

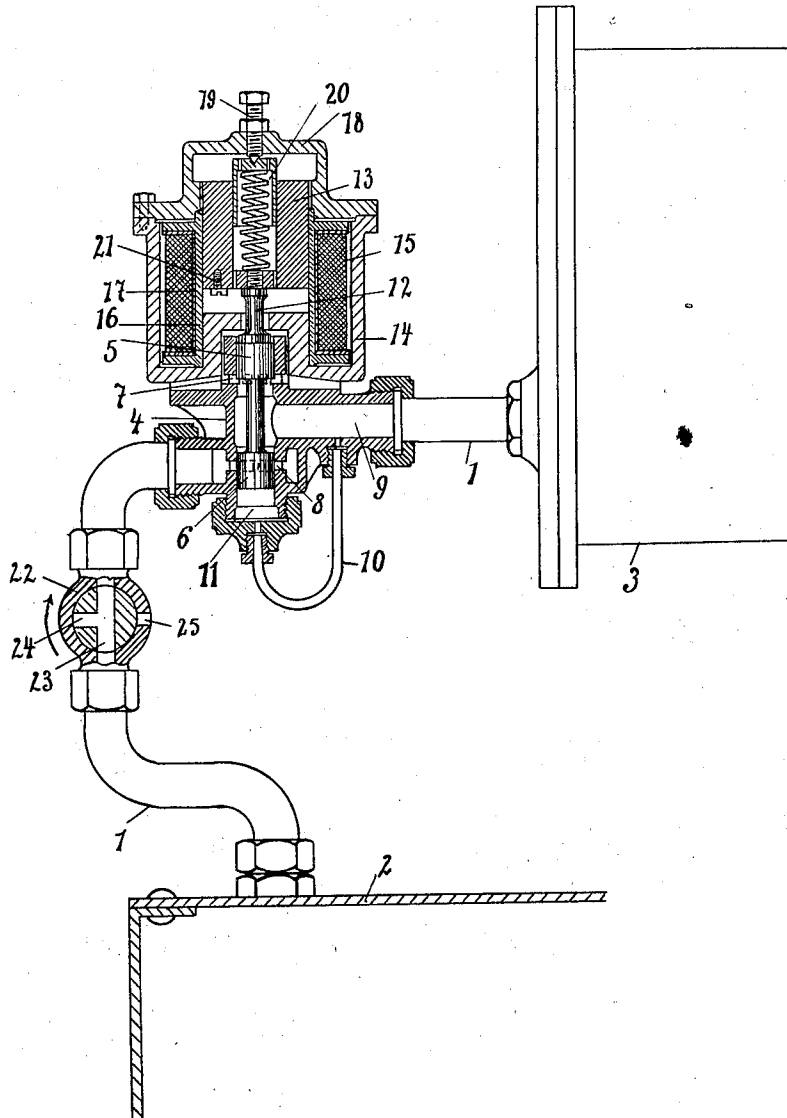
No. 828,939.

PATENTED AUG. 21, 1906.

E. KRAMER.
AIR PRESSURE BRAKE.
APPLICATION FILED AUG. 3, 1904.

3 SHEETS—SHEET 1.

Fig 1.



Witnesses:

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Inventor:

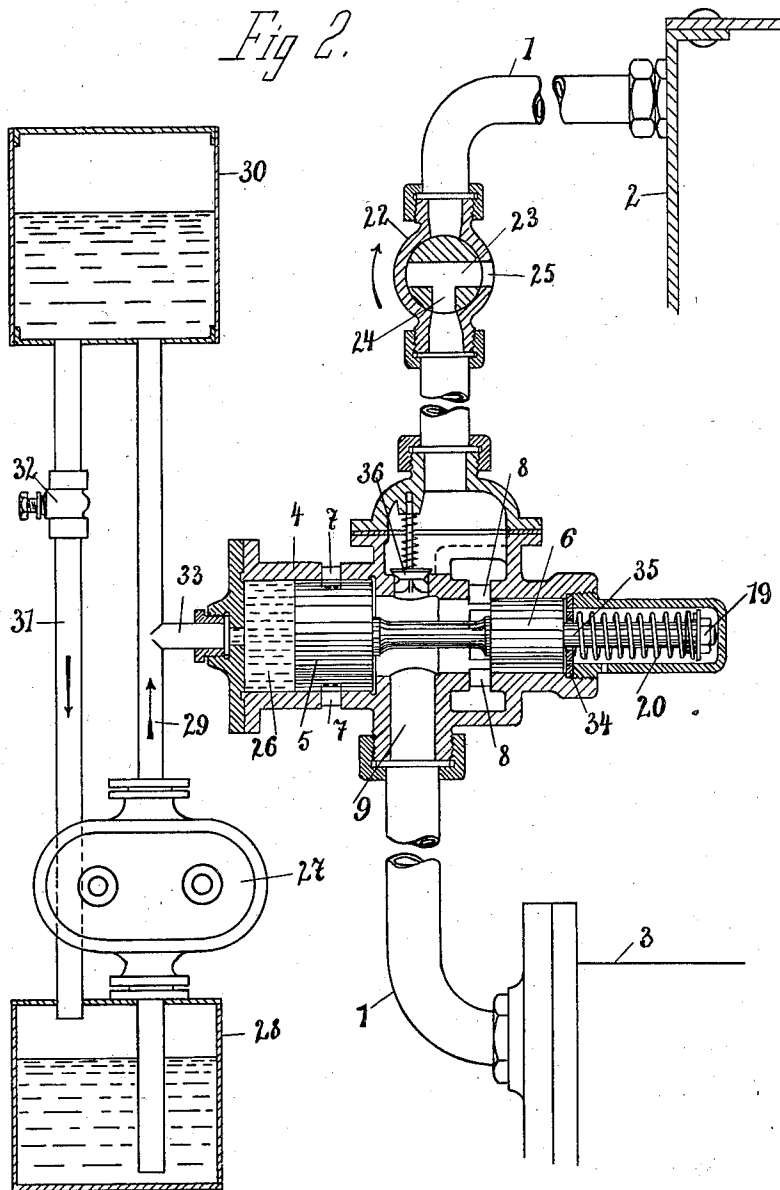
Erwin Kramer.

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3 SHEETS—SHEET 2.



Witnesses:

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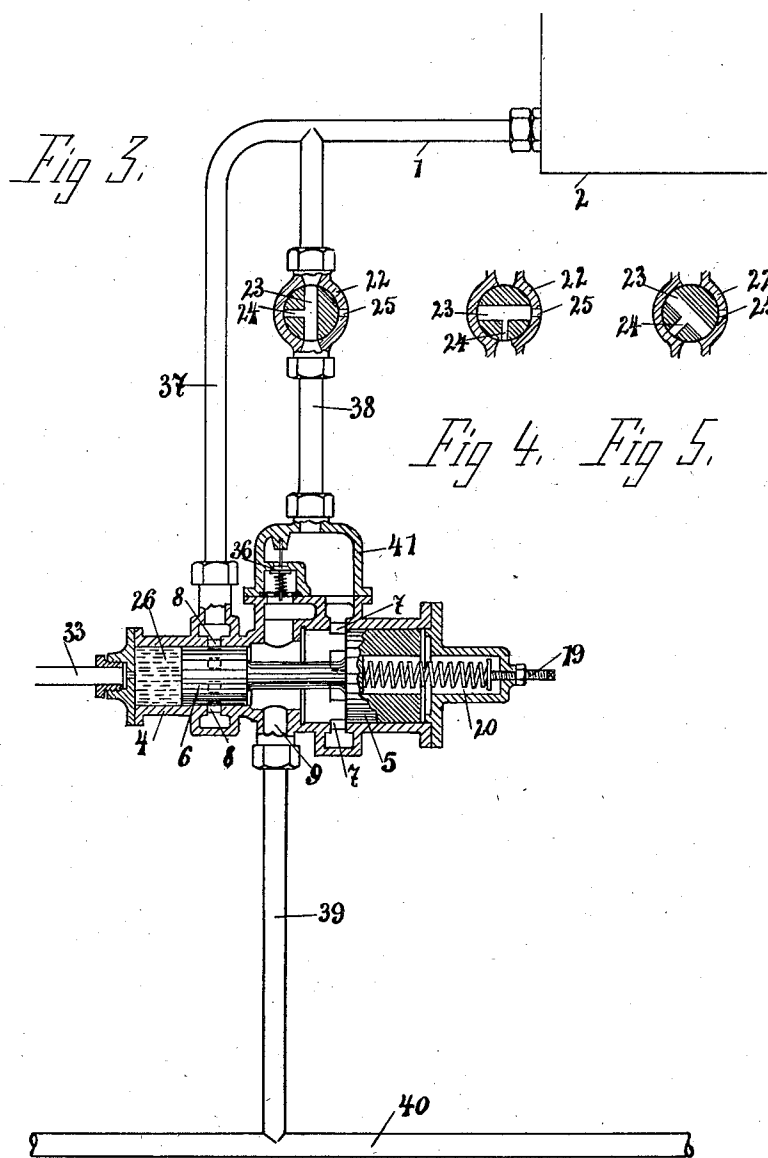
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3 SHEETS—SHEET 3.



Witnesses:
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ERWIN KRAMER, OF BERLIN, GERMANY.

AIR-PRESSURE BRAKE.

No. 828,939.

Specification of Letters Patent.

Patented Aug. 21, 1906.

Application filed August 3, 1904. Serial No. 219,402.

To all whom it may concern:

Be it known that I, ERWIN KRAMER, a subject of the King of Prussia, German Emperor, residing at No. 9 Paul street, Berlin, Germany, have invented certain new and useful Improvements in Air-Pressure Brakes, of which the following is a specification.

My invention relates to a wheel-block brake operated by compressed air.

The object of my invention is to provide an air-pressure brake in which the pressure given to the brake-blocks above a certain speed depends on the rotative velocity of the wheels. This automatic effect is attained in such way that the valve device which charges or discharges the compressed air into or out of the brake-cylinder or a main valve which controls the main brake-pipe continuous throughout the train is regulated by a device which acts on the valve with a varying force, tending to displace the same in accordance with the velocity of rotation of the wheel-axle. In connection with this force two additional forces, one of which is produced by the compressed air in the brake-cylinder and the other by a spring, act in the same or opposite directions and displace the piston or distributing slide of the valve if one of the said forces increases or decreases in size till equilibrium is restored, thereby altering the pressure in the brake-cylinder accordingly, so that at all times the brake-blocks are set with such a force as is necessary for producing the maximum of braking effect, which can be practically obtained.

In the accompanying drawings, which form a part of this specification, I have illustrated the mechanism by which I attain these effects.

Figure 1 represents a vertical sectional view of a brake-valve connected with a solenoid and the connections of the device with the reservoir and the brake-cylinder. Fig. 2 is a longitudinal sectional view of a brake-valve and a device adapted to produce fluid-pressure. Fig. 3 is a longitudinal sectional view of a controlling brake-valve. Figs. 4 and 5 are cross-sections showing the driver's brake-cock in different positions.

Similar numerals of reference indicate corresponding parts in the several figures of the drawings.

In the braking device represented by Fig. 1, which is principally intended for use in electric street-railways or the like, the brake-cylinder is fed directly from the main reser-

voir. The distributing-valve 4, inserted into the brake-pipe 1, running from the reservoir 2 to the brake-cylinder 3, is connected with a suitable electromagnet which controls the 60 valve.

In the barrel 4 of the valve a double piston 5 6 is displaceable upward and downward. By the movement of the upper piston 5 the exhaust-ports 7 are opened and closed, 65 through which latter the compressed air can be discharged to the atmosphere, while the lower piston 6 controls the inlet-ports 8, through which the air is admitted from the reservoir 2 into the valve 4, passing from 70 thence into the brake-cylinder 3 through a branch 9. The ports 7 cannot be opened by the piston 5 before the ports 8 are closed by the piston 6, and vice versa.

A by-pass 10 allows the pressure to pass 75 from the sleeve 9 into a chamber 11 at the lower end of the valve, so that the pressure bearing on the bottom side of the piston 6 is equal to that in the brake-cylinder.

A rod 12 rigidly connects the upper end of 80 the double piston 5 6 with the iron core 13 of a solenoid, to the iron casing 14 of which the valve 4 is attached. The coil 15 is wound on a bobbin 16 in the customary manner and insulated therefrom by a layer 17 of suitable 85 material. The iron cover 18, closing the casing 14, surrounds the upper end of the core 13 at a short distance. However, if the core is drawn deeper into the coil the cross-section of the path of the lines of force from the 90 cover to the core will be reduced, in consequence of which the core takes and maintains a definite position for every intensity of the energizing-current. Instead of this arrangement other electromagnets producing the 95 same effect may be used.

In a concentric cavity of the core 13 a spring 20 is arranged which can be adjusted by a set-screw 19, which spring tends to press the double piston 5 6 downward. A screw 100 21 permits of regulating the deepest position of the core 13.

The driver's brake-cock 22 is arranged in the brake-pipe 1 at any convenient place. It possesses in its tap the usual passage 23, 105 which allows the air to pass from the reservoir 2 to the brake-cylinder 3, as shown in Fig. 1, and a lateral branch 24. On turning the tap by ninety degrees in the direction of the arrow the air can escape from the brake-cylinder 3, through the valve 4, ports 8; pas- 110 sages 24 23, and a perforation 25 in the body

of the three-way cock 22 to the atmosphere, after the double piston has been lifted above the ports 7, exhausting some pressure, so that the piston reaches its deepest position below the ports 8.

The operation of the braking device is as follows: If the brake is not applied, the spring 20 forces the double piston 5 6 into its deepest position, thereby closing the ports 7 and opening the ports 8. When the driver will apply the brake, he brings the tap of the brake-cock 22 into the position shown in Fig. 1, connecting at the same time the two terminals of the car-electromotor with the terminals of the winding 15 of the solenoid by means of the switch-controller. The compressed air then passes from the reservoir 2, through the ports 8, sleeve 9, and pipe 1, into the brake-cylinder 3, thereby setting the brake-blocks, while the same pressure is communicated to the chamber 11 through the by-pass 10. The pressure in the chamber 11 then lifts the double piston 5 6 with a certain force tending to shut off the inlet-ports 8. This force is balanced by the force of the spring 20 and by the magnetic force of the solenoid working on the core 13, which two forces act in the opposite direction to the pressure. The said magnetic force depends on the speed of rotation of the wheel-axle, as with a greater speed of rotation a higher intensity of current is produced in the car-motors, which constitute generators in the described connection than with a lower speed of rotation. Thus at a given velocity an equilibrium is produced between the different forces as soon as the double piston is displaced to the corresponding position, whereby the pressure in the brake-cylinder is regulated to the respective amount. If with a decreasing velocity of the car the magnetic force of the solenoid diminishes, the pressure in the chamber 11 will predominate and push the double piston upward until the ports 7 are opened and part of the compressed air is exhausted from the brake-cylinder, whereupon the double piston is again forced downward by the spring 20 in consequence of the reduced pressure in the brake-cylinder and in the chamber 11. Thus the valve regulates the pressure of the brake-blocks on the wheels automatically until the car is brought to a stand. Owing to the explained automatic effect of the device, the wheels cannot happen to be held fast or locked, so as to be prevented from rotation, as with the beginning slip of the wheels the rotative speed of the same and the magnetic force of the solenoid decrease, in consequence of which the valve device is actuated, as above stated, and caused to discharge air from the brake-cylinder, thus relieving the brake-blocks from pressure until the wheels have resumed their original rotative speed. If, on the contrary, on an incline or for any other reason the car

increases in velocity, the intensity of current generated in the motors rapidly increases too, giving the solenoid a greater magnetic force, which pushes the core to a deeper position, whereby the inlet-ports 8 are opened, so that pressure is admitted to the brake-cylinder, which sets the brake-blocks with a greater force, as will be easily understood.

Instead of the solenoid any other device which depends on the rotation of the wheel-axle may be employed. For example, the double piston may be connected with a centrifugal governor coupled with the wheel-axle, the force of which varies according to the velocity of rotation, so that the valve is controlled in conformity therewith.

In the braking device shown in Fig. 2 fluid-pressure is employed instead of the magnetic force. The fluid is introduced into a chamber 26 of the valve 4, where it acts on the outer side of the piston 5. The fluid (either oil, glycerin, or air or the like) is forced by a pump 27 of any construction (either rotary or piston pump) driven by the wheel-axle and circulated from a vessel 28 through a pipe 29 into an air-chamber 30, where it compresses the air contained therein, whereupon it flows back into the vessel 28 through a pipe 31. A throttle-screw 32, arranged in the latter, permits of regulating the pressure in the air-chamber 30. A branch pipe 33 establishes the connection between the pipe 29 and the chamber 26. The pressure in the chamber 30 and of the fluid varies in conformity with the rotative speed of the wheels, which pressure therefore constitutes an equivalent of the magnetic force of the solenoid.

The double piston 5 6 has the form of a differential piston, and the pressure operating in the brake-cylinder acts on the inner side of the larger piston 5 in this construction.

Besides the inlet-ports 8 a return-valve 36 is provided which permits the escape of air but not the entrance of the same. The object of this arrangement is to permit the exhaust of air from the brake-cylinder 3, when the driver's valve 22 is turned to the position shown in the drawings, even if the ports 8 are closed by the piston 6. A return-valve 36 may also be used in connection with the distributing-valve shown in Fig. 1 for the same purpose.

The spring 20 is wound around a bolt 35, attached to the piston 6, and bears with one end against a disk 34, secured to the body 4 and with the other end against the adjusting-nut 19, screwed on the bolt 35.

The pressure in the brake-cylinder acts also on the inner side of the larger piston 5 and tends to displace the double piston 5 6 to the left hand. The fluid acts on the outer side of the piston 5, and therefore tends to displace the double piston to the right. The spring 20 works on the nut 19, thus giving the double piston connected therewith by

the bolt 35 an impulse to the right. These three forces displace the double piston until an equilibrium is produced, thereby regulating the passage of air into or out of the brake-cylinder in conformity with the rotative velocity of the wheel-axle, as explained with respect to Fig. 1.

In the brake device shown in Figs. 3 to 6, which is adapted for use in trains having a main brake-pipe continuous through the entire length of the train, the operation of the valves is indirect in so far as the regulating main valve charges the main brake-pipe and the triple valves with pressure for taking off the brakes, while the pressure is reduced for applying the brakes and regulated in conformity with the rotative speed of the wheels.

The main controlling-valve, Fig. 3, is suitably arranged on the engine and connected with the wheel-axle through the chamber 26, the pump 27, and the other accessory parts for production of circulation and fluid-pressure, (shown in Fig. 2,) so that the position of the double piston depends on the speed of rotation of the wheels.

The pipe 1, connected to the main reservoir 2, continues in two branch pipes, one of which, 37, opens into the inlet-ports 8, while the other branch pipe 38, provided with the driver's brake-cock 22, is in open communication with a cap 41. The exhaust-ports 7 open into the latter, in which a return-valve 36 is also arranged which permits the compressed air to enter the main controlling-valve but not to exhaust. A pipe 39, jointed to the sleeve 9, connects the main valve with the continuous brake-pipe 40, to which the triple valves of the several cars are connected. The fluid and the air push the double piston to the right hand, while the spring tends to displace it to the left hand.

When the brake is not in operation, the main controlling-valve, the brake-pipe 40, the triple valves, and the small reservoirs of the several cars are charged with pressure which is admitted from the main reservoir 2 through the driver's brake-cock 22, turned into the position shown in Fig. 3. If both ports 7 and 8 should happen to be closed by the pistons 5 and 6, respectively, the air enters the controlling-valve through the return-valve 36 and passes through the pipe 39 into the brake-pipe 40, thereby displacing the double piston 5 6 to the right hand and opening the ports 7.

In order to set the brake-blocks, the driver turns the cock 22 to the position shown in Fig. 4, thus permitting part of the compressed air to escape from the pipe 40 to the atmosphere through the pipe 39, controlling-valve, ports 7, cap 41, pipe 38, and passages 24 23 25. The reduction of pressure operates the triple valves in the well-known manner. At the same time the double piston 5 6 of the main controlling-valve is pushed to the left

hand by the spring 20, which now predominates over the air-pressure, thereby closing the ports 7 partially or entirely. If the reduction of pressure thus obtained was becoming too low without a sufficient fluid-pressure in the chamber 26, the said movement of the double piston to the left continues until the ports 8 are opened and compressed air can enter the controlling-valve through the pipe 37 and pass into the brake-pipe 40 and the triple valves, which latter are operated so as to relieve the brake-blocks from pressure. The increased air-pressure then displaces the pistons 5 6 to the right, closing both ports 7 and 8. The same effect of releasement of the brakes is produced with the decreasing velocity or with the wheels locked, so as to be prevented from rotation. Then the fluid-pressure in the chamber 26 decreases, so that the force of the spring predominates over the two other forces and the pistons are displaced to the left, as above explained. On the other hand, if the driver desires to put the main controlling-valve out of use and to leave the brakes without automatic regulation he lets escape part of the pressure by turning the cock 22 into the position shown in Fig. 4, whereupon he reverses it into a position in which further exhaust is prevented, Fig. 5.

It will be obvious that the mechanism of the brake may be varied in several ways without departing from the principle of my invention. I therefore do not wish to be limited to the constructional forms shown in the drawings for examples; but

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a distributing-valve of air-pressure brakes, the combination with a valve-barrel having inlet and exhaust ports; of a distributing piston-slide adapted to open and close the said ports; a spring bearing on the piston with one end and with the other end on a rigid support attached to the valve-body; a chamber provided in the valve in which the distributed air-pressure reacts on the piston; and means adapted to produce a force which acts on the piston and varies according to the rotative speed of the car-wheels, substantially as described.

2. In a distributing-valve of air-pressure brakes, the combination with a valve-barrel having inlet and exhaust ports; of a piston-slide adapted to open and close the said ports; a spring bearing on the piston with one end and on a support attached to the valve-barrel with the other end; a chamber in the barrel in which the distributed air-pressure reacts on the piston; and a device which acts on the piston with a force varying in conformity with the rotative speed of the wheels, substantially as described.

3. A distributing-valve of air-pressure brakes, consisting of a barrel; inlet and ex-

haust ports formed therein; a by-pass closed
by a return-valve; a slide adapted to open
and close the said ports; a spring supported
on a rest attached to the barrel, which spring
bears on the slide; and a chamber in the bar-
rel in which the distributed air reacts on the
slide; in combination with a device con-
nected to the wheel-axle which produces a
force varying with the rotative speed and
acts on the piston in such a manner that the
pressure working in the brake-cylinder is au-
tomatically regulated in accordance with the
rotative speed of the wheels, substantially as
described.

4. An air-pressure brake, consisting of a
distributing-valve, having a barrel with inlet
and exhaust ports formed therein; a slide dis-
placeable in the barrel and adapted to open
and close the said ports; a spring bearing on a
support attached to the barrel and acting on
the slide; and a chamber in the barrel in
which the distributed air reacts on the slide;
in combination with a device connected to
the wheel-axle which produces a force vary-
ing with the rotative speed and acts on the
piston in such a manner that the pressure of
the brake-blocks to the wheels is automati-
cally regulated in accordance with the rota-
tive speed of the wheels, substantially as de-
scribed.

5. A distributing-valve of air-pressure
brakes, consisting of a barrel with inlet and
exhaust ports formed therein; a slide adapted
to open and close the said ports; a spring sup-
ported on the barrel and bearing on the slide;
and a chamber in which the distributed air
reacts on the slide; in combination with a de-
vice capable of producing a force varying
with the rotative speed of the wheels; all so
arranged that the three forces acting on the
piston in opposite directions displace the
same in such a manner that the pressure of
the brake-blocks onto the wheels is automati-
cally regulated in conformity with the ro-
tative speed of the wheels, substantially as
described.

6. An air-pressure brake, consisting of a

distributing-valve, having a barrel with inlet
and exhaust ports formed therein; a slide
adapted to open and close the said ports; a
spring supported on the barrel and bearing
on the said slide; and a chamber in which the
distributed air reacts on the slide; in combi-
nation with a device capable of producing a
force which varies with the rotative speed of
the wheels, whereby the said force together
with the forces produced by the spring and
the distributed air act on the slide in such a
manner that the pressure working in the
brake-cylinder is automatically regulated in
accordance with the rotative speed of the
wheels, substantially as described.

7. In a distributing-valve of air-pressure
brakes, the combination with a valve-barrel,
having inlet and exhaust ports; of a dis-
tributing-slide adapted to open and close the
said ports; a spring bearing on the piston
with one end and with the other end on a
rigid support attached to the valve-body;
means which allow the distributed air to act
on the piston; and means adapted to produce
a force which acts on the piston and varies
according to the rotative speed of the car-
wheels, substantially as described.

8. In a distributing-valve of air-pressure
brakes, the combination with a valve-barrel
having inlet and exhaust-ports; of a slide
adapted to open and close the said ports; a
spring bearing with its one end on the piston
and with its other end on a support attached
to the valve-barrel; means for regulating the
tension of the spring; means which allow the
distributed air to act on the piston; and a de-
vice which acts on the piston with a force
varying in conformity with the rotative
speed of the wheels, substantially as de-
scribed.

In testimony whereof I have signed my
name hereunto in presence of two witnesses.

ERWIN KRAMER.

Witnesses:

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HENRY HASPER.