Aug. 7, 1962 H. S. DETWILER ET AL 3,048,004

ELECTRIC WATCH

Filed April 9, 1959 2 Sheets-Sheet 1

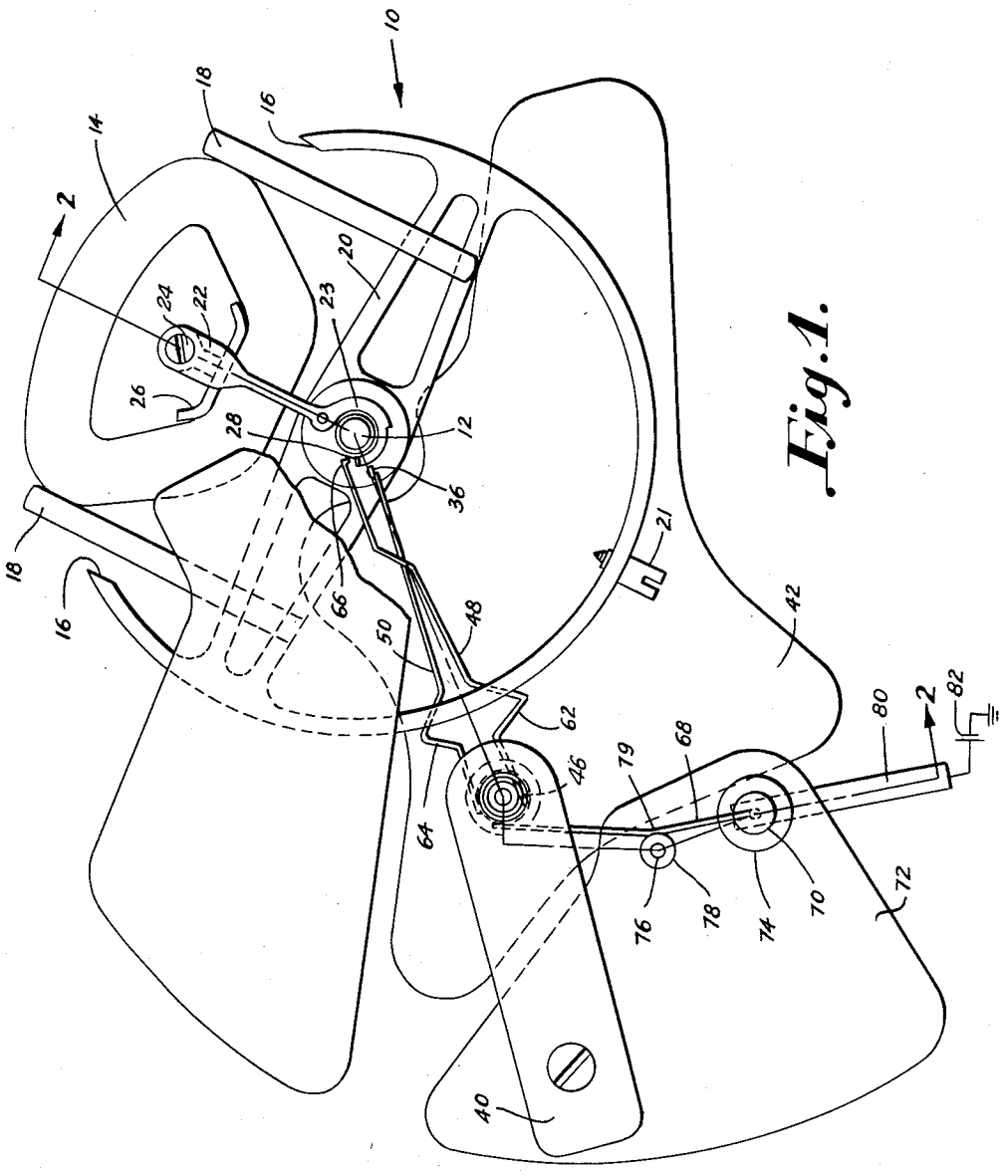


Fig. 1.

INVENTORS

HARRY S. DETWILER, DECEASED,
BY DELMA A. DETWILER, ADMINISTRATRIX
CARL A. NELSON

BY Diggins & LeBlanc
ATTORNEYS

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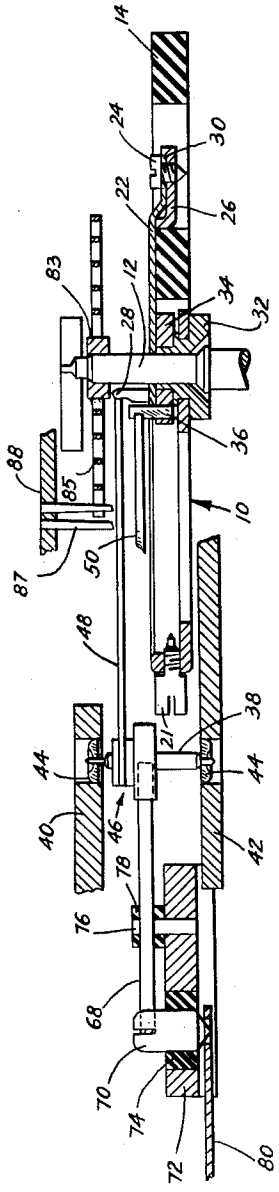


Fig. 2.

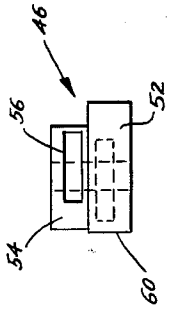


Fig. 4.

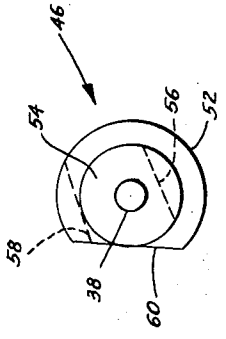


Fig. 3.

INVENTORS

HARRY S. DETWILER, DECEASED,
BY DELMA A. DETWILER, ADMINISTRATRIX
CARL A. NELSON

BY Diggins & Le Blanc
ATTORNEYS

United States Patent Office

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3,048,004

ELECTRIC WATCH

Harry S. Detwiler, deceased, late of Lancaster County, Pa., by Delma A. Detwiler, administratrix, Lancaster County, Pa., and Carl A. Nelson, Lancaster County, Pa., assignors to The Hamilton Watch Company, Lancaster, Pa., a corporation of Pennsylvania

Filed Apr. 9, 1959, Ser. No. 805,312
7 Claims. (Cl. 58—28)

This invention relates to a contact system for battery operated electric wrist watches and more particularly relates to a contact system which produces a relatively constant contact pressure and which will maintain its initial adjustment.

The contact system of the present invention is intended to be used in an electric watch of the type having an oscillating coil in which the coil is carried on the balance wheel of the watch and energized on the forward swing of the balance wheel at the moment the coil passes over a pair of permanent magnets carried in the frame of the watch. This energization of the coil produces a magnetic flux within the coil which acts in a direction opposite to the permanent magnetic field and produces a thrust or kick against the coil which oscillates the balance wheel in one direction. The motion of the balance wheel is customarily arrested and returned by a conventional hairspring, at which time the balance wheel oscillates in the reverse direction and during this time the coil is not energized as it passes through the permanent magnetic field.

Contact mechanisms have been devised in which a movable contact separate from the balance wheel has been controlled and adjusted from two hubs mounted near the balance staff. One such two-hub system is disclosed in assignee's copending application Serial No. 551,791, filed December 8, 1955, now Patent No. 2,954,663, dated October 4, 1960. In this type of system, one end of a movable contact is frictionally carried by a collet on a first post and the end of a trip spring is mounted on a second post. The tip spring is utilized to control the motion of the movable contact and is also frictionally carried by a collet on the second post. While this system has worked satisfactorily the arrangement of the present invention presents certain material advantages. The reduction in the number of posts and parts involved provides a reduction in cost and the nature of the system provides a permanence of the original contact adjustment and setting. A relatively constant contact pressure is attained so as to eliminate "hash" in the coil current.

Accordingly, it is a primary object of the present invention to provide a contact system for a battery operated watch in which a movable spring contact maintains a relatively constant contact pressure during its contact making period.

It is another object of the present invention to provide a novel means for adjusting the contact period in a contact system for an electric watch.

It is still another object of the present invention to provide an improved means for prepositioning a movable spring contact in a contact system for an electric watch.

It is another object of the present invention to provide a novel means for insuring that a movable spring contact maintains electric contact with an oscillating electric contact carried by the coil of an electric watch.

It is still another object of the present invention to provide a novel means for returning a movable spring contact to its initial position out of the path of oscillation of an oscillating electrical contact after contact has been made.

These and further objects and advantages of the present invention will become more apparent upon reference to the following specification and claims and appended drawings wherein:

FIGURE 1 is a plan view showing the contact system of the present invention;

FIGURE 2 is a sectional view taken along the lines 2—2 of FIGURE 1;

FIGURE 3 is a plan view of a novel anchor hub used in the present invention; and

FIGURE 4 is a front elevational view of FIGURE 3.

Referring now to FIGURE 1, a balance wheel generally indicated at **10** is suitably mounted for oscillation on a balance staff **12**. A periodically energized coil **14** is mounted in a cut-out portion **16** in the balance wheel **10** and is supported by a pair of beryllium-copper spring members **18** which are suitably attached to a skeletonized cross arm **20** of the balance wheel **10** as by welding. The balance wheel carries one or more poising screws indicated at **21**. Reference may be made to assignee's copending application Serial No. 781,809, filed December 19, 1958, for the details relating to the mounting of the periodically energized coil **14**.

A coil contact member **22** is attached by any suitable means, such as screw **24**, to a support member **26** which is cemented to the coil **14** and connected to one terminal thereof. Coil contact member **22** has an arcuately curved portion **23** surrounding and insulated from the balance staff **12** and carries an upstanding electrical contact **28** at the end thereof. The axial position of upstanding electrical contact **28** is variable by virtue of a slot **30** in the end of coil contact member **22**. (See FIGURE 2.)

A collet **32** frictionally engages the balance staff **12** and serves as a support for the balance wheel **10**. A brass roller **34** is also carried on a ledge of collet **32** above the attachment of the balance wheel to the collet. This brass roller **34** carries a pin or cam member **36** called a trip jewel, the purpose of which will be described presently.

Referring now to FIGURES 1 and 2, an anchor hub arbor **38** is freely mounted for rotation between a contact bridge **40** and a lower bridge **42** by a pair of olived bearings **44** and is thereby insulated from the frame of the watch. Anchor hub arbor **38** carries an anchor hub indicated generally at **46**. A contact spring **48** and a trip spring **50** are securely attached to anchor hub **46** as by welding.

Reference is now made to FIGURES 3 and 4 for the details of the anchor hub **46**. Reference to these figures discloses that anchor hub **46** consists of a base portion **52** and an upper portion **54**. Upper portion **54** is slotted at **56** to receive one end of the electrical contact spring **48**. Similarly, the base portion **52** is slotted at **58** to receive one end of trip spring **50**. Slots **56** and **58** are positioned so that the radial distance to slot **56** is equal to the radial displacement of upstanding electrical contact **28** from balance staff **12** and the radial distance of slot **58** is made equal to the radial distance of trip jewel **36** from the balance staff **12**. This positioning of the slots **56** and **58** equal to the radial displacement of upstanding electrical contact **28** and trip jewel **36** is to insure that the anchor hub rotates through the same angular displacement as the balance staff **12** during the time cycle of the make and break contact.

Referring once again to FIGURES 1 and 2, the electrical contact spring **48** and trip spring **50** are shown to be provided with looped portions **62** and **64** respectively. Looped portion **62** enables the free end of electrical contact spring **48** to be adjusted so as to insure that it always contacts upstanding electrical contact **28** when oscillated into position therefor and loop **64** provides adjustability for the length of time that the trip spring **50** engages the

leading edge of the trip jewel **36**. Since the electrical contact spring **48** and the trip spring **50** are fixedly attached to the anchor hub **46** such as by welding within slots **56** and **58**, these members will retain their initial position in a positive manner. A precious metal contact **66** is carried on the free end of electrical contact spring **48** and engages the upstanding electrical contact **28** which also is preferably made from a precious metal such as gold.

A flat tension spring **68** engages a flat surface **60** of anchor hub **46** to position the hub while permitting resilient motion away from the pre-established rest position. In this rest position, which is shown in FIGURE 1, the end of the contact spring **48** is out of the path of movement of the upstanding contact **28**. The other end of flat tension spring **68** is frictionally held within a kerf in a spring post **70** which extends through a contact bridge **72** which is suitably mounted above the pillar plate or frame of the watch. The spring post **70** is electrically insulated from the contact bridge **72** by means of an insulating bushing **74**. A compensating tension post **76** carrying an insulating bushing **78** bears against flat tension spring **68** at a bend **79** therein intermediate its ends. This post may be bent slightly to adjust the tension of spring **68** against hub **46**. In addition to this, the spring **68** may be bent between post **76** and hub **46** in order to preposition the hub. A battery lead **80** is connected to the positive terminal of the battery **82** for the electric watch while the negative terminal of the battery is grounded to the watch frame. The second terminal of coil **14** is grounded to the balance wheel and staff and thence through collet **83**, hairspring **85** and stud **87** to the watch frame.

The operation of the contact mechanism is as follows: Current flows from the battery **82** to energize the coil **14** only at the moment that it is in the magnetic field and produces a magnetic thrust against the coil which, in conjunction with the reaction of the hairspring, produces an oscillating motion. At the position shown in FIGURE 1, the balance wheel **10** is about to oscillate in a counterclockwise direction under the influence of the hairspring. The forward face of the trip jewel **36** is in engagement with trip spring **50** and causes the anchor hub **46** to follow by rotating in the opposite direction. It will be noted that at this moment, the precious metal contact **66** of electrical spring contact **48** is not in engagement with the upstanding contact **28**. However, because of its length, the offset nature of the attachment of electrical spring contact **48** to anchor hub **46** and the relative position of the anchor hub with respect to the upstanding contact **28**, electrical spring contact **48** will make electrical contact with upstanding contact **28** by virtue of its relatively faster rotation. That is to say, the trip jewel **36** engages the trip spring **50** and causes the anchor hub **46** to rotate against the holding force of spring **68** thereby also causing movement of the contact spring **48** in the same direction.

The energization circuit comprises battery **82**, battery lead **80**, spring post **70**, flat tension spring **68**, anchor hub **46**, electrical spring contact **48**, upstanding contact **28** of coil contact member **22**, and electrical ground contact for the other terminal of coil **14**, not shown, balance staff **12**, collet **83**, hairspring **85**, stud **87**, and the frame of the watch to the negative terminal of battery **82**. This energization of coil **14** imparts the driving thrust for balance wheel **10** and the duration of this thrust is determined by the adjustment loop **64** of trip spring **50** which in turn determines when trip spring **50** will slip past the forward face of trip jewel **36**. As soon as trip spring **50** slips past the forward face of trip jewel **36**, the only force acting on anchor hub **46** is that of the tension spring **68** which immediately returns the anchor hub to its initial predetermined position by virtue of the flat surface **60** on anchor hub **46** thereby breaking the electrical contact with a snap action. Adjustment loop **62** adjusts the wiping engagement of precious metal contact **66** with upstanding electrical contact **28**.

As the balance wheel **10** rotates in a clockwise direction, the coil **14** will not be energized since the trailing face of trip jewel **36** will pass by the trip spring **50** which will yield to its motion. Precious metal contact **66** will be thus moved out of the path of upstanding contact **28**. The balance wheel **10** will then begin its counterclockwise oscillation so that the forward face of the trip jewel **36** will again engage the trip spring **50** in the position shown in FIGURE 1.

The radial distance from the longitudinal axis of arbor **38** to slot **56** in which electrical spring contact **48** is fixedly contained is the same as the radial distance from the axis of balance staff **12** to upstanding electrical contact **28**. Similarly, the radial distance to slot **58** which fixedly contains the end of trip spring **50** is equal to the radial distance from the axis of the balance staff **12** to the pin or cam member **36**. Thus, the angular displacement of the balance staff will be equal to that of the anchor hub staff, thereby insuring a relatively constant contact pressure.

It will be apparent from the foregoing that in addition to providing a contact system having a relatively constant contact pressure during the contact making period, the present invention provides a novel adjusting means by loops **62** and **64** which insures reliability of adjustment. A single hub is used to control the motion of the electrical spring contact and trip spring thereby providing a reduction in the number of parts with a concomitant saving in production costs. Both the electrical contact spring **48** and the trip spring **50** are made relatively stiff to insure that the breaking action will be substantially instantaneous and that the pre-positioning of the anchor hub **46** will be accurate.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In an electric watch operated by a battery, an oscillating balance staff, a coil carried by said balance staff for oscillation through a magnetic field, means for periodically connecting said coil to said battery comprising a first electrical contact carried by said coil for oscillation therewith, a freely rotatable shaft mounted parallel to said balance staff, a hub mounted on said freely rotatable shaft for rotation therewith, a second electrical spring contact member fixedly mounted at one end to said hub and engageable with said first electrical contact, said hub being provided with a flat surface, a third electrical spring contact member constantly engaging said flat surface on said hub for positioning said second electrical spring contact member in an initial position out of the path of oscillation of said first electrical contact, cam means driven by said balance staff to cause said spring contact member to engage said first electrical contact as said first electrical contact oscillates in a first direction, said cam means being operable only during a portion of the oscillation of said first electrical contact in said first direction, and said third electrical spring contact member being operable through engagement with said flat surface on said hub when said cam means is inoperable to return said second electrical spring contact member to said initial position.

2. In an electric watch operated by a battery, an oscillating balance staff, a coil carried by said balance staff for oscillation through a magnetic field, means for periodically connecting said coil to said battery comprising a first electrical contact carried by said coil for oscillation therewith, a freely rotatable shaft mounted parallel to

said balance staff, a hub mounted on said freely rotatable shaft for rotation therewith, a second electrical spring contact member fixedly mounted at one end to said hub and engageable with said first electrical contact, said hub being provided with a flat surface, a third electrical spring contact member, means for biasing a terminal portion of said third electrical spring contact member constantly into engagement with said flat surface on said hub for positioning said second electrical spring contact member in an initial position out of the path of oscillation of said first electrical contact, cam means driven by said balance staff to cause said spring contact member to engage said first electrical contact as said first electrical contact oscillates in a first direction, said cam means being operable only during a portion of the oscillation of said first electrical contact in said first direction, and said third electrical spring contact member being operable through engagement with said flat surface on said hub when said cam means is inoperable to return said second electrical spring contact member to said initial position.

3. In an electric watch operated by a battery as set out in claim 2 wherein said means for biasing said third electrical spring contact member consists of a rotatable insulated post carrying the end of said third electrical spring contact member opposite said terminal portion and a fixed insulated post contacting said third electrical contact member intermediate its ends.

4. In an electric watch, an oscillatable balance staff, a coil carried by said staff for oscillation through a magnetic field, means for periodically energizing said coil comprising a first electrical contact carried by said staff for oscillation therewith, a freely rotatable shaft mounted parallel to said balance staff, a hub mounted on said shaft, a second electrical spring contact member fixedly mounted at one end to said hub and engageable with said first electrical contact, spring means holding said hub in a rest position wherein said second electrical spring contact member is out of the path of oscillation of said first electrical contact, a cam arm carried by said hub and extending towards said balance staff, cam means carried by said balance staff for engagement with said cam arm when said balance staff rotates in one direction to move said second contact member into engagement with said first contact, said first contact being located a distance from the axis of said balance staff substantially equal to the distance of said second spring contact member from the axis of said shaft, and said cam means being located a distance from said balance staff substantially equal to the distance of said cam arm from the axis of said shaft, whereby said second contact member engages said first contact with substantially constant pressure during the period of contact.

5. An electric watch as defined in claim 4 wherein said cam arm is provided with means for varying the length of time said cam means is in engagement with said cam arm when said balance wheel rotates in said one direction.

6. An electric watch as defined in claim 5 wherein said last-mentioned means comprises a looped portion of said cam arm, whereby said cam arm may be longitudinally adjusted.

7. An electric watch as defined in claim 6 wherein said second electrical spring contact is looped intermediate its ends to permit adjustment of the position of the free end of said spring contact.

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