

Sept. 7, 1943.

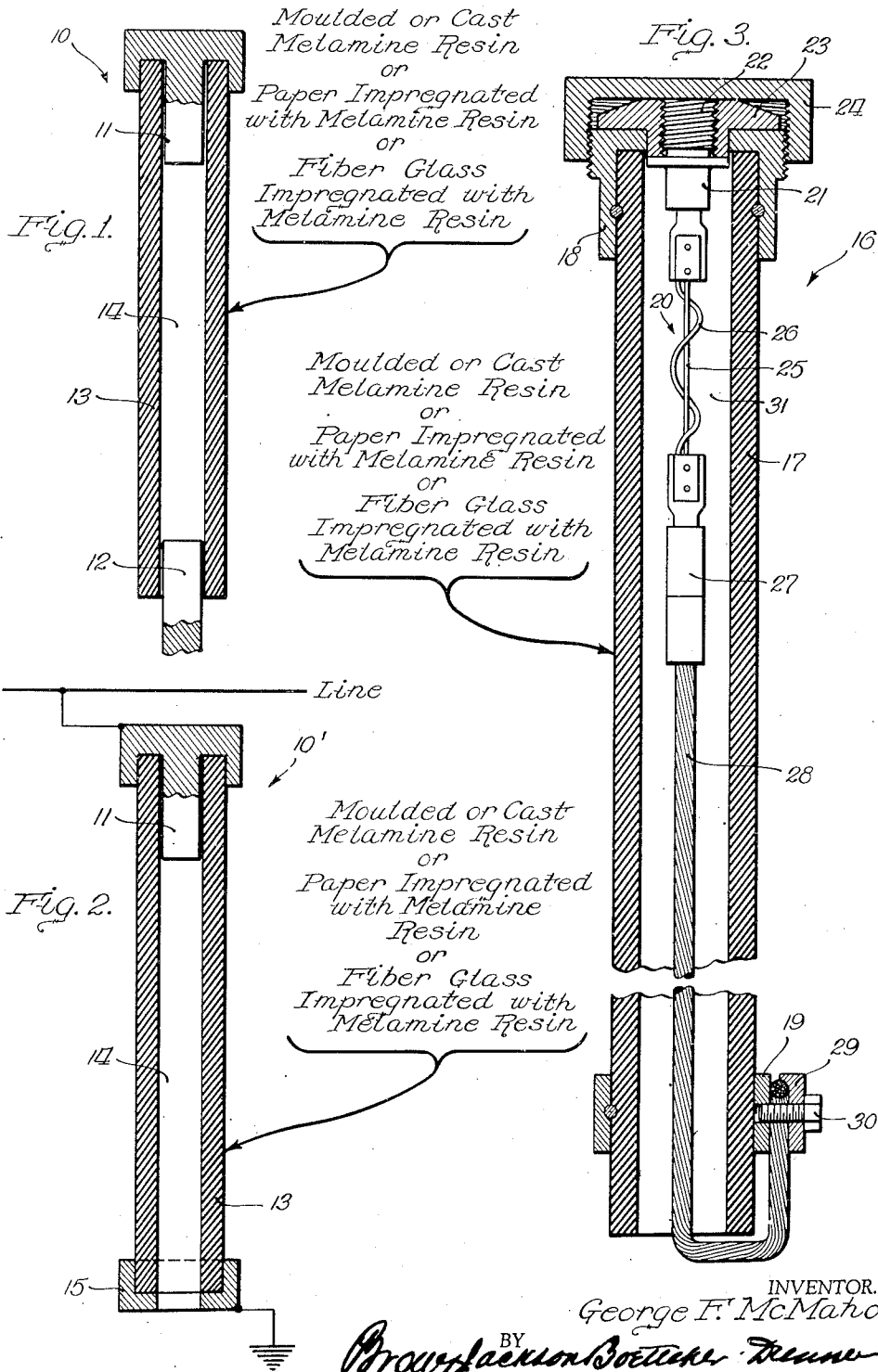
G. F. McMAHON

2,328,825

ARC EXTINGUISHING MEANS

Filed Sept. 25, 1941

4 Sheets-Sheet 1



Sept. 7, 1943.

G. F. McMAHON

2,328,825

ARC EXTINGUISHING MEANS

Filed Sept. 25, 1941

4 Sheets-Sheet 2

Fig. 4.

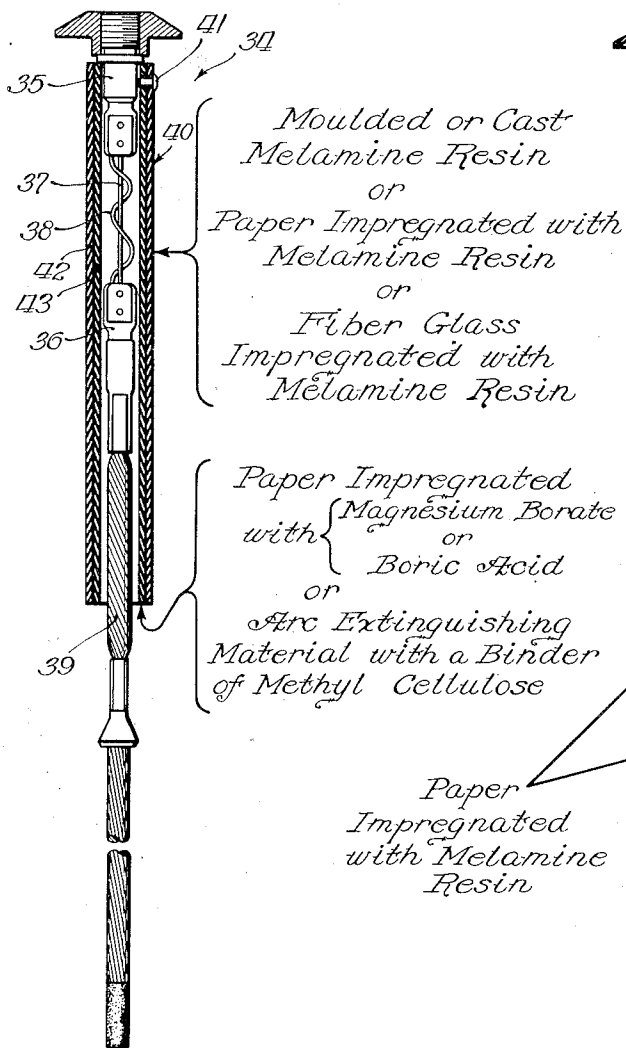
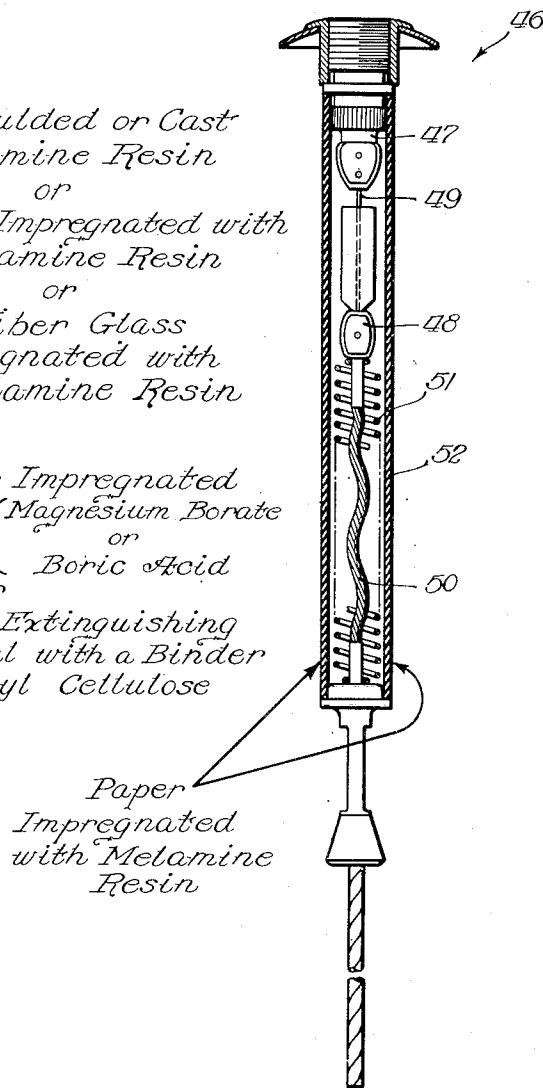


Fig. 5.



INVENTOR.

George F. McMahon

BY

Brooklyn, N.Y.
Attys.

Sept. 7, 1943.

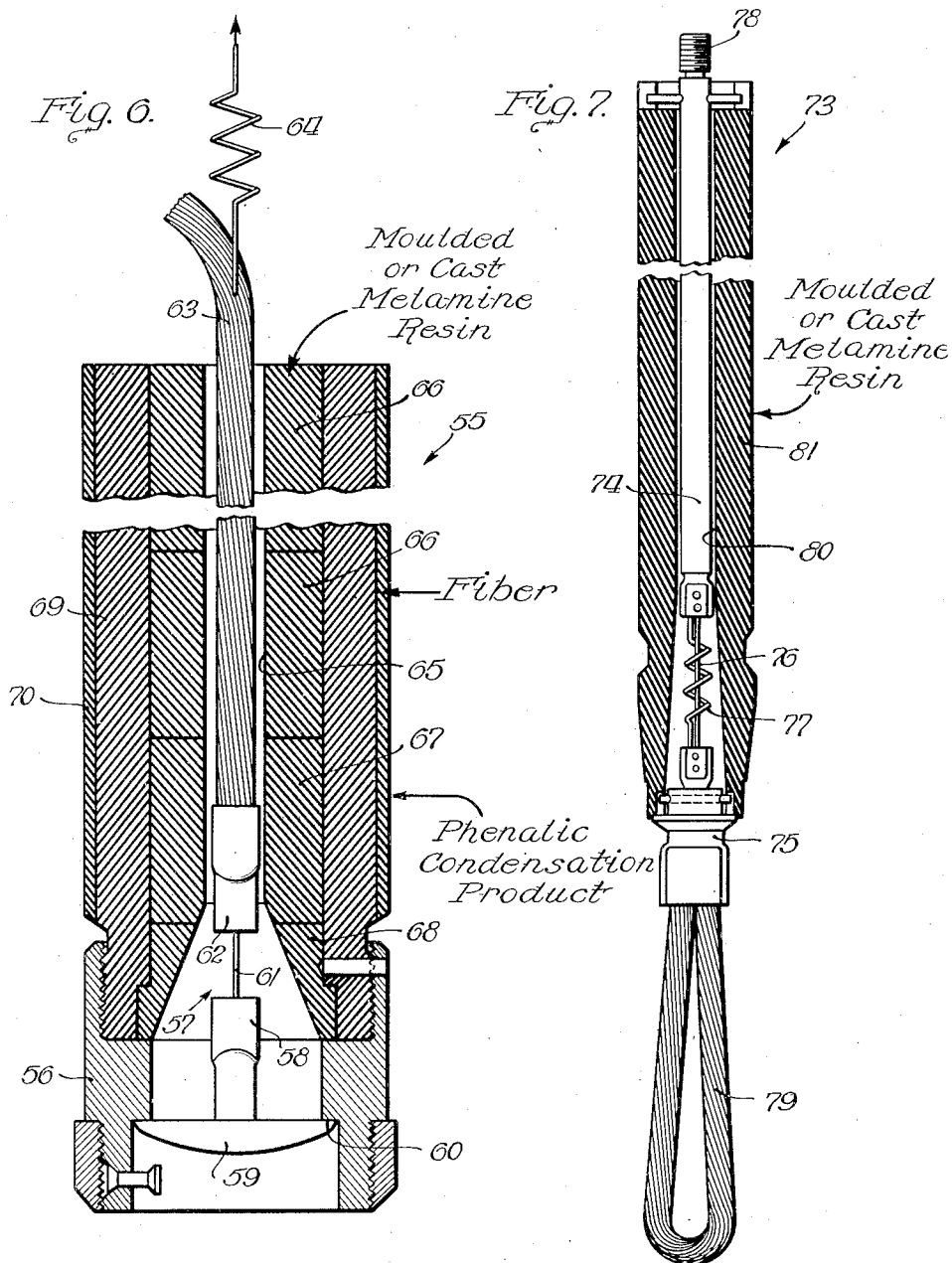
G. F. McMAHON

2,328,825

ARC EXTINGUISHING MEANS

Filed Sept. 25, 1941

4 Sheets-Sheet 3



INVENTOR.
George F. McMahon
BY *Maxwellson & Botten* Attys.

Sept. 7, 1943.

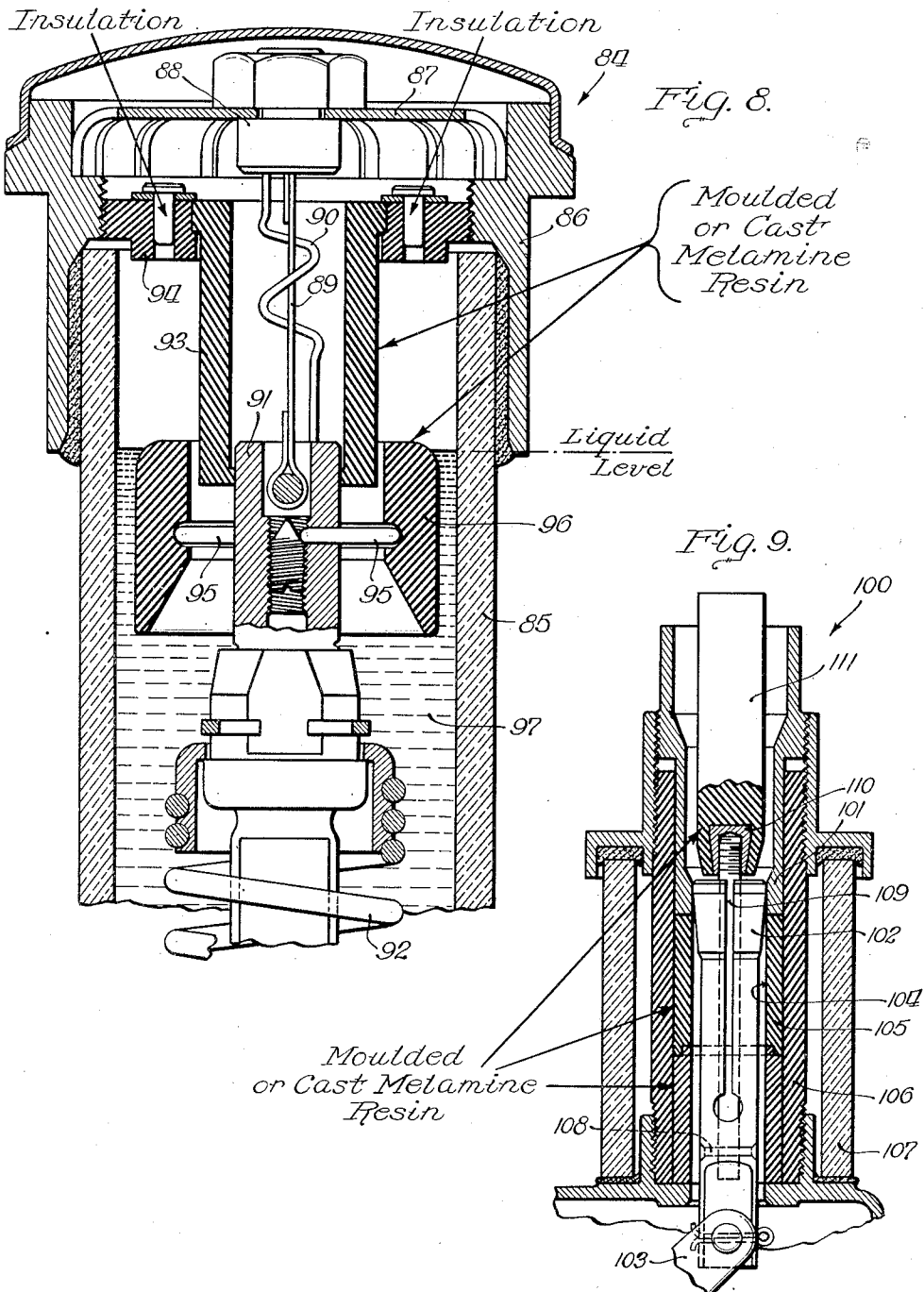
G. F. McMAHON

2,328,825

ARC EXTINGUISHING MEANS

Filed Sept. 25, 1941

4 Sheets-Sheet 4



INVENTOR.
George F. McMahon

BY
Proffackon Brothers, Denver
Attys.

UNITED STATES PATENT OFFICE

2,328,825

ARC-EXTINGUISHING MEANS

George F. McMahon, Chicago, Ill., assignor to
Schweitzer & Conrad, Inc., Chicago, Ill., a cor-
poration of Delaware

Application September 25, 1941, Serial No. 412,217

26 Claims. (Cl. 200-120)

My invention relates, generally, to circuit interrupting apparatus, such as circuit breakers, lightning arresters and fuses, and it has particular relation to new and improved arc extinguishing materials therefor.

In circuit interrupting apparatus it is customary to provide a structure for confining the arc that is drawn on operation of the device to interrupt the circuit. The surface of such a structure adjacent the arc is preferably formed of a material which will evolve an arc extinguishing medium under the heat of the arc so as to quickly destroy or put out the arc or create a condition such that it cannot be sustained. After the arc is extinguished the structure preferably has insulating characteristics such that there is no likelihood of an arc being reformed or restriking between the live parts of the circuit. It is customary to place circuit interrupters of this character out of doors where they are subject to the weather. Therefore, it becomes desirable to so construct the arc confining and extinguishing structure that it is relatively unaffected by the weather.

It has been customary in the past to make the arc confining and extinguishing structure of different kinds of materials, each particularly adapted to perform certain functions. Thus, the material forming the surface adjacent the arc is adapted to evolve a relatively large quantity of arc extinguishing medium. Such material, as employed in the past, was relatively weak from a mechanical standpoint and did not have weather resisting characteristics. Accordingly, it has been the practice to surround such a material with another material which was relatively strong and capable of resisting the pressures incident to circuit interruptions. In many instances, the pressure resisting material did not possess sufficient weather resisting properties and it was customary to surround it with material which did have good weather resisting characteristics.

An object of my invention is to provide an arc confining and extinguishing structure which may be formed of material of homogeneous character throughout and which combines in it all of the desired characteristics for such a structure thereby not requiring that different kinds of material be employed to make up a composite arc extinguishing and confining structure as has been required in the past.

The following characteristics are desirable in an arc extinguishing and confining structure:

1. It should be capable of being machined, moulded, cast, or formed into the shape desired.
 2. It should be mechanically strong or strong enough to meet any treatment in handling or assembly work. The surface should be hard to resist ordinary scratching and abuse while in service.
 3. It should be insoluble in water.
 4. It should be stable at ordinary operating temperatures and should not soften or change its shape at a temperature of 100° C.
 5. It should be non-inflammable.
 6. It should be non-corrosive, either before or after operation or arc extinction.
 7. It should be non-poisonous or not dangerously poisonous.
 8. It should be able to extinguish within reasonable clearances in circuit interrupting apparatus high or low alternating currents at high voltages.
 9. Its insulating characteristics should be high.
 10. It should be strong enough to resist the pressure incident to circuit interruption.
 11. It should not "track" or produce a conducting path of carbon or crack or produce an excessive amount of soot upon operation under high voltage stresses.
 12. It should be relatively unaffected by prolonged exposure to bright sunlight, moisture and extremes of normal operating temperature.
- Another object of my invention is to provide circuit interrupting apparatus having an arc confining and extinguishing structure formed of a homogeneous material and having essentially all of the foregoing characteristics.
- Other objects of my invention will, in part, be obvious and in part appear hereinafter.
- For a more complete understanding of the nature and scope of my invention reference can be had to the following detailed description taken in connection with the accompanying drawings in which:
- Figure 1 is a longitudinal sectional view which illustrates diagrammatically a circuit interrupter of the separable contact member type;
- Figure 2 is a view, similar to that shown in Figure 1, showing a lightning arrester construction;
- Figure 3 is a longitudinal sectional view of a circuit interrupter of the fuse type;
- Figures 4 and 5 are longitudinal sectional views of different forms of replaceable or renewable fuse links;
- Figures 6 and 7 are longitudinal sectional views of different forms of replaceable fuse links or cartridges;

Figure 8 is a longitudinal sectional view of the upper end portion of a liquid type fuse in which the present invention is incorporated; and

Figure 9 is a longitudinal sectional view of one form of load-break device for use in conjunction with a disconnecting switch of the knife blade type.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates, generally, a circuit interrupter having a fixed or stationary contact member 11 and a movable contact member 12. In the circuit closed position the contact member 12 is in engagement with the stationary contact member 11 so as to complete a circuit there-through. The circuit is opened by separating the contact members 11 and 12. The circuit interrupter may be employed in an alternating current circuit the current carrying capacity of which normally is of the order of several hundred amperes at voltages ranging upwardly from 2300 volts. It will be understood that these figures are in no wise to be considered as limiting the application of the present invention but are employed merely for illustrative purposes. The circuit interrupter 10 can be employed for circuits having less current carrying capacity and operating at lower voltages.

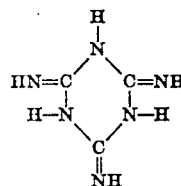
The primary function of the circuit interrupter 10 is to interrupt or extinguish the arc formed between the contact members 11 and 12 in an efficient manner. For this purpose an arc extinguishing and confining structure 13 is provided within which the arc between the contact members 11 and 12 is drawn in the bore 14 thereof.

For the reasons indicated hereinbefore it is desirable that the arc confining and extinguishing structure be formed of a material which possesses various characteristics so that it is unnecessary to employ more than one material in making up the same.

I have found that melamine and other similar compounds derived from cyanamid, dicyanodiamid or guanidine from which synthetic resins or condensation products can be produced are satisfactory materials for this purpose. Melamine is a pure chemical and has been manufactured as such. It crystallizes from hot water as white monoclinic prisms. It has a chemical formula of $C_3H_6N_6$ and it sublimes in the neighborhood of $350^\circ C$. It does not seem to have any true melting point at atmospheric pressure. Melamine reacts with aqueous solutions of formaldehyde and other chemicals forming condensation products or synthetic resins varying in solubility depending upon how they are made or compounded during the reacting process. Variations in time, temperature and the use of catalysts are some of the controlling factors. The resultant condensation products are generally called melamine formaldehyde resins. Melamine is non-inflammable as are the melamine formaldehyde resins. Their non-inflammability is due to the high nitrogen content. Some of the reacting resins can be placed in solution either with water, water and alcohol or hydrocarbons, the preferable solvent being a water-alcohol mixture. Some resins are more stable than others and stabilizing reagents may be employed. These solutions can be used to impregnate fibrous materials or they can be mixed with other fibrous materials or fillers and dried without condensation and polymerization setting in and later used to form solid heat resistant insulating bodies un-

der heat and pressure in suitable moulds or dies. Wood flour can be used as a filler. Of particular value are powdered fillers containing magnesium, such as magnesium hydroxide, magnesium oxide, magnesium silicate and magnesium borate. Pure silica can be used. Compositions containing from 30% to 50% of melamine formaldehyde resin with these fillers can be used to advantage. The resins will condense and polymerize under heat and pressure evolving some formaldehyde and water vapor and thereafter are insoluble in water and a great many other solvents.

Melamine is a nitrogen containing cyclic organic compound. It is also known as 2,4,6-triamino-1,3,5 triazine, as cyanuric acid amide and as cyanuric triamide. Its chemical structure can be represented by a six membered ring compound with alternate carbon and nitrogen atoms in the ring. This ring is indicated by the following conventional diagram.



It will be observed that no oxygen is present in this compound. Although melamine itself contains no oxygen, when it is combined with formaldehyde it is likely that some oxygen is present in the final product containing one or more molecules of water of crystallization. Since melamine is oxygen free, it is reasonable to conclude that the polymerized or condensed resins thereof will be comparatively low in oxygen as during the process of moulding under heat and pressure some formaldehyde and water vapor is lost into the atmosphere.

Melamine contains theoretically 66% nitrogen by weight. It is because of this high nitrogen content that resins of melamine are relatively non-inflammable. Also, because of the relatively high nitrogen content the melamine resin provides a satisfactory arc extinguishing material from which nitrogen, hydrogen and possibly small amounts of carbon containing gases are evolved due to the heat of the arc. This is highly effective in extinguishing the arc and preventing its restriking.

Melamine can be produced by many different processes but the most common or widely used methods make use of dicyanodiamide, cyanimide or guanidine as already mentioned.

In producing melamine other products of similar nature are derived, namely, melam, melem, melon, ammelide and ammeline. All are cyclic organic compounds with nitrogen positioned in the ring structure and can be used to advantage in the production of resinous condensation products satisfactory for arc extinguishing purposes.

Resins can be produced from the melamines, preferably methylolamines by esterification. These products may be soluble in water, water and alcohol, hydrocarbons or are insoluble.

Melamine is weakly alkaline or basic in character and reacts therefore with many organic and inorganic compounds to produce stable compounds. With organic bases or acids complex resins are produced. One of the products produced through the reaction of melamine and formaldehyde is hexamethylolmelamine, and

contains one molecule of water of crystallization.

Melamine under certain conditions forms more complex nitrogen compounds one of which is tri-cyanmelamine.

Melamine formaldehyde resins with modifying reagents, such as the carbohydrates, and polyhydric alcohols may be used although such additions have to be made with care in order not to produce electrically conducting materials.

Resinous products may be used by reacting melamine with alkyl and aromatic aldehydes and ketones.

Unlike the urea formaldehyde resins, the melamine formaldehyde resins are more stable and water resistant. The urea formaldehyde condensations decompose at 350° F. whereas some of the melamine condensations are stable at 435° F. and in some cases 500° F., a valuable feature in electrical devices subject to abnormal temperature rise under service conditions.

The arc extinguishing and confining structure 13 can be formed in different ways such as moulding, casting or impregnation. For example, it can be formed of moulded melamine resin. This resin can be obtained from the American Cyanimid Company and is sold under the designation "M-187 Melmac." Two grades of "M-187 Melmac" are available, one for compression moulding and the other for transfer moulding. The transfer grade contains a small amount of plasticizer while the other does not. These compositions comprise melamine formaldehyde resins and asbestos. They can be readily moulded under suitable heat and pressure to provide the desired shape of arc extinguishing and confining structure 13. The moulding powders may or may not contain variable amounts of suitable plasticizer that facilitates formation of the desired shapes. The moulding process is preferably carried out at a temperature of about 310° F. with the pressure ranging from about 1200 to about 2400 pounds per square inch.

The structure 13 can be formed in tubular shape by moulding under heat and pressure a sheet of paper that has been impregnated with melamine formaldehyde resin. A resin sold by the American Cyanimid Company under the designation "S-77-V Melmac" has been found to be particularly useful for this purpose. The paper is impregnated with this resin by applying one or two coats with a brush to one side. White alpha cellulose absorbent paper or white or colored paper can be used. After the paper is coated or impregnated with the melamine resin it is permitted to dry for a few hours. Then it is wound on a mandrel under heat and pressure to the desired thickness of tubing. The mandrel is preferably maintained at a temperature ranging from 150 to 180° F. After the tube is formed, it is cured at or above this temperature range. If it is desired to hasten the curing of the tube, it can finally be carried out at a temperature of about 212° F. or somewhat above this temperature. Because of these relatively low temperatures, the paper is not affected adversely as would be the case if it were necessary to use substantially higher temperatures.

Coatings of melamine formaldehyde varnishes that are dried and baked are valuable arc resistant materials and are not easily affected by chemicals, especially those alkaline in reaction.

The structure 13 can also be formed of fiber glass impregnated with melamine resin. The fibrous material in sheet form is first covered or impregnated with the melamine formaldehyde resin solution and then after drying it is rolled

into tubular form under heat and pressure to polymerize the resin and form a homogeneous construction.

In Figure 2 of the drawings there is illustrated at 10' a lightning arrester of the expulsion type. It is similar to the circuit interrupter 10, Figure 1, except that it has a stationary lower terminal 15 which, as shown, is connected to ground. The terminal 11 is arranged to be connected to a high voltage line in accordance with conventional practice.

In Figure 3 of the drawings there is illustrated, generally, at 16 a circuit interrupter of the fuse type having an arc confining and extinguishing structure 17 in tubular form with terminals 18 and 19 at its ends. This construction provides the well known form of plain expulsion tube fuse device.

The terminals 18 and 19 are connected by a replaceable fuse link, illustrated generally at 20. The fuse link 20 comprises an upper terminal 21 having a threaded shank 22 on which is threaded a removable button head 23. It will be noted that the button head 23 abuts the upper end of the terminal 18 and that it is secured thereto by a screw cap 24. Depending from the terminal 21 are strain and fusible elements or wires 25 and 26. The strain wire 25 is preferably formed of nickel chromium alloy and the fuse wire 26 is preferably formed of silver. However, it will be understood that other metals can be employed for the strain and fusible wires 25 and 26. At their lower ends the strain and fusible wires 25 and 26 are fastened to a lower terminal 27 which is connected by means of a flexible conducting lead 28 to the lower fuse tube terminal 19. It is clamped thereto by a clamp 29 that is held in place by a screw 30.

The tube or arc extinguishing and confining structure 17 can be formed, as indicated, of moulded melamine resin or paper impregnated with melamine resin or fiber glass impregnated with melamine resin. The tube 17 can be formed from these materials in the same manner as described for the structure 13 of Figure 1.

It will be observed that the tube 17 is formed of a single homogeneous material. That is, it is not formed of composite material having a liner of fiber, as in the prior art, and an outer covering of phenolic condensation product. It can be used out of doors where it is subjected to the direct action of the weather since it is extremely weather resistant. The inner surface forming the bore 31 when subjected to the heat of the arc formed on fusing of the strain and fusible wires 25 and 26 between the terminals 21 and 27 evolves an arc extinguishing medium, i. e., nitrogen, which creates an expulsive effect to drive the terminal 27 out of the lower end of the tube 17 thereby extending the arc and at the same time substituting in the arc space a relatively inert non-ionized medium which prevents the arc from restriking.

In Figure 4 of the drawings there is illustrated generally at 34 a replaceable fuse link of the type as shown in Ramsey Patent No. 2,144,707. The fuse link 34 comprises terminals 35 and 36 interconnected by strain and fusible elements 37 and 38. It will be understood that the terminal 35 is arranged to be connected to one circuit terminal while the terminal 36 is arranged to be connected by a flexible conductor 39 to another circuit terminal.

Surrounding the terminals 35 and 36 and the strain and fusible elements 37 and 38 is an arc

confining and extinguishing structure or sleeve, shown generally at 40. The sleeve 40 comprises an outer sleeve 42 formed of moulded melamine resin or paper impregnated with melamine or fiber glass or other fibrous material impregnated with melamine resin. The inner sleeve or liner 43 is formed of material which is capable of evolving a relatively great quantity of water vapor. It can be formed of paper impregnated with magnesium borate or boric acid or it may be formed by arc extinguishing material with a binder of methyl cellulose as described in my copending application, Serial No. 369,162, filed December 9, 1940. The liner 43 is provided for evolving water vapor as an arc extinguishing medium. In some instances it is desirable to employ this construction rather than to use the outer sleeve 42 alone without the liner 43. The particular construction used will depend upon the conditions that are to be met by the replaceable fuse link 34 in operation.

The composite sleeve 40 is arranged to be held in place on the terminal 35 by means of a pin 41. If desired other means, such as knurling the terminal 35 can be employed for holding the composite sleeve 40 in place.

In Figure 5 of the drawings there is illustrated, generally, at 46 a replaceable spring link of the type shown in the copending application of Lindell, Serial No. 70,280, filed March 23, 1936. This fuse link comprises terminals 47 and 48 interconnected by a fusible element 49. The terminal 47 is arranged to be connected to one circuit terminal while the other terminal 48 is arranged to be connected by flexible conductor 50 to another circuit terminal. A coil tension spring 51 is provided for applying a predetermined tension to the fusible element 49. Surrounding the terminals 47 and 48 and the fusible element 49 is a sleeve 52 which provides an arc extinguishing and confining structure. The sleeve 52 is preferably formed of paper impregnated with melamine resin.

The fuse link constructions shown in Figures 4 and 5 of the drawings are substantially unaffected by being immersed in water for relatively long periods. On being removed from the water there is no warpage as is the case with other materials, such as fiber for example.

In Figure 6 of the drawings there is shown, generally, at 55 a replaceable fuse link or fuse cartridge that is similar to the fuse link or cartridge shown in Triplett Patent No. 2,183,728. The replaceable cartridge 55 comprises a terminal 56 which is arranged to be connected to one line terminal. Connected to the terminal 56 is a replaceable fuse link, indicated generally at 57. The link 57 comprises a terminal 58 having a head portion 59 abutting shoulder 60 provided by the terminal 56. The terminal 58 is connected by a fusible element 61 to another terminal 62 which is connected by a flexible conductor 63 to another circuit terminal. A spring, indicated diagrammatically at 64, applies a tension to the fusible element 61 and serves to withdraw the terminal 62 through a bore 65 when the fusible element 61 is blown. The bore 65 is formed in cylindrical blocks 66, 67 and 68 of moulded melamine resin composition. The blocks 66, 67 and 68 of melamine resin serve as a solid arc extinguishing material and an arc extinguishing medium comprising nitrogen, hydrogen and small amounts of carbon containing gases, is evolved therefrom due to the heat of the arc formed between the terminals 58 and 62 on blowing of the fusible element 61 which serves to assist in extinguishing this arc and expelling the terminal

58 and the attached head portion 59 from the terminal 56.

The blocks of molded melamine resin composition 66, 67 and 68 are positioned within a cylinder 69 of insulating material, preferably fiber, which in turn is encased in a sleeve 70, preferably formed of phenolic condensation product. It will be understood that instead of forming the moulded melamine resin in the cylindrical blocks 66, 67 and 68 and providing the fiber sleeve 69 and the outer sleeve 70 of phenolic condensation product, all of this insulating material could be formed of one piece moulded melamine resin composition.

In Figure 7 of the drawings there is shown, generally, at 73 a replaceable or renewable fuse link or fuse cartridge of the type illustrated in Triplett Patent No. 2,226,838. The renewable link or cartridge 73 comprises a rod-like terminal 74 and an opposite terminal 75. The terminals 74 and 75 are interconnected by a strain element 76 and a fusible element 77. The rod-like terminal 74 is threaded as indicated at 78 for connection to one circuit terminal. The terminal 75 is provided with a looped flexible conductor 79 for connection to the other circuit terminal.

The terminals 74 and 75 and the strain and fusible elements 76 and 77 are located in a bore 80 of an arc extinguishing and confining structure or sleeve 81 which is preferably formed of moulded or cast melamine resin composition. It will be observed that in the construction illustrated in Figure 7 and described hereinbefore, the arc extinguishing or confining structure 81 is formed of a single piece of material and is not formed by two or more insulating materials as is the case in the construction shown in Triplett Patent No. 2,226,838.

In Figure 8 of the drawings there is illustrated, generally, at 84 a portion of a liquid fuse construction which is similar to that shown in Conrad Patent No. 2,091,430. The fuse construction 84 comprises a sleeve 85 of suitable insulating material, such as glass, which has at its upper end a terminal 86. A metallic spider 87, which is carried by the terminal 86, supports a terminal 88 from which depend strain and fusible elements 89 and 90. The strain and fusible elements 89 and 90 are connected to a terminal 91 that is arranged to be retracted into the housing or sleeve 85 by a coil tension spring 92.

Surrounding the strain and fusible elements 89 and 90 is an arcing chamber or tube 93 that is held in place by a threaded ring 94 of suitable insulating material, such as a phenolic condensation product.

In order to inject a liquid arc extinguishing medium into the arcing chamber 93, the terminal 91, which is retracted by the spring 92, is provided with radially extending pins 95 which support a liquid director 96. It will be understood that the liquid director 96 is moved downwardly into a liquid dielectric 97 when the strain and fusible elements 89 and 90 blow and that the liquid is forced by the liquid director 96 into the arcing chamber 93 where it assists in extinguishing the arc and deionizing the arc space. The fuse liquid 97 that is employed can be of the type disclosed in my Patent No. 2,077,429.

The arcing chamber 93 and the liquid director 96 are preferably formed of moulded or cast melamine resin. This material is not soluble in or does not react with any of the arc extinguishing liquids now used in the fuse construction shown in Conrad Patent No. 2,091,430 and also described in my Patent No. 2,077,429.

In Figure 9 of the drawings there is illustrated, generally, at 100 a portion of a load-break device which is employed in the switch construction disclosed in the copending application of Lindell and Van Ryan, Serial No. 349,898, filed August 2, 1940. The load-break device 100 is employed preferably in conjunction with a disconnecting switch of the knife blade type for opening the circuit after and closing it before the knife blade is moved to the switch open or closed position. It will be understood that the construction shown in Figure 9 is not limited to this particular use.

The switch construction 100 comprises a stationary generally cylindrical terminal 101 and a movable generally cylindrical terminal 102 that is attached to a lever 103, only a portion of which is shown. It will be understood that the lever 103 is connected to a suitable operating mechanism for moving the terminal or contact member 102 into and out of engagement with the terminal or contact member 101.

The contact member 102 is arranged to move in a bore 104 of a two part sleeve or liner 105 of moulded or cast melamine resin. Surrounding the liner 105 is a sleeve 106 of insulating material such as phenolic condensation product. An outer sleeve 107, formed of ceramic material such as porcelain, surrounds the liner 105 and sleeve 106, as shown. It will be apparent that the sleeve or liner 105 can be replaced or renewed readily, if necessary.

Attached by a pin 108 to the movable contact member 102 is a trailer rod 109 that is threaded into an insert 110 around which is moulded a trailer or plug 111 of melamine resin. The sleeve or liner 105 and the trailer or plug 111 can be moulded or cast with sufficient accuracy so that no machining or other finishing thereof is required.

When the contact member 102 moves downwardly into the bore 104 and away from the stationary contact member 101, an arc is drawn therebetween, if the circuit is opened under load conditions. This arc is quickly extinguished since it is confined between the bore 104 and the outer surface of the trailer or plug 111 which moves into the bore 104 as the contact member 102 is moved downwardly.

The use of melamine resin for the sleeve 105 and plug 111 is particularly advantageous in the construction of the load-break device 100. In this device reliance for quickly extinguishing arcs is placed to a considerable extent on the relatively close fit between the sleeve 105 and plug 111. It is desirable that the dimensions of the sleeve 105 and plug 111 remain substantially unchanged regardless of arcing over their surfaces. That is, the erosion due to the formation of arcs over these surfaces should be inappreciable. When melamine resin is employed for making the sleeve 105 and plug 111, this end is substantially achieved.

Since it is obvious that there are many other uses of the arc extinguishing material disclosed herein than the particular ones described hereinbefore and shown in the accompanying drawings, it will be understood that the foregoing description and the constructions shown in the accompanying drawings are to be construed as illustrative and not in a limiting sense.

I claim as my invention:

1. In electrical apparatus, a conductor from which an arc may be drawn, and arc extinguishing and confining means along the path of the arc from which an arc extinguishing medium can

be evolved due to the heat of the arc for extinguishing the same, said means comprising a resin derived from a cyclic organic compound with nitrogen positioned in the ring structure.

2. In electrical apparatus, a conductor from which an arc may be drawn, and arc extinguishing and confining means along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing the same, said means comprising melamine.

3. In electrical apparatus, a conductor from which an arc may be drawn, and arc extinguishing and confining means along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing the same, said means comprising melamine formaldehyde resin.

4. An electric circuit interrupter comprising, in combination, conductor means between which an arc is formed on interruption of the circuit, and arc extinguishing and confining means along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing the same, said arc extinguishing and confining means comprising a resin derived from a cyclic organic compound with nitrogen positioned in the ring structure.

5. An electric circuit interrupter comprising, in combination, conductor means between which an arc is formed on interruption of the circuit, and arc extinguishing and confining means along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing the same, said arc extinguishing and confining means comprising melamine resin.

6. A fuse device comprising, in combination, means adapted to fuse and form an arc on the occurrence of an overload in an electric circuit, and an arc extinguishing and confining structure along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing it, said structure comprising a resin derived from a cyclic organic compound containing nitrogen positioned in the ring structure.

7. A fuse device comprising, in combination, means adapted to fuse and form an arc on the occurrence of an overload in an electric circuit, and an arc extinguishing and confining structure along the path of the arc from which an arc extinguishing medium can be evolved due to the heat of the arc for extinguishing it, said structure comprising melamine formaldehyde resin.

8. A replaceable cartridge or fuse link comprising, in combination, a pair of spaced terminal members, fusible means interconnecting said terminal members, and an insulating sleeve surrounding said fusible means comprising a resin derived from a cyclic organic compound containing nitrogen positioned in the ring structure.

9. A replaceable cartridge or fuse link comprising, in combination, a pair of spaced terminal members, fusible means interconnecting said terminal members, and an insulating sleeve surrounding said fusible means comprising melamine resin.

10. An arc confining and extinguishing structure comprising melamine resin.

11. An arc confining and extinguishing structure comprising melamine resin and an inorganic filler.

12. An arc confining and extinguishing struc-

ture comprising melamine resin and a magnesium containing filler.

13. An arc confining and extinguishing structure comprising from 30 to 50% by weight of melamine formaldehyde resin and the balance comprising substantially magnesium borate.

14. An arc confining and extinguishing structure comprising a synthetic resin derived from the class consisting of cyanamidé, dicyanodiamide and guanidine.

15. An arc confining and extinguishing structure comprising a resin derived from a cyclic organic compound containing nitrogen in the ring structure and an alkaline-earth element.

16. An arc confining and extinguishing structure comprising a resin derived from a cyclic organic compound containing nitrogen in the ring structure and a metallic hydrate.

17. A composite sleeve forming an arc confining and extinguishing structure comprising an outer layer containing melamine resin, and a liner therefor containing a material capable of evolving a relatively large quantity of arc extinguishing medium when subjected to the heat of an electric arc.

18. A composite sleeve forming an arc confining and extinguishing structure comprising an outer layer containing melamine resin, and a liner therefor containing a material capable of evolving a relatively large quantity of water vapor when subjected to the heat of an electric arc.

19. An electric circuit breaker comprising, in combination, separable contact members between which an arc is drawn on separation thereof, a sleeve into which the arc is drawn, and a plug disposed to be moved into said sleeve for confining said arc between its outer surface and the inner surface of said sleeve, the material form-

ing the outer surface of said plug comprising melamine resin.

20. An electric circuit breaker comprising, in combination, separable contact members between which an arc is drawn on separation thereof, a sleeve into which the arc is drawn, and a plug disposed to be moved into said sleeve for confining said arc between its outer surface and the inner surface of said sleeve, the material forming the outer surface of said plug and the inner surface of said sleeve comprising melamine resin.

21. Method of making an arc confining and extinguishing structure which comprises impregnating fiber glass with melamine resin.

22. Method of making an arc confining and extinguishing structure which comprises, moulding a mixture of melamine resin and inorganic filler to the desired shape and size under heat and pressure.

23. Method of making an arc confining and extinguishing structure which comprises, moulding a mixture of melamine resin and inorganic filler to the desired shape and size at a temperature of about 310° F. and under pressure ranging from about 1200 to about 2400 pounds per square inch.

24. Method of making an arc confining and extinguishing structure which comprises impregnating a sheet of fibrous material with melamine resin, and winding the impregnated sheet on a mandrel under sufficient heat and pressure to polymerize the resin.

25. An arc confining and extinguishing structure comprising melamine resin and an organic filler.

26. An arc confining and extinguishing structure comprising melamine resin and a filler of cellulose.

GEORGE F. McMAHON.

DISCLAIMER

2,328,825.—*George F. McMahon*, Chicago, Ill. ARC-EXTINGUISHING MEANS. Patent dated Sept. 7, 1943. Disclaimer filed Sept. 19, 1946, by the assignee, *Schweitzer & Conrad, Inc.*

Hereby enters this disclaimer to claims 11, 22, and 23 of said patent.

[*Official Gazette October 22, 1946.*]

DISCLAIMER

2,328,825.—*George F. McMahon*, Chicago, Ill. ARC-EXTINGUISHING MEANS. Patent dated Sept. 7, 1943. Disclaimer filed Sept. 19, 1946, by the assignee, *Schweitzer & Conrad, Inc.*

Hereby enters this disclaimer to claims 11, 22, and 23 of said patent.

[*Official Gazette October 22, 1946.*]