DRAWOUT MECHANISM FOR K-LINE CIRCUIT BREAKERS

INTRODUCTION

In order to make the K-Line circuit breakers mobile for operation, testing, storage, maintaining and removal from its switchboard compartment, a four position drawout unit has been made an integral part of the breaker design. Such an arrangement is shown in Fig. 1. During the moving of the circuit breaker to and from the basic four positions, interlocking provisions have been made to prevent moving of the circuit breaker when the circuit breaker mechanism is in the closed position.

The same interlocks prevent closure of the circuit breaker when positioned between the basic operation positions.

The drawout cradle is a separate unit which can readily be inserted into a switchboard compartment. This cradle is assembled in the compartment by four mounting bolts in the bottom of the unit. The rear of this cradle forms a steel isolation barrier between the circuit breaker and the bus compartment of the switchboard.

In the CONNECTED or operating position, the circuit breaker's primary and control electrical circuits are so engaged as to perform their functions of carrying load currents to provide protection for the equipment and afford switching means of that circuit.

In the TEST position, the operator is permitted to safety test and inspect the circuit breaker and its associated electrical control circuits without disturbing the primary electrical system.

In the DISCONNECTED position, the circuit breaker is completely isolated electrically and may be safely stored in this position when the primary circuit is to remain de-energized for some definite period. The withdrawal mechanism may be padlocked in this position to prevent being manipulated by unauthorized persons.

The WITHDRAWN position permits the removal of the circuit breaker from the compartment, for ease of maintenance, or parts replacement, and transferring the circuit breaker to a more essential load circuit because of more effective load dispatching.

The operator is fully protected from contact with live parts by a completely dead-front design, complemented with dependable and reliable visual indications which show when the circuit breaker is in any of the four basic positions. The position indicator can be seen on the upper left side plate of the cradle housing and a cooperating pointer on the right-front breaker frame. Provisions are also furnished to permit padlocking the breaker in the open position in any of the basic locations, and the breaker can be left in TEST or DISCONNECTED positions with doors closed for safety, or for storage, and as protection against dust or moisture. It also serves to prevent operation by unauthorized personnel. In these positions, the door may be opened for inspection without disturbing the locking provisions.

DESCRIPTION AND OPERATION

Drawout Contacts

The primary separable contacts are sturdy and self-aligning which provide positive electrical contact engagement between the circuit breaker separable contacts and the stationary separable contacts.

Silver-to-silver contacts are furnished. Positive electrical contact is made through the use of heavy compression springs bearing upon a group of individual contact fingers, thus affording multiple contact areas. Strong insulating moldings provide protection from accidental voltage failures. In the TEST, DISCONNECTED and WITHDRAWN positions of the circuit breaker, the primary contacts of the circuit breaker are safely isolated from the primary circuits of the system. The primary separable contacts are engaged only in the CONNECTED position of the circuit breaker.

The secondary contacts are compact contacts which are used to provide connection from the internal circuit breaker control circuits to the external control circuits. They can be furnished so that they are engaged only in the CONNECTED or only in the TEST position. They are disengaged in the DISCONNECTED and WITHDRAWN positions. These contacts ordinarily are continually engaged in the CONNECTED and TEST positions. The connection in the TEST position provides means whereby the circuit breaker control circuits can be electrically tested with the primary circuits isolated.

If the circuit breaker primary separable contacts separate when carrying load current, the contacts will be called upon to perform a function for which they are not designed-the interrupting of an electrical circuit. Under such conditions, the resulting arcing will badly erode the contact surfaces, and the ionized gases generally will provide a conducting path between terminals of opposite electrical polarity. Thus, serious fault currents will be permitted to flow, which could cause extensive damage to the whole switchboard. For this reason safety interlocking is furnished which will prevent changing the circuit breaker position without

DRAWOUT MECHANISM (Cont.)

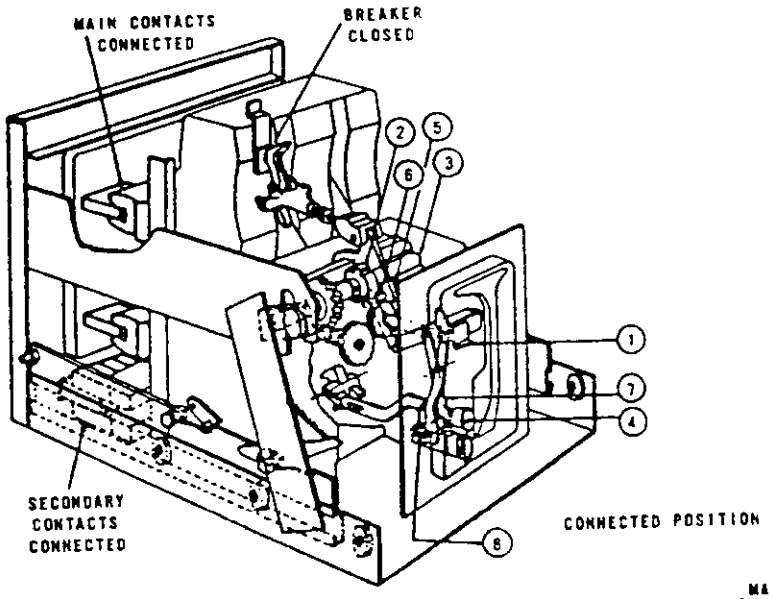

Fig. 1(a)

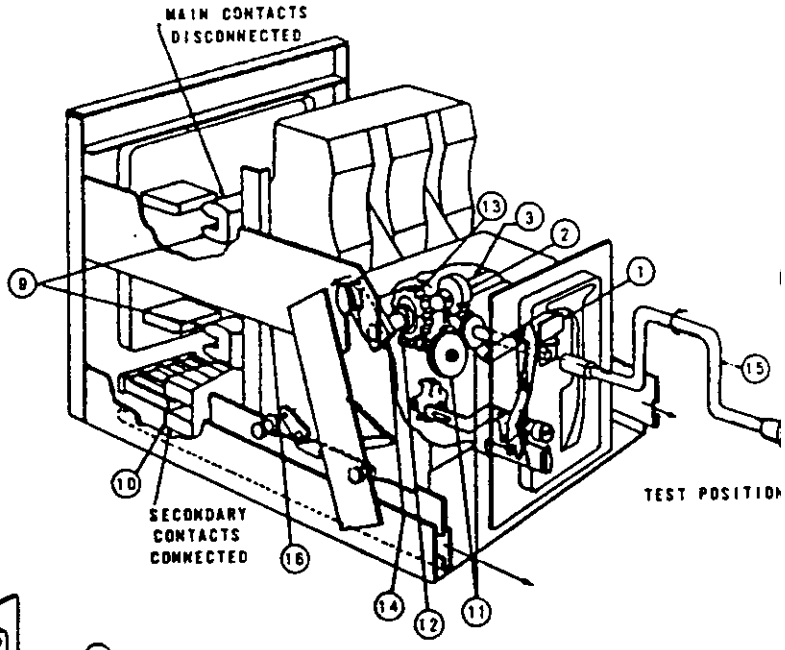

Fig. 1(b)

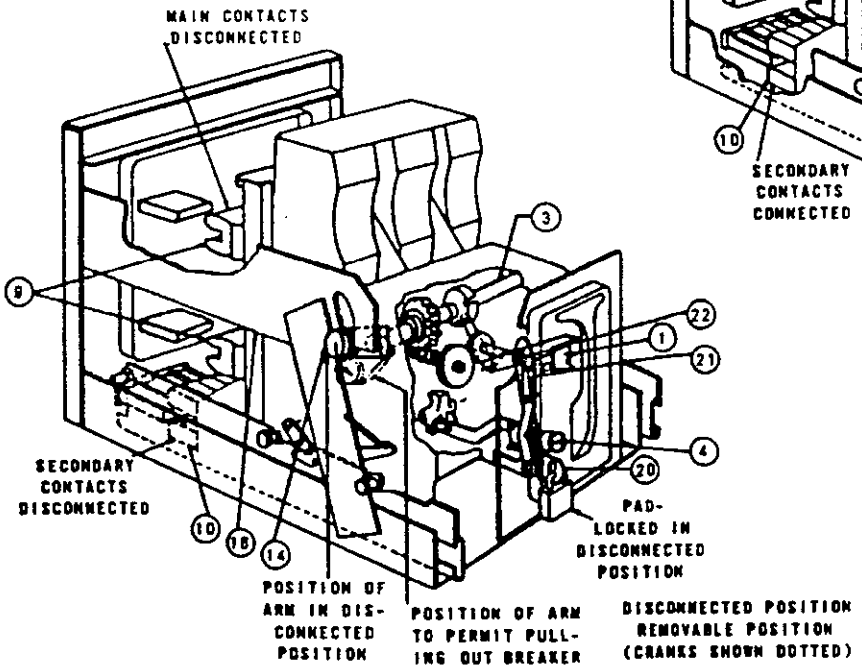

Fig. 1(c)

DRAWOUT MECHANISM (Cont.)

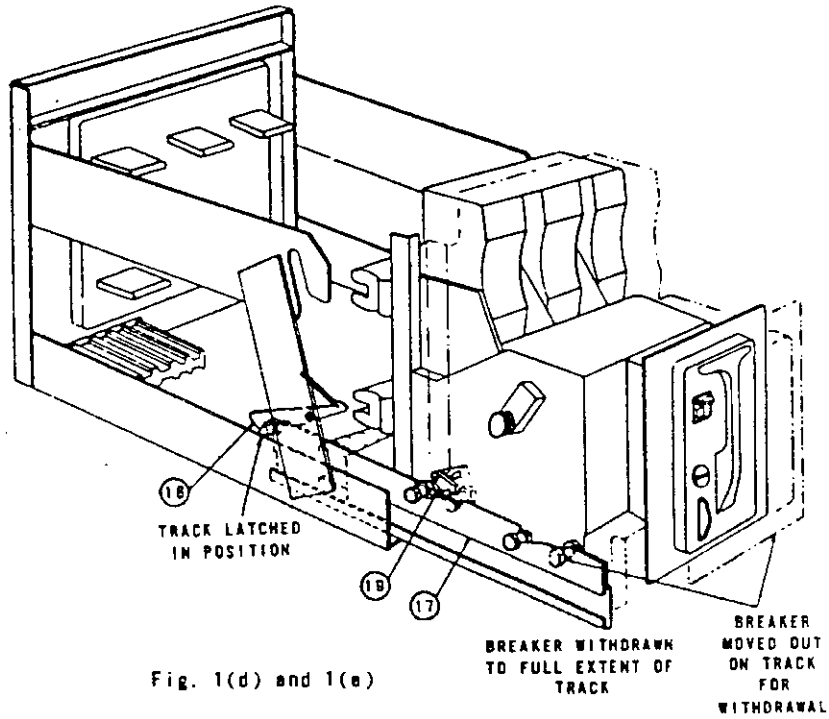

Fig. 1(d) and 1(e)

LEGEND

1. Shutter
2. Cam
3. Gear shaft
4. Trip button
5. Jack shaft
6. Pin (jack shaft)
7. Link
8. Bell crank
9. Separable contacts (main)
10. Separable contacts (secondary)
11. Gears
12. Worm drive
13. Worm wheel
14. Crank arms
15. Crank handle
16. Cradle housing bars
17. Tracks
18. Latch (track)
19. Latch (breaker)
20. Lockout plate (padlock)
21. Lever
22. Pin

first tripping open circuit breaker contacts.

The drawout mechanism on the K-3000 and K-4000 circuit breakers is similar to the K-225 to K-2000 breaker, with the following exceptions:

1. Tracks must be pulled down prior to racking
2. The mechanism has positive stops in all positions
3. Replacing the drawout shutter is a lever that is raised when the breaker is open to allow racking.

Racking Operation (Fig. 1(b))

The means of racking the breaker from one position to another is done by inserting a hand crank into an escutcheon opening and rotating this crank (15). A normally-closed shutter is interlocked to prevent movement of the circuit breaker drawout mechanism when the circuit breaker contacts are closed.

Should the operator in cranking from one position to another remove the crank when the circuit breaker is between positions, the shutter (1) will be held up by cam (2) on shaft (3). This cam is so positioned on the shaft to allow the shutter (1) to be raised and lowered only in the CONNECTED, TEST and DISCONNECTED positions of the circuit breaker. The circuit breaker cannot be closed while the shutter is raised. This provides a definite interlock which guards against the circuit breaker being closed unless properly positioned.

A ground contact maintains electrical contact from the CONNECTED to the TEST position, thus providing continued safety to the operator from contact with hazardous voltages.

It requires fourteen turns of the hand crank to reach TEST position from the CONNECTED position. Six additional turns is required to reach the DISCONNECTED position, and five more turns to the WITHDRAWN position.

Connected Position

Figure 1(a) shows the circuit breaker in the CONNECTED position. At this point, the shutter (1) can not be raised unless the circuit breaker contacts are tripped open. This is done by pushing in the trip button (4). Rotation of the jack-shaft (5) to open position of the circuit breaker contacts, moves interference pin (6) which permits raising the shutter. While the shutter is raised, the circuit breaker is held in a maintained trip-free position through link (7) and bell crank (8). This prevents the circuit breaker from being closed when the drawout mechanism is in a position for moving the circuit breaker from one position to the other.

Test Position

Rotating the drawout hand crank counter-clockwise moves the circuit breaker to TEST position Fig. 1(b). In this stage, the main separable contacts (9) are disconnected, while the secondary separable contacts (10) are still connected.

DRAWOUT MECHANISM (Cont.)

Through a series of gears (11), worm drive (12), worm wheel (13), gear shaft (3) and crank arms (14) the rotation of the drawout crank handle is transformed into linear motion of the circuit breaker as the crank arms (14) move against the cam surfaces in the cradle housing (16). Removal of the crank in TEST position allows the shutter to drop, thereby releasing the interlock system. The circuit breaker may now be closed electrically or manually since the secondary control contacts are still connected. In this position, the various devices on the circuit breaker and their associated electrical circuits can be checked and tested without disturbing the primary electrical system.

Disconnected Position

Continued rotation of the crank from TEST position to DISCONNECTED position as shown in Figure 1(c) serves to disconnect the main contacts (9) and the secondary contacts (10) which leaves the circuit breaker electrically isolated but still retained in the cradle (16) by the arms (14) being interlocked with the cam surfaces of the cradle bars.

This position is used to provide storage of the circuit breaker when the electrical circuit which it serves is to remain de-energized.

Withdrawn Position (Figs. 1(c) and 1(d))

From the DISCONNECTED position, a continued counter-clockwise rotation of the crank will turn the shaft (3) so arms (14) are clear of cradle bars (16) and the circuit breaker and tracks (17) out to the position shown in Figure 1(d). This shows the withdrawn track latched in position against the cradle support and latch (18). The track is held in this position, while the circuit breaker is removed from the tracks.

Prior to racking the circuit breaker in, the tracks are released from these latches by press-

In the fully WITHDRAWN position, the circuit breaker may be inspected or it may readily be removed from its cradle. By lifting the retaining latches (19), the circuit breaker may be pulled forward and out of the retaining notches to the fully extended position where it may be readily removed by a simple vertical lift.

Padlocking (Fig. 1(c))

The circuit breaker may be padlocked in the CONNECTED, TEST or DISCONNECTED position by removing the crank and pushing in trip button (4) which then permits pulling out the lockout plate (20). This exposes a slot to which one to three standard padlocks may be attached to lock the circuit breaker in the tripped position, and also to lock the circuit breaker in a definite chosen position relative to the cradle. Locking between positions is prevented by lever (21) which interlocks lockout plate (20) with shutter (1) by pin (22) so that the circuit breaker can not be padlocked unless the shutter is closed.