With a major adjustment, the drums must be removed in order to inspect the general condition of the brake system and to perform other operations necessary to complete the adjustment.

When necessary to remove brake shoes from a hydraulic system, install a brake cylinder piston clamp before removing the brake shoes, Figs. 18 and 19. This will prevent the cylinder pistons from being forced out of position and will thus prevent brake fluid loss. Remove the brake shoe return springs, using the pliers shown, Fig. 18. The same pliers are used to reconnect the springs.

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.

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 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.

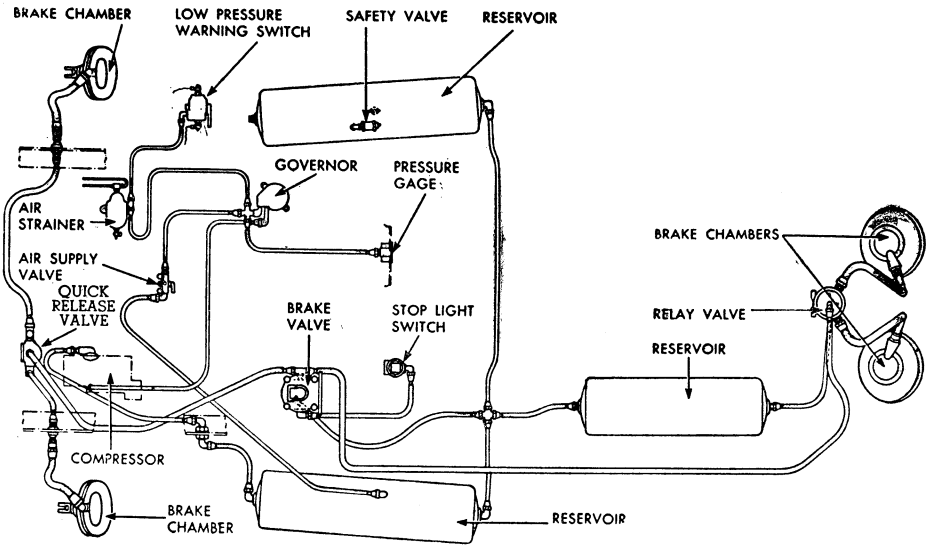

Fig. 1 Air brake diagram for a dump truck

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.

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 chambers 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 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.

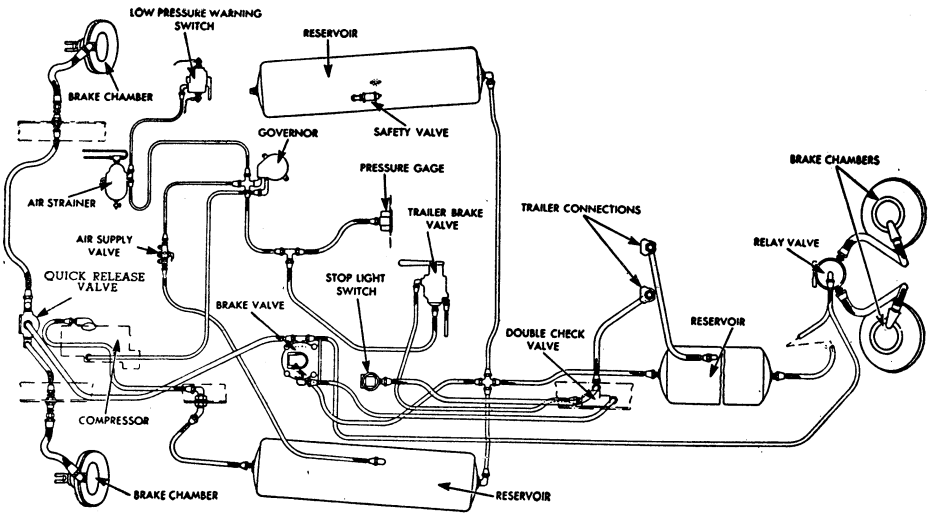

Fig. 2 Air brake diagram for a tractor truck

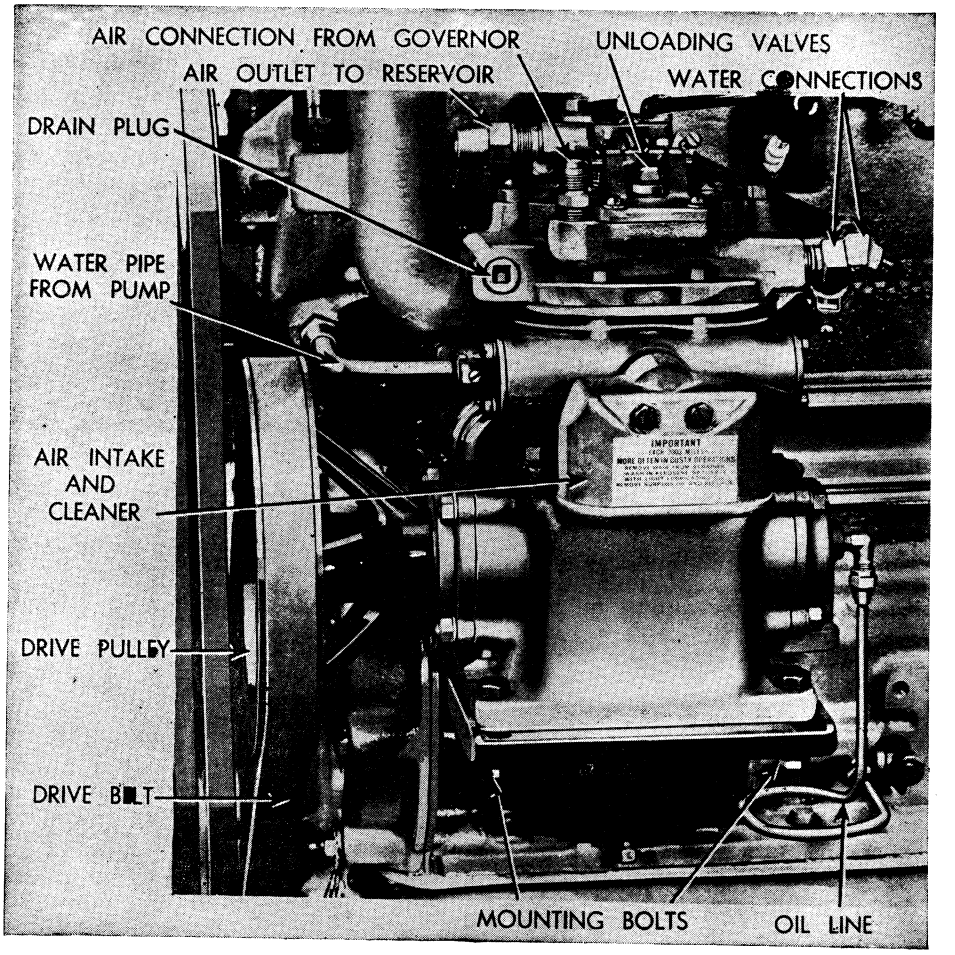

Fig. 3 Air compressor installed

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

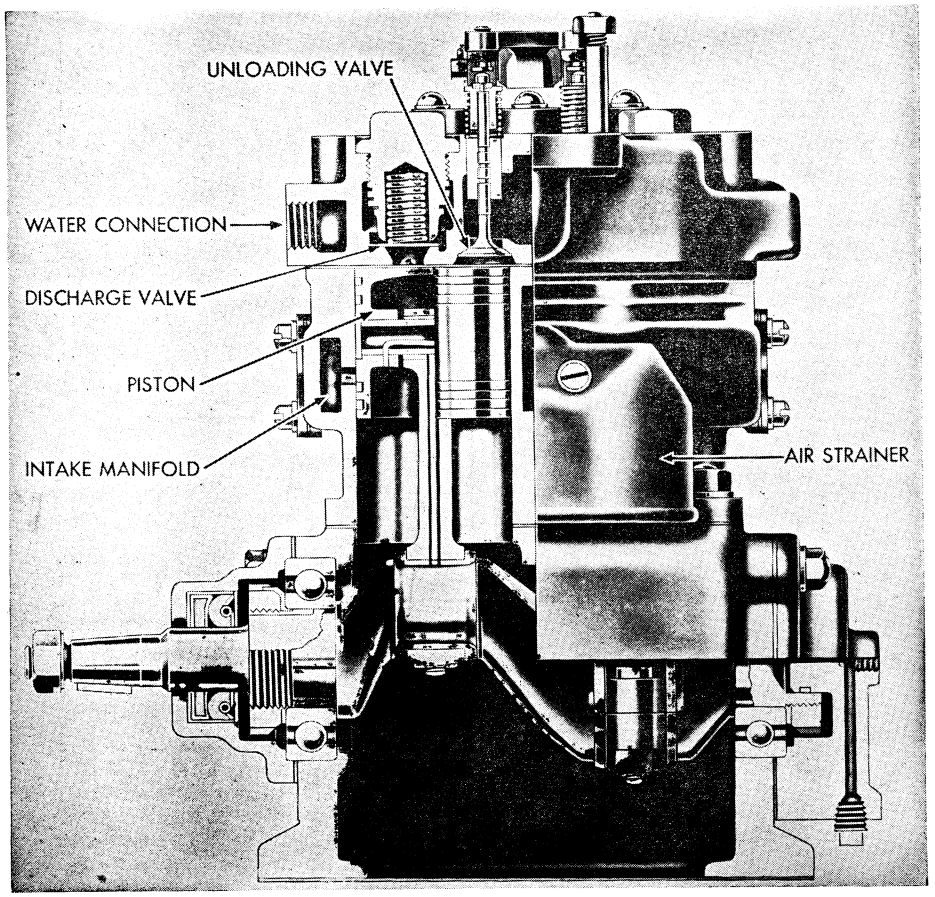

Fig. 4 Sectional view of air compressor

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.

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.

COMPRESSORS

Operation

All air 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

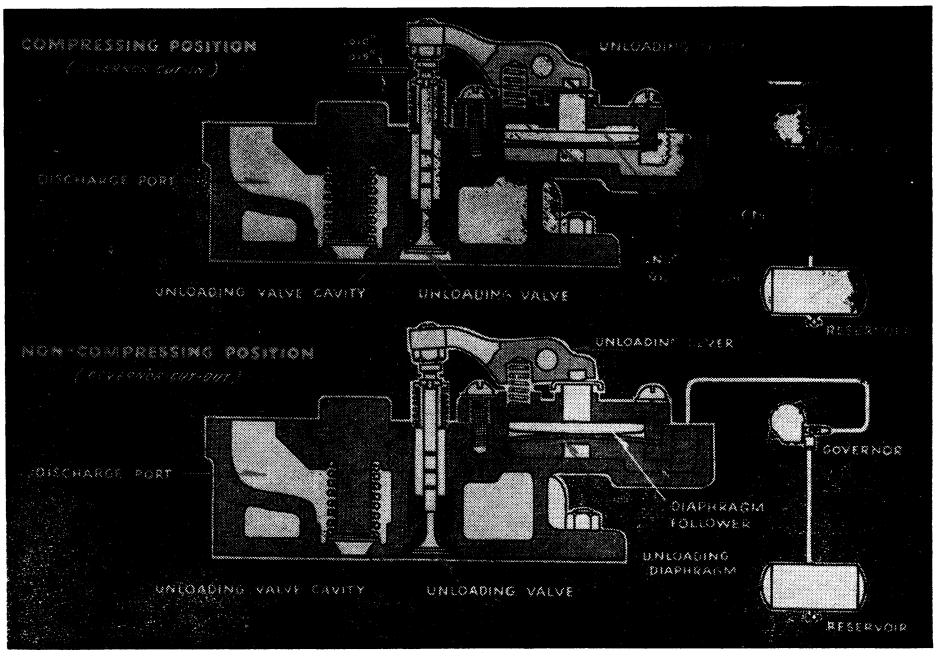

Fig. 5 Compressor unloading mechanism

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.

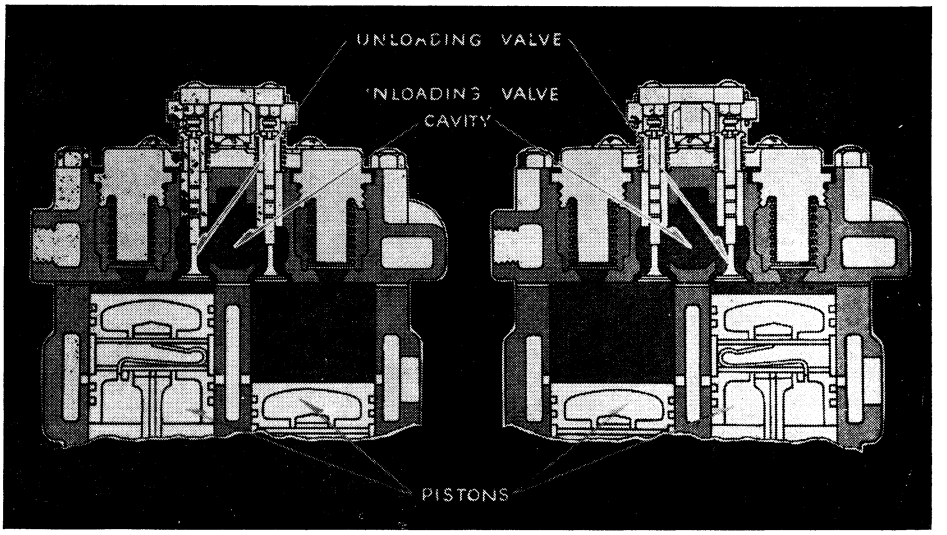

Fig. 6 Passage of air during non-compression

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 adjust if necessary, Fig. 7. Clearance must be .010-.015". To adjust 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-lubricating 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 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 being 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. Exessive 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.

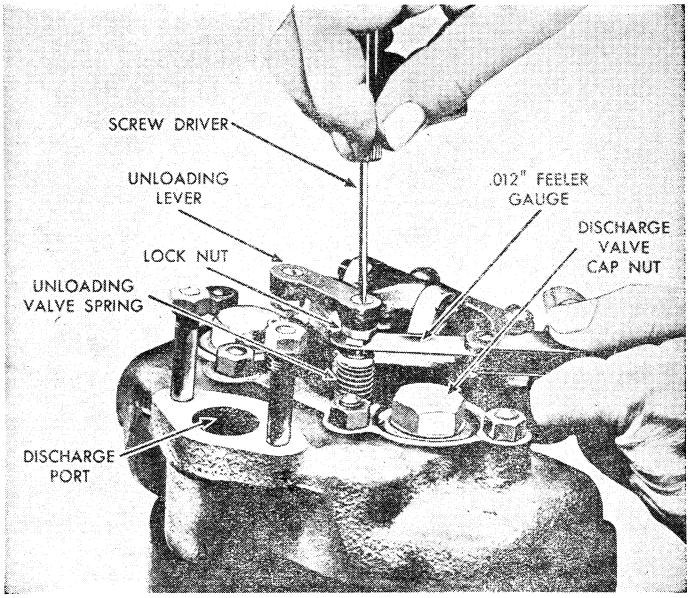

Fig. 7 Adjusting compressor unloading valve clearance

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.

GOVERNORS

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.

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.

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 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 thor-

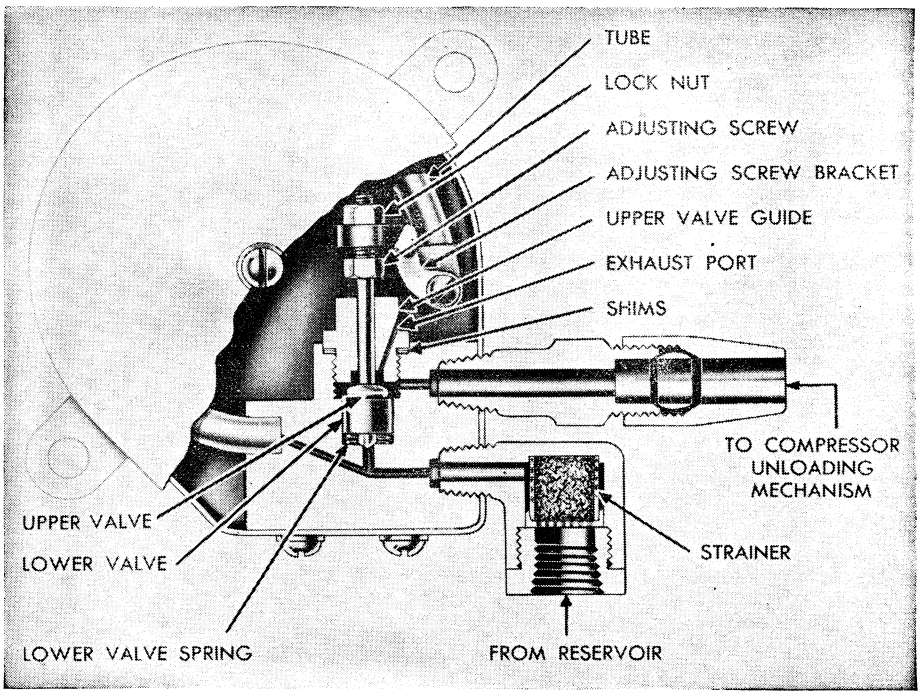

Fig. 8 Sectional view of Type O-1 Governor

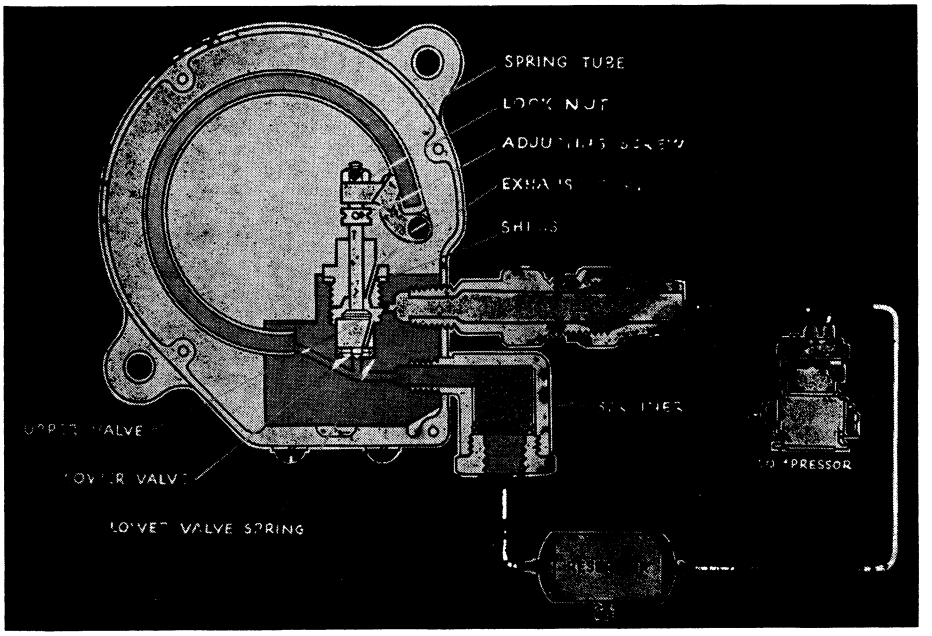

Fig. 9 Cut-out position of governor (compressor not operating)

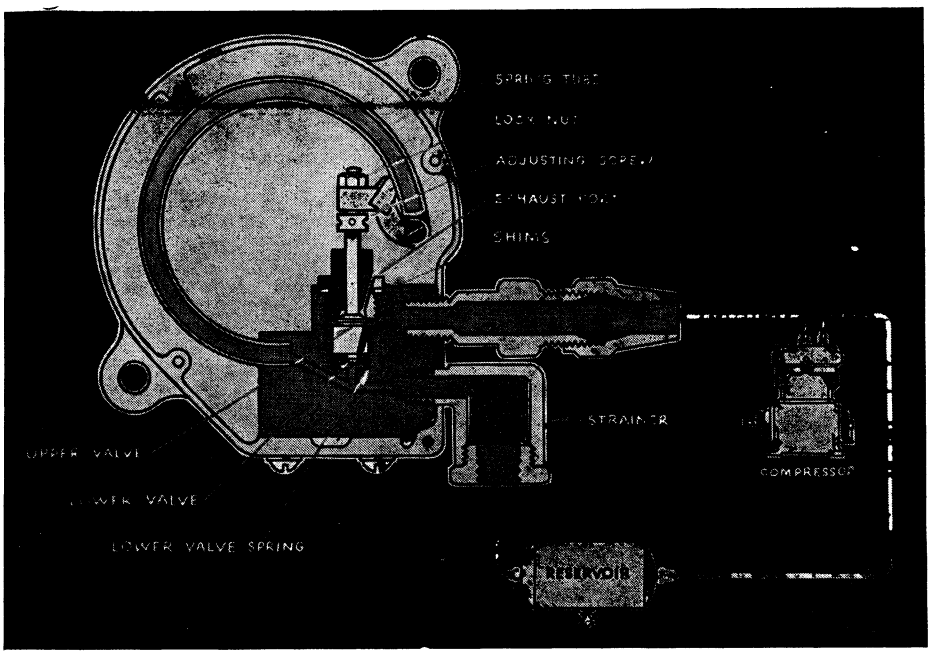

Fig. 10 Cut-in position of governor (compressor operating)

oughly in cleaning solvent, otherwise it must be replaced.

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.

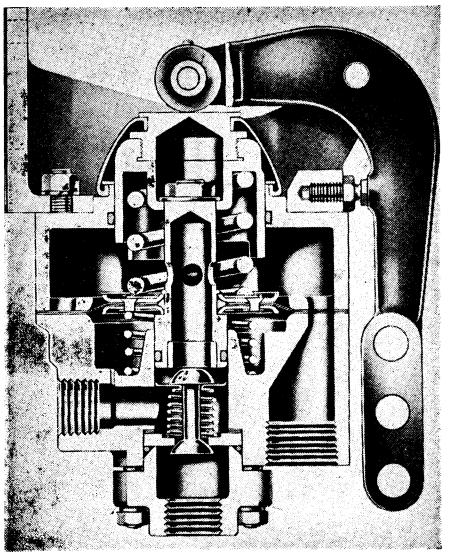

Fig. 11 Sectional view of Type D-1 Lever-Operated Brake Valve

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.

BRAKE VALVES

Brake valves 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.

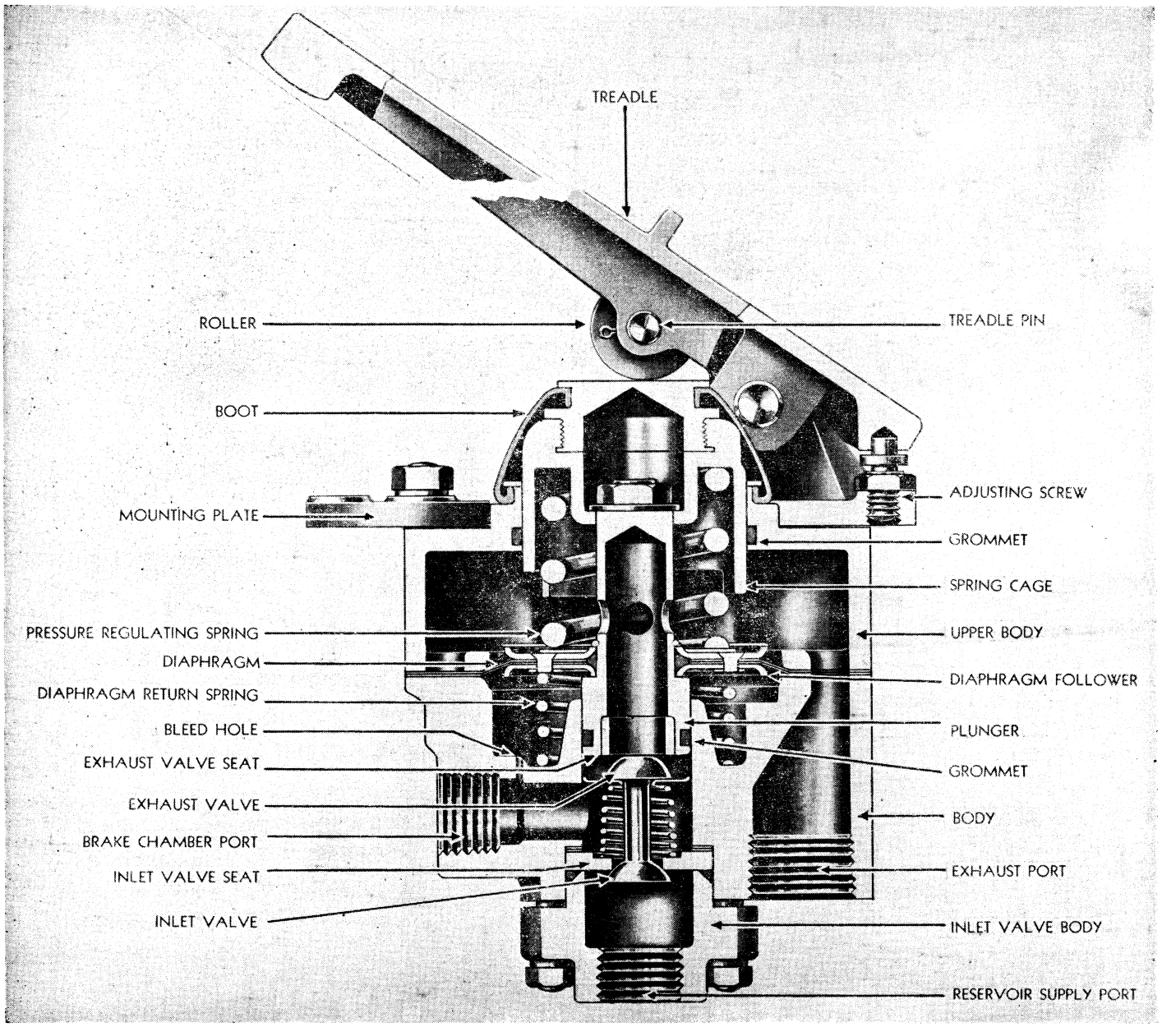

Fig. 12 Sectional view of Type D-1 Treadle-Operated Brake Valve

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 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 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 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 adusting 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 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.

BRAKE VALVES

Hand Operated

Hand-operated 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.

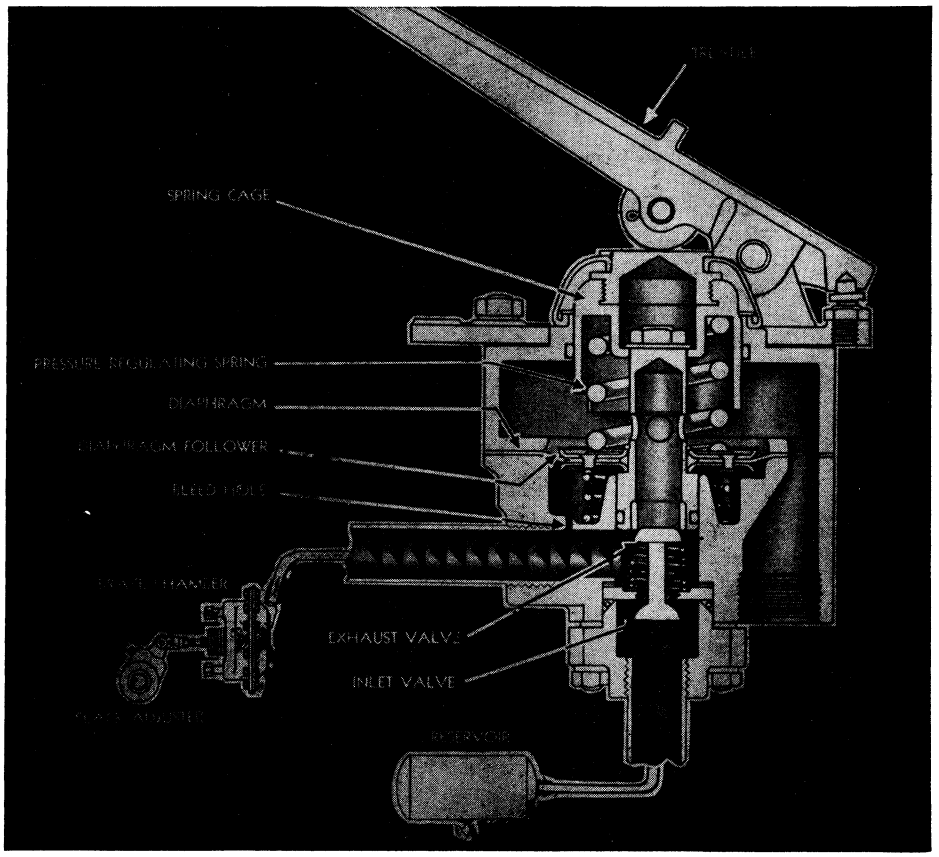

Fig. 13 Applying position of D-1 Brake Valve

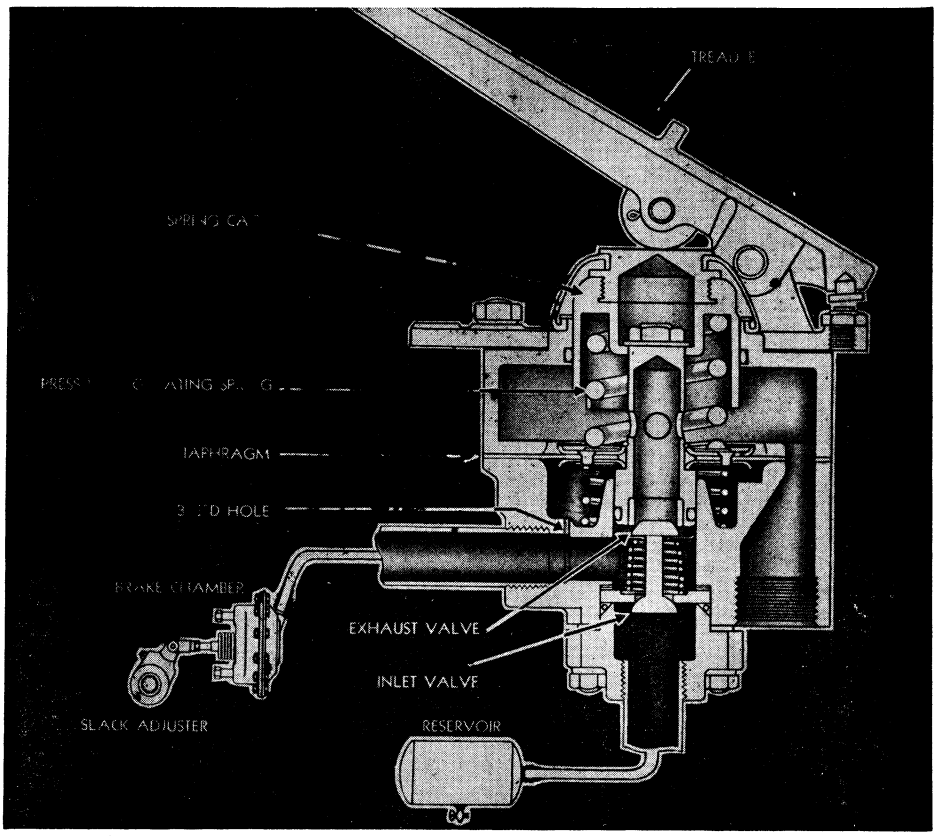

Fig. 14 Holding position of D-1 Brake Valve

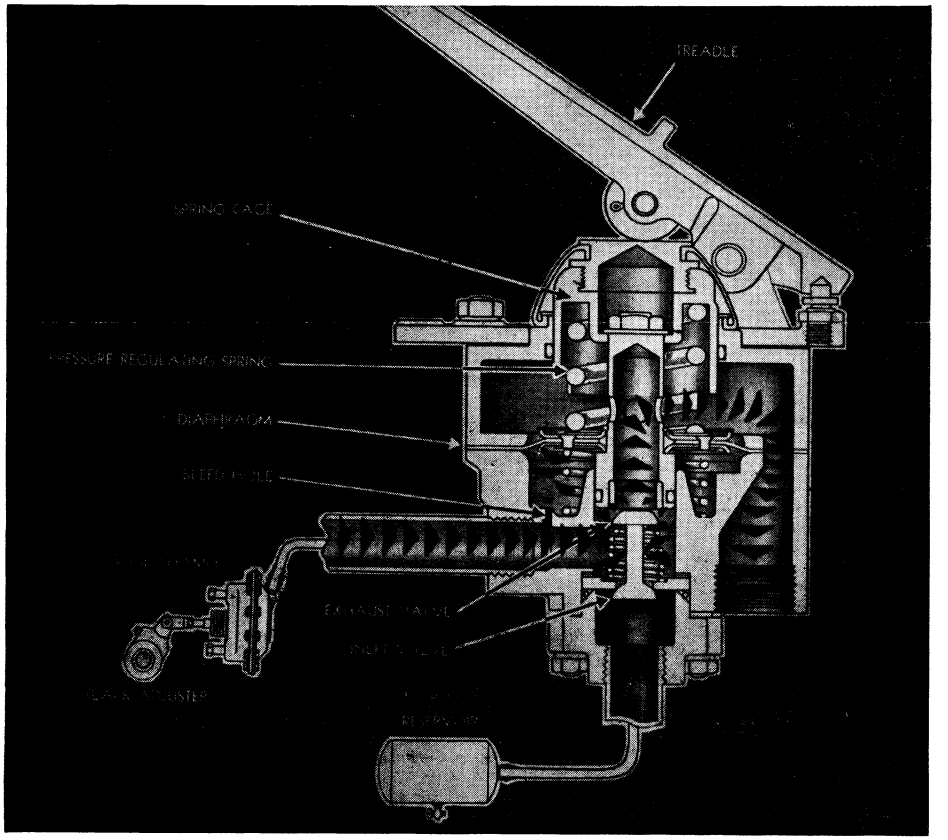

Fig. 15 Releasing position of D-1 Brake Valve

The 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.

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 happens, 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 precautions such as blocking the wheels must be taken as there is the possibility the air pressure in the system may be depleted due to leakage and the brakes release after a reasonable lapse of time.

Operating Tests

Check the delivery pressure of the brake valve, using an accurate air pressure test gauge. The test gauge may be conveniently connected to the service line outlet at the rear of the vehicle. With the brake valve handle moved to its fully applied position, the brake valve must deliver at least 60 pounds pressure.

Move the brake valve handle to several different positions between fully applied and fully released positions and observe that the air pressure registered

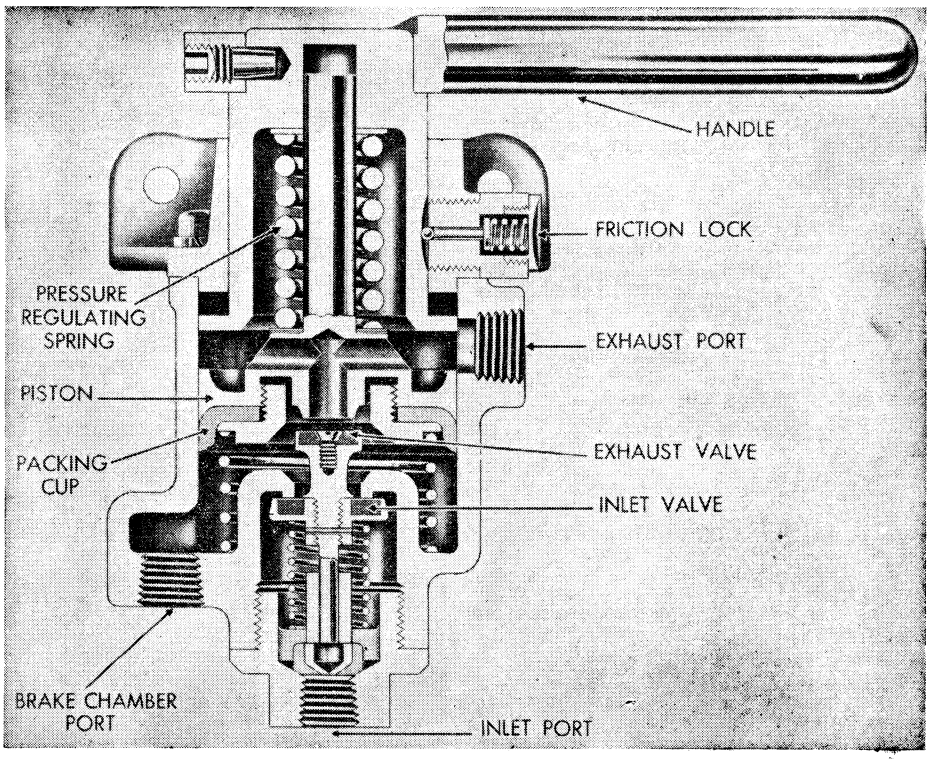

Fig. 16 Sectional view of Type HP Hand-Operated Brake Valve

by the test gauge varies in accordance with the position to which the handle is moved.

Leakage Tests

1. With brake valve handle in released position, coat the exhaust port with soapsuds to check for leakage.
2. With brake valve handle in fully applied position, coat the exhaust port with soapsuds to check for leakage.
3. Leakage in excess of a one-inch soap bubble in one second is not permissible in either of these tests. If excessive leakage is found, it will usually be caused by dirty or worn valves or valve seats and the inlet and exhaust valve assembly or the complete brake valve must be repaired or replaced. Leakage due to dirty valves and valve seats may be corrected by removing the inlet and exhaust valve assembly and cleaning the valves and valve seats. Leakage due to worn valves may be corrected by installing a new inlet and exhaust valve assembly. If the valve seats are pitted or worn excessively, or if the installation of a new inlet and exhaust valve assembly does not correct the leakage, the brake valve must be repaired or replaced.

QUICK RELEASE VALVE

The purpose of the quick release valve is to reduce the time required to release the brakes by hastening the exhaust of air pressure from the brake chambers. It is most commonly used with front wheel brake chambers.

The valve consists of a body, Fig. 20, containing a spring loaded diaphragm so arranged as to permit air pressure to flow through the valve in one direction but when the supply pressure is reduced, the air which has passed through the valve is permitted to escape through the exhaust port.

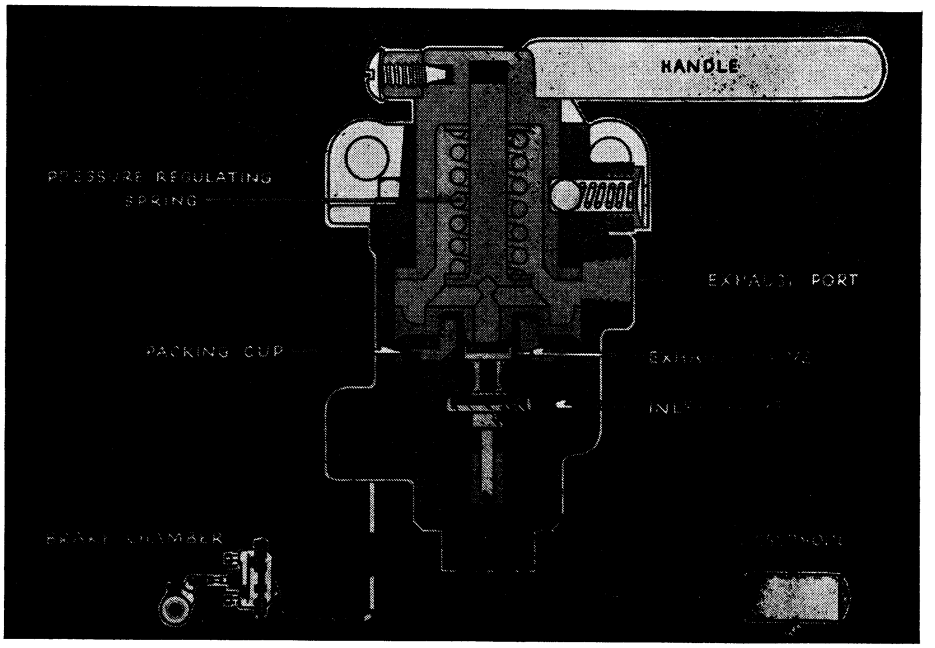

Fig. 18 Holding position of HP Brake Valve

Operation

The quick release valve assumes three positions during normal operation. These three positions are (1) the applying position, when air pressure is passing through the valve into the brake chambers; (2) the holding position, when pressure is being held in the brake chambers; (3) the releasing position, when the brake chamber pressure is being exhausted, Fig. 21.

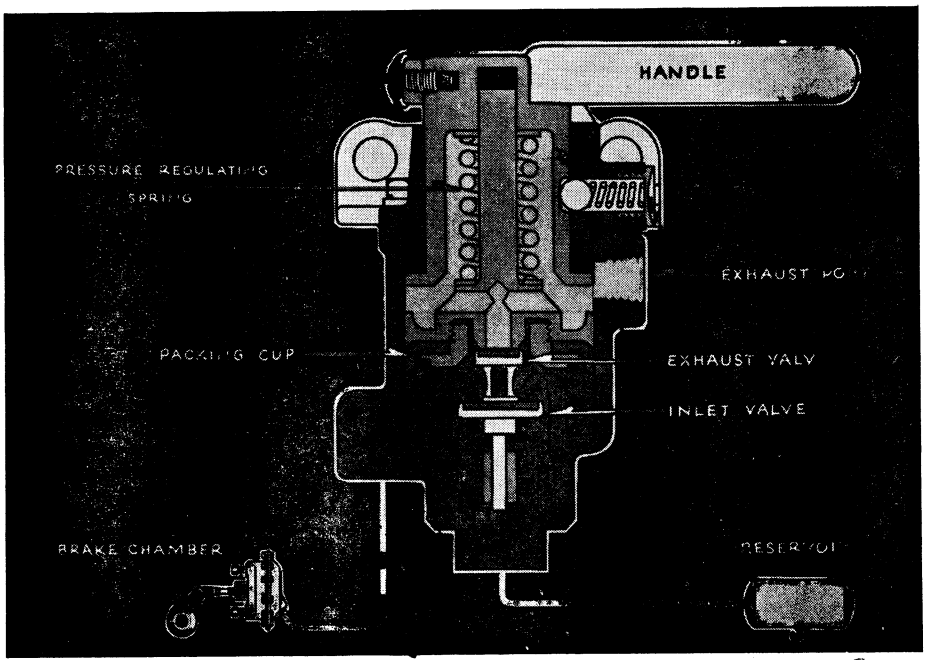

Fig. 17 Applying position of HP Brake Valve

When air pressure from the brake valve enters the top connection of the quick release valve, the diaphragm moves down and closes the exhaust port. Air pressure then deflects the outer edges of the diaphragm downward and flows out the side connections to the brake chambers, applying the brakes.

As soon as the brake chamber pressure below the diaphragm equals the brake valve pressure above the diaphragm, the force of the spring below the diaphragm forces the outer edge of the diaphragm back up against the body, although the center of the diaphragm keeps the exhaust port closed. This is the holding position.

If the brake valve pressure on top of the diaphragm is released, the brake chamber pressure below the center of the diaphragm raises it, which opens the exhaust port and permits brake chamber pressure to be released through the exhaust port.

If the brake valve pressure on top of the diaphragm is only partially released, the diaphragm assumes its holding position as soon as the pressures above or below it are equalized.

In this manner, the quick release valve reacts to pass any increased brake valve pressure through it to the brake chambers, or quickly releases the brake chamber pressure when the brake valve pressure is reduced and thus maintains the same pressure in the brake chambers as the brake valve is delivering.

Operating Tests

Apply the brakes and observe that when the brakes are released, air pressure is completely exhausted through the exhaust port of the valve. Be sure exhaust port is not restricted in any way.

Leakage Tests

With brakes applied, coat the exhaust

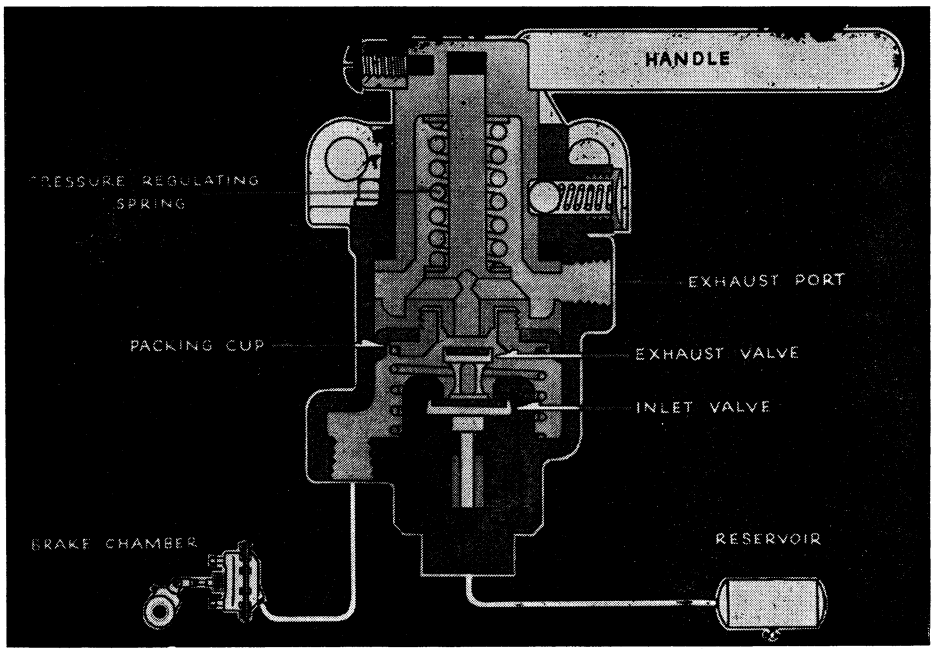

Fig. 19 Releasing position of HP Brake Valve

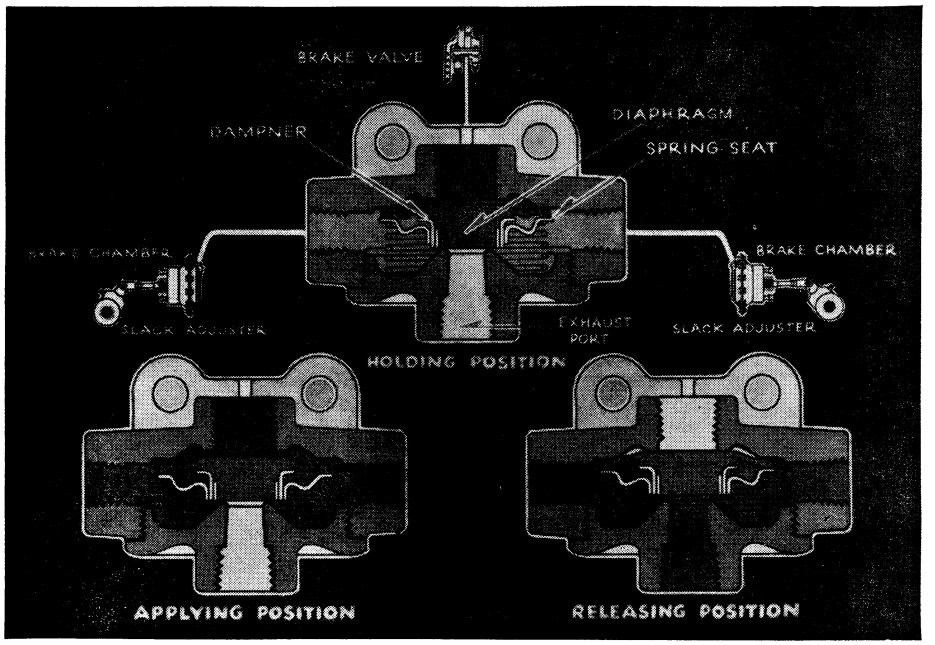

Fig. 21 Applying, holding and releasing positions of Quick Release Valve

port with soapsuds to detect leakage. Leakage in excess of a one-inch soap bubble in one second is not permissible.

RELAY VALVE

The relay valve, Fig. 22, speeds up the application and release of the rear wheel brakes. It is controlled by the brake valve and keeps the air pressure in the rear brake chambers the same as the pressure being delivered by the brake valve. It reacts to even slight changes in pressure and raises, lowers, or completely exhausts the air pressure in the rear brake chambers as the brake valve raises, lowers, or completely exhausts air pressure from it.

Operation

The operation of the relay valve is controlled by the air pressure delivered to it by the brake valve. Air pressure from the brake valve is delivered to the cavity above the rubber diaphragm and because this cavity is comparatively small and therefore subject to quick changes in air pressure, the action of the valve in changing its delivered pressures is also very rapid.

The mechanism inside the valve assumes three positions during normal

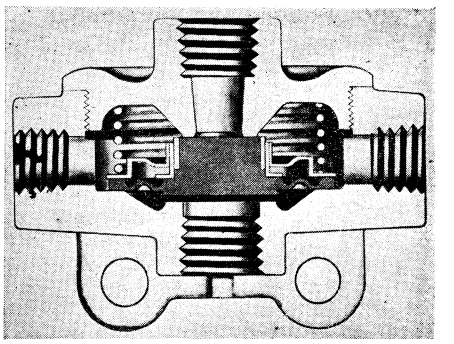

Fig. 20 Sectional view of Quick Release Valve

operation. These three positions are (1) the applying position, when the valve is actually delivering air pressure to the brake chambers; (2) the holding position, when the valve is maintaining or holding a constant pressure in the brake chambers; (3) the releasing position, when the valve is releasing or reducing the air pressure in the brake chambers.

As air pressure from the brake valve enters the cavity above the diaphragm, the diaphragm is depressed, Fig. 23. The diaphragm thus seals the exhaust port beneath its outer edge and its center is deflected, forcing the diaphragm guide down against the top of the supply valve. Further movement forces the supply valve off its seat and air pressure from the reservoir flows through the supply valve into the cavity below the diaphragm which is connected to the brake chambers. In this position, air pressure is flowing directly from the reservoir through the relay valve into the brake chambers, applying the brakes.

As soon as the air pressure below the diaphragm equals the air pressure above the diaphragm, the force of the supply valve spring lifts the center of the diaphragm to its normal position and closes the supply valve. This limits the air pressure being delivered to the brake chambers by the relay valve to the same pressure as that being delivered to the relay valve by the brake valve. In this position, the supply valve is closed and action of the spring and air pressure on top of the diaphragm keeps the outer edge of the diaphragm sealing the exhaust port. Thus, the valve is in its holding position, maintaining the same air pressure in its brake chambers as the brake valve is delivering to it, Fig. 24. A rise in brake valve pressure causes the same action until the higher pressure in the brake chambers is similarly established.

If the brake valve pressure above the diaphragm is reduced, the brake chamber pressure below the diaphragm overcomes the pressure above it and the diaphragm lifts still further. This opens the exhaust port under the outer edge of the diaphragm, permitting pressure in the brake chambers to exhaust until a lower balanced pressure is reached. If the brake valve pressure is released entirely, the relay valve also releases all pressure from the brake chambers, thus fully releasing the brakes, Fig. 25.

The purpose of the by-pass port in the valve is to be sure the air pressure de-

livered to the brake chambers is always exactly the same as the air pressure delivered to the relay valve by the brake valve.

Operating Tests

With the air brake system charged, apply brakes and check to be sure the rear wheel brakes controlled by the relay valve apply promptly. Release brakes and check to be sure air pressure is exhausted from the exhaust port of the relay valve promptly.

Leakage Tests

With brakes released, coat the exhaust port with soapsuds to determine leakage. With brakes fully applied, coat the exhaust port with soapsuds to determine leakage. Leakage in excess of a one-inch bubble in one second is not permissible in either of these tests. If excessive leakage is found, the relay valve must be repaired or replaced.

RELAY EMERGENCY BREAKAWAY VALVE

The relay emergency valve consists of a relay valve and emergency valve. The assembly is regularly used in the air brake system of trailers.

The relay emergency valve acts as a relay station to control brakes on a trailer, and to apply automatically the trailer brakes if the trailer should break away from the towing vehicle. In addition to providing this safety feature, the relay emergency valve speeds up operation of the brakes during both application and release.

The RE-1C relay emergency valve, Fig. 26, is mounted separately from the reservoir, being connected to the reservoir by a supply line. The RE-1 relay emergency valve, Fig. 27, is mounted on the reservoir, making a supply line unnecessary.

Operation of both the RE-1 and RE-1C valve is controlled by air pressure delivered to it by the brake valve on the towing vehicle. This brake valve air pressure is delivered to the relay emergency valve through the service line connecting the towing vehicle to the trailer, and enters the cavity above the relay diaphragm. Because this cavity is small and therefore subject to quick changes in air pressure, the action of the valve in changing its delivered pressure is also very rapid.

The mechanism inside the relay emergency valve assumes several positions during operation:

1. Charging trailer reservoir positions: (a) Air pressure below 70 pounds. (b) Air pressure above 70 pounds.
2. Normal operation positions: (a) Released position, when there is no air pressure in the brake chambers. (b) Applying position, when the valve is delivering or increasing the air pressure to the brake chambers. (c) Balanced position, when the valve mechanism is balanced or maintaining a constant pressure in the brake chambers. (d) Releasing position, in which the valve is reducing or releasing air pressure from the brake chambers.
3. Emergency position: In which the valve automatically delivers full pressure to the brake chambers. This occurs when air pressure in the emergency line drops suddenly due to uncoupling the emergency line (when parking a trailer) or in the event of a trailer "break-away."

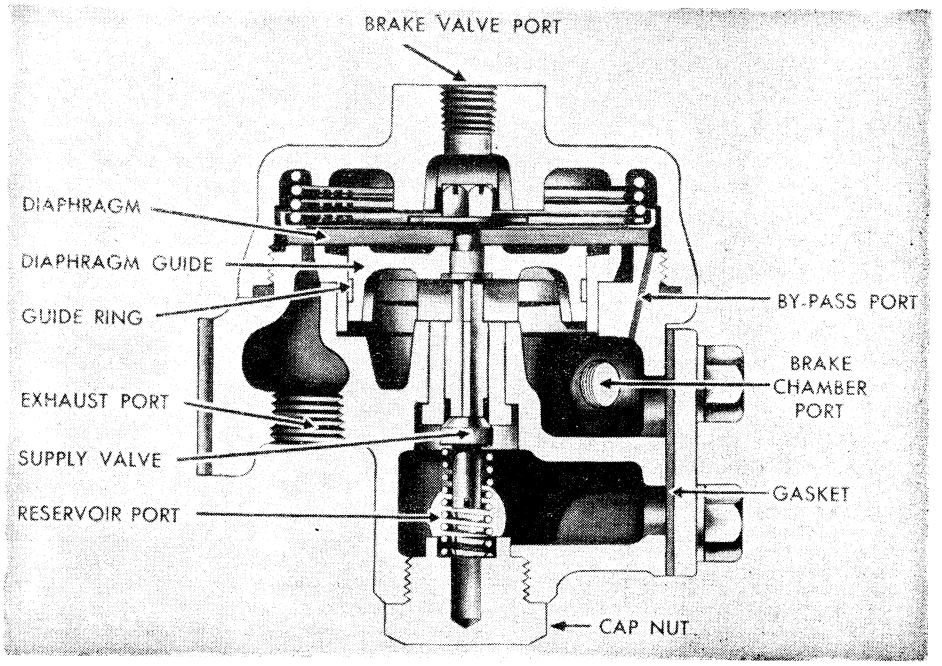

Fig. 22 Sectional view of Relay Valve

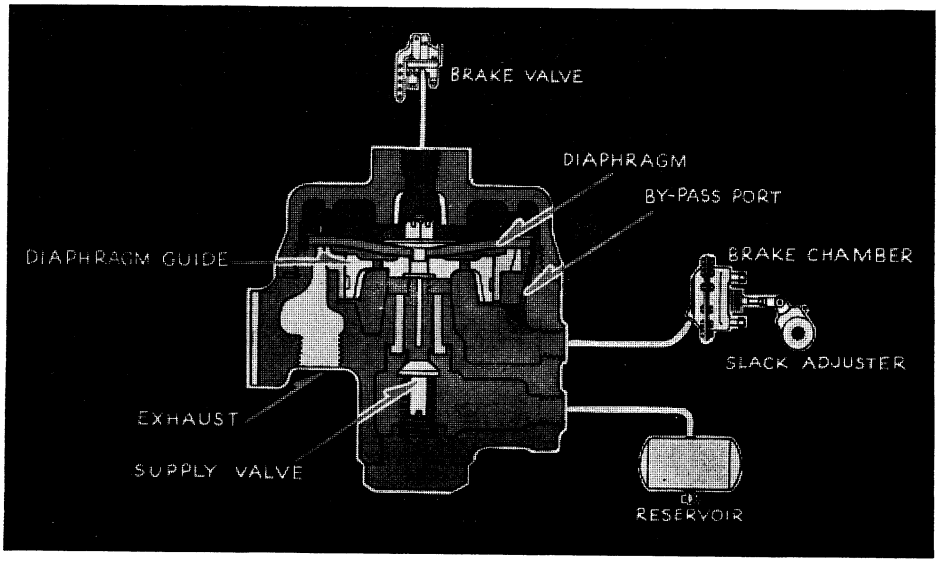

Fig. 23 Applying position of Relay Valve

Preventive Maintenance

Daily: With the trailer air brake system "charged", close the cut-out cock in the emergency line at rear of towing vehicle and disconnect the emergency hose line to the trailer. Inspect to be sure trailer brakes apply automatically without any noticeable leakage at the exhaust port of the relay emergency valve, or at the emergency line hose coupling at the front of the trailer.

Connect the emergency hose line to the trailer and open the cut-out cock. Inspect to be sure the trailer brakes release automatically and that there is no noticeable leakage at the relay emergency valve.

Every year or after each 50,000 miles, disassemble relay emergency valve and clean all parts. Install new diaphragm, gasket, grommet, and check valve.

Operating Tests

With the air brake system "charged", apply brakes. Inspect brake action on all wheels of the trailer for prompt braking application.

Release brakes and inspect to be sure air pressure is exhausted promptly from the exhaust port.

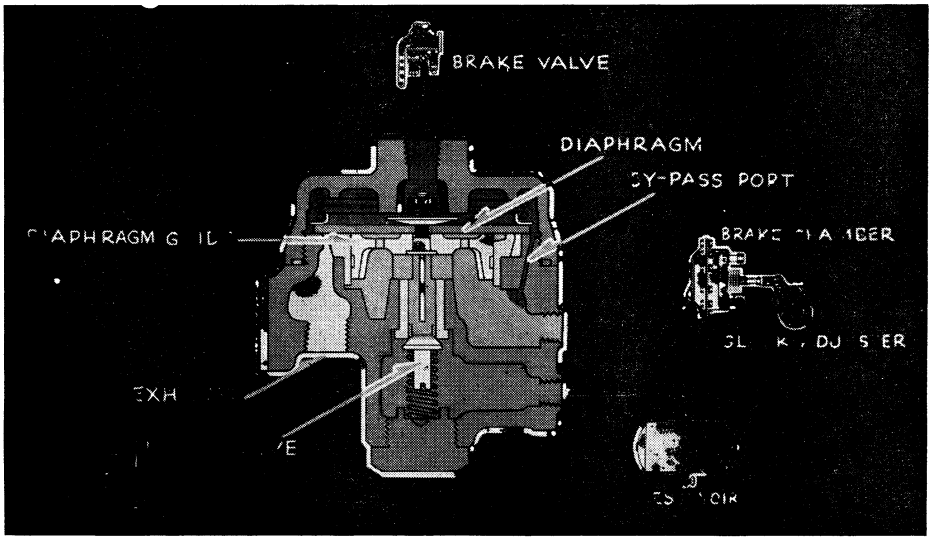

Fig. 24 Holding position of Relay Valve

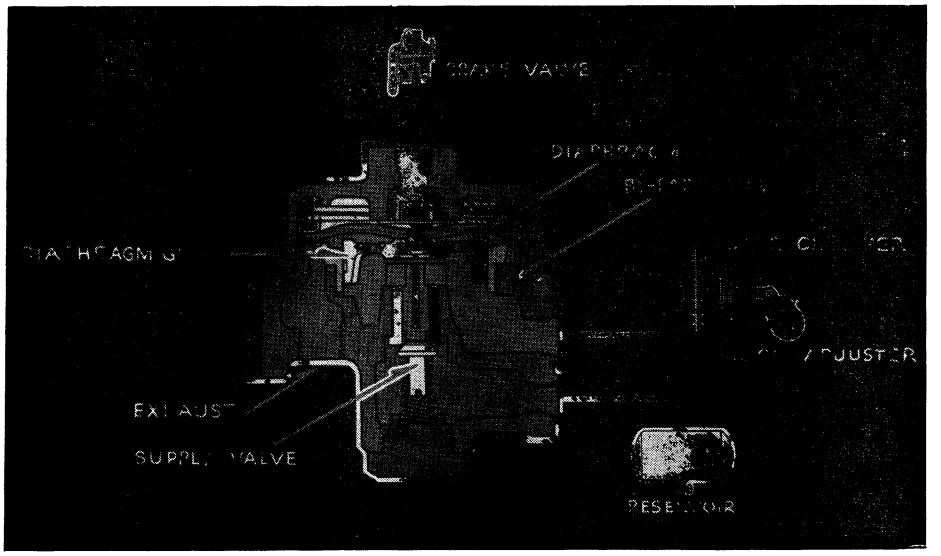

Fig. 25 Releasing position of Relay Valve

With trailer air brake system fully "charged", close the cut-out cock in the emergency line (on towing vehicle) and disconnect the emergency line from the trailer. Inspect trailer brakes for automatic application. Connect emergency line, open cut-out cock and inspect brakes for automatic release.

Leakage Tests

Leakage in any of the following tests should not exceed a one-inch soap bubble in one second. If excessive leakage is found, the valve must be repaired or replaced.

1. With brakes released, coat the exhaust port with soapsuds to determine leakage.
2. With brakes fully applied, coat the exhaust port with soapsuds to determine leakage.
3. With relay emergency valve in emergency position, coat the exhaust port of the valve with soapsuds to determine leakage. Also test for leakage at the emergency line coupling on the trailer.

BRAKE CHAMBERS

Brake chambers convert the energy of compressed air into the mechanical force and motion necessary to operate the brakes.

In order to meet the requirements for different braking forces, brake chambers are made in several different sizes. All sizes are made for several different types of mountings, such as stud mounting, bracket mounting, and flange mounting.

Operation

As air pressure enters the brake chamber behind the diaphragm, the diaphragm forces the push rod outward, thus rotating the slack adjuster, brake camshaft and brake cam, applying the brakes, Fig. 28. The higher the air pressure admitted to the brake chamber, the greater the force pushing the brake lining against the drum. If all air pressure is released from the brake chamber, the brake shoe release springs and brake chamber release springs return the brake shoes, brake cam, slack adjuster, brake chamber push rod and diaphragm to released position, releasing the brakes.

Maintenance

Every month or after each 2,000 miles, check travel of brake chamber push rods and adjust brakes if necessary. Push rod travel should be kept at a minimum without brakes dragging. Excessive travel shortens the service life of brake chamber diaphragms and also results in slow braking response.

Every year or after each 50,000 miles, disassemble brake chambers and clean all parts. Install new diaphragms. When replacing release springs, be sure to use the correct spring, otherwise uneven braking will result.

Operating Tests

Apply brakes and observe that push rods move out promptly without binding. Release brakes and observe that push rods return to release position promptly without binding. Check travel of push rods to be sure it is at the minimum without brakes dragging.

Leakage Tests

With brakes fully applied, coat the brake chamber bolting flanges holding the diaphragm in place with soapsuds to check for leakage. No leakage is permissible. If leakage is found, tighten flange bolts. All flange bolts must be tightened evenly but only sufficiently to prevent leakage, otherwise the diaphragm will be distorted and premature failure will result.

With brakes fully applied, check for leakage through the diaphragm by coating the clearance hole around the push rod and the drain hole in the non-pressure plate with soapsuds. No leakage is permissible. If leakage is found, the diaphragm must be replaced.

CAUTION—Always be sure the correct release spring is used in any brake chamber. Also be sure the brake chamber on the opposite side of the vehicle's axle has the same release spring; otherwise uneven braking will result.

If a new diaphragm is installed in the brake chamber on one side of the vehicle, a new one also should be installed in the corresponding brake chamber on the other side, otherwise this may also cause uneven braking.

After the brake chamber is installed, the brakes must be adjusted and checks made to be sure the linkage does not bind. Adjustment of the push rod length by altering the location of the yoke may be necessary. With brakes released, the angle formed by the push rod and slack adjuster must be greater than 90°, and all slack adjusters should be set at the same angle. With the brakes fully applied, after being adjusted, this angle should still be greater than 90°. In other words, the slack adjuster should not go

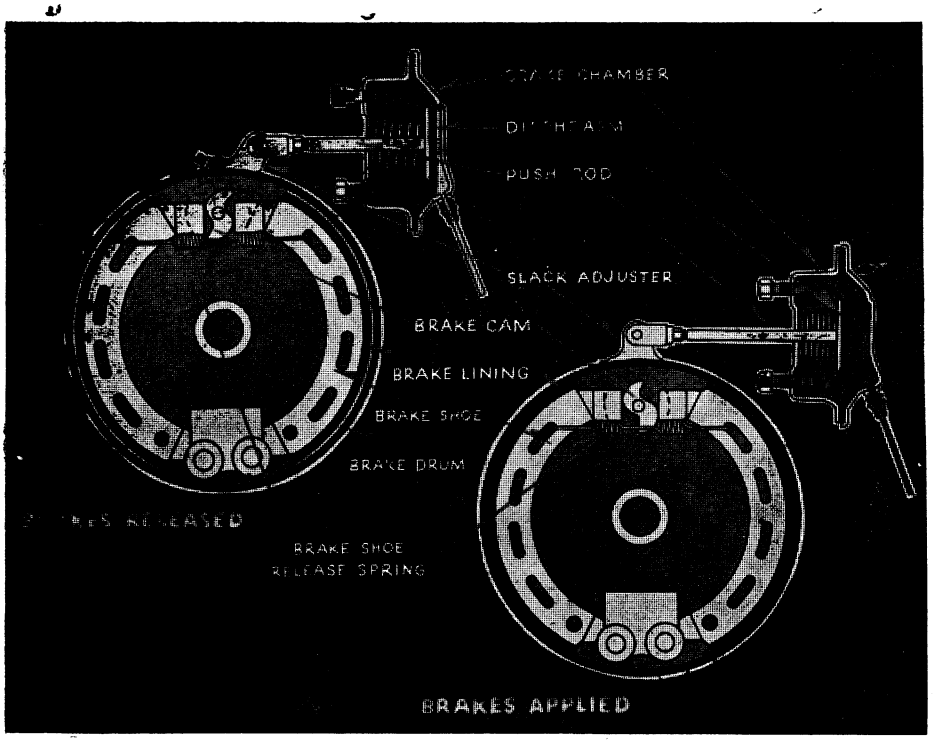

Fig. 28 Brake positions when released and applied

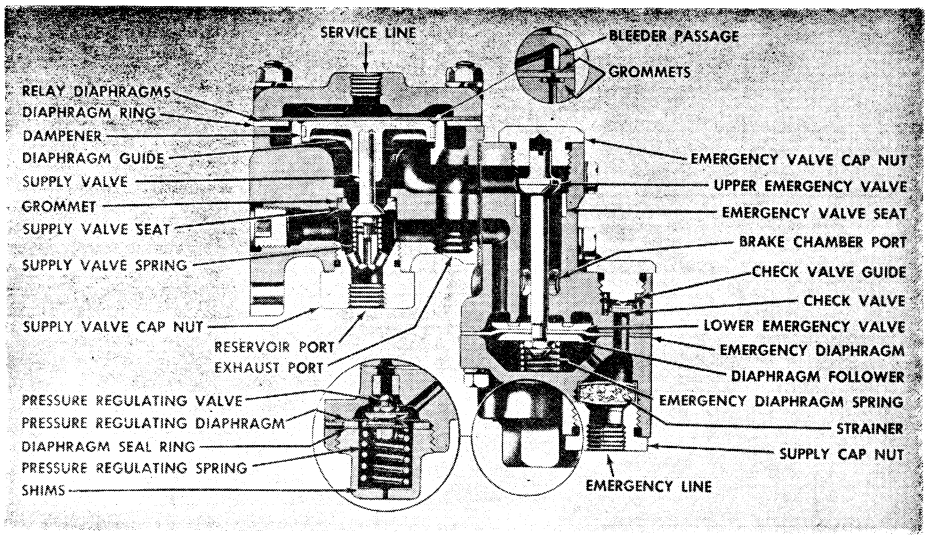

Fig. 26 Sectional view of Type RE-1C Relay Emergency Valve

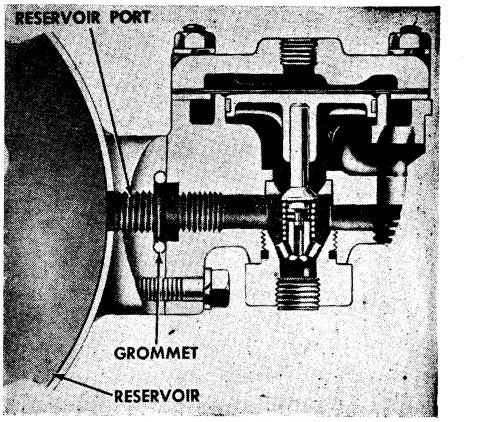

Fig. 27 Sectional view of Type RE-1 Relay Emergency Valve mounted on reservoir

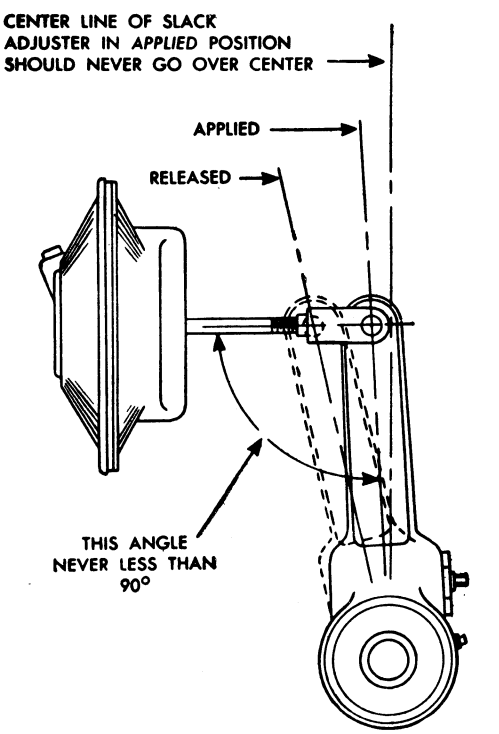

Fig. 29 Slack adjuster position

"over center" when the brakes are applied, Fig. 29. The position of the push rod yoke on the push rod should be adjusted if necessary until these conditions prevail.

SLACK ADJUSTER

One slack adjuster is used at each brake chamber. Slack adjusters consist of a worm and gear enclosed in a body which also serves as an adjustable lever, Fig. 30. They provide a quick and easy means of adjusting the brakes to compensate for lining wear. During brake operation, the entire slack adjuster rotates bodily with the brake camshaft. During brake adjustment, the worm moves the gear so as to change the position of the lever arm in relation to the brake camshaft.

Testing

Adjust brakes and note brake chamber push rod travel when brakes are applied. Make several brake applications, and again check push rod travel. Push rod travel must remain the same after as it was before adjustment. If the push rod travel increases, or if difficulty is experienced in keeping the brakes adjusted in service, the slack adjuster must be replaced.

Maintenance

The worm gear and worm should be kept well lubricated. This can be done by removing the plug and filling the cavity with a good grade of chassis lubricant every 1,000 miles.

DOUBLE CHECK VALVE

A double check valve, Fig. 31, is used on the trailer truck at the frame side rail. It is connected into the air lines from the relay valve to the trailer lines. The purpose of the double check valve is to control the brakes on the trailer or towed load. If the double check valve was not used when one of the brake valves was moved to its applied position, air pressure from the reservoir would escape through the exhaust port

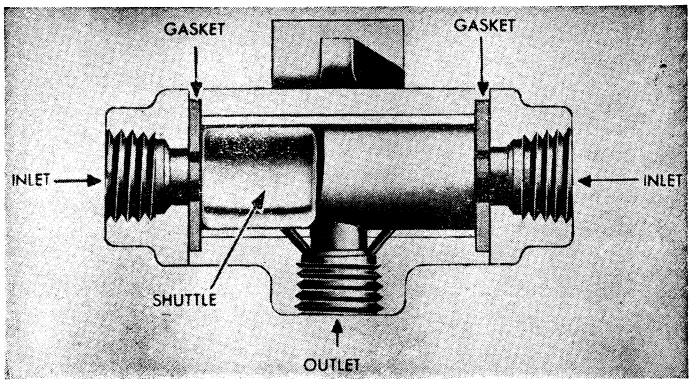

Fig. 31 Sectional view of Double Check Valve

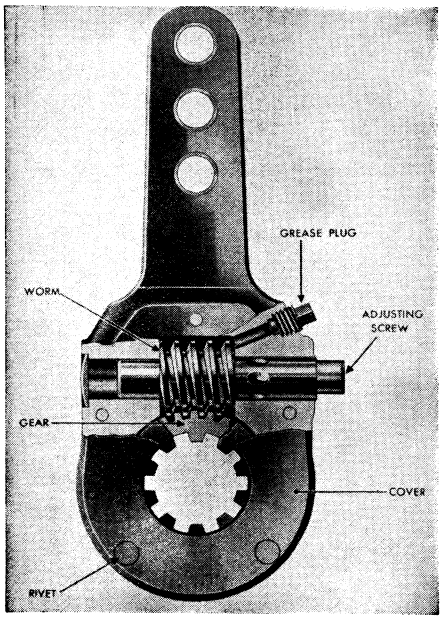

Fig. 30 Sectional view of Slack Adjuster

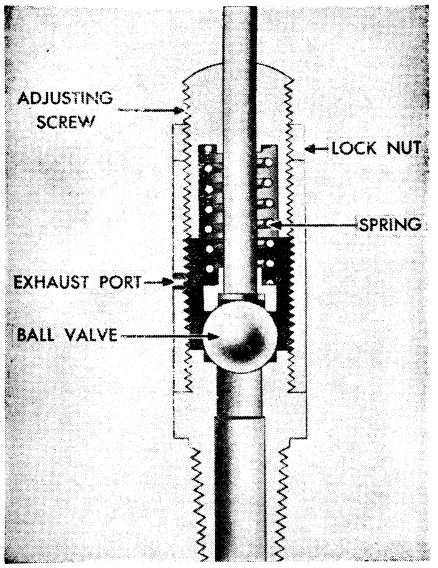

Fig. 32 Sectional view of Safety Valve

of the other brake valve, whose exhaust valve would be open.

When the 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, in this manner preventing any loss of air pressure through the open exhaust valve of the brake valve not being operated.

Testing

With the brake system fully charged and both brake valves in released position, move one of the brake valves to applied position, and check with soapsuds for leakage at the exhaust port of the brake valve not being operated. Repeat test with the other brake valve. Leakage in excess of a 3-inch bubble in 3 seconds is not permissible. If excessive leakage is found, the defective double check valve must be replaced.

CUTOUT COCKS

Cutout cocks have a tapered key ground to the body to prevent leakage. A passage is provided through the key so that when the key is turned to its open position, air is permitted to flow through the cock. When the key is turned to the closed position, air is prevented from flowing through the cock.

Cutout cocks are used in the service and emergency lines of the tractor truck to provide a means of closing off these lines when they are not being used.

The cutout cock is open when the handle is at a 90-degree angle with the body of the cock, and closed when the handle is parallel with the body of the cock. Stops are provided so that the handle cannot be turned beyond its normal positions.

Always open and close a cutout cock by hand. Never strike the handle with a hammer or similar instrument, as the cock would be damaged and leakage would develop.

Testing

With brakes applied and cutout cock closed (hose line disconnected) test with soapsuds for leakage past the key. Also check for leakage through the body by coating the outside of the cutout cock with soapsuds.

With brakes applied and cutout cock open (hose line connected) check for leakage through the body by coating the outside of the cutout cock with soapsuds.

Leakage in excess of a 3-inch soap bubble in 3 seconds in either of these tests is not permissible.

Leakage is caused by a dirty or scored key or body. Leakage due to dirt is corrected by cleaning parts and applying a light coating of cup grease to the key. Leakage due to a scored key or body cannot be repaired, and the cutout cock must be replaced.

SAFETY VALVE

The purpose of the safety valve is to protect the air brake system against excessive air pressure. Should the air pressure in the air brake system rise above the setting of the safety valve at 150 pounds, the valve opens and permits pressure above 150 pounds to be exhausted. It is located on one of the reservoirs.

The safety valve, Fig. 32, consists of a spring-loaded ball check valve which is set to "blow off" at 150 pounds air pressure.

Pressure Setting Tests

Connect an accurate test gauge in the air brake system so as to register reservoir pressure. A simple way to do this is to connect the air gauge to the emergency line at the rear of the tractor truck and open the emergency line cutout cock.

With the engine running, temporarily stop governor operation by turning the air supply valve on the dash panel to its air supply position, and permit the air pressure in the air brake system to rise until the test gauge registers 150 pounds.

When the test gauge registers 150 pounds, the safety valve must release or "blow off." If the safety valve does not release, stop the engine immediately and adjust the pressure setting of the safety valve. Do not permit air pressure in the air brake system to build up higher than 150 pounds, otherwise the compressor may become damaged.

To adjust the pressure setting of the safety valve, loosen the lock nut and turn the adjusting screw. Turning the screw counter-clockwise lowers the pressure setting. Turning it clockwise raises the setting.

Turn the adjusting screw as required until the safety valve releases at 150 pounds pressure registered on the test gauge. Then tighten the lock nut. Reduce air pressure to normal of approximately 100 pounds by applying and releasing the brakes.

Leakage Tests

With the air brake system fully charged to approximately 100 pounds, coat the safety valve all over with soapsuds to check for leakage. Leakage of a one-inch soap bubble in five seconds is not permissible. Slight leakage may sometimes be corrected by lightly tapping the end of the release pin. If this fails to correct the leakage, replace the safety valve.

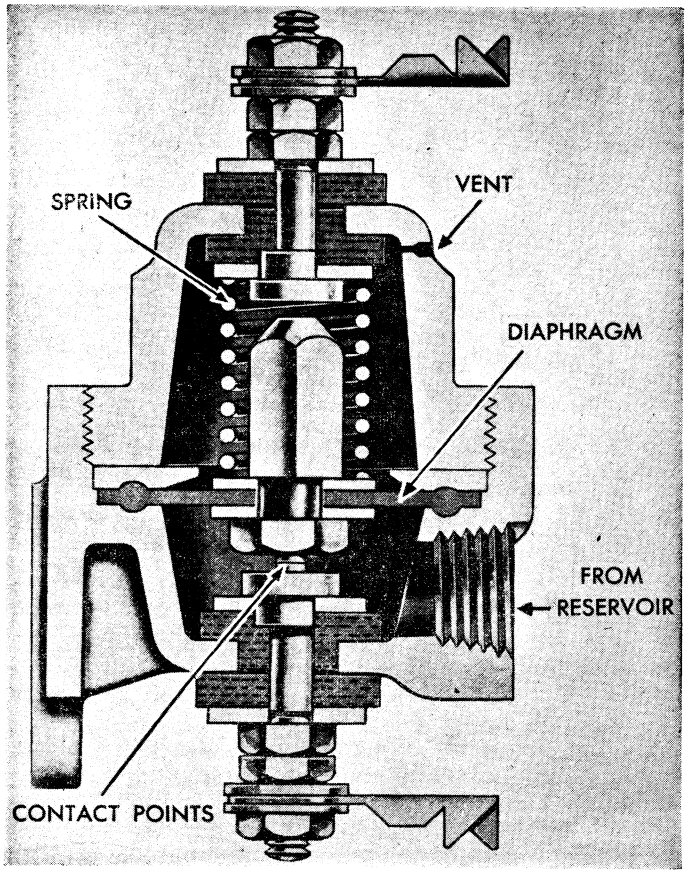

Fig. 33 Sectional view of Low Pressure Indicator

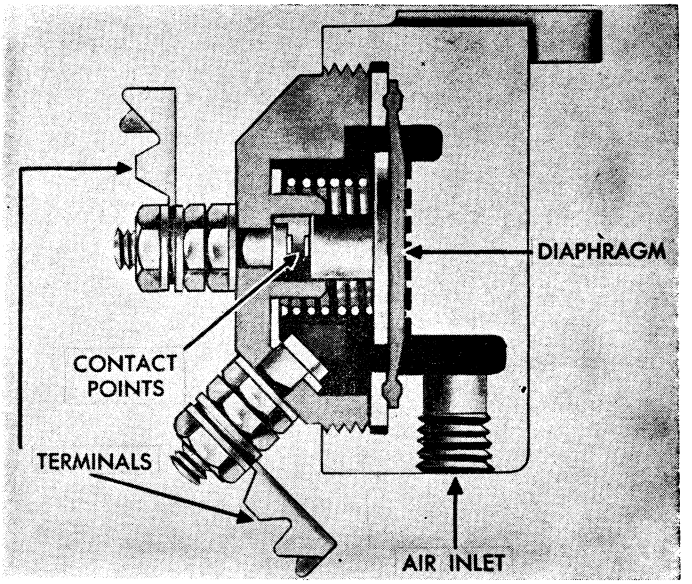

Fig. 34 Sectional view of Stop Light Switch

RESERVOIRS

Air reservoirs are made of sheet steel with electrically welded seams. Pipe-tapped ferrules, welded in place, are used at the openings. Two reservoirs are normally used.

Reservoirs are tested under a 250-pound pressure, and treated on the inside with a rust preventive.

The purpose of reservoirs is to provide a place to store compressed air so that there will be an ample supply available for immediate use in brake operation. They also provide storage for sufficient compressed air to permit several brake applications after the engine has stopped.

Another function of the reservoir is to provide a place where the air, heated during compression, may cool and cause the oil and water vapors to condense.

Leakage Tests

With the air brake system charged, coat the outside of the reservoir with soapsuds to check for leakage. If any leakage is found, replace the reservoir.

Inspection

Inspect inside and outside surfaces for damage or corrosion. A small flashlight is helpful when inspecting the interior. If damage or corrosion is found that would weaken the reservoir, replace the reservoir.

Moisture taken in with the air through the compressor collects in the reservoirs and necessitates draining the reservoirs daily, or as frequently as necessary to keep the system free of moisture. Reservoirs are drained by using the drain cock. Be sure to close drain cocks after all moisture has been removed.

DRAIN COCKS

Drain cocks have a brass body fitted with a tapered brass key. The drain cock is open when the handle is parallel to the body, and closed when the handle is at right angles to the body.

Drain cocks are installed in the bottom of each reservoir in the air brake system to provide a convenient means of draining the condensation which normally collects in the reservoirs.

Always open a drain cock by hand. Never strike the handle with a hammer or any other instrument, as the cock would be damaged and leakage would develop.

Testing

With the air brake system charged, test with soapsuds for leakage past the key. Also check for leakage through the body by coating the outside of the drain cock with soapsuds. Leakage in excess of a three-inch bubble in three seconds is not permissible.

Leakage is caused by dirty or scored key or body. Leakage due to dirt is corrected by cleaning parts and applying a thin coating of cup grease on the key. Leakage due to a scored key or body cannot be repaired, and the drain cock must be replaced.

AIR STRAINERS

An air strainer mounted on the dash panel is sometimes used to trap any dirt or foreign matter which might otherwise go into windshield wipers. It also serves as a condensing chamber to cool the compressed air and to remove any oil or water from the air.

AIR PRESSURE GAUGE

The purpose of the dash-mounted air pressure gauge is to register the amount of air pressure in the air brake system. While air pressure gauges of this type are commercially accurate, they must never be confused with, or substituted for, test air gauges which are intended primarily for accurately checking air pressure in the air brake system.

Only test gauges known to be accurate are to be used for checking brake valve delivery pressures, governor pressure settings, and other tests. Test gauges differ from ordinary dash gauges in respect to material and workmanship much as an expensive watch differs from a cheaper one, and due to these differences they are more accurate over their entire range, and maintain their accuracy over longer periods.

Testing

The simplest way to check the dash air pressure gauge for accuracy is to compare the pressures registered by the gauge over its normal pressure range with the pressures registered by a test gauge known to be accurate.

A dash gauge which loses its accuracy must be replaced. The continued use of a gauge showing an error of more than five pounds is not recommended.

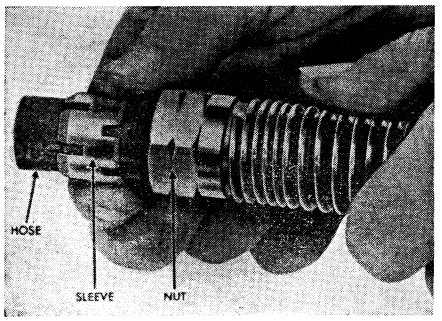

Fig. 35 Installing connector nut and sleeve on hose

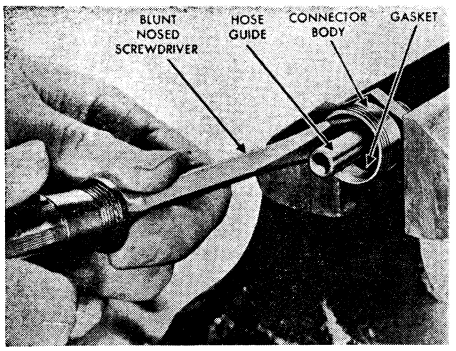

Fig. 36 Installing gasket in bottom of recess in connector body

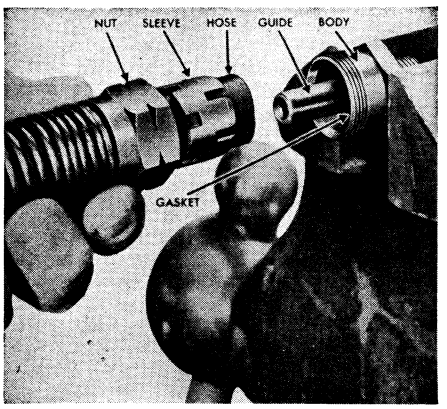

Fig. 37 Assembling hose to connector body

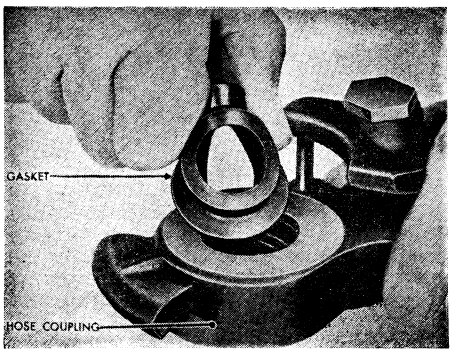

Fig. 38 Method of installing gasket in hose coupling

AIR SUPPLY VALVE

The air supply valve is sometimes mounted on the dash panel. Its purpose is to provide a convenient means of using the air pressure in the air brake system for such purposes as tire inflation.

The air supply valve is installed in the line between the governor and reservoir. When the handle of the air supply valve is turned to its air supply position, the governor is connected into the air brake system. The compressor operates continuously under these conditions, and pressures as high as the 150-pound setting of the safety valve may be obtained.

The handle of the air supply valve under normal conditions must be parallel with the body of the valve.

When air supply is desired, connect an air hose to the side connection of the valve by removing the cap nut. Turn the handle of the air supply valve to its air supply position, forming an angle of 90 degrees with the body of the valve to permit air pressure up to 150 pounds to be delivered through the side connection.

Turn the valve handle only by hand. Never strike it with a hammer or other heavy tool, as the valve would be damaged and leakage would result.

Testing

With the brake system charged, coat the entire valve with soapsuds to check for leakage. Leakage in excess of a one-inch bubble in three seconds is not permissible. If leakage is excessive, replace the valve.

LOW PRESSURE INDICATOR

The low pressure air indicator, Fig. 33, is a safety device designed to give an automatic warning whenever the air pressure in the air brake system is below 50-70 pounds. Operating as an air-controlled switch of an electrical circuit, the low pressure indicator automatically sounds a buzzer when the air pressure drops too low. On some vehicles, a light is used to indicate low pressure, in place of the buzzer.

Testing

Drain the air brake system, turn on the ignition and start the engine. The low pressure indicator buzzer must sound (or warning light light) until the air pressure in the air brake system reaches a point between 50 and 70 pounds when the buzzer must stop sounding.

Continue to build up air pressure in the air brake system until the pressure reaches at least 75 pounds. Stop the engine and reduce the pressure by making brake applications. Check to see at what pressure the buzzer again sounds. The buzzer must sound when the pressure reaches a point between 70 and 50 pounds.

Leakage Test

With the air brake system fully charged, coat the outside of the low pressure indicator with soapsuds to check for leakage. No leakage is permissible. Leakage at the lower diaphragm screw can sometimes be corrected by removing the electrical connection and carefully tightening the terminal screw nut. Leakage through the small vent hole in the cover signifies a leaking diaphragm, and the low pressure indicator must be replaced.

STOP LIGHT SWITCH

The stop light switch is mounted on the left-hand frame side rail. Stop light switches are electro-pneumatic switches which close the stop light electrical circuit when the brakes are applied, Fig. 34.

Testing

With all air pressure exhausted from the air brake system, move the brake valve to applied position and start the engine. Observe at what pressure registered by the dash gauge the stop lights light. Stop lights must light before the dash gauge registers 10 pounds pressure.

With brakes applied, coat the stop light switch with soapsuds to check for leakage. No leakage is permissible. If leakage is found, the stop light switch must be replaced.

HOSE & CONNECTORS

Hose and hose fittings provide a means of making flexible air connections between points on a vehicle which normally change their position in relation to each other, also of making flexible connections between two vehicles.

All hose assemblies include detachable type hose connectors with spring guards. Hose assemblies used to connect the air brake system to another vehicle are fitted with hose couplings.

The two hose lines or hose couplings at the rear of the tractor truck are marked by tags identifying them as "Service" or "Emergency."

Testing

If any evidence is found indicating that a hose line is restricted, remove and blow air through it in both directions to be sure the passage through the hose is not obstructed in any way.

With the brakes applied to be sure that the hose line being tested is under pressure, coat the outside of the hose and connections with soapsuds to check for leakage. No leakage is permissible. Leakage at the connectors is sometimes corrected by tightening the connector nut. If this fails to correct the leakage, replace the connectors, hose, or both.

Replacement

Hose assemblies are easily replaceable by removing the detachable connectors and installing a new piece of hose.

1. Remove connector nuts and pull hose out of connector body.
2. Do not attempt to remove used sleeve from hose.
3. Cut a piece of new hose to required length, being sure that the cut is made at right angles to outside wall

of hose, and that end of hose is smooth.

4. Blow out hose with air line to remove all cuttings.
5. Place connector nut and sleeve on hose, Fig. 35, being sure that barbs on inside of sleeve point toward end of hose that is being connected.
6. Push gasket into bottom of recess in connector body, Fig. 36.
7. Put end of hose in connector body, making sure that end of hose is against bottom of the recess, Fig. 37.
8. Move sleeve, if necessary, until it is against edge of connector body. Tighten connecting nut only enough to insure an air-tight joint.
9. When installing a hose assembly where both ends are permanently connected, the hose connector at either end is used as a swivel by loosening the nut on one of the connectors. Turn the hose in the loose connector before the connector nut is again tightened. This permits the installation of the hose without kinking or twisting.

HOSE COUPLINGS

Hose couplings provide an easy and convenient method of connecting and disconnecting air lines between vehicles by hand. The design of the hose couplings is such that when two of them are coupled together, pressure is put on two rubber gaskets, making an air-tight seal.

Dummy couplings are made in two general designs, some being fitted with brackets to permit them to be rigidly mounted on the vehicle, while others are fitted with a chain attaching them to the vehicle. The bracket type is used where the dummy coupling is to serve as a fastening for holding hose lines when not in use, whereas the chain type is used for blocking off hose couplings rigidly mounted on the vehicle as used on a tractor truck. The purpose of the dummy coupling is to prevent the entrance of dirt or other foreign matter into the air brake lines when the lines are not being used.

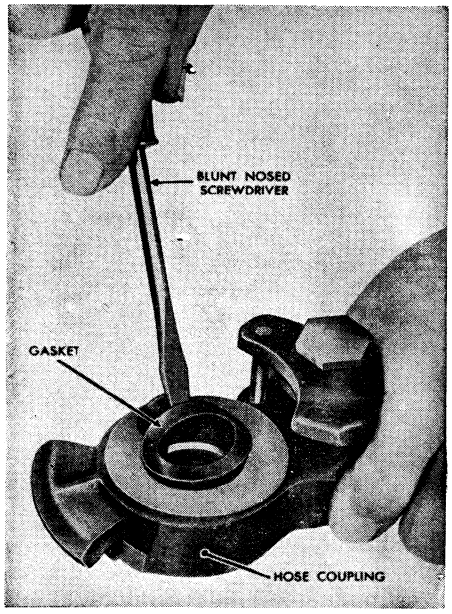

Fig. 39 Push gasket into hose coupling as shown

Testing

With the hose couplings connected and brakes applied, coat the hose couplings all over with soapsuds to check for leakage. No leakage is permissible.

Leakage is usually caused by worn, damaged or improperly installed gaskets. To correct, install new gaskets.

Remove the old gasket by prying out with a screw driver. Before attempting to install a new gasket, be sure the groove in the coupling in which the gasket fits is thoroughly cleaned, otherwise it will be impossible to install a new gasket properly.

To install a new gasket, partially collapse it with the fingers, Fig. 38, and enter one side of the gasket flange in the groove in the coupling. Then use a blunt-nosed screw driver or similar tool to push the gasket into place, Fig. 39. When properly installed the exposed face of the gasket will be flat—not twisted or bulged at any point.

TUBING

Operating Tests

If any evidence is found that a tubing line is restricted, remove and blow air through it in both directions to be sure the passage through the tubing is not obstructed in any way. Inspect tubing for partial restrictions such as may be caused by dents or kinks. Damaged tubing must be replaced.

Leakage Tests

With the air brake system fully charged, the governor cut out, and brakes applied, coat all tubing lines and fittings with soapsuds to check for leakage. No leakage is permissible. Leakage at a tubing fitting is sometimes corrected by tightening the fitting nut. If this fails to correct the leakage, replace the fitting, tubing, or both.

VACUUM BRAKES

BENDIX HYDROVAC

First Series

Hydrovac is a trade name for Bendix "one-unit" vacuum power braking system for use on trucks, tractors and buses equipped with hydraulically actuated brakes. It combines into one compact unit a hydraulically actuated contral valve, a tandem-piston power cylinder and a hydraulic slave cylinder, Figs. 1, 2 and 3.

The assembly is a complete self-contained vacuum power brake system which eliminates the need for external levers or linkage. Connections to the vehicle braking system are entirely hydraulic, consisting of a line from the hydraulic master cylinder to the Hydrovac, and a hydraulic line from the Hydrovac connecting to the wheel cylinders of the vehicle braking system.

Contrasted with conventional vacuum power brake systems, the Hydrovac is connected hydraulically instead of mechanically to the braking system.

Operation

The power cylinder of the Hydrovac, Fig. 1, is divided into two equal compartments, each of which is provided with a piston (certain Hydrovac units which require less power, use a design with only one cylinder and piston in operation otherwise these units work as described). The two pistons work on one piston rod so that the effect is that of two cylinders placed end-to-end with pistons connected in tandem. A conical spring serves to return the pistons to released position when the air pressures on both sides of each piston are balanced.

Hydraulic pressure from the master cylinder acts upon the hydraulic piston in the control valve assembly, Fig. 2, and forces its diaphragm towards the valves. This movement of the diaphragm moves the valves into the applied, holding or released positions.

The hydraulic slave cylinder, Fig. 3, is provided with a piston and rubber cup similar to the vehicle master cylinder. In that way, fluid is forced to the vehicle wheel cylinders to apply the brakes.

The end of the piston push rod fits into a tapered valve which seats against the hydraulic piston. A passage through the hydraulic piston allows fluid to pass through when the valve is off its seat, that is, when the power cylinder pistons are in released position.

In the released position, Fig. 4, the vacuum valve (A) is open, atmospheric valve (B) is closed, and vacuum is present on both sides of the power cylinder pistons (C, D, E, F).

When the driver first steps upon the brake pedal, the passage through the hydraulic piston is open because the power cylinder pistons are in released position. As hydraulic pressure builds up, the control valve moves into applied position, causing the power cylinder piston to act. The first movement of the piston rod closes the passage through the hydraulic piston. Further movement in the applied direction forces the hydraulic piston further into the cylinder and thus applies the brakes.