W. HILDEBRAND.

TRIPLE VALVE FOR SINGLE CHAMBER COMPRESSED AIR BRAKES.

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1,425,477. Patented Aug. 8, 1922.

Fig. 1

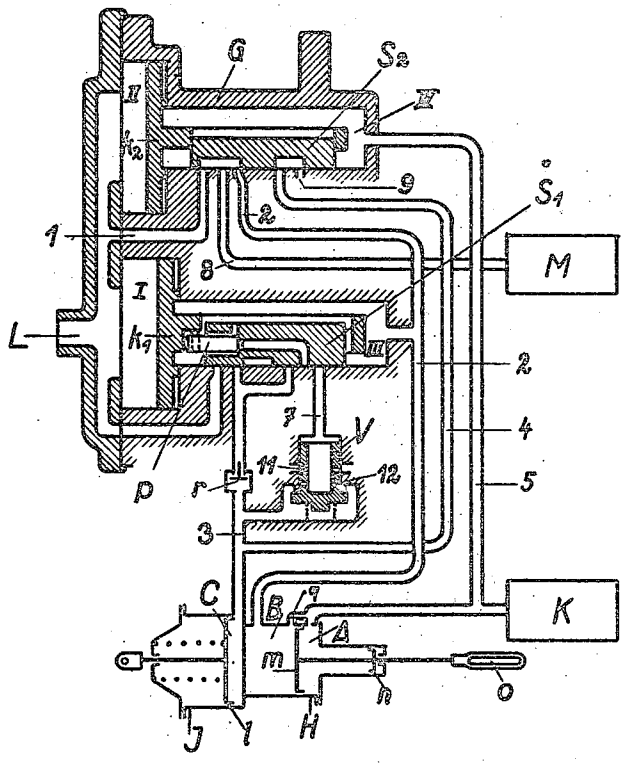


Fig. 2

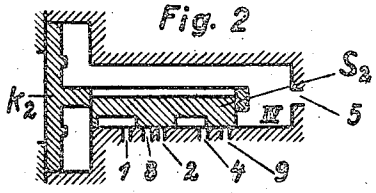


Fig. 3

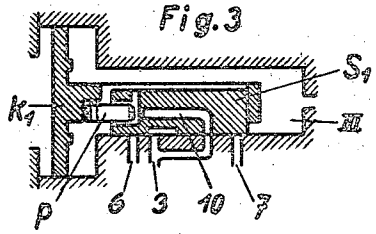
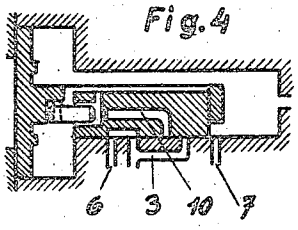


Fig. 4



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TRIPLE VALVE FOR SINGLE-CHAMBER COMPRESSED-AIR BRAKES.

1,425,477. Specification of Letters Patent. Patented Aug. 8, 1922.

Application filed August 26, 1921. Serial No. 495,513.

To all whom it may concern:

Be it known that I, WILHELM HILDEBRAND, a German citizen, residing at Neue Bahnhofstrasse 9–17, Berlin-Lichtenberg, Germany, have invented certain new and useful Improvements in Triple Valves for Single-Chamber Compressed-Air Brakes, of which the following is a specification.

This invention relates to a triple valve for a single chamber compressed air brake, of the kind in which the auxiliary air reservoir is divided by a dividing piston into two chambers the volume of which can be varied and which therefore permits in addition to a graduated intensification of the action of the brake of a graduated release thereof also and a constructional form of which is shown by way of example in Figure 1 of the specification of German Patent 291179.

In the known triple valves for such brakes both the operation of applying or putting on the brake and also that of releasing or taking it off is controlled by a common controlling device, which consists of two slide valves, viz, a main and a graduator valve, which are placed one above the other and operated by a common controlling piston.

In the known quick-action and passenger train brake of the Kunze-Knorr constructional type, the triple valve of which is based on this principle, the slide valves, owing to the considerable dimensions of the brake cylinders, are rather large, with the result that there is produced between them owing to the high working pressure of about five atmospheres, a large amount of friction, which in actual practice, leads frequently to inconveniences, inasmuch as owing to this friction the main valve is prematurely carried along with the graduator valve when the brake is put on, that is to say before the graduator valve has completed the travel required by the play provided between the main valve and the rear contact face of the frame-shaped piston rod of the controlling piston. This phenomenon is manifested in an undesirable manner on the action of the brake which consequently and naturally takes place in a manner different to that corresponding to the intention of the engine driver working the brake.

According to this invention this disadvantage is obviated by providing the triple valve with a separate controlling device for both the operation of putting on and taking off the brake, the two controlling pistons which operate these controlling devices being connected on one side with the main train pipe and therefore always exposed on this side to the pressure in the main train pipe, while the slide valve chamber, in which the controlling device which regulates the operation of putting on the brake is contained, is connected to that chamber of the auxiliary air reservoir which furnishes compressed air to the single chamber brake cylinder when the brake is put on, while on the contrary the slide valve chamber for the controlling device which regulates the operations of taking the brake off is connected to the other chamber of the auxiliary air reservoir. This arrangement affords the additional advantage that two separate positions of the brake, a working and a quick-action position can be provided, without there being any fear of an unintentional jumping of the controlling device out of the working brake position into the quick-action brake position, because the comparatively small contents of the chamber of the auxiliary air reservoir which supplies compressed air to the single chamber brake cylinder when the brake is put on, suffers a large amount of expansion, so that its pressure, which decreases only slowly when the brake is normally applied, is by no means capable of overcoming the pressure in the main train pipe acting on the other side of the controlling piston.

As it is possible, owing to this distribution of the work to two different controlling devices, to make these, which according to this invention are constructed in the form of slide valves, of smaller dimensions than has been possible where main and graduator slide valves are employed, the total frictional work which has to be performed is also less than in the type of construction which has hitherto been usual.

A constructional form of the invention is illustrated in the drawing by way of example as applied to a single chamber brake, the auxiliary air reservoir of which is divided into two variable chambers by a dividing piston, which under certain circumstances acts as a brake piston.

Figure 1 shows a triple valve according to

the present invention in section, in conjunction with the corresponding brake apparatus, diagrammatically shown, in the filling or release position.

Figure 2 shows the device for controlling the taking off of the brake in the position which it assumes each time the brake is applied.

Figure 3 shows the controlling device for regulating the operation of putting on the brake in the working brake position.

Figure 4 shows the same in the quick-action position.

The triple valve G is connected at L to the continuous main train pipe. It has the two piston chambers I and II which are in open connection with the main train pipe and in which are contained the two controlling pistons k^1 and k^2. The piston k^1 is connected in the well known way with a certain amount of play to the slide valve S^1, which regulates the operation of putting the brake on. The piston k^2 on the contrary, is rigidly connected to the slide valve S^2 which serves to regulate the operation of taking the brake off. J is the well known single chamber brake cylinder with the piston l. H is the air reservoir, which is divided by the piston m into two chambers A and B. K is a chamber which is connected to the auxiliary air reservoir and increases the chamber A. M is a receiving chamber which in the release position is connected to the main train pipe and accelerates the release of the brake after it has been applied. p is the graduator valve provided in the well known way in the main slide valve; r is a non-return valve built into the pipe 3 leading to the brake cylinder J. V is a valve the purpose and action of which will be more fully described hereafter.

The action of the apparatus is as follows:

Supposing the brake to be charged and the controlling devices in the release position shown in Figure 1, compressed air will be allowed to escape from the main train pipe L in the well known way through the driver's brake valve for the purpose of initiating an application of the brake. At every drop in the pressure in the main train pipe the controlling piston k^2 assumes the position shown in Figure 2, in which it shuts off all the ports controlled by it. It receives its movement from the pressure in the auxiliary reservoir which acts on its right hand side, as the chamber IV is connected by the pipe 5 to the chamber K and the chamber A of the auxiliary air reservoir H. The controlling piston k^1, which regulates the admission of the compressed air to the single chamber brake cylinder when the brake is applied, has assumed on a so-called working application of the brake the position shown in Figure 3 in consequence of the fall of pressure in the main train pipe. At the same time the graduator valve p provided in the controlling slide valve S^1 has first opened, and the controlling slide valve has then moved so far towards the left that the port 10 in it controlled by the graduator valve is brought into register with the right hand branch port of the passage 3 leading to the single-chamber brake cylinder. The compressed air flows from the chamber B of the auxiliary air reservoir H through the port 2 into the chamber III of the triple valve casing, then by the opened graduator valve and by the port 10 in the slide valve S^1 into the passage 3, opens the spring controlled non-return valve r and passes into the chamber C of the single chamber brake cylinder J where it acts in the well known way. If at the same time the reduction of pressure in the main train pipe has only been a slight one, the compressed air flowing from B to C by the route described suffers a greater reduction of pressure than the pressure in the main train pipe does with the result that the controlling piston k^1 moves so far towards the right that it closes the graduator valve p thus bringing about the cut off position of the brake.

When the brake has been applied and it is found that the action of the brake is too powerful, a graduated reduction of the action of the brake is brought about by slightly increasing the pressure in the main train pipe by means of the driver's brake valve. When this is done both the controlling pistons in the triple valve casing assume the release position shown in Figure 1.

The compressed air then escapes through the pipe 3 and the pipe 4 which branches off therefrom by the right hand hollow in the slide valve S^2 and the opening 9 leading into the open air from the chamber C of the single-chamber brake cylinder until this connection is cut off, which takes place as soon as the air flowing out of the main train pipe through the pipe l, the left hand hollow in the valve S^2 and the pipe 2 into the B chamber of the auxiliary air reservoir H has pushed the piston m therein over to the right and consequently has produced an increased pressure in the A chamber of the auxiliary air reservoir and the chamber IV connected with it owing to the presence of the small counter piston n. The piston k^2 is then pushed over towards the left and the operation of releasing the brake interrupted before it is completed. Owing to the presence of the chamber M the increase of the pressure in the chamber B of the auxiliary reservoir is effected comparatively quickly. By this means it is possible to bring about any desired greater or smaller grades of the release of the brake.

If a quick or emergency action of the brake is initiated and the main train pipe rapidly and abundantly emptied by the

driver's brake valve for this purpose, then both the controlling pistons rapidly assume their left hand position, and the slide valve S^2 at the same time again cuts off all the ports which it controls and the slide valve S^1 establishes connection between the pipes 6 and 3 (see Figure 4). Air therefore flows from the main pipe into the C chamber of the single-chamber brake cylinder. At the same time the pipe 7 leading through the valve V to the brake cylinder is uncovered by the controlling slide valve S^1, and the compressed air from the chamber B of the auxiliary air reservoir therefore flows through the pipe and the chamber III into the pipe 7, forces the valve V downwards against the action of the spring pressing on it from below thereby closing the holes in the body of the valve which register with one or more openings leading into the open air, and passes through the openings 12 (which are now uncovered) and the pipe 3 into the chamber C of the single chamber brake cylinder. If an equalization of pressure has taken place between the brake cylinder and the chamber B of the auxiliary air reservoir, the spring provided beneath the valve V closes it and the compressed air still contained in B escapes through the openings 11 into the atmosphere. The piston *m* of the auxiliary reservoir which has already moved over towards the left under the action of the excess of pressure acting in the chamber A and in the chamber K is pushed into its extreme left hand position. The loop *o* is brought into contact with a bolt in the brake rigging and the action of the brake is intensified by the co-operation of the piston *m* to the highest possible degree.

If after the brake has been applied the pressure in the main train pipe is again raised by the driver's brake valve for the purpose of taking the brake off, the controlling devices again assume the position shown in Figure 1. When they do so slide valve S^1 which controls the application of the brake closes all the ports which it controls, after the graduator valve *p* has first been closed. The slide valve S^2 which effects the operation of releasing the brake returns to its right hand extreme position, connecting the main train pipe L to the chamber B of the auxiliary air reservoir H by means of the port *l*, the left hand hollow in the slide valve and the pipe 2. As soon as the piston in this latter has assumed its right hand extreme position under the action of the increasing pressure in B, air flows from the main train pipe through the small opening *q* into the A chamber, fills the chamber K and passes through the pipe 5 into the chamber IV of the triple valve casing. The chamber C of the single-chamber brake cylinder is connected by the pipes 3 and 4, and the right hand hollow in the slide valve S^2 to the pipe 9 and therefore with the atmosphere.

The invention is not limited to the constructional form shown in the drawing. The controlling pistons may also be given a different spatial arrangement. It is important that on one side they shall be subjected to the pressure in the main train pipe, while on the other side the piston which moves the controlling slide valve S^1 is subjected to the pressure in the chamber B and the one which regulates the operation of releasing the brake is subjected to the pressure in the chamber A of the auxiliary air reservoir.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In a triple valve for a single chamber compressed air brake, a slide valve for controlling the operation of applying the brake and a second slide valve for controlling the operation of releasing the brake and two pistons for operating respectively the said slide valves, means whereby one side of each of said pistons is subjected to the pressure in the main train pipe the other side of one piston to one chamber of the auxiliary air reservoir and the other side of the second piston to the other chamber of the said auxiliary air reservoir, substantially as and for the purpose specified.

2. Triple valve for single-chamber compressed air brakes with an auxiliary air reservoir divided into two chambers by a movable dividing piston, characterized by the fact that the control of the operations of applying and releasing the brake are each effected by a separate controlling slide valve, each of which is operated by a controlling piston subjected on one side to the pressure in the main train pipe and of which the one which regulates the operation of applying the brake is subjected on its other side to the pressure in that chamber of the auxiliary air reservoir which, when the brake is applied, delivers its pressure into the single-chamber brake cylinder, while the controlling piston which regulates the operation of releasing the brake is subjected on its other side to the pressure in the other chamber of the auxiliary air reservoir.

WILHELM HILDEBRAND.