REMOTE CLOSING POWER LOAD PICKUP DEVICE

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References Cited
UNITED STATES PATENTS
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ABSTRACT
A fused, remote closing power load pickup device for electrically interconnecting an overhead power line with electrical apparatus, wherein is included a switch member movable toward and away from a latching contact therefor with a lever and a lanyard being operably connected to the switching member so that it may be safely shifted from open disposition to its closed position in latched relationship with the contact therefor from a remote location.

12 Claims, 9 Drawing Figures
REMOTE CLOSING POWER LOAD PICKUP DEVICE

This invention relates to power load pickup or line-tapping switch devices for use in connecting electrical apparatus to an overhead power line.

Devices of the type referred to are disclosed in United States Letters Pat. Nos. 2,025,321 and 2,637,795. As is fully shown and described in these patents, a pivotal switch member is adapted to be latched in place against a contact thereon. A fusible element carried by the switch member is operably associated with mechanism supporting the member so that upon melting of the fusible element under a fault current, the switch member drops away from the latching contact to open the circuit. Normally, the swingable switch member of these devices is shifted to a closed position to electrically interconnect apparatus such as an electrical transformer with the power line, by use of an insulative stick tool or the like requiring that the workman be quite close to the power load pickup when the switch member is closed against the latching contact assembly. Such devices find particular utility in energizing transformers and the like subsequent to repair and replacement work. If the switch member of the device is closed against a fault current, destruction of the transformer can occur, resulting in severe injury to the workman by showering him with hot oil from the transformer or sharp splinters from destroyed ceramic insulators, due to his close proximity to the electrical apparatus being energized. Another problem associated with such power load pickup devices is their tendency to oscillate or “pinwheel” about the overhead conductor when the switch member is shifted to a closed position or upon destruction of the fusible element thereof as a result of fault current.

Accordingly, it is the most important object of the present invention to provide a power load pickup device wherein the switch member thereof may be closed from a remote location so as to prevent injury to the workman.

An important object of the invention is to provide a power load pickup of the class described wherein a line clamp electrically connects the pickup to the overhead power line, and at the same time fastens the device in a depending relationship from the line in such a manner that the device may be used anywhere necessary without requiring additional mechanical support therefor.

Yet another object of the invention is to provide such a power load pickup and accompanying clamp which are configured and relatively arranged to maintain stability during closing as well as during fault current interruption, to thereby prevent oscillation or “pinwheeling” of the device relative to the overhead line. A corollary to this objective is to prevent oscillation by configuring the device such that the rotating member thereof swings about an axis that extends generally perpendicularly to the overhead line.

Another object of the invention is to provide a power load pickup as described in the preceding objects wherein the switch member embodies a fuse holder and an internal, fusible element as the conductive, rotative member of the power load pickup in order to provide additional workman safety while at the same time precluding the necessity of using an additional fusible element in conjunction with the device.
FIG. 5 is a transverse, cross-sectional view taken along line 5-5 of FIG. 1; FIG. 6 is an enlarged, fragmentary, partially cross-sectional elevational view of the lower end of the device when the switch member is disposed in the open position thereof; FIG. 7 is a perspective view of the remote closing power load pickup device installed on an overhead power line in readiness to be closed from a remote location such as the ground. FIG. 8 is a perspective view of the remote closing power load pickup device in conjunction with a permanently fused protective device; and FIG. 9 is a perspective view of the remote closing power load pickup device in conjunction with a self-protected transformer and a safety fuse hanger.

Referring now more particularly to the drawings, there is illustrated a remote closing power load pickup device generally designated by the numeral 10 which includes an elongated, vertically arranged support 12, and an elongated, vertically arranged conductive switch member 14 laterally spaced to one side of support 12. The device also includes a hot line clamp 16 which fastens support 12 in depending relationship from an overhead power line electrical conductor 18. Device 10 is operable to interconnect overhead power line 18 with electrical apparatus such as a high voltage transformer 20 (FIG. 7) for energization thereof.

Support 12 includes an electrically insulative body 22 having electrically conductive terminal structures 24 and 26 secured to upper and lower ends thereof. Hot line clamp 16 includes a stationary upper jaw 28 affixed to upper terminal structure 24, and a movable lower jaw 30 which may be advanced toward and away from the upper jaw 28 by virtue of eye screw 32 to firmly grip power line 18.

While the present invention is concerned primarily with providing a remote closing power pickup device adapted to be directly affixed to an overhead power line in a conventional manner, it is not so limited. For example, if it is desired to secure the device to another form of prop such as a line support 19 (see FIG. 7), this can be done by providing means connected to the device which accomplishes this purpose and positions the device in any desired relationship relative to the overhead power line 18. In such a case an electrical connection means would also be provided to electrically connect the contact on the support with the overhead power line.

The conductive switch member 14 illustrated includes a hollow fuse holder 34 having a headable fusable link 36 therewith having a tail which protrudes out of the open lower end of the fuse holder 34. The head portion of link 36 is electrically interconnected to an outer, electrically conductive ferrule 38 at the upper end of fuse holder 34. Another ferrule 40 is secured around the outside of the lower end of the fuse holder 34. The upper end of fuse holder 34 may be closed by a frangible disc 42, and projecting laterally from upper ferrule 38 is a fixed contact in the form of an extension 44.

Upper terminal mounting structure 24 of support 12 carries a deflectable spring contact 46 located to engage extension 44 as well as a spring metal latch having a hook portion which releasably engages a lip 47 therefor on contact 44 at the upper end of conductive member 14.

The terminal structure 26 at the lower end of support 12 connects with lower ferrule 40 of conductive member 14 by pivot means in the form of toggle linkage generally referred to by the numeral 48. Toggle linkage 48 includes a rotary contact section 50 having trunnions 52 extending transversely to be received in aligned openings 54 in laterally extending arms 56 of lower terminal structure 26. Lower ferrule 40 is pivotally interconnected with rotary contact section 50 at pivot 58, with a spring 60 biasing the ferrule and contact section 50 in opposite directions. Rotary contact section 50 also carries a spring-loaded, rotary fuse link ejектор 62. The lower end of fuse link 36 is secured to contact section 50 by tightening of knurled nut 64 on stud 65 carried by contact member 50. Link 36 engages ejector 62 so that when pulled taut, link 36 forces ejector 62 into a cocked position as illustrated in FIG. 6. Rotary contact section 50 has a contact face 66 thereon which is engageable with a strap-like metallic contact 68 secured to lower terminal structure 26 on the insulative support 12. The toggle linkage 48 thus far described is generally of the type more completely described in U.S. Pat. Nos. 3,026,391 and 3,614,700 to which reference may be made for a more full description of the structure and operation thereof though not necessary to a full understanding of the present invention.

Also carried by rotary contact section 50 and thereby operably secured to the lower ferrule 40 of the fuse holder, is a lever arm 70 which is attached to contact section 50 by means of rivets 87. Lever arm 70 includes an offset stretch 72 and a radially extending stretch 74 that extends generally oppositely from conductive member 14. Such arrangement of lever arm 70 locates the same closely adjacent the trunnions 52 upon which the toggle linkage 48 rotates, while at the same time maintaining lever 70 in spaced relationship to ejector 62 and link 36 to allow free movement thereof. Looped through and secured to an outer end of lever arm 70 is an actuating lanyard 76 of a length such that when device 10 is mounted on an overhead line, the lanyard extends downwardly therefrom to ground level as illustrated in FIG. 7. This arrangement of lever arm 70 upon toggle linkage 48, as well as the point of securement of lanyard 76 to the lever arm, allows the lanyard to be pulled downwardly to cause rotation of toggle linkage 48 and conductive member 14 in a clockwise direction about trunnions 52 as viewed in FIG. 6.

Lower terminal structure 26 on support 12 also has a lateral stretch 78 integral therewith in electrical contact with the contact 68, and an electrical terminal 80 is secured to stretch 78. Stretch 78 also carries a transversely extending parking stud 82 as can best be seen in FIG. 2. Parking stud 82 presents a transversely offset section adapted to receive a second hot line clamp 84 of configuration similar to the hot line clamp 16. Line clamp 84 is adapted to be connected to an electrical conductor or other conductive structure to be energized as, for example, electrical transformer 20 as shown in FIG. 7, through the medium of an electrical conductor 86 extending from clamp 84 to terminal 80 at the lower end of the insulative support 12.

In use, the remote closing power load pickup device 10 is moved toward the working station on a conductor with the member 14 in its open position as illustrated in FIGS. 6 and 7 whereby the upper contacts 44 and 46 on the member and the support are disengaged and the member 14 extends generally at right angles to the ver-
tical support 12. Also, when raising the device 10 to its operating position, the second line clamp 84 is preferably carried on parking stud 82 so that the device may be conveniently moved as a compact unit. Before lifting the device 10 to a location adjacent the overhead power line 18, if not already fused, the fuse link 36 is inserted and pulled taut around toggle linkage 48 to place ejector 62 in itscocked position. The fuse link end 36 is secured under knurled nut 64. By manipulation of a conventional hot line stick tool the upper line clamp 16 may be secured to the overhead power line 18 by rotation of eye screw 32 so that the support 12 and entire device 10 is fastened in depending relationship from the overhead power line. In this connection, line clamp 16 is of overall, rigid construction so that no further mechanical support is required in mounting the device on the overhead power line. The opposite end of the other line clamp 84 is then secured to the proper terminal lead conductor to the transformer 20 again by use of conventional hot line tools so that the device is in readiness to be closed to energize transformer 20.

Upon completing the above preliminary steps, the workman descends from the power line pole or shifts the aerial support bucket away from the switch device to a remote location as, for example, shown in FIG. 7, by pulling lanyard 76 (which is preferably strung in conjunction with a conventional pulley 75 as shown), conductive member 14 rotates on the axis of trunnions 52 and shifts to its closed position wherein the lower contacts 66 and 68 are in electrical contact and the upper contacts 44 and 46 are in latching interengagement. If the pickup device 10 closes against a fault current capable of destroying transformer 20 notwithstanding ultimate reopening of switch 10, the workman is at a safe, remote location to prevent injury.

Upon closing of the device 10 against a fault current, a part of the fusible element is melted, resulting in severing of fuse link 36. As a result, ejector 62 is released to whip fuse link 36 downwardly out of the way. At the same time, underside toggle linkage 48 collapses, causing contact section 50 to rotate in a clockwise direction as illustrated in FIG. 4, and the lower contact ferrule 40 to rotate relatively oppositely thereto about pivot 58. The entire conductive member 14 accordingly drops downwardly to release its upper contact 44 from latching interengagement with contact 46 to the relative position of the elements as illustrated in FIG. 4. Subsequently, conductive member 14 rotates about pivot 58 outwardly to its open-indicating position as illustrated in FIG. 7.

In many operations prior to installing the load pickup device 10 on the power line 18, a permanently fused protective device 89 is fused and left in open (disengaged) position. The load pickup device is then installed as described above and the clamp 84 is thereafter attached to the lead from the cutout 89 (see FIGS. 7 and 8 where this embodiment is shown). After the device 10 is closed with the lanyard, the lineman climbs the pole and swings the cutout fuse holder closed, using his switch stick or similar device, thereby completing the circuit through this path paralleling the load pickup device. The clamp 84 is then disengaged from the cutout lead and returned to the parking stud 82 and the device 10 is removed from the line using conventional hot-line tools.

In FIG. 9, a self-protected transformer is employed without using the cutout 89. In this instance the permanent transformer lead is temporarily supported by a stud at the lower end of an insulating member (such as a safety fuse hanger 91) isolating the transformer lead from the line 18.

The device 10 is now installed and operated as previously described. If there is no fault and the fuse in the load pickup device 10 holds, the lineman climbs the structure and, using conventional hot-line tools, removes the clamp 86a attached to the permanent lead 86 from the stud 92 and engages the line 18, thus paralleling the load pickup device 10. Following the procedure described for FIG. 1, the clamp 84 is removed from the lead 86 and secured to the parking stud 82, and the device 10 is removed from the line.

Preferably, the upper hot-line clamp 16 is configured and arranged relative to support 12 so that the plane of device 10 is generally aligned with the length of the conductor 18 but slightly offset therefrom as best shown in FIG. 3. In particular, the conductive member 14 and support 12 which have longitudinal axes lying in a common, generally vertical plane, are fastened to the overhead power line so that this vertical plane is at a slight acute angle relative to the horizontally extending length of overhead power line 18. Upon severing of the fuse link 36 by interruption of a fault current, the exhaust gases generated inside conductive member 14 are discharged through the open lower end as well as through the upper end of the fuse holder upon rupture of frangible disc 42. The location of the fuse holder in a plane only slightly removed from parallelism with the longitudinal axis of the conductor prevents transmission of gas discharge reactionary forces to the device 10 in directions which would tend to cause oscillation or "pinwheeling" of the device about overhead power line 18. The slightly offset relationship of the upper end of conductive member 14 relative to the overhead power line assures that the gases exhausting through the upper end thereof do not impinge upon overhead power line 18 and thereby burn the conductor strands or blast potentially damaging fuse elements into the line.

The configuration and arrangement of lever arm 70 allows free rotation of ejector 62 so that lever arm 70 does not interfere with the automatic opening induced by the toggle linkage 48 upon interruption of a fault current. Lever arm 70 is also arranged so as to place a minimum amount of strain upon fuse link 36 to prevent early breakage thereof as the conductive member is being shifted to its closed position by downward pulling upon lanyard 76. Furthermore, the location of lanyard 76 at the end of stretch 74 which extends generally radially oppositely from conductive member 14 assures that maximum leverage is retained during rotation of member 14 to its closed position, as such closed position is neared. This arrangement assures firm, positive closing of the device.

Preferably, the outer ends of trunnions 52 are threaded to receive nuts 53 which cooperate with the arms 56 on the lower terminal structure 26 and interlock with the encircling ridge 88 to properly hold toggle linkage 48 and the rotating, conductive member 14 in proper alignment relative to the lower end of support 13 and prevent inadvertent disengagement of the trunnions 52. Accordingly, as member 14 is rotated from its open to its closed position, the movable contact 44 on the upper end thereof remains in alignment with the fixed contact 46 to assure proper interengagement.
thereof when the closed position is reached. The conductive member 14 and contact section 50 may be easily inserted and removed from support 12 by simply backing off the nuts 53 and inserting or removing the trunnions 52 through the open-sided openings 54. The offset stretch 72 of lever arm 70 facilitates easy replacement of the fusible element and fuse link 36 into fuse holder 34 as stretch 72 is displaced from the open, lower end of fuse holder 34.

As indicated above, toggle linkage 48 is arranged such that member 14 rotates about an axis defined by trunnions 52 and thereby extends generally transversely to the overhead power line 18 to assure minimum oscillation and "pinwheeling" thereof upon closing of the device. To further minimize sway of device 10 about the overhead power line 18, hot-line clamp 16 is located such that it is in general vertical alignment with the center of gravity of support 12. Accordingly, the relative structural arrangement of device 10 (including the positioning of hot-line clamp 16 at angle relative to overhead power line 18 and above the center of gravity of support 12, the arrangement and configuration of lever arm 70 upon the lower toggle linkage 48, the location of the point of securement of lanyard 76 to lever 70, and the transversely extending rotary axis defined by trunnions 52) produces positive and correct closing of the device when actuated from a remote location at ground level by pulling upon lanyard 76, as well as minimum movement of the same if the device is closed into a fault current.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A remote closing power load pickup device adapted when closed to electrically interconnect an overhead power load line with other electrically conductive structure, said device comprising:
   an elongated, insulative support;
   an elongated, conductive member generally laterally spaced from said support;
   means pivotally interconnecting lower ends of said support and said member to allow rotation of the latter;
   interengageable electrical contacts on said support and said member spaced from said lower ends thereof, said member being rotatable from an open position wherein said contacts are disengaged to a closed position with said contacts in latching interengagement;
   clamp means secured to said support and adapted to electrically connect said contact on the support with the overhead power line and to fasten said support in depending relationship from the overhead power line at a location above the ground;
   means electrically connected to said lower end of the member and adapted to be connected with said other electrically conductive structure whereby rotation of the member to said closed position thereof closes the device to electrically interconnect the overhead power line and said structure;
   a lever secured to said member adjacent said lower end thereof and extending radially outwardly from said pivot means; and
   an actuating lanyard secured to said lever at a point radially spaced from said pivot means whereby downward displacement of the lanyard rotates said member from said open position to said closed position thereof to close the device without inducing substantial oscillation thereof relative to the overhead power line, said lanyard extending away from the member to an extent to allow closing of the device from a remote location.

2. A device as set forth in claim 1, wherein said lever extends radially outwardly from said pivot means generally oppositely from said member.

3. A device as set forth in claim 2, wherein said clamp means includes a rigid line clamp secured to an upper end of the support in electrical connection with said contact on the support, said clamp being configured to grip the overhead power line to electrically connect same with said contact on the support and to fasten said device in depending relationship from the overhead power line.

4. A device as set forth in claim 3, wherein said member comprises a fuse holder and a severable, conductive, current responsive fuse carried therewith.

5. A device as set forth in claim 4, wherein said pivot means includes toggle linkage connected with said support and said fuse holder and operably connected with said fuse to urge said fuse holder to drop out to said open position thereof in response to destruction of said fuse, said lever being configured and disposed in noninterfering relationship to said toggle linkage allowing free movement of said fuse holder upon severing of the fuse.

6. A device as set forth in claim 5, wherein both ends of said fuse holder are constructed for discharge of an arc induced gas therethrough whereby gases generated inside said fuse holder upon severing of said fuse are exhausted through both said upper and lower ends of the fuse holder to restrain said device against oscillation relative to the overhead power line.

7. A device as set forth in claim 6, wherein said support and said member are arranged with longitudinal axes thereof lying in a common, generally vertical plane, said clamp locating the device with said vertical plane disposed at a slight acute angle relative to the overhead line whereby said upper end of the member is transversely offset to one side of the overhead power line.

8. A device as set forth in claim 3, wherein said line clamp is disposed in generally vertical alignment with the center of gravity of said support to provide stability for the device when depending from the overhead power line.

9. A device as set forth in claim 3, wherein said member and said support are arranged with longitudinal axes thereof lying in a common, generally vertical plane, said pivot means being configured and arranged whereby said member and said lever rotate about an axis extending generally transversely to said vertical plane and at an angle relative to the overhead power line to restrain the device against oscillation relative to the overhead power line upon closing of the device.

10. A device as set forth in claim 9, wherein said pivot means includes a bracket secured to said lower end of the support having a transverse opening therein, and a trunnion operably secured to said lower end of the member and received in said opening for rotation about said axis extending generally transversely to said vertical plane.

11. A device as set forth in claim 3, wherein is provided second electrical contacts adjacent said lower ends of the member and the support which are in elec-
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9. A remote closing power load pickup device adapted when closed to electrically interconnect an overhead power load line with other electrically conductive structure, said device comprising:
an elongated, insulative support;
an elongated, conductive member generally laterally spaced from said support;
means pivotally interconnecting lower ends of said support and said member to allow rotation of the latter;
interengageable electrical contacts on said support and said member spaced from said lower ends thereof, said member being rotatable from an open position wherein said contacts are disengaged to a closed position with said contacts in latching engagement;
means secured to said device and adapted to fasten said support to prop means in a desired relationship relative to the overhead power line;

electrical connection means secured to said support adapted to electrically connect said contact on the support with the overhead power line;
means electrically connected to said lower end of the member and adapted to be connected with said other electrically conductive structure whereby rotation of the member to said closed position thereof closes the device to electrically interconnect the overhead power line and said structure;
a lever secured to said member adjacent said lower end thereof and extending radially outwardly from said pivot means; and
an actuating lanyard secured to said lever at a point radially spaced from said pivot means whereby downward displacement of the lanyard rotates said member from said open position to said closed position thereof to close the device without inducing substantial oscillation thereof relative to the overhead power line, said lanyard extending away from the member to an extent to allow closing of the device from a remote location.

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