PATENT SPECIFICATION

194,407

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PROVISIONAL SPECIFICATION.

No. 33,372, A.D. 1921.

Improvements in and relating to Electrically Operated Clocks.

I, CYRIL FREDERICK JOHNSTON, of Broadwater, Addiscombe Road, Croydon, in the County of Surrey, a British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to electrically operated clocks and has reference to that type of clock wherein an impulse is given periodically to the pendulum of a master clock through mechanism controlled by an electro-magnet and simultaneously electro-magnets associated with variously placed dials are energised to effect an increment of movement to the hands.

Clocks conforming to the foregoing are now quite well known and operate on the whole satisfactorily but they suffer from the defect that the periodical movement is noisy owing to the rapidity of movement of the armatures of the magnets into contact with their poles and this rapid movement which has to be transmitted to the ratchet mechanism of the dial is also likely to encourage undue wear and derangement of the more or less delicate mechanism.

This difficulty has been recognised and attempts to counteract it have been made by supporting the armatures of the magnets pivotally and giving these armatures curves conforming to curved magnet poles, the arrangement being such that the armatures, instead of contacting suddenly with the magnet poles, swing about a centre and brush across the curved magnet pole without actual contact. This arrangement is satisfactory so far as the elimination of noise is concerned but it has the serious defect that the magnet armature, by reason of its inertia, is liable to move beyond its proper position relative to the magnet pole when the magnet is energised.

The object of the present invention is to provide such a construction that the foregoing defects are eliminated and the primary feature of the invention is the provision of an electric clock mechanism wherein the magnet armature is suspended and given a curvature relatively to the curvature of the magnet pole such that the air gap between the armature and the magnet pole gradually diminishes as the armature brushes across the pole to its attracted position and is there arrested without any positive contact between the armature and the magnet pole.

The invention further comprises a particular construction, arrangement and combination of parts forming a complete electric clock as will hereafter appear.

An electric clock according to our invention comprises as is usual a master clock mechanism and a magnetically operated ratchet and pawl mechanism both mechanisms involving special features.

The controlling pendulum of the master clock is of the gravity driven type, the gravity lever performing the two functions of propelling the pendulum and making the electrical contact which transmits the current for driving the subsidiary dials.

The pivoted gravity lever has its end normally resting on a catch but is released at each revolution of a ratchet wheel—which occurs every half minute—and in falling this lever imparts an impulse to the pendulum through the medium of a roller operating upon a pallet and crutch and then makes electrical contact between a platinum peg depending from it and a platinum contact carried by a contact lever which projects horizontally beneath. This contact lever is connected to and moved with the arma-

ture lever, both the contact lever and the armature lever being fixed to the same arbor.

The armature proper is carried on the lower end of the lever and co-operates with the magnet pole. The armature has a curved face which slides over or brushes across a curved magnet pole without however any positive contact taking place. The curvature of the armature and the pole are, however, such that the air gap between them diminishes as the armature moves to attracted position, this arrangement ensuring a smooth movement of the armature and the elimination of noise. The movement of the armature also moves the contact lever, which as aforesaid is on the same arbor, and this lifts the gravity lever until the latter reaches a position where an ebonite or other insulating block operates to break the contacts carried as aforesaid by the gravity lever and the contact lever respectively. The electrical circuit is then broken and cannot be re-established again until the half minute ratchet wheel again releases the gravity lever and permits it to fall.

The dial movement is in principle of usual form but is specially designed to eliminate noise.

The minute hand is directly driven by a ratchet wheel having 120 teeth and the hour hand is geared down in the usual manner. Every time the controlling pendulum of the master clock makes contact the circuit to the magnet of the dial mechanism is established and the magnet thus energised attracts its armature. The armature is pivotally suspended and the curvature of its operating face is such as to give the diminishing air gap as the armature opposite the magnet pole as before described with reference to the master clock mechanism; the curvature of the magnet pole is such that the gap between it and the armature would widen should the armature tend to overshoot. On the arbor of the armature a cam is provided which moves with the armature movement and this cam operates a pivoted actuating lever through the medium of an antifriction roller carried by the lever. This actuating lever has a driving spring fixed to its one end and its other end carries a lever to which is attached the tooth or click which engages the teeth of the driving ratchet wheel. Every time the armature is attracted the cam is partially rotated and imparts movement to the actuating lever sufficient to allow the driving tooth or click to fall into engagement with the next tooth of the driving ratchet wheel.

This movement stresses the driving spring—which is a flat or leaf spring restrained at its free end by a fixed stop—immediately the electrical circuit is broken this spring operates to return the parts to normal position, the driving ratchet wheel being moved one tooth, a back stop being provided in the usual way to prevent retrogade movement.

The foregoing mechanism will be found to be reliable and silent in operation which are the main *desiderata* of my invention.

Dated this 12th day of December, 1921.

A. A. THORNTON,
Chartered Patent Agent,
8, Quality Court, Chancery Lane, London, W.C. 2,
For the Applicant.

PROVISIONAL SPECIFICATION.

No. 4723, A.D. 1922.

Improvements in or relating to Electrically Operated Clocks.

I, CYRIL FREDERICK JOHNSTON, of Broadwater, Addiscombe Road, Croydon, in the County of Surrey, a British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to electrically operated clocks having controlling mechanism of the kind forming the subject of Application for Patent No. 33,372 of 1921, and has for its object to provide means for ensuring the continuous positive action of such mechanism when applied to clocks wherein irregularities in operation might arise such as in clocks having hands of such a size that wind pressure or ill balance might interfere with the constant accurate working of such controlling mechanism.

The invention comprises means for locking the minute and hour hand train operating ratchet wheel of the electromagnetic pawl and ratchet mechanism, and for keeping it locked during the intervals between its operation by its electro magnetic pawl.

The mechanism for effecting this locking operation may consist of a pawl or tooth arranged at the end of a lever pivoted to the clock framing, and adapted to be operated by a cam designed to force the point of the pawl or tooth between the ratchet teeth and hold it there during the

said interval, the cam being arranged on the pivot shaft of the armature of the electro magnet and which also carries the cam adapted to operate the main ratchet feeding pawl. The locking ratchet pawl lever is preferably provided with a roller adapted to be engaged by the cam.

It will be readily understood that by the above construction means are provided whereby the ratchet wheel will be prevented from rotating under its electro-magnetically operated pawl and its ordinary non return spring pawl, during the intervals between the periodic operations of its electro-magnetically operated pawl.

Dated this 17th day of February, 1922.

A. A. THORNTON,
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Quality Court, Chancery Lane, London, W.C. 2,
For the Applicant.

COMPLETE SPECIFICATION.

Improvements in and relating to Electrically Operated Clocks.

I, CYRIL FREDERICK JOHNSTON, of Broadwater, Addiscombe Road, Croydon, in the County of Surrey, a British subject, do hereby declare the nature of this invention and in what manner the same to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to electrically operated clocks and has reference to that type of clock wherein an impulse is given periodically to the pendulum of a master clock through mechanism controlled by an electro-magnet and simultaneously electro-magnets associated with variously placed dials are energised to effect an increment of movement to the hands.

Clocks conforming to the foregoing are now quite well known and operate on the whole satisfactorily but they suffer from the defect that the periodical movement is noisy owing to the rapidity of movement of the armatures of the magnets into contact with their poles and this rapid movement which has to be transmitted to the ratchet mechanism of the dial is also likely to encourage undue wear and derangement of the more or less delicate mechanism.

This difficulty has been recognised and attempts to counteract it have been made by supporting the armatures of the magnets pivotally and giving these armatures curves conforming to curved magnet poles, the arrangement being such that the armatures, instead of contacting suddenly with the magnet poles, swing about a centre and brush across the curved magnet pole without actual contact. This arrangement is satisfactory so far as the elimination of noise is concerned but it has the serious defect that the magnet armature, by reason of its inertia, is liable to move beyond its proper position relative to the magnet pole when the magnet is energised.

Heretofore in an electric clock having gravity lever pendulum impulse impacting mechanism, the crutch of the pendulum is provided with a counterweighted pawl and drives an escapement ratchet wheel, and receives an impulse from the gravity lever from which the pawl disengages a catch holding the gravity lever. The gravity lever is arranged to close the circuit on an electro-magnet by contact with a pivoted armature of the electro magnet, and this armature resets the gravity lever. The electrical contacts of the armature are separated by a mechanical contact when the armature is held against the magnet. It has also been proposed heretofore in an electro-magnet signalling device to use a two pole electro-magnet to operate the signal, the electro-magnet having a rotary disc or plate armature carrying the signal and adapted to be rotated by the magnet about an axis parallel to the poles of the magnet, such armature having opposite disposed wings or pole pieces tapered in the plane of the plate or disc and made of helical shape on the faces of them which move over the flat ends of the poles of the magnet.

The present invention comprises electrically operated clock mechanism of the kind consisting of a number of variously placed dials controlled by a master clock having a pendulum the swing of which is controlled by an electro-magnet, wherein the electro-magnets of the master clock and dials have a curved pole piece over which is suspended a curved armature operating the circuit contacts, the curvature of the armature relatively to that of the pole piece of the magnet being such that the air gap between the armature and the pole piece gradually diminishes while the armature is swinging over the pole piece to its maximum pull or arresting position without any positive contact taking place between the armature and the pole piece.

In the preferred construction of the mechanism the swinging of the pendulum

of the master clock may be controlled by an electro-magnet provided with an oscillatory armature having an arm carrying a contact of the circuit of the electro magnet of the master clock and of the magnets of the various dial movements in series therewith, and according to a further feature of the invention in such mechanism a gravity operated contact making lever arranged to be held out of contacting position by a catch releasable periodically by ratchet wheel mechanism of the kind in which the ratchet wheel is rotated by a pawl attached to the pendulum crutch is, after dropping into engagement with the contact on the armature arm and closing the circuit of the electro magnet, lifted by the armature arm into catch engaging position, and during the latter portion of such movement the armature arm by engagement with a block of insulating material under the contact making lever separates the contacts.

The controlling pendulum or crutch of the master clock is of the gravity driven type, the gravity lever performing the two functions as proposed heretofore of propelling the pendulum and making the electrical contact which transmits the current for driving the subsidiary dials.

In a further feature of the invention the ratchet wheel of each electro magnetically operated dial hand train is provided with means for positively locking it and for keeping it locked during the intervals between its operation by its electromagnetic pawl.

An embodiment of the invention is illustrated by the accompanying drawings, wherein Figure 1 is a general view of the master clock mechanism, Figures 2 and 3 are views of a portion thereof with the parts moved to different positions, Figures 4 and 5 are two forms of dial movements.

In the construction shown in Fig. 1 a gravity lever 2 pivoted at 3 has its end resting normally on a spring controlled catch 4 pivoted at 5 and held in engaging position by a spring 6. This catch is released at each revolution of a ratchet wheel 7 by means of a pin 8 secured to the shaft 9 of the ratchet wheel the pin 8 being of such a length that it will engage the lower end of the catch 4, as the ratchet wheel rotates.

During the falling of the gravity lever 2 an impulse is imparted to the master clock pendulum 10 by means of a roller 11 mounted upon the gravity lever and adapted to operate upon a cam or inclined surface 40 of a member or pallet 12 secured to or formed on the pendulum crutch 13 as used heretofore, the continued downward movement of the gravity lever 2 causes the platinum contact peg 15 depending from it to make contact with a similar contact 16 arranged immediately below it and carried on an arm 17 extending from a lever 18 connected to the oscillatory armature 19 of the electromagnet 20. Swing movement is transmitted from the pendulum 10 to the crutch 13 in the usual way by pins 75 extending from the latter to the sides of the former. The armature carrying rod 18 and the contact arm 17 connected thereto swing about a pivot shaft or arbor 21 in such a manner as to carry the armature 19 across the pole piece 22 of the electro-magnet 20. The armature 19 has a curved face arranged to move over a curved face on the pole piece 22 without making contact therewith, their curvatures being such that the air gap between them will diminish as the armature moves to the maximum pull or arresting position. This arrangement ensures a smooth movement of the armature and the elimination of noise and may be effected by making the centres of such curves eccentric to the pivot 21.

After the gravity lever 2 has fallen sufficiently to close the contacts 15 and 16 and establish an energising circuit in the electro-magnet 20, the pull of the magnet on the armature 19 turns its lever 18 about the pivot 21 and so raises the contact arm 17 and thereby the gravity lever 2 until the latter reaches a position where a block 23 of ebonite or other suitable insulating material secured under the gravity lever 2 is engaged by the arm 17 so that further movement of the arm 17 will separate the contacts 15 and 16. This movement is ensured by fixing the block 23 at a position on the gravity lever 2, nearer to the pivot or fulcrum 3 than the contact 15, and arranging the block engaging portion of the arm 17 at a greater distance from its pivot or fulcrum 21 than the contact 16.

The electric circuit is then opened and held open by a catch plate 24 secured above the gravity lever 2 near its fulcrum 3 and extending beyond its free end to engage the spring-controlled catch 4, which catch is again released after the pendulum crutch 13 has been oscillated a sufficient number of times to bring the catch releasing pin 8 into contact with the catch 4. The rotation of the ratchet wheel 7 is effected in the usual manner by engagement of the teeth thereof with a pawl 25 secured to the crutch pallet 12.

In Figure 2 the parts are shown in the position they will occupy after the pin 8 has been moved by the ratchet wheel 7 to engage and release the catch 4 from the gravity lever 2, and the latter has fallen

to bring the contacts 15 and 16 into engagement. In Fig. 3 the parts are shown in the position they will occupy when the contacts 15 and 16 are separated by the continued upward movement of the arm 17 after being moved by the armature after contact 15 has been lowered on to contact 16 by the release of the arm 2.

The mechanism is mounted on a suitable frame or standard 30, on which are also mounted the insulated terminals 31 and 32 which are connected respectively to a suitable source of electric current and the lead to the electro-magnet of the dials in the usual way. The terminal 31 is connected by a lead 33 to the contact 15 through the gravity lever 2, while the terminal 32 is connected by a lead 34 to the coil on winding of the magnet 20 the other end of the magnet winding being connected by a lead 35 to the contact 16 through the arm 17 which is connected to the armature lever 18 by an insulated joint 36.

In order to ensure noiseless working, the gravity lever 2 is provided with a felt or like buffer 37, and the armature 19 is provided with a similar buffer 38.

The dial movement is in principle of the usual form wherein the minute hand is operated periodically by electro-magnetic ratchet mechanism energised periodically by the master clock. In the present example the minute hand is directly connected to a ratchet wheel 50 Figure 4 having say 120 teeth, the ratchet wheel 7 of the master clock being rotated once very half minute. The curvature of the armature and pole pieces are as described with reference to the master clock, and which are such that the air gap widens when the armature tends to overshoot its maximum pull position. On the arbor 51 of the armature 52 a cam 53 is provided which moves with the armature, and this cam is arranged to operate a ratchet pawl lever 54 through the medium of a roller 56 mounted on the lever. The ratchet pawl 54 is pivoted at 55 and is provided with a spring 57 arranged to force it in the direction to cause the pawl 58 connected to the free end of the lever 54 to operate in the teeth of the ratchet wheel 50. Every time the armature 52 is attracted the cam 53 is partially rotated and imparts movement to the actuating lever 54 sufficiently to allow the driving pawl 58 to fall into engagement with the next tooth of the ratchet wheel 50. This movement stresses the spring 57 which is a flat or leaf spring restrained at its free end by a fixed stop 59, immediately the electric circuit is broken the spring 57 operates to return the pawl lever 54 to its normal position thereby moving the ratchet wheel by one tooth, a back stop or retaining pawl 60 is provided in the usual manner to prevent retrograde movement of the ratchet wheel 50.

In the locking dial movement shown in Figure 5 a pawl or tooth 62 is arranged on the end of a locking lever 63 pivoted to the framing at 61. The locking lever 63 is adapted to be operated by a cam 64 engaging a roller 76 mounted on the locking lever, the cam being so designed that when in locking position it prevents the movement of the tooth from the engagement between the teeth of the ratchet wheel 66 in which position it is held by a spring 65. This locking is designed to take place during the intervals between the operations of the electro-magnet 169 on the armature 68 pivoted on the shaft 67 the cam 64 being arranged on the pivot shaft 67 to which the arm carrying the armature 68 is secured. The cam 64 is extended along the shaft 67 so that a portion of it will operate through the roller 69 the pawl actuating lever 70 pivoted at 77. The pawl actuating lever 70 operates a pawl 71 in the same manner as described with reference to the pawl 58 (Figure 4).

The ratchet wheel 66 is provided with a retaining pawl 72 operating in the same manner as the pawl 60 Figure 4. The spring 65 is connected at one end to the locking lever 63 and at the other to the arm of the pawl 71 so as to act as a spring for both members.

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. Electrically operated clock mechansim of the kind consisting of a number of variously placed dials controlled by a master clock having a pendulum the swing of which is controlled by an electro-magnet, wherein the electro-magnets of the master clock and dials have a curved pole piece over which is suspended a curved armature operating the circuit contacts, the curvature of the armature relatively to that of the pole piece of the magnet being such that the air gap between the armature and the pole piece gradually diminishes while the armature is swinging over the pole piece to its maximum pull or arresting position without any positive contact taking place between the armature and the pole piece.

2. Electrically operated clock mechanism in accordance with Claim 1, wherein the air gap between the armature and the pole piece gradually increases

while the armature is swinging over the pole piece from its maximum pull or arresting position.

3. Electrically operated clock mechanism in accordance with Claim 1, and of the kind consisting of a number of various placed dials controlled by a master clock having a pendulum the swing of which is controlled by an electro-magnet provided with an oscillatory armature having an arm carrying a contact of the circuit of the electro-magnet of the master clock and of the magnets of the various dial movements in series therewith, wherein a gravity operated contact making lever arranged to be held out of contacting position by a catch releasable periodically by ratchet wheel mechanism of the kind in which the ratchet wheel is rotated by a pawl attached to the pendulum crutch, is, after dropping into engagement with the contact on the armature arm and closing the circuit of the electro-magnet, lifted by the armature arm into catch engaging position, and during the latter portion of such movement the armature arm by engagement with a block of insulating material under the contact making lever separates the contacts.

4. Electrically operated clock mechanism in accordance with Claim 3, wherein the gravity operated contact lever is provided with a spring retaining catch plate secured above the lever near its pivot and extending beyond its free end.

5. Electrically operated clock mechanism in accordance with Claim 1, having a gravity driven controlling pendulum or crutch in the master clock, wherein the gravity lever performs the two functions of propelling the pendulum and making electrical contact which transmits the current for driving the subsidiary dials.

6. Electrically operated clock mechanism in accordance with Claim 1, having dial hands operated by electro-magnetic ratchet wheel mechanism comprising an oscillatory armature and a spring actuated ratchet pawl lever having a roller adapted to be engaged by a cam mounted on the pivot shaft of the armature and whereby the return stroke of the pawl lever is effected against the action of the spring.

7. Electrically operated clock mechanism in accordance with Claim 1 and having dial hand trains operated by electro-magnetic ratchet wheel mechanism, wherein each of such ratchet wheels is provided with means for positively locking it and for keeping it locked during the intervals between its operation by its electro-magnetic pawl.

8. Electrically operated clock mechanism in accordance with Claim 7, wherein the positive lock mechanism consists of a spring operated toothed locking lever adapted to be locked by a cam during the intervals between the operation of the electro-magnet of the dial hand ratchet wheel mechanism.

9. Electrically operated clock mechanism having its parts constructed, arranged and adapted to operate substantially as described with reference to the accompanying drawings.

Dated this 12th day of September, 1921.

A. A. THORNTON,
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8, Quality Court, Chancery Lane, London, W.C. 2,
For the Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1923.

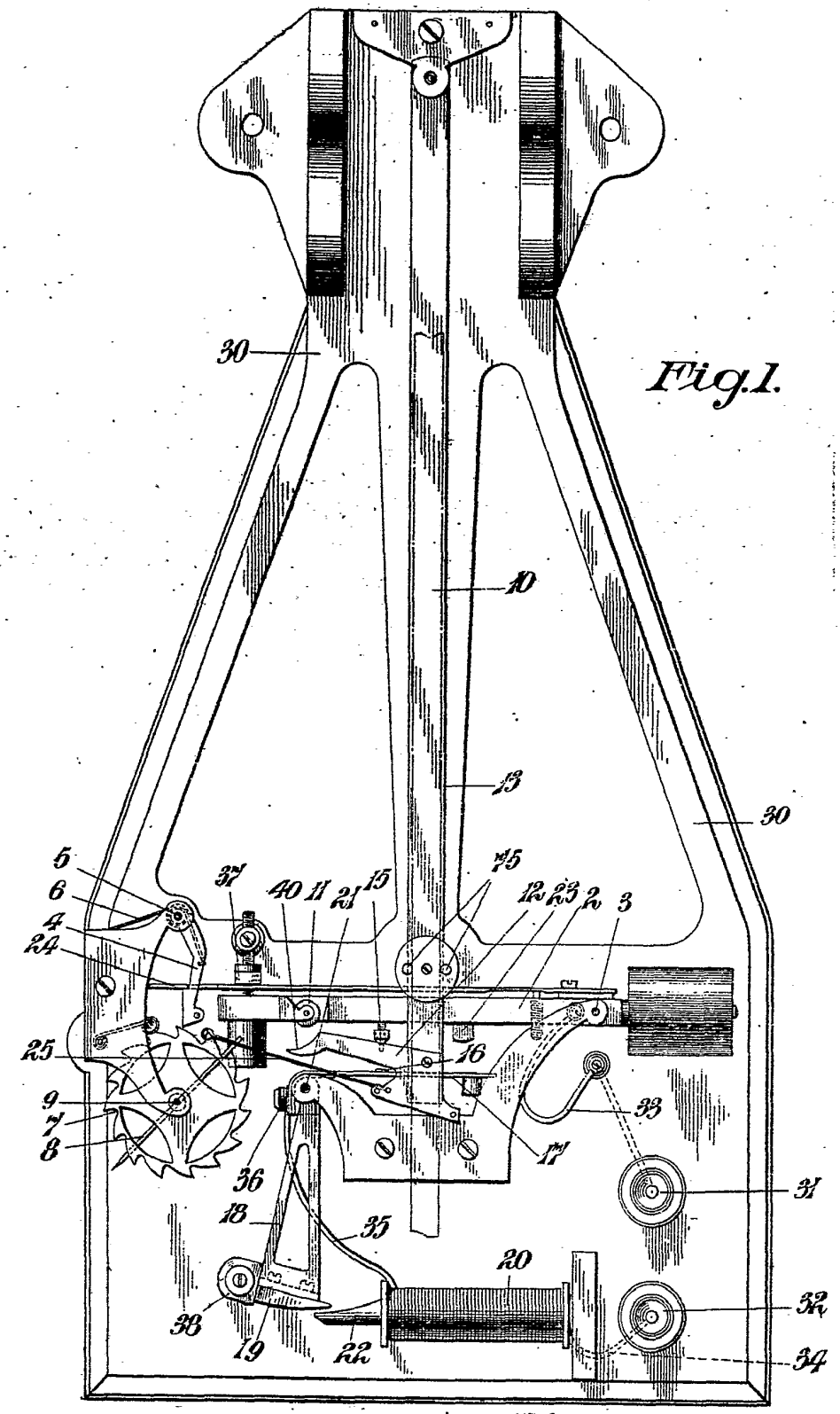
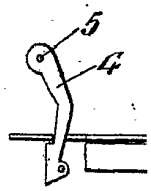
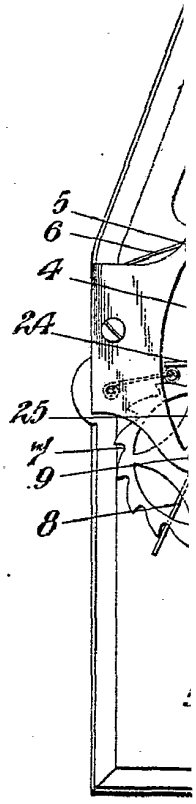


Fig. 1.





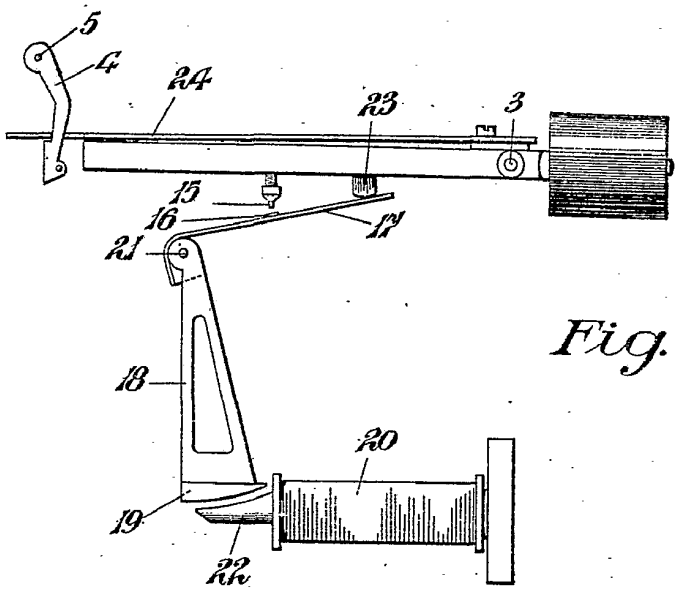
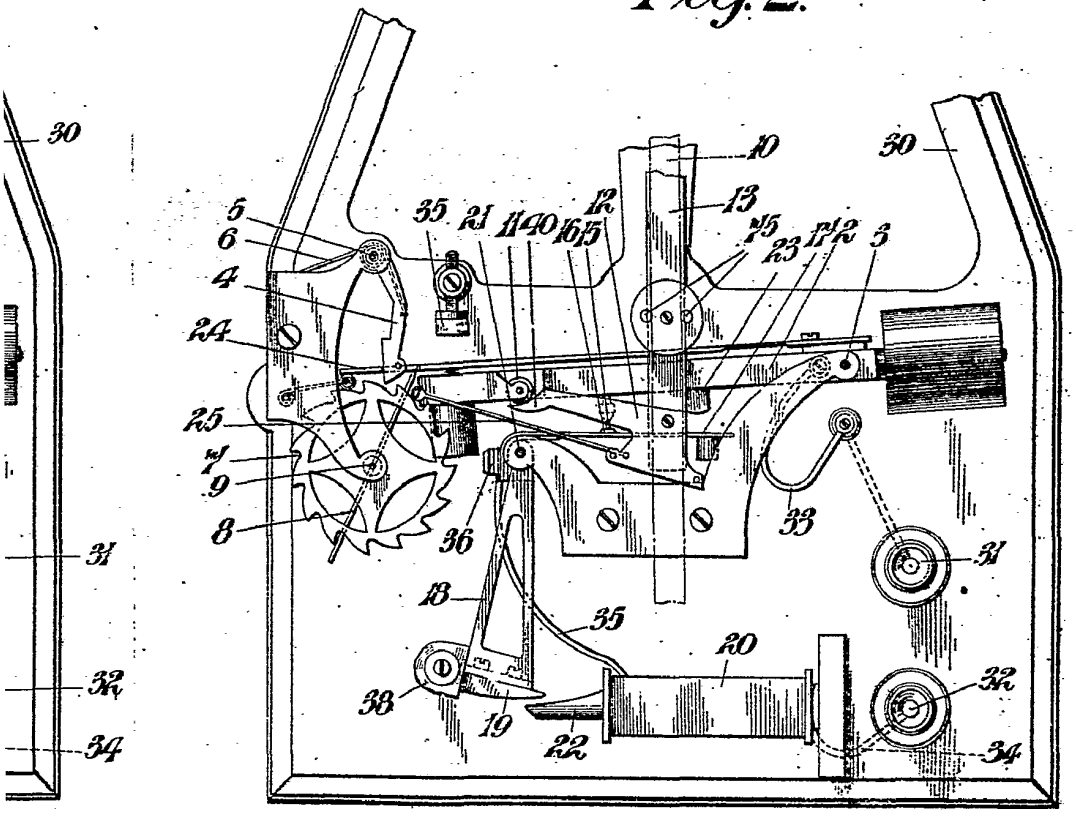


Fig. 3.

Fig. 2.



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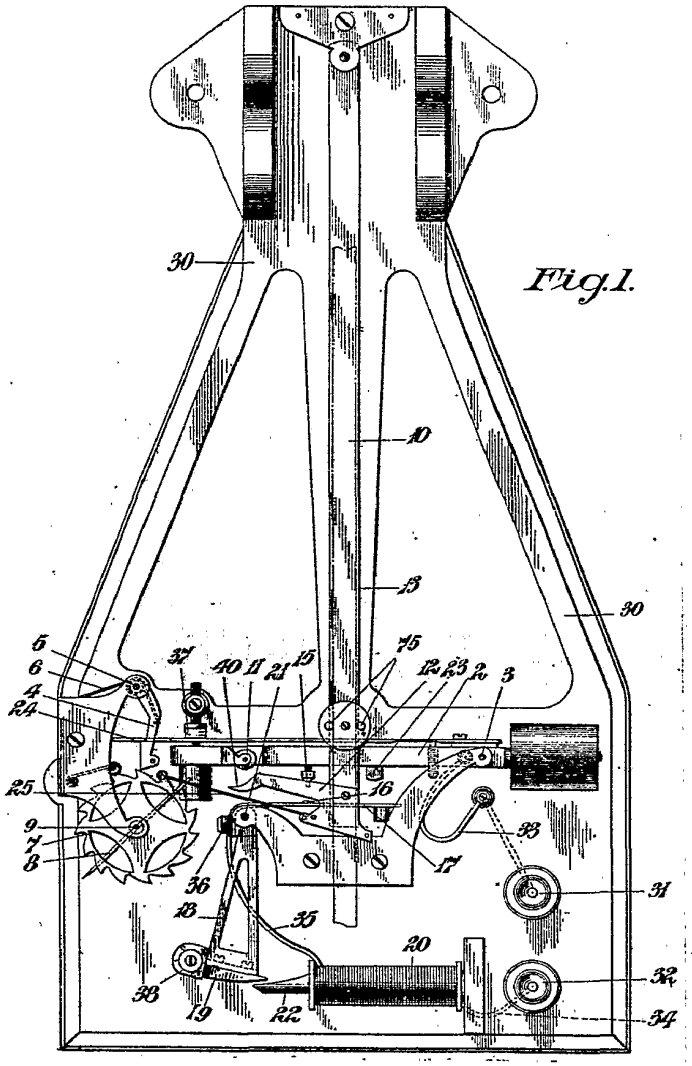


Fig. 1.

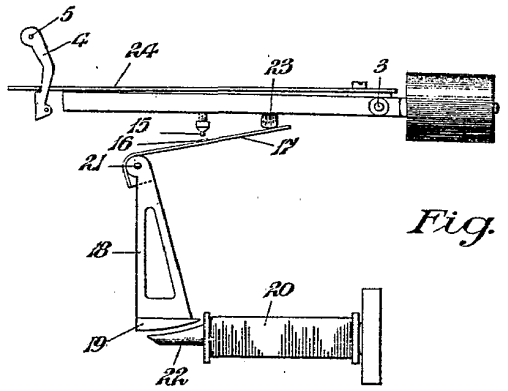
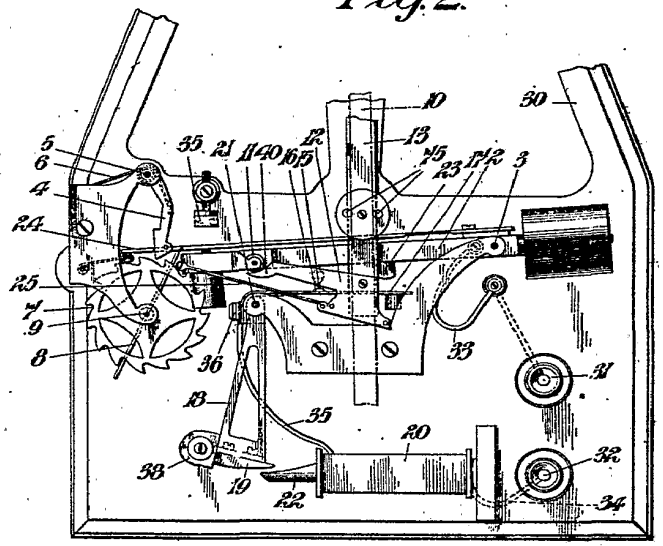


Fig. 3.

Fig. 2.



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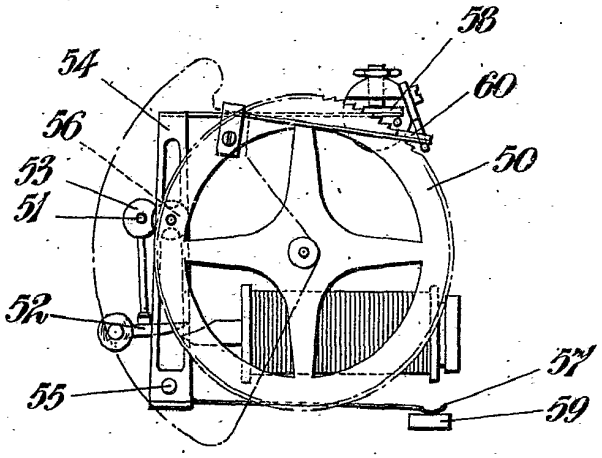

Fig. 4.

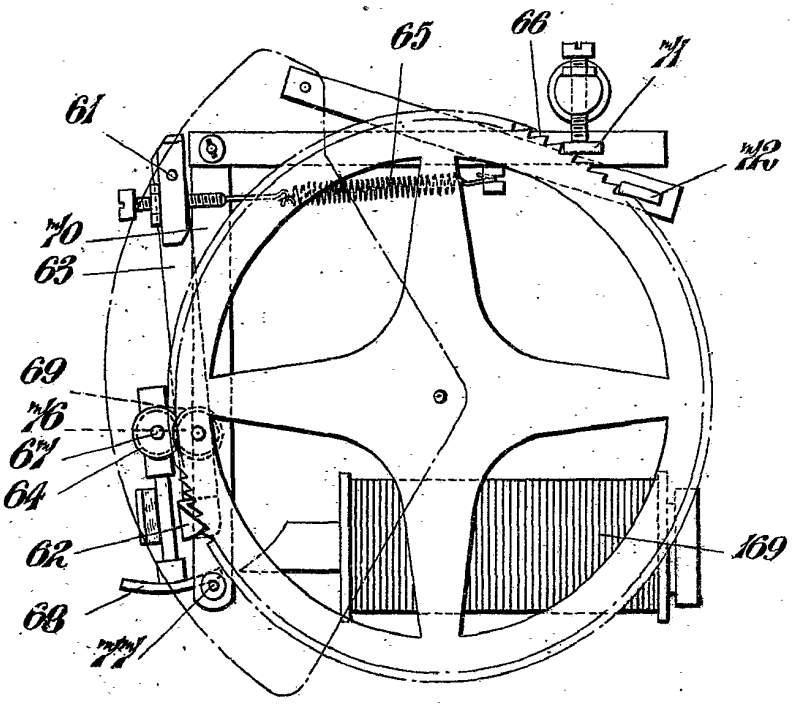

Fig. 5.

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