

[54] ALARM WRISTWATCH

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[51] Int. Cl.G04c 21/34
[58] Field of Search58/19, 20, 21, 57.5

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[57] ABSTRACT

The alarm device of the watch comprises a switch controlled by the watch movement for switching on the alarm at the desired time. This switch is mounted directly on the watch movement coaxially to the watch hands. The remaining elements of the alarm device (buzzer, battery, switch, interrupter, setting mechanism) are all together carried by a supporting member arranged for receiving the watch movement and holding it firmly within the watch case.

15 Claims, 11 Drawing Figures

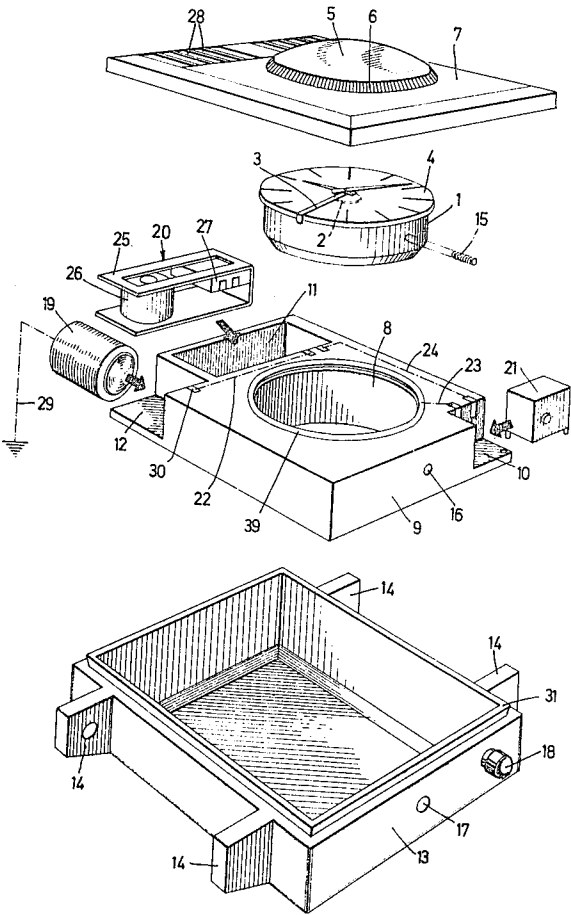


FIG. 3

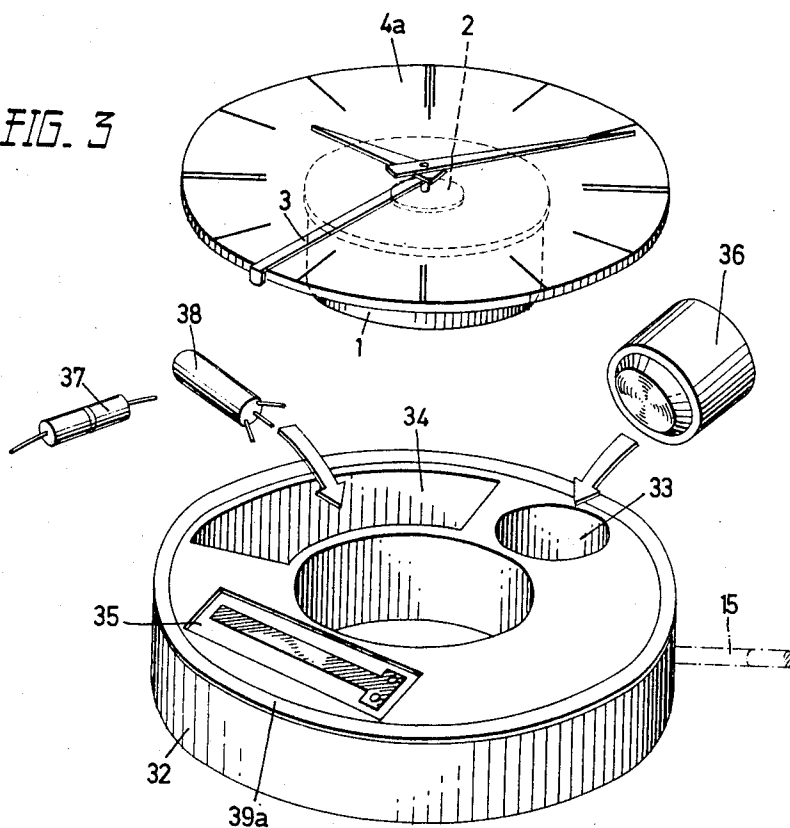


FIG. 2

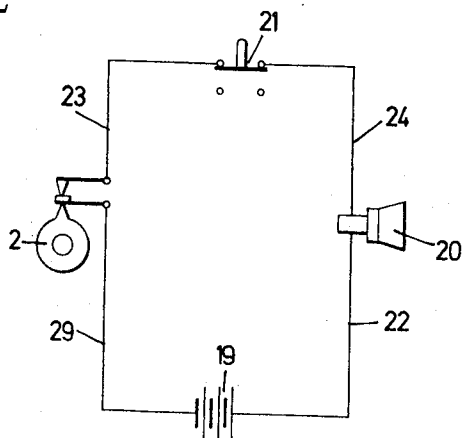


FIG. 4

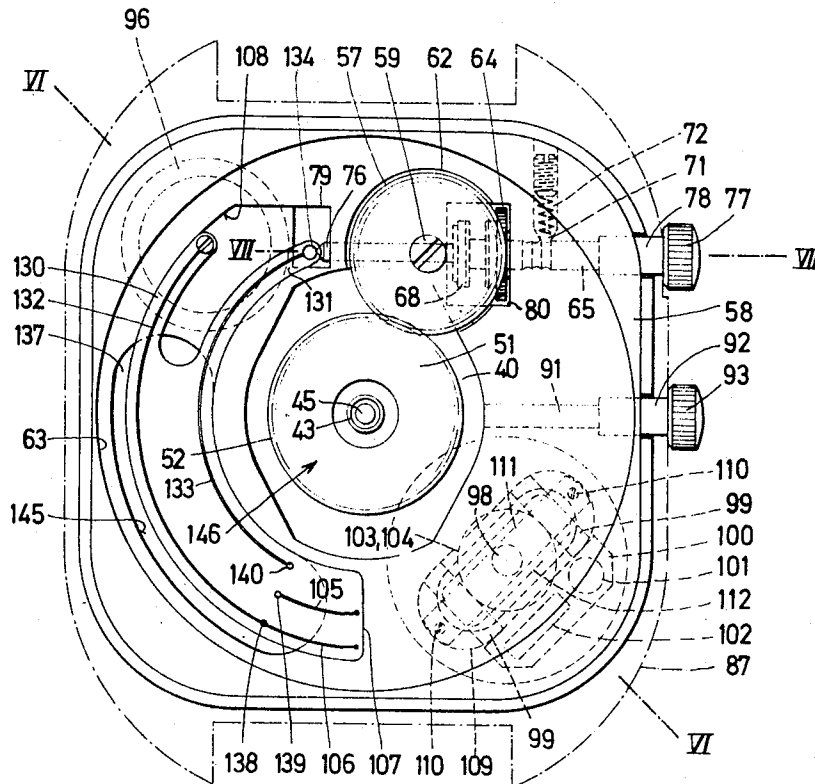


FIG. 5

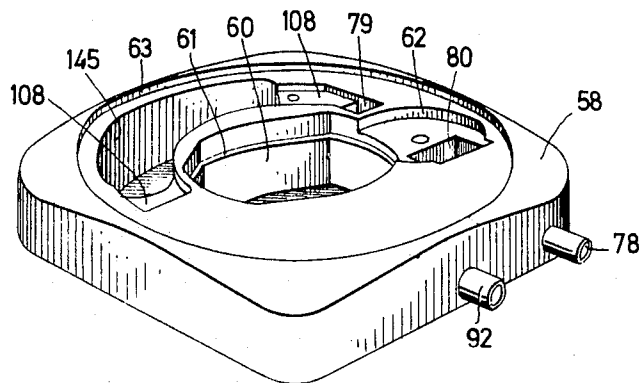


FIG. 6

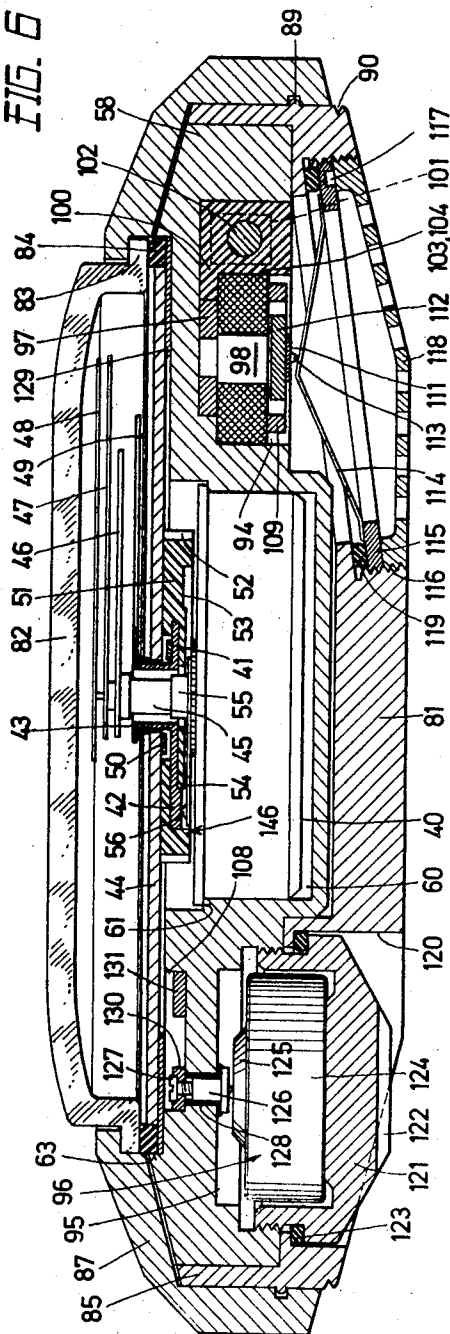


FIG. 7

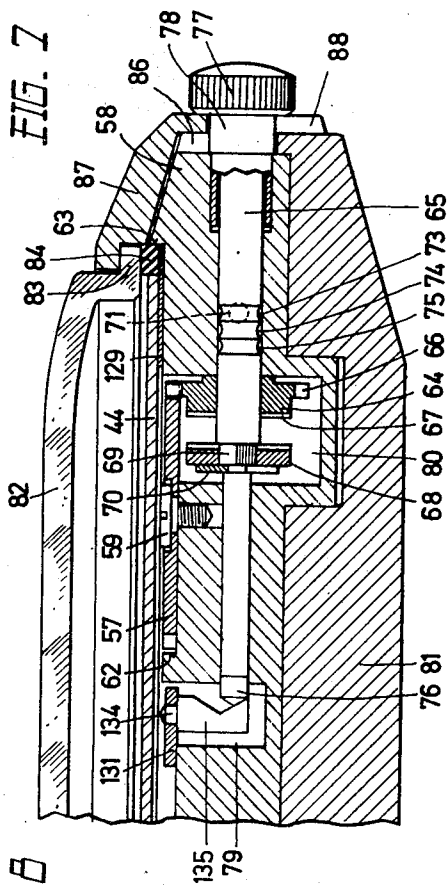


FIG. 8

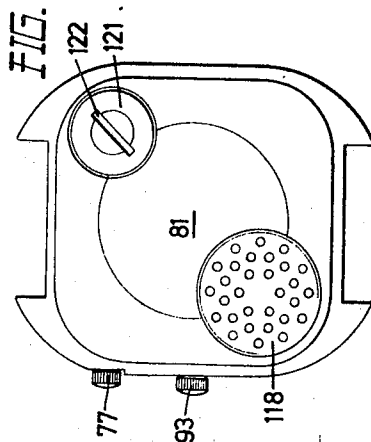
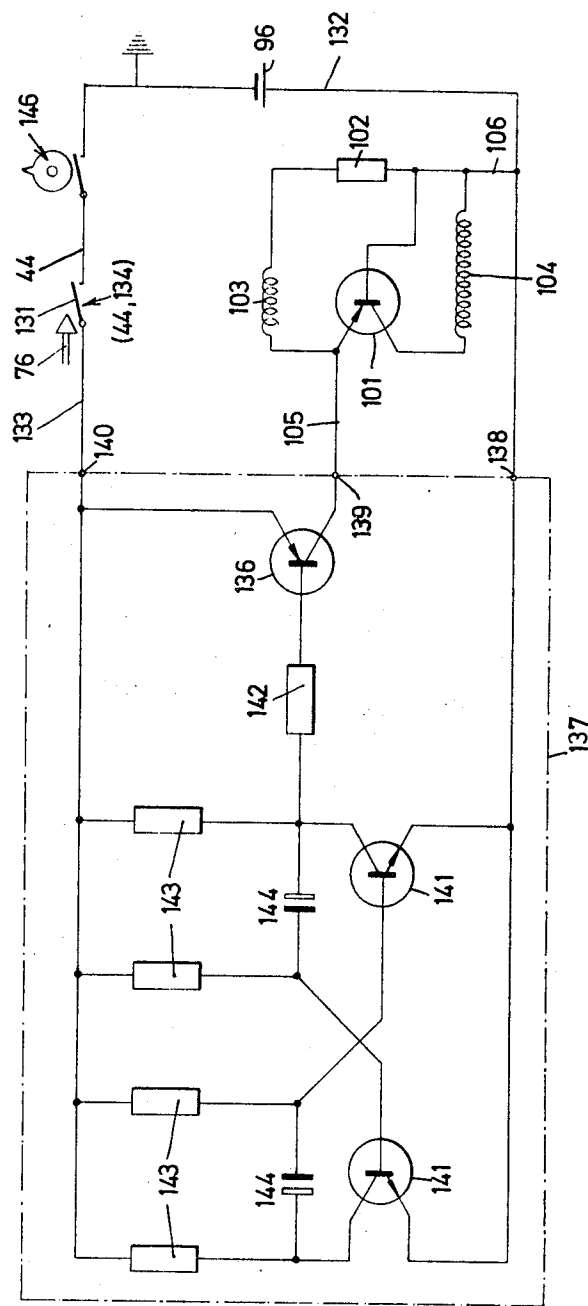
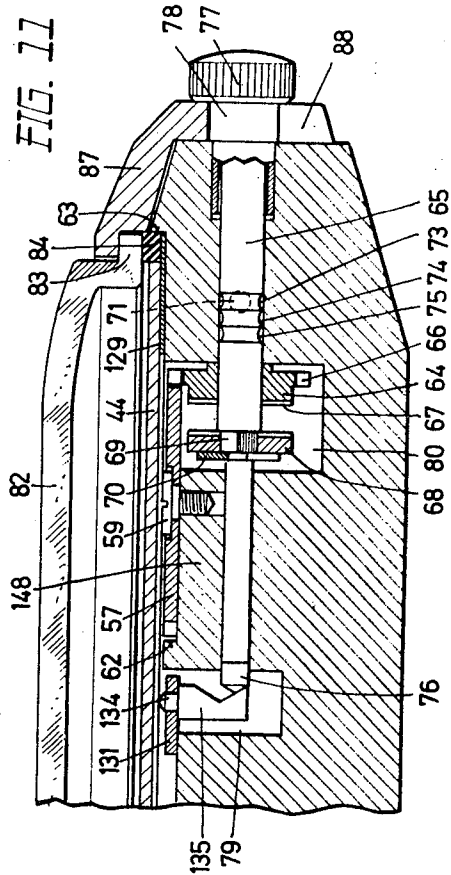
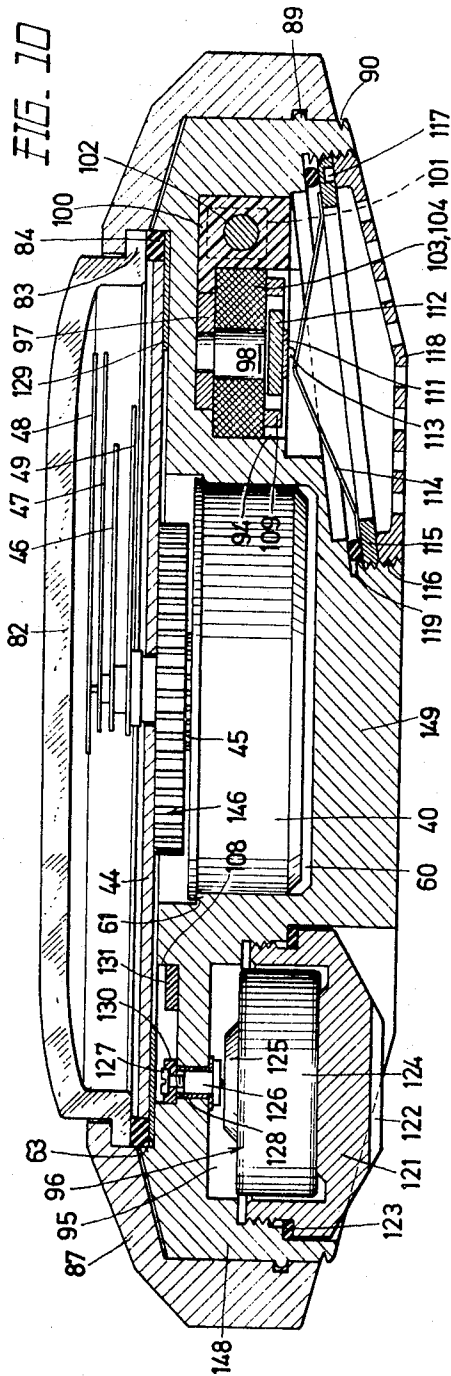


FIG. 9





ALARM WRISTWATCH

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to alarm wristwatches and, in particular, to alarm wristwatches comprising a usual watch movement with a spring motor and a mechanical escapement mechanism, a switching device for switching on the alarm at the desired time being mounted on said movement, said switching device having a switch with two contact elements, one of said contact elements being carried by a member driven by the watch movement and the other contact element being carried by an adjusting member.

SUMMARY OF THE INVENTION

The main problem of the invention is to produce an alarm wristwatch provided with an electrical alarm device while using a usual mechanical watch movement without having to modify that movement, the alarm device being arranged in such a manner that the watchmaker who has to assemble the watch can proceed in the usual manner without having to take care of the electrical circuit elements and of the electrical connections to be provided therebetween.

It is therefore an object of the invention to provide a supporting member for receiving the watch movement and holding it firmly in place within the watch case, said supporting member further carrying all the circuit means of the alarm device which are to be electrically interconnected.

Another object of the invention consists in providing the watch with a rotary bezel driving the alarm hand in order to avoid any modification of the standard movement.

These alarm setting means which are perfectly suitable in a table clock, can, however, be objectionable in a wristwatch. The bezel of a wristwatch is, indeed, exposed to come in contact with foreign bodies such as pieces of clothes, and so on and to be driven in rotation without notice of the watch carrier thus causing the alarm time to be modified inadvertently.

These drawbacks can easily be removed by providing a supporting member which carries not only the circuit means of the alarm device which have to be interconnected, but also the setting means of the alarm device. These setting means can comprise a setting wheel of the alarm hand, which can advantageously be driven from outside the watch case by means of a setting stem pivotally mounted in the supporting member carrying the different elements of the alarm device. The provision of such a setting stem does not constitute any complication of the manufacture of the watch case, because that stem can also serve as a control member of the manually operable switch which has to be provided for switching out the alarm at will.

The supporting member carrying the different parts of the alarm device can consist of an independent piece located in the watch case. The watch case bottom has, in that event, to be provided with openings for ensuring a free propagation of the sounds produced by the alarm device and for enabling a replacement of the battery without having to open the watch case. In order to protect the membrane producing the audible sounds and to close the opening provided for the removal of the battery, some members have to be secured to the watch case bottom so that the latter has to be made thicker than usual.

The last requirement can advantageously be avoided by making the supporting member carrying the different parts of the alarm device integral with the watch case bottom.

Still further objects of the invention will become apparent in the course of the following description.

BRIEF DESCRIPTION OF THE DRAWING

Four embodiments of the watch according to the invention are represented diagrammatically and by way of example in the accompanying drawings in which:

FIG. 1 is a perspective and exploded view of the first embodiment;

FIG. 2 is a wiring diagram of the alarm device of the watch represented in FIG. 1;

FIG. 3 is a perspective view similar to that of FIG. 1 showing some elements of the second embodiment;

FIG. 4 is a plan view of the third embodiment, the bezel, the glass, the hands and the dial having been removed;

FIG. 5 is a perspective view on a smaller scale of a piece of FIG. 4;

FIG. 6 is a cross-sectional view on a larger scale along line VI—VI of FIG. 4;

FIG. 7 is a part sectional view similar to that of FIG. 6 along line VII—VII of FIG. 4;

FIG. 8 is a plan view from the under side on a reduced scale of the third embodiment;

FIG. 9 is a wiring diagram of the electrical control device of the same embodiment;

FIG. 10 is a sectional view similar to that of FIG. 6, but showing the fourth embodiment, and

FIG. 11 is a sectional view similar to that of FIG. 7 showing some parts of the fourth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The watch represented in FIG. 1 is a rectangular wristwatch. It comprises a circular usual watch movement 1 provided with a self-winding mechanism and comprising a spring motor and a mechanical escapement. The watch movement 1 is of a standard type. A switching device 2 is, however, mounted on movement 1 for switching on the alarm.

For that purpose the switching device 2 comprises a metallic disc made integral with a tubular projection on which the alarm hand 3 is rigidly set. This tubular projection is journaled in the central opening of dial 4 which is made out of an insulating plastic material. The metallic disc of the switching mechanism 2 and its tubular projection are partly embedded in a body member made out of an insulating plastic so as to insulate that piece from the hour wheel around which it is mounted for free rotation and, consequently, from the ground mass of the watch including movement 1. The metallic disc of the switching device 2 has, however, one point of its periphery which is not covered by the plastic. A resilient arm (not shown) carried by the hour wheel (not shown) is arranged for coming in contact with the uncovered part of the metallic disc of switching device 2 when the hour wheel is in a predetermined angular position with respect to the disc of switching device 2, i.e., when the watch hands indicate the same hour as the alarm hand 3. The resilient arm carried by the hour wheel and the metallic disc of switching device 2 constitute the two contact elements of a switch of the switching device.

The position of alarm hand 3 can be set at will by rotating the glass 5 of the watch. For that purpose glass 5 is carried by a bezel 6 snap-fitted onto an annular projection of a cover member 7. The mechanical driving connection between glass 5 and hand 3 is ensured by means of a notch (not shown) provided in the peripheral rim of the glass and in which the outer end of hand 3 extends.

Movement 1 is mounted in a recess 8 of an encasing member 9 moreover provided with recesses 10, 11 and 12 for the different circuit means of the electrical alarm device. Member 9 is made out of an insulating plastic material; its contour is similar to that of the watch case. The sizes of member 9 are chosen in such manner that this member can be snugly inserted into a lower piece 13 of the watch case comprising the bottom thereof and carrying the wristband attaching lugs 14. A usual winding and hand-setting stem 15 extends throughout corresponding openings 16 of member 9 and 17 of piece 13. The latter, moreover, carries a control button 18 to permit the alarm device to be rendered operative or to be stopped at will.

The electrical alarm device is fed by means of a battery 19 and it comprises a buzzer 20 and a switch 21 which are electrically interconnected by means of conductors 22, 23, 24 carried by member 9. As indicated by the arrows in FIG. 1, the

switch 21 the buzzer 20 and the battery 19 are mounted in recesses 10, 11 and 12, respectively, of member 9.

The buzzer 20 comprises a frame member 25 constituted by a plate bent in such manner as to have a U-shape. Frame member 25 carries a magnetized tube 26 in which coils (not shown) are located. These coils are connected to a transistorized circuit comprising circuit means 27 also secured to frame member 25. Circuit means 27 cause the current flowing through the coils located in tube 26 to be modified thus producing a variation of the magnetic flux. That variation in turn causes a spring blade (not shown) extending above tube 26 to vibrate at a natural frequency. The buzzer 20 and in particular its spring blade are arranged in such manner that the natural frequency of that spring blade will range within the audible spectrum. That spring blade transmits its vibration to a membrane (not shown) which is secured to cover member 7 below openings 28 provided in this cover member for setting the membrane in communication with the atmosphere and thus ensuring a free propagation of the sounds produced by that membrane. Dust cannot, however, enter the watch movement through openings 28 because of the membrane of the buzzer.

The different elements of the alarm device are interconnected as shown in the diagram of FIG. 2. The buzzer 20 is mounted in series in the circuit of battery 19 together with switch 21 and switch 2 mounted on movement 1. While one pole of battery 19 is in contact with an insulated terminal 30 provided on member 9 (FIG. 1) and connected by means of conductor 22 to buzzer 20, the other pole of battery 19 is connected to the movement 1 through the ground mass of the watch including the lower watch case piece 13, with which this other pole of the battery is in contact. In FIGS. 1 and 2 the last connection has been indicated by conductor 29 which electrically connects that pole of the battery to the resilient arm of the switching device 2. When the switch of this device 2 is closed, current flows through the alarm hand 3 and the metallic disc of device 2. The outer end of hand 3 is bent downwards in such a manner as to come in contact with an annular collector 39 carried by member 9 and connected to switch 21 through conductor 23. When switch 21 is also closed, the buzzer 20 is energized through conductor 24. The spring blade of the latter vibrates and, consequently, strikes against the membrane secured to cover member 7.

Any standard watch movement, circular or not, which is to be found on the market, can be used in the watch described. A switching device 2 has merely to be added to that movement.

Assembling the watch described does, moreover, not raise any particular problem for the watchmaker. Once he has received a fully equipped encasing member 9 carrying buzzer 20 and switch 21, he can handle that member as any usual encasing member. After having set that member in the lower watch case piece 13 he need only shift battery 19 into recess 12, after which cover member 7 can be snap-fitted on a projection 31 of the lower watch case piece 13.

The second embodiment (FIG. 3) represents the application of the invention to a circular alarm wristwatch. In this embodiment the movement 1, to which a switching device 2 has been added as in the first embodiment, is held in place within the watch case (not shown) by means of a supporting member 32 constituting an enlargement ring. As member 9 of the first embodiment this enlargement ring 32 is provided with recesses 33, 34, 35 for the accommodation of a battery 36, control members 37, 38 (similar to members 27 of the first embodiment) and the buzzer, respectively. In this second embodiment the members provided for controlling the buzzer are preferably mounted in a remote position with respect to the buzzer so as to adapt the space occupied by the elements of the alarm device to the particular shape of ring 32.

In this second embodiment the watch case opening provided for setting the membrane of the buzzer in communication with the atmosphere, is advantageously provided in the bottom of the watch case thus enabling the use of a dial 4a extending outwards so far as to reach the periphery of the watch

case as well as the use of watch hands having lengths adapted to the sizes of the dial. For that purpose, an annular collector 39a need only be provided along the outer edge of the enlargement ring instead of providing it along the inner edge of ring 32.

As in the first embodiment the alarm hand 3 can also be set by means of a rotary bezel and the winding and hand-setting stem 15 also extends across ring 32.

The wristwatches according to the third and to the fourth embodiments are represented in FIGS. 4 to 9 and 10, 11, respectively. Since these watches are composed to a large extent of the same elements and accordingly only slightly differ from each other, these two watches are hereinafter described simultaneously, the differences therebetween being indicated as the description proceeds.

The watch case of these two watches has a square shape with rounded corners. Their movement 40 has a rectangular shape with arcuate sides. Movement 40 is a usual standard movement with a spring motor and a mechanical escapement. A switching device 146 is mounted on movement 40 to ensure switching on the alarm at the desired time. Device 146 comprises a metallic disc 41 carrying an arm 42 extending radially outwards and constituting one contact element of a switch controlled by the watch movement. Disc 41 is made integral with a tubular projection 43 (FIG. 6) journaled in the central opening of dial 44. Disc 41 is thus mounted for rotary motion coaxially to the hour wheel 45 carrying the hour hand 46, to the cannon pinion (not shown) carrying the minute hand 47 and to the shaft carrying the seconds hand 48. Projection 43 carrying the alarm hand 49 has a diameter large enough to avoid any contact either with the sleeve of the hour hand 46 or with the tubular projection on which that sleeve is set. Electrical current is led to arm 42 through the dial 44 which is metallic and completely insulated from the ground mass including the movement 40 and the watch case as described more in detail hereinafter. The electrical connection between dial 44 and the metallic piece (41 to 43) is ensured by means of a thin waved metallic spacer ring 50 inserted between dial 44 and disc 41, the waves of that spacer ring alternately bearing on either one of these two elements. In order to insulate the metallic piece (41 to 43) from movement 40, disc 41 and its arm 42 are embedded in a body member 51 made out of an insulating plastic. Body member 51 is provided at its periphery with a toothing 52 by means of which it can be driven in rotation in a manner described hereinafter. An annular groove 53 coaxial to projection 43 is provided in the surface of body member 51 directed toward the movement 40. The depth of groove 53 is chosen in such a manner that arm 42 will have a radially extending narrow projection being flush with the bottom of groove 53. The second contact element of the switching device described is carried by the hour wheel 45. It is constituted by a resilient arm 54 made integral with a sleeve 55 set onto the tubular projection of the hour wheel 45. An embossing 56 is formed at the end of arm 54 and the latter is bent in such a manner as to cause embossing 56 to bear against the bottom of groove 53.

When the watch is normally running, body member 51 remains at rest so that the hour wheel 45 moves arm 54 and causes embossing 56 to slide along the bottom of groove 53. At the exact moment at which embossing 56 comes in contact with the projection of arm 42 being flush with the bottom of groove 53, the moment at which the watch hands 46 and 47 indicate the same hour as the alarm hand 49, the switch of device 146 controlled by the watch movement is closed. The width of the projection of arm 42 being flush with the bottom of groove 53 can be reduced to such an extent that the switch of device 146 remains closed at most for 10 minutes if the alarm is not manually interrupted by actuating another switch disclosed hereinafter.

The position of the alarm hand 49 can be set from outside the watch case by means of a setting mechanism represented in FIGS. 4, 7 and 11. That mechanism comprises a setting wheel 57.

In the third embodiment the setting wheel 57 is pivotally mounted on an encasing member 58 provided for movement 40. Wheel 57 is, therefore, held in place by means of a screw 59 (FIG. 7) provided with a bearing surface. Member 58, which is represented in perspective in FIG. 5, is provided with recess 60 having the same shape as movement 40. A shoulder 61 formed in recess 60 serves as an abutting surface for a peripheral rim of the baseplate of movement 40. A shallower recess 62 communicating with recess 60 is provided for the accommodation of setting wheel 57. As shown in FIG. 7 recess 62 is, however, deep enough to avoid any contact between wheel 57 or its fixation screw 59 and the dial 44 which is circular and extends within a recess 63 of member 58.

In the fourth embodiment (FIG. 11) the screw 59, about which setting wheel 57 is pivotally mounted, is screwed into a peripheral portion 148 of the watch case bottom 149; and the recess 60, the shoulder 61 and the further recesses 62 and 63 are provided in portion 148 made integral with the watch case bottom 149 (see also FIG. 10).

In both embodiments setting wheel 57 meshes with the toothing 52 of body member 51 (FIG. 4) so that wheel 57 may thus drive the alarm hand 49. Wheel 57 is itself driven in rotation in the same manner as the crown wheel of the usual winding mechanisms provided in watches with a spring motor, i.e., by means of a setting pinion 64 idly mounted on a bearing surface of a setting stem 65. For that purpose, pinion 64 is provided firstly with teeth 66 extending radially outwards (FIGS. 7 and 11) and meshing with wheel 57, and secondly with ratchet teeth 67 extending in an axial direction and with which a corresponding toothing of a clutch wheel 68 can be brought into meshing relation upon shifting setting stem 65 in an axial direction. Clutch wheel 68 is set on a square portion 69 of stem 65 so as to be rigidly fixed to that stem for rotary motion. A springy latch ring 70 engaging a groove of stem 65 holds clutch wheel 68 axially in place on the square portion 69.

FIGS. 4 and 7, on the one hand, and 11, on the other hand, show that setting stem 65 does not reach the watch movement; it is journaled either in the encasing member 58 (third embodiment) or in the watch case lower piece (148, 149) (fourth embodiment). The setting stem 65 has three different working positions according to the axial position of the stem. These axial positions are determined by means of a ball 71 set under the action of a spring 72 and cooperating with three grooves 73, 74 and 75 of stem 65. In the position represented in the drawing, stem 65 is pushed into its innermost position. Ball 71 engages groove 73. Clutch wheel 68 is remote of pinion 64 and the inner end 76 of stem 65 actuates a manually operable switch (disclosed hereinafter) of the alarm device so as to break the control circuit of that device and to stop the alarm. When stem 65 is, on the contrary, pulled into its outermost position, in which ball 71 engages groove 75, the two crown toothings of clutch wheel 68 and setting pinion 64 are in meshing relation so that the rotary motion of stem 65 will be transmitted to the alarm hand 49. Finally, when ball 71 engages groove 74, stem 65 is in an intermediate axial position in which neither its inner end 76 nor the clutch wheel 68 are operative. The intermediate position of stem 68 is that in which the alarm device of the watch described is ready to operate as soon as the watch hands 47, 48 will indicate the same time as the alarm hand 49. Even in stem 65 is inadvertently driven in rotation in that intermediate axial position, the alarm hand will not be moved. A crown 77 fixed to the outer end of stem 65, which extends through a tube 78 secured to member 58 in the third embodiment and to the lower watch case piece (148, 149) in the fourth embodiment, enables actuating stem 65 from outside the watch case.

FIGS. 7 and 11 show that the members of the manually operable switch controlled by the inner end 76 of stem 65, on the one hand, and that the setting pinion 64 and the clutch wheel 68, on the other hand, are located in recesses 79 and 80, respectively, of member 58 in the third embodiment and of the lower watch case piece (148, 149) in the fourth embodiment. Recesses 79, 80 are only open on the side of the dial 44.

FIG. 7 shows how recesses 79, 80 are closed on the side of the bottom 81 of the watch case in the third embodiment. FIGS. 6 and 10 similarly show that recess 60 provided for the watch movement 40 is also only open on the dial side. The three recesses 60, 79 and 80 are communicating. The space in which they open is, however, tightly closed by means of the watch glass 82. For that purpose glass 82, which is circular, is provided with a peripheral flange 83 lying on a watertight gasket 84 extending around dial 44 within recess 63 of member 58 (FIGS. 4 to 7) or of the lower watch case piece (148, 149) (FIGS. 10 and 11).

In the third embodiment member 58, which has a shape similar to that of the watch case, is set into a wall 85 made integral with the bottom 81 (FIG. 6). Wall 85 is provided with a U-shaped cutout 86 (FIG. 7) providing for the passage of tube 78 and the setting stem 65 of the alarm hand.

In both embodiments the flange 83 of glass 82 is pressed onto the watertight gasket 84 by means of a bezel 87 made integral with a sidewall which is provided with a U-shaped cutout 88 for tube 78 as the sidewall 85 of bottom 81 in the third embodiment. Projections 89 of the lower watch case piece (81, 85), (148, 149) engage corresponding grooves provided in the inner surface of the sidewall made integral with bezel 87 thus ensuring the fixation in axial direction of the two watch case pieces, while notches 90 provided in the corners of the lower watch case piece (81, 85), (148, 149) can be engaged by a sharp tool for opening the watch case.

As shown in FIG. 4 the winding and hand-setting stem 91 of the watch movement 40 extends in parallel with the setting stem 65 of the alarm hand. Stem 91 extends throughout a radial bore of member 58 in the third embodiment and of the lower watch case piece (148, 149) in the fourth embodiment. The outer end of stem 91 extends throughout a tube 92 secured to member 58 and to the lower watch case piece (148, 149), respectively, in these two embodiments. A crown 93 similar to crown 77 is fixed to stem 91. As for tube 78, the bezel 87 and the lower watch case piece (81, 85), each is provided with a U-shaped cutout for tube 92.

In order that the passages provided for stems 65 and 91 through member 58 and the lower watch case piece (148, 149), respectively, do not jeopardize the tight closure of the space comprised between that element and the glass 82, space in which the watch movement 40 is enclosed, the joints between crowns 77 and 93 and the corresponding tubes need only be made tight by means of watertight gaskets located in said crowns as well known to those skilled in the art.

Member 58, on the one hand, and the lower watch case piece (148, 149), on the other hand, moreover, carry the different elements of the alarm device of the watch described. These elements chiefly comprise a buzzer which is mounted outside the space enclosing the watch movement 40. For that purpose, member 58 (FIG. 6) and the lower watch case piece (148, 149) (FIG. 10) each is provided with a recess 94 which, in the third embodiment, opens in the surface of member 58 directed toward the watch case bottom 81 and, in the fourth embodiment, opens in the outer surface of the watch case bottom 149. In the two embodiments recess 94 is closed on the side of dial 44. Moreover, member 58 as well as the lower watch case piece (148, 149) each is provided with a recess 95 for the battery 96 feeding the alarm device of the watch with electrical current. As recess 94, recess 95 is also provided outside the space enclosing the watch movement 40. It similarly opens either in the surface of member 58 directed toward the bottom 81 or in the outer surface of bottom 149 and it is similarly closed on the dial side.

The buzzer of the alarm device of the watch described firstly comprises a ferromagnetic plate 97 (FIGS. 6 and 10) which is located on the bottom of recess 94. A ferromagnetic core 98 is fixed to plate 97. Two permanent magnets 99 (FIG. 4) having a parallelepipedic shape are set on plate 97 near the ends thereof. The height of magnets 99 is equal to that of the part of core 98 projecting above plate 97. The buzzer, moreover, comprises a plastic body member 100 which is

located in recess 94 on the side of plate 97. In the third embodiment body member 100 is flush with the lower surface of the encasing member 58. In the two embodiments body member 100 carries the electric circuit means ensuring the operation of the buzzer. These electric circuit means comprise a transistor 101 and a resistor 102 both embedded in body member 100. Said means also comprise two coils 103, 104 which are rigidly secured to body member 100, for instance by gluing, and which extend around core 98 between magnets 99 (FIGS. 4, 6 and 9). As shown in FIG. 9 the coils 103 and 104 are connected to the input circuit and the output circuit, respectively, of transistor 101 which starts oscillating as soon as its input lead 105 and its output lead 106 are connected to an electrical potential.

Tests made with a transistor 101 of the type AC 129, a resistor 102 of 400 ohms, a coil 103 with 420 windings and a coil 104 with 840 windings have been satisfactory.

Since the coils 103 and 104 are glued onto member 100 in which the other circuit means are embedded, the extremely thin threads, the diameter of which is about five one-hundredths mm., which protrude from coils 103 and 104 and are connected to transistor 101 and resistor 102, are also embedded in body member 100 and, consequently, protected.

The input lead 105 and the output lead 106 of the oscillator described hereabove can be connected to terminals being flush with body member 100 by passing either through encasing member 58 or through the lower watch case piece (148, 149) from a plate 107 (FIG. 4). In the third embodiment plate 107 is secured to encasing member 58 and it extends within a recess 108 provided in the upper surface of member 58 and, in the fourth embodiment, it is secured to the lower watch case piece (148, 149) so as to extend in a similar recess 108 provided in the upper surface of that lower watch case piece. In the two embodiments a part of the leads 105 and 106 is printed on the upper surface of plate 107 made out of an insulating material.

To retain the magnets 99 and the body member 100 in place within recess 94, a frame member 109 made out of an magnetic material and extending above magnets 99 and coils 103, 104, is secured at its two ends either to member 58 or to the lower watch piece (148, 149) by means of two screws 110. The latter, moreover, serve to secure the ends of a spring blade 111 on frame member 109 so that blade 111 extends above magnets 99, coils 103, 104 and core 98. A ferromagnetic armature 112 is secured to blade 111 so as to extend within frame member 109, however, without coming in contact either with magnets 99 or with core 98.

As soon as leads 105 and 106 are connected to an electrical potential, the current oscillations produced by the transistor 101 in the coils 103, 104 cause the armature 112 to be periodically attracted and blade 111 to vibrate at a natural frequency which can range between 600 and 900 Hz.

A projection 113 is formed in the center of blade 111 and it strikes against a conical plastic membrane 114 which produces an audible sound when the transistorized oscillator is energized. Membrane 114 is made with a flat peripheral flange which is secured for instance by gluing to a threaded ring 115 screwed into a tapped opening 116 of bottom 81 (FIG. 6) or 149 (FIG. 10) of the watch case. The outer surface of ring 115 is provided with holes 117 which can be engaged by an appropriate tool for screwing and unscrewing ring 115 in opening 116. A perforated cover member 118 formed with a peripheral threaded rim portion is screwed into opening 116 above ring 115. Cover member 118 protects membrane 114 by preventing foreign bodies from coming into contact with the membrane and tearing the same. The perforations of cover member 118 place membrane 114 in communication with the atmosphere thus enabling a free propagation of the sound produced by that membrane.

To excite membrane 114 under the best possible conditions, projection 113 of blade 111 advantageously strikes against the membrane at a point located as near as possible to its apex, i.e., to its center point. Due to the fact that the blade 111 is

fixed at its two ends, it is also the center point of this blade which has the largest amplitude when the transistorized oscillator is energized, and which strikes against the membrane 114. The use of a blade 111 fixed at its two ends has the advantage of enabling the use of a membrane 114 having a relatively large diameter and of locating membrane 114 in the vicinity of one corner of the watch located on the same side as the crowns 77 and 93 as shown in FIG. 8. As regards blade 111 it is arranged in a direction perpendicular to the diagonal of the watch case passing through the center of membrane 114 as shown in FIG. 4. A buzzer which, instead of a blade fixed at its two ends, would comprise a blade fixed only at one end and, consequently, strike against a plastic membrane out its other end, would not permit such a location of the buzzer within the watch case. A buzzer with a spring blade fixed only at one end could, firstly, not comprise a membrane as large as that represented in the drawing unless it would strike the membrane at a point remote from its apex, which would be disadvantageous. Moreover, such a membrane could not be located in the same corner of the watch case. In order that the end of the spring blade reaches the center of the membrane, the spring blade should, indeed, extend in parallel with one of the two sides of the watch case adjacent to the corner occupied by the membrane. Now, FIG. 4 shows that there would be no place for the spring blade either along the watch case side where the crowns 77 and 93 are provided, because of the winding and hand-setting stem 91, or along the other side of the watch case because of the watch movement. The only possible location for such a buzzer comprising a spring blade fixed only at one end would thus be along the opposed watch case side. Under those conditions the buzzer membrane should be located in the vicinity of one of the two watch case corners adjacent to said watch case side. In such a location the buzzer membrane would have the drawback of producing sounds which would be damped much more than in the embodiments represented in the drawing. The audible vibrations emitted through the perforations of cover member 118 would propagate themselves within the cloth's sleeves of the watch carrier and be lost while in the embodiment represented, the vibrations emitted can freely propagate themselves since the membrane 114 is located on the hand side of the watch carrier.

Since blade 111 is fixed at its two ends, it will be observed that the amplitude of its oscillations is relatively small. Moreover, in order that its projection 113 conveniently strikes against membrane 114, the apex of the latter must be set at a very exact distance from blade 111. If membrane 114 is set too far away from blade 111, the latter will no longer reach membrane 114 upon vibrating. On the contrary, if membrane 114 is set too near to blade 111, it impedes the latter. By making tests, it can easily be noticed that the distance between membrane 114 and blade 111 must be set with a precision of about some hundredths of mm. Since blade 111 is fixed to the encasing member 58 in the third embodiment, and since membrane 114 is fixed to the watch case bottom, these two buzzer members do not come automatically at the exact distance to each other, even if they are fixed with a great precision to their supports. It is, indeed, not possible to manufacture a series of members 58 and of lower watch case pieces (81, 85) so that upon introducing one of those encasing members into any watch case bottom, the former comes to lie in an exactly predetermined position relative to the bottom. Because of the source of errors resulting from the assembling conditions, a possibility of setting the distance between blade 111 and membrane 114 after having set member 58 into the watch case, is advantageously to be provided.

In the embodiment of FIG. 6, that setting possibility results from the fact that membrane 114 is not rigidly fixed to the bottom 81 in a definite position. Upon screwing more or less ring 115 carrying membrane 114, the latter is moved in a direction parallel to the watch axis and can thus be set at the desired distance from blade 111. That distance obviously need not be measured. Once the watch case has been finally closed, it suf-

fices to cause blade 111 to vibrate by energizing the transistorized oscillator. The workman entrusted with the setting operation of the buzzer can then easily move membrane 114 by screwing ring 115 more or less since the latter is accessible from outside the casing after having removed cover member 118. To set membrane 114 in the correct position, that workman will be guided by the quality of the sound produced by the membrane. When that sound has an optimum quality, the setting operation is performed and the cover member 118 need only be screwed in place where it serves as a locknut.

In the embodiment of FIG. 10 membrane 114 is fixed under the same conditions to the bottom 149. Setting its distance to blade 111 can thus be carried out as in the embodiment of FIG. 6.

To prevent perspiration from entering the buzzer by passing through the threads of opening 116 and ring 115, a watertight gasket 119 is set below ring 115 which compresses more or less gasket 119 on a shoulder of bottom 81 (FIG. 6) or 149 (FIG. 10), according to the position in which membrane 114 is finally set. In order that gasket 119 ensures the tight closure of the buzzer, whichever the position of membrane 114 may be, the gasket is chosen with a cross section enabling relatively important deformations of the gasket.

The tight closure thus obtained is, however, not of the kind which would enable submitting the watch to the same tests as the usual watertight watches. Upon submitting the watch described to an overpressure of several atmospheres, the gaskets provided in this watch would certainly hold the overpressure, but the membrane 114 would be torn. That membrane can only be submitted to overpressures of about 1 atm.

In spite of that condition, it would be possible, even in the embodiment of FIG. 6, to ensure the tightness of the watch case space occupied by the buzzer in the same manner as that occupied by the movement. For that purpose a watertight gasket similar to gasket 84 could be inserted between member 58 and the watch case bottom 81.

It should be observed, in the third and fourth embodiments, that if the watch were incidentally submitted to an overpressure tearing membrane 114, no damage would result for the watch movement 40. Only the space occupied by the buzzer would be immersed. If such an immersion caused some damage to the buzzer, merely replacing the latter would restore the watch completely.

The last operation could be made more easy in the fourth embodiment by using a compact buzzer. In such a buzzer, blade 111 and membrane 114 would not be fixed to the watch case lower piece but to an independent support such as, for instance, a capsule which could then be introduced as a single unit into a recess of the watch case lower piece.

To permit replacing the battery 96 in the third embodiment without having to open the watch case, the bottom 81 is provided with an opening 120 (FIG. 6) coaxial to recess 95 of member 58. Opening 120 is closed by means of a bushing 121 screwed into member 58. A slot 122 enables rotating bushing 121.

It has already been pointed out hereabove that recess 95 provided in member 58 for the battery 96 does not communicate with the space enclosing the watch movement 40. If battery 96 leaked or produced corrosive emanations, movement 40 would accordingly not be injured. To avoid an immersion of the space enclosing battery 96 if the watch were immersed, a watertight gasket 123 is inserted between two shoulders of bushing 121 and bottom 81, respectively.

The fourth embodiment (FIG. 10) only differs from the third one by the fact that bushing 121 is screwed into the watch case lower piece (148, 149) provided with the recess 95 for battery 96.

The positive pole of battery 96, constituted by a cap member 124, is electrically connected to the ground mass of the watch through bushing 121. As regards the negative pole 125 of the battery, it is in contact with a stud 126 held in place by means of a screw 127 in a bore either of member 58 (FIG.

6) or of the lower watch case piece (148, 149) (FIG. 10). The passage of stud 126 through its supporting member—member 58 or lower watch case piece (148, 149)—is tightly closed by means of a sleeve 128 which could also insulate the stud if the supporting member were made out of an electrically conducting material.

That supporting member can be made out of different materials. It could be metallic and have been machined out of a full blank or alternatively have been injected. However, it will preferably be made out of an insulating plastic either by moulding or by injection. In the embodiment of FIG. 10 it could then be covered by a metal coating. In spite of these advantages, it is, however, the first event which has been supposed in the two embodiments described. In that event the metallic dial 44 must, of course, be perfectly insulated from the ground mass of the watch and, in particular, from the support 58 or (148, 149) to avoid shunting the switch of device 146 mounted coaxially to the watch hands. For that purpose, an insulating ring 129 is inserted between dial 44 and said supporting member. Instead of securing dial 44 to the watch movement 40 in the usual manner, this dial, which is substantially larger than the movement, is fixed to the support 58 or (148, 149) by means of feet (not shown) which enter blind holes of the support. Insulating sleeves have, of course, to be inserted between the dial feet and said support to avoid any short circuit.

Screw 127 holding stud 126 in place simultaneously serves to fix to support 58 or (148, 149) one of the two arms 130, 131 made integral with plate 107 carrying a printed circuit. In addition to the parts of leads 105 and 106 described hereabove, that printed circuit still comprises two conductors 132 and 133 (FIGS. 4 and 9). The conductor 132 firstly extends along arm 130 and then along plate 107 so as to connect the negative pole of battery 96 to the buzzer lead 106. As regards conductor 133, it also extends in part over plate 107 and in part along arm 131 at the end of which it is connected to a stud 134 carried by arm 131 and made integral with a cam 135 (FIG. 7). Arm 131 is bent out of the plane of plate 107 so as to cause stud 134 to bear normally on dial 44 thus establishing an electrical connection between these two members which constitute the contact elements of a manually operable switch provided for stopping the alarm at will. In the position represented in the drawing that switch is held open by means of stem 65 which is in its innermost position in which its inner end 76 engages cam 135 thus holding stud 134 remote from dial 44.

If, in a modification of the third and fourth embodiments represented in the drawing, the conductor 133 were directly connected to lead 105 of the printed circuit 107, the control circuit of the electrical alarm device of the watch described would be established from the negative pole 125 of battery 96 through the conductor 132 to the buzzer, then from the buzzer through lead 105 and conductor 133 to the switch (44, 134), then from that switch through the dial 44 to the switch 146 and, finally, from that switch through the ground mass back to the positive pole 124 of battery 96 (see also FIG. 9). In this Figure it can be observed that the two switches are mounted in series and must consequently be closed together to energize the buzzer. As already described hereabove the manually operable switch (44, 134) is closed when setting stem 65 has been pulled in its intermediate or in its outmost position. As regards the switch of device 146, it is closed when the watch hands 46, 47 indicate the same time as the alarm hand 49. To cause the alarm device to ring at a predetermined time in the modification considered, the alarm hand 49 need only be set at that time by means of crown 77 by firstly pulling the setting stem in its outmost position and then by pushing that stem in its intermediate position to prevent the alarm hand from moving upon inadvertently rotating crown 77.

In a further modification, it would be possible to replace the two grooves 74 and 75 by a single one having such a cross section that ball 71 would automatically thrust stem 65 in its intermediate position under the action of spring 72 when releasing crown 77 after having set the alarm hand 49.

In the intermediate position of stem 65, the switch (44, 134) is closed. At the time desired the other switch will close and switch on the alarm. The watch carrier can then stop the alarm at will by pushing crown 77 so as to move stem 65 to its innermost position in which its inner end 76 engages cam 135 and opens switch (44, 134). If the watch carrier, for any reason, did not actuate crown 77 so as to open switch (44, 134), the alarm would stop itself at the moment at which embossing 56 would leave the projection of arm 42 being flush with the bottom of groove 53 of body member 51 in the course of the normal run of the watch, i.e., after at most 10 minutes. As long as the two switches (44, 134) and 146 are closed, the buzzer is permanently energized and membrane 114 produces a continuous sound.

In the two embodiments represented in FIGS. 4 to 9 and 10, 11, respectively, the conductor 133 is, however, not directly connected to lead 105 of the buzzer. An electronic interrupter comprising a transistor 136 (FIG. 9) associated with a control device 137 (see also FIG. 4) is connected between these two conductors. Device 137 has three terminals: 138, to which lead 106 and conductor 132 of the printed circuit 107 are connected; 139, to which the buzzer lead 105 is connected, and 140, to which the conductor 133 of the printed circuit 107 is connected. Device 137 includes a multivibrator of the flip-flop type with two transistors 141, which is connected to the base of transistor 136 through a resistor 142 (FIG. 9). When device 137 is energized, its multivibrator causes the bias of the base of transistor 136 to oscillate by jumping between two predetermined values. Resistor 142 is chosen in such a manner that, for one potential of the base of transistor 136, the latter allows current to flow between terminals 140 and 139 of device 137, whereas the other potential of the base of transistor 136 interrupts the current flow between terminals 140 and 139. By an appropriate choice of the four resistors 143 and of the two condensers 144 which all together determine the time constant of the multivibrator, it is possible to adjust, on the one hand, the frequency of the current interruptions produced by transistor 136 between terminals 140 and 139, and, on the other hand, to adjust the relative length of these current interruptions with respect to the time intervals during which current flows.

The device 137 thus produces an intermittent sound: With the help of device 137, the watch manufacturer can, at will, produce short interruptions of the alarm following each other at more or less spaced time intervals, or, on the contrary, cause membrane 114 to operate only during very short time periods, at time intervals which are more or less spaced apart from each other.

As shown in FIGS. 4 and 5, the device 137 is mounted below plate 107 carrying the printed circuit. Device 137 is located in a recess 145 of encasing member 58 or of the lower watch case piece (148, 149).

It appears from the above-standing description that the encasing member 58 of the third embodiment or the lower watch case piece (148, 149) of the fourth embodiment not only carries the elements of the alarm device which have to be positively electrically interconnected, i.e., the buzzer, the manually operable switch and the battery, but also all the setting and adjusting members of the alarm, i.e., those which enable setting the time at which the alarm has to be switched on as well as those for adjusting the nature of the alarm. With the exception of battery 96 which is usually set in place when selling the watch, all the other elements of the alarm device, except wheel 57, can be mounted on member 58 or on the lower watch case piece (148, 149) independently of movement 40. These assembling operations can even be carried out at a place remote from that where the watch movement is assembled. The operation of the buzzer on member 58 or on the lower watch case piece (148, 149) can also be checked without the watch movement. The watchmaker who has to assemble the watch, can then handle member 58 or the lower watch case piece with all the elements carried thereby as a single unit in the same manner as the usual encasing members with which the watchmaker is familiar. The watch movement

40 can indeed be set into member 58 or into wall 148 and then fixed thereto by means of the known securing means. After that operation the setting wheel 57, the dial 44 and the hands can be set in place in the usual manner. In the third embodiment the whole unit thus obtained will still have to be inserted into the lower watch case piece (81, 85). The glass 82 and the bezel 87 need only be set thereover and pressed down until projections 89 enter the corresponding grooves. Then comes the only moment at which the watchmaker has to take care of the alarm device by setting the position of membrane 114 in the manner described hereabove.

It should be understood that the watch could also be provided with a circular movement instead of that represented in the drawings. Moreover, the movement could comprise a self-winding mechanism.

It should be observed that the electrical alarm device described does not comprise any electrical conductor which would be exposed to the risk of being broken, for instance because of an inappropriate handling of the supporting member of the alarm device. Although the switching device 146 controlled by the watch movement has to be mounted on the latter, the watchmaker who assembles the watch, has not to take care of the electrical contacts which have to be established between the circuit means carried either by member 58 or the lower watch case piece (148, 149) and the switching device 146. The latter is automatically connected to the control circuit of the alarm device, on the one hand, through the ground mass including the watch movement and the watch case, and, on the other hand, through the insulated dial.

In spite of the locations both of the buzzer and of the battery at the corners of the watch case, the latter can be bevelled at its periphery as the usual flat watches, because these two elements of the electrical alarm device can be made with very reduced sizes.

What is claimed is:

1. An alarm wristwatch comprising, in combination, a watch case, a watch movement of the type comprising a spring motor and a mechanical escapement mechanism, said movement being located in said watch case and including a member driven at a predetermined rate and an adjustable member, an electrical alarm device comprising a switching device and further circuit means, each of them being electrically connected to the other ones, said switching device comprising a switch with a pair of contact elements, one of said contact elements being carried by said driven member of the watch movement and the other contact element being carried by said adjustable member, said watch case having a bottom constituting a supporting member arranged for receiving said watch movement and holding it firmly within said watch case, said supporting member carrying said further circuit means of the electrical alarm device, said alarm device further comprising a buzzer enclosed in a watertight housing, the watch case bottom having an outer surface and being provided in said outer surface with a fully blind hole having no opening but that in the bottom outer surface, said housing of the buzzer being located in said blind hole and secured therewithin.

2. An alarm wristwatch comprising, in combination, a watch case, a watch movement of the type comprising a spring motor and a mechanical escapement mechanism, said movement being located in said watch case and including a member driven at a predetermined rate and an adjustable member, an electrical alarm device comprising a switching device and further circuit means, each of them being electrically connected to the other ones, said switching device comprising a switch with a pair of contact elements, one of said contact elements being carried by said driven member of the watch movement and the other contact element being carried by said adjustable member, and a supporting member arranged for receiving said watch movement and holding it firmly within said watch case, said supporting member carrying said further circuit means of the electrical alarm device, wherein said supporting member is provided with a first recess arranged for

receiving an electrical battery constituting the source of electrical energy of said alarm device, with a second recess arranged for receiving a manually operable switch which can be controlled from outside said watch case, and with a third recess arranged for receiving a buzzer forming part of said alarm device and being fed by said battery when said manually operable switch as well as the switch of said switching device both are closed.

3. The alarm wristwatch of claim 2, in which said buzzer comprises a resilient member that upon energization of the buzzer oscillates at a natural frequency ranging within the audible spectrum, said resilient member mechanically transmitting its oscillation to a membrane producing the audible sounds.

4. The alarm wristwatch of claim 3, further comprising a supporting piece forming part of said watch case and being provided with an opening, said membrane being carried by said supporting piece and extending across said opening thereof while tightly closing said opening.

5. An alarm wristwatch comprising, in combination, a watch case, a watch movement of the type comprising a spring motor and a mechanical escapement mechanism, said movement being located in said watch case and including a member driven at a predetermined rate and an adjustable member, an electrical alarm device comprising a switching device and further circuit means, each of them being electrically connected to the other ones, said switching device comprising a switch with a pair of contact elements, one of said contact elements being carried by said driven member of the watch movement and the other contact element being carried by said adjustable member, said watch case having a bottom constituting a supporting member arranged for receiving said watch movement and holding it firmly within said watch case, said supporting member carrying said further circuit means of the electrical alarm device, said alarm device further comprising setting and adjusting means carried by said watch case bottom.

6. The alarm wristwatch of claim 5, in which said setting and adjusting means comprise a setting stem and a setting mechanism controlled by said stem, said setting stem being pivotally mounted in the watch case bottom and said setting mechanism being mounted in said bottom from the inner surface thereof.

7. The alarm wristwatch of claim 6, in which said setting and adjusting means of the alarm device further comprise an electronic interrupter controlled by a multivibrator for periodically interrupting the sounds produced by the alarm device, said interrupter being also mounted in the watch case bottom from the inner surface thereof.

8. The alarm wristwatch of claim 6, in which said alarm device comprises a manually operable switch for stopping the alarm at will, said setting stem being shiftably mounted in the watch case bottom and arranged for controlling said manually

operable switch.

9. An alarm wristwatch comprising, in combination, a watch case, a watch movement of the type comprising a spring motor and a mechanical escapement mechanism, said movement being located in said watch case and including a member driven at a predetermined rate and an adjustable member, an electrical alarm device comprising a switching device and further circuit means, each of them being electrically connected to the other ones, said switching device comprising a switch with a pair of contact elements, one of said contact elements being carried by said driven member of the watch movement and the other contact element being carried by said adjustable member, a supporting member arranged for receiving said watch movement and holding it firmly within said watch case, said supporting member carrying said further circuit means of the electrical alarm device, and said alarm device further comprising setting and adjusting means carried by said supporting member.

10. The alarm wristwatch of claim 9, in which said setting and adjusting means comprise an electronic interrupter controlled by a multivibrator and mounted in series with said switch of the switching device and said manually operable switch.

11. The alarm wristwatch of claim 9, further comprising an alarm hand, an alarm hand setting wheel and means for actuating said alarm hand setting wheel from outside said watch case, said alarm hand setting wheel forming part of said setting and adjusting means.

12. The alarm wristwatch of claim 11, in which said means for actuating said alarm hand setting wheel comprise a setting stem pivotally mounted in said supporting member.

13. The alarm wristwatch of claim 12, in which said further circuit means comprise a manually operable switch, said setting stem being shiftably mounted in said supporting member and controlling said manually operable switch.

14. The alarm wristwatch of claim 13, in which said setting stem has an outermost control position in which it is operatively connected to said alarm hand setting wheel, an innermost control position in which it opens said manually operable switch, and an intermediate position in which it is unclutched from said alarm hand setting wheel and it leaves said manually operable switch closed.

15. The alarm wristwatch of claim 14, further comprising a metallic dial and a resilient arm carried by said supporting member, said resilient arm carrying camming means, one contact of said manually operable switch and an electrical conductor connecting said contact to the other elements of said further circuit means, said dial constituting the other contact of said manually operable switch and electrically connecting one contact element of said switch of the switching device to said further circuit means, said setting stem cooperating with said camming means for opening said manually operable switch.

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