DIESEL TRACTION

BRITISH RAILWAYS
WESTERN REGION

B.R. 33057/26

BRITISH RAILWAYS - WESTERN REGION

DUAL BRAKING EQUIPMENT
DIESEL ELECTRIC AND DIESEL HYDRAULIC LOCOMOTIVES

NOTES AND DRAWINGS FOR STUDENTS ON THE THEORY AND OPERATION OF EQUIPMENT FOR DUAL BRAKED LOCOMOTIVES.

Diesel Training School,
SWINDON.

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This book is intended for students attending courses at the Western Region Diesel Training School and is supplementary to "An Introduction to Diesel Electric Traction".

CONTENTS

BRAKE EQUIPMENT

The safe working of a passenger or any other type of train, is dependent upon the reliability and efficiency of the brake power placed at the disposal of the driver.

To bring a train to rest is considered by many to be as important a task, as setting it in motion, some even regard it as even more vital for while no accident is possible so long as the train remains stationary, once in motion serious consequencies may ensue, if the brakes fail or do not respond satisfactorily.

The function of a brake is to absorb the energy possessed by a moving train, this is usually achieved by converting the energy into heat by friction between wheels and brake blocks, when the brake is applied. The force which is applied to the brake blocks must be sufficient to bring a train to rest in a desired distance, but this force must not be too great or there will be a tendency for the wheels to skid.

The earliest forms of brakes were of the hand operated type, but these soon became obsolete as the weight and speed of trains increased and were gradually displaced by different forms of power brake, all of which in the early stages were non-automatic, so that in the event of a breakaway or parts becoming disconnected the brake was rendered practically useless. The Vacuum Brake and Air Brake being the most successful were gradually improved so that when certain conditions appertaining to public safety were laid down by an Act of Parliament in 1889, these were the only two braking systems able to fulfil the conditions. These conditions still apply to the working of passenger trains today but they are also desirable for the operation of freight trains if these are to be worked at higher speeds.

Freight trains of un-braked stock, depend upon the locomotive brake and on the hand brake of the guards van and on certain sections of the line where gradients are severe, the braking is supplemented by stopping the train and applying a proportion of the hand brakes on the wagons of the train.

For working passenger trains it is necessary that the brake on the train should be:-

(a) Continuous and capable of being applied to every vehicle on the train.

(b) Instantaneous in action and capable of being applied by Driver or Guard.

(c) Self applying in the event of the train becoming divided.

These conditions are fulfilled by the Automatic Vacuum Brake and the Automatic Air Brake systems both of which are in use today.

Before the pre-grouping of the railways in 1923, the ratio of air braked to vacuum braked rolling stock was about 2 to 3. In 1923 the decision was made to accept the vacuum brake as standard. The decision in favour of this brake was probably taken on the grounds of cost and freedom from patent and manufacturing rights and because the dominant railway companies had the vacuum brake and hardly any non-passenger carrying stock was brake fitted. The difficulties over long trains with vacuum brake did not arise and were presumably not foreseen.

There was an occasion in 1955 when there was an opportunity to change over to the air brake, but the operating difficulties concerned with the transitional period tipped the scales in favour of retaining the vacuum brake on locomotive hauled stock in spite of the technical advantage. As a result of a fresh look in the way that the railways should be run in this country, and with the advent of block train working, the decision was made in 1964 to equip locomotives and rolling stock with the Automatic Air Brake.

THE AUTOMATIC VACUUM BRAKE

This braking system makes use of atmospheric pressure which is approximately 15 p.s.i. although this may vary as the atmosphere changes.

If air is withdrawn from an enclosed chamber the pressure in that chamber would be reduced. If all the air could be removed from the chamber a perfect vacuum would exist i.e. with no atmospheric air present, the pressure in the chamber would be zero.

Vacuum is measured in inches of mercury (h.g.) and a perfect vacuum represents 30 inches of mercury and zero pressure and zero inches of mercury equals 15 p.s.i. Therefore it will be evident that every 2 inches of vacuum represents approximately 1 p.s.i. of atmospheric pressure.

On locomotives and vehicles provided with vacuum brake equipment, a pipe runs the full length of each vehicle known as the "Train Pipe". This pipe is connected to adjacent vehicles by flexible hose pipes, with air tight couplings. To seal the train pipe at each end of the train the hose is slipped over a dummy coupling, the rubber ring of which effects an air tight closure.

The locomotive and vehicles comprising the train each have one or more vacuum brake cylinders, which are connected to the train pipe. Each brake cylinder contains a piston which is connected to the brake blocks of the vehicle by suitable rigging. The piston is an easy fit in the bore of the cylinder and is kept air tight by means of a rubber ring or band, which allows the piston to move freely up and down in the cylinder.

On locomotives an exhausting device is provided for creating the regulation amount of vacuum in the train pipe and brake cylinders, which on British Railways is 21 inches h.g.

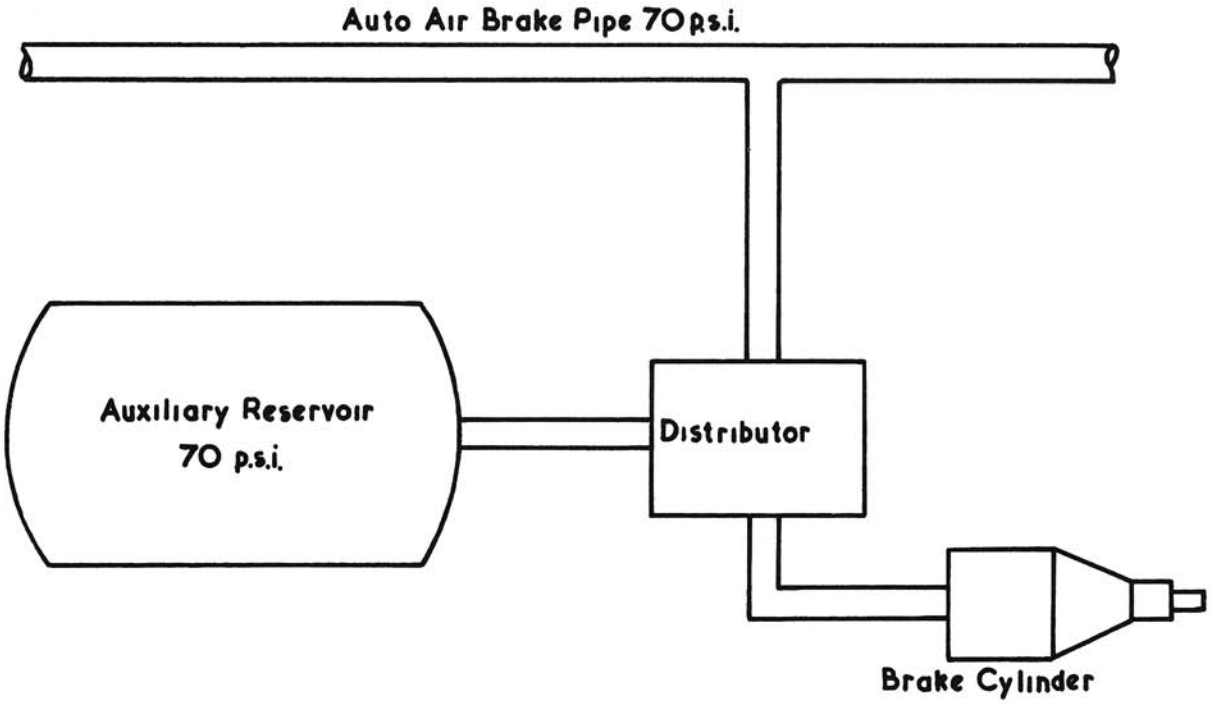
Under normal conditions i.e. brakes off, a state of vacuum is maintained in the train pipe and on both sides of the pistons in the brake cylinders, the piston resting on the lower cover of the brake cylinders.

To apply the brakes, atmospheric air is admitted to the train pipe (by a valve under the control of the driver), so that the vacuum on the lower side of the brake cylinder pistons is completely or partially destroyed, the vacuum on the upper side being retained by a sealing device. The pressure in the brake cylinder is then greater on the underside of the piston than above it, therefore the piston moves upwards operating the brake rigging and applying the brake blocks to the wheels.

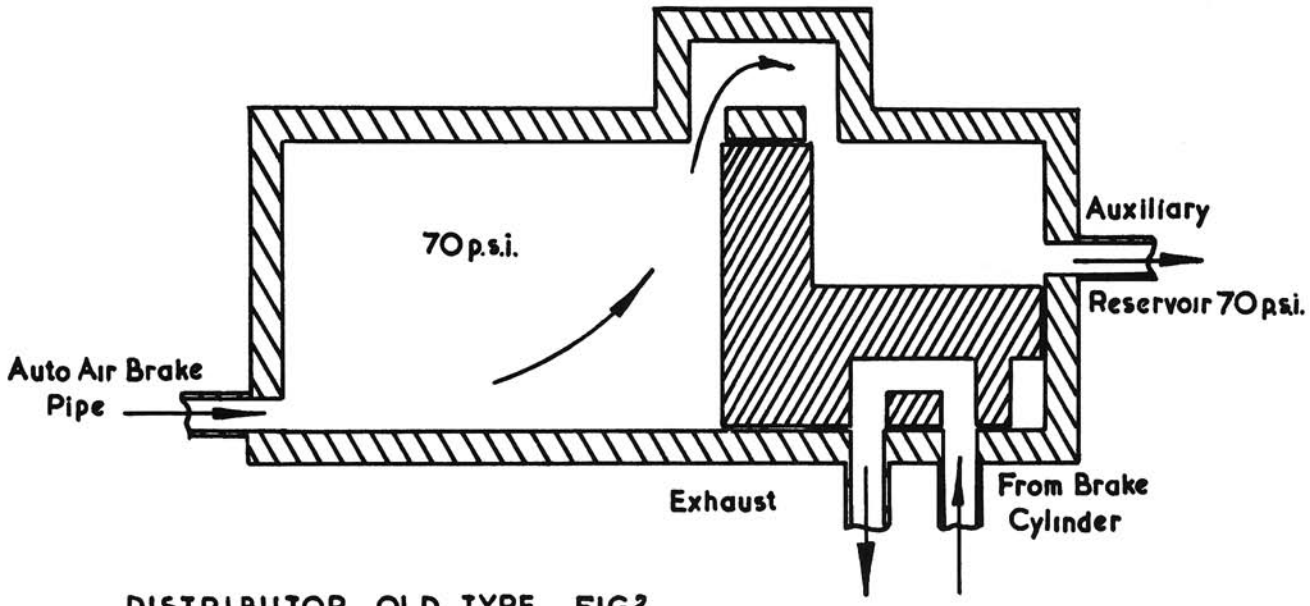
In a normal application of the brakes, the Driver can admit the desired amount of atmospheric air into the train pipe, by way of the Drivers application valve, the quantity of air admitted regulating the power of the application. Full brake power is available when vacuum in the train pipe is fully destroyed.

To release the brake, air which has been admitted to the train pipe and cylinders is exhausted and the pistons fall, under the action of gravity, to the bottom of the brake cylinders, allowing the brake blocks to come off the wheels.

A brake system of this type is inexhaustible in that repeated applications and releases will not affect the brake power. The whole system is surrounded by atmospheric air, which supplies the braking force, so that in the event of a pipe or hose breakage, air will pass into the pipes and apply the brakes automatically.



AUTOMATIC AIR BRAKE SINGLE PIPE SYSTEM FIG 1



DISTRIBUTOR OLD TYPE FIG2

THE AUTOMATIC AIR BRAKE

Single Pipe System (Fig. 1)

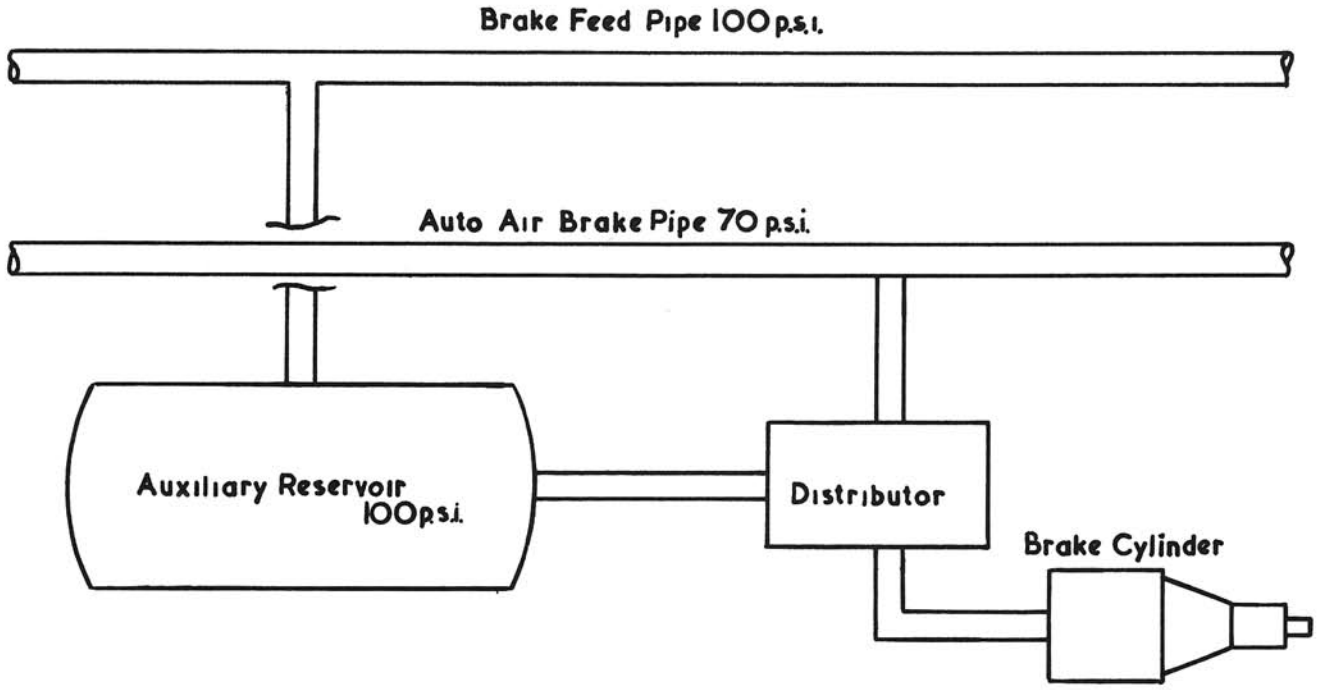
On the locomotive or power vehicle of the train fitted with Automatic Air Brake equipment is a compressor, suitably driven, which compresses air and delivers it into a main reservoir system. Each vehicle of a train fitted with air brake equipment has a brake pipe, a distributor valve, an auxiliary reservoir and brake cylinder. The brake pipe runs the full length of each vehicle and is connected to the adjacent vehicle by a flexible hose, each hose having a shut-off cock.

The brake pipe is charged with compressed air from the main reservoir via the drivers brake valve, which is adjusted to maintain a desired pressure in the brake pipe, i.e. 70 p.s.i. From the brake pipe, compressed air flows past a piston in the distributor into the auxiliary reservoir, charging these reservoirs to brake pipe pressure. (Fig. 2).

The brake is applied by reducing the pressure in the brake pipe which causes the pistons of the distributor to move, and permit some of the compressed air stored in the auxiliary reservoirs to pass to the brake cylinders, the piston of which is forced outward and, by means of suitable rigging, applies the brake blocks to the wheels.

The brake is released by restoring the pressure in the brake pipe. This causes the pistons of the distributor to move, and connect the brake pipe to the auxiliary reservoirs, cutting off the compressed air supply from the auxiliary reservoirs to the brake cylinders and also opening the brake cylinders to atmosphere. Springs in the brake cylinder will return the pistons to the release position, and withdraw the brake blocks from the wheels.

The control of the brake is usually left in the hands of the driver, although in an emergency the guard can apply the brake. Should part of the train brake away, a hose rupture or damage occur to the equipment on the train allowing air to escape from the brake pipe, the brakes will automatically be applied.



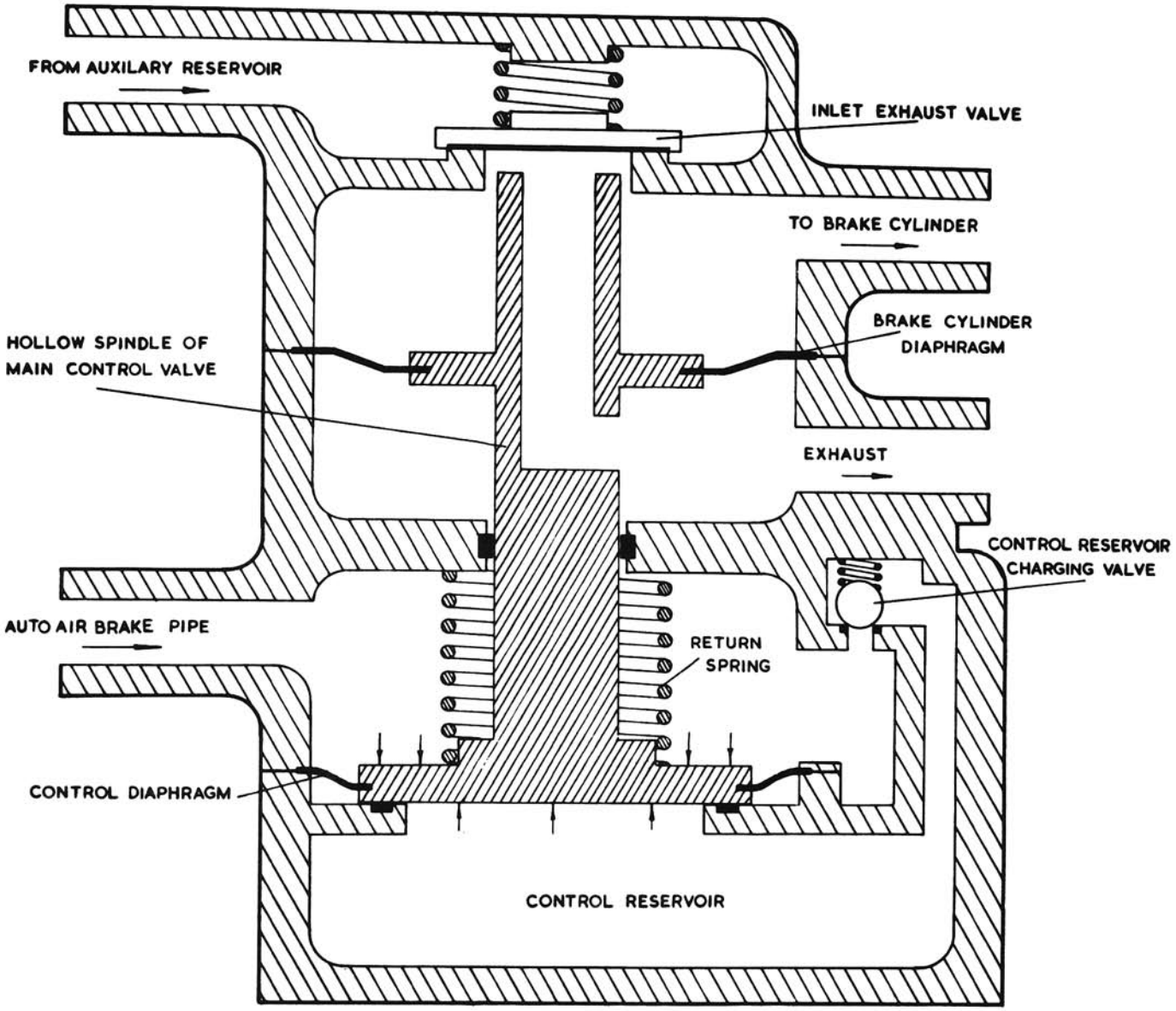
AUTOMATIC AIR BRAKED TWO PIPE SYSTEM FIG 3

Two Pipe System (Fig. 3)

When the automatic air brake pipe is charged to 70 p.s.i. the distributor (Fig. 4) is also charged at 70 p.s.i. the auxiliary reservoir is charged at 100 p.s.i. from the brake feed pipe and the brake cylinder connected to atmosphere at the distributor.

The brake is applied by reducing the pressure in the automatic air brake pipe. This pressure reduction in the distributor connects the auxiliary reservoir to the brake cylinders, giving a brake application in proportion to the drop in pressure of the automatic air brake pipe.

To release the brake the automatic air brake pipe and the distributor pressure must be restored to 70 p.s.i. The auxiliary reservoir is already charged at 100 p.s.i. from the brake feed pipe, therefore the release of the brakes on a train will be quicker than a single pipe system.

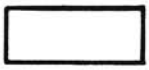


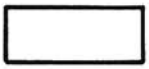
AIR BRAKE DISTRIBUTOR (RELEASE POSITION)

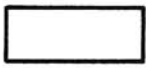
FIG. 4.

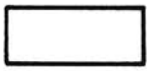
DM

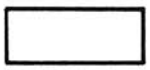
DUAL AIR BRAKE SYSTEM (METCALFE)
Brush/Sulzer - Type 4 Locomotives
Brake Schematic Colour Scheme

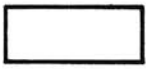
Main Reservoir Pressure 118 - 140 p.s.i. 

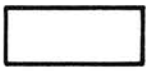
Brake Feed/Reservoir Equalising Pipe pressure 100 p.s.i. 

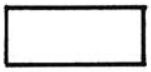
Auto Air Brake Pipe Pressure 70 p.s.i. 

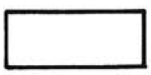
Auto Air Brake Pipe Pressure below 70 p.s.i. 

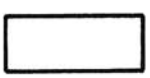
Control Air Pressure 70 p.s.i. 

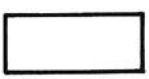
Vacuum Train Pipe 21" 

Vacuum Train Pipe below 21" 

Vacuum Chamber 21" 

Triple Valve to Relay Valve - pressure 0 - 50 p.s.i. 

Direct Air Brake Valve to Relay Valve 0 - 75 p.s.i. 

Relay Valves to Brake Cylinders 0 - 75 p.s.i. 

DUAL BRAKE LOCOMOTIVES

The conversion of a locomotive to deal with Air Braked as well as Vacuum Braked Trains entails the fitting of additional equipment, and an increase in the air pressure on the locomotive from 100 p.s.i. to 140 p.s.i. The reservoir capacity in the locomotive is increased to approximately 30 cu.ft. and an additional compressor is installed.

The Drivers Vacuum Brake Valve is removed and replaced by a Driver Self Lapping Automatic Air Brake Valve, together with other changeover devices, which are fitted to enable the various types of trains to be controlled with one brake handle.

During the changeover period from Vacuum to Air Braking on the rolling stock, a locomotive may have to deal with 4 types of trains:-

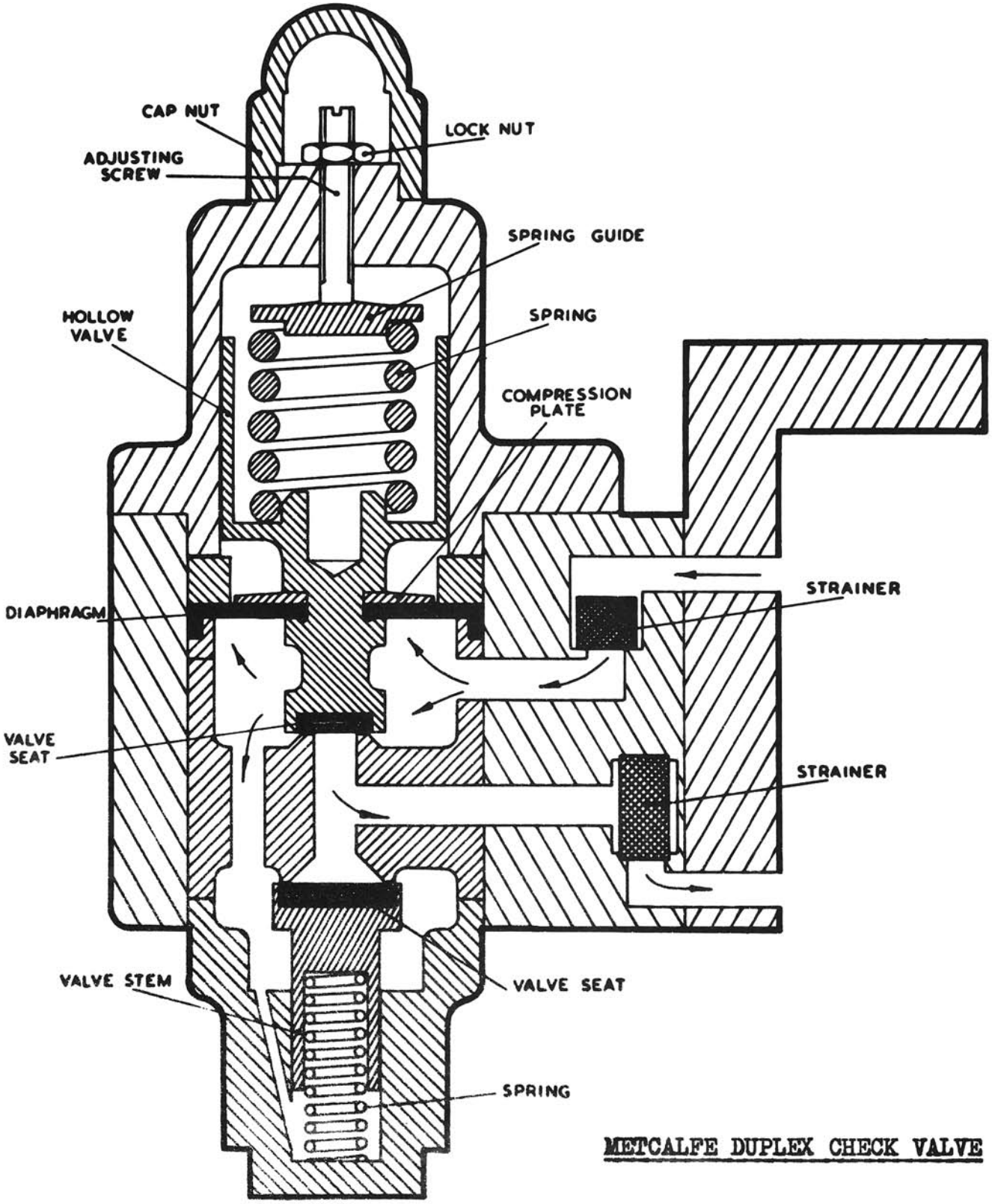
(a) Vacuum Goods (Unbraked)

(b) Vacuum Passenger (Braked)

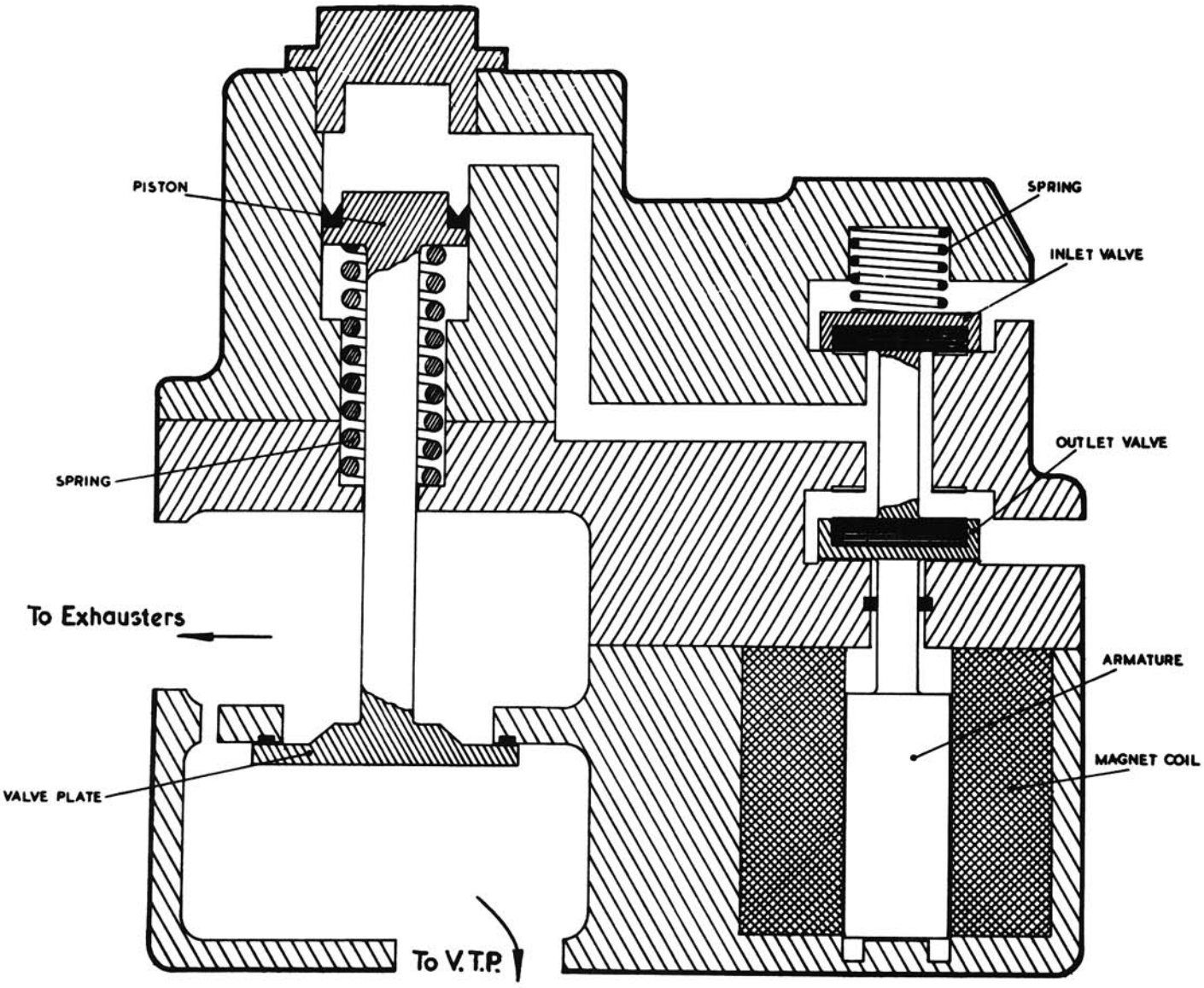
(c) Air Passenger

(d) Air Goods

When working a vacuum braked train two exhausters and one compressor will be required to operate, but when working an air braked train, two compressors will be required and no exhausters. In addition various emergency equipment will require to be operated to give the appropriate emergency brake application on the type of train that is being worked. All this is taken care of by a four position Brake Selector Switch.

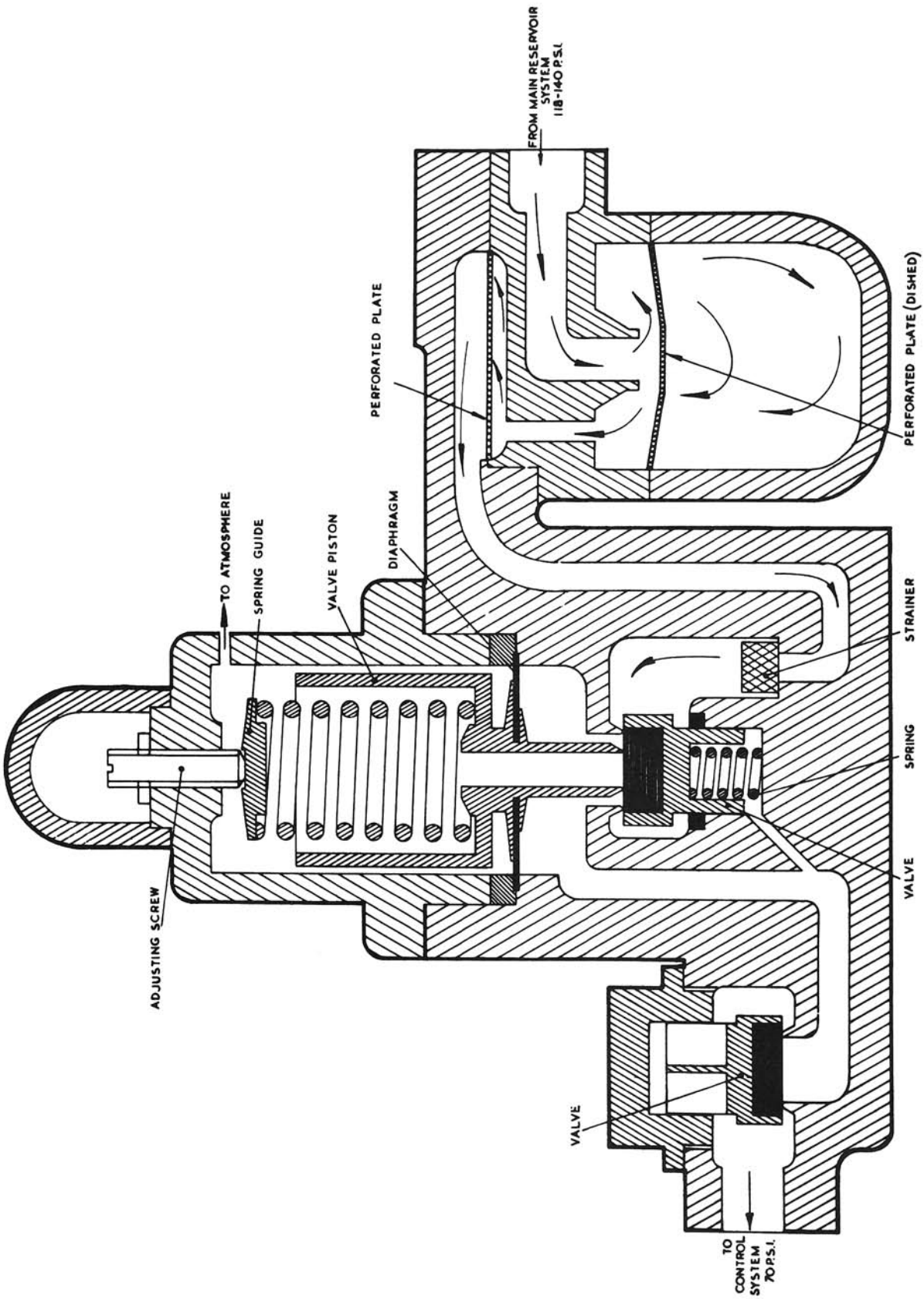


METCALFE DUPLEX CHECK VALVE



METCALFE AIR OPERATED CHOKE VALVE

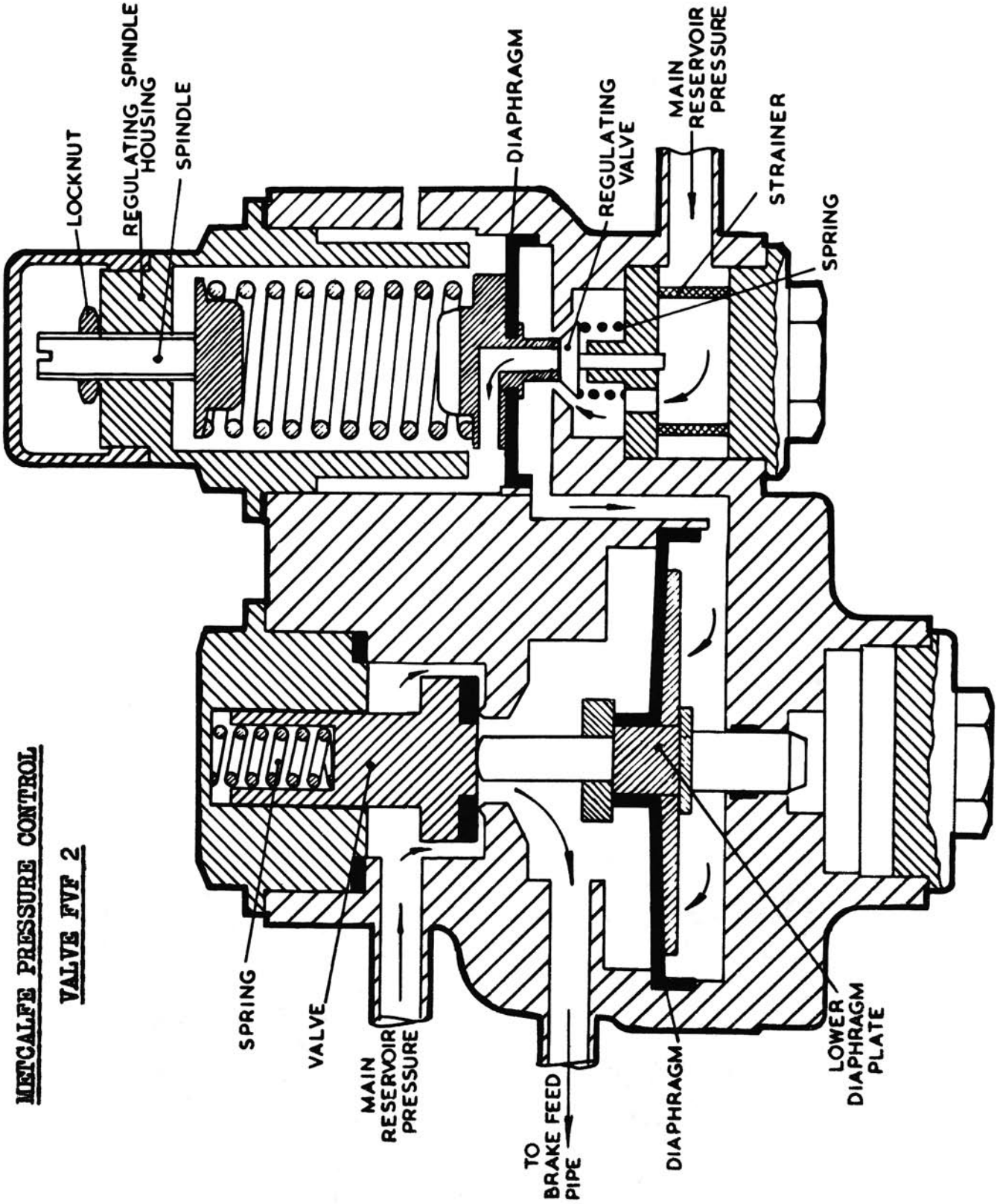
Shown De-Energised

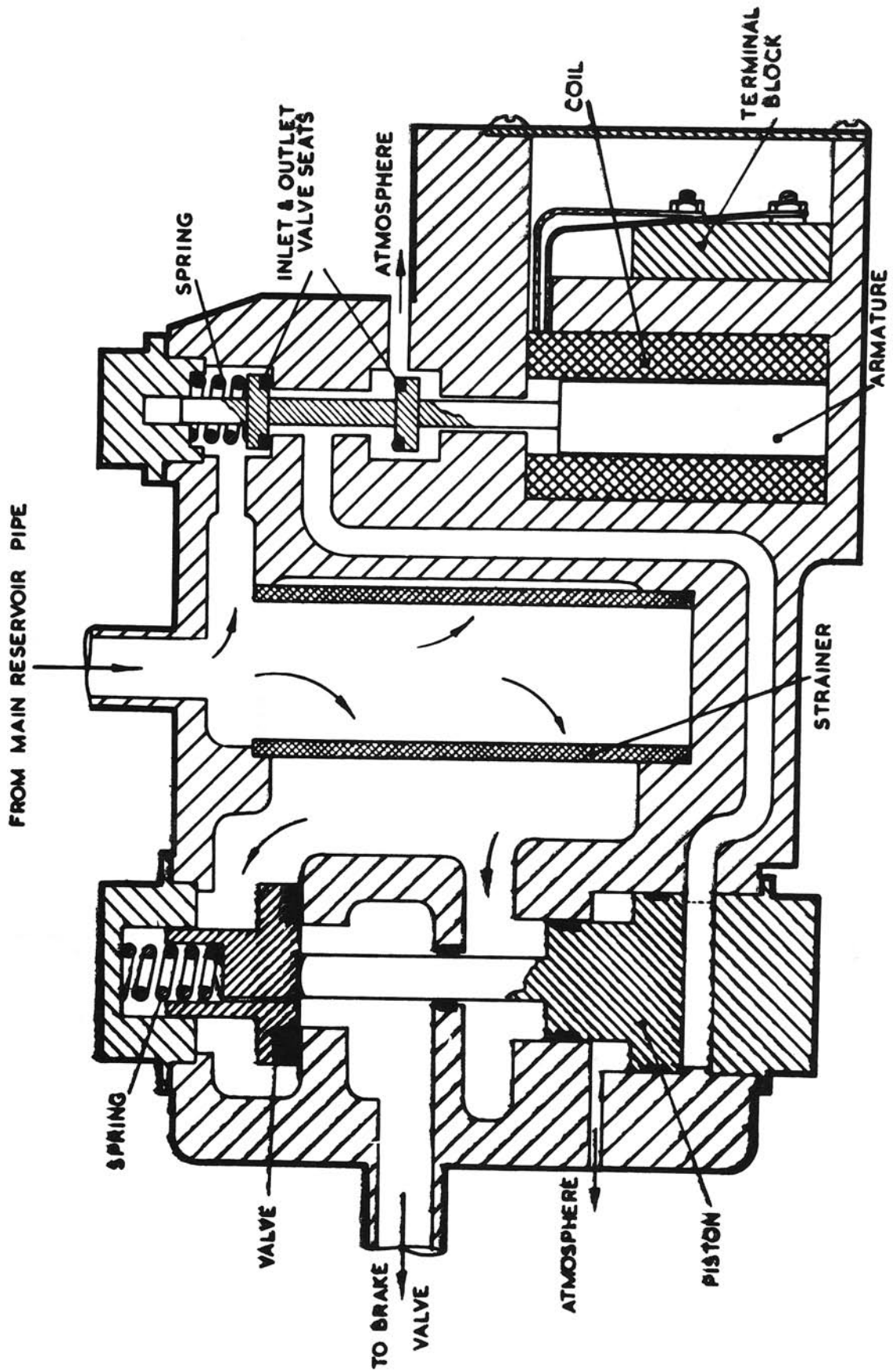


METCALFE. COMBINED STRAINER REDUCING VALVE AND CHECK VALVE

METCALFE PRESSURE CONTROL

VALVE FVF 2

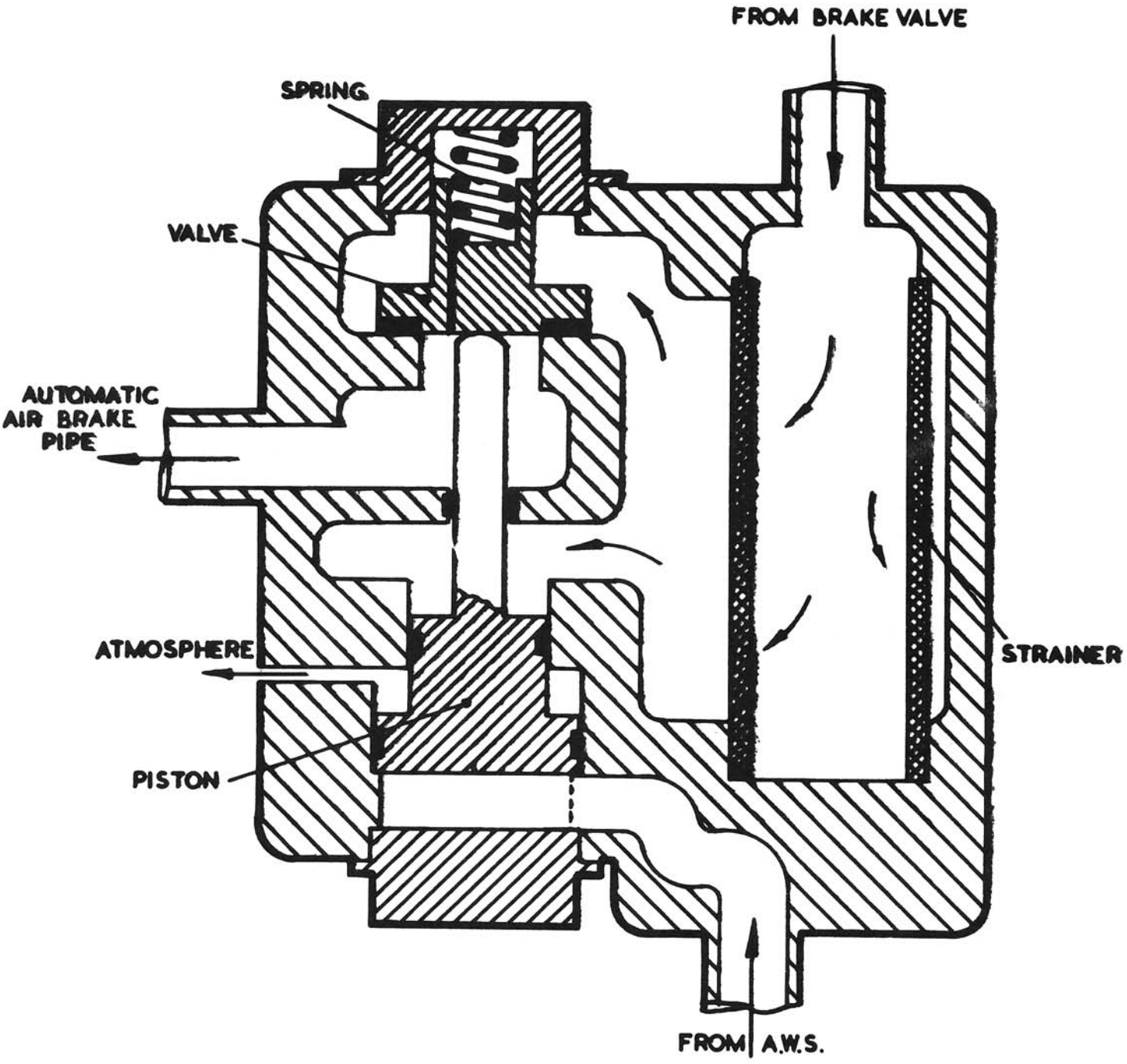




METCALFE BRAKE VALVE ISOLATOR

TYPE EBV 1/A

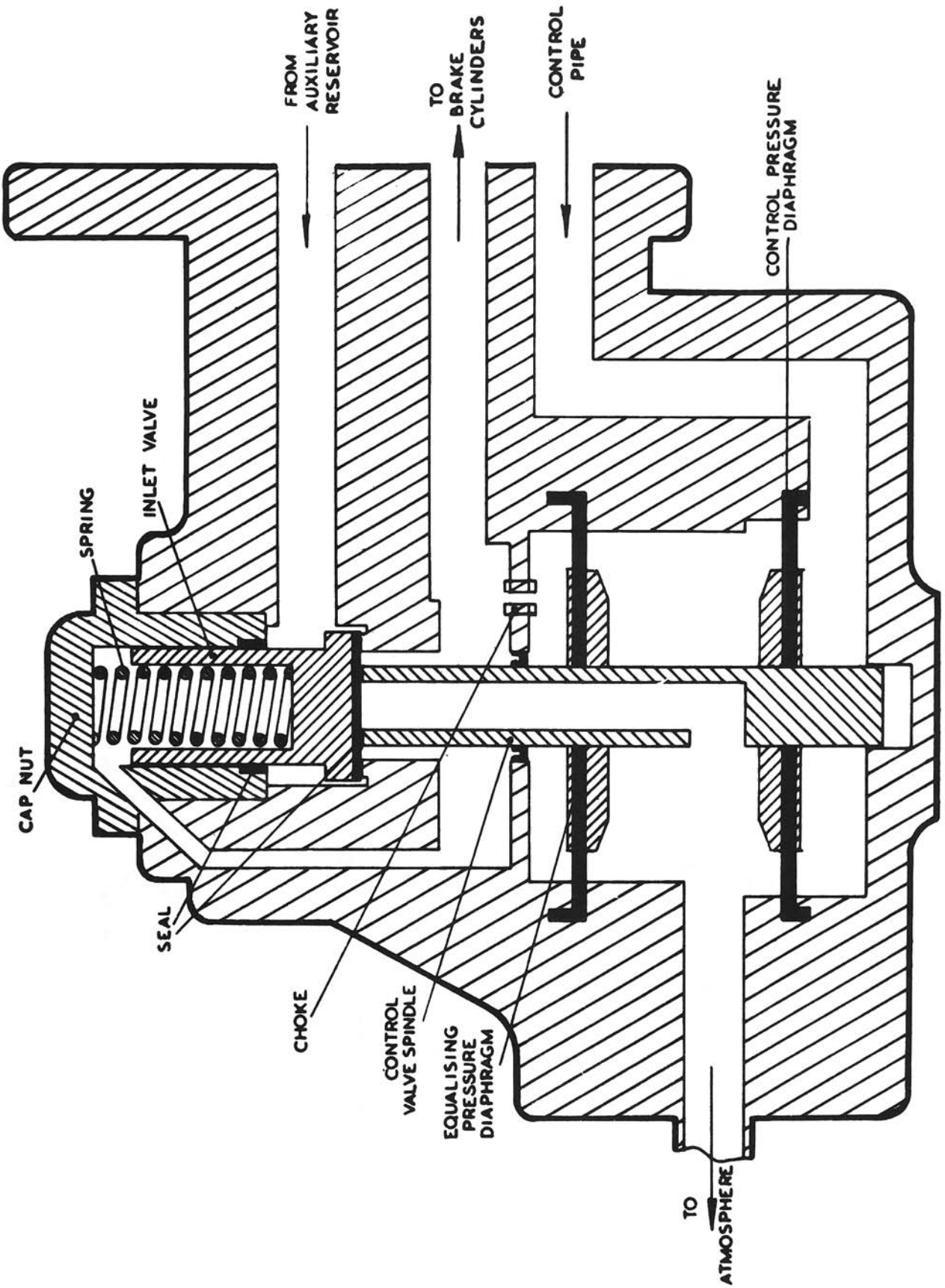
D.S.D. FEED CUT-OFF VALVE No. 25



METCALFE BRAKE VALVE

ISOLATOR TYPE BV 1/A

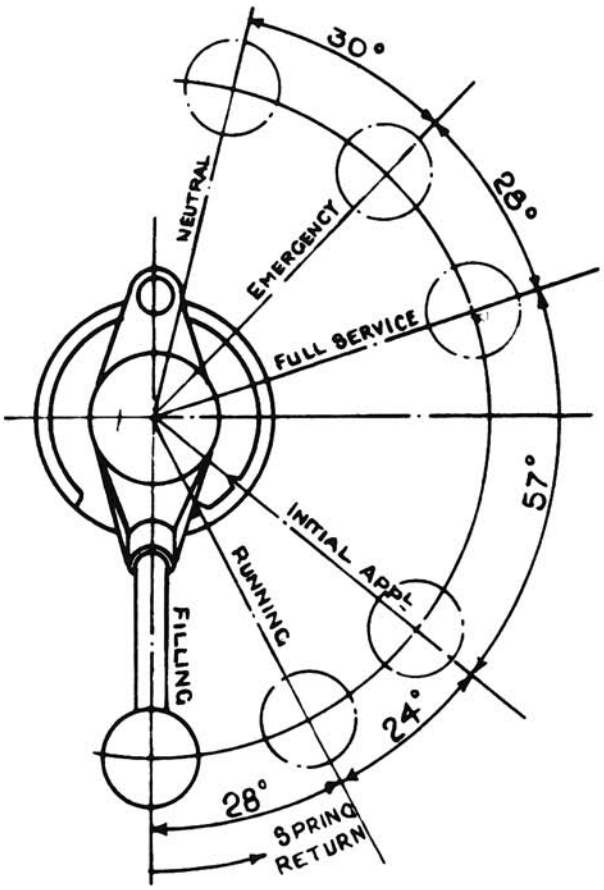
No. 20



METCALFE D.1. AIR RELAY VALVE

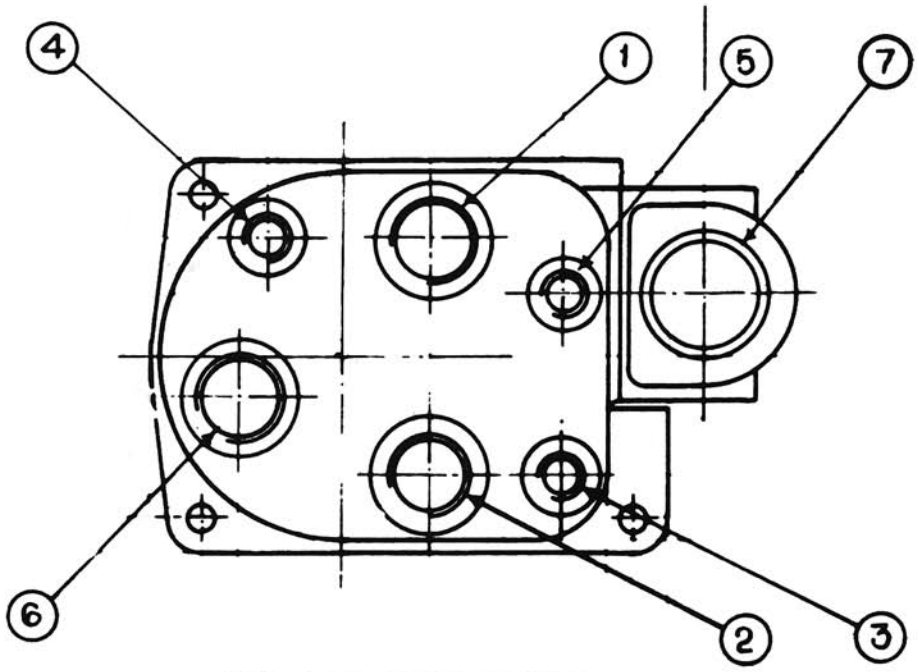
CONNECTIONS

1. Main Reservoir
2. Brake Pipe (Air)
3. Control Reservoir
4. Reduction Reservoir
5. Timing Reservoir
6. Exhaust
7. Vacuum Train Pipe

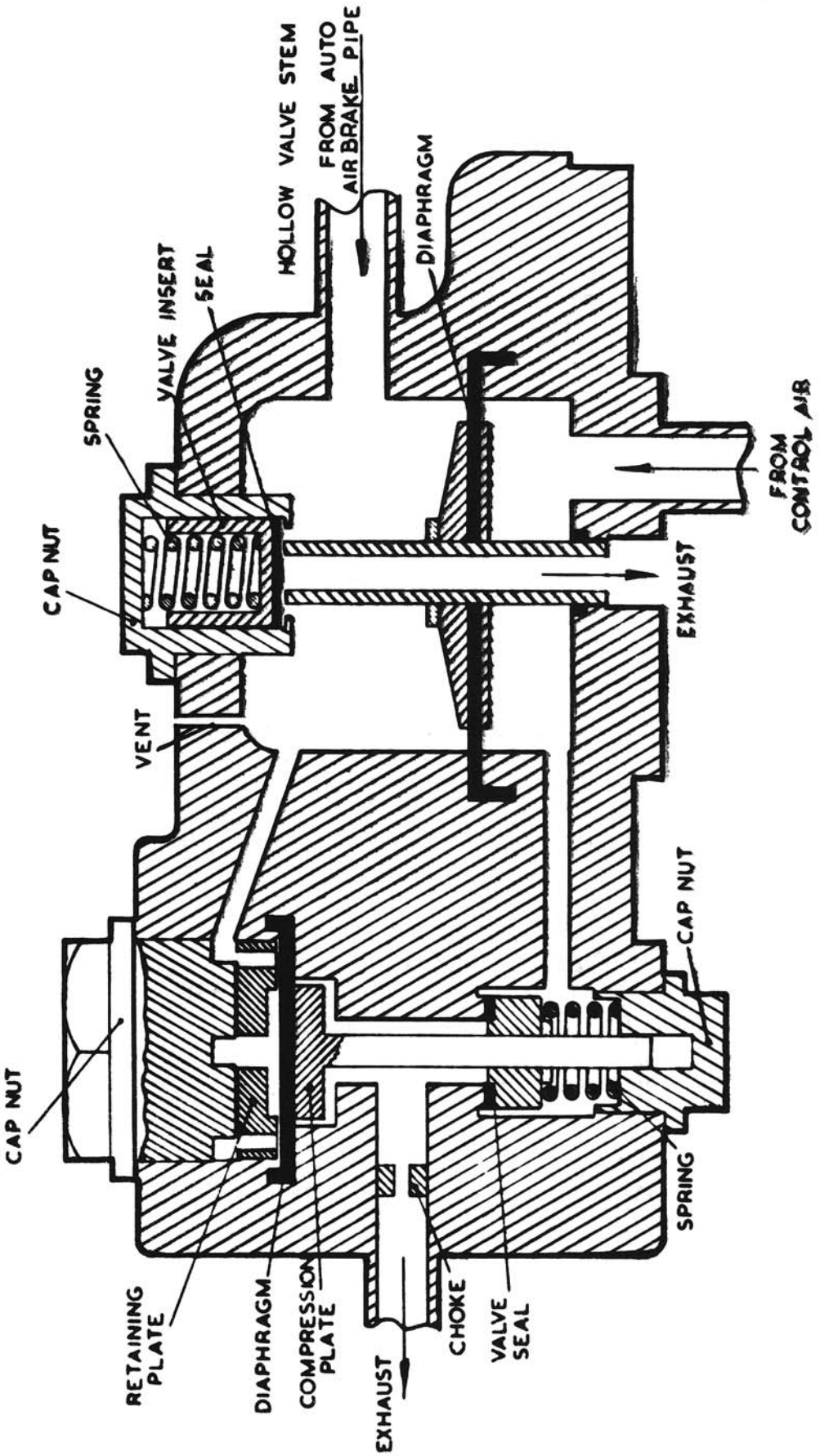


METCALFE DRIVERS AIR BRAKE

VALVE F.V. 4



VIEW OF CONNECTIONS

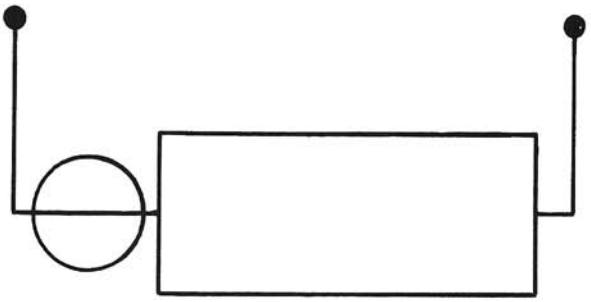


METCALFE D.S.D. VALVE T.M.V.7

A.W.S. E.P. VALVE UNIT

(Baldwin Type - Dual Air Locos)

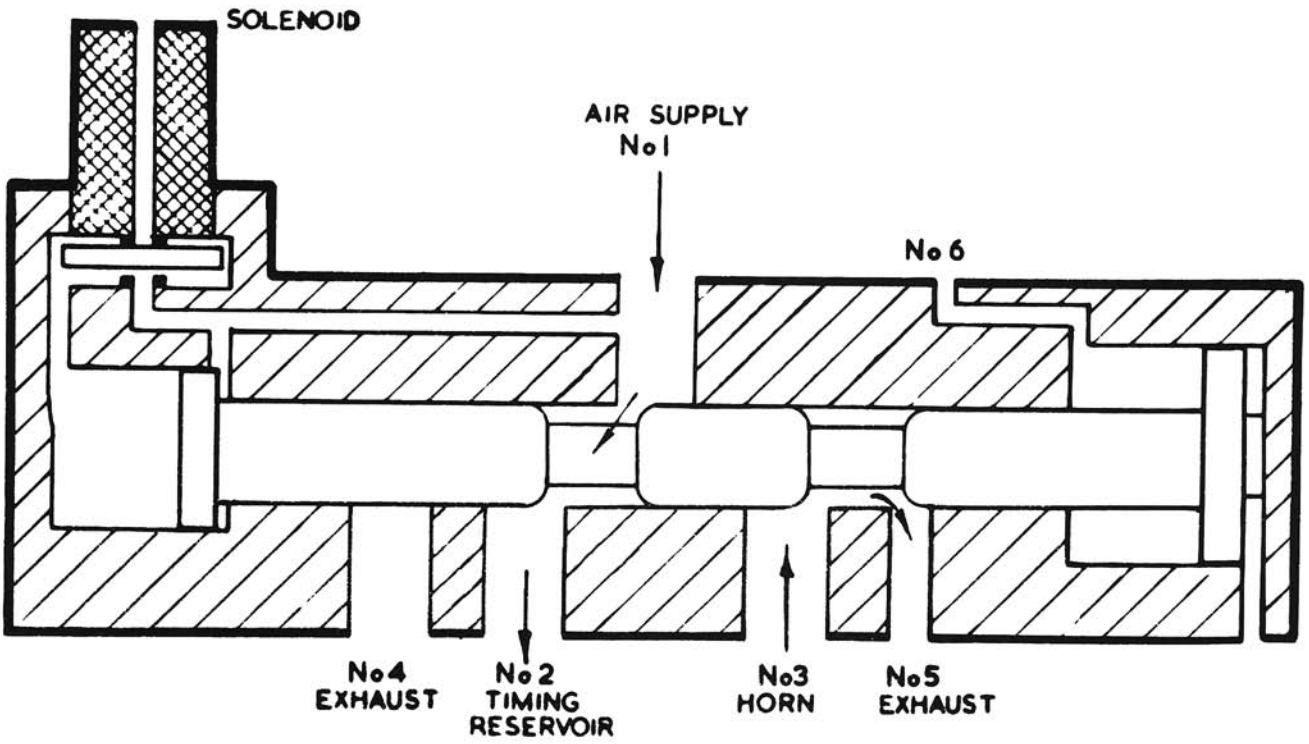
The A.W.S. E.P. valve is energised via the A.W.S. circuits when the Change end switch handle is in the up 'ON' position in the driving cab.



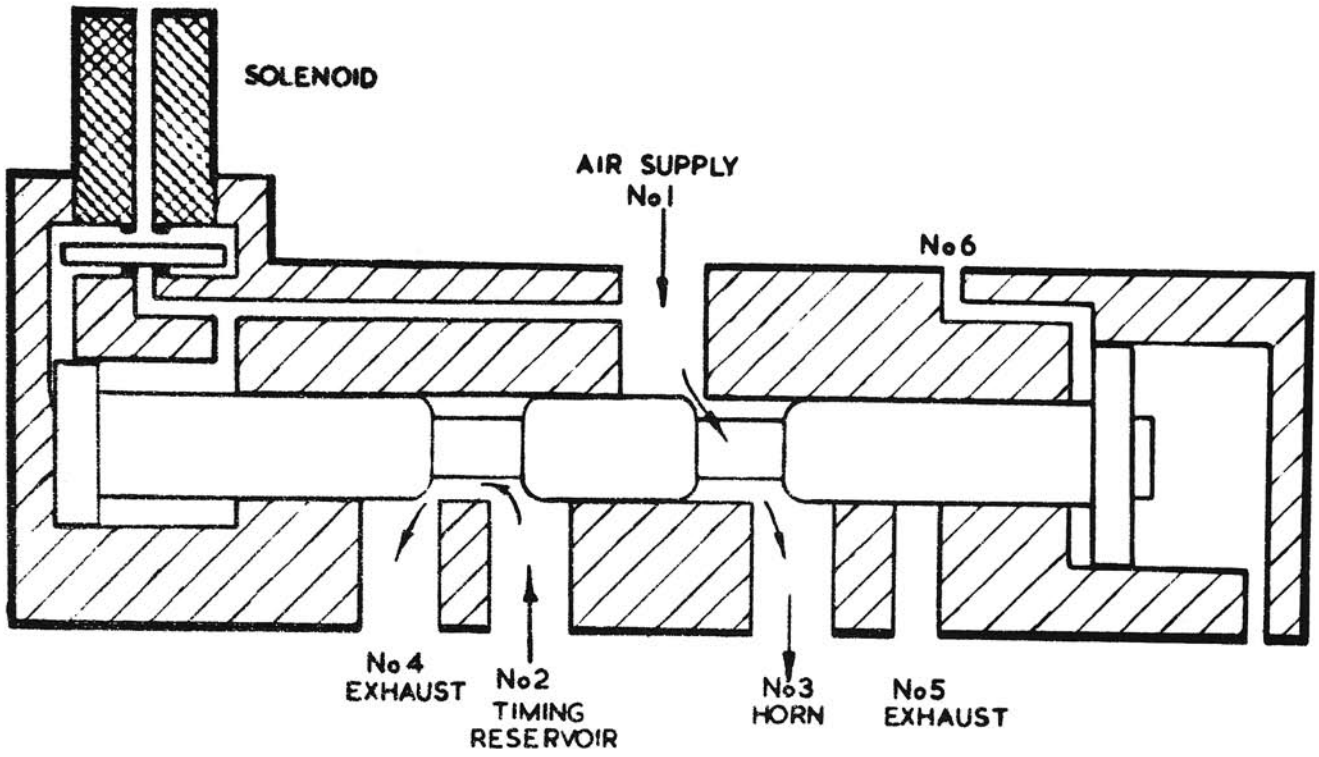
In this position, main reservoir air pressure supplied to connection No. 1, passes through the A.W.S. E.P. valve to the A.W.S. Delay or Timing Reservoir. The horn is vented to atmosphere via the connections Nos. 3 and 5 (Fig. 1).

When the A.W.S. operates, to give a "warning", the E.P. valve is de-energised (Fig. 2). This allows the valve to move across connecting main reservoir air pressure to the horn via connections Nos. 1 and 3, and the A.W.S. Delay or Timing Reservoir is vented to atmosphere via connections 2 and 4.

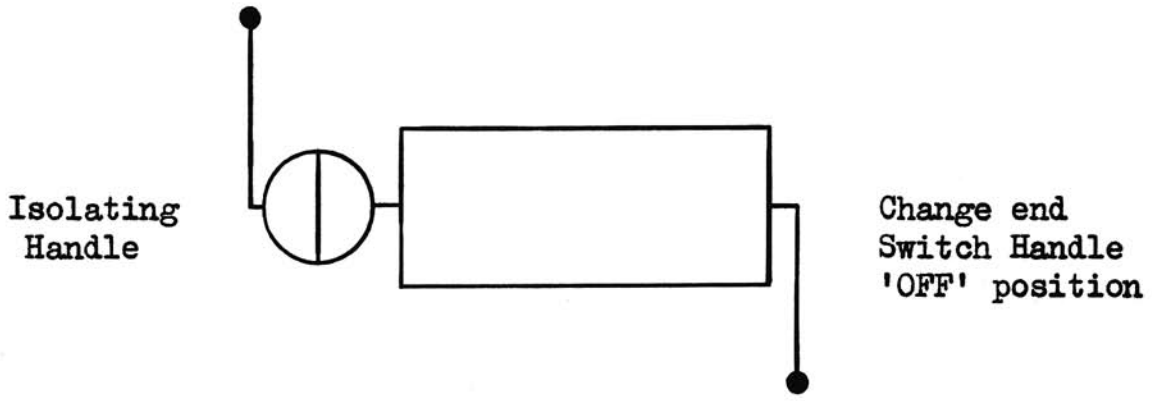
In the Non-Driving Cab, with the Change end switch handle in the down 'OFF' position, an air supply to connection No. 6 holds the A.W.S. E.P. valve unit in its "energised" position, thus supplying air to the A.W.S. Delay or Timing Reservoir.



A.W.S. E.P. VALVE (SHOWN ENERGISED) Fig. 1



A.W.S. E.P. VALVE (SHOWN DE-ENERGISED) Fig. 2



Should the A.W.S. equipment fail, it is isolated by turning the isolating handle (Red) to the down position in the affected cab. This gives a main reservoir air supply to connection No. 6 thus holding the A.W.S. E.P. valve unit in the "energised" position pneumatically.

If, at any time, it is required to bring into use an A.W.S. that has been isolated, the Change end Switch handle MUST be placed in the down 'OFF' position before moving the isolating handle (Red) from the down isolated position, to the up 'IN USE' position, after which it is necessary to place the Change end Switch handle in the up 'ON' position to regain control in that cab.

WH

DUAL AIR BRAKE SYSTEM (LAYCOCK/WESTINGHOUSE)

D.1000 Class Locomotives

Brake Schematic Colour Scheme

Main Reservoir Pressure 118 - 140 p.s.i.

Brake Feed/Reservoir Equalising Pipe Pressure 100 p.s.i.

Auto Air Brake Pipe - pressure 70 p.s.i.

Auto Air Brake Pipe - pressure below 70 p.s.i.

Control Air Pressure - 70 p.s.i.

Vacuum Train Pipe - 21"

Vacuum Train Pipe - below 21"

Vacuum Chamber - 21"

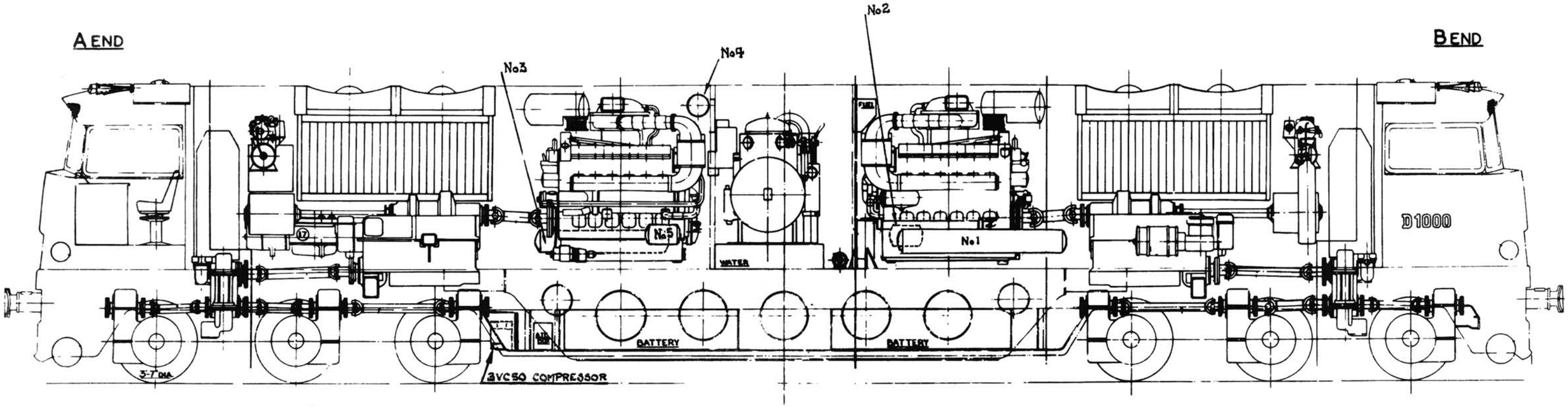
Distributor to Diaphragm Relay Valves - Pressure 0 - 57 p.s.i.

Limiting Valve to VA-1 Control Valve - pressure 24 p.s.i.

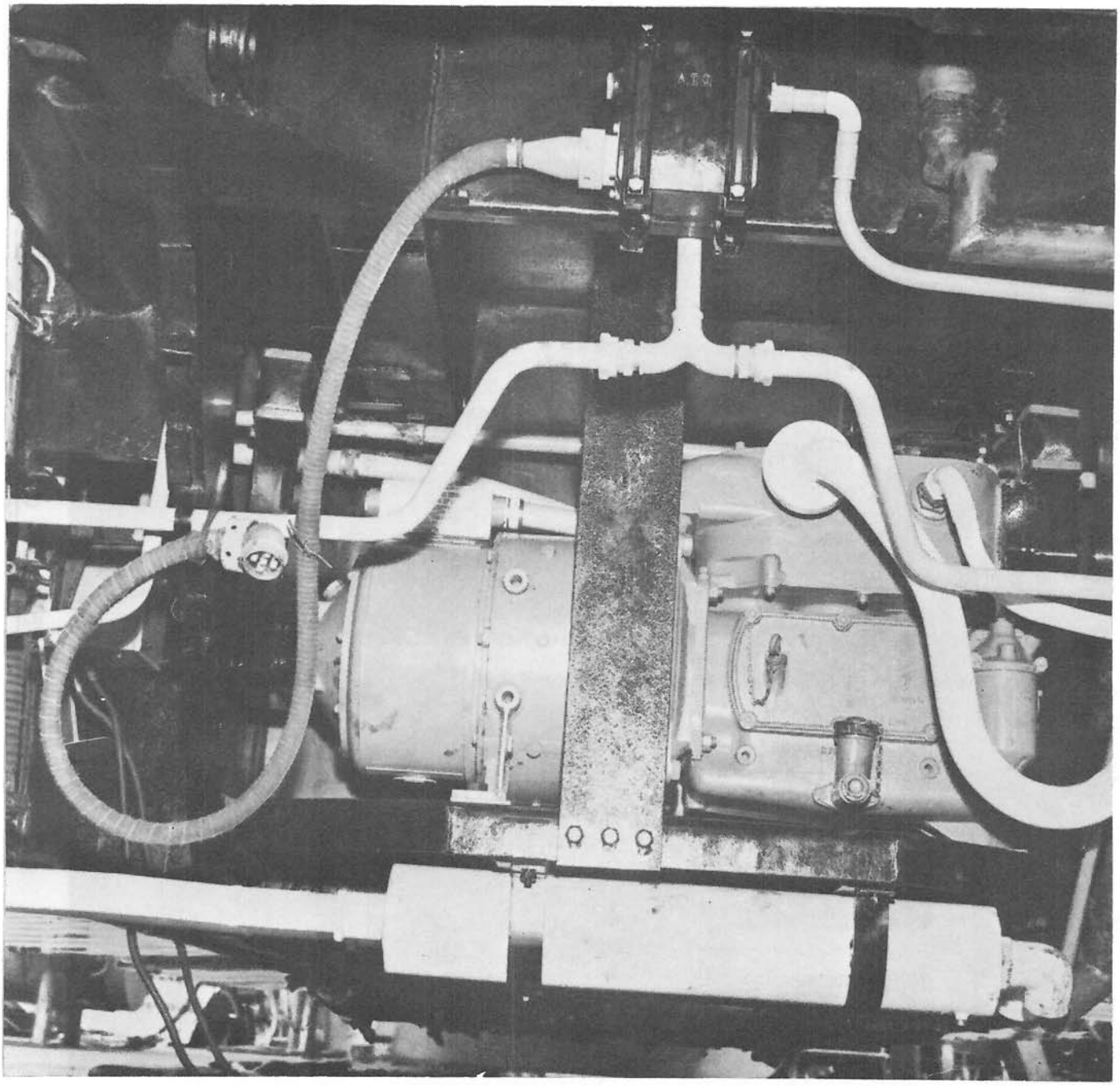
Pressure Reducing Valve to Straight Air Brake Valve - pressure 57 p.s.i.

Straight Air Brake Valve to KR-1)
)
)
Relay Valve pressure 0 - 57 p.s.i.)

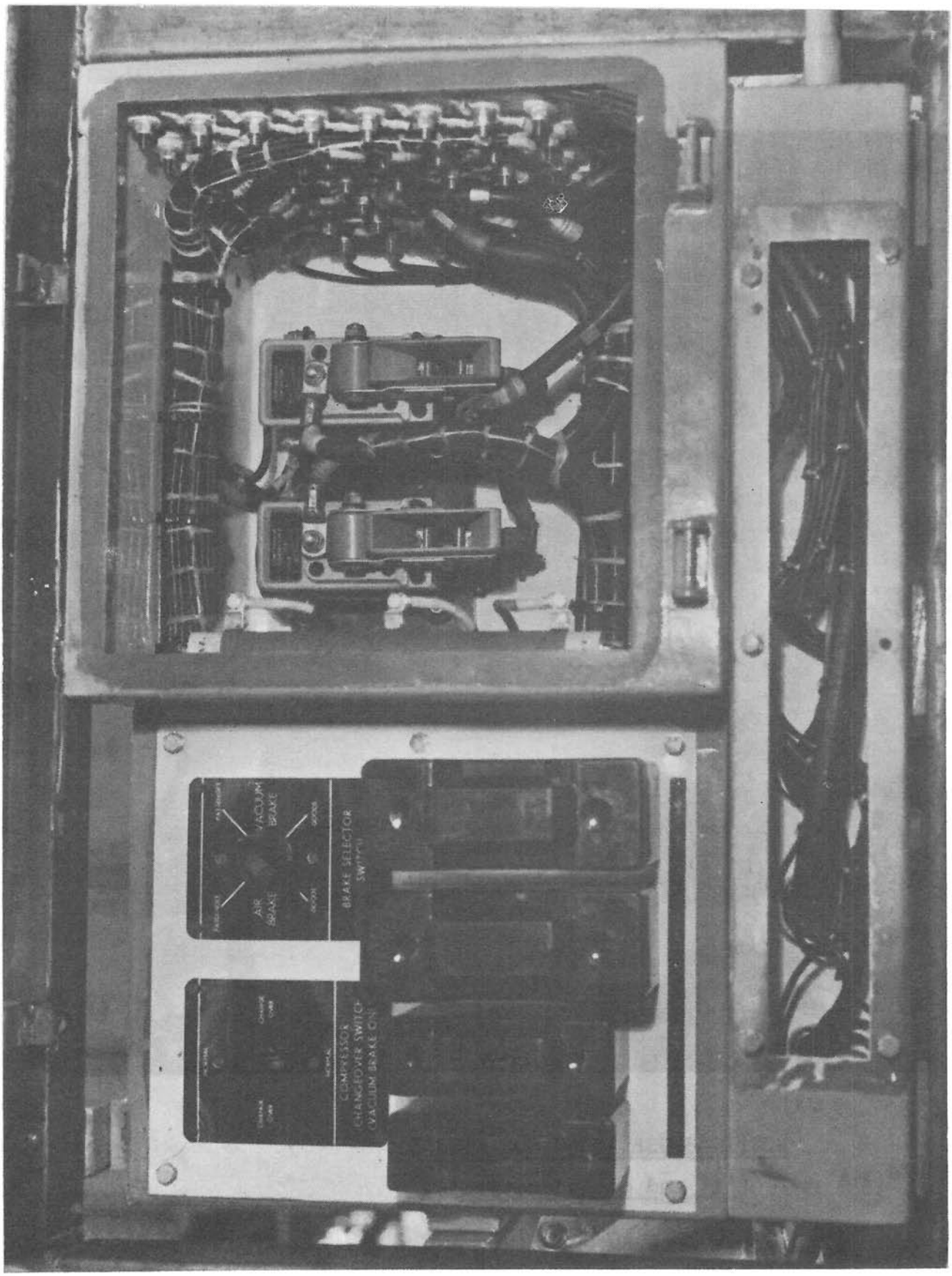
Relay Valves to Brake Cylinders - pressure 0 - 57 p.s.i.



LAYOUT OF BRAKE RESERVOIRS



WESTINGHOUSE 3VC50 COMPRESSOR
('A' end of Locomotive)



BRAKE SELECTOR AND CHANGEOVER SWITCH
AND COMPRESSOR FUSES

SIMPLIFIED CONTROL AND POWER CIRCUIT DIAGRAMS FOR COMPRESSORS AND EXHAUSTERS ON D.1000 CLASS DUAL BRAKE LOCOMOTIVES

This diagram has been drawn with the express purpose of explaining simply:-

(a) How the compressors and exhausters are controlled.

(b) What happens when an engine or dynostarter fails.

(c) Procedure to be carried out when a compressor fails.

Both compressors and exhausters will run if both engines and dynostarters are running. There is no battery supply to the compressors although the exhausters can be run from the battery for testing purposes only.

BRAKE SELECTOR SWITCH (B.S.S.)

There is a four position switch situated in the boiler room on the bulkhead adjacent to 'B' engine with a visual indication of the switch position provided in each cab. The switch determines:-

(a) The number of compressors that will operate.

(b) Whether exhausters will operate or not.

The four switch positions are identified as follows:-

1.	Air Goods	In either of these positions, both compressors will run, but both exhausters will be stopped, and since there is no vacuum, the vacuum governor will be 'shorted out'.
2.	Air Passenger	
3.	Vacuum Passenger	In either of these positions, both exhausters will run but only one compressor.
4.	Vacuum Goods	

Additional magnet valves are operated from the brake selector switch although their function is beyond the scope of the diagram under consideration.

All contacts in the diagram are shown in the correct relative position for the following conditions:-

Engine stopped, air pressure below 118 p.s.i.
and no direction of travel selected.

AIR GOODS AND AIR PASSENGER

Assume the locomotive to be driven from 'A' cab, that a FORWARD direction of travel has been selected and the engines and dynostarters are running then with the Control Circuit Breaker closed a positive feed is made available from the dynostarters via cable 71R, the Control Circuit Breaker and cable 52 to both controllers.

With the FORWARD direction selected on 'A' end controller, the circuit is now made via cable 58, the Change-over switch and cable 458. Because 'A' engine and dynostarter are running contact VR(A) will be closed thus completing the circuit via cable 463, compressor contactor coil, cable 460, compressor governor, cable 8, Control Circuit Breaker and cable 74 back to negative.

With compressor coil energised, contact C(A) will close, completing the power circuit from 'A' dynostarter to 'A' compressor.

When the Brake Selector Switch is in the Air Passenger or Air Goods position, contacts 'r' or 'u' are bridged so completing a circuit from cable 58 to 58R, through Change-over Switch, cable 459, closed contact VR(B) (because 'B' engine and dynostarter are running) cable 464, compressor contactor coil, cable 460, Compressor Governor, cable 8, Control Circuit Breaker and cable 74, back to negative.

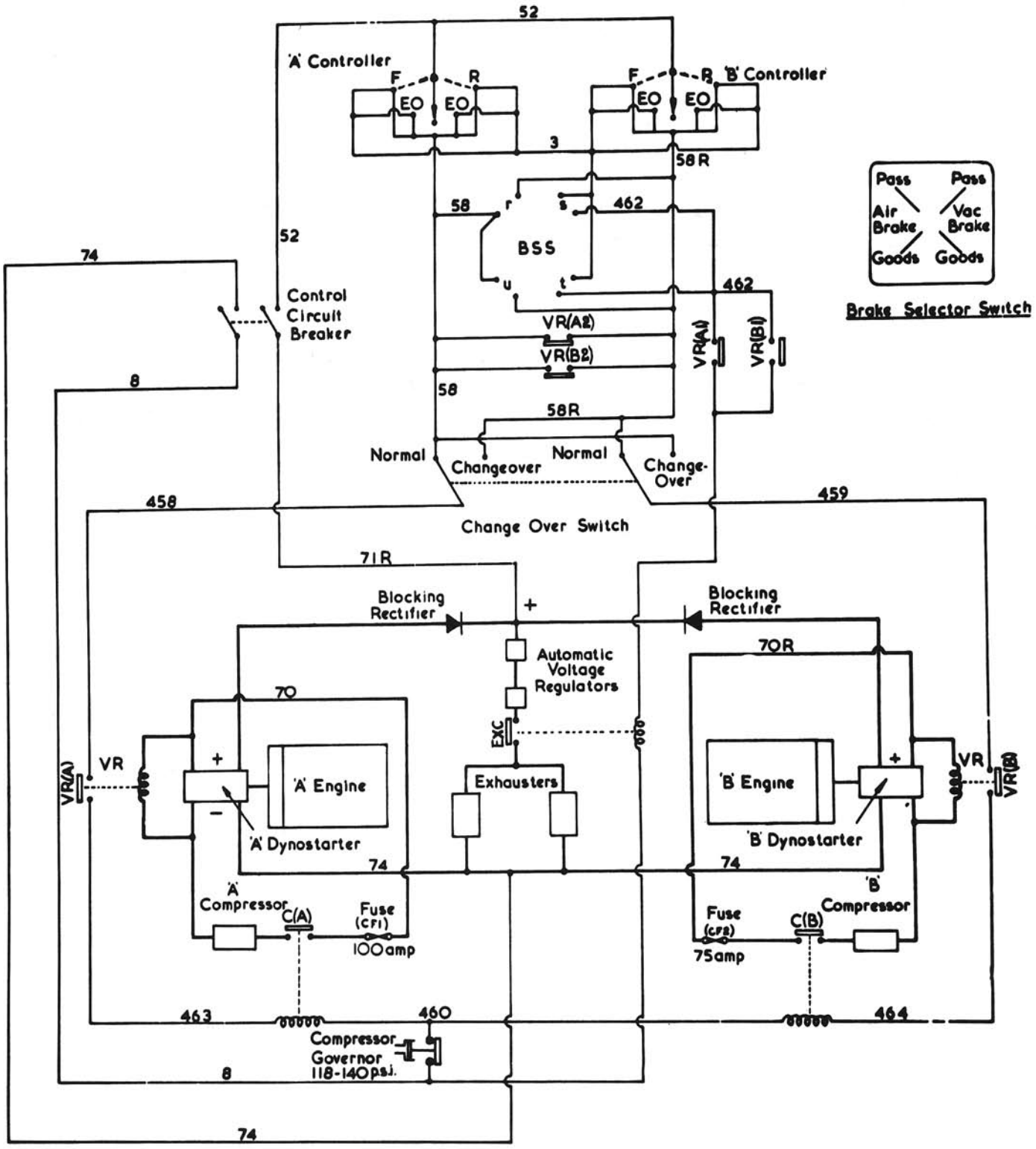
With the compressor coil energised, contact C(B) will close, completing the power circuit from 'B' dynostarter to 'B' compressor.

The only connection between cable 58 and 58R will be via the Brake Selector Switch as contacts VR(A2) or VR(B2) will be open when both engines and dynostarters are running.

VACUUM PASSENGER AND VACUUM GOODS

When working a vacuum fitted train, both exhausters and one compressor will run. The compressor which operates will be determined by the cab from which the locomotive is driven.

Assume the locomotive to be driven from 'A' cab, that a FORWARD direction of travel has been selected and the engines and dynostarters are running, then with Control Circuit Breaker closed, a positive circuit is made from the dynostarters via cable 71R, through the Control Circuit Breaker to cable 52, and both controllers. With the FORWARD direction



SIMPLIFIED CONTROL & POWER CIRCUIT DIAGRAM FOR COMPRESSORS & EXHAUSTERS ON D1000 CLASS DUAL BRAKE LOCOMOTIVES

selected on 'A' end controller, the circuit is now made via cable 58, the Changeover Switch and cable 458. Because 'A' engine and dynostarter are running, contact VR(A) will be closed thus completing the circuit to cable 463, through the compressor contactor coil to cable 460, compressor governor, cable 8, Control Circuit Breaker and cable 74, back to negative.

With the compressor coil energised, contact C(A) will close, completing the power circuit from 'A' dynostarter to 'A' compressor.

Because contacts VR(A2) and VR(B2) are open and the Brake Selector Switch is in either Vacuum Goods or Vacuum Passenger positions, no circuit is made to 'B' compressor contactor coil therefore 'B' compressor will not run.

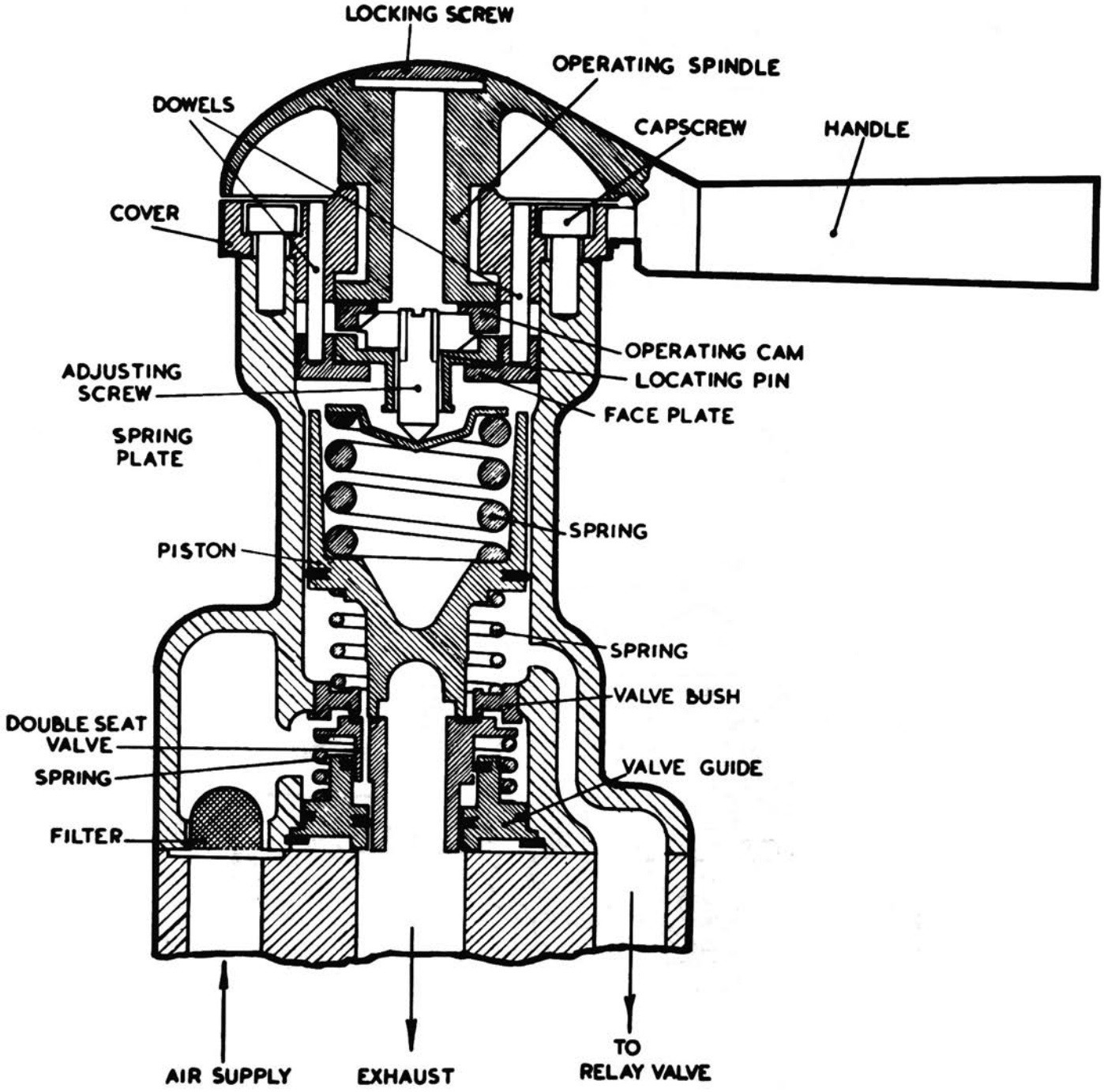
When the Brake Selector Switch is in either Vacuum Passenger or Vacuum Goods position, contacts 's' or 't' are bridged, completing a circuit from cable 52 via controller ('A' cab - FORWARD direction) to cable 3 and cable 462. Contacts VR(A1) and VR(B1) will be closed (both engines running) completing circuit to cable 113, Exhauster Contactor Coil, cable 8, Control Circuit Breaker, cable 74 and back to negative. With Exhauster Contactor Coil energised, contact EXC will close to complete dynostarter and exhauster power circuits. Two exhausters and one compressor are now operating.

If 'A' engine or 'A' dynostarter should stop, contact VR(A) will open and the circuit to 'A' compressor contactor coil will be broken. Contact VR(A2) will close thus completing a circuit from cable 58, through closed VR(A2) to cable 58R, Changeover Switch, cable 459, closed contact VR(B), cable 464, compressor contactor coil, cable 460, compressor governor, cable 8, Control Circuit Breaker, cable 74 and back to negative. With compressor contactor coil energised, contactor C(B) will close to complete power circuit from 'B' dynostarter to 'B' compressor. Therefore, should 'A' engine fail, the changeover from 'A' to 'B' compressor is automatic.

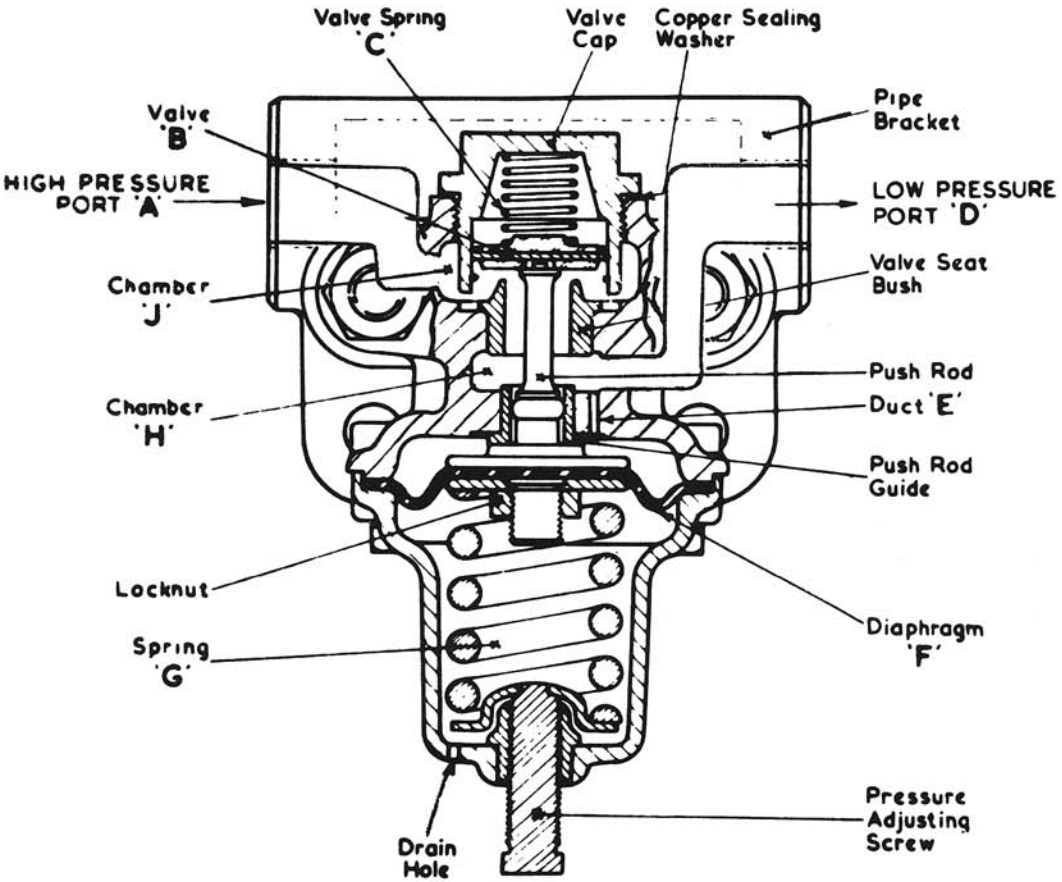
Now assume that 'A' compressor fails but 'A' engine and dynostarter continue to run. In this instance the changeover is not automatic and the Changeover Switch must be turned from NORMAL to the CHANGEOVER position. This will then complete a circuit from cable 58 to cable 459 and so energise the compressor contactor coil for 'B' compressor which will then commence to run.

Should the locomotive be now driven from 'B' cab, the Changeover Switch must be returned to NORMAL before 'B' compressor will run.

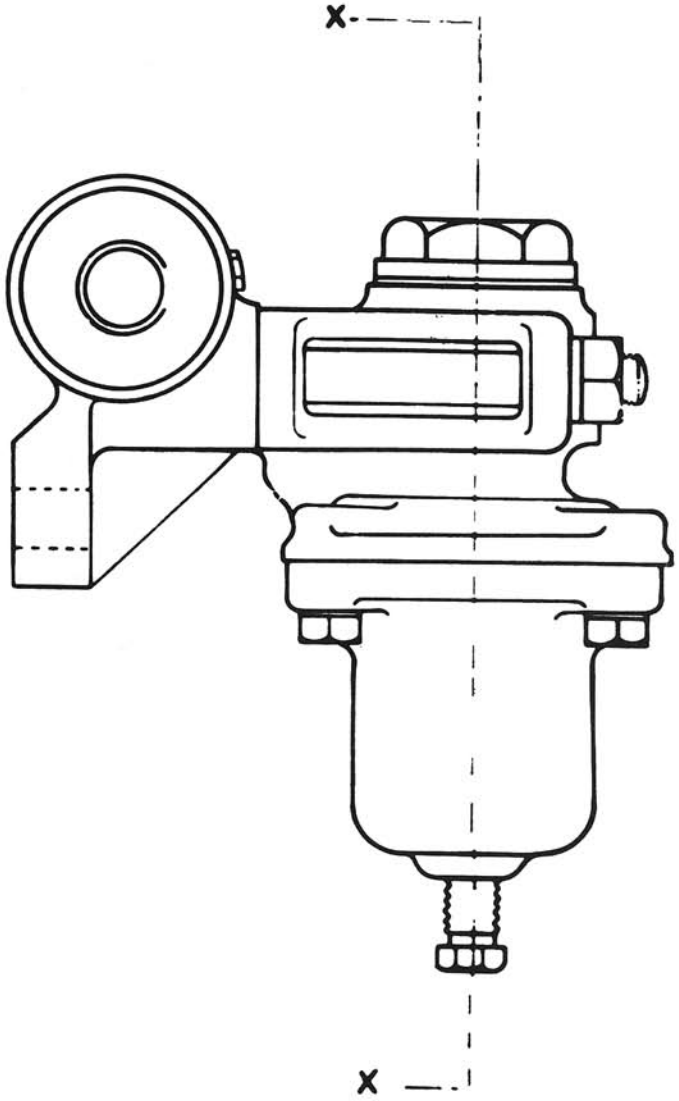
NOTE: Should an engine or dynostarter fail at one end and the compressor fail at the other, the locomotive is then a complete failure.



LAYCOCK SELF-LAPPING DRIVERS BRAKE VALVE



SECTION XX

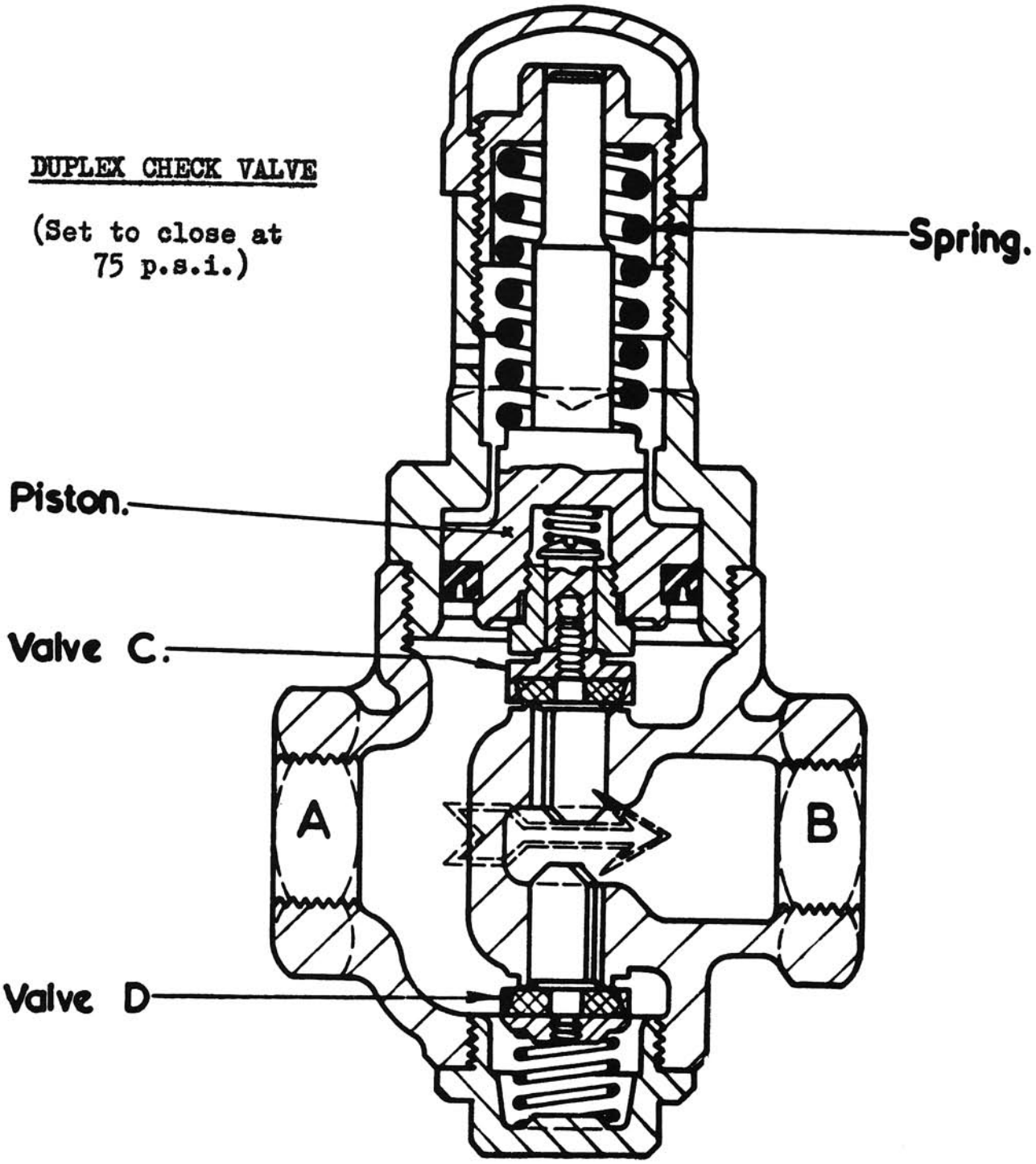


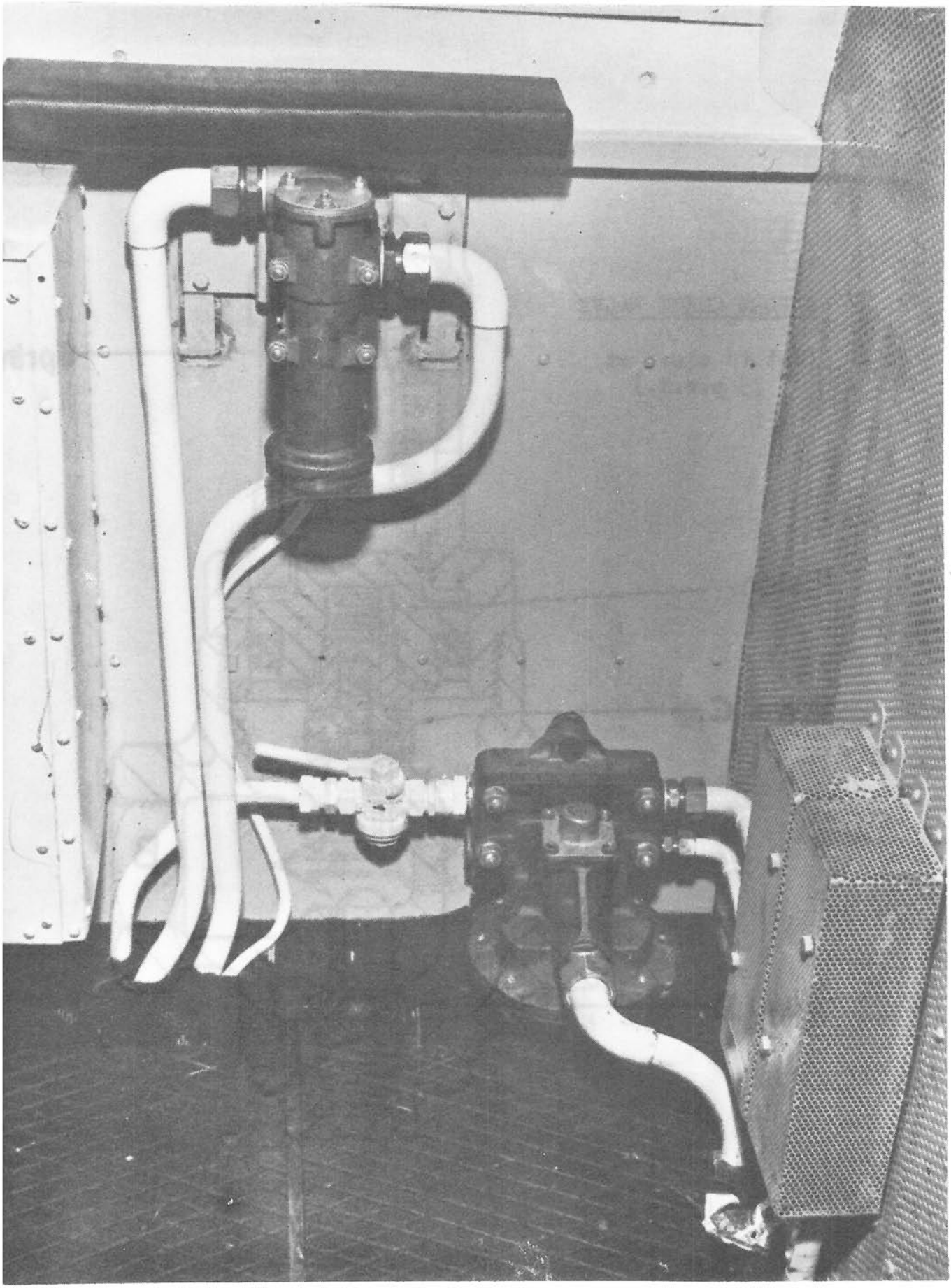
LIMITING VALVE 'C'

Set at 100 p.s.i.

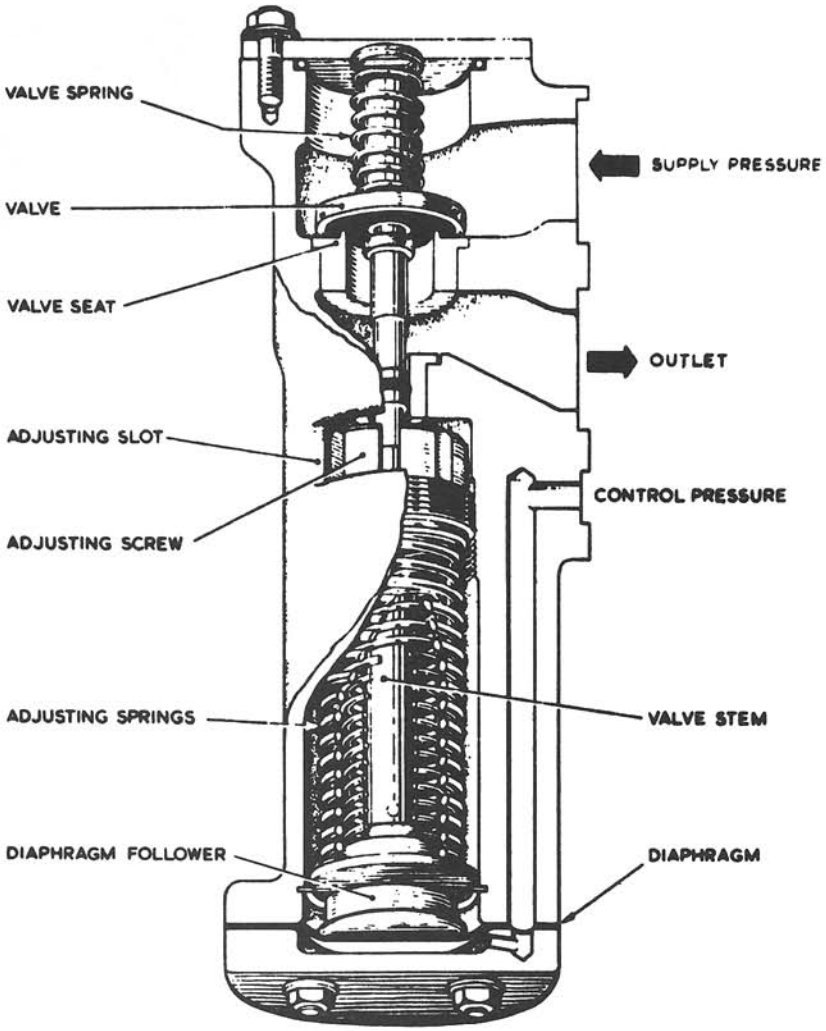
DUPLEX CHECK VALVE

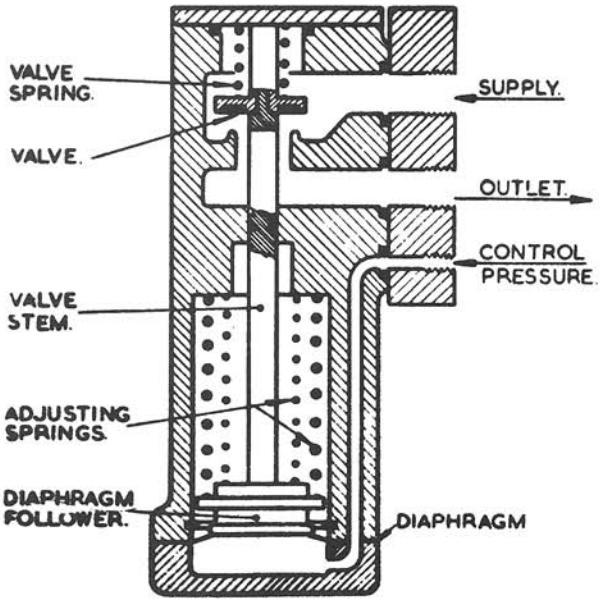
(Set to close at
75 p.s.i.)



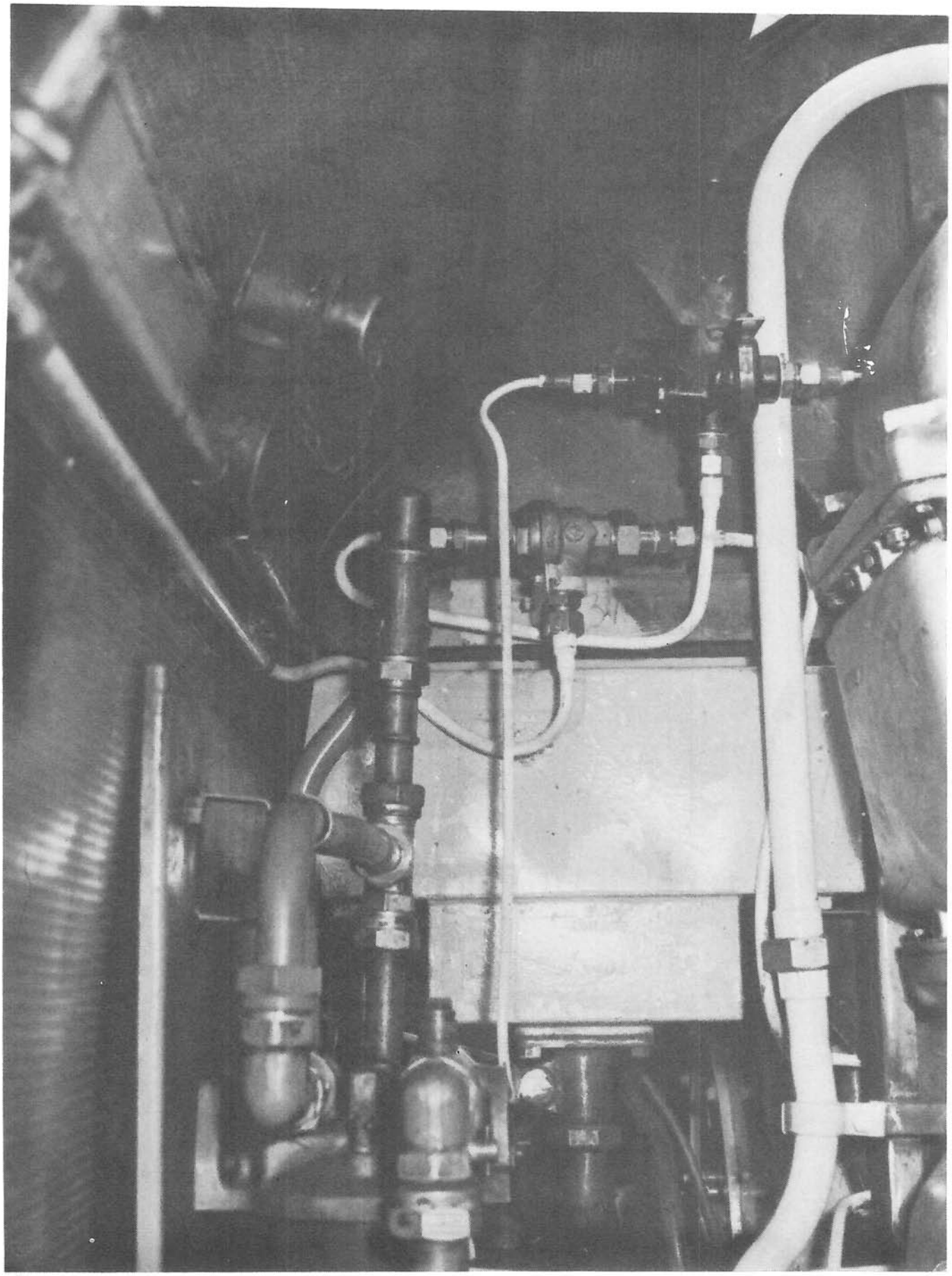


BRAKE VALVE FEED CUT-OFF AND DIAPHRAGM RELAY VALVE

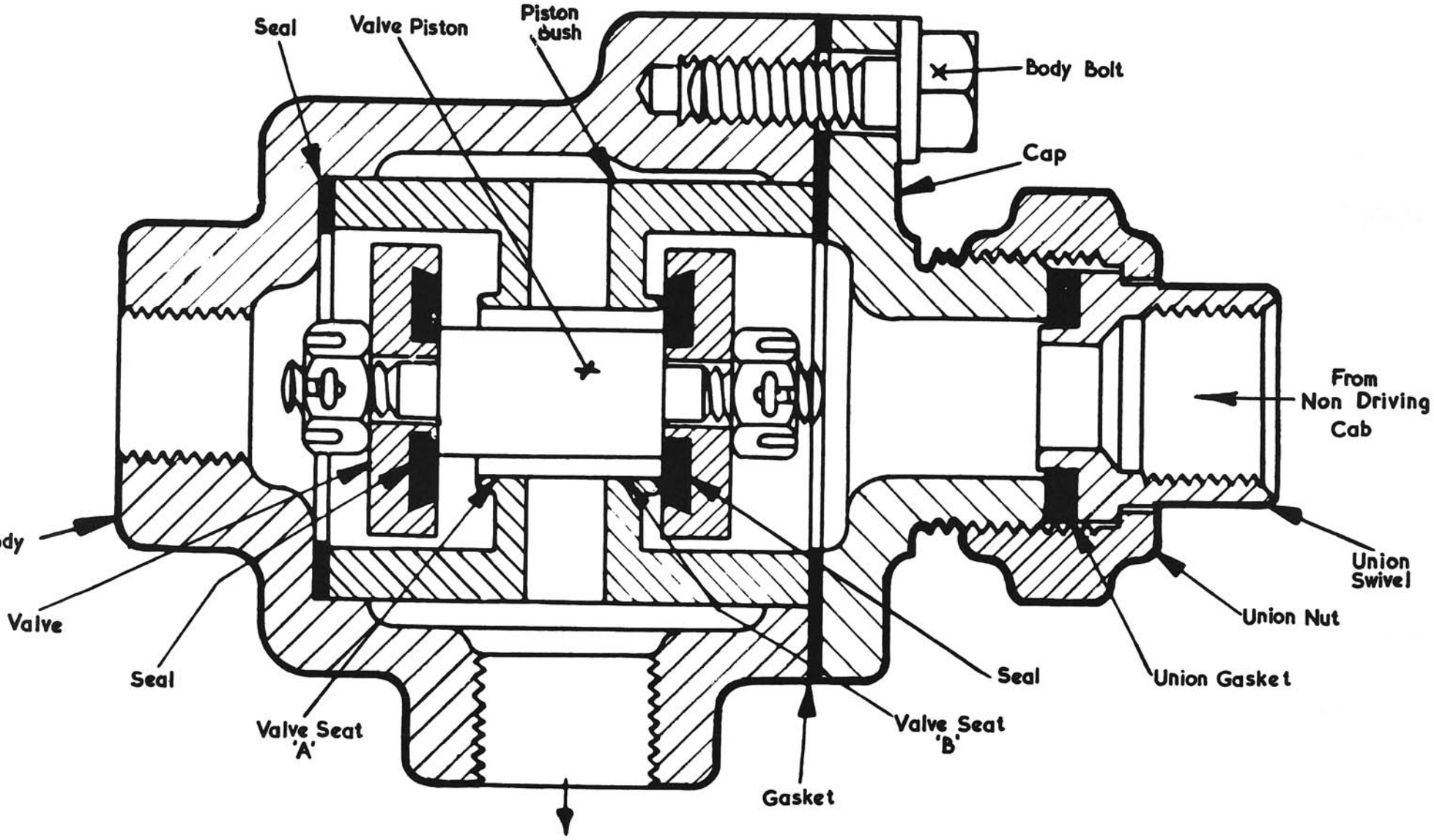




BRAKE VALVE FEED CUT-OFF VALVE

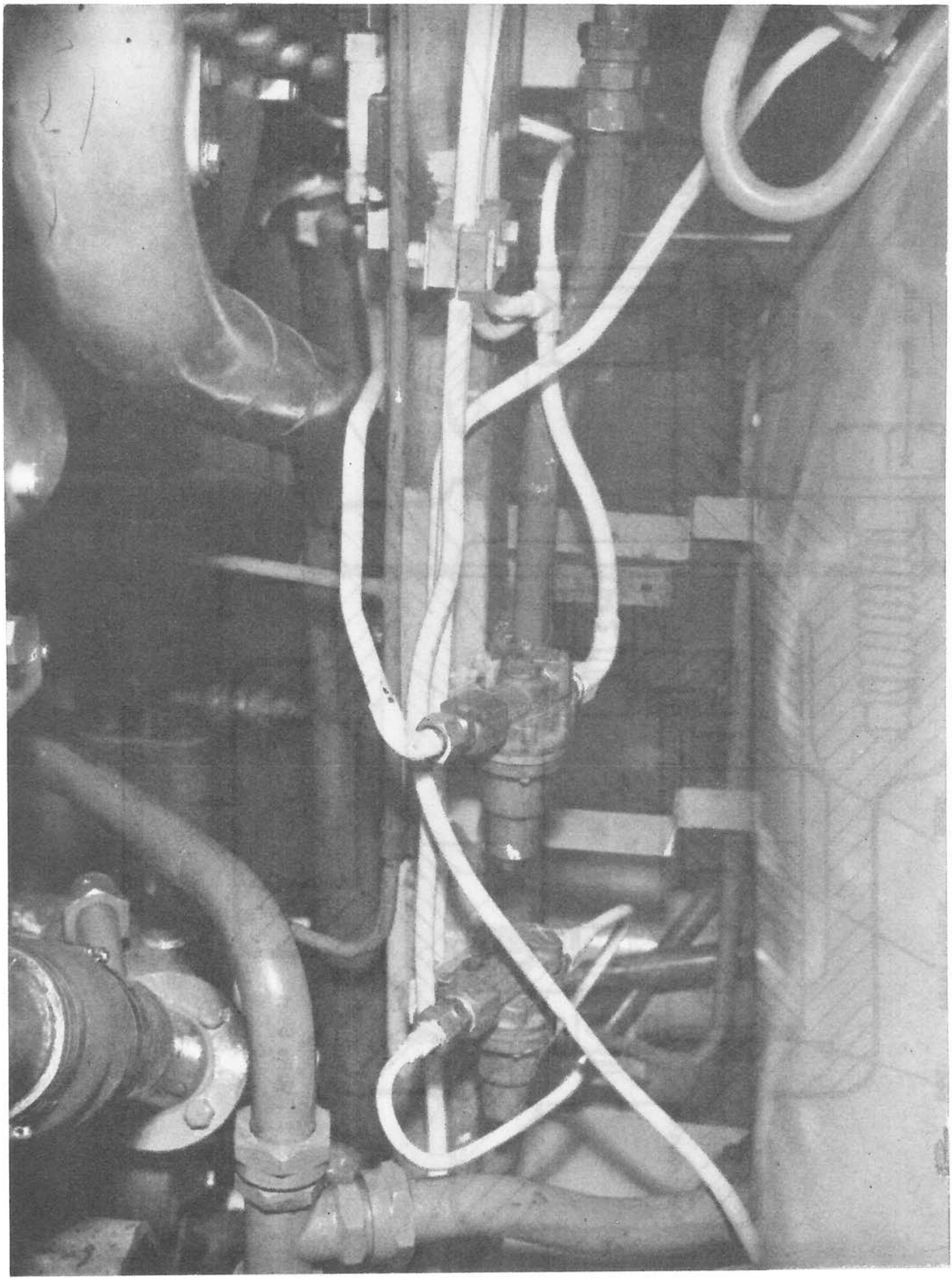


No. 19 DOUBLE CHECK VALVE

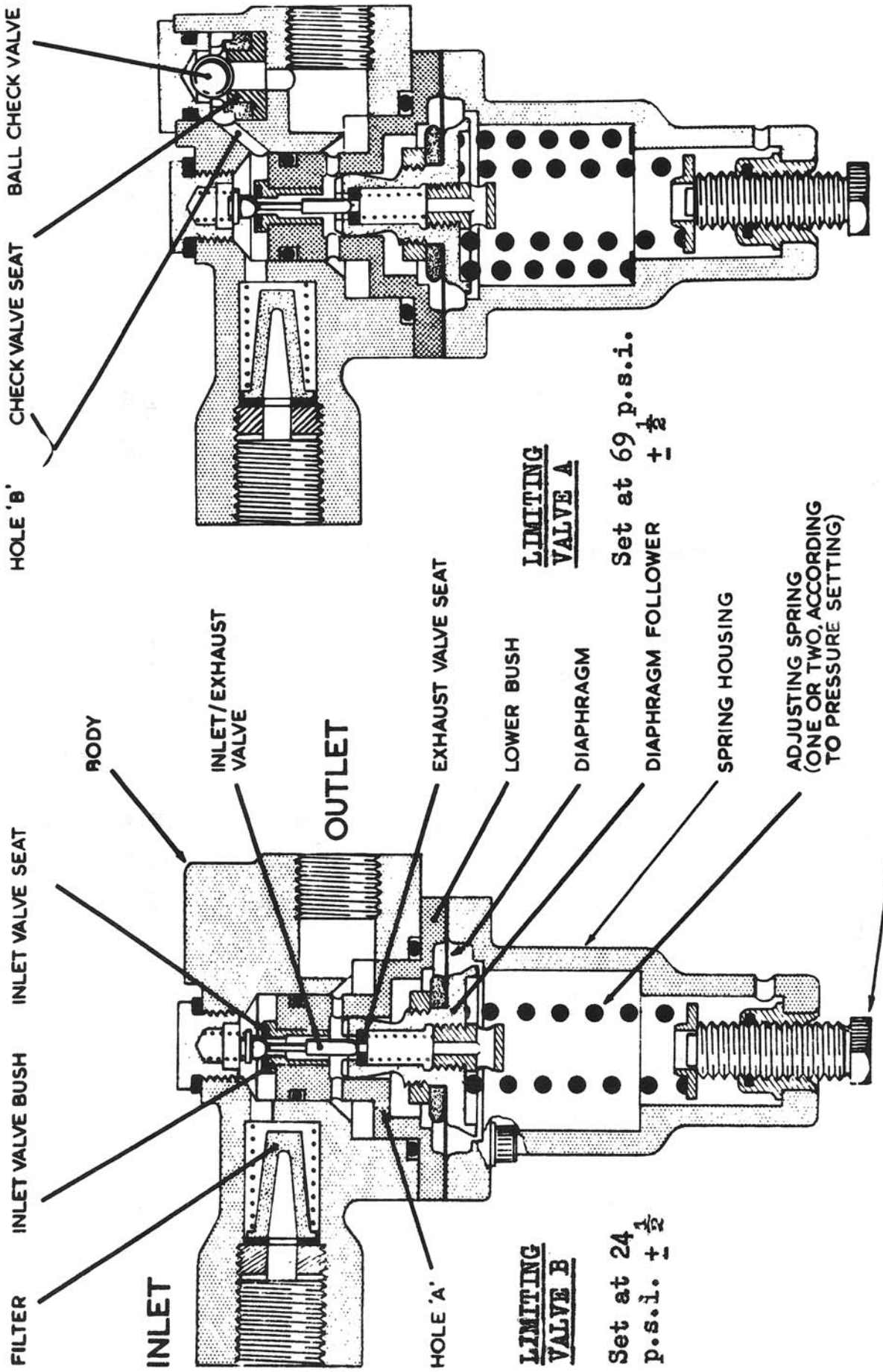


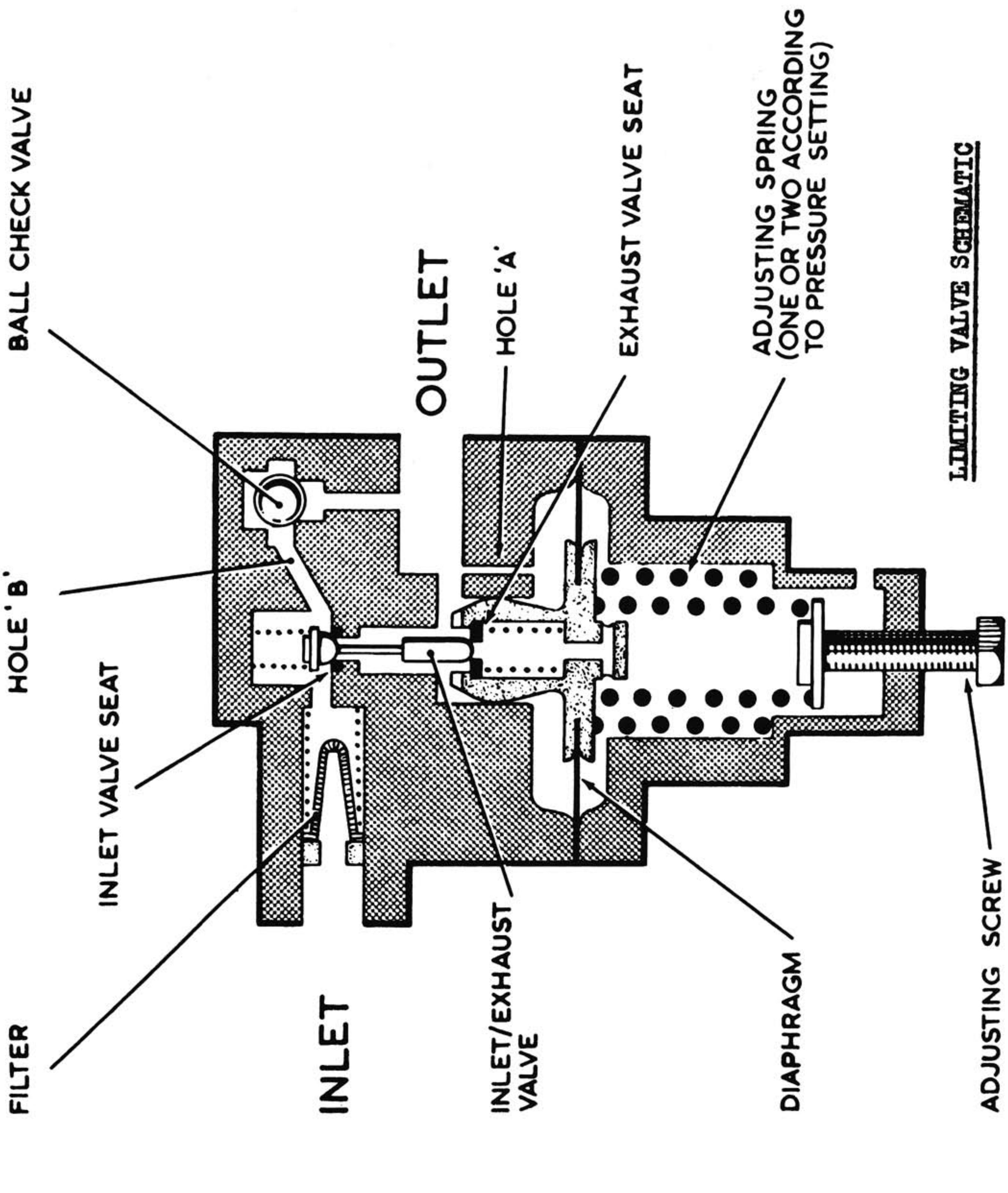
No 19 DOUBLE CHECK VALVE

WH

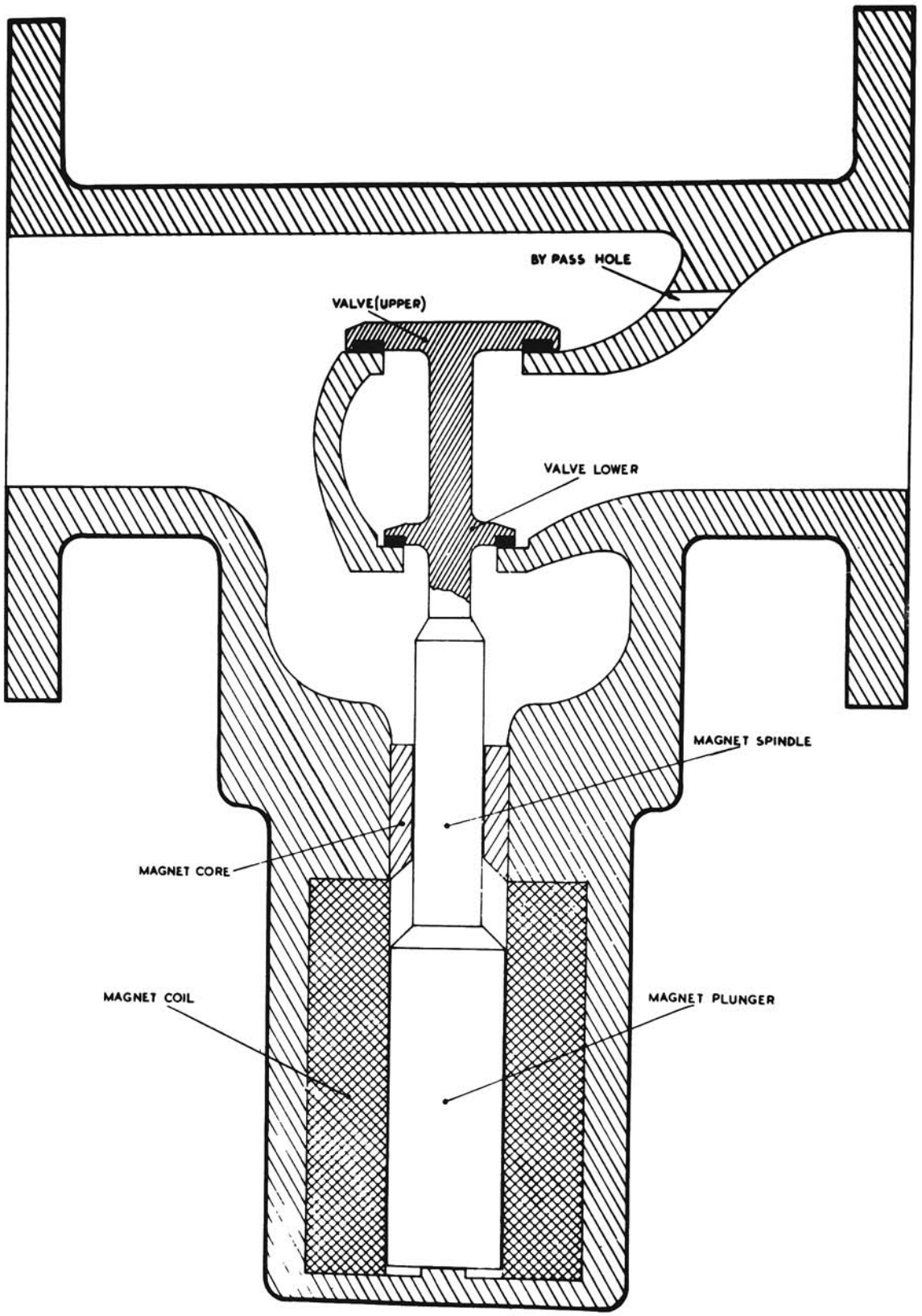


LIMITING VALVES 'A' AND 'B'

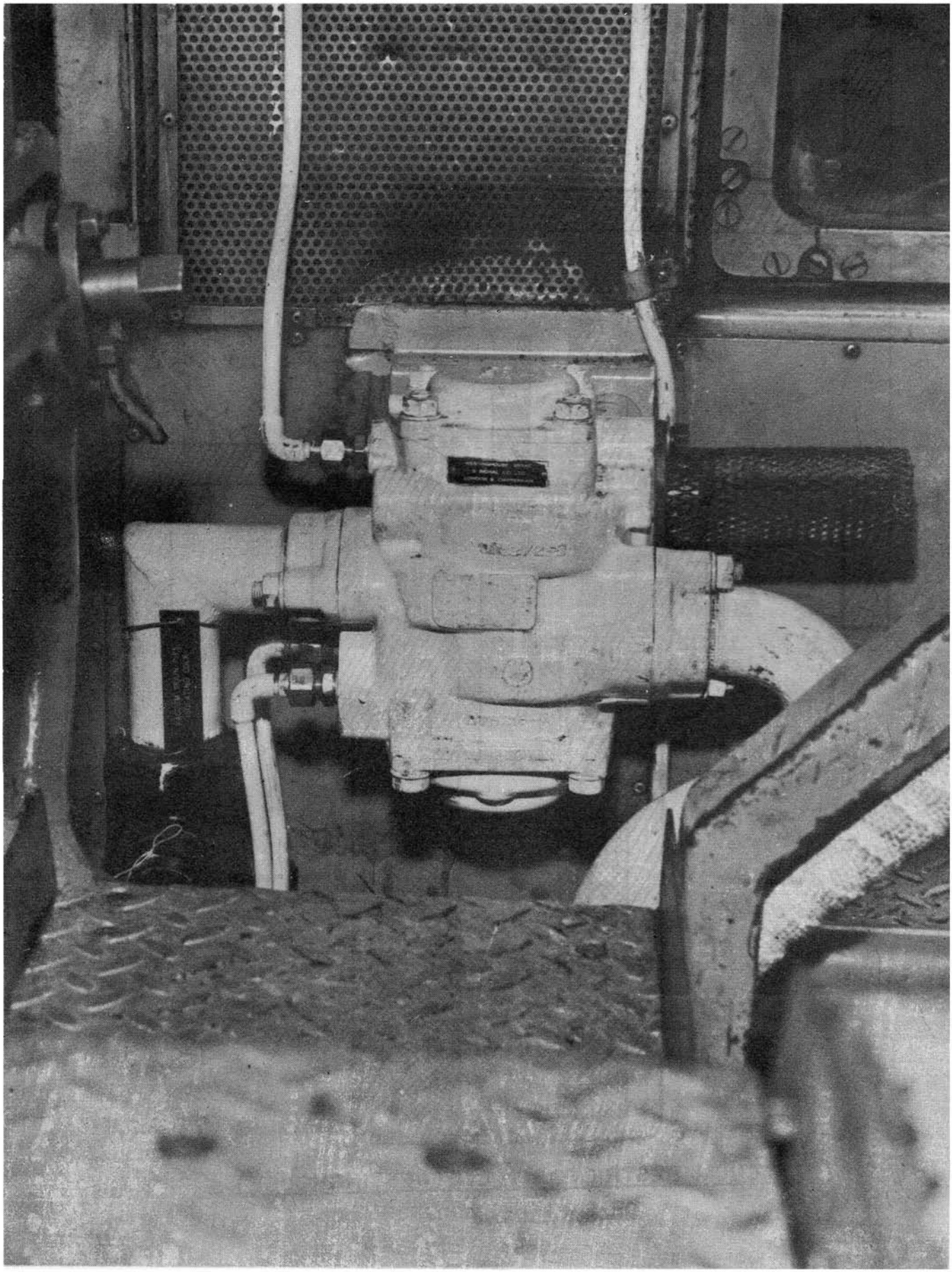




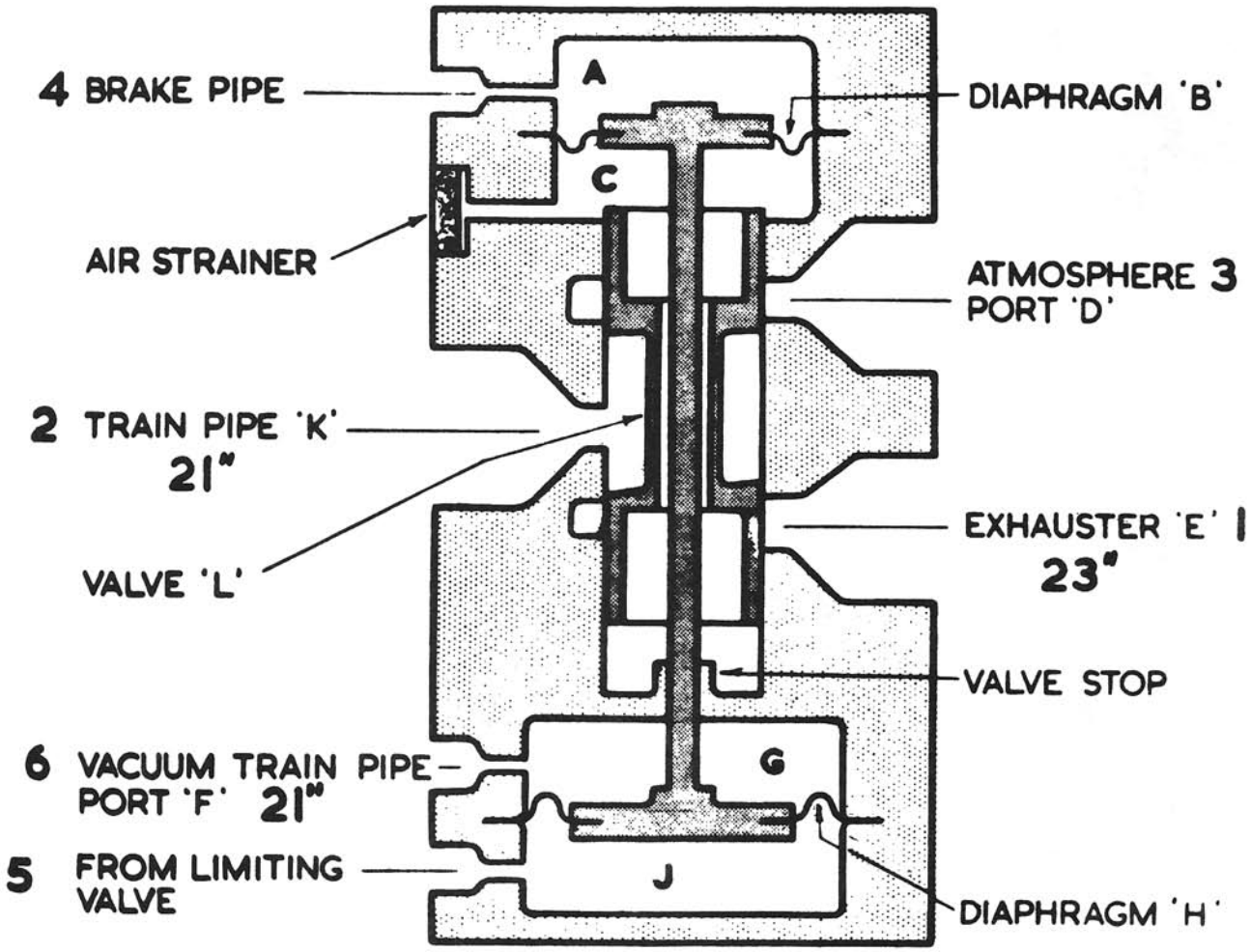
LIMITING VALVE SCHEMATIC



VACUUM RESTRICTOR VALVE (WESTINGHOUSE)
DE-ENERGISED



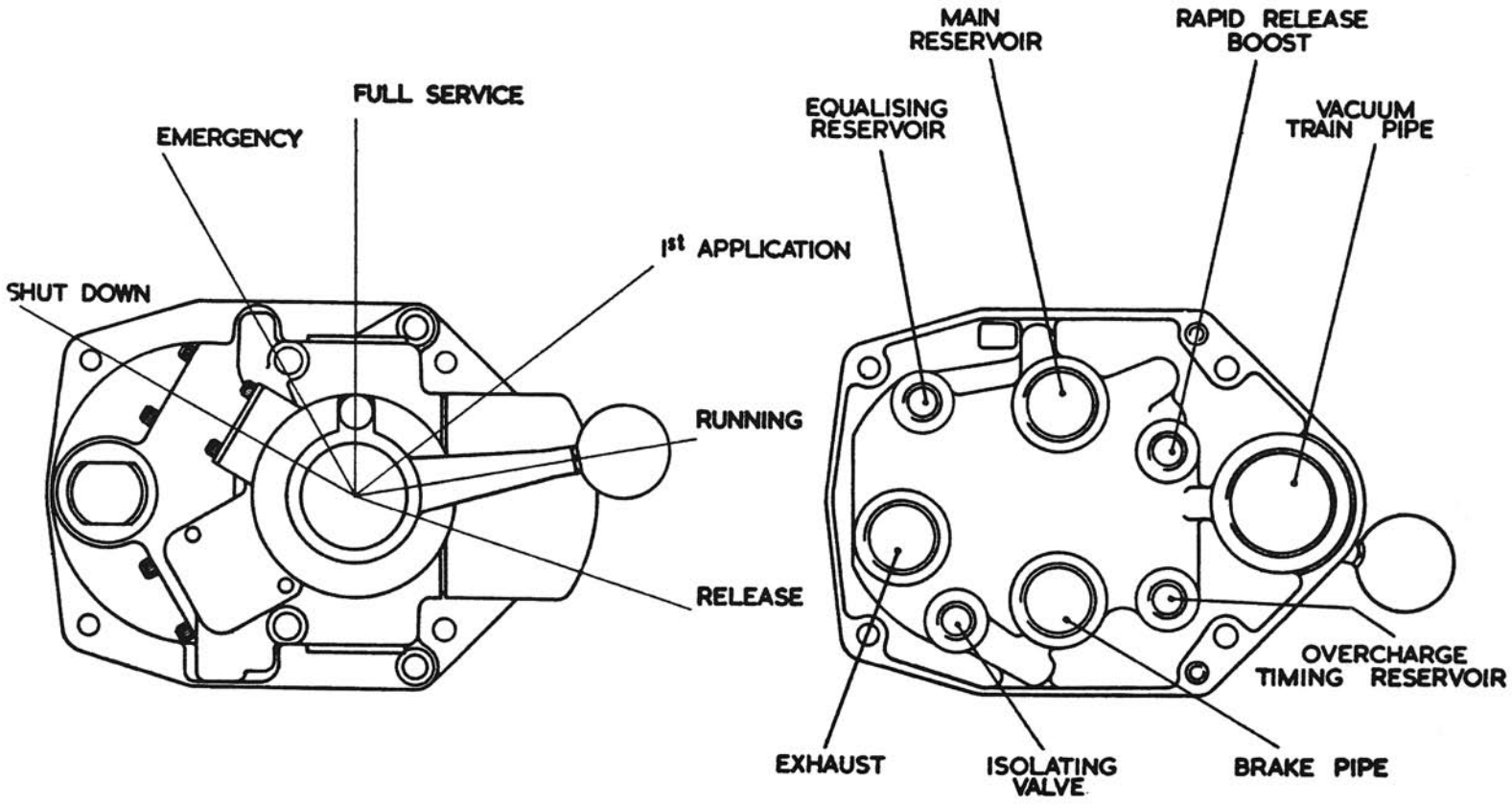
VA 1 CONTROL VALVE



TYPE VAI CONTROL VALVE. WESTINGHOUSE

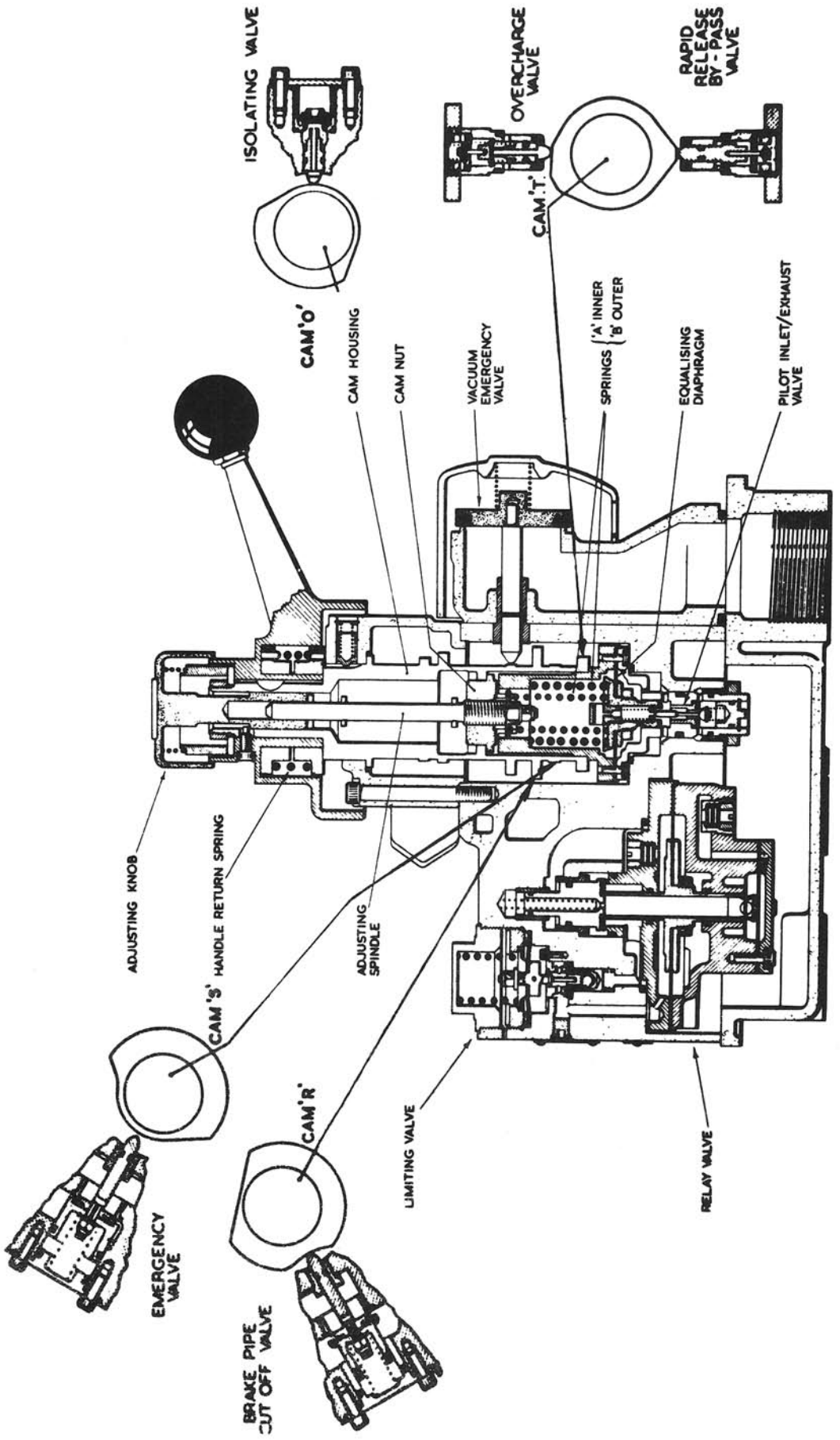
DRIVERS DESK - 1000 CLASS LOCOMOTIVE

M.8.A. DRIVERS BRAKE VALVE WESTINGHOUSE

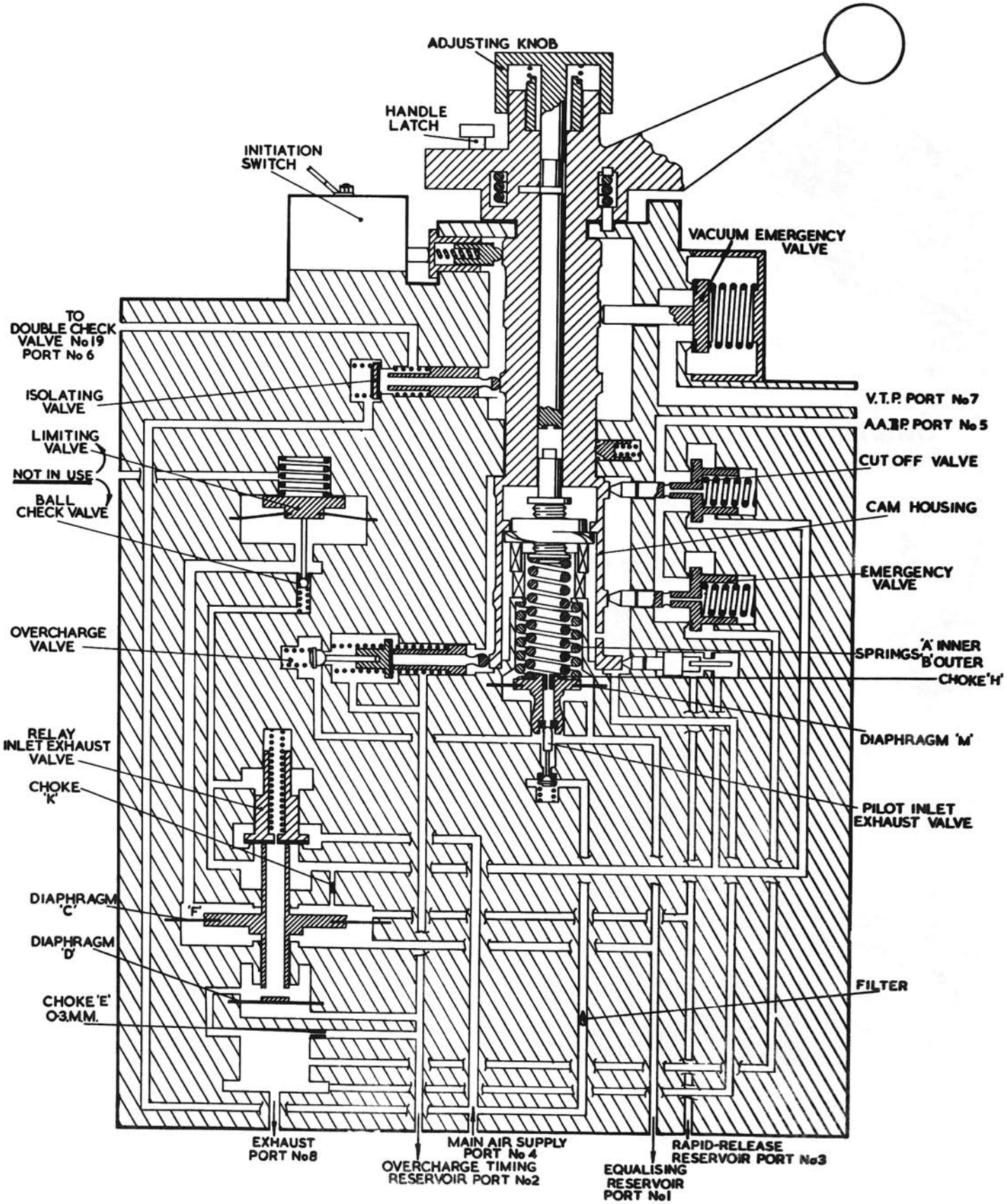


HANDLE POSITION	ISOLATING VALVE	BRAKE PIPE CUT-OFF VALVE	BRAKE PIPE EMERGENCY VALVE	VACUUM EMERGENCY VALVE	OVERCHARGE VALVE	INITIATION SWITCH CONTACTS	BRAKE PIPE PRESSURE	
							lb/sq.in.	Kg/Sq.cm.
RELEASE	CLOSED	FULLY OPEN	CLOSED	CLOSED	INLET OPEN	BROKEN	76	5.4
RUNNING	CLOSED	RESTRICTED OPEN	CLOSED	CLOSED	INLET/EXHAUST CLOSED (BLEED)	BROKEN	70	5.0
1st APPLICATION	CLOSED	FULLY OPEN	CLOSED	CLOSED	EXHAUST OPEN	MADE	63 – 65	4.4 – 4.56
FULL SERVICE	CLOSED	FULLY OPEN	CLOSED	CLOSED	EXHAUST OPEN	MADE	46	3.2
EMERGENCY	CLOSED	CLOSED	OPEN	OPEN	EXHAUST OPEN	MADE	0	0
SHUT-DOWN	OPEN	CLOSED	CLOSED	CLOSED	EXHAUST OPEN	BROKEN	-	-

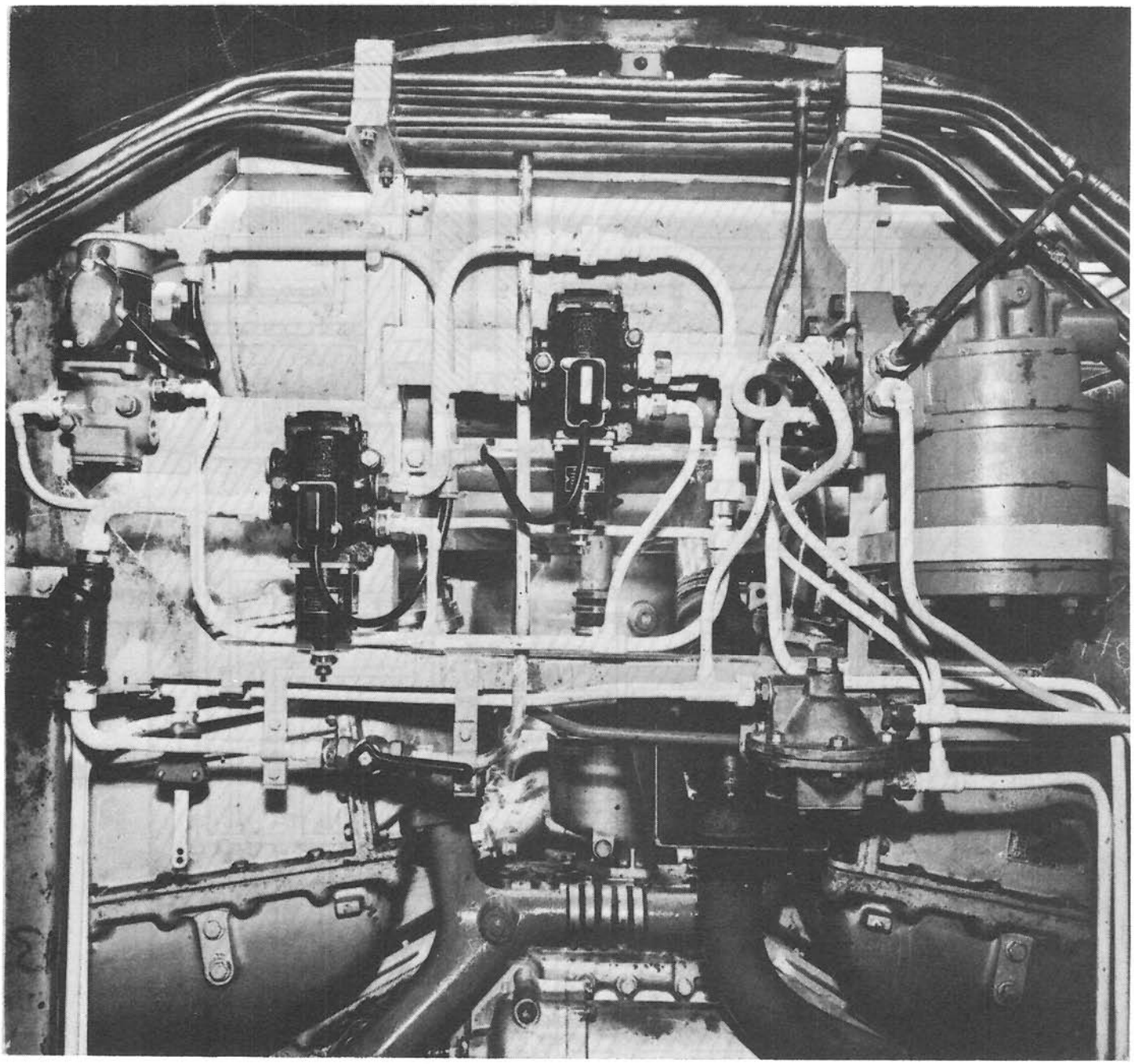
WH



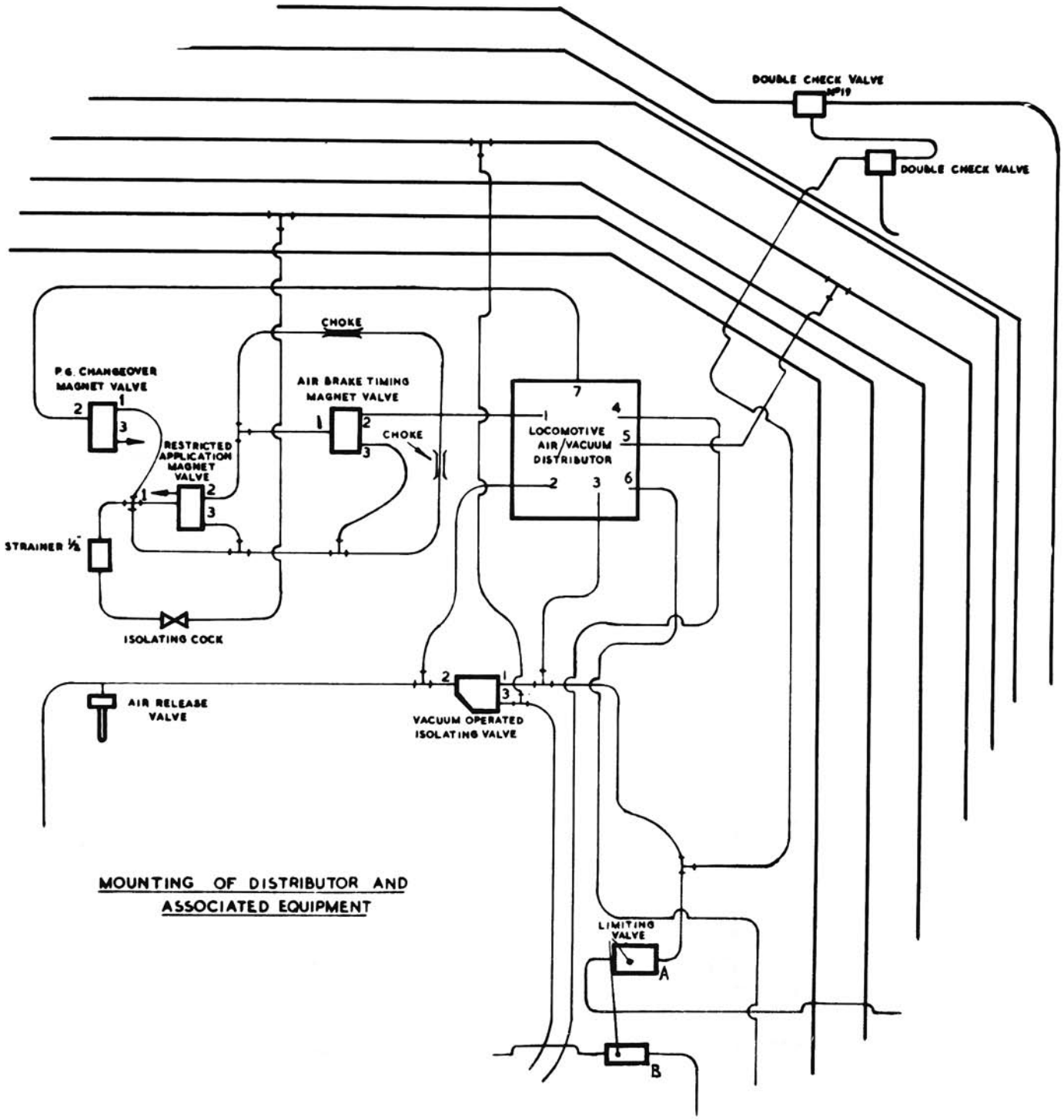
M.8.A. DRIVERS BRAKE VALVE WESTINGHOUSE



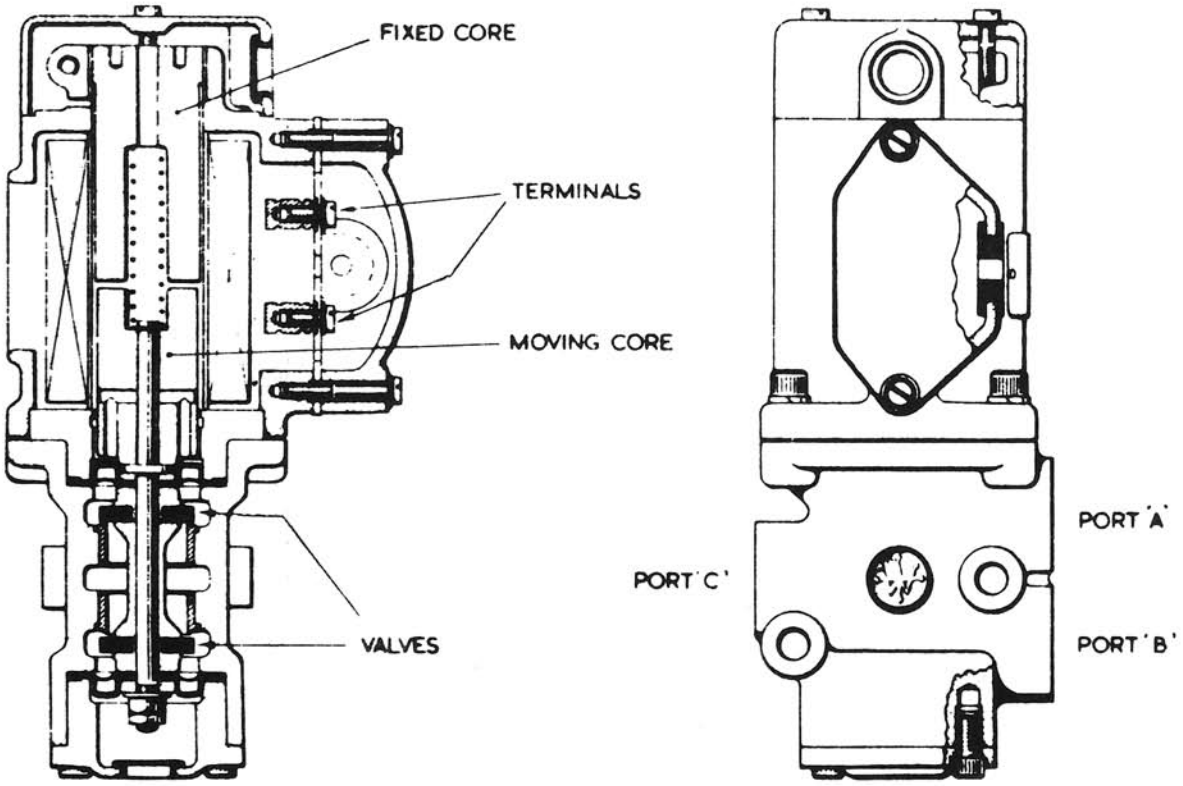
WESTINGHOUSE M.8A. DRIVERS BRAKE VALVE (RUNNING POSITION)



LOCOMOTIVE DISTRIBUTOR AND MAGNET VALVES

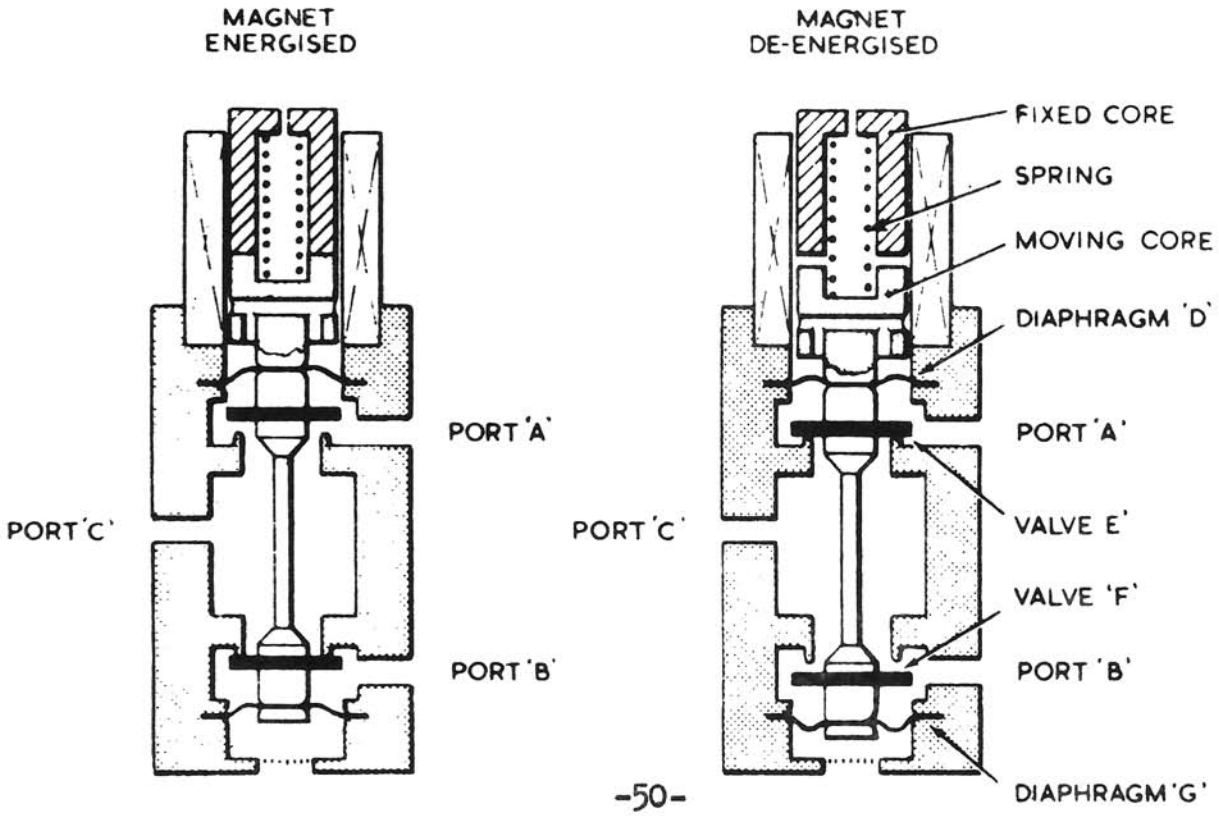


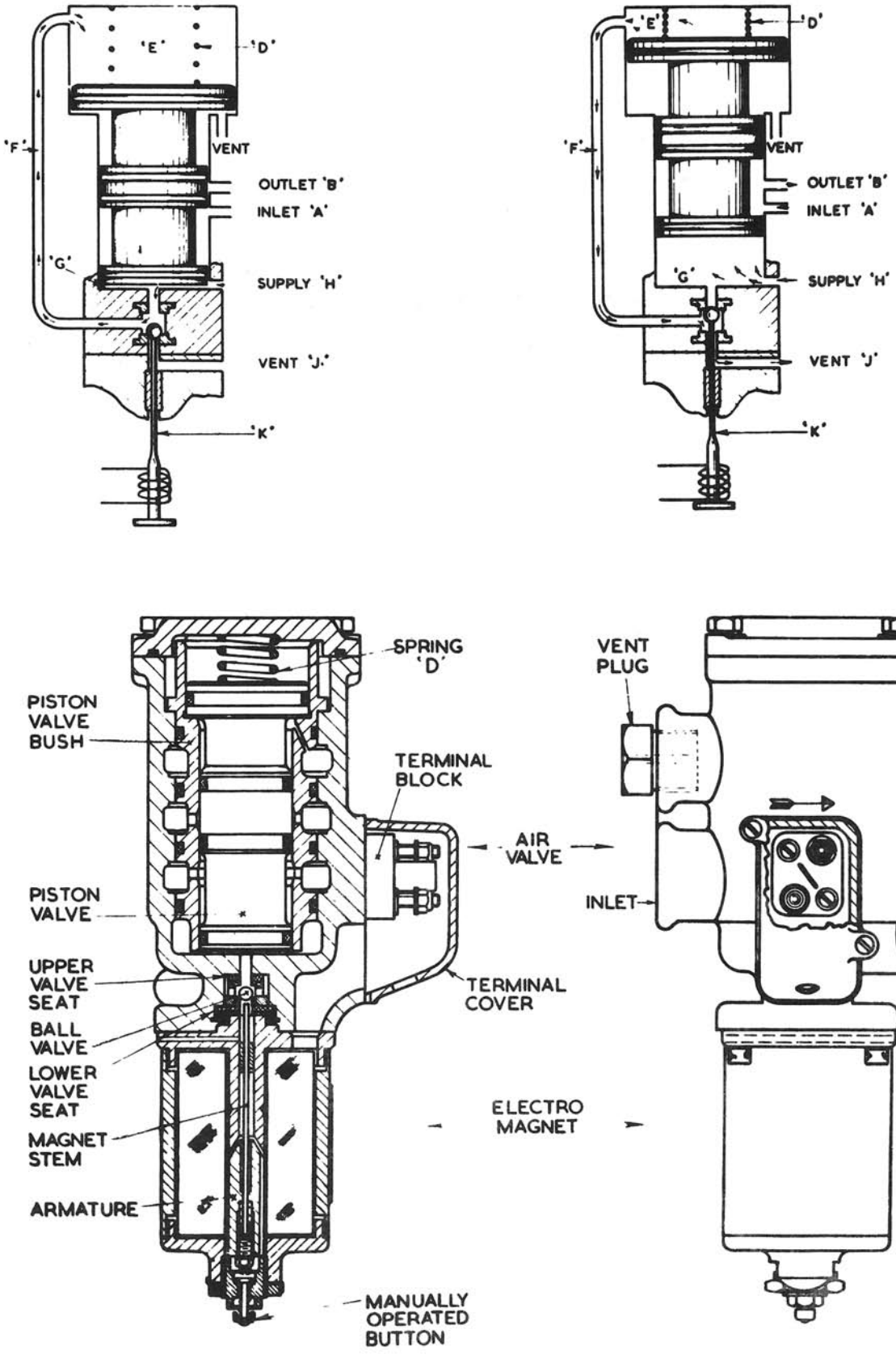
MOUNTING OF DISTRIBUTOR AND ASSOCIATED EQUIPMENT



PASSENGER GOODS CHANGEOVER AND D.S.D.

MAGNET VALVE





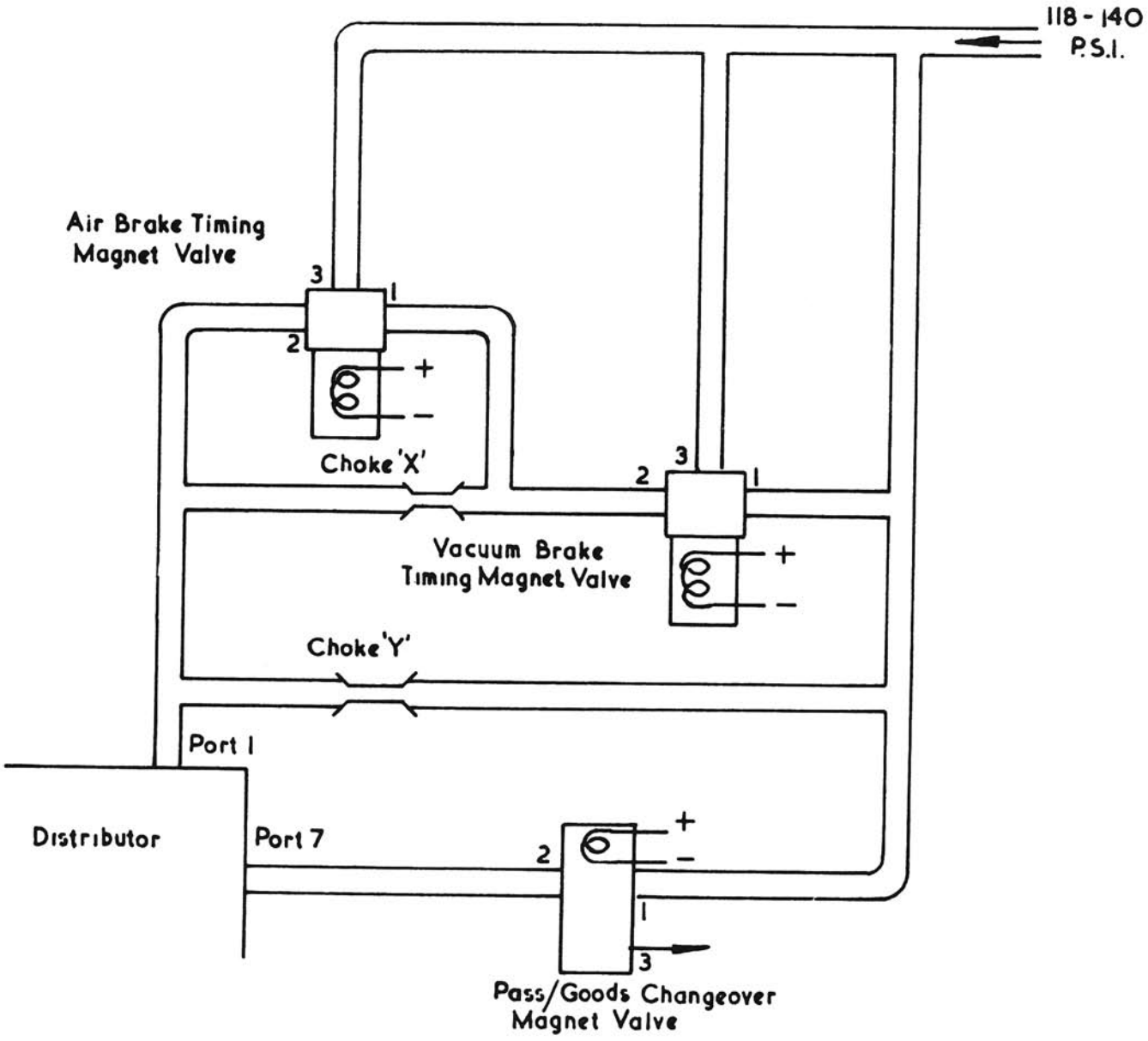
AIR AND VACUUM BRAKE TIMING MAGNET VALVE

BRAKE SELECTOR SWITCH CHART

		VACUUM		AIR	
		GOODS	PASSENGER	PASSENGER	GOODS
1	Air Brake Timing Magnet Valve	De-energised Closed No air passes	De-energised Closed No air passes	Energised Open Air passes	Energised Open Air passes
2	Vacuum Brake Timing Magnet Valve	De-energised Closed No air	Energised Open Air passes	Energised Open Air passes	Energised Open Air passes
3	Passenger/ Goods Changeover Magnet Valve	De-energised Closed No air passes	De-energised Closed No air passes	De-energised Closed No air passes	Energised Open Air passes
4	Brake Application Unit Magnet Valve	Energised Closed	De-energised Open	De-energised Open	De-energised Open

BRAKE SELECTOR SWITCH

VACUUM/AIR PASS/GOODS CONDITION



AIR FLOW TO DISTRIBUTOR WHEN

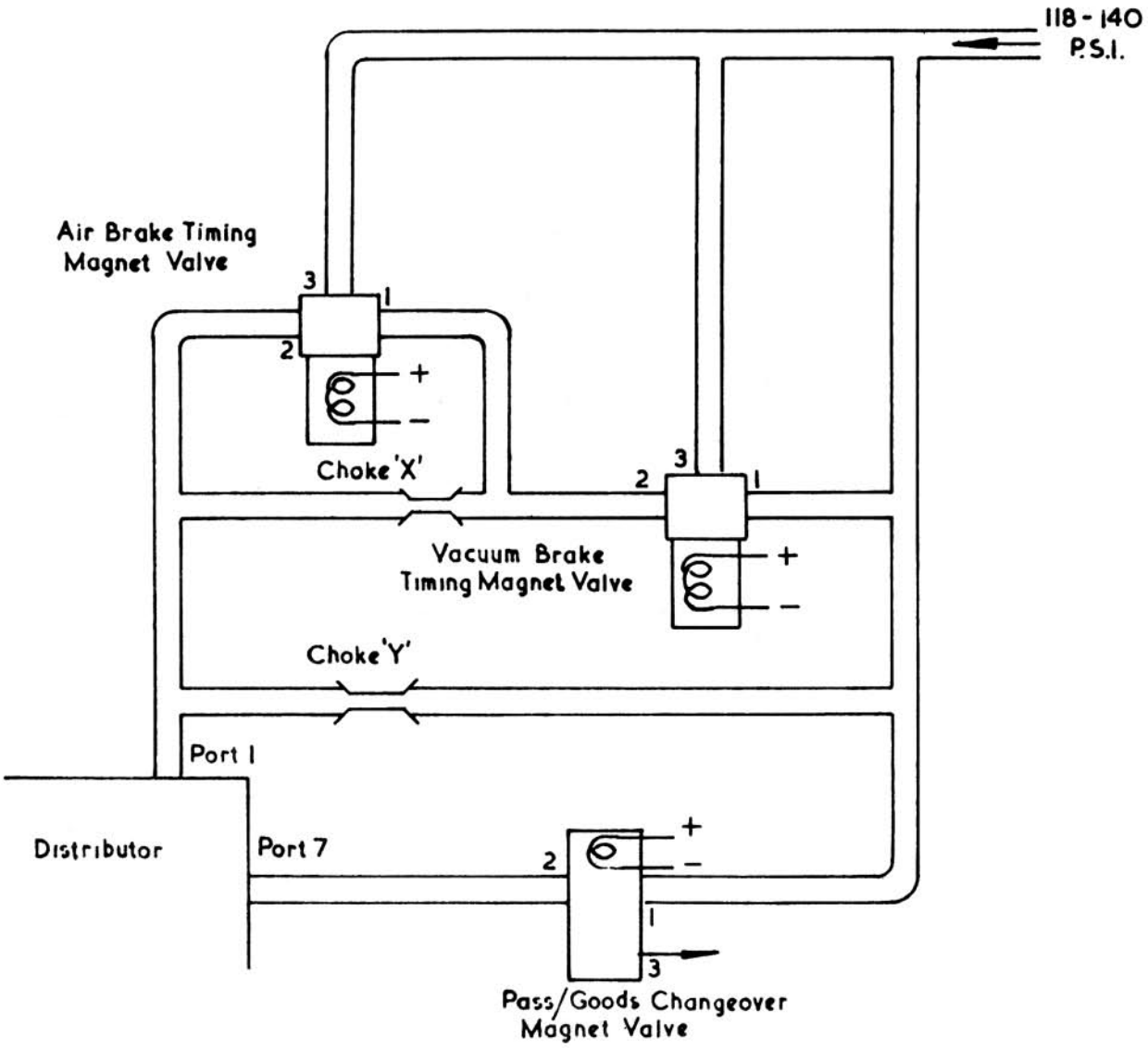
Air Brake Timing Magnet Valve

Vacuum Brake Timing Magnet Valve

Pass/Goods Changeover Magnet Valve

BRAKE SELECTOR SWITCH

VACUUM/AIR PASS/GOODS CONDITION



AIR FLOW TO DISTRIBUTOR WHEN

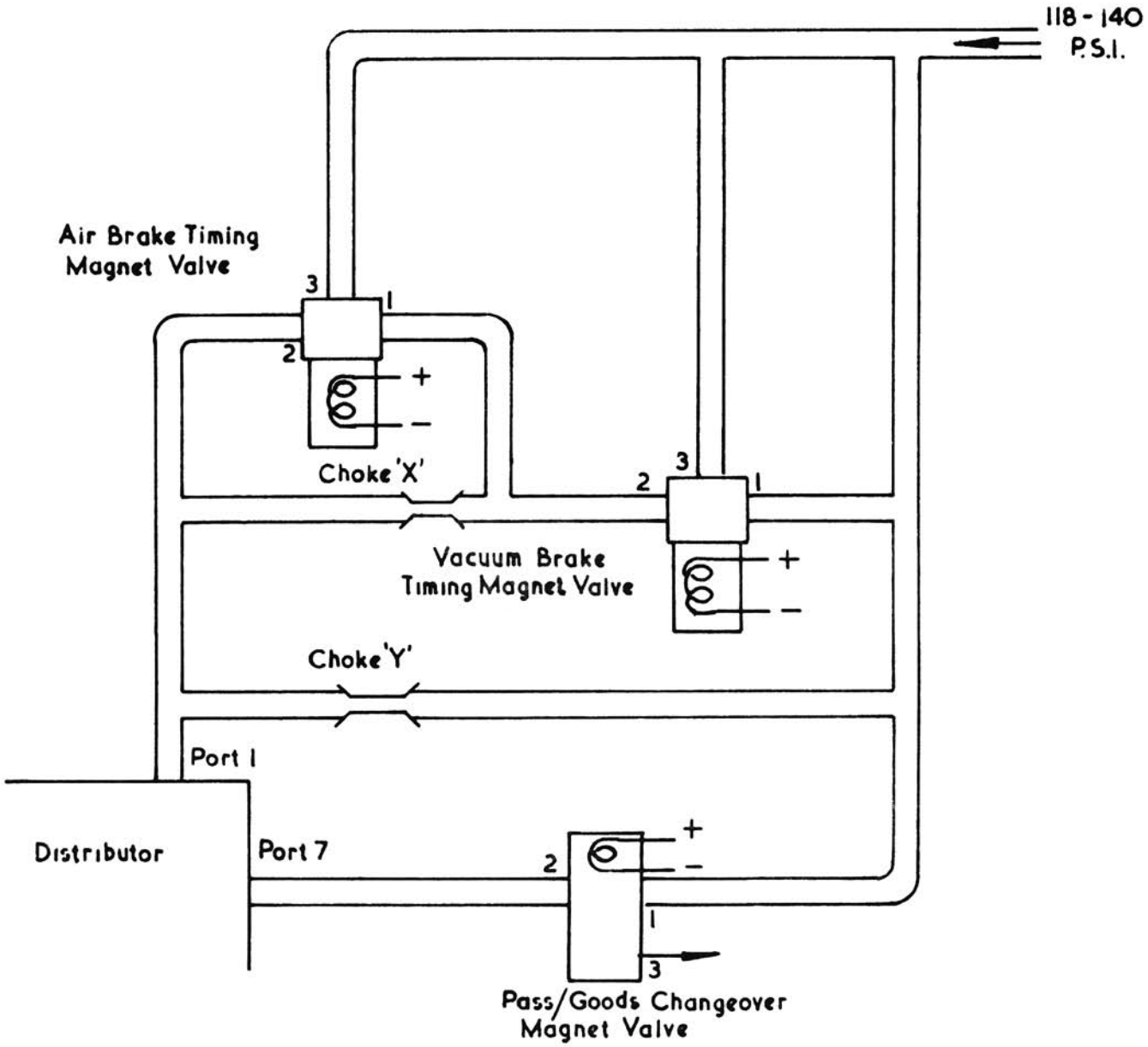
Air Brake Timing Magnet Valve

Vacuum Brake Timing Magnet Valve

Pass/Goods Changeover Magnet Valve

BRAKE SELECTOR SWITCH

VACUUM/AIR PASS/GOODS CONDITION



AIR FLOW TO DISTRIBUTOR WHEN

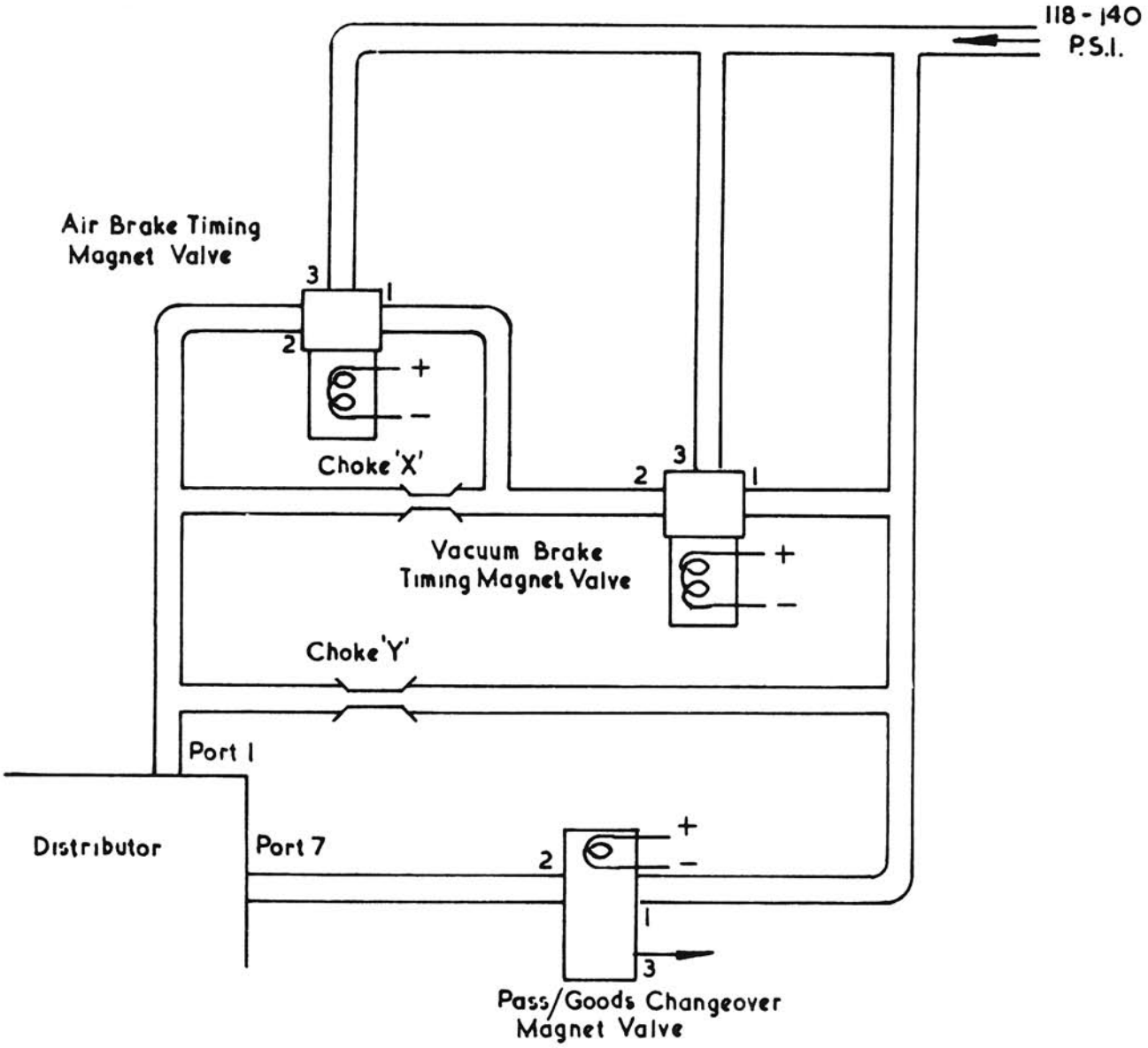
Air Brake Timing Magnet Valve

Vacuum Brake Timing Magnet Valve

Pass/Goods Changeover Magnet Valve

BRAKE SELECTOR SWITCH

VACUUM/AIR PASS/GOODS CONDITION

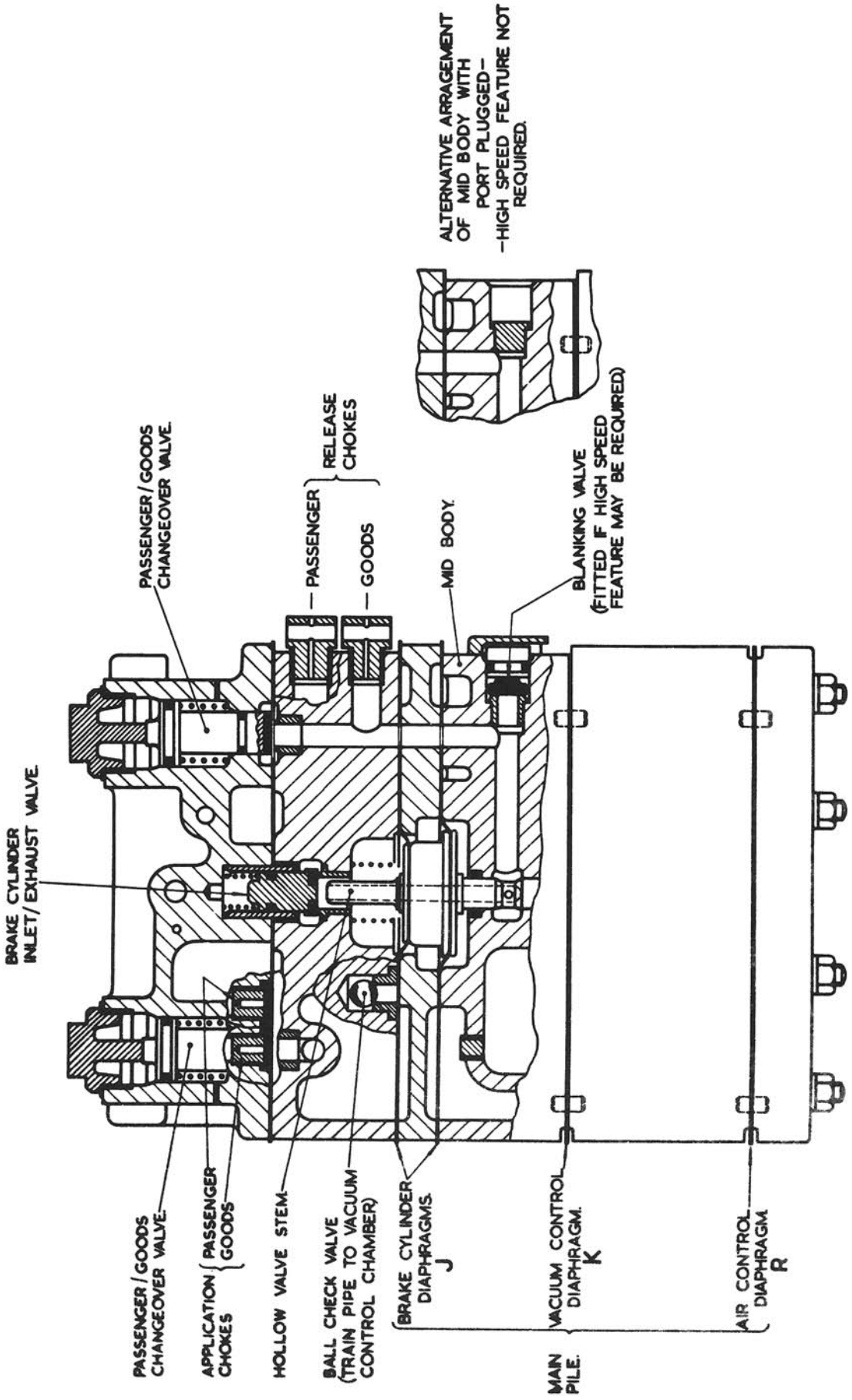


AIR FLOW TO DISTRIBUTOR WHEN

Air Brake Timing Magnet Valve

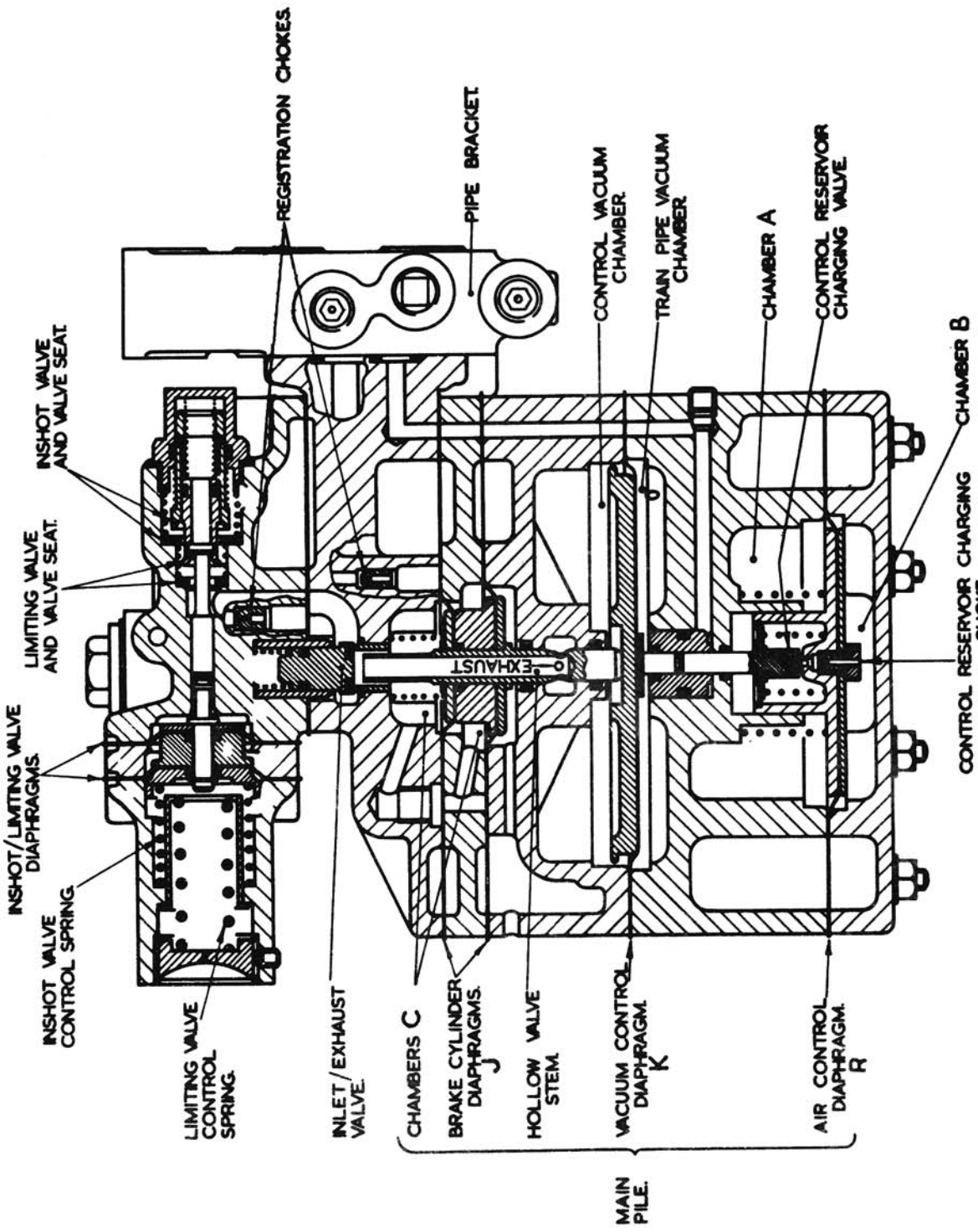
Vacuum Brake Timing Magnet Valve

Pass/Goods Changeover Magnet Valve



SECTIONED VIEW SHOWING PASSENGER/GOODS CHANGEOVER VALVES & CHOKES ALSO ALTERNATIVE ARRANGEMENT OF MID BODY.

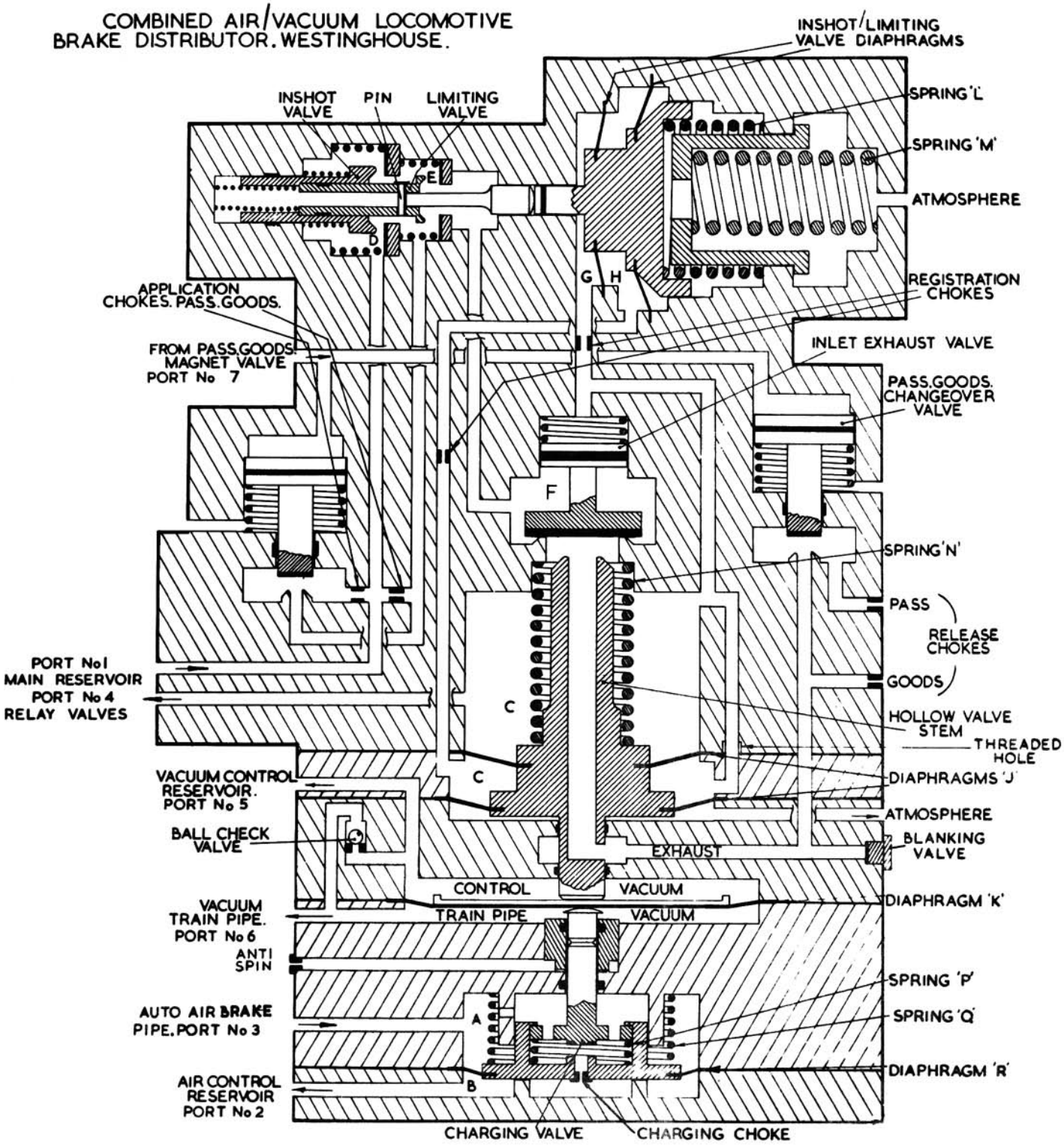
COMBINED AIR VACUUM LOCOMOTIVE BRAKE DISTRIBUTOR

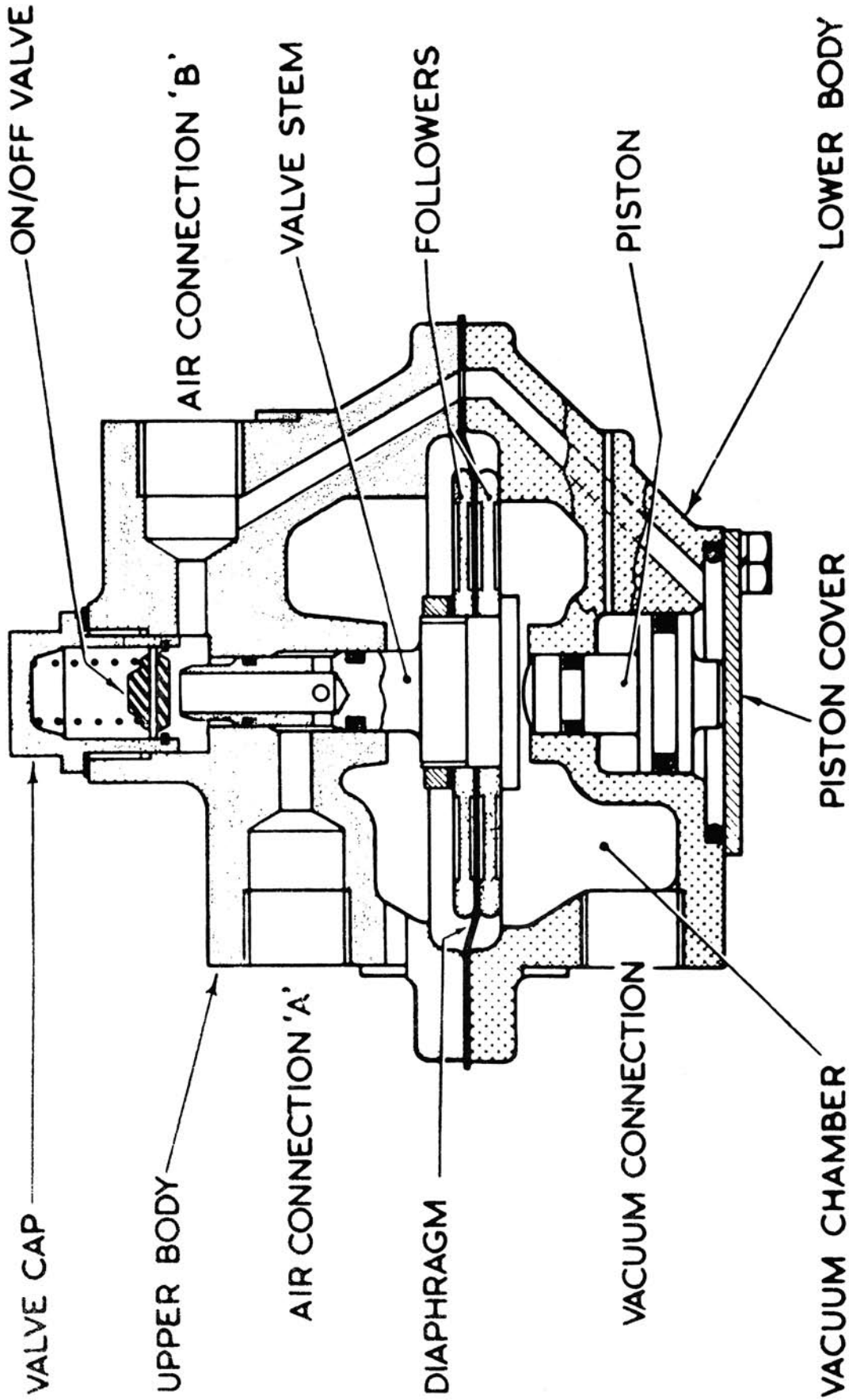


SECTIONED VIEW

COMBINED AIR/VACUUM LOCOMOTIVE BRAKE DISTRIBUTOR

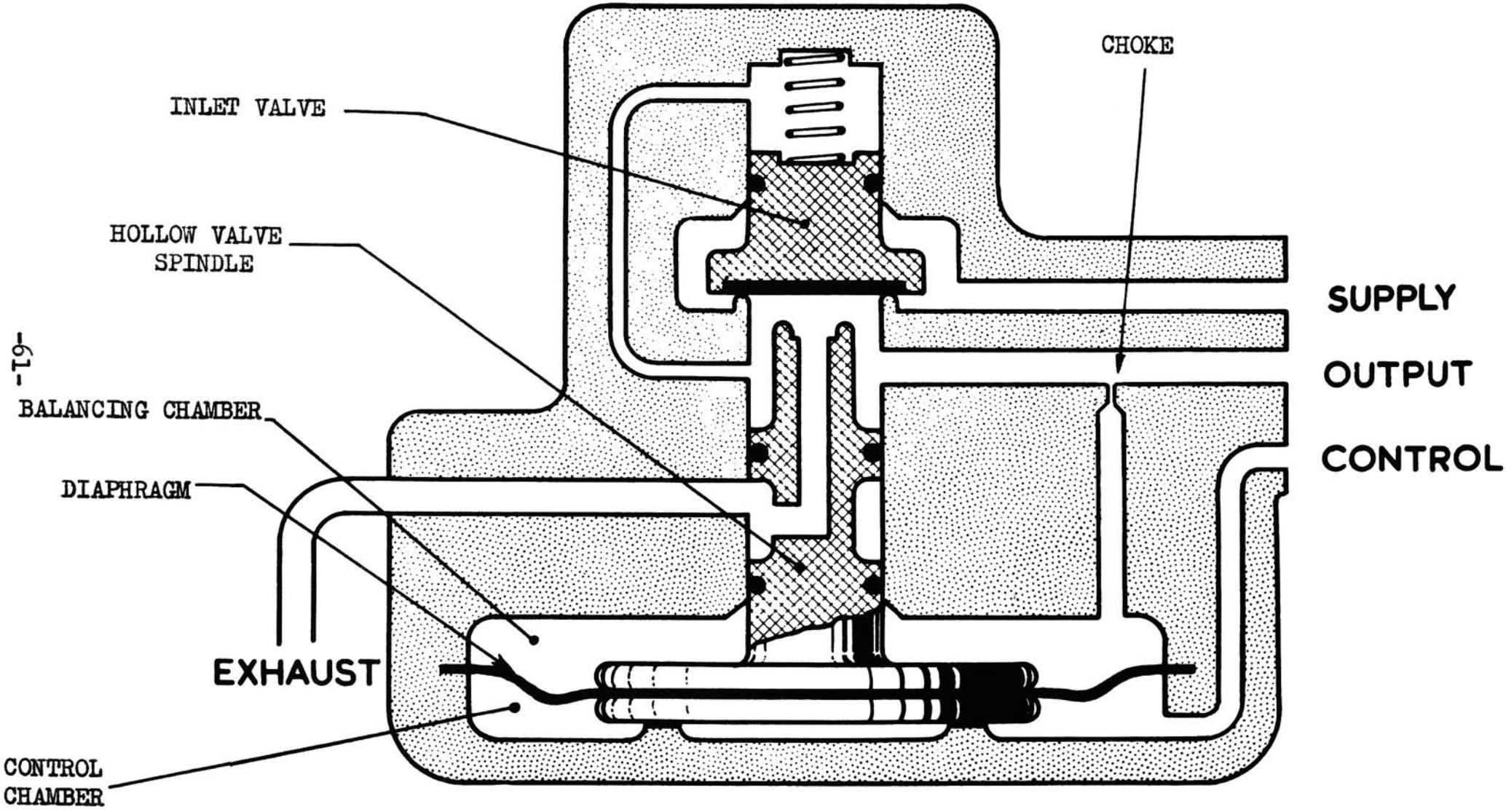
COMBINED AIR/VACUUM LOCOMOTIVE BRAKE DISTRIBUTOR. WESTINGHOUSE.





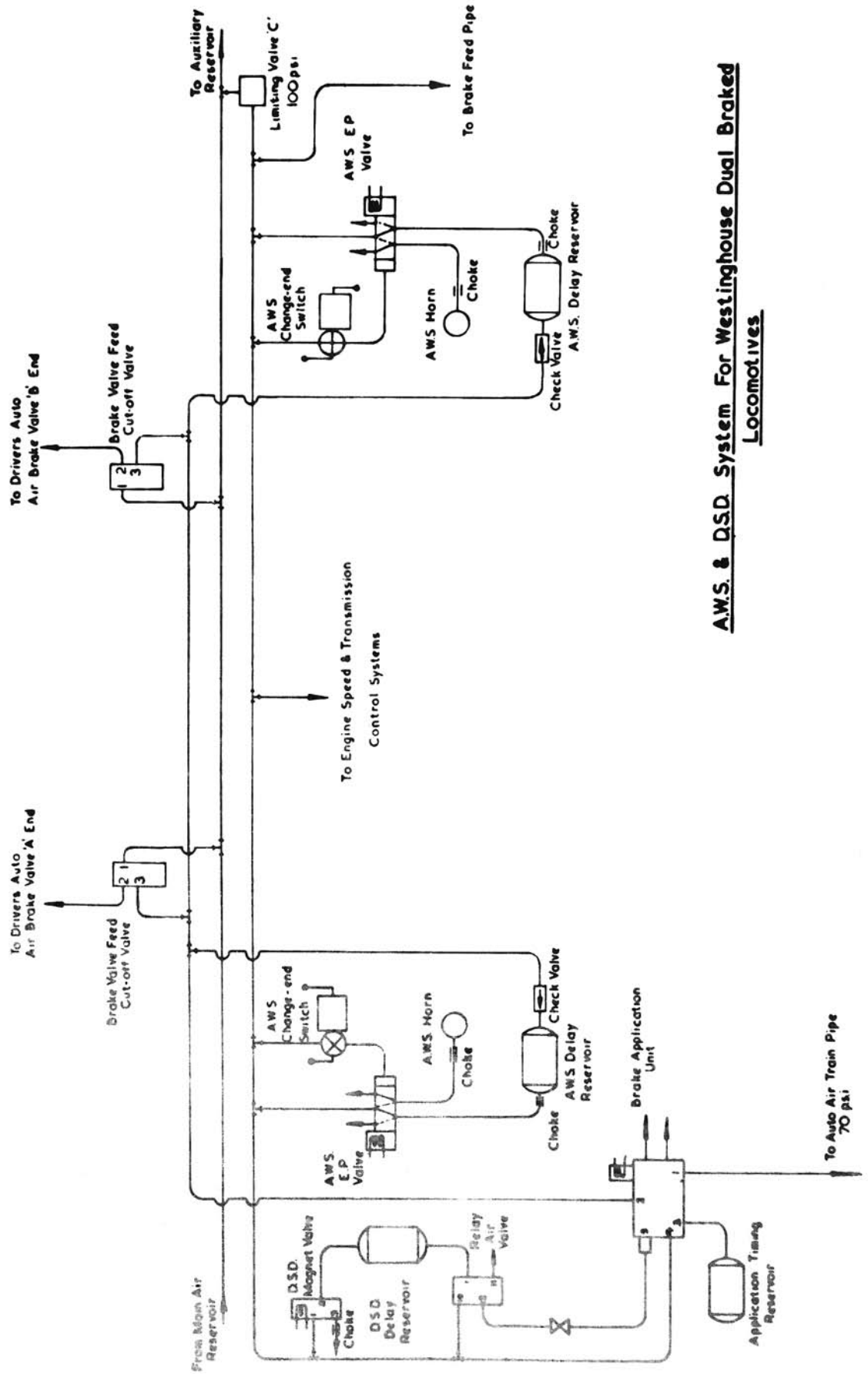
VACUUM OPERATED ISOLATING VALVE

(Shown in Vacuum Condition)

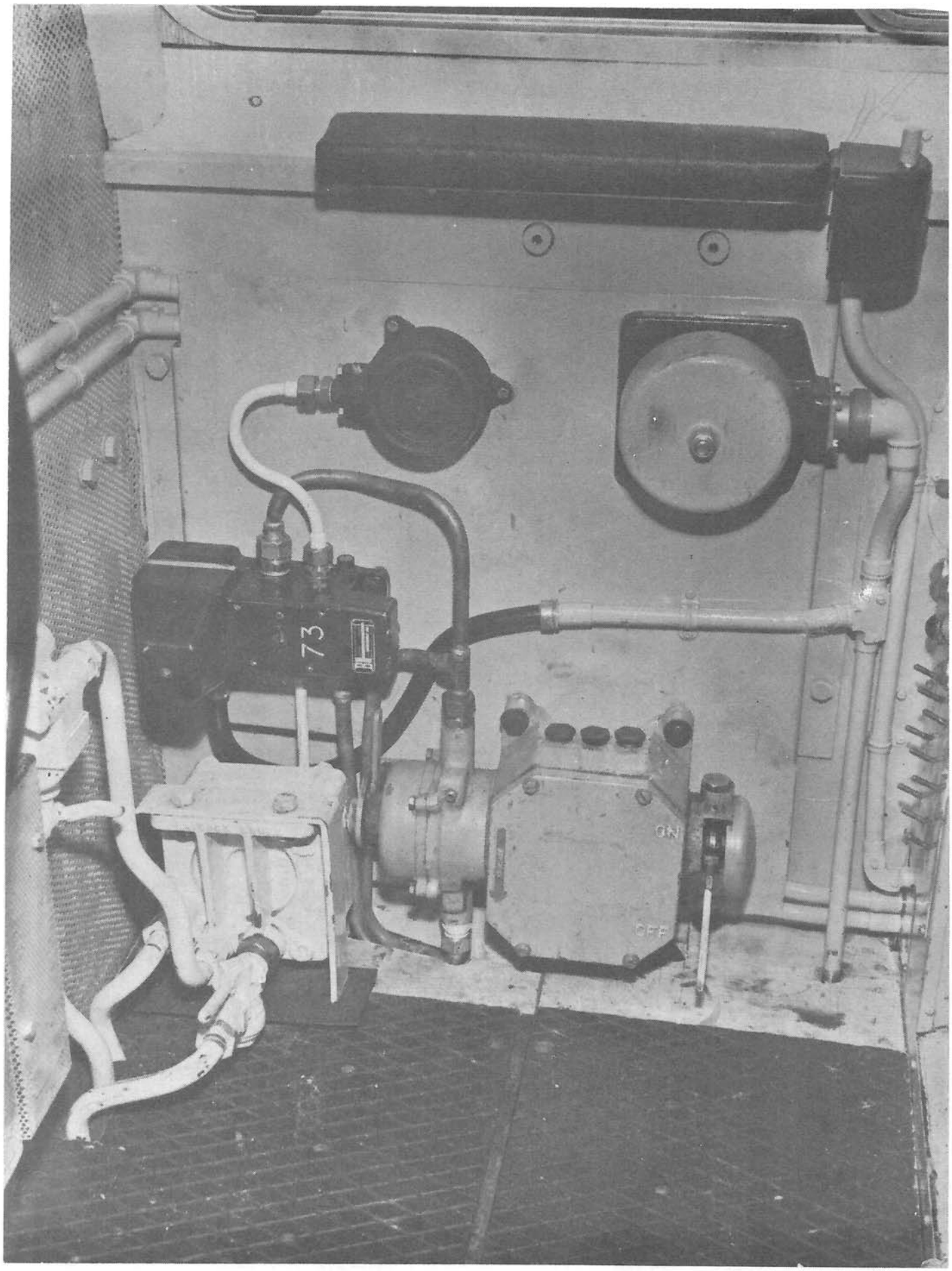


RELAY VALVE (DIAPHRAGM) - WESTINGHOUSE

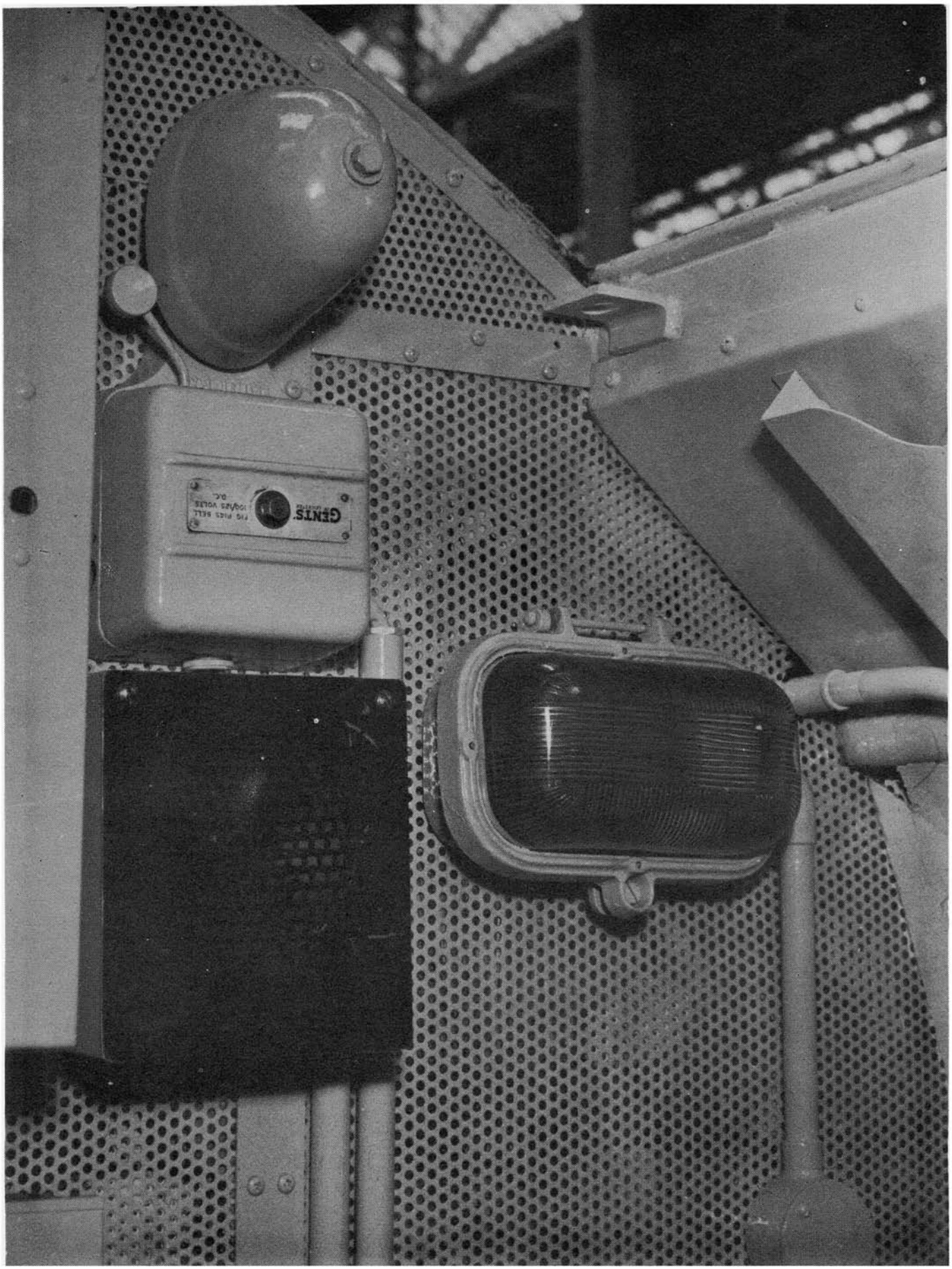
WH



A.W.S. & D.S.D. System For Westinghouse Dual Braked Locomotives



A.W.S. VALVES AND K.R - 1 RELAY VALVE



VIGILANCE CONTROL SPEAKER

Extract from Memorandum issued by The Railway Technical Centre, DERBY.
July, 1968.

MAIN LINE LOCOMOTIVES - D.S.D. EQUIPMENT
SOME NOTES FOR LOCOMOTIVE DRIVERS

Certain locomotives are now appearing fitted with the new-style D.S.D. Equipment and a slightly different technique is required.

The driver's D.S.D. foot pedal switch has three positions:-

1. OFF position
2. MID position
3. FULLY DEPRESSED position

The MID position requires only a light pressure and has the same function as the old type of D.S.D. foot pedal.

The FULLY DEPRESSED position requires a heavier foot pressure and its purpose is to cancel a D.S.D. application.

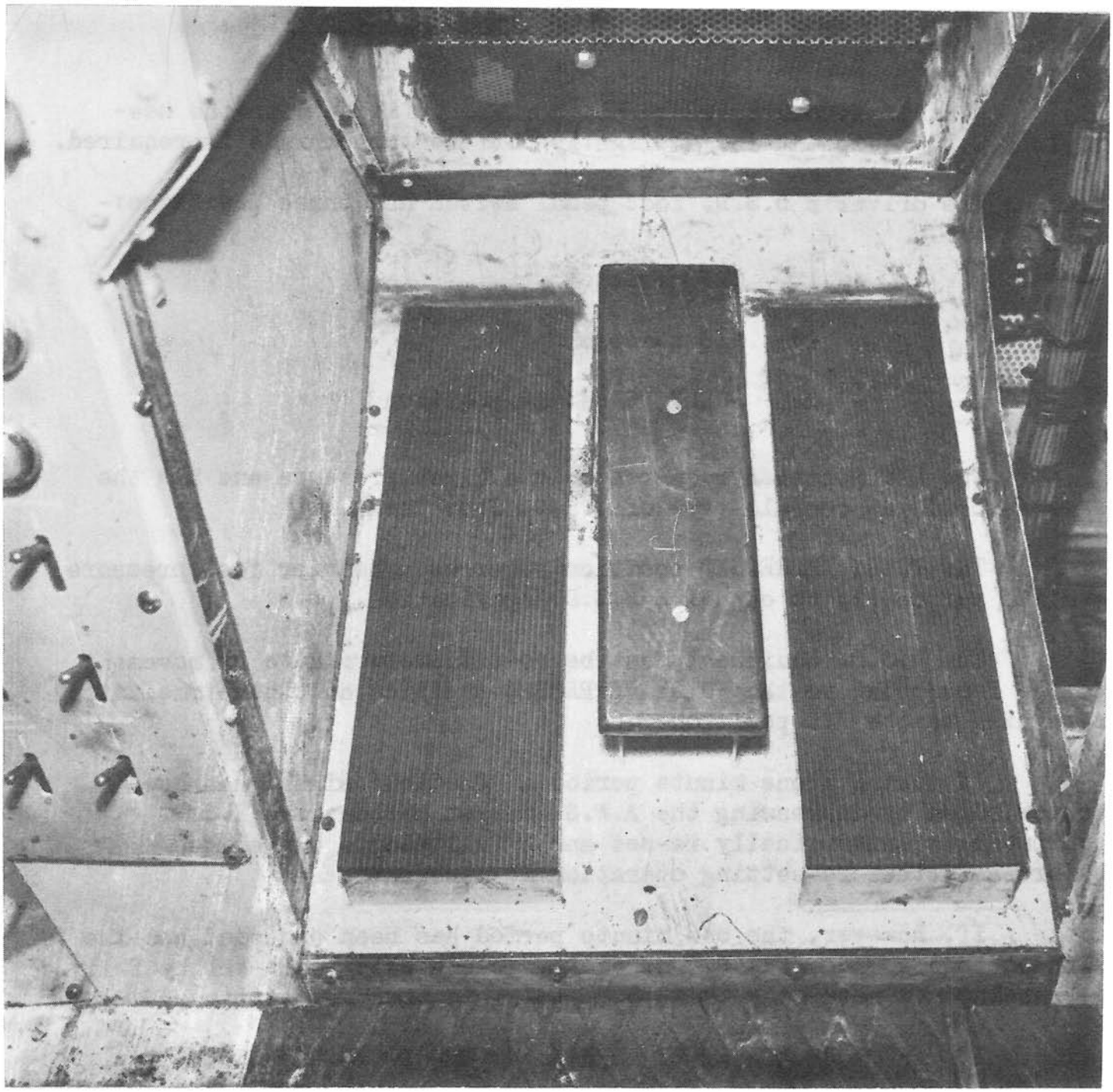
The D.S.D. Equipment must be re-set every minute by movement of the foot pedal to the FULLY DEPRESSED position and then immediately returning to the MID position.

If during a one minute period a 'Caution' signal has been acknowledged by depressing the A.W.S. re-set button, the D.S.D. equipment is automatically re-set and a full minute can elapse before a further re-setting operation is necessary.

If, however, the one minute period has been exceeded and the warning tone sounds, the D.S.D. equipment can only be re-set by fully depressing and returning the D.S.D. pedal to the MID position.

IT CANNOT BE RE-SET BY DEPRESSING THE A.W.S. RE-SET SWITCH

Consequently, after the driver's normal preparation and starting procedure, the following must be carried out:-



DRIVERS D.S.D. FOOT PEDAL

1. Select FORWARD or REVERSE on the Master Controller.

2. Fully depress D.S.D. foot pedal switch and immediately return to MID position.

   The Locomotive can now be moved under power.

3. The D.S.D. Equipment must be re-set every minute whilst the Master Controller handle is in the FORWARD or REVERSE position.

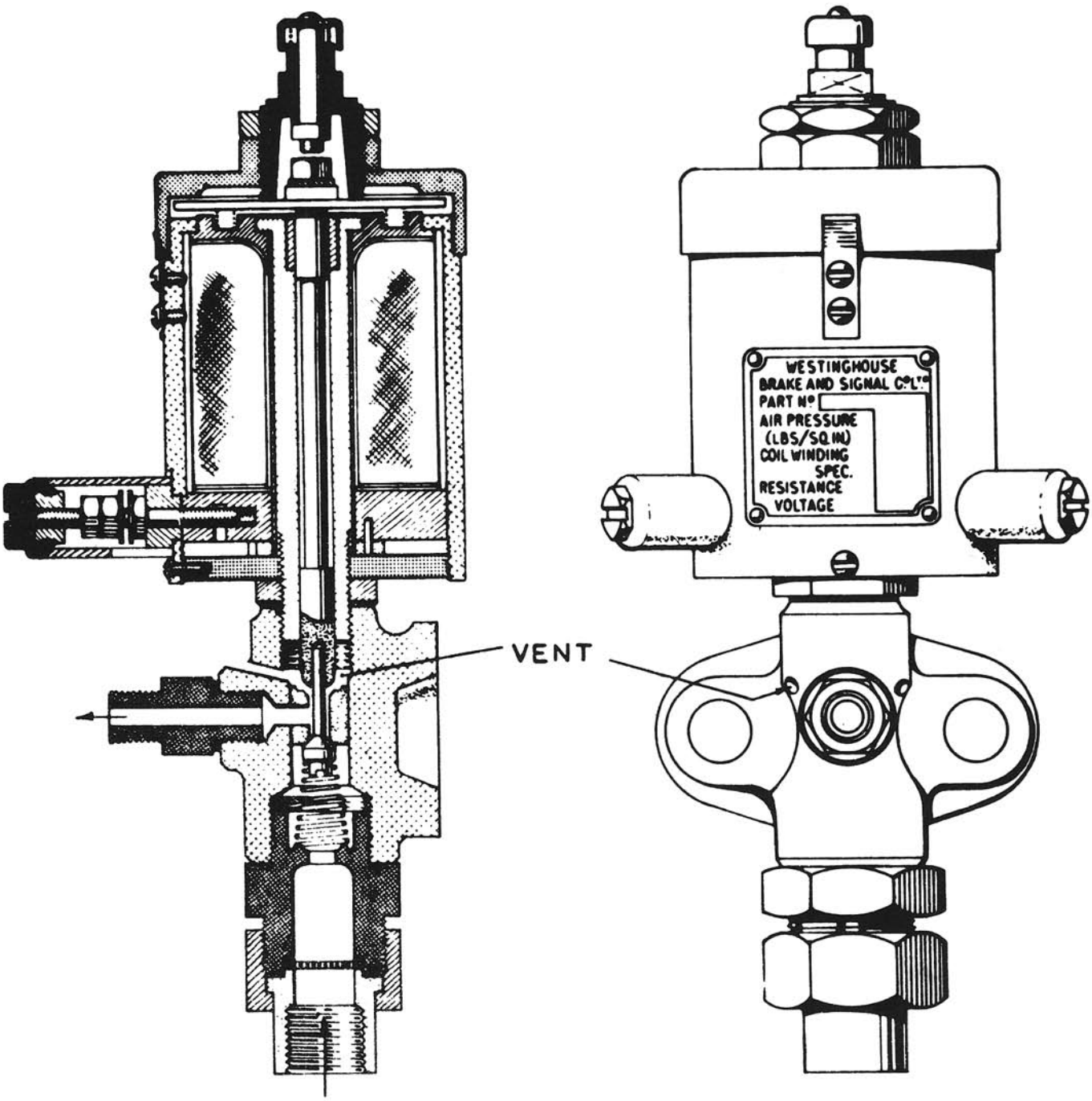
If the D.S.D. Equipment is not re-set, the warning tone will sound and 5 to 7 seconds later the vacuum train pipe will be destroyed and thus a brake application made.

Two D.S.D. Push Buttons are provided in each cab and can be used as an alternative to the D.S.D. foot pedal switch. Each Push Button has the three positions, namely:-

1. OFF position

2. MID position

3. FULLY DEPRESSED position



D.S.D. MAGNET VALVE P9.A.

D.S.D. SYSTEM

D.S.D. Magnet Valve kept energised by "Vigilance Control". Air at 100 p.s.i. passes through Magnet Valve, when energised to D.S.D. Delay Reservoir, and to port No. 1 of Relay Air Valve.

Air at 100 p.s.i. also enters:-

(a) Relay Air Valve at port No. 10.

(b) Brake Application Unit at port No. 4, and out at port No. 5 to port No. 12 of Relay Air Valve.

OPERATION

When D.S.D. Magnet Valve de-energised, air from port No. 1 of Relay Air Valve will pass to atmosphere via D.S.D. Delay Reservoir and choke in D.S.D. Magnet Valve.

When pressure reaches 50 p.s.i. on underside of diaphragm in Relay Air Valve, valve will move down and allow air coming in at port No. 12 from Brake Application Unit to atmosphere.

A.W.S. SYSTEM

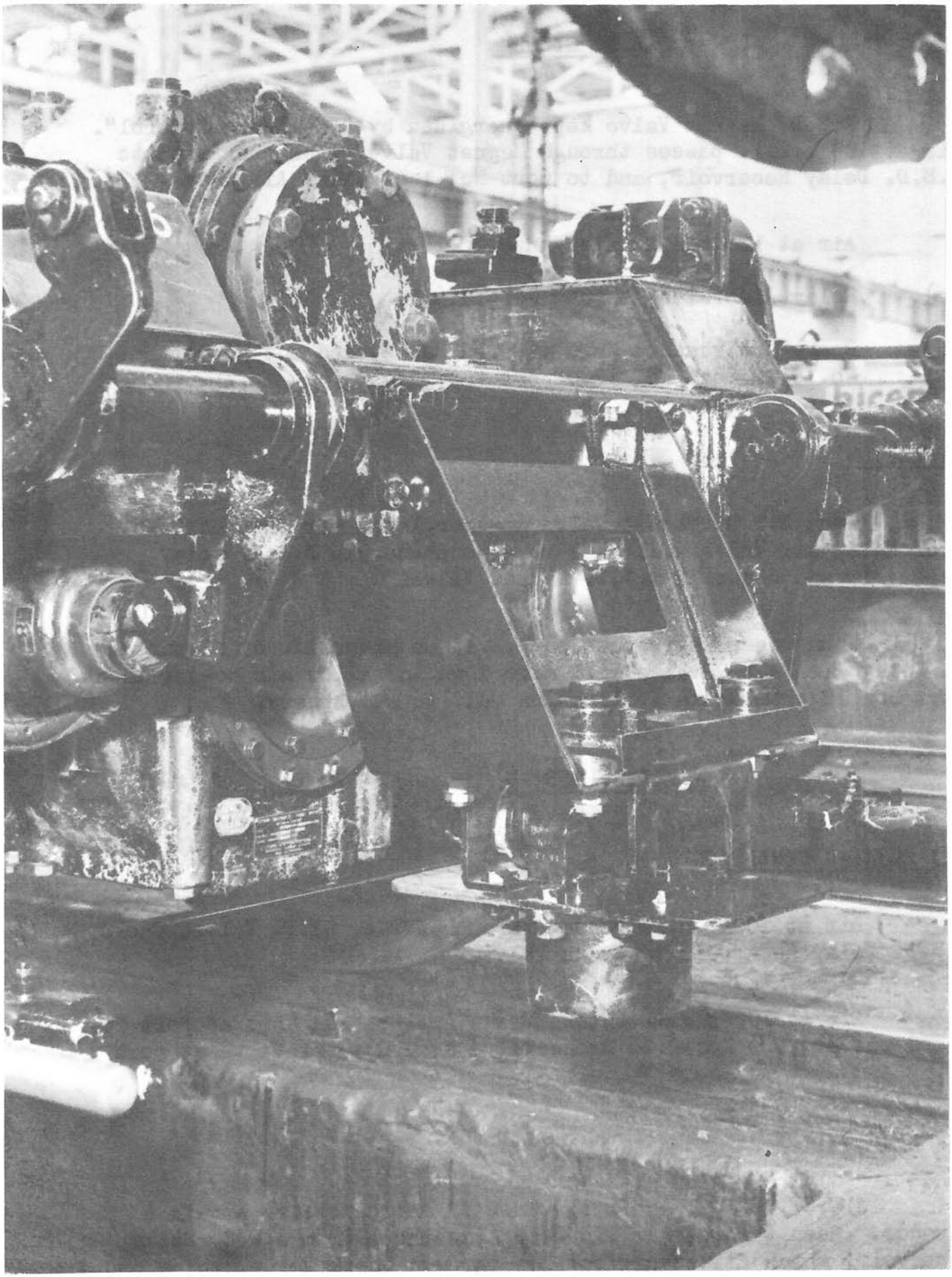
(1) RUNNING CONDITION

Air at 100 p.s.i. passes through A.W.S. E.P. Valve, Choke, A.W.S. Delay Reservoir to Check Valve.

Air at 100 p.s.i. enters Brake Application Unit at port No. 4 and out at port No. 2 to Brake Valve Feed Cut-off Valve at port No. 3 and down to Check Valve.

(2) APPLICATION

A.W.S. E.P. Valve will throw if not cancelled within 3 seconds. When thrown, air flows to atmosphere from A.W.S. Delay Reservoir, which allows air to flow through Check Valve, which drops pressure at Brake Valve Feed Cut-off Valve and at port No. 2 of Brake Application Unit.



A.W.S. RECEIVER

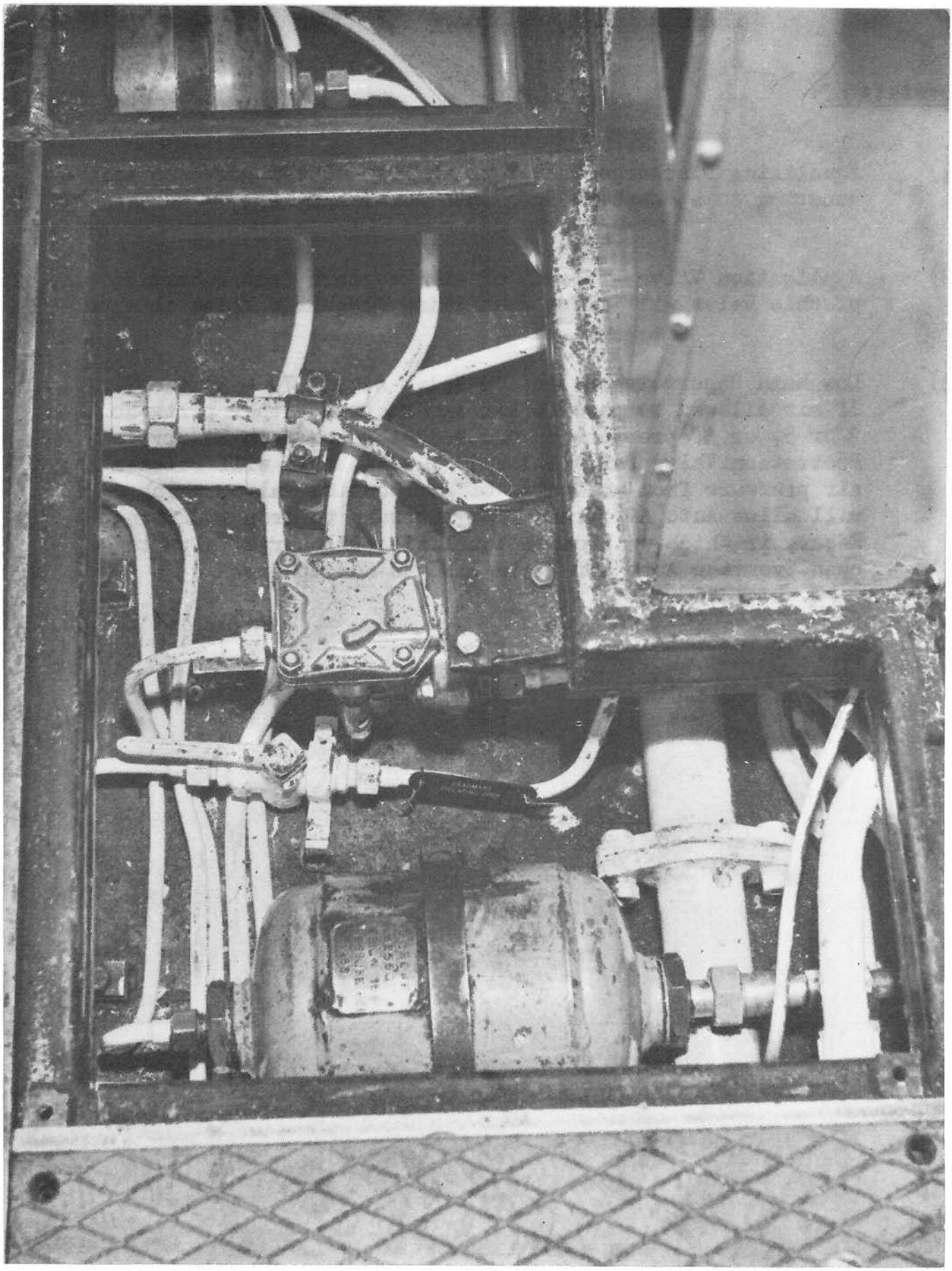
BRAKE APPLICATION UNIT

Consists of:-

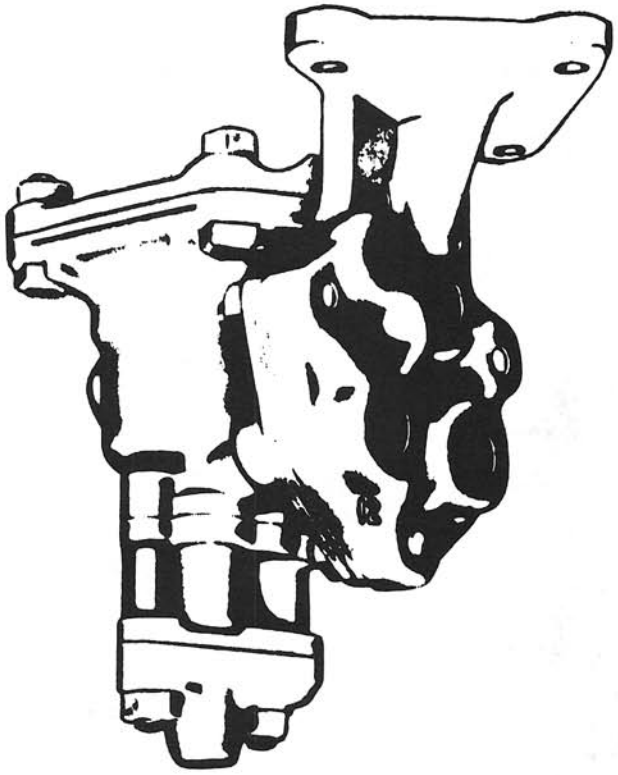
(1) Equalising Discharge Valve, which when closed prevents air escaping to atmosphere from Auto Air Train Pipe.

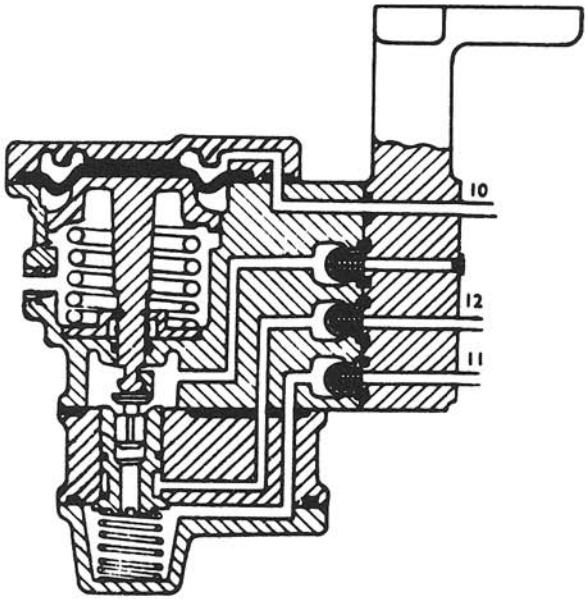
(2) Application Valve, release of air pressure from underside of this valve will cause Equalising Discharge Valve to open.

(3) Low Main Reservoir Protection Valve set at 70 - 90 p.s.i. If air allowed to pass to atmosphere from either ports No. 2 or 5, or if pressure on underside of Low Main Reservoir Protection Valve falls below 70 p.s.i., this will release air pressure from underside of Application Valve, which will allow Auto Air Train Pipe pressure to drop in Timing Reservoir which will cause Equalising Discharge Valve to open, venting Auto Air Train Pipe to atmosphere.

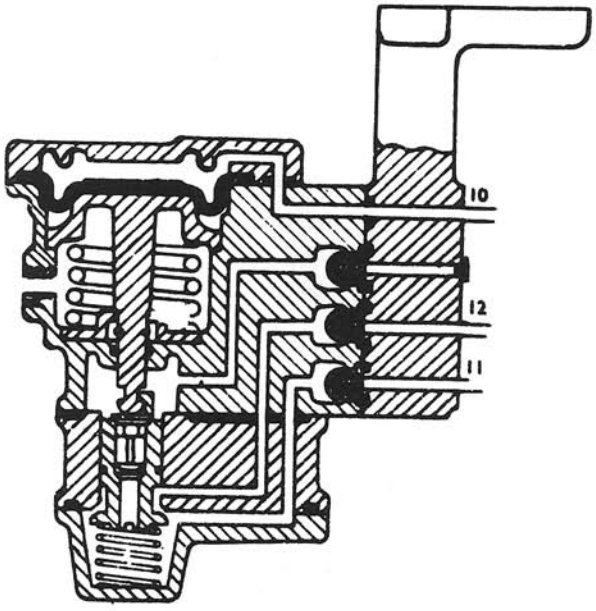


RELAY AIR VALVE



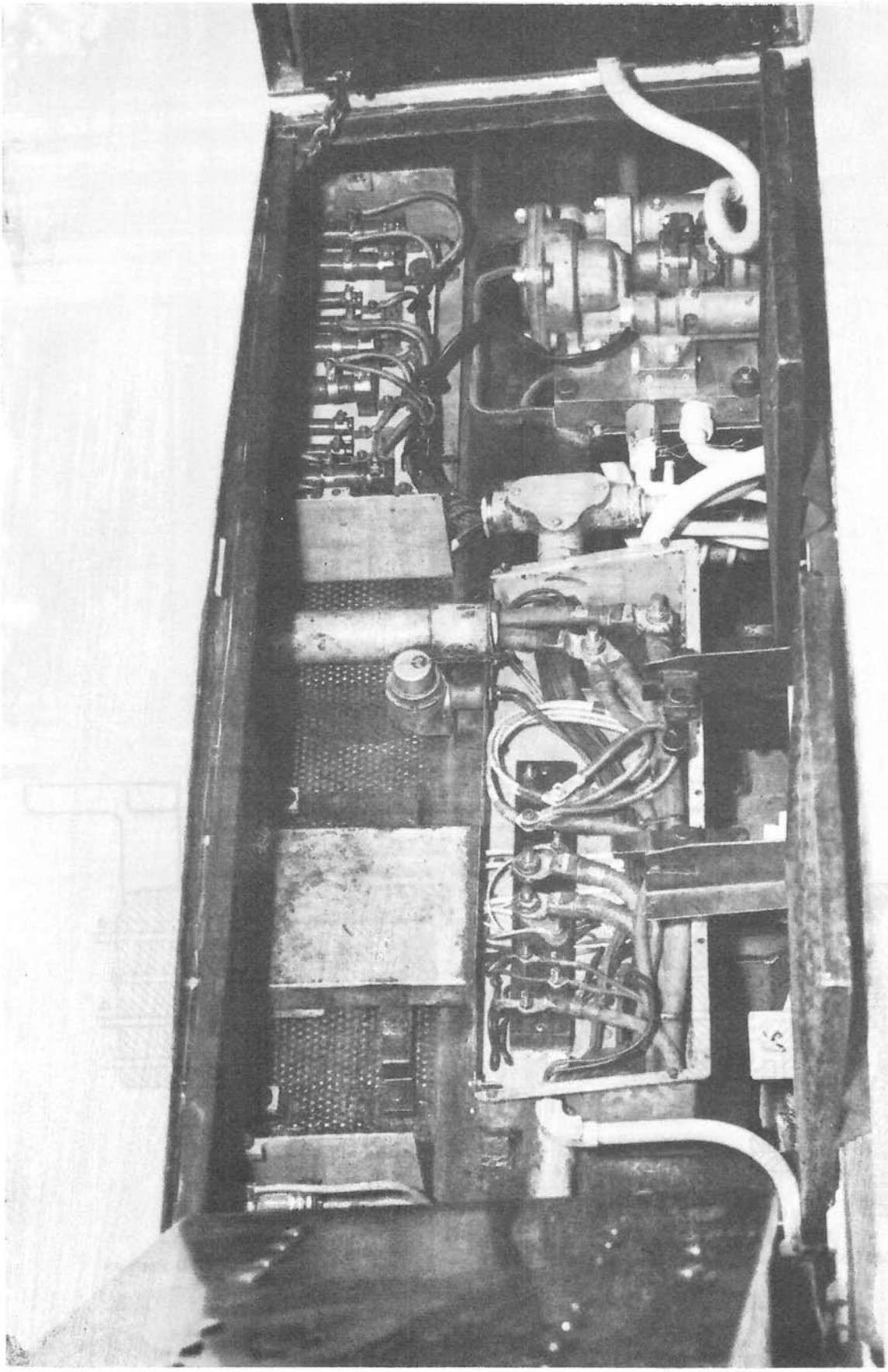


RELEASED Position

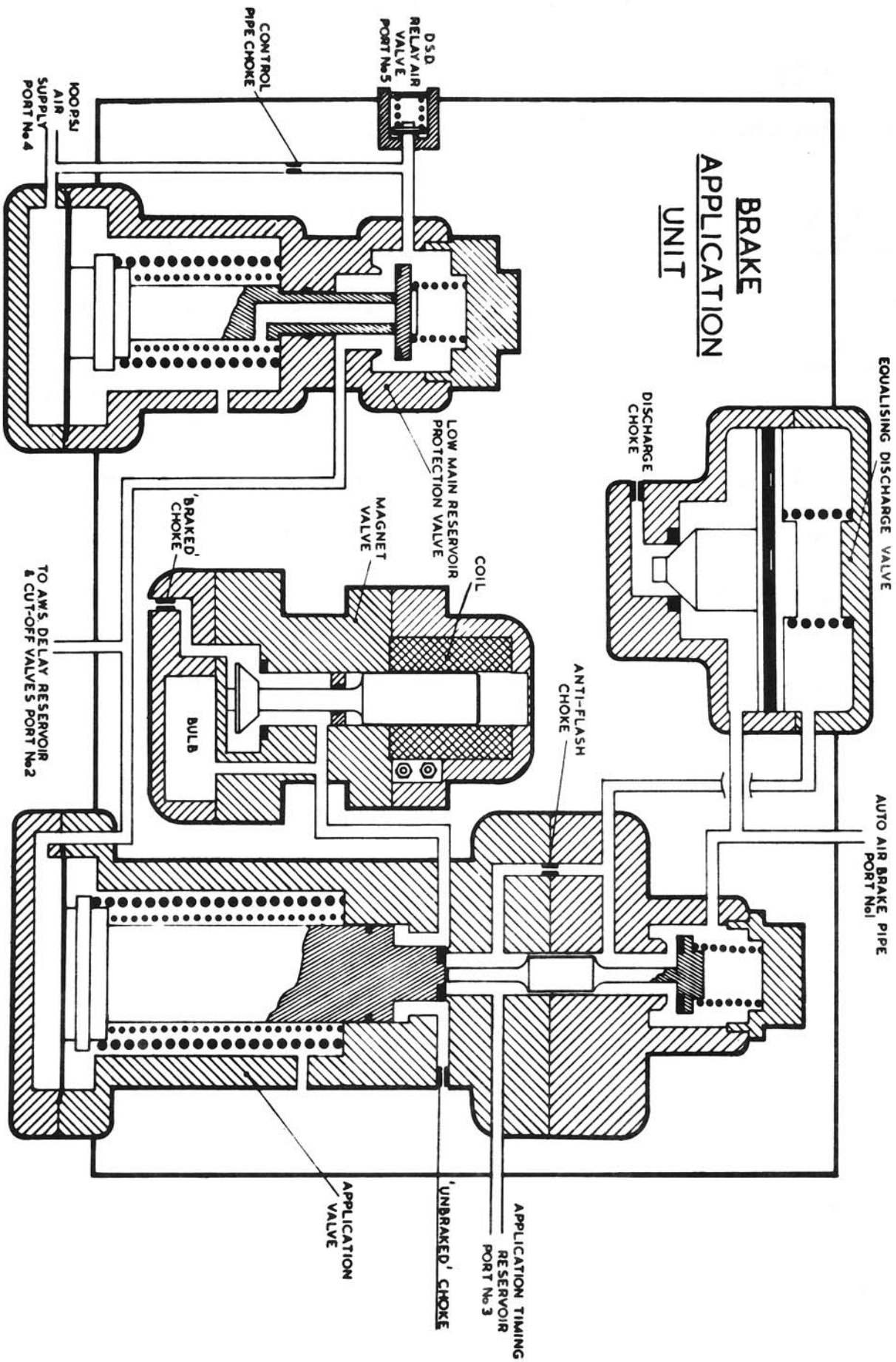


APPLIED Position

WESTINGHOUSE RELAYAIR VALVE



BRAKE APPLICATION UNIT



1000 CLASS DUAL BRAKE LOCOMOTIVES

POSITION OF BRAKE EQUIPMENT

ITEM	POSITION
Compressor (Westinghouse 3Vc 50) 'A' end.	Displaced Triangular Fuel Tank. 'A' end.
Suction Strainer (H.I.S.) and Antifreeze Unit (3 pints).	Near 'A' Compressor. Left side of Locomotive.
1¼ Check Valve.	Adjacent 'B' Compressor.
Compressor (Laycock VV 100/100) B end.	'B' end of Locomotive. Non corridor side. Adjacent 'B' Transmission.
Intercooler 'B' Compressor.	On 'B' end Triangular Tank.
1" Check Valve.	Adjacent 'B' Compressor.
Automatic Drain Valves.	Adjacent 'B' end Triangular Tank.
Main Reservoirs.	As diagram page 23.
Compressor Governor. Set to close at 118 p.s.i. and open at 140 p.s.i. Type PGS E.19.	Left hand side - Boiler Room.
⅜ Isolating Cock.	Left hand side - Boiler Room, below Compressor Governor.
Brake Selector and Changeover Switch and Compressor Fuses.	In Boiler Room, on bulkhead adjacent to 'B' engine.
Safety Valve (set 150 p.s.i.).	'A' cab - under floor.
Centrifugal Dirt Collector and 1" Isolating Cock.	Adjacent to Reservoir under 'A' end apron.
Filter and Pressure Reducing Valve. RM 38 set at 57 p.s.i.	Right hand side of boiler room.
Self Lapping Straight Air Brake Valve.	Drivers Desk.

Double Check Valve.	Boiler Room.
Relay Valve K.R - 1.	In cab, floor level - Drivers side.
Limiting Valve C set at 100 p.s.i.	'B' end nose.
Duplex Check Valve set to close at 75 p.s.i.	'B' end nose.
Brake Valve Feed Cut-off Valve.	Under Co-drivers arm rest.
No. 19 Double Check Valve.	'A' end. Non-corridor side, adjacent A engine intercooler.
Auto Air Brake Pipe Governor, set to close at 56 p.s.i. and open at 42½ p.s.i. Type PGS E.28.	Left hand side - Boiler Room.
Limiting Valves 'A' and 'B'.	Right hand side of Boiler Room between 'A' engine and boiler.
Vacuum Exhausters 4V 110G.	'A' end of Locomotive. Non-corridor side adjacent 'A' Transmission.
Suction Strainer Vacuum Restrictor Valve Relief Valve set at 23 hg.	Adjacent to Exhausters.
VA 1 Control Valve set at 21 hg.	'A' end, right hand side, adjacent to A engine cardan shaft, walkway.
2" Isolating Cock.	Adjacent VA 1 Control Valve.
Vacuum Control Governor set to close at 15 hg. and open at 12½ hg. Type E.2.	'B' end under Co drivers desk.
Drivers Automatic Air Brake Valve. M.S.A.	Drivers Desk.

3 Chamber Reservoir.	'A' and 'B' nose Compartment.
Exhauster Speed up Governor set to close at 65 p.s.i. and open at 51½ p.s.i. Type PGS E.28.	'A' and 'B' nose Compartment.
Distributor and associated equipment (Page 49).	In Boiler Room on bulkhead adjacent to 'A' engine.
Relay Valve (Diaphragm Type).	In cab, floor level - Co-drivers side.
Air Control Reservoir) Vacuum Control Chamber)	In Boiler Room, between 'A' engine and boiler.
Vacuum Control Magnet Valve.	Under cab floor 'A' end.
D.S.D. Magnet Valve.	In cab desk 'A' end.
D.S.D. Delay Reservoir) Relayair Valve) ½" D.S.D. Isolating Cock)	Under cab floor 'A' end.
Brake Application Unit.	'A' end nose Compartment.
Application Timing Reservoir.	Under cab floor 'A' end.
A.W.S. Equipment.	Floor level - In 'A' and 'B' Cab. Drivers side.