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[54] **ELECTRONIC TIMEPIECES**
16 Claims, 9 Drawing Figs.

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318/127

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[50] Field of Search. **58/23, 23**
TF, 23 BA, 28, 28 A; 318/127; 310/36

[56]

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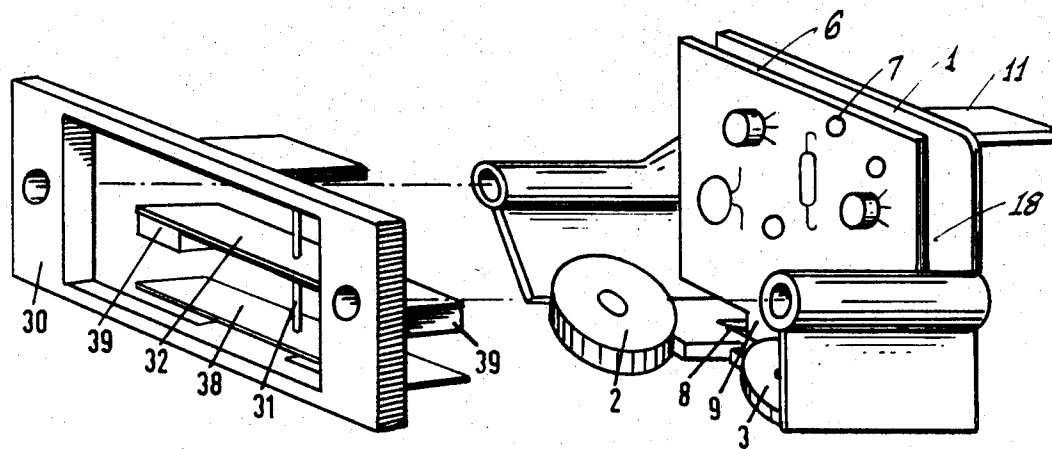
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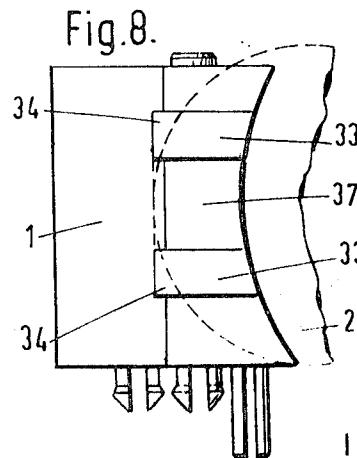
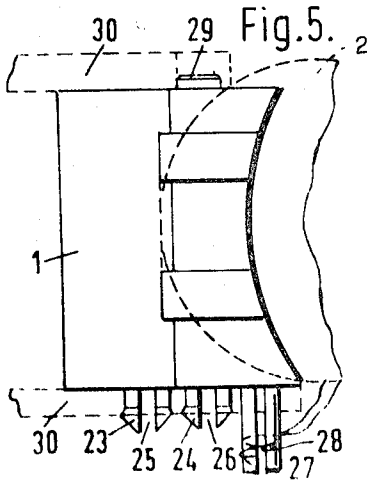
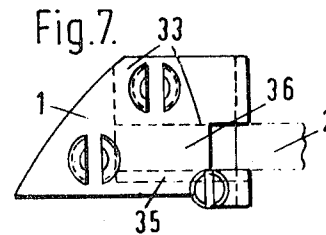
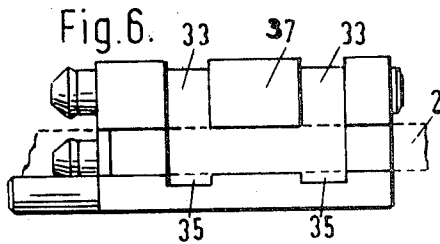
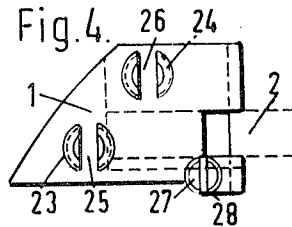
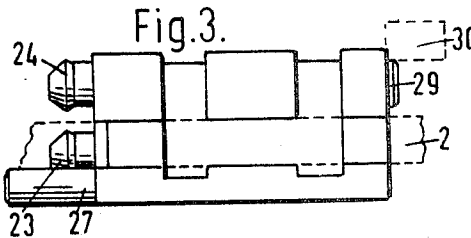
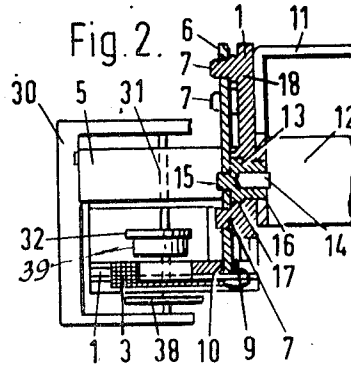
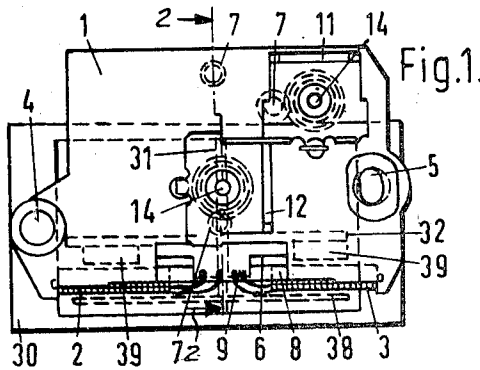
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ABSTRACT: The invention relates to an electronic clock with a balance oscillatory system which is mounted in an oscillating frame and which carries at least one permanent magnet. This permanent magnet moves over at least one fixed coil carried by a coil holder which is detachably connected with the aforesaid frame, a conductor plate being further provided for carrying electric components of an electronic circuitry.

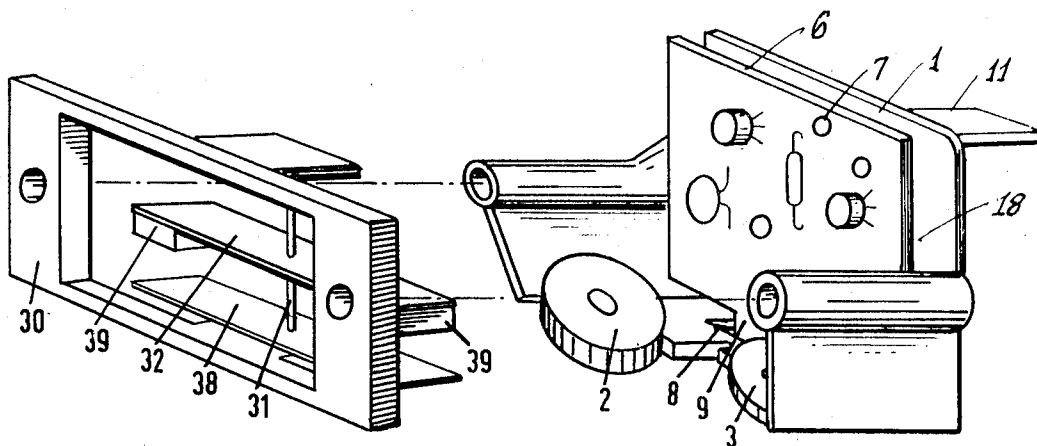




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Fig. 9



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ELECTRONIC TIMEPIECES

Normally the conductor plate and coil holder are joined to form a common unit. This unit is fastened to a base or work plate. This known arrangement has the disadvantage that inaccuracies or distortions, archings, etc. of the conductor plate influence the position of the coil in relation to the oscillatory system. Another disadvantage is to be seen in that due to inadvertence and negligence through inserting the coil the latter may be easily damaged by wire ends of electric components mounted in the conductor plate.

Such coil holder therefore serves at the same time as conductor plate for the electronic components. This known design has further considerable disadvantages in terms of production. As these components are to be soldered to the conductor plate in the course of series or quantity production in a zinc bath, this step or operation must be carried out before the coils are placed in the coil holder. As the coils are often injured when being inserted in the coil holder, the entire unit becomes unserviceable and useless and must be discarded if the coil wire breaks, when the coil is glued to the coil holder.

The invention aims at the avoidance of these disadvantages, which in a timepiece of the above-mentioned disadvantages, is due to the fact that the coil holder and the conductor plate are separate parts and that the conductor plate is detachably fastened to the coil holder, and the coil holder, in turn, is releasably fastened to the oscillatory frame.

Through this novel arrangement it is ensured that the coil always occupies its correct position in relation to the oscillatory system. Further, it is of advantage that if the coil would be damaged, not the entire conductor plate is required to be replaced or changed.

In order that the coil wires soldered to the conductor plate cannot break in case of distortion or tensioning occurring between conductor plate and coil holder, it would be expedient to use sufficiently long wires. Such long coil wires have, however, the disadvantage that they may be torn during mounting or installation of the unit or during subsequent repairs. If, on the other hand, the connecting wires are kept as short as possible, there is danger that upon distortion or tensioning of the plastic parts these wires will break or crack.

It is further known practice to provide the coil holder with a segment-shaped recess into which the coil is inserted, which is then glued thereto. It is disadvantageous in such structure that the adhesive substance will be able to flow along the coil holder, which carries at the same time the electronic components. Also it is possible that adhesive substance flows onto the coil surface and, if applied too heavy, results in a striplike formation on the permanent magnets which are arranged on the balance system, with adhesive deposited on the coil surface. This arrangement has the further inconvenience that the coil holder does not afford an accurate and satisfactory positioning of the coil in the direction of the coil axis.

In another form of construction the coil is held between two elastic lobes of the coil holder in a tonglike fashion. In such case the use of an adhesive may be avoided. This assembly, however, has the disadvantage that the elastic lobe parts can easily touch and damage the coil wire upon manipulation and insertion of the coil. It is further possible that due to vibrations the coil becomes disengaged and loose in the coil holder.

SUMMARY OF THE INVENTION

These and other disadvantages are overcome pursuant to this invention. In a device of the above-mentioned type this is achieved according to the invention in that the conductor plate is fastened to a wall of the coil holder, this wall having an opening or clearance into which projects that part of the conductor plate carrying the coil connections, the forward end of such connector applying against the wall defining said opening with a force which is directed perpendicular to the plane of the conductor plate.

With such a design it is ensured that the connecting wires can be made as short as possible without danger of breaking.

Due to this construction it is further rendered possible that the current supply to the conductor plate occurs through plugs which are connected with the coil holder and the conductor plate by means of rivets. The design may be such that at the same time the casing surrounding the clockwork is fastened to such rivets, without this attachment leading to a deformation of the position of the coil holder relative to the conductor plate and vice versa.

The invention fulfills also the purpose of avoiding still further disadvantages in that the coil holder of the above-mentioned type possesses walls which embrace a part of the coil and are provided with slots for receiving and distributing the applied adhesive substance. By these slots it is ensured that the introduced adhesive is in a restricted area and cannot flow onto the coil surface as well as onto the surface of the coil holder.

It is therefore one of the primary objects of the invention to provide means contributing to an effective and practicable assembly of highly sensitive and precise instrumentalities in connection with electronic timepieces.

It is another object of the invention to provide means conducive to a considerable reduction of wasteful operational steps and substantial elimination of impairments encountered in the series production of electronic components and their arrangement relative to each other, especially in electronic devices.

A further object of the invention resides in the provision of means rendering the possibility of employing less highly trained personnel and work force and of markedly cutting down the manufacturing cost of vital electronic component parts and their buildup for use in precision and like industries.

These and other objects of the invention ensue from the following detailed description, reference being had to the attached drawings, the latter being exemplary and explanatory of the principles of the invention and being in no way restrictive thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

in the drawings:

FIGS. 1 to 8 show two embodiments according to the invention.

FIG. 1 illustrates the rear view of a coil holder with installed conductor plate, the balance wheel with frame being shown behind said coil holder.

FIG. 2 is a section through FIG. 1 taken along line 2—2 and seen in side elevation.

FIG. 3 shows a part of the coil holder of a second embodiment pursuant to the invention, the attachment of the coil holder being seen in front view.

FIG. 4 illustrates the holder of FIG. 3 in side view.

FIG. 5 is a top plan view of FIG. 4.

FIGS. 6 to 8 are corresponding views to those of FIGS. 3 to 5 illustrating coil attachment positions.

FIG. 9 is an exploded view, seen in perspective, of the embodiment of FIG. 1.

DETAILED SPECIFICATION OF THE INVENTION

Referring now more specifically to FIGS. 1 and 2, there is disclosed a coil holder 1 with inserted coils 2 and 3. In this mode of execution the coil holder 1 is fastened to two posts 7 of the frame 30 by the engagement with two corresponding openings 4 and 5. The coil holder 1 is L-shaped in cross section. One leg of the coil holder supports coils 2 and 3, while the other leg 18 carries conductor plate 6. At the juncture of the two legs of the coil holder 1 is a clearance or opening 8. Into this opening 8 there protrudes the projecting piece or part 9 of the conductor plate 6 carrying the coil connections (contact bank).

The conductor plate 6 is retained on the coil holder 1 by means of knob-shaped elements or posts 7. The front end of part 9 carrying the coil connections, applies against wall 10 which defines opening 8. Through force fit exerted perpen-

dicular to the plane of the conductor plate 6, part 9 is thus secured.

This design renders the possibility that the connection wires from coils 2, 3 to the conductor plate 6, via part 9 of this plate 6 may be reduced in length and kept as short as possible without the danger that upon subsequent and gradual tensioning of the plastic holder 1 the coil connection wires would tear or break. As mentioned above, part 9 is press fitted onto the coil holder 1 in the direction of coils 2, 3 through pressure exerted onto wall 10 of opening 8.

The frame or vibrator frame 30 serves to journal and suspend the balance wheel mechanism, especially the spiral balance wheel spindle 31. On this spindle or shaft 31 are arranged the spiral hairspring (not shown), a first oscillatory element 32 and a second or lower oscillatory element 38. Element 32 carries two permanent magnets 39, one of which induces in coil 2, upon oscillation movement of the balance unit, a voltage which is amplified in a transistor circuit (not shown, but known per se) and furnishes in the working coil 3 a pulse-type current, which brings about via permanent magnet 39 adjacent coil 3 a mechanical drive pulse acting on the oscillatory timepiece system. The components of the transistor circuitry (transistor, resistors, capacitors, etc.) are arranged and mounted on the conductor plate 6 (see FIG. 9 for the sake of clarity).

On the back of the coil holder 1 are arranged plugs 11 and 12 for the supply of electric current. These plug plates are fastened by rivets 13, which are riveted on one hand by a rivet head 16 to plugs 11, 12 and are anchored on the other hand, to conductor plate 6 by means of rivet head 15 force fitted on plate 6 (FIG. 2).

In order that the rivet forces are absorbed exclusively by the coil holder 1, each rivet 13 is provided with an offset part 17, so that the rivets taper in the direction of plugs 11, 12. The bores in the coil holder 1, 18 are adapted to conform to such rivet shape. In this way it becomes possible that the sides of the rivets 13 facing the plugs 11, 12 carry each a threaded bore 14. By means of these threaded bores 14, the work capsule (not shown) can be attached and held in position.

The tightening forces on the capsule are again absorbed exclusively by coil holder 1, 18. The work capsule extends over the entire clockwork and out of its rear walls project the pins of plugs 11, 12 which serve to connect the timepiece to an electric current supply source.

It should be mentioned also that the system of the balance mechanism swings with a relatively small amplitude of say $\pm 8^\circ$. For greater clarity the balance mechanism and vibratory frame are shown in broken lines in FIGS. 1, 2 but in full lines in FIG. 9.

In the example according to FIGS. 1 and 2 the attachment of the coil holder 1 and oscillatory frame 30 is carried out through posts on the oscillation frame, on which the coil holder is engaged by means of bores 4 and 5. Advantageously there may be employed instead of this type of attachment a catch-type attachment, as shown in FIGS. 3 to 5. This snap attachment as shown in these figures can be utilized also as attachment means carried out between coil holder 1 and conductor plate 6, the posts 7 being then designed as snap pins 23, 24.

In coil holder 1 there is inserted a section of coil 2 or 3 as the case may be. The detachable connection with the oscillatory frame occurs via these pins 23 and 24, which are each provided with a central slot 25, 26. These yieldable pins 23, 24 are inserted in corresponding bores of frame 30 where they snap in and remain in engagement. On the coil holder side located opposite these pins there is arranged a set pin 29 which rests on a bearing surface of frame 30 and together with pins 23 and 24 ensure the proper and accurate position of the coil 2 and coil holder 1.

Before being soldered to the conductor plate, the wire ends of the coil are introduced into slot 28 of pin 27 and are wound for position on and around this pin.

Instead of the connection with frame 30 the coil holder 1 can also be connected to the conductor plate 6 in approximately the same manner.

According to FIGS. 6 to 8 the attachment of coils 2, 3 in holder 1 is effected as follows.

The coil holder 1 has a recess 36 (FIG. 7) for accommodating coil 2. Thereby coil 2 is embraced along a section thereof in a tong-shaped manner. The top side of the coil holder has a slot 33, which terminates in and communicates with a slot 34 on the rear wall provided with recess 36. This slot or recess 36 ends at the underside and is in the form of a groove 35 as seen on the bottom. It is advantageous if these two slit systems are arranged side by side on the holder 1, so that part 37 extending between the two slots 33 assumes a design which is yieldable at the top of the holder. Slight elasticity would suffice, as a retaining or clamping effect is only required during the time that the adhesive is not yet set and hardened.

After insertion of coil 2 into recess 36 (FIG. 7) the adhesive is placed into the slots 33, thence flows through the slots or groove 35. During the introduction of the adhesive substance and during its hardening stage the coil holder may be preferably held at slight inclination.

All the above and other modifications of the invention are covered by the latter in its broadest aspects and the invention is not considered to be limited to the specific embodiments herein shown and described. Departures may be had without deviating from the principles of the invention and without sacrificing its advantages.

What we claim is:

1. In an electronic timepiece structure equipped with an oscillatory balance wheel system, which is mounted on a frame carrying permanent magnet means adapted to move past at least one fixed coil in a coil holder which, in turn, is detachably connected to said frame, and which employs a conductor plate for mounting thereon electronic components of an electronic circuitry; the improvement which is characterized in that said coil holder and said conductor plate constitute separate units, of which the conductor plate is detachably fastened to the coil holder, whereas said coil holder, in turn, is releasably fastened to the said frame.

2. In an electronic structure according to claim 1, characterized in that said coil holder is provided with at least one projecting pin terminating in an axial slot which is shaped for snap engagement with a bore of said frame.

3. In a structure according to claim 2, characterized in that a further pin is arranged having a slot for anchorage on said frame.

4. In a structure according to claim 1, characterized in that said coil holder carries at least one fitting pin, which comes to rest on a bearing face provided on said frame.

5. In a structure according to claim 1, characterized in that said coil holder carries a pin with an axial slot arranged for anchoring therein conductor ends of said coil.

6. In a structure according to claim 1, characterized in that said conductor plate is fastened to a wall facing said coil holder, said wall having an opening with which a part of said conductor plate is engageable, which part carries coil connections, the front end of said part being force fitted in an opening in a wall directed perpendicular to the plane of said conductor plate.

7. In a structure according to claim 6, characterized in that said coil holder is L-shaped in cross section, one leg thereof carrying said coils, the other leg thereof mounting said conductor plate, said opening being provided at the juncture of said two legs.

8. In a structure according to claim 6, characterized in that said conductor plate is connected to said coil holder by means of posts provided on the coil holder.

9. In a structure according to claim 6, characterized in that said coil holder mounts plug means for the supply of electric current.

10. In a structure according to claim 9, characterized in that said coil holder carries hollow rivets for retaining said plug

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means by virtue of each rivet head, whereas said conductor plate is force fitted onto projection means forming parts of said rivets.

11. In a structure according to claim 10, characterized in that said rivet of said coil holder is provided with an offset part and tapers in the direction of said plug means.

12. In a structure according to claim 9, characterized in that the face of said rivet confronting said plug means is provided with a threaded bore.

13. In a structure according to claim 1, characterized in that the walls defining said coil holder are structured to embrace a part of said coil and are provided with slots for receiving an adhesive substance to attach said coil in the coil holder.

14. In a structure according to claim 13, characterized in

that a slot is arranged on one face of said holder which terminates in a recess for said coil, which, in turn, opens into a slot disposed at an opposite face of said holder, said latter slot being groove-shaped to provide a bottom.

15. In a structure according to claim 13, characterized in that said coil holder is provided with two types of slots, one of which is provided at the top surface of the coil holder which communicates with another slot at the bottom face, which includes a recessed groove.

16. In a structure according to claim 15, characterized by an intermediate yieldable wall part located between two slots on the top surface of said holder.

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