Sept. 4, 1928. 1,683,047

T. E. MURRAY, JR., ET AL

METHOD OF FORMING AXLE HOUSINGS

Filed March 1, 1927 2 Sheets-Sheet 1

Fig. 1.

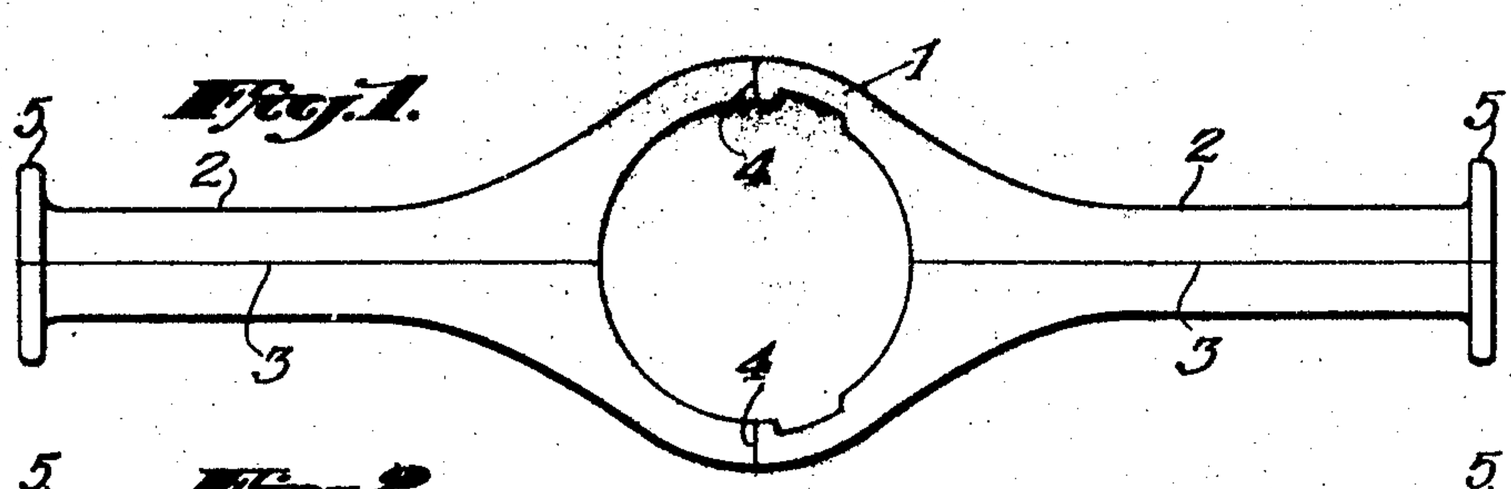


Fig. 2.

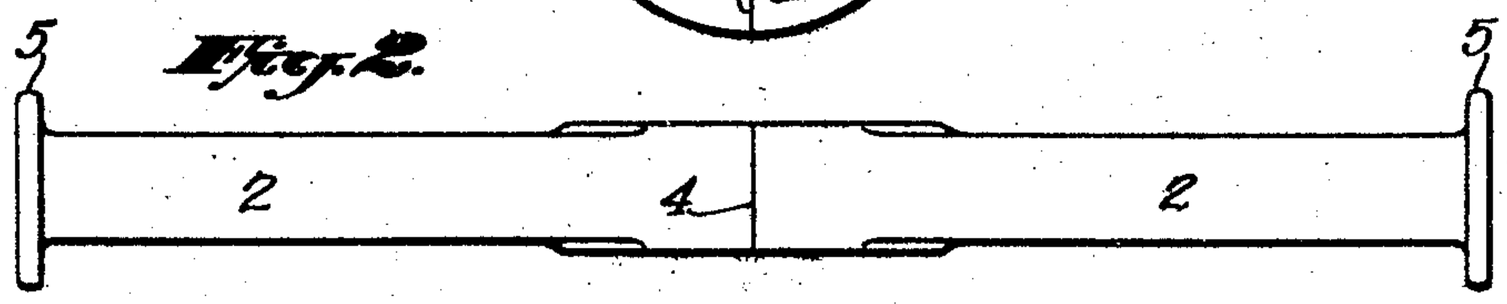


Fig. 3.

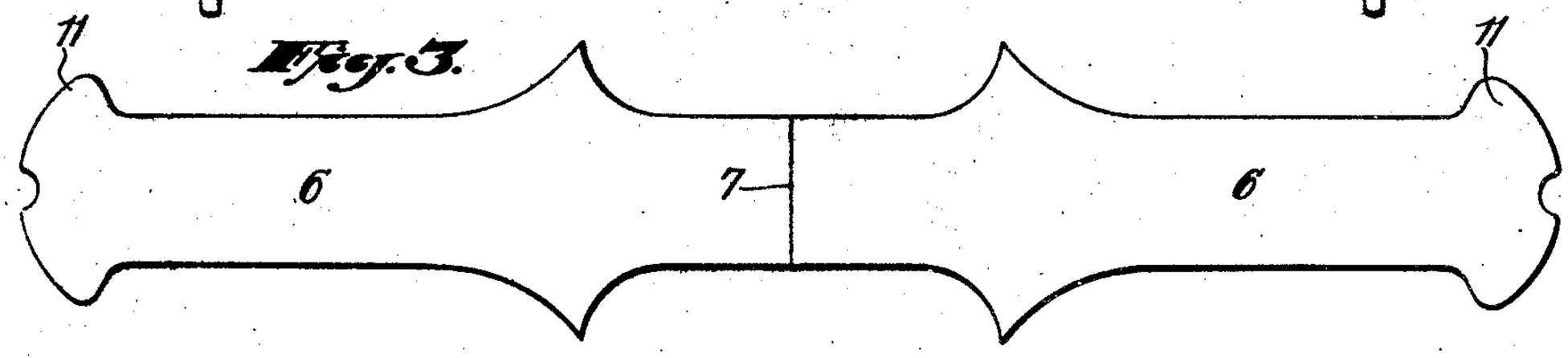


Fig. 4.

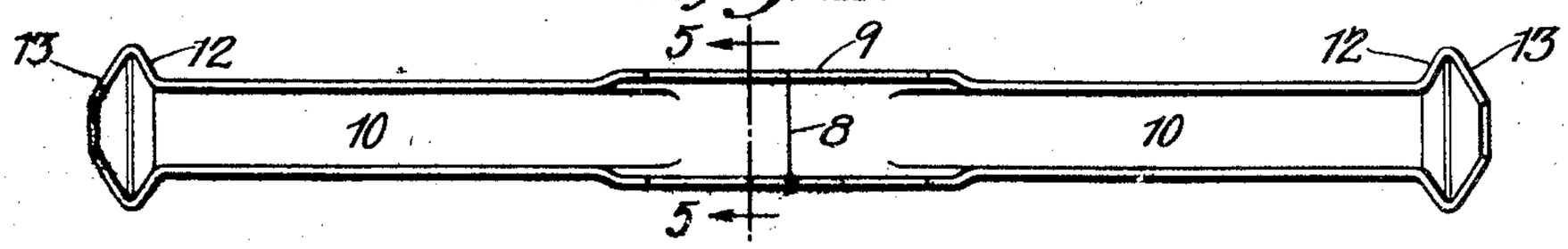


Fig. 5.

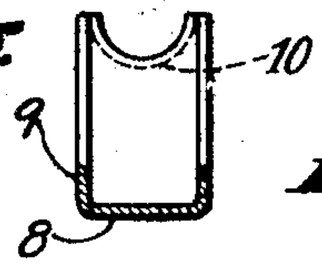


Fig. 6.

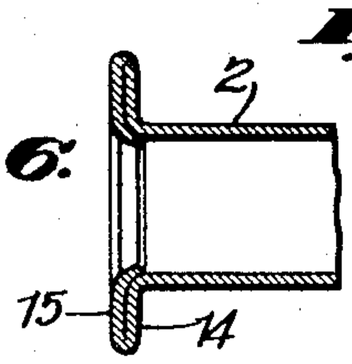


Fig. 7.

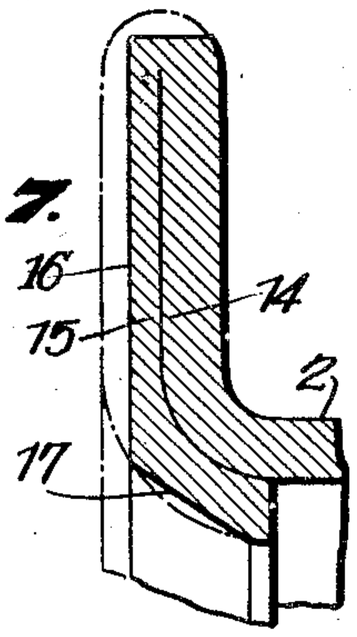


Fig. 8.

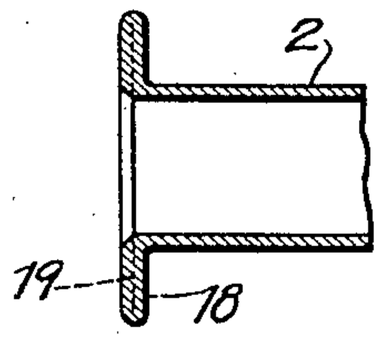


Fig. 9.

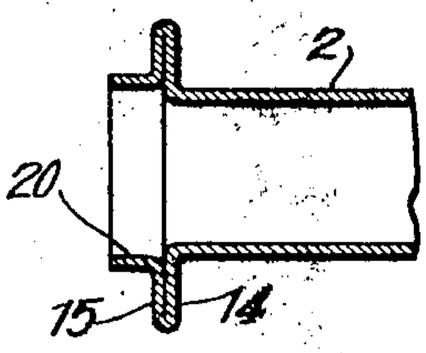
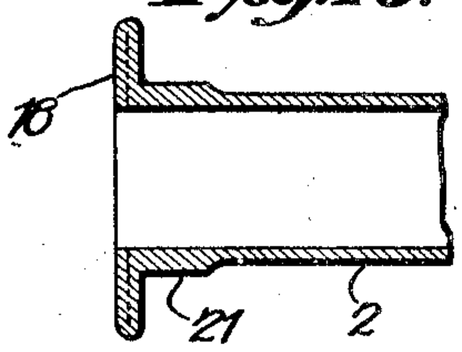


Fig. 10.



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ATTORNEY

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Fig. 11.

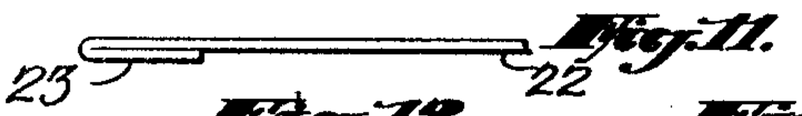


Fig. 12.

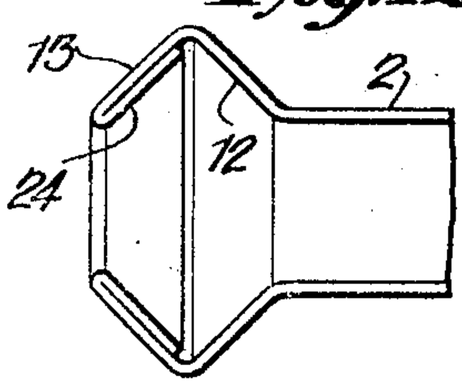


Fig. 14.

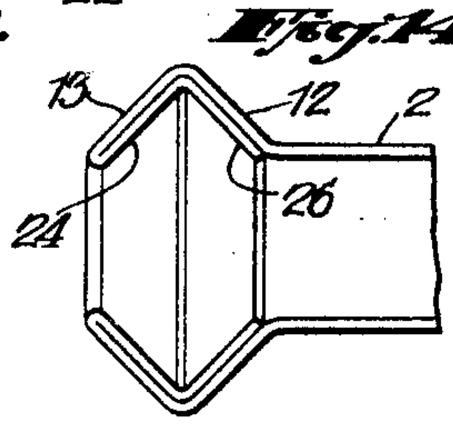


Fig. 15.

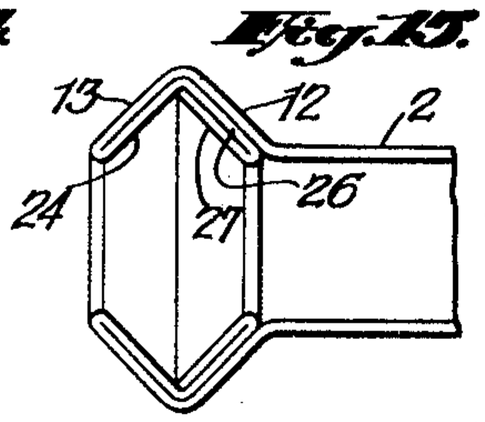


Fig. 16.

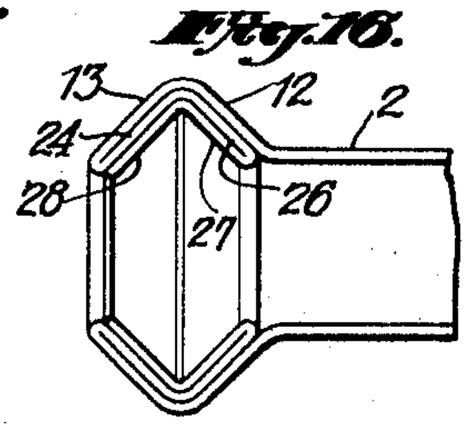


Fig. 13.

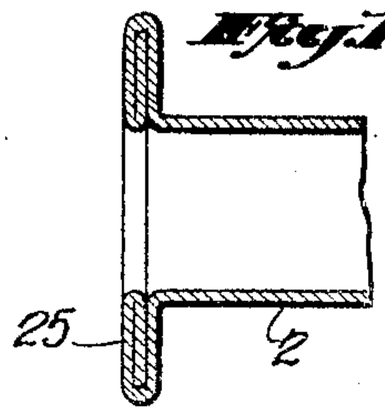


Fig. 17.

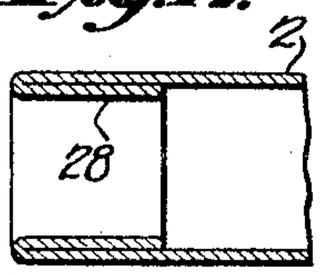


Fig. 18.

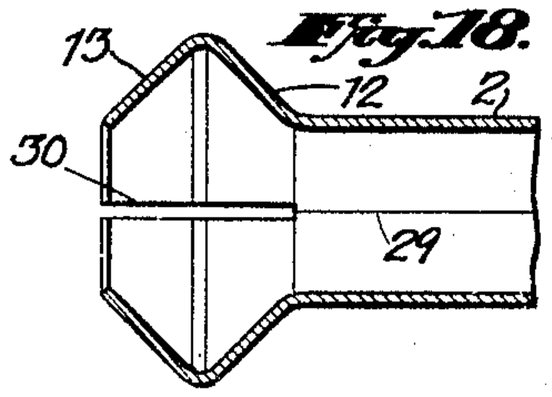


Fig. 19.

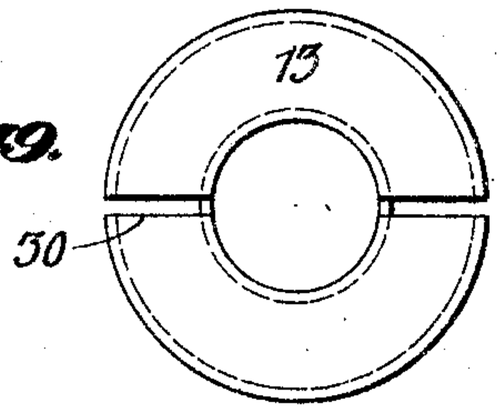


Fig. 20.

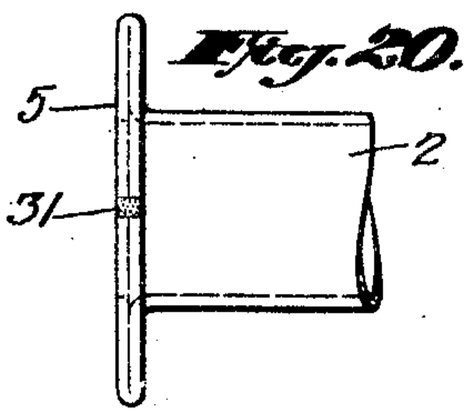


Fig. 21.

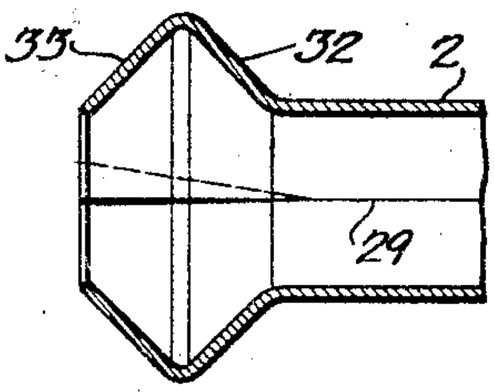


Fig. 22.

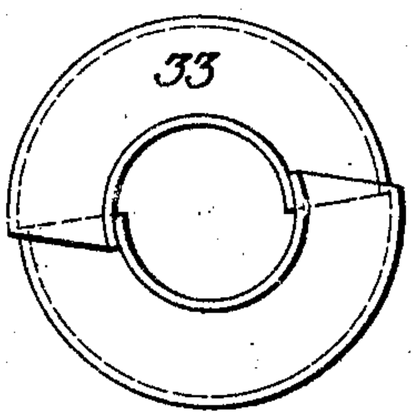


Fig. 23.

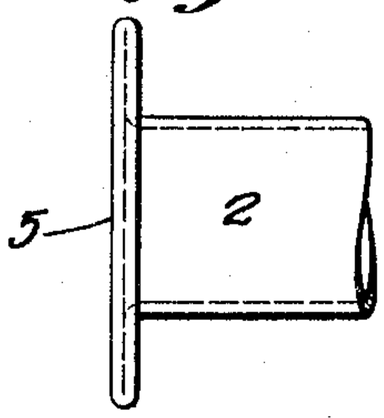


Fig. 24.

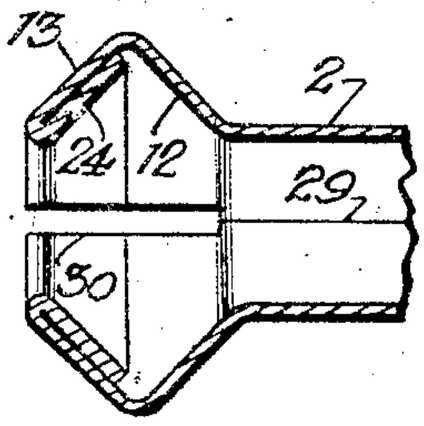


Fig. 25.

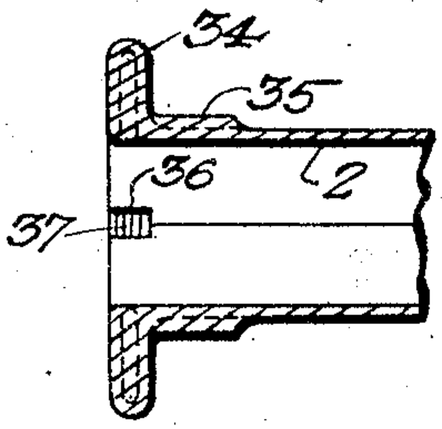
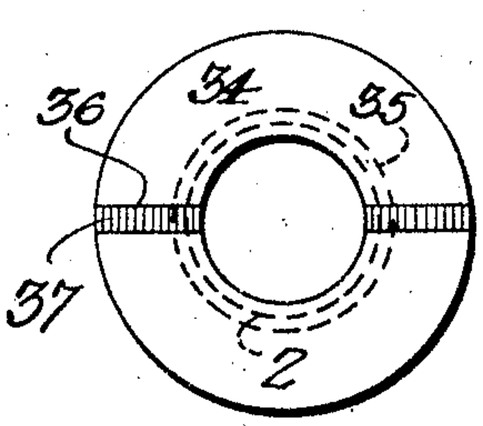


Fig. 26.



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Patented Sept. 4, 1928. 1,683,047

UNITED STATES PATENT OFFICE.

THOMAS E. MURRAY, JR., AND HERBERT H. WILLIAMS, OF BROOKLYN, NEW YORK; SAID WILLIAMS ASSIGNOR TO THOMAS E. MURRAY, OF BROOKLYN, NEW YORK.

METHOD OF FORMING AXLE HOUSINGS.

Application filed March 1, 1927. Serial No. 171,756.

The invention aims to provide an economical axle housing, with particular reference to the end portions thereof.

Fig. 1 is a side elevation, and Fig. 2 is a plan of a complete axle housing;

Fig. 3 is a plan of a blank from which a segment of the housing is formed;

Fig. 4 is a plan of a segment bent up from a blank;

Fig. 5 is a cross-section of Fig. 4 on the line 5—5;

Fig. 6 is a cross-section of an end of the housing as first formed;

Fig. 7 is a partial view of the same after finishing;

Figs. 8, 9 and 10 are views similar to Fig. 6 illustrating modifications;

Figs. 11, 12 and 13 illustrate an alternative method of production in successive stages;

Figs. 14, 15 and 16 illustrate modifications on the same principle;

Fig. 17 is a longitudinal section illustrating another modification;

Figs. 18, 19 and 20 are respectively a longitudinal section and an end and side elevation illustrating another method; and

Figs. 21, 22 and 23 are similar views of another modification;

Figs. 24, 25 and 26 illustrate a combination of the steps illustrated in the other figures; being respectively a blank and a section and end view of the product.

The axle housing has a central annular portion 1 formed approximately on a circle about a transverse axis, and end portions 2 constituting tubes on a longitudinal axis. The housing is made of segments united along longitudinal edges, preferably by butt welded joints 31. The segments may be made from half-length blanks united by transverse joints 4 through the central portion, as described in a copending application of Thomas E. Murray, jr., No. 170,177, filed February 23, 1927. On the ends of the housing are flanges indicated as a whole by the numeral 5.

Such housings may be made up in various ways, one of which is illustrated in Figs. 3 to 7. Fig. 3 shows a flat blank made up of two half-lengths 6 with a transverse butt weld 7 at the center, this blank is then bent and drawn to the segmental shape of Figs. 4 and 5, and two of such segments welded together as explained in connection with Figs. 1 and 2. The central portion 8, Fig. 4, is approximately semicircular about the transverse axis, with inwardly bent edges or flanges 9, and the end portions 10 are substantially semicircular.

The blank of Fig. 3 has at the ends laterally extended portions 11 which are bent outward and then inward as in Fig. 4 at 12 and 13. When the segments are welded together these end portions are bent inward to come together and form the flanges 5 as shown in Fig. 6 of two plies 14 and 15. These may be afterwards machined off as in Fig. 7 to provide accurate finished bearing faces 16 and 17.

Forming the end flanges of axle housings in this way has several advantages. The metal can be economically stamped from a sheet in one piece with the adjoining parts of the housing; so that the end flange costs practically nothing additional as far as steel is concerned. There is a large saving of labor in such an integral end flange compared with the usual separately formed piece applied to the ends of the tube. The flange is thicker than the wall of the tube, as it should be for strength. In compressing the end folds together the pressing tools are gauged to move to a certain distance from the center of the middle ring 1 so that they determine accurately and identically the length of each end of the housing, and also the overall length. The widths of the flanges are varied according to the extent of the compressing movement, but this is unimportant and the length can be determined without considering the resulting width. The main bending operations to form the segments may be performed cold, but the bending up operations on the flanges are best performed by first heating the metal. This permits certain operations in the nature of hot forging by which certain supplementary advantages can be obtained.

The complete operation, as we prefer to practice it consists in stamping out the half blanks, welding them together in whole blanks, shearing or otherwise removing the flash or extruded metal at the weld, bending the blanks in a succession of operations of the usual kind to form segments, trimming the bowl or central annulus, but welding the longitudinal joints while enclosing the reinforcing ring, removing the outside flash and the inside flash except at the ends,

heating the ends and flattening them while gauging them with reference to the center of the annulus and truing or lining up the product. Various supplementary operations may be performed, as described hereinafter, for example. Variations may also be introduced in the operations above described. The welding of the longitudinal joint may extend only over the straight portions of the end tubes, leaving the welding of end portions to be performed after they are flattened to form the end flanges.

By heating the ends of the housing, the extra metal at these points can be folded not only into two plies but into a practically integral flange 18, Fig. 8, of double thickness. This is done by placing dies at the back and front faces and subjecting the hot metal to such pressure as to weld the parts together along the line indicated at 19 and at the same time form the flange accurately.

Fig. 9 shows how the ends can be bent in two plies 14 and 15 with a tubular extension 20 beyond the flange.

Fig. 10 shows a solid flange 18 like that of Fig. 8 and shows a length 21 of tubing upset in the forging operation to form a wall of extra thickness which strengthens this portion of the tube and provides an improved support for bearings and other fittings.

Fig. 11 is an edge view of a strip 22 which is flat and has an end portion 23 folded over against it. Such a strip may then be bent as in Fig. 12 to form the end tube 2 and the bent portions 12 and 13 as before, with the folded over portion of the strip forming an extra ply 24. When these parts are compressed endwise we have the result shown in Fig. 13, a flange 25 three times as thick as the wall 2 of the tube.

By folding over a longer portion at the end of the flat strip, the bent up product will be as in Fig. 14 with the extra metal at 26 so that the finished flange will be four-ply. By folding over a still greater length of the strip and then doubling the end of this back again an extra ply appears as at 27, Fig. 15, so as to produce a five-ply flange. And by still further increasing the end of the last fold the added portion will appear as at 28, Fig. 16, and the result will be a six-ply flange. This principle may be extended as desired.

The ends of the housing may be strengthened without flanging by a similar method. Fig. 17 shows the end of a segment reinforced by an extra ply 28. This is made from a strip like that of Fig. 11, folded over at the end. The extra ply may be on either the outside or the inside of the segment. Two such segments welded together will present the extra ply 28 as an extra tube reinforcing the end of the tube 2. By folding the end of the strip a second time, we can secure a reinforcement similar to that of Fig. 15 of three thicknesses at one point and two thicknesses at another; or similar to that of Fig. 16, of three thicknesses throughout. And this principle can be extended at will. This method is described and claimed in a pending application of Thomas E. Murray, Serial No. 166,625, filed February 8, 1927. In the present application it is claimed only in connection with axle housings made of segments struck up from flat blanks, in which connection it provides a most economical method of effecting an advantageous thickening of the housing walls where they particularly require it.

We have described the butt welding of the segments together, and we believe this is the best method of uniting the segments. Similar flanges and thickened ends may be produced, however, where other styles of joint are used. Figs. 18, 19 and 20 illustrate a method using arc-welding for all or part of the job. The ends of the segments are so shaped that when they are joined to form the tube 2 the longitudinal joint 29 (butt-weld or arc-weld or other type) ends at the beginning of the bends 12 and 13, leaving spaces 30 between the edges of the opposed segments. These may be filled with metal deposited by the electric arc as indicated at 31, Fig. 20, deposited either before or after pressing the parts together to form the flange 5.

According to Figs. 21 to 23, the surplus metal at the ends of the strips is such that the parts 32 and 33 on one segment will overlap those on the other segment, as shown in the end view, Fig. 22. The joint 29 made as in Fig. 18, extends only to the enlarged portion 32. When the parts are heated they may be compressed and forged to form the flange 5 of Fig. 23.

The several supplementary operations of folding the ends of the blank to overlapping positions, compressing the flanges and forging the ends and extending the butt weld to but not including the end portions are illustrated in Figs. 24 to 26. The ends of the segments are folded over in the same way as in Fig. 12, but with recessed portions so that when they are joined to form the semi-finished tube of Fig. 24 they are butt welded along the line 29 leaving spaces 30 between the portions which are to form the flange. These portions are then compressed endwise and forged to form the flanges 34, Figs. 25 and 26, and the upset wall portion 35 of extra thickness, with radial slots 36 which are afterwards filled in with deposited metal 37 to unite the parts and complete the annular flange.

The end flanges and method of forming them indicated in Figs. 1 to 6 are covered in

an application of Herbert H. Williams, Ser. No. 83,331 filed January 23, 1926; and the combination method of forming such end flanges on half-length blanks, in the application of Thomas E. Murray, jr. above referred to. The present application is directed to the particular improvements illustrated in the other figures.

Various other modifications in the design and method of operation may be made by those skilled in the art without departing from the invention as defined in the following claims.

What we claim is:—

1. The method of forming axle housings which consists in forming flat blanks, folding back the ends of said blanks to form overlapping portions of extra thickness, then bending said blanks with their overlapping portions into segments and uniting the segments along longitudinal edges.

2. The method of forming axle housings which consists in forming flat blanks, folding back the ends of said blanks while flat to form overlapping portions of multiple thickness, then bending such blanks with their overlapping portions up to segmental shape with the end portions bent outward and inward in longitudinal section and uniting the segments along longitudinal edges and compressing the end portions in the longitudinal direction to form flanges of more than two plies in thickness.

3. The method of forming axle housings which consists in bending up sheet metal to form segments having their end portions bent outward and inward in longitudinal section, uniting said segments together along longitudinal edges, heating the ends and compressing them endwise to form flanges and to forge them as desired and simultaneously upsetting the ends of the tubes back of the flanges.

4. The method of forming axle housings which consists in bending up sheet metal to form segments having their end portions bent outward and inward in longitudinal section, uniting said segments together along longitudinal edges by welds extending to but not including said end portions and compressing the end portions in the longitudinal direction to form flanges.

5. The method of forming axle housings which consists in bending up sheet metal to form segments having their end portions bent outward and inward in longitudinal section, uniting said segments together by butt welds extending to but not including said end portions, uniting said end portions together by deposited metal and compressing the end portions in the longitudinal direction to form flanges.

In witness whereof, we have hereunto signed our names.

THOMAS E. MURRAY, JR.
HERBERT H. WILLIAMS.