No. 806,455. PATENTED DEC. 5, 1905.

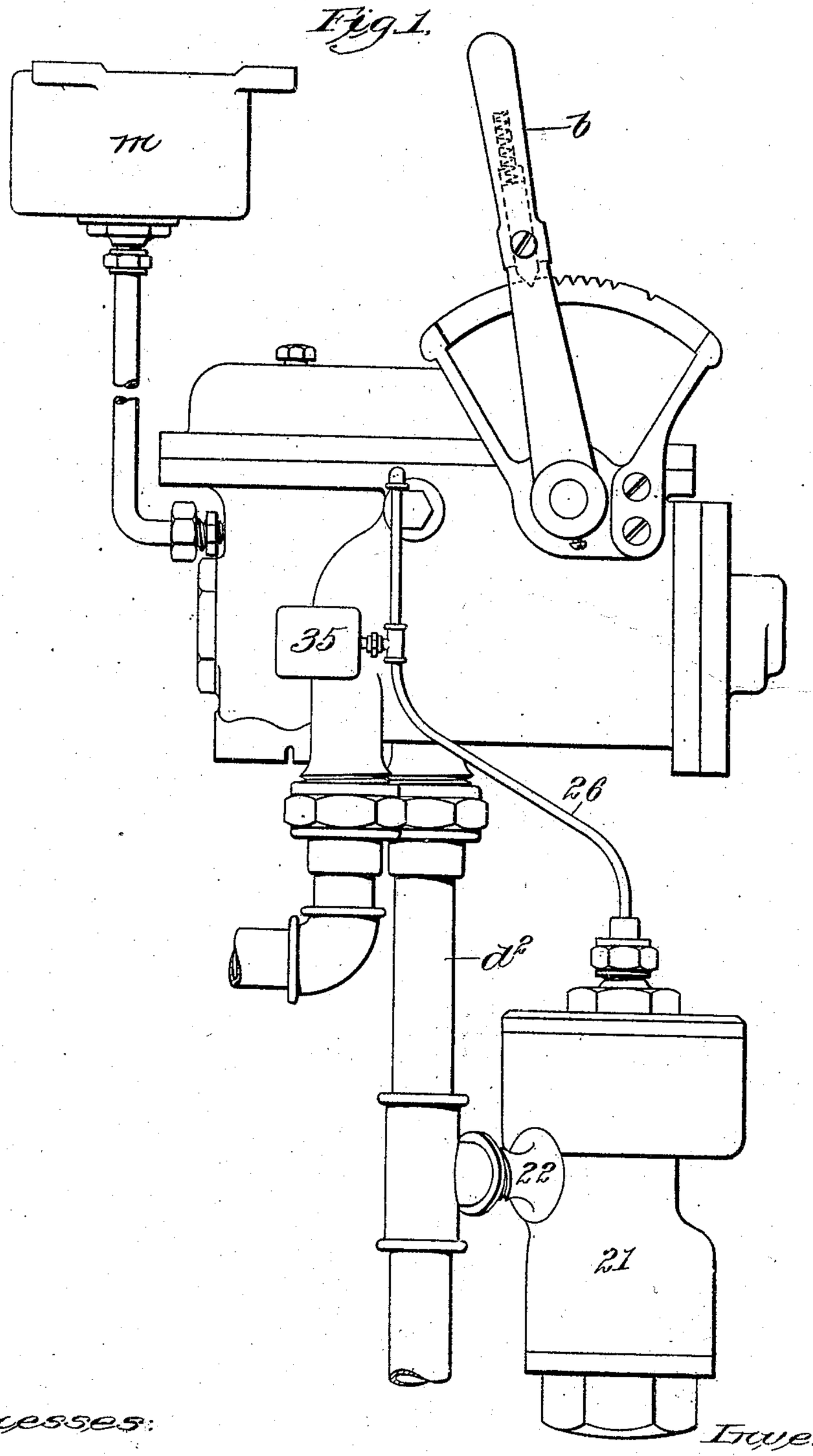
H. F. BICKEL.

ENGINEER'S BRAKE VALVE.

APPLICATION FILED APR. 10, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2,

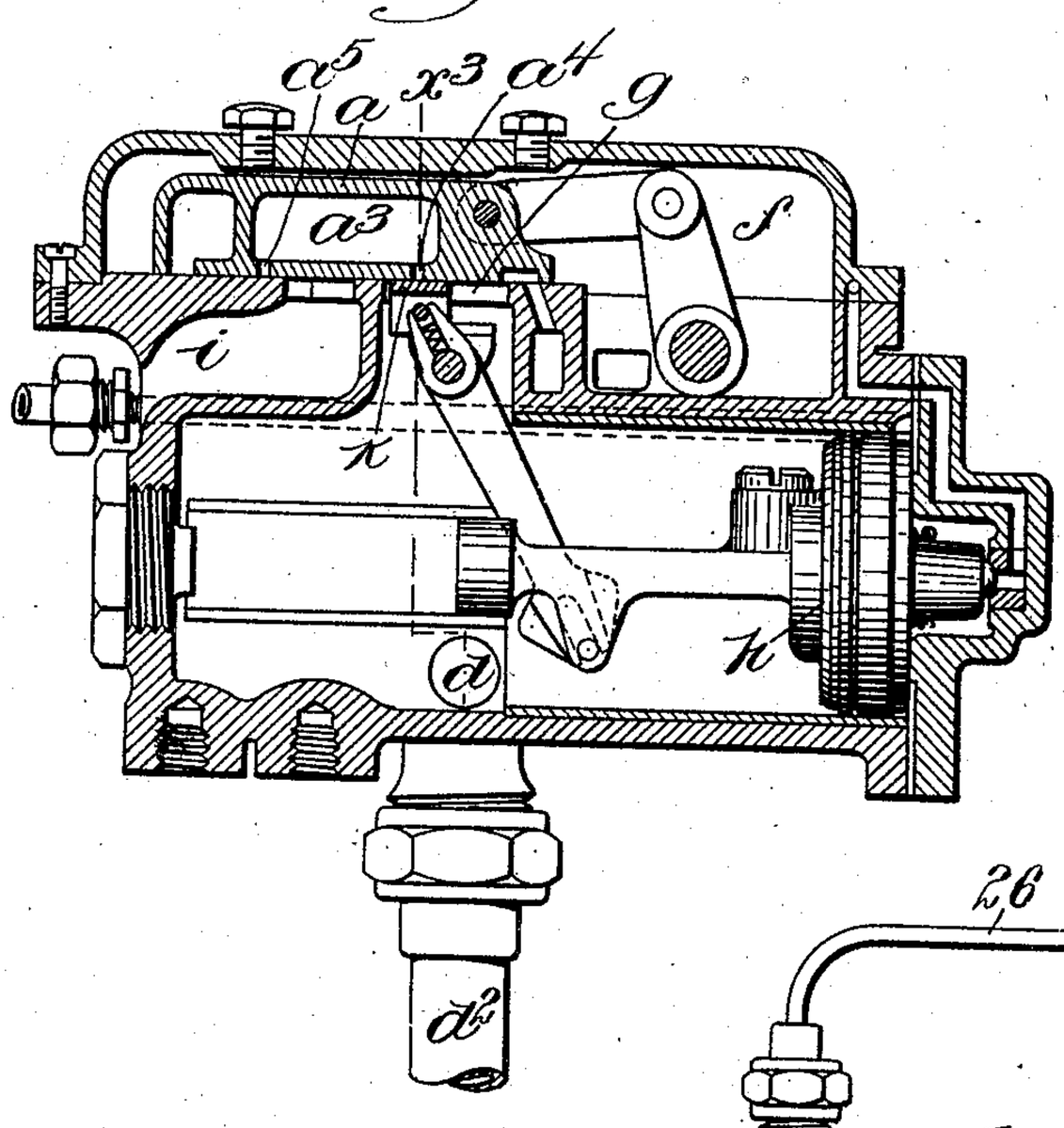



Fig. 3,

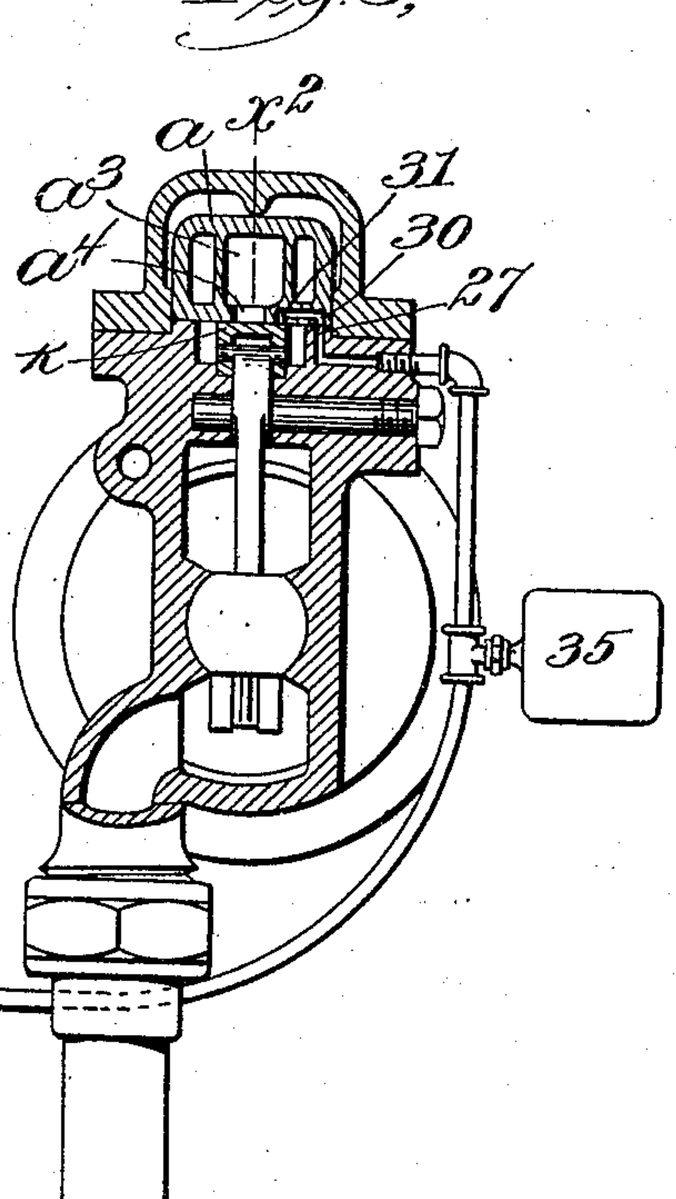



Fig. 4,

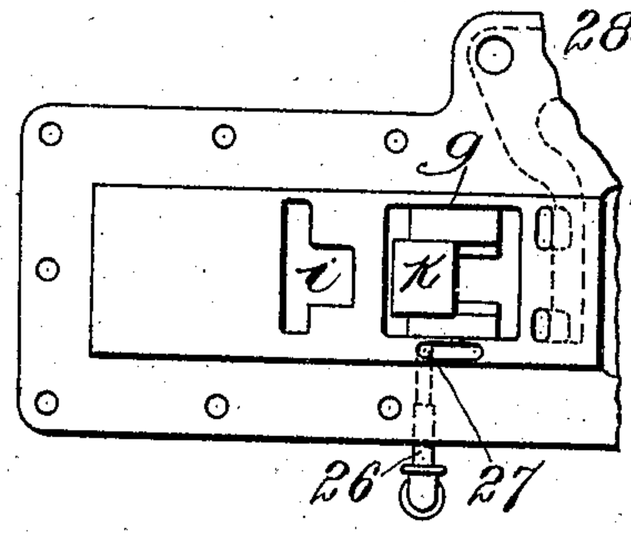
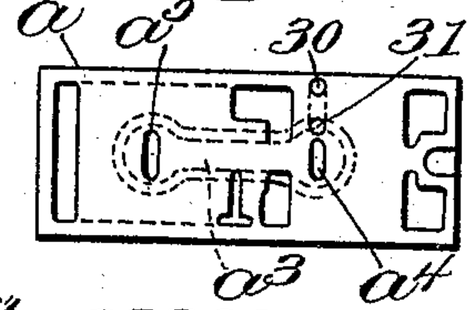



Fig. 5,

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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.

## ENGINEER'S BRAKE-VALVE.

No. 806,455. Specification of Letters Patent. Patented Dec. 5, 1905.

Application filed April 10, 1905. Serial No. 254,787.

*To all whom it may concern:*

Be it known that I, HENRY F. BICKEL, a citizen of the United States, residing in Plainfield, in the county of Union and State of New Jersey, have invented an Improvement in Engineers' Brake-Valves, 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 the appliances operated by or under the control of the engineer for controlling the brakes of an automatic system.

The invention is shown as employed in connection with an engineer's brake-valve of the character of that shown in Letters Patent to Vaughan and McKee, No. 504,290, dated August 29, 1893, and in patent to Robert C. Augur and Henry C. Bickel, No. 725,020, dated April 14, 1903, to which reference may be had, although the invention is applicable in whole or in part to engineers' valves of other constructions. The type of engineer's valve shown in said patents to illustrate a practical embodiment of the present invention is characterized by a cut-off valve for closing the escape-passage through which the train-pipe air is permitted to escape in the operation of applying the brakes, which cut-off valve is operated by a piston subjected to train-pipe pressure upon one side and upon the other side to the pressure of a determinate quantity of air which normally is under pressure equal to that of the train-pipe, and which when the train-pipe pressure is reduced moves the piston and causes the cut-off valve to be operated to close the train-pipe escape when the train-pipe pressure has been reduced the desired amount. The opening of the train-pipe escape-passage in engineers' valves of this type is effected by the movement of a hand-operated valve and opens an escape-passage of definite size which is subsequently closed gradually by the automatically-operated cut-off valve. The escape-passage thus opened in response to the manual act of the engineer is of a size determined in the construction of the valve and is made small in order to avoid danger of making too sudden a reduction in train-pipe pressure when said passage is opened, since if the reduction in train-pipe pressure is made too suddenly an emergency application of the brakes may be produced when only a moderate service application is desired. With the said train-pipe escape-passage made small enough to avoid danger of causing an emergency application of the brakes on a short train it will not reduce the train-pipe pressure sufficiently rapidly to effect a prompt service application of the brakes on a long train, because of the greater capacity of the train-pipe to be vented, and in the case of a very long train the reduction on one or more cars at the rear of the train in many instances is not rapid enough to take care of the flow of air from the auxiliary reservoir to the train-pipe through the feed-port of the triple valve, so that the brakes are not applied at all on such cars.

The object of the present invention is to provide, in combination with an engineer's valve, an auxiliary train-pipe-vent valve, hereinafter called an "accelerating-valve," which is automatically called into operation when used with a long train to open at a predetermined time an additional vent for escape of air from the train-pipe, so as to accelerate the reduction of train-pipe pressure, although by reason of the capacity of the train-pipe on a long train it will not reduce the train-pipe pressure with sufficient rapidity to cause an emergency application of the brakes to be made.

Figure 1 is a side elevation of an engineer's brake-valve provided with an accelerating-valve in accordance with the present invention. Fig. 2 is a longitudinal section on line $x^2$, Fig. 3, of the engineer's brake-valve, illustrating the application of the present invention thereto. Fig. 3 is a transverse section of the brake-valve on line $x^3$, Fig. 2, and of the accelerating-valve and its appurtenances for affording an additional train-pipe vent in accordance with the present invention when the train is long. Fig. 4 is a plan view of the valve-seat of the engineer's valve, and Fig. 5 is an underneath plan showing the seating-face of the hand-operated valve of the engineer's valve.

The main portion of the engineer's valve is shown as of the same construction as that forming the subject of patent to Augur and Bickel, No. 725,020, to which reference may be had for a full understanding of the construction and mode of operation of the valve, if desired.

For an understanding of the present case it is sufficient to point out that the various operations of admitting air to the train-pipe and

exhausting it therefrom for the purpose of controlling the brakes are produced by the main hand-operated slide-valve *a*, which works in a chamber *f*, supplied with compressed air from the main reservoir on the locomotive, said valve working on a seat over an opening *g*, communicating with a chamber below the valve, which is connected directly by passage *d* with the train-pipe $d^2$ of an automatic air-brake system, which may be of the well-known construction such as commonly used on steam-railroads in the United States. The movement of the slide-valve *a* by the engineer for applying the brakes establishes communication from the train-pipe through said opening *g* and passage $a^4$ in the face of the valve and passage $a^3$ in the body of the valve to another passage $a^5$ in the face of the valve which is by the same movement placed in communication with the exhaust-passage *i*, leading to the atmosphere, the result being that when the valve *a* is moved by the handle *b*, Fig. 1, a certain distance toward the right from the position shown in Fig. 2 air is permitted to escape from the train-pipe through the opening *g* in the valve-seat and the passages $a^4$ $a^3$ $a^5$ in the valve and the exhaust-passage *i* to the atmosphere. The escape of air from the train-pipe which is thus brought about by the movement of the slide-valve *a* is automatically stopped after the desired reduction in train-pipe pressure, the said stopping of the escape of air being effected by the cut-off valve *k*, working on the seating-face of the valve and closing the opening $a^4$, said cut-off valve being operated by a piston *h*, subjected on one side to train-pipe pressure and on the other side to the pressure of a confined body of air in the small reservoir *m*, Fig. 1. The capacity of the train-pipe-discharge passage $a^4$ employed for thus discharging the train-pipe air for making service applications of the brakes and of the corresponding discharge-passage in other constructions of engineer's valve is made small in order that the reduction in train-pipe pressure when said passage is open may not be rapid enough on short trains, where the train-pipe capacity is relatively small, to cause an emergency application of the brakes to be made. When made of such capacity, the reduction in train-pipe pressure on long trains is relatively slow on account of the greater capacity of the train-pipe and when, for example, the trains are of greater length than an ordinary passenger-train—as, for example, in long freight trains—the reduction in train-pipe pressure may be made too slowly to meet the requirements of an effective service application of the brakes, possibly rendering it necessary for the engineer to resort to an emergency application when a service application, if it could be more promptly made, would be sufficient and more suitable for the conditions under which the train is being stopped.

In accordance with the present invention an accelerating-valve is provided which is under control of the engineer's valve and also is controlled in its operation by the rate or rapidity of reduction in train-pipe pressure, being caused to operate to open an additional escape-passage from the train-pipe only when the reduction in train-pipe pressure through the usual discharge-passage $a^4$ in the engineer's valve is slower than is necessary to avoid danger of an unintentional emergency application of the brakes—as, for example, on trains of greater length than ten cars. The said accelerating-valve comprises a valve proper, 20, shown as of the puppet type, though it may be of other well-known types, and working on a seat in a chamber or casing 21, which may be applied at any point in the air-brake system where connection may be had with the train-pipe $d^2$ and with the engineer's valve and is preferably located in proximity to the engineer's valve, or it may be, if desired, incorporated in the actual structure of the engineer's valve.

The space in the chamber 21 below valve 20 communicates by passage 22 with the train-pipe $d^2$, the train-pipe pressure thus acting upon the valve 20 with a tendency to press the latter to its seat. The stem 23 of the accelerating-valve 20 passes through a discharge-passage 24, leading from the seat of the valve 20, and is connected with a piston 25, working in a cylinder connected by passage 26 to a port 27 (see Fig. 4) in the seat of the main slide-valve *a* of the engineer's valve. The space below the piston 25 is provided with an escape-passage 28 to the atmosphere, and the piston has a relatively small passage 29 through or around it, affording communication from the space in the cylinder connected by passage 26 with the engineer's valve to the side of the piston which is in communication with the atmosphere through the relatively large opening 28.

The passage 27 in the seat of the hand-operated valve *a* of the engineer's valve has a groove or port-opening extending lengthwise of the seat in the direction of movement of the slide-valve *a* and of such length as to be in connection with an opening 30 in the face of the valve *a* (see Fig. 5) in all of the positions of said valve occupied in making a service application of the brakes, said opening 30 being, however, out of register or communication with the port 27 and blanked by the valve-seat in the other positions of the slide-valve commonly known as "release" position, "running" position, "lap" position, and "emergency" position.

The opening 30 in the face of the valve communicates by a passage formed in the valve with an opening 31 through the face of the valve adjacent to the opening or passage $a^4$ through which train-pipe air escapes in making service applications of the brakes, the said opening 31 being in approximately the

same working relation to the cut-off valve *k* as the said service escape-passage $a^4$. In other words, the operation of the main valve *a* of the engineer's valve, which causes the train-pipe escape-passage $a^4$ to be opened, also causes the port 31 to be placed in communication with the train-pipe air in the space below the valve-seat and permits train-pipe air to flow to the ports 30 27 and thence to the passage 26 into the chamber or cylinder of the piston 25, connected with the accelerating-valve 20, so as to act upon the said piston in a direction to open the valve 20 in opposition to train-pipe pressure exerted thereon.

The size of the passage 31 30 27 26, leading to the piston-chamber, and the capacity of said piston-chamber, which may be conveniently increased by a reservoir or chamber 35, communicating therewith at any convenient point, is such as to require a predetermined interval of time before the pressure on the piston 25 becomes sufficient to overcome that upon the valve 20 and to cause the latter to open. Consequently, on comparatively short trains where the train-pipe pressure escaping through the passage $a^4$ falls rapidly, the cut-off valve *k* will be operated to close both the escape-passage from the train-pipe and the passage 31 30 27 26, leading to the accelerating-valve piston, before the said accelerating-valve has been opened, and consequently the said accelerating-valve will not be operated at all. If, however, the train-pipe pressure falls at a relatively slow rate, as on a long train, the pressure acting on the piston 25 will become sufficient to overcome the train-pipe pressure on the valve 20 and to open the latter, thus permitting train-pipe air to escape also past the said valve 20 and its stem 23, through the escape-passage 28, to the atmosphere. This additional escape of train-pipe air will thus accelerate the fall in train-pipe pressure; but the escape at $a^4$ will be closed by the cut-off valve *k* when the desired pressure reduction, determined by the amount of movement of the valve *a* toward the right, has been attained, and at the same time further admission of train-pipe air to act upon the piston 25 will be also cut off by the cut-off valve *k* closing the port 31, and the confined air acting upon the piston 25 will soon escape through the passage 29, thus permitting the accelerating-valve 20 to close gradually at about the same time that the normal train-pipe escape-passage $a^4$ is closed by the cut-off valve *k*.

The accelerating-valve 20 is shown as acted upon by a spring 32, tending to close the same, and obviously if the construction of the accelerating-valve were such that the train-pipe air or pneumatic pressure did not tend to close it the closing operation might be effected entirely by the action of a spring.

While for convenience of illustration the accelerating-valve has been herein shown as combined with an engineer's valve of a known type, it is obvious that an accelerating-valve of essentially the same character might be combined with engineer's valves of other construction.

The introduction of the accelerating-valve, in combination with the engineer's valve, does not necessitate any change in the mode of manipulating the latter and does not require any attention, since if the trains are of such length that its operation is not required the accelerating-valve will not be opened nor affect the control produced by the engineer's valve in any way, while, on the other hand, if the trains are of such length as to render the more rapid escape of air desirable the accelerating-valve is called into action and affords the desired increase in the rate of reduction of train-pipe pressure.

The mode of operation of an accelerating-valve, in combination with an engineer's valve, as herein described, to open an additional discharge-passage from the train-pipe after a certain period of discharge of train-pipe air through the engineer's valve in the usual manner is of great advantage, as it causes the brakes to be applied moderately at the head of a long train at the beginning of the operation, while train-pipe air is discharging only through the engineer's valve, and thereafter causes the brakes to be applied more rapidly and forcibly throughout the train when the additional vent from the train-pipe is afforded by the opening of the accelerating-valve. The moderate application at the head of the train checks its speed relatively to the rear part, so that the slack in the couplings is all taken up without severe shock before the more rapid and powerful application of the brakes is produced.

I claim—

1. The combination with an engineer's valve of an air-brake apparatus having instrumentalities for controlling the escape of air from the train-pipe; of an accelerating-valve controlling an additional escape-passage from the train-pipe; and means for actuating said accelerating-valve by pressure responsive to the appliances for controlling the escape of air through the engineer's valve, substantially as described.

2. The combination with an engineer's valve of an automatic air-brake system having instrumentalities for controlling the escape of air from the train-pipe, and an automatically-operating valve to close the train-pipe-air-escape passage; of an accelerating-valve controlling an additional escape-passage from the train-pipe; and an actuating-piston therefor subjected to pressure from the main pipe through a passage controlled by the said automatically-operated valve, substantially as and for the purpose described.

3. The combination with the engineer's valve of an automatic air-brake apparatus hav-

ing instrumentalities for controlling the escape of air from the train-pipe, of an accelerating-valve controlling an additional escape-passage from the train-pipe; an actuating-piston for said accelerating-valve working in a chamber open to the atmosphere at one side of said piston, and communicating at the other side with the train-pipe while air is being discharged from the train-pipe at the engineer's valve; and a relatively small passage for communication from one to the other side of said piston, substantially as and for the purpose described.

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

HENRY F. BICKEL.

Witnesses:
R. P. CONRAD,
E. MCGARRAH.