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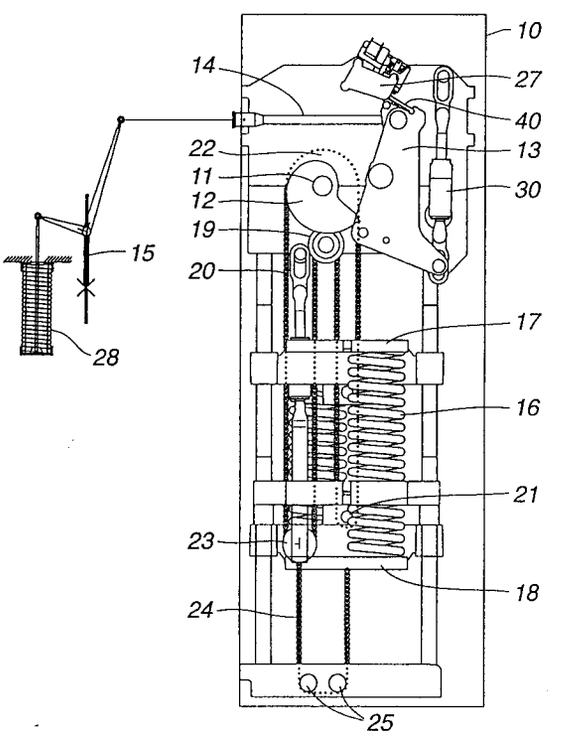
## (54) Operating device for circuit breakers.

(57) The invention relates to an operating device intended for high-voltage circuit breakers and comprising an operating shaft (11) which influences an operating lever (13) connected to the movable contact (15) of the circuit breaker. The operating device comprises a closing spring (16) and an opening spring (28). After each completed closing operation, a motor tensions the closing spring (16) again, and the closing spring tensions the opening spring (28) upon closing of the circuit breaker. The closing spring is kept tensioned by a closing latch. The breaker contact (15) is kept closed and the opening spring (28) is kept tensioned by a tripping latch (27). The operating lever (13) is provided with a spring-loaded catch flap (40) which cooperates with the fixedly mounted tripping latch (27). The catch flap has the shape of a substantially rectangular plate, one edge portion of which is designed to serve as a rotary shaft and is rotatably fixed to a bearing seat formed in the operating lever (13).

*Fig. 1*




EP 0 668 600 A1

## TECHNICAL FIELD

The present invention relates to an operating device, intended for electric circuit breakers, of the kind described in the preamble to claim 1. The operating device is primarily intended for $SF_6$ breakers for outdoor substations with a rated voltage of the order of magnitude of 40 kV and higher, but the operating device may advantageously be used also for other types of circuit breakers. The operating device comprises closing springs, which in tensioned condition contain the necessary energy for closing of the breaker and for charging of the opening springs of the breaker.

## BACKGROUND ART

A spring-actuated operating device of the above-mentioned kind is previously known from DE-C-1948405. The known operating device comprises, inter alia, an operating shaft for closing the circuit breaker, closing springs for rotating the operating shaft, a tensioning device with a driving shaft for charging the closing springs via an endless chain, and latching devices for limiting the rotation of the operating shaft upon each closing and for latching the operating shaft during the charging of the closing springs. A problem with spring-actuated operating devices of this kind is to master the energy stored in the springs, which energy is to be released rapidly to operate the circuit breaker. It is then important for the parts included to be easily movable, to have a small mass inertia, and to be designed to withstand the very great forces developed by the springs.

## SUMMARY OF THE INVENTION

The invention aims to provide an operating device of the above-mentioned kind which, in comparison with corresponding prior art designs, provides faster operation, has smaller dimensions and is so designed that its manufacturing cost is lower.

To achieve this aim the invention suggests an operating device for circuit breakers according to the introductory part of claim 1, which is characterized by the features of the characterizing part of claim 1.

According to the invention, the operating lever of the operating device is provided with a spring-loaded catch flap which cooperates with the fixedly mounted tripping latch. In similar manner, a latching arm fixed on the operating shaft is provided with a similar catch flap, which cooperates with the fixedly mounted closing latch. Since the catch flap is in the shape of a substantially rectangular plate, one edge portion of which is designed to serve as a rotary shaft and rotatably fixed in a bearing seat formed in the operating lever and in the latching arm, respectively, many advantages are obtained, of which the following may be mentioned:

- The catch flap can be arranged such that the spring force acts in the plane of the flap and is taken up rectilinearly. In this way, an optimum utilization of material is obtained, such that the mass inertia of the flap can be minimized.
- The catch flap requires little angular motion to achieve tripping, because the rotary shaft lies in the plane of the flap. This provides faster operation.
- The number of parts can be minimized since the catch flap does not need any separate rotary shaft with associated bearings, attachments, etc.
- The catch flap is very easy to mount and requires no adjustment.
- Simple maintenance (only lubrication).

## BRIEF DESCRIPTION OF THE DRAWINGS

By way of example, the invention will now be described in greater detail with reference to the accompanying drawings, wherein

- Figure 1 shows an embodiment of an operating device according to the invention, in normal operating position,
- Figure 2 shows the same operating device immediately after an opening operation,
- Figure 3 shows the operating device immediately after a closing operation,
- Figure 4 shows the operating device during charging of the closing springs,
- Figure 5 is a perspective exploded view of a latching member intended for cooperation with the closing latch and capable of being fixed on the operating shaft,
- Figure 6 shows, in perspective view from behind, the latching arm and the catch flap of the latching member, and
- Figure 7 shows in an end view the operating shaft of the operating device with its closing latch in engaged position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The operating device shown in the drawings is intended for high-voltage circuit breakers of, for example, the kind described in Asea Journal 1983, No. 3, pp. 16-21. The different parts of the operating device, with the exception of the opening springs of the circuit breaker, are enclosed in a

cabinet 10. The operating device has an operating shaft 11, on which is mounted a cam disk 12 which, via an operating lever 13 and an operating rod 14, influences the movable contact 15 (schematically shown in Figs. 1-4) of the circuit breaker. Closing of the circuit breaker is performed by turning the operating shaft 11 in a clockwise direction (Fig. 3), which is achieved with the aid of a number of closing springs 16 in the form of compression springs which are tensioned between an upper fixed spring bridge 17 and a lower vertically displaceable spring bridge 18. The spring tensioning is performed with the aid of a motor which drives a chain wheel 19, which with the aid of a catch is prevented from rotating in the reverse direction. The interconnection of the closing springs 16, the motor-driven chain wheel 19 and the operating shaft 11 is performed with the aid of an endless chain 20, in which the lower spring bridge 18 is suspended from a chain wheel 21. From the wheel 21 the chain 20 passes over a chain wheel 22 fixed to the operating shaft 11 and continues via an idler sprocket 23 and the driven chain wheel 19, and finally returns to the wheel 21. A stretching chain 24, running over two idler rolls 25 journalled in the bottom of the operating cabinet, is fixed at one end to the shaft of the idler sprocket 23 and at the other end to the lower spring bridge 18. The task of the stretching chain 24 is to keep the endless chain 20 stretched.

A closing latch 26 (Figs. 4 and 7) is arranged near the operating shaft 11, such that the shaft can only rotate one revolution upon each closing operating. Further, a tripping latch 27 is arranged near the operating lever 13 to keep the movable contact of the circuit breaker in the closed position after a closing operation.

Figure 1 shows the operating device in its normal operating position, wherein the contact 15 of the circuit breaker is in the closed position and the closing springs 16 and the opening spring 28, which is placed adjacent the linkage system of the circuit breaker, are tensioned. The circuit breaker is retained in the closed position by the tripping latch 27 which takes up the force from the tensioned opening spring 28. If the circuit breaker now receives a tripping impulse, the operating device can open the circuit breaker and is able to carry out a complete rapid auto-reclosing whereby, following its opening, the breaker closes automatically after a predetermined time interval of 0.3s and, if the fault remains, opens again immediately.

Upon opening of the circuit breaker (Fig. 2), the tripping latch 27 is released by its magnet. The opening spring 28 carries out the operation, whereby the circuit breaker opens. The operating lever 13 moves to the left and is positioned with its stop roller 29 against the cam disk 12. The movement of the contact system is damped in the end position by a damping device 30.

Upon closing of the circuit breaker (Fig. 3), the closing latch 26 is released by its magnet. The driven chain wheel 19 is blocked against rotation, the energy in the closing springs 16 thus being transferred via the chain section 20a to the chain wheel 22 with the associated cam disk 12. This causes the cam disk to drive the operating lever 13 to the right where it is blocked in the end position by the tripping latch 27. The velocity of movement is slowed down in the end position by a damping device 31, and the latching arm 32 fixed on the operating shaft 11 again reaches its initial position towards the closing latch 26.

As soon as a closing operation has taken place, the motor which drives the chain wheel 19 (Fig. 4) is automatically started. The chain wheel 22 with the cam disk 12 fixed on the operating shaft 11 stands still, since the latching arm 32 is locked against the closing latch 26, whereby the chain section 20b lifts the spring bridge 18. This causes the closing springs 16 to become tensioned again and the operating device again assumes the normal operating position.

Figures 5 and 6 show the latching member which is intended for cooperation with the closing latch and which comprises the latching arm 32, capable of being fixed to the operating shaft 11, and a catch flap 40 supported by the latching arm. This catch flap has the shape of a substantially rectangular plate, one edge portion 41 of which is designed to make contact with the closing latch 26, whereas the opposite edge portion 42 is designed with an arc-shaped contour to be able to serve as a rotary shaft. At the first-mentioned edge portion 41, the catch flap 40 is provided with two lugs 43 extending from the plane of the flap and provided with oblong through-holes 44. The catch flap 40 is mounted in the latching arm 32 by pushing the edge portion 42 of the catch flap sideways into a slot 33 in the latching arm adapted to the edge portion. The slot 33 has a longitudinal opening 34, the width of which is larger than the thickness of that portion of the catch flap which is located nearest the edge portion 42 but smaller than the transverse dimension of the edge portion. In this way, the catch flap is fixed in the longitudinal direction. The fixing of the catch flap in the lateral direction is achieved with the aid of a resilient tubular pin 35 which is fixed in the hole 36 in the latching arm 32, thus engaging into a transversal slot 45 provided in the edge portion 42 of the catch flap, the slot having such a depth that the rotary motion of the catch flap is not prevented by the pin 35. Between the catch flap 40 and the latching arm 32, two (or more) compression springs 37 are arranged. With the aid of two locking pins 39, fixed

into holes 38 in the latching arm 32 and engaging into the oblong holes 44 of the guiding lugs 43, the angle of rotation of the catch flap 40 is limited.

Figure 7 shows the operating shaft 11 with the catch flap 40 mounted on the latching arm 32 in engagement with the closing latch 26. This latch comprises two cascade-connected, spring-actuated roll latches, which may be released by means of a release magnet 46. The contact points of the latches are marked by circles 48, 49.

The tripping latch 27 and the catch flap mounted on the operating lever 13 are of the same design as those shown in Figures 5-7.

## Claims

1. An operating device for circuit breakers comprising an operating shaft (11) which is adapted to influence an operating lever (13) connected to the movable contact (15) of the circuit breaker, wherein the operating shaft (11) only has one direction of rotation whereas the operating lever (13) is rotatable back and forth between two positions corresponding to the closed and open positions of the circuit breaker, an opening spring (28) connected to the movable contact of the circuit breaker, a closing spring (16) which exerts a torque on the operating shaft (11), a tensioning member (19) for charging the closing spring, a closing latch (26) for keeping the closing spring (16) in tensioned condition, and a tripping latch (27) for keeping the opening spring (28) in tensioned condition and the contacts of the circuit breaker closed, **characterized** in that the operating lever (13) is provided with a catch flap (40), adapted to cooperate with the tripping latch (27) and biassed by a resilient member (37), said catch flap being in the form of a substantially rectangular plate in which one (41) of two parallel edge portions (41, 42) has an edge surface adapted to make contact with the tripping latch (27) whereas the other edge portion (42) has an edge surface with an arc-shaped contour to form a rotary shaft which is rotatably fixed in a bearing seat (33) formed in the operating lever (13).

2. An operating device according to claim 1, **characterized** in that the operating shaft (11) supports a latching arm (32) which is provided with a catch flap (40) of a design similar to the catch flap of the operating lever (13) and adapted to cooperate with the closing latch (26).

3. An operating device according to claim 1 or 2, **characterized** in that the catch flap (40) is pro-vided with a guiding lug (43), arranged at said first edge portion (41), with an oblong hole (44), a locking pin (39) fixed in the operating lever (13) and in the latching arm (32), respecively, engaging into said oblong hole to limit the angle of rotation of the catch flap.

4. An operating device according to any of the preceding claims, **characterized** in that the bearing seat (33) of the operating lever (13) and the latching arm (32), respectively, consists of a slot which is adapted to said second edge portion (42) of the catch flap (40) and which has an oblong opening (34), the width of which is smaller than the transverse dimension of the edge portion but larger than the thickness of that part of the catch flap which is located nearest the edge portion.

5. An operating device according to any of the preceding claims, **characterized** in that said second edge portion (42) of the catch flap is provided with a transversal slot (45), a locking pin, fixed to the operating lever (13) and to the latching arm (32), respectively, engaging into said transversal slot to fix the catch flap (40) in the lateral direction.

Fig. 2

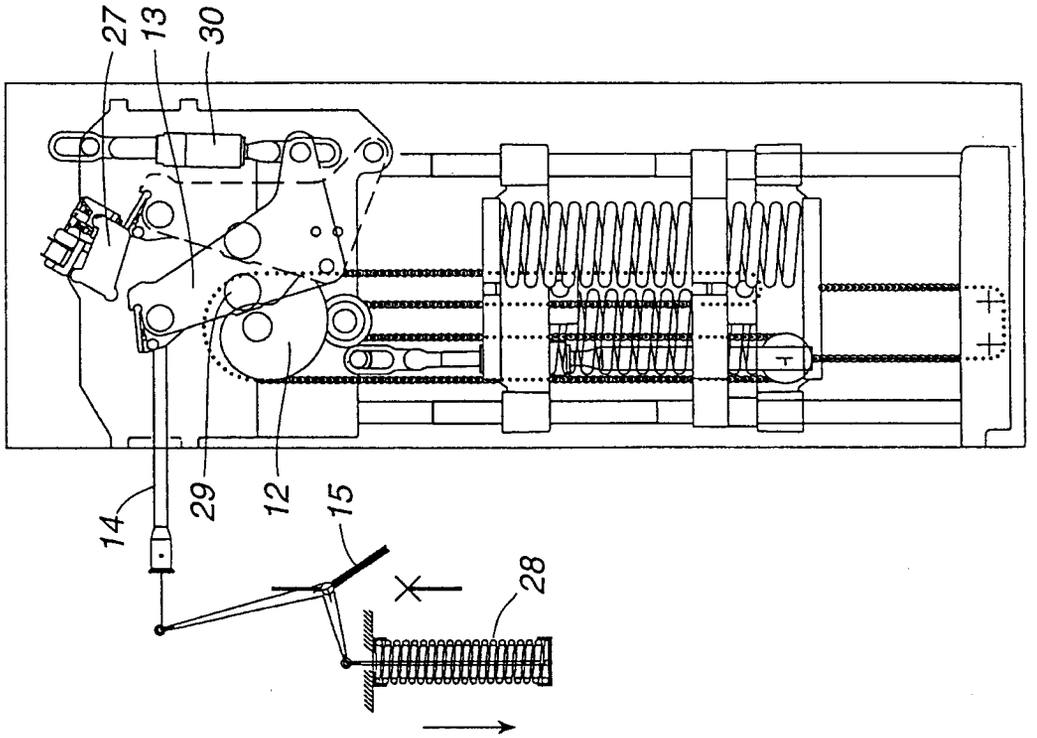

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Fig. 1

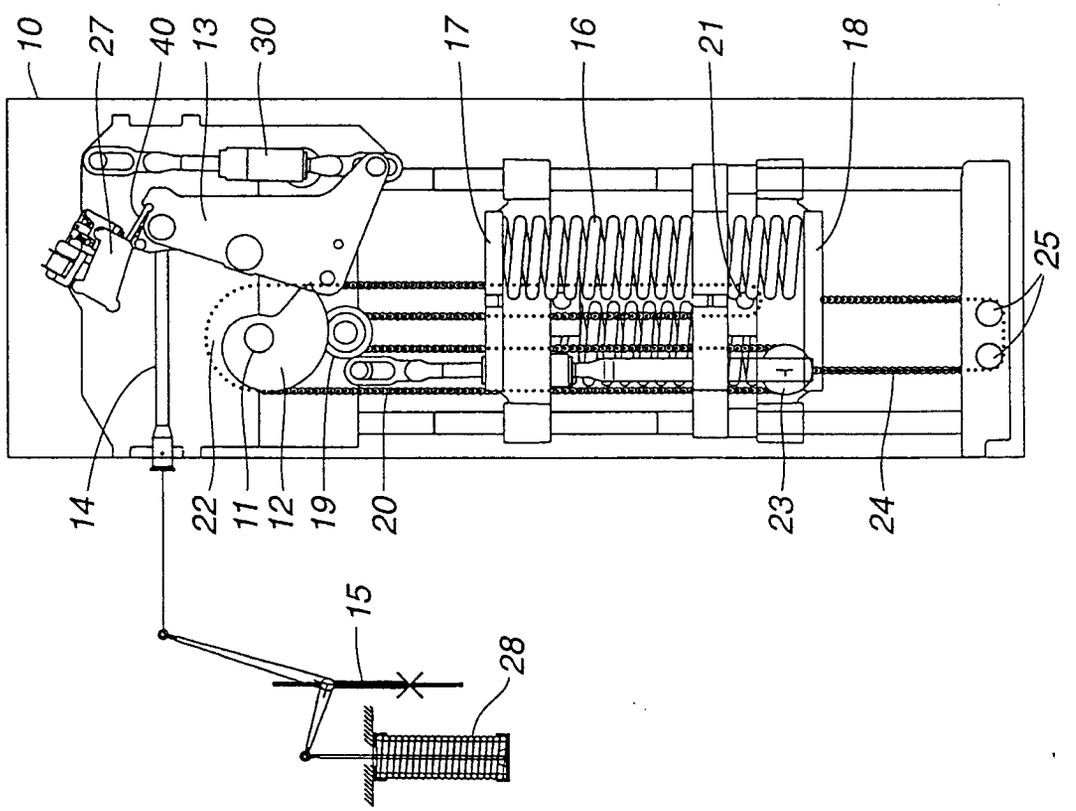
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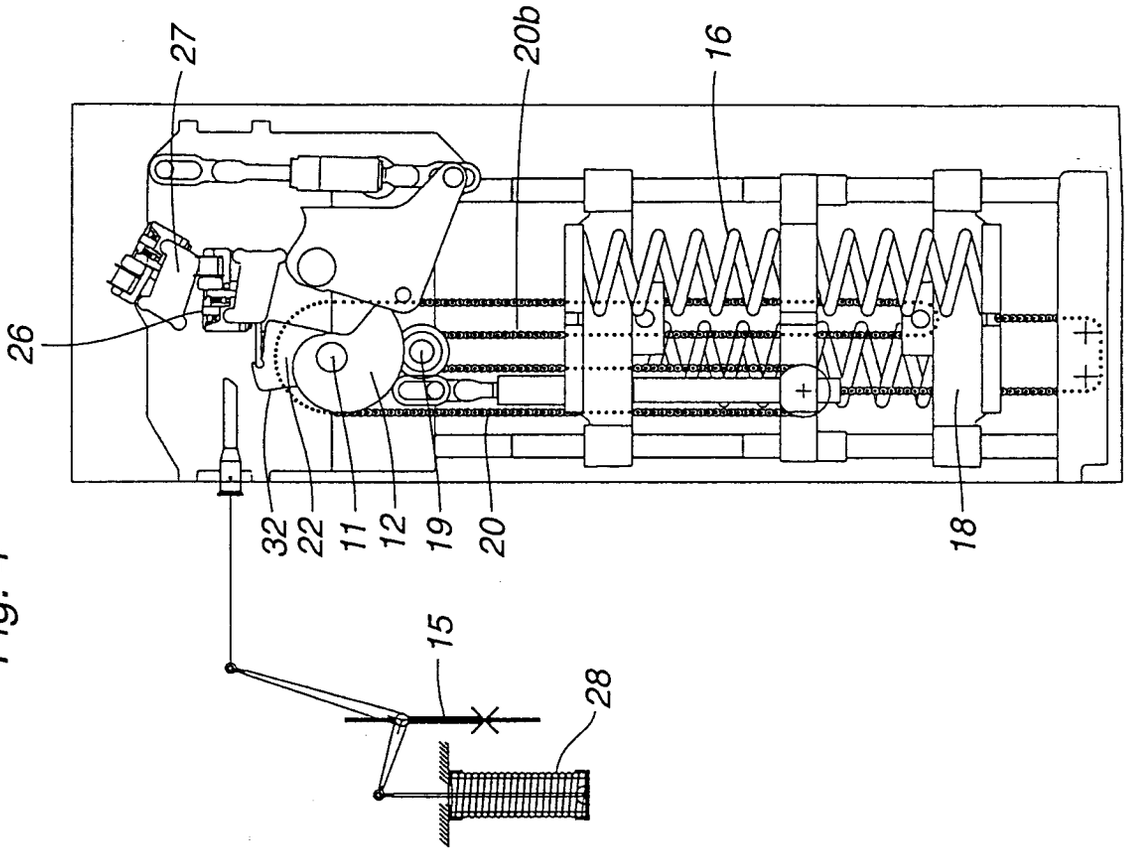
Fig. 4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20b
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Fig. 3

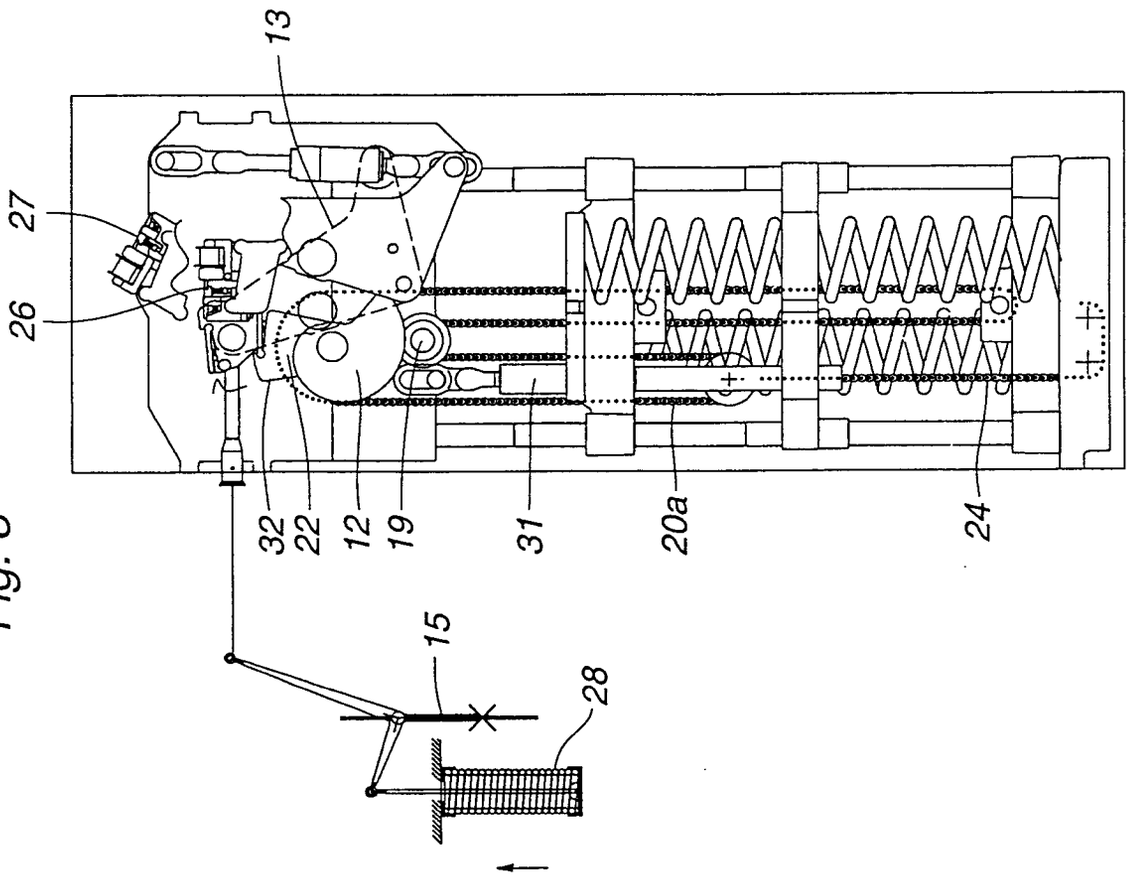
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Fig. 5

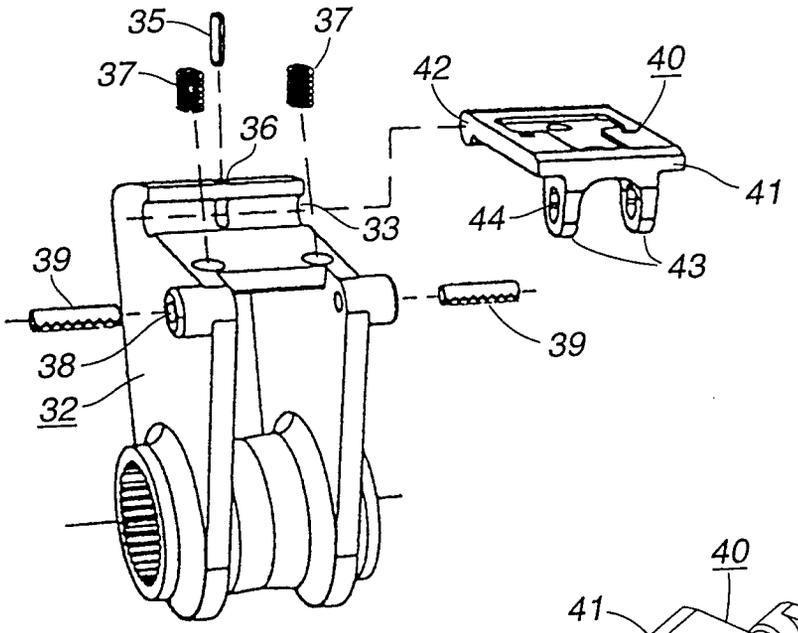



Fig. 6

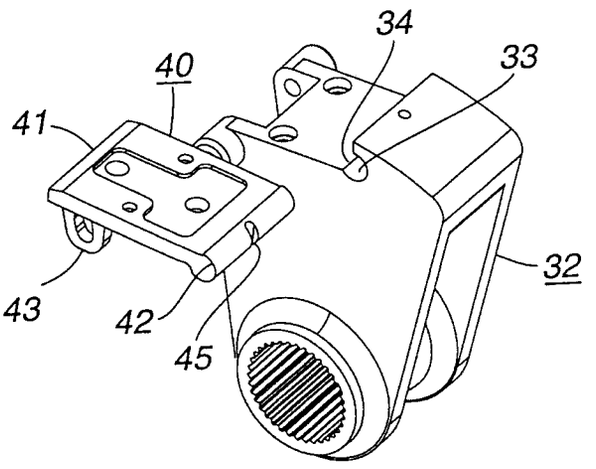
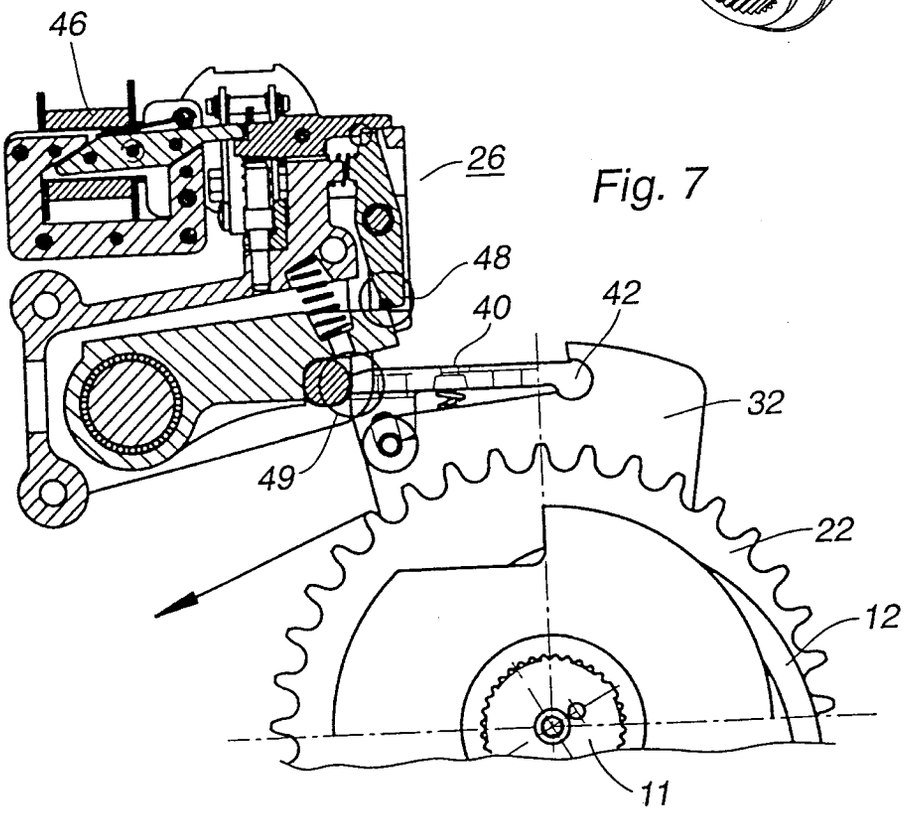



Fig. 7



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# EUROPEAN SEARCH REPORT

Application Number
EP 95 10 2239.1


## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.6) |
|---|---|---|---|
| A | SE, B, 332 451 (ALLMÄNNA SVENSKA ELEKTRISKA AB), 8 February 1971 (08.02.71)<br>* see the whole document *<br>----- | 1-5 | H01H 3/30 |

TECHNICAL FIELDS SEARCHED (Int. Cl.6)

H01H
F01B
F04C
F16D
F16H

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| STOCKHOLM | 15 May 1995 | BERTIL NORDENBERG |

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