May 29, 1934. D. M. DUNWOODIE 1,960,732

WIRE BENDING MACHINE

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FIG 1

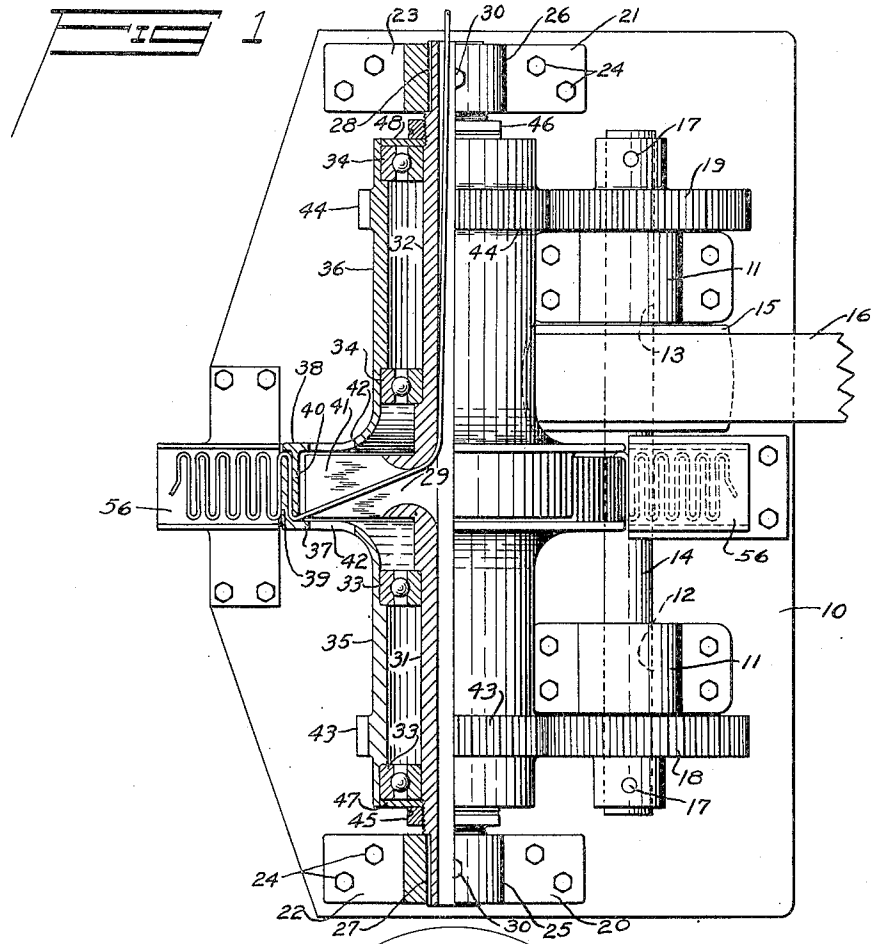
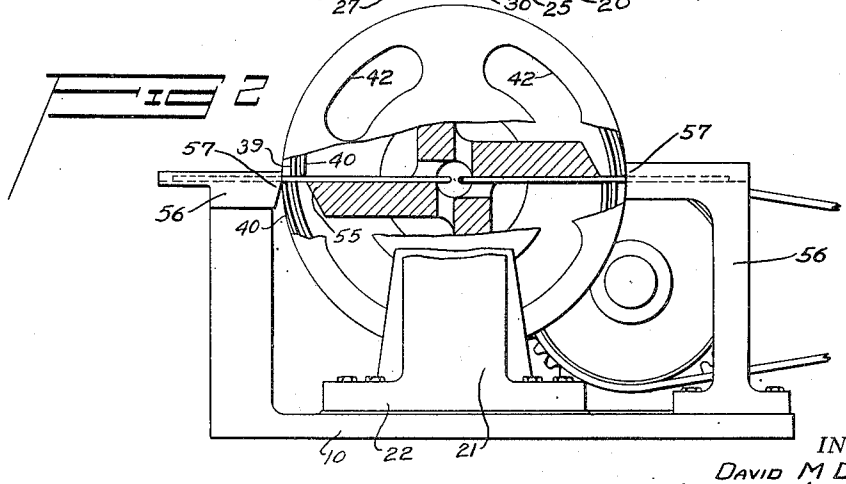


FIG 2



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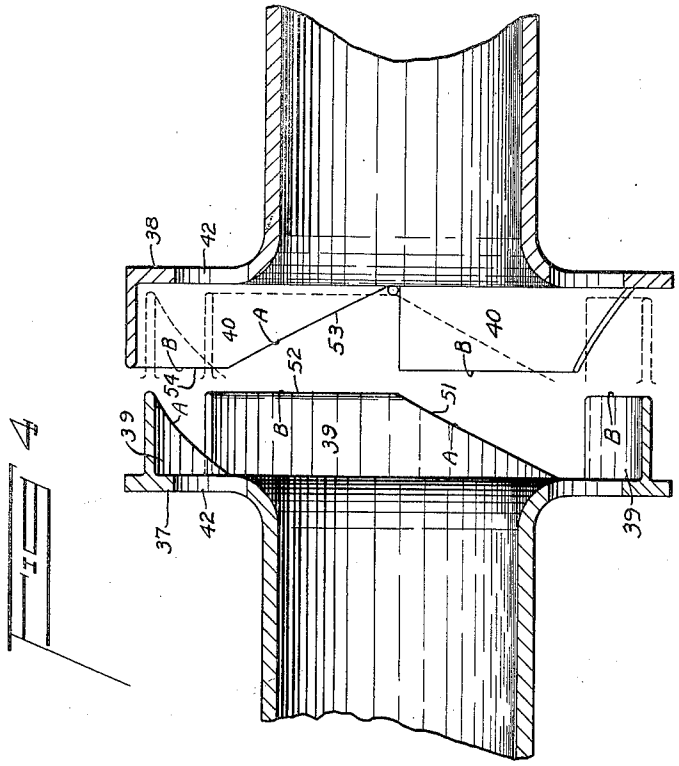


FIG. 4

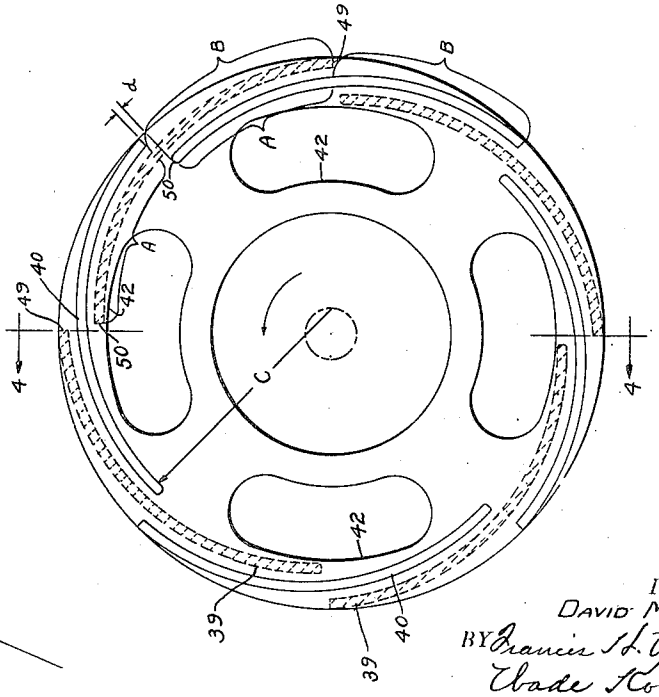


FIG. 3

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WIRE BENDING MACHINE

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FIG. 5

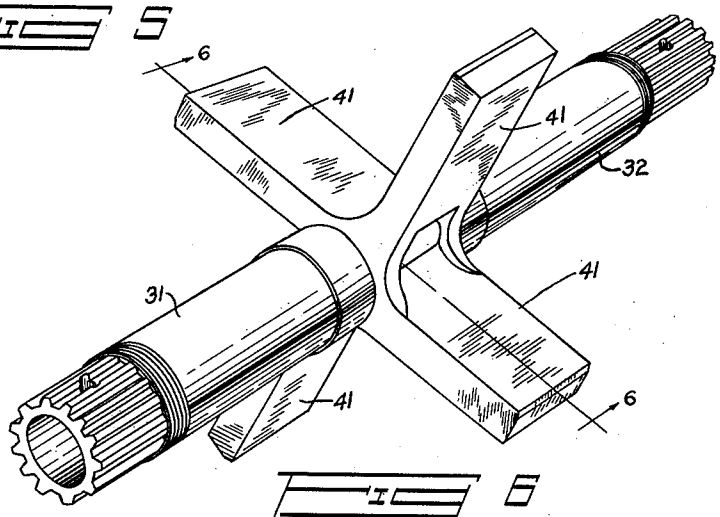


FIG. 6

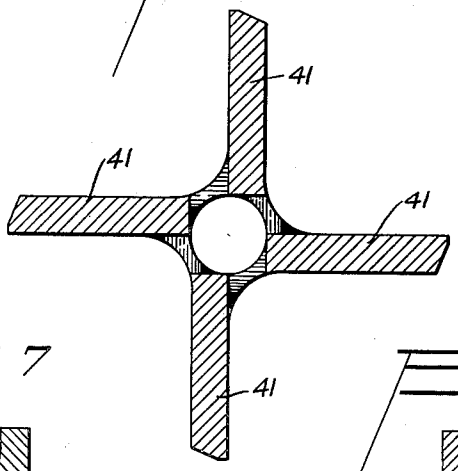


FIG. 7

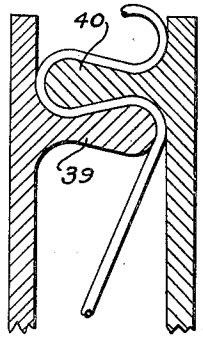


FIG. 8

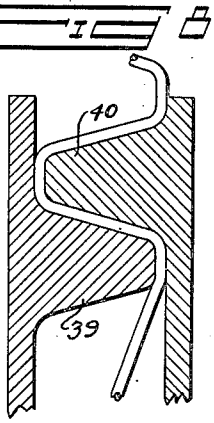
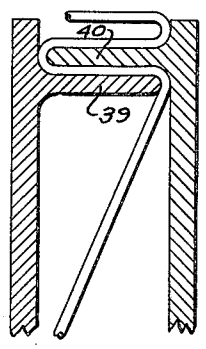


FIG. 9



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UNITED STATES PATENT OFFICE

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WIRE BENDING MACHINE

David M. Dunwoodie, Trotwood, Ohio

Application January 20, 1933, Serial No. 652,704

13 Claims. (Cl. 140—105)

The present invention relates generally to improvements in wire bending machines for bending or crimping wire capable of being used as resistances for electrical apparatus, garment stays or reinforcing members adapted for use in connection with hose clamps of the type set forth in my Patent No. 1,779,806 and delivering the crimped product in a flat, straight ribbon without tendency to curl or coil, and more particularly to a machine in which the wire is bent back and forth alternately in opposite directions to form a series of oppositely disposed loops or end portions united by a series of intermediate transverse portions or crossings lying at or nearly at right angles to the length of the product.

An object of the present invention is to provide in a machine of this character means for forming a crimped product which comprises a pair of dies, each die including a set of wire bending or forming vanes in diametrically opposite staggered relationship, the vanes being so mounted as to move continuously in one direction in a circular path.

A further object of the present invention is to provide a machine of this character which may be operated rapidly and therefore has a large output, which bends the wire into substantially uniform loops and, lastly, which is capable of forming series of loops having different forms or configurations and which may accommodate wire of different sizes.

A further object of the present invention is to construct each set or series of wire bending or forming figures with a cam shaped bending portion and a holding portion in continuation of the bending portion adapted for holding the alternate loops of the end portions of the product, the wire bending portions of the said bending vanes of the one die being so disposed with the holding portion of the forming vanes of the other die such that the crimping of the wire is accomplished by a simultaneous holding of the forming vanes of the one die while the bending portions of the vanes of the other die are bending the wire.

A further object of the present invention resides in providing the dies in a machine of this character with a plurality of forming vanes which are arcuate in longitudinal cross-section, each vane being eccentrically arranged with respect to the axis of rotation of the dies so that when rotating the forming vane will automatically feed the looped product from the machine, this being accomplished simultaneously as the wire is being bent.

A further object of the present invention resides in concentrically spacing the sets of forming vanes in overlapping relation with respect to one another in such a manner that the wire in feeding into the space between these overlapping portions is bent into shapes corresponding to the outline of the transverse cross-sections of the forming vanes.

A still further object of the present invention is to provide a bending machine of this character which is capable of crimping or bending a plurality of wires simultaneously and separately.

In the accompanying drawings:

Fig. 1 is a plan view of a preferred embodiment of my invention;

Fig. 2 is an end view thereof;

Fig. 3 is an enlarged detail end view of the dies with the forming vanes arranged thereon partially in cross-section;

Fig. 4 is a plan view of Fig. 3 showing the forming dies and vanes in an "exploded" position;

Fig. 5 is an enlarged view in perspective of the wire supporting member;

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5; and

Figs. 7, 8 and 9 are enlarged detail views illustrating the various forms of the product which may be made by changing the cross-section of the forming vanes.

Referring more particularly to the drawings wherein corresponding parts are designated by like numerals throughout the several views, the machine in a preferred embodiment of my invention herein illustrated comprises a base member 10 having upwardly extending posts 11 mounted on the one side thereof. These posts are provided with bearings 12 and 13 which are in axial alignment with respect to one another, as shown in Fig. 1. Within the posts 11 are rotatably mounted the ends of a drive shaft 14 carrying a pulley 15 adapted for connection by means of the belt 16 with a source of motive power such as an electric motor or the like (not shown). The ends of the drive shaft 14 have fixedly mounted thereon, as by pins 17, driving gears 18 and 19.

The base member 10 has provided on its opposite side a pair of brackets 20 and 21 having flange portions 22 and 23 respectively, each of said flange portions being removably secured to the base member 10 by machine screws 24. The brackets 20 and 21 are provided with bearing portions 25 and 26 respectively, which are axially aligned with respect to one another and disposed in parallel relation to the axis of rotation of the drive shaft 14. The bearing portion of each bracket is splined as indicated by numerals 27

and 28 within which the splined ends of a hollow wire feeding member 29 are snugly received. To insure against endwise movement of the wire feeding member in its supporting brackets, machine screws 30 are provided to secure the splined portion of the wire feeding member and bearing portion of the brackets together, as indicated in Fig. 1.

The wire feeding member 29 is formed intermediate its splined ends with bearing portions 31 and 32 adapted for carrying pairs of spaced ball bearings 33 and 34 upon which a pair of drums or forming dies 35 and 36 are rotatably mounted. As shown in Fig. 1, each drum is provided with a circular flanged end portion 37 and 38 formed with sets of cooperating wire bending or forming vanes generally indicated by numerals 39 and 40. The flanged end portion of the dies are spaced from one another in order to accommodate a plurality of radially extending arms 41 formed centrally of the wire feeding member 29, these latter serving the purpose of supporting the wire as it is feeding into and being crimped by the forming vanes of the dies. The flanged portion of each die is also provided with a plurality of openings 42, as shown in Figs. 1 and 2, through which pliers or other suitable means may be inserted to grasp the end of the wire and manually feed it into the wire bending vanes 39 and 40.

The outer end of each forming die is formed with gear teeth as shown at 43 and 44, which are adapted for meshing engagement with the driving gears 18 and 19 respectively. Lock nuts 45 and 46 threaded upon the ends of the wire feeding member 29 are adapted to bear against the end plates 47 and 48 of each forming die to prevent endwise movement of the forming dies on the wire feeding member 29.

As pointed out hereinabove, each forming die is provided with a flanged end portion 37 and 38 which include cooperating sets of wire bending vanes 39 and 40. In the present illustrative case, each set of wire bending vanes comprises four in number, each of which, as will be noted by referring to Fig. 3, is arcuate in longitudinal cross-section, each vane being eccentrically disposed with respect to the axis of rotation of its forming die. Each vane is positioned adjacent the peripheral edge of the flanged portions of the dies and is provided with a forward portion A, hereinabove referred to as a forming portion, and a rearward portion B in continuation of its forming portion, hereinabove referred to as a holding portion. The forming vanes, as hereinabove stated, are eccentrically arranged with respect to the axis of rotation of the forming dies. In the present embodiment of my invention this is accomplished by generating a smooth curve having a diameter C taken from a plurality of equally spaced points located on a circle having its center coincident with the axis of rotation of the drums. Any well-known method of generating a curve of this nature may, however, be employed. The rearward edge 49 of each vane, as a result of this construction terminates at a point substantially coincident with the peripheral edge of the flanged portions 37 and 38, the forward portion of each vane being disposed inward with respect to the peripheral edge of the flanged portions 37 and 38 to provide a camming action, the purpose of which will hereinafter be set forth.

The rearward edge 49 of each vane is projected forwardly of the forward edge 50 of its next succeeding vane a distance "*d*", substantially equal to the diameter of the wire adapted to be used. It is to be understood that any number of vanes may be provided on the forming dies depending upon the number of products it is desired to bend or crimp. Furthermore, it is apparent that the distance "*d*" may be varied for each set of vanes to accommodate different sizes of wires to be used in the machine.

When assembled in the machine the bending vanes 39 of the one forming die are disposed in opposed spaced relation with the vanes 40 of the other forming die. This relation of the forming vanes is shown best in Fig. 3. As will be noted these vanes when in assembled relation are so disposed with one another such that the rearward or holding portion of the vanes of each set are in overlapping relation with respect to the forward or forming portion of the vanes of the opposite set and spaced therefrom a distance equal to or slightly greater than the diameter of the wire to be crimped.

For convenience the forming dies are illustrated in Fig. 4 in an "exploded" condition. As shown in this figure, the forming portion of the set of vanes 39 comprises an outwardly extending forming or camming edge 51 extending outwardly from the flanged portion 37 to its outer edges 52 of the vane 39. In a like manner the forming portion of each vane of the set 40 includes a forming or camming edge 53 extending outwardly from the flanged portion 38 to the outer edges 54 of the vanes 40. In each instance the length of the forming edges 51 and 53 correspond in length to the forming portion A hereinabove mentioned.

Referring more particularly to Fig. 2, it will be noted that the radially extending arms 41 of the member 29 have their outer edges 55 closely adjacent the inner edge of the forming vanes in order to support the wire when feeding into the forming vanes. Guideways 56 are provided for receiving the crimped product as it is feeding from the machine having their inner edges 57 closely adjacent the outer edges of the forming vanes in order to firmly support the wire as it is fed from the forming vanes.

The bending of the wire or the shape of the crimped product is determined by the shape of the vanes in lateral cross-section by reason of the fact that the wire when feeding into the machine is bent back and forth within the space between the forming vanes. Figs. 7, 8 and 9 are illustrative of vanes having cross-sections of different contour which may be employed to form crimped products having different shapes.

In Fig. 4 there is shown in dotted line the position assumed by the forming vanes 39 with respect to the forming vanes 40 when the drums are in assembled relation with respect to one another with the outer edges of the forming vanes 39 and 40 spaced from the circular flanged portions 37 and 38 a distance substantially equal to the diameter of the wire being used so that when loading the machine prior to bending the wire may be manually inserted within this space and held by friction between the edge 52 of the vanes and the base portion of the vanes 40.

The operation of the device is as follows. The wire is adapted to be fed from spools (not shown) into the hollow bore of the wire feeding member 29 in the manner illustrated in Fig. 1 and by inserting pliers or other suitable means through the openings 42 in the forming dies the wire may be manually inserted between the space hereto-

fore mentioned. When the machine is in operation, rotation of the drive shaft 14 will in turn rotate the forming dies 35 and 36 together in the same direction and in so doing the wire is caused to be bent back and forth between the forming vanes and crimped into a shape corresponding to the shape of the cross-section of the vanes. By reason of the positioning of the holding portion of the vanes on the one die with respect to the forming portion of the vanes of the other die in the manner illustrated in Figs. 3 and 4, it will be apparent that as the forming portion of the vanes on the one die are bending the wire, the holding portion of the oppositely disposed vanes are holding the portion already bent and in this manner the wire is caused to be bent alternately in opposite directions around the forming vanes as the drums are being rotated, the wire thus bent being free to move within the space between the forming vanes. By reason of their eccentric mounting on the dies 35 and 36 the vanes 39 and 40 in being rotated simultaneously feed the wire from the spools, bends the same and thereafter delivers the bent product into the guideways 56. It will thus be apparent that a simultaneous forming and feeding action is obtained by reason of the shape of the vanes and their eccentric mounting with respect to the axis of rotation of the forming dies.

Any number of sets of forming dies may be provided to accommodate different sizes of wire it is desired to use, it being apparent that by changing the distance "d" between the forward and rearward edges of the forming vanes and the space between the overlapping portions of the vanes when assembled, wires of different sizes may be bent.

I claim.

1. In a wire bending machine, means for bending a straight wire alternately to form a series of oppositely disposed loops connected by transverse portions or crossings, and means for supporting said wire as it is feeding into said bending means, said bending means comprising a plurality of forming dies adapted for rotation in the same direction, each die including a series of vanes, the series of vanes on the one die being adapted for bending the wire laterally in one direction, the vanes on the other die being adapted for bending the wire laterally in the opposite direction.

2. In a wire bending machine, means for bending a straight wire alternately to form a series of oppositely disposed loops connected by transverse portions or crossings, and means for supporting said wire as it is feeding into said bending means, said bending means comprising a plurality of forming dies adapted for rotation in the same direction, each die including a series of vanes, the series of vanes on the one die being adapted for bending the wire laterally in one direction, the vanes on the other die being adapted for bending the wire laterally in the opposite direction, the series of vanes on the one die being so disposed with respect to the series of vanes on the other die and with each other such as to automatically feed the wire forwardly as it is being bent.

3. In a wire bending machine, means for bending a straight wire alternately to form a series of oppositely disposed loops connected by transverse portions or crossings, and means for supporting said wire as it is feeding into said bending means, said bending means comprising a plurality of forming dies adapted for rotation in the same direction, each die including a series of vanes, the series of vanes on the one die being adapted for bending the wire laterally in one direction, the series of vanes on the other die being adapted for bending the wire laterally in the opposite direction, each of said vanes including a holding portion and a bending portion, the holding portion of the vanes on the one die being so disposed with respect to the bending portion of the vanes of the other die such as to hold a transverse portion of the bent wire as the forming portion of the vane on the other die is bending the next succeeding transverse portion.

4. In a wire bending machine, a support, means for feeding a wire along said support, a pair of rotary forming dies adapted for rotation in the same direction, a series of staggered forming vanes on each of said dies, the vane of each series including a holding portion and a bending portion, the holding portion of the vanes on the one die being disposed oppositely from the bending portion of the vanes on the other die.

5. In a wire bending machine, a support, means for feeding a wire along said support, a pair of rotary forming dies adapted for rotation in the same direction, a set of forming vanes on the one die, a set of forming vanes on the other die adapted when in assembled relation to intermesh with the set of vanes on said first-mentioned die and in spaced relation therewith, each of the vanes of each series including a holding portion and a bending portion, the holding portion of the vanes on the one die being disposed in overlapping relation with the bending portion of the vanes on the other die.

6. In a wire bending machine, a support, means for feeding the wire along said support, a pair of rotary dies adapted for rotation in the same direction, a series of staggered forming vanes on each of said dies, each vane including a holding portion and a bending portion in continuation of its holding portion, said vanes when assembled together being so arranged such that the holding portion of the vanes on the one die is disposed in overlapping relation with the bending portion of the vanes of the other die and in spaced intermeshing relation therewith to provide a sinuous groove therebetween for the wire.

7. In a wire bending machine, a support, means for feeding the wire along said support, a pair of rotary dies adapted for rotation in the same direction, a series of staggered forming vanes on each of said dies, each vane including a holding portion and a bending portion in continuation of its holding portion, said vanes when assembled together being so arranged such that the holding portions of the vanes on the one die are disposed in overlapping relation with the bending portions of the vanes of the other die and in spaced intermeshing relation therewith to provide a sinuous groove therebetween for the wire, the spaces between the overlapping portions of said vanes being at least equal to the diameter of the wire being bent.

8. In a wire bending machine, a support, means for feeding a wire along said support, a pair of diametrically opposed rotary dies adapted for rotation in the same direction, each die including a circular flanged portion, a series of staggered forming vanes arcuate in longitudinal cross-section on each of said dies and including a holding portion and a bending portion in continuation of its holding portion, said vanes when assembled being so arranged with respect to one another such that the holding portions of the vanes on the one die are disposed in overlapping relation with the bending portions of the vanes

of the other die and in spaced intermeshing relation to provide a sinuous groove therebetween at least equal to the diameter of the wire being used.

9. In a wire bending machine as set forth in claim 8, in which the series of vanes of one die are oppositely disposed to that of the other die and in which the forming portions of each series of vanes are provided with camming edges projecting outwardly from the circular flanged portion of each die for alternately bending the wire laterally in opposite directions.

10. In a wire bending machine, a support, means for feeding a wire along said support, a pair of diametrically opposed rotary members adapted for rotation in the same direction, each member including a circular flanged portion, the flanged portion of the one die being arranged in opposing relation with the flanged portion of the other die, a set of forming vanes arcuate in longitudinal cross-section on one of said flanged portions, a set of forming vanes arcuate in longitudinal cross-section and equal in number to the said first-mentioned set of vanes disposed on the flanged portion of the other member, each vane including a holding portion and a bending portion in continuation of its holding portion, said vanes when assembled together being so arranged such that the holding portions of the vanes on the one member are disposed in overlapping relation with the bending portions of the vanes of the other member and in spaced intermeshing relation therewith to provide a sinuous groove therebetween for receiving a wire.

11. In a wire bending machine, a support including a plurality of radially extending arms, means for feeding a wire along the arms of said support, a pair of diametrically opposed rotary members adapted for rotation in the same direction, each member including a flanged portion, the flanged portion of the one die being arranged in opposing relation with the flanged portion of the other die, a set of forming vanes arcuate in longitudinal cross-section on one of said flanged portions, a set of forming vanes arcuate in longitudinal cross-section and equal in number to the said first-mentioned set of vanes disposed on the flanged portion of the other member, each vane including a holding portion and a bending portion in continuation of its holding portion, said vanes when assembled together being so arranged such that the holding portion of the vanes on the one member is disposed in overlapping relation with the bending portion of the vanes of the other member and in spaced intermeshing relation therewith to provide a sinuous groove therebetween for receiving a wire.

12. In a bending machine as set forth in claim 8, said series of vanes on each die being characterized by having their axes eccentrically disposed relative to the axis of rotation of said dies in order to feed the wire forwardly as the same is being bent.

13. In a bending machine as set forth in claim 8, said series of vanes being characterized by being eccentrically disposed relative to the axis of rotation of said dies with their forming portions spaced inward with respect to the peripheral edge of said flanged portion and their holding portions terminating substantially coincident with the peripheral edge of said flanged portion to provide a camming action for feeding said wire forwardly as said dies are being rotated.

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