United States Patent

N. CHRISTENSEN.

METHOD FOR SHAPING METAL TUBING.

APPLICATION FILED APR. 25, 1921.

1,432,279.

Patented Oct. 17, 1922.

2 SHEETS—SHEET 1.

Fig. 1

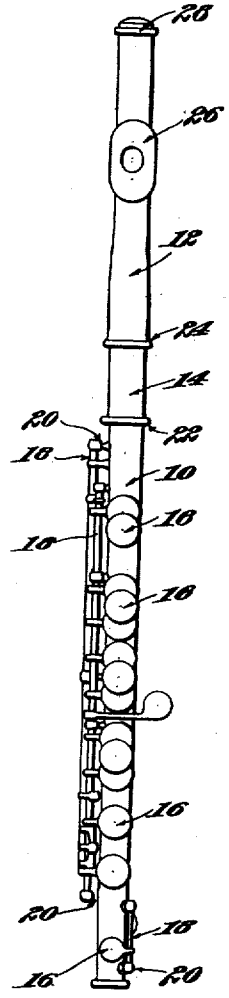


Fig. 3

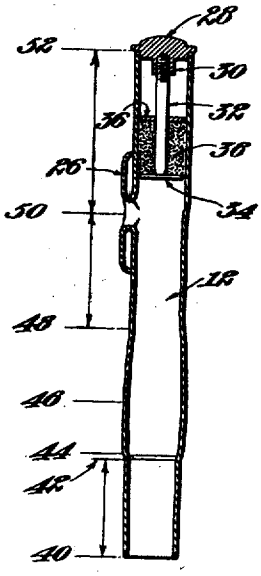
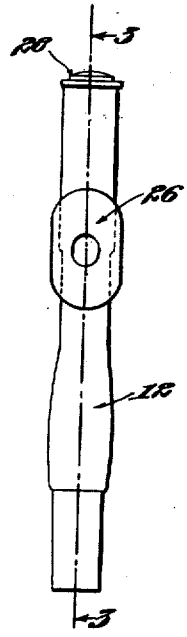


Fig. 2



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2 SHEETS—SHEET 2.

Fig. 4

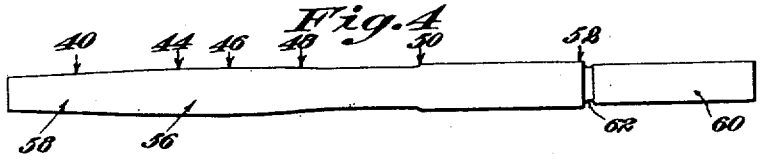


Fig. 5

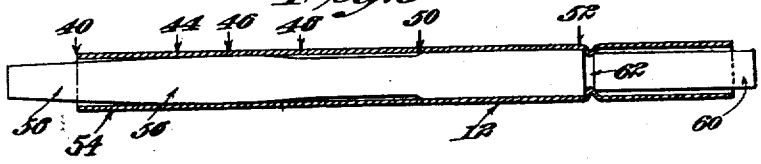


Fig. 6

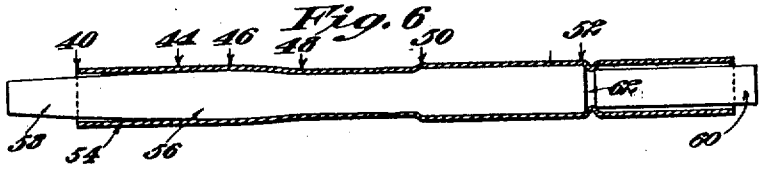


Fig. 7

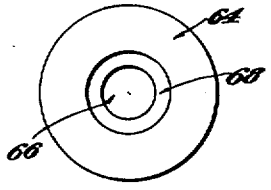


Fig. 8

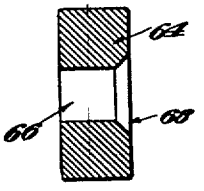
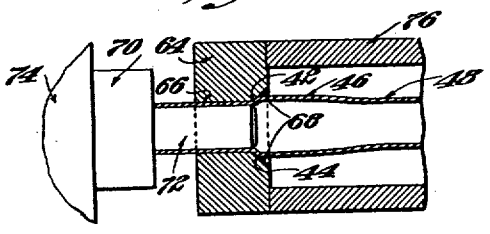


Fig. 9



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UNITED STATES PATENT OFFICE.

NILS CHRISTENSEN, OF BOSTON, MASSACHUSETTS.

METHOD FOR SHAPING METAL TUBING.

Original application filed June 20, 1918, Serial No. 305,553. Divided and this application filed April 25, 1921. Serial No. 464,342.

To all whom it may concern:

Be it known that I, NILS CHRISTENSEN, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and Improved Method for Shaping Metal Tubing, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to a method for shaping metal tubing to vary the diameter thereof and is designed especially with reference to the making of a head-piece for piccolos and this application is a division from a prior application filed by me in the United States Patent Office on June 20, 1918, Serial No. 305,553, now Patent No. 1,376,004, dated April 26, 1921, for piccolos and similar instruments.

In that application I described a head-piece for metallic piccolos which was provided with a bore having a varying diameter and also disclosed the method by which this result was accomplished. Although my invention is designed with particular reference to the making of such a head-piece having a bore of varying diameter, yet it is susceptible for use in other ways where it is desired to shape metal tubing for the purpose of giving it a bore having a varying diameter.

The main object of this invention is the provision of a simple, accurate and effective method for shaping metal tubing to produce a bore having a varying diameter.

Other objects of the invention will be more specifically set forth and described hereinafter.

Briefly my invention contemplates a method of shaping metal tubing consisting in first providing an arbor of hard steel or similar material of the exact configuration and diameter which it is desired to secure in the bore of the tubing; then mounting the arbor within the tubing and securing it in place therein in any suitable manner and then driving the tubing and arbor through a series of leaden cakes, each cake being provided with a central opening and these openings diminishing in size in said series, in order to reduce the tubing to the shape of the arbor and finally driving the arbor out of the tubing without changing the shape of the latter. In the following description, I shall, for the purpose of illustration, describe my method as applied to the shaping of the metallic tube for forming a head-joint for piccolos.

In the drawings illustrating the preferred form of my invention, Figure 1 is a top elevation of a piccolo having a head-piece constructed by my method; Fig. 2 is a similar view on an enlarged scale of the head-piece; Fig. 3 is a longitudinal sectional view of the head-piece on line 3—3 in Fig. 2; Fig. 4 is a side elevation of an arbor for forming the head-piece; Fig. 5 is a longitudinal sectional view of a piece of tubing from which the head-piece is formed, showing the arbor within the tubing and before the tubing has been reduced to the arbor; Fig. 6 is a view similar to Fig. 5 but showing the tube reduced to fit the arbor; Fig. 7 is a plan view of a die for reducing the diameter of the joint-end of the head-piece; Fig. 8 is a cross-sectional view of the die shown in plan view in Fig. 7; and Fig. 9 is a view partly in section and partly in elevation of the die and head-piece mounted in a lathe illustrating the method of removing the die from the head-piece after the joint-end has been reduced.

In Figure 1 of the drawings I have shown a complete piccolo comprising a body-portion 10 and a head-piece 12, the two being capable of separation at the joint 14. The body-portion 10 is of the usual well known construction, cylindrical in bore and having various stops 16, 16, supported on side rails 18, 18, carried by posts 20, 20, mounted on the body-portion 10. The end of the body-portion is enlarged at 14 to receive the joint-end of the head-piece and the body-portion and the head-piece may be provided with beads 22 and 24 respectively to conceal the joint and to make an attractive appearance.

The head-piece is provided with a mouth-piece or embouchure 26 of usual construction and is closed by a cap 28 screw-threaded onto the end. On the inside surface of the cap 28 is arranged a central boss 30 which is bored and threaded to receive a screw 32 having a flat head 34 and a washer 36 between which is mounted a stop 38 for closing that end of the head-piece adjacent to the embouchure 26. All of the foregoing

parts are of well known and usual construction.

The new feature of the head-piece consists in enlarging its bore adjacent to the joint. This enlargement begins at the point approximately half way between the mouth-hole in the embouchure and the joint portion of the head-piece and gradually increases to the highest point, remains constant for a short distance and then decreases slightly for a short distance until it reaches the joint where it drops to the constant dimension of the joint and the body-portion of the piccolo. In the drawings, Figure 3, the head-piece is shown in sectional view and the enlargement is exaggerated in order better to show this feature. For the purpose of illustration, I have shown in Figure 3 various lines numbered 40 to 52 inclusive, directed to various parts of the head-piece, which is shown in this figure approximately full size, and the following inside dimensions in thousandths of an inch, I have found give excellent results. From point 40 to point 42 the inside diameter of the joint is 437 thousandths, the same as the inside diameter of the bore of the body-portion. Between points 42 and 44 the bore increases from 437 thousandths at 42 to 457 thousandths at 44. From point 44 to point 46, the bore gradually and uniformly increases to 459 thousandths at 46. For approximately one third of the distance between point 46 and point 48, the bore remains 459 thousandths and then drops gradually until at 48 it is 433 thousandths. Between points 48 and 50 the bore is constant at 433 thousandths. At point 50 it increases to 438 thousandths and remains at that figure to point 52.

The method of shaping the metal tubing to form the head-piece is as follows. I first take a piece of suitable metal tubing 54 of greater length than the head-piece and place in it a steel arbor of the form shown in Fig. 4. The arbor has a main portion 56 which is in outside form and dimensions identical with the form and inside dimensions desired in the head-piece and reduced end portions 58 and 60. In Fig. 4 I have marked the parts of the arbor corresponding to the points 40 to 52 inclusive in Fig. 3. Near point 52 the arbor is provided with an annular groove 62 into which the metal tubing 54 is first spun in order to prevent its displacement on the arbor during the process of forming the tube around the arbor.

After the tubing has been arranged on the arbor as shown on Figure 5, the arbor and tubing are pushed end 60 foremost through cakes of lead of substantially the form of the die shown in Figures 7 and 8, having a central bore slightly smaller than the tubing. This operation reduces the size of the tubing slightly and by using successive cakes, each having a smaller bore, the tubing is finally reduced to fit the arbor closely. I have found as a rule that this result can be accomplished by using three cakes but more may be used if desired. At the end of this operation the tubing is in the form shown in Fig. 6, the end of the tubing adjacent the end 58 of the arbor not having been reduced to any material extent because the holes in the leaden cakes have been enlarged by the cakes being forced over the enlarged portion of the arbor.

It will be observed that the arbor between the points 48 and 50 is approximately five one thousandths of an inch less in diameter than between points 50 and 52, but I have found that the pressure exerted by the leaden cakes will reduce the tubing to the arbor between the points 48 and 50 even though the cakes have first passed over the larger part of the arbor between points 50 and 52.

After the tubing has been fitted to the arbor it is cut annularly at the groove 62 and the arbor is then driven out of the tubing at the groove end by grasping the tubing with one hand and striking the end 60 of the arbor on a solid support. I have also found that there is sufficient elasticity in the tubing so that even when the part of the arbor between points 50 and 52 has been pushed through the part of the tubing between 48 and 50, that after the arbor is out that part of the tubing between 48 and 50 will return to its reduced size.

After the tubing has been removed from the arbor the portion of the tubing between points 40 and 44 is next reduced to form the joint by placing that end through a metal die 64 having a central bore 66; the bore being bevelled at 68 to receive the end of the tube. This operation may be performed in any suitable manner, such, for instance, as placing the die in a lathe and then forcing the tube through the die into the position shown in Figure 9. This reduces that end of the tubing to the diameter desired for the joint.

In order to drive the tubing out of the die I provide a suitable plug having a head 70 and a central extending portion 72 adapted to be inserted within the tubing in the die as shown in Figure 9. The die, tubing and plug are then mounted in an ordinary lathe with the tail-piece 74 of the lathe in engagement with the head of the plug 70 and the head-piece 76 of the lathe in engagement with the die. A spindle in the lathe is then turned to cause the tail-piece to approach the head-piece, thereby forcing the die to the end of the tubing from which it may be easily removed.

By the foregoing method it is possible to secure a great variety of different shaped bores in metal tubing and where nicety and

exact accuracy is desired, such for instance, as in musical instruments, the results attained are of great importance.

What I claim is:

1. A method of shaping metal tubing, consisting in forming a piece of tubing around an arbor of the shape desired for the finished work by forcing the tubing and arbor through one or more cakes of soft metal and then removing the arbor from said tubing after it has been formed.

2. A method of shaping metal tubing, consisting in providing an arbor of the exact shape and dimension desired for the inside bore of the tubing, mounting said tubing on said arbor and then forcing the arbor and tubing through leaden cakes to reduce the tubing to fit said arbor.

3. A method of shaping metal tubing, consisting in taking an arbor of the exact shape and dimension desired for the inside bore of the tubing, mounting the tubing on said arbor and securing said tubing thereon by spinning a portion of the tubing into a groove; then forcing the arbor and tubing through a leaden cake to reduce the tubing to fit said arbor and then removing the arbor therefrom by forcing it out of one end of said tubing.

4. A method of shaping metal tubing consisting in providing an arbor having a portion of the exact form and dimension of the bore desired in said tubing and being provided with an annular groove, placing a piece of tubing of the required length on said arbor and spinning it into said groove on said arbor to hold the tubing thereon; then forcing the arbor and tubing through a plurality of leaden cakes, each of said cakes being provided with a smaller bore than the previous one in order to reduce the tubing to fit the arbor.

5. A method of shaping metal tubing, consisting in providing an arbor having a portion of the exact form and dimension desired for the bore of said tubing, mounting the said tubing upon said arbor and securing it thereto by spinning or otherwise, and then forcing the arbor and tubing through a plurality of leaden cakes, each of said cakes being provided with a smaller bore than the previous one in order to reduce the tubing to fit the arbor and finally cutting the tubing at the desired point and driving the arbor out of one end of said tubing.

6. A method of shaping metal tubing, consisting in forming a piece of tubing around an arbor of the shape desired for the finished work by forcing the tubing and arbor through a cake of soft metal, having a bore sufficiently small to reduce said tubing to fit said arbor.

In witness whereof, I hereunto set my hand this twenty-third day of April, 1921.

NILS CHRISTENSEN.