D. J. ANGUS.

MOVABLE ELEMENT FOR METERS

APPLICATION FILED MAY 20, 1918.

1,370,179.

Patented Mar. 1, 1921.

3 SHEETS—SHEET 1.

Fig. 2.

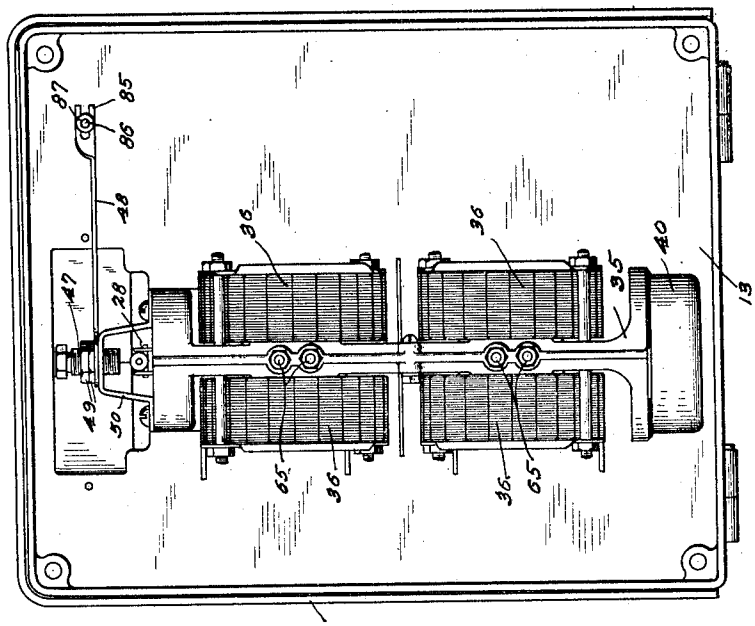
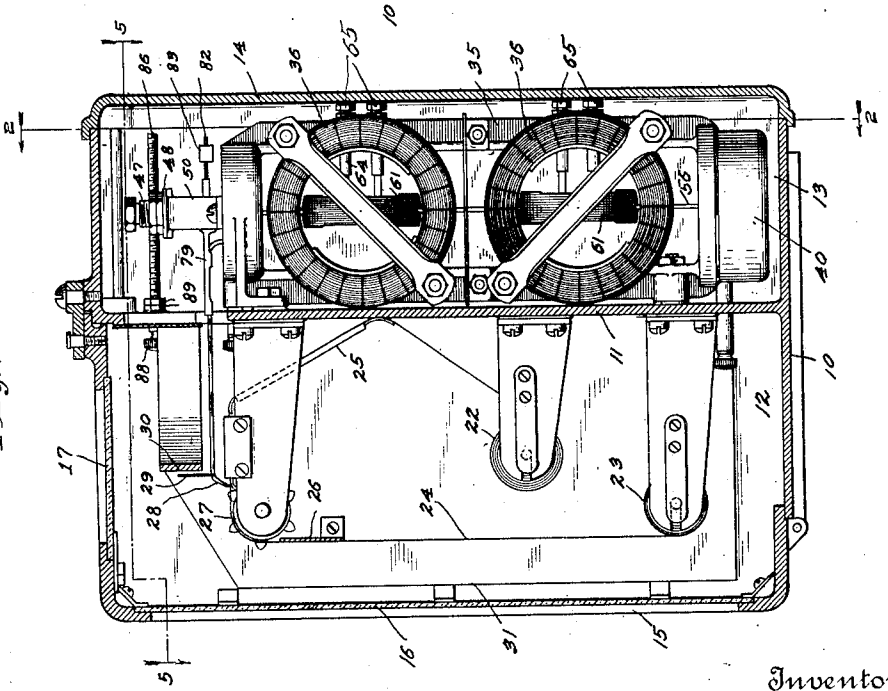


Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 3.

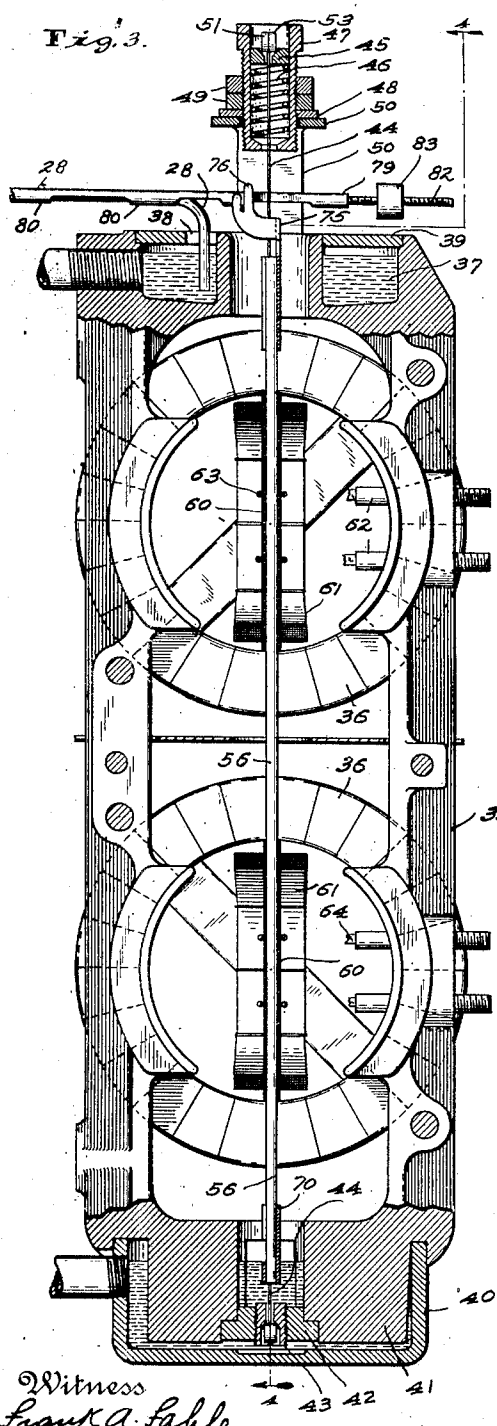
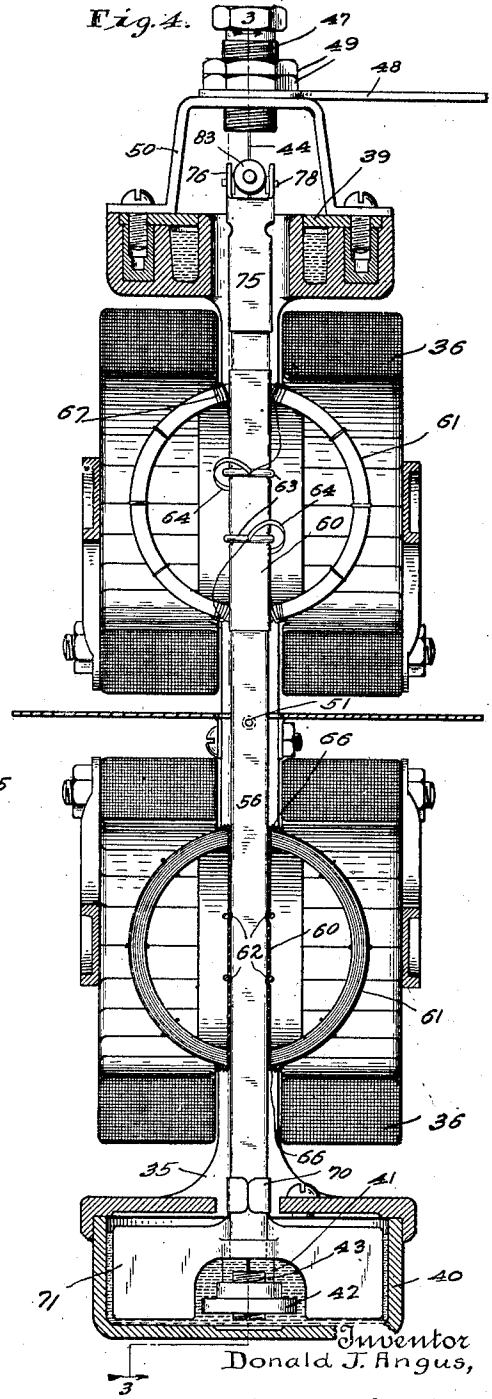


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

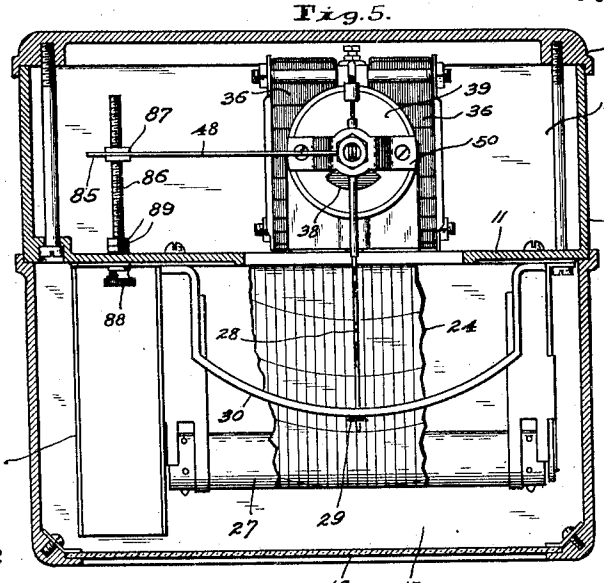


Fig. 6.

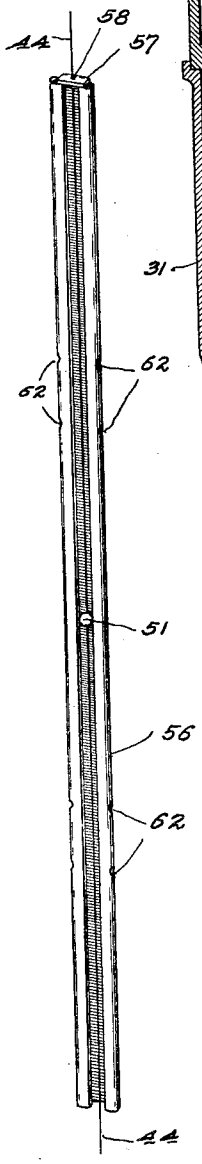


Fig. 7.

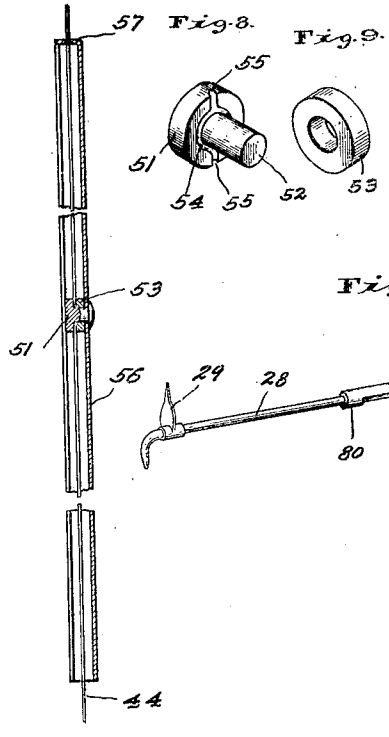


Fig. 8.

Fig. 9.

Fig. 10.

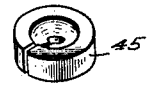


Fig. 11.

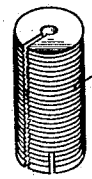


Fig. 12.

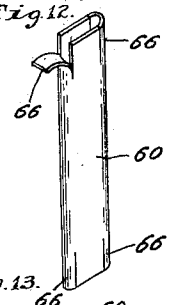


Fig. 13.

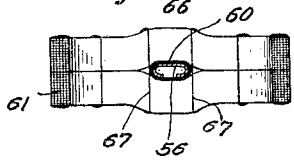


Fig. 14.

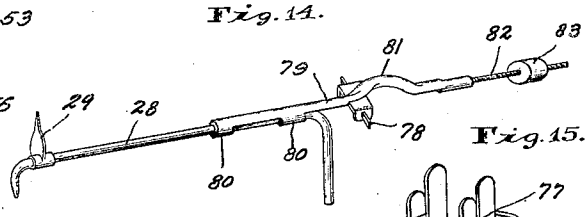
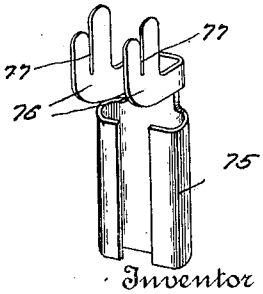


Fig. 15.



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UNITED STATES PATENT OFFICE.

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MOVABLE ELEMENT FOR METERS.

1,370,179. Specification of Letters Patent. Patented Mar. 1, 1921.

Application filed May 20, 1918. Serial No. 235,572.

To all whom it may concern:

Be it known that I, DONALD J. ANGUS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Movable Element for Meters, of which the following is a specification.

It is the object of my invention to provide an improved construction and mounting of the movable element of a meter.

The general arrangement of the meter and the structure of the stationary element form the subject-matter of my co-pending application Ser. No. 235,573, and the two point suspension of the movable element on the torsion wire forms the subject-matter of my co-pending application Ser. No. 235,574, both of even filing date herewith; and the construction and mounting of the pen form the subject-matter of my co-pending application Ser. No. 392,036, filed June 26, 1920.

The present application relates to the details of construction of the movable element and of the mounting of the torsion wire.

The accompanying drawings illustrate my invention as applied to an electric meter. Figure 1 is a vertical section through an electric meter embodying my invention; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a vertical section on a larger scale, in partial elevation, through the working elements of the meter; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is a horizontal section through the meter, with some parts broken away, the section being taken substantially on the line 5—5 of Fig. 1; Fig. 6 is a perspective on a larger scale of the mounting of the supporting staff of the movable element on the torsion wire; Fig. 7 is a longitudinal sectional detail of this staff and wire, with the parts broken away so that the remainder may be on a still larger scale; Figs. 8 and 9 are detail perspectives of the construction of the rivet and washer which are used for clamping the torsion wire at the ends and also for fastening to the main supporting staff at an intermediate point; Fig. 10 is a perspective detail of the spring-pressed disk in which the upper end of the torsion wire is mounted; Fig. 11 is a perspective detail of the screw in which the lower end of the torsion wire is mounted; Fig. 12 is a perspective detail of one of the insulating tubes by which the movable coil is mounted on the main supporting staff; Fig. 13 is a transverse section through one of the movable coils, showing its mounting; Fig. 14 is a perspective view of the removable pen; and Fig. 15 is a perspective detail of the clip by which the pen is supported on the main supporting staff.

The main casing 10 of the meter is divided by a vertical partition 11 into a front compartment 12 containing the record-making parts and the rear compartment 13 containing the metering parts. The metering parts and the record-making parts are all supported on the partition 11. The rear compartment 13 is closed by a removable back 14; and the front compartment 12 is closed by a hinged front cover plate 15 which forms the front, sides, and top of such compartment and has windows 16 and 17 of glass or other transparent material in front and top.

Suitably mounted in the front compartment 12 are a supply roll 22 and a winding roll 23 of a record sheet 24; which passes over suitable guides 25 and 26 and a feed roller 27, so that it has a horizontal portion visible through the top window 17 and on which the record is made by a pen 28, and a vertical portion on which the most recently made part of the record is visible through the front window 16. The pen 28 carries a pointer 29 which moves over an indicating scale 30, so that visual indication of the instantaneous condition being measured is given. The record sheet is driven in any suitable manner, as by clockwork, preferably inclosed in a casing 31 mounted within the compartment 12. This driving means operates the winding roll 23 and the feed roller 27, in any suitable manner.

Mounted within the compartment 13 on the partition 11 is the stationary non-magnetic frame 35 of the metering parts of the meter. This frame in the electric meter shown carries in any suitable manner the stationary coils 36 which produce the desired magnetic field. At its upper end the frame 35 is provided with an ink well or cup, through an arc-shaped slot 38 in the cover 39 of which the rear end of the pen 28 dips to feed the pen by capillary action. Fastened to the lower end of the frame 35 there is a liquid-holding cup 40, into which a partition 41 from the frame 35 projects downwardly to form a baffle plate retarding the liquid movement therein. Suitably mounted in the lower end of this partition

41 is a disk 42 which in turn carries a split screw plug 43 (shown in detail in Fig. 11) for supporting the lower end of the torsion wire 44 on which the movable element of the meter is carried. The upper end of the torsion wire is correspondingly mounted in a disk 45 (shown in detail in Fig. 10) spring-pressed upwardly by a spring 46 within a hollow plug 47. This plug 47 has a screw-threaded mounting within one end of an adjusting lever 48 and in a pair of lock nuts 49, and the adjusting lever 48 rests on a bridge 50 mounted on the upper end of the frame 35. The upper face of the disk 45 and the lower end of the screw plug 43 are recessed to receive a rivet in which the ends of the torsion wire 44 are fastened. This rivet comprises a head 51 and a shank 52, and a coöperating washer 53 through which the shank 52 projects; so that by riveting the end of the shank 52 the head 51 and washer 53 are clamped together. The under face of the head 51 is provided with a groove 54 around the shank 52, which groove communicates with two opposite radial grooves 55, so that the torsion wire may be laid in these grooves either part way or all the way around the shank 52. This furnishes a rigid fastening for the ends of the torsion wire, without affecting the characteristics thereof.

A similar washer and rivet are provided at an intermediate point in the wire 44, but here the shank 52 is slightly longer and projects through the wall of the main supporting staff 56 which carries the movable element of the meter; so that at this intermediate point the torsion wire 44 is riveted to the staff 56, and when the staff turns about its axis, along which the torsion wire lies, the parts of the torsion wire above and below this riveted point are twisted or untwisted. This fastening provides a rigid attachment between the intermediate point of the wire and the staff, without affecting the temper of the torsion wire, as would be the case if solder or other heat-requiring fastening were used.

The staff 56 is a flattened tube, with a longitudinal slot extending its full length on the opposite wall from that to which the intermediate rivet is fastened. This slot permits the ready attachment of this intermediate rivet to the wire and staff, for it is wide enough to permit the passage of such rivet. It also permits the torsion wire to be put in place within the staff without the necessity of being threaded all the way through the staff; it is for the same reason that the screw plug 43 and disk 45 are slotted. The staff 56 is conveniently made from a strip of sheet metal bent into the desired shape. In order to hold the staff 56 in upright position on the wire 44, it is provided, preferably only at the upper end, with an integral guide finger 57 which is bent down across the end of the staff and is provided with a hole 58 through which the torsion wire 44 extends. This provides a guiding support for the staff 56 on the wire 44 at a point removed from the point of rigid attachment formed by the intermediate rivet 51. The general idea of mounting the movable element of the meter on the torsion wire by this two point support—one point of rigid attachment and one guiding point—forms the subject-matter of my copending application Ser. No. 235,574.

A flattened insulating tube 60 (shown in detail in Fig. 12) forms the direct support for each pair of movable coils 61. In the meter shown there are two pairs of movable coils 61, each pair acting as a unit and coöperating with one pair of the stationary coils 36, of which there are also two pairs shown; but the number of sets of coöperating coils may be anything desired. All the sets act correspondingly to produce a deflection of the movable element of the meter. Each insulating tube 60 is of such size that it fits closely over the main supporting staff 56. The edges of the main supporting staff 56 are provided with two sets of notches 62 beneath each insulating tube 60, and the insulating tube 60 is clamped to the staff 56 by wire clamping clips 63 which extend around the tube 60 opposite each set of notches 62 to force the insulating material of the tube 60 into such notches. This holds the insulating tube 60 firmly in its proper place on the main supporting staff 56. The wire clips 63 also constitute the terminals of the associated pair of movable coils 61, the free ends of the wires of such pair of coils being soldered or otherwise fastened to such clips, and the clips being connected by flat strips 64 to the binding posts 65 mounted in the frame 35. The strips 64 extend from their wire clips to their binding posts in opposite directions around the staff, so as to balance each other in their mechanical effect on the torque of the movable element. The ends of the flattened insulating tube 63 are slit near each edge to provide tongues 66 at both edges at each end. These tongues are bent outward to lie against a portion of the outer face of the associated pair of movable coils 61, and these movable coils are lashed to these tongues by threads 67. This forms a rigid mounting for the movable coils 61 on the main supporting staff 56. By having the staff 56 and tube 60 flattened, they produce a minimum displacement of the associated pair of movable coils 61 where they pass beneath such coils.

To the lower end of the main supporting staff 56 is attached a sheet metal clip 70, which has formed on it a paddle 71 dipping into the liquid in the cup 40, so as to provide

a damping device. The flattened character of the main supporting staff 56 facilitates the attachment of this clip 70.

Another sheet metal clip 75 (shown in detail in Fig. 15) is mounted on the upper end of the main supporting staff 56, for carrying the pen 28. This sheet metal clip 75 has two upwardly extending arms 76 in which there are registering slots 77, the plane determined by these slots 77 being displaced forwardly from the torsion wire 44, as is clear from Fig. 3. The slots 77 receive a knife blade 78 on which is mounted a pen carrier 79. This pen carrier has attached to it at its forward end the pen 28, by a pair of fingers 80 surrounding the tubular body of the pen (as is clear from Fig. 14). To the rear of the knife blade 78, the pen carrier 79 has a curved offset portion 81 where it passes the torsion wire 44, so that it will not interfere with such torsion wire; and beyond such offset portion is provided with a rearwardly projecting screw 82 on which is screw mounted a counterweight 83, which may be adjusted to control the vertical position of the marking end of the pen 28 and its downward pressure on the record sheet. The pen unit, comprising the pen 28 proper, the pen carrier 79, and its supporting knife blade 78, may readily be removed, by lifting the knife blade 78 from the slots 77. Such removal is desirable for convenience and protection in shipping and installing the meter, and in filling and cleaning the pen.

In order to adjust the torsion of the torsion wire 44 to bring the pen 28 and the pointer 29 to the proper zero point, the adjusting lever 48 may be operated to vary the circumferential position of the upper end of the torsion wire 44. This is conveniently done by providing the outer end of the adjusting lever with a fork 85, through which an adjusting screw 86 projects. This adjusting screw is provided with a slotted nut 87 which coöperates with the fork 85, so that when the screw 86 is turned the nut 87 and therefore the outer end of the adjusting lever 48 are moved to vary the circumferential position of the upper end of the torsion wire 44. Preferably the screw 86 extends through the partition 11, and is provided in the front compartment 12 with a knurled head 88, whereby it may be operated, the screw being held in proper position with relation to the partition 11 by the head 88 and a pair of lock nuts 89 in the compartment 13.

I claim as my invention:

1. In a meter, the combination of a torsion wire, a hollow staff along which said wire extends substantially axially, said staff being provided with a longitudinal slot so that the torsion wire may be inserted laterally into it, fastening means for attaching to said staff a point of said torsion wire within it, and a movable meter element mounted on said staff.

2. In a meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff being provided with a longitudinal slot so that the torsion wire may be inserted laterally into it, a rivet insertible through said slot for rigidly attaching to said staff a point of the torsion wire within it, and a movable meter element mounted on said staff.

3. In a meter, the combination of a torsion wire, a sheet metal member bent into the form of a slotted tube along which said torsion wire extends substantially axially, said slot permitting the lateral insertion of said wire into said tube, and a movable meter element mounted on said tube.

4. In an electric meter, the combination of a torsion wire, a hollow staff along which said wire extends substantially axially, said staff being fastened to said wire within it, and a pair of coils mounted side by side on said staff on opposite sides thereof, said staff being flattened in the plane of said coils so as to produce a minimum displacement of the coils where they pass it.

5. In an electric meter, the combination of a torsion wire, a hollow staff along which said wire extends substantially axially, said staff being fastened to said wire within it, and a pair of coils mounted side by side on said staff on opposite sides thereof.

6. In a meter, the combination of a sheet metal member bent into the form of a flattened tube slotted along one flat side, said sheet metal member having at an end an integral guide finger bent across the end and provided with a perforation substantially in line with the axis of the tube, a torsion wire extending through said perforation and through the tube substantially along its axis, and a rivet insertible through said slot and fastening said torsion wire to said tube at a point removed from said finger.

7. In a meter, the combination of a sheet metal member bent into the form of a tube, said sheet metal member having at an end an integral guide finger bent across the end and provided with a perforation substantially in line with the axis of the tube, a torsion wire extending through said perforation and through the tube substantially along its axis, and means fastening said torsion wire to said tube at a point removed from said finger.

8. In a meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said staff being provided with notches, a clip around said tube in the plane of

said notches to force part of the tube into the notches in the staff to lock the tube and staff together, and a movable meter element mounted on said tube.

9. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said tube being of insulating material and said staff being provided with two notches beneath said tube, two clips around said tube in the planes of said two notches respectively to force parts of the tube into the notches to lock the tube and staff together, and a coil mounted on said tube and having terminals connected to said two clips respectively.

10. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said staff being provided with notches, a clip around said tube in the plane of said notches to force part of the tube into the notches in the staff to lock the tube and staff together, and a pair of coils mounted side by side on said tube on opposite sides thereof, both staff and tube being flattened in the plane of said coils.

11. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said tube being of insulating material and said staff being provided with two notches beneatn said tube, two clips around said tube in the planes of said two notches respectively to force parts of the tube into the notches to lock the tube and staff together, and a pair of coils mounted side by side on said tube on opposite sides thereof, both staff and tube being flattened in the plane of said coils, and terminals of said coils being connected to said two clips respectively.

12. In a meter, the combination of a torsion wire; a slotted staff along which said wire extends substantially axially; a rivet fastening to said staff a point of the wire within the latter, said rivet comprising a shank extending through the staff, a head on said shank, and a washer between which and the head the wire is clamped, said head being an arc-shaped groove around the shank and a pair of opposite radial grooves communicating with the arc-shaped grooves so as to receive the torsion wire; and a movable meter element mounted on said staff.

13. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff and fastened thereto, and a pair of coils mounted side by side on said tube on opposite sides thereof, said tube being slotted at the ends to provide fingers which are bent outward to engage said coils.

14. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube teles oped over said staff and fastened thereto, and a pair of coils mounted side by side on said tube on opposite sides thereof, said tube being slotted at the ends to provide fingers which are bent outward to engage said coils, said staff and tube being flattened in the plane of said coils, and said fingers being bent outward substantially in the plane of the coils.

15. In a meter, a torsion wire; a movable meter element mounted thereon; a rivet attached to an end of said torsion wire, said rivet comprising a head, a shank, and a washer held against the head by the riveting of said shank, and one of the faces between said head and washer being provided with a circular groove around said shank and a radial groove communicating with said circular groove to receive the torsion wire; and a supporting member against which said rivet bears.

16. In a meter, a torsion wire, a movable meter element mounted on said torsion wire, head members on the ends of said torsion wire, abutments against which said head members bear, and a hollow plug in which one of said abutments is spring-mounted so as to put tension on said torsion wire, said hollow plug being circumferentially adjustable.

17. In a meter, a torsion wire, a movable meter element mounted on said torsion wire, head members on the ends of said torsion wire, abutments against which said head members bear, a hollow screw plug in which one of said abutments is spring-mounted so as to put tension on said torsion wire, adjusting nuts for adjusting said screw plug longitudinally, and means for adjusting said screw plug circumferentially.

18. In a meter, the combination of a sheet metal member bent into the form of a tube slotted along one side, said sheet metal member having at an end an integral guide finger bent across the end and provided with a perforation substantially in line with the axis of the tube, a torsion wire extending through said perforation and through the tube substantially along its axis, and a rivet insertible through said slot and fastening said torsion wire to said tube at a point removed from said finger.

19. In an electric meter, the combination of a torsion wire, a staff along which said

wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said tube being of insulating material and said staff being provided with a notch beneath said tube, a clip around said tube in the plane of said notch to force part of the tube into the notch to lock the tube and staff together, and a coil mounted on said tube and having a terminal connected to said clip.

20. In an electric meter, the combination of a torsion wire, a staff along which said wire extends substantially axially, said staff and said wire being fastened together at a point within the staff, a tube telescoped over said staff, said tube being of insulating material and said staff being provided with a notch beneath said tube, a clip around said tube in the plane of said notch to force part of the tube into the notch to lock the tube and staff together, and a pair of coils mounted side by side on said tube on opposite sides thereof, both said staff and tube being flattened in the plane of said coils, and a terminal of said coils being connected to said clip.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 15th day of May, A. D. one thousand nine hundred and eighteen.

DONALD JAMES ANGUS.

Witnesses:
R. E. KENNEDY,
E. P. HIXSON.