July 14, 1959 W. J. GINGRICH 2,894,367

EPOXY RESIN CAST BALANCE WHEEL

Filed Feb. 8, 1954

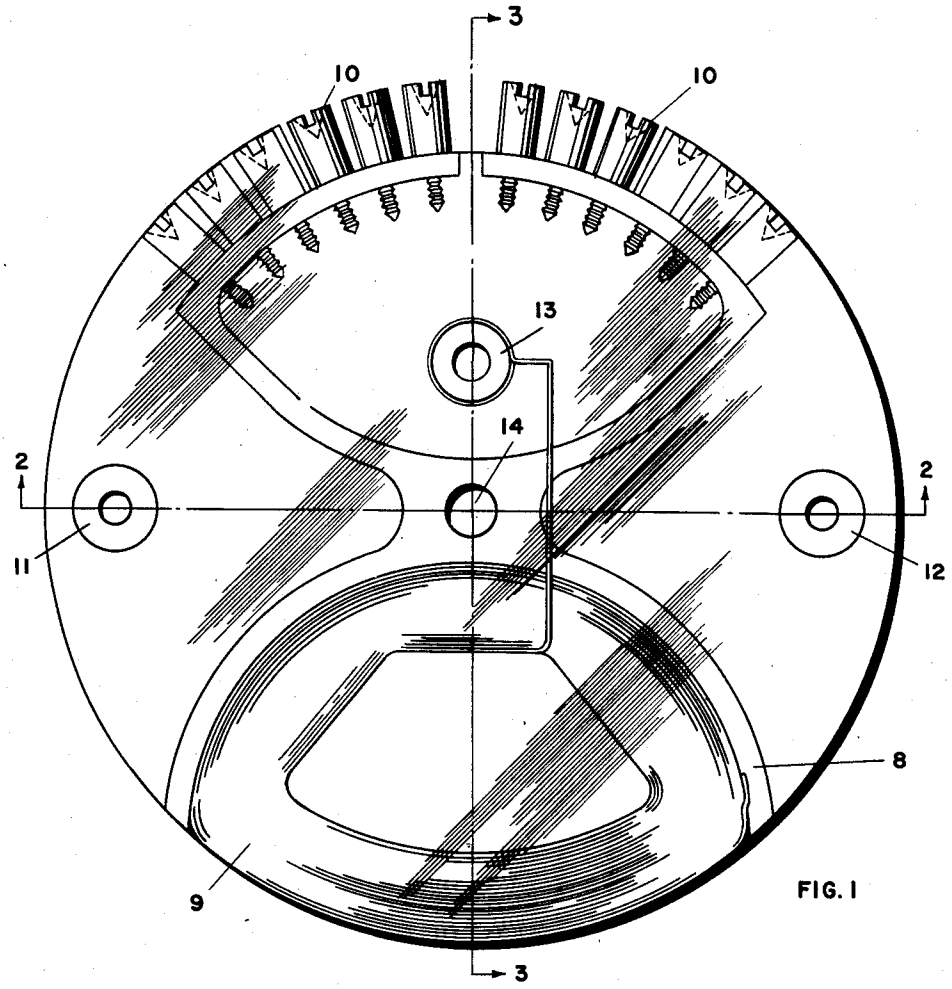


FIG. 1



FIG. 2



FIG. 3

INVENTOR

WILMER J. GINGRICH

BY W. W. Gould

ATTORNEY

United States Patent Office 2,894,367 Patented July 14, 1959

2,894,367

EPOXY RESIN CAST BALANCE WHEEL

Wilmer J. Gingrich, Lancaster, Pa., assignor to Hamilton Watch Company, Lancaster, Pa.

Application February 8, 1954, Serial No. 408,695

3 Claims. (Cl. 58—28)

This invention relates to the use of an epoxy type resin to cast a balance wheel for an electric watch.

In the development of the electric watch it has been found necessary to have a movable coil formed of extremely fine wire and to mount this coil on the balance wheel. Because the balance wheel of a watch requires handling many times in the manufacture of the watch and later in the cleaning and adjusting of the watch, it is necessary to protect the coil against the slightest abrasion which would rub the insulation from the extremely fine wire and render the coil inoperative.

The object of the present invention is to demonstrate the use of a particular type of resin for casting the balance wheel.

It is a further object of the present invention to show that certain characteristics, such as the ability to control shrinkage during the casting operation, the need of being able to pour without undue heating and the absence of cold flow after the casting process, are desirable.

It is a further object of the present invention to show that it is necessary to have a casting resin which is tough but sufficiently stable to hold its shape and to be resistant to the ordinary cleaning fluids used in cleaning a watch, as well as being a dielectric insulator and resistant to the oil which is used to lubricate watches.

The invention is shown in the accompanying drawing in which:

Figure 1 is a top plan view of the cast balance wheel.

Figure 2 is a cross section on line 2—2 of Figure 1.

Figure 3 is a cross section on line 3—3 of Figure 1.

In an electric watch having oscillating coil, the more turns of wire the coil carries the more efficient the watch motor is. To make a great number of turns it is necessary to use an extremely fine wire of a size .0008 inch in diameter. This wire must be protected against any handling whatsoever after having been once set in place, and a balance wheel was designed having an hour glass metallic body 8 in which a coil 9 is held at one end of the body and a series of balance screws 10 carried at the other end of the body.

In the mold, pins (not shown) are positioned so that poising washers 11 and 12 may be set in position. Nut 13 and center hole 14 are also positioned over pins to locate the nut and the hour glass shaped body in the mold.

An epoxy type casting resin such as Scotch Cast—Resin #2, a product of the Minnesota Mining and Manufacturing Company, is used in this particular instance and to it is added an accelerator to polymerize the resin. The manufacture of epoxy resins of this type is discussed in detail in Greenlee Patents Nos. 2,615,007 and 2,615,008.

Also is added a filler consisting of a 325 mesh fused quartz powder selected because the linear coefficient of expansion is extremely small. The mixture of resin, accelerator and filler is poured into a mold at room temperature. The curing process takes place without pressure and the resulting product is tough but sufficiently stable to hold shape.

The epoxy type resin is used and after many trials found to be the only resin which will meet the qualifications desired because the resin is 100% solids containing no solvent. It has been found with experimentation that with any resin containing a solvent it is impossible to control the shrinkage during the casting operation. In the casting of the balance wheel, a diameter of .556 inch must be maintained holding a tolerance to less than .001 of an inch. In the making of a watch balance, this diameter is extremely critical and experimentation has shown that this type of resin is one type which may be cast within the allowable shrinkage.

Experimentation further shows that the resin is one of the few that pours at room temperature, that is polymerized by the addition of an accelerator and needs no pressure or heat during the casting operation. This makes it possible to measure the exact amount, by weight, needed to make a balance wheel. Again the weight of the balance wheel of a small watch is extremely critical and must be maintained to certain small fractions.

A filler consisting of 325 mesh fused quartz powder is added. This filler is selected because the linear coefficient of expansion of the quartz powder is extremely small and the need of very little expansion in the balance wheel of a watch is another critical factor.

The epoxy type casting resin with the addition of the filler is one which shows no cold flow after curing. The resistance of the cast balance wheel to cleaning fluids such as acetone, naphtha, trichloroethylene, carbon tetrachloride, alcohol and alkaline cleaners, and its dielectric properties make it the one material which may be used to produce a satisfactory cast balance wheel for an electric watch.

What is claimed is:

1. A balance wheel for an electric watch comprising a skeleton body, an electric coil positioned within said skeleton body, and a molded portion of solid epoxy resin encasing said skeleton body and said electric coil, said solid epoxy resin portion being integrally bonded to said skeleton body and said electric coil.

2. A balance wheel according to claim 1 wherein said solid epoxy resin portion includes a filler consisting of fused quartz powder.

3. A balance wheel for an electric watch including an outer portion of solid epoxy resin, a skeleton body and an electric coil positioned within said outer portion and integrally bonded thereto.

References Cited in the file of this patent

UNITED STATES PATENTS

2,577,703	Fillinger	Dec. 4, 1951
2,585,115	Greenlee	Feb. 12, 1952
2,602,785	Wiles et al.	July 8, 1952

OTHER REFERENCES

"Ethoxylines," appearing on pp. 85–88 of the November 1950, issue of Modern Plastics.