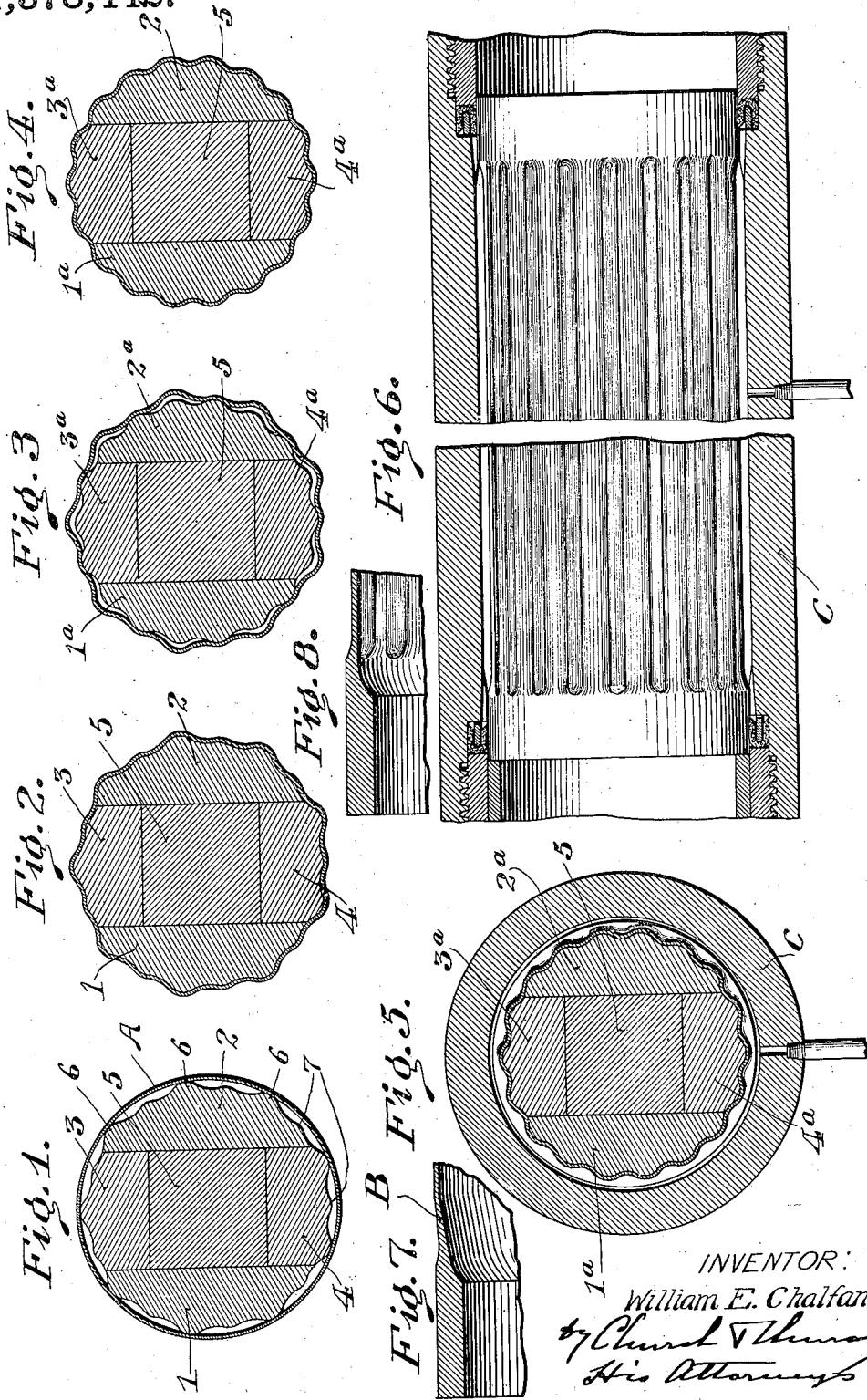


W. E. CHALFANT.
 PROCESS OF CORRUGATING CYLINDRICAL BODIES.
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1,378,442.

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INVENTOR:
 William E. Chalfant,
 by *Charles V. Thurn*
 His Attorney

UNITED STATES PATENT OFFICE.

WILLIAM E. CHALFANT, OF GLENSIDE, PENNSYLVANIA, ASSIGNOR TO LANSTON
MONOTYPE MACHINE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A COR-
PORATION OF VIRGINIA.

PROCESS OF CORRUGATING CYLINDRICAL BODIES.

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To all whom it may concern:

Be it known that I, WILLIAM E. CHALFANT, a citizen of the United States, residing at Glenside, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Processes of Corrugating Cylindrical Bodies; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention relates to the art of corrugating metal by bending, and more especially to that branch of the art having to do with the corrugation of cylinders. The practical development of the invention has been along the lines of corrugating water jackets for machine guns, and while it will be described in connection with the production of this class of devices it will be understood that the invention may be employed in the corrugating of any cylindrical or other bodies which are endless in cross section or which have a curvature, the general form of which it is desired to preserve.

In carrying the invention into practice the cylindrical wall is internally supported at points opposite the external crests of desired external corrugations and then external pressure is applied to said wall between the points of support throughout the area to be corrugated with the result that the cylindrical wall is deflected inwardly to form external valleys. In the refinements of the process especially where it is desired to secure great regularity and uniformity of the corrugations, without setting up objectionable strain in the metal, the inward bending of the wall between the supports is arrested at or not carried beyond a point where the neutral axis of the bent metal wall equals in length the neutral axis of the cylindrical wall before bending and, regardless of this condition, it is preferred that the bending shall be performed in successive stages, the cylindrical wall being first supported on the inside at points which are spaced apart a greater distance than the distance between adjacent corrugations and after the wall has been pressed inwardly in the intervals, the points of internal support are shifted to the inwardly deflected portions of the wall and external pressure ap-

plied to force the previously supported portions of the wall inwardly. The ultimate internal support should, especially where accuracy and uniform appearance is desired, conform to the internal face of the wall in its final corrugated form, and the logical and most efficient means for applying uniform external pressure is a hydraulic press in which the liquid bears directly against the external face of the wall.

In the accompanying drawings,—

Figure 1 is a transverse section of a cylinder having within it a support in the form of a sectional mandrel, the contour of which corresponds to the shape of the cylinder after external pressure has been applied.

Fig. 2 is a similar view after external pressure has been applied.

Fig. 3 is a similar view with a support in the form of a sectional mandrel, the contour of which corresponds to the final shape to be given the cylindrical body and with which the mandrel engages at the inwardly deflected parts.

Fig. 4 is a similar view after external pressure has been applied.

Figs. 5 and 6 are a transverse and a longitudinal section of a hydraulic press cylinder with a corrugated machine gun water jacket in position therein.

Fig. 7 is a detail section near one end of a water jacket cylinder before being corrugated.

Fig. 8 is a similar view after corrugation.

Like reference characters indicate the same parts in the several figures.

In the drawings adopted for illustrating the invention, the internal support for the cylindrical wall is in the form of a sectional mandrel preferably made up of five sections, four of which, indicated by the numerals 1, 2, 3, and 4, in Figs. 1 and 2, and by 1^a, 2^a, 3^a, 4^a, in the remaining figures, are held in place and properly positioned with relation to each other by a square center section 5.

The sections of the mandrel are separately positioned within the cylinder A, preferably by first positioning the sections 1 and 2, then the sections 3 and 4, and finally the center section 5, to hold all the sections in their proper relation to each other. The contour of the assembled mandrel of Figs. 1 and 2 is such that it contacts with the

inner side of the cylindrical wall at points where alternate external ridges will be formed, and these points on the mandrel may be termed the high ribs or ridges 6. Between the high ribs 6 valleys are formed in which are ribs or ridges 7 of less height than the ribs 6, and preferably of a height which will correspond to the height of the ribs or ridges which will determine the height of the corresponding external ridges or corrugations of the final product. Having placed the mandrel in position, the jacket and mandrel are now placed in the cylinder C of the hydraulic press and uniform external pressure applied, with the result that the cylindrical wall is forced inwardly against the mandrel as shown in Fig. 2. The mandrel is then removed and the mandrel shown in Figs. 3 to 5 inserted. This mandrel has its contour formed to give the final shape to the cylindrical wall and it will be noted from Fig. 3 that the ribs or ridges of the mandrel initially support the wall at those points where it is deflected inwardly and register with or fit into the low ridges of the said wall. The jacket and mandrel are now inserted in the press cylinder C and external pressure again applied, thereby deflecting the previously supported portions of the wall inwardly and completing the formation of the corrugations.

In the preferred contour lines and proportions the neutral axis of the cylindrical wall and of the corrugated wall are of the same length and this is also true with respect to the intermediate stage shown in Fig. 2. As a result the metal as a whole forming the cylindrical wall is not stretched or condensed, but its original uniform thickness and strength is preserved in the finished product.

Where, as in the formation of a water jacket for machine guns, the corrugations terminate short of the end of the cylinder, as in the example shown in the drawings, it is preferable to preliminarily shape, by cutting, those portions of the wall at the ends of the corrugations in such wise that the wall will be simply bent into the desired shape and the length of the neutral axis will be substantially the same in the blank and in the finished product.

The formation which in practice has been found to accomplish the desired end is shown in Fig. 7 and the change in the formation by corrugating is shown in Fig. 8. In said figures it will be seen that the wall increases in thickness and decreases in diameter at B in Fig. 7, and when corrugated the reduction in diameter of the cylinder at the external crests of the ridges provides the necessary metal for the valleys, leaving the neutral axis of the wall of substantially the same length and the gradual tapering away of the corrugations is in pro-

portion to the diameter of the cylinder and consequently the corrugations may be formed with the imposition of minimum strains in the metal of the wall. In fact, it is thought substantially the only strains are those due to the bending of the metal wall and exist only on opposite sides of the neutral axis.

By providing metal supports for the cylindrical wall, both when in cylindrical form as in Fig. 1, and when at the intermediate stage, as in Fig. 3, the uniformity of the action of the external pressure is insured and by spacing the points of support a very considerable distance apart the area of the wall exposed for deflection is vastly increased and the pressure required is correspondingly less to accomplish the desired deformation.

What is claimed is:

1. The process of forming corrugated cylinders in which the corrugations form arcs of less radius than the radius of the cylinder, which consists in supporting the internal face of the cylinder wall along lines opposite the crests of desired corrugations, simultaneously applying pressure to the external face of said wall between the lines of support and thereby bending said wall inwardly between the points of support, supporting the internal face of the inwardly bent portions of the wall and thereby preventing elongation of the neutral axis due to the bending movement and then removing the external pressure and internal supporting means.

2. The process of corrugating a cylindrical body which consists in supporting said body on the interior at points spaced from each other a distance greater than the distance between desired adjacent corrugations, then applying external pressure and forcing the cylindrical wall inwardly between the points of support, then supporting the inwardly deflected portions of said wall, and finally applying external pressure and forcing the previously supported portions of the wall inwardly.

3. The process of corrugating a cylindrical body which consists in supporting said body on the interior at points spaced from each other a distance greater than the distance between desired adjacent corrugations, then applying external pressure and forcing the cylindrical wall inwardly between the points of support, arresting inward movement of the deflected part at points of desired intermediate corrugations, then supporting deflected portions of said wall at the points of desired intermediate corrugations, and finally applying external pressure and forcing the previously supported portions of the wall inwardly.

4. The process of forming corrugated cylinders with corrugations having arcs of

curvature of less radius than the radius of the cylinder which consists in applying pressure to the external face of the cylinder wall, supporting the internal face of
5 said wall at intervals spaced from each other to permit the said wall to bend inwardly between the points of support without stretching the material forming the cylinder and increasing the length of the neutral axis and in arresting such bending of
10 the wall when the neutral axis is of substantially the length of the neutral axis of the wall of the cylinder before bending.

5. The process of corrugating a cylindrical body, which consists in supporting said
15 body on the interior at points opposite alternate external crests of desired corrugations, then applying external pressure and forcing the cylinder wall inwardly between
20 the points of support, then supporting the inwardly deflected portions of the wall at points opposite the external crests of desired corrugations and finally applying external pressure and forcing the first supported portions of the wall inwardly.

WILLIAM E. CHALFANT.