J. M. FEDDERS.

METAL BENDING MACHINE.

APPLICATION FILED MAR. 12, 1914.

1,148,670.

Patented Aug. 3, 1915.

5 SHEETS—SHEET 1.

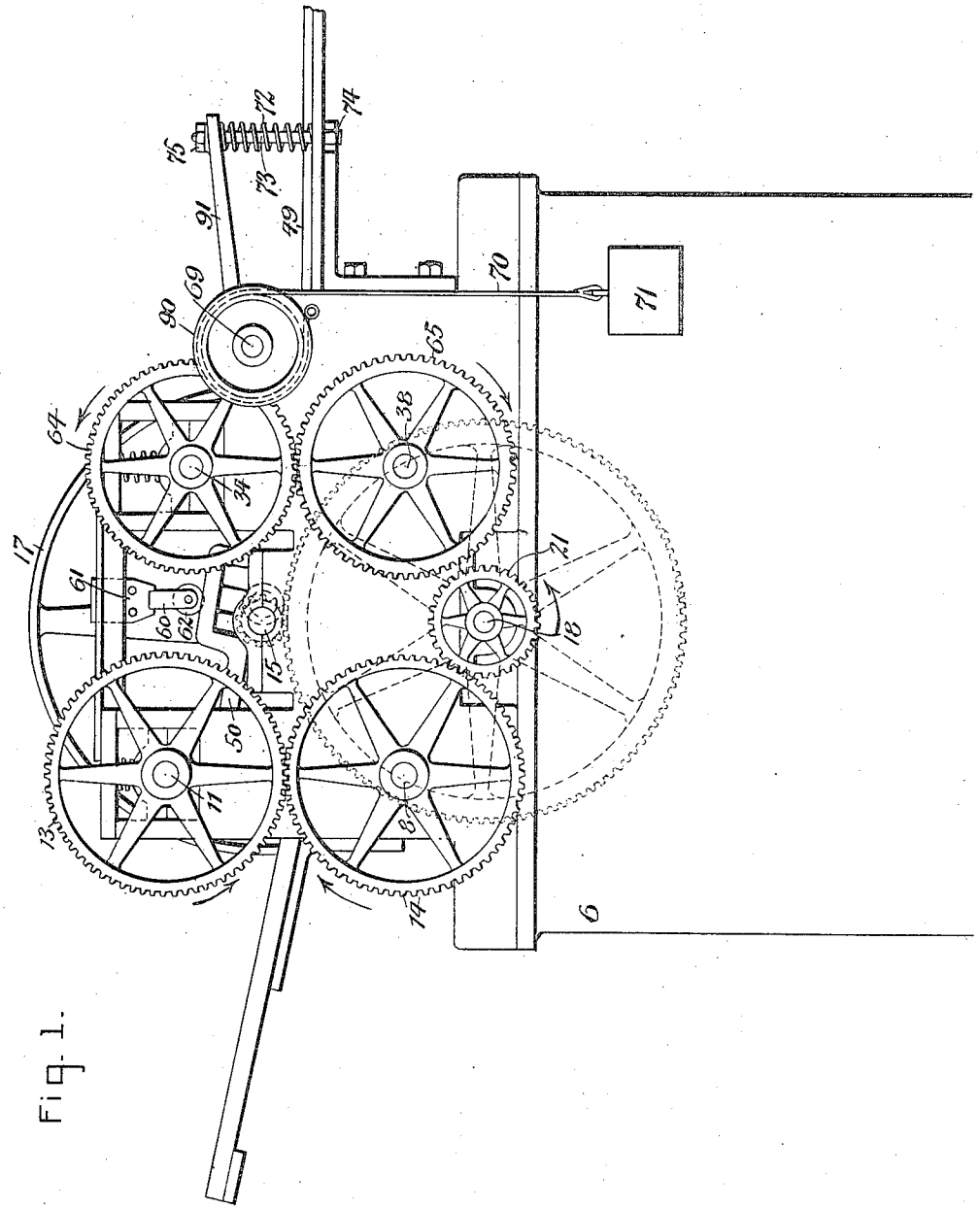


Fig. 1.

WITNESSES

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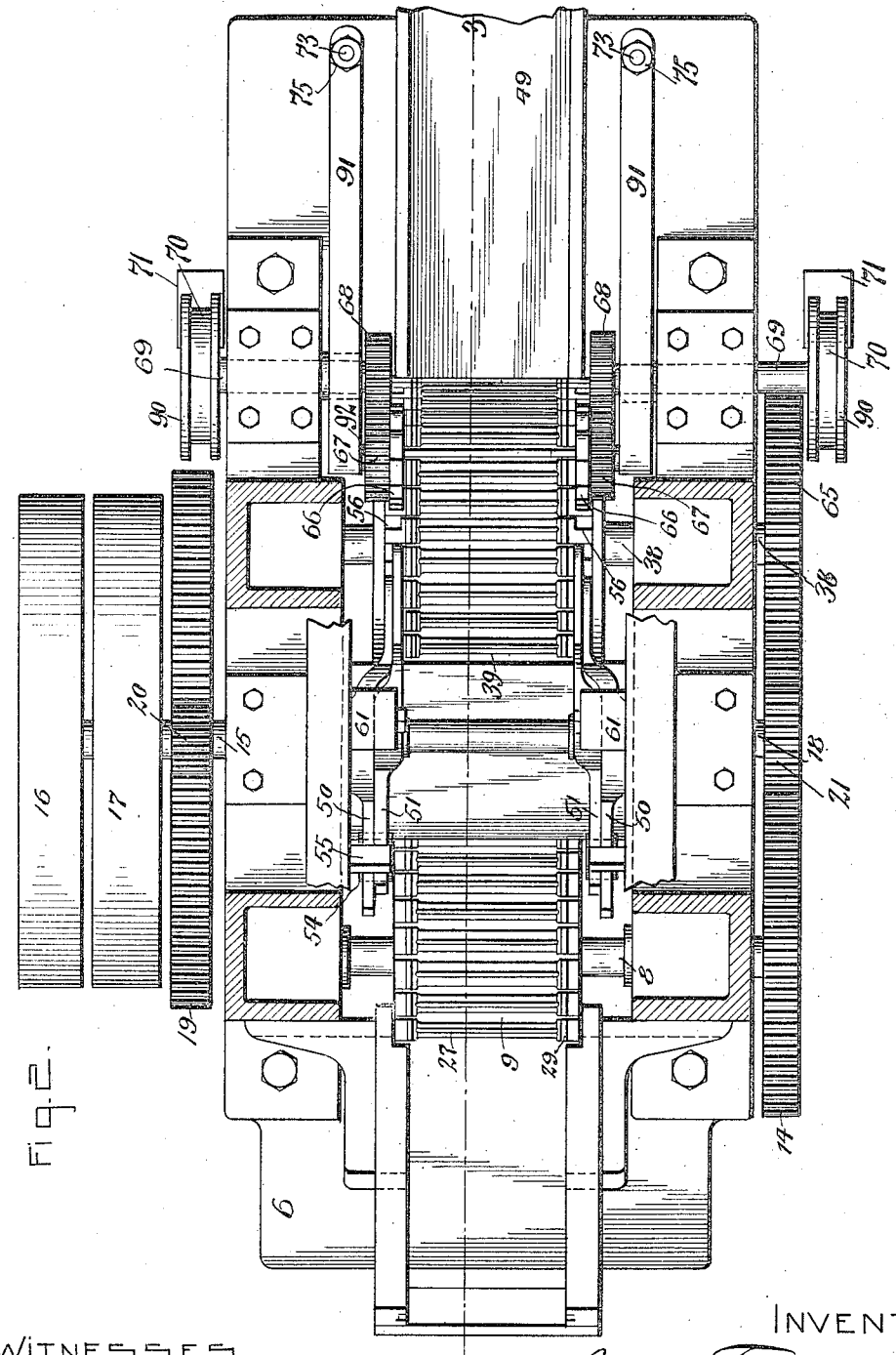


Fig. 2.

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5 SHEETS—SHEET 3.

Fig. 3.

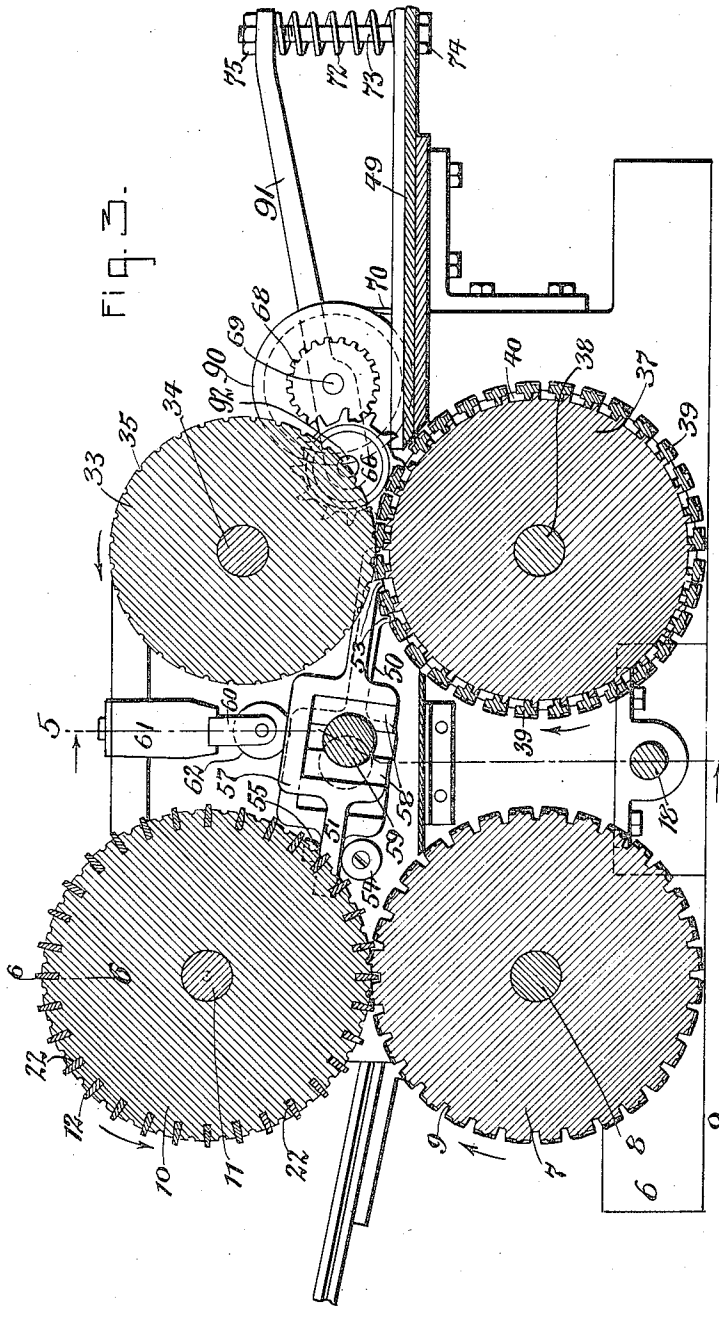
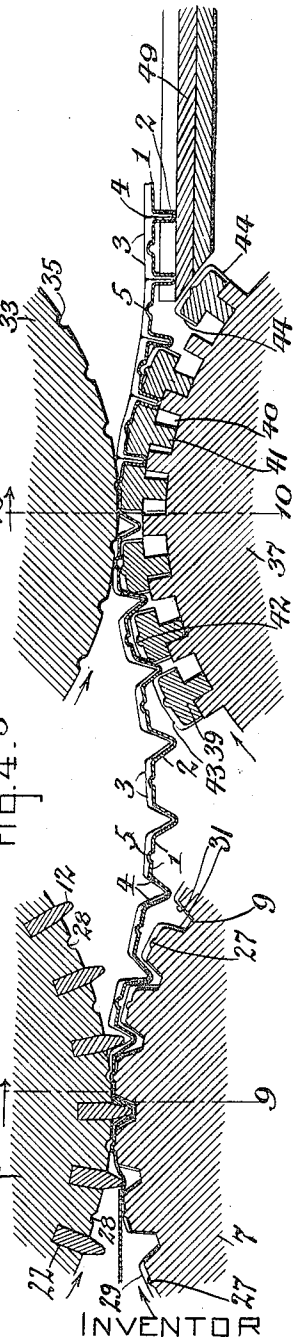


Fig. 4.



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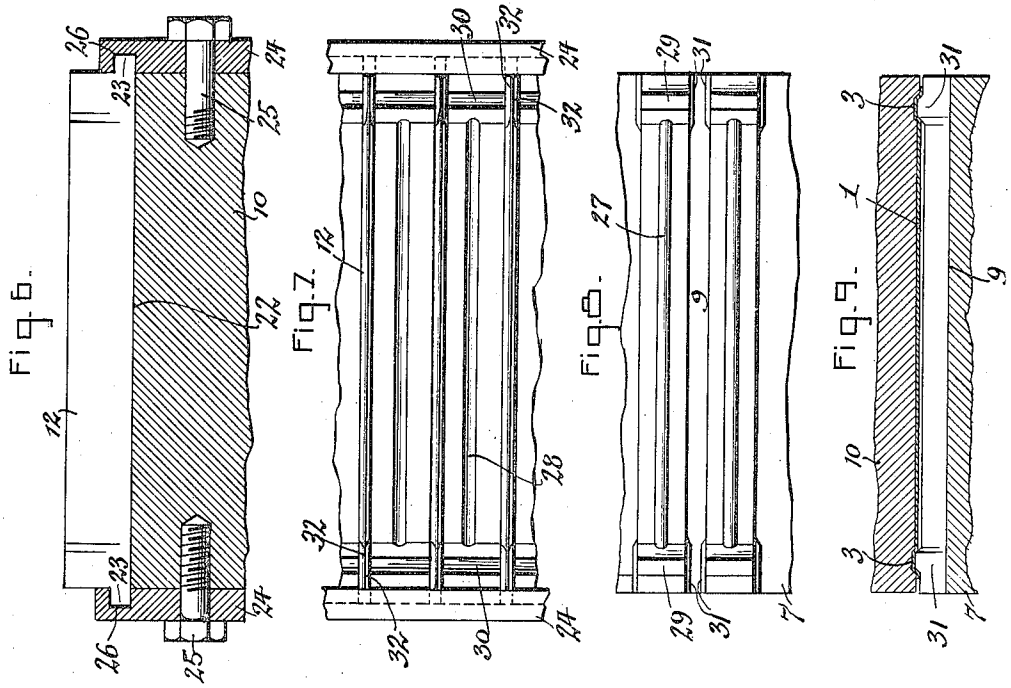
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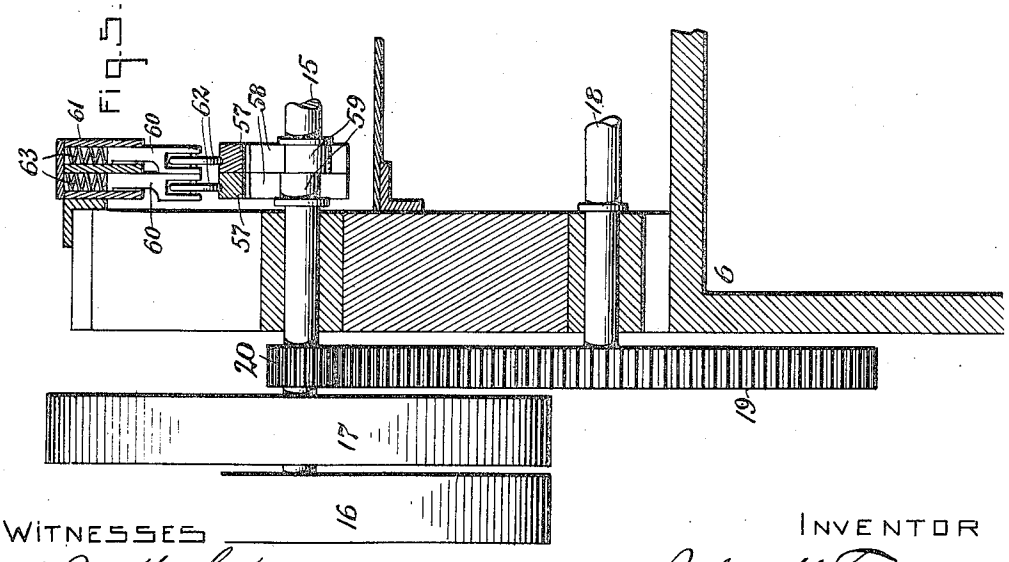
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5 SHEETS—SHEET 4.





WITNESSES

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5 SHEETS—SHEET 5.

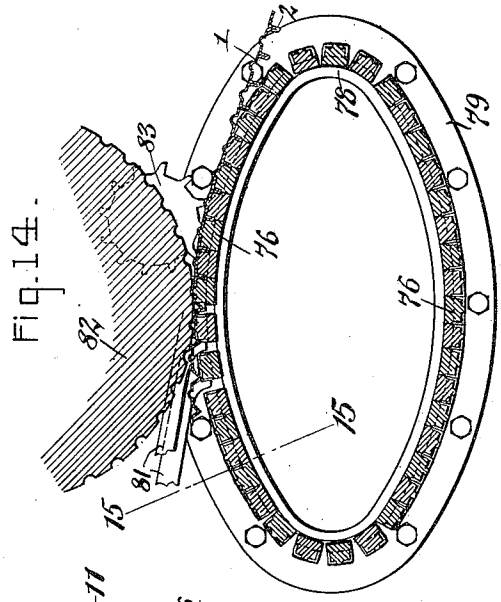


Fig. 14.

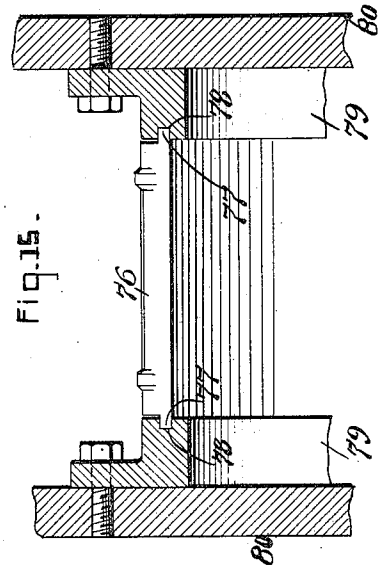


Fig. 15.

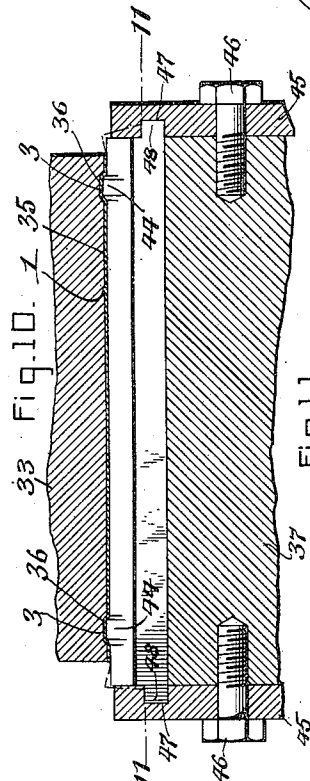


Fig. 10.

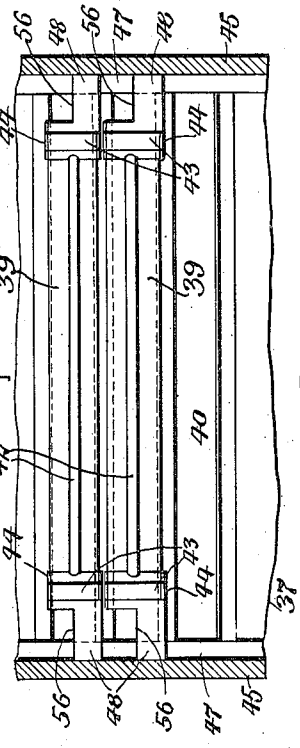


Fig. 11.

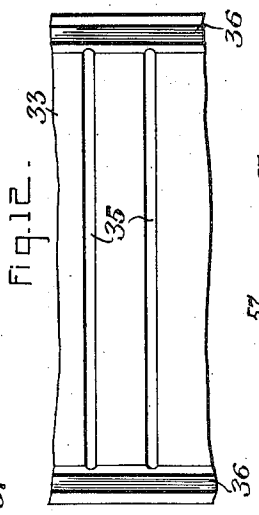


Fig. 12.

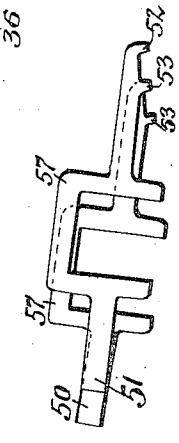


Fig. 13.

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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.

1,148,670. Specification of Letters Patent. Patented Aug. 3, 1915.

Application filed March 12, 1914. Serial No. 824,114.

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 producing plaits, folds or corrugations at intervals on a strip of metal which is to be used for forming the water and air tubes of an automobile radiator, although the machine may also be used for plaiting strips of this character for other purposes.

It is the object of this invention to provide a machine whereby plaited strips of sheet metal may be produced expeditiously, reliably and economically.

In the accompanying drawings: Figure 1 is a side elevation of a sheet metal plaiting or corrugating machine embodying my invention. Fig. 2 is a sectional top plan view of the same with the upper rollers of the preliminary and final plaiting devices omitted. Fig. 3 is a fragmentary vertical longitudinal section, on an enlarged scale, taken in line 3—3, Fig. 2, and showing the preliminary and the final plait forming devices. Fig. 4 is a similar view, on a still larger scale, showing only the operative portions of the preliminary and final plait forming devices. Fig. 5 is a fragmentary vertical transverse section, on a reduced scale, taken in line 5—5, Fig. 3. Fig. 6 is a fragmentary section, on an enlarged scale, of the upper preliminary plaiting roll, taken in line 6—6, Fig. 3. Fig. 7 is a fragmentary face view of this last mentioned roll. Fig. 8 is a fragmentary face view of the lower preliminary plaiting roll. Fig. 9 is a fragmentary section, taken in line 9—9 Fig. 4, showing the coöperating parts of the preliminary plaiting rolls. Fig. 10 is a fragmentary section taken in line 10—10, Fig. 4 showing the coöperating parts of the final plaiting rolls. Fig. 11 is a fragmentary sectional face view of the lower plaiting roll, the section being taken in line 11—11, Fig. 10. Fig. 12 is a fragmentary face view of the upper final plaiting roll. Fig. 13 is a detached side elevation of two adjacent shifting bars which form part of the mechanism whereby the final plaiting rolls and the parts associated therewith are operated. Fig. 14 is a fragmentary vertical longitudinal section showing a modified construction of the means whereby the completion of the plaits in the strip of metal is effected. Fig. 15 is a fragmentary cross section, on an enlarged scale, taken in line 15—15, Fig. 14.

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

Although this machine may be organized for plaiting or corrugating strips of sheet metal for producing various articles, that shown in the drawings is designed more particularly for producing plaited radiator strips which comprise a plurality of longitudinal webs 1, a plurality of transverse plaits 2 each of which has the outer edges of its walls united while the inner edges of these walls are connected respectively with the opposing ends of two adjacent webs, longitudinal offsets 3 formed at the opposite ends of the webs, longitudinal offsets 4 formed on opposite ends of the opposing sides of the walls of the plaits, and transverse beads 5 formed on each web parallel with the plaits and extending from one offset to the other of the respective web, as shown in Figs. 4, 9 and 10.

In its general organization this machine comprises a pair of coöperating preliminary plaiting rolls to which the blank or unplaited sheet or strip of metal is supplied by any suitable means and which operates to produce a succession of partly formed plaits at intervals on the strip, and a pair of final plaiting rolls which receive the strip from the preliminary plaiting rolls and operate upon the same to complete the formation of the plaits so that the strip is ready to be assembled with other parts for producing an automobile radiator. The working parts of the machine are mounted in a main frame 6 which may be of any suitable construction to serve this purpose. The preliminary plaiting rolls preferably comprise a lower roll or roller 7 mounted on a horizontal shaft 8 which is journaled in suitable transverse bearings on the frame and provided on its periphery with an annular row of die grooves 9 which are arranged parallel with the axis of this roll, and above this lower roll is arranged an upper preliminary plaiting roll or roller 10 which is mounted on a horizontal shaft 11 journaled transversely in suitable bearings on the main frame and provided on its periphery with an annular

row of longitudinal die blades 12 which are arranged parallel with the axis of this last mentioned roller and are adapted to engage with the die grooves 9 of the lower roller 7. These two rolls are caused to turn in unison so that their opposing coöperating parts move forwardly by means of two intermeshing gear wheels 13, 14 secured to the corresponding ends of the shaft of these rolls. The preliminary rolls may be driven in any suitable manner, the means for this purpose shown in Figs. 1, 2 and 5, consisting of a horizontal driving shaft 15 journaled transversely in suitable bearings on the main frame in front of the preliminary plaiting rolls and provided at one end with tight and loose pulleys 16, 17 adapted to receive a driving belt, and a horizontal counter shaft 18 journaled transversely in the lower part of the main frame and provided at one end with a gear wheel 19 which meshes with a gear pinion 20 on the driving shaft and provided at its other end with a gear pinion 21 which meshes with the gear wheel 14 of the shaft of the lower preliminary plaiting roll.

The die blades of the upper plaiting roll are preferably made separate from the body of this roller and seated at their inner edges in longitudinal channels 22 formed in the periphery of this roll so as to permit of renewing these blades from time to time as they become worn out. In order to confine these die blades in the channels of the body of the roll 10 each of the die blades is provided at its opposite ends adjacent to its inner edge with a pair of laterally projecting locking lugs 23 which are engaged by locking disks or plates 24 detachably secured to opposite ends of the upper preliminary roll body by means of screws 25, as shown in Fig. 6 or otherwise, and provided on the inner sides of their peripheral portions with annular grooves 26 which receive the locking lugs 23. By this means the preliminary plaiting blades can be readily removed when worn and interchanged for new ones without dismantling any considerable portion of the machine. As the strip of metal is fed forwardly between this pair of preliminary plaiting rollers a plurality of longitudinal webs and plaits are formed in alternation thereon. At the same time that the plaits are formed on the strip the beads on the webs are also formed by longitudinal ribs 27 arranged on the periphery of the lower preliminary plaiting roller between the die grooves 9 thereof and engaging with longitudinal die grooves 28 formed on the upper plaiting roller between the blades thereof, and while passing between this pair of plaiting rollers the longitudinal offsets 3 are produced at opposite ends of the webs by circumferential ribs 29 arranged at opposite ends of the lower preliminary plaiting roller and engaging with corresponding grooves 30 in the upper preliminary plaiting roller, and the offsets 4 at corresponding ends of the walls of the plaits are formed on the same side of the strip as the longitudinal offsets of the webs, by providing the opposite ends of each die groove 9 in the lower plaiting roller with offsets 31 which are adapted to coöperate with corresponding depressions 32 on the sides of the die blades 12 at opposite ends thereof. After the preliminary plaiting of the strip has been thus effected the same passes forwardly between the members of the secondary or final plaiting device which completes the formation of the plaits. This final plaiting device comprises an upper die or plaiting roll or roller 33 which is mounted on a horizontal shaft 34 journaled transversely in suitable bearings on the main frame and provided in its periphery with longitudinal grooves 35 adapted to receive the beads of the webs and also provided adjacent to its opposite ends with circumferential grooves or recesses 36 which are adapted to receive the longitudinal offsets of the webs, as shown in Fig. 10. Below the upper final plaiting roll is arranged a final plaiting roll or supporting roller 37 which is mounted on a horizontal shaft 38 journaled transversely in suitable bearings on the main frame and provided on its periphery with a plurality of die sections 39 which are movable circumferentially relative to the body of the lower final plaiting roll and adapted to coöperate with the upper final plaiting roll. Each of these die sections is constructed in the form of a transverse bar which is capable of moving circumferentially to a limited extent on the periphery of the lower final plaiting roll by providing the periphery of the latter with a series of transverse grooves 40 each of which receives the narrow inner portion 41 of one of the die sections, each of said inner portions being of greater width than the width of the reduced inner portion of the companion die section. The outer peripheral side or face of each die section is provided with a transverse die rib 42 which is adapted to engage with the concave side of the bead on a web of the plaited strip of metal, two circumferential ribs 43 arranged at opposite ends of the peripheral face of the die section and adapted to engage with the longitudinal offsets of the webs, and the radial sides of each die section are provided at their opposite ends with laterally offset portions 44 which are adapted to engage with the outer sides of the offset portions of the plait walls at opposite ends thereof. The several die sections of the lower final plaiting roll are permitted to move circumferentially thereon but are held against radial movement thereon by a retaining and guiding device which preferably comprises

two plates or disks 45 secured to opposite ends of the lower final plaiting roll by means of screws 46, as shown in Fig. 10, or otherwise, and provided on the inner opposing sides of their marginal portions with circumferential locking grooves 47 which receive locking lugs 48 formed at opposite ends of the die sections adjacent to the inner edges thereof.

The strip with the partially formed plaits thereon is fed between the opposing faces of the upper final plaiting roller and the die sections of the lower final plaiting roller and as this strip passes between these parts the walls of each plait are pressed toward each other so that the opposite ends of the walls of each plait engage with each other while the intermediate parts of the same are slightly separated, thereby putting the strip in readiness for assembling with other parts of the radiator. As the strip having the partially formed plaits approaches the incoming side of the upper and lower final plaiting rollers each of the partially formed plaits passes between the opposing radial sides of two adjacent die sections which latter are at this time separated to permit of the entrance of the respective plait between the same and the adjacent webs are arranged upon the circumferential face of the two die sections. After each plait has been thus deposited between two die sections that die section in rear of the plait is pushed circumferentially forward toward the die section in front of the plait whereby the plait is pinched between the die sections and closed and its formation is completed. Upon thus pushing each die section forwardly its longitudinal die rib 42 is brought in line with a longitudinal groove 35 of the upper plaiting final roller so that the companion transverse bead of the adjacent web is gripped between the same, thereby interlocking the respective die section and the upper final plaiting roll and causing the respective die section to operate as an abutment against which the next following die section is pushed for completing the formation of the next following plait in the strip. As the die sections move out of interlocking engagement with the upper final plaiting roll on the front or outlet side of the same these die sections again separate circumferentially from each other in succession and permit the completely formed or folded plaits to withdraw therefrom and enable the strip to slide tangentially relatively thereto over a delivery table 49 arranged tangentially adjacent to the outlet side of the lower final plaiting roller.

The forward movement of the final plaiting rollers is effected solely by the pushing operation which is exerted against the die sections in the act of completing the formation of the plaits, whereby proper engagement of the surfaces of the final plaiting roller and associated parts with the previously formed surfaces of the strip is insured without necessitating any accurate relative adjustment of these parts to secure harmony of action. The preferred means for effecting this forward movement of the die sections and the parts associated therewith is constructed as follows:—50, 51 represent two pairs of longitudinally movable shifting bars the members of each pair being arranged adjacent to opposite ends of the final plaiting rollers and each of these bars being provided at its front end with two teeth 52, 53 which are arranged one behind the other while the rear end of each of these bars is guided on the adjacent part of the main frame preferably by means of a roller 54 mounted on the frame and engaging with the underside of the shifting bar and a guide lug 55 projecting inwardly from the main frame into engagement with the upper side of the shifting bar. These shifting bars are so operated that the members of each pair at opposite ends of the final plaiting rollers move forwardly while the other pair move rearwardly. During the forward movement of each pair the front teeth thereof engage with the rear side of one of the die sections at opposite ends thereof and move the same tightly against the preceding die section while the rear teeth thereof engage with the rear side of the next following die section at opposite ends thereof and move the same with the die section which is engaged by the front teeth. To permit the shifting bars to thus engage with the opposite ends of the die sections these ends are reduced, as shown at 56 in Figs. 2 and 11, whereby the teeth of the shifting bars are enabled to enter between the end portions of the die sections.

The oscillating or reciprocating movement of the shifting bars is preferably effected by providing each of the shifting bars on its central part with a yoke or guideway 57 for two transversely sliding shoes 58 which receive between them a crank or eccentric 59 formed on the adjacent part of the driving shaft. The cranks for one pair of shifting bars are arranged diametrically opposite the cranks for the other pair of shifting bars so that during the rotation of the driving shaft one pair of shifting bars is moved forwardly for completing the formation of a plait while the other pair of shifting bars are moved rearwardly in position to engage the next following die section preparatory to completing the next following plait. In this manner a practically continuous rotary motion is imparted to the die sections and the two final plaiting rollers. During the return movement of the shifting bars the teeth thereof trip over the end portions of the die sections

and are then depressed into engagement with the end portions of the next following die sections, for which purpose these shifting bars are held yieldingly in their lower position by tension devices each of which comprises a vertically movable slide 60 guided in a bracket 61 on the adjacent part of the main frame and provided at its lower end with an anti-friction roller 62 engaging with the upper side of the yoke of the respective shifting bar, and a spring 63 mounted on said bracket and engaging with the upper end of said slide, as shown in Figs. 1, 3 and 5.

The upper and lower plaiting rollers are compelled to turn together by means of intermeshing gear wheels 64, 65 secured to the corresponding ends of the shafts of these rollers. These gear wheels are preferably of the same diameter, as shown in Fig. 1, but in order to compensate for the slack between the several die sections mounted on the periphery of the lower final plaiting roll the diameter of the latter and the radial thickness of the die sections taken together is made sufficiently greater than the diameter of the upper final plaiting roller, as shown in Fig. 3, so as to compensate for this slack and permit the die sections while in engagement with the periphery of the upper final plaiting roll to move at the same rate of speed, thereby insuring proper engagement of the gripping surfaces of the upper final plaiting roller and the die sections with opposite sides of the plaited or corrugated strip of metal.

In order to assist the upper final plaiting roll to hold the die sections sufficiently firm so that each one in turn serves as a practically rigid abutment while the next following die section is being moved toward the same for completing the formation of a plait between these die sections, a yielding retarding device is provided which resists the advance of the die sections on the outlet side of the passage between the two final plaiting rollers. In its preferred form this yielding retarding device comprises two star or toothed tappet wheels 66 mounted adjacent to opposite ends of the final plaiting rollers and above opposite ends of the die sections as they issue forwardly from between said rollers so that each of these die sections in turn engages its opposite ends with the teeth on the lower sides of the retarding wheels and causes the latter to be turned forwardly. This movement of the retarding wheels is frictionally resisted preferably by the means which are shown in the drawings and which comprise a driving gear wheel 67 connected with each retarding wheel on the outerside thereof and meshing with a driven gear wheel 68 arranged in front of the same, a shaft 69 carrying the driven gear wheel 68 and provided at its outer end with a brake drum 90 and a brake band 70 surrounding the brake drum and secured at one end to the adjacent part of the main frame and provided at its opposite end with a weight 71 for drawing the brake band tightly around the brake drum. By this means a frictional resistance is produced which acts in opposition to the forward turning movement of the two retarding wheels so that the teeth of the latter by engaging with the front side of opposite ends of the die sections operate to resist the forward movement of these die sections and aid not only in holding the foremost operative die sections back and aiding the upper feeding roller to form an abutment against which the trailing members of the operative die sections are pressed, but also causing the die sections after clearing the upper final plaiting roll on the front side thereof to remain clamped together for a short time and thereby properly control the movement of the completed strip as it passes from the final plaiting rollers to the receiving table.

At times it is desirable to move the retarding wheels out of their operative position, for instance, when it is desired to draw a strip of metal through the machine when getting the machine ready and also when a strip has to be removed which has accidentally become jammed in the machine, at which time the retarding wheels should be out of the way in order to avoid interference with the free rotation of the die sections. This is made possible by mounting the shafts 69 in fixed bearings on the main frame and providing shifting levers 91 each of which is pivoted to turn concentrically about one of the shafts 69 and is provided on its rear arm with a pivot 92 upon which one of the retarding and driving gear wheels turns while its front arm is yieldingly pressed upwardly by means of a spring 72 interposed between the underside of this front arm and the adjacent part of the main frame. The position of each retarding wheel relative to the corresponding ends of the die sections may be adjusted by means of an upright adjusting bolt 73 passing through corresponding openings in the front arm of the respective shifting lever and the adjacent part of the frame and having its head 74 engaging the underside of the frame and its screw nut 75 bearing against the upper side of the front arm of the adjusting lever. Upon turning the screw nut 75 in one direction or the other the shifting lever may be turned so as to engage the teeth of the retarding wheel the required extent with the ends of the companion die sections.

Instead of mounting the die sections on a rotatable supporting roll as shown in the construction represented in Figs. 1–13, the

die sections may be mounted upon a fixed guide, as shown in Figs. 14 and 15. In this last mentioned construction a plurality of die sections 76 operating substantially like the die sections shown in Figs. 2, 3, 4, 10 and 11, are provided at their opposite ends adjacent to their inner edges with laterally projecting guide lugs 77 which slide in oval guideways 78 formed in plates 79 secured to the adjacent parts of the stationary main frame 80. These die sections are pushed one at a time forwardly by means of shifting bars 81 similar to the shifting bars shown in Figs. 2, 3 and 13, so that each die section is in turn pushed forwardly into engagement with the periphery of the upper final plaiting roller 82 and the next preceding die section for causing a partially formed plait of the strip between the same to be converted into a completely formed plait. As each die section clears the final plaiting roll 82 on the front side thereof the same pushes the next die section in advance of the same forwardly, which movement is in turn transmitted successively to the several die sections so that the same are caused to travel around the oval path of the guideways until they again reach the position where they are pushed forwardly by the shifting bars. When employing this stationary form of support or guide for the die sections the opposite ends of the die sections may be engaged by the star wheels 83 of a retarding device similar to that shown in Figs. 2 and 3 for controlling the movement of the die sections on the delivery side of the upper final plaiting roller.

This machine for producing plaited strips of sheet metal can be operated very rapidly so as to secure a comparatively large output of such articles, the same requires comparatively little power for its operation, its working parts are not subjected to undue wear, and it is not liable to get out of order easily.

I claim as my invention:

1. A machine for bending sheet metal comprising a plurality of die sections arranged in an endless row and adapted to receive between them partially formed plaits on a sheet of metal, and means for causing adjacent die sections to be moved relatively to each other for engaging a plait of said sheet between the same.

2. A machine for bending sheet metal comprising a plurality of die sections arranged in an endless row and adapted to receive between them partially formed plaits on a sheet of metal means for causing adjacent die sections to be moved relatively to each other for engaging a plait of said sheet between the same, and a roller coöperating with the outer faces of said die sections.

3. A metal bending machine comprising a plurality of die sections arranged in an endless row, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for moving said die sections forward successively.

4. A metal bending machine comprising a plurality of die sections, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for moving said die sections forward successively, comprising shifting bars provided with teeth adapted to engage with opposite ends of the die sections.

5. A metal bending machine comprising a plurality of die sections, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for moving said die sections forward successively, comprising shifting bars provided with teeth adapted to engage with opposite ends of the die sections and means for reciprocating said shifting bars.

6. A metal bending machine comprising a plurality of die sections, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for moving said die sections forward successively, comprising shifting bars provided with teeth adapted to engage with opposite ends of the die sections and means for reciprocating said shifting bars comprising a shaft having cranks operatively connected with said shifting bars.

7. A metal bending machine comprising a plurality of die sections, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for pushing said die sections forwardly in succession comprising reciprocating shifting bars provided at their front ends with teeth engaging with opposite ends of said die sections, guides for the rear ends of said shifting bars, a shaft provided with cranks operatively connected with the central parts of said shifting bars, and means for holding said shifting bars yieldingly in engagement with said die sections.

8. A metal bending machine comprising a plurality of die sections, each two adjacent die sections being movable relatively and adapted to receive between them the plait of a sheet of metal, and means for pushing said die sections forwardly in succession comprising reciprocating shifting bars provided at their front ends with teeth engaging with opposite ends of said die sections, guides for the rear ends of said shifting bars, a shaft provided with cranks operatively connected with the central parts of said shifting bars, and means for holding said shifting bars yieldingly in engagement with said die sections comprising slides hav-

ing rollers engaging with said shifting bars, brackets in which said slides are guided and springs mounted on said brackets and operating against said slides.

9. A metal bending machine comprising an endless row of die sections, a support upon which said die sections are mounted, means for successively moving said die sections relative to each other and into an operative position and a roller coöperating successively with the outer faces of said die sections.

10. A metal bending machine comprising a supporting roller, and a plurality of die sections mounted in an endless row on the periphery of said supporting roller and capable of circumferential movement thereon relatively to each other.

11. A metal bending machine comprising a supporting roller, a plurality of die sections mounted in an endless row on the periphery of said supporting roller and capable of circumferential movement thereon relatively to each other, and a die roller coöperating with the outer faces of said die sections.

12. A metal bending machine comprising a supporting roller, a plurality of die sections mounted in an endless row on the periphery of said roller and capable of circumferential movement thereon relatively to each other, and means for limiting the circumferential movement of each die section on said supporting roller.

13. A metal bending machine comprising a supporting roller, a plurality of die sections mounted in an endless row on the periphery of said roller and capable of circumferential movement thereon relatively to each other, and means for limiting the circumferential movement of each die section on said supporting roller, comprising longitudinal grooves formed on the periphery of said supporting roller and each adapted to receive the inner portion of one of said die sections.

14. A metal bending machine comprising a supporting roller, a plurality of die sections mounted in an endless row on the periphery of said supporting roller and capable of a limited circumferential movement thereon relatively to each other, and means for confining said die sections on the supporting roller.

15. A metal bending machine comprising a supporting roller, a plurality of die sections mounted on the periphery of said supporting roller and capable of a limited circumferential movement thereon, and means for confining said die sections on the supporting roller comprising laterally projecting lugs arranged at opposite ends of the die sections, and locking plates secured to opposite ends of the supporting roller and provided with grooves which receive said locking lugs.

16. A metal bending machine comprising a supporting roller, a plurality of die sections mounted in an endless row on the periphery of the supporting roller and capable of circumferential movement thereon relatively to each other, and a die roller having its periphery coöperating with the peripheral faces of said die sections.

17. A metal bending machine comprising a supporting roller, a plurality of die sections mounted on the periphery of the supporting roller and capable of circumferential movement thereon, and a die roller having its periphery coöperating with the peripheral faces of said die sections, the pitch line of the several die sections being greater than the pitch line of said die roller.

18. A metal bending machine comprising a supporting roller, a plurality of die sections mounted on the periphery of the supporting roller and capable of circumferential movement thereon, a die roller having its periphery coöperating with the peripheral faces of said die sections, the pitch line of the several die sections being greater than the pitch line of said die roller, and means for turning said supporting roller and die roller in unison.

19. A metal bending machine comprising a supporting roller, a plurality of die sections mounted on the periphery of the supporting roller and capable of circumferential movement thereon, a die roller having its periphery coöperating with the peripheral faces of said die sections, the pitch line of the several die sections being greater than the pitch line of said die roller, and means for turning said supporting roller and die roller in unison consisting of intermeshing gear wheels of like diameter connected with said rollers.

20. A metal bending machine comprising a plurality of die sections, arranged in an endless row, a support upon which said die sections are movably mounted relatively to each other, means for advancing said die sections, and means for retarding the forward movement of said die sections.

21. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star wheels having teeth adapted to be engaged by opposite ends of the die sections.

22. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star

wheels having teeth adapted to be engaged by opposite ends of the die sections and means for retarding the forward rotation of said star wheels.

23. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star wheels having teeth adapted to be engaged by opposite ends of the die sections and means for retarding the forward rotation of said star wheels comprising driving gear wheels connected with said star wheels, driven gear wheels meshing with said driving gear wheels, brake drums operatively connected with said driven gear wheels, and brake bands engaging with said brake drums.

24. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star wheels having teeth adapted to be engaged by opposite ends of the die sections and means for moving each of said star wheels toward and from the path of said die sections.

25. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star wheels having teeth adapted to be engaged by opposite ends of the die sections and means for retarding the forward rotation of said star wheels comprising driving gear wheels connected with said star wheels, driven gear wheels meshing with said driving gear wheels, brake drums operatively connected with said driven gear wheels,— brake bands engaging with said brake, drums, and means for adjusting said star wheel toward and from the die sections comprising a rock lever pivoted concentrically with said brake drum and driven gear wheel and carrying the adjacent star wheel and driving gear wheel.

26. A metal bending machine comprising a plurality of die sections, a support upon which said die sections are movably mounted, means for advancing said die sections, and means for retarding the forward movement of said die sections comprising star wheels having teeth adapted to be engaged by opposite ends of the die sections and means for retarding the forward rotation of said star wheels comprising driving gear wheels connected with said star wheels, driven gear wheels meshing with said driving gear wheels, brake drums operatively connected with said driven gear wheels,— brake bands engaging with said brake drums, and means for adjusting said star wheel toward and from the die sections comprising a rock lever pivoted concentrically with said drum and driven gear wheel and having one of its arms supporting the adjacent star wheel and driving gear wheel, a spring engaging with the other arm of said shifting lever and operating to turn the same in the direction for carrying the teeth of the star wheel into the path of said die sections, and an adjusting bolt having its head and nut engaging one with the stationary part and the other with said adjusting lever.

Witness my hand this 10th day of March, 1914.

JOHN M. FEDDERS.

Witnesses:
THEO. L. POPP,
ANNA HEIGIS.