

June 14, 1932.

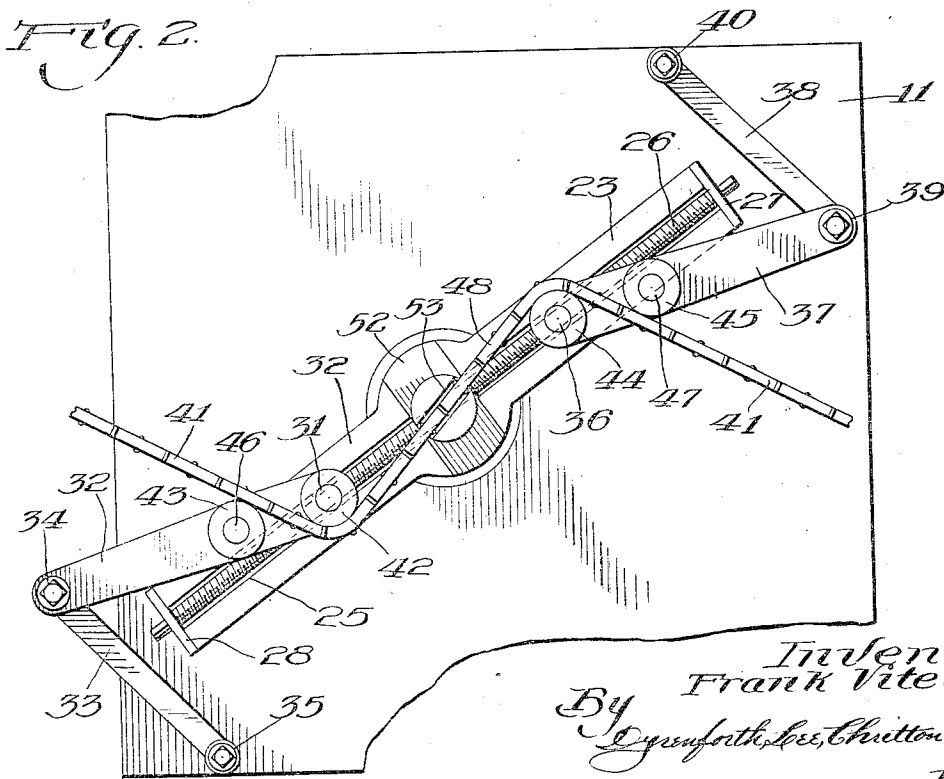
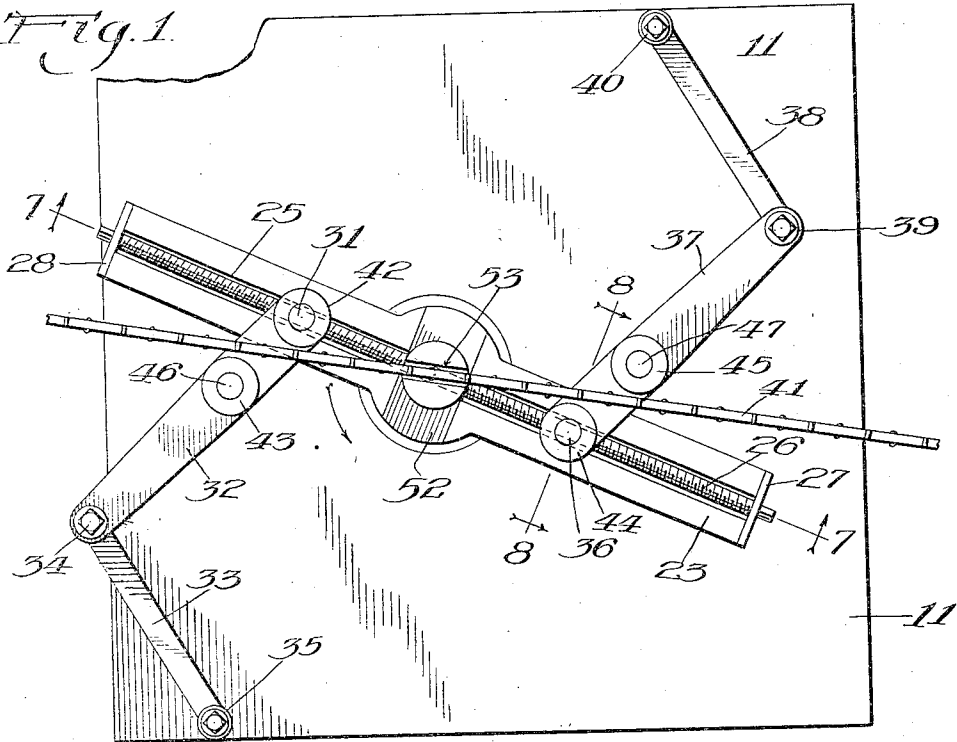
F. VITELLI

1,863,513

BENDING MACHINE

Filed May 8, 1930

4 Sheets-Sheet 1



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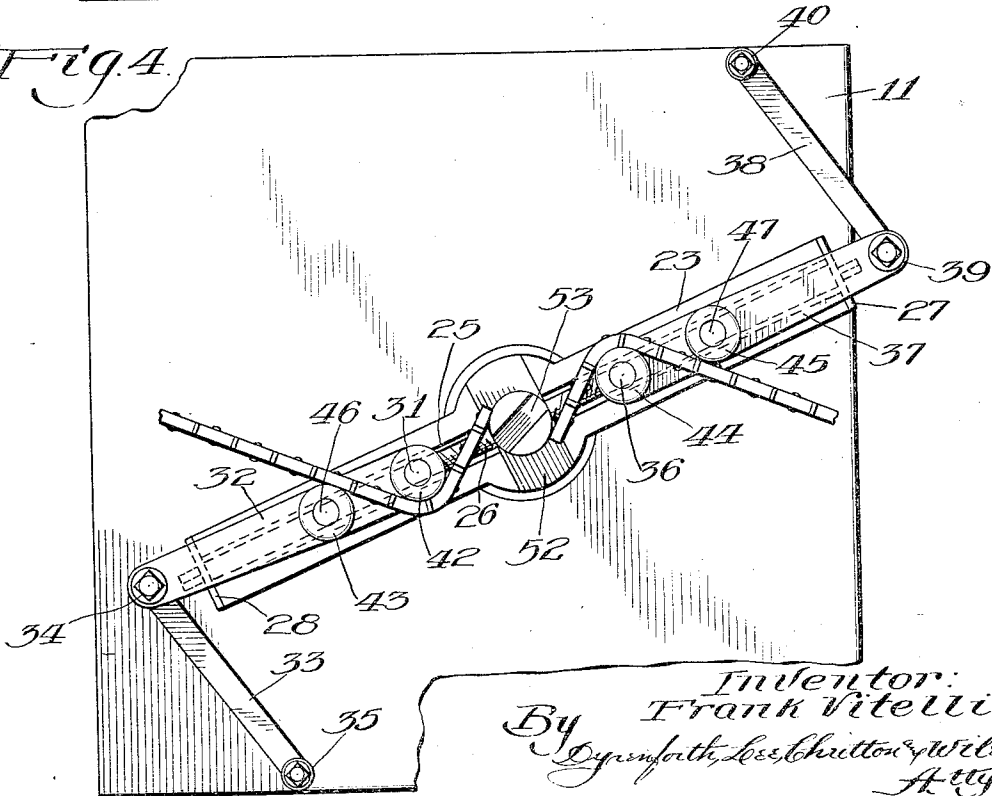
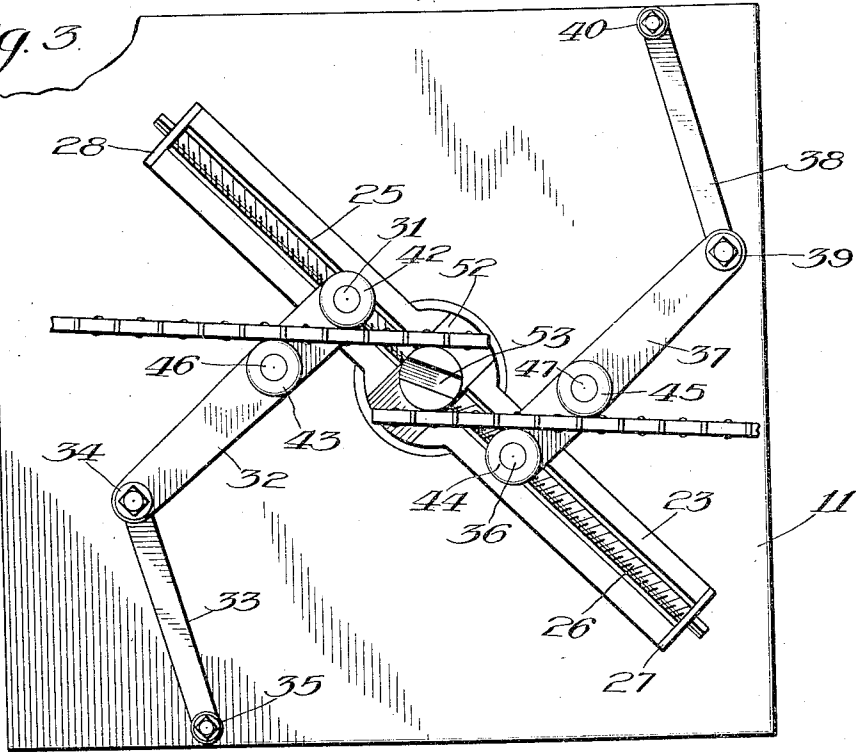
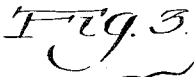
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BENDING MACHINE

Filed May 8, 1930

4 Sheets-Sheet 2



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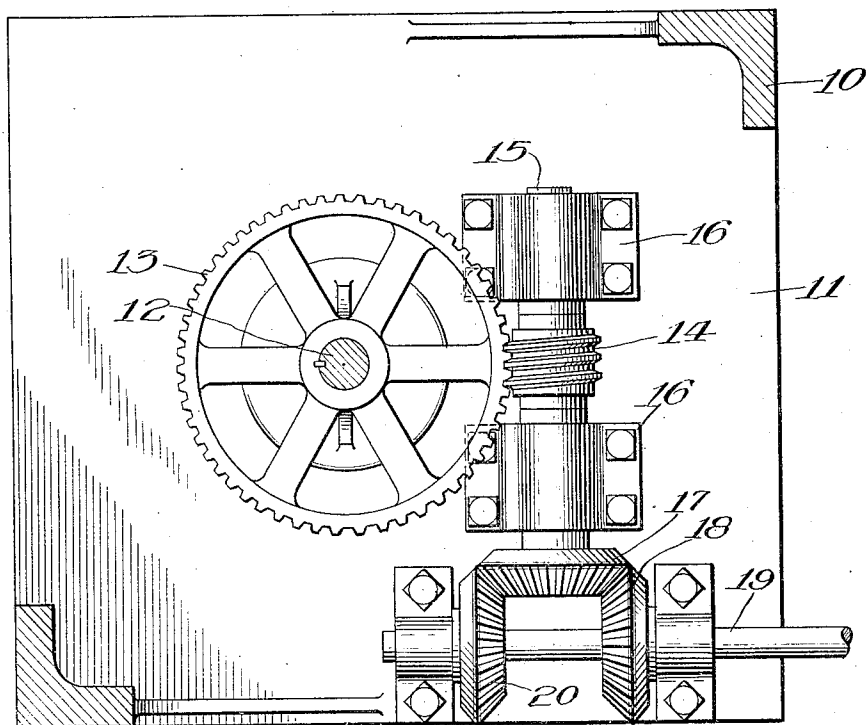
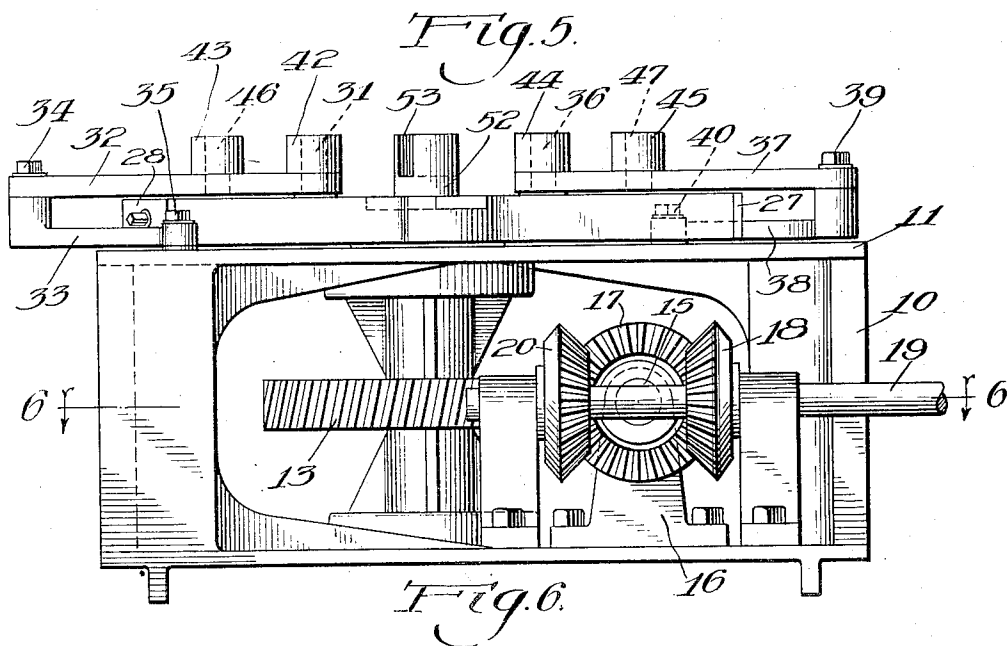
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BENDING MACHINE

Filed May 8, 1930

4 Sheets-Sheet 3



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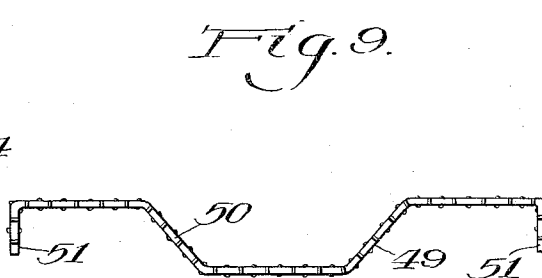
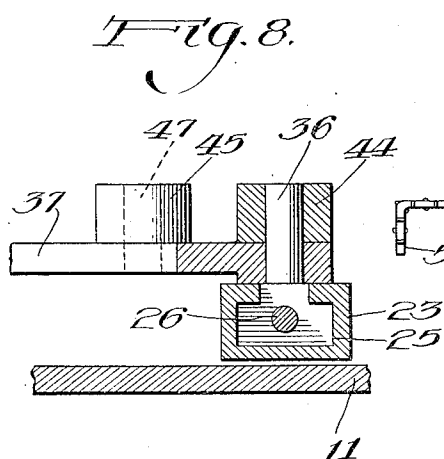
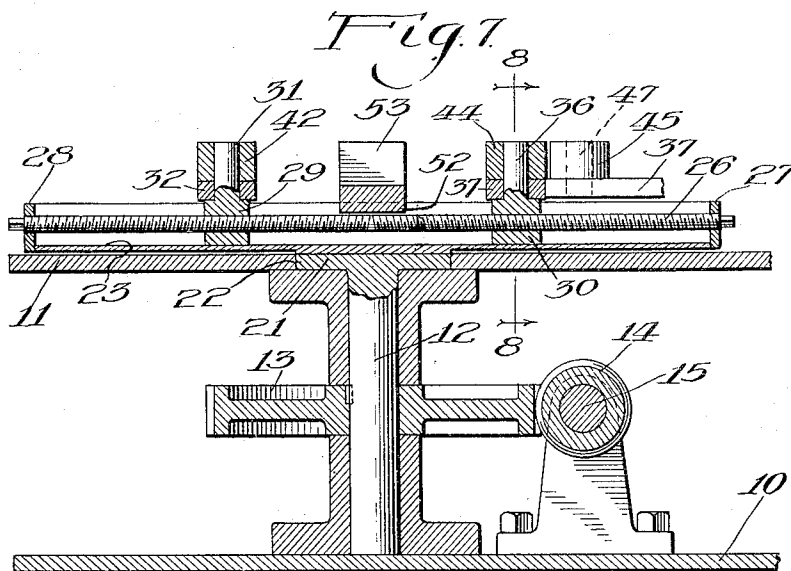
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BENDING MACHINE

Filed May 8, 1930

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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BENDING MACHINE

Application filed May 8, 1930. Serial No. 450,757.

My invention relates more particularly to machines for bending rods or bars such as, and more especially, concrete-reinforcing bars, the present application being a continuation in part of my application for United States Letters Patent Serial No. 358,005, filed April 25, 1929.

Reinforcing bars for use in certain situations are provided with bodily offset portions of general yoke form between their ends, commonly produced by reversely bending the bars; one of my objects being to provide a novel, simple, and positively operating machine for this purpose.

Other more specific objects are as follows:

To provide a machine by which the number of operations required for producing such offset portions will be reduced.

To provide a machine by which each offset portion of the bar may be produced by only two operations.

To provide a machine for the purpose stated which may be adjusted to vary the depth of the offset portion.

To provide a machine for the purpose stated which may be adjusted to vary the angularity of the opposite side portions of said offset portions.

To provide a machine for the purpose stated which may be adjusted to vary the depth of the offset portions and the angularity of the opposite side portions thereof.

To provide a machine for the bending of bars, or rods, from which the bars, or rods, may be easily removed after bending.

To provide a machine which will make bends greater than right angle bends if desired.

To provide a machine which will receive to be bent, bars, or rods, of different sizes without requiring adjustment of the parts of the machine.

To provide a machine which will be adapted for varying the radii of the bend, or bends, produced in the article.

To provide a machine wherein the resistance afforded by the article to bending is so balanced as to render the machine practical for mechanical operation.

To provide a machine by which reinforcing

bars having deflected portions may be quickly and easily produced and with the minimum requirement of labor; and other objects as will be manifest from the following description.

Referring to the accompanying drawings:

Figure 1 is a plan view of a machine embodying my invention showing the parts thereof in the position they occupy for receiving the bar to be bent, the latter being shown in position in the machine.

Figure 2 is a view like Fig. 1 and of the parts therein shown illustrating the positions occupied by the parts of the machine in the movement thereof for producing a certain deflection of the bar.

Figure 3 is a view like Fig. 1 and of the parts of the machine therein shown, with separate bars, the ends of which are to be bent, shown in position in the machine preparatory to bending them.

Figure 4 is a view like Fig. 3 and of the parts and the bars therein shown, illustrating the positions occupied by the parts of the machine in the movement thereof for producing a certain deflection at an end of each bar.

Figure 5 is a view in side elevation of the machine of Fig. 1.

Figure 6 is a plan section taken at the line 6—6 on Fig. 5 and viewed in the direction of the arrows.

Figure 7 is a broken sectional view taken at the line 7—7 on Fig. 1 and viewed in the direction of the arrows.

Figure 8 is an enlarged section taken at the irregular line 8—8 on Fig. 1 and viewed in the direction of the arrows; and

Figure 9, a view in side elevation of an example of a concrete reinforcing bar bent to shape by the machine of the preceding figures.

Referring to the particular illustrated embodiment of my invention, it comprises a casing structure represented generally at 10 and having a top plate portion 11.

Rotatably mounted in the casing 10 is a shaft 12 shown as provided with a gear 13 rigid therewith and meshing with a worm 14 fixed on a shaft 15 journaled in bearings 16 in the casing and provided with a bevel gear 17 meshing with a bevel gear 18 rigid

on a drive shaft 19 and with a bevel gear 20 journaled on this shaft.

The upper end of the shaft 12 is provided with a disk portion 21 located in an opening 22 in the casing-top 11, this disk carrying a bar 23 the longitudinal axis of which is coincident with the center of the disk 21, this bar being rigid with the disk 21 and shown as spaced vertically from the casing-top 11.

The bar 23 is shown as provided with an upwardly-opening dovetail groove 25 extending lengthwise of this bar and coincident with the longitudinal axis thereof and in which a shaft 26 having right and left-hand threads at its opposite ends, respectively, is journaled at its end portions in plates 27 and 28 secured to the ends of the bar 23, the terminal ends of the shaft 26 being of square shape in cross section to receive a wrench for rotating this shaft in either direction.

The shaft 26 is provided at opposite sides of the shaft 12 with nuts 29 and 30 which engage the threaded portions, respectively, of the shaft 26, these nuts being adjustable toward and away from each other simultaneously and relative to the center of the shaft 12, by rotating the shaft 26.

The nut 29 is provided with an upwardly extending pin 31 journaled in one end of one lever section 32 of a jointed lever mechanism, the other section of which is represented at 33. The lever 32 is pivotally connected at its other end with the adjacent end of the lever 33, as represented at 34, the other end of the lever 33 being pivotally connected with the casing-top 11 as represented at 35.

The nut 30 is provided with a pin 36 journaled in one end of the lever section 37 of another jointed lever mechanism the other arm of which is represented at 38. The arms 37 and 38 are pivotally connected together as indicated at 39 and the arm 38 is pivotally connected with the casing top 11 as indicated at 40 at the side of the shaft 12 opposite that at which the arm 33 is pivoted to the casing top 11.

In the particular machine shown there is associated with the lever sections 32 and 37 pairs of spaced apart stop surfaces into the spaces between which the object to be bent, such as the bar represented at 41, is positioned, and by the relative movement of which the bar is bent into the desired condition.

The stop surfaces referred to and associated with the arm 32 are represented at 42 and 43 and those thereof which are associated with the arm 37 are represented at 44 and 45. All of these stop surfaces are shown in the form of rollers, the rollers 42 and 44 being journaled on the upper ends of the pins 31 and 36, respectively, and the rollers 43 and 45 pivoted on pins 46 and 47, respectively, carried by the arms 32 and 37.

The arrangement of the various parts described is such that by rotating the shaft 19 in one direction the stop surfaces 42, 43, 44 and 45, are moved into the position shown in Fig. 1 wherein they are adapted to have inserted therebetween the bar 41 to be bent. Upon positioning the bar as stated and as shown in Fig. 1, the shaft 19 is driven in a direction to rotate the shaft 12, and with it the bar 23, in counterclockwise direction in Fig. 1.

The pivotal connections of the levers 32 and 37 with the bar 23, through the medium of the pins 31 and 36 and the nuts 29 and 30 in the particular construction shown, and the pivotal connections of the levers 33 and 38 with the casing of the machine and the pivotal connections of these levers with the levers 32 and 37, operate, when the shaft 12 is rotated as stated, to cause the pairs of stop surfaces to be bodily rotated as units in counterclockwise direction in Fig. 1 about the axis of shaft 12 and the surfaces 43 and 44 to revolve about the axes of the pins 31 and 36, respectively.

In thus moving, the stop surfaces referred to operate to produce a double bend in the bar 41 as shown in Fig. 2 thereby causing one end of the bar to be offset laterally relative to the other end thereof in substantially parallel relation thereto, with the connecting portion therebetween and represented at 48, extending at angles to the ends of the bar, thereby producing one side portion of the bodily offset portion 49 of the bar shown in Fig. 9. The stop surfaces 42, 43, 44 and 45 are then returned to the normal position shown in Fig. 1 by reversely rotating the shaft 19 and the bar is bent to form the opposite angularly disposed side portion 50 by operating on it as above described.

It will be noted that with each of the above described bending operations of the machine two bends are produced simultaneously and thus to form the offset portion 49 two operations only of the machine are required to be performed.

By the machine shown the angles at which the portions 49 and 50 are caused to extend relative to the body portion of the bar, depend upon the degree to which the shaft 12 is rotated in counterclockwise direction from the position shown in Fig. 1, the greater the degree of rotation of this shaft the greater the angles at which the portions 49 and 50 of the bar extend relative to the body portions thereof, it being possible with the machine shown and above described to bend the bar beyond right-angle condition, if desired.

By rotating the shaft 26 the pairs of stop surfaces may be adjusted toward each other to cause the bodily offset portions of the bar to be of less depth, or adjusted away from each other to cause these offset portions to be of greater depth, as desired.

The machine shown thus not only provides for the forming of the portions 49 and 50 at different angles relative to the body portions of the bar and of different lengths, but also for any desired combination of these features, it being possible by the nut and screw arrangement provided to make adjustments to small fractions of an inch.

It is often desirable to bend the ends of bars to extend at an angle to the body portions thereof as represented at 51 of the typical reinforcing bar shown in Fig. 9, and this is provided for in the machine shown by the provision of a head 52 fixed to the shaft 12 to be revoluble therewith, this head providing at diametrically disposed portions thereof stop-surfaces which as shown in Figs. 3 and 4 may serve to hold the extremities of the bars to be bent at their ends while undergoing the bending in the actuation of the parts from the position shown in Fig. 3 to the position shown in Fig. 4 where right-angle bends are to be produced.

The head 52 contains a slot 53 to receive the bar to be bent when a plurality of bends are to be formed in the bar as for example as shown in Figs. 1 and 2.

The machine shown lends itself to the bending of the various parts of the bar shown in Fig. 9 by a series of progressive steps thereby facilitating the production of the desired bends. Thus a bar to be bent to the position shown in Fig. 9 is introduced at one end into the machine as represented of the bar at the right-hand side of Fig. 3 and the machine operated to produce the bend 51 at one end of the bar. The bar is then removed from the machine, slid along the latter and repositioned for bending to form one side of the stirrup portion, following the formation of which the other side of the stirrup is formed as hereinbefore described. After the stirrup is formed the bar is slid along to position its other end in the machine as represented of the bar at the left-hand side of Fig. 3 and the machine operated to produce the bend at this end of the bar, it being understood that the first bend to be produced in the next bar to be bent may be produced while producing the last bend in the preceding bar.

The stop surfaces of each pair thereof are preferably spaced apart a relatively great distance as compared with the thickness of the bars to be bent, as shown, whereby the bar after the machine has been operated to bend the bar may be released for removal from the machine, merely by slightly reversely operating the machine.

Furthermore the stop surfaces are preferably removable permitting of the substitution of different sized rollers for varying the space between the stop surfaces of each pair thereof, particularly the rollers on the

pins 31 and 36 where bends of different radii are to be produced.

As will be noted the clamping action for bending the bar, where two bends are made simultaneously, is substantially equal at opposite sides of the center of the shaft 12, viz., at opposite sides of the center line of the applied force, and thus the machine is rendered highly practical in operation as the resistance presented to bending force is, in effect, balanced.

While I have illustrated and described a particular construction embodying my invention, I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article, both said pair of stop surfaces and said third stop surface being supported for movement bodily relative to each other, and one of said pair of stop surfaces being revoluble about the axis of the other thereof, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

2. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article, said pair of stop surfaces and said third stop surface being supported for movement bodily relative to each other, said pair of stop surfaces rotatable as a unit, and one of said pair of stop surfaces being revoluble about the axis of the other thereof, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

3. In a bending machine, the combination of a rotatable member, a jointed lever mechanism pivoted at one end to a relatively stationary part of the machine and at its opposite end to said rotatable member eccentrically of the axis of the latter, a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, one of said stop surfaces being connected with said lever mechanism eccentric of the pivotal connection of the latter with said rotatable member and the other of said stop surfaces being coaxial with said last-referred-to connection, and a third stop surface for engagement with another part of the article, said member being movable from a position in which said stop surface eccentric of the pivot of said

rotatable member extends to one side of a line passing through the other stop surface of said pair and said third stop surface, to a position in which said eccentrically disposed stop surface extends at the other side of said line.

4. In a bending machine, the combination of a rotatable member, a jointed lever mechanism pivoted to a relatively stationary part of the machine, means pivotally connecting said lever mechanism with said rotatable member eccentrically of the axis of the latter, a pair of stop surfaces on said lever mechanism adjacent said rotatable member for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article and connected with said rotatable member and positioned eccentrically of the axis of said rotatable member, one of said pair of stop surfaces being coaxial with the connection between said lever mechanism and said rotatable member, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop-surfaces about the axis of the other thereof.

5. In a bending machine, the combination of a rotatable member, a jointed lever mechanism pivoted at one end to a relatively stationary part of the machine and at its opposite end to said rotatable member eccentrically of the axis of the latter and adjustable toward and away from said axis, a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, one of said stop surfaces being connected with said lever mechanism eccentric of the pivotal connection of the latter with said rotatable member and the other of said stop surfaces being coaxial with the connection between said mechanism and said rotatable member, and a third stop surface for engagement with another part of the article, said member being movable from a position in which said stop surface eccentric of the pivot of said rotatable member extends to one side of a line passing through the other stop surface of said pair and said third stop surface, to a position in which said eccentrically disposed stop surface extends at the other side of said line.

6. In a bending machine, the combination of a rotatable member, a jointed lever mechanism pivoted to a relatively stationary part of the machine, means pivotally connecting said lever mechanism with said rotatable member eccentrically of the axis of the latter, said means being adjustable toward and away from said axis, a pair of stop surfaces on said lever mechanism adjacent said rotatable member for engagement with an article to be bent and inserted therebetween, one of said stop surfaces being coaxial with the connection between said mechanism and said rotatable member, and a third stop surface for engagement

with another portion of the article and connected with said rotatable member and positioned eccentrically of the axis of said rotatable member, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

7. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a second pair of stop surfaces for engagement with another portion of the article, each stop surface of each pair thereof being mounted for bodily movement in the bending operation and one surface of each pair thereof being rotatable about the other of said surfaces.

8. In a bending machine, the combination of a rotatable member, stop surfaces on said member substantially diametrically disposed, other stop surfaces associated with said first referred to stop surfaces, respectively, and spaced therefrom, and means whereby said last named stop surfaces will rotate about the first-named stop surfaces, respectively.

9. In a bending machine, the combination with a rotatable member, stop surfaces on said member substantially diametrically disposed, other stop surfaces associated with said first-referred-to stop surfaces, respectively, and spaced therefrom, and means whereby said last-named stop surfaces are rotated about said first-named stop surfaces, respectively, in the same direction.

10. In a bending machine, the combination of a rotatable member, stop surfaces on said member substantially diametrically disposed, other stop surfaces associated with said first-referred-to stop surfaces, respectively, and spaced therefrom, and lever mechanism connected with said rotatable member at substantially diametrically disposed portions and with which said second-referred-to stop surfaces are connected for operating, when said member is rotated, to rotate said second-named stop surfaces about said first-named stop surfaces, respectively.

11. In a bending machine, the combination of a rotatable member, a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a second pair of stop surfaces for engagement with another portion of the article inserted therebetween, one of the stop surfaces of each pair thereof being connected with said rotatable member, and means for rotating the others of said stop surfaces about those which are connected with said rotatable member.

12. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article, both said pair of stop surfaces and said third

stop surface being supported for movement bodily relative to each other, one of said pair of stop surfaces being revoluble about the axis of the other thereof, and means for producing said movement, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

13. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article, said pair of stop surfaces and said third stop surface being supported for movement bodily relative to each other, said pair of stop surfaces rotatable as a unit, one of said pair of stop surfaces being revoluble about the axis of the other thereof, and means for producing said movement, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

14. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a second pair of stop surfaces for engagement with another portion of the article, each stop surface of each pair thereof being mounted for bodily movement, one surface of each pair thereof being rotatable about the other of said surfaces, and means for producing said movement.

15. In a bending machine, the combination of a rotatable member, stop surfaces on said member substantially diametrically disposed, other stop surfaces associated with said first referred to stop surfaces, respectively, and spaced therefrom, lever mechanism connected with said rotatable member at substantially diametrically disposed portions and with which said second referred to stop surfaces are connected for operating, when said member is rotated, to rotate said second-named stop surfaces about said first-named stop surfaces, respectively, and means for actuating said rotatable member.

16. In a bending machine, the combination of a rotatable member, a shaft rotatable thereon and extending crosswise of the axis of said member, said shaft being reversely threaded at its opposite ends, nuts threaded on said shaft, pairs of spaced apart members at opposite sides of the axis of said rotatable member presenting stop surfaces to receive between them work to be bent and operatively engaging said nuts, and means operating when said rotatable member is rotated to revolve one stop member of each pair thereof about the other member thereof.

17. In a bending machine, the combination of a rotatable member, a shaft rotatable thereon and extending crosswise of the axis

of said member, said shaft being reversely threaded at its opposite ends, nuts threaded on said shaft, pairs of spaced apart members at opposite sides of the axis of said rotatable member presenting stop surfaces to receive between them work to be bent and operatively engaging said nuts, and jointed lever mechanisms pivoted to a relatively stationary part of the machine and operatively engaging said nuts, respectively, and operating when said rotatable member is rotated to revolve one stop member of each pair thereof about the other member thereof.

18. In a bending machine, the combination of a rotatable member, a jointed lever mechanism pivoted at one end to a relatively stationary part of the machine and at its opposite end to said rotatable member eccentrically of the axis of the latter, a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, said stop surfaces being eccentric of the axis about which said member rotates, one of said stop surfaces being carried by, and movable with, said lever mechanism, and a third stop surface for engagement with another part of the article, said member being movable from a position in which said stop surface on said lever mechanism extends to one side of a line passing through the other of said stop surfaces of said pair and said third stop surface, to a position in which said stop surface on said lever mechanism extends at the other side of said line.

19. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, and a third stop surface for engagement with another portion of the article for holding the article while being bent by said pair of stop surfaces, said pair of stop surfaces and said third stop surface being bodily relatively movable, said pair of stop surfaces being rotatable as a unit, and one of said pair of stop surfaces being revoluble about the axis of the other thereof.

20. In a bending machine, the combination of a pair of stop surfaces for engagement with an article to be bent and inserted therebetween, a third stop surface for engagement with another portion of the article for holding the article while being bent by said pair of stop surfaces, said pair of stop surfaces and said third stop surface being bodily relatively movable, said pair of stop surfaces being rotatable as a unit, and one of said pair of stop surfaces being revoluble about the axis of the other thereof, and means for producing such movement, said third stop surface operating to resist the side thrust exerted on the article in the rotation of the revoluble one of said pair of stop surfaces about the axis of the other thereof.

21. In a bending machine, the combination of a rotatable member, a pair of stop sur-

faces for engagement with an article to be bent and inserted therebetween, and a second pair of stop surfaces for engagement with another portion of the article inserted therebetween, said pairs of stop surfaces being eccentric of the axis of rotation of said rotatable member, one of the stop surfaces of each pair thereof being connected with said rotatable member, and means for rotating the others of said stop surfaces about those which are connected with said rotatable member.

22. In a bending machine, the combination of a rotatable member, a pair of stop surfaces on said member at one side of its axis of rotation for engagement with an article to be bent and inserted therebetween, and a third stop surface on said member at the opposite side of the axis of rotation of said member for engagement with another portion of the article for holding the article while being bent by said pair of stop surfaces, one of said pair of stop surfaces being revolvable about the axis of the other thereof, and means operating to revolve the revolvable one of said pair of stop surfaces.

23. In a bending machine, the combination of a rotatable member, a pair of stop surfaces on said member at one side of its axis of rotation for engagement with an article to be bent and inserted therebetween, a second pair of stop surfaces on said member at the opposite side of the axis of rotation of said member for engagement with another portion of the article inserted therebetween, one of the stop surfaces of each pair thereof being connected with said rotatable member, and means for rotating the others of said stop surfaces about those which are connected with said rotatable member.

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