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AIR BRAKE.

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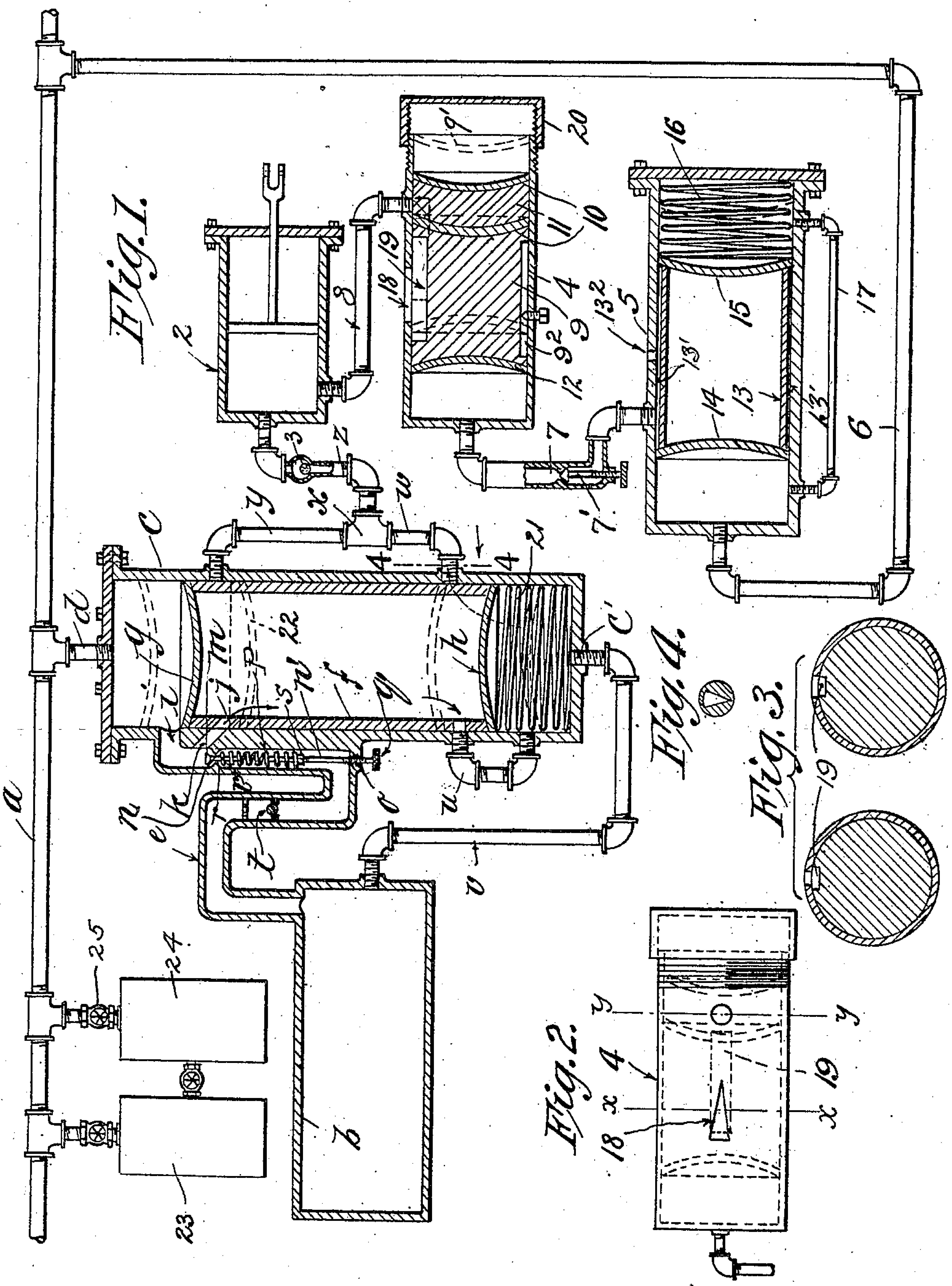

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AIR-BRAKE.

No. 838,520. Specification of Letters Patent. **Patented Dec. 18, 1906.**

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To all whom it may concern:

Be it known that I, Benjamin Canell, a citizen of the United States of America, residing at West Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Air-Brakes, of which the following is a specification.

This invention relates to automatic air-brake mechanisms; and it has for its object to provide a structure that does away with the use of the ordinary "triple valve," and for a further object of allowing the instantaneous recharge of the auxiliary reservoir after the application of the brakes, also a recharge of the auxiliary reservoirs when the brakes are on.

A still further object of my invention is the provision of what I call a "straight-air" emergency application of the brakes from the main reservoir without drawing the air from the auxiliary reservoirs; and another object is in providing means for cutting off the cars without "bleeding" the auxiliary reservoirs.

Another object is for providing means for releasing the brakes at the rear end of the train first; and a still further object is for partially releasing the brakes and holding the balance of air retained in the brake-cylinder, and finally for preventing an overcharge of the auxiliary reservoirs.

In the drawings forming part of this application, Figure 1 is a diagrammatic view of my invention. Fig. 2 is a detailed view of a portion of my release mechanism. Fig. 3 shows transverse sectional views taken on the line *x x* and *y y*, respectively, of Fig. 2. Fig. 4 is a view taken on line 4 4 of Fig. 1, showing the triangular shape of the opening in the side of the casing which communicates with the pipe leading to the brake-cylinder.

Referring to the drawings in detail, *a* designates the train-pipe, that extends in the ordinary manner under all of the cars.

b designates one of the auxiliary reservoirs.

c designates the casing of the main valve, that is connected to the train-pipe *a* by means of the short pipe *d*. The casing *c* and auxiliary reservoir *b* are in communication with each other by means of the pipe connection *e*. In practice this connecting element and auxiliary reservoir are cast as one piece with the casing *c*. Located within the cylindrical part of this casing is a reciprocating hollow valve *f*, that has a substantially air-tight fit within the casing *c*.

g and *h* indicate cup-washers that are secured to the valve *f* in any approved manner, and preferably are made of leather. The upper edge of one of the washers is normally flush with one edge of the port *i*, leading to the auxiliary reservoir *b*, as shown.

j designates a small opening through the wall of the valve *f*, that is adapted to register with a correspondingly small opening *k* in the pipe connection *e* when the valve *f* is in its normal position.

Located within the pipe connection *e*, leading from the casing *c* to the auxiliary reservoir *b*, is a valve *m*, carried on the upper end of the upper stem *n*. The lower section of the stem is designated at *n'* and threaded, as shown at *o*, and engaging a threaded opening in the pipe connection *e*, as shown.

The openings *j* and *k* are made small in order to prevent the air from the auxiliary reservoir from passing rapidly therethrough when the pressure in the train-pipe is reduced to apply the brakes, as will be described below.

Encircling the valve-stem sections *n* and *n'* is a spring *p*, that can be adjusted to any suitable pressure by simply rotating the milled head *q* on the lower end of the valve-stem *n*, the spring *p* being located within the shoulders *r* in the pipe *e* and attached to the stem-section *n'* at its upper end, as shown at *r*, and rests on a collar *s* on the stem *n* at its lower end. Normally the tension of the spring is adjusted so as to operate at seventy pounds more or less—the ordinary running-pressure used in the auxiliary reservoirs and train-pipe.

Within the pipe connection *e* is located a ball-valve *t*, preferably made of rubber and opening so as to permit compressed air to pass freely from the casing *c* to the auxiliary reservoir *b* and to close when the air flows in the opposite direction from the auxiliary reservoir.

u designates a by-pass from one end of the casing *c* to the interior of the valve *f*. It will readily be seen that the compressed air may freely pass from the lower end of the casing *c* by means of this by-pass through the small registering openings *j* and *k* to the opposite end of the valve *f*, thereby equalizing the pressure on both ends of the valve.

v designates a pipe connecting the auxiliary reservoir *b* with the interior of the casing *c*, as designated at *c'*.

w designates a pipe communicating with the interior of the casing *c*, but is normally closed by the valve *f*. The pipe *w* is connected with a T-coupling *x* on one side thereof, the other side of the coupling being connected to a pipe *y*, that opens into the casing *c*, near the upper end thereof, but is normally closed by the valve *f*, as shown.

z is a pipe connected with the coupling *x* and one end of the brake-cylinder 2. The opening in the side of the casing *c* where the lower end of the pipe *w* connects is triangular in shape, (see Fig. 4), the purpose of which will be set forth. Located within this pipe *z* is a ball-valve 3, that is constructed the same as the ball-valve *t* described above and operates in the same manner.

4 and 5 designate two cylinders that I employ for effecting the release of the brakes after an application. The cylinder 5 communicates at one end, by means of a pipe 6, with the train-pipe *a*, the two cylinders 4 and 5 being connected with each other by means of the pipe 7, which has an adjustable valve 7' thereon to vary the flow of air therethrough.

The brake-cylinder 2 is connected to the cylinder 4 by means of a pipe 8. Within the cylinder 4 is located a reciprocating valve 9, having at one end thereof two cup-washers 10, with a spacing-piece 11 between them.

12 designates a cup-washer secured on the end of the valve 9 and at the opposite end thereof from the cup-washers 10.

13 designates a hollow reciprocating valve located within the cylinder 5 and provided on each end with cup-washers similar to those described above in connection with the valve *f*. This valve is slightly spaced from the inner walls of the cylinder 5, as shown at 13', the purpose of which will be described below. Between the end of the cup-washers 14 and 15 and the ends of the cylinder 5 is a spring 16, located in the end of the cylinder opposite the pipe 6.

17 designates an equalizing by-pass for the valve 13, so that air can pass from one end of the valve to the other.

The spring 16 is designed to work at a predetermined pressure—as, for example, twenty pounds to the square inch. The tension of this spring may be varied in any suitable way—as, for instance, in the same manner as the spring *p* described above.

The upper side of the cylinder 4 is provided with a V-shaped opening 18, (see Fig. 2,) that is adapted to permit the air from the brake-cylinder to escape to the atmosphere through the groove 19 in the valve 9. This groove 19 is rectangular in shape, as shown in cross-section in Fig. 3.

Normally the end portion 11 of the valve 9 is so placed that the communication from the brake-cylinder 2 through the pipe 8 to the cylinder 4 is cut off, as shown in Fig. 1. The end of the cylinder 4 is provided with an adjustable cap 20 for varying the tension of the confined air between the end of the valve 9 and the cap, as readily understood. The purpose of this confined air is to move the valve 9 back again toward the left after the brakes have been released in order to cut off the communication to the atmosphere-opening 18 of the pipe 8 from the brake-cylinder.

The operation of my invention is as follows: The normal pressure in the train-pipe *a* and auxiliary cylinders is maintained at about seventy pounds by placing the engineer's valve in the usual running position, the air passing from the train-pipe *a* to the main casing *c* through the port *i*, past the valve *m*, ball-valve *t*, into the auxiliary cylinder *b*. From this cylinder it can pass through the pipe *v* to the opposite end of the casing *c* and also through the small registering openings *k* and *j* into the valve *f* and by-pass *u* to the lower end of the casing *c*, as shown by the arrows. It will therefore be seen that the valve *f* is in equilibrium. In practice I do not make the registering openings *j* and *k* and by-pass *u* and *w*, *x*, *y*, and *z* as shown, but provide a passage-way in the casing itself for allowing the air to pass from one end thereof to the other, thus equalizing the pressure on both ends of the valve *f*. This pasage-way is formed when the casing *c* is cast by coring it out, as readily understood. When the brakes are applied, the engineer reduces the pressure in the train-pipe in the ordinary way. The air in the auxiliary cylinder attempts to escape through the pipe connection *e*; but in doing so the ball-valve *t* is driven against its seat, thus cutting off the flow of air through this passage. It therefore flows freely through the pipe *v*, forcing the valve *f* upward and closing the port *j* and by-pass *u* and opening the communication leading from the casing *c* to the pipe *w*, past the ball-valve 3, and into the brake-cylinder 2, thus applying the brakes, it being understood that communication from the brake-cylinder 2 to the cylinder 4 is closed by the portion 11 of the valve 9. In order to instantaneously recharge the auxiliary reservoirs when the brakes are on, the engineer throws his valve again into running position—that is, seventy pounds. This position of the valve draws air from the reservoir 23, which in turn is supplied from the high-pressure reservoir 24 through the reducing-valve in the pipe, (shown as connecting the cylinders 23 and 24.) The valve *m*, being set to operate above seventy pounds, is open. The valve *f* meanwhile has moved back to normal position by reason of gravity, (the valve *f* standing in a vertical position,) covering the opening to the pipe *w* to the brake-cylinder.

Consequently the air from the train-pipe can freely pass into the auxiliary reservoir and instantaneously recharge the auxiliary reservoirs when the brakes are on. The instantaneous recharge is possible because of the large volume of air in the cylinders 23 and 24 to draw from. To release the brakes, the engineer by means of his valve allows the main-reservoir pressure of ninety pounds to pass from the main reservoir 23 to the train-pipe *a* through the pipe 6 and into the cylinder 5, moving the valve 13 toward the right against the tension of the spring 16, so that the end of the pipe 7 is uncovered, allowing air to pass into the left-hand end of the cylinder 4, throwing the valve 9 therein to the dotted-line position 9′, thus allowing the air in the brake-cylinder 2 to pass through the pipe 8, groove 19 in the valve 9, and out through the V-shaped opening 18 to the atmosphere. Meanwhile this superior pressure in the train-pipe has entered the casing *c*, forcing the valve *f* back to normal position, opening the port *i*, and recharged the auxiliary reservoir. The construction of the main valve *f* permits the auxiliary reservoir to be recharged when the brakes are on, when the engineer reduces the pressure in the train-pipe and the compressed air from the auxiliary reservoir closes the valve *t* and escapes through the pipe *v* into the casing *c*, raising the valve *f* to the dotted-line position, and thus cutting off communication through the port *i* from the casing *c*, and when the engineer throws his valve into running position again (or seventy pounds) the valve *f* is driven downward again into its original position, closing the port from the casing *c* to the pipe *w*, thus permitting the air to flow through the port *i* past the valve *m* and into the pipe connection *e* to the auxiliary reservoir *b* and also through the small passage-ways *j* and *k*, equalizing-pipe *u*, and the pipe *v* to the auxiliary reservoir. The air in the brake-cylinder is therefore confined, holding the brakes on, and permits the auxiliary cylinders to be recharged.

In order to apply the brakes quickly in case of an emergency, the engineer throws air into the train-pipe *a* and casing *c* at one hundred and forty pounds from the high-pressure reservoir 24 by opening his straight-air valve 25. This rapid inrush of air at such a high pressure forces the valve *f* downward against the tension of the spring 21, which is made to operate at about one hundred and ten pounds, and at the same time the valve *m* is closed, also the communication through the small ports *j* and *k*. The opening to the pipe *y* is therefore uncovered. The valve *f*, then being in the dotted-line position 22, allows the high pressure to pass directly through the pipe *y*, past the valve 3, into the brake-cylinder 2. This path for the air is what I term a "straight-air" emergency application of the brakes. When this application of the brakes is made, the high pressure also passes, through the pipe 6, to the left-hand end of the cylinder 5, forcing the valve 13 toward the right against the tension of the spring 16. The equalizing-pipe 17, being so small, does not allow enough air to pass therethrough to prevent this movement of the valve 13. The port to the pipe 7 is therefore uncovered, allowing the high pressure to pass to the left-hand end of the cylinder 4 and forcing the valve 9 toward the right, placing the air confined in the end of the cylinder 4 under compression. The valve 9, by reason of this high pressure, is driven so far toward the right that the triangular atmospheric opening 18 is almost entirely cut off by the valve 9, therefore confining the air in the brake-cylinder 2 and applying the brakes. The operation of releasing the brakes after this emergency application is as follows: The engineer closes the straight-air valve 25, the pipe 17 equalizing the pressure at both ends of the valve 13, allowing the valve to move back again to normal position, cutting off the opening to the pipe 7, the spring 16 aiding in this return movement of the valve 13. Meanwhile the confined air in the capped end of the cylinder 4 has driven the valve 9 back, permitting the atmospheric opening 18 and groove 19 to register, thus allowing the air in the brake-cylinder 2 to escape to the atmosphere. In the return movement of the valve 9 the air in the left-hand end of the cylinder 4 freely passes through the pipe 7 to the space 13′ and out through the opening 13^2 to the atmosphere.

The operation of "cutting off" cars from the train without bleeding the auxiliary reservoirs of each car is effected by the brakeman throwing the angle-cock in the pipe between the cars to cut-off position in the usual manner; but on account of the natural leakage from the train-pipe the brakes are applied, thus bringing the car to a standstill. In order to prevent this application of the brakes when it is not needed, the trainmen are obliged to bleed the air out of the auxiliary reservoirs of each car; but by means of my construction the operation of bleeding is unnecessary, for the reason that the valve *f* always stands in equilibrium on account of the air in the auxiliary reservoirs having free access to both ends of the valve *f* through the pipe connection *v*, by-pass *u*, small ports *j* and *k*, and pipe connection *e*. The valve *f* therefore immediately accommodates itself to any variation of pressure in the train-pipe and always maintains the pipe *w* to the brake-cylinder closed. There is, therefore, no danger of the brake being applied, and the necessity of bleeding the auxiliary reservoirs is overcome.

In order to release the brakes at the rear end of the train first, the air in the train-pipe when the engineer throws his valve into release position has necessarily less pressure at the end of the train than at the forward or middle part thereof. Consequently the valve 9 is not forced or driven as far toward the end of the cylinder 4, thus leaving a greater portion of the triangular-shaped opening 18 uncovered (see Fig. 2) and a corresponding rapidity of flow of the air from the brake-cylinder to the atmosphere.

In order to partially release the brakes and hold the balance of the air retained in the brake-cylinder, the engineer quickly throws on the reservoir-pressure of ninety pounds, which passing through the pipe 6 quickly throws the valve 13 against the spring 16, uncovering the passage-way from the cylinder 5 to the pipe 7 and quickly throwing the valve 9, so as to uncover the port 18 and allow the air in the brake-cylinder to escape to the atmosphere, and as soon as the engineer cuts off this supply of superior pressure the valve 13, by reason of the equalizing-pipe 17, comes back to normal position, shutting off the pipe 7 to the cylinder 4 and allowing the valve 9, by reason of its confined air in the end of the cylinder 4, to move back to its normal position, thus closing the outlets through the pipe 8 and retaining the air in the brake-cylinder. When the valve 9 moves back again toward the left, the air in the left-hand end of the cylinder 4 and pipe 7 can freely escape to the atmosphere by reason of the space 13′ around the valve 13, which communicates with the atmosphere through the opening 13^2, as readily understood.

The ports *j* and *k*, being made comparatively small in size, prevent the air when a straight application is made from passing therethrough rather than forcing the valve *f* downwardly; but by having these ports *j* and *k* small there is no danger of a very large quantity of the air under high pressure from passing through these ports and preventing the action of the valve *f* from uncovering the port to the pipe *y*.

One of the objects of making the equalizing-openings *u*, *j*, and *k* in the wall of the casing *c* is to overcome the objection of providing means in the valve *f* for keeping these ports always in register, as would be necessary.

The valve 9 is provided with a guiding groove or channel 9^2 for receiving a screw 9^3, as shown, for preventing the valve 9 from rotation and for keeping the groove or channel 19 always in line with the atmospheric opening 18.

In the ordinary system as at present used when the auxiliary reservoir is "overcharged" the brakes are applied automatically; but in my construction the pressure in the train-line and auxiliary reservoir always remains equal by reason of the free access of air to both ends of the valve *f*, as heretofore described, and consequently, no matter what the pressure of air may be in the train-pipe, the valve *f* will remain in equilibrium without any danger of uncovering the pipe *w* to the brake-cylinder.

The opening in the side of the casing *c* where the pipe *w* connects is made triangular in shape, the acute angle being placed toward the lower end of the casing. The object of this construction is to allow a gradual application of the brakes.

What I claim is—

1. In an automatic air-brake mechanism, the combination with a train-pipe, a casing, a valve therein, means for equalizing the pressure at both ends of the casing, an auxiliary reservoir having communication with one end of the casing and also communication with the opposite end of the same whereby, when pressure is reduced in the train-pipe the equalizing means are operated and the communication from one end of the casing to the auxiliary reservoir is closed, and whereby when the brakes are released the initial position of the parts is restored.

2. In an automatic air-brake mechanism, in combination with a train-pipe, a valve-casing, a valve therein, an auxiliary reservoir having communication therewith to the valve-casing and at opposite ends of the valve, a brake-cylinder, a pipe leading from the valve-casing and normally closed by the valve, a release mechanism comprising two cylinders, valves therein, one of the cylinders having communication with the train-pipe, the other cylinder having communication with the brake-cylinder, a pipe connecting the two cylinders, an equalizing-pipe communicating with opposite ends of one of the cylinders whereby when the engineer throws his valve into release position, the air in the brake-cylinder escapes to the atmosphere, and whereby when he quickly throws his valve back to running position, the air is partially retained in the brake-cylinder.

3. In an automatic air-brake mechanism, the combination with the train-pipe, a main-valve casing, a valve therein having cup-washers at each end, an auxiliary reservoir communicating with one end of the casing and adjacent the train-pipe connection therewith, two valves in said communication and operating in opposite directions, a pipe forming communication with one end of the casing in the interior of the valve, a pipe connecting the auxiliary reservoir and said casing at the opposite end of its connection with the train-pipe, ports opening from the interior of the valve to the passage-way from the casing to the auxiliary reservoir whereby when an application of the brakes is made the valve is moved so as to form communication with the brake-cylinder and the communication from the casing to the auxiliary res-

ervoir is cut off, and whereby when the brakes are released the valve is automatically restored to normal position, as described.

4. In an automatic air-brake mechanism, the combination with the train-pipe, a main-valve casing, a valve therein having cup-washers at each end, an auxiliary reservoir communicating with one end of the casing and adjacent the train-pipe connection therewith, two valves in said communication and operating in opposite directions, the pipe forming communication with one end of the casing in the interior of the valve, a pipe connecting the auxiliary reservoir and said casing at the opposite end of its connection with the train-pipe, ports opening from the interior of the valve to the passage-way from the casing to the auxiliary reservoir whereby when an application of the brakes is made the valve is moved so as to form communication with the brake-cylinder and the communication from the casing to the auxiliary reservoir is cut off, a brake-cylinder having communication with the casing at two points thereof, a valve in said communication, a cylinder having communication with the brake-cylinder and having a V-shaped opening in one side thereof, a valve in said cylinder adapted for placing the V-shaped opening in communication with the brake-cylinder, and communicating means with one end of said cylinder and the train-pipe whereby when the engineer places his valve for throwing in a pressure greater than the running pressure the brakes are released.

5. In an automatic air-brake mechanism, the combination with a train-pipe, a casing, a valve therein having a cup-washer at each end, means for equalizing the pressure at both ends of the valve, an auxiliary reservoir having communication with both ends of the casing, a brake-cylinder, pipe connections between the same and the casing and normally closed by the valve therein, releasing means comprising two cylinders, one connected to the brake-cylinder, and the other to the train-pipe, and a pipe connection between the two, each having a valve therein, the valve in the cylinder adjacent the brake-cylinder being provided with a groove for placing the interior of the brake-cylinder in communication with the atmosphere, said cylinder also having an adjustable cap for varying the tension in one end of the valve therein, the valve in the other cylinder being provided with a cup-washer at each end, means for equalizing the air-pressure at both ends of the valve last mentioned, whereby when the pressure in the train-pipe is reduced below running pressure, communication from the auxiliary reservoir to the train-pipe is cut off and the pipe to the brake-cylinder and casing is placed in communication with the auxiliary reservoir, whereby the brakes are applied and the equalizing means between the ends of the valve within the casing is cut off, and whereby when the air in the train-pipe is raised above the normal running pressure, the brakes are released as described.

6. In an automatic air-brake mechanism in combination with a train-pipe, auxiliary reservoir, and brake-cylinder, valve mechanism between the auxiliary reservoir and the brake-cylinder, and connecting means therefor, a release mechanism comprising two cylinders, valves therein, one of the cylinders being connected to the brake-cylinder and the other to the train-pipe, and connecting means between the cylinders, the cylinder connected to the brake-cylinder having a triangular atmospheric opening therein, the valve therein being constructed so as to place said opening and brake-cylinder in communication whereby when the engineer throws on a superior pressure, the valve in the cylinder adjacent the brake-cylinder at the end of the train is moved a less distance than those at the forward end of the train, whereby the brakes at the rear end of the train are released before the others, as described

7. In an automatic air-brake mechanism, the combination with a train-pipe and auxiliary reservoir and brake-cylinder, a casing, a valve therein having cup-washers at each end and normally covering two openings to the brake-cylinder, means in the casing for maintaining the valve in equilibrium so that both openings are closed, whereby the necessity of "bleeding" is overcome, as described.

8. In an automatic air-brake mechanism, the combination with a train-pipe and auxiliary reservoir, and brake-cylinder, a casing, a valve therein having cup-washers at each end and normally covering two openings to the brake-cylinder, means in the casing for maintaining the valve in equilibrium so that both openings are closed, a release mechanism comprising two cylinders, one being connected with the brake-cylinders and the other with the train-pipe, a pipe connecting the two cylinders, valves within said cylinders whereby, after the brakes are applied, a partial escape of air in the brake-cylinders may be effected, as described.

9. In an automatic air-brake mechanism in combination with the train-pipe, auxiliary reservoir, and brake-cylinder, a casing having two means of communication with the auxiliary reservoir, and two means of communication with the brake-cylinder, a valve in the casing whereby a "straight-air" application may be made, the valve at the same time cutting off one of the means of communication from the casing to the auxiliary reservoirs and brake-cylinder, as described, and means for releasing the brakes.

10. In an automatic air-brake mechanism in combination with the train-pipe, auxiliary reservoir, and brake-cylinder, a casing, pipe

connections thereto from the train-pipe, a valve therein normally closing the pipe connection to the brake-cylinder, a release mechanism comprising two cylinders one of them being connected to the train-pipe, the other connected to the brake-cylinder, and communicating means between them, valves in said cylinder, a triangular atmospheric opening in the cylinder adjacent the brake-cylinder, a valve therein and provided with a passage-way for placing the triangular opening and the connecting means to the brake-cylinder in communication, a cap on the cylinder adjacent the brake-cylinder for varying the tension of confined air between one end of the said cylinder and the valve therein, a valve in the cylinder connected to the train-pipe and spaced from the inner wall thereof, an equalizing-pipe therefor, a spring between one end of the valve and the end of the cylinder, and means for affording communication between the spaces between the valve and cylinder and the atmosphere whereby when air above the normal running pressure is applied to the train-pipe the valve to the casing uncovers the opening to the brake-cylinder, and whereby the valves in the cylinders of the release mechanism are moved so as to nearly cut off the escape of air from the brake-cylinder to the atmosphere, and whereby after the pressure at both ends of one of said cylinders is equalized, the valve in the other cylinder can return to normal position permitting the air in the brake-cylinder to escape to the atmosphere, and the confined air at the end of the cylinder connected to the train-pipe can escape around the valve therein to the atmosphere, whereby the brakes are released, as described.

11. In an automatic air-brake mechanism, the combination with the train-pipe, auxiliary reservoir and brake-cylinder, two reservoirs connected with each other and with the train-pipe, a casing, a valve therein and normally closing the port to the brake-cylinder, equalizing means in the casing for both ends of the valve, communicating means from both ends of the casing to the auxiliary reservoir, a valve in one of the communicating means, and set above normal running pressure, said valve standing in a vertical position, whereby when the pressure in the train-pipe is reduced the brakes are applied and whereby when the engineer throws his valve into normal running position the auxiliary reservoirs are instantaneously recharged, as described.

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