H. F. BICKEL.

AIR BRAKE APPARATUS.

APPLICATION FILED JUNE 1, 1908.

962,546. Patented June 28, 1910.

Fig. 1.

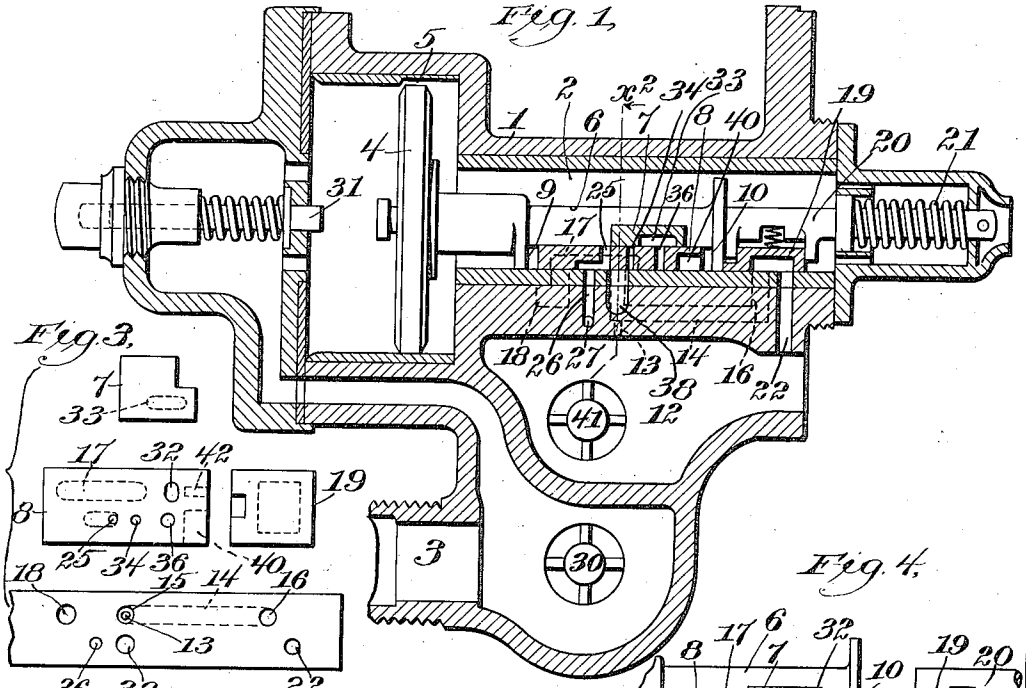


Fig. 3.

Fig. 2.

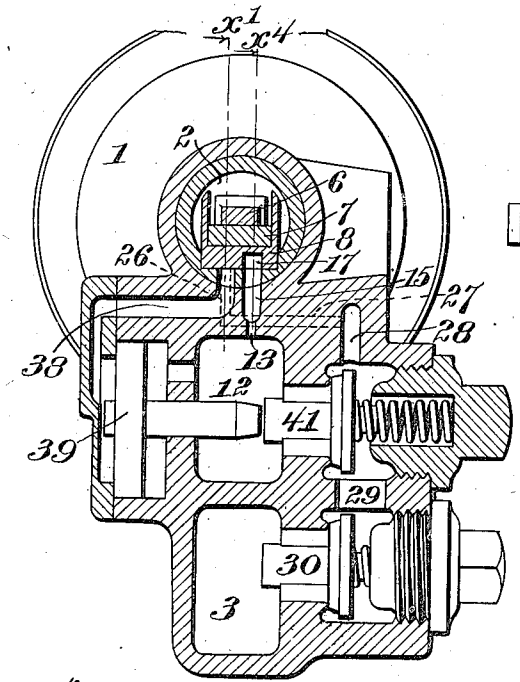


Fig. 4.

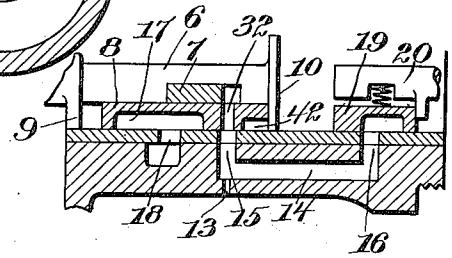


Fig. 5.

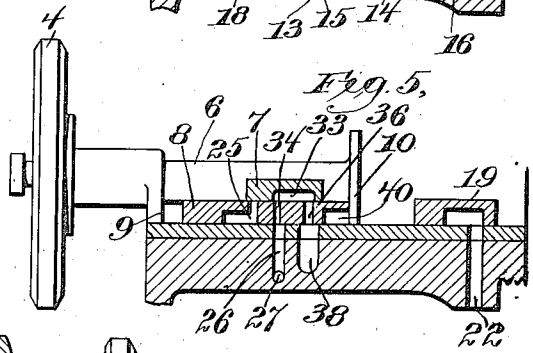
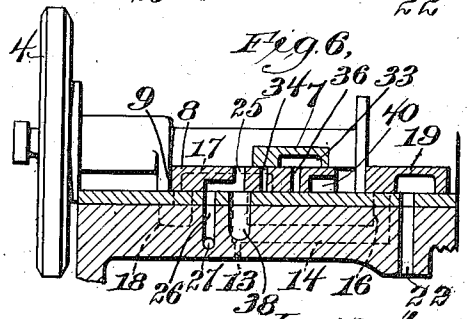


Fig. 6.



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UNITED STATES PATENT OFFICE.

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AIR-BRAKE APPARATUS.

962,546. Specification of Letters Patent. Patented June 28, 1910.

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To all whom it may concern:

Be it known that I, HENRY F. BICKEL, a citizen of the United States, residing in New York, in the county of New York and State of New York, 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 automatic air brake apparatus and consists in novel features of construction of the triple valve.

One of the objects of the invention is to control the exhaust of air from the brake cylinders in the releasing operation in such manner that the release of the brakes near the head of a train is retarded or delayed relative to that of the brakes toward the rear of the train. This is especially desirable on long trains when the brakes are released while the train is running, as it tends to keep the train bunched together at the couplings, the cars at the forward end of the train remaining retarded until those at the rear end are fully released. This result is accomplished by the employment, in combination with the triple valve proper and graduating valve operated by the triple valve piston in the usual manner, of a supplemental or exhaust controlling valve which is operated when the train pipe pressure is strongly in excess of auxiliary reservoir pressure, in such manner as to shut off the main exhaust passage from the brake cylinder and to leave effective only an exhaust passage of relatively small capacity, so that the air will be exhausted from the brake cylinder relatively slowly, as compared with the exhaust in the equipment in which the exhaust controlling valve has not been thus operated. On a long train, the train pipe pressure, when admitted for the purpose of releasing the brakes, will not rise to so high a point toward the rear end of the train, as near the front end, by reason of the friction in the train pipe, with the result that, at the beginning of the release operation, the exhaust controlling valve will be operated by the greater preponderance of train pipe pressure over auxiliary reservoir pressure on the cars near the head of the train, (the first twenty cars, more or less,) while on the cars farther to the rear the preponderance of train pipe pressure over auxiliary reservoir pressure will not be sufficient to operate the exhaust controlling valve, but will operate the main valve in the usual manner to open the main exhaust from the brake cylinders, causing them to release the brakes promptly, while the brakes at the head of the train are releasing more slowly through the smaller exhaust passage only, and, therefore, keep the forward part of the train retarded until the cars toward the rear have run forward enough to take up the slack in the couplings, as is desired in the release operation. Provision is also made in the main valve and graduating valve of the triple valve whereby the air is admitted from the train pipe to the auxiliary reservoir for recharging the latter through an additional passage, besides the usual feed groove past the triple valve piston, and whereby air is admitted from the train pipe directly to the brake cylinder in making service applications of the brakes.

Figure 1 is a longitudinal section, on line x^1, Fig. 2, of a triple valve for an automatic air brake apparatus embodying this invention, with the parts in the position occupied when the brakes are released, which will be referred to as the normal position; Fig. 2 is a transverse section thereof on line x^2, Fig. 1; Fig. 3 is a plan view of the valve seat and of the several movable valves; Fig. 4 is a longitudinal section, on line x^4 of Fig. 2, but with the parts in the position occupied in making a service application of the brakes; Fig. 5 is a longitudinal section on line x', Fig. 2, also with the parts in the position occupied in making a service application; and Fig. 6 is a longitudinal section, on line x' of Fig. 2, with the parts in the position occupied in making a slow release of the brakes.

In its main working elements the triple valve is similar to those that have been in extensive use. It comprises a main body or shell 1, having a space or chamber 2 communicating with the auxiliary reservoir, and a space or chamber 3 communicating with the train pipe, and containing the triple valve piston 4 which is subjected to train pipe pressure on one side (the left hand, as seen in Fig. 1), and to auxiliary reservoir pressure at the other side. There is a feed groove 5 which affords communication past the piston 4 when near the limit of its movement toward the right hand, as shown in Fig. 1, through which air may feed from the

train pipe into the auxiliary reservoir until the latter is charged to the same pressure as that in the train pipe. The rod or stem 6 of the triple valve piston 4 engages with the graduating valve 7 so as to move the same upon the main valve 8 when the triple valve piston is moved by the preponderance of pressure upon one or the other side thereof, and the said piston stem 6 has shoulders 9 and 10 which receive the main valve 8 between them, but are farther apart than the length of said main valve, so that the piston and graduating valve may have a movement independent of the main valve until one or the other of the said shoulders engages the said main valve and causes it to accompany the piston and graduating valve in the further movement.

The features thus far described are substantially the same as have been heretofore employed, and operate in the usual manner to perform the usual functions, namely to control the flow of air relative to the train pipe, auxiliary reservoir, brake cylinder, and atmosphere, by passages contained in and controlled by the said valves which will be hereinafter described.

Referring now to the novel or distinctive features of the construction of the triple valve appliance, the space or chamber 12 below the seat of the main valve 8, communicates with the brake cylinder in the usual manner, and also communicates through the small passage 13 with the brake cylinder supply and exhaust port 14 having openings 15 and 16 in the valve seat, the opening 15 being controlled by the main valve 8 which has a cavity 17 (see Figs. 3 and 4) which, in the release position of the main valve 8 (either the usual or normal release position, or the slow release provided for, as hereinafter described) connects the brake cylinder port 14 at the port opening 15 with the exhaust port 18 leading to the atmosphere, or other point for discharge of air from the brake cylinders. The port opening 16 from the brake cylinder port 14 is controlled by a supplementary or exhaust controlling valve 19 which is engaged by shoulders on a stem or plunger 20 acted upon by a spring 21 which tends to retain the said valve 19 in the position shown in Fig. 1, but yields to permit the valve to be moved toward the right to the position shown in Fig. 6, when acted upon by a sufficient pressure to overcome the force of said spring. When the exhaust controlling valve 19 is in its normal position, as shown in Fig. 1, its cavity connects the passage 14, 16 with a passage 22 of relatively large capacity as compared with the passage 13, leading to the brake cylinder chamber 12, so that with the parts in normal position, as shown in Fig. 1, there is a free exhaust from the brake cylinder, through the passage 22, valve 19, passages 16, 14, 15, and cavity 17 in the main valve 8, to the final exhaust 18, and with the parts in this position the air will exhaust rapidly from the brake cylinder and cause a prompt release of the brakes pertaining thereto. The stem 6 of the triple valve piston 4, when moved toward the right by preponderance of train pipe pressure over auxiliary reservoir pressure, engages the stem 20 of the exhaust controlling valve 19, and if train pipe pressure is only moderately greater than the auxiliary reservoir pressure, the spring 21 will cause the triple valve piston to be arrested in the position shown in Fig. 1, and air will feed through the feed groove 5 past the piston from the train pipe into the auxiliary reservoir in the usual manner, while the exhaust from the brake cylinder will take place promptly through the passage 22 and controlling valve 19, and passages 16, 14, 15, 17, 18, as before described, as well as through the small passage 13 into the passage 14, and thence to the final exhaust passage 18. If, however, train pipe pressure preponderates more strongly over auxiliary reservoir pressure, it will cause the spring 21 to be compressed, and will admit of the further movement of the piston 4 to the extreme right of its traverse, to the position shown in Fig. 6, carrying with it the exhaust controlling valve 19 which, by this movement, will close the opening 16 into the exhaust passage 14, and thus render the passage 22 non-effective, and the exhaust from the brake cylinder will be only through the small passage 13 into the passages 14, 15, 17 and 18, so that the brakes will be released relatively slowly.

It is to be observed that the exhaust cavity 17 in the main valve 8 is of such size and location that it effectively connects the passages 15 and 18 when said valve 8 is moved only to the position (against the shoulder 9, as seen in Fig. 1) at which the triple valve piston is arrested by engagement with the stem 20 of the exhaust controlling valve, as when train pipe pressure does not preponderate over auxiliary reservoir pressure sufficiently to overcome the spring 21, and also when the said main valve is in the position to which it is carried by the shoulder 9 when the train pipe pressure on the triple valve piston preponderates sufficiently to compress the spring 21 and shift the exhaust controlling valve 19, as shown in Fig. 6, as well as when said valve 8 is at any point between these positions.

It will be recognized that the action of the exhaust controlling valve 19 is automatic, and that in the release operation it will be shifted on the cars near the head of the train, because of the greater preponderance of train pipe pressure over that in the auxiliary reservoir, while, toward the rear part of the train where the preponderance of

train pipe pressure is less, by reason of the friction in the train pipe, and of the feeding of air into the auxiliary reservoirs toward the head of the train, it will be insufficient to overcome the spring 21, and, in the release operation, the parts will move merely to the position shown in Fig. 1 (except that the main valve 8 will be against the shoulder 9) and the air will be exhausted from the brake cylinders promptly and practically the same as in the operation of triple valves heretofore commonly used. In those equipments near the head of the train in which the exhaust controlling valve 19 has been shifted by a preponderance of train pipe pressure, as above described, the spring 21 will act to shift the said valve 19 back to the normal position, carrying the triple valve piston 4 and the graduating valve 7 with it in this movement, as soon as the auxiliary reservoir is charged to approximately the same pressure as that in the train pipe, so that the parts will stand in the position shown in Fig. 1 when the brakes are released and the system is charged, or in normal condition ready to make another application of the brakes.

The various ports and passages controlled by the main valve 8 and graduating valve 7 may be best understood by pointing out the ones that are effective and describing their functions in the different positions of the valves, taken in the different operations of the brakes in service.

In the normal or release position shown in Fig. 1, or in the slow release position in which the piston 4 has made its extreme movement toward the right, a feed passage 25 (see Fig. 6) in the main valve is uncovered by the graduating valve 7, and is in communication with a passage 26 in the main valve seat, which communicates by passage 27 (shown in dotted lines in Fig. 2) with a passage 28 communicating with a space or chamber 29 which communicates by a passage controlled by a check valve 30 with the space or chamber 3 that communicates with the train pipe, so that train pipe pressure, being in preponderance over auxiliary reservoir pressure, opens the check valve 30, and air feeds past the same into the chamber 29, and thence through passages 28, 27, 26, 25 into the main chamber 2 of the triple valve that communicates with the auxiliary reservoir which is thus charged more rapidly than would be the case if replenished only through the usual feed groove 5. The check valve 30 prevents back flow from the auxiliary reservoir into the train pipe, so that the effect of auxiliary reservoir pressure to move the triple valve piston toward the left from the position shown in Fig. 1 when the train pipe pressure is reduced is not impaired.

In order to make a service application of the brakes the train pipe pressure is reduced, as usual, a greater or less amount, according to the force of application desired, and such reduction leaves the pressure in the auxiliary reservoir in preponderance, so that it forces the piston 4 toward the left, to the point where it is arrested by the spring pressed plunger 31 which prevents further movement of the piston when the reduction in train pipe pressure is made relatively slowly, as in service applications. In this movement of the triple valve piston 4, the graduating valve 7 moves on the main valve 8 until the shoulder 10 of the piston rod engages the main valve, after which the latter moves on the main valve seat without further change in relative position of the main and graduating valves, the valves coming to the position shown in Figs. 4 and 5. The movement of the graduating valve on the main valve uncovers the through port 32 in the main valve (see Fig. 4) and also brings the cavity 33 in the graduating valve in position to connect the through passage 34 in the main valve with the passage 36 therethrough, as shown in Fig. 5. With the main and graduating valves in this position, the movement of the main valve on its seat brings the passage 32 therethrough into communication with the passage 15 in the valve seat, (see Fig. 4) so that air from the auxiliary reservoir may pass by the graduating valve through the passage 32 in the main valve into the passage 15, and thence by passage 13 and by passages 16 and 22 and the cavity in the exhaust controlling valve 19, into the chamber 12, and thence into the brake cylinder, and thus cause the brakes to be applied by pressure from the auxiliary reservoir in the usual manner. At the same time, the passage 34 through the main valve (see Fig. 5) has been brought into communication with the passage 26, and the passage 36 into communication with the passage 38 in the valve seat, which passage 38 leads to one side of the emergency piston 39, as shown in Fig. 2, the space at the other side of said piston communicating with the chamber 12 that is connected with the brake cylinder. As before explained, the passage 26 communicates with the train pipe space 3 under control of the check valve 30, and, consequently, since train pipe pressure is in excess of brake cylinder pressure, air will pass from the train pipe through the check valve 30, into chamber 29, and by the passages 28, 27, 26, 34, 33 (in the graduating valve) 36 and 38, and thence past the emergency piston, which has a loose fit in its cylinder or small passage past it, into the chamber 12 and brake cylinder, which thus receives pressure from the train pipe, as well as from the auxiliary reservoir in making a service application. Some part of the passage for air from the train pipe to the brake cylinder above de-

scribed must be made relatively smaller than the brake cylinder, as, for example, by making the through port 34 in the main valve of the passage from the auxiliary reservoir to sufficiently small size, so that in charging the brake cylinder the pressure in the auxiliary reservoir will fall more rapidly than that in the train pipe, and as soon as the auxiliary reservoir pressure thus falls a trifle below the train pipe pressure, the preponderance of the latter on the piston 4, will move the same toward the right, and in so doing, will shift the graduating valve 7 on the main valve 8, but the latter will not be disturbed, but will arrest the piston by the shoulder 9, as preponderance of train pipe pressure is only sufficient to move the graduating valve, which, in this movement, closes the through port 32 (Fig. 4) and thus prevents further passage of air from the auxiliary reservoir into the brake cylinder, and also closes the through port 34 (Fig. 5) and thus prevents further passage of air from the train pipe into the brake cylinder, so that the parts remain with the slight preponderance of train pipe pressure over auxiliary reservoir pressure on the triple valve piston which causes this movement of the graduating valve to take place. The parts remain in this position with the brakes applied with a force dependent upon the amount of reduction in train pipe pressure that was made until some further change of train pipe pressure is made, either a further reduction to increase the braking pressure which will result in a movement of the triple valve piston and graduating valve to the position in which they again establish communication through the passages 32 and 34, as before described, or an increase in train pipe pressure which causes the piston to be moved to the right, and the air to be exhausted from the brake cylinders and the auxiliary reservoirs to be recharged, as has been previously described.

In order to make an emergency application of the brakes, the train pipe pressure is suddenly reduced, leaving the auxiliary reservoir pressure greatly in preponderance so that the piston 4 makes its traverse toward the left promptly, and upon encountering the spring pressed plunger 31 compresses the spring thereof and moves a short distance beyond the position above described which it occupies in making service applications. In this further movement, the main valve, which is recessed at 40, uncovers the port 38, so that the auxiliary reservoir pressure is admitted to act upon the emergency piston 39, (see Fig. 2) and moves it forcibly toward the right, from the position shown in Fig. 2, so that it opens the spring pressed emergency valve 41 controlling communication between the chamber 29 and the brake cylinder chamber 12, so that train pipe pressure in the chamber 3 opens the check valve 30 and passes through chamber 29 and past valve 41 into the chamber 12, and thence into the brake cylinder. At the same time, the recess 42 in the main valve uncovers the port 15 in the valve seat, so that air flows from the auxiliary reservoir through said recess 42 into the port 15 and thence into the port 14, and thence into the brake cylinder, the same as in the service application before described. The opening of the emergency valve 41 and flow of train pipe air into the brake cylinder, as has been described, is practically instantaneous, and as soon as the pressure in the train pipe falls below that in the brake cylinder, the check valve 30 closes, and with the piston 4 cuts off the train pipe completely from the communication with the auxiliary reservoir and brake cylinder, so that air is confined therein, and when equalized in the auxiliary reservoir gives the maximum pressure obtainable in the latter.

Claims.

1. In a triple valve for an automatic air brake apparatus, the combination of the main valve governing the exhaust of air from the brake cylinder, and an independently movable exhaust controlling valve and a triple valve piston adapted to actuate both the said valves whereby the exhaust may be caused to take place through passages of different capacity dependent upon the preponderance of pressure acting upon said triple valve piston, substantially as and for the purpose described.

2. The combination of the main valve and its actuating piston of a triple valve, with an independently movable brake cylinder exhaust controlling valve; and an actuating spring therefor, said controlling valve being adapted to be actuated by the triple valve piston and said actuating spring, substantially as described.

3. In a triple valve for an automatic air brake apparatus, the combination of the main valve and its actuating piston, and an independently movable spring-actuated exhaust controlling valve; of passages communicating with the brake cylinder and controlled by said main and exhaust controlling valves, whereby exhaust passages of different capacity for discharge of air from the brake cylinder are provided, substantially as and for the purpose described.

4. In a triple valve for an automatic air brake apparatus, the combination of the main valve and its actuating piston and an independently movable exhaust controlling valve; of a brake cylinder exhaust and supply passage having port openings in the seat of said main and exhaust controlling valves, said brake cylinder passage comprising a relatively small passage constantly in communication with the port opening into the

main valve seat and a relatively large passage controlled by the exhaust controlling valve, said exhaust controlling valve being actuated by a spring and by the triple valve piston, and being moved to close the relatively large passage when the triple valve piston is acted upon by sufficient preponderance of train pipe pressure to overcome the force of said spring, substantially as described.

5. In a triple valve for an automatic air brake apparatus, the combination with the main valve and its actuating piston governing communications between the train pipe, auxiliary reservoir, brake cylinder, and atmosphere; of an independent brake cylinder exhaust controlling valve controlled by said piston which provides a relatively large exhaust passage from the brake cylinder when train pipe pressure preponderates a predetermined amount above auxiliary reservoir pressure; and causes a relatively small exhaust passage only to be afforded when the train pipe pressure preponderates a greater amount, whereby in the release operation the brakes are released less promptly at the head than at the rear portion of a train.

6. In a triple valve for an automatic air brake apparatus, the combination of the main valve governing the exhaust of air from the brake cylinder with an independently movable exhaust controlling valve whereby the exhaust may be caused to take place at one time through a passage of large capacity, and at another time through a passage of small capacity only, 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:
E. A. JOHNSON,
E. G. PIERCE.