United States Patent

[11] **3,570,759**

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[73] Assignee **Olympia Werke AG Wilhelmshaven, Germany**
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[33] **Germany**
[31] **P 18 16 497.1**

[54] **SWITCHING MECHANISM**
8 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **235/133**
[51] **Int. Cl.** **G06c 7/10,** G06c 9/00, G06c 15/26
[50] **Field of Search** ..... 235/133, 58, 60.28, 60.31, 60 (GEN)

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ABSTRACT: A switching mechanism for a mechanical decade counter has a movable setting member with a projection and a movable transfer member with gear teeth. One of these members has a projection and the other a portion defining a recess. A spring is so arranged that it transmits force between the setting member and the transfer member. The projection and the recess combine to form a bearing which permits the setting member and the transfer member to be fitted together in such a manner that in the assembled state one covers at least a part of the other. One of the members, preferably the transfer member, is constructed from an elastic material. The switching mechanism may be either a rotary mechanism or a linear mechanism. In the former case, the recess is in the transfer member at its center of arc and fits over a centrally located boss on the setting member. Overlapping surfaces are provided on the periphery of each member. In the latter case, the transfer member is U-shaped with the projection on one of its legs. More than one bearing may be provided on each switching mechanism.

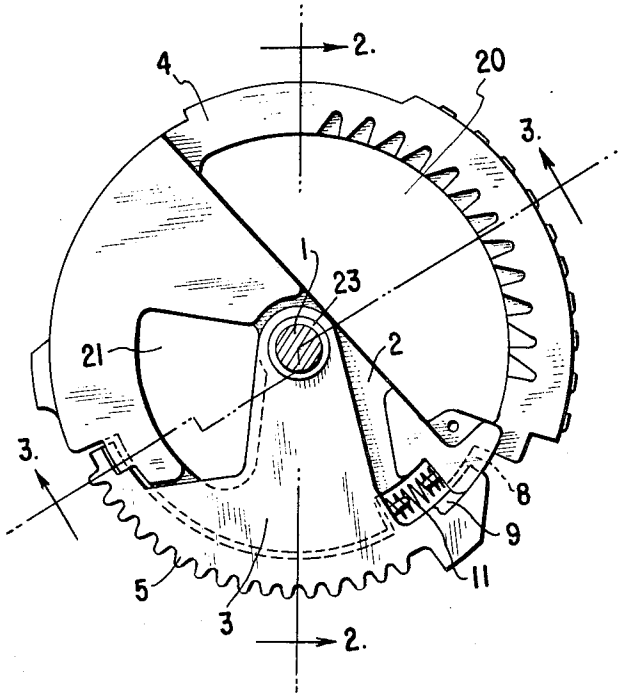

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Fig. 1

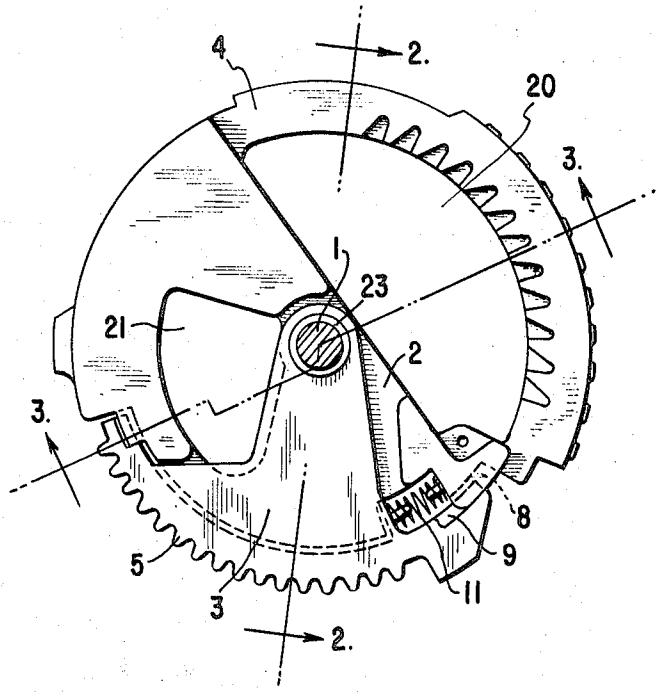
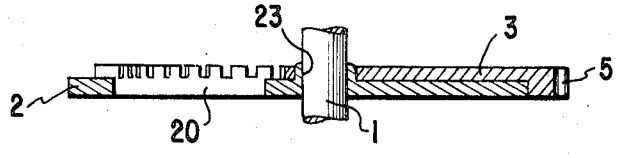


Fig. 2



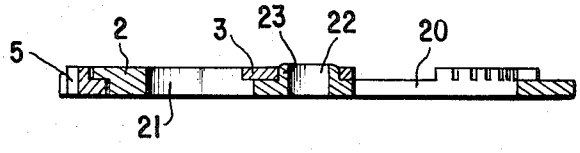


Fig. 3

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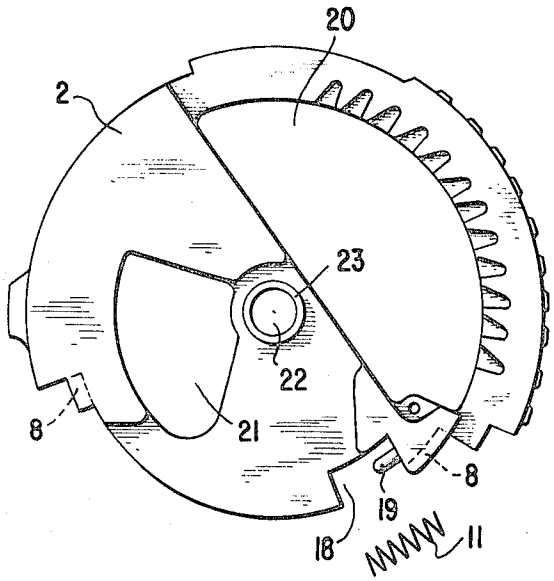
Fig. 4a



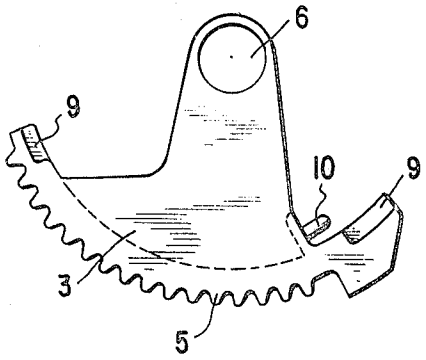


Fig. 4b

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Fig. 5

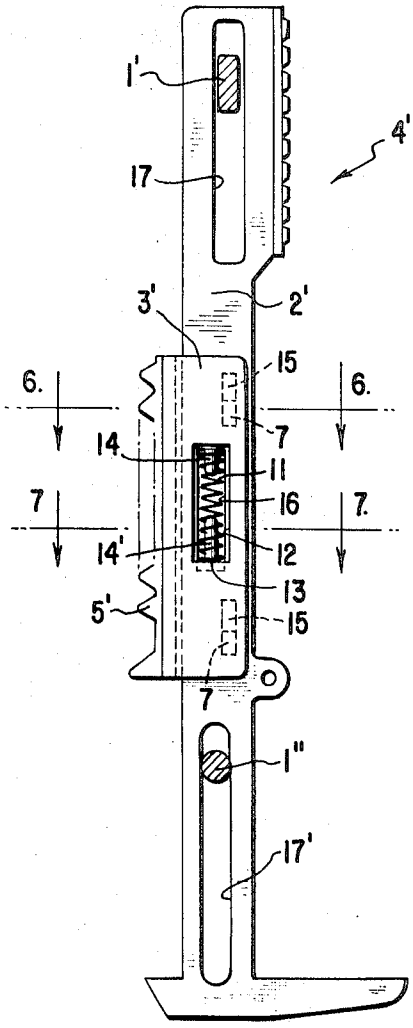
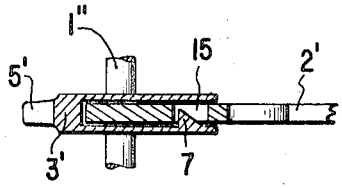


Fig. 6



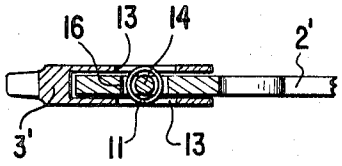


Fig. 7

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SWITCHING MECHANISM

BACKGROUND OF THE INVENTION

The present invention relates to a switching mechanism for decade counters, such as mechanical ratchet-wheel decade counters used in calculators. One of the mechanisms is used with each decade, and includes a setting member which can be moved back and forth and a transfer member with gear teeth which is connected with the setting member in a force-transmitting relationship by means of a spring which acts on the two switching mechanism members. The two members are arranged to be movable relative to each other for accomplishing decade switching. The switching mechanism per se, shown in the drawings of the present application, in general, of the type shown and described in U.S. Pat. No. 2,475,510 and U.S. Pat. No. 2,486,959.

In the known switching mechanisms of the type mentioned above, the magnitude and direction of the required movement between the setting member and the transfer member is generally determined after the central bearing for the switching mechanism has been installed. This procedure may result in overloading the spring, which is connected with the two switching mechanism members in an earlier manufacturing step, and lead to malfunctioning of the calculator. In addition, the usual routing of the individual structural components within the factory may also overload the spring. In order to prevent such an overload from occurring, the assembly of the setting member, transfer member and spring is handled with the utmost care up to the installation of the central bearing mentioned above. This required the assembly to be inevitably transported in expensive, special containers and to be tested at least once for operativeness.

A further disadvantage of the known mechanisms is that they are not adapted for the use of pressure springs as the spring element.

SUMMARY OF THE INVENTION

It is an object of the present invention to eliminate the disadvantages mentioned above simply and inexpensively.

To this end, a detent connection, which is known in the precision engineering art, is provided between a setting member and a transfer member which are arranged to be movable with respect to one another in a certain direction.

This object is accomplished according to the present invention by providing the setting member and the transfer member, one of which is made of an elastic material, with at least one common bearing permitting relative movement with respect to each other. In one preferred embodiment, this common bearing connects the two switching mechanism members in a releasable manner, so that in the assembled state they partially cover one another on both sides at their peripheries, and so that at least one protrusion on one of the members engages in an associated recess in the other member. This simple construction achieves the required magnitude and direction of movement between the setting member and the transfer member at the time they are assembled, without incurring additional expenses for protective devices.

To assure the desired ease of movement of the transfer members with respect to the setting members of the switching mechanism, a preferred embodiment of the present invention is distinguished by providing an extension on the setting member constructed so as to function as a spacer ring in such a manner that the force of a spring which presses the switching mechanism members against an abutment on the shaft is unable to produce a friction contact between a transfer member and its two adjacent setting members or its adjacent setting member and transfer member, as the case may be.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view, partly in cross section, of a first embodiment of a switching mechanism according to the present invention.

FIG. 2 is a cross-sectional view of one decade of the switching mechanism of FIG. 1 taken generally along line 2–2 of FIG. 1.

FIG. 3 is a cross-sectional view of one decade of the switching mechanism of FIG. 1 with the shaft removed taken generally along line 3–3 of FIG. 1.

FIG. 4*a* is a side-elevational view of the setting member of the switching mechanism of FIG. 1.

FIG. 4*b* is a side-elevational view of the transfer member of the switching mechanism of FIG. 1.

FIG. 5 is a side-elevational view, partly in cross section, of a second embodiment of a switching mechanism according to the present invention.

FIG. 6 is a cross-sectional view of one decade of the switching mechanism of FIG. 5 taken generally along the line 6–6 of FIG. 5.

FIG. 7 is a cross-sectional view of one decade of the switching mechanism of FIG. 5, before its installation on the center switching mechanism bearing, taken generally along the line 7–7 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 through 4*b* show a first preferred embodiment of a switching mechanism 4 for a decade counter according to the present invention. Switching mechanism 4 has a setting member 2 and a transfer member 3, and is mounted on shaft 1. Shaft 1 is attached in a well-known manner to the walls of a suitable housing (not shown). Transfer member 3 is in operative connection with at least one of the counters of a calculator (not shown). The switching mechanism 4 consists of at least two alternate groups of adjacently disposed switching mechanism members. The first group comprises setting member 2 and the second group comprises transfer member 3.

The configuration of setting member 2 is more clearly shown in FIG. 4*a*. As can be seen from FIG. 4*a*, with the aid of FIGS. 2 and 3, setting member 2 is provided with a projection 23 in the form of a boss. This boss 23 helps define a hole 22 which is sized to fit on shaft 1. Setting members 2 are also provided with recessed abutment surfaces 8 on the surface away from said boss 23, which are located at approximately the midpoint of the width of the setting member 2. Member 2 contains, for example, printing types and means such as setting pins for questioning setting members representing different values. The members 2 also have several openings provided for specific purposes. Opening, or recess, 18 has a spring-retaining pin 19 centrally disposed on one of its surfaces. Cutout areas 20 and 21 hold and guide, respectively, the drive spring or common collecting rod required for each decade of the switching mechanism 4. These elements are mounted in their usual manner.

The transfer member 3, as best shown in FIG. 4*b*, defines a circular arc segment with its center in the center of the hole 6. Gear teeth 5 are arranged along the circumference of the arc. A spring-retaining pin 10 is provided on one side of the member 3, and two countersurfaces 9 are provided at each end thereof. These countersurfaces 9 are also located at approximately the half width of the transfer member 3 in the manner of abutment surfaces 8 of member 2, and are so dimensioned that they can be brought into overlapping connection with the abutment surfaces 8 when the mechanism is assembled. The thickness of hole 6 is almost equal to half the width of the switching mechanism 4 and is so dimensioned that it will fit over boss 23 of member 2.

The assembly of the two switching mechanism members 2 and 3 can now be achieved in a very simple manner. After the abutment surfaces 8 have been brought into contact with the countersurfaces 9, the transfer member 3 is placed on the setting member 2 until the hole 6 of the transfer member 3, which preferably is constructed of a highly elastic material, is fitted over the boss 23 of the setting member 2. This provides the common bearing. Then it is only necessary to push the tension coil spring 11 onto the guide pins 10 and 19.

As can be seen best in FIGS. 2 and 3, the boss 23 of the setting member 2 acts as a spacer ring, which in the assembled state of the switching mechanism 4 extends above the plane of the outer surface of the transfer member 3. Thus, no contact, with its undesirable friction, can occur between a transfer member 3 and the adjacent setting members 2 and transfer members 3. As stated above, these groups of members can be held together in a well-known manner, such as by the force of a spring.

A particular advantage of the embodiment of FIGS. 1 through 4*b* is that the overlapping surface portions of switching mechanism members 2 and 3 only extend to approximately half the width of the switching mechanism 4. This means that due to the relatively slight changes in cross section of the members 2 and 3, materials which can be easily injection molded can be used, e.g. molded plastic materials.

FIGS. 5 through 7 show a second embodiment of a switch mechanism according to the present invention. This embodiment has linear motion and is mounted on two shafts, 1′ and 1″. Switching mechanism 4′ is made up of a setting member 2′ and a transfer member 3′. Setting member 2′ is an elongated plate member having a slot 17 in one of its ends for receiving and guiding shaft 1′ and a slot 17′ for receiving shaft 1″ in the other of its ends. Setting member 2′ also has an aperture 16 located approximately midway between its ends. Spring guide pins 14 and 14′ are formed in the aperture 16 from the material cut away to form the aperture so as to be oriented along the elongated axis of the setting member 2′. Pins 14 and 14′ receive a tension coil spring 11. Two recesses 15 are formed in the setting member 2′ for a purpose to be set out below (see FIG. 6).

The transfer member 3′ is fabricated in the shape of a U. Teeth 5 are formed on its close end, so as to form a rack. Rectangular apertures 12 are formed in each of the legs of the member 3′ as an aid for mounting the tension coil spring 11 on the pins 14 and 14′. The lower edge of each of the apertures 12 serves as an abutment surface 13 for the tension spring 11 (see FIG. 7). Projections 7 are formed on the inner surface of the legs of the member 3′ near the opened portion thereof. These projections 7 serve as detent elements and are dimensioned to mate with recesses 15 in member 2′ to form the common bearing.

When the members 2′ and 3′ are assembled, the detents 7 are latched in the recesses 15. This can be accomplished by merely snapping the U-shaped transfer member 3′, which is also preferably of a highly elastic material, over the setting member 2′ so that the projections 7 engage in recesses 15. The coil spring 11 can then be mounted on pins 14 and 14′.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations and the same are intended to be comprehended within the meaning and range of the equivalents of the appended claims.

We claim:

1. A switching mechanism for decade counters comprising, in combination:
   a. a setting member;
   b. a transfer member having a set of gear teeth;
   c. a spring member arranged to engage both said setting member and said transfer member so as to transfer force between them; and
   d. at least one bearing means which is common to both said setting member and said transfer member and includes a projection on one of said members and a portion defining a recess on the other of said members, and is for mounting said setting member and said transfer member together for movement with respect to each other when they are fitted together in such a manner that one of said members covers at least a part of the other of said members.

2. A switching mechanism as defined in claim 1 wherein one of said members is constructed of a highly elastic material.

3. A switching mechanism as defined in claim 2 wherein said setting member is a disc defining a centrally located hole for admitting a shaft, said protrusion being a boss extending axially outward from one face of said disc and surrounding the hole, and two abutment surfaces arranged on a part of the periphery of the opposite face of said disc, said transfer member defining said recess and having two countersurfaces which mate with said abutment surfaces, so that in the assembled state the said members cover one another in part on both sides of their peripheries.

4. A switching mechanism as defined in claim 3 wherein said boss is dimensioned so as to extend axially past the plane of the furthest surface of said transfer member so as to provide a spacer ring between said transfer member and a member adjacent to it, whereby a clearance is maintained between said transfer member and a member adjacent to it.

5. A switching mechanism as defined in claim 4 wherein said transfer member defines a circular arc portion with the gear teeth along the circumference of the arc and the recess at the center of the arc.

6. A switching mechanism as defined in claim 2 wherein said transfer member is a U-shaped member with two arms and having at least one projection on one of its arms, said projection being a detent, and wherein said setting member defines at least one recess for engaging said at least one detent.

7. A switching mechanism as defined in claim 6 wherein said transfer member is provided with two detents and said setting member is provided with two recesses.

8. A switching mechanism as defined in claim 7 wherein the gears of said transfer member are located along the outer surface of the closed end of said U-SH U-shaped member and wherein said setting member is an elongated member having two slots to accept shafts therein and wherein said transfer member defines a rectangular cutout portion in its legs and said setting member defines a matching cutout portion having a pair of opposed pins to retain said spring member.