R. COWEN.

MACHINERY FOR MANUFACTURING WATER TIGHT HOSE.

No. 189,610. Patented April 17, 1877.

FIG. 1.

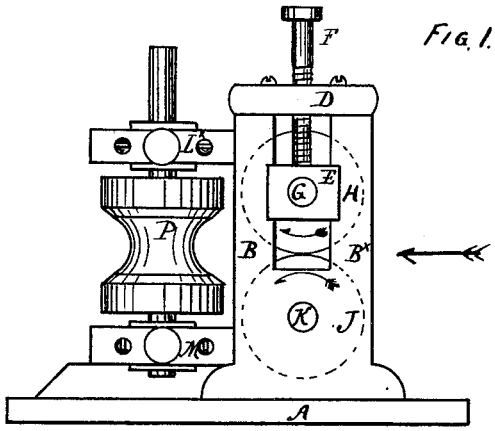


FIG. 3.

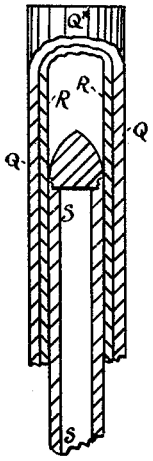


FIG 2.

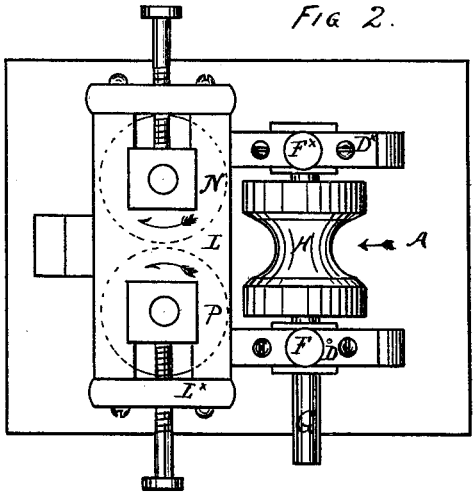
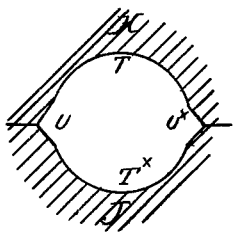


FIG 4



WITNESSES

F. J. Davis.

Jerome Davis.

INVENTOR

Robert Cowen,

per Lemuel P. Deuks. atty.

UNITED STATES PATENT OFFICE.

ROBERT COWEN, OF CAMBRIDGEPORT, MASSACHUSETTS.

IMPROVEMENT IN MACHINERY FOR MANUFACTURING WATER-TIGHT HOSE.

Specification forming part of Letters Patent No. **189,610**, dated April 17, 1877; application filed September 7, 1876.

To all whom it may concern:

Be it known that I, ROBERT COWEN, of Cambridgeport, Middlesex county, State of Massachusetts, have invented a new and Improved Process and Machinery for Making Water-Tight Hose, of which the following is a specification:

The nature of my invention is that of a process, and the necessary machinery to carry it out, to coat with india-rubber, or other gum, the inside of a hollow woven or knit cylinder of cotton, linen, or other textile fiber; and the object is the production of a water-tight hose for the passage of steam, water, and other liquids.

Figure 1 is a side view of my machine. Fig. 2 is a top view of the same. Fig. 3 is a side view of the article produced, with a portion of the apparatus used. Fig. 4 is hereinafter explained.

The device is made of metal throughout.

In the drawings, A, Figs. 1 and 2, is the platform, from which proceed upward B $B^{\times}$, Fig. 1, two square pillars, called the right-hand standards, being one of a pair placed opposite each other, and located, in Fig. 2, respectively beneath the portions of the device marked D and $D^{\times}$. $D^{\times}$, Figs. 1 and 2, is called the right-hand cross-piece, and is a bar of metal resting on the top of the pillars B $B^{\times}$, passing across from one to the other, and firmly screwed to them. A similar bar, $D^{\times}$, called the left-hand cross-piece, which is similarly disposed above the left-hand standard, is seen from above in Fig. 2. E, Fig. 1, is the upper box, being a square piece of metal held and sliding up and down between the uprights B $B^{\times}$, being raised or lowered at pleasure by means of the screw F, Figs. 1 and 2, which passes perpendicularly through the right-hand cross-piece D. This upper box, with its screw F, is one of a pair, the other screw, marked $F^{\times}$ in Fig. 2, passing through the cross-piece $D^{\times}$, and raising or lowering the mate to the box E. This mate box (not represented in the drawings) opposite to the box E acts with that box in supporting the horizontal shaft G, Fig. 1, which carries H, Figs. 1 and 2, the upper one of a pair of rollers, (the lower roller being marked J in Fig. 1.) These rollers are short solid cylinders, and are grooved round their surfaces at their center, the sectional shape of the grooves being seen in Fig. 2. Also, in Fig. 4 the aperture formed at the point of contact of the two rollers H and J is shown, where it is seen that the vertical section of that part of the aperture which is formed by the groove in the upper roller H is in the form of a hemispherical arch, whose sides, at the lower part, are cut away, and the grooves in the under roller J being similarly fashioned, the aperture between the rollers H and J is of greater diameter horizontally than it is perpendicularly. The lower roller J, seen in Fig. 1, is borne by a shaft, K, by means of two bearings, one seen in Fig. 1, formed by a mass of metal joined to (being cast between) the two uprights B $B^{\times}$. Appropriate gearing on the respective shafts G and K causes the simultaneous rotation of the two rollers. L, of shape as seen in Fig. 2, is the upper piece of a pair of slabs of metal, called the second roller-bearers, joined to the left-hand side of the pillars B and its mate on the other side. The edge of the slab L is concealed from view in Fig. 1 by the upper cross-piece $L^{\times}$. The slab of metal called the under roller-bearer, is similar to the upper one L, and its edge is concealed in Fig. 1 by the lower cross-piece M. P, Fig. 1, (and in dashed lines in Fig. 2,) is a solid cylinder or roller exactly similar, groove and all, to the rollers H and J, and is borne, with its axis vertical, by means of a shaft passing from the upper second roller-bearer downward to the lower one M. Another roller like it, N, Fig. 2, is similarly borne, close to the roller P, by the slab L and its mate M beneath, and the rollers N and P of this pair are rotated simultaneously by appropriate gearing. These rollers are borne by their shafts in sliding boxes, two pairs (one pair is seen in Fig. 2) held respectively by the upper and under roller-bearers, which boxes are graduated by screws, seen in the drawing, similar to those controlling the first described pair of rollers. This pair of rollers N and P being grooved, as shown in Fig. 4, a similar aperture to that therein shown is left between them.

In Fig. 3, $Q^{\times}$ is a side view of a piece of woven cotton hose, seen in section (the other

side being cut away at one part) at the points marked Q Q. At the points R R, Fig. 3, are seen, in the cut-away portion, the edges of a cylinder of india-rubber. Inside the woven cotton cylinder, being of slightly less diameter than the latter, and, with its upper portion inside the rubber cylinder, is seen the mandrel S S. This is a hollow cylinder of metal, the bore of which is connected in any convenient manner with an apparatus for supplying hot air or steam, or hot water, or other heated fluid, to keep the mandrel heated. The end of this mandrel which enters first into the hose is seen to be furnished with a cone, which is solid. The use of this cone is to separate more readily the walls of the rubber tube as the mandrel advances.

Operation of the invention: The mandrel being of the same length as the lengths of hose it is proposed to line, say fifty feet, is used as a mold upon which I form a coating of non-vulcanized, but vulcanizable, rubber compound, and afterward stripping the tube of gum from the mandrel, I draw the gum tube into the woven or knit hose the whole length of the latter. I then insert inside the gum tube the same mandrel. The machine above described being set in motion, the two pairs of rollers H J and N P are rotated in the directions shown by the arrows in Figs. 1 and 2, and the mandrel with its surroundings being presented to the grooves, at the point shown by the arrow at the right hand in Fig. 1, is drawn into the grooves, and being slightly larger than the aperture made by them, is compressed above and below. (But not, it is to be noted, on the sides by this pair of rollers. The creation of a ridge in the rubber inside, longitudinally, is thus avoided.) The portions of the cotton hose impinged upon by the rollers at the points marked T T^{x} in Fig. 4 are forcibly pressed and forced down upon the rubber tubing, when, the resistance of the mandrel preventing further compression, the rubber compound being in its non-vulcanized state plastic or softened by the heat from the heated mandrel, is in part forced outward into the body of the inside of the fiber hose, and between the fibers of the same, so that it can neither slip nor be stripped. The remainder of the rubber, being the larger portion, remains coated round the inside of the woven hose, and when the metallic cylinder is withdrawn the inside surface of the rubber coating is found perfectly smooth and free from holes or cracks. The mandrel, hose, &c., continuing on its course, passes through the second pair of rollers N P, when the portion of the hose, at U U^{x}, Fig. 4, not theretofore compressed, by reason of the lateral enlargement of the aperture made by the grooves in the rollers, (seen in Fig. 4,) is duly pressed down, the same action again taking place on the rubber cylinder. This completes the action of the rollers upon the whole circumference of the hose, which is then exposed to the requisite temperature, and heated, as is practiced in vulcanizing rubber, and the hose is finished.

I do not claim the making of water-tight hose by means of fastening one end of the woven cylinder, placing a cylinder of rubber therein, and applying heat by means of steam let on inside the rubber. This mode, among other disadvantages, leaves the interior of the coated hose rugous and rough, thus opposing enormous friction to the passage through it of a stream of water, while the interior of my hose is perfectly smooth, added to which, as the cement holding the rubber of the objectionable kind of hose is not vulcanized, its power of cohesion is very small, and if the water, being under pressure, once gets in between the rubber and the cotton the former is likely to be stripped from the latter, which can never happen with the hose resulting from my process.

Nor do I claim the forcing of a graduated series of disks through a dissolved mass of rubber contained in the woven hose. This mode blisters the rubber by means of the air necessarily involved, and, further, leaves the rubber coating of uneven thickness.

I practice my method of interior coating indifferently with hose knit continuously or woven in sheets, bent, and sewed or made in any other manner, or of any material; and I do not confine myself to the coating of those hollow articles which are cylindrical in section, as I can make my heated tube of any shape in section which may be desirable, and I sometimes use gutta-percha or other vulcanizable gums.

The essential features of my process are the formation by knitting or weaving and sewing of a continuous hose, the placing within the same of a continuous tube of similar shape formed of a gummy vulcanizable material, and placing within this a hollow metallic device, in the interior of which is contained hot air, steam, heated fluid, or other heat-retaining medium, then applying compression, and then the completion by heat of the vulcanizing of the gummy compound; and I do not limit myself to the use of two pairs of rollers only, and I sometimes use but one set of rollers, passing the hose twice or more times between them, with the addition of one roller to the pair, making three, the mandrel, being readily returned to the point of starting.

I sometimes change the shape of my groove from that shown in the drawings, and cut away one roller, so as to admit the passage of the raised seam portion of a hose made by sewing together a plain woven fabric, thus dispensing with the rubber welt now used.

I do not claim the cementing of the outer layers of a water-tight hose together by the use of rollers, mandrel, and cement.

I claim—

1. The process of coating the inside of a woven or knit tube of cylindrical or other

shape of cotton or other textile fiber, by first drawing a gummy tube into the tube, then inserting a heated incompressible body therein, while applying external pressure, and subsequently vulcanizing the same, all substantially as described.

2. In a machine for the manufacture of water-tight hose, the combination, with one or more pairs of grooved rollers, of a solid head mandrel adapted for use, substantially as shown, and for the purpose set forth.

ROBERT COWEN.

Witnesses:
JOHN MCCLELLAN,
LEMUEL P. JENKS.