No. 863,799. PATENTED AUG. 20, 1907.

C. E. HOLMES.

ELECTRIC METER.

APPLICATION FILED NOV. 23, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

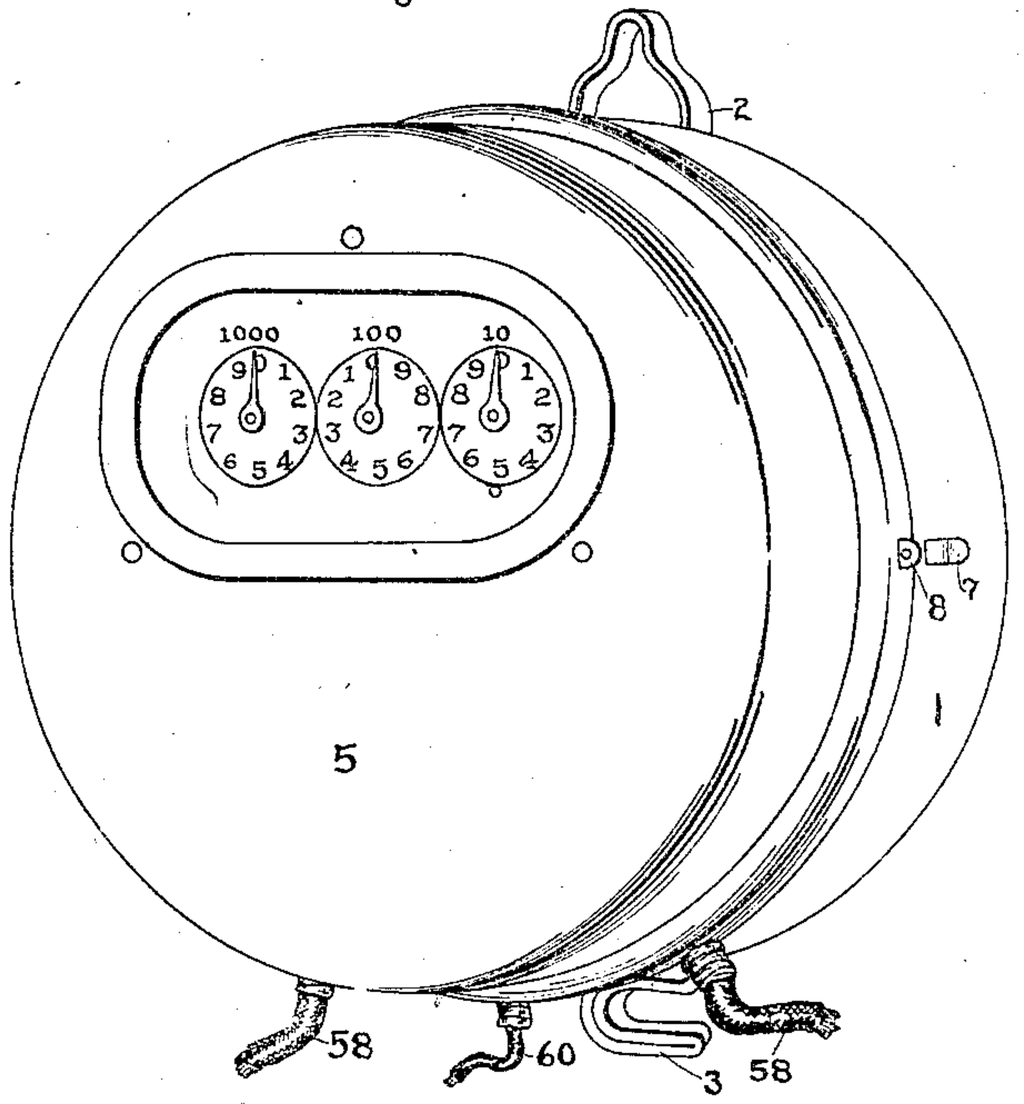

Fig. 2.

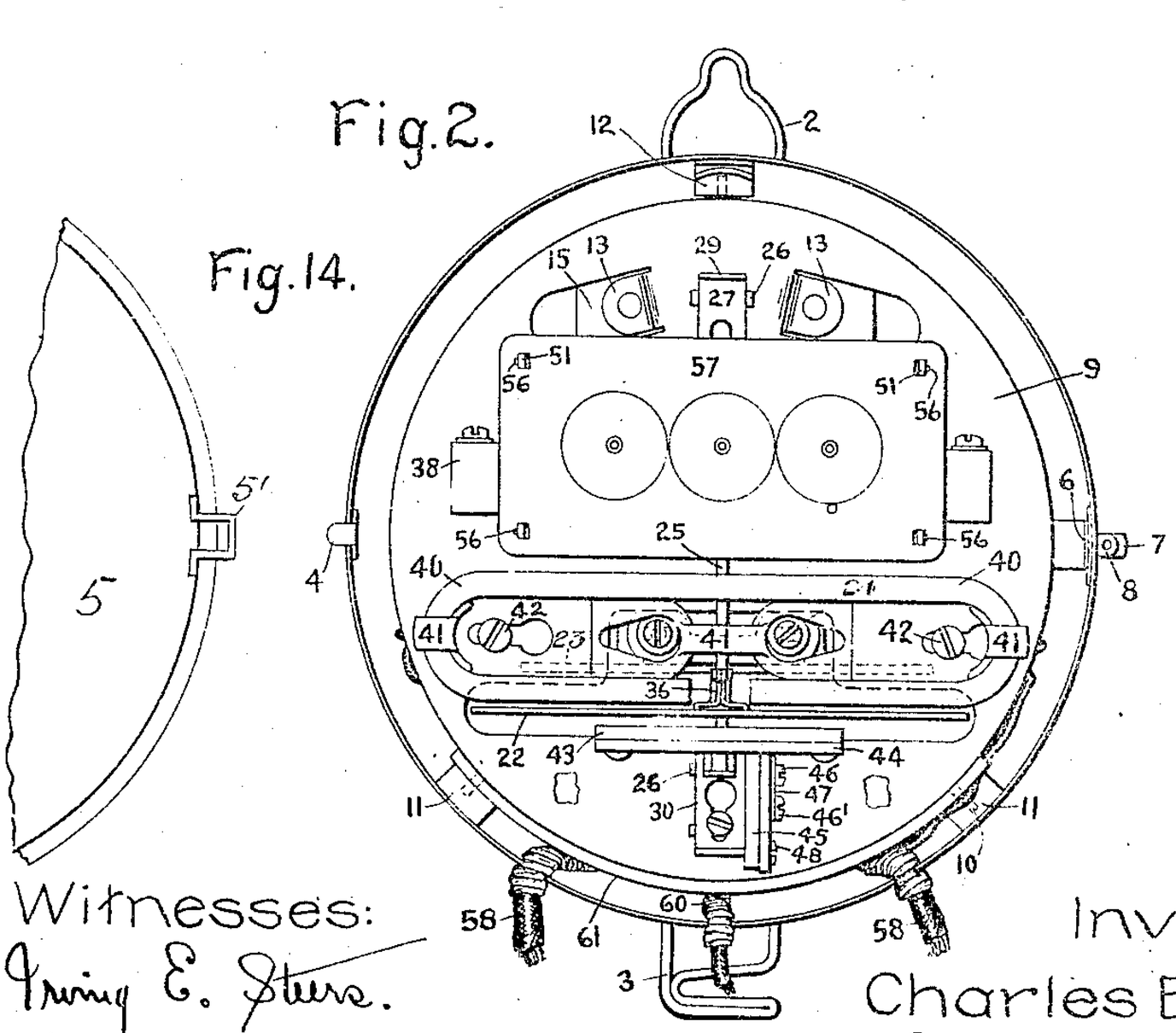

Fig. 14.

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3 SHEETS—SHEET 2.

Fig. 3.

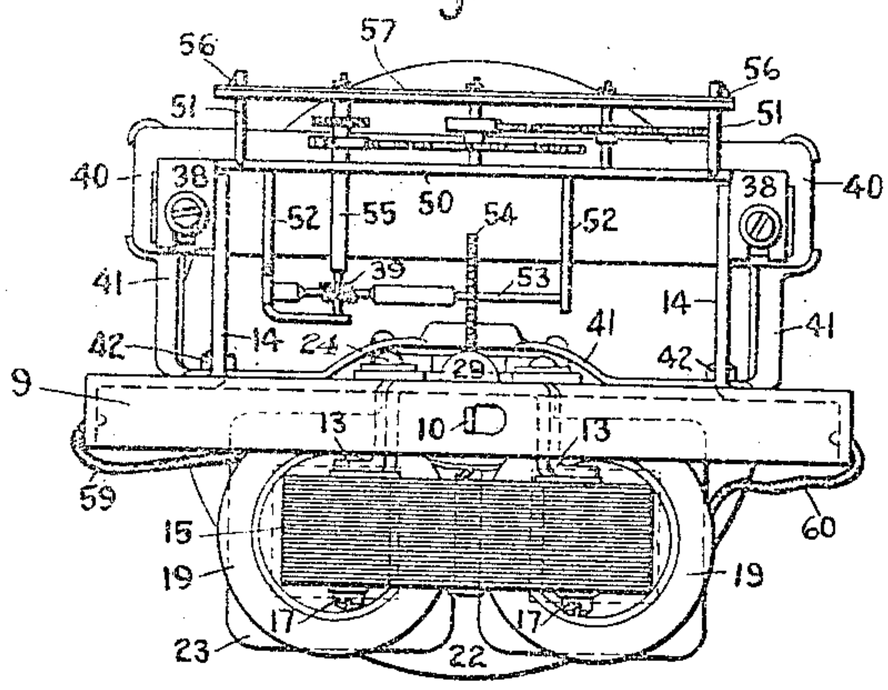


Fig. 4.

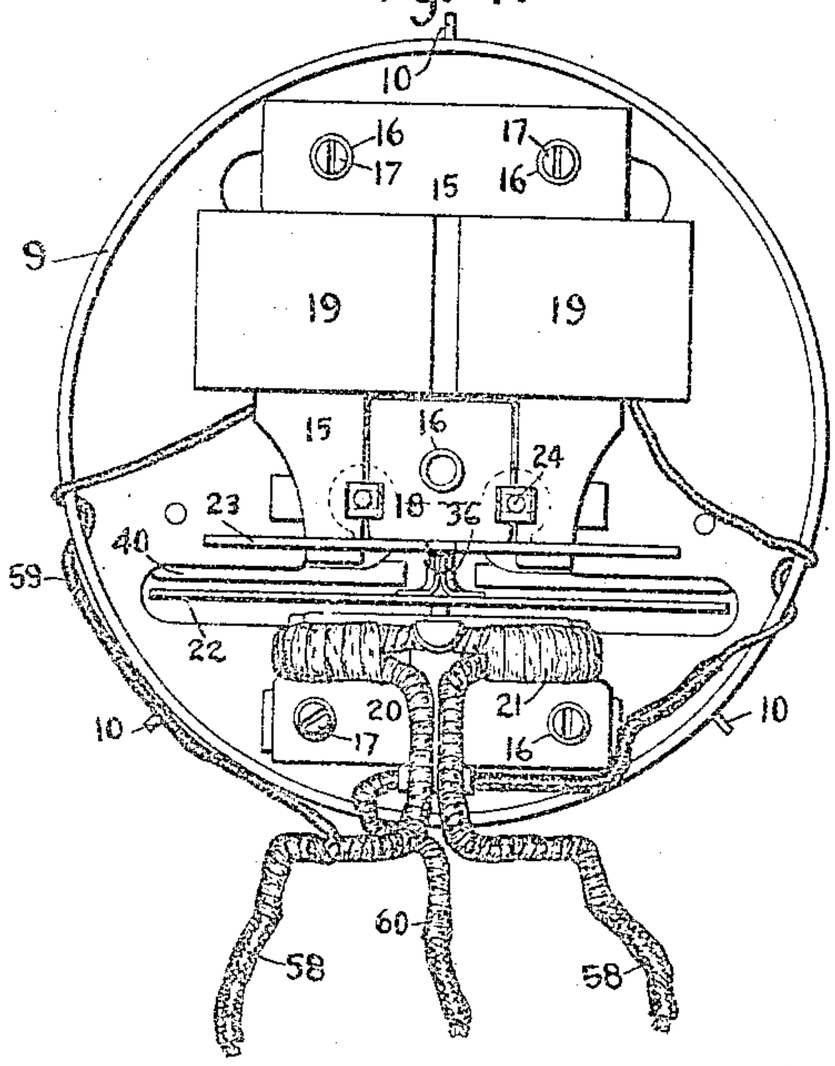
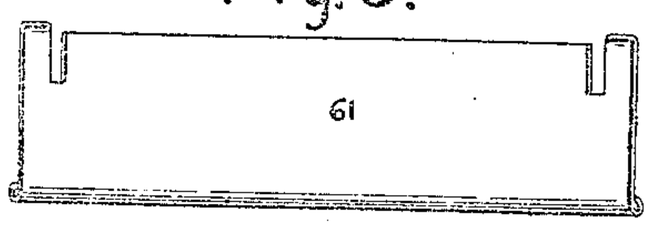


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

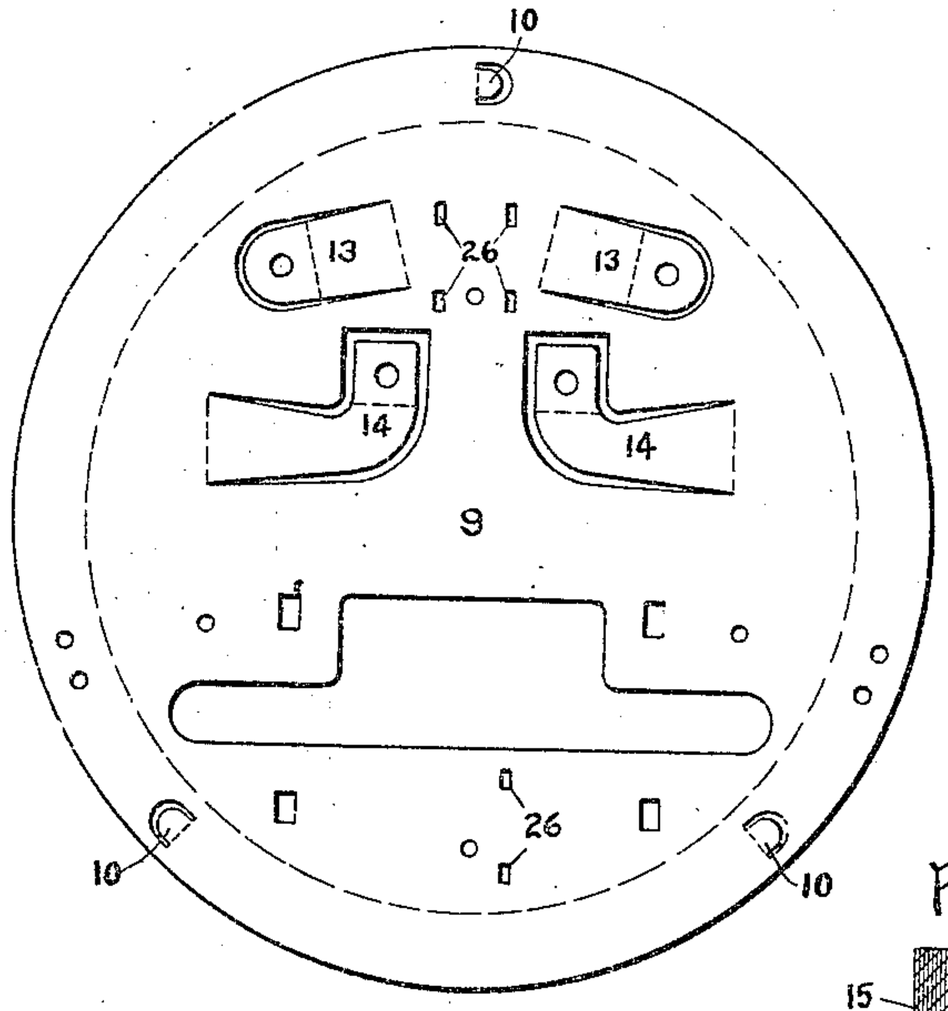


Fig. 9.

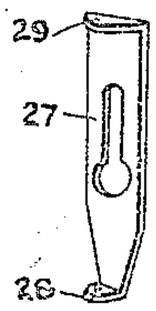


Fig. 10.

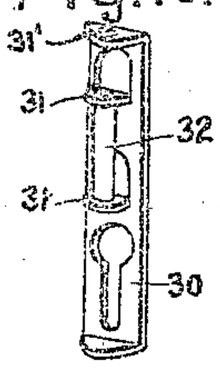


Fig. 11.

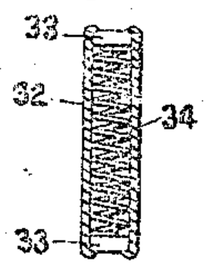


Fig. 7.

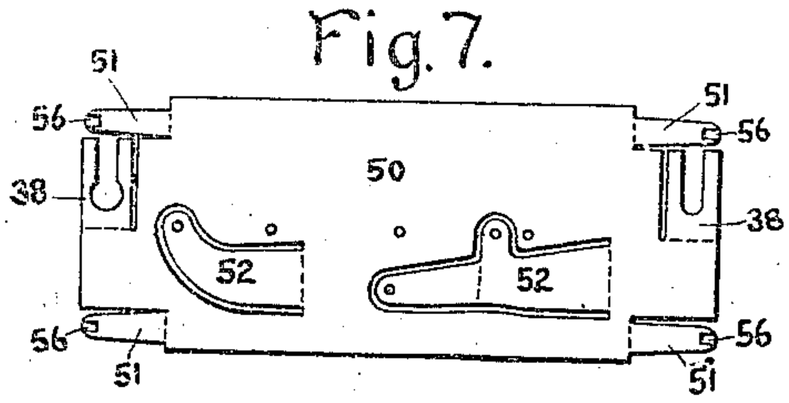


Fig. 8.

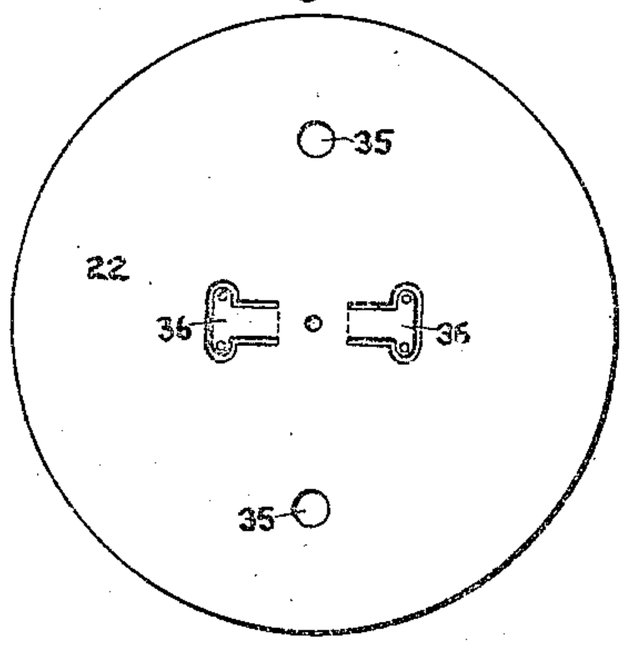


Fig. 12.

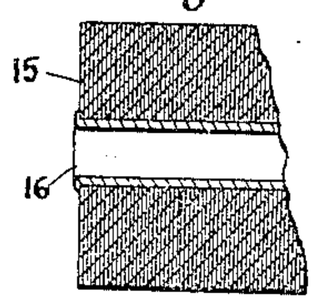
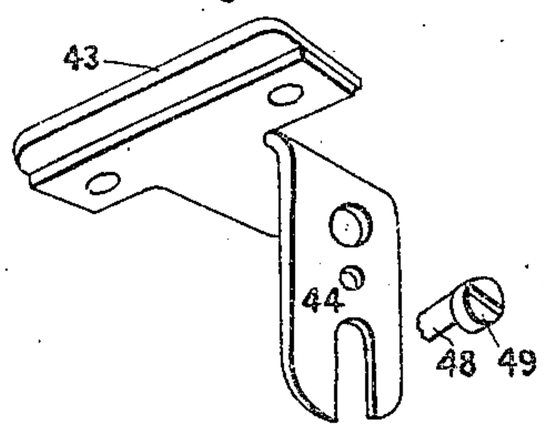


Fig. 13.



Witnesses:

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UNITED STATES PATENT OFFICE.

CHARLES E. HOLMES, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC METER.

No. 863,799. Specification of Letters Patent. Patented Aug. 20, 1907.

Application filed November 23, 1904. Serial No. 233,942.

To all whom it may concern:

Be it known that I, CHARLES E. HOLMES, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Meters, of which the following is a specification.

This invention relates to electric meters, with special reference to integrating electric meters of the motor type.

The invention relates more particularly to integrating induction meters, but certain features of the invention are applicable also to direct-current integrating motor meters, and other features are applicable to electrical measuring instruments of all classes.

The primary object of my invention is to reduce the cost of meters of this type, and I accomplish this by constructing and arranging the parts so that the meter is of small size and light weight, by making many of the parts of sheet-metal punchings, some of them having integral arms bent in proper relation to support other parts, by eliminating binding-posts and running the leads direct to the coils of the meter, and by securing many of the parts together without using screws.

Another object of my invention is to make the parts of the meter readily accessible, and one way which I have adopted for accomplishing this is to assemble all the parts on a supporting member and detachably securing this member within the casing of the meter.

Another object of my invention is to provide an improved means for adjusting the damping effect and with it the speed of rotation of the moving element of the meter.

These and other objects, together with the details of construction and mode of operation of my improved meter, will be better understood by reference to the following description taken in connection with the accompanying drawings, which illustrate the preferred embodiment of my invention.

The novel features of my invention will be definitely indicated in the claims appended hereto.

In the drawings, Figure 1 is a perspective view of the meter; Fig. 2 is a front view with the cover removed; Fig. 3 is a top view of the operating mechanism; Fig. 4 is a back view of the same; Fig. 5 is a view of the guard; Fig. 6 is a plan view of the supporting member; Fig. 7 is a plan view of the back plate of the dial; Fig. 8 is a plan view of the disk armature; Fig. 9 is a perspective view of the upper bearing; Fig. 10 is a perspective view of the lower bearing; Fig. 11 is a sectional elevation of the tube carrying the bearing block; Fig. 12 is a detail of the magnetic circuit; Fig. 13 is a perspective view of the armature of the damping device; and Fig. 14 shows a detail of the casing.

Referring to the drawings, the meter is inclosed within a casing of drawn metal of circular form consisting of a back and cover. Riveted to the back 1 are two supporting feet 2 and 3 for mounting the meter on a wall or other support. These feet are made from metal strips bent to the proper shape and riveted to the back 1, the foot 2 being of key-hole form and the foot 3 in the form of a slot opening at the side. By this construction the screws for supporting the meter may be secured in position and the meter afterwards placed thereon by placing foot 2 over the upper screw, then lowering the meter until the screw is at the top of the opening and then turning the meter on the upper screw as a pivot until the foot 3 is in proper relation to the lower screw. It will be seen that this construction also permits taking the meter from the wall without removing any screws. At the edge of the back 1 on one side is a tongue 4, and the cover 5 is provided with an eye 5′ on that side. Secured to the back on the opposite side is a stiff flat spring 6 having a button 7 thereon extending through a slot in the back 1 and extended at its upper end to form a tongue 8 which is bent at an angle and is adapted to protrude through an eye in the cover 5. This tongue 8 is provided with a hole through which a sealing wire may be passed to prevent anyone from gaining access to the meter.

All of the operating mechanism of the meter is supported on a central diaphragm or supporting member 9, and this supporting member is detachably mounted within the casing. The entire operating mechanism can therefore be quickly and readily taken out of the casing so that all parts are perfectly accessible for inspection or repair, and this may be done without even removing the meter from the wall or other support. For this purpose the supporting member 9 is provided with three lugs 10, two of which enter receivers or openings in strips 11 which are riveted to the back 1. A stiff flat spring 12 turned up slightly at its outer end and provided with a suitable receiver or opening is riveted to the back at the top of the meter. To secure the operating mechanism in position within the casing the two lower lugs 10 on the supporting member 9 are inserted in the holes in the strips 11 and then a slight downward pressure on the supporting member causes the upper lug 10 to engage the spring 12 and force it upward until the lug enters the hole in the spring and the latter then snaps over it and holds the operating mechanism securely. The cover 5 may then be put on by hooking the tongue 4 in the eye on one side of the cover, pressing button 7 and then pressing the cover down over the rim of the back, whereupon the button is released and spring 6 snaps back carrying tongue 8 through the eye in the cover. The cover is then held securely on both sides and a seal wire may be threaded through the opening in tongue 8.

As above described, all the operating parts of the me-

ter are secured on a supporting member 9, and this member is preferably a sheet-metal punching. As the motor mechanism is secured on one side of the member 9 and the magnetic retarding device on the other side, the member 9 is preferably made of iron or other magnetic material in order to take advantage of its shielding effect against magnetic fields. The punching which forms the member 9 is shown in Fig. 6; its outer edge is turned over at right angles along the line of the dotted circle, and the portions 10 are bent as indicated by the dotted lines to form the projecting lugs 10 above referred to. The member is punched so as to form portions 13, 13 and 14, 14, which may be bent at right angles along the dotted lines to support parts of the meter. The portions 13, 13 are bent backwards as shown in Figs. 2 and 3 and support a part of the meter motor. As is usual in induction meter motors, the magnetic circuit consists of bundles of laminations of sheet metal on which series and potential coils are wound. One set of laminæ 15 are U-shaped and are secured together by brass tubes 16, as shown in Fig. 12, the ends of which are expanded to hold the laminæ together. Tubes 16 may if desired be insulated with an outer coating of enamel. When properly secured together by the tubes 16, the U-shaped laminæ 15 are mounted in an inverted position by bolts or screws 17 which are inserted through the tubes 16 and screwed into threaded openings in the ends of the arms 13. By this construction the laminæ are held tightly together independently of the screws 17 so that even if the screws become loose there will be no rattling or humming in the meter. Another set of laminæ 18 are secured together in like manner and placed between the legs of the U-shaped set 15 for the purpose of short-circuiting a large part of the magnetic flux imposed by the potential coils leaving but a small part to pass through the disk. The air gaps between the two sets 15 and 18 are spaced by metal tubes 24 which not only determine their width but insure them against change. Potential coils 19, 19 are wound on the legs of the U 15 and connected in series. Opposite the ends of the legs of the U, as shown in Fig. 4, are mounted a third set of laminæ 20 around which the series coil 21 is wound, the latter consisting of only a few turns of wire of relatively large cross-section. The disk armature 22 of the motor is arranged for rotation in the narrow space between the sets of laminæ 15 and 20. A starting plate 23 consisting of a punching of sheet copper in the form of a double loop as shown in dotted lines in Fig. 3, is mounted in position with a leg of the U extending through each loop and is horizontally adjustable as shown in dotted lines in Fig. 4. The operation of the meter motor as thus constructed will be readily understood by those skilled in the art.

The shaft 25 of the disk armature is mounted for rotation in bearings secured on the front of the supporting member 9. To simplify the construction and facilitate adjustment of the bearings, projections 26 are struck up from the supporting member 9 as shown in Fig. 6 between which the bearings are held. The upper bearing 27 consists of a punching of sheet brass, as shown in Fig. 9, having its ends bent at right angles to the body portion and provided with a key-hole slot. The lower end portion 28 has an opening therein through which the reduced upper end of the shaft 25 extends. It will thus be seen that the upper bearing is readily adjustable by merely loosening the one screw which holds it and moving it vertically between the projections 26 by means of the upper end portion 29. The support 30 for the lower bearing for shaft 25 is also of sheet metal and slides between projections 26 struck up from the supporting member 9 and a bracket 45 secured by rivets to member 9 or formed integral with the member 9 as the arms 13 and 14 are; the lower end of the bearing is bent at right angles to facilitate adjustment and a key-hole slot is provided as in the case of the upper bearing. Above the key-hole slot are two projections 31 integral with the body portion and bent at right angles thereto; the upper projection 31 has an opening therein and the lower one a depression in its upper side. Between the two projections 31 a tube 32, shown in Fig. 11, is adapted to be supported by springing the projections apart and slipping the tube in between them. Within the tube 32 at each end is a jewel bearing block 33, preferably a sapphire, cupped and polished to form a frictionless bearing for shaft 25, and a coiled spring 34 within the tube tends to keep the sapphires at the ends of the tube. The lower end of shaft 25 is tapered off and the point extends through the opening in the upper projection 31 and rests on the jewel at the top of the tube 32. The shaft being supported on a sapphire step bearing rotates with a minimum friction, and when one sapphire is worn the tube 32 may be reversed. When both sapphires 33 are worn the tube may be taken out and replaced by a new one while the rough sapphires are being repolished. The support 30 is also provided at its upper end with a portion 31′ bent at right angles and provided with an opening through which the shaft extends and which therefore prevents lateral displacement of the shaft of the meter. The disk armature 22 is also a punching of sheet metal having holes 35 therein to prevent creeping and stamped, as shown in Fig. 8, to provide integral arms 36 which are bent back on the disk and upwards, as shown in Figs. 2 and 4, and then screwed together on either side of shaft 25 to hold the disk in proper position on the shaft.

The means for retarding the rotation of the moving element of the meter consists of a single-C-shaped magnet 40 mounted horizontally in front of the supporting plate 9, and above the disk armature, as shown in Fig. 2. The air gap of the magnet is in the lower side. The magnet is supported by a sheet-metal punching 41 held by screws 42 on the member 9 and provided with outwardly extending integral arms formed to grip the magnet. Below the rotatable disk armature 22 is an armature 43 for the magnet 40, and the means for adjusting the speed of the meter consists in adjusting this armature toward and away from the disk 22 to vary the air gap between the poles of the magnet 40 and its armature 43. Armature 43 is carried by an angle piece 44, as shown in Fig. 13, secured to and pivoted on bracket 45 by a screw 46. A spring washer 47 is placed under the head of screw 46 and a screw 46′ which holds washer 47 to the angle piece so that when the screws are loosened there still remains some pressure against the angle piece preventing its dropping out of place and so destroying is former adjustment. Below the openings for the screws 46 and 46′ the angle piece is provided with a vertical slot and a rivet 48 in bracket 45 having an eccentric head 49, as shown in Fig. 13, fits snugly be-

tween the sides of this slot. Thus by loosening screw 46 somewhat and turning the rivet 48 with a screw-driver, the angle piece is shifted on screw 46 as a center and raises or lowers the armature 43.

The portions 14, 14 of the supporting member 9 are bent forward on the dotted lines in Fig. 6 and turned over horizontally at the ends to support a dial by which the revolutions of the moving element of the meter are registered, as shown in Fig. 3. The back plate 50 of this dial is a punching of sheet brass, as shown in Fig. 7, having integral arms 51 which are bent forward to support the front plate of the dial, integral arms 52 which are bent back to support the shafts by which the dial train is geared to the meter shaft, and integral arms 38 by which the dial is secured to the arms 14. The arms 52 support a shaft 53 carrying a worm wheel 54 which meshes with a worm on the shaft 25. These arms may readily be sprung apart far enough to slip shaft 53 into its bearings. A worm 39 is formed on shaft 53 and meshes with a worm wheel on the drive shaft 55 of the dial train which also has a bearing in one of the arms 52. The arms 51 have projections 56 struck up on their outer ends and the front plate 57 of the dial is provided with suitable openings corresponding to the arms 51. In assembling the dial, the front plate is pressed down over the ends of the arms 51 which are pressed back until the projections 56 snap over the front of the plate 57. It will thus be seen that no screws are used in securing the parts of the dial together. The dial face is preferably cut on the front of the front plate. In the cover 5 is an opening over the dial face provided with a glass.

The leads 58 from the series coil 21 are brought up around member 9 and extend out of the casing direct through corresponding recesses at the junction of the back 1 and cover 5, no binding-posts for the leads being used. The insulation of the leads 58 is reinforced about the points where they pass out of the casing and the openings in the casing are so small that their sides become embedded in the thick insulation, thus securely anchoring the leads to prevent them from being pushed into or pulled out of the casing and disturbing the proper operation of the meter. One of the leads 59 to the potential coils 19 is electrically connected to one of the series leads 58 within the meter and the other 60 extends through a third opening in the casing for connection to the other side of the circuit, this lead being anchored in the casing as were the series leads 58. For further protection against straining, the leads 59 and 60 may be carried through one or more openings in the member 9 as shown in Fig. 4. As an additional precaution, a guard 61 may be provided within the casing directly opposite the openings for the leads to prevent sticking a needle or the like through one of the openings and against the disk armature 22. The guard 61 is shaped as shown in Fig. 5, and when in position the slots fit over the two lower lugs 10 between the strips 11 and member 9 as shown in Fig. 2.

I have described the features of my invention herein as applied to an integrating induction motor meter, but I wish it understood that most of the features of my invention are equally applicable to commutating motor meters and some of them are applicable to measuring instruments generally.

The construction illustrated and described may be modified without departing from the spirit of my invention and I aim to cover all such modifications in the claims appended hereto.

What I claim as new and desire to secure by Letters Patent of the United States is,

1. An electric meter having a casing, an operating mechanism, means for detachably supporting the entire operating mechanism within the casing, and a yielding member which when depressed permits of removing the entire operating mechanism from the casing.

2. An electric meter having a casing, a supporting member, operating mechanism supported entirely upon said member, means for detachably supporting said member within the casing, and a spring which when depressed permits of removing the entire operating mechanism from the casing.

3. An electric meter having a casing, a supporting member, operating mechanism supported entirely upon said member, supports secured within the casing, and coöperating lugs and receivers on the supports and member one of which is flexibly mounted whereby the operating mechanism is detachably supported within the casing.

4. An electric meter having a casing, supports secured therein one of which is flexibly mounted, a supporting member formed from a sheet-metal punching on which the entire operating mechanism of the meter is supported, and portions integral with said member bent to form lugs cooperating with openings in said supports whereby the operating mechanism is detachably supported within the casing.

5. In an electric meter, a casing in which the operating mechanism is contained, consisting of a back and cover, a rigidly supported tongue and an eye on the back and cover on one side, a spring-positioned tongue and an eye on the back and cover on the other side, and means for moving the spring-positioned tongue from outside the casing, said tongue having an opening therein for a seal wire.

6. An electric meter having a casing comprising two parts which fit together, a coil within said casing, and insulated leads extending through openings in said casing at the junction of said two parts, said openings being shaped to clamp the insulation of said leads firmly when the two parts are fitted together and to permit the free removal of said leads when said parts are separated.

7. An electric meter having a casing, coils carrying the current to be measured within the casing, leads from the coils running direct through openings in the casing, and means preventing slipping of the leads in said openings.

8. An electric meter having a casing consisting of two parts which fit together, coils within the casing, leads from the coils running direct through openings in the casing formed by corresponding depressions in the two parts of the casing, and means to prevent slipping of the leads in said openings.

9. An electric meter having a casing, coils within the casing, leads from the coils running direct through openings in the casing, and insulation on the leads in which the sides of the openings are embedded to hold the leads firmly.

10. An electric meter having a casing, coils carrying the current to be measured within the casing, leads from the coils running direct through openings in the casing, and a guard within the casing directly opposite said openings.

11. An electric meter comprising a supporting member consisting of an iron punching having integral arms stamped out and bent to both sides of the punching, electric motor mechanism secured to said arms on one side of said punching, and a permanent magnet to retard the moving element of the motor secured to other of said arms on the other side of said punching.

12. In an electric meter having an electric motor driven by the current to be measured and a dial for registering the rotations of the moving element of the motor, a supporting member formed from a sheet-metal punching and having integral arms bent to support the dial and a portion of the motor mechanism.

13. In an electric measuring instrument, a shaft, bearings therefor, a disk of conducting material carried by the

shaft, a magnet mounted on one side of the disk, a pivoted armature therefor mounted opposite the poles of the magnet on the other side of the disk, and means for moving the armature on its pivot toward and away from the disk to vary the air gap between the magnet and its armature.

14. In an electric measuring instrument, a shaft, bearings therefor, a disk of conducting material carried by the shaft, a magnet mounted on one side of the disk, a pivoted armature therefor mounted opposite the poles of the magnet on the other side of the disk and having an opening therein, and a rotatable member having an eccentric movement within said opening.

15. In an electric measuring instrument, a shaft, bearings therefor, a disk of conducting material carried by the shaft, a magnet mounted on one side of the disk, an armature therefor mounted opposite the poles of the magnet on the other side of the disk, a screw securing the armature to a support, means to prevent movement of the armature when the screw is loosened, an opening in the armature, and a rotatable member having an eccentric head within said opening.

16. In an electric measuring instrument, a rotatable shaft and a sheet-metal plate having integral arms formed from portions of the plate and bent to provide means for securing the plate to the shaft.

17. In an electric measuring instrument for alternating currents, a bundle of laminæ, a metallic tube extending through openings in the laminæ and turned over at its ends to secure them firmly together, and means for securing the laminæ in position consisting of a bolt passing through the tube.

18. An electric meter comprising a shaft, bearings therefor, an electric motor whose armature is carried by the shaft, means for retarding the rotation of the shaft comprising a permanent magnet mounted in proximity to a member of conducting material carried by the shaft, and means for registering the rotations of the shaft, comprising a dial having front and back plates, and a dial train mounted between them and geared to the shaft, said back plate being formed from a sheet-metal punching having integral arms bent forward to support the front plate and projections on the ends of the arms to retain the front plate in proper position.

19. An electric meter comprising a shaft, bearings therefor, an electric motor whose armature is carried by the shaft, means for retarding the rotation of the shaft, comprising a permanent magnet mounted in proximity to a member of conducting material carried by the shaft, and means for registering the rotation of the meter shaft, comprising a dial having front and back plates, a dial train mounted between them, said back plate being formed from a sheet-metal punching having integral arms bent backward, a bearing for the drive shaft of the dial train in one of said arms, and a shaft supported by said arms geared to the meter shaft and to said drive shaft.

20. In an electric measuring instrument, a bearing for a vertical shaft, consisting of a sheet-metal punching having a lengthwise slot for a supporting screw and an integral end portion bent substantially at right angles to the body portion and provided with an opening for the end of the meter shaft.

21. In a measuring instrument, a step bearing for a vertical shaft, comprising a tubular member partially closed at its ends, two jewels therein, and a coiled spring within said member between the two jewels to hold them normally at the ends of the tubular member, said tubular member being reversible whereby either jewel may be put in service.

22. In an electric measuring instrument, a lower bearing for a vertical shaft, consisting of a sheet-metal punching having two integral portions bent substantially at right angles to the body portion, one of which has an opening therein, a member supported between said integral portions, and a jewel bearing block carried by said member in alinement with said opening in the bent portion of the punching.

23. In an electric meter, a supporting member, projections struck up therefrom, a shaft, a bearing therefor consisting of a sheet-metal punching having a slot therein vertically adjustable between said projections and a screw extending through said slot and into the supporting member to secure the bearing in any adjusted position.

24. In an electric measuring instrument, a lower bearing for a vertical shaft consisting of a sheet-metal punching having two integral portions bent substantially at right angles to the body portion, one of said bent portions having an opening through which said shaft extends, and a jewel step bearing supported upon the other bent portion.

In witness whereof I have hereunto set my hand this 18th day of November 1904.

CHARLES E. HOLMES.

Witnesses:
JOHN A. MCMANUS, JR.,
DUGALD MCK. MCKILLOP.