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ELECTRICAL FUSE ELEMENT

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4 Claims. (Cl. 75—166)

1

This invention relates to alloys useful for forming fuse elements for electrical fuses and to fuse elements formed from these alloys.

The invention is particularly concerned with alloys for forming fuse elements designed to carry small currents and to blow at small current values. A particular problem is involved in the design of low current fuses since, in the past, in order to cause an untensioned fuse to blow at low currents, either the cross section of the fuse element had to be made so small as to be difficult of manufacture and too fragile for use, or the resistance of the metal of which the element was made had to be so high as to cause excessive heating and excessive voltage drop at rated currents. For this reason it has been common to design low-current fuses so that the fuse wire is constantly maintained under tension by a spring device thus making it possible for low-resistance wires of larger cross section to blow at a lower current than would normally be required in the absence of tension.

The present invention provides a relatively low-resistance fuse wire alloy which is capable of blowing at low currents without the application of tension while having a cross section sufficiently large to permit simple manufacture and handling without breakage. The alloy also possesses other advantages. It is easily formed into wires of small cross section by an extrusion process. Fuse wires formed from the alloy are cheap in cost, are readily solderable and will not sag excessively when operated for long periods at rated currents.

These results are obtained according to the present invention with an alloy of lead, bismuth, cadmium and antimony in approximately the following proportions:

	Per cent by weight
Bismuth	14.5
Cadmium	2.5
Antimony	1.0
Lead—remainder, together with incidental impurities.	

Long lengths of wire can be extruded with this alloy having diameters as small as .004 inch. Such a wire, of .004 inch diameter, when used in lengths of about one and one-half inches as a fuse wire in an electrical fuse will carry .35 ampere indefinitely but will blow within 210 seconds at .5 ampere. The assembled fuse will not maintain an arc in excess of .1 second when blown at 500 volts with the current limited to ten amperes.

The proportions of the alloy referred to above

2

will normally be held within the following manufacturing limits:

	Per cent by weight
Bismuth	14 to 15
Cadmium	2 to 3
Antimony	.9 to 1.1
Lead—remainder, together with incidental impurities.	

Where the operating conditions are less critical the proportions of each of the components in the alloy may be varied somewhat. Thus, in the alloy above, the antimony content may be varied between .5 per cent and 1.5 per cent, the cadmium content may be varied between 1.5 per cent and 3.5 per cent and the bismuth content may be varied between 10 per cent and 20 per cent. The lead used in forming the alloy may be pure lead or any of the commercial grades of primary lead containing the usual impurities.

The specific ingredients used in the alloy as well as the proportions are important in achieving the results of the invention. The high proportion of lead insures the formation of a large proportion of primary lead grains in the alloy upon solidification. These primary lead grains, which are responsible for the desired low electrical resistance, are surrounded by a low melting, higher resistance eutectic matrix which permits the fuse to blow at the desired low currents. The low melting eutectic results from the presence of the bismuth, chosen for its outstanding ability to lower the melting point, and the cadmium, chosen because of its low solubility in the primary lead. The antimony content is responsible for preventing the sagging of the wire from becoming excessive when it is carrying rated currents.

What is claimed is:

1. An alloy consisting of the following ingredients in approximately the following proportions:

	Per cent by weight
Bismuth	14.5
Cadmium	2.5
Antimony	1.0
Lead—remainder, together with incidental impurities.	

2. A fuse alloy consisting of the following ingredients in approximately the following proportions:

	Per cent by weight
Bismuth	14 to 15
Cadmium	2 to 3
Antimony	.5 to 1.5
Lead—remainder, together with incidental impurities.	

3. An electrical fuse wire formed of an alloy consisting of the following ingredients in the following proportions, together with incidental impurities:

	Per cent by weight
Bismuth	10 to 20
Cadmium	1.5 to 3.5
Antimony	.5 to 1.5

Lead—remainder.

4. An electrical fuse comprising a fuse wire formed of an alloy consisting of the following ingredients in approximately the following proportions:

	Per cent by weight
Bismuth	14.5
Cadmium	2.5
Antimony	1.0

Lead—remainder, together with incidental impurities.

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No references cited.