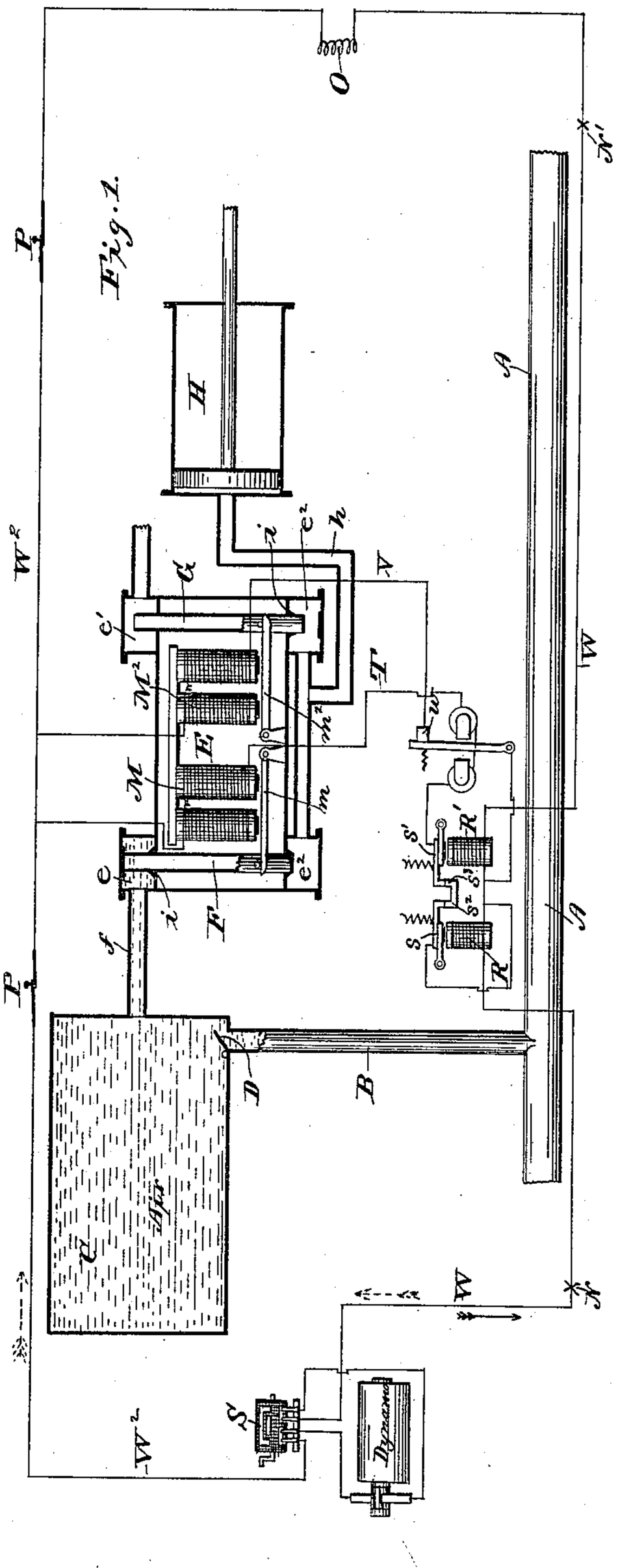
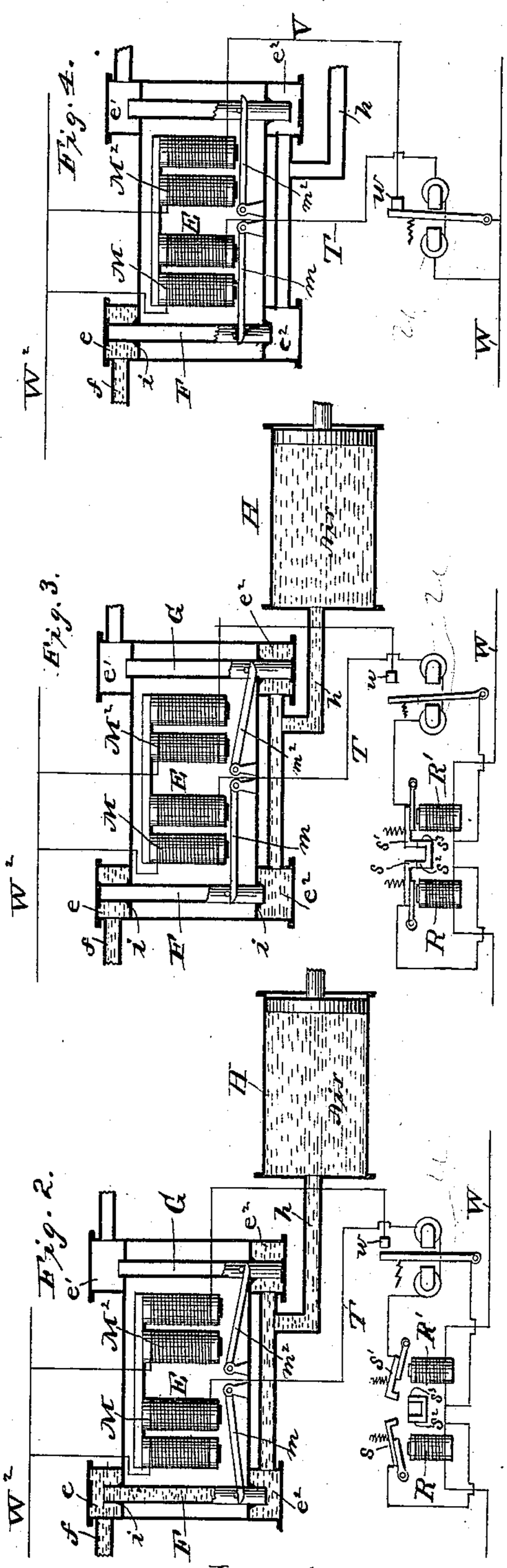
(No Model.) 2 Sheets—Sheet 1.

H. HOLLERITH.

ELECTRO MAGNETICALLY OPERATED AIR BRAKE FOR RAILWAY CARS.

No. 334,021. Patented Jan. 12, 1886.





Witnesses.
Chas. R. Burr
Thomas Durant

Inventor
Herman Hollerith
by Church & Church
his Attorneys.

(No Model.) 2 Sheets—Sheet 2.

H. HOLLERITH.

ELECTRO MAGNETICALLY OPERATED AIR BRAKE FOR RAILWAY CARS.

No. 334,021. Patented Jan. 12, 1886.

Fig. 5.

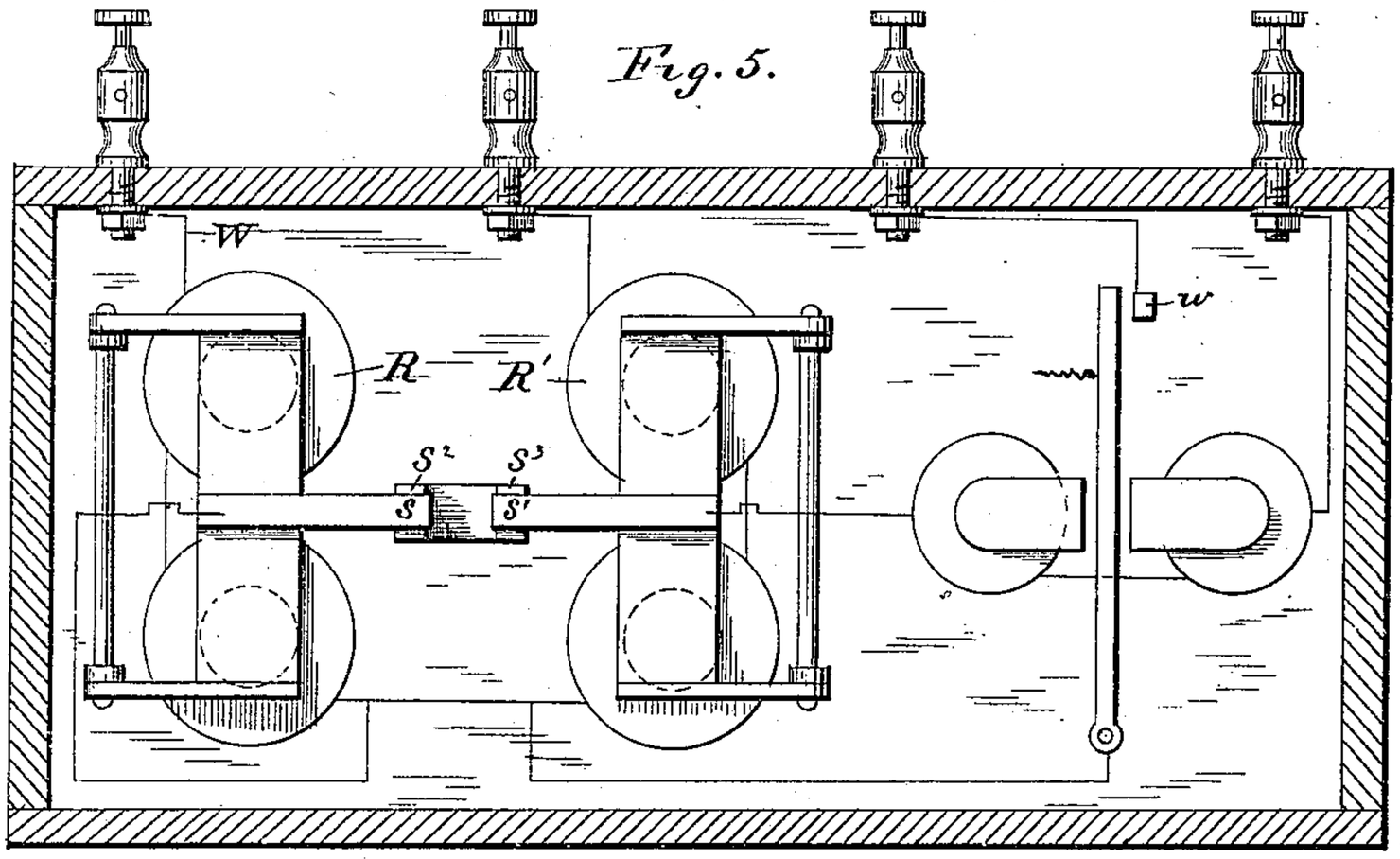


Fig. 6.

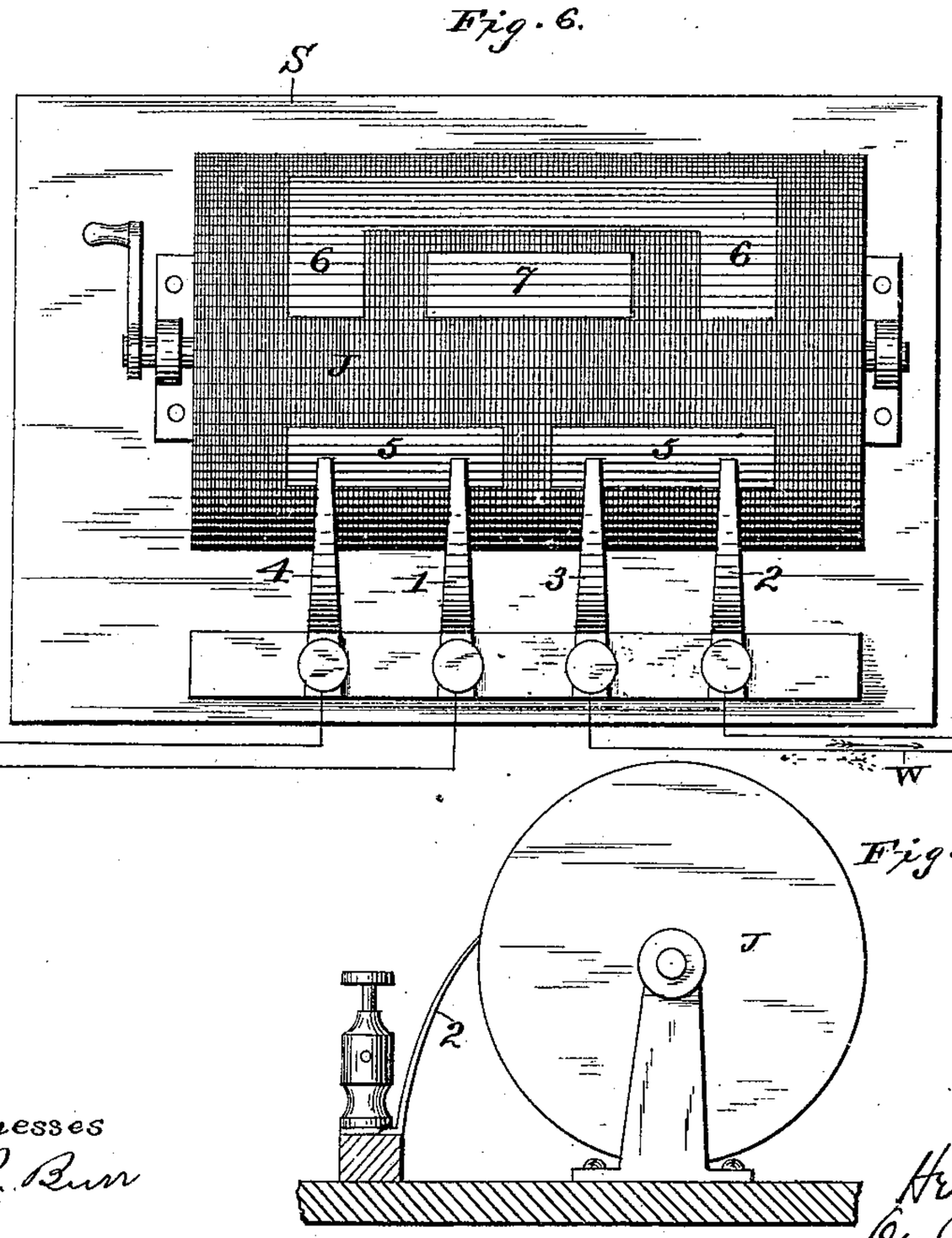


Fig. 7.

Witnesses
Chas. R. Burr
Thomas Durant

Inventor
Herman Hollerith
by Church & Church,
his Attorneys.

UNITED STATES PATENT OFFICE.

HERMAN HOLLERITH, OF ST. LOUIS, MISSOURI.

ELECTRO-MAGNETICALLY-OPERATED AIR-BRAKE FOR RAILWAY-CARS.

SPECIFICATION forming part of Letters Patent No. 334,021, dated January 12, 1886.

Application filed April 30, 1885. Serial No. 164,009. (No model.)

To all whom it may concern:

Be it known that I, HERMAN HOLLERITH, of St. Louis, in the county of St. Louis and State of Missouri, have invented certain new and useful Improvements in Air-Brakes for Railways; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

In an application for Letters Patent prepared by me and about to be filed in the United States Patent Office, and designated by me as "Application A," I have shown and described an air-brake system in which are employed a series of valves for controlling the inlet of compressed air from the air-supply to the brake-cylinders, and another series of valves, independent of the first-named series, for separately controlling the exhaustion of air from the brake-cylinders into the open air, each of said two series of valves being operated by means of a separate series of electro-magnets arranged in electric circuits extending throughout the train, and adapted when opened to cause the brakes to be applied, and when closed to release the brakes.

In the present case I design to cover an improvement upon or modification of the arrangement of circuits and electrical appliances for controlling the valves shown in my said Application A.

I will first describe the new plan in full, and will then point out what I deem to be its particular features of novelty in the claims at the end of this specification.

Referring to the accompanying drawings, Figure 1 represents a diagram of so much of the equipment of an engine and one car of a train as is necessary to show the application of my invention, the valve controlling the inlet of compressed air to the brake-cylinder of the car being shown closed, and the valve controlling the exhaustion of air from said brake-cylinder being shown open, so as to put the cylinder in communication with the open air. Fig. 2 is a view showing the position of the various parts when the brakes are on, the inlet-valve open, and the exhaust-valve closed; Fig. 3, a view showing the position of the parts when the brakes are on and both the inlet and exhaust valves closed. Fig. 4 represents a modification of the arrangement shown in Fig. 1. Fig. 5 shows a practical mode of inclosing or boxing the several relays employed in the construction shown in Fig. 1. Fig. 6 is a view of the switch or current-reverser employed for manipulating the current, so as to cause it to flow in either direction or to be interrupted entirely. Fig. 7 is an end view of the same.

Similar letters of reference in the several figures indicate the same parts.

A represents the main air-pipe, through which the air, compressed and forced into it at the engine, is conveyed throughout the train; B, the branch pipe leading from said main pipe into the auxiliary reservoir C; D, the check-valve in the auxiliary reservoir.

E is the valve casing containing the tubular inlet-valve F and the tubular exhaust-valve G. The upper end of said valve F operates within a small chamber, *e*, which is in communication through a pipe, *f*, with the auxiliary reservoir, and the upper end of the exhaust-valve G operates within another small chamber, *e'*, which is in communication with the open air, while the lower ends of both said valves operate within small chambers e^2 e^2, in communication with each other and with the brake-cylinder H, through a pipe, *h*. The inlet-valve F seats upward, while the exhaust-valve G seats downward, and each is provided with suitable packings, *i*, to prevent the passage of air from the upper to the lower chambers, in which they respectively operate, save down through the valves themselves, when the latter are shifted to the proper positions. The piston in the brake-cylinder is connected to the brake-levers in the usual manner.

Upon the engine is mounted a suitable current-generator, I, preferably consisting of a compound dynamo-electric machine, (such as used in connection with incandescent-lamp circuits,) which regulates the current according to the external resistance. The current-conducting wires from this dynamo extend to a suitable current-reverser—such, for instance, as that shown in Fig. 6—wherein one wire, designated —, is connected to a contact-finger, 1, and the other wire, designated +, is con-

nected to a contact-finger, 2, while the outgoing circuit-wire W is connected to a contact-finger, 3, and the return-wire W^2 to a contact-finger, 4. The ends of all these contact-fingers are adapted to bear upon a cylinder, J, the body of which is of insulating material, but has metallic conducting portions 5, 5, 6, and 7. When the cylinder is turned so as to bring the fingers 2 3 upon one metal surface 5 and the fingers upon the other metal surface 5 what may be termed a "direct current" will be sent through the circuit in the direction indicated by the full-line arrows in Fig. 1; but when the cylinder is turned so as to bring the fingers 2 4 upon the metal surface 6 and the contact-fingers 13 upon the metal surface 7 the current will be reversed, and will flow in the direction indicated by the dotted arrows in Fig. 1, and when all said contact-fingers bear upon the insulated portion of the cylinder the circuit is broken and no current at all passes. It is designed that this current-reversing apparatus, or any other which may be substituted for it, shall be arranged upon the engine in convenient position to be operated by the engineer and enable him to control the current.

Interposed in the outgoing portion W of the circuit on each car are two relays, R R′, the armatures s' of which form part of a branch circuit, T, which also include the coils u of a polarized relay and an electro-magnet, M, which controls, through an armature, m, the inlet-valve F of the air-brake apparatus. Another branch circuit, V, includes the armature w of the polarized relay, and an electro-magnet, M^2, which controls, through an armature, m^2, the exhaust-valve G of said air-brake apparatus.

The circuit W W^2 extends throughout the train and consists of insulated wires carried through the main air-pipes and suitably coupled between the cars, or the outgoing wire may be passed through the air-pipe and the air-pipe itself, or the track used as a return-conductor, the arrangement of the conductors being a matter purely arbitrary.

It should be understood that each car of the train is provided with the valve magnets and relays arranged in multiple arc, as shown in Fig. 1, a suitable resistance being interposed between the outgoing and return conductors at the rear of the last car of the train, as shown at O, Fig. 1, for the purpose of preventing short-circuiting of the battery when the relays have closed the branch circuits.

Normally the switch or current-reverser is turned into the position shown in Fig. 6, which maintains a direct current in the circuit, causes both branch circuits T and V to be closed, and the electro-magnets M M^2, arranged therein, to close the inlet-valves and open the exhaust-valves, thus keeping the brakes off, as shown in Fig. 1.

To apply the brakes it is only necessary to break the circuit by means of the switch or current reverser S, located at the engine, or by the rupture of the circuit at any point by the conductor, a circuit-breaker—such as shown at P—being preferably arranged upon each car for this purpose. The instant the circuit is broken the magnets controlling both the inlet and exhaust valves on all the cars of the train instantly release said valves and they drop into the position shown in Fig. 2, the inlet-valves being opened and the exhaust-valves seated, thereby permitting compressed air to rush into the brake-cylinders and apply the brakes. When a sufficient pressure has been obtained in the brake-cylinders, and it is desired to retain said pressure therein, the switch or current-reverser is turned by the engineer into the position which will bring the contact-fingers upon the metal portions 6 and 7 and close the circuit W W^2 again, but cause a reverse current to flow through it in the direction indicated by the dotted arrows in Figs. 1 and 3. This reversed current will pass through the branch circuits T, and by energizing the electro-magnets M therein will close the inlet-valves; but the polarized armatures forming parts of the circuits V will be shifted toward the opposite poles of their respective magnets, causing the demagnetization of the magnets M^2 by the interruption of the current, and consequently allowing the exhaust-valves to remain closed.

If it is desired to augment the pressure in the brake-cylinders, without entirely releasing the brakes, for the purpose of compensating for the leakage of air from said cylinders—as, for instance, in coming down a long grade, where it is essential that the brakes be kept on more or less the whole time—it can be accomplished by the opening and closing of the circuit by the switch apparatus with the reversed current still on, which will open and then close the inlet-valves and permit additional compressed air to enter the brake-cylinders and to be confined therein, the exhaust-valve meanwhile remaining closed.

By the provision of the two relays R and R′ upon each car a rupture of the circuit upon each car, and the consequent application of the brakes is caused, whenever any one or more of the cars become detached from the train, and whether the current-generator be at one end of the train or the other, such breaking of the circuit and application of brakes occurring as well upon the body of the train as upon the car or cars detached therefrom. For instance, should the rupture of the circuit occur on one side of said relays, as at N, Fig. 1, both relays R and R′ would be demagnetized, and their armatures would leave their contacts s^2 s^3, thus rupturing the branch circuit T at two points, as shown in Fig. 2, thereby causing the armature of the polarized relay to leave its contact w, the result being the liberation of both the inlet and exhaust valves from their respective magnets, and the

consequent application of the brakes. On the other hand, should a break occur on the other side of said relays, as at N′ in Fig. 1, the relay R′ only would at first be demagnetized and release its armature, so as to break the circuit T, the demagnetization of the relay R not taking place till after the circuit T was so broken, because its armature being down against its contact s^2, would remain down, though the circuit were broken at N′, by reason of the uninterrupted flow of the current through the circuit T. The necessity, therefore, of employing two relays when the generator or the engine carrying the generator is desired to be connected to either end of the train is made apparent.

Where the engine is always connected to the same end of the train, it is only necessary to employ one relay, and that a polarized one, as shown in Fig. 4. With this arrangement the direct current will shift the polarized armature and cause the current to pass through both circuits T and V and effect the closing of the inlet-valve and the opening of the exhaust-valve, while a breaking of the circuit between the relay and generator will cause both magnets to release their armatures, opening the inlet and closing the exhaust-valve, and applying the brakes, and the re-establishment of the circuit with a reverse current will cause the circuit V to remain open, but will pass the current through the circuit T in a manner to close the inlet-valve and retain the pressure in the brake-cylinder, the exhaust remaining in the meanwhile closed.

While I have shown herein my invention applied to a brake system in which compressed air is employed, it is evident that it can readily be applied to the various vacuum-brake systems by any person skilled in the art without the exercise of any invention on his part.

Having thus described my invention, I claim as new—

1. In an air-brake system, the combination, with a valve arranged in the line of communication from the power-chamber to a brake-cylinder, and another independent valve arranged in the line of communication from the brake-cylinder to the external air, of a main electric circuit having magnets for separately controlling the said independent valves, and a switching device operated by a reversal of the current to cut out the electro-magnet which controls the valves in the line of communication from the brake-cylinder to the external air, substantially as described.

2. In an air-brake system for railway-trains, the combination, on each car, of an air-supply or power chamber, a brake-cylinder and brakes operated thereby, and separate inlet and exhaust valves for controlling the admission of pressure to the brake-cylinders, and the exhaustion of pressure therefrom, with an electric circuit extending throughout the train, and having arranged therein a series of electro-magnets for controlling the inlet-valves, and another series of electro-magnets for controlling the exhaust-valves, and a switching device operated by reversal of the current to cut out the electro-magnets which control the exhaust-valves, substantially as described.

3. In an air-brake system for railway-trains, the combination, on each car, of an air supply or power chamber, a brake-cylinder, brakes operated thereby, and separate inlet and exhaust valves for controlling the admission of pressure to the brake cylinder, and the exhaustion of pressure therefrom, with an electric circuit having arranged therein an electro-magnet for controlling the inlet-valve, another independent electro-magnet for controlling the exhaust-valve, a switching device operated by the reversal of the current to cut out the electro-magnet which controls the exhaust-valve, and relays for cutting out or putting in both valve-magnets when the main circuit is broken or established, substantially as described.

4. In an air-brake system for railway-trains, the combination, on each car, of an air-supply or power chamber, a brake-cylinder and brakes operated thereby, and separate inlet and exhaust valves for controlling the admission of pressure to the brake-cylinders and the exhaustion therefrom, with an electric circuit extending throughout the train and having arranged therein a series of electro-magnets for controlling the inlet-valves, and another series of electro-magnets for controlling the exhaust-valves, a switching device, operated by reversal of the current, to cut out the electro-magnets which control the exhaust-valves, and a switch, under the control of the engineer, for establishing, breaking, or reversing the current in the main circuit, substantially as described, for the purpose specified.

5. In an air-brake system, the combination, substantially as herein described, of the main air-pipe, auxiliary reservoir, brake-cylinder, intermediate valve-casing, independent inlet and exhaust valves, the main electric circuit and branch circuits T and V, the former including the electro-magnet which operates the inlet-valve, the polarized relay, and the armatures of the relays or magnets in the main circuit, and the latter including the magnet which controls the exhaust-valve, and the armature of the polarized magnet, the whole constructed and arranged substantially as described.

HERMAN HOLLERITH.

Witnesses:
SIM. T. PRICE,
A. J. STEWART.