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T. DUNCAN.

ELECTRIC METER.

APPLICATION FILED DEC. 29, 1903.

NO MODEL.

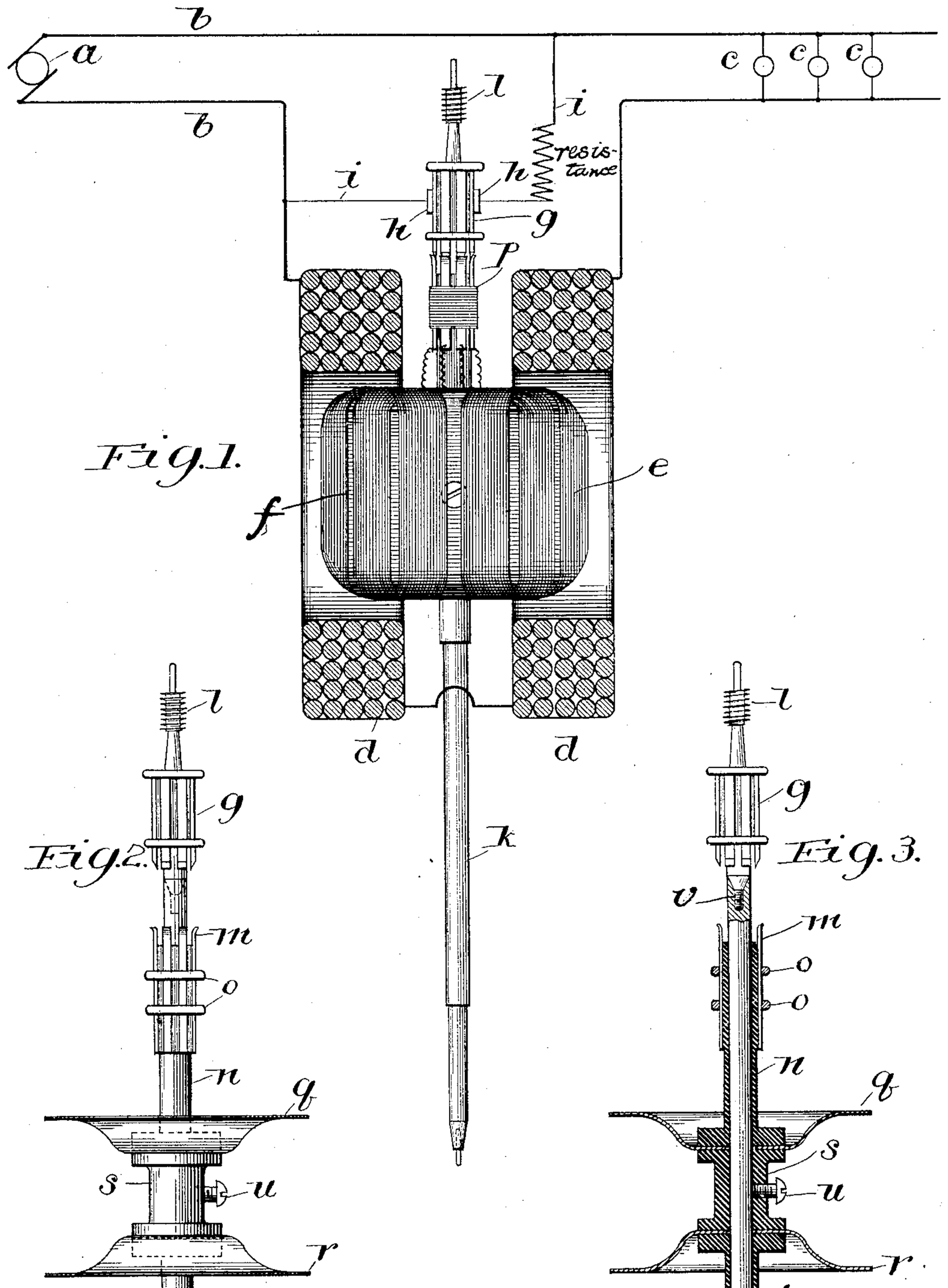

Fig. 1.

Fig. 2.

Fig. 3.

Witnesses:
Carl A. Crawford
Leon Stroh

Inventor:
Thomas Duncan
by G. L. Craig
his Attorney

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UNITED STATES PATENT OFFICE.

THOMAS DUNCAN, OF LAFAYETTE, INDIANA.

ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 753,556, dated March 1, 1904.

Application filed December 29, 1903. Serial No. 186,994. (No model.)

To all whom it may concern:

Be it known that I, THOMAS DUNCAN, a citizen of the United States, residing at Lafayette, in the county of Tippecanoe and State of Indiana, have invented a certain new and useful Improvement in Electric Meters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to and has a most useful embodiment in commutated integrating wattmeters, and has for its object the provision of an improved construction whereby parts of the rotating elements may be made separable to enable the substitution of new parts at the place of use of the apparatus for those that are injured in service.

The invention is realized in a meter having a stationary current field-winding, a rotatable pressure-winding subdivided into coils and constituting an armature-winding, and a commutator for the pressure-winding whose segments have separable connection with the terminals of the coils of the pressure-winding.

The preferred embodiment of the invention is found in a construction, including the armature-coils and switching mechanism, serving to effect connection between said coils and the mains, which switching mechanism includes the segments of the commutator or switch elements that are electrical continuations of the segments of the commutator and which I contemplate as being parts of the commutator-segments.

A construction that satisfactorily realizes the invention is one wherein the terminals of the pressure-coils are in the form of switch-blades that preferably constitute spring-fingers equal in number to the commutator-segments and adapted to be moved relatively to the commutator-segments, so that connection between the commutator-segments and the said terminals may be readily effected and broken. The commutator and the pressure-winding are preferably mounted to move longitudinally with respect to each other, and in order that the injured element—the commutator or the armature, as the case may be, or both—may be readily removed from the armature-shaft the portion of the shaft carrying the commutator and the portion carrying the armature are preferably made separable, the sections being desirably united by threaded connection.

The advantage of my invention in meter practice will be very readily appreciated, for it enables a new armature to be placed upon the meter shaft or spindle in substitution for an injured armature by any meter operator without having to unsolder the connections or terminals of the armature from the commutator to effect the removal of the injured element and again solder the commutator-segments and armature-terminals. Hitherto the operation of replacing damaged meter-armatures has been considered very difficult and objectionable on account of the very small size of the armature-wires and the manipulation of the connections between the armature-winding terminals and the commutator-segments by some one especially skilled or educated in this delicate work. In many central-station plants the work of replacing injured armatures is not undertaken because of the delicacy of the operation required, but instead the entire spindle, with its armature and commutator, is returned to the manufacturer to have the work performed. This substitution of new armatures is quite frequent, because of the injury of armatures of meters in service by lightning, the commutators being also frequently injured by the same agency.

I will explain my invention more fully by reference to the accompanying drawings, illustrating the preferred embodiment thereof, in which—

Figure 1 indicates portions of a meter essential to an understanding of the invention, the current field-coils being indicated in section, while the circuit connections of the meter are diagrammatically indicated. Fig. 2 is a view in elevation of the upper portion of the rotating element shown in Fig. 1 slightly modified, the armature-winding being removed for the sake of clearness, the support for the armature being lowered to effect disconnection between the commutator-segments and the armature-terminals. The structural parts in this figure are shown in elevation. Fig. 3

is a view similar to Fig. 2, excepting that the armature-support and parts fixed with respect thereto are indicated in section, the upper end of the armature-shaft section being also indicated in section to show the mechanical connection with the shaft-section carrying the commutator.

Like parts are indicated by similar characters of reference throughout the different figures.

In Fig. 1 I have shown a source of current *a*, which may be considered either an alternating or a direct current generator, that furnishes current to the mains *b b*, that lead to any selected district of consumption, the lamps *c c* being indicated as one type of translating means at such district of consumption. One of the mains *b* includes the stationary current field-winding of the meter, which winding is preferably subdivided into coils *d d*. To complete the meter into the form of a wattmeter, there is provided an armature-winding *e*, subdivided into coils *f f*, as is well understood to those skilled in the art. These coils are connected with the segments *g* of a commutator, which segments are engaged by the brushes *h h*, that are connected with the mains *b b* by means of the shunt-conductors *i i*, each main having a brush connected therewith whereby the coils of the armature-winding are included in bridge of the mains to be subject to the pressure impressed upon the circuit, the current field-winding and the armature thus coöperating to produce a rotation of the meter-spindle *k*, with respect to which the armature is normaly fixed, such rotation being in proportion to the watts. It is understood that the armature spindle or shaft *k* is associated with the usual instrumentalities completing the meter structure, there being indicated at the upper end of the spindle a worm *l* for operating the counting-train. The armature-winding has its coils provided with any suitable form of terminals *m*, which may be mounted upon an insulating-support *n* and which may be held thereupon by one or more rings *o*, of insulating material, as indicated in Figs. 2 and 3, or by means of thread *p*, wound about the terminals and coated with shellac or other insulating varnish, as indicated in Fig. 1. The support *n* is preferably in the form of a sleeve which extends downward to the base of the bowl of the cup-shaped frame or support *q*, the lower end of the sleeve *n* being preferably enlarged into a flange, as indicated. There is a lower cup-shaped support *r*, symmetrically arranged with respect to the support *q*. A core *s* is interposed between the cup-shaped supports, while a flanged sleeve *t* is locked in engagement with the cup *r*. The elements *n*, *q*, *s*, *r*, and *t* are fixed with respect to each other and are together slidable upon the shaft *k* when the set-screw *u* is loosened. The terminals *m* are desirably in the form of spring-fingers and constitute elements of switches, the other elements of which switches reside in the commutator-segments *g*, the said commutator-segments being extended downwardly in the form of continuations, the lower ends of these segment continuations being beveled, so that the spring-fingers, that are slightly flared, may have positive sliding and frictional contact with the segments at their said continuations.

In assembling the parts of the rotating element the armature and its support are moved along the shaft until the requisite engagement between the parts of the switches comprising the segments of the commutator and the spring-fingers is effected, whereupon the set-screw *u* is moved into locking engagement with the shaft. Access to the screw by a screw-driver is had between the coils of the armature. To replace an armature, the set-screw is loosened, the armature, its support and terminals are moved along the shaft, and a new armature is then moved along the shaft and secured in position in the manner just described. The shaft *k* is preferably made in sections, the sections being desirably united by threaded engagement, as indicated at *v*, the upper section carrying the commutator, which desirably is removed in order to more effectively permit the removal of the disabled armature and the substitution of a new armature. It will be apparent that the ends of the coils may be soldered to the fingers *m* at a factory, where every possible facility is at hand and where such soldering may be accomplished without any difficulty. The armature-winding is of course well insulated from the shaft, the sleeve portion *n* directly effecting insulation between the fingers *m* and the shaft. If the commutator alone should be damaged, the set-screw *u* is loosened, whereby the armature, with its extended terminals, may be lowered, whereafter the upper end of the shaft may be unscrewed and replaced by a new shaft-section carrying the commutator and in the instance shown also the worm *l*.

I believe it to be broadly new with me to assemble the set of armature-coil-terminal contacts and the set of contacts comprising the commutator-segments in tubular formation in which contacts of one set slide over contacts of the other set by a relative sliding movement of said sets longitudinally of the armature-shaft and wherein one contact (preferably the armature-coil terminal) of each pair thus separably included in circuit with an armature-coil is a strip-spring, the armature-terminals being substantially fixed with respect to the armature. Particularly do I believe such an arrangement and construction to be new in wattmeters. By sliding contacts of one set over the other compensation for wear may be effected.

I have shown well-known resistance in series with the armature, which use of resistance is not novel with me.

It is obvious that changes may readily be made in the form of my invention herein illustrated without departing from the spirit of the invention, and I do not, therefore, wish to be limited to the precise construction illustrated; but,

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A wattmeter having a current field-winding, a rotating pressure field-winding, subdivided into armature-coils having terminals substantially fixed with respect to the armature and forming one set of contacts, said armature with its terminals being together slidable longitudinally of the armature-shaft to effect connection and disconnection, and a commutator whose segments form another set of contacts, the sets of armature-coil-terminal contacts and commutator-segment contacts being assembled in tubular formation, substantially as described.

2. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having strip-metal terminals forming one set of contacts and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being assembled in tubular formation and relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and permit physical separation of armature and commutator, contacts of one set being adapted to slide over contacts of the other set, substantially as described.

3. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being assembled in tubular formation and relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and to permit physical separation of armature and commutator, one contact of each pair of engaging contacts being a strip-spring having sliding engagement over its companion, substantially as described.

4. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being assembled in tubular formation and relatively movable to effect connection and disconnection of the armature and to permit physical separation of armature and commutator, one contact of each pair of engaging contacts being a strip-spring having sliding engagement over a companion, substantially as described.

5. A wattmeter having a current field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts and a commutator whose segments form another set of contacts, the sets of armature-coil contacts and commutator-segment contacts being assembled in tubular formation relatively movable to effect connection and disconnection of the armature and to permit physical separation of the armature and commutator, one contact of each pair thus separably included in circuit with an armature-coil being a strip-spring, substantially as described.

6. A wattmeter having a current field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals substantially fixed with respect to the armature and forming one set of contacts, said armature with its terminals being together slidable longitudinally of the armature-shaft to effect connection and disconnection, and a commutator whose segments form another set of contacts, the sets of armature-coil-terminal contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and permit physical separation of armature and commutator, substantially as described.

7. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having strip-metal terminals forming one set of contacts, and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and permit physical separation of armature and commutator, contacts of one set being adapted to slide over contacts of the other set, substantially as described.

8. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts, and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and to permit physical separation of armature and commutator, one contact of each pair of engaging contacts being a strip-spring having sliding engagement with its companion, substantially as described.

9. A wattmeter having a field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being relatively movable to effect connection and disconnection of the armature and commutator, one contact of each

pair of engaging contacts being a strip-spring having sliding engagement over a companion, substantially as described.

10. A wattmeter having a current field-winding, a rotating pressure field-winding subdivided into armature-coils having terminals forming one set of contacts, and a commutator whose segments form another set of contacts, the set of armature-coil contacts and commutator-segment contacts being relatively movable to effect connection and disconnection of the armature and to permit physical separation of the armature and commutator, one contact of each pair thus separably included in circuit being a strip-spring, substantially as described.

11. A motor having a rotating winding subdivided into armature-coils having terminals substantially fixed with respect to the armature and forming one set of contacts, said armature with its terminals being together slidable longitudinally of the armature-shaft to effect connection and disconnection, and a commutator whose segments form another set of contacts, the sets of armature-coil contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and permit physical separation of armature and commutator, substantially as described.

12. A motor having a rotating winding subdivided into armature-coils having strip-metal terminals forming one set of contacts, and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and to permit physical separation of armature and commutator, contacts of one set being adapted to slide over contacts of the other set, substantially as described.

13. A motor having a rotating winding subdivided into armature-coils having terminals forming one set of contacts, and a commutator whose segments form another set of contacts, the sets of armature-contacts and commutator-segment contacts being relatively slidable longitudinally of the armature-shaft to effect connection and disconnection of the armature and to permit physical separation of armature and commutator, one contact of each pair of engaging contacts being a strip-spring having sliding engagement over a companion, substantially as described.

In witness whereof I hereunto subscribe my name this 24th day of December, A. D. 1903.

THOMAS DUNCAN.

Witnesses:

LEON STROH,

G. L. CRAGG.