

No. 651,053.

Patented June 5, 1900.

F. PHILIPS.
APPARATUS FOR BENDING SHEET METAL.

(Application filed June 30, 1899.)

(No Model.)

5 Sheets—Sheet 1.

FIG. 1.

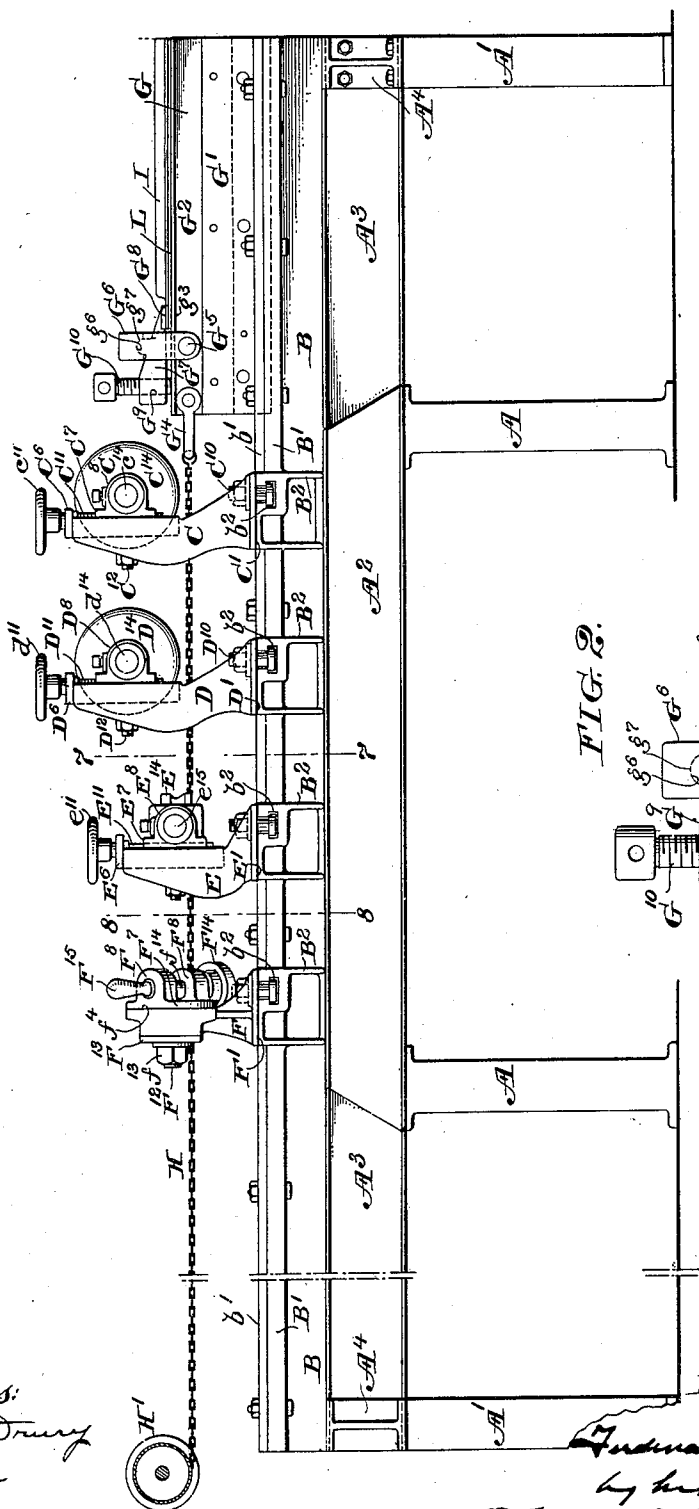
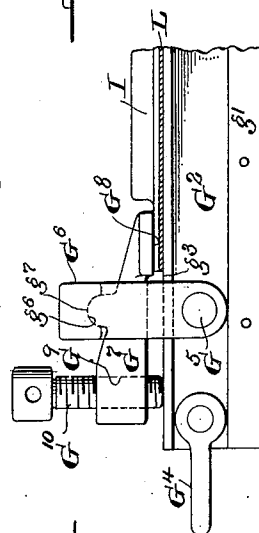


FIG. 2.



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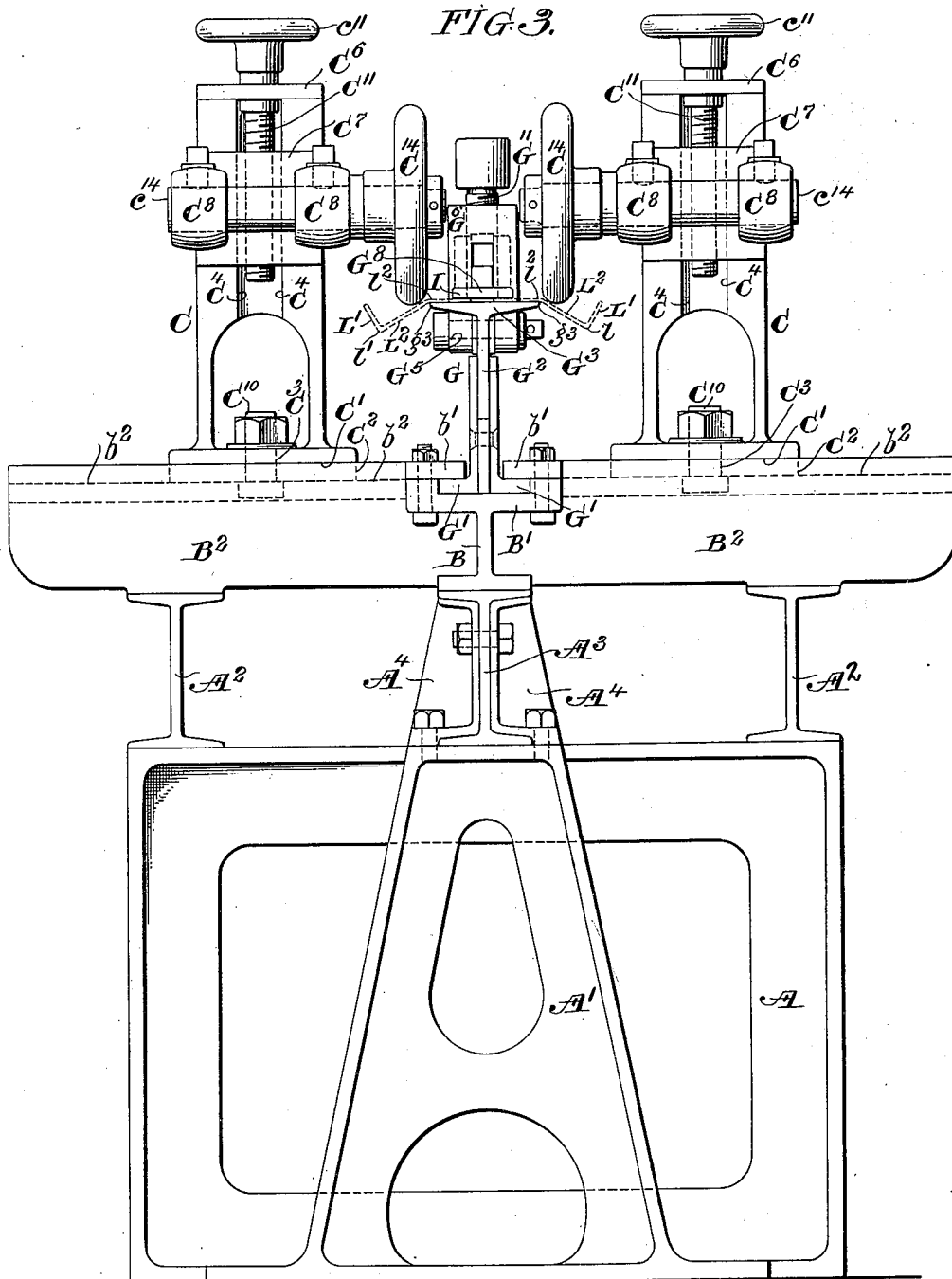
F. PHILIPS.

APPARATUS FOR BENDING SHEET METAL.

(Application filed June 30, 1899.)

(No Model.)

5 Sheets—Sheet 2.



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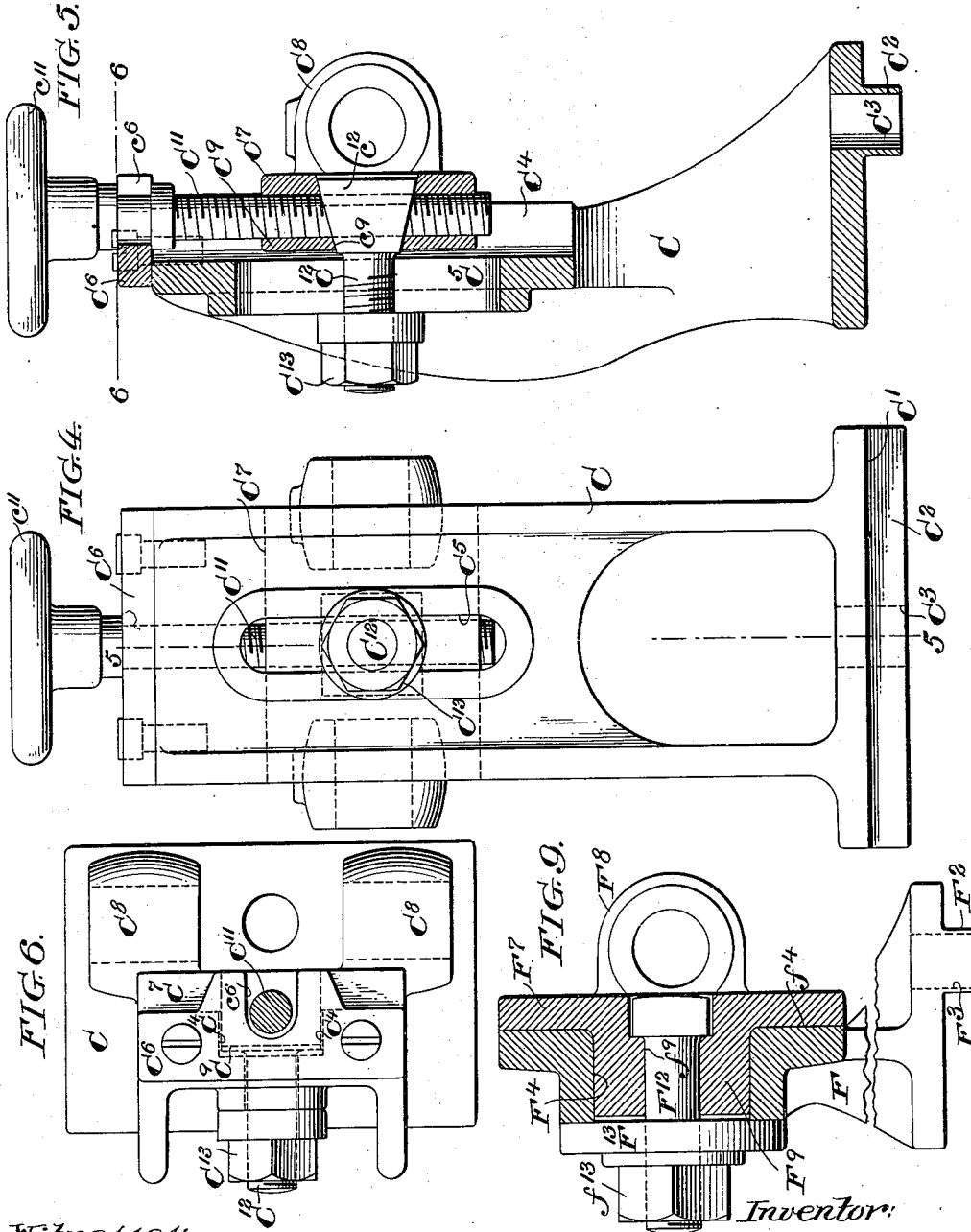
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APPARATUS FOR BENDING SHEET METAL.

(Application filed June 30, 1899.)

(No Model.)

5 Sheets—Sheet 3.



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(Application filed June 30, 1899.)

(No Model.)

5 Sheets—Sheet 4.

FIG. 8.

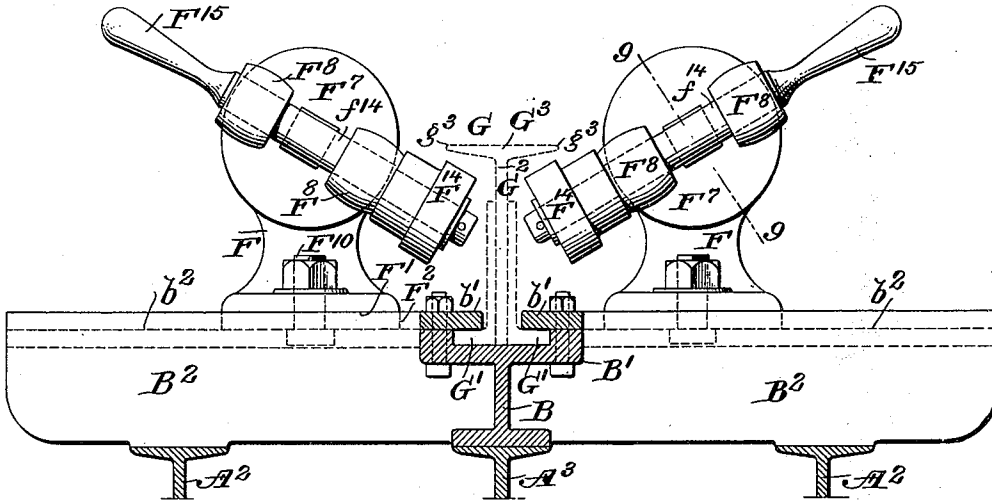
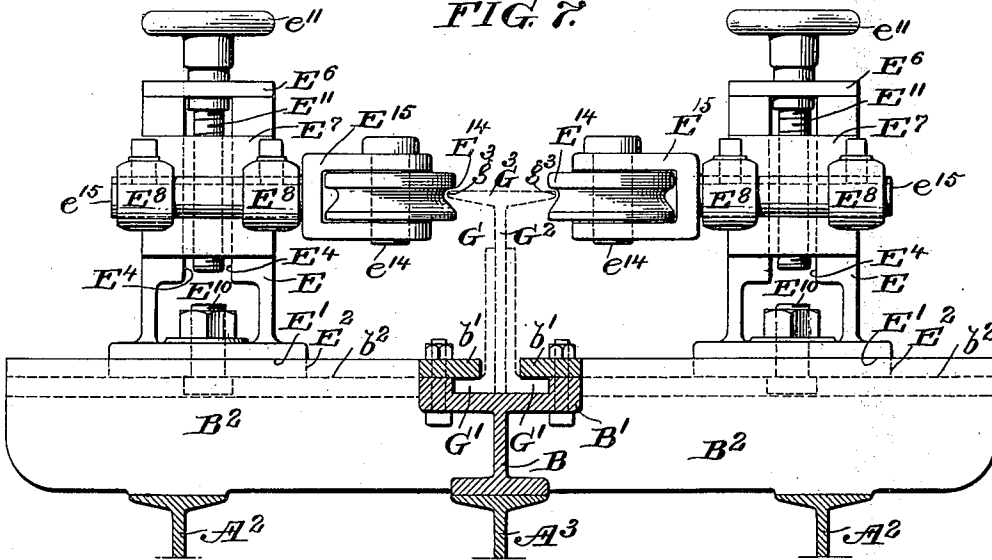


FIG. 7.



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APPARATUS FOR BENDING SHEET METAL.

(Application filed June 30, 1899.)

(No Model.)

5 Sheets—Sheet 5.

FIG. 10.

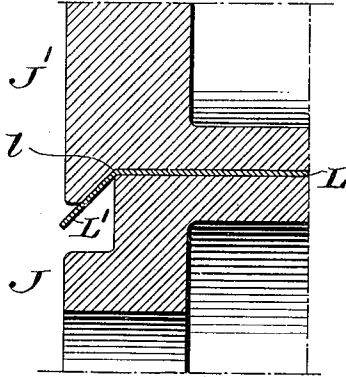


FIG. 11.

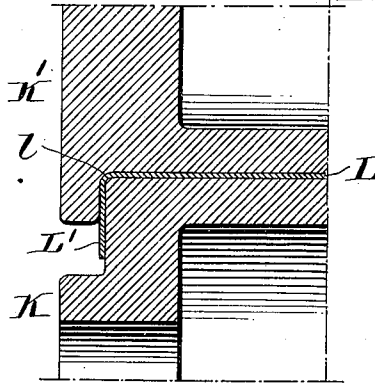


FIG. 12.

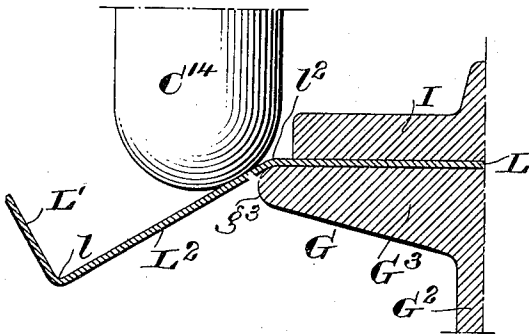


FIG. 13.

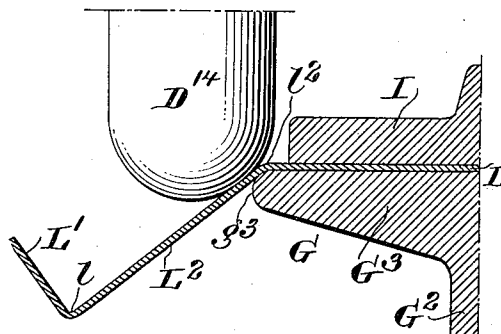


FIG. 14.

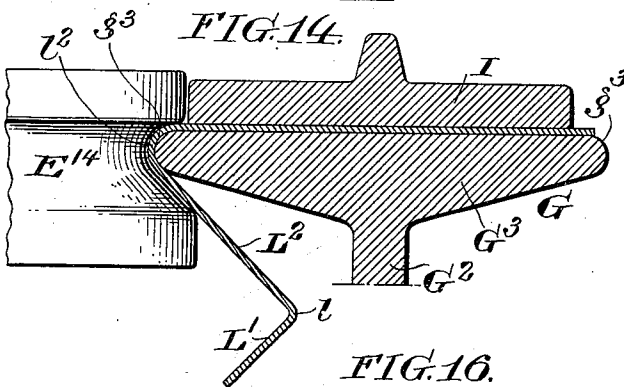


FIG. 15.

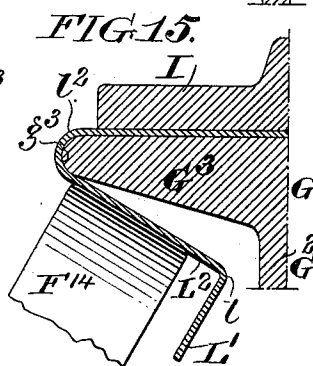


FIG. 16.

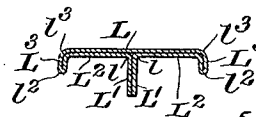
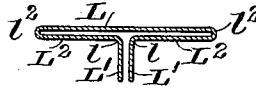


FIG. 17.

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UNITED STATES PATENT OFFICE.

FERDINAND PHILIPS, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR BENDING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 651,053, dated June 5, 1900.

Application filed June 30, 1899. Serial No. 722,412. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND PHILIPS, a subject of the Emperor of Germany, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Apparatus for Bending Sheet Metal, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to apparatus for bending sheet metal, and is especially designed for bending metal into a form adapted to be used in the manufacture of pulley-rims, though it is adapted for general use as well.

My new pulley-rim is made from a two-ply T-shaped bar formed by folding sheet metal along parallel longitudinal lines to form a two-ply head either with or without edge flanges, but in all cases with an intermediate longitudinal flange forming the web of the T, as described in my application filed January 21, 1899, Serial No. 702,903. My preferred method of folding this form from sheet metal consists in first bending up the edges of the metal sheet for a width equal to the designed height of the web of the T and then along parallel longitudinal lines bending the plate down and under to form the two-ply head and cause the upwardly-bent flanges to extend downwardly parallel to each other and form the web of the T. Preferably the flanges forming the web are abutted together, so as to form a two-ply web.

The mechanical features of my invention for folding the sheet as described will be best understood as described in connection with the drawings in which they are illustrated, and in which—

Figure 1 is a side elevation of my plate-bending machine; Fig. 2, an enlarged elevation showing the means by which the clamp is moved to the movable table. Fig. 3 is an end elevation of the machine viewed from the right-hand side of Fig. 1. Fig. 4 is an elevation showing the construction of the roller-supporting standard, such as is indicated at C and D in Fig. 1, the view being taken from the left-hand side of said figure. Fig. 5 is a sectional elevation of this standard, taken on the section-line 5 5 of Fig. 4. Fig. 6 is a plan view of the same, taken on the sec-

tion-line 6 6 of Fig. 5. Fig. 7 is a sectional elevation taken through the machine on the line 7 7 of Fig. 1 looking toward the left; Fig. 8, a similar sectional elevation taken on the section-line 8 8 of Fig. 1. Fig. 9 is a sectional elevation of the standard F, partly in section, as on the line 9 9 of Fig. 8. Figs. 10 and 11 are sectional views of rolls adapted for forming the first fold in the plate, said rolls not forming part of the machine illustrated in the other drawings. Fig. 12 is an end view showing the operation of the rollers C¹⁴ in my machine. Fig. 13 is a view showing the operation of the rollers D¹⁴ in my machine. Fig. 14 is a view showing the operation of the rollers E¹⁴ in my machine. Fig. 15 is a view showing the operation of the roller F¹⁴. Fig. 16 is a sectional view of my sheet-metal structural form, and Fig. 17 a similar view showing a modification of said structural form.

A A indicate intermediate supporting-frames of my machine, and A' A' end support-ing-frames.

A² A² indicate I-beams supported on the frames A A, and A³ A³ an intermediate centrally-lying I-beam supported on both the terminal and intermediate frames, A⁴ A⁴ indicating clamping-irons conveniently used for securing the I-beams in place, as best shown in Fig. 3.

B is a stationary guide-table supported, as shown, on the I-beam A³ and having a longitudinal slit or groove formed in its head B', over the edges of which groove extend longitudinal guide and clamping bars, as indicated at b' b'; these bars being secured in place by bolts, as indicated.

B² B² indicate laterally-extending supports, the outer ends of which are sustained by the I-beams A² and each of which is formed with a T-shaped slot, as indicated at b², said slot running at right angles to the groove in the table B B'.

C, D, E, and F are adjustable standards or supports for the bending-rolls, each movable along one of the lateral table extensions B², for which purpose they are made with flat faces, as C' D', &c., from which extend webs C² D², &c., fitting in the upper part of the T-shaped slot b², and each formed with a perforation, as indicated at C³ D³, &c., through

which pass bolts C^{10} D^{10} , &c., the head situated in the lower and broader part of the slot b^3 , while the bolt extends upward through the perforation C^3 and through the bottom plate of the standard, so that a clamping-nut will screw upon it to hold the standard in any desired position. The two standards C and D are alike in construction, and it will suffice to describe the standard C, as shown in Figs. 4, 5, and 6. It is formed with a groove, as indicated at C^4 , on its front face, through the back of which is formed a slot C^5 . Across the top of the standard and over the groove C^4 is secured a plate C^6 , having a slot cut in it from its front edge, as indicated at c^6 , for the easy insertion of the adjusting-screw.

C^7 is a plate, to the front of which are secured bearings, as indicated at C^8 C^8 , and from the rear of which extends a guide-head C^9 , fitting in the slot C^4 of the standard and having a dovetailed recess formed near its center, as indicated at c^9 , while a threaded perforation runs through it from top to bottom.

C^{11} is an adjusting-screw the threaded portion of which screws into the perforation in the head C^9 and to the top of which is secured a hand-wheel c^{11} , between the hub of which and the collar secured on the screw is left a space which fits into a groove c^6 in the plate C^6 by which the adjusting-screw is supported.

C^{12} is a clamping-bolt having an angular head fitting in the dovetailed mortise C^9 , the bolt extending through the groove C^5 and having a clamping-nut and washer, as indicated at C^{13} , for securing it in place.

c^{14} is a stud-bearing secured in the bearing C^8 and upon which is journaled the bending-roller C^{14} .

The standard E, while shorter than the standards C and D, is substantially like them in construction, and its parts need not therefore be described in detail except to point out that the stud-bearing (here indicated at e^{15}) has formed at its end a fork E^{15} , which supports the vertical bearing e^{14} , upon which the horizontal groove-roller E^{14} is journaled. The standard F and parts coacting with it (see Figs. 1, 8, and 9) are of somewhat-different construction. In place of having a guide-slot in its front it is formed with a horizontal circular opening, as indicated at F^4 , Fig. 9, and a plain face f^4 , Figs. 1 and 9, surrounding this opening. Against this plain face fits the plate F^7 , formed with a rearwardly-extending circular hub F^9 , Fig. 9, said hub fitting in the circular perforation F^4 and being formed with a bolt-hole f^9 , terminating in a front recess for the head of the bolt. Bearings F^8 are secured to the front of the plate F^7 , and the bolt F^{12} extends through the perforations f^9 and through a locking-washer F^{13} , fitting on the back of the standard, a clamping-nut f^{13} screwing on the end of the bolt, supported by the bearings F^8 F^8 .

f^{14} is the bearing-shaft, upon which the bending-rollers F^{14} are journaled, and has for

convenience in adjusting the angle of the rollers handles F^{15} extending out from its other end.

G indicates a sliding work-holding table supported and moving in the longitudinal groove in the table B B'. As shown, it is made up of an upright web G^2 , having a T-shaped head G^3 and angle-irons $G'G'$ secured to each side of the web and lying in the groove of table B' below the flanges b' .

g^3 g^3 indicate the parallel edges of the head of the table.

G^4 is a link secured to the front edge of the table G and to which in turn is secured a chain H, winding on a winding-drum H', Fig. 1.

G^5 indicates a swivel-bolt passing through the web G^2 of the table G and upon the ends of which is pivotally secured the U-shaped saddle-piece G^6 , having preferably, as shown, a rounded recess g^6 on its under side.

G^7 is a clamping-jaw having at or near its center a projection g^7 , fitting in the recess g^6 , and at one end a jaw G^8 and at the opposite end a threaded perforation G^9 .

G^{10} is a clamping-screw the threads of which are engaged with the threads of the perforation G^9 and the end of which presses against the top of the table G.

I is a clamping-plate which is placed upon the sheet of metal lying on the table G and clamped down upon it by means of clamping-jaws at each end, such as has been described with reference to the front of the table.

J and J', Fig. 10, are rolls having the general conformation illustrated and by means of which the edges of a flat plate L are bent down, as indicated at L'.

K and K', Fig. 11, are rolls having the conformation illustrated and by means of which the bent edge or flange L' is further bent to or nearly to a right angle to the body of the plate L.

A plate, such as L, having been passed through rolls J J' and K K', has its edges flanged or bent in, in the direction which, with reference to the further bends afterward made in the opposite direction, I will call "upward," and I will further explain that the length of the folds or flanges L' is that determined upon for the depth of the web of the T to be formed on the T-shaped bar made from the plate. Having been brought to this form, the plate, with the flanges L' turned upward, is clamped between the head G^3 of the table G and the clamping-bar I, with its edges projecting over the lateral edges of the table, the breadth of which determines the head of the T to be formed. The table, with the plate clamped upon it, is then drawn, by means of the drum H' and chain H, along the grooved guide-table B' and so that the rolls C^{14} , D^{14} , E^{14} , and F^{14} act successively on the projecting edges of the plate L. The action of the roll C^{14} is shown in Fig. 12, its function being to bend down a flange or fold L^2 of the plate along a line l^2 . The action of the roller D^{14} simply carries this bending further, so as to

bring the partially-bent plate into proper relationship to the rolls E^{14} , which, as shown in Fig. 14, press the fold L^2 inward under the table G, while the rolls F^{14} , as shown in Fig. 15, carry on this upward folding of the plate to or nearly to the under face of the table G. By a single passage through the machine the plate is brought to the form indicated in Fig. 15, which shows but one of the symmetrical halves of the plate, and by the action of further mechanism (not shown and not forming part of my present invention) the plate is further bent to the form indicated in Fig. 16 or, if desired, to that indicated in Fig. 17. I have not illustrated mechanism for finishing the bends, because the further bending of the plate from the form shown in Fig. 15 can be accomplished either by hand or mechanism, and, if mechanism is used, by many different kinds of mechanism.

Where, as shown in Figs. 16 and 17 and as I prefer to make my structural sheet-iron forms, the flanges $L' L'$ are brought together to form a two-ply web for the T, the folds l^2 should be formed at a distance from the fold l equal to one-quarter the distance between the folds $l l$. If, however, a filling-piece is to be inserted between the folds $L' L'$, as may sometimes be desirable, the distance between the fold-lines l and l^2 will of course be less than a quarter of the distance between the fold-lines $l l$.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a machine for bending sheet metal, a fixed table, having a longitudinal guideway formed in it in combination with a series of bending devices secured on the sides of the guideway and a longitudinally-movable work-holding table, arranged to move in the guideway of the fixed table and with the edges g^3 of which the bending devices coact.

2. In a machine for bending sheet metal, a fixed table, having a longitudinal guideway formed in it in combination with a series of laterally-adjustable bending devices secured

on the sides of the guideway and a longitudinally-movable work-holding table, arranged to move in the guideway of the fixed table and with the edges g^3 of which the bending devices coact.

3. In a machine for bending sheet metal, a fixed table, having a longitudinal guideway formed in it in combination with a series of bending devices secured on the sides of the guideway, a longitudinally-movable work-holding table, arranged to move in the guideway of the fixed table and with the edges g^3 of which the bending devices coact, a clamping-bar, adapted to hold the sheet metal between it and the top of the work-holding table and means for clamping said bars in place on said table.

4. In a machine for bending sheet metal, a fixed table, having a longitudinal guideway formed in it in combination with a series of laterally-adjustable bending-roll supports secured on the sides of the guideway, one or more pairs of convex-edged substantially-vertical rolls, vertically adjustable in their supporting-frames, a pair of concave-edged substantially-horizontal rolls, also vertically adjustable in their supporting-frames, a pair of angularly-inclined rollers, adjustable about a center in their supporting-frames and a longitudinally-adjustable work-holding table, arranged to move in the guideway of the fixed table and with the edges of which the bending-rolls aforesaid coact in bending the sheet metal.

5. In a machine for bending sheet metal a fixed table, having a longitudinal guideway formed in it and a series of transverse slotted extensions, in combination with a work-holding table longitudinally movable in the guideway of the fixed table and a series of bending-device holders, adjustable in the slots of the transverse extensions aforesaid.

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Witnesses:

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