Jan. 26, 1926. 1,571,171

C. H. STRUPE

PROCESS OF FORMING KETTLES AND DIE THEREFOR

Filed Nov. 10, 1924

Fig. 1.

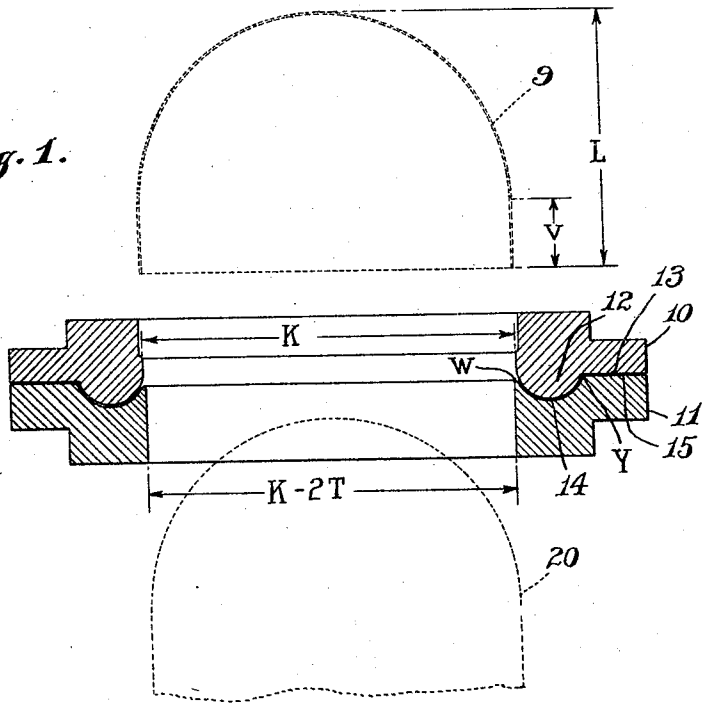
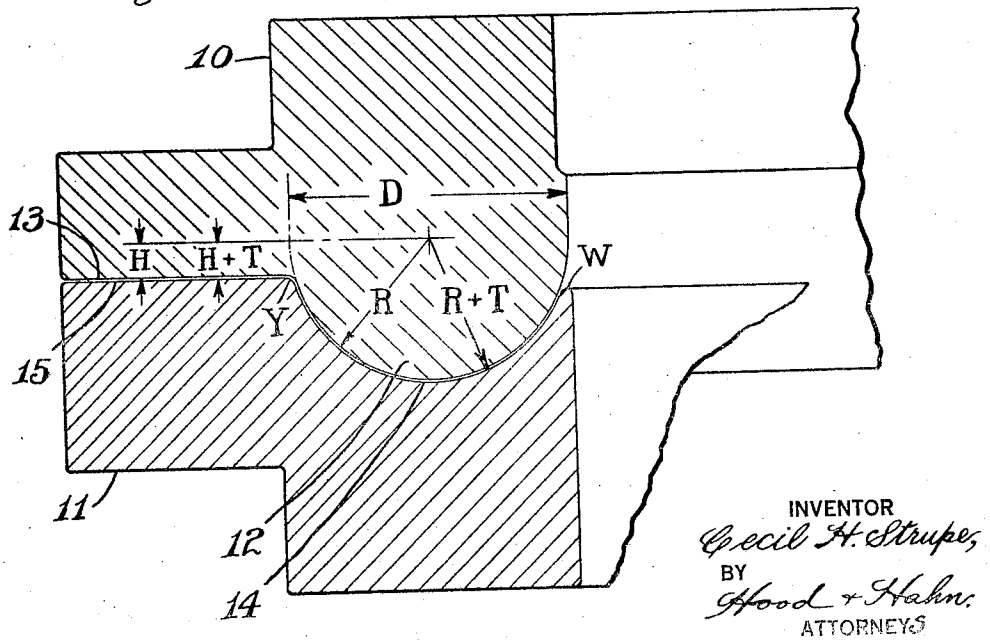


Fig. 2.



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Patented Jan. 26, 1926. 1,571,171

UNITED STATES PATENT OFFICE.

CECIL H. STRUPE, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO LEEDY MANUFACTURING COMPANY, OF INDIANAPOLIS, INDIANA, A CORPORATION OF INDIANA.

PROCESS OF FORMING KETTLES AND DIE THEREFOR.

Application filed November 10, 1924. Serial No. 749,100.

To all whom it may concern:

Be it known that I, CECIL H. STRUPE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented new and useful Processes of Forming Kettles and Die Therefor, of which the following is a specification.

The object of my invention is to produce by a single drawing and pressing operation, thin sheet metal kettles having a hemispherical bottom and a surmounting cylindrical barrel, the invention being particularly directed to the production of kettles for tympany from thin sheet copper or other suitable metal.

Heretofore apparently insurmountable difficulties have been experienced in many attempts to produce tympani kettles by a pressing or drawing operation owing to the production of ineradicable wrinkles.

I have discovered that satisfactory kettles may be produced by drawing the metal over an annular rib surrounding the drawing opening, at the same time subjecting the flanking metal over and beyond the rib to a suitable pressure between the two surfaces surrounding the drawing opening and lying substantially at right angles to the axis of the draw.

The accompanying drawings illustrate suitable dies by means of which the object of my invention may be attained.

Fig. 1 is an axial section of a pair of cooperating ring die members embodying my invention, the cooperating plunger and resulting kettle being indicated in dotted lines, and Fig. 2 is a fragmentary axial section on a scale approximately half-size.

In the drawings 10 indicates a ring die or drawing element which will be hereafter referred to as the drawing ring, and 11 indicates a cooperating ring die which will be hereafter called the pressure member.

The drawing member consists of a main ring body having an internal effective diameter K equal to the desired external diameter of the kettle 9. Flanking opening K, and tangent thereto, is a rib 12 having a radius R and this rib is externally flanked by a pressure surface 13 which is most conveniently at right angles to the axis of the opening K, and spaced a distance H from a parallel plane passing through the axis of rib 12 toward the entrance end of the ring.

The pressure ring 11 has an internal diameter equal to K—2T, where K is the same as the internal diameter of ring 10 and T is the thickness of the sheet metal from which the kettle is to be formed. Flanking the internal diameter of ring 11 is an annular groove 14, the axis of which is spaced from the axis of the ring 11 a distance equal to the spacing of the axis of rib 12 from the axis of ring 10; and also spaced from the active end-face 15 of ring 11 by a distance equal to H—T, where H is the same as H in ring 10; T equal to the thickness of the material to be handled;

At the junction W between groove 14 and the internal diameter of ring 11 the material of the ring is rounded over in order to give sufficient strength to the point W and provide for smoothness of drawing.

The edge Y, at the junction between groove 14 and pressure surface 15 is also rounded until smoothness of action is attained. I am not able to give precise instructions as to the formation of the pressure ring at this point because in practice it is found that some variations are required dependent upon the quality of the particular metal which is to be drawn. Any die maker, however, will readily understand that the edge Y is to be so rounded as to permit the metal, as it is drawn from between the pressure surfaces 13 and 15, over rib 12, to flow smoothly and eliminate any wrinkles which may have been or may be formed during the process of manipulation.

Cooperating with the two ring dies is a plunger 20 indicated by dotted lines in Fig. 1 and having a hemispherical end surrounded by a cylindrical portion. It will of course be readily understood that the rings need not be two circles although, of course, they must be mates, and that in case the rings are not two circles, the plunger must be oblated to correspond with the rings.

Starting with a substantially circular piece of sheet metal of proper thickness and

of a diameter sufficiently greater than the external diameter of the ring formed by the rib 12 to provide sufficient material for the cylindrical portion of the desired kettle, said sheet is clamped between the drawing ring and pressure ring so that the plate is initially formed into a central, and substantially flat portion, a surrounding annular rib or corrugation, and a surrounding flat portion substantially parallel with the central portion but spaced therefrom by the distance H, said distance being determined in a manner to be described. The two rings will be held together by a pressure sufficient to exert the proper drawing effect upon the metal and plunger 20 will be driven down through the rings, the metal being drawn between the rings through this space between rib 12 and groove 14, the wrinkles being ironed out during the process and the process resulting in a kettle having a hemispherical bottom and a super-imposed cylindrical portion V.

Kettles for tympano vary considerably in dimensions and as a result of experiments in producing kettles 24 inches in diameter, 16 inches in depth; 25 inches in diameter, 16½ inches in depth; 27 inches in diameter, 18½ inches in depth, and 28 inches in diameter, 18½ inches in depth, all having hemispherical bottoms and of material initally 0.040 of an inch in thickness, I have found the relative proportions may be determined satisfactorily by the following formula:

D=diameter of cross-section of rib 12.

$$R=\frac{D}{2}.$$

B=diameter of blank.

T=thickness of blank.

V=the vertical heighth of the cylindrical portion of the kettle.

K=external diameter of the kettle.

L=depth of kettle (length of draw).

H=variable, for determining drawing tension of the kettle.

25%=elongation for copper. This percentage is a variable, dependent upon a material of the blank.

$$D=\frac{K}{6}.$$

$$B=25\%\ (K=D)-K-2V.$$

$$H=\frac{K}{RL}-T.$$

The pressure to be applied to the dies will be proportional to the frictional resistance of the dies and the metal used and will also be dependent upon the elastic limit of the metal of the blank. This will be readily determined by any skilled press man.

I claim as my invention:

1. The method of forming thin sheet metal kettles which comprises forming an annular corrugation in a blank, annularly supporting the blank in the corrugation immediately adjacent the desired kettle diameter, exerting a frictional resistance upon the metal of the blank in and beyond the corrugation, and exerting a drawing pressure upon the blank within the annular support substantially at right angles to the plane of the axis of the corrugation.

2. The method of producing sheet metal kettles comprising annularly supporting a blank approximately at the desired kettle diameter, exerting a drawing pressure upon the metal of said blank within the annular support, laterally flexing the metal progressively outside and adjacent the annular support and exerting upon the blank outside the annular support a frictional resistance during radial movement of the material of the blank towards the axis of draw.

3. The method of producing sheet metal kettles comprising annularly supporting a blank approximately at a desired kettle diameter, exerting a drawing pressure upon the metal of said blank within the annular support, laterally and reversely flexing the metal progressively outside and adjacent the annular support, and exerting upon the blank outside the annular support a frictional resistance during the radial movement of the metal of the blank towards the axis of draw.

4. The method of drawing sheet metal kettles, which comprises forming an annular corrugation in a blank, the inner edge of the annulus being substantially of the diameter of the mouth of the finished kettle, holding the blank clamped between annular forming dies, and exerting drawing pressure upon the central region of the blank within the annular forming dies, whereby the drawing of the metal takes place substantially as a continuity of the inner edge of the annular corrugation.

5. A ring die comprising a drawing ring and a mating pressure ring, the drawing ring having an annular rib tangent to its bore and the pressure ring having an annular groove mating with the rib of the drawing ring and having a bore whose radius is less than that of the drawing ring by an amount approximately the thickness of the metal to be operated upon.

6. A ring die comprising a drawing ring and a mating pressure ring, the drawing ring having an annular rib tangent to its bore and an externally flanking pressure surface, and the pressure ring having an annular groove mating with the rib of the drawing ring and having a bore whose radius is less than that of the drawing ring by an amount approximately the thickness of the metal to be operated upon.

7. A ring die comprising a drawing ring and a mating pressure ring, the drawing

ring having an annular rib tangent to its bore and an externally flanking pressure surface, and the pressure ring having an annular groove mating with the rib of the drawing ring and having a bore whose radius is less than that of the drawing ring by an amount approximately the thickness of the metal to be operated upon, and also having a flanking pressure surface mating with the pressure surface of the drawing ring.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana, this 7th day of November, A. D. one thousand nine hundred and twenty-four.

CECIL H. STRUPE.