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Complete Specification Left, 18th July, 1910—Accepted, 18th Jan., 1911

PROVISIONAL SPECIFICATION.

Improvements in Electric Clocks.

We, THOMAS JOHN MURDAY, and THE REASON MANUFACTURING COMPANY, LIMITED, both of Lewes Road, Brighton, in the County of Sussex, both Electrical Engineers, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in electric clocks, the object of this invention being to provide an electrically driven time piece in which the pendulum common to clocks of such type is replaced by a coiled spring and balance wheel, the arbor or spindle upon which the latter is mounted being arranged to receive an impulse from the armature of an electro-magnet when the oscillations of the balance wheel fall below a predetermined period.

It is carried out as follows:—

The balance wheel which is preferably made in the form of a heavy flanged disc whose internal portion excepting a central boss and two or more radiating arms is cut away; is disposed upon a vertical arbor suitably pivoted at top and bottom.

Within the flanged balance wheel or at any other suitable point on the balance arbor is disposed a coiled spring its outer end being adjustably fast to a cock. The upper and lower parts of the arbor carry roller ended arms, the upper one adapted to engage the forks of a rocking lever whilst the lower is adapted to receive an impulse from the armature of an electro-magnet tangentially disposed towards it.

The rocking lever has diverging arms above its pivot one of which carries counterpoised clicks adapted to actuate under the movement of the rocking lever a push and pull ratchet wheel in the time train, which push and pull motion, formed, *inter alia*, the subject matter of Letters Patent No. 22,819/08, the hour, minute, and second hands (if the latter be employed), being geared in the usual manner to the push and pull ratchet wheel, the said ratchet wheel being driven at a speed determined by the spring on the balance arbor.

The balance wheel carries peripherally a thin pivoted depending plate or wiper, adapted to move over a notched contact block mounted on a spring switch contact arm.

The operation of this invention is as follows:—

The balance wheel is started by giving it a slight turn in a direction to coil the spring, which causes a series of successive oscillations in the wheel and in coilings and uncoilings of the spring. During such movement the wiper clears the contact block, and the circuit remains open, but when the oscillation is less than the predetermined amount the wiper engages the block, depresses it, and causes the spring switch arm to close the electro-magnetic circuit and impart an impulse to the lower roller ended lever on arbor, which causes the arbor to regain its lost oscillatory rotation. The upper roller ended lever on arbor, has meantime oscillated between the forks of the rocking lever, thereby driving the time train through the push and pull gear already described.

Hence it will be observed that this type of electric clock can be well driven from a dry cell or other portable form of electric energy, though current from

[*Price* 8*d*.]

the ordinary supply mains or equivalent source may be employed, the winding of the electro-magnet being varied accordingly.

The duration of contact or tangential movement of the driving armature, and the revolution of the arbor, are both variable quantities, depending upon the circumstances of design or requirement.

Dated this 18th day of January, 1910.

FRANCIS HERON ROGERS,
Agent for the Applicants,
Broad Sanctuary Chambers, Westminster, S.W.

COMPLETE SPECIFICATION.

Improvements in Electric Clocks.

We, THOMAS JOHN MURDAY, and THE REASON MANUFACTURING COMPANY, LIMITED, both of Lewes Road, Brighton, in the County of Sussex, both Electrical Engineers, 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 relates to improvements in electric balance wheel clocks, and has for its object the construction of a clock in which the time keeping is constant irrespective of variations in the strength of the electric current.

Hitherto in some types of electrically operated balance wheel clocks, the impulses, giving renewed energy to the balance wheel, have been arranged to occur at certain fixed or definite intervals of time, usually once per minute, and in this way the amplitude of the oscillations, and consequently the time keeping, vary with every alteration of current strength, gradually dying down to a point insufficient to actuate the wheel train, and finally stopping long before the battery is exhausted.

However, in some other types of electrically operated balance wheel clocks the impulses are given to the balance wheel whenever the oscillations fall to or below a prearranged limit whereby steady time keeping is secured irrespective of any variations in the electric current, but this is only accomplished by the attraction of an armature on the balance staff. According to our invention the impulse is given when the oscillations fail, but, as in those of the first type, by the stroke of a lever and a special form is given thereto. Further, the impulses are given electrically, whereas in some types of electric balance wheel clocks the impulses are given mechanically, that is to say by means of a spring discharged and electrically reset at fixed intervals. In this method the driving force is a practically constant factor, but the balance wheel vibrations die down more or less quickly according to the variations in friction of the wheel train; and should the friction materially increase on account of dust or drying of the oil, the balance wheel may have ceased to impel the train before the period for the next impulse has arrived.

The impulses given to the balance wheel are transmitted to the train by means of a crank fixed on the oscillating balance wheel arbor and giving reciprocating motion to a rocking lever carrying counter balanced pawls which engage a ratchet wheel in the train.

The improvements are carried out as follows:—

The balance wheel which is preferably made in the form of a heavy flanged disc or ring whose internal portion excepting a central boss and two or more radiating arms is cut away; is disposed upon a vertical arbor suitably pivoted at top and bottom.

Within the flanged balance wheel or at any other suitable point on the balance arbor is disposed a coiled spring, its outer end being adjustably fast to a cock. The upper and lower parts of the arbor carry roller ended arms, the upper one adapted to engage the forks of a rocking lever whilst the lower is adapted to receive an impulse from the armature of an electro-magnet tangentially disposed towards it.

The rocking lever has diverging arms above its pivot one of which carries counterpoised clicks adapted to actuate under the movement of the rocking lever a push and pull ratchet wheel in the time train, which push and pull motion, formed, *inter alia*, the subject matter of Letters Patent No. 22,819/08, the hour, minute, and second hands (if the latter be employed), being geared in the usual manner to the push and pull ratchet wheel, the said ratchet wheel being driven at a speed determined by the spring on the balance arbor.

The balance wheel carries peripherally a thin pivoted depending plate or wiper, adapted to move over a notched contact block mounted on a spring switch contact arm.

The operation of this invention is as follows:—

The balance wheel is started by giving it a slight turn in a direction to coil the spring, which causes a series of successive oscillations in the wheel and in coilings and uncoilings of the spring. During such movement the wiper clears the contact block, and the circuit remains open, but when the oscillation is less than the predetermined amount the wiper engages the block, depresses it, and causes the spring switch arm to close the electro-magnetic circuit and impart an impulse to the lower roller ended lever on arbor, which causes the arbor to regain its lost oscillatory rotation. The upper roller ended lever on arbor, has meantime oscillated between the forks of the rocking lever, thereby driving the time train through the push and pull gear already described.

Hence it will be observed that this type of electric clock can be well driven from a dry cell or other portable form of electric energy, though a current from the ordinary supply mains or equivalent source may be employed, the winding of the electro-magnet being varied accordingly.

The duration of contact or tangential movement of the driving armature, and the revolution of the arbor, are both variable quantities, depending upon the circumstances of design or requirement.

In order to describe this invention more particularly reference is made to the accompanying drawings, in which:—

Figure 1 is a front part sectional elevation.

Figure 2 is a back view of the push and pull movement.

Figure 3 is a plan of electro-magnets and balance wheel.

In the drawings, standards 1 are secured to the base plate 2, and carry a cross member or bridge 3 upon which the movement plate 4 is mounted and against which the upper part of the balance wheel spindle 5 is pivoted.

The spindle 5 is pivoted at its lower end into a jewelled or metal adjustable footstep 6.

The spindle 5 carries on its length a crank 7, having a roller covered crank pin 9, a coiled spring 10 (operating in a manner similar to the hair spring of a watch), a balance wheel 11, and an impulse crank 12. The balance wheel 11 is accurately hung on the spindle 5 and is preferably made from invar or similar metal whose co-efficient of expansion is small, jockey weights 13 are fixed on its periphery to obtain accurate balance.

Below the balance wheel 11 is a switch contact consisting of a steel spring 14 pivoted at 15 to the insulated pillar 16, the other end of said spring being adapted to open the electric circuit when in its inoperative position against the terminal 17, and to close the circuit when pressed against the terminal 18, both terminals 17 and 18 are adjustable and secured to the pillar 16*a*, the terminal 18 being "live", and forming part of the battery or other electrical circuit.

Mounted on the spring 14 is a steel contact crutch 19, adapted to receive the knife edge of a wiper 20 that is screwed to one of the arms 21 of the balance wheel 11. The wiper 20 has its knife edge loosely hinged to the body portion and secured to the balance wheel arm 21 so that as the said wheel oscillates the wiper slides over the crutch 19 without depressing the spring 14 or closing the circuit. When however the arc of oscillation of the wiper falls to a predetermined value, the wiper does not wholly pass the crutch, its knife edge entering one of the crutch serrations, and the balance wheel in reversing its direction of rotation depresses the spring 14, owing to the wiper being too long to pass the crutch without depressing it when the dead centres of the crutch serration and the wiper are coincident.

An electro-magnet 25 is in circuit with the switch contact, the armature 26 carrying an extension or hammer 27 which is adapted to strike the impulse crank 12, attached to the spindle 5 so that the lost oscillation is restored to the balance wheel. The spring 10 is fast to the boss 30 on the spindle 5, its other end being attached to the depending clip 31, screwed to the cross bar 32 mounted on brackets on the pillars 1. A regulator 33 is pivoted on the bar 32 and thereby can move through an arc of 180°, enabling a very accurate regulation of the spring.

The crank pin 9 oscillates with the shaft 5, between the prongs of a fork 33 (see Figure 2). This fork is attached to a rocking lever 34 pivoted at 35 between the movement plate 4 and cock 36. The lever 34 has a double pronged extension, one prong 37 carrying counterbalanced wire arms 38, 38*a*, acting as push and pull pawls which impart rotary motion to the ratchet wheel 39 forming part of the clock wheel train. The other arm 40 of the lever 34 carries a jockey counter weight 41, so that the ratchet wheel 39 is relieved from sudden impulses, which might cause the wheel to race. The clock movement 42 driven from the ratchet wheel 39 is of an ordinary hour and minute hand pattern. The face of the clock may be of glass, as shewn, and be held by clips 43, screwed against the movement plate 4.

When batteries are used the base 44 is made hollow to contain the batteries 46 as shewn in Figure 1, suitable connections being made to the armature contact pillars and switch terminals from below.

In operation the balance wheel is rotated by hand to start the oscillation, and so soon as the wiper 20 fails to clear the crutch 19 the spring 14 is depressed closing the circuit, causing the electro-magnet to be energised, and the hammer 27 attached to its armature 26 to strike the impulse crank 12 and restore the lost oscillatory movement to the spindle 5 and balance wheel 11. This movement of the spindle 5, actuates through the crank 9 the rocking lever 34, driving the movement train 42.

As the battery power becomes feeble the impulse is weaker, and consequently the arc of oscillation less, and the depression of the contact switch more frequent, the apparatus thereby regulating its impulses according to the battery strength, the amplitude of oscillation thereby remaining to all intents and purposes constant and never able to fall below the predetermined value.

It will be noted that a clock made on these lines is employing current from primary batteries under the most favourable conditions, an interval ranging in frequency from 30 seconds to 2 minutes, elapsing between momentary contacts when the circuit is closed. The invention is not necessarily limited to primary circuits, though for the purposes of commerce batteries are preferably employed.

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

1. In an electrically driven balance wheel clock having a contact making device adapted to close the actuating circuit and a spring and balance wheel

fast on the same arbor, the combination therewith of an impulse crank and an electro magnet operating to drive the clock by imparting a fresh impulse to said balance wheel when the oscillations of the same fall to or below a prearranged limit, whereby time keeping is constant irrespective of current variations, substantially as described.

2. In an electrically driven balance wheel clock having a balance wheel and a crank fixed on a common oscillating arbor, the combination therewith of a pivoted rocking lever whose forked extremity engages said crank, said lever on one of its arms carrying counterbalanced pawls, said arm and pawls being counterbalanced by a weight on the other arm, and of a ratchet wheel adapted to be rotated to drive the clock train, by the reciprocating motion imparted to said lever by said crank, in the manner and by the means substantially as described.

3. An electrically driven balance wheel clock constructed and operating substantially as described.

Dated this 18th day of July, 1910.

FRANCIS HERON ROGERS,
Agent for the Applicants,
Broad Sanctuary Chambers, Westminster, S.W.

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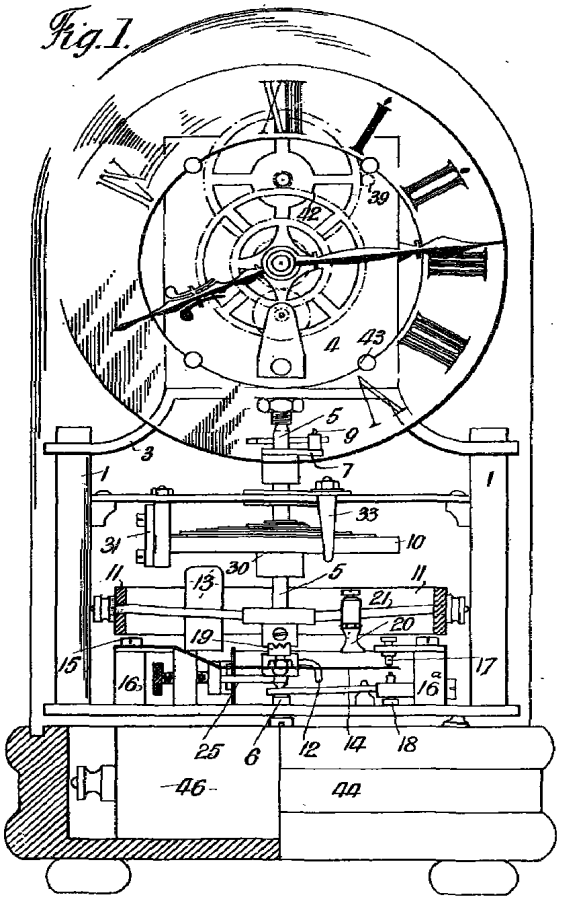
A.D. 1910. JAN. 18, No. 1326.
MURDAY & *others'* COMPLETE SPECIFICATION.

(2 SHEETS)

SHEET 1

Fig. 1.



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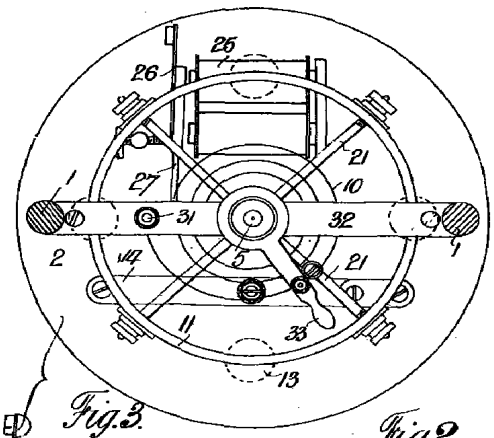

Fig. 3.

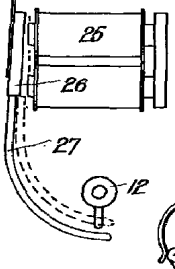

Fig. 2.

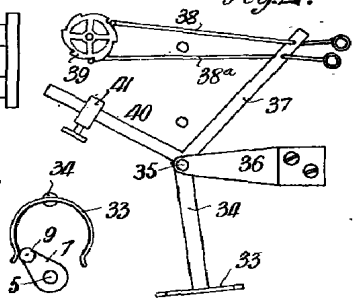

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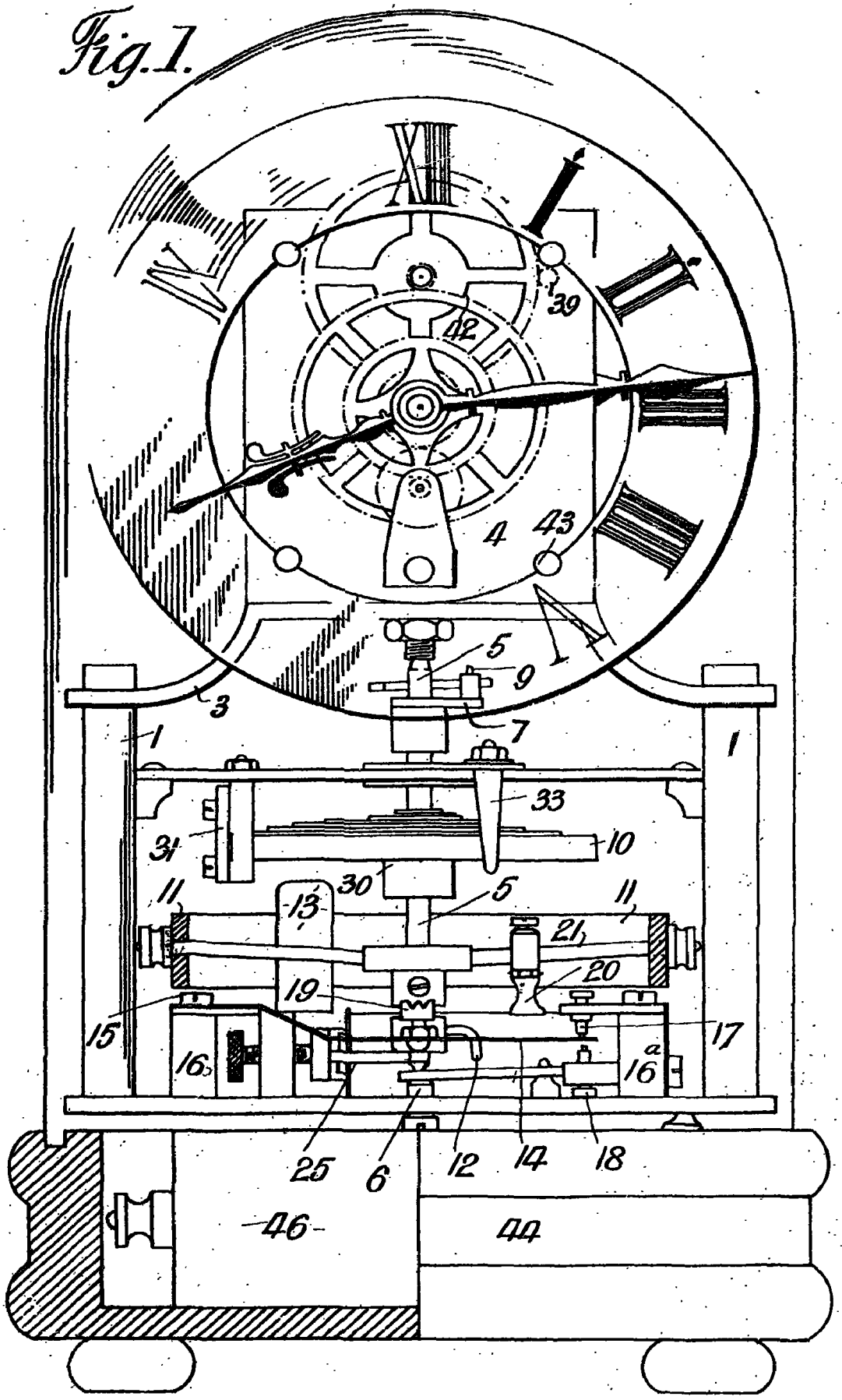
Fig. 1.



[This Drawing is a reproduction of the Original on a reduced scale.]

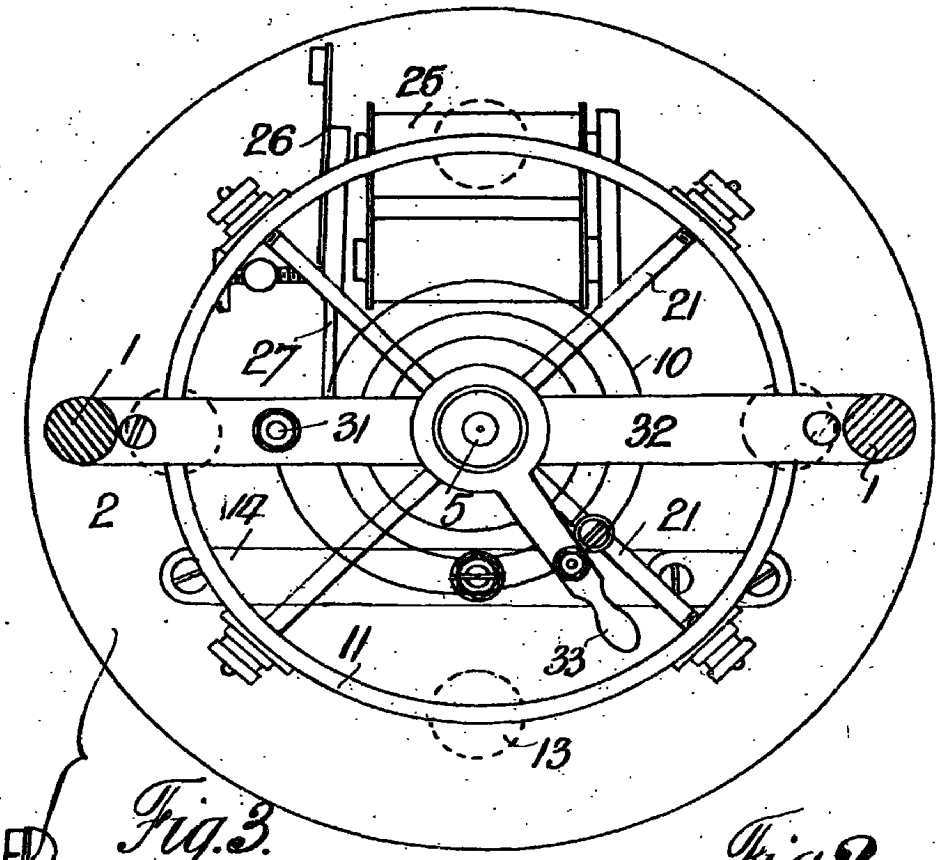
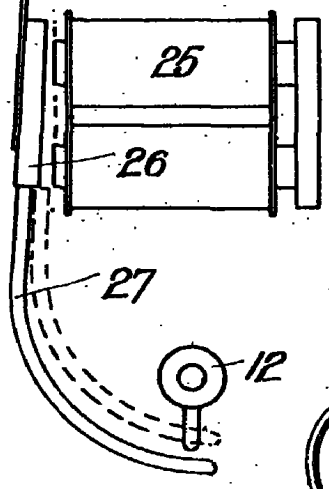


Fig. 3.



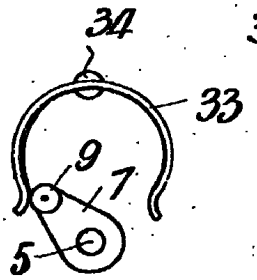


Fig. 2.

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