEUTRAL gear.
DO NOT MOVE THE REVERSING HANDLE WHEN THE TRAIN IS IN MOTION.

6. STOPPING THE ENGINES

6.1 With the power controller handle at IDLING, the driver's safety device applying the brakes and the control circuit key at ON.

6.1.1 Press the engine stop button until all engine lights are extinguished.

6.1.2 Apply the parking brake and turn the control circuit key to OFF.

7. TOGGLING THE GEARBOX BRAKE BANDS

At a convenient time during the turn of duty, or as soon as possible if slipping gearbox bands are suspected, proceed as follows:-

7.1 With the train stopped, fully apply the brakes.

7.2 Obtain full air pressure.

7.3 Stop the engines.

7.4 Depress the power controller handle.

7.5 With the reversing handle at FORWARD, select 1st, 2nd and 3rd gears, in turn, six times, pausing five seconds in each gear. Return the gear selector to NEUTRAL.

7.6 Restart the engines when necessary and proceed normally.

8. RUNNING OF DIESEL ENGINES AND HEATERS IN STATIONS, SIDINGS ETC.

8.1 With the exception of situations where side starting would be impossible due to platforms, or dangerous due to conductor rails, or movement of vehicles on adjacent roads, engines must be stopped if the standing time is to exceed 5 minutes.

NOTE: The exceptions do not include situations where some engines are accessible on one side of the train only, because it will then be possible to start the remaining engines from the driving compartment.

8.2 Heaters may be left running for 30 minutes after the engines have been stopped.

DESCRIPTION OF THE GRESHAM AND CRAVEN QUICK RELEASE VACUUM BRAKE SYSTEM

Fig. 3 shows the basic features of the Quick Release Vacuum Brake System. The vacuum release reservoirs (E) provided on each vehicle are normally maintained at a high vacuum of approximately 29 in. Hg. These reservoirs are connected to the exhauster (A) through an automatic isolating valve (D) which remains open until the vacuum in the release reservoir falls to 19 in. Hg. A feed valve (F), is fitted between the release reservoir, the brake valve (G) and the brake pipe. The feed valve ensures that the vacuum in the brake pipe does not exceed 21 in. Hg. By this arrangement, when it is necessary to release the brakes not only will the exhauster (A) draw air out of the system, but there is a reservoir of high vacuum available which accelerates the withdrawal of air from the brake pipe and compensates for the fact that the belt-driven exhauster may be running at low speeds for considerable periods.

Fig. 4 shows the details of the Automatic Isolating Valve and the Feed Valve respectively.

With the quick release brake it is necessary to have, in addition to the normal

vacuum brake pipe, a high-vacuum pipe connecting all the vacuum release reservoirs and this pipe will be maintained at 29 in. Hg in the RUNNING position. Fig. 3 shows the complete arrangement of the brake system of a two-car diesel train composed of one power car and one driving trailer. It will be seen that there are two exhausters on the power car, but none on the driving trailer car.

It will be noted that item (M) in Fig. 3 is the D.S.D. Valve. This unit consists of four main items – a solenoid-operated control valve, a manifold fitted with an isolating valve, a timing chamber and an emergency valve.

Fig. 5 shows a diagram of a vacuum brake cylinder. This is a rolling ring E1 type which is now standard on British Railways. These cylinders are of the combined type and consist of an outer steel shell which forms the top-side space and an inner cast-iron cylinder. The piston fits easily into the cylinder and has a deep head with a relieving groove to take the rolling ring in the "brake off" position. The groove keeps the rolling ring in alignment and prevents permanent distortion of the ring when the cylinder stands for a long time with the piston in the OFF position.

The piston carries a ball valve fitted in a cage with a direct communication between the underside of the ball and the top-side space, and with a passage from above the ball to the outside of the piston, and thus to the underside of the rolling ring in the OFF position.

The piston rod passes out of the cylinder through a gland box, which forms an air tight joint on the rod when the cylinder is under vacuum. The bottom end of the piston rod has a slotted hole for the pin which connects to the brake levers. The brake gear is arranged to come against a stop release, so that the piston can fall the extra distance permitted by the slot. When making a brake application. the first ½" or so of piston movement can thereby take place freely, which helps the piston ring to move out of its groove evenly. The maximum stroke of the piston is 8½" and in normal working the stroke is adjusted so that it is limited to 4½"-5".

When vacuum is created in the brake pipe, air passes freely from the bottom side of the piston, which will then fall by its own weight when an equal vacuum exists on both sides of it. With the piston in the "brake off" position, air can be withdrawn from the top side through the ball valve, until a working vacuum is attained on both sides.

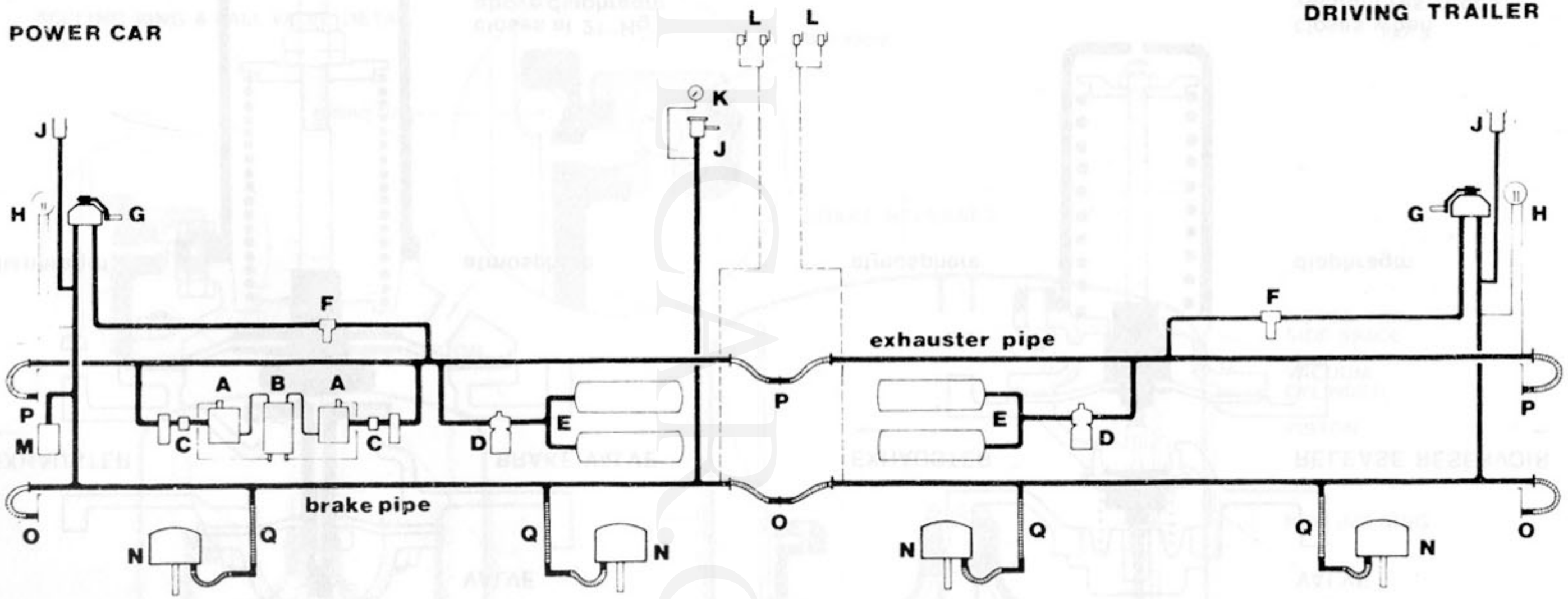
When the brake is applied, air enters the bottom side of the cylinder from the brake pipe and presses down on the ball valve, thereby preserving the vacuum on the top side. The piston therefore rises due to the difference in vacuum and the brakes are applied. The ring rolls between the piston and the cylinder wall, preserving an air-tight seal and also cutting off communication between the top side of the piston and the bottom side space. This prevents loss of top-side vacuum due to leakage past a worn or damaged ball valve seat.

D.M.U VACUUM BRAKE

FIG. 3

QUICK RELEASE SYSTEM: TWO CAR SET

POWER CAR **DRIVING TRAILER**



D.M.U. VACUUM BRAKE QUICK RELEASE SYSTEM: TWO CAR SET

KEY TO DRAWING

A. ENGINE-DRIVEN ROTARY EXHAUSTER
B. OIL SEPARATOR
C. FILTER AND NON-RETURN VALVE
D. AUTOMATIC ISOLATING VALVE
E. RELEASE RESERVOIRS
F. FEED VALVE
G. DRIVER'S BRAKE VALVE
H. DUPLEX GAUGE: BRAKE PIPE & RELEASE RESERVOIR
J. EMERGENCY BRAKE VALVE (ONE IN CAB, ONE IN GUARD'S COMPARTMENT)
K. GAUGE
L. PASSENGER COMMUNICATION VALVE (Fitted in driving compartment on some vehicles).
M. COMBINED DEADMAN'S CONTROL AND EMERGENCY VALVE
N. BRAKE CYLINDER (ONE PER BOGIE)
O. BRAKE PIPE HOSE CONNECTION
P. EXHAUSTER PIPE HOSE CONNECTION
Q. HOSE CONNECTION, VEHICLE UNDERFRAME TO BOGIE.

VACUUM BRAKE, QUICK RELEASE SYSTEM

feed valve

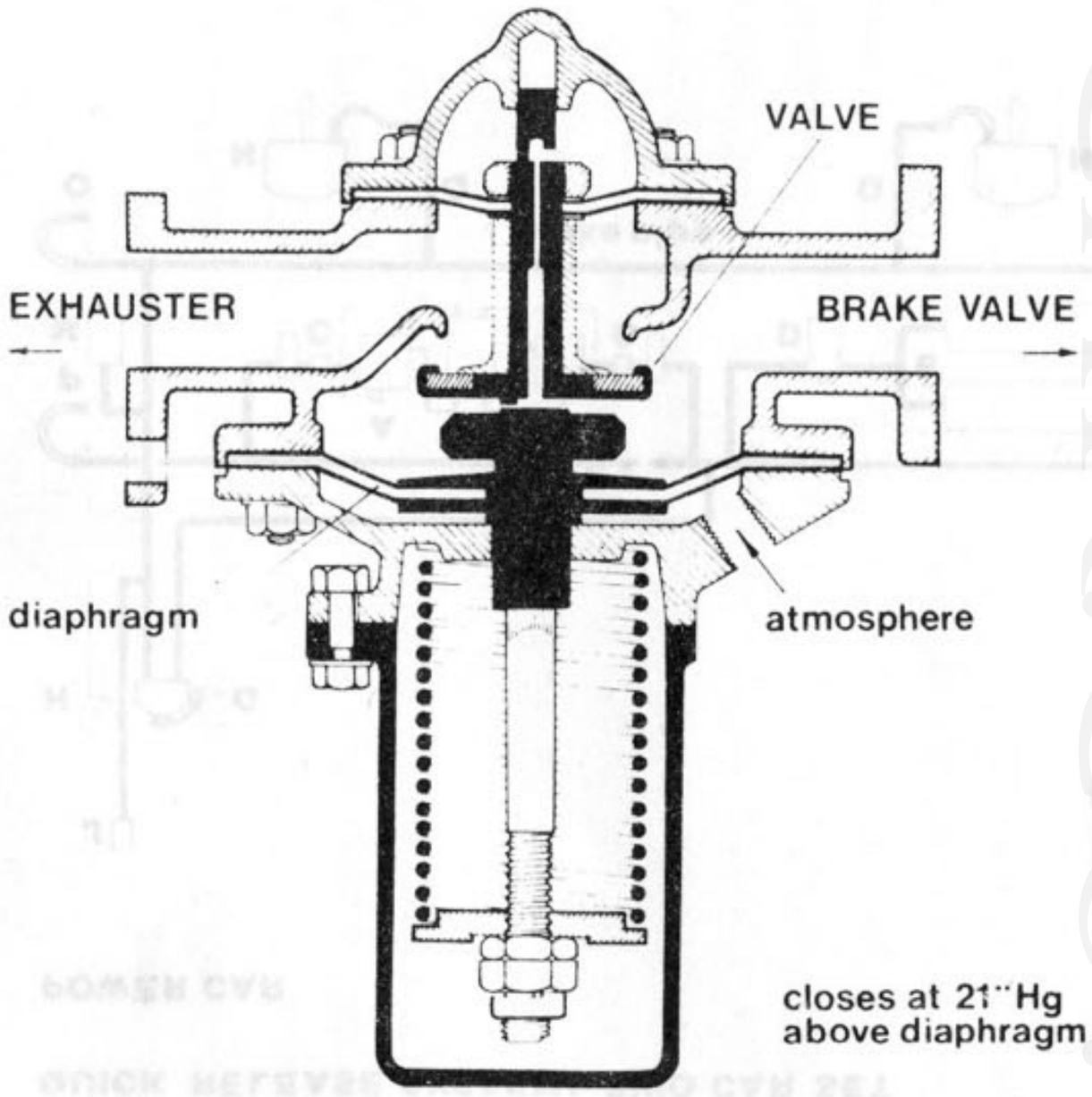
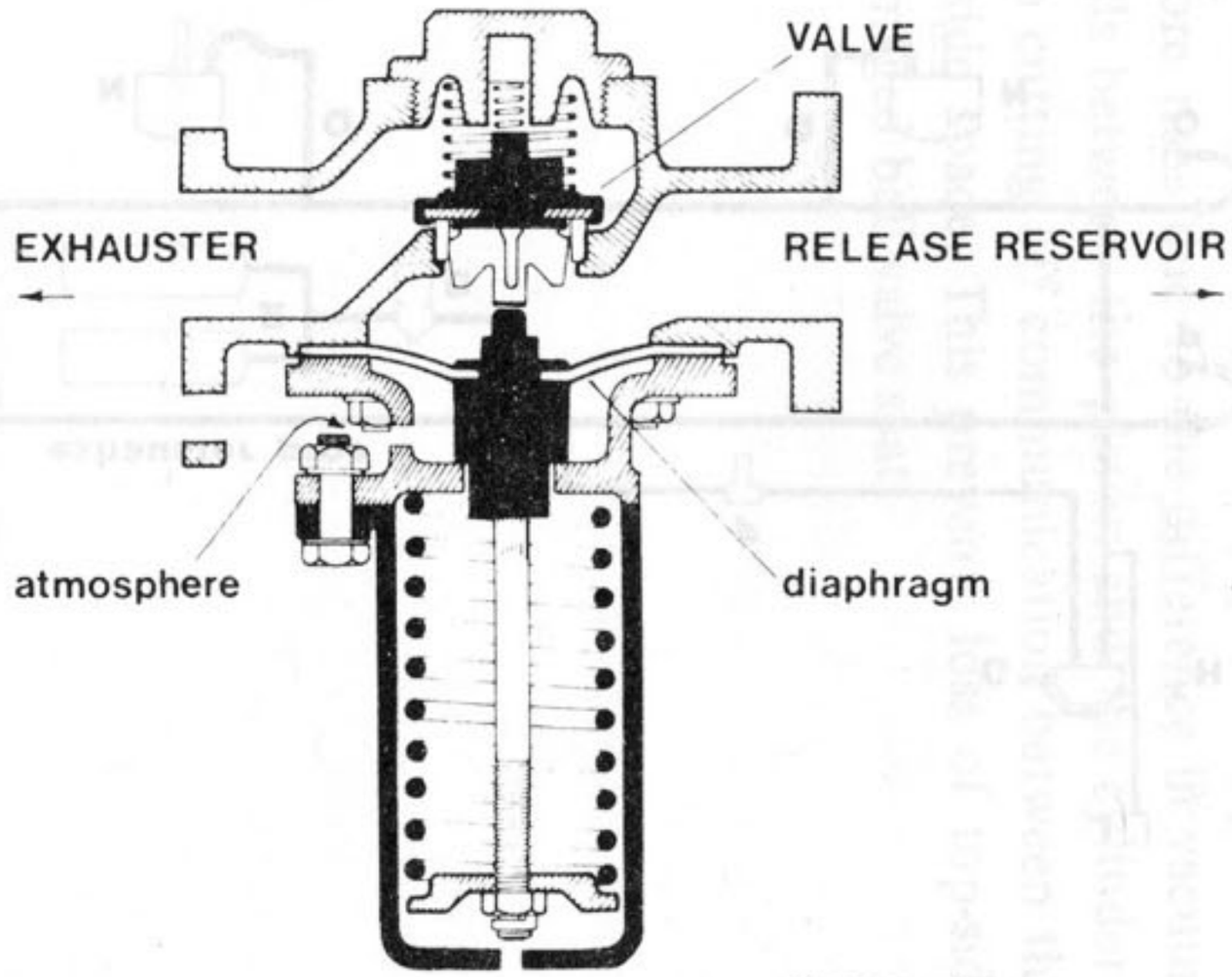


FIG.4

automatic isolating valve



vacuum brake cylinder

FIG. 5