United States Patent

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[54] **UNIDIRECTIONAL ROTARY DRIVE COUPLING DEVICE FOR A WATCH MOVEMENT**
7 Claims, 2 Drawing Figs.

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[50] **Field of Search** ..... 192/46; 58/82 R, 82 A

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ABSTRACT: A unidirectional rotary drive coupling device for a watch movement, comprising a ratchet mechanism positioned in the axial space between two coaxially arranged wheels.

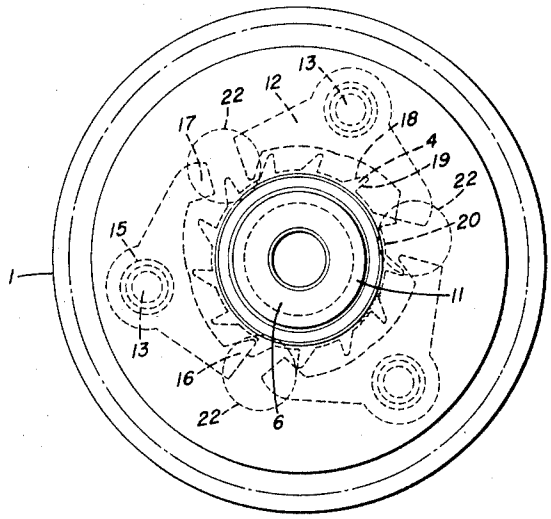
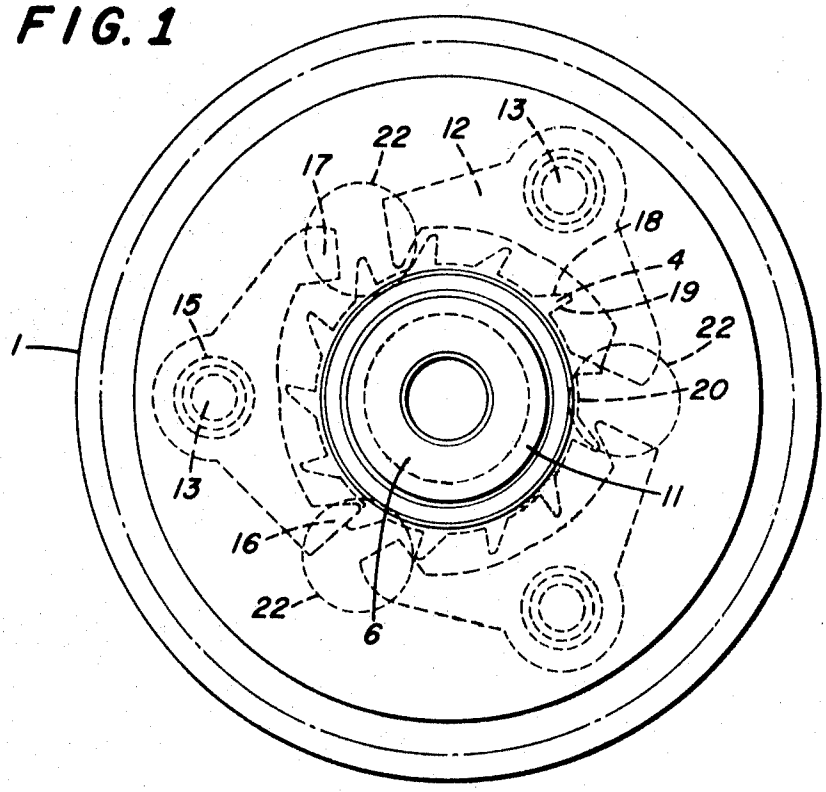


FIG. 1



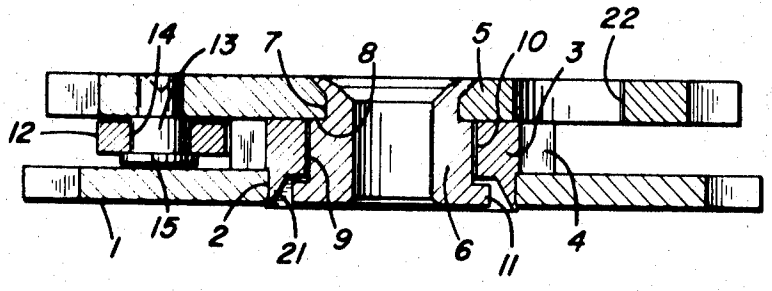


FIG. 2

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UNIDIRECTIONAL ROTARY DRIVE COUPLING DEVICE FOR A WATCH MOVEMENT

This invention relates to an improved rotary drive coupling device of the ratchet type, that is, the type which provides a unidirectional driving relationship between two members, said device being especially intended for watch movements, wherein such coupling devices are quite commonly employed.

Unidirectional or freewheel coupling devices are well known in numerous watch movements, particularly to form the reversers of automatic winding mechanisms of wristwatches, in which instance, two coupling devices generally are combined to form the reverser. In certain designs, the two devices are placed side by side, with their axes parallel, while in other instances they are coaxial and one element may be common to both devices. The side-by-side arrangement is advantageous in that the axial thickness thereof is considerably reduced relative to the known coaxial arrangements.

In any event, in order to provide a reverser for an automatic winding device, it is essential to limit clearances and dead spaces so as to decrease as far as possible the number of lost strokes and to effectively utilize all the displacements of the oscillating mass.

It is an object of this invention to provide a coaxial-type rotary drive coupling device especially for watch movements whose overall axial thickness is considerably reduced relative to known coaxial-type coupling devices.

It is a further object of this invention to provide a coaxial-type rotary drive coupling device which is simple and economical to construct and which is highly effective as to efficiency and wearability.

Another object of this invention is the provision of an arrangement as aforementioned, which is susceptible to being produced according to mass production techniques.

A still further object of this invention is the realization of a coupling device wherein the lost motion between successive ratchet teeth may be reduced to a fraction of the circumferential pitch between two successive ones of said teeth.

Other objects are those which are inherent in the device as disclosed herein.

Generally, the objects of this invention are realized through an arrangement wherein a ratchet-type mechanism is mounted in the axial space between coaxially arranged driving and driven wheels, with respective mutually cooperating bushing-type bearing elements being rigidly secured to respective ones of said wheels along mutually coextensive axial extents thereof. Further, the object of reducing the lost motion as aforementioned is generally attained through the use of a ratchet mechanism including a plurality of pawls, each having a different phase relationship with the teeth of a rotary rachet wheel whereby, instead of the lost motion being equal to the pitch between successive teeth as in the case when only one pawl is used, the lost motion is reduced to a fraction of said pitch, the denominator of said fraction being equal to the number of pawls. In other words, two pawls result in a lost motion equal to one-half the tooth pitch while three pawls result in a lost motion equal to one-third the tooth pitch.

A detailed description of a preferred embodiment of realization of the present invention follows with reference to the accompanying drawing, wherein:

FIGS. 1 and 2, respectively, are a top plan and an axial sectional view of a coupling device according to this invention.

The device shown in the drawing comprises a first toothed wheel 1 of relatively large diameter composed of a metal disc of constant thickness provided with a central circular opening 2. An intermediate element 3 of reduced diameter having a toothing 4 formed of 13 teeth is fastened to the wheel 1. For this purpose, there is integral with said intermediate element an annular rib 21 the outer side face of which is adjusted to the dimensions of the opening 2. As can be seen from FIG. 2, this rib 21 engages in the opening 2 in a crimp fit to assure the rigid fastening of the two elements 1 and 3 to each other.

The toothing 4 is composed of narrow teeth the two flanks 18 and 19 of which are inclined in the same direction with respect to the radial plane passing through the crest of the tooth. They are separated by portions of cylindrical surface 20 which define laterally the element 3. The device described comprises a second member coaxial to the first and itself comprising a second toothed wheel 5 of a diameter slightly less than the wheel 1 and a hub 6 of tubular form which is fastened at one of its ends to the wheel 5. For this purpose, the latter has a central opening 7 in which the said end of the hub is force fitted and crimped. Positioning in axial direction is assured by a shoulder 8 present on the hub 6 and by a conical crimping flange of the end of the hub 6.

The side face of the hub 6 has a cylindrical portion 9 which extends from the edge of the shoulder 8 which is engaged in the central opening 10 of the intermediate element 3. The clearance between the opening 10 and the pivot surface 9 is adjusted in such a manner as to permit the relative rotation of the two members of the device without substantial friction while assuring sufficiently precise guidance in order that the operation of the pawls described below be properly assured.

Axial displacement of the two wheels 1 and 5 relative to each other is restricted by virtue of the clearances being strictly limited in order to obtain optimum operating conditions. As a matter of fact, at its end opposite the wheel 5, the hub 6 has a collar 11 of rectangular profile which protrudes beyond the cylindrical bearing surface 9. The axial height of said bearing surface 9 between the collar 11 and the wheel 5 is preferably 2/100 mm. greater than the height of the cylindrical face 10 of the member 3. When a force tends to move the two wheels 1 and 5 axially apart, the collar 11 strikes against the lower face of the element 3, which face is flat and extends within the rib 21. In any event, the collar 11 is housed entirely within the axial extent of the rib 5 and of the opening 2 so that the total height of the device is not greater than that determined by the thicknesses of the wheels 1 and 5 and of the toothing 4 with due allowance for operating clearance.

The pawl mechanism which assures the functions of unidirectional coupling between the wheels 1 and 5 comprises three pawls 12, each of which is mounted on a pivot stud 13 force fitted in an opening in the wheel 5. Each stud 13 has a pivot surface 14 and an axial retention collar 15 which extends to near the inner face of the wheel 1.

The pawls 12 are 120° apart circumferentially about the ratchet wheel 3 and each of them has a locking nose 16, one of the faces of which is oriented in such a manner as to unidirectionally lockingly engage with the teeth 4, and a change nose 17 shaped in such a manner as to be pushed radially away from and by the teeth 4 is it is engaged between them, regardless of the direction of relative rotation between the toothing 4 and the wheel 5. In FIG. 1 it can be seen that the three pawls are identical and that since the toothing 4 comprises a number of teeth which is a multiple of three plus one, the distance between the pawls is one-third of the pitch of the toothing. Thus the lost motion upon a reversal of the direction of operation, is at most one-third of the pitch between successive teeth.

The device described can be combined with a second identical device to constitute a reverser. In this case, the two devices are arranged side-by-side, the respective wheels 1 being in engagement with each other while the respective wheels 5 both mesh with a pinion which could, for instance, be rigidly connected with the oscillating mass of a self-winding movement. The use of the devices described makes it possible to produce a reverser which takes up a very small amount of axial space. The two hubs 6 can be each fitted on a pivot stud and in this case one of the wheels 1 can drive an intermediate wheel which is a part of the rewinding device.

However, as variant, it would also be possible to mount one of the coupling devices on a pinion the shaft of which is force fitted within the hub 6.

The wheel 5 is provided with three openings 22 by means of which it is possible to check the condition of the noses of the pawls 12 and of the teeth 4 and to lubricate said members.

The device described thus constitutes a high-precision unit of dependable operation with maximum efficiency and extremely small dimensions.

The device described lends itself to various uses. It can be constructed and stored as a completely finished unit having the tolerances and clearances necessary to assure good operation. In order to constitute a reverser, two symmetrical devices can be used placed side-by-side, one of them driving a winding pinion.

Various details of the herein disclosed preferred embodiment are illustrative and not limitative of the applicability of the herein disclosed inventive concept, it being intended that said concept be applicable to various modifications of said details which modifications are well within the purview of one skilled in the art.

What is claimed is:

1. A unidirectional rotary drive coupling device for a watch movement, comprising: A first and a second toothed wheel rotatively mounted about a common axis and axially spaced apart from each other; an intermediate member positioned in the axial space between said teeth and being rigidly fastened to said first wheel, said intermediate member including a ratchet toothing; a pawl mechanism on said second wheel engageable with said ratchet toothing whereby said first and second wheels are unidirectionally rotatively interconnected through said ratchet toothing and said pawl mechanism, and including a central bore extending throughout the axial extent of said wheels and of said intermediate member; a hub member rigidly fastened to said second wheel and extending through said bore, said intermediate member and said hub member being fastened to said first and second wheels respectively, along mutually coextensive axially lengthwise portions thereof; and cooperating abutment means on said hub member and on said intermediate member restricting axial displacement of said first wheel in a direction away from said second wheel, said abutment means extending axially no further than the axially outermost radial surface of said first wheel, whereby the axial thickness of said device is no greater than the sum of the axial thicknesses of said first and second wheels and of the thickness of said pawl mechanism plus a reasonable clearance to permit movement of the respective parts relative to each other.

2. The device of claim 1, said intermediate member and said first wheel being secured to each other by means of radial crimp fit of said first wheel about one end of said intermediate member and said second wheel being likewise secured to said hub member.

3. A unidirectional rotary drive coupling device for a watch movement, comprising: A first and a second toothed wheel rotatively mounted about a common axis and axially spaced apart from each other; an intermediate member positioned in the axial space between said teeth and being rotatively rigid with said first wheel, said intermediate member including a ratchet toothing; a pawl mechanism on said second wheel engageable with said ratchet toothing whereby said first and second wheels are unidirectionally rotatively interconnected through said ratchet toothing and said pawl mechanism, and including a central bore extending throughout the axial extent of said wheels and of said intermediate member, said pawl mechanism comprising a plurality of pivoted pawls arranged symmetrically circumferentially about said ratchet toothing, each pawl including a first and a second nose circumferentially spaced apart from each other relative to said ratchet toothing, said pawls being arranged whereby only one of said noses on each of said pawls may engage said toothing at any one time, said first nose on each pawl being a locking nose arranged to lockingly engage said ratchet toothing, and said second nose on each pawl being a change nose arranged to be pushed radially away from said ratchet toothing pursuant to rotation of the latter in either rotative sense; a hub member rigidly secured to one of said wheels and extending through said bore and cooperating abutment means on said hub member and on said intermediate member of the other one of said wheels, restricting axial displacement of said one wheel in a direction away from said other wheel.

4. The device of claim 3, said pawls each comprising a pair of arms extending in generally opposite direction from the pivot axis of the pawl, said noses being located on a respective different one of said arms.

5. The device of claim 3, said pawls each being pivoted about a fixed pivot axis relative to said second wheel.

6. The device of claim 3, said ratchet toothing comprising a plurality of ratchet teeth circumferentially spaced apart from each other to an extent so as to permit a degree of free rotation of said intermediate member relative to said pawl mechanism pursuant to the driving engagement of said first nose being transferred from one of said ratchet teeth to a next succeeding ratchet tooth.

7. The device of claim 3, wherein said pawls are arranged with each said first nose thereof in a different position of engagement with said ratchet toothing whereby only one of said first noses lockingly engages said toothing at any one time and whereby the lost motion in changing over such locking engagement from one to the other of said first noses is equal to a fraction of the circumferential pitch between the ratchet teeth.

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