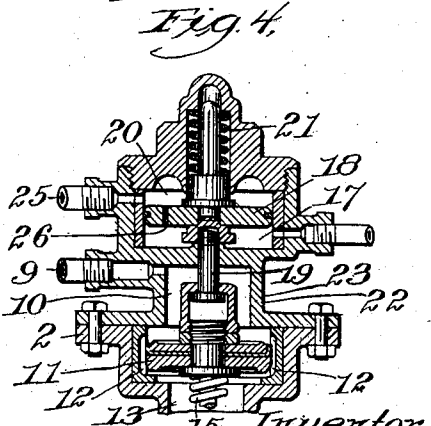
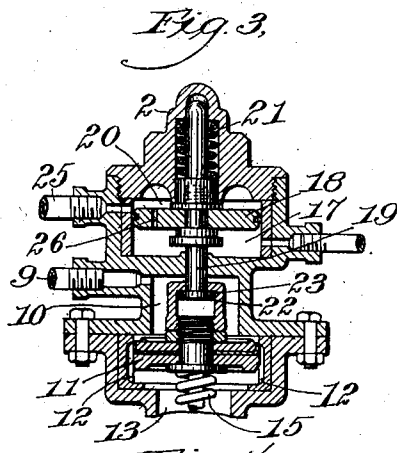
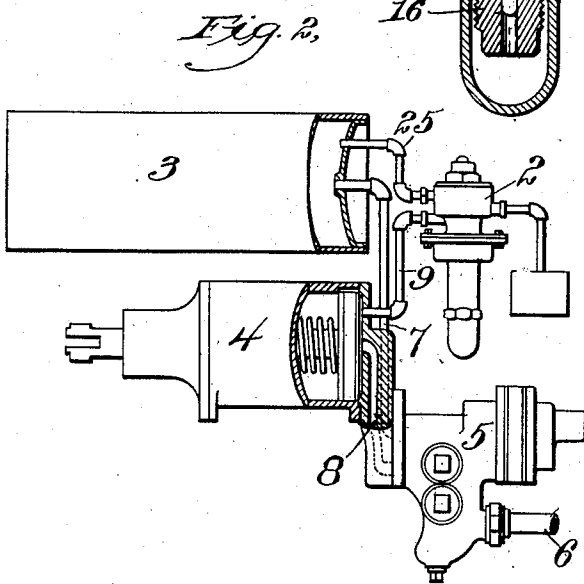
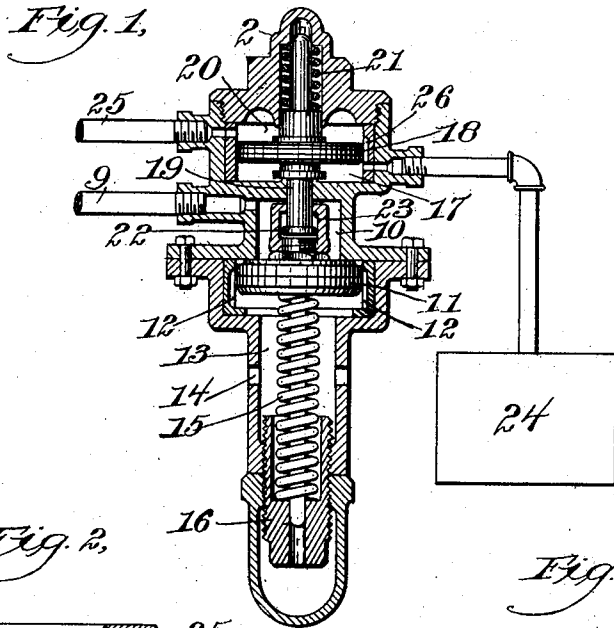


J. P. KELLY.
AIR BRAKE.

APPLICATION FILED NOV. 27, 1903.

NO MODEL.



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UNITED STATES PATENT OFFICE.

JOHN P. KELLY, OF WATERTOWN, NEW YORK, ASSIGNOR TO NEW YORK AIR BRAKE COMPANY, A CORPORATION OF NEW JERSEY.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 761,683, dated June 7, 1904.

Application filed November 27, 1903. Serial No. 182,836. (No model.)

To all whom it may concern:

Be it known that I, JOHN P. KELLY, of Watertown, county of Jefferson, and State of New York, have invented an Improvement in Air Brakes, of which the following description, in connection with the accompanying drawings, is a specification, like numerals on the drawings representing like parts.

This invention relates to an air-brake apparatus, and is shown as employed in an apparatus of the kind commonly known as the "automatic" air-brake, in which the brake-cylinder is charged with air from an auxiliary reservoir on the car under control of a triple valve cooperating with the train-pipe, auxiliary reservoir, and brake-cylinder to cause the brakes to be applied and released in response to changes in pressure of air in the train-pipe which may be controlled by the engineer.

The present invention relates mainly to an appliance to be used in connection with the brake-cylinder or with the passage through which air is admitted to and exhausted from the brake-cylinder in the operation of applying and releasing the brakes, and is especially applicable to brakes designed for use on trains running at high speed.

For very fast running trains it has been found desirable to provide greater power for the brakes than is employed in connection with rolling-stock of the same character which is regularly run at a considerably lower speed, and one way of providing for increased power of the brakes is to increase the air-pressure employed in the system beyond that commonly used on trains regularly running at a lower speed. For example, an equipment designed for use on trains regularly running at about forty miles an hour as a maximum, and having the standard or normal air-pressure in the train-pipe and auxiliary reservoirs seventy pounds, might be used with an air-pressure of one hundred and ten pounds for trains regularly running at a maximum speed of sixty miles or more. In emergency applications of the brakes the maximum pressure should be attained in the brake-cylinders as promptly as possible, and with a high-speed equipment

the pressure in the brake-cylinders produced in emergency applications of the brakes may be sixty per cent. or more greater than that commonly employed in a similar equipment as used on trains normally running at a considerably lower speed. While the increased brake-cylinder pressure is effective and desirable to reduce the speed of a rapidly-running train as soon as possible, it is likely to give too great braking force after the speed of the train has been materially reduced and might then cause the locking of the wheels, so that they would slide on the rails, thus damaging the wheels and acting less effectively to bring the train to a standstill than if the braking force were just less than that which is sufficient to lock the wheels against rotation.

The present invention is embodied in a relief-valve communicating with the brake-cylinder and operating normally to prevent increase of brake-cylinder pressure beyond a predetermined amount, said relief-valve having combined therewith means whereby its operation in response to the pressure in the brake-cylinder may be modified and deferred, so that brake-cylinder pressure may be maintained greater than that at which the relief-valve normally opens for a predetermined regulable period of time. The higher pressure above that which normally operates the relief-valve to prevent further increase in pressure is employed in emergency applications of the brakes and will be hereinafter referred to as "abnormal" or "excessive" brake-cylinder pressure, and the apparatus forming the subject of the present invention is intended to cause such abnormal brake-cylinder pressure to be maintained in emergency applications of the brakes for a definite interval of time after the application has been made, in which time the speed of the train will have been materially reduced, and at the end of said period of time the relief-valve will be opened and cause a reduction of brake-cylinder pressure to the normal amount or maximum pressure that is employed in service distinguished from emergency applications of the brakes.

The apparatus forming the subject of this

invention comprises a discharge-passage from the brake-cylinder to the atmosphere and a relief-valve proper, which normally retains said passage closed and is actuated in the direction to open the valve by the pressure in the brake-cylinder and in the direction to close the valve by a predetermined force, such as that of a spring, which may be set to retain any desired normal maximum pressure in the brake-cylinder and which is overbalanced by an increase in said brake-cylinder pressure beyond said maximum to permit the relief-valve to open and permit the excess of pressure to escape.

The apparatus also comprises, in combination with such relief-valve, means for temporarily applying an additional force acting in opposition to brake-cylinder pressure on the relief-valve under certain conditions, such as those pertaining to an emergency application of the brakes, so that under said conditions the brake-cylinder pressure may be increased beyond that which normally overcomes the force for holding the relief-valve closed without overcoming the said normal force on the relief-valve and the additional force applied thereto, so that the said abnormal or increased pressure is maintained in the brake-cylinder. Means are also provided whereby the additional or abnormal force tending to prevent opening of the relief-valve is gradually reduced, so that at the end of a regulable period of time the brake-cylinder pressure will overcome the resistance to the opening of the relief-valve, and the additional force tending to close the relief-valve will finally be entirely withdrawn, so that the relief-valve will cause the brake-cylinder pressure to be reduced to the normal maximum amount, beyond which it is not substantially increased in the regular service applications, in which the additional force for closing the relief-valve is not brought into action.

Figure 1 is a longitudinal section of an air-brake appliance forming the subject of this invention, the parts being shown in normal position occupied when the brakes are released. Fig. 2 is a diagram view showing the main components of a car equipment of an automatic air-brake apparatus provided with means for controlling the brake-cylinder pressure in accordance with this invention, and Figs. 3 and 4 are sectional details of a portion of the apparatus shown in Fig. 1 in different positions occupied in the operation and also illustrating certain modifications which will be explained.

The appliance forming the subject of this invention, which will be called a "brake-cylinder relief-valve," is shown at 2 in Fig. 2 in connection with the usual car equipment of what is commonly known as the "quick-action automatic air-brake system," said car equipment comprising also the auxiliary reservoir 3, brake-cylinder 4, and quick-action

triple valve 5, which latter is connected with the train-pipe 6 and controls the various communications that are called into action in the handling of the brakes—namely, an exhaust-passage from the brake-cylinder to the atmosphere which is opened for releasing the brakes and is closed preparatory to applying the brakes and a communication 7 8 from the auxiliary reservoir 3 to brake-cylinder 4, which is opened and closed in making graduated applications of the brakes, and a communication (not shown) from the train-pipe 6 to the auxiliary reservoir 3, which is opened when the brakes are released for recharging of the auxiliary reservoir up to the pressure normally carried in the train-pipe. The details of the car equipment, and especially of the triple valve, are not fully shown, as they may be of any usual construction, and such apparatus is in extensive use and well known to those familiar with this art.

For a proper understanding of the relief-valve 2, forming the subject of this invention, it is sufficient to state that normally when the train is running with the brakes released the pressure in the auxiliary reservoirs 3 throughout the train is substantially equal to that maintained in the train-pipe 6 and that upon a reduction in train-pipe pressure the exhaust from the brake-cylinder to the atmosphere is closed and communication from the auxiliary reservoir to the brake-cylinder established until the flow of air from the auxiliary reservoir into the brake-cylinder reduces the pressure in the former to that established by the engineer in the train-pipe, after which the communication from the auxiliary reservoir to the brake-cylinder is closed with the pressure in the auxiliary reservoir again substantially equal to that in the train-pipe, which condition is maintained until a further increase of braking force is required, which is accomplished by permitting pressure to escape from the train-pipe and causing the communication from the auxiliary reservoir to the brake-cylinder to be opened and again closed when the auxiliary-reservoir pressure has equalized with the newly-established pressure in the train-pipe. A moderate reduction in train-pipe pressure thus permits a relatively small amount of air to flow from the auxiliary reservoir into the brake-cylinder and applies the brakes with moderate pressure, and the braking pressure may be increased in response to further diminutions in train-pipe pressure until the increasing brake-cylinder pressure equalizes with the falling auxiliary-reservoir pressure, at which time the maximum braking force is attained, and further reduction in the train-pipe pressure produces no change in the condition of the brake apparatus. A sudden reduction in train-pipe pressure to or below the said pressure of equalization of the auxiliary reservoir and brake-cylinder air or maximum braking pressure causes

the communication between the auxiliary reservoir and brake-cylinder to be fully opened, so that the full pressure of equalization is very quickly attained in the brake-cylinder in response to such reduction in train-pipe pressure, which is made by the engineer in case of emergency or is made in the event of the breaking of the train-pipe in any way, as by the parting of a coupling. For convenience of referring to concrete conditions it may be assumed that a pressure of one hundred and ten pounds is normally carried in the system (in the train-pipe and auxiliary reservoirs) and that this would give a braking pressure of eighty-five pounds in the brake-cylinder, as the pressure of equalization in the brake-cylinder and auxiliary reservoir when communication is made and maintained between the two, as in making an emergency application of the brakes with no discharge-passage or relief-opening from the brake-cylinder. It may be assumed, furthermore, that sixty pounds pressure in the brake-cylinder is the normal maximum, which is all that should be exerted in the brake-cylinder in making the usual service stops, or even emergency stops after the speed of the train has become materially reduced, as a greater braking pressure applied when the train is moving relatively slowly will be liable to lock the wheels and cause them to slide on the track, which is, as well known, highly objectionable. With the brake apparatus proportioned and charged as just assumed it is possible to obtain as a maximum eighty-five pounds pressure in the brake-cylinder, and if the apparatus comprised only the usual equipment this could be produced in service applications of the brakes by the successive increases in brake-cylinder pressure or by a relatively slow continuous flow of air from the auxiliary reservoir to the brake-cylinder, such as is produced in making a full service application of the brakes, in which the engineer causes the train-pipe pressure to be continuously reduced, but at a comparatively slow rate. The appliance forming the subject of this invention is for the purpose of preventing brake-cylinder pressure being increased substantially beyond the desired predetermined maximum, assumed to be sixty pounds in the brake-cylinder in service applications, but to permit of its being applied to the full pressure attainable in an emergency application and retained at such abnormal pressure for a certain period of time, after which it is reduced to the normal maximum of sixty pounds. The relief-valve 2, which contains instrumentalities for accomplishing these results, is connected by a duct or passage 9 with the brake-cylinder 4, said passage 9 opening into a chamber 10 in said relief-valve. The brake-cylinder pressure, whatever it may be, is therefore present at all times in said chamber 10 and acts upon a piston or movable abutment 11, which in this instance also con-

stitutes the relief-valve proper, said abutment controlling one or more grooves or passages 12 in the cylinder in which it works, which passages are open or uncovered when said piston 11 is moved away from the chamber 10 by the brake-cylinder pressure exerted therein, so that air may then pass from said chamber 10 through said passages 12 into the space or spring-chamber 13 at the other side of said piston, which chamber has an opening or escape-passage 14 to the atmosphere. The brake-cylinder pressure in the chamber 10, acting upon the piston 11, is opposed by a predetermined force, such as that of the spring 15, the force or pressure of which may be adjusted by the spring-support 16, and is set to balance the air-pressure in the chamber 10 at the normal maximum desired to be carried in the brake-cylinder—for example, sixty pounds—so that as soon as the brake-cylinder pressure rises above sixty pounds it is sufficient to overcome the force of the spring 15 and if no other agency is called into action will then move the piston 11 to open the passages 12 and permit air to escape from the chamber 10 and brake-cylinder until its pressure is no longer sufficient to overcome spring 15, which will then move back the piston 11 and prevent further escape of air from the brake-cylinder through the relief-valve. The appliances thus far described, therefore, operate like an ordinary relief-valve or safety-valve to prevent substantial increase of pressure in the brake-cylinder beyond that which is sufficient to overcome the spring action on the relief-valve and cause the same to be opened.

In order to prevent the relief-valve from opening when an excess of pressure is desired to be produced and maintained for a certain period of time in the brake-cylinder, as in the case of an emergency application of the brakes, means are provided for augmenting or supplementing the force of the spring 15 in opposition to the brake-cylinder pressure in the chamber 10 acting on the piston 11. This supplemental force, as shown in this instance, is derived from a fluid-pressure in the chamber 17 acting upon a supplemental piston or movable abutment 18, the stem 19 of which is adapted to cooperate with the piston 11. Normally and during service applications of the brakes the fluid-pressure in the chamber 17 is substantially equal to that in the chamber 20 at the opposite side of the piston 18, which then is in balanced condition and is in its position nearest to the piston 11, as shown in Fig. 1. A light spring may be used, as shown at 21, to retain the piston 18 normally in the position shown in Fig. 1 when the fluid-pressures on said piston 18 are balanced. In this position there is sufficient space between a head or enlargement 22 on the piston rod or stem 19 and a cooperating shoulder 23 on a nut or stem connected with the piston 11 to admit of the full working movement of said piston

11 before the parts 22 23 come into engagement. If, however, the pressure in the chamber 20 is reduced below that in the chamber 17, the piston 18 will be moved in the direction away from the piston 11 far enough to bring the enlargement 22 near enough to the shoulder 23 to prevent operative movement of the piston 11 without also engaging and carrying the piston 18 in the same direction that said piston 11 moves in opening the vent-passage 12. (See Fig. 3.) With the parts in this latter position, therefore, the brake-cylinder pressure in the chamber 10 before it can open the vent 12 must overcome not only the force of the spring 15, but also the fluid-pressure in the chamber 17 acting on the piston 18, and consequently a corresponding increase in brake-cylinder pressure may be made before the vent-valve can be opened to prevent a still further increase in said brake-cylinder pressure. In order to provide for the requisite pressure conditions in the chambers 17 and 20 to control the piston 18, the said chamber 17 is made of sufficient size, or, preferably, for convenience of construction, is placed in communication with a small reservoir 24, to contain a supply of air to act upon the piston 18 when it is desired to supplement the force of the spring 15. The said chamber or space 17 and 24 is charged from the chamber 20, which is placed by a pipe or duct 25 in communication with some part of the air-brake system in which the proper pressure conditions exist—such, for example, as the auxiliary reservoir 3 or train-pipe 6—it being deemed desirable to make said connection with the auxiliary reservoir, as shown in Fig. 2, although it is to be understood that there is no limitation to this specific arrangement. The space 17 24 is supplied or charged through a small passage 26 through or around the piston 18, said passage being shown in Fig. 1 as a groove in the wall of the cylinder in which the piston 18 works and being shown in Fig. 3 as a small opening directly through the piston 18. Air may thus flow at a comparatively slow rate from the chamber at one side to the chamber at the other side of the piston 18, according as the pressure at one or at the other side is greater, and normally the chamber 17, together with the reservoir 24, (which is practically only an extension of said chamber 17 and may therefore be hereinafter understood as included therein,) is charged to the same pressure as normally maintained in the system—*i. e.*, in the train-pipe and auxiliary reservoirs—with which the chamber 20 communicates. When train-pipe pressure and auxiliary-reservoir pressure are reduced comparatively slowly, as in making service applications of the brakes, the air will flow from the chamber 17 into the chamber 20, so as to reduce the pressure in the chamber 17 at about the same rate as that in the chamber 20, thus leaving the

piston 11 under the sole control of the spring 15 and brake-cylinder pressure in the chamber 10, so that the relief-valve is opened as soon as the brake-cylinder pressure begins to exceed the normal maximum desired for service applications of the brakes, and consequently although the system is supplied with air sufficient to give a greater brake-cylinder pressure the desired maximum will not be exceeded in service applications of the brakes. When, however, the train-pipe pressure is reduced suddenly, as in making an emergency application of the brakes, the auxiliary-reservoir pressure is also reduced suddenly, and consequently the pressure in the chamber 20 is reduced suddenly whether said chamber is connected with the train-pipe or auxiliary reservoir, and the pressure in the chamber 17 is prevented from equally rapid reduction by the smallness of the passage 26 relative to the capacity of the chamber 17, (including 24,) so that the pressure in 17 on the piston 18 is unbalanced and moves the said piston away from the piston 11 and so as to engage the shoulders 22 23, so that the piston 11 cannot be moved to open the relief-passages 12 except by brake-cylinder pressure in chamber 10 sufficient not only to overcome the spring 15, but also the added resistance of the fluid-pressure in the chamber 17 acting on the piston 18. (See Fig. 3.) The parts may be so proportioned that the additional pressure on piston 18 is sufficient to overcome the additional or abnormal pressure produced in the brake-cylinder from all sources in making an emergency application of the brakes, so that said pressure will be retained in the brake-cylinder unaffected by the presence of the relief-valve 11 in the apparatus. This condition, however, is prevented from being continued too long by the fact that the pressure is escaping from the chamber 17 through the passage 26 or through such other escape as may be provided, and therefore the additional force preventing the opening of the relief-valve 11 is gradually diminished until finally the brake-cylinder pressure is sufficient to open the relief-valve, and as the pressure in the chamber 17 becomes finally exhausted or equalized with the pressure remaining in the chamber 20 the brake-cylinder pressure finally encounters only the resistance of the spring 15, the same as in service applications of the brakes, and is reduced by escaping through the relief-passage to the normal maximum exerted in the service applications.

When the chamber 20 is connected with the auxiliary reservoir 3, as shown, the back flow or discharge of air from the chamber 17 is into the auxiliary reservoir and thence into the brake-cylinder; but, as before stated, this arrangement is not necessary, the important matter being that the chamber 17 should contain air at a higher pressure than the chamber 20 at the moment when an emergency ap-

plication of the brakes is made and that the pressures in said chambers should be normally approximately equal and should equalize after a predetermined time interval in which that in the chamber 17 remains in preponderance.

Where the chamber 17 is supplied by a groove, as shown at 26 in Fig. 1, said groove may be of sufficient size to cause the pressures to equalize with reasonable promptness; but when the pressure in 20 is suddenly reduced the movement of the piston 18 in response to the then preponderating pressure in 17 may partially close said passage 26, so as to give the required time before the pressure in 17 will fall sufficiently to allow the brake-cylinder pressure to be relieved.

The parts are shown in Fig. 4 in the position occupied when the relief-valve is open and air is escaping through or past the same from the brake-cylinder to the atmosphere.

The lost-motion connection at 22 23 between the relief-valve-actuating abutment 11 and the supplemental abutment or piston 18 is not essential, as the piston 18 might move with the piston 11 when the pressures on piston 18 are approximately equal; but the said lost-motion connection is desirable, as it leaves the piston 11 unaffected except by the spring 15 in the usual operations, which take place except in emergency applications.

I claim—

1. An automatic fluid-pressure brake system comprising an auxiliary reservoir, a triple valve and a brake-cylinder combined with a relief-valve controlling an escape-passage from the brake-cylinder, said relief-valve being acted upon by brake-cylinder pressure tending to open the same, and a predetermined force opposed to said brake-cylinder pressure; and means for temporarily augmenting the said opposing force; substantially as and for the purpose described.

2. The combination with the auxiliary reservoir, triple valve and brake-cylinder; of an automatic fluid-pressure brake, with a brake-cylinder relief-valve controlling an escape-passage from the said brake-cylinder, and means for delaying the opening of said valve whereby an abnormally high pressure may be

retained in the brake-cylinder for a determinable period of time before the relief-valve is opened, substantially as and for the purpose described.

3. A relief-valve comprising a discharge-valve and movable abutment controlling the operation of the same, exposed at one side to the fluid-pressure to be relieved, and at the other side to a predetermined opposing force; and means for augmenting said opposing force, whereby the fluid-pressure required to open said valve may be increased, substantially as described.

4. The combination of the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve of an automatic air-brake apparatus, with a brake-cylinder relief-valve and movable abutment or actuator therefor, exposed at one side to brake-cylinder pressure, and at the other to a predetermined opposing force, a supplemental movable abutment cooperating with the valve-actuating abutment and exposed at opposite sides to fluid-pressures which are normally equal; and means for reducing the pressure at one side of the said supplemental abutment relative to that at the other side, in response to an emergency application of the brakes.

5. The combination of the train-pipe, auxiliary reservoir, brake-cylinder, and triple valve, of an automatic air-brake apparatus, with a brake-cylinder relief-valve actuated by brake-cylinder pressure, and a supplemental movable abutment having an operative connection with said relief-valve and exposed to fluid-pressures on both sides, and a connecting-passage between the fluid-chambers at opposite sides of said supplemental piston whereby the pressures in said chambers equalize in a determinable period of time after one of said pressures is in preponderance over the other.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN P. KELLY.

Witnesses:

JNO. F. MALONEY,
W. F. NICOL.