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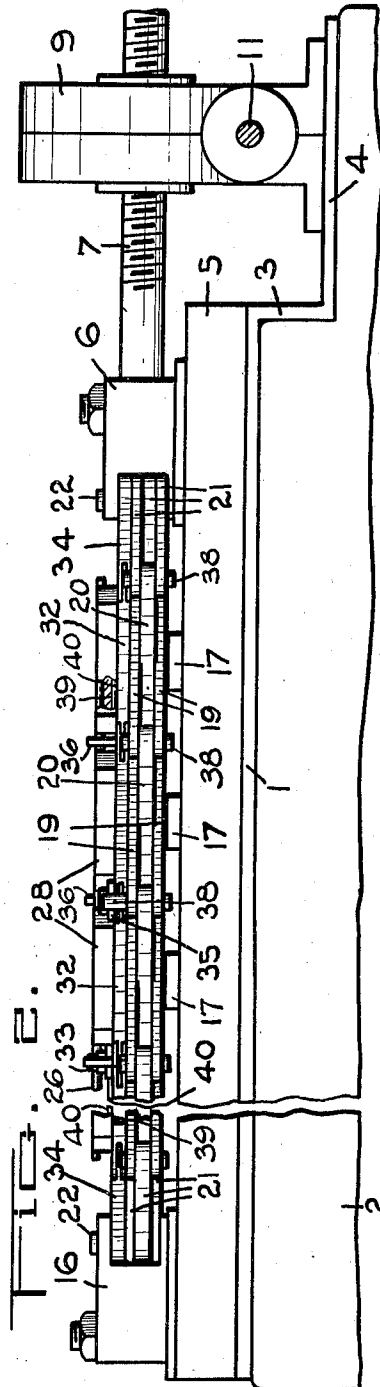
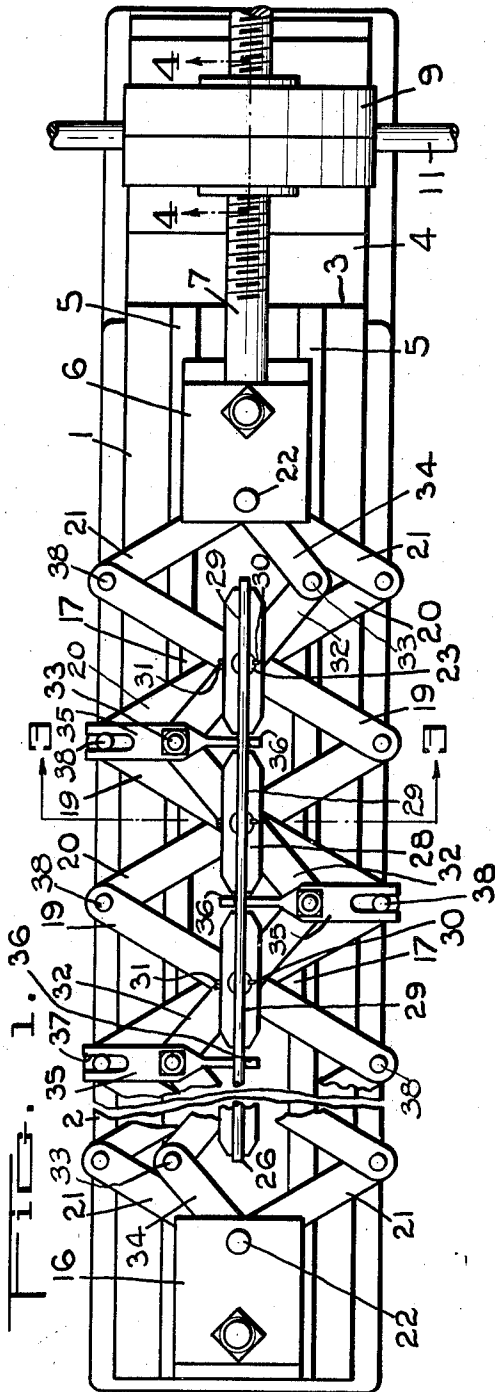
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2,086,736

ROD BENDING MACHINE

Filed Jan. 31, 1936

2 Sheets-Sheet 1



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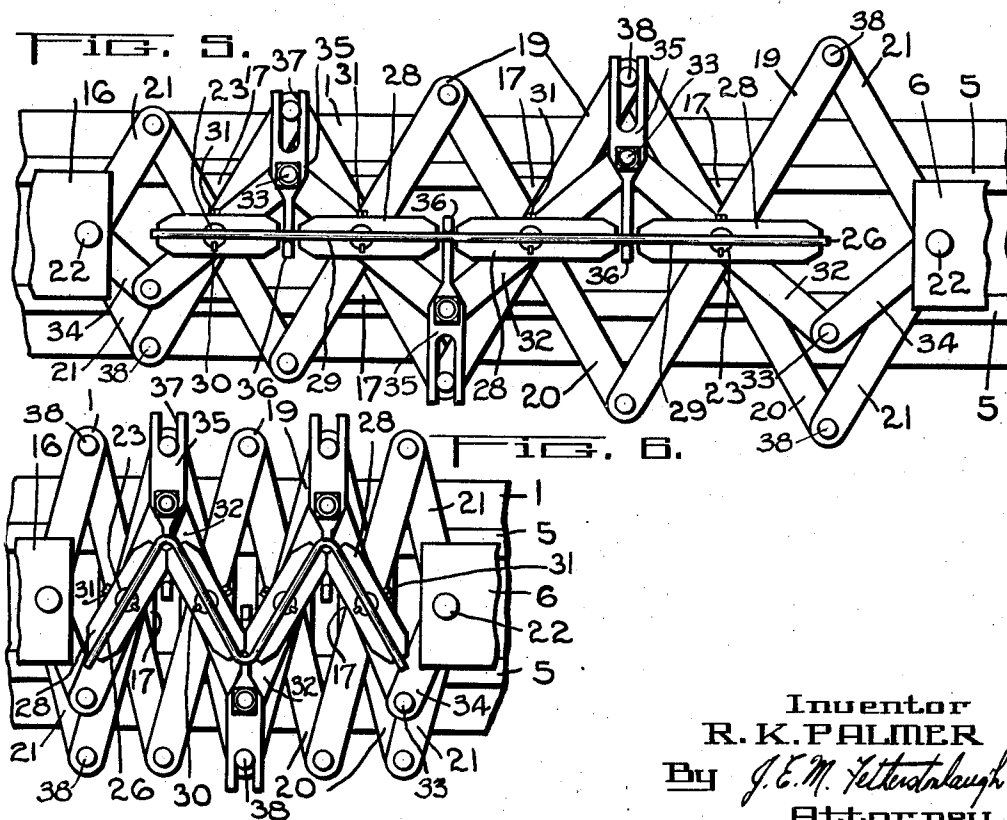
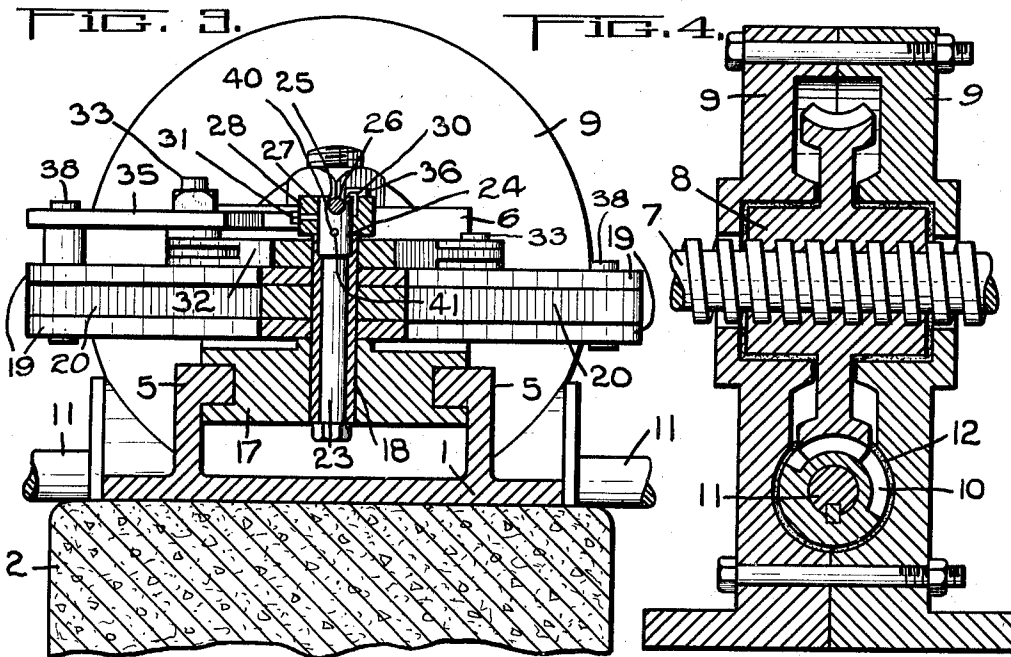
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ROD BENDING MACHINE

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15 Claims. (Cl. 153—20)

My invention relates to improvements in rod bending machines, and the object of the invention is to devise means for simultaneously effecting a plurality of bends in a straight rod.

5 A further object is to devise means for facilitating the starting of the bending operation.

A still further object is to construct a machine which, by the changing of the elements of the bending mechanism, will produce a bent rod in 10 which the bends are differently disposed and may be either uniform or variable.

My machine is particularly applicable for forming from straight rods Z or zig-zag skeleton webs for structural shapes or for forming reinforcing 15 rods for concrete constructions, it being understood that the web so formed has all its bends disposed in the same plane.

With the above and other objects in view which will hereinafter appear as the specification proceeds, my invention consists, in its preferred embodiment, of the construction and arrangement 20 all as hereinafter more particularly described and illustrated in the accompanying drawings in which:—

25 Fig. 1 represents a plan view, shortened intermediately, of my machine.

Fig. 2 is a side elevational view thereof.

Fig. 3 is an enlarged vertical cross-sectional view taken on the line 3—3 (Fig. 1).

30 Fig. 4 is an enlarged vertical sectional view of the driving gears of my machine taken on the line 4—4 (Fig. 1).

Fig. 5 is a fragmentary view similar to Fig. 1 showing an alternative arrangement of bending 35 elements for a bent rod in which the bends taper in height from one end to the other, and

Fig. 6 is a fragmentary view similar to Fig. 1 showing the elements of the machine in the position they assume when the rod is completely 40 bent.

Like characters of reference indicate corresponding parts in the different views.

My machine comprises a bed 1 preferably supported on a concrete base 2, a bracket 3 on the 45 bed having a plate 4 secured thereto. Opposed guides 5, 5 extend longitudinally and centrally of the bed 1 in which a driving block 6 is adapted to slide, such driving block being secured to one end of a longitudinal screw 7. The screw 7 is 50 carried in a correspondingly threaded gear 8 journaled in a split housing 9 secured to the plate 4. The gear 8 meshes with a worm 10 on a shaft 11 also journaled in the housing 9 and which may be driven by any suitable power means. The 55 housing 9 is adapted to be filled with heavy oil

or grease and sealing rings 12 therefor may be disposed on the shaft 11 between each end of the worm 10 and the adjacent face of the housing 9. The threading of the screw 7 is preferably of the square type.

A stationary block 16 is secured in the guides 5 at the end of the bed 1 remote from the housing 9, and a plurality of blocks 17 are adapted to slide in the guides 5 between the blocks 6 and 16. Each sliding block 17 has a vertically dis- 10 posed hollow fulcrum bearing 18 secured therein on which crossed links 19 and 20 of a lazy tongs mechanism are pivoted intermediately of their length. Each link 20 is interposed between the 15 links 19 which are double and the free ends of the double links are pivoted to the corresponding free ends of the single links. The end links 21 of the lazy tongs mechanism are half links and are pivoted on fulcrum pins 22, 22 secured in the 20 blocks 6 and 16 respectively.

A pin 23 is rotatably secured in the bore of each fulcrum bearing 18, and has an enlarged head 24 projecting above the bearing in which is a notch 25 to receive the rod 26 to be bent. The heads 24 of the pins are received in central verti- 25 cal orifices 27 in rod clamps 28 which are provided with longitudinal rod-receiving grooves 29 of the same cross-section as the notches 25 in the pin heads, which grooves and notches are adapted to register with each other, the clamps being 30 secured against rotation on the pins by, for example, keys 30, and against vertical displacement therefrom by set-screws 31.

Links 32 are pivoted intermediately of their length on the fulcrum bearings 18 above the 35 bars 19 and 20 and their free ends are pivoted together on pins 33, the end links 34 of such link system being half links pivoting on the fulcrum pins 22 in the blocks 6 and 16. The links 32 and 34 are of such length that ad- 40 jacent links are always disposed at an angle to each other even when the lazy tongs mechanism is extended to the limits of its travel. A bend starting hook 35 is secured to each of the pins 33 to overlies the bars 32, one end of 45 which is adapted to underlie the bar 26 to be bent when the latter is positioned in the clamps 28 and has a rod engaging upstanding projection 36 thereon, and the other end of which is provided with a longitudinal slot 37 in which 50 one of the pivot pins 38 for the levers 19 and 20 is adapted to slide.

A longitudinal notch 39 is also provided in the lower face of each clamp 28 which is adapted to receive a cable 40 running longitudinally of 55

the machine through orifices 41 in the head 24 of each pin 23 and anchored at each end in the corresponding pin head, which serves to align the clamps 28 when the lazy tongs mechanism is extended.

The operation of the device is as follows: By rotating the shaft 11 in the proper direction the worm 10 thereon causes the gear 8 to rotate, and since such gear is held against axial displacement in the housing 9 the screw 7 draws the driving block 6 in the guides 5 away from the fixed block 16 which results in the lazy tongs mechanism being opened up until the cable 40 has rotated the clamps 23 into such position that all the rod receiving grooves 29 therein are in alignment. During such movement of the lazy tongs mechanism the links 32 and 34 move the starting hooks 35 toward the longitudinal centre line of the lazy tongs. The rod 26 to be bent is then inserted into the grooves 39 and the shaft 11 is rotated in the opposite direction to cause the screw 7 to move the driving block 6 towards the fixed block 16. When this occurs, the closing up of the link system 32, 34 causes the starting hooks 35 to move away from the longitudinal centre line of the lazy tongs and the projections 36 engage the rod 26 and start the bending operation which is then continued by the closing up of the lazy tongs mechanism.

It will be observed that, due to their angular relationship, the links 32, 34 carrying the starting hooks swing faster than the links 19, 20 of the lazy tongs mechanism, but slower than the rod bends once the bends are started and since the starting hooks are disposed alternately on opposite sides of the lazy tongs mechanism a rod bent alternately one way and then the other is fabricated. It will also be evident that the moving relationship between the starting hooks, the rod clamps and the rods is always such that there is complete clearance between these parts.

It will be obvious from the above description and the drawings that by altering the length of the links 19 and 20 and the length of the rod clamps 28 the rod instead of being bent to have uniform bends through its length may be so bent that these bends taper from one end to the other (Fig. 5), from each end towards the centre, or in any other desired arrangement.

An advantage of my improved machine is that a large number of bends may be made in a rod therewith simultaneously, so that the machine will have a very high output of bent rods.

Yet another advantage is that, by providing a number of interchangeable rod clamps, lazy-tong links and bend starting links of different dimensions for the machine, a number of different types of bent rods having different arrangements of the bends may be produced in the one machine.

A further advantage is that the position of each bend in a rod bent in my machine is always exactly located by the rod clamps, so that all bent rods produced in the machine with one set of clamps are exact duplicates of each other and the bends of each rod lie wholly in one plane. In addition, substantially the whole length of each part of a rod between bends is supported by a rod clamp during bending of a rod, resulting in such parts being straight in the finished bent rod.

What I claim as my invention is:

1. A rod bending machine comprising a plurality of rotatable rod engaging elements, means for slidably positioning the rod engaging ele-

ments in alignment and in spaced relation to receive a rod to be bent, means for engaging the rod between each pair of rotatable rod engaging elements for effecting initial bending of the rod, and means for simultaneously decreasing the spacing between the rotatable rod engaging elements in the means for slidably positioning the latter to complete the bending of the rod.

2. A rod bending machine comprising a lazy tongs, means for opening and closing the lazy tongs, rotatable rod engaging elements positioned at the central intersections of the bars of the lazy tongs, means for aligning the rod engaging elements during opening of the lazy tongs to receive a rod to be bent and means coacting with the lazy tongs for engaging the rod between each pair of rotatable rod engaging elements and adapted to effect initial bending of the rod, the closing of the lazy tongs serving to complete the bending of the rod.

3. A rod bending machine as claimed in claim 2 wherein the means for opening and closing the lazy tongs comprises means in the machine for positioning one end of the lazy tongs, a screw secured to the other end of the lazy tongs, a rotatable element threaded on said screw and secured against axial displacement in the machine, and means for rotating the rotatable element.

4. A rod bending machine as claimed in claim 2 wherein the rod aligning means comprises a flexible member interconnecting said rotatable rod engaging elements.

5. A rod bending machine as claimed in claim 2 wherein the means coacting with the lazy tongs for engaging the rod comprises a plurality of levers each pivoted on the lazy tongs at a central intersection of a pair of bars thereof, a pin pivotally connecting one end of each lever to one end of the adjacent lever and a rod engaging member carried on each pin, the length of the levers being such that the rod engaging members are disposed alternately on opposite sides of the longitudinal centre line of the lazy tongs when the latter is open.

6. A rod bending machine comprising a bed, a guideway thereon, a plurality of blocks slidably secured in the guideway, a fulcrum on each block, a pair of crossed bars pivoted intermediately of their ends on each fulcrum and pivotally connected together to form a lazy tongs, means for opening and closing the lazy tongs, a rod clamp rotatably positioned on each fulcrum, means for aligning the rod clamps during opening of the lazy tongs to receive a rod to be bent, a plurality of levers pivoted intermediately of their ends one on each fulcrum, a pin pivotally connecting one end of each lever to one end of the adjacent lever, and a bend starting hook carried on each pin, said levers being of such length that the bend starting hooks are disposed alternately on opposite sides of the longitudinal centre line of the lazy tongs when the latter is open.

7. A rod bending machine as claimed in claim 6 wherein the means for opening and closing the lazy tongs comprises a member secured in the guideway to which one end of the lazy tongs is pivotally secured, a member slidable in the guideway to which the other end of the lazy tongs is pivotally secured, and means for moving the member slidably in the guideway away from and toward the member secured in the guideway.

8. A rod bending machine as claimed in claim 6 wherein the means for opening and closing the lazy tongs comprises a member secured in the

guideway to which one end of the lazy tongs is pivotally secured, a member slidable in the guideway to which the other end of the lazy tongs is pivotally secured, a threaded rod secured to the member slidable in the guideway, a rotatable member threaded on the rod, means on the bed for rotatably supporting the rotatable member against axial displacement in the machine, and means for rotating the rotatable member.

9. A rod bending machine as claimed in claim 6 wherein each rod clamp comprises a block having a rod receiving groove therein.

10. A rod bending machine as claimed in claim 6 wherein each rod clamp comprises a block having a rod receiving groove therein and the rod clamp aligning means comprises a flexible member secured at one end to the fulcrum adjacent one end of the lazy tongs and at the other end to the fulcrum adjacent the other end of the lazy tongs and means on each rod clamp for engaging the flexible member.

11. A rod bending machine as claimed in claim 6 wherein each bend starting hook comprises a plate, a hooked projection thereon adapted to underlie and engage the rod to be bent, and means on the plate and engaging the lazy tongs for maintaining the hook at right angles to the axis of extension of the lazy-tongs during opening and closing of the lazy tongs.

12. A rod bending machine comprising a bed, a guideway thereon, a plurality of blocks slidable in the guideway, a hollow fulcrum bearing projecting from each block, a pair of levers journaled on each fulcrum bearing in X formation, a pin connecting one free extremity of each lever to the opposite extremity of the adjacent lever, a fixed block in one end of the guideway, a pin secured in the block, a pair of links pivotally connecting the pin with the free extremities of the adjacent pair of crossed levers, a driving block slidable in the other end of the guideway, a pin secured in the driving block, a pair of links pivotally connecting the pin with the free extremities of the adjacent pair of crossed levers, a threaded rod secured to the driving block, a worm gear threaded on the rod, a housing secured to the bed and in which the gear is journaled against radial displacement, a worm journaled in the housing and meshing with the gear, a pin rotatably secured in each fulcrum

bearing, a rod clamp mounted on each pin, means for aligning the rod clamps to receive a rod to be bent during outward movement of the driving block in the guideway, a bend starting bar journaled intermediately of its ends on each fulcrum bearing, a pin pivotally connecting one extremity of each bend starting bar to one extremity of the adjacent bar, a link pivotally connecting the pin in the fixed block to the free end of the adjacent bend starting bar, a link pivotally connecting the pin in the driving block to the free end of the adjacent starting bar, the lengths of the bend starting bars being such that each is disposed at an angle to its neighbour when the driving block is positioned at the outer limit of its movement in the guideway, and a bend starting hook pivoted on each pivot pin of the bend starting bars adapted to engage the rod to be bent at a point between each adjacent pair of rod clamps, the bend starting hooks being directed alternately towards opposite sides of the guideway.

13. In a rod bending machine as claimed in claim 12, a head on the pin rotatably secured in each fulcrum bearing and having a rod receiving transverse groove therein, a rod clamp comprising a block having a pin head receiving orifice therein and a rod receiving groove adapted to register with the groove in the pin head, and means for preventing relative rotation of the pin head and the clamp.

14. A rod bending machine as claimed in claim 12 wherein the means for aligning the rod clamps comprises a cable secured at one end to the pin rotatably secured in the fulcrum bearing adjacent the fixed block and at the other end to the pin rotatably secured in the fulcrum bearing adjacent the driving block and passing through orifices in the intervening pins and through grooves in the rod clamps registering with such orifices.

15. A rod bending machine as claimed in claim 12 wherein each bend starting hook comprises a plate having an orifice for receiving one of the said pins pivotally connecting a pair of starting bars and having a slot therein adapted to slidably receive the pin on which the adjacent levers of the first mentioned lever system are pivoted.

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