(No Model.) 3 Sheets—Sheet 1.

F. A. ACHARD.

ELECTRIC APPARATUS FOR WORKING RAILWAY BRAKES.

No. 253,148. Patented Jan. 31, 1882.

Fig. 1

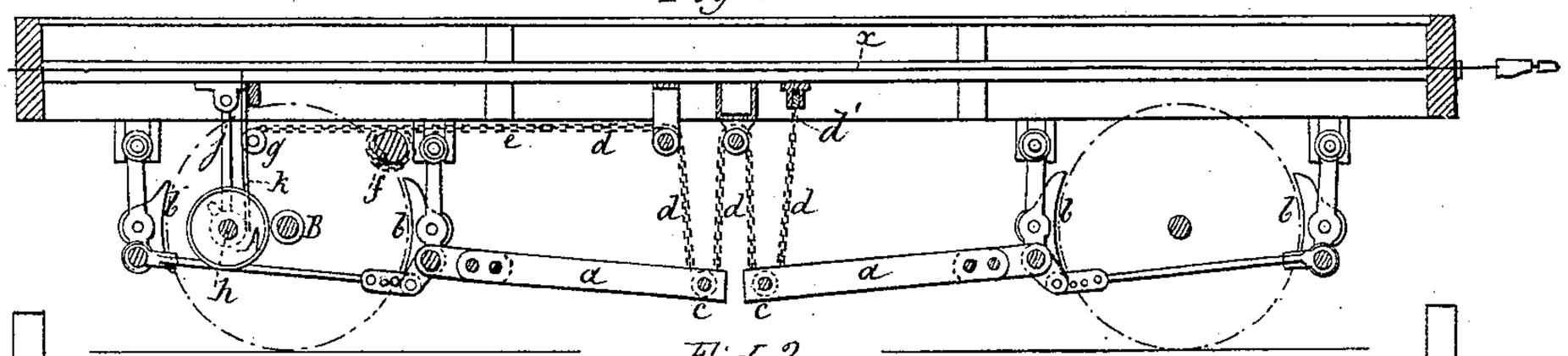


Fig. 2

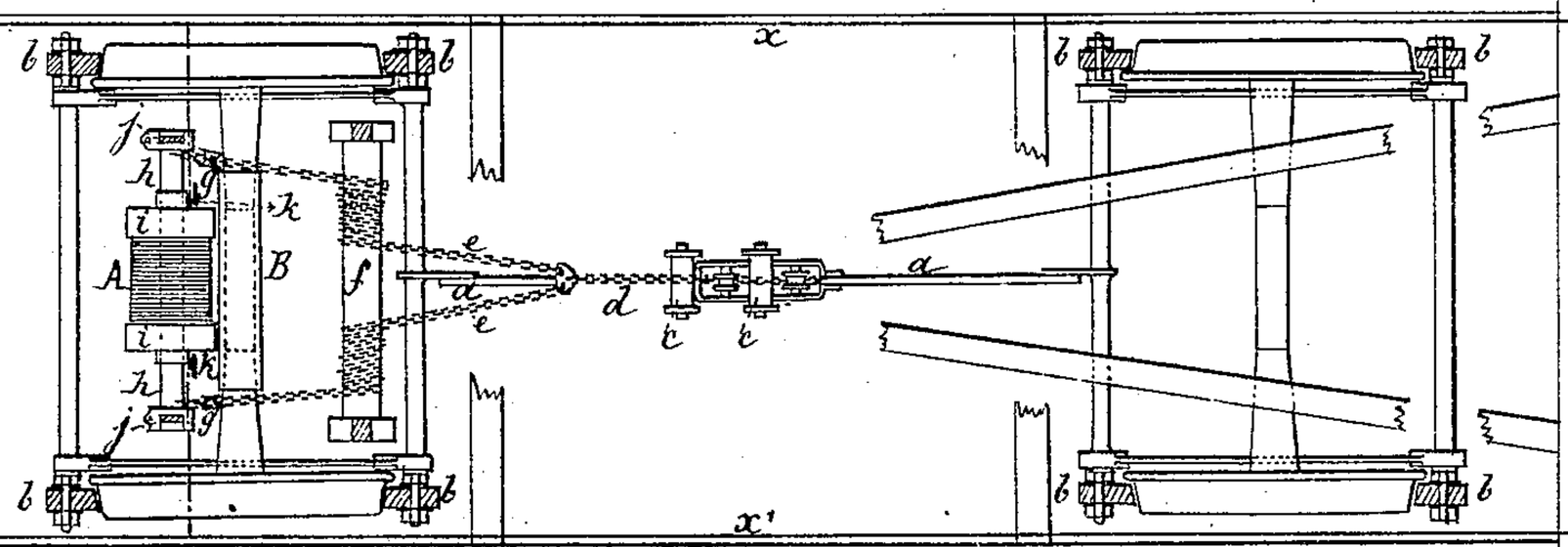


Fig. 3

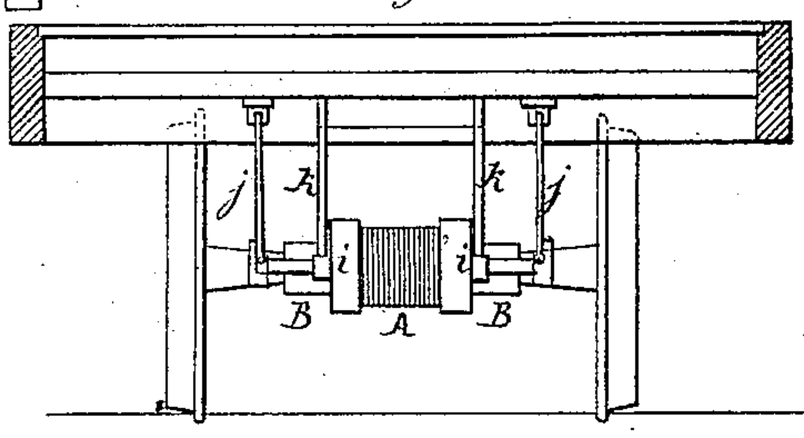


Fig. 4

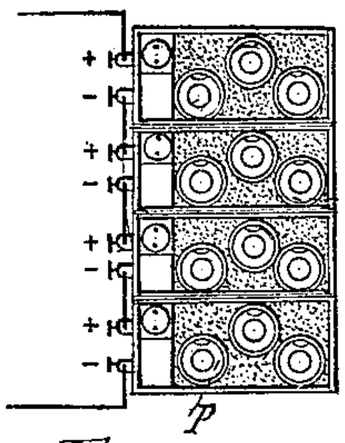


Fig. 6

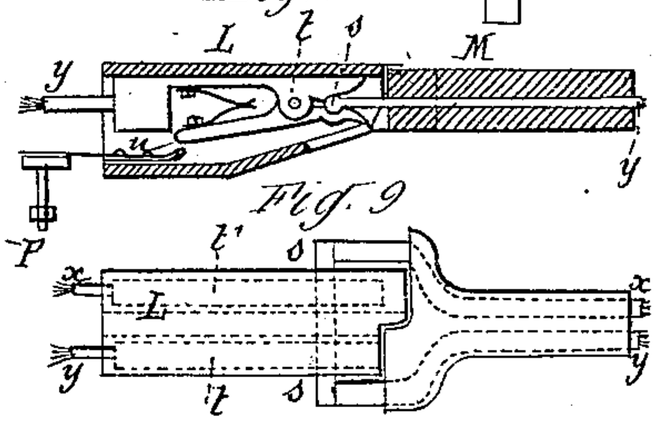


Fig. 9

Fig. 5

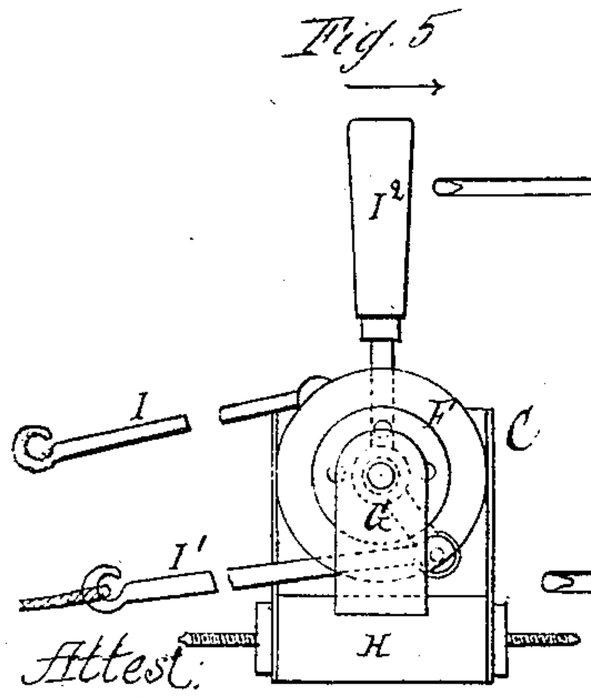


Fig. 6

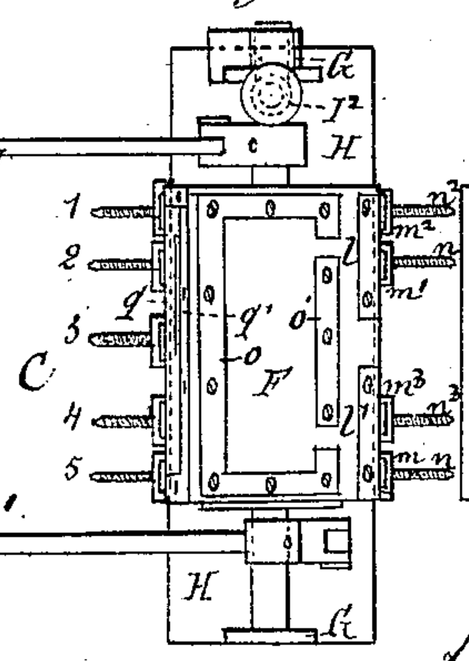
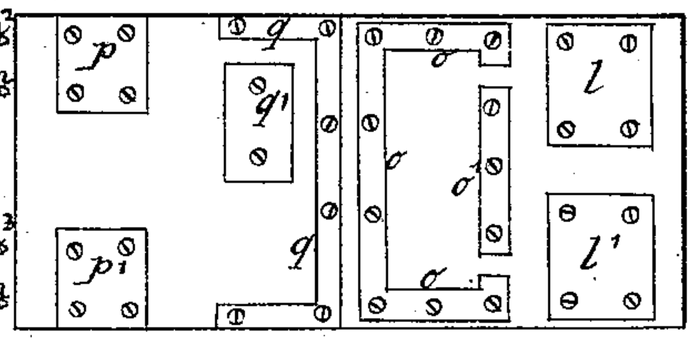


Fig. 7



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his attorney.

(No Model.)

3 Sheets—Sheet 2.

F. A. ACHARD.

ELECTRIC APPARATUS FOR WORKING RAILWAY BRAKES.

No. 253,148. Patented Jan. 31, 1882.

Fig. 10.

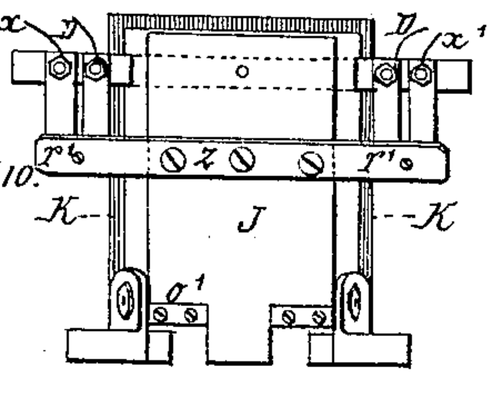


Fig. 11

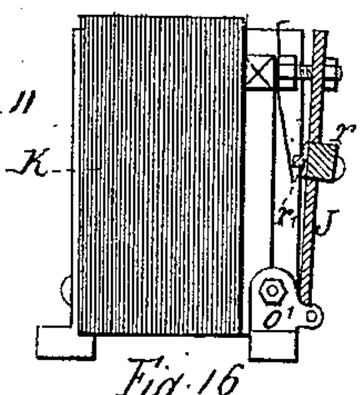


Fig. 12.

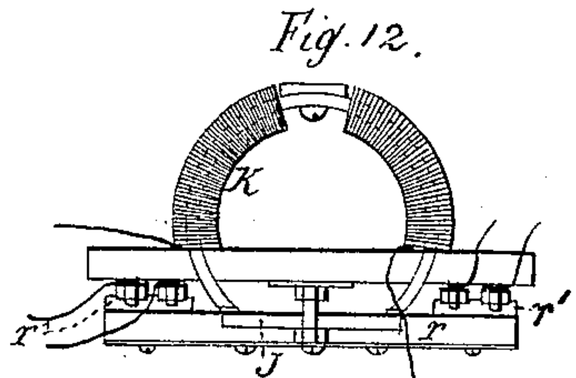


Fig. 16

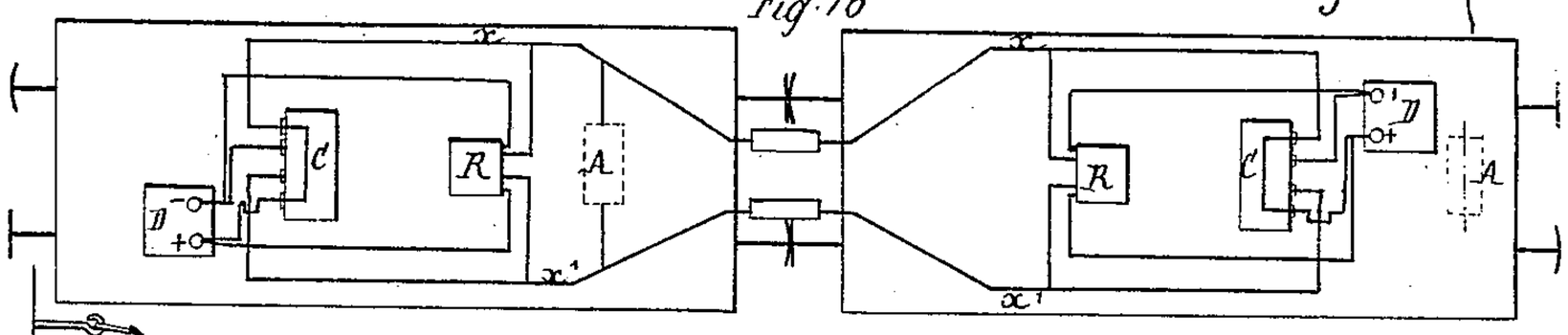


Fig. 1a

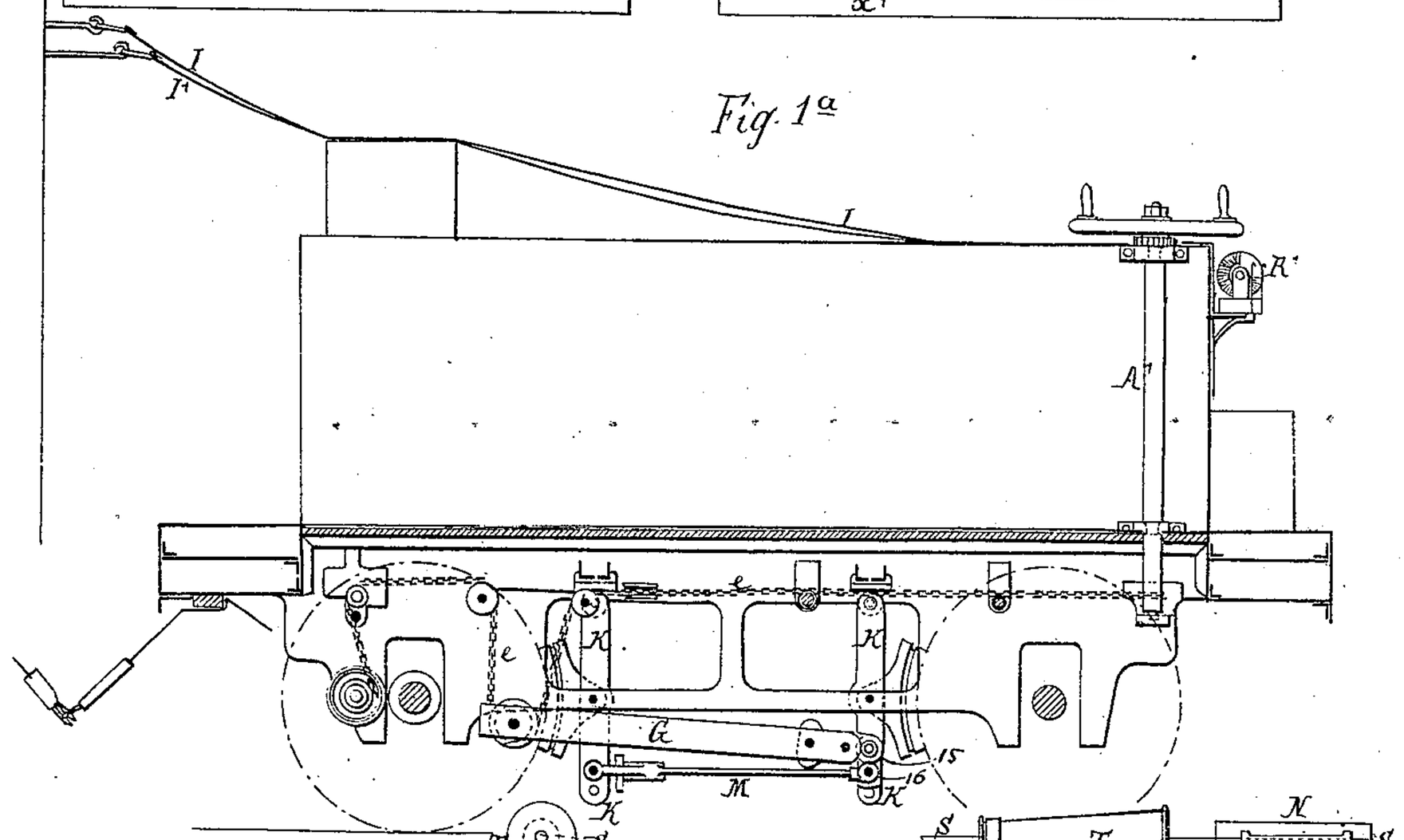


Fig. 13

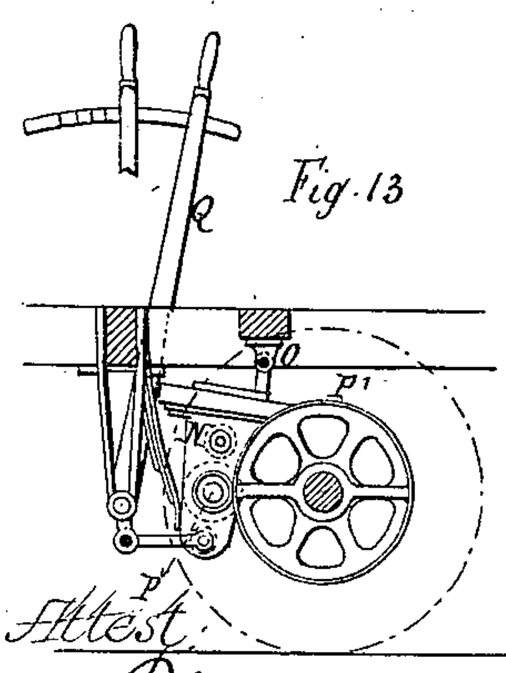


Fig. 14

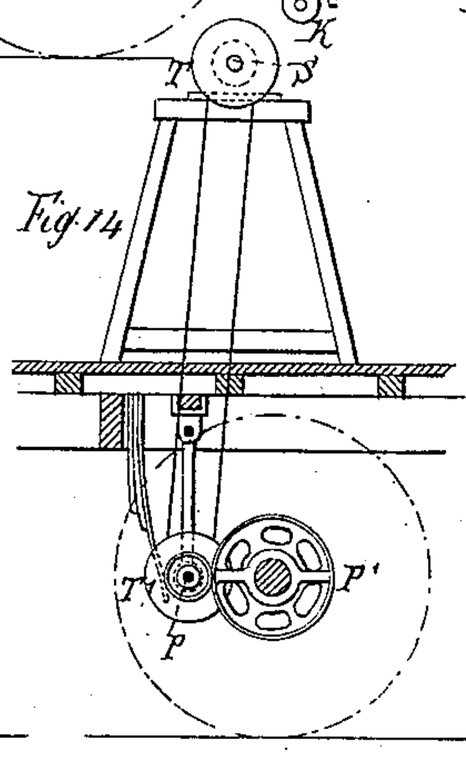
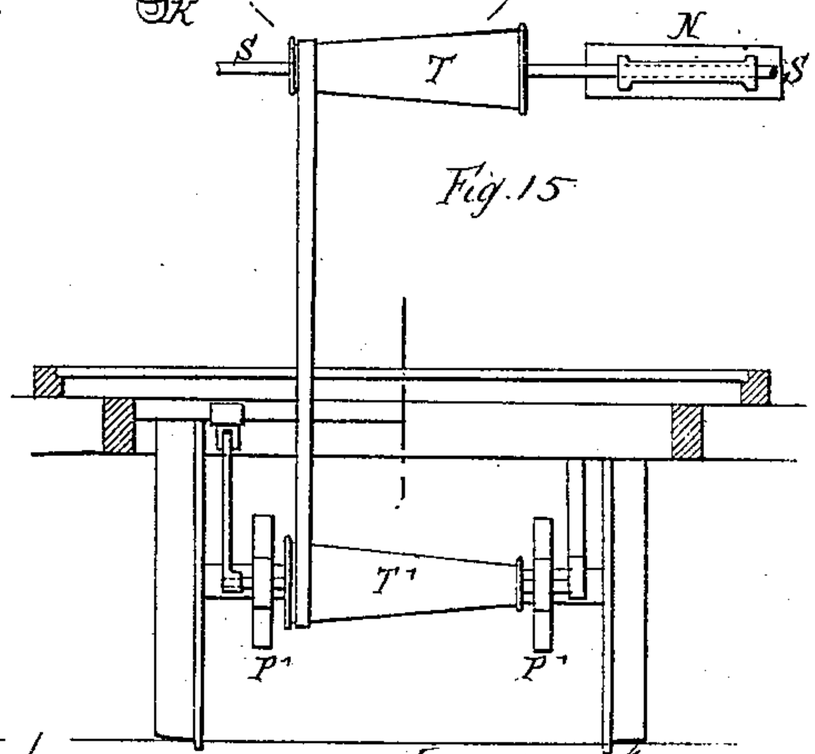


Fig. 15



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ELECTRIC APPARATUS FOR WORKING RAILWAY BRAKES.

No. 253,148. Patented Jan. 31, 1882.

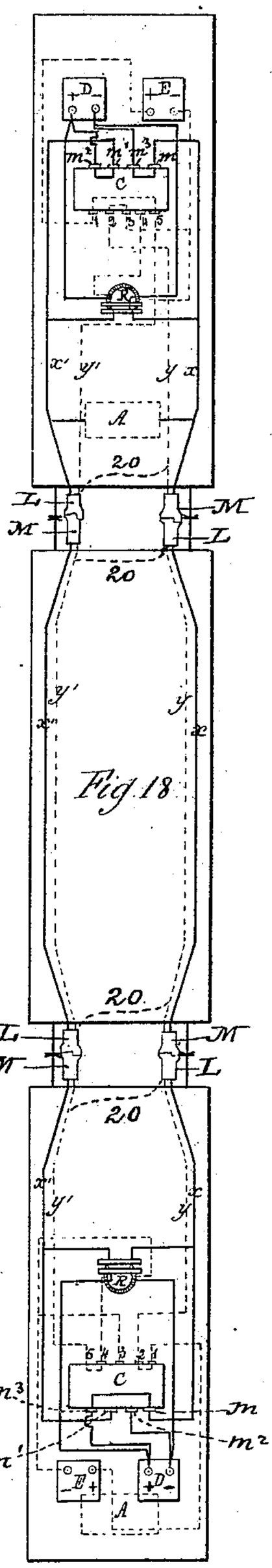

Fig. 18.

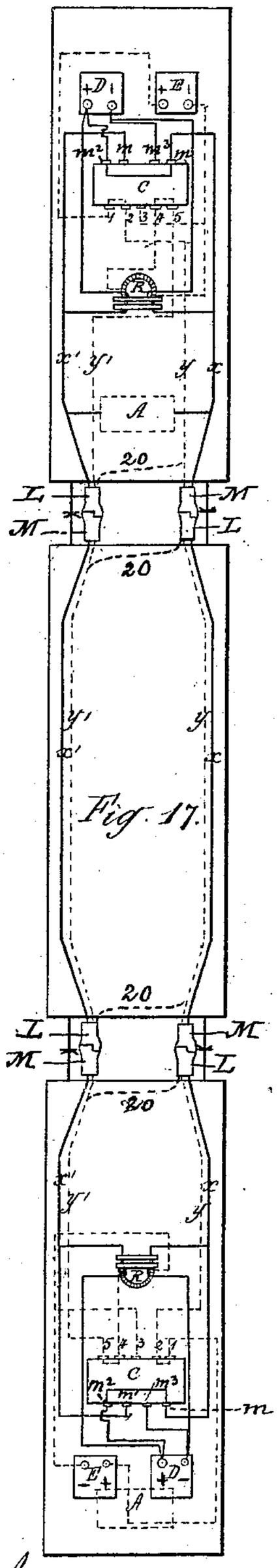

Fig. 17.

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UNITED STATES PATENT OFFICE.

FERDINAND A. ACHARD, OF PARIS, FRANCE.

ELECTRIC APPARATUS FOR WORKING RAILWAY-BRAKES.

SPECIFICATION forming part of Letters Patent No. 253,148, dated January 31, 1882.

Application filed March 17, 1881. (No model.) Patented in England June 17, 1880.

To all whom it may concern:

Be it known that I, FERDINAND AUGUSTE ACHARD, of Paris, in the Republic of France, have invented certain new and useful Improvements in Electric Apparatus for Working Railway-Brakes, of which improvements the following specification is a full description.

This invention relates to electric apparatus for working railway-brakes; and it consists of improvements in the construction and working of the electric apparatus, so as to render the system completely practical and absolutely certain.

The leading or characteristic features in the present improvements are as follows:

First. A pile or other convenient source of electricity is used at each end of the train. If the engineer or conductor works the commutator in order to put the brakes of the vehicles of a train into action, the two extreme piles, placed one in the front car and the other in the rear car, both send their currents into the electro-magnets of all the cars. Thus, if the tension of one of the currents diminishes gradually in intensity by going farther from the pile which engenders it, each vehicle will none the less receive an equal quantity of electricity by the addition or combination of the two currents arising from the simultaneous action of the two piles, because the intensities of the two piles vary in an inverse sense.

Second. The brake apparatus works automatically. In case of a coupling breaking the current is immediately closed for the two separate parts of the train and the brakes act instantaneously.

Figures 1, 2, and 3 of the accompanying drawings illustrate in sectional elevation, plan partly in section, and end view, respectively, a car-frame fitted with electric-brake apparatus constructed in accordance with the invention. Fig. 1ª is a sectional elevation, showing similar apparatus applied to a tender. Fig. 4 is a plan of a form of electric pile or battery which may be employed in the improved system, and Figs. 5 and 6 an end view and plan, respectively, of the commutator for putting on or taking off the brakes. Fig. 7 represents a development of the cylinder to show the contact-pieces. Figs. 8 and 9 are sectional elevation and plan, respectively, of the devices for completing the circuit between the different cars throughout the train; Figs. 10, 11, and 12, front view, side elevation, and plan of a relay used in the system; and Figs. 13, 14, and 15 views of means for driving a magneto-electric machine to operate the brakes in place of a battery. Fig. 16 is a diagram illustrating the application to a train of two cars; and Figs. 17 and 18, similar diagrams, showing the application to a train of three cars.

The brake apparatus shown in Fig. 1 will first be described.

The ordinary brake-levers, *a*, which act on the blocks *b*, are fitted at their ends with grooved pulleys *c*, over which passes a chain, *d*, the end of which is fixed at *d'*. To this chain are attached two others, *e*, carried obliquely, which are wound several times over a drum, *f*, supported by brackets under the car-frame. These chains *e* afterward pass over guide-pulleys *g*, and their ends are attached to the shaft *h* of the electro-magnet A, supported in bearing, so as to be free to turn. The guide-pulleys *g* may be dispensed with and the chains *e* led directly from the drum *f* to the shaft *h* of the electro-magnet A. This electro-magnet has at each end a disk, *i*, which is intended to touch the axle B and be rotated by it by friction when the current is sent. The magnet is suspended from the carriage-frame by rods *j*, and spring-plates *k*, of steel covered with copper, constantly tend to separate the electro-magnet from the axle B. It is by these spring-plates *k* that the current is transmitted to the electro-magnet. At the upper end of each plate *k* abuts a wire which is attached to the general conductor *x x'*, which extends the whole length of the train, so that each electro-magnet is supplied by derivation from the main circuit. When a current from the pile (or battery, such as shown in Fig. 4) is sent into the main circuit the electro-magnet A is attracted toward the axle B and is made to turn, being driven by friction. The chains *e* wind upon the axle *h* of the magnet and raise the brake-levers *a*. As soon as the current ceases the levers fall by their own weight and the brakes are released.

In the apparatus shown in Fig. 1ª, when the brake is applied the winding of the chains *e* has the effect of raising the large arm-lever G,

which causes the blocks to bear against the wheels by means of the rods M and the swinging supports, K. The large arm of lever G is fixed to the shaft 15, having its bearings in the forward supports, K. Short arms attached to the shaft are jointed at 16 to the rods M, which at their opposite ends are jointed to the rear supports, K.

In order to regulate at will the application of the electric brake, a regulator, R′, is placed near the engineer, which, according to its position, offers a greater or less resistance to the passage of the current, and the intensity of the current is thus more or less weakened. In the tender the chain can be extended, as shown, to a pulley fixed on a prolongation of a shaft, A′, which the engineer can turn by a hand-wheel, so as to work the brake by hand.

In a train any desired number of cars may be provided with this apparatus, or the tender and rear car, or the two end cars only, may be provided therewith. In order to equalize the current at all points, an electric pile or other convenient source of electricity is employed at each end of the train and the two are simultaneously applied. This result is accomplished by the aid of a commutator. A circuit additional to that by which the current is sent to the brakes is employed and a relay in the additional circuit. The commutator is so constructed and arranged that it connects in the battery at its own end of the train, and at the same time alters the electrical connections of the additional circuit, and thus operates the relay, which is placed at the opposite end of the train, and connects in the brake-circuit the battery at that end also. In applying the system a commutator and relays are preferably placed at each end of the train, and in operation each commutator cuts out its own relay and operates that at the opposite end of the train. This arrangement is shown in Figs. 16, 17, and 18; but in Fig. 16 the additional circuit and its piles are not shown.

D represents the piles for operating the brakes; $x\ x'$, the brake-circuit, in branches of which the electro-magnets A are placed, as before explained; C, the commutator; R, the relays; E, the piles for operating the relays, and $y\ y'$ (shown in dotted lines) the additional relay-circuit. The wires $y\ y'$ put the two piles E in opposition—that is to say, they put into respective communication the positive poles and negative poles of these piles.

The electrical connections are established by means of a commutator composed of a wooden cylinder, F, capable of turning in supports G, fixed to a platform, H. This cylinder can be turned at will, either by means of rods or cords I I′ or by means of a hand-lever, I^2, or other suitable device. The cord I′, which is pulled to send the current, is fastened at one end, so that if the coupling between the cars should break or part the cord will stretch and act upon the commutator. On one of the faces of the commutator the cylinder carries two copper plates, $l\ l'$, (see Figs. 6 and 7,) for putting into communication the copper pieces $m\ m'\ m^2\ m^3$, fixed to studs $n\ n'\ n^2\ n^3$. The wires from the pile D are connected with the pieces $m^2\ m^3$ and the wires $x\ x'$ with the pieces $m\ m'$. The commutator therefore occupies the position shown in Figs. 5 and 6 and in upper end of Fig. 18 when it is wished to send a current into the wires $x\ x'$. The cylinder F also carries a bent plate, o, and a metallic strip, o'.

When it is desired to release the brakes the commutator is turned in the direction of the arrow, Fig. 5. When the pieces $m\ m'$ touch the bent plate o and the pieces $m^2\ m^3$ the metallic strip o' an inverse current is sent through the line, which destroys the residual magnetism and the brakes are released. In a very little time after, contact between the plates m' m^2 and the stops o' is broken, the plates resting on the wooden cylinder, and all current is interrupted. On the other face the commutator carries five studs, and the cylinder is fitted with plates $p\ p'$, with a bent piece, q, and with a plate, q'. At the stud 1 the positive wire from the pile E in the front part of the train terminates, and the stud 2 communicates with the positive pole of the pile E of the rear car through the intermediation of the commutator in this car. When at rest the plates of the studs 1 and 2 are in communication through the plate p. In like manner the studs 4 and 5 are connected, the stud 4 with the negative pole of the front pile E and the stud 5 with the negative pole of the rear pile E, and when at rest communicate through the plate p'. The two positive and negative poles of the front and rear piles E are therefore in communication. They are in opposition, and consequently without effect. The stud 3 is also in communication with the negative pole of the adjacent pile E, and a relay, R, is placed on the wire, which makes the stud 4 communicate with the negative pole. The relay is not actuated, as the piles are in opposition; but when the commutator is turned communication is made between the studs 2 and 3 through the plate q', and between the studs 1 and 5 through the bent piece q, and there is therefore communication between the positive pole of the rear pile E and the negative pole of the corresponding front pile, and reciprocally the negative pole at the rear communicates with the positive pole at the front. The two piles E at front and rear are thus united in tension, and a current passes over wires $y\ y'$. As the rear commutator has not been touched, the rear relay is subjected to the action of this current and enters into action. At the front the rotary movement of the commutator has insulated the front relay, so that this is not submitted to the action of the current from the piles E at front and rear. In order that the working of the apparatus may be more readily understood, it is supposed to be at rest in Fig. 17 and in action in Fig. 18. In normal position no current passes into the wires $x\ x'$ of the electro-magnets, and the wires $y\ y'$ put the piles E at front and rear in opposition. If one of the commu-

tators, either in front or rear, be turned, there is immediately sent into the wires *x x'* a current from the pile D, placed near the commutator operated upon, and at the same time the relay in the same car is insulated and the piles E at front and rear are coupled in tension by the wires *y y'*. The relay opposed to the commutator acted upon receives the current from these piles E, enters into action, and closes the circuit from the pile D, situated in the same car. The two piles D therefore both send simultaneously a current into the electro-magnets A, which thus receive the same quantity of electricity.

The relay which is employed by preference is shown in Figs. 10, 11, and 12. It is composed of a horseshoe electro-magnet, K, through which circulates at the proper time the current from the piles E. Opposite the poles of this magnet is an armature, J, which oscillates on the point *o'* and carries a cross-piece of an insulating material, *r*. To this are fixed contacts *r'*, which close the circuit between the wires coming from the pile D and those which lead to the line-wires *x x'*.

In order to make the connections between the vehicles the arrangement represented in vertical section, Fig. 8, and plan, Fig. 9, is employed. It consists of two wooden supports, L M, one of which incloses one of the ends of each of the wires *x* and *y*. Each of them terminates in a round rod, *s*, which is held in a jointed spring-nipper, *t t'*, in the support L, which is fixed under the vehicle. To establish the communication it is sufficient to push the support M against the support L, so that the rods *s* engage in the nippers *t t'*. They can be separated by forcibly pulling them apart. The nipper *t*, which unites the lengths of wire *y*, is arranged so that if the rod *s* is drawn away—in case of the couplings breaking, for example—it makes contact with a copper plate, *u*. The couplers at opposite sides of the train, between each pair of cars, are reversed—that is to say, at the end of each car the support L is on one side and the support M on the other, as shown in Figs. 17 and 18. From the plate *u* a wire, 20, (shown in dotted lines,) extends to the opposite conductor, *y* or *y'*. It will therefore be understood that in case of the couplings breaking the opposition of the two piles E will instantaneously cease, and the circuit from the pile E of each of the parts of the train will be closed by the said transverse wire, the two relays at front and rear will enter into action, and each of them will send into the electro-magnets of the part of the train which corresponds to it the current from its pile D. Consequently all the brakes will be applied.

The electric piles employed are by preference those of the Planté system. Instead of employing piles as the source of electricity for operating the brakes, magneto-electric and dynamo-electric induction-machines can be employed, worked by the wheels of the cars in which they are placed; or, again, an induction-machine may be placed on the locomotive and put into motion by a rotary steam-engine or by an ordinary cylinder-engine.

In Fig. 13 a magneto-electric machine, N, is shown suspended from the car-frame by supports O. It carries pulleys P, which come into contact with the pulleys P' P', keyed on the axle. The machine is moved to or from the axle at will. By means of the hand-lever Q the electric current is produced or interrupted.

Figs. 14 and 15 show in side view and front elevation an arrangement in which the machine is fitted above the frame on a shaft, S, carrying a cone, T, connected by a strap with the cone T'. This receives, when desired, the movement of the axle against which it is pushed. The cones T T' permit the speed of the magneto-electric machines to be varied, or, more correctly, the strap which connects the cones is shifted according to the speed of the train.

The employment of induction-machines equally allows of the brakes being automatic.

For charging or priming these machines it will be well to add a small magneto-electric machine with permanent magnet, which will be actuated by the axles of the car, and, if required, can be arranged on the same shaft as a large machine. This small additional machine will furnish a current all ready for changing the direction of the action. It will work as a relay-pile for producing the automatic action of the brakes, any breakage of the coupling having the effect of closing the circuit which acts on the electro-magnets of the brakes.

It is obvious that modifications may be made without departing from the spirit of the invention.

Having now fully described the said invention and the manner of carrying the same into effect, what I claim is—

1. The combination, with the electric apparatus for operating the brakes of a railway-train, comprising drums suspended by swinging supports beneath the car-body, and electro-magnets connected with said drums, and adapted by their attraction to bring and hold said drums in contact with the car-axles, of two piles or sources of electricity located at opposite ends of the train, and means, as indicated, for simultaneously bringing said piles into action, so that the brakes throughout the train receive substantially the same quantity of electricity, as set forth.

2. The combination, with an electric circuit and electric-brake apparatus located on branches of said circuit, so as to be supplied by derivation therefrom, of two piles or other sources of electricity at opposite ends of the train, adapted to be simultaneously brought into action, substantially as described.

3. The combination, with the brake apparatus and circuit for conveying electricity thereto and two piles or sources of electricity, of a commutator and relay, with connections for connecting said piles in the brake-circuit, substantially as described.

4. The combination of brake-circuit, electric-brake apparatus supplied by said circuit, a re-

lay-circuit, a relay located in the relay-circuit and adapted to connect in with the brake-circuit a pile or other source of electricity, two piles normally connected in opposition in said relay-circuit, and a commutator with conductors and contacts, as indicated, whereby said piles can be connected in tension to operate the relay, substantially as described.

5. The combination, with electric circuits extending through a railway-train and electric-brake apparatus in the cars of said train, of electric piles, and means, as indicated, for connecting in said piles, arranged symmetrically at opposite ends of the train, substantially as described.

6. In an electric-brake apparatus, the electro-magnets, the swinging supports for suspending the same from the car-frame, and the springs for supplying electricity thereto, combined and operating substantially as described.

7. The combination, in an electric brake system, with electric apparatus for applying the brakes, of a normally-closed circuit containing piles or other sources of electricity connected in opposition and placed at opposite ends of the train, said circuit comprising suitable conductors on the several cars, and of couplings for completing the circuit through the train, constructed and operating substantially as described, so that in case a coupling breaks the circuit is automatically closed for the two parts of the train and the brakes applied, as set forth.

8. The combination of the brake-circuit, its piles, the additional circuit, its piles and relays, and the commutator for altering simultaneously the connections of the two circuits, substantially as described.

9. The combination of the brake apparatus, the brake-circuit and its piles, the relay, the relay-circuit and its piles, the couplings between the cars for the two circuits, and the commutators, substantially as described.

10. The combination, with electric-brake apparatus, conductors for supplying electricity thereto, one or more piles, and a commutator, of operating cords or rods connected with said commutator, substantially as described.

11. The combination, with the commutator or the controlling device of a brake system, of a cord connected at one end with the commutator or device and fastened at the other to a car of the train other than that on which the commutator is placed, so that the tension on the cord caused by separating of the train acts upon said commutator or device and applies the brakes, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

FERDINAND AUGUSTE ACHARD.

Witnesses:
ROBT. M. HOOPER,
E. DE ROUGEMONT.