

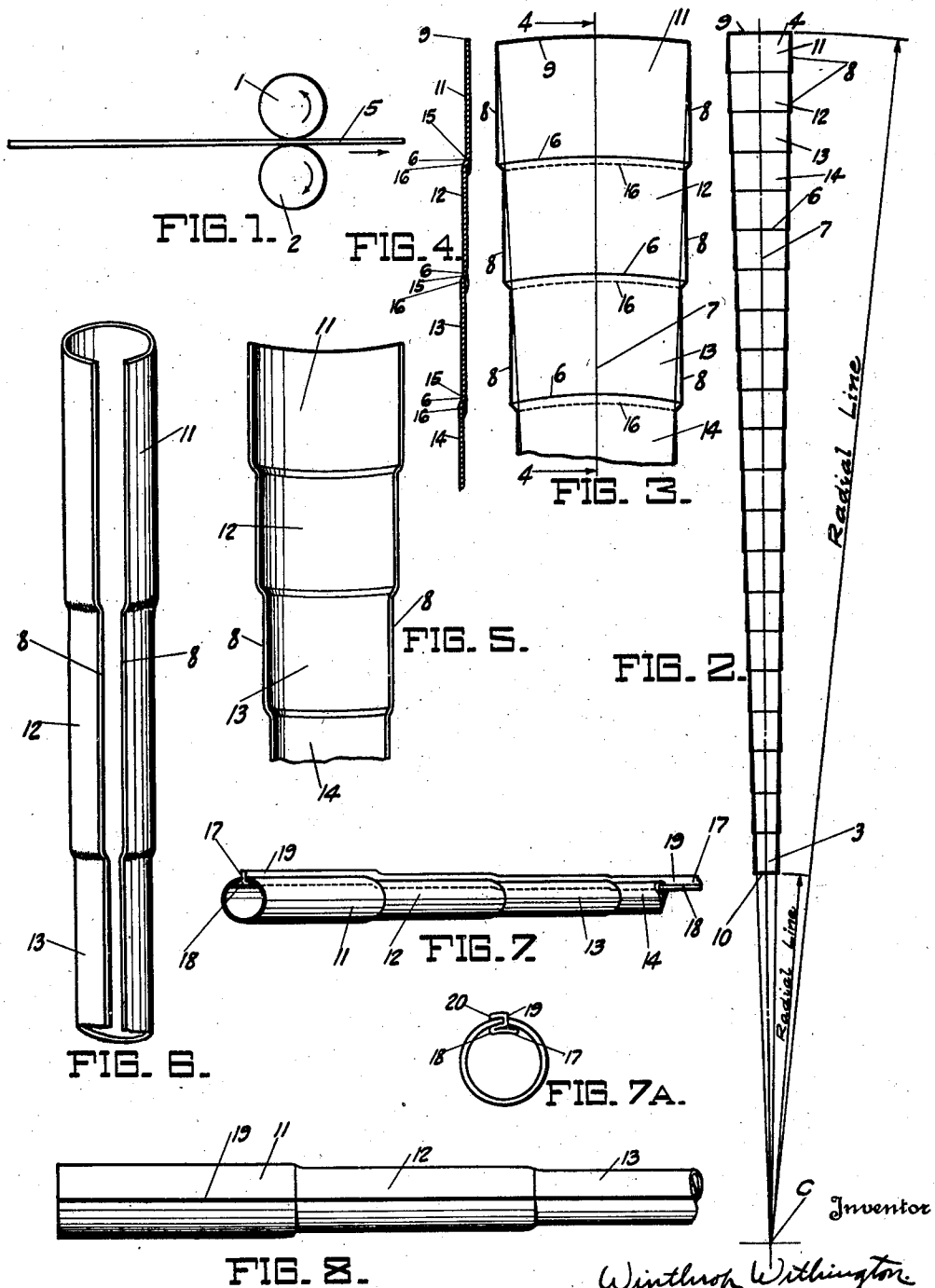
June 24, 1930.

W. WITHINGTON

1,765,709

METHOD FOR MAKING PROGRESSIVELY REDUCED TUBES

Filed Sept. 28, 1928



234

Winthrop Withington

Frank M. Slough

Attorney.

UNITED STATES PATENT OFFICE

WINTHROP WITHINGTON, OF CLEVELAND, OHIO, ASSIGNOR TO THE AMERICAN FORK
& HOE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

METHOD FOR MAKING PROGRESSIVELY REDUCED TUBES

Application filed September 28, 1928. Serial No. 309,097.

This invention relates to methods for forming tubes of varying diameters and relates particularly to the provision of an improved method for forming a tube of thin sheet metal, the finished tube to comprise successive longitudinally disposed integral sections of successively less and less diameters proceeding from an end of the tube toward its other end.

More particularly my invention relates to an improved method for making tubes or shafts adaptable for use for golf clubs, fishing rods, or the like.

An object of my invention is to provide an improved process for economical manufacture of stepped tubular shafts for golf clubs, fishing rods or the like.

Another object of my invention is to provide an improved method of producing stepped tubular shafts or rods wherein successive longitudinally disposed sections are of successively less and less diameters, and in which the finished sections are substantially tubular in form, with rounded shoulders provided between the sections.

Other objects of my invention and the invention itself will become apparent from the following description of a process embodying my invention, and by reference to the accompanying drawings illustrating successive forms which a sheet metal blank may be caused to take after being operated upon according to the different steps of my improved process.

Referring to the drawings:

Fig. 1 illustrates a strip of sheet metal being passed between rolls to vary the thickness of the strip in different portions of its length.

Figs. 2, 3 and 4 illustrate, respectively, the form of a rolled sheet of metal after being blanked by a press or the like to effect a proper shape for the sheet whereby succeeding steps of the process may be more advantageously carried out, Fig. 3 being an enlargement of a fragmental portion of the blank of Fig. 2, and Fig. 4 an enlarged longitudinal sectional view of such a fragment as illustrated in Fig. 3.

Fig. 5 is a view of a fragmental portion of

the blank of Fig. 3 after a forming operation has been accomplished thereon.

Fig. 6 illustrates a fragment of the work after a further step of the process.

Fig. 7 illustrates the work with a metallic binding insert applied thereto for a purpose hereinafter explained.

Fig. 7^a is an end elevational view of the partially completed tube of Fig. 7.

Fig. 8 illustrates a fragment of a finished tubular shaft resulting from the carrying out of the different steps of my improved process.

In the above figures it will be understood that in order to illustrate the process by means of drawings, illustrations have been made in some of the figures, particularly, with the transverse dimensions multiplied and the longitudinal dimensions reduced, so that the principles of my invention may be readily understood, even though usually the work operated upon will be made much longer, relative to the transverse dimensions as illustrated, which may be relatively reduced.

For instance, assuming that it is desired to make a shaft for golf clubs having the form of the golf shaft illustrated in United States Letters Patent to Robert H. Cowdery, No. 1,670,530 dated May 22, 1928, the successive steps of the process embodying the principles of my invention may be illustrated as shown in the drawings, although the relative dimensions, as might be scaled from the drawings, would be varied as will be well understood.

A stepped tubular shaft, substantially as illustrated in the said Cowdery patent, may be formed according to my improved process in the following way.

First a strip of sheet metal of a width of about $2\frac{1}{4}$ inches is passed between cylindrical rolls 1 and 2 of Fig. 1, which operate upon a strip 42 inches long, and placed with its opposed surfaces spaced about .012 inches apart, when the entering end of a strip having an initial thickness of .016 inches passes between the rolls, and thence as the strip is progressively passed through the rolls, the rolls are separated to a somewhat greater degree up to a separation of .016 inches. This for producing a shaft for golf clubs or the

like, whose wall thickness is to vary from .012 inches at one end to .016 inches at the other end.

As described in the said Cowdery patent, I prefer to make tubular golf shafts with the walls thickened toward that end which is of less diameter, and I therefore preferably prepare the strip, from which the shaped blank of Figs. 2 and 3 is made, with its thickness varying, say, from .016 at one end, to .012 at the other end, and in subsequently cutting, by means of suitable dies, the blank of Figs. 2 and 3 from the strip. I place the strip in the press between the blank dies with the thicker end 3 disposed at that end of the die where the resulting blank is of less width and the other end 4 of lesser thickness, at the end of the die forming the blank portion of greater width.

Figs. 2 and 3 illustrate the shape of the blank as it is shaped by the shearing effect of suitable dies, or after being sheared from the strip 5 of Fig. 1 in any suitable manner. It is to be understood that in Figs. 2 and 3, the transverse lines 6 and the longitudinal medial line 7, are only employed indicatively for a purpose later described.

The form of the blank is that shown by the solid border lines 8, 9 and 10, which define a strip of sheet metal sheared at both sides along parallel lines for short distances, and then the width of the sheared strip is increased for a second length of strip and the strip is successively widened in portions proceeding longitudinally of the strip in one direction, and the successive sections having parallel sides so formed by shearing, are progressively increased in width preferably, in the case of the golf shaft blank, by an amount equal to .047 inches for each strip, the total increase from the end section of less width to the end section of greatest width being thus accumulatively about 1 inch in a golf shaft whose greatest diameter of section is $\frac{5}{8}$ inch and whose less diameter of section is $\frac{1}{8}$ inches, these values being approximate.

Fig. 3 shows the form of both lateral and one of the end edges of the blank, and contains also a showing of the medial line 7 and the transverse arcuate lines 6, illustrated in Fig. 2.

The blank so formed, is then subjected to a forming operation wherein each successive section, such as the sections 11, 12, 13 and 14, are displaced in stepped relative producing shoulders 15 at the junctions of the stepped flat sections. Each of the stepped sections has a pair of parallel side edges 8 and arcuate ends, such as the end edge 9 for the section 11, and the arcuate transversely extending shoulder border 6 for said section, and also the intermediate sections such as 12 and 13 have parallel sides 8 and arcuate border portions 6 and 16.

I have indicated by dotted lines, the loca-

tion of the borders 16 for the sections 12, 13 and 14. The metal between the construction lines 6 and 16, of Fig. 3, is formed into the inclined shoulder portions 15 in the succeeding step of the forming process, resulting in the stepped blank of Fig. 4.

The form of the transversely extending arcuate shoulders 15, to produce the stepped blank of Fig. 4, is accomplished by offsetting the blank at each step to a laterally disposed parallel plane, and the shoulders are formed arcuately on radii having a common center, indicated at C, Fig. 2, these radii being indicated as converging to the point C, the longest one defining the arcuate edge 9, being marked "Radial line," as is also the shortest one, forming the arcuate edge 10 at the smaller end of the blank.

The shoulders formed between the construction lines 6 and 16 in the sheet metal blank, as illustrated in Fig. 4, are preferably pressed to rounded form, which will be better illustrated in the figures of drawing illustrating further steps of the process.

The stepped strip is then folded into the form of a tube by first giving it the form of a stepped trough, as illustrated in Fig. 5, which illustrates the stepped sections as being of approximately semi-cylindrical form, and the edges 8 are then brought together. Fig. 6 illustrates the edges brought very nearly together and Fig. 7 illustrates one way of uniting the edges which have been infolded to give the work the form of a stepped tube having sections each of successively less and less diameters, each section being preferably in the form of a cylinder, the sections being joined by rounded shoulders offsetting the successive sections relative to the adjacent sections.

The edges 8 of the seam extending longitudinally of the tube formed according to the preceding steps, may be secured together in any suitable way, such as by welding, brazing, or according to the method of securing the edges of a seamed tubular shaft, illustrated and described in the prior patent to William L. R. Emmet, No. 1,550,153, patented August 18, 1925, except that the steel strip herein illustrated at 19, will comprise integral longitudinally disposed portions offset each from the other, preferably to a degree corresponding to the offset of the walls of the tubular sections 11, 12, 13 and 14, etc., of the formed tube of Fig. 7.

The lengths of the offset integral sections of the strip will preferably likewise correspond to the lengths of the tubular sections.

I have indicated in Fig. 7, an initial step of applying a strip formed in transverse sections, like that illustrated in the said Emmet patent, but comprising stepped sections, except that the upstanding flange 19 of the strip is preferably not deflected laterally until

after its insertion between the matched edges 8 of the seamed tube.

Fig. 7^a shows the strip 17 with its base flanges 18 in engagement with the inner wall of the tube and its upstanding flange 19, deflected laterally as illustrated at 20, intimately engaging the outer surface of the border portion of one of the edges 8.

The thin steel strip being placed between the edges and overlapping in close contact the inner and outer surface of the tube, as described, the edges and strip mutually support each other in proper relation for brazing. A cuprous brazing material, such as pure copper, silver, or copper aluminum alloy, is then placed in the form of wire within the tube adjacent the connecting strip, and held in that relation by any suitable means while the tube is inserted in a furnace in an atmosphere of hydrogen, kept at a temperature about the melting point of copper. The fused copper will then run into the interstices between the connecting strip 17 and the adjacent portions of the body of the tube, forming a very secure union between these parts.

The surplus connecting material, comprising projecting portions of the strip flange 19, and of the brazing material, are then subsequently removed by grinding or in any other suitable way, to give the finished tube the form as illustrated in Fig. 8, the seam comprising the joining portion of the strip flange 19 being hardly visible, and may be concealed by any suitable protective coating which may be given the exterior surfaces of the tube before it is embedded in commercial articles such as golf shafts.

I may practice my invention in some embodiments without progressively increasing the thickness of wall of the strip illustrated in Figs. 1 and 2, towards one end of the strip, but I find that such a preliminary process is highly desirable to give the resultant shaft, when used for golf club shafts, the most desirable distribution of weight and resiliency in different longitudinally disposed relative portions of the tube.

Where such a preliminary operation is not had for golf club shafts, the smaller ends of the shafts are preferably larger in diameter than where the walls of such end portions are thickened in order to avoid undue breakage of the shafts.

Although I have described one method of securing the edges, comprising the seam of the tubular shaft, together, my invention is not limited thereto, and the edges may be secured in any suitable way.

I reserve the right also to accomplish the performance of any of the above successive steps of my improved process simultaneously at one operation, since within the skill of the art it is possible to accomplish any blanking and forming operation practically simulta-

neously, and within the purview of my invention.

I am aware also that other and extensive departures may be made from the embodiment process described, but without departing from the spirit of the process comprising my invention, which is defined in the claims subsequently appended hereto.

I claim:

1. The method of making tubes comprising shearing from a thin sheet of steel a substantially flat strip having its longitudinal side edges inclined progressively inwardly at intervals throughout substantially the entire length of the strip, interposed between longitudinally disposed strip sections of successively less and less width proceeding towards an end of the strip, then bodily offsetting the successively narrowed sections to form steps extending transversely across the strip between the inclined edge portions, then transversely arcuately folding the stepped strip to bring the side edges into contiguously opposed relative positions, and then rigidly securing the contiguous side edges together.

2. The method of making tubes comprising shearing from a thin sheet of steel a substantially flat strip having its longitudinal side edges inclined progressively inwardly at intervals throughout substantially the entire length of the strip, interposed between longitudinally disposed strip sections of successively less and less width proceeding towards an end of the strip, then bodily offsetting the successively narrowed sections to form steps extending arcuately transversely across the strip between the inclined edge portions, then transversely arcuately folding the stepped strip to bring the side edges into contiguously opposed relative positions, and then rigidly securing the contiguous side edges together.

3. The method of making tubes comprising shearing from a thin sheet of steel a substantially flat strip having its longitudinal side edges inclined progressively inwardly at intervals throughout substantially the entire length of the strip, interposed between longitudinally disposed strip sections of successively less and less width proceeding toward an end of the strip, then bodily offsetting the successively narrowed sections to form steps extending arcuately transversely across the strip between the inclined edge portions, the arcuately extending steps between the successively offset sections being all formed on radii having a substantially common center, then transversely arcuately folding the stepped strip to bring the side edges into contiguously opposed relative positions, and then rigidly securing the contiguous side edges together.

4. The method of making tubes comprising cutting from a thin sheet of resilient metal a substantially flat strip having integral lon-

gitudinally aligned straight-sided sections of successively greater width proceeding towards one end of the strip, then offsetting the sections successively to form steps having an inclined offsetting connection portion, and then folding the strip arcuately to bring the lateral edges of the strip together, and then integrally securing the edges together throughout their lengths.

10 5. The method of making tubes comprising cutting from a thin sheet of resilient metal a substantially flat strip having integral longitudinally aligned straight-sided sections of successively greater width proceeding towards one end of the strip, the side edges intermediate the sections being relatively oppositely inclined to an equal degree from the axis of the strip, then offsetting the sections successively to form steps having an inclined offsetting connection portion, and then folding the strip arcuately to bring the lateral edges of the strip together, and then integrally securing the edges together throughout their lengths.

25 6. The method of making tubes comprising cutting from a thin sheet of resilient metal a substantially flat strip having integral longitudinally aligned straight-sided sections of successively greater width proceeding towards one end of the strip, offsetting the sections successively to form steps having an inclined offsetting connection portion, and then folding the strip arcuately to bring the lateral edges of the strip together, and then integrally securing the edges together throughout their lengths, the offsetting connecting portions intermediate each of the sections, being arcuately formed on radii of successively increased length proceeding toward the widest portion of the strip, all of the radii having substantially a common center disposed beyond the narrowest end of the strip in the projection of the longitudinal axis thereof.

45 7. The method of making tubes comprising cutting from a thin sheet of resilient metal a substantially flat strip thicker at one end than at the other end, having integral longitudinally aligned straight sided sections of successively greater width proceeding towards one end of the strip, and bodily offsetting the sections then folding the strip arcuately to bring the lateral edges of the strip together and then rigidly securing the edges together.

80 8. The method of making tubes comprising the passing of a thin sheet of metal between rolls, meanwhile varying the spacing between the rolls progressively, and then cutting therefrom a blank in the form of a strip thicker at one end than at the other end, having integral longitudinally aligned straight-sided sections of successively greater width proceeding towards one end of the strip bodily offsetting the sections, then folding the

strip arcuately to bring the lateral edges of the strip together, and then rigidly securing the edges together.

9. The method of making tubes comprising the passing of a thin sheet of metal between rolls, meanwhile varying the spacing between the rolls progressively, and then cutting therefrom a blank in the form of a strip thicker at one end than at the other end, having integral longitudinally aligned straight-sided sections of successively greater width proceeding toward the thinner end of the strip, bodily offsetting the sections, then folding the strip arcuately to bring the lateral edges of the strip together, and then rigidly securing the edges together.

In testimony whereof I hereunto affix my signature this 26th day of September, 1928.

WINTHROP WITHINGTON.