United States Patent [19]

Shimizu

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[45] **Apr. 16, 1974**

[54] **DIAL FOR WRIST WATCH AND A METHOD OF MAKING THE SAME**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **58/127 B,** 58/127 R

[51] **Int. Cl.** **G04b 29/00**

[58] **Field of Search** ..... 58/127 R, 127 B, 126 R, 58/126 A; 29/177, 470.1

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Assistant Examiner—U. Weldon

[57] **ABSTRACT**

A dial for a wrist watch comprises a dial body formed of a flat plate of aluminum and rivet like pin members made of aluminum material and for securing supporting the dial plate body to a time-keeping mechanism. The head portion of each pin member is formed so as to fit into a recess formed on the reverse surface of the body and being integrally fixed to the recess by means of ultrasonic wave welding. Also, a method of making the dial for the wrist watch is characterized in that when the head portion of the pin member is joined to the recess, a chip of the ultrasonic wave welding machine is pressure bonded to the head portion to provide the ultrasonic wave vibration so as to integrally join the head portion to the recess.

2 Claims, 13 Drawing Figures

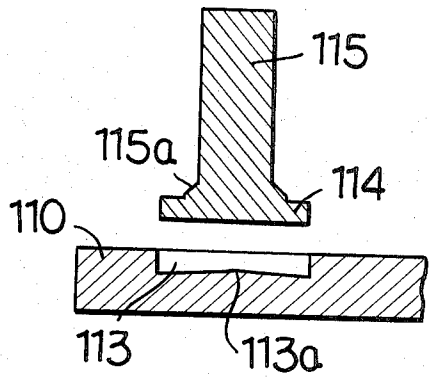


Fig - 1

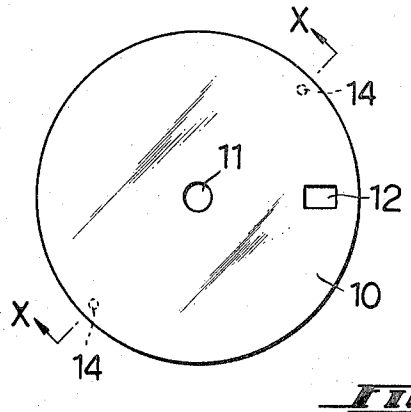


Fig - 2

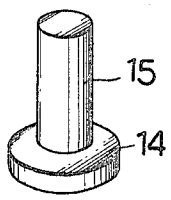


Fig - 3

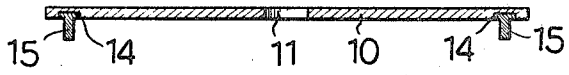


Fig - 4

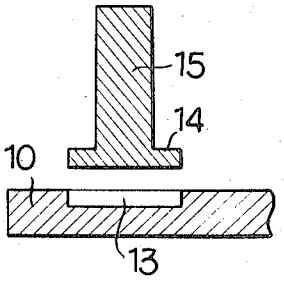
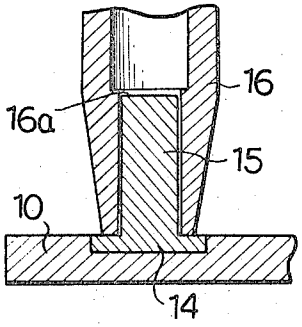


Fig - 5



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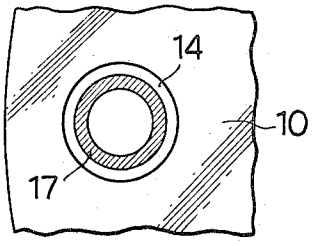

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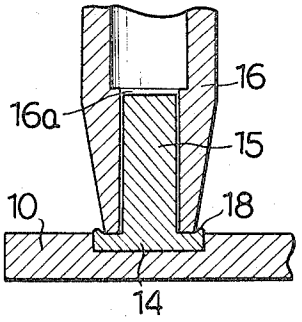


Fig - 8

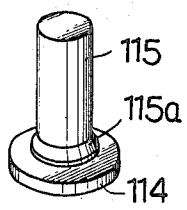


Fig - 9

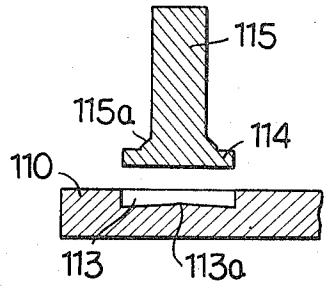


Fig - 10

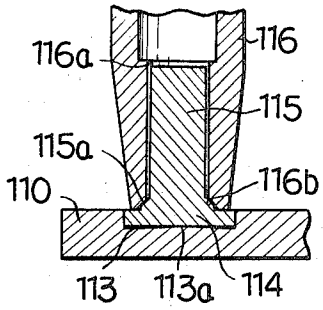


Fig 11

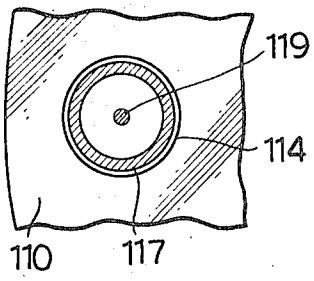


Fig 12

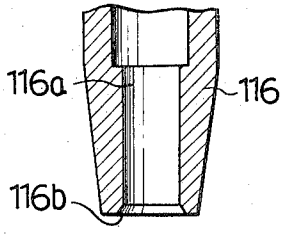
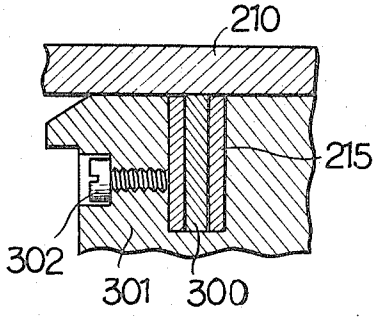


Fig - 13



DIAL FOR WRIST WATCH AND A METHOD OF MAKING THE SAME

SUMMARY OF INVENTION:

The present invention relates to a dial structure for a wrist watch and to a method of making the same, and more particularly to a dial that is provided with a pin for securing the dial to a time-keeping mechanism and a method of joining the pin to the dial.

According to the broad concept of the present invention, the dial for the wrist watch comprises a dial body and a pin bonded to its reverse surface. The pin is inserted into a hole formed in the time-keeping mechanism and a set screw is urged against the pin in a right angle direction whereby the dial is fixed on the upper surface of the time-keeping mechanism.

The conventional dial is made of brass and a hollow pin in bonded by means of a soldering means. Thus the pin is soldered on the dial by soldering; for example, silver solder is sealed inside of the hollow pin and this pin is tack welded to the dial by spot welding. Thereafter the silver solder is melted by a burner or furnace, and the joint is formed by the application of the silver solder.

However, according to this welding method, there are disadvantages that not only involve the troublesome work of performing tack welding prior to the soldering, and also a substantial high degree technique is required. Further, there is considerable difficulty involved even if the pin is tack welded to the dial body nickel, The pin can easily be bent due to the high temperature heating action of the furnace or burner when the dial is fixed to the time-keeping mechanism, the bent pin obviously must be straightened. Further more, at the time of welding, the silver solder and flux flow as an integral body which leaves a convex mark on the periphery of the welded portion, and such a convex mark poses a problem when the dial is fixed to the time-keeping mechanism.

Also, the brass which is the material of the conventional dial has disadvantages such as it is more expensive than aluminum, its weight is heavier and also it has the difficulty of requiring forming work or surface treating and the like. Also, when the dial making involves electroplating with nickel, cyanide is used which is poisonous and which therefore is potentially harmful to the human body. Also, the residue therefrom may eventually flow to rivers which will become a public hazard.

On the other hand, heretofore, use of aluminum as the material in constructing the dial has been attempted. Even though the welding technique of aluminum is advanced, there is a distinct disadvantage that the strength of the dial is reduced during such process. The present status of the art is that efforts of making an aluminum dial of a high precision as a time-keeper part by a practical method has been unsuccessful. Additional disadvantages of this process are enumerated in the following; (1) when the pin is joined to the dial body by means of soldering, a convex mark is produced on the periphery of the welded portion as mentioned in the foregoing; (2) since the dial body is to be of a thin wall thickness and its volume is to be small, its structure and material necessarily become annealed by the heating action of soldering which results in a substantial remarkable loss of strength, and returning it to its original strength is difficult; (3) although the foregoing disadvantage (2) can be eliminated if aluminum solder that melts at low temperature is used, in such a process alumite is formed and the aluminum solder and flux are not highly resistant to chemicals also erosion may occur and the joint portion of the pin tends to separate.

When aluminum is used as the material for the dial for the wrist watch, the foregoing disadvantages can be overcome. Further many advantages can be obtained with a dial made of aluminum as compared with the conventional dial made of brass. Some examples are (1) the dial can be made of a light weight; (2) the post or succeeding processing or treatment such as forming, surface coating and printing and the like can be easily performed; (3) desirable designs can be provided and (4) the dial can be constructed at low cost.

Under the circumstances as outlined above, the present inventor has confirmed, as a result of energetical studies, a method of making the dial for wrist watch method made of aluminum material which is free completely from the foregoing disadvantages.

The present invention is characterized in that the dial body is formed of aluminum material a recess is formed at a predetermined position on the body; a rivet like pin member is formed of aluminum or similar material; a head portion of the pin member fits into the recess; and the head portion and the recess are joined by the welding energy of an ultrasonic wave.

BRIEF DESCRIPTION OF DRAWINGS:

FIGS. 2 through 6 and FIGS. 8 through 12 show first and second embodiments, respectively, of the present invention;

FIG. 1 is a top plan view of the dial body;

FIG. 2 is a perspective view of the first embodiment of the pin;

FIG. 3 is an enlarged cross sectional view taken along line X — X of FIG. 1.

FIGS. 4 and 9 are cross sectional views of the dial and the pin before the pin is welded;

FIGS. 5 and 10 are cross sectional views of the condition where the pin is welded to the dial by the chip of the ultrasonic wave welding machine;

FIGS. 6 and 11 are bottom plan views, partially in section, of the dial body and the pin integrally welded together;

FIG. 7 is a cross sectional view showing one adverse example where the pin is welded to the dial body by the chip of the ultrasonic wave welding machine;

FIG. 8 is a perspective view of the second embodiment of the pin;

FIG. 12 is a cross sectional view of the chip used for welding the pin of the second embodiment to the dial plate; and

FIG. 13 is a cross sectional view of a structural arrangement wherein the dial is welded by the conventional method to the pin and the dial-pin unit is fixed to the time-keeping mechanism.

PREFERRED EMBODIMENT OF THE INVENTION:

Referring now to the accompanying drawings, two preferred embodiments of the invention will be described in detail with specific reference to FIGS. 2–6 and FIGS. 8–12, respectively. In FIG. 1, a circular flat dial plate 10 is provided with a circular center hole 11

and a rectangular aperture **12.** As shown in FIG. **3** and FIG. **4,** a circular recess **13** is formed in the vicinity of the periphery of the reverse surface of the dial body **10.** The recess **13** is formed by measuring a predetermined position on the dial with the use of a jig for accurately positioning and by boring the recess with an endmill or dia. The pin **15** and the dial body **10** are secured to a time-keeping mechanism. The pin **15** is formed with a rivet like shape as shown in FIG. **2** is integrally provided with a head portion **14** of a flat circular shape, and is made of aluminum or similar material. The diameter of the head portion **14** is slightly smaller than the diameter of the recess **13,** and also its wall thickness is equal to the depth of the recess **13** or is slightly shallower than the depth.

As shown in FIG. **5,** in order to weld the pin **15** to the dial body **10,** after fitting the head portion **14** to the recess **13,** a hollow portion **16***a* of the chip **16** of the ultrasonic wave welding machine is inserted to operatively contact the pin **15.** The tip portion of the chip **16** is operatively urged against the head portion **14,** by the ultrasonic wave oscillation being applied thereto When the oscillation is applied, the recess **13** and the head portion **14** are thereby welded integrally by the welding energy of the ultrasonic wave.

Since the pin **15** that is welded to the dial body **10** is employed for securing the dial to the time-keeping mechanism, it is required to have a high tensile strength and bending strength.

According to end results of an experiment conducted by the present inventor, a thickness of the head portion **14** was made 0.18 mm, its diameter was 0.9 mm, a diameter of the pin **15** was 0.65 mm,; the pressure of the chip **16** for the head portion **14** was **5** kg, and its pressure contact time was 0.25 sec., the current of the ultrasonic wave welding machine was 2.5A, and the ultrasonic wave welding machine whose oscillating frequency was 19.5 $\pm$ KH_2 was used; the pin **15** whose recess **13** was welded to the head portion **14** could withstand the tensile strength of **6** kg and also could withstand the bending strength (angle of 20°) of **15** times in the right and left directions or forward and backward directions, and such tensile strength and the bending strength having such values to substantially surpasses the tensile strength and bending strength ordinarily required for welding of the the pin to the dial plate body.

In the present invention, the saliant features are that, as mentioned in the foregoing, the recess **13** being provided in the dial plate body **10,** the head portion **14** of the pin **15** being fitted and ultrasonically welded into the recess **13** whereby the joint surface of both elements can be made larger thus stronger. Also, with the foregoing arrangement, when the above-mentioned joining is made, there are advantages in that the erection of the pin **15** on the surface of the dial body **10** and the application of the pressure of the chip **16** to the pin **15** become extremely easy.

FIG. **6** illustrates the joining structure of **13** and the head portion **14.** It can be recognized that a welded portion **17** is formed in ring shape and the reason for such form is that the tip portion of the chip **16** is formed in ring shape and thusly is made to correspond to the portion that is that to be urged against. The pressure contacting portion produces a strong abrading action as compared with the other portion. In order to join not only the ring like welding portion **17** but also the other portion, it may be considered that the pressure of the chip **16** against the head portion **14** can be made greater and its pressure contacting time can be prolonged. However the pressure and the pressure contacting time should not exceed certain maximum values. As shown in FIG. **7,** there in such a situation, there is a possible adverse effect in that a bulged portion **18** can be formed on the periphery of the head portion **14.** The bulged portion **18** becomes an obstacle in the case where the dial plate body **10** is fixed to the time-keeping mechanism. Also the convex mark whose shape can be similar to the head portion **14** is produced on the surface of the dial plate body **10,** or the concave portion **13** is broken and the finish of the surface of the dial plate **10** becomes deteriorated.

As shown in FIG. **8,** the pin **115** is provided with an enlarged diameter tapered neck portion **115**a at the joint of the stem portion and the head portion **114.** This enlarged neck portion does not become a problem when the dial body **110** is fixed to the time-keeping mechanism. The neck portion **115**a plays a role of preventing the shearing off the pin **115** from the stem portion of the pin **115** from the head portion **114** when the force of a fixed tensile and/or bending strength is applied to the pin **115.** Namely, when the pin **115** is being welded to the dial body **10** the stem portion of the pin **115** may be sheared off from the head portion **114** when the an excess tensile and/or the bending force is applied to the pin **115.** However, with the pin **115** being an enlarged provided with neck portion **115**a at its stem portion, there is a substantial increase in the tensile strength and bending strength as compared with the arrangement where the pin which is not provided the enlarged neck portion **115***a.*

Also, as shown in FIG. **9** and FIG. **10,** the dial body **110** is provided with a different shaped surface in the recess, according to the second embodiment. A recess **113** is provided with a surface **113**a whose center or medial section is elevated and is tapered from the medial section to the periphery of the recess. The projecting surface **113**a produces abrading action that is necessary for its joining to the center surface of the head portion **114.** Therefore when the required tensile and/or bending force is applied to the pin **115,** it plays a role of preventing the shearing off of the head portion **114** from the concave portion **113.** Namely, as described previously, the head portion **14** for the recess **13** may be sheared off from the recess **13** when an excess tensile and/or bending force is applied to the pin as the ring like portion **17** along is being integrally welded thereto. Where the recess **113** is provided with the surface **113**a the necessary abrading action is produced on recess **113** and the center surface of the head portion **114** when the tip portion of the chip **116** is pressure contacted with the head portion **114.** Therefore, as shown in FIG. **11,** in addition to a welded portion **117,** the welded portion **119** is formed on the center surface. As a result, the tensile and/or bending strength for the pin **115** becomes remarkably improved as compared with a recess that has not been provided with the projecting surface **113***a.*

In the present invention, the head portion **114** of the pin **115** being provided with an enlarged neck portion **115***a* can be welded to the recess **113.** Also, the head portion of the pin **115** can be welded to the recess **113** that is provided with the surface **113**a. Therefore, vari-

ous structural arrangements of the elements can be effected.

As shown in FIG. **10** and **12**, the chip **116** has a structure which is substantially identical with that of the chip **16**, with the exception that a tapered expanded portion **116**b is provided at the tip of the hole whose shape is adapted to engage with the enlarged neck portion **115**a.

In FIG. **13**, the conventional dial **210** is provided with a pin **215**. The pin **215** is made with a hollow shape, and inside thereof is sealed with silver solder **300**. The pin **215** is welded to the dial **210** by means of the silver solder **300** the disadvantage of which has already been explained. The dial **210** having been mounted in contact with pin **215**, as shown in FIG. **13**, is then inserted in a time-keeping mechanism **301**. A set screw **302** is pressure contacted with the pin **215** at right angles from the lateral direction whereby the pin is fixed to the time-keeping mechanism **301**.

It is to be noted in the present invention that the dial bodies **10** and **110** may be made of an alloy whose principal component is aluminum which alloy can be welded by ultrasonic welding. Also instead of providing the tapered surface **113***a* on the recess **113**, a portion whose shape is similar to the tapered surface **113***a* may be provided on the center surface of the head portion **114**. Also, the present invention is not to be limited to the numerical values described in the foregoing description.

What is claimed is:

1. A dial structure for a wrist watch comprising in combination:

a dial body formed of a flat plate of aluminum and having front and rear surfaces, said dial body having a plurality of circular recesses positioned on its rear surface adjacent the periphery thereof, each of said recesses having an inner surface continuously tapering from an elevated medial section to the periphery thereof; and

a plurality of circular rivet like pin members, each of said pin members formed of an aluminum material and having elongated stem and flat head portions, said stem portion integrally joined with said flat head portion and adapted to engage with a time keeping mechanism, said stem portion having an enlarged neck portion at the joint of said stem portion and said flat head portion, said enlarged tapered neck portion adapted to engage with an ultrasonic welding machine, said flat head portion of each of said pin members fixedly joining in a perpendicular manner with said elevated medial section of each of said inner surfaces of said recesses, respectively, of said dial body, said joint between said flat head portion and said elevated medial section adapted to be accomplished by the welding of said ultrasonic welding machine.

2. A dial structure for a wrist watch according to claim **5**, wherein said enlarged neck portion tapers from a large cross sectional area at the joining peripheral line to a smaller cross sectional area a short distance from said joining peripheral line and said smaller cross sectional area at the connecting peripheral line between said neck portion and the body of said stem portion is substantially equal to the cross sectional area of the body of said stem portion.

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