N° 20,878 A.D. 1907

*Date of Application, 20th Sept., 1907*

*Complete Specification Left, 20th Mar., 1908—Accepted, 10th Sept., 1908*

PROVISIONAL SPECIFICATION.

# Improvements in and relating to Motor-driven Clocks, Electrically Controlled.

We, ISAAC HARDY PARSONS of Kibworth Harcourt, Leicestershire, Electrical Engineer, and ALFRED ERNEST JOSEPH BALL, of 38 St. Saviour's Rd. East, Leicester, Clockmaker, do hereby declare the nature of this invention to be as follows:—

This invention relates to electrically driven clocks and chiefly to the class in which the clock wheel work is rotated by some form of electric motor either of a type designed for producing a slow motion, or other type suitably geared.

The object of this our invention is to cause such motor driven wheel work to rotate in such a manner that it becomes subservient to, and keeps time with, a transmitter or master clock of the class which sends out electrical impulses through a circuit at half minute or at other regular frequent intervals.

A further object is to arrange that instead of being driven continuously by the motor, the clock wheel work is propelled by it in short stages, such stages being performed in less time than that of the periodical intervals of the electrical impulses of the master clock.

In carrying this our invention into effect, we employ a special motor or a motor of any suitable type which conveniently produces a slow motion or an ordinary type suitably geared, or a reciprocating motor in the form of an electrically driven pendulum preferably of the type which draws on its source of electrical energy; (which may be applied either mechanically or electrically) each time the amplitude of its vibrations falls below a certain predetermined value.

We construct the clock work so that after it has been driven forward to an extent which coincides with the periodical intervals of the contacts of the master clock, but in a lesser time, the motor mechanism comes upon a portion of the wheel, at which say a tooth is purposely cut away, or at which a clutch is released, so that the clock wheel work is no longer driven.

The motor is then preferably allowed to work idly until the periodical impulse from the master clock contact operates an electro-magnet attached to the apparatus, the armature of which either temporarily places a moveable tooth into the gap or operates a suitable clutch device, or its equivalent, to enable the clock wheel work to be re-started. This cycle of operations is then repeated, and the clock hands or recording or other clock work apparatus is thereby rotated in synchronisation with the master or transmitting clock.

In one form of motor driven clock according to this our invention, we employ a motor pendulum which is maintained in vibration by means of a gravity lever, which on being tripped by a depending link, or equivalent device (which operates when the amplitude of the pendulum's vibration falls below a certain value), falls on to say, a pallet of the pendulum, and thus imparts an impulse.

The gravity lever on completing such impulse closes a circuit and is replaced electro-magnetically to its potential position.

An alternative method of maintaining the vibrations of the pendulum of a

[*Price* 8*d*.]

reciprocating motor is to employ the Hipp contact or similar device, which will close a circuit, on the amplitude falling, such circuit containing an electro-magnet which drives the pendulum direct by attracting an armature connected thereto.

We cause a reciprocating motor to drive our wheel work in the following manner:—

We provide the motor pendulum with a pawl which drives the ratchet wheel tooth by tooth. We gear this ratchet wheel to the clock wheel work, by worm gear or by other convenient means, and we arrange the number of the teeth in the ratchet wheel and the length of the pendulum, so that the ratchet wheel, is advanced a certain definite distance at each stage the distance so moved coinciding with the time of the intervals of the electrical impulses of the master clock, as hereinbefore described. At the completion of each stage we arrange that the driving pawl comes upon a portion of the wheel in which a tooth is purposely cut away, so that the pendulum no longer drives the wheel, but oscillates idly in the space from which a tooth is missing.

Mounted in close proximity to the driving pawl, we arrange another pawl which also oscillates with the pendulum and which for the purpose of this specification we will term the relay pawl. This relay pawl normally rides clear of a pin or projection, standing out say from the side of the ratchet wheel, and occupying a position equivalent to that of the missing tooth.

At each half minute or other interval of impulse of the master clock a current controlled by the latter is caused to momentarily excite a small electro-magnet disposed within the frame of the clockwork, the armature of which say, releases a detent of the relay pawl so that it is allowed to fall and so engage the pin of the ratchet wheel. This relay pawl then enables the pendulum on its next swing to drive forward the ratchet wheel to the extent of the missing tooth and so allow the driving pawl to again engage a tooth and so drive the ratchet wheel forward another stage as before.

Instead of engaging a pin at the side of the ratchet wheel, the relay pawl may engage a tooth in advance or a tooth behind the driving pawl, its length being modified accordingly, or in lieu of cutting away a tooth, we may employ a cam or projection to lift the pawl out of engagement with the ratchet wheel, or we may in some instances employ a moveable tooth, which is brought into position within the gap by the small electro magnet.

After the relay pawl or equivalent has operated, it is replaced to its normal position by means of a projection or cam attached to the ratchet wheel.

Dated this 19th. day of September, 1907.

I. HARDY PARSONS,
ALFRED E. J. BALL.

## COMPLETE SPECIFICATION.

### Improvements in and relating to Motor Driven Clocks, Electrically Controlled.

We, ISAAC HARDY PARSONS of Kibworth Harcourt, Leicestershire, Electrical Engineer, and ALFRED ERNEST JOSEPH BALL, of 38, St. Saviours Rd. East, Leicester, Clockmaker., 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 electrically driven clocks and chiefly to the class in which the clock wheel work is rotated by some form of electric motor, either of a type designed for producing a slow motion, or other type suitably geared.

The object of this our invention is to cause such motor driven wheel work to rotate in such a manner that it becomes subservient to, and keeps time with, a transmitter or master clock of the class which sends out electrical impulses through a circuit at half minute or at other regular frequent intervals.

A further object is to arrange that instead of being driven continually by the motor, the clock wheel work is propelled by it in short stages, such stages being performed in less time than that of the periodical intervals of the electrical impulses of the master clock.

In carrying this our invention into effect, we employ a special motor or a motor of any suitable type which conveniently produces a slow motion, or an ordinary type suitably geared, or a reciprocating motor in the form of an electrically driven pendulum preferably of the type which draws on its source of electrical energy, (which may be applied either mechanically or electrically) each time the amplitude of its vibrations falls below a certain predetermined value.

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The motor is then preferably allowed to work idly until the periodical impulse from the master clock contact energises an electro-magnet attached to the apparatus, the armature of which either temporarily places a moveable tooth into the gap or operates a suitable clutch device, or its equivalent, to enable the clock wheel work to be re-started. This cycle of operations is then repeated, and the clock hands or recording or other clock work apparatus is thereby rotated in synchronisation with the master or transmitting clock.

In one form of motor driven clock according to this our invention, we employ a motor pendulum which is maintained in vibration by means of a gravity lever which on being tripped by a depending link, or equivalent device (which operates when the amplitude of the pendulum's vibration falls below a certain value), falls on to say, a pallet of the pendulum, and thus imparts an impulse.

The gravity lever on completing such impulse closes a circuit and is replaced electro-magnetically to its potential position.

An alternative method of maintaining the vibrations of the pendulum of a reciprocating motor is to employ the Hipp contact or similar device, which will close a circuit on the amplitude falling, such circuit containing an electro magnet which drives the pendulum direct by attracting an armature connected thereto.

We cause a reciprocating motor to drive our wheel work in the following manner:—

We provide the motor pendulum with a pawl which drives the ratchet wheel tooth by tooth. We gear this ratchet wheel to the clock wheel work, by worm gear or by other convenient means, and we arrange the number of the teeth in the ratchet wheel and the length of the pendulum, so that the ratchet wheel is advanced a certain definite distance at each stage, the distance so moved coinciding with the time of the intervals of the electrical impulses of the master clock, as hereinbefore described. At the completion of each stage we arrange that the driving pawl comes upon a portion of the wheel in which a tooth is purposely cut away, so that the pendulum no longer drives the wheel, but oscillates idly in the space from which a tooth is missing.

Mounted in close proximity to the driving pawl, we arrange another pawl which also oscillates with the pendulum and which for the purpose of this specification we will term the relay pawl. This relay pawl normally rides clear of a pin or projection, standing out say from the side of the ratchet wheel, and occupying a position equivalent to that of the missing tooth.

At each half minute or other interval of impulse of the master clock a current controlled by the latter is caused to momentarily excite a small electro-magnet disposed within the frame of the clockwork, the armature of which say, releases a detent of the relay pawl so that it is allowed to fall and so engage the pin of the ratchet wheel. This relay pawl then enables the pendulum on its next swing to drive forward the ratchet wheel to the extent of the missing tooth and so allow the driving pawl to again engage a tooth and so drive the ratchet wheel forward another stage as before.

Instead of engaging a pin at the side of the ratchet wheel, the relay pawl may engage a tooth in advance or a tooth behind the driving pawl, its length being modified accordingly, or in lieu of cutting away a tooth, we may employ a cam or projection to lift the pawl out of engagement with the ratchet wheel, or we may in some instances employ a moveable tooth, which is brought into position within the gap by a small electro-magnet.

After the relay pawl or equivalent has operated, it is replaced to its normal position by means of a projection or cam attached to the ratchet wheel.

Referring to the annexed drawings illustrative of this our said invention, in which like letters indicate like or equivalent parts;—

Fig 1 illustrates diagrammatically an electrically controlled motor driven clock according to this our invention, the energy being imparted to the pendulum electro-magnetically; control being by a relay pawl.

Fig 2 illustrates in part a motor driven clock, in which the energy of the pendulum is maintained by a gravity lever which after imparting an impulse thereto is replaced electro-magnetically.

Figs 3 & 4, show in part propelments and relay mechanism in which a tooth is protected by a cam or mask to effect the control.

Figs 5 & 6, show in part views of the propelment and relay mechanism in which a moveable tooth or equivalent is raised in and out of action to effect the control.

A further example of propelment and relay mechanism is shown in Fig 1 already referred to and in which the relay pawl is lowered to an active position and engages a tooth or equivalent in lieu of moving or masking a tooth.

Fig 7 shows a form of contact on the "Hipp" principle, but which however, provides a quicker break.

Referring to Fig. 1. A shows the pendulum, B a crutch vibrating therewith, C a pallet or equivalent, which may be attached either to the pendulum or to the crutch. D shows an electro-magnet, E an armature, $E^1$ an extension thereof which engages the pallet C. F shows an escapement or propelment wheel and G a driving worm mounted on the same arbor therewith. On this arbor is also mounted a disc $F^1$ carrying a relay pin (or pins) $F^2$. H shows a worm wheel, driven by the same worm and which may conveniently be arranged to revolve once per hour, and so carry the minute hand. I shows a propelling pawl which enables the pendulum to propel the escape or propelment wheel tooth by tooth, while J shows a back stop click. K shows the relay pawl, while L shows a relay click which normally holds the relay pawl in its inactive position. M shows the relay armature and N, $N^1$ the relay magnet which receives the electric impulses from the master or controlling clock. O shows the depending link or toggle of the "Hipp" pattern, while P shows the usual notched block. R, $R^1$ & $R^2$ show the contact springs while S shows a non-inductive shunt usually employed for the purpose of reducing sparking at the contacts $R^1$ and $R^2$.

The action of this clock movement is as follows:—The pendulum A on being set in vibration propels the propelment wheel F tooth by tooth by means of the pawl I until the latter comes upon a portion of the wheel F at which a tooth is purposely cut away as shown. This pawl I then oscillates idly in the space from which a tooth is missing. On an electric impulse from the master clock flowing through the electro-magnet N,—$N^1$, the armature M is attracted

and its extension $M^1$ by means of the pin $L^1$ lifts the click L and allows the relay pawl K to fall into its active position, the armature M returning to its normal position against the stop $N^2$. In oscillating with the pendulum, the relay pawl K engages the pin $F^2$ and in propelling the wheel through the space of one tooth enables the pawl I to engage the next tooth and so advance the wheel F as before.

After a few oscillations the depending projection $K^1$ (on the pendulum swinging to the left) bears against the pin $F^2$ and causes the relay pawl K to lift until its tail piece $K^2$ is again held up by the click L from which position it is again ready to operate as before.

The reciprocating motor or pendulum is maintained in vibration by the electro-magnet D operated either by the well known "Hipp" contact device as shown by the toggle O block P and contact springs R, $R^1$, and $R^2$, or by the contact making device shown in Fig. 7. On being energised by either these or other suitable contacts, the magnet D attracts the armature E and by means of its extension $E^1$, applies an impulse to the pendulum, by means of the pallet C. This form of impulse and disposition of armature and magnet, employs the magnetic energy under very efficient conditions. The magnet D is of the usual two pole type, one pole only being shown.

Referring to Fig 2, $E^2$ shows a gravity lever provided with a weight $E^6$ and provided further with a roller $E^3$. The pendulum is furnished with an impulse pallet C after the manner of our prior Patents Nos; 24620 of 1904, and 919 of 1907. This gravity device operates as follows;—

On the toggle O failing to leave the block P due to a diminished arc of the pendulum, the lever R on being depressed releases the catch $R^4$ from the pin $E^4$. The gravity lever in descending causes its roller $E^3$ to roll down and bear on to the pallet C thus imparting an impulse to the pendulum. On the completion of this impulse the stiff spring $E^7$ depresses the relay tongue $E^8$ into contact with the screw $E^9$ when the local circuit is completed and the electro-magnets D, and $D^2$, become energised. The gravity lever $E^2$ then becomes lifted due to the attraction of the armature E, and the circuit remains closed until broken by the contacts $R^{41}$ & $R^5$, on the catch $R^4$ resuming its normal position. The action of these contacts are fully described in our prior Patent No. 27445 of 1906.

Fig 3 shows an example of propelment and relay mechanism in which a tooth of the propelment wheel F at the end of each stage is masked by the mask K, in consequence of this mask being lifted to its acting position by the pin $F^2$ of the escape wheel F on the last tooth of that stage being fed forward. The mask then remains in this position guarding the next tooth, the pawl I meanwhile riding on the mask. On the electric impulse however from the master clock or equivalent flowing through the magnet N, the armature $M^1$ no longer supports the tail $K^1$ of the masking lever K, which then falls clear of the propelment wheel teeth and allows the pawl I to propel the wheel tooth by tooth as before. This action proceeds until the pin $F^2$ or another such pin again lifts the mask K into its protecting position when the propelment again awaits the electric impulse as before.

Referring to Fig 4; in this example of propelment and relay mechanism, the armature end carrying the mask K rotates with the propelment wheel F while the magnet N is fixed to the framework.

Normally the mask K is in the position shown, but after passing the back stop click a fixed cam not shown engages with the pin $T^1$ of the click T and permits the armature M to rise under the pressure of a spring not shown, taking with it the mask K. This mask prevents further advancement of the wheel F and the pawl I rides idly thereon. On the electric impulse flowing through the magnet N the armature is drawn down until the click T slips under the pin $F^2$ and thus holds the mask clear of the driving pawl when the wheel F advances as before.

Referring to Figs 5 & 6, in this example of propelment and relay mechanism the armature M carrying the moveable tooth $F^2$, rotates with the wheel F, being pivotally connected to the arbor at $M^3$.

The magnet N is fixed to the frame-work as also is a fixed cam shaped projection $K^4$.

This form of relay mechanism operates as follows:—

Before the moveable tooth $F^2$ passes under the pawl I the inclined or cam shaped projection $K^4$ releases the click T and the spring $M^2$ brings the moveable tooth in its inactive position as shown, and the click T moves out of contact with the projection $K^4$. The pawl I (shown in section in Fig. 5) then rides idly on that portion of the wheel at which a tooth is purposely cut away (this action may also be seen by reference to Fig 1).

On the electric impulse flowing through the electro magnet N the armature M in consequence of its being immediately over this magnet is attracted, and in turning on its pivot $M^3$ raises the moveable tooth into its active position where it is held by reason of the click T engaging with the armature M. The click I is then able to feed the wheel F past the waiting position, and is then able to advance the wheel tooth by tooth as before.

Referring to Fig 7 the depending link O as shown in Figs 1 & 2 is replaced by a trailer $O^2$, which is lightly supported by a spring $O^3$. A lug $O^4$ trails around the platform P in the direction of the arrows so long as the arc vibration of the pendulum is normal.

On, however, the lug $O^4$ of the trailer $O^2$ failing to clear the platform P, it returns and engages the shoulder $P^1$ and in bearing against same, depresses the contact R against the contact $R^2$. The electro magnet D being then energised, attracts the armature E giving the pendulum A an impulse. On the moving armature reaching a position directly above the electro magnet, the lug $O^4$ becomes pushed out of engagement with the shoulder $P^1$ of the platform P by the now rising end of the platform $P^2$, and the contact lever R instantly returns to its normal position impelled by the spring $R^6$, thus breaking the circuit with a rapid action.

It is obvious that a motor driven clock in accordance with this our invention may be constructed in a variety of different forms, without departing from the spirit of this our invention.

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 a motor-driven clock, the automatic disconnecting of the motor from the clock mechanism by the said mechanism, after it has been driven the required distance by the motor, and the reconnecting of the same by the electric impulse from a master or controlling clock, or other controlling source, substantially as and for the purpose herein described.

2. In a motor-driven clock in which a tooth (or teeth) of the escape or propelled or equivalent wheel is omitted, or masked, or put out of action in some equivalent manner, the replacement of the missing tooth, or the removal of the mask, or the effecting of an equivalent action by the electric impulse from a master or controlling clock substantially as, and for the purpose herein described.

3. In a (reciprocating) motor-driven clock electrically controlled after the manner claimed in Claim One, the obtainment of an impulse to the pendulum by a gravity lever bearing against an inclined pallet of the pendulum, on such lever being automatically released, when the arc of vibration falls below a given value.

4. In combination, a motor-driven clock electrically controlled after the manner claimed in Claim One, the closing of the local or motor circuit by a trailer such as $O^2$ and a platform such as P, operating as herein described

with reference to Fig. 7, or by any other equivalent circuit-closing device, on the arc of the pendulum falling below that required to drive the clock, substantially as described.

Dated this 19th day of March, 1908.

I. HARDY PARSONS.
ALFRED E. J. BALL.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1908.

A.D. 1907. Sep. 20. N:: 20,878.

PARSONS & *another's* Complete Specification.

(4 SHEETS)

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

SHEET 1.

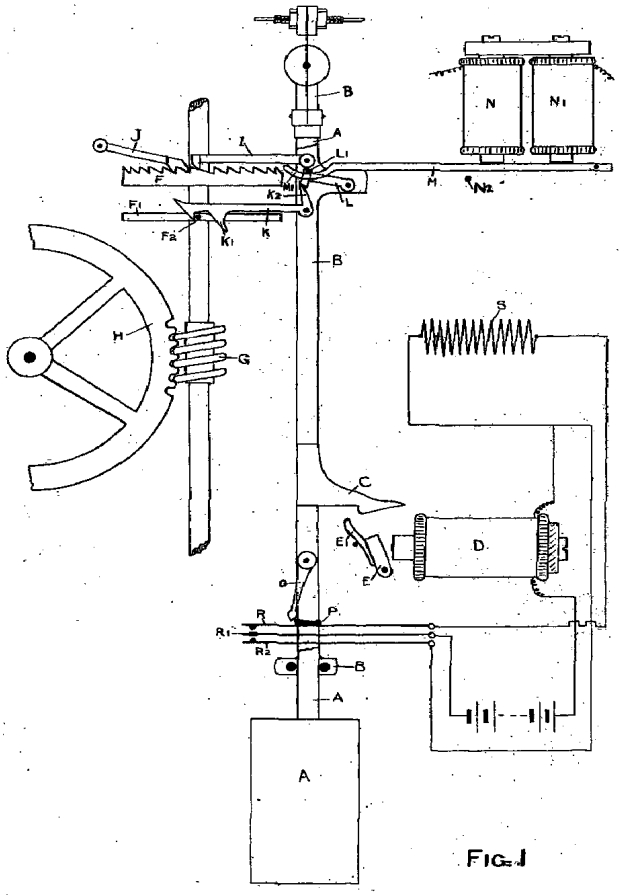


FIG. 1

SHEET 2

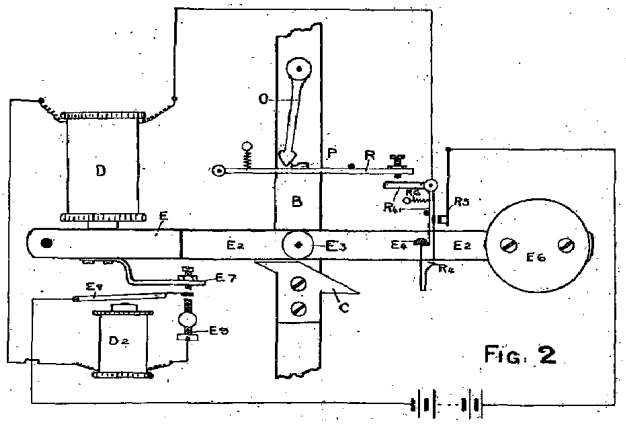


FIG. 2

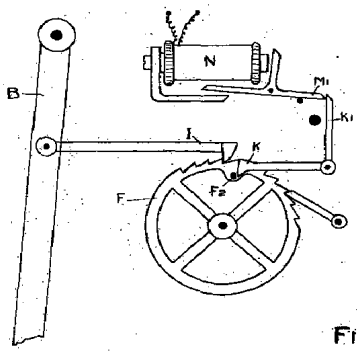


FIG. 3



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*SHEET 1.*

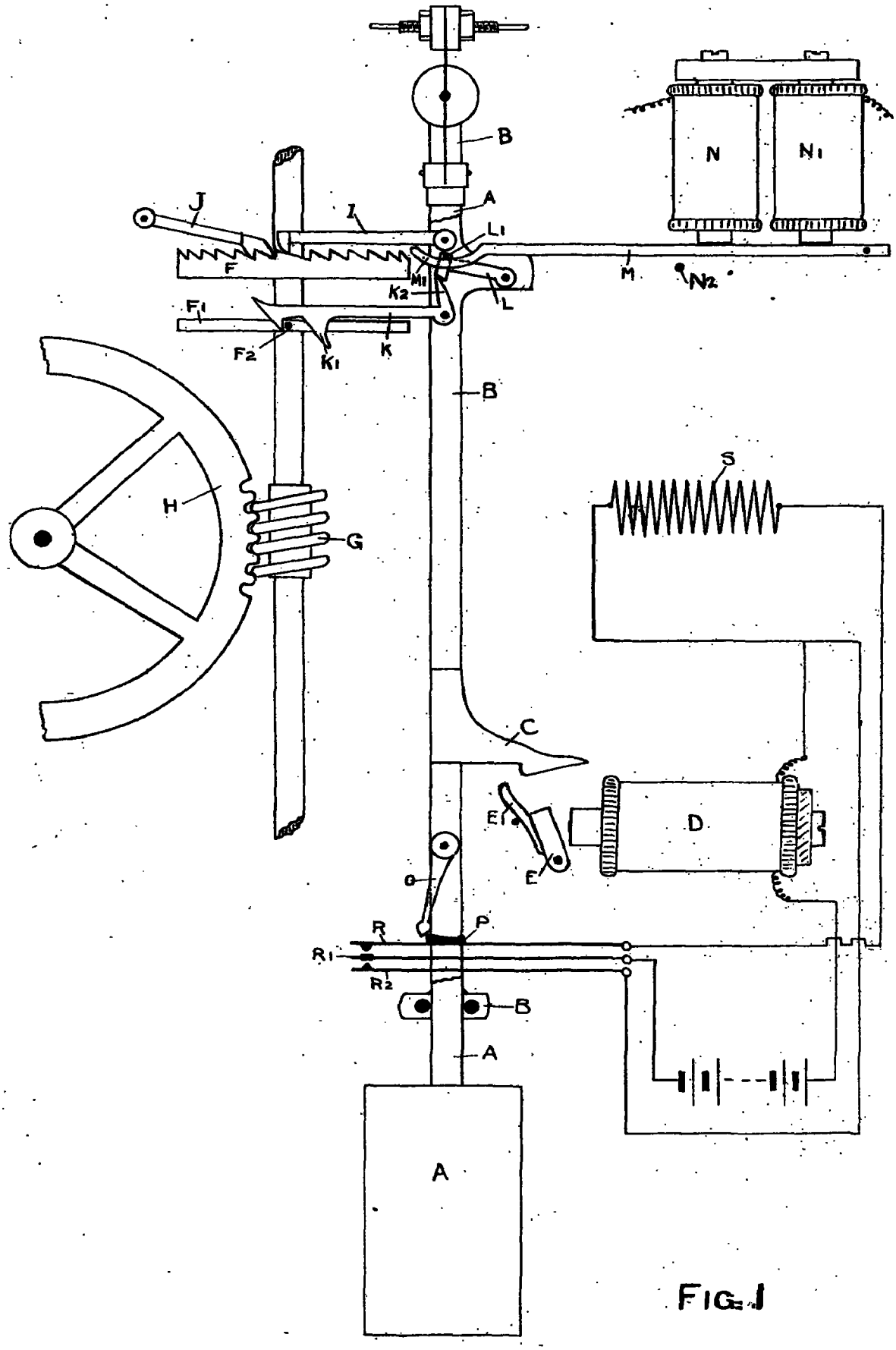


FIG. 1

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

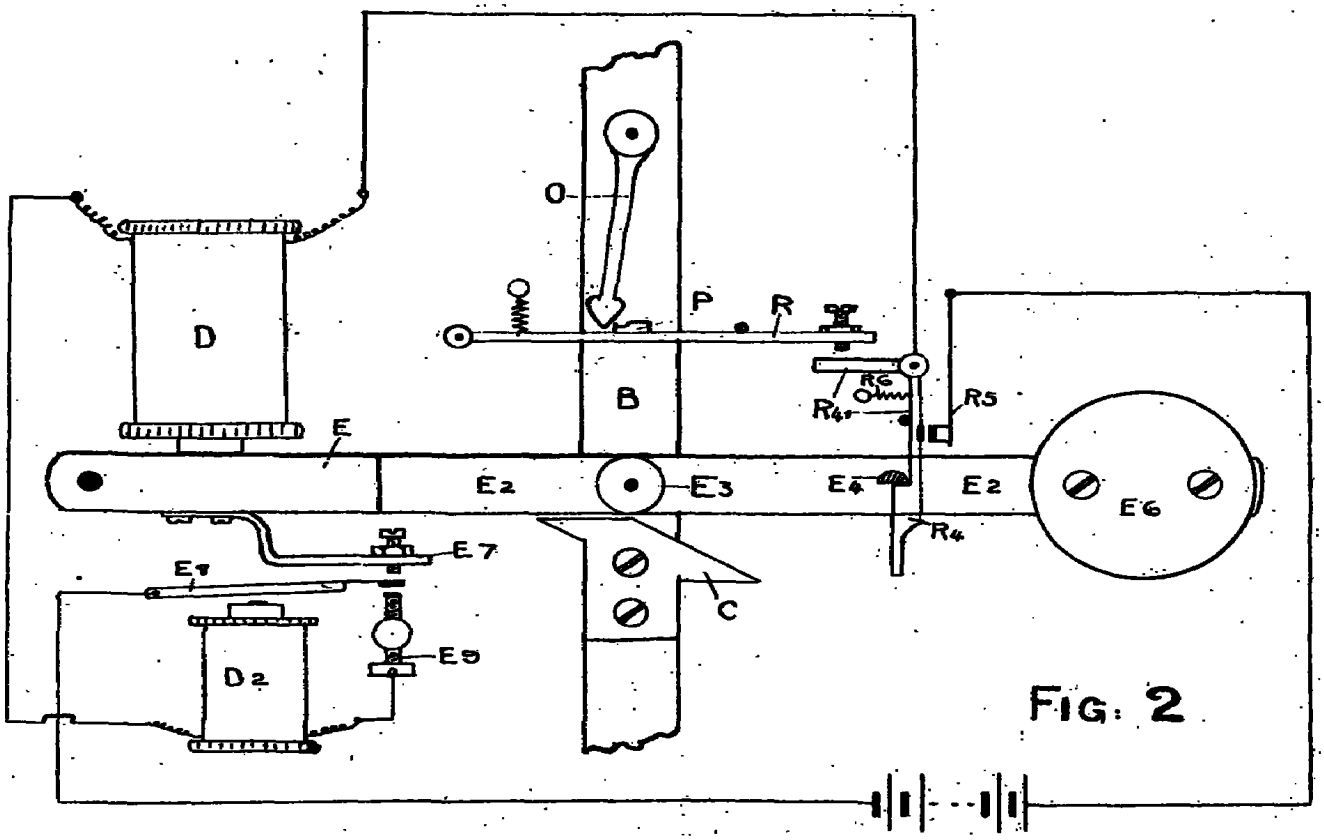


FIG. 2

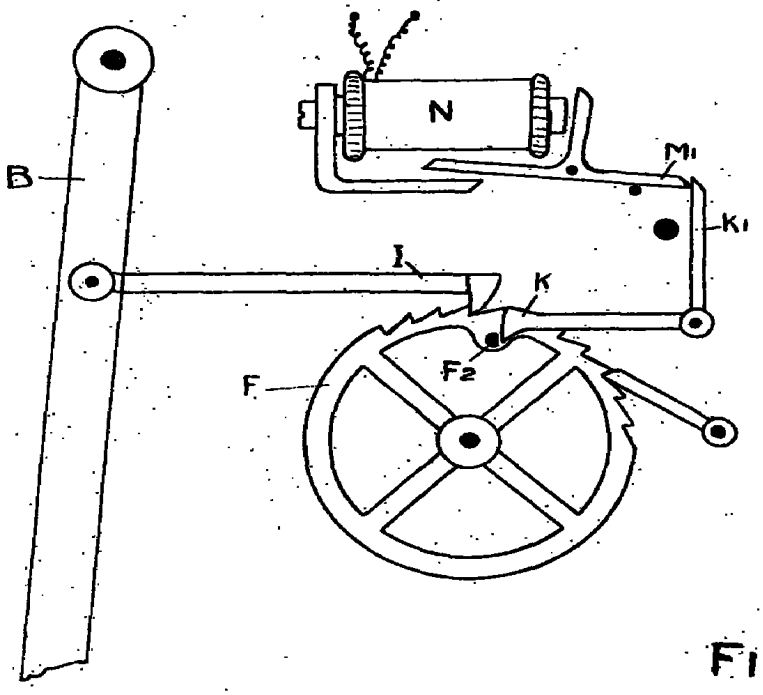


FIG. 3



Malby & Sons, Photo-Litho.

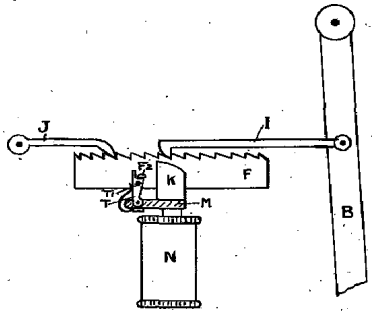


FIG. 4

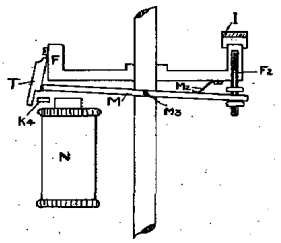


FIG. 5

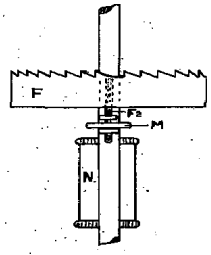


FIG. 6



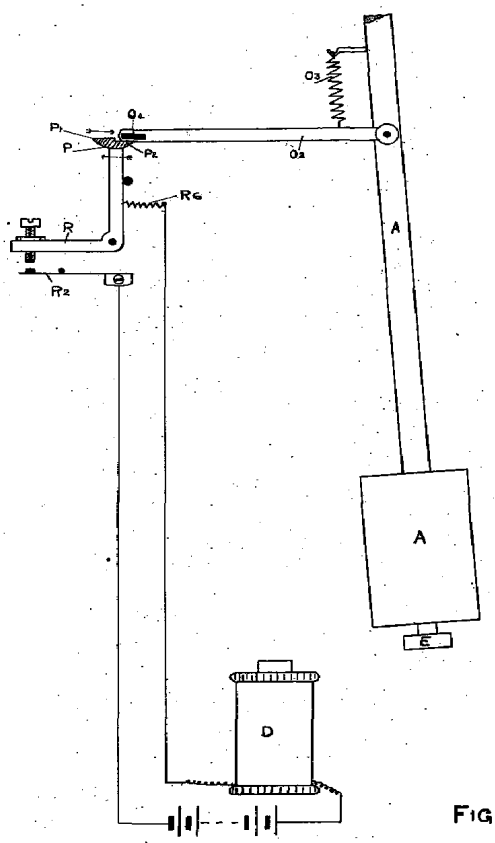


FIG. 7





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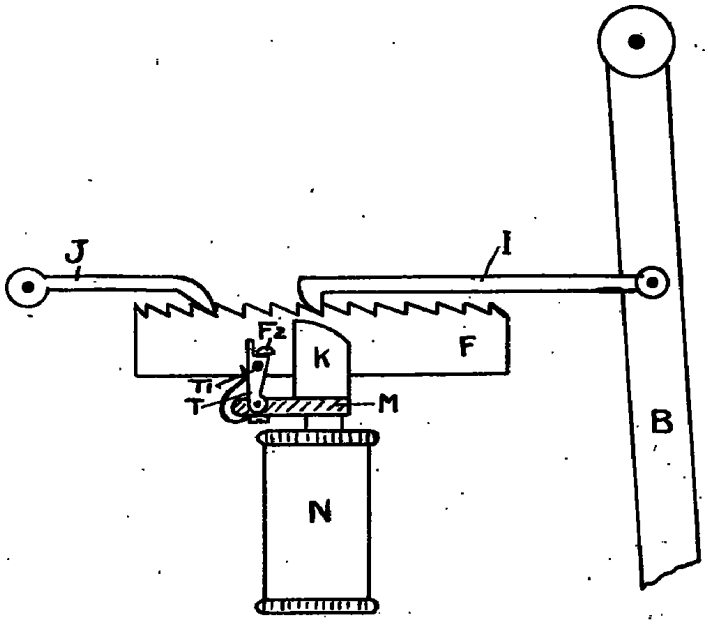


Fig. 4

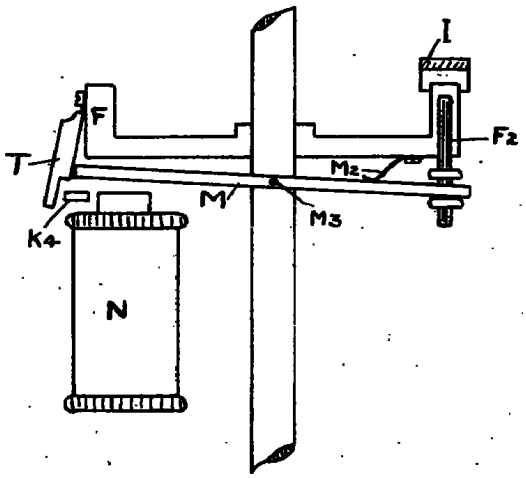


Fig. 5

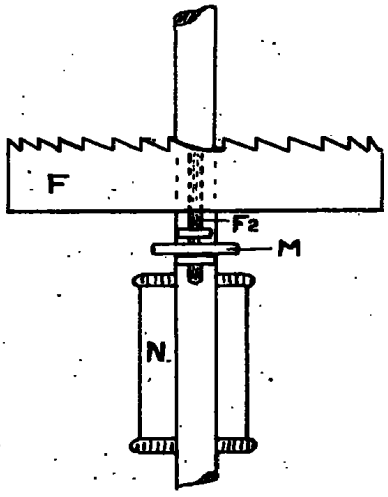


Fig. 6

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

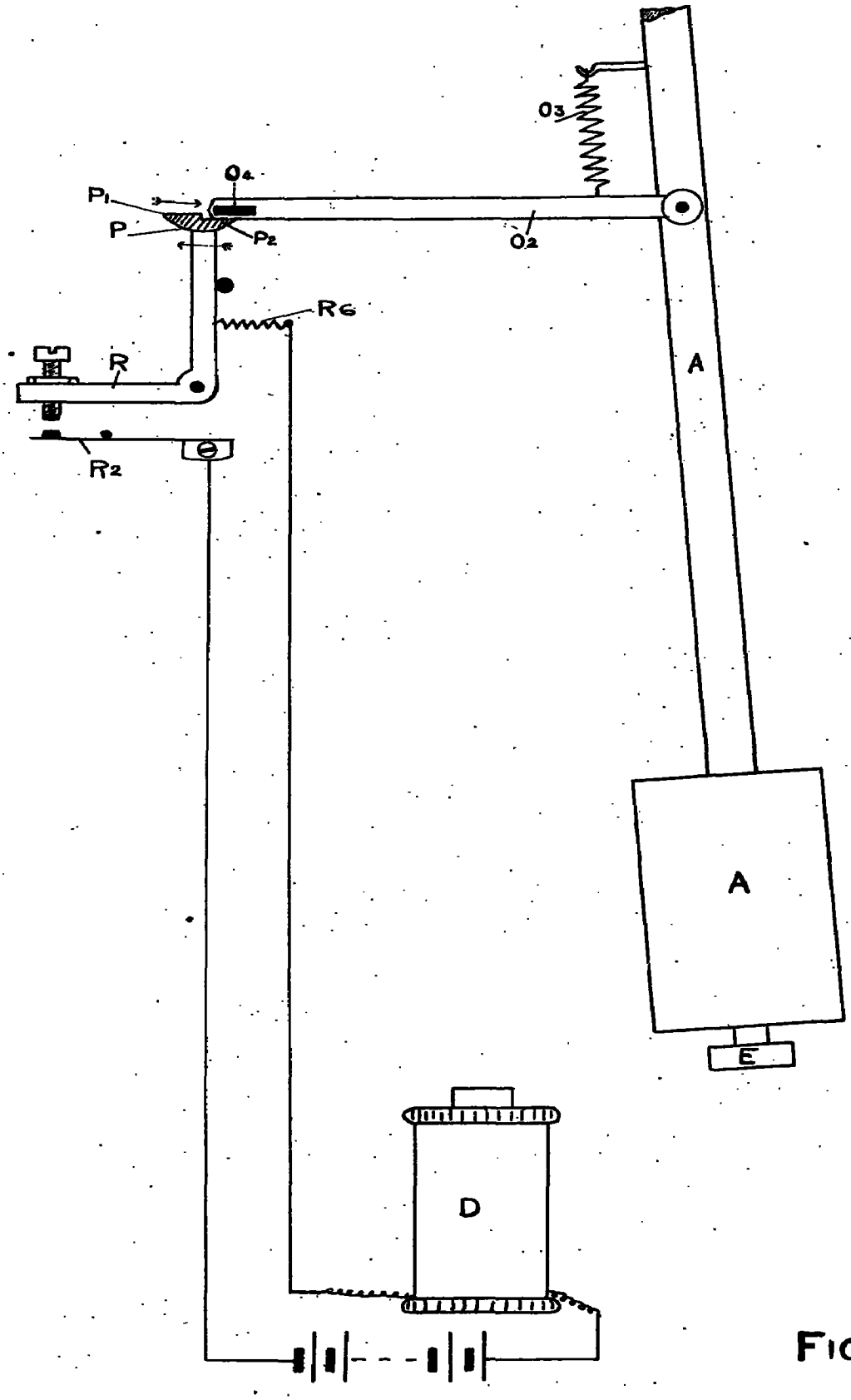


FIG. 7



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