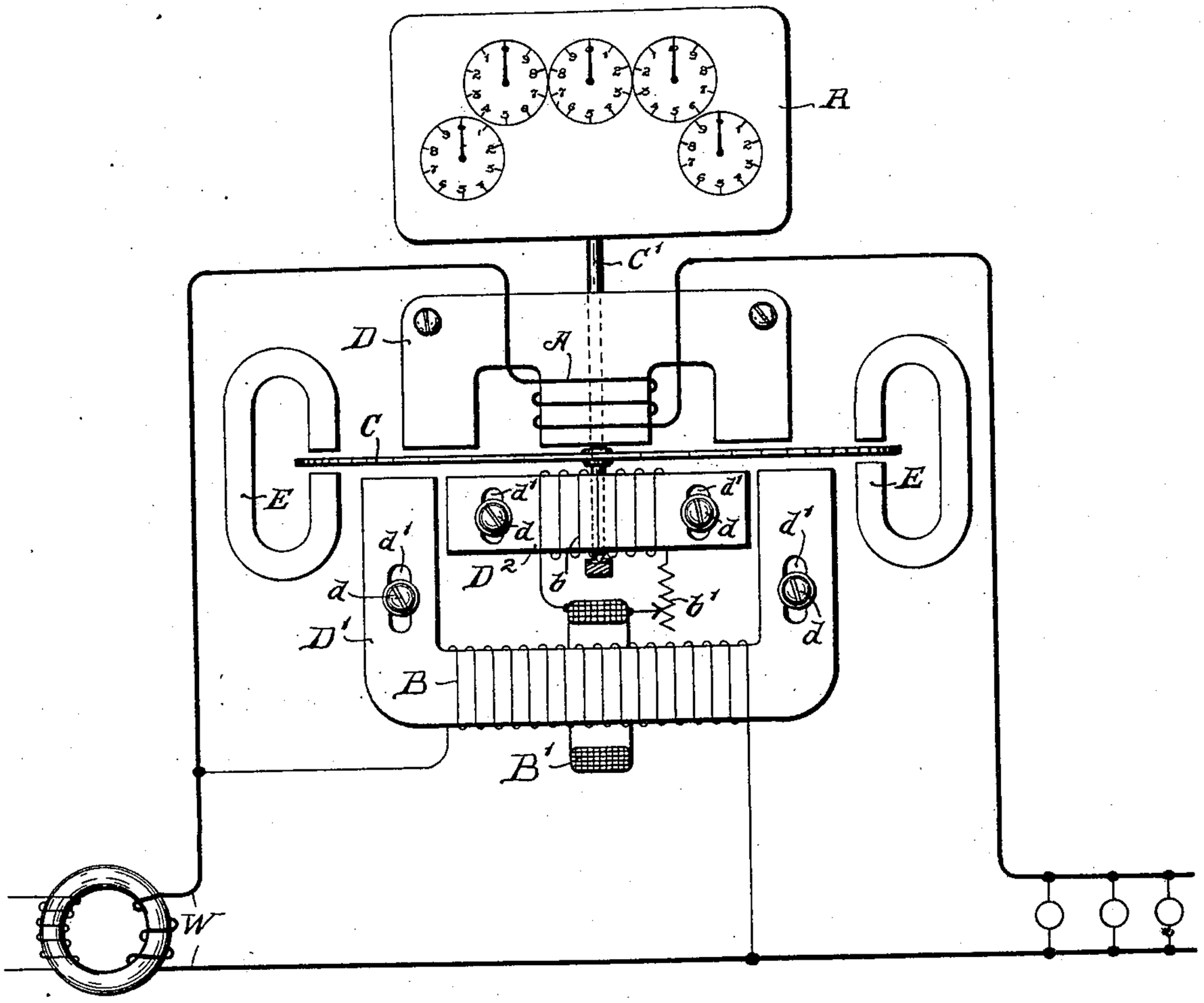
No. 698,669. Patented Apr. 29, 1902.

T. DUNCAN.

ELECTRIC METER.

(Application filed Nov. 18, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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ELECTRIC METER.

SPECIFICATION forming part of Letters Patent No. 698,669, dated April 29, 1902.

Application filed November 18, 1899. Serial No. 737,423. (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 specification.

This invention relates to improvements in induction motor-meters for alternating-current work, and has for its object to provide a novel and efficient form of meter having improved means of calibration throughout a wide range of adjustment and suitable for accurate service with both inductive and non-inductive loads.

The invention consists in the matters hereinafter set forth, and particularly pointed out in the appended claims.

In the accompanying drawing the figure is a front elevation, partially diagrammatic, of an integrating wattmeter embodying my improvement.

A designates the series field-coil of the meter, B its volt or shunt field-coil, and C a disk armature that is mounted to rotate upon a spindle C′, to which an ordinary registering mechanism R is suitably geared. As herein shown, the series coil A is mounted above the armature, upon the middle pole of a three-pole laminated iron or steel core D, while the volt-coil B is mounted upon a U-shaped laminated core D′ below the armature, the poles of both cores being directed toward the latter and terminating in close proximity thereto and the cores and coils being located away from the center of the armature, so that there is no interference with the spindle C′, which in the view shown passes behind the coils and cores, as indicated by dotted lines. The coil A is connected in series in the work-circuit W and the coil B in shunt across the line, the self-inductance of the latter coil producing a phase displacement by reason of which the armature will be inductively rotated. As will be understood by those skilled in the art, however, the lag produced by the core D′ will not amount to ninety degrees, and to increase such lag to the full quadrature necessary to accurate service under all conditions of load-inductance additional lagging means are necessary. To this end a third magnetic core D^2 is shown as placed horizontally beneath the armature between the poles of the core D′ and is wound with a coil *b*, which is connected in a closed circuit in series with a secondary volt-coil B′, that is mounted in inductive relation to the main volt-coil B, with the effect of producing a resultant magnetic field lagging the full ninety degrees desired. An adjustable resistance *b*′, inserted in the closed circuit with the coils *b* and B′, permits an exact adjustment of the phase displacement, while the usual magnetic drag E serves to maintain the armature speed proportional to the torque exerted.

The adjustment of meters to regulate the speed of the armature in calibration is usually accomplished as to small variations by adjusting the drag-magnets and as to wider changes by varying the current through the shunt-circuit either by varying the number of turns in the volt-coil or by the use of a variable resistance. In the present construction a further and improved means of adjustment in this respect is provided by so mounting the cores D′ and D^2 as to make them adjustable relatively to each other and to the armature C. To this end both of said cores are shown as secured in place by clamping-screws *d*, which pass through vertical slots *d*′ in said cores, so that either or both of the cores may be raised or lowered, as desired, and then clamped fast in adjusted position. To accomplish a reduction in armature speed, one or both of the cores D′ and D^2, according to the amount of change of speed required, is moved away from the armature, while to increase the speed they are moved nearer to the armature. In this manner considerable changes in the armature speed may be accomplished without difficulty and without requiring any changes in the windings of the shunt or pressure coils, while the finer adjustments may still be secured by adjustment of the drag-magnet. The design of meter thus set forth is exceedingly simple and economical of construction and also powerful and efficient in operation, since the arrangement of parts shown gives a double-motor effect, as the shifting fields produced be-

tween the poles of the series and shunt-cores set up separate shifting fields, each of which exerts an actuating torque on the armature.

As specified, the preferred embodiment of my invention contains a core for the pressure-winding formed in two parts which are relatively adjustable, whereby the amount of magnetic flux through the armature due to the pressure field-winding may be controlled to regulate the speed of the armature. The core disclosed also forms a closed magnetic circuit for lines of force set up by the pressure-winding, this magnetic circuit comprising core portions sufficiently magnetically separated to introduce sufficient reluctance into the magnetic circuit to force the required number of lines of force through the armature. By effecting a bodily movement of this closed magnetic circuit toward the armature the speed of the armature may be controlled. By adjusting the component parts of the magnetic circuit the degree of reluctance therein may be changed and the flux through the armature further controlled. I am able to secure very effective adjustment of the phase of the field due to the pressure-winding by providing the coil B′ upon one of the core portions and the coil *b* in circuit with coil B′ upon the other core portion.

I no not wish to be limited to the precise disclosure of the invention herein shown and particularly described, and modifications may readily be made without departing from the spirit of my invention.

I claim as my invention—

1. An electric meter comprising a rotary armature, three-pole magnetic core D mounted on one side of the armature with its poles terminating in proximity thereto, U-shaped magnetic core mounted on the opposite side of the armature with its poles terminating in proximity thereto, third core D^2 extending longitudinally between the poles of the U-shaped core, and coils mounted on said cores, substantially as described.

2. An electric meter comprising a rotary armature, series and volt coils for actuating said armature, a magnetic core upon which the volt-coil is mounted, an auxiliary core arranged with its poles in proximity to the main core, a coil mounted on said auxiliary core, and an auxiliary volt-coil mounted in inductive relation to the main volt-coil and connected in a closed circuit with the winding on the auxiliary core, substantially as described.

3. An electric meter comprising a rotary armature, series coil A and volt-coil B, U-shaped core D′ upon which the volt-coil is mounted, core D^2 extending between the poles of the core D′, one or both of said cores being adjustably mounted, coil *b* mounted upon the core D^2, and coil B′ mounted in inductive relation to the coil B and connected in a closed circuit with the coil *b*, substantially as described.

4. In a meter, the combination with the coils thereof for producing magnetic fields differing in phase, of a core for one of said coils formed in two portions having magnetic reluctance between the same, a coil B′ on one of the core portions, and a coil *b* in circuit with said coil B′ upon the other core portion, substantially as described.

5. In a meter, the combination with the coils thereof for producing magnetic fields differing in phase, of a core for one of said coils formed in two portions having magnetic reluctance between the same, one of said core portions containing the latter coil, a coil B′ upon said core portion, and a coil *b* in circuit with said coil B′ upon the other core portion, substantially as described.

6. In a meter, the combination with the coils thereof for producing magnetic fields differing in phase, of a core for one of said coils formed in two portions having magnetic reluctance between the same, one of said core portions containing the latter coil, a coil B′ upon said core portion, a coil *b* in circuit with said coil B′ upon the other core portion, and a phase-modifier *b′* associated with the coils B′, *b*, substantially as described.

7. In a meter, the combination with the coils thereof for producing magnetic fields differing in phase, of a core for one of said coils formed in two portions having magnetic reluctance between the same, one of said core portions containing the latter coil, a coil B′ upon said core portion, a coil *b* in circuit with said coil B′ upon the other core portion, and a phase-modifier *b′* in circuit with the coils B′, *b*, substantially as described.

8. In a meter, the combination with the coils thereof for producing magnetic fields differing in phase, of a core for one of said coils formed in two portions having magnetic reluctance between the same, one of said core portions containing the latter coil, a coil B′ upon said core portion, a winding *b* in circuit with said coil B′ upon the other core portion, and a phase-modifying resistance *b′* in circuit with the coils B′, *b*, substantially as described.

9. A motor provided with two windings for producing magnetic fields differing in phase, one of said windings being divided into two field-coils, of a secondary coil in inductive relation with one of the field-coils, which field-coil thus constitutes a primary inducing winding, the second field-coil being included in a closed circuit with, and supplied by, current from said secondary coil, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two subscribing witnesses, this 14th day of November, A. D. 1899.

THOMAS DUNCAN.

Witnesses:

JAMES W. DALTON,

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