No. 610,462. Patented Sept. 6, 1898.

# B. L. STOWE.

## TUBULAR WOVEN FABRIC.

(Application filed Mar. 31, 1898.)

(No Model.)

Fig. 1.

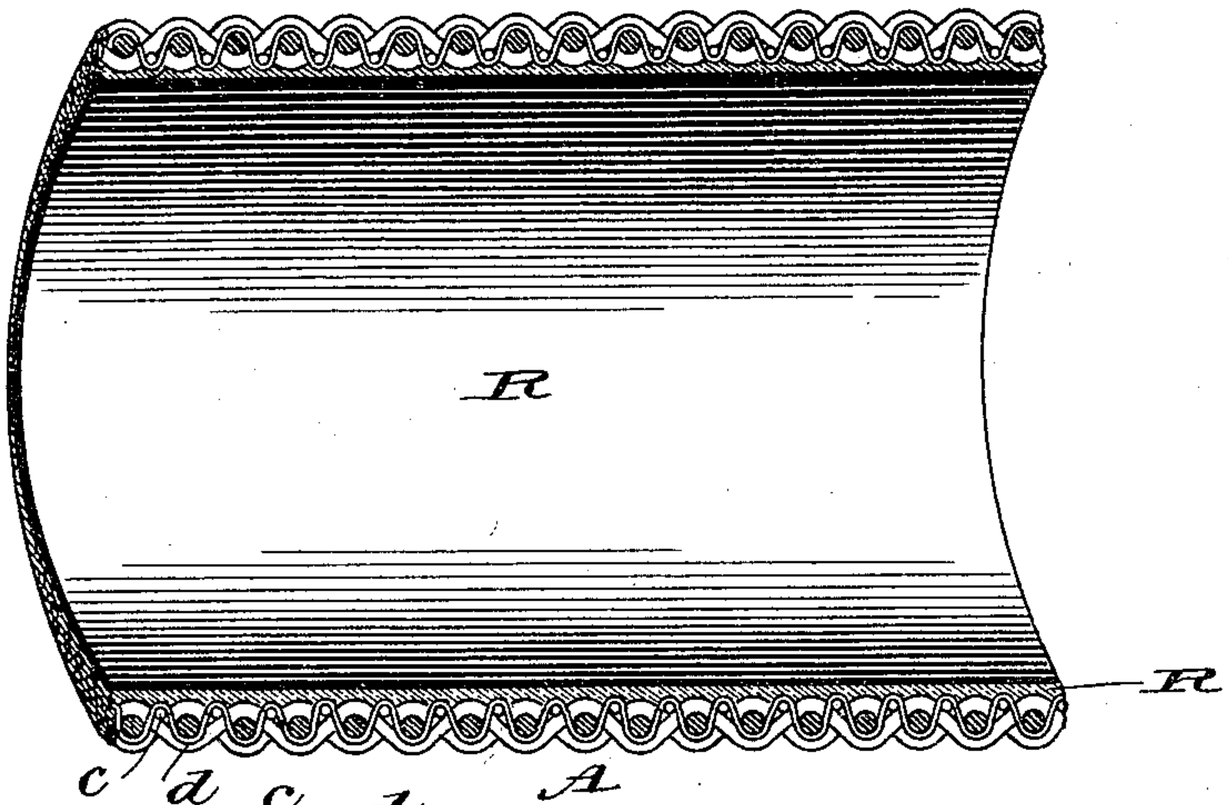



Fig. 2. c

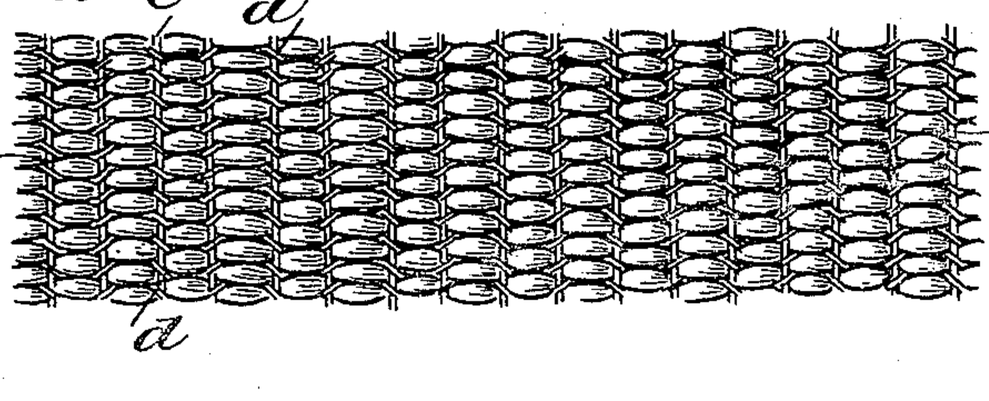



Fig. 3. b

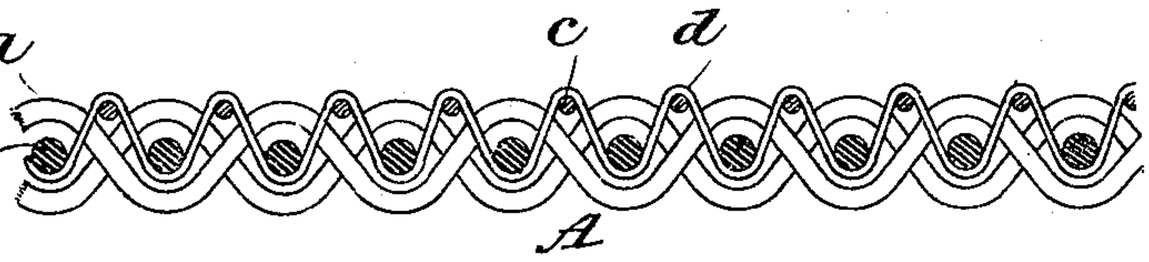



Fig. 4.

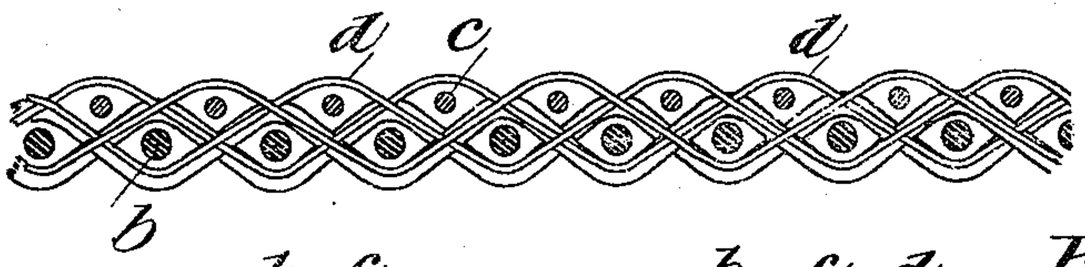



Fig. 5.

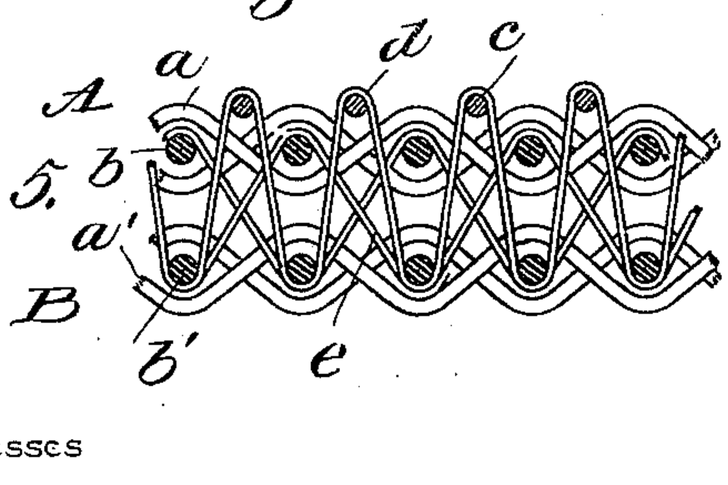
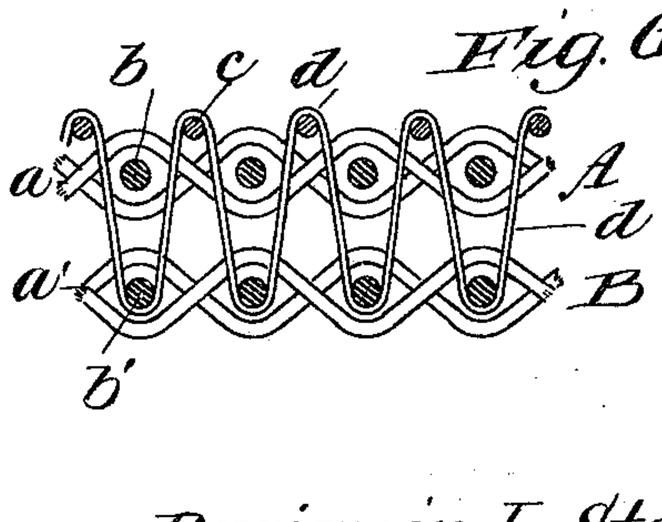



Fig. 6.




Witnesses

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# UNITED STATES PATENT OFFICE.

BENJAMIN L. STOWE, OF JERSEY CITY, NEW JERSEY.

## TUBULAR WOVEN FABRIC.

SPECIFICATION forming part of Letters Patent No. 610,462, dated September 6, 1898.

Application filed March 31, 1898. Serial No. 675,885. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN L. STOWE, of Jersey City, in the State of New Jersey, have invented a certain new and useful Improvement in Tubular Woven Fabrics, of which the following is a specification.

My invention relates to tubular woven fabric for hydraulic or fire hose; and its object is to provide the same with a smooth interior surface for reception of the rubber lining.

It has long been a special requirement of high insurance authorities that the rubber lining after insertion in and application to the tubular external fabric shall be entirely free from corrugation; but it has heretofore been impracticable to secure this desirable result without incorporating objectionable features into the hose. There have been several methods essayed of attaining the result above specified, as follows: The lining has been made very thick; but this has been found objectionable not only because the cost of tubing is increased, but also because a thick lining cracks and deteriorates more rapidly than a thinner one. The lining has been "hard-cured," so as not to sink in the furrows or corrugations of the ordinary tubular woven fabric to the same extent as would a softer one; but this hardening process tends to shorten the life of the rubber. There has been applied to the rubber tube a soft backing that would sink into the furrows and interstices of the fabric and fill them, while permitting the interior surface of the tube itself to remain smooth; but this expedient has been found objectionable owing to the fact that such soft backing from its nature is not a compound well suited for hydraulic-hose lining. Usually two of the preceding methods have been employed in combination; but whether used singly or collectively they are seriously objectionable for the reasons stated.

My invention is directed to the hose fabric itself and is intended to produce in such fabric a practically smooth and even interior surface, thus doing away with the necessity of employing any of the objectionable expedients above referred to and enabling me to produce a finished hose provided with a waterway free from corrugations and yet to employ the best method of lining. To this end I lay in the furrows or interspaces between the weft or filling of the ordinary tubular fabric and on the interior surface of said fabric an additional weft or filling which is of a size to fill snugly the interspace in which it is laid and is there bound in place by its own warp-strands. In this simple way I am enabled to impart to the tubular fabric a smooth interior surface upon which a thin rubber lining can be laid and secured, so that it shall be substantially smooth and without corrugation throughout the length of its waterway.

In the accompanying drawings, to which I shall now refer for a better understanding of my invention, Figure 1 represents in longitudinal section a piece of a single-ply woven-fabric rubber-lined hydraulic hose made in accordance with my invention. Fig. 2 is a developed plan of a portion of the interior surface of the tubular woven fabric without the rubber lining. Fig. 3 is a longitudinal section of the fabric on a scale more enlarged than in Fig. 1. Figs. 4, 5, and 6 represent sectional views of modifications hereinafter more particularly referred to.

In the drawings, and particularly in Figs. 3, 4, 5, and 6, the strands are represented on an enlarged scale and widely separated from one another in order that the structure of the fabric may be more readily understood. In the actual fabric the strands are of course packed closely together.

In Fig. 1, R is the rubber lining, and A is the external woven tubular fabric.

The fabric shown in Figs. 1 to 3 is one which without the addition of the strands requisite to effectuate my invention would be an ordinary single-ply seamless woven hose fabric, of which *a* is the warp and *b* is the filling. In the furrows or corrugations between the filling-strands *b* I lay during the process of weaving the fabric tube an additional filling *c*, which is held and incorporated into the fabric by its own warp *d*. Both the warp *d* and the filling *c* thus added to the fabric will preferably be of fine yarn just sufficient in size when incorporated in the fabric to fill the furrows between the ordinary filling yarn or yarns *b* on the interior surface of the hose

fabric, thus making this surface practically smooth and without corrugation, as indicated in the drawings.

In the fabric shown in Figs. 1 to 3 a single set or series of warps is employed to bind the leveling-filling in place in the fabric. The same result can be attained in other ways—as, for example, by the employment of two sets or series of warps *d*, as shown in Fig. 4, similar to the main warps *a* and manipulated in practically the same way as the latter during the weaving operation.

In Fig. 5 I have illustrated the application of my invention to a regular two-ply hose fabric, of which A is the inner ply and B is the outer ply. The regular warp and weft of the inner ply are lettered *a* and *b*, respectively. The regular warp and weft of the outer ply are lettered *a'* and *b'*, respectively, and the binding-strands which bind the two plies together are lettered *e*.

Under my invention the leveling filling-strands *c* are laid in the furrows between the main filling-strands on the interior surface of the inner ply and are bound in place, like similar strands *c* in Fig. 3, by a single set or series of warp-yarns *d*, which pass through from the inside to the outside of the multiply fabric. I can, if desired, dispense with the binding-strands *e* of Fig. 5 and use the strands *d* both for tying the leveling weft-strands *c* in place and for binding the two plies together. This modification is illustrated in Fig. 6.

I can, if desired, use in the multiply fabric two sets or series of warps *d*, the same as illustrated in the single-ply fabric in Fig. 4.

In the hose fabric thus made the interior surface of the fabric tube is smooth, the alternating fillings *c* and *b* being so laid and incorporated into the fabric as together to constitute a practically continuous surface unbroken by furrows or corrugations, and this I believe to be new with me.

What I claim, therefore, and desire to secure by Letters Patent, is—

1. A tubular woven fire or hydraulic hose fabric, having incorporated in its structure leveling weft-strands laid on the interior surface of the tubular fabric in the furrows or corrugations between the usual filling-strands of said fabric, and warp-strands by which said additional leveling-strands are held, substantially as and for the purposes hereinbefore set forth.

2. Hydraulic or fire hose consisting of a tubular woven fabric having incorporated into its structure additional leveling weft-strands *c* laid on the interior surface of said fabric to fill the corrugations or furrows which otherwise would exist between the usual filling-strands of the fabric, warp-strands *d* for said additional leveling-strands, and a rubber lining applied and secured to the interior surface of said tubular fabric, substantially as and for the purposes hereinbefore set forth.

In testimony whereof I have hereunto set my hand this 26th day of March, 1898.

BENJAMIN L. STOWE.

Witnesses:
NATHAN STOWE,
ALBERT P. MERWIN.