No. 824,314. PATENTED JUNE 26, 1906.

F. L. SESSIONS.

ELECTRIC LOCOMOTIVE AND MEANS FOR CONTROLLING THE SAME.

APPLICATION FILED AUG. 6, 1903.

3 SHEETS—SHEET 1.

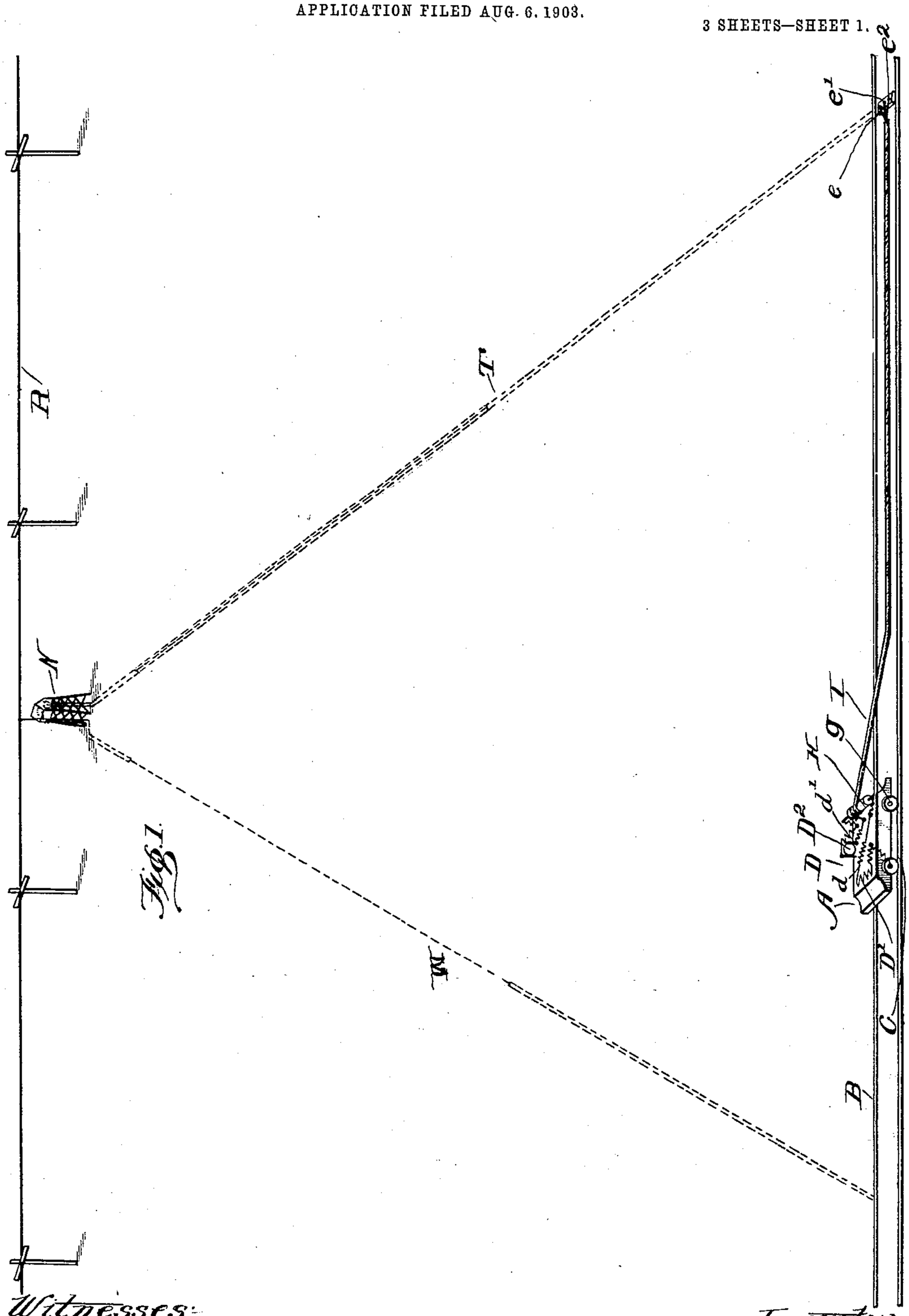

Fig. 1.

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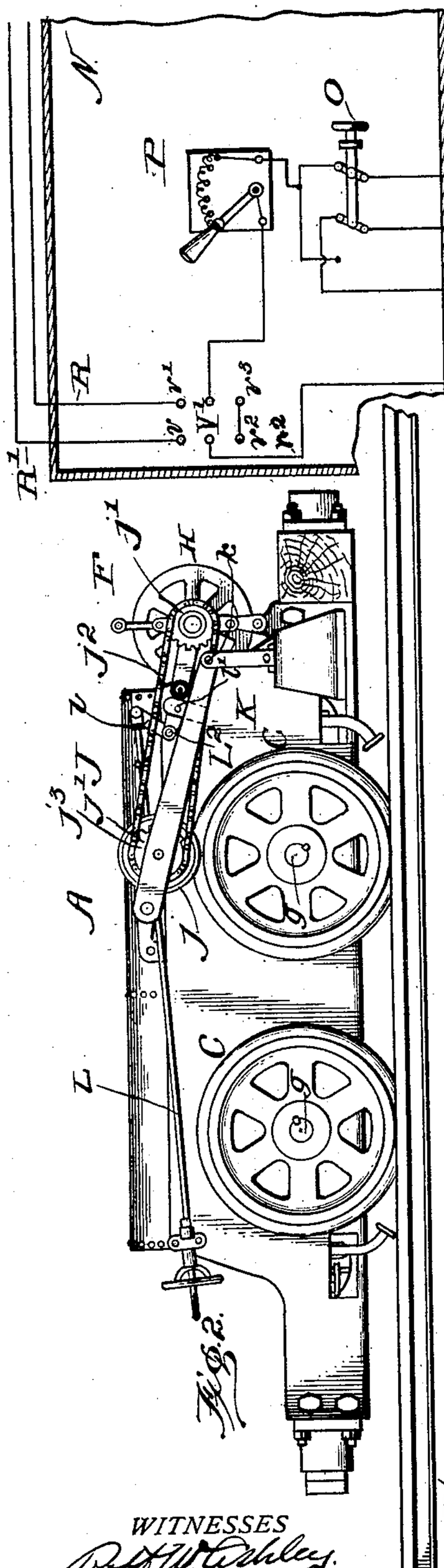

Fig. 2.

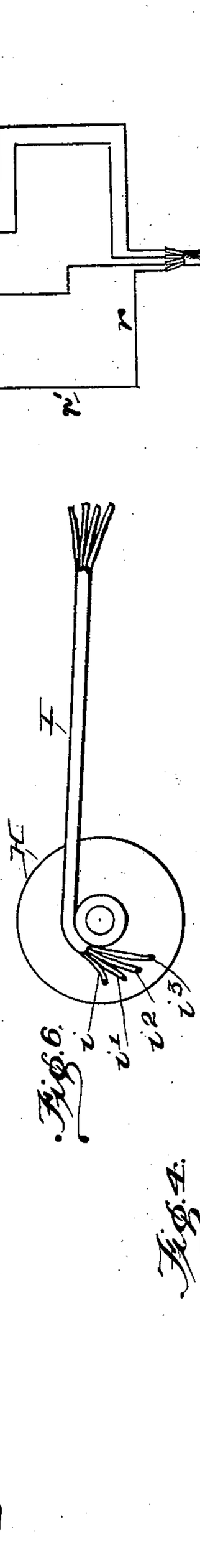

Fig. 6.

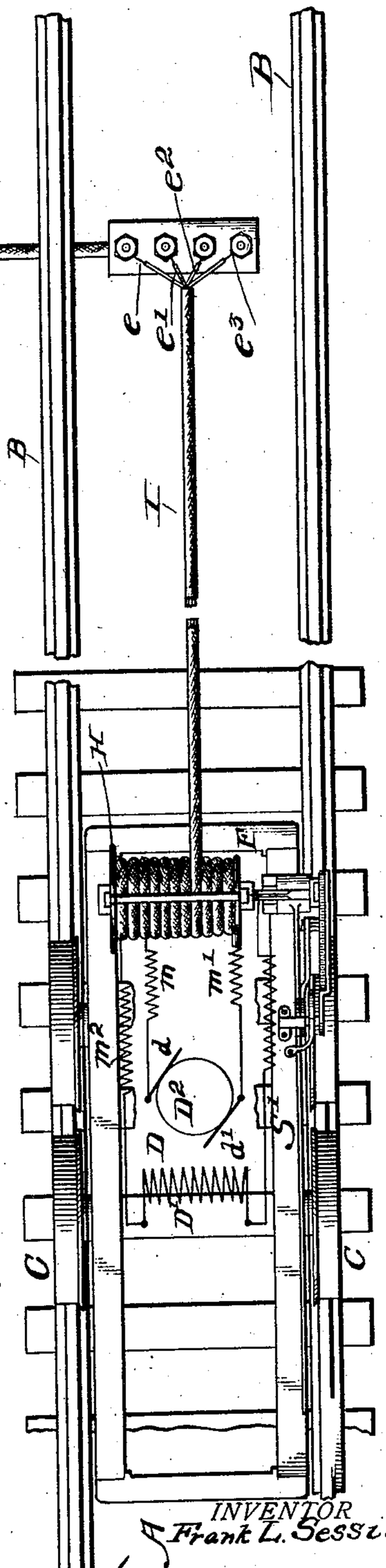

Fig. 4.

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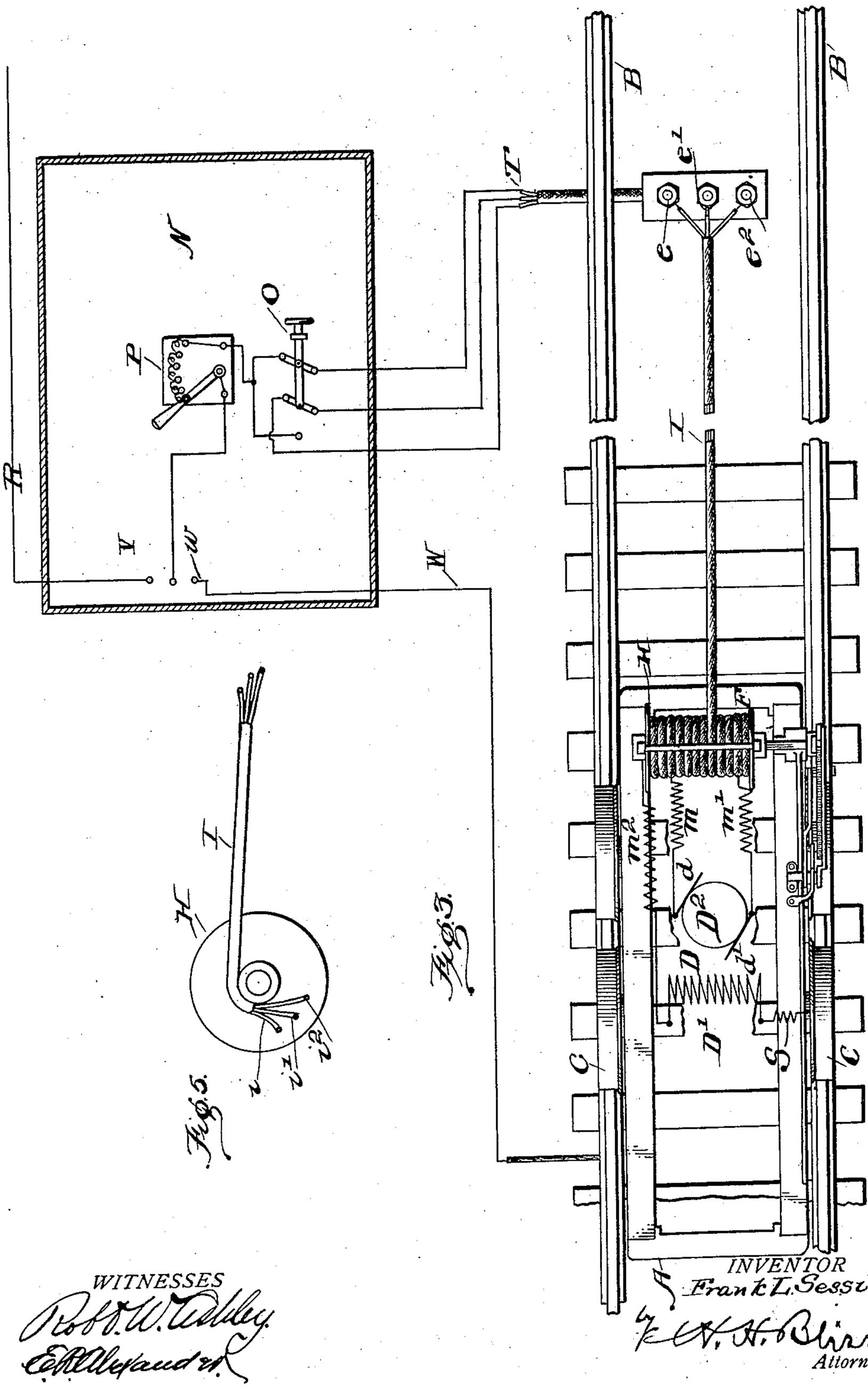

Fig. 3.

Fig. 5.

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ELECTRIC LOCOMOTIVE AND MEANS FOR CONTROLLING THE SAME.

No. 824,314. Specification of Letters Patent. Patented June 26, 1906.

Application filed August 6, 1903. Serial No. 168,530.

To all whom it may concern:

Be it known that I, FRANK L. SESSIONS, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Electric Locomotives and Means for Controlling the Same, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to improvements in the means for controlling the movements of electrically-propelled cars or locomotives of the class in which use is made of a flexible conductor, generally of the form of a cable, which is paid out from and wound up by an automatically-actuated reeling mechanism mounted on the car or locomotive. In earlier applications, Serial No. 119,667, filed August 14, 1902, and Serial No. 149,377, filed March 24, 1903, I have illustrated electric cars or locomotives of this general class, those in the said applications being more particularly for use as "car gathering" devices for coal-mines.

In the present case I have designed means whereby electric cars with flexible conductors and reeling mechanism can be operated by an operator at a point distant from the car itself, such locomotives and operating devices being useful, for instance, in mills where hot metal is handled and transported, such as billets, slag, &c.

Figure 1 is a view of a conventional and diagrammatic character illustrating a system of electric control embodying my improvements. Fig. 2 is a side view of an electric car or locomotive, such as can be used in a system embodying my improvements. Fig. 3 is a plan view showing the same and also illustrating diagrammatically the means for controlling it. Fig. 4 shows a modification in which there is a fourth wire or flexible conductor-section for current return introduced into the cable. Fig. 5 illustrates the separation of the conductors within the cable in Figs. 1 and 3 at the ends adjacent to the winding mechanism. Fig. 6 is a similar view showing the separation of the conductor ends of the cable in Fig. 4.

In the drawings, A indicates the car or vehicle as a whole, it being mounted upon the track-rails B by means of the track-wheels C, fitted thereto. This car is propelled by means of the electric motor D, which is mounted upon it and connected by gearing to the axles *g g* of the car. The motor has a field element including one or more coils (indicated conventionally at D′) and an armature with brushes, (conventionally illustrated at D^2 *d d′*.)

F indicates as an entirety the winding mechanism by which flexible conductors or conductor-sections can be wound up or paid out, as desired. This winding mechanism includes with other parts a reel or drum H, mounted in suitable supports on the car A. To this reel are connected the ends of three conductor-sections, of wire, respectively insulated, but bound together (except at their terminal parts) to form a cable I, the end of one conductor being shown at *i*, that of the second at *i′*, and that of the third at i^2. The other ends of these cable conductor-sections are respectively connected to fixed connectors at *e e′* e^2. As the car A moves away from the fixed terminal devices at *e e′* e^2 it pays out the cable I. As it returns toward them it automatically takes it up and winds it again. The winding mechanism is indicated by J as an entirety. It consists of a wheel *j*, actuated by the car-wheel C, preferably by frictional contact of the periphery of the latter with the periphery of the former. Power for rotating the reel is transmitted from the wheel *j* to the wheel *j′* on the axis of the drum. Sprocket-gearing is used, having the chain j^2, the sprocket-wheel j^3 on the same shaft with the friction-wheel *j*, and the aforesaid sprocket-wheel *j′* on the reel-shaft.

The circumstances and conditions experienced by a locomotive intended for the work here contemplated are such that there will ordinarily be a permanently-maintained connection between the track-wheel *g* and the drum-wheel *j′*. The car may be regarded as continually moving forward and back over the same fixed path. Hence there will not under ordinary working conditions be any necessity for disengaging the reel from the driving parts; but at times it is desirable to effect such disengagement in order to relieve the track-wheels from the work of turning the reel and its driving parts—as, for exam

ple, when the locomotive is to be taken from one place of working to another at a considerable distance. To permit such disengagement, the wheel *j* is mounted on an arm or in a frame K, pivoted at *k*. The arm or frame is moved up and down by means of a rod L, pivoted to a bell-lever *l*, which is flexibly connected by a link *l'* to a bar or frame K. The bell-lever is pivoted at L^2 to the vehicle.

With the movable frame may be combined a lock to hold it in either of its positions. The reel-terminals of the cable-reel conductors, respectively, have contact with the terminals of the conductor-sections *m m' m²*, respectively, connected with the brushes *d* and *d'* of the motor and with the field-coil D'.

The operator's station is indicated as a whole by N. The apparatus there comprises a reversing-switch O, a controller P, and a main-line switch V. R indicates the main line, which supplies current, and S indicates the conductor-section, which connects the field-coils of the motor with the return side of the circuit, here the rails B, on which the locomotive moves. At T there are three conductor-sections extending, respectively, from the fixed connectors *e e' e²* to the proper terminals or contact-points of the switch at O. The several parts of the circuit are connected up in such way that the operator can reverse the current through two of the wires of the cable-reel sections, permitting it to flow continuously in one direction through the third section. This third section is the one connected to the field-coil. The other two sections are those which are connected through the reel-terminals to the armature-terminals. By means of these devices the operator though at a distance is able to readily control the locomotive and the cars which it is propelling and can regulate their movements in either direction.

A haulage apparatus of this character can be used in many places where it is impracticable to employ a system depending upon a trolley—that is, a sliding or rolling contact moving along a stationary conductor. In many places small locomotives are needed capable of hauling trains of small cars and so small as not to be able to carry and accommodate an operator, together with the means for controlling and manipulating the electrical parts. Where a powerful current is used, the controller, the switching mechanism, and other electrical parts require a relatively large amount of space, and to accommodate these and the person of the operator much more room is needed than is available. Again, cars capable of self-propulsion and of propelling other vehicles are frequently needed along elevated trackways where either from narrowness of the structure or other reasons it is not practicable to have cars large enough to accommodate an operator and the parts which he requires. In any of these cases if trolleys and trolley-poles of the ordinary character are used there is constant liability for them to become disengaged from the stationary conductor and great inconvenience and loss of time result. An apparatus such as I have devised and have herein presented meets the requirements and conditions that I have referred to. The flexible conductors are at all times positively connected mechanically and electrically with the motor and with the conductor-sections, from which they derive their current, and there is under ordinary circumstances no liability of detachment or disengagement. A small locomotive-car with a heavy motor capable of receiving a powerful current can be used either on a track system near the ground or one elevated upon a narrow framework. Again, the liability of loss from breakage from such parts as the controllers, the switching devices, the cut-outs, &c., is obviated, as these are all stationary and in safe position, so that even in case the locomotive should be derailed no loss from the destruction of such parts can happen.

Around steel and iron plants it is frequently necessary to transport loads of hot material, as molten metal or liquid slag, and bars and plates of red or white hot solid metal. The heat from such bodies makes it practically impossible for an operator to ride upon the locomotive or the train to control them; but with an apparatus of the kind I have set forth such difficulties as these are readily overcome.

At V there is a switch of such nature as either to connect the above-described apparatus with the main line R or to cut it out from that and connect it with the conductor-section W, which is shown as electrically connected to the track. The switch at V is a single-pole double-throw switch, and when it is connected with the main line the operation above described for reversing the motor can be followed. If it is desired to brake the locomotive, the motor is short-circuited through the resistance. This is accomplished by throwing the switch at V to the terminal *w* and throwing the reverse-switch so as to make the motor a self-exciting generator. The current in the motor-armature is reversed, and the motor becomes a generator and the braking of the locomotive is effected and may be graded by the controller. The car can then be moved in the opposite direction by restoring switch V to the main line.

In some cases it will be difficult, if not impossible, to use the rails B for the return side of the electric circuit. Under such circumstances I employ a modification of the above arrangement of sections of the electric circuit, such as is illustrated more or less conventionally in Fig. 4. Here there are two

overhead or insulated wires or main lines R R′. The return-line R′ is connected to the terminal S′ of the field-coil by means of a fourth conductor-section in the cable having one stationary terminal at e^3 and one at the reel indicated by i^3. r is a conductor-section extending from the terminal e^3 to the return-line of the main circuit, it being preferably formed in two parts, one at r', which extends to the operator's station, and one at r^2, which extends from the station through the switch at V′ to the main wire. The other three conductor-sections of the cable-wire are arranged to operate substantially the way as in the case above, more fully described and shown in Fig. 1 and others. In order to short circuit the motor through the resistance with this apparatus, a two-pole double-throw switch is used at V′. When connection is made with the terminals at $v\ v'$, the current travels from and to the main lines in the way above described. If the switch be thrown so as to connect with the terminals at $v^2\ v^3$, the main line is cut out, and the motor is connected up in such way as to become a generator, as above described, and the braking of the locomotive will be effected.

What I claim is—

1. In an electric haulage system, the combination of the car, the motor for propelling the car having a reversible rotary member, a set of flexible electric conductor-sections, a reel on the car for winding up and paying out the said flexible conductor-sections, a stationary device at a point remote from the car for reversing the electric current passing through more or less of the flexible conductor-sections and through one element of the motor, substantially as set forth.

2. In an electric haulage system, the combination of the car, the motor on the car having a field-magnet element and a reversible armature element geared to the car-wheels, the winding mechanism, three flexible conductor-sections adapted to be simultaneously wound up and paid out by the said winding mechanism, one of said conductors being electrically connected with the terminals of one element of the motor and the other two being respectively connected with the terminals of the other element, a stationary controller at a point distant from the said car for controlling the current through all of the said three flexible sections, and a stationary reversing mechanism at said point for reversing the terminals of the two aforesaid flexible conductor-sections on the winding mechanism connected to the terminals of one element of the motor, substantially as set forth.

3. In an electric haulage system, the combination of the car, the motor for propelling the car, having a reversible rotary member, a stationary electric conductor for supplying current, a plurality of flexible conductors adapted to conduct the current from said stationary conductor to the motor on the car, means for cutting said stationary conductor out or in, means for establishing a short circuit through the motor, and a reversing means for reversing the reversible member of the motor, all of said electric circuit-controlling means being arranged at a fixed point remote from the car, and means for paying out and winding up said flexible conductors as the car moves from and toward said fixed point respectively, substantially as set forth.

4. In an electric haulage system, the combination of the car, the motor on the car having a reversible rotary member, a stationary conductor for supplying current to the motor, a cut-out for said conductor, means for establishing a short circuit through the motor arranged at a point remote from said car and having a circuit through the rotary motor element, and a circuit through the sationary motor element, and means in the circuit through one of the elements for reversing its terminals, substantially as set forth.

5. In an electric haulage system, the combination of the car, the motor on the car, the stationary conductor, the switch remote from the car for cutting said conductor out or in, the controller remote from the car, and means remote from the car for establishing a short circuit through the controller and through the motor when the said supply-conductor is cut out, substantially as set forth.

6. In an electric haulage system, the combination of the car, the motor on the car, the branch conductor for conveying electric current from the main conductor to the motor, said branch conductor including a controller and a current-reversing mechanism, both arranged at a point remote from the car and stationary relative thereto, a current-return conductor-section on the other side of the motor, and means for connecting the conductors of the said two sections to form a short circuit through the controller and the motor, substantially as set forth.

7. In an electric haulage system, the combination of the car, the motor for propelling the car, a set of flexible electric conductor-sections, electrically connected with said motor, a reel on the car for winding up and paying out the said flexible conductor-sections, and a stationary device arranged at a point remote from said car for reversing the current passing through certain of said flexible conductor-sections to cause the reversal of direction of rotation of the motor.

8. In an electric haulage system, the combination of the car, the electric motor for propelling the car, a series of flexible electric conductor-sections electrically connected to the

said motor, a reel for winding up and paying out the said flexible conductor-sections, and a stationary device at a point remote from the car for reversing the electric current passing through certain of said conductor-sections to cause the reversal in direction of rotation of the motor.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK L. SESSIONS.

Witnesses:
C. E. WAXBOM.
W. G. NATHO.