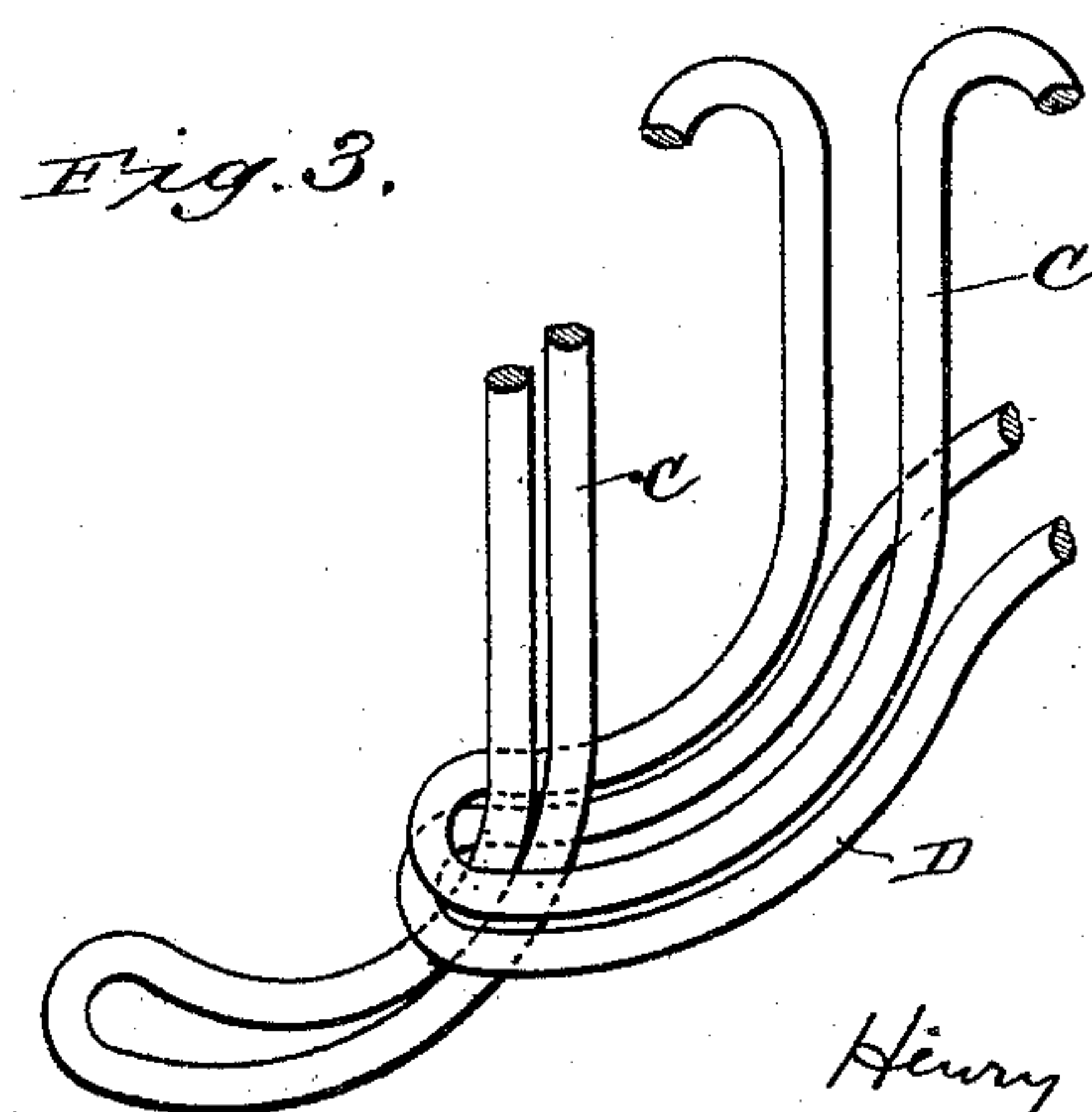
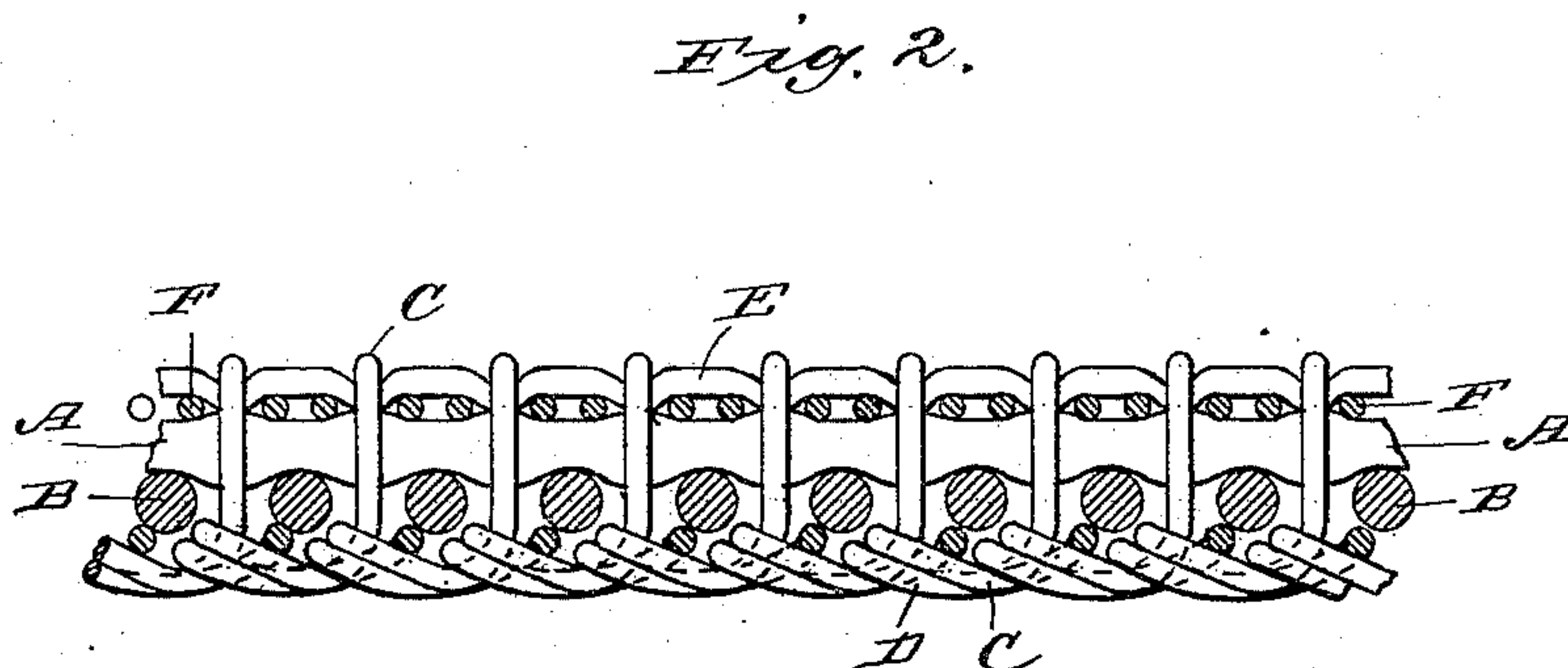
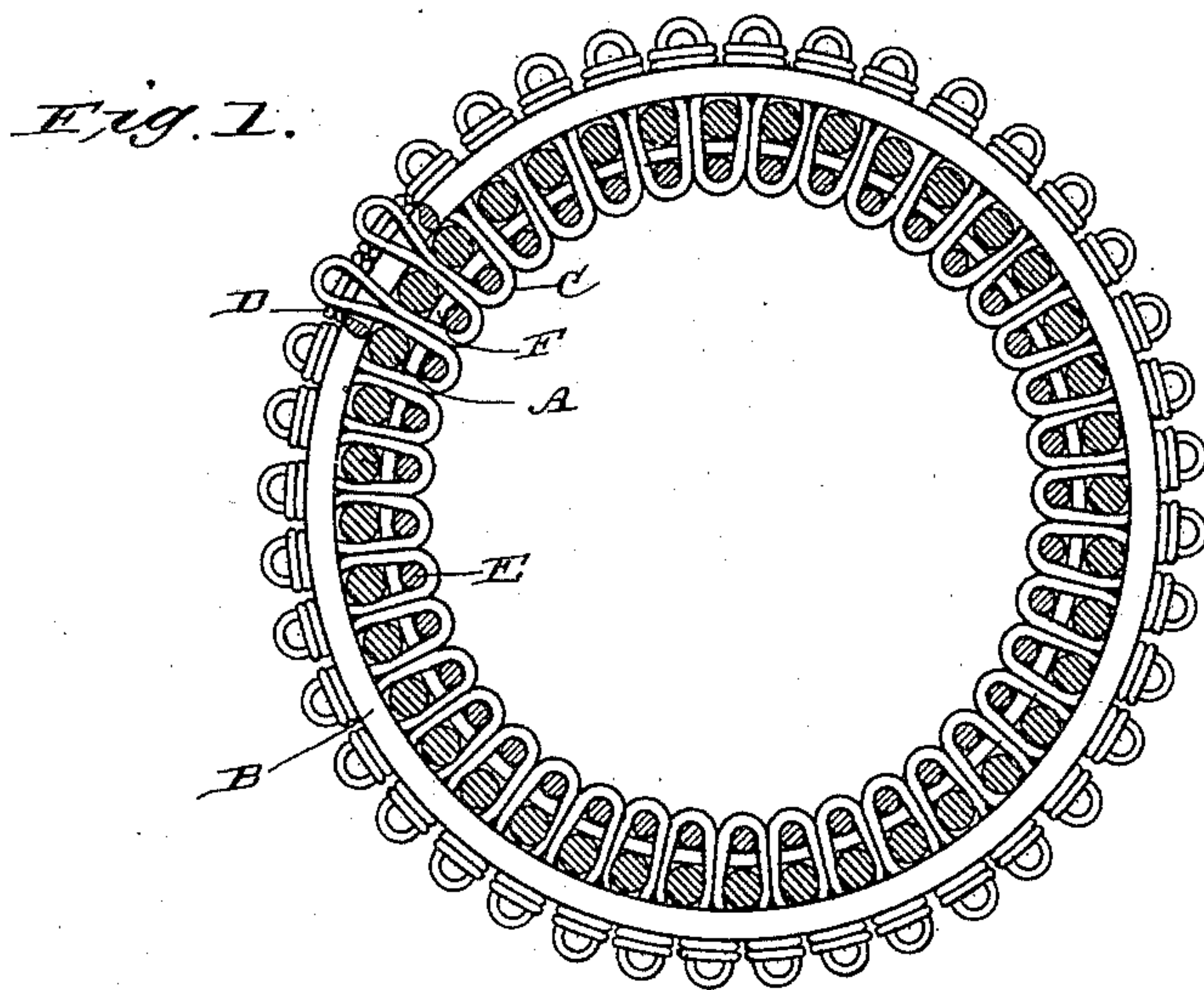


(Specimens.)

H. F. HERKNER.
KNIT FABRIC FOR HOSE.

No. 408,384.

Patented Aug. 6, 1889.



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KNIT FABRIC FOR HOSE.

SPECIFICATION forming part of Letters Patent No. 408,384, dated August 6, 1889.

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To all whom it may concern:

Be it known that I, HENRY F. HERKNER, a citizen of the United States, residing at the city of Brooklyn, Kings county, and State of New York, have invented a new and useful Improvement in Knit Fabrics for Hose, of which the following, taken in connection with the accompanying drawings, is a full, clear, and accurate description.

My invention relates to the production of a new knit fabric for use in hose and other similar articles, whereby a smooth and elastic material is produced.

One of the difficulties which have been found to exist in the use of rubber-lined fabrics, especially fire-hose composed of a fabric tube, is that the inner surface of the tube as knitted is rough, and the rubber hardens in the interstices of said inner surface, thus causing a great tendency on the part of said rubber lining to get pinched and crack when bent or flattened by winding on a reel or by passing over a window-sill at a fire, &c. This roughness of the inner surface follows necessarily from the fact that large and firm cords must be used for the warp and filling threads in order to give the required strength.

The object of my invention is, without altering the general construction of the fabric, to provide a smooth inner surface having substantially no interstices for the inflowing of the rubber, and so that there shall be no pinching or cracking of the rubber lining in winding or bending the hose when in use. I have found that this pinching or cracking arises from the fact that when the rubber lining is inserted it has an irresistible tendency before hardening to flow into the interstices left between the adjacent inner warp-threads and above the inner filling-threads.

In the ordinary mode of manufacturing hose or circular tubing the warp-threads are held perpendicular in the machine and form a circle of the diameter desired for the hose or other fabric, and the filling-thread is wrapped round the whole circle thus arranged, it simply resting against the outside of the warp-threads and practically at right angles thereto, although of course by the time the filling-thread has gone round the circle once the tubular fabric has been pulled automatically down out of the way, so that

the filling-thread in next passing around the cylinder runs immediately above its previous position relatively to the fabric, although in the same place relatively to the machine. Thus it will be seen that there is a very slight climbing spiral to the filling-thread. This is true of the construction of the fabric whatever number of plies are made, the warp-threads being held rigidly perpendicular in concentric circles and the filling-thread for each set of warp being wound round just outside its own set of warp. This arrangement of course would at once fall to pieces when taken from the machine were it not for a binding or knitting thread which, being normally inside of the inner warp-tube, is drawn out between each two warp-threads in succession by each of a set of needles arranged in a circular head outside the outer warp-tube and formed into a loop through which another portion of the knitting-thread is drawn by the same needle when it next becomes its turn to draw out the knitting-thread, which happens after the filling-thread has been laid around outside the warps and after all the other needles of the circular head have in turn drawn a loop of the knitting-thread from the inside to the outside. Thus the fabric is rendered coherent.

It is obvious that as each horizontal row of loops of the knitting-thread is separated from the rows of loops immediately above and below it by spaces equal to the thickness of the horizontal filling-threads, and each two warp-threads are separated from each other by the loops of knitting-threads passing between them, there must necessarily be left square or oblong interstices on the inner surface of the tube, one diameter of which interstices will correspond with the diameter of the filling-thread and the other diameter with twice the diameter of the knitting-thread, and the depth of which corresponds with the diameter of the warp-threads. It is in these interstices that the rubber filling penetrates and by means of which it gets pinched and cracked.

In hose or tubing as ordinarily knit there necessarily are square or oblong interstices left between each two adjacent warp-threads, with a depth extending outward to the inner filling-thread. Into these interstices the rub-

ber flows. When the rubber lining hardens, the clinging of that portion of the lining which is found in the interstices to the rest of the lining is so great that the bending or winding or other process of flattening the hose, which of course can only be done by stretching or contracting the warp or filling threads with regard to each other, has a strong tendency to break or crack the lining itself instead of simply pulling that portion away from the rest.

I have found that by making the inner ply of the hose or tubing of a single warp-thread of substantially half the diameter of the outer warp-threads, and with two filling-threads of smaller diameter than the other filling-threads and of substantially the same diameter as the small inner warp-thread, the tendency of the two smaller filling-threads to ride upon the outer filling-thread of a two-ply fabric results in forcing the two small filling-threads, one on each side, down into the interstices between adjacent filling-threads of the outer ply, and the reduced diameter of the inner warps lessens their prominence on the inner surface of the fabric. Moreover, as in practice the knitting or binding thread and inner warps will be of substantially the same diameter at those points where the knitting-thread overlies the inner warps and draws them into the body of the fabric until they touch the outer warps, there will be neither projection nor depression out of the plane of the inner warps. By this means an inner surface is given to the hose sufficiently smooth entirely to overcome the cracking or breaking of the lining, the inner wefts forming a smooth surface broken only by the slight ribs or prominences of the inner warps and knitting-thread and having only slight separations at the points where the loops of the knitting-thread pass to the outer surface of the fabric.

My invention consists in a knit fabric composed of a main or larger outer warp-thread, a main or larger outer filling-thread, a smaller inner warp-thread, and two or more smaller inner filling-threads, all bound together by a continuous knitting or binding thread with or without the addition of a cover-thread on the outside of the fabric.

One form of my invention is shown in the accompanying drawings, in which—

Figure 1 is a horizontal cross-section of the fabric in tubular form. Fig. 2 is a vertical cross-section. Fig. 3 is an enlarged view of the loop made by the binding and cover thread at the outside of the fabric.

Same letters indicate similar parts in the different figures.

A A are the main or outer warp-threads, and B B the main or outer filling-threads. These outer threads are of firm and strong texture.

E E and F F are the inner warp and filling threads, respectively, and are of less diameter than the outer threads. The inner filling-threads F are also more in number than the outer threads, the arrangement which I prefer being two inner filling-threads for one inner warp.

C is the continuous binding-thread, which, starting on the outside of the fabric, runs in between strands of the filling-threads, around the inner warp, and out again between the same strands of filling-threads. Then, being joined by the cover-thread, (if used,) it forms a loop, through which it passes when it reaches that point on the next row of stitches. It then runs back again between the same strands of filling-threads around the next warps, and so on.

Although not necessary to the making of the stable fabric, the cover-thread D D is very desirable for many purposes, and among others in order to secure the neat appearance of the outside of the tube which it gives.

The method of constructing this fabric by hand or otherwise will, I think, be readily seen from the drawings without further description.

I claim—

1. A knit fabric composed of a main outer warp-thread, a main outer filling-thread, a smaller inner warp-thread, and two smaller inner filling-threads, which are forced down one on each side of the larger filling-thread, all bound together by a continuous binding-thread, which on the inside of the fabric passes around the inner warps, substantially as shown and described.

2. A knit fabric composed of a main outer warp-thread, a main outer filling-thread, a smaller inner warp-thread, two smaller inner filling-threads, which are forced down one on each side of the larger filling-thread, all bound together by a continuous binding-thread, which on the inside of the fabric passes around the inner warps, and a cover-thread, substantially as shown and described.

In testimony whereof I have hereunto set my hand this 20th day of December, 1887.

HENRY F. HERKNER.

In presence of—

R. T. VAN BOSKERCK,
CHARLES G. COE.