No. 680,504. Patented Aug. 13, 1901.

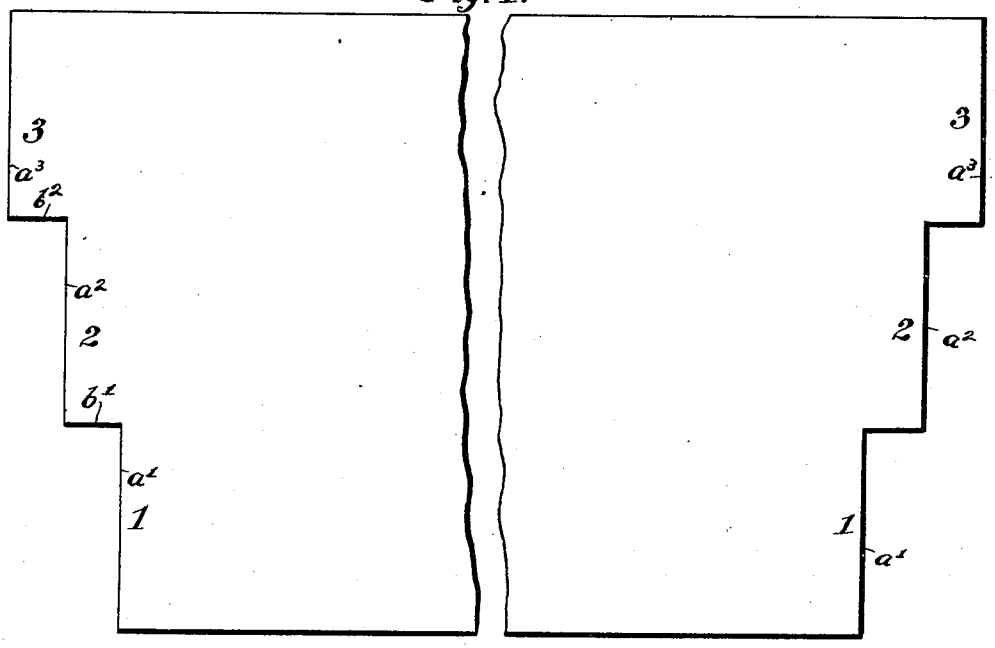
H. H. SHEPARD & F. H. FISH.

HOSE.

(Application filed Oct. 31, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



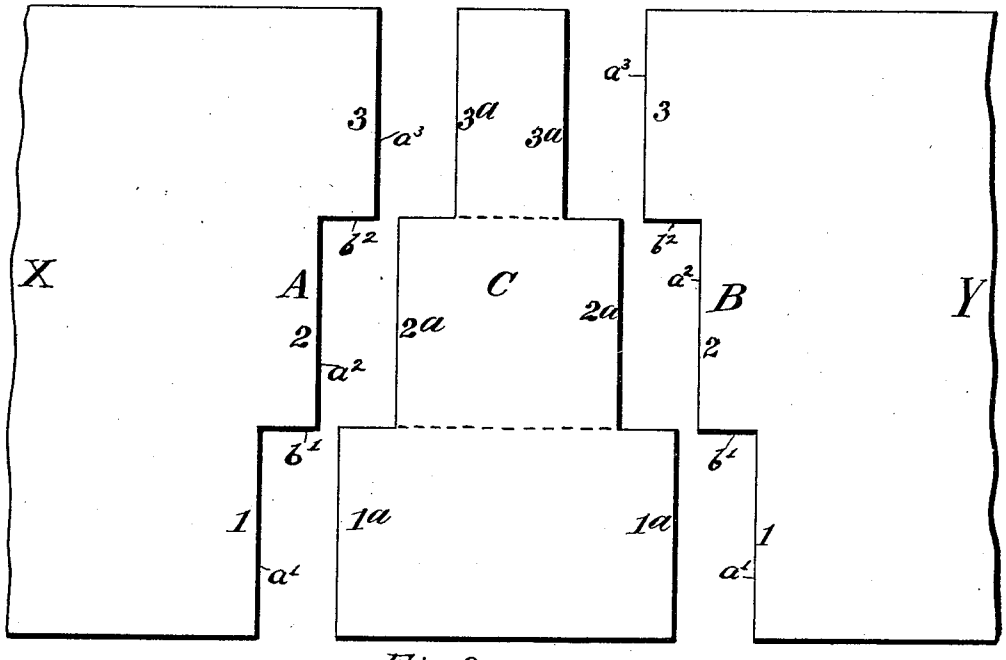


Fig. 2.

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Fig. 3

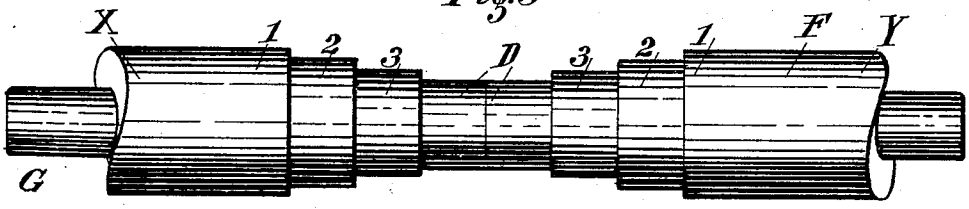


Fig. 4

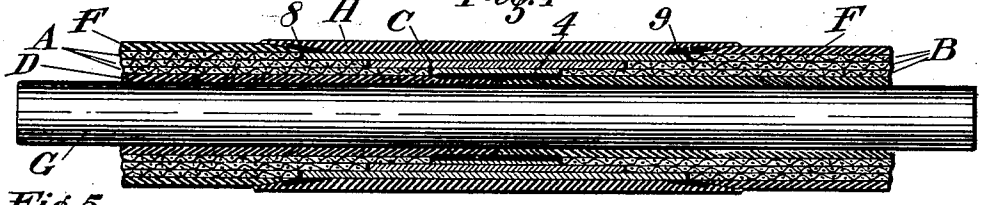


Fig. 5

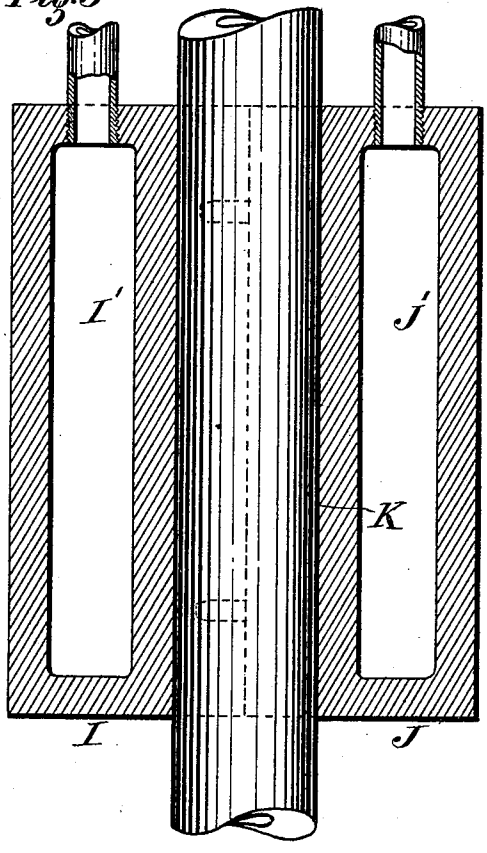
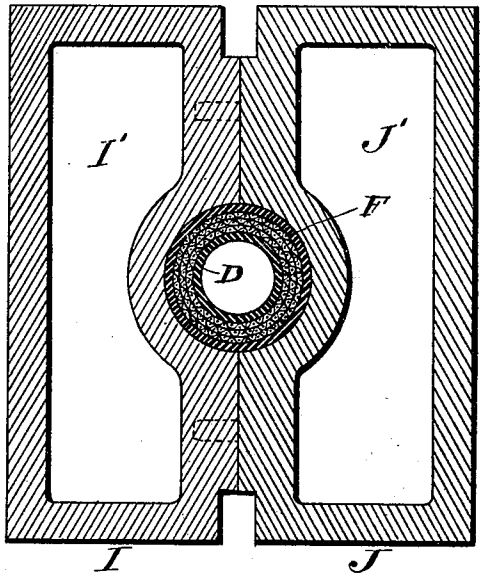


Fig. 6



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Fig. 7

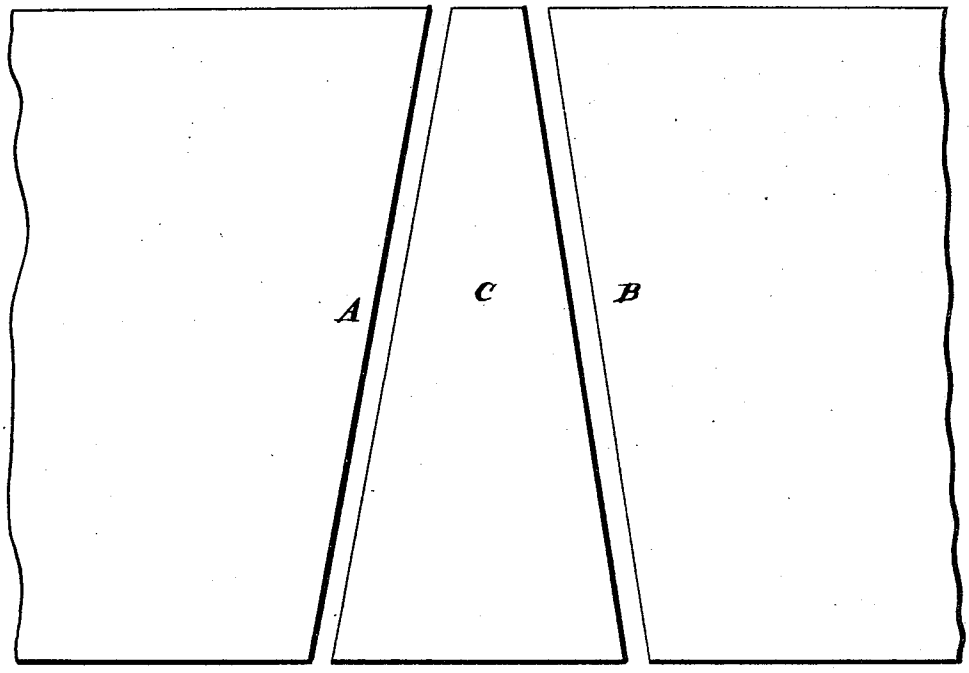
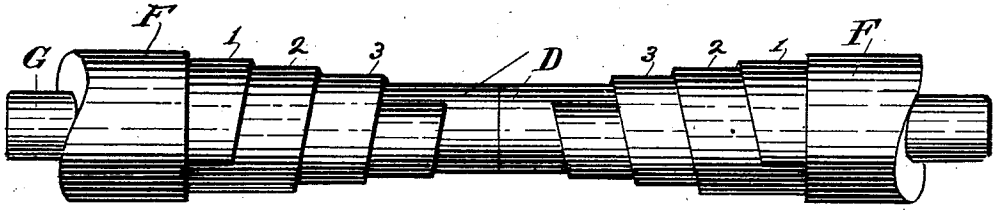


Fig. 8



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UNITED STATES PATENT OFFICE.

HARRY H. SHEPARD AND FRANK H. FISH, OF BRISTOL, RHODE ISLAND.

HOSE.

SPECIFICATION forming part of Letters Patent No. 680,504, dated August 13, 1901.

Application filed October 31, 1900. Serial No. 34,998. (No model.)

To all whom it may concern:

Be it known that we, HARRY H. SHEPARD and FRANK H. FISH, of Bristol, in the county of Bristol and State of Rhode Island, have invented a new and useful Improvement in Hose, of which the following is a specification.

Heretofore commercial hose composed of plies of rubber and fabric has generally been limited to lengths of about fifty feet, and for greater distances it has been customary to couple together a plurality of such lengths by metallic couplers. For a long time the need has been felt in the market for hose in greater lengths; but practical difficulties have existed as obstacles to its manufacture, which it is the object of our present invention to overcome.

We have discovered that a plurality of separately constructed and vulcanized hose-sections can be combined into an efficient continuous hose by uniting such vulcanized sections by an unvulcanized splice and applying a vulcanizing heat to the zone including said splice and the adjoining section ends. We have invented the means for embodying and utilizing this discovery.

By the aid of our present invention we are enabled to place upon the market hose in continuous lengths which are practically unlimited, the hose being of approximately equal strength and diameter at all parts and being manufactured without any great addition of expense either in cost of labor or of apparatus.

In the accompanying drawings, Figure 1 represents, with middle broken away, the duck or other fabric friction-coated on both sides with rubber and cut in one form adapted for the body of each section of our hose. Fig. 2 represents, before being rolled up, the edges of the rubber-coated duck A B of two sections X Y to be spliced together and the rubber-coated duck splicing-piece C between them. Fig. 3 represents the adjacent ends of two hose-sections X Y in position ready for the application of the splice and held together by the short splicing-mandrel. Fig. 4 is a longitudinal section at the joint when completed. Figs. 5 and 6 are longitudinal and cross sections of the mold holding the joint for vulcanizing. Fig. 7 shows a modified manner of cutting the material for forming the hose and joint. Fig. 8 shows the adjacent ends of two hose-sections made in this modified manner ready for joining.

From inspection of the two patterns given in Figs. 2 and 7 it will be seen that the adjacent ends of the rubber-coated textile material for adjacent hose-sections are cut on lines which diverge from each other, while the splicing-strip is also cut on similar diverging lines. The textile material for the splicing-strip thus forms approximately the complement of the textile material in the adjacent hose-sections, being therefore adapted to fill in the space between the adjacent ends of each convolution of the textile material in the two sections being spliced. In Fig. 2 the line of divergence is an angle-line composed of longitudinal and transverse lines, while in Fig. 7 it is a straight diagonal line; but we do not limit ourselves to either form of line. In both forms the winding of the textile material of each hose-section on the inner tube produces at each end in general outline the form of the frustum of a cone composed of a series of steps, which are in the figures numbered 1, 2, and 3.

In making each hose-section with the form of cut shown in Fig. 2 we prefer to proceed as follows: An inner tube D of rubber compound the full length of the section is placed on the ordinary hose mandrel or pole. Duck friction-coated with rubber on both sides is cut at its ends, as shown in Figs. 1 and 2, so as to present at opposite ends diverging angle-lines composed of transverse lines $a' a^2 a^3$ and longitudinal lines $b' b^2$. Each longitudinal line is cut slightly longer than the circumference of the ply which it is to form in the hose, so that it slightly overlaps itself. The number of transverse lines corresponds with the number of plies of textile material in the finished hose. The duck so cut is wrapped three times (for a three-ply hose or more times for a greater-ply hose) around the inner tube D, and the top or outer ply is covered by a ply of rubber, forming the usual outer rubber tube or cover F. The hose-section thus made is shown in Fig. 3 and is then vulcanized in the usual manner.

To join together two vulcanized sections made as above described, we proceed as follows: The ends of two sections, as X and Y, are brought together, as shown in Fig. 3,

upon a short splicing-mandrel G, which extends a short distance into the end of each, the protruding ends D of the inner rubber tubes of the two sections abutting against each other. The protruding steps 1 2 3 of the rubber-coated textile material are smeared with rubber cement. A piece of sheeted rubber compound 4 is wrapped around the protruding ends D, so as to extend from the edge of the inner step 3 of one section to the edge of the inner step 3 of the other section, and is pressed by a roller until it adheres firmly. The two edges of this piece 4 overlap each other slightly. A piece of duck C, friction-coated with rubber on both sides and corresponding in texture with the duck forming the body of both sections, is cut, as shown in Fig. 2, so that its two edges are disposed inversely to the edges of the sections A and B, the portions to form the several plies between the steps being lettered 1^a, 2^a, and 3^a, respectively. The first ply portion 3^a is wound around the piece 4, drawn tightly, and rolled down until it substantially fills the space up to the level of the steps 3 on the two sections. The portion 3^a is long enough so that it overlaps itself. Now the winding of the splicing-piece C is continued until the second ply portion 2^a, which is drawn tightly and rolled down, substantially fills the space between the steps 2 up to the level of such steps. The portion 2^a of the splicing-piece is made long enough to overlap itself also. Now the winding of the splicing-piece is continued until the third ply portion 1^a fills the space between the steps 1 substantially up to the level of the same, and it is also made long enough to overlap itself. Next two pieces of friction-tape 8 and 9 are applied, so as to cover the joint between third ply portion 1^a of the splicing-piece C and step 1 of each of the sections being spliced. Next an outer layer H of sheeted rubber compound is applied, so as to overlap the outer rubber tube of each section and cover all of the parts between the same, including the friction-tapes and the entire splice. As each part is applied it is forced against the part underlying it and thoroughly rolled down, the short mandrel G enabling this to be done without contracting the internal diameter at the splice.

To vulcanize the joint formed as above, we employ a mold constructed as shown in Figs. 5 and 6. This mold consists of the two parts I and J, which when placed together face to face provide an open passage K of sufficient size to inclose the splice and extend slightly beyond the splice at each end. Means is provided for heating both of these mold parts, such as providing each of them with a steam-chamber, as I' J', or any other suitable means. Means is also provided whereby these two mold parts may be pressed powerfully together, so as to reduce the external diameter of the splice to substantially the diameter of the two sections spliced. The splice is wrapped with a piece of cloth and placed in the mold, with the two spliced sections protruding from opposite ends of the mold. Sufficient pressure is exerted to reduce the outside diameter of the splice to the diameter of the sections spliced, and sufficient heat is applied to the mold parts for the purpose of thoroughly vulcanizing the splice. The heat for vulcanizing the splice will also cause the rubber compounds of the splice and of the rubber cement and of the spliced sections to unite, so as to make a substantially homogeneous union.

After the completion of the above operations by which two sections of hose are spliced together it remains to remove the short splicing-mandrel G. For this purpose we apply at either end of the combined sections the nozzle from a gas or liquid supply under pressure, while holding the hose lengthwise distended and straight from the point occupied by the splicing-mandrel to the opposite end. The gas or liquid pressure on one side of the short splicing-mandrel G will without other assistance drive it out of the opposite end.

The vulcanizing might be done after the expulsion of the mandrel by the use of other means of keeping the hose distended at the splice while being vulcanized.

By repeating the splicing operation as often as is necessary as many sections of hose may be spliced together as is desired, so as to produce a substantially continuous hose of unlimited length, which from end to end is continuously vulcanized and is for practical purposes of a strength nearly equivalent to what its strength would be if the duck were continuous and unspliced.

If the duck be cut according to the pattern of Fig. 7, the edges of the steps 1, 2, and 3 will be spirally disposed, as shown in Fig. 8, instead of being in planes at right angles to the axis of the hose, as shown in Fig. 3. The operations of splicing, vulcanizing, and expelling the splicing-mandrel are, however, substantially the same.

In the drawings each splicing-strip is shown as composed of a continuous piece of textile material, and this is the preferable construction, but it might be divided, so that each ply of the splicing-strip would be a separate piece from the other plies of the same. Thus in Fig. 2 the splicing-piece might be divided on the dotted lines which extend across it longitudinally of the hose.

We claim—

1. As an article of manufacture, a hose composed of a plurality of sections, the plies of textile material in the adjacent ends of every two sections forming a series of receding steps, in combination with a complemental splicing-piece, secured to said steps of both sections by vulcanization, substantially as described.

2. In combination a plurality of hose-sections, each containing an inner rubber tube upon which is superposed plies of textile ma-

terial so disposed that the end of each succeeding ply recedes farther from the end of said inner tube, and a divergent splicing-piece so disposed as to overlap the plies of the two sections and secured thereto by vulcanization, substantially as described.

3. In combination, two vulcanized hose ends, each having the general outline of the frustum of a cone and a splicing-piece filling the space between the sides of said frusta and vulcanized thereto, substantially as described.

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