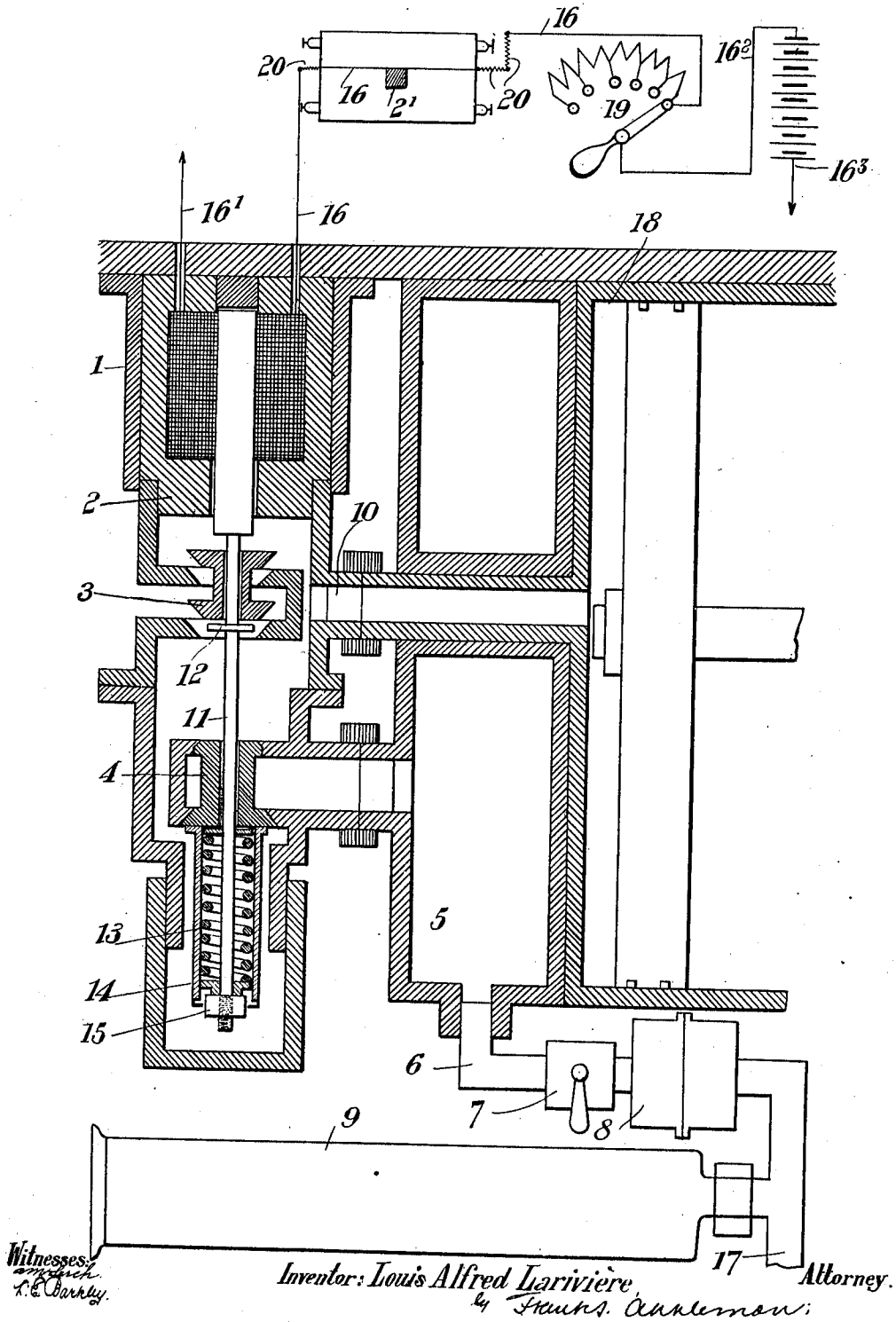


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ELECTROPNEUMATIC BRAKE.
APPLICATION FILED JUNE 13, 1910.

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LOUIS ALFRED LARIVIÈRE, OF PARIS, FRANCE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LOUIS ALFRED LARIVIÈRE, a citizen of the French Republic, and resident of Paris, France, have invented a certain new and useful Electropneumatic Brake, of which the following is a specification.

This invention has for its object a brake system comprising an electro-pneumatic valve whereby the ordinary air brake as such may be dispensed with.

One of the objects of this invention is to provide a brake of the kind described which receives its air from a reservoir containing air compressed to a very high pressure and placed under each vehicle whereby the train-pipe connecting the vehicles together may be dispensed with. This brake is adapted to aid the action of the ordinary air brake and thus provide for rapid and synchronous application of the brake-blocks. This brake may also allow the use of a train pipe having a reduced diameter and remaining void of air between two feed operations. As a matter of fact, by placing suitably a valve under each vehicle, the feeding of the ordinary reservoir may be carried out in an intermittent manner only as the train pipe no longer serves to the propagation of the brake action.

The accompanying drawing given by way of example shows the electro-pneumatic brake which forms the subject matter of this invention. The figure of the drawing is a diagrammatical view of the brake system some of the parts thereof being shown in section.

The electro-pneumatic valve comprises a casing or valve body 1 which is divided into four parts: The first part contains the electromagnet 2, the second one the escape valve 3, the third one the inlet valve 4 and the fourth one the spring 13 and the controlling nut 15. The valve 3 is partly balanced with a tendency of being applied on its seat by the inside pressure which may be increased by the pressure furnished by a spring. When the valve is open, it establishes the communication between the brake cylinder 18 and the valve on one hand and the atmosphere on the other hand. The valve 4 is also partly balanced and has a tendency of being opened by the pressure of the air coming from the reservoir 5 which is a controlling reservoir because the said valve which is composed of two conuses which

are rigidly connected together, has a lower conus which has an area slightly larger than that of the upper conus while the reverse is the case in valve 3.

The reservoir 5 is connected by a pipe 6, a cock 7, a pressure reducing device 8, with the reservoir 9 containing highly compressed air and which may be filled when necessary by means of a feed pipe 17. The reservoir 5 which is not absolutely necessary, is provided with a transversely arranged duct 10 adapted to connect the valve with the brake cylinder 18.

The two valves 4 and 3 are hollowed out in their center and through these central passages extends the rod 11 which is made integral with the core of the electromagnet 2 intended to actuate the valves. The double conus of the valve 3 is raised at the required moment by the disk 12 keyed on the rod 11. The double conus of valve 4 carries at its bottom a housing containing the spring 13 which when compressed between the disk 14 and the bottom of its housing, holds the valve 4 in its closed position.

The electrical devices may be mounted in series or in shunt relation. If they are connected together in series relation a metallic conductor 16, which is suitably insulated runs along the train, one of its ends 16¹ being earthed while the other 16² is connected with the positive pole of a source of electricity the negative pole 16³ of which is also earthed. Between the two ends of the conductor are inserted at least one rheostat 19, the flexible cables 20 connecting each carriage to the following one, the electromagnets 2, 2' and so on of the valves. The whole forms a closed circuit which is completed by the earth and comprises the source of electricity as well as the apparatuses. If instead of the earth a return wire is used or if the apparatuses are connected together in shunt relation, in the usual manner, two conductors in the place of one are required.

The function of the brake is as follows:—Supposing the train being running and the engine driver being about to brake, the electro pneumatic valve occupies on each carriage the position shown by the diagram on the drawing. The valve 3 is open and the valve 4 is closed. Actuating the rheostat 19 the engine driver inserts a calculated resistance into the electric circuit whereby the intensity of the current is reduced as is the attractive power of the electromagnet

2 the core of which descends under the action of the tension spring 13. The valve 3 is closed and the spring is allowed to expand but not to a sufficient extent for allowing the valve 4 to open. Inserting another
 5 resistance into the circuit, the engine driver again reduces the attractive force of the magnet 2; the spring 13 expands entirely, the disk 14 butts against the bottom of its
 10 housing and the double conus of the valve 4 becomes integral with the rod 11. As the lower conus 4 of the valve has a surface which is slightly larger than that of the upper conus, the pressure exerted by the air
 15 contained in the reservoir 5 on the lower conus forces the core of the electromagnet 2 to descend and the valve 4 to open thereby leaving a passage to the air which thus is allowed to enter the brake cylinder 18. When
 20 the force exerted by the pressure of the air on the outside of the valve, added to the attractive force of the magnet gives a total which is equal or superior to the force exerted by the air on the inside, the valve 4
 25 closes because the core of the electromagnet rises but without opening the valve 3 for in order to obtain this result it is necessary that the intensity of the current be near its maximum. At this moment, there is, as readily
 30 seen, a certain amount of air in the brake cylinder and the valve 4 is closed. In this state, when the engine driver still reduces the intensity of the current, he introduces a fresh amount of air into the brake cylinder
 35 but at a higher pressure than that which already existed therein and so on. With a liquid rheostat the pressure existing in the brake cylinder is therefore a continuous function of the intensity of the current in
 40 the circuit. When it is desired to release the brakes, all that will be required is to remove the resistances inserted into the circuit. The electromagnet thus gains again its maximum attractive force, closes the
 45 valve 4 and opens the valve 3 thus putting the brake cylinder in communication with the atmosphere. In case the connection between two vehicles of the train being broken, the circuit is interrupted and the brakes are
 50 at once applied.

It may be stated here that the brake may be applied to a single vehicle and that the valve might be used for various purposes. Besides the properties which are common to
 55 all electro pneumatic brakes, the brake which has been described above has still important advantages. It allows of the pneumatic intercommunication being dispensed with between the vehicles of the train. It has
 60 the following advantages:—1. In the valve the state of equilibrium is obtained by the opposition of two forces which are equal and act against each other, one of these forces resulting from the pressure of a fluid (air),
 65 the other being the resultant of two fluids

(air and electricity) while in similar existing brakes the state of equilibrium is obtained by forces resulting from one and the same fluid: the air. 2. After a first manipulation for obtaining a given pressure in the
 70 brake cylinder, the magnetic system produces alone all the movements which are required for maintaining this pressure and this without any new intervention of the operator and during a space of time which
 75 is only limited by the amount of air disposable that is to say during a practically illimited space of time. 3. With this system one may obtain arrangements which allow of the speed reducing force of the de-
 80 vice being rendered proportionate to the weight of the vehicle. This may be obtained for instance when the devices are mounted in shunt relation by inserting into the circuit of the magnets or cutting out therefrom
 85 a resistance arranged under the vehicles.

Other objects and advantages of my invention will be apparent from the foregoing specification.

Having now fully described my said invention what I claim and desire to secure by Letters Patent is:—

1. In an electro-pneumatic brake, a brake cylinder, a reservoir adapted to receive highly compressed air, means for introducing
 95 air into said reservoir, a partly balanced double inlet valve adapted to establish communication between said reservoir and said brake cylinder, a partly balanced double escape valve adapted to establish communication between said brake cylinder and the
 100 atmosphere, an electro-magnet, a core in said magnet, said valves having central passages adapted to be positioned in alinement with the axis of said core, said core having a rod-
 105 member passing through the passages of said valves, said rod having a disk adapted to coöperate with the escape valve for opening said valve, and resilient means adapted to deliver its action upon said rod; and
 110 means for controlling the action of said magnet.

2. In an electro pneumatic brake, a brake cylinder, a reservoir adapted to receive highly compressed air, means for introducing
 115 air into said reservoir, a partly balanced double conus inlet valve adapted to establish the communication between the said reservoir and the said brake cylinder, a partly balanced double conus escape valve
 120 positioned above said inlet valve and adapted to establish the communication between the said brake cylinder and the atmosphere, an electro-magnet, a core in the said electro-magnet, central passages in said valves which
 125 are positioned in line with the axis of the core of said electromagnet, a rod made integral with said core of the electromagnet and passing through the said passages of the
 130 valves, a disk secured to said rod under the

said escape valve and adapted to coöperate with the latter so as to open it, a housing connected to the lower surface of said inlet valve in line with the passage thereof, a
5 coiled spring inclosed in the said housing and surrounding the said rod, a bottom on said housing, a disk secured to the free end of said rod and adapted to serve as an abutment for said spring, means for control-
10 ling the position of said disk on the said rod

and means for controlling the function of said electromagnet from the engine, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

LOUIS ALFRED LARIVIÈRE.

Witnesses:

JACK H. BAKER,
H. C. COXE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
