J. M. FEDDERS.

METAL BENDING MACHINE.

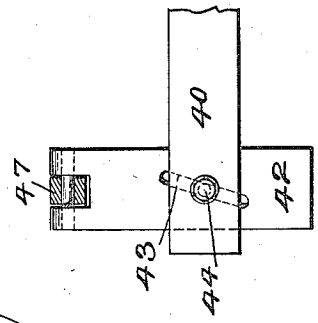
APPLICATION FILED MAY 2, 1913.

1,149,356.

Patented Aug. 10, 1915.

4 SHEETS—SHEET 1.

Fig. 2.



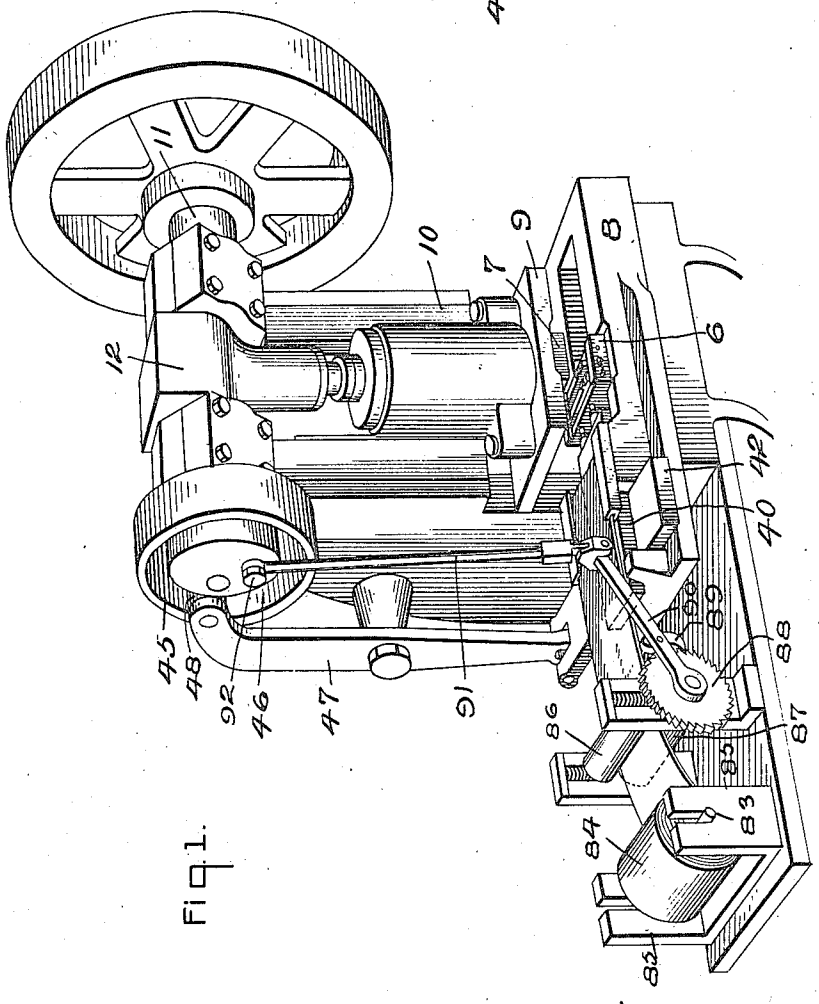


Fig. 1.

WITNESSES

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4 SHEETS—SHEET 2.

Fig. 5.

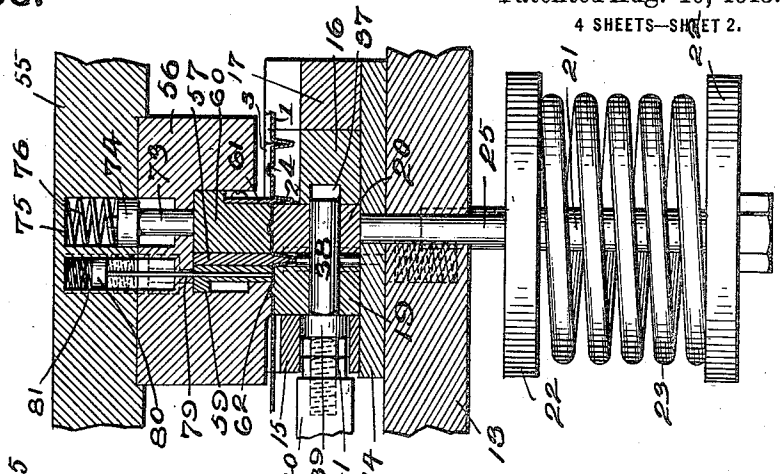


Fig. 4.

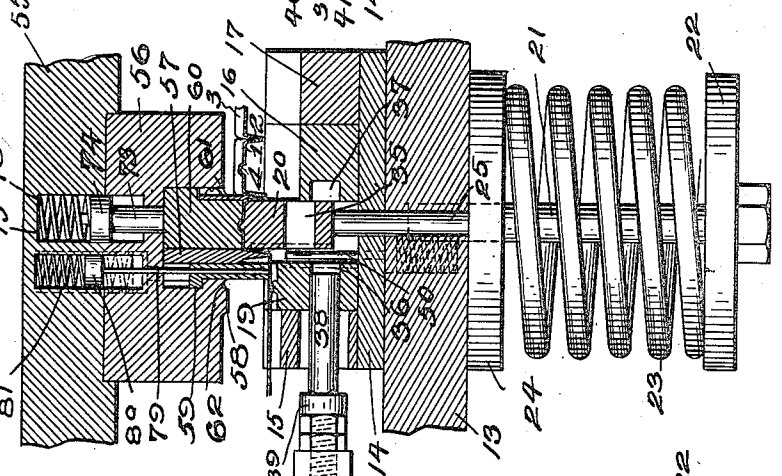
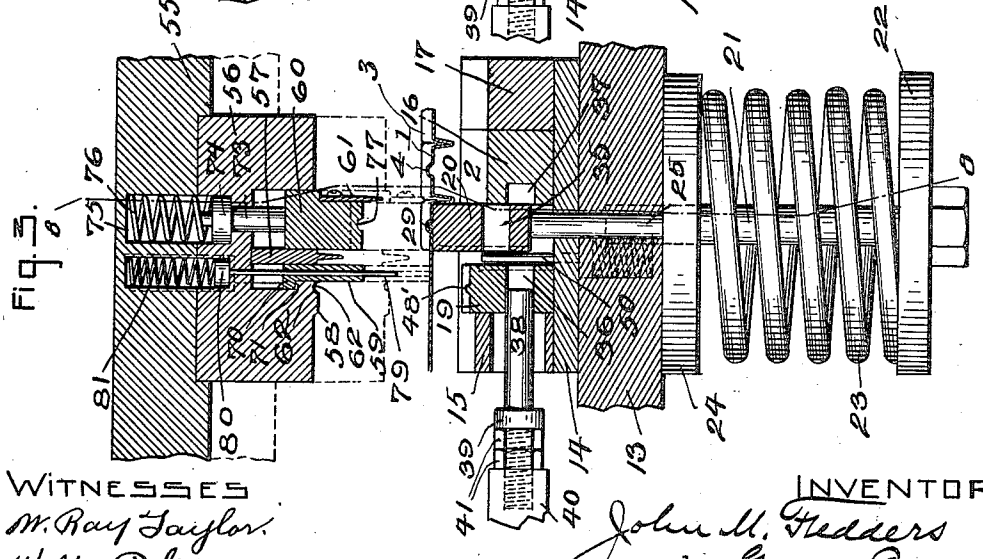


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 13.

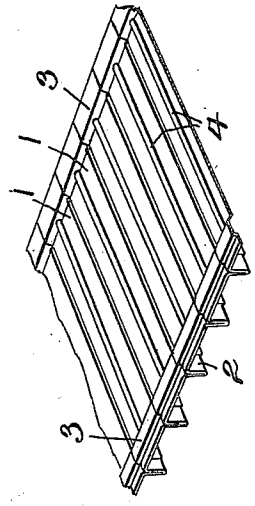


Fig. 11.

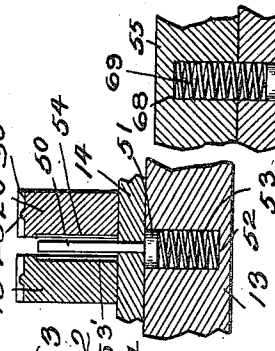


Fig. 12.

Fig. 14.

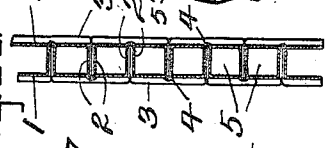


Fig. 7.

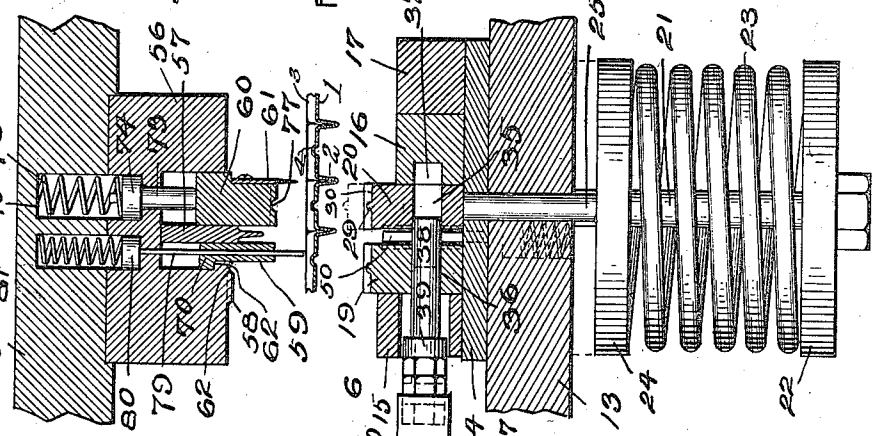
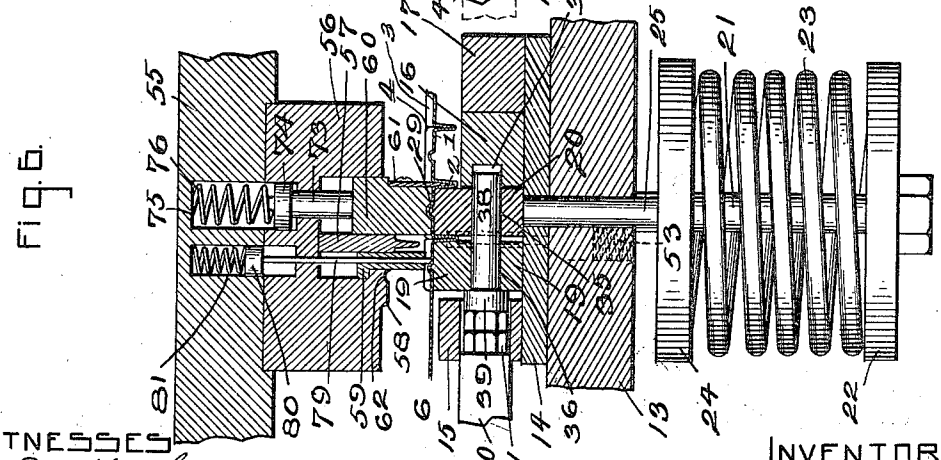


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 9.

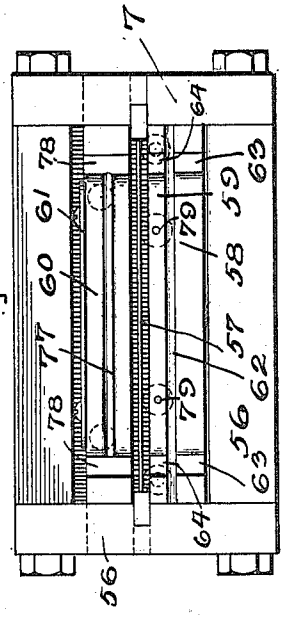


Fig. 10.

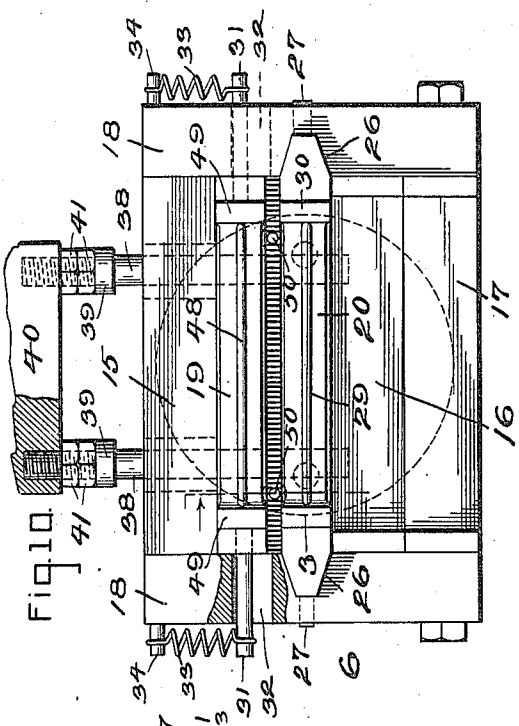
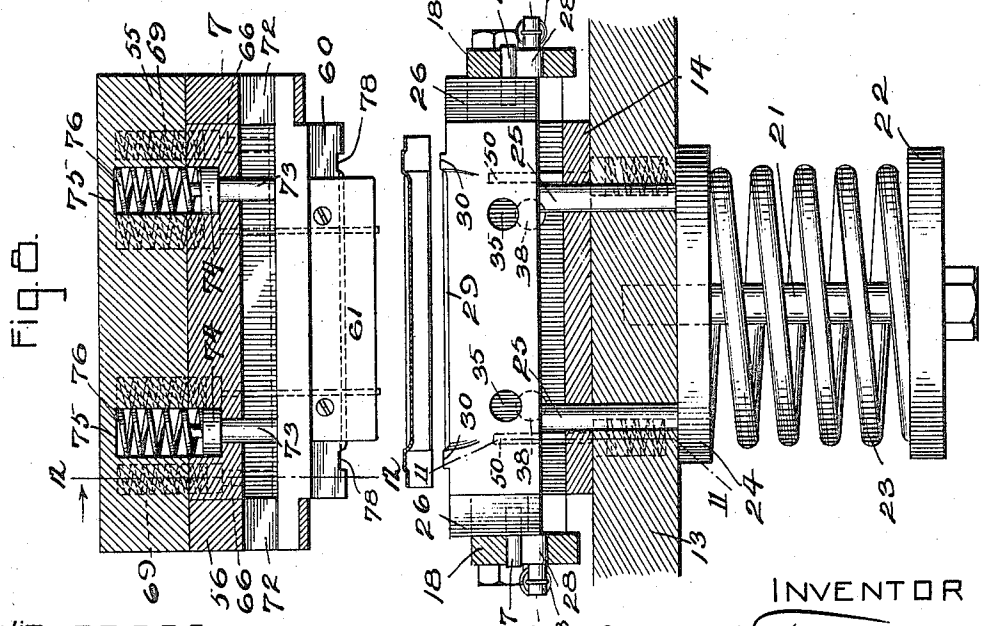


Fig. 8.



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UNITED STATES PATENT OFFICE.

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

METAL-BENDING MACHINE.

1,149,356. Specification of Letters Patent. Patented Aug. 10, 1915.

Application filed May 2, 1913. Serial No. 764,978.

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.

The object of this invention is to produce a simple, durable and reliable machine for bending sheet metal expeditiously and economically so as to form thereon a succession of laterally projecting plaits and also longitudinal offsets so that these strips may be used in the manufacture of water cooling radiators for automobiles.

In the accompanying drawings: Figure 1 is a perspective view of a metal bending machine embodying my improvements. Fig. 2 is a fragmentary horizontal section showing part of the mechanism for operating the locking device for one section of the die. Figs. 3, 4, 5, 6 and 7 are fragmentary vertical longitudinal sections of the die and punch of the bending machine showing the parts of these members in the different positions which they occupy during the operation of producing a radiator strip. Fig. 8 is a vertical transverse section taken in line 8—8, Fig. 3 and showing the radiator strip disengaged from the die and punch. Fig. 9 is a bottom plan view of the punch. Fig. 10 is a top plan view of the die. Figs. 11 and 12 are fragmentary vertical longitudinal sections taken in the correspondingly numbered lines in Fig. 8. Fig. 13 is a perspective view of a portion of the radiator strip which is produced by the metal bending machine of this invention. Fig. 14 is a vertical section showing the manner of assembling two of these radiator strips for producing a plurality of air tubes.

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

Although my improved metal bending machine may be utilized for producing strips of metal which have been bent into various forms the machine illustrated in the drawings is designed more particularly for producing a radiator strip of sheet metal which in its finished condition comprises a succession of transverse webs 1 which are arranged lengthwise side by side in a longitudinal row, a plurality of laterally projecting plaits 2 the walls of which are connected at their outer edges while their inner edges are connected respectively with the opposing transverse edges of two adjacent webs, outwardly projecting offsets or beads 3 arranged longitudinally at opposite lateral edges of the webs and in a direction lengthwise of the strip, and a plurality of outwardly projecting beads 4 each of which is arranged lengthwise on the central part of each web and forms a longitudinal groove or seat on the inner side of the respective web, as shown in Fig. 13. In the assembled condition of two strips of this character each plait of one strip is arranged between two plaits of the other strip and engages its free edge with the groove or seat on the web of the other strip between the two plaits thereof, thereby forming a row of air tubes 5 between the two strips, as shown in Fig. 14. The longitudinal beads on the outer sides of the strips engage with corresponding beads on the strips of adjacent rows of air tubes, thereby forming intervening channels or conduits between adjacent rows of air tubes as shown in Fig. 14 through which the water flows and is cooled by the air passing through the tubes. The grooves or seats 4 are not as deep as the beads 3, as shown in the drawings, so that they do not obstruct the water passage between the opposing strips of adjacent rows of air tubes.

The die or lower member of the bending machine taken as a whole is represented in the drawings by the numeral 6 and the punch or upper member thereof which is movable vertically toward and from the die is indicated as a whole by the numeral 7. The die is mounted on the stationary holder, support or table 8 forming a part of the main frame of the machine while the punch is mounted on a vertically movable head or holder 9 which is guided in any suitable manner on a standard 10 forming part of the main frame and projecting upwardly from the rear part of the table. Although the punch may be operated by any suitable means the same is represented in the drawings as being raised and lowered by means of a crank shaft 11 journaled horizontally and transversely in the upper part of the standard and having its crank connected by means of a pitman or connecting rod 12 with the punch holder as shown in Fig. 1.

The die in its general organization com-

prises a body having a horizontal main base 13, a horizontal sub-base 14 resting upon the main base, a front cross bar 15 mounted on the front part of the sub-base, a rear cross bar preferably constructed of two sections 16, 17 which are mounted transversely on the rear part of the sub-base, and two longitudinal side bars 18 connecting corresponding ends of the front and rear bars so as to produce, in effect, a body having a rectangular socket in its upper side. Within this socket of the body are arranged the main or working sections of the die which comprise a front die section 19 arranged immediately in rear of the front cross bar, and a rear die section or holding section 20 arranged in rear of the front die section and engaging its rear side with the front face of the front section 16 of the rear cross bar. The rear die section is capable only of vertical movement while the front die section is capable only of horizontal movement toward and from the rear die section for the purpose of decreasing and increasing the space between the opposing vertical faces of these die sections and operating upon the strip of metal in a manner which will presently appear.

Normally the rear die section is yieldingly held in its elevated position in which the upper side of the same is above the level of the front die section and the cross bars of the die body. The preferred means for holding the rear die section in this position as shown in the drawings comprise a supporting rod 21 secured with its upper end to the underside of the main base of the die body, a supporting disk 22 mounted on the lower end of this supporting rod, a lifting spring 23 engaging its lower end with the supporting disk, a lifting disk 24 engaging with the upper end of the lifting spring, and two lifting rods 25 guided vertically in ways formed in the main and sub-bases of the die body and engaging their lower ends with the upper side of the lifting disk while their upper ends engage with the underside of the rear die section. The upward movement of the rear die section under the action of the lifting spring 23 is limited by engagement of the lifting disk 24 with the underside of the main base. The rear die section is guided on the body of the die by constructing its opposite ends of tapering or V-shaped form, as shown at 26 in Fig. 10, and engaging the same with correspondingly shaped vertical grooves or ways in the adjacent parts of the inner sides of the longitudinal bars of the die body. The rear die section is further guided and also prevented from being lifted out of the die body by means of stop pins 27 projecting laterally from opposite ends thereof into vertical slots 28 formed in the adjacent portion of the body side bars, as shown in Fig. 8. On its upper side the rear die section is provided in the central part thereof with a transverse rib 29 and near opposite ends thereof with longitudinal ribs 30.

Normally the front die section is yieldingly held in its foremost position and against the front cross bar of the die body by means which preferably comprise two guide pins 31 projecting laterally from opposite ends of this die section through longitudinal slots 32 in the longitudinal bars of the die body and two springs 33 arranged on the outer sides of these longitudinal bars and each connected at one end with one of the guide pins 31 while its opposite end is connected with a supporting pin 34 on the adjacent part of the respective longitudinal bar, as shown in Fig. 10. Means are provided for holding the rear die section, when depressed, temporarily in this position and means are also provided for moving the front die section toward the rear die section while the latter is in its depressed position, said locking mechanism for the rear die section and the means for shifting the front die section rearwardly being preferably combined and constructed as follows:

35 represents two locking openings formed lengthwise in the rear die section and adapted when this section is in its lowered position to be arranged in line with corresponding locking openings 36, 37 formed respectively in the front die section and in the front section of the rear cross bar of the body.

38 represents two horizontally and longitudinally movable locking pins or rods which in their foremost position have their rear ends arranged within the guide openings of the front die section, as shown in Fig. 3, but which in their rearmost position enter the locking openings on the rear die section and the rear cross bar and hold the rear die section in its depressed position, as shown in Figs. 5 and 6. Adjacent to its front end each of the locking pins is provided with a rearwardly facing shoulder 39 which is adapted to engage with the front side of the front die section. In the foremost or retracted position of each locking pin its shoulder 39 is disengaged from the front side of the front die section, as represented in Figs. 3 and 4. After the locking pin during its rearward movement has passed through the respective locking opening of the rear die section and has entered the locking opening of the rear cross bar the shoulder 39 of the locking pin engages with the front side of the front die section, as shown in Fig. 5, so that during the last portion of the rearward movement of the locking pin its shoulder causes the front die section to be moved rearwardly toward the rear die section, as shown in Fig. 6.

The reciprocating movement of the two

locking pins for locking and unlocking the rear die section in its lowered position and also moving the front die section toward the rear die section and permitting the springs 33 to again move the front die section into its forward position may be effected by various instrumentalities but preferably by the means which are shown in the drawings and which are constructed as follows: 40 represents a longitudinally movable slide which is guided in horizontal ways on the front part of the main base of the die body and to the rear end of which the locking pins 38 are adjustably secured preferably by providing the front ends of the locking pins with screw threads which engage with correspondingly threaded openings in the rear end of the longitudinal slide and locking nuts 41 applied to the screw threaded portions of the locking pins and engaging the rear end of the longitudinal slide. 42 represents a horizontally and transversely movable slide guided in a way formed on the front part of the die base below the longitudinal slide 40 and provided with an oblique slot 43 forming a cam which receives a pin 44 depending from the front end of the longitudinal slide. 45 represents a rotatable cam mounted on the adjacent end of the crank shaft of the machine and provided on its outer side with a cam groove 46. 47 represents an upright rock lever pivoted on the standard of the machine and provided on its upper arm with a roller 48 which engages with the groove of the rotatable cam while its lower arm is operatively connected with the transversely movable slide 42, as shown in Fig. 1. During each operation of the machine the rotatable cam 47 moves the transversely movable slide forward and backward whereby the cam slot 43 causes the longitudinal slide to make a forward and backward stroke, the movements of these parts being so timed that they harmonize with the movements of other parts of the machine with which they cooperate. The upper side or face of the front die section is provided on its central part with a transverse rib 48′ and adjacent to its opposite ends with longitudinal ribs 49 which are in line with the longitudinal ribs of the rear die section.

Means are provided for ejecting or lifting the strip of sheet metal from the front and rear die sections after each stamping operation which means are preferably constructed as follows: 50 represents two vertical ejector pins arranged between the front and rear die sections and each guided with its lower part in a guideway formed in the adjacent parts of the sub-base and the main base of the die body, as shown in Fig. 11. Each of these ejector pins is yieldingly held in its elevated position in which its upper end is near the top of the die section by means of a head 51 arranged at the lower end of the ejector pin and guided in a pocket 52 formed in the main base of the body, and a spring 53 arranged in said pocket and bearing at its lower end against the bottom of this pocket and at its upper end against the underside of said head. The upward movement of each ejector pin is limited by engagement of its head with the underside of its sub-base, as indicated in Fig. 11. In order to permit the front die section to approach the rear die section without interfering with the ejector pins the opposing vertical faces of these die sections are provided with recesses 53′, 54 in line with each ejector pin which provide the necessary clearance adjacent to these pins and prevent the same from being pinched between the front and rear die sections as the front section moves toward the rear section.

In its general organization the punch comprises a body having a base 55 which is secured to the vertically movable punch holder, a punch block 56 secured to the underside of the punch base, a forming blade 57 fixedly mounted on the central part of the punch block so as to project downwardly from the underside thereof vertically in line with the space between the front and rear die sections, a front punch section 58 arranged on the underside of the punch block vertically in line with the front part of the face of the front die section, an intermediate punch section 59 capable of vertical motion relatively to the punch block and arranged between the front punch section and the forming blade and vertically in line with the rear part of the front die section, a rear punch section or holding section 60 movable vertically relatively to the forming blade and the punch body and arranged in rear of the forming blade and vertically in line with the rear die section, and a gage blade 61 mounted transversely on the rear side of the rear punch section vertically in line with the rear side of the rear die section.

The underside or face of the front punch section is provided at its rear corner with a transverse groove 62 for coöperation with the transverse rib of the front die section and adjacent to its opposite ends the front punch section is provided with longitudinal grooves 63 which coöperate with the front parts of the longitudinal ribs of the front die section. The main part of the face of the intermediate punch section is flat and adapted to coöperate with the flat rear part of the face of the front die section and near its opposite ends the same is provided with longitudinal grooves 64 which are adapted to coöperate with the rear parts of the longitudinal ribs of the front die section. The intermediate punch section is guided in a

way 65 on the punch block and is yieldingly held in its depressed position relatively to the front punch section so as to project below the latter by means which preferably comprise two shifting rods 66 guided in vertical ways formed in the upper part of the punch block and engaging their lower ends with the upper edge of the intermediate punch section, a bearing head 67 arranged at the upper end of each shifting rod 66 and guided in a pocket 68 formed partly in the adjacent part of the punch block and in the punch base and a spring 69 arranged in the pocket 68 and bearing at its upper end against the bottom of this pocket and at its other end against the head of this shifting pin, as shown in Fig. 12. The downward movement of the intermediate punch section relatively to the front punch section is limited by means of a downwardly facing shoulder 70 formed on the intermediate punch section and engaging with an upwardly facing shoulder 71 on the punch block, as shown in Figs. 3 and 12.

The rear punch section or holding section is guided in a suitable way 72 on the underside of the punch block and is yieldingly held in a depressed position relatively thereto so that the face thereof is below the face of the front punch section and also below the forming blade, this being preferably effected by means of two shifting pins 73 guided in suitable openings in the upper part of the punch block and each connected at its lower end with the rear punch section, a head 74 secured to the upper end of each of these shifting rods and movable vertically in a pocket 75 formed in the adjacent upper part of the punch block and the punch base and a spring 76 arranged in this pocket, and bearing at its lower end against the head 74 and at its upper end against said pocket. The downward movement of the rear punch section relatively to the punch block is limited by the heads the shifting pins 73 engaging with the lower ends of the pockets 75, as shown in Fig. 3. The underside or face of the rear punch section is provided on its central part with a transverse groove 77 which is adapted to coöperate with the transverse rib of the rear die section and adjacent to its opposite ends the same is provided with longitudinal grooves 78 which are adapted to coöperate with the longitudinal ribs of the rear die section.

Retaining means are provided for holding the sheet metal strip in place on the rear die section preparatory to engaging the strip by the parts of the die and punch which change the shape of the same. These retaining means preferably comprise two vertical retaining rods 79 each of which is arranged in corresponding vertical openings formed in the intermediate punch section and the upper part of the punch block, a bearing head 80 arranged at the upper end of each retaining rod and movable vertically in a pocket 81 formed in the adjacent part of the punch block and base, and a spring 82 arranged in this pocket and bearing at its lower end against the bearing head 80 while its upper end engages with the upper end of said pocket. In the normal position of each retaining pin the same is moved downwardly relatively to the intermediate punch section so that its lower end projects below the lower edge or face of this punch section, the downward movement of this pin in this direction being limited by the bearing head 80 at its upper end engaging with the lower end of its companion pocket 81, as shown in Fig. 3.

Various means may be provided for supplying the strip of sheet metal from which the radiator section is made those shown in the drawings for this purpose being suitable and constructed as follows: 83 represents an arbor or spindle upon which a roll 84 of the sheet metal strip is mounted and which is journaled at its opposite ends in bearings 85 mounted on the main frame of the machine. From the roll 84 the strip of metal passes forwardly between two feed rollers 86, 87, mounted in suitable bearings on the frame. One of these feed rollers, preferably the lower one is provided with a ratchet wheel 88 which is engaged by a feed pawl 89 mounted on a rocking feed lever 90 which is pivoted concentrically with the ratchet wheel. A rocking motion is imparted to the ratchet lever by means of a connecting rod 91 connected at its lower end with the free end of the rock lever while its upper end is pivoted by means of a crank pin 92 to the outer side of the rotatable cam on one side of the center of the crank shaft. This strip feed mechanism is so timed that when the punch is elevated so as to provide a clear space between the same and the die the strip of sheet metal is advanced one step after which the strip of metal is permitted to remain at rest until the same is operated upon by the punch and die.

After each operation of the machine and while the punch is raised the strip of metal is advanced one step and placed with the last formed plait against the rear side of the rear die section, the last formed transverse bead in engagement with the rib of the rear die section, and the last formed longitudinal bead over the longitudinal ribs of the rear die section, as shown by full lines in Fig. 3. At this time the locking pins are in their foremost position, the front die section is in its forward position, the rear die section is elevated, the intermediate punch section is projected below the front punch section, the retaining pins project below the intermediate punch section, and the

rear punch section projects below the forming blade. The punch now descends and during the first part of this movement the plungers 79 engage first with the sheet and then the gage blade engages with the previously formed plait, the rear punch section engages with the top of the sheet metal blank so that the same is gripped between this punch section and the rear die section and the retaining rods 79 engage with the strip in front of the rear die section and are caused to retract upwardly into the punch, as shown by dotted lines in Fig. 3, thereby obtaining a firm grip upon the strip of metal for reliably holding the same in place preparatory to performing the next stamping and bending operation on the same. During the next portion or step of the downward movement of the punch, the forming blade and the intermediate and front punch sections move downwardly while the rear punch section and gage blade remain at rest, this being due to the greater strength of the main lifting spring 23 which holds the rear die section in its elevated position as compared with the spring 76 which tends to depress the rear punch section. During this second downward step of the punch the forming blade bends the sheet metal strip downwardly along the front vertical side of the rear die section, thereby forming the rear wall of one of the plaits, as shown in Fig. 4. During the next portion or third step of the downward movement of the punch the rear punch section moves downwardly in unison with the punch block and forming blade by reason of the upper end of the rear punch section being engaged by the upper end of its guideway, thereby causing the rear die section to be depressed and the strip of sheet metal to be bent downwardly along the rear side of the front die section for forming the front wall of the plait, as shown in Fig. 5. The stock for thus forming the front wall of the plait is supplied by the strip of metal moving forward at this time without restraint between the front die section and the front and intermediate punch sections so that no stretchiing of the metal occurs while forming a plait in the same. Immediately after the forming blades completes the plait the punch effects the final step of its downward stroke whereby the intermediate punch section recedes into the punch body but is pressed with its face against the rear part of the front die section by engagement of the upper end of this die section with the upper end of its guideway in the punch block, thereby forming the rear parts of the longitudinal beads and the front punch section engages with the front part of the front die section and forms the transverse bead on the strip and also the front portions of the longitudinal beads, as shown in Fig. 5. As the rear die section begins its downward movement the locking pins also begin their rearward movement and after the rear die section completes its downward movement the locking pins enter the locking openings of the rear die section and the locking openings of the rear cross bar, as shown in Fig. 5, thereby locking the rear die section in its depressed position. During the first part of the subsequent rising movement of the punch the forming blade is withdrawn from between the front and rear die sections, the rear punch section and gage blade remain in engagement with the strip of metal and the locking pins complete their rearward stroke so that their shoulders engage with the front side of the front die section and push the same rearwardly toward the rear die section, whereby the partly formed plait is now completed by pressing the two walls of the same together, as shown in Fig. 6. The punch is now raised to its highest position and its parts assume their normal position to permit the sheet of metal to be fed forward another step either by hand or mechanical means as indicated in Fig. 7 and then the locking pins are moved forwardly so as to first permit the front die section to recede from the rear die section and release its grip upon the plait which has just been formed.

During the operation of forming the plait in the sheet of metal by bending the latter downwardly between the front and rear die sections the upper ends of the ejector pins are engaged and these pins are depressed in opposite directions to the resilience of their springs but the instant the front die section recedes from the rear die section the ejector pins are quickly raised by their springs and engage the lower edge of the plait which has been formed and lift the strip above the die sections so that the strip is free to be fed forwardly another step by the strip feed mechanism. The plaited part of the strip is raised by its resilience above the die section of the press so as to be free to pass forward between the die and punch sections when the latter are separate but if desired this may be aided by hand or mechanical means. During the last part of the forward movement of the locking pins the same are withdrawn from the rear die section and the latter is raised into engagement with the underside of the strip by the spring 23. The machine now begins another series of operations for producing the next following plaits and transverse and longitudinal beads in the strip of metal, the several steps above described being repeated for each cycle of operations of the machine.

In the operation of this machine the strip of sheet metal is always under perfect control, and the same is at no time free to be-

come displaced, thereby insuring absolute uniformity in bending and plaiting the same, whereby when two finished strips of this character are assembled they will fit each other accurately and permit of producing rows or tiers of radiator tubes which are of uniform construction and permit of producing a radiator which is regular and neat in appearance.

I claim as my invention:

1. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, and means for locking said rear die section temporarily in its depressed position comprising a horizontally movable locking pin movable in corresponding openings in said die sections.

2. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, and means for locking said rear die section temporarily in its depressed position comprising a horizontally movable locking pin movable in corresponding openings in said die sections, a longitudinally movable slide carrying said locking pin and provided with a shifting pin, a transversely movable slide having a cam slot which receives the shifting pin, a rotatable cam, and a rock lever having one arm connected with said transversely movable slide while its other arm is operated on by said cam.

3. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, means for locking said rear die section temporarily in its depressed position and reciprocating said front die section comprising a horizontally reciprocating locking pin engaging with openings in said front and rear die sections and provided with a shoulder for engaging said front die section and moving the same toward the rear die section.

4. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, means for locking said rear die section temporarily in its depressed position and reciprocating said front die section comprising a horizontally reciprocating locking pin engaging with openings in said front and rear die sections and provided with a shoulder for engaging said front die section and moving the same toward the rear die section, and a spring device for moving the front die section away from the rear die section.

5. A sheet metal bending machine comprising a die having a fixed body section provided with a locking opening, a rear vertically movable die section having a locking opening, a front die section movable horizontally toward and from the rear die section and having a locking opening, a horizontally movable locking pin guided in the opening of said front die section and adapted to engage with the openings of said body section and rear die section in the depressed position of the latter, and a punch movable toward and from said die and having a plaiting blade adapted to move into and out of the space between the front and rear die sections.

6. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, means for locking said rear die section temporarily in its depressed position and a spring device for holding said rear die section yieldingly in an elevated position when released.

7. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, means for locking said rear die section temporarily in its depressed position, and a vertically movable ejector pin arranged between said die sections.

8. A sheet metal bending machine comprising a die having a rear die section which is movable vertically, a front die section which is movable horizontally toward and from the rear section, a punch having a blade adapted to bend a part of the sheet metal between said front and rear die sections, means for locking said rear die section temporarily in its depressed position, the opposing sides of said die sections being provided with recesses, and a vertically movable ejector pin adapted to engage with said recesses of said die sections and to move the sheet metal blank upwardly out of the space between said die sections.

9. A sheet metal bending machine comprising a die having a vertically movable rear

die section, and a horizontally movable front section, and a vertically movable punch having a body section adapted to coöperate with the horizontally movable die section, a blade fixed on the body of the punch and adapted to pass between the front and rear die sections, and a holding section mounted yieldingly on the body of the punch and adapted to coöperate with the rear die section.

10. A sheet metal bending machine comprising a die having a vertically movable rear die section, and a horizontally movable front section, and a vertically movable punch having a body section adapted to cooperate with the horizontally movable die section, a blade fixed on the body of the punch and adapted to pass between the front and rear die sections, a holding section mounted yieldingly on the body of the punch and adapted to coöperate with the rear die section and a holding section yieldingly mounted on the punch body and adapted to engage with the front die section.

11. A sheet metal bending machine comprising a die having a vertically movable rear die section, and a horizontally movable front section, and a vertically movable punch having a body section adapted to cooperate with the horizontally movable die section, a blade fixed on the body of the punch and adapted to pass between the front and rear die sections, a holding section mounted yieldingly on the body of the punch and adapted to coöperate with the rear die section, and a gage blade mounted on said holding section and adapted to engage with a plait in the sheet metal blank in rear of the rear die section.

12. A sheet metal bending machine comprising a die having a vertically movable rear die section, and a horizontally movable front section, and a vertically movable punch having a body section adapted to coöperate with the horizontally movable die section, a blade fixed on the body of the punch and adapted to pass between the front and rear die sections, a holding section mounted yieldingly on the body of the punch and adapted to coöperate with the rear die section, a holding section yieldingly mounted on the punch body and adapted to engage with the front die section, and a gage blade mounted on said holding section and adapted to engage with a plait in the sheet metal blank in rear of the rear die section.

13. A sheet metal bending machine comprising a die having a vertically movable rear die section, and a horizontally movable front section, and a vertically movable punch having a body section adapted to cooperate with the horizontally movable die section, a blade fixed on the body of the punch and adapted to pass between the front and rear die sections, a holding section mounted yieldingly on the body of the punch and adapted to coöperate with the rear die section, a holding section yieldingly mounted on the punch body and adapted to engage with the front die section, a gage blade mounted on said holding section and adapted to engage with a plait in the sheet metal blank in rear of the rear die section, and a locking device for temporarily holding the rear die section in its depressed position.

14. A sheet metal bending machine comprising a vertically movable rear die section, a horizontally movable front die section, means for temporarily locking the rear die section in its depressed position and moving the front die section toward the rear die section, a rear punch section movable toward and from the rear die section, a gage blade movable with the rear punch section and past the rear side of the rear die section, a forming blade movable independently of said rear punch section and between said front and rear die section, an intermediate punch section movable independently of said forming blade and rear punch section and adapted to coöperate with the rear part of the front die section, and a front punch section movable with said forming blade and adapted to coöperate with the front part of said front die section.

Witness my hand this 30th day of April 1913.

JOHN M. FEDDERS.

Witnesses:
THEO. L. POPP,
ANNA HEIGIS.