

## PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) METHOD OF DAMPING CONTACT SPRING

(71) We, TIMEX CORPORATION, a Corporation organized under the laws of the State of Delaware, United States of America, of Waterbury 20, Connecticut, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a contact spring assembly for an electrically driven timepiece, for example an electric watch.

In conventional electric watches, the contact spring vibrates after engaging the contact pin. This vibration is generally undesirable and, to eliminate the possibility of malfunction, the spring must be adjusted extremely accurately and its functional length maintained within close tolerance. In some watch designs, damping of the contact spring is necessary for proper functioning.

It is an object of this invention to provide a new and improved contact spring assembly for a timepiece.

Another object of this invention is to provide a new and improved contact spring assembly for a timepiece wherein a damping means is provided to minimize vibrations of the spring.

According to the invention, there is provided a contact spring assembly for an electrically driven timepiece, comprising: a contoured base of insulating material, an electrically conductive contact-supporting member embedded within the base and extending outwardly therefrom, a contact spring having a free end and being mounted to the contact-supporting member, and a damping material within which a portion of the contact spring is embedded to minimize the vibrations thereof.

In an embodiment a contact spring assembly for an electric watch comprises an elongated contact spring affixed at one end to a base member with the other end free to engage a contact pin on an oscillating balance wheel. A slotted or grooved portion of the base extends outwardly therefrom with

a portion of the contact spring extending through the groove a predetermined distance from the fixed end. The spring portion within the groove is surrounded or potted with a selected damping material to reduce spring vibrations after contact with the contact pin. The damping material can be readily and inexpensively applied in a controlled amount about the spring. This damping reduces time-consuming spring adjustments and the possibility of handling damage. The spring length may also be reduced resulting in a decrease in current consumption and an increase in motor efficiency.

By positioning an intermediate portion of the contact spring in a slotted member and surrounding that portion with a selected damping material, it is possible to dampen the spring in an expeditious and inexpensive manner. Such an arrangement also significantly reduces the required adjustment to the contact spring and reduces the possibility of handling damage which often occurs when the balance wheel is turned manually with the spring caught on the pin or between the jewel and pin.

Some preferred embodiments of the present invention will now be more clearly described by way of example, reference being made to the accompanying drawings wherein:

Figure 1 is a top schematic view of a contact spring assembly according to the invention illustrating the co-operation of the spring with a contact pin mounted on a balance wheel of an electric watch;

Figure 2 is a perspective view of the contact spring assembly; and

Figure 3 shows an alternative mounting arrangement for the contact spring in a contact spring assembly according to the invention.

As shown in Figure 1 of the drawings, an electric watch includes a balance wheel 10 having a substantially annular outer rim 11 and a spoke 12 extending inwardly from the rim 11 and terminating in a yoke portion 13. A balance coil 14 is mounted between arms 16 and 17 of the yoke 13 to co-operate with

fixed magnets (not shown) in the functioning of the electrical circuit for the watch. As the other mechanism of the watch and such electrical circuits may be conventional in construction and operation they will not be described in detail herein.

A contact pin 18 and a contact jewel 19 are also mounted on the yoke 13 near the balance staff axis 21. The contact assembly 20 co-operates with the contact pin 18 and jewel 19 during the oscillation of the balance wheel 10 to complete the electrical circuit and provide an impulse to the balance wheel 10.

The contact assembly 20 includes a contoured base member 22 of a plastics material such as polyester fibre-filled diallyl orthophthalate resin. A contact member 23 comprising a curved metal strip portion 24, an intermediate portion (not shown because it is within the base member 22) and a narrow mounting portion 26 is moulded within the base 22 with the portions 24 and 26 extending outwardly from substantially opposite portions of the base 22. The mounting portion 26 includes an end section 27 which is arranged generally perpendicular to the main body of mounting portion 26 of the member 23 to facilitate attachment of a contact spring 28 thereto.

The spring 28 is mounted to the end section 27 of member 23 by means such as soldering. A protruding portion 29 extends outwardly from the base 22 and includes a slot 31 within which an intermediate section of the spring 28 is held in a damping material 32. The damping material is selected to reduce vibrations of the spring 28 after contact with the contact pin 18 as will be further described below. Suitable damping materials include plastics materials of the urethane family which preferably have a hardness 25-30 (shore A durometer hardness) are durable in that they have long life and resist the cleaning solutions commonly used to clean watches, and possess the necessary elasticity. It is convenient if the damping material is initially a liquid which can readily be deposited within the slot 31 and about the intermediate section of the contact spring 28 and is then cured in place to adhere to the walls of the slot and to the spring to form an integral assembly. An example of a preferred damping material is the material known as "Chem-O-Sol" manufactured by the Chemical Products Corporation of East Providence, Rhode Island. It is to be understood of course that other damping materials having similar properties which would minimize the vibrations of the contact spring 28 may also be satisfactory. Since the slot 31 has an open upper end the spring 28 may be readily potted with the damping material 32. Ideally, the

slot 31 should be spaced as close to the fixed end of spring 28 as possible.

While the invention is illustrated above in one preferred embodiment, other variations may be envisioned within the scope of the present invention. For example, the slot 31 and, in fact, the mounting portion 26 of member 23 may be shaped in a number of suitable configurations. In Figure 3, an end member 35 which is integral with or is rigidly affixed to the main body of mounting portion 26 of the contact member 23 has an upright mounting portion 33 and an inwardly off-set portion 34 defining a U-shaped slot 31 in proximity to the mounting portion 33. The end of the contact spring 28 is affixed to the mounting portion 33 by solder 36 and the spring 28 is potted with the damping material 32 in the slot 31. As a further embodiment, it may be possible to eliminate the base portion 29 of Figure 2 entirely and coat the end portion of spring 28 with plastics in the area of mounting section 27.

In operation of the watch, see Figure 1, the balance wheel 10 oscillates bringing the contact spring 28 into engagement with the contact pin 18. The instant the contact spring 28 touches the contact pin 18, fixed on the balance wheel 10, current flows through the balance drive coil 14. The current induces a magnetic field which opposes the field of a fixed magnet (not shown). The opposition of the magnetic fields imparts an impulse to the balance wheel 10 when the magnet is in place.

The purpose of the contact jewel 19 is to limit the physical contact between the contact pin 18 and the contact spring 28 so that the flow of electrical energy occurs at a precise position during the rotation of the balance. With the present invention the spring 28 can be made shorter than hitherto consonant with still engaging the pin 18 and the jewel 19 since there is little likelihood that no contact will be made due to the vibrations of the spring 28. Shortening the spring lessens the chance of stubbing the tip of the spring 28 on the contact jewel 19. With a shorter spring, there is the possibility of a reduction in current consumption and a gain in motor efficiency.

Damping of the contact spring 28 minimizes the vibrations of the spring after contact with the pin 18/jewel 19 arrangement. With the present invention which includes a damped spring 28, the adjustment of the spring 28 can be less critical and time consuming and the tolerances on its functional length need not be controlled quite so strictly.

#### WHAT WE CLAIM IS:—

1. A contact spring assembly for an electrically driven timepiece, comprising: a con-

fixed magnets (not shown) in the functioning of the electrical circuit for the watch. As the other mechanism of the watch and such electrical circuits may be conventional in construction and operation they will not be described in detail herein.

A contact pin 18 and a contact jewel 19 are also mounted on the yoke 13 near the balance staff axis 21. The contact assembly 20 co-operates with the contact pin 18 and jewel 19 during the oscillation of the balance wheel 10 to complete the electrical circuit and provide an impulse to the balance wheel 10.

The contact assembly 20 includes a contoured base member 22 of a plastics material such as polyester fibre-filled diallyl orthophthalate resin. A contact member 23 comprising a curved metal strip portion 24, an intermediate portion (not shown because it is within the base member 22) and a narrow mounting portion 26 is moulded within the base 22 with the portions 24 and 26 extending outwardly from substantially opposite portions of the base 22. The mounting portion 26 includes an end section 27 which is arranged generally perpendicular to the main body of mounting portion 26 of the member 23 to facilitate attachment of a contact spring 28 thereto.

The spring 28 is mounted to the end section 27 of member 23 by means such as soldering. A protruding portion 29 extends outwardly from the base 22 and includes a slot 31 within which an intermediate section of the spring 28 is held in a damping material 32. The damping material is selected to reduce vibrations of the spring 28 after contact with the contact pin 18 as will be further described below. Suitable damping materials include plastics materials of the urethane family which preferably have a hardness 25-30 (shore A durometer hardness) are durable in that they have long life and resist the cleaning solutions commonly used to clean watches, and possess the necessary elasticity. It is convenient if the damping material is initially a liquid which can readily be deposited within the slot 31 and about the intermediate section of the contact spring 28 and is then cured in place to adhere to the walls of the slot and to the spring to form an integral assembly. An example of a preferred damping material is the material known as "Chem-O-Sol" manufactured by the Chemical Products Corporation of East Providence, Rhode Island. It is to be understood of course that other damping materials having similar properties which would minimize the vibrations of the contact spring 28 may also be satisfactory. Since the slot 31 has an open upper end the spring 28 may be readily potted with the damping material 32. Ideally, the

slot 31 should be spaced as close to the fixed end of spring 28 as possible.

While the invention is illustrated above in one preferred embodiment, other variations may be envisioned within the scope of the present invention. For example, the slot 31 and, in fact, the mounting portion 26 of member 23 may be shaped in a number of suitable configurations. In Figure 3, an end member 35 which is integral with or is rigidly affixed to the main body of mounting portion 26 of the contact member 23 has an upright mounting portion 33 and an inwardly off-set portion 34 defining a U-shaped slot 31 in proximity to the mounting portion 33. The end of the contact spring 28 is affixed to the mounting portion 33 by solder 36 and the spring 28 is potted with the damping material 32 in the slot 31. As a further embodiment, it may be possible to eliminate the base portion 29 of Figure 2 entirely and coat the end portion of spring 28 with plastics in the area of mounting section 27.

In operation of the watch, see Figure 1, the balance wheel 10 oscillates bringing the contact spring 28 into engagement with the contact pin 18. The instant the contact spring 28 touches the contact pin 18, fixed on the balance wheel 10, current flows through the balance drive coil 14. The current induces a magnetic field which opposes the field of a fixed magnet (not shown). The opposition of the magnetic fields imparts an impulse to the balance wheel 10 when the magnet is in place.

The purpose of the contact jewel 19 is to limit the physical contact between the contact pin 18 and the contact spring 28 so that the flow of electrical energy occurs at a precise position during the rotation of the balance. With the present invention the spring 28 can be made shorter than hitherto consonant with still engaging the pin 18 and the jewel 19 since there is little likelihood that no contact will be made due to the vibrations of the spring 28. Shortening the spring lessens the chance of stubbing the tip of the spring 28 on the contact jewel 19. With a shorter spring, there is the possibility of a reduction in current consumption and a gain in motor efficiency.

Damping of the contact spring 28 minimizes the vibrations of the spring after contact with the pin 18/jewel 19 arrangement. With the present invention which includes a damped spring 28, the adjustment of the spring 28 can be less critical and time consuming and the tolerances on its functional length need not be controlled quite so strictly.

#### WHAT WE CLAIM IS:—

1. A contact spring assembly for an electrically driven timepiece, comprising: a con-



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- toured base of insulating material, an electrically conductive contact-supporting member embedded within the base and extending outwardly therefrom, a contact spring having a free end and being mounted to the contact-supporting member, and a damping material within which a portion of the contact spring is embedded to minimize the vibrations thereof.
2. A contact spring assembly in accordance with Claim 1 wherein the base includes an outwardly projecting portion having a slot formed therein, said contact spring extends through the slot and the damping material is arranged within the slot.
3. A contact spring assembly in accordance with Claim 2, wherein the contact-supporting member includes a relatively narrow body portion and an end portion extending at an angle thereto to facilitate mounting of one end of the contact spring, and the projecting portion of the base is spaced in close proximity to the contact-supporting member to dampen the spring near the said one end thereof.
4. A contact spring assembly in accordance with Claim 1, wherein the contact-supporting member includes a body portion and an end portion comprising a mounting portion and a slotted portion, the contact spring is affixed to the mounting portion and the damping material is arranged in the slotted portion.
5. A contact spring assembly in accordance with Claim 4, wherein the slotted portion is off-set relative to the mounting portion and said slotted portion being in close proximity to the mounting portion.
6. A contact spring assembly in accordance with any one of claims 2 to 5, wherein the damping material adheres to both the walls of the slot and the contact spring to form an integral assembly, said material being readily deposited within said slot and about the contact spring.
7. A contact spring assembly in accordance with claim 1, wherein the damping material comprises a coating of a plastics material about one end of the contact spring, said end being mounted to the contact-supporting member.
8. A contact spring assembly for an electrically driven timepiece constructed, arranged and adapted to operate substantially as hereinbefore described with reference to Figures 1 and 2 or Figure 3 of the accompanying drawings.
9. An electric watch incorporating the contact spring assembly in accordance with any one of the preceding claims.

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