

1,194,602.

R. E. CURTIS.
SHEET METAL FOLDING MECHANISM.
APPLICATION FILED MAY 29, 1908.

Patented Aug. 15, 1916.
3 SHEETS—SHEET 1.

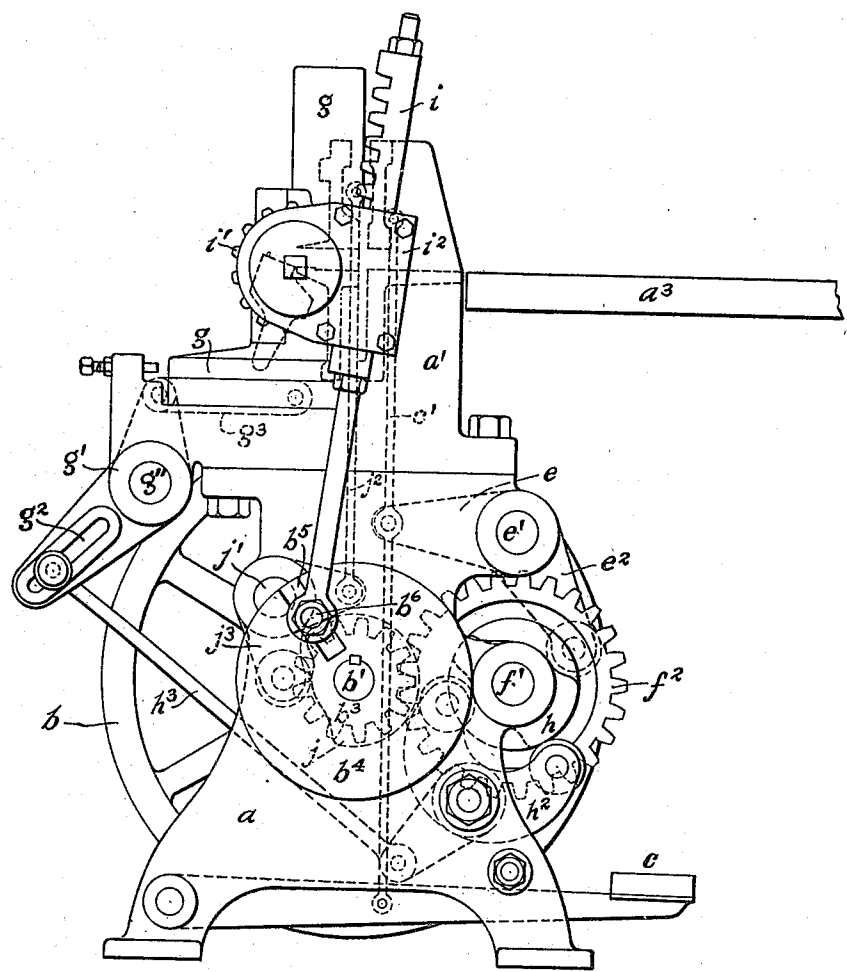


Fig. 1.

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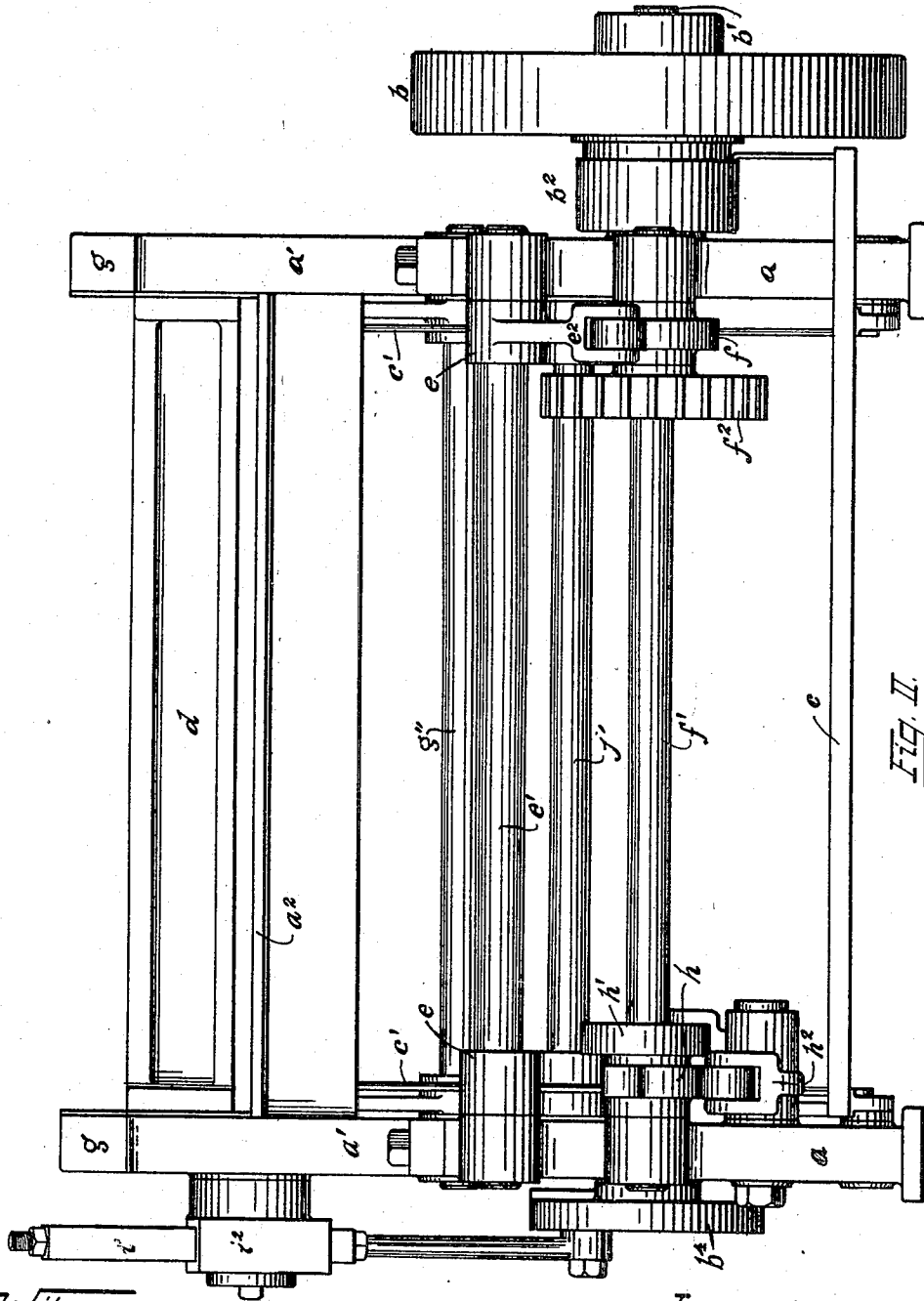


FIG. II.

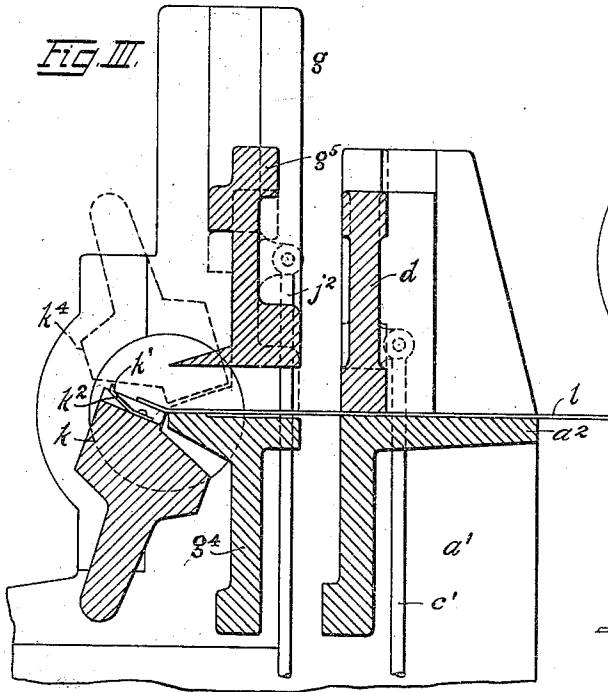
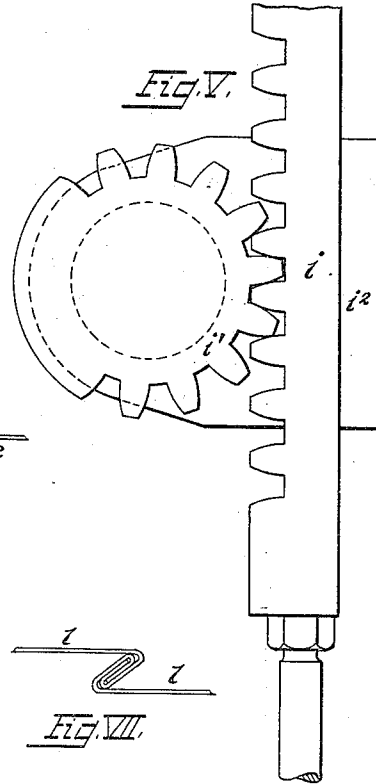
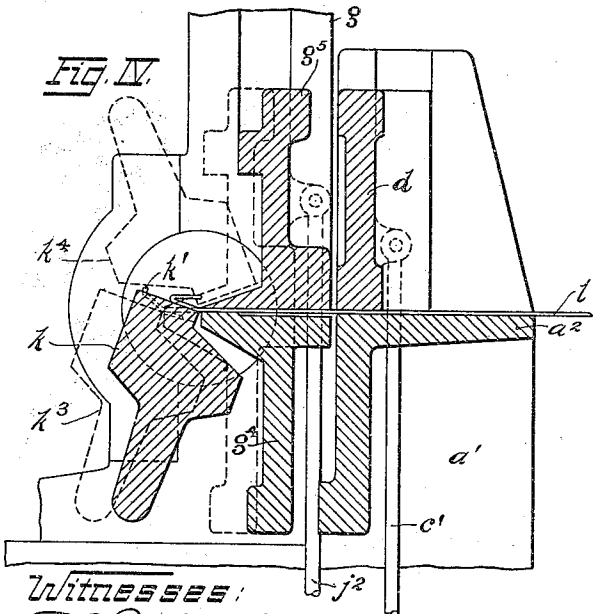
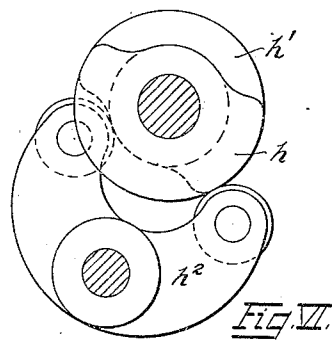
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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SHEET-METAL-FOLDING MECHANISM.

1,194,602.

Specification of Letters Patent. Patented Aug. 15, 1916.

Application filed May 29, 1903. Serial No. 435,735.

To all whom it may concern:

Be it known that I, ROY E. CURTIS, a citizen of the United States of America, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Sheet-Metal-Folding Mechanism, of which the following is a specification.

My invention relates to improvements in sheet-metal folding-mechanism, and has for its object the provision of a machine, preferably power driven, which at a single operation will effect one or more folds in the sheet metal.

More particularly, my invention is designed to complete the double lock or folded end for uniting strips of sheet metal in relatively long lengths, and for accomplishing the same rapidly and during a single continuing operation, without the necessity for readjusting or gaging the sheet. Hand-operated appliances are now employed in the art for effecting a single fold, or a double fold by readjusting the sheet metal and the gage of the appliance. My improved construction, however, not only is preferably power driven, but by reason of its structure, is adapted to accurately fold or form the double lock at the end of quite irregular or uneven pieces of sheet metal.

Briefly adverting to this construction, I may say that it comprises a clamping or brake mechanism, which secures the sheet in place and a reciprocating folding mechanism which is operated independently of the former to be advanced for forming the first or initial fold, and to be retracted to its normal position for forming the second interlocking fold. In other words, the folding-member first forms the interior fold of the double-lock, in its extended position, and then the final or exterior fold thereof, in its retracted position. The several parts are timed and operated together through the intermediation of gears and cams, respectively connected to the separate members. These details will now be explained, together with the operation of my improved mechanism, by making reference to the accompanying drawings, wherein:—

Figure I is a side or end view in elevation, of the machine embodying my invention. Fig. II is a rear view thereof also in elevation. Fig. III is an enlarged sectional view illustrating the clamping and folding mechanism

nearly in position to effect the initial fold. Fig. IV is a similar view of the parts in the retracted position, wherein the final fold is about to be formed. Fig. V is an enlarged detail showing the means for operating the folding member. Fig. VI is also an enlarged detail illustrating the cam-controlled rocker member; and Fig. VII is a fragmentary side view showing the double interlocked edges of two united sheets of metal.

Throughout the several figures of the drawings, I have indicated similar parts by the same character of reference.

Between two heavy side-frames, formed of united castings a a' , are mounted the several parts of the machine. The bed plate a^2 , supplemented by the extension or table a^3 , serves to carry the sheet or sheets of metal to be operated upon. Power is applied to the heavy pulley wheel b connected with the shaft b' , by means of the clutch b^2 , controllable by the treadle c . The lateral rods c' unite said treadle with the clamping jaw d , which rods are also intermediately connected with the rocker arms e , mounted upon the shaft e' . These rocker arms in turn are controlled by the cam f , carried upon the gear-driven shaft f' , which cam is engaged by the roller-bearing extension arm e^2 . The shaft f' is actuated through the medium of the gear f^2 , which bears the relation two to one to the driving gear b^3 positioned upon the main shaft.

The mechanism just described, it will be seen, is that for actuating the gripping jaw d , sliding vertically within the upper portion of the frame a' . The depression of the treadle c , through the connecting rods c' , immediately draws the jaw d downward and clamps the sheet metal upon the bed plate a^2 , while the clutch being actuated through suitable connections, at once engages the elevated portion of cam f with the roller upon the extension arm e^2 , thereby mechanically clamping said jaw d to the bed plate during the complete operation of the machine.

A reciprocating frame g carries the folding mechanism, and is controlled by the double cam h h' , engaged by the roller bearing rocker part h^2 (details being shown in Fig. VI), which rocker part is connected by means of rod h^3 with the bell crank lever g' , affording an adjustable connection therefor in the slot g^2 . The upper end of said arm is

connected with the reciprocating frame g by means of the link g^3 , as shown in dotted lines. The shaft g'' connects the two side levers g' .

At the end of shaft b' , exterior of the frame a , is mounted the wheel b^4 , having a slot b^5 for adjustably accommodating the crank pin b^6 . Upon the crank pin is journaled the reciprocating rack member i , which engages at its upper end the mutilated gear i' controlling the folding member k , and is retained in place by the housing i^2 . The supporting jaw g^4 , carried upon the frame g (see Figs. III and IV particularly), is in the plane of the bed plate a^2 , and forms practically a continuation thereof. The reciprocating folding jaw g^5 is mounted to slide vertically in ways provided in the upper portion of frame g , and is controlled by the connecting rods j^2 , through the action of cams j mounted at either end of the shaft b' , and engaging the pivoted bell crank levers j^3 . The oscillating folding member k is provided with spring mounted gages k' , and is connected to rotate with the gear i' about the forward edge of the supporting jaw g^4 . Said gages normally extend above the face of the folding jaw k , but are depressible within the recesses, wherein they are adjustably mounted upon spring shanks k^2 . The normal relation of the parts, with the frame g in its retracted position, is as indicated in Fig. IV, with the exception that the gripping jaw d , and the folding jaw g^5 are normally elevated above their co-acting members.

With the parts in the normal position, as stated above, the sheet of metal l is advanced along the table a^3 , and beneath the gripping and folding jaws, until it is brought into engagement with the gages k' upon the folding member. The treadle c is then depressed, thereby clamping the metal upon the bed plate a^2 . Simultaneously the clutch b^2 is thrown in and through the medium of gears and cam f' , the arm e^2 actuates the rocker arm e to retain the clamping jaw d in its depressed or operative position. At the same time, the rocker arm h^3 is actuated by its cams to advance the frame g , toward the left, through the medium of connecting rod h^3 and the pivoted lever h' , whereupon the cam j acting upon the arm j^3 , and the associated connecting rods j^2 , serves to depress the folding jaw from the position shown in Fig. III, and engage it with the sheet metal, as indicated by dotted lines in said figure. The rotation of wheel b^4 in turn causes the downward reciprocation of rack i , and the rotation of gear wheel i' and connected folding member k to the position likewise indicated by dotted lines in Fig. III. Thus, it will be seen that the first or initial fold is completed along the edge of the metal.

It is to be borne in mind that the gears b^3 and f^2 bear the relation of one to two, and accordingly upon the completion of the first

fold, the folding jaw g^5 will be released, and by reason of the engagement of the rocker arm h^2 with the opposing sides of the respective cams h h' , the reciprocating frame g will now be retracted into its initial position, *i. e.*, closely adjacent to the bed plate and frame a' .

The clutch b^2 is of well known construction and adjusted for automatic release upon the completion of two revolutions of the connected shaft. Consequently shaft b' will rotate a second time, thereby first depressing the jaw g^5 into its second folding position shown in Fig. IV, whereupon the folding member k will be actuated as before to effect a second fold; its extended position now being indicated by the dotted lines k^3 , and its folding position by the dotted lines k^4 . Immediately upon the completion of the second fold, the respective cams serve to release the jaws g^5 and d which are at once lifted to their elevated positions, while the folding member k is returned to its initial or depressed position, shown in full lines, and the clutch automatically releases the machine from its driving pulley.

By reason of the initial actuation of the gripping member through the action of the foot treadle c , the sudden start or jar which otherwise would be occasioned by the abrupt cam face of cam f , required for the gripping member is avoided, but it is apparent that the machine may be started simply by throwing in the clutch. However, said clutch preferably is connected with the treadle as described to secure the intermittent actuation of the machine. For this purpose, a clutch substantially like the one shown in Fig. 12 of Ray's Patent, No. 802,524, October 24th, 1905, may be employed.

From the foregoing, it will be appreciated that by reason of the relative automatic reciprocation or movement of the gripping and folding appliances of my improved machine, it is possible to complete a plurality of folds during a single continuing operation. The mechanism set forth effects successive interior and exterior folding operations, whereby the edge of the metal is interiorly folded, as is necessary to form a double-lock joint. Preferably, the machine is constructed to operate as herein set forth, although the reverse operation involving a reciprocating gripping mechanism or a modified folding appliance may be substituted in accordance with my broad improvements. As initially stated too, the device preferably is power driven, although the sequence of operation is obtainable as well in a machine actuated by hand or foot power. Moreover, by reason of the adjustments positively afforded in the slotted wheel b^4 and arm g' , the width and angle of the fold are alterable in the particular machine shown in the drawings, while by

modifying the cams, for example, it is seen that further variations in the operation may be readily effected.

The foregoing being contemplated by my invention, I now claim and desire to secure, together with such modifications as may be made by mere skill, the following:—

1. In a machine of the class described, the combination with a gripping and a folding appliance, of means for securing the relative movement thereof toward and from each other, and additional means for actuating the folding mechanism to accomplish successive interior and exterior folding operations during a single continuing actuation of the machine, substantially as set forth.

2. In a machine of the class described, the combination with gripping and folding appliances, of interrelated cams and connecting members respectively adapted to effect the relative movement of said appliances toward and from each other, and a plurality of duplicated folding movements of the folding appliance upon each gripping actuation of the former appliance, substantially as set forth.

3. In a machine of the class described, the combination with a gripping member, of a co-acting pivotal folding appliance, means for effecting their relative movement toward and from each other, and cam-controlled members for securing a plurality of duplicated folding movements for the latter during each actuation of the gripping member, substantially as set forth.

4. In a machine for forming interlocking folds, the combination with a gripping member and its co-acting bed plate, of a folding frame mounted to reciprocate toward and from the latter, a stationary support, a reciprocating jaw, and a rotating folding member upon the said folding frame, interrelated cam shafts bearing cams and connecting mechanism for effecting the reciprocation of said frame, and a plurality of successive rotatable folding operations for said member upon each depression of the gripping jaw, substantially as set forth.

5. In a power machine for folding sheet metal, the combination with a driving shaft, of a cam shaft geared to rotate therewith in the relation of one to two, a gripping member, its cam and connecting mechanism associated with the cam shaft, a folding frame, its cam and connecting mechanism also associated with said cam shaft to effect the reciprocation of the frame, a folding jaw and its cam associated with the driving shaft, and a folding member and driving mechanism actuated by said driving shaft whereby two folding operations are effected and a complete reciprocation of the frame is secured during each rotation of the cam shaft, substantially as set forth.

6. In a machine for forming double inter-

locking folds, the combination with a gripping member and its coacting bed plate, of a pivoted folding mechanism, means for effecting their relative movement toward and from each other, adjusting means for said folding mechanism, and additional means for pivotally actuating the folding mechanism to accomplish successive interior and exterior folding operations during a single continuing actuation of the machine, substantially as set forth.

7. In a machine for forming double interlocking folds, the combination with a gripping member and its coacting bed plate, of a reciprocatory folding frame, a pivotal folding appliance thereon, associated means for effecting the reciprocation of the frame and for accomplishing successive interior and exterior folding operations of said appliance during a single continuing actuation of the machine and in different positions of the material treated, substantially as set forth.

8. In a machine of the class described, a revoluble folding member, and cam actuated mechanism for intermittently moving said member to make successive folds and to grip the work while being operated on and automatically accomplishing the relative movement of the folding-member and the work to receive such folds.

9. In a machine of the class described, the combination with a frame, and edge folding means carried by the frame, of a reciprocatory part mounted at one side of the folding means, means movable with such part for gripping work fed to the folding means, and mechanism operative to actuate said gripping means to grip and hold the work during the folding operations, and to effect the relative movement of the edge-folding means and the work to receive successive folds.

10. In a machine of the class described, an oscillatory folding member, means for clamping the work and coöperating with the folding member to form folds therein, and mechanism for intermittently oscillating said member, intermittently moving the clamping means to grip and release the work, and to accomplish the relative movement of the folding-member and the work for successive folds.

11. In a machine of the class described, an oscillatory folding member, work clamping means associated therewith, a supporting table, means carried by the table for gripping the work, and mechanism operative to oscillate the said member to form successive folds, and to actuate the clamping means to intermittently grip and release the work, the table gripping means to hold the work stationary to and the table to change the position of the folding-member and the work for successive folds.

12. In a machine of the class described, the combination with a folding member, of gripping mechanism associated therewith for clamping the work during folding operations, and automatic mechanism operative to impart successive folding movements to said folding member, to actuate the gripping mechanism, and to effect the relative movement of the folding member and gripping mechanism for subjecting the work to successive folding operations, substantially as set forth.

13. In a machine of the class described, the combination with the folding-member, of a work holding part, work clamping means associated with such part, an intermittently revoluble shaft, and mechanism actuated by said shaft to operate the gripping means to cooperate with the work-holding means to hold the work and to effect the relative movement of the folding-member and the work holding means for accomplishing successive folds.

14. In a sheet metal jointing machine, the combination with a bed, of gripping mechanism for clamping the sheet thereto, automatic folding means adapted to form suc-

cessive folds in the sheet, one within the other, and mechanism for effecting the relative movement of the bed and folding means to effect said successive folds, substantially as set forth.

15. In a sheet metal jointing machine the combination of a bed, means for clamping a sheet thereon, and automatic means adapted to successively form folds in the sheet, one within the other, while the sheet is immovably held in one position by said bed and clamping means, substantially as set forth.

16. In a sheet metal jointing machine the combination of a bed, means for holding the work in place thereon, a folding form movable lengthwise of the bed into different positions on the work for making successive folds thereon, and means for bending the work over said form in its different positions, substantially as set forth.

Signed at Cleveland this 27th day of May, A. D., 1908, in the presence of two subscribing witnesses.

ROY ELMER CURTIS.

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ALBERT LYNN LAWRENCE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."