No. 630,382. Patented Aug. 8, 1899.

W. B. MANN.

APPARATUS FOR OPERATING AIR BRAKES.

(Application filed Feb. 27, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 2.

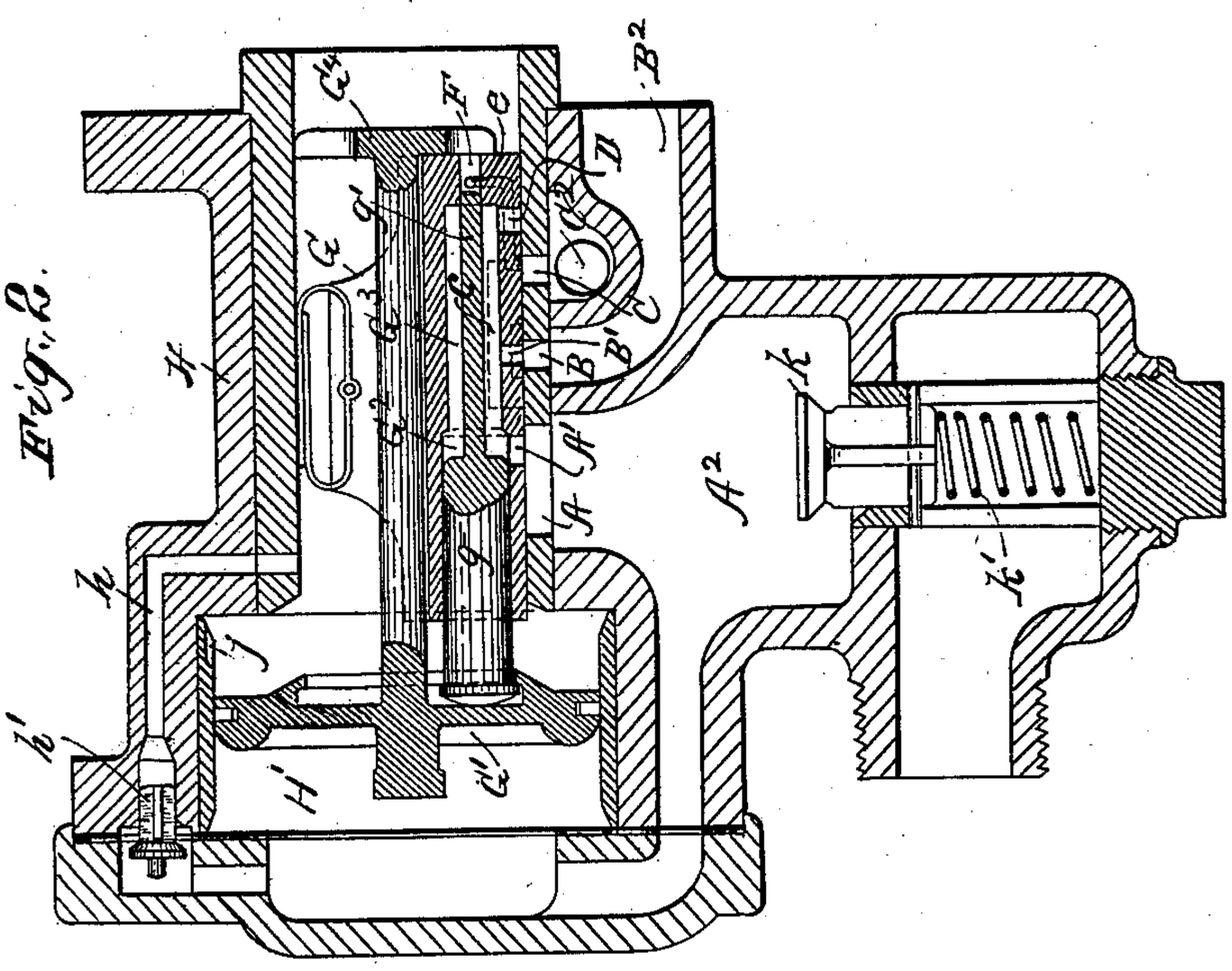
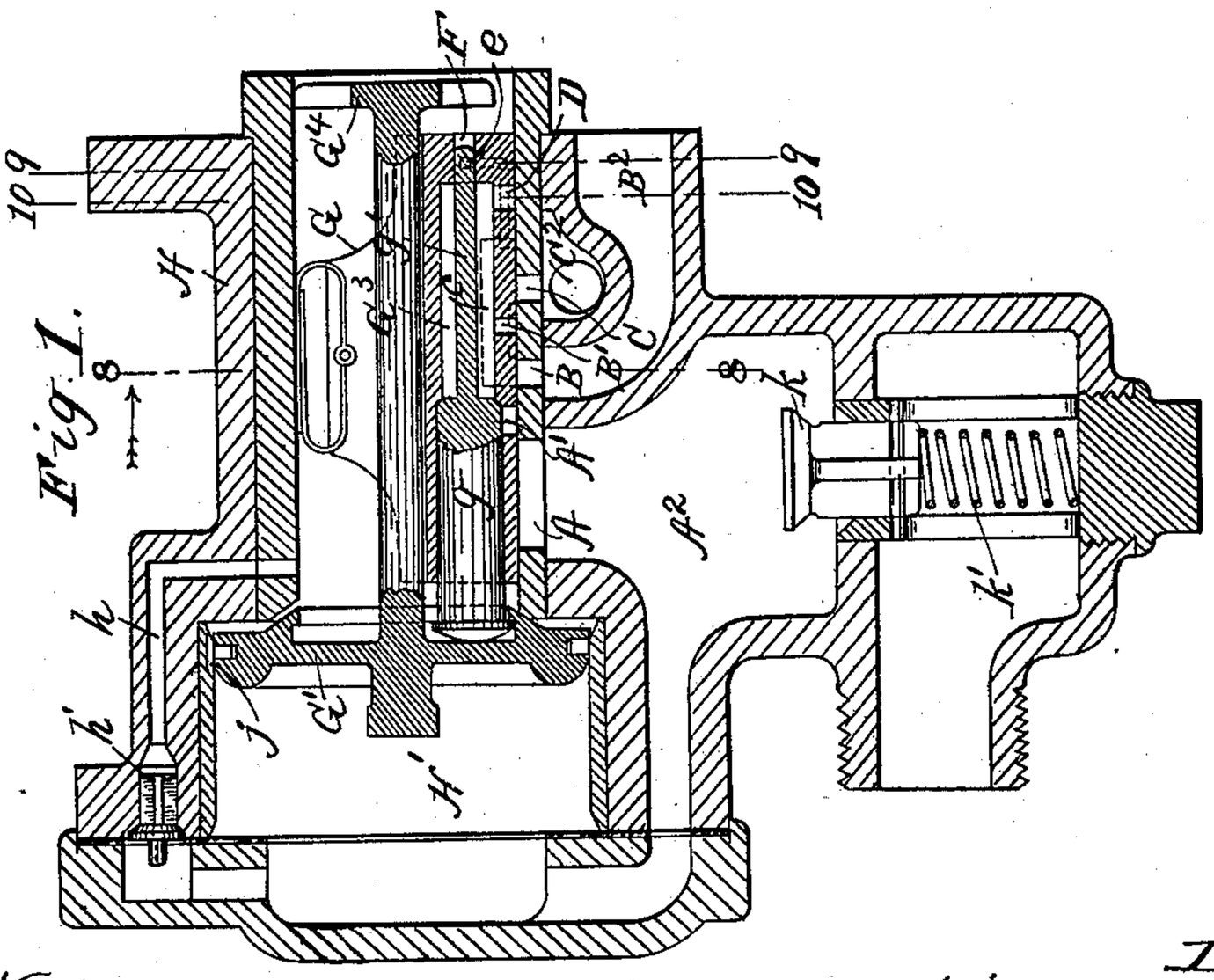


Fig. 1.



Witnesses.
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S. T. Cameron

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by Philip Mauro
his attorney.

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(No Model.) 3 Sheets—Sheet 2.

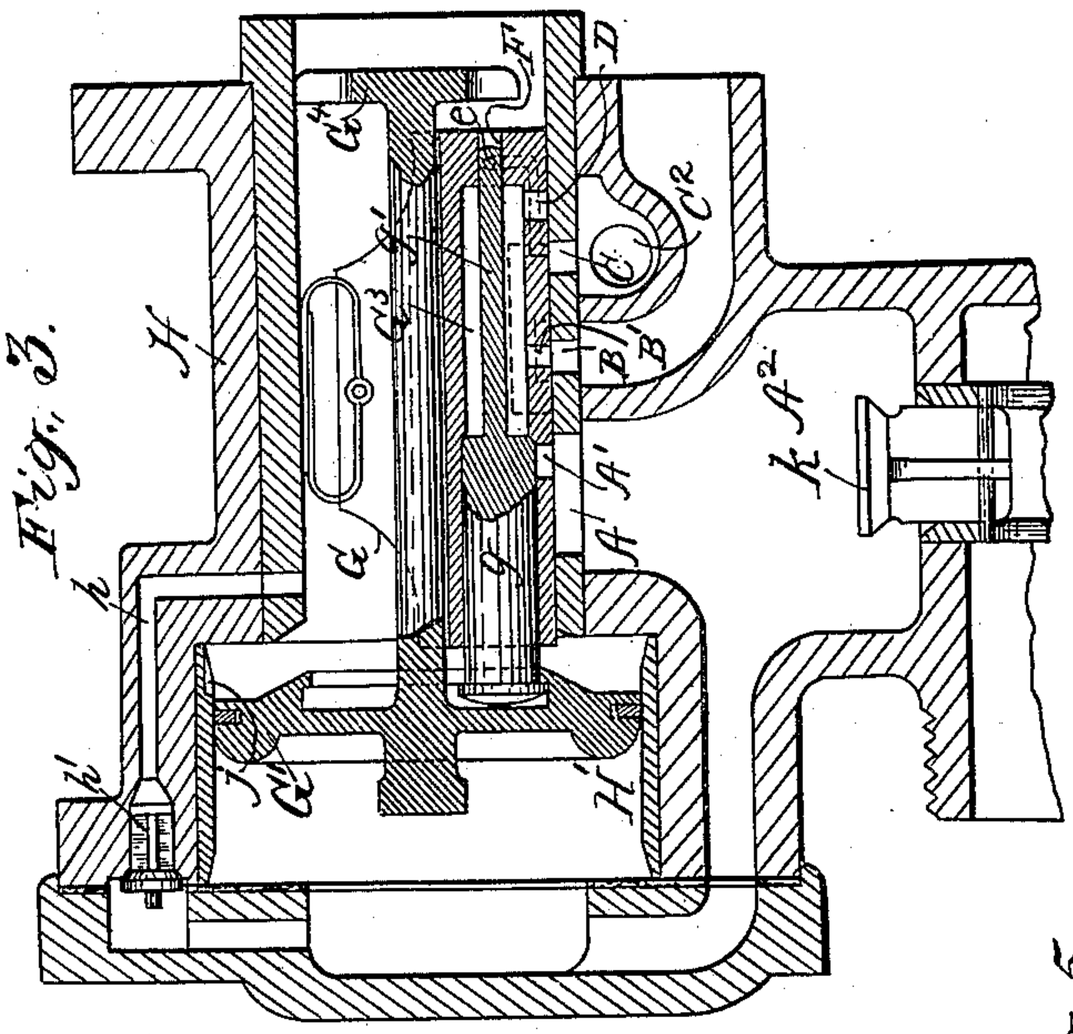

Fig. 3.

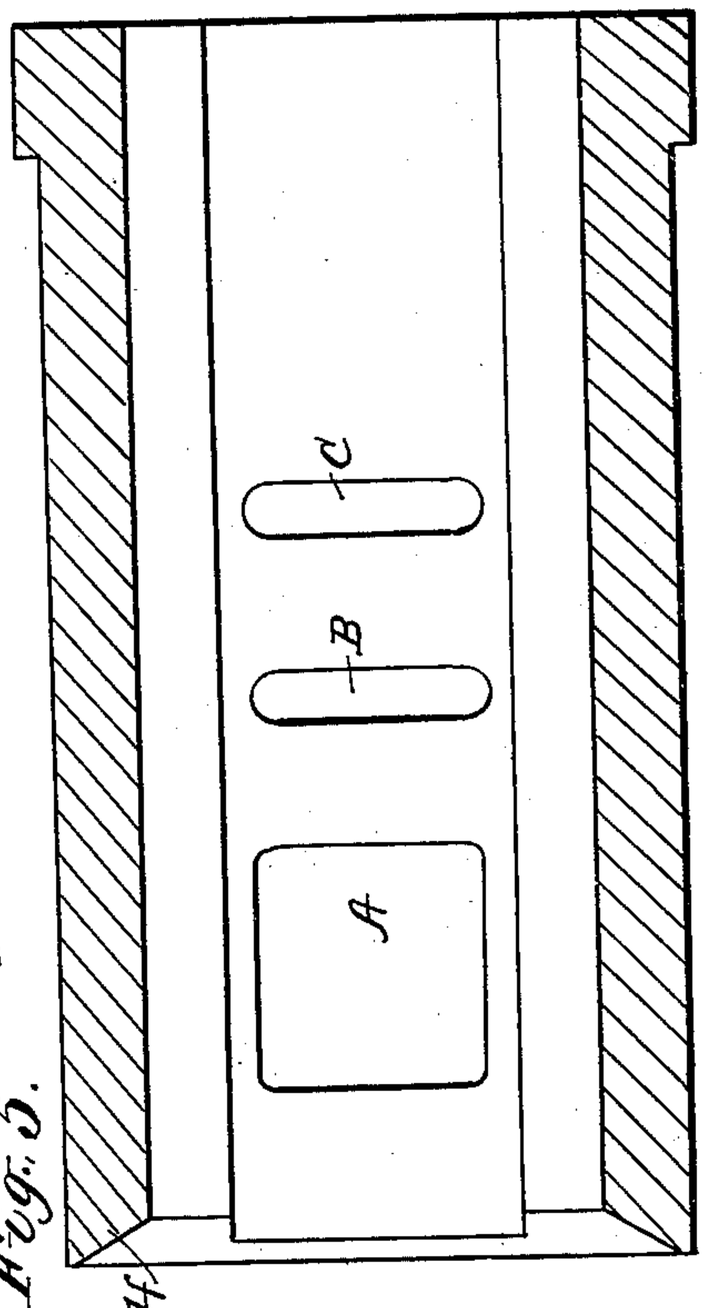

Fig. 5.

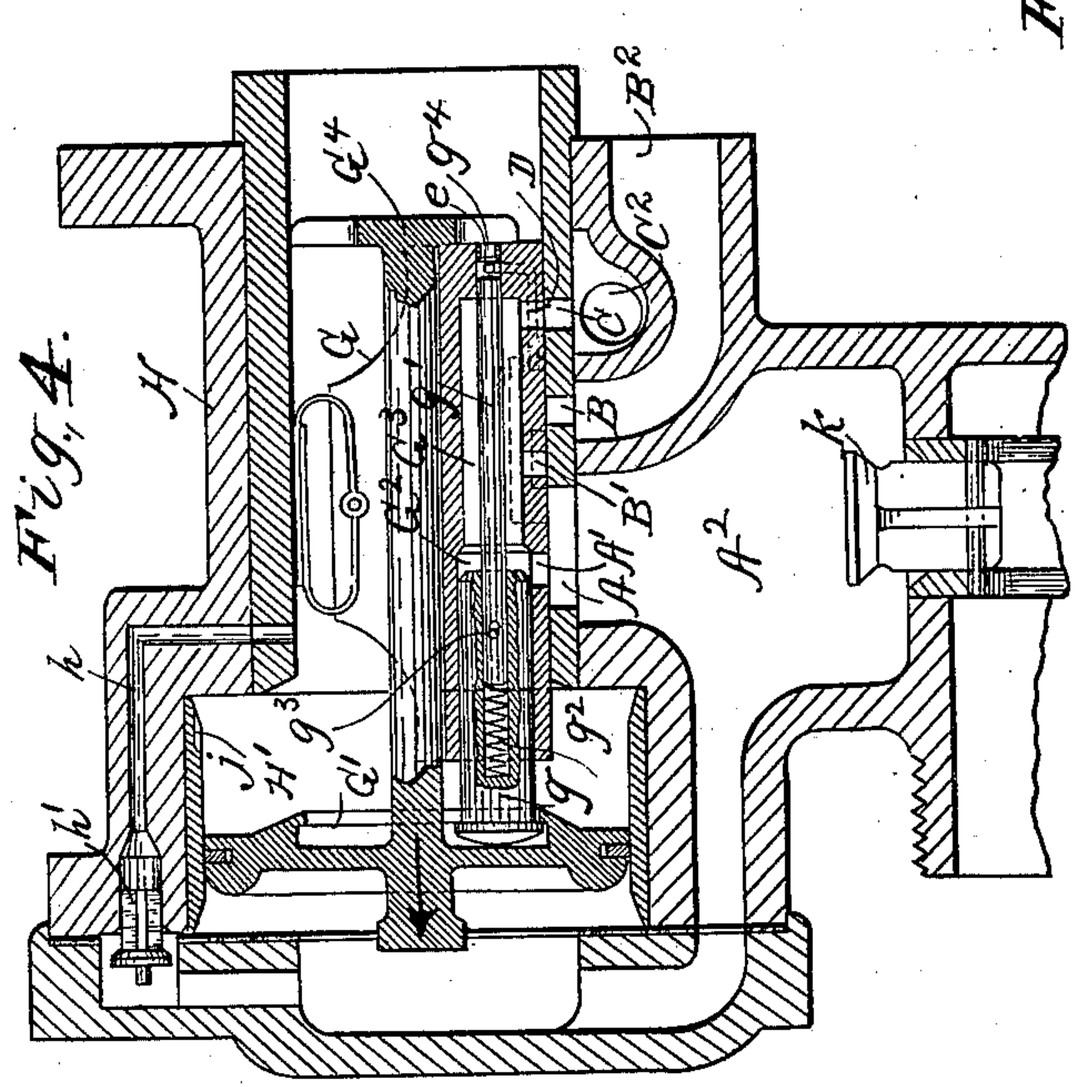

Fig. 4.

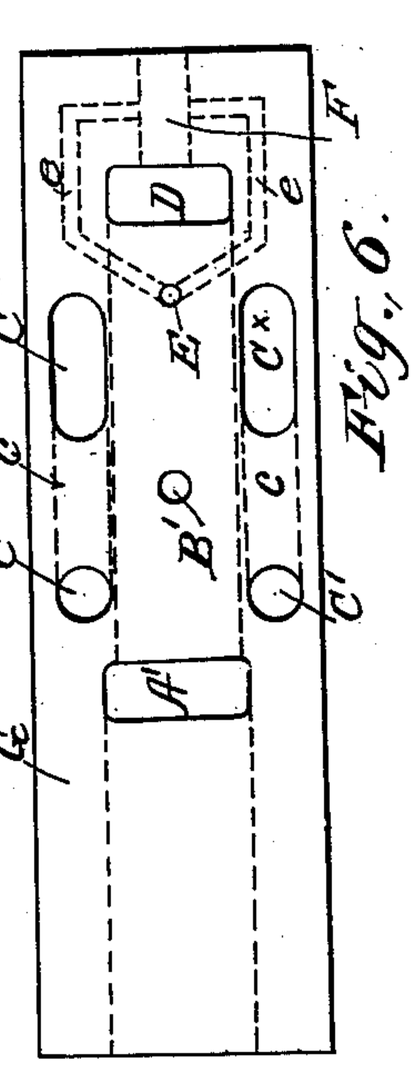

Fig. 6.

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(No Model.) 3 Sheets—Sheet 3.

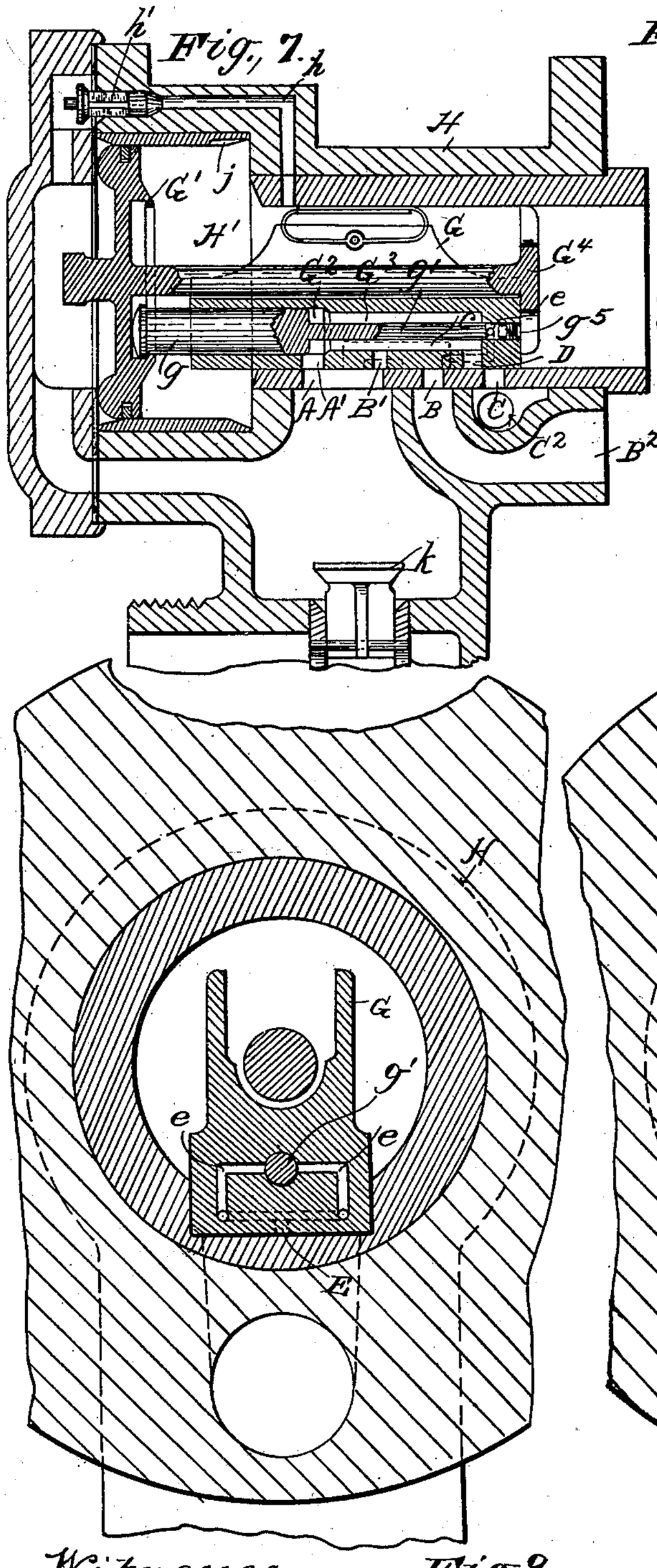

Fig. 7.

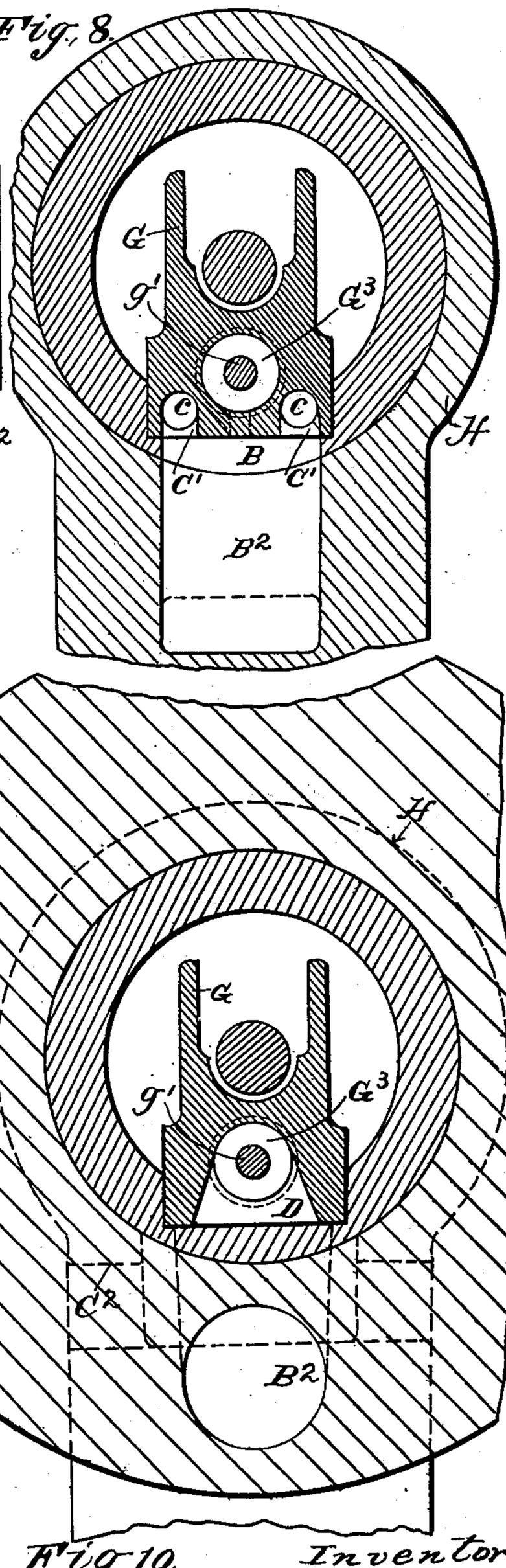

Fig. 8.

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM B. MANN, OF BALTIMORE, MARYLAND.

APPARATUS FOR OPERATING AIR-BRAKES.

SPECIFICATION forming part of Letters Patent No. 630,382, dated August 8, 1899.

Application filed February 27, 1899. Serial No. 706,990. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. MANN, a resident of the city of Baltimore, State of Maryland, have invented a new and useful Apparatus for Operating Air-Brakes, which invention is fully set forth in the following specification.

My invention relates to air-brakes for railway-trains, and more particularly to an improved apparatus for operating such brakes.

In operating air-brakes by my improved mechanism I employ the usual or any suitable main reservoir, train-pipe, auxiliary reservoir, and brake-cylinder; but instead of relying upon air taken from the auxiliary reservoir to actuate the piston of the brake-cylinder, as heretofore, I conduct air direct from the train-pipe to the brake-cylinder for braking purposes and utilize the air in the auxiliary reservoir to reinforce or maintain the pressure in the train-pipe during the braking operation. I am aware that in some instances air has heretofore been taken direct from the train-pipe to the brake-cylinder for the purpose of lowering the pressure in the train-pipe, so as to facilitate quick serial action of all the triple valves of a train in making emergency stops, but in such instances reliance is placed mainly upon the pressure taken from the auxiliary reservoir to secure the powerful application of the brakes, the air entering the brake-cylinder from the train-pipe only incidentally assisting to that end. In my system, however, the entire braking pressure is due to air passing directly from the train-pipe to the brake-cylinder, the pressure in the train-pipe being maintained or reinforced by air conducted thereto from the auxiliary reservoir, and this is the case in service as well as in emergency applications.

My improved apparatus may assume various forms. In my application Serial No. 706,989 I have shown a form of apparatus in which no air is permitted to escape from the train-pipe to the atmosphere either in service or emergency applications, but in which all air passing from the train-pipe (except that at the engineer's valve) goes directly into the brake-cylinder. In such application I have described and claimed, broadly, an apparatus for operating air-brakes which consists in conducting train-pipe air direct to the brake-cylinder and reinforcing the train-pipe pressure by air drawn from the auxiliary reservoir and also a specific apparatus for slightly reducing train-pipe pressure below normal, then gradually admitting compressed air from the train-pipe to the brake-cylinder, and at the same time gradually reinforcing the air-pressure in the train-pipe with air from the auxiliary reservoir, and I shall not therefore make in this application any claim either to the generic or specific apparatus mentioned, but shall claim herein the specific apparatus for making a large reduction of train-pipe pressure below normal or running pressure, rapidly admitting compressed air from the train-pipe to the brake-cylinder, and reinforcing the air-pressure in the train-pipe with air from the auxiliary reservoir. Furthermore, I shall claim an apparatus for operating air-brakes by making a large reduction in train-pipe pressure below normal or running pressure by momentarily permitting air to escape from the train-pipe to the atmosphere, then rapidly admitting air direct from the train-pipe to the brake-cylinder, and reinforcing the air-pressure in the train-pipe with air from the auxiliary reservoir.

It will be understood that while I have hereinafter described but a single set of apparatus the invention contemplates the employment of a plurality of sets of such apparatus connected together in series. Preferably the apparatus used is in the form of a triple valve of peculiar and novel construction, a series of such valves being connected by a train-pipe in the manner well understood in the art.

In the apparatus described in my application above referred to the large reduction in train-pipe pressure necessary to initiate emergency or quick action is secured through the engineer's valve, after which the first rush of air from the train-pipe to the brake-cylinder is sufficient to produce the quick serial reduction of pressure throughout the train-pipe upon which quick action depends. In the present application the initial reduction for emergency stops is also made through the engineer's valve; but the triple valve in shifting from release to emergency position momentarily opens a passage from the train-pipe to the atmosphere, and thereby secures

in the train-pipe the rapid serial reduction upon which quick action depends.

Various forms of apparatus may be employed to carry out my invention; but I have invented an apparatus in the form of a triple valve which is particularly well adapted for the purpose. This valve itself is of novel construction, and the inventive idea involved therein may receive many different mechanical expressions. One form which this part of the invention may assume I have embodied in the drawings forming a part of this specification, in which—

Figure 1 is a longitudinal vertical section of my improved triple valve and connected parts, portions thereof being shown in elevation and the valve and operating-piston being in release position. Fig. 2 is a view similar to Fig. 1, with the parts in the position they assume when air is passing from the train-pipe to the brake-cylinder for service applications of the brakes. Fig. 3 is a view similar to Fig. 2, except that the operating-piston and graduating-valve have moved slightly to the right, thereby closing communication between the train-pipe and the brake-cylinder, but holding pressure in the latter for a service application. Fig. 4 shows the parts in the act of moving to emergency position and at the instant when a passage is opened from the train-pipe to the atmosphere. Fig. 5 is an enlarged plan view of the triple-valve casing, showing the ports therein; and Fig. 6 is a like view of the face of the triple valve and showing in dotted lines the ducts and chambers formed in the valve. Fig. 7 is a view similar to Fig. 1, but with the parts in emergency position. Fig. 8 is an enlarged transverse vertical section on the line 8 8, Fig. 1. Fig. 9 is a similar section on the line 9 9, Fig. 1; and Fig. 10 is a like section on the line 10 10, Fig. 1.

Like letters refer to like parts in all the views, in which—

H is a triple-valve casing having formed therein port A, leading to the train-pipe A^2, port B, leading to the brake-cylinder B^2, and port C, leading to the atmosphere through passage C^2.

G is a slide-valve operated in a common and well-known way by the piston G′ moving in cylinder H′ and having on its piston-rod a head G^4 for engaging the valve to operate it, but with a certain amount of lost motion between the piston and piston-head on the one hand and the valve on the other. The valve G has a port A′ opening from the face of the valve into a chamber G^2 and ports B′ and D from the face of the valve into a chamber G^3. The port B′ is smaller than port A′ or D and is located between them, while the chamber G^3 communicates with chamber G^2 at one end and at the other end with a passage F, which extends from chamber G^3 out through the end of the valve G, as shown.

Formed in the body of the valve G and preferably on opposite sides of the chamber G^3 are ducts *c c*, each having ports C′ and $C^\times$ opening to the face of the valve, the ports $C^\times$ $C^\times$ being oblong in shape for a purpose which will hereinafter be explained. One or more and preferably two ducts *e e* lead from the passage F through the body of the valve G to a port E, opening out through the face of the valve. A graduating-valve *g* is operatively connected to the piston G′, so as to move therewith, said valve seating on the valve-seat between chambers G^2 G^3 and normally closing communication between said chambers. There is a forwardly-projecting stem *g′* extending from the graduating-valve *g* through the chamber G^3 into the passage F, so as to normally close the ducts *e e*. This stem *g′* may be and preferably is formed integral with the graduating-valve *g*, as shown in Figs. 1, 2, 3, and 5, or it may be in the form of a separate stem, Fig. 4, entering a central longitudinal bore in the graduating-valve *g* against the tension of a spring g^2, which has a tendency to eject the stem *g′*, but is prevented by a pin-and-slot connection g^3. When this latter form is employed, a valve-seat g^4 is formed in the passage F and the end of the stem seats thereon. When the integral-stem construction of Figs. 1, 2, 3, and 5 is adopted, the stem preferably fits closely in the passage F without abutting against a seat, though, if desired, a yielding spring-seat g^5 may be employed, as shown in Fig. 7.

I provide a conduit, so that air may always be free to pass from the auxiliary reservoir to the train-pipe, and place in said conduit a valve freely opening toward train-pipe pressure. Any suitable form of conduit may be employed; but I prefer a conduit *h* formed in the body of the valve-casing and communicating at one end with the auxiliary reservoir and at the other end with the train-pipe, and in said conduit I place the valve *h′*, opening toward train-pipe pressure. A suitable check-valve *k* is placed in the train-pipe, which valve is normally held open by a spring *k′*.

The operation of my improved mechanism is as follows: Assuming the parts to be in the position shown in Fig. 1 and a normal pressure of, say, eighty pounds in the train-pipe, air will pass through the usual feed-in valve *j′* until the pressure in the auxiliary reservoir is also eighty pounds. In this position there will be no pressure in the brake-cylinder, because the latter is in communication with the atmosphere through ducts *c c*, whose ports C′ C′ register with port B and ports $C^\times$ $C^\times$ with exhaust-port C. By slightly lowering the pressure in the train-pipe through the engineer's valve the piston G′ will be caused to move to the position shown in Fig. 2—that is, it will be caused to make a partial traverse of its cylinder H′, thereby unseating the graduating-valve *g* and withdrawing stem *g′* from over the ends of ducts *e e* in passage F, the end of the stem still remaining in the passage, however, preventing communication be-

tween chamber G^3 and the auxiliary reservoir through said passage. This same movement of the piston G′ has shifted the valve G so that port A′ registers with port A, B′ with B, and E with C and so that ports C′ C′ of ducts *c c* no longer register with B. The brake-cylinder is therefore cut off from communication with the atmosphere and air flows from the train-pipe to the brake-cylinder through ports A A′, chambers G^2 G^3, and ports B B′; but since this latter port is a restricted one the air passes from the train-pipe to the brake-cylinder but gradually, and while it is so doing a substantially equal amount of air is passing from the auxiliary reservoir to the train-pipe through conduit *h* and past valve *h′*, thereby preventing the valve from taking quick action. During the time the parts remain in the position shown in Fig. 2 not only is the air flowing from the train-pipe to the brake-cylinder and from the auxiliary reservoir to the train-pipe, but it is also passing from the auxiliary reservoir to the atmosphere by way of passage F, ducts *e e*, and ports E, C, and C^2. The result is that the pressure on the auxiliary-reservoir side of the piston G′ soon sinks to a point very slightly below that on the train-pipe side of said piston, and the latter therefore moves gently from the position shown in Fig. 2 to that of Fig. 3, thereby seating the graduating-valve *g*, which closes port A′ as well as communication between chambers G^2 and G^3, and also advancing stem *g′* over ducts *e e*, so that air no longer escapes from the auxiliary reservoir to the atmosphere. A slight decrease in the train-pipe pressure through the engineer's valve will again cause the piston G′ to take the position shown in Fig. 2, from which position it will automatically return to that of Fig. 3. The engineer may thus by repeated slight reductions in the train-pipe pressure graduate the pressure in the brake-cylinder up to the point where the pressure in the train-pipe, auxiliary reservoir, and brake-cylinder is equalized. If it be desired to make an emergency application of the brakes, the engineer makes a sudden large reduction of, say, from eight to twelve pounds in the train-pipe by venting the latter to the atmosphere through the engineer's valve, thereby causing the piston G′ to quickly shift from any one of the positions shown in Figs. 1, 2, or 3 to that shown in Fig. 7—that is, the piston makes its full traverse, taking with it the main valve to the position shown in Fig. 7. In moving to this position the port D is carried across port C while port A′ is still in register with port A, so that during the time that port D is crossing port C the train-pipe is in communication with the atmosphere through ports A A′, chambers G^2 G^3, and ports D, C, and C^2, as clearly shown in Fig. 4, which shows the parts in the act of moving to the left, as indicated by the arrow on the piston. As the piston and main valve continue this movement the parts are shifted from the position shown in Fig. 4 to that of Fig. 7. In this latter position the port D has moved across port C and is no longer in register therewith, and the train-pipe is therefore cut off from the atmosphere, but not until the pressure in the train-pipe has been sufficiently reduced to secure the prompt emergency throw of the piston G′ of the next triple valve in the series. When the parts reach the position shown in Fig. 7, the ducts *c c* are in free communication with the train-pipe through ports C′ C′ A and in like communication with the brake-cylinder through the ports $C^\times$ $C^\times$ B, so that the air suddenly rushes in great volume direct from the train-pipe to the brake-cylinder, while auxiliary-reservoir air rushes out through the conduit *h* to reinforce the train-pipe pressure. During the time that the air is escaping from the train-pipe to the atmosphere through ports A A′, chambers G^2 G^3, and ports D, C, and C^2 train-pipe air is also passing through ports A C′ C′, ducts *c c*, and ports $C^\times$ $C^\times$ B to the brake-cylinder, as will be best understood by inspecting Fig. 4. It will thus be seen that I secure the reduction in train-pipe pressure upon which quick serial action depends by simultaneously conducting air both to the atmosphere and to the brake-cylinder. By opening the train-pipe to the atmosphere I insure the rapidity of reduction in pressure necessary for serial quick action, and by simultaneously opening the train-pipe to the brake-cylinder I do not only assist in rapidly reducing the train-pipe pressure, but I also commence to raise the pressure (and hence to secure braking action) before the triple valve has finished its travel to emergency position. This is rendered possible by the oblong shape of the ports $C^\times$ and the size of the port A.

It will be readily understood that in case the train breaks in two the interior pressure quickly closes the valve *k* against the tension of its spring *k′*, the triple valve and its piston assume the position shown in Fig. 7, and the auxiliary-reservoir air passes to the brake-cylinder by way of conduit *h* and ducts *c c*.

From the foregoing it will be perceived that my invention is capable of being embodied in an exceedingly simple apparatus and that therefore the first cost and the chances of defective operation are reduced to a minimum.

Having thus described my invention, what I claim is—

1. The combination of the train-pipe and brake-cylinder with a triple valve the main valve for which has a duct through which air from the train-pipe is vented to the atmosphere, and a duct through which air is simultaneously vented to the brake-cylinder.

2. The combination of the train-pipe and the brake-cylinder with means admitting train-pipe air to the brake-cylinder and to the atmosphere upon a lowering of train-pipe pressure and means simultaneously reinforcing train-pipe pressure.

3. The combination of the train-pipe, aux-

iliary reservoir and brake-cylinder with means momentarily opening and then closing a passage from the train-pipe to the atmosphere and means opening a passage from the auxiliary reservoir through the train-pipe to the brake-cylinder upon a lowering of train-pipe pressure.

4. In an air-brake mechanism, the combination of means momentarily permitting the escape of air from the train-pipe to the atmosphere at a plurality of points along the pipe, with means admitting air from the train-pipe to the brake-cylinders and means simultaneously reinforcing the air-pressure in the train-pipe.

5. In an air-brake mechanism, the combination of means serially conducting air from the train-pipe to the atmosphere at a plurality of points, with means serially conducting air from the train-pipe to a plurality of brake-cylinders, and means conducting air from the auxiliary reservoirs to the atmosphere, the several sets of means operating simultaneously.

6. The combination of the train-pipe, and a series of auxiliary reservoirs and brake-cylinders, with means venting the train-pipe to the atmosphere at a plurality of places along the pipe, and means simultaneously conducting air from the train-pipe to the brake-cylinders and from the auxiliary reservoirs to the train-pipe.

7. The combination of the train-pipe, and the brake-cylinder with the triple-valve casing having ports leading to the train-pipe, to the brake-cylinder and to the atmosphere, a triple valve having a passage connecting the train-pipe and atmosphere ports during the traverse of the valve and a second passage in said valve connecting the train-pipe and brake-cylinder ports when the valve has completed its traverse.

8. The combination of the train-pipe, the brake-cylinder, the auxiliary reservoir, and a passage conducting air from the auxiliary reservoir to the train-pipe, with the triple-valve casing having ports leading to the train-pipe, to the brake-cylinder and to the atmosphere, a triple valve having a passage connecting the train-pipe and atmosphere ports during the traverse of the valve, and a second passage in said valve connecting the train-pipe and brake-cylinder when the valve has completed its traverse.

9. The combination of the train-pipe, and the brake-cylinder with a triple-valve casing having ports leading to the train-pipe, to the brake-cylinder, and to the atmosphere and a triple valve having a duct or passage which connects the brake-cylinder and atmosphere ports when the ports are in release position, but which connects the train-pipe and brake-cylinder ports when the parts are in emergency position, said triple valve also having another passage which connects the train-pipe and atmosphere ports while the parts are shifting from release to emergency position.

10. The combination of a train-pipe and a brake-cylinder, with means simultaneously conducting air from the train-pipe to the atmosphere and to the brake-cylinder upon a large reduction of train-pipe pressure, and then closing the passage to the atmosphere while leaving that to the brake-cylinder open, and means reinforcing train-pipe pressure.

11. The combination of a train-pipe, a brake-cylinder and an auxiliary reservoir with means simultaneously conducting air from the train-pipe to the atmosphere, from the train-pipe to the brake-cylinder and from the auxiliary reservoir to the train-pipe.

12. The combination of a train-pipe, and a series of brake-cylinders and auxiliary reservoirs, with means acting serially to simultaneously conduct air from the train-pipe to the atmosphere, from the train-pipe to the brake-cylinder and from the auxiliary reservoir to the train-pipe.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM B. MANN.

Witnesses:
JOSEPH T. GOTT,
JAMES M. FAIRBANK.