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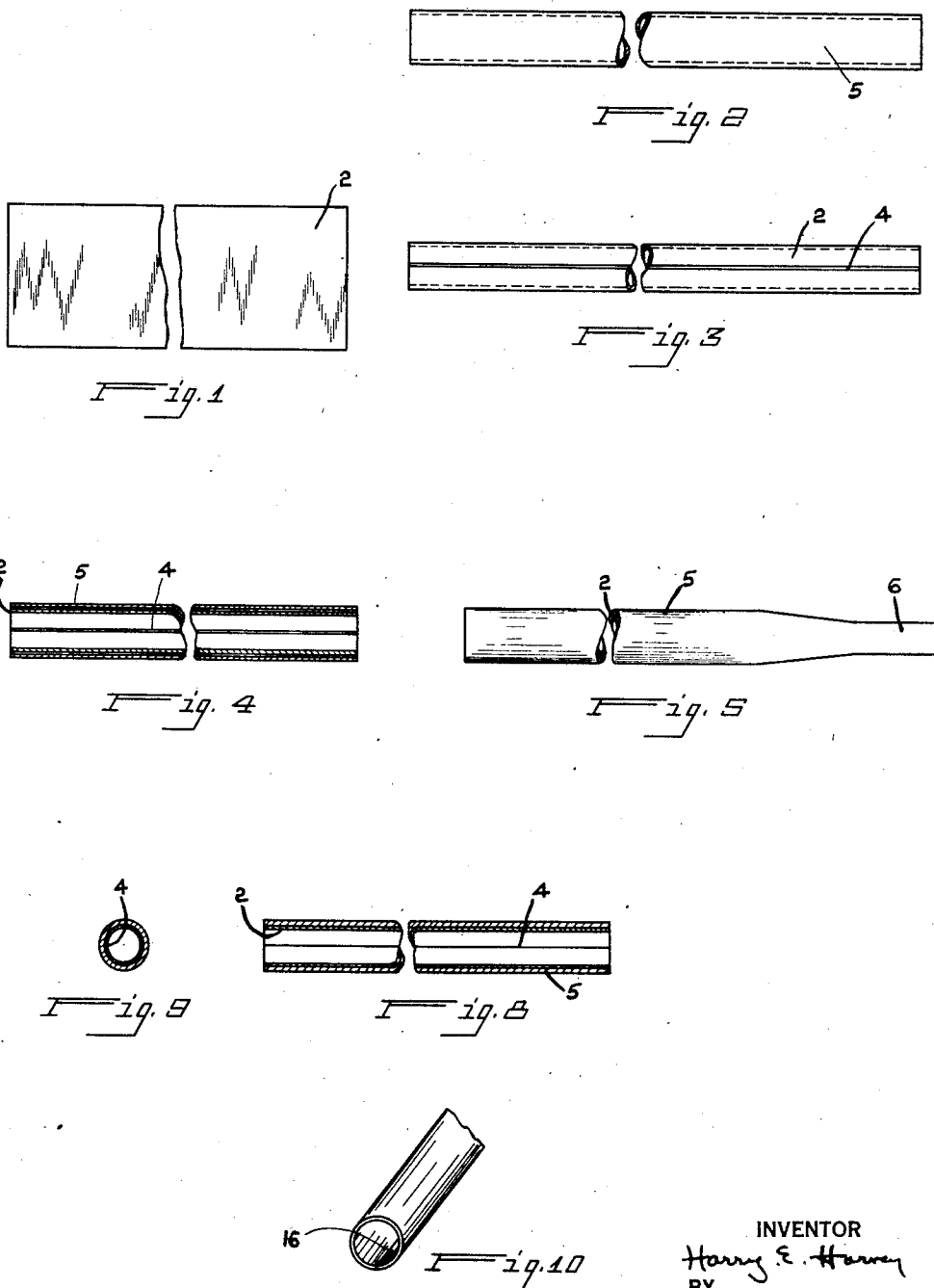
H. E. HARVEY

1,839,964

PROCESS FOR MAKING BIMETALLIC TUBES

Filed Jan. 28, 1925

2 Sheets-Sheet 1



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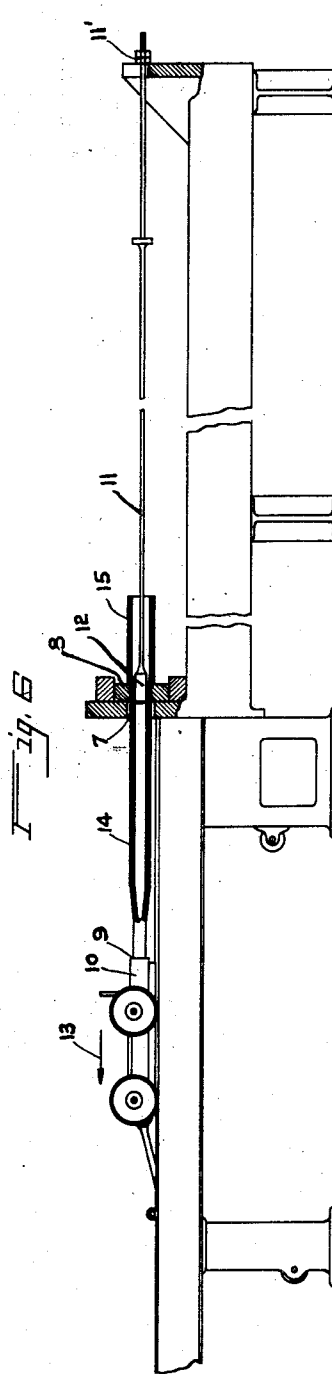
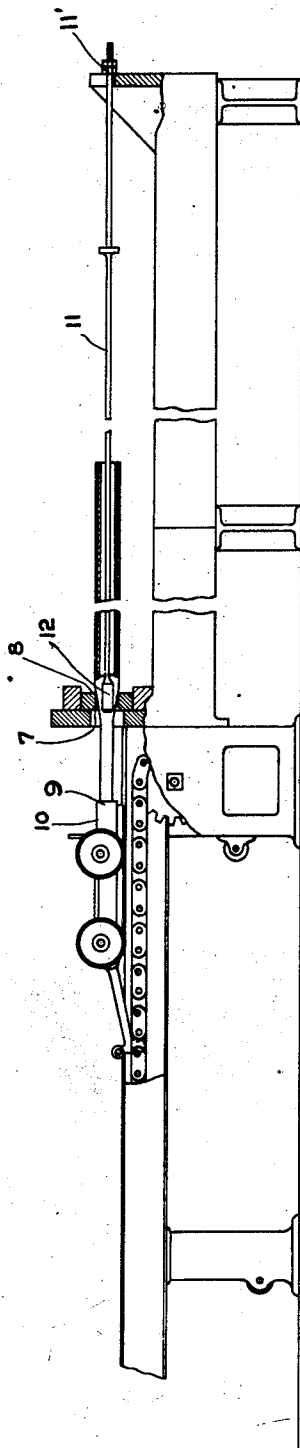
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PROCESS FOR MAKING BIMETALLIC TUBES

Filed Jan. 28, 1925

2 Sheets-Sheet 2



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HARRY E. HARVEY, OF CLEVELAND HEIGHTS, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO STEEL AND TUBES, INC., OF CLEVELAND, OHIO, A CORPORATION OF OHIO

PROCESS FOR MAKING BIMETALLIC TUBES

Application filed January 28, 1925. Serial No. 5,255.

My invention relates to a novel process for making bi-metallic tubes, and relates particularly to a process whereby tubes having an exterior surface of steel and an interior surface of a bearing metal such as bronze or brass may be formed in lengths to be later cut up into suitable lengths for bushings and the like.

An object of my present invention is to provide a novel process for forming tubes for bushings from separate tubes of steel and of a bearing metal, telescoping them within one another and then uniting them firmly together so that even in severe use the tubes will not become separated but will be to all intents and purposes a single tube having an inner bearing surface and an outer protective surface.

Another object of my invention is to provide a process whereby tubes of this kind may be formed from steel and bearing metal tubes of varying sizes, but the resultant bi-metallic tube conforming closely to predetermined dimensions both as to inside and outside diameters.

Another object of my invention is to form a tube as above described by cold drawing it through dies and without the application of heat.

Another object of my invention is to provide a tube in which the desired intimate connection is obtained between the concentric tubular elements thereof of different materials and in which the inner tube may be a tube having a seam along a side thereof, but which seam during the operation of the process herein described, will become closed and the inner element of the composite tube will become to all intents and purposes, seamless, since the seam will be closed so tightly as to be practically unnoticed by vision or in the operation of the bushings employing such tubes.

Other objects of my invention and the invention itself will become apparent as the description thereof progresses, and in which description reference will be had to the accompanying drawings illustrating the carrying out of my invention, using for purpose of example, certain diagrammatic illustrations

of tubes and the tools which may be employed to operate on said tubes.

Referring to the drawings—

Fig. 1 shows a strip of sheet bearing metal, a portion being broken away so as to condense the figure as to length;

Fig. 2 shows a steel tube;

Fig. 3 shows the bearing metal sheet rolled into the form of a seamed tube;

Fig. 4 shows the bronze tube telescoped within the outer steel tube, the tubes being separated slightly since the bronze tube is of less outer diameter than the inside diameter of the steel tube;

Fig. 5 shows the two tubes as swaged at one end to point such an end;

Fig. 6 shows the introduction of the pointed tubes through the opening of a drawing die, a mandrel being placed within the tubes and the pointed end of the tubes projecting through the die being grasped by jaws of a tube drawing bench;

Fig. 7 shows the same parts and the tube of Fig. 6 except that the drawing of the tubes down to a tube of lesser diameter has progressed for a certain distance along the tube;

Fig. 8 shows a longitudinal medial section of a portion of a tube bi-metallic in character, after being passed through the drawing dies of Figs. 6 and 7;

Fig. 9 shows a transverse section at right angles to the section of Fig. 8 of the tube of Fig. 8, and

Fig. 10 shows in perspective, a view of an outer steel butt-welded seamed tube which may be advantageously employed in my process.

In practicing my novel process, it is immaterial whether the start be made with sheet metal in the form of a ribbon of metal for the two parts of material operated upon in the process, since these can be preliminarily made into tubes of different material; or the process may be carried out employing two tubes each of a different material such as steel and bronze preliminarily made by any well known process for making tubes.

In the broadest aspects of my invention, it is immaterial whether or not one or both of the tubes are seamless or seamed tubes, my

invention being applicable to both kinds of tubes, either seamed or seamless, although the process may be carried out very advantageously in a case where the inner tube, particularly, is a seamed tube, since in this case the seam of the tube need not be closed prior to being operated upon according to my improved process to that degree which is requisite where the bi-metallic resultant tube is to be employed as a bushing and the inner surface of which is to form a bearing. Therefore, although Fig. 1 illustrates the bearing material as being first had as a sheet and then as illustrated in Fig. 3, such a sheet indicated at 2 is rolled to a tubular form with a longitudinal seam which is shown at 4.

In the broadest aspects of my invention, it is immaterial whether or not this preliminary step is as shown or not; however, in the carrying out of my process, such imperforate tube as shown at 2 is insertable within an outer tube illustrated in Fig. 2 at 5, the outer tube 5 being of greater inside diameter than the outside diameter of the inner tube 2, so that the two may be telescoped as illustrated in Fig. 4, readily.

In preparing the tubes or in choosing tubes for the further steps of my improved process, it is desirable that the inside diameter of the imperforate inner tube 2 will be greater than the resultant inside diameter of the bi-metallic resultant tube to an extent, depending upon the width of seam 4 to be closed plus an additional slight amount which insures that the point 4 will be closed tightly, and the resultant metal being disposed of by elongation of the tube in the drawing process as subsequently described.

As telescoped in Fig. 4, the two tubes fit together loosely, so therefore, as shown in Fig. 5, they may preferably be more closely secured together by swaging or otherwise pointing the telescoped tubes to make the end 6 as shown in Fig. 5 of less diameter than the balance of the tube; this swaging or pointing causes the outer tube to grasp firmly the end of the inner tube. The pointing of the telescoped tubes permits a reduced end 6 of the tubes to be inserted through the opening 7 of a drawing die 8, and also permits the reduced end of the telescoped tubes to be grasped as shown at 9, by the jaws 10 of a suitable power drawing mechanism.

A mandrel comprising a rod 11 fixed at one end to the tube drawing bench as at 11' and having a head 12 having an outside diameter equal to the inside diameter of the bi-metallic tube desired to be secured as a result of the process, is inserted within the bi-metallic or telescoped tubes, at a point within the opening in the drawing die so that the swaging of the tubes may be accomplished with a high degree of efficiency.

The jaws 10 of the drawing mechanism are then pulled away from the drawing die

in the direction indicated by the arrow 13 and pull the telescoped tubes, through the opening 7 of the drawing die 8 around the mandrel head 12; this opening is of less diameter than the outside diameter of the outer tube, and therefore the outer tube will be compressed and elongated and this compression will in turn compress and elongate the inner tube, but to a lesser degree, since part of the compression of the outer tube only brings the inner walls of the outer tube into firm compressive contact with the outer walls of the inside tube. An additional compression closes the seam of the inner tube and draws down both tubes in diametrical size, accomplishing likewise an elongation of the two tubes; the extent of this elongation varies somewhat according to the diametrical sizes of the tube chosen in the first place.

Fig. 7 shows the jaws 10 grasping the pointed and shaped end of the joined tubes drawn to a position in the direction of the arrow 13, and shows a portion such as shown at 14 of the joined tubes reduced in outside diameter relative to the portion of the tubes 15 not yet passed through the drawing die 8. The process is continued, preferably, until the entire length of telescoped tubes has passed through the opening in the drawing die. At such time the telescoped tubes will both have been drawn down as illustrated in Figs. 8 and 9 to a size where the outer wall of the inner tube is in tight intimate contact with the inner wall of the outer tube, the contact between the tubes being so firm that to all intents and purposes the two tubes may be considered as an integral tube, the outer surface being of steel, the inner surface of bronze or other bearing material, and the seam of the inner tube shown at 4 being so tightly closed as to be scarcely visible and not perceptible in use when sections of the tube are used as bearings with the inner surface of the inner tube employed as a bearing surface. When a butt-welded outer steel tube such as that shown in Fig. 10 is employed instead of a seamless tube, I preferably leave the welded burr part 16 inwardly protruding along the seam thereof, since in the drawing of the telescoped tubes, especially where as herein described the inner tube is of softer metal, this projecting burr or rib 16 bites into the material of the inner tube and serves as a key to hold the two parts relatively non-rotatable.

While I have described and illustrated by means of diagrams a particular way of carrying out my improved process, employing certain tools conventionally shown and referred to, I am aware that my process may be carried out using other tools and devices colorably different from that herein shown and described, and starting with tubes of dif-

ferent sizes or forms than that herein shown, but without departing from the spirit of my invention. In the practical carrying out of my invention, it is likely that during the drawing process the drawing die and the tube portion being passed through the die, will be continuously cooled and lubricated by a lubricating fluid passed over it, and that like well known precautions will be taken during the carrying out of the process.

I claim:—

1. The process of forming a bi-metallic tube for bearing bushing purposes comprising the telescoping of a steel tube having a longitudinal butt-welded seam and an inwardly projecting welding rib along the seam over a tube of bearing material and in drawing and compressing the tubes together to cause the rib of the outer tube welding seam to bite into the softer material of the inner tube to key the tubes together.

2. A bi-metallic bearing comprising a liner of bearing material, an outer shell surrounding the liner and formed of harder material than the liner, the shell and liner being compressed into surface to surface contact throughout, and an axially extending projection extending from the shell into locking engagement with the liner.

3. A bi-metallic bearing comprising a liner of bearing material, and an outer shell surrounding and gripping the same compressively, the shell having a longitudinally extending inwardly projecting burr of harder material than the liner, the burr projecting into the liner and locking the liner and shell against relative rotation.

4. A bearing tube comprising a liner of bearing material, and a steel outer shell compressively gripping the liner having a longitudinally extending inward projection, the liner and shell being locked against relative rotation by engagement of the projection in the liner.

5. The process of forming bi-metallic bearing tube which comprises inserting a liner tube of bearing metal within a welded tubular shell having a longitudinally extending burr of relatively hard metal projecting from its inner surface, and then drawing the tube and shell to reduce the diameter of both so that surface to surface contact is caused throughout the tube and shell and so that the burr of the shell is permanently interlocked with the liner.

6. A bi-metallic composite bearing tube comprising a tubular ferrous metal shell, an imperforate tubular liner of sheet bearing metal therein having its longitudinal edges pressed into abutting contact with each other, and means in the form of an irregular surface on one of the members penetrating into the surface of the other member for preventing relative movement of the shell and liner.

7. A composite bearing comprising a tubu-

lar steel shell member and a longitudinally split tubular sheet metal bearing liner member unitarily secured therein by penetration of one member into the surface of the other.

8. A bearing comprising a hard tubular shell and a softer tubular sheet metal liner having a longitudinally extending seam which is closed by the hard tubular shell, said shell and liner being united against relative movement by the penetration of one part into the surface of the other part.

9. The process of forming a composite bearing tube which comprises inserting a longitudinally split sheet metal bearing liner into a steel tube, one of the meeting surfaces of the liner and tube being irregular, and then bringing the tube and liner into such close engagement with each other that the parts will be anchored against relative rotative movement by penetration of the irregularities on one surface into the other surface.

In testimony whereof I hereunto affix my signature this 30th day of December, 1924.

HARRY E. HARVEY.