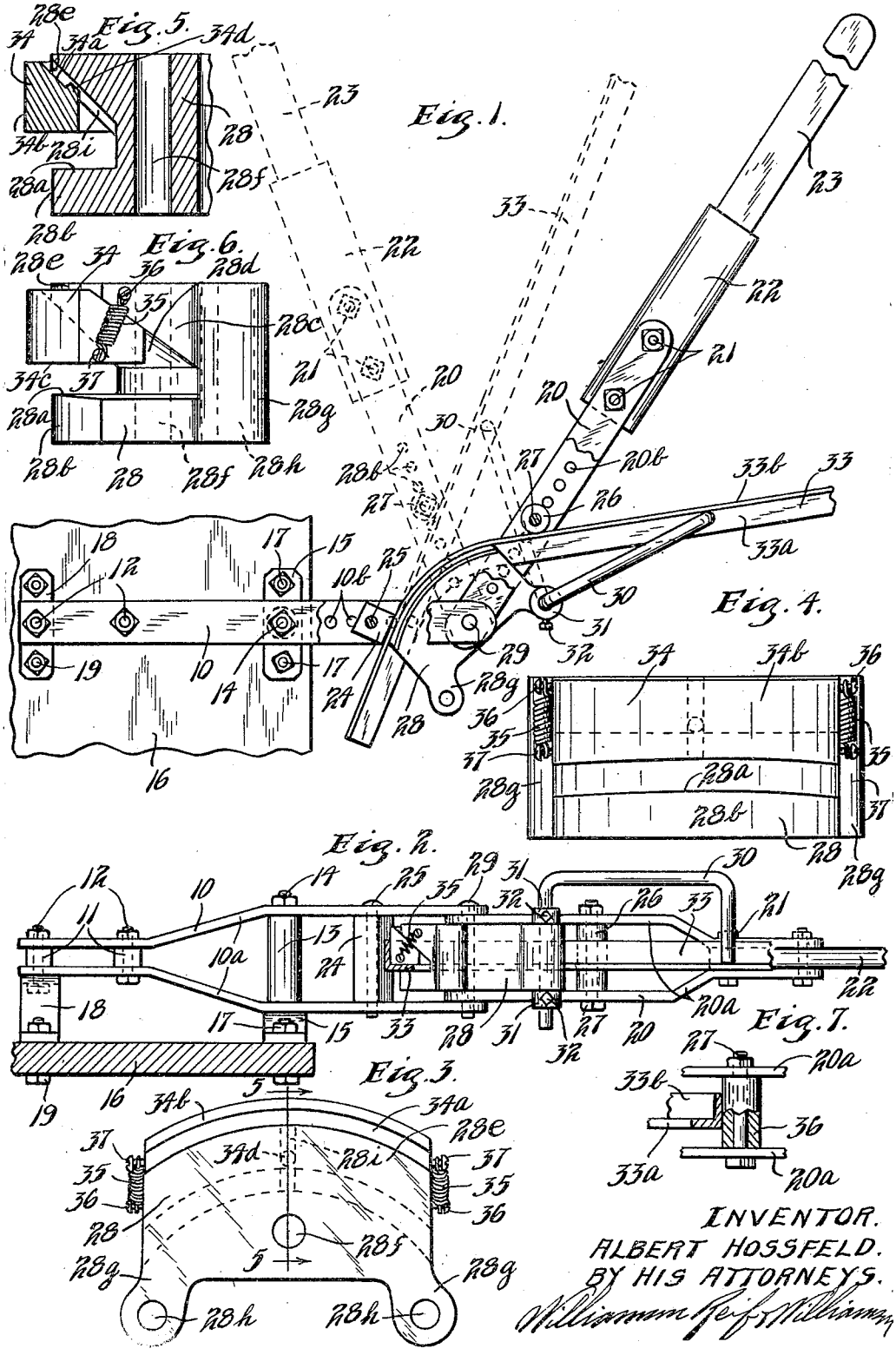
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DIE FOR BENDING ANGLE BARS

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DIE FOR BENDING ANGLE BARS

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This invention relates to a bending machine and particularly to a bending machine adapted to bend angle members or the ordinary angle bars. Heretofore great difficulty has been experienced in bending angle bars while cold. When an angle bar is bent about an axis perpendicular to one flange of the bar and at one side of said flange with the edge of said flange on the concave side of the bend, the metal in the flange is upset or increased in thickness. The flange must be held between surfaces on the die and if it is bent while between the surfaces the upset of the bar causes it to grip the surfaces so that great difficulty is experienced in releasing the bar. The neutral line of the bend in relation to the flange extends along a longitudinal line substantially at the midpoint of the flange transversely thereof. While the metal at the edge of said flange is upset the metal at the opposite edge of the flange adjacent the other flange is stretched and the bar tends to twist about a longitudinal axis. There is also a tendency for the bar to bend about an axis extending transversely thereof. The bending of an angle bar and maintaining its proper shape has therefore been a very difficult problem.

It is an object of this invention therefore to provide a bending machine and die in which an angle bar can be easily and quickly bent and the proper shape thereof maintained.

It is a further object of the invention to provide a bending machine in which an angle bar can be quickly bent with the concave side of the bend extending along one edge of the flange of the bar and about an axis perpendicular to said flange and said bar quickly released after it is bent.

It is more specifically an object of the invention to provide a die for bending an angle bar comprising a stationary member, a movable member, said members having substantially parallel surfaces between which one flange of the bar is engaged, said members being movable toward and from each other to grip and release said flange.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views, and in which:—

Fig. 1 is a plan view of the device, certain parts being broken away and others shown in horizontal section and some parts shown in different positions in dotted lines;

Fig. 2 is a view in side elevation of the machine shown in Fig. 1;

Fig. 3 is a top plan view of the bending die;

Fig. 4 is a view in front elevation of the bending die;

Fig. 5 is a vertical section taken on line 5—5 of Fig. 3 as indicated by the arrows;

Fig. 6 is a view in end elevation of the bending die, and

Fig. 7 is a partial view in side elevation showing the bending roller, a portion thereof being in section.

Referring to the drawings, a bending machine is shown having a stationary bending arm 10, and while this arm may be variously formed and mounted, in the embodiment of the invention illustrated it is shown as comprising a pair of spaced bars 10*a* having their flat sides parallel, the same being closely adjacent at one end and separated by the thimbles 11 and connected by headed and nutted bolts 12. The other ends of bars 10*a* are parallel and spaced a greater distance, said bars thus having intermediate divergent portions. A spacing thimble 13 is disposed between the outer ends of bars 10*a*, a headed and nutted bolt 14 extending therethrough and through the bars and also through the central portion of a small bracket 15 having its end portion secured to a work table or bench 16 by headed and nutted bolts 17. Another bracket 18 is disposed adjacent the approximate end of the bars and one of the bolts 12 extends through the central portion thereof, bracket 18 also being secured at its ends to bench 16 by headed and nutted bolts 19. The bars 10*a* have their outer ends rounded and are provided with a plurality of spaced holes 10*b* vertically aligned in the respective bars as shown. The machine also has a

swinging or bending arm 20 also formed of spaced flat bars 20*a* having their flat sides parallel, the inner ends of the arms being spaced so that they substantially fit between the outer ends of bars 10*a*. The outer ends of bars 20*a* are closer together and are connected by spaced headed and nutted bolts 21 which also pass through a flat open-ended sleeve 22. A bar 23 is inserted in the outer end of sleeve 22 and is of considerable length, a part of said bar being shown as broken away in Fig. 1. A block 24 substantially square in cross section is disposed between the outer ends of bars 10*a* and held therebetween by a headed pin 25 extending through a hole in the block and a pair of the holes 10*b*. The hole in block 24 is eccentric to the center of said block. A bending roller 26 is disposed between the bars 20*a* and held therein by a headed and nutted bolt 27 extending centrally through said roller and a pair of holes 20*b*, said bars 20*a* being provided with a plurality of the holes 20*b* extending therethrough and vertically aligned in the respective bars as shown. The inner ends of bars 20*a* are also rounded.

A die is provided for bending angle bars, the same comprising a stationary member 28. Member 28 has a surface 28*a* which in the embodiment of the invention illustrated is shown as a substantially horizontal surface. Surface 28*a* is substantially flat but may desirably be provided with a slight convex curvature. The outer or front surface 28*b* of member 28 is shown as curved on a radius the same as the radius of the desired bend. Member 28 is shown as having an upper portion 28*c* and while this portion might be separate from member 28, in the embodiment of the invention illustrated it is shown as being integral with said member. Portion 28*c* has a downwardly inclined surface 28*d* and while this might be of various angles, in the embodiment of the invention illustrated it is shown as disposed at an angle of 45 degrees to the horizontal. Portion 28*c* also has a front surface 28*e* curved the same and vertically aligned with surface 28*b*. Member 28 has a hole 28*f* extending vertically therethrough midway between the ends thereof and some distance from its front surface adapted to have a headed pivoted pin 29 passed therethrough which pin also passes through the ends of bars 10*a* and 20*a* and connects the same for relative swinging movement. Member 28 also has lugs 28*g* projecting rearwardly at its end portions each of which as shown has extending vertically therethrough a hole 28*h*. A rod 30 is provided bent at a right angle at each end, one end of which is adapted to extend through one of the holes 28*h*, said rod having collars 31 secured thereto above and below arms 20 respectively by any suitable means such as the set screws 32 which collars engage the lugs 28*g*. The other end of rod 30 is adapted to substantially engage the top of the flange 33*a* of the angle bar 33 which is to be bent. Member 28 has a central groove 28*i* in the surface 28*d* thereof. A movable member 34 is provided which member has a surface 34*a* parallel to and substantially engaging the surface 28*d* of member 28. It will be understood that, as shown in Figs. 3 and 6, surfaces 28*d* and 34*a* are curved at substantially the same radius as surfaces 28*b* and 28*e*. Movable member 34 also has a front surface 34*b* curved on the same radius as surface 28*b* which surface as stated has a curvature substantially equal to the curvature of the desired bend. Member 34 has a bottom surface 34*c* which is substantially flat, but may desirably be slightly concave and parallel to surface 28*a*. A lug 34*d* which projects from surface 34*a* is disposed in and adapted to slide in groove 28*i*. Tensile coiled springs 35 are disposed at either end of members 28 and 34 the ends of which members are substantially flush and said springs are fastened at their upper ends respectively to screws 36 in member 28 and screws 37 in member 34.

In operation the swinging or bending arm 20 will be moved substantially to the position shown in dotted lines in Fig. 1. The block 24 and roller 26 will be disposed as shown and the angle bar 33 will be inserted between block 24 and the member 34. One flange shown as a horizontal flange will extend under member 34 in contact with surface 34*c* and the vertical flange will engage surface 34*b*. The operator then swings bar 23 and presses roller 26 against the angle member 33. The pressure of the vertical flange 33*b* of said angle member against the front of movable member 34 causes said member to move inwardly and downwardly owing to the inclined surfaces 28*d* and 34*a* and surface 34*c* moves downwardly so that the horizontal flange 33*a* is gripped between surfaces 34*c* and 28*a*. The rod 30 is swung so that its free end is over the flange 33*a*. The operator now by swinging bar 23 bends the angle about the front surface of member 34 as shown in full lines in Fig. 1. As soon as pressure is released from the bending arm 20 and roller 26 and angle 33 is moved slightly outwardly, member 34 is pulled upwardly by springs 35 to the position shown in Fig. 6. The operator can now push the angle bar 33 further along if it is desired to bend the same further. The angle bar 33 can thus be successively bent about the die comprising members 28 and 34 until the desired bend as been secured. The pressure against the front of member 34 holds the flange 33*a* in position and prevents any twisting or buckling thereof due to the fact that the flange is engaged betwen surfaces 34*c* and 28*a*. The angle is kept from lifting at its outer end by rod 30. The lug 34*d* moving in slot 28*i* acts as a guide in the movement of member 34 and resists any tendency for end-

wise movement. The stoving up or thickening of the edge of flange 33*a* gives the angle bar a tendency to bend upwardly. The surfaces 28*a* and 34*c* are given a slight downward curve to counteract this tendency which is due to the spring of the metal. After the bend is made the metal springs back slightly and is thus in perfectly flat condition.

From the above description it is seen that applicant has provided a simple and very efficient structure of die for bending angle bars, particularly when the bar is to be bent about an axis perpendicular to one flange with the edge of said flange on the inside or concave side of the bend. The bar is effectively held in place while the bending pressure is applied and any warping or twisting of the bar is prevented. The angle bar can be very quickly bent and as stated, can be moved endwise after each successive bend to give as great a curvature as desired. Different dies, of course, will be used for different curvatures. The device has been amply demonstrated in actual practice and found to be very successful and efficient.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts without departing from the scope of applicant's invention, which, generally stated, consists in a device capable of carrying out the objects above set forth, in the novel parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. A bending machine having a die for bending an angle bar comprising two relatively movable members with substantially parallel surfaces adapted to engage a flange of said angle bar therebetween, resilient means holding one of said members in position with said surfaces separated, said members being relatively moved in the bending operation to cause said parallel surfaces to engage said flange against the action of said resilient means.

2. A bending machine having a die about which angle iron is to be bent comprising, a stationary member with a surface with which one flange of the angle iron engages, a movable member having a surface with the desired curvature of the bend and having a surface extending substantially at right angles to said curved surface substantially parallel to said surface on said stationary member, said movable member being movable toward the stationary member and engaging the opposite side of the flange engaging said first mentioned surface and movable away from said stationary member after the angle iron is bent.

3. The structure set forth in claim 1 and a member engaging the top of the flange resting on said stationary member at some distance from said die to prevent upward movement of the angle member.

4. The structure set forth in claim 2 and a swinging member having a portion disposed at some distance from said die and resting on top of the flange of the angle member disposed between said parallel surfaces to prevent upward movement of said angle member.

5. A bending machine having a die about which angle iron is to be bent comprising a stationary member having a surface with which one flange of the angle iron engages, a movable member having a curved surface and having a surface extending substantially at right angles to said curved surface substantially parallel to said surface on said stationary member, resilient means holding said movable member in position with said parallel surfaces separated and means for guiding said movable member toward said stationary member to cause said parallel surfaces to move nearer together, said movable member being caused to move toward said stationary member by the pressure of the angle iron against said curved surface, one flange of said angle iron being engaged between said parallel surfaces, said movable member being retracted to normal position by said resilient means after the angle iron is bent.

6. A bending machine having a die about which angle iron is to be bent comprising a stationary member with a substantially flat surface and having a surface inclined at an angle to said flat surface, a movable member having an inclined surface engaging said latter surface and movable therealong, said movable die having a substantially flat surface extending parallel to said first mentioned surface and having a surface with a curvature of the desired bend, means holding said movable member in position with said parallel surfaces spaced, said movable member being movable by the pressure of the angle iron against its curved surface to bring said parallel surfaces into engagement with opposite sides of one flange of the angle iron.

7. A bending machine having a die about which an angle bar is to be bent comprising a stationary member having a substantially flat surface with which one flange of the angle bar engages, said member having a surface extending substantially at 45 degrees to said first mentioned surface, a movable member having a surface parallel to said last mentioned surface and substantially in contact therewith and having a surface substantially parallel to said first mentioned surface of the stationary member, tensile springs connected at their ends respectively to said movable and stationary members whereby when bending pressure of the angle iron is brought against said curved surface of the

movable member it will move toward the stationary member to bring said first mentioned surface and the surface parallel therewith together and engage the flange of the angle bar therebetween.

8. A bending machine having in combination, a stationary arm, a swinging arm, a pivot pin connecting said arms, a die mounted on said pivot pin comprising a stationary member having a surface with which one flange of the angle bar to be bent engages, a movable member having a surface substantially parallel to said surface, means for guiding said movable member to cause said last mentioned surface to approach said first mentioned surface, said movable member having an outer surface with a curvature substantially equal to the curvature of the desired bend, a block on said stationary arm, adjacent one end of said die, a roller carried on said swinging arm adjacent the other end of said die whereby pressure can be exerted on an angle bar, the flange of said bar engaging said outer surface of the movable member and moving it to bring said parallel surfaces into engagement with the first mentioned flange of said angle bar.

9. A bending machine having a die for bending an angle bar comprising relatively movable members adapted to engage a flange of said angle bar therebetween, one of said members being moved by the other flange of said angle bar in the bending operation to cause the members to engage said first mentioned flange under pressure.

10. A bending machine having a die about which an angle bar is to be bent, comprising a stationary member having a surface with which a face of a flange of the angle bar engages, a movable member having a bending surface and a surface extending in angular relation to said bending surface and substantially parallel to said surface of said stationary member, said movable member being movable toward the stationary member to cause said angularly extending surface to engage the opposite face of said flange engaging said first mentioned surface, and adapted to be moved away from said stationary member after the angle bar is bent.

11. A bending machine having a die about which an angle bar is to be bent, comprising a stationary member, a member movable relatively thereto and having a bending surface, and means for engaging a flange of said angle bar to bend it about said bending surface, said means being operative upon said movable member during the bending operation to move it toward said stationary member to grip the other flange of said angle bar between said stationary and movable members, and said stationary and movable members being adapted to release their grip upon said other flange at the expiration of the bending operation upon said angle bar.

12. A device for bending angle bars having in combination, a die member having a substantially flat surface and having a surface inclined at an angle to said flat surface, a second die member having a flat surface substantially parallel to said flat surface, a curved surface engageable by said angle bar, and a surface inclined to its flat surface disposed to engage the first mentioned inclined surface, said angle iron engaging the curved surface of said second member in the bending operation, said members being relatively moved by said inclined surface to cause said flat surfaces to approach and grip one flange of said angle bar.

13. A device for bending angle irons having in combination, a pair of relatively movable die members having thereon respectively flat surfaces between which one flange of said angle bar is disposed, one of said dies having a curved surface engageable by said angle bar, and wedge means causing movement of said dies to cause said flat surfaces to grip one flange of said bar therebetween.

14. A machine for bending angle irons having in combination, a die member with a substantially flat surface, a second die member having a flat surface disposed substantially parallel to said flat surface and having a curved surface engaged by said angle bar in the bending operation, means for moving said angle bar against said curved surface, and means carried by said dies for causing relative movement thereof when said angle bar is pressed against said curved surfaces to cause said other surfaces to grip one flange of said angle bar.

In testimony whereof I affix my signature.

ALBERT HOSSFELD.