

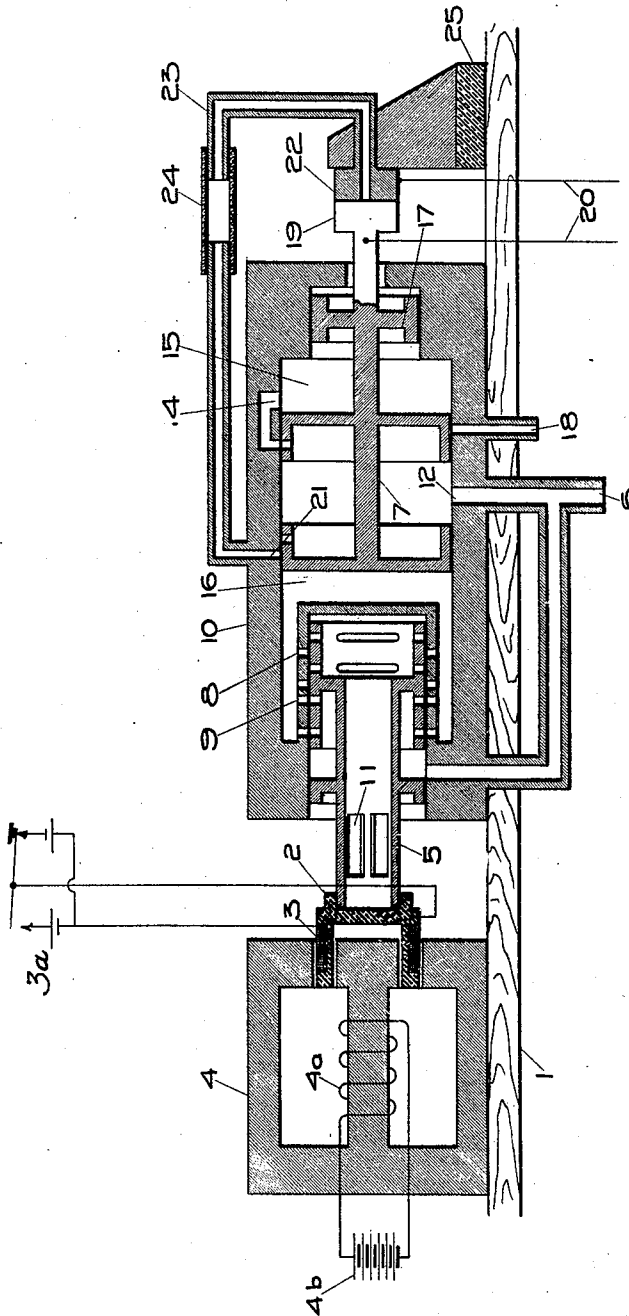
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ELECTROPNEUMATIC TELEGRAPH CONTROL RELAY

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## UNITED STATES PATENT OFFICE.

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ELECTROPNEUMATIC TELEGRAPH CONTROL RELAY.

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*To all whom it may concern:*

Be it known that I, HARADEN PRATT, a citizen of the United States, and a resident of the city and county of San Francisco and State of California, have invented an Improvement in Electropneumatic Telegraph Control Relays, of which the following is a specification.

My invention relates broadly to radio telegraphic communication and more specifically to a means for controlling radio telegraphic transmitters and has for its primary object the provision of means for accomplishing such control, whereby rapid manipulation at operating telegraphic speeds in excess of that possible with ordinary manual manipulation may be effected.

With the majority of telegraphic control devices heretofore used in the art, a high speed of transmitting operation has been difficult to attain, particularly with radio transmitting equipments of large size and large power, where high frequency currents of large amplitude are encountered. This invention provides a means whereby these difficulties may be overcome.

A further feature of the invention is the employment, if necessary, of one or more air blasts, automatically timed by a suitable valve, whereby the contacts of the device may be subjected to the force of the blast or blasts only when they are open.

The annexed drawing selected to illustrate the invention shows in cross section the electro-pneumatic telegraph control relay.

The equipment is mounted on a base 1 and comprises an electro-magnetic system actuated by a local electric current, the electro-magnet being designed so that the moving armature 2 has a small inertia and carries the coil 3 wound on an insulated bobbin which is actuated by the controlling current. This magnet has a very low time constant  $L/R$ , where  $L$  is its inductance and  $R$  is its resistance, because, first, it has an extremely low inductance, second, no magnetic material is used in the armature, and third, the number of turns of the moving coil 3 is small. This small number of turns is possible because the permanent magnet 4 having winding 4<sup>a</sup> permanently energized by

battery 4<sup>b</sup> is very strong, and therefore the required mechanical force can be obtained by the use of a small current in the armature winding 3. A further reduction in the time constant may be obtained by the well known method of inserting a resistance in series with the control circuit, and employing a correspondingly higher voltage.

This electro-magnet, therefore, by its construction is capable of faithfully following the rapid current impulses impressed on its armature in high speed telegraphic operation by any suitable circuit 3<sup>a</sup>. This invention, however, is not limited to the particular magnet system or circuit arrangement shown, but applies to any electro-magnet system capable of being operated from a telegraph control circuit, which embodies a low mechanical inertia of moving parts and a low electrical time constant, in combination with a valve controlled pneumatically operated contact system, substantially as explained hereinafter.

The purpose of the pneumatic device is to furnish the necessary mechanical force to operate a relatively heavy metal contact piece, which could not be obtained from the comparatively weak electro-magnet.

A valve 5, is directly attached to armature 2, of the electro-magnet 4 and is moved by the armature which thus controls a supply of air from pipe 6 at any pressure desired for actuating a double piston structure 7. When current is circulated in the proper direction through coil 3 the valve is moved to the right admitting air under pressure through ports 9 to the left of the double piston structure 7, which is thereby also moved to the right. A reversal of the current in coil 3 will move the valve 5 to the left closing ports 9, which cuts off the air to the cylindrical space 16 and opening ports 8, which releases the air confined in the cylinder 10 to the atmosphere through openings 11.

The piston valve 5 of this device is from its structure balanced as regards air pressures, and therefore readily follows the movements of the electro-magnet 2, to which it is attached, admitting or releasing air under pressure to or from the main cylinder of the device. Compressed air is also supplied continuously to the space between

the double pistons of the structure 7 through opening 12 from pipe 6, and the two pistons being of the same area are therefore balanced with respect to the pressure in the intervening space as described in the case of the valve 5. When this piston 7 is in its extreme right hand position, air is admitted through the port 14 producing a back pressure upon the structure in space 15. This back pressure is less than the forward pressure produced in space 16, because of the small aread piston 17, and the piston structure 7 therefore does not move. When, however, air pressure in space 16 is removed, the pressure in space 15 is immediately available and acts to return piston structure 7 to its left hand position, and the air escapes through ports 18 which are uncovered.

Piston structure 7 directly operates a contact 19 which makes and breaks the current in the circuit 20, which is being controlled. A port 21 opened or closed by the movement of piston 7 furnishes compressed air to the electrical contacts 19 and 22 through tube 23, insulated from cylinder 10 by means of bushing 24, so that when the contacts are opened a blast of air will ensue, thereby blowing out any arc which may develop when the circuit is broken at that point and which also assists in cooling the contacts. The stationary contact 22 is insulated from the base 1 by an insulating section 25.

Having described my invention, what I claim and wish to protect by Letters Patent of the United States is:

1. An electro-pneumatic key including a permanent magnetic field, an armature having a winding associated therewith, a circuit including means to supply electric impulses of a telegraphic nature to said winding, a pneumatic valve supporting said armature in said field and operating in response to said armature, a pneumatically operated piston structure in alignment with and controlled by said valve, and an electrical contactor directly attached to said piston structure.

2. A circuit controller including a controlling valve, means for operating said valve, a multiple piston structure, a source of fluid pressure, means controlled by said valve for placing said piston structure under unidirectional pressure and create a movement thereof, means controlled by the movement of said structure to create a pressure thereon less than and opposed to said first pressure, means controlled by said valve to release said first pressure and permit the piston structure to return to normal position, means controlled by the return movement of said piston structure to release said second pressure, and circuit controlling means operated by said piston structure.

3. A circuit controller including a con-

trolling valve, means for actuating said valve, a triple piston structure cylindrically enclosed, two of said pistons being equally aread and adjacent and one of lesser area, a source of fluid pressure, means for maintaining the space between said equal aread pistons under constant pressure, means controlled by said valve for putting one of said equal aread pistons under pressure and releasing it from pressure, means controlled by the second equal aread piston for putting the space between it and the lesser aread piston under pressure and releasing said space from pressure, and circuit controlling means operated by said piston structure.

4. Means for converting feeble periodical effort into intensified periodical effort of the same frequency comprising a fluid pressure actuated motor having a controlling valve actuated by said feeble effort, a multiple piston structure cylindrically enclosed, a source of fluid pressure, a series of intake and exhaust ports, all being so coordinated that the valve opens one of said ports to permit said pressure to create a unidirectional motion of said piston structure, the structure while in motion opens a second port to permit said pressure to create a pressure unequally opposing said motion, the valve opens a third port to release said first pressure and permit a return motion of said piston structure, and the piston structure opens a fourth port to release said second pressure, and means attached to said piston structure for utilizing the resulting intensified effort of said piston structure.

5. Means for converting feeble periodical effort into intensified periodical effort of the same frequency comprising a fluid pressure actuated motor having a controlling valve actuated by said feeble effort, a multiple piston structure, a source of fluid pressure, means controlled by said valve for placing said piston structure under unidirectional pressure and create a movement thereof, means controlled by the movement of said structure to create a pressure thereon less than and opposed to said first pressure, means controlled by said valve to release said first pressure and permit the piston structure to return to normal position, means controlled by the return movement of said piston structure to release said second pressure, and means attached to said piston structure for utilizing the resulting intensified effort of said structure.

6. Means for converting feeble periodical effort into intensified periodical effort of the same frequency comprising a fluid pressure actuated motor having a controlling valve actuated by said feeble effort, a triple piston structure cylindrically enclosed, two of said pistons being equal aread and adjacent and one of lesser area, a source of fluid pressure,

means for maintaining the space between said equal aread pistons under constant pressure, means controlled by said valve for putting one of said equal aread pistons under pressure and releasing it from pressure, means controlled by the second equal aread piston for putting the space between it and the lesser aread piston under pressure and releasing said space from pressure, and means attached to said piston structure for utilizing the resulting intensified effort of said structure. 10

HARADEN PRATT.