N° 12,375 A.D. 1904

Date of Application, 31st May, 1904

Complete Specification Left, 23th Feb., 1905—Accepted, 31st May, 1905

PROVISIONAL SPECIFICATION.

Improvements in Electric Clocks or Time Indicators and like Mechanism.

I, GEORGE BENNETT BOWELL, of 6 Scarsdale Villas, Kensington in the County of London, Electrician, do hereby declare the nature of this invention to be as follows:—

This invention has for its object to provide means in a system or circuit of electrically operated or controlled step-by-step time indicators or the like for preventing any indicator on the system or circuit from missing its periodic propelling or controlling current.

For the sake of clearness but without wishing to bind myself to any particular form of apparatus in detail to the exclusion of modifications which would be substantially the same I will describe this present invention in one form as applied to a system of electric clocks in which a master clock having an electro-magnet for winding its spring say once a minute and a contact closed by the running down of the spring and opened by the electro-magnet is employed to work in conjunction with a plurality of indicators which have electro-magnets for the purpose of moving forward their hands say at each minute. Hitherto such a system has been operated by connecting all the electro-magnets to one circuit and controlling the supply of current to that circuit by means of the contact above described which I will call the transmitter contact. In my invention I connect this transmitter contact to control only the circuit of the electro-magnet in one indicator. That indicator I provide with another contact closed upon the action of its electro-magnet and this contact closes the circuit of the next indicator and the last indicator's contact closes the circuit of the magnet in the master clock and this during its action opens the transmitter contact. It will thus be seen that the movements are operated in cascade or concatenation the result being a proper interlock between the master clock and all the indicator movements. It will be seen that to a certain extent this invention is applicable to many known systems of electric clocks and other similar step-by-step devices (such as gun-range indicators, and similar numerical indicators for other purposes, and also engine room order telegraphs) but in conjunction with it I prefer to employ movements in which the electro-magnets are of special construction having their armature hinged at or to one pole-piece and arranged for a long travel across the inside of the other pole-piece. The armature is employed to drive the indicating mechanism either on its inward stroke or on its return stroke performed by spring or weight. Any of the well known arrangements of click-work are of course applicable or for preferance I employ as clicks or pawls cylindrical pins working in suitable holes the one hole being in the armature itself or in a block attached to the armature, and the other being in a fixed block. These pins may be plain cylinders or may be of a modified shape such as being provided with enlarged heads or ends.

[*Price* 8*d*.]

This invention I may use either for working by local batteries or by a common battery, and I may either employ mechanisms driven by spring or weight and controlled by electro-magnets or mechanisms operated by the electro-magnets.

Dated this 31st. day of May, 1904.

WHEATLEY & MACKENZIE,
40 Chancery Lane, London, W.C.
Agents.

COMPLETE SPECIFICATION.

Improvements in Electric Clocks or Time Indicators and like Mechanism.

I, GEORGE BENNETT BOWELL, of 6 Scarsdale Villas, Kensington, in the County of London, Electrician, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has for its object to provide means in a system or circuit of electrically operated or controlled step by step time indicators or the like for preventing any indicator on the system or circuit from missing its periodic propelling or controlling current; and consists in a master clock device including a transmitter and a receiver, in combination with a series of controlled clock devices, each including a transmitter and a receiver, the master clock transmitter being connected to the receiver of the first controlled clock device, the transmitter of the controlled clock devices being connected respectively to the receiver of the next controlled clock device and the transmitter of the last controlled clock device being connected to the receiver of the master clock.

For the sake of clearness, but without wishing to bind myself to any particular form of apparatus in detail to the exclusion of modifications which would be substantially the same, I will describe this present invention in one form as applied to a system of electric clocks in which a master clock having an electro-magnet for winding its spring say once a minute and a contact closed by the running down of the spring and opened by the electro-magnet is employed to work in conjunction with a plurality of indicators which have electro-magnets for the purpose of moving forward their hands say at each minute.

The transmitter contact is connected to control the circuit of the electro-magnet in one indicator, that is provided with another contact closed upon the action of its electro-magnet and this contact closes the circuit of the next indicator and the last indicator's contact closes the circuit of the magnet in the master clock and this during its action opens the transmitter contact. It will thus be seen that the movements are operated in cascade or concatenation, the result being a proper interlock between the master clock and all the indicator movements. It will be seen that to a certain extent this invention is applicable to many known systems of electric clocks and other similar step by step devices such as gun range indicators and similar numerical indicators for other purposes and also engine room order telegraphs.

The electro-magnets of the time indicators or the like are of special construction having their armature hinged at or to one pole-piece and arranged for a long travel across the inside of the other pole-piece. The armature is employed to drive the indicating mechanism either on its inward stroke or on the return stroke effected by a spring or weight. Any of the well-known arrangements of clockwork are of course applicable or for preference I employ as clicks or pawls

cylindrical pins working in suitable holes, the one hole being in the armature itself or in a block attached to the armature, and the other being in a fixed block. These pins may be plain cylinders or may be of a modified shape such as being provided with enlarged heads or ends.

This invention I may use either for working by local batteries or by a common battery, and I may either employ mechanisms driven by spring or weight and controlled by electro-magnets or mechanisms operated by the electro-magnets.

Referring to the drawings, Fig. 1 shows diagrammatically the arrangement of an electrically controlled clock system arranged according to this invention, and Fig. 2 is a diagram showing the step by step clock dial actuating mechanism.

In Fig. 1 the wheel a is adapted to be driven by the click a^1 attached pivotally to the armature a^2 which is centred at a^3 and is adapted to be attracted by an electro-magnet s^4 against the resistance of the spring a^4. The armature a^2 is provided with a contact surface which can make contact with the insulated contact spring a^6, connected to the terminal s^5 and the terminal s^6 is connected to the armature a^2. The wheel a drives the wheel c preferably through the spring connection c^1 and the wheel c drives the escapement c^2 c^3 through the wheels c^4 c^5 in the usual manner, the click c^6 retaining the tension of spring c^1 during the winding action.

The lines m^1 m^2 lead from the master clock to the first indicator dial m on the route and include in their circuit the battery m^3 and electro-magnet m^4. The terminals m^5 m^6 are connected respectively to the movable and fixed contact points m^7 m^8 and these contact points are adapted to be brought together when electro-magnet m^4 is energised, m^7 being pulled by the magnet against m^8.

From m^5 m^6 another similar circuit n^1, n^2, n^4 is provided to the second indicator dial n and another similar circuit n^6, n^7, o^1, o^2, o^4 to the third indicator o and so on. There may of course be any desired number of such circuits and the last terminals o^5 o^6 are connected to the electro-magnet s^4 of the master clock and include the battery s^3.

The action of the apparatus is as follows:—Under the influence of spring a^4 and armature a^2 pivoted at a^3 the click a^1 bears upwardly and impels the wheel a, which drives, either direct or through the maintaining spring the wheel c, the rate of progression of this wheel being determined by the escapement c^2 c^3 which is provided with any suitable form of pendulum or its equivalent. Presently the armature a^2 rises far enough to close the circuit from battery m^3 through line m^2 terminal s^6 armature a^2 contact spring a^6 terminal s^5, line m^1, terminal,—electro-magnet m^4, terminal, and back to battery m^3, the current through this electro-magnet operating the mechanism for propelling the hands of the first indicator dial, and also closing contacts m^7 m^8 whereby circuit m^5, m^6, n^1, n^2,—to the electro-magnet of indicator dial n is completed, this in turn closes circuit n^5, n^6, o^1, o^2, of indicator dial o which again *etc. etc.* closes circuits through as many indicator dials as there may be on the circuit and the last such closes the circuit from battery s^3 the terminal s^7 electro-magnet s^4 terminal s^8 lines o^{10} o^{11} back to battery s^3, this battery s^3 thus furnishing current to electro-magnet s^4 which draws down armature a^2, thus rewinding the clock and cutting out the circuit through m^1 m^2, &c., in consequence of which if all the indicator dials' hands progress as they should do the various circuits are successively cut out and the electro-magnet s^4 releases its armature a^2 and spring a^4 continues to drive the master clock.

It will be observed that so long as the action of electro-magnet s^4 is sufficiently quick or the number of indicator dials controlled sufficiently large or the action of each sufficiently slow, the armature a^2 completes its full stroke before current ceases in electro-magnet s^4, but this can be ensured if desired by adding in shunt with contact spring a^6 or substituting therefor another contact spring as a^7 adapted to make contact with a suitable surface of click a^1 or any other of the many wellknown devices for ensuring that although the contact is closed only at the completion of the outward stroke of the armature yet it is not

broken until nearly the completion of its inward stroke. In practice however this addition is not found to be essential.

Although the master clock is above described as being wound up periodically by the electro-magnet I may also employ an alternative form of master clock in which its train may be driven by a spring or weight wound by hand, also where the installation may include one or more large indicator dial movements I may connect the winding side of the master clock either directly or through any convenient arrangement of leading off rods to the main wheel of such an indicator dial, and in either of these cases I prefer to employ as a transmitter contact some suitable device operated by or in conjunction with the escapement or its train, and the electrical circuits may include the magnet of the large indicator dial either as the only electro-magnet in the system or as the first of a series of interlocked circuits as above described or as the last or in fact in any convenient manner. Also an installation may consist of a number of operated dials arranged in groups so that each group may be interlocked with respect to the other groups but one or more groups may include a plurality of indicator movements, such a plan being particularly applicable when parts of the installation are connected through open wires, so that by having the last circuit brought into, or otherwise arranged to signal to, a central office a check can be kept upon the working condition of all the lines whether the wires be overhead, underground or internal.

Referring to Fig. 2, 1 is the arbor upon which the minute hand is fixed, this arbor makes one revolution in an hour and carries also the wheel 2. The wheel 2 is prevented from running back by the spring or click 3 and in the position shown is prevented from running forward by the sliding click or plunger 4 which bears at its outer end against a fixed banking provided by the pillar 5, the spring 6 intervening so as also to serve the purpose of pushing the click in towards the wheel when the movement is operated. The plunger 4 is fitted into the armature 7 which is cut away at 8 to permit of space for the wheel 2, the click 4 may have a banking 9 provided to limit its inward travel, the armature 7 is pivoted at 10; the drawing shows the armature in section at this part for the sake of showing clearly the position of the plunger 4. The upward movement of the armature 7 may be limited by the banking pin 11 which may be covered with some suitable material such as the piece of leather 12. This banking pin is not always a necessity especially when the inward stroke of the plunger 4 is limited.

The downward movement of the armature 7 may be limited by convenient banking such as the spring 13 attached to the pillar 14. This banking is adjustable by turning the pillar 14, and the banking above described for the outward travel of plunger 4 may be made adjustable by the screw 15 or this screw may be omitted and the pillar 5 may be eccentric. The armature 7 is adapted to be lifted by the electro-magnet 16, this electro-magnet having pole-pieces 17 and 18 and by the suitable arrangement of these pole-pieces an approximately uniform pull throughout the stroke is obtained from the magnet, this because the pole-piece 17 acts upon the armature with a tendency to increase its pull inversely as the square of the distance between them, but pole-piece 18 being in the same magnetic circuit, counteracts this tendency because the relation between angular movement of the armature and approach of the armature to the pole-piece 18 is of the reverse order, that is to say, the rate of approaching pole-piece 18 is lessened as the armature gets nearer to its near position. A counter balance weight 19 is provided from the armature 7 so that the effective amount of weight for driving the wheel 2 may be adjusted.

The action of the apparatus is as follows:—Upon the electro-magnet being excited by the current transmitted from a master clock the armature 7 is raised, this allows spring 6 to push plunger 4 into the range of the next tooth of wheel 2, upon cessation of current the armature 7 falls back and in doing so drives the wheel 2 into its next position, the spring or click 3 readily allowing

of this movement but then preventing recoil. Overshooting of the wheel 2 is prevented by the plunger 4 and spring 6 arriving against the screw 15. The hands to be driven are balanced. It will be noticed that no pressure due or caused by the momentum of the intermittently driven parts is borne by the pivots 10 of the armature 7 but is transmitted by the plunger 4 through spring 6 to the screw 15.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In an electrically controlled clock system, a master clock device including a transmitter and a receiver, in combination with a series of controlled clock devices each including a transmitter and a receiver, the master clock transmitter being connected to the receiver of the first controlled clock device, the transmitter of the controlled clock devices being connected respectively to the receiver of the next controlled clock device and the transmitter of the last controlled clock device being connected to the receiver of the master clock.

2. In an electrically controlled clock system, a master clock arrangement consisting of an escapement mechanism, a spring or weight driving the clock, an electro magnet for winding up the spring or weight, a battery for operating the electro-magnet, a circuit connecting the battery and electro-magnet and a contact switch operated by the clock mechanism, in combination with a number of receiver circuits, each containing one or more electrically operated clock indicator mechanisms, a battery, an electro-magnet and a contact switch operated by the electro-magnet, the first circuit including the master clock contact switch, the contact switch of any circuit being connected to the next circuit and the contact switch of the last circuit being connected in the circuit of the master clock.

3. In an electrically controlled clock system, the ratchet mechanism substantially as described with reference to Fig. 2 of the drawings.

4. In an electrically controlled clock system, the electro-magnet and its armature, substantially as described with reference to Fig. 2 of the drawings.

5. In an electrically controlled clock system, the step by step clock dial operated mechanism substantially as described with reference to Fig. 2 of the drawings.

6. The electrically controlled clock system substantially as described with reference to the drawings.

Dated this 28th day of February, 1905.

WHEATLEY & MACKENZIE,
40, Chancery Lane, London, W.C.
Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1905.

A.D. 1904. MAY 31. N° 12,375.
BOWELL'S COMPLETE SPECIFICATION.

Fig. 1.

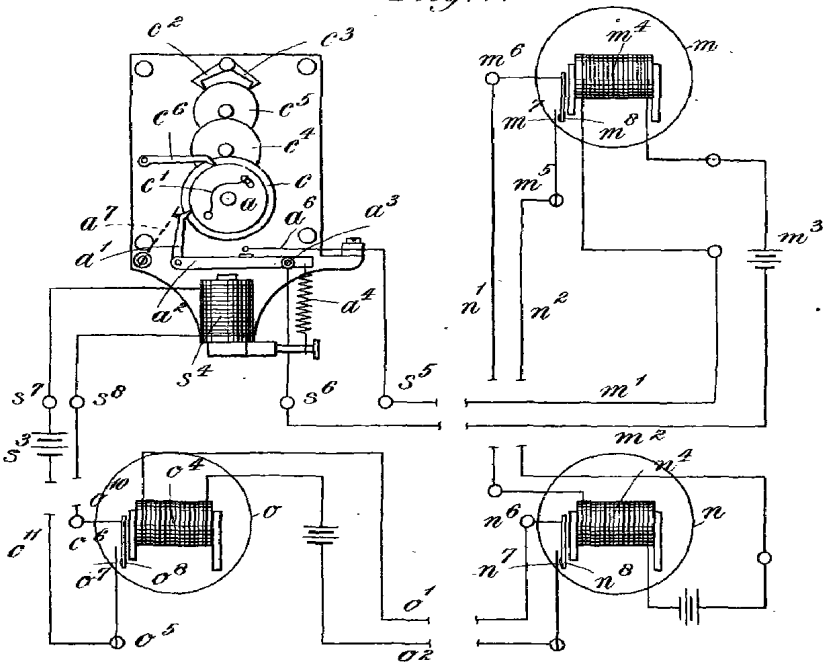
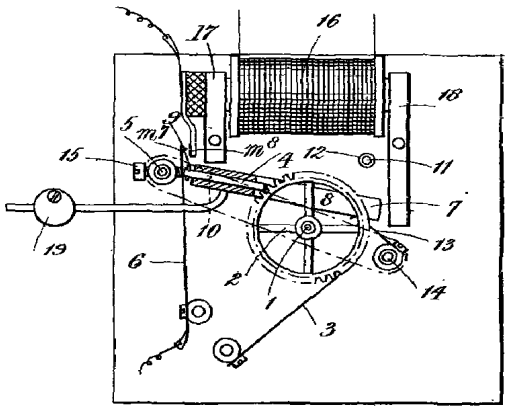


Fig. 2.



Maltby & Sons, Photo-Litho

Fig. 1.

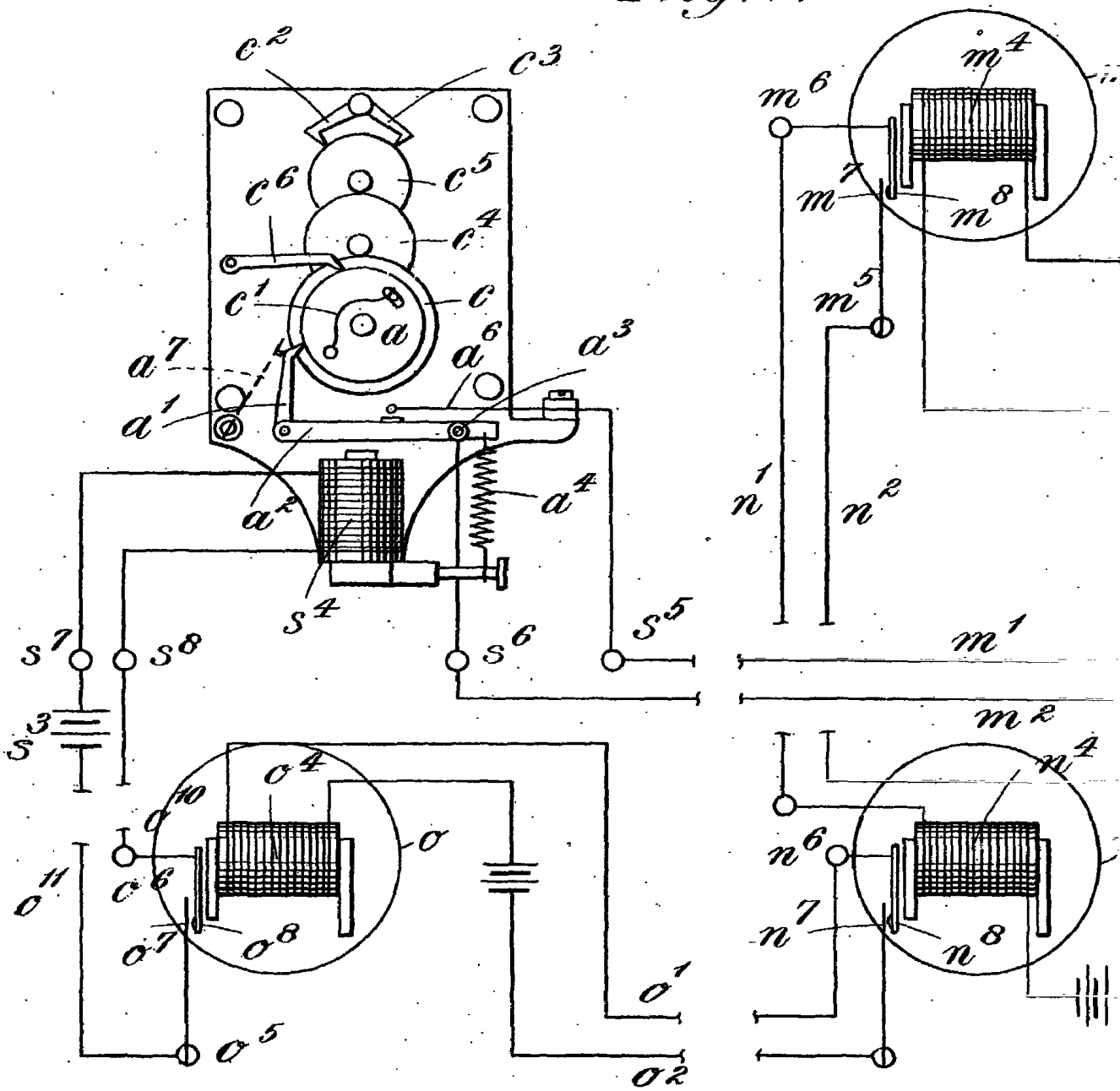
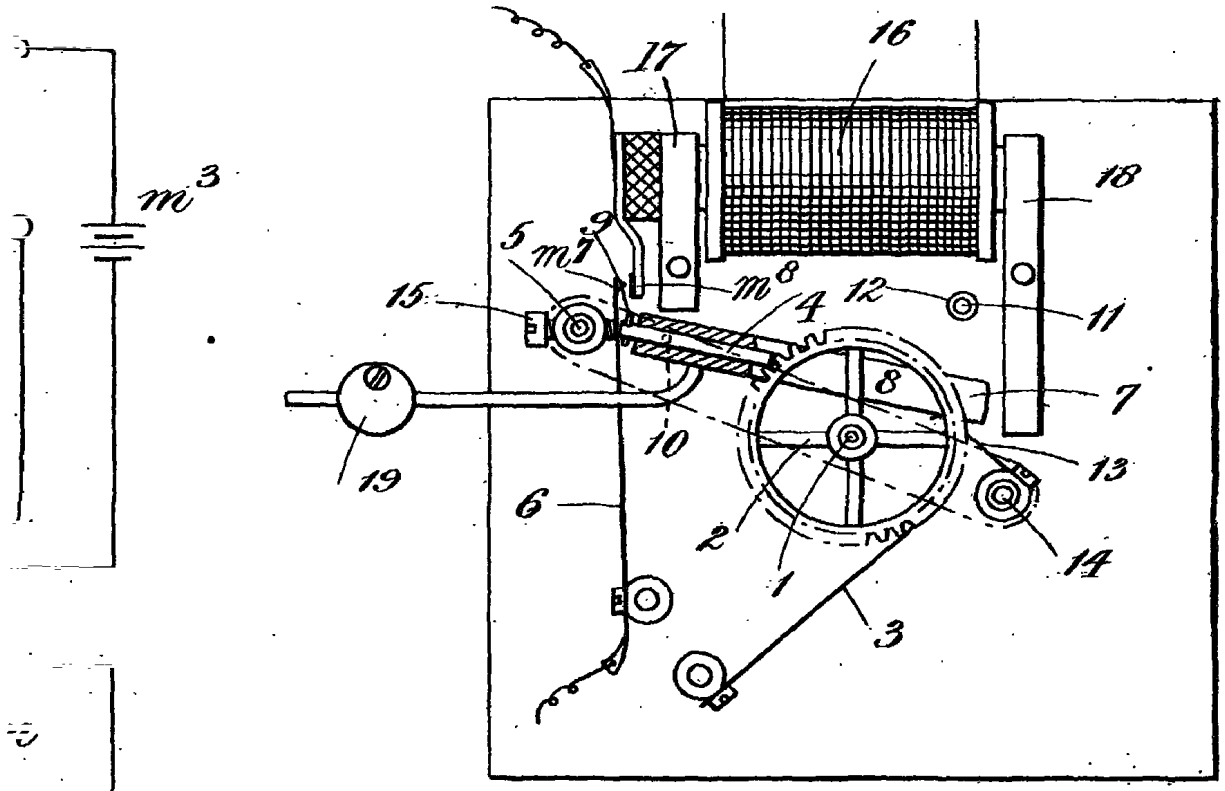


Fig. 2.



Malby&Sons, Photo-Litho.