(No Model.) 2 Sheets—Sheet 1.

T. S. E. DIXON.

AIR BRAKE FOR RAILROAD CARS.

No. 382,032. Patented May 1, 1888.

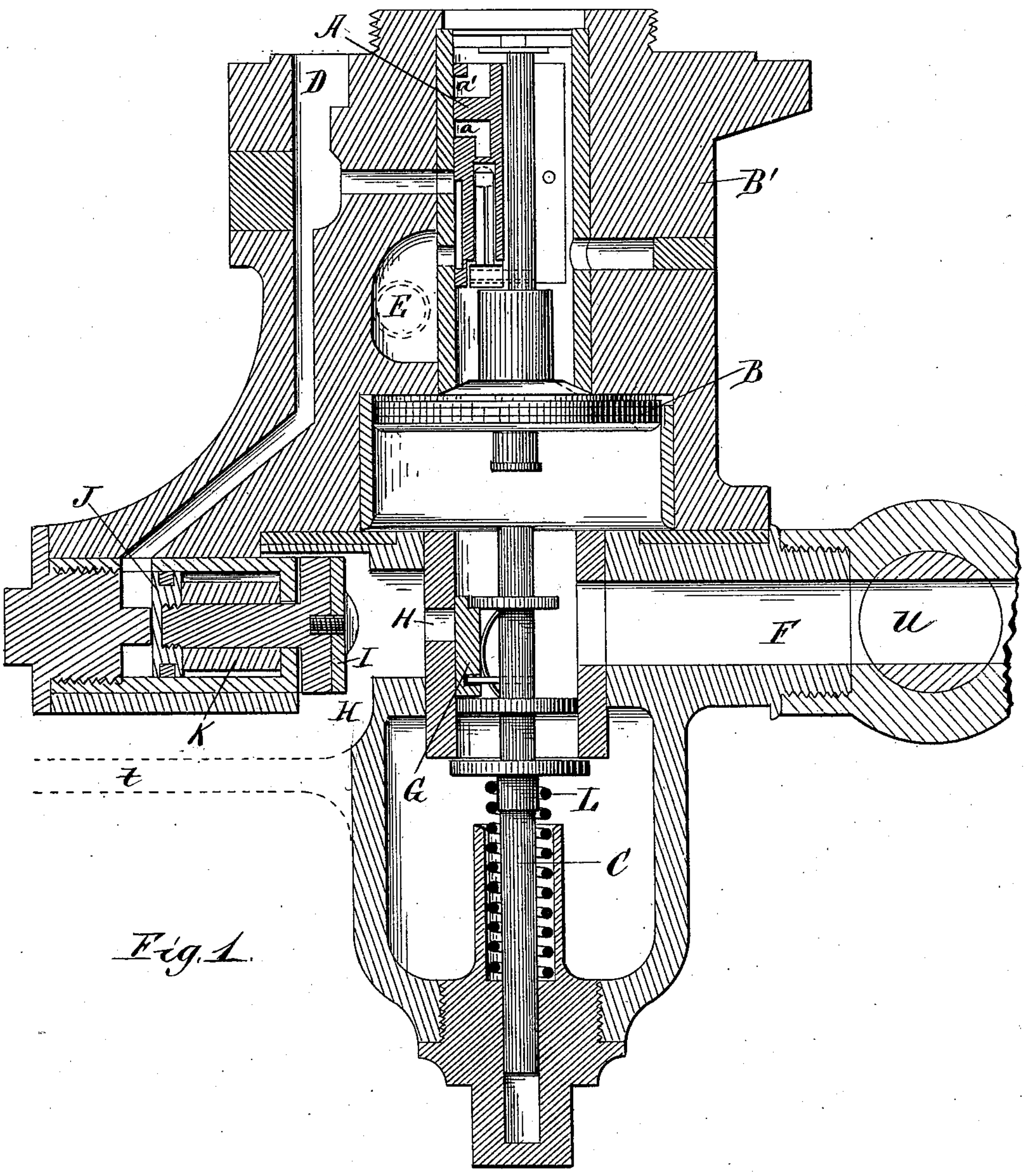

Fig. 1.

Witnesses.
W. C. Corliss.
Wm. M. Hill.

Inventor,
Theron S. E. Dixon.
By Hill & Dixon,
His Attys.

(No Model.) 2 Sheets—Sheet 2.

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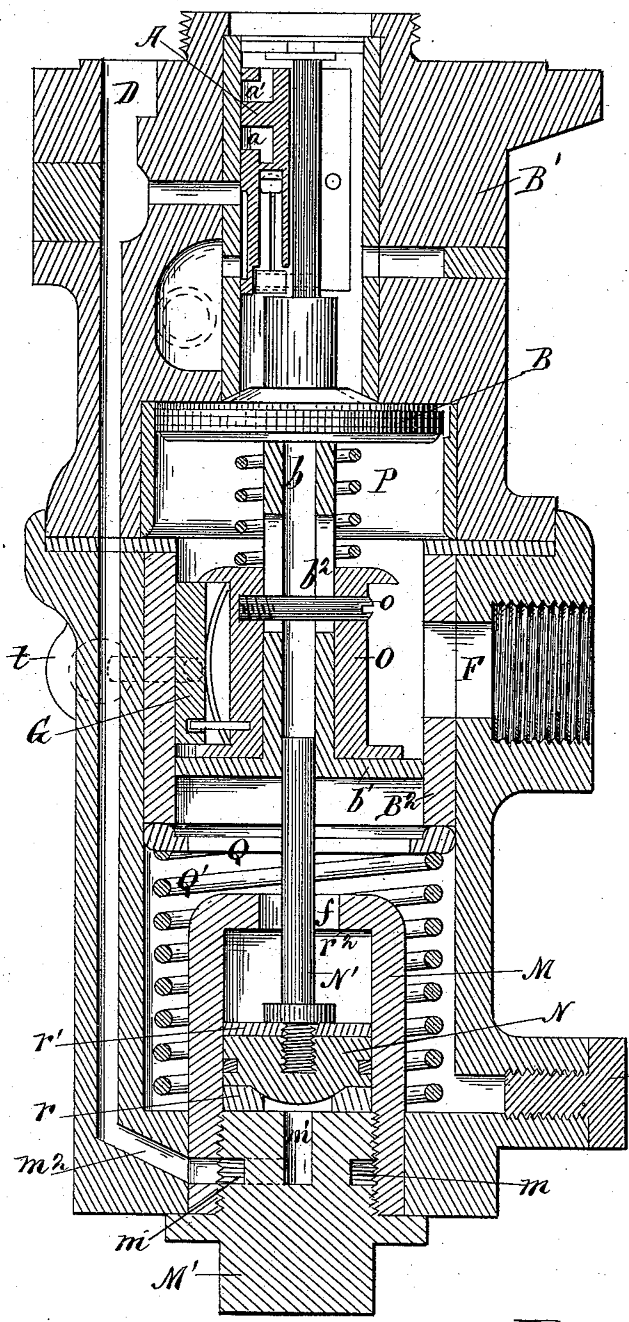

Fig 2

Witnesses
W. C. Corlies.
Wm. M. Hill.

Inventor
Theron S. E. Dixon,

By Hill & Dixon,
His Attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

THERON S. E. DIXON, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO LYSANDER HILL, OF SAME PLACE.

AIR-BRAKE FOR RAILROAD-CARS.

SPECIFICATION forming part of Letters Patent No. 382,032, dated May 1, 1888.

Application filed December 16, 1887. Serial No. 258,112. (No model.)

To all whom it may concern:

Be it known that I, THERON S. E. DIXON, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Brakes for Railroad-Cars, of which the following is a specification.

Figure 1 is a sectional view of a form of my improvement, and Fig. 2 is a sectional view of a modification of my improvement.

My invention relates to the so-called "automatic" air-brake system, in which the engineer, by charging and venting a train-pipe at the locomotive, operates a valve-controlling piston on each car to admit compressed air from a separate storage-reservoir to the brake-cylinder and discharge it therefrom at will, for the purpose of setting and releasing the brakes. In consequence of the air having to travel from the neighborhood of each valve-controlling piston along the train to the vent-cock at the locomotive, in order to reduce the train-pipe pressure sufficiently to operate such piston, it follows that the brakes are not applied simultaneously on the several cars, but consecutively, beginning at the front and ending at the rear of the train. It has been found in practice that the interval of time between the setting of the brakes on any two contiguous cars is sufficient to enable the rear car of the two to run forward and strike the next car ahead, after the brakes have been set on the latter and before they are set on the former, thereby causing more or less shock between the two cars, and that the amount of this shock increases toward the rear end of the train, and in long trains becomes very damaging at the rear cars when the emergency-stop is applied to bring the train to a sudden halt. It has also been demonstrated by the electrical air-brake that if the brakes be simultaneously applied on all the cars the train, however long, will come to a quick and easy stop without shock. Efforts have been made, with more or less success, to cause the venting of the train-pipe at the locomotive for emergency-stops to effect a substantially instantaneous reduction of air-pressure throughout the entire length of the train-pipe by producing a local discharge from the train-pipe at each car, and thereby shortening the distance that the air has to travel to escape from said pipe. To that end the pistons and ports have been so constructed that when the emergency-stop is applied they first cause the brake-cylinders to be partially charged with compressed air from the car-reservoirs, and then open a vent from the train-pipe to the brake-cylinder under each car to effect a series of local discharges from the train-pipe to the several brake-cylinders, a valve arranged in an air-passage from the train-pipe to the brake-cylinder and subject on the one side to the pressure of the train-pipe and on the other side to the pressure of the brake-cylinder, aided by a spring, serving to close the local discharge when the pressures of the train-pipe and brake-cylinder become nearly equalized. In a structure having such mode of operation, however, several obstacles intervene tending to hinder the perfect accomplishment of the purpose desired. First, the air endeavoring to pass from the train-pipe into the brake-cylinder encounters initially the resistance of the compressed air already vented from the car-reservoir into said cylinder; secondly, as fast as it enters the brake-cylinder it increases this initial resistance and contributes to its own further retardation; thirdly, the amount which can be thus vented into a partially-filled brake-cylinder is quite limited; fourthly, to whatever extent the train-pipe air enters the brake-cylinder it contributes to hasten the closing of the local discharge, thus allowing the latter only an instant to operate and materially limiting its capacity; fifthly, the quick charging of the brake-cylinder, which results from admitting air into it simultaneously from the train-pipe and reservoir, applies the brakes almost instantly with full force on the car where it occurs before the sudden local reduction of pressure in the train-pipe has had time to fully reach and affect the valve on the next car in rear, and thereby tends to counteract the very effect desired—to wit, the prevention of "shock." Experience with the old brake systems long in use on passenger-cars has shown that so abrupt an application of brake-pressure is not in any way advantageous, and it is especially undesirable in a system where, in order to prevent shock, the setting of the brakes on any car should not be fully completed before it begins on the next car in rear. Even with an apparatus having so imperfect a mode of operation, however, the reduction of train-pipe pressure along the train has proved sufficiently quick, under favorable conditions, to demonstrate the fact that variations of air-pressure produced by the manipulation of a cock on the locomotive are inherently capable of controlling the application of the brakes by reservoir-pressure on long trains without substantially injurious shock, and that there is therefore no necessity for resorting to uncertain, expensive, and easily-deranged electrical appliances to govern the admission of air to the brake-cylinder.

The object of my invention is to so improve the construction and mode of operation of automatic air-brakes as to avoid the disadvantages hereinabove set forth by producing sudden, unobstructed, and ample local discharges from the train-pipe, and giving them time to reach and affect the brakes on each car during the setting of the brakes on the next car ahead and before such setting is fully completed.

To this end the first and main part of my invention consists, essentially, in cutting off and dispensing with the passage from the train-pipe to the brake-cylinder and locally venting the train-pipe directly to the atmosphere through a passage or port, which is opened by preliminarily lowering the pressure in the train-pipe and closed by a sufficient increase of pressure in the brake-cylinder.

Another and independent improvement consists in so constructing and applying the spring-valve, which closes the local discharge, that said valve shall not close and cut off the discharge until after the train-pipe pressure has fallen below that of the brake-cylinder, thereby lengthening the period and increasing the amount of the local discharge.

Another and independent improvement consists in combining in one and the same valve the functions of opening and closing the local discharge-passage.

Other improvements will be sufficiently indicated by the several claims hereto appended.

My improvements are severally capable of embodiment in many different structural forms and arrangements, and with one or more than one valve for controlling each local discharge-passage.

In order to partially illustrate the variety of structure that may be employed, I have on Sheet 1 of the drawings represented a form of apparatus in which one valve effects the opening and another the closing of said passage; and on Sheet 2 another form of apparatus, in which a single valve performs both functions, it being understood that these are only some of the many ways in which my improvements may be carried into practice.

I will now describe the structures shown in the drawings, their mode of operation, and the manner in which they effect the more important advantages resulting from such new mode of operation.

For convenience of description, and because the Westinghouse automatic air-brake is well-known in the art and will be understood without minute explanation, I prefer to illustrate my improvements as applied to that system, although they are equally applicable in connection with other automatic systems.

In the drawings, Fig. 1, A represents the well-known piston-valve of the Westinghouse automatic air-brake, B being its controlling-piston arranged in a valve-casing, B′; C, its supplementary spring-stem; D, the passage from the car-reservoir to the brake-cylinder; E, the exhaust from the brake-cylinder to the open air; F, the train-pipe; *a*, the port which puts the car-reservoir into communication with the brake-cylinder for service-stops or grading; *a′*, the port which effects the same communication for emergency-stops, and G the valve which, when opened by the movement of the piston to apply the emergency-stop, permits the local discharge to take place from the train-pipe. In the different constructions of the Westinghouse apparatus the valve G—that is to say, the valve which opens to allow said local discharge from the train-pipe when the emergency-stop is applied—assumes different forms, and is in some instances operated directly and in others indirectly by the movement of the main piston B. For the purposes of illustration I have selected one of these forms as typical of all valves that normally hold the local discharge closed and only open it when the emergency-stop is applied. In this form the valve G is a slide-valve supported by the supplementary stem C, which is struck and moved only when the main piston is in the act of applying the emergency-stop.

My improvements are as follows: First, I cut off and dispense with all communication between the train-pipe and brake-cylinder, and in lieu thereof provide an open air-port, H, through which, when the local discharge is taking place, the air will vent from the train-pipe directly to the atmosphere without encountering any resistance from the air-pressure in the brake-cylinder, and without tending to force the brakes too abruptly against the car-wheels, using the reservoir-air alone to set the brakes, as in the old passenger system. The local discharge having been thus established may be closed by a separate valve, I, through the action of a small piston or diaphragm, J, which is subject on one side to the increasing pressure of the brake-cylinder air and on the other side to the decreasing pressure of the train-pipe air, whereby the local discharge when once opened will be held open so long as the train-pipe pressure exceeds that of the brake-cylinder, and will thereafter be automatically closed by the latter. At the option of the constructor, a spring may or may not be applied to aid in opening or closing the valve I; or, in lieu of a spring, the air-surfaces acted upon by the brake-cylinder air and the train-pipe air, respectively, may be made differential, so that an excess of pressure on the one side or the other will be requisite to seat or unseat the valve. This feature (the spring or its equivalent) is, however, independent of my main invention, which is fully operative with or without it. As the result of the general construction above described, and from the fact that the brake-cylinder fills from the reservoir alone, the local discharge-port will be held open longer and the venting of the train-pipe will consequently be more ample and complete than when, as heretofore, said cylinder is filled from both the reservoir and train-pipe. As compared with the old method of venting the train-pipe into the brake-cylinder, my new mode of operation therefore produces the triple effect of venting without resistance into an unlimited space and for a longer period, and the practical effectiveness of the local discharge is thereby greatly increased. The time required to fill the brake-cylinder from the reservoir will depend entirely upon the size of the emergency-port, and hence can be adjusted as experience shall determine to be best.

Secondly, as my next improvement, I connect with said valve I or piston J a spring, K, arranged to act with the train-pipe pressure and against the brake-cylinder pressure to hold said valve open for a limited time after the brake-cylinder pressure equals or exceeds that of the train-pipe, thereby allowing a still longer time for the latter to vent to the atmosphere and producing a correspondingly more effective reduction of its pressure by the local discharge. The force of this spring when thus applied should be so proportioned as to allow a sufficient increase of brake-cylinder pressure to overcome it and close the local discharge, and should also be so limited as not to equal (in terms of air-pressure per square inch of piston-surface) that of the spring marked L, (or other spring employed in returning the main piston B from its emergency-stop position,) in order that the local discharge may not interfere with the movements of the main piston. Differential surfaces may also be employed as the equivalent of the spring K, care being taken to adjust the difference of area, so as to proportion and limit its action, as above indicated. In the form shown in Fig. 1 the spring K is a rubber sleeve, serving not only as a spring, but also as an air-tight packing for the piston J when the brake-cylinder is filled. Heretofore a spring has been used to aid the brake-cylinder pressure to close the local discharge into the brake-cylinder by acting with the brake-cylinder air against the train-pipe air, and has accordingly diminished rather than increased the extent and effectiveness of the local discharge, such arrangement being, however, an absolute necessity where the train-pipe and car-reservoir both vent into the brake-cylinder at the same moment, and thus enable the reservoir-air to pass around into the train-pipe unless the communication be closed before the pressure in the brake-cylinder exceeds that in the train-pipe.

My third improvement consists in combining in a single valve the functions of the two valves G I—that is to say, the functions of opening and closing the local discharge. Any valve performing these two functions must be capable of two independent movements—to wit, one movement resulting from the traverse of the main piston to apply the emergency-stop, and another movement resulting from the increasing pressure in the brake-cylinder. Of the various constructions that may be devised for this purpose I prefer the one shown in Fig. 2. In this figure M represents a small cylinder secured in the outer or lower end of the casing B′ and closed at its exposed end by a plug, M′, having a circumferential recess, *m*, which communicates on the one hand with a central bore, *m′*, extending from the line of the recess to the inner end of the plug, and on the other hand with a passage, m^2, leading from the brake-cylinder or from the passage through which said cylinder is filled by the action of the triple valve. In the small cylinder M a piston, N, (the general equivalent of the piston J, above described,) is arranged, packed air tight and subject on one side to the air-pressure of the brake-cylinder derived through the passages m^2 m' m, and on the other side to the air-pressure of the train-pipe, which freely enters the small cylinder through an opening, *f*, in its inner end. Attached to the main piston B is a tubular stem, *b*, terminating at its lower end in a flange, *b′*, which performs the double function of guiding the lower end of stem *b* and supporting a thimble, O, and which either fits so loosely in casing B′ as to allow the air from train-pipe F to pass freely around it to cylinder M, or else is provided with holes for that purpose. A stem, N′, attached to piston N, extends up into the tubular stem *b*. The office of the thimble O is to support and control the valve G, which governs the local discharge-port. (Shown in dotted lines.) To this end the thimble is normally held seated on the flange *b′* by the force of a light spring, P, but is able to slide on the stem *b*, and is provided with a bar or key, *o*, which passes through a slot, b^2, in stem *b*. Below the flange *b′* is a sliding ring, Q, pressed upward by a spring, Q′, against the lower end of the bushing B^2 of the casing B, and projecting slightly inside of the line of said bushing. The ordinary drip-plug is shown at B^3. The operation is as follows: The normal position of the several parts is as shown in Fig. 2. When the train-pipe air-pressure is reduced sufficiently to apply the emergency-stop, the main piston B descends, carrying down with it the flange *b′*, which in turn strikes and moves down the ring Q against the resistance of spring Q′ until the upper end of valve G comes below the local discharge-port and the pin *o* reaches or nearly reaches the upper end of stem N′, whereupon the air from the train-pipe vents through said port to the atmosphere. At or near the time when the local discharge is thus opened the valve A also opens the emergency-port a', which puts the car-reservoir in communication with the brake-cylinder and fills the latter with reservoir air. When the increasing pressure in the brake-cylinder sufficiently exceeds the decreasing pressure in the train-pipe, it lifts the piston N, causing the stem N', which slides freely in the tubular stem b, to strike the key or pin o and push the thimble up against the resistance of spring P, thereby closing the local discharge. With respect to the resistance thus offered to the movement of the small piston N the spring P, it will be observed, is the general equivalent of the spring K, above described. The readmission of air-pressure through the train-pipe will now release the brakes and reseat the piston N at the lower end of the cylinder M, thus bringing all the parts to their normal position.

With the construction last above described important advantages are gained by arranging a packing ring or seat, r, of rubber, leather, or other suitable material, at the inner end of the plug M', and another, r', at the upper side of the piston N, and so proportioning the parts that when the piston N is at the lower extremity of its movement it will seat on the packing-ring r, and when at the upper extremity of its movement it will seat the packing-ring r' against the annular surface r^2 at the upper end of cylinder M, thus closing the joint air-tight in either instance and holding it closed by the force of the air-pressure upon said piston, so that the air can neither leak from the train-pipe to the brake-cylinder when the latter is empty nor from the brake-cylinder to the train-pipe when the conditions are reversed. I deem it best that the tension of the light spring P should be sufficient to overcome the friction of the slide-valve G, but with the construction here shown that the force of the spring P per square inch upon the piston N should not exceed the combined force of the springs P Q' per square inch upon the main piston B, in order that when the train-pipe begins to be refilled from the locomotive the piston N may not yield before the main piston commences its return movement. In the construction illustrated in Fig. 2 the piston N, by reason of its relation to the packing-rings, r r', has a very peculiar action, being, when seated thereon, a differential piston and while in traverse non-differential. The result is that when the local discharge is opened the piston N remains seated on the ring r until the brake-cylinder pressure acting on the small under surface inside of the ring overbalances the train-pipe pressure acting on the much larger upper surface, and hence the local venting of the train-pipe does not cease until its pressure is reduced considerably below that of the brake-cylinder. On the other hand, when the train-pipe commences to be refilled, the packing-ring r' being seated against the annular upper end of the cylinder M and the train-pipe pressure acting only on the area of the opening f, while the brake-cylinder pressure acts upon the entire lower side of the piston, the latter will necessarily remain immovable until the main piston B, returning to its normal position, releases the brakes and discharges the pressure from the under side of the piston N. The piston N, therefore, cannot move in either direction until the moment arrives when such movement is necessary, and the instant it commences such movement its differential character disappears and an increased force is brought to bear upon it to render its movement positive and certain, thus affording exactly the conditions for its most advantageous operation. Instead of rubber, leather, or other soft surfaces at r r', the piston and its seats may be ground to an air-tight joint. A dust shield or guard, t, (shown in dotted lines) is preferably applied to the open end of the local discharge-passage to prevent dust from entering and tending to interfere with the action of the valves. U is a cock arranged in the local branch of the train-pipe, by which the pneumatic apparatus of any car may be cut off from the train-pipe in case the brakes of such car should become disabled, or for any other reason.

The effect of my several improvements is to insure a local discharge so free, quick, and ample and a consequent reduction of the train-pipe pressure so sudden and decided that a positive and powerful action will be produced almost instantly upon the piston-valve of the next car, and so on throughout the train, at the same time setting the brakes more slowly, so as to bring them all, as nearly as possible, into simultaneous action and cause the train to come to a quick and easy stop without shock. The time involved in setting the brakes will depend entirely upon the size of the emergency-port, which may be adapted to any requirement.

Having thus described my invention, I claim as new—

1. The combination of the brake-cylinder, the train-pipe, the car-reservoir, and the main valve-operating piston with a passage leading from the train-pipe to the open air for locally venting the train-pipe to the atmosphere, and with means whereby said passage is opened by preliminarily lowering the pressure in the train-pipe in applying the emergency-stop, and closed by a sufficient increase of pressure in the brake-cylinder, substantially as described.

2. The combination of the brake-cylinder, the train-pipe, the car-reservoir, and the main valve-operating piston with a passage leading from the train-pipe to the open air for locally venting the train-pipe to the atmosphere, and a valve or valves which open said passage by the movement of the main valve-operating piston in applying the emergency-stop and close it by the increase of pressure in the brake-cylinder, substantially as described.

3. The combination of the brake-cylinder,

the train-pipe, the car-reservoir, and the main valve-operating piston with a passage leading from the train-pipe to the open air for locally venting the train-pipe to the atmosphere, and a valve which opens said passage when the main valve-operating piston opens the emergency-port, and which is controlled by the movement of that piston, substantially as described.

4. The combination of the brake cylinder, the train-pipe, the car-reservoir, and the main valve-operating piston with a passage leading from the train-pipe to the open air for locally venting the train-pipe to the atmosphere in applying the emergency-stop, and a valve which closes said passage by the pressure of the air in the brake-cylinder, substantially as described.

5. The combination, in a fluid-brake mechanism, of a train-pipe, brake-cylinder, air-reservoir, and a main valve-operating piston, B, with a discharge-passage leading from the train-pipe to the open air, provided with a valve, which is operated by the final movement of the piston B in applying the brakes for emergency-stops, thereby venting the train-pipe to the atmosphere, substantially as described.

6. The combination of the brake cylinder, the train-pipe, the car-reservoir, the main valve-operating piston, the passage leading from the train-pipe to the open air for locally venting the train-pipe directly to the atmosphere in applying the emergency-stop, and the valve for closing said passage by an increase of pressure in the brake-cylinder, with a spring or its equivalent to aid in holding said passage open against the increasing pressure of the brake-cylinder, substantially as described.

7. In a fluid-brake mechanism, the combination of the main piston B with a supplementary piston N, and a single valve operated by said pistons whose movement opens and closes the local discharge-passage leading from the train-pipe to the atmosphere, substantially as described.

8. In a fluid-brake mechanism, the combination of the main piston B with a valve operated thereby to open the local discharge-passage leading from the train-pipe to the atmosphere, and a supplementary piston for operating said valve to close said discharge, substantially as described.

9. In a fluid-brake mechanism, the combination of the main piston B with a valve operated thereby to open the local discharge-passage leading from the train-pipe to the atmosphere, and a supplementary piston, which under the influence of the brake-cylinder pressure operates said valve to close said discharge, substantially as described.

10. In a fluid-brake mechanism in which the movement of air to and from the brake-cylinder is controlled by a main valve-piston, the combination of an auxiliary piston actuating a valve which vents the train-pipe to the atmosphere, with a packing-ring or seat for the purpose of preventing the movement of the piston until a substantial difference of pressure upon its opposite sides has been attained without impairing by a continuance of the differential surface the force of the movement of the piston when once it is initiated, substantially as described.

11. In a fluid-brake mechanism, the combination of the seat r with the auxiliary piston N, which operates to close the local discharge, whereby said discharge is held open after the pressure in the brake-cylinder equals that in the train-pipe, but is effectually closed when the train-pipe pressure becomes further reduced, substantially as described.

12. In a fluid-brake mechanism, the combination of the seat r^2 with the auxiliary piston N, which operates to close the local discharge, whereby said discharge when closed is held closed during the readmission of air to the train-pipe, even under a greater pressure in the train-pipe than in the brake-cylinder, and until the pressure in the brake-cylinder is reduced, substantially as described.

13. In a fluid-brake mechanism, the combination of the seats r r^2 with the auxiliary piston N, which operates to close the local discharge, whereby said discharge is held open until the pressure in the train-pipe is less than that in the brake-cylinder, is then effectually closed through the further decrease of pressure in the train-pipe, and remains closed until by the discharge of the brake-cylinder the pressure therein becomes less than that in the train-pipe, substantially as described.

14. In a fluid-brake mechanism, the combination of the valve-carrying thimble O with a stem, b, and spring P, substantially as described.

15. In a fluid-brake mechanism, the combination of the piston B and valve G and the valve-carrying thimble O with the stem b and spring P, and with the ring Q and its spring Q′, substantially as described.

16. In a fluid-brake mechanism, the combination of the piston B and valve G and the valve-carrying thimble O and its pin o with the piston N and its stem N′, substantially as described.

17. In a fluid-brake mechanism, the combination of the piston B and valve G and the piston-rod N′ with the hollow stem b, the thimble O, the pin o, and the spring P, substantially as described.

THERON S. E. DIXON.

Witnesses:
L. HILL,
WM. M. HILL.