Sept. 20, 1960 F. LEIMENSTOLL 2,953,041

DRIVE ARRANGEMENT FOR SELF-WINDING TIME-PIECE

Filed Aug. 20, 1956 2 Sheets-Sheet 1

FIG. 1

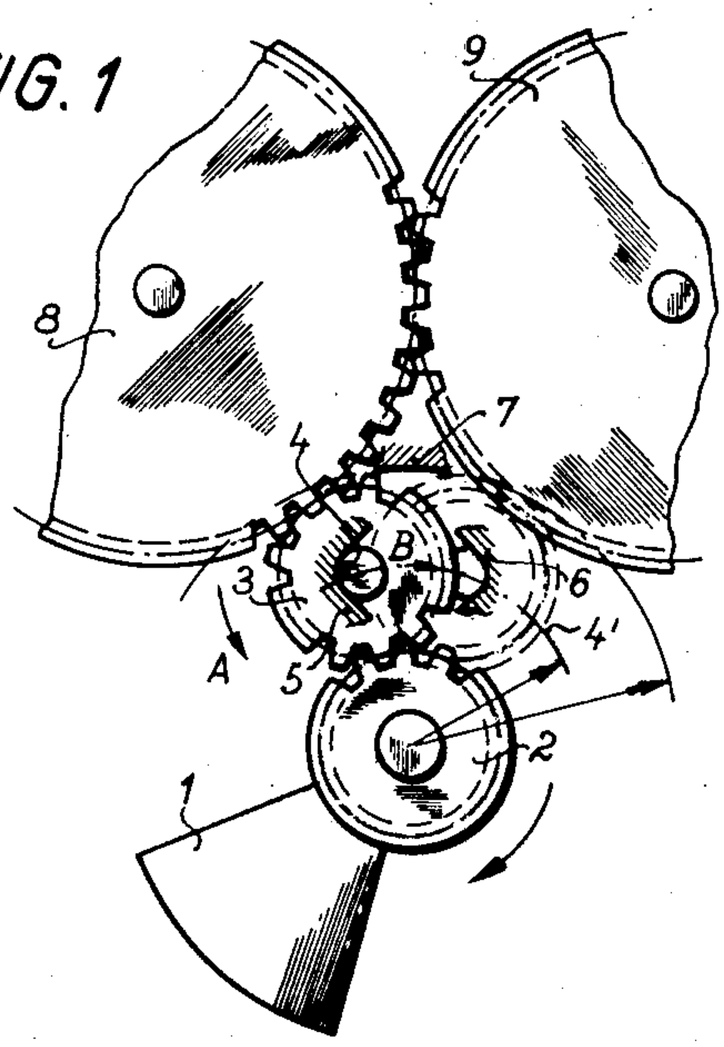

FIG. 2

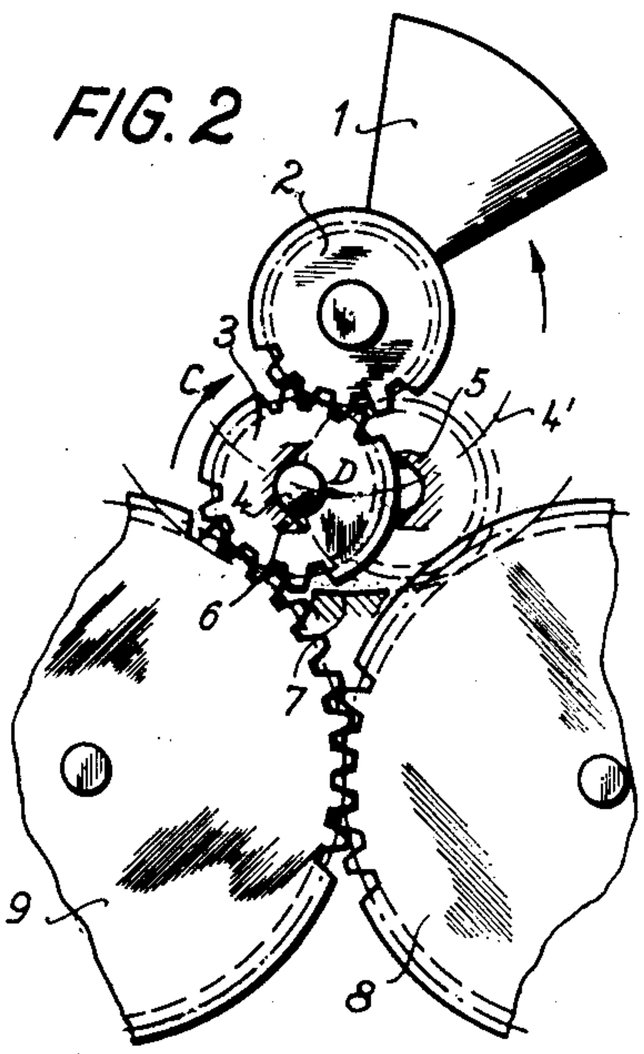

FIG. 3

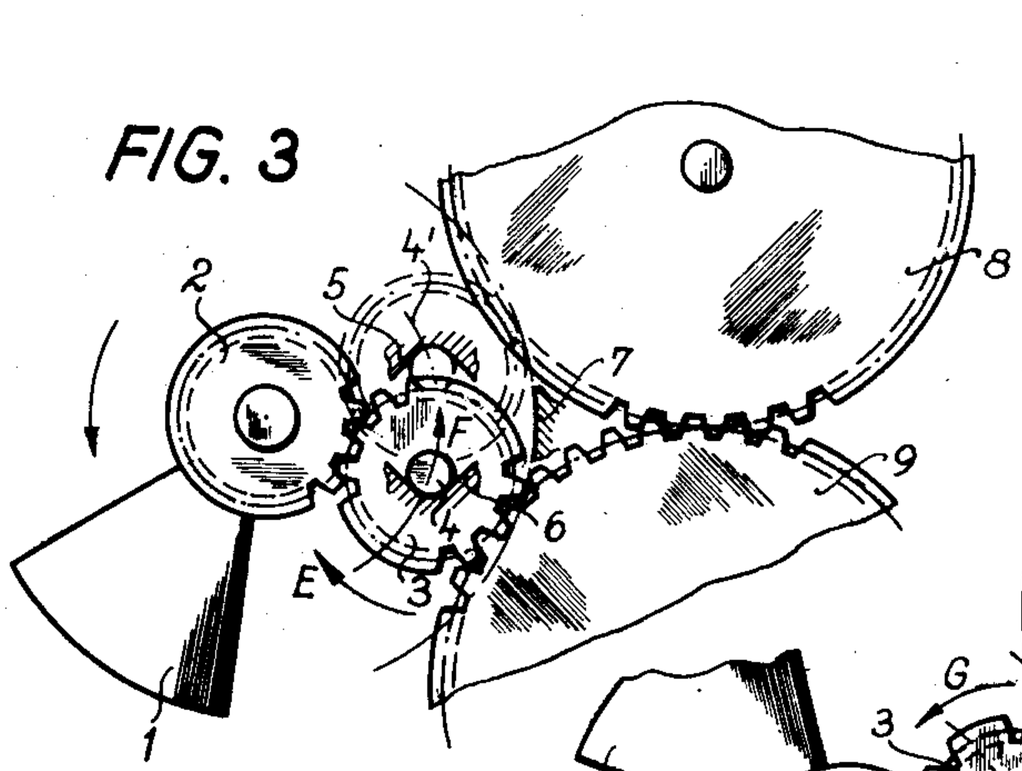

FIG. 4

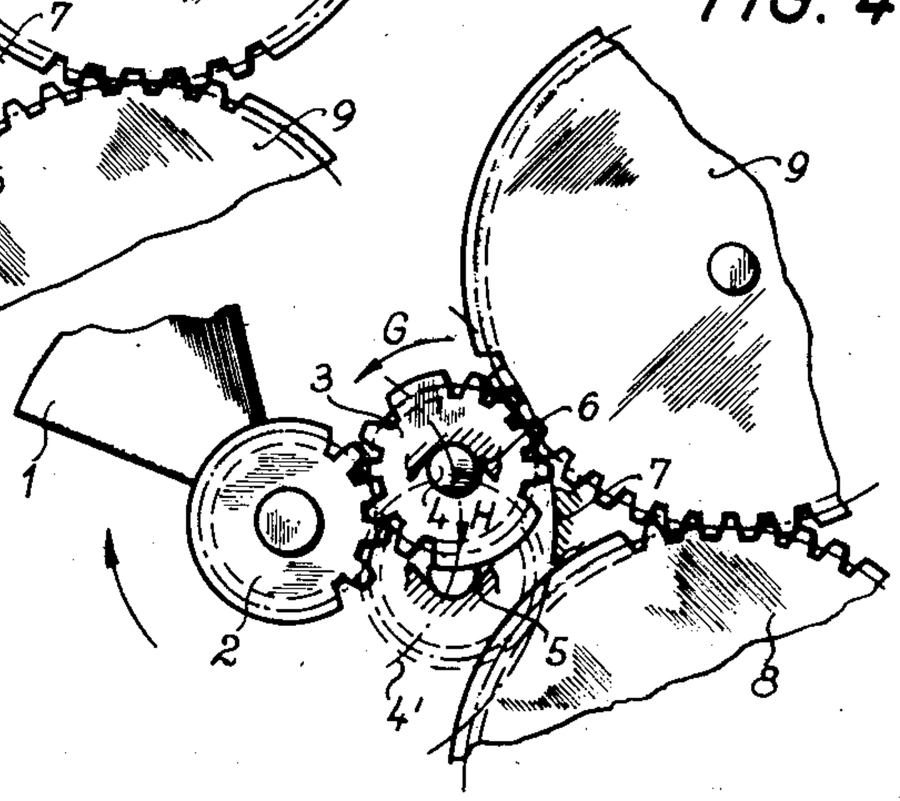

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FIG. 5

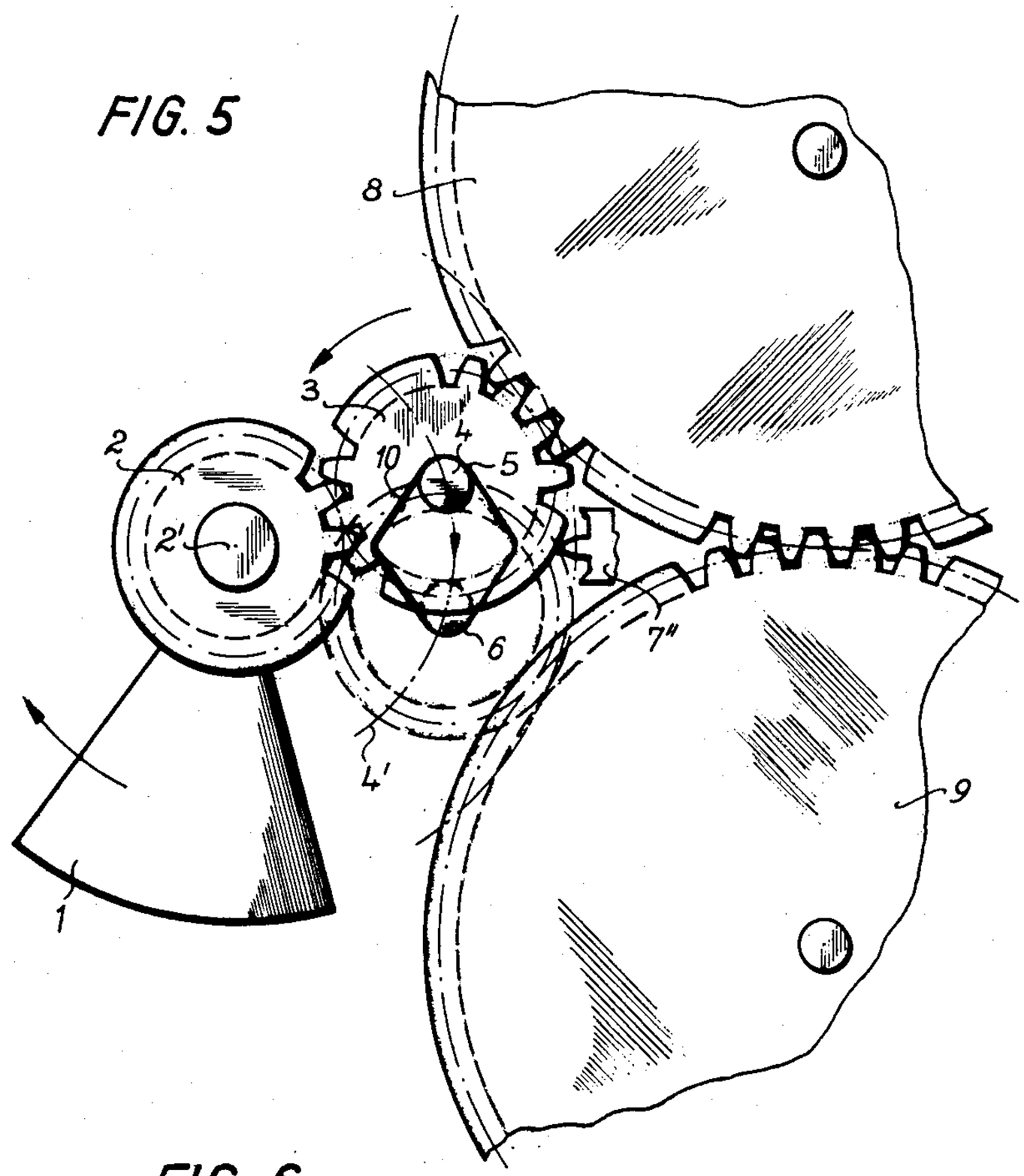
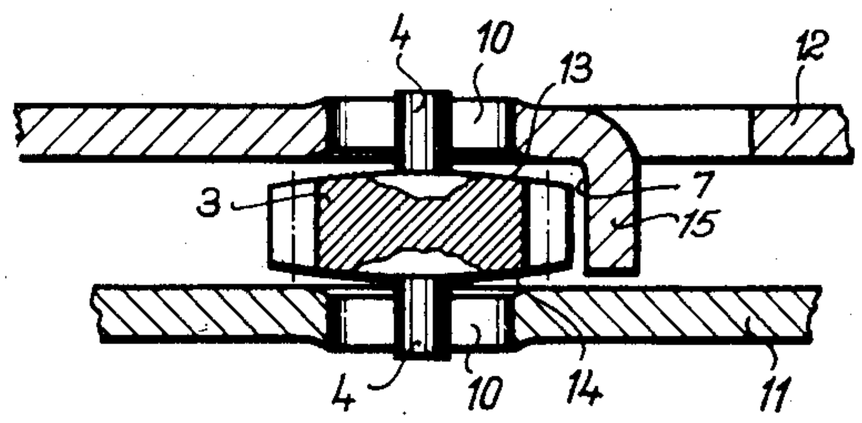


FIG. 6



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United States Patent Office

2,953,041

Patented Sept. 20, 1960

2,953,041

DRIVE ARRANGEMENT FOR SELF-WINDING TIME-PIECE

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Filed Aug. 20, 1956, Ser. No. 604,967

Claims priority, application Germany Aug. 19, 1955

10 Claims. (Cl. 74—812)

This invention relates to a self-winding time-piece having an inertia controlled rotor, rotatable in both directions, and a pinion driven thereby which brings a change-over pinion with which it is in permanent mesh alternativlely into engagement with a winding wheel or an intermediate wheel according to the direction of rotation of the rotor, the change-over pinion being guided between its two alternative end positions.

In known types of self-winding watches of this kind the change-over pinion is guided by a pin arranged laterally of the change-over pinion. This lateral arrangement of the guide means for the change-over pinion produces a tilting movement which tends to cant the change-over pinion. Though the canting effect may not be considerable the very existence of a constant tilting couple impairs the freedom of action of the change-over pinion, and gives rise to unavoidable faults.

Known types of self-winding watches suffer from another drawback. This consists in that in the two end positions the teeth of the change-over pinion are pressed into tight engagement with the teeth of the winding or intermediate gears and this likewise adversely affects the freedom of the watch movement.

According to the present invention these defects are avoided by arranging that the pivot pin of the change-over pinion comes into contact with fixed limit stops in both its end positions and that the change-over pinion itself is guided peripherally. By peripherally guiding the change-over pinion the winding torque can be transmitted to the winding and intermediate wheels without the setting up of tilting moments, so that the freedom of action of the change-over wheel is thereby assured. Moreover, the fixed limit stops define the two end positions of the change-over pinion, so that in the two end positions undue friction between the teeth of the change-over pinion and the winding and intermediate wheels cannot occur.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a diagrammatic representation of the disposition of the change-over pinion, the pinion being located above the rotor;

Figure 2 is a diagrammatic representation of the disposition of the change-over pinion, with the pinion located below the rotor;

Figures 3 and 4 are diagrammatic representations of the disposition of the change-over pinion, with the pinion on either side of the rotor;

Figure 5 shows diagrammatically a construction in which the change-over pinion is guided by a toothed segment, and

Figure 6 is a section through the change-over pinion and its bearings.

The driving pinion **2** is coaxially secured to a rotor **1** which is adapted to rotate in either direction. Associated with the pinion **2** is the change-over pinion **3**, the two pinions being in constant mesh and the change-over pinion **3** is movable between two positions in which it

engages either the winding wheel **8** or the intermediate wheel **9** according to the direction of rotation of the rotor **1**.

The change-over pinion **3** is guided in the region of the periphery thereof during its movement between the two positions thereof by the interengagement of its teeth with the teeth of the driving pinion **2** and by a guide surface **7** which is preferably circular and concentric with the axis of rotation **2'** of the driving pinion **2**. If desired the guide surface may be in the form of a toothed segment **7''** as shown in Fig. 5, and such a toothed segment may be used instead of the circular guide surface **7** shown in Figs. 1–4. The angular extent of movement of the change-over pinion **3** is limited by half bearings **5** and **6** with which the pivot pins **4** of the pinion **3** come into contact when it engages either of the wheels **8** or **9**. The fixed limit stops **5** and **6** (half bearings) are preferably of circular contour and extend through an arc of less than π or less than 180°. The bearings or abutment faces may be stamped out of two blanks **11** and **12** and/or bridges or the like, and may have any suitable geometrical contour to provide an opening **10**, such as a diamond shaped opening, for the movement of the pivot pins during the angular deflection of the change-over pinion **3**.

The guide surface **7** may be embodied in a lip **15** stamped or pressed into the blank **12** or bridge or the like.

The winding wheel **8** and the intermediate wheel **9** which are in permanent mesh are of equal size if symmetrically disposed with reference to the axis **2'** of the rotor or of dissimilar size if they are asymmetrically located.

To reduce friction in certain positions of the time-piece (for instance when the time-piece is held horizontally) and to reduce the effort required to effect the angular movement of the change-over pinion **3** (Fig. 3), the latter is preferably made of a material of low specific weight such as a light metal or a synthetic plastic such as one belonging to the group of the polyamides. Moreover the two faces **13** and **14** of the change-over pinion **3** may be cambered, Fig. 6, preferably spherically, to reduce axial frictional resistance.

The mechanism operates as follows: The time-piece is automatically wound in a manner that is well understood, by the motion of the rotor **1** being transmitted by the driving pinion **2** through the change-over pinion **3** either directly to the winding wheel **8** or via the intermediate wheel **9** which further transmits the torque through appropriate reduction gears and ratchet mechanism to the mainspring of the time-piece.

The change-over pinion **3** changes from engagement with the winding wheel **8** into engagement with the intermediate wheel **9**, or vice versa, as will be hereinafter explained.

When the watch is in the position shown in Fig. 1, assuming the rotor to revolve in the direction of the arrow and assuming a smooth guide surface **7** to have been provided, the change-over pinion **3** will be deflected by the driving pinion **2**, without performing a rotary movement of its own, along the circular path **4'** in the direction of arrow B until its pivot pins **4** make contact with the limit stops **6** so that the change-over pinion **3** will then be in engagement with the intermediate wheel **9**. The change-over pinion will experience no friction at all. If a toothed sector **7''** is provided, the change-over pinion **3** will be forced to rotate in the direction of the arrow A and slight friction will occur in the teeth.

When the watch is in the position shown in Fig. 2 assuming the rotor **1** to revolve in the direction of the arrow, the change-over pinion **3** will roll either on the smooth guide surface **7** or on the toothed segment **7''**,

whichever has been provided, and the pivots 4 will move along a circular path 4' in the direction of arrow C until they come into contact with the limit stop 5 so that the change-over pinion will then be in engagement with the winding wheel 8. In either case the change-over pinion will experience only rolling friction.

When the watch is in the position shown in Fig. 3, assuming the rotor 1 to revolve in the direction of the arrow and assuming a smooth guide surface 7 has been provided, the change-over pinion 3 will not be deflected into engagement with the winding wheel 8. It is therefore expedient to orientate the self-winding mechanism in such a way that this case corresponds with the most infrequent position of the watch. However, if a toothed sector 7'' has been provided the change-over pinion 3 will roll between the teeth of the driving pinion 2 and of the toothed sector 7'' with its pivots 4 moving in the direction of arrow F along the circular path 4', performing a relative rotation in the direction of arrow E, until its pivots 4 contact the limit stop 5 and its teeth will then be in engagement with the winding wheel 8. Again the change-over pinion 3 will experience only rolling friction. In this case a low weight of the change-over pinion 3 is a particular advantage.

When the watch is in the position shown in Fig. 4, assuming the rotor 1 to revolve in the direction of the arrow and assuming a smooth guide surface 7 to have been provided, the change-over pinion 3 will drop without friction under its own weight in the direction of arrow H until its pivots 4 contact limit stop 5 and it will then be in engagement with the intermediate wheel 8. However, if a toothed sector 7'' has been provided, the change-over pinion 3 will roll between the teeth of the driving pinion 2 and of the toothed sector 7'', performing a relative rotary motion in the direction of arrow G. Again only rolling friction will be experienced.

The provision of a smooth race 7 has the advantage in certain pivotal positions of not submitting the change-over wheel 3 to friction, whereas more particularly in the position shown in Fig. 3 and to some extent in the horizontal positions of the watch which are not specially shown as in the general disposition of the self-winding mechanism they must be considered the most infrequent positions, the change-over pinion 3 is not actually deflected. The provision of a toothed sector 7'' produces a certain amount of rolling friction in every angular position of the watch but it creates a positive coupling between the change-over pinion and the movements of the rotor 1 and therefore ensures the deflection of the change-over pinion 3 in any case.

Whichever of the two forms of construction is to be preferred depends upon the general location of the self-winding mechanism within the watch and on frequency statistics. In any event, both forms of construction create far less friction than known arrangements or, alternatively, a positive change-over of the change-over pinion is assured in every position of the watch with the help of the simplest possible means.

I claim:

1. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a change-over pinion in permanent mesh with said driving pinion and being movable between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means in the form of a circular segment concentric with the axis of said driving pinion and contacting said change-over pinion at the crests of the teeth thereof during the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; and stop means to limit the movement of said change-over pinion.

2. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel meshing with said winding wheel; a change-over pinion in permanent mesh with said driving pinion and being movable between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means in the form of a circular segment concentric with the axis of said driving pinion and being located at the side of said change-over pinion opposite said driving pinion and between the peripheries of said winding wheel and said intermediate wheel, said guide means contacting said change-over pinion at the crests of the teeth thereof during the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; and stop means to limit the movement of said change-over pinion.

3. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a pivot pin; a change-over pinion in permanent mesh with said driving pinion and fixedly mounted on said pivot pin, said change-over pinion together with said pivot pin being movable along a given path between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means contacting said change-over pinion at the crests of the teeth thereof during the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; and a pair of stationary stops located spaced from each other along said given path and having each a concave abutment face facing said pivot pin and said pivot pin abutting in said two positions of said change-over pinion against said abutment faces, respectively.

4. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a pivot pin; a change-over pinion in permanent mesh with said driving pinion and fixedly mounted on said pivot pin, said change-over pinion together with said pivot pin being movable along a given path between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means contacting said change-over pinion at the crests of the teeth thereof during the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; and a pair of stationary stops located spaced from each other along said given path and having each a concave abutment face facing said pivot pin and said pivot pin abutting in said two positions of said change-over pinion against said abutment faces, respectively, said abutment faces being in the form of circular segments having a radius substantially equal to the radius of said pivot pin and extending through an arc of less than 180°.

5. In a self-winding time-piece having an inertia con-

trolled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a change-over pinion in permanent mesh with said driving pinion and being movable between the first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermedaite wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means in the form of a curved rack and having a plurality of teeth meshing with the teeth of the change-over pinion during the movement thereof between said first and second position thereof for guiding said changeover pinion during said movement thereof; and stop means to limit the movement of said change-over pinion.

6. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a change-over pinion in permanent mesh with said driving pinion and being movable between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means in the form of a curved rack, arranged along a circular segment concentric with the axis of said driving pinion and having a plurality of teeth meshing with the teeth of the change-over pinion during the movement thereof between said first and second position thereof for guiding said change-over pinion during said movement thereof; and stop means to limit the movement of said change-over pinion.

7. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a change-over pinion turnable about an axis and in permanent mesh with said driving pinion, having end faces of substantially spherical configuration and being movable between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means contacting said change-over pinion at the crests of the teeth thereof during the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; a plate extending substantially normal to said axis of said change-over pinion and engaging one of said spherical end faces thereof; and stop means to limit the movement of said change-over pinion formed on said plate.

8. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a pivot pin; a change-over pinion in permanent mesh with said driving pinion and mounted on said pivot pin, said change-over pinion being movable along a given path between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second positions according to the direction of movement of said rotor; guide means contacting said change-over pinion in the region of the periphery thereof during

the movement of said change-over pinion between said first and second position thereof for guiding said change-over pinion during said movement thereof; and a pair of plates respectively located on opposite sides of said change-over pinion and substantially normal to said pivot pin, said plates being respectively formed with elongated cutouts through which opposite ends of said pivot pin respectively extend, said cutouts respectively extend along said given path and being bounded at opposite ends thereof by circular abutment faces having a radius substantially equal to the radius of said pivot pin and extending respectively through an arc of less than 180°, said cutouts having intermediate said ends thereof a width greater than at said ends.

9. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a pivot pin; a change-over pinion in permanent mesh with said driving pinion and fixedly mounted on said pivot pin, said change-over pinion together with said pivot pin being movable along a given path between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second position according to the direction of movement of said rotor; guide means contacting said change-over pinion along the crests of the teeth thereof for guiding said change-over pinion during its movement between said positions thereof; and at least one plate substantially normal to said pivot pin, said plate being formed with an elongated cutout through which one end of said pivot pin extends, said cutout extending along said given path and being bounded at opposite ends thereof by concave abutment faces and said cutout having intermediate said ends thereof a width greater than the diameter of said pivot pin.

10. In a self-winding time-piece having an inertia controlled rotor and a driving pinion associated therewith, in combination, a winding wheel; an intermediate wheel; a pivot pin; a change-over pinion in permanent mesh with said driving pinion and fixedly mounted on said pivot pin, said change-over pinion together with said pivot pin being movable along a given path between a first position in which said change-over pinion engages said winding wheel and a second position in which said change-over pinion is disengaged from said winding wheel and engages said intermediate wheel, said change-over pinion being moved between said first and said second position according to the direction of movement of said rotor; at least one plate substantially normal to said pivot pin, said plate being formed with an elongated cutout through which one end of said pivot pin extends, said cutout extending along said given path and being bounded at opposite ends thereof by concave abutment faces and said cutout having intermediate said ends thereof a width greater than the diameter of said pivot pin; and guide means integrally formed with said plate and contacting said change-over pinion along the crests of the teeth thereof for guiding said change-over pinion during its movement between said first and said second position thereof.

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