

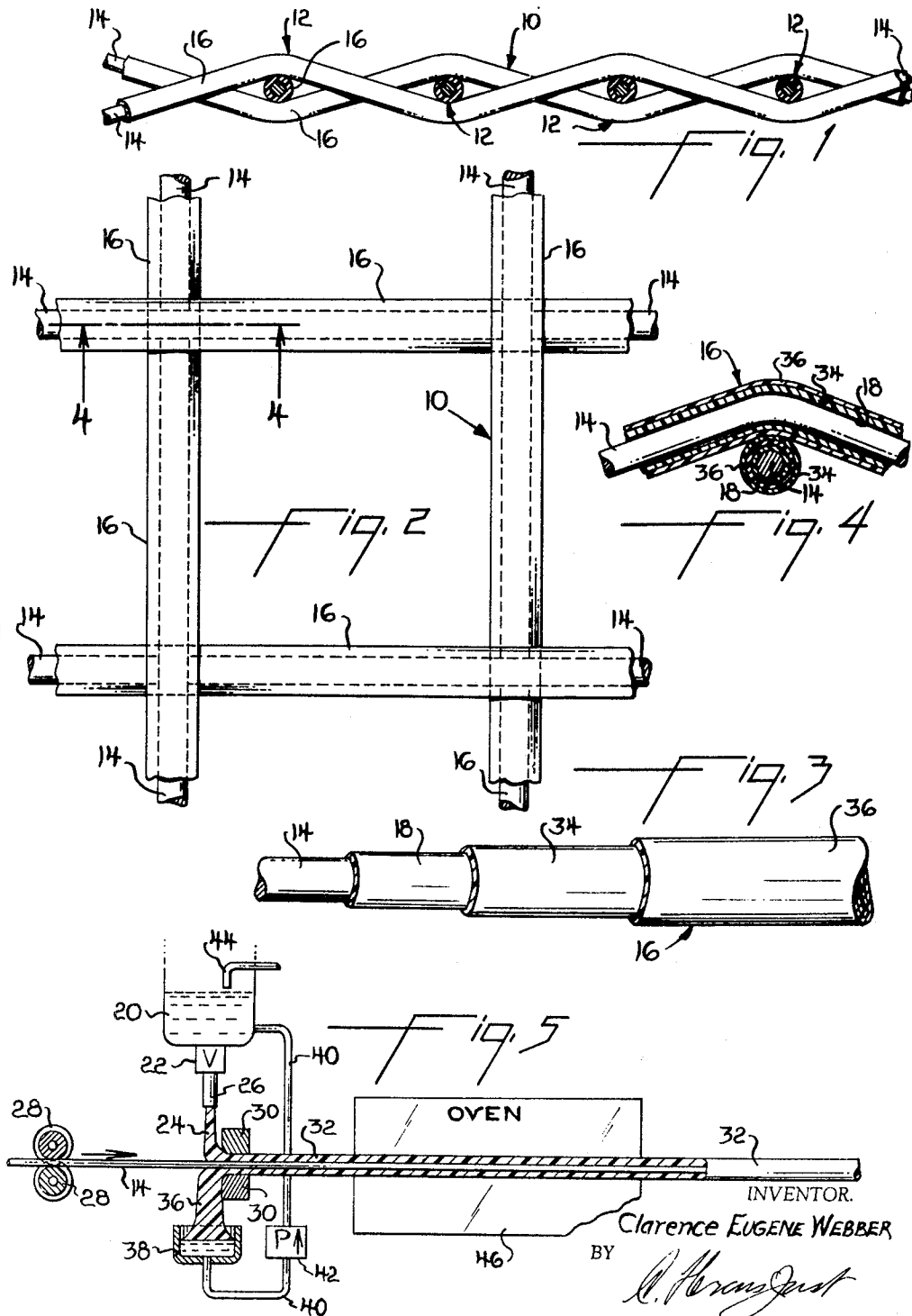
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RESIN CLAD METAL WIRE CLOTH

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RESIN CLAD METAL WIRE CLOTH

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This invention relates to an open mesh wire cloth woven from metallic wire filaments clad with synthetic resin, and a preferred method of making the same. More particularly, it relates to wire cloth woven from resin clad wire which, without such resin coating thereon, would be subject to attack by various atmospheres of a corroding nature.

It is well known that open mesh wire cloth woven from bare wire composed of iron or steel is highly subject to rusting from normal atmospheric conditions due to the presence of moisture in the atmosphere, as well as from contact by rain. Accordingly, for many years, it has been customary to coat iron or steel wire cloth with suitable material such as paint, lacquer, or the like. Usually, such coating is applied after the cloth is woven, principally because it is difficult to first coat the wire and then weave it into cloth without the coating chipping or cracking.

In an effort to provide relatively non-corroding wire cloth, substantial quantities of wire cloth now are produced from bronze or copper wire, and still other wire cloth is woven from aluminum wire. Even wire cloth woven from this type of metal nevertheless is subject to certain types of corrosion, this particularly being evident when such wire cloth used as insect screening is mounted in wooden frames which are painted a light color, the result being that corrosion from the wire screen gradually washes down upon the frame and discolors the same. Corrosion of wire cloth woven from this type of material also takes place to various degrees when it is exposed to salt atmosphere such as found at the seashore or in marine use, as well as upon small islands in the ocean.

It is well recognized that when aluminum is exposed to normal atmospheric conditions and particularly to those having a salt content, the outer surfaces of aluminum will oxidize and, particularly where aluminum wires woven into wire cloth cross each other in the weave, chafing and wear takes place due to vibration from wind and the like, whereby the useful life of such wire cloth is not as long as it could be if some means were available for preventing such oxidation or other form of corrosion. Similar results occur with steel, copper or bronze wire cloth.

As in regard to preventing corrosion of iron or steel wire cloth, attempts have been made to minimize the corrosion of wire cloth woven from copper or bronze wire, as well as aluminum wire, such as by coating the wire cloth with suitable paint or lacquer after the cloth is woven, primarily because the weaving of coated wire, when coated with conventional materials heretofore used, can not be woven to the desired degree of satisfaction due to chipping or splitting of the coating during the weaving operation.

It is the principal object of the present invention to provide an open mesh wire cloth woven from metallic wire filaments having a protective cladding or coating applied by a novel process comprising part of the inven-

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tion, said cladding comprising synthetic resin which is firmly bonded to the wire core of the composite filament and the resin cladding being applied in such manner that it is of very uniform thickness throughout the length of the wire filaments. Though the cladding or coating is sufficiently pliable to permit weaving of wire cloth therefrom without chipping or splitting of the resin, said resin is still sufficiently hard so as to resist any appreciable indenting of the resin at the cross-over points of the warp and weft wire filaments in the weave of the cloth, whereby said resin coating is of substantially uniform thickness around the wire core even at the cross-over points thereof.

Another object of the invention is to apply the resin cladding to the wire filaments by a novel process which insures firm bonding of the resin cladding to the metallic wire core, such process principally comprising first applying an initial, very thin bonding layer of uniform thickness which, upon curing, shrinks into very tight engagement with the wire core and also conforms to the surface of the metallic wire core, including any minute imperfections therein. After the same is sufficiently cured, preferably several additional thicker layers of synthetic resin are applied sequentially to the base coating and to each other, each of these additional layers being substantially completely cured before the next layer is added, whereby a suitable toughness and hardness of homogeneous resin cladding is formed upon and bonded to the metallic wire core to resist any appreciable indentation of the wire filaments at the cross-over points thereof in the weave of the cloth.

Details of the foregoing objects and of the invention, as well as other objects thereof, are set forth in the following specification and illustrated in the accompanying drawing comprising a part thereof.

In the drawing:

Fig. 1 is an enlarged cross-sectional view of open mesh wire cloth formed from metallic wire cores clad with synthetic resin in accordance with the principles of the present invention.

Fig. 2 is a still further enlarged fragmentary plan view of a single square of the woven wire cloth formed in accordance with the present invention.

Fig. 3 is an exemplary side view of a section of resin-clad metallic wire filaments such as used to form the woven wire cloth illustrated in Figs. 1 and 2, certain portions of the various layers of resin cladding being removed to illustrate the manner in which the cladding is formed upon the wire core.

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2 and illustrating particularly an exemplary cross-over point in the weave of the wire to show the lack of any substantial indentation of the resin cladding at such cross-over point.

Fig. 5 is a diagrammatic elevation illustrating an exemplary apparatus by which the resin-clad wire filaments may be formed in accordance with the present invention prior to the same being woven into resin-clad wire cloth.

In accordance with the principles of the present invention, the woven open mesh wire cloth 10 may be woven upon conventional looms such as presently are used for weaving wire cloth, and including shuttles holding bobbins of the weft wire, for example, a reed bar to beat up each weft filament after insertion in the shed of the weave to insure a uniform weave pattern, and all other usual equipment on a conventional wire cloth loom. The composite wire filaments 12 comprise metallic wire cores 14 which are clad with an integrally bonded and substantially homogeneous synthetic resin laminated coating generally indicated 16. In the various figures, it is to be understood that it has been necessary considerably to exaggerate the thickness of this coating, and especially the

various laminations thereof, in order to illustrate the same adequately.

The metallic wire cores 14 may be of any suitable metal such as iron or steel, aluminum, copper or bronze, brass, or the like. For use as normal insect screening, to which the present invention is highly applicable, a conventional diameter of metallic wire core frequently used is of the order of between .007 and .009 inch in diameter. Relatively strong metal such as iron or steel will permit the use of a metallic wire core of the smaller size, while relatively softer metal such as aluminum, copper, bronze and the like, preferably require the use of the higher order of diameter of the range set forth above.

The composite synthetic resin cladding or coating 16 applied to a metallic wire core of the range of diameters set forth above need only be of a thickness of approximately .002 inch, thereby providing an overall diameter for the composite wire filament of a range between .011 and .013 inch. Such dimensions are not to be regarded as restrictive however, since the basic principles of the invention permit variations in such dimensions.

Synthetic resins which are preferred to provide the composite cladding or coating 16 preferably are of a thermosetting nature or, if a thermoplastic resin is used, appropriate plasticizing agents including cross-linking compounds are employed which results in a synthetic resin closely resembling thermosetting resins when cured. Any appropriate synthetic resin having these general characteristics may be employed to form the composite cladding or coating 16, among such possible resins being vinyl resin to which a plastisol is added which also includes a cross-linking agent of any appropriate type, the plastisol acting as a plasticizer; polyethylene to which an appropriate cross-linking agent is added and the resin coating may be subjected to suitable heat radiation to render the same substantially thermosetting when cured; and a linear polyamide to which suitable cross-linking agents have been added, whereby the resulting resin, when cured, will have distinct thermosetting properties.

The composite resin cladding or coating 16 preferably is applied to the metallic wire core in a laminated manner. First, a base coating 18 is applied directly to the metallic wire core 14 so as to have a substantially uniform thickness throughout the length of the coated filament. The base coating 18 may be applied by apparatus similar to that shown in Fig. 5 for example, wherein the resin is maintained at a predetermined level in a reservoir 20 and a control valve 22 regulates the volume of resin solution 24 discharged from delivery pipe 26 onto the metallic wire 14 as it is fed in the direction of the arrow between grooved guide rolls 28 to a sizing die 30 which is shown in cross-section in Fig. 5. The central opening of die 30 is only very slightly larger than the diameter of the metallic wire 14, whereby the exemplary resin coating 32 applied to the bare or previously coated wire 14 is of predetermined thickness, depending upon the size of the die opening for any particular layer of resin to be applied to the wire 14. The coating 32 is greatly exaggerated in this figure and may comprise any one of the base coating 18, the second coating 34, or the exemplary final coating 36, illustrated in detail in Fig. 3, it being understood that this exact number of coatings and thicknesses thereof are intended to be exemplary rather than restrictive.

The resin solution 24, in flowing onto wire 14, completely surrounds the same and an excess amount of such solution is maintained adjacent the entrance end of the die opening, thereby preventing contact of wire 14 with the die, and solution 36 flowing into a receptacle 38 from which it is conducted through pipe 40 to the reservoir 20 by the pump 42. Make-up amounts of resin solution are supplied to reservoir 20 by spout 44 connected to any suitable source of the resin solution, not shown.

Immediately upon any individual coating of resin solution such as one of the three exemplary coatings 18, 34

and 36, shown in Fig. 3, being applied to the wire 14, the coated wire is immediately passed into an oven 46 of sufficient length and heated to a suitable temperature to completely cure and harden that particular layer of resin coating.

The resin solution supplied to the entrance end of sizing die 30 is maintained at a temperature which is well below the curing temperature of the resin, such as between about 85 and 95° F., while the temperature maintained within the oven 46 is preferably of the order between 325 and 400° F., 375° F. being the preferred temperature when using the resin material specifically described hereinafter as a preferred example. The preferred temperature utilized in oven 46 is below that at which the resin will char but is sufficiently high to insure rapid curing to produce desired hardness and toughness within the resin coating, as well as sufficient flexibility to enable the coated wire to be coiled for use in the loom upon which the resin clad metal wire cloth is woven, without chipping or splitting.

Assuming for example that either aluminum or steel wire is to be used as the wire core for the cloth to be woven in accordance with the present invention, and further assuming that vinyl resin is selected as the cladding or coating material to be applied to the metal core, it has been found that if the base or primer coating 18 comprises a plastic solution comprising essentially about 15% solid resin dissolved in about 85% plastisol of a highly volatile nature and including one or more cross-linking agents, a very fluid solution results which is capable of somewhat penetrating the exterior surface of the wire 14 while the volatile carrier ingredients of the solution are evaporating during the movement of the coated wire through the oven 46. During such coating of the wire and curing of the base coating 18 of the resin, the wire 14 may be moved at the rate of 500 feet per minute or higher which, incidentally, is materially faster than speeds used in applying similar fluid-type resin coatings to metallic wires to form electrically insulated wire conductors of various kinds. Further, it is highly practical to feed multiple parallel strands of wire simultaneously through the coating apparatus and oven, whereby the total production is vastly increased over the coating of a single strand individually. The length of the oven 46 also is such as to permit the resin coating to cure fully and the volatile vehicle thereof to be completely evaporated substantially by the time the wire emerges from the exit end of the oven.

The exemplary intermediate cladding or coating 34 and the exemplary final cladding or coating 36 preferably are each thicker than the base coating 18. Assuming further, for example, that the total composite resin coating to be applied to the wire 14 is not to exceed .002 inch, the thickness of the base coating 18 should not exceed .0005 inch and preferably is slightly less than this in thickness. The principal function of the thin base coating 18 is to bond very firmly to the wire 14 by shrinking the same tightly into minute conformity with the outer surface thereof and also to provide a base with which the subsequent coatings are compatible for effective bonding, whereby a substantially unitary composite and homogeneous resin cladding or coating 16, which is substantially .002 inch in thickness, for example, is formed upon the wire 14.

The coating layers 34 and 36 are successively applied to the base coating 18 and the intermediate coating 34 respectively by apparatus similar to that shown in Fig. 5 except that the sizes of the central openings in the die 30 are selected to produce the desired outer diameter of the coating to be applied, thereby accurately controlling the thickness of each coating. Also, these subsequent coatings are applied by using resin solutions which are substantially more viscous than the base coating 18, such resin solutions essentially consisting of up to 90% solid resin material such as vinyl compounds and including cross-

link and plasticizing agents, dissolved in at least 10% of volatile vehicle to provide a relatively hard resin coating layer when the same has been cured and the volatile portions of the solution have been evaporated by passing the same through the oven 46 at the desired temperature within the range specified above and at a high speed of the order of 500 feet per minute or more.

The base coating on the bare metallic wire 14 or the resin coatings subsequently applied thereto are sized accurately by the selected opening in die 30 throughout the length of the wire and, rather than use a separate oven to cure each resin coating and evaporate the volatile content thereof, a single oven 46 may be used by passing the coated wire successively in opposite directions through the oven and around suitable guide pulleys, additional coatings being applied to the wire immediately before each passage through the oven.

It has been found that by applying a plurality of resin coatings to the metallic wire core 14 by the process described above and illustrated in the drawing, not only is a uniform diameter of the resin-clad wire produced but the cladding is sufficiently hard to substantially resist any indentation thereof at the cross-over points as is illustrated in exemplary manner in Fig. 4. Hence, when open mesh wire cloth is woven from such resin-clad wire filaments, the substantial lack of indentation of the resin at the cross-over points of the weave will result in the wire cloth racking readily, thereby being conformable with ease to irregularities, for example, in frames to which the wire cloth is applied, especially when serving as insect screening.

Further, although the resin-clad wire which is formed in accordance with the above described process has a relatively hard composite resin coating thereon, the wire may be coiled and also woven without chipping or splitting of the coating, whereby the metallic wire cores at the cross-over points of the woven cloth, as shown in Fig. 4, are uniformly covered by resin which is free from chipping and cracks, thereby insuring protection of all parts of the wire filaments and woven wire cloth from corrosive agents in the atmosphere. In addition, the double thickness of the composite resin coatings 16 at the cross-over points of the weave of the cloth provides an improved construction to insure protection of the wire from corrosion effects of the atmosphere at such cross-over points of the weave which are the points where vibration conditions such as produced by wind or the like tend to disintegrate conventional coatings such as paint and lacquer, whereby corrosion of the metallic core usually commences at such points.

From the foregoing, it will be seen that the present invention comprises an open mesh wire cloth woven from suitable metallic wire filaments clad with one of a number of synthetic resin materials, which cladding is in the nature of a composite, laminated series of superimposed coatings firmly bonded to the metallic wire core and to each other and is sufficiently hard to prevent any appreciable indenting of the resin coating at the cross-over points of the weave, even though the weft filaments are beaten-up by the reed bar of the loom into the shed of the weave, thereby insuring protection of the metallic wire core for long periods of time from corrosive elements within the atmosphere to which the wire cloth is subjected. Substantially free racking or skewing within the plane of the wire cloth also is provided so as to permit ready adap-

tation of the wire cloth to irregularities in frames or other items to which the cloth is to be connected. Such hardness of the resin coating and consequent lack of indentation at the cross-over points of the weave insures that the wire cloth will be resistant to wearing of the resin coatings generally and especially at the cross-over points, for long periods of time.

The process comprising the present invention also is responsible not only for permitting the fluid-type resin coated composite wire filaments to be manufactured at speeds far greater than those customarily used heretofore, but the manner of applying the various individual coatings which are laminated to the wire and each other produces the desired hardness in the laminated coating which is responsible for the substantial lack of indentation of the resin coating at the cross-over points of the weave of the cloth.

While the invention has been described and illustrated in its preferred embodiments, and has included certain details, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways falling within the scope of the invention as claimed.

I claim:

1. Open mesh wire cloth woven from metallic wire filaments each clad with a plurality of protective coatings comprising solely substantially uniform thickness of synthetic resin thereon applied successively in liquid form to the wire before weaving, and successively hardened to provide a resin clad woven wire cloth having substantially no indentations formed in said coatings at locations where the wire filaments cross each other in the weave of the cloth, whereby said resin-clad wire cloth is protected uniformly throughout to resist corrosion and will rack to permit adaptation of said cloth to irregularities in frames and the like to which said cloth may be attached.

2. Open mesh wire cloth woven from metallic wire filaments each clad with a plurality of protective coatings comprising solely substantially uniform thickness of synthetic resin thereon applied successively in liquid form to the wire before weaving and successively hardened to provide a resin clad woven wire cloth having substantially no indentations formed in said coatings at locations where the wire filaments cross each other in the cloth, the innermost coating being shrunken tightly into minute uniformity with said metallic wire filaments to bond firmly thereto and also form a base coating to which the next successive coating is bonded firmly, whereby said resin-clad wire cloth is protected uniformly throughout to resist corrosion and will rack to permit adaptation of said cloth to irregularities in frames and the like to which said cloth may be attached.

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