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WIRE SCREEN CLOTH

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This invention relates to aluminum screen cloth, and relates particularly to aluminum screen cloth made of composite or duplex wires.

Because of aluminum's light weight, durability, attractive appearance, and non-staining characteristics, it has been proposed heretofore to make wire fabric from it and its alloys for use as screen cloth or the like. However, difficulty has been experienced in producing aluminum wire which was of sufficiently fine gauge for use as screen cloth and which could still be woven as wire fabric; which was sufficiently resistant to corrosion, and which had the necessary mechanical properties for such fabric. With many aluminum alloy compositions, wire of the small gauges necessary for making screen cloth could not be drawn. Also, material which could be drawn to the necessary gauge frequently did not have sufficient resistance to the impact and repeated bending involved in weaving of wire fabric to keep it from breaking during that operation. Furthermore, such screen cloth as was produced did not possess as much resistance to corrosion as is desirable, and as a result the fabric was not sufficiently durable. One of the best aluminum screen cloths prior to this invention was made of an alloy consisting of 94 per cent aluminum and 6 per cent magnesium. Though suitable for some purposes, such screen cloth deteriorated rapidly in severly corrosive atmospheres—as for example near the seashore—with the result that it often had to be replaced after being in service for about a year.

It is an object of this invention to provide an improved, durable aluminum screen wire in the form of a duplex wire or strand having a core of one aluminum base alloy with a coating thereon of another aluminum base alloy. It is a further object of this invention to provide duplex aluminum screen wire in which the core and coating are intimately bonded to each other, and in which the coating is continuous, notwithstanding the working operations necessary to the production of small diameter fabric wire. Another object of this invention is the provision of duplex aluminum screen wire having a coating that offers electrolytic protection to the core, and in itself possesses suitable inherent corrosion resistance. An additional object of this invention is to provide duplex aluminum screen wire that is not only suitably strong and corrosion resistant, but one that can also be woven readily as screen cloth.

In accordance with our invention aluminum screen cloth is woven from duplex wire composed of a core of an aluminum base alloy containing magnesium, and preferably chromium or manganese, or both, which core has a continuous coating of another, corrosion-resistant aluminum base alloy which has an electrode potential higher than the electrode potential of the core alloy; i. e. an alloy which is more anodic than the core material. The alloy forming the core is an aluminum base alloy consisting of from 4 to 6 per cent magnesium, and preferably either 0.01 to 0.5 per cent chromium, or 0.01 to 1 per cent manganese, or both, the balance being substantially aluinum. The chromium and manganese serve to increase the hardness of the alloy and to increase its resistance to corrosion. The alloy forming the coating for the core is an aluminum base alloy consisting of from 0.5 to 3 per cent zinc, 0.5 to 2 per cent magnesium, and 0.25 to 1.25 per cent silicon (the magnesium and silicon being present in about the ratio in which they form the compound magnesium silicide), and either 0.1 to 0.5 per cent chromium or 0.1 to 1 per cent manganese, the balance being substantially aluminum. The core and coating alloys may also contain small amounts of the impurities normally found in aluminum, such as iron and silicon, though preferably the impurities in the core should not exceed a total of 0.3 per cent, and the impurities in the coating should not exceed 0.25 per cent. In addition to the ingredients mentioned above, titanium, molybdenum, vanadium, tantalum, zirconium, boron, or columbium may be added to either alloy in amounts up to 0.5 per cent—preferably between 0.1 and 0.3 per cent—to improve the grain structure and working characteristics of the materials. The expression "substantially aluminum" as used herein is meant to include aluminum with or without additions of one or more of the elements mentioned in the preceding sentence, in the ranges indicated, as well as aluminum containing the impurities normally found therein.

The coating ordinarily constitutes about 5 to 15 per cent of the diameter of the wire, the variation in thickness being a result of the forming operations to which the wire is subjected in preparing it. The coating not only protects the core mechanically, but since the coating has an electrode potential higher than the core, it also prevents corrosion of the core through electrolytic action. That is, a flow of current between the coating and the core in the presence of a corrosive medium (electrolyte) results in attack of the coating, rather than of the core.

Consequently, the properties of the core are not impaired thereby.

The composition which is preferred for the core alloy is from 5 to 5.5 per cent magnesium, 0.05 to 0.2 per cent chromium, 0.05 to 0.2 per cent manganese, and the balance aluminum, while the preferred composition for the coating alloy is from 1.5 to 2.25 per cent zinc, 1.1 to 1.4 per cent magnesium, 0.5 to 0.9 per cent silicon (the magnesium and silicon being present in the ratio corresponding to the compound Mg_2Si), either 0.2 to 0.3 per cent chromium, or 0.2 to 0.5 per cent manganese, and the balance aluminum. Aluminum screen cloth wire which has proved to be particularly satisfactory consists of a core having a nominal composition of about 5.25 per cent magnesium, 0.1 per cent chromium, 0.1 per cent manganese, and the balance aluminum, plus impurities; and a coating having a nominal composition of 2 per cent zinc, 1.25 per cent magnesium, 0.7 per cent silicon, 0.25 per cent chromium, and the balance aluminum, plus impurities. The electrode potential of the core, as measured in an aqueous solution containing 53 grams of sodium chloride and 3 grams of hydrogen peroxide per liter, against a tenth normal calomel electrode, is approximately 0.88 volt, and the electrode potential of the coating is approximately 0.97 volt. Thus, the electrode potential of the coating is higher than that of the core.

Wire usually used in making screen cloth varies in size from 0.01 to 0.015 of an inch in diameter. Duplex wire of such size may be made by first preparing a duplex metal ingot consisting of a core of the core alloy surrounded by a coating of the coating alloy. The composite ingot is then hot rolled to suitable size for drawing the metal into wire in the usual manner employed for drawing wire. Although it is difficult or impossible to hot roll some duplex aluminum materials satisfactorily because of differences in the hot rolling temperatures of the core and the coating, both the core and the coating of our composite material can be hot rolled satisfactorily at about 800° to 850° F., and consequently the composite material can be hot rolled without difficulty. Also, the drawing characteristics of the material are such that the coating on the finished wire is continuous and unbroken. The hot working of the metal during the rolling of material improves the bond between the core and the coating alloys. The finshed wire has proper tensile and yield strength for wire fabric, and has the ability to withstand without fracturing the bending and impact incident to weaving it into fabric. In order to avoid any undue stiffness, sleaziness, bulges, ridges, and unevenness in spacing of the wires of the fabric, it is preferable to subject the wires to the treatments described in the copending application, Serial No. 345,818, of William T. Ennor. However, after the fabric has been woven, no rolling or other treatments are necessary to prepare it for use, though the fabric may be painted with aluminum paint or other paint, if desired, or provided with a chemically-produced coating.

As an example of this invention wire cloth or fabric was woven from duplex wire in which the core consisted of 5.25 per cent magnesium, 0.1 per cent chromium, 0.1 per cent manganese, and the balance aluminum, and the coating consisted of 2 per cent zinc, 1.25 per cent magnesium, 0.7 per cent silicon, and 0.25 per cent chromium. The wires had an average diameter of 0.013 of an inch, the average thickness of the coating being about 7 per cent of that diameter. Specimens of the fabric were exposed at the seashore at a point where much spray from the ocean came in contact with them. Specimens of wire fabric made from wires having an average diameter of 0.013 and consisting of 94 per cent aluminum and 6 per cent magnesium were also exposed at the same location for comparison. The average tensile strength of wires of the latter fabric was 7.1 pounds at the beginning of the test, and the average tensile strength of the duplex wire was 6.7 pounds. At the end of one year the wires consisting of 94 per cent aluminum and 6 per cent magnesium had corroded to such an extent that they had an average tensile strength of only 0.95 pound; some of the wires had even corroded in two. On the other hand, the duplex wires had an average tensile strength of 5.83 pounds, and all of the wires were still unbroken.

We claim:

1. A screen cloth strand comprising a duplex wire having a core of an alloy containing from 4 to 6 per cent magnesium, the balance being substantially aluminum, said core having a coating thereon of an alloy containing from 0.5 to 3 per cent zinc, 0.5 to 2 per cent magnesium, 0.25 to 1.25 per cent silicon, and a hardening element from the group consisting of chromium 0.1 to 0.5 per cent and manganese 0.1 to 1 per cent, the balance being substantially aluminum.

2. A screen cloth strand comprising a duplex wire having a core of an alloy containing from 4 to 6 per cent magnesium and at least one hardening element from the group consisting of chromium 0.01 to 0.5 per cent and manganese 0.01 to 1 per cent, the balance being substantially aluminum, said core having a coating thereon of an alloy containing from 0.5 to 3 per cent zinc, 0.5 to 2 per cent magnesium, 0.25 to 1.25 per cent silicon, and a hardening element from the group consisting of chromium 0.1 to 0.5 per cent and manganese 0.1 to 1 per cent, the balance being substantially aluminum.

3. A screen cloth strand comprising a duplex wire having a core of an alloy containing about 5 to 5.5 per cent magnesium, 0.05 to 0.2 per cent chromium, and 0.05 to 0.2 per cent manganese, the balance being substantially aluminum, said core having a coating thereon of an alloy containing about 1.5 to 2.25 per cent zinc, about 1.1 to 1.4 per cent magnesium, about 0.5 to 0.9 per cent silicon, and a hardening element from the group consisting of chromium about 0.2 to 0.3 per cent and manganese about 0.2 to 0.5 per cent, the balance being substantially aluminum.

4. A screen cloth strand comprising a duplex wire having a core of an alloy containing about 5.25 per cent magnesium, about 0.1 per cent chromium, and about 0.1 per cent manganese, the balance being substantially aluminum, said core having a coating thereon of an alloy containing about 2 per cent zinc, about 1.25 per cent magnesium, about 0.7 per cent silicon, and about 0.25 per cent chromium, the balance being substantially aluminum.

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