N° 10,271 A.D. 1902

Date of Application, 5th May, 1902

Complete Specification Left, 5th Feb., 1903—Accepted, 26th Mar., 1903

PROVISIONAL SPECIFICATION.

Improvements in Apparatus for Automatically Supplying Electric Power to Operate Mechanism in Clocks and other Instruments or Machines.

I. HERBERT SCOTT 6 Selborne Terrace Bradford Yorks Manager do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in electric clocks, instruments, or machines, in which a pendulum balance wheel, or torsion wheel driving a train of wheels is kept in motion by the intermittent excitation of an electromagnet.

Previous attempts have been made to construct electric clocks in which the magnet is excited when the swing or amplitude of the pendulum falls below the normal, but they have failed owing to the complication and delicacy of the automatic circuit closers employed and to the necessary friction entailed by the apparatus added, and to the interruption of the current caused by the fouling of the contact points.

My invention has for its object, to simplify and cheapen the construction, and ensure the reliability of, such clocks instruments or machines, by providing for the excitation of the magnet at the proper time without the addition of any apparatus other than that required to drive the train of wheels, and so to reduce the friction of the working parts to a minimum; to ensure that the circuit shall be opened and closed at the exact points desired during the smallest possible and most efficient part of the arc described by the pendulum balance wheel, or torsion wheel, such contact only being made when the swing or amplitude, of the pendulum, or the rotary motion of the balance or torsion wheel has fallen below the normal: and to provide for the self cleaning of the contact points by means of a wiping or moving contact. It is applicable to clocks, self registering barometers and the like, workmen's tell tale check instruments, advertising machines or toys, or any similar instrument or machine in which a train of wheels is required to be driven, the invention herein described may also be employed to wind up the spring of any such instrument or machine or of the striking train of a striking clock by the method set forth in the Specification of Patent No. 2922 1893 granted to another and myself, or in any other well known manner.

In the patent referred to there is described an electric clock in which the pendulum carries a driving pawl actuating a ratchet wheel, the motion of the pawl being limited by means of a radial rod and rocking lever and the excitation of an electro-magnet caused by one of the clock wheels making contact with a fixed point at regular intervals. In practice this method has been found unreliable, extra friction being added by the radial rod and rocking lever and variations in the battery causing stoppage of the clock when insufficient impetus is given to the pendulum to carry the train of wheels round to the next contact point.

By my present invention the frequency of contact is determined by the strength of the battery which must be completely exhausted before it fails to actuate the pendulum. I dispense with the radial rod & rocking lever and employ an

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ordinary ratchet wheel which is fixed on one of the arbors of the train of wheels; and, pivoted on the pendulum and carrying a platinum contact pin, a driving pawl of ordinary construction, on which is hinged or pivoted a secondary pawl or wire set slightly in advance of it. With the normal swing of the pendulum the two pawls which may act on the same tooth or on different teeth of the ratchet wheel cause it to revolve by both dropping into gear with the ratchet tooth or teeth, a stop pawl or click preventing its backward movement on the return stroke; with a diminished swing of the pendulum the outer driving pawl only drops into gear causing the ratchet to revolve and the inner pawl rides on the top of the ratchet tooth and during its forward movement in this position the platinum pin which it carries wipes an adjustably fixed platinum wire and closes the circuit at the exact moment when an armature fixed on the pendulum approaches an electro-magnet, causing a current, which may be supplied by any suitable battery, to flow through the coils of the magnet and giving an impetus to the pendulum; the exact period of excitation of the magnet and the points at which contact is made and broken, are regulated by the position of the adjustable wire, beyond which the contact pin is carried by the inner driving pawl, on its return journey the inner pawl causes the contact pin to clear the fixed wire by dropping off the top of the tooth into the same position as the outer pawl; the two pawls may be pivoted separately at one or at two different points on the pendulum instead of one on the other

In a modification I employ one driving pawl which is made with a step, or with two engaging parts set closely together; with a diminished swing of the pendulum the step only engages with the tooth of the ratchet and prevents the pawl from dropping to the bottom of the tooth; contact is made as before by the pawl assuming, and moving forward in, this higher position

In another modification I employ one driving pawl and a ratchet wheel which is made with a step or notch in each tooth; with a diminished swing of the pendulum the driving pawl, engages with and rides on the step or notch and makes contact as described above by assuming & moving forward in a higher position than when it engages, as it does with the normal swing of the pendulum, with the ratchet tooth in the ordinary way; or two ratchets one set slightly in advance of the other may take the place of the step ratchet

In another modification the stop pawl or click is provided with a step or with two engaging parts set closely together; when owing to diminished swing of the pendulum this step only engages with the ratchet tooth, the click with a contact pin mounted thereon, is kept at the top of the tooth, and by assuming this position during the return stroke of the driving pawl it is wiped by a contact pin carried by the driving pawl, or in place of one click with two engaging parts I may employ two clicks or stop pawls, one set slightly in advance of the other, acting on the same tooth or on different teeth of the ratchet; with diminished swing of the pendulum one remains on the top of the ratchet tooth and makes contact as already described

In another modification I employ two driving pawls, one acting on the top side of the ratchet wheel on the forward swing of the pendulum and the other acting on the under side of the ratchet on the return swing of the pendulum; I employ a pawl or click with a contact pin mounted thereon which with diminished swing remains on the top of the ratchet tooth and makes contact with, or is wiped by, a pin fixed on one of the driving pawls

In another modification I may employ the wiping contact made by one of the clock wheels described in Patent 2922/1893 already referred to, or by any other suitable means make contact at fixed intervals and cause the circuit to be broken when the swing of the pendulum is normal by means of the relative positions of the two driving pawls engaging with the ratchet teeth as previously described, the circuit being closed when owing to the diminished swing of the pendulum one of the pawls rides on the top of one of the teeth, and open when both pawls engage, and in this position separate two wires or contact points, one of which

may be carried by the inner pawl and one adjustably fixed independently of the pawls, or one carried by the outer pawl and one by the inner pawl; or I may employ an additional ratchet wheel, not fixed to the train of wheels but loosely revolving and actuated by one of the driving pawls, it is caused to revolve with a normal swing of the pendulum and by lifting a click or wire, effects the separation of two contact points, and so breaks the circuit.

I may employ, in place of the pendulum a balance wheel oscillating in bearings, or a torsion wheel suspended by wires or otherwise, and in carrying out the method first described I modify it as follows. On the balance or torsion wheel or on an oscillating wheel actuated thereby, are pivoted the two driving pawls one set slightly in advance of the other actuating a ratchet wheel, an armature is fixed on the balance or torsion wheel and an electromagnet is set in such a position that the armature is carried close past it by the oscillation of the wheel, when this falls below the normal the travel of the driving pawls is reduced and the outer pawl only engages and rotates the ratchet, the inner pawl rides on the top of the ratchet tooth and causes a contact pin which the pawl carries to wipe an adjustably fixed wire causing excitation of the magnet at the moment when the armature approaches it and restoring the oscillation of the wheel

In any of the other methods described the balance or torsion wheel may take the place of the pendulum in the same manner

Dated this Third day of May 1902.

HERBERT SCOTT.

COMPLETE SPECIFICATION.

Improvements in Apparatus for Automatically Supplying Electric Power to Operate Mechanism in Clocks and other Instruments or Machines.

I, HERBERT SCOTT, of 6, Selborne Terrace, Bradford, in the County of York, 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 clocks, instruments, or machines in which a pendulum, balance wheel, or torsion wheel, driving a train of wheels is kept in motion by the intermittent excitation of an electro magnet.

My invention has for its object to simplify and cheapen the construction and ensure the reliability of such clocks, instruments or machines by providing for the excitation of the magnet at the proper time without the addition of any apparatus other than that required to drive the train of wheels and so to reduce the friction of the working parts to a minimum; to ensure that the circuit shall be opened and closed at the exact points desired during the smallest possible and most efficient part of the arc described by the pendulum, balance wheel or torsion wheel, such contact only being made when the swing or amplitude of the pendulum, or the rotary motion of the balance or torsion wheel has fallen below the normal; and to provide for the self cleaning of the contact points by means of a wiping or moving contact.

It is applicable to clocks, self registering barometers and the like, workman's tell tale check instruments, advertising machines or toys, or any similar instrument or machine in which a train of wheels is required to be drven. The invention herein described may also be employed to wind up the spring of any such instrument or machine or of the striking train of a striking clock by the method set forth in the Specification of Patent No. 2922 of 1893, granted to another and myself or in any other well known manner.

In the patent referred to there is described an electric clock in which the pendulum carries a driving pawl actuating a ratchet wheel, the motion of the pawl being limited by means of a radial rod and rocking lever and the excitation of an electro magnet caused by one of the clock wheels making contact with a fixed point at regular intervals. In practice this method has been found unreliable, extra friction being added by the radial rod and rocking lever and variations in the battery causing stoppage of the clock when insufficient impetus is given to the pendulum to carry the train of wheels round to the next contact point.

By my present invention the frequency of contact is determined by the strength of the battery which must be completely exhausted before it fails to actuate the pendulum. I dispense with the radial rod and rocking lever and employ an ordinary ratchet wheel which is fixed on one of the arbors of the train of wheels, and pivoted on the pendulum and carrying a platinum contact pin, a driving pawl of ordinary construction on which is hinged or pivoted a secondary pawl or wire set slightly in advance of it. With the normal swing of the pendulum the two pawls which may act on the same tooth or on different teeth of the ratchet wheel cause it to revolve by both dropping into gear with the ratchet tooth or teeth, a stop pawl or click preventing its backward movement on the return stroke, with a diminished swing of the pendulum the outer driving pawl alone drops into gear causing the ratchet to revolve and the inner pawl rides on the top of the ratchet tooth and during its forward movement in this position, the platinum pin which it carries wipes an adjustably fixed platinum wire and closes the circuit at the exact moment when an armature fixed on the pendulum approaches an electro magnet, causing a current, which may be supplied by any suitable battery, to flow through the coils of the magnet and giving an impetus to the pendulum; the exact period of excitation of the magnet and the points at which contact is made and broken are regulated by the position of the adjustable wire, beyond which the contact pin is carried by the inner driving pawl, on its return journey the inner pawl causes the contact pin to clear the fixed wire by dropping off the top of the tooth into the same position as the outer pawl; the two pawls may be pivoted separately at one or at two different points on the pendulum instead of one on the other.

To fully describe my invention reference is made to the accompanying sheet of drawings in which similar reference numerals indicate corresponding parts in each of the figures.

Figure 1 represents a back elevation of such parts of a clock as are required to shew the application of my improvements.

Figure 2 is a plan view of the working parts of the same.

Figure 3 is a separate elevation of the pawl and ratchet arrangement.

Figures 4 to 13ª are views illustrating different modifications.

Figure 14 is an elevation shewing the invention applied to a balance.

Referring firstly to Figures 1, 2 and 3. The clock case 2, the movement plates 3, the movement or train of wheels 5, the hands or pointers 6 and the pendulum 7 can be of any ordinary construction excepting, as regards a spring or weight driven clock, that the pendulum has an iron armature 8 at the bottom, which, when the pendulum is in oscillation, passes closely over the poles 9 of an electro-magnet 10. A battery is shewn at 12 for exciting the magnet. One wire 13 from the battery passes to a suitable metallic stud 14 fixed in the block 15 composed of insulating material, or bad conductor of electricity, and the wire 13ª from the other pole of the battery after passing to the magnet is carried up and connected to the back plate of the movement. The ratchet wheel 18 is fixed to the arbor 19 of the primary pinion 20 of the train of wheels and the two light pawls 21 and 22 which are freely pivoted to the pendulum rod 7 rest upon the top of the ratchet wheel 18. The pawl 22 has its engaging pin *a* beyond the engaging pin *c* of the pawl 21 and it may be termed the auxiliary pawl as it is only in operation when the pawl 21 is engaged in closing the circuit. When the pendulum is oscillating through an arc from its maximum downwards to a certain

length both pawls when moving in the direction of the arrow—Figure 3—pass from the tooth they previously engaged to the next tooth and on their reverse movement draw the ratchet wheel round one tooth. A light check pawl 25 is provided to prevent the ratchet wheel moving in the reverse direction, excepting to the extent hereinafter referred to. When the oscillation of the pendulum becomes diminished below the arc required to carry the pawl 21 over so that it is free to fall on to the next tooth the auxiliary pawl comes into action to draw the wheel round and as it does so the pawl 21 rides on the top or crown of the tooth on which it rests, consequently the spring contact wire 23 carried by such pawl momentarily engages the metallic stud 14 and closes the circuit of the electro-magnet. This is arranged to take place just as the armature 8 is on the point of passing the poles of the electro-magnet when moving in the direction of the arrow—Figure 1—and by the magnet attracting the armature impulse is given to the pendulum in the usual way.

I find it desirable that the ratchet wheel arbor 19 should be quite free in its bearings so that when the pawls are moving in the directions of the arrow—Figure 3—the ratchet wheel can turn with them until stopped by the check pawl, for when the pendulum is at its maximum swing it may at each oscillation move the ratchet wheel almost the distance of two teeth and therefore if the ratchet wheel were not free there would be danger of closing the circuit when the pawls moved in the direction of the arrow, Figure 3.

In Figure 4 both the pawls 21 and 22 are shewn pivoted to the pendulum instead of one to the other as in Figure 3. Although the two pawls 21 and 22 in these figures are shewn in operation on the same tooth of the ratchet wheel it is not at all essential that they should be made in this way for they would work quite well on the same principle if arranged to engage separate teeth.

In Figure 5 an arrangement is shewn in which a single pawl 21^a is used with two engaging parts. One form of this pawl is shewn in plan in Figure 6, a^1 and c^1 being the two engaging pins. In this case when the diminished swing of the pendulum prevents both engaging parts passing on to the next tooth the pawl rides on the top of the tooth and so makes contact.

In Figure 7 a single pawl 21^c is used in conjunction with a ratchet with stepped teeth. When owing to diminished length of the pendulum's arc of oscillation the pawl fails to fall over the second step or notch but rides upon or in it, consequently the contact is made.

Figures 7^a and 8 shew a slight modification of the latter arrangement, two ratchet wheels being used connected together side by side and one slightly in advance of the other so as to combinedly form stepped teeth.

Figure 9 shews an arrangement in which the stop pawl 22^c makes contact to complete the circuit. In this case the pawl is made with a stepped end and if owing to diminished swing of the pendulum the pawl fails to fall to the bottom of the tooth the wire 22^a carried by the pawl makes contact with the wire 30 carried by the driving pawl 21^c and closes the electric circuit. The wire 30 is carried by the pawl in order to obtain a wiping contact. The drawing shews the relative position of the pawls immediately after making contact.

Figure 9^a illustrates a modification of Figure 9 which may be considered an improvement in as much as the pawl 22^c and the driving pawl 21^c engage diametrically opposite sides of the ratchet, therefore the wiping pressure of the contact points is positive for the reason that each pawl acts against the other. The pawl 22^c is kept in contact with the ratchet wheel by the balance weight 31.

Figure 10 shews a slightly different arrangement, a stop pawl 25 being used and a contact pawl 22^d employed to make a contact with the wire 30.

In the modification shewn in Figure 11 the ratchet is turned whilst the pendulum swings in both directions. For this purpose the second pawl 21^e is pivoted to the pendulum 7 and is held in contact with the ratchet wheel by the balance weight 31. In this figure the drawing shews the position of the pawls immediately before making contact.

I find it desirable that the two contact points should be pressed together at the moment of contact as shewn in Figures 6 to 7ª and with regards to Figures 9, 10 and 11 to pivot the stop catch pawl so that it bears on the underside of the ratchet as shewn in Figure 9ª for the same purpose.

I may employ a second break in the circuit and close this second break at regular intervals by contact made by one of the clock wheels, as described in the Specification of Patent No. 2922 of 1893, or in other convenient way close the second break in the circuit at frequent intervals and close the other break in the circuit by any of the above described means. Figure 12 illustrates one way of doing this, and consists of a separate ratchet wheel 50 simply mounted on a stud which may be located on the opposite side of the pendulum. This is arranged to be turned the distance of one tooth at each swing of the pendulum by the pawl 51 but when the arc of the swing becomes reduced to a certain length the pawl 51 fails to reach and engage the next tooth of the ratchet which remains stationary and consequently the contact is unbroken as the pawl 52 remains at rest upon the contact point 53.

Another arrangement for the same purpose is shewn in Figure 13. In this case a wiping finger 60 is mounted on the insulated ratchet 18 and closes the second break in the circuit each time it meets the spring 61, The primary closing and opening of the circuit being effected by the pawl 21 and the contact point 14 or as shewn in Figure 13ª by the pawl 21 and the pawl 22 in which latter case one of the pawls must be insulated from the pendulum and the wire from one pole of the latter coupled to it. Contact is made between the two pawls when the spring 23 carried by the pawl 21 engages the top of the loop 24 carried by the pawl 22.

Figure 14 shews the arrangement described with reference to Figures 1, 2 and 3 or 4 applied to a balance instead of a pendulum. In this figure 7ª is the balance wheel 8ª is the armature, 9ª are the poles of the magnet, the pawl 21 is pivoted to a pin on the balance wheel.

I am quite aware that it is not new in electrically driven clocks to give an impulse to the pendulum by an electro-magnet momentarily excited each time the arc of oscillation of the pendulum becomes reduced to a certain length but so far as I know a commercially successful arrangement is not in vogue mainly I believe on account of the greater number of working parts as well as greater friction than pertains in my invention.

In the foregoing description I have referred to a train of wheels which term I intend to include any other form of transmission mechanism.

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. The improved means of closing the circuit of an electro-magnet for the purpose of imparting impulse to a pendulum or balance, comprising a ratchet wheel, a check pawl and a driving pawl the movement of the latter being controlled so far as the opening and closing of the circuit is concerned by the teeth of the ratchet wheel alone in order that when the oscillation of the pendulum or balance diminishes to a certain extent such driving pawl takes a slightly different path and thereby closes the circuit by a wiping contact, substantially as herein shown and described.

2. The improved means of closing the circuit of an electro-magnet for the purpose of imparting impulse to a pendulum or balance, comprising a ratchet wheel, a check pawl, a stepped or duplex driving pawl controlled so far as the opening and closing of the circuit is concerned by the teeth of the ratchet wheel alone, so that when the swing of the pendulum diminishes to a certain extent the circuit is closed by a wiping contact substantially as described.

3. The improved means of closing the circuit of an electro-magnet for the purpose of imparting impulse to a pendulum or balance, comprising a ratchet

wheel, a driving pawl and a stepped or duplex stop pawl the movement of such pawls being controlled so far as the opening and closing of the circuit is concerned by the teeth or the ratchet wheel alone so that when the swing of the pendulum diminishes to a certain extent the circuit is closed by a wiping contact, substantially as described.

4. The improved means of closing the circuit of an electro-magnet for the purpose of imparting impulse to a pendulum or balance, comprising, a ratchet wheel, a driving pawl, a contact pawl and a stop pawl, substantially as herein shown and described.

5. The improved device described with reference to Figures 1, 2 and 3 or Figure 4, for the purpose specified.

6. The improved device described with reference to Figures 5 and 6, for the purpose specified.

7. The improved device described with reference to Figure 7 or Figures 7ª and 8, for the purpose specified.

8. The improved device described with reference to Figure 9 and 9ª or Figure 10, for the purpose specified.

9. The improved device described with reference to Figure 11, for the purpose specified.

10. The combination with any of the devices illustrated in the drawings, of means for making and closing a second break in the circuit, substantially as described.

11. The improved means of closing the circuit of an electro-magnet for the purpose of imparting impulse to a pendulum or balance consisting of a device for periodically closing the circuit and a second device for intermittently closing the circuit when the oscillation of the pendulum or balance diminishes to a certain extent

Dated this 4th day of February 1903.

DRACUP & NOWELL,
Patent Agents, Bradford.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1903.

A.D. 1902. May 5. N° 10,271.

SCOTT'S Complete Specification.

1 SHEET.

Fig 1.

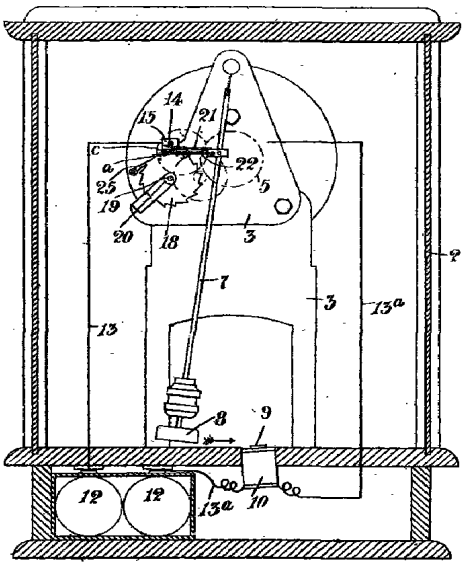

Fig 2.

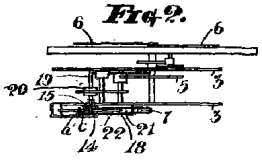

Fig 6.

Fig 3.

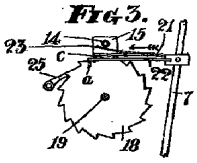

Fig 4.

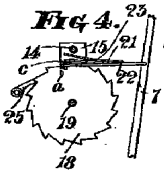

Fig 5.

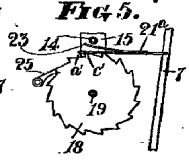

Fig 7.

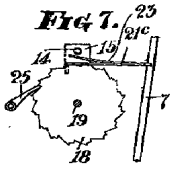

Fig 7a.

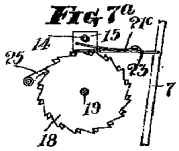

Fig 9.

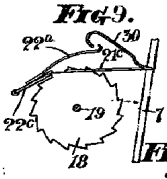

Fig 10.

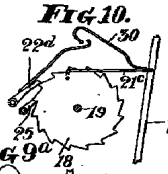

Fig 11

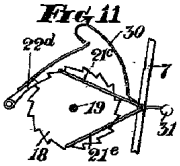

Fig 8.

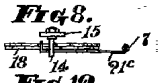

Fig 9a

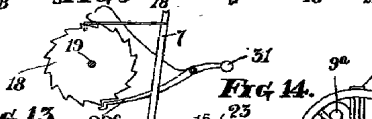

Fig 12.

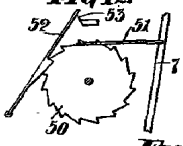

Fig 13.

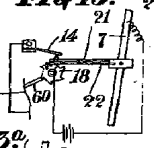

Fig 14.

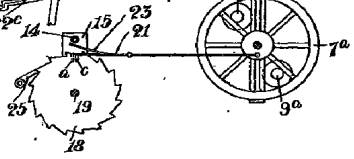

Fig 13a.

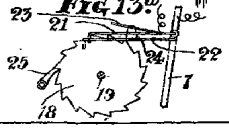

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Fig 1.

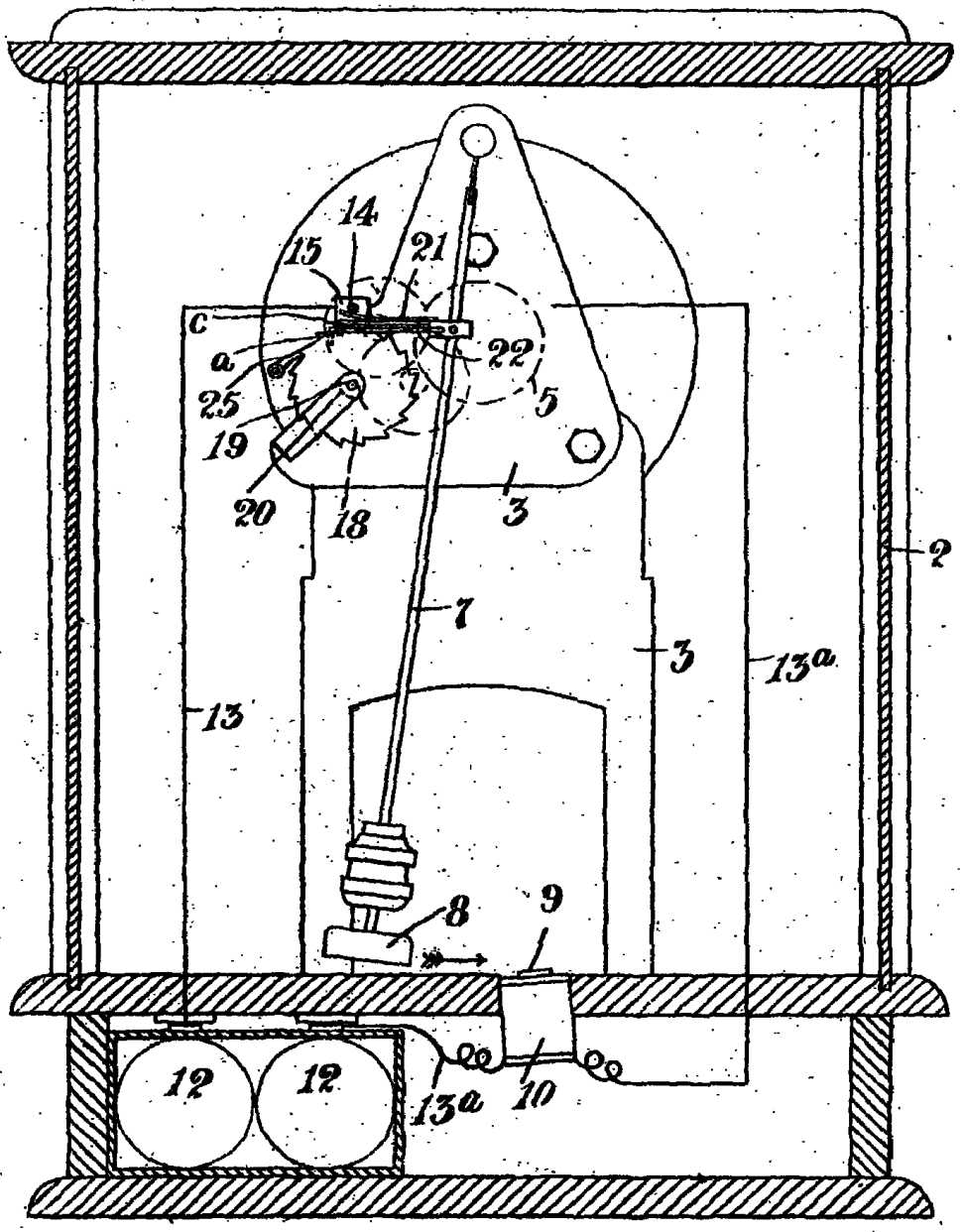
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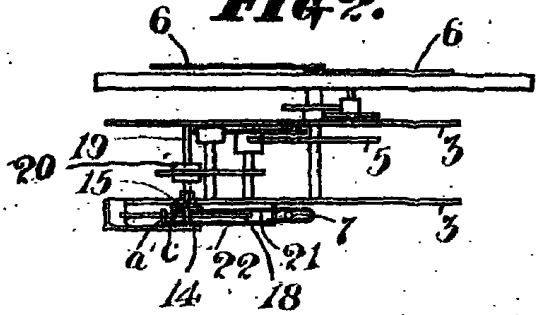
Fig 2.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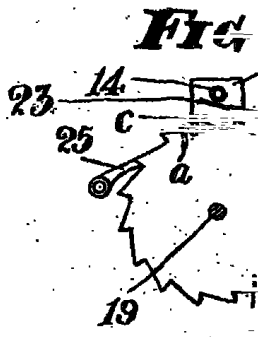
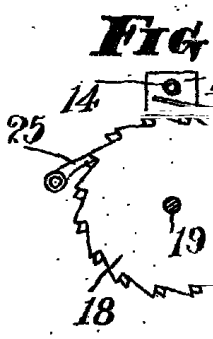

23
14
c
25
a
19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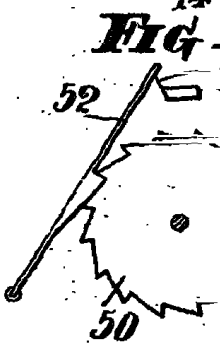

52
50

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

FIG 6.

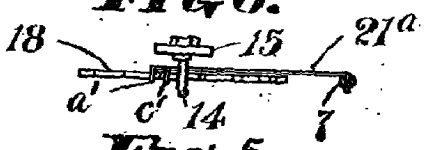


FIG 4.

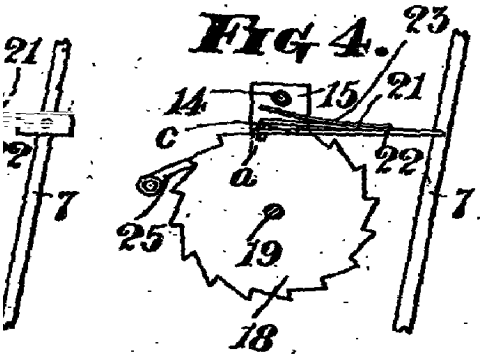


FIG 5.

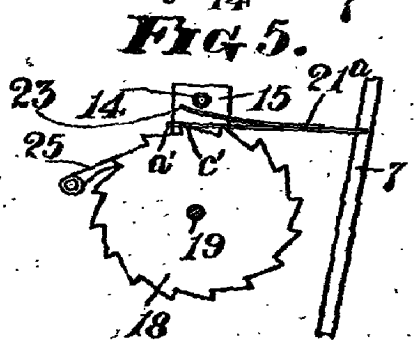


FIG 7.

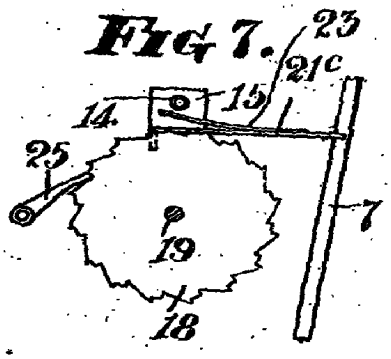


FIG 9.

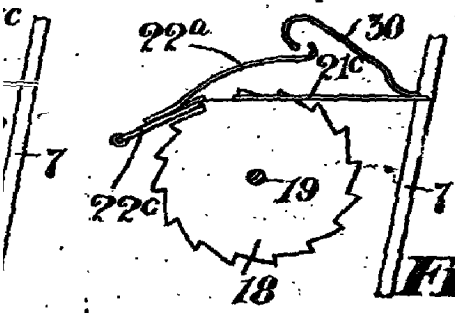


FIG 10.

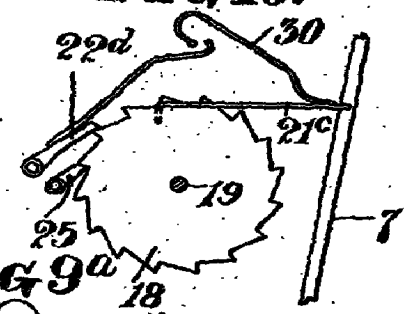


FIG 11

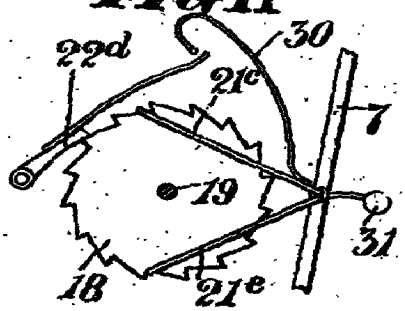


FIG 9a

FIG 13.

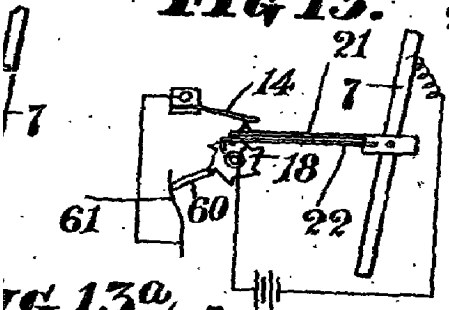


FIG 14.

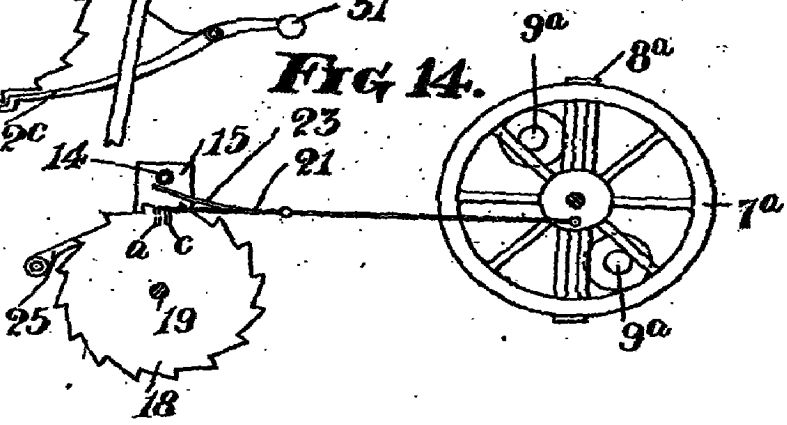
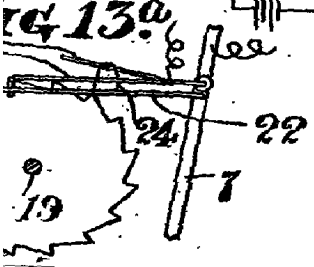


FIG 13a.



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