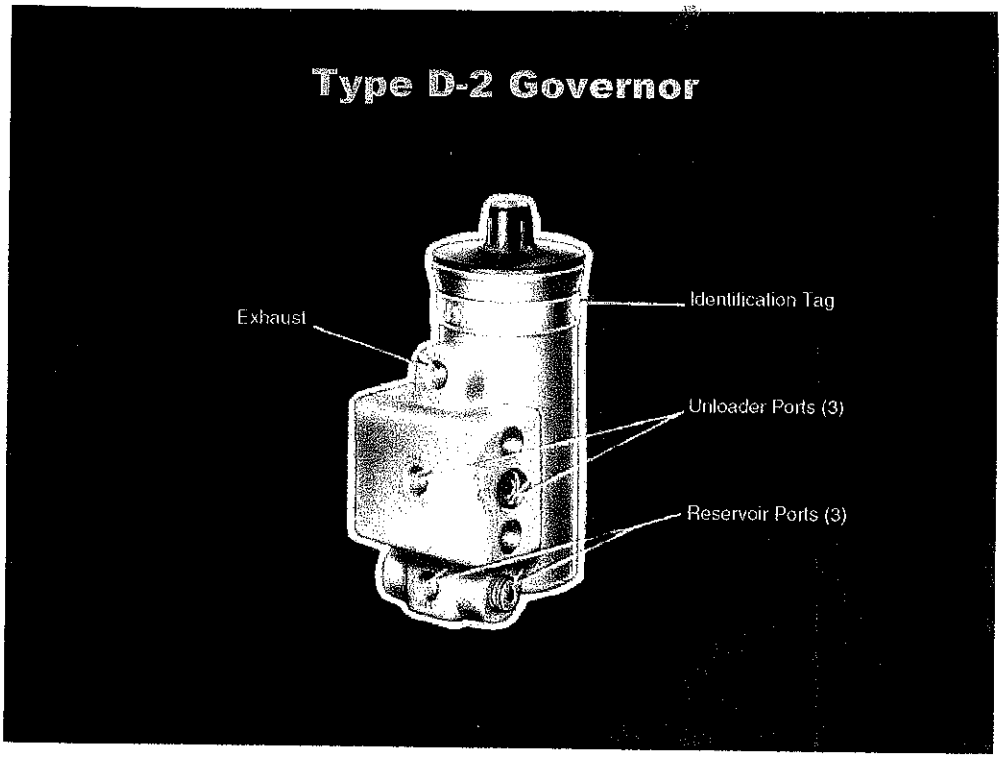


Description

The D-2 Governor, operating in conjunction with the unloading mechanism,automatically controls the air pressure in the air brake or air supply system between a maximum (cut-out) pressure and a minimum (cut-in) pressure. The compressor runs continually while the engine runs, but the actual compression of air is controlled by the governor actuating the compressor unloading mechanism which stops or starts the compression of air when the maximum or minimum reservoir pressures are reached.

Note that the governor can control several items with its unloader port air including:

Compressor, Dryer, Holset ECON Valve, Automatic reservoir purge, etc. All these connections and components must be completely airtight to prevent high duty cycle and rapid governor cycling.

Ports

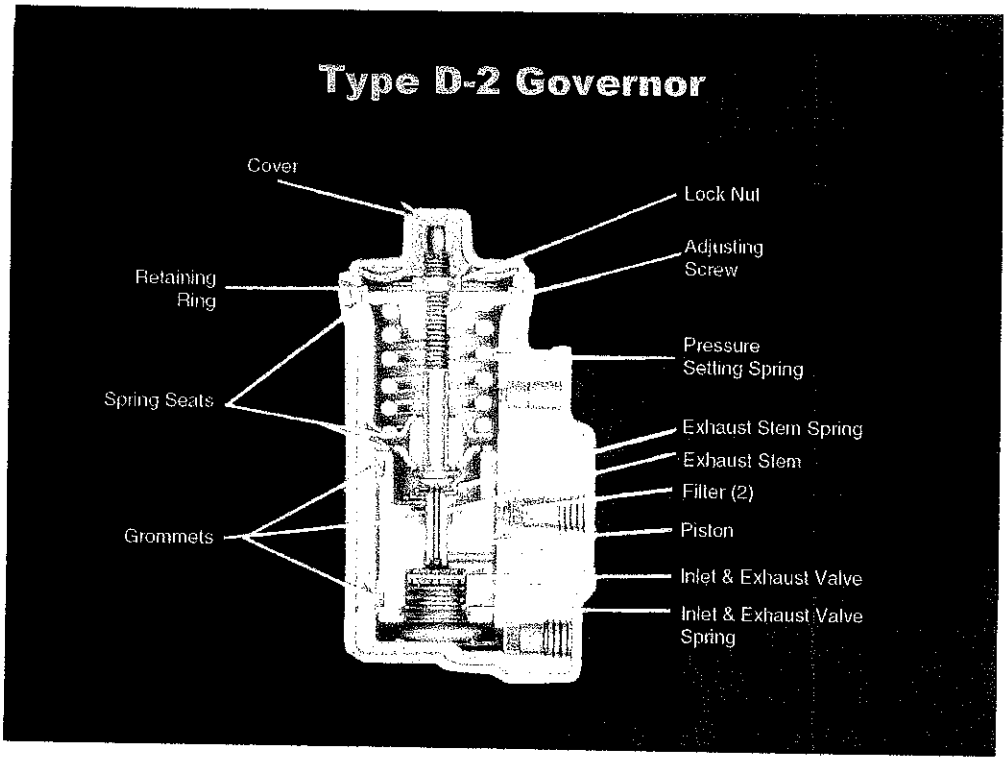
Consists of three reservoir ports (1/8 inch NPT.), three unloader ports (1/8 inch NPT.) and one exhaust port (1/8 inch NPT.). Note NPT. = National Pipe Threads

Governor Adjustment

To **raise** the pressure settings, turn the adjusting screw **counter-clockwise**. To lower the pressure settings,turn the adjusting screw clockwise. Note: Be careful not to over adjust. Each 1/4 turn of the adjusting screw raises or lowers the pressure setting approximately 4 to 6 psi. (Note: The pressure range between cut-in and cut-out is not adjustable.)

Operating Test

Start the vehicle engine and build up air pressure in the air brake system and check the pressure registered by a dash or test gauge at the time the governor cuts out, stopping the compression of air by the compressor. The cut-out pressure should be in accordance with the pressure setting of the piece number being used. With the engine still running, make a series of brake applications to reduce the air pressure and observe at what pressure the governor cuts in the compressor. As in the case of the cut-out pressure, the cut-in pressure should be in accordance with the pressure setting of the piece number being used.



Name and review ID internal parts

Keep exhaust port open - do not plug

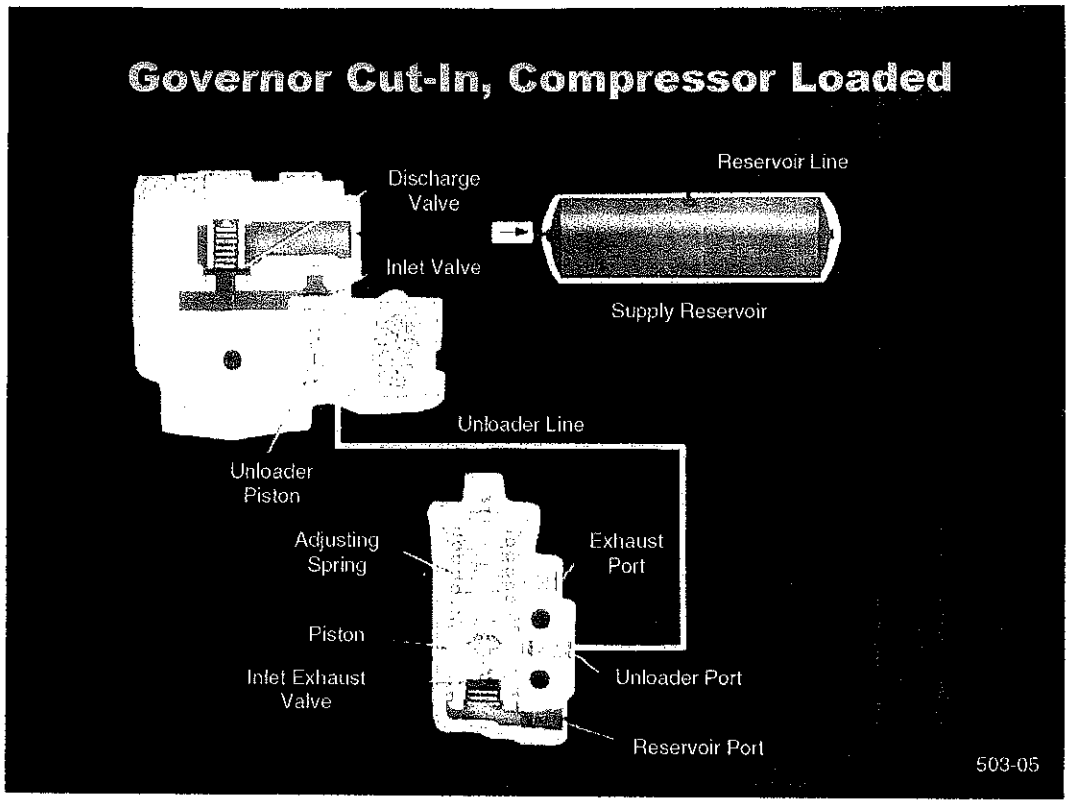
Adjustment- there is a 20 PSI difference between cut-in and cut-out

1) remove rubber cap and loosen lock nut
2) 1/4 of a turn counter clockwise increases pressure 4 to 6 PSI
3) cut-in and cut-out pressures move together
4) pump the brakes and rebuild air pressure, did the pressure move in the direction you wanted?
5) make another slight adjustment as required

If you just start turning the adjusting screw the dash gauges will NOT move.

Newer vehicles have cut-out pressure set at 130PSI, old standard 120PSI.

Some governors are not adjustable.



Operation - Loaded State

Compressor is actively pumping air.

D-2 governor is sending **no** air to the compressor unloaders at this time.

Compressor unloader plungers have no external signals to control them – springs hold them up and out of play.

Compressor inlet valves are free to float up and down naturally during piston cycles. This builds compression in the cylinders which is sent to the air system.

As the system supply reservoir air pressure drops to the cut-in setting of the governor, the force exerted by the air pressure on the piston will be reduced so that the pressure setting spring will move the piston down. The inlet valve will close and the exhaust will open. With the exhaust open, the air in the unloader line will escape back through the piston, through the exhaust stem and out the exhaust port.

OBSOLETE - RETAIN, OR SERVICE AM 5-11-70

APPROVED	DATE	J.M.
B. Johnson Jr. V.	9/17/31	8-8-31.
202997		S.V. 9-17-31.

TYPE "U" AIR COMPRESSOR

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.

REVISIONS

4 8-21-42. Traced L.T. ch'd. DA

5 2-26-45 5/16 Holes were 3/8." CHC-CHD-AJN

6 9-23-48 Pc. No. 202997 WAS NOT OBSOLETE. 2 3/32" R & 3/8" DIA. WERE NOT ON LEFT HALF RM. CHD. GWS

7 3-26-51 CORK WAS 1/32" THICK SN CHD HAK ECN 17843

8 4-20-51 CORK WAS .031" ±.010" -.000" THICK AND UNIFORMITY NOTE WAS NOT ON. RIL CHD GWS ECN-17986

9 7-31-52 MATERIAL SPEC. (SHEET E114) WAS NOT ON. RIL CH'D. HAK ECN-19526

10 9-30-53 MATERIAL WAS .047 ±.010" THICK. CORK SPEC. BW-216M (SAE G-2114) GHC CHD MJS ECN 21589

11 2-18-54 "A" WAS 23/32" FOR PC. NO. 203462 VRL CHD JD ECN 22099

12 5-11-70 PC NO 203462 & DWG NO 202997 OBSOLETE RETAIN FOR SERVICE AM CHD RJT ECN 44552 5-22-70

TOLERANCES FOR FINISHED DIMENSIONS NOT SPECIFIED ±.005" FOR DECIMALS, ±.016" FOR FRACTIONS.

MATERIAL SEE NOTE | PATTERN OR FORGING No.

TREATMENT

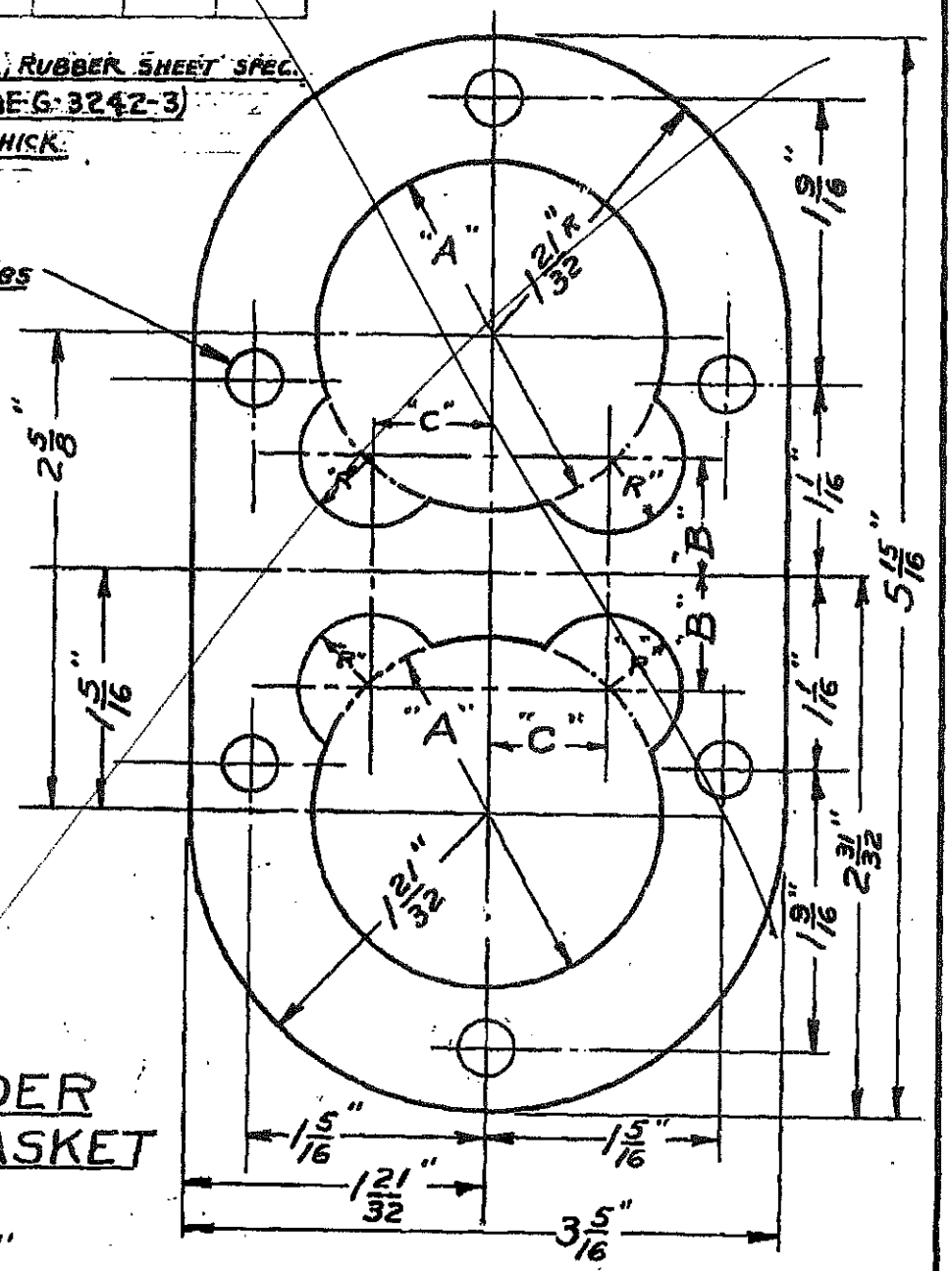
THIS PRINT IS LOANED SUBJECT TO RETURN UPON DEMAND AND IS NOT TO BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO OUR INTERESTS.

REMOVE ALL BURRS AND SHARP EDGES.

Pc. No.	"A"	"B"	"C"	"R"	
202997	1 15/16"	4/64"	21/32"	13/32"	OBSOLETE
203462	2 1/8"	4/64"	21/32"	13/32"	OBS.-RETAIN

NOTE: GASKET MUST BE OF UNIFORM THICKNESS WITHIN .005"

MATERIAL: CORK, RUBBER SHEET SPEC. BW-250-M (SAE-G-3242-3) .031" ±.004" THICK.



CYLINDER HEAD GASKET

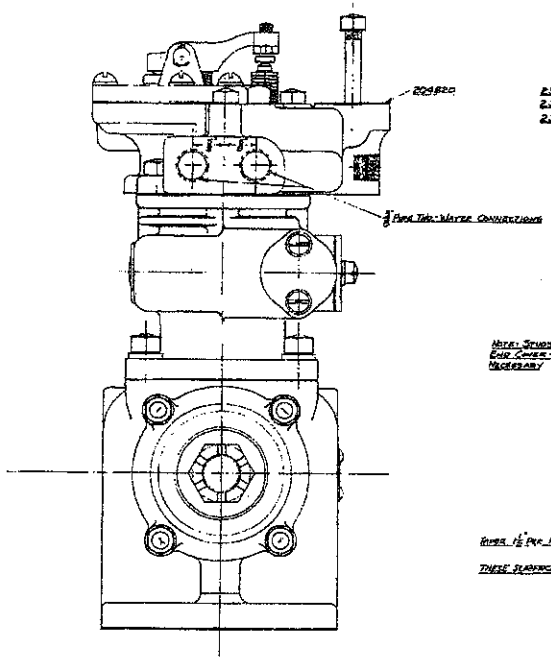
SCALE: 12" = 1'-0"

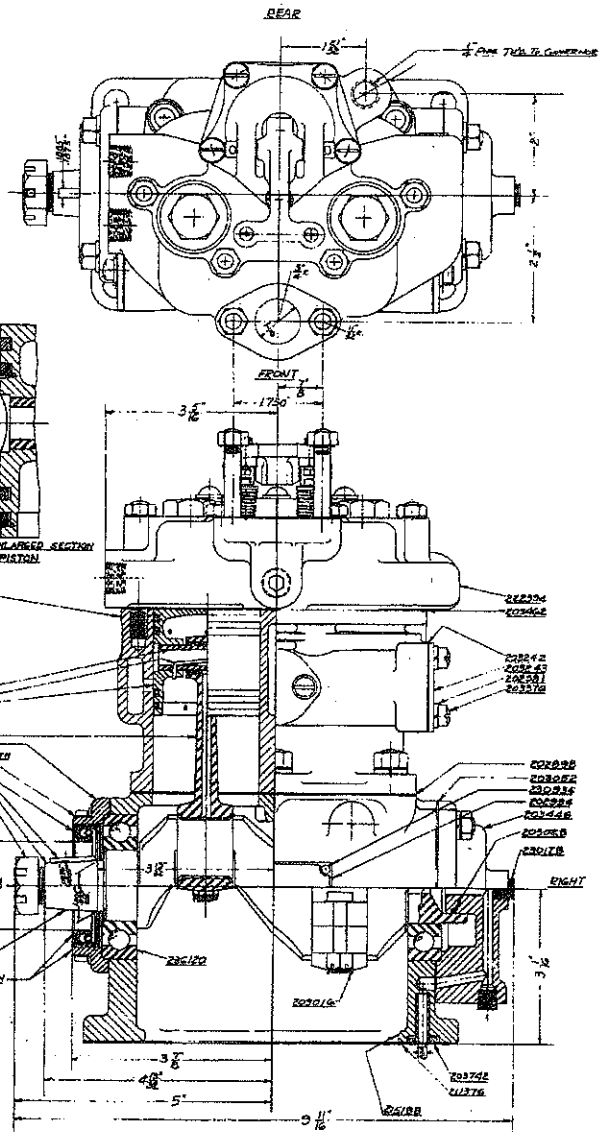
OBSOLETE - RETAIN FOR SERVICE

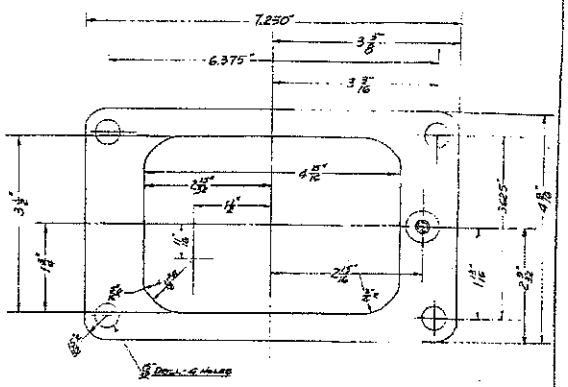
220069

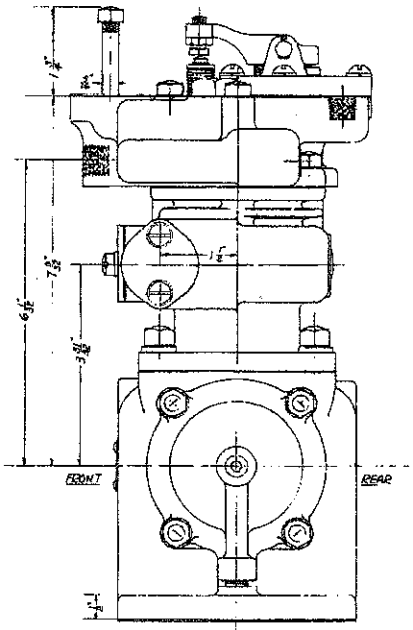
OBSOLETE AM 1-16-70

Bendix Westinghouse
2UE 7¼ VM mod.
F14247 220069 Ser
396 GMC 361 CID Inline 6 cyl.









TYPE 2-UE-7¼-VM AIR COMPRESSOR 220069

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.

(Lower End Same as TU Flo 00)
Von Head Gskt.

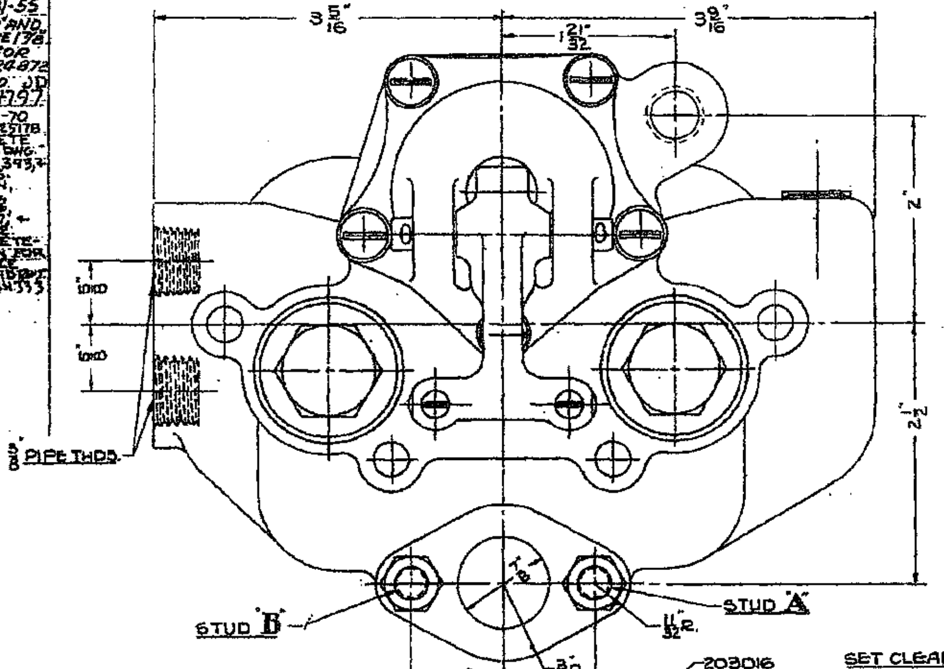
OBSOLETE-RETAIN FOR SERVICE   AM 4-29-70

APPROVED	DATE		
Stephen Vonreck	4/10/46	R.W.K. 2-5-46	CYLINDER HEAD COMPLETE FOR TYPE 2-U-7¼-W AIR COMPRESSOR
222393		DAA 2-7-46	BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE CO.

TOLERANCES FOR FINISHED DIMENSIONS NOT SPECIFIED ±.005" FOR DECIMALS. ±.015" FOR FRACTIONS.
MATERIAL
PATTERN OR FORGING NO.
TREATMENT

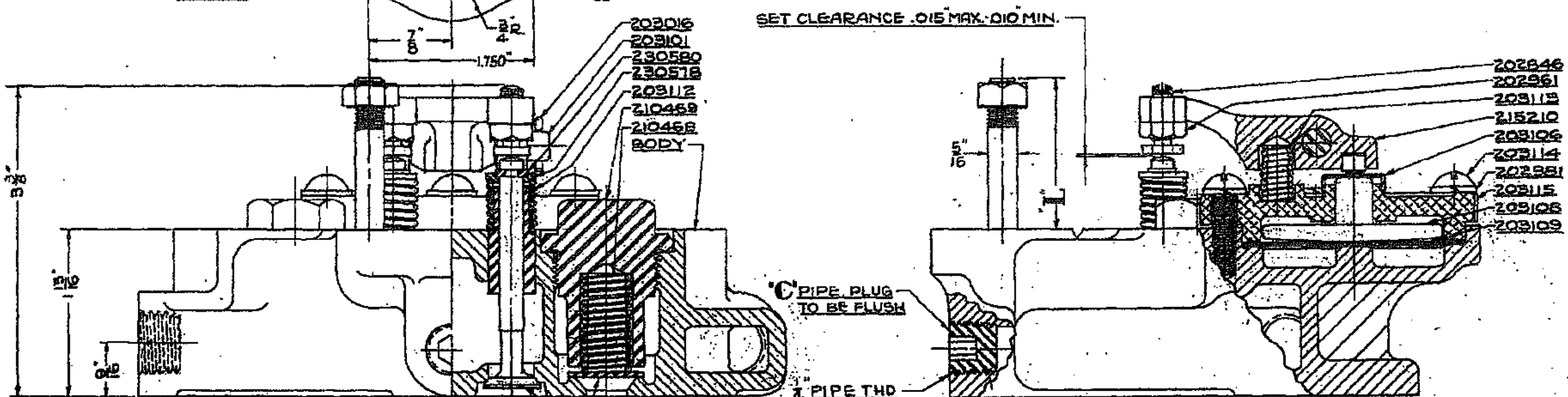
THIS PRINT IS LOANED SUBJECT TO RETURN UPON DEMAND AND IS NOT TO BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO OUR INTERESTS.

REMOVE ALL BURRS AND SHARP EDGES.



	PIECE Nº	BODY PIECE Nº	LENGTH "L" STUD "A"	LENGTH "L" STUD "B"	"C" PIPE PLUG
①	222393	222389	7/8	7/8"	1/4"
①	222394	222390	1 3/4	1 3/4	1/4"
OBSOLETE	222395	222391	1 3/4	1 3/4"	1/4"
①	222396	222392	—	—	1/4"
TRANSFERRED	222461	222460	1 3/4"	1 3/4"	1/4"
①	223036	223035	1 3/4"	1 3/4"	1/4"
①	221787	222391	1 3/4"	1 3/4"	1/4"
①	224872	224873	1 25/32"	1 25/32"	
OBSOLETE	225178	225177	1 1/8"	1 1/8"	1/4"

① OBSOLETE-RETAIN FOR SERVICE



OBSOLETE-RETAIN FOR SERVICE

DOCUMENTO CONTROLADO DE FORMATO ELECTRÓNICO: Antes de utilizarlo se requiere verificar el nivel de revisión o su vigencia.
CONTROLLED ELECTRONIC MEDIA DOCUMENT: Verification of revision level or adequacy is required before use.

flat surface on the camshaft. The spring then forces the ball cage to the right so that the rubber seal is pressed against the valve seat.

When the vehicle is stopped on an upgrade with the brakes applied and the clutch pedal depressed, the ball rolls against the rubber seal which, in turn, rests against the valve seat, preventing the brake fluid in the wheel cylinders from returning to the master cylinder. Pressure is therefore maintained in the wheel cylinders to keep the brakes applied.

When the clutch pedal is released, the camshaft is rotated and lifts the ball cage away from the valve seat, allowing brake fluid to pass through the valve to the master cylinder, thus releasing the brakes.

When the vehicle is on a downgrade, the ball rolls away from the rubber seal, rendering the valve inoperative regardless of clutch pedal position.

The hill holder does not affect the ordinary use of the brakes for when the brakes are applied, pressure of the fluid from the master cylinder forces the ball cage back against the spring even if the clutch pedal is depressed, allowing fluid to flow through the outlet through the wheel cylinders.

HILL HOLDER ADJUSTMENT—In adjusting the hill holder, first be sure it is level. This can be determined with a spirit level mounted on the two bosses on top of the housing.

The control rod, which is connected to the lever, must be so set that the brakes release just ahead of clutch engagement or when the vehicle begins to accelerate. If brake release is delayed, the effective rod length should be shortened. Should the brakes release too quickly—permitting the vehicle to move backward before clutch engages—the rod should be lengthened.

AIR BRAKES

BENDIX-WESTINGHOUSE

Air brake equipment on trucks and truck-tractors provides a means of controlling the brakes through the medium of compressed air. Air brake equipment consists of a group of devices, Figs. 1 and 2; some maintain a supply of compressed air, some direct and control the flow of compressed air, and others transform the energy of compressed air into the mechanical force and motion necessary to apply the brakes. Different types and sizes of devices are used on different types of vehicles to meet the operating requirements, but they are all fundamentally the same. Following are the devices comprising a typical truck or truck-tractor air brake system, with a brief description of the function of each device.

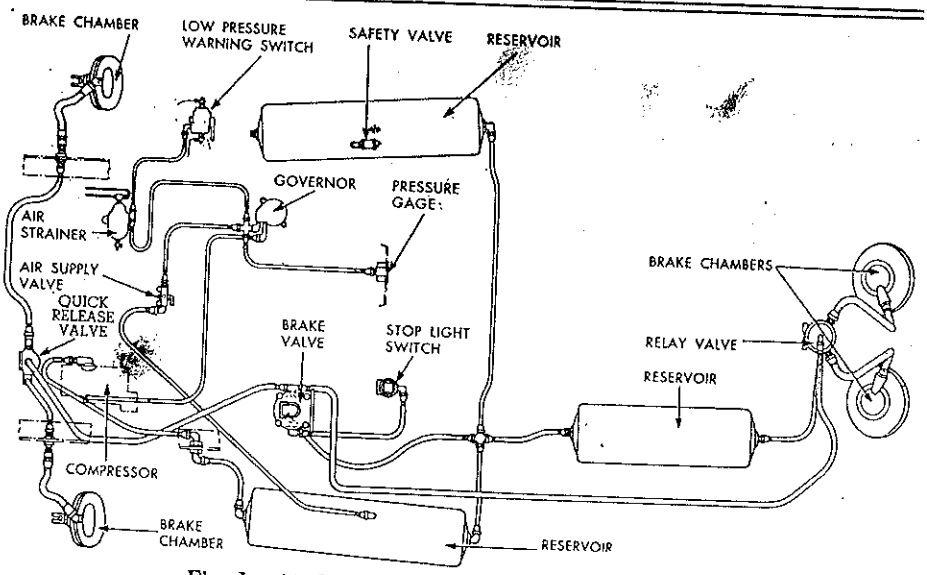


Fig. 1 Air brake diagram for a dump truck

COMPRESSOR—The compressor supplies the compressed air to operate the brakes.

GOVERNOR—The governor controls the compression of air by the compressor. Although the compressor runs continuously when the engine is running, the governor, acting in conjunction with the unloading mechanism in the compressor cylinder head, stops and starts the compression of air by the compressor when the desired maximum and minimum air pressures are present in the air brake system.

BRAKE VALVE—The brake valve controls the air pressure being delivered to the brake chambers and in this way controls the operation of the brakes.

QUICK RELEASE VALVE—This valve

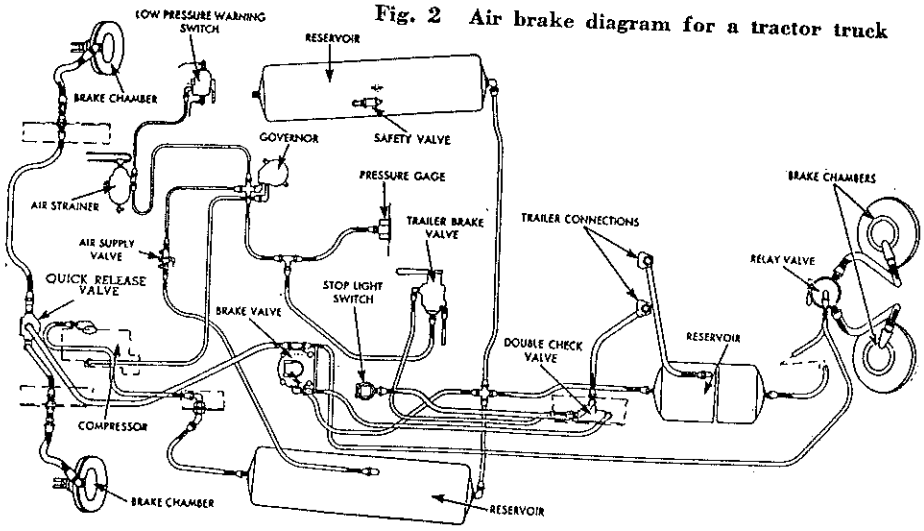


Fig. 2 Air brake diagram for a tractor truck

speeds the release of air pressure from the front wheel brake chambers.

RELAY VALVE—This valve speeds the application and release of air pressure from the rear wheel brake chambers.

BRAKE CHAMBERS & CYLINDERS—Brake chambers and brake cylinders transform the energy of compressed air into the mechanical forces and motion necessary to apply the brakes. One brake chamber or one brake cylinder on each wheel.

SLACK ADJUSTERS—Slack adjusters provide a quick and easy method of adjusting the brakes to compensate for brake lining wear. One slack adjuster is used for the brakes on each wheel.

COCKS—Cut-out cocks are used in the trailer connection lines to permit these lines to be closed when they are not being used. Reservoir drain cocks are used also, mounted at the bottom of the reservoir. The drain cocks permit draining the oil and water which collects in the reservoir.

TUBING & FITTINGS—Tubing and tube fittings connect the different air brake devices in the air brake system.

HOSE & COUPLINGS—Flexible hose lines and hose fittings are used where it is necessary to have an air line between two points of a vehicle which change their position in relation to one another. Hose lines also make connections between two vehicles, and in such cases they are provided with hose couplings to permit the connections to be easily connected or disconnected.

Dummy couplings seal the hose couplings against the entrance of dirt when the hose couplings are not in use. Dummy couplings on the back of tractor cabs also provide a place for attaching the free ends of connecting hose that is not being used.

SAFETY VALVE—This valve protects the air brake system against excessive air pressure.

RESERVOIRS—Reservoirs store the compressed air until it is needed for brake operation and provide sufficient air pressure to make several brake applications even after the engine has stopped.

AIR GAUGE—The air gauge, mounted on the instrument panel, registers the pressure in the air brake system.

AIR SUPPLY VALVE—In some cases, the air supply valve is included to provide an easy means of obtaining compressed air from the air brake system for such purposes as tire inflation.

LOW PRESSURE INDICATOR—This indicator is often provided to warn the driver by sounding a buzzer or by lighting a warning light if for any reason the air pressure in the air brake system falls below a safe operating point.

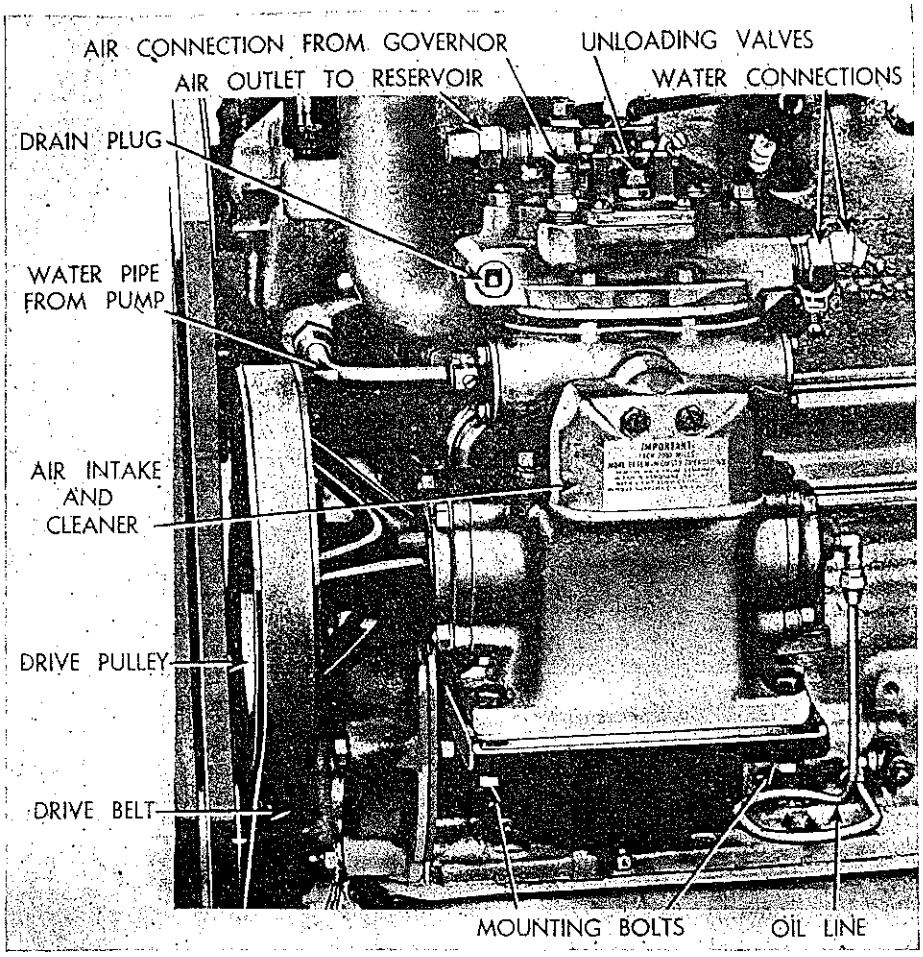


Fig. 3 Air compressor installed

STOP LIGHT SWITCH—The air operated stop light switch provides a simple means of controlling the stop lights of the vehicle.

AIR HORN—On some vehicles the air horn is included to provide an effective warning signal.

ALCOHOL EVAPORATOR—On some vehicles the alcohol evaporator is included to prevent moisture freezing in the air brake system.

OPERATION

With air brake equipment, the brakes are applied or released by depressing or releasing the brake pedal. The brake valve is so constructed and connected that its two controlling valves—intake valve and exhaust valve—are opened or closed as required. As long as the brake pedal is in the release position, the intake valve in the brake valve is held closed, sealing reservoir air pressure, while the exhaust valve is held open so that all air pressure in the brake chambers and in the connecting lines is exhausted to atmosphere.

As the brake pedal is depressed, the exhaust valve in the brake valve is closed and the intake valve is opened, permitting air pressure from the reservoir to pass through the brake valve and into the brake chambers. This air pressure in the brake chambers causes the brake chamber push rods to move the slack adjusters so the cams are rotated, forcing the brake shoes against the brake drums, applying the brakes. The air pressure going to the brake chambers is determined by how far the pedal is depressed.

As the brake pedal is released, the intake valve in the brake valve is closed and the exhaust valve is opened so that the air pressure in the brake chambers is permitted to exhaust to atmosphere. When the pressure in the brake chamber is exhausted, the force of the brake chamber springs and the brake shoe return springs returns the brake chamber rods, slack adjusters and brake shoes to their normal position, releasing the brakes.

Air brake systems for trucks hauling trailers or for truck-tractors hauling semi-trailers often include a hand-operated brake valve and a double check valve in addition to the regular standard devices, Fig. 2. The use of the hand brake valve

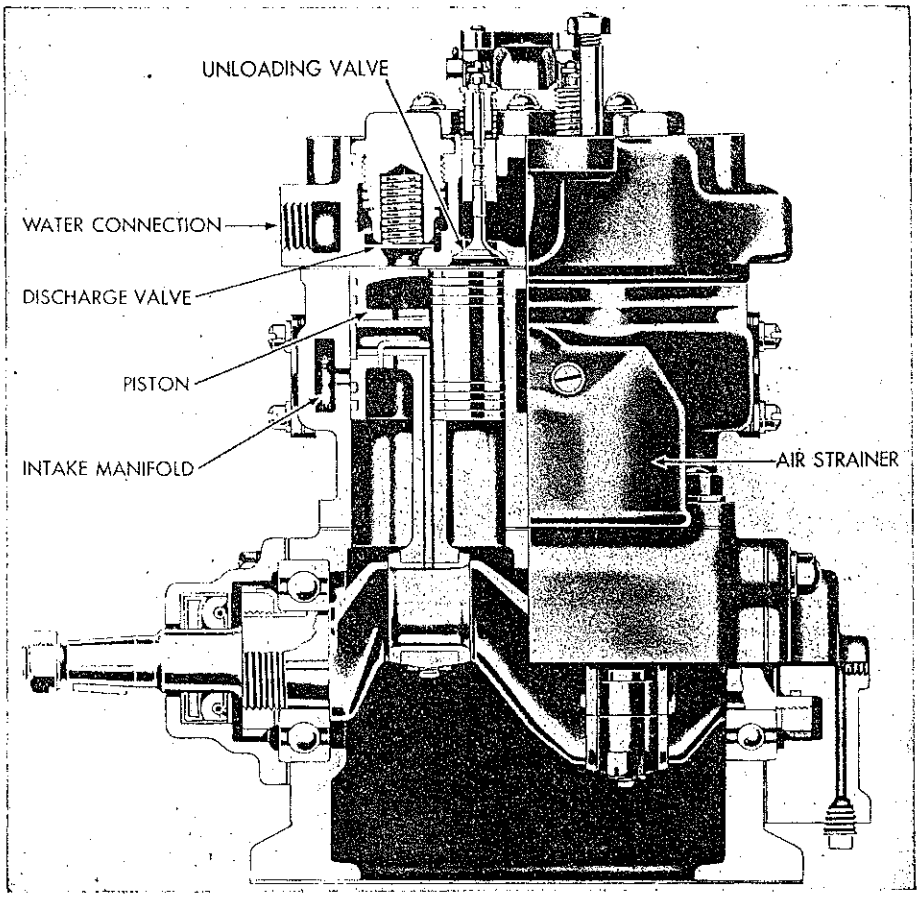


Fig. 4 Sectional view of air compressor

makes it possible for the brakes on the trailer to be applied by the driver independently of the truck or tractor brakes.

The double check valve directs the flow of compressed air to the trailer service line when either the foot-operated or hand-operated brake valve is applied. If a double check valve was not used, and one of the brake valves was moved to its applied position, air pressure from the reservoir would escape through the exhaust port of the other brake valve, because the exhaust valve of the other brake valve would be open. When a double check valve is used and one of the brake valves is moved to the applied position, the double check valve blocks off the line leading to the other brake valve and in this manner prevents any loss of air pressure through the open exhaust valve of the brake valve not being operated.

Independent control of the brakes on a trailer is valuable under adverse road conditions when it is sometimes desirable to apply the brakes on the trailer without applying the brakes on the truck or tractor.

OPERATING INSTRUCTIONS

Operating the brakes of an air-braked vehicle differs very little from operating the brakes of a passenger car. Because operation of the brake pedal requires very little physical effort, proper control of the brakes is easily accomplished.

The distance the brake pedal is depressed determines the amount of air pressure delivered to the brake chambers, and the brake chamber pressure determines the braking force. Thus the driver may definitely control the brakes of the vehicle by keeping in mind the fact that he is operating a brake valve capable of giving finely graduated brake control and making full use of this feature.

An air-braked vehicle should not be moved unless the air gauge shows at least 60 pounds pressure in the air brake system, because the brakes are not fully effective at lower pressures. While operating the vehicle, the driver should periodically observe the air pressure registered by the dash gauge to be sure it is being maintained properly. If the air pressure drops to a low point, or if the warning buzzer or light signifies that the pressure is low, the vehicle should be stopped and the trouble corrected.

The best stop results when the brake application is as hard at first as the speed, condition of the road, and passenger comfort permits, and then graduated off as the speed decreases. As the stop is completed, there should be only sufficient air pressure in the brake chambers to hold the vehicle stationary. The brakes must never be applied lightly at first and the braking pressure increased as the speed decreases, as this will result in a very rough stop.

The brake pedal should not be "fanned," as this merely wastes compressed air and has no bearing on correct braking results.

The brake pedal should not be fully depressed except in cases of emergency as this causes full braking force to be delivered to the wheels and this should not be necessary in ordinary service.

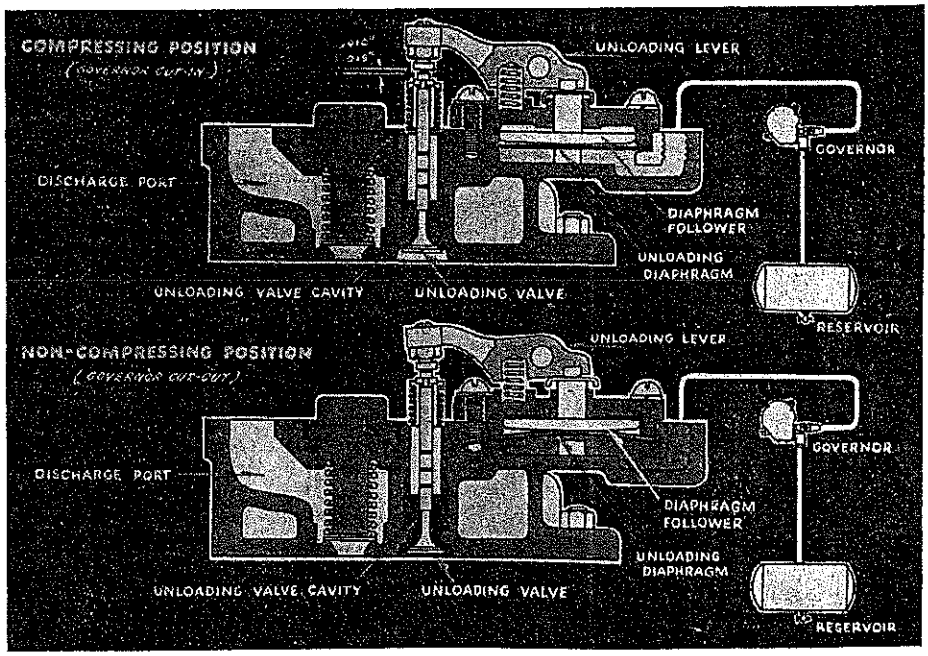


Fig. 5 Compressor unloading mechanism

AIR BRAKES

Normally the engine is used to assist the brakes by not disengaging the clutch until the engine reaches idling speed.

In the event a trailer breaks away from a truck or tractor, the driver must immediately apply the brakes and bring the truck or tractor to a stop. Then the truck or tractor should be held with the hand brake while the cut-out cocks in the emergency and service lines are closed. The truck or tractor air brake system will then be recharged to normal pressure.

When disconnecting trailers from trucks or tractors, the emergency feature of the air brake system on the trailer is often used to lock the trailer brakes. This is approved practice but the air brake system must not be depended upon to hold a vehicle parked. The parking brake must always be applied or the wheels blocked.

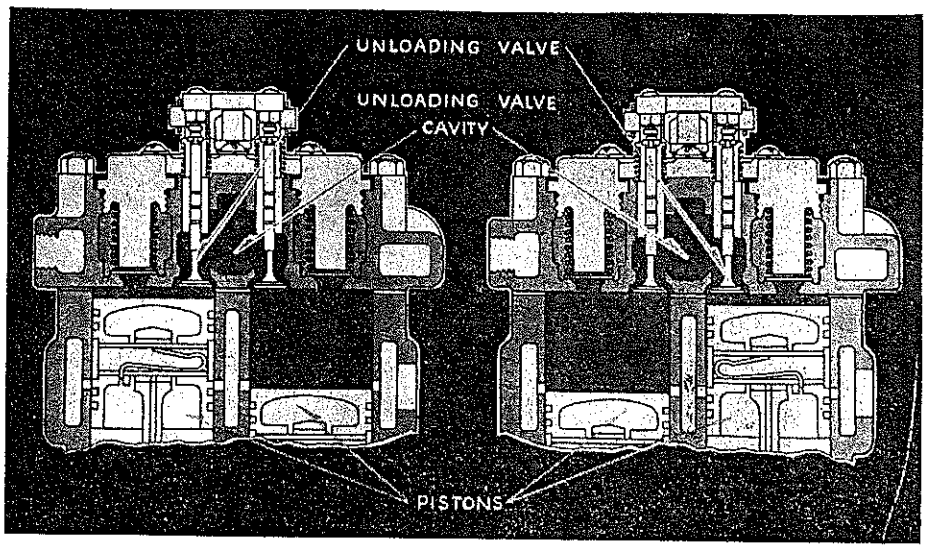


Fig. 6 Passage of air during non-compression

AIR BRAKE SYSTEM MAINTENANCE

Successful maintenance of air brake equipment depends upon systematic inspection and repair of each device at regular intervals. Service and mileage determine the frequency of these intervals and a program of regular inspection periods should be established.

The following instructions deal with each individual air brake device in turn and describe the operation of each unit.

TYPE U COMPRESSOR

All Bendix-Westinghouse compressors are identified by the number stamped on the name plate riveted to the side of the crankcase. Name plates also show the serial number and type of the compressor but compressors cannot be identified by the serial number or the type designation.

The type designation shown on the name plate is in accordance with the following:

Number of cylinders.....2 or 3
Type of Compressor.....E or U
Lubrication.....Eng.-E or Self-S
Rated capacity.....7¼ or 12
Type of mounting.....Flange-F
Horizontal-H
Vertical-V
Type of cooling.....Air-A
Water-W

Thus a 2UE7¼VW compressor is a two-cylinder, type U, engine-lubricated compressor with a displacement of 7¼ cubic feet per minute at 1250 rpm, vertically mounted and water cooled (see Fig. 3).

OPERATION—All type U compressors run continuously while the engine is running but the actual compression of air is controlled by the governor which, acting in conjunction with the unloading mechanism in the compressor cylinder head, starts or stops the compression of air by loading or unloading the compressor when the air pressure in the air brake system reaches the desired minimum (80-85 pounds) or maximum (100-105 pounds).

During the downstroke of each piston, a partial vacuum is created above the piston and as the piston nears the bottom of its stroke, it uncovers intake ports on the cylinder wall, Fig. 4. Air then enters the cylinder above the piston by passing through the intake strainer, the intake manifold, and the intake ports in the cylinder wall.

As each piston begins its upstroke, it covers the intake ports in the cylinder wall, and the air which has entered the cylinder is trapped above the piston. As the piston continues its upstroke, the air above the piston is compressed until the pressure lifts the discharge valve and the compressed air is discharged through the discharge line into the reservoir.

As each piston starts its downstroke, each discharge valve returns to its seat, preventing the compressed air from returning to each cylinder, and the same cycle is repeated.

When the air pressure in the reservoir reaches the maximum setting of the governor, air pressure passes through the governor into the cavity below the unloading diaphragm in the compressor cylinder head, Fig. 5. The air pressure lifts the unloading diaphragm and one end of the unloading lever. The unloading lever then pivots on its pin and the other end pushes the unloading valves off their seats.

With the unloading valves off their seats, the unloading cavity forms a passage between the cylinders above the pistons. Thus, during the upstroke of each piston, air merely passes back and forth through this passage and compression is stopped, Fig. 6. When the air pressure in the reservoir drops to the minimum setting of the governor, the governor releases the air pressure from beneath the unloading diaphragm. The unloading valve springs then return the unloading valves to their seats and compression is resumed.

DAILY SERVICE—If the compressor is of the self-lubricated type, check the oil level in the compressor crankcase and replenish if necessary. If the compressor is engine lubricated, no attention should be given to this item other than the usual check of the engine oil level dipstick.

Should it be necessary to drain the engine cooling system to prevent freezing, always drain the compressor cylinder head, Fig. 3.

EVERY MONTH OR 2000 MILES—Clean compressor air strainer. Remove and wash all parts including curled hair in cleaning solvent. Saturate curled hair in clean engine oil and squeeze dry before replacing it in strainer.

If compressor is self-lubricated type, drain and flush compressor crankcase and refill with clean engine oil.

Check compressor mounting and drive for alignment, belt tension, etc. Adjust if necessary.

EVERY 6 MONTHS OR 10,000 MILES—If the compressor is engine lubricated, clean oil supply line to compressor.

Check compressor unloading valve clearance and adust if necessary, Fig. 7. Clearance must be .010-.015". To adust clearance, loosen lock nuts and turn adjusting screws until proper clearance is obtained and tighten lock nuts. Clearance can be checked only when governor is cut in (compressor not unloaded). Check unloading valve lever for binding.

If the compressor is self-lubricated type, service crankcase breather. Wash breather in cleaning solvent.

Remove compressor discharge valve cap nuts and check for presence of excessive carbon. If carbon is excessive, clean the compressor cylinder head; also check

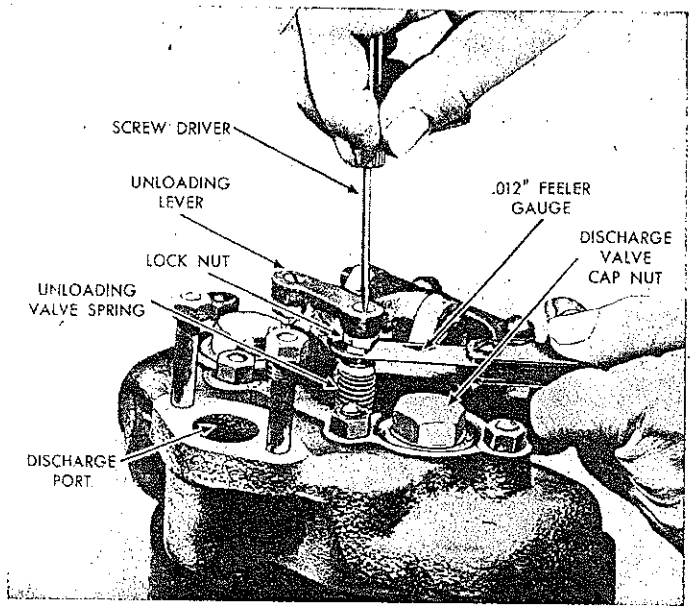


Fig. 7 Adjusting compressor unloading valve clearance

compressor discharge line for carbon and clean or replace the line if necessary.

INSPECTION—

1. Be sure compressor air strainer is clean and properly installed. Also be sure blanking covers and gaskets are installed on all strainer openings not be ing used in the compressor intake manifold.
2. With compressor running, check for noisy operation and oil or water leaks.
3. Check unloader valve clearance.
4. Check compressor drive for alignment, belt tension, etc.
5. Check to be sure compressor mounting bolts are secure.

OPERATING TESTS—Because of the many different types of air brake systems found on different types of vehicles, it is difficult to set up any specific series of tests to determine the condition of the compressor on a vehicle. Failure of the compressor to maintain normal air pressure in the air brake system of a vehicle usually denotes loss of efficiency due to wear, provided leakage in the remainder of the system is not excessive. Another sign of wear is excessive oil passing. If either of these conditions develop and inspection shows the remainder of the air brake equipment to be in good condition, the compressor must be repaired or replaced.

AIR LEAKAGE TESTS—Air leakage past the discharge valves can be detected by fully charging the air brake system and then with the engine stopped, carefully listening at the compressor for the sound of escaping air. This must be done in a quiet place and if air pressure can be heard escaping inside the compressor, the discharge valve leakage is excessive, and the compressor cylinder head or the complete compressor must be replaced.

With the air brake system fully charged (governor cut out) coat the unloading box cover with soapsuds to check for leakage past the unloading diaphragm. Leakage of a one-inch soap bubble in three seconds is permissible. If excessive leakage is found, the compressor cylinder head or complete compressor should be repaired or replaced.

TROUBLE SHOOTING

COMPRESSOR FAILS TO MAINTAIN ADEQUATE PRESSURE IN AIR BRAKE SYSTEM—

1. Dirty intake strainer.
2. Excessive carbon in compressor cylinder head or discharge line.
3. Discharge valves leaking.
4. Excessive wear.
5. Drive belt slipping.
6. No clearance at compressor unloading valves.
7. Unloading valves stuck open.
8. Excessive leakage of unloading valves.

COMPRESSOR PASSES EXCESSIVE OIL—

1. Excessive wear.
2. Dirty air strainer.
3. Excessive oil pressure.
4. Oil return line or passage to engine crankcase plugged.
5. Compressor crankcase flooded.
6. Back pressure from engine crankcase.
7. Oil rings improperly installed.

NOISY OPERATION—

1. Backlash in drive coupling or drive gears.
2. Loose drive pulley.
3. Excessive carbon in cylinder head or discharge line.
4. Worn or burnt out bearings.
5. Excessive wear.

COMPRESSOR DOES NOT UNLOAD—

1. Defective unloading diaphragms.
2. Excessive clearance at unloading valves.
3. Unloading cavity plugged with carbon.
4. Unloading mechanism binding or stuck.

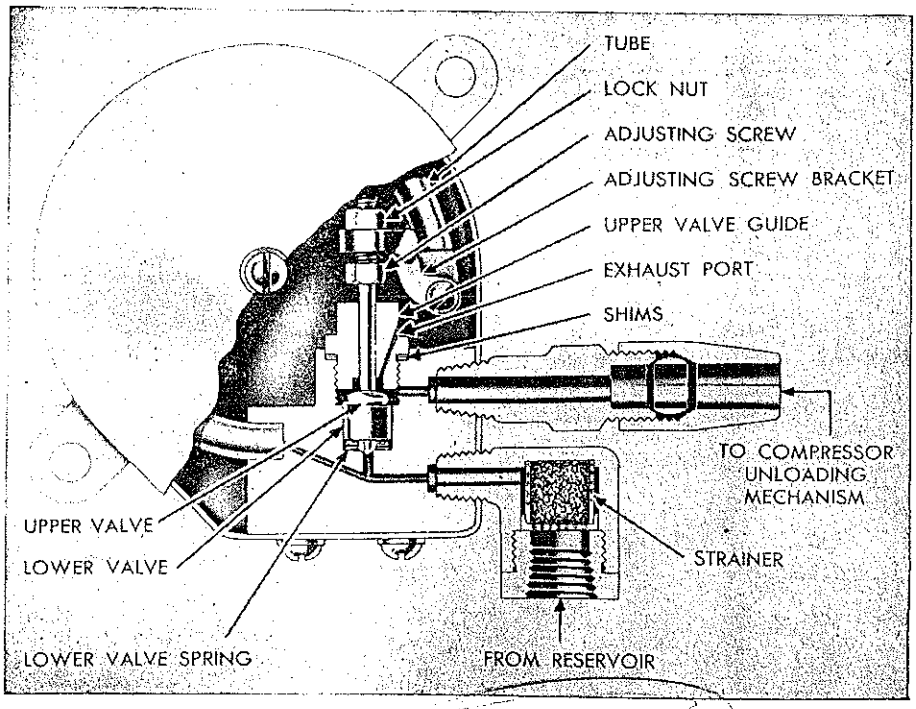


Fig. 8 Sectional view of Type O-1 Governor

TYPE O-1 GOVERNOR

The purpose of the compressor governor is to control automatically the air pressure being maintained in the reservoirs of the air brake system by the compressor between the maximum pressure desired (100-105 lbs.) and the minimum pressure required for safe brake operation (80-85 lbs.). To understand the function of the governor, it should be remembered that while the compressor may run continuously, actual compression of air is controlled by the governor, which, acting in conjunction with the compressor unloading mechanism, stops or starts compression when these maximum and minimum reservoir pressures are reached.

The design of the compressor governor is based on the principle of a Bourdon tube, which is a flattened metal tube bent to a curve that tends to straighten under internal pressure, Fig. 8. This reaction by the tube, due to changes in air pressure in the tube, increases or decreases the spring load on the valve mechanism of the governor and makes the valve mechanism assume its "cut in" or "cut out" positions in accordance with the air pressure in the reservoir.

Two types of governor cases will be found in service, one being a die cast case and the other a pressed steel case. Both types of cases are interchangeable with each other and the working parts of the governor used in both types of cases are identical.

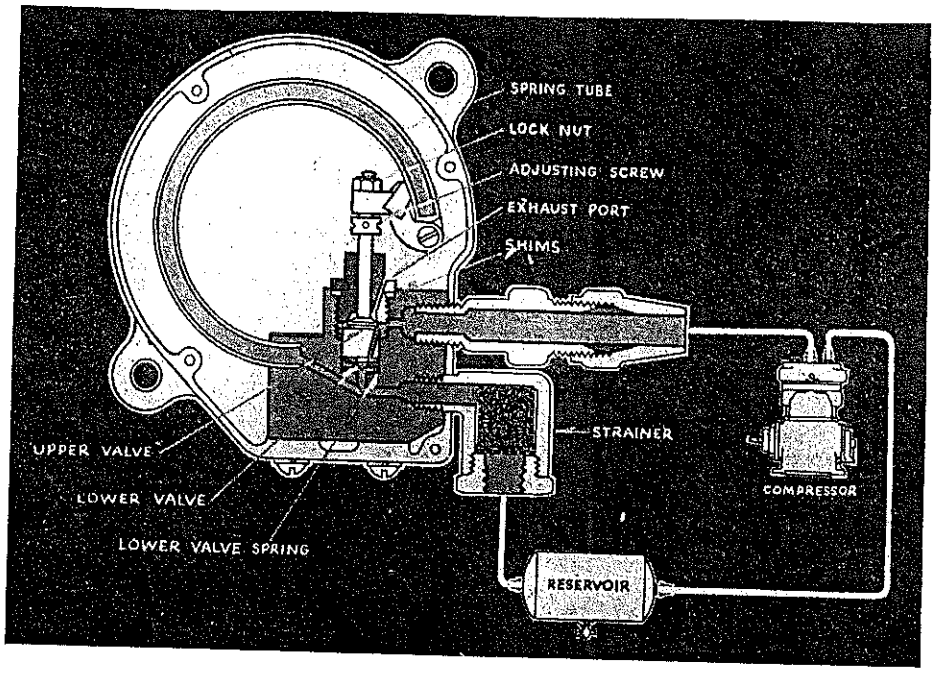


Fig. 10 Cut-in position of governor (compressor operating)

OPERATION—Air pressure from the reservoir enters the governor through the strainer and is always present below the lower valve and in the spring tube. As the air pressure increases, the load exerted on the lower valve by the spring tube decreases, because the spring tube tends to straighten out.

When the reservoir air pressure reaches the cut-out setting of the governor (100-105 lbs.) the spring load of the spring tube on the upper and lower valves has been reduced enough to permit air pressure to raise the lower valve off its seat, Fig. 9. This movement of the lower valves raises the upper valve to its seat which closes the exhaust port. Air then flows up through the small hole in the lower valve and out the upper connection to the unloading mechanism of the compressor cylinder head. When this occurs, the unloading valves in the compressor cylinder head are opened and further compression of air is stopped.

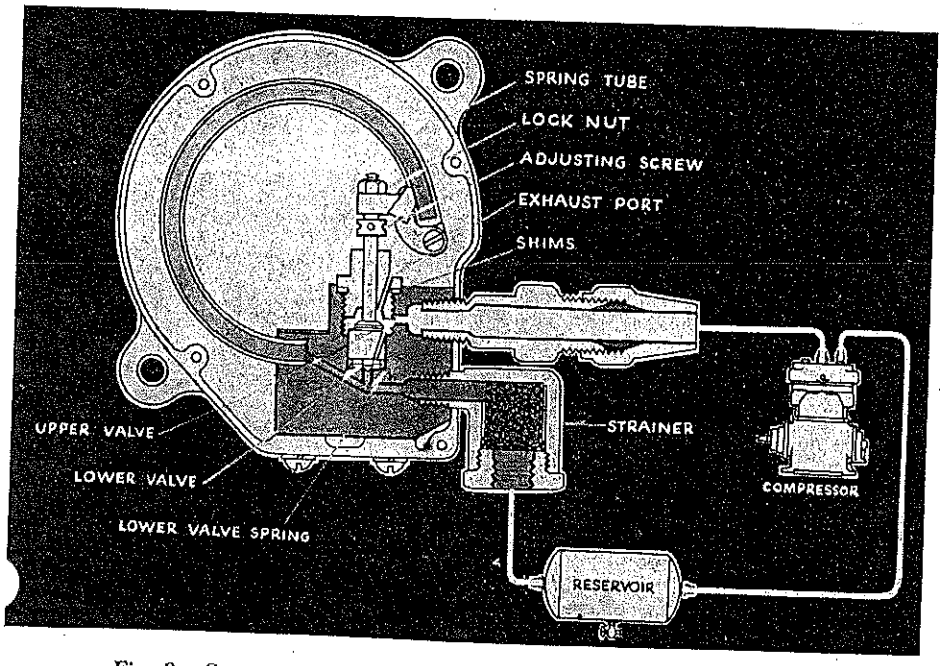


Fig. 9 Cut-out position of governor (compressor not operating)

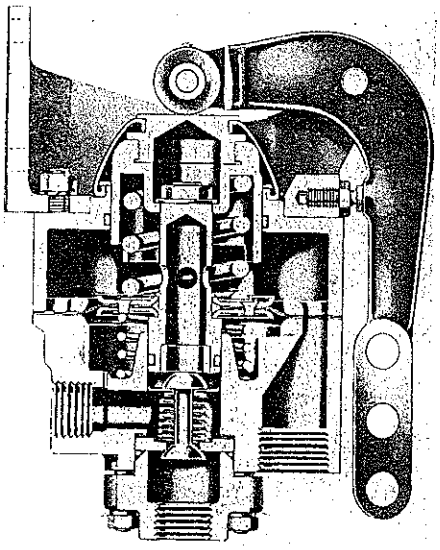


Fig. 11 Sectional view of Type D-1 Lever-Operated Brake Valve

As the air pressure in the reservoir drops to the cut-in setting of the compressor governor (80-85 lbs.) the pressure of the spring tube on the upper valve increases and forces the upper valve down off its seat, Fig. 10. This movement also seats the lower valve, preventing reservoir air pressure from passing through the governor. With the upper valve off its seat, air pressure in the unloading diaphragm cavity in the compressor cylinder head escapes through the exhaust port in

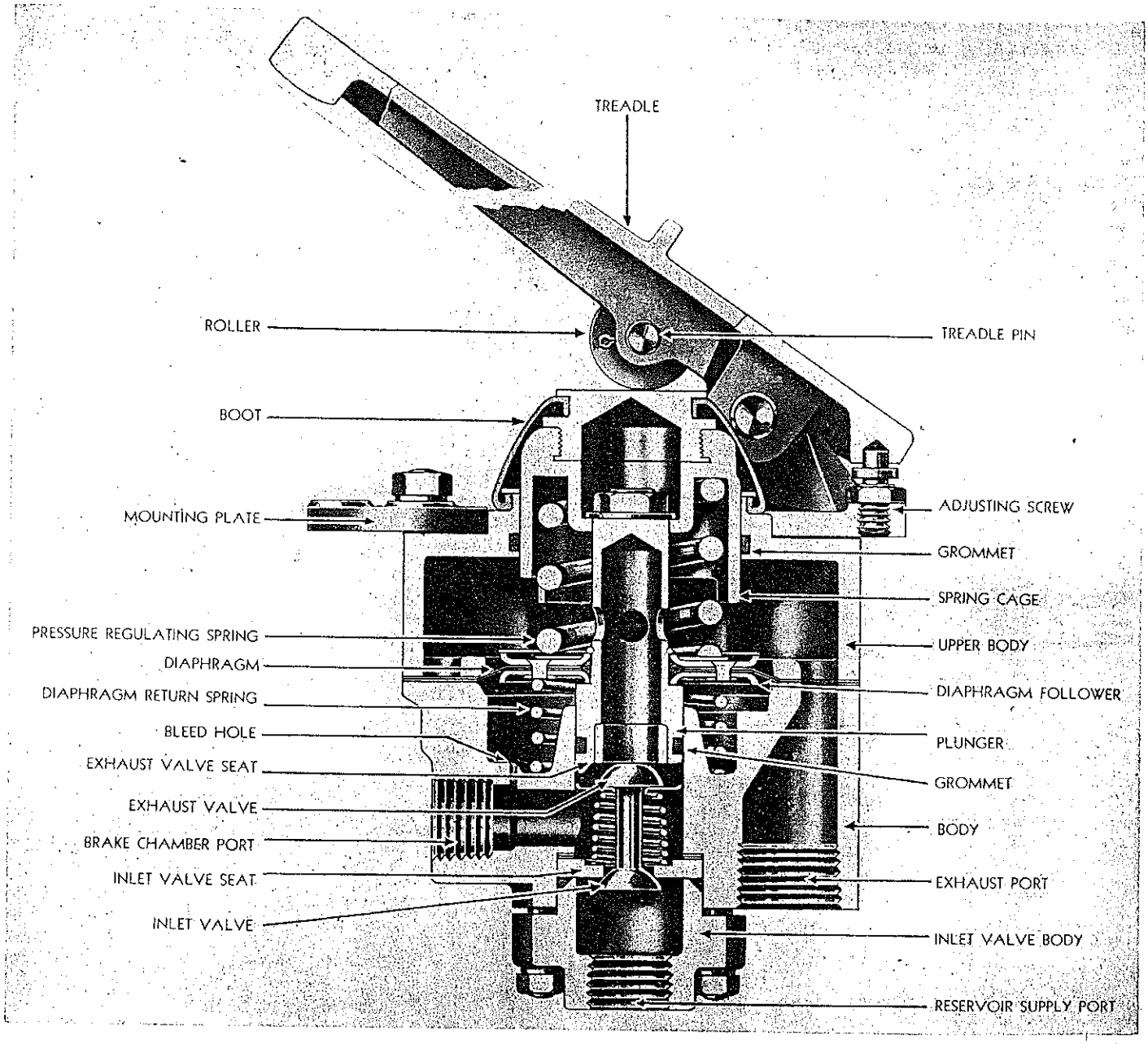


Fig. 12 Sectional view of Type D-1 Treadle-Operated Brake Valve

the governor. This permits the unloading valves in the compressor cylinder head to close and compression is resumed until reservoir pressure again rises to the cut-out setting of the governor.

PREVENTIVE MAINTENANCE— Every six months or after each 10,000 miles, remove the governor air strainer and wash all parts in cleaning solvent. Lamb's wool in the air cleaner may be used again if it can be washed thoroughly in cleaning solvent, otherwise it must be placed.

Every year or after each 25,000 miles, disassemble the governor and clean all parts. Clean or replace both tubing lines connected to the governor.

OPERATING TESTS—

1. With the engine running, build up air pressure in the air brake system and observe at what pressure registered by the dash gauge the governor cuts out, stopping further compression. The governor must cut out between 100 and 105 pounds.
2. With engine running, slowly reduce the air pressure in the air brake system by applying and releasing the brakes and observe at what pressure registered by the dash gauge the governor cuts in and the pressure is resumed. The governor must cut in between 80 and 85 pounds.
3. Before condemning or adjusting the pressure settings of the governor, be sure the dash gauge is registering accurately. This may be done by using an accurate test gauge to check the pressure registered by the dash gauge.
4. When necessary, the pressure settings (cut-in and cut-out pressures) may be adjusted after removing the cover. The pressure settings are raised by loosening the adjusting screw lock nut and turning the adjusting screw clockwise viewed from the top, Fig. 8. Pressure settings may be lowered by turning the adjusting screw counter-clockwise. The lock nut must be tightened after any adjustment.
5. If the governor cannot be adjusted to cut-in and cut-out at the proper pressure settings, it must be replaced.

6. Adjustment of the range between the cut-in and cut-out pressure is made by removing shims beneath the upper valve guide, Fig. 8, to increase the range or by installing additional shims to decrease the range.

LEAKAGE TESTS—

1. Remove cover and with governor in its cut-out position, test for leakage by applying soapsuds to the exhaust port.
2. With the governor in its cut-in position, test for leakage by applying soapsuds to the exhaust port.
3. Leakage in excess of a one-inch soap bubble in three seconds is not permissible in either of the above tests. If excessive leakage is found, the governor must be replaced.
4. Install cover after making tests.

TYPE D-1 BRAKE VALVE

D-1 brake valves have replaced the old B-4-B valve in modern air brake systems. They are fitted with either a treadle or a lever suitable for connecting to a conventional brake pedal, Figs. 11 and 12. Movement of the treadle or brake pedal controls the movement of an inlet valve and exhaust valve which in turn control the air pressure being delivered to or released from the brake chambers on the vehicle.

To fully apply the brakes with a type D-1 brake valve, the treadle (or brake pedal) must be fully depressed; whereas when the treadle is only partially depressed, correspondingly less braking force is developed. In other words, the farther the driver depresses the treadle, the greater the air pressure delivered to the brake chambers and the more effective the brake application.

At any time the brakes of the vehicle may be partially released by the driver, permitting the treadle or brake pedal to partially return towards released position, or they may be entirely released by permitting the treadle to return to full released position. In this manner, the amount of force being applied to the brakes of the vehicle is always under control of the driver.

OPERATION—As the driver depresses the treadle, pressure is exerted on top of the pressure regulating spring and diaphragm. As the diaphragm moves downward, the exhaust valve seat moves downward against the exhaust valve and closes it, Fig. 13. Continued movement of the diaphragm downward pushes the inlet valve off its seat. Air pressure from the reservoir then flows through the inlet valve and out the brake chamber ports to the brake chambers, applying the brakes.

When the air pressure being delivered to the brake chambers from the cavity below the diaphragm overcomes the mechanical force being exerted on top of

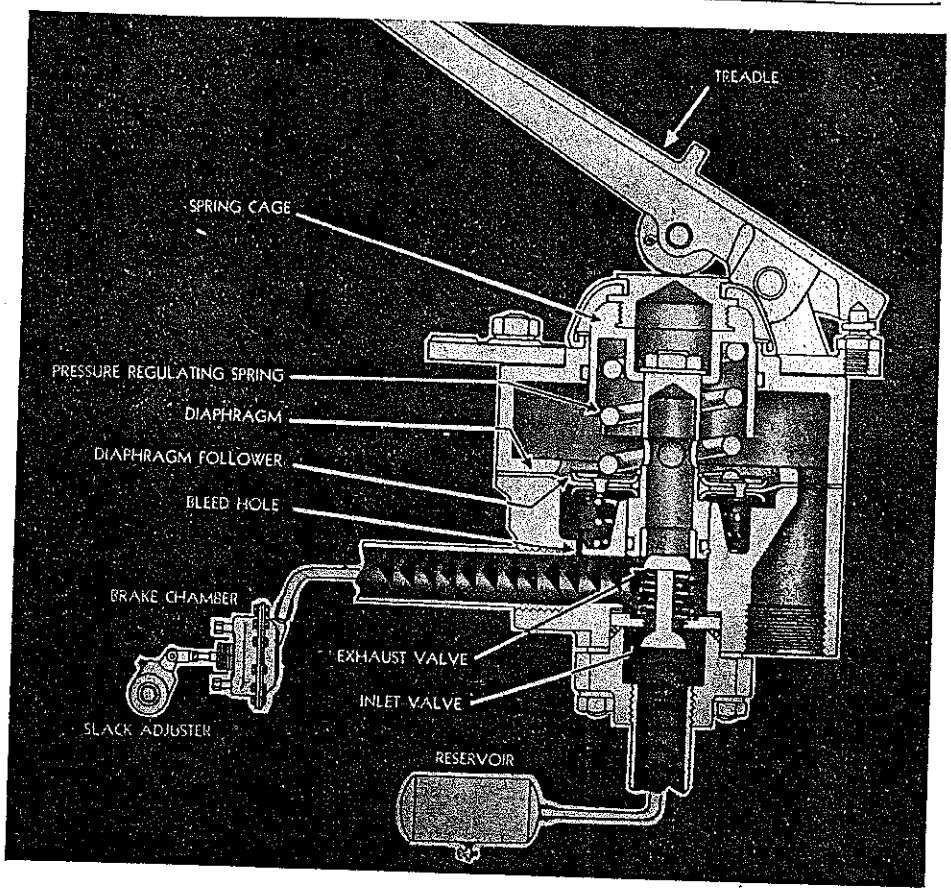


Fig. 13 Applying position of D-1 Brake Valve

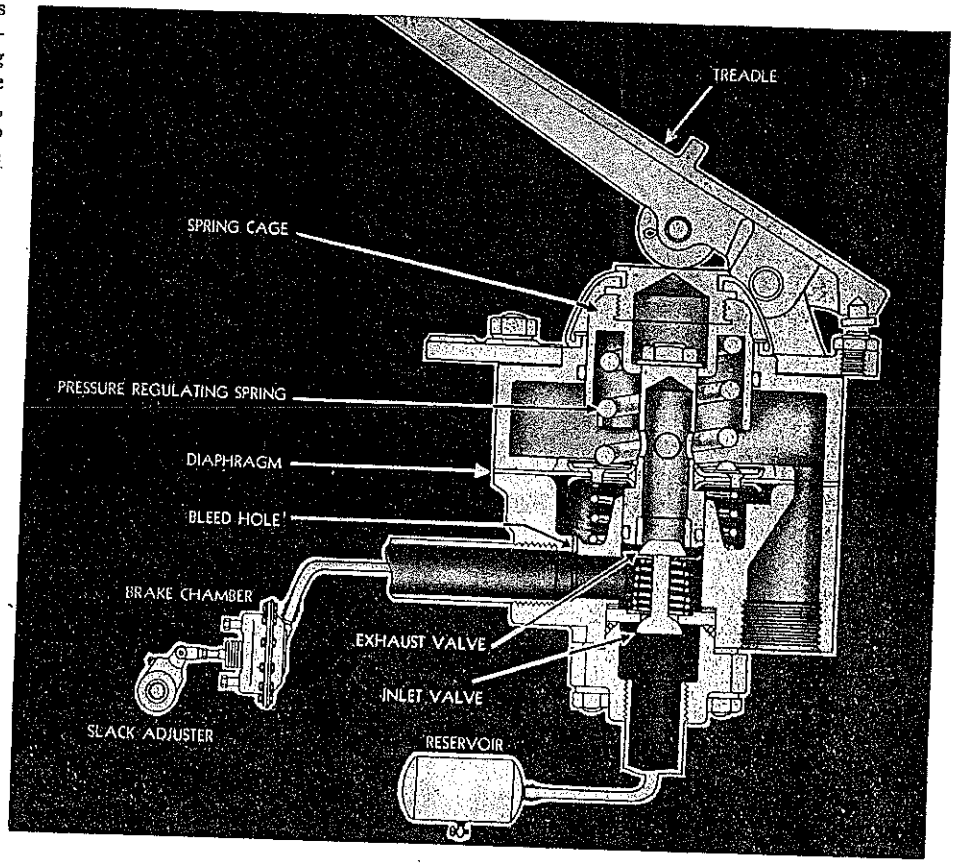


Fig. 14 Holding position of D-1 Brake Valve

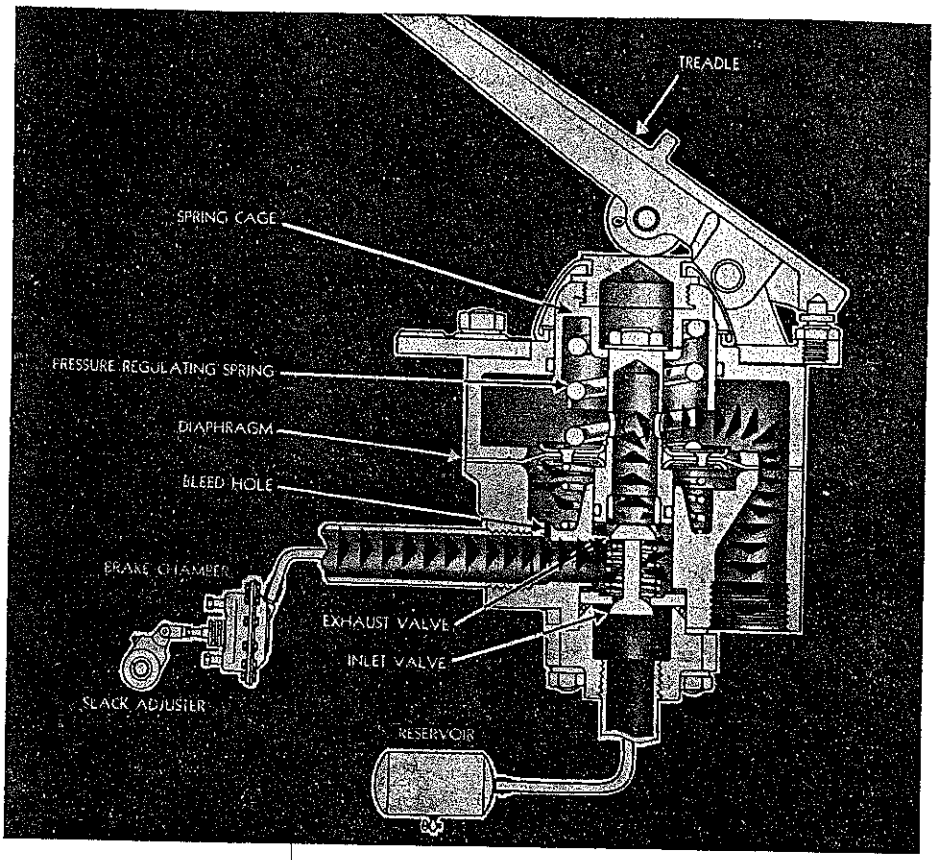


Fig. 15 Releasing position of D-1 Brake Valve

the diaphragm, the diaphragm lifts and the inlet valve closes, cutting off further supply of air pressure to the brake chambers, while the exhaust valve remains closed, preventing any escape of air pressure through the exhaust port, Fig. 14. Should the driver depress the treadle further, and put additional force on top of the diaphragm, a corresponding increase in the air pressure being delivered to the brake chambers results.

If the driver permits the treadle to partially return toward its fully released position, thus reducing the mechanical force on top of the diaphragm, the air pressure below the diaphragm overcomes the mechanical force on top of it and the diaphragm lifts still further. When this happens, the inlet valve remains closed but the exhaust valve opens to exhaust air pressure from the brake chambers until the air pressure below the diaphragm again balances the mechanical force on top of it. If the driver permits the treadle to return to fully released position, Fig. 15, the exhaust valve remains open and all air pressure from the brake chambers is exhausted and the brakes on the vehicle are fully released.

If the driver depresses the treadle to fully applied position, the pressure regulating spring is compressed and the spring cage strikes the diaphragm follower. Under these conditions, the inlet valve is held open, permitting full reservoir pressure to pass through the brake valve into the brake chambers.

PREVENTIVE MAINTENANCE—Every month or after each 2,000 miles, lubricate the treadle (or lever roller and hinge pin and linkage with lever type valve) with engine oil.

On lever type brake valve only, check to be sure that with brake fully applied, pedal contacts floor boards or pedal stop. With brake released, check to be sure that the lever arm on the brake valve contacts the adjusting screw on the brake valve. Adjust the pedal stop, or linkage, if necessary, to provide for this. After any adjustment, check the brake valve delivery pressure.

Every year or after each 50,000 miles, disassemble the brake valve and clean all parts.

OPERATING TESTS—Check the delivery pressure of the brake valve, using an accurate air pressure test gauge. If the vehicle has trailer connections, the test gauge may be conveniently connected to the service line outlet at the rear of the vehicle. With the treadle (or pedal) fully depressed, the brake valve must be delivering approximately full reservoir pressure as registered by the dash gauge.

On some vehicles, the treadle (or pedal stop or linkage) is arranged so as to prevent the brake valve delivering full reservoir pressure. This arrangement must not be altered on such vehicles unless it is necessary to do so in order to correct the maximum delivery pressure. A higher maximum delivery pressure will increase the effectiveness of the brakes.

If the lever type brake valve does not deliver approximately full reservoir pressure when the brake pedal is fully depressed, adjust the pedal stop or linkage

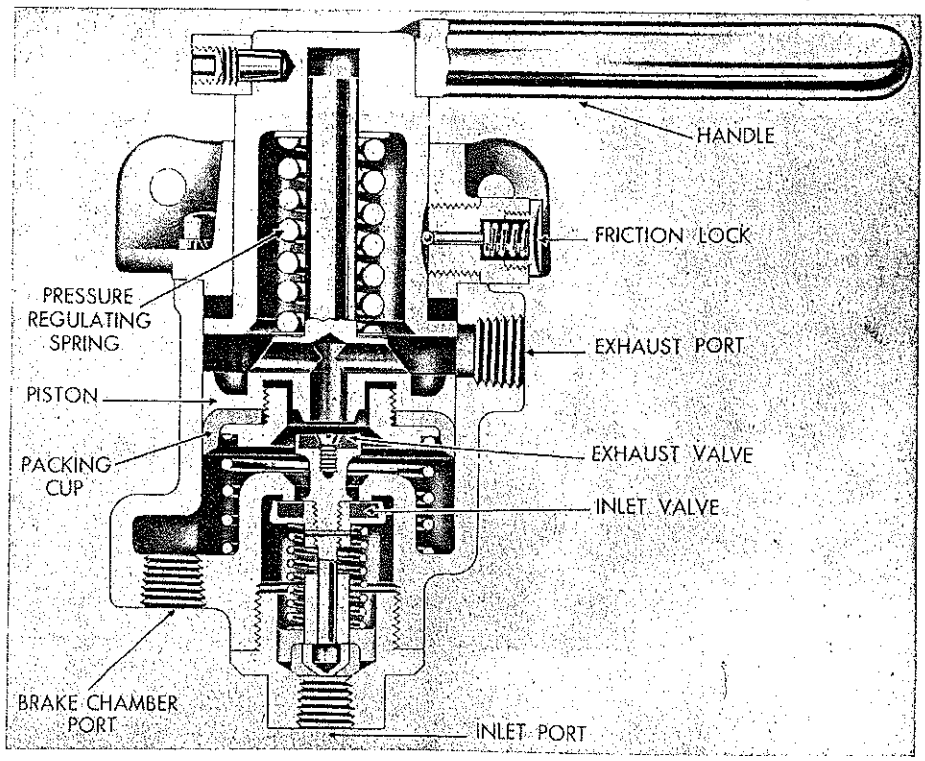


Fig. 16 Sectional view of Type HP Hand-Operated Brake Valve

so as to increase the travel of the brake valve lever. This should increase the delivered pressure. When making this adjustment, make sure that the pedal is stopped in the maximum applying position by the pedal striking either a pedal stop or the floor boards.

Depress the brake pedal to several positions between fully released and fully applied and check to be sure the delivered air pressure registered by the test gauge varies in accordance with the position in which the pedal is held. The brake valve must control all delivery pressures between approximately 5 and 70 pounds.

LEAKAGE TESTS—With treadle fully released, coat the exhaust port with soapsuds to check for leakage. Repeat this test with the treadle fully depressed. With either of these tests, leakage in excess of a one-inch soap bubble in one second is not permissible. If excessive leakage is found, the brake valve must be repaired or replaced.

TYPE HP BRAKE VALVE

Type HP brake valves, Fig. 16, are used for controlling the brakes on a trailer independently of the brakes on the towing vehicle. They are usually mounted on the steering column or on the dash and the driver may put the handle in any of several positions between brakes released and brakes fully applied so the brakes on the trailer are kept applied until the brake valve handle is returned to release position.

The distance the brake valve handle is moved in a clockwise direction toward applied position determines the severity of the brake application. The driver may, therefore, control the brakes on the trailer as the speed, load and road conditions require.

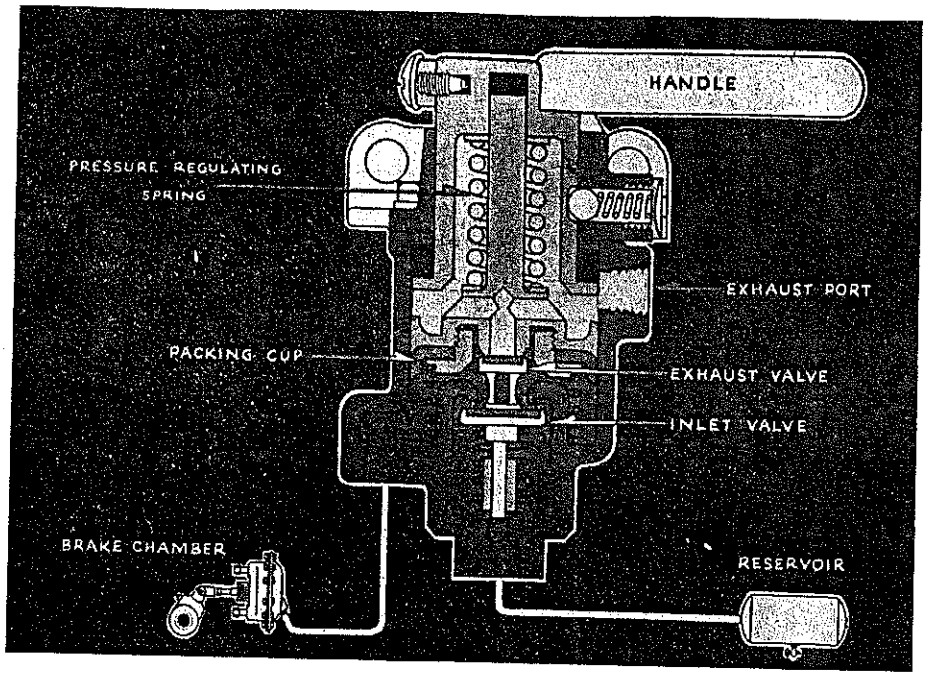


Fig. 17 Applying position of HP Brake Valve

OPERATION—As the brake valve handle is moved toward applied position, Fig. 17, pressure is exerted on the top of the pressure regulating spring and the piston assembly moves downward. When this hapens, the exhaust valve seat engages the exhaust valve and closes the passage to the exhaust port. The exhaust valve and inlet valve are part of the same assembly, therefore, after the exhaust valve is closed and the piston assembly continues its movement downward, the inlet valve is forced off its seat. This permits air pressure from the reservoir to pass through the inlet valve and out the connection leading to the service line and the brakes on the trailer.

As soon as the air pressure below the piston assembly overcomes the mechanical force on top of it, the piston assembly lifts, the intake valve closes, cutting off any further air supply, and the exhaust valve remains closed, preventing any loss of air pressure through the exhaust port, Fig. 18. Any further movement of the handle toward fully applied position adds additional mechanical force on top of the piston assembly and correspondingly increases the delivered air pressure.

If the brake valve handle is moved toward released position, the mechanical force on top of the piston assembly is decreased. This permits the air pressure below the piston assembly to lift it still further, thus opening the exhaust valve and permitting air pressure to exhaust from the service line until a lower air pressure is established to balance the lesser mechanical force acting on top of the piston assembly, Fig. 19.

In this manner, the brake application on the trailer may be graduated during both application and release of the brakes and the position of the brake valve handle always determines the air pressure being delivered through the service line to the trailer brake equipment.

The handle of the brake valve is fitted with a friction lock so it will remain in whatever position it is placed by the driver. The brake valve should never be used, however, to hold the brakes applied when vehicles are being parked or when the driver is off duty. If the vehicles are parked on a hill or grade, other precau-

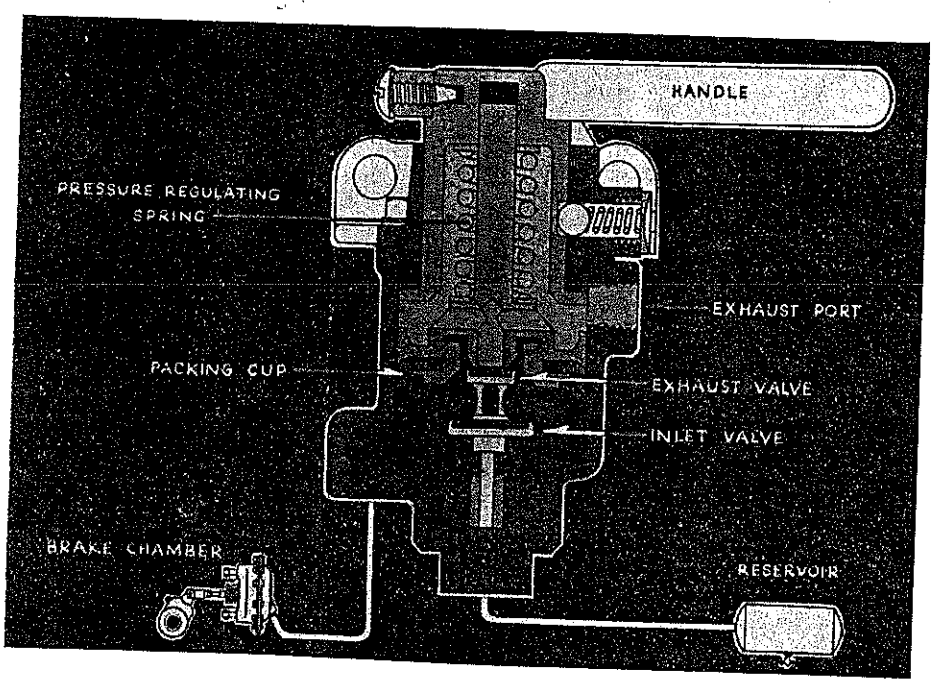


Fig. 18 Holding position of HP Brake Valve