INSTRUCTION PAMPHLET

No. 5061

MARCH, 1939

WESTINGHOUSE TRAIN AIR SIGNAL SYSTEM

WESTINGHOUSE AIR BRAKE CO.
PITTSBURGH, PA., U. S. A.

THE TRAIN AIR SIGNAL SYSTEM *for* STEAM ROAD SERVICE

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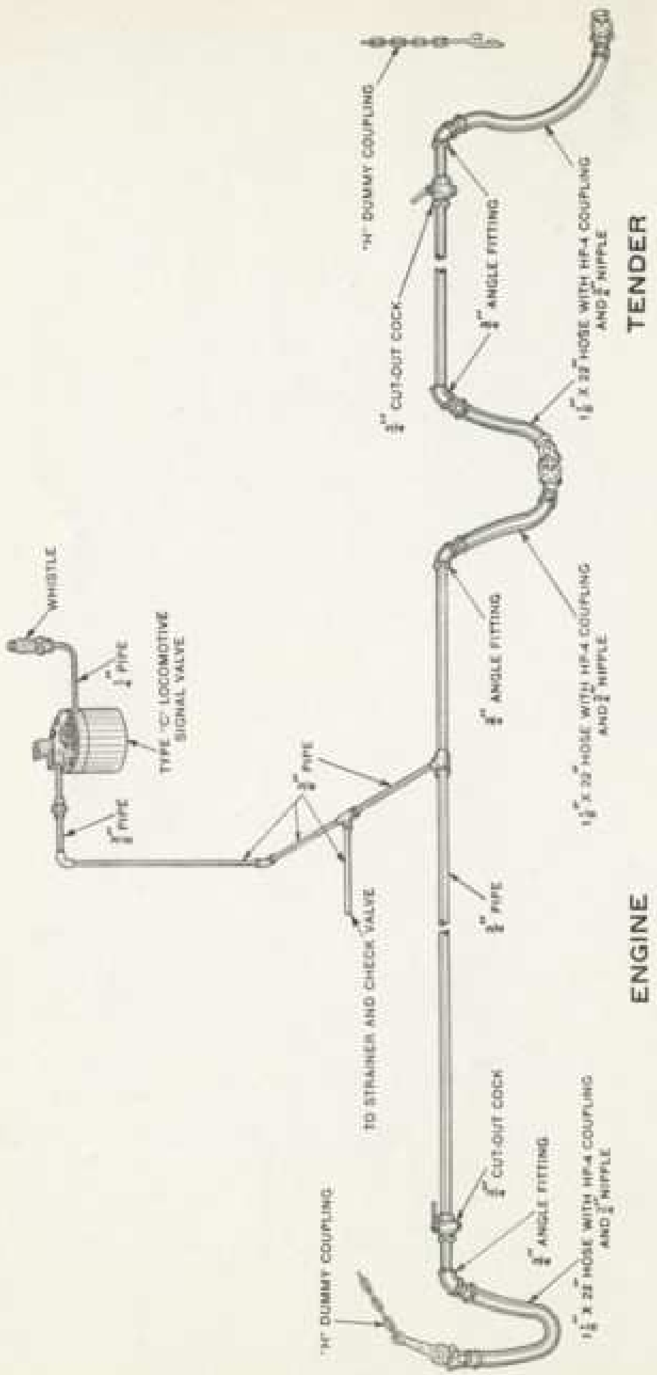

Fig. 1. Piping Diagram of Air Signal Apparatus used on Locomotives with ET Brake Equipment

WESTINGHOUSE
TRAIN AIR SIGNAL SYSTEM
(Steam Road Service)

The Air Signal System is an arrangement providing means for signalling to the engineman from any part of the train by means of signal cords in each car. Figs. 1 and 2 show the general arrangement of the parts comprising the system upon a locomotive and car respectively. The illustrations are not intended to show the actual location of the parts but are diagrammatic piping diagrams showing the relative location of each part.

Parts of the System

Two Car Discharge Valves per car, through which signal pipe pressure is reduced when the signal cord is pulled.

A Signal Valve on the locomotive, which operates when the signal pipe pressure is reduced to blow the signal whistle.

A Signal Whistle on the locomotive, which is sounded to give the signal to the engineman.

A Combined Strainer and Check Valve on the locomotive, which protects against the entrance of dirt into the signal valve and prevents loss of signal pipe air in case of breakage of the reducing valve pipe, also reduces pressure as supplied by the reducing valve at 45 pounds to 42 pounds for use in the signal pipe.

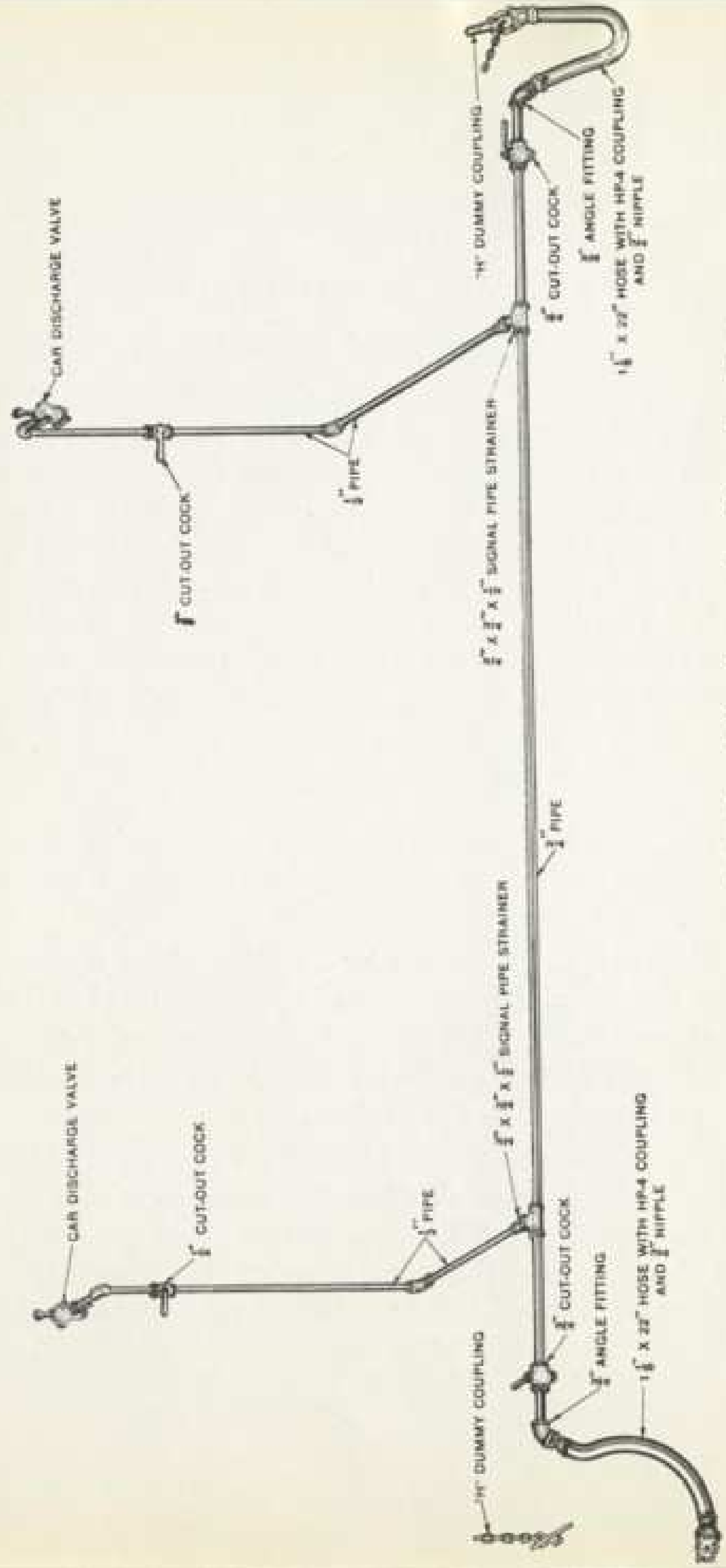

Fig. 2. Piping Diagram of Air Signal Equipment for Passenger Cars

Various Cut-out Cocks, Air Strainers, Hose Connections, Dummy Couplings, etc., the location and uses of which will be readily understood from the piping diagrams above mentioned.

A Signal Reducing Valve is used with the old style A-1 engine equipment to reduce main reservoir pressure for use in the signal system.

The signal pipe is continuous throughout the train, the connections between vehicles being made by means of flexible hose and couplings. Pressure maintained in the signal pipe, by means of the combined strainer and check valve with the ET locomotive equipment, is 3 pounds less than the adjustment of the reducing valve. With the A-1 engine equipment, the signal pipe pressure is that for which the signal reducing valve is adjusted.

Fig. 3. Photographic View of the Type "C" Signal Valve and the Signal Whistle

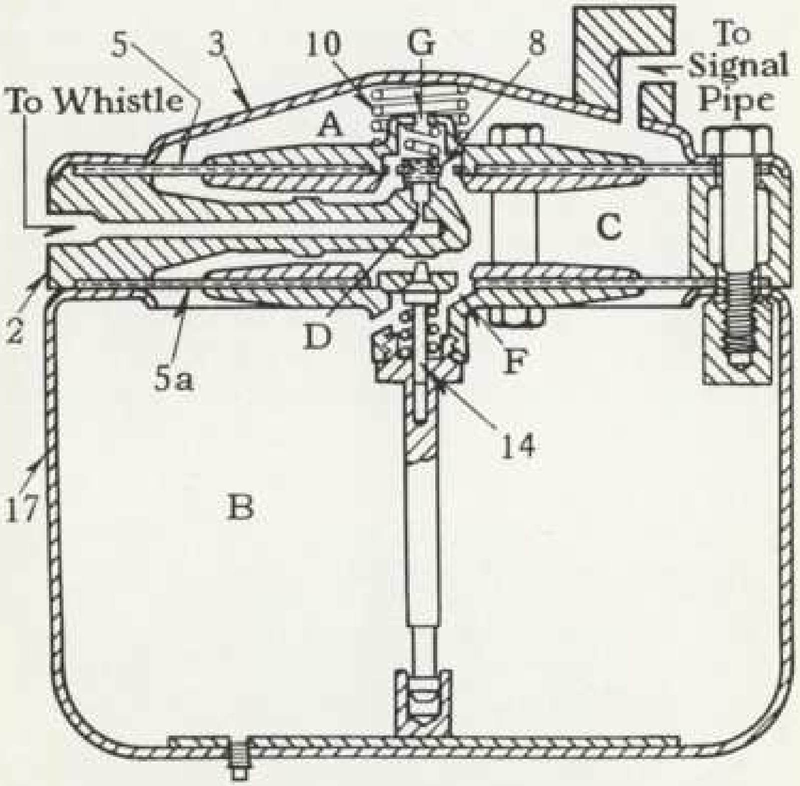

Fig. 4. Diagrammatic View of the Type "C" Signal Valve

DESCRIPTION OF PARTS

Type "C" Signal Valve

This signal valve comprises three portions—a body 2, a top cover 3, and the volume chamber (or bottom cover) 17, see Fig. 4. Two mounting brackets are attached to the top cover which also provides a 3/8" pipe connection for the signal pipe. The whistle is connected to the body portion (see Fig. 3) by means of a 1/4" pipe tap.

Each of the three portions is a separate chamber, divided by the parallel diaphragms 5 and 5*a* of the body portion, see diagrammatic view, Fig. 4. Signal pipe pressure is always present in chamber A above diaphragm 5. Air in this chamber can flow through port G and through passages around seated upper valve seal 8 to chamber C between the two diaphragms. From this chamber, air flows through choke F into (and charges) the volume chamber B under the lower diaphragm 5*a*.

When a reduction of signal pipe pressure in chamber A is made at a faster rate than air can flow from volume chamber B through choke F, pressure in chamber C above diaphragm 5*a* will be lower than that below in volume chamber B, and both diaphragms will be deflected upward since they are rigidly connected by means of diaphragm spacers 11 (Fig. 5). The upward diaphragm movement will unseat whistle valve (upper valve seal) 8 and allow air to flow from chamber C through choke D to the whistle.

Chamber C is connected to the signal pipe through port G and to volume chamber B through choke F, so that air flows to the whistle from both the signal pipe and the volume chamber B. Port G is larger than choke F and, therefore, most of the air used to blow the whistle is taken from the larger volume or the signal pipe. Because of the small size of choke F as compared to port G, the pressure in chamber C between the diaphragms will drop at a faster rate than that in volume chamber B, and the diaphragms will move upward far enough so that with a given rate of signal pipe reduction, check valve 14 will be unseated and supplement the flow of air through choke F from volume chamber B.

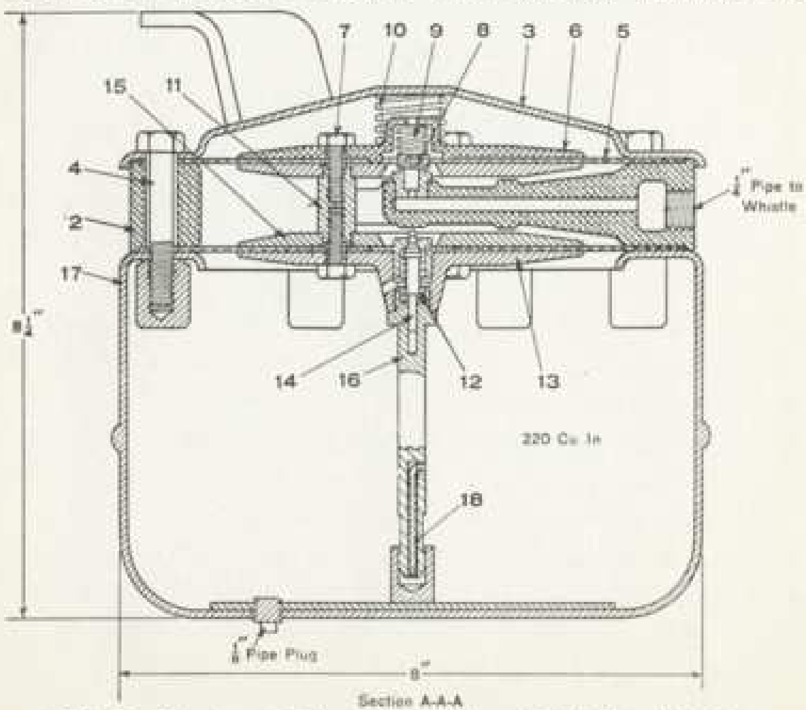

Fig. 5. Sectional View of the Type "C" Signal Valve

With this additional opening, the pressure in volume chamber B will be reduced at a faster rate than the signal pipe pressure in chamber A, and the diaphragms (assisted by spring 10) will be deflected downward, allowing check valve 14 to seat and also seating the whistle valve 8, thereby preventing further flow of air to the whistle. The upper stem of valve 14 is tapered and has a close fit in its guide when the valve is seated. The purpose of this is to obtain approximately the same length whistle blast regardless of train length.

With a very short train, the rate of reduction of signal pipe pressure will be fast and there will be considerable drop of pressure in chamber A. This causes the diaphragms to deflect upward their full travel and check valve 14 will have its maximum opening past the tapered stem, which will reduce the pressure in volume chamber B at a rapid rate below signal pipe pressure, resulting in a quick downward deflection of the diaphragms and a short whistle blast.

With long trains, the rate of signal pipe reduction will be slow and the amount of reduction for a given length of discharge valve opening will be small. The upward diaphragm deflection will be less than with a fast rate of signal pipe reduction. As check valve 14 will be only partially opened, the stem will restrict the valve opening and the reduction of pressure in volume chamber B (necessary to create a closing differential on the diaphragms) will be at a rate which will insure whistle valve 8 remaining unseated long enough to provide approximately the same length of whistle blast as that obtained with a short train.

Port G and diaphragm 5 are for the purpose of providing the proper relation of pressure between the signal pipe and volume chamber B necessary to blow the whistle. This diaphragm makes a seal between chambers A and C except for port G. The size of this port is fixed to supply signal pipe air to the whistle, and at the same time, not prevent flow of air from volume chamber B, which is necessary for the upward diaphragm deflection and the closing of whistle valve 8.

Choke F (No. 69 drill) fixes the charging rate of chamber B and is of the proper size to provide desired sensitiveness of operation.

Choke D (No. 50 drill), by restricting the rate of air flow to the whistle, provides the proper balance of pressures in chambers "B" and "C".

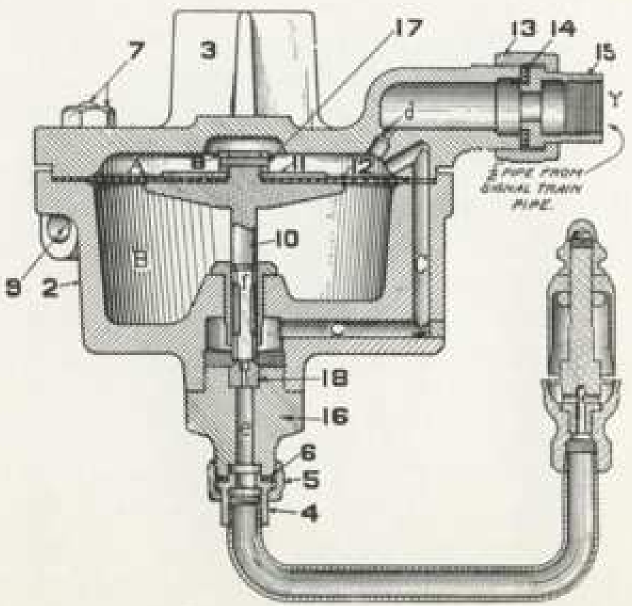

Fig. 6. Signal Valve

Lower diaphragm *5a* opens and closes the whistle valve 8 as a pressure differential is created between that in the signal pipe and in the volume chamber B.

Check valve 14 provides for a uniform length of whistle blast for varying train lengths.

The main function of diaphragm spring 10 is to stabilize the valve and to prevent false signals.

An oil wick 18, Fig. 5, provides a means of lubricating the lower end of valve guide 16.

Former Standard Signal Valve

This signal valve is no longer considered standard, having been superseded by the improved Type "C" signal valve described on the preceding pages.

Referring to Fig. 6, the two compartments A and B are separated by a diaphragm 12. The diaphragm stem 10 which is attached to the diaphragm extends through a bushing, its lower end acting as a valve on the seat in cap nut 16 above passage *e*. Diaphragm stem 10 fits its bushing snugly to a point where a peripherical groove is cut in the stem, below which it is milled in triangular form.

The air from the signal pipe enters the signal valve at the pipe connection marked "½" Pipe from Signal Train Pipe" and flows through port *d* into chamber A, and through passage *c* and port *f* (past the diaphragm stem) into chamber B.

Upon being charged, a sudden reduction of pressure in the signal pipe, as caused by the opening of a car discharge valve, reduces the pressure in chamber A (through port *d*) faster than that in chamber B can reduce through port *f*, past the diaphragm stem.

The higher pressure in chamber B, acting on the lower face, then forces the diaphragm and stem upward and momentarily permits air to escape from the signal pipe and chamber B to the signal whistle, past the seat in the small bush and through passage *e*. The resulting blast of the whistle serves as a signal to the engineman. With the closing of the car discharge valve, the pressures in chambers A and B are quickly balanced and the valve at the end of stem 10 returned to its seat.

The *Car Discharge Valves*, Fig. 7, are usually located at the ends of the car, one in each vestibule, above the door and opposite the opening through which the signal cord passes. The signal cord should be accessible from the car platform and extend not more than five feet inside the car. The car discharge valve is connected to the signal pipe by a branch pipe, in which is placed a cut-out cock, and a signal pipe strainer is used as a

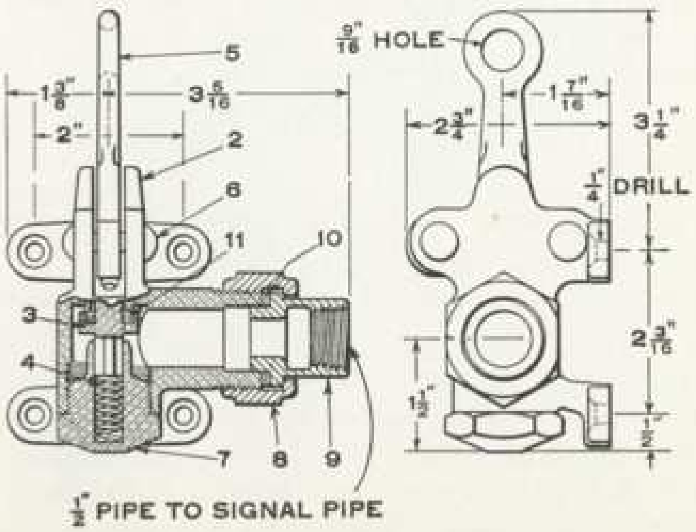

Fig. 7. Car Discharge Valve

means of connection between the branch pipe and the signal pipe.

A pull on the signal cord causes lever 5 to open valve 3, permitting a small quantity of air to escape to the atmosphere, thereby reducing signal pipe pressure and causing the signal valve to operate to blow the signal whistle.

The *Combined Strainer and Check Valve*, Fig. 8, is used with the No. 6-ET equipment and is located in the piping between the reducing valve and the signal pipe; an arrow cast on the body indicating the direction of the flow of air.

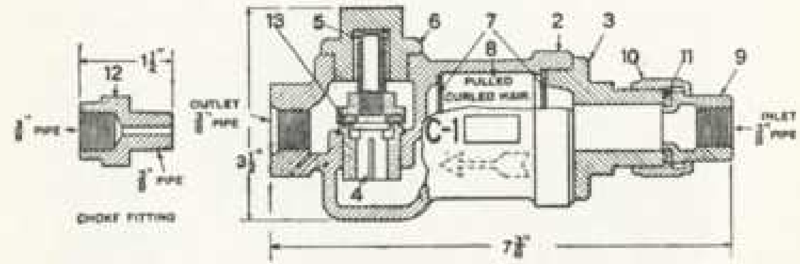

Fig. 8. Combined Strainer and Check Valve

Reducing valve air entering through the union connection marked "*Inlet* 3/8" *Pipe*," flows through the curled hair strainer to the chamber under check valve 13 and lifting the check valve from its seat, flows through choke fitting 12 to the signal pipe.

The spring 5 above check valve 13 exerts a downward pressure of about 3 pounds on this valve and consequently limits the air pressure on top of the valve to 3 pounds less than the reducing valve pressure in the chamber under the valve. As the reducing valve is set for 45 pounds with the No. 6-ET equipment, the pressure maintained in the signal pipe will be 42 pounds.

The use of the choke fitting 12, which limits the rate of the flow of air through the combined strainer and check valve, permits the momentary reductions in signal pipe pressure necessary for the operation of the signal valve, during operation of the car discharge valves. Without the use of the choke fitting, it would be impossible to obtain the necessary reductions in signal pipe pressure, as the pressure would be maintained by the reducing valve as fast as exhausted through the car discharge valve.

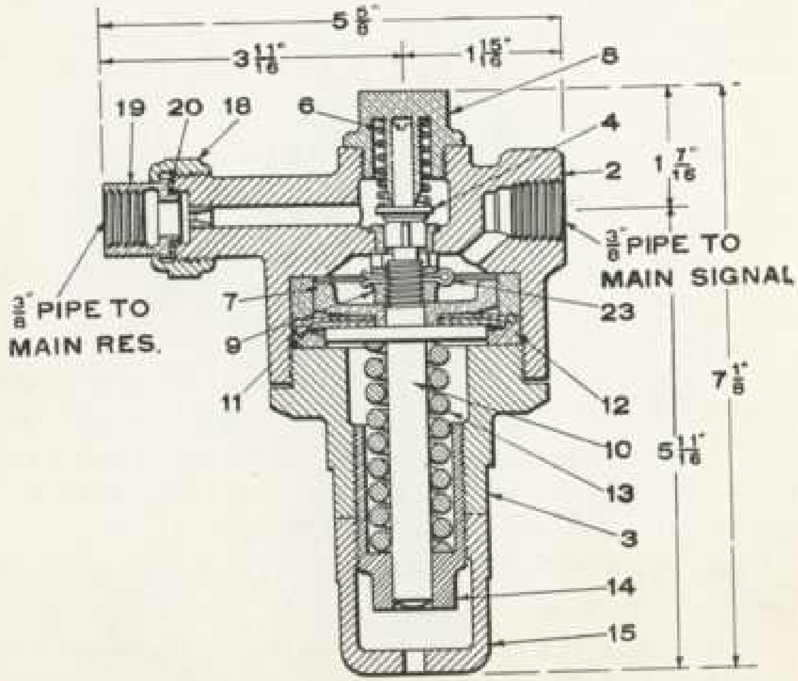

Fig. 9. Signal Reducing Valve

With the No. 8-ET equipment, the signal pipe charging device is incorporated with the pedestal brake valve

The *Signal Reducing Valve*, Fig. 9, is used only with the old style A-1 engine equipment and performs the same functions as the reducing valve and the combined strainer and check valve with the ET equipment.

The signal reducing valve is generally adjusted to maintain a pressure of 42 pounds in the signal pipe.

Referring to Fig. 9, piston 7 and stem 10 are supported by spring 13; 4 is the supply valve which is moved from its seat by the piston stem 10, and is seated by spring 6. The force exerted by spring 13 is so adjusted, by means of regulating nut 14, that an air pressure of 42 pounds in the chamber above piston 7 is required to depress the piston.

With the valve parts in the position shown, air from the main reservoirs entering through the union connection marked "*3/8" pipe to main reservoir*" flows under supply valve 4 into the chamber above piston 7 and thence to the signal pipe, through the tapped opening "*3/8" pipe to main signal.*"

As soon as the pressure in the signal pipe, and hence in the chamber above piston 7, reaches 42 pounds (the adjustment of spring 13), the pressure in the chamber above piston 7 forces the piston down, thereby permitting spring 6 to force supply valve 4 to its seat. This cuts off the flow of main reservoir air to the signal pipe until, through leakage or opening of the car discharge valves, the signal pipe pressure becomes sufficiently reduced to enable spring 13 to raise piston 7 and thereby unseat supply valve 4.

MAINTENANCE

Inasmuch as any discharge of air from the signal pipe causes the air whistle to sound on the locomotive, it is obvious that all air signal pipes should be perfectly tight so that signals will not be incorrect and will not occur when not intended.

The air signal system on passenger trains should be tested at all originating terminals at the same time that the air brake equipment is tested, and if any parts are found defective, they should be either replaced or repaired before train departure.

The signal pipes should be tested for leakage separately from the brake pipe, and the leakage noted by a gage. The drop in signal pipe pressure, due to leakage, should not exceed three pounds per minute from standard signal line pressure.

Defective signal valves should be tested on the standard signal valve test rack in accordance with the code of tests covered by Instruction Leaflet No. 2377 for the old style signal valves, and Instruction Leaflet No. 2377-1 for the improved Type "C" Signal Valves.

GENERAL

The period of time in holding the car discharge valve open when producing signals should be from one to two seconds, depending upon the length of the train. For a train of less than ten cars one second duration for discharge from signal pipe. For a train of more than ten cars, two seconds duration for discharge.

An interval of three seconds should be permitted to elapse between successive discharges of air from the car discharge valve in order to insure stabilization of the signal pipe pressure. This time interval should be slightly increased upon trains of exceptional length.

Whenever possible, the reducing valve and signal valve should be so located inside the cab that they will be protected from excessive temperature ranges.

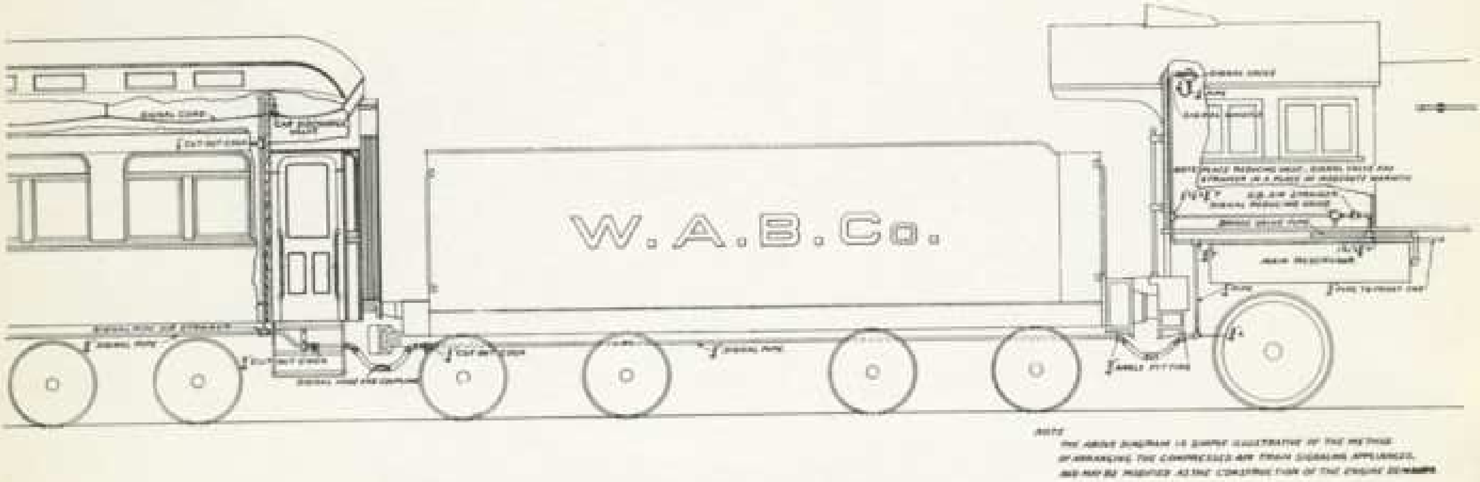

Fig. 10. General Arrangement of Train Air Signal System
(Locomotive with old A-1 Brake Equipment)