United States Patent [19]

Wilson

[11] **3,772,489**

[45] **Nov. 13, 1973**

[54] **RACKING SAFETY DISCONNECT SWITCH FOR VACUUM CIRCUIT BREAKERS**

[75] Inventor: **George A. Wilson,** Pineville, Pa.

[73] Assignee: **I-T-E Imperial Corporation,** Philadelphia, Pa.

[22] Filed: **July 17, 1972**

[21] Appl. No.: **272,429**

[52] **U.S. Cl.**..... **200/50 AA,** 200/144 R, 200/148 R, 200/153 SC

[51] **Int. Cl.** **H01h 33/42**

[58] **Field of Search** ..... 200/50 AA, 144 R, 200/144 B, 148 R, 148 H, 153 SC, 153 R

[56] **References Cited**

UNITED STATES PATENTS

2,943,163	6/1960	Hay	200/50 AA
2,673,260	3/1954	Lester et al.	200/50 AA

FOREIGN PATENTS OR APPLICATIONS

1,080,983	8/1967	Great Britain	200/153 SC

Primary Examiner—J. R. Scott

Attorney—Sidney G. Faber et al.

[57] **ABSTRACT**

A spring-actuated disconnect switch is connected in series with the contacts of a truck-mounted vacuum interrupter and the main disconnect contacts of the circuit breaker. The disconnect switch is carried on the truck and the disconnect switch contacts are open and remain open when the main disconnects are racked closed. Racking the breaker to the connected position charges a disconnect switch spring operating mechanism which can be remotely discharged to close the disconnect switch after the breaker is racked to a connected position.

6 Claims, 4 Drawing Figures

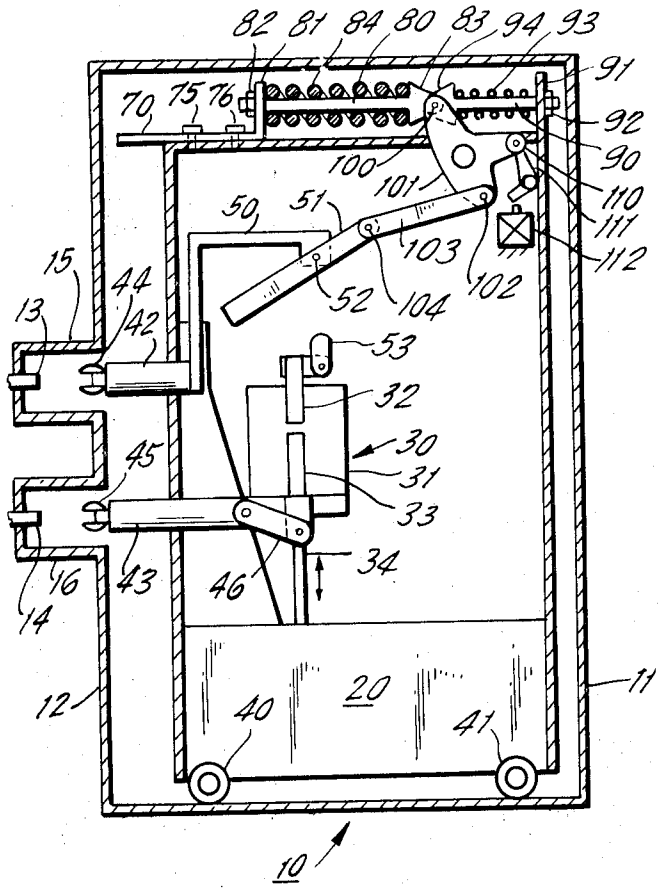


FIG. 3.

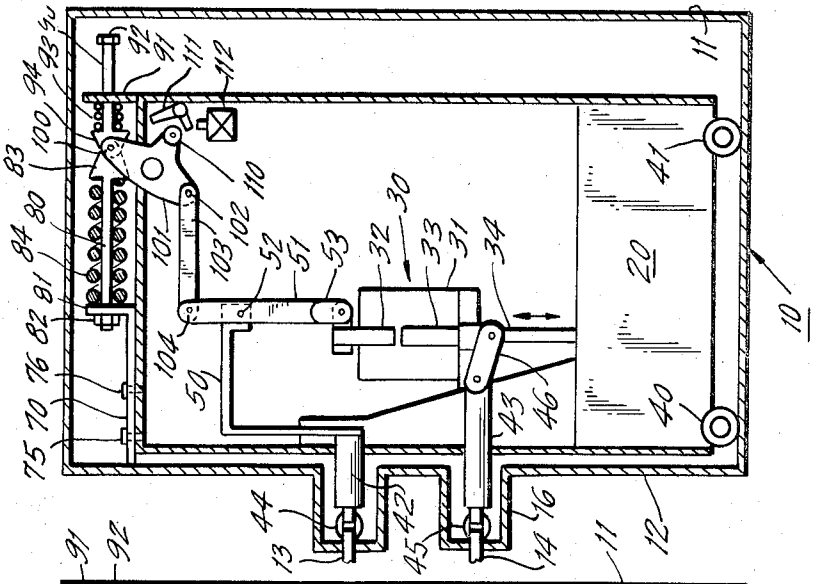


FIG. 2.

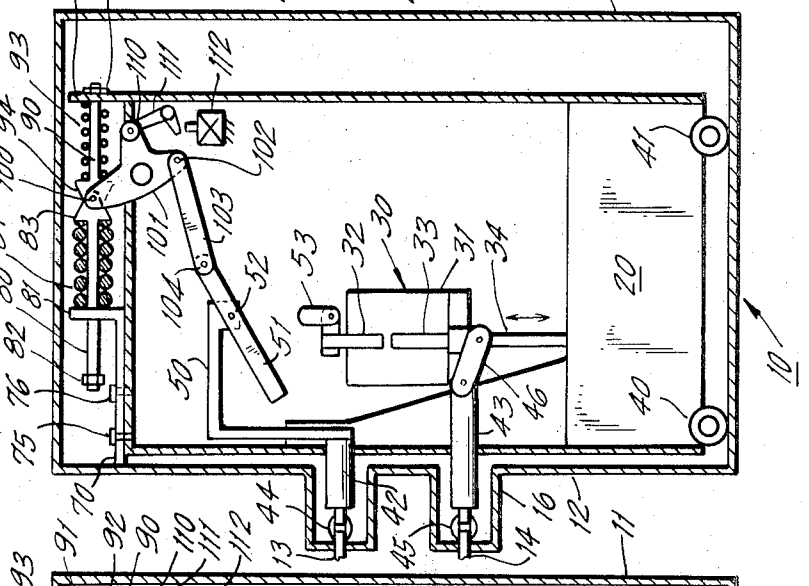
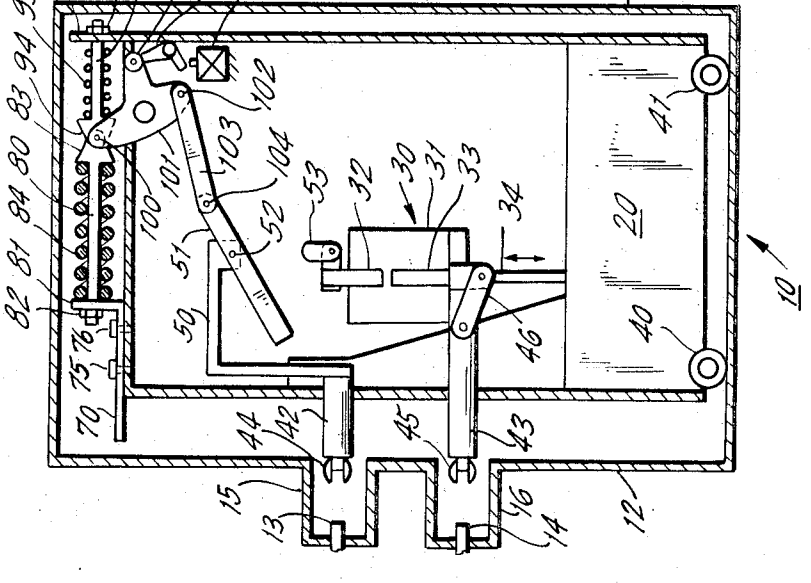


FIG. 1.



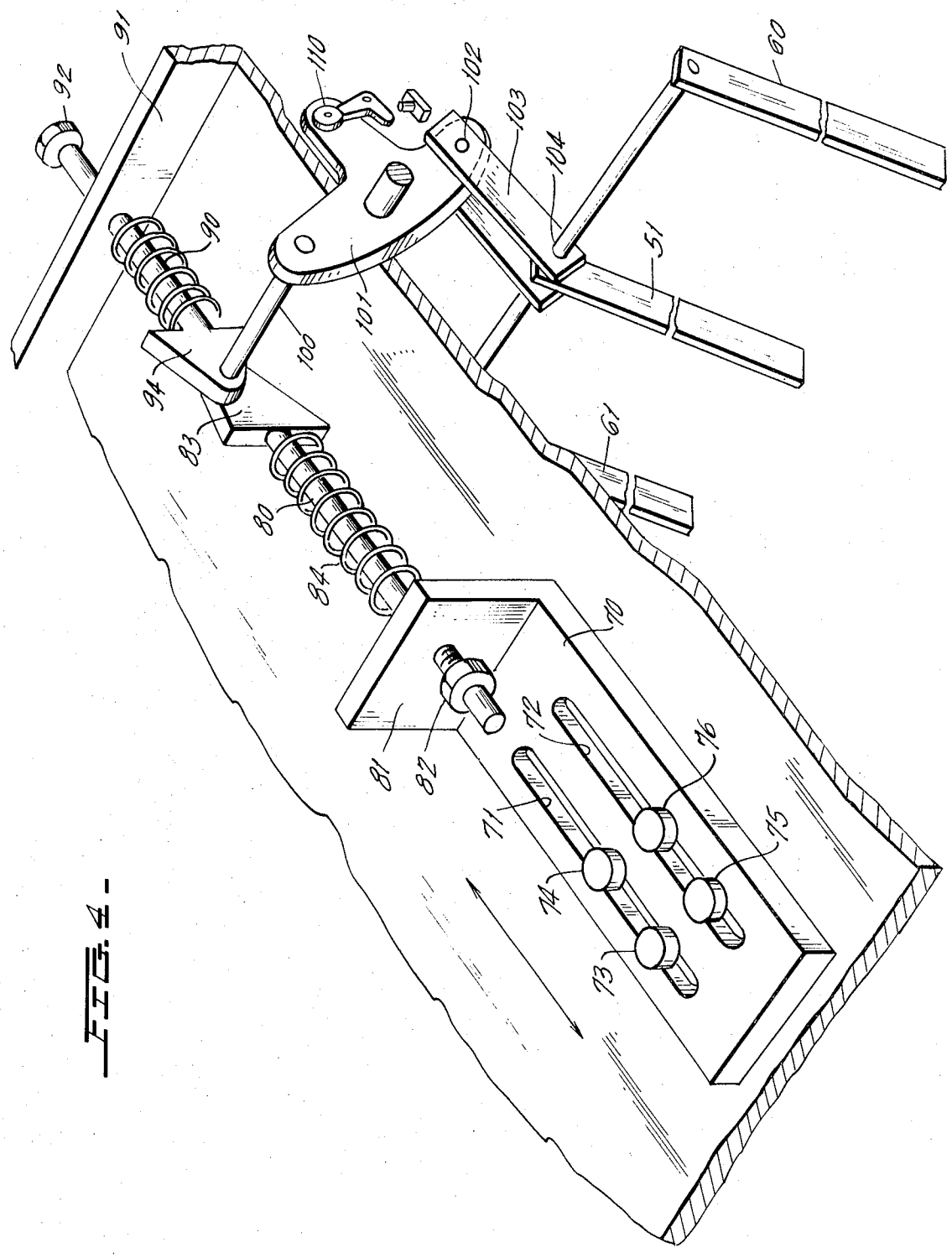

92
91
110
102
103
104
60
90
51
100
101
94
83
61
80
84
10
81
82
12
76
71
15
14
73

FIG. 4

RACKING SAFETY DISCONNECT SWITCH FOR VACUUM CIRCUIT BREAKERS

BACKGROUND OF THE INVENTION

This invention relates to a safety disconnect switch for truck-mounted vacuum breakers and more particularly relates to a novel disconnect switch which allows the final connection of a circuit breaker in an energized circuit from a remote position. Thus, personnel are removed from possible harm if a supposedly open vacuum interrupter has leaked air and could flash over when the truck-mounted unit is racked to its connected position.

Truck-mounted circuit breakers are well-known and are commonly mounted for movement within a cubicle with disconnect contacts at the back of the truck-mounted unit engaging or disengaging stationary disconnect contacts at the back of the cubicle wall which are connected to energized circuits. It is necessary that the circuit breaker contacts are open when the breaker is racked to its connected position in which the breaker disconnects engage the cubicle disconnect contacts so that the disconnect contacts are not subjected to arcing duty.

When air magnetic type breakers are truck-mounted, there is little chance of arcing when the disconnect contacts are engaged, due to breakdown of the open breaker contacts. Where vacuum interrupters are used as the interrupting element, however, it is possible that a vacuum bottle has leaked sufficient air while the breaker was in its disconnected position to permit flash over within the bottle when the breaker is racked into the connected position and engages an energized circuit. Such an occurrence could be hazardous to personnel in direct contact with the breaker racking mechanism.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention, an additional disconnect switch is provided for each pole of a truck-mounted vacuum circuit breaker where the safety disconnect switch is spring-closed by a spring which is charged by the racking operation when the breaker is racked to its connected position. The charged closing spring may be remotely operated before the contacts in the vacuum bottle are closed. Thus, if the bottle was indeed faulty, the movement of the breaker to the connected position will not cause arcing at the disconnects since the safety disconnect mounted on the truck is still open.

Note that the device of the invention does not necessarily protect the breaker or the circuit being protected from the consequences of closing the safety disconnect with a leaky bottle in the circuit, but rather permits the operator to operate the final disconnect from a remote position and to avoid contact with the breaker at this critical time.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevational view, partly in cross-section, of a truck-mounted vacuum circuit breaker which contains the safety disconnect switch of the invention with the breaker racked to its disconnect position.

FIG. 2 shows the arrangement of FIG. 1 where the breaker has been racked to its connected position, with the safety disconnect switch open.

FIG. 3 is similar to FIG. 2, but shows the safety disconnect switch closed.

FIG. 4 is a perspective diagram of the spring-operating mechanism which is charged by racking the breaker closed, as shown in FIGS. 1–3.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, and particularly FIGS. 1, 2 and 3, there is shown a stationary, standard steel cubicle 10, which has a front door 11 and a rear wall 12. The rear wall 12 conventionally contains fixed disconnect contacts 13 and 14 for each pole of a multipole circuit breaker. Similar contacts for the other two poles of a conventional three-phase circuit breaker would be lined up behind contacts 13 and 14 in FIGS. 1, 2 and 3.

Stationary contacts 13 and 14 are accessible through suitable bushing sleeves 15 and 16, of any conventional configuration.

A truck-mounted circuit breaker 20, which is also of conventional construction, is mounted within cubicle 10 and is provided with a suitable racking mechanism (not shown) which enables the mechanism to be controllably moved from the position shown in FIG. 1 (the disconnect position), to the position shown in FIGS. 2 or 3 (the connected position). A typical racking mechanism which could be used in connection with the present invention could be the mechanism shown in U.S. Pat. No. 3,235,681 in the name of Pokorny et al., and assigned to the assignee of the present invention.

The truck-mounted circuit breaker 20 may also contain a plurality of poles, only one of which is shown in FIGS. 1, 2 and 3, where the individual poles contain vacuum interrupters. Thus, FIGS. 1, 2 and 3 schematically show a vacuum interrupter 30 which consists of an evacuated enclosure 31, having a fixed contact rod 32 and a movable contact rod 33 which is movable into and out of engagement with the fixed contact 32.

Note that the contacts 32 and 33 are shown in their disengaged position in FIGS. 1, 2 and 3. These figures also show an operating rod 34 extending upwardly from a suitable operating mechanism (not shown) in the base of truck 20. The double-headed arrow next to rod 34 indicates its direction of movement in operating the vacuum interrupter contacts.

The truck-mounted breaker frame 20 is rollably mounted on wheels 40 and 41 and contains a pair of movable disconnect contact bushings 42 and 43, which carry tulip-clip type terminals 44 and 45 respectively, which are engageable with fixed disconnect contacts 13 and 14 respectively. Thus, in FIG. 1, the contacts 44 and 45 are retracted since the breaker is in its disconnect position, whereas in FIGS. 2 and 3, contacts 44 and 45 engage contacts 13 and 14 with the breaker racked to its connected position.

Contact 45 is conventionally connected to conductive pivot link 46, which is, in turn, connected to movable contact 33 of the vacuum interrupter and to the operating rod 34.

Disconnect contact 44, in accordance with one aspect of the invention, is connected to a conductive L-shaped member 50 which, in turn, pivotally mounts a disconnect switch blade 51 at pivot point 52. The disconnect blade 51 is then movable between an engaged and disengaged position with respect to a stationary jaw contact 53 which is fastened to fixed contact 32 of vacuum interrupter 30. Note that there will be one discon-

nect blade 51 for each respective vacuum interrupter. Thus, the breaker shown in FIGS. 1–3 may be a three-phase breaker with three vacuum bottles 30. Therefore, as shown in FIG. 4, there will be three disconnect switch blades 51, 60 and 61 for the three vacuum interrupters defining the three phases of the breaker.

The operating mechanism for operating disconnect switch blades 51, 60 and 61 includes an angle member 70 which is slidably mounted on the top of truck unit 20. Slots 71 and 72 in member 70 (FIG. 4) are received by guide buttons 73, 74, 75 and 76 which are secured to the top of cubicle 12. A shaft 80 extends through an opening in flange 81 of member 70 and has a stop-nut 82 on the end thereof. The other end of shaft 80 contains an enlarged head portion 83 and a heavy closing spring 84 is compressed between the flange 81 and enlarged head 83. The enlarged head 83 is further connected to the forward end of shaft 90 where the shaft 90 is slidably received through an opening in an upwardly extended wall portion 91 of the truck unit 20. A stop-nut 92 is placed on the right-hand end of shaft 90 and an opening spring 93 is mounted on shaft 90 and is captured between portion 91 and an enlarged head 94 of shaft 90.

Pin 100 connects members 83 and 94 together and is pivotally connected to the upper end of a jackshaft 101, which is suitably fixedly mounted on the truck 20. The lower end of jackshaft 101 is pivotally connected by pin 102 to link 103. The other end of shaft 101 is pivotally connected by pin 104 to the disconnect blades 51, 60 and 61.

The jackshaft member 101 also contains a roller latch 110 which is latched by a suitable pivotal latch member 111, which is conventionally rotatably mounted on the truck 20. The upwardly extending latch arm of member 111 is movable to latch beneath the roller 110 to latch the jackshaft 101 in the position shown in FIGS. 1 and 2. Suitable spring biasing means (not shown) hold the latch member 111 in the position shown so that latch member 111 may be moved away from its latching position by the actuation of a solenoid 112. Solenoid 112 acts to strike the lower leg of latch member 111 to rotate the latch clockwise, thereby to defeat the latch to the roller 110.

The operation of the safety disconnect switch of the invention is as follows:

In FIG. 1, the breaker is in its disconnected position and the disconnect switch blade 51 is open. The disconnect is held in this open position by virtue of the latching of latch roller 110 by the latch member 111, which prevents the counterclockwise rotation of jackshaft 101 under the influence of spring 84. The operator who wishes to place the breaker or unit 20 in service merely racks the breaker to its connected position of FIG. 2 by racking in the conventional manner. In the position of FIG. 2, contacts 44 and 45 conventionally engage stationary disconnects 13 and 14 where these stationary disconnects are connected to an energized circuit. In a like manner, the poles disposed behind the single pole shown in FIGS. 1, 2 and 3 are connected to an energized circuit or line. The circuit is not completed to the breaker, however, since the disconnect blade 51 (along with blades 60 and 61) is still open. Note also that the vacuum interrupter contacts are presumably open although, due to leakage in the vacuum bottle, the interrupter may not have its full dielectric integrity and contacts 32–33 might flash over when contacts 44 and 45 and 13 and 14 approach one another.

In accordance with the invention, the racking of the truck unit 20 to the connected position of FIG. 2 causes the left-hand end of member 70 to engage the interior surface of the rear panel 12 thereby to move member 70 to the right relative to the truck 20 and thereby compressing closing spring 84. Note, however, that shaft 80 is latched against movement due to the increasing compressive force in spring 84 by the latch member 111. The operator may now move to a remote position and close a relay contact (or operate a lanyard) which causes the energization of solenoid 12 which moves its plunger upwardly to rotate latch member 111 clockwise. This then defeats the latch on the latch roller 110 so that jackshaft 101 may rotate under the influence of spring 84 in a clockwise direction. This then causes the movement of link 103 and disconnect contact blade 51 to the closed position shown in FIG. 3.

Accordingly, if the bottle 30 is indeed faulty and its open contacts flashover, there will be arcing between disconnect blade 51 and jaw contact 53 but the operator will be removed from the general area of the circuit breaker and therefore will not be endangered by this condition.

It will be noted in FIG. 3 that the closing of the disconnect blade 51 and partial expansion of spring 84 causes the compression of opening spring 93, which is somewhat weaker than spring 84. The relative strengths of springs 84 and 93 is such that when the breaker is racked from the position of FIG. 3 to the disconnected position of FIG. 1, during the racking the spring 93 will expand to rotate jackshaft 101 counterclockwise and toward its latched position and, at the same time, will open the disconnect blade 51 so that it may serve its next protective function when the circuit breaker is reconnected in the energized circuit.

It should be specifically noted that the operating circuit for operating the vacuum interrupter operating shaft 34 may be interlocked with jackshaft 101 such that the vacuum interrupter cannot be closed unless the jackshaft 101 is in the disconnect open position of FIGS. 1 and 2.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited, not by the specific disclosure herein, but only by the appended claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. In combination; a metallic cubicle, a truck-mounted vacuum interrupter movable by a racking mechanism within said metallic cubicle, and a safety disconnect switch; said metallic cubicle having a pair of fixed disconnect contacts therein; said truck-mounted vacuum interrupter having a pair of movable disconnect contacts mounted thereon which are movable into and out of engagement with said fixed disconnect contacts as said truck-mounted interrupter is racked between a connected and dis-connected position within said cubicle; said truck-mounted vacuum interrupter having first and second vacuum interrupter terminals; said first interrupter terminal connected to one of said pair of movable disconnect contacts; said safety discon-

nect switch including a movable switch blade means movable independently of movement of said truck-mounted vacuum interrupter between an open position which disconnects said interrupter terminals from an external circuit and a closed position in which one end of said switch blade means is connected to the other of said pair of movable disconnect contacts, and the other end of said switch blade means is connected to said second interrupter terminal; and remotely operable operating means for operating said switch blade means to its said closed position when said truck-mounted vacuum interrupter is in its said connected position.

2. The combination of claim **1** wherein said operating means includes a spring-charged mechanism and latch therefore; said spring-charged mechanism being connected to said truck-mounted vacuum interrupter and charged responsive to movment of said truck-mounted vacuum interrupter to said connected position and being latched in a charged condition by said latch; and a remotely operable latch defeating means for releasing said latch to discharge said spring-charged mechanism; said spring-charged mechanism connected to said switch blade means and moving said switch blade means to said closed position when said latch is released.

3. The combination of claim **2** which further includes an opening spring charged by the operation of said operating means when closing said switch blade means; said opening spring connected to said switch blade means and moving said switch blade means to its said open position when said truck-mounted circuit interrupter is moved to its said disconnected position.

4. The combination of claim **2** which further includes movable bracket means movably mounted on said truck-mounted vacuum interrupter and having one portion thereof engageable by a portion of said cubicle and another portion thereof engaging said spring-charged mechanism, whereby movement of said truck-mounted vacuum interrupter to its said connected position causes said movable bracket means to engage said cubicle and to move relative to said cubicle to charge said spring-charged mechanism.

5. The combination of claim **1** which further includes an opening spring charged by the operation of said operating means when closing said switch blade means; said opening spring connected to said switch blade means and moving said switch blade means to its said open position when said truck-mounted circuit interrupter is moved to its said disconnected position.

6. The combination of claim **1** wherein said switch blade means is pivotally mounted relative to said other of said pair of movable contacts.

* * * * *