STORED-ENERGY OPERATING MECHANISM

BASIC REQUIREMENTS OF STORED-ENERGY CLOSING MECHANISMS

1. Adequate closing power
2. High contact speed in closing
3. Trip-free operation with high speed opening
4. Ease and simplicity of operation
5. Long life and low maintenance
6. Compact size

The stored energy mechanism accepts a predetermined amount of energy from the operator and then releases this energy to close and latch the breaker contacts closed. The operator may supply the energy at any desired rate, but the energy cannot be released to close the contacts until the predetermined amount of energy has been supplied. After the required energy has been released, the operator can in no way impede the "snap-action" closing of the breaker.

The stored energy closing mechanism must perform four basic steps in its normal cycle of operation, as follows:

1. Receive and store energy supplied by the operator.
2. Release and transform this energy into a closing force on the breaker contacts.
3. Latch the breaker in a closed position.
4. Allow the breaker to trip under fault or other specified conditions.

The functions listed above are illustrated in photographs attached. These photographs present, in phantom form, the principal parts of the circuit breaker involved in the operation of the manually-operated stored energy closing mechanism. Also attached is a perspective view, Figure 1 of the manual-operated spring-close mechanism. This view is shown with the mechanism ready to be charged by the operator, preparatory to closing of the circuit breaker contacts.

Manual Stored Energy Closing Mechanism

The circuit breaker must be open and the closing handle must be in the reset position, shown in Figure 2, before breaker closing operation may be initiated. The following sequence of operations then occur within the mechanism as the operator pulls downward on the closing handle:

Figure 2 shows the breaker in the open position with the closing mechanism springs ready to be charged so as to subsequently close the circuit breaker contacts.

In Figure 3 it is shown that the operator supplies the stored closing energy by a single downward thrust of the operating handle (1). This handle acts as a lever and forces the hand closing cam (2) to rotate in a clockwise direction. This action extends the closing springs (3) downward. Continued motion of the operating handle extends the springs until sufficient energy is stored. This stored energy is ultimately used to vigorously force the breaker contacts closed. At some late part of the downward motion of the operating handle, a pin on the hand closing cam engages a camming surface of the hold-up latch (4) and rotates the latch in a counter clockwise direction. The continued extension of the closing springs have meanwhile forced the first stage closing cam (5) to tend to turn in a clockwise direction, being restrained from moving downward by the left-hand roller carrier (6) which in turn is prevented from moving by the latch surface of the hold-up latch and the positioning of the primary latch (7). When the hold-up latch continues to pivot, by the downward motion of the operating handle the roller carrier is permitted to slip by the latching surface of the hold-up latch.

Figure No. 4 shows where the exertion of pressure of the closing springs on the first stage closing cam with the release of the latch roller carrier in a counter clockwise direction being pivoted about the center roller of the roller carrier resting on the latch surface of the primary latch. The other end of the roller carrier moves upward forcing the jackshaft cam (8) to rotate in a clockwise direction very rapidly, moving the contact arm assembly (9) into closed position with regard to the stationary contact structure (10). The prop latch

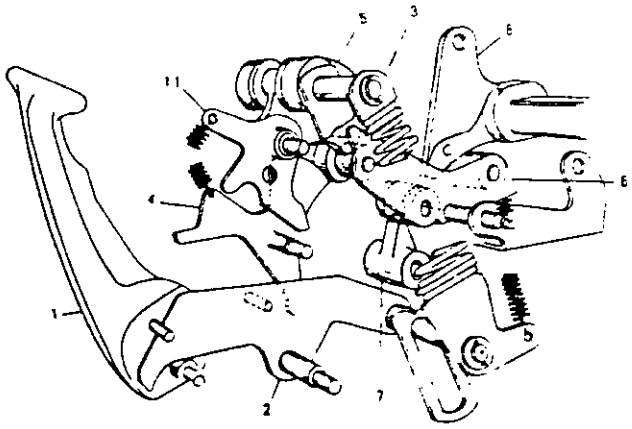

Fig. 1 - Mechanism ready to be charged by operator preparatory to closing of the circuit breaker contacts.

STORED-ENERGY MECHANISM (Cont.)

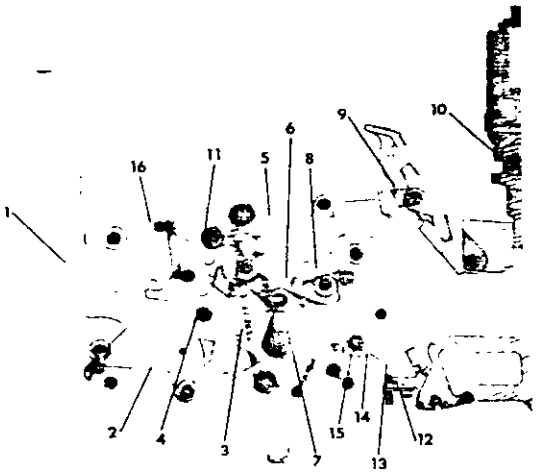

Fig. 2 - Open position.

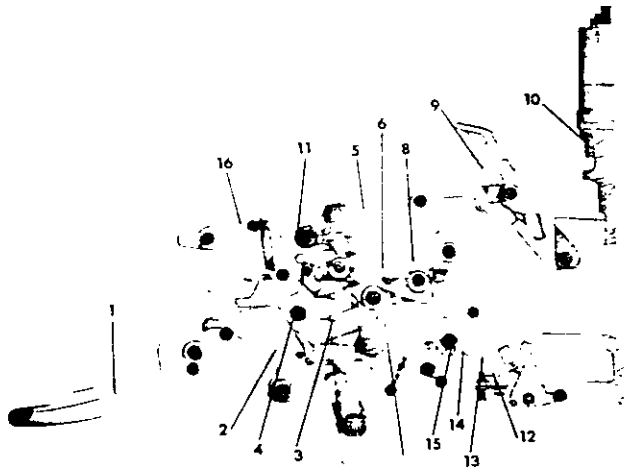

Fig. 3 - Open position with spring almost fully charged just before latch release.

(11) meanwhile has been rotated in a counter clockwise direction by the downward motion of the first stage closing cam, latching the roller carrier, which in turn holds the breaker contacts in the closed position. Figure 5 shows where the operating handle, after being released by the operator, will then return to the normal position.

Figure 6 shows the tripping of the circuit breaker by overcurrent trip devices. This automatic trip of the breaker starts action when the overcurrent armature trip screw (12) strikes the tripper (13) on tripper bar (14), rotating it. This in turn releases the latch on the latch bar assembly (15). This action, at the same time, allows the primary latch to rotate in a counter clockwise direction, releasing the support under roller carrier and allowing it to move in a downward direction being guided in the diagonal slot in the mechanism housing (16) under the influence of the opening springs of the circuit breaker. The jackshaft will then rotate in a counter clockwise direction thus opening the circuit breaker contacts. The mechanism then resets automatically to the conditions shown in Figure 2 by the action of an auxiliary spring pulling the roller carrier assembly back to supported position on primary latch.

Figure 7 shows the hand trip operation done by manual pressure applied to the hand trip button on face plate of the breaker. This moves a link that cams the latch bar assembly in a counter clockwise direction, thereby releasing the primary latch and allowing it to rotate in the same direction, unlatching the roller carrier, therefore giving same action as is accomplished in automatic tripping of the circuit breaker.

The stored energy closing mechanism thus provides a safe, positive, and economical method of attaining high speed closing with manually operated low voltage power circuit breakers.

Electrical Stored-Energy Closing Mechanism

In addition to the manually-operated spring-closed mechanism described above, there is also available a motor-operated spring-close mechanism which is operable from a remote location by means of an electrical contact.

This motor-operated spring-close mechanism is similar in principle to the manually-operated spring-close mechanism described and pictured in preceding text. It differs only in that the closing-springs are charged by means of a small, fractional horsepower electric motor. The speed of this motor is geared down to provide the proper speed most suited to operate the closing mechanism.

The springs are charged immediately upon application of the control power by the energization of the motor circuit through limit switches on the closing-spring linkage and on the circuit breaker. The closing springs are held in this charged position, by a holding latch, until released by the energization of a small electromagnetic solenoid. The release of this latch then allows the spring to exert a thrust to close the circuit breaker contacts.

Electrical circuits are furnished which allows the circuit breaker to be closed and opened from a remote location by means of a control switch.

STORED-ENERGY MECHANISM (Cont.)

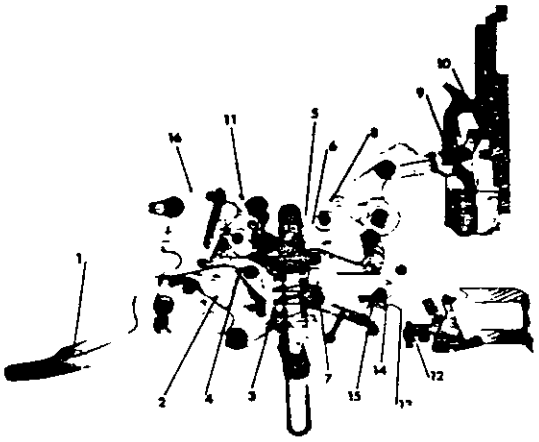

Fig. 4 - Closed position just after close of contacts.

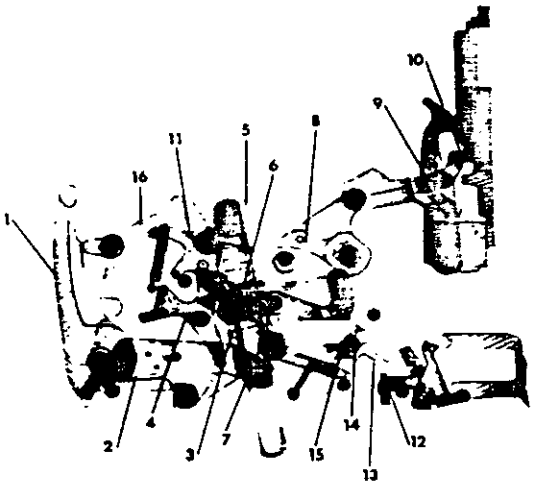

Fig. 5 - Closed position with closing spring and operating handle back to normal position.

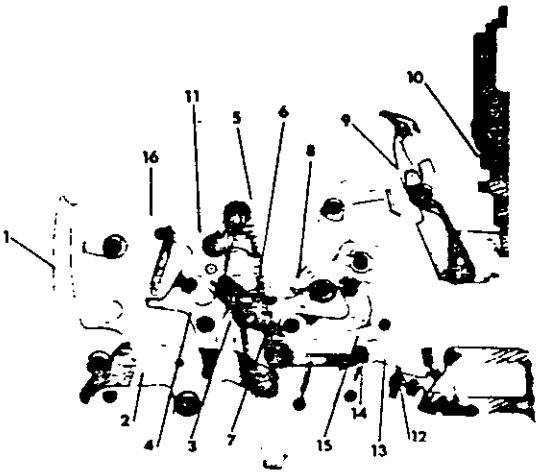

Fig. 6 - Overcurrent trip just after trip operation.

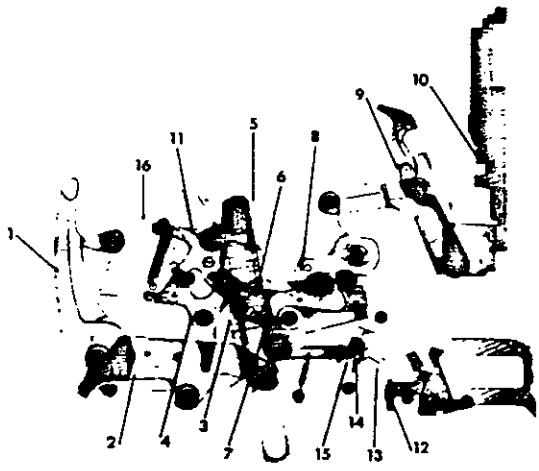

Fig. 7 - Hand trip just after trip operation.