Jan. 3, 1950 E. H. YONKERS 2,493,432

FUSED CUTOUT

Filed Dec. 7, 1944 3 Sheets-Sheet 1

Fig. 1.

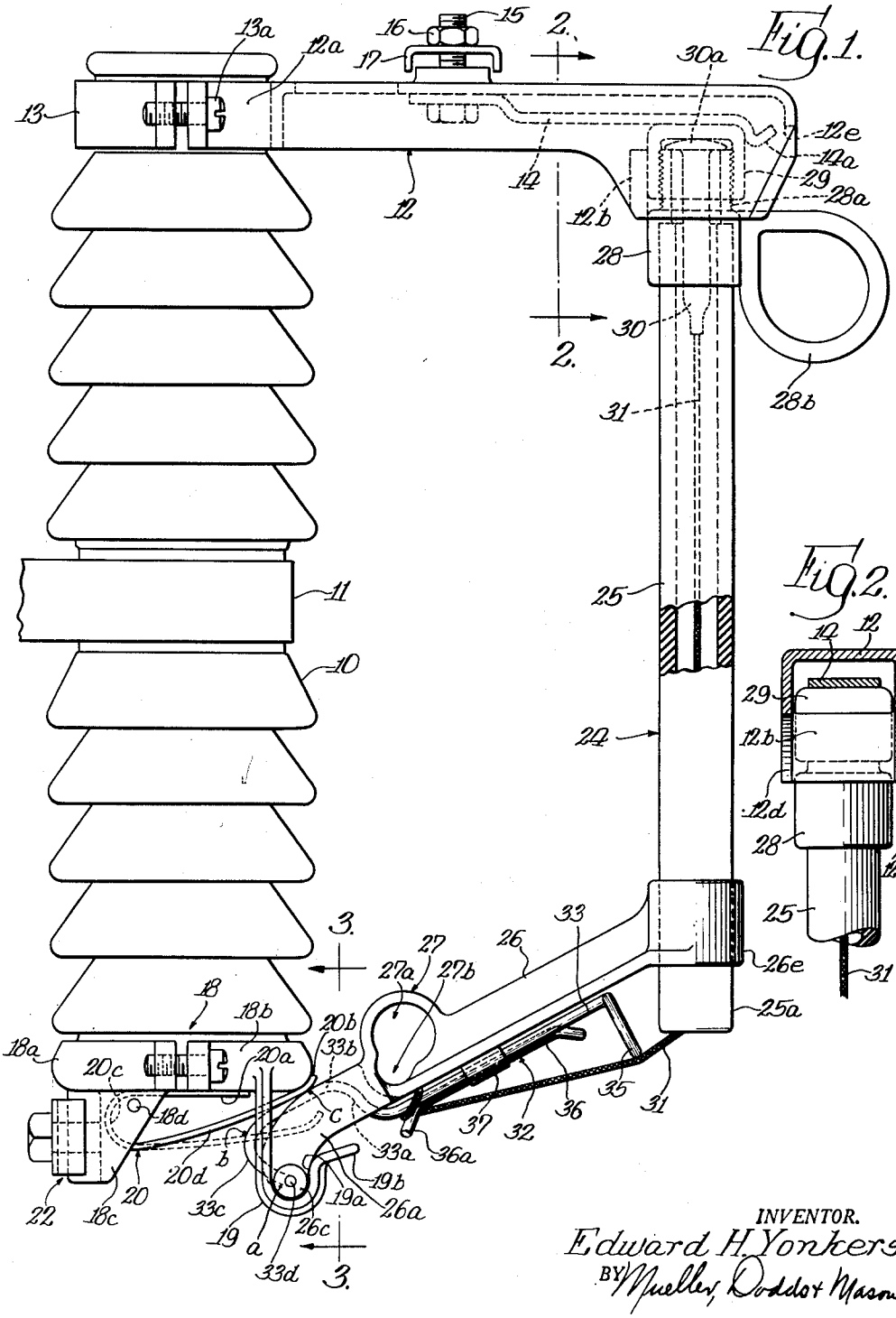


Fig. 2.

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FUSED CUTOUT

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Fig. 3.

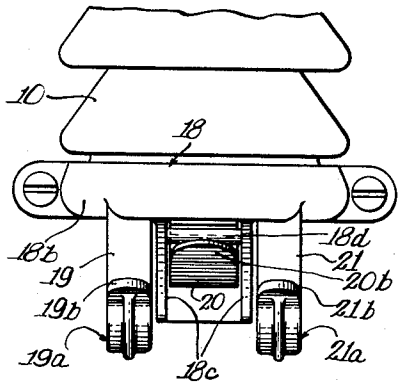


Fig. 4.

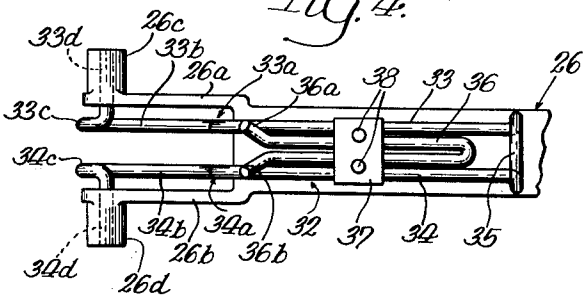


Fig. 5.

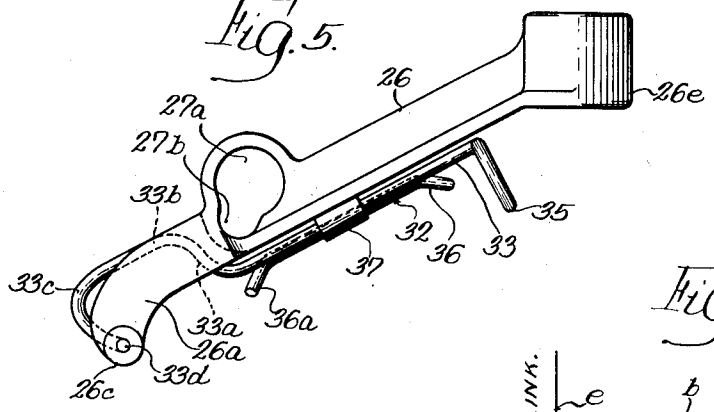


Fig. 6.

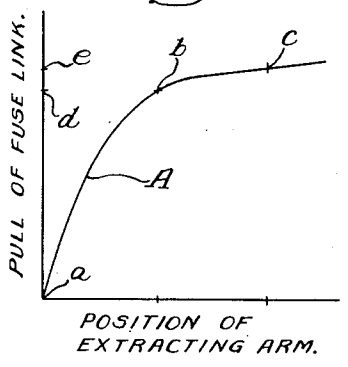
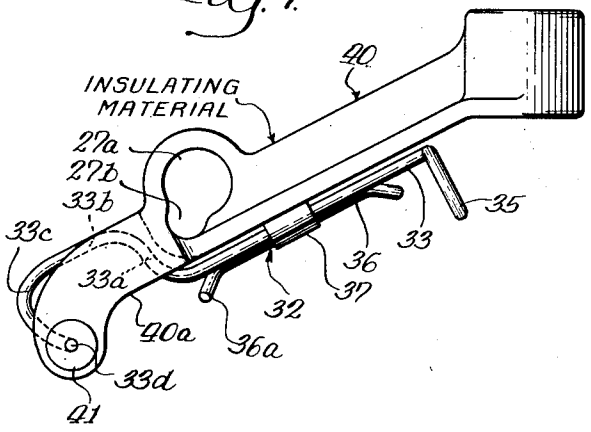


Fig. 7.



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FUSED CUTOUT

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Fig. 8.

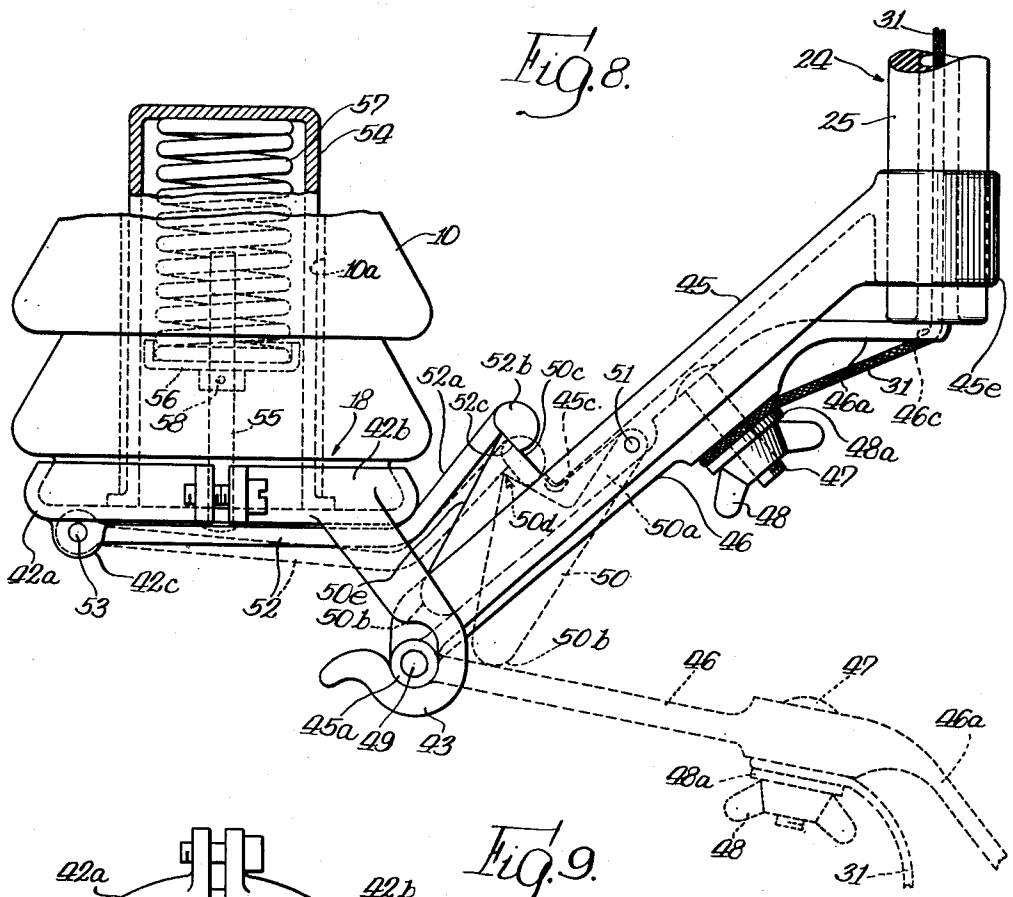
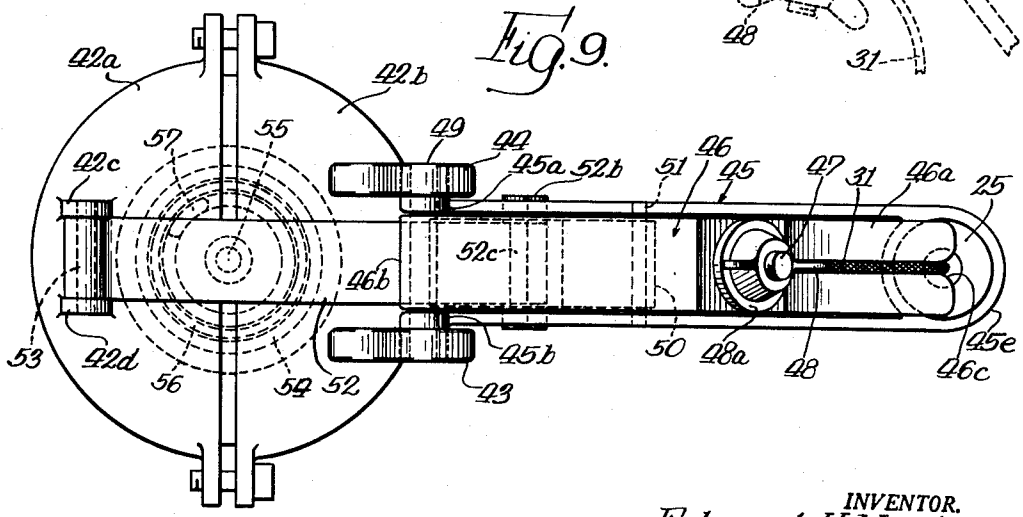


Fig. 9.



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UNITED STATES PATENT OFFICE

2,493,432

FUSED CUTOUT

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Application December 7, 1944, Serial No. 567,021

24 Claims. (Cl. 200—114)

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The present invention relates to fused cutouts, and has for one of its objects the provision of an improved cutout which is of simple and rugged construction, is thoroughly reliable in operation, and in which the fuse tube assembly may be easily and quickly mounted upon or detached from the spaced terminals of the insulator assembly.

It is another object of the present invention to provide an improved fused cutout of the stationary fuse tube type which embodies all of the operating advantages of the dropout type of cutout without the attendant disadvantages.

It is another object of the present invention to provide an improved and simple mechanism for quickly withdrawing the fuse link conductor from the fuse tube of the cutout when the fuse link is ruptured.

According to another object of the invention, the biasing means for the fuse extracting mechanism is arranged to perform the additional function of guiding both ends of the fuse tube assembly into engagement with the terminals of the insulating support as the fuse tube assembly is mounted upon the insulating support.

In accordance with still another object of the invention, the means for biasing the fuse extracting mechanism is detached from the fuse tube assembly and serves to produce pressure engagement between the current conducting and engaged hinge parts of the two assemblies so long as the fuse extracting mechanism is not operated.

According to a further object of the invention, the coacting parts of the biasing and extracting means are so arranged that the tension imposed upon the fusible element of the fuse link cannot be increased above a predetermined value as the biasing means is stressed, and force is applied to the extracting means during substantially the full movement of the extracting means to withdraw the fuse link conductor from the fuse tube.

According to yet another object of the invention, an improved arrangement is provided for interposing an isolating or anti-leakage current gap between the fuse tube and one of the terminals of the support incident to fuse rupture.

In accordance with a still further object of the invention the structure is so arranged that an insulating member is electrically interposed in series with the fuse tube between the terminals of the suport when the fuse link is ruptured, thereby to minimize leakage current flow between the terminals over the inner surface of the tube after fuse rupture occurs.

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It is a further object of the invention to provide a cutout of the character described wherein the biasing means for the fuse extracting mechanism performs the added function of producing fuse tube dropout when the fuse link within the tube is ruptured.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which;

Fig. 1 is a side view, partially in section, illustrating an improved cutout characterized by the features of the present invention;

Fig. 2 is a sectional view taken along the lines 2—2 of Fig. 1;

Fig. 3 is a fragmentary front view taken along the lines 3—3 in Fig. 1 with the fuse tube assembly removed further illustrating the lower terminal assembly of the insulating support embodied in the device;

Fig. 4 is a fragmentary bottom view of the fuse tube assembly illustrating the construction of the fuse extracting arm embodied therein;

Fig. 5 is a side view of the supporting and extracting arms forming a part of the fuse tube assembly;

Fig. 6 is a curve illustrating one of the operating characteristics of the device;

Fig. 7 is a side view illustrating a modified supporting and extracting arm construction;

Fig. 8 is a fragmentary side view illustrating a modified form of the invention, and;

Fig. 9 is an underside view of the structure shown in Fig. 8.

Referring now to the drawings, and more particularly to Figs. 1 through 5 thereof, the present improved fused cutout is there illustrated as comprising the usual insulating support in the form of a petticoat insulator 10 having a center zone longitudinally thereof clampingly embraced by a bracket 11 which may be utilized in supporting the cutout upon a pole or another suitable supporting structure. At its respective upper and lower ends the insulating support 10 is provided with spaced apart upper and lower terminals indicated generally at 12 and 18, respectively, and between which a fuse tube assembly 24 of the expulsion type is adapted to be supported.

Specifically, the upper terminal 12 comprises a conductive channel member of U-shaped cross section throughout its length and having an integrally formed half collar 12a at one end thereof

for embracing the collar seat provided at the upper end of the insulating support **10**. This portion of the terminal **12** is clamped against the seating surface of the support **10** by means of a half collar clamping member **13** and clamping screws **13***a* disposed upon opposite sides of the support **10**. At the laterally extended end thereof, the upper terminal member is provided with downwardly extending hood skirts **12***c* and **12***d*, the upper portions of which are arranged in meeting engagement with an overhanging lip **12***e* extending downwardly from the top part of the channel shaped terminal member **12**. Thus, the parts **12***c*, **12***d* and **12***e* define a hooded or partially enclosed space at the extended end of the terminal member **12** for receiving therewithin the upper end of the fuse tube assembly **24**. To prevent this end of the fuse tube assembly from being moved beyond a predetermined point longitudinally of the skirts **12***c* and **12***d* as the assembly is swung into its closed circuit position, a stop member **12***b* is connected transversely between the two identified skirts. This member, which may be formed integral with the skirts **12***c* and **12***d*, is arranged to coact with a leaf spring catch member **14** in retaining the upper end of the fuse tube assembly **24** against outwardly swinging movement to the open circuit position thereof. One end of the spring **14** is anchored to the under side of the upper terminal member by means of a terminal screw **15** which is threaded through a reinforced top side portion of the terminal member. A clamping washer **17** and a nut **16** threaded on the screw **15** may be utilized to establish line wire connections with the upper terminal member.

The detachable fuse tube assembly **24** comprises the usual expulsion fuse tube **25** formed of an inner layer of pressed fibre or the like, having good arc extinguishing gas evolving properties, and an outer layer of paper impregnated with a synthetic resin plastic material having excellent insulating properties. At its upper end, this fuse tube is provided with a terminal ferrule **28** having a threaded end portion for receiving the internally threaded terminal cap **29**. The two last-mentioned terminal parts are arranged to have the head **30***a* of a fuse link **30** clamped therebetween internally of the fuse tube **25**. This link which preferably is of the improved form disclosed and claimed in applicant's copending application, Serial No. 533,824, filed May 3, 1944, now Patent No. 2,453,688 granted Nov. 9, 1948, is provided with a pigtail conductor **31** extending longitudinally of the tube **25** and out of the open lower end of this tube.

The tube **25** is arranged to be supported by a laterally extending and conductive supporting arm **26** which is of inverted T-shaped cross section throughout the major portion of its length. This supporting arm is provided with a ferrule **26***e* through which the lower open end **25***a* of the fuse tube **25** is driven to provide a pressed fit connection therebetween. Interengageable hinge parts respectively mounted upon the lower terminal **18** of the insulating support **10** and the extended end of the supporting arm **26** are provided for pivotally supporting the fuse tube assembly **24** upon the insulating support **10**. Specifically, the lower insulator terminal **18** is comprised of two half-cup parts **18***a* and **18***b* which are screw clamped to embrace the lowermost petticoat of the insulator **10**. The terminal part **18***b* is provided with hinge means in the form of two transversely spaced apart, hook shaped brackets **19**

and **21** having aligned trunnion receiving seats **19***a* and **21***a* formed therein. These brackets also respectively include guide noses **19***b* and **21***b* which are utilized in the manner explained below to guide the hinge trunnions of the fuse tube assembly **24** into engagement with the seats **19***a* and **21***a*. The other part **18***a* of the lower terminal **18** is provided with a downwardly extending portion having spaced apart parallel sides **18***c* within which is supported the curved portion **20***c* of a U-shaped tensioning spring **20**. This portion of the terminal part **18***a* is also used to mount the clamping parts of a line terminal assembly **22** in an obvious manner. The U-shaped tensioning spring **20** is held assembled with the terminal part **18***a* by means of an assembly pin **18***d* extending between the walls **18***c* in a manner such that the spring leg **20***a* rests in bearing engagement with the lower walls of the two terminal parts **18***a* and **18***b*.

As indicated above, the hinge parts of the fuse tube assembly **24** comprise a pair of trunnions **26***c* and **26***d* located at the extended end of the supporting arm **26** and extending transversely outward therefrom. More specifically, the supporting arm **26** is provided at its extended end with a forked portion comprising transversely spaced end parts **26***a* and **26***b* having the trunnions **26***c* and **26***d* formed integral therewith at their respective ends. The two identified trunnions are adapted for seating engagement with the trunnion seats **19***a* and **21***a*, respectively, of the two brackets **19** and **20**.

For the purpose of rapidly withdrawing the fuse link conductor or pigtail **31** from the fuse tube **25** upon rupture of the fusible element of the link, there is provided a fuse extracting arm **32** of two-part, all wire construction which is pivotally supported upon the arm **26** and is substantially coextensive in length therewith. The main part of this arm is comprised of a length of stiff wire which is bent into the configuration shown in Figs. 4 and 5 of the drawings to have parallel extending spaced apart side pieces **33** and **34**, an end bridge **35**, and end pivot pieces **33***d* and **34***d* which are respectively seated within aligned bearing openings bored centrally of the trunnions **26***c* and **26***d*. Thus the extracting arm **32** has the same axis of rotation as the fuse tube assembly **24**. The second part **36** of the arm is comprised of a reversely bent length **36** of spring wire, the parallel side pieces of which are disposed substantially between the side pieces **33** and **34** and are held assembled upon these side pieces by clamping means comprising a metal strap **37** and clamping screws **38**. This clamping assembly is disposed at the longitudinal center of the wire part **36** so that the ends of this part may be resiliently deformed away from the side pieces **33** and **34** of the other extracting arm part. The ends **36***a* and **36***b* of the wire part **36** are spread apart and bent downwardly so that in cooperation with the adjacent segments of the side pieces **33** and **34** they form forked openings for receiving the end of the conductor **31** therewithin.

In order to tension the fuse link conductor **31** through the arm **32**, camming means are formed integral with the side pieces **33** and **34** to coact with the spring **20***d* in producing a downwardly directed pull upon the conductor **31** as the fuse tube assembly is rotated into its closed circuit position. Specifically, this camming means comprises a curved wire segment **33***c*, a substantially flat segment **33***b* and an offset segment **33***a* interposed between the pivot segment **33***d* and the

side pieces 33; and corresponding segments 34c, 34b and 34a of identical configuration interposed between the pivot segment 34d and the other side piece 34. These camming parts are normally disposed between the spaced apart end parts 26a and 26b of the supporting arm 26 to be engaged by the lip end 20b of the spring leg 20d which extends between the two hinge brackets 19 and 21. As explained more fully below, the shape of the camming segments 33b, 33c, 34b and 34c of the arm 32 is of considerable importance in obtaining the desired pull upon the fuse link conductor 31 and in preventing this conductor from being tensioned in excess of a predetermined pull.

In order to provide for switch stick manipulation of the hinge trunnions 26c and 26d into engagement with the trunnion seats of the brackets 19 and 21, respectively, the upstanding center part of the T-shaped supporting arm 26 is enlarged at a point adjacent the forked end of the arm to provide for the formation of an opening therein into which the hook of a switch stick may be inserted. This opening is comprised of a first part 27a of enlarged diameter through which the switch stick hook may be inserted, and an offset part 27b of smaller diameter into which the shank portion of the hook may be projected to prevent disengagement of the hook and the fuse tube assembly. To facilitate swinging of the fuse tube assembly into and out of its closed circuit position, the upper terminal member or ferrule 28 of this assembly is similarly provided with an enlarged and integrally formed loop 28b into which the hook of a switch stick may be readily inserted.

From the above explanation it will be apparent that when the fuse tube assembly 24 is detached from the terminals of the insulating support 10, the supporting arm 26 and the extracting arm 32 are freely rotatable relative to each other. When it is desired to fuse the assembly 24, the terminal cap 29 is unscrewed from the ferrule 28 and a fuse link 30 inserted within the chamber of the tube 25 so that the pigtail conductor 31 thereof projects out of the open lower end 25a of the tube. Following this operation, and with the extracting arm 32 firmly engaged against the supporting arm 26, the projecting end of the conductor 31 is carried over the bridge portion 35 of this arm, tensioned and jerked between one of the arm pieces 33 and 34 and the associated end 36a or 36b of the wire 36. In this regard, it is noted that the spacing between the parallel portions of the wire length 36 and the adjacent arm pieces 33 and 34 is such that when the conductor 31 is pulled therebetween, it is tightly squeezed and thus frictionally held against removal by applying tension to the portion thereof which overlies the bridge 35. Thus, the pigtail conductor serves tightly to hold the arm 32 in engagement with the underside of the supporting arm 26. After the described operations are completed, the terminal cap 29 may be threaded onto the ferrule 28 to clamp the head 30a of the fuse link tightly against the upper end of the ferrule.

In order to mount the fuse tube assembly 24 upon the terminals of the insulating support 10, the hook of a switch stick is first inserted through the opening 27a to bring the shank portion of the hook into registry with the opening part 27b of reduced diameter. Interlocking of the hook shank with the sides of the small diameter opening 27b serves to prevent inadvertent removal of the assembly 24 from the end of the switch stick. In this regard it is noted that the switch hook opening is positioned along the supporting arm 26 adjacent the extended end thereof so that as the switch hook is elevated to raise the assembly 24, the center of gravity of the assembly is well below the hook, thus providing for maintenance of the interlocked connection between the hook and the small diameter opening 27b, and for easy manipulation of the trunnions 26c and 27d into engagement with the brackets 19 and 21 of the lower terminal 18. As these trunnions are manipulated to bring the same into engagement with the identified brackets, they are first engaged with the guide noses 19b and 21b of the brackets. Concurrently with such engagement, the upturned lip 20b of the biasing spring 20 engages the camming surfaces 33c and 34c of the extracting arm 34. Thus, as the assembly 24 is manipulated to push the extended end of the arm 26 toward the brackets 19 and 21, the spring 20, through its engagement with the extracting arm 32, functions to guide the trunnions 26c and 26d into seating engagement with the seats 19a and 21a.

After the assembly 24 is thus pivotally mounted upon the lower terminal 18 of the insulating support 10, the hook of the switch stick may be withdrawn from the openings 27a and 27b and inserted into the opening of the loop 28b for the purpose of rotating the assembly 24 about the trunnions 26c and 26d into its closed circuit position. As the fuse tube assembly 24 is rotated in a counterclockwise direction to its closed circuit position, the arm 20d of the biasing spring 20 rides up the camming surfaces 33c and 34c of the extracting arm 32. Thus, the spring 20 is caused to react between the support 10 and the extracting arm 32 to perform two additional functions. First, it biases the bridge end 35 of the extracting arm 32 away from the supporting arm 26 to tension the pigtail conductor 31 and hence the fusible element within the fuse link 30. Secondly, it functions to force the trunnions 26c and 26d into pressure engagement with the seats 19a and 21a of the brackets 19 and 20. Such pressure engagement between the two identified trunnions and their engaging brackets serves accurately to center the upper end of the fuse tube assembly 24 relative to the front or entrance opening between the skirts 12c and 12d of the upper terminal 12. Thus, the upper end of the assembly 24 is, through the action of the spring 20, forced into a setting such that regardless of the direction from which the upward pivoting force is imposed upon the assembly, it will move between the skirts 12c and 12d during the final pivotal movement of the assembly into its closed circuit position. As the terminal cap 29 is moved between the skirts 12c and 12d, it engages the catch portion 14a of the spring 14 and rides beneath this portion of the spring until it is brought to bear against the stop part 12b. During final movement of the terminal cap 29 toward the stop part 12b the catch portion 14a of the spring 14 rides over the edge of the cap 29, thereby firmly to hold the upper end of the fuse tube assembly against rotation away from the closed circuit position thereof. Thus, the fuse tube assembly 24 is fixedly mounted upon the insulating support 10 to provide a fused current path between the two terminals 12 and 18. Specifically, this path extends from the terminal screw 15 through the conductive arm 12 and the spring 14 to the terminal cap 29. From this point, the conductive path extends through the fusible element of the link 30 by way of the flexible pigtail conductor 31, the extracting arm 32,

the spring **20** and brackets **19** and **21**, and the conductive terminal parts **18***a* and **18***b* to the line terminal assembly **22**. It will be noted that the springs **14** and **20** serve to hold all contacting parts of the fuse tube assembly and insulator terminals in pressure engagement to minimize contact resistance therebetween.

So long as current flow over the described conductive path between the terminals **12** and **18** does not exceed the current-time fusing characteristic of the link **30**, the fusible element within the link **30** serves mechanically to hold the extracting arm **32** in its set position against the underside of the supporting arm **26**. When, however, this fusible element is required to carry current in excess of a predetermined magnitude for more than a predetermined interval, it is ruptured to relieve the holding force imposed upon the extracting arm **32** through the pigtail **31**. The spring **20**, in reacting between the support **10** and the camming surfaces of the arm **32** is thus rendered operative rapidly to rotate the arm **32** downwardly about the pivot portions **33***d* and **34***d* thereof, thereby to withdraw the pigtail conductor **31** from the lower end of the fuse tube **25**. In this regard it is noted that the arm **32** is of substantial length, such that rotation thereof through a relatively small angle produces a relatively large displacement between the bridge end **35** thereof and the lower end of the tube **25**. Further, this arm is of small mass and hence has little inertia, thus insuring rapid acceleration of the bridge end **35** thereof away from the lower end of the fuse tube **25**. In fact, the arm **32** and the spring **20** are preferably so designed that the arc is sufficiently elongated during the first voltage half cycle following fuse rupture to prevent breakdown of the gap during the next succeeding voltage half cycle. Further, the length of the extracting arm **32** and the angle of movement of the bridge end **35** thereof is such that, under any and all conditions of fuse rupture, all of the pigtail conductor **31** and the lower unfused segment of the fuse link are completely removed at high speed from the bore of the fuse tube **25** to hang downwardly in alignment with the long axis of the insulating support **10**. This arrangement is to be distinguished from conventional dropout cutouts wherein only partial pigtail conductor extraction is produced incident to fuse rupture. With the arm **32** and the pigtail conductor **31** in these positions, an indication is provided that the fuse link within the tube **25** has been ruptured.

One of the problems involved in the construction of any cutout embodying a fuse extracting mechanism is that of preventing the fusible element of the link from being overtensioned to change the operating characteristics of the link. The critical tension beyond which the fusible element of the link should not be tensioned varies for links of different sizes or current ratings. In general, however, it is safe to employ a pull not exceeding 12 pounds upon the pigtail conductor of a link of the smallest rating. In the illustrated embodiment of the invention, the camming parts **33***b*, **33***c*, **34***b* and **34***c* are so shaped that the pull exterted upon the pigtail conductor **31** is limited substantially not to exceed a predetermined value. Thus it will be noted that the camming parts **33***c* and **34***c* are of sharply increasing radius away from the axis of rotation of the assembly **24** and hence are effective rapidly to deform the leg **20***d* of the spring **20** during initial movement of the fuse tube assembly **24** toward its closed circuit position. During movement of the camming lip **20***b* over these camming parts of the arm **32**, the tension imposed upon the fusible element of the link **30** through the conductor **31** is increased in accordance with the characteristic curve A illustrated in Fig. 6 of the drawings. Specifically, as the spring arm **20***d* is moved from a position in engagement with the points *a* along the camming parts **33***c* and **34***c* to a position in engagement with the points *b* therealong, the tension imposed upon the fusible element of the link is rapidly increased from a zero value to a value *d* which may be approximately 3 or 4 pounds. During continued rotation of the assembly **24** toward its closed circuit position, the spring arm **20***d* rides upon the parts **33***b* and **34***b* of the arm **32**. These camming parts are of only slightly increasing radius relative to the axis of pivotal rotation of the assembly. Accordingly, for a large angle of movement of the assembly **24**, there occurs only a small increase in the deformation of the spring **20**. As a result, and again referring to Fig. 6 of the drawings, the tension imposed upon the fusible element of the link is only increased the small increment *d*—*e* during movement of the arm **20** *d* from the points *b* to the points *c* in engagement with the arm parts **33***b* and **34***b*. Thus, it will be noted that after the fuse tube assembly is rotated through a predetermined angle, further rotation of the assembly towards its closed circuit position produces only a small increase in the tension imposed upon the fusible element of the link. It will also be noted that as the fuse tube assembly is rotated into its closed circuit position, the point of engagement by the arm **32** with the spring arm **20***d* is shifted away from the end **20***c* of the spring **20** toward the lip end **20***b* of the arm **20***d*, thereby further to decrease the rate of increase in the force acting against the arm **32** for a given angular movement of the assembly **24**. This shift in the point of engagement between the two arms **20***d* and **32** definitely contributes to the small increase *d*—*e* in the biasing force exerted upon the conductor **31** during the final angular movement of the assembly **24** into its closed circuit position.

In accordance with a further feature of the invention, the fuse link tensioning facilities are so arranged that force is imposed upon the extracting arm **32** throughout the full range of angular movement thereof. Thus the configuration of the camming parts **33***b*, **34***b*, **33***c*, and **33***d* is such that during rotation of the arm **32** to extract the conductor **31** from the fuse tube, the lip **20***b* of the spring **20** is biased against these parts until the arm **32** is rotated through an angle in excess of 90 degrees or to a position substantially in longitudinal alignment with the support **10**. Further, and again due to the small change in radius of the parts **33***b* and **34***b* between the points *b* and *c* therealong and the shift in the point of engagement between the arms **20***d* and **32** backwardly along the arm **20***d*, the biasing force acting upon the arm **32** remains substantially constant and at a high value during movement of the arm **32** through the major portion of the angle through which it may be rotated when the fusible element of the link **30** ruptures. Thus the described features all contribute to fast and positive removal of the pigtail conductor **31** from the fuse tube **25** when the fusible element of the link **30** is ruptured.

Another problem involved in obtaining entirely satisfactory operation of the cutout is that of minimizing leakage current flow between the

terminals 12 and 18 of the insulating support 10 after the fuse link has been ruptured and the pigtail conductor 31 extracted from the fuse tube 25. In this regard it is known in the art that the pressed fibre forming the inner layer of a fuse tube is a poor insulator, particularly in a damp atmosphere, such that a high resistance conductive path is provided between the ends thereof. Accordingly, in the absence of an isolating gap between the inner surface of the tube and the lower terminal 18, a small leakage current tends to flow between the terminals 12 and 18 following operation of the cutout in the manner explained above. This current may ultimately result in carbonization of the inner surface of the tube, followed by tracking of the current and an increase in the magnitude of the leakage current flow. In the illustrated embodiment of the invention, a gap is provided in the leakage current path by projecting the lower end 25*a* of the tube 25 substantially below the ferrule 26*e* of the arm 26. With this structure the insulation impregnated outer layer of the tube end 25*a* having excellent current insulating properties provides an insulating barrier or gap between the conductive arm 26 and the inner surface of the tube 25. The length of this gap is equal to the distance between the ferrule 26*e* and the lower end of the tube 25 and is entirely sufficient to prevent any appreciable leakage current flow between the terminals 12 and 18.

In accordance with a further feature of the present invention, the last-mentioned problem is completely obviated by employing in the fuse tube assembly a lower supporting arm 40 of the character shown in Fig. 7 of the drawings. As there illustrated, the supporting arm 40 is formed of molded insulating material, such, for example, as a molded synthetic resinous plastic material, or another material having the requisite structural strength and electrical insulating properties. The physical configuration of the arm 40 is identical with that of the arm 26 described above, but all sections thereof are enlarged in order to enhance the structural strength of this member. At its extended end, the arm 40 is provided with metal trunnions 41 which extend in opposite direction transversely outward from the end parts 40*a* of the arm and are embedded in these parts of the arm during molding of the arm. These metal trunnions are adapted for engagement with the trunnion seats of the brackets 19 and 20 in the exact manner explained above and serve pivotally to support the pivot parts 33*d* and 34*d* of the extracting arm 32. With this structural modification of the cutout completely shown in Fig. 1 of the drawings, the fused conductive path between the terminals of the cutout extends only through the extracting arm 32 between the pigtail conductor 31 and the lower terminal 18. Accordingly, when the fusible element is ruptured and the arm 32 is moved to extract the pigtail conductor 31 from the fuse tube, an elongated isolating gap or insulating barrier comprising the entire length of the arm 40 is interposed between the lower insulator terminal 18 and the inner surface of the fuse tube 25, thereby positively to prevent leakage current flow between the terminals 12 and 18.

In the embodiment of the invention illustrated in Figs. 8 and 9 of the drawings, substantially all of the above-described operating features are provided, together with facilities for producing fuse tube dropout movement after the fuse link conductor extracting operation is completed.

Aside from the structural differences pointed out immediately below, this embodiment of the invention is exactly the same as that illustrated in Fig. 1 of the drawings and described above. Accordingly corresponding reference numerals have been used to identify corresponding parts of the two structures. In brief, the lower terminal assembly 18 of the modified construction comprises two terminal parts 42*a* and 42*b* which are clamped to embrace the lowermost petticoat of the insulator 10. The terminal part 42*b* is provided with downwardly extending spaced apart trunnion brackets 43 and 44 for pivotally supporting the fuse tube assembly 24. The terminal part 42*a* includes two integrally formed downwardly depending bracket pieces 42*c* and 42*d* which in cooperation with an axis pin 53 serve pivotally to support a biasing arm 52. This arm is biased to move downwardly away from the lower end of the insulating support 10 by means of a spring 57 acting through a pin 55 which extends downwardly between the terminal parts 42*a* and 42*b* to engage the upper surface of the arm 52. Intermediate its ends this pin carries an assembly pin 58, which supports a cup 56 having the lower end of the spring 57 seated therewithin. The identified parts 55, 56 and 57 are housed within an inverted housing cup 54 which is projected within a central opening 10*a* extending upwardly from the lower end of the insulator 10, and is provided with a flanged mouth which rests upon the terminal parts 42*a* and 42*b*. Normally, and with the fuse tube assembly disassembled from the trunnion brackets 43 and 44, the spring 57 is expanded to project the pin 55 downwardly through the opening between the terminal parts 42*a* and 42*b*. Expansion of this spring is, however, limited through engagement of the cup 56 with the upper surfaces of the terminal parts 42*a* and 42*b*. Like the Fig. 1 embodiment of the invention, the fuse tube assembly 24 employs a conductive supporting arm 45 for pivotally supporting this assembly upon the trunnion brackets 43 and 44. This arm is of generally channel-shaped cross section throughout the major portion of its length and is provided with a ferrule portion 45*e* fixedly embracing the lower end of the fuse tube 25 to support this tube. At the extended end thereof, the upper transverse part of the member 45 is cut away to terminate at the point 45*c*, in order that a camming member 50 may project upwardly therethrough. At their extreme extended ends the side flanges of the member 45 are provided with integrally formed oppositely extended trunnions 45*a* and 45*b* which are adapted to seat within the trunnion seats of the brackets 43 and 44. These trunnions also serve pivotally to support an elongated extracting arm 46 at one end thereof. This arm is of the proper width to seat within the side flanges of the channel-shaped member 45 and includes an angularly extending nose 46*a* which extends transversely of the lower open end of the fuse tube 25 and is notched as indicated at 46*c* to receive the pigtail conductor 31. The extended portion of this conductor is connected to the arm 46 by clamping means comprising a screw 46, a wing nut 48 and a clamping washer 48*a*.

As indicated above, the camming member 50 is adapted to project between the side flanges of the member 45 upwardly from the upper edge of this member. It is of half-paddle configuration and includes a handle 50*a* which is pivotally mounted upon the arm 45 at its end by means of an axis pin 51 extending between the side

flanges of the member **45**. Normally, the lower edge of this camming member bears against the upper surface of the extracting arm **46**, with the camming nose **50***b* thereof disposed adjacent the pivot pin **49**. Along its upper edge the member **50** is provided with a V-shaped latching part **50***d* having an edge surface **50***c* which is adapted to bear against the nose surface **52***c* of the biasing arm nose **52***b* to restrain the fuse tube **24** against dropout movement under the influence of the spring **57**. At this point it is noted that the nose **52***b* of the arm **52** is of greater length than the width of the member **45**.

Briefly, to consider the manner in which the fuse tube assembly **24** is mounted upon the support **10**, it will be understood that when this assembly is fused, the pigtail **31** of the fuse link in use is clamped between the extracting arm **46** and the washer **48***a* to restrain this arm within the channel of the supporting arm **45** and hence to restrain the camming member **50** in the full line position illustrated in Fig. 8 of the drawings. In mounting the assembly **24** upon the insulating support **10**, the extended end of the arm **45** is engaged with the biasing arm **52** and pushed upward and to the right to carry this arm between the brackets **43** and **44**. The assembly is then manipulated to engage the trunnions **45***a* and **45***b* with the trunnion seats of the brackets **43** and **44**. The assembly **24** may now be pivoted into its closed circuit position wherein the upper end thereof is very lightly held in engagement with the upper terminal of the insulating support **10**. Incident to this pivotal movement of the assembly **24** the nose **52***b* of the biasing arm **52** rides up the edge **50***e* of the camming member **50** to tension this camming member against the extracting arm **46** and thus exert a downwardly directed pull upon the pigtail conductor **31**. Thus the fusible element of the fuse link is tensioned as the assembly **24** is rotated into its closed circuit position. During the final movement of the assembly **24** into its closed circuit position, the nose **52***b* of the biasing arm **52** rides over the upper end of the edge **50***e* permitting the arm **52** to rotate slightly so that an interlocking connection is provided by the engaged surfaces **52***c* and **50***c*. This interlocking connection, in conjunction with engagement of the upper end of the fuse tube with the upper terminal of the insulating support, serves to restrain the assembly **24** in its closed circuit position.

When, due to an overload current condition, the fusible element of the fuse link is ruptured, the extracting arm **46** is freed for clockwise pivotal movement about the axis pin **49**. Accordingly the interlocking connection between the surfaces **50***c* and **52***c* of the two parts **50** and **52** is broken, permitting the camming member **50** to be pivoted in a counter clockwise direction under the influence of the biasing force exerted thereon by the spring **57** through the arm **52**. As the member **50** is thus rotated, the camming nose **50***b* thereof is slid downward and away from the pivot pin **49** along the upper surface of the arm **46**. This forced movement of the member **50** serves rapidly to pivot the extracting arm **46** in a clockwise direction to withdraw the pigtail **31** from the fuse tube **25**. After a predetermined amount of pivotal movement of the two members **46** and **50**, the displaced ends of the biasing arm nose **52***b* engages the upper surface of the supporting arm **45** to exert a thrust against this arm in the direction required to disengage the upper end of the fuse tube assembly from the latching spring of the

upper insulator terminal. The spring **57** is of sufficient strength to overcome the light holding force restraining the upper end of the fuse tube assembly **24** against pivotal dropout motion. Accordingly, this end of the assembly is forced out of engagement with the latching spring carried by the upper insulator terminal to permit pivotal dropout movement of the assembly **25** in a clockwise direction about the trunnions **45***a* and **45***b*. Thus, the upper and lower insulator terminals are electrically disconnected and the fuse tube assembly is moved to a position indicative of the fact that the fuse link therein has been ruptured.

While there have been described what are at present considered to be the preferred embodiments of the invention, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a fused cutout which includes an insulating support, spaced terminals mounted upon said support and a fuse assembly adapted to be rotated into closed circuit position electrically to interconnect said terminals; the means for pivotally supporting said assembly at one end thereof and for aligning the other end of said assembly for engagement with one of said terminal means, which comprises coacting and engageable pivot parts respectively carried by said support and said assembly, and spring means reacting between said assembly and said support to force said pivot parts into pressure engagement as said assembly is rotated into closed circuit position, said spring means including a part for guiding said pivot parts into engagement as said assembly is mounted upon said support.

2. In a fused cutout which includes an insulating support, spaced terminals mounted upon said support, pivot means mounted upon said support and a fuse assembly having pivot means engageable with said first-named pivot means and rotatable into closed circuit position electrically to interconnect said terminals; a single spring including a part for guiding said pivot means into engagement as said assembly is mounted upon said support and thereafter operative to force said pivot means into pressure engagement as said assembly is rotated into said closed circuit position.

3. In a fused cutout which includes an insulating support, spaced terminals mounted upon said support, pivot means forming a part of one of said terminals, and a fuse tube assembly having pivot means engageable with said first-named pivot means and rotatable into a closed circuit position wherein a fuse link disposed in the fuse tube of said assembly electrically interconnects said terminals; a single spring including a part for guiding said pivot means into engagement as said assembly is mounted upon said support and thereafter operative to force said pivot means into pressure engagement and to tension said fuse link as said assembly is rotated into said closed circuit position.

4. A fused cutout comprising a support, spaced terminals carried by said support, tensioning means carried by said support, and a fuse tube assembly adapted for detachable connection with said terminals and comprising a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm rigidly mounted upon said tube to extend laterally away from the open end of said tube

and provided with pivot means at the extended end thereof for pivotally supporting the assembly upon said support, and a fuse link conductor extracting arm pivotally supported upon said supporting arm for connection with the projected end of a fuse link conductor and provided with a camming surface for engaging said tensioning means.

5. A fused cutout comprising a support, spaced terminals carried by said support, tensioning means carried by said support, and a fuse tube assembly adapted for detachable connection with said terminals and comprising a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm rigidly mounted upon said tube to extend laterally away from the open end of said tube and provided with at least one transversely extending bearing element at its extended end for pivotally supporting the assembly upon said support, an extracting arm adapted for connection with the projected end of a fuse link conductor and supported upon said supporting arm for pivotal movement about the axis of said bearing element, and camming means adapted to engage said tensioning means thereby to tension the fuse link conductor through said arm.

6. A fused cutout comprising a support, spaced terminals carried by said support, tensioning means carried by said support, and a fuse tube assembly adapted for detachable connection with said terminals and comprising a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm rigidly mounted upon said tube to extend laterally away from the open end of said tube and provided with transversely spaced end parts at its extended end, bearing elements extending transversely of said arm outwardly from said end parts for pivotally supporting the assembly upon said support, an extracting arm adapted for connection with the projected end of a fuse link conductor and supported upon said supporting arm for pivotal movement about the axis of said bearing elements, and camming means disposed between said end parts to engage said tensioning means, thereby to tension the fuse link conductor through said arm.

7. In a fused cutout, a support provided with a pair of spaced brackets having aligned trunnion receiving openings therein, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with transversely extending trunnions engageable with said openings pivotally to support said fuse tube upon said brackets for rotation into a closed circuit position, spring means carried by said support and including a part for guiding said trunnions into said openings as said fuse tube and arm are mounted upon said brackets, an extracting arm adapted for connection with the projected end of a fuse link conductor and provided with camming means engageable with said spring means to tension the fuse link conductor as said fuse tube is rotated about the axis of said trunnions into its closed circuit position, and pivot means supporting said extracting arm upon said supporting arm for pivotal movement about the axis of said trunnions.

8. In a fused cutout, a support provided with a pair of spaced brackets having aligned trunnion receiving openings therein, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with transversely spaced end parts, trunnions extending from said end parts transversely of said arm and engageable with said openings pivotally to support said fuse tube upon said brackets for rotation into a closed circuit position, an extracting arm adapted for connection with the projected end of a fuse link conductor and provided with camming means disposed between said end parts, pivot means supporting said extracting arm upon said supporting arm for pivotal movement about the axis of said trunnions, and tensioning means mounted upon said support between said brackets and provided with a part for engaging said camming means to guide said trunnions into said openings as said fuse tube and arm are mounted upon said brackets and to tension the fuse link conductor through said extracting arm as said fuse tube is rotated into its closed circuit position.

9. In a fused cutout, a support provided with hinge means, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said first-named hinge means pivotally to support said fuse tube upon said support, an extracting arm adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm upon said supporting arm for rotation about the same axis as said fuse tube, and spring means reacting between said support and said extracting arm to tension said conductor.

10. In a fused cutout, a support provided with hinge means, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said first-named hinge means pivotally to support said fuse tube upon said support for rotation into a closed circuit position, an extracting arm adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm at one end thereof upon said supporting arm for rotation about the same axis as said fuse tube, and spring means carried by said support to react against said extracting arm adjacent said one end thereof as said fuse tube is rotated into its closed circuit position, thereby to tension said conductor through said extracting arm.

11. In a fused cutout, a support provided with spaced hinge brackets, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said brackets pivotally to support said fuse tube upon said support, an extracting arm coextensive with said supporting arm along the lengths thereof and adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm at one end thereof upon said supporting arm for rotation about the same axis as said fuse tube, and tensioning means carried by said support, said tensioning means including a part extending between said brackets to react

between said support and a portion of said extracting arm adjacent said one end thereof as said fuse tube is pivoted into its closed circuit position, thereby to tension said conductor through said extracting arm.

12. A fused cutout comprising an insulating support provided with spaced hinge brackets at one end and with a terminal catch at the other end, a fuse tube having a closed terminal end engageable with said catch and an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said brackets pivotally to support said fuse tube upon said support, an extracting arm coextensive with said supporting arm along the lengths thereof and adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm at one end thereof upon said supporting arm for rotation about the same axis as said fuse tube, and tensioning means operative upon rupture of a fuse link within the fuse tube to first push said extracting arm away from said supporting arm, thereby to withdraw the conductor of the link from said tube, and to then push the terminal end of the tube out of engagement with said catch, thereby to release said tube for dropout movement.

13. A fused cutout comprising an insulating support provided with spaced hinge brackets at one end and with a terminal catch at the other end, a fuse tube having a closed terminal end engageable with said catch and an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said brackets pivotally to support said fuse tube upon said support, an extracting arm coextensive with said supporting arm along the lengths thereof and adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm at one end thereof upon said supporting arm for rotation about the same axis as said fuse tube, tensioning means operative upon rupture of a fuse link within the fuse tube to first push said extracting arm away from said supporting arm, thereby to withdraw the conductor of the link from said tube, and to then disengage the terminal end of said fuse tube from said catch, and means for preventing said tensioning means from disengaging the terminal end of said fuse tube from said catch until after said conductor is at least partially withdrawn from said tube.

14. A fused cutout comprising an insulating support provided with spaced hinge brackets at one end and with a terminal catch at the other end, a fuse tube having a closed terminal end engageable with said catch and an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said brackets pivotally to support said fuse tube upon said support, an extracting arm coextensive with said supporting arm along the lengths thereof and adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm at one end thereof upon said supporting arm for rotation about

the same axis as said fuse tube, an actuating element pivotally supported by said supporting arm and engaging said extracting arm, and tensioning means carried by said support and including a part engageable with said actuating element as said fuse tube is rotated to engage the terminal and thereof with said catch, thereby to tension the conductor of a fuse link housed within said tube and to operate said actuating element and extracting arm to extract the conductor from said tube upon rupture of the link, and also engageable with said supporting arm to push the terminal end of the fuse tube out of engagement with said catch when said actuating part and extracting arm are operated to extract the fuse link conductor from the fuse tube, said part of said tensioning means and said actuating element including interlocked portions for normally preventing said tensioning means from disengaging the terminal end of the fuse tube from said catch.

15. In a fused cutout which includes a support, spaced terminals carried by said support and a fuse tube adapted for detachable mounting upon one of said terminals and provided with an open end; a fuse link disposed within said tube and provided with a conductor extending out of said open end, extracting means disposed adjacent the open end of said tube to complete the fused circuit between said terminals and operative to withdraw said conductor from said tube in response to rupture of said fuse link, and an elongated insulating member extending between said tube and one of said terminals pivotally to support said tube upon said one terminal and to insulate the inner surface of said tube from said one terminal after said extracting means has operated.

16. In a fused cutout which includes a support, spaced terminals carried by said support and a fuse tube adapted for detachable mounting upon one of said terminals and provided with an open end; a fuse link disposed within said tube and provided with a conductor extending out of said open end, a conductive extractive arm extending laterally between the open end of said tube and one of said terminals to complete the fused circuit between said terminals and to withdraw said conductor from said tube in response to rupture of said fuse link, an elongated insulating member extending between said tube and said one terminal pivotally to support said tube upon said one terminal and to insulate the inner surface of said tube from said one terminal after said extracting means has operated, and means pivotally supporting said extracting arm upon said member at a point adjacent said one terminal.

17. A fused cutout comprising an insulating support, spaced terminals carried by said support, a fuse tube assembly including terminals respectively engageable with said first-named terminals, and a single spring for guiding both terminals of said fuse tube assembly into engagement with the respective first-named terminals as said fuse tube assembly is mounted upon said support.

18. In a fused cutout, a support provided with a terminal including hinge means, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said first-named hinge means piv-

otally to support said fuse tube upon said support for rotation into a closed circuit position, an extracting arm adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm upon said supporting arm at a point adjacent the extended end of said supporting arm, and spring means mounted upon said support for reacting between said support and said extracting arm as said fuse tube is rotated into its closed circuit position, thereby to tension said conductor through said extracting arm and to bias said arm for fuse extracting movement.

19. In a fused cutout, a support provided with a terminal including hinge means, a fuse tube having an open end from which an extractable fuse link conductor is adapted to project, a supporting arm extending laterally away from the open end of said tube and provided at its extended end with hinge means engageable with said first-named hinge means pivotally to support said fuse tube upon said support for rotation into a closed circuit position, an extracting arm adapted for connection with the projected end of a fuse link conductor, means pivotally supporting said extracting arm upon said supporting arm at a point adjacent the extended end of said supporting arm, and spring means for reacting between said support and said extracting arm as said fuse tube is rotated into its closed circuit position, thereby to tension said conductor through said extracting arm and to bias said arm for fuse extracting movement, said supporting arm being formed of insulating material, thereby to insulate the inner surface of said tube from said terminal when said extracting arm is operated to effect fuse conductor extraction.

20. In a fused cutout which includes a support, spaced terminals carried by said support and a fuse tube adapted for detachable mounting upon one of said terminals and provided with an open end; a fuse link disposed within said tube and provided with a conductor extending out of said open end, extracting means for completing the fused circuit between said terminals and operative to withdraw said conductor from said tube in response to rupture of said fuse link, and insulating means extending between said tube and one of said terminals to support said tube upon said one terminal and to insulate the tube from said one terminal after said extracting means has operated.

21. In a fused cutout which includes an insulating support and a fuse tube assembly detachably mounted upon said support for pivotal movement into its closed circuit position; the means for tensioning the conductor of a fuse link disposed within said tube incident to rotation of said assembly into its closed circuit position and for withdrawing said conductor from said tube incident to rupture of said fuse, which comprises engaged and relatively slidable biasing and camming elements individually mounted upon different ones of said support and assembly for engagement in response to rotation of said assembly into its closed circuit position.

22. In a fused cutout which includes an insulating support and a fuse tube assembly detachably mounted upon said support for pivotal movement into its closed circuit position; the means for tensioning the conductor of a fuse link disposed within said tube incident to rotation of said assembly into its closed circuit position and for withdrawing said conductor from said tube incident to rupture of said fuse, which comprises engaged and relatively slidable biasing and camming elements individually mounted upon different ones of said support and assembly for engagement in response to rotation of said assembly into its closed circuit position, the slidably engaged surface of at least one of said elements being shaped to substantially arrest any increase in the tension imposed on said conductor during the latter part of the movement of said assembly into its closed circuit position.

23. In a fused cutout, a support provided with a pair of spaced brackets having aligned bearing surfaces, a fuse tube assembly including a supporting member having pivot parts engageable with said bearing surfaces to support said assembly upon said brackets for rotation into a closed circuit position, curved camming means on said supporting member and movable toward said brackets as said assembly is rotated into its closed circuit position, and spring biased cam engaging means carried by said support and including a part extending between said brackets to engage said camming means as said assembly is rotated into its closed circuit position, thereby to force said pivot parts into pressure engagement with said bearing surfaces as said assembly is rotated into its closed circuit position.

24. In a fused cutout, an elongated support, a pair of spaced brackets mounted upon one end of said support to extend away from said one end of said support and having aligned trunnion seats therein, a fuse tube assembly including a fuse tube and a supporting member extending laterally away from one end of said fuse tube and provided with trunnions at the end thereof engageable with said trunnion seats to support said assembly upon said brackets for rotation into a closed circuit position, curved camming means on said supporting member above said trunnions and moveable toward said brackets as said assembly is rotated into its closed circuit position, and a U-shaped spring having one leg mounted upon said one end of said support and the other leg extending between said brackets to engage said camming means as said assembly is rotated into its closed circuit position, thereby to force said trunnions into pressure engagement with said seats as said assembly is rotated into its closed circuit position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 22,412	Schultz et al.	Dec. 21, 1943
2,292,341	Ramsey	Aug. 4, 1942
2,324,114	Schultz et al.	July 13, 1943
2,328,818	Lindell et al.	Sept. 7, 1943