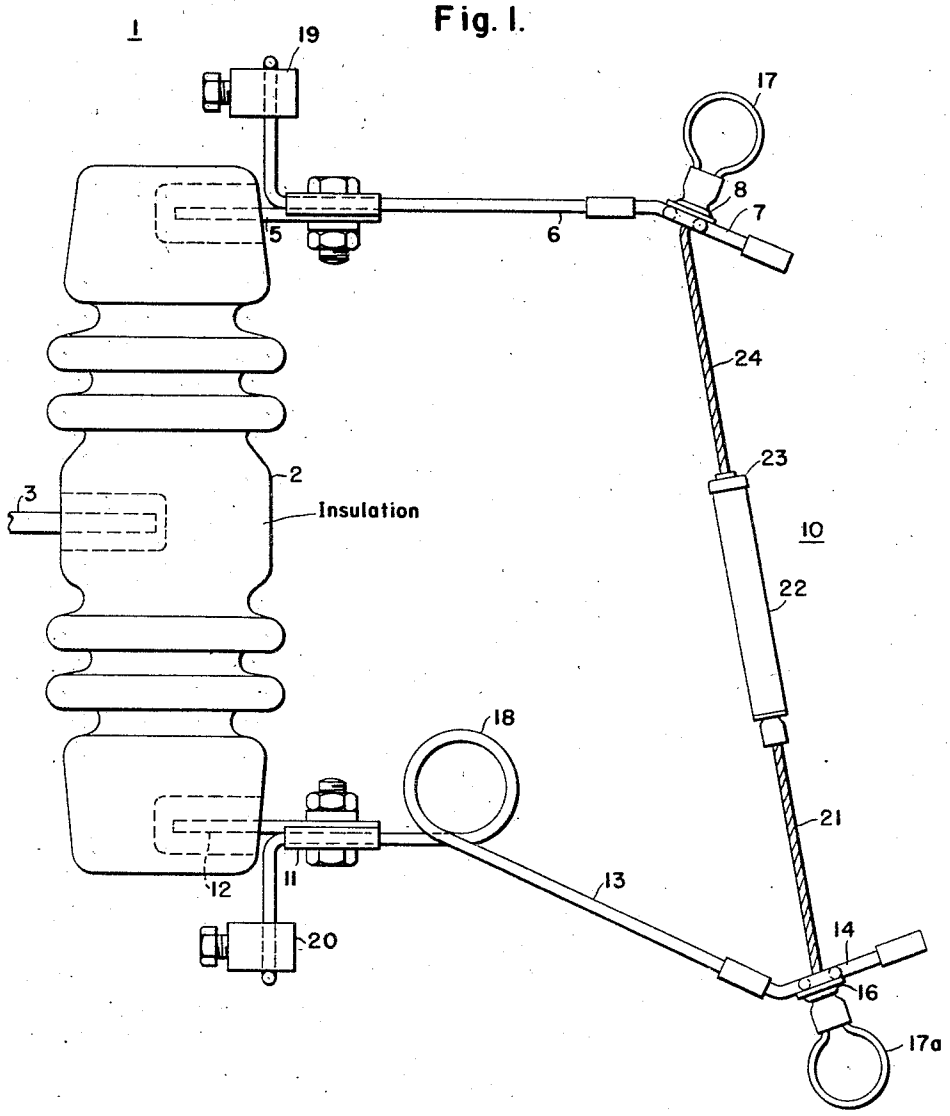
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FUSE CONSTRUCTIONS

Filed Nov. 29, 1952 4 Sheets-Sheet 1

Fig. 1.



WITNESSES:

John E. Hearley

W. K. Grout

INVENTOR

James M. Wallace

BY

Ralph W. Swingle

ATTORNEY

Jan. 28, 1958 J. M. WALLACE 2,821,604

FUSE CONSTRUCTIONS

Filed Nov. 29, 1952 4 Sheets-Sheet 2

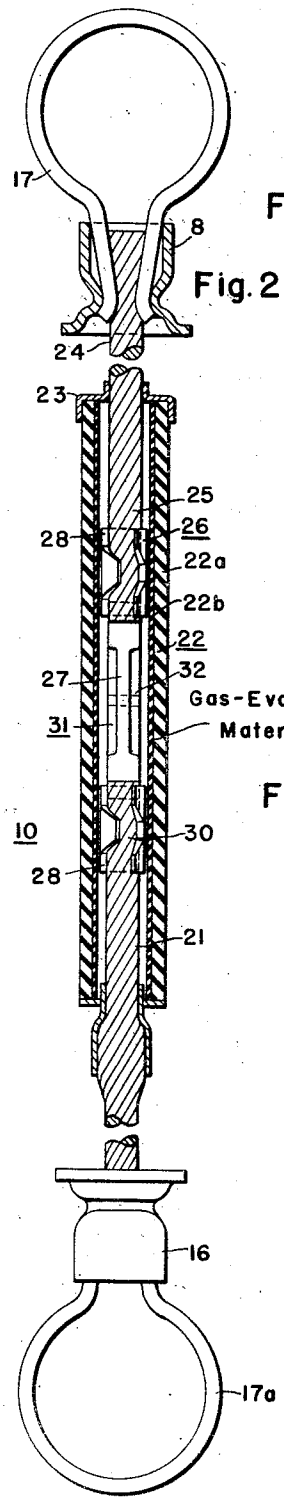


Fig. 2.

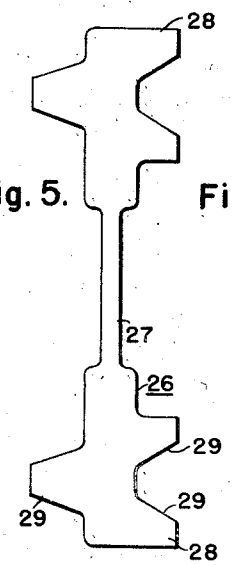


Fig. 5.

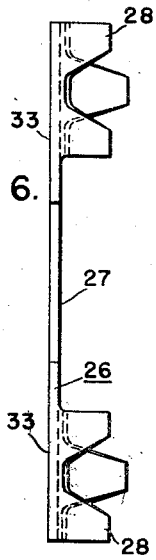


Fig. 6.



Fig. 7.

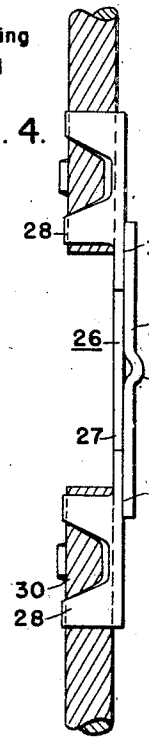


Fig. 4.

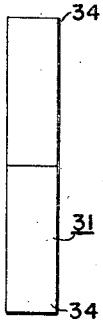


Fig. 8.

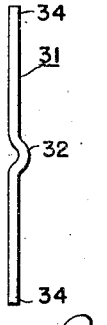


Fig. 9.

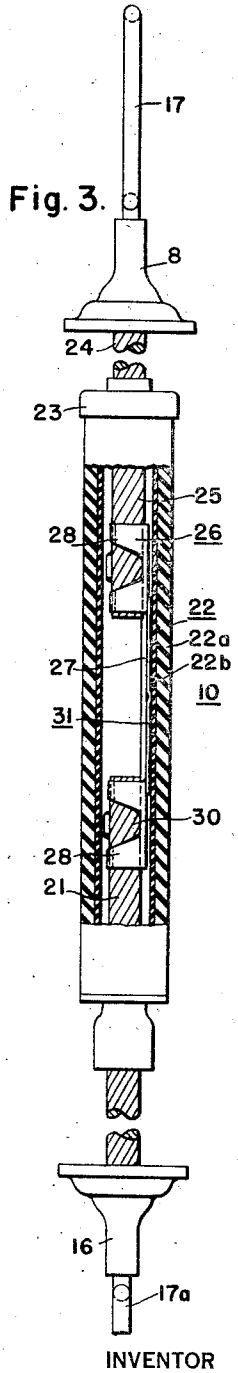


Fig. 3.

INVENTOR
James M. Wallace
BY
Ralph W. Sumple
ATTORNEY

Jan. 28, 1958 J. M. WALLACE 2,821,604

FUSE CONSTRUCTIONS

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Fig. 11.

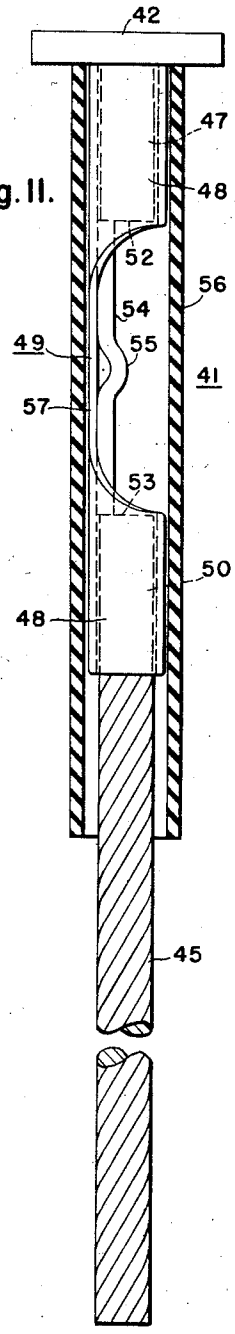


Fig. 10.

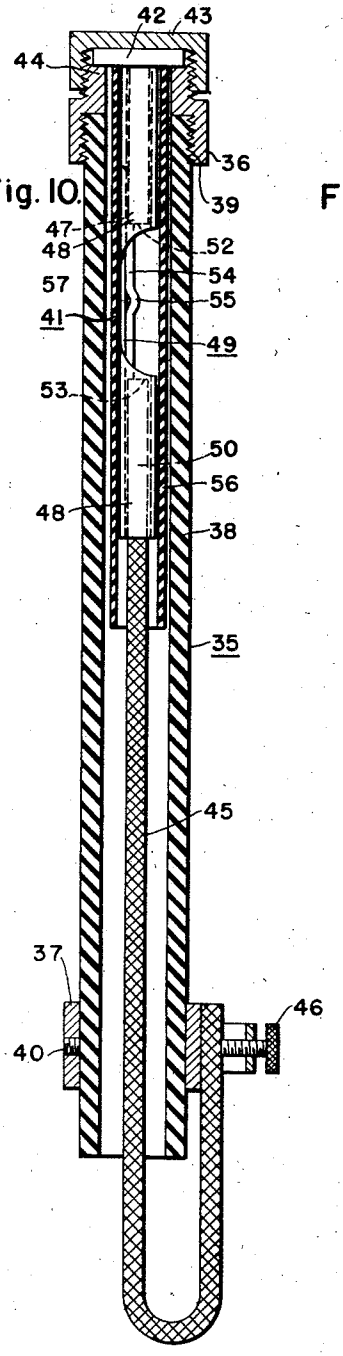
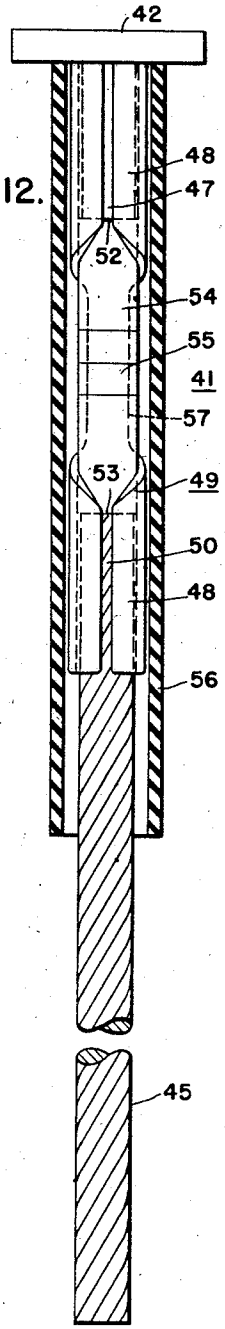


Fig. 12.



WITNESSES:

John E. Hanley

W. R. Crouse

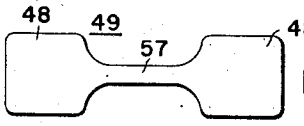


Fig. IIA.

INVENTOR

James M. Wallace

BY

Ralph W. Swingle

ATTORNEY

Jan. 28, 1958 J. M. WALLACE 2,821,604

FUSE CONSTRUCTIONS

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Fig. 13.

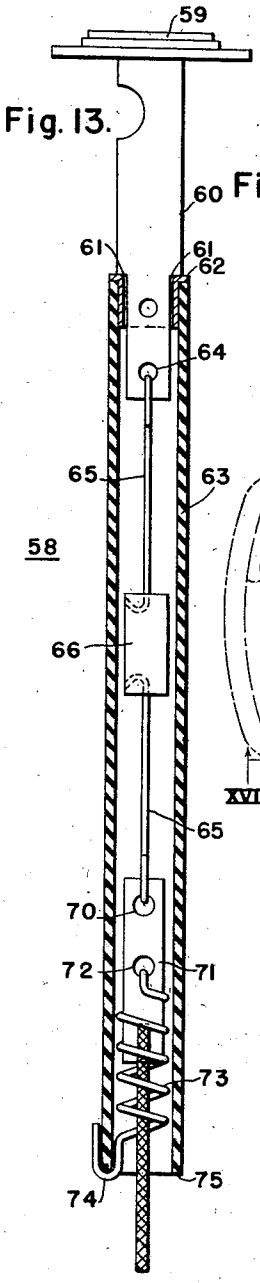


Fig. 15.

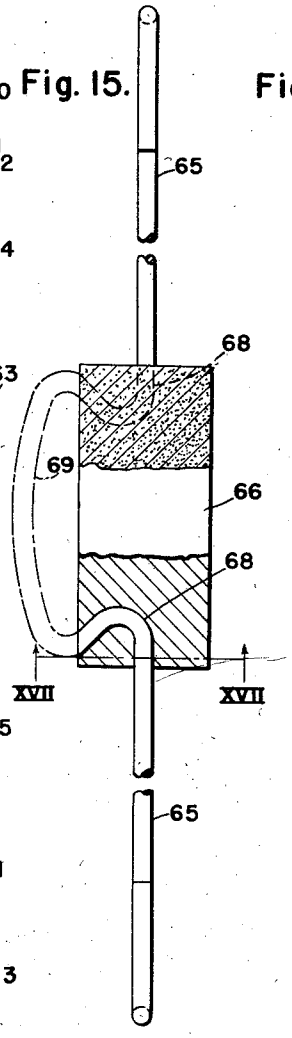


Fig. 16.

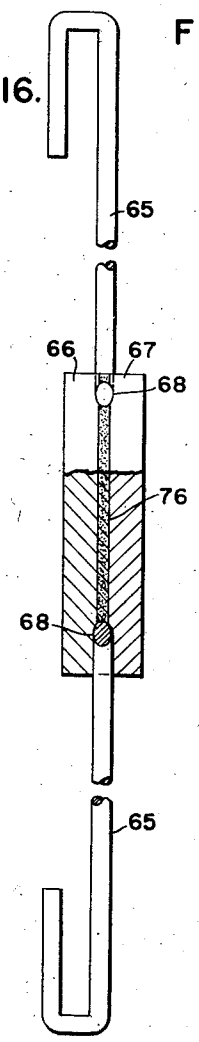


Fig. 14.

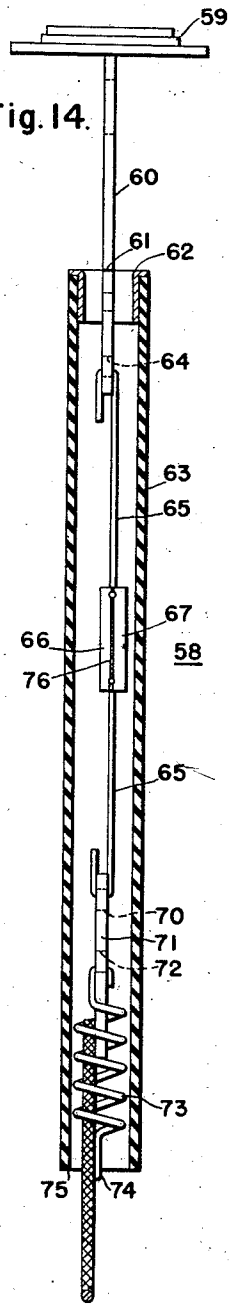
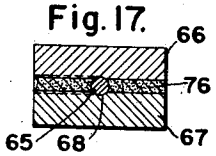


Fig. 17.



WITNESSES:

John E. Healy

W. R. Crout

INVENTOR

James M. Wallace

BY

Ralph W. Swingle

ATTORNEY

United States Patent Office 2,821,604 Patented Jan. 28, 1958

2,821,604

FUSE CONSTRUCTIONS

James M. Wallace, Montclair, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application November 29, 1952, Serial No. 323,185

2 Claims. (Cl. 200—135)

This invention relates generally to circuit-interrupting devices, and more particularly, to fusible interrupting devices adapted to automatically interrupt a circuit upon the passage therethrough of currents of a predetermined magnitude.

A primary object of my invention is to provide an improved fusible interrupting device which will be more economical to manufacture than those heretofore used in the industry, and, more important, which will be more effective and efficient in operation.

A more specific object of my invention is to provide a novel fuse link which will have an improved "strain-wire" construction.

It is well known in the art to parallel the fuse, in a fusible interrupting device, with a strain wire, the latter having a relatively high tensile strength to hold in tension a retracting spring, which serves to separate the fuse terminals upon the fusion thereof. The retracting spring, which is under tension, rapidly separates the fuse terminals and so brings about a greater contact of the established arc within the interior of an enclosing tube, within which the fusible device is housed. Generally, the interior walls of the housing or fuse tube evolve an arc-extinguishing gas upon contact with the arc drawn upon fusion of the device.

Since the tensile strength of the fuse itself is relatively low, it is common practice to relieve the fuse of such tensile stresses by the employment of the parallel-disposed strain element, the latter furnishing the high tensile strength required to maintain the retracting spring under tension.

Prior art constructions of this type have been rendered ineffective and subject to faulty operation by the strain elements breaking under normal conditions due to mechanical failure, or being improperly secured to the fuse terminals. Since fusible devices are a high quantity production item, it is necessary to provide a construction adapted for rapid assembly, and which will make allowance for any errors which may occur during the assembly operation by the human factor. Accordingly, it is a further object of my invention to provide an improved strain-wire construction, which not only will be effective, maintain its tensile strength, avoid the possibility of being misassembled, but will also be economical to manufacture.

Further objects and advantages of my invention will be readily apparent upon reading the following specification, taken in conjunction with the drawings, in which:

Figure 1 is a side elevational view of an open-link cut-out, depicted in the fused condition;

Fig. 2 is an enlarged, fragmentary, vertical sectional view through the open-link fuse employed in the construction illustrated in Fig. 1;

Fig. 3 is a view taken at right angles to Fig. 2;

Fig. 4 is an enlarged view of the fuse proper of Fig. 3, to more clearly indicate the method of attachment of my improved strain clip;

Fig. 5 is a plan view of the strain clip in blank form;

Fig. 6 is a side elevational view of the strain-clip blank after preforming operations have taken place;

Fig. 7 is an end view of the strain clip of Fig. 6;

Fig. 8 is a plan view of the fuse proper;

Fig. 9 is an edge view of the fuse shown in Fig. 8;

Fig. 10 is a vertical, sectional view through a fuse holder having therein a fuse-refill unit incorporating features of my invention;

Fig. 11 is an enlarged sectional view of the fuse-refill unit employed in the fusible interrupting device of Fig. 10;

Fig. 11A is a plan view of the strain-clip blank employed in this form of my invention; and

Fig. 12 is a view similar to Fig. 11, but shown at right angles thereto.

Referring to the drawings, and more particularly to Fig. 1 thereof, the reference numeral **1** generally designates an open-link cut-out employing my invention, and shown in the fused condition. The cut-out **1** includes a support insulator **2**, preferably composed of a suitable weather-proof material, such as porcelain or the like, which is supported in a substantially vertical position as shown, by a mounting plate **3**. The mounting plate **3** is secured to any suitable support, such as a cross-bar associated with the top of a distribution pole, not shown.

Secured by a support **5** at the upper end of the insulator **2** is an upper contact arm **6**, preferably formed of a suitable resilient wire, such as a Phosphor bronze wire. The contact arm **6** is, therefore, inherently somewhat resilient, and serves to support, in a return bend **7** thereof, the eyelet **8** of an open-link fuse, generally designated by the reference numeral **10**.

Clamped by a clamp **11** to a support plate **12**, at the lower end of the insulator **2**, is a lower or bottom contact arm assembly **13**. The contact arm assembly **13** is formed of wire, preferably resilient and preformed as shown. Again the wire is preferably Phosphor bronze, and the free end of the arm **13** has a return bend **14**, which securely holds the lower contact button **16** of the open-link fuse **10**.

As well known by those skilled in the art, the open-link fuse **10** is mounted in place by the usual hook stick, one prong of which is inserted within the upper loop **17** of the fuse link **10**, so that the contact button **16** may be guided into position within the return bend **14**. When this is done, the further upward movement of the hook stick causes the helical spring **18**, integrally formed with the arm **13**, to be moved into tension at the same time that the loop **17** is raised upwardly into position within the return bend **7** of the upper contact arm **6**.

Upon the occurrence of a short-circuit condition in the line connected to the terminals **19, 20**, the fuse link **10** will fuse and the lower cable **21** will be released to permit the lower contact arm **13**, under the tension of the spring **18**, to withdraw the fuse remnants out of the fuse tube **22**, thereby extinguishing the arc and breaking the circuit. When this occurs, a maintenance man must remove the loops **17**, **17***a* from the contact arms **6**, **13** and replace the spent fuse link **10** with a new fuse link.

Figures 2–9 more clearly show the internal construction of the open-link fuse **10**. Referring to these figures, with particular attention being directed to Figs. 2 and 3 thereof, it will be noted that the fuse tube **22** is of composite construction, the tube **22** comprising an outer tube **22***a* formed of a weather-proof material, such as a suitable phenolic condensation product, and an inner tube **22***b*, which is preferably composed of a gas-evolving material, such as fiber.

Disposed at the upper end of the fuse tube **22** is a cap **23**, which is preferably soldered to the upper cable **24**. Hence, the cap **23** closes the upper end of the fuse tube **22** to prevent rain or snow entering therein.

Secured, as by soldering, to the lower end of the con-

ducting cable 24, constituting a fuse terminal 25, is a strain clip 26, the configuration of which is more clearly shown in Figs. 5–7 of the drawings.

Preferably the strain clip 26 is stamped from sheet material into blank form, as indicated in Fig. 5. Preferably the strain clip is formed of a high-resistance material having the requisite mechanical strength, such as material being a copper-nickel alloy, for example.

Following the blanking operation producing the clip, as shown in Fig. 5, preforming operations are manipulated to result in the strain clip 26 assuming the configuration as shown in Figs. 6 and 7.

It will be observed that the strain clip 26 has an intermediately disposed strain strap portion 27 and clamping portions 28 at the opposite ends thereof. Each clamping portion 28 has lugs 29 which embrace the fuse terminals 25, 30, the lower fuse terminal 30 constituted by the upper end of the conducting flexible cable 21.

As mentioned, soldering operations are performed at each clamping end 28 following the clamping of the lugs 29 about the cables 21, 24. The flexible leads or cables 24, 21 may be formed of a plurality of tinned copper strands.

Soldered to the clamping portions 8, at opposite ends of the strain clip 26, is a fuse 31, more clearly shown in Figs. 8 and 9 of the drawings. Preferably the fuse 31 has a bend 32 formed therein so that the entire strain will be taken by the strain clip 26, and not by the fuse 31. As shown in Fig. 4, it will be noted that with the construction used, the lower sides of the clamping portions 28 of the strain clip 26 form suitable surfaces 33, to which the ends 34 of the fuse 31 may be soldered.

With the construction shown, upon a fault condition occurring in the circuit, the fuse 31 and the strain-strap portion 27 of the strain clip 26 will be fused substantially simultaneously, to thereby permit the helical spring 18 of the cut-out 1 to withdraw the cable 21 and the lower fuse terminal 30 from the open lower end of the fuse tube 22. The arc established between the fuse terminals 25, 30 will be brought into engagement with the gas-evolving material of the inner fuse tube 22*b*. The turbulent evolution of gas from the inner fuse tube 22*b* will pass through the drawn arc and eject the lower fuse terminal 30 out of the lower end of the fuse tube 22 to rapidly extinguish the lengthening arc.

During the occurrence of light overloads of a continuing nature, which may be harmful to the apparatus protected by the fuse link 10, the fuse 31, which normally carries most of the current, will fuse first, thereby forcing the total current to pass through the high-resistance strain clip 26 through the strain-strap portion 27 thereof.

The result will be a fusion of the strain-strap portion 27, which will thereby permit the spring 18 to withdraw the lower fuse terminal 30 out of the fuse tube 22, as before, with arc extinction taking place in a similar manner.

It will be observed that the strain clip 26 is easily blanked out in economical fashion, and may be readily formed. Moreover, the expansive areas 33 of the clamping portions 28 provide a secure grip upon the cables 21, 24 when the strain clip 26 is clamped thereto. Also, the aforesaid expansive areas 33 provide considerable soldering area between the clamping portions 28 and the cables 21, 24. Further, the said expansive areas 33 provide good seats for the ends of the fuse 31 to be soldered thereto, as indicated in Fig. 4 of the drawings. The result is a strong "strain-wire" fuse-link construction, in which high-tensile strength is achieved in the strain element, with no chance of mechanical breakage under normal conditions.

In the modification of my invention illustrated in Figs. 10–12, it will be observed, with particular attention being directed to Fig. 10 thereof, that a fuse holder 35 is provided, having an upper terminal ferrule 36 and a lower terminal collar 37. The terminal ferrule 36 is preferably threadedly secured to the upper end of the fuse tube 38, as at 39. A set screw 40 secures the terminal collar 37 rigidly in place adjacent the lower end of the fuse tube 38.

The fuse-refill unit, generally designated by the reference character 41 in Figs. 11 and 12, is passed downwardly interiorly within the fuse tube 38, as shown in Fig. 10, with the head 42 thereof clamped between the top of the terminal ferrule 36 and a terminal cap 43, the latter being threadedly secured to an upper extension 44 of the ferrule 36. The lower end of the cable, or tail, 45 is secured by a set screw 46, having a knurled head, to the terminal collar 37.

As well known by those skilled in the art, the terminal ferrule 36 and the terminal collar 37 electrically and mechanically engage suitable fuse clips, not shown, connecting thereby the fuse holder 35 into the circuit to be protected.

Referring more particularly to Figs. 11 and 12, it will be observed that the head 42 has a lower depending rod-shaped portion 47 constituting a fuse terminal which is embraced by the clamping portion 48 of a strain clip 49, the configuration of the blank form of which is more clearly shown in Fig. 11A of the drawings.

In a manner similar to that heretofore described in connection with Fig. 5, the strain clip 49 is blanked out, as shown in Fig. 11A. Preferably, it is formed from a suitable high-resistance material such as a copper-nickel alloy. As mentioned, one clamping portion 48 thereof is crimped to the rod portion 47 of the head 42, and is soldered thereto following such crimping operation. The other clamping portion 48 is crimped and soldered to the fuse terminal end 50 of the flexible conducting cable 45.

Situated between the lower terminal end 52 of the rod portion 47 of the head 42 and the upper end 53 of the cable 45 is a fuse 54 having a bend 55 (Fig. 11). The fuse 54 is soldered into place upon the clamping portions 48 of the strain clip 49.

Following such operations, an enclosing tube 56 is slipped over the cable 45 in the manner shown in Fig. 11. At least the inner surface of the tube 56 is of a material which will evolve an arc-extinguishing gas when contacted by an electric arc.

The complete assembly of the fuse-refill unit 41 within a fuse holder 35 is depicted in Fig. 10. During heavy overload conditions, or under short-circuit situations, the fuse 54 and the strain-strap portion 57 of the strain clip 49 will be disintegrated, substantially simultaneously. The resulting arc established between the fuse terminals 52, 50 will contact the inner wall of the fuse tube 56, thereby evolving a considerable quantity of gas. The pressure of such evolved gas will forcibly eject the lower fuse terminal 50 and the cable 45 out of the open lower end of the fuse tube 56, the cable 45 hanging downwardly from the terminal collar 37 indicating thereby a blown condition of the fuse.

During light continuing overloads of a harmful nature, the fuse 54 will first fuse, thereby forcing the total current to pass through the strain-strap portion 57 of the strain clip 49. Since the strain clip 49 is formed of a relatively high-resistance material, it will soon fuse, thereby establishing an arc between the fuse terminals 50, 52. Gas evolution and arc extinction occur as in the same manner described in connection with short-circuit conditions.

From the foregoing constructions, it will be apparent that I have provided an improved and highly effective fuse-link construction involving an improved "strain-wire" construction. The strain clips 26, 49 are mechanically strong, easily and economically manufactured, and are highly resistant to mechanical failure under normal operating conditions. An application of my invention to fusible interrupting devices eliminates the uncertainty of faulty operation of the prior-art strain elements. Moreover, with the constructions which I disclose, it will be apparent that there is considerable soldering and crimp-

ing area involved, so that there is no likelihood of soldering connections breaking or of cables pulling loose. In addition, it will be noted that the construction is compact, and easily assembled into a complete fuse-refill unit.

Although I have shown and described specific structures, it is to be clearly understood that the same were merely for the purpose of illustration, and that changes and modifications may be readily made, by those skilled in the art, without departing from the spirit and scope of the invention.

I claim as my invention:

1. A fusible interrupting device wherein a fuse link assembly electrically interconnects a pair of spaced fuse terminals and wherein overload protection is obtained by fusion of the fuse link assembly, characterized by the combination of a strain element composed of conducting sheet material through which current may pass, an elongated fuse secured adjacent the ends of the strain element in electrical parallel thereto, the conducting strain element having at least one widened clamping end portion embracingly clamping the inner end of one of the fuse terminals, said widened clamping end portion being an integral part of the strain element and formed of the same conducting sheet material as the strain element, and the current passing through the strain element after the fuse melts.

2. A fusible interrupting device wherein a fuse link assembly electrically interconnects a pair of spaced fuse terminals and wherein overload protection is obtained by fusion of the fuse link assembly, characterized by the combination of a strain element composed of conducting

sheet material through which current may pass, an elongated fuse secured adjacent the ends of the strain element in electrical parallel thereto, the conducting strain element having at least one end crimped to one fuse terminal, said one end of the conducting strain element being an integral part of the strain element and formed of the same conducting sheet material as the strain element, and the current passing through the strain element after the fuse melts.

References Cited in the file of this patent

UNITED STATES PATENTS

1,226,151	Weinberg	May 15, 1917
1,663,333	Carmean	Mar. 20, 1928
2,043,024	Williams	June 2, 1936
2,050,277	Crabbs et al.	Aug. 11, 1936
2,056,760	Austin	Oct. 6, 1936
2,172,226	Smith	Sept. 5, 1939
2,174,767	Triplett et al.	Oct. 3, 1939
2,208,440	Williams	July 16, 1940
2,250,210	Smith	July 22, 1941
2,324,044	Tripplett et al.	July 13, 1943
2,394,590	Boothe	Feb. 12, 1946
2,493,601	Smith	Jan. 3, 1950
2,563,566	Von Hoorn	Aug. 7, 1951
2,640,128	Fahnoe et al.	May 26, 1953

FOREIGN PATENTS

185,889	Great Britain	Sept. 21, 1922

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,821,604

January 28, 1958

James M. Wallace

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the drawings, Sheet 4 should be canceled; in the heading to Sheets 1, 2 and 3, line 3, for "4 Sheets", each occurrence, read --3 Sheets--.

Signed and sealed this 29th day of April 1958.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE

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January 28, 1958

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KARL H. AXLINE
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ROBERT C. WATSON
Commissioner of Patents