June 8, 1948. W. J. OGDEN 2,442,859

METAL FORMING MACHINE.

Filed April 12, 1945 4 Sheets-Sheet 1

Fig. 1

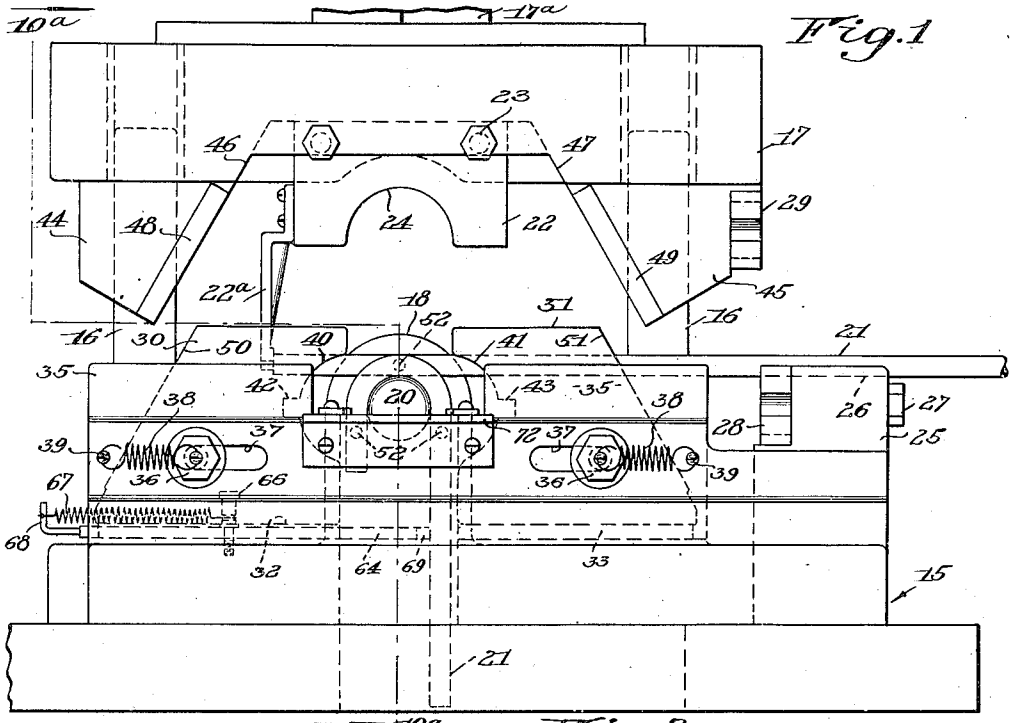


Fig. 2

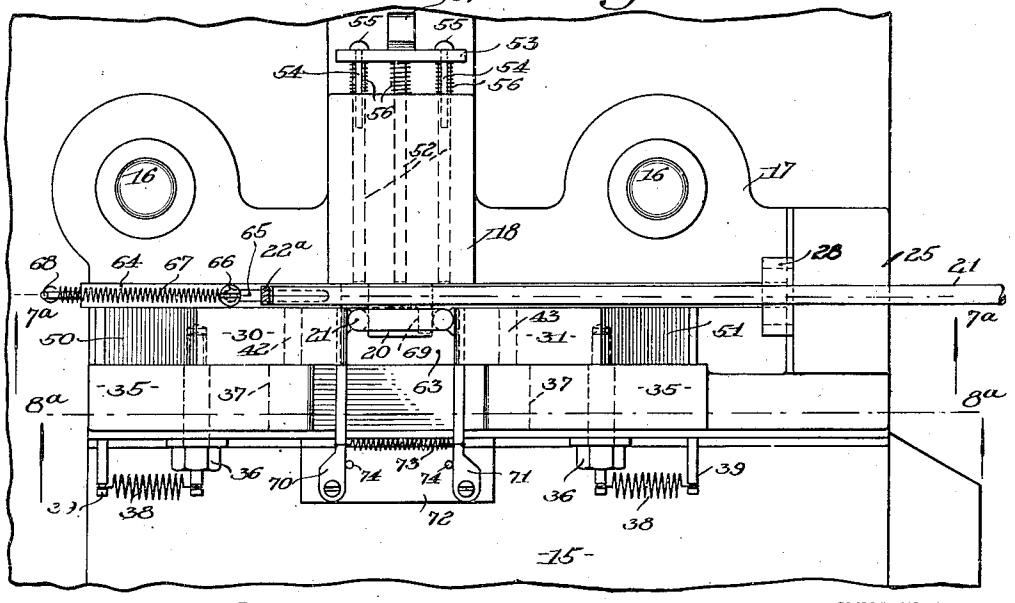
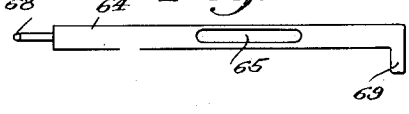


Fig. 3



INVENTOR.
William J. Ogden
BY
Edward H. Rumpston
his Attorney

June 8, 1948. W. J. OGDEN 2,442,859

METAL FORMING MACHINE

Filed April 12, 1945 4 Sheets-Sheet 2

Fig. 4

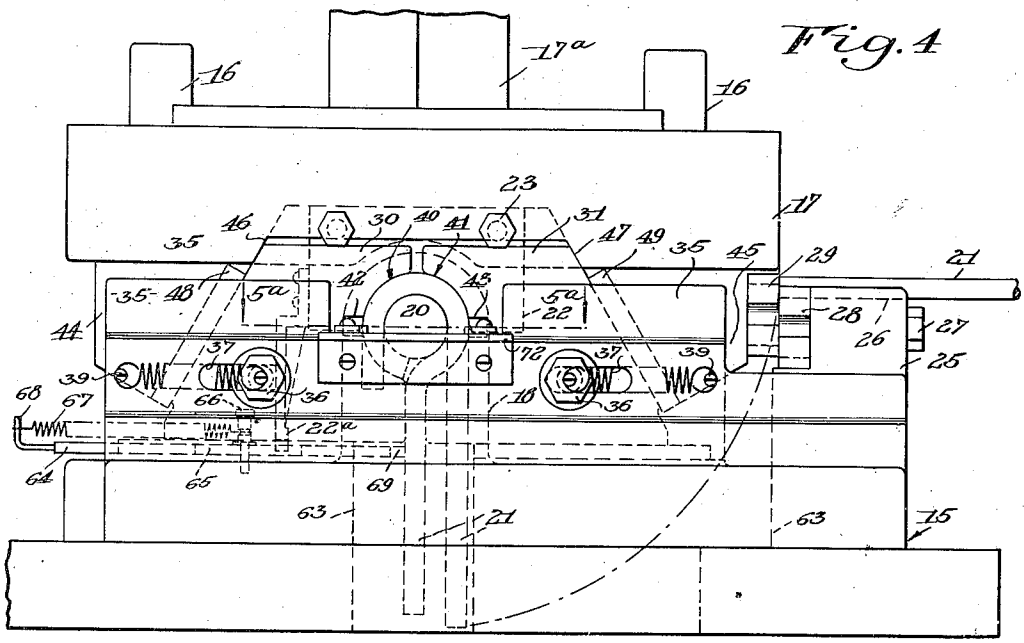


Fig. 5

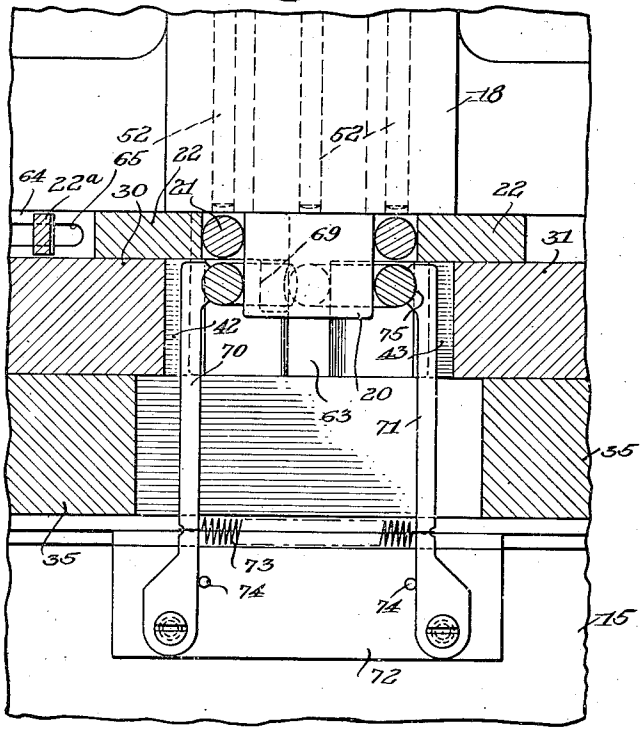
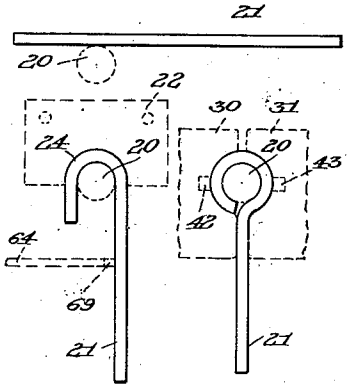


Fig. 6



INVENTOR.
William J. Ogden
BY Edward H. Rumpston
his Attorney

June 8, 1948. W. J. OGDEN 2,442,859

METAL FORMING MACHINE

Filed April 12, 1945 4 Sheets-Sheet 3

Fig. 7

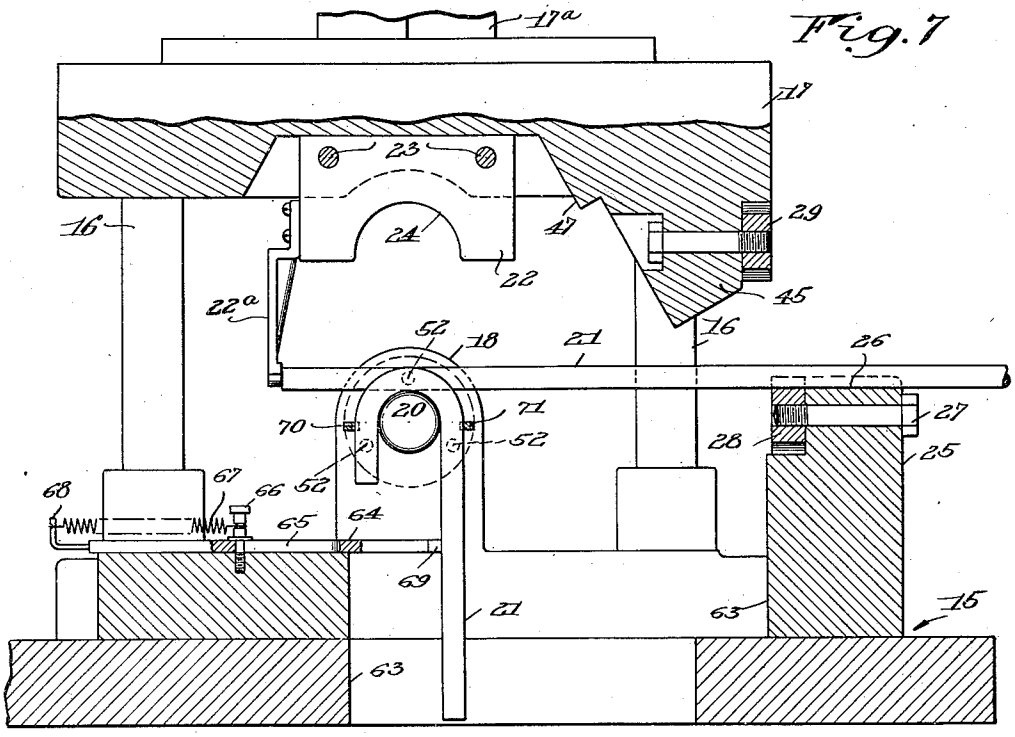
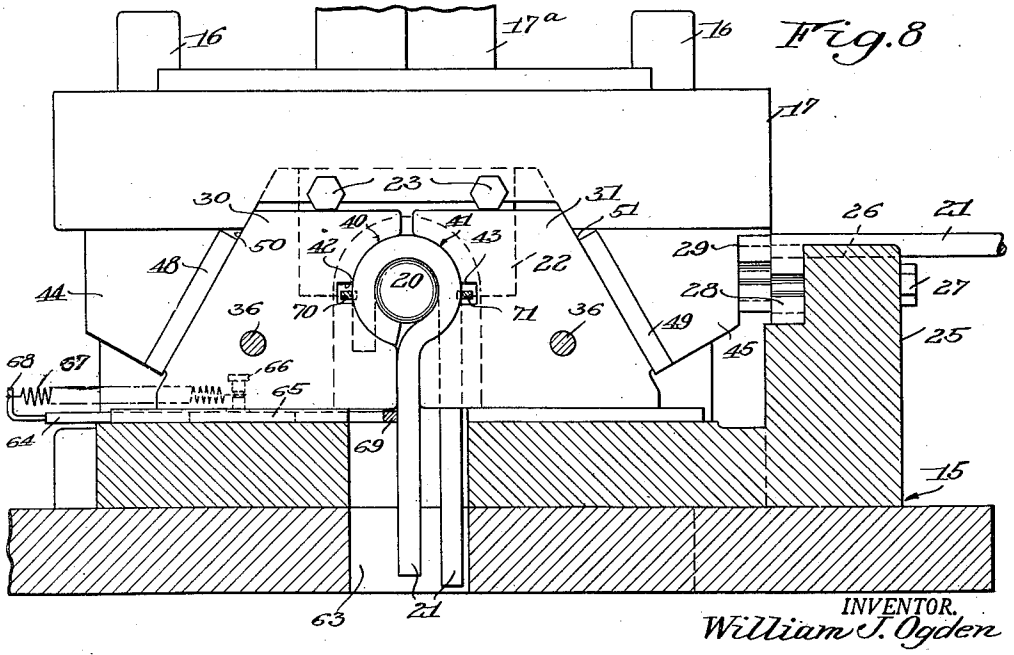


Fig. 8



INVENTOR.
William J. Ogden
BY Edward N. Cumpston
his Attorney

June 8, 1948. W. J. OGDEN 2,442,859

METAL FORMING MACHINE

Filed April 12, 1945 4 Sheets-Sheet 4

Fig. 9

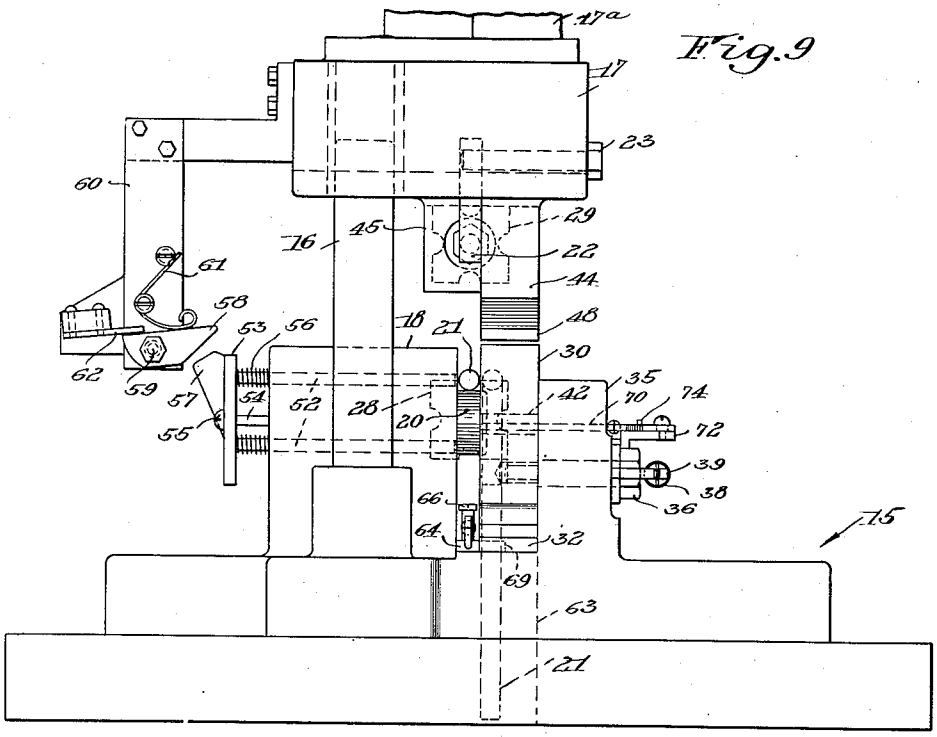
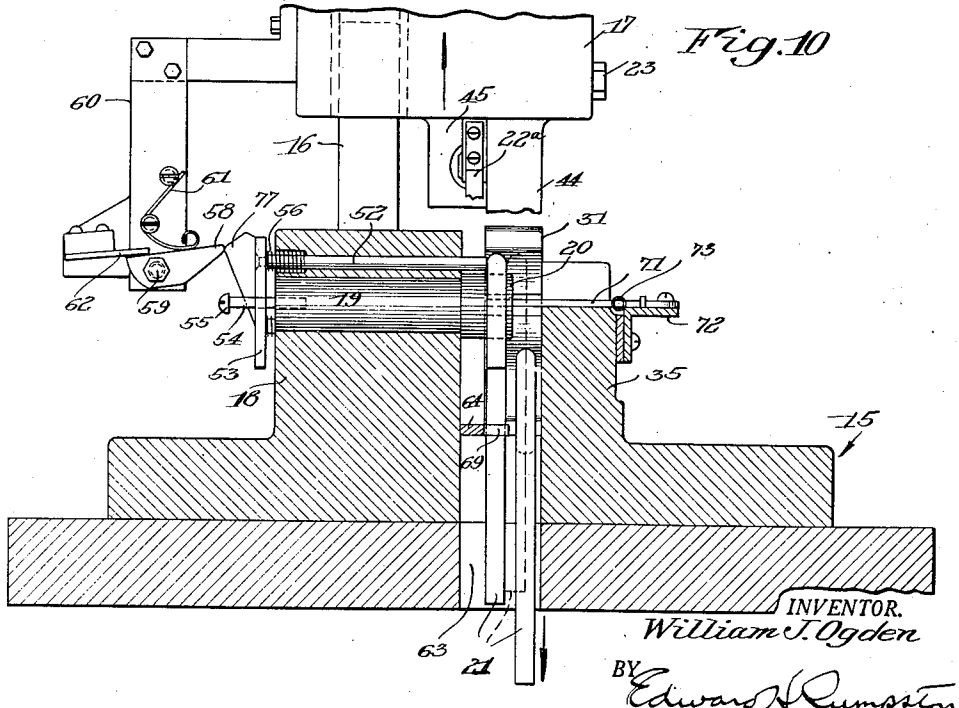


Fig. 10



INVENTOR.
William J. Ogden
BY Edward H. Rumpston
his Attorney

Patented June 8, 1948

2,442,859

UNITED STATES PATENT OFFICE

2,442,859

METAL FORMING MACHINE

William J. Ogden, Shortsville, N. Y., assignor to Papec Machine Company, Shortsville, N. Y., a corporation of New York

Application April 12, 1945, Serial No. 587,883

13 Claims. (Cl. 153—34)

1

This invention relates to metal forming machines and, more particularly, to rod bending machines, such as employed to form the eye portion of eye pins, bolts, hooks and the like, one object of the invention being to provide a more simple, practical and efficient machine of the character described.

Another object is to provide an improved machine of the above character capable of more accurately bending rods of substantial diameter without preliminary heating.

Another object is to provide a more automatic machine of the above type adapted for rapid production with a minimum of labor and expense.

To these and other ends the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawings:

Fig. 1 is a front elevation of a machine, partly broken away, embodying the present invention;

Fig. 2 is a top plan view of lower portions of the same, partly in section;

Fig. 3 shows a work guiding part detached;

Fig. 4 is a view similar to Fig. 1, but showing the dies closed on the work;

Fig. 5 is an enlarged section of portions of the machine on the line 5*a*—5*a* in Fig. 4;

Fig. 6 is a diagrammatic view of the successive operations of the machine;

Fig. 7 is a front elevation substantially on the line 7*a*—7*a* in Fig. 2;

Fig. 8 is a similar view on the line 8*a*—8*a* in Fig. 2, but showing the dies closed on the work;

Fig. 9 is a side elevation as viewed from the left in Fig. 1, and

Fig. 10 is a sectional elevation on the line 10*a*—10*a* in Fig. 1.

The invention is embodied in the present instance in a fixture for use with a die press of usual construction, but may be embodied directly in a die press itself, and provides a machine for bending metal rod stock of substantial, say, one-half inch diameter, to form an eye pin or finger shown in Figs. 6 and 8, for use as part of a feeding drum of a silage handling machine.

The present fixture comprises a frame, base portions of which, indicated generally at 15 (Figs. 1 and 2), are adapted for attachment to the bed of a press and carry the lower die elements hereafter described. Dowel guides 16 guide an upper head 17 carrying an upper die element, a shear plate and other parts, being reciprocated vertically by a shank 17*a* connected by any suitable means (not shown) with the ram of the press.

2

Rising from the rear of the base portion 15 is a post 18 (Figs. 9 and 10), in which is fixed a stationary, horizontal mandrel 19 having at its forward end a cylindrical portion 20 projecting forwardly from the post 18 and serving as one of the relatively movable die elements or members hereafter described. The rod 21 is first bent reversely, or into a U shape, around the mandrel 20, by means of an upper die element or plate 22 fixed in the head as by screws 23 and reciprocated vertically close to the front face of post 18. This die element has a substantially semi-circular forming surface 24 for bending the rod about the mandrel 20, the curved surface 24 having a diameter approximating the outer diameter of the eye to be formed in the rod.

The rod may be presented for such bending after being precut to final length, but the machine preferably comprises shearing means for cutting the rod to such length from a bar of stock, to facilitate feeding and increase the rate of production. For this purpose, the base portion of the machine has a post 25 having its top formed with a channel 26 along which a bar of stock may be slid longitudinally to present its end to the shearing means and between the mandrel and the die. An arm 22*a*, depending from the upper die 22, serves as a gauge or stop for locating the rod in the machine. The inner side of the top of the post has fixed thereto, as by means of a bolt 27, a square-shaped shear plate 28 having one of its cutting recesses alined with channel 26 in the post. A similar upper shear plate 29 is fixed to the adjacent end of the head 17, for cutting cooperation with the lower shear plate 28, to cut off a length of rod in the descent of the head. These parts are so arranged that the length of rod is sheared from the stock bar as the upper die engages the rod to free the rod for downward bending by the die.

The operations so far described are schematically illustrated in Fig. 6, where a length of rod 21 is shown presented above the mandrel 20, then bent downwardly by the upper die 22 around the mandrel into U shape, ready for further bending to complete the eye shape, by a second set of dies now to be described.

The second set of dies for completing the eye shape comprises, preferably, a pair of members or plates 30 and 31. These plates have their bottom edges slidably supported on ways 32 and 33 (Figs. 8 and 9) fixed on a horizontal surface 34 of the base of the frame in rear of an upright wall 35, which further guides the members 30 and

31 and to which they are slidingly attached by means of bolts 36 fixed in the die members so as to project forwardly through slots 37 in the wall 35 with washers under their heads abutting the front face of the wall, as shown. A coiled tension spring 38 is fixed to each bolt and to a screw 39 on the wall and serves to normally maintain the die member in its outward or open position.

The die members 30 and 31 have circular forming surfaces 40 and 41 for engaging the sides of the U-shaped end formed on the rod by the first set of dies and continuing the bending thereof to complete the eye or ring, as shown diagrammatically in Fig. 6. These forming surfaces are recessed at 42 and 43 for a clearance purpose hereafter described. The members 30 and 31 are moved inwardly to form the rod by actuating connections with the upper die 22 or the head which carries it, such connections comprising depending wings 44 and 45 on the head (Figs. 1 and 9), having inclined opposing faces 46 and 47, preferably surfaced by hardened wear strips 48 and 49 for engagement with correspondingly inclined outer edges 50 and 51 on the die members 30 and 31. It is evident from this construction that as the first set of dies, comprising the mandrel 20 and the upper die 22, are closed in a vertical direction, the second set of dies, comprising the mandrel and the members 30 and 31, are simultaneously closed in a horizontal direction to complete the forming of the eye in the end of the rod. For this purpose, a feeding means is provided for feeding a partially bent rod from the first to the second set of dies and for discharging a completed rod from the second set of dies, during each opening movement of the dies, as will now be described.

The means for feeding the rod from one set of dies to the other comprises, preferably, a series of rod fingers 52 (Figs. 9 and 10) sliding longitudinally in openings bored through the post 18 in spaced relation about the mandrel. The rear ends of the rod fingers are fixed in a plate 53 sliding on a pair of pins 54 fixed in the mandrel and having heads 55 for limiting the outward movement of the plate under the action of compression springs 56 coiled about the fingers 52 in recesses in the post 18, as shown. Plate 53 carries an inclined cam surface 57 for cooperation with a dog 58 pivoted at 59 on a bracket 60 fixed on the ram. A spring 61 tends to hold the opposite end or tail of the dog against a stop plate 62 on the bracket, which may serve also as a shear plate to yield and protect the feeding means in case of positive obstruction. During the descent of the head from the position shown in Fig. 9 to initially engage and bend a length of rod fed into the machine, the dog 58 yields upwardly without actuating the feeding means, but on the return or upward stroke of the head, as shown in Fig. 10, the dog cams the plate 53 forwardly to advance the fingers 52 and feed or slide the partially bent rod along the mandrel to position for operation thereon by the second set of dies during the subsequent downward stroke of the head. At the same time, the previously completed rod is pushed off the end of the mandrel, as shown in Fig. 1, and discharged or dropped from the machine through an opening 63 in the base of the frame.

Means are provided for continuously engaging and guiding the rod in position for operation thereon by both sets of dies and while being fed from one set to the other, comprising, preferably,

an arm 64 (Figs. 1, 3 and 9) sliding on the surface 34 of the base of the frame between the front of the mandrel post 18 and the slideway 32 of die member 30. The arm is formed with an elongated slot 65 embracing a stud bolt 66 in the frame for limiting the sliding movement of the arm. A coiled tension spring 67 is connected to the bolt and to a finger 68 on the arm for yieldably sliding the arm inwardly. The inner end of the arm is formed with a transversely turned guiding foot 69, positioned to engage the shank of the rod to hold it in vertical position, while being fed along the mandrel to position for engagement and final bending by the second set of dies. During the bending in the second set of dies, the guide arm yields as shown in Fig. 4, but is released upon discharge of a finished rod, for return by its spring to position for engaging and guiding the succeeding length of rod as described.

The rod positioning and guiding means comprises also a device for accurately locating a length of rod longitudinally of the mandrel as it is fed to position for operation thereon by the second set of dies, such means comprising, preferably, a pair of spaced parallel arms 70 and 71 (Figs. 2 and 5) pivoted at their outer ends on a horizontal bracket 72 on the outer face of the front wall 35 of the base. These arms are drawn toward each other by a coiled tension spring 73 against stop pins 74. The inner ends of the arms are formed with recesses 75 curved to fit the rod, the arms being slightly beveled at the inner ends of the recesses so that, as the rod is advanced by the feeding means, it spreads the arms and drops into the recesses 75 thereof by which the rod is accurately located lengthwise of the mandrel in position for cooperation with the horizontally moving dies 30 and 31, the latter being formed with the recesses 43 described above so as to clear the arms 70 and 71 in the closed position of the dies, as shown in Figs. 5 and 8.

In operation, the head being raised, a stock length of the rod material is slid along the channel 26 in the top of post 25 between the shear plates 28 and 29, and over the mandrel 20 into engagement with the stop 22*a*. As the head descends, a length of rod is sheared off and engaged between the mandrel and the upper die 22 which bends the rod around the mandrel into U shape as shown. As the head rises again, the feeding means slides the partially bent rod along the mandrel under guiding engagement by the foot 69 of the guide arm until the rod is snapped into the recesses of the guide arms 70 and 71 which positions it longitudinally of the mandrel for cooperation with the horizontally moving dies 30 and 31. As the head again descends to repeat the operation so far described, the dies 30 and 31 are closed to continue the bending of the rod around the mandrel to complete its eye shape. As the head again rises and another length of rod is fed along the mandrel as described, the completed rod is pushed off the end of the mandrel and discharged from the machine. The machine is preferably driven continuously during such operation, although it may be operated intermittently if so desired.

The described construction accomplishes the cutting off and bending of a rod of substantial diameter in a cold state in two operations, automatically and rapidly and so as to require merely the labor of feeding the stock into the machine. After severing from the stock, the lengths of rod are continuously and precisely fed and guided, from one set of dies to the other, and discharged

in completed state. No interruption of the operation of the machine is required for feeding in, positioning, removing, or otherwise handling the work and the machine affords a rapid rate of production with marked economy of time and labor.

The invention thus accomplishes its objects and while it has been herein disclosed by reference to the details of a preferred embodiment, it is to be understood that such disclosure is intended in an illustrative, rather than a limiting sense, as it is contemplated that various modifications of the construction and arrangement of the parts will readily occur to those skilled in the art, within the spirit of the invention and the scope of the appended claims.

I claim:

1. A rod bending machine comprising a set of relatively movable dies for bending a length of rod to partially form the same, a second set of relatively movable dies for performing a second bending operation on said rod, said sets of dies having a die element in common, actuating means for operating said sets of dies simultaneously for operating simultaneously on a plurality of lengths of rod, and means for feeding a length of rod along said common die element from one of said sets of dies to the other thereof for successive operations thereon.

2. A metal forming machine comprising a set of relatively movable dies for bending a work piece to partially form the same, a second set of relatively movable dies for continuing the bending of the work piece, said sets of dies having a die element in common, actuating means for closing said sets of dies simultaneously, and means for sliding said work piece along said common die element from one of said sets of dies to the other thereof for successive operations thereon.

3. A metal forming machine comprising a set of relatively movable dies for bending a work piece to partially form the same, a second set of relatively movable dies for continuing the bending of the work piece, said sets of dies having a stationary die element in common, actuating means for operating said sets of dies in timed relation with each other, and means for sliding said work piece along said common die element from one of said sets of dies to the other thereof for successive operations thereon.

4. A metal forming machine comprising a set of relatively movable dies for bending a work piece to partially form the same, a second set of relatively movable dies for continuing the bending of the work piece, said sets of dies having a stationary die element in common, actuating means for said sets of dies for closing the same simultaneously, and means for feeding said work piece from one of said sets of dies to the other thereof for successive operations thereon.

5. A metal forming machine comprising a set of relatively movable dies for bending a work piece to partially form the same, a second set of relatively movable dies for continuing the bending of the work piece, said sets of dies having a stationary die element in common, actuating connections between said sets of dies for opening and closing the same simultaneously, and means for feeding said work piece along said common die element from one of said sets of dies to the other thereof for successive operations thereon.

6. A metal forming machine comprising shear plates, a set of dies movable relatively to one another in one direction for bending a work piece to partially form the same, a second set of dies movable relatively to one another in a direction transverse to the direction of movement of said first set of dies for continuing the bending of the work piece, actuating means for opening and closing said shear plates and said sets of dies simultaneously, and means for feeding said work piece from one of said sets of dies to the other thereof for successive operations thereon.

7. A rod bending machine comprising a stationary mandrel, a die element movable toward and from said mandrel for partially bending a rod, a pair of die members movable toward and from said mandrel for continuing the bending of said rod, actuating means for operating said die element and members in timed relation with each other, and means for feeding said rod along said mandrel from said die element to said die members for successive operations thereon.

8. A rod bending machine comprising a stationary mandrel, a die element movable in one direction toward and from said mandrel for partially bending a rod, a pair of die members movable in opposite directions, respectively, toward and from said mandrel, transversely to the direction of movement of said die element, for subsequently completing the bending of said rod, actuating means for moving said die element and said pair of die members in timed relation with each other for operating simultaneously on a plurality of rods, and means for feeding a rod from said die element to said die members for successive operations thereon.

9. A rod bending machine comprising a stationary mandrel, a die element movable in one direction toward and from said mandrel for partially bending a rod, means for moving said element, a pair of die members movable in opposite directions, respectively, toward and from said mandrel, transversely to the direction of movement of said die element, for continuing the bending of said rod, cam means connecting said die element with said pair of die members for moving said members during the movement of said element for operating simultaneously on a plurality of rods, and means for feeding a rod from said die element to said die members for successive operations thereon.

10. A rod bending machine comprising a frame, a set of relatively movable forming dies on said frame, positioning means on said frame comprising a gauge for presenting rod stock to said dies, means spaced from said dies for shearing a length of rod from said stock while positioned between said forming dies, a second set of relatively movable dies on said frame for continuing the bending of said length of rod to complete the forming thereof, means for actuating said shearing means and said sets of dies in timed relation with each other for bending a plurality of rods simultaneously, and means for feeding a rod from one of said sets of dies to the other thereof for successive operations thereon.

11. A rod bending machine comprising a frame, a set of relatively movable forming dies on said frame, positioning means on said frame comprising a gauge for presenting rod stock to said dies, cooperating shear plates spaced from said dies and connected with a movable one of said dies and with said frame, respectively, for shearing a length of rod from said stock while positioned between said forming dies, a second set of relatively movable dies for continuing the bending of said rod, means for actuating said shear plates and said sets of dies in timed relation with each other for simultaneously bending a plurality of

rods, and means for feeding a rod from one of said sets of dies to the other thereof for successive operations thereon.

12. A rod bending machine comprising a frame, a set of relatively movable forming dies on said frame, positioning means comprising a gauge on said frame for presenting a length of rod stock to said dies, shear plates actuated by a movable one of said dies for shearing a length of rod from said stock for bending in said set of dies to partially form the same, a second set of relatively movable dies on said frame for continuing the bending of said rod, said sets of dies having a stationary die element in common, actuating means for actuating said shear plates and said sets of dies in timed relation to each other for simultaneously bending a plurality of rods, and means for feeding a rod along said common die element from one of said sets of dies to the other thereof for successive operations thereon.

13. A rod bending machine comprising a frame, a stationary mandrel on said frame, a die element movable in one direction on said frame toward and from said mandrel, positioning means comprising a gauge on said frame for presenting a length of rod stock to said mandrel, means for shearing a length of rod from said stock for bending by said die element on said mandrel to partially form the same, a pair of die members movable in opposite directions on said frame toward and from said mandrel, transversely of the direction of movement of said die element, for continuing the bending of said rod, means for actuating said shearing means and die element and members in coordinated timed relation for simultaneously bending a plurality of rods, feeding means for moving a rod along said mandrel from said die element to said die members for successive operations thereon and for discharging the same from said machine, and means for continuously engaging and positioning said rod relative to said die element and members and while being fed therebetween.

WILLIAM J. OGDEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
261,977	Adt	Aug. 1, 1882
270,362	Alpress	Jan. 9, 1883
711,631	Irvin	Oct. 21, 1902
1,517,693	Arnt et al.	Dec. 2, 1924
2,158,176	Dewey	May 16, 1939

FOREIGN PATENTS

Number	Country	Date
254,504	Great Britain	July 8, 1926
325,683	Great Britain	Feb. 9, 1929