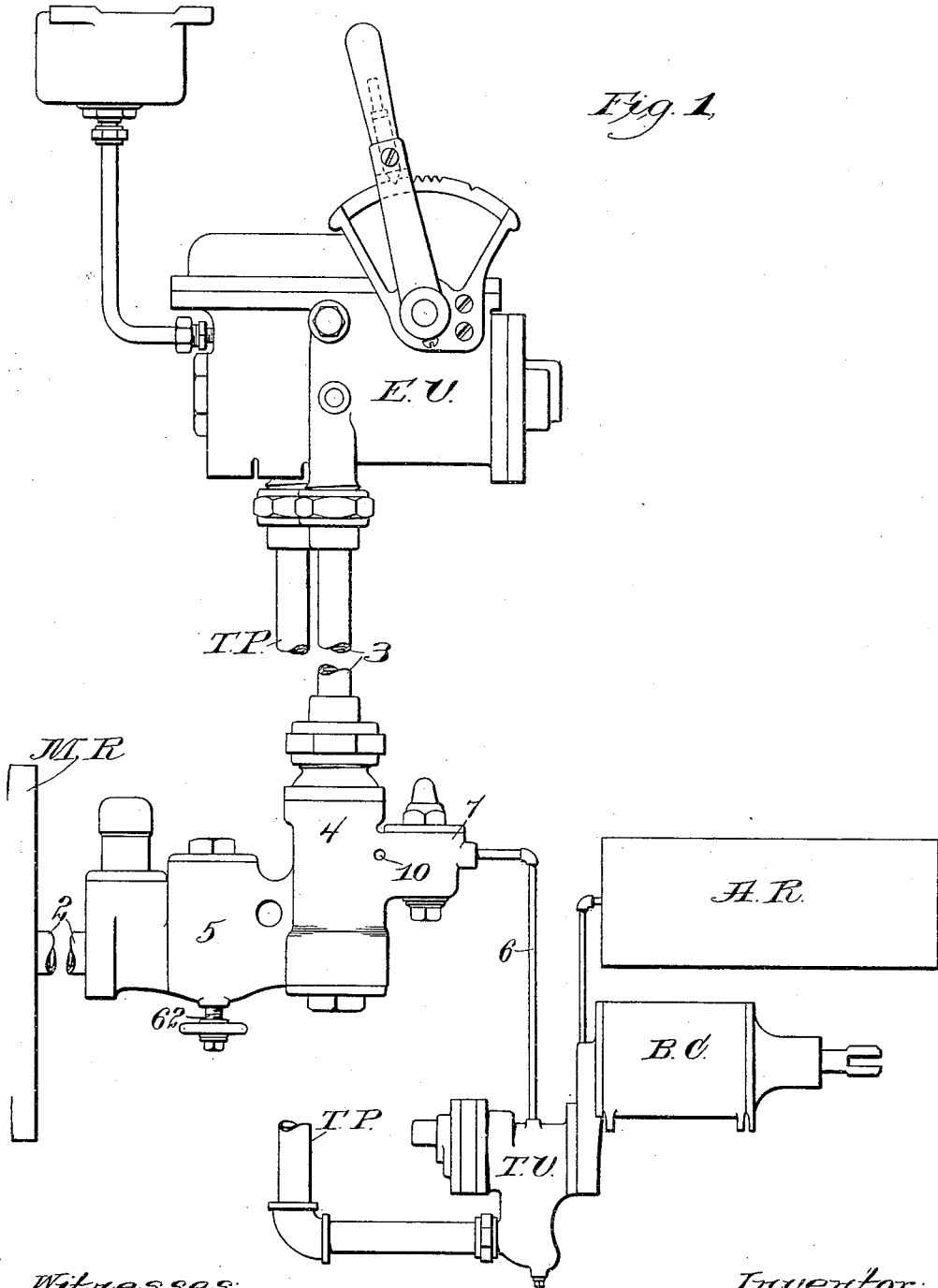


No. 823,023.

PATENTED JUNE 12, 1906.

H. F. BICKEL.  
AIR BRAKE APPARATUS.  
APPLICATION FILED NOV. 6, 1905.

2 SHEETS—SHEET 1.



*Fig. 1*

*Witnesses:*  
*Gas Maloney*  
*Conroy*

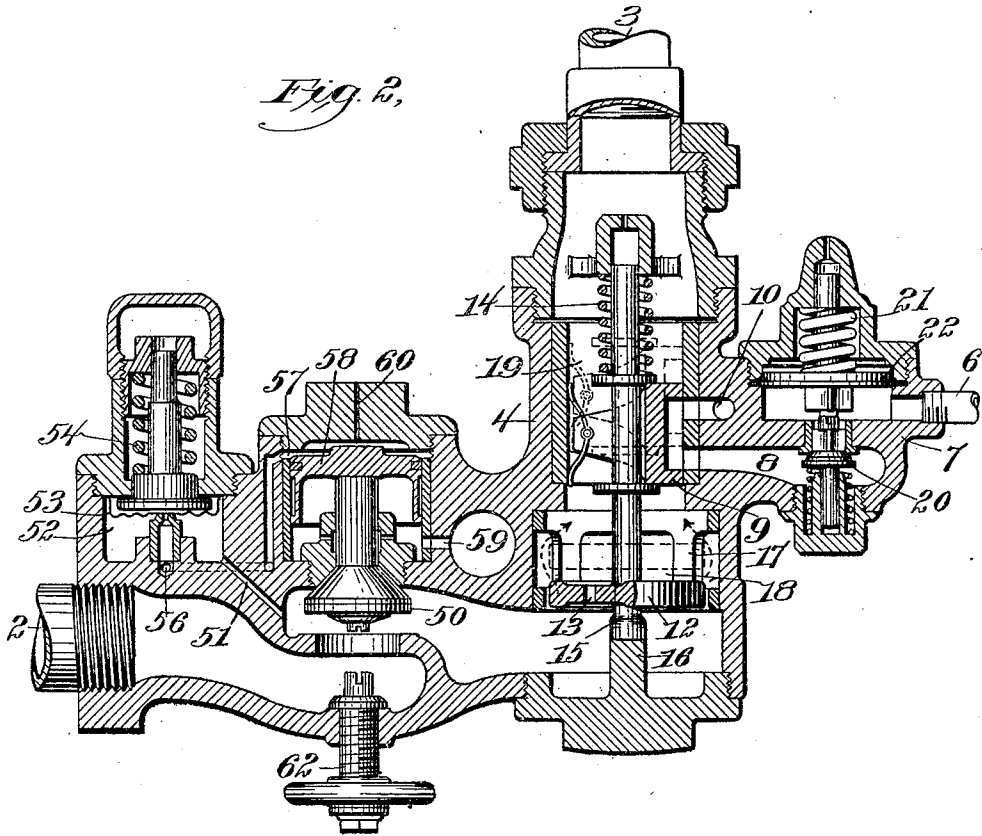
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2 SHEETS—SHEET 2.



*witnesses:*  
*Jas. J. Maloney*  
*James J. [unclear]*

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# UNITED STATES PATENT OFFICE.

HENRY F. BICKEL, OF PLAINFIELD, NEW JERSEY, ASSIGNOR TO NEW YORK AIR BRAKE COMPANY, A CORPORATION OF NEW JERSEY.

## AIR-BRAKE APPARATUS.

No. 823,023.

Specification of Letters Patent.

Patented June 12, 1906.

Application filed November 6, 1905. Serial No. 286,098.

*To all whom it may concern:*

Be it known that I, HENRY F. BICKEL, a citizen of the United States, and a resident of Plainfield, in the county of Union and State of New Jersey, have invented an Improvement in Air - Brake Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to an air-brake apparatus, and is applicable to air-brake apparatus of the kind now generally used upon steam-railways and known as the "automatic air-brake."

The object of the present invention is to obviate certain objections or difficulties that are experienced in the operation of automatic air-brake apparatus as heretofore commonly used, which are as follows:

In the operation of releasing the brakes while the train is running the brakes near the head of the train will be released in response to the admission of air through the train-pipe earlier than the brakes toward the rear of the train by reason of the resistance to the flow of air through the train-pipe. This results in subjecting the couplings on the draw-bars between the cars of the train to severe strain, because, the brakes on the forward part being released, the cars in that portion tend to move forward and draw away from those toward the rear portion of the train, the brakes on which are not yet released, and on long trains the resulting strain is sometimes sufficient to break apart the couplings at some point in the length of the train, and thus to cause serious inconvenience and danger. This difficulty is overcome by appliances forming the subject of the present invention, which consist in means for retaining one or more of the brakes at the head of the train—as, for example, the brakes on the locomotive or tender—applied during the operation of releasing the brakes throughout the remainder of the train, the retardation at the head of the train being sufficient to hold back the cars near the forward part of the train, the brakes of which are released, until the brakes have become released throughout the entire length of the train, thus keeping the cars bunched together and

preventing the strains upon the couplings which arise when the brakes are released in one part of the train while they remain applied in another part of the train.

The appliances forming the subject of this invention for retaining some of the brakes applied near the head of the train during the release operation operate automatically to release said brakes at the head of the train as soon as the brakes have become released throughout the entire length of the train, and thus do not materially delay the operation of releasing the brakes, although they serve efficiently to prevent objectionable strains upon the couplings or connections of the train during the release operation.

Figure 1 is a diagram of a sufficient portion of an air-brake apparatus to illustrate this invention, and Fig. 2 is a sectional view of the appliances for causing the brakes at the head of the train to remain applied until the brakes throughout the remainder of the length of the train have been released in the operation of releasing the brakes.

Referring to Fig. 1 of the drawings, the main appliances of the air-brake apparatus may be of any suitable or usual construction and arrangement, they comprising the main reservoir M R, connected by pipe 2 3 with the engineer's valve E V, which controls admission of air to the train-pipe T P and discharge of air therefrom for the purpose of governing the action of the brakes in the usual manner, the said train-pipe communicating on each car with the triple valve T V, controlling the communications between the train-pipe and the auxiliary reservoir A R, and the brake-cylinder B C, forming a part of each car equipment, in the usual manner.

As the construction and mode of operation of an apparatus of this character is well known, it is unnecessary to make any detailed explanation of the apparatus, it being sufficient for an understanding of the appliances specially involved in the present invention to know that in the operation of the automatic air-brake system the brakes are applied by a reduction of train-pipe pressure, commonly effected by discharging air from the train-pipe through the engineer's valve, and that the brakes are released by increasing the train-pipe pressure by admitting air

from the main reservoir through the engineer's valve into the train-pipe, the initial slight increase in pressure in the train-pipe operating each triple valve to open the connected brake-cylinder to the exhaust, and thus cause the air to be discharged from the brake-cylinder, and also to establish a relatively small communication from the train-pipe to the auxiliary reservoir, so that the latter becomes recharged to the normal pressure carried in the system, which is commonly seventy pounds in freight-train equipments, this pressure being maintained throughout the train-pipe and auxiliary reservoirs of the train while the brakes are released or in running condition.

The appliances forming the subject of the present invention employed in coöperative relation with the usual air-brake appliances above referred to comprise means for preventing the release or retaining and, if need be, increasing the braking pressure in the brake-cylinder in one or more of the equipments near the head of the train and preferably in the equipment on the locomotive or tender, as that is always at the head of the train under normal conditions of running. The said appliances in the apparatus herein shown as an embodiment of the invention comprise a valvular appliance 4, interposed in the train-line at any point between the main reservoir and the brake equipment, the brake of which is to remain applied during the release operation until the remainder of the brakes on the train have been released, the said valvular appliance 4 being herein shown as interposed in the pipe 2 3 between the main reservoir and the engineer's valve, there being also shown a reducing-valve 5 between the main reservoir and the valvular appliance 4. The said reducing-valve is not herein claimed, as it has no essential operative relation to the appliances forming the subject of this invention. It serves to prevent the pressure in the train-line and appliances beyond the same from exceeding a predetermined amount for which the said valve may be set, while the pressure in the main reservoir may be maintained any desired amount in excess of the maximum thus determined for the train-pipe by the reducing-valve in order to provide an amount of air under high pressure for the purpose of recharging the system with reasonable promptness when the brakes are to be released after an application.

The valve proper, 50, of the reducing-valve is acted upon by the pressure coming from the main reservoir through passage 2 with a tendency to open the said valve, and the air-space leading to and communicating with the train-pipe for the air which has passed said valve 50 communicates by passage 51 with a pressure-chamber 52, in which it acts upon a diaphragm 53 in opposition to a spring 54,

the force of which may be set in accordance with the pressure desired to be carried in the train-pipe.

When the pressure of the air which has passed the valve 50 in the train-line exceeds the amount for which the spring 54 is set, it lifts the diaphragm 53, which operates as a valve controlling a passage 56, leading to a cylinder or piston-chamber 57, containing a piston 58 of larger area than the opening controlled by the valve 50, which piston is then forced down by the pressure entering the passage 56, and thus closes the valve 50, preventing further admission of air from the main reservoir to the train-pipe, so that the desired predetermined pressure in the latter is not materially exceeded. A vent-passage 59 is provided from the space below piston 58 to the atmosphere, and a small leak-passage 60 is provided from the space above said piston, the result being that when the pressure in the train-pipe falls below the predetermined amount for which the spring 54 is set the passage 56 is closed and the pressure escapes from above the piston 58 through leak-passage 60, permitting the train-pipe pressure on the valve 50 again to open the same and admit air to the train-pipe until the predetermined pressure is obtained therein, when the reducing-valve will act, as before described, to prevent the said pressure from being exceeded. A handled stem 62 is provided for moving the valve 50 positively, if need be.

The valvular appliance 4 controls a communication 6 from the exhaust-passage of the triple valve T V (see Fig. 1) of the brake equipment that is to remain applied during the release operation, the said exhaust-passage being the exhaust controlled by the triple valve from the brake-cylinder to the atmosphere, which is opened by the movement of the triple-valve piston in response to an increase in train-pipe pressure, as in the operation of releasing the brakes, and which remains open is the normal running condition while the brakes are released.

Referring to Fig. 2, the duct 6 from the exhaust-passage of the brake-cylinder and triple valve communicates, through valve appliances in the casing 7, the purpose of which will be hereinafter explained, with a port 8 in the seat of a valve 9, which in the position shown in full lines, Fig. 3, connects the said port 8 with the exhaust-passage 10, leading to the atmosphere. The said valve 9 is adapted to be operated by a piston or abutment 12, interposed in the train-line or main duct, through which the air flows from the main reservoir to the train-pipe in the operation of charging the train-pipe, the said piston 12 being loose-fitting or provided with passages through or around it, as indicated at 13, such that a moderate or slow flow of air (such as the flow to compensate for leak-

age of the train-pipe pressure and the flow which takes place while the auxiliary reservoirs are being recharged) may pass the piston without moving the same in opposition to the spring 14, which tends to retain the parts in the position shown in full lines, Fig. 2, in which the stem 15, connecting the valve 9 and piston 12, is held by the spring 14 against a stop 16. The cylindrical chamber or lining 17, in which the piston 12 works, is provided with lateral openings 18, such that when the piston 12 is moved to the dotted-line position the air can flow with comparative freedom past the periphery of the piston, as indicated by the dotted arrows. The movement of the piston 12 to the dotted-line position also moves the valve 9 to dotted-line position, cutting off communication between the exhaust-passage 6 from the triple valve and the exhaust-port 10 to the atmosphere and establishing communication between said exhaust-passage 6 and the interior of the valve-chamber 19 of the valve 9, which chamber is a part of the line of communication from the main reservoir to the train-pipe and contains air at train-pipe pressure.

The operation of the appliances thus far described is as follows, they affecting the action of the apparatus only in the release operation: In releasing the brakes the engineer's valve is manipulated to establish a comparatively free communication between the pipe 2 3, leading from the main reservoir, and the train-pipe T P, so that compressed air flows rapidly from the main reservoir into the train-pipe, the pressure in which is at this time below the normal by an amount determined by the braking force which has been produced in the preceding application of the brakes. The rapid flow of air from the inlet-passage 2 to the outlet-passage 3 of the valve appliance 4 produces sufficient excess of pressure upon the side of the piston 12 toward the inlet to cause the said piston to be moved against the force of the spring 14 to the dotted-line position, when a passage will be afforded through the openings 18 around the piston for the comparatively free flow of air. This movement of the piston 12 will move the valve 9 to the position to cut off communication with the exhaust-port 10 and to establish communication from the valve-chamber 19 and train-line through the pipe 6 to the exhaust-passage in the triple valve from the brake-cylinder of the equipment controlled by the appliances under consideration, the result being that in response to the movement of the triple-valve piston the brake-cylinder exhaust instead of being connected to the atmosphere, and thus exhausting the brake-cylinder pressure and releasing the brakes, is connected to the train-line, which thus tends to charge the brake-cylinder and prevents the brake-cylinder pressure from being re-

duced and the brakes from being released in that equipment. The parts will remain in this condition so long as the train-pipe is receiving air freely, which goes on until it has become charged throughout the entire length of the train sufficiently to move all of the triple valves to release position, and thereby to release the brakes, after which the slower flow of air employed in recharging the auxiliary reservoirs does not give sufficient rapidity of flow to produce sufficient pressure on the piston 12 to overcome the force of the spring 14, which will thereupon move the piston 12 back to the normal position shown in full lines, and the further relatively slow flow of air from the main reservoir to the train-pipe for fully recharging the auxiliary reservoirs will then take place through the passages in or around the abutment 12. When the piston thus moves to its normal position, it carries with it the valve 9, thereby connecting the exhaust-passage 6 from the brake equipment under consideration to the exhaust-port 10 and permitting the air to be exhausted from the brake-cylinder of said equipment when the train-pipe has become charged sufficiently to release the brakes throughout substantially the whole length of the train.

It will be observed that the timing of the release of the brake equipment subjected to the action of the special appliances is automatic and that the release will take place practically as soon as the brakes have been released throughout the train, whatever its length may be, and consequently the head portion of the train will remain retarded until the remainder of the train has become fully released, thereby eliminating the strains incident to the release of the brakes at the head of the train, while those at the rear remain applied.

The valve appliance 7, before mentioned, is for the purpose of governing the amount of braking pressure in the brake-cylinder of the equipment, which remains applied during the release operation. The said valve appliance is essentially a pressure-regulating valve comprising a valve proper, 20, controlling communication between the passages 6 and 8 and being shown in the form of a check-valve which would naturally be seated when the pressure in 8 is greater than the pressure in 6. The said valve 20 is acted upon by a spring 21, bearing upon a diaphragm or piston engaging the stem of the valve 20 and tending to retain the same open or unseated.

The diaphragm or piston 22 is subjected to the pressure in the passage 6 between the valve 20 and the triple valve and brake-cylinder, and the spring 21 is adjusted to balance a pressure on the diaphragm 22 substantially equal to the pressure which it is desired should be maintained in the brake-cyl-

inder of the equipment, the brakes of which are to be retained applied until the remainder of the brakes of the system have become released. The spring 21 may be set, for example, to balance a pressure of thirty-five pounds to the inch in the passage 6. If, therefore, the braking pressure is less than that amount at the time when the brakes are released, the opening of the valve 9 in the release operation, as before described, will permit air to flow from the train-line through the passage 8 and past the valve 20 into the passage 6 and brake-cylinder and will increase the braking pressure in said brake-cylinder until it rises to the desired predetermined amount, when the said pressure, acting upon the diaphragm 22, will overcome the spring 21 and lift the diaphragm, and thus permit the valve 20 to be seated and prevent further admission of air from the train-pipe to the brake-cylinder. As soon, however, as the valve 9 establishes communication with the exhaust-port 10 the brake-cylinder pressure, acting upon the valve 20, will unseat the same, and the brake-cylinder pressure will be exhausted, the spring 21 retaining the valve 20 open normally, so that no pressure is retained in the brake-cylinder. If the brake-cylinder pressure was greater than the predetermined amount at the time when the release operation was performed, the valve 20 would remain seated and the braking pressure then in the brake-cylinder would be retained until the brakes had been released throughout the train the same as before described.

It will be recognized that the closing of the exhaust from the equipment affected by the apparatus, as is done by the valve 9, would prevent the release of the brakes even if communication were not established from the train-line to the brake-cylinder and that a useful result would be obtained without the further provision for establishing communication from the train-line to the said brake-cylinder.

It is obvious that the appliances herein described do not depend for their operation upon the specific construction of the appliances of the air-brake system or equipment with which they are employed and that the invention is applicable to various forms of air-brake equipment of the general character of that herein described.

The term "train-line" is herein used to indicate substantially the entire line of communication in the system adapted to be supplied from the main reservoir.

What I claim is—

1. The combination with an automatic air-brake apparatus; of means responsive to flow of air into the train-pipe in the release operation for delaying the discharge of air from the brake-cylinder of one of the brake equipments, substantially as described.

2. The combination with the brake-cylinder of an automatic air-brake apparatus; of a valve controlling the exhaust from said brake-cylinder; and means responsive to flow of air through the train-pipe for operating said valve to close said exhaust while air is flowing through the train-pipe in the operation of releasing the brakes, substantially as described.

3. The combination with a brake-cylinder of an automatic air-brake apparatus; of a valve controlling a communication from said brake-cylinder to the train-pipe and to the atmosphere; and means responsive to flow of air through the train-pipe in the operation of releasing the brakes for moving said valve to cut off communication from the brake-cylinder to the exhaust, and establish communication with the train-pipe, substantially as described.

4. The combination with a brake-cylinder; of a valve controlling the exhaust from said brake-cylinder; a piston controlling said valve subjected to the flow of air for charging the train-pipe, and provided with passages for accommodating a relatively small flow of air; and a spring acting in opposition to the pressure of air upon said piston, as described, whereby the piston is moved in opposition to the spring only in response to a relatively large flow of air through the train-pipe such as takes place in the operation of releasing the brakes.

5. The combination with a brake-cylinder of an automatic air-brake apparatus; of a valve controlling a communication from said brake-cylinder to the train-pipe and to the atmosphere; means responsive to flow of air through the train-pipe in the operation of releasing the brakes for moving said valve to cut off communication from the brake-cylinder to the exhaust, and establish communication with the train-pipe; and a pressure-regulating valve in said communication from the train-pipe to the brake-cylinder adapted to be closed when the pressure in the brake-cylinder exceeds a predetermined amount.

6. The combination of a brake-cylinder, and a valve controlling the release of braking pressure therefrom, with an actuating-piston for said valve subjected to pressure of air flowing into the train-pipe, and a spring acting in opposition to said pressure; a relatively small passage for train-pipe air past said piston when in normal position, and a relatively large passage past said piston when moved by train-pipe pressure in opposition to said spring, release of braking pressure from said brake-cylinder being prevented by said piston when moved by the rapid flow of air into the train-pipe for releasing the brakes.

7. In an automatic air-brake apparatus, means responsive to the release operation for preventing the release of the brakes of one or

more equipments at the head of the train;  
and means responsive to the release of the  
remainder of the brakes throughout the  
train for causing the release of the brakes at  
5 the head of the train, for the purpose of pre-  
venting the pulling apart of the train during  
the release operation.

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

HENRY F. BICKEL.

Witnesses:

JAMES D. CARTIN,  
HERBERT L. KENAH