United States Patent

Himi et al.

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[54] SPRING OPERATED MAKING DRIVING MECHANISM FOR CIRCUIT BREAKING AND SWITCHING DEVICE

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March 27, 1970 Japan.....45/29294

[52] **U.S. Cl.**.....**200/153 SC,** 74/2, 185/40 R

[51] **Int. Cl.**.....**H01h 3/30**

[58] **Field of Search**.....200/153 SC, 153 P; 185/37, 185/39, 40 R; 74/2

[56] **References Cited**

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[57] **ABSTRACT**

The actuating mechanism for a circuit breaker or switch has a bar moved longitudinally by a spring. The spring is charged by a reversible electric motor which first turns an internally threaded gear on the bar to shift the gear along the bar and thereby to engage a latch on the gear with a remotely controlled mechanism, and thereafter turns the axially secured gear to shift the bar and thereby to tension the spring. The bar is moved by the spring when the mechanism releases the latch.

2 Claims, 5 Drawing Figures

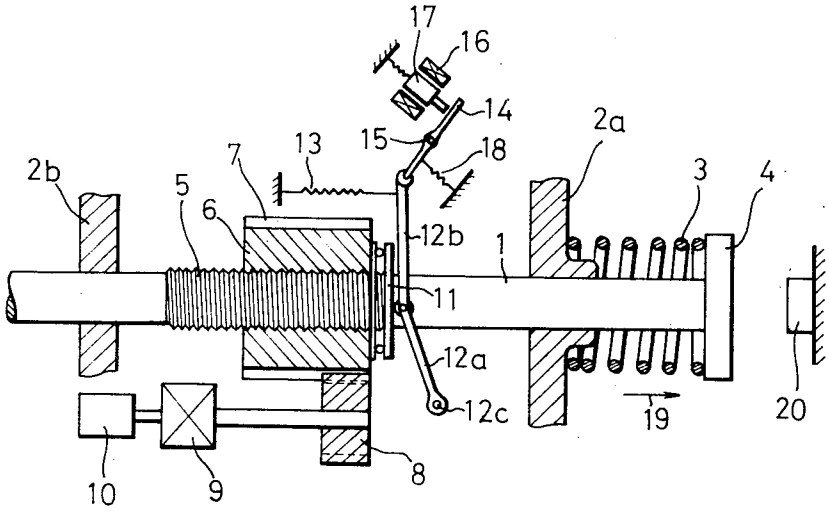

FIG.1

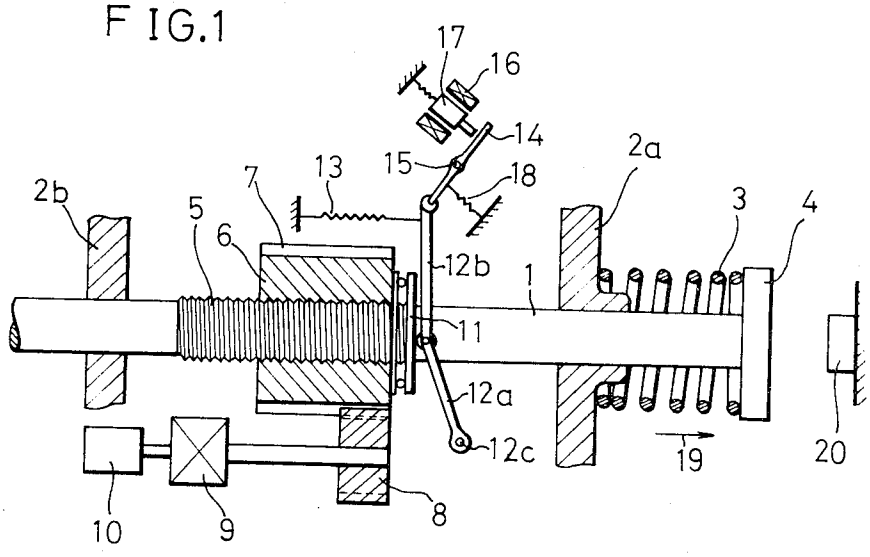

FIG.2

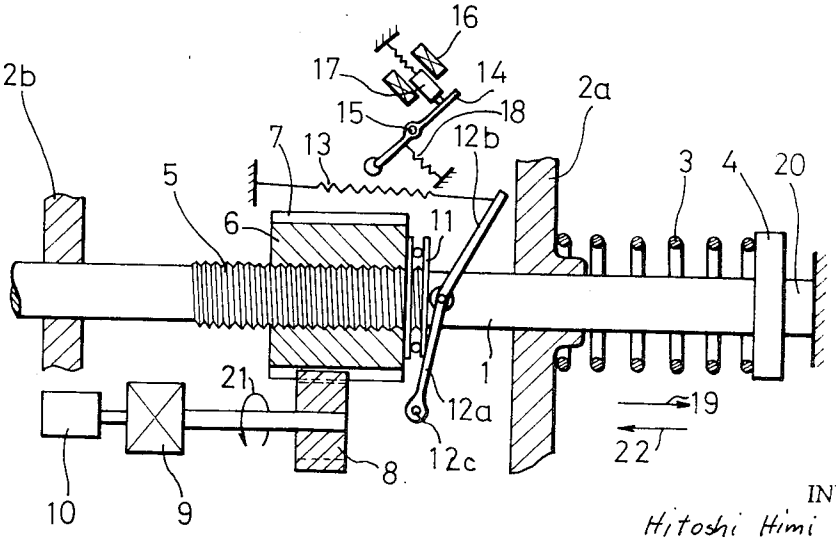

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FIG. 3

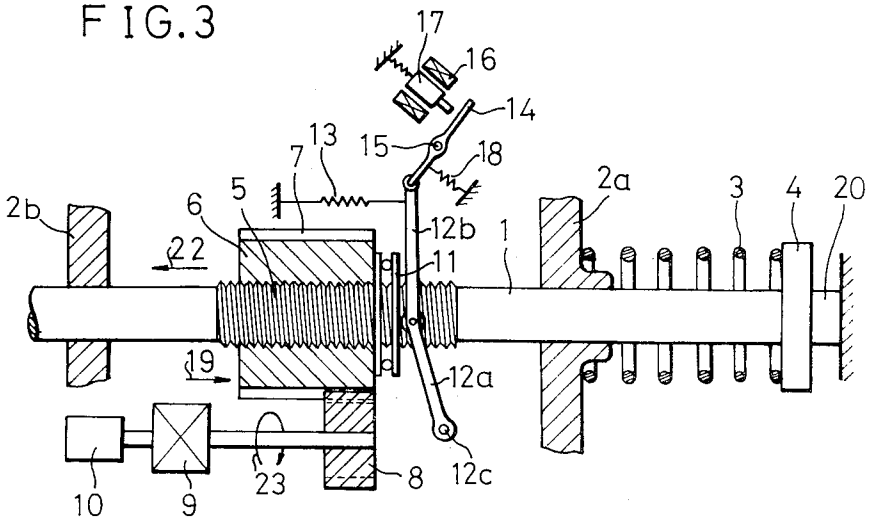


FIG. 4

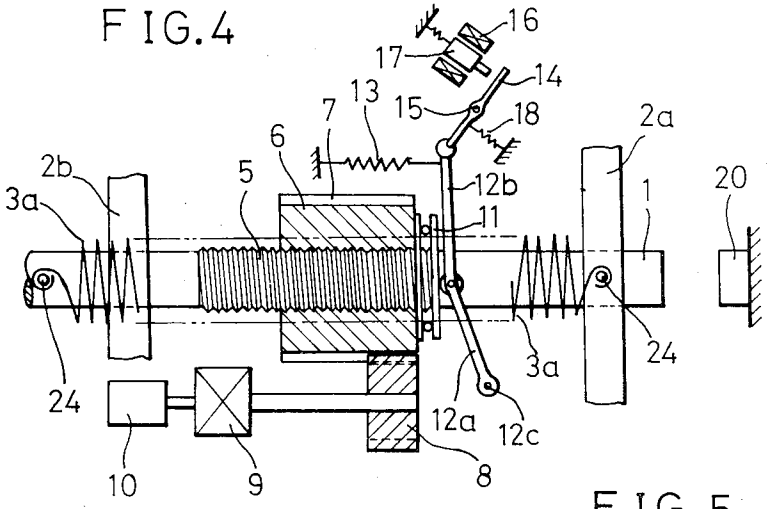
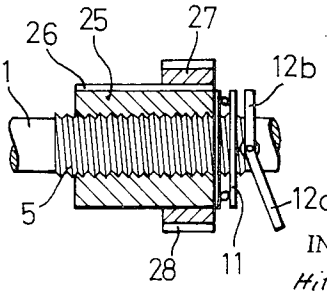


FIG. 5



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SPRING OPERATED MAKING DRIVING MECHANISM FOR CIRCUIT BREAKING AND SWITCHING DEVICE

This invention relates to circuit breaking and switching devices, and particularly to a spring-operated actuating mechanism for a circuit breaker or switch.

More specifically the invention relates to an improved device for tensioning the operating spring. It is an object of the invention to provide a simple and inexpensive actuating mechanism of the type described which occupies but little space.

In its more specific aspects, the invention provides an elongated bar as the actuating member of the mechanism. The bar is partly threaded and supported in bearings for movement in the direction of its longitudinal axis. An internally threaded member carrying external gear teeth is mounted on the bar. A spring is energized, when the bar moves axially in one direction, and relaxes when it moves the bar in the opposite direction. A reversible motor can turn a gear meshingly engaging the internally threaded member and thereby energize the spring, as will presently be explained. Axial movement of the threaded member in the afore-mentioned opposite direction can be prevented by a latch until the latch is released by a remotely controlled release mechanism which thereby permits the bar to be moved by the energized spring.

The invention will be understood more fully from the following detailed description of preferred embodiments when considered in connection with the appended drawing in which:

FIG. 1 shows a switch actuating mechanism of the invention in elevational section;

FIGS. 2 and 3 illustrate the device of FIG. 1 in different operating positions;

FIG. 4 illustrates a modified actuating mechanism of the invention in elevational section; and

FIG. 5 shows yet another actuating mechanism of the invention in fragmentary elevational section.

Referring initially to the apparatus shown in FIGS. 1 to 3, there is seen a driving bar 1 received in stationary bearings 2*a*, 2*b* for movement in the direction of its longitudinal axis. A helical compression spring 3 is interposed between the bearing 2*a* and a collar 4 on the bar 1. A portion of the bar 1 between the bearings 2*a*, 2*b* is provided with threads 5 on which an internally threaded gear 6 is mounted coaxially. The teeth 7 of the gear 5 mesh with a gear or pinion 8 on the output shaft of a speed reducing gear mechanism 9 operated by a reversible motor 10.

A thrust bearing 11 coaxial with the bar 1 and the gear 6 is mounted on the later. One end 12*a* of a latch arm is pivoted on a stationary shaft 12*c*. The other end 12*b* is biased by a spring 13 to keep the latch arm engaged with the bearing 11. In the position shown in FIG. 1, the free end 12*b* of the latch arm is engaged by a hook 14 mounted on a pivot 15, and may be released from the hook when an electromagnet 16 is operated and its armature 17 strikes the hook 14 to shift it against the restraint of the biasing spring 18.

The afore-described apparatus operates as follows:

In the position of the apparatus shown in FIG. 1, the spring 3 is in the compressed condition and cannot move the bar 1 in the direction of the arrow 19 because the latch arm 12*a*, 12*b* is engaged by the hook 14. When the magnet 16 is operated, the hook 14 releases the latch arm 12*a*, 12*b*, and the spring 3 moves the bar 1 until it engages a fixed abutment 20. The teeth 7 of the gear 6 are long enough to maintain meshing engagement with the pinion 8 when the position seen in FIG. 2 is reached,

The operating member of the associated switch or circuit breaker (not shown) is connected to the end of the bar 1 which is not seen in the drawing, and axial movement of the bar from the position of FIG. 1 into that of FIG. 2 operates the switch or circuit breaker.

The motor 10 is energized thereafter to rotate the pinion 8 in the direction of the arrow 21 (FIG. 2). The gear 6 is thereby moved threadedly on the bar 1 in the direction of the arrow 22 toward the position of FIG. 3 while the bar is held stationary by the spring 3. The latch arm 12*a*, 12*b* is pivoted by engagement with the thrust bearing 11 under the force of the spring 13, and is engaged by the hook 14 when the position of FIG. 3 is reached.

The motor 10 is then reversed to turn the pinion 8 in the direction of the arrow 23 (FIG. 3). Axial movement of the gear 6 toward the bearing 2a in the direction of the arrow 19 being blocked, the bar 1 is moved against the restraint of the spring 3 away from the abutment 20 in the direction of the arrow 22 until the position shown in FIG. 1 is restored. Rotation of the bar 1 is prevented by non-illustrated keys and keyways in the bearings 2*a*, 2*b*. The motor 10 is energized and reversed in proper timed sequence by a control unit, not shown.

The afore-described apparatus is simple and easily assembled. It occupies but little space.

The modified apparatus of the invention shown in FIG. 4 is substantially identical with that described with reference to FIGS. 1 to 3, but employs a helical tension spring 3*a* instead of the afore-described compression spring 3. The ends of the spring 3*a* are attached to radial pins 24 on the bearing 2*b* and on the portion of the bar 1 spaced from the bearing 2*b* in a direction away from the bearing 2*a*. It operates in the same manner as the spring 3 to energize the working stroke of the bar 1 away from the abutment 20, and is charged by means of the motor 10 as described above.

The devices of FIGS. 1 to 3 and 4 may further be modified in the manner shown in FIG. 5. The internally threaded gear 6 may be replaced by an internally threaded sleeve 25 whose outer surface carries an axial key 26. A ring 27 is secured against rotation on the sleeve 25 by engagement with the key 26 and is provided with external gear teeth 28 for engagement with the drive pinion 8. The operation of the apparatus is not changed by this modification.

What is claimed is:

1. An actuating mechanism for a circuit breaking and switching device comprising, in combination:
   a. a driving bar member having a longitudinal axis;
   b. bearing means supporting said bar member for axial movement;
   c. an internally threaded member carrying gear teeth and threadedly engaging said bar member for movement about said axis;
   d. spring means arranged for being energized by movement of said bar member in one axial direction, said spring means moving said bar member in the opposite axial direction when relaxing;
   e. operating means for turning said threaded member about said axis relative to said bar member, said operating means including a gear member meshing with said internally threaded member, and motor means for turning said gear member in either of two opposite directions while said gear member meshes with said internally threaded member;
   f. latch means engageable with said threaded member for preventing axial movement of the threaded member in said opposite direction; and
   g. releasing means for releasing said latch means when in the engaged condition and for thereby permitting said axial movement of the threaded member and of the bar member engaged thereby.

2. A mechanism as set forth in claim 1, wherein said teeth are mounted on a carrier secured on said internally threaded member against relative rotation about said axis, but axially slidable on the internally threaded member.

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