Sept. 24, 1963 P. WUTHRICH 3,104,517

PLANETARY GEAR WINDING MECHANISM

Filed Jan. 29, 1962 4 Sheets-Sheet 1

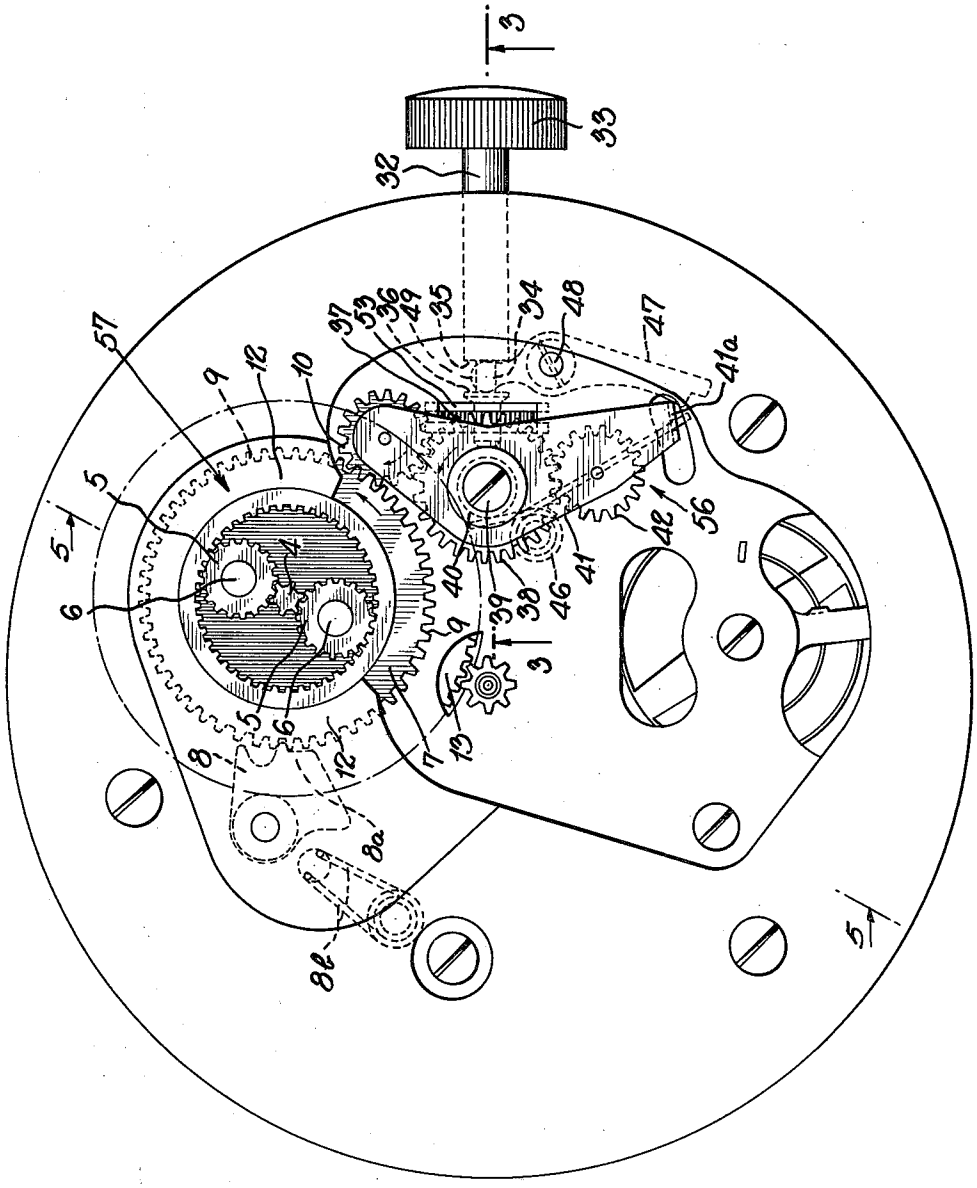

Fig. 1.

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PLANETARY GEAR WINDING MECHANISM

Filed Jan. 29, 1962 4 Sheets-Sheet 2

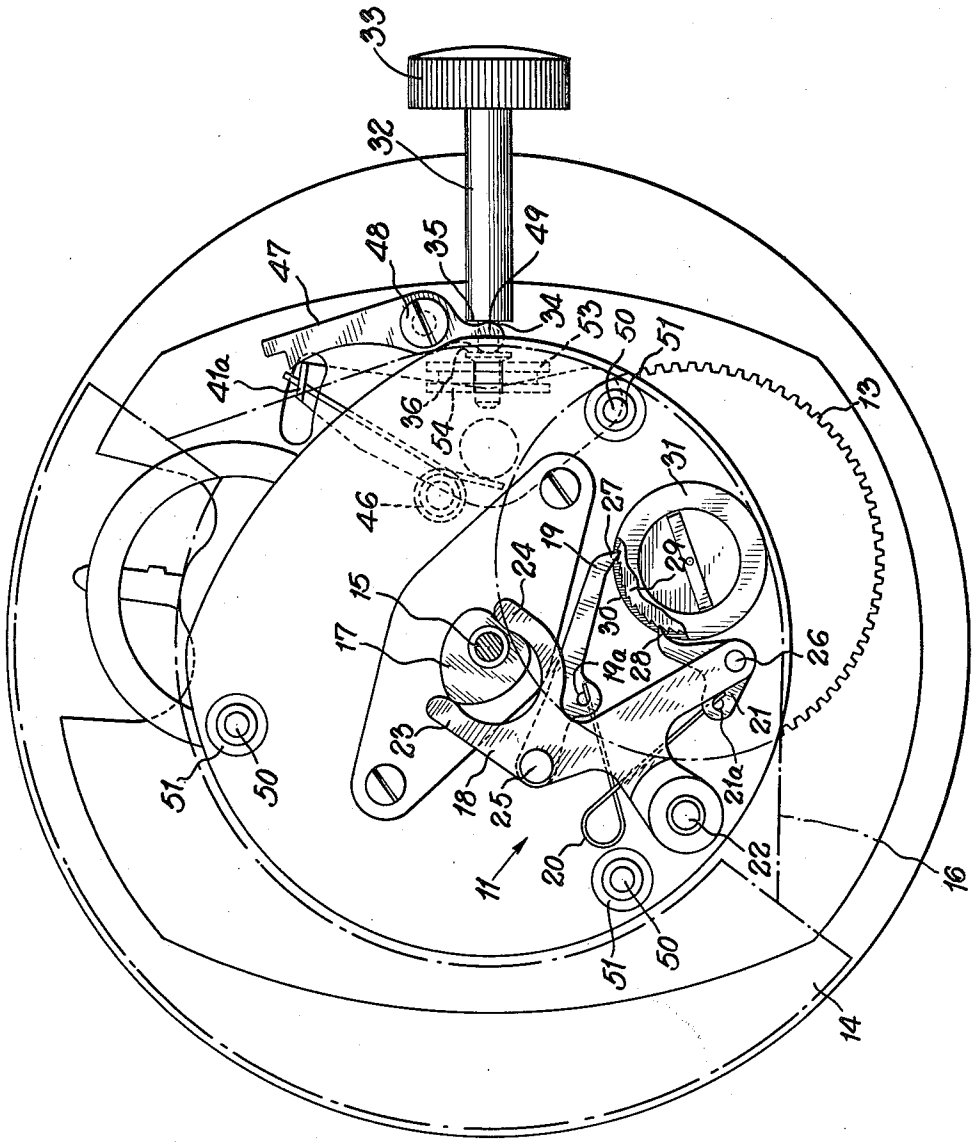

Fig. 2.

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PLANETARY GEAR WINDING MECHANISM

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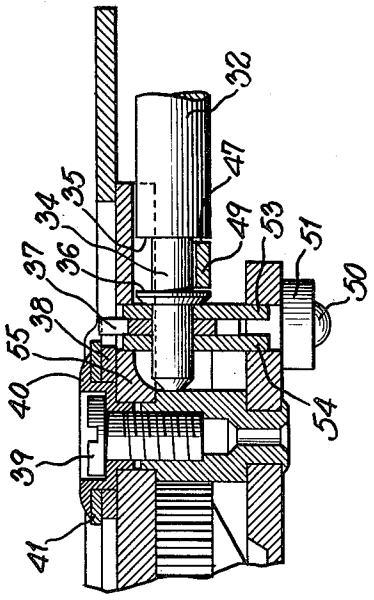

Fig. 3.

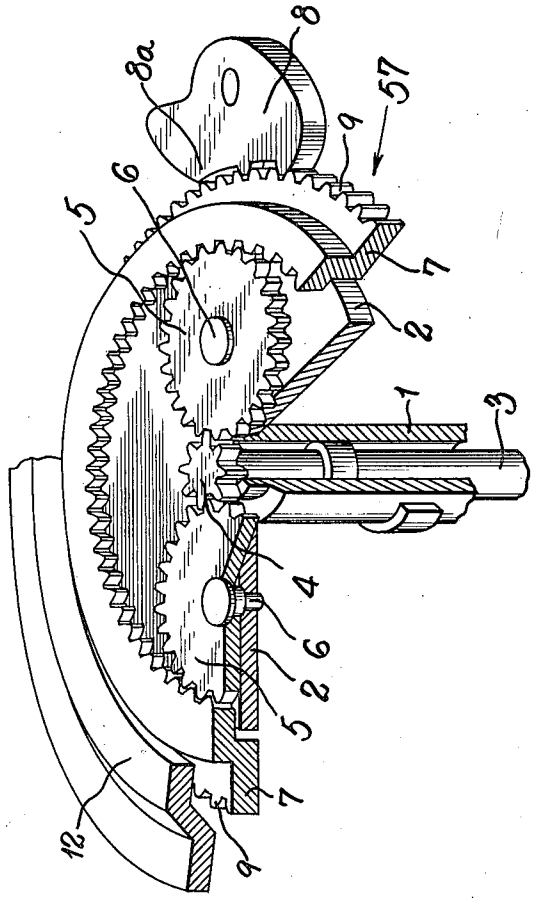

Fig. 4.

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PLANETARY GEAR WINDING MECHANISM

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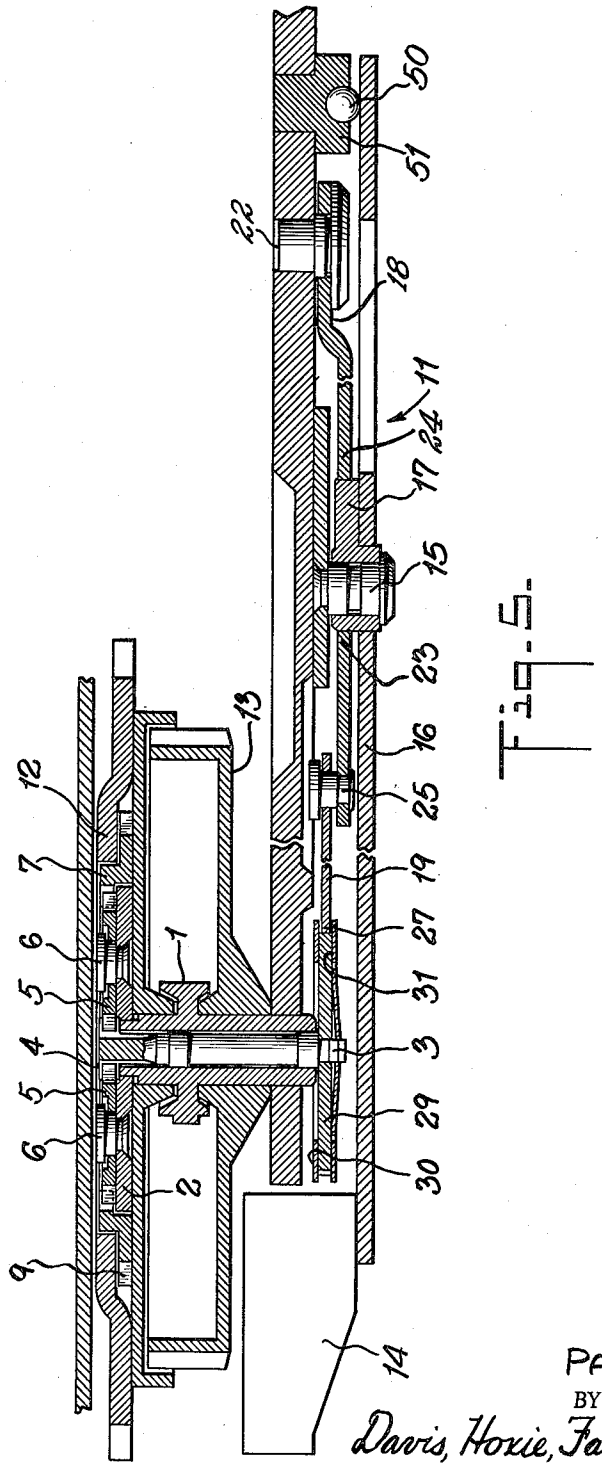

Fig. 5.

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3,104,517

PLANETARY GEAR WINDING MECHANISM

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5 Claims. (Cl. 58—82)

The present invention relates to watch mechanisms and more particularly to a mechanism for winding a watch both automatically and manually.

Automatically winding wrist watches, in which the mainspring is generally wound by the movement of a weight in response to movement of the wearer's arm, often also have a manual winding means which is used when automatic winding is insufficient, for example, when the wearer does not swing his arm sufficiently. Both automatic and manual winding is achieved by winding a spiral mainspring. A mechanism currently used in such watches to convert both the automatic and manual action into winding rotation consists of two one-way clutches, each of which drives a gear connected to the arbor of the watch mainspring, and a reduction gear train for the automatic winding mechanism. The clutches are relatively costly, utilize many parts, experience wear on their shafts and gear teeth, and inefficiently rotate parts not needed for winding.

The objectives of the present invention are to provide a mechanism for winding the mainspring of a watch from automatic and manual action, which mechanism is comparatively simple, inexpensive, durable, efficient in winding, and has a built-in gear reduction ratio.

In accordance with the present invention, a planetary gear mechanism is provided whose relatively small center pinion gear (sun gear) is preferably connected to the automatic winding mechanism for gear reduction. A plurality of planetary gears divide the rotational forces so that there is less strain on the shafts and gear teeth as compared to the use of a single gear.

One embodiment of the present invention is shown in the attached drawings in which:

FIG. 1 is a top plan view of the front of the watch of the present invention with the case, crystal, face and hands removed;

FIG. 2 is a bottom plan view of the back of the watch of the present invention with the case removed and with the plate holding the swinging weight shown in outline;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a partly broken away perspective view showing the planetary gear system of the watch; and

FIG. 5 is an extended developed sectional view taken along lines 5—5 of FIG. 1.

The watch of the present invention includes an automatic winding means, shown generally at 11, a manual winding means, shown generally at 56, and a planetary gear system, shown generally at 57.

The planetary gear system 57 (FIGS. 1 and 4) utilizes a hollow arbor 1 attached to the mainspring of the watch (not shown). The controlled unwinding of the mainspring rotates the barrel 13 as in conventional watch movements to power the time gear train to the watch hands. A planet pinion plate 2 is integrally attached to the top of the arbor 1. A pinion shaft (rotor) 3 passes through the arbor 1 and is attached at its bottom end to the automatic winding means 11. A planet wind pinion gear 4 (the sun gear) is integrally attached at the top of the pinion shaft 3. A pair of planet pinions 5 are secured on the planet pinion plate 2 on opposite sides of planet wind pinion gear 4 by shafts 6 which allow the planet pinions 5 to rotate freely and mesh with gear 4.

Ratchet wheel 7, an annular ring provided with gear teeth on its inside and outside periphery, has inside gear teeth which mesh with the planet pinions 5 and has outside gear teeth 9 which mesh with click 8 and with winding gear 10. Preferably, pinion gear 4 has a small diameter compared to ratchet wheel 7, whereby a gain in gear ratio is provided so that the small rotating forces from the automatic winding means may wind the mainspring, which may be relatively heavy. During automatic winding, click 8, which is limited in its rotation by spring 8*b*, holds the ratchet wheel against clockwise rotation through its shoulder portion 8*a*, thereby allowing planet pinions 5 to rotate freely on the inside of the wheel. This type of click, well known in the art, pivots slightly about its axis clockwise during counterclockwise rotation of wheel 7. If the wheel 7 starts to turn clockwise, click 8 pivots so that its lower tooth meshes between two teeth of teeth 9. In order for furher clockwise motion of wheel 7, it would be necessary that click 8 pivot counterclockwise. However, click 8 cannot pivot counterclockwise because shoulder 8*a* presses against teeth 9 and consequently wheel 7 cannot rotate clockwise. In manual winding, gear teeth 9 are rotated counterclockwise by gear 10 (FIG. 1). The automatic wind mechanism 11 holds the pinion shaft 3, and therefore wind pinion 4, against rotation during manual winding. The rotation of ratchet wheel 7 rotates the planet pinions 5 causing the plate to revolve and wind the mainspring. A retaining ring 12 holds the ratchet wheel 7 in position so that it may rotate freely.

The automatic winding means 11 of the watch (FIGS. 2 and 5) includes a weight 14 which revolves by inertia on movement of the watch about the center 15 of the plate 16, to which the weight is attached. Plate 16 rides on the bearings 50 held in the bearing blocks 51. A cardioid cam 17 is staked to the bottom of plate 16. Means 11 also includes a forked rocker arm 18, a first pawl 19, a single coil biasing spring 20 having extended arms, and a second pawl 21. The forked rocker arm 18 is rotatably connected on shaft 22. The fork arms of rocker 18, which are its left arm 23 and its right arm 24, both ride on the camming surface of cam 17. Rotation of the cam 17 forces the forked lever 18 into a short oscillating sideways movement about its pivot 22. The first pawl 19 is pivotally connected at its end 25 to forked lever 18 by staking. The second pawl 21 is pivotally connected near its center at 26 by staking. One end of the spring 20 protrudes through the hole 19*a* in pawl 19 and its other end protrudes through the hole 21*a* in pawl 21. Spring 20 biases the pawls inward towards each other so that the point 27 of pawl 19 and the point 28 of pawl 21 are biased against a ratchet wheel 29. Ratchet wheel 29 is sandwiched between the bottom plate 30 and the top plate 31 enabling the points 27 and 28 to normally remain in contact with wheel 29. Ratchet wheel 29 is attached to pinion shaft 3. Rotation of the pinion shaft 3 causes the planet pinions 5 to rotate which, in turn, rotates plate 2 which rotates the arbor 1 winding the mainspring.

The manual winding means 56 (FIGS. 1 and 3), as in conventional watches, includes the winding stem 32 which protrudes through an opening in the watch case and terminates in crown 33 having striations. Stem 32, inside of the watch case, has a narrow portion 34 providing an inner shoulder 36 and an outer shoulder 35. A cog gear 37 is secured at the bottom portion of shaft 32 and is held upright by support plates 54 on top and 53 on the bottom (FIG. 3). Cog gear 37 meshes with center gear 38 which is rotatably secured at its center by screw 39 and bushing 40. Screw 39 and bushing 40 rotatably secure plate 41 to support member 55. Wind-

ing gear 10 and idling gear 42 are staked to plate 41 at their centers so as to freely rotate. The plate assembly, consisting of plate 41 and gears 10, 38 and 42, may be rotated about its pivot screw 39 and bushing 40. A biasing spring 46 urges the plate assembly in the counterclockwise direction by pressure on a downward turned flange 41*a* of plate 41. A two-position arm 47, which is screwed at its pivot 48 so that it may rotate, has one of its arms 49 positioned between the inner shoulder 36 and the outer shoulder 35 of stem 32, while its other arm is positioned against flange 41*a*. When stem 32 is pulled outwardly, it rotates arm 47 clockwise and thereby rotates plate 41 clockwise so that gear 10 does not mesh with teeth 9 of ratchet wheel 7. When stem 32 is pushed inwardly, gear 10 meshes with wheel 7 to manually wind the watch.

With the planetary gear mechanism of the present invention, the mainspring is automatically wound by rotation of the weight without movement or turning of the manual winding gears. This efficiency of automatic winding enables the mainspring to be wound with relatively less motion of the watch. The mainspring is wound manually without movement or turning of the automatic winding mechanism, so that the automatic mechanism experiences relatively less wear than with other types of combined movements.

I claim:

1. A watch including a mainspring, both automatic and manual winding means and a planetary gear system, the planetary gear system including a center wind gear, a plurality of planet gears meshing with the wind gear, a plate, an annular ring having inner gear teeth, means

rotatably attaching the planet gears to the plate and means connecting the plate and the mainspring to wind the mainspring wherein the planet gears mesh with the inner gear teeth of the ring, the automatic winding means is attached to and drives the center wind gear and the manual winding means is in contact with the ring and drives it.

2. A watch as in claim 1 wherein the ring has outer gear teeth, the manual winding means includes a winding stem and a plurality of meshing gears and the outer teeth of the ring mesh with a gear of the manual winding means.

3. A watch as in claim 1 wherein the center wind gear is attached to the automatic winding means by a pinion shaft and the automatic winding means includes a ratchet wheel secured to the shaft.

4. A watch as in claim 3 in which the automatic winding means also includes a rotatably mounted weight, a cam driven by rotation of the weight, and a plurality of pawls operated by the cam, which pawls rotate the ratchet wheel.

5. A watch as in claim 1 in which the annular ring is relatively large compared to the center wind gear.

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