No. 808,150.

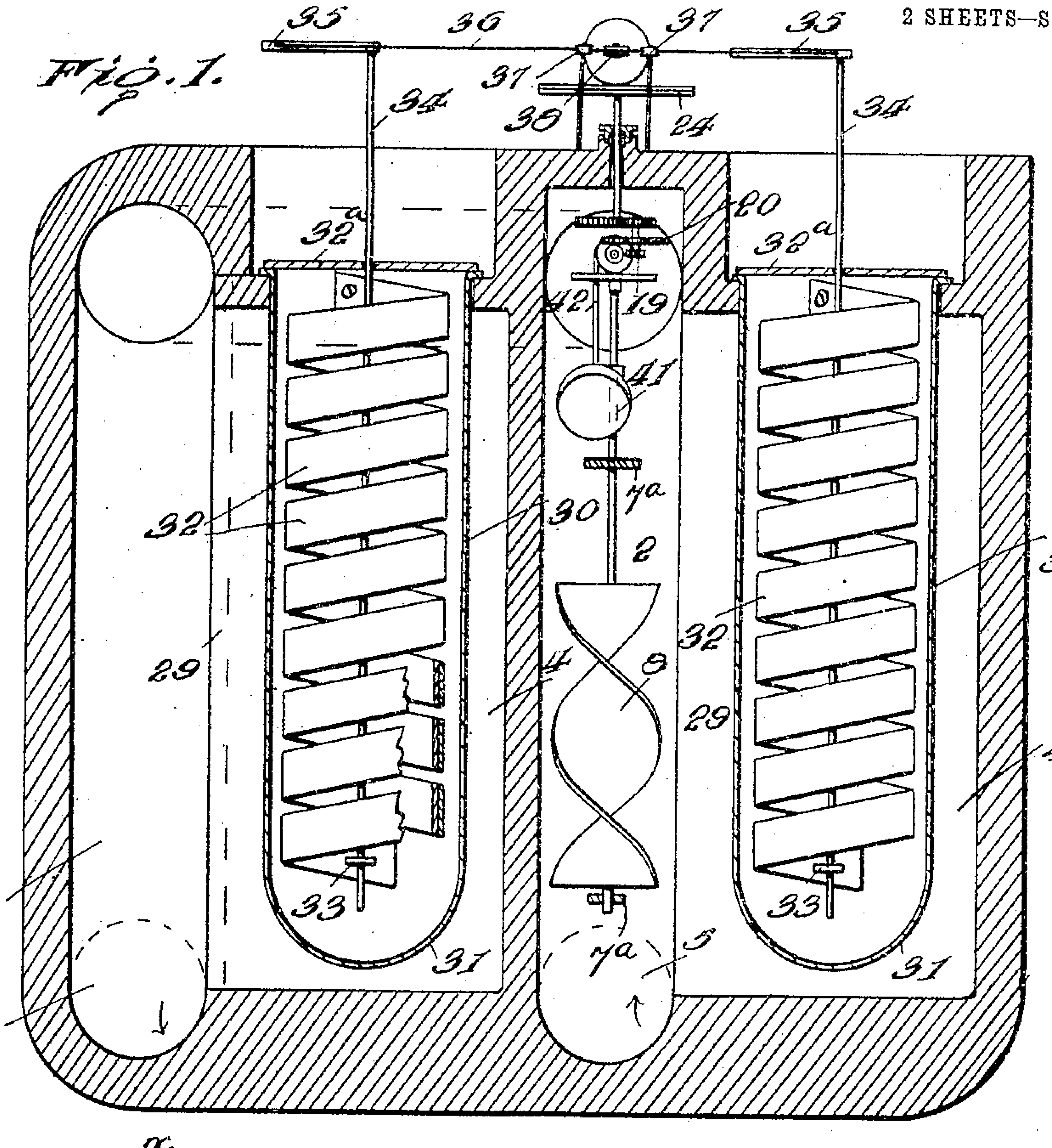
PATENTED DEC. 26, 1905.

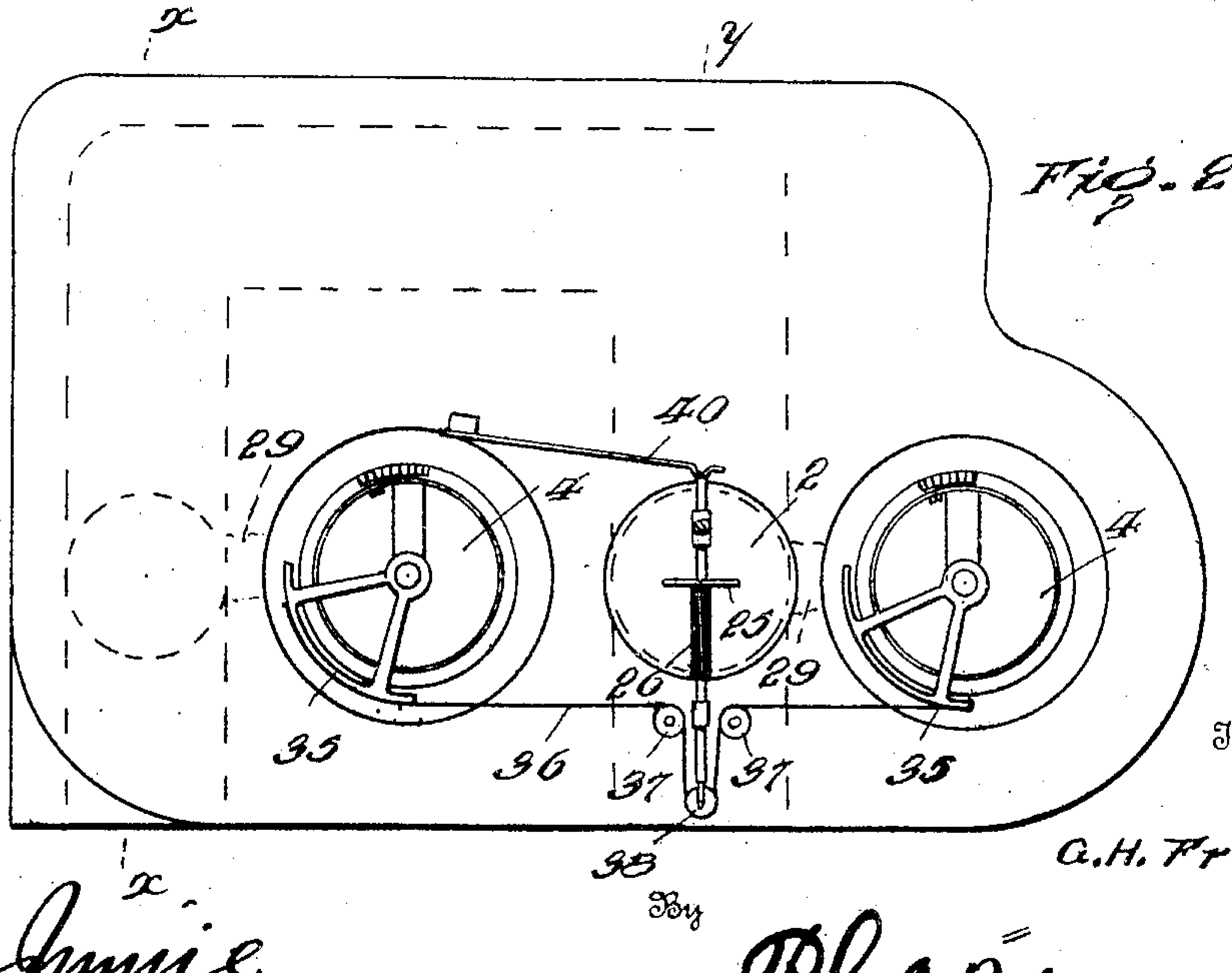
G. H. FRISTOE.

METER.

APPLICATION FILED FEB. 25, 1905.

2 SHEETS—SHEET 1.





Witnesses

[signature]

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2 SHEETS-SHEET 2.

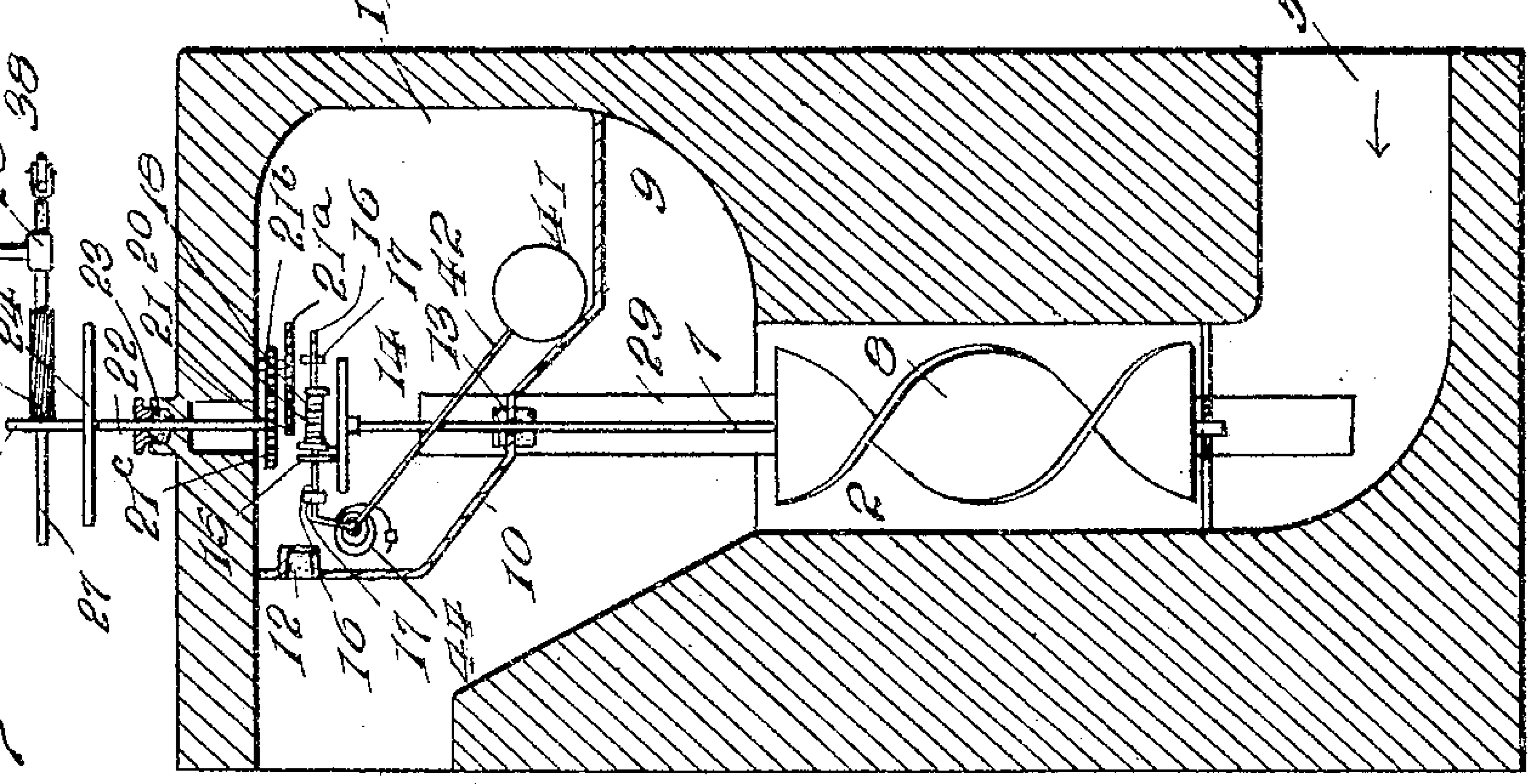

Fig. 4.

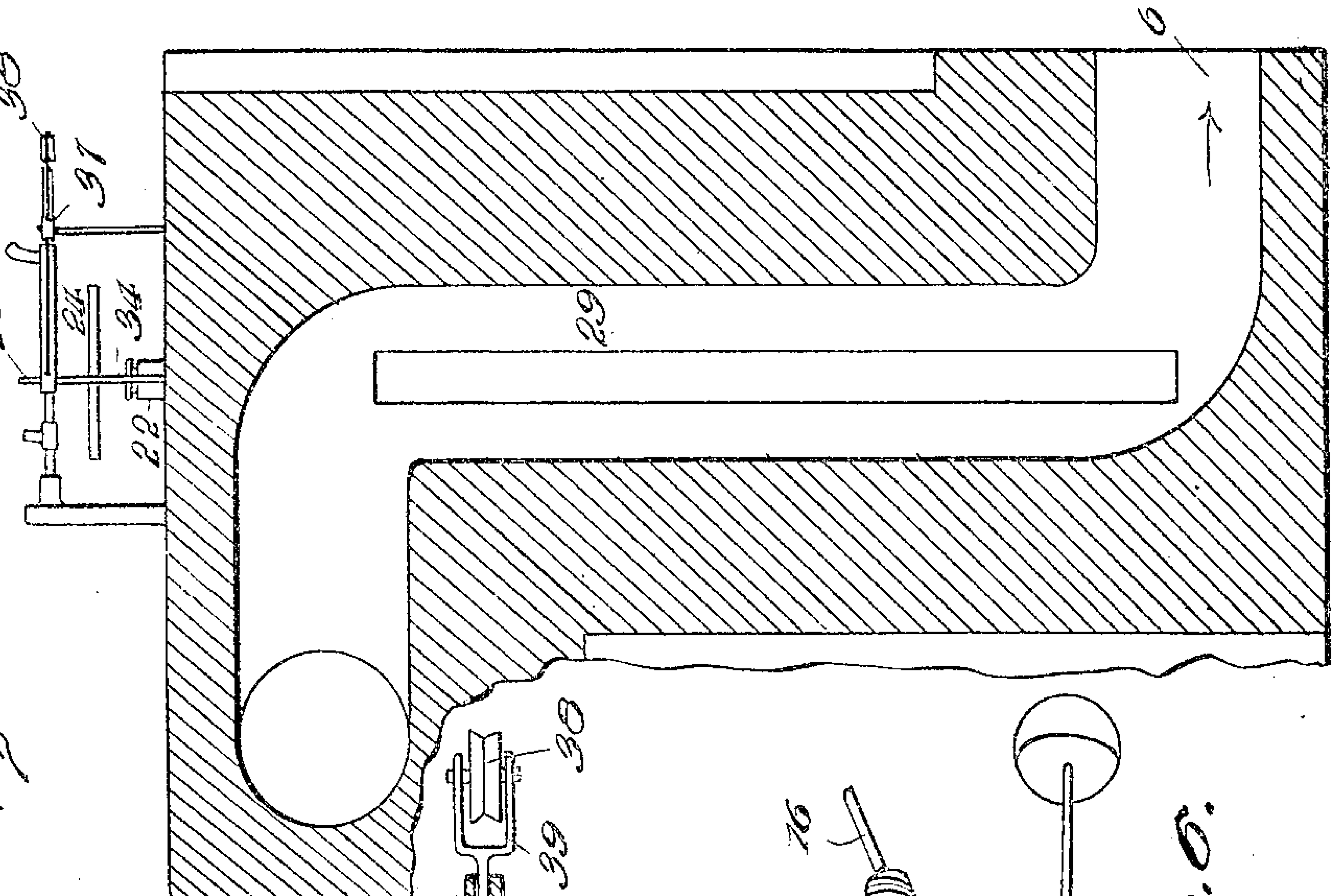

Fig. 3.

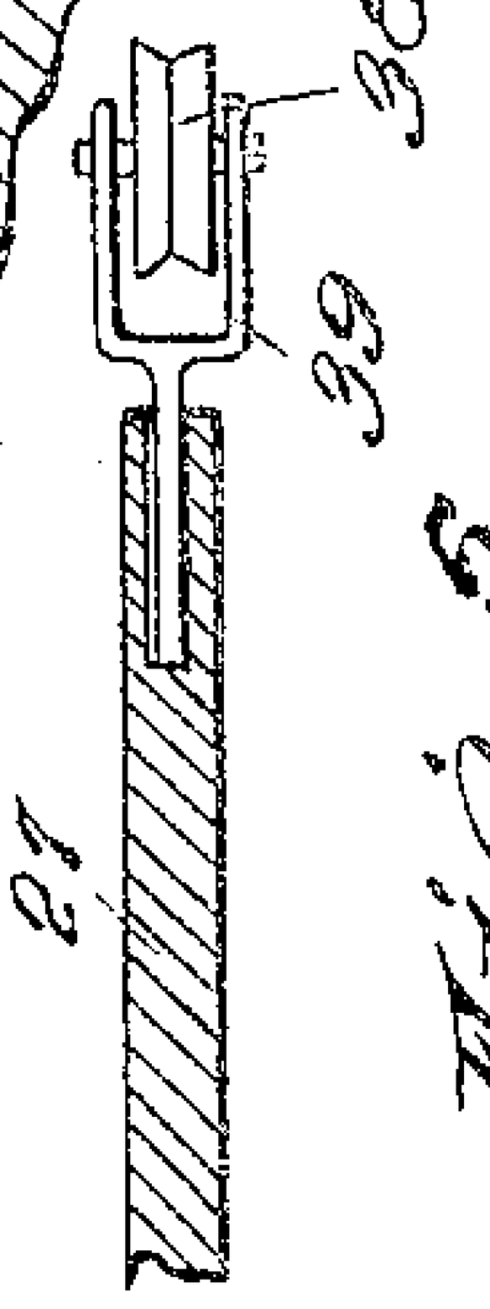

Fig. 5.

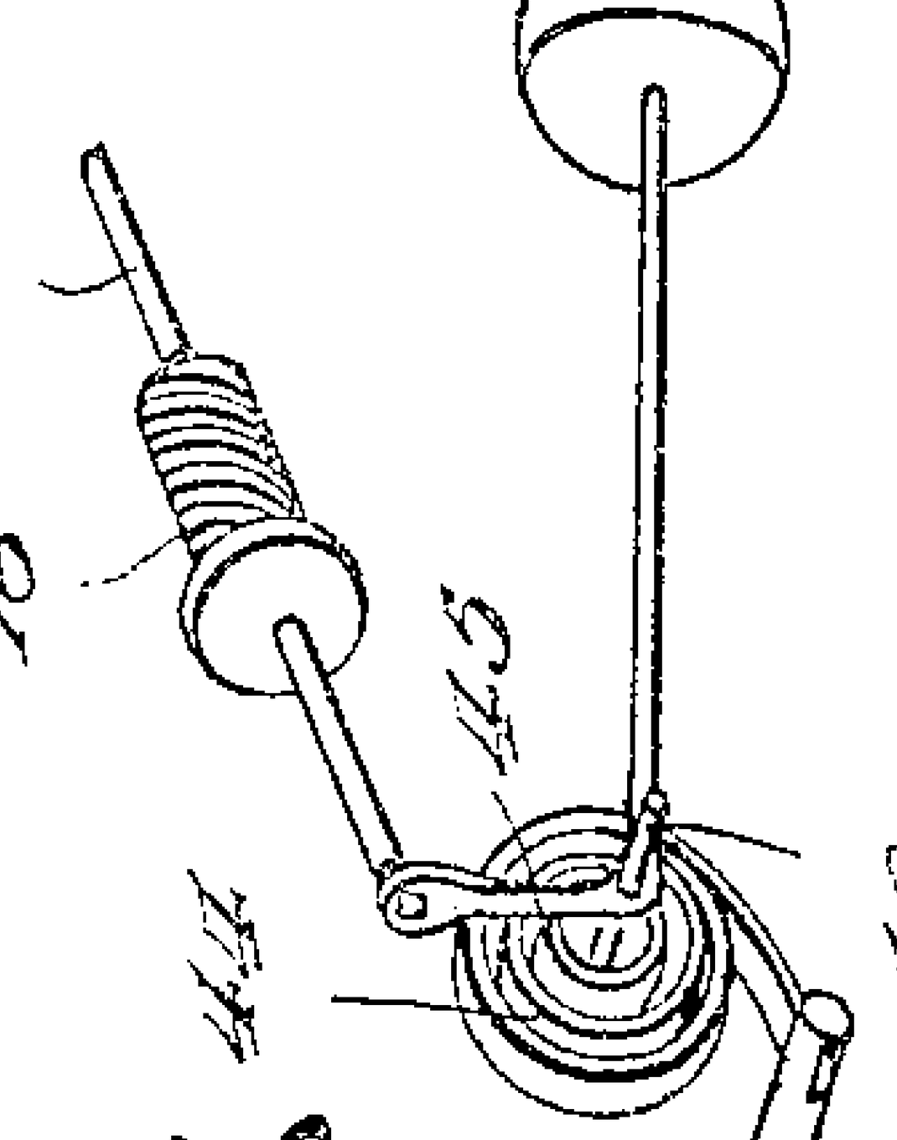

Fig. 6.

Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE H. FRISTOE, OF TORONTO, CANADA.

METER.

No. 808,150. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed February 25, 1905. Serial No. 247,375.

To all whom it may concern:

Be it known that I, GEORGE H. FRISTOE, a citizen of the United States, residing at Toronto, Province of Ontario, Canada, have invented certain new and useful Improvements in Meters, of which the following is a specification.

This invention embodies an improved construction of meter particularly designed for registering the heat units lost or consumed in any form of installation.

The meter is primarily intended for use in connection with flowing substances—such as water, gases, vapors, or the like—to ascertain efficiency of such or for any similar purpose.

The invention involves peculiar operating mechanism, the parts of which are constructed and arranged with a view to promoting the accuracy and effectiveness of the device to a maximum in accomplishing the desired results.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the result reference is to be had to the following description and accompanying drawings.

While the invention may be adapted to different forms and conditions by change in the structure and minor details without departing from the spirit or essential features thereof, still the preferred embodiment is shown in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal sectional view through a meter embodying the invention. Fig. 2 is a top plan view of the meter. Fig. 3 is a vertical sectional view taken on the line X X of Fig. 2. Fig. 4 is a view similar to Fig. 3, the section being taken on the line Y Y of Fig. 2. Fig. 5 is a perspective view showing the mounting of the yoke carried by the register-gear-wheel shaft. Fig. 6 is a detail perspective view showing more clearly parts of the density-regulator.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

Broadly speaking, the invention contemplates the use of a meter construction having a suitable passage for the fluid therethrough, which passage is divided into a plurality of chambers or compartments in a manner which will be more fully described hereinafter.

The invention contemplates the provision of a suitable register or recording dial actuator with a suitable driver therefor, which in turn is operated by a motor. The motor is actuated by the fluid as it passes through the meter and interposed between the driver and the fluid-actuated motor is a speed changing or varying mechanism controlled by a density-regulator of peculiar construction. The register-actuator is also in coöperative relation with suitable thermo-controlled devices, whereby the position of the regulator is varied with relation to the driver, the aforesaid thermal devices being also actuated by the variation in the temperature of the fluid as it passes through the meter.

In the practical embodiment of the invention the meter consists of a suitable casing or body through which the fluid passes in order that the variation in the heat may be measured in accomplishing the purposes of the invention. The meter-casing or body of the meter is designated 1 and may be of any suitable general construction, being divided into a supply-chamber 2, a discharge-chamber 3, and auxiliary chambers 4 in communication with the respective supply and discharge chambers. The supply-chamber 2 is provided with a suitable inlet 5 at the lower portion thereof and communicates at its upper portion with the upper portion of the adjacent discharge-chamber, the outlet 6 of the latter being located near its lower extremity.

A fluid-operated motor is provided in the supply-chamber 2 of the meter, and said motor preferably comprises a shaft 7, upon which is mounted a spiral 8. The shaft 7 is mounted in suitable bearings provided in bars 7^a, arranged in the chamber 2, and the fluid as it enters the inlet 5 actuates the spiral 8 in a manner readily apparent, transmitting rotary movement to the shaft 7, according to the velocity of the fluid.

The upper portion of the chamber 2 is enlarged, as shown at 9, and the enlarged portion 9 is separated from the body of the chamber 2 by means of a partition 10, hermetically sealed to the sides and other portions of the casing 1 when secured in place. The partition 10 in its disposition as above described forms a density-chamber 11 at the upper portion of the chamber 2, and this chamber 11 is in communication with the chamber 2 in order that the density of the fluid in the chamber 11 may be substantially the same as that which is passing through the supply or discharge chambers of the meter. An opening 12 in the partition 10 admits of passage of fluid

into the chamber 11, and the opening 12 is preferably closed by porous or aborbent material, which prevents foreign matter from entering the chamber 11, but admits the fluid, as above premised. The shaft 7 of the fluid-actuated motor extends through the partition 10 into the chamber 11 and coöperates with mechanism in this chamber, which is of such a nature as to necessitate the use of such a compartment in order that foreign matter entering the chamber 2 may not interfere with the parts of the mechanism last mentioned. The shaft 7 passes through a stuffing-box 13, provided upon the partition 10 at the opening therein, through which said shaft extends, and this stuffing-box may be packed with suitable material of a porous nature, so as to exclude foreign matter, but admit the fluid into the chamber 11 as it passes through the meter.

Upon the upper end of the shaft 7 is mounted a horizontal wheel or disk 14, which is constantly revolved by the fluid as it passes through the supply-chamber 2. Operating upon the outer face of the wheel 14 is a second wheel 15, having the peripheral portion thereof in frictional contact with the wheel 14, so that motion may be transmitted to said wheel 15 as the fluid-motor is being operated. The wheel 15 is adapted to traverse the upper side of the wheel 14 from the center of the latter to the peripheral portion, and the wheel 15 is carried by a shaft 16, mounted in suitable bearing-brackets 17, disposed in the chamber 11. The wheel 15 is keyed or otherwise secured to the shaft 16 for rotation therewith, and the said shaft is adapted for longitudinal movement, so as to enable the wheel 15 to traverse the upper side of the wheel 14 in the manner before described. Mounted upon the shaft 16 is a worm 18, having a feather-and-spline connection with the shaft, and this worm engages with the worm-wheel 19 at the lower end of a short vertical shaft 20, mounted adjacent the shaft 16. The shaft 20 is provided at its upper end with a suitable gear 21, which comprises one of a train of gears 21, 21^a, 21^b, and 21^c, by which differential motion is communicated to another vertical shaft 22, the lower end of which passes through the casing 1 into the chamber 11, the upper end thereof being exterior of the casing 1, as shown most clearly in the drawings. The shaft 22 passes through a stuffing-box 23, carried by the casing 1, so as to prevent escape of the fluid which passes through the meter. The gear-wheel 21^c of the train of gears above mentioned is carried by the lower or inner extremity of the shaft 22. The upper extremity of the shaft 22 is provided with a friction disk or wheel 24, which comprises a driver similar to the wheel 14, carried by the motor-shaft 7 and located in the density-chamber 11. The wheel 24 is also arranged in a horizontal plane, and a second wheel 25 is adapted to traverse the upper surface of the wheel 24, as described with reference to the member 25 of the mechanism in the chamber 11. The wheel 25 is formed with a gear extension 26, toothed annularly and of considerable length. The member 25 thus practically forms a gear-wheel which is designed to coöperate with a second gear-wheel (not shown) in mesh with the part 26 and forming the driving-gear of the recording dial or like device. The wheel 25 is mounted upon a horizontal shaft 27, carried in a suitable bearing-bracket 28 and adapted for longitudinal movement, so that the wheel 25 may be shifted toward and from the peripheral portion of the wheel 27 in the practical operation of the invention. The elongated form of the gear extension 26 of the wheel 25 is necessary that the same may always remain in mesh with the actuating gear-wheel of the recording or registering dial during the longitudinal movement of the wheel 26 across the face of the member 24. The recording-dial and direct mechanism is not illustrated, since any type of this device may be used in connection with the motor; but it will be understood that the member 25 directly operates the dial or registering device, by which the loss of heat of the fluid which passes through the meter is registered.

The train of gears 21, 21^a, 21^b, and 21^c, together with the members 15 and adjacent parts, comprise a speed-varying mechanism for the driver 24, as will be readily seen. The speed mechanism is governed by a density-actuator, which will be hereinafter set forth.

The casing 1 of the meter has been before described as being provided with auxiliary chambers 4. The chambers 4 are preferably arranged parallel with the chambers 2 and 3, and communication is established between the chambers 2 and 3 and their auxiliary chambers by cutting away or slotting the walls which separate the chambers, as shown most clearly at 29. It will thus be seen that the temperature of the fluid passing through the meter is readily appreciated in the chambers 4, because of the communication established between the various chambers according, as above premised. Within each of the auxiliary chambers 4 of the meter are mounted casings 30, said casings being of approximately cylindrical form and closed at their lower ends, as shown at 31. The upper ends of the casings 30 extend through the top of the casing 1, and they are normally closed by closures 32^a. The upper extremities of the casings 30 are flanged, so as to rest upon the upper side of the casing 1 and hold the casings in proper position within the auxiliary chambers 4. The sides of the casings 30 are such that the same are spaced from the walls of the compartments or chambers 4 throughout their length, admitting of free flow of the fluid passing through the meter about the casings, the influence of such fluid being distributed equally about the casings throughout

the length thereof. In each of the casings 30, which are sealed to the casing 1 of the meter, are located thermo-coils 32, each of which is composed, preferably, of two flat strips of steel and brass united at adjacent sides by soldering and coiled to assume the spiral formation above mentioned. The spirals 32 have the volutes thereof of the same size throughout their length, the lengths of said springs being uniform. Further, the elements 32 are so secured in the casings 30 as to be disposed exactly central of the casings. As is well known, the substance from which the elements 32 are made is very susceptible to the influence of varying temperature, and the formation of the spirals 32 is such as to admit of contraction and expansion thereof according to well-known principles. The disposition of the elements 32 within the casings 30 is such that the same are readily influenced by the variation in the temperature of the fluid which passes through the meter, and these spirals 32 are utilized as actuating means coöperating with the wheel 25, carried by the shaft 27. Attaching members 33 are projected from the lower extremities of the coils 32 and are secured to shafts 34, arranged centrally of the coils and passing through openings in the covers or closures 32[a] of the casings 30. The upper ends of the shafts 34 terminate in a plane about on a line with that in which the shaft 27 operates, and each shaft 34 carries at its upper extremity grooved segments 35. The grooved segments 35 of the shafts 34 are connected by a connection 36, which is preferably a silk strand of suitable length and directly attached to the segments. The connection 36 passes about spaced grooved pulleys 37 and thence about a third grooved pulley 38, the latter being carried by the shaft 27 at one end thereof. The pulley 38 is located some distance from the pulleys 37, and in order that the connection 36 may pass to the pulley 38 said connection is necessarily deflected in its length, differential movement of the segments 35, under conditions which are herein described, accomplishing a variation in the length of the deflected portion of the said connection 36, so as to cause movement of the register-actuator which consists of the wheel 25 and adjacent gear or pinion element 26. The pulley 38 is mounted in a yoke 39, having swivel connection with the shaft 27, so that the shaft may freely rotate without communicating rotation to the part which supports the pulley 38 directly. The connection 36 is normally under tension, owing to the provision of the spring 40, one end of which is suitably secured to the casing 1 of the meter, an opposite end bearing against that portion of the shaft 27 opposite the pulley 38.

The movement of the wheel 24, which directly actuates the recording device, is regulated by a density-regulating device which is located in the density-chamber 11. Thus the revolutions of the disk or wheel 24 will be proportionate with the density of the fluid in passing through the meter. A float 41 is mounted in the chamber 11, and this float preferably comprises a hollow or metallic ball or the like carried by a rod 42, which may be pivotally mounted upon a shaft 43. The float 41 is normally held in an ascertained position by means of a spring 44, which coöperates with the shaft 43 in accomplishing this result. Adjacent this pivotal point the rod 42 is provided with an arm 45, which projects therefrom and connects with one extremity of the shaft 16, carrying the wheel 15. The shaft 16 is thus adapted to be actuated by the arm 45, the latter permitting longitudinal movement of the shaft under certain conditions of service. In accordance with the well-known principle that heat diminishes density and cold increases density it will be seen that variation in the density of the fluid which passes through the meter will influence the float 41, for as the temperature lowers the increase in the density of the fluid will cause said float to rise, permitting the disk or wheel 15 to travel toward the periphery of the motor-actuated wheel 14, the revolution of the part 15 corresponding or being proportional to the density of the substance which is to be registered. The movement of the wheel 24, carried by the shaft 22, of course corresponds with that of the wheel 15, said wheel 24 being actuated through the train of gearing by the member 15. The speed of the wheel 24 is therefore also proportionate with the density of the fluid in the meter. As the fluid passes through the meter the variation in the temperature of the fluid is apparent in the compartments or chambers 4 as well as in the discharge and supply chambers 2 and 3, and such variation in temperature influences the elements 32 in a manner which will be obvious. When the variation temperature in the chambers 4 is substantially the same, the spirals 32 coil and uncoil in the same direction of rotation and to the same extent. When the spirals 32 move as above mentioned, the connection 36 moves freely about the pulleys 37 and 38 without varying the position of the shaft 27; but as soon as the temperatures of the fluid in the chambers 4 are different the degree of movement of the spirals 32 will be likewise different, so that the connection 36 will be placed under tension and the shaft 27 will be moved against the tension of the spring 40 to cause the wheel 25 to move toward the periphery of the wheel 24. Reiterating, it will be seen that the revolutions of the disk 25 will be exactly proportionate with the difference of the temperatures by which the two spirals 32 are influenced, and the actuation of the wheel 25 will be such as to operate the recording dial or device, so that the exact loss of heat of the fluid will be registered.

It will of course be understood that the mech-

anism above the casing 1 will be suitably inclosed, so as to prevent entrance of foreign matter which might be detrimental to the proper working of the recording and adjacent mechanisms.

Having thus described the invention, what is claimed as new is—

1. In a meter of the class described, the combination of a driver, a density-regulator for the driver, a register-actuator deriving motion therefrom, and a thermo-controller for varying the relative position of the driver and actuator.

2. In a meter of the class described, the combination of a driver, a register-actuator deriving motion therefrom, a thermo-controller comprising independent elements, and a connection between said thermal elements and register-actuator.

3. In a meter of the class described, the combination of a driver, a register-actuator deriving motion therefrom, a thermo-controller comprising independent elements, and a connection between said elements and the actuator and varied in its length by the differential movement of said elements.

4. In a meter of the class described, the combination of a driver, a register-actuator deriving motion therefrom, a thermo-controller comprising independent elements, and a connection between said thermal elements and register-actuator, said connection being normally under tension and affected by differential movement of said elements.

5. In a meter of the class described, the combination of a register-actuator, a driver deriving motion therefrom, a thermo-controller comprising independent elements, a connection between the elements of the thermo-controller and the register-actuator, and yielding means for holding the register-actuator in intimate contact with the connection aforesaid.

6. In a meter of the class described, the combination of a register-actuator, a driver deriving motion therefrom, a thermo-controller comprising independent elements, and a flexible connection between the thermal elements and deflected in its length, the degree of deflection of the connection being susceptible of variation.

7. In a meter of the class described, the combination of a register-actuator, a driver deriving motion therefrom, a thermo-controller comprising independent elements, and a flexible connection between the thermal elements and deflected in its length, the degree of deflection of the connection aforesaid being susceptible of variation by differential movement of the thermal elements.

8. In a meter of the class described, the combination of a register-actuator, operating mechanism therefor including a speed-changing mechanism, and a density-regulator embodying a float and coöperating with the speed-changing mechanism.

9. In a meter of the class described, the combination of a register-actuator, operating mechanism therefor including a speed-changing mechanism, a density-regulator including a float, means for holding said float normally in a predetermined position, and means actuated by the float and operably connected with the speed-changing mechanism.

10. In a meter, the combination of a supply-chamber, a density-chamber in the length of said supply-chamber, a density-regulator in said density-chamber, a driver, a register-actuator operated by the driver, means operably connecting the density-regulator with the driver, and a thermal coil in the meter connected with the register-actuator.

11. In a meter, the combination of a supply-chamber, a density-chamber in the length of said supply-chamber, a density-regulator in said density-chamber, a driver, a register-actuator operated by the driver, and means including speed-changing mechanism arranged in the density-chamber and operably connecting the density-regulator and the driver.

12. In a meter of the class described, the combination of a register-actuator, a driver, thermo-controlled means for positioning the actuator with reference to the driver, and actuating mechanism for the driver including a density-regulator.

13. In a meter of the class described, the combination of a register-actuator, a driver, thermo-controlled means for positioning the actuator with reference to the driver, actuating mechanism for said driver including a speed-changing mechanism, and a density-regulator for said speed-changing mechanism.

14. In a meter of the class described, the combination of a fluid-actuated motor, a register-actuator, a driver, and thermal devices for positioning the actuator with reference to the driver and operated by fluid passing through the meter.

15. In combination with a meter having a fluid-passage therethrough, a motor operated by fluid passing through the meter, a driver, a register-actuator operable by the driver, and thermal devices for varying the relative positions of the driver and register-actuator.

16. In combination with a meter having a fluid-passage therethrough, a motor operated by fluid passing through the meter, a driver, a register-actuator operable by the driver, and thermal devices influenced by the fluid passing through the meter for varying the relative positions of the driver and register-actuator.

17. In combination with a meter having a fluid-passage therethrough, a motor operated by fluid passing through the meter, a driver, a register-actuator operable by the driver, and thermal devices at different points in the length of the passage for varying the relative positions of the driver and register-actuator.

18. In combination with a meter having a fluid-passage therethrough, a motor operated

by fluid passing through the meter, a driver, a register-actuator operable by the driver, thermal devices at different points in the length of the passage for varying the relative positions of the driver and register-actuator, and a variable connection between the thermal devices.

19. In combination with a meter having a fluid-passage therethrough, a motor operated by fluid passing through the meter, a driver, a register-actuator operable by the driver, thermal devices for varying the relative positions of the driver and register-actuator, and a density-regulator for the driver.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE H. FRISTOE. [L. S.]

Witnesses:

WILLIAM E. RAMEY,

ALBERT HACKER.