PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in Electric Clocks.

We, ISAAC HARDY PARSONS, of "The Croft," Kibworth Harcourt, near Leicester, Electrical Engineer, and ALFRED ERNEST JOSEPH BALL, of 212, East Park Road, Leicester, Clockmaker, do hereby declare the nature of this invention to be as follows:—

This invention relates to certain improvements in, and developments of, electric clocks, the improvements and developments having particular reference to clocks of the type described in our prior Patents 24,620/1904, 919/1907, and 106,702 (of 1916).

The objects of this, our present invention, are mainly to further eliminate friction and other disturbing influences which tend to interfere with the natural vibration of the pendulum, to lessen or remove the friction of the work of releasing the gravity lever, and, or, to lessen the slight friction accompanying the gravity impulse to the pendulum.

The herein-described improvements consists, in part, in means whereby the energy required for effecting the periodic release of the gravity lever is provided by the replacing magnet and stored in a spring, weight, or equivalent and afterwards released to effect the purpose, instead of power being taken from the pendulum, the work remaining to be performed by the pendulum being consequently reduced to that of simply releasing or controlling the said energy at the required instant, and in cases where an impulse has to take place at, say, half minute intervals, to also propel the idle or scape wheel, so as to obtain the said half minute or equivalent intervals.

In one form of this invention the energy may be stored in a "time element", the release of the energy being afterwards effected by the said time element as will be hereinafter described.

In carrying this our invention into effect, we may in one form thereof provide a lever—say spring impelled—in which energy has been previously stored as above referred to. We dispose this lever—(which for the purpose of this specification we will term the release lever)—near the supporting catch of the gravity lever. We adapt the "release lever" so that when released, it in turn and by the energy stored in it, releases the supporting catch of the gravity lever, allowing the latter to operate, and while the gravity lever is descending, the release lever also holds the supporting catch clear of the gravity lever, so that it may be entirely free to impart its impulse to the pendulum. At the termination of the gravity impulse the armature of the replacing electro-magnet lifts the gravity lever to its potential position, and at the same time re-energises the release lever, so that the latter is ready to operate at the next period.

In one form the release lever is held in its position by a very light catch which is periodically released either by the pendulum direct, or when the impulse to the pendulum is desired at, say, half minute intervals, through the medium of a scape or count wheel.

In another form the operation of the release lever is controlled by the "time element" above referred to, and the release lever may be a part integral therewith.

As a consequence of the use of the above described methods of releasing the gravity lever or equivalent, the work imposed on the pendulum is of the lightest nature, and interference with its natural vibration is reduced to a minimum.

In order to lessen the slight friction which accompanies the action of the application of the gravity impulse, we

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modify the gravity lever by pivotting it in a position coincident with the bending point of the suspension spring, arranging the end of the lever, say, horizontally, with a depending arm to engage the side of the pendulum rod. We suitably dispose a catch to hold the gravity lever in its potential position, and provide a hinged or equivalent part to engage the pendulum only during the impulse.

We may combine the hinged part which engages the pendulum, and the catch which supports the lever, so that on the catch being released, the hinged part engages the pendulum (or a part attached thereto) without undue drop, the release being timed by the pendulum, so that it occurs at the correct position in the path of the pendulum's swing. We provide for the electric replacement of the gravity lever on the termination of its impulse stroke.

When effecting the release of the gravity lever by a "time element", which we rewind or re-energise by the action of the replacing magnet at each operation of the gravity lever, and which we time to correspond with the periodicity of the gravity impulse to the pendulum, we further arrange that the action of energisation of the "time element" sets or corrects the time of same so that it is kept in synchronisation with the pendulum. We arrange the time element so that at the end of its operation it releases the supporting catch precisely at a predetermined position in its arc, and we may employ the pendulum or a part oscillating therewith for a short portion of the pendulum's arc to define the exact moment of release.

The "time element" may take the form of a short pendulum constructed, say, on the metronome principle when the release is required at each swing or at each alternate swing of the pendulum, and of a short pendulum operated by a short train of wheels terminating in a dead beat or recoil escapement action, when the release is required at intervals greater than a complete vibration of the pendulum, or an air brake or equivalent may be employed in some instances.

It will be seen that with the employment of a "time element" the work and friction of effecting the periodic release of the driving force would be eliminated, and consequently a free pendulum obtained.

Dated this 15th day of October, 1919.

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

COMPLETE SPECIFICATION.

Improvements in Electric Clocks.

We, ISAAC HARDY PARSONS, of "The Croft," Kibworth Harcourt, near Leicester, Electrical Engineer, and ALFRED ERNEST JOSEPH BALL, of 212, East Park Road, 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 certain improvements in, and developments of, electric clocks, the improvements and developments having particular reference to clocks of the type described in our prior Patents 24,620/1904, 919/1907, and 106,702 (of 1916).

The objects of this, our present invention, are mainly to further eliminate friction and other disturbing influences which tend to interfere with the natural vibration of the pendulum, to lessen or remove the friction of the work of releasing the gravity lever, and, or, to lessen the slight friction accompanying the gravity impulse to the pendulum.

The herein-described improvements consists, in part, in means whereby the energy required for effecting the periodic release of the gravity lever—which in this invention is released while the pendulum is swinging towards zero, and is supported in its normal position by a mechanical catch—is provided by the replacing magnet and stored in a spring weight or equivalent, and afterwards released to effect the purpose, instead of power being taken from the pendulum, the work remaining to be performed by the pendulum being consequently reduced to that of simply releasing or controlling the said energy at the required instant, and in cases where an impulse has to take place at, say, half minute intervals to also propel the idle or scape wheel, so to obtain the said half minute or equivalent intervals.

In one form of this invention, the energy may be stored in a "time element", the release of the energy being afterwards effected by the said "time element" as will be hereinafter described.

In carrying this, our invention, into effect, we may in one form thereof provide a lever—say spring impelled—in which energy has been previously stored as above referred to. We dispose this lever—(which for the purpose of this specification we will term the release lever)—near the supporting catch of the gravity lever. We adapt the "release lever" so that when released, it in turn and by the energy stored in it, releases the supporting catch of the gravity lever, allowing the latter to operate, and while the gravity lever is descending, the release lever also holds the supporting catch clear of the gravity lever, so that it may be entirely free to impart its impulse to the pendulum. At the termination of the gravity impulse, the armature of the replacing electro-magnet lifts the gravity lever to its potential position, and at the same time re-energises the release lever, so that the latter is ready to operate at the next period.

In one form the release lever is held in its position by a very light catch which is periodically released either by the pendulum direct, or when the impulse to the pendulum is desired at, say, half minute intervals, through the medium of a scape or count wheel.

In another form the operation of the release lever is controlled by the "time element" above referred to, and the release lever may be a part integral therewith.

As a consequence of the use of the above described methods of releasing the gravity lever or equivalent, the work imposed on the pendulum is of the lightest nature, and interference with its natural vibration is reduced to a minimum.

In order to lessen the slight friction which accompanies the action of the application of the gravity impulse, we may modify the gravity lever by pivotting it in a position coincident with the bending point of the suspension spring arranging the weighted end of the lever, say, horizontally, with a depending arm to engage the side of the pendulum rod. We suitably dispose a catch to hold the gravity lever in its potential position, and provide a hinged or equivalent part to engage the pendulum only during the impulse.

This hinged or equivalent part is provided for the purpose of bridging the gap or space between the active end of the depending arm and the pendulum at the moment of the release of the gravity lever, in order to prevent the excessive drop which has hitherto been unavoidable when obtaining an impulse to the pendulum in a similar manner by a gravity lever which is released during the same swing as that in which the impulse is given.

A further advantage afforded by the use of the hinged piece or equivalent is that the arc of the pendulum may be increased with a risk of the pendulum fouling the depending arm at each swing on the one hand, or without the necessity of re-setting the position of the depending arm on the other hand.

We may combine the hinged part with the catch which supports the lever, so that on the catch being released, the hinged part promptly engages the pendulum (or a part attached thereto) without undue drop, the release being timed by the pendulum, so that it occurs at the correct position in the path of the pendulum's swing. We provide for the electric replacement of the gravity lever on the termination of its impulse stroke. This arrangement largely removes the slight friction which often accompanies the action of the roller of the gravity lever.

When effecting the release of the gravity lever, by a "time element", which we rewind or re-energise by the action of the replacing magnet at each operation of the gravity lever, and which we time to correspond with the periodicity of the gravity impulse to the pendudum, we further arrange that the action of energisation of the time element sets or corrects the time of same so that it is kept in synchronisation with the pendulum. We arrange the time element so that at the end of its operation it releases the supporting catch precisely at a predetermined position in the pendulum's arc, and we may employ the pendulum or a part oscillating therewith for a short portion of the pendulum's arc to define the exact moment of release as will be hereinafter described.

The "time element" may take the form of a short pendulum constructed, say, on the metronome principle when the release is required at each swing, or at each alternate swing of the pendulum, or of a short pendulum operated by a short train of wheels terminating in a dead beat or recoil escapement action, when the release is required at intervals greater than a complete vibration of the pendulum, or an air brake or equivalent may be employed in some instances.

It will be seen that with the employment of a "time element" the work and friction of effecting the periodic release of the driving force would be eliminated, and consequently a free pendulum obtained.

Referring to the annexed drawings in which like letters indicate like or equivalent parts, Fig. 1 shows diagramatically the invention arranged to discharge the release lever of a master clock at half minute or equivalent intervals.

Fig. 2 shows an arrangement whereby the release lever operates at every vibration of the pendulum, while

Fig. 2^A is a fragmental drawing showing the same arrangement adapted to half minute operation or other frequency.

Fig. 3 shows an arrangement whereby the release lever operates at every vibration by means of a "time element", while

Fig. 3^A shows the position of the release lever and catch during an impulse to the pendulum.

Fig. 4 shows an arrangement whereby the release lever operates at, say, half minute intervals by means of a "time element".

Fig. 5 shows an improved arrangement whereby the application of a gravity impulse to the pendulum is effected without the accompanying friction of a roller, while

Fig. 6 shows the same arrangement with the addition of a release lever.

Referring to Fig. 1, A shows the release lever pivotted to the frame at A^1, and energised by the spring A^2. A^3 shows a part adapted to engage the supporting catch B (which in turn is supported from the base of the clock by the spring B^2) and A^4 a part adapted to be engaged and held by a (light) catch C. The catch C which is pivoted at C^1 is held in its normal position by the spring C^2.

D shows a replacing rod working slidably between guides D^1 and D^2, and returned by a spiral compression spring D^3. This replacing rod communicates motion from the armature R to the releasing lever A.

The release and its co-acting parts operate as follows:—

On the scape wheel M being rotated by the vibration of the pendulum through the driving pawl K^1 the pin M^2 attached to the former finds in its path the end C^3 of the lever C, and on depressing same releases the end A^4 of the releasing lever A. This lever then moves to the left under the influence of the spring A^2 and the projection A^3 engages the supporting catch B, and releases the gravity lever E in a manner known to the art. The pin M^2 is so placed in the wheel M in relation to its teeth that the roller Q (with the gravity lever) falls on the pallet K at the position shown before imparting the gravity impulse to the pendulum by rolling down the inclined face K^4. On the completion of the gravity impulse to the pendulum, electrical contact is made by the contacts T, T^1 as described in connection with Fig. 5 of prior Patent No. 106,702, and the gravity lever is then replaced to its potential position. In addition to replacing the gravity lever, the armature R also pushes the replacing rod D to the right, causing it to slide through the guides D^1 and D^2 and its end D^4 replaces the releasing lever to its potential position, thus storing energy in the spring A^2 ready to be released at the next periodic gravity impulse to the pendulum. A separate electro-magnet in series or parallel with the main magnet may replace the release lever to its potential position.

The spring D^3 then returns the rod D to its normal position. We dispose the projection A^3 of the releasing lever A near the spring A^2 so as to obtain the maximum power of same for releasing the catch B, and we dispose the end A^4 at a distance from the spring so as to reduce the pressure to a minimum to facilitate unlocking.

Referring to Fig. 2, this figure shows a construction of master clock in which the gravity lever operates at each vibration of the pendulum, the action of the mechanism in other respects being as in Fig. 1.

In vibrating with the pendulum, the arm K^5 causes the detent K^6—which is pivotally connected therewith at K^7—to engage the extension C^3 of the catch C when swinging to the left, and so disengages the releasing lever as described in reference to Fig. 1.

When swinging to the right, the detent passes freely over the extension C^3 with which a light engagement only is made. When it is desired that in this construction of master clock, the pendulum receives an impulse at less frequent impulses than at every vibration, we dispose a scape wheel between the detent K^6 and the lever C and provide one or more pins such as M^2 in the scape wheel, the arrangement being as shown in fragmental drawing Fig. 2^A.

Referring to Fig. 3 which shows a construction of master clock with the release

lever controlled by a "time element" in the form of a "metronome" pendulum, A shows the release lever pivotted at A^1; B the supporting catch pivotted at B^2; and B^{31} its returning spring. A^4 shows an extension arm which carries a fixed impulse pallet K^5, and a pivotted impulse pallet K^6 fulcrummed at K^7. K^8 shows a double ended pendulum pivotted at K^9 and weighted at K^{10} and K^{11}. K^{12} shows an anchor piece against which the pallets K^5 and K^6 operate. The operation of the clock is as follows.

Assuming that the release lever A has been lifted to its potential position by the previous impulse through its arm D^1 by the armature screw D it at once begins to descend by gravity.

The pallet K^6 which is pivotally connected to the release lever, presses on the end K^{121} of the anchor K^{12}, causing the pendulum K^8 to swing in a clockwise direction. On swinging through a predetermined arc, the acting end of the pallet K^6 parts company with the end K^{121}, due to its weighted arm K^{61} bearing on the part A^5, and preventing the pallet K^6 from following the anchor K^{12} by turning on its pivot K^7. The pallet K^6 therefore, escapes, and the pallet K^5 consequently engages and bears on the end K^{122} of the anchor K^{12}, which latter, in rocking, will have risen to meet it.

The release lever continues its descent, and now swings the pendulum in an anticlockwise direction. At the end of its swing, the pallet K^5 escapes from the end K^{122}, and the point A^3 engages the arm B^3 and releases the catch B from the supporting pin of the gravity lever E, thus effecting its release.

The release is timed to occur early in the pendulum's swing to the left, the roller Q first dropping on the dead face of the impulse pallet K before imparting the gravity impulse in a well-known manner, and as described in prior Letters Patent hereinbefore mentioned.

The fact of the roller first dropping on to the dead face gives the release action a little latitude, in the event of any variation occurring in the time-keeping of the "time element", such variation not affecting the time-keeping of the pendulum of the clock, provided that the roller drops on to the dead face K, and not on to the active face K^4. Any error in the time-keeping of the time element is prevented from being cumulative by the stopping and re-starting of the pendulum of same by the lifting and falling action of the release lever which occurs during the gravity impulse to the pendulum of the clock, and the replacement of the gravity lever. The "time element" pendulum is rendered motionless during the impulse to the clock pendulum in consequence of its weight K^{10} resting against the fixed stop K^{14}.

Fragmental drawing Fig. 3^A illustrates the manner in which the catch B is held clear of the gravity lever E during the impulse given by the latter.

Referring to Fig. 4, this figure shows a construction of master clock with its release lever controlled by a "time element" which runs for a greater time than the complete vibration of the pendulum of the clock, and the control operates as follows:—

Assuming the release lever A to have been reset by the previous periodical impulse, it descends by gravity assisted by the spring A^2. The pawl K^6 engages the ratchet wheel K^{12} and rotates the tooth wheel K^{123} and scape wheel K^{124}, which latter wheel oscillates the anchor escapement K^{125}, and with it the pendulum K^8. While the pawl K^6 is descending, the extension K^{61} presses against, and slides down the fixed stop K^{141}. On reaching the bottom of the stop, the end K^{61} escapes to the left, and moves past the hinged flap K^{62}, allowing the release lever A to fall suddenly on to the arm B^3, thus effecting the discharge of the gravity lever E. The extension A^{31} sets the pendulum K^8 against the fixed stop K^{14} so as to obtain a definite starting position—a definite finishing position being obtained from the fixed block K^{141}, and the co-acting part K^{61}. It is obvious, however, that the method of obtaining a definite starting and finishing position may be varied. During the resetting of the release lever A the end K^{61} passes over the top of the fixed block K^{141}, and regains its original position, being assisted in this action by the returning springs K^{15} and K^{16}.

The parts B^4 and K^{126} shown by dotted lines may be added to the lever B and pendulum I, to enable the pendulum to determine or define the exact amount of release of the gravity lever E, as hereinbefore mentioned. When these parts are added the action is as follows:—

On the part A falling and depressing by means of its screw A^3 the member B^3 of the part B, the extension B^4 rests momentarily on the part K^{126}. The pendulum K^8 is timed so that the falling of the lever A takes place at the end of the half-minute, or other period, while the pendulum is swinging to the left. The part B^4 then slides off the part K^{126}

at a definite position of the pendulum, so that the roller Q drops on to the pallet K always at the same point.

Referring to Figs. 5, 5A and 6, which show an improved method of effecting the gravity impulse to the pendulum, E shows the gravity lever, and E^1 the depending arm of same. Q shows the hinged part which is pivotted to the depending arm at Q^1. Q^2 shows its catch which normally is held by the fixed catch B. Q^5 shows the active end which engages the pallet K of the pendulum I. The action of this form of gravity impulse is as follows:—

On the scape wheel M being rotated by the vibrations of the pendulum I through the driving pawl K^1 the pin M^2 engages the end C^3 of the lever C and its end C^4 depresses the end Q^4 of the hinged part Q. Meanwhile the end Q^5 enters the depression K^4 of the pallet K, and on the catch Q disengaging from the fixed catch B, the part Q^5 engages (with a slight "drop") the perpendicular face of the depression or step K^4. The gravity lever then, together with its depending arm and hinged piece, travels in company with the pendulum imparting to it an impulse until the contact T^1 of the arm R meets its fellow contact T, when the motion of the gravity lever is arrested, and the gravity lever and its attachments are replaced to their potential position in a well-known manner.

In order to insure that the catch Q^2 engages the fixed stop B on the gravity lever being replaced to its potential position, additional pressure is brought to bear on the returning spring Q^6 of the lever Q by the stop screw N, bearing on to the said spring Q^6 at a point nearer to its base than the normal stop pin E^5.

Fig. 5^A which is a fragmental drawing, shows an alternative position for the fixed stop B. In this figure the active end Q^5 slides off the stop B on to the perpendicular face of the depression or step K^4. We may by, say, making the arm C elastic, cause the active end Q^5 to first press on to the dead face K^{41} from which it would slide into engagement with the perpendicular face of the depression K^4, with the result that no appreciable drop would take place when the gravity lever commences its impulse to the pendulum.

In Fig. 6 the employment of a release lever is shown. This release lever may, if desired, discharge the hinged part just prior to the perpendicular side of the step K^4 arriving in line with the end Q^5 of the hinged part Q. The end Q^5 would then press momentarily against the dead face K^{41} prior to engaging the perpendicular face of the step K^4.

While, in the accompanying figures we have shown the gravity impulse as taking place at zero, it is understood that the application of the gravity impulse may preferably commence before the pendulum reaches zero. Figs. 1, 2, 5 & 6 show the parts in position for the release of the gravity lever and the gravity impulse to the pendulum to take place during the following swing of the said pendulum.

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 electric clock employing a gravity lever to periodically impart a mechanical impulse to a pendulum, the said lever being normally supported by a mechanical catch, a spring or weight in which the energy necessary to discharge the gravity lever is stored, and which obtains such energy by or from the current impulse which operates the electric clock, and releasing means whereby the release of the said spring or weight—and consequently the release of the energy to discharge the gravity lever—is effected at a predetermined point in the arc of the said pendulum, while the said pendulum is swinging towards zero.

2. In an electric clock employing a gravity lever to periodically impart a mechanical impulse to the pendulum, the said lever being normally supported by a mechanical catch, a spring or weight in which the energy necessary to discharge the gravity lever is stored, and which obtains such energy by or from the moving armature which resets the gravity lever of the electric clock, and releasing means whereby the release of the spring or weight is effected at a predetermined point in the arc of the said pendulum, while the said pendulum is swinging towards zero.

3. In an electric clock, a gravity lever which periodically imparts a mechanical impulse to the pendulum, the lever being normally supported by a mechanical catch, a spring or weight in which the energy necessary to discharge the gravity lever is stored, and which obtains such energy from an electro-magnet operated by the current impulse which resets the gravity lever, and releasing means whereby the release of the spring or weight is effected by the said pendulum at a predetermined point in its arc, while the said pendulum is swinging towards zero.

4. In an electric clock employing a gravity lever to periodically impart a mechanical impulse to a pendulum, a spring or weight in which the energy necessary to discharge the gravity lever is stored, and which obtains such energy by or from the current impulse which operates the electric clock, and means whereby the release of the spring or weight is effected by a "time element", the action of which is arranged to synchronise with one or more vibrations of the pendulum of the clock, and which "time element" is re-energised and re-set at each current impulse, so that the time of release is maintained in relation to a pre-determined position of the pendulum in its arc.

5. In an electric clock in which the vibration of the pendulum is maintained by gravity applied to the pendulum, a gravity lever pivotted at the position (approximately) coincident with the bending point of the suspension spring of the pendulum, and a depending arm of the gravity lever disposed near to the pendulum the release of the gravity lever and the obtainment of the gravity impulse to the pendulum being effected by means of a hinged member attached to the end of the depending arm or equivalent of the gravity lever, which hinged member while being disengaged from a fixed supporting catch, engages a projection or other part of the pendulum, and on the disengagement being completed applies or communicates the full weight of the gravity lever to the pendulum, without undue drop and without opposition to its swing, the release and impulse being effected while the pendulum is swinging towards zero, the gravity lever being afterwards replaced to its potential position electro-magnetically.

6. In an electric clock as in the preceding claims, a release lever impelled by a spring or weight in which the energy necessary to discharge the gravity lever has been obtained and stored by the current impulse of the previous replacement of the gravity lever, the disengagement of the gravity lever by the said spring or weight, and the whole arranged so that the said release lever holds the supporting catch of the gravity lever clear of the said gravity lever during the application of the gravity impulse to the pendulum.

7. In an electric clock, improved releasing and impulsing mechanism, constructed, arranged and adapted to operate, as herein described and shown.

Dated this 16th day of July, 1920.

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

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1921.

SHEET 1

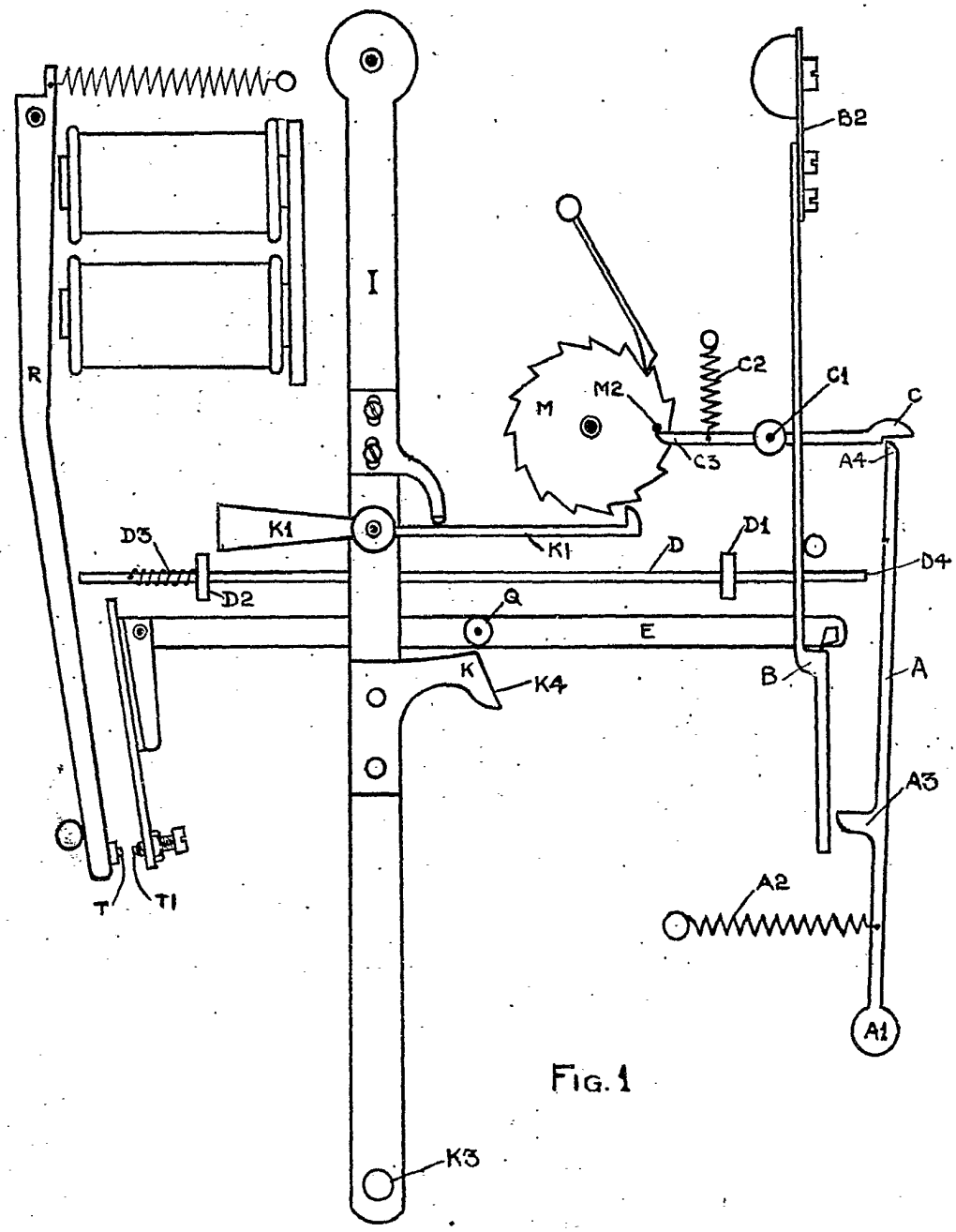

FIG. 1

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

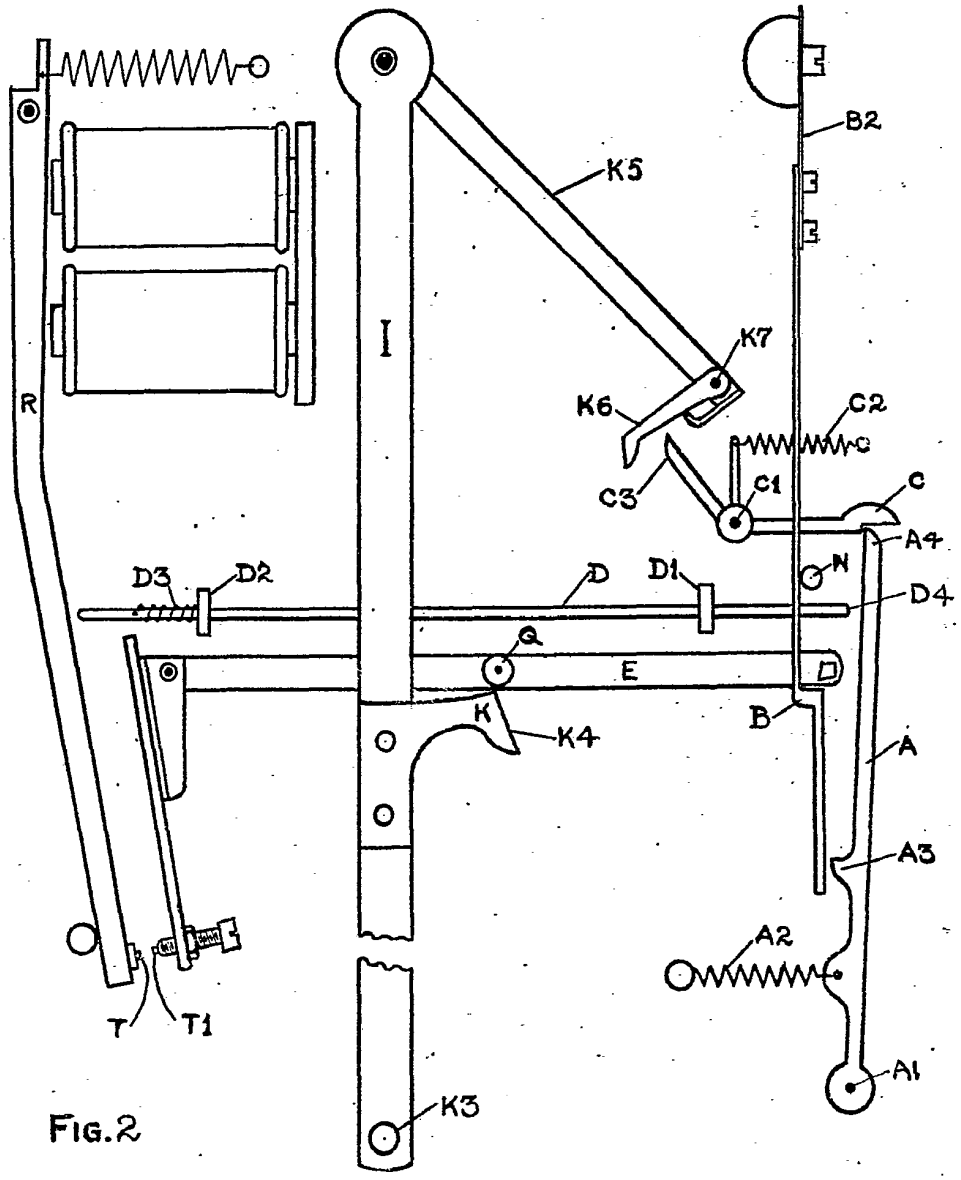

FIG. 2

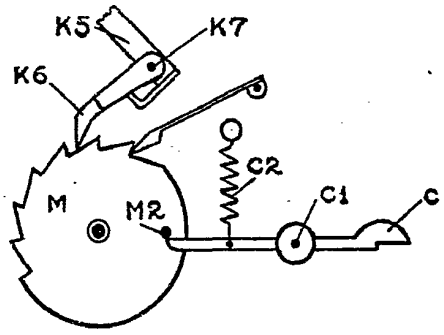

FIG. 2A.

Malby&Sons, Photo-Litho

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SHEET 1

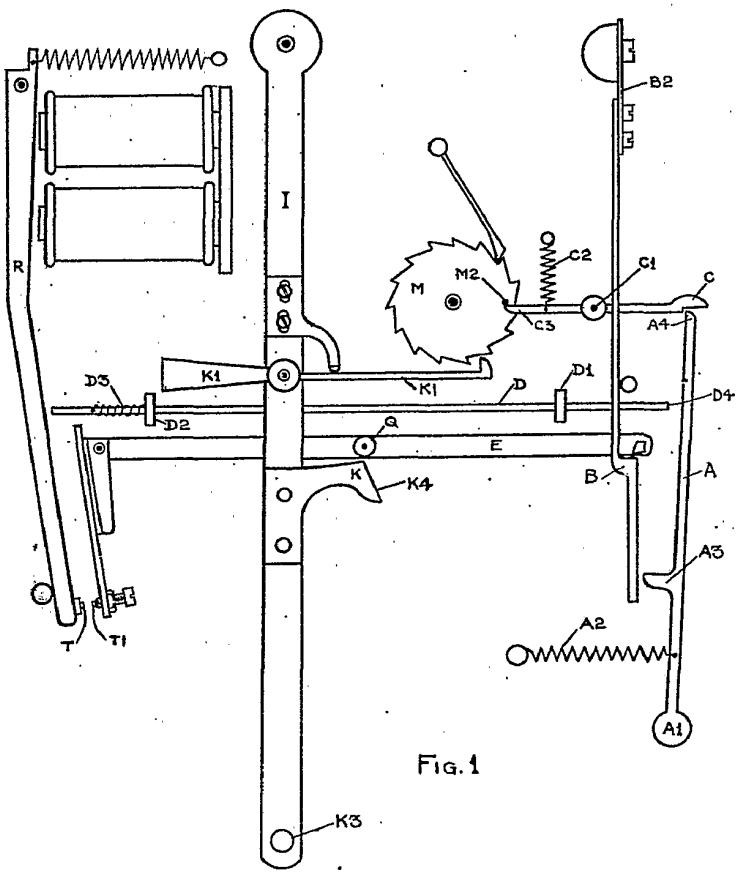

FIG. 1

SHEET 2

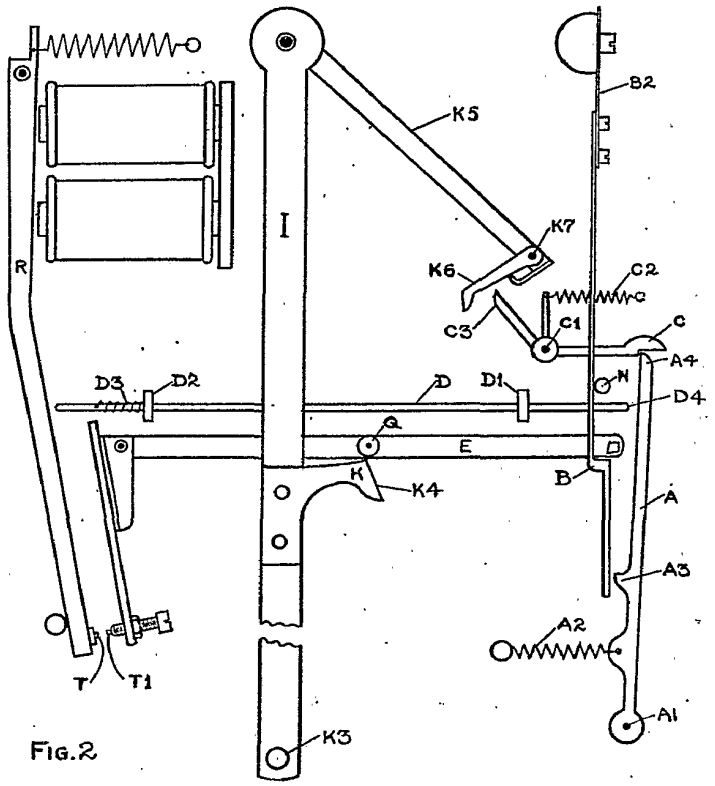

FIG. 2

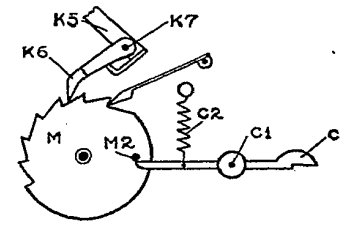

FIG. 2A.

Malby & Sons, Photo-Litho.

SHEET 3

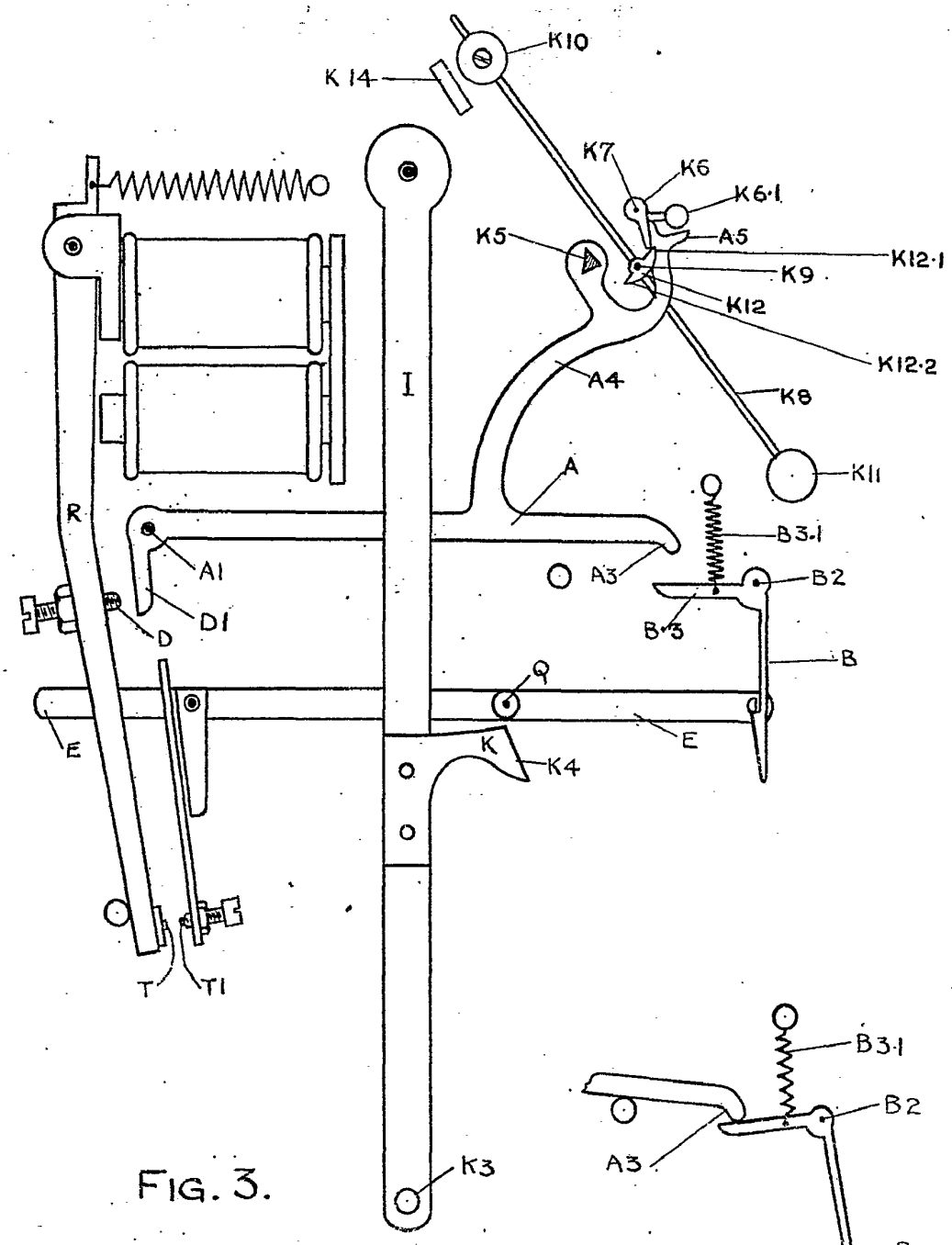

FIG. 3.

FIG. 3A

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

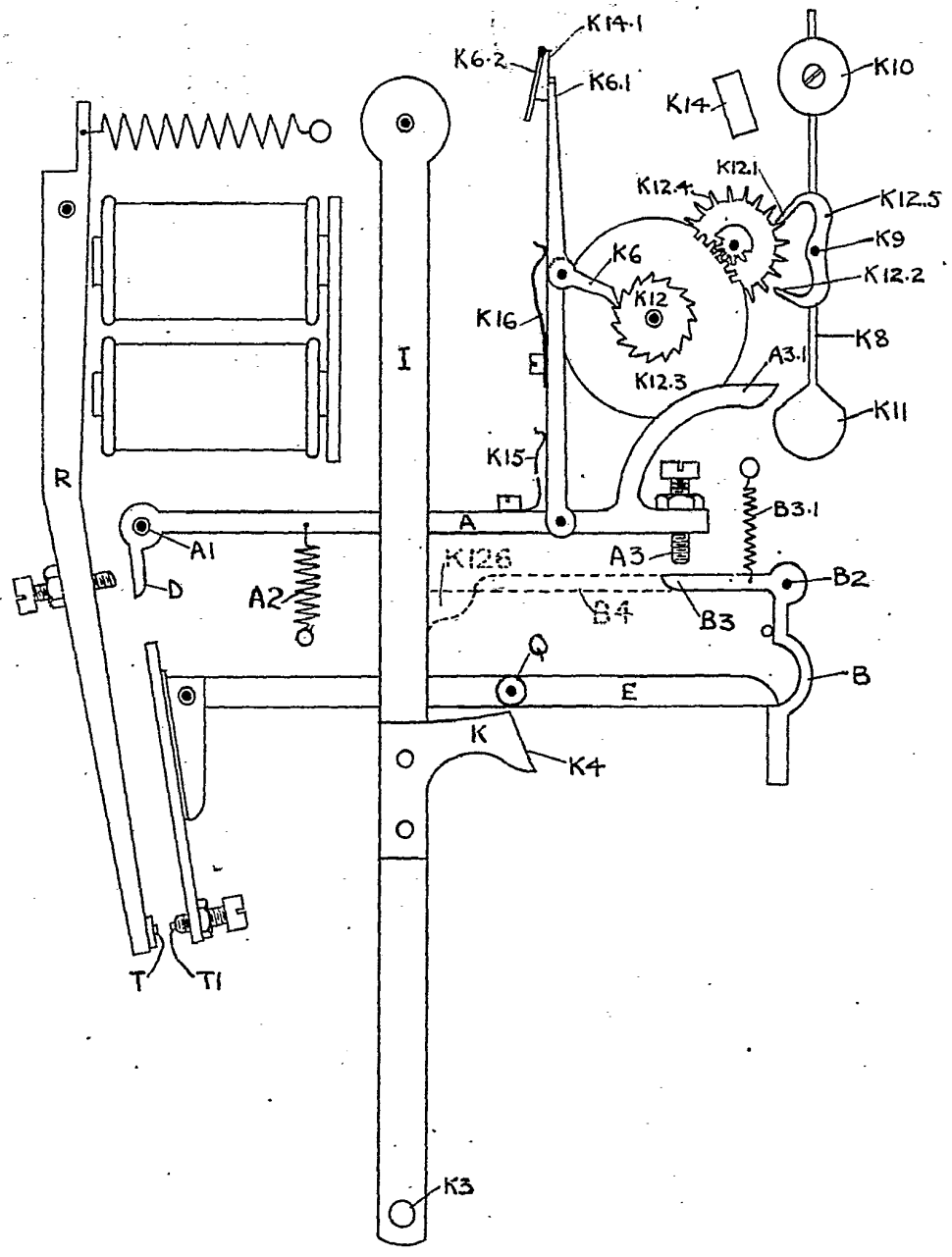

FIG. 4.

Malby&Sons, Photo-Litho

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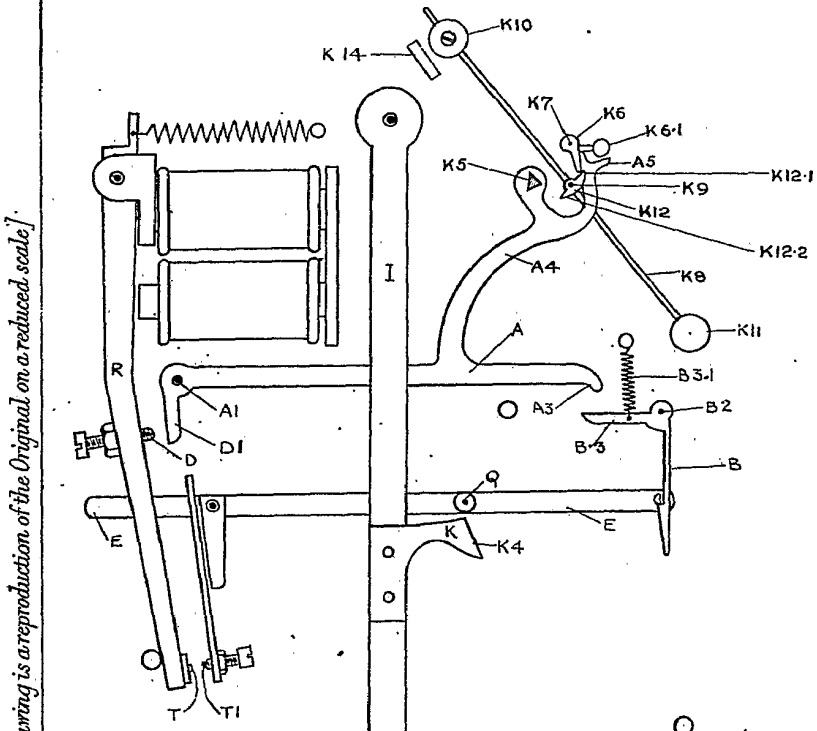

FIG. 3.

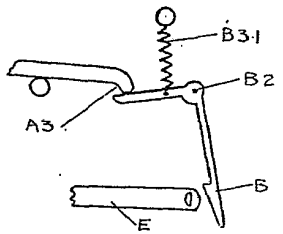

FIG. 3A

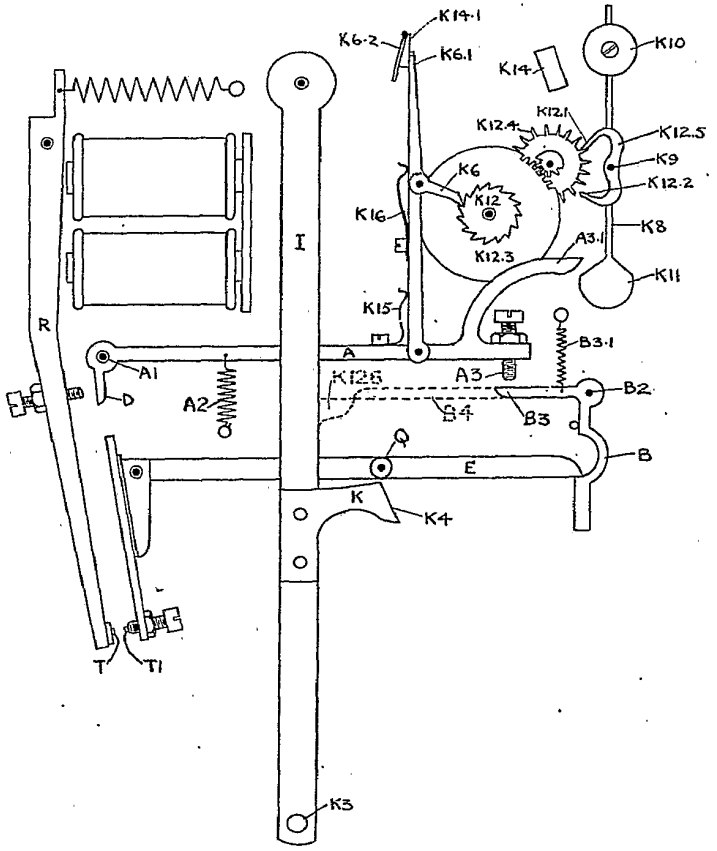

FIG. 4.

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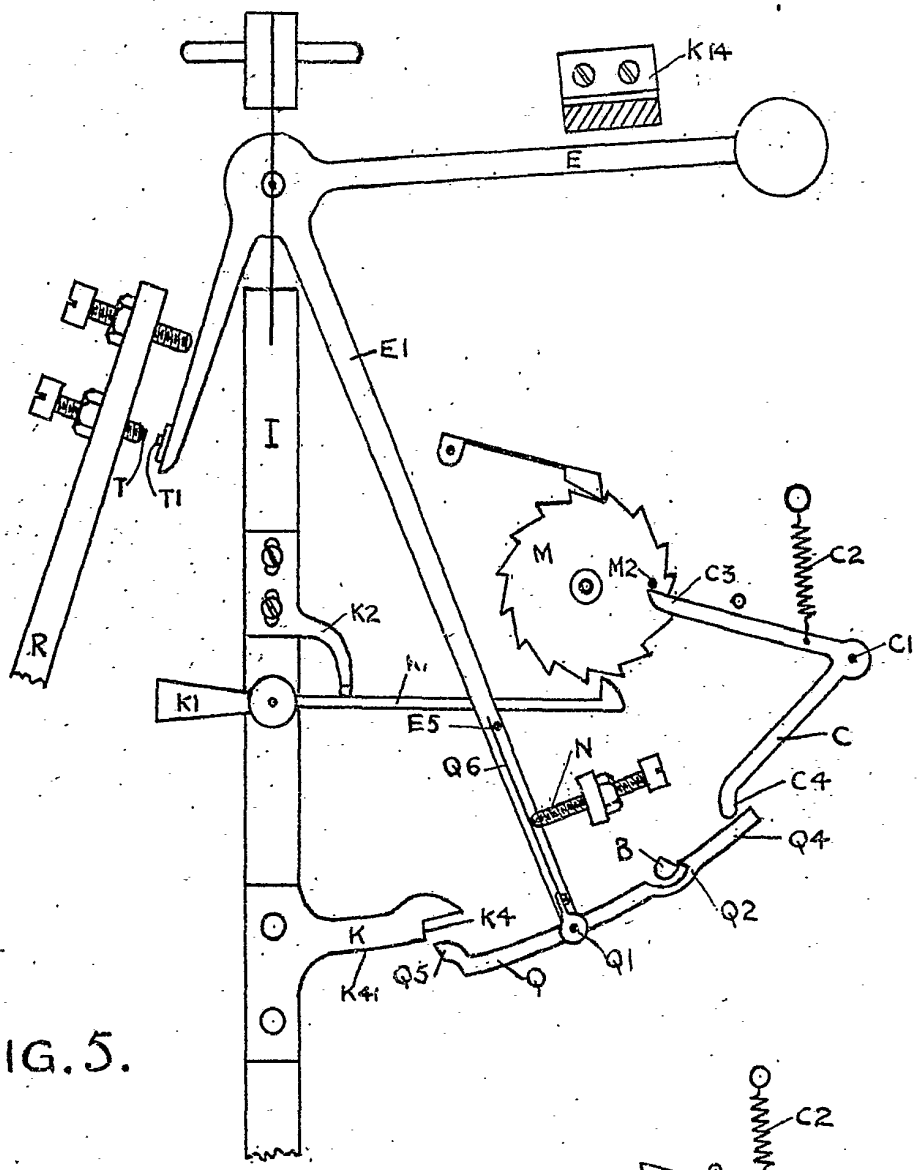

FIG. 5.

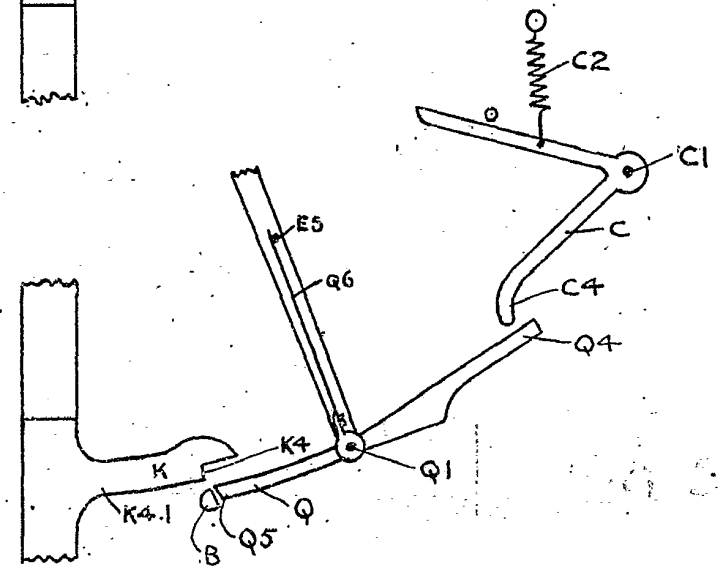

FIG. 5A.

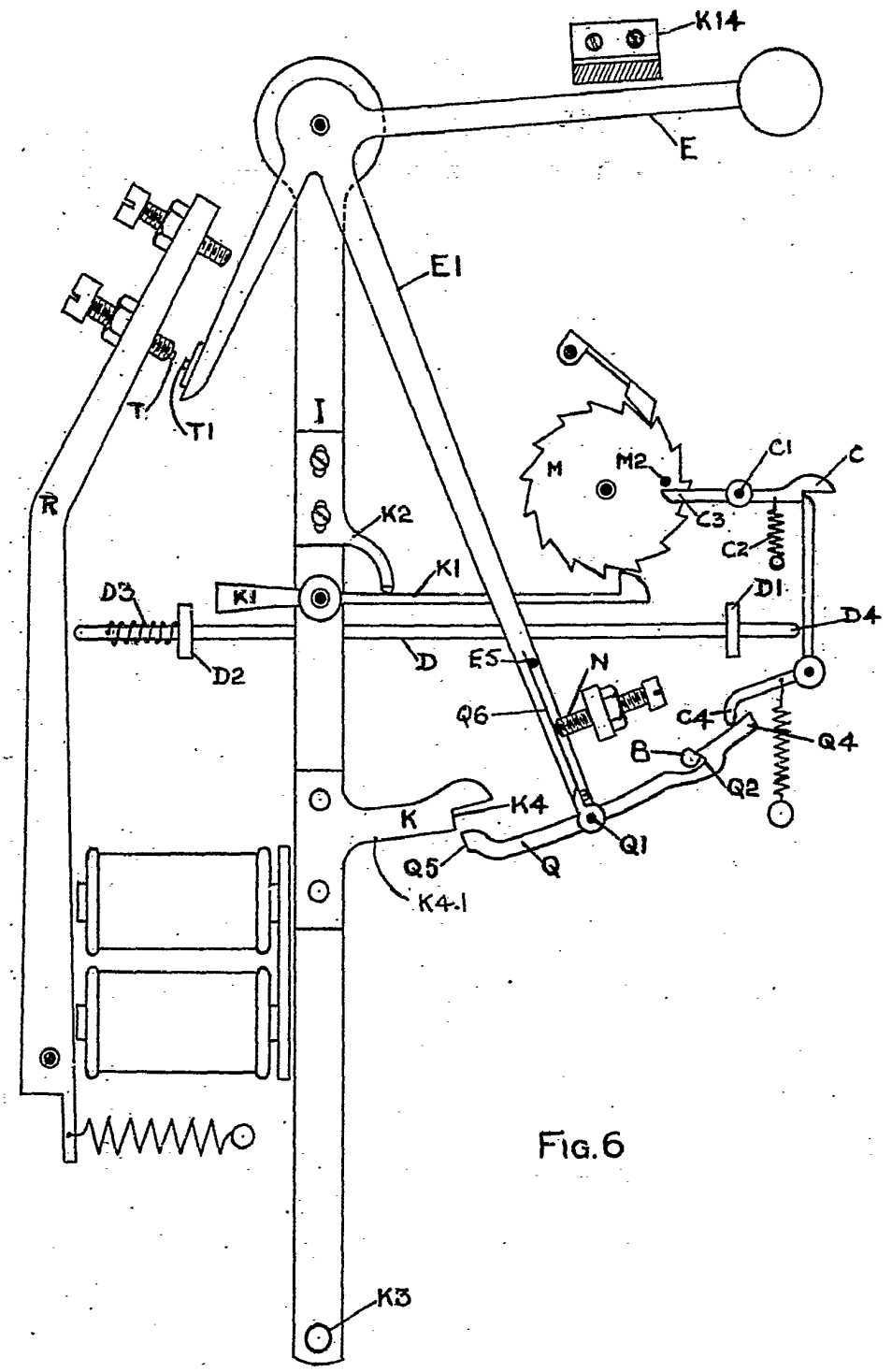

Fig. 6

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160,204 COMPLETE SPECIFICATION

6 SHEETS

SHEET 5

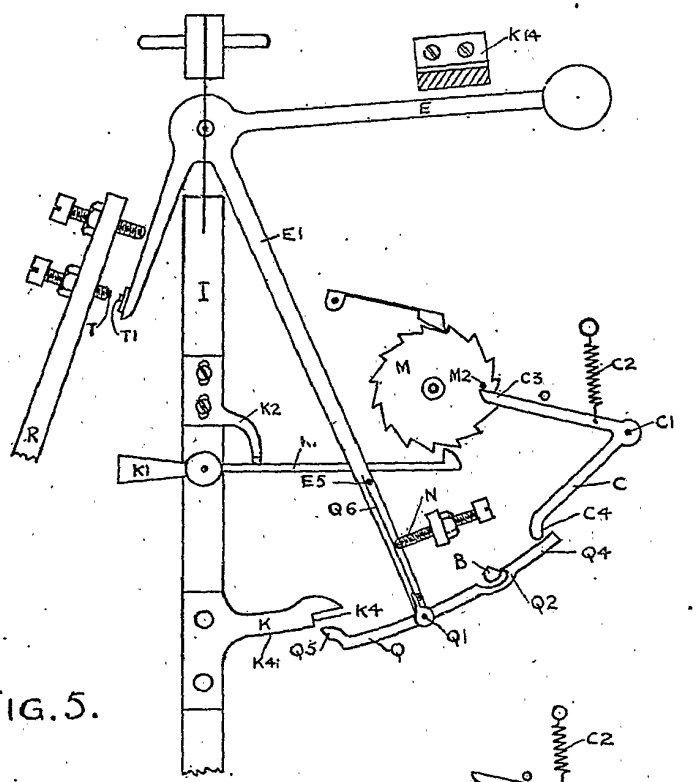

FIG. 5.

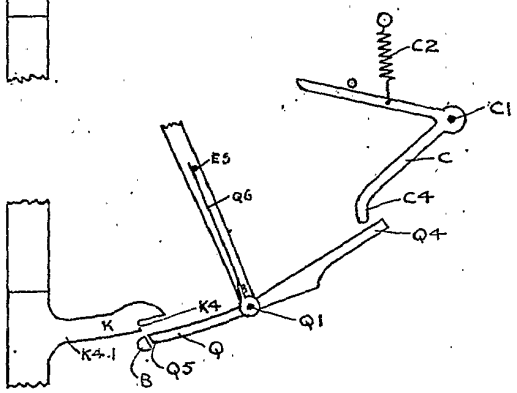

FIG. 5A.

SHEET 6

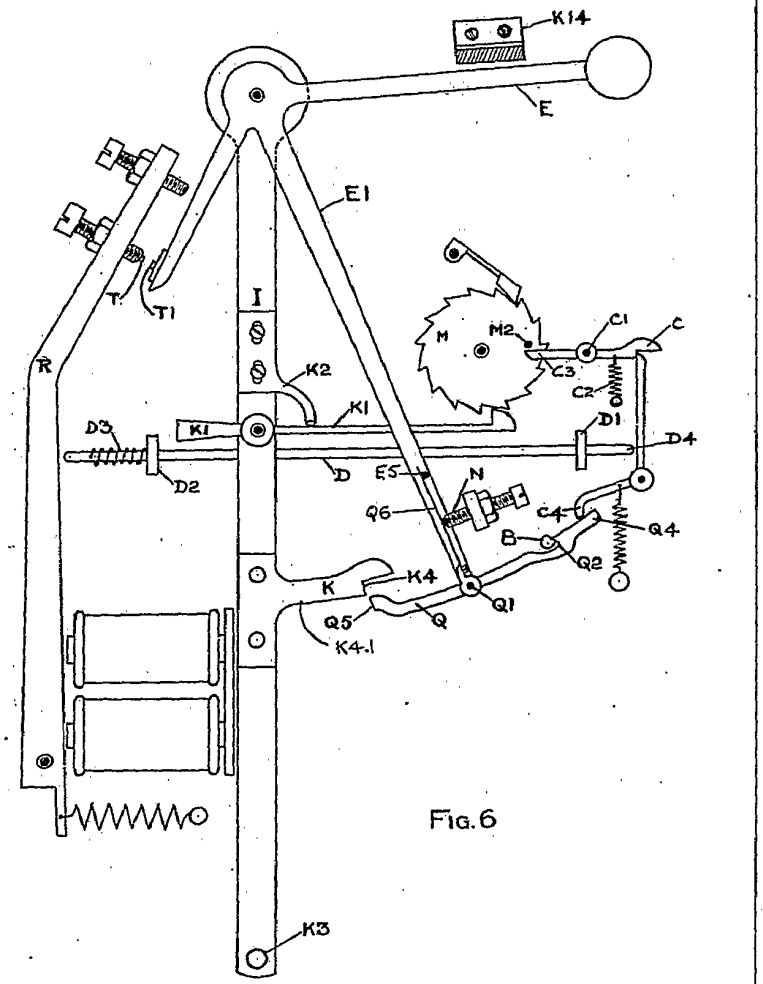

FIG. 6

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

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