

Sept. 2, 1941.

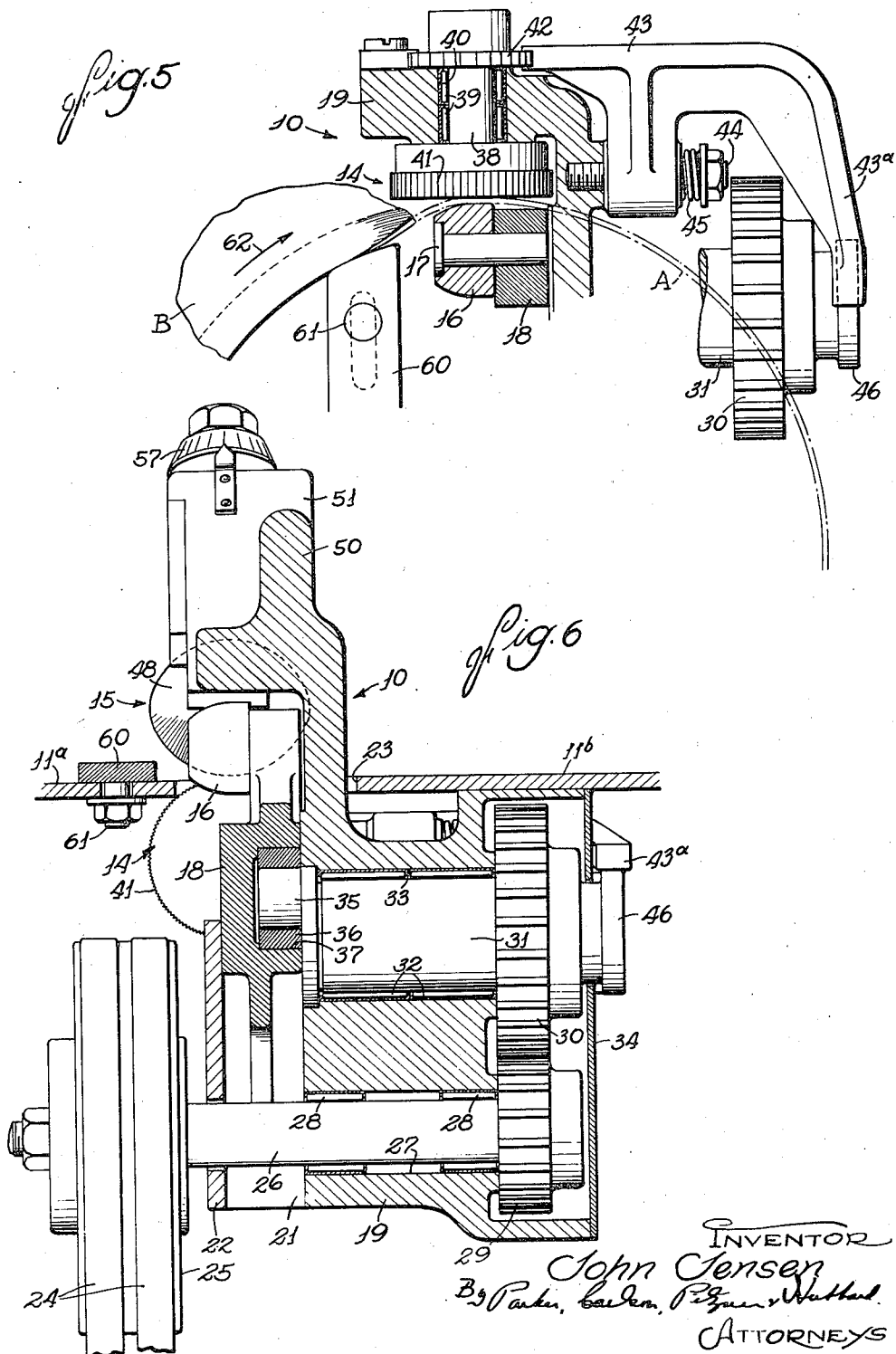
J. JENSEN

2,254,289

SHEET METAL WORKING MACHINE

Filed Jan. 14, 1939

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,254,289

SHEET METAL WORKING MACHINE

John Jensen, Rockford, Ill., assignor to Whitney
Metal Tool Company, Rockford, Ill., a corpora-
tion of Illinois

Application January 14, 1939, Serial No. 250,956

12 Claims. (Cl. 153—26)

The invention relates to sheet metal working machines and more particularly to a novel power actuated machine for bending edge flanges on sheet metal.

Occasions frequently arise for edge flanging sheet metal. For example, in making Pittsburgh joints in ducts and the like one of the sheets of metal to be joined is fashioned with a reentrantly bent edge portion constituting a pocket extending along such edge. A complemental simple edge flange is formed along the abutting edge of the other sheet of metal, which is to be joined to the first sheet, so that this latter flange may be inserted into the pocket in the first mentioned sheet edge. The bending of such an edge flange is a fairly simple matter in an ordinary bending brake if the edge of the sheet is straight. In the frequently recurring event that the edge is curved or otherwise irregular in contour, however, it is not possible to flange the sheet edge in a bending brake and it has heretofore frequently been necessary to perform the operation by hand.

One object of the present invention is to provide a sheet metal edge flanging machine which is adapted to fashion a flange along the edge of a sheet of metal no matter how irregular in contour or how long such edge may be.

A more specific object of the invention is to provide a machine of the character set forth embodying a large and unobstructed work table surface and means operable at substantially one point only on the table for gripping and progressively flanging the edge of a sheet of metal moved past the same, so that the sheet can be placed on the table surface and slid around on it with full freedom of movement in any direction as may be required to feed an irregularly contoured edge on the sheet through said gripping and flanging means with each successive incremental portion of the sheet edge always advancing through such means in one predetermined direction.

Another object of the invention is to provide a sheet metal edge flanging machine embodying a pair of cooperating rollers for gripping the sheet and aiding in shaping the flange on it, together with a single means manipulable to adjust the relative position of the parts in two directions simultaneously so as to accommodate both the body and flange portions of sheets of different thickness.

Still another object of the invention is to provide a machine of the type set forth having a novel arrangement for progressively feeding and flanging a sheet of metal and in which the feed-

ing and flanging devices are operated in a predetermined timed relation.

Further objects and advantages of the invention will become apparent as the following description proceeds taken in connection with the accompanying drawings in which:

Figure 1 is a general perspective view of a sheet metal edge flanging machine embodying the invention.

Fig. 2 is a perspective of a sheet metal work blank with curved edges flanged by a machine such as that of Fig. 1.

Fig. 3 is an enlarged vertical sectional view of the flanging head for the machine of Fig. 1.

Fig. 4 is an enlarged detail view, partly in section along the line 4—4 in Fig. 3, showing the feed roller ratchet drive.

Fig. 5 is a transverse sectional view along the line 5—5 in Fig. 3.

Fig. 6 is a vertical sectional view along the line 6—6 of Fig. 3.

The particular machine (Fig. 1) chosen for exemplification and explanation of the invention includes a flanging head, designated generally by the numeral 10, located substantially centrally of a rather large flat work surface or work table 11. A rectangular hollow base or shell 12, with a suitable interior reinforcing frame work (not shown in detail), supports the table 11 and houses the motor or other actuating means for driving the power actuated elements of the flanging head 10 as well as the lower portion of this flanging head. Preferably, the work table 11 is made in two separable sections 11^a and 11^b screwed to the top of the base 12 (Fig. 3) so that one or both sections may be readily removed to afford access to the interior of the base.

The flanging head 10 (Fig. 3) includes three principal elements, viz.: a pair of cooperating clamping rollers 14 and 15, and a power actuated hammer or bending head 16. In the particular construction shown the lower roller 14 serves as a power driven feed roller while the upper roller 15 is fashioned as an anvil to cooperate with the hammer 16. This hammer 16 is preferably vertically reciprocable and in such reciprocatory movement progressively bends an edge flange A on the body portion B of a sheet metal workpiece (Figs. 3 and 5), as the work piece is fed past the reciprocating hammer by the feed roll 14.

The bending head or hammer 16 has been shown herein (Figs. 3, 5 and 6) as being contoured in the form of a portion of a sphere carried by pin 17 on the upper end of a generally

rectangular slide 13. The slide 13 is confined by a guide structure for vertical sliding movement on the front of a rigid cast frame 19. The frame 19 is in turn bolted to a pair of horizontal angle bars 20 (Fig. 3) included in the interior framework of the base 12. The guide structure which receives the slide 13 includes a pair of vertical flanges 21 projecting from the forward face of the frame 19 and an overlying removable guide plate 22 (Fig. 6) bolted to the front edges of these flanges. In this way the hammer 16 is supported for vertical reciprocation in a path such that it is alternately projected through and withdrawn from an aperture 23 in the center of the work table 11.

To drive the reciprocating hammer 16 a suitable electric motor or the like (not shown) is housed within the base 12. This motor may be connected by V-belts 24 (Fig. 6) with a pulley 25 on a shaft 26 which is journaled by pin bearings 23 within a transverse bore 27 in the frame casting 19. This power driven rotatable shaft 26 is connected through a Scotch yoke mechanism with a vertically reciprocable hammer slide 13. In particular, a pinion 29, fast on the shaft 26, meshes with a gear 30 fast on a crank shaft 31, which is journaled by pin bearings 32 in a second transverse bore 33 in the frame casting 19. A removable cover plate 34 closes the space at the rear end of the frame 19 which receives the pinion 29 and gear 33. On the forward end of the crank shaft 31 is an eccentrically located crank pin 35 journaled within a cross slide or block 36 (Figs. 3 and 6), which is confined for endwise sliding movement within a transverse groove 37 in the inner face of the hammer slide 13. Consequently, rotation of the crank shaft 31 through the medium of the electric driving motor connected to it, serves to reciprocate the hammer slide 13 vertically and thereby alternately project the hammer 16 upwardly through the opening 23 in the work table and to withdraw the same.

The feed roller 14 is fixed on the end of a stub shaft 38 (Fig. 5), which is journaled by pin bearings 39 for rotation about a horizontal axis in a bore 40 fashioned in a projection on the frame casting 19. To insure a firm frictional grip of the feed roller 14 on the work piece B an annulus of teeth 41 is fashioned on the roller. Upon reference to Figs. 3 and 6 it will be seen that this toothed portion of the roller is located to project through the aperture 23 with its active upper face substantially flush with the top of the work table 11.

Intermittent rotation of the feed roller 14 is accomplished in timed relation with the reciprocation of the hammer slide 13. For this purpose a ratchet type of drive has been provided herein, including a ratchet wheel 42 (Figs. 4 and 5) fast on the outer end of the stub shaft 38. A feed pawl 43, engageable with the ratchet wheel 42, is pivotally mounted for oscillation about a horizontal axis on a pin 44 (Fig. 5) threaded in the frame casting 19. A helical torsion spring 45 encircling the outer end of the pin 44 and anchored at its opposite ends to the pawl 43 and to the pin respectively serves to bias the pawl to a position in which it is normally disengaged from the ratchet 42. Power actuation of the pawl in the opposite or feeding direction is accomplished by a peripheral cam 46 fast on the outer end of the crank shaft 31 and engageable with a lateral projection 43^a on the pawl 43. Of course, the spring 45 also serves to hold the projection 43^a in engagement with the cam 46. The cam 46 is posi-

tioned, with respect to its axis of rotation, so that the pawl will be actuated to advance the ratchet wheel 42, and thereby turn the feed roller 14 for the distance of one tooth on the ratchet wheel, while the hammer 16 is retracted. In this way the feed and hammer strokes are caused to alternate in timed relation.

Inadvertent reverse rotation of the feed roller 14 is prevented by a back-up pawl 42^a (Fig. 4). This pawl is yieldably urged into engagement with the ratchet wheel 42, by a helical compression spring 42^b.

The anvil roller 15 is preferably fashioned to present opposite frusto-conical end faces 47 and 48 (Fig. 3) merging at right angles to each other in an annular peripheral edge 49 on the roller. The face 47 is arranged so that its active lower portion parallels in spaced relation the top of the feed roller 14 while the other face 48 parallels the path of movement of the hammer 16. It will be evident to those skilled in the art that the angle of the flange A, fashioned on the work piece, can be changed by building the machine so that the hammer 16 reciprocates at the desired angle with respect to the active face of the feed roller and with the faces on the anvil roller 15 disposed at a corresponding angle to each other. In the present instance the parts have been arranged for bending a right angle flange as was previously noted.

With the parts arranged in the manner described above the face 47 on the anvil roller 15 presses the body portion B of the work piece firmly against the intermittently actuated feed roller 14 so that the latter advances successive increments of the edge of the work piece to the hammer 16. Upon each upward projection of the hammer it presses the next increment of the work blank edge upwardly against the face 48 on the anvil roller so that a right angle edge flange is progressively formed along the work piece.

To afford adjustment of the flanging head 10 to accommodate sheets of different thicknesses or gauges, the anvil roller 15 is mounted for adjustment toward and away from the cooperating feed roller 14 and hammer 16, and in a path lying in the plane bisecting the angle between the feed roller face and the path of hammer movement. In other words, this path of adjustment lies, in the present instance, in the plane of the edge 49 on the anvil roller 15. Accordingly, when the anvil roller 15 is shifted bodily along this path of adjustment the clearances at both its faces 47 and 48 are changed simultaneously and in equal amounts.

In the particular construction illustrated (Fig. 3) the adjustable mounting for the anvil roller embodies a gooseneck projection 50 on the frame casting 19, which extends upwardly above the work table 11 and over the aperture 23 in the latter. In an enlargement or head 51 on the outer end of the neck 50 is fashioned an axial bore 52 extending in the direction of anvil roller adjustment. A yoke 53 is disposed for axial sliding movement within this bore and the anvil roller 15 is journaled by pin 54 between the arms of this yoke. An adjustment screw 55 threaded in the outer end of the head 51 has a rotary-spline connection 56 with the roller supporting yoke 53. In this way threading of the screw 55 into or out of the bore 52 serves to shift the anvil roller 15 correspondingly toward or away from the feed roller 14 and hammer 16. A graduated scale 57 on the screw 55 cooperates with fixed pointer 58 to show the clearance be-

tween the rollers 14—15, as well as between the roller 15 and hammer 16. To hold the screw 55 fixedly in adjusted position a lock nut 59 is threaded on the outer portion of the screw.

In the operation of the machine the anvil roller 15 is adjusted by the screw 55 as heretofore described, to accommodate a sheet of metal B of particular thickness. Also, as a preliminary adjustment a gauging stop or abutment 60 (Figs. 5 and 6) located on the face of the work table 11 at the entrance side of the feed roller 14 is adjusted for the width of the flange which the operator desires to form on the work piece. In general the width of the flange will be substantially equal to the distance between the nose of the abutment 60 and the face 48 on the anvil roller 15. Consequently, the abutment gauge 60 is mounted for longitudinal adjustment on the table 11 by pin and slot connection 61. The nose of the abutment 60 is preferably curved as indicated at Fig. 5 so that the abutment may be turned about the connecting pin 61 in such manner that the incline on its nose portion conforms roughly with the curvature of the edge of the sheet being flanged.

In the course of the preliminary adjustments described above the leading end of the edge portion of the work piece is placed between the cooperating rollers 14—15 and the anvil roller 15 locked in position so that it presses this leading end portion of the work piece firmly against the feed roller 14. The operator then starts the driving motor and the ratchet driven feed roller 14 advances the work piece B in short intermittent steps. Between each advancing step of the work piece the hammer 16 is projected upwardly through the aperture 23 in the work table, thereby striking the work piece and bending each successive portion, which is presented to it, upward against the anvil roller face 48 in the form of a flange A. As this flanging operation proceeds the operator guides the sheet of metal into the flanging head 10 so that each successive increment of the edge portion being bent always enters the rollers 14—15 in substantially the same direction. The direction of work advances is indicated by the arrow 62 in Fig. 5. Since the surface of the work table 11 is substantially unobstructed the operator is free to slide the work piece about the table surface as may be required by the contour of the work piece edge. Also, since the flanging head 10 is located generally centrally of the work table surface the machine can be readily utilized for bending a flange on the periphery of an interiorly located aperture in the work piece as well as on its outer periphery. In this way the machine may be used successively to form both inner and outer flanges as, for example, on the work piece B, shown in Fig. 2.

Although a particular embodiment of the invention has been shown and described in some detail, there is no intention to thereby limit the invention to such embodiment, but on the other hand the appended claims are intended to cover all alternative constructions and modifications falling within the spirit and scope of the invention.

I claim as my invention:

1. In a sheet metal edge flanging machine the combination of, an anvil roller presenting opposite frusto-conical end faces merging in an annular peripheral edge on the roller, a hammer movable in a path passing from said roller edge toward the axis thereof and generally paralleling

in closely spaced relation the adjacent roller face, a cooperating clamping roller arranged in opposed relation to the other face and said anvil roller, and power actuated means for rotating at least one of said rollers intermittently in timed relation to the active strokes of said hammer in said path past said anvil roller face.

2. In a sheet metal edge flanging machine the combination of, an anvil roller presenting opposite frusto-conical end faces merging substantially at right angles to each other in an annular peripheral edge on the roller, a hammer reciprocable in a path passing from said roller edge toward the axis thereof and generally paralleling in closely spaced relation the adjacent roller face, said hammer being fashioned with a head having a surface forming at least a portion of a sphere, a cooperating clamping roller provided with a roughened frictional gripping surface on its periphery disposed in opposed relation to the other face on said anvil roller, power means for reciprocating said hammer, and means including a ratchet mechanism actuated by said same power actuating means for imparting an intermittent rotative feed motion to said clamping roller in timed relation with the reciprocations of said hammer.

3. An edge flanging machine for sheet metal working comprising, in combination, a feed mechanism embodying a pair of relatively movable members presenting opposed surfaces adapted to receive a sheet of metal therebetween, one of said members also presenting an anvil surface, a hammer movable in a path transverse to the plane of the sheet to bend a marginal edge portion thereof against said anvil surface, and power actuated means for actuating said feed mechanism intermittently to feed the work piece sheet in incremental steps in timed relation with the movement of said hammer.

4. An edge flanging machine for sheet metal working comprising, in combination, a movable power actuated hammer, and means including a cooperating pair of rollers for feeding a work piece in incremental steps past said hammer and in timed relation with the movement of the latter, one of said rollers presenting an anvil surface against which a sheet metal flange on the work piece is bent by the hammer.

5. An edge flanging machine for sheet metal working comprising, in combination, a power actuated hammer movable in successive active and return strokes, and means including a cooperating pair of rollers for gripping a sheet of metal adjacent the edge thereof and feeding the edge portion of the sheet past said hammer in incremental steps, said feed steps being produced during the return strokes of said hammer, and one of said rollers presenting an anvil surface against which the sheet metal edge portion struck by the hammer in its active strokes is pressed.

6. A sheet metal edge flanging machine comprising, in combination, a work table presenting a large unobstructed surface with an opening substantially at its center, a pair of cooperating feed rollers arranged with one roller in said opening and generally below said surface and with the other roller above it, power actuated means connected in driving relation with at least one of said rollers, and a power actuated bending head projectable from below said surface through said opening.

7. A machine adapted to flange a curved marginal edge of a sheet of metal comprising, in combination, power actuated means for bending

successive small increments of the marginal edge of a sheet presented thereto, power actuated means for feeding a marginal edge portion of a sheet to said first named means in small incremental steps and in timed relation with the operation of said first named means, said last named means including a pair of opposed rollers with an anvil surface formed on one of said rollers against which said first named means bends the edge of the work piece, means for supporting a sheet in any desired succession of angular positions about said first named means whereby the edge portion thereof may be fed to said first named means in a constant direction of feed irrespective of the irregularity of said edge portion, and means for gauging the depth of the edge portion of the sheet presented to said first named means.

8. A sheet metal edge flanging machine comprising, in combination, a work table presenting a large unobstructed surface with an opening substantially at its center, a pair of cooperating feed rollers rotatable about axes in a common plane and arranged with one roller in said opening and generally below said surface and with the other roller above it, power actuated means connected in driving relation with at least one of said rollers, and a power actuated bending head projectable from below said surface through said opening along a path lying in said plane.

9. A sheet metal edge flanging machine comprising, in combination, a work table presenting a large unobstructed surface with an opening substantially at its center, a pair of cooperating feed rollers arranged with one roller in said opening and generally below said surface and with the other roller above it, power actuated means connected in driving relation with at least one of said rollers for rotating the same intermittently, a power actuated bending head operable in timed relation with said actuating means and projectable from below said surface through said opening at one side of one of said rollers which serves as an anvil, and gauge means on said table for determining the width of the projecting portion of a sheet of metal fed through said rollers in position to be bent against said anvil roller by said bending head.

10. A sheet metal edge flanging machine comprising, in combination, a work table presenting a large unobstructed surface with an opening substantially at its center, an anvil roller and a

cooperating feed roller, said anvil roller presenting opposite end faces of frusto-conical shape merging in a peripheral edge on the roller, means journaling said feed roller for rotation about a horizontal axis with the upper portion of the feed roller periphery exposed through said opening and lying substantially flush with said table surface, means including an upwardly projecting support adjacent said opening journaling said anvil roller for rotation about an axis lying in a common plane with said feed roller axis and inclined thereto so that one end face on said anvil roller opposes said exposed peripheral portion of said feed roller, a hammer vertically projectable from below said table through said opening along the other end face on said anvil roller and along a path at one side of said roller and lying generally in said plane, and power actuated means for intermittently rotating said feed roller and for driving said hammer in timed relation.

11. A sheet metal edge flanging machine comprising, in combination, a pair of cooperating rollers, one of said rollers presenting opposite frusto-conical end faces merging substantially at right angles to each other in a peripheral edge on the roller, said rollers being rotatably mounted with the other roller disposed with a peripheral face opposed to one of said frusto-conical faces on said one roller, a power actuated hammer arranged for movement past the other frusto-conical face on said one roller, and means for adjustably shifting said one roller in a path of adjustment bisecting the angle between the face of said other roller and said path of movement of said hammer, whereby adjustment of said one roller along said path will serve to vary simultaneously and in equal amounts the clearances between said rollers and between said one roller and said hammer.

12. An edge flanging machine for sheet metal work comprising, in combination, a feed mechanism including a pair of rollers adapted to receive a sheet of metal therebetween and power actuated means for revolving at least one of said rollers to feed the sheet, one of said rollers having an anvil surface thereon, a hammer movable in a path transverse to the plane of the sheet to bend a marginal edge portion thereof against said anvil surface, and power actuated means for driving said hammer.

JOHN JENSEN.