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F. CHAPSAL.

BRAKE APPARATUS FOR RAILWAY VEHICLES.

No. 555,075. Patented Feb. 25, 1896.

Fig. 1.

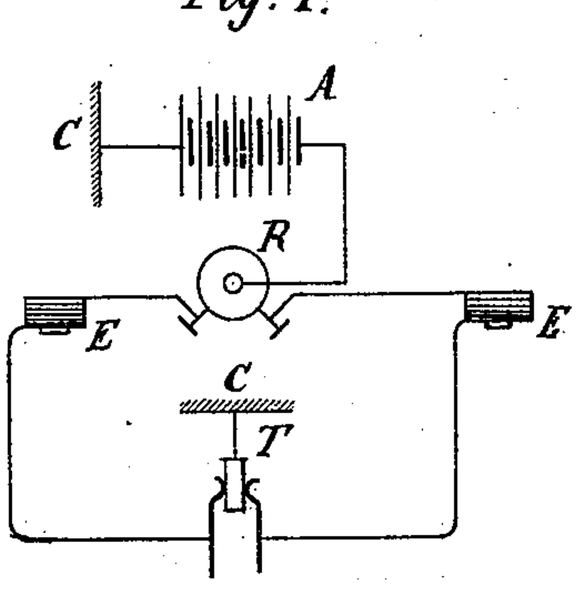

Fig. 2.

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Fig. 3

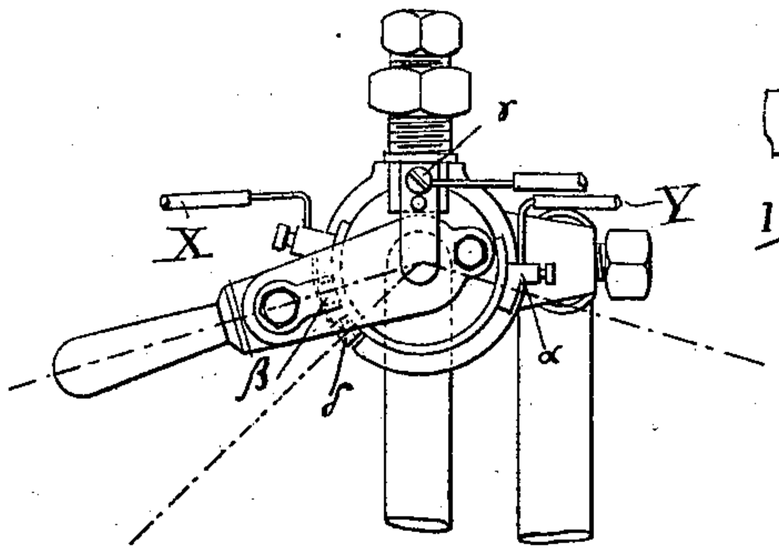


Fig. 4

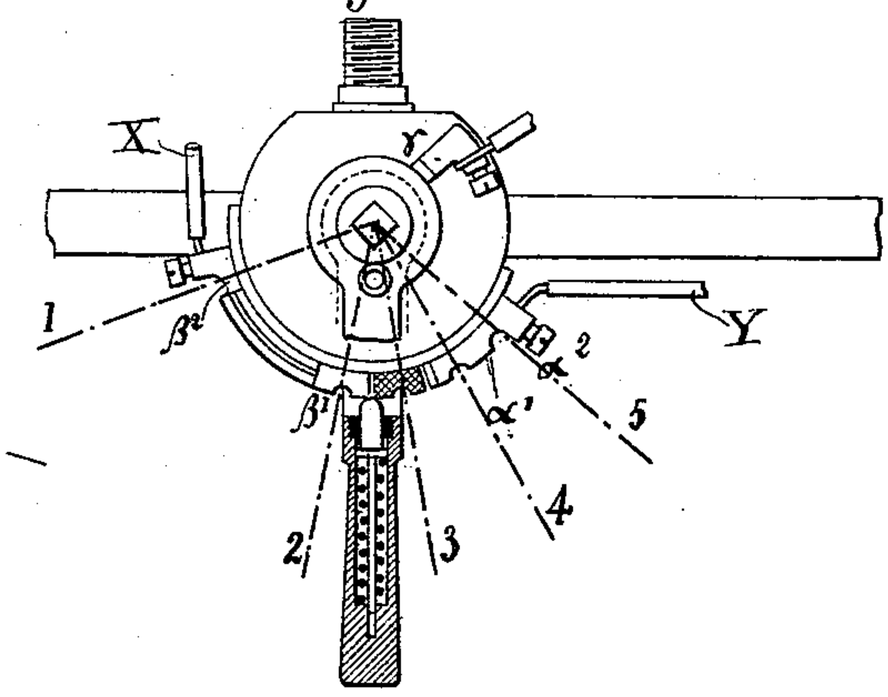
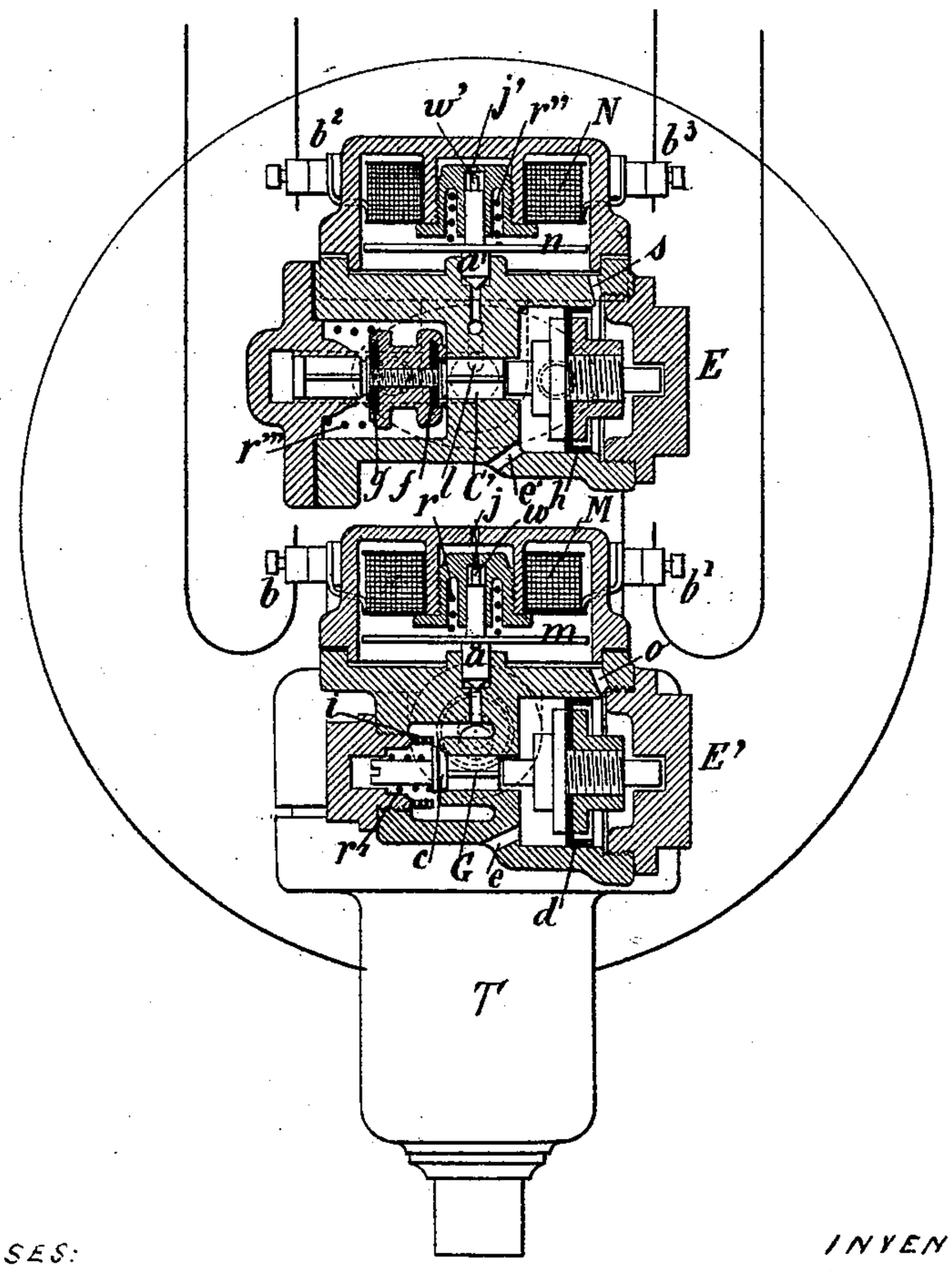


Fig 5.



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BRAKE APPARATUS FOR RAILWAY VEHICLES.

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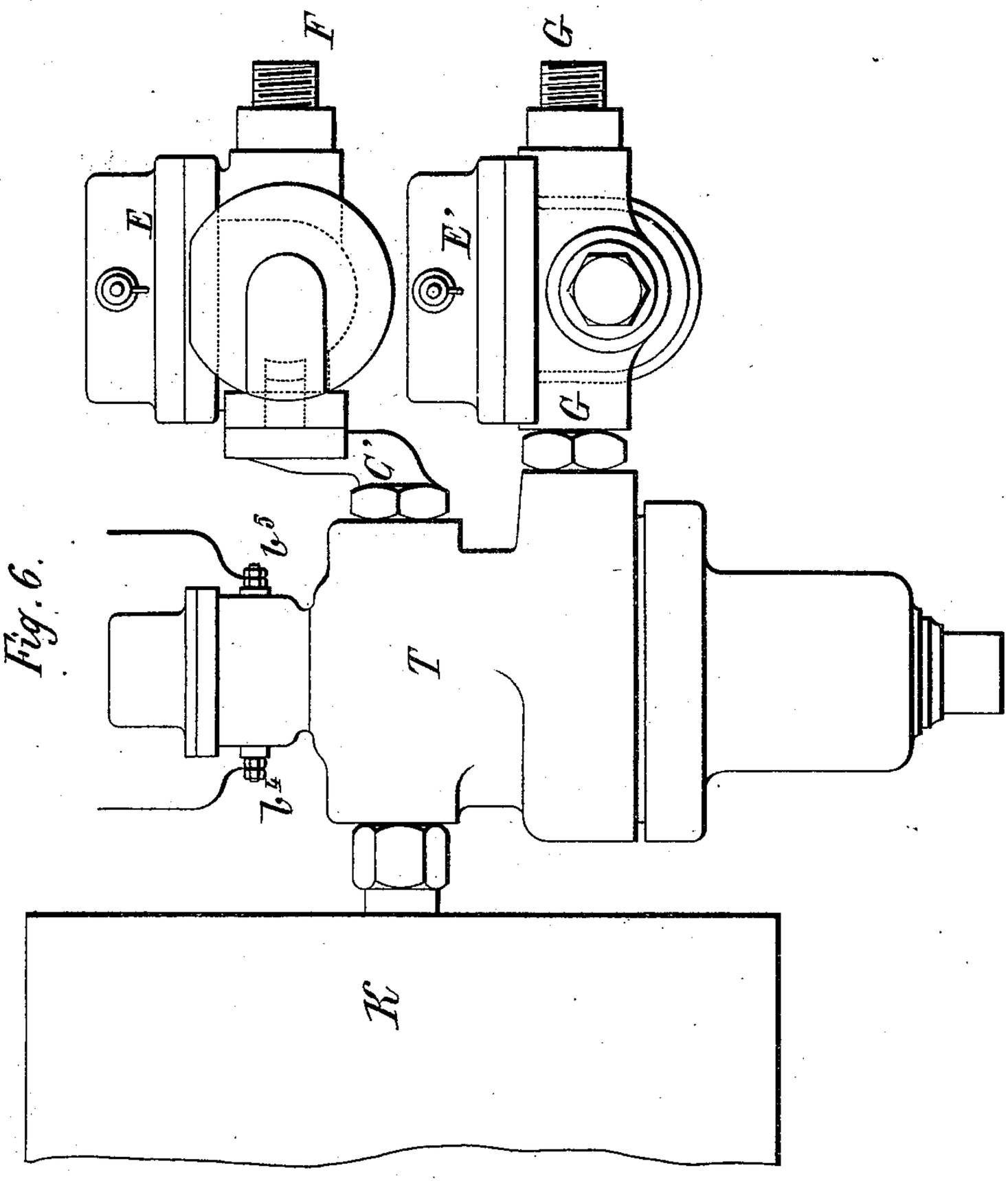
Fig. 6.



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UNITED STATES PATENT OFFICE.

FRANÇOIS CHAPSAL, OF PARIS, FRANCE.

BRAKE APPARATUS FOR RAILWAY-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 555,075, dated February 25, 1896.

Application filed October 4, 1895. Serial No. 564,620. (No model.) Patented in France June 4, 1894, No. 239,025, and in Belgium February 26, 1895, No. 114,303.

To all whom it may concern:

Be it known that I, FRANÇOIS CHAPSAL, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in and Relating to Brake Apparatus for Railway-Vehicles, (which invention is the subject-matter of Letters Patent in France, No. 239,025, dated June 4, 1894, and in Belgium, No. 114,303, dated February 26, 1895,) of which the following is a specification.

When the number of carriages on a train exceeds twenty-five or thirty, the use of continuous pneumatic brakes becomes extremely difficult, not to say impracticable, because of the retardation which takes place in the applying and releasing of the brakes, due to the slowness of the circulation of air in the train-pipe. It is this difficulty of operation which has doubtless delayed the application of continuous brakes to freight-trains, notwithstanding the efforts made to attain an acceleration of their action on trains of great length. On the other hand, electric brakes, which have an instantaneous operation, whatever be the length of the train, have not received important applications, notwithstanding that they are already old, by reason of the considerable risk of uncertainty of operation, which may cause sudden failure at the moment of an emergency stop.

I have devised a combination of the two systems to give a satisfactory and sure result, the electropneumatic brake being operated by the same manipulation as the ordinary brake, and the electric control having for its object only to render the action of the brake instantaneous over all the length of the train by causing the simultaneous and rapid operation of all the distributers, or by replacing their action on each vehicle up to the moment when they set themselves in motion. This simultaneous setting in action by the same manipulation of the two modes of operation is most indispensable for the braking, since the sudden non-action of the electric control, which might not be perceived until too late in case of failure, might lead to grave casualties by reason of the retardation introduced into the ordinary operation of the brake, if its employment were only optional.

The electropneumatic brake of my invention, which I am about to describe, realizes the condition above indicated.

In effect, as soon as the engineer applies the brake, an electric current flows instantly the entire length of the train and puts all the distributers in action at the same time, but as soon as the latter act the brakes operate in the ordinary manner, and the electric control is automatically suppressed by the active movement of the distributers. The braking is hence instantaneous, whatever may be the length of the train, and the adjustability of the brake, as well as its automatic character, is preserved, since the braking is thus effected and graduated in the ordinary manner.

If the engineer throws off the brake, a new electric current commences instantly to release the brakes over all the length of the train and it continues on each vehicle until the distributer is set in motion. The electric operation is then suppressed by the play of the distributer as before, and the throwing off of the brakes is effected in the ordinary manner. The electric control is thus only an auxiliary to the ordinary control of the brakes, destined to render the action instantaneous, whatever the length of the train, while it ceases automatically as soon as it has set the ordinary brakes in action, as well for the braking as for the releasing.

While it seems preferable to have only adjustable brakes on trains of great length, in order to avoid the reactions due to sudden stoppages, my invention is nevertheless perfectly applicable to brakes generally considered non-adjustable, such as the Westinghouse, for example. It is this application to the ordinary Westinghouse brake that I will describe as an example.

Figure 1 of the accompanying drawings is a diagram of the electric system. Fig. 2 is a sectional elevation of the brake mechanism with the additions provided by my invention. Fig. 3 is a plan of the engineer's valve. Fig. 4 is a sectional plan of a preferred construction of engineer's valve. Fig. 5 is a vertical sectional elevation of a modified construction. Fig. 6 is a side elevation of the construction shown in Fig. 5.

In Fig. 1, A represents the source of elec-

tric energy, as a dynamo or accumulator; R, the engineer's valve; T, a commutator applied to the triple valve; E, the electric brake-release valve; E′, the electric-braking valve, and C C the contacts with the frames of the vehicles, constituting earth connections. In this diagram there are only two line-wires, one for applying brakes, the other for releasing. The return of the current takes place through the earth by way of the brake mechanisms and piping, which are connected to the running-gear.

In Fig. 2, T is the distributer or "triple valve" of the Westinghouse brake. K is the auxiliary reservoir; E, the electric brake-release valve; E′, the braking-valve. G is the pipe connecting with the train-pipe. Y is the braking-circuit wire, and X the releasing-circuit wire. These wires are connected between the vehicles by couplings having suitably-arranged contacts.

The braking-valve E′ comprises an electromagnet M having its coil connected between two binding-posts $b\,b'$. This magnet when excited attracts an armature or plate m pressed away by a spring r, the drawing up of this plate having the effect of withdrawing a spindle valve or tappet a from its seat and of closing an opening j to the exterior by pressing against it a valve or tappet w. It comprises further a diaphragm d held between two plates, (or in Fig. 5 a piston,) which in its lower position serves to unseat a valve or tappet c, which is pressed to its seat by a spring r'.

The pipe G communicates with the train-pipe and with the chamber beneath the valve c. The duct i connects with this the space beneath the valve a. The duct e communicates from beneath the diaphragm d with the exterior, while the duct o communicates from the upper side of the diaphragm d with the chamber above the valve a.

The brake-releasing valve E comprises an electromagnet N, connected between two posts b^2 and b^3. This magnet when excited attracts an armature or plate n, pressed off by a spring r'' and connected to a valve or tappet a', which when the plate is attached is lifted from its seat, and by the same movement it closes a valve or tappet w' against an orifice j' leading to the exterior. This valve E comprises also a diaphragm h, held between two plates, (replaced in Fig. 5 by a piston,) which sustains a movable system composed of two valves or tappets f and g, pressed up by a spring r'''.

The passage or tube C′ communicates with the conduit which connects the triple valve with the brake-cylinder. The passage F communicates with the brake-cylinder. The duct $l\,l$ connects from the passage C′ to the under side of the valve a'. The duct e' communicates from the under side of the diaphragm h to the exterior, and the duct s leads from the chamber above the valve a' to the space above the diaphragm h.

As for the triple valve, the only modification which it has undergone consists in replacing its upper plug by a chamber containing a commutator mounted on its rod x. This chamber has two binding-posts b^4 and b^5, which communicate, the first with the post b of the braking-valve and the second with the post b^2 of the brake-releasing valve. These binding-posts connect to two flexible contacts t and t', one of which is in contact with the rod x, while the other is out of contact therewith, and vice versa, according to the position of the rod, these contacts being effected by the shape of the contacting surfaces on the commutator.

The binding-post b' of the braking-valve connects with the braking-circuit wire Y, while the post b^3 of the releasing-valve connects with the releasing-circuit wire X.

The mode of operation may now be understood. To apply the brakes, the engineer in turning the engineer's valve to the braking position throws the electric current into the braking-circuit. Instantly the electromagnet M lifts the plate m and consequently the valve a. The compressed air in the train-pipe, which acts against the valve c, flows through the ducts $i\,i\,a\,o$ and acts upon the upper side of the diaphragm d, which it presses down, thus unseating the valve c, so that the air in the train-pipe may escape freely to the exterior under each car by the duct e. The forcing down of the diaphragm d is effected with the greatest possible speed, since there is on one side of it the full train-pipe pressure and on the other side the pressure of the atmosphere; but from the instant that the fall of pressure in the train-pipe produced by the action of the electric valves on the cars has led to the operation of the triple valves the current is suddenly interrupted as soon as the contact t' has parted contact with the spindle x, and consequently the electromagnet M is discharged and all the parts of the valve E′ resume their normal positions. The compressed air above the diaphragm d escapes by the duct j. From this moment only the pneumatic brake remains in action.

To release the brakes the engineer replaces his valve in the position of release, which immediately throws a current into the release-valves. The electromagnet N in each then acts upon the plate n and lifts the valve a'. The air which was compressed in the brake-cylinder during the braking, and which circulates through the pipes C and F, passes by the ducts $l\,l\,a'\,s$ and acts against the upper side of the diaphragm, pressing it down and unseating the valve f, which permits the air from the brake-cylinder to escape by the duct e' to the exterior under each vehicle. At the same time the valve g closes the communication between the brake-cylinder and the auxiliary reservoir, so as to avoid all loss of air from the latter; but as soon as the pressure of air in the train-pipe resulting from the position of the engineer's valve becomes sufficient to restore the triple valve the electric

current through the electromagnet N ceases by the circuit being interrupted at *t*, and the parts of the valve E resume their normal positions, the continued escape of air from the brake-cylinder taking place through the triple valve, as usual.

As with the brake-valve, I obtain the greatest possible rapidity of action of the diaphragm *h*, since on one side there is the pressure of the brake-cylinder and on the other only the pressure of the atmosphere, by reason of the closing of the upper orifice *j'* by the valve *w'*.

In the preceding description I have assumed, as shown in Fig. 1, that the return-current of the circuit, both of braking and releasing, passes as an earth-circuit through the body of the framework; but evidently nothing prevents the use of a special return-wire, if preferred, and, if considered desirable, the two modes may be combined for greater security.

I have assumed thus far the use of an ordinary engineer's valve, (shown in Fig. 3,) which has been arranged for the purpose, and which comprises three contacts $\alpha\ \beta\ \gamma$, which permit, according to the position of the lever, of passing a current either into the braking-circuit Y (position α) or into the releasing-circuit X, (position β.) The contact γ which communicates with the lever is connected to the battery A, Fig. 1. In the position δ there is no passage of current.

In case it is desired to apply my system with one of the valves of the equalizing-discharge type shown in Fig. 4, in which the neutral zone is much more extended than in the ordinary engineer's valve, I may divide this neutral zone into three parts corresponding to three distinct positions of the handle of the valve. The position 3 or absolute neutral position does not permit the passage of any current nor any escape of air from or introduction into the train-pipe. The position 4 being in the neutral zone of the valve permits the passage of an electric current into the braking-circuit, but without loss of air from the train-pipe through the engineer's valve. There is in this place a contact α' connected to the contact α^2, which is joined to the wire Y, which leads to the braking-valves. The position 2 is likewise in the neutral zone and permits of passing a current into the releasing-circuit, but without introduction of air into the train-pipe through the valve. To this end I arrange a contact β', connected to the contact β^2, to which is joined the wire X, which leads to the brake-releasing valves. The contacts $\alpha'\ \alpha^2\ \beta'\ \beta^2$ are mounted on an insulating-ring of ebonite. There results from this construction this important advantage, that by putting the valve to the position 4 I may, for descending grades and for slackening speed, produce whatever fall of pressure I desire in the train-pipe, and by restoring the valve to the position 3 I may maintain whatever pressure is desired in the brake-cylinders, a result which it is impossible to attain conveniently by voiding air through the engineer's valve because of the eddies or fluctuations of pressure which occur in the train-pipe. Further, by putting the handle to the position 2 I may release the brakes electrically without introducing air into the train-pipe, thus avoiding sudden checking of speed under full headway, which results in the blocking of one or more cars by reason of ruptures in the train-pipe or the couplings, or of depression in the train-pipe resulting from local leaks or from a slowing up of the air-pump.

The arrangement which I have described for the ordinary Westinghouse brake is equally applicable to all other analogous systems, with suitable modification, and in particular to the quick-action Westinghouse brake, to which it would permit of graduated braking while giving to the release the rapidity of action which it lacks. In this latter case I could avail, for example, of the slide-valve of the triple valve as the commutator, or of a piece connected to this slide, or of any other part the movement of which would result from the setting in action of the triple valve.

It is obvious that there is nothing to prevent the application of my electropneumatic brake to the Westinghouse brake already provided in my system of brakes which I have patented in France by Patent No. 226,918, of January 16, 1893.

The description given of Fig. 2 applies equally to Figs. 5 and 6, which show a different arrangement of the same parts, designated by the same letters, except that the diaphragms *d* and *h* are replaced by their mechanical equivalents—pistons.

I claim as my invention the following-defined novel features, substantially as hereinbefore set forth, namely:

1. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and brake-cylinder, of an electric valve connected to accelerate the action of the brake, an electric circuit controlling it, and a commutator in said circuit operated by the distributer for stopping the action of the electric valve as soon as the distributer has acted.

2. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric braking-valve for accelerating the braking action of the brake, comprising an electromagnet, and a valve controlled thereby adapted when open to permit an escape of air from the train-pipe independently of the distributer, an electric circuit controlling said magnet, and a commutator in said circuit operated by the distributer for stopping the action of said electric valve as soon as the distributer has acted.

3. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric braking-valve for accelerating the braking action of the brake, comprising an electromagnet, a

valve operated thereby adapted to admit the compressed air from the train-pipe to act on a diaphragm, the said diaphragm, and a valve unseated by the displacement of said diaphragm, and controlling a duct from the train-pipe to the atmosphere, whereby the excitation of said magnet acts through said diaphragm to open said valve and permit an escape of air from the train-pipe.

4. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric braking-valve for accelerating the braking action of the brake, comprising an electromagnet M, its armature *m*, a valve *a* operated thereby, a duct *i o* from the train-pipe to said valve and thence to a diaphragm-chamber, a diaphragm *d* therein, a valve *c* operated by said diaphragm, and a passage from the train-pipe to said valve and thence to the exterior.

5. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric braking-valve for accelerating the braking action of the brake, comprising an electromagnet M, its armature *m*, a valve *a* operated thereby, a duct *i o* from the train-pipe to said valve and thence to a diaphragm-chamber, a chamber inclosing said magnet, having an outlet-orifice *j*, a valve *w* therefor operated by said armature, a diaphragm *d*, a valve *c* operated by said diaphragm, and a passage from the train-pipe to said valve and thence to the exterior.

6. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, operative pneumatically to apply and release the brakes of an electric brake-releasing valve for accelerating the releasing action of the brake, comprising an electromagnet, and a valve controlled thereby adapted when open to permit an escape of air from the brake-cylinder independently of the distributer.

7. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric brake-releasing valve for accelerating the releasing action of the brake, comprising an electromagnet, and a valve controlled thereby adapted when open to permit an escape of air from the brake-cylinder independently of the distributer, an electric circuit controlling said magnet, and a commutator in said circuit operated by the distributer for stopping the action of said electric valve as soon as the distributer has acted.

8. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric brake-releasing valve for accelerating the releasing action of the brake, comprising an electromagnet, a valve operated thereby adapted to admit the compressed air from the brake-cylinder to act on a diaphragm, the said diaphragm, and a valve unseated by the displacement of the diaphragm controlling a duct opening from the brake-cylinder to the atmosphere.

9. The combination with a pneumatic brake comprising a distributer, an auxiliary reservoir and a brake-cylinder, of an electric brake-releasing valve for accelerating the releasing action of the brake, comprising an electromagnet, a valve operated thereby adapted to admit the compressed air from the brake-cylinder to act on a diaphragm, the said diaphragm, and two valves operated by the displacement of said diaphragm, the first arranged to be unseated thereby and controlling a duct opening from the brake-cylinder to the atmosphere, and the other arranged to be seated thereby, and closing the passage communicating from said electric release-valve and brake-cylinder to the distributer, to permit the loss of air from the latter.

10. The combination with a pneumatic brake of an electric brake-releasing valve E, comprising an electromagnet N, its armature *n*, a valve *a'* operated thereby, a duct leading from the brake-cylinder pipe to said valve and thence to a diaphragm-chamber, a diaphragm *h* therein, valves *f* and *g* operated by said diaphragm, the first normally closing an outlet from the brake-cylinder to the exterior, and the second normally open and adapted when displaced to close a passage communicating from the brake-cylinder and valve *f* to the distributer of the pneumatic brake, and a spring *r'''* for restoring said valves.

11. The combination with a pneumatic brake comprising an engineer's valve, and on each car a brake-cylinder, auxiliary reservoir and distributer, of an electric system comprising an electric valve on each car adapted to accelerate the action of the brake, a circuit leading thence to the engineer's valve, and commutator-contacts applied to the latter, said contacts being arranged with reference to the neutral zone of the valve to admit of a closure of said circuit when the valve is in the neutral zone, whereby the brakes may be controlled by the electric system without inlet or outlet of air through the engineer's valve, in essentially the manner set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FRANÇOIS CHAPSAL.

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