(No Model.) 2 Sheets—Sheet 1.

J. D. P. SCHENCK.

AIR BRAKE.

No. 524,073. Patented Aug. 7, 1894.

FIG: I.

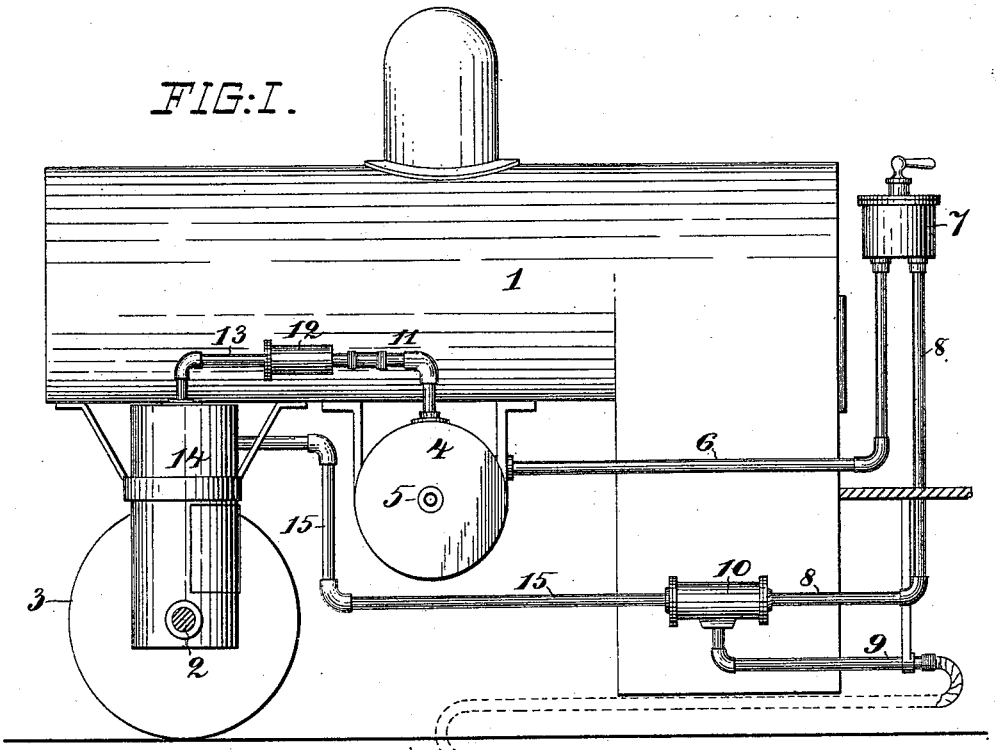


FIG: I.a

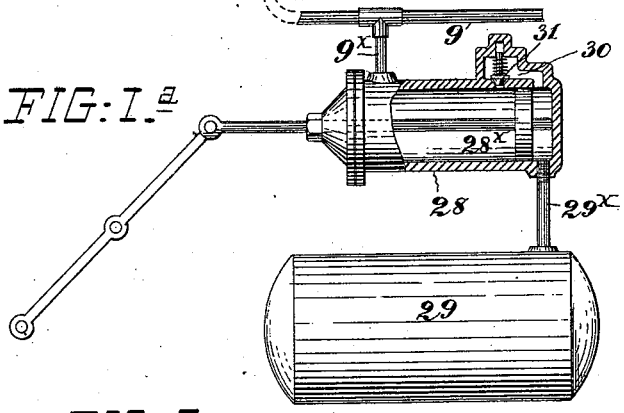
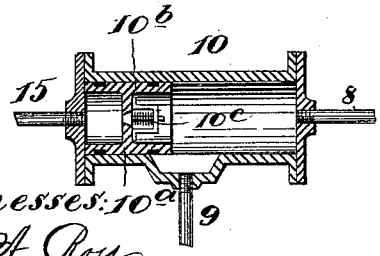


FIG: 5.



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(No Model.) 2 Sheets—Sheet 2.

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AIR BRAKE.

No. 524,073. Patented Aug. 7, 1894.

FIG: 2.

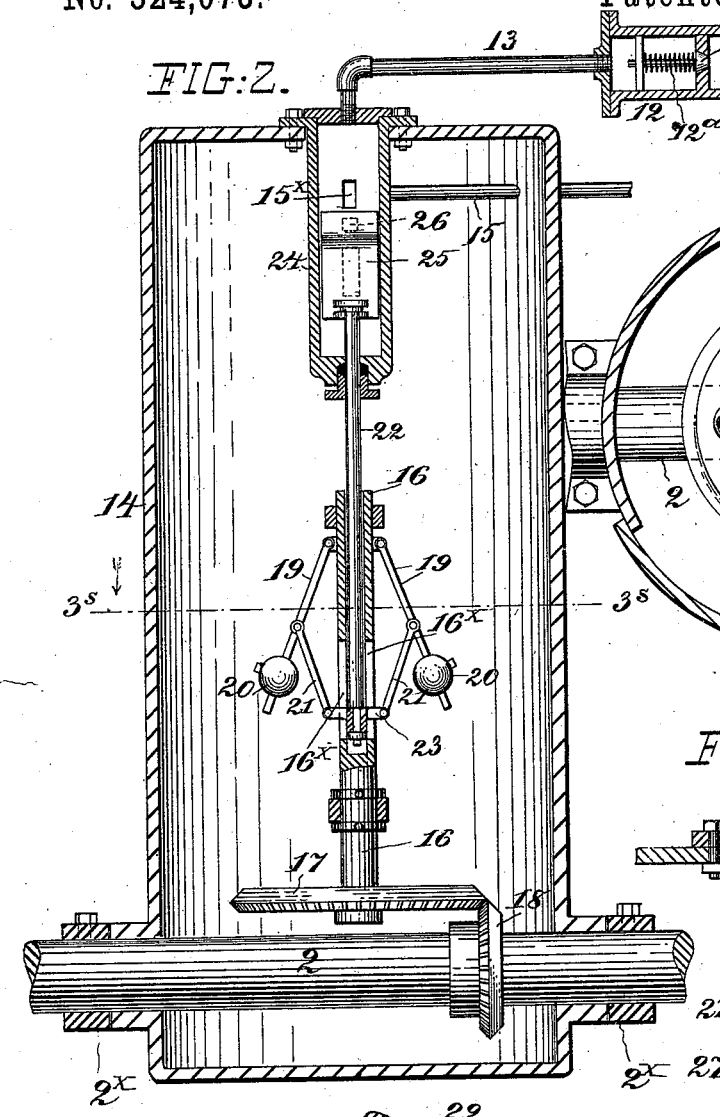


FIG: 3.

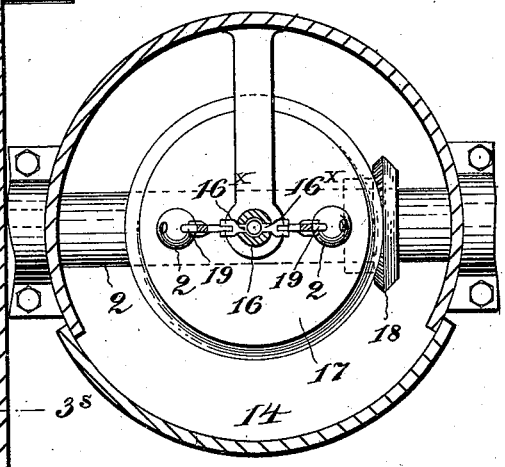


FIG: 4.

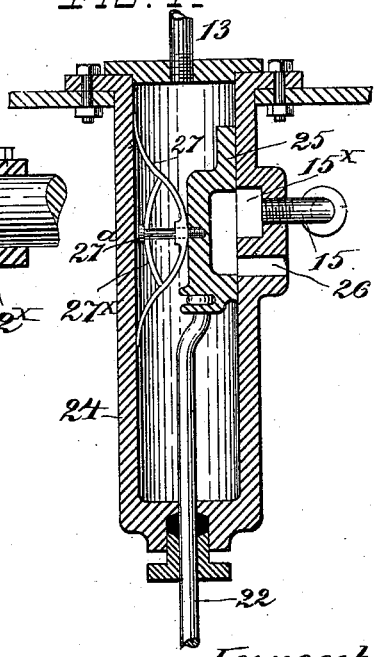
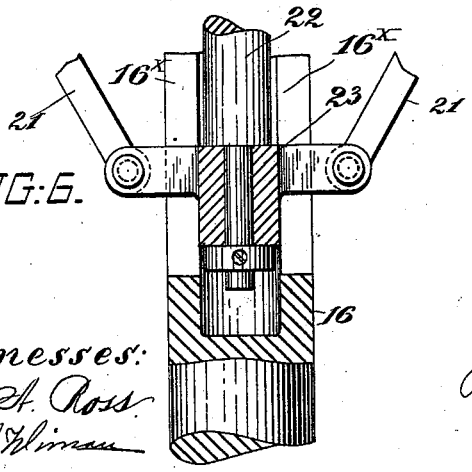


FIG: 6.



Witnesses:
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UNITED STATES PATENT OFFICE.

JOHN D. P. SCHENCK, OF NASHVILLE, TENNESSEE.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 521,073, dated August 7, 1894.

Application filed July 12, 1893. Serial No. 480,256. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. P. SCHENCK, a citizen of the United States, residing at Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Air-Brakes, of which the following is a specification.

My invention relates to the class of brakes employed on railway cars wherein compressed air is employed for setting the brakes when the train-pipe is opened to the atmosphere, and the invention consists in automatic controlling mechanism for the brakes.

As ordinarily constructed the air-brake mechanisms with which cars are equipped have no means, so far as I am aware, for adapting the pressure on the brake-piston to suit different speeds at which the train is moving, and as a train moving at a high rate of speed will permit of the use of a far greater pressure on the brake-piston without injury to the wheels from locking and sliding, than can safely be employed with the same train at a low rate of speed, it follows that much depends, in the proper operation of the brakes, on the care, or the skill and attention of the train engineer.

The object of this invention is to provide an automatic mechanism adapted to permit the brake to act with the maximum efficiency at both high and low rates of speed and at the same time to prevent the engineer from applying the full pressure to the brakes and thus sliding the wheels, when the train is running at a low speed.

In carrying out my invention I employ an automatic valve arranged between the engineer's valve and the train-pipe or brake-cylinder, adapted to cut off the train-pipe from the engineer's valve whenever the pressure behind the automatic valve is greater than that in front of it; and I employ a centrifugal governor driven from one of the axles of the locomotive, the tender, or a car, which controls the admission, behind said automatic valve, of air from the main reservoir at a predetermined reduced pressure, whereby, when the train is running at a slow or moderate speed it is impossible for the engineer to put the full pressure on the brakes as any reduction of pressure in the train-pipe below that behind the automatic valve, will cause said valve to move forward and cut off the communication of the train-pipe with the atmosphere and thus maintain a reduced pressure in front of the piston in the brake-cylinder. At the same time, if the speed of the train be increased beyond a certain limit, the governor, acting on a valve, will cut off the supply of air at a reduced pressure to the casing behind the automatic valve and will open the said casing to the atmosphere so as to relieve said valve entirely from pressure behind it and neutralize its functions, thus permitting the engineer to apply the full pressure to the brakes. The reduction of pressure of the air is or may be effected by any ordinary reducer arranged at any point between the air-reservoir and the casing of the automatic valve, but preferably between said reservoir and the valve actuated by the governor.

My invention will be fully described hereinafter with reference to the accompanying drawings and its novel features will be carefully defined in the claims.

Figure 1 is a somewhat diagrammatic view of a portion of a locomotive provided with braking mechanism embodying my improvements, said mechanism being represented in side-elevation on a small scale. Fig. 1ª is a somewhat diagrammatic sectional view of the portion of the braking mechanism on one of the cars of the train. Fig. 2 is an enlarged, vertical mid-section of the centrifugal governor, its casing, and the reducer. Fig. 3 is a transverse, horizontal section taken in the plane indicated by line 3^s, 3^s, in Fig. 2. Fig. 4 is a vertical, sectional view of the valve mechanism actuated by the governor, on a large scale. Fig. 5 is a longitudinal mid-section of the automatic valve and its casing, on a large scale. Fig. 6 is a sectional detail view of the governor on a large scale.

Referring to Fig. 1, 1 is the locomotive, 2 is one of the axles thereof, preferably the rear axle of the truck, and 3 is one of the wheels on the axle.

4 is the main reservoir for compressed air, which will be supplied from a compressor (not shown) in the usual way through a pipe 5.

6 is a pipe which leads compressed air from the reservoir 4 to the engineer's valve, 7. This valve will be, or may be, of the usual kind. A pipe 8 connects the engineer's valve

with the train pipe, 9, through the medium of the casing 10 of an automatic valve which will be hereinafter more particularly described.

A pipe 11, from the air-reservoir 4, connects with the casing 12 of a pressure reducer, and the air from this reducer passes by a pipe 13 to the chamber of a valve controlled by a centrifugal governor within a casing 14. A pipe 15 connects the said valve chamber with the casing 10 of the automatic valve.

The general arrangement of the above instrumentalities is not essential to my invention and may be varied to suit circumstances, but they will usually be mounted on the locomotive.

I will now explain the construction of the mechanisms not seen in Fig. 1 with reference to the detail views.

As illustrated in Fig. 5, the casing 10, of the automatic valve is a cylinder, and the valve, 10^a, therein is a piston-valve. The pipe 8 connects with the casing 10 at one end and the pipe 15 connects with said casing at the opposite end, whereby the valve 10^a is interposed between them. The train-pipe 9 connects with the casing 10, at its side. For convenience of description I denominate that side of the piston-valve 10^a adjacent to the inlet from the pipe 15, the rear of the valve, and the other side the front.

I will now describe the construction of the governor and the valve it controls, with especial reference to Figs. 2, 3, 4 and 6. Within the casing 14, is mounted in suitable bearings a vertically arranged governor shaft, 16, which carries at its lower end a bevel wheel, 17, gearing with a bevel pinion, 18, on the axle 2. The governor comprises, as here shown, the arms, 19, coupled at their upper ends to lugs on the shaft 16, the balls, 20, on said arms, and the links, 21, coupled at their upper ends to the arms 19. The shaft 16 is tubular at its upper part, and fitting telescopically in it is a valve-stem, 22. Collared on the lower part of this valve-stem is a ring, 23, which has two lugs that project from it at opposite sides and are coupled to the respective links 21. The lugs on the ring 23 project out through and play in longitudinal slots, $16^\times$, in the tubular part of the shaft 16. Thus the axle 2, imparts rotary motion to the governor shaft and balls about the non-rotative valve-stem, and when the balls of the governor are thrown out by centrifugal force the valve-stem is lifted or moved upward.

In the upper part of the casing 14, is mounted a valve-chest, 24; the stem 22 enters this chest and is coupled to a slide-valve, 25, therein. This valve always covers an exhaust port, 26, which opens to the atmosphere, and the cavity in the under side of the valve may, when the valve is moved upward to the position seen in Fig. 4, open the port 26, to a port $15^\times$, leading to the pipe 15, whereby the chamber of the automatic valve 10^a, back of the latter valve, is opened to the atmosphere. The pipe 13 enters the valve-chest 24, and admits air to the same under reduced pressure, and when the valve 25 moves down in the chest far enough to uncover the port $15^\times$, air under reduced pressure will be admitted to the chamber of the automatic valve 10^a back of the latter. The seat of the valve 25 being vertical, the valve is held up to the seat by a bow spring, 27, the tension of which is regulated by a bar, $27^\times$, which bridges the hollow of the spring, and a screw 27^a, which passes through the bar and spring and screws into the valve.

The reducing valve in the casing 12, may be of any kind; as shown in Fig. 2, it consists of a cone-valve, $12^\times$, which closes toward the air-reservoir, 4, and is backed by a spring 12^a. The tension required in this spring will be governed by the amount of reduction in the pressure that may be desired.

In Fig. 1^a, 28, is the brake-cylinder, $28^\times$, is the piston therein, coupled in the usual way to the brake-lever, and 29, is the supplementary air-reservoir, connected by a pipe, $29^\times$, with the cylinder 28 behind the piston. The train-pipe 9 is connected with the cylinder in front of the piston by a pipe, $9^\times$, and a by-pipe, 30, connects with the cylinder at its respective ends, just in front of, and back of the piston $28^\times$, when the latter is at rest. In this by-pipe is a check-valve 31, opening toward the reservoir 29. I have shown this mechanism somewhat diagrammatically, as it is not claimed specifically herein but only employed for illustration.

So far as described the operation is as follows: Let us suppose, for illustration that the pressure in the main reservoir 4 is seventy pounds, and the reducing valve in casing 12 reduces the pressure to thirty-five pounds, or one-half. The train is running at a moderate speed and the pressure in the train-pipe, the brake-cylinder 28, and the auxiliary reservoir, 29, is seventy pounds. The train being at slow speed, the governor will have drawn down the valve 25 (see Figs. 2 and 4) until communication is established between the pipes 13 and 15 through the valve-chest, and consequently there will be a pressure back of the automatic valve 10^a (Fig. 5) of thirty-five pounds, and a pressure in front of said valve in the casing 10, of seventy pounds. Now if the engineer desires to set the brakes he will find it impossible to drain the pressure in the train-pipe below about thirty-three pounds, for, if the pressure in the casing 10 in front of the valve 10^a falls below this, the pressure back of the valve will drive it forward and close the communication of the train-pipe with the atmosphere by cutting off pipe 9 from pipe 8. At the mechanism under the car (see Fig. 1^a), the effect will be as follows: Normally, with the brakes off, there is a pressure in the brake-cylinder on both sides of the piston, and also in the reservoir 29, of about seventy pounds, but when the train-pipe is opened to the atmosphere by the engineer in order to set the brakes, the pressure in front of the piston $28^\times$ is reduced and the piston is

driven forward (to the left in Fig. 1ª), cutting off the by-pipe 30 from communication with the cylinder in front of the piston, and if there were nothing to prevent it the full pressure behind the piston would be utilized in setting the brakes. But by reason of the back pressure in the train-pipe produced by the cutting off of said pipe from the atmosphere by the automatic valve 10ª, the pressure in front of the brake-piston will be about thirty-three to thirty-five pounds and the effective braking pressure will be the difference between this pressure and that at the back of the piston.

I will now suppose another case in which the same conditions exist except that the train is running at a high rate of speed. In this case the governor, rotating more rapidly in proportion to the rate of speed of the train, has raised the valve-stem 22 and valve 25 to the position seen in Fig. 4, where the air under reduced pressure in the valve-chest is cut off from the pipe 15, and the port 26 is opened to the port 15×. Thus the rear face or side of the automatic valve 10ª will be open to the atmosphere, and said valve will be inert. Under these conditions the engineer is able to put on the full brake pressure, as there is nothing to prevent his draining the train-pipe of all pressure.

The brakes are released by the engineer setting his valve 7 so as to admit air from the reservoir 4 under full pressure through pipes 6 and 8 to the valve-casing 10 in front of valve 10ª. This pressure forces said valve back (to the left in Figs. 1 and 5) and allows the air to pass to and through the train-pipe 9 and branch 9× (Fig. 1ª) to the cylinder 28 in front of piston 28×, thus forcing said piston back and releasing the brakes. When the piston 28× has moved back far enough to uncover the by passage 30, the pressure on the two faces of the piston will be balanced, as the air in front of the piston will lift the valve 31 and pass around the piston. It is immaterial to my invention how the brake-cylinder 28 is mounted under the car; the end of this cylinder at the left in Fig. 1ª is usually called the front end, but the car on which it is mounted may move with either end forward.

The function of the casing 14 is to protect the governor, the gearing, and other inclosed mechanism from dust, and to provide suitable bearings for the parts. At its base the casing snugly incloses the axle 2, which may have collars, 2×, to prevent lateral movement of the casing thereon. The casing is supported on the axle and may be held erect by any suitable framing which will permit of the play of the locomotive body up and down on the springs. I contemplate connecting the pipe 11 to the air-reservoir 4 by a flexible pipe to allow for all movement of the body on its springs.

I prefer to mount the governor balls adjustably on the arms in order that they may be shifted out or in along the arms, as occasion may require.

The object in placing the reducing valve or device between the reservoir 4 and the valve-chest 24, is in part to relieve the valve 25 from pressure, and in part to prevent it from acting as a check-valve between the valve-casing 10 and the port 26.

I prefer to put in the automatic valve 10ª (see Fig. 5) a valve 10ᵇ, which opens toward the front and is held closed by a spring, 10ᶜ, which exerts a pressure equal to thirty-five pounds to the inch. The object of this valve is to allow air to pass through the automatic valve in case the engineer should drain the train-pipe suddenly and reduce the pressure so low as to cause the valve to move and cut off the train-pipe when not desired.

For example, if the train is running at low speed with say seventy pounds pressure in front of the valve 10ª and thirty-five pounds behind it, the sudden opening of the engineer's valve may reduce the pressure in front of the valve to say thirty-four pounds for an instant, while the pressure in the brake cylinders of the rear cars is still above that pressure, and before the air coming forward in the train-pipe can equalize the pressure in casing 10, the valve 10ª may move forward and cut off the train-pipe. The valve 10ᵇ will prevent this.

It will be seen from the foregoing description that the essential instrumentalities required in my braking mechanism in order to attain the end sought, are: first, an automatic cut-off valve situated between the engineer's valve and the train-pipe; second, means for supplying and conducting to the casing of the automatic valve, back of the latter, air under a tension less than that in the main reservoir, a controlling valve situated in the conduit for such air of lower tension, and a governor, driven from one of the axles of the train, which operates said controlling valve and determines, by or through the speed of the train, whether air under such lower tension shall be admitted behind the automatic valve or not. These instrumentalities, whatever may be their specific form, construction, or arrangement, constitute the novel features of the braking apparatus.

If the air under reduced pressure be taken from the main reservoir 4, a reducer will have to be employed, but it is not material to my invention that the said air be taken from this reservoir; it may be supplied from any source.

I have shown an air-brake cylinder and apparatus in Fig. 1ª merely to illustrate the operation of the other mechanism. This device illustrated in Fig. 1ª is shown and claimed in another pending application of mine, Serial No. 434,863, filed May 31, 1892.

Having thus described my invention, I claim—

1. An air-brake mechanism for railway trains having the following essential instru-

mentalities, namely, an automatic cut-off valve 10^a between the engineer's valve and the train-pipe, means for supplying air, under a tension less than the normal tension in the main reservoir, to the valve-casing 10 of the automatic valve and back of the valve 10^a therein, a controlling cut-off valve in the conductor for the air of low tension whereby the admission of air behind the automatic cut-off valve 10^a may be controlled, and a governor, geared to one of the axles of the train and operating said controlling valve, whereby the pressure that may be applied in setting the brakes is governed by the speed at which the train is moving, substantially as set forth.

2. In an air-brake mechanism for railway trains, the combination with a main compressed air-reservoir, a train-pipe, a conduit for air connecting said reservoir and train-pipe, and an engineer's valve in said conduit and controlling the flow of air through the same, of a valve-casing 10, which forms a part of said conduit between the engineer's valve and the train-pipe, a piston-valve 10^a, in said casing and adapted, when displaced in a forward direction to cut off communication between the train-pipe and engineer's valve, means for admitting compressed air at a tension below that in the main reservoir, behind said valve 10^a, a valve which controls the admission of air behind said valve 10^a, and a governor, driven from an axle of the train, which operates said controlling valve.

3. In an air-brake mechanism for railway trains, the combination with a main compressed air-reservoir, a train-pipe, a conduit for air connecting said train-pipe and reservoir, and an engineer's valve in said conduit and controlling the flow of air through the same, of a valve-casing in said conduit and forming a part thereof, a valve in said casing adapted, when closed, to cut off communication between the engineer's valve and the train-pipe, a conduit connecting the main air-reservoir with said valve-casing 10 back of the valve 10^a therein, whereby air under tension may be admitted behind the valve for closing it, a reduction valve in said conduit for reducing the tension of the air flowing to the valve-casing, a controlling valve in the last named conduit which controls the flow of air to the casing, and a governor, geared to and driven by one of the axles of the train, said governor being coupled to and actuating said controlling valve, substantially as set forth.

4. In an air-brake mechanism for railway trains, the combination with the compressed air-reservoir, the train-pipe, a conduit for compressed air connecting said reservoir and train-pipe, and the engineer's valve situated in said conduit and controlling the flow of air through the same, of a valve-casing 10 arranged between the engineer's valve and the train-pipe and forming a part of said connecting conduit, a valve 10^a in said casing adapted to be opened by air under tension coming from the engineer's valve, and to be closed by air under tension admitted behind it, means substantially as described for admitting air under a tension less than the maximum tension behind said valve, and automatic means substantially as described for cutting off the admission of such air behind said valve when the train is moving at high speed, as set forth.

5. In an air-brake mechanism for railway cars, the combination with a compressed air-reservoir, a train-pipe a conduit for air connecting said reservoir and train-pipe, an engineer's valve arranged in and controlling the flow of air through said conduit, and an automatic valve 10^a in said conduit between the engineer's valve and the train-pipe, said valve adapted to be opened by compressed air coming from the engineer's valve and to be closed by pressure at its back, of means for controlling the admission of air to the back of said valve comprising a valve-chest 24, having ports $15^\times$ and 26, the latter opening to the atmosphere, a slide valve, 25, in the chest and controlling said ports, an air-conduit leading from the air-reservoir to the said chest, a reducing valve in said conduit, and a centrifugal governor, driven from an axle of the train and coupled to the said valve 25, whereby the displacement of said valve is proportioned to the speed at which the train is moving, substantially as set forth.

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

JOHN D. P. SCHENCK.

Witnesses:
HENRY CONNETT,
JAMES K. DUFFY.