No. 720,979. PATENTED FEB. 17, 1903.

W. STANLEY.

METER.

APPLICATION FILED APR. 5, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

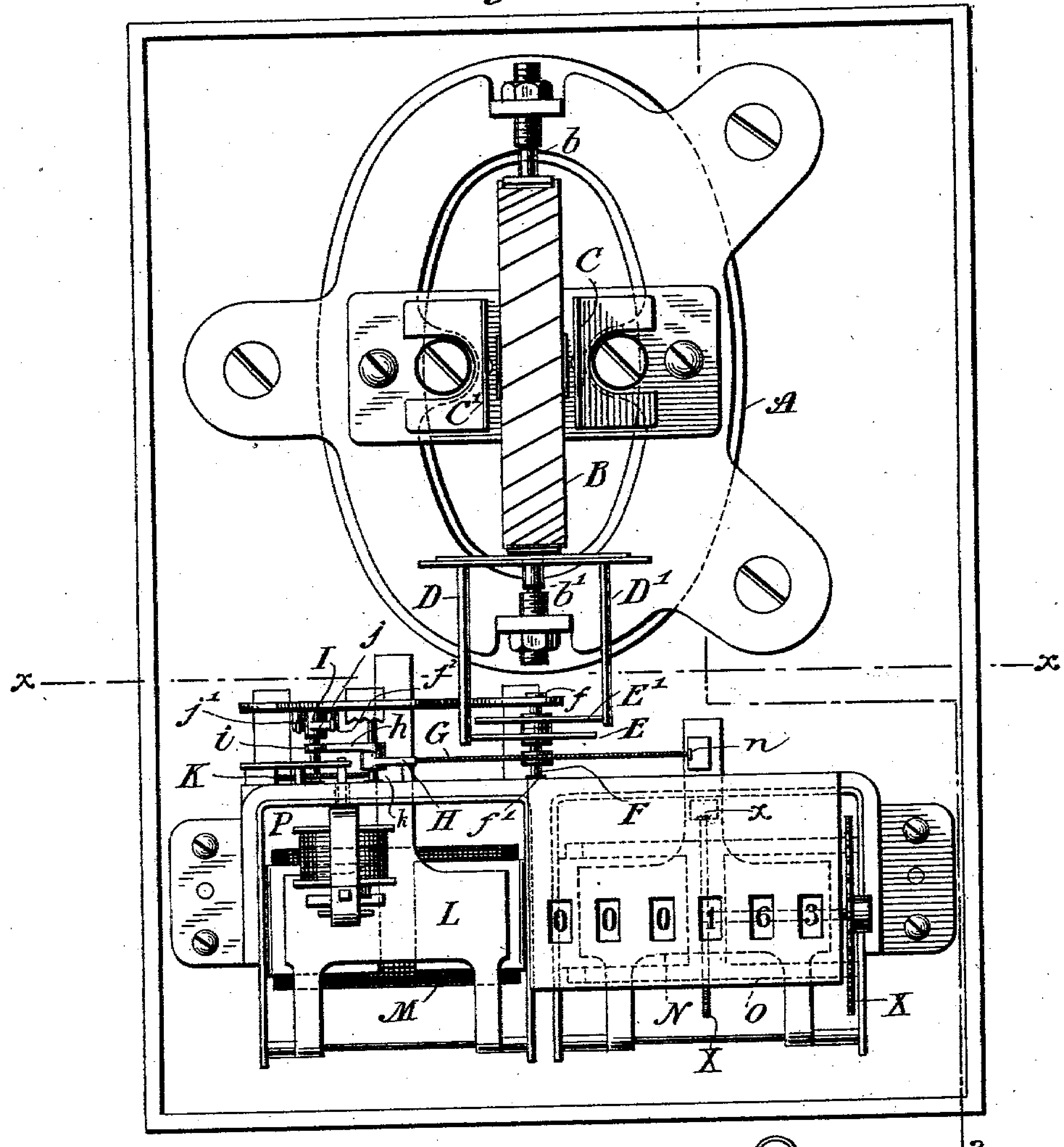


Fig. 4.

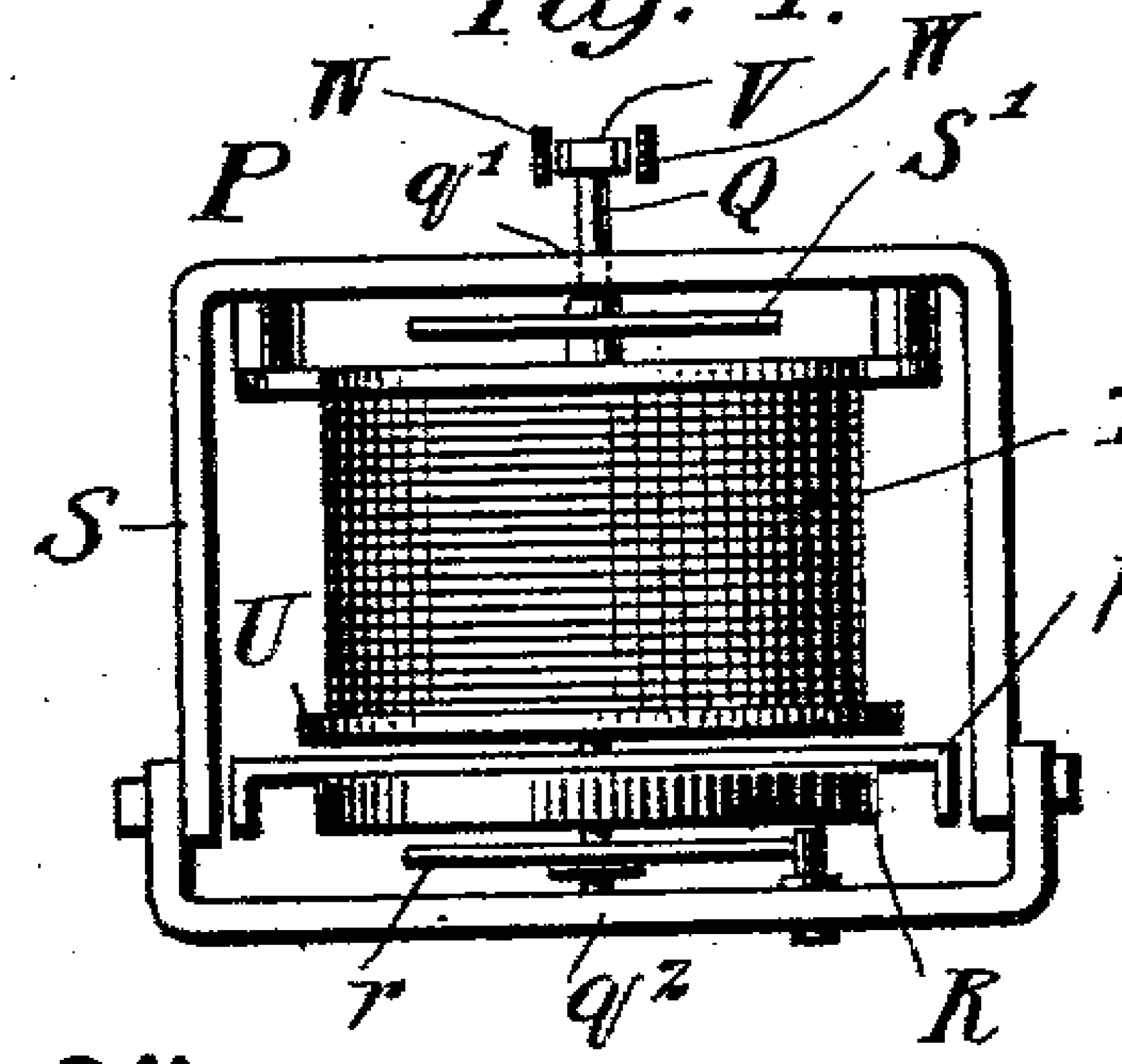


Fig. 5.

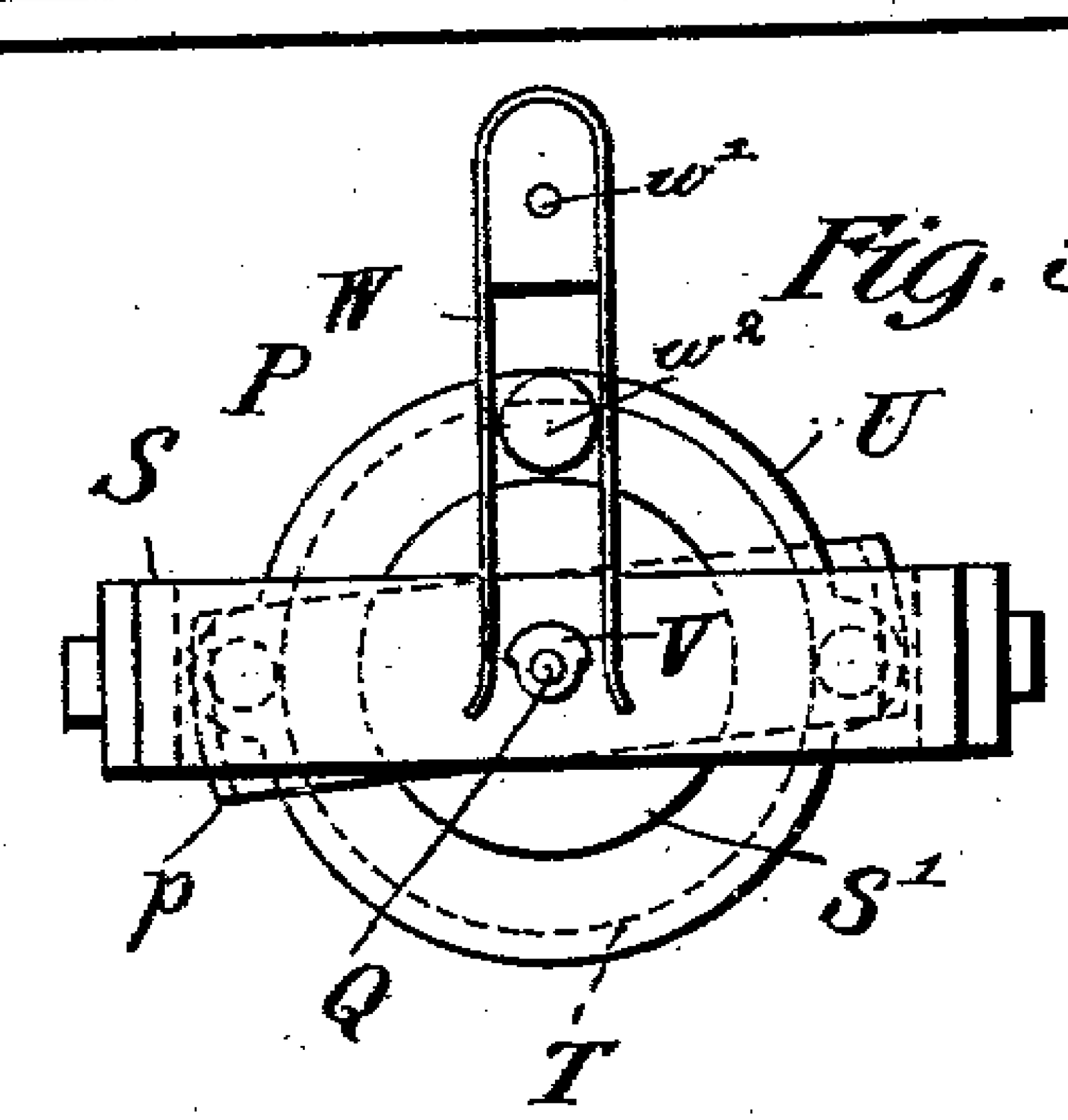
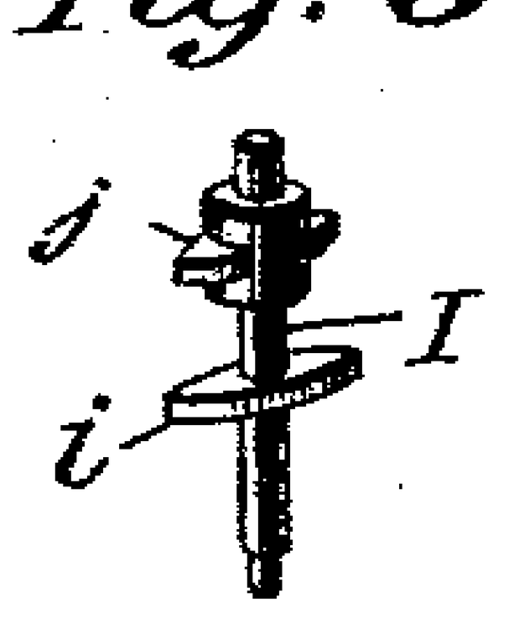


Fig. 8.



Witnesses

Inventor:-
William Stanley,
By his Attorney

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

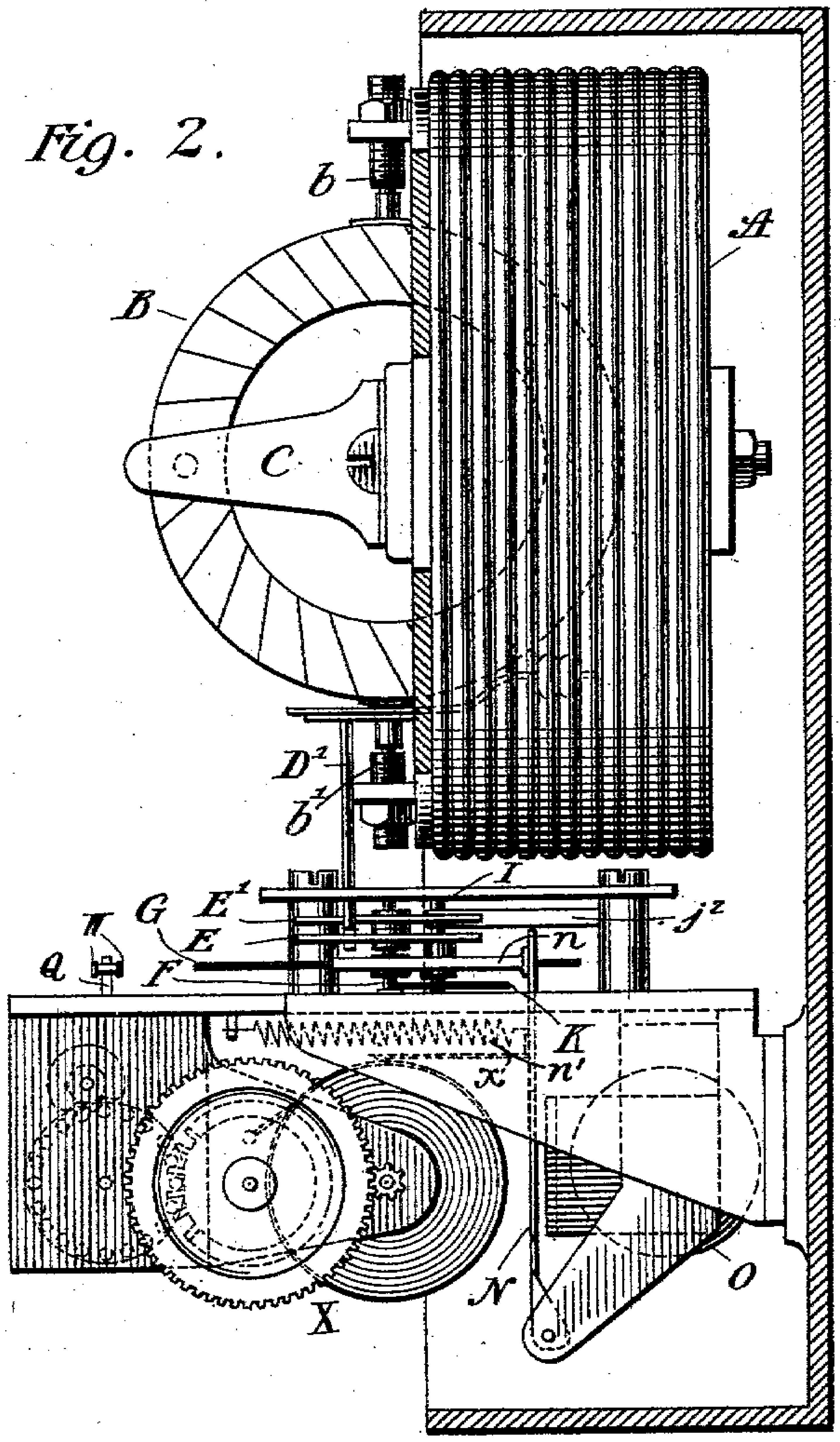


Fig. 6ª.

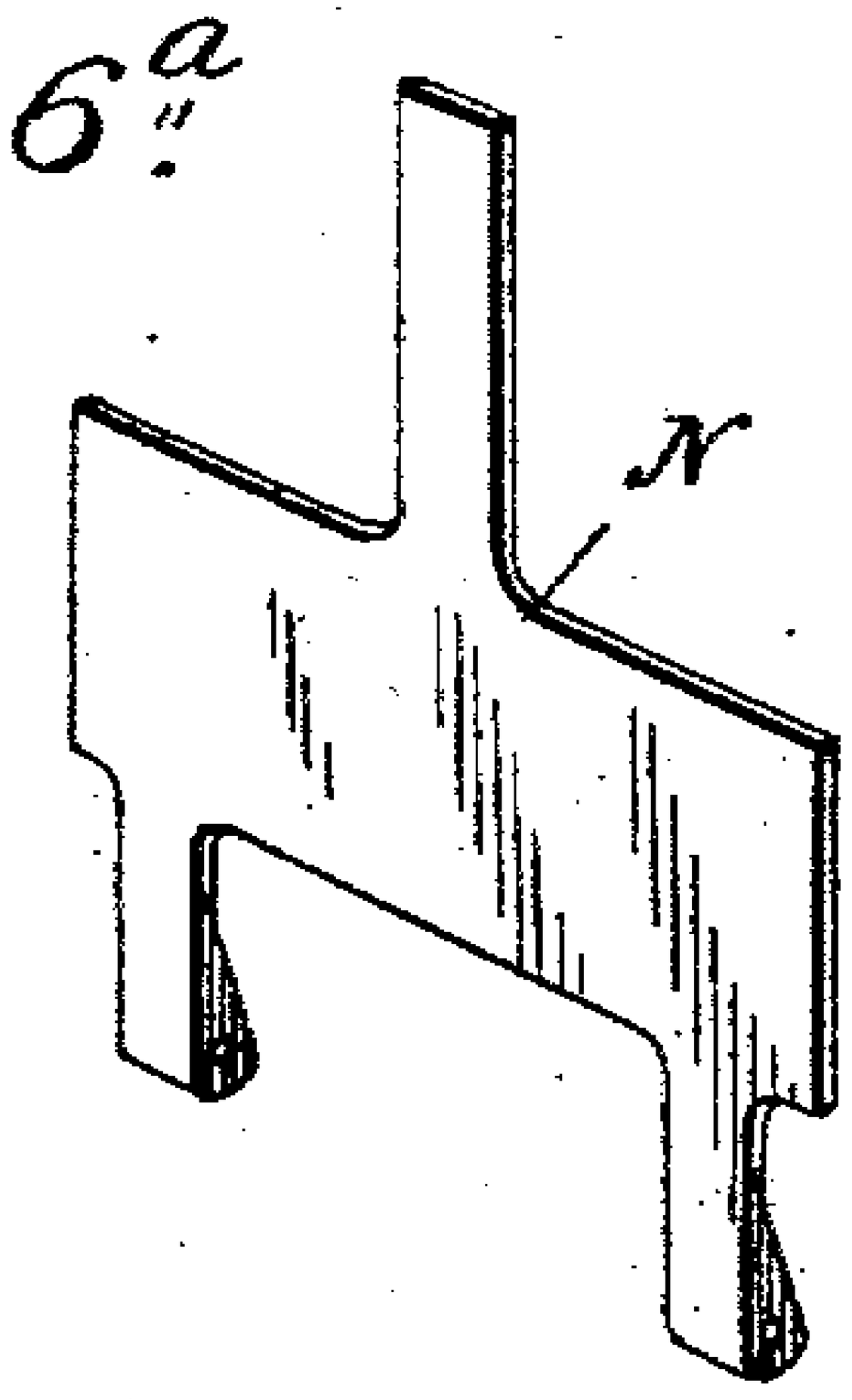
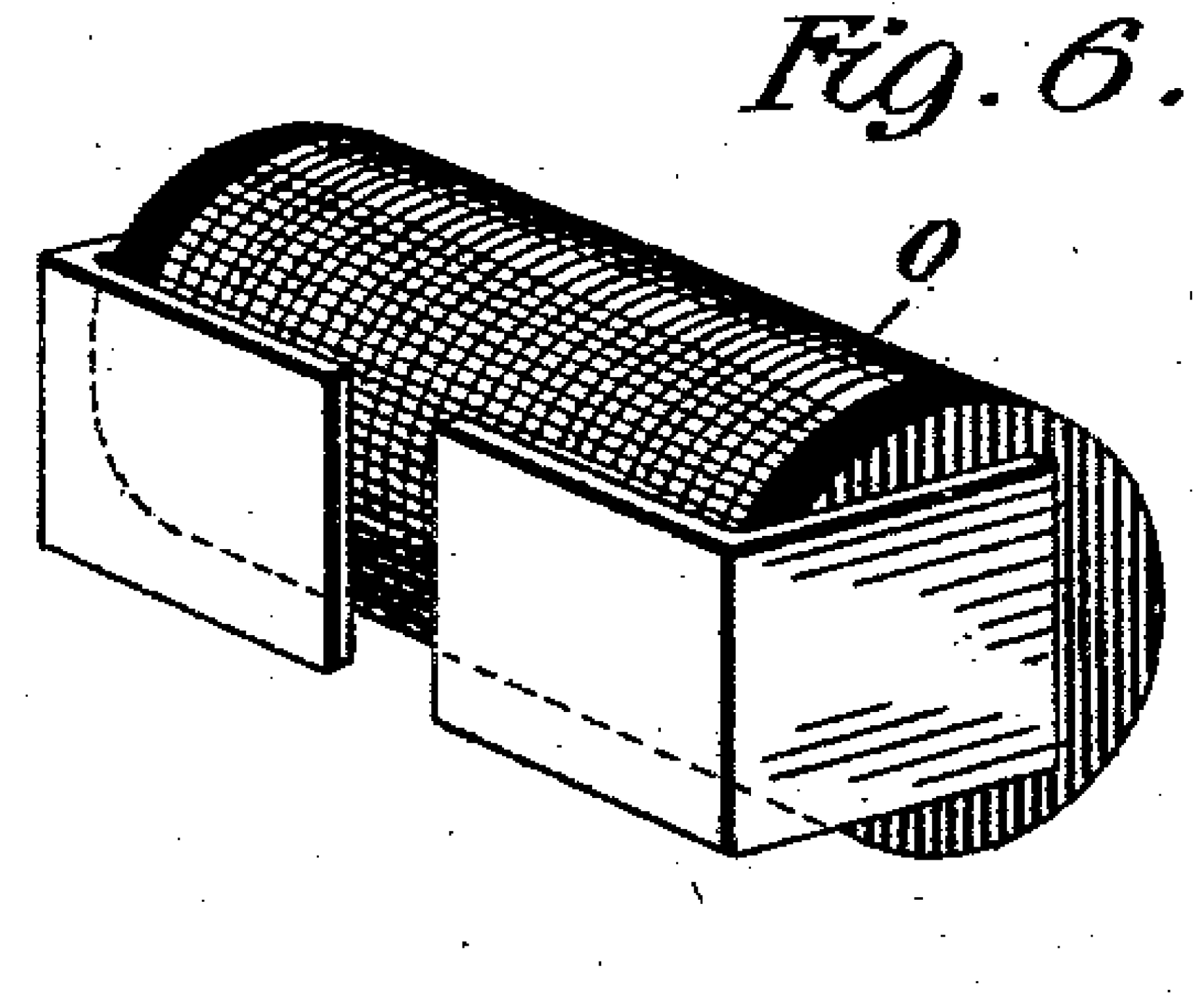


Fig. 6.



Witnesses

Inventor:—
William Stanley
By his Attorney

No. 720,979. PATENTED FEB. 17, 1903.

W. STANLEY.

METER.

APPLICATION FILED APR. 5, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

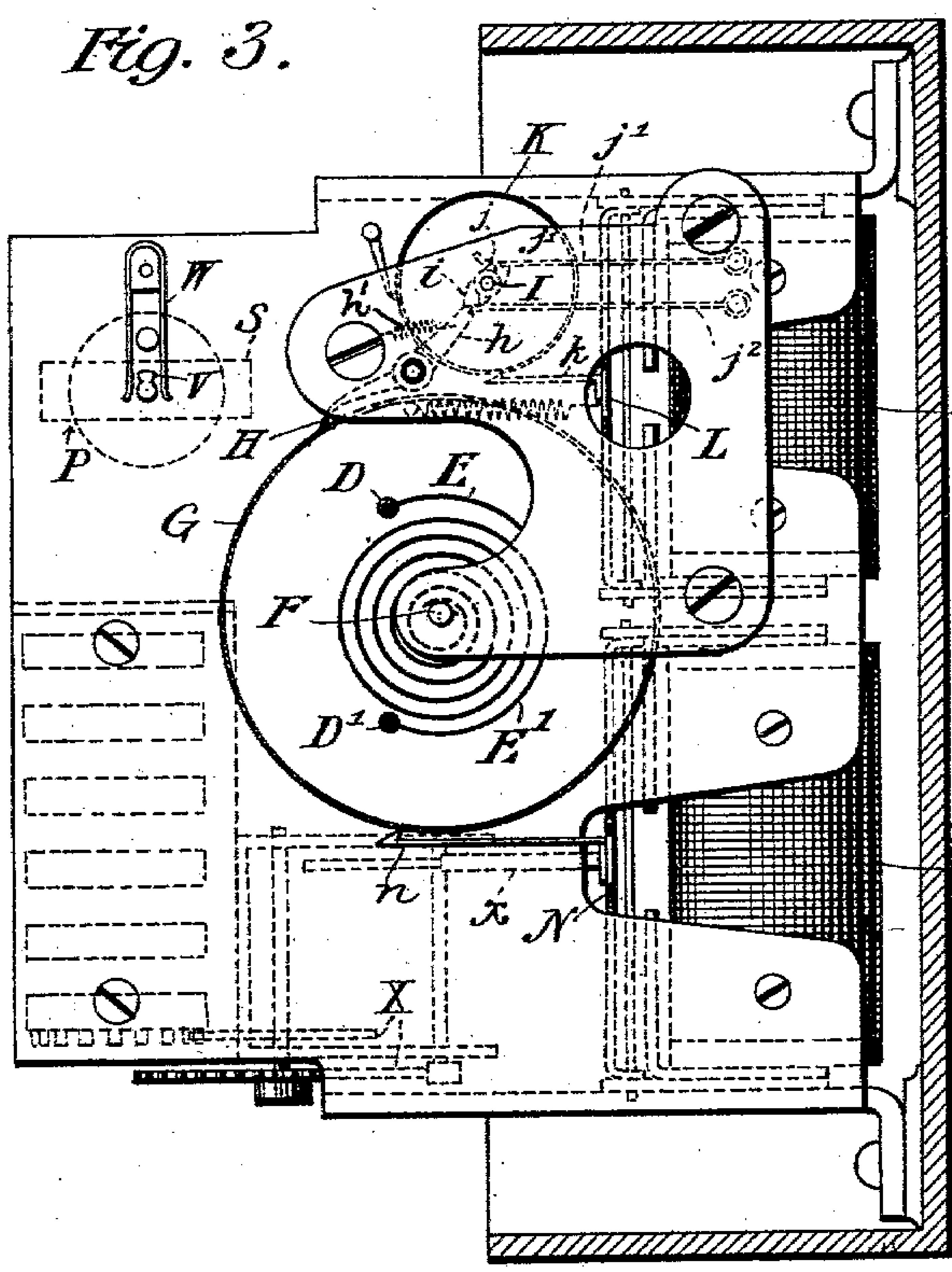
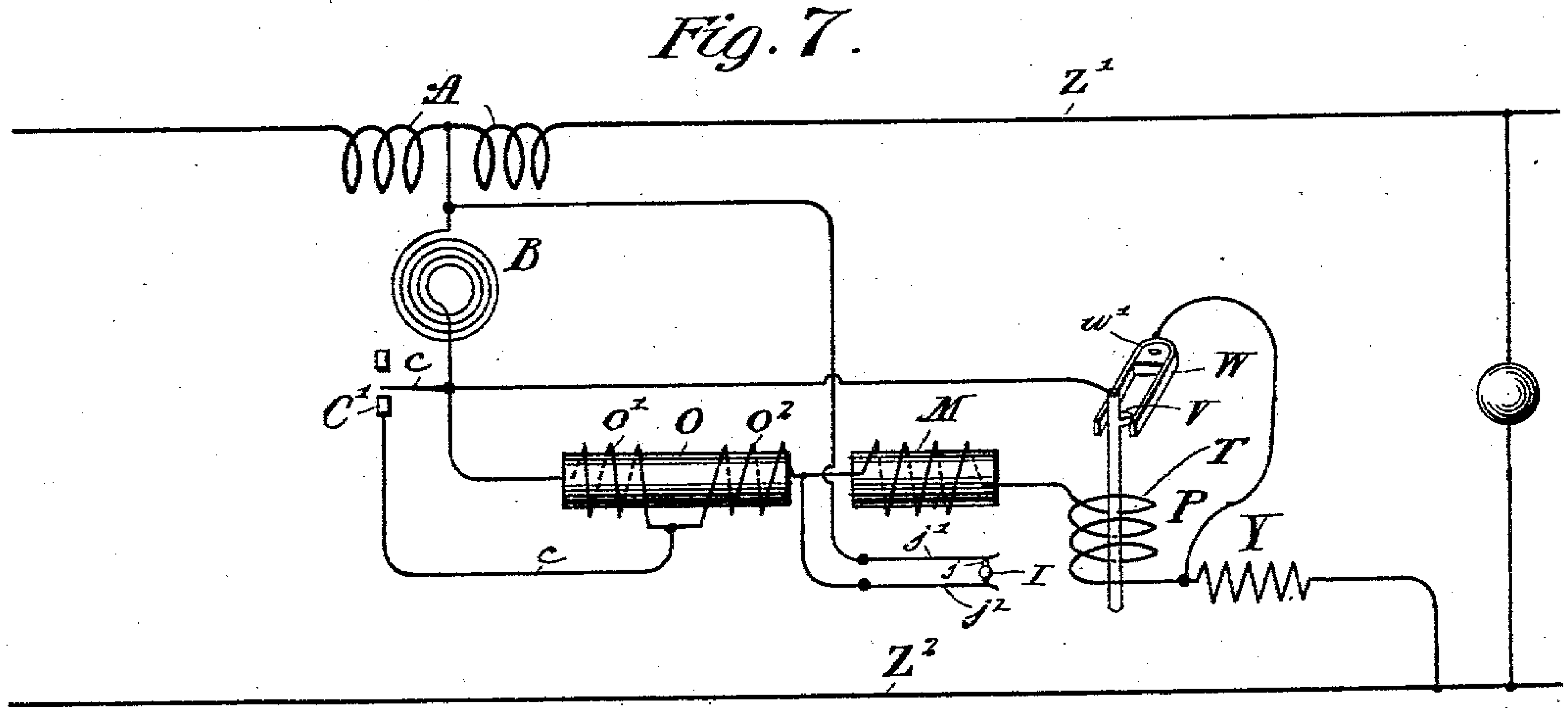


Fig. 7.



Witnesses
Frank S. Ober
A. P. S. Allyn

Inventor:—
William Stanley,
By his Attorney
[signature]

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO STANLEY INSTRUMENT COMPANY, OF GREAT BARRINGTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

METER.

SPECIFICATION forming part of Letters Patent No. 720,979, dated February 17, 1903.

Application filed April 5, 1902. Serial No. 101,562. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, a citizen of the United States, residing at Great Barrington, in the county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Meters, of which the following is a full, clear, and exact description.

My invention relates to meters for measuring the energy of electric currents of either the continuous or alternating type, and has for its object to produce a simple and accurate measuring device that can be easily made and installed and in which there are no delicate parts which will quickly break down, as is the case in many so-called "meters" in use at the present time.

It consists, essentially, of a dynamometer, a time-beater, and means controlled by said time-beater for integrating the energy indications during short periods, and is very closely accurate, since the energy passing during any one of most of such short periods is substantially constant.

Referring to the drawings, Figure 1 is a front view of the meter. Fig. 2 is a side elevation of the same. Fig. 3 is a sectional view on the line X X of Fig. 1. Fig. 4 is a detail view of the time-beater. Fig. 5 is a detail of the same. Fig. 6 is a detail view of an actuating-magnet. Fig. 6^a is a detail view of its armature. Fig. 7 is a diagram of circuits. Fig. 8 shows a detail.

Referring more particularly to the drawings, A is the series coil, through which passes the current to be measured.

B is a shunt-coil, the coils A and B forming a dynamometer. The coil B is mounted so as to swing on the pivots $b\,b'$ and is restrained from any considerable movement by the stops C C'. This coil B carries two depending arms D D', which are connected to volute springs E E', whose inner ends are fastened to the shaft F. This shaft F is journaled at $f\,f'$ and carries a wheel G, having very fine teeth in its periphery, about two hundred to the inch. Engaging with these teeth is a detent H, which is retracted by the spring h' and has an extension h, with which a cam i, mounted on the revolving shaft I, engages at intervals, so as to lift the detent out of engagement with the teeth of the wheel G. This shaft I also has a projection j, of conducting material, which twice during each revolution makes contact with the springs j' j^2, temporarily short-circuiting an actuating-magnet, hereinafter described, and also the shunt-coil B. This shaft I carries also a wheel K, which is engaged by a pawl k, attached to the spring-retracted armature L of the magnet M. This magnet M is intermittently energized, thus moving the armature L and pawl k backward and forward, so as to revolve the wheel K. The wheel G is also engaged by a pawl n, which is attached to an armature N of the actuating-magnet O. This magnet is also intermittently energized, and, together with the spring n', moving the pawl n back and forth causes the wheel G to rotate. The intermittent movements of the magnets M and O are caused by the time-beater P, which is always in motion and causes the current to pass through the coils on these magnets or shunts it around them, as hereinafter described. The magnet O is also controlled by the shunt-coil B, which when in its central position throws the magnet out of action, but when in contact with the conducting-stop C', as is the case when any current is passing through the series coils A, throws it into action.

The time-beater P is shown in detail in Fig. 4 and consists of an armature p, carried by a rotatable shaft Q, mounted in bearings q' q^2. This shaft also carries a small balance-wheel R and a spring r, tending to keep it in such a position that the armature p is slightly out of alinement with the iron frame S. It also has an iron disk S', which acts to distribute the magnetism to the frame S. About the iron shaft Q is a coil T, wound on a copper bobbin U, which is in series with the shunt-coil B. The shaft Q also carries a small cam V, which makes and breaks contact with the forked spring W during each oscillation, thereby intermittently energizing and short-circuiting the coil T and the coils of the magnets M and O. The short-circuiting and consequent deënergizing exist at the beginning

and end of each oscillation. The open-circuiting, by reason of a slight movement of the spring W about its axis w', due to the action of the cam V on the preceding oscillation, takes place only during the latter part of each first half-oscillation. The movement is limited by the stop w^2 between the arms of the spring W. The intermittent energizing of the coil T by intermittently magnetizing the elements S and p keeps the shaft Q, with its armature and cam V, oscillating, and also keeps armature L and its pawl k moving all the time. It also keeps the armature N of the magnet O, together with its pawl, moving, except when the position of the shunt-coil B prevents it. The shunt-coil B controls the action of this magnet by making contact with the conducting-stop C', and thus short-circuiting one of two opposing coils o' o^2, which are wound in opposite directions on the core of that magnet, the stop C' being connected by the conductor c to the point between said opposing coils.

X is the integrating-train, which is actuated by a pawl x, also mounted on the armature N, so that whenever that armature is permitted to be operated by the position of the shunt-coil B it revolves the wheel G and also moves the integrating-train.

Referring to the diagram of circuits in Fig. 7, A represents the series coils; B, the shunt-coil; C', the conducting-stop, and c the conductor, short-circuiting the coil o when the shunt-coil engages with C'. O is the integrating-magnet. M is the magnet which actuates the mechanism for releasing the detent H and short-circuits the shunt-coil B at the end of stated periods. P is the time-beater, which, with its cam V and fork W, at every oscillation by short-circuiting the magnets M and O and its own coil T energizes and deënergizes them so that they perform their respective functions. Y is a resistance in the armature-circuit to keep the current down. Z' and Z^2 are the mains supplying energy to the translating devices in series with the coils A.

The operation of the device is as follows: The time-beater P is oscillating all the time and causing current to pass intermittently through the coils on magnets M and O. When current flows through the shunt-coil B and the series coil A, lamps being in circuit, the shunt-coil moves into contact with C', compressing the springs E E'. The contact with C' short-circuits the opposing coil o' of the magnet O, causing said magnet to be polarized and to actuate its armature, which in turn actuates its pawl and causes the wheel G to slowly rotate against the thrust of the springs E E'. When the springs are so wound up as to overcome the torque due to the currents in the coils A B, the coil B breaks away from the stop C', thus depolarizing the magnet O and stopping the wheel G, which remains fixed until at the end of an indicating period the magnet M has actuated its mechanism so as to release the detent H, whereupon the wheel G flies back to its initial position, and the shunt-coil B, being also at the same time short-circuited by the projection j engaging with the terminals j' and j^2, swings to its central position. As soon as projection j breaks contact the coil B is again energized and the mechanism operates as before. Since the armature N also actuates the integrating-train, that train will be moved during each interval marked by the time-beater's release of the detent H an amount corresponding to the energy consumed during that interval, assuming that the rate of consumption will remain unchanged during such interval except in a few negligible instances. In this way the device furnishes an accurate measuring and recording instrument of the energy passing.

I have shown the detent H released by a separate magnet rather than directly by the action of the time-beater itself, since this relieves the time-beater of all work or duty other than the mere energizing and deënergizing of a portion of the circuit.

Various modifications may be made in the device without departing from the spirit of my invention. When used with alternating currents, care must be taken to laminate the iron cores and to prevent the formation of eddy-currents—such, for instance, as in the copper bobbin U, which in such case may well be dispensed with.

The method herein described is claimed in another pending application, Serial No. 115,815, filed July 16, 1902.

What I claim is—

1. In a meter, the combination of a dynamometer, a time-beater, and an integrating-train actuated by said time-beater.

2. In a meter, the combination of a dynamometer, a time-beater, an integrating-train actuated thereby, said time-beater having an exciting-coil, and means for periodically making and breaking a shunt-circuit around said coil.

3. In a meter, the combination of a dynamometer, a time-beater having an exciting-coil and an integrating-train electrically actuated thereby, said time-beater having means for periodically energizing and deënergizing its exciting-coil and producing electric impulses for electrically actuating said train.

4. In a wattmeter, the combination of a time-beater for producing a given value of motion in a given time, an electrodynamometer for periodically expressing by its torque the value of energy transmitted through it and an integrating system recording the sum of the torque values developed by the dynamometer in terms of time.

5. In a meter, the combination of a dynamometer, a time-beater mechanism for marking indicating periods, and an integrating mechanism, actuated and controlled by said time mechanism and dynamometer, to inte-

grate amounts proportional to the energy in circuit during each period.

6. In a meter having indicating periods the combination of a dynamometer, a time-beater consisting of a magnetic circuit having a spring-restrained oscillating portion, windings for energizing said magnetic circuit and means for periodically short-circuiting said windings, and an integrating train, actuated and controlled by said dynamometer and time-beater so as to integrate during each indicating period an amount proportional to the dynamometer torque during such period.

7. In a meter the combination of a dynamometer, a time-beater in a shunt across the mains, an integrating-magnet actuated by said time-beater and controlled by said dynamometer.

8. In a meter in combination, a dynamometer and a time-beater, an integrating-magnet actuated by said time-beater and controlled by said dynamometer, a second magnet actuated by said time-beater to mark the periods within which integration is made.

9. In a meter in combination, a dynamometer, a time-beater, an integrating-magnet and a period-making magnet said magnets being actuated by said time-beater.

10. In a meter in combination, a dynamometer, a time-beater, an integrating-magnet controlled by said dynamometer and actuating a pawl to overcome its torque, a release-magnet operating to restore the elements to their normal relation, said magnets being actuated by said time-beater and an indicating mechanism operated by said integrating-magnet.

11. In a meter, the combination of the series coil A, the shunt-coil B, the integrating-magnet O with a time-beater actuating the magnet O and controlling the periods of integration and an integrating device.

12. In a meter, the combination of the series coil A, the shunt-coil B, an integrating-magnet O actuating a spring-restrained wheel, a time-beater-actuating mechanism to periodically release said wheel and restore the parts to normal condition and an integrating train.

13. In a meter, the combination of a dynamometer, a time-beater, a mechanism for making periods of integration actuated thereby, and an indicating mechanism indirectly actuated by said time-beater to integrate the energy passing.

14. In a meter in combination, a dynamometer having coils A and B, a time-beater, an integrating-magnet and a marking-magnet all in series with the shunt-coil B, a circuit around the energizing-coils of said devices controlled by the time-beater, a shunt around the shunt-coil B and the integrating-magnet controlled by the marking-magnet, and a shunt around one of two opposing coils upon the integrating-magnet controlled by said shunt-coil.

15. In a meter, the combination of an oscillating armature, a spring-actuated wheel, a pawl in engagement therewith and means actuated by said armature for periodically releasing said pawl.

16. In a meter, the combination of a shunt-coil, an oscillating armature, a spring-actuated wheel, a pawl in engagement therewith, means actuated by said armature for periodically releasing said pawl and means for short-circuiting said shunt-coil during the time said pawl is released.

Signed at New York city this 14th day of February, 1902.

WILLIAM STANLEY.

Witnesses:
JOHN F. KELLY,
J. S. MCDONALD.