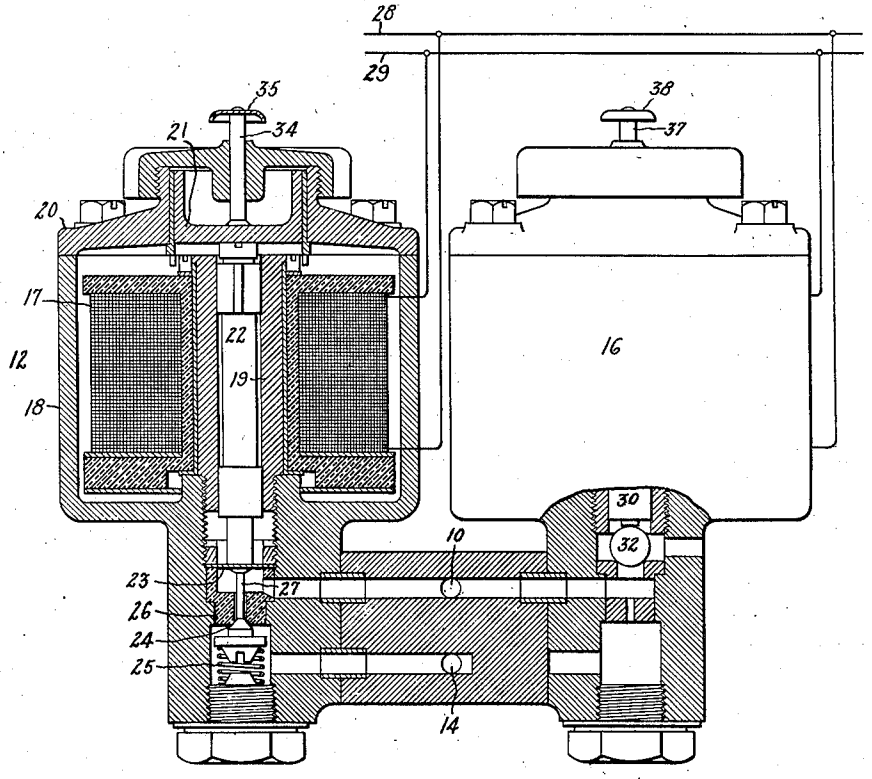
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FLUID CONTROL MEANS

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Inventor:
William T. Gray,
by Harry E. Dunham
His Attorney.

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FLUID CONTROL MEANS

William Train Gray, Altrincham, England, assignor to General Electric Company, a corporation of New York

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3 Claims. (Cl. 50—10)

My invention relates to fluid control means and has for its object to provide a regulating device whereby the pressure of a supply of fluid in a receiver for instance, delivered from an independent source of fluid at a greater pressure, may be controlled in accordance with the variations in the voltage or current of an electric circuit.

In accordance with my invention in one form thereof the regulating device comprises an electromagnetically biased inlet or minimum pressure valve interposed in the supply conduit to the receiver, and an electromagnetically retained non-return relief or maximum pressure valve connected to the receiver, the biasing means for both of which valves are responsive to the voltage or current of the electric circuit. Conveniently the inlet or minimum pressure valve is provided with a spindle arranged for axial movement in accordance conjointly with the excitation voltage applied to a solenoid coil associated therewith, the fluid pressure on the reduced pressure side of the valve, and a slight biasing force, to operate a valve member and permit the flow of fluid pressure. A thin metal diaphragm forms part of the body or casing of the valve so as to be subjected on its inner side to the fluid pressure at the outlet of the valve, and the spindle is disposed externally of the casing and bears against said diaphragm so that the latter functions as a means of applying to the spindle a force proportional to the reduced fluid pressure in opposition to the force exerted by the solenoid. The fluid inlet valve may thus be operated to maintain fluid pressure at a value not less than a predetermined value in accordance with the voltage applied to the solenoid.

The relief valve associated with the inlet valve is preferably of a somewhat similar type, and exhausts the fluid for instance to atmosphere, when the excitation voltage applied to its operating solenoid coil is less than a predetermined value corresponding to the fluid pressure desired. Conveniently this valve comprises a ball valve, held on its seating by a spindle actuated by an armature which is biased towards the ball when the associated solenoid coil is excited.

Referring to the drawing I have shown an elevation partly in section of a device embodying my invention.

Referring to the drawing I have shown my invention in one form as applied to a traction control gear, having a receiver (not shown) connected by a delivery pipe 10 and a valve 12 to a supply pipe 14, in which receiver it is desired to maintain an air pressure reduced from that of the independent source of supply, to a value substantially representative of the voltage in an energizing circuit.

A maximum limit valve 16 exhausting to the atmosphere is connected at its inlet side to the pipe 10. The electromagnetic biasing means for each valve are substantially the same, the biasing means for the valve 12 being shown in section. The biasing means comprise a solenoid coil 17 disposed within a cylindrical metal casing 18 around a hollow core member 19. Within a cover 20 for the casing 18 is slidably disposed an armature 21 which bears at its under side on the upper end of a spindle 22, slidably disposed within the hollow core member 19. The spindle 22 bears at its lower end on a thin phosphor-bronze diaphragm 23 forming part of the valve body and securely retained within a tubular extension at the lower end of the casing 18. This diaphragm is subjected on its under side to the air pressure in the pipe 10, and it therefore transmits to the spindle 22 a force which is representative of the air pressure to be balanced by the electromagnetic force applied by the solenoid coil 17. A small conically seated valve 24 slightly biased by a light helical spring 25 against a seating 26 is secured to the lower end of a small rod 27 which bears at its upper end lightly on the under side of the diaphragm 23 and slightly deflects it in addition to taking the weight of the spindle 22, the armature 21 and its associated parts, when the valve 24 is closed, by reason of the sufficient excess of inlet pressure over outlet pressure. The solenoid coil 17 may be excited by any convenient circuit, preferably of low voltage, as indicated by conductors 28 and 29, to produce an electromagnetic axial force on the spindle 22 thereby causing the valve 24 to open and remain open until the air pressure in the pipe 10 acting on the under side of the diaphragm 23 counterbalances the axial force on the spindle 22 and allows the valve 24 to close. Consequently the reduced pressure in the pipe 10 cannot be less than that corresponding to the excitation voltage of the coil 17 according to the predetermined relation. The voltage and current of the supply means can be manually controlled as desired.

In order to ensure that this reduced pressure in the pipe 10 is not greater than that corresponding to this excitation voltage the spindle 30 of the relief or maximum limit valve 16 is arranged to bear on a ball 32 of a ball valve so that the latter is maintained on its seating against the air pressure in the receiver pipe 10 to prevent escape of the air, provided that the excita-

tion voltage applied to the solenoid coil of the valve 16 is at least equal to a predetermined value in relation to the air pressure.

The armature 21 of the inlet valve 12 is provided with a spindle 34 which projects through the cover 20 of the casing 18. This spindle is provided at its upper end with a button 35 permitting the spindle to be depressed manually to open the valve 24 and admit air to the receiver pipe 10, thus indicating that the valve is operating satisfactorily. The relief valve 16 may also be provided with a projecting spindle 37 and button 38 to enable the operation of the ball 32 to be tested manually.

It will be evident that the fluid regulating arrangement above described is susceptible of many modifications within the scope of the invention, and that the minimum and maximum limit valves may be employed either singly or in combination in many cases where it is desired to regulate the pressure of a fluid supply in accordance with either the voltage or the current of the supply circuits 28 and 29. In certain cases, for example when a substantially constant demand exists for the fluid at the reduced pressure, so that the pressure of the fluid in the pipe 10 never exceeds the maximum limit required, and a moderately slow response of the valve 12 will suffice, the relief valve may be dispensed with.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination with a fluid supply pipe and a delivery pipe of a regulating device for controlling the pressure of fluid in said delivery pipe, comprising an electromagnetically biased inlet valve interposed between said pipes, an energizing circuit, an operating coil for said valve responsive to a variable electrical condition of said circuit for applying a force in a direction to open said valve, a spindle for said valve arranged for axial movement conjointly in accordance with said electrical condition and with the fluid pressure, and means for biasing said spindle against opening movement by said coil, a relief valve connected to said delivery pipe, a relief valve operating coil therefor for biasing said relief valve to a closed position, and means connecting said relief valve operating coil to said circuit so as to be responsive to said variable electrical condition of said circuit.

2. Means for maintaining substantially constant the fluid pressure in a delivery pipe, comprising a supply pipe for delivering air under pressure to said delivery pipe, a valve interposed between said supply and delivery pipes, a spring biasing said valve to its normally closed position, a spindle for biasing said valve to its open position, a diaphragm located between said spindle and said valve and responsive to the pressure in said delivery pipe, an operating coil for said spindle, a supply circuit, means for energizing said coil in response to a variable electrical condition of said supply circuit whereby the operation of said valve is determined as a function of said electrical condition, a second valve connected to said delivery pipe and arranged to be operated to its open position to connect said delivery pipe to atmospheric pressure, an operating coil for said second valve arranged to bias said valve to its closed position, and means for energizing said second valve from said supply circuit whereby variations in the voltage of said supply circuit will change in opposite directions the bias exerted respectively on said first and second valves.

3. The combination with a fluid supply pipe and a delivery pipe, of a regulating device for controlling the pressure of fluid in said delivery pipe comprising a valve connected between said supply pipe and said delivery pipe, biasing means for biasing said valve to a closed position, a spindle for said valve, a diaphragm located between said spindle and said delivery pipe and having one face exposed to the fluid pressure in said delivery pipe, an armature, means mounting said armature in operative relation with said spindle, an operating coil for moving said armature to bias said valve to open position, a supply circuit, conductors for connecting said coil to said circuit whereby the pressure in said delivery pipe will be determined as a function of the voltage of said supply circuit, a normally closed electromagnetically biased relief valve for said delivery pipe, conductors for connecting said relief valve to said circuit so that the excessive pressure required in said delivery pipe to operate said relief valve will be determined as a function of the voltage of said supply circuit.

WILLIAM TRAIN GRAY.