M. J. McMARTIN.

METHOD OF MAKING PIPE.

APPLICATION FILED OCT. 8, 1909.

999,390.

Patented Aug. 1, 1911

2 SHEETS—SHEET 1.

Fig. 1

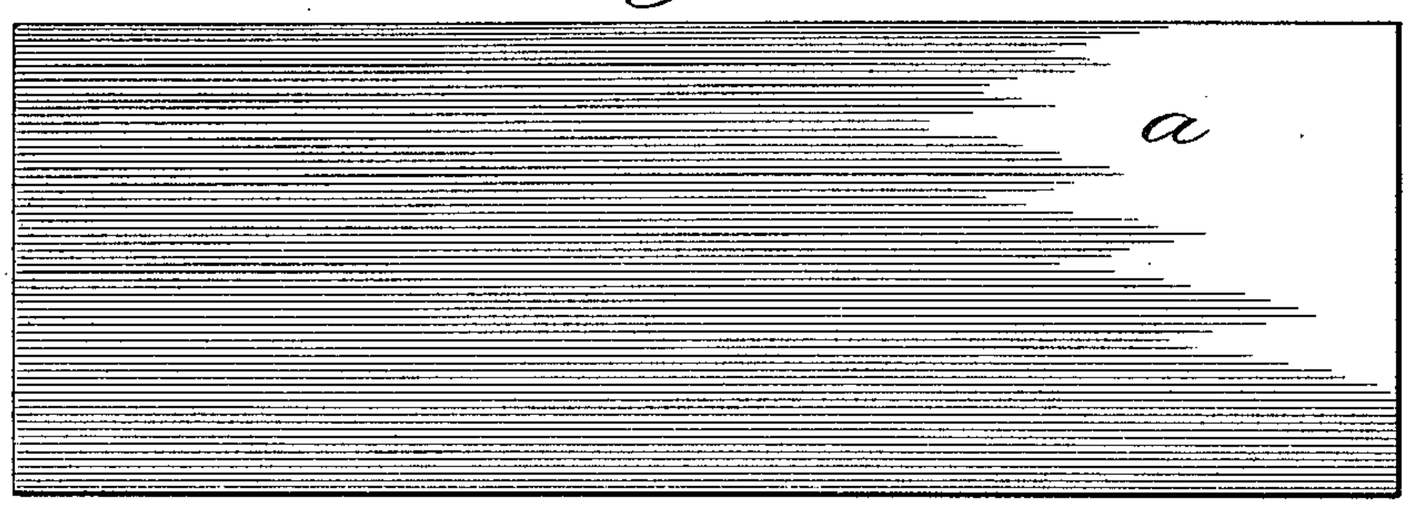


Fig. 2.

Fig. 3

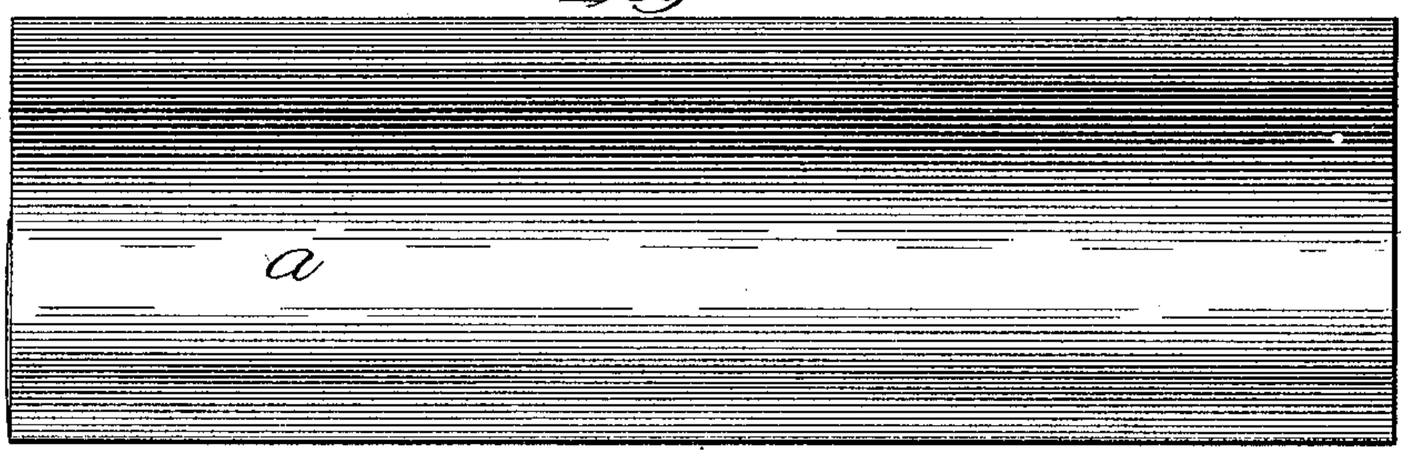


Fig. 4.

Fig. 5.

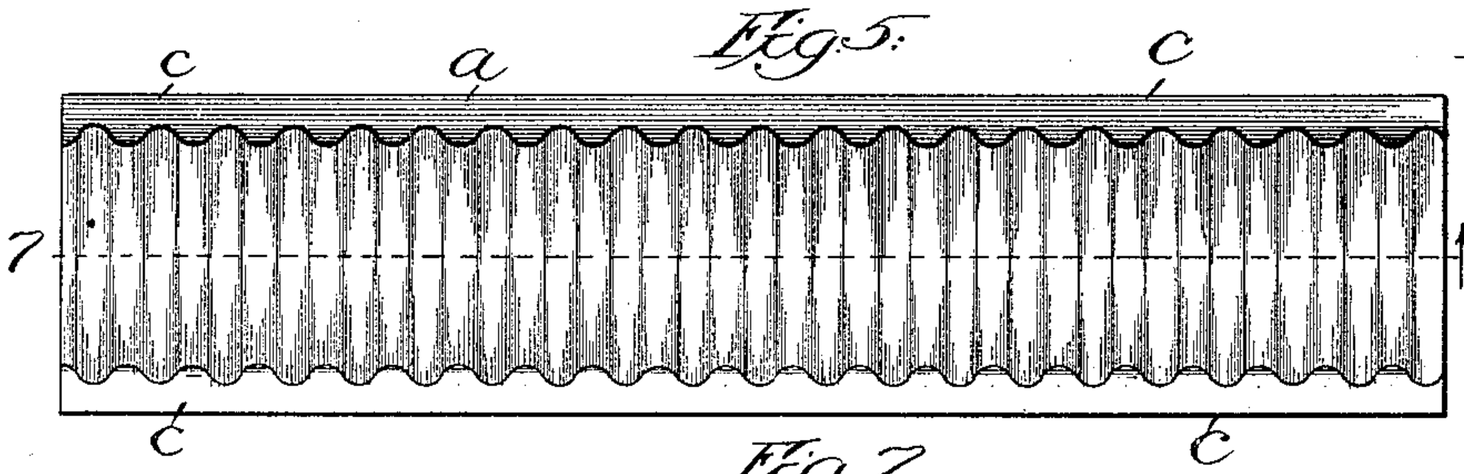


Fig. 6.

Fig. 7.

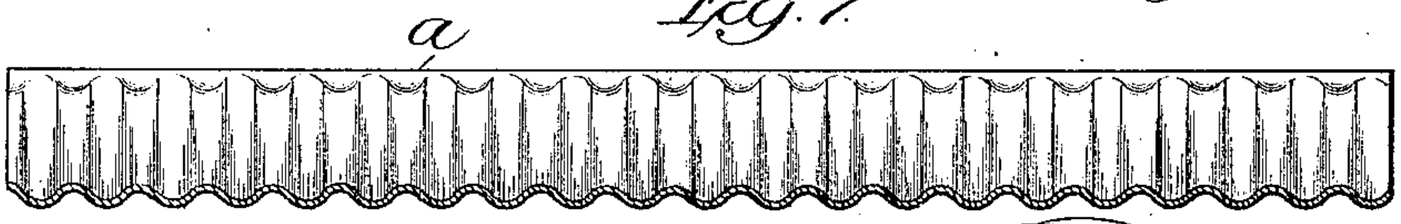


Fig. 8.

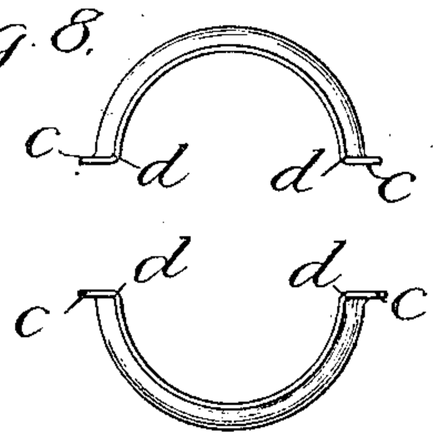
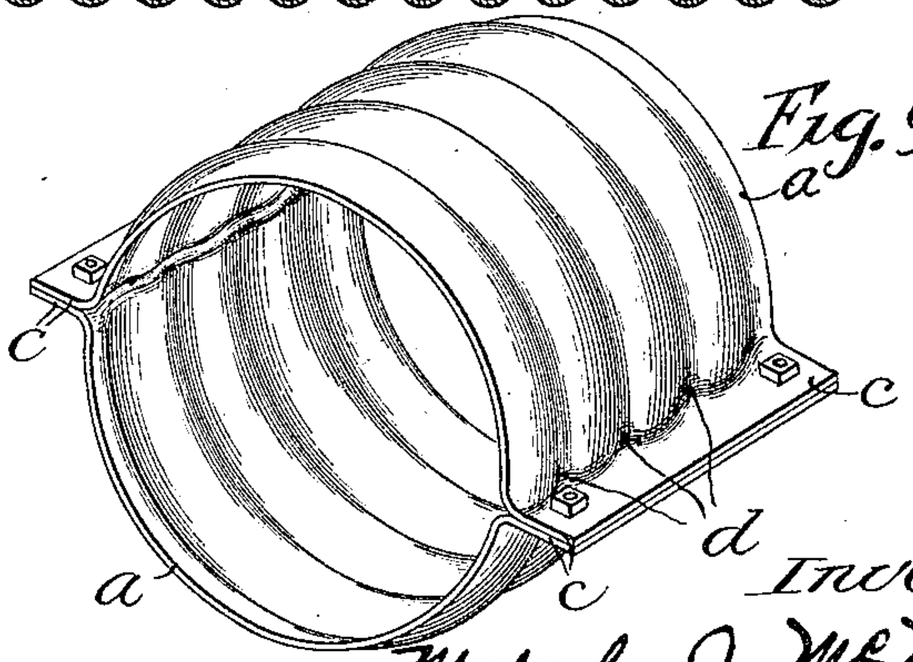


Fig. 9.



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2 SHEETS—SHEET 2.

Fig. 10.

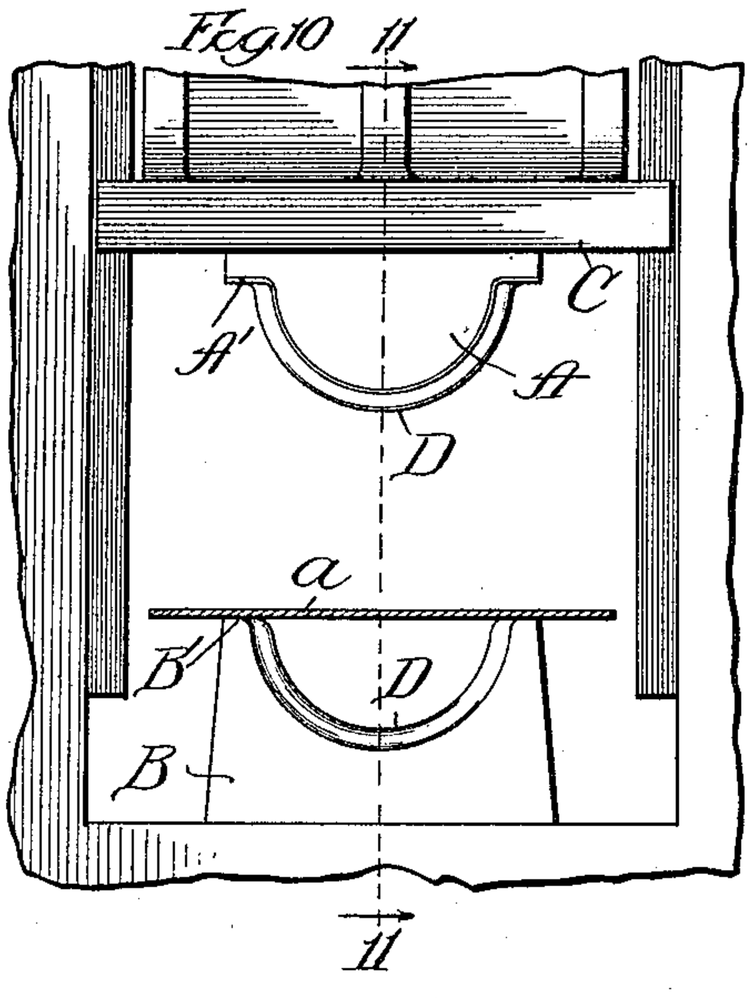
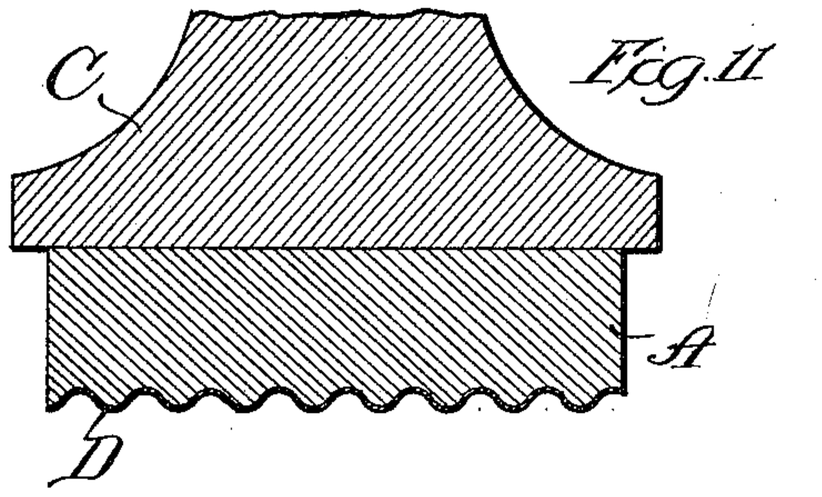


Fig. 11.



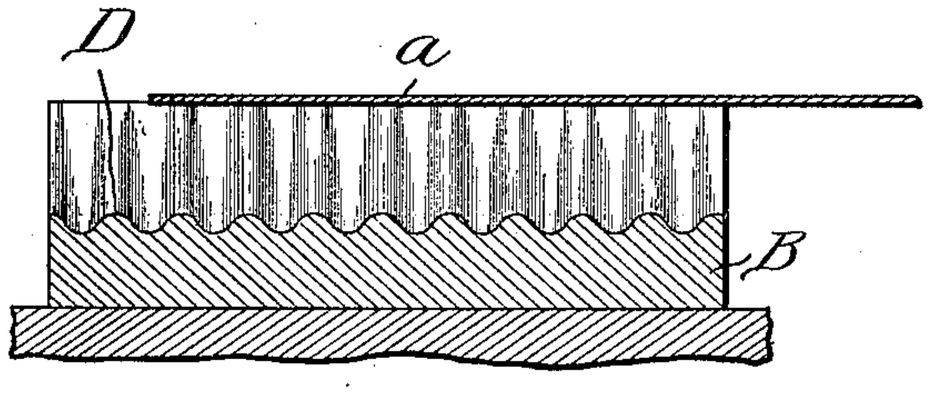


Fig. 12.

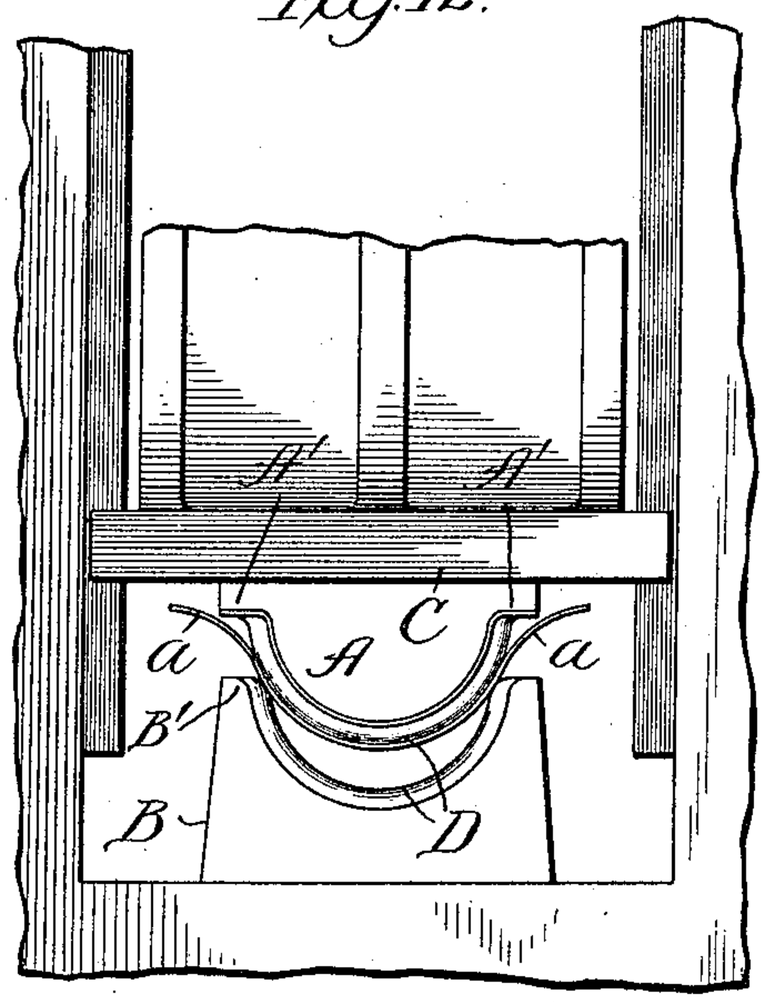
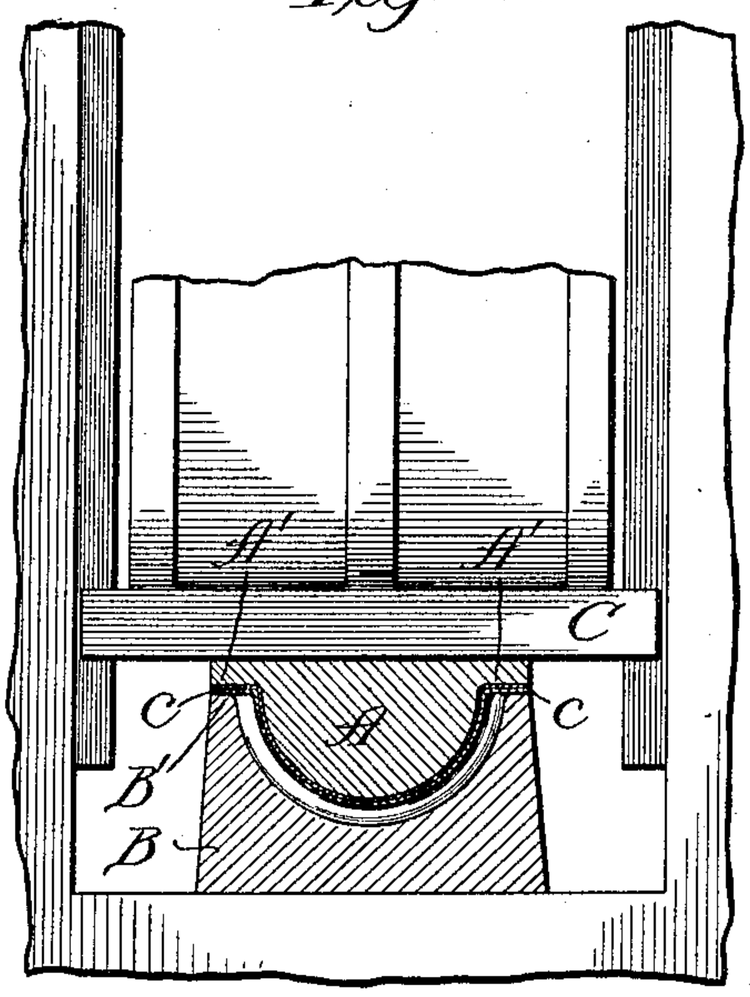


Fig. 13.



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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING PIPE.

999,390. Specification of Letters Patent. Patented Aug. 1, 1911.

Application filed October 8, 1909. Serial No. 521,667.

To all whom it may concern:

Be it known that I, MALCOLM J. McMARTIN, a citizen of the United States, residing at Duluth, in the county of St. Louis and State of Minnesota, have invented certain new and useful Improvements in Methods of Making Pipe, of which the following is a specification.

My invention relates to a method of making sheet metal pipe to be used as culverts, drains, and the like. Pipe of this character is usually made of galvanized iron wrought into cylindrical form, the cylinder being divided longitudinally into two similar sections, each of said sections being provided with longitudinal flanges, some times plain and some times corrugated, the body of the pipe being usually provided with transverse ribs or corrugations, symmetrically arranged and extending to or through the marginal flanges. These semi-cylindrical sections with their flanged margins are constructed in various lengths and of various diameters, the sections usually being from twenty-four to forty-eight inches in length and the diameter of the cylinder made from two such sections varying from six inches to six feet. Heretofore and so far as I am aware the sheet metal from which these semi-cylindrical sections or segments are formed has been subjected to the action of fluted rollers or dies whereby they are corrugated transversely of the sheet and then such corrugated sheets are passed through curving dies, the same consisting usually of three rollers whereby the curved form is imparted to each such corrugated sheet. Obviously the curving of such corrugated sheets requires the application of great force, since the corrugations stiffen and brace the sheet transversely. It is estimated that a corrugated sheet has twenty-nine times the strength of a plain or uncorrugated sheet in a pipe of average size. Further, if it be desired to produce a pipe having a corrugated body portion and flat or plain flanges the margins of such corrugated sheet must be flattened, thus subjecting the metal to two bending operations and consequently tending to weaken it. Furthermore, the curving of these sheets after they are corrugated has a distorting effect upon the metal which results in breaking the coating or galvanizing, thus exposing the raw metal and resulting in weakening the plate and deterioration by rust.

It is the purpose of my invention to avoid the difficulties encountered in the manufacture of these semi-cylindrical pipe sections, and this I accomplish by a method of procedure which has the effect to produce the corrugating or off-setting of the body of the sheet and its final curvature simultaneously, the result being that the metal is not harmfully stretched or distorted and the galvanizing is undisturbed.

My improved method also facilitates the economical manufacture of semi-cylindrical pipe sections and lends itself admirably to the formation of plain or uncorrugated longitudinal flanges upon the edges of the corrugated sections, thus affording greater rigidity in the completed article than if said corrugations extended across the securing flanges.

Generally stated, my improved method consists in subjecting a plain sheet of metal to such action that its body portion is transversely curved, corrugated or dished and while its side margins are bent to provide lateral flanges.

This method may be carried out by various instrumentalities which form no part of my process, as the method herein described and claimed might be carried out by various means or even by hand and such simple tools or accessories as a properly faced hammer and a suitable die. I have, however, shown in the accompanying drawings a convenient form of apparatus for economically carrying out my said method, but it will be understood that the same may be varied and the particular form thereof is not essential to my invention.

In the accompanying drawings—Figures 1 and 2 show a plain sheet of metal in plan and end view. Figs. 3 and 4 show the same sheet partially curved. Figs. 5 and 6 show the sheet bent into semi-cylindrical form with the corrugations and flanges fully developed. Fig. 7 is a longitudinal sectional elevation on the line 7—7 of Fig. 5. Fig. 8 is an end view of two of said sections separated, but occupying mating relation to each other. Fig. 9 is a perspective view of two of said sections joined to produce the cylindrical pipe. Figs. 10, 11, 12 and 13 are different views, all of them fragmentary, of parts of an apparatus for carrying out my improved method; Fig. 10 showing two cooperating dies, separated with the metal sheet interposed between them, and Fig. 11

being a sectional view on the line 11—11 viewed at right angles to that of Fig. 10. Fig. 12 is an end view showing the partial curvature of the sheet corresponding to Figs. 3 and 4, and Fig. 13 shows the fully developed section corresponding to Figs. 5 and 6.

Obviously, the carrying out of my invention involves a progressive treatment of the blank and each step of the progression may be repeated several times in such development, but the complete method involves a continuous modification of the form of the sheet from the beginning to the end of the operation during which there is developed the transversely curved and corrugated forms and the longitudinal securing flanges. Furthermore, this treatment may be said to reach a crucial stage, viz., at that point wherein the final form is given to the transverse corrugations and marginal flanges, without distorting the metal composing either of said parts, and this treatment is particularly important as regards that part of the structure bounded by the depressed and outstanding portions of the corrugations and the adjacent straight flanges.

I will describe one method of carrying out my invention in connection with the apparatus suggested in the drawings premising that the treatment will vary somewhat, depending upon the length and width of the sheets, the depths of the corrugations and other factors.

Assuming that it is desired to produce a pipe composed of semi-cylindrical sections with straight marginal flanges and to corrugate said sections transversely and that the completed section is to be of suitable length and diameter, I take a plain sheet as *a*, Fig. 1 of requisite dimension and subject it first to a transverse curving operation by the aid of suitable accessories, such as the dies A and B shown in Fig. 10. The die A is mounted upon a suitable cross-head C and is arranged to drop so as to strike the sheet while the latter is lying upon the die B. The force of the blow thus delivered produces the partial curve shown in Fig. 12. The faces of the dies, which are semi-cylindrical are shown in Fig. 11, and the die faces D′ being so shaped as to impart transverse corrugations to the sheet. If preferred, the die need not be as long as the sheet desired to be corrugated, as the latter may be passed through the die, subjecting its portions successively to the curving and later to the corrugating and flanging operations. For the purpose of producing the flanges the acting face of the dies A. B. will be provided with angular shoulders A′ and B′ which come into action when the curved form and corrugations have been well developed. In Fig. 12 the sheet is shown partially curved and just prior to the beginning of the corrugating action. In Fig. 13 the corrugation is fully developed and at the end of this corrugating action the margins of the sheet will have been bent at right angles to the plane of the axis to produce the lateral flanges *c*. It will be understood that intermediate the stages shown in Figs. 10 and 11 and in Figs. 12 and 13 there may be a number of successive curving and corrugating operations, each being a duplicate of the preceding one and simply carrying the process one step further. Obviously, the curving precedes the corrugating but the curving action continues simultaneously with the corrugating action until the latter is completed, and therefore, the metal is at no time subjected to the great strain necessary to curve a fully corrugated sheet. These two operations, taking place as above stated, progressively and simultaneously, constitute the major and important part of the process. From this it results that the metal is uniformly stretched and is not subjected to undue strain at any part thereof, the various forms being progressively developed, with the result that the portions of the pipe bounded by the bases of the corrugations and the marginal flanges, as indicated by the letter *d*, are not subjected to any rupturing strain. This result is exceedingly important, as will be understood from the fact that in the previous methods of manufacturing such pipe, wherein the sheet was first corrugated and then curved, rupturing strains occurred, thereby weakening the pipe at the bases of the corrugations and breaking the coating thereof.

My improved method may be characterized as hammering as distinguished from rolling and the action is progressive as distinguished from a single forming operation. It will also be understood that the corrugations are developed by an action akin to drawing; that is to say, the formation of the corrugation begins at the point indicated in Fig. 12 and is completed at the stage indicated in Fig. 13. Intermediate these stages, the corrugations are developed by a continuous stretching of the metal of the blank, the distortion taking place in both longitudinal and transverse planes, but, being so gradual as not to subject the metal to undue strain or rupture its coating.

I claim:

1. The herein described method which consists in initially bending a blank to a partial semi-cylindrical form, continuing the bending pressure and thereby completing the semi-cylindrical formation, and corrugating the blank in the direction of the curvature of the form after the initial bending and during the final bending, substantially as described.

2. The herein described method which consists in initially bending a blank to a partial semi-cylindrical form, continuing the

bending pressure and thereby completing the semi-cylindrical formation in an intermediate portion of the blank without affecting opposite edge portions thereof, corrugating the semi-cylindrical portion of the blank in the direction of its curvature after the initial bending and during the final bending which completes the form, and bending the edge portions of the blank into substantially radial out-standing flanges, substantially as described.

MALCOLM J. McMARTIN.

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