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ELECTRICAL RESISTANCE WIRE

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1

This invention deals with electrical resistance wire and more particularly with fuse wire suitable for use in the ignition of explosives.

Resistance wire for igniting or setting off explosives usually consists of a precious metal alloy comprising metals of the platinum group, e. g. an alloy of platinum-iridium containing from 10% to 20% iridium and preferably an alloy of 80% platinum and 20% iridium. Such platinum group alloys, although advantageous in view of their electrical and physical properties, are very expensive for utilization as fuse wire. Attempts have been made to substitute at least part of the precious metals with base metals for the sake of economy. However, with the addition of base metals, the resultant fuse wire in some cases proved disadvantageous in that the desirable physical properties of the platinum group metals, e. g. platinum-iridium alloy, were not attainable and the wires were of inferior durability and were rendered susceptible to corrosion by the atmosphere or the substance in which they were embedded. In other cases, alloys of platinum and base metals have provided acceptable substitutes for platinum-iridium alloys with, however, a compromise between economy and the desirable properties of platinum-iridium.

It is an object of this invention to provide a fuse wire suitable for use in the ignition of explosives. It is another object of this invention to provide an alloy fuse wire having highly desirable electrical and physical properties and which is more economical than platinum-iridium alloy fuse wires. It is a further object of this invention to provide an electrical resistance wire consisting of an alloy of platinum and base metals. Other objects and advantages of this invention will become apparent from the following description.

The electrical resistance wire or fuse wire, according to this invention, consists of an alloy containing platinum, chromium and nickel wherein the platinum content does not exceed 98% and the combined chromium and nickel content does not exceed about 7%. More specifically, such resistance wire may be formed from an alloy comprising 93% to 98% platinum, 1% to 6% chromium and 1% to 6% nickel, the chromium content preferably not exceeding 2%; the best embodiment of electrical resistance wire consists of about 93% platinum, about 1% chromium and about 6% nickel.

2

The alloy resistance wires according to the invention have high melting points which are in excess of the ignition point of the detonating charges and have high electrical resistance and great strength, as well as excellent corrosion resistance under conditions of storage and normal use. The electrical resistance wire of the invention is, therefore, suited in particular for use as a fuse wire for setting off explosives. My invention makes it possible to eliminate the use of iridium, a metal highly expensive at all times and often even unavailable in sufficient quantities, so that the fuse wire of my invention serves as an excellent replacement for the platinum iridium alloy resistance wire heretofore used.

Electrical resistance wires which I have found suitable for use as fuse wires may be supplied, for instance, in the form of wires having a diameter of 0.0016'' and less. The alloy resistance wire of 93% platinum, 1% chromium and 6% nickel, for example, has a tensile strength 126,300 pounds per square inch when hard, and 86,000 pounds per square inch when annealed at 1000° C. Its electrical resistivity is 209.7 ohms/mil/ft., and an electrical resistance wire consisting of such alloy, and having a diameter of 0.0013'', will have a breaking load of 150 grams and an electrical resistance of 314.1 ohms/yd. 5,600 feet of resistance or fuse wire can be manufactured from one (1) ounce of such alloy.

Suitable resistance wire or fuse wire may also consist of an alloy within the range 96% to 98% platinum, 1% chromium and 1% to 3% nickel having a tensile strength of from 75,000 to 98,300 pounds per square inch when hard, a tensile strength of from 50,200 to 68,300 pounds per square inch when annealed at 1000° C., and a resistivity of from 160.8 to 185.1 ohms/mil/ft. Where the resistivity is lower for any alloy within the scope of the invention than for the platinum-iridium alloy heretofore used, the same resistivity can be obtained by decreasing the diameter of the wire manufactured from such alloy. However, a preferred alloy fuse wire comprises, approximately, 93% to 98% platinum, 1% to 2% chromium and 1% to 6% nickel.

The following table illustrates some of the resistance wires of the invention in direct comparison with 80% platinum-20% iridium alloy wire:

Alloy	Resistivity, Ohms/mil/ft.	Diameter, Inches	Resistance, Ohms/yd.	Breaking Load, Grams	Ft./Oz.
Pt80Ir20	200	.00146	300	150	4,430
Pt94Cr1Ni5	202.2	.0014	307	145	4,800
Pt93Cr1Ni6	209.7	.0013	314.1	150	5,600
Pt95Cr2Ni3	242.7	.0015	291	180	4,300
Pt93Cr2Ni5	256.5	.0016	285.7	230	3,800

From the above table, it is apparent that with the embodiment, a wire of 93% platinum, 1% chromium and 6% nickel alloy, the use of the expensive platinum-iridium alloy is eliminated and there is provided a fuse wire having the same breaking load as possessed by the platinum iridium fuse wire and having an excellent resistivity. Also, a substantially greater length of wire can be manufactured from one ounce of alloy, which enhances the economy of the fuse wire of this invention.

Where greater resistances are desired in electrical resistance wires, for example for purposes other than fuse wire, the wire may consist of alloys within the range of 93% to 95% platinum, 1% to 2% chromium and 3% to 5% nickel, the properties of some such wires being illustrated in the table.

The invention, therefore, provides an electrical resistance wire of an alloy consisting substantially of platinum, chromium and nickel as a substitute for the more expensive platinum-iridium alloy electrical resistance wires.

What I claim is:

1. Electrical resistance wire consisting of an alloy of platinum, chromium and nickel, wherein the platinum content is between 93% and 98%, the nickel content is between 1% and 6%, the chromium content is from 1% to 2%, and the combined chromium and nickel content not exceeding 7% of the alloy.

2. Electrical resistance wire consisting of an alloy of platinum, chromium and nickel, wherein the platinum content is about 93%, the chromium content about 1% to 2%, and the nickel content about 6%, the combined content of chromium and nickel being not in excess of 7%.

3. Electrical resistance wire consisting of an alloy of platinum, chromium and nickel, wherein the platinum content is between 96% and 98%, the chromium content is about 1%, and the nickel content is between 1% and 3%.

4. Electrical resistance wire consisting of an alloy of platinum, chromium and nickel, wherein the platinum content is between 93% and 95%, the chromium content is about 2%, and the nickel content is between 3% and 5%.

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