No. 883,788. PATENTED APR. 7, 1908.

H. F. COBB.

METHOD OF CORRUGATING SHEET METAL.

APPLICATION FILED JUNE 10, 1907.

Fig. 1

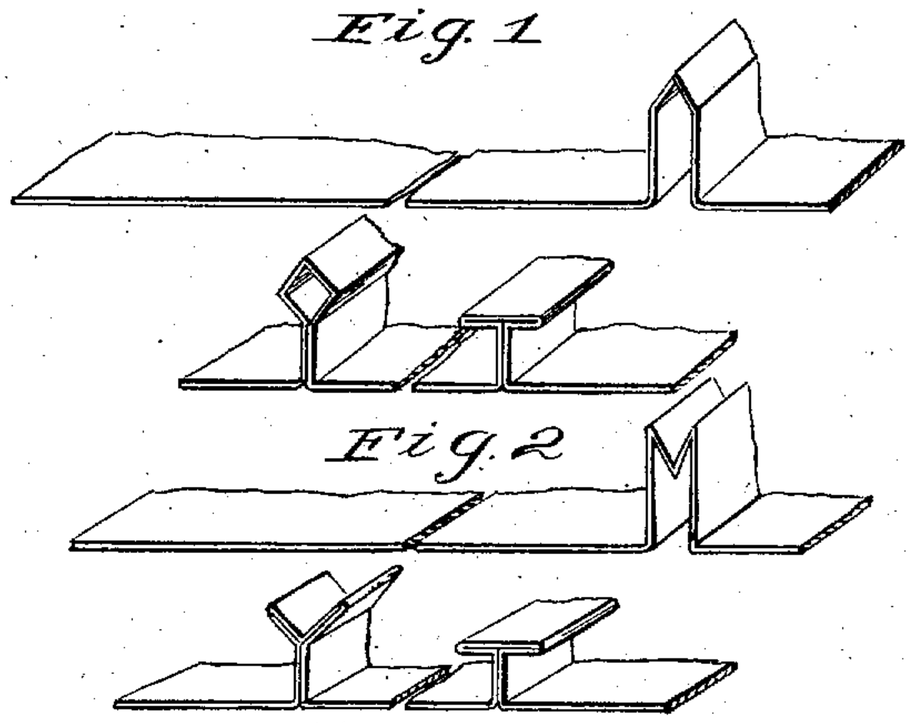


Fig. 2

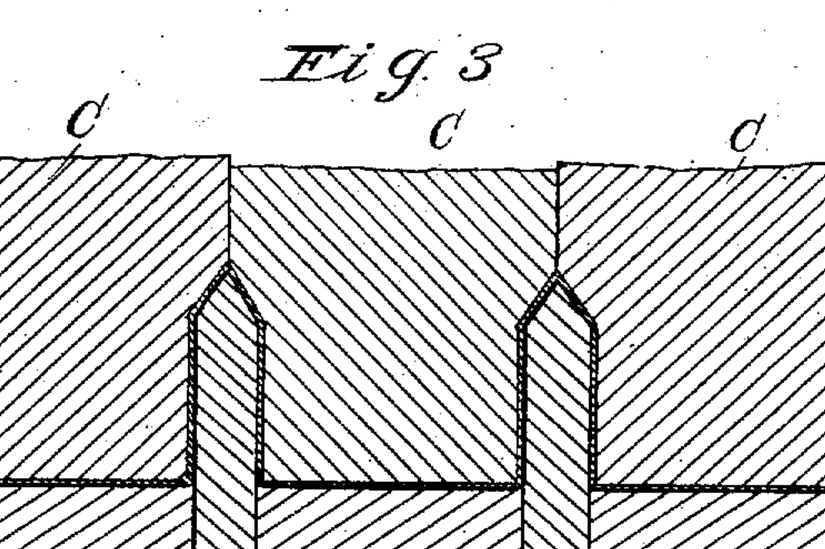


Fig. 3

Fig. 4

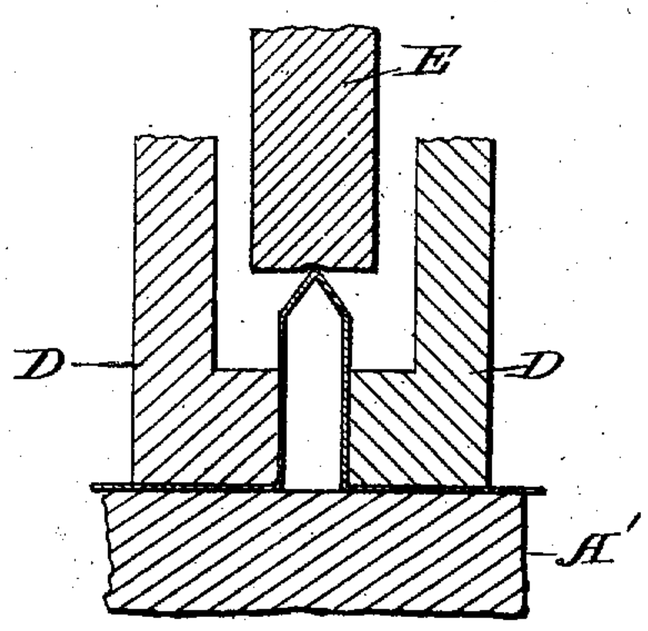


Fig. 5

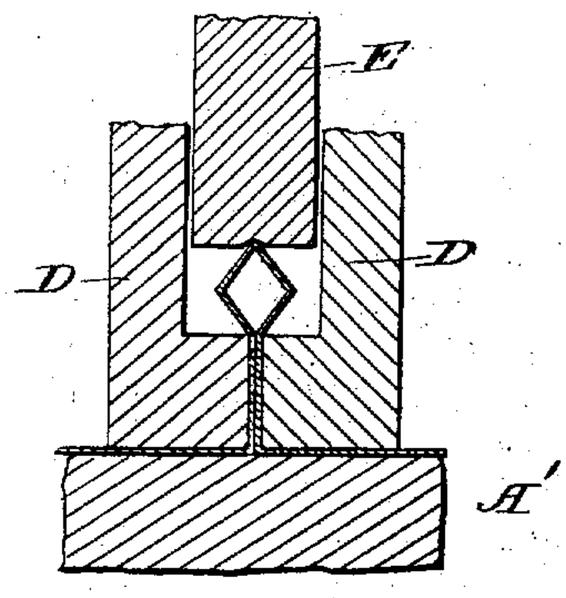


Fig 6

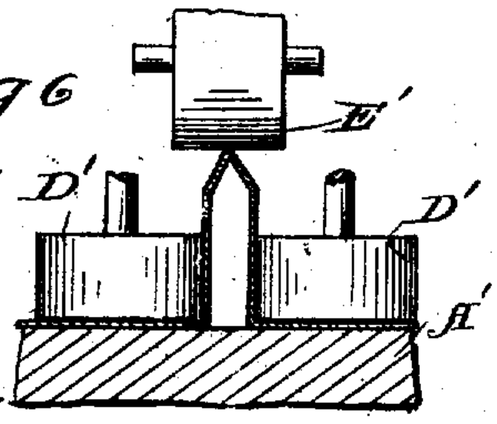
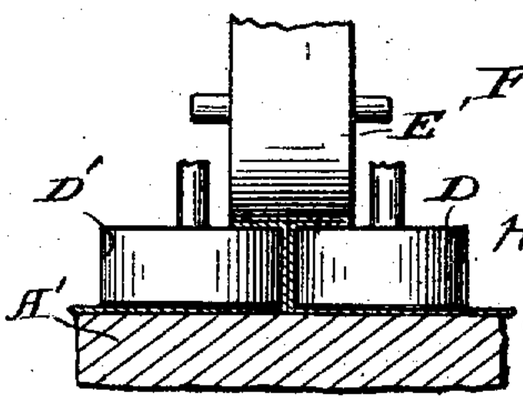


Fig. 7



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UNITED STATES PATENT OFFICE.

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METHOD OF CORRUGATING SHEET METAL.

No. 883,788. Specification of Letters Patent. Patented April 7, 1908.

Application filed June 10, 1907. Serial No. 378,060.

To all whom it may concern:

Be it known that I, HERBERT F. COBB, a citizen of the United States, resident of Cleveland, county of Cuyahoga, State of Ohio, have invented a new and useful Improvement in Methods of Corrugating Sheet Metal, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle so as to distinguish it from other inventions.

My invention relates in general to the art of metal bending and particularly to the corrugating of sheet metal.

Said invention has more especial regard to that class of corrugating processes wherein the sheet or material to be treated is passed between or beneath dies or plungers and thereby stamped or impressed into the desired form. The form of corrugation, for the production of which my method has been devised, is one having a lower closed web portion and an outer laterally divergent portion, such as is utilized in combined reinforcing and centering sheets for concrete structures of the kind described in my pending application filed February 18, 1907, Serial No. 357,799.

The object of the present invention is the provision of a mode of manufacture whereby not merely the production of the peculiar type of corrugated sheet referred to may be expedited and rendered less expensive than by prevailing methods, but whereby the same result may be achieved in connection with various other of the several types of corrugated metal sheets now on the market.

To the accomplishment of the above and related objects, said invention consists of the means and steps hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode constituting, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:—Figure 1 shows in perspective broken sections of a sheet of metal representing the several stages in its transformation from the plain initial form to the completed corrugation; Fig. 2 is a similar view showing a slight variation in the method of forming a corrugation of the same type as in Fig. 1; Fig. 3 is a cross-sectional view of a gang or train of plunger dies, in connection with a supporting bed, between which the material to be corrugated is placed in the first stage of my improved method; Fig. 4 is a similar cross-sectional view of compression plates or dies adapted to receive the material as left by the apparatus shown in Fig. 3 and perform thereon the second and third steps of the operation, such apparatus being shown at the beginning of the second step; Fig. 5 is a cross sectional view corresponding to Fig. 4 showing the same apparatus at the conclusion of the second step in the operation and just before the beginning of the third, or final, step; Fig. 6 is a view corresponding with Fig. 4 except that the compression plate or dies are shown as being replaced by rolls; and Fig. 7 is a view showing the same modication, but with the parts in their final operative positions.

Having reference then to Fig. 3, A designates a bed plate providing a fixed surface preferably horizontally disposed upon which the sheet to be corrugated is preliminarily placed. Mounted so as to be vertically reciprocable in, or through, such bed A, are a plurality of dies or forming members B that in their upper positions are adapted to project a fixed distance above the surface of the bed. Vertically movable above bed A is a corresponding series of dies, or forming members, C, that in their lowermost positions are adapted to rest upon the surface of said bed and to fit in between the upwardly projecting dies B so as to impress the sheet of material, previously reposing flat upon said surface, with the form presented by the outline of the meeting faces of said two sets of dies and bed surface. This form as illustrated in Fig. 3 is that of an upright corrugation, the upper end of which converges to a sharp apex.

In operation it is designed that first the two central dies B of the train or series of lowermost dies be raised into their upwardly projecting positions. In fact they can, so far as their operation is concerned, be fixedly maintained in such raised position. The portion of the sheet resting on top of these dies will, of course, be correspondingly raised or elevated. That one of the upper series of dies C corresponding with the interspace between the two raised lower dies is thereupon depressed and the portion of the sheet in question forced into the form provided by the intermediate portion or face of bed A and the two inwardly directed faces of dies B. The flow of material to accommodate or per-

mit the sheet to assume this form is obviously free and unhampered from both sides. Following the depression of the centrally located die C, corresponding pairs of dies on each side thereof are brought down simultaneously and thereafter the successive lower dies B elevated, whereby successive non-adjacent sections of the sheet are pressed against the fixed surface provided by the bed and each intermediate section is folded or indented from below by the upward movement of the lower dies.

Obviously the formation of successive corrugations is accompanied by the same freedom of movement on the part of the sheet to assume the form of the corrugation as was the case in the first instance, above described. In other words, by forming the portions (in the case in hand, halves,) of each corrugation successively instead of stamping or punching the entire corrugation at one blow a very considerable reduction in the friction against the dies to which the sheet is subjected in the process of corrugation is effected and consequently a corresponding reduction in the tension to which such sheet is subjected, is likewise had. Such lessening of such friction and tension not only renders necessary less force to operate the corrugating machinery, but also permits the use of more brittle sheet steel, that is, of a steel having a higher elastic limit, and hence superior in use, but very apt to break in prevailing methods of manufacturing corrugated sheets therefrom. The operation of forming the successive corrugations may also be described as consisting in the folding of the sheet through angles aggregating less than two hundred and seventy degrees at any one blow of the forming die, this resulting in leaving the sheet free and unhampered to flow around the end of the die. The sheet, thus formed with a series of upright corrugations of the kind appearing in the second section of Fig. 1, is subjected to the second and third steps of the operation, illustrated in Figs. 4 and 5. These steps consist, briefly stated, in laterally compressing together the lower portions of the said corrugations and thereupon pressing, or bearing down, upon the upper portions so as to flatten the same out. These steps may be carried on in the order named, or practically simultaneously, as desired and found most convenient.

The form of apparatus shown in Figs. 4 and 5 for accomplishing the first of the two steps under consideration comprise simply two compression plates or rolls D, movable in a plane transverse of the corrugation to be acted upon, the sheet resting upon a table A′ pending the operation. By bringing these two plates together and at the same time preferably retaining the upper portion of the corrugation against movement, such upper portion is given the enlarged or laterally divergent form appearing in the third section of Fig. 1. For some purposes it may be well to state that this or similar forms of corrugations will serve equally well with the ultimate product here sought for the use to which the sheet in hand is particularly designed, namely, that of a combined centering and reinforcement for concrete structures. To give the corrugation, however, the more desirable completely closed T shape it is merely necessary to press down upon such open upper portion whereupon the same is flattened out, as will be obvious, to form the arms of the T. This, in the apparatus illustrated, is accomplished by simply pressing down the die or block E upon the corrugation.

As will be readily understood, in place of blocks or compression plates D and E, that must necessarily extend the whole length of the corrugation, rolls, as D′ E′, movable along such corrugations from one end to the other thereof may be employed. The mode of operation of such rolls it is thought will be fully evident from an inspection of Figs. 6 and 7 without further comment or description.

As has been stated, other forms than the corrugation of T cross section may be found desirable for the purpose named and can be produced with equal facility by the steps and apparatus just described. Variation may also be made, even where the corrugation of T cross-section is ultimately desired, in the intermediate forms given the corrugation. Thus by variation in the form of the dies in Fig. 3 an upright corrugation of the type illustrated in section 2 of Fig. 2 may be produced, which corrugation upon being laterally compressed in the second step presents the Y cross-section shown in the third section of Fig. 2. The downward movement of die member E, or corresponding roll E′, serves to bend the arms of such Y into the desired horizontal position as before.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the process herein disclosed, provided the step or steps stated by any one of the following claims or the equivalent of such stated step or steps be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. The method of forming a corrugation in a sheet of material, which consists in moving a forming member against one side of the sheet; moving another member against the other side of the sheet to press a section of such sheet against the contiguous face of said first member, whereby a portion of a corrugation is formed; and then moving a third member from the first side of the sheet to similarly press such sheet against the contiguous face of said second member, whereby the remainder of such corrugation is formed.

2. The method of corrugating a sheet of material, which consists in repeating the following series of steps to form successive corrugations: moving a forming member against one side of the sheet; moving another member against the other side of the sheet to press a section of such sheet against the contiguous face of said first member, whereby a portion of a corrugation is formed; and then moving a third member from the first side of the sheet to similarly press such sheet against the contiguous face of said second member, whereby the remainder of such corrugation is formed.

3. The method of corrugating a sheet of material, which consists in repeating the following series of steps to form successive corrugations; moving a forming member against one side of the sheet; moving another member against the other side of the sheet to press a section of such sheet against the contiguous face of said first member, whereby a portion of a corrugation is formed; and then moving a third member from the first side of the sheet to similarly press such sheet against the contiguous face of said second member, whereby the remainder of such corrugation is formed, the last step of one series and the first step of the next being performed simultaneously.

4. The method of corrugating a sheet of material, which consists in relatively approaching one forming member from one side and a pair of spaced members from the other side of the sheet to press corresponding sections of the latter against the respective lateral faces of said first member, whereby portions of two corrugations are formed; and then similarly moving a second pair of spaced members from the same side of the sheet as said first member, to press such sheet against the contiguous faces of said first pair of members, the remaining portions of the sheet being left free.

5. The method of forming corrugations in a sheet of material, which consists in approaching a forming member to one side of the sheet; moving a pair of relatively spaced members against the other side of the sheet to press corresponding sections of the latter against the respective contiguous faces of said first member, whereby portions of two corrugations are formed; and then moving the second pair of relatively spaced members from the first side of the sheet to similarly press the latter against the respective contiguous faces of said first pair of members, the remaining portions of the sheet being left free.

6. The method of corrugating a sheet of material, which consists in relatively approaching one forming member from one side of the sheet and pairs of spaced members alternately from the other side of the sheet and such first side to press corresponding sections of such sheet against the contiguous faces of said first member and of successive pairs of the other members, whereby portions of corresponding pairs of corrugations are first formed and thereupon such portions completed, the remaining portions of the sheet being left free.

7. The method of corrugating a sheet of material, which consists in approaching a forming member to one side of the sheet; and then moving pairs of relatively spaced members alternately against the other side of the sheet and such first side to press corresponding sections of such sheet against the contiguous faces of said first member and of successive pairs of the other members, whereby portions of corresponding parts of corrugations are first formed and thereupon such portions completed, the remaining portions of the sheet being left free.

8. The method of corrugating a sheet of material, which consists in first impressing therein a series of upright corrugations and thereupon laterally compressing the lower portions of said corrugations by elements movable against the respective sides of said corrugations from the upper side of the sheet, and bearing down upon the upper portions of said corrugations whereby a lower web portion and an outer laterally divergent portion is formed.

9. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion which consists in first impressing therein a series of upright corrugations converging to a relatively sharp apex, thereupon laterally compressing the lower portions of said corrugations, and at the same time retaining the outer portions against movement.

10. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion which consists in first impressing therein a series of upright corrugations converging to a relatively sharp apex, and thereupon laterally compressing the lower portions of said corrugations by elements movable against the respective sides of said corrugations from the upper side of the sheet, and bearing down upon the upper portions of said corrugations.

11. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists in forming a series of upright corrugations therein by folding such sheet between the contiguous faces of dies to form successive portions of each corrugation, such sheet being folded in each instance through angles aggregating less than two hundred and seventy degrees, and thereupon laterally compressing the lower portions of said corrugations.

12. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists in forming a series of upright corrugations therein by folding such sheet between the contiguous faces of dies to form successive portions of each corrugation, such sheet being folded in each instance through angles aggregating less than two hundred and seventy degrees, and thereupon laterally compressing the lower portions of said corrugations and bearing down upon the upper portions thereof.

13. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists in impressing successive folds or indentations in said sheet alternately from opposite sides, whereby a series of upright corrugations are formed, and thereupon laterally compressing the lower portions of said corrugations.

14. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists in impressing successive folds or indentations in said sheet alternately from opposite sides, whereby a series of upright corrugations are formed, and thereupon laterally compressing the lower portions of said corrugations and bearing down upon the upper portions thereof.

15. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists first in folding said sheet between the contiguous faces of a series of forming dies alternately moving from opposite sides of said sheet whereby a series of upright corrugations are formed and thereupon laterally compressing the lower portions of said corrugations and bearing down upon the upper portions thereof.

16. The method of forming in a sheet of material corrugations having a lower web portion and an outer laterally divergent portion, which consists first in pressing successive non-adjacent sections of said sheet against a fixed surface, each preceding intermediate section being previously folded or indented from the side of said sheet disposed towards such surface, whereby a series of upright corrugations are formed, and thereupon subjecting the lower portion of each of said corrugations to the action of two members movable in a plane transverse of said corrugation, and to a third member movable in a plane parallel therewith.

Signed by me, this 4th day of June, 1907.

HERBERT F. COBB.

Attested by:
E. R. RODD,
JNO. F. OBERLIN.