(No Model.)

2 Sheets—Sheet 1.

E. E. RIES.

ELECTRO DYNAMIC MOTOR.

No. 390,904. Patented Oct. 9, 1888.

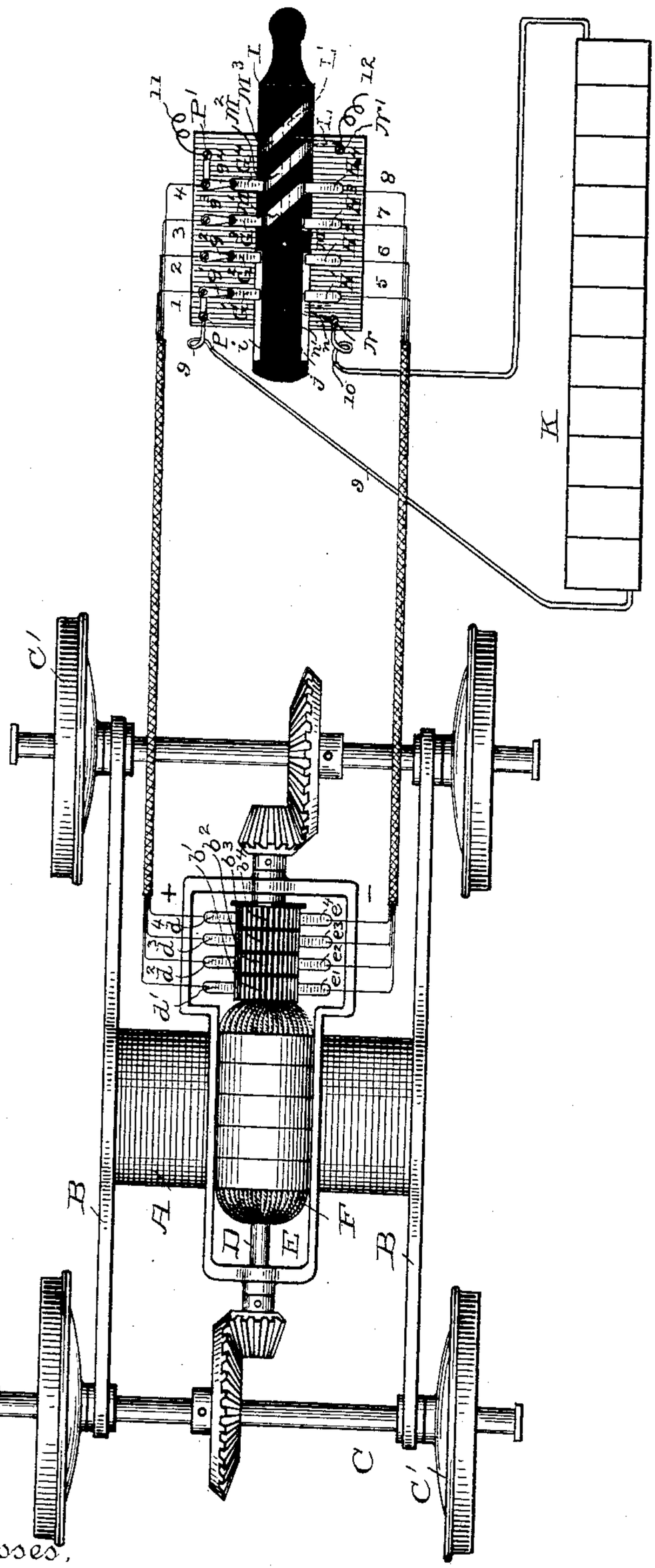


Fig. 1.

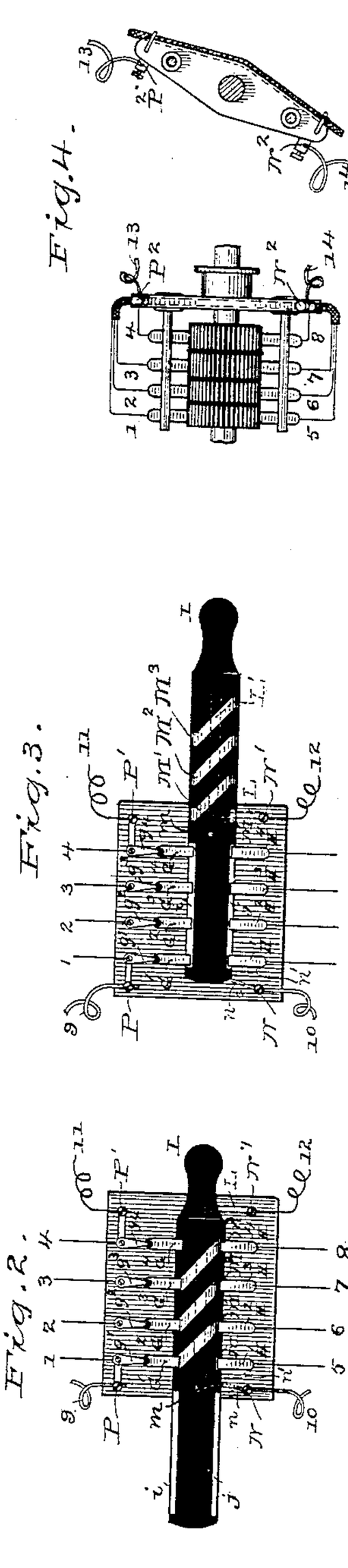


Fig. 4.

Fig. 3.

Fig. 2.

Witnesses,

H. A. Laud.

Stephen D. James.

Inventor,

Elias E. Ries,

By his Attorney

Frankland James.

(No Model.)

2 Sheets—Sheet 2.

E. E. RIES.

ELECTRO DYNAMIC MOTOR.

No. 390,904. Patented Oct. 9, 1888.

Fig. 4.

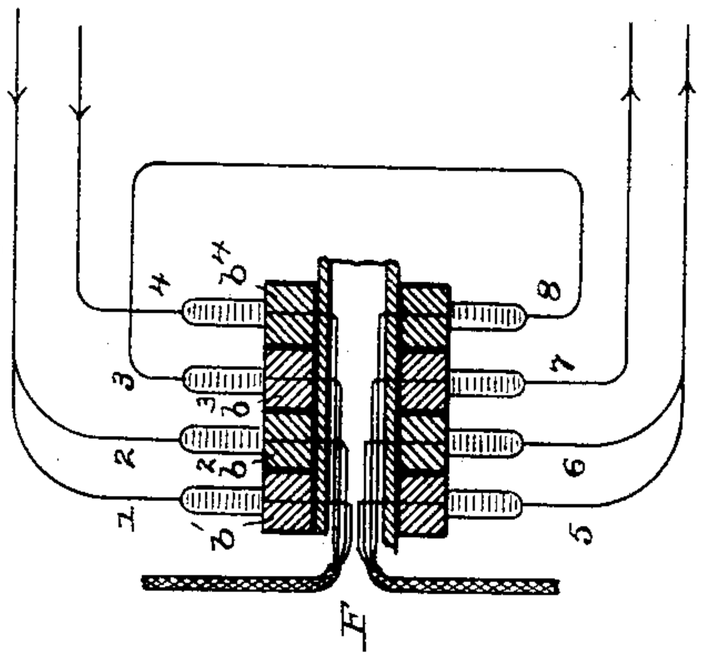


Fig. 6.

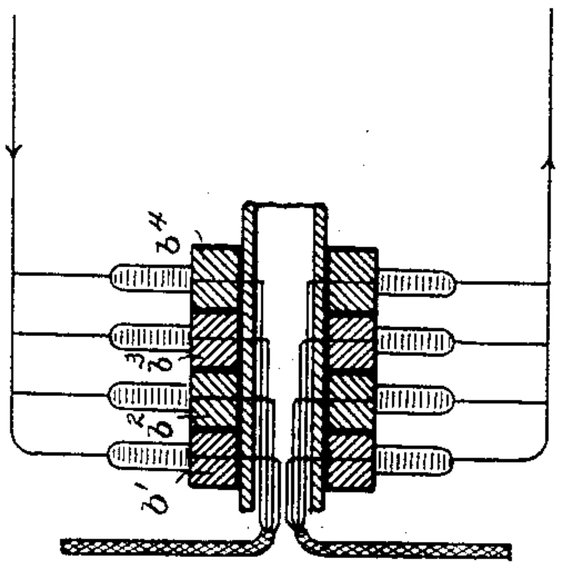


Fig. 5.

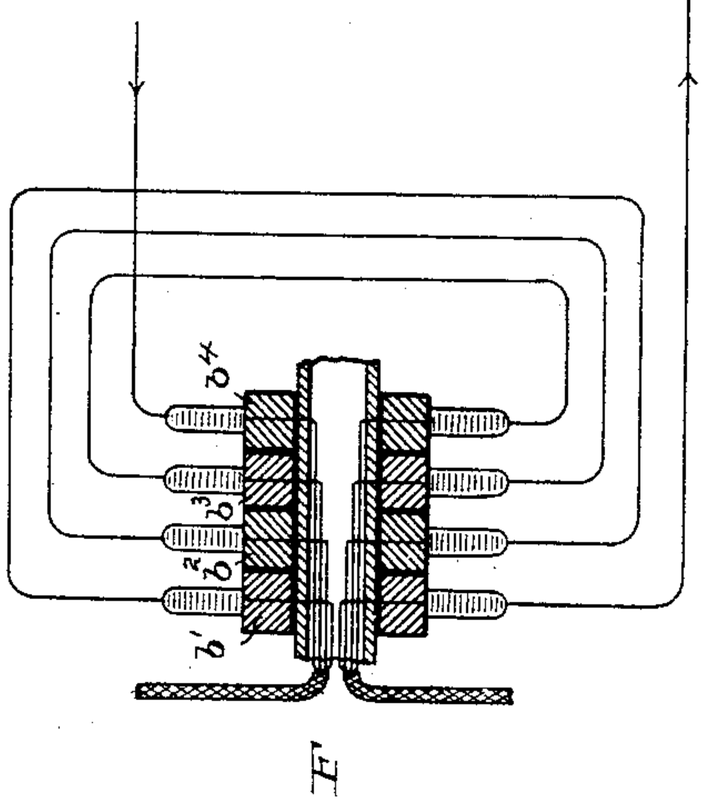


Fig. 10.

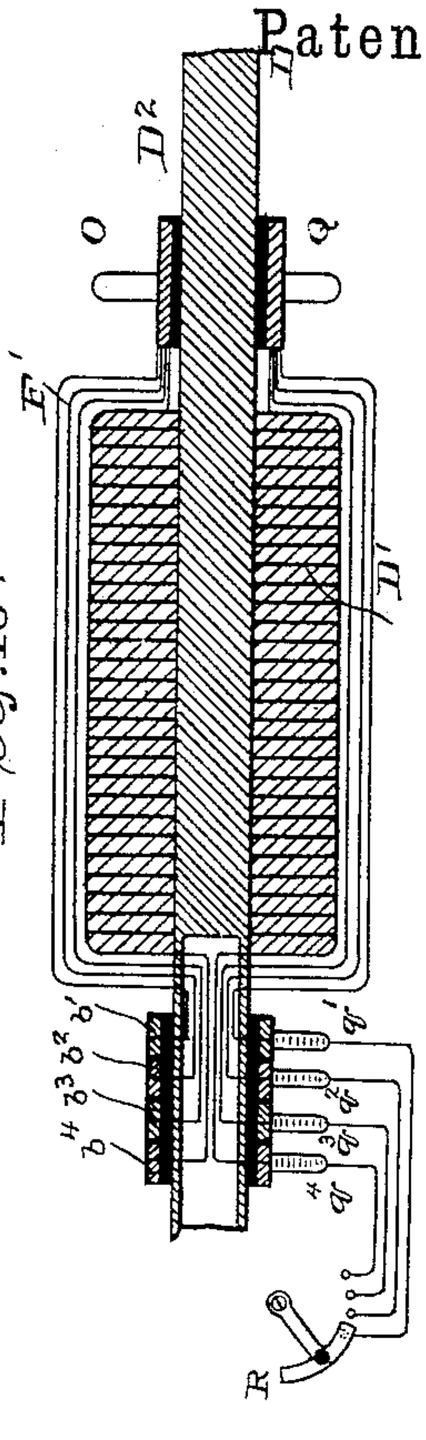


Fig. 8.

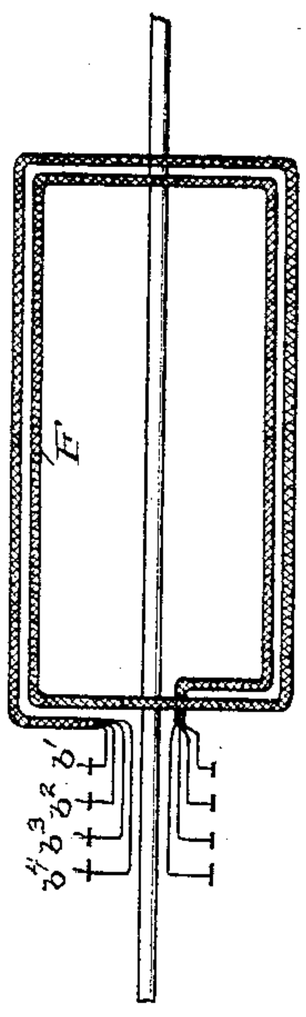


Fig. 12.

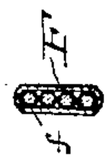


Fig. 11.

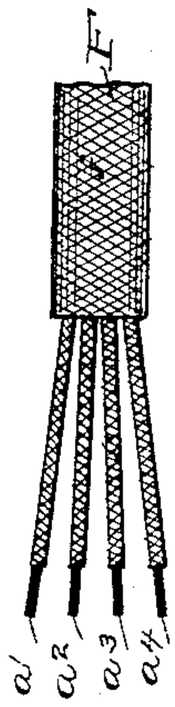
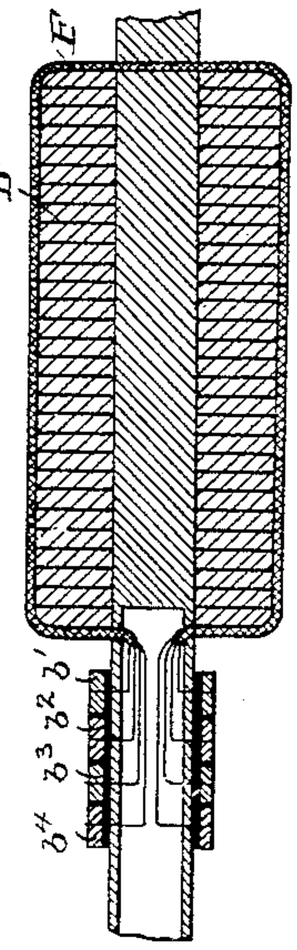


Fig. 9.



Witnesses,
H. A. Lamb.
Stephen D. Jamus.

Inventor,
Elias E Ries,
By his Attorney
Frankland Jamus

UNITED STATES PATENT OFFICE.

ELIAS E. RIES, OF BALTIMORE, MARYLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO RIES & HENDERSON, OF SAME PLACE.

ELECTRO-DYNAMIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 390,904, dated October 9, 1888.

Application filed July 22, 1887. Serial No. 244,975. (No model.)

To all whom it may concern:

Be it known that I, ELIAS E. RIES, a citizen of the United States, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Electro-Dynamic Motors, (Case A,) of which the following is a description.

My present invention relates to improvements in electro-dynamic motors; and it consists, broadly, of a motor having a divisibly-wound armature and a commutator divided into as many separate portions as there are separable divisions in the armature-winding; also in a novel form of switch, by means whereof the various windings of the armature may be connected or grouped to form as different combinations between the windings as though separate differently-wound armatures were used. I also effect various combinations and changes of relationship between the main-line conductors from which current is supplied to the motor and to which current is supplied by the motor when acting as a generator, and also a storage-battery which, by means of my novel methods of winding and connecting, is charged from the motor acting as a generator and in turn discharges through the motor to add to the effect of the line-current without any interference therewith whenever power is required in excess of the standard current furnished by the main line.

It also relates to an improved form of conductor for winding the armature.

I have by way of illustration shown my improved motor as applied to the propelling of a railway-car, although it will be apparent that it may be applied to any other work with equally good results. When, however, it is applied as shown, the factor of momentum becomes an important consideration in connection with the capabilities of my improvements.

In electric-railway construction it is well understood that the motive power must be capable of overcoming the steepest grade with the heaviest load it is intended to haul, one or two short steep grades frequently necessitating the installation and constant maintenance of a much larger and more expensive plant than would otherwise be necessary. By my invention this increased expense is avoided, since on all downgrades the motor will be converted into a generator to a greater or less extent, according to the steepness of the grade and the speed at which the armature is being rotated by the moving vehicle. With my improved switch a greater or less portion of the armature-coils can be connected in parallel or in series in order to produce currents of a character suitable to the effect desired. For example, should the gage indicate that the storage-battery is sufficiently charged and the vehicle be moving rapidly on its momentum, the armature-coils will be connected in series in order to generate currents of sufficiently high electro-motive force to feed into the line. If, on the contrary, the storage-battery requires charging and the speed is still great, one, two, or any desired number of the armature-coils should be so connected in series to feed into the line, while the remaining one or more should be connected to the storage-battery in parallel if more than one is so connected.

It follows from what has been said that where unusually-steep grades are encountered, such as the constant current maintained upon the line-conductors will not furnish power enough to overcome, by means of the switch and divisible armature-windings a portion only of the coils of the armature are connected with the line, the remaining coils being connected with the storage-battery, so that under such conditions the armature is supplied with current both from the line and storage batteries, thereby increasing its power sufficiently to enable it to perform the added work.

The details of construction and arrangement will be hereinafter pointed out and described, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a motor mounted in operative position upon a railway-car truck, the switch and connections being shown diagrammatically. Figs. 2 and 3 are detail views showing different positions of the switch shown in Fig. 1. Fig. 4 is a detail showing a modified form of switch. Fig. 5 is a diagram of the circuits when connected as shown in Fig. 2. Fig. 6 shows the circuits as in Figs. 3 and 4. Fig. 7 is a diagrammatic representation of the circuits with the switch in posi-

tion shown in Fig. 1. Fig. 8 is a diagrammatic representation of the armature-winding. Fig. 9 is a sectional elevation of the armature. Fig. 10 shows a modified form of winding and connecting; and Figs. 11 and 12 are detail views, on an enlarged scale, showing the preferred form of construction and arrangement for the conductors forming the cable or band with which the armature is for convenience wound.

Similar letters denote like parts throughout.

A is the motor, which is mounted upon supports B, secured to the axles C, upon which are suitable wheels, C', constituting a railway-car truck.

Upon the shaft D is mounted the armature E, which, as shown, is wound with a number of separate conductors, a' a^2 a^3 a^4, which, for convenience, are assembled in the form of a flat cable, F.

The commutator is divided into four sections, b' b^2 b^3 b^4, which represent the windings a' a^2 a^3 a^4, respectively, and upon which bear positive commutator-brushes d' d^2 d^3 d^4, the negative set being represented by brushes, e' e^2 e^3 e^4, from which lead separate conductors 1 2 3 4, representing the positive brushes, and 5 6 7 8, representing the negative, the said conductors terminating at a corresponding series of switch-brushes, G' G^2 G^3 G^4 and H' H^2 H^3 H^4, arranged on opposite sides of a sliding switch, I, on the switch-board J. Between the ends of the conductors 1 2 3 4 and the switch-brushes G' G^2 G^3 G^4 are interposed manual switches g' g^2 g^3 g^4.

K is a storage-battery, shown diagrammatically for completeness of illustration, and it is connected with the switch by conductor 9, which is secured to binding-post P, which is in electrical connection with the switch g'. The opposite extremity of the storage-battery is connected by conductor 10 with binding-post N, from which extends a spring-contact, n, which normally rests against a contact arm or stop, n', extending from the switch-brush H'. The binding-posts for the line-wires are shown at P' N', the binding-post P' being in electrical contact with the switch g^4 and the comparatively high-tension line-wire 11, while the negative binding-post N' is connected to the opposite terminal of the line 12 and extends by spring L to the series return-connection L'. The battery, being charged whenever surplus current is available from the motor acting as a generator, is always ready to feed into the motor-circuit, and is independent of the line-conductors, and, it will be evident, may serve to propel the car in case of accident to the line-conductors or in case it is desired to take the car beyond their reach. The place between the two series of switch-brushes is occupied by the sliding switch I, which carries at one portion the parallel conducting-strips ij, said parallel strips being of a length sufficient to connect all the positive and all the negative brushes together in multiple arc. The opposite portion of the switch is provided with cross-strips M' M^2 M^3, which extend obliquely across the face of the switch I, their terminals being equidistant and coincident with the switch-brushes, so that when that portion of the switch is in operative position, as shown in Fig. 2, the switch-brush G' will rest upon the positive end of the cross strip M' and the switch-brush H^2 upon the negative end of the said strip, and so on throughout, the first of the series H' resting upon a separate terminal, M, directly opposite the positive end of the cross-strip M', which said terminal extends to and forms part of what I have called the "series return conducting-strip" L', indicated by dotted lines extending along the center of the inner portion of the switch I, the said strip being below the surface of the switch I and having its forward portion always in connection with the spring-brush L, located in its path and extending to the negative binding-post N'. The switch I is further provided with a stop or pin, m, which, when the switch is moved to the position shown in Fig. 2, where it is desired to connect all the portions of the motor in series, will engage the spring-contact n, and by moving it away from its contact n' will open the circuit leading to the secondary battery. The pins m and spring contacts n n' may be placed in other positions when it is desired to cut out the battery or the line-wires under other conditions than those specifically mentioned. Whenever it is desired to connect the four divisions of the commutator in series circuit permanently, an arrangement such as shown in Fig. 4 will answer the purpose. As there shown, the conductors 4 and 5 are connected, respectively, to binding-posts P^2 N^2, and thence to the secondary battery or line by conductors 13 14, the remaining brushes being connected in series, as shown in Fig. 5, by conductors 1 2 3 6 7 8, assembled in cable 15. For permanent parallel connection, the upper and lower brushes are all connected, respectively, to the binding-posts P N.

In Figs. 11 and 12 is shown a flat cable composed of the conductors a' a^2 a^3 a^4, previously referred to as constituting the separate windings of the armature, said conductors being separately insulated and then united together in series in the form of a flat cable, F, by means of suitable insulated material, f.

In Fig. 8 is shown diagrammatically the winding of one section of the armature, and in Fig. 9 is shown a sectional view of the armature, D being the shaft, F the cable-winding, D' the core, and b' b^2 b^3 b^4 the divided commutator, as hereinbefore described.

In Fig. 10 is illustrated a modification of the foregoing, D' being the core, and D being the armature-shaft. The winding F' may be similar to that in the armature just described, or it may be with separate strands. In any event the winding is the same in quantity, and the terminals of the coils are connected to separate collector-rings or a divided commutator, b' b^2 b^3 b^4, as already described. In addition to these, however, a second commutator, D^2, is provided, to each section of which commu-

tator all of the strands of the different windings of each section of the armature are connected, so that, the current being taken from the commutator D^2 by brushes O Q in the usual manner by means of an additional set of brushes, q' q^2 q^3 q^4, upon the collector-rings or commutators b' b^2 b^3 b^4 and connections leading to a four-point switch, R, all or a portion of the windings of said armature can be connected so as to deliver current to the main brushes O Q, the coils not so connected being inactive for the time being.

In the diagram Fig. 7 the switch is in position shown in Fig. 1, the circuits being through two coils of the armature by conductors 3 4 and 7 8 and diagonal strips M' M^2, by which they are connected in series, as shown, the remaining coils, by conductors 1 2 and 5 6, being connected in parallel by reason of their both resting upon the parallel strips *i j*, making the connection shown.

In Fig. 6 all portions of the armature-winding and all commutators are connected together in parallel circuit, the position of the switch being then as shown in Fig. 3. As shown in Fig. 5, the position of the switch is that of Fig. 2 when the battery is cut out by means of the pin *m*, and all the armature-sections are connected diagonally across the switch by the diagonal strips M' M^2 M^3, whereby the end of one winding is connected to the beginning of the next, and so on throughout, connecting all the coils of each section of the armature in series as though wound with one continuous conductor.

It will be evident that various minor modifications and changes may be made without in any way departing from the spirit of my invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an electro-dynamic motor, an armature having a plurality of separate or divisible windings, and separate sources of electricity therefor differing, respectively, in tension or electro-motive force, substantially as described.

2. In an electro-dynamic motor, an armature having separate or divisible windings, a grouping-switch representing the terminals of said separate windings, and separate sources of electricity connected to said switch, whereby the said currents may be directed through more or fewer of the armature-coils simultaneously and in the same direction, substantially as described.

3. The combination of an electro dynamic motor having a multiple-wound armature, separate sources of electricity therefor, and a switch representing the terminals of the separate armature-windings, whereby any two or more of the said windings may be connected with separate sources of electricity of different tensions, substantially as described.

4. In an electro-dynamic motor, an armature provided with a number of separate conductors, two or more working-circuits, and means for connecting one or more of said armature-conductors in each working-circuit and for varying the resistance of each armature-circuit as required, substantially as described.

5. In an electro-dynamic motor, the combination of an armature having divisible windings, a switch to which said windings are separately connected, a plurality of separate circuit-wires leading therefrom, a moving part on said switch, and a circuit-breaker arranged to be operated by the said moving part to open the remaining external circuit or circuits when all the windings are grouped into one, substantially as described.

6. In an electro-dynamic motor, the combination of an armature having divisible windings, a switch to which said windings are separately connected, circuit-connections leading to a secondary battery, and separate circuit-connections leading to the line-conductors, and a moving part on said switch arranged to open the battery-circuit when all the windings are grouped into connection with the line, substantially as described.

7. In an electro-dynamic motor, the combination of an armature having a plurality of separate or divisible windings, a plurality of working-circuits, a switch to which the working-circuits and the divisible conductors are connected, and a moving part on said switch carrying conducting-strips adapted to engage the terminals of the said conductor, whereby any one of the working circuits may be connected to any one or more of the armature-conductors, substantially as described.

8. In an electro-dynamic motor, an armature provided with a number of separate conductors, a plurality of working-circuits therefor, and means for connecting any one of said external circuits with the coils of said armature, substantially as described.

9. In an electro-dynamic motor, an armature having divisible windings consisting of a cable composed of the desired number of separately-insulated conductors united by an exterior covering of insulating material, substantially as described.

10. In an electro-dynamic motor, an armature provided with a number of separate conductors, a plurality of working-circuits, and means, substantially such as described, for connecting a varying number of the armature-coils in each of said working-circuits, as set forth.

11. An electro-dynamic motor the armature of which is provided with separate and independent sets of coils of different electrical resistance from the other and energized by independent currents from different sources, substantially as described.

12. The combination, with an electrically-propelled railway-car or other vehicle, of an electro-dynamic motor mounted thereon and adapted to propel the same, and having its armature provided with independent windings,

an electrical conductor or conductors carrying current of relatively high tension extending along the line of travel and arranged to normally supply said motor with propelling-current, a secondary battery or batteries carried on said vehicle and designed to supply said motor under certain conditions with electric current of lower tension, and means for connecting any desired number of said armature-windings with one or both of said sources, substantially as described.

13. The combination, with an electrically-propelled railway-car or other vehicle, of an electro-dynamic motor mounted thereon and adapted to propel the same, and having its armature provided with a number of independent windings, a line conductor or conductors, and a secondary battery arranged to supply the said motor, either alternately or jointly, with electrical currents differing in tension, and a switch for connecting said armature-windings in parallel or series order, as desired, and thereby adapt the resistance and winding of the motor to the requirements of the current of either or both the supply-circuits, substantially as described.

14. An electric-railway motor having an armature provided with separate windings, in combination with two sources of current differing in electro-motive force for alternately supplying the motor-circuit, and a switch for connecting the separate windings in parallel or series order to conform to the nature of current supplying the said motor, substantially as described.

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

ELIAS E. RIES.

Witnesses:
FRANKLAND JANNUS,
JNO. T. MADDOX.