(No Model.) 4 Sheets—Sheet 1.

A. I. AMBLER.

ELECTRIC TRAIN BRAKE APPARATUS.

No. 395,682 Patented Jan. 8, 1889.

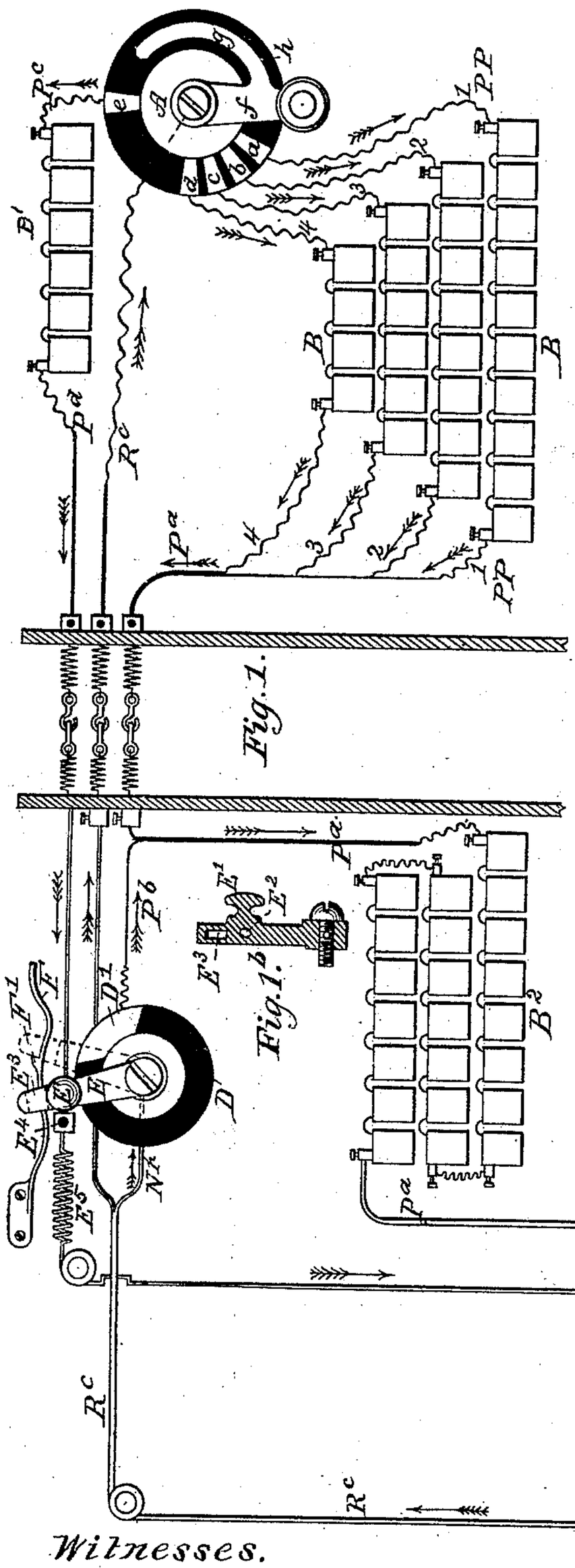


Fig. 1.

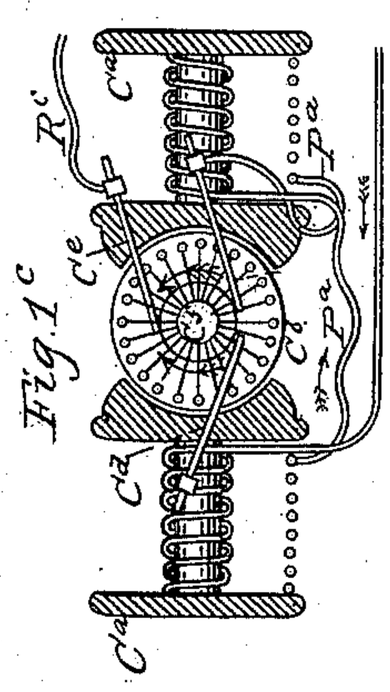


Fig. 1c

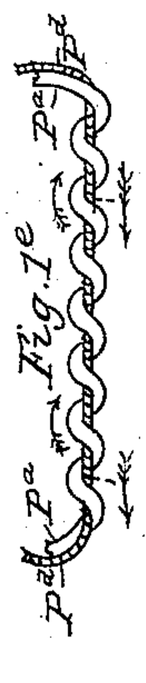


Fig. 1e

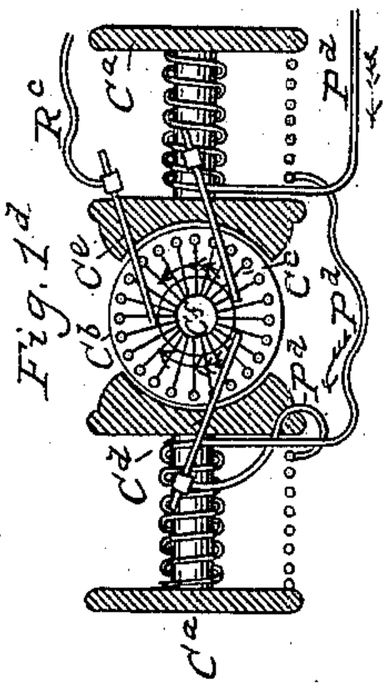


Fig. 1d

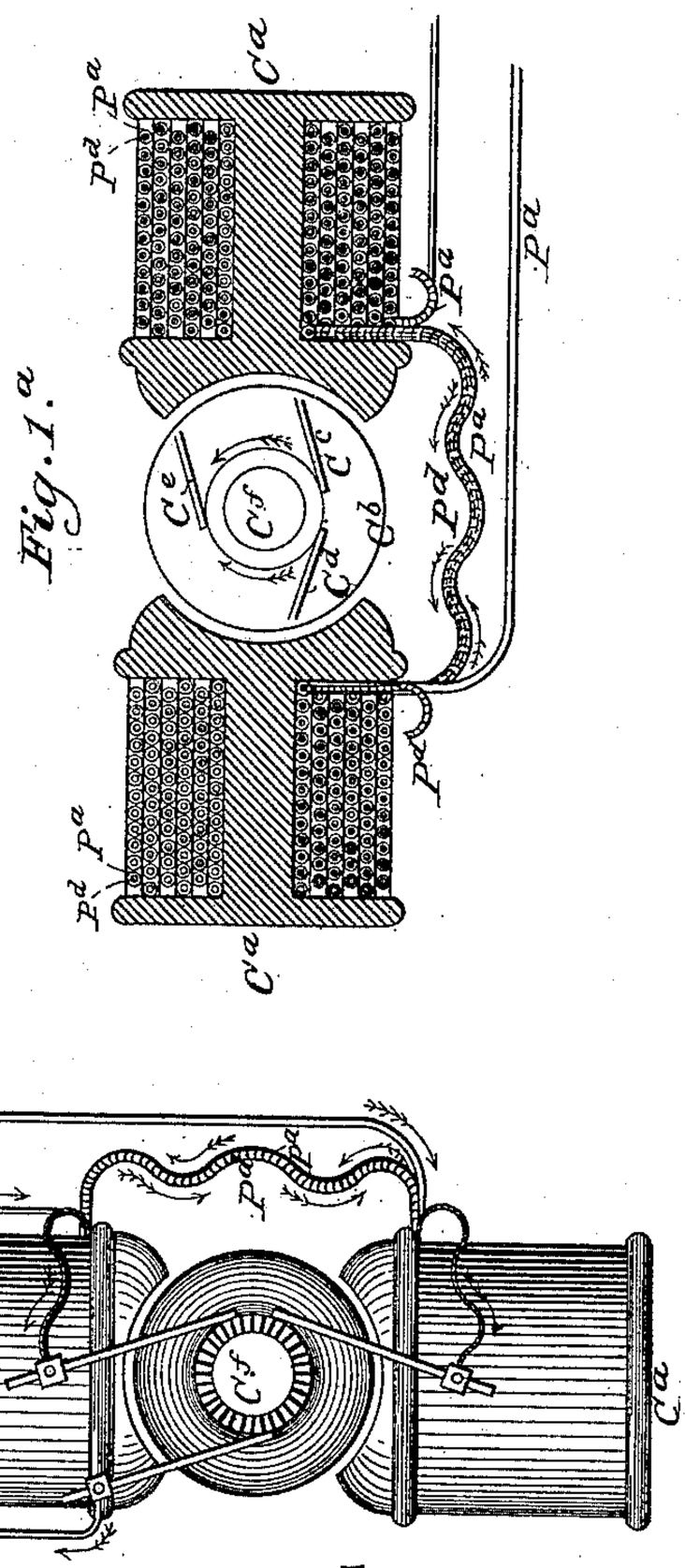


Fig. 1a

Fig. 1b

Witnesses.
Wm. A. Schwenborn.
A. R. Townshend

Inventor.
Augustus I. Ambler
E. B. Clark
Atty.

(No Model.) 4 Sheets—Sheet 2.

A. I. AMBLER.

ELECTRIC TRAIN BRAKE APPARATUS.

No. 395,682. Patented Jan. 8, 1889.

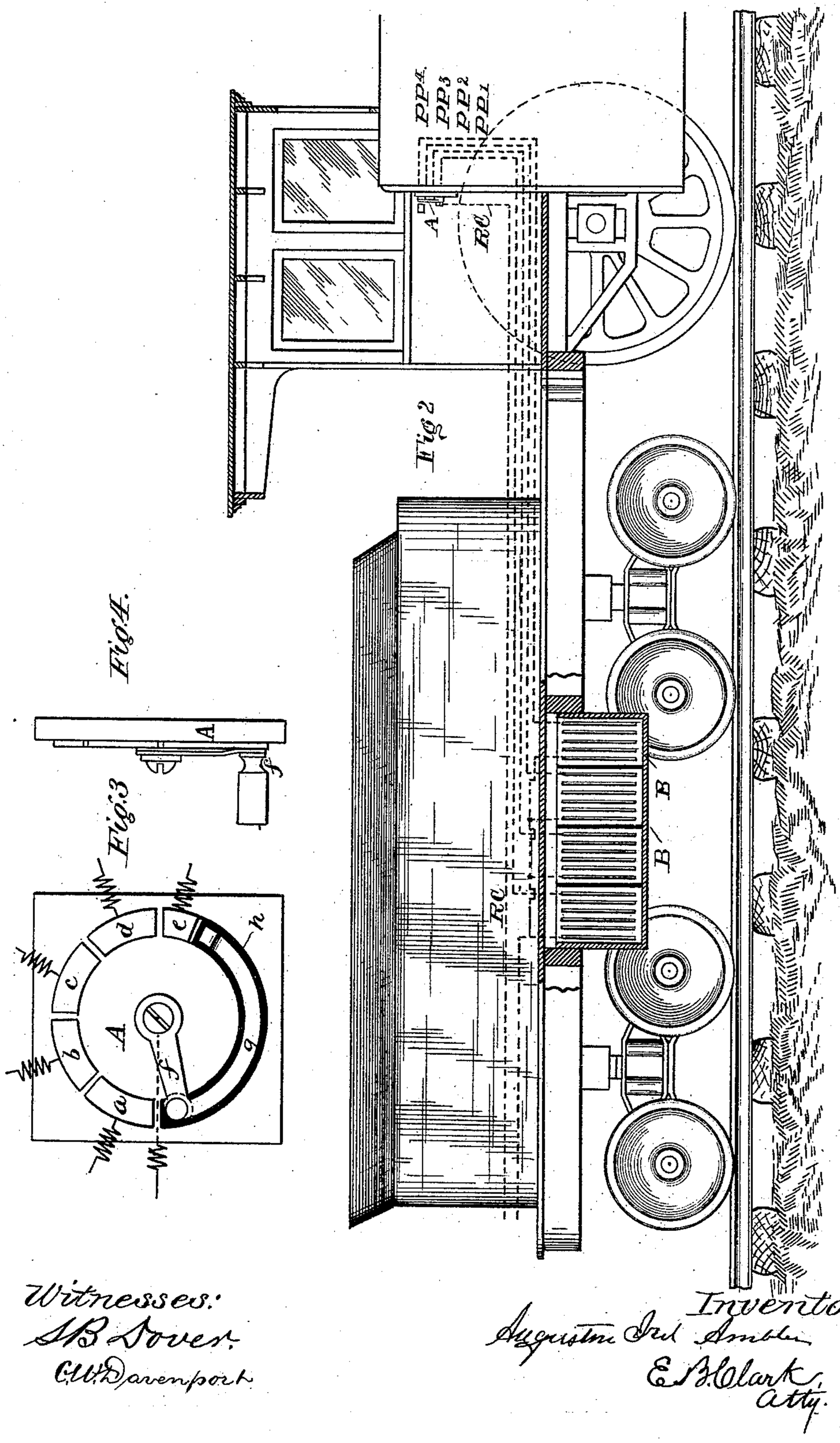


Fig. 4.

Fig. 3

Witnesses:
A B Dover
C. W. Davenport

Inventor:
Augustus Ird Ambler
E. B. Clark
Atty.

(No Model.) 4 Sheets—Sheet 3.

A. I. AMBLER.

ELECTRIC TRAIN BRAKE APPARATUS.

No. 395,682. Patented Jan. 8, 1889.

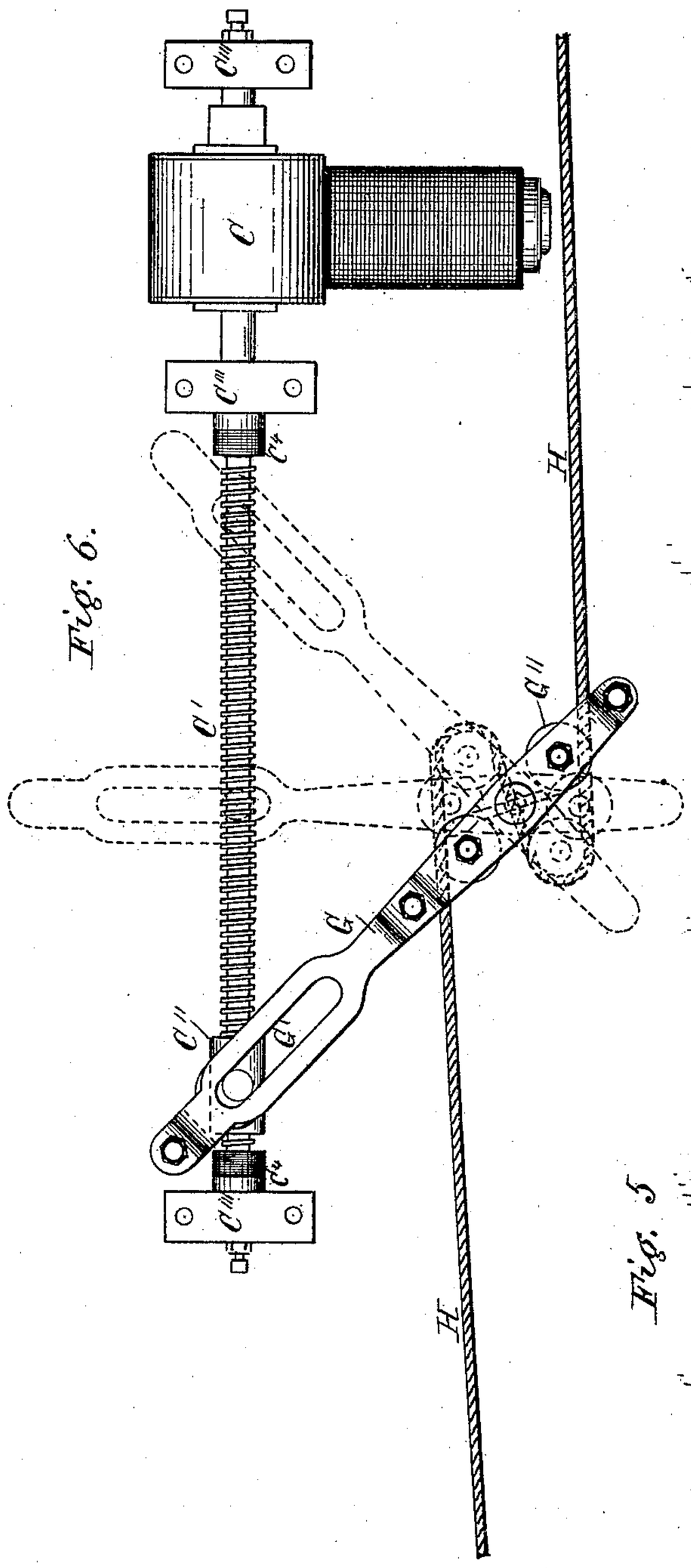


Fig. 6.

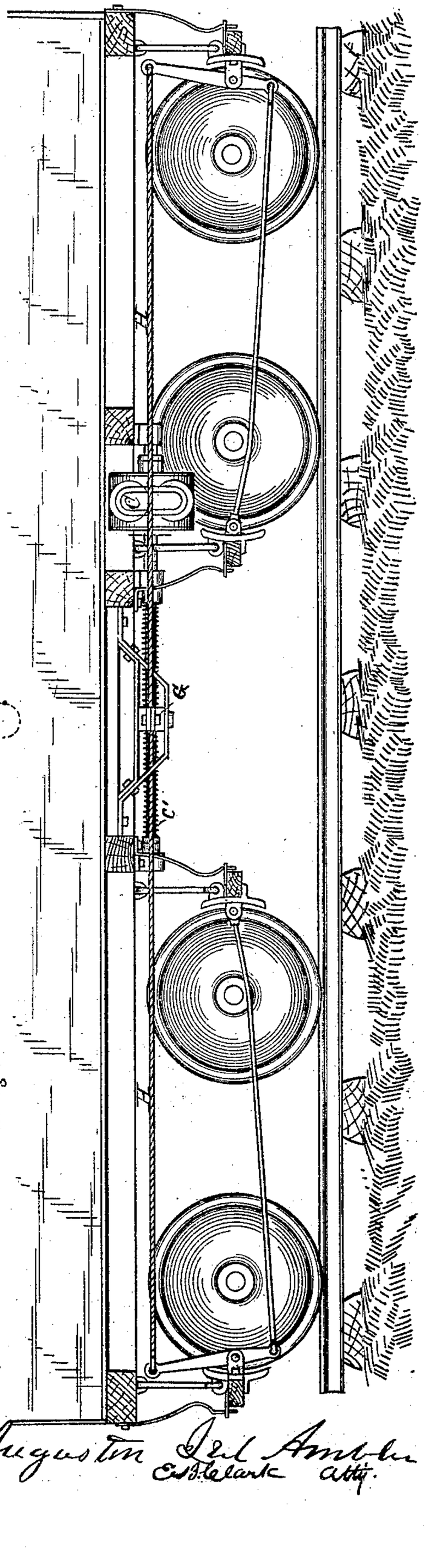


Fig. 5

Witnesses:
S. B. Dover.
C. W. Davenport

Inventor:
Augustus Ide Ambler
by E. B. Clark Atty.

(No Model.) 4 Sheets—Sheet 4.

A. I. AMBLER.

ELECTRIC TRAIN BRAKE APPARATUS.

No. 395,682. Patented Jan. 8, 1889.

Fig. 7

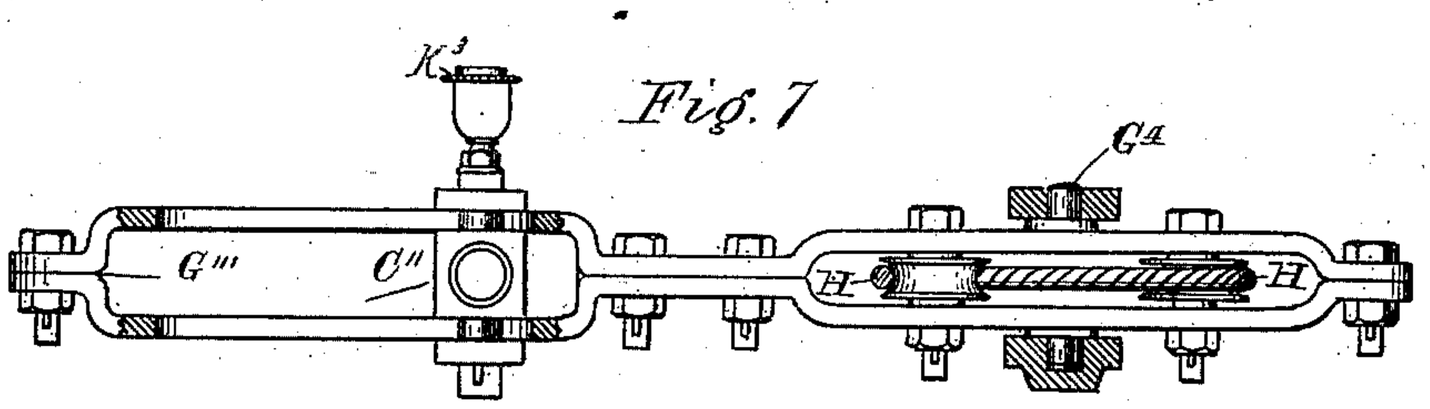


Fig. 8

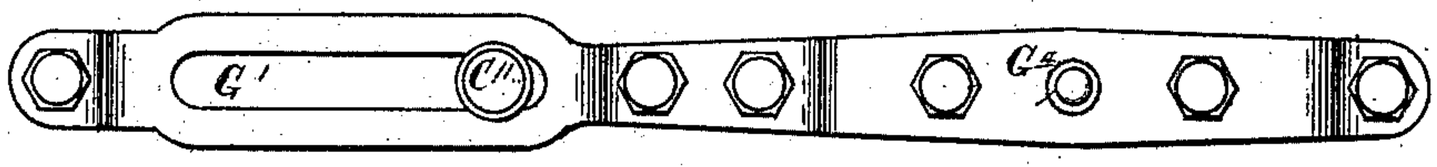


Fig. 9

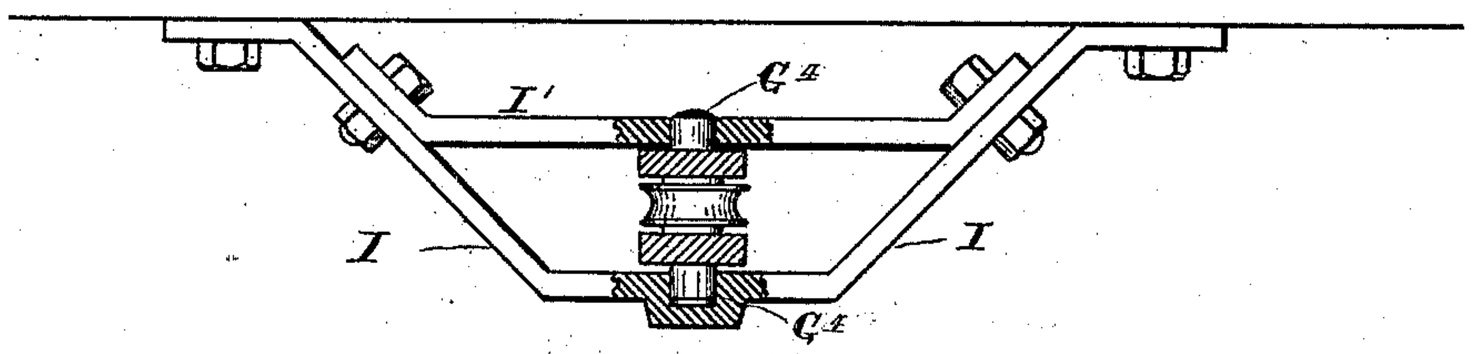


Fig. 10

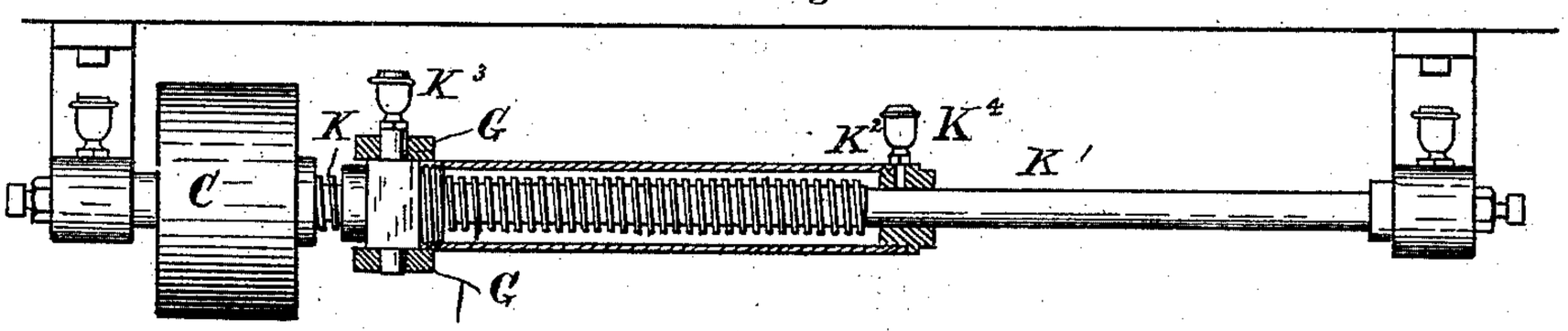
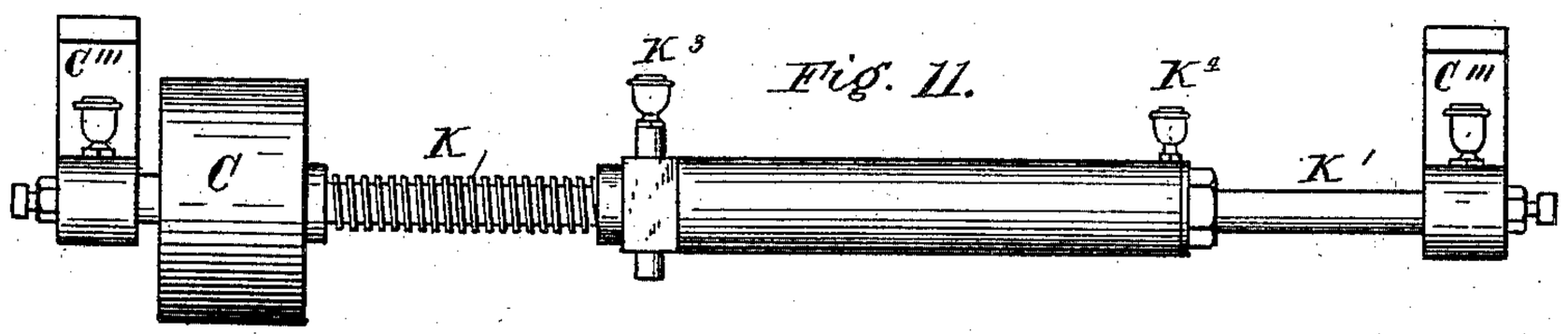


Fig. 11.



Witnesses:
S. B. Dover.
C. W. Davenport

Inventor:
Augustin Isel Ambler
E. F. Clark atty.

UNITED STATES PATENT OFFICE.

AUGUSTIN IREL AMBLER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO ROSELINE N. AMBLER, OF SAME PLACE.

ELECTRIC TRAIN-BRAKE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 395,682, dated January 8, 1889.

Application filed April 18, 1888. Serial No. 271,027. (No model.)

To all whom it may concern:

Be it known that I, AUGUSTIN IREL AMBLER, of the city of Washington, District of Columbia, have invented new and useful Improvements in Electric Train-Brake Apparatus for Application and Use upon Locomotives and Railroad-Cars, of which the following is a specification.

This invention relates to a combination of electric rotary motors and mechanical construction of parts by which I am enabled to apply and release the brakes upon each car of the train to which it is applied from the locomotive and to increase and decrease the power as may be required in practical use, and by which means, also, the brakes may be operated and set at each end in case the train breaks in two or is accidentally separated, and for the purpose of putting the whole braking-power of the train in the hands of the engineer without impairing the efficiency of the hand-brake system, and so that each truck on each car may receive automatically the same amount of pressure—in other words, that the pressure upon the trucks automatically equalizes itself, and this is done to avoid or prevent sliding or skidding wheels in applying and using the brakes, which results are attained substantially as hereinafter described, and pointed out in the claims, reference being had to the accompanying drawings, forming a part of this specification.

In constructing and applying a train-brake apparatus of this character I employ a reversible electromotor, a screw or worm shaft, a traverse or lug nut moving thereon, elastic cushions on each end of the screw or worm shaft, a central lever of appropriate construction, hereinafter described, sheaves or frictional pulleys, and a wire rope or flexible connection connecting the long arms of the truck-levers, and suitable storage-batteries to energize the motor, a switch-board both on the locomotive and on each of the cars composing the train, and conducting-wires for electrical connections and circuits to operate and control the same.

I will now proceed to describe the several parts of the apparatus by the following figures and drawings, illustrated on all the sheets following, and by the letters and numerals of the several parts of the drawings, in which similar letters and numerals of reference indicate corresponding parts in all the figures.

Figure 1, Sheet 1, is a side view of storage-batteries, switch-board on locomotive and car, a reversible electromotor in elevation, conducting or transmitting wires, contact-brushes, and connections. Fig. 1^a is a sectional view of the electromotor and its immediate connections, showing the winding in series and section of the helices of the two field-magnets, showing also that there are two wires, insulated from each other, united together in the form of a cable, so that the core is wound and the cable series composing the helix in each magnet is wound the same as it would be wound if the helix or winding was only of one wire instead of two insulated wires, the purpose of which is to enable me to send at different times a current through the motor in opposite directions, as shown by the arrows on the armature (and with the lines of transmitting-wires) of the motor, to energize the same for setting and releasing the brakes by opposite movements of the sliding contact-arm on the switch-board A. Fig. 1^b is a section of a sliding contact-arm, E, on switch-board D. Fig. 1^c is a view of a form of motor, partly in elevation and partly in section, showing the circuit connected only with contact-brush C^c. Fig. 1^d is a similar view of the motor, showing the circuit connected only with contact-brush C^d. Fig. 1^e is a view of the cable enlarged, showing the connection between the two magnets.

Fig. 2, Sheet 2, is an elevation of the cab of a locomotive and a tender, showing switch-board, connecting-wires, and storage-batteries in section of tender, (cut away.) Fig. 3 is a plan view of switch-board and connecting-wires. Fig. 4 is a side elevation of switch-board A.

Fig. 5, Sheet 3, is a side elevation of the lower part of the body of a car with running-gear, including brake-shoes, hangers, springs, and truck-levers, with my invention and connections attached. Fig. 6 shows a plan view of the operating parts of my invention, including a mere external form of motor, worm-shaft, central lever, wire rope to connect at each end with the long arms of the truck-le-

vers at each end of the car to operate the brakes. The dotted lines of the central lever illustrate the movement of the same from the minimum to the maximum of pressure.

Fig. 7, Sheet 4, shows a side view of the lever, the sheaves, wire rope partly around the sheaves, end of screw, traverse or lug nut, slots, loops, and pintles for the fulcrum of the lever, and plan of construction. Fig. 8 is a top or plan view of the lever, showing slot for the traverse of the nut on the worm-shaft. Fig. 9 is a hanger in which the lever is located and operated by movement upon its fulcrum. Fig. 10 is a shaft of double the length of the worm or threaded part, and provided with a sleeve connected to and moving with the traverse or lug nut, so that when not in use it covers and protects from dust the screw part of the shaft, which runs in oil supplied by the oil-cups to the sleeve. Fig. 11 shows the shaft of Fig. 10 with the traversing or lug nut and sleeve about half-way between the minimum and maximum of traverse.

A, Figs. 1, 3, and 4, Sheets 1 and 2, is the switch-board, located on the locomotive at the hand of the engineer. This switch-board has divisions, called "fixed contact-pieces," *a*, *b*, *c*, *d*, and *e*. It also has a sliding contact-arm, *f*, and follower *g*.

h indicates the insulated part of the switch-board A, on which the sliding contact-arm *f* and follower *g* rest when not in use in setting or releasing the brakes.

B is a series of independent batteries so connected as to use one or more of the series, as may be desired, in setting the brakes. These batteries are located on the locomotive or tender. B′ is also an independent battery, but to be used only in releasing the brakes. Battery B is connected by wires P P, 1, 2, 3, and 4 with fixed contact-pieces *a*, *b*, *c*, and *d* on switch-board A, and said battery is also connected with battery B^2 by connecting-wires 1, 2, 3, and 4, and by main-line wire P^a and by a continuation of wire P^a with the motor. B′ is connected by wire P^c with fixed contact-piece *e* and by line-wire P^d with the electromotor, and both these wires P^a and P^d are insulated and united in one cable in passing through and connecting the magnets of the motor, and both have a common or main return-current wire, R C, to the center post of the switch-board A. By means of the opposite motions of the armature C^b, commutator C^f, and exit contact-brush C^e, as noted by the arrows at the right and left of the commutator, the brakes are set and released. (See also reference-letters P^a and P^d, referring to the helices at the right and left of Fig. 1^a.)

B^2 is a combined series of batteries connected together and located on each car and brought into circuit in setting, but not in releasing, the brakes, as will be hereinafter described.

C is the reversible electromotor.

C^a C^a are the field-magnets of the motor.

C^b is the armature of the motor.

C^e is the contact-brush of conducting-wire P^a.

C^d is the contact-brush for reversing-wire P^d, and C^e is the contact-brush for the exit of the current.

C^f is the commutator.

R^c is the wire for the return-current to the center post on the switch-board A, and N^p is a branch of wire R^c from R^c to center post of switch-board D on each car. The ends of the contact-brushes should be made rounded, so as not to obstruct the commutator in passing its divisions in opposite directions. Such brushes are called "finger-end brushes."

C′ is the worm-shaft; C″, traverse-nut on worm-shaft. C‴ are the hangers to support the same, and C^4 are rubber or elastic cushions, (shown in cross-lines at each end of the worm-shaft;) D, switch-board on each car to operate the brakes therefrom by closing the circuit of the electric current, either by hand or automatically, should the train break apart.

D′ is the fixed contact-piece.

E is the sliding contact-arm on switch-board D.

E′ is a knob on arm E to move the arm by hand into contact with D′.

E^2 is a passage through arm E for the line-wire P^d; E^3, a passage through the arm E for the spring F.

E^4 is a bearing or fixed lug on line-wire P^d to press the arm E upon the fixed contact-piece D′ to connect the circuit when the train breaks apart.

E^5 is a coil on the line-wire P^d to yield or stretch apart, so that the arm E can traverse to and connect itself with fixed contact-piece D′.

F is a spring passing through arm E, and F′ is a catch on spring F to hold the sliding contact-arm E in contact with fixed contact-piece D′ and retain the circuit till released by hand.

P^b is a branch wire connecting fixed contact-piece D′ with main line, Fig. 1, P^a, and battery B^2, and by a continuation of the line-wire P^a with the motor.

C, Figs. 6, 7, 8, 9, and 10, is the central lever, the construction, application, and operation of which are distinguishing features of the invention. The top or plan view of this lever and its position and location are shown in Fig. 6, Sheet 3, while the train is running and the brakes are free. The different positions of this lever are also shown in dotted lines in the same figure when the power is in operation to set the brakes. The central position shows when the slack is taken up, the springs overcome, and the brake-shoes are brought in contact with the tread of the wheels, and at the extreme right it is shown, also in dotted lines, at the maximum of pressure, having traversed a quarter of a circle. Figs. 7 and 8 of this lever show the mode of construction; Fig. 9, the manner of locating it in the hanger or chair and the frame-work in which it is

hung; and in Fig. 10 is shown a sectional view by which it is connected with the traverse nut and sleeve. The exact construction of this lever will be described hereinafter.

G′ are the slots or channels in the long arm of the lever, located above and below the traverse-nut and worm-shaft, and through which pass the lugs or projections on the traverse-nut, and by means of which the lever is moved upon the segment of a circle to set and release the brakes, and so that the extreme end of the lever may move in the segment of a circle, while the nut moves in a straight line upon the worm-shaft, and, further, so that the leverage may decrease and increase from the minimum to the maximum of movement, as shown in Fig. 6 by the dotted lines of its traverse.

G″ are sheaves or frictional pulleys, partly around which passes the wire rope H.

G‴ is the loop or opening in the long arm of the lever, in which is located the traverse-nut, the long arm of the lever moving back and forth, as hereinbefore shown.

G^4 are the lugs or projections forming the fulcrum of the lever. These lugs or pintles are located above and below the central part of the loop and central between the two sheaves and equidistant therefrom; H H, the wire rope connecting the long arms of the truck-levers on each car, and which in its central part passes through the loop of the short arm of the lever and partly around the sheaves, as clearly shown in the drawings.

I is the hanger or chair in which lever G is located and has its fulcrum, and which is bolted up to the bottom of the body of the car in a central position.

I′ is the cap-piece bolted to the hanger. Both parts of the central part of the hanger have an opening or recess to receive the fulcrum pivots or pintles G^4 of the lever G, as also clearly shown in the drawings.

K is the worm part of the screw-shaft, Figs. 10 and 11. K′ is the smooth or turned-down part of this shaft.

K^2 is the sleeve or covering of the worm when not in use in braking, being connected with the traverse-nut and moving with it; K^3, an oil-cup to lubricate traverse-nut and worm-shaft; K^4, an oil-cup to lubricate the smooth part of the shaft, and also to supply oil to its end of the worm part of the shaft; P P 1 2 3 4, transmitting-wires from all the fixed contact-pieces on switch-board A to battery B, and from battery B, by line-wire P^a, to battery B^2 and to the motor C, to set the brakes up to the maximum of pressure. This combination of batteries is so connected with the switch-board and fixed contact-pieces as to enable the operator to use the batteries 1, 2, 3, and 4, according as he operates the sliding contact-arm upon the switch-board A.

Lever G is constructed, preferably, in two parts, Fig. 7, Sheet 4, and firmly bolted together. This is to enable me to place between them at the long arm of the lever the traverse-nut C″, so that the lugs will enter the slots G′ above and below, (see Figs. 7 and 8,) each part being so formed as when bolted together to form a loop at each end of the lever—at the long-arm loop G‴, Fig. 7, Sheet 4, for the movement of the lever backward and forward above and below and embracing the traverse-nut C″, and at the other end for the admission of the sheaves and the passage of the wire rope H to equalize the pressure.

In the long arm of the lever and in each part, above and below, I plane out slots or channels G′ nearly the full length of the loop G‴. In these slots or channels the lever moves above and below the lugs or pintles of the nut backward and forward in setting and releasing the brakes. For the purpose of a fulcrum to the lever G above and below and outside of the center of the loop at the short arm of the lever, I "jump on" or forge on lugs G^4 pivotal or pintle pieces, which are turned round to a bearing to fit the recesses in the plates I and I′ of the chair or hanger for the fulcrum and support of the lever, and the lugs or pivotal projections on the traverse-nut C″ in the slots G′ are made and finished in the same way, so that the lever may move smoothly in the slots in which they (the pintles) are fitted to work. This arrangement of parts at the long arm of the lever is so constructed that while the traverse-nut is moving in a straight line upon the worm-shaft from the minimum to the maximum of traverse and return the extreme end of the lever is moving in the form of a segment of a circle without binding laterally the traverse-nut in its direct movement upon the worm-shaft, which would destroy its action, and by these means I am enabled to obtain the greatest leverage at the minimum and maximum of movement, which is very important in the use of the electric current in its application to a train-brake, while the combination of the loop, the sheaves, and fulcrum at the other end of the lever enables me to equalize and utilize the power employed to the best advantage upon the brakes.

It will also be seen by the dotted lines, Fig. 6, Sheet 3, that the lever G at the zenith or center of its movement is at right angles to the traverse-nut C″ and worm-shaft C′, and at the minimum and maximum of its movement it is, as shown, at angles of forty-five degrees, and that it has its greatest leverage at the starting and stopping points of its motion and its least leverage at the exact center, where it is least required, the movement of the lever from the starting-point to the center being for the purpose of taking up the slack, overcoming the springs, (used to keep the brake-shoes off the tread of the wheels on all cars,) and bringing the brake-shoes in contact with the tread of the wheels, the real labor and braking being done after the lever passes the center—that is to say, all the stopping being done in the movement of the lever from the center of motion to the max-

imum of pressure. The object of this principle and the application of this combination of parts are to enable the electric current with its wonderful rapidity of movement to "get up" speed under the least resistance, cause the lever to reach and pass the center, and then to increase the leverage up to the maximum of pressure required and retain the same until the cars are stopped, and by this combination and movement the short arm of the lever also moves in the form of a segment of a circle, but of smaller diameter, and by means of the sheaves and wire rope and its connection with the long arms of the truck-levers the force employed is equalized upon the wheels of both the trucks of the car in braking the train. These principles of movement and the mechanical combination of parts employed enable me to set the brakes in the least possible time, and almost instantaneously to release the same, and in case the train breaks apart to set the brakes by means of the switch-board device and connections on each car automatically, and thus in certain cases prevent or modify disaster, and by the same means, in certain other cases, to enable the conductor to operate the brakes on any car throughout the train.

It will also be observed that an essential element or pinciple of my invention is found in the fact that the long arm of the central lever, G, must be so constructed and applied to a traversing nut upon a worm-shaft as to move at its extreme end upon a segment of a circle and thereby diminish and increase its leverage in its movement from minimum to maximum of pressure, and by reversing the movement perform precisely the same function in releasing the brakes, while the traverse-nut upon the shaft C′ moves in both directions in a straight line, and at the same time the short arm of the lever must also move upon the segment of a circle, but of less diameter than and in an opposite direction from the long arm of the lever, to ultimate, equalize, and utilize upon the brakes the force employed, and for these purposes this principle of motion, this combination of parts, and this mechanical construction, application, and mode of operation are required.

The plan of construction and the immediate connection of the electromotor is illustrated by Figs. 1 and 1[a] of Sheet 1, to wit: The cores of the field-magnets are wound in series in the usual way, starting in and fully winding the helix at the left-hand magnet, Fig. 1[a], then out to and through the right-hand magnet, uniting the two magnets in one circuit, in each case beginning at the core and terminating at the outer winding, and also in each case at the end of the magnet nearest to the armature. The helices and connecting-wires of these magnets are formed of two or more wires made in the form of a cable and perfectly insulated from each other, but wound in forming the helix of each magnet and in connecting them in circuit as one wire; and for the purpose of applying the force to brake the train and release the brakes six or seven wires may be insulated and made up in one cable where it passes through and connects the magnets, only one of which wires would be required in reversing the motor and in releasing the brakes. I also use three contact-brushes—one, C[e], for setting the brakes, one, C[d], for reversing the armature and releasing the brakes, and one, C[e], for the return-current in both cases by a main return-current wire to complete the circuit.

It will be observed that two wires (or, if desired, a series of wires) form the part of the cable commencing at the left-hand magnet, and these wires are united only in one cable where they pass through and connect the magnets, as shown by the arrows, which clearly illustrate the direction of the two currents in opposite directions, but which has nothing to do with the construction and connection of the two magnets, the cable being made and connected as shown in the drawings.

By reference to Fig. 1[c], it will be seen that the winding of the wire commences on the left-hand magnet at the right-hand side of the core, and thence continues in series out to the circumference of the magnet in one wire, as shown, thence passes to the other magnet, thence to and around the core of that magnet nearest to the armature, and in series to the outer periphery of the magnet, thence to the contact-brush C[e], through commutator C[f] and armature C[b] to contact-brush C[e], thence through return-current wire R[c] to center post of switch-board A, thereby making the circuit complete from contact-pieces *a b c d*, or either of them, to set the brakes. It will be here observed that there is no connection with contact-brush C[d], and therefore no circuit. By reference to Fig. 1[d] it will be seen that the windings of the wire are the same as in Fig. 1[c], but that the connection is made only to contact-brush C[d].

The batteries being charged and placed in position, the mode of operation is as follows: The engineer, when he desires to slow down-grade or brake his train lightly, moves his sliding contact-arm *f* on the switch-board A to fixed contact-piece *a*, which brings No. 1 of battery B into circuit, from which conducting-wire 1 transmits the current to conducting-wire P[a], thence to battery B[2], and from battery B[2] by a continuation of line-wire P[a] to and through the left-hand magnet of the motor, (see Fig. 1[a],) thence to and through the right-hand magnet, thence to contact-brush C[e], thence by commutator C[f] to and through the armature C[b], thence, as illustrated by the arrow to the right, to contact-brush C[e], thence by return-current R[c] to center post of switch-board A, and the circuit is complete. To increase the force and make a quicker stop the sliding contact-arm *f* is moved on to fixed contact-piece *b*, which brings into electric circuit No. 2 of battery B, the circuit being closed

and the current passing precisely as in the former case, with the addition of the force of No. 2 to No. 1 of battery B, which has been connected by means of follower *g*, and this force can be increased to any desirable extent by means of additional fixed contact-pieces on the switch-board A and by additional batteries to correspond therewith. I have shown in this connection four fixed contact-pieces, *a*, *b*, *c*, and *d*, and four batteries to correspond therewith, P P, 1, 2, 3, and 4. Thus it will be seen that by closing the circuit the electromotor, by means of the batteries in circuit, will rotate the worm-shaft, the traverse or lug nut will move up upon the shaft, carrying with it the long arm of the lever G, to the extent of the force employed to the maximum of pressure, while by the movement of the short arm of the lever, and by means of the sheaves and wire-rope connections with and between the long arms of the truck-levers and the brake-shoes, the brakes will be set to the extent of the force employed. To reverse the motor and release the brakes, the sliding contact-arm *f* and follower *g* are moved backward from the insulated part *h* of the switch-board A until the follower is connected with the fixed contact-piece *e*, when the circuit for reversing the motor will be closed. The current will then run on the transmitting-wire P^c to and through battery B′, thence direct by wire P^d to its connection with wire P^a, when the two wires, being completely insulated from each other, form a cable and are wound in series, in the form of a cable, as one wire through and connecting both magnets, as aforesaid, the current now passing first through the right-hand magnet, then to and through the left-hand magnet, and out of the cable to the contact-brush C^d, thence by the commutator to and through the amature, as indicated by the arrow to the left of the armature, to the contact-brush C^e, thence by return-current wire R^c to the center post of switch-board A, as in the former case. By this means the worm-shaft is reversed and the lug-nut and central lever return back to the starting-place, when the circuit is again opened by returning the sliding contact-arm and follower to the insulated part of the switch-board.

Should the train break apart, the sliding contact-arm E on the switch-board D will be drawn by stretching the coil E^5 upon and connected with the fixed contact-piece D′, and be caught by the dog or catch F′ on the spring F, (clearly shown in the drawings by reference to the dotted lines of the arm E,) and it will there be held till released by hand. This contact will close the circuit, and by means of the branch wire P^b battery B^2 will be brought into circuit, the current will run upon the main-line wire P^a, and be carried through all parts of the electromotor, as before described, and pass out of the motor by contact-brush C^e to main return-current wire R C, to branch wire N^p, thence to center post of switch-board D, and the brakes will be set. When this circuit is closed by hand, the same results will follow—that is, the brakes will be set. To release the brakes on the car, bear down on the spring F, so that the catch will pass through the passage E^3, and move the arm back to the insulated part of the switch-board. In setting and releasing the brakes, the current will run in the line of the arrows, passing through the batteries employed, the field-magnets, the armature of the motor, and return by the main return-current wire R C to the center post of switch-board A, or by wire R C and branch wire N^p to the center post on switch-board D on each car. I am enabled to obtain these results by means of an electromotor, which may be reversed by the movement in opposite directions of a sliding contact-arm, with follower, fixed contact-pieces, independent batteries and circuits for transmitting two separate electric currents (by one main return-current wire) at different times and in opposite directions through the magnets of the motor, and by suitably connected wires, substantially as described, and shown in the drawings.

It will also be seen that when one circuit is open the other is necessarily closed, so that the current must take the closed circuit. The circuits cannot be both closed at the same time; but all the circuits are open when not in use, and hence the energy of the batteries is only employed or exhausted when in actual use in braking or releasing the brakes, and as so short a time is required to brake and stop the train and release the brakes, the storage-batteries charged to ten hours would do the braking of the train from the Atlantic to the Pacific Oceans and return several times without recharging the batteries, one hour giving one hundred and eighty and ten hours eighteen hundred stops.

Of course it will be understood that a very small current of electrical energy is required to reverse the motor and release the brakes, as there is on each car a powerful tendency of resistance to enforce the back action, so that only a very light current is required to energize the motor for that purpose, and which the introduction of a small and single insulated wire and a single battery on the locomotive or tender will amply supply for the entire train, while the cable for the transmitting-current to set the brakes may be made of as many wires as desired to afford ample force to brake the largest trains.

The number of storage-batteries required depends upon the capacity of the motor to utilize them to advantage, which application and trial will readily determine. The use of the batteries is only required during the time employed in setting the brakes and stopping the train—viz., from fifteen to twenty seconds in time and from four hundred to six hundred feet in distance. By the application of this

brake all disasters resulting from defective or inefficient braking would be practically avoided.

From the very full description and mode of operation I have given of my invention it will be clear that I do not broadly claim a worm-shaft and traversing nut actuated by an electromotor to move a lever in a direct line with said shaft or diagonally or at right angles thereto.

Having thus described my invention and its mode of operation, so that persons skilled in the art to which it belongs can apply and operate the same, what I claim as new, and desire to secure by Letters Patent, is—

1. In a brake for railroad-trains, an electromotor, a series of independent batteries to energize said motor, a sliding contact-arm, fixed contact-pieces, and switch-board, substantially as described, to close and open the circuit between the motor and one or more of said independent batteries, the screw-shaft, the traverse-nut having lugs or projections thereon, a central lever, and connections between said lever and the truck-levers and brake-shoes of each car in the train, substantially as shown, as and for the purpose specified.

2. In a brake for railroad-trains, a worm-shaft, a lug-nut to traverse thereon, an electromotor to actuate said shaft, a series of independent batteries to energize said motor, a sliding contact arm or switch, with follower to close and open the circuit between said motor and one or more of said independent batteries, independent fixed contact-pieces, truck-levers, brake-shoes, and the connections between said worm-shaft and said truck-levers and said brake-shoes, substantially as described.

3. A brake for railroad-trains, comprising a screw or worm shaft, an electromotor to actuate said shaft, a series of independent batteries which may be brought into electrical connection with said motor, a switch-board having independent fixed contact-pieces, a sliding contact arm or switch, with a follower to close and open the circuit between said motor and one or more of said batteries, a lug-nut to move on said screw-shaft, a central lever, and flexible connection with the truck-levers to set and release the brakes, substantially as shown and described.

4. In a train-brake for railroad-cars, a screw or worm shaft, a movable lug-nut thereon, and a lever connected at one end with said nut above and below and embracing the same to prevent lateral binding in its movement on the worm-shaft, and at the other end connected by means of a flexible connection passing partly around sheaves or frictional pulleys with the truck-levers, and by their connections with the brake-shoes of each car in the train, substantially as described.

5. In a brake for railroad-trains, the combination of a worm-shaft, a movable nut thereon having a lug above and below, a central lever connected at one end with said nut and embracing the same and moved thereby and at the other end by means of sheaves or pulleys, and a wire rope or flexible connection connected with the truck-levers and their connections by the brake-shoes of each car to operate the same and equalize the pressure thereon, in combination with an electromotor and independent batteries to energize said motor, substantially as described, and for the purpose set forth.

6. The combination, with the brake-shoes, truck-levers, and wire rope or flexible connection therewith, of a swinging central lever, through the short arm of which passes said flexible connection from the long arm of one truck-lever to the other and partly round the sheaves or pulleys to operate the brake-shoes and equalize the pressure thereon on each car, substantially as described.

7. The combination of a screw-shaft, a movable nut having lugs, a lever connected therewith and embracing the same and to be moved thereby, and the truck-levers and brake-shoes of a railroad-car, an electromotor, a series of independent batteries to energize the motor, and the switch-board having fixed contact-pieces and a sliding contact arm or switch to throw either one or all of said batteries into circuit to set the brakes upon each car throughout the train, substantially as described.

8. The combination of a screw-shaft, an electromotor to actuate said shaft, a traversing lug-nut and the connections between said nut and the truck-levers and brake-shoes of each car, and a series of independent electric batteries, a switch-board having independent fixed contact-pieces, separate electrical connections between each of said fixed contact-pieces and one of said batteries, and a switch or sliding contact-arm and follower connected therewith to throw one or more of said batteries into and out of circuit with the motor, substantially as described.

9. The combination, with a worm-shaft, an electromotor to actuate the same, and connections between said shaft and the brake-shoes of a railroad-car, of a series of independent batteries, a switch-board having independent fixed contact-pieces, separate electric connections between each of said fixed contact-pieces and each of said batteries, and a switch with a follower to throw one or more of said fixed contact-pieces and their connecting-batteries into and out of circuit with the motor, and transmitting-wires for return-circuit, substantially as described.

10. In a train-brake for releasing the brakes, the combination of an independent battery, transmitting and return current wires and connections to complete the circuit, a reversible electromotor, a fixed contact-piece upon the switch-board, and a sliding contact-arm, with a follower, by means of which upon a backward movement the follower may be connected with the fixed contact-piece, and the

circuit closed for releasing the brakes, the magnets energized, the motor reversed, and the brakes released, substantially as shown and described.

11. In a train-brake, the combination of a worm-shaft, an electromotor to actuate the same, a sleeved nut having lugs moving upon said screw or worm shaft, with a lever having a looped end to embrace the opposite sides of said nuts to prevent undue lateral pressure or binding on said screw, and slots above and below to receive the lugs or projections upon said nut, and sheaves or pulleys carried at the opposite end of said lever, and a flexible or movable connection between the long arms of the truck-levers to actuate the brake-shoes and equalize the pressure, substantially as described.

12. The combination of a worm-shaft, a lug-nut moving thereon, a central lever pivoted to swing upon a fulcrum in the hanger or chair bolted to the central and under part of the body of each car, sheaves or pulleys pivoted in the loop of the short arm of said lever, the fulcrum of said lever being located between said sheaves and equidistant therefrom, and the flexible connection between the truck-levers and the brake-shoes of each car, substantially as described.

13. The central lever having the following combination and elements of construction, viz: a fulcrum pivoted to swing in the hanger, sheaves or pulleys to equalize the pressure, a loop for the sheaves and the passage of the rope at one end, and a loop and slots at the other end for the traverse of the lug-nut to actuate the lever, substantially as described.

14. In a railroad-train brake, a series of independent batteries, an electromotor and transmitting electric-current and return wires, an independent switch-board having a sliding contact-arm, a single fixed contact-piece, and a spring having a dog or catch by means of which the current in circuit may be thrown upon the magnet of the motor and there retained for the purpose of setting the brakes either automatically or by hand on each car in case of accident or disaster, substantially as described, and for the purpose set forth.

AUGUSTIN IREL AMBLER.

Witnesses:
J. N. FANT,
JNO. T. ARMS.