

(No Model.)

6 Sheets—Sheet 1.

R. A. PARKE, F. L. CLARK & T. J. HOGAN.
AIR BRAKE.

No. 506,185.

Patented Oct. 3, 1893.

FIG. 2.

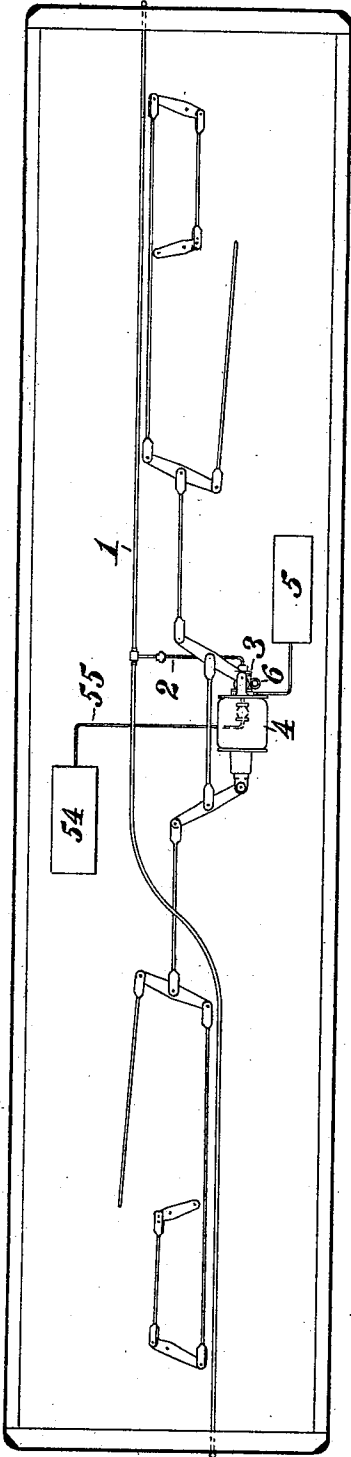
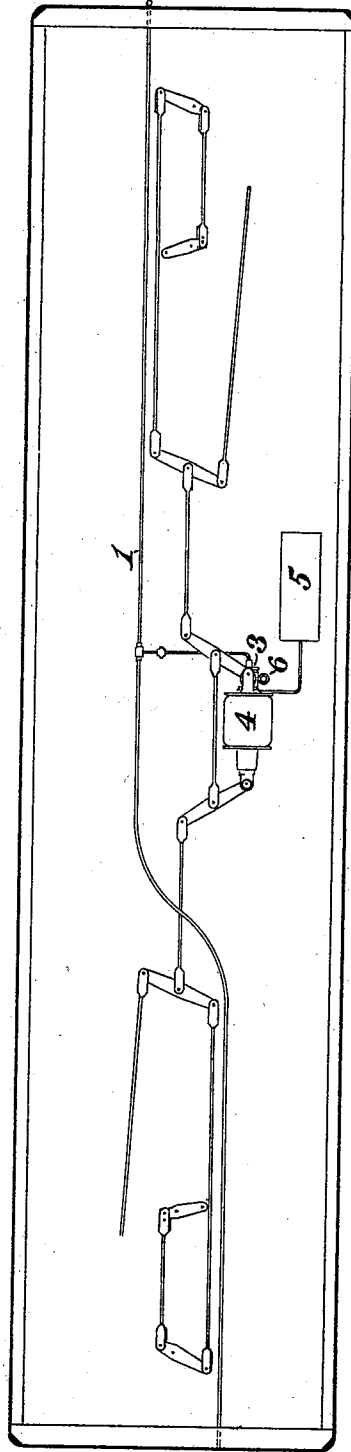


FIG. 1.



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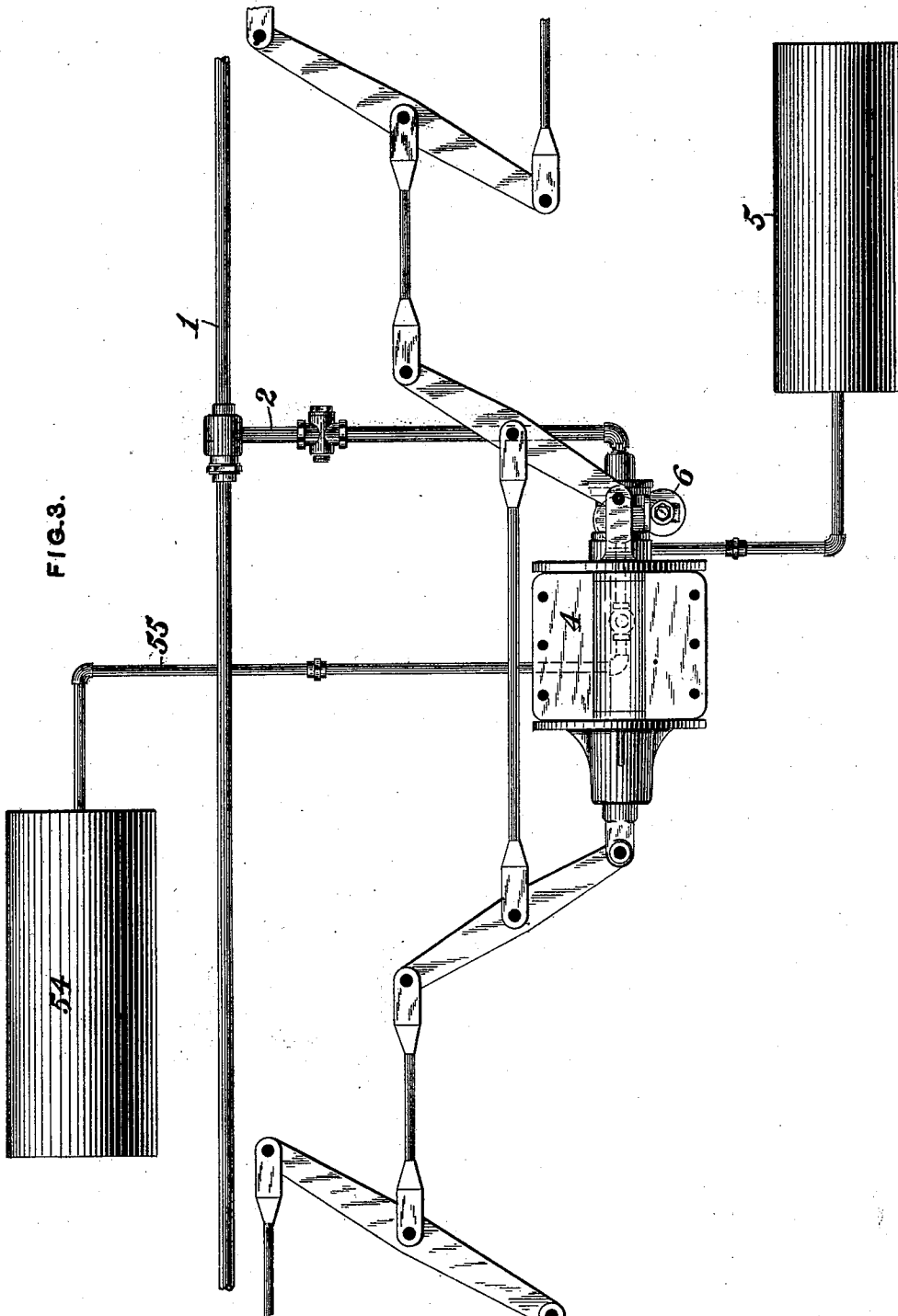


FIG. 3.

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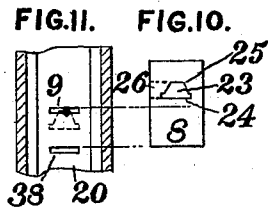
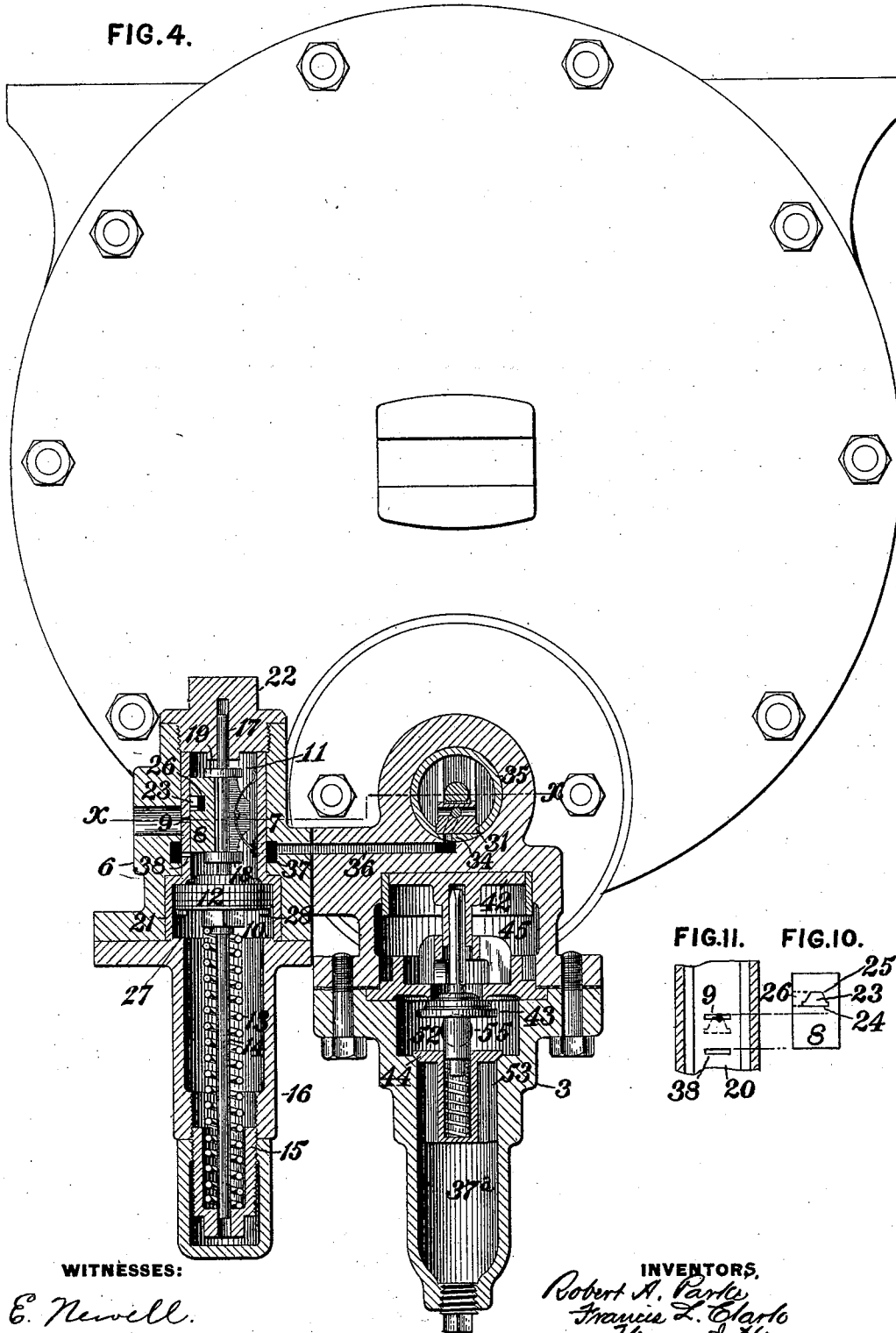
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FIG. 4.



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6 Sheets—Sheet 4.

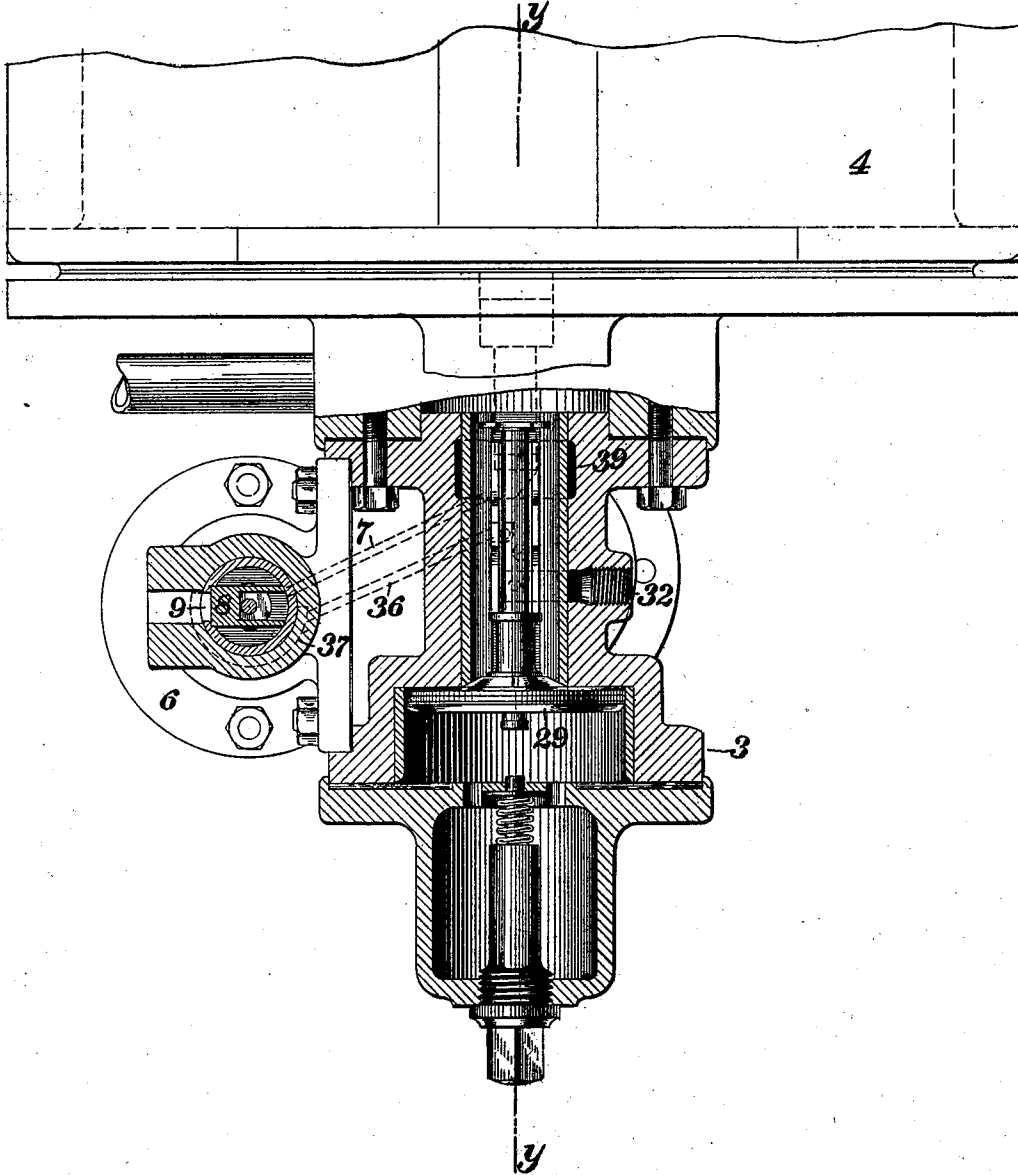
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FIG. 5.



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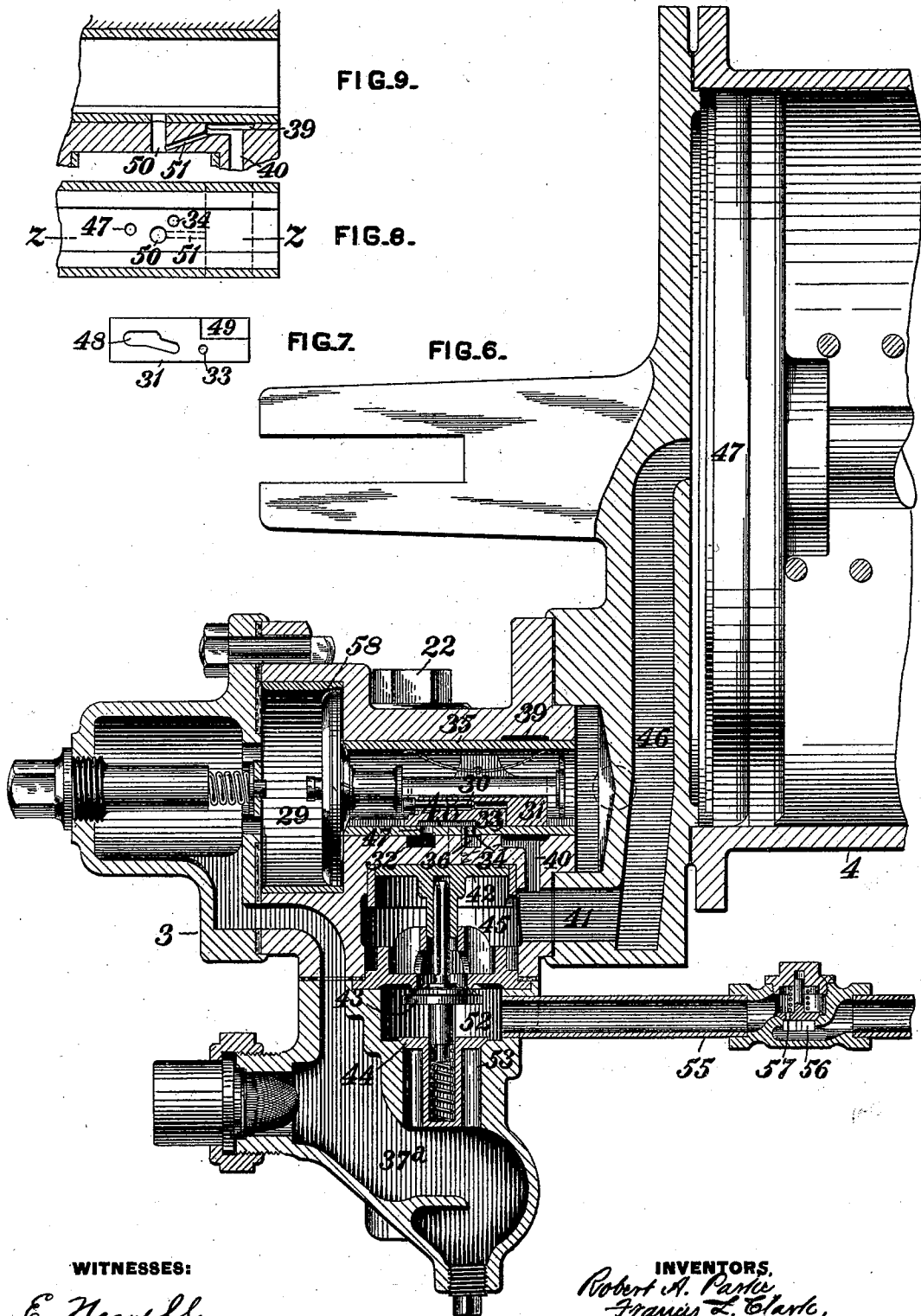
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6 Sheets—Sheet 6.

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FIG.12.

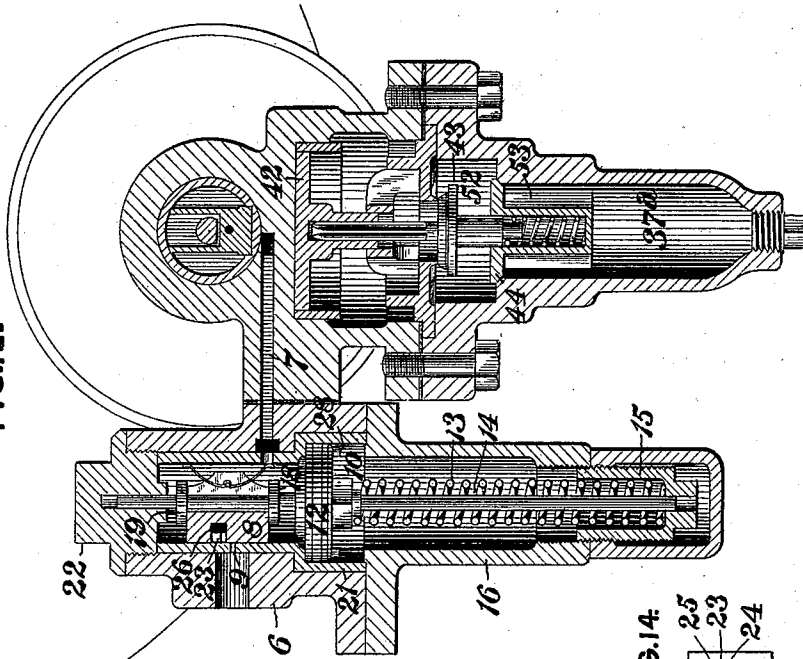


FIG. 14.

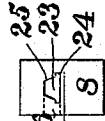


FIG. 15.

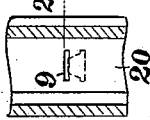
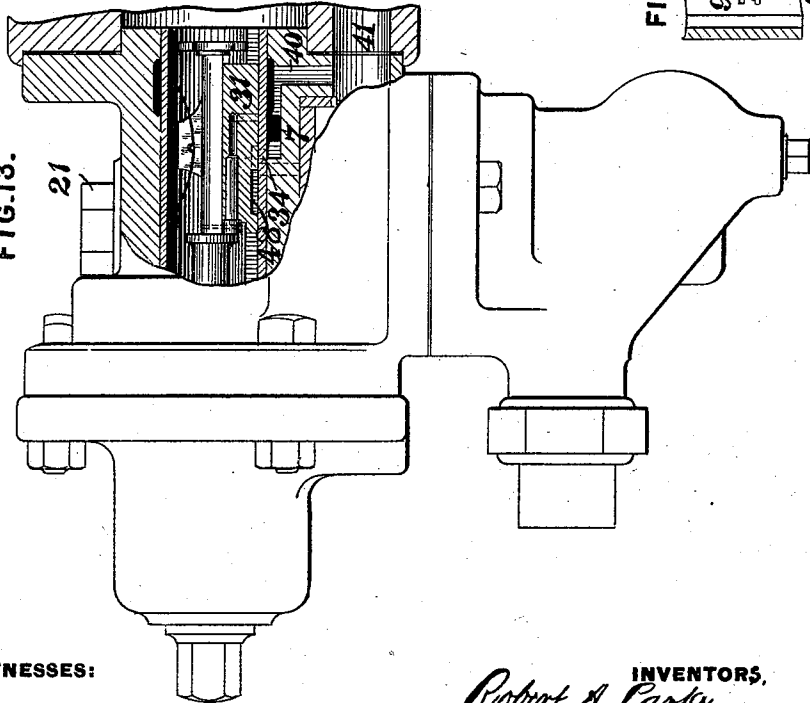


FIG.13.



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UNITED STATES PATENT OFFICE.

ROBERT A. PARKE, OF NEW YORK, N. Y., AND FRANCIS L. CLARK, OF WILKINSBURG, AND THOMAS J. HOGAN, OF PITTSBURG, PENNSYLVANIA, ASSIGNORS TO THE WESTINGHOUSE AIR BRAKE COMPANY, OF PITTSBURG, PENNSYLVANIA.

AIR-BRAKE.

SPECIFICATION forming part of Letters Patent No. 506,185, dated October 3, 1893.

Application filed June 23, 1893. Serial No. 478,653. (No model.)

To all whom it may concern:

Be it known that we, ROBERT A. PARKE, residing at New York, in the county and State of New York, and FRANCIS L. CLARK, residing at Wilkinsburg, and THOMAS J. HOGAN, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, citizens of the United States, have jointly invented or discovered a certain new and useful Improvement in Air-Brakes, of which improvement the following is a specification.

The object of our invention is to provide a quick action automatic brake apparatus, in which a higher degree of braking power than heretofore may be made available for emergency applications of the brakes, in the operation of trains at exceptionally high speeds, without involving an increase in the braking power normally exerted in making ordinary or service applications of the brakes.

To this end our invention consists in certain novel combinations of devices hereinafter set forth, whereby the maximum force with which the brakes are applied in making service applications is limited to an amount less than that due to the maximum expansive pressure of the fluid contained in the auxiliary reservoir, the force with which the brakes are applied in making emergency applications is greatly increased, and the degree of such force is automatically reduced as the speed of the train is slackened.

The improvement claimed is hereinafter fully set forth.

Our invention is particularly designed for application upon trains which are run at extremely high speeds, and which, by reason of such high speed and of the variations of speed necessary in service, require the exertion of a braking force which is variable within a comparatively wide range. Under our invention, we provide means whereby the ordinary graduated application may be made when running at ordinary speeds, or in making a gradual stop from high speed, and a very powerful application may be made when the train is moving at high speed and the wheels are revolving at their greatest velocity. We

also provide for the gradual reduction of the force of such powerful applications, as the speed of the train slackens, in order to prevent the sliding of the wheels, and the objectionable results incident thereto.

In the practice of our invention, we employ an auxiliary reservoir and brake cylinder, of such relative capacity that a full service application of the brakes may be effected by supplying, from the auxiliary reservoir to the brake cylinder, only a degree of pressure less than that due to the equalization of pressures in the auxiliary reservoir and brake cylinder. The graduated and full applications for service stops may be made in the usual manner, but in making these stops any fluid under pressure released from the auxiliary reservoir to the brake cylinder, in excess of the amount necessary to produce, in the brake cylinder, the predetermined pressure required for making a full service application, is permitted to escape into the atmosphere, so that, although the amount of fluid stored in the auxiliary reservoir is sufficient to produce, in the brake cylinder, a pressure much greater than that required for a full service application, this greater pressure cannot be obtained therein by gradual reductions of train pipe pressure.

In connection with the brake cylinder and triple valve, we provide a supplementary valve device which controls a supply port to the brake cylinder and a release port from the brake cylinder to the atmosphere, and which is so adjusted as to close the release port and open the supply port so long as the pressure in the brake cylinder does not exceed the amount necessary for making a full service application of the brakes.

In making service applications of the brakes by gradual reductions of train pipe pressure, the supply port is closed by the supplementary valve when the full service pressure is obtained in the brake cylinder. This pressure may be obtained in the brake cylinder so gradually as to effect merely the closing of the supply port, without opening the release port, and without a complete expansion of

the auxiliary reservoir fluid into the brake cylinder and the fluid will then be confined in the brake cylinder at the limit of pressure required for service applications. It may occur, however, that in making a service application, the brakes may then be released and applied again immediately without further charging the auxiliary reservoir as the pressure in the brake cylinder approaches the limit desirable for a full service application, the final admission of fluid to the brake cylinder may produce therein a pressure more or less in excess of that required. Such excess of pressure may be great enough not only to close the supply port controlled by the supplementary valve, but also to effect a quick opening of the release port to such an extent as to secure a quick reduction of pressure to the limit required. The release port of the supplementary valve device will then again be closed, and both the release port and the supply port of the supplementary valve device will remain closed until the brake cylinder pressure is reduced in releasing the brakes by means of the triple valve, when the supply port will again be opened. When a quick reduction of train pipe pressure is effected for the purpose of making an emergency application of the brakes, pressure is supplied to the brake cylinder from the auxiliary reservoir and from the train pipe, as in the standard Westinghouse quick action system; and, as shown in one modification of our invention, it may be supplied from a supplementary reservoir by means of the quick action valve device. In the quick action automatic brake systems heretofore in use, when the quick action triple valve is operated to produce an emergency application, an equalization of pressures takes place almost instantly between the auxiliary reservoir and brake cylinder, so that the full effect of the auxiliary reservoir air is obtained in the brake cylinder immediately. With our improvement the pressure thus exerted in the brake cylinder exceeds that exerted in service applications, not merely by the amount due to the admission of train pipe air to the brake cylinder, but also by the amount due to the excess of pressure in the auxiliary reservoir above that necessary for service applications, and, further, by the amount due to the admission of air from the supplementary reservoir, in cases where the latter is employed. When this very high pressure is admitted to the brake cylinder, the brakes are instantly applied with a maximum force, which is greatly in excess of the force which would be necessary or safe, at ordinary speeds, or which could be safely applied at any speed, if it continued to act without reduction as the speed of the train slackened. It is necessary, therefore, that this force should be gradually diminished as the speed of the train slackens, and the wheels turn more slowly, so as to prevent the wheels from being gripped so tightly that they will

slide on the rails, and, in order to provide for such reduction, we employ the supplementary valve device before referred to, which, in addition to its function of limiting the force of a service application, operates to gradually release the pressure from the brake cylinder in emergency applications, until that pressure is reduced to the limit permitted in full service applications.

In the accompanying drawings: Figure 1 is a general plan view of a brake apparatus illustrating an application of our invention; Fig. 2, a similar view of a modification in which a supplementary reservoir is employed; Fig. 3, a plan view, on an enlarged scale, showing more clearly the fluid pressure devices illustrated in Fig. 2; Fig. 4, a vertical section, on a further enlarged scale, of a quick action triple valve and a supplementary valve device showing the quick action triple valve connected to a brake cylinder head; Fig. 5, a horizontal section, on the line x, x , of Fig. 4, of the quick action triple valve and supplementary valve device, the brake cylinder to which the triple valve casing is connected being shown in plan; Fig. 6, a vertical section on the line y, y , of Fig. 5, the quick action triple valve and brake cylinder both being shown in section; Fig. 7, a view of the face of the slide valve of the quick action triple valve; Fig. 8, a plan view of the seat of the slide valve of the quick action triple valve; Fig. 9, a section through a part of the casing of the quick action triple valve on the line z, z , of Fig. 8; Fig. 10, a view of the face of the slide valve of the supplementary valve device; Fig. 11, a view of the seat of the slide valve of the supplementary valve device with ports as shown in Fig. 4; Fig. 12, a section through a supplementary valve device and quick action triple valve showing a modification of our invention; Fig. 13, an elevation and partial section through the quick action triple valve shown in Fig. 12, the section being on a plane at right angles to that of Fig. 12; Fig. 14, a face view of the slide valve of the supplementary valve device shown in Fig. 12, and Fig. 15, a view of the seat of the slide valve shown in Fig. 14.

The arrangement of the train pipe 1, branch pipe 2, quick action triple valve 3, brake cylinder 4, and auxiliary reservoir 5, shown in the drawings, is similar to that employed in the Westinghouse quick action brake system, but our improvements are not in anywise limited in their application to such or any other specific construction and arrangement of brake apparatus.

In the preferred form of our improvement shown in detail in Figs. 4 to 11, both inclusive, we employ in connection with a quick action triple valve device a supplementary valve device in which a piston chamber, 10, and a slide valve chamber, 11, communicating therewith, are formed in a casing 6 and lined with a bushing 21. A piston 12 is fitted in the chamber 10 and is normally held in po-

sition against one end of the chamber by means of a spring 13, which surrounds the piston stem 14, and bears at one end against the piston 12 and at the other end against a hollow adjusting nut 15, which is screwed into the section 16 of the casing which incloses the spring 13 and stem 14. A stem 17 projects from the piston 12 into the slide valve chamber 11, and is provided with two collars, 18 and 19, between which the slide valve 8 is fitted, so that any longitudinal movement of the stem 17 and piston 12 slides the valve 8 on its seat 20. The chamber 11 is closed at one end by the screw cap 22, which acts as a guide for the stem 17, and the passage 7, shown in dotted lines in Fig. 5, connects the chamber 11 with the annular space 39, which is formed in the casing of the triple valve around the bushing 35. As is usual in the standard Westinghouse quick action triple valve, this annular space 39 is always in open communication with the brake cylinder through the passages 40, 41, and 46; therefore the chamber 11 will always be in open communication with the brake cylinder. The passage 7 may, however, open directly into either of the passages 40, 41 or 46, or directly into the brake cylinder. A supply port 38 is formed in that portion of the bushing 21 which forms the seat of the slide valve 8 and connects the chamber 11 with an annular passage 37, formed in the casing 6 of the supplementary valve device around the bushing 21. This annular passage 37 is connected by means of a passage 36 with the service port 34 formed in the bushing 35 of the quick action triple valve. It will be seen that, with this construction, the service port 34 does not communicate directly with the passage 40 leading to the brake cylinder, and, therefore, any fluid which passes from the auxiliary reservoir through the service port 34, must flow through the passages 36, 37, 38, chamber 11, and passages 7, 40, 41, and 46 to get into the brake cylinder.

The slide valve 8 has formed in its face a port 23, which communicates, by means of a side port 26, with the chamber 11. The port 23 is of the form shown in Fig. 10, and consists of a narrow rectangular portion 24 having a tapering extension 25 formed on one of its sides. The port 9, in the valve seat 20, is of the same form and about the same dimensions as the rectangular portion 24 of the port 23, in the face of valve 8. When in its normal position, and when the brakes are off, the valve 8 closes the release port 9 and opens the port 38, and when fluid under pressure is admitted to the brake cylinder, the valve 8 remains in its normal position, so far as the ports 9 and 38 are concerned, so long as the brake cylinder pressure is below that necessary for a full service application of the brakes.

The brake cylinder, 4, and auxiliary reservoir, 5, are so proportioned that with the usual normal pressure in the train pipe and

auxiliary reservoir, a full service application of the brakes may be obtained by a comparatively low pressure per unit of area acting on the piston of the brake cylinder; and this pressure, while it is capable of producing the same effect, is considerably less per unit of area than the equalized pressure heretofore and now ordinarily employed in making a full service application.

A service application of the brakes is effected by making a gradual reduction of train pipe pressure, which permits the auxiliary reservoir pressure to move the piston, 29, of the triple valve, 3, and with it the small graduating valve 30; the slide valve, 31, is then moved to close communication between the brake cylinder and the exhaust passage 32 and to open the port or passage 33, in the slide valve 31, to the port 34 in the bushing 35. The fluid from the auxiliary reservoir then flows through the passage 33 in the valve and through the port 34 in the bushing 35, into the passage 36 and annular passage 37, which surrounds the bushing 21 of the valve chamber 11. From the passage 37 the fluid passes through the supply port 38 in the bushing 21 and fills the chamber 11 of the supplementary valve device 6, and then flows through the passage 7 into the annular passage 39, surrounding the bushing 35 of the quick action triple valve, which communicates by means of the passages 40, 41 and 46 with the brake cylinder. Fluid from the auxiliary reservoir will continue to flow, through the passages described, into the brake cylinder, until the reservoir pressure is reduced below that in the train pipe, when the piston 29 will be moved by the train pipe pressure sufficiently to cause the graduating valve 30 to close the passage 33 in the slide valve, and thereby cut off communication between the auxiliary reservoir and the brake cylinder. A further reduction of train pipe pressure will permit the auxiliary reservoir pressure to move the piston 29 and with it the graduating valve 30, sufficiently to again open the passage 33 and permit an additional flow of fluid from the auxiliary reservoir to the brake cylinder. This may be repeated until the pressure acting on the piston, 47, of the brake cylinder is sufficiently great to produce a full service application of the brakes. This full service pressure is obtained in the brake cylinder by permitting only a partial expansion of the auxiliary reservoir fluid thereinto, and it is considerably less than the pressure which would be exerted if the auxiliary reservoir and brake cylinder pressures were equalized. As soon as sufficient pressure has accumulated in the brake cylinder to effect a full service application, the fluid pressure in the chamber 11 of the supplementary valve device 6, which is at all times in communication with the brake cylinder, moves the piston 12 against the resistance of the spring 14, and causes the valve 8 to close the port 38 and thereby prevent the further admission of

fluid to the brake cylinder. In case the pressure in the brake cylinder is just sufficient for a full service application of the brakes, no further movement of the valve 8 occurs, but if the final admission of fluid to the brake cylinder has been sufficient to produce a slight excess of pressure above that necessary for a full service application, the piston 12 and slide valve 8 will be moved far enough not only to close the supply port 38, but also to open the release port 9 by causing the wide portion of the port 23 of the slide valve to register with the release port 9 in the bushing 21, and thereby produce a maximum opening for the release of pressure from the brake cylinder. The pressure in the brake cylinder is then quickly reduced by the release of fluid therefrom which flows through the passages 46, 41, 40, 39, and 7, into the chamber 11 of the supplementary valve device, and from the chamber 11, through the side port 26 in the slide valve 8, and through the port 23 in the face of the slide valve and port 9 in the bushing 21, to the atmosphere. The reduction of pressure thus effected in the brake cylinder and chamber 11, permits the spring 13 to move the piston 12 and valve 8 back again far enough to close the release port 9 without opening the port 38. Any further graduated reduction of train pipe pressure will not cause a further admission of fluid under pressure from the auxiliary reservoir to the brake cylinder unless the reduction of pressure in the brake cylinder, through leakage or otherwise, has been great enough to cause the opening of the port 38. When a high degree of pressure is suddenly exerted in the brake cylinder, as is the case in emergency applications of the brakes, the pressure in the brake cylinder, and in the chamber 11, acting on the piston 12, compresses the spring 13 and moves the piston 12 and valve 8 suddenly to the extremity of their stroke. In this position the projections 28, on the piston 12, bear against the shoulder 27, on the section 16 of the casing, and the narrow end of the tapered portion 25, of the port 23, registers with the port 9, in the valve seat 20. The upper edge of the port 23 passes the upper edge of said port 9, as shown by the dotted lines in Fig. 11, so as to leave but a very slight opening for the escape of fluid. This permits a slight release of the fluid and a slow reduction of pressure at first, but as the fluid continues to escape and the pressure lowers, the diminished pressure on the piston 12 permits the spring 13 to move the piston and valve gradually backward movement, the wider portions of the port 23 successively register with the port 9, and the ports 23 and 9 finally present the maximum opening through which the pressure is quickly reduced to the degree employed in making a full service application. The valve 8, continuing its backward movement, then quickly closes the release port 9, and no

further reduction of pressure takes place until the brakes are released by increasing the train pipe pressure.

In order to produce an emergency application of the brakes, we employ the construction of quick action triple valve device shown in detail in Figs. 6, 7, 8, and 9. When a sufficiently great and rapid reduction of train pipe pressure is effected, the piston 29 is moved, by auxiliary reservoir pressure, to the limit of its stroke, and the slide valve 31 is moved into position where it closes communication between the brake cylinder and the atmosphere, the cutaway portion 49 of the slide valve uncovering the quick action port 50. Fluid from the auxiliary reservoir then passes through the port 50 to the piston 42, and by acting on the piston 42, unseats the valve 43, which permits the fluid in the chamber 52 to pass to the brake cylinder, thereby reducing the pressure in the chamber 52 and permitting the fluid from the train pipe to flow through the passages 37^a, 53, chambers 52, and 45, and passages 41, and 46, to the brake cylinder. As soon as the port 50 is uncovered by the cutaway portion 49 of the slide valve 31, fluid from the auxiliary reservoir also flows to the brake cylinder through the port 50 and passages 51, 40, 41, and 46. When the train pipe pressure is increased for the purpose of releasing the brakes, the slide valve 31 is moved back to its normal position in which the cavity 48 of the slide valve 31 connects the service port 34 and emergency port 50 with the exhaust port 47. The fluid in the brake cylinder then escapes through the passages 46, 41, and 40, and thence either through the passage 51 and emergency port 50 to the cavity 48, or through the passage 7, chamber 11, and passages 38, 37, and 34, to the cavity 48, and from the cavity 48 through the port 47 and passage 32 to the atmosphere. As shown in Figs. 2 and 3, there may be further provided a supplementary reservoir 54, which is connected, as shown in Figs. 4 and 6, by a branch pipe, 55, with the chamber 52 in the casing of the quick action triple valve, in such manner that air from the train pipe 1, and branch pipe 2, may pass through the chamber 37^a, passage 53, chamber 52, and pipe 55, into the supplemental reservoir 54, when the train pipe is charged for the purpose of releasing the brakes. In order that the charging of the reservoir 54 may not interfere with the prompt release of the brakes, a check valve, 56, through which extends a small passage, 57, is located in the pipe 55, in such manner as to close or seat toward the supplementary reservoir, 54, when the flow of fluid is from the train pipe toward the supplementary reservoir. The supplementary reservoir 54 is then charged gradually, through the small passage 57, and the accumulation of pressure on the train pipe side of the triple valve piston, 29, moves that piston, and the slide valve, 31, of the triple valve, to their normal positions, in which the

brake cylinder is connected, through the slide valve, 31, with the atmosphere, communication between the auxiliary reservoir 5 and the brake cylinder is closed, and the feed passage 58 from the train pipe to the auxiliary reservoir 5 is opened. The charging of the auxiliary reservoir and supplementary reservoir will continue, until the pressure in each is substantially the same as the pressure in the train pipe.

In making an emergency application of the brakes, the piston 29 and valve 31 are moved, on a sufficiently great and rapid reduction of train pipe pressure being made, to release fluid under pressure from the auxiliary reservoir, 5, to the brake cylinder and to the piston 42. The piston 42 is then and thereby moved so as to open the quick action valve 43, which permits air to flow from the chamber 52 to the brake cylinder, and the reduction of pressure caused thereby permits the air in the train pipe to open the check valve 44 and flow to the brake cylinder. If a supplementary reservoir 54 be also employed, the fluid under pressure therein will co-incidentally open the check valve 56 to its full capacity, and flow through the pipe 55, chambers 52 and 45, and passages 41 and 46, to the brake cylinder. When the supplementary reservoir, 54, is employed, the effective pressure exerted in the brake cylinder is not only materially greater than the pressure exerted in making service applications of the brakes, but is also materially greater than that heretofore exerted in making emergency applications.

A modification of our invention is shown in Figs. 12, 13, 14, and 15, in which the supply port 38 in the supplementary valve device, and the connections 36 and 37 thereto, from the service port 34, are omitted. The service port 34 is connected, as shown in Fig. 13, directly with the passage 40 in the casing of the quick action triple valve, and when it is opened by the movement of the slide valve 31, the fluid from the auxiliary reservoir flows directly into the passages 40 and 41 and thence to the brake cylinder. The chamber 11, of the supplementary valve device 6, is always in communication with the passages 40, 41, and with the brake cylinder, through the passage 7, and the piston 12 is, therefore, always subjected on one side to brake cylinder pressure. The valve seat 20 of the slide valve, 8, has a release port, 9, formed in it, as shown in Figs. 12 and 15, and the valve 8 is provided with a port 23, as shown in Fig. 14, which port is of substantially the same form as that shown in Fig. 10. The port 23 is always in communication with the chamber 11, through the side port 26 in the valve 8, as shown by dotted lines in Fig. 14, and registers with the port 9 as before described. Whichever form of supplementary valve device is employed, if preferred, the rectangular release port, 9, may be formed in the valve 8, and a port similar in form to the port 23

may be formed in the valve seat, but in a position the reverse of that shown in the drawings; or a series of ports may be employed instead of a single port in the valve and its seat. Our invention, therefore, is not limited to the specific construction shown in the drawings.

It will be obvious that in lieu of the piston 12, a flexible diaphragm, or any other movable abutment constituting the mechanical equivalent of a piston, may be employed, in the discretion of the constructor, and without departure from the essential features of our invention.

It will be seen that by means of our invention the pressure and quantity of fluid in the auxiliary reservoir may not only be greater than is necessary for a full service application of the brakes, but may be sufficient for a number of applications, and this we regard as an important feature of our invention as it permits repeated applications of the brakes to be made in quick succession without the necessity of waiting to recharge the auxiliary reservoirs. It is, therefore, an essential feature of our invention not only that the capacity, but also the normal condition as to pressure and volume of fluid, of the auxiliary reservoir, shall be such as to exceed what is necessary for a single full application of the brakes. And no unusual or accidental excess can interfere in any way with the prompt and efficient application of the brake, but may increase the efficiency. And to secure a new and improved action or operation of the brakes under these conditions is one of the objects of our invention.

We claim as our invention and desire to secure by Letters Patent—

1. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a quick action triple valve, a brake cylinder, and a valve device controlling a brake cylinder port, for limiting the brake cylinder pressure in making service applications of the brakes to a predetermined amount, and for gradually reducing the brake cylinder pressure from the maximum emergency pressure to the full service pressure in making emergency applications of the brakes, substantially as set forth.

2. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a brake cylinder, a triple valve and a quick action valve device, by means of which two different degrees of pressure may be exerted in the brake cylinder in making full service and emergency applications respectively, a valve device for regulating the pressure in the brake cylinder, a release port or ports in said valve device through which fluid is released from the brake cylinder to the atmosphere, and a valve controlling said release port, and provided with means by which a full opening of the release port is effected when the brake cylinder pressure is slightly in excess of the full service pressure, a small

degree of opening when the full emergency pressure is exerted in the brake cylinder, and a gradually increasing degree of opening as the pressure is reduced from full emergency
5 to full service pressure, substantially as set forth.

3. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a brake cylinder, a triple valve, and a
10 valve device controlling a brake cylinder port whereby the full service pressure in the brake cylinder is limited to a degree less than the maximum pressure which may be obtained by a complete expansion of the auxiliary res-
15ervoir fluid when at its normal pressure into the brake cylinder, substantially as set forth.

4. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a brake cylinder, a triple valve, a quick
20 acting device for effecting emergency applications of the brakes, and a supplemental release valve device for gradually reducing the emergency brake cylinder pressure to the service pressure, substantially as set forth.

5. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a brake cylinder, a triple valve, and a
25 valve device controlling a passage from the service port of the triple valve to the brake
30 cylinder, substantially as set forth.

6. The combination, in an automatic fluid pressure brake system, of an auxiliary reservoir, a brake cylinder, a triple valve, and a
35 supplemental valve device controlling the passage of fluid from the service port of the triple valve to the brake cylinder and from the brake cylinder to the atmosphere, sub-
stantially as set forth.

7. In a fluid pressure brake system the combination with a train pipe, an auxiliary res-
40ervoir, a brake cylinder, and a triple valve controlling the admission of fluid from the auxiliary reservoir to the brake cylinder of a supplementary reservoir, and a valve device

controlling the admission of fluid from the 45 supplementary reservoir to the brake cylinder, substantially as set forth.

8. In a fluid pressure brake system the combination with a train pipe, an auxiliary res-
50ervoir, a brake cylinder, and a supplementary reservoir, of a quick action triple valve which releases fluid from the auxiliary reservoir to the brake cylinder in service applications of the brakes, and from the supplementary res-
55ervoir and train pipe to the brake cylinder in emergency applications of the brakes, substantially as set forth.

9. The combination, in an automatic fluid pressure brake system, of an auxiliary reser-
50voir, a brake cylinder, a quick action triple valve, a supplementary reservoir, and means for gradually charging the supplementary reservoir from the train pipe and permitting a rapid discharge from the supplementary
65reservoir to the brake cylinder, substantially as set forth.

10. In a fluid pressure brake system, the combination, with a train pipe, an auxiliary
70reservoir, and a brake cylinder, of a triple valve device for releasing fluid from the auxiliary reservoir to the brake cylinder, a supplementary reservoir and a valve device for releasing fluid from the train pipe and supplementary reservoir to the brake cylinder, substantially as set forth.

In testimony whereof we have hereunto set
75our hands.

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FRANCIS L. CLARK.
THOMAS J. HOGAN.

Witnesses as to R. A. Parke:

CARL M. VAIL,
C. W. PERKINS.

Witnesses as to F. L. Clark and T. J. Ho-
gan:

J. SNOWDEN BELL,
F. E. GAITHER.