(No Model.)

W. T. BOTHWELL.

AUTOMATIC FLUID PRESSURE BRAKE APPARATUS.

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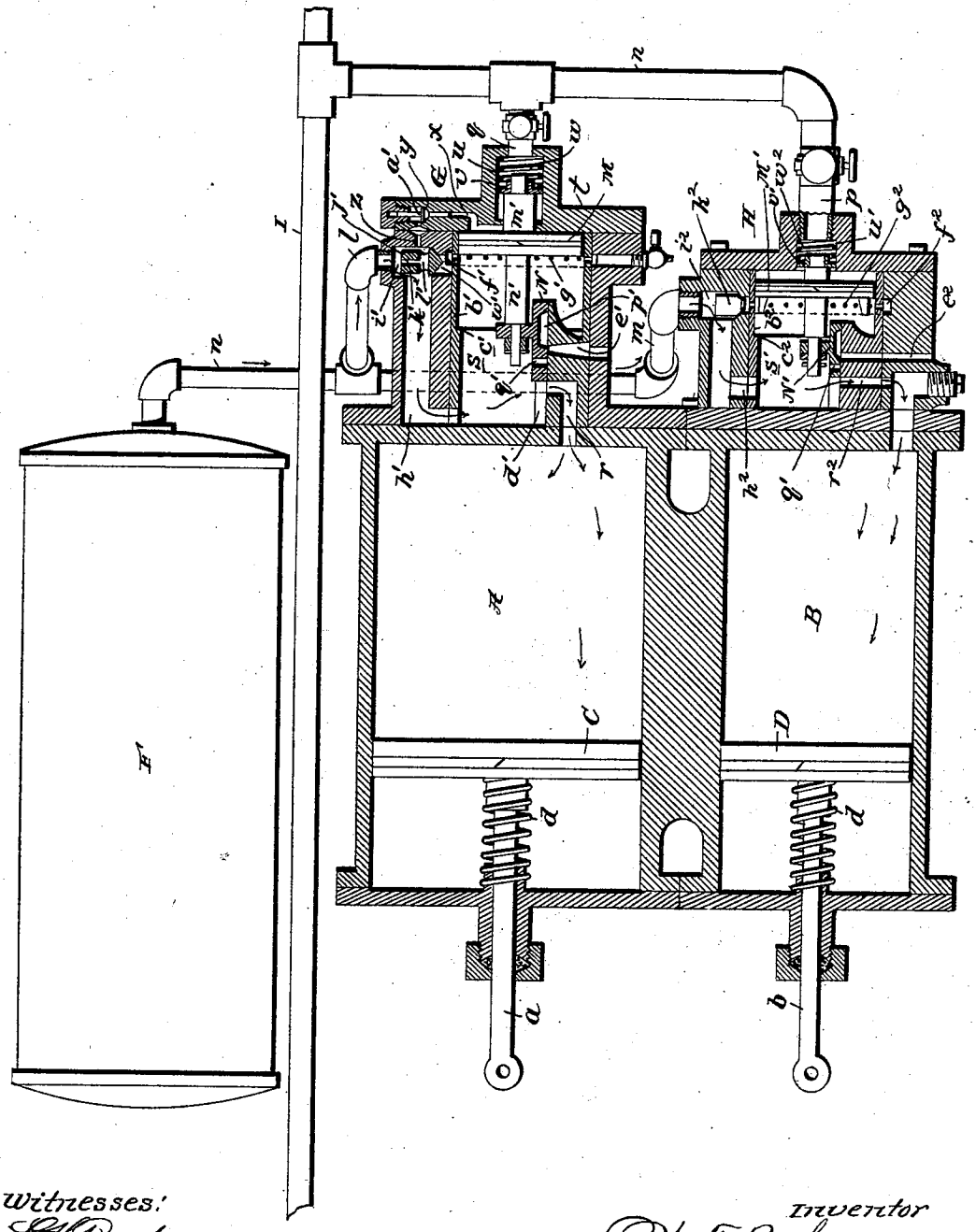

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AUTOMATIC FLUID-PRESSURE BRAKE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 595,760, dated December 21, 1897.

Application filed November 4, 1897. Serial No. 657,435. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM T. BOTHWELL, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Automatic Fluid-Pressure Brake Apparatus; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in automatic fluid-pressure brake apparatus; and it has for its general object to provide such an apparatus in which the brakes may be applied with great force in making emergency stops without involving the maintenance of a high pressure in the auxiliary reservoir and train-pipe, and one in which the degree of force with which the brakes are applied may be quickly or gradually reduced as the speed of the train slackens in order to prevent the sliding of the wheels and the objectionable results incident thereto, and in which the reduction of force is effected with the loss of but a minimum amount of pressure and at the same time the auxiliary reservoir is replenished, so as to admit of the brakes being reapplied with full force at any time before the train comes to a full stop.

Other objects and advantages of the invention will appear from the following description and claims when taken in connection with the annexed drawing, in which—

The figure is a vertical section illustrating the two brake-cylinders and two triple valves of my improved apparatus in conjunction with the auxiliary reservoir, which is shown in elevation.

Referring by letter to said drawing, A B indicate the two brake-cylinders of my apparatus, which are preferably placed side by side, as shown, and C and D indicate the pistons, which are arranged in the cylinders A B, respectively, and may have their rods *a b* surrounded by the usual springs *d* for releasing the brakes when the pressure is removed. The said rods *a b* of the pistons C D are designed to be connected together and with the brake-beams in such a manner that when one or both of the pistons are forced forwardly by the pressure behind them the brake-beams will be drawn against the wheels, and when the piston C is alone backed by pressure the power of the application will be less than when both pistons are subjected to the action of the pressure.

F indicates the auxiliary reservoir of my apparatus I indicates the train-pipe, and G H indicate the triple valves, which are connected with the reservoir by the pipes *l*, *m*, and *n* and with the train-pipe I by the pipes *p* and *q*. The triple valve G is generally similar to that disclosed in my prior application, filed November 23, 1893, Serial No. 491,725, and it has a port or passage *r*, which leads from the interior of its valve-chamber *s* into the interior of the brake-cylinder A, as shown. The outer head *t* of said triple valve G is provided with a port or passage *u* for connection with the train-pipe branch *q*, and this port or passage *u* leads into the valve-chamber *s* on one side of the piston and contains an annulus *v*, which annulus furnishes a bearing for one end of the cushion or resistance spring *w*, the opposite end of which may bear against the inner end of the train-pipe branch. Said head *t* is also provided with a port or passage *x*, which communicates at its inner end with the valve-chamber *s* and has its outer end closed by a nut, cap, or the like, and in this passage *x* is a valve-seat *y*, and passing laterally from said passage above the valve-seat *y* is a passage *z* in the body of the valve-casing, for a purpose presently described.

Arranged within the passage *x* above the valve-seat *y* is a check-valve *a'*, which is designed to bear upon said seat when pressure in the train-pipe has been reduced, as will be presently explained, and to raise from said seat and allow communication to be established between the passages *x z* when pressure has been increased in the train-pipe.

Within the valve-chamber *s* is arranged a bushing *b'*, which is turned to form a stop or shoulder *c'*, designed to limit the movement of the valve-piston. This bushing *b'* has formed in it a valve-seat *d'*, and leading from this valve-seat is an exhaust-passage *e'*, which is arranged about the proportional distance illustrated from the brake-cylinder passage *r*, which also leads from the valve-seat. In the triple-valve casing at a suitable distance

from the forward end is an annular groove f', which communicates with a passage w', and this annular groove is covered, as shown, by the bushing b', which has a circular series of holes g' connecting the valve-chamber with said annular groove. The triple-valve casing is also provided with a large passage h', which communicates at one end with the valve-chamber s on one side of the piston and communicates at its opposite end with said valve-chamber on the opposite side of the piston through the medium of the passages x z, and, furthermore, communicates with the auxiliary-reservoir port or passage i', as shown. At the base of the port or passage i' is a valve-seat, and on this valve-seat is arranged a check-valve j', which preferably has the communicating vertical and transverse passages k' l', so that fluid-pressure can at the same time move through both passages for a purpose which will presently appear.

M indicates a piston which is arranged in the larger portion of the valve-chamber s and is provided on its forward side with a projection m', which is designed to bear against the spring-backed annulus v, and N indicates a slide-valve which is mounted on the rod n' of the piston M. This valve N is arranged to slide on the seat d', and it is provided in its under side with a recess p' and is also provided with a vertically-disposed aperture q', the purpose of which will presently be described.

The valve-piston M when in its extreme forward position rests against the forward head t of the valve-casing, as shown, and I therefore provide the groove or passage r' in the inner side of said head t in order to connect the train-pipe port or opening and the passage x when the valve-piston is in such position.

The triple valve H, which has its valve-chamber s' connected with the brake-cylinder B by a passage r^2, is provided with a train-pipe port or opening u', an auxiliary-reservoir port or opening i^2, an exhaust-passage e^2, an annular groove f^2, communicating with the port or passage i^2, a bushing b^2, having a shoulder c^2, and openings g^2, communicating with the groove f^2, a valve k^2, arranged in the port or passage i^2, a passage h^2, connecting the valve-chamber and the port or passage i^2, a piston M', and a valve N', and is generally similar to the triple valve G in all respects except that it lacks the passages r', x, and z and the check-valve a', before described.

w indicates a spring which backs the annulus v, against which the stem of the piston M of the triple valve C bears, and w^2 indicates the spring which backs the annulus v', against which the stem of the piston M' of the triple valve H bears, and which spring w^2 is stronger than the spring w, for a purpose presently described.

In the drawing the slide-valves N N' of the triple valves G H, respectively, are shown in the positions which they are caused to assume by a sudden and material reduction of the pressure in the train-pipe. When the valves N N' are in this position, the brake-cylinder passages r r' are entirely uncovered and the fluid-pressure from the auxiliary reservoir will therefore pass through the port or passage i', passage h', valve-chamber s, and passage r of the triple valve G into the brake-cylinder A, and through the port or opening i^2, passage h^2, valve-chamber s', and passage r^2 of the triple valve H into the brake-cylinder B, and acting against the pistons C D in both cylinders A B will, by reason of the two cylinders and pistons being employed, apply the brakes with great power and force, although the degree of power of the pressure in the auxiliary reservoir may be low as compared with that of the pressure normally maintained in the auxiliary reservoirs of automatic fluid-pressure brakes at present in use. The powerful and forcible application of the brakes above described greatly exceeds the force which is necessary or even safe at ordinary speeds, or which could be safely applied at any speed if it was continued without reduction as the speed of the train diminished. It is necessary for this reason that the initial force of the application should be gradually reduced as the speed of the train diminishes in order to prevent the wheels from being locked so tightly that they will slide on the rails. This may be effected by the engineer manipulating his valve so as to gradually increase the pressure in the train-pipe. When this is done, it will be seen that by reason of the spring w^2 of the valve H being stronger than the spring w of the valve G, while the piston M and valve N of the valve G will remain in the position shown, the piston M' and valve N' of the valve H will be moved, so that said valve N', through the medium of the recess in its under side, will effect communication between the brake-cylinder passage r^2 and the exhaust-passage e^2. When this is done, the degree of force with which the brakes are applied will be reduced by the exhaust of the fluid-pressure from the cylinder B alone, and consequently it will be seen that but a minimum amount of fluid-pressure is lost. The exhaust of the fluid-pressure from the cylinder B may be effected gradually or quickly, as is most desirable, by the gradual or quick increase of the pressure in the train-pipe, and it will be perceived that simultaneously with the exhaust of the pressure from the cylinder B the auxiliary reservoir will be replenished, so as to admit of the brakes being reapplied with full force at any time before the train comes to a full stop, which is an important desideratum.

If it is desired to still further reduce the force or power of the application after the fluid-pressure has been exhausted from the cylinder B without entirely releasing the brakes, such reduction may be effected by the

engineer gradually increasing the pressure in the train-pipe, so as to overcome the pressure back of the piston M, and move the valve N, so as to enable the same to partially or entirely cover the passage r; and when it is desired to release the brakes it is simply necessary for the engineer to increase the train-pipe pressure sufficiently to move the piston M and valve N rearwardly the full extent, when the recess p' of said valve will effect communication between the passage r and exhaust-passage e' and will close both of said passages to the valve-chamber, so that the fluid-pressure entering from the train-pipe will pass to the auxiliary reservoir and replenish the same.

To make a service application with my improved apparatus, it is simply necessary for the engineer to reduce the train-pipe pressure sufficient to enable the auxiliary-reservoir pressure by acting on the piston M of the triple valve G to move the valve N thereof and uncover the port or passage r, leading to the brake-cylinder A. This movement of the piston M and valve N in the triple valve G is effected without moving the piston M′ and valve N′ of the triple valve H on account of the stronger spring-back of said piston M′ of the valve H, and it permits the fluid-pressure to enter the brake-cylinder A alone, and consequently the brakes will not be applied with such great force as when the fluid-pressure is admitted into both brake-cylinders.

When the brakes are applied by the admission of fluid-pressure into the cylinder A alone, they may be released in the usual manner by increasing the pressure in the train-pipe sufficient to overcome the auxiliary-reservoir pressure.

When the degree of force with which the brakes are initially applied in the making of an emergency or a service stop is diminished in the manner before described to prevent locking of the wheels and it is desired before the train comes to a full stop to reapply the brakes with the same force as the initial application, it is simply necessary for the engineer to reduce the pressure in the train-pipe, so as to enable the auxiliary-reservoir pressure to move the piston M′ and the valve N′ of the triple valve H so as to admit the fluid-pressure to the brake-cylinder B. In other words, while the piston M and valve N of the triple valve G rest in the position illustrated or in a position to admit fluid-pressure to the cylinder A through the port q' the piston M′ and valve N′ of the triple valve H may be moved by reason of the degree of pressure in the train-pipe being varied, so as to connect the brake-cylinder passage r^2 and the exhaust-passage e^2 to effect the exhaust of fluid-pressure from the brake-cylinder and diminish the degree of force with which the brakes are applied, and may then be moved so as to bring the port q' over the passage r^2, or so as to entirely uncover said passage r^2 and readmit fluid-pressure to the cylinder B to effect a reapplication of the brakes with the initial force.

By reason of the apparatus described brakes may be applied with ample force to make a service stop and may be applied with great power and force to make an emergency stop, although the degree of power of the pressure in the auxiliary reservoir and train-pipe may be low as compared with that of the pressure normally maintained in the auxiliary reservoirs and train-pipes of automatic fluid-pressure brakes at present in use, which is a very important advantage, as is obvious.

While my improved apparatus is designed and adapted to powerfully apply the brakes when but a low degree of pressure is maintained in the auxiliary reservoir and train-pipe, yet it may be used to advantage when a high degree of pressure is maintained in both the auxiliary reservoir and train-pipe, and consequently it will be seen that it may be used in conjunction with automatic air-brake apparatus, such as at present in use— that is to say, it may be connected with the same train-pipe as the ordinary apparatus and may be operated in concert with such apparatus by varying the degree of pressure in the train-pipe. It is desirable, however, when my improved apparatus is used in conjunction with the ordinary apparatus, or when a high degree of pressure is maintained in the reservoir and train-pipe, to admit the fluid-pressure into but one of the brake-cylinders in order to make a service stop, as its admission into both cylinders would result in a too forcible application of the brakes. To accomplish this without interfering with the operation of the triple valve H when an emergency application is to be made, I make the spring w, which backs the annulus v', against which the stem of the piston M′ of the triple valve H bears, stronger than the corresponding spring w of the triple valve G, as before described. Consequently it will be seen that a greater reduction of pressure in the train-pipe is necessary in order to enable the auxiliary-reservoir pressure to move the piston M′ and its valve N′ than is necessary to enable the auxiliary-reservoir pressure to move the piston M and valve N of the triple valve G. By reason of this it will be appreciated that when the degree of pressure in the train-pipe is reduced slightly below that of the pressure in the auxiliary reservoir the piston M and valve N of the triple valve G will be moved by the auxiliary-reservoir pressure, while the piston M′ and valve N′ of the triple valve H will remain stationary and the fluid-pressure will enter the cylinder A alone. When, however, the degree of pressure in the train-pipe is reduced to a considerable extent below that of the auxiliary-reservoir pressure, such auxiliary pressure will move the pistons and valves of both triple valves and entering the cylinders A B will

effect a powerful application of the brakes, such as is desirable when an emergency stop is to be made.

For the sake of clearness I would have it distinctly understood that while the triple valve G is preferable because fluid-pressure may be fed to the auxiliary reservoir when the brakes are applied and while they are applied I do not desire to be understood as confining myself to such construction of triple valve, as triple valves of any suitable construction may be employed in lieu of the triple valves G H.

I have specifically described the construction and arrangement of my improved apparatus in order to impart a full, clear, and exact understanding of the same; but I do not desire to be understood as confining myself to such construction and arrangement, as such changes or modifications may be made in practice as fairly fall within the scope of my invention.

Having described my invention, what I claim is—

1. In an automatic fluid-pressure brake system, the combination of an auxiliary reservoir, a train-pipe, two brake-cylinders A, B, a triple valve having a valve-chamber, train-pipe, auxiliary-reservoir and exhaust openings or ports communicating with the valve-chamber and also having an opening or port communicating with the valve-chamber and the brake-cylinder A, a valve in said chamber adapted to control communication between the exhaust and brake-cylinder openings or ports and between the valve-chamber and brake-cylinder opening or port, a piston to operate said valve, a check-valve adapted to control communication between the auxiliary-reservoir port or opening and that part of the valve-chamber in front of the piston, a passage connecting the auxiliary-reservoir opening or port and the valve-chamber on the side of the piston with which the brake-cylinder port or opening communicates, a passage connecting the auxiliary-reservoir port or opening and the valve-chamber on the side of the piston with which the train-pipe port or opening communicates, and a check-valve arranged in this latter passage and adapted to permit air to pass through the passage to the auxiliary-reservoir port or opening and prevent its return through the passage, and a second triple valve having a valve-chamber, train-pipe, auxiliary-reservoir, and exhaust openings or ports communicating with the valve-chamber and also having an opening or port communicating with the valve-chamber and the brake-cylinder B, a valve in said chamber adapted to control communication between the exhaust and brake-cylinder openings or ports and between the valve-chamber and brake-cylinder opening or port, a piston to operate said valve, a check-valve adapted to control communication between the auxiliary-reservoir port or opening and that part of the valve-chamber in front of the piston, and a passage connecting the auxiliary-reservoir opening or port and the valve-chamber on the side of the piston with which the brake-cylinder port or opening communicates, substantially as and for the purpose set forth.

2. In an automatic fluid-pressure brake system, the combination of an auxiliary reservoir, a train-pipe, two brake-cylinders A, B, a triple valve H, having a valve-chamber, train-pipe, auxiliary-reservoir and exhaust openings or ports communicating with the valve-chamber and also having an opening or port communicating with the valve-chamber and the brake-cylinder B, a valve in said chamber adapted to control communication between the exhaust and brake-cylinder openings or ports and between the valve-chamber and brake-cylinder opening or port, a piston to operate said valve and a spring backing the piston, and a second triple valve G, having a valve-chamber, train-pipe, auxiliary-reservoir and exhaust openings or ports communicating with the valve-chamber and also having an opening or port communicating with the valve-chamber and the brake-cylinder A, a valve in said chamber adapted to control communication between the exhaust and brake-cylinder openings or ports and between the valve-chamber and brake-cylinder openings or ports, a piston to operate said valve, and a spring backing said piston; said spring being of less strength than the spring backing the piston of the triple valve H, substantially as specified.

3. In an automatic fluid-pressure brake system, the combination of an auxiliary reservoir F, a train-pipe, two brake-cylinders A, B, a triple valve H, connected with the train-pipe, auxiliary reservoir and brake-cylinder B, and having an exhaust port or opening, and adapted to effect communication between the auxiliary reservoir F, and the brake-cylinder B, communication between said brake-cylinder and an exhaust and communication between the train-pipe and the auxiliary reservoir F, and a triple valve G, connected with the train-pipe, auxiliary reservoir F, and brake-cylinder A, and adapted to effect communication between the auxiliary reservoir F, and the brake-cylinder A, communication between said brake-cylinder and an exhaust and communication between the train-pipe and the auxiliary reservoir F, and embodying such a construction that a greater pressure in the train-pipe is necessary to move its valve than is necessary to move the valve of the triple valve H, substantially as and for the purpose set forth.

4. In an automatic fluid-pressure brake system, the combination of an auxiliary reservoir, a train-pipe, two brake-cylinders and two triple valves connected with the auxiliary reservoir and the train-pipe and each connected with one of the brake-cylinders and each having an exhaust and a spring backing its piston; one of said springs being

stronger than the other and the valve which is provided with the weaker spring having a passage for affording an escape for the train-pipe pressure, substantially as specified.

5. In an automatic fluid-pressure brake mechanism, the combination with a train-pipe, an auxiliary reservoir, and a plurality of brake-cylinders, of valve mechanism operative by a partial reduction of train-pipe pressure for automatically supplying fluid-pressure to one or more of the brake-cylinders according to the rapidity of the variations in train-pipe pressure between certain limits above the atmosphere and also operative by an increase of train-pipe pressure for exhausting fluid-pressure from one or more of the brake-cylinders according to the variations in train-pipe pressure, substantially as specified.

6. In an automatic fluid-pressure brake mechanism, in which applications of the brake may be effected by varying the pressure in the train-pipe between certain limits above the pressure of the atmosphere, the combination with a train-pipe, an auxiliary reservoir, and a plurality of brake-cylinders; of valve mechanism whereby fluid under pressure is admitted to one of the brake-cylinders on a moderate or gradual reduction of the train-pipe pressure and to both brake-cylinders on a more rapid reduction of train-pipe pressure, and whereby fluid-pressure is exhausted from one brake-cylinder on a moderate or gradual increase of train-pipe pressure and from both cylinders on a greater or more rapid increase of train-pipe pressure, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM T. BOTHWELL.

Witnesses:
FREDERICK PLATZ,
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