

F. A. BUESCHER.
METHOD OF FORMING METAL TUBES AND TUBULAR ARTICLES.
APPLICATION FILED NOV. 25, 1912.

1,120,271.

Patented Dec. 8, 1914.

Fig. 1

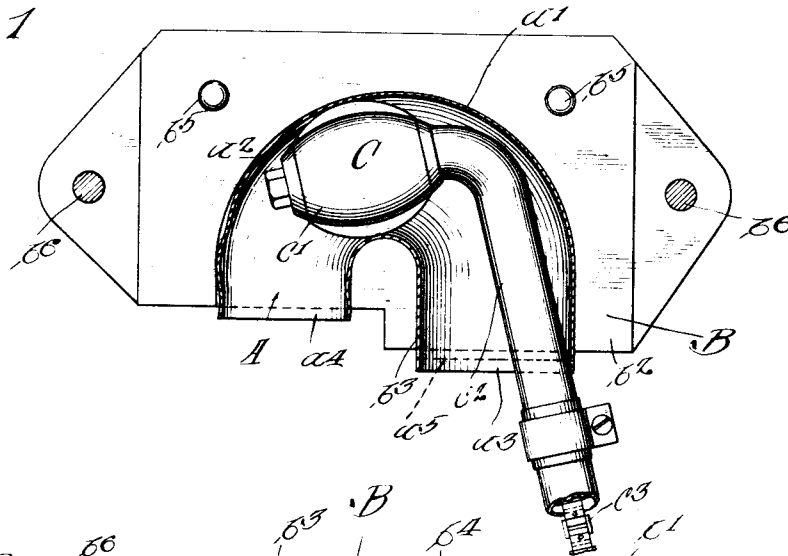
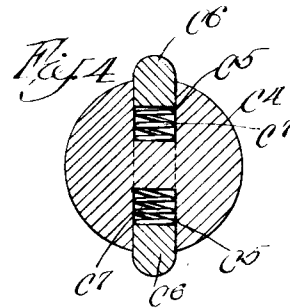
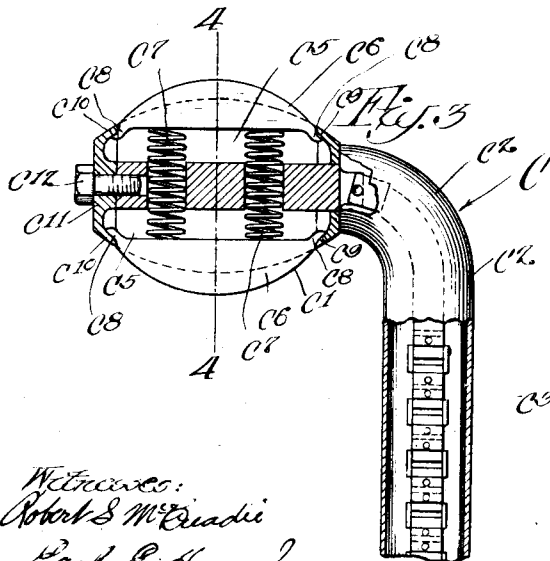
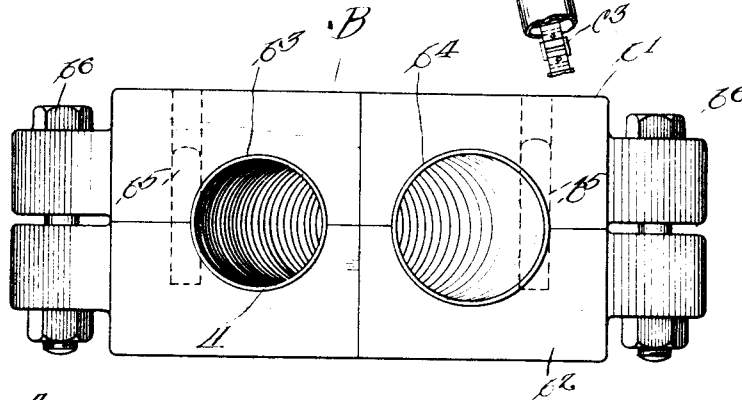


Fig. 2



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Att'y.

UNITED STATES PATENT OFFICE.

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METHOD OF FORMING METAL TUBES AND TUBULAR ARTICLES.

1,120,271.

Specification of Letters Patent.

Patented Dec. 8, 1914.

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To all whom it may concern:

Be it known that I, FERDINAND AUGUSTUS BUESCHER, a citizen of the United States, and a resident of Elkhart, Elkhart county, Indiana, have invented certain new and useful Improvements in Methods of Forming Metal Tubes and Tubular Articles, of which the following is a specification.

My invention relates to an improved method of making tubular articles and has particular reference to improvements in methods for making tubes or analogous articles by internal pressure.

The object of my invention is to provide a method by means of which the cost of the manufacture of tubular articles shall be materially reduced; the production of duplicate tubular articles facilitated; the production of curved tubular articles, such as elbows and return bends, reduced to a practical manufacturing proposition; and whereby similar or duplicate tubular articles may be made to accurately conform with each other as to size and shape.

A further object of my invention is to provide a method by means of which partly formed tubular articles made of soft ductile metal shall be quickly and easily brought to a finished form and the metal thereof tempered to a desired hardness.

A further object of my invention is to provide a method by which metallic tubular parts of musical instruments can be produced at a relatively low cost and automatically given the tone quality desired.

My invention resides in a method of forming tubes or analogous articles which consists in producing an article of approximately the size and shape of the finished article desired, placing the partially formed article within a die, the inner surface of which conforms accurately with the size and shape of the finished article to be produced, then spinning and forming the wall of the partly formed article into contact with and causing it to conform to the inner surface of the die.

My invention also resides in the method of making tubular articles wherein a partly finished tube without an open seam and roughly shaped to the form and dimensions desired is placed within a conforming die and is then expanded into direct and close contact with the inner surface of the die, by

means of an expander having oppositely disposed spring pressed spinning members which forcibly draw or spin the wall of the tube outwardly against the inner surface of the die.

My invention also resides in the method of forming and tempering parts for musical instruments which consists in first roughly forming the tubular part to approximately the form desired and of slightly smaller dimensions, then expanding the part, within a suitable die, to the dimensions desired by drawing or spinning the walls of the part outwardly into contact with the inner surface of the die.

My invention is also resident in the method of forming tubular articles comprising the series of steps hereinafter described, and particularly pointed out in the appended claims.

My improved method is particularly adapted for the production of tubular parts or members used in the construction of musical instruments. These parts are usually made of relatively thin or light sheet metal and the walls of the tubular members can therefore be relatively easily conformed to and with the surface of the inclosing die. My improved method, besides serving to facilitate the manufacture of such tubular articles, also serves to give a desired tone quality to the articles, for the reason that the drawing or spinning of the metal in the process of conforming the partly formed article with the surface of the die, serves to temper or harden the metal of which the article is made, and the extent of the hardening or tempering can be readily regulated to give the exact tone quality desired.

My invention will be more readily understood by reference to the accompanying drawings, in which I have illustrated a die and a suitable spinning device which I have found best adapted for the production of return bend elbows. It should be understood that my method is not limited to the production of return bend elbows but that it can be applied with equal facility and with equal beneficial results to the manufacture of other forms of tubular articles which may be either straight or curved, either tapered or of uniform diameter from end to end or which vary in diameter otherwise than tapered from end to end.

In said drawings Figure 1 is a sectional view of a tapered return bend elbow and illustrates my novel method of finishing same. Fig. 2 is a side elevation of a die showing the elbow in position. Fig. 3 is an enlarged central section of the spinning tool. Fig. 4 is a transverse section of the spinning tool on the line 4—4 of Fig. 3.

The article which I have illustrated as being partly formed is a return bend or elbow A. B represents the die within which the tube is being formed, and C represents an interior spinning and drawing tool of a form which I have found to be particularly well adapted to the production of the tubular return bend A. The die B which I have shown is formed of an upper member b^1 and a lower member b^2 , each of which is provided with a suitable die matrix b^3 accurately conforming with each other and adapted, when the two parts b^1 and b^2 of the die are properly clamped together, to provide a complete die matrix b^4 of the desired shape, form and size. These two parts of the die B are set accurately in proper relative positions by means of suitable guiding dowels b^5 , and they are adapted to be firmly held together in their proper relative positions by any suitable means such as the clamping bolts b^6 . The spinning and drawing tool C, which I have illustrated, comprises a rotatable head c^1 mounted upon a curved stationary tubular handle c^2 , and within the handle is arranged a suitable flexible shaft c^3 by means of which the head c^1 can be rotated. The head c^1 consists of an ovoid shaped member c^4 which is provided at diametrically opposite points with longitudinal radial openings c^5 adapted to receive radially movable spinning members c^6 . These spinning members c^6 are diametrically disposed and are adapted to be pressed against the inner surface of the tube by means of compression springs c^7 mounted within the body of the head c^1 . The spinning members c^6 are so formed that the largest dimension measured diametrically across the two members is approximately at the middle of the length of the spinning head and from this point they taper inwardly toward each end of the head. Each end of each of these members is provided with an inwardly projecting lip c^8 which is received within an overhanging part c^9 of the head c^1 at one end and within an overhanging part c^{10} of a washer c^{11} at the other end, and the washer c^{11} is held in position by a centrally arranged bolt c^{12} . This construction prevents the members c^6 from escaping from their slots c^5 . The tapered form of the members provides a device which can be readily forced into the tube to cause the tube to conform with the die, the wedging shape of the members facilitating this operation. The handle c^2 of

the member C is bent as shown so that the spinning head C can be readily inserted into the interior of the return bend as clearly illustrated in Fig. 1 for the purpose of forming the whole extent of the return bend. It will now be clear that the spinning tool having been forced into the tube from one end to the position shown in Fig. 1 can be removed therefrom and can then be forced into the tube from the opposite end. In Fig. 1 I have shown the return bend A as having the portion a^1 through which the forming tool C has been forced, as being conformed accurately with and to the inner surface of the die and I have shown the portion a^2 , through which the spinning tool has not as yet been forced, as not conforming with the surface of the die but varying therefrom.

I have shown the return bend as being of greater diameter at the end a^3 than at the end a^4 and as being uniformly tapered from one end to the other. It will now be apparent that my improved method is equally applicable to the accurate formation of tapered tubes which are straight instead of curved, or to tubes which vary in diameter from end to end in other ways than being uniformly tapered. Also it could be applied to the manufacture of tubes which are uniform in diameter and either straight or curved, the fundamental idea being that the tube is first roughly formed into approximately the size and shape desired, it is then confined and held against rotation within a die, the inner surface of which conforms accurately with the shape, form and size of the finished article, and then the roughly formed article is expanded into perfect contact with the inner surface of the die by means of an interiorly disposed spinning tool which draws, forms or expands the tubular article so that its wall properly conforms with the inner surface of the die. The dotted line a^5 in the end a^3 of the tube illustrates the initial position of the end of the tube before the spinning operation has been performed and indicates the amount which the tube is extended in length in the spinning and drawing operation. The spinning operation which thus expands the tube to accurately conform with the die lengthens the tube, and draws or thins out the wall of the tube and thereby tempers or hardens the tube to a certain extent.

I am enabled to attain the desired tone quality by controlling the degree to which the walls of the tubes are hardened or tempered and I can accomplish this through several means. I subject the tube to a more or less severe action of the spinning head, both by varying the pressure of the forming parts c^6 against the wall of the tube and by varying the rapidity with which the drawing head is inserted through the tube

as compared with the speed of rotation. The head preferably revolves at a high speed and is preferably advanced slowly through the tube, the drawing effect preferably being such that the tube is drawn longitudinally, to substantially the amount shown in Fig. 1.

By means of my method I am enabled to reduce the time necessary for forming a tube in the ratio of practically twenty to one as compared to the old hand method of hammering the tube to complete its finish. Furthermore, when the formed tube is taken from the die it requires only to be buffed to give it the proper surface finish, whereas a tube finished by the old method requires to be ground and polished before the desired smoothness of surface can be produced.

Another very advantageous feature of my invention is now evident, viz. that every one of the articles produced in a particular die will be the exact duplicate, as to form and diameter, of every other article produced therein. This latter feature is very valuable particularly in the rapid manufacture of musical instruments, for the reason that it reduces these parts, which have heretofore been made by hand and of more or less varying dimensions, to a uniformity of shape and size with which the other parts can be more easily, quickly and perfectly assembled.

As many modifications of my invention will readily suggest themselves to one skilled in the art, I do not limit my invention to the particular steps or to the exact sequence of steps herein illustrated and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The herein described method of forming a thin-walled tapered tubular article whose medial line or axis is not a straight line, and which consists in forming a tube approximately to the dimensions and form of the finished tube, confining the tube within a die having a similar axis and said die having an inner surface of the dimensions and tapered form of the finished tube, then progressively forming the tube wall into contact with the inner surface of the die by applying pressure to the inner surface of the tube at substantially opposite points and progressively advancing the points of application through the tube on spiral lines, the forward movement of the points of application following the axis of the die.

2. The herein described method of forming a bent tubular article which is tapered and which consists in forming the tube approximately to the dimensions and tapered form of the finished tube, confining the tube within a die, the inner surface thereof having the bent and tapered form of the finished tube, then conforming the wall of the tube with the inner surface of the die by applying pressure within the tube at two substantially opposed points, moving said points of application in a circular path, and advancing them through the tube, the direction of said advancement being controlled by the inclosing die.

3. The herein described method of forming a tapered tubular elbow, which consists in forming a thin-walled tapered elbow approximately to the dimensions of the finished elbow, confining the elbow within a die having an inner surface of the elbow shape and the dimensions of the finished elbow, forcing the wall of the tube into contact with the inner surface of the die by applying pressure thereto at substantially opposite points, moving said points of application circumferentially of the tube, and simultaneously advancing them through the elbow and controlling the direction of the forward movement thereof to coincide with the axis of the elbow.

4. The herein described method of forming a tapered tubular return bend, which consists in forming a return bend slightly smaller than the dimensions of the finished tube, confining the bend within a die having an inner surface of the tapered form and the dimensions of the finished return bend, then forcing the wall of the return bend into contact with the inner surface of the die by applying pressure thereto at substantially opposite points, at one end of the bend, moving said points of pressure circumferentially and advancing them through the bend from one end to and past the middle portion of the bend, then applying pressure within the other end of the bend at substantially opposite points, moving said points circumferentially of the tube, and simultaneously advancing them through the tube to and beyond the middle portion of the bend.

In testimony whereof, I have hereunto set my hand, this 21st day of November, 1912, in the presence of two subscribing witnesses.

FERDINAND AUGUSTUS BUESCHER.

Witnesses:

M. SIMON,
E. F. WILSON.