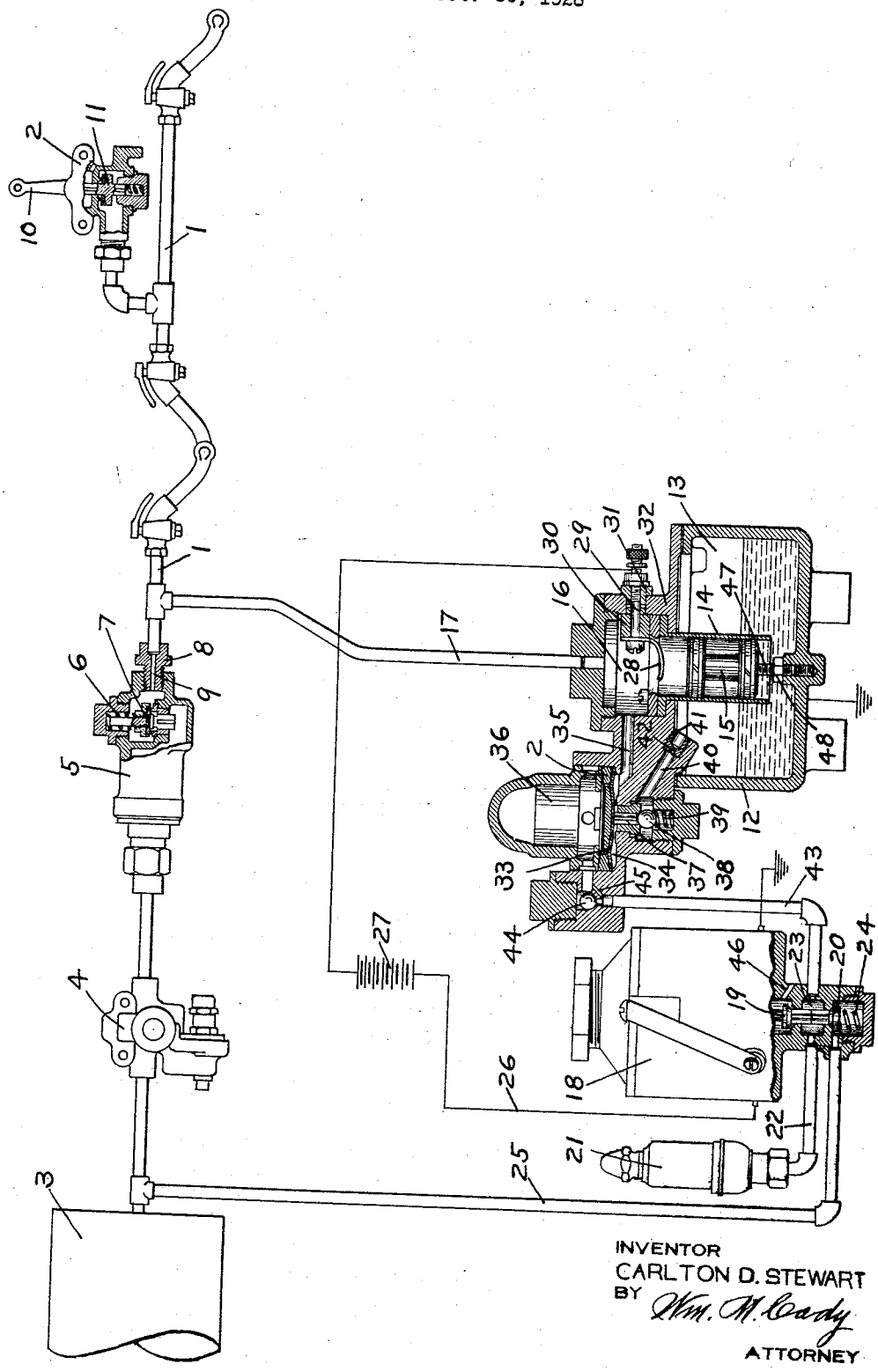
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ELECTROPNEUMATIC SIGNAL SYSTEM

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# UNITED STATES PATENT OFFICE

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## ELECTROPNEUMATIC SIGNAL SYSTEM

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This invention relates to signal systems, and more particularly to an electro-pneumatic signal system for railway service, by which a signal may be sounded on the locomotive or on a car.

The train signal system now extensively employed on railway trains comprises a train signal pipe, which is normally charged with fluid under pressure, a pneumatically operated signal device on the locomotive, which is adapted to be operated when the pressure in the signal pipe is reduced, and a discharge valve device associated with the train signal pipe on each car of the train and operable to vent fluid under pressure from the train signal pipe.

While the above described signal system has been in use for many years, there has been from time to time complaints as to the operation, particularly as the length of trains is increased. With a long train signal pipe, due to inevitable leakages, a reduction in pressure in the signal pipe, initiated by the opening of a discharge valve, progressively loses in intensity, as it travels to the signal device on the locomotive. The present pneumatically operated signal device is not sufficiently sensitive to respond, unless the reduction in pressure therein is quite pronounced and the result is that there may be a failure of the signal device to operate at times.

According to my invention, a signal controlling apparatus is provided which is more sensitive to light reductions in pressure in the signal pipe.

One object of my invention is to provide an electro-pneumatic signal system in which the signal train pipe now employed on railroads for operating a pneumatic signal on the locomotive, is utilized to operate an electro-pneumatic signal device.

Another object of my invention is to provide an electro-pneumatic signal system which is positively responsive to small variations in fluid pressure in the signal train pipe.

Other objects and advantages will be apparent in the following more detailed description of the invention.

In the accompanying drawing, the single figure is a diagrammatic view of an electro-pneumatic signal system embodying my invention.

The usual signal train pipe is employed and is indicated by the reference numeral 1. On each car, a manually operated discharge valve device 2 is connected to the signal pipe. On the locomotive, fluid under pressure is supplied to the signal pipe from the usual main reservoir 3, through a reducing valve 4 and a combined strainer and check valve device 5. The reducing valve device 4 is usually set to supply fluid at a pressure of about 45 pounds and the spring 6 of the check valve 7 exerts a pressure of about 3 pounds on the check valve, so that the pressure in the signal pipe is maintained at about 42 pounds.

A choke fitting 8 is associated with the valve device 5, the passage 9 limiting the rate of flow of fluid to the signal pipe so as to permit the momentary reduction in signal pipe pressure, necessary for the operation of the signal sounding device.

Associated with the signal pipe 1 on each car of the train is a discharge valve device indicated generally by the reference numeral 2 of the usual well known construction, comprising a casing 50 having a valve chamber 51 containing a discharge valve 11 having a stem 52 adapted to be operated by the rocking of the handle 10 to move the discharge valve 11 from its seat. The valve chamber 51 is connected to the signal pipe 1, and when the valve 11 is unseated, fluid is vented from valve chamber 51 and the signal pipe 1, to the atmosphere, through port 53.

According to my invention, there is provided on the locomotive, an electro-pneumatic signal device comprising a casing 12 having a reservoir 13 which is partially filled with a suitable liquid, such as transformer oil, to about the level shown in the drawing.

Extending downwardly into the reservoir 13 is a cylinder 14, open at both ends and containing a double headed piston 15. The under face of the lower piston head is exposed to the pressure of the liquid in the reservoir and the upper face of the upper piston head is exposed to the pressure of fluid in a cham-

ber 16, which is connected by pipe 17 to the train signal pipe 1.

An electro-pneumatic valve device is provided, comprising an electro-magnet 18 adapted to operate double beat valves 19 and 20. An audible signal device 21 is connected by pipe 22 to the space 23 intermediate the valves 19 and 20, and valve chamber 24 of valve 20 is connected by pipe 25 to the main reservoir 3.

One terminal of magnet 18 is connected to ground and the other terminal to a wire 26 containing a source of current 27, and wire 26 is connected to a yielding contact 28, the contact carrying bolt 29 being insulated from the casing 12 by blocks of insulation 30 and 31.

The contact 28 is positioned in the cylinder 14, so that upon upward movement, the piston 15 will engage the contact. The casing 12 is connected to ground, so that a circuit is completed through the magnet 18, when the piston 15 engages the contact 28.

In the casting 32, which provides a closure for the reservoir 13, is mounted a flexible diaphragm 33, having the chamber 34 at one side connected by passage 35 with chamber 16 and having a volume chamber 36 at the opposite side of the diaphragm.

The diaphragm 33 is adapted to operate a stem 37 which engages a ball check valve 38, subject to the pressure of a spring 39, tending to seat the valve, said valve controlling communication from diaphragm chamber 34 to a passage 40 which leads to the reservoir 13, above the liquid therein. A choke fitting 41, having a restricted passage 42, is disposed in passage 40.

When there is fluid pressure in chamber 34, the diaphragm 33 assumes the position shown in Fig. 1, with the follower plate 60 engaging the stop ring 61.

Chamber 36 is connected to a pipe 43 which leads to the chamber 23 of the electro-pneumatic valve device, and a check valve 44 controls communication from pipe 43 to chamber 36, a restricted passage 45 being provided around said check valve to permit the slow exhaust of fluid under pressure from chamber 36.

When the signal pipe 1 is charged with fluid under pressure, fluid is also supplied through pipe 17 to chamber 16 and flows through passage 35 to diaphragm chamber 34. The diaphragm 33 is then moved upwardly, permitting the spring 39 to move the check valve 38 to its seat. Fluid pressure from chamber 16 equalizes into the reservoir 13, past the check valve 38, and the pressure in the reservoir builds up to the pressure in the chamber 16 except for a slight differential due to the pressure of the light spring 39 on the check valve.

The fluid pressures being equal on opposite sides of piston 15, the piston is maintained in its lower position by gravity.

When fluid under pressure is vented from the signal pipe 1 by operation of a discharge valve 11, in order to sound a signal on the locomotive, even a slight reduction in signal pipe pressure results in a drop in pressure in chamber 16.

The fluid pressure in the reservoir 13 does not drop with the pressure in chamber 16, since check valve 38 prevents back flow from the reservoir, so that the higher pressure in the reservoir 13 acts on the liquid therein and this differential pressure acts on piston 15 to force same upwardly. The area of liquid in reservoir 13 being greater than the area of piston 15, a considerable upward movement of the piston 15, due to the differential pressure in the chamber 13, will result in only a slight lowering of the level of liquid in the reservoir 13.

The upward movement of piston 15 causes same to engage the contact 28, so as to close the circuit of magnet 18. The magnet 18 being thus energized, the valve 19 is shifted to its seat, while the valve 20 is unseated. Fluid under pressure is now supplied from the main reservoir pipe 25 to the signal device 21 which then sounds a signal.

Fluid under pressure is also supplied through pipe 43 to the volume chamber 36 and the diaphragm 33 is thereby forced downwardly, so as to cause the check valve 38 to be unseated.

Fluid under pressure can now flow from reservoir 13 through the restricted port 42 back to the chamber 16, but so long as the discharge valve is held open, the rate of drop in pressure in chamber 16 exceeds the rate of drop in pressure in reservoir 13, due to the flow through the restricted port 42. Consequently, the piston 15 is held up in engagement with contact 28, and the whistle will continue to blow so long as the signal discharge valve is held open, at least until the pressure in reservoir 13 finally equalizes with the pressure in chamber 16.

When the discharge valve is closed, the drop in pressure in chamber 16 ceases, and the pressure in said chamber is quickly built up by flow through the port 9, so that the slight excess pressure in reservoir 13 is quickly neutralized by the build up of pressure in the chamber 16, so that the piston 15 is returned to its lower position by gravity. The circuit of magnet 18 is thus broken and the magnet being deenergized, the valve 20 is moved to its seat and the valve 19 is unseated. Fluid under pressure supply to the signal device 21 being thus cut off, the signal ceases to sound.

The diaphragm 33 is then moved upwardly, the fluid pressure in chamber 36 being permitted to exhaust to the atmosphere by

way of port 45 and the magnet controlled atmospheric port 46.

It will be noted that the ball check valve 38 is not unseated until the magnet 18 is energized by the movement of the piston 15 to engage the contact 28, so that there is no back flow from the reservoir 13 through the restricted port 42 until the piston 15 has been moved upwardly to engage the contact 28, and thus the full pressure with which the reservoir 13 is initially charged is available to effect the upward movement of the piston 15.

When, however, the magnet 18 is energized, so that the valve 20 is unseated and fluid under pressure from the reservoir 3 is supplied to the chamber 36, the valve 38 is unseated to permit back flow from reservoir 13, through the restricted port 42 to the chamber 16. The port 42 being restricted, the pressure in reservoir 13 will not fall quite as rapidly as the pressure in chamber 16 falls during the period the discharge valve 11 is held open, so that the slightly higher pressure in reservoir 13 will maintain the piston 15 in its circuit closing position. The differences in pressures being slight, the pressures in chamber 16 and in the reservoir 13 quickly equalize when the discharge valve 11 is closed, so that the movement of the piston 15 to open the circuit quickly follows the closing of the discharge valve 11.

An adjustable stop may be provided for the piston 15, comprising a stud 47, having screw-threaded engagement in the casing 12 and engaging the piston 15. The stud is provided with a lock nut 48, so that when the stud is positioned as desired, it may be locked in the adjusted position by the nut.

The purpose of the stop is to provide for adjustable travel of the piston 15 to meet service conditions. It will be evident that the greater the movement of the piston 15, the greater the drop in signal pipe pressure required to cause the piston to engage the contact 28 and consequently, the travel can be adjusted, if desired, so as not to function on very slight fluctuations in signal pipe pressure as may be unintentionally caused, for example, by any slight opening up of the hose couplings, when rounding curves, and the like.

The check valve 44 and restricted port 45 prevents a too rapid venting of fluid from volume chamber 36, so that the diaphragm 33 will hold the check valve 38 unseated for a sufficient length of time to ensure equalization of fluid under pressure from reservoir 13 to chamber 16.

When the signal apparatus is frequently used, oil tends to work past the piston 15 and be retained in chamber 16 and the oil serves as an arc extinguisher.

It will be noted that the liquid in the receptacle and acting on the area of the piston 15 constitutes a U tube having legs of different areas, so that when the level of the liquid in the large area leg drops a small amount the piston 15 is displaced to a much larger extent, due to flow of liquid from the reservoir 13 into the small area leg of the tube below the piston 15.

While one illustrative embodiment of the invention has been described in detail, it is not my intention to limit its scope to that embodiment or otherwise than by the terms of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a train signal system, the combination with a train signal pipe normally charged with fluid under pressure and a fluid pressure operated signal device, of a casing having a chamber containing liquid, a cylinder, a piston in said cylinder exposed on one side to the liquid in said liquid chamber, and subject on the opposite side to the fluid pressure in another chamber of said casing, which chamber is connected to said pipe, means normally permitting the equalization of fluid pressures between said fluid pressure chamber and said liquid chamber, means for restricting flow of fluid under pressure from the liquid containing chamber to the fluid pressure chamber, means operative upon movement of said piston for controlling the fluid pressure for operating said signal device, means for reducing the pressure in the train signal pipe, said piston being moved through the medium of the liquid in the liquid chamber by the fluid pressure acting on the liquid in the liquid chamber upon a reduction in fluid pressure in the train signal pipe and thereby in said fluid pressure chamber.

2. In a train signal system, the combination with a train signal pipe normally charged with fluid under pressure and a fluid pressure operated signal device, of a casing having a liquid containing chamber and a fluid pressure chamber connected to said pipe, a cylinder, a piston in said cylinder subject on one side to the pressure in said fluid pressure chamber and exposed on the opposite side to the liquid in said liquid chamber, the area of the piston being substantially less than the area of the liquid in said liquid chamber, means for normally permitting equalization of fluid pressures between the fluid pressure chamber and the liquid containing chamber at a restricted rate, means controlled by the movement of said piston for controlling the fluid pressure for operating said signal device, means for reducing the pressure in the train signal pipe, said piston being moved through the medium of the liquid in the liquid chamber by the fluid pressure acting on the liquid, upon a reduction

in pressure in said signal pipe and the consequent reduction in fluid pressure in said fluid pressure chamber.

3. In an electro-pneumatic train signal system, the combination with a train signal pipe normally charged with fluid under pressure and a fluid pressure operated signal device, of electrically controlled means for controlling the fluid pressure for operating said signal device, a casing having a liquid containing chamber and a fluid pressure chamber connected to said pipe, a cylinder, a piston in said cylinder subject on one side to the fluid pressure in said fluid pressure chamber and exposed on the opposite side to the liquid in said liquid chamber, means operated by said piston for controlling the electric circuit of said electrically controlled means, means permitting equalization of fluid pressures between the liquid chamber and the fluid pressure chamber at a restricted rate, means for reducing the pressure in the train signal pipe, said piston being operated through the medium of the liquid in the liquid chamber by the fluid pressure acting on the liquid, upon a reduction in fluid pressure in said pipe and consequently in said fluid pressure chamber.

4. In an electro-pneumatic signal system, the combination with a fluid pressure operated signal device and electrically controlled means for controlling the fluid pressure for operating said signal device, of a casing having a chamber containing liquid and having a fluid pressure chamber, a cylinder, a piston in said cylinder subject on one side to the pressure of fluid in said fluid pressure chamber, means controlled by said piston for controlling the circuit of said electrically controlled means, the liquid in the liquid chamber acting on the area of one side of said piston, which area is substantially smaller than the area of the liquid in the liquid chamber, means for venting fluid under pressure from the fluid pressure chamber, means for reducing the pressure in the train signal pipe, a check valve for controlling flow of fluid under pressure through a restricted port to the liquid chamber, and a movable abutment operated by fluid under pressure for actuating said check valve to permit the venting of fluid under pressure from said liquid chamber.

5. In an electro-pneumatic signal system, the combination with a fluid pressure operated signal device, and electrically controlled means for controlling the fluid pressure for operating said signal device, of a casing having chambers, a cylinder associated with said casing, a piston in said cylinder subject on one side to the pressure in one of said chambers and on the opposite side to the pressure in another of said chambers, means operated by said piston for controlling the circuit of said electrically controlled means, means for reducing the pressure in the train signal pipe, said piston being movable by a reduction in fluid pressure in the chamber at one side, mechanism operated by fluid under pressure for venting fluid under pressure from the chamber at the opposite side of said piston, and means for supplying fluid under pressure to said mechanism upon supplying fluid under pressure to said fluid pressure operated signal device.

In testimony whereof I have hereunto set my hand, this 9th day of October, 1928.

CARLTON D. STEWART.