Feb. 14, 1961 A. BEYNER 2,971,324

LEVER ESCAPEMENT FOR TIMEPIECES

Filed Jan. 28, 1958

FIG.1

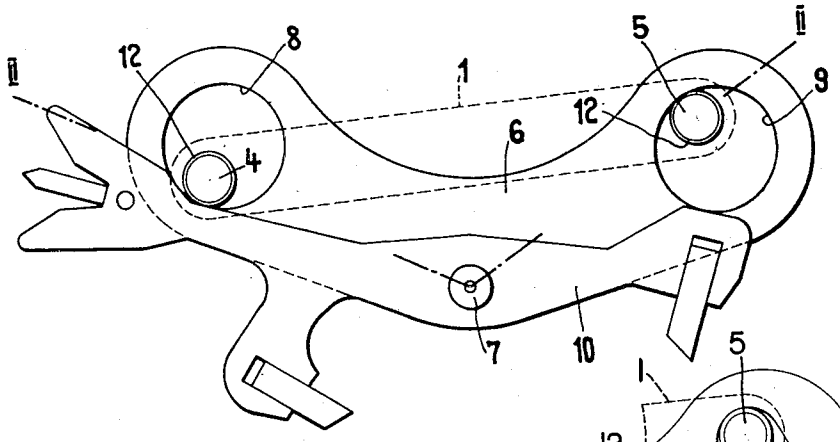


FIG. 3

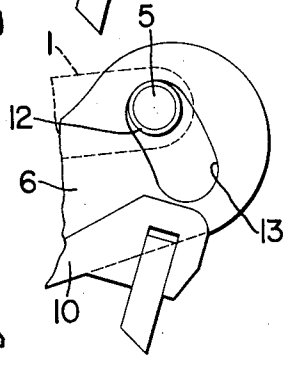
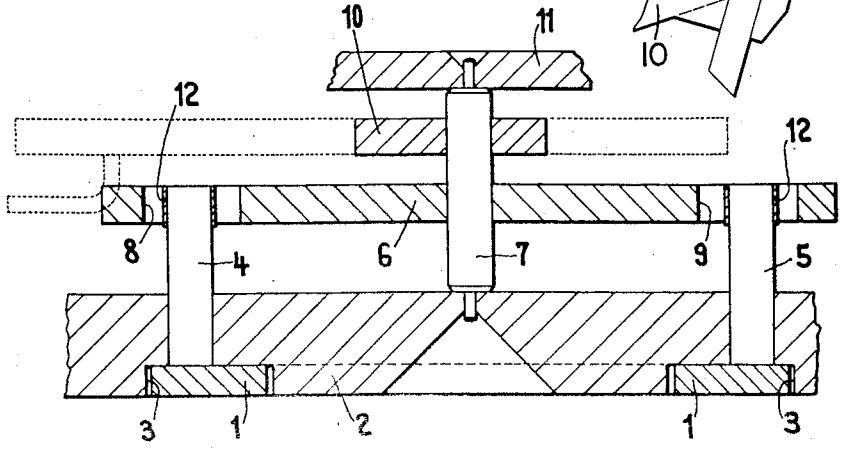


FIG.2



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LEVER ESCAPEMENT FOR TIMEPIECES

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The present invention relates to a lever escapement for timepieces, and more particularly to a magnetic device for holding the lever in its end positions. The said device is particularly intended for electric timepieces having a driving balance in which transformation of the reciprocating motion of the balance into a unidirectional motion is effected by means of an escape mechanism including a roller keyed on the balance staff, a lever, and an escape wheel. The mechanism being such that the escape wheel is controlled by the lever and is rotated always in the same direction.

Since the escape wheel is driven by the lever, there is no "draft" effect of the wheel on the lever in order to hold the latter against the banking pins. The lever, therefore, is free, thus causing a frequent interaction of the guard pin and of the small roller, which serve for locking the lever. This interaction impairs the quality of the timing adjustment of the timepiece.

A number of devices have already been proposed for holding the lever against the banking pins. Most of these devices are mechanical and include springs, jumpers, etc. by means of which the lever can be retained in each of its end positions. These devices are generally difficult to construct and must be adjusted by the worker who assembles the timepiece and require frequent lubrication.

Another device has been proposed for holding the lever against the banking pins, chiefly in mechanical watches. In this known device, the arrangement of the escapement is modified so as to do away with the draft effect of the escape wheel on the lever, and the lever is held against the banking pins by magnetic means, e.g. by magnetic banking pins. The device forming the subject-matter of the present invention is based on this principle but presents many improvements and advantages over the known construction.

In a timepiece with a driving balance, the motor of which is not polarized, it is essential that the moving armatures rigidly fixed to the balance and the stationary armatures or pole shoes of the stator not become permanently magnetized as the magnetism would cause a lack of isochronism. The above-mentioned prior magnetic device leads, owing to its design, to the magnetization of the armatures of the motor through magnetic leakage.

The device according to the invention aims at avoiding any magnetic leakage. It is broadly characterized by a permanent magnet secured to the pillar plate of the movement of the timepiece, two magnetic banking pins bearing against the ends of the said magnet and defining the geometrical path of the lever and cooperating for this purpose with a member made from a magnetizable material, said member being keyed on the pallet arbor and having two holes in each of which is engaged one of said banking pins, the said member permitting closing practically completely the magnetic circuit of the permanent magnet and providing the attracting effect required for the lever.

The accompanying drawing shows, by way of example, one embodiment of the invention.

Fig. 1 is a plan view of this embodiment.

Fig. 2 is a cross-sectional view taken along the line II—II in Fig. 1.

Fig. 3 is a fragmentary view of a modification of the invention.

The device illustrated in the drawing comprises a permanent magnet 1 consisting of a bar relatively long with respect to its section. The magnet 1 is made from an alloy having a great remanence and a great coercive force, such as the products "Ticonal" or "Alnico" (registered trade names). The magnet 1 is magnetized in its longitudinal direction, so that, for instance, the south pole is situated left and the north pole right in Figs. 1 and 2. The permanent magnet 1 is secured in a manner not illustrated to the pillar plate 2, in a recess 3 provided in the bottom face of the pillar plate 2. Two cylindrical pins 4 and 5, made from an alloy having a very high magnetic permeability, are driven into the pillar plate 2 and bear against the ends of the magnet 1. The pins 4 and 5 extend at right angles to the magnet 1. The magnet 1, therefore, forms a bridge over the pins 4 and 5.

In order to close as completely as possible the magnetic field of the magnet 1 and of the pins 4 and 5, a magnetic shunt, consisting of a metal sheet 6 cut out from a material having a very high magnetic permeability and a low remanence, is keyed on the pallet arbor 7. The section of the shunt 6 is determined in such a manner that it should by no means be saturated by the flux of the permanent magnet 1. In the plate 6 are provided two round holes 8 and 9.

The lever 10, pivoted between the pillar plate 2 and the pallet bridge 11, is of the type in which the fork lies by the side of the pallets, but it is to be understood that it might as well be of the type in which the fork would lie approximately on the imaginary straight line connecting the axis of the escape wheel to the axis of the lever.

The plate 6 is keyed on the pallet arbor 7 and the pins 4 and 5 are arranged in the pillar plate 2 in such a manner that the movement of the lever 10, defined by its "lift" angle, is limited by the fact that the walls of the holes 8 and 9 of the plate 6 come into contact with the banking pins 4 and 5. Thus, in each of both end positions of the lever 10, the magnetic circuit is closed practically without any gap. Its reluctance is therefore extremely low with respect to the leakage reluctance of the magnet 1 towards the armatures of the motor, which represents a great advantage with respect to the known above-mentioned device including merely magnetic banking pins.

On the other hand, the described device has the following advantage: Upon the movement of the lever 10 relatively to the banking pins 4 and 5, these pins permanently remain within the round holes 8 and 9 of the magnetic shunt 6, so that the device, during the whole movement of the lever 10, works with very low reluctances of the magnetic circuit. Since the attraction of the shunt 6 by the pins 4 and 5 might be relatively strong as the shunt 6 "sticks" to the banking pins 4 and 5, a thin sleeve 12 made from a non-magnetic material may be secured to the pins, at the height of the shunt 6, so as to provide a small gap preventing the shunt 6 from sticking to the pins 4 and 5. The sleeve 12 may consist of a simple varnish, a sheet of plastic material or else a thin-walled piece of non-magnetic metal.

In a modified device according to the invention, the holes 8 and 9 of the shunt 6, instead of being round, may be elongated, as shown in dotted lines at 13 in Fig. 3. This preferred elongated shape of the holes of the shunt 6 permits closing still more completely the magnetic circuit

of the permanent magnet 1, whatever the position of the lever 10 may be.

Although the described device is more particularly intended for use in electric timepieces with a driving balance, it is to be understood that it can also be used in mechanical timepieces.

While I have described and illustrated one embodiment of my invention, I do not wish to unnecessarily limit the scope thereof, but reserve the right to make such modifications and rearrangements of the several parts as may come within the purview of the accompanying claims.

What I claim is:

1. In a timepiece movement, a pillar plate, a spindle, a swingable escapement lever keyed on said spindle, a permanent magnet secured to the pillar plate, two magnetic banking pins bearing against the ends of said magnet, a member made of a magnetizable material, said member being keyed on the spindle of said lever and having two holes in each of which is engaged with play, one of said banking pins, so as to draw the lever into its end positions and to hold it in these positions, said banking pins thus limiting the oscillatory movement of said lever, said member being so shaped as to practically completely close the magnetic circuit of the permanent magnet.

2. In a timepiece movement according to claim 1, said permanent magnet consisting of a bar relatively long with respect to its section and being magnetized in its longitudinal direction.

3. In a timepiece movement according to claim 1, a recess provided in the bottom face of the pillar plate, said permanent magnet being accommodated in said recess.

4. In a timepiece movement according to claim 1, said banking pins extending at right angles to said permanent magnet.

5. In a timepiece movement according to claim 1, said holes in said member being round.

6. In a timepiece movement according to claim 1, said holes in said member having an elongated shape.

7. In a timepiece movement according to claim 1, a thin sleeve made of a non-magnetizable material, said sleeve being secured to said banking pins, at the level of said member, so as to form a small gap preventing said member from sticking to said banking pins.

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