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INDEXING MECHANISM FOR A BATTERY OPERATED ELECTRIC WATCH

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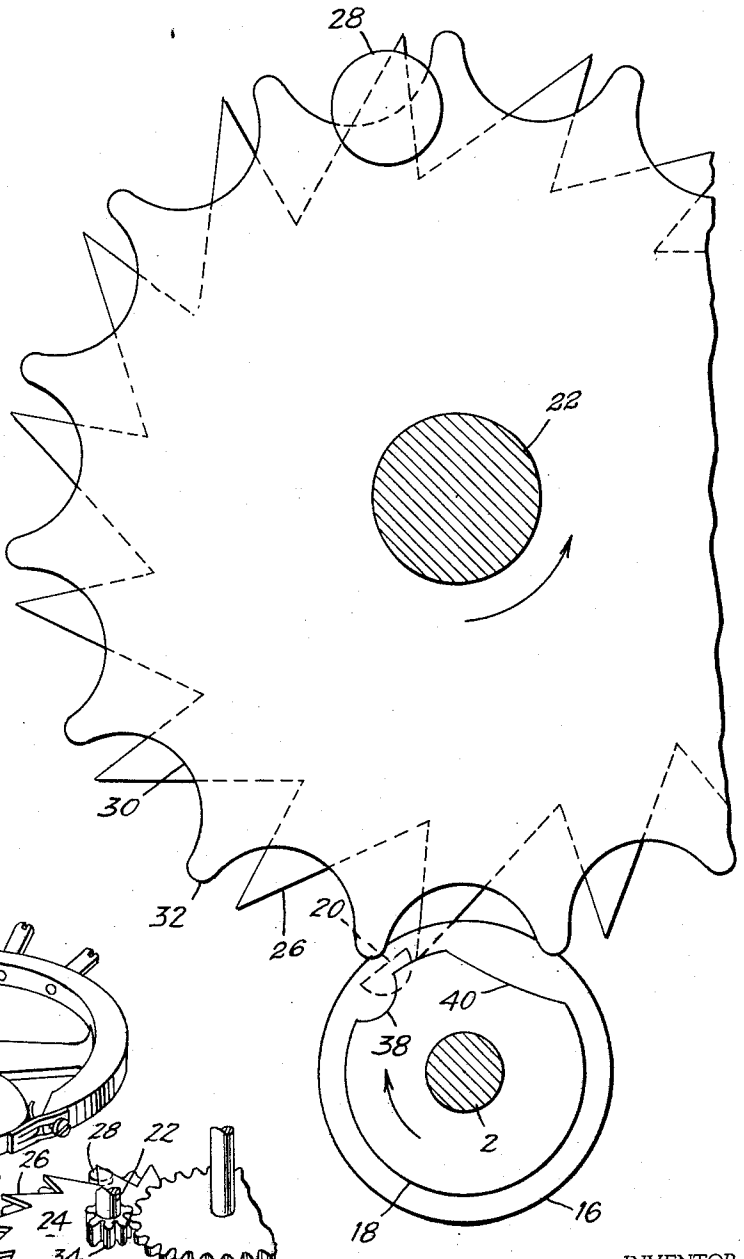


Fig. 2

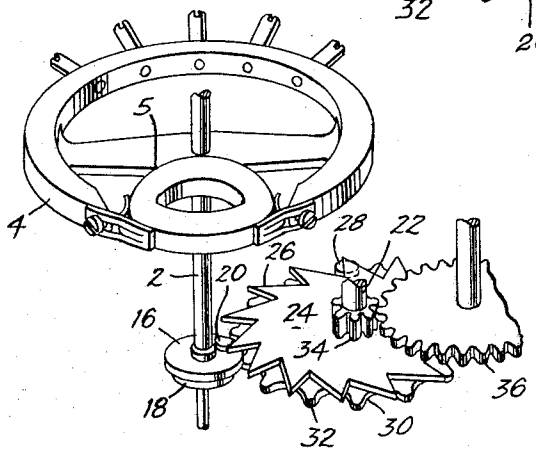


Fig. 1

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INDEXING MECHANISM FOR A BATTERY OPERATED ELECTRIC WATCH

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This invention relates to battery operated electric watches and more particularly relates to an improved double index prevention device for use in such watches.

In certain types of battery powered electric watches now in use, an index roller is mounted on the balance shaft and carries an index jewel which engages the teeth of the index wheel upon rotation of the balance staff. An indexing magnet is commonly provided to detent the index wheel when it has rotated one tooth in the forward direction. In this type of watch, it is often difficult to assure that the index wheel advances only one tooth. In some cases, the magnitude of the energy imparted to the index wheel causes the index wheel to be carried past its first opportunity to detent while, in other cases, accidental indexing in either direction can be caused by shock.

According to the present invention, it has now been found that it is possible to limit the rotation of the index wheel to one tooth in the forward direction for each oscillation of the balance staff by providing the balance staff with a safety roller that interacts with a safety wheel mounted coaxially with the index wheel in a unique fashion to prevent double indexing.

It is therefore an object of the present invention to provide an electric watch in which double indexing is prevented.

It is another object of the present invention to provide a novel safety roller and safety wheel structure that will prevent double indexing in an electric watch.

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

FIGURE 1 is a perspective view of the indexing system of the present invention; and

FIGURE 2 is a partial bottom view of the apparatus shown in FIGURE 1.

Referring to FIGURE 1, a balance staff 2 carrying a balance wheel 4 is mounted for oscillatory motion in any well known manner in an electric watch. For this purpose, the balance wheel 4 may be provided with a coil 5 adapted to cooperate with fixed magnets. Also mounted on the balance staff is an index roller 16 and a safety roller 18. An index jewel 20 of any desired configuration is mounted on the index roller 16.

An index shaft 22 is mounted in any suitable fashion adjacent to the balance staff 2. An index wheel 24 is mounted on the index staff 22 and is provided with a number of saw-tooth teeth 26. An indexing magnet 28 is provided in a known manner and cooperates with the teeth 26 to act as a detent for the index wheel 24. Also mounted on the index shaft is a safety wheel 30. The wheel 30 is provided on its periphery with a number of symmetrical scalloped teeth 32 which cooperate with the safety roller 18 in a manner to be more fully explained below. An index pinion 34 is also mounted on the index staff and meshes with the first gear 36 of the watch train. Although the index magnet of the perferred embodiment cooperates with the teeth of the index wheel, it may, if desired, be made to cooperate with this safety wheel.

The safety roller 18 is provided with a forward passing hollow 38 (FIGURE 2) which provides a clearance

for the upcoming tooth of the safety wheel when the safety wheel is caused to rotate by rotation of the index shaft. In the preferred embodiment, this forward passing hollow takes the form of an arcuate indentation in the periphery of the safety roller 18 so as to cooperate with the rounded teeth 32 of the safety wheel 30. The teeth of the safety wheel and the forward passing hollow in the safety roller may take any form desired so long as the forward passing hollow 38 allows one of the teeth 32 to clear the safety roller 18 as the safety wheel is rotated.

The safety roller 18 is also provided with a reverse clearance hollow 40. In the embodiment shown, this reverse clearance hollow takes the form of a second arcuate indentation on the periphery of the safety roller 18, this second arcuate indentation having a much greater radius than that provided for the forward passing hollow and covering a greater part of the periphery of the wheel than does the forward passing hollow. As is the case with the forward passing hollow, the reverse clearance hollow may take any form adapted to allow the safety wheel to reverse slightly, as described more fully below.

In the operation of the system shown in FIGURE 1, as the balance staff 2 swings in the counterclockwise direction, the index jewel 20 mounted on the index roller 16 contacts the lagging edge of one of the teeth 26 of the index wheel 24. As the index roller continues to rotate in a counterclockwise direction, the index jewel causes the index wheel to rotate in a clockwise direction. The rotation of the index wheel causes the entire index assembly, including the safety wheel, index staff and index pinion to also rotate in a clockwise direction.

As the index jewel advances the index wheel, the forward passing hollow 38 allows passage of only one safety wheel tooth 32. The index magnet 28 then exerts a detenting force on one of the teeth of the index wheel. In the event that the kinetic energy imparted to the index wheel by the index jewel is so great that the index wheel is carried past its first opportunity to detent, the next upcoming tooth on the safety wheel will collide with the periphery of the safety roller, thus bouncing the index wheel assembly back into proper relationship with the detenting magnet.

When the balance staff rotates in the clockwise direction, the index jewel 20 will contact the leading edge of a tooth 26 of the index wheel and while sliding along this leading edge will cause the index wheel to rotate slightly in the counterclockwise direction against the force of the index magnet. As the index wheel is backed up in this manner, the reverse clearance hollow 40 in the safety roller allows the safety wheel tooth to similarly back up without striking the periphery of the safety roller. The index jewel then slides clear of the tooth 26 and the index magnet snaps the index wheel back to its detented position.

As a result of the operation of the system described above, an electric watch can be provided in which double indexing is prevented by the simple addition of a uniquely constructed safety roller and safety wheel which cooperate to prevent more than one tooth of the index wheel from advancing per passage of the balance wheel past dead center in the forward direction. The system also acts effectively to prevent accidental indexing caused by shock in either the forward or reverse direction.

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. A mechanical double index prevention device for use in an electric watch comprising an oscillating balance staff, an index roller carried by said balance staff, an index jewel mounted on said index roller, a safety roller mounted on said balance staff, said safety roller being provided with a first and second peripheral indentation, a rotatable index assembly, said index assembly including an index wheel having a plurality of teeth on its periphery and a safety wheel having a plurality of teeth on its periphery, said index jewel engaging with the teeth of said index wheel to cause rotation of said index assembly in a first direction when said balance staff rotates in one direction, said first peripheral indentation of said safety roller engaging the teeth of said safety wheel to limit rotation of said index assembly in said first direction, said second peripheral indentation of said safety roller allowing a limited rotation of said index assembly in a second direction when said balance staff rotates in an opposite direction.

2. The apparatus of claim 1 wherein said first indentation is arcuate and said teeth of said safety wheel are symmetrical.

3. The apparatus of claim 2 wherein said second indentation is arcuate, said second arcuate indentation having a radius larger than said first arcuate indentation.

4. A mechanical double index prevention device for use in an electric watch comprising an oscillating balance staff, an index roller carried by said balance staff, an index jewel mounted on said index roller, a safety roller mounted on said balance staff, a first arcuate indentation located on the periphery of said safety roller, a second arcuate indentation located on the periphery of said safety roller, said second indentation having a radius larger than said first arcuate indentation, a rotatable index staff, a first wheel having a plurality of teeth on its periphery carried by said index shaft, a second wheel

having a plurality of teeth on its periphery carried by said index shaft, an indexing magnet, said indexing magnet cooperating with the teeth of said first wheel to act as a detent for said rotatable index staff, said index jewel engaging the teeth of said first wheel for moving said rotatable index staff in step by step rotation in a first direction, said teeth of said second wheel engaging said first arcuate indentation for limiting rotation of said rotatable index staff in said first direction, said teeth of said second wheel engaging said second arcuate indentation for limiting rotation of said rotatable index staff in a second direction as said balance staff rotates in an opposite direction.

5. The apparatus of claim 4 wherein the teeth of said first wheel are of the saw-tooth type and said teeth of said second wheel are of the symmetrical scolloped type.

6. The apparatus of claim 5 wherein the outside diameter of said first and said second wheel are equal.

7. In an electric watch having an oscillating balance staff and a rotatable index staff, driving indexing means on said balance staff, driven indexing means on said index staff, said driving indexing means on said balance staff cooperating with said driven indexing means on said index staff to impart step-by-step rotation in one direction to said index staff as said balance staff oscillates, a wheel having a plurality of teeth on its periphery carried by said index staff, a roller mounted on said balance staff, said roller having a first peripheral indentation and a second peripheral indentation, said first indentation cooperating with said teeth for allowing limited rotation of said wheel in a first direction, said second indentation cooperating with said teeth for allowing limited rotation of said wheel in a second direction.

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