2 Sheets--Sheet 1.

G. WESTINGHOUSE, Jr.

Steam and Air-Brakes.

No. 144,006. Patented Oct. 28, 1873.

FIG. I.

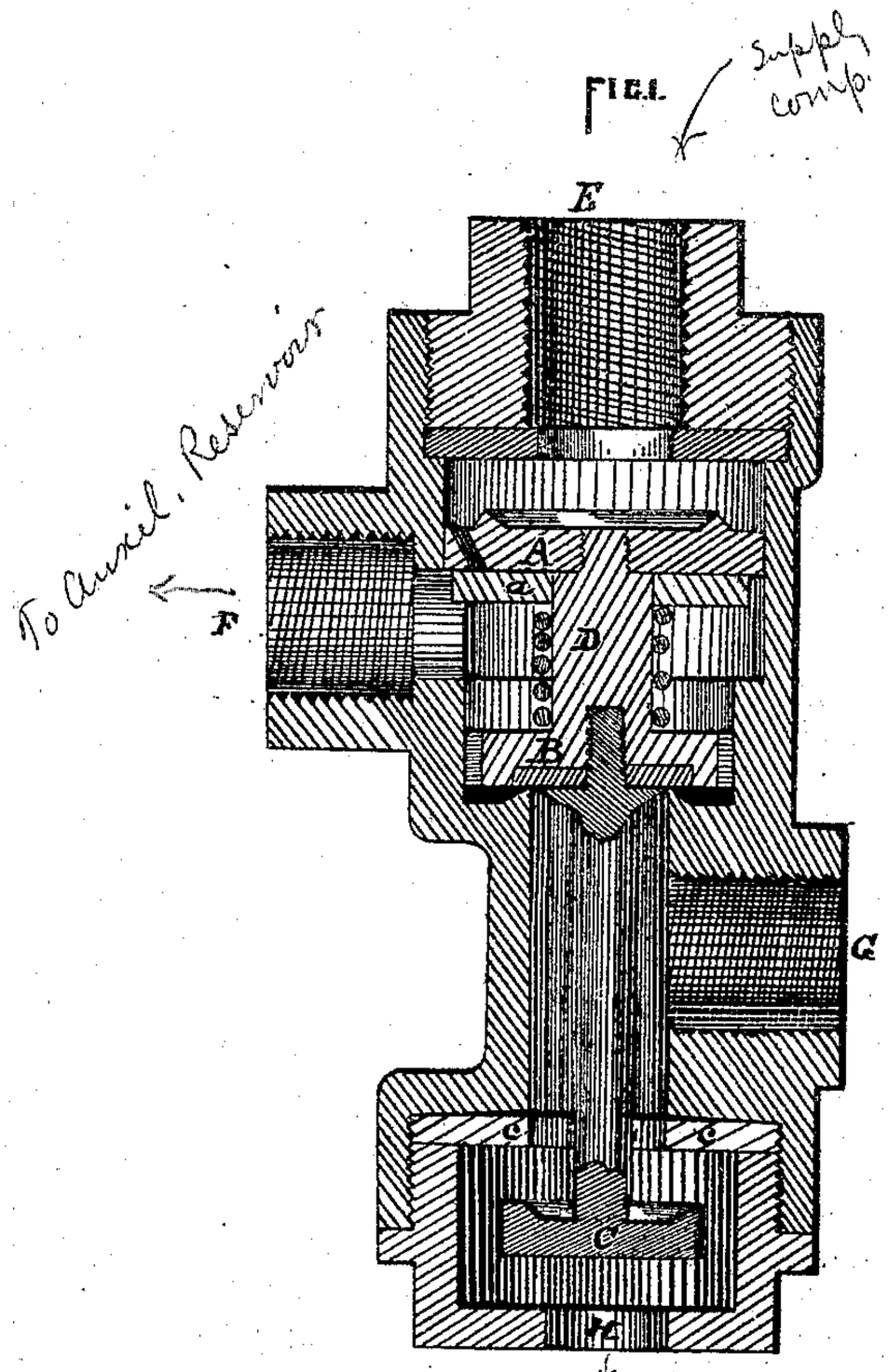


FIG. II.

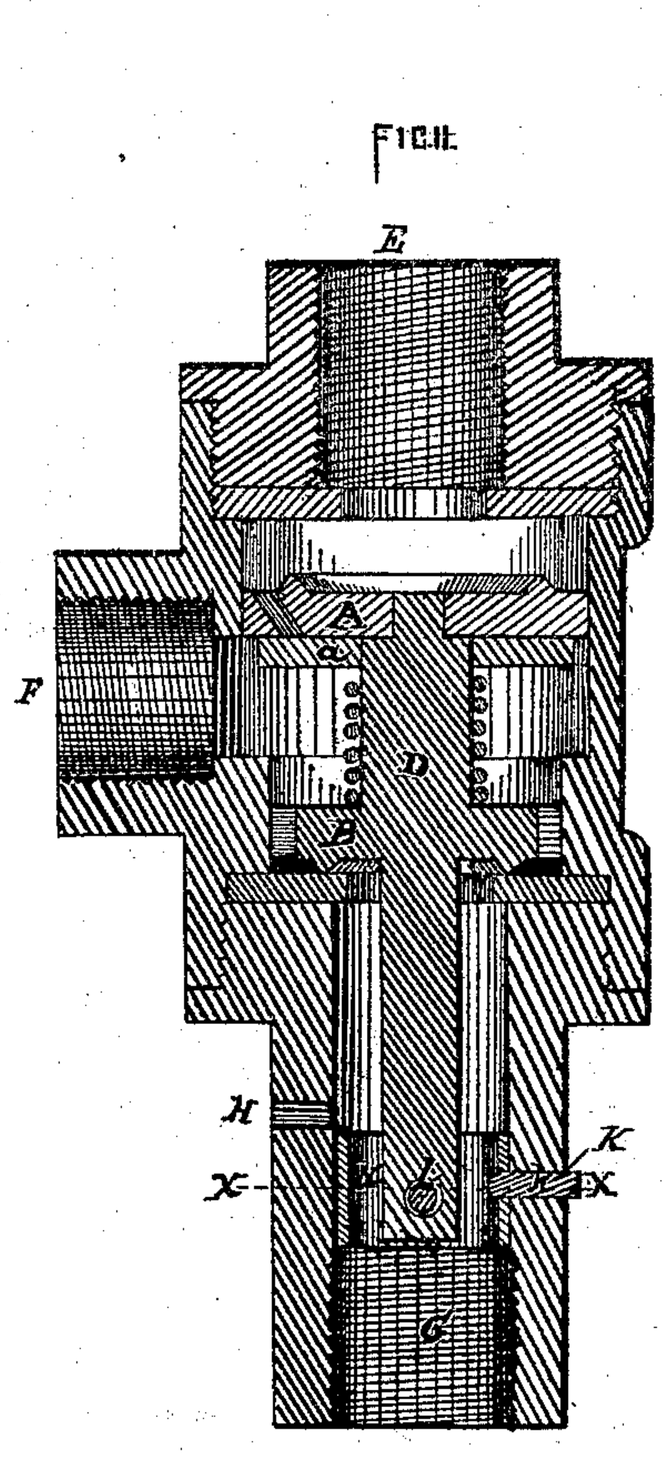


FIG. III.

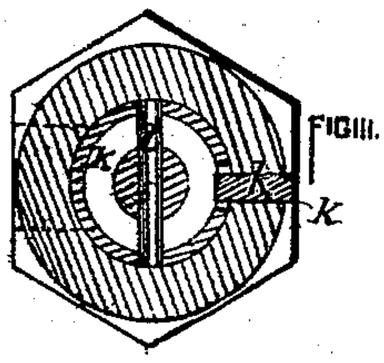
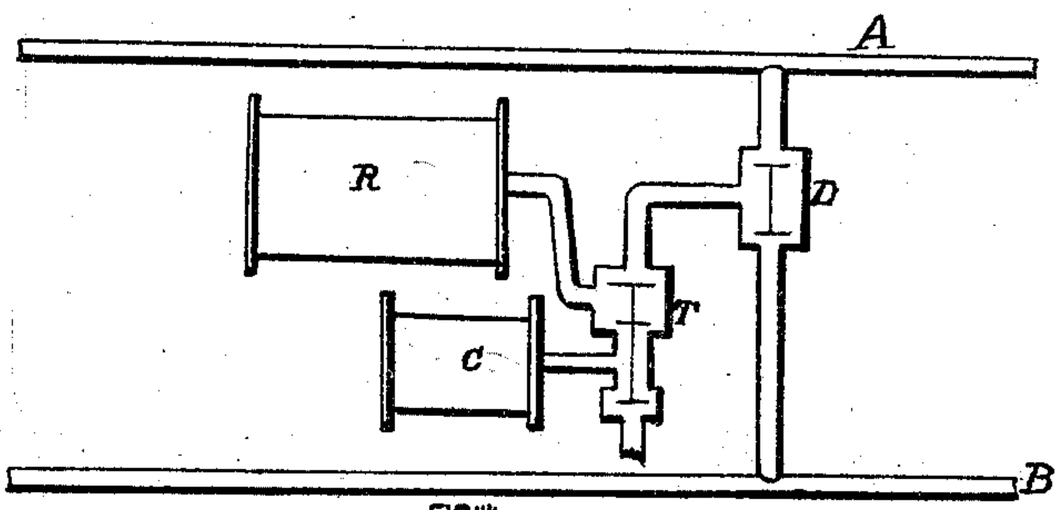


FIG. IV.



Witnesses.

R. F. Wentworth

J. Isaac Kay

Inventor

George Westinghouse Jr.
by Bakewell, Christy & Kerr
his atty's

2 Sheets--Sheet 2.

G. WESTINGHOUSE, Jr.

Steam and Air-Brakes.

No. 144,006. Patented Oct. 28, 1873.

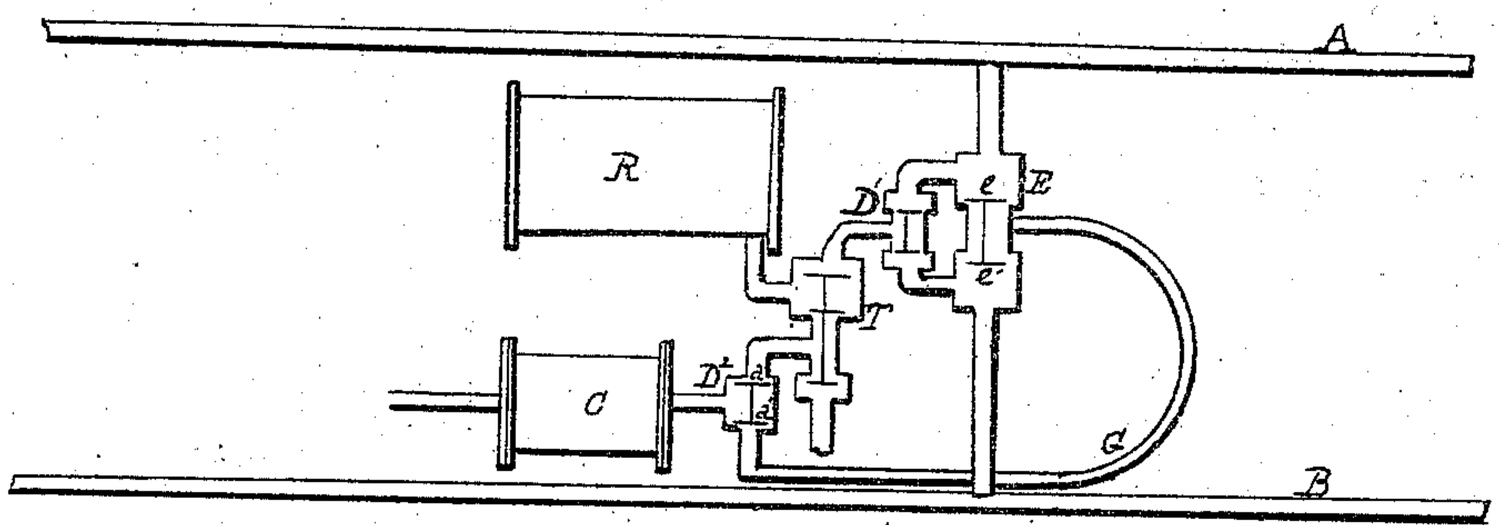


FIG.V.

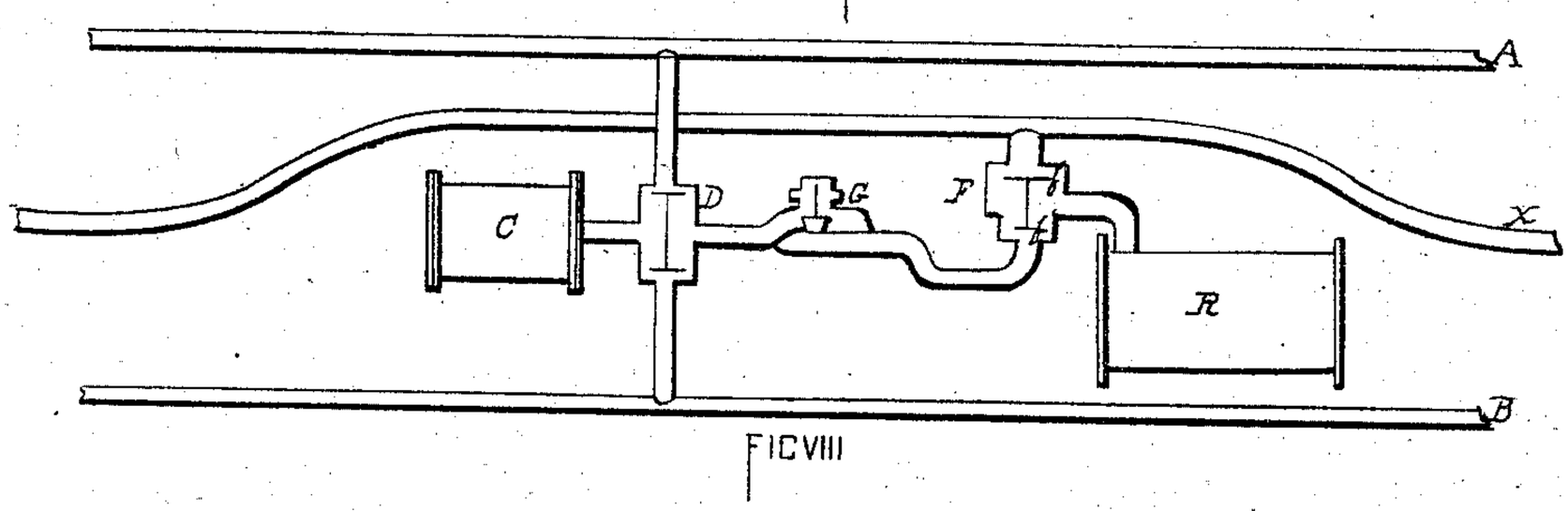


FIG.VIII

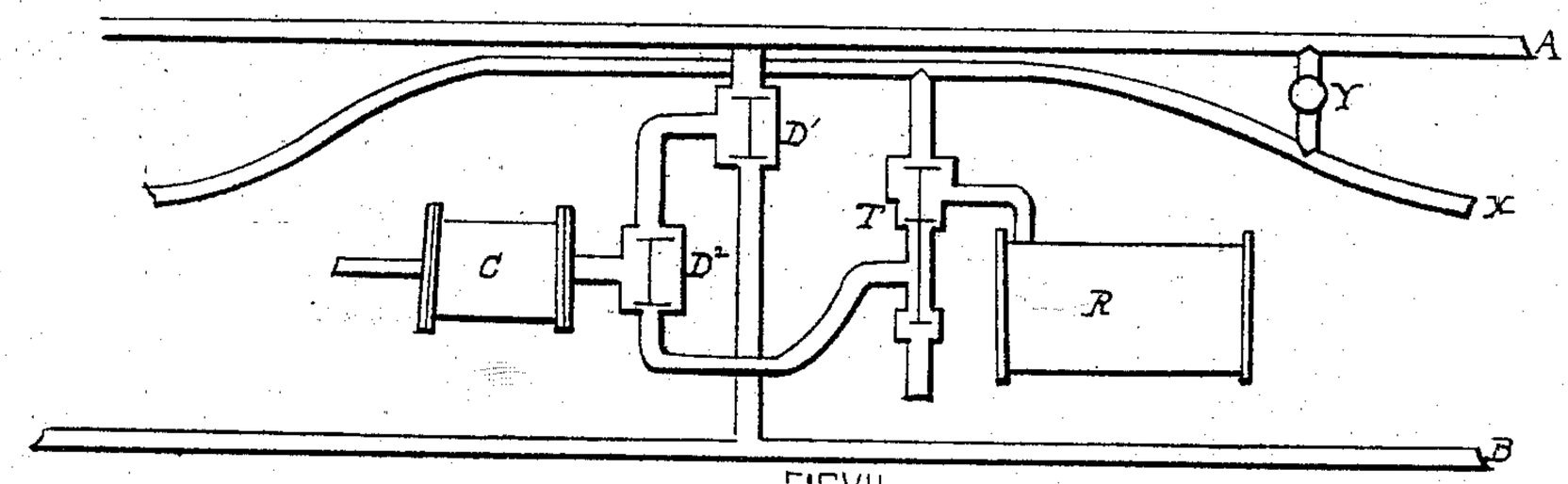


FIG.VII.

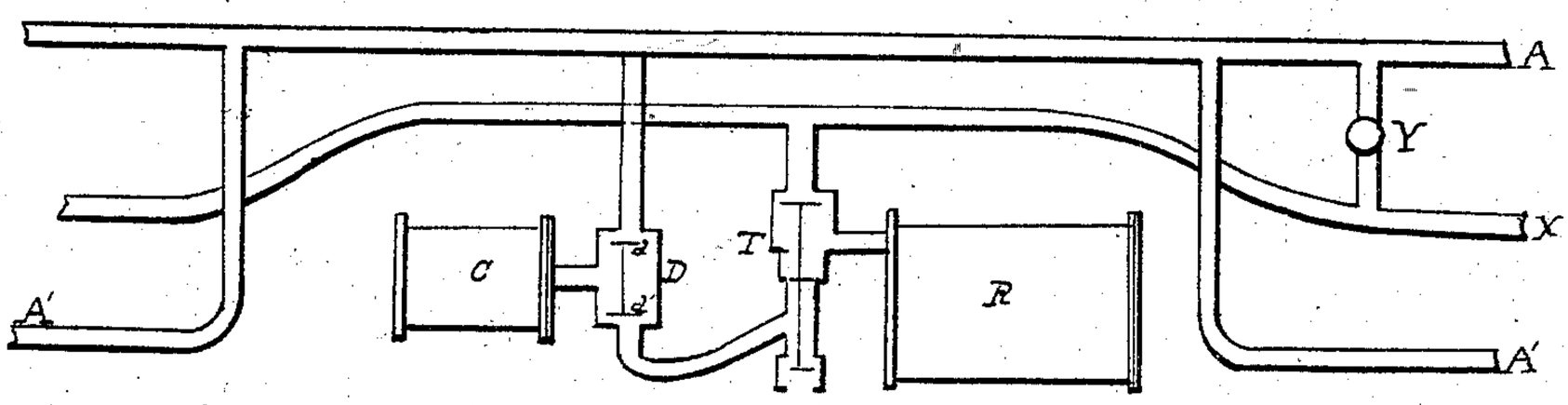


FIG.VI.

Witnesses.

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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN STEAM AND AIR BRAKES.

Specification forming part of Letters Patent No. **144,006**, dated October 28, 1873; application filed July 24, 1873.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Steam and Air Brakes; and I do hereby declare the following to be a full, clear, and exact description thereof, which, taken in connection with the accompanying sheets of drawings hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvement, by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to secure by Letters Patent—that is to say:

In the specifications of patents obtained by me March 5, 1872, Nos. 122,404 and 122,405, and August 8, 1871, No. 117,841, were described various arrangements and constructions of pipes, valves, and apparatus, whereby compressed air could be made to operate brakes and communicate signals in a railway-train.

My present invention relates to an improved construction of the valves and pipe couplings employed in such apparatus.

I will first describe my improved construction of valves, referring to Figure 1, which represents a section of the valve-box. This valve-box has three chambers or compartments, and is provided with three valves, A, B, and C, united by one stem. The first or upper chamber communicates, by the end passage E, with the pipe by which compressed air is conveyed throughout the train, and, by the side passage F, with the auxiliary reservoir of compressed air. In this chamber there are two valves, A and B, on the same stem of which the upper valve, A, has a greater area than the lower valve, B, and has holes through it near its periphery covered by a disk, *a*, pressed against its back by a spring. The second chamber communicates, by a side passage, G, with the brake-cylinder, and the third chamber has an opening, H, to the atmosphere. This third chamber contains the third valve, C, also on the same stem, which can close upward against a caoutchouc or leather seating, *c*, when the valve A is closed against its upper seat. The seating *c* is made with a little space between its inner edge and the body of the valve-box, so that when the valve C bears against it the pressure of air above the seating shall press it against the raised annular edge of the valve C, and thereby insure the tightness of its closure.

The operation of these valves is as follows: Assuming that the auxiliary reservoir is not charged with compressed air, when compressed air is admitted into the air-pipe it enters by the passage E, and, its pressure acting on the larger valve A, opens it and closes the valve B. The compressed air thus admitted flows through the holes in the valve A, pressing away the disk *a* that covers them, and, by the passage F, to the auxiliary reservoir, which it charges. At the same time the valve C, being on the same stem with A and B, is opened, and air from the brake-cylinder issues, by the passage G, past the valve C and through the opening H to the atmosphere; so that the brakes are taken off by relieving the piston in the brake-cylinder from pressure.

If now it be required to put on the brakes, air is allowed to escape from the air-pipe, either by opening a cock or valve by hand or automatically, (in the manner described in the specifications referred to above,) when the air-pipe or its connections give way, or when a carriage becomes detached or runs off the line. The auxiliary reservoir having been charged with compressed air, as described above, the pressure communicated through the passage F acting on the larger area of the valve A, and finding no escape by the holes in its periphery, which are closed by the disk *a*, raises that valve against its seat, and so closes communication with the air-pipe by the passage E. At the same time the valve B is opened, and the valve C is closed. Compressed air then flows from the auxiliary reservoir by the passage F, past the valve B, through the passage G to the brake-cylinder, where it acts on the piston so as to put on the brakes.

Thus, by means of this triple-valve arrangement, when the air-pipes communicating with E are charged with compressed air the auxiliary reservoirs are charged and the brakes are taken off, and when air is discharged from the air-pipes, the brakes are put on by the action of the air stored in the auxiliary reservoir.

Fig. 2 represents a section of a construction of such a valve-box in which the lower disk-valve C is replaced by a sliding-ring valve, K.

In this case the opening to the atmosphere is a side passage, H, and the communication to the brake-cylinder is by the end passage G.

Fig. 3 represents a sectional plan on the line X X. The ring K acts as circular slide, which closes the opening H when the valve A is seated, and leaves it open, as shown in Fig. 2, when the valve B is seated.

The ring is divided at one side to allow it to spring so as to make an air-tight fit in the cylindrical part of the valve-box in which it fits, and a steady-pin, *k*, projecting into the slit of division prevents the ring from turning round. The ring is connected to the valve-stem by a pin, *l*, passing through the sides of the ring and the stem. The action is in this case the same as that described with reference to Fig. 1.

I have described the action of this valve arrangement as if it communicated with only one air-pipe. By combining it, however, with double valves connected by a stem, such as have been described in the specifications above referred to, either or both of the duplicate air-pipes serve to work upon the auxiliary reservoir and brake-cylinder, as above described.

By referring to the before-mentioned specifications it will be seen that these double valves are of two kinds, one which opens the passage from the pipe of higher pressure and closes the passage to the pipe of lower pressure, and the other which closes the passage from the pipe of higher pressure and opens that to the pipe of lower pressure.

In connecting the duplicate air-pipe with the valve-box above described, and with the brake-cylinder, such double valves may be arranged in the manner shown in the diagram plan, Fig. 4. In this diagram A and B represent the two air-pipes, communicating throughout a train; R, the auxiliary reservoir; and C the brake-cylinder. T is the triple-valve arrangement, above described, and D is one of the double-valve arrangements described in the specification above referred to, whereby either of the pipes A or B, that contains air at lower pressure than the other, is cut off. It will be seen that compressed air conveyed along either or both of the pipes A and B will operate on the auxiliary reservoir R and the brake-cylinder C by means of the triple-valve arrangement T, in the manner above described.

Sometimes it is desirable that either of the two communicating air-pipes may be employed to charge the reservoir, while the other pipe may be used to operate the brakes. An arrangement of valves for this purpose is shown in the diagrammatic plan, Fig. 5, where A and B represent the two air-pipes; C, the brake-cylinder; R, the auxiliary reservoir; T, the triple-valve arrangement, above described; D^1 and D^2, double valves, such as that marked D in Fig. 4; and E, one of the other kind of double-valve arrangements, described in the former specification referred to above, whereby the pipe containing air at higher pressure is cut off from communication.

From this arrangement it will be seen that one of the pipes—such as A—may be employed to charge the reservoir R, the compressed air from A passing by the one end of E, and past one of the valves in D^1, acting on the large valve in T, so as to open it and the farthest valve, and close the middle valve of T, and passing the larger valve of T to the reservoir R. At the same time the other pipe, B, may be charged with compressed air for putting on the brakes, the air from that pipe passing the open valve *e'*, and thence by the pipe G to the valve-box D^2, where it will open the valve *d'* and close *d*, and thence to the brake-cylinders C, where the pressure will act on the piston so as to put on the brakes. If, now, the pipe B be relieved of pressure, then, the valve *e* being closed and *e'* being open, the air in the pipe G will have its pressure reduced. The valves *d d'* will then be in equilibrium, allowing the air from the brake-cylinder to escape past either or both of them, and either past the third valve in T to the atmosphere, or by the pipe G and past the valve *e'* to the discharge-pipe B. Again, assuming the reservoir R to have been charged with compressed air, and the pipe B to be relieved of pressure, by relieving the other pipe A of pressure the brakes will be put on, for the valves in E and D^1 being then in equilibrium the pressure is taken off the large valve in T, which is therefore closed, opening the second valve in T and closing the third, so that compressed air will flow from R past the open valve in T, and opening the valve *d* and closing *d'* into the brake-cylinder C.

Two pipes communicating throughout a train may be applied in connection with valves in the manner represented on the diagram plan, Fig. 6. Here the one air-pipe A is shown with branches A' at each end of the carriage for convenience of coupling, as has already been described by me in the former specifications referred to. The other pipe, X, communicates with the triple-valve arrangement T. Assuming that X is charged with compressed air, it charges the auxiliary reservoir R, keeping open the large valve in T and the third valve, and closing the middle valve. Then compressed air admitted into the pipe A will open the valve *d* and close *d'*, and pass into the brake-cylinder C, so as to put on the brakes; and when air is discharged from A, the valves *d* and *d'* being in equilibrium, the air from C will pass either *d* into the pipe A or *d'* past the third valve in T to the atmosphere, and thus the brakes will be taken off. Again, the pipe A being relieved of pressure the brakes can be put on by discharging air from the pipe X, for then the larger valve in T and the third valve will be closed, and the middle valve will be opened, so that compressed air will flow from the reservoir R past the valve *d'* to the brake-cylinder C. The air can be discharged from X, either by a cock or valve opening, directly to the atmosphere, or by a cock, Y, in a branch connecting X with A. In this case the air admitted from X to A may serve for sig-

naling by sounding-whistles or working-gages connected to the pipe A in the manner described in former specifications referred to. Instead of one pipe, A, with branches A′, as shown in Fig. 6, two pipes, A and B, with a third pipe, X, may be employed, as shown in the diagram plan, Fig. 7. Here it will be seen that either of the pipes A or B can be employed to work the brakes, while X, when charged, is employed to charge the reservoir R, and when discharged to permit the air stored in the reservoir to work the brakes. The contents of the pipe X may be discharged into the atmosphere by a cock or valve, or into one of the other pipes, as A, by means of a branch provided with a cock or valve, the pipe A being thus rendered available for communicating signals. The three pipes A, B, and X may be employed with a combination of valves such as is shown in the diagram plan, Fig. 8, where F represents a double-valve arrangement, such as was described in previous specifications referred to, having the upper valve *f* of larger area than the lower valve *f′*. D is a double-valve arrangement like that described above and marked with the same letter, and G is a check-valve of any known description. It will be seen that the reservoir R can be charged from the pipe X, the valve *f* being opened and *f′* closed by the pressure of the air in the pipe X. At the same time the brakes can be put on by charging either or both of the pipes A or B with compressed air, and taken off by discharging the air from both. Again, if the pipes A and B be closed, and air be discharged from X, the air stored in the reservoir R closes the valve *f*, opens *f′*, and passes G to the brake-cylinder C, so as to put on the brakes, and also to charge the pipes A and B for communicating signals. In this case the check-valve G performs the function of the third valve C above described, and in such construction is the mechanical equivalent therefor, the valves *f f′* corresponding in function and structure to the two upper valves of Fig. 1.

It will readily be understood that the several kinds of valve arrangements described in this and in the former specifications referred to can be combined in many other ways, so as to effect the working of brakes and communication of signals according to various systems of operation.

The arrangements shown in the diagrams, Figs. 4, 5, 6, 7, and 8, described above, are given as examples of how such combination of valves may be made, and although in these, for the sake of distinctness, the several valves are shown as if they were fitted in separate chambers, it may be readily understood that they might be fitted into separate compartments of one valve-box, so as to secure greater simplicity and compactness of construction. The same features of construction and combination may be employed in connection with hydraulic gas or other fluid brakes. In connection with hydraulic brakes, an accumulator should take the place of the reservoir.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of the triple valve A B C, seated as described, the valve-case connection E, above the valve A, to an air-supply pipe, a connection, F, between the valves A B with an auxiliary reservoir, a connection, G, below the valve B, with the brake-cylinder, substantially as set forth.

2. A triple valve arranged, in combination with a line of brake-pipe, auxiliary reservoir, and brake-cylinder, so that by the introduction of compressed air or steam the auxiliary reservoir will be charged and the brakes let off, and when the air is let off from such pipes an opening will be made from the auxiliary reservoir to the brake-cylinder, substantially as set forth.

In testimony whereof I, the said GEORGE WESTINGHOUSE, Jr., have hereunto set my hand.

GEORGE WESTINGHOUSE, Jr.

Witnesses:

JOHN H. BAILEY,

G. H. CHRISTY.