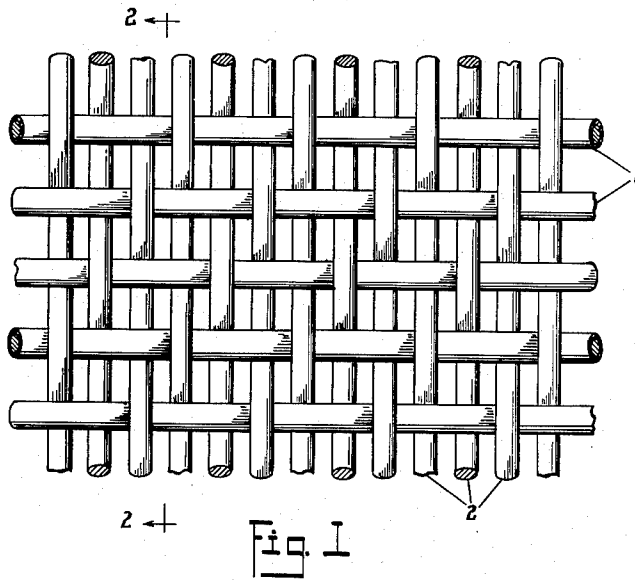
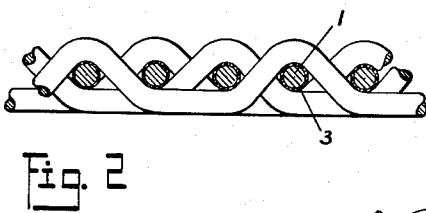
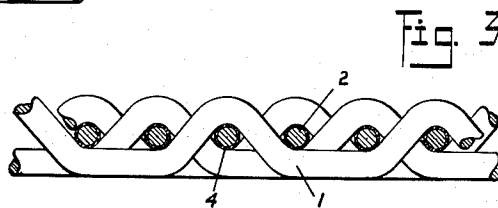
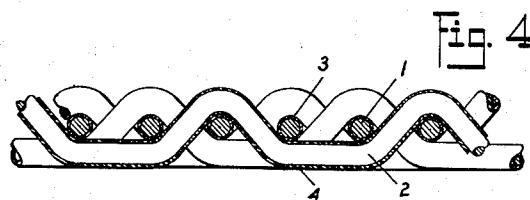
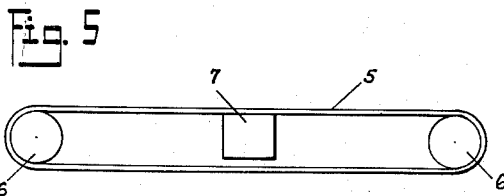


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A. G. HOSE ET AL
FOURDRINIER WIRE CLOTH

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INVENTORS
ALFRED G. HOSE,
LAURENCE D. KUNSMAN AND
GEORGE P. WENNES
BY
Teane, Kramer, Sturges & Fetzer
ATTORNEYS

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2,992,469

FOURDRINIER WIRE CLOTH

Alfred G. Hose, Cleveland, Laurence D. Kunsman, Willoughby Lake, and George P. Wennes, Lyndhurst, Ohio, assignors to The Lindsay Wire Weaving Company, Cleveland, Ohio, a corporation of Ohio

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This invention relates, as indicated, to an improved Fourdrinier wire cloth for use in fabricating wire cloth belts for use on Fourdrinier paper-making machines.

Fourdrinier paper-machine wire cloth has heretofore been woven from warp wires and shute wires composed of Phosphor bronze and brass, respectively. While wire cloth formed of these materials has performed reasonably satisfactorily in the past, it has now been discovered that the life of Fourdrinier wire cloth belt can be substantially increased by coating prior to weaving either or both of the warp and shute wires with a very thin coating of a water insoluble solid film forming material. Such plastic coating of the warp and/or shute wires used in the fabrication of Fourdrinier wire cloth belts has provided still further advantages.

As a result of plastic coating such wires, improvement in the weaveability of ordinary Fourdrinier alloys is found, and additionally, it has been found that shute alloys which cannot ordinarily be woven into and used in Fourdrinier wire cloth, now become available for use. Success with these additional alloys results, it is believed, from the lubricative effect of the plastic, mitigation of the influence of certain undesirable metal surface characteristics, and the rendering of the shear strength of the alloy less critical by allowing less severe shute driving force in the weaving operation. The cloth as woven, whether entirely of Phosphor bronze alloy or with the additional shute material alloys hereby made available, has considerably greater resistance to failure by bending, or fatigue failure. This is found to be true in either direction in which the coated wire is used. When used in both directions, i.e., for warp and shute, a greater gain in bend resistance results than that which might be expected from use in either singular direction.

Still other advantages which have been secured by reason of providing coated warp and/or shute wires, have included an increase in life of the belt on the paper-making machine, improved drainage allowing better water removal with less stationary suction-box vacuum on the paper machine, and improved corrosion resistance of the coated wire compared with the uncoated wire.

Where lighter alloys now become available as the shute wire, it is possible to use a less dense metal for the shute thereby reducing the weight of the wire cloth by as much as 20%.

It is a principal object of this invention, therefore, to provide an improved Fourdrinier paper-making machine wire cloth belt.

Other objects of the invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends said invention, then, consists of the means herein-after fully described and particularly pointed out in the appended claims, the following description and annexed drawings setting forth in detail certain illustrative embodiments of the invention, such disclosed means constituting, however, but a few of the various forms in which the principle of this invention may be employed.

Briefly stated then, this invention contemplates the provision of a woven wire belt for a Fourdrinier machine, comprising warp wires having a diameter of 0.007" to 0.0105" and shute wires having a diameter of 0.008" to 0.0120" at least one of such classes of wires being coated

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prior to weaving with a solid water insoluble film-forming material adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter.

In the annexed drawings:

FIG. 1 is an enlarged plan view of a woven wire fabric or cloth of twill weave showing the larger shute wires horizontally.

FIG. 2 is a cross-section taken on the line 2—2 of FIG. 1, showing a coating on the shute wires.

FIG. 3 is a cross-section of a Fourdrinier wire cloth showing a coating on the warp wires.

FIG. 4 is a cross-section showing the shute wires of FIG. 3 also being coated.

FIG. 5 is a diagrammatic view of a wire fabric in accordance with our invention mounted on the rollers and passing across a suction box of a Fourdrinier paper-making machine.

It has been found that by applying by known wire coating techniques, any of a wide variety of plastic coatings to Fourdrinier warp and/or shute wires, that these wires can be woven without destruction of the plastic and provide substantial improvement in the finished Fourdrinier wire cloth.

Generally speaking, the materials which can be applied to the wire to obtain the advantages of the present invention are high molecular weight thermoplastic or thermosetting polymers, having an average molecular weight generally in the range of above 1,000 up to several hundred thousand. The nature of the polymeric material used in forming the films on the warp and/or shute wires is not critical. The only necessary physical qualifications of the resin or polymer, being that it shall be water insoluble in its dried or hardened form, and that it be applied to form a continuous rather than a discontinuous film. Thus, there may be used for forming these solid insoluble films, polyamide resins such as nylon, e.g., nylon formed from hexamethylene-diamine and adipic acid; polyurethane resins, which are esters of dicarbamic acid and a glycol, e.g. the condensation product of hexamethylene-diisocyanate with pentomethylene glycol; linear and branched polyethylene crystalline polypropylene, e.g. such as produced in accordance with Belgium Patent 538,782, and polytetrafluoroethylene; vinyl chloride polymers, vinyl chloride-vinyl-acetate co-polymers, melamine-formaldehyde, butylated melamine-formaldehyde resins, urea-formaldehyde, phenol-formaldehyde resins, etc. The high polymer resins may be coated onto the wire by well-known techniques, and the films may be deposited either from lacquer solutions, or from aqueous emulsions of the resins, or as plastisols or organisols. The polyamide and the polyurethane resins, for example are conveniently deposited from lacquer solutions, while the polyethylene, polypropylene, and tetrafluoroethylene resins are conveniently deposited from aqueous dispersion.

One method by which these plastic materials are applied to the individual strands of warp and shute wires is identical to the process used for coating magnet wire or other such electric wire with an enamel coating. Basically, the wire is passed through a bath of the lacquer, through sizing dies, and then to a curing oven where the resin carrier or solvent is evaporated from the wet film covering prior to or during any subsequent polymerization of the resin which may occur. Certain of the resins are deposited in fully polymerized form as a solid film, and certain other resins may be deposited in a form such that by heating in an oven, further polymerization and hardening does occur. Baking enamels, such as, the melamine and urea-formaldehyde resins undergo further polymerization and cross-linking to harden films cast therefrom.

For the purposes of the present invention, it is preferred to employ a multi-coating process in order to se-

cure a degree of adhesion of the plastic coating to give the most satisfactory product.

Referring more particularly to FIG. 1 there is here shown, a much enlarged plan view of a Fourdrinier wire cloth of twill weave. The shute wires 1 are horizontally disposed and the warp wires 2, are vertically disposed in the drawing. FIG. 2 is a cross-sectioned view on the line 2—2 of FIG. 2 showing the shute wire 1 in cross-section and having a solid plastic coating 3, thereon. FIG. 3 is a cross-section of a Fourdrinier wire cloth showing the warp wires in cross-section as they would appear with a plastic coating 4 thereon. FIG. 4 is a cross-section of FIG. 3 showing the shute wires also having a plastic coating 3 thereon. FIG. 5 shows in diagrammatic form, a Fourdrinier belt 5 mounted on rollers 6 and passing over suction box 7.

The wires which may be coated in accordance with the present invention include brass, bronze, aluminum, steel and stainless steel wires having the following size ranges:

	Diameter
As shute wires -----	0.008"—0.0120"
As warp wires -----	0.0070"—0.0105"

Nominally, 0.0005" is added to the diameter of any given wire size by the coating process. The specific tolerance held in coating these sizes ranges from plus or minus 0.0001" on the small diameters to plus or minus 0.0002" on the larger sizes.

As examples of the manner in which the coatings are generated in three successive passes through the wire coating process, the following schedule is illustrative of two extreme sizes:

	Diameter, inches	
	Bare 0.0070	Bare 0.0120
First pass-----	0.00715	0.0122
Second pass-----	0.0073	0.0123
Third pass-----	0.0075	0.0125

The amount of build of film thickness on the wire diameter is limited to 0.0005" nominal, for the following reasons: This amount of build does not interfere with the seam brazing operation (see Patent 2,496,052, dated Jan. 31, 1950) which makes the Fourdrinier wire cloth into an endless Fourdrinier wire cloth belt. This amount of build is the optimum amount needed for uniform continuity of coating. This amount of build is that which has been found to impart optimum weaveability to the wire. Beyond this amount of build, the cloth becomes sleazy during operation on the paper machine.

The seam brazing operation is critically dependent on the cleanliness of the immediate area of seaming, and excessive carbonaceous residue from plastic coating interferes with the character and quality of the seam. Uniformity of the coating is important to control the uniformity of shute count during weaving and this is critically dependent on extremely accurate control of the dimensions of the sizing dies used in the wire-coating process. Such accuracy is secured by sorting at 75 to 150 magnifications by shadowgraph microscope. The dies are sorted to the nearest 0.00025".

Coatings in excess of a 0.0005" build on the diameter seriously affect the performance of the Fourdrinier belt on the machine. While the plastic between the warp and shute at the cross-over point forms a mechanical lock during weaving, the load on the belt during operation of the paper machine and the elevated temperature of the operation causes the wire to stretch and become sleazy. This almost invariably causes wrinkling and subsequent immediate tearing of the belt. This is a drastically expensive type of failure. With builds of 0.0005" or less on the diameter, these difficulties are not encountered.

In usual practice, if the warp and/or shute wires are not coated, there is limitation on the choice of alloys which can be made for these wires. The warp alloy has remained unchanged for years, and is a grade C Phosphor bronze with the following nominal composition: copper, 92.5%, tin 7.5%, phosphorous, 0.30%. By plastic coating of this alloy wire, it is found that the properties of fatigue, strength, corrosion resistance and ductility can be substantially improved.

The shute alloys for Fourdrinier wire cloth have run through the alpha-brass composition range. In recent years the following alloys have been used.

- (1) 80% copper, 20% zinc.
- (2) 83% copper, 17% zinc.
- (3) 85% copper, 15% zinc.

These alloys suffer from lack of corrosion resistance and have been used in the nickel and tin-plated forms. In addition the following alloys of special composition have been tried to gain weaveability and corrosion resistance:

- (1) Tin brass composed of 0.5%—1% tin, 80% copper, balance, zinc.
- (2) Aluminum brass—Unsuccessful.
- (3) Silicon-bronze—Unsuccessful.
- (4) Aluminum alloys—Unsuccessful.

By coating the unsuccessful alloys immediately above-mentioned in accordance with the present invention and weaving them as shute wires, Fourdrinier wire cloth belts of satisfactory performance have been made. An aluminum alloy composed of 5% magnesium, .1% manganese, .1% chromium, balance aluminum, has been used as a shute wire when coated with nylon enamel purchased as number 12 fine wire nylon enamel, consisting of 15% solids as prime chip of nylon dissolved in cresylic acid, to be used as received without dilution at 110°—115° F.

When increased resistance to shute direction distortion in the belt is needed, it has been found that a steel alloy wire such as any low carbon basic open-hearth stock having an average composition, for example, of 0.3% carbon or less, less than 1.65% manganese, the balance iron, and trace impurities or any other low carbon steel which has been bright-annealed and has a liquor finish, may be used. Coating increases the flexibility of the steel wire and imparts corrosion resistance rendering it suitable for use in the manufacture of Fourdrinier wire cloth.

In the manufacture of Fourdrinier wire cloth belts, the direction of travel of the belt coincides with the direction of the warp wires. The shute wires are, therefore, cross-wise of the direction of travel of the belt. In describing the wire cloth, the art makes reference to the number of wires per inch rather than the number of openings per inch as is usual, for example, in classifying screens for particle size classification purposes. Thus, a 30 by 28 mesh wire cloth indicates 30 warp wires per inch of length and 28 shute wires per inch of width, the warp being mentioned first. Size ranges run from 16 x 14 mesh to 98 x 96 mesh. The coarsest mesh belts are used for production of paper board, while the finest mesh belts are used for production of cigarette and condenser paper. The intermediate size meshes range in usage from heavy kraft papers to tissue papers. In general, the amount of open area ranges from about 34.5% in the 16 x 14 mesh wire belts to 22% for the 98 x 96 mesh. These percentages mean for example, that 0.345 square inch for each 1 square inch is open area.

There has been provided in the present invention, an improved Fourdrinier wire cloth in which either one or both of the warp and shute wires has been coated with a very thin coating not exceeding as addition of 0.0005" to the diameter of the wire and woven into a wire cloth to form a belt for use in a Fourdrinier paper-making machine. The life of the belts formed of warp and shute

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wire, either or both of which are coated, is greatly improved. The range of alloys which can be used as shute wire is greatly expanded and problems of corrosion resistance are greatly alleviated. The drainage of water from the paper pulp, through the wire cloth, is more complete and rapid, and the normal difficulties of heavier coatings on wire, such as sleaziness in the cloth, are avoided.

Other modes of applying the principle of this invention may be employed instead of those specifically set forth above, changes being made as regards the details herein disclosed provided the elements set forth in any of the following claims or the equivalent of such be employed.

It is therefore, particularly pointed out and distinctly claimed as the invention:

1. A woven wire belt for a Fourdrinier machine having a mesh size in the range of from about 16 x 14 to about 98 x 96 comprising warp wires having a diameter of from 0.007" to 0.0105" and shute wires having a diameter of 0.008" to 0.0120", at least one of such classes of wires having a coating thereon of a solid water insoluble non-metallic film-forming material adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter.

2. A woven wire belt for a Fourdrinier machine having a mesh size in the range of from about 16 x 14 to about 98 x 96 comprising warp wires having a diameter of from 0.007" to 0.0105" and shute wires having a diameter of 0.008" to 0.0120" said warp wires having a coating thereon of a solid water insoluble non-metallic film-forming material adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter.

3. A woven wire belt for a Fourdrinier machine having a mesh size in the range of from about 16 x 14 to about 98 x 96 comprising warp wires having a diameter of from 0.007" to 0.0105" and shute wires having a diameter of 0.008" to 0.0120" said shute wires having a coating thereon of a solid water insoluble non-metallic film-forming material adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter.

4. A woven wire belt for a Fourdrinier machine having a mesh size in the range of from about 16 x 14 to about 98 x 96 comprising warp wires having a diameter of from 0.007" to 0.0105" and shute wires having a diameter of from 0.008" to 0.0120" said warp wires and said shute wires having a coating thereon of a solid water insoluble non-metallic film-forming material adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter.

5. A woven wire belt for a Fourdrinier machine in accordance with claim 1, in which the solid water insoluble film-forming material is a thermoplastic resin.

6. A woven wire belt for a Fourdrinier machine in

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accordance with claim 1 in which the solid water insoluble film-forming material is a thermosetting resin.

7. A woven wire belt for a Fourdrinier machine in accordance with claim 1 in which the solid water insoluble film-forming material is a polyamide resin.

8. A woven wire belt for a Fourdrinier machine in accordance with claim 1 in which the solid water insoluble film-forming material is nylon.

9. A woven wire belt for a Fourdrinier machine in accordance with claim 1 in which the solid water insoluble film-forming material is polyethylene.

10. A woven wire belt for a Fourdrinier machine in accordance with claim 1 in which the solid water insoluble film-forming material is a polyurethane resin.

11. A woven wire belt for a Fourdrinier machine in accordance with claim 3 in which the warp wires are Phosphor bronze, and the shute wires are of aluminum alloy.

12. A woven wire belt for a Fourdrinier machine in accordance with claim 3 in which the warp wires are of Phosphor bronze and the shute wires are of low carbon steel.

13. The method of making a woven wire belt for a Fourdrinier paper machine which comprises the steps of coating a Phosphor bronze warp wire having a diameter of about 0.0070" to 0.0105" with a water insoluble non-metallic film-forming material to provide a solid coating adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter, coating an aluminum alloy shute wire having a diameter of from 0.008" to 0.0120" with a water insoluble non-metallic film-forming material to provide a solid coating adding no more than 0.0005" plus or minus (0.0001" to 0.0002") to the wire diameter and weaving said coated wires to form a Fourdrinier wire cloth.

14. A process in accordance with claim 13 in which the water insoluble film-forming material is a solution of a thermoplastic resin in an organic solvent, and wherein each of said coating steps to provide the desired thickness of water insoluble film forming material on the respective wire is performed in a plurality of successive stages resulting in a laminar-like application of build-up material on the wire.

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