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H. V. BROWN.

SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

No. 548,032. Patented Oct. 15, 1895.

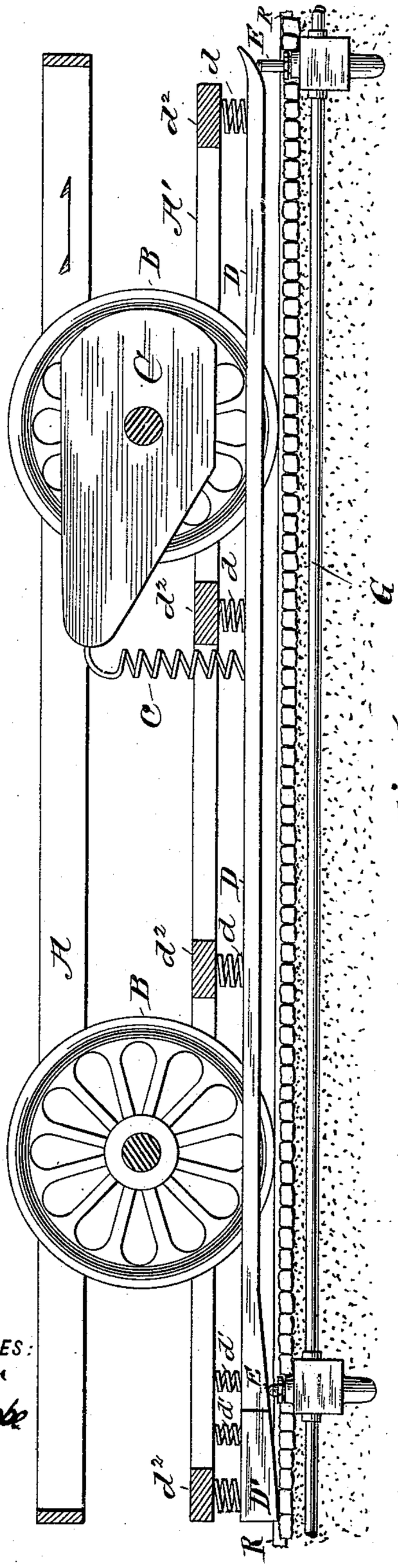

Fig. 1.

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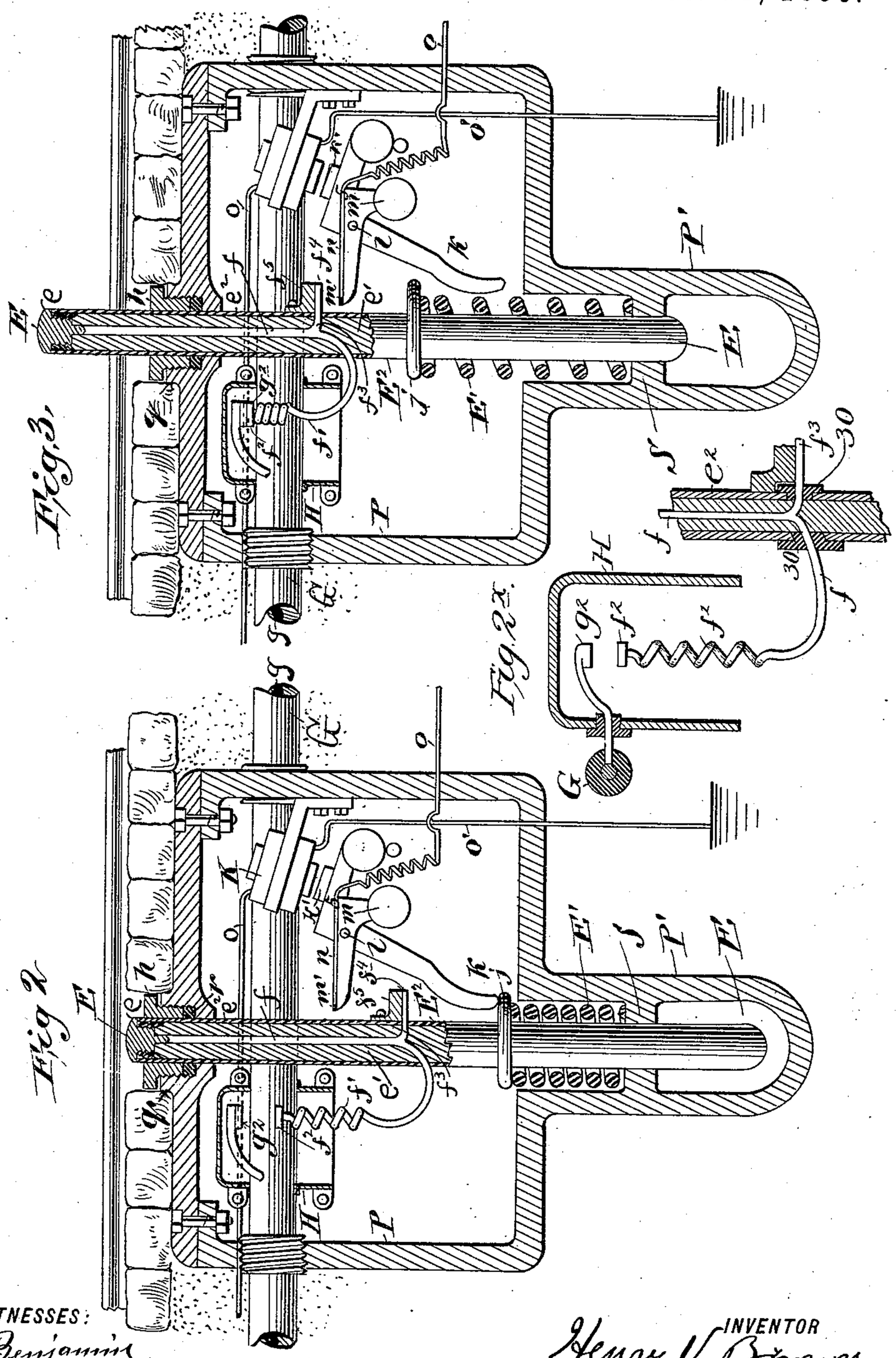

Fig. 3.

Fig. 2.

Fig. 2x.

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Fig. 3.

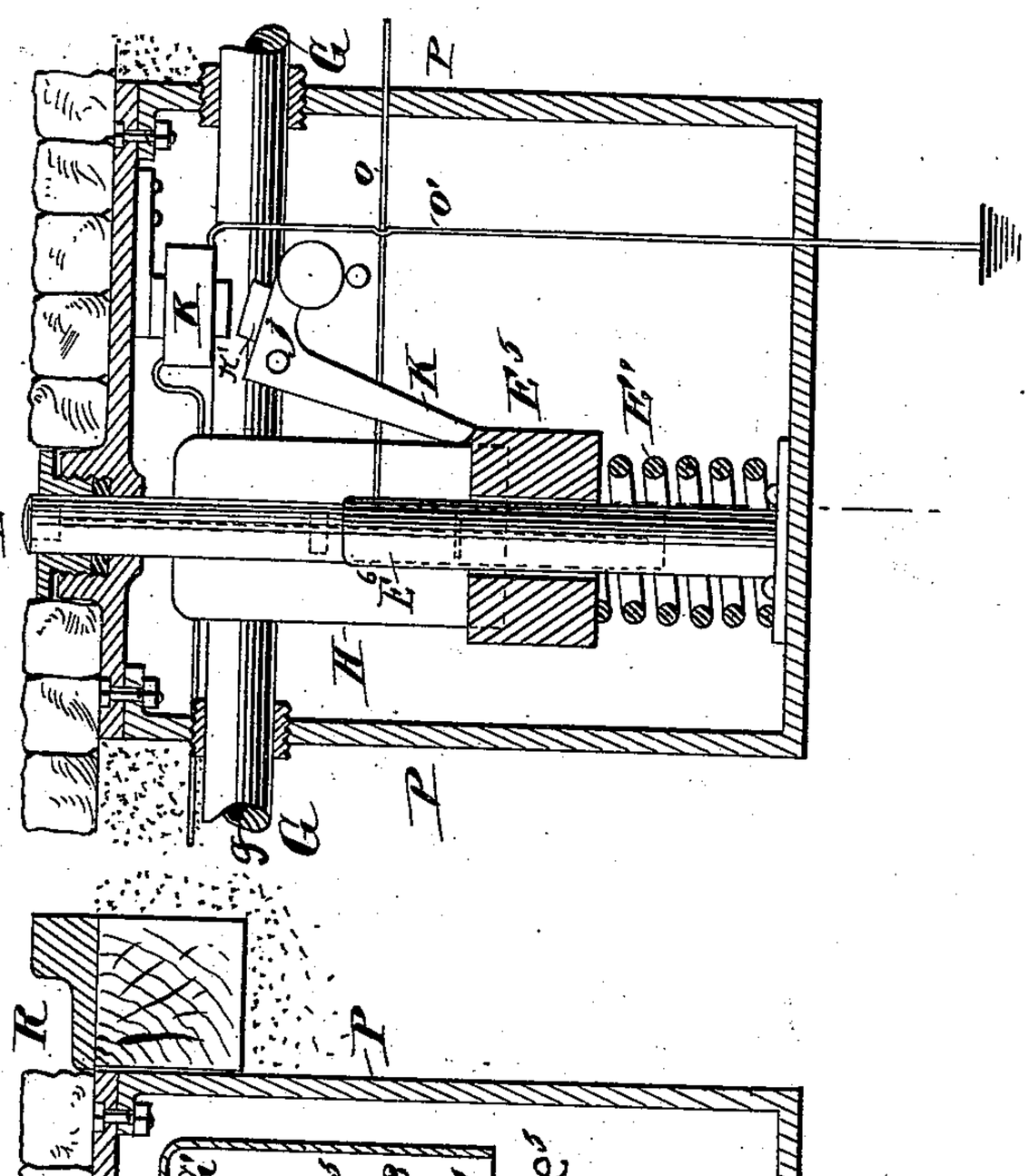
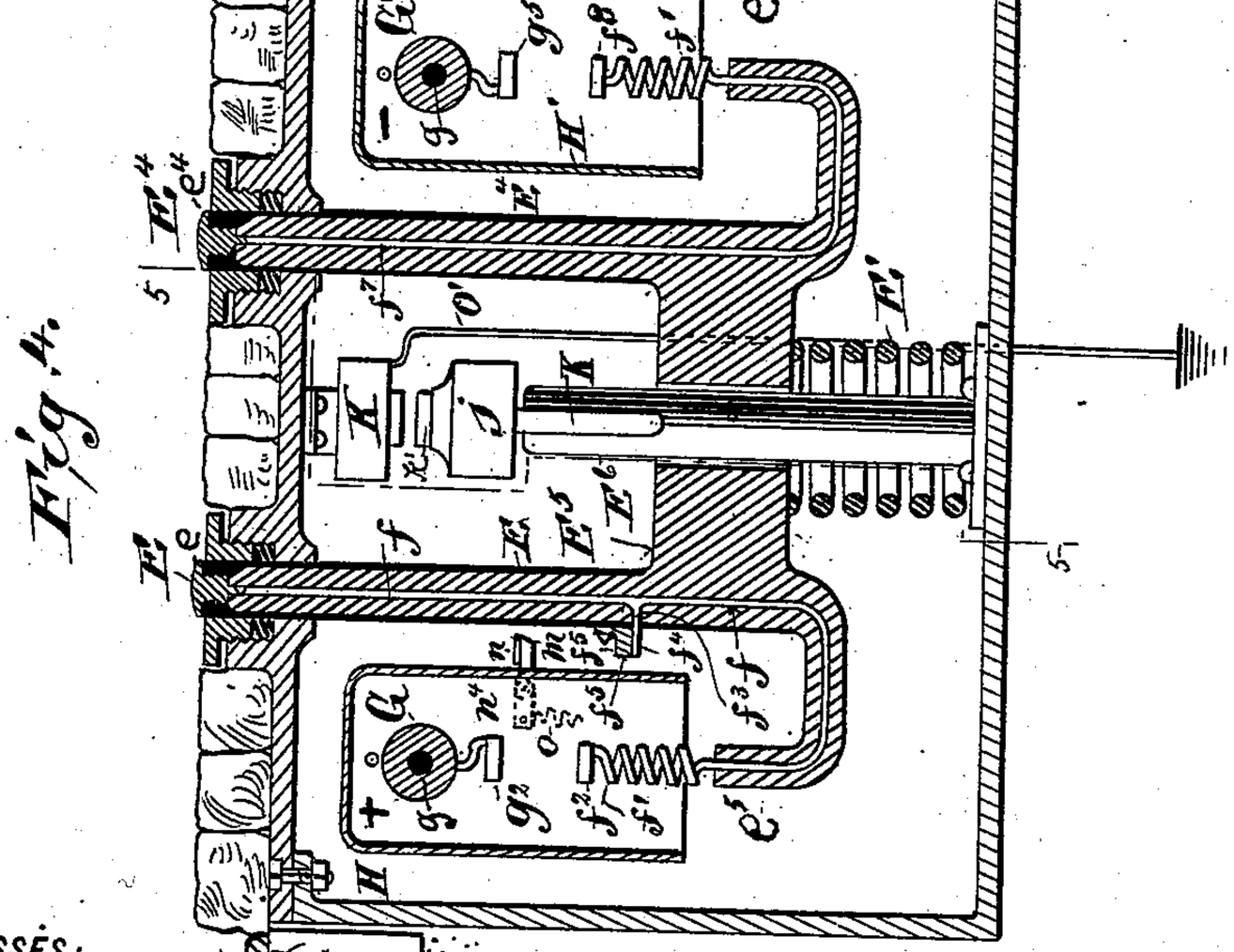


Fig. 4.



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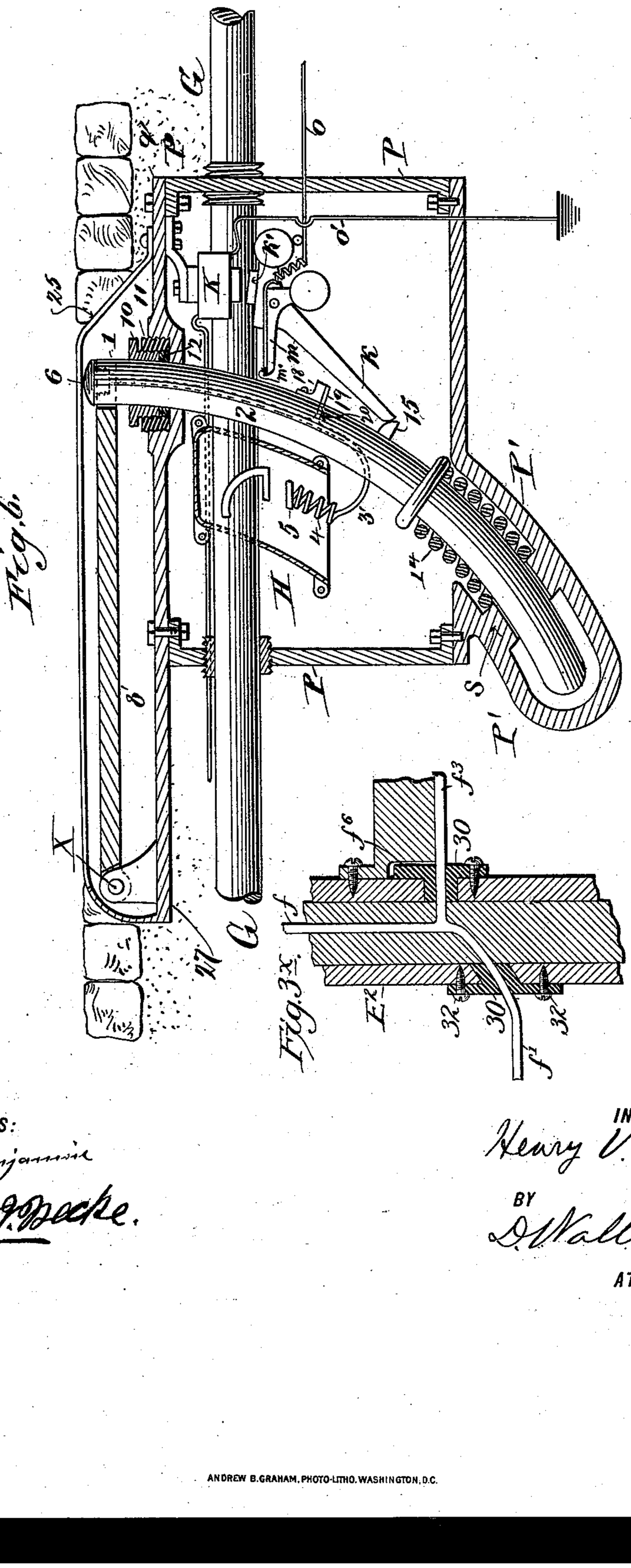

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UNITED STATES PATENT OFFICE.

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SUPPLY SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 548,032, dated October 15, 1895.

Application filed November 21, 1894. Serial No. 529,526. (No model.)

To all whom it may concern:

Be it known that I, HENRY V. BROWN, a citizen of the United States, and a resident of the city of Brooklyn, county of Kings, State of New York, have invented a new and useful Improvement in Systems of Electrical Traction, of which the following is a specification.

This invention relates to improvements in systems of electrical traction of that class wherein the current for the motor on the car is taken from a main circuit by suitable brushes.

Particularly, the invention relates to improvements in that class of systems that have the main circuit underground.

The invention consists, first, in combining with the main underground circuit shiftable current-carriers, which are normally out of contact with the main circuit, but while a car is passing over them rise into contact with said circuit, and with suitable brushes on the car, so that the current is taken by means of the current-carriers from the main circuit to the motor on the car. When the car has passed over the current-carrier, it again descends out of contact with the circuit and becomes dead. At the same time the current-carrier has descended out of harm's way from passing vehicles. It is also the purpose of the upward movement of the current-carriers, in addition to closing the connection between the motor and the main circuit, to lift the electrically-conductive tops of the current-carriers (the bodies thereof being made of non-conductive materials) above the reach of water and snow on the streets, in order that "short-circuiting" may be thereby avoided and that the operation of the system shall be certain in all kinds of weather and shall not be liable to the interruptions which attend other underground systems.

The invention consists, second, in combining with the circuit-carriers suitable devices on the car for pushing the carriers down and suitable catches in the carrier-boxes for holding and releasing the carriers at the proper times, and I prefer to operate said catches electrically.

The invention consists, third, in combining with the main circuit and carriers inverted air-chambers, which will provide an air-lock around the contacts on the circuits and the carriers and prevent water from ever rising to the contacts.

Referring to the drawings which accompany the specification to aid the description, Figure 1 is a sectional elevation showing two of the carriers and a car with a brush which is just coming into contact with one carrier and just passing out of contact with the carrier immediately behind. The wheels and sill of the car only are indicated. Figs. 2 and 3 are sectional details on, a large scale, of a single carrier and its equipment and respectively showing the carrier in its lowest and its highest position. The car is not indicated in these figures. Fig. $2^{\times}$ illustrates the arrangement of the main cable outside of the air-chamber and with a branch wire carried into said air-chamber and terminating in a suitable contact. Fig. $3^{\times}$ is a broken sectional detail on a larger scale, showing a method of insulating the joints where the branches of the conductor pass through the shells of the current-carriers. These figures show a system arranged to carry the return-circuit through the ground or through the rails in any usual manner. Fig. 4 is a sectional detail of a system provided with a return main circuit and two series of carriers—one for the out, the other for the return circuit. Fig. 5 is a sectional elevation on the line 5 5 of Fig. 4. Fig. 6 is a sectional detail of a modification of a carrier, it now being curved and moving around a center.

A, Fig. 1, is the sill of a car; B, the wheels; C, the motor-case; *c*, the circuit to the motor.

D is a brush, of suitable conductive material—as iron, steel, or copper—preferably extending beneath and nearly the entire length of the car-body and supported, preferably, by insulated springs *d d*, from the cross-pieces d^2 of the lengthwise stringer A′ of the truck of the car. Description of the arrangement of said stringer is unnecessary, as it is well known to car-builders, is in common use, and is not *per se* claimed as any part of this invention. The under face of said brush D should be made of considerable width to provide for the cars going around curves, and the brush is preferably set inside the wheels B. The front end of said brush D is preferably curved up, as shown, and near the rear end it descends on an easy slope. Immediately be-

hind the brush I prefer to put a separate piece D′, which slopes down until it just clears the street. The joint between the parts D and D′ may be filled with insulating material. Said brush D is electrically connected with the wire to the motor C.

E E are current-carriers arranged between the rails, and so as to come at proper times into contact with the brush D and at distances apart a little less than the length of said brush. Said current-carriers are posts having electrically-conductive caps E, insulated from the shells e^2, e' being insulating filling, as wood, in the said shells. A wire f passes from the cap e out by an insulated joint through the shell e^2, having a long terminal insulated-spring portion f', provided with a contact piece or button f^2. The aforesaid joint, where the wire f passes through the shell E^2, is insulated by means of a sleeve, of rubber or other non-conductor 30, which encircles the wire and fills the hole in said sleeve E^2. The flanges of said sleeve may be secured to the shell E^2 by screws 32, as shown in Fig. 3. The main circuit G, consisting of an insulated cable g and extending along the line from the generators, has at suitable corresponding intervals contacts g^2.

H is an inverted air-chamber inclosing the contact g^2, which is preferably arranged near the top of the chamber, which said chamber descends some distance below the contact f^2. The cable G passes through or to one side of said air-chamber H, the said cable or the insulated wire of the contact g^2 passing through the wall of the air-chamber with an air-tight joint, as is shown in Fig. 4. This said air-chamber forms an air-lock around the contacts f^2 g^2 and prevents water from rising to the same. Of course when the cable G passes to one side of the air-chamber H the wire of the contact g^2, properly insulated, will pass through the wall of said air-chamber. A shunt f^3 leads from the wire f by an insulated joint 30, similar to the joint 30, where the wire f passes through the shell E^2, Fig. 3, through the shell of the carrier E to a contact f^4, set beneath an insulating projection f^5 of the carrier E. The carrier E is elevated by a spring E′ coiled between a shoulder on said carrier and a guide S, through which the lower part of the carrier works. Any other equivalent device may of course be substituted for the spring E′. To retain the carriers E in the lowest position and release them any suitable device may be employed, and I prefer an electrically-operated catch for the purpose. A useful arrangement of the same is shown in Figs. 2 and 3, k' being a long arm of a lever adapted to engage an insulated shoulder of the carrier E when said carrier is in its lowest position. The end of the lever is preferably curved on an arc having the fulcrum l as a center, and the surface of the shoulder j may also be curved. The other arm of said lever carries an armature k', K being an electromagnet supported on a bracket and adapted to attract said armature. A switch m is pivoted to be actuated by the projection f^5, and preferably on the fulcrum l, m^5 being a weight to hold said switch normally about horizontal, (or a spring can be used for the same purpose,) n being a conductor set on the non-conducting body of the switch m and electrically connected with the shunt-wire O, which, properly insulated, leads to the electromagnet of the next forward carrier. Said shunt-circuit is coiled near the switch to make a spring to permit of the necessary motions of the switch. I prefer to set the conductor n into the body of the switch m, so as to leave a non-conducting toe m' between the said conductor n and the carrier E. In wiring up the system it will be understood that the one pole of each electromagnet K is connected by the shunt-circuit O with the switch of the next preceding carrier, so that the passage of a car over one carrier will enliven the magnet of the next carrier and release said next carrier in the manner to be hereinafter described. Said magnet K may also be "grounded" by wires o', as indicated.

P is a case containing the carrier and its equipment. A stuffing-box p q with packing r is provided on the cover of the case through which the carrier E works with water-tight fit. If desired, any suitable provision may be made for oiling the stuffing-boxes. P′ is a cylindrical depression on the bottom of the case P to receive the lower end of the carrier E. The main circuit G and the shunt-circuit O will, of course, be carried in any suitable manner, as in pipes, below the surface of the ground from case to case, there being water-tight joints wherever the pipes pass through the walls of the cases P. As said pipes do not require to be buried at any depth and need but small trenches, and as the cases are of small area, the cost of the necessary excavation is but small.

The operation is as follows: Suppose a car is moving in the direction of the arrow, Fig. 1, and in such a position that the inclined part at the rear end of the brush D is passing over a carrier E and the front end of the brush is approaching the next forward carrier, which is as yet held in its lower position by its catch. Now, as the car proceeds, the incline at rear of the brush D and part D′ pushes down said rear carrier E from the position of Fig. 3 to that of Fig. 2. As said carrier descends, the contact f^2 still remains for a certain part of its descent in contact with the button or contact g^2, because of the spring part f' of the circuit f, and the current is not interrupted. Now, while the said carrier E is so descending, and before the contact with the main circuit is broken, the conductor f^4 comes down on the conductor n of the switch m and shunts a part of the current through the shunt-circuit O to the electromagnet K of the said next forward carrier. Said magnet attracts the armature k' of the lever k, draws said lever off the shoulder j, and releases said carrier, which

immediately rises to the position of Fig. 3. This action takes place, preferably, just before the turned-up forward end of the brush D arrives over said carrier. At the instant that the front end of the brush D comes on the top of the front carrier the brush spans the interval between two carriers, and at this instant there are two contacts between the brush and the main circuit. In this manner there can be no instant of time at which the brush D is not in contact with at least one live carrier, and the current will always be energizing the motor. As the forward carrier rose, the insulated part of the projection f^5 pushed up the switch m and the conductor f^4 did not make any contact with the conductor n of the said switch. As said projection f^5 passed above the switch, said switch dropped back to the horizontal position, Fig. 2. Some little time before the said carrier arrived at its highest position the button f^2 made contact with the button g^2, the spring f' compressing as the carrier E continued its ascent. Thus it is evident that at the highest position the carrier is in contact with, but at its lowest position is out of contact with, the main circuit G, and that at both the lowest and highest positions the shunt-circuit to the next forward electromagnet is broken. Only during a certain portion of the downward movement of the carrier is the shunt-circuit closed through the switch m and the conductor f^4. The relative positions of the buttons g^2 f^2, conductor f^4, switch m, and the vertical play of the carrier E, are such that the conductor f^4 will not close the shunt-circuit O until the carrier has descended a certain distance, and that said shunt-circuit will remain closed long enough to insure the releasing of the catch of the next forward carrier.

In Figs. 4 and 5 the system is shown arranged to operate with a return-conductor, G G′ being respectively the out and return branches of the main circuit, which are throughout their length separate from each other. E and E^4 are their respective current-carriers. The posts of said carriers are connected by a cross-piece E^5, in which is a hole, through which works a guide-post E^6, E′ being the spring to raise the carriers. The construction of the carriers, their caps E E^4, and wires f f^7, respectively, and their insulation are the same as hereinbefore described. The foot of each carrier E^5 E^5 may be turned laterally and up, so as to be vertically below the bottom of the respective air-chambers H H′. The circuits G G′ pass through the upper part of said air-chambers H H′, respectively, with air-tight joints, or, of course the contacts g^2 g^5 may be led through the walls of the chambers, as hereinbefore mentioned. The catch K, arranged to be operated by the electromagnet K in the manner herein described, normally bears on the cross-piece E^5, as shown in Fig. 5. When the current passes through the electromagnet from the preceding carrier, the said magnet attracts the armature K′, draws the catch from the cross-piece E^5, and allows both carriers E E^4 to rise simultaneously, making contact, respectively, with the cables G G′. The switch m, provided with a conductor n, which is electrically connected with the shunt-current o, leading to the next forward electromagnet, as hereinbefore described, is now pivoted independently from the catch k, but is operated by the projection f^5 and conductor f^4 as the carrier rises and descends in the manner hereinbefore described. The said switch m, (shown in Fig. 4,) is also applicable to the single-carrier system hereinbefore fully described. With the two circuits and sets of carriers there will of course be two brushes arranged side by side beneath the car but insulated from each other, so that one brush will pass over the one, the other brush over the other series of carriers. In this case the one brush will be connected with the one, the other brush with the other pole of the motor. Each of said brushes will be in all respects similar to that before described, and does not require further description.

In Fig. 6 is shown a carrier arranged to rise and fall around a center. The carrier 1 being a hollow curved pipe, with X as a center of movement and filled with some insulating material 2, contains a wire 3, connected with a spring 4, and contact-button 5, 6 being the conductive cap of the carrier insulated from the shell of the carrier. Said carrier is rigidly connected with the arm 8, fulcrumed at x, and works through a stuffing-box having a gland 10, with a curved hole to fit the carrier. Said gland threads into a sleeve 11, which in turn threads into the top of the box P, 12 being the usual packing. 14 is the spring to push up the carrier. 15 is the shoulder engaged by the catch k, K being the electromagnet to operate the same. m is the switch arranged as before, 18 being the projection on the carrier 1 and 19 the conductor of the shunt-wire 20. H is the air-chamber, as before. To protect the arm 8 a hood, 25 is placed on top of the case P, with a slot in the top through which the arm 8 and carrier 1 work. To avoid making the case P very long, I prefer to put a bracket 27 on the end to support the pivot of the arm 8. It will be understood that when the electromagnet attracts the armature K′ the catch k releases the carrier 1, which is pushed up, moving on a circular arc around the center X as it rises. In other respects the operation is the same as hereinbefore described.

Now, having described my improvements, I declare that what I claim as my invention is—

1. The combination in an electrical traction system of a main circuit, vertically shiftable current carriers arranged to be normally out of contact with the main circuit and a catch adapted in one position to restrain and in another position to release said carriers, and an electro magnet arranged to actuate said

catch and being momentarily electrically connected with the next preceding current carrier, substantially as described.

2. The combination in an electrical traction system of a main circuit a series of vertically shiftable current carriers, electrically operated catches adapted to normally hold said carriers out of contact with said main circuit and connected by a shunt circuit with a switch which is adapted to make and break connection with the preceding carrier as the same shifts substantially as described.

3. In an electrical traction system the combination with a series of current carriers of a catch for each carrier, an electro magnet adapted to operate the catch, a shunt circuit to the magnet, and a switch in said shunt circuit operated by another carrier, substantially as described.

4. The combination in an electrical traction system of a series of shiftable current carriers, catches therefor, shunt circuits adapted to throw said catches electrically, and switches in said shunt circuits adapted to be actuated by said current carriers, substantially as described.

5. The combination in an electrical traction system, of a main cable, contacts thereon, inverted air chambers around said contacts, shiftable current carriers adapted to make and break contact with said contacts of the main cable, shunt circuits adapted to be electrically connected with said main cable through said current carriers and catches for said current carriers operated by the said shunt circuits, substantially as and for the purpose described.

6. The combination, in an electrical traction system, and with a car containing a motor, and a series of current carriers arranged along the line, of a brush on the car adapted to make contact with the current carriers, and a rear inclined part electrically separated from the main body of the brush and adapted to push down the current carriers, substantially as described.

7. The combination in an electrical traction system of a motor on a car, a brush on the car electrically connected with the motor, a main circuit, a series of vertically shiftable current carriers arranged a less distance apart than the extreme length of the brush, contacts on the main circuit, electrodes on the current carriers, and said contacts and electrodes one or both provided with compressible springs, catches adapted to normally retain the current carriers in their lowest position, electro magnets arranged to throw off said catches, switches arranged to make and break connection with the current carriers, shunt circuits from each catch to the magnet of the next forward carrier, and said contacts, electrodes and switches arranged so that the shunt circuit is broken at both extremes of the carriers' motion and is closed for a time between those extremes substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 18th day of October, 1894.

HENRY V. BROWN.

Witnesses:
BERNARD J. BECKE,
DAVID WALTER BROWN.