Aug. 15, 1939. A. WACHS 2,169,669

ANGLE IRON BENDING MACHINE

Filed Oct. 26, 1937 2 Sheets-Sheet 1

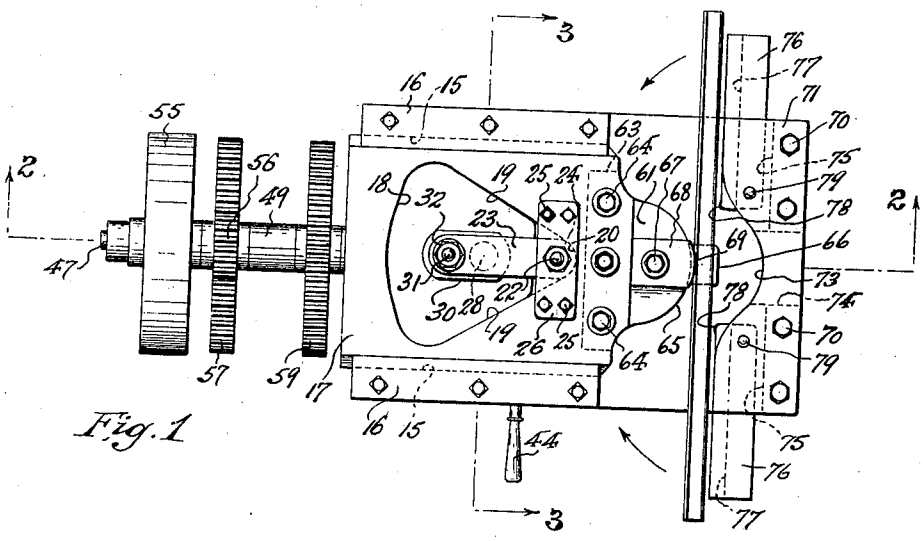


Fig. 1

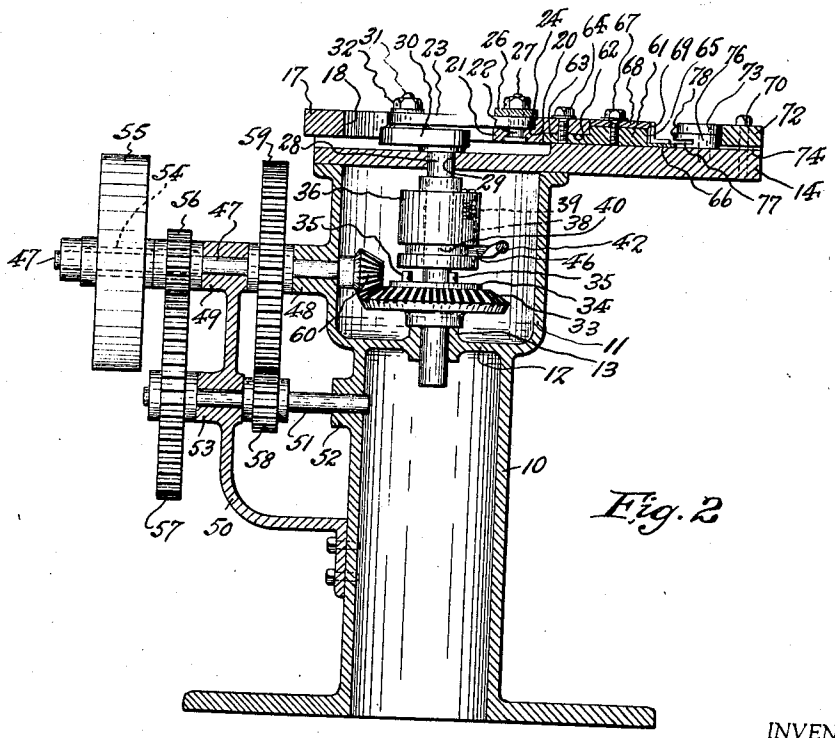


Fig. 2

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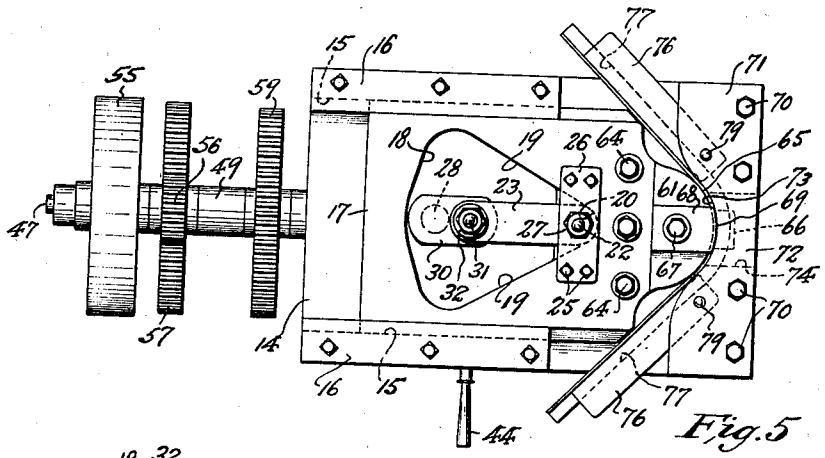


Fig. 5

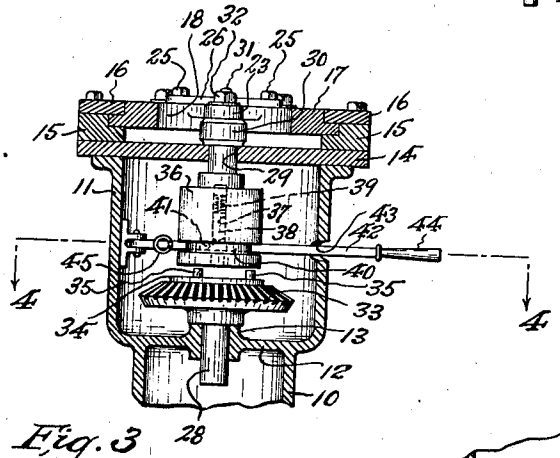


Fig. 3

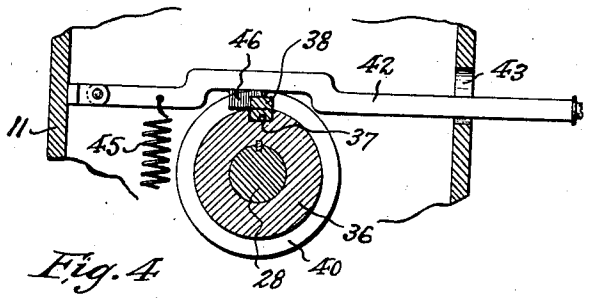


Fig. 4

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2,169,669

ANGLE-IRON BENDING MACHINE

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Application October 26, 1937, Serial No. 171,025

7 Claims. (Cl. 153—48)

This invention relates to machines for bending angle-iron bars and similar material.

An object of this invention is to provide a novel and simple construction of power actuated bending machine especially adapted to bend angle-iron bars and like flanged materials in the direction of the lengths thereof, and in such manner that a smooth drawing and forming of the bend in the same is attained without producing fractures, wrinkles, buckles or other undesirable distortions.

Another object of the invention is to provide a novel form and construction of cooperative male and female bending dies, together with means to reciprocate the movable male die relative to the fixed female die, and to provide, in connection with the female die, novel auxiliary supporting and bending arms operative to hold the material beyond the zone of bending stresses under rigid control and securely braced and supported against undesired angular distortion, twisting or displacement from the uniform plane desired to be attained in the finished work. Said latter means being also operative to assist the bending operations as to compensate for any springy reaction in the immediate area of the formed bend, to the end that the arms of the bend material beyond the immediate area of bend will diverge to form the specific included angle desired in the finished work.

Another object of the invention is to provide a novel power transmission means for actuating the bending die mechanism; said transmission means including means operative to automatically arrest operation of the dies upon completion of the cycle of bending operations.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of this invention is shown in the accompanying drawings, in which—

Fig. 1 is a top plan view of the novel bending machine with the bending dies occupying normal initial or inactive position; Fig. 2 is a longitudinal vertical section of the machine, taken on line 2—2 in Fig. 1; and Fig. 3 is a fragmentary transverse vertical section of the machine, taken on line 3—3 in Fig. 1.

Fig. 4 is a fragmentary horizontal section, taken on line 4—4 in Fig. 3, but drawn on an enlarged scale.

Fig. 5 is a top plan view of the machine with the bending dies shown in active or bend forming position.

Similar characters of reference are employed in the hereinabove described views, to indicate corresponding parts.

Referring to the drawings, the reference character 10 indicates the pedestal or base of the machine, which is formed at its upper end to provide a hollow or chambered housing 11, in the bottom wall or partition 12 of which is provided a vertical central bearing 13.

Suitably secured to and horizontally extending over the housing 11 is a bed-plate 14, bordering the sides of the rearward portion of which are guide members 15 and cooperating keeper plates 16.

Reciprocably slidable in and between said guide members 15 is a carrier plate 17. The body of said carrier plate 17 is cut away to provide a clearance opening 18, the opposed longitudinal sides 19 of which are disposed to converge toward the forward end portion of said carrier plate, the same being arranged to terminate in an arcuate thrust-seat 20. Integrally formed in connection with said carrier plate 17, between the converging sides 19 thereof and below the plane of said thrust-seat 20 is a shelf or flange 21. Mounted in said shelf or flange 21, to project upwardly from the top surface thereof, is a pivot-stud 22 with which is pivotally connected the forward end of a link 23. Said link 23 is provided at its forward end with a rounded bearing portion 24 which abuts or seats against said thrust-seat 20. Secured, by bolts or other suitable fastening means 25, to the top surface of said carrier plate 17, to bridge across the forward end of said link 23, is a bridge plate 26 through which the upper end of said pivot-stud 22 projects. Said upper end of the pivot-stud 22 is threaded to receive a nut 27 which serves to hold the same in place.

The means for reciprocating the carrier plate 17 comprises a vertical driven shaft 28, the lower end of which is journaled in the bearing 13, and the upper end of which is journaled in and extends through a bearing opening 29 provided in said bed-plate 14. Affixed to the upper end of said driven shaft 28, above said bed-plate 14, and so as to revolve within the clearance opening 18 with which said carrier plate 17 is provided, is a crank member 30, upon the upwardly extending crank pin 31 of which is pivotally engaged the rearward end of said link 23, the latter being retained in connection therewith by a nut 32 engaged upon the free end of said crank pin 31 which is threaded to receive the same.

Mounted to rotate freely upon the lower end of

said driven shaft 28 above said bearing 13 is a bevel gear 33, to the upper face of which is suitably secured a plate 34 carrying upstanding circumferentially spaced clutch pins 35. Affixed to said driven shaft 28, in upwardly spaced relation to said bevel gear 33 and its clutch pins 35, is a collar 36. Vertically movable in a guideway 37 with which said collar is provided is a clutch bolt 38 adapted to be downwardly projected by spring means 39 to dispose its lower end portion in the path of revolution of said clutch pins 35. Said collar 36 is provided with an annular channel 40 which intersects the path of movement of said clutch bolt 38, and said clutch bolt is provided with a notch adapted to form a lift shoulder 41 movable across said channel 10. Pivotally connected with the housing 11 is a control lever 42 which is aligned with the channel 40 of said collar 36. The free end portion of said control lever 42 extends exteriorly of said housing 11 through a suitably shaped opening or slot 43 provided in a wall of the latter. The outer end of said control lever terminates in a handle portion 44. Said control lever 42 is yieldably urged by spring means 45 toward said collar 36. Formed in connection with said control lever, so as to enter laterally into the channel 40 of said collar 36 is a tapered lift piece 46 adapted to engage the lift shoulder 41 of said clutch bolt 38 thereby to raise the latter against the tension of the thrust spring 39, and thus to upwardly retract the lower end portion of said clutch bolt 38 out of the path of movement of said clutch pins 35, whereby a clutched relation of said bevel gear 33 to said driven shaft 38 is normally released.

Said bevel gear 33 is driven from a suitable source of power by a reduction gear type transmission so as to assure adequate power or force application to the bending die means to be actuated by reciprocatory movement of said carrier plate 17. An illustrative form of such transmission comprises a drive shaft 47 mounted in bearings 48 and 49 respectively provided in connection with a wall of said housing 11 and with a bracket extension 50 of the pedestal or base 19, and a key shaft 51 mounted in bearings 52 and 53 respectively provided in connection with said pedestal or base 10 and said bracket extension 50. Rotatably mounted on the outer end of said drive shaft 47 is a tubular shaft or sleeve 54 upon which is fixed a driving pulley 55, and also fixed on said sleeve 54 is a spur gear 56 which meshes with a large gear wheel 57 fixed on said lay shaft 51, whereby the latter is driven. Fixed on said lay shaft 51 is a spur gear 58 which meshes with a large gear wheel 59 fixed on said drive shaft 47, whereby said latter shaft is actuated. Fixed on the inner end of said drive shaft 47 is a pinion 60 which meshes with and drives said bevel gear 33.

The bending die means per se comprises a male die member 61 which is affixed to the forward end of said carrier plate 17. Preferably the forward end portion of said carrier plate 17 is undercut to provide a socket or seat 62 to receive a tail-piece 63 with which the male die member is provided; fastening bolts 64 being applied through the carrier plate and said tail-piece 63. The forward or free end of said male die member is shaped to provide a convex working face 65, which will usually comprise a semi-circular form. Preferably formed integral with the forward or free end of said male die member, to project forwardly beyond the working face 65 and in the plane of the bottom portion thereof, is a supporting toe portion 66 of reduced width. Affixed to the top of said male die member 61, by a bolt 67 or other suitable fastening means, is a presser piece 68 having at its forward free end an undercut chamfered lip 69 which slightly overhangs the working face 65 of said male die member.

Affixed to the outer or forward end portion of the bed-plate 14, by bolts 70 or other suitable fastening means, is a female die block 71 the central portion of which constitutes a female die member 72, the inner portion of which is formed to provide a concave working face 73 which, for making right angled bends in bars operated upon, is of curvilinear form of circular extent approximating a quarter of a circle having a radius corresponding substantially to the radius of the semi-circular male die member. The underside of said female die member 72 is provided with a central cutaway portion to provide a channel 74, which extends beyond or backwardly from the working face 73, and is adapted, at proper times, to receive the supporting toe portion 66 of said male die member. The under side inner portions of said die block 71 are cut away to provide receiving spaces 75, extending laterally in opposite directions from points adjacent the ends of the working face 73 of said female die member. Pivotally connected by fulcrum pins 79 to and between said female die block 71 and the bed-plate 14, to normally enter said spaces 75, are oppositely extending auxiliary supporting and bending arms 76 which extend outwardly from and beyond the respective ends of the working face 73 of the female die member 72. Each supporting and bending arm 76 is provided, in its side toward the male die member, with a longitudinal outwardly open channel 77 to receive the horizontal flange of an angle-iron bar desired to be bent. At the inner end of each supporting and bending arm 76 is a projecting nosing 78 which extends slightly beyond the face plane of the arm, the same being engageable by the vertical flange of an angle-iron bar desired to be bent.

The operation of the machine is as follows:

When the machine is idle, the carrier plate 17 and the male die member 61 carried thereby occupies a normal initial retracted position, as shown in Figs. 1 and 2. Under such condition, the clutch-bolt 38 is in inactive raised position as supported by the lift-piece 46 of the control lever 42, and consequently, if power is being transmitted through the described reduction gear transmission, the bevel gear 33 turns idly about the stationary driven shaft 28.

When the machine is thus idle, the angle iron bar desired to be bent is deposited upon the supporting toe portion 66, with its vertical flange backed against the working face 65 of the male die member 61 and its horizontal flange, which overlies or rests upon the supporting toe portion 66, directed toward the female die block 71.

The angle-iron bar having been placed in position as described, the operator swings over the control lever 42 to withdraw the lift-piece 46 from beneath the shoulder 41 of the clutch-bolt notch, thus freeing the clutch-bolt 38 so that the same will be projected downwardly by its spring 39 to carry its lower end portion into the path of revolution of the clutch-pins 35 which are revolved by the bevel gear 33. The nearest approaching clutch-pin 35 will engage the lowered clutch-bolt 38, thereby impelling the collar 36 and driven shaft 28 to partake of the rotary movement of the driven bevel gear 33. Once this transmission

of driving power to the driven shaft 28 is initiated, the operator releases the control lever 42, whereby the spring 45 connected therewith returns the same to normal initial position with its lift piece 46 entered in the annular channel 40 of the collar 36 ready, at the proper time, to again retract the clutch bolt 38 to normal inactive raised position.

The rotary movement imparted to the driven shaft 28 causes the crank member 30 to revolve, thereby transmitting, through the link 24, motion to the carrier plate 17. The initial movement of the carrier plate 17 is in a forward direction operative to move the male die member 61 toward the female die member 72 and its cooperating auxiliary supporting and bending arms 76. The forward movement of the male die member, as it closes upon the stationary female die member, first carries forward the angle-iron bar so that its horizontal flange is caused to enter the channels 77 of the auxiliary supporting and bending arms until the vertical flange abuts the nosings 78 of said arms 76. After this, as forward movement of the male die member continues toward the end of its operative stroke, the angle-iron bar will be forcibly pressed against the nosings 78 of the arms 76, whereby these arms will be caused to swing inwardly about their fulcrum pins 79 respectively in the directions of the arrows shown in Fig. 1. This inward swinging movement of the auxiliary supporting bending arms 76 operates to swing inwardly the end portions of the angle-iron bar, thus initiating the bending of its intermediate portion about the male die member 61 with a drawing or stretching effect, until finally the vertical flange at said intermediate portion of the angle-iron bar is engaged between the opposed working faces of the male and female die members, under the meeting pressure of which the desired bend is completed. The operation of the chamfered lip 69 of the presser piece 68 carried by the male die-member is for the purpose of forcing slightly outward the free marginal portions of the vertical flange of the angle-iron bar at the medial zone of bend, as the bend is completed, to thereby stretch the metal, and thus prevent the formation of wrinkles, buckles or similar distortions in the area of bend.

Owing to the provision of the somewhat projecting nosings 78 at the inner ends of said auxiliary supporting and bending arms 76, the latter, as the bending operations are completed, are swung inwardly somewhat beyond the lines of right-angle divergence, thus forcing the extending straight end portions of the angle-iron bar somewhat beyond the positions whereby the same will include the desired finished right angle divergence. This excess movement compensates for any springy reaction of said straight end portions, so that such reaction, when bending pressures are relaxed, will merely return the arms to the desired finished right angle divergence required in the bent bar.

Upon completion of the forward movement or stroke of the carrier plate 17, whereby the bending die members are brought into cooperative relation producing the bending effects upon the angle-iron bar, the crank member 30, by its continued revolution, operates to retract the carrier plate 17 and the male die member 61 to normal initial positions. As the crank-member approaches completion of its revolution, the collar 36 likewise approaches completion of a corresponding revolution so that the clutch-bolt 38 is carried into engagement with the lift-piece 46 of the control lever 42, whereby said clutch-bolt is again raised to disengage the same from the driving clutch-pin 35, whereupon the driven shaft 28 and its crank member 30 is stopped upon completion of one revolution, and the die mechanism is caused to remain idle although the power transmission mechanism continues to run. It will thus be obvious that operation of the die mechanism is automatically arrested upon completion of each bending operation, so that the finished work may be removed and new work applied, whereupon the above described cycle of operations may be repeated, when the operator, by means of the control lever 42, again trips the clutch-bolt 38.

In the accompanying drawings I have shown my invention and have described the same in the above specification merely in a preferred form and by way of example, but obviously many alterations and variations may be made therein and in its component mechanisms and parts as well as in the mode of operation thereof, which will still be comprised within the spirit of my invention. Generally speaking, I desire it to be understood that I do not limit myself to any specific form or embodiment except in so far as is defined in the herefollowing claims.

I claim—

1. In a machine for the purpose described, in combination cooperative bending die means comprising a stationary female die and a reciprocable male die opposed thereto, auxiliary bending arms respectively pivotally connected with opposite sides of said female die and adapted to be actuated when engaged by the work as the latter is pressed by the male die toward the female die to thereby swing said bending arms with initial bending effect upon the work, and said arms having nosings at their inner ends inwardly spaced from their pivotal points, said nosings being disposed to project beyond the planes of the work engaging faces of said arms thereby to cause an excess bending effect upon the engaged extending end portions of the work to compensate for springy reaction thereof after bending pressure thereupon is relaxed.

2. In a machine for the purposes described, in combination, cooperative bending die means comprising a stationary female die and a reciprocable male die opposed thereto, said male die having a presser piece providing a work engaging undercut chamfered lip overhanging the vertical central portion of the working face thereof, auxiliary bending arms respectively pivotally connected with opposite sides of said female die and adapted to be actuated when engaged by the work as the latter is pressed by the male die toward the female die to thereby swing said bending arms with initial bending effect upon the work, and said arms having nosings at their inner ends inwardly spaced from their pivotal points, said nosings being disposed to project beyond the planes of the work engaging faces of said arms thereby to cause an excess bending effect upon the engaged extending end portions of the work to compensate for springy reaction thereof after bending pressure thereupon is relaxed.

3. In a machine for the purposes described, in combination, cooperative bending die means comprising a stationary female die and a reciprocable male die opposed thereto, said male die having a presser piece providing a work engaging undercut chamfered lip overhanging the vertical central portion of the working face thereof, said male

die also having a work supporting toe member projecting forwardly beyond its working face in the plane of its bottom side, auxiliary bending arms respectively pivotally connected with opposite sides of said female die and adapted to be actuated when engaged by the work as the latter is pressed by the male die toward the female die to thereby swing said bending arms with initial bending effect upon the work, and said arms having nosings at their inner ends inwardly spaced from their pivotal points, said nosings being disposed to project beyond the planes of the work engaging faces of said arms thereby to cause an excess bending effect upon the engaged extending end portions of the work to compensate for springy reaction thereof after bending pressure thereupon is relaxed.

4. In a machine for bending angle-iron bars, cooperative bending die means comprising a stationary female die and a reciprocable male die opposed thereto, auxiliary supporting and bending arms respectively pivotally connected to extend from opposite sides of said female die and adapted to be actuated when engaged by the work as the latter is pressed by the male die toward the female die to thereby swing said bending arms with initial bending effect upon the work, said arms having longitudinally extending channels laterally open along the working faces thereof and adapted to receive the horizontal flange of an angle-iron to be bent so as to permit said working faces to operatively engage the vertical flange of the latter, and said arms having nosings at their inner ends inwardly spaced from their pivotal points, said nosings being disposed to project beyond the planes of said working faces of the arms thereby to cause an excess bending effect upon the engaged extending end portions of the work to compensate for springy reaction thereof after bending pressure thereupon is relaxed.

5. In a machine for bending angle-iron bars as defined in claim 4, wherein said male die is provided with a presser piece having an undercut chamfered lip overhanging the vertical central portion of the working face thereof to engage the free edge portion of the vertical flange of said angle-iron bar.

6. In a machine for bending angle-iron bars as defined in claim 4, wherein said male die is provided with a supporting toe member projecting forwardly beyond its working face in the plane of its bottom side, the same being adapted to support the angle-iron to be bent with the horizontal flange of the latter disposed and aligned to enter said receiving channels of said auxiliary supporting and bending arms.

7. In a machine for bending angle-iron bars as defined in claim 4, wherein said male die is provided with a supporting toe member projecting forwardly beyond its working face in the plane of its bottom side, the same being adapted to support the angle-iron bar to be bent with the horizontal flange of the latter disposed and aligned to enter said receiving channels of said auxiliary supporting and bending arms, and wherein said male die is further provided with a presser piece having an undercut chamfered lip overhanging the vertical central portion of the working face thereof to engage the free edge portion of the vertical flange of said supported angle-iron bar.

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