No. 698,653. Patented Apr. 29, 1902.

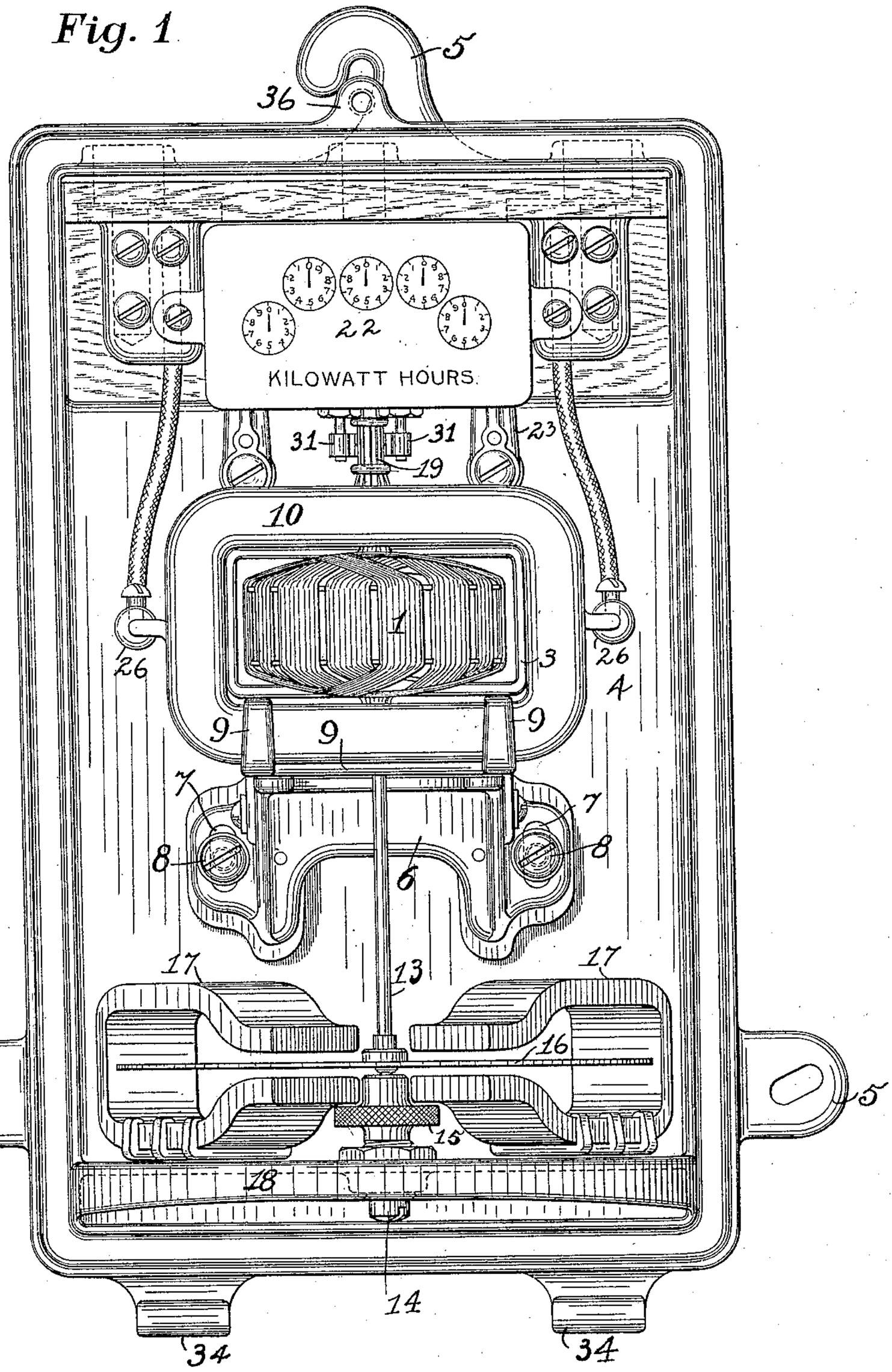
T. DUNCAN.

DIRECT CURRENT METER.

(Application filed Aug. 28, 1899. Renewed Oct. 2, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1



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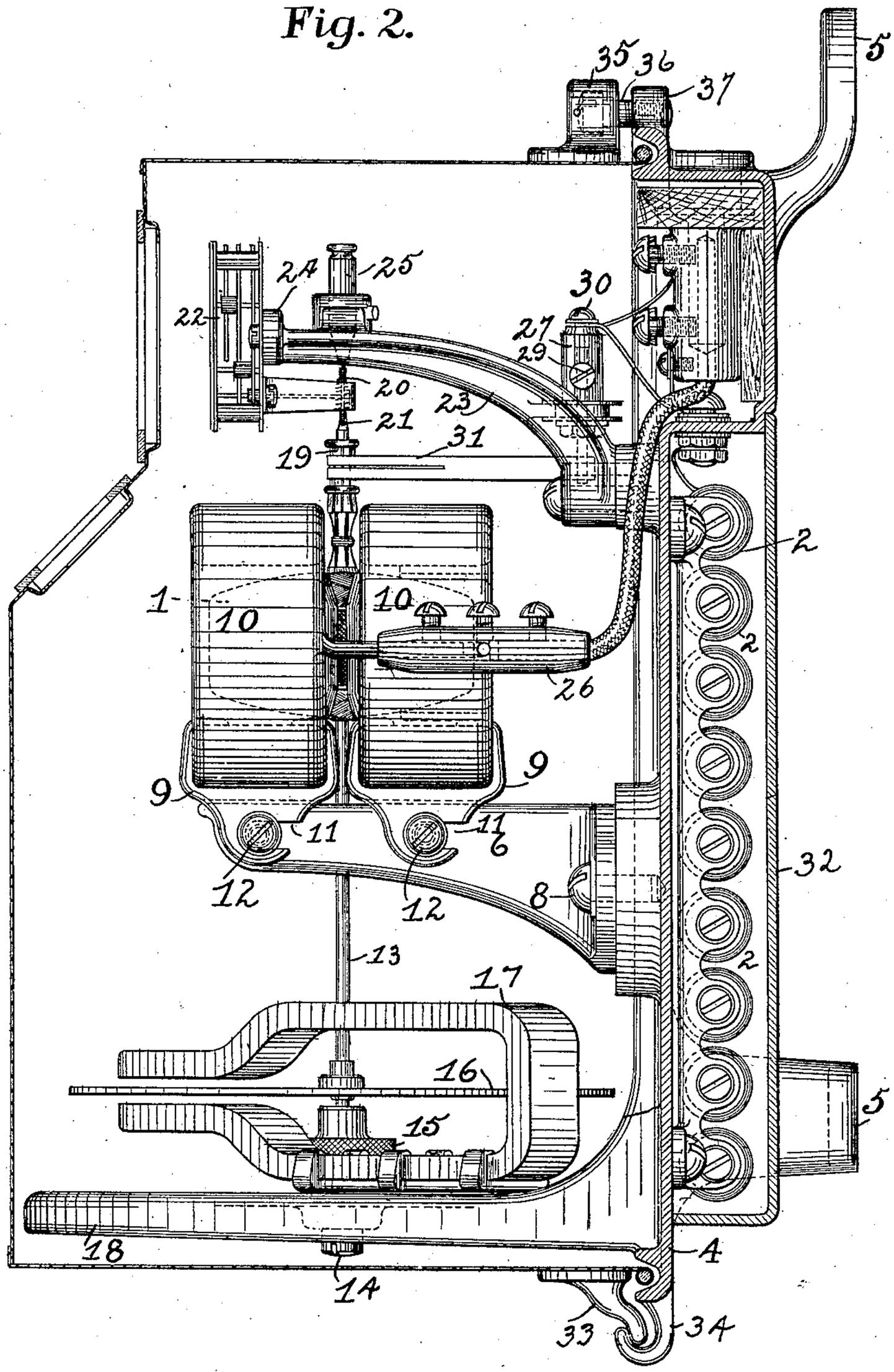
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 3.

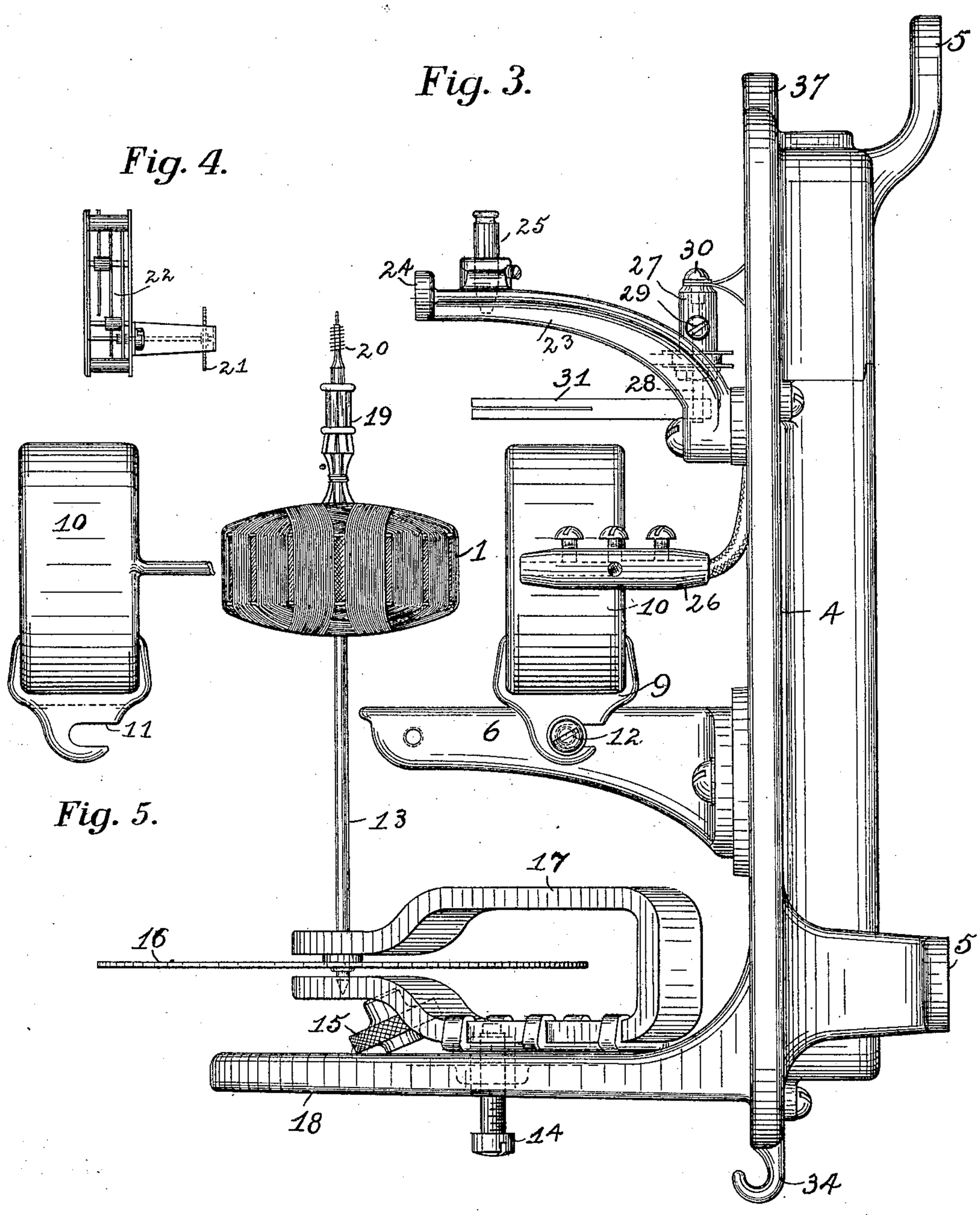

Fig. 4.

Fig. 5.

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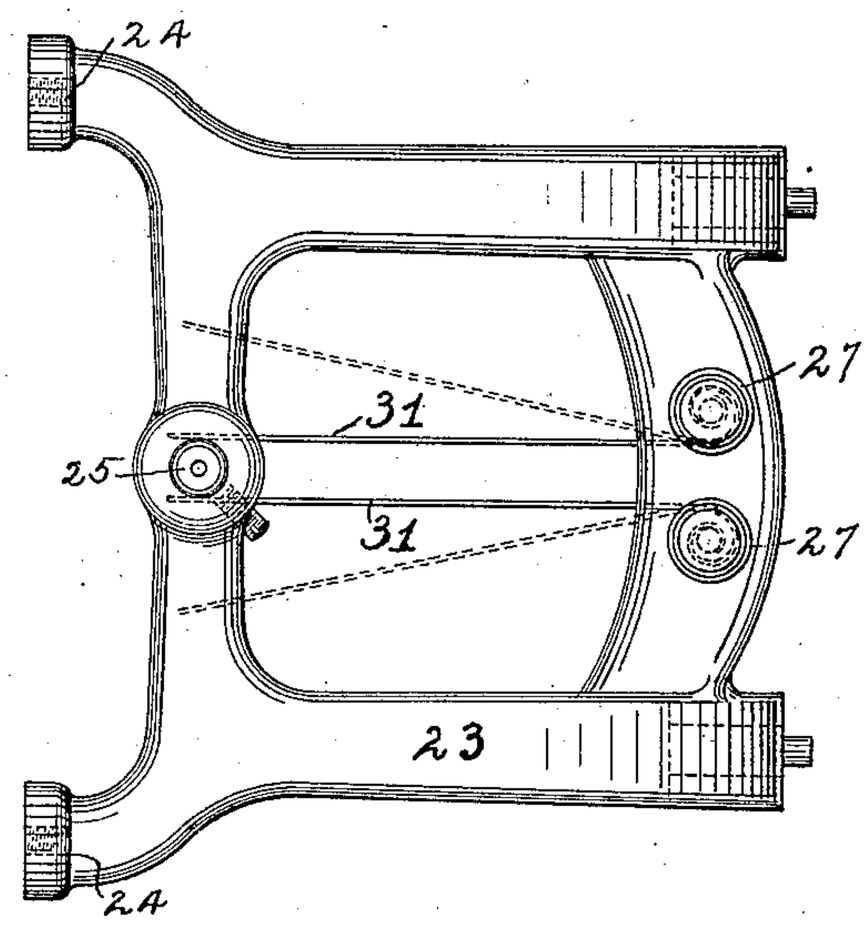
(No Model.) 4 Sheets—Sheet 4.

Fig. 6.



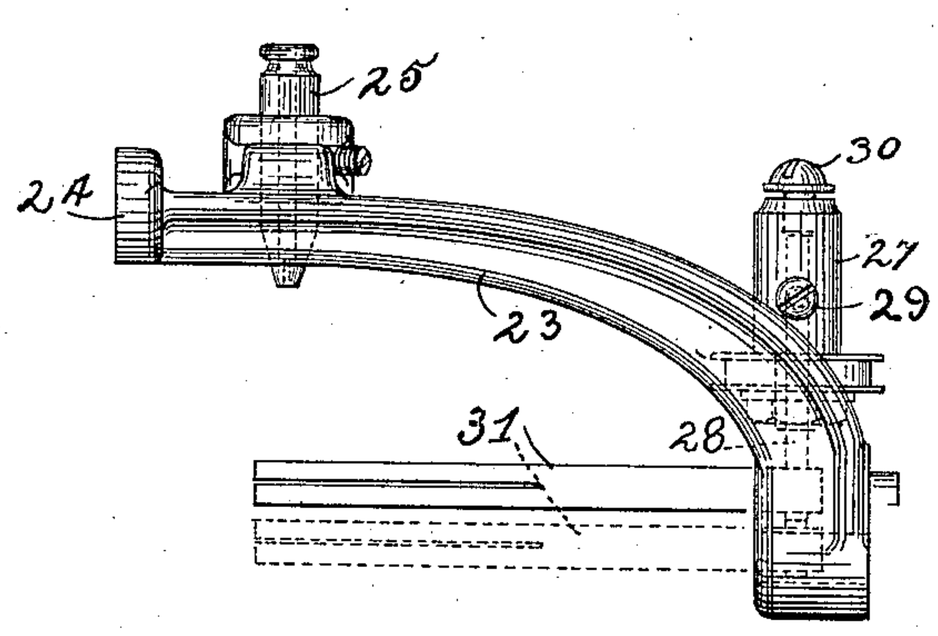


Fig. 7.

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UNITED STATES PATENT OFFICE.

THOMAS DUNCAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DIRECT-CURRENT METER.

SPECIFICATION forming part of Letters Patent No. 698,653, dated April 29, 1902.

Application filed August 28, 1899. Renewed October 2, 1901. Serial No. 77,301. (No model.)

To all whom it may concern:

Be it known that I, THOMAS DUNCAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Direct-Current 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 motor-meters, and principally to that class of motor-meters known as "commutated" motor-meters employed for measuring energy in consumption-circuits.

My invention has for its object the improvement in the construction of parts and arrangement of parts of direct-current wattmeters whereby difficulties heretofore present in apparatus of this class are overcome.

More particularly my invention has for its object, first, the provision of improved means whereby the field-coils of the meter may be accurately adjusted with relation to the armature and easily removed to gain access to the meter parts; second, an improved mounting for the armature to enable the same and parts mechanically united therewith to be removed readily for inspection and repairs without the necessity of disassembling a large number of the meter parts having no immediate connection with the armature, thereby overcoming this objectionable necessity which exists in meters as constructed hitherto. A third object of my invention is to provide an improved mounting for the measuring-train which permits of ready access to the commutator, and, fourth, to provide an improved mounting of the commutator-brushes, readily to permit the removal of the brushes from the commutator for the purpose of cleaning the commutator, to effect a vertical adjustment of the commutator-brushes to secure an even wear upon the commutator, and speedily to adjust the tension of the brushes.

The objects sought to be attained by my present invention are desirable to enable those who are not skilled mechanically and who are not particularly familiar with details of direct-current-meter construction to gain access to parts of the meter that have to be cleaned, tested, and repaired at intervals to keep them in good working condition. The accumulation of foreign matter in the moving parts of meters increases the friction and tends to detract from the accuracy of its readings. Moreover, if the brushes are maintained in engagement with but one zone of the commutator irregularities will be worn into the commutator, which will cause sparking at the brushes, this sparking oxidizing the silver alloy or other material from which the commutator is constructed, which will increase the resistance in the bridge-conductor including the armature, and thereby injuriously affect the operation of the meter.

Other features and objects of the invention will be hereinafter pointed out.

I will explain my invention by reference to the accompanying drawings, illustrating the preferred embodiment thereof.

In the drawings, Figure 1 is a front elevation of my improved direct-current wattmeter, the casing being removed. Fig. 2 is a side elevation, partially in section, of the meter. Fig. 3 is a side view of the meter, parts being removed. Fig. 4 is a side view of the registering-train. Fig. 5 is a side view of one of the field-coils. Fig. 6 is a plan view of a part of the frame of a meter with the brushes mounted in place thereon. Fig. 7 is a side elevation of the mechanism shown in Fig. 6.

Like parts are indicated by similar numerals of reference throughout the different views.

The armature 1 is adapted for inclusion in a bridge of the working circuit with resistance 2 in a manner well understood by those skilled in the art. A supplemental coil 3 is provided for the purpose of securing an initial torque to compensate for friction. This coil is also included in the same bridge conductor with the armature and resistance. A vertical or back frame-plate 4 is provided with rearwardly-extending ears 5 5, the lower ears being provided with oblique slots for the reception of retaining-screws, which enable the meter to be readily placed in a vertical position, while the upper and central ear is in the form of a hook to permit the meter readily to be hung in position upon the shank of a screw. The adjustment of the meter to a vertical position is secured by swinging the

meter upon the point of suspension provided by the upper ear 5, which is permitted by the oblique slots in the lower ears 5, already referred to.

Upon the back plate is secured a forwardly-extending base or bracket 6, which is provided at its sides with vertical slots 7, through which retaining-screws 8 are passed into the back plate, the vertical slots permitting of the vertical and leveling adjustment of the base or bracket. Clamps 9 are provided upon the bracket for the purpose of securing the field-coils 10 in position, these clamps extending transversely across the bracket, the lower extensions of the clamps being provided with horizontal slots or recesses 11 for receiving the retaining-screws 12, which engage the bracket, and thereby affording not only a horizontal adjustment of the field-coils, but also a swinging adjustment upon the screws 12 as centers. The vertical and leveling adjustment of the bracket 6 by means of the screws 8 and the horizontal and swinging adjustment of the field-coils upon the brackets by means of the screws 12 constitute practically a universal adjustment of the field-coils with reference to the armature and permit the adjustment of the field-coils to conform to any slight irregularities of the armature, and thus secure the most effective relation between the field-coils and the armature.

Two field-coils are usually employed in direct-current wattmeters, between which the armature is disposed, and by the provision of the vertically-adjustable bracket for supporting the field-coils and the horizontally-adjustable clamps mechanically uniting the field-coils with the bracket I am enabled readily to secure the proper central adjustment of the armature with relation to these coils.

The armature 1 is carried upon a vertically-disposed spindle 13, mounted at its lower end to rotate in a jeweled bearing carried upon the upper end of the stud 14, a thumb-nut 15 being employed for raising the spindle vertically away from the jeweled bearing. An aluminium disk 16 is preferably employed to form one element of a retarding device, being secured to the spindle 13, the other elements of the retarding device, permanent magnets 17, being clamped in place upon the base-plate 18 of the meter-frame, through which plate the stud 14, supporting the lower armature-bearing, passes. The commutator-segments 19 are mounted upon the spindle 13 and are preferably located above the armature. A worm 20 is carried upon the upper end of the armature-spindle and is adapted to mesh with a wheel 21 of the counting-train 22.

In order to make the commutator accessible, I mount the counting-train above the same, for which purpose I provide a support 23, secured to and extending forwardly from the back 4, this support being provided with extensions 24, located above the commutator and projecting forwardly beyond the upper bearing 25, also carried by the support 23. The frame of the counting-train is directly secured to the extensions 24, the counting-train being thereby located above and extending forwardly beyond the commutator.

To remove the armature, the leads of the front field-coil are first disunited from the connectors 26, whereupon the screws 12, securing the front coil in place, are loosened to permit this field-coil to be moved forwardly away from the armature. Each connector is provided with three binding-screws, one for securing the connector to the main conductor, another for securing a lead of the forward coil to the connector, and the intermediate binding-screw for uniting a lead of the rear coil with the connector, the field-coils of the meter thus being included in parallel. The meter-train may next be removed from its support, after which the armature may be removed readily from its bearings. The removal of the armature is thus easily accomplished without disassembling a large number of parts of the meter, and the removed parts may be restored as easily to their places.

Two brush-holders 27 are mounted upon the support 23, these brush-holders being provided with binding-screws 30 for connection with the bridge-conductor to include the armature in series therewith. Each brush-holder has a spindle 28, disposed within an axial bore contained in the holder, a screw 29 passing through the brush-holder 27 into engagement with the spindle. The anchored ends of the commutator-brushes 31 are formed in spirals, the inner ends of the spirals being secured to the spindles 28. By releasing the screws 29 the tension of the brushes may be delicately adjusted, the spiral ends of the brushes lending themselves to secure this delicate adjustment. The spindles 28 are preferably unthreaded to permit the same to be moved up and down in the brush-holders to secure the vertical adjustment of the brushes and to permit them to be removed easily. The screws 29, it will be apparent, serve to secure both the vertical and rotary adjustments of the spindles 28.

By reference more particularly to Fig. 2 it will be observed that I have provided a compartment 32, in which the resistance 2, that is preferably subdivided into a number of coils, may be placed. By the subdivision of the resistance-wire the convolutions need not be compact, and so sufficient radiation is afforded to prevent undue heating. The compartment 32 is formed in part of the back 4 and a cover inclosing the resistance. The meter-casing is provided with two lugs 33 along its rear lower edge, which engage with corresponding lugs 34 upon the frame of the meter, thereby to form a joint between the cover and meter-casing somewhat similar to a hinge connection. A lug 35 is carried upon the top of the meter-casing near the middle of the rear upper edge, a screw 36 serving to unite the lug 35 with a lug 37, carried upon

the upper part of the meter-frame, the screw 36 and the hinge connection 33 34 serving to maintain the casing in place.

It is obvious that changes may be made from the embodiment of the invention herein shown and particularly described, and I do not therefore desire to be limited to the precise details of construction shown, as changes may be made in the apparatus without departing from my invention; but,

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

1. In a direct-current meter, the combination with the field portion of the meter, of an armature, a frame for supporting the armature and field portion, and means for effecting the universal adjustment of the field portion readily to effect the proper relative disposition of the field portion and armature, substantially as described.

2. In a direct-current meter, the combination with an armature, of a field-coil adjustably and detachably secured in front of the armature, and a frame for the meter for supporting the armature and field-coil, substantially as described.

3. In a direct-current meter, the combination with an armature, of two field-coils, one located in front of the armature and the other to the rear thereof, the rear field-coil being adjustable with relation to the armature, substantially as described.

4. In a direct-current meter, the combination with an armature, of the two field-coils, one located in front of the armature and the other to the rear thereof, the said coils being adjustable with relation to the armature, substantially as described.

5. In a direct-current meter, the combination with an armature, of two field-coils, one located in front of the armature and the other to the rear thereof, the said field-coils being adjustable with relation to the armature and to each other, substantially as described.

6. In a direct-current meter, the combination with an armature, of two field-coils, one located in front of the armature and the other to the rear thereof, the said field-coils being mounted to have swinging adjustment.

7. In a direct-current meter, the combination with an armature, of a horizontally-adjustable field portion therefor, and frame portions for supporting the armature and field portion, substantially as described.

8. In a direct-current meter, the combination with an armature, of a field portion therefor adjustable in a vertical plane, and frame portions for supporting the armature and the field portion, substantially as described.

9. In a direct-current meter, the combination with a frame therefor, of a vertically-adjustable horizontally-extending base secured to the frame, field-coils mounted upon the base, and an armature located between the field-coils, substantially as described.

10. In a direct-current meter, the combination with a frame therefor, of a vertically-adjustable horizontally-extending base secured to the frame, field-coils mounted upon the base, an armature located between the field-coils, and means for supporting the field-coils upon the base, permitting of the horizontal adjustment of the field-coils upon the base, substantially as described.

11. The combination with the vertical back portion of the frame of a meter, of a support 23 projecting forwardly therefrom, a base 18 also projecting forward from the vertical back portion of the frame, a bearing carried in the base, an armature spindle or shaft journaled at its lower end in said bearing, an armature upon the spindle, a commutator also provided upon the said spindle, an upper bearing for the spindle carried by the support 23 intermediate between the forward and rear ends of the support, and a counting-train engaging the spindle and mounted above the commutator upon the forward end of the support 23 in front of the upper bearing for the spindle, substantially as described.

12. In a direct-current meter, the combination with an armature mounted to rotate in a horizontal plane, of a commutator therefor, two horizontally-disposed commutator-brushes each spirally formed at one end and adapted to engage the commutator at the other end, vertically-disposed spindles 28, to which the brushes are secured at their spiral ends, vertical brush-holders 27 provided with bores for receiving the said spindles, the spindles being rotatable in said bores, whereby the adjustment of the brushes may readily be effected, and clamping-screws 29 passed through the sides of the brush-holders transversely and serving to engage the spindles 28 to secure the same in the position to which they have been rotated, substantially as described.

13. In a direct-current meter, the combination with an armature mounted to rotate in a horizontal plane, of a commutator therefor, two horizontally-disposed commutator-brushes, each spirally formed at one end and adapted to engage the commutator at the other end, vertically-disposed spindles 28 to which the brushes are secured at their spiral ends, vertical brush-holders 27 provided with elongated bores for receiving the said spindles, the spindles being rotatable and movable vertically in said bores, whereby the rotary and vertical adjustment of the brushes may readily be effected, and clamping-screws 29 passing through the sides of the brush-holders transversely and serving to engage the spindles 28 to secure the same in the position to which they have been rotated and vertically placed, substantially as described.

In witness whereof I hereunto subscribe my name this 21st day of August, A. D. 1899.

THOMAS DUNCAN.

Witnesses:

CHARLES A. BROWN,

CHARLES E. HUBERT.