

No. 718,911.

PATENTED JAN. 20, 1903.

N. A. CHRISTENSEN.
TRIPLE VALVE FOR AIR BRAKES.

APPLICATION FILED APR. 15, 1901.

NO MODEL.

2 SHEETS—SHEET 1.

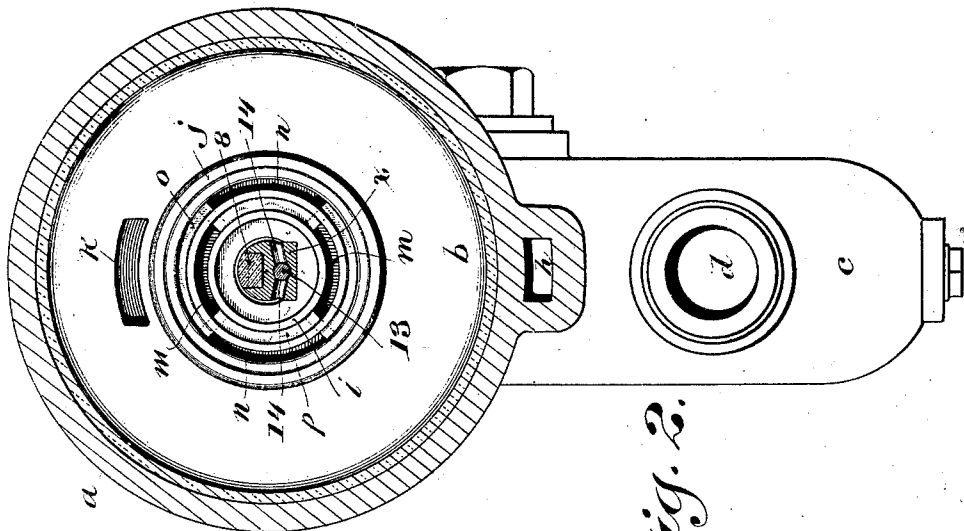


Fig. 2.

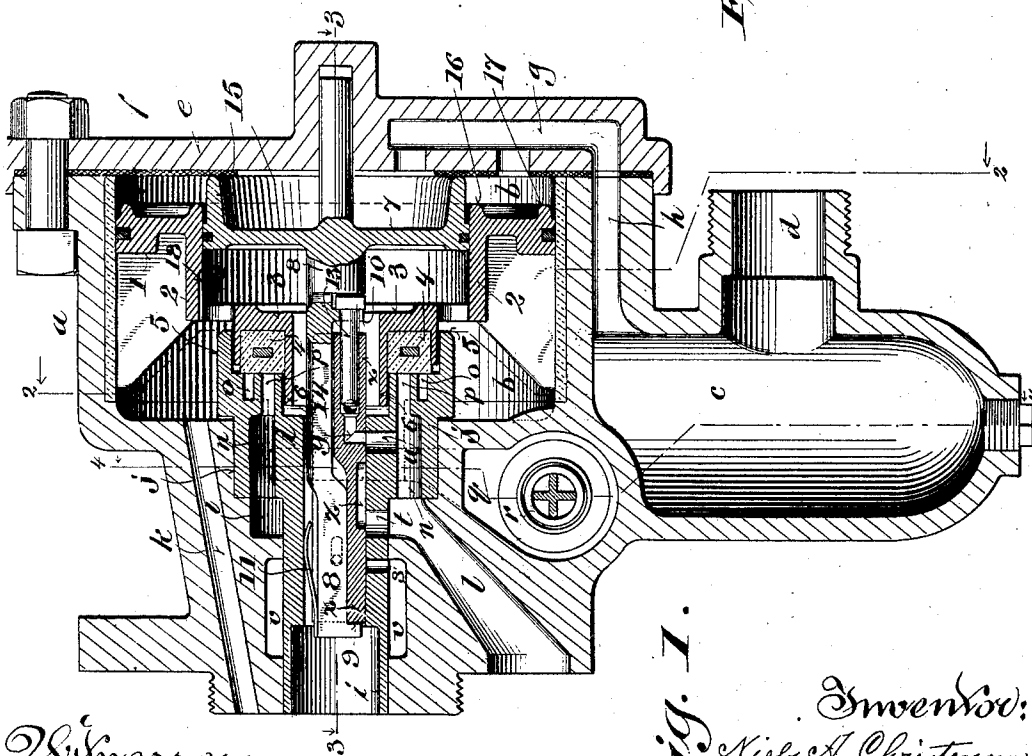


Fig. 1.

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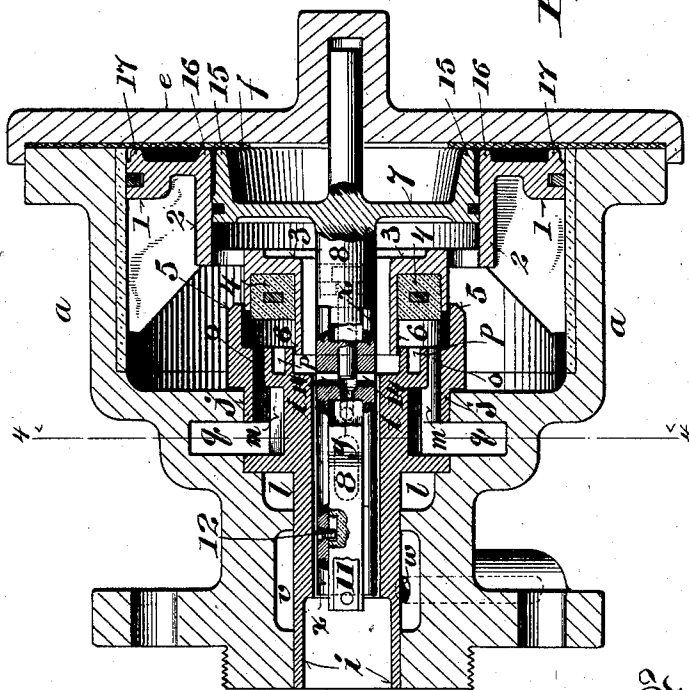
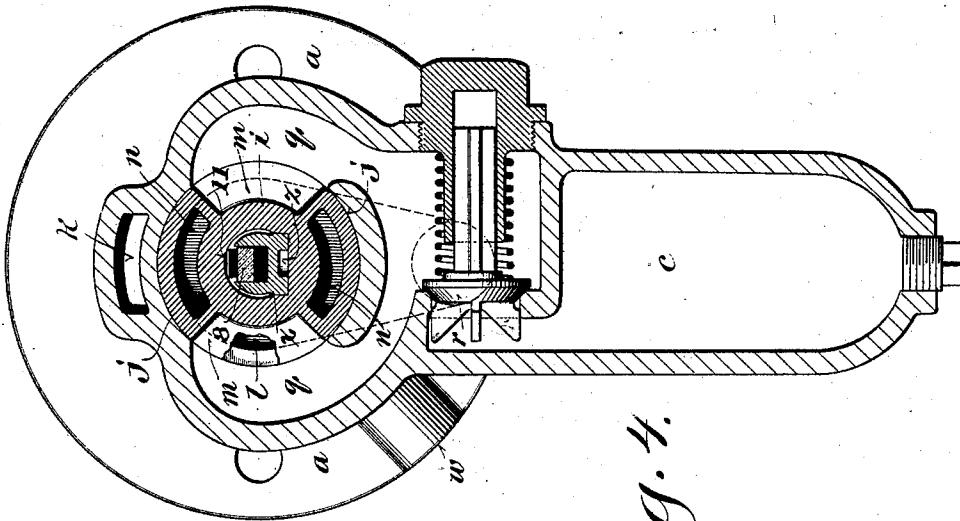
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

NIELS ANTON CHRISTENSEN, OF MILWAUKEE, WISCONSIN.

TRIPLE VALVE FOR AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 718,911, dated January 20, 1903.

Application filed April 15, 1901. Serial No. 55,842. (No model.)

To all whom it may concern:

Be it known that I, NIELS ANTON CHRISTENSEN, a subject of the King of Denmark, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Triple Valves for Air-Brakes, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

This invention relates to and consists of improvements upon triple valves of the general kind shown and described in United States Letters Patent No. 580,846, granted to me April 20, 1897.

The objects of these improvements are to confine the movement of the main piston within limits necessary to operate the main valve, to enable the emergency-piston to open the emergency-valve without aid from the main piston, to balance the main valve, to insure a close fit and freedom of movement of the main valve on its seat, to avoid leakage between the emergency-valve and its seat in case said valve is turned, and generally to improve the construction and operation of triple valves of the kind to which my improvements relate.

It consists in certain novel features of construction and in the arrangement and combinations of parts hereinafter particularly described, and pointed out in the claims.

In the accompanying drawings like characters designate the same parts in the several figures.

Figure 1 is a vertical longitudinal section of a triple valve embodying my invention. Fig. 2 is a vertical cross-section thereof on the line 2-2, Fig. 1. Fig. 3 is a horizontal longitudinal section on the line 3-3, Fig. 1; and Fig. 4 is a vertical cross-section on the line 4-4, Figs. 1 and 3.

a is the valve-case, formed in its larger end with a cylindrical piston-chamber *b* and below it with a drip-chamber *c*, having a neck or connection *d* for the attachment of the train-pipe in the usual manner. At its larger end the valve-case is provided with a detachable cover *e*, which is bolted thereto with an interposed gasket *f* and affords access to the piston-chamber. It is formed with a passage *g*, which opens into the piston-chamber *b* and communicates through a passage *h* with the

upper end of the drip-chamber *c*. A bushing composed of inner and outer parts or cylinders *i* and *j* is fitted into a longitudinal opening in the valve-case and extends from the piston-chamber *b* through the smaller end of said case, which is attached to and communicates with the auxiliary reservoir and brake-cylinder through passages *k* and *l*. Between the inner and outer parts *i* and *j* of said bushing are formed longitudinal passages *m* and *n*, which terminate at their inner ends toward the piston-chamber *b* in concentric annular ports *o* and *p*. The passages *m* open laterally at their opposite ends into passages *q*, formed in the valve-case *a*, as shown in Figs. 3 and 4. The passages *q* communicate through a port controlled by a check-valve *r* with the drip-chamber *c*, to which the train-pipe is attached. The passages *n* communicate at their ends opposite the port *p* with an annular enlargement of the passage *l*, leading to the brake-cylinder, as shown in Fig. 1. The inner part *i* of the bushing is formed in the under side with ports *s*, *t*, and *u*. The port *s* opens into an annular recess *v*, formed in the valve-case around part *i* of said bushing, and communicates, as shown in Fig. 3, through a lateral passage *w* with the atmosphere.

x is the main valve, which controls communication between the brake-cylinder and the atmosphere and between the brake-cylinder and the auxiliary reservoir for releasing and making service applications of the brakes. It is made of approximately D shape in cross-section and is loosely fitted in the inner part *i* of the bushing, the bore of which is correspondingly shaped by a drift. Said valve is formed through its inner end with a longitudinal bore *y*, which at its opposite end opens through the face of the valve, so as to register with the port *u* when the valve is moved to the extreme right, as shown in Fig. 1. A cavity *z* is also formed in the face of said valve and arranged to connect the ports *s* and *t* when the valve is moved to the extreme left for releasing the brakes.

An annular winged piston 1 is fitted to work in the chamber *b*. It is formed around its inner margin with a cylinder 2 and at the inner end of said cylinder with an annular valve-back 3, in which is fitted a packing-

ring 4, of hard rubber or other suitable material. The valve back or base 3 fits loosely on the outer side into a rim 5 on the outer part *j* of the bushing, and a tubular extension or rim 6 on the inner margin of said valve back or base fits into a corresponding recess in the inner end of the inner part *i* of said bushing, thus forming restricted openings for the passage of auxiliary-reservoir air from the piston-chamber *b* on the outside and from the interior of the inner part *i* of the bushing on the inside to the port *p* when said valve is opened.

A piston 7, fitted to work in the cylinder 2 of the annular piston 1, is formed or provided with a stem 8, which is loosely fitted and movable a limited distance in a longitudinal groove in the back or upper side of the main valve *x* without effect upon said valve.

The stem 8 is formed with shoulders 9 and 10, adapted to engage with the ends of the slide-valve *x* and to move said valve after taking up the play into release and service positions.

A bow-spring 11, attached to the upper side of said stem and bearing against the top of the inner part *i* of the bushing, holds the working face of the valve *x* snugly against its seat. The valve is secured to said stem by a screw 12 passing through one side of the valve into a slot in one side of the stem, as shown in Fig. 3.

A needle graduating-valve 13, fitted in the port *y* of the valve *x* and having a seat at its inner end therein, is engaged by a head at its outer end with a forked lug on the under side of the stem 8. Adjacent to said seat the valve *x* is formed with lateral passages 14, opening into the bore *y*, for admitting auxiliary-reservoir air into said bore and thence to the brake-cylinder through the port *u* and passages *n* and *l* when the main valve *x* and the graduating-valve 13 are moved to the extreme right, as shown in Fig. 1.

To limit the main piston 7 to the movement required for service application of the brakes and prevent its further traverse by the operation of the annular emergency-piston 1, said piston 7 is formed with an annular rim 15, which serves by engagement with the gasket *f* to stop said piston in its outward movement in the position in which it is shown in Figs. 1 and 3. The emergency-piston 1 is also formed on its outer side near its inner and outer margins with annular ribs 16 and 17, which, with the rim 15 on the main piston and gasket *f*, serve when both pistons are moved to the extreme right, as shown in Fig. 3, for emergency applications of the brakes to prevent the leakage of air from the auxiliary reservoir into the train-pipe in case the packing of either piston is defective.

The inner part *i* of the bushing is in open communication at both ends at all times with the auxiliary reservoir, so that the main valve *x* is subjected at both ends to the same pressure and is consequently balanced.

The usual leak-groove or restricted passage 18 for charging the auxiliary reservoir with compressed air from the train-pipe is formed in the cylinder 2 of the emergency-piston 1, as shown in Fig. 1.

My improved triple valve, as hereinbefore described, operates as follows: For making a service application of the brakes the usual reduction of pressure—say from five to six pounds—is made in the train-pipe. When this occurs, the main piston 7 is shifted to the right, as shown in Fig. 1, by the greater pressure in the auxiliary reservoir. The initial movement of the piston 7 to the right unseats the graduating-valve 13 and cuts off communication between the auxiliary reservoir and train-pipe through the groove 18. The further movement of said piston in this direction causes the shoulder 9 on its stem to engage with the main valve *x* and shift it into the position in which it is shown in Fig. 1. Communication between the passage *l*, leading to the brake-cylinder and the atmosphere through the port *t*, cavity *z*, port *s*, recess *v*, and passage *w*, is cut off, and the inner end of the passage *y*, controlled by the graduating-valve, is brought into register with the port *u*. Compressed air thereupon flows from the auxiliary-reservoir connection through the openings 14, passage *y*, port *u*, and passages *n* and *l* into the brake-cylinder. As soon as the pressure in the auxiliary reservoir is reduced to or slightly below the reduced train-pipe pressure the main piston 7 will be moved back to the left sufficiently to close the graduating-valve 13, which is very sensitive in operation, and then stopped in a position to cut off communication between the auxiliary reservoir and train-pipe, as well as between the auxiliary reservoir and brake-cylinder. The pressure thus admitted to the brake-cylinder will be considerably below that in the auxiliary reservoir, and the brakes will be held applied with a force corresponding to the pressure in the brake-cylinder, while the conditions last-above stated remain unchanged. To apply the brakes with still greater force, a further reduction from two to three pounds is made in the train-pipe pressure, and the operations above explained will be repeated. Thus the brakes may be applied with a gradually-augmented force until the pressures in the brake-cylinder and auxiliary reservoir are equalized.

To release the brakes, the train-pipe pressure is restored and acting in opposition to the reduced auxiliary-reservoir pressure shifts the main piston 7 back to the left. The shoulder 10 on the piston-stem engaging with the valve *x* carries the passage *y* out of register with the port *u* and the cavity *z* over the ports *s* and *t*, through which air thereupon escapes from the brake-cylinder to the atmosphere. At the same time communication is established through the groove 18 between the brake-cylinder and the auxiliary reservoir, and the latter is gradually re-

charged with compressed air until the pressure therein reaches that in the train-pipe.

To make an emergency application of the brakes, an abnormal reduction—say from ten to twelve pounds—is made in the train-pipe pressure. When this occurs, the unbalanced auxiliary-reservoir pressure shifts both the emergency and main pistons 1 and 7 to the extreme right, as shown in Fig. 3. This cuts off communication between the brake-cylinder and the atmosphere and also between the auxiliary reservoir and the train-pipe through the groove 18 and at the same time unseats the emergency-valve 4, uncovering the annular ports *o* and *p*. The unbalanced pressure in the train-pipe will thereupon open the check-valve *r*, and air will rush from the train-pipe through the passages *q* and *m*, ports *o* and *p*, and passages *n* and *l* into the brake-cylinder. The flow of air under higher pressure from the auxiliary reservoir into the brake-cylinder will in the meantime be retarded by the restricted openings between the rims of the emergency-valve and the rims on the bushing *i j* until the pressure in the brake-cylinder nearly equals that in the train-pipe, whereupon the check-valve *r* will close and the pressure in the brake-cylinder will be augmented by the air under higher pressure thus held back in the auxiliary reservoir. Train-pipe air vented at an abnormally reduced pressure into the brake-cylinder, as above explained, will assist in applying the brakes, and the further reduction in train-pipe pressure thus produced will cause all the triple valves connected with the same train-pipe to operate simultaneously or in quick succession. After the pressure in the brake-cylinder equals the reduced train-pipe pressure and the check-valve *r* is closed, air under higher pressure will continue to flow from the auxiliary reservoir into the brake-cylinder until the pressures therein are equalized. Thus the most powerful application of the brakes possible is made simultaneously or in quick succession on all the cars of a long train.

By restoring the normal pressure in the train-pipe the moving parts of the valve mechanism will be restored to their original positions, so as to release the brakes and recharge the auxiliary reservoir.

A slide-valve having a flat face fitted to a flat seat has been found in practice more satisfactory than a piston-valve, because it works with greater freedom and certainty and is less liable to leak. By terminating the passages *m* and *n* in continuous annular ports indentation of the packing-ring 4 of the emergency-valve, such as would cause it to leak if it were turned or shifted, which is liable to occur, is avoided. The emergency-piston 1 is made of sufficient area to operate the emergency-valve 4 without aid from the main piston 7, so that in case the main piston should stick in its cylinder 2 and fail to respond to the usual reduction in train-pipe pressure

for service application of the brakes the emergency-valve would still be operated by the emergency-piston upon making a greater reduction in the train-pipe pressure. The main piston is accordingly provided with a stop by which it is limited to the traverse necessary for making service applications of the brakes, and any extra or unnecessary movement thereof by the emergency-piston in making emergency applications of the brakes is avoided.

It will be observed that the emergency-valve is so arranged with relation to the main piston that in case the latter should stick in the cylinder 2 or fail for other reasons to operate in response to the usual reduction of pressure for service applications it would upon a further reduction of pressure being made be shifted by the emergency-piston far enough to the right, as shown in Fig. 1, to cause the main valve *x* to close the exhaust-port and cut off the escape of air from the brake-cylinder to the atmosphere. It will be observed also that when the parts of the valve are in release and running position the emergency-valve 4 will be exposed on one side to atmospheric pressure to an extent equal at least to the area of the annular port *p*, while on the other side its entire area will be exposed to auxiliary-reservoir pressure. As these areas which are exposed under the conditions assumed to different pressures are constant factors, a predetermined reduction of train-pipe pressure will be required to unseat the emergency-valve and effect an emergency application of the brakes, and the emergency-valve will be held positively against its seat by the unbalanced auxiliary-reservoir pressure upon it until such predetermined reduction in train-pipe pressure is made or until the auxiliary-reservoir and brake-cylinder pressures are equalized in applying the brakes with the greatest available force. Under the last-mentioned condition of balanced auxiliary-reservoir and brake-cylinder pressures there will be no preponderance of pressure tending to unseat the emergency-valve, and the brakes being applied with full force it is immaterial whether said valve is held tightly closed or not. A spring for holding the emergency-valve to its seat is thus rendered unnecessary and is therefore dispensed with.

Various changes in minor details of construction and in the arrangement of parts may be made without departing from the principle and intended scope of my invention.

I claim—

1. In a triple valve for air-brakes, the combination of a valve-case provided with annular ports communicating respectively with the train-pipe and brake-cylinder, a valve normally closing said ports, and a piston for operating said valve, substantially as described.

2. In a triple valve for air-brakes, the combination of a valve-case having annular ports communicating respectively with the train-

pipe and brake-cylinder connections, a main valve controlling communication between the brake-cylinder and auxiliary-reservoir connections and between the brake-cylinder and the exhaust-port, an annular emergency-valve normally closing said annular ports, an annular piston fitted to work in said case and connected with said emergency-valve, and an independently-movable main piston fitted to work in said annular piston and connected by a stem which passes through said annular emergency-valve with the main valve, substantially as described.

3. In a triple valve for air-brakes, the combination of a valve-case having a piston-chamber and train-pipe and auxiliary-reservoir connections communicating with opposite ends of said chamber, a bushing extending longitudinally through said case, communicating at the ends with said chamber and with the auxiliary reservoir, and having laterally-opening ports communicating with the brake-cylinder and with the atmosphere, and annular ports at its inner end opening into the piston-chamber and communicating respectively with the train-pipe and with the brake-cylinder, a main valve fitted in said bushing and controlling communication between the lateral ports therein, an annular emergency-valve normally closing the annular ports at the inner end of said bushing, an annular emergency-piston fitted to work in said piston-chamber and connected with said annular valve, a main piston fitted to work in said annular piston and loosely connected by a stem passing through the emergency-valve with the main valve, and a graduating-valve controlling a port in the main valve and connected with the main piston, substantially as described.

4. In a triple valve for air-brakes, the combination of a valve-case having a piston-chamber and train-pipe and auxiliary-reservoir connections communicating respectively with opposite ends of said chamber, a bushing extending from said chamber through one end of said case and having laterally-opening

ports communicating with the brake-cylinder and with the atmosphere and ports at its inner end opening into the piston-chamber and communicating respectively with the train-pipe and with the brake-cylinder, a main valve fitted in said bushing and controlling communication between the brake-cylinder and the auxiliary reservoir and between the brake-cylinder and the atmosphere, an annular emergency-valve loosely fitting into the end of said bushing and normally closing the ports at its inner end, a rim on said bushing extending over said valve, and a rim on said valve extending into said bushing and forming restricted openings for the passage of auxiliary-reservoir air to the brake-cylinder when said valve is opened, an annular piston fitted to work in said piston-chamber and connected with said emergency-valve, and an independently-movable piston fitted in said annular piston and connected with the main valve, substantially as described.

5. In a triple valve for air-brakes, the combination of a valve-case having a piston-chamber and train-pipe and auxiliary-reservoir connections communicating respectively with opposite ends of said chamber, an annular piston fitted in said chamber and formed with annular ribs on the end toward the train-pipe connection, a piston fitted within said annular piston and formed on the end toward the train-pipe connection opening into said chamber through ports, one between the annular ribs on the annular piston and the other within the radius of the annular rim on the other piston, a main valve connected with the inner piston, and an emergency-valve connected with the annular piston, substantially as described.

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

NIELS ANTON CHRISTENSEN.

Witnesses:

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C. M. BOTTUM.