(No Model.) 4 Sheets—Sheet 1.

L. C. CROWELL.

MACHINE FOR BENDING METAL PLATES.

No. 478,090. Patented July 5, 1892.

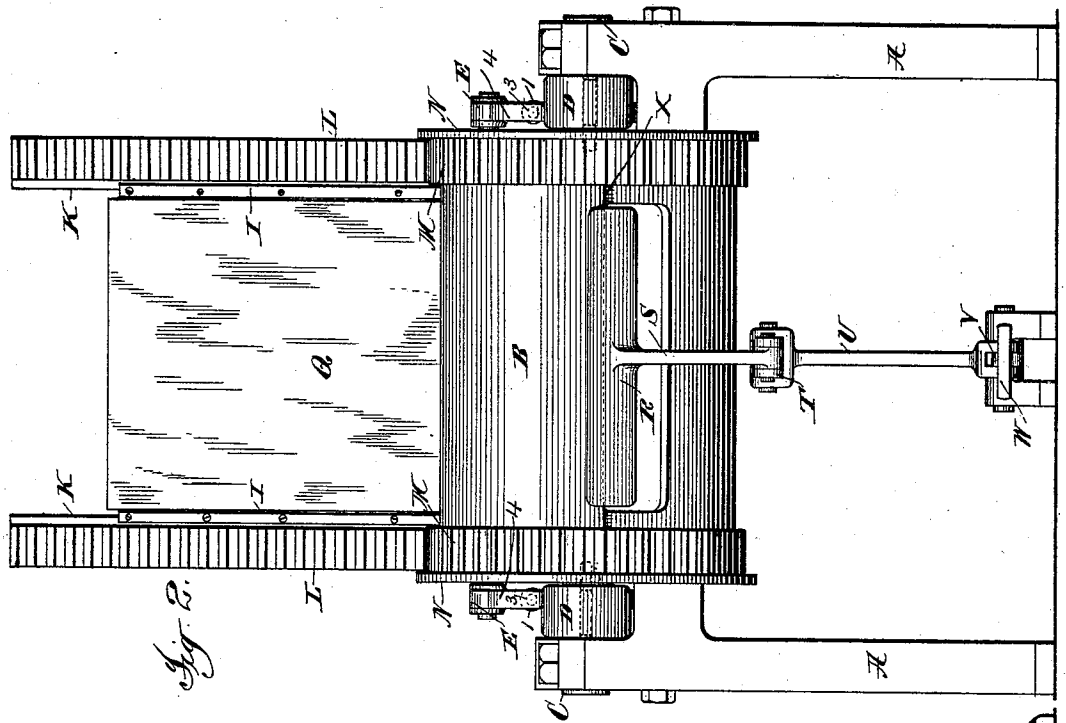

Fig. 2.

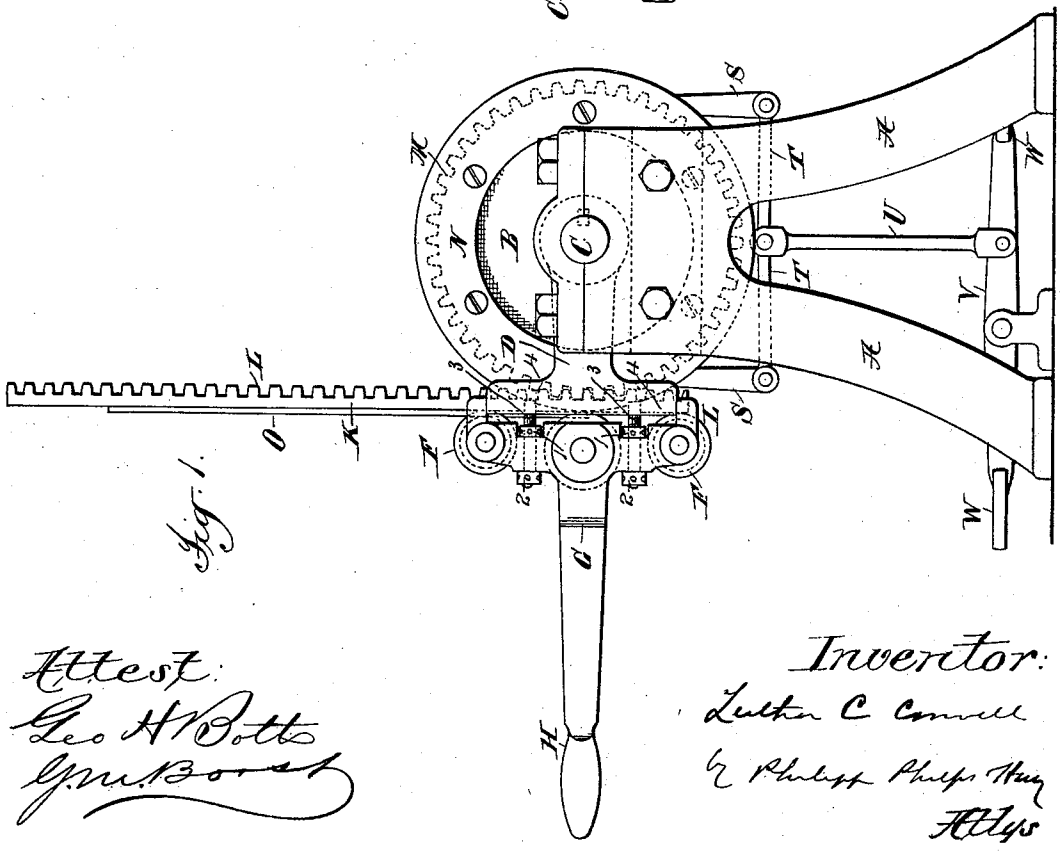

Fig. 1.

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L. C. CROWELL.

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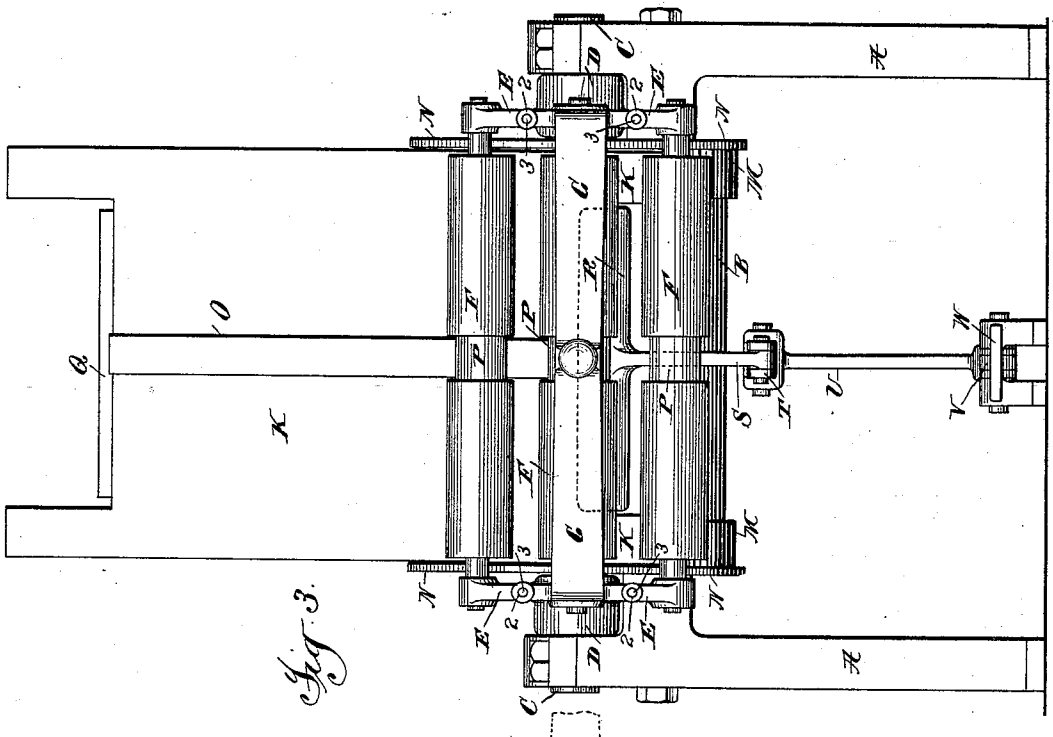

Fig. 3.

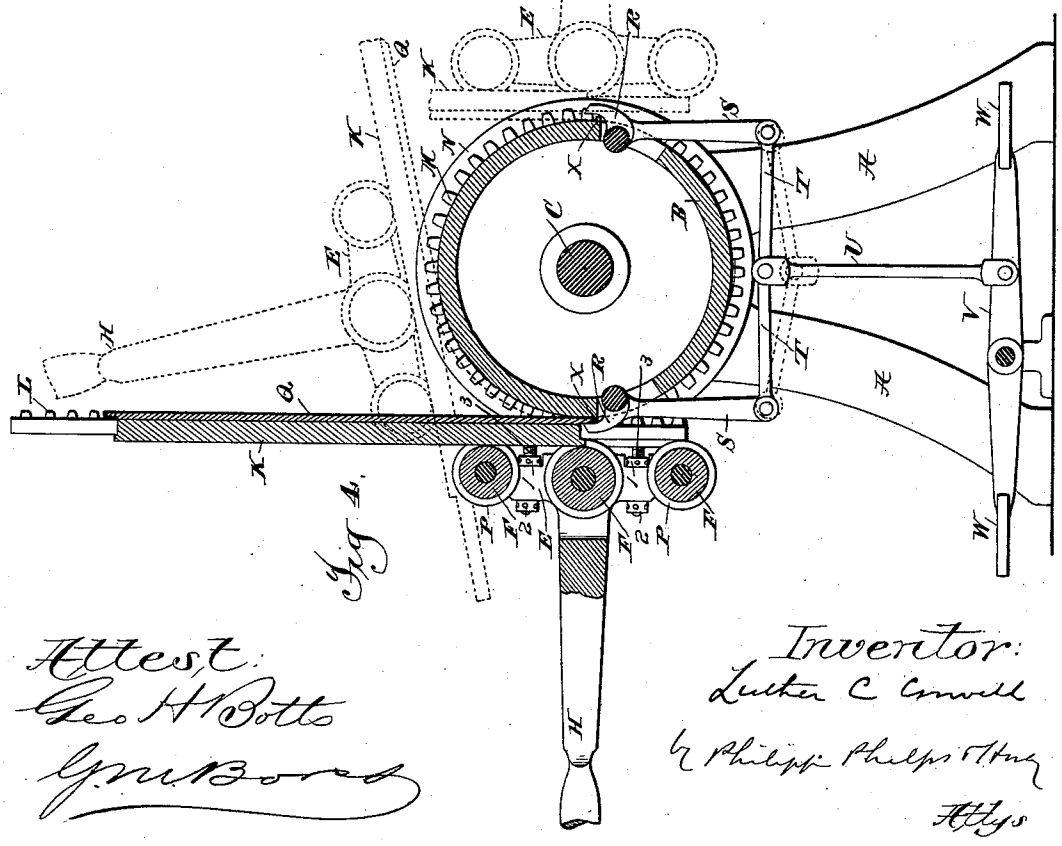

Fig. 4.

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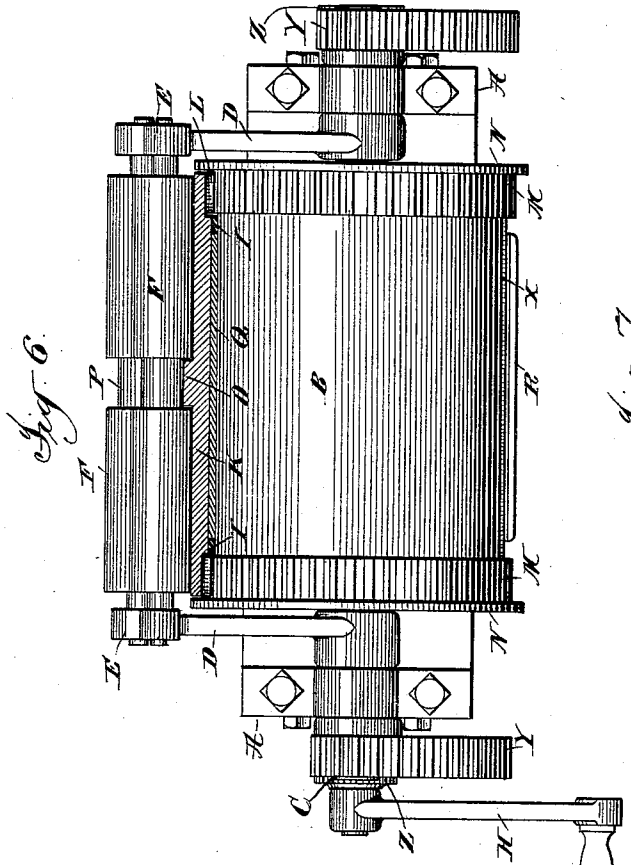

Fig. 6.

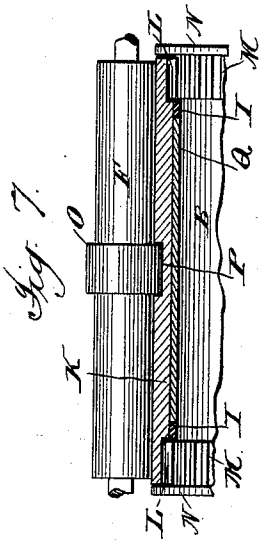

Fig. 7.

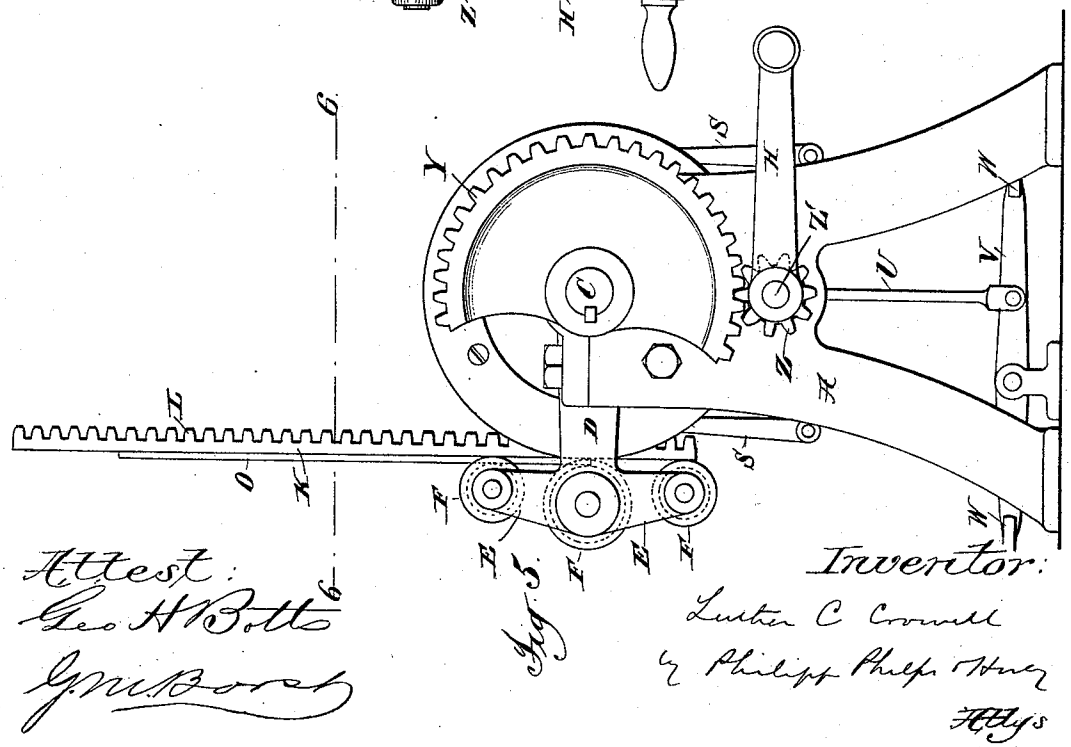

Fig. 5.

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L. C. CROWELL.

MACHINE FOR BENDING METAL PLATES.

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Fig. 9.

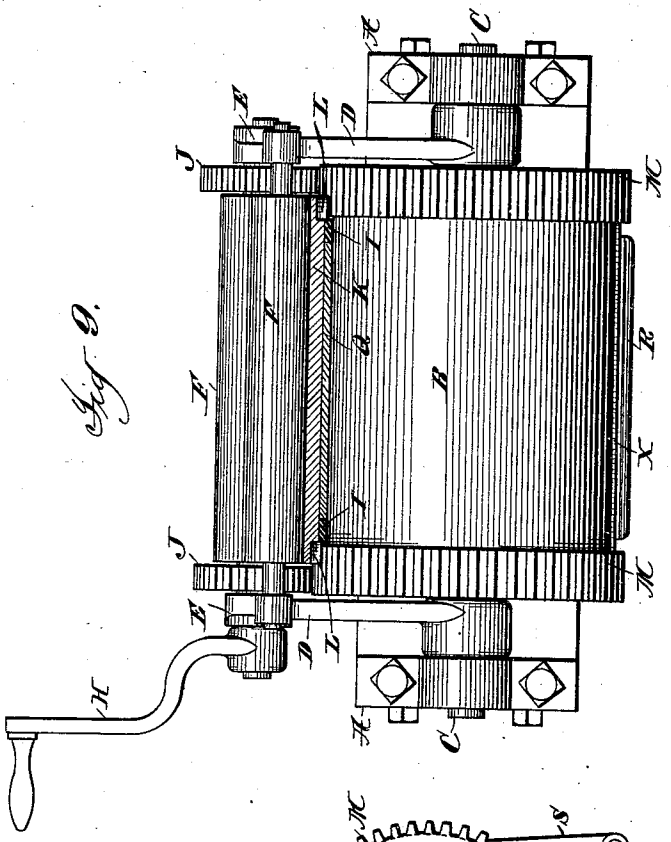
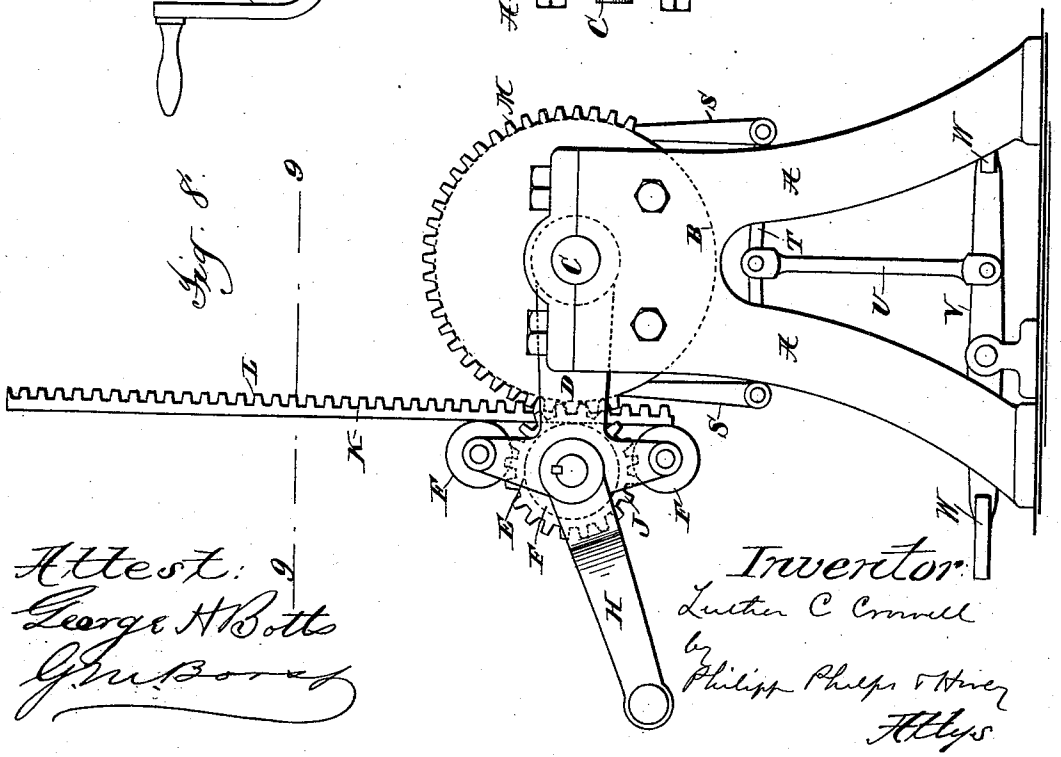


Fig. 8.



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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO ROBERT HOE, STEPHEN D. TUCKER, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

MACHINE FOR BENDING METAL PLATES.

SPECIFICATION forming part of Letters Patent No. 478,090, dated July 5, 1892.

Application filed December 13, 1890. Serial No. 374,549. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Machines for Bending Metal Plates, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to machines for bending metal plates, its object being to provide an improved machine of this class.

While the invention is of general application in all arts in which metal plates are bent, the machine in which it is embodied has been designed and is especially adapted for use in bending stereotype or electrotype plates, and will be described as thus applied.

In the accompanying drawings, forming a part of this specification, Figure 1 is a side view of a bending-machine embodying my invention in its preferred form. Fig. 2 is an end view looking to the left in Fig. 1. Fig. 3 is an end view looking to the right in Fig. 1. Fig. 4 is a central longitudinal section showing the parts in different positions in dotted lines. Fig. 5 is a side elevation of a modified form of machine. Fig. 6 is a sectional plan of the same, the section being taken on the line 6 6 of Fig. 5. Fig. 7 is a detail showing a slight modification. Fig. 8 is a side elevation of another form of machine; and Fig. 9 is a sectional plan of the same, the section being taken on the line 9 9 of Fig. 8.

Referring especially to Figs. 1 to 4, A is the frame of the machine, in which is supported in a fixed position the bending-cylinder B. Arms D are mounted at each end of the cylinder B, so as to oscillate concentrically therewith, these arms being preferably splined to rock-shaft C central to the cylinder, although they may be loosely mounted on a stationary shaft or studs. The arms D extend outward beyond the surface of the cylinder, and each carries outside the cylinder a cross-arm E, in which cross-arms are loosely mounted three bending-rolls F, lying in a plane tangential to the cylinder. The cross-arms E are connected by a bar G, which is provided centrally of the machine with an operating-handle H. The bending-rolls F are set at a slight distance from the surface of the bending-cylinder B, and between the bending rolls and cylinder is a table K, between which and the bending-cylinder the plate is bent, and which is provided at each side with racks L, meshing with gears M upon each end of the cylinder. The cylinder is provided with flanges N outside the gears M, which serve to guide the table K and retain it in position longitudinally of the cylinder, and a further guide is provided by the rib O upon the side of the table opposite the cylinder, which engages with recesses P in the bending-rolls F, so that the table is held firmly in position by the shoulders of the recesses. Bars I serve as side guides to the stereotype-plate Q to insure an accurate alignment of the type.

For clamping the edge of the stereotype-plate to the bending-cylinder the following means are provided: On each side of the bending-cylinder B is pivotally mounted a grip R, extending approximately to the full length of the cylinder between the gears M, these grips R being provided with arms S, connected by pivoted links T to one end of a connecting-rod U, pivoted at its opposite end to lever V, which may be operated from either end of the machine by the treadles W. The bending-cylinder is provided at each side just inside the grips R with a lip X, upon which the plate is supported in position to be gripped. The links T form a toggle-joint, which is operated by the treadle to open or close the grips and lock them in either position.

For the purpose of adjusting the bending-rolls F so as to graduate the pressure upon the plate and to compensate for wear of parts the cross-arms E are preferably adjustably secured to the arms D, as shown in Fig. 1, the adjustment being effected by means of lock-nuts 1 2 and threaded rods 3, secured in the cross-heads 4 of arms D.

The operation of the machine is as follows: The parts being in the position shown in Fig. 1, with the operating-handle horizontal and the table vertical, the grips are opened by

moving the toggle-arms into the position shown in dotted lines in Fig. 4, and the plate Q is passed downward between the table and cylinder until it rests upon the lip X inside the grip R on that side of the cylinder, as shown in that figure, the proper alignment of the plate being obtained by the inner side of one or both of the bars I. The toggle-arms R are then moved from the position shown in dotted lines in Fig. 4 to that shown in full lines, closing the grip and clamping the plate firmly to the cylinder, the grip being locked by the toggle-joint. The bending-rolls F are then moved about the bending-cylinder by the handle H, the edge of the plate remaining clamped to the bending-cylinder and the plate being bent around the cylinder as the bending-rolls and table are carried successively into the different positions shown in dotted lines in Fig. 4. When the handle and bending-rolls have completed a half-circuit and are brought into a position upon the opposite side of the cylinder corresponding to that at the beginning of their movement, the toggle-arms T are operated to open the grip and the bent plate is removed. The operation is then repeated by inserting another plate on the side of the cylinder opposite that receiving the first plate and the plate bent by the reverse movement of the handle and bending-rolls.

In Figs. 5 and 6 I have shown a machine in which the operation is substantially the same except in the means for carrying the bending-rolls around the cylinder. In this construction the shaft C is provided at each end with a segmental gear Y, these gears engaging with pinions Z at each end of a shaft Z′, which may be operated by means of a handle H on the shaft, as shown, or in any other suitable manner.

In Fig. 7 I have shown a modification in which the arrangement of recess and rib in the bending-rolls and table is reversed, the rib being upon the rolls and the recess upon the table. This may be found preferable in machines for heavy work, as the bending-rolls are not weakened, as in the construction previously described.

In Figs. 8 and 9 I have shown a machine which is simpler in some respects than those previously described and in which the bending pressure is more largely multiplied. In this construction the central or main bending-roll F is provided at each end with a gear J, which gears engage the stationary gears M outside of the racks L upon the table. The handle H is then secured directly to the shaft of the roll F. Thus by the operation of the handle H the roll F is rotated, and at the same time the bending-rolls are carried around the cylinder B by the engagement of the gears J M. As in this construction the table K is held firmly in position by the gears J on either side and they in turn are held in position by arms D, the central recess and rib O P may be omitted and the rolls bear directly upon the rear face of the table K throughout their length. It will be understood that means for adjusting the bending roll or rolls relatively to the bending-cylinder may be used with this construction, as in Fig. 1.

While I have shown my plate-bending machine in its most complete form as constructed for bending stereotype and electrotype plates, it is evident that certain features of the construction shown may be omitted and the machine still be a practical operative machine for the purpose for which it is designed. Thus while I have shown and prefer to use a rigid table outside the plate traveling about the cylinder in planes tangential thereto this table may be omitted, in which case I preferably use in bending stereotype and electrotype plates a sheet of leather board or similar flexible material placed over the face of the type, as usual in machines for bending such plates. A similar sheet may be used also with the table if desired. In bending plain metal sheets, moreover, in which the pressure of the bending-rolls upon the face of the plates is unobjectionable, the plate may be bent by the direct engagement of the bending-rolls.

While it is preferable to use a series of bending-rolls lying in a plane tangential to the cylinder, as shown, so that one or more advance rolls partially bend the plate, and the bend is completed by a roll close to the surface of the cylinder, in order that the plate may be gradually bent, this is not absolutely essential; but a single roll may be used with the table, the roll pressing the table and plate directly against the surface of the cylinder, as segmental roll E of the drawings. In some arts, moreover, it may be found possible and even desirable to substitute for the bending-rolls a non-rotating bar, and in claiming the construction by which plates may be bent about the cylinder in either direction I do not limit myself to a bending-roll, but claim, broadly, a bending-abutment of any form.

While the construction shown forms a very simple and convenient means of causing the table to travel about the cylinder, it is evident that other means may be used for the same purpose, and I claim the table traveling about the cylinder and geared to the cylinder so as to retain its tangential position relatively thereto independently of any special means by which this movement is produced.

It will be seen that by my construction I provide a machine of great simplicity and strength in which the plates are uniformly bent and the wear of parts reduced to a minimum and in which there is no waste of power on the return movement of the parts, the plates being bent upon both movements of the bending-rolls relatively to the cylinder. It will be understood, however, that the feature of providing grips at each side of the cylinder and bending plates by movements in either direction is not essential to my in-

vention, broadly, but that a machine in which plates are bent in but one direction may be used to carry out my invention.

What I claim is—

1. The combination, with a stationary bending-cylinder to which the edge of the plate to be bent is secured, of a series of bending-rolls moving in an arc concentric with said cylinder and lying in a plane tangential thereto, substantially as described.

2. The combination, with a stationary bending-cylinder to which the edge of the plate to be bent is secured, of a table outside the plate, supported to travel about the cylinder while rigidly held in planes tangential thereto, and a bending-roll engaging the outer side of said table and moving in an arc concentric with said cylinder, substantially as described.

3. The combination, with a stationary bending cylinder to which the edge of the plate to be bent is secured and which is provided with gears at each end, of a table outside the plate, having racks at each side meshing with said gears, and a bending-roll engaging the outer side of said table and moving in an arc concentric with said cylinder, substantially as described.

4. The combination, with a stationary bending-cylinder to which the edge of the plate to be bent is secured and which is provided with gears at each end, of a table outside said plate, having racks at each side meshing with said gears, and a series of bending-rolls engaging simultaneously the outer side of said plate and moving in an arc concentric with said cylinder, substantially as described.

5. The combination, with a stationary bending-cylinder to which the edge of the plate to be bent is secured, of a table having a rack-and-gear connection with said cylinder and means for causing said table to travel about the cylinder, substantially as described.

6. The combination, with a stationary bending-cylinder to which the edge of the plate to be bent is secured and which is provided with gears at each end, of a table outside the plate, having racks at each side meshing with said gears, and means for causing said table to travel about said cylinder, substantially as described.

7. The combination of a stationary bending-cylinder, a grip at each side for clamping the edge of the plate to be bent to the cylinder, and means for bending plates about the cylinder in either direction, substantially as described.

8. The combination of a stationary bending-cylinder, a grip on each side of said cylinder for clamping the edge of the plate to be bent to said cylinder, a toggle-joint connected to and operating both grips, and means for bending plates about the cylinder in either direction, substantially as described.

9. The combination of a stationary bending-cylinder to which the edge of the plate to be bent is secured, a table outside the plate, supported to travel about the table while rigidly held in planes tangential thereto, a stationary gear at each end of the cylinder, a rotatable bending-roll mounted outside the table to move in an arc concentric with said cylinder and in engagement with the table, and gears on said bending-roll meshing with the stationary gears, substantially as described.

10. The combination of stationary bending-cylinder B, provided with means for clamping the edges of plates to be bent, a stationary gear M at each end of the cylinder, table K outside said plate, supported by racks L at each side, meshing with gears M, arms D, swinging concentrically with said cylinder, and rotatable bending-roll F, mounted in said arms and having gears J, meshing with gears M outside the racks L, substantially as described.

11. The combination, with stationary bending-cylinder B, provided with means for clamping the edges of plates to be bent and with the gear M at each end, of table K outside the plate, supported by racks L at each side, meshing with gears M, one or more guides I on said table, and one or more bending-rolls engaging the outer side of the table and moving in arcs concentric with the bending-cylinder, said table and bending roll or rolls being provided with corresponding projections and depressions by which the table is held in position, substantially as described.

12. The combination, with a stationary bending-cylinder provided with grips at each side for clamping the edge of plates to be bent to the cylinder, of a bending-abutment moving in an arc concentric with said cylinder and constructed to bend plates on its movement in either direction, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
G. M. BORST,
C. J. SAWYER.