J. M. FEDDERS.

METAL BENDING MACHINE.

APPLICATION FILED FEB. 24, 1916.

1,226,490.

Patented May 15, 1917.

5 SHEETS—SHEET 1.

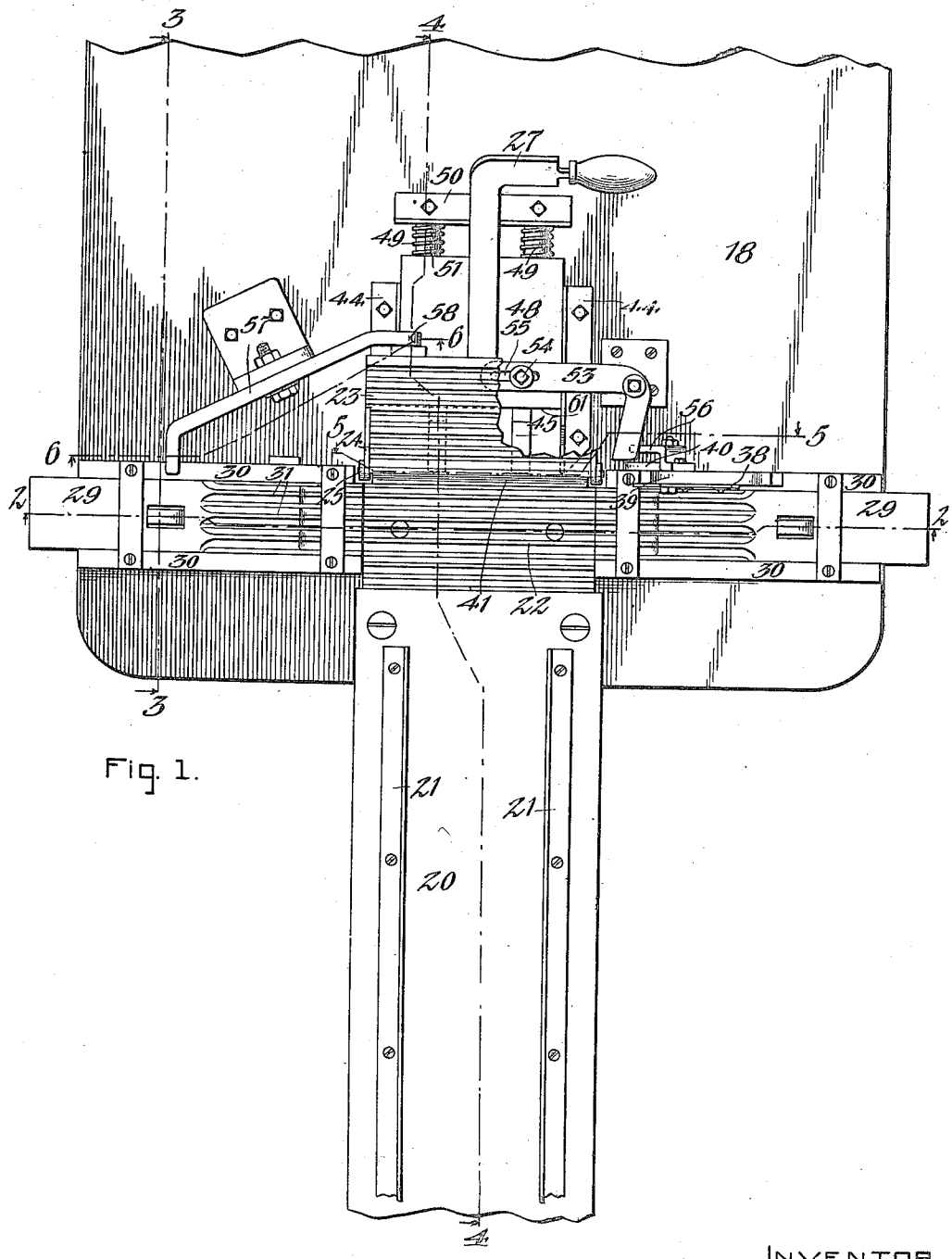

Fig. 1.

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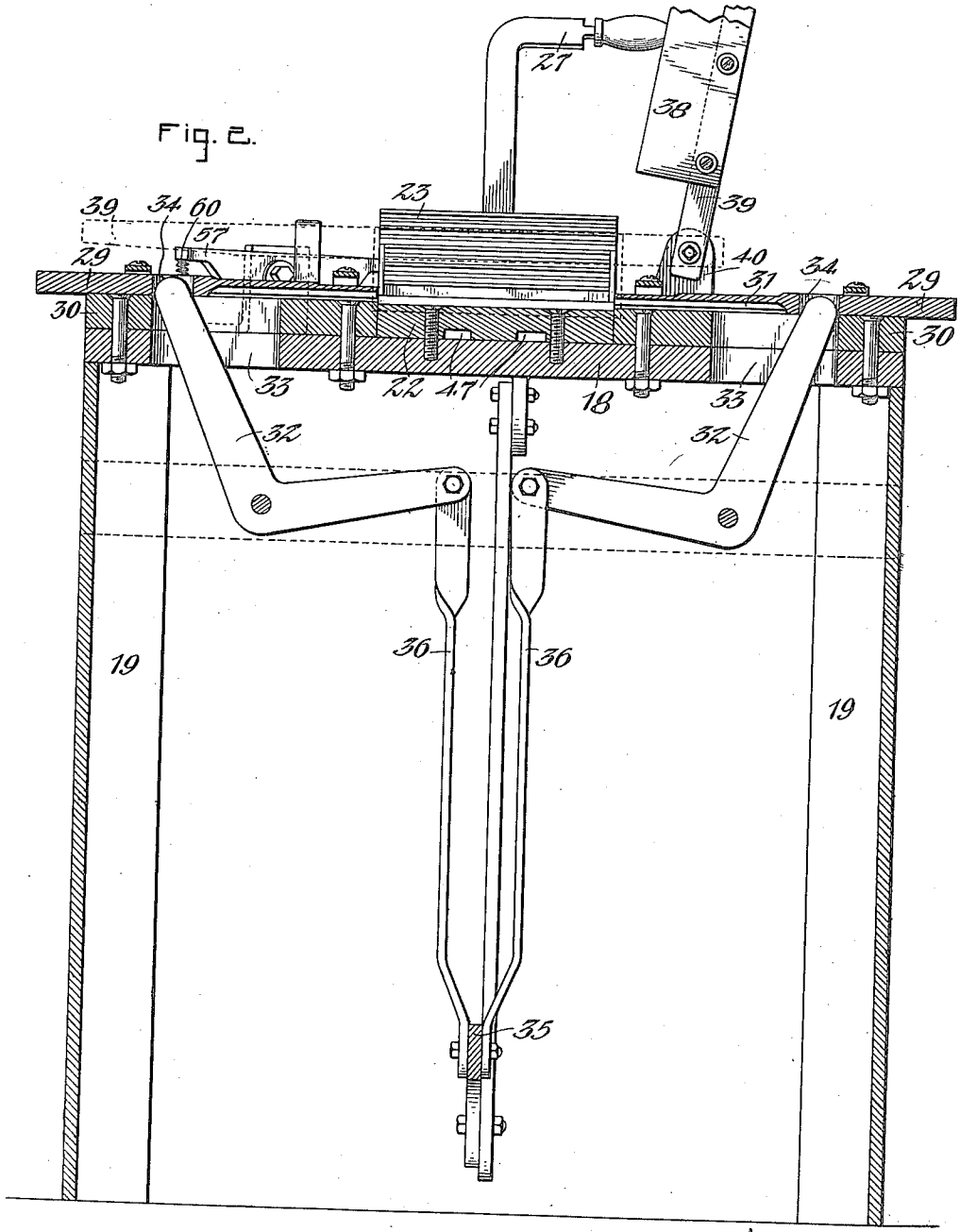
5 SHEETS—SHEET 2.

Fig. 2.



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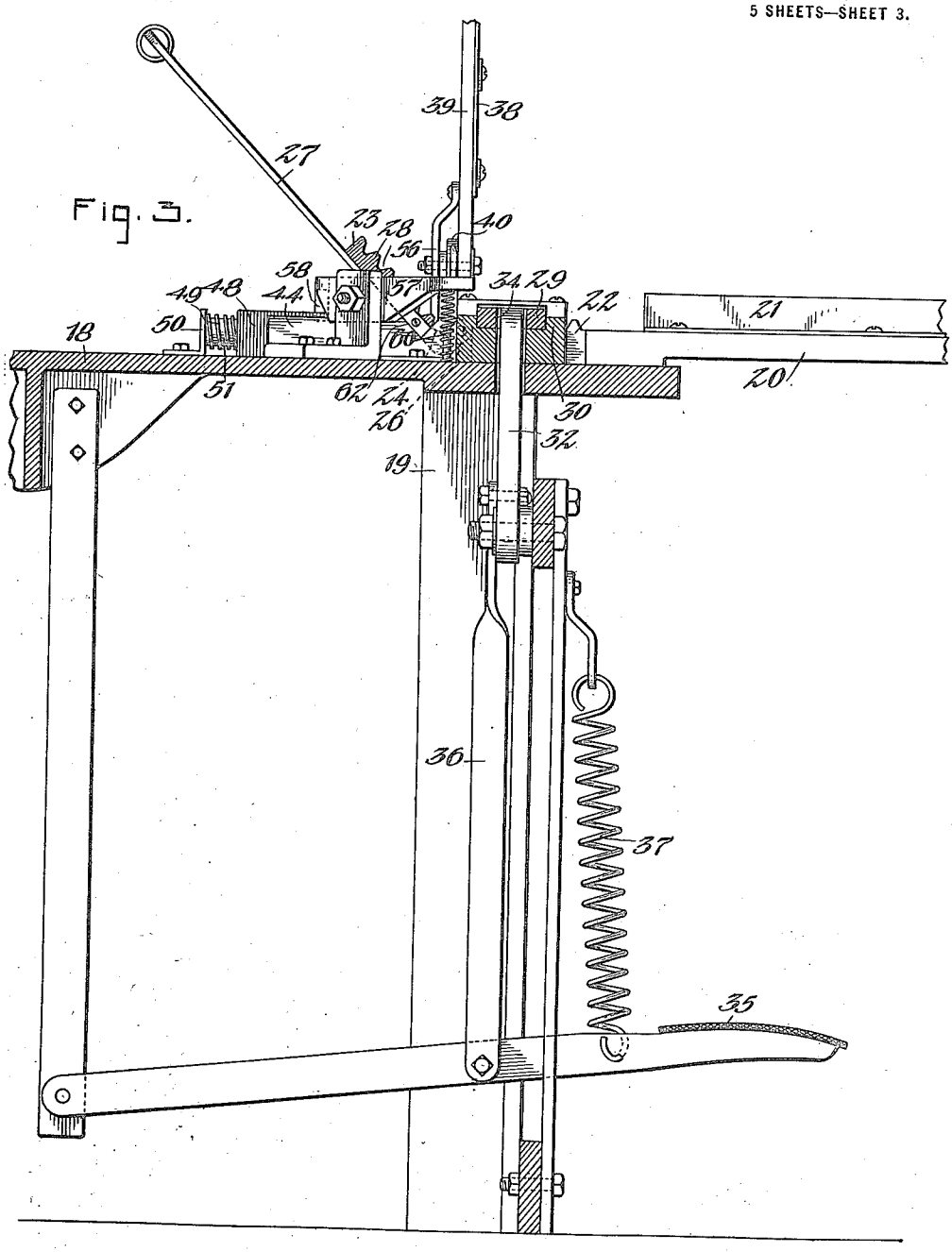
5 SHEETS—SHEET 3.

Fig. 3.



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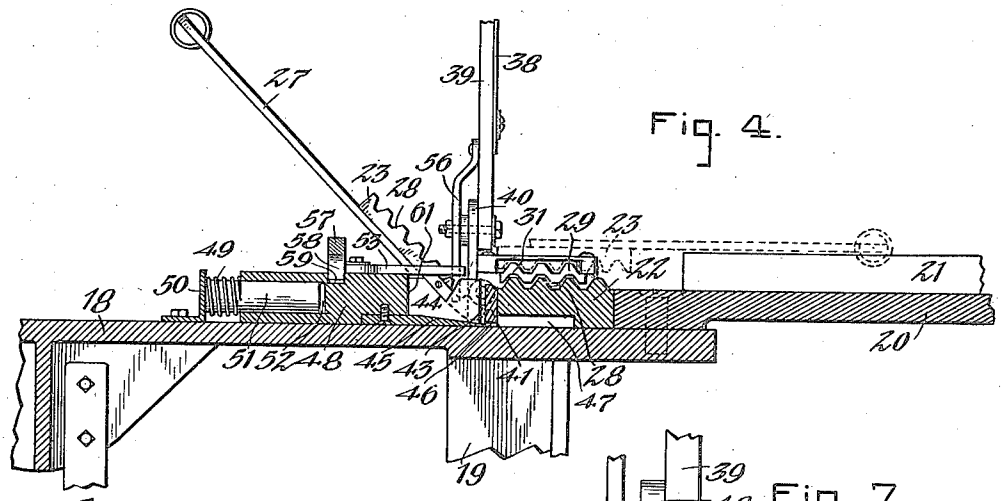

Fig. 4.

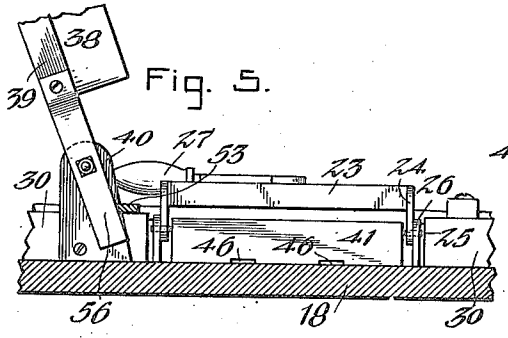

Fig. 5.

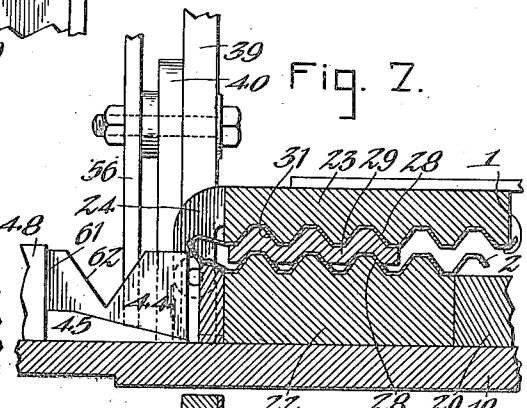

Fig. 7.

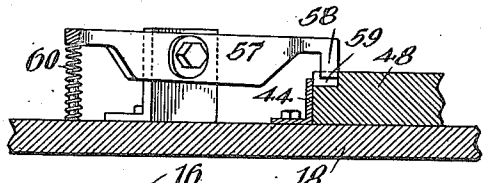

Fig. 6.

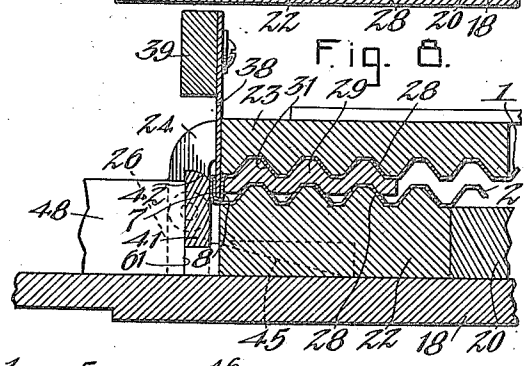

Fig. 8.

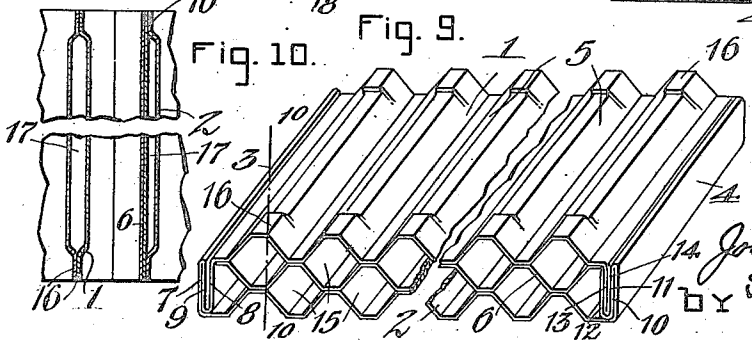

Fig. 9.

Fig. 10.

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5 SHEETS—SHEET 5.

Fig. 11.

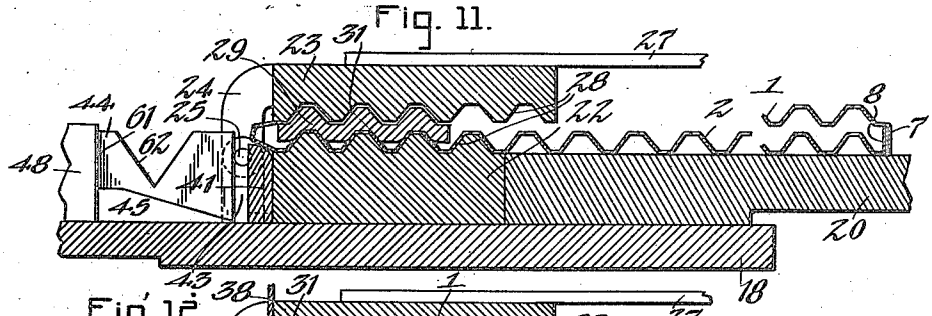


Fig. 12.

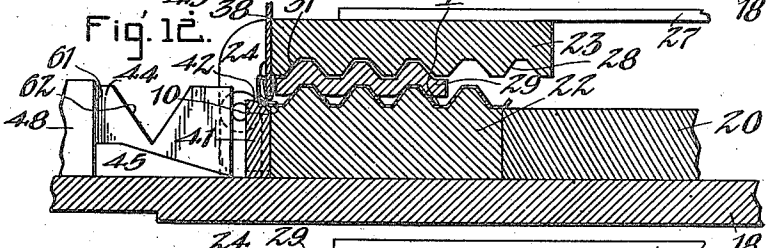


Fig. 13.

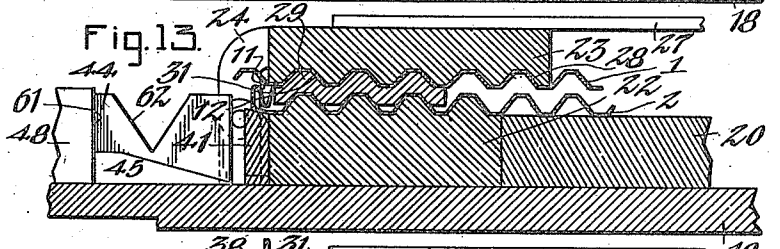


Fig. 14.

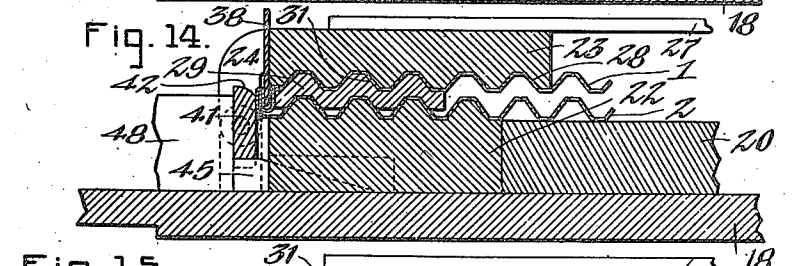
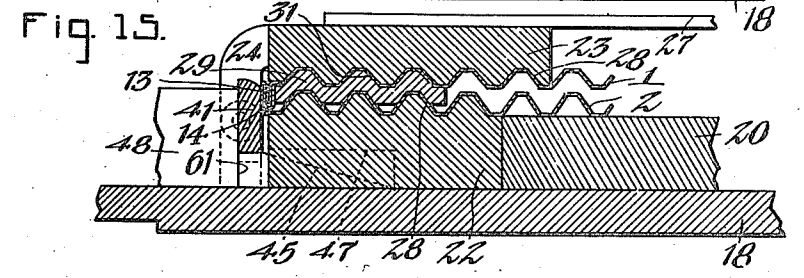


Fig. 15.



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BY Cooper & Popk

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UNITED STATES PATENT OFFICE.

JOHN M. FEDDERS, OF BUFFALO, NEW YORK, ASSIGNOR TO FEDDERS MANUFACTURING COMPANY, INC., OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

METAL-BENDING MACHINE.

1,226,490. Specification of Letters Patent. Patented May 15, 1917.

Application filed February 24, 1916. Serial No. 80,155.

To all whom it may concern:

Be it known that I, JOHN M. FEDDERS, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Metal-Bending Machines, of which the following is a specification.

This invention relates to a machine for bending strips of metal for use in the manufacture of that class of radiators through which water is circulated for cooling explosion engines. In some forms of radiators, as heretofore constructed, a plurality of pairs of metal strips are assembled in such manner that a plurality of water tubes are formed each of which is composed of two longitudinal side walls having their longitudinal edges connected with each other while their intermediate parts are separated to form a water passage and the extremities of each longitudinal wall are connected by a solder joint with the opposing longitudinal wall of another water tube for the purpose of excluding the entrance of water into the air spaces between adjacent tubes when several tubes constituting the core of the radiator are assembled with the inlet and outlet headers of the radiator through which the water to be cooled is supplied to one end of the tubes and the cooled water is carried off from the opposite ends of these tubes.

The object of this invention is to provide a simple and efficient machine whereby the opposing longitudinal walls of two adjacent water tubes may be made from a single strip of sheet metal by doubling such strip about half way on its length and connecting the corresponding ends of these side walls by end walls so as to form an air space between these walls in such manner that the same may be readily rendered water tight by the application of solder thereto and thereby not only reduce the cost of manufacture but also reduce the amount of waste material incident to the methods heretofore employed in making radiators and also insuring greater security against leakage.

In the accompanying drawings:

Figure 1 is a top plan view, partly broken away, of a bending machine embodying my invention. Fig. 2 is a vertical transverse section of the same taken on line 2—2, Fig. 1. Fig. 3 is a vertical longitudinal section of the same taken on line 3—3, Fig. 1. Fig. 4 is a fragmentary vertical longitudinal section taken on line 4—4, Fig. 1. Figs. 5 and 6 are fragmentary vertical transverse sections taken on the correspondingly numbered lines in Fig. 1. Figs. 7 and 8 are fragmentary vertical longitudinal sections of the machine, on an enlarged scale, showing different positions of the parts at different stages in the operation of doubling or folding an integral end wall between the two side walls of a radiator strip. Fig. 9 is a fragmentary perspective view of a radiator core unit in its completed form. Fig. 10 is a fragmentary section of a radiator core having units made by this machine the section being taken on line 10—10, Fig. 9. Figs. 11–15 are fragmentary vertical longitudinal sections of the machine, on an enlarged scale, showing different positions of its parts during the successive operations thereof for forming a lock jointed or seamed end wall between the free ends of the two side walls of a strip of metal.

Similar characters of reference indicate corresponding parts throughout the several views.

This machine is more particularly designed for folding or bending and locking or seaming a strip of metal of any suitable shape so as to form two side walls 1, 2 which are connected at two of their corresponding ends by an integral end wall 3 while their opposite corresponding two ends are connected by a seamed or locked end wall 4 so as to produce part of a unit of a radiator core, as shown in Fig. 9. In this figure the two side walls are provided with transverse corrugations 5 so that when the same are assembled with other side walls of like character tortuous water tubes are produced through which water is conducted from one end thereof to the other, and between these opposing side walls of adjacent tubes suitable corrugated radiating webs, strips or

fins 6 may be placed for the purpose of dividing this space into a plurality of air conducting passages. The integral end wall 3 between the side walls of this strip is formed by bending that part of the metal strip at its turn so that the same is doubled twice upon itself into substantially the shape of the letter Z and comprises an outer ply 7 connected at one edge with the adjacent end of one of the side walls, an inner ply 8 connected with the adjacent end of the other side wall, and an intermediate ply 9 connected at its opposite transverse edges with the opposite corresponding transverse edges of the inner and outer plies 7 and 8. The several plies of this integral end wall may be so formed that the inner and intermediate plies are spaced apart and the outer and intermediate plies are closed together, as shown in Figs. 8 and 9, or these plies may be all pressed together, as shown at the right of Fig. 11. The interlocked or seamed end wall at the opposite free ends of the side walls of this strip is composed of a female member which comprises an outer ply 10 connected at one of its edges with one of the side walls, an intermediate ply 11 connected at one of its transverse edges with the opposite transverse edge of the outer ply 10, and an inner ply 12 connected with the corresponding transverse edge of the intermediate ply but separated therefrom so as to form a transverse groove, and a male member arranged on the corresponding end of the other side wall by doubling the same so as to form an inner ply 13 which is connected at one of its transverse edges with the corresponding end of the companion side wall and an outer ply 14 which is connected at one of its transverse edges with the corresponding edge of the inner ply 13 and forming a tongue which is arranged in the groove of said female member, as shown in Figs. 9 and 15.

The several plies forming the locked end wall of the strip are preferably pressed together after the same are assembled and in addition thereto this locked joint is soldered so as to seal the same against leakage. For convenience of manufacture only the several plies of the seamed or jointed end wall are pressed together while the several plies of the end wall at the opposite ends of the side walls are separated, so that this separation serves as an indicator to the operator as to which of the ends of the walls require soldering to produce a water tight joint in the completed radiator.

The radiating webs, fins or plates 6 are preferably provided with transverse corrugations and inserted in the space between the walls 1 and 2 for the purpose of dividing this space into a plurality of air passages 15 and completing the core unit. As shown in Fig. 9, one of such radiating plates is arranged between two of such side walls and divides said space into air passages which are staggered relative to each other. The outer sides of the side walls of the radiator core unit are provided with lateral off-sets 16 at the longitudinal edges thereof so that when the walls of each unit engage with the walls of other units in assembling the parts of a radiator core a plurality of water passages 17 are formed between the adjacent side walls of different units through which the water for cooling a gas engine is circulated. In the completed radiator the abutting longitudinal edges of the side walls of the several units are sealed by solder or otherwise and the opposite ends of the water tubes are connected with water headers or boxes in the usual and well known manner, common to this art.

The main frame which supports the working parts of the machine may be of any suitable construction but as shown in the drawings the same comprises a horizontal table 18, and a plurality of legs 19 supporting the table on the underside thereof.

20 represents a shelf which projects horizontally forward from the front end of the table and upon which the strip of metal which is to be operated on by the machine is supported at the outer end thereof. This strip is confined against lateral displacement by means of two longitudinal guide bars 21 arranged on the upper side of the shelf, as shown in Figs. 1 and 3. 22, 23 represent two relatively movable bending or holding jaws or dies which are adapted to fold the strip of metal into two sections or walls and to hold the same in connection with other parts while a transverse integral folder end wall is formed on one end of these side walls and a jointed or seamed end wall is formed between the opposite ends thereof. In the preferred construction one of these jaws, for instance the jaw 22 is rigidly mounted on the upper side of the table immediately in front of the rear end of the shelf while the other jaw 23 is movable and adapted to swing vertically toward and from the lower jaw. For this purpose the upward jaw is pivotally supported at its rear end adjacent to the rear end of the lower jaw by means of two hinge lugs 24 arranged at opposite longitudinal edges of the heel portion of the movable jaw and pivoted by means of transverse pins 25 to lugs 26 projecting upwardly from the table adjacent to the heel or rear end of the lower or fixed jaw, as best shown in Figs. 1, 3 and 5. The upper jaw may be moved toward and from the lower jaw by any suitable means, for instance by a handle 27 secured to the outer side of the upper jaw and projecting laterally therefrom as best shown in Figs. 1 and 2.

The faces of the lower and upper jaws

are provided with transverse flutes or corrugations 28 which correspond in form to the corrugations of the strip of metal which is to be folded. When completed each unit has two side walls and is provided with an integral end wall at one end of its side walls and a jointed end wall at the opposite ends of these side walls.

While the two sections or side walls of a strip are folded one over the other between the lower and upper holding jaws these two walls are separated from each other and retained in their proper position by a mandrel which preferably comprises two sections 29, 29 which are movable horizontally toward and from each other into and out of the space between the two holding jaws. These two mandrel sections are guided in suitable ways 30 which are arranged horizontally and transversely on the upper side of the table on opposite sides of the lower forming and holding jaw so that these two mandrel sections may be moved horizontally toward each other over the lower jaw and abut with their opposing inner ends about midway of the width of the lower jaw when the same are in their operative position, but may be retracted laterally so that the same clear the upper surface of the lower jaw. The inner portions of the two mandrel sections are provided on their upper and lower sides with flutes or corrugations 31 which correspond to the flutes or corrugations on the faces of the lower and upper bending and holding jaws so that the lower side wall of a strip may be clamped between the underside of the mandrel sections and the lower jaw and the upper side wall of this strip may be clamped between the upper side of the mandrel sections and the underside of the upper jaw without distorting or changing the formation of the corrugations of this strip while those portions thereof adjacent to the side walls are being operated upon. The mandrel sections may be moved toward and from each other into and out of their operative position by any suitable means, this being accomplished in a satisfactory manner by the means which are shown in the drawings and which comprise two elbow levers 32 pivoted to swing vertically on the main frame below the table and each projecting with its upper arm through a slot 33 in the table and into an opening 34 in the outer part of the corresponding mandrel section, a treadle 35 pivoted on the frame below the table and connected by means of upright links 36 with the lower arms of the elbow levers and a spring 37 connecting this treadle with the adjacent fixed part of the frame. When free the treadle is raised by means of the spring so that the elbow levers are turned in the direction for moving the mandrel sections apart or into their inoperative position at which time the fluted parts thereof clear the top of the lower clamping jaw. Upon depressing the treadle in opposition to the resistance of the spring 37 the elbow levers are turned in the direction which causes the two mandrel sections to move inwardly toward each other so that their fluted inner portions extend over the lower jaw and the opposite ends of the mandrel sections meet on a line with the center of the lower jaw or substantially so.

In the operation of this machine, so far as the upper and lower holding jaws and the mandrel sections are concerned, the operator first places the previously corrugated strip of metal on the lower jaw with a part thereof projecting beyond the inner or rear end thereof and some of the corrugations of this strip engage the corrugations of this jaw. The mandrel sections are now moved inwardly over the lower jaw and that part of the corrugated strip resting thereon so that the corrugated underside of these sections fit the upper side of the strip. The upper jaw is now swung forwardly and downwardly so that that part of the strip in rear of the lower jaw is bent forwardly and downwardly and clamped between the corrugated upper side of the mandrel sections and the corrugated underside of the upper jaw. During this bending of the corrugated strip the two side walls thereof are brought side by side and a portion of the metal of this strip projects beyond the rear ends or edges of the upper and lower jaws and the mandrel sections. This projecting portion is folded or doubled upon itself by means which are preferably constructed as follows:

38 represents a transverse folding blade which is adapted to be moved vertically immediately in rear of the upper holding jaw and mandrel sections and toward and from the rear part of the lower holding jaw for the purpose of causing the lower edge of this blade to engage that portion of the metal strip which projects beyond the rear ends of these jaws and mandrel sections and bending the same downwardly preferably into doubled form. This folding blade is mounted on a vertically swinging operating lever 39 which is pivoted at one end on an upwardly projecting lug 40 arranged on the upper side of the table on one side of the holding jaws and mandrel sections.

Immediately in rear of the lower holding jaw is arranged a vertically movable bending die 41 which in its lowered position forms practically a rearward extension of this jaw and supports the adjacent part of the metal strip on its underside while the folding blade moves downwardly toward the same. But after the blade has completed its downward movement this bending die is moved upwardly along the rear side of this blade and bends that portion of the metal strip which projects beyond the rear side

of the blade upwardly into double form against this last mentioned side of the blade. In order to enable this bending die to perform this operation without injuring or cutting the metal strip its upper front corner is rounded, as shown at 42 so as to operate upon the metal gradually or uniformly without a cutting action. The bending die may be guided and operated by any suitable means but the same is preferably guided at its opposite ends in vertical guideways or slots 43 formed in two longitudinal guide bars or rails 44 arranged lengthwise on the table in rear of the upper and lower holding jaws and mandrel sections. The downward motion of the bending die is preferably effected by gravity and the upward movement of the same is produced by two horizontally and longitudinally movable lifting wedges 45 which are arranged above the table and movable back and forth underneath the lower edge of the bending die. In its lowermost position the bending die rests upon the table and at that time the lifting wedges are arranged in rear of the bending die, as shown in Figs. 4, 7, 11, 12 and 13. Upon moving the lifting wedges forwardly the same engage with the underside of the bending die and raise the same, as shown in Figs. 8, 14, and 15. The lower edge of the bending die is preferably provided with notches 46, as shown in Fig. 5, for receiving the wedges and preventing lateral displacement of the bending die relative to the wedges, and the lower rear part of the lower holding jaw is provided with recesses 47 which receive the wedges in their forward position. At their rear ends the wedges are secured to the lower front part of a horizontally and longitudinally movable slide 48 which is guided on its underside on the top of the table and at its opposite longitudinal edges between the guide bars or rails 44. The forward movement of this slide and the wedges mounted thereon is produced by spring pressure which is preferably derived from two helical springs 49 which are interposed between the rear end of the slide 48 and a bracket 50 secured to the upper rear part of the table and each of which is retained in place by means of a guide rod 51 supporting the respective spring and secured at its rear end to the bracket 50 and sliding with its front end in a longitudinal horizontal opening 52 in the rear part of the slide. The rearward movement of the slide and the parts connected therewith is produced by means of a horizontally swinging elbow lever 53 pivoted on the top of the table adjacent to the folding blade lever and having an inner arm which is connected with the upper side of the slide by means of a pin 54 secured to the slide and passing through a slot 55 in the adjacent arm of the elbow lever while the outer arm is adapted to be engaged by a finger or tail 56 secured to the folding blade lever and projecting below the fulcrum thereof, as shown in Figs. 1, 4 and 5. During the last portion of the upward and lateral movement of the blade lever its tail or finger 56 engages with the outer arm of the slide elbow lever 53 and turns the same in a direction which will cause the inner arm thereof to move the slide rearwardly. The engagement of this tail with the slide elbow lever also operates as a stop to limit the lateral movement of the blade lever. When the slide reaches its rearmost position the same is automatically locked against forward motion by means of a catch device which preferably consists of a latch or locking lever 57 pivoted on the adjacent part of the table so as to swing vertically and having an inner arm which is provided with a locking nose 58 adapted to project downwardly into a recess or opening 59 in the upper side of the slide, and having an outer arm which projects horizontally across the path of the blade lever on that side of the holding jaws and mandrel sections opposite to where the blade lever is fulcrumed. The locking latch tends constantly to turn in the direction for engaging its nose with the locking opening of the slide by means of a spring 60 arranged between the underside of its outer arm and the top of the table, as shown in Fig. 6. On its front end the slide is provided with a vertical hammer or striking face 61 extending transversely across the same which hammer or striking face is adapted to deliver a blow against the rear side of the bending die 41 under the action of the springs 49 after the bending die has been raised by the lifting wedges and thereby cause that part of the strip which has been bent upwardly against the rear side of the folding blade to be pressed together evenly and uniformly. In order to permit this bending die to move not only vertically but also horizontally for adapting the same to the upwardly bent part of the strip and also to move slightly under the blow of the slide this bending die is fitted sufficiently loose in the guideways 43 so as to permit of the necessary longitudinal play for this purpose.

In order to limit the rearward movement of the upper holding jaw and to support the same in the proper position to receive the strip of metal a stop is provided which is preferably formed by notching the upper parts of the guide bars 44 so as to form stop face 62, as shown in Figs. 3, 4, 7 and 11–13 against which the rear part of the upper or holding jaw may rest when the same is not in use and in its inoperative or open position.

In the operation of this machine a previ-

ously corrugated and off-set strip of metal having a total length somewhat greater than the combined length of two side walls and two end walls of a radiator unit is first placed lengthwise upon the guide shelf and over the faces of the lower and upper holding jaws so that that part of this strip adjacent to the center thereof is arranged between the rear ends of the two holding jaws and spans the space between the same. At this time the parts of the machine are in the position indicated by full lines in Figs. 1, 2, 3, 4 and 6. The operator now depresses the treadle so as to move the two mandrel sections inwardly over that portion of the corrugated strip which rests upon the lower holding jaw and then moves the upper holding jaw forwardly and downwardly toward the upper side of the mandrel sections, whereby the strip is folded about midway of its length so that two side walls or sections are formed which are arranged side by side and gripped between the opposing corrugated surfaces of the mandrel sections and the holding jaws and an integral transverse portion which connects the rear ends of these two side walls is left in a position in which it projects beyond the rear edges or ends of the holding jaws and mandrel sections and overhanging the upper edge of the bending die, as shown in Fig. 7. The operator now moves the blade lever downwardly so that the lower edge of the blade engages with the upper part of the integral transverse portion of the strip and bends or doubles the same downwardly along the rear edges of the mandrel sections and toward the lower part of this strip. During the last portion of this downward movement of the blade the free end of the blade lever engages with the outer arm of the latch lever and depresses the same, whereby the inner arm thereof is raised and disengages its locking nose from the locking recess of the slide. The instant this occurs the slide flies forwardly quickly under the pressure of the springs 49 and during this movement the wedges first raise the bending die so as to turn the rearmost portion of the integral turn of the strip upwardly along the rear side of the folding blade and immediately after this bending die has been thus raised into its elevated position the front or hammer end of the slide strikes a blow against the rear side of the bending die so as to flatten out and compress the folded portions of the integral turn between the side walls of the strip and integral end wall is thus produced which connects the two side walls at one pair of their corresponding ends, this end wall comprising three plies which are so folded relatively to each other as to produce substantially a Z-shaped form in cross section the outer loop of which consists of the outer and intermediate plies which are pressed together while the inner loop consists of the inner and intermediate plies which are separated from each other, as shown in Figs. 8 and 9. If desired, these several plies may be pressed together by moving the blade lever into its uppermost or retracted position so as to withdraw the blade from the inner loop of the integral end wall and retract the slide into its rearmost locked position, after which the locking latch may be operated by hand independently of the folding blade for causing the wedges to again lift the bending die in rear of the outer loop of the integral end wall preparatory to receiving a blow from the front hammer end of the slide and pressing the outer loop of the integral end wall tightly against the inner loop thereof. For operating the elbow lever 53 in the manner described the folding lever 39 is moved backwardly farther than necessary to clear the folding jaws 22, 23, 29 and after the slide has been locked in its retracted position the folding lever is again moved with its tail 56 away from the elbow lever to permit the latter to operate freely.

After the integral end wall has been thus formed on the two side walls of the strip the latter is removed from the machine after first raising the upper holding jaw and withdrawing the mandrel sections and then that side wall of the strip having the greater length is placed upon the shelf and the lower holding jaw so that a portion of the free end of this wall projects rearwardly over the bending die and the adjacent part of the face of the upper holding jaw. The mandrel sections are then moved inwardly over the lower side wall of the strip and then the upper holding jaw is moved downwardly upon the mandrel sections, whereby the rearwardly projecting end of the lower side wall is bent forwardly and downwardly and clamped between the upper side of the mandrel sections and the upper holding jaw and the turned portion of this end of this wall is left in a position in which the same projects over the upper end of the bending die, as shown in Fig. 11. The folding blade is now pressed downwardly so as to form a downward doubled bend in the upper part of this projecting end portion which in effect produces an upwardly opening transverse groove on this part of the strip, as shown in Fig. 12. The upper holding jaw is now raised and the free rear end of the other side wall of the strip is placed upon the upper side of the mandrel sections and held in place thereon by again lowering the upper holding jaw, as shown in Fig. 13. When the upper side wall is thus placed between the mandrel sections and the upper holding jaw its rear free end projects rearwardly beyond this mandrel section and the holding jaws and overlaps the doubled turn

at the rear end of the lower side wall of the strip, as shown in the last mentioned figure. The folding lever is now again lowered so that the lower edge of its blade doubles the projecting rear end of the upper side wall and pushes the same downwardly in the form of a plait into the groove formed by the concave or open side of the plait at the rear end of the lower side wall, as shown in Fig. 14. When the blade is moved downwardly to form the grooved plait at the rear end of the lower wall, as shown in Fig. 12 the blade lever is not lowered to its fullest extent so that the latch lever is not operated for releasing the slide, whereby the bending die at this time is not raised nor pressed forwardly against that part of the strip in rear of the blade. When, however, the blade is moved downwardly for forming a plait at the rear end of the upper side wall and pushing the same into the grooved plait of the lower side wall the blade lever is moved so as to complete its downward stroke and engage the latch lever for withdrawing the same from the slide and permit the latter to be projected by the springs 49 and cause the wedges to raise the bending die and the hammer face of this slide to deliver a blow against the rear side of this die. This results in that part of the strip in rear of the blade being bent upwardly and pressed firmly against the rear side thereof, as shown in Fig. 14. The end wall at the opposite corresponding ends of the side walls is now complete for certain purposes which end wall is produced by interlocking or seaming the folded or plaited portions arranged at the free ends of the strip and forming continuations of the side walls thereof. If desired, the several plies of metal forming the interlocking plaits of this seamed joint may be pressed together by first raising the blade out of engagement from the interlocked plaits of this end wall and retracting the slide until the same is caught by the latch and then operating the latch so as to release the slide and permit the wedges thereof to raise the bending die and its hammer face to deliver a forward blow against the bending die while the blade is removed from the interlocked plaits, as shown in Fig. 15.

The strip may now be removed by raising the upper holding jaw and withdrawing the two mandrel sections therefrom.

After one of these strips has been bent into this form so as to provide two side walls and two end walls at the opposite ends thereof radiating means of any suitable character such as the corrugated fins or webs shown in Figs. 9 and 10, are placed between the side walls for dividing this space into a plurality of air tubes or channels, thereby completing a unit. A plurality of such units are then assembled so as to form water tubes between the opposing walls of the adjacent units and then the several units are dipped at their front and rear ends into a solder bath for uniting the same and a coating of solder is also applied to the interlocked end walls of the units so as to exclude water from the corresponding air passages, thereby completing the core of the radiator. Thereafter this core is assembled with the upper and lower water boxes or headers and inclosed by a frame for furnishing the radiator in a well known manner.

My improved machine for bending, folding and interlocking a strip of metal in the manner described for producing part of a radiator core unit permits of accomplishing this work easily, expeditiously and effectively without necessitating any waste in material from which the strip is made, thereby effecting a considerable economy in the manufacture of this type of radiator.

I claim as my invention:

1. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, and a mandrel adapted to support the parts of said strip on the inner sides thereof and comprising two sections which are movable laterally into and out of the space between said jaws from opposite sides thereof.

2. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, and a mandrel adapted to support the parts of said strip on the inner sides thereof and comprising two sections which are movable laterally into and out of the space between said jaws from opposite sides thereof and means for operating said mandrel sections simultaneously.

3. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, and a mandrel adapted to support the parts of said strip on the inner sides thereof and comprising two sections which are movable laterally into and out of the space between said jaws from opposite sides thereof, and means for operating said mandrel sections simultaneously comprising elbow levers connected with said mandrel sections, a treadle connected with said levers, and a spring operating to lift said treadle and turn the levers in the direction for removing said mandrel sections from said jaws.

4. A metal bending machine comprising a pair of jaws which are relatively movable and adapted to bend a strip of metal so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws and adapted to support the parts of said strip on the inner sides thereof while the outer sides of said parts are engaged by said jaws, and means for plaiting the strip in rear of said mandrel and jaws comprising a vertically swinging folding blade movable toward and from the rear ends of said mandrel and jaws.

5. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, and a support for said strip below said blade.

6. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, and a vertically movable die supporting the strip below said blade and in rear of said lower jaw.

7. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw and a guide for said die.

8. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade.

9. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip and a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die.

10. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip,—a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die and a reciprocating slide carrying said wedge.

11. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip and a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die, a reciprocating slide carrying said wedge, a spring for pushing said slide and wedge forwardly and a latch for holding said slide in its rearward position.

12. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip and a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said

die, a reciprocating slide carrying said wedge, a guide rod engaging at its front end in an opening in said slide, a fixed bracket for the rear end of said rod, a spring mounted on said rod between said slide and bracket, and a latch pivoted on a fixed support and adapted to engage said slide and hold the same in its rearward position.

13. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip and a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die, a reciprocating slide carrying said wedge, a spring for pushing said slide and wedge forwardly, a latch for holding said slide in its rearward position and means for moving said slide rearwardly.

14. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip,—a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die,—means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die, a reciprocating slide carrying said wedge, a spring for pushing said slide and wedge forwardly, a latch for holding said slide in its rearward position comprising a horizontally swinging lever having one of its arms connected with said slide, and a vertically swinging lever engaging the other arm of said horizontally swinging lever.

15. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die, a reciprocating slide carrying said wedge, a spring for pushing said slide and wedge forwardly, a latch for holding said slide in its rearward position and means for moving said slide rearwardly comprising a horizontally swinging lever having one of its arms connected with said slide, and a vertically swinging lever engaging the other arm of said horizontally swinging lever, said vertically swinging lever carrying said folding blade.

16. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die, a reciprocating slide carrying said wedge, a spring for pushing said slide and wedge forwardly, a latch for holding said slide in its rearward position and means for moving said slide rearwardly comprising a horizontally swinging lever having one of its arms connected with said slide, and a vertically swinging lever engaging the other arm of said horizontally swinging lever, said vertically swinging lever carrying said folding blade and said latch being arranged in the path of said vertically swinging lever.

17. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, means for raising said die in rear of said blade, and means for striking a forward blow against the rear side of said die while the latter is in its elevated position.

18. A metal bending machine comprising a lower fixed jaw, a vertically swinging upper jaw movable toward and from the lower jaw and adapted to bend a strip of metal between them so that two parts thereof are arranged side by side, a mandrel movable into and out of the space between said jaws, a folding blade movable vertically in rear of

said mandrel and jaws and adapted to form a plait in said strip, a vertically movable die supporting the strip below said blade and in rear of said lower jaw, a guide for said die, and means for raising said die in rear of said blade comprising a movable wedge engaging with the underside of said die and a reciprocating slide carrying said wedge and provided at its front end with a hammer face which is adapted to strike a blow against the rear side of said die while the latter is in its elevated position.

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