PATENT SPECIFICATION

433,098

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Specification Accepted: Aug. 8, 1935.

COMPLETE SPECIFICATION

Electric Contact for Maintaining the Movement of Electromagnetically Oscillated Balance Wheels

I, JEAN THÉODORE DELVINIOTTI, a French Citizen, of 5, Avenue du Colonel Bonnet, Paris, France, 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:—

The present invention relates to electric clockwork movements having a balance wheel of which the movement is maintained by an electromagnet which is energised periodically and has for its subject a system of electric contacts which open and close the exciting circuit of the electromagnet at predetermined periods of the movement of the balance wheel. The invention has the advantage of ensuring, at will, one or two closures of the electric circuit in one or both directions of oscillation of the balance wheel.

It also has the following advantages:—

(a) The property of placing the contact point or points at any suitable point of the arc described by the pendulum for the purpose of effecting the closing of the electric circuit at the precise instant which is essential for the maximum efficiency.

(b) The property of imparting to these contacts the arc of operation necessary for obtaining the duration of useful contact.

(c) Reducing to a very low value the resistance opposed to the balance wheel whilst contact is being made. The contact system according to the invention enables the exciting circuit to be closed and broken exactly at the desired moments and for the desired period of time, in spite of the great rapidity of operation. At the same time it ensures the effective operation of the contacts and the protection of the actuating members of the said contacts against the effects of heating due to breaking sparks. Its use is particularly advantageous in clocks of small size.

Devices are known wherein the shaft of the balance wheel is provided with one or more inclined blades acting as cam surfaces which, during the oscillation of the balance wheel, move a pivoted lever bearing thereon and returned resiliently, the said lever producing the closing of a circuit at a moment of its course and the opening thereof at the moment at which it is returned to its position of rest. The invention has for its subject improvements in these devices mainly relating to the following points:—

1. The composition and construction of the members of the interrupter system.

2. The thermal and possibly the electric insulation or spacing of the contact members relatively to the mechanical portion of the interrupting device.

3. The method of construction of contact-operating cam projections.

The contact system according to the present invention comprises essentially a resilient blade enclosed at one end and provided at its other end with a guide member capable of engaging with a cam surface or with cam surfaces, secured to the spindle of the balance wheel, which move it from its position of equilibrium at predetermined moments and for predetermined periods of time under the action of the cam surface by which it is guided; this resilient blade acting on a conducting rod forming one of the contact members so as to bring it, at the desired moment, into contact with one or more contact members arranged transversely to the said rod at the end of one or more blades, which are themselves resilient, so as to close the energising circuit of the electromagnet, after which the disengagement of the resilient blade from the cam surface opens the contacts at a predetermined moment and thus breaks the circuit of the electromagnet.

The arrangement of the contact members, at right angles to one another, at the ends of the resilient blades, has the advantage of ensuring good contact dur-

ing the entire period of time during which the current passes.

This arrangement may be obtained in various ways, the guide member provided at the end of the blade which co-operates with the cam surfaces may itself form a contact member and in this case the blade by which it is carried is connected to one of the poles of the electric circuit, whilst the transverse rod which forms the other contact member is mounted on a second blade which is connected to the other pole.

In another form of construction the guide member acts through the medium of a thermally insulating sleeve on the contact rod located at the end of the resilient metal blade connected to one of the poles of the circuit.

In another form of construction the guide member itself carries the contact rod.

The resilient blades carrying the contact members are preferably stressed against counter blades.

The cam surfaces are so dimensioned as to ensure the closing and opening of the contacts at predetermined moments and for predetermined periods of time; when two cam surfaces are used so as to actuate a contact in each direction of oscillation of the balance wheel, these cam surfaces may be actuated so as to produce identical contacts at each half-oscillation, or even to produce different contacts either as regards duration or as regards the point of the oscillation at which they are made.

From the description which follows, giving by way of example various forms of construction of the invention, the various features will appear.

In the accompanying drawings:—

Figs. 1 and 2 show respectively an elevation and plan of one form of construction of the invention.

Figs. 3 and 4 show diagrammatically the operation of the contacts of the preceding device during the oscillations of the pendulum.

Figs. 5 and 6 show respectively in elevation and in plan a second form of construction of the invention.

Figs. 7 and 8 show respectively in elevation and in plan a third form of construction of the invention.

Figs. 9, 10 and 11 show in plan various arrangements of the cams.

Figs. 12, 13, 14 and 15 show various phases in the operation of the contacts.

Figs. 16 and 17 show respectively in plan and in elevation a method of mounting the cams on the balance wheel.

The contact system shown in Figs. 1 and 2 is actuated by the shaft 1 of the oscillating balance wheel 13. The shaft 1 carries on a ferrule 2 two inclined blades 3, 3*a*, acting as cam surfaces. A post 7 in electrical connection with the metal framework carries a very flexible blade 5 and a counter blade 6 serving to prevent vibrations of the blade 5. The end of the blade 5 carries a contact member 4 of good electrically conducting metal.

A post 11 receiving electric current is insulated from the framework by the ring 12 and carries a blade 9 stressed against a support 10. This blade 9 carries at its end a contact member 8 of good electrically conducting metal and which is located transversely to the member 4.

Referring by way of example to Fig. 3, it will be seen that as the shaft 1 pivots in the direction of the arrow, the cam projection 3 meets the member 4, secured to the flexible blade 5 and raises this. During this movement the member 4 meets the member 8 of the blade 9, this latter being strongly stressed against its support 10.

At this moment the electric circuit is closed and passes through the positive terminal, the insulated post 11, the stressed blade 9, the contact member 8, the contact member 4, the flexible blade 5, the post 7 connected to the framework and the negative terminal.

When the member 4 passes off the cam projection 3 it leaves this and contact is broken. Then the cam projection 3*a* in turn meets the member 4 of the cam projection and this is simply lowered by this cam projection without closing contact. On the return movement the operation takes place but in the opposite direction and the cam projection 3*a* closes the contact. Referring by way of example to Fig. 4, it will be seen that the shaft 1, pivoting in the direction of the arrow, the cam projection 3 lowers the member 4 without closing contact; then the member 4 returning to its raised position, the cam projection 3*a* comes into contact with the member 4 of the blade 5, this is raised and during this movement the member 4 meets the member 8 of the blade 9 and by reason of this fact the electric circuit is closed.

On the return movement the same operation takes place but in the reverse direction and it is the cam projection 3 which establishes contact.

In the form of construction described, the member of the interrupter system which co-operates with the cam projections also forms the contact proper.

In the methods of construction shown in Figs. 5, 6, 7 and 8 the member 4 which co-operates with the cam projections and which is secured to the end of the flexible blade 5 no longer comes into contact with the member 8 secured to the end of the

flexible blade 9. By way of example a pin 14 arranged perpendicularly to this blade establishes the electric contact.

In Figs. 5 and 6 the member 4 which co-operates with the cam projections 3 and 3*a* carries a sleeve 15 of insulating material and bears against the pin 14 of suitable metal carried by the flexible blade 6, forming a counter blade, the latter resting on a fixed support 16. On the insulated post 11 are mounted two flexible blades 9 and 9*a* carrying at their ends contact members 8 and 8*a* of suitable metal, as also the two supports 10 and 10*a* on which the said blades 9 and 9*a* rest. By way of example, counter blades 17 and 17*a* may be mounted on the same insulated post 11.

It will be seen that the shaft 1 of the balance wheel pivoting in the direction of the arrow in Fig. 6, the cam projection 3 meets the member 4, secured to the end of the flexible blade 5 and raises this, the pin 14 secured to the end of the flexible counter blade 6 being also raised. During this movement the pin 14 meets the contact members 8 and 8*a*, secured to the ends of the blades 9 and 9*a*, the latter being well stressed downwardly by the counter blades 17 and 17*a*, and at this moment the electric circuit is closed. When the member 4 has passed over the cam projection 3 it releases this and the electric circuit is broken.

The enormous increase in temperature produced by the spark of the breaking current is thus not easily transmitted to the member 4 and consequently the lubrication of this member 4 necessary for its continuous co-operation with the cam projections 3 and 3*a* is effectively preserved, the lubricant used not being liable to be deteriorated by the increase in temperature, and as the points of contact of the pin 14 with the contact members 8 and 8*a* are spaced from the end of the member 4 which co-operates with the cam projections, the lubricant placed on these cam projections cannot pass by capillarity to the contact points and thus obstruct the passage of current. Finally, as the two blades 9 and 9*a* are placed at an equal distance from the axis of the member 4, a torsional movement cannot be produced whilst they are being raised.

The shaft 1 of the balance wheel continuing its movement after the falling off of the member 4, the cam projection 3*a* in turn meets the member 4, which is lowered to allow this cam projection to pass. During this operation the insulating sleeve 15 leaves the contact pin 14 which is held in position as the blade 6, to the end of which it is secured, is stressed against its support 16.

When the cam projection 3*a* releases the member 4, the sleeve 15 returns to its position against the pin 14.

From this will be clearly understood the well-defined position occupied by the pin 14 when at rest and which at this moment bears against the support 16, which position always remains the same.

In the method of construction shown in Figs. 7 and 8, the member 4 which co-operates with the cam projections 3 and 3*a* itself carries the contact pin 14.

This arrangement has been considered more particularly for small sizes. The counter blades for the flexible blades 9 and 9*a* have been omitted. These latter are slightly stressed and come to rest on the supports 10 and 10*a*.

From the foregoing it will be seen that the shaft 1 of the balance wheel pivoting in the direction of the arrow, the cam projection 3 raises the member 4 and consequently the member 14. This latter meets the two contact members 8 and 8*a* and the electric circuit is closed.

When the member 4 passes from the cam projection 3, it is released therefrom and the electric circuit is broken, the shaft 1 of the balance wheel continuing its movement; the cam projection 3*a* in turn comes against the member 4 which is lowered. During this movement the blade 5 leaves the counter blade 6 which remains stressed against its fixed support 16.

When the member 4 is released the blade 5 again resumes its position bearing lightly against the counter blade 6.

Referring to Fig. 3, it will be seen that the cam projections 3 and 3*a* are so disposed that in the two directions of oscillation the contacts are closed during the period of oscillation during which the balance wheel moves away from the position of equilibrium, whilst in Fig. 4 they are disposed so as to close the contacts during the period of oscillation during which the balance wheel approaches the position of equilibrium.

Such an arrangement of the cam projections is shown in plan in Figs. 9, 10 and 11. In Fig. 9 the two cam projections 3 and 3*a* are arranged symmetrically and have the same length in such a manner that contact is made in a manner exactly symmetrically both when the balance wheel swings away from the position of equilibrium and when it swings towards this position. In Fig. 10 the engaging edges of the cam projections 3 and 3*a* are symmetrical, but the cam projection 3*a* has an arc of operation larger than the cam projection 3 in such a manner that the contacts are made at symmetrical points but are of different duration during the two movements. In Fig. 11 the two

engaging edges of the two cam projections are disposed in an unsymmetrical manner; the arcs of operation may be equal or unequal so that contact is made at unsymmetrical points of the two swings of the balance wheel with an equal or different duration.

It will be understood that the device of the invention may only be provided with a single cam projection, contact being then only made once per complete oscillation of the balance wheel.

Referring to Figs. 12, 13, 14 and 15, which show the phases of operation of the contact for the arrangement in Figs. 1 and 2, it will be seen in Fig. 12 that at the moment of the member 4 meeting one of the cam projections 3, contact of the said member with the member 8 is not established. It is only after a certain movement (Figs. 13 and 14) that the cam projection 3 holds the member 4 against the finger 8 of the blade 9 (this latter being strongly stressed).

It will be seen, by reference to Fig. 15, that the arc of contact may be extended by extending, by a horizontal portion, the outline of the cam projection 3, which does not increase the mechanical resistance opposed by the contact.

This arrangement may also be applied to the devices in Figs. 5 and 6 or 7 and 8.

Figs. 16 and 17 show a method of mounting the cam projections. In the metal boss 2, secured to the shaft of the balance wheel, are drawn two saw cuts each of which is to receive one of the cam projections 3, 3*a*. These may be of metal, hard stone, cardboard or cloth treated with the product sold on the market under the registered trade mark " Bakelite."

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. In a clockwork movement with a balance wheel actuated by an electromagnet, an electric contact system actuated by the balance wheel itself for the purpose of periodically opening and closing the energising circuit of the said electromagnet comprising, in combination, a blade spring connected to one of the poles of the electric circuit and carrying at its free end a transverse conducting rod forming a contact member; opposite this contact member and arranged perpendicularly thereto one or two contact members each at the end of another blade spring connected to the other pole of the electric circuit, on the shaft of the balance wheel either an inclined blade (3) in the case where the contact only operates in one direction of oscillation of the balance wheel, or two blades (3 and 3*a*) inclined in opposite directions to one another, in the case where the contact operates in both directions of oscillation of the balance wheel; in co-operation with the said inclined blade or blades a guide member (4) secured to the end of one resilient member (5) and which, guided by the inclined blade or blades, acts on one of the contact members so as to bring it into contact position, whilst when it moves off the blade (3 or 3*a*) by which it is guided the contact members are spaced apart by the spring systems by which they are carried, thus interrupting the circuit.

2. Contact system according to claim 1, wherein one or all the springs carrying contacts bear against fixed supports.

3. System according to claims 1 and 2, wherein the guide member (4) serves at the same time as a contact member, the current being supplied thereto by the resilient member (5) by which it is carried.

4. Contact system according to claim 1 or 2, wherein the guide member, thermally, and if necessary electrically, insulated from the contact member by an insulating sleeve, pushes at its centre the transverse contact member so as to bring this into contact at its ends with the contact members of the second system of springs.

5. Contact system according to claims 1 and 2, wherein the transverse contact member is secured to the guide member (4) itself, the resilient member (5) supporting the latter serving at the same time for the supply of current.

6. Contact system according to any of claims 1, 2, 3, 4, and 5, wherein the springs are provided with counter springs.

7. Contact system according to any of claims 1, 2, 3, 4, 5 and 6, comprising two inclined blades for actuating the guide member wherein the two blades inclined in opposite directions to one another have arcs of operation of different length for the purpose of producing different periods of contact in the two directions of oscillation of the balance wheel.

8. Contact system according to any of claims 1, 2, 3, 4, 5 and 6, comprising two blades inclined in opposite directions to one another for actuating the guide member, wherein the said blades are mounted unsymmetrically relatively to the position of rest of the balance wheel for the purpose of making contact at different moments in the two directions of oscillation.

9. Contact system according to any of claims 1, 2, 3, 4, 5, 6, 7 and 8, wherein the oblique surfaces of the inclined blades are extended by a horizontal surface.

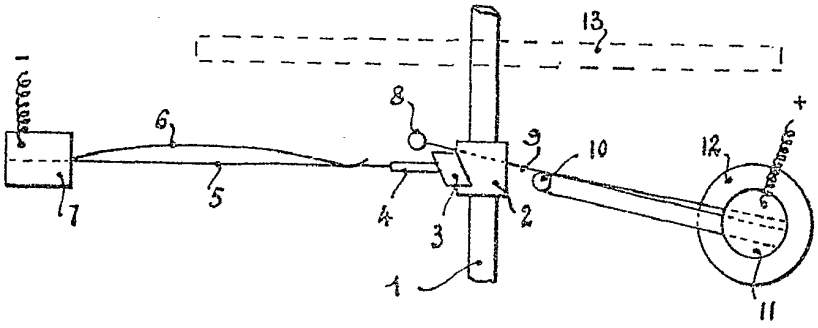
10. Contact system according to any of claims 1, 2, 3, 4, 5, 6, 7, 8 and 9, wherein the inclined blades are blades of metal, ruby, cardboard or fabric treated with material sold on the market under the registered trade mark "Bakelite," inserted into oblique slots formed in an annular member secured to the shaft of the balance wheel.

11. Contact systems for electric clocks with a balance wheel actuated by an electromagnet, substantially as described and illustrated.

Dated this 31st day of August, 1934.
HY. FAIRBROTHER,
Chartered Patent Agent,
30 and 32, Ludgate Hill, London, E.C.4.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1935.

Fig. 1



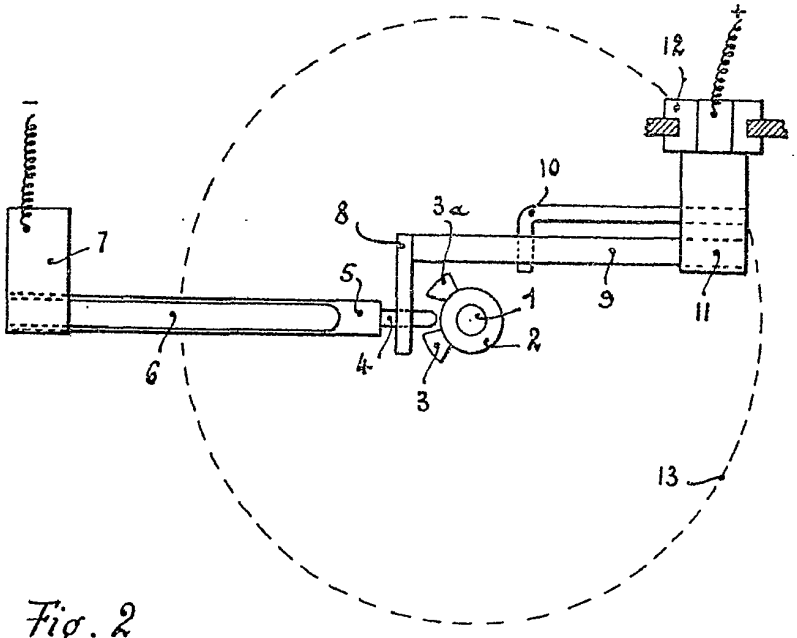


Fig. 2

Fig. 3

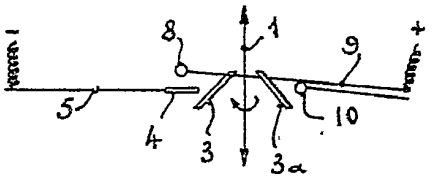


Fig. 4

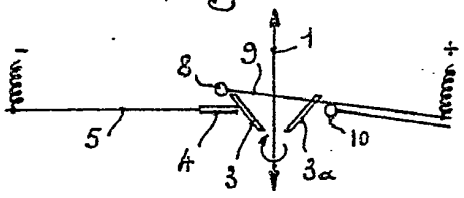


Fig. 9

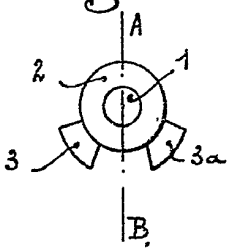


Fig. 10

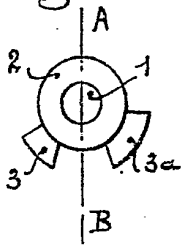


Fig. 11

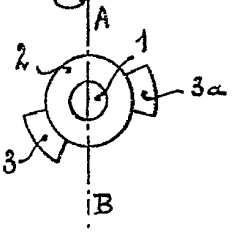


Fig. 12

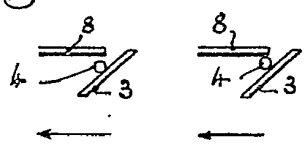


Fig. 14

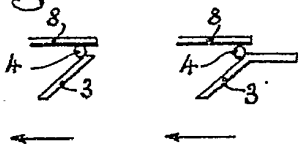


Fig. 13

Fig. 15

Fig. 16

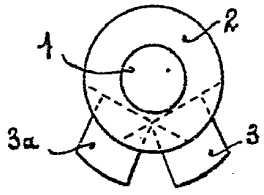


Fig. 17

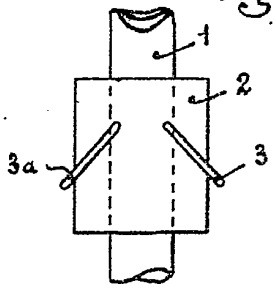


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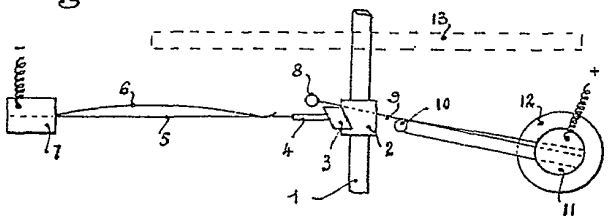
Fig. 1



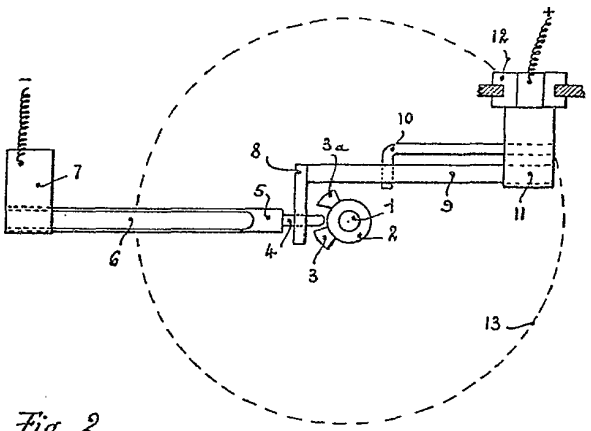


Fig. 2

Fig. 3

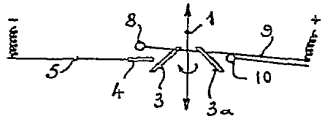


Fig. 4

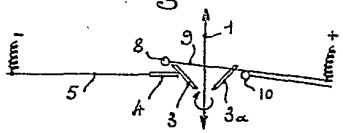


Fig. 9

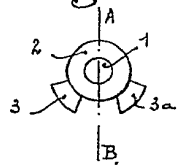


Fig. 10

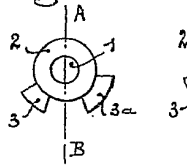


Fig. 11

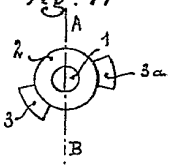


Fig. 12

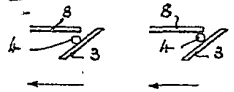


Fig. 14

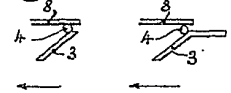


Fig. 13

Fig. 15

Fig. 16

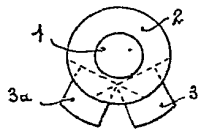


Fig. 17

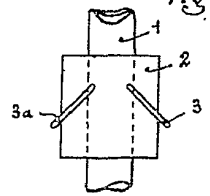


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Fig. 5

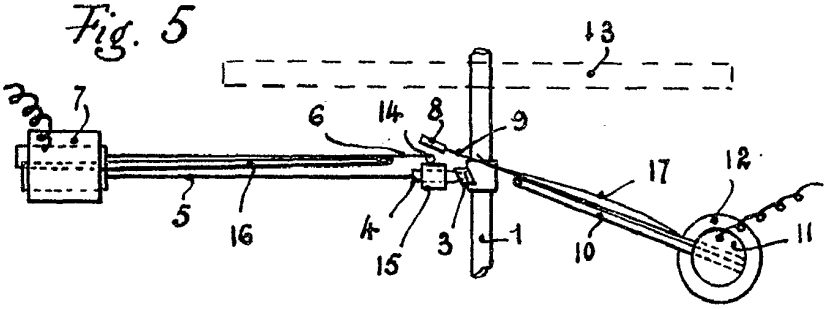


Fig. 6

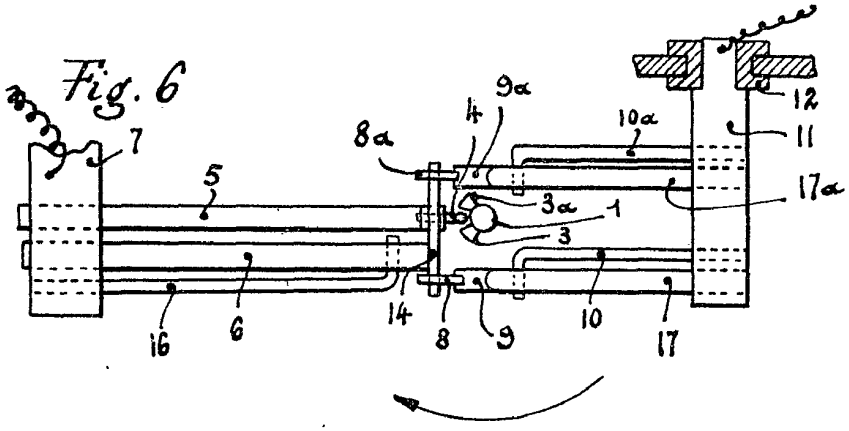


Fig. 7

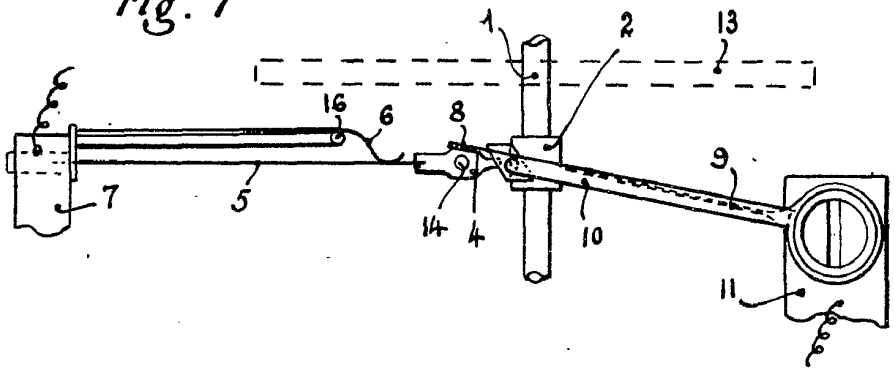
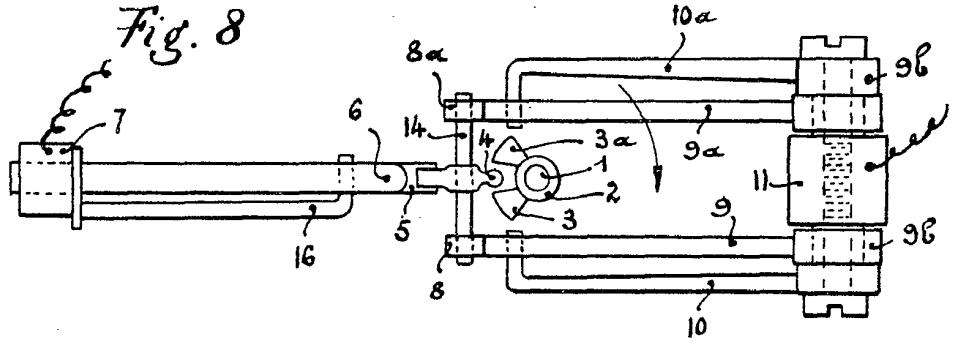


Fig. 8



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