

**Aug. 26, 1941.**

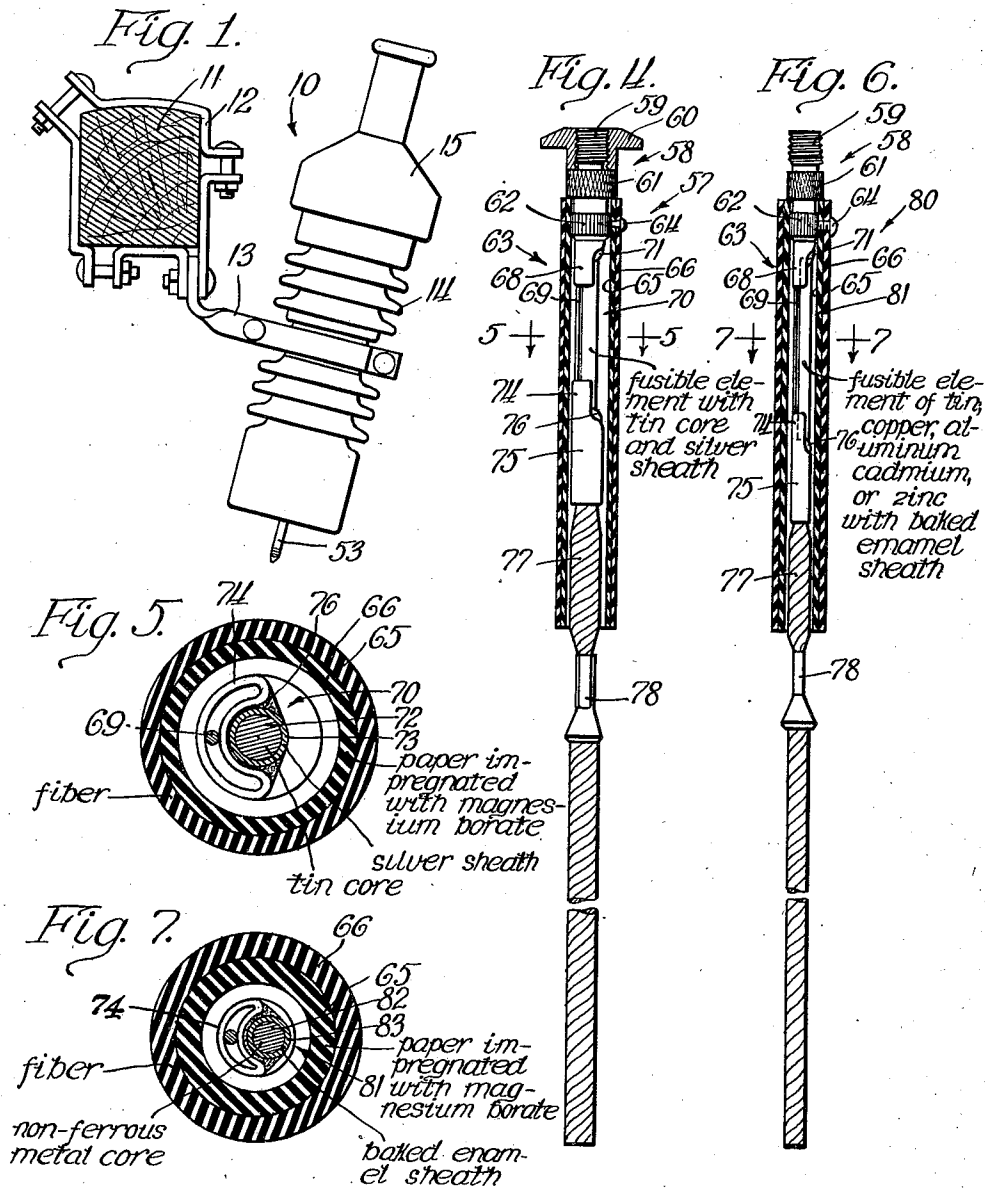
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**2,253,720**

## FUSE CONSTRUCTION

Filed April 12, 1940

2 Sheets-Sheet 1



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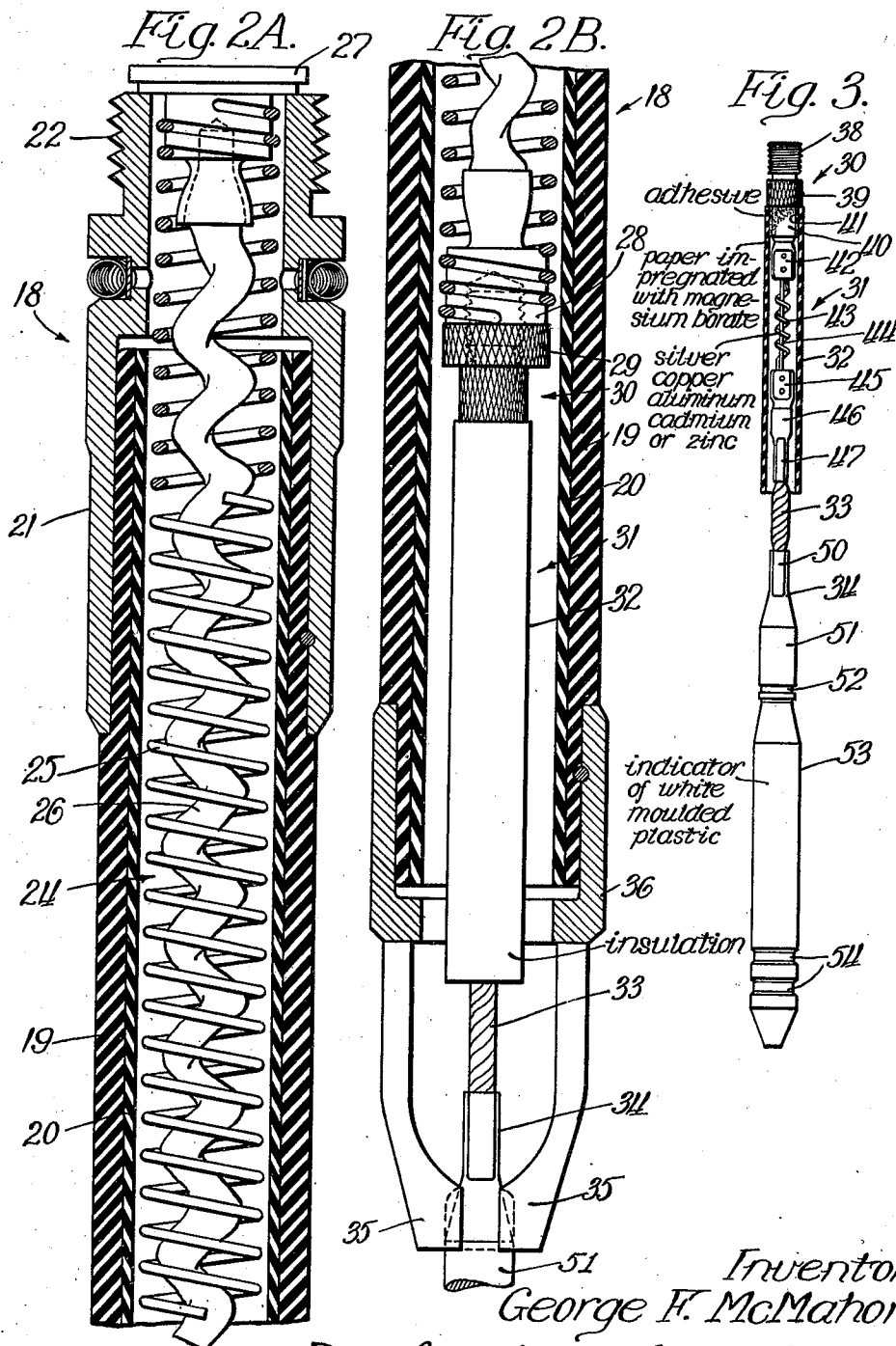
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FUSE CONSTRUCTION

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,253,720

## FUSE CONSTRUCTION

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15 Claims. (Cl. 200—120)

This invention relates generally to circuit interrupting apparatus and it has particular relation to fuse links.

An object of this invention is to secure the insulating tube or sleeve of a fuse link to one of the link terminals by adhesive means.

Another object of this invention is to provide, as a part of a fuse link, an indicator which by its absence or presence shows whether or not the fuse link has blown.

Still another object of this invention is to provide a fuse link with a composite sleeve the lining and sheath of which have different characteristics.

A further object of this invention is to mount a fusible element comprising a tin core and a silver sheath in generally U-shaped link terminals.

A still further object of this invention is to surround a fusible element comprising a tin core and a silver sheath or tin alone with an arc extinguishing material.

Another object of this invention is to prevent oxidation of a tin fusible element surrounded by magnesium borate.

A further object of this invention is to facilitate grasping a terminal of a fuse link for applying it to and removing it from an external terminal.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

Accordingly, this invention is disclosed in the embodiments thereof shown in the accompanying drawings, and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the constructions hereinafter set forth, the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of this invention, reference may be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of one form of cutout in which the fuse links of the present invention may be employed;

Figures 2A and 2B, taken together, constitute a longitudinal sectional view showing the details of construction of the fuse tube that is adapted to be inserted in the cutout shown in Figure 1;

Figure 3 is a view in side elevation, the fuse tube being shown in section, of a fuse link which may be employed in the fuse tube shown in Figures 2A and 2B;

Figure 4 is a view in side elevation, the fuse tube being shown in section, of another form of fuse link;

Figure 5 is a detail sectional view, at an enlarged scale, taken along the line 5—5 of Figure 4;

Figure 6 shows another embodiment of the fuse link; and

Figure 7 is a detail sectional view, at an enlarged scale, taken along the line 7—7 of Figure 6.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates, generally, a cutout which may be mounted on a suitable support such as a crossarm 11 by means of a suitable clamp 12. A bracket 13 is secured, as shown, to the clamp 12 and is arranged to support a housing 14, which is preferably formed of porcelain. At its upper end a handle 15 is provided which may be grasped by the hand of a lineman for removing the fuse tube from the housing 14.

In Figures 2A and 2B of the drawings the reference character 18 designates, generally, the preferred construction of the fuse tube that is attached to the handle 15 and inserted in the housing 14, Figure 1. The fuse tube 18 comprises an outer housing 19, preferably of a phenolic condensation product, such as "Bakelite" or other thermosetting or thermoplastic material, and a liner 20 formed, for example, of fiber or fibrous material impregnated with magnesium borate. At its upper end the fuse tube 18 is provided with a line terminal 21 which is arranged to be connected to a corresponding terminal in the housing 14, Figure 1. At its upper end the terminal 21 is threaded, as indicated at 22, for receiving the handle 15, Figure 1.

Within the fuse tube 18 there is provided a spring and cable assembly that is shown generally at 24. This assembly comprises a coil tension spring 25 within which there is positioned a flexible conductor or cable 26. The spring 25 and cable 26 are secured at their upper ends to a spring and cable fastener 27 which has a flanged head that rests against the upper end of the terminal 21, as shown. The lower ends of the spring 25 and cable 26 are secured to a spring and cable fastener 28 which constitute this an external terminal and which has a knurled section 29 to facilitate its being gripped by a suitable tool such as a pair of pliers for application of or removal from a terminal, shown generally at 30, of a replaceable fuse link, shown generally at 31. The fuse link 31 is provided with a tube or sleeve 32 of insulating material and it has projecting out of

its lower end a flexible lead 33 onto which a wedge shaped terminal 34 is deformed for interfittng between upstanding ears 35 of a lower line terminal 36 which is mounted at the lower end of the fuse tube 18.

The details of construction of the cutout previously described are generally the same as those illustrated and described in Ramsey Patent No. 2,108,993. It is to the particular details of the construction of the fuse link 31 that the present invention is directed.

In Figure 3 of the drawings, certain of the novel features embodied in the fuse link construction of the present invention are shown. It will be observed that the fuse tube terminal 30 is generally rod-like in character and therefore that it is relatively infusible. Its upper end portion 38 is threaded for attachment to the spring and cable fastener 28. Just below the threaded portion 38 there is provided a knurled portion 39 for receiving a suitable tool such as a pair of pliers in order to facilitate grasping the terminal 30 for application to or removal from the spring and cable fastener 28.

Immediately below the knurled portion 39 there is provided a generally cylindrical portion 40 to which the tube or sleeve 32 is secured by means of a suitable adhesive 41. Adhesive material is employed for holding the tube or sleeve 32 in place instead of a pin, as shown in Figures 4 and 6 hereinafter described, in order to reduce the outside diameter of the assembly so that the fuse link can be inserted in a fuse tube having an internal diameter only slightly larger than the outside diameter of the fuse link.

The tube or sleeve 32 is preferably formed of rolled paper impregnated with magnesium borate as disclosed in the copending application of McMahon, Serial No. 266,991, filed April 10, 1939.

The lower end portion 42 of the terminal 30 is generally tubular in construction and is deformed onto the upper ends of fusible and strain elements 43 and 44. The fusible element 43 may be formed of non-ferrous metal such as silver, copper, aluminum, cadmium, zinc or alloys of these metals, while the strain element 44 is formed of a high strength alloy, such as a nickel chromium alloy. The lower end portions of the fusible and strain elements 43 and 44 are secured by having the upper end portion 45 of a generally rod-like terminal 46 deformed thereon. The lower end of the terminal 46 is generally tubular in character and as indicated at 47 it is deformed onto the upper end of the flexible lead 33. The upper end portion 50 of the wedge-shaped terminal 34 is deformed onto the lower end of the flexible lead 33.

It is desirable that a readily visible indicator be provided for indicating by its absence or presence whether or not the fuse link 31 has blown. For this purpose the wedge-shaped terminal 34 is provided with a generally tubular section 51 which is deformed, as indicated at 52, onto the upper end of an elongated insulator member 53 which constitutes an indicator member. The member 53 is preferably formed of a white moulded plastic so that it will be readily visible from the ground. As shown in Figure 1, the indicator member 53 projects a substantial distance below the lower end of the housing 14 so that it is readily visible. At its lower end the indicator member 53 is provided with grooves 54 for receiv-

ing a pull-up string for facilitating the re-fusing of the fuse tube 18.

In operation, when the fusible and strain elements 43 and 44 of the fuse link 31 blow, the spring 25 is no longer restrained. Accordingly, it retracts the upper fuse link terminal 30 and tube or sleeve 32 secured thereto into the tube 18, thereby elongating the arc formed between the relatively infusible terminals 30 and 46 for extinguishing the same. Due to the heat of the arc thus formed, water may be evolved from the inner surface of the tube or sleeve 32 and it further assists in extinguishing the arc. Since the lower fuse link terminal 46 is no longer restrained, it and the indicator member 53 drop out or are blown out of their normal positions at the lower end of the tube 18. It will thus be apparent that the presence of the indicator member 53 at the lower end of the housing 14 shows that the fuse link 31 has not blown. However, its absence indicates that it has blown and that the cutout should be re-fused.

In Figure 4 of the drawings, another embodiment of the fuse link construction is shown generally at 57. The link 57 is provided with an upper relatively infusible terminal that is shown, generally, at 58. Its upper end portion is threaded as indicated at 59 for attachment to the spring and cable fastener 28, Figure 2B, or for receiving a flanged fitting 60 for mounting in other types of cutouts, such as an expulsion type of cutout. Below the threaded portion 59 there is provided a knurled portion 61 for facilitating the securing of the terminal 58 in position or removing it therefrom, as previously described.

Below the knurled portion 61 there is provided a longitudinally knurled portion 62 over which a composite tube or sleeve, shown generally at 63, is positioned. This composite sleeve 63 may be secured to the terminal 58 by means of a transversely extending pin or screw 64.

The composite sleeve 63 preferably comprises a liner 65 formed of rolled paper impregnated with magnesium borate and an outer sheath 66 formed of fiber. The magnesium borate in the liner 65 evolves a considerable amount of water vapor under the heat of an arc for assisting in extinguishing it while the fiber sheath 66 serves to reinforce the liner 65 and protects the same in handling. The fiber sheath 66 also possesses arc extinguishing properties but to a lesser degree than magnesium borate.

The lower portion 68 of the upper fuse link terminal 58 is of a tubular construction and is deformed onto the upper end of a strain element 69 which, as previously indicated, may be formed of a nickel alloy wire. In deforming the lower portion 68 of the terminal 58, a generally U-shaped fusible element receiving portion is formed and in this, one end of a fusible element, shown generally at 70, is soldered, as indicated at 71.

As shown in Figure 5 of the drawings, the fusible element 70 comprises a core 72, formed principally of tin, and a sheath 73, formed principally of silver. The silver-tin fusible element is more fully described in the copending application of Triplett, Serial No. 144,789, filed May 26, 1937.

Referring again to Figure 4 of the drawings, it will be observed that the lower end of the strain element 69 is secured in the upper end portion 74 of a lower fuse link terminal 75. The portion 74 of the terminal 75 is generally tubular

in construction and it is deformed onto the lower end of the strain element 69 for fastening thereto. In deforming the portion 74 a generally U-shaped fusible element receiving portion is provided, as described in the portion 68 and in it the lower end of the fusible element 70 is positioned and secured in place by solder 76.

The generally U-shaped portions 68 and 74 of the fuse link terminals 58 and 75 form a cradle construction which is described in more detail in Triplett et al. Patent No. 2,174,767.

The lower fuse link terminal 75 is deformed onto one end of a flexible lead 77 which extends out of the lower end of the composite sleeve or tube 63. A wedge-shaped terminal 78 is deformed onto the flexible lead 77, intermediate its ends, for interfitting with the ears 35, Figure 2B, of the lower terminal 36. If the fuse link 57 is employed in other types of cutouts, then the lower end portion of the flexible lead 77 is secured to the corresponding terminal, as will be readily understood.

In Figure 6 of the drawings, the fuse link shown generally at 80 is generally similar in construction to the fuse link 57, shown in Figure 4, and described hereinbefore. However, in the fuse link 80 the fusible element, shown generally at 81, is composed of non-ferrous metal such as copper, cadmium, aluminum, zinc or alloys of the same, as indicated at 82 in Figure 7 of the drawings.

With a view to preventing oxidation of the tin core 82, or of other cores consisting of readily oxidizable metals, the core is provided with a baked enamel sheath 83 which is capable of withstanding without injury the heat generated by the core 82 substantially up to or just below its melting point. Preferably, the enamel sheath 83 is formed by spraying on the tin core 82 after it has been assembled in the terminals 58 and 75 a lacquer which can be obtained in the open market under the trade name of "Duranite." After the spraying operation has been completed, the assembly is placed in an oven and baked at 250° F. to 275° F. for about one hour in order to harden and polymerize the resin in the lacquer.

Fuse links of the type herein disclosed are particularly well adapted to clear low current faults at low power factor and high recovery voltage. It has been found that operation under these conditions using the present invention is superior to results obtained when other materials such as fiber are used.

Since certain further changes may be made in the foregoing constructions and different embodiments of the invention can be made without departing from the scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

What is claimed as new is:

1. In a fuse, in combination, a pair of terminal means and fusible means interconnecting the same, one of said terminal means being rod-like in character and adapted to be connected to an external terminal at one end and to said fusible means at the other end, a sleeve of insulating material containing magnesium borate telescopically related to said pair of terminal means, and adhesive means securing said sleeve to said one terminal means intermediate its ends, the other terminal means being free to move out of said sleeve on blowing of said fusible means.

2. A fuse link comprising, in combination, a pair of terminal means adapted to be connected

to line terminals and interconnected by fusible means, an elongated insulator member acting as an indicator, and a sleeve constituting an extension of one of said terminal means and deformed onto one end of said elongated insulator.

3. In a fuse, in combination, a pair of spaced relatively infusible terminals, fusible means interconnecting said terminals, and a composite insulating sleeve surrounding said fusible means having a sheath formed of arc extinguishing material and a liner closely fitting therewith and carrying magnesium borate.

4. In a fuse, in combination, a pair of spaced relatively infusible terminals, fusible means interconnecting said terminals, and a composite insulating sleeve surrounding said fusible means having a fiber sheath and a liner extending throughout its entire length and carrying magnesium borate.

5. In a fuse, in combination, a pair of spaced relatively infusible terminals, fusible means interconnecting said terminals, a composite insulating sleeve telescopically related to said terminals and having a fiber sheath and a liner carrying magnesium borate, and means for securing said composite sleeve to at least one of said terminals.

6. In a fuse, in combination, a pair of spaced relatively infusible terminals, fusible means interconnecting said terminals, a composite insulating sleeve telescopically related to said terminals and having a fiber sheath and a liner carrying magnesium borate, and means for securing said composite sleeve to one of said terminals, the other terminal being free to move out of said sleeve on blowing of said fusible means.

7. In a fuse, in combination, a pair of terminal members having end portions extending toward each other, said end portions having laterally opening aligned U-shaped fusible element receiving portions, strain means interconnecting said terminal members, a fusible element comprising a tin core and a silver sheath secured in said U-shaped fusible element receiving portions, and a sleeve of insulating material surrounding said fusible element and carrying magnesium borate in such position that it is exposed to the heat of the arc formed on blowing of said fusible element.

8. In a fuse, in combination, a pair of terminals having tubular end portions extending toward each other, a strain element interconnecting said terminals with its ends disposed in said tubular end portions, said tubular end portions being deformed in such manner as to form substantially U-shaped fusible element receiving portions, a fusible element comprising a tin core and a silver sheath also interconnecting said terminals with its ends disposed in said U-shaped fusible element receiving portions, and a sleeve of insulating material secured to at least one of said terminals and surrounding said fusible element and carrying magnesium borate in such position that it is exposed to the heat of the arc formed on blowing of said fusible element.

9. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element interconnecting said terminals comprising a core composed principally of tin and a sheath composed principally of silver, and a sleeve of insulating material carrying magnesium borate surrounding said fusible element.

10. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element

interconnecting said terminals comprising a core composed principally of tin and a sheath composed principally of silver, and a sleeve of cellulosic material impregnated with magnesium borate surrounding said fusible element.

11. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element interconnecting said terminals comprising a core composed principally of tin and a sheath composed principally of silver, and a rolled paper sleeve impregnated with magnesium borate surrounding said fusible element.

12. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element selected from the class consisting of tin, copper, aluminum, cadmium and zinc interconnecting said terminals, and a sleeve of insulating material carrying magnesium borate surrounding said fusible element.

13. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element

selected from the class consisting of tin, copper, aluminum, cadmium and zinc interconnecting said terminals, and a sleeve of cellulosic material impregnated with magnesium borate surrounding said fusible element.

14. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element selected from the class consisting of tin, copper, aluminum, cadmium and zinc interconnecting said terminals, and a rolled paper sleeve impregnated with magnesium borate surrounding said fusible element.

15. In a fuse, in combination, a pair of spaced relatively infusible terminals, a fusible element composed of an oxidizable metal interconnecting said terminals, an enamel coating on said fusible element to prevent oxidation thereof, and a sleeve of insulating material carrying magnesium borate surrounding said fusible element.

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