No. 834,074. PATENTED OCT. 23, 1906.

J. S. PATTERSON.

HOSE.

APPLICATION FILED AUG. 30, 1905.

FIG. 1.

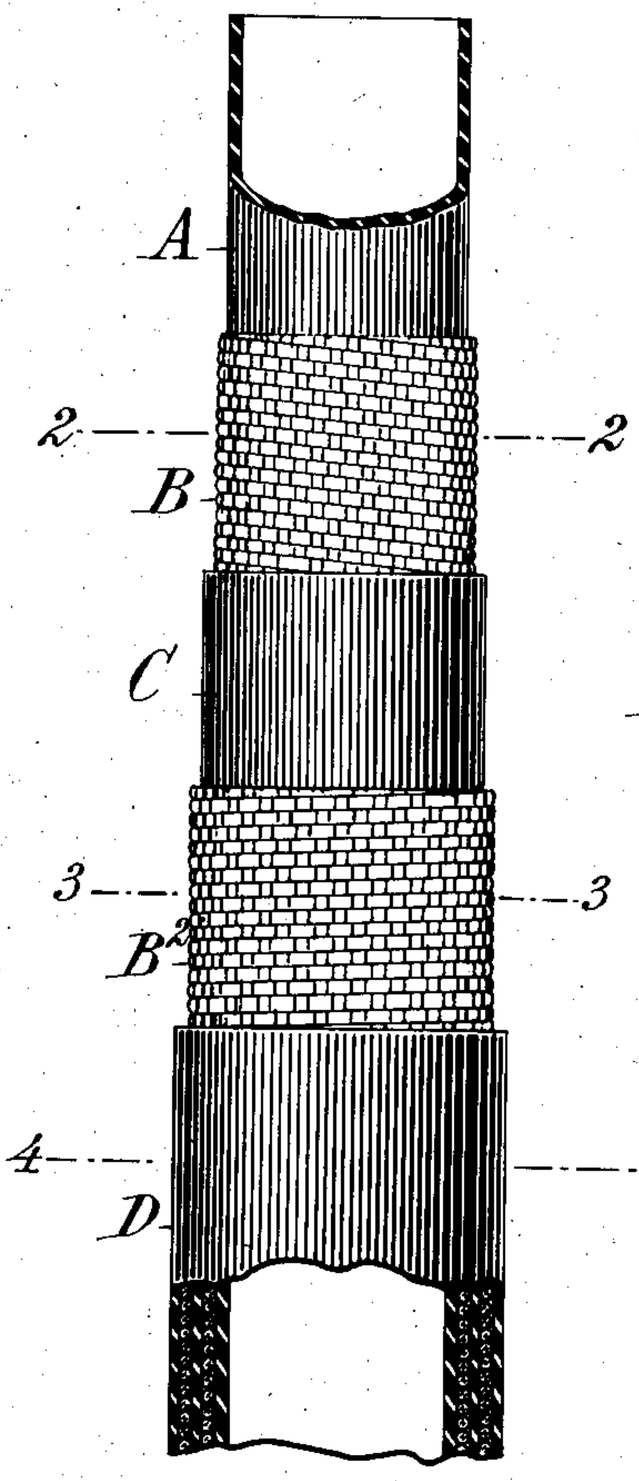

FIG. 2.

FIG. 3.

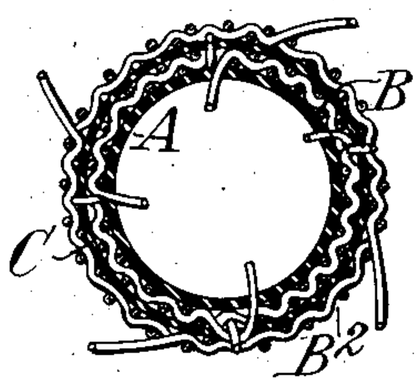

FIG. 4.

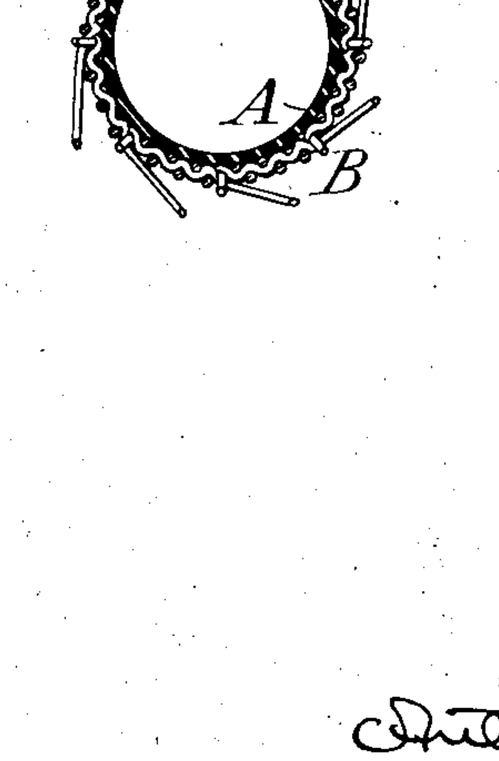

FIG. 6.

FIG. 5.

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UNITED STATES PATENT OFFICE.

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HOSE.

No. 834,074. Specification of Letters Patent. Patented Oct. 23, 1906.

Application filed August 30, 1905. Serial No. 276,387.

To all whom it may concern:

Be it known that I, JOHN S. PATTERSON, a citizen of the United States, residing at Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Hose, of which the following is a specification.

This invention relates to rubber or analogous hose of the kind having cores or strengthening-webs of textile fabric.

Prior to this invention rubber hose has been chiefly of three kinds or types—namely, first, "fabric hose," comprising a flat web of woven fabric saturated with rubber or composition and wound on a mandrel for as many turns as give the number of thicknesses desired to make, for example, two-ply, three-ply, or four-ply hose; second, "braided hose," where the textile core is formed of threads braided together, so that one of the series of threads proceeds in right-hand spirals and the other in left-hand spirals, usually at an angle or pitch of approximately forty-five degrees; third, "woven hose," where the fabric layer is woven in a circular loom, the warp-threads extending longitudinally and the wefts running around in a spiral, which is of very low pitch if a single shuttle is used, and the pitch of which increases with a given size of weft in direct proportion to the number of shuttles, so that with a four-shuttle loom the weft has quite a perceptible pitch. With each of these kinds of hose there is ordinarily an inner lining-tube of rubber and an outer covering of rubber or rubber composition, often protected externally by a layer of friction fabric. With each kind also the textile core is usually so impregnated with rubber or the like as to be impervious, and in case of two or more layers or plies of textile fabric these are united by the impregnating composition or by an intervening layer of rubber or other cementing material.

The fabric hose has in the past been the most extensively used. The fabric is ordinarily cut on the bias, so that it is applied with its warp and weft threads extending obliquely to the hose. It is sometimes also applied with its threads extending longitudinally and transversely of the hose. The disadvantages of fabric hose are that it is unsymmetrical and with a bias fabric is liable to swell and stretch under pressure, and for use with steam or other fluid under pressure a leak in the inner tube is commonly followed by a burrowing of the fluid between the layers of fabric, thereby destroying their adherence and ultimately ruining the hose.

Braided hose has had a comparatively limited use owing to its inherent defect that by reason of the steep spiral of its textile threads it swells under pressure and if loosely braided also stretches endwise. In some instances it is found to swell transversely and shorten endwise under pressure. Braided hose is intrinsically weak and incapable of successfully sustaining a material internal pressure.

The most perfect hose heretofore made has been the woven hose. It is very strong, does not expand or swell under pressure, and ordinarily does not stretch or shorten. Its incapability of expanding, however, renders it almost impossible to force the shank of a coupling into it without injuring it, which in practice is a serious disadvantage. It also is subject to a tendency to twist under pressure, owing to the fact that its weft-threads are applied spirally. This tendency would be practically eliminated or scarcely perceptible if the core were woven with only a single shuttle lying on a single weft, because of the low pitch of the spiral of such weft; but this makes its production so slow as to be unduly expensive. It is desirable to operate the circular loom with at least four shuttles, and preferably with eight shuttles, since thereby with a given speed of rotation the hose is woven four times or eight times as fast as would be the case with a single shuttle; but the use of four wefts gives such a perceptible pitch that the hose exhibits a very annoying twist under pressure. This defect is much more marked with eight wefts and becomes so annoying that the use of eight shuttles is practically interdicted. The steeper pitch is due to the combined width of the wefts for one turn, being (according to the number of shuttles) four or eight times the width of a single weft.

My present invention relates to woven hose of two or more plies and aims to avoid the tendency of the hose to twist under pressure and to impart to it sufficient elasticity to enable it to receive the shank of a coupling

without injury, while avoiding any weakening of the hose in its resistance to internal pressure.

To these ends my invention provides as the reinforcing means a combination of two (or more) layers or plies of woven fabric each of the character produced by weaving on a circular loom—that is to say, each has longitudinal warps and spiral wefts, the wefts of one fabric or web being right-hand and those of the other being left-hand spirals. The weft spirals should be of equal pitch in order that the tendency of an internal pressure to impart a right-hand twist to one web shall be neutralized by its tendency to impart an equal left-hand twist to the other web. To this end the two webs or textile layers are interengaging, being so united that neither can move or twist under pressure independently of the other. This is best done by cementing them together by an intervening layer of rubber composition.

While my invention is embodied in a two-ply hose, it is not limited thereto, since there may be two, three, or more layers of tubular woven fabric with their wefts extended spirally in alternately opposite directions, so as to mutually resist and neutralize the twisting tendency of one another.

While my invention might be realized in a hose the woven layers of which have each but a single weft-thread, yet it is preferable that the wefts be spirals of steeper pitch, and preferably at least as steep as that corresponding to the use of four wefts or to the employment of four shuttles in the loom. My invention goes further, however, and contemplates the employment of eight or even more shuttles, depending, however, upon the size and diameter of the hose, in order that the weft-threads may be laid on in a spiral of a sufficiently steep pitch to impart a certain amount of elasticity or expansibility under internal pressure, but without permitting the hose to materially yield to this pressure.

My invention avoids both extremes of pitch heretofore used—namely, the nearly zero pitch of a single weft in a woven hose, on the one hand, and the approximately forty-five-degree pitch of the respective threads in the core of a braided hose. Such number of shuttles as will afford a pitch for the weft-threads varying between five degrees and ten degrees to a plane perpendicular to the axis of the hose will be found to best realize the conditions of my invention. Take, for example, a hose of two inches internal diameter with its fabric core woven with eight shuttles, using a thread of the size ordinarily used giving about sixteen meshes to the inch, the pitch of the wefts will be about seven degrees, and this will be found in practice to give excellent results. This or approximately this pitch affords a slight capacity of expansion, sufficient, especially when accompanied by a longitudinal compressive strain, to enable the shank or thimble of a coupling to be forced into the end of the hose without bursting or injuring it, since the wefts are thereby forced back upon themselves to a spiral of lower pitch, accompanied by a corresponding lateral expansion, which is most marked in the inner layer or core and is partly taken up by the intervening layer or tube of rubber commonly provided between the webs or cores.

Having thus indicated the nature of my invention, I will now proceed to describe in detail one embodiment thereof with reference to the accompanying drawings, wherein—

Figure 1 is an elevation of my improved hose, partly dissected away to show its successive layers, the hose here shown having a two-ply core. Fig. 2 is a transverse section thereof on the line 2 2 in Fig. 1, showing a four-weft fabric woven upon the lining-tube. Fig. 3 is a transverse section on the line 3 3, showing the inner and middle fabric layers woven on. Fig. 4 is a transverse section on the line 4 4. Fig. 5 is a dissected elevation showing a four-ply hose. Fig. 6 is a transverse section thereof on the line 6 6, showing an eight-weft fabric woven upon the lining-tube.

In the drawings the illustration of the woven fabrics is partly conventional and is not to be taken as a mathematically exact portrayal thereof.

In the drawings, let A designate the usual inner or lining tube, which is commonly made of pure rubber. Around this is woven the inner fabric layer B. Around this is applied a layer of any cementitious material, preferably a layer C of rubber. Around this is woven a layer B^2 of fabric, the wefts of which are pitched in the contrary direction to that of the fabric B. For a two-ply hose the outer covering D will be at once applied, as shown in Fig. 1, but for a three-ply or four-ply hose another layer C^2 of rubber is applied over the fabric B^2, and over this is wound a third fabric layer B^3. For a four-ply hose another layer C^3 of rubber is applied, and over this a fourth layer B^4 of fabric is woven on, and, finally, the outer covering-layer D is applied in the usual manner. The fabric layers B B^2 B^3 B^4 are woven on successively by means of an ordinary circular loom, using as many shuttles as are necessary to impart to the wefts the desirable pitch or inclination. When the layers of hose are thus united, the hose is cured or vulcanized in the usual manner, whereby the layers are thoroughly and permanently cemented together.

In two-ply hose the outer and inner fabric layers should have their wefts of equal and opposite pitch. This is done preferably by using wefts of the same size and an equal number of shuttles running in contrary direc-

tions. For a three-ply hose the two inner layers may thus equally oppose each other, and being ordinarily of sufficient strength to resist any internal pressure for which the hose is designed to be used the outer fabric layer or core may have some other or different pitch or may be applied according to some other or different system or of different material without affecting my invention. Preferably, however, the outer layer is woven on like the others and has its wefts pitched contrary to those of the next inner layer. Any number of textile layers may be used, according to the degree of strength required.

My improved hose is non-twisting and practically non-expansible and does not materially shorten under pressure. If made with the wefts of a suitable pitch—say from seven degrees up to any practicable limit—it is given a sufficient expansibility to enable it to receive the hose-coupling shanks without injury. The hose has the utmost pliability consistent with the requisite strength, and as its layers are wholly distinct leakage through either one of the rubber tubes or layers A C does not result in any spiral burrowing of the contained fluid nor in any leakage or disruption of the hose.

While I have described my invention as applied to hose, it will be understood that it may be used in the manufacture of other devices—such, for instance, as electric cables or the like.

I claim as my invention the following-defined novel features substantially as hereinbefore specified, namely:

1. A hose comprising two tubular woven interengaging webs, the one within the other, each having longitudinal warps and spiral wefts, and the wefts of said webs being respectively right and left spirals.

2. A hose comprising two tubular woven interengaging webs, the one within the other, each having longitudinal warps and spiral wefts, and the wefts of said webs being respectively right and left spirals of equal pitch.

3. A hose comprising two tubular woven interengaging webs, the one within the other, each having longitudinal warps and spiral wefts, the latter four or more in number for each web, and the wefts of said webs being respectively right and left spirals.

4. A hose consisting of a lining-tube, a woven web inclosing it, a second woven web cemented to the first, and an outer covering layer, said webs having each longitudinal warps and spiral wefts, the latter being spirals of opposite pitch.

5. A hose comprising a plurality of tubular woven interengaging webs one within another, each web having longitudinal warps and spiral wefts, the latter having sufficient pitch to afford a slight expansibility under longitudinal compression, and the wefts of said webs being spirals of opposite pitch.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN S. PATTERSON.

Witnesses:
EUGENE V. MYERS,
THEODORE T. SNELL.