(No Model.)

R. M. McKINNEY.

AUTOMATIC AIR BRAKE.

No. 311,196. Patented Jan. 27, 1885.

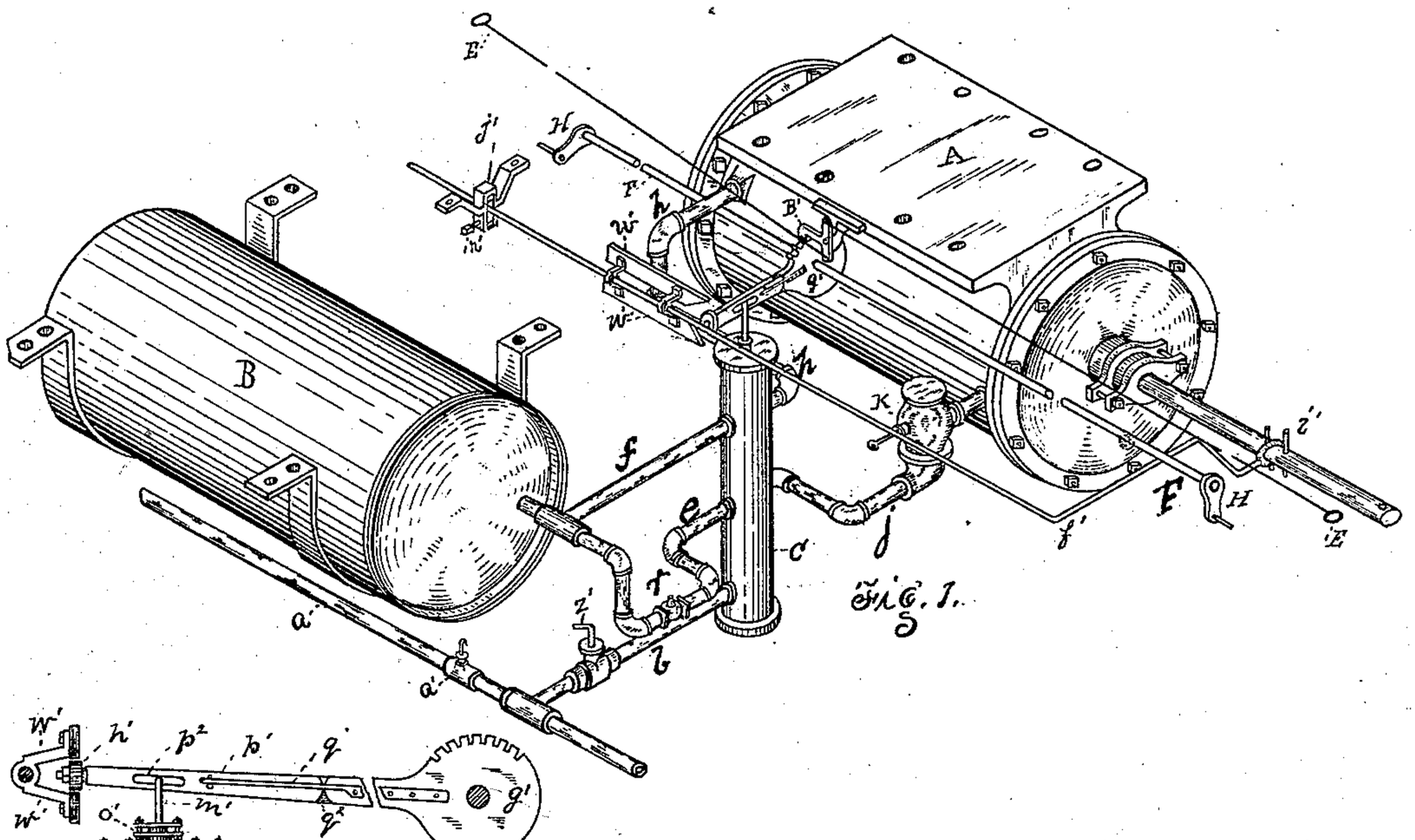

Fig. 1.

Fig. 3.

Fig. 2.

Witnesses.

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AUTOMATIC AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 311,196, dated January 27, 1885.

Application filed May 19, 1884. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. MCKINNEY, a citizen of the United States, residing at Elizabeth, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Air-Brakes; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my apparatus as applied to a car. Fig. 2 is an end view, partly in section. Fig. 3 is an enlarged sectional view of the valve-chamber and an elevation of the mechanism for controlling the brake or brakes which are to be applied.

Like letters refer to like parts wherever they occur.

The object of the present invention is to so utilize air-pressure in applying and releasing brakes as to place the brakes perfectly within the control of the engineer, so that he may apply the brakes alike to all the cars in the train or to the cars singly or in groups at any part or parts of the train which may be previously determined upon by the officers; to provide means whereby the brakes will be automatically applied to both sections of the train in case it should part; and also to provide means whereby the conductor may apply the brakes to the several cars of the train, having the same control thereof for such purposes as the engineer. The brakes are both applied and released by the power of compressed air, and the method adopted is to alternately reverse the pressure on a piston or like device which controls the valves of the brake-cylinder.

The main feature of the apparatus therefore consists in the combination of a brake-cylinder, a reservoir, a main supply-pipe, a valve-chamber which communicates with both the reservoir and brake-cylinder, and a valve so arranged within the valve-chamber as to be moved by either the compressed air in the main supply-pipe or the compressed air in the reservoir, accordingly as the pressure is greater in the one or the other. A second feature, especially valuable in this connection, is the combination, with the valve which controls the passage between the reservoir and brake-cylinder, of means for balancing the valve against the pressure in the reservoir, so that a greater or less reduction of pressure will be required in the main supply-pipe to operate the valve, and of means for relieving the valve of the added power when first moved, so that the decrease of pressure in the reservoir shall not permit the closing of the valve between the reservoir and brake-cylinder.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates a brake-cylinder, one of which is placed on each car, and has its piston-rod *e'* connected with the brakes, so as to operate the same. B indicates a suitable reservoir, likewise located on the car, and C an interposed valve-chamber.

Extending along the train from a suitable pump on the engine is a conducting-pipe, *a*, which is connected with the cylinder A and reservoir B of each car by a branch pipe, *b*, provided with a valve, *z'*, by which it can be closed when any car is to be cut out of the train. This branch pipe *b* delivers into one end of a valve-chamber, C. The valve-chamber C (see Figs. 2 and 3) is preferably of cylindrical shape, though any other form desired may be employed, and is connected with the reservoir B by a pipe, *e*, having a check-valve, *r*, which prevents the return of the air when the pressure is lowered in conducting-pipe *a*. It is also connected with one end of the brake-cylinder A by a pipe, *j*, having a reducing-valve, K, which will be hereinafter more fully described. The reservoir B is connected with the upper part of valve-chamber C by a pipe, *f*, and the upper part of the valve-chamber is connected with the opposite end of the brake-cylinder A by a pipe, *h*, which may also be provided with a reducing-valve, K, if desired.

Within the valve-chamber C is a piston, *l*, or disk, arranged so that its opposite faces are acted on by the pressure of the air in the conducting-pipe *a* and in the reservoir B. The rods of piston *l* carry three valves, one of which, *n*, is adjusted so as to control the port *i*, leading to one end of the brake-cylinder and its exhaust-port *p*, another, *n'*, to control the port *g*, leading to the other end of the brake-cylinder and its exhaust-port *q*, while the third valve, *o*, controls the port *d*, which leads from the valve to the reservoir B. The port (or

pipe *f*) leading from the reservoir to the valve-chamber C is always open, so that the pressure in the reservoir is constantly maintained on the upper face of piston *l*.

The devices thus far described embody the first point of the invention, and operate as follows: Air under the desired pressure passes from main or conducting pipe *a* through pipe *b*, (and finding the valves of C in the position shown in Figs. 2 and 3,) enters pipe *j*, passes thence into brake-cylinder A, and, forcing the piston thereof to the opposite end of the cylinder, (if it is not already in that position,) takes off the brakes. The air also passes by pipe *e* to the reservoir B, and thence by pipe *f* to the valve-chamber C on the opposite side of piston *l*, from which it originally entered valve-chamber C. As the pressure is now equal on both sides of the piston *l* of the valve-chamber, the valves are in equilibrium and will not move; but when the engineer desires to apply the brakes he reduces the pressure in main or conducting pipe *a*, which of course reduces the pressure on that side of piston *l*. This disturbs the equilibrium of the valve, and as the pressure in the reservoir, and consequently that on the opposite face of piston *l*, is greater than on the side next the main conducting-pipe *a*, the piston *l* moves down, (or over, as the case may be,) causing valve *n* to connect port *i* with the exhaust *p*, valve *o* to close port *d*, leading to reservoir B, and to open port *g*, leading from the valve-chamber C to the opposite end of brake-cylinder A, whereupon the compressed air from reservoir B passes by pipes *f* and *h* to cylinder A, and forces over its piston, applying the brakes. The application of the brakes of course reduces the pressure in reservoir B. When the brakes are to be taken off or released, the engineer increases the pressure in main pipe *a* until it exceeds the pressure in the reservoir, whereupon, the pressure on the piston *l* of the valve, or in that side of the valve-chamber C, being greater than on the opposite side, the piston *l* moves back into its former position, (shown in Figs. 2 and 3,) carrying with it the valves *n n' o*, uncovering the ports *d i*, and connecting port *g* with the exhaust *q*, permitting the compressed air to pass by pipe *e* to the reservoir B, and by pipe *j* to the cylinder A, taking off the brakes, as hereinbefore specified, while the air from the opposite end of the brake-cylinder A escapes through pipes *h*, valve *n'*, and exhaust-port *q*. To this part of the invention pertains the means by which the control of the brakes is given to the conductor as well as to the engineer, and this consists in a valve, *a'*, placed on the main pipe *a* at any convenient point, to which is attached a conductor's cord, so that he may at will operate the valve so as to reduce the pressure in the main pipe *a*, and thus apply the brakes, as hereinbefore specified.

The next feature of the invention is the means whereby the brakes of any one or more of the cars may be applied without applying the brakes of the remaining cars. For this purpose the end of the valve-rod *m* (see valve-chamber C, Fig. 3) is extended through the valve *n'*, and provided with a cross-bar, *t*, to which is attached one end of a spiral spring, *s*, the opposite end of said spring being attached to a stirrup or yoke, *b'*, from which a rod, *m'*, passes through a stuffing-box, *o'*, on the valve-chamber C, and engages in a slot or oblong hole, p^2, in a radial arm, *p'*. The radial arm *p'* (which is hinged, as at q^2, and held in position by a spring, q^3, for purposes which will hereinafter appear) terminates at one end in a spurred disk, *g'*, which is keyed to and operated by a rod, F, suitably journaled, extending under the car, and provided with cranks H H. By turning the cranks H and rod F the spurred disk *g'* is rotated, and with it the radial arm *p'*, to bring the desired tension or compression on spring *s*, and the spurred disk and radial arm *p'* are then locked in position by a suitable dog or holding-pawl, B'. In its normal condition the spring *s* is inoperative, leaving the piston *l* of the valve-chamber C to be balanced by the equal pressure of the air on both of its faces and to move readily when the equilibrium is disturbed; but in proportion as the radial arm *p'* is raised in manner as hereinbefore specified and pressure brought to bear on the spiral spring *s* will the valve resist the pressure of the air in the reservoir B, and the greater will be the reduction of pressure in the main pipe *a* necessary to cause the valve to move and open the pipe *h* leading to the brake-cylinder A; but if the radial arm be lowered and the spring *s* be in tension, then a corresponding less reduction will be necessary to operate the valve than when in its normal condition, thereby increasing the range in pressure to operate the valve. Therefore, when the brakes on any given car or any group of cars are to be set without applying the remainder of the brakes, the springs *s* of the valves (of chamber C) of such cars are left without tension or compression, so that the piston *l* will move on the slightest reduction of pressure in main pipe *a*, while the springs *s* of the valves in chamber C on the remaining cars are compressed more or less, so that a greater reduction of pressure in main pipe *a* is required to operate them than is required for the first mentioned. It will be evident that by grading the compression of springs *s* the brakes can be applied singly in succession or by groups in succession at the will of the train officers. It is also evident that if the spring *s*, after being compressed, was allowed to act continuously upon the valve in valve-chamber C, Fig. 3, there would come a time when the pressure in reservoir B (and the upper part of the valve-chamber C) so approached the pressure in the main pipe *a* that the power of the spring would draw up the valves, close the port *g*, and take off the brakes. To prevent this, I provide devices which relieve the valve of the action of spring *s* as soon as it is first overcome by the re-

duced pressure in main pipe *a*, which devices may be of the general character of those which I will next describe. The radial arm *p'*, which is pivoted to its spurred disk *g'* and held in position by a spring, q^3, as before specified, is provided on its outer end with a wheel, *h'*, which engages between the traveling parallel bars *w'*. (See Figs. 1 and 3.) These parallel traveling bars *w' w'* are placed a distance apart about equal to the diameter of the wheel *h'*, and have at their forward ends inclines which will engage the wheel on the end of the radial arm *p'*, whether the same be above or below the plane marking the space between the bars *w' w'*, and said bars are secured to and move with a bent rod, *f'*, attached to the piston-rod *i'*, and supported at its free end by a bearing, *j'*, through which it moves and in which it is adjustable by means of a set-screw, *r'*. By means of the set-screw *r'*, which may be placed in either of a series of holes in the bearing *j'*, the rod *f'* may be raised or lowered to change the plane which the traveling bars *w' w'* move and to adjust them with relation to the outer end of radial arm *p'*. If, now, the springs *s* of the valves in valve-chamber C have been compressed by elevating the arm *p'* so as to require a greater reduction of the pressure in the main pipe *a* to move the valve, as soon as the valve is moved and the compressed air from the reservoir B passes by pipe *h* into the cylinder A, on the commencement of the stroke of the piston to apply the brakes the movement of the bent rod *f'* will carry with it the traveling bars *w' w'*, which engage the end of radial arm *p'*, and prevent it from rising to again compress the spring or will force it down (as the case may be) to take the compression off of the spring and prevent its further action when the pressure in the reservoir B falls or approaches that in the main pipe *a*. The traveling bars are first intended to reduce the spring *s* to its normal condition, or by raising the plane of motion of the traveling bars, which will place the spring *s* slightly in compression, and then operate valve to apply but a small pressure on piston of brake-cylinder, as when the engineer wishes to "slow up," the raising is done by set-screw *r'*. The reverse movement of the piston in brake-cylinder A, when the brakes are taken off as hereinbefore described, will of course cause the parallel bars *w' w'* to move in the opposite direction and release the radial arm *p'*, which, rising, will restore the compression of the spring and the consequent upward draft on the piston *i*.

In the foregoing description of these increased pressure and locking devices I have spoken of the spring *s* as a spiral, and the force as applied by compression, but it is evident that a spring of another character may be employed, and that the pressure may be applied by tension instead of compression; and that other locking devices than the traveling bars *w' w'*, engaging the end of the radial arm *p'*, may be used to counteract the force of spring *s* when the piston of brake-cylinder A is first moved in applying the brakes. The pressure used to apply the brakes is much greater than that required to release them, and therefore to save in the quantity of air used to release the brakes, as well as to prevent in a great degree the leakage around the piston and packing of cylinder A while the brakes are being released, I arrange in the line of pipe *j* a reducing-valve, K, which may be of any of the several well-known and suitable constructions. In the present instance it is shown as having somewhat the form of a safety-valve provided with a lever and a sliding weight, but no claim is herein made to the said construction, as it is especially reserved for the subject-matter of another patent. A reducing-valve is also valuable in air-brakes, not only in the position shown in Figs. 1 and 2, and for the purpose before specified, but is of great value when arranged on the pipe *h*, (or between the power and the piston in applying the brake,) to permit a change in the force applied to the brake when the car is loaded and when it is empty, and I wish the following matter to be understood as applying to it when so placed as well as when located in the position shown in Figs. 1 and 2.

Having thus set forth the nature and advantages of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an air-brake apparatus, the combination of a brake-cylinder, a reservoir, a main air-supply, and a valve arranged with relation thereto so as to release the brakes by an increase in the main air-supply, and apply them by decreasing the same, as and for the purposes set forth.

2. In an air-brake apparatus, the combination of a brake-cylinder, a reservoir, a main air-supply, an interposed valve-chamber, a piston arranged in the valve-chamber so that its opposite heads are subjected the one to the pressure in the main supply-pipe and the other to the pressure in the reservoir, valves actuated by said piston, air-pipes which lead to opposite ends of the brake-cylinder, and pipes leading from the valve-chamber to the reservoir, one of said pipes being provided with a check-valve, substantially as and for the purposes specified.

3. In an air-brake apparatus, the combination, with an air-reservoir, a brake-cylinder, and a main air-supply, of the valve-chamber having the two ports leading to the reservoir, the two ports leading to the brake-cylinder, and the exhaust-port, and the piston having the three slide-valves which control said ports, substantially as and for the purposes specified.

4. In an air-brake apparatus, the combination of a brake-cylinder, a reservoir, a main supply-pipe, a valve-chamber provided with valves actuated by disturbing the equilibrium of pressure in the reservoir and main supply-

pipe, and a conductor's valve located on the main supply-pipe, substantially as and for the purposes specified.

5. In an air-brake apparatus, the combination of a brake-cylinder, a reservoir, a main supply-pipe, a valve-chamber provided with a valve actuated by disturbing the equilibrium of pressure in the main supply-pipe and reservoir, a spring-resistance for increasing the resistance of the valve to pressure in the reservoir, and a locking device for restricting the action of the spring, substantially as and for the purposes specified.

6. In an air-brake apparatus, the combination, with a balanced valve, of an auxiliary spring, an adjustable radial spring-arm, and traveling locking-bars actuated from the piston-rod of the brake-cylinder, substantially as and for the purposes specified.

7. In air-brake apparatus, the combination, with a balanced valve, of an auxiliary spring, a radial spring-arm for increasing or decreasing the power of the auxiliary spring, and adjustable traveling locking-bars actuated from the piston-rod of the brake-cylinder, substantially as and for the purpose specified.

8. In an air-brake, the combination, with the air-supply pipe, the brake-cylinder, and pipes leading to opposite sides of the piston thereof, of a reducing-valve interposed between the air-supply and brake-cylinder and opening inwardly toward the latter, substantially as set forth and described.

In testimony whereof I affix my signature, in presence of two witnesses, this 17th day of May, 1884.

ROBERT M. McKINNEY.

Witnesses:

JAMES M. NEVIN,

JOHN N. WHITE.