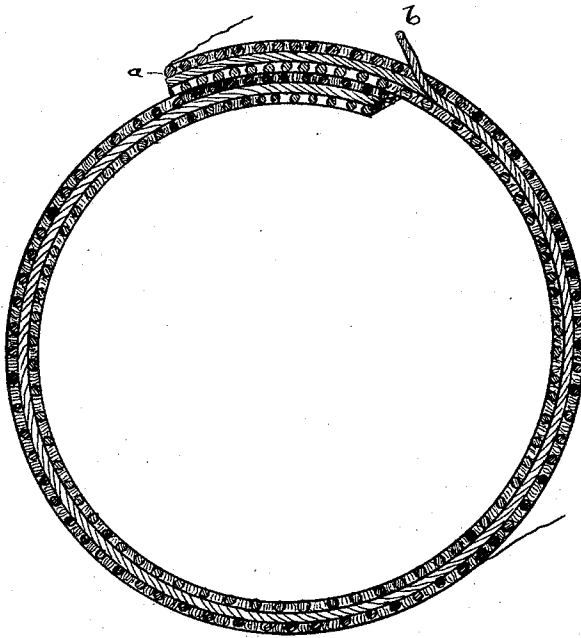


T. A. DODGE & E. A. STREET.
Hydraulic-Hose.

No. 156,017.

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UNITED STATES PATENT OFFICE.

THEODORE A. DODGE, OF CAMBRIDGE, AND EDWIN A. STREET, OF BOSTON,
MASSACHUSETTS.

IMPROVEMENT IN HYDRAULIC HOSE.

Specification forming part of Letters Patent No. **156,017**, dated October 20, 1874; application filed September 28, 1874.

To all whom it may concern:

Be it known that we, THEODORE A. DODGE, of Cambridge, and EDWIN A. STREET, of Boston, both in the State of Massachusetts, have made certain inventions and Improvements in Hydraulic Hose; and we do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of such invention sufficient to enable those skilled in the art to practice it.

Hydraulic hose has been made in several well-known ways, as by riveting in tubular form flat strips of leather, or plying rubber-coated strips around a mandrel several times, and uniting the plies by adhesive mixtures, or by curing; by weaving tubular hose on looms constructed for the purpose; or by weaving flat strips and uniting them in tubular form, the edges being lapped.

When hose of any kind is subjected to pressure by passing through it water or other fluids coming from a height, or forced into the same by a pump, engine, or other power, this pressure causes a strain within the hose which acts laterally much more than longitudinally—*i. e.*, the strain upon the parts is in a line encircling the hose, and not running its length. This is seen in the fact that when a hose ruptures under pressure the fibers that run around the hose are the ones broken, and not those running along the hose, and the break is always between the longitudinal fibers. A hose rarely breaks the other way, and when it does it is always on account of some injury to the parts, and not owing to the pressure; but in making leather, or what is known as rubber "ply" hose, the strength of the textile fabric of which the hose is made is about the same longitudinally as laterally, and in the latter greater longitudinally; and in making hose from woven fabrics, the strength is generally greatest longitudinally, because manufacturers of textile fabrics are in the habit of making the warp of all goods stronger than the weft or "filling," and all looms are organized to do work this way. All textile fabrics are made longer than they are broad, and it is natural to have the greater strength on the warp or longitudinal strand of the fabric

rather than on the weft or lateral, because the warp is generally called upon to bear the most pressure. This is particularly the case with canvas or duck. The purposes for which this is used, as sails, awnings, &c., cause the strain to be much more considerable on the warp than on the weft. For this reason looms have been generally so organized that they cannot throw a weft or filling that is as stout or heavy as the warp.

In making hydraulic hose by weaving a tubular structure it has been common to obviate this difficulty by using stronger material in the weft than in the warp, because the weft-strand is less in size, as above explained. Thus, when the warp is made of cotton, the weft would be made of linen, which has much greater tensile strength; but the effect of this is bad, because the different materials do not act alike under like conditions. They do not stretch and contract alike under pressure, or when saturated with water, and do not stand the high heat required for curing the rubber generally in hose, with like results. For these and other reasons, mixing different fibers is undesirable in such textile fabrics.

There have also been made tubes where there were two weft-strands in order to make greater lateral strength, thus producing a fabric of double thickness; and this is also undesirable, because of the considerable weight added to the structure.

These facts also apply to flat fabrics, from which hose or other articles are made, the filling having been made of stronger material, or else a double filling used; but we are not aware that prior to our invention, canvas or other fabrics suitable for hydraulic hose or other similar manufactures have ever been made, whether flat or tubular, in which were used a single warp and a single weft, both of the same material, and the weft made stronger than the warp, for the purpose of resisting lateral pressure.

It is very desirable in hydraulic hose to combine lightness with strength. Hose can be made by the old methods to stand any pressure, however great, but it will then be too heavy to be readily used.

The object of this invention is to secure this

end of uniting great strength in hose to extreme lightness. In order to accomplish this we prefer to organize the loom which weaves the material to be made into hose so that it may be able to throw a single weft of any desirable heft and strength through the strand of the warp. We then select from the material of which the strands are to be made that for the weft with great care, and make up with more or less twist, according as this gives greater or less tensile strength. It is an essential part of this invention that the weft strands shall be stronger, and generally of more bulk than the warp-strands, while of the same material. We then weave the canvas, duck, or other fabric in the usual manner, having done which we cut the material in widths suitable for the size of hose to be made, unless we have woven the widths to suit, and form a hose by lapping the edges and uniting the same by any suitable means, as is well understood, for which purpose a hand-set rivet or the well-known hose-sewing machines of Rice, Blake, or Richardson, may be used; or a tube may be woven in the same manner, having a weft-strand continuously passing around and between the weft-strands, which weft is made stronger than the warp. Such hose may be made up with or without rubber

lining, or rubber may be placed inside or out by any of the well-known methods.

In the drawing is shown a piece of hose made of a fabric in which the weft is stronger than the warp, and in which such weft runs around the hose, to resist lateral pressure, *a* being the warp and *b* the filling, and *b* being stronger than *a*.

Having thus described our invention, we do not claim any improvements in looms, as these may form the subject of future applications for Letters Patent; but

We do claim—

1. Hydraulic hose made of woven material of single thickness, in which the weft-strands are of the same material and stronger than the warp-strands.

2. Hydraulic hose made of a strip of textile fabric of single thickness, in which the weft-strands, being of the same material as the warp-strands, are made stronger than the warp-strands, substantially in the manner and for the purpose set forth.

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