

(21) Application No 8804880.6

(22) Date of filing 01.03.1988

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(51) INT CL⁴
H01H 71/52

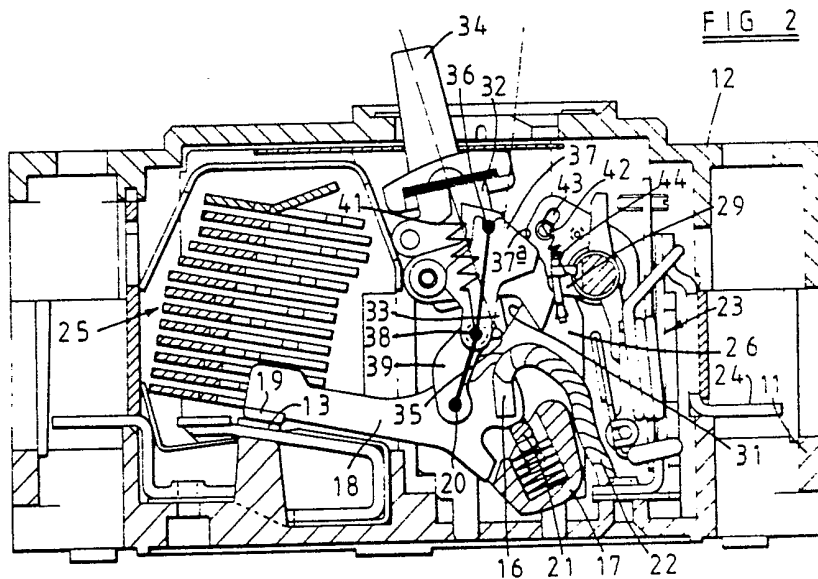
(52) UK CL (Edition J)
H1N NCN. N175 N187 N190 N201 N214 N231 N542
N588 N631 N634 N700 N706 N744 N818

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) **H1N NCA NCG NCN NCX**
INT CL⁴ **H01H**

(54) **Circuit breaker**

(57) A circuit breaker includes a housing (11, 12) a movable contact (19) movable into and out of engagement with a fixed contact (13), an operating lever (32, 34) movable manually relative to the housing between an OFF position and an ON position, linkage means (37, 38, 39, 41) including a spring loaded over-centre mechanism for transmitting movement of the lever to the moving contact, a blocking element (42) resiliently urged to move relative to the housing to a position such that abutment between the operating lever (32, 34) and the element (42) will prevent movement of the operating lever into its OFF position, and, a surface (37a) on the linkage means which, during movement of the moving contact away from the fixed contact, engages and moves the element (42) against the action of its resilient bias (44) to a position wherein the element permits the lever to be moved into its OFF position. The operating lever (32, 34) is thereby prevented from moving to its OFF position should the contacts (13, 19) weld together.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1982.

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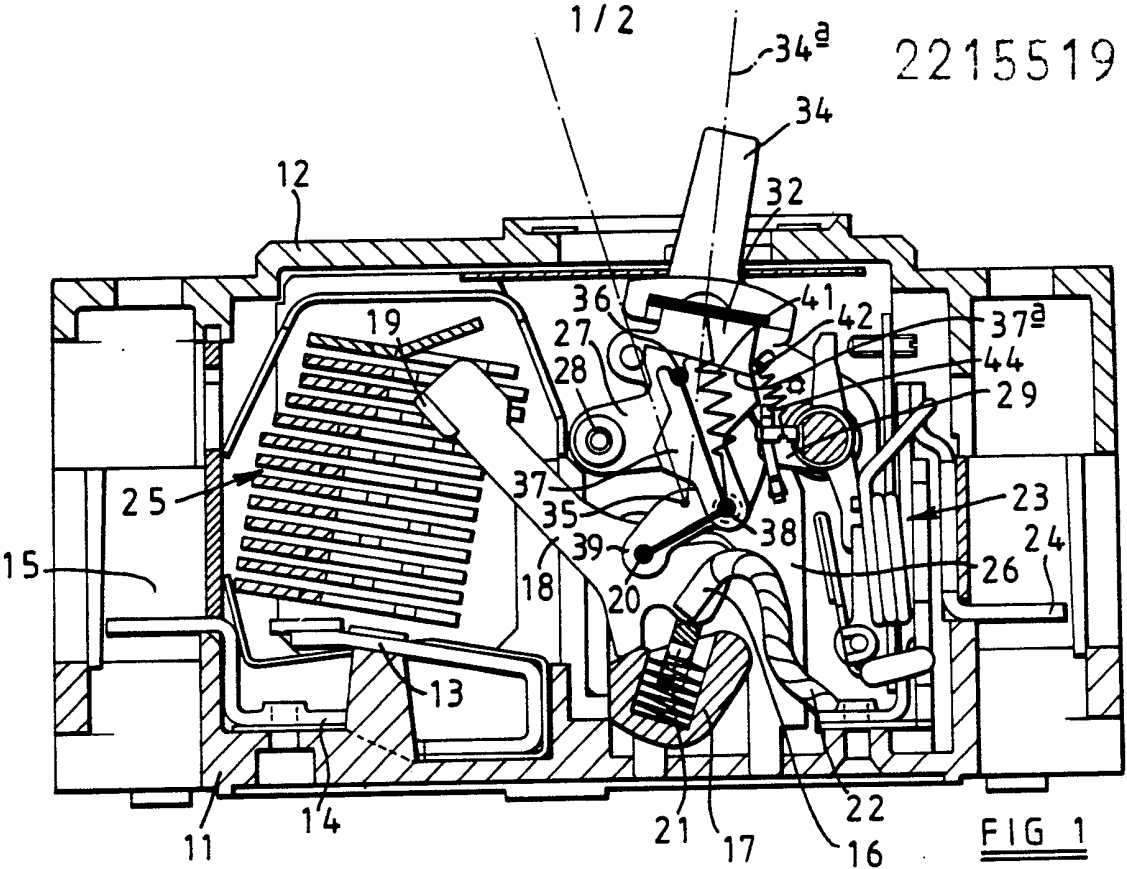


FIG 1

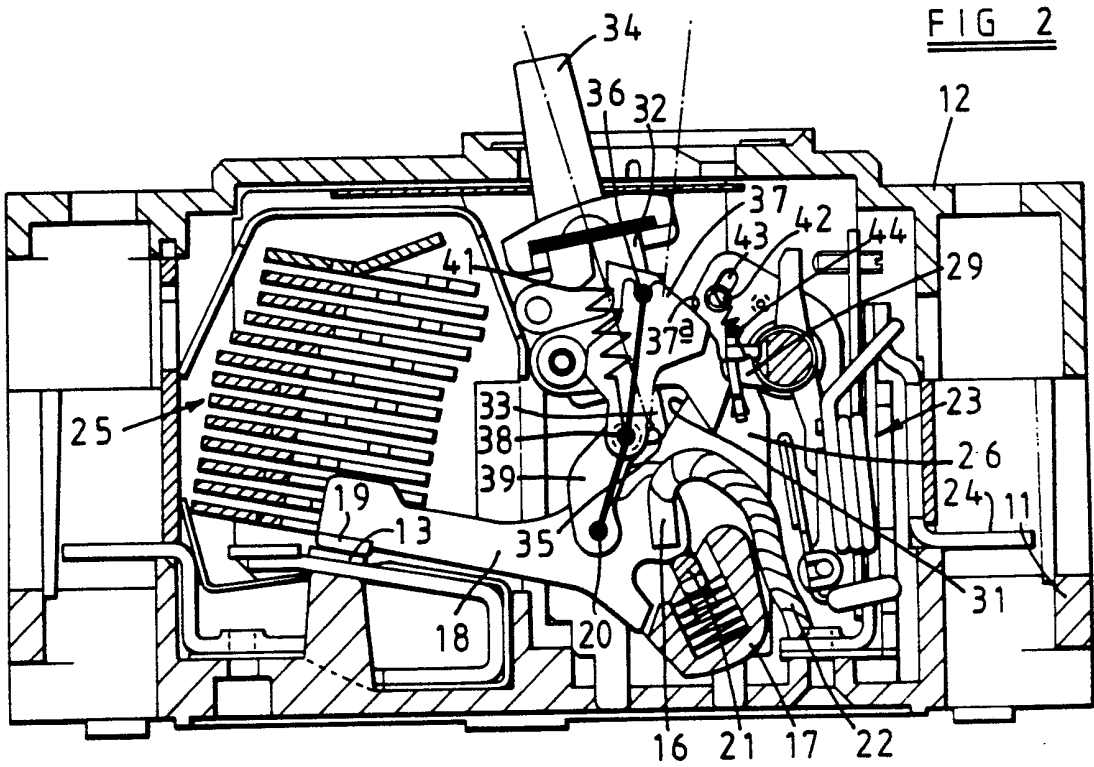
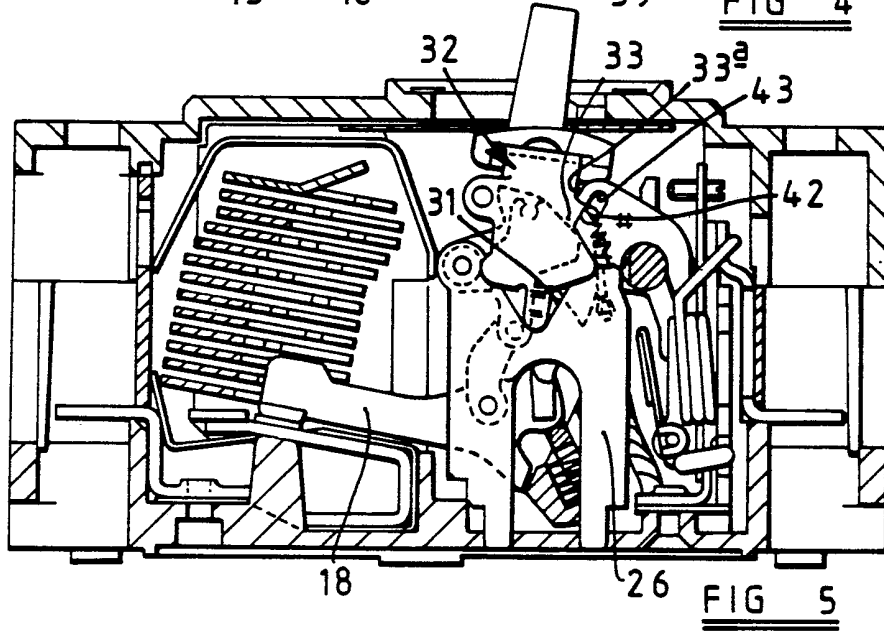
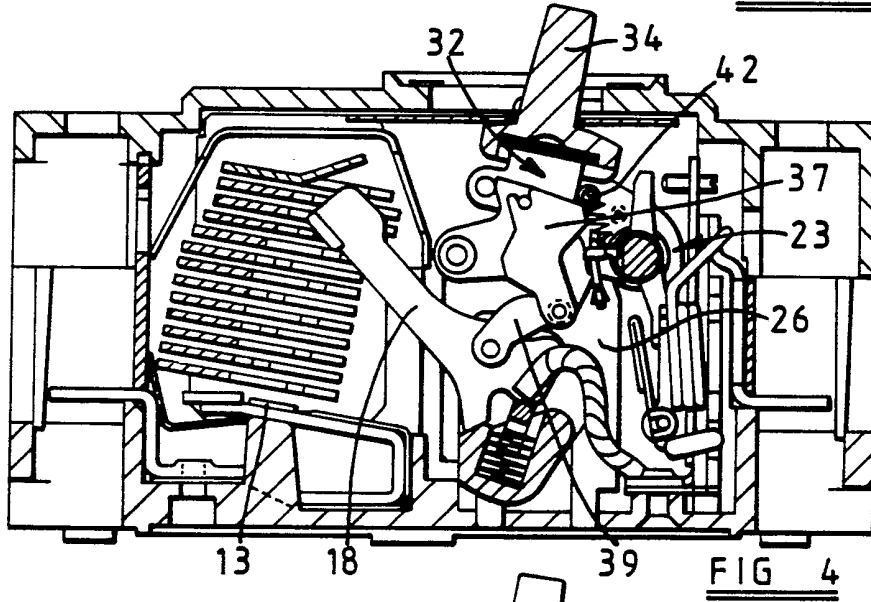
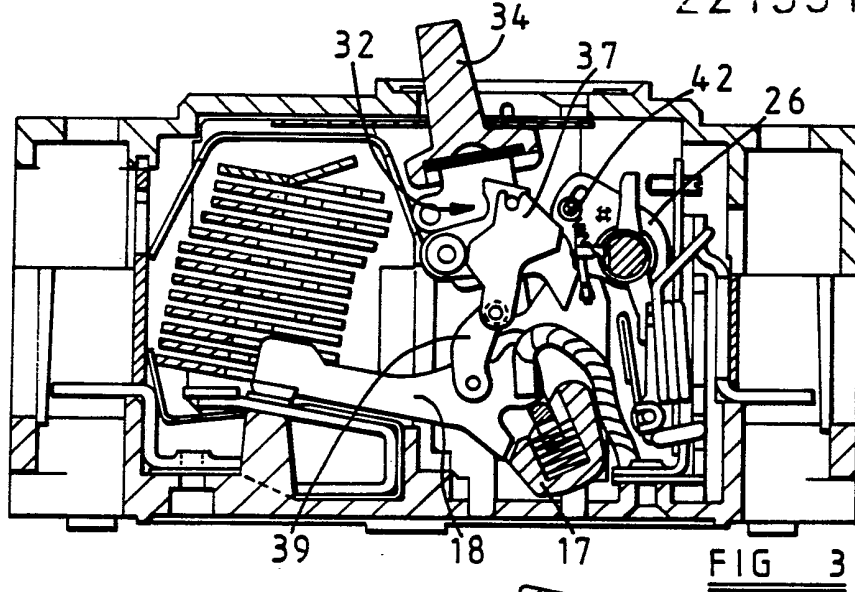


FIG 2



CIRCUIT BREAKER

This invention relates to circuit breakers the kind usually known as moulded case circuit breakers.

A known form of moulded case circuit breaker is illustrated in European patent 0145990 which provides a good explanation of the manner in which a manual operating lever is coupled to the electrical contacts of the circuit breaker to effect movement of the moving contact or contacts relative to the respective fixed contact or contacts. For convenience throughout this specification it will be assumed that the circuit breaker is a single pole device, having a single fixed contact and a single movable contact for engagement with the fixed contact. It is however to be recognised that the invention disclosed herein is equally applicable to multi-pole circuit breakers wherein one or more additional contact pairs is provided, the movable contacts being capable of movement in unison into and out of engagement with their respective fixed contacts.

It is known to link the manual operating lever to the movable contact through a spring loaded over-centre mechanism, and to provide a latch-release mechanism whereby the contacts can be opened, and the manual operating lever can be returned to its OFF position, in the event of certain fault conditions arising in the circuit controlled by the circuit breaker.

A problem experienced with circuit breakers of the kind illustrated in European patent 0145990 is the possibility of the operating lever being returned manually to the OFF position while the contacts of the circuit breaker remain closed. For example, there can

be a fault condition in which the current flowing through the fixed and movable contacts causes the movable contact to weld to the fixed contact before the latch-release mechanism can be operated. In such circumstances it is possible for an operator to return the operating lever to the OFF position and although the lever will not remain in the OFF position when released, it is possible for an operator in some way to lock the lever in the OFF position. For example the circuit breaker may incorporate locking means for holding the lever in an OFF position with the aim of preventing unauthorised operation of the circuit breaker. However, it will be recognised that if an operator locks the operating lever in the OFF position while the contacts are welded closed, then the false impression is given that the circuit controlled by the circuit breaker is denergised when in fact the circuit may be live by virtue of the circuit breaker contacts being welded in their closed position.

It has previously been proposed to provide a blocking member movable with the moving contact of the circuit breaker so that while the moving contact is in a closed position the blocking member prevents movement of the operating lever to the OFF position. The prior proposals have however necessitated a significant increase in the complexity of the operating mechanism of the circuit breaker and it is an object of the present invention to provide a circuit breaker wherein the above problem is obviated in a simple and convenient manner.

In accordance with the present invention there is provided a circuit breaker including a housing, fixed and movable electric contacts within the housing, the movable contact being movable into and out of engagement with the fixed contact, an operating lever

movable manually relative to the housing between an OFF position and an ON position, linkage means including a spring loaded over-centre mechanism for transmitting movement of said lever to said moving contact to move the moving contact relative to the fixed contact, a blocking element resiliently urged to move relative to said housing to a position such that abutment between the operating lever and the element will prevent movement of the operating lever into its OFF position, and, a surface on said linkage means which, during movement of the moving contact away from the fixed contact, engages and moves said element against the action of its resilient bias to a position wherein said element permits said lever to be moved into its OFF position.

Preferably said blocking element is a pin extending parallel to the axis of pivotal movement of the lever.

One example of the present invention is illustrated in the accompanying drawings wherein,

Figure 1 is a diagrammatic side elevational view of a moulded case circuit breaker in its OFF position with parts thereof omitted for clarity, and certain lines added thereto for explanatory purposes,

Figure 2 is a view similar to Figure 1 but illustrating the circuit breaker in the ON position,

Figure 3 is a view similar to Figure 2 but to a reduced scale, and with certain of the guide lines of Figure 1 omitted,

Figure 4 is a view similar to Figure 3 but illustrating the OFF position, and

Figure 5 is a view similar to Figures 3 and 4 but illustrating movement of the operating lever towards the OFF position in a condition of the circuit breaker where the contacts are held closed.

Referring to the drawings, the moulded case circuit breaker includes a two part moulded synthetic resin housing of generally rectangular form, the housing comprising a base 11 closed by a cover 12, the cover 12 being secured in position by screws or bolts. Secured to the base is a fixed electrical contact 13 electrically connected by a copper strip 14 to a clamp type terminal 15 accessible at the exterior of the housing. Mounted in the base 11, for pivotal movement about an axis 16 extending transverse to the base 11, is an electrically insulating moving contact carrier 17 to which is pivotally attached an elongate copper arm 18 defining, at its free end, the moving contact 19 of the circuit breaker. The axis 20 of pivotal connection of the arm 18 to the carrier 17 is parallel to, and spaced from, the axis 16 and during normal use of the circuit breaker the arm 18 does not move relative to the carrier 17, and instead the two move as a unitary structure about the axis 16. The end of the arm 18 remote from the contact 19 includes a cam surface engaged by a spring pressed plunger 21 housed within the carrier 17. The plunger urges the arm 18 to pivot relative to the carrier 17 to a rest position.

An electrically conductive flexible braid 22 is electrically connected at one end to the arm 18, and is connected at its opposite end through a latch-release mechanism 23 to a clamp type terminal 24 accessible at the end of the housing remote from the terminal 15.

Positioned above the fixed contact 13 and slotted to permit the appropriate arcuate movement of the end region of the arm 18, is a plate stack 25. The plate stack 25 is of known form, and is arranged to receive, and dissipate, an arc generated between the moving contact 19 and the fixed contact 13 as the contacts open.

Anchored to the base 11 and upstanding on opposite sides of the root portion of the arm 18 are first and second spaced, parallel, metal side plates 26 (only one of which is seen in Figures 1 to 4). Positioned between the side plates 26, with its plane parallel to the plane of the plates 26, is a latch plate 27. The latch plate 27 is equally spaced from both side plates 26 and has one end pivotally connected thereto by means of a transversely extending steel pin 28 the ends of which engage the plates 26. The pin 28 extends parallel to the axis 16, and the end of the plate 27 remote from the pin 28 is received, and retained, by a latch member 29 of the latch release mechanism 23. During normal use of the circuit breaker, that is to say when there is no fault condition, the plate 27 is held, by the combined action of the pin 28 and the latch member 29 in fixed relationship to the side plates 26.

The uppermost edges of the side plates 26 each include a V-shaped recess 31 the apices of the recesses 31 being rounded. Extending downwardly to engage the rounded apices of the recesses 31 are respective parallel legs 33 of a U-shaped metal lever member 32. The integral base, joining the legs 33, of the member 32 carries a moulded synthetic resin member 34 which protrudes outwardly through an elongate aperture in the cover 12, the members 32 and 34 together constituting the manual operating lever of the circuit breaker and being pivotable relative to the housing about an axis 35 parallel to the axis 16 and disposed adjacent the apices of the recesses 31.

Extending through the latch plate 27 adjacent its upper edge is a pin 36 opposite ends of which protrude from the plate 27. First and second upper link plates 37 (only one of which is seen in the

drawings) are disposed adjacent opposite faces respectively of the latch plate 27 and have notches at one end thereof engaged around the projecting portions of the pin 36. Thus the plates 37 are pivotable relative to the latch plate 27 about the axis of the pin 36. At their opposite ends the latch plates 37 protrude below the latch plate 27 and are interconnected by a transversely extending pin 38 to which is pivotally connected one end of each of a pair of parallel spaced lower link plates 39. The opposite ends of the link plates 39 are pivotally connected to the arm 18 and the carrier 17 on the axis 20 of movement of the arm 18 relative to the carrier 17. A pair of helically wound tension springs 41 are positioned between the upper link plates 37 and the side plates 26 respectively and are stretched between the pin 38 and the base of the lever member 32.

Figures 1 and 2 include heavy black lines interconnecting respectively the axis of the pins 36 and 38 and the axis 20 and the axis of the pin 38, these lines indicating the effect of the link plates 37 and 39 respectively. Figures 1 and 2 also show a line 34a which is effectively lengthwise of the manual operating lever and passes through the axis 35 and the point of connection of the springs 41 and the lever. Figure 1 illustrates the parts of the circuit breaker in the OFF position with the contact 19 spaced from the contact 13. It can be seen that the links 37, 39 form substantially a right angle with the pin 38 at its apex. The line 34a extends between the axes of the pins 36 and 38 and thus the springs 41, which are prestressed during assembly of the circuit breaker urge the lever 32, 34 to pivot further in a clockwise direction (as viewed in Figure 1) this movement being prevented by abutment of surfaces on the member 32 and the plates 26.

Manual movement of the lever 34 in a counter-clockwise direction about the axis 35 stretches the springs 41, and as the line 34a of action of the lever 34, 32 moves past the axis of the pin 36 the force of the springs 41 is applied to the pin 38 in a direction to straighten the linkage 37, 39. Since the pin 36 cannot move, the straightening action of the linkage 37, 39 is effected by downward movement of the axis 20 which of course can only take place as a result of counter-clockwise movement of the arm 18 and carrier 17 about the axis 16. Thus the contact 19 is driven into engagement with the contact 13, and as the contact 19 engages the contact 13 the pin 38 moves beyond the axis 35 so that in effect the lever and linkage moves over-centre and a further slight permitted movement of the lever 34, 32 in a clockwise direction takes place under the action of the spring 41 relieving the tension in the spring 41 slightly. The linkage 37, 39 as not completely straightened, and so when abutment of the legs 33 of the member 32 with the pin 28 prevents further movement of the lever 34, 32 the residual stress in the springs 41 pulling against the pin 38 in a direction to further straighten the linkage, loads the contact 19 against the contact 13 thereby applying contact pressure.

The mechanism so far described is conventional, and it will be understood by the expert in the art that initial movement of the lever 34, 32 from the OFF position towards the ON position stresses the springs 41 without moving the contacts 19 until a point in the movement is reached at which the contact 19 moves rapidly into engagement with the contact 13. During return movement of the lever 34, 32 from the ON position as shown in Figure 2 to the OFF position as shown in Figure 1 the reverse of all of the movements above takes place in that the springs 41 are initially

stressed until the mechanism moves over-centre at which point the contact 19 is rapidly moved away from the contact 13 by the springs 41 at the same time that the lever 34, 32 is urged into its OFF position relative to the housing.

In the event that the contact 19 welds to the contact 13 then the lever 34, 32 can still be moved against the action of the springs 41, manually towards its OFF position. In order to prevent the lever moving into its OFF position there is provided a pin 42 extending parallel to the axis 35, and supported at its ends in parallel arcuate slots 43 in the side plates 26. Springs 44 urge the pin 42 to the lower ends of the slots 43, and when the pin 42 is located at the lower ends of the slots 43 it lies in the path of movement of the legs 33 of the lever member 32. Abutment of the legs 33 with the pin 42 is evident in Figure 5. It can be seen that the legs 33 have cut away regions 33a above the point of abutment with the pin 42 and during normal operation of the circuit breaker, that is to say when the arm 18 and carrier 17 move normally to a contact open position, the pin 42 is lifted against the action of the springs 44 by a surface 37a on each of the upper link plates 37, so that the pin 42 aligns with the regions 33a and the lever 34, 32 is permitted to reach its OFF position relative to the housing. It will be recognised that in the event that the contact 19 welds to the contact 13 both the lower pivot axis 20 and the upper pivot axis 36 of the linkage 27, 29 will be fixed and thus there will be no movement of the linkage accompanying movement of the lever 34, 32 from the ON position towards the OFF position. Thus the surface 37a of the link plates 37 will not abut, and lift the pin 42, and the pin 42 will remain in a position blocking movement of the lever 34, 32 into its OFF position.

Although it is of no significance to the present invention it is to be noted that the latch-release mechanism 23 can be actuated by excess current flowing through the connection between the moving contact and the terminal 24 so as to release the latch member 29 and free the latch plate 27 for pivotal movement about the axis of the post 29. Such movement of the latch plate 27 leads to immediate release of the moving contact 19 provided that the moving contact 19 has not welded to the fixed contact 13, and return of the lever 34, 32 to its OFF position. Furthermore, a massive overload current flowing through the arm 18 and the conductive strip associated with the fixed contact 13 gives rise to electromagnetic repulsion between the strip and the arm 18 thereby "blowing" the moving contact 19 away from the fixed contact 13. This movement of the arm 18 takes place against the action of the spring pressed plunger 21 and is pivotal movement of the arm 18 about the axis 20 relative to the carrier 17. Thus the contact 19 can disengage from the contact 13 without movement of the lever and linkage.

In the event that the switch is a multiple pole switch then additional moving contact arms 18 will be carried by extensions of the carrier 19 and there will be associated fixed contacts but there will be only one lever and linkage mechanism. The other moving contact arms will follow the movement of the arm 18 both during opening and closing, except in the event that a "blow-off" of one of the arms occurs, in which case that particular arm will move relative to the carrier 17 but the other arms will not move.

CLAIMS.

1. A circuit breaker including a housing, fixed and movable electric contacts within the housing, the movable contact being movable into and out of engagement with the fixed contact, an operating lever movable manually relative to the housing between an OFF position and an ON position, linkage means including a spring loaded over-centre mechanism for transmitting movement of said lever to said moving contact to move the moving contact relative to the fixed contact, a blocking element resiliently urged to move relative to said housing to a position such that abutment between the operating lever and the element will prevent movement of the operating lever into its OFF position, and, a surface on said linkage means which, during movement of the moving contact away from the fixed contact, engages and moves said element against the action of its resilient bias to a position wherein said element permits said lever to be moved into its OFF position.

2. A circuit breaker as claimed in claim 1 wherein said blocking element is a pin extending parallel to the axis of pivotal movement of the lever.

3. A circuit breaker substantially as hereinbefore described with reference to the accompanying drawings.