H. S. HUBBELL.

FLEXIBLE TUBING.

APPLICATION FILED JAN. 21, 1911.

1,053,394. Patented Feb. 18, 1913.

Fig. 1.

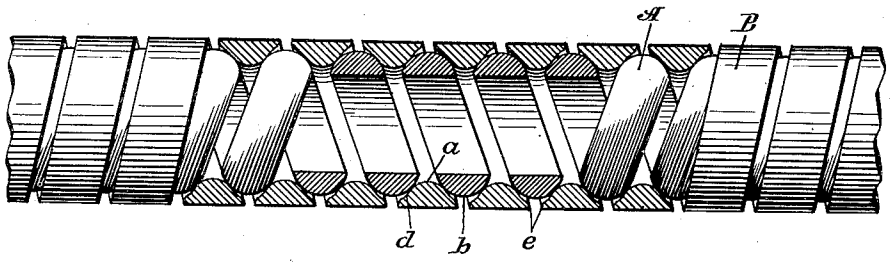


Fig. 2.

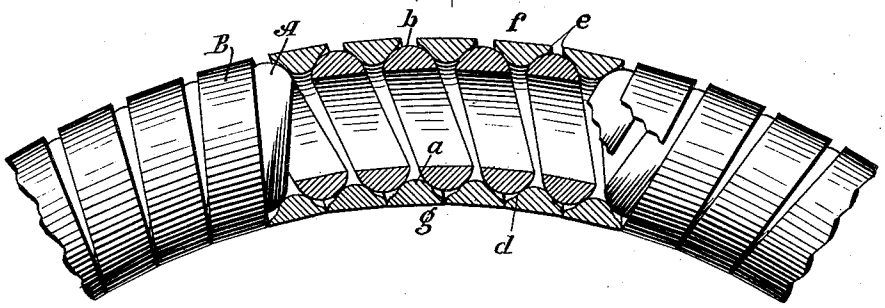
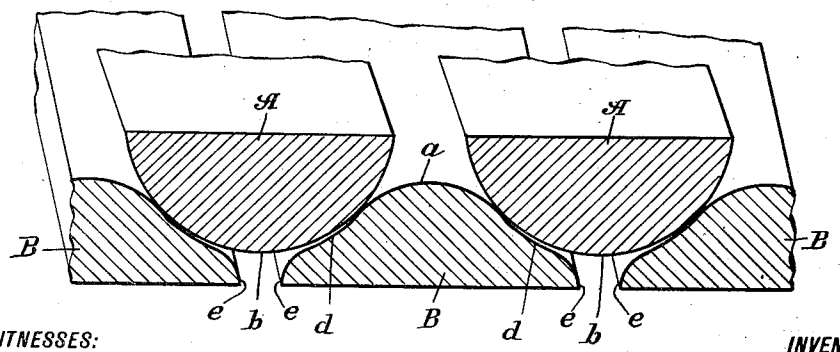


Fig. 3.



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FLEXIBLE TUBING.

1,053,394. Specification of Letters Patent. **Patented Feb. 18, 1913.**

Application filed January 21, 1911. Serial No. 603,935.

To all whom it may concern:

Be it known that I, HENRY S. HUBBELL, a citizen of the United States, and resident of Ashburnham, county of Worcester, and State of Massachusetts, have invented certain new and useful Improvements in Flexible Tubing, of which the following is a specification.

My invention relates to flexible tubing and has for its object to provide a tubing of this character which will not be liable to leak and is extremely flexible, and which may be used as a casing for flexible shafts, particularly such as are adapted for connection with speedometers, or portable tools.

The particular object of my invention is to provide a flexible tubing which will bend easily, but upon being released will immediately straighten itself out and which at all times when bent will take a curve of the greatest possible radius so as not to cramp the flexible shaft which the tubing incases. In other words, in my improved construction it is impossible to bend the flexible tubing sufficiently to cramp the shaft inside thereof unless an undue force is exercised.

My invention will be fully described hereinafter and the features of novelty will be pointed out in the appended claim.

Reference is to be had to the accompanying drawings in which—

Figure 1 is an elevation, partly in section of a portion of my improved tubing showing the same straight; Fig. 2 is a similar view showing the flexible tube temporarily held in a curved condition; and Fig. 3 is an enlarged detail, longitudinal section, of a portion of the tube.

The tubing comprises an inner coil of wire A, the coils of which are substantially semi-circular in cross section, with the flat surface thereof forming the interior wall of the tubing. A second wire B is coiled about the wire A on the outside thereof, the coils of the wire B overlapping and extending between the coils of the wire A so as to close the spaces therebetween. The coils of the outside wire B have an ogee shape in cross section as clearly shown in the drawings and are provided with convex surfaces *a* which in the normal position of the tube contact with the convex surfaces *b* of the inner coil A tangentially, as in Fig. 3. The said outer wire B is further provided with concave portions *d* which extend or flare out from the convex portions *a* and extend over and overlap, but normally do not engage the surfaces *b* of the inner coil A. The edges *e e* of adjacent coils of the outer wire B, when the tubing is in its straight condition, nearly meet and practically cover up the inner wire A, the spaces between them controlling the amount of curvature which may be given to the structure. The outer wire therefore substantially conceals said inner wire and produces a more desirable finish than if the inner wire were more exposed. The convolutions of the inner wire are preferably farther apart than those of the outer wire, so that they will not contact on bending as shown in Fig. 2. This prevents the inner wire when bent from crowding the outer wire away from it laterally. When the tube is bent, the edges *e e* may be brought into contact with each other at the inside of the curve see Fig. 2 and thus also serve as stops to limit the normal bending movement of the tube and prevent cramping of the interior flexible shaft. In other words, the coils of the outer wire B are so proportioned that the normal bending limit of the tube is reached when the edges *e e* contact. During this bending, the inner wire A on the outer periphery enters the concave portions *d* of the outer wire, while on the inner periphery it rides on the convex portions *a* of the wire B. This results in bringing the wire A nearer the outer circumference *f* of the bent tubing and farther away from the inner circumference *g* than it was in a straight position. In other words when bent, as in Fig. 2 the inner wire assumes a position which is eccentric to the outer wire. All of which causes the tube to receive a tendency when bent to straighten itself as soon as released from bending effort. The foregoing construction also insures a tight joint or connection between the coils at all times. A cam action is secured through the coöperation of the opposed curves of the inner and outer coils so that a stress is exerted by said opposed curves of the coils as the tube is bent and the flexible tubing tends to straighten itself the moment it is released. To increase this tendency to straighten itself out after having been bent both wires A and B are preferably made of a material having a cer-

tain amount of spring or resiliency the outer wire in this case being preferably made of a material such as brass or steel and having a greater amount of resiliency than the inner wire.

My invention thus provides a flexible tubing which is particularly adapted for use as a casing for flexible shafting for speedometers, and may also be used as a conduit in which the usual interior pressure is about 20 lbs. to the square inch, the flat inner surface of the inner wire providing a smooth inner bore of maximum diameter in any given size of tubing.

Further in my improved construction, as already stated, it is impossible to cramp the flexible interior shaft through the bending of the tube unless a destructive force is applied.

My improved tubing under all conditions is also grease tight so that the inner shaft may be at all times maintained in a thoroughly lubricated condition.

Various modifications may be made within the scope of the claim without departing from the spirit of my invention.

I claim as my invention:—

A flexible tubing comprising an inner coil and an outer coil located between the convolutions of said inner coil, the inner surfaces of the convolutions of said outer coil having an ogee shape in cross section and engaging the inner coil along a relatively narrow line in the normal position of the tubing.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HENRY S. HUBBELL.

Witnesses:
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