

## [54] PAWL AND RATCHET DEVICE

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74/144, 505; 58/23 R; 151/14 R, 21 R

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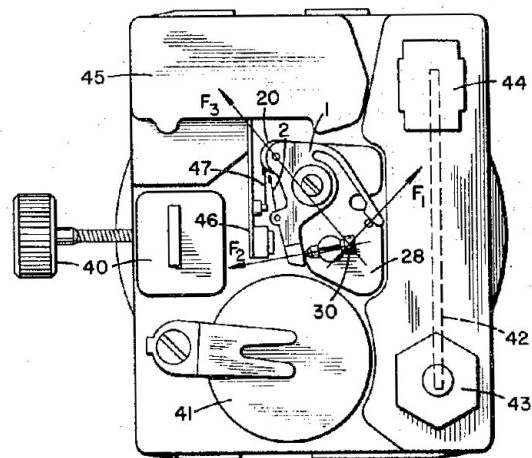
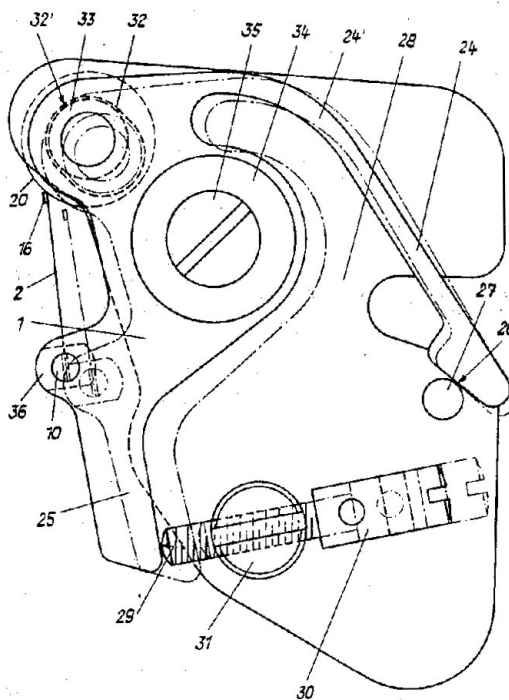
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## [57] ABSTRACT

The holding pawl of a pawl and ratchet device is independently adjustable for phase and pressure on a ratchet. A fork-like support carrying the holding pawl can be translationally moved to bring the pawl into engagement with a ratchet. To adjust the phase, the support is then pivoted about the axis of the ratchet by elastic deformation of an arm of the support. Displacement and pivoting of the support is effected by pressure on converging bearing surfaces on the arms of the support. The holding pawl is pivotally friction mounted on the support to enable adjustment of its pressure on the ratchet.

**4 Claims, 3 Drawing Figures**



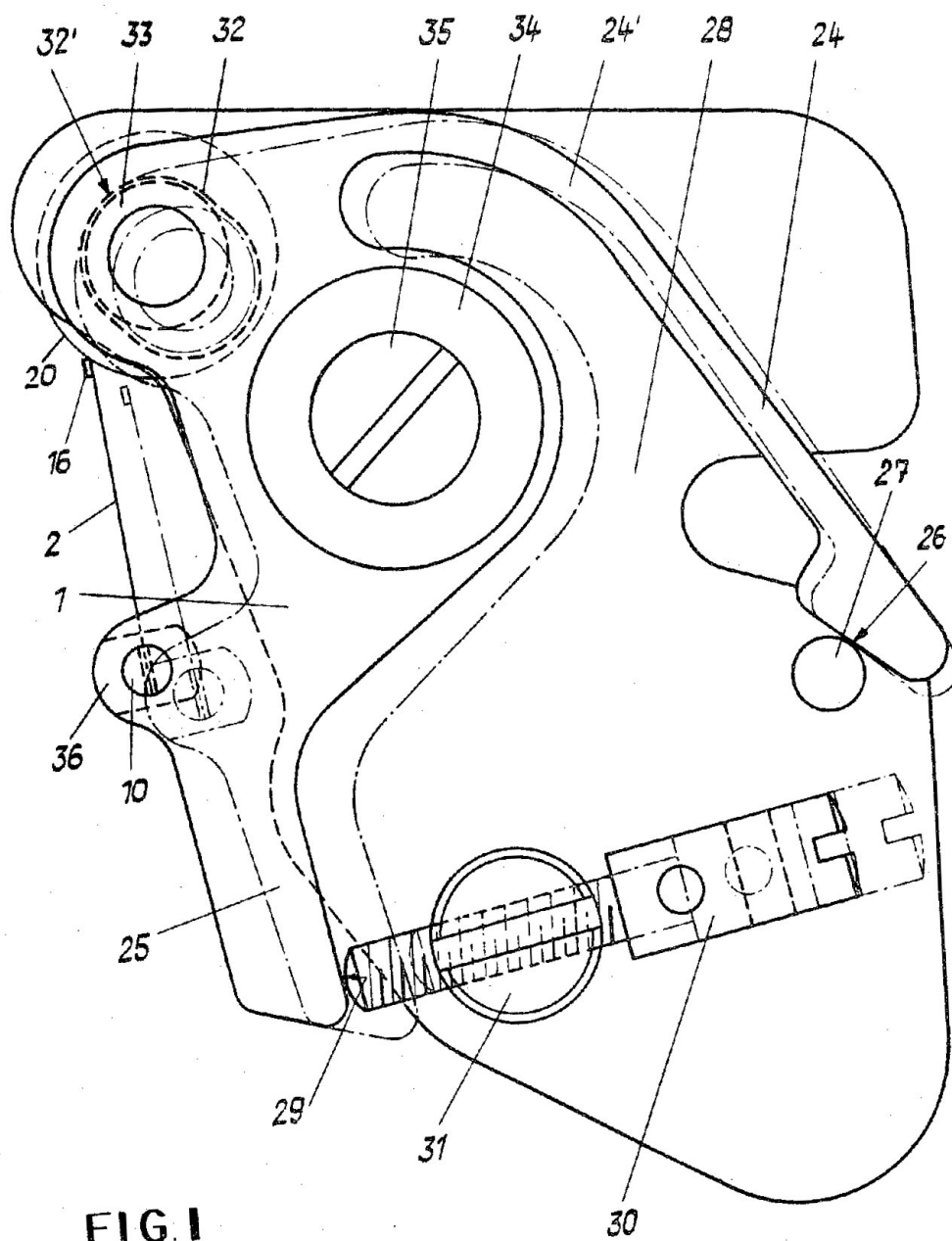
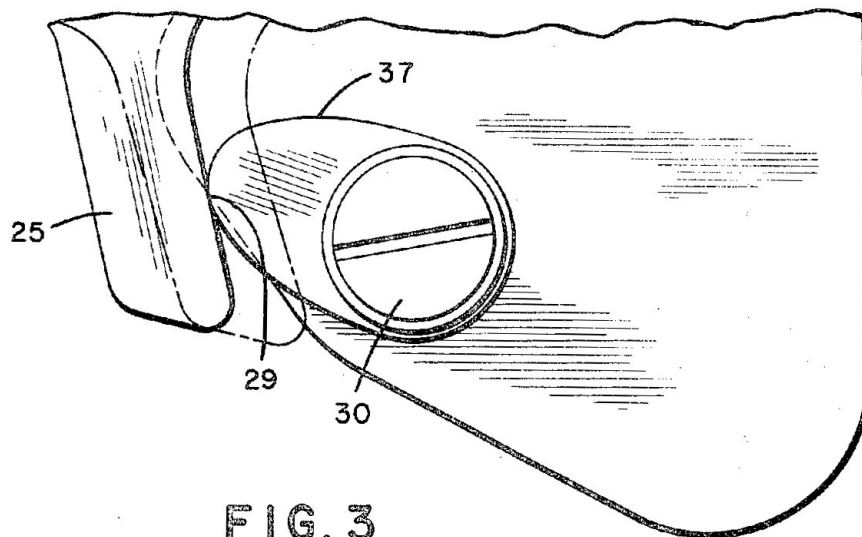
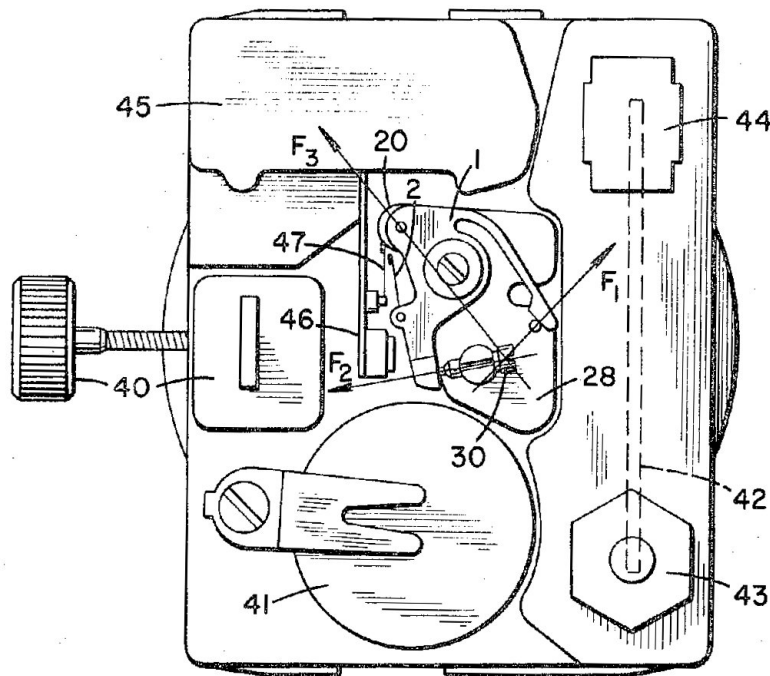


FIG. 1

FIG. 2



## PAWL AND RATCHET DEVICE

## OBJECTS OF THE INVENTION

This invention relates to devices for the transformation of oscillating movement into unidirectional, rotational movement and is more specifically concerned with pawl and ratchet mechanisms.

It is an object of the invention to provide an improved pawl and ratchet device, particularly suitable for horological applications, in which the phase of a holding pawl and its pressure upon the ratchet can be independently adjusted and the assembly of which is simplified.

## SUMMARY OF THE INVENTION

The invention concerns a device for transforming an oscillating movement into unidirectional movement comprising a ratchet rotatably mounted about an axis perpendicular to a fixed plate, and a driving pawl and a holding pawl for cooperation with the ratchet.

This device comprises, in combination:

i. a support member carrying the holding pawl the support member being movably mounted on the fixed plate by means permitting rotational movement of the support member about an axis of the ratchet and translational movement of the support member relative to said axis between a first position and a second position. The said mounting means comprise an arcuate bearing surface coaxial with said axis for contact between the plate and the support member when in the second position;

ii. means for moving the support member from the first position in which the holding pawl is spaced apart from the ratchet to the second position in which the holding pawl operatively engages the ratchet. The moving means comprises first and second abutment surfaces on the support member, the first and second surfaces converging in the direction of said axis, and adjustable abutment means on the fixed plate for outwardly urging the first and second abutment surfaces to provide a resultant force on the support member in the direction of said axis;

iii. means for adjusting the phase with which the holding pawl engages the ratchet. The phase adjusting means comprises an elastically deformable section of the support member arranged so that when the support member is in the second position adjustment of the moving means to outwardly urge the first and second abutment surfaces causes pivoting of a part of the support member and the holding pawl about said axis by elastic deformation of said section; and

iv. means for adjusting the angular location of the holding pawl on the support member to thereby enable adjustment of the pressure of the holding pawl on the ratchet.

## DESCRIPTION OF A PREFERRED EMBODIMENT

FIG. 1 of the accompanying drawings schematically shows, by way of example, an embodiment of the invention.

FIG. 2 shows the device illustrated in FIG. 1 in an electro-mechanical watch movement.

FIG. 3 is a view of the lower portion of the device illustrated in FIG. 1, however, showing an adjustable abutment eccentric.

A holding pawl 2 is fixed on a mobile support member 1 having two arms 24 and 25. The support member

is in a resilient material so that the arm 24 can be flexed about an elastically deformable section 24'. The arm 24 has an abutment surface 26 bearing against a pin 27 fixed on a plate 28 of a gear-train bridge carrying a ratchet wheel 20. The arm 25 also has an abutment surface 29 bearing against an adjustment screw 30. The abutment surfaces 26 and 29 are flat and inclined relatively to one another. The adjustment screw 30 is transversally mounted on an adjusting stop 31 fixed on the plate 28 and axially slotted to enable clamping of the screw 30.

The support member 1 carries a pivoting axle 33 engaging in an oblong slot 32 in the plate 28. The slot 32 terminates with a semi-cylindrical bearing surface 32' coaxial with the axis of the ratchet wheel so that when the axle 33 bears against the surface 32' it is coaxial with the ratchet 20.

On the drawing, the position of various members upon mounting is shown in dotted-dashed lines, the holding pawl 2 being disengaged from the ratchet wheel 20. The normal operative position of the device is shown in full lines.

By screwing the regulating screw 30 in the stop 31, the support member 1 is displaced until the axle 33 arrives at the end of the oblong hole 32, i.e., against the semi-cylindrical surface 32' which serves as a bearing. By continuing to turn the screw 30, the arm 25 of support member 1 pivots about the axle 33, which thus enables an adjustment of the phase of the holding pawl 2 in relation to a driving pawl, not shown, which driving pawl can be located at any convenient location of the periphery of the ratchet. The elastic deformation of section 24' of the arm 24 ensures that this adjustment is carried out free of play.

The resultant of the forces exerted on the abutment surfaces 29 and 26 by the screw 30 and pin 27 respectively ensures a permanent reaction of the semi-cylindrical surface 32' against the pivoting axle 33 and prevents displacement of this axle along the slot 32.

A foil-like washer 34 fixed on the support 1 by a screw 35 screwed into the plate 28 exerts a permanent perpendicular pressure on the support 1, hence eliminating any play in this direction between the support 1 and the plate 28. The screw 35 is of smaller diameter than an aperture (not shown) in the member 1 through which it passes, whilst the washer 34 is of greater dimensions than this aperture. The support member 1 is thus allowed sufficient angular play to pivot in relation to the plate 28 about axle 33.

To adjust the pressure of the holding pawl 2, i.e., of its end 16, against the ratchet 20, the pin 36, which is friction mounted by an axle 10 in a hole in the support 1, is angularly adjusted about the axle 10.

FIG. 2 shows an electro-mechanical watch movement having the inventive device therein, although the device might be used in any suitable movement. In FIG. 2 the device is located in the midst of a watch movement which includes hand setting mechanism 40, battery 41, quartz crystal 42 extending between a condenser for frequency adjustment 43, and electrical circuitry which is represented by enclosure 44. Resonator or motor 45 has oscillating arm 46 extending therefrom and driving pawl 47 is attached to oscillating arm 46. Driving pawl 47 is shown in engagement with ratchet wheel 20 which is also engaged by holding or returning pawl 2, as already described in conjunction with FIG. 1. It will be appreciated that the device described in de-

tail in FIG. 1 and shown in the movement illustrated in FIG. 2 may be installed in a timepiece movement such as that shown in FIG. 2 by securing plate 28 in the watch movement and then turning screw 30 to move and flex the mobile support member 1 thereby displacing the support means and bringing return pawl 2 into contact with ratchet 20. In this way, the delicate ratchet and pawl mechanism in timepieces may be installed while disengaged, and after installation, engaged by the turning movement of an adjustment screw 30. Before the present invention, the installation of such a driving mechanism often resulted in damage to its delicate parts.

As a variant, the adjustable abutment means for acting against the surface 29 could comprise an eccentric. As shown in FIG. 3, an eccentric surface 37 attached to adjustment screw 30 may engage abutment surface 29 on arm 26 of the mobile support member 1. The remainder of the device may be substantially as illustrated in FIG. 1, and adjustment of the device to engage a ratchet and pawl is accomplished by turning the adjustment screw 30.

Another possible variant is that the pivoting axle could be carried by the plate whilst the support member would be slotted; in such a variant, the arcuate bearing surface would be that opposite surface 32' as shown.

What is claimed is:

1. A device for transforming an oscillating movement of a driving pawl into unidirectional movement, comprising: a ratchet rotatably mounted about an axis perpendicular to a fixed plate, and a driving pawl for cooperation with the ratchet;

a support member carrying a holding pawl for engaging the ratchet, the support member being movably mounted on the fixed plate by means permitting rotational movement of the support member about the axis of the ratchet and translational movement of the support member relative to said axis between a first position and a second position, said mounting means comprising an arcuate bearing surface coaxial with said axis for contact between the plate and the support member when in the second position;

means for moving the support member from the first position, in which the holding pawl is spaced apart from the ratchet, to the second position, in which the holding pawl operatively engages the ratchet, said moving means comprising first and second abutment surfaces on the support member, the first and second surfaces converging in the direction of said axis, and adjustable abutment means on the fixed plate for outwardly urging the first and second abutment surfaces to provide a resultant force on the support member in the direction of said axis; said adjustable abutment means selected from the group consisting of: (1) an eccentric rotatably mounted on the plate, and (2) a screw mounted transversely in a stop member mounted on the plate;

means for adjusting the point of contact at which the holding pawl engages the ratchet for adjusting the phase of the movement of the ratchet, said adjusting means comprising an elastically deformable section of the support member arranged so that when the support member is in the second position adjustment of the moving means to outwardly urge

the first and second abutment surfaces causes pivoting of a part of the support member and the holding pawl about said axis by elastic deformation of said section; and means for adjusting the angular location of the holding pawl on the support member for adjusting the pressure of the holding pawl on the ratchet.

2. A device for transforming an oscillating movement of a driving pawl into unidirectional movement, comprising:

a ratchet rotatably mounted about an axis perpendicular to a fixed plate;

a support member carrying a holding pawl for engaging the ratchet, the support member being movably mounted on the fixed plate by means permitting rotational movement of the support member about the axis of the ratchet and translational movement of the support member relative to said axis between a first position and a second position, said mounting means comprising an arcuate bearing surface coaxial with said axis for contact between the plate and the support member when in the second position;

means for moving the support member from the first position, in which the holding pawl is spaced apart from the ratchet, to the second position, in which the holding pawl operatively engages the ratchet, said moving means comprising first and second abutment surfaces on the support member, the first and second surfaces converging in the direction of said axis, and an eccentric adjustable abutment means on the fixed plate for outwardly urging the first and second abutment surfaces to provide a resultant force on the support member in the direction of said axis;

means for adjusting the phase with which the holding pawl engages the ratchet, comprising an elastically deformable section of the support member arranged so that when the support member is in the second position adjustment of the moving means to outwardly urge the first and second abutment surfaces causes pivoting of a part of the support member and the holding pawl about said axis by elastic deformation of said section; and

means for adjusting the angular location of the holding pawl on the support member for adjusting the pressure of the holding pawl on the ratchet.

3. A device for transforming an oscillating movement of a driving pawl into unidirectional movement comprising:

a ratchet rotatably mounted about an axis perpendicular to a fixed plate;

a support member carrying a holding pawl for engaging the ratchet, the support member being movably mounted on the fixed plate by means permitting rotational movement of the support member about the axis of the ratchet and translational movement of the support member relative to said axis between a first position and a second position, said mounting means comprising an arcuate bearing surface coaxial with said axis for contact between the plate and the support member when in the second position;

a screw passing through an aperture in the support member and screwed into the plate, the diameter of the screw being smaller than the aperture, and a washer larger than the aperture urged by the

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screw against the support member to hold the support member to the plate without play perpendicular to the plane of the plate and support member; means for moving the support member from the first position, in which the holding pawl is spaced apart from the ratchet, to the second position, in which the holding pawl operatively engages the ratchet, said moving means comprising first and second abutment surfaces on the support member, the first and second surfaces converging in the direction of said axis, and adjustable abutment means on the fixed plate for outwardly urging the first and second abutment surfaces to provide a resultant force on the support member in the direction of said axis; means for adjusting the phase with which the holding pawl engages the ratchet, comprising an elastically deformable section of the support member arranged so that when the support member is in the second position adjustment of the moving means to outwardly urge the first and second abutment surfaces causes pivoting of a part of the support member and the holding pawl about said axis by elastic deformation of said section; and means for adjusting the angular location of the holding pawl on the support member for adjusting the pressure of the holding pawl on the ratchet.

4. A device for transforming an oscillating movement of a driving pawl into unidirectional movement, comprising:

- a ratchet rotatably mounted about an axis perpendicular to a fixed plate;
- a support member carrying a holding pawl for engaging the ratchet, the support member being movably mounted on the fixed plate by means permitting rotational movement of the support member about

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the axis of the ratchet and translational movement of the support member relative to said axis between a first position and a second position, said mounting means comprising a slot in the fixed plate terminating with a semicylindrical bearing surface coaxial with said axis when said support member is in said second position, and an axle on the support member engaging in the slot, the said resultant force on the support member urging the axle towards said bearing surface;

means for moving the support member from the first position, in which the holding pawl is spaced apart from the ratchet, to the second position, in which the holding pawl operatively engages the ratchet, said moving means comprising first and second abutment surfaces on the support member, the first and second surfaces converging in the direction of said axis, and adjustable abutment means on the fixed plate for outwardly urging the first and second abutment surfaces to provide a resultant force on the support member in the direction of said axis;

means for adjusting the phase with which the holding pawl engages the ratchet, comprising an elastically deformable section of the support member arranged so that when the support member is in the second position adjustment of the moving means to outwardly urge the first and second abutment surfaces causes pivoting of a part of the support member and the holding pawl about said axis by elastic deformation of said section; and

means for adjusting the angular location of the holding pawl on the support member for adjusting the pressure of the holding pawl on the ratchet.

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