

No. 753,192.

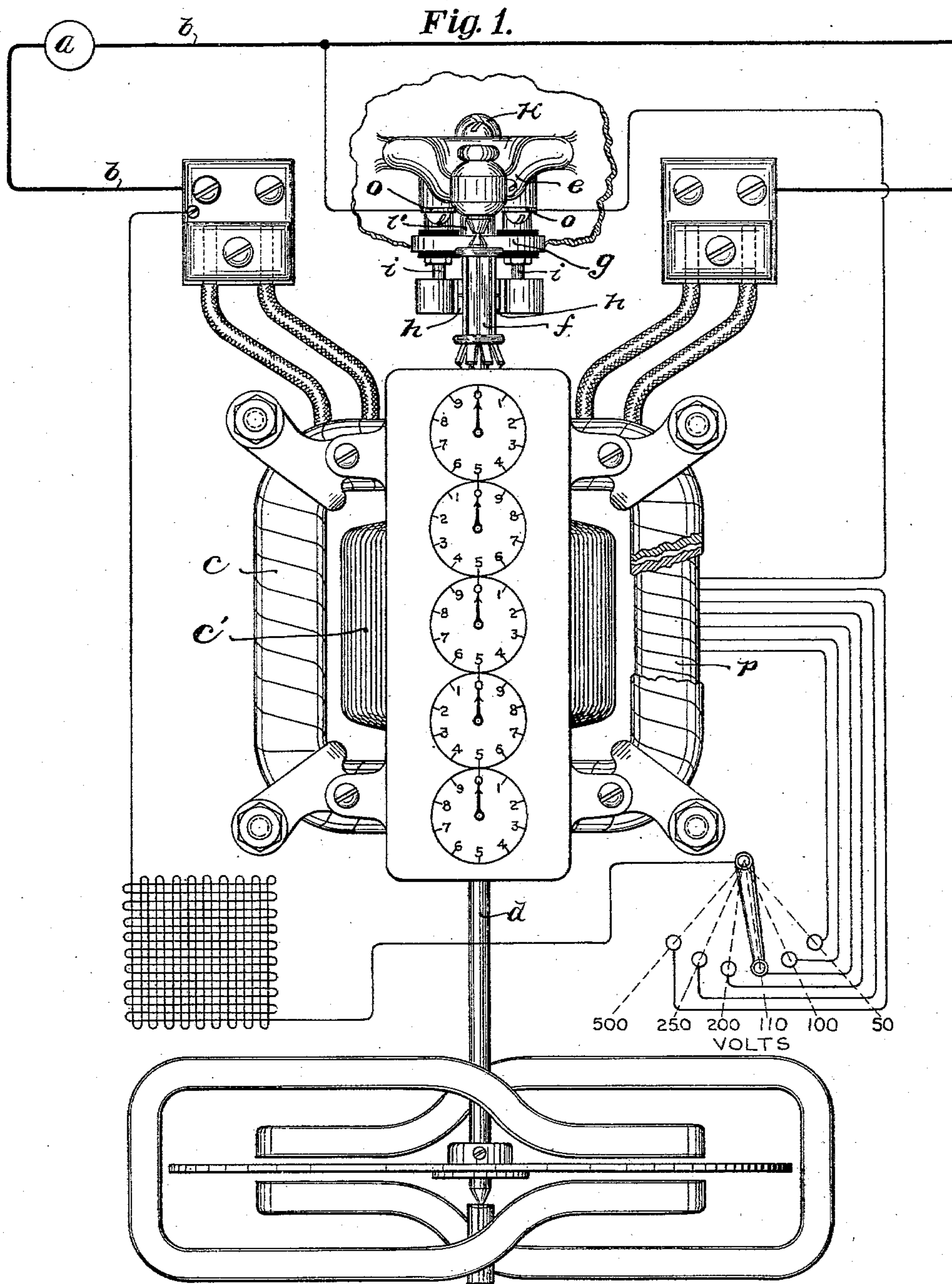
PATENTED FEB. 23, 1904.

T. DUNCAN.  
ELECTRIC METER.

APPLICATION FILED JULY 18, 1901.

NO MODEL.

3 SHEETS—SHEET 1.



WITNESSES:

*Max W. Label.*  
*Harvey L. Hanson.*

—BY

*Charles A. Brown*  
*Cragg & Belfield*  
ATTORNEYS.

INVENTOR.

THOMAS DUNCAN

No. 753,192.

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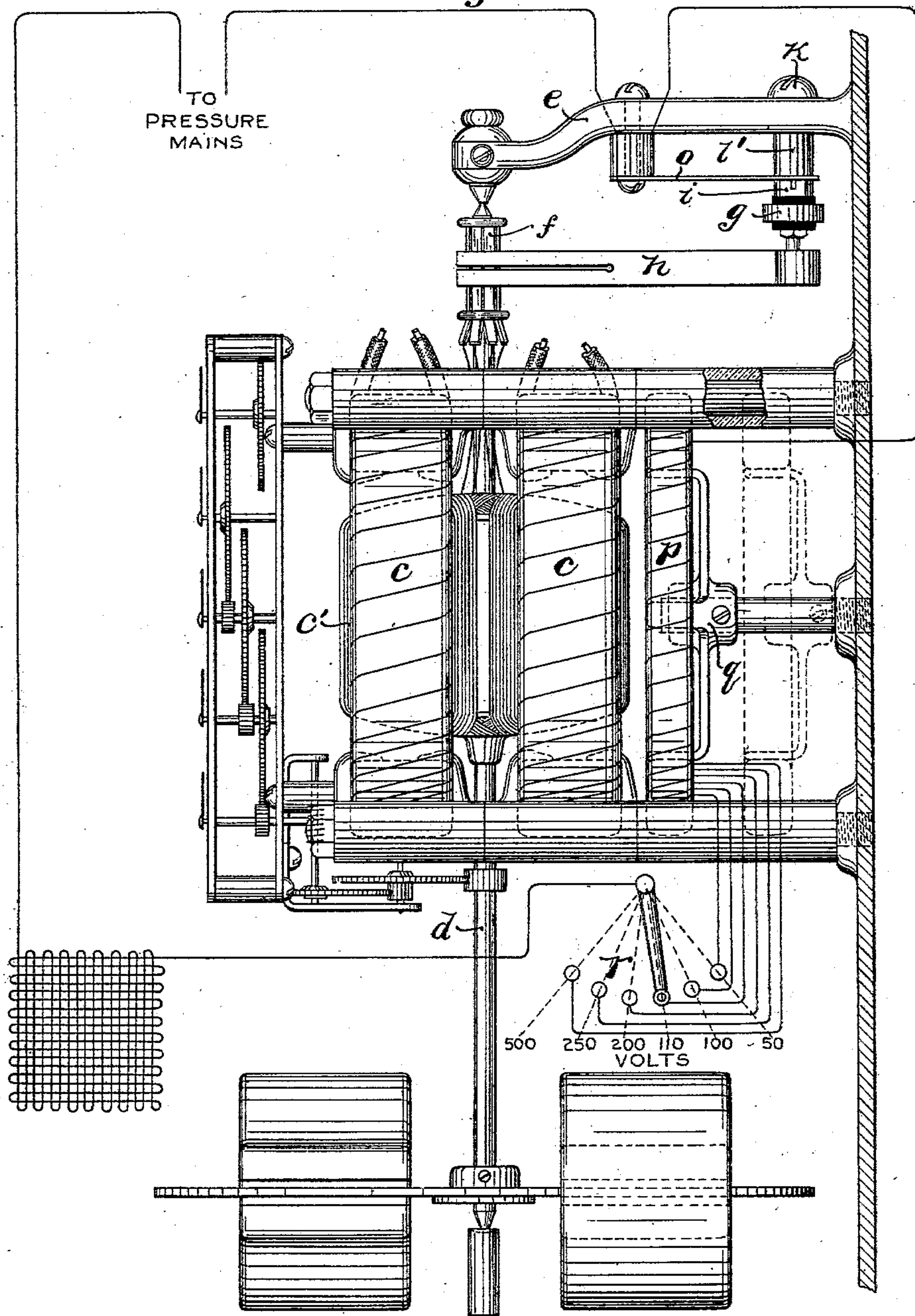
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NO MODEL.

3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

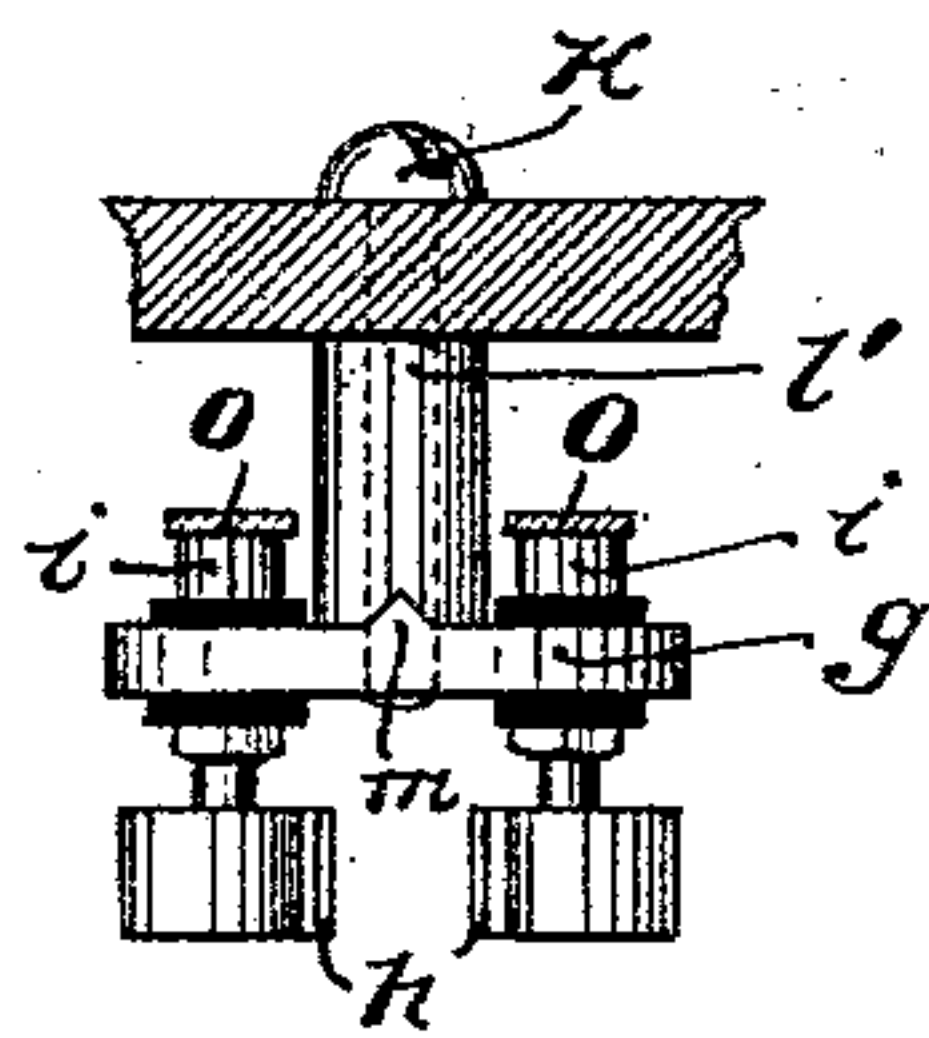


Fig. 4.

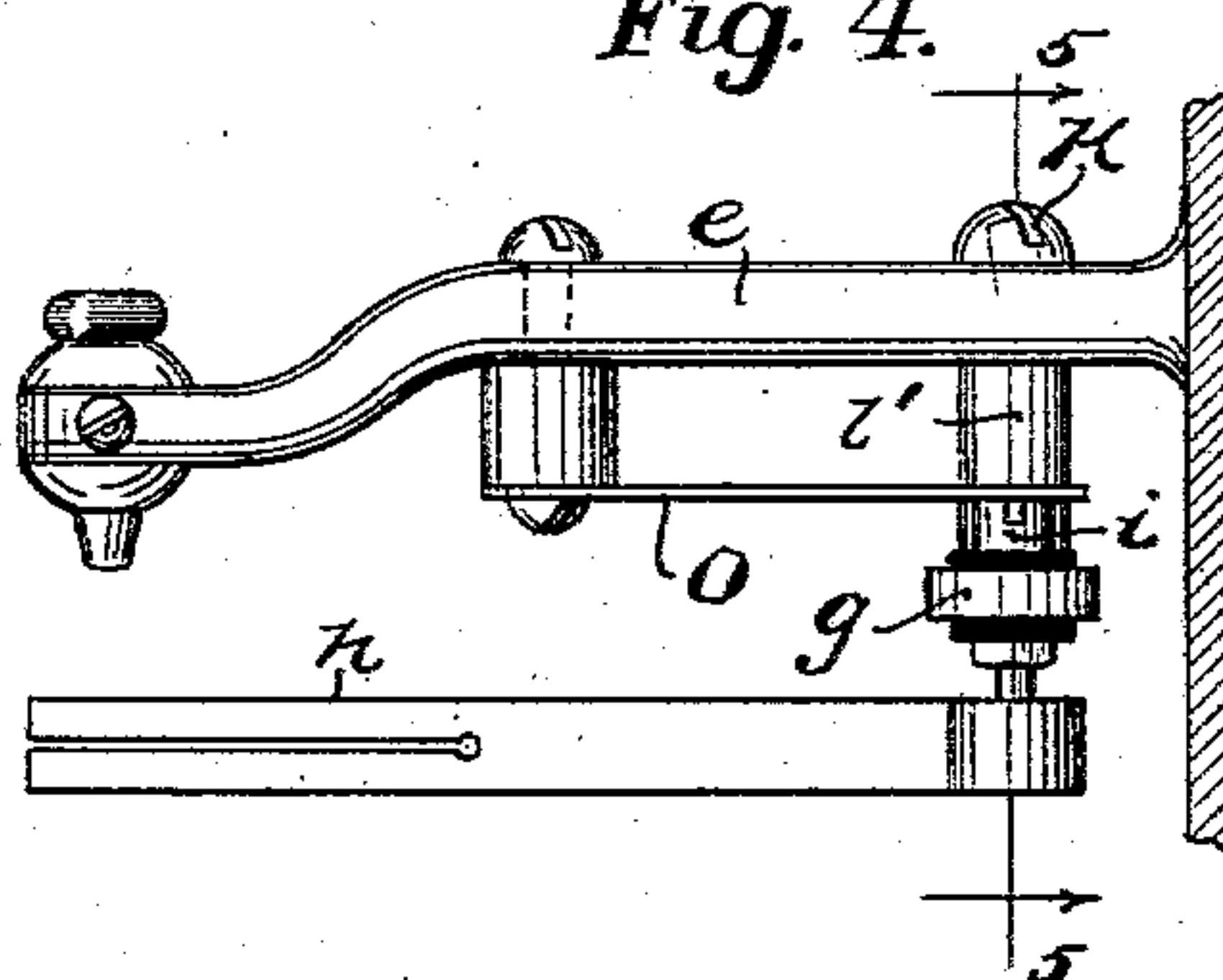


Fig. 5.

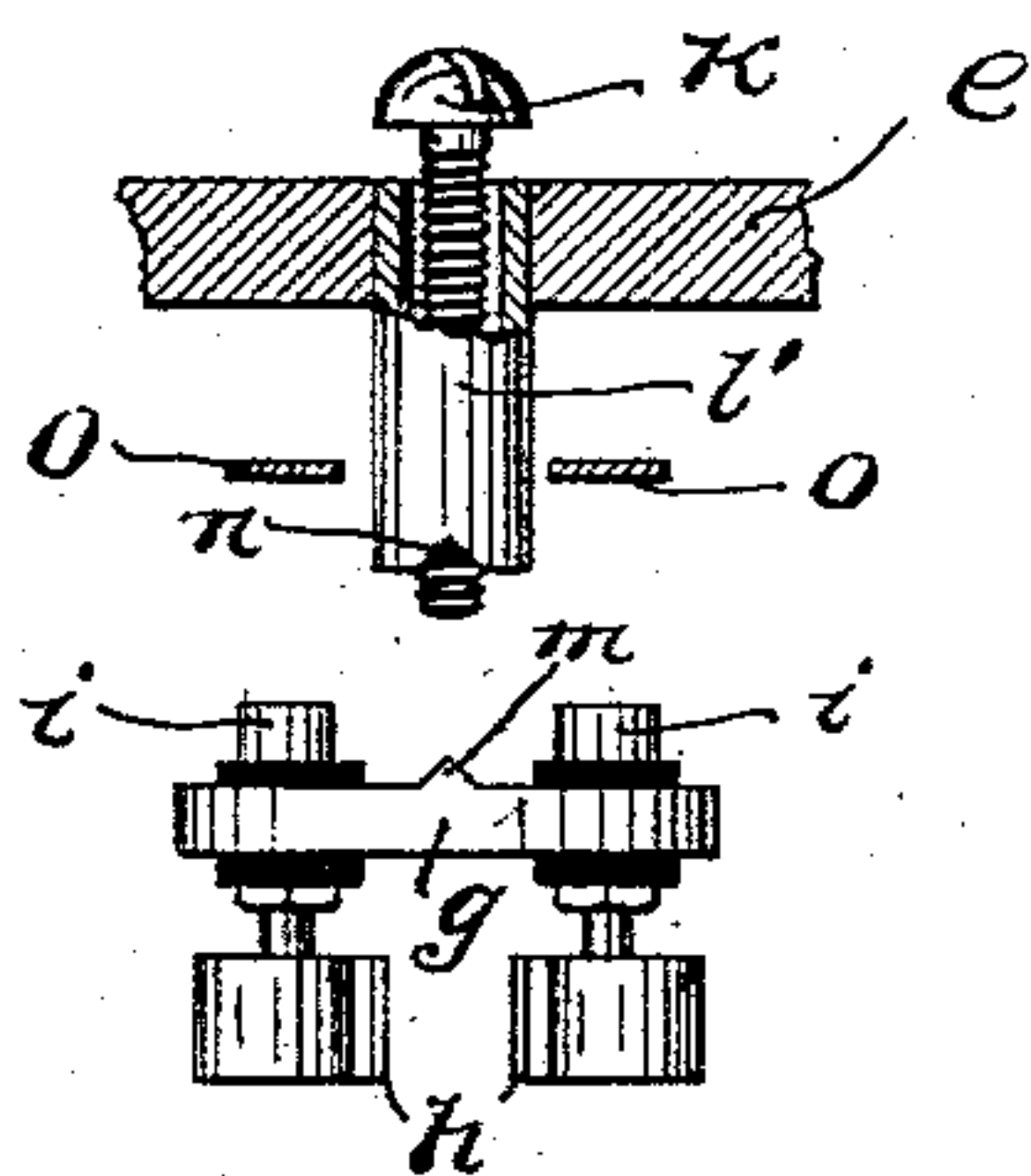
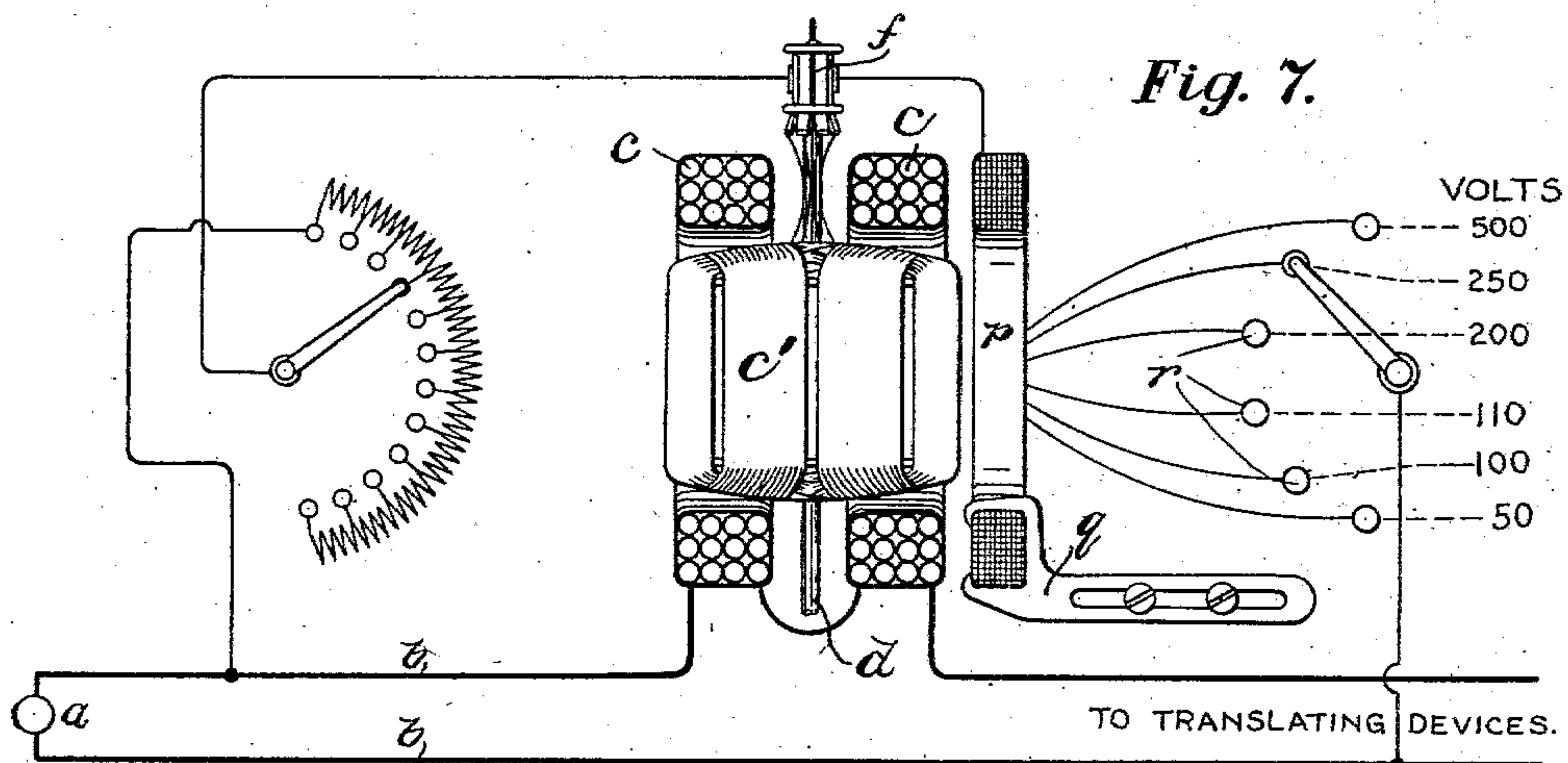
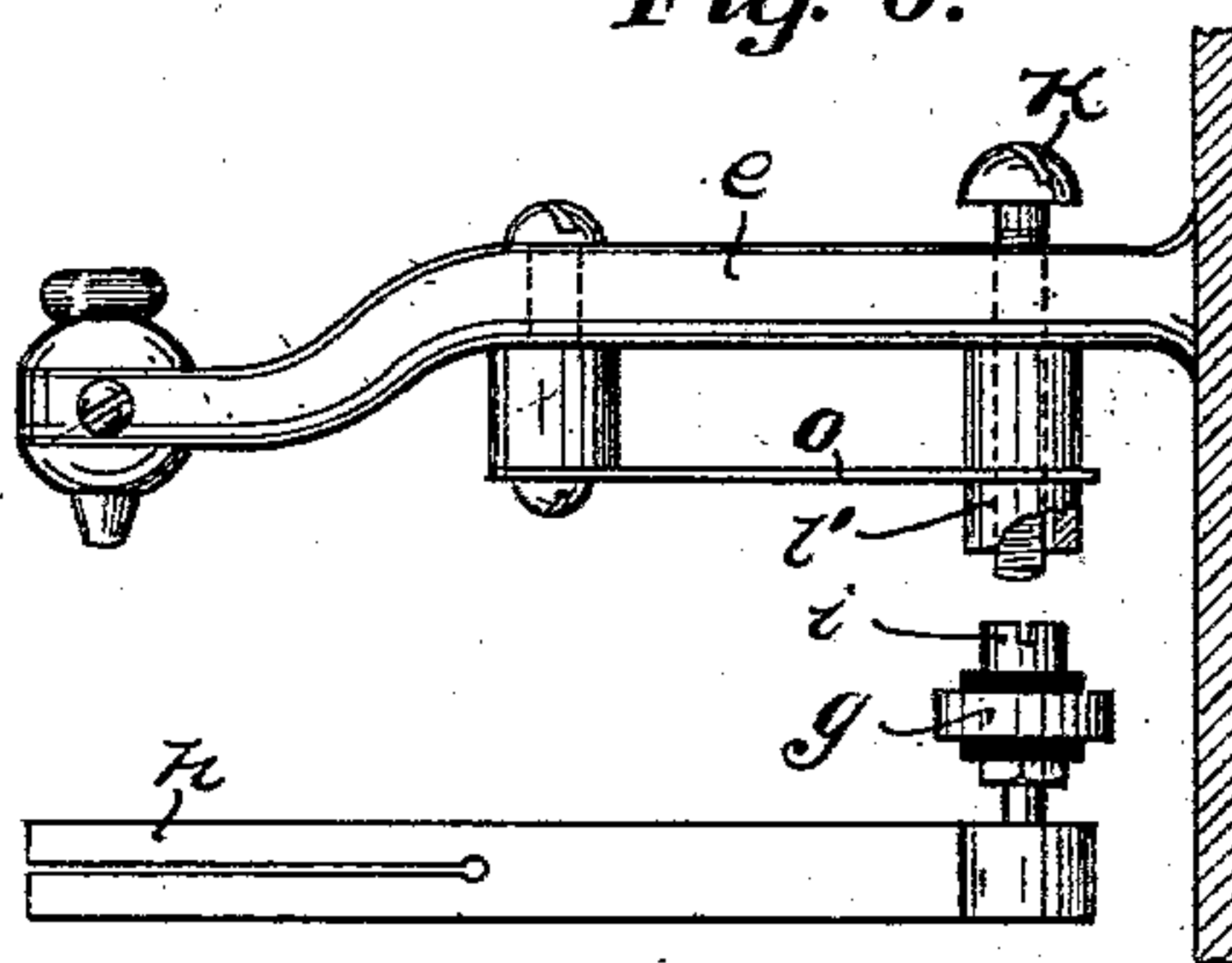


Fig. 6.



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# UNITED STATES PATENT OFFICE.

THOMAS DUNCAN, OF CHICAGO, ILLINOIS.

## ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 753,192, dated February 23, 1904.

Application filed July 18, 1901. Serial No. 68,751. (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 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 motor-meters, and has for its objects, first, the provision of electromagnetic means for compensating for variation in the pressure-field due to variation in voltages in working circuits, whereby a meter of given pattern may be used on circuits of different voltages, and, second, the provision of means whereby the commutators and commutator-brushes of commutated motor-meters may be readily polished without disturbing the tension adjustment of the brushes.

In practicing the first feature of my invention I prefer to employ an auxiliary field-winding and switching means in combination therewith, whereby more or less of the winding may be included in circuit to increase or decrease the field due thereto to compensate for an increased or decreased field in the pressure-winding due to variation in line-pressure. This field-winding may be physically adjustable, whereby it may be moved toward or from the armature of the meter.

In practicing the second feature of my invention I prefer to employ a support for the commutator-brushes which is removably secured to the frame of the meter or other suitable support and which carries the devices for effecting the tension adjustment of the brushes. By removing this support containing the brushes and the tension-adjusting means the commutator may be readily reached and cleaned, as well as the brushes, whereafter the brushes may be quickly replaced and engaged with the commutator without modifying the tension thereof upon the commutator.

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

Figure 1 is a front elevation of a meter con-

structed in accordance with the invention as associated with a system of distribution. Fig. 2 is a side view of the structure illustrated in Fig. 1, certain of the circuit connections being diagrammatically indicated. Fig. 3 is a detail view showing the removable support for the brushes and tension-adjusting devices. Fig. 4 is a side view of a portion of the meter-frame upon which the brush-support is removably secured. Fig. 5 is a view on line 5 5 of Fig. 4 with the brush-holder, however, removed. Fig. 6 is a side elevation of the parts as they appear in Fig. 5. Fig. 7 illustrates a modification of the means I employ for compensating for variation in the field of the pressure-winding of the meter.

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

In Fig. 1 I have illustrated a generator *a* supplying current to transmission-mains *b*, that convey the same to suitable translating devices. A commutated motor-meter is in this instance illustrated, although features of the invention are useful in connection with other types of meter. The current-coils *c c* are for the purpose of convenience connected in parallel with each other and in series with one of the mains. The pressure-winding is in this instance in the form of an armature-winding *d*, mounted upon a rotatable shaft *d*, which is secured at its upper and lower ends in suitable bearings, the upper bearing being provided in an arm *e*, projecting from the meter-frame. The upper end of the shaft *d* may support a commutator *f*.

Possibly the greatest trouble experienced in the care and management of commutated motor-meters arises in connection with the commutator and brushes. These become black, especially when pure silver is employed, wherever sparking results the meter then soon becoming unfit for service unless the commutator and brushes are cleaned and polished. This cleaning and repolishing should be accomplished without altering the tension given the brushes when the meter is originally calibrated at the factory. The brushes and commutator are usually cleaned while they are located upon the meter, the result being usually imperfectly accomplished. To make



the cleaning of the commutator and its brushes easy, I employ a detachable support *g*, holding the brushes *h h* and the tension-adjusting means *i i*, the brushes *h h* being mounted upon the pins secured to the tension-adjusting means. The support *g* is secured in position by means of a screw *k*, passing through the arm *e*, and a sleeve or tube *l'*, driven into the casting or arm *e*. By loosening the screw *k* the support *g* together with the brushes and tension-adjusting means are bodily detached from the meter, permitting access to the commutator and brushes to clean the same. After cleaning the support *g* may be readily replaced in position, obviously without modifying the tension of the brushes, and to secure the proper relative placement of the commutator-brushes with respect to the rest of the apparatus a lug or wedge-shaped portion *m* is provided upon the support *g*, engaging a corresponding recess *n* in the sleeve *l'*.

In order to avoid the necessity of coupling and uncoupling the wires in cleaning the commutator and its brushes, I prefer to employ contact-springs *o o*, that are included in the pressure-circuit and which engage the metallic portions *i i* in electrical connection with the brushes *h h*, the springs *o o* being forced into contact with the portions *i i* when the screw *k* is tightened.

My improved means for adjusting for different pressures comprises an auxiliary pressure-winding *p*, preferably in series with the armature and which is preferably mounted to be bodily movable, as indicated in Figs. 2 and 7, where sliding supports *q q* are illustrated, and which is also provided with circuit connections whereby the number of turns of the same included in circuit may be varied to compensate for the degree of magnetizing effect due to the armature or pressure winding. I have illustrated the switching devices *r* in Figs. 2 and 7, that register with contact-buttons that are marked with the voltages, upon which the arm of each switching device should be placed, to correspond with the voltage of the particular working circuit. If the meter is used, for example, on fifty volts, the switch is put on contact-button 50, which cuts in circuit all of the turns of the compensating or corrective coil *p*. I thus am enabled to provide a meter of uniform standard that is adapted for working circuits of different pressures, so that the cost of manufacture of meters may be greatly reduced, as the machinery for one style need only be used, and the quantity of meters kept in stock may be reduced to a minimum.

I believe it to be broadly new with me to provide switching mechanism in association with the auxiliary-pressure field-coil (that coil supplied in addition to the main or current field-coils and the armature) whereby the number of turns of the auxiliary coil may be varied irrespective of the precise use such an organ-

ism is put to. For example, I have found such an instrumentality to be of particular service where the auxiliary coil acts as a friction compensating coil.

While I have herein shown and particularly described the preferred embodiment of my invention, it is obvious that changes may readily be made without departing from the spirit thereof, and I do not, therefore, wish to be limited to the precise disclosure herein set forth; but,

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

1. A motor-meter provided with an armature-winding, a commutator for the armature, commutator-brushes for engaging the commutator to connect the armature in circuit, a detachable support for the commutator-brushes, a sleeve *l'*, and a screw *k* passing through the same into engagement with the said detachable support, substantially as described.

2. A motor-meter provided with an armature-winding, a commutator for the armature, commutator-brushes for engaging the commutator to connect the armature in circuit, a detachable support for the commutator-brushes, a sleeve *l'*, and a screw *k* passing through the same into engagement with the said detachable support, the support being provided with a projection *m* engaging a corresponding recess of the sleeve, whereby the brushes may be exactly reset to their original position, substantially as described.

3. A motor-meter provided with an armature-winding, a commutator for the armature, commutator-brushes for engaging the commutator to connect the armature in circuit, a detachable support for the commutator-brushes, springs *o o* secured upon the meter-frame, and parts *i i* in electrical connection with the brushes, brought into engagement with the springs *o o* when the detachable support is replaced, the said springs *o o* serving to convey current to the commutator-brushes and armature, substantially as described.

4. The combination with a motor-meter, of an adjustable auxiliary-pressure field-winding, a step-by-step adjusting means for adjusting the field of this auxiliary field-pressure winding to compensate for a variation in the field of a main-pressure winding, whereby the meter may be adapted to circuits of different voltages, and a calibrated scale associated with said step-by-step adjusting means, whereby the voltage for which said auxiliary field-pressure winding is adjusted may be ascertained, substantially as described.

5. The combination with a motor-meter, of an adjustable auxiliary-pressure field-winding, and step-by-step adjusting means for varying the number of turns of the said auxiliary winding to compensate for a variation in the field of a main-pressure winding, whereby the meter may be adapted to circuits of different voltages, substantially as described.



6. The combination with a motor-meter, of an adjustable auxiliary-pressure field-winding, and step-by-step adjusting means for adjusting the said winding bodily and means for adjusting the number of turns thereof to compensate for a variation in the field of a main-pressure winding, whereby the meter may be adapted to circuits of different voltages, substantially as described.

7. The combination with a motor-meter, of an adjustable auxiliary-pressure field-winding, and step-by-step adjusting means for varying the number of turns of the said auxiliary winding to compensate for a variation in the field of a main-pressure winding, substantially as described.

8. The combination with a motor-meter, of an adjustable auxiliary-pressure field-winding, and step-by-step adjusting switching mechanism for varying the number of turns of the said auxiliary winding to compensate for a variation in the field of a main-pressure winding, substantially as described.

9. The combination with a source of current, of mains leading therefrom to supply translating devices, a motor-meter having a current field-winding and a wound armature with its commutator and brushes, said armature being subject to the pressure of the circuit, an auxiliary coil in addition to the armature and field coils for adjusting the voltage of the meter and subject to the pressure of the circuit and provided to furnish a field for the armature and a switching device having a number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby render more or less of said coil subject to the pressure of the circuit and adjust the meter to the line-pressure, substantially as described.

10. The combination with a source of current, of mains leading therefrom to supply translating devices, a motor-meter having a current field-winding and a wound armature with its commutator and brushes, said armature being subject to the pressure of the circuit, an auxiliary coil in addition to the armature and field coils for adjusting the voltage of the meter and subject to the pressure of the circuit and provided to furnish a field for the armature, and switching mechanism for rendering more or less of said coil subject to the pressure of the circuit and adjust the meter to the line-pressure, substantially as described.

11. In a meter, the combination with the motor element thereof, including field portions and a wound armature with its commutator and brushes, of an auxiliary-pressure coil in addition to the armature and field coils for producing a field for the armature and a switching device having a number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby include more or less of said coil in circuit, substantially as described.

12. In a meter, the combination with the motor element thereof, including field portions and a wound armature with its commutator and brushes, of an auxiliary coil for adjusting the voltage of the meter and provided in addition to the armature and field coils adapted to be located between the mains of the system containing the meter for producing a field for the armature and a switching device having a number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby include more or less of said coil in circuit and adjust the meter to the line-pressure, substantially as described.

13. In a meter, the combination with the motor element thereof, including field portions and a wound armature with its commutator and brushes, of an auxiliary coil for adjusting the voltage of the meter and provided in addition to the armature and field coils adapted to be located between the mains of the system containing the meter for producing a field for the armature, and switching mechanism for including more or less of said coil in circuit and adjust the meter to the line-pressure, substantially as described.

14. In a meter, the combination with the motor element thereof, including field portions and a wound armature with its commutator and brushes, of an auxiliary-pressure coil in addition to the armature and field coils for producing a field for the armature, and switching mechanism for including more or less of said coil in circuit, substantially as described.

15. The combination with a source of current, the mains leading therefrom to supply translating devices, a motor-meter having a pressure-winding and a current field-winding, an auxiliary coil in addition to the pressure and current field-coils for adjusting the voltage of the meter and subject to the pressure of the circuit and provided to furnish a field for the armature and a switching device having a number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby render more or less of said coil subject to the pressure of the circuit and adjust the meter to the line-pressure, substantially as described.

16. In a meter, the combination with the motor element thereof, including pressure and current windings, of an auxiliary coil for adjusting the voltage of the meter and provided in addition to said windings adapted to be located between the mains of the system containing the meter for producing a field for the armature and a switching device having a number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby include more or less of said coil in circuit and adjust the meter to the line-pressure, substantially as described.



17. The combination with a source of current, of mains leading therefrom to supply translating devices, a motor-meter having a pressure-winding and a current field-winding, 5 an auxiliary coil in addition to the pressure and current field-coils for adjusting the voltage of the meter and subject to the pressure of the circuit and provided to furnish a field for the armature, and switching mechanism 10 for rendering more or less of said coil subject to the pressure of the circuit and adjust the meter to the line-pressure, substantially as described.

18. In a meter, the combination with the motor element thereof, including pressure and 15 current field-windings, of an auxiliary-pressure coil for adjusting the voltage of the meter and provided in addition to the armature and field windings for producing a field for the armature and a switching device having a 20 number of contact-buttons connected with different portions of said coil, and a switch-arm adapted to engage said buttons and thereby include more or less of said coil in circuit 25 and adjust the meter to the line-pressure, substantially as described.

19. In a meter, the combination with the motor element thereof, including pressure and current field-windings, of an auxiliary-pressure coil for adjusting the voltage of the meter and provided in addition to said windings 30 for producing a field for the armature, and switching mechanism for including more or less of said coil in circuit and adjust the meter to the line-pressure, substantially as described. 35

20. In a meter, the combination with the motor element thereof, including pressure and current windings, of an auxiliary - pressure coil for adjusting the voltage of the meter and provided in addition to said windings adapted 40 to be located between the mains of the system containing the meter for producing a field for the armature, and switching mechanism for including more or less of said coil in circuit and adjust the meter to the line-pressure, substantially as described. 45

In witness whereof I hereunto subscribe my name this 23d day of May, A. D. 1901.

THOMAS DUNCAN.

Witnesses:

GEORGE L. CRAGG,

HERBERT F. OBERGFELL.