May 14, 1935. F. W. GREER 2,001,273

WIRE BENDING MACHINE

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Fig. 1

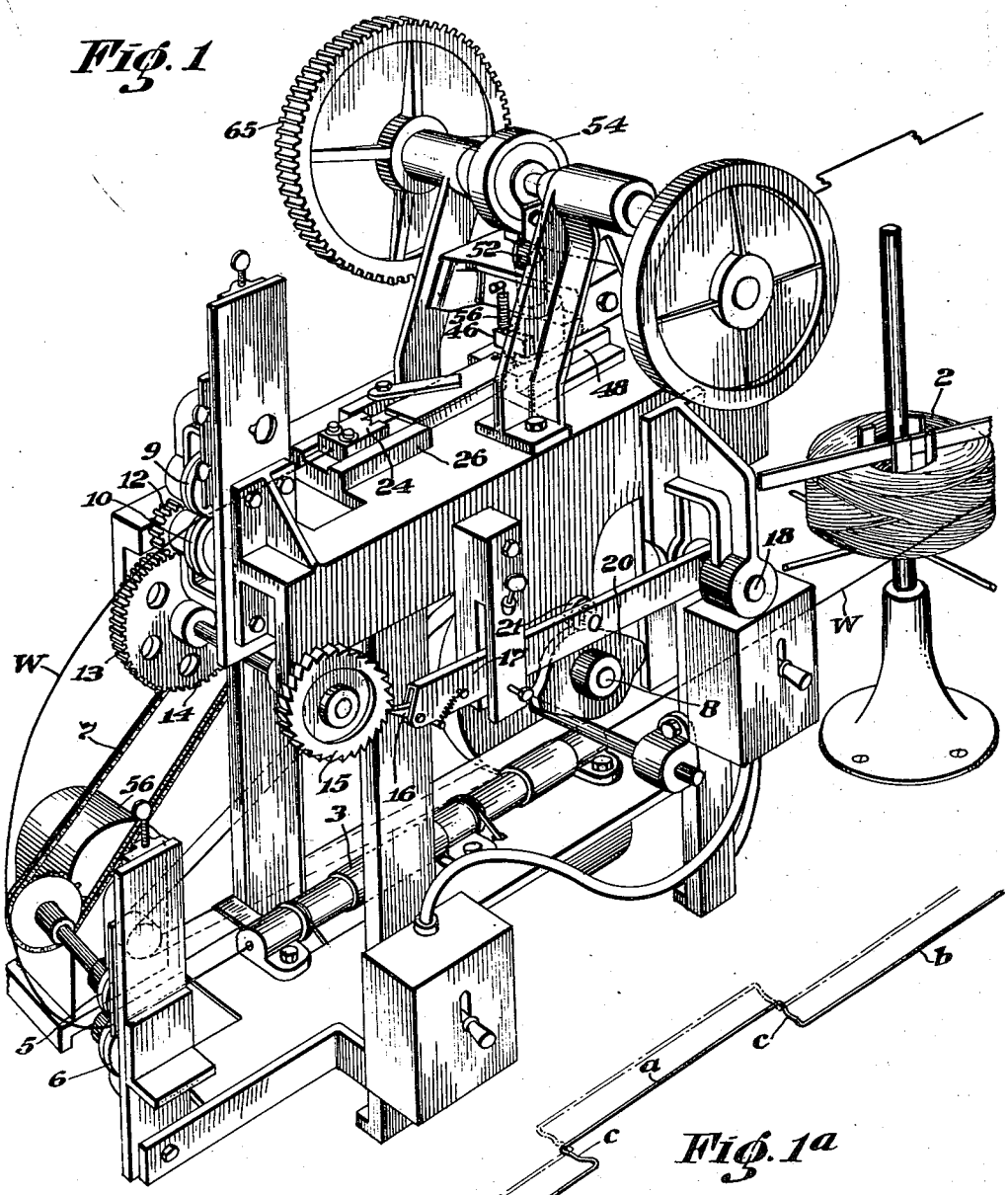


Fig. 1a

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Fig. 2

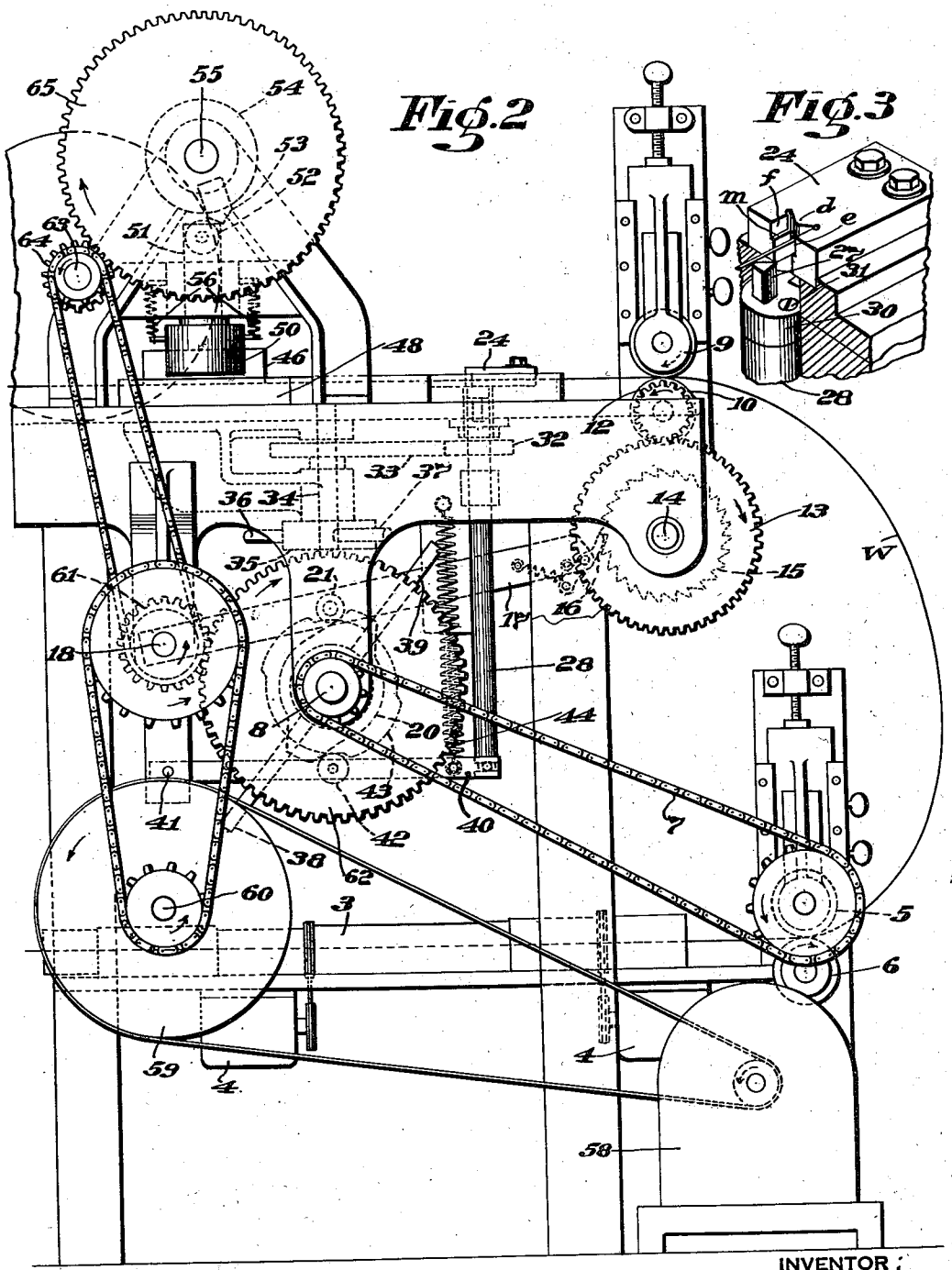


Fig. 3

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Fig. 4

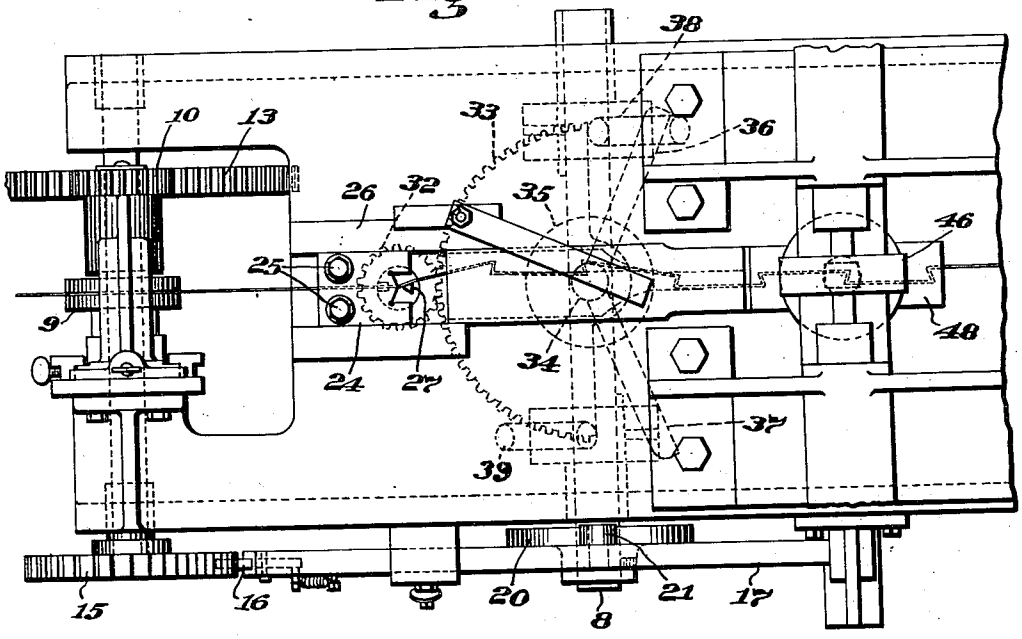


Fig. 5

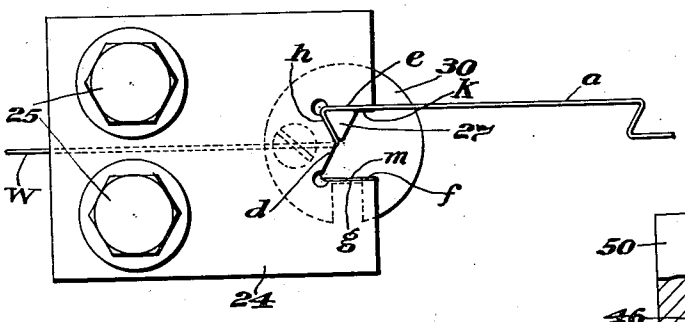
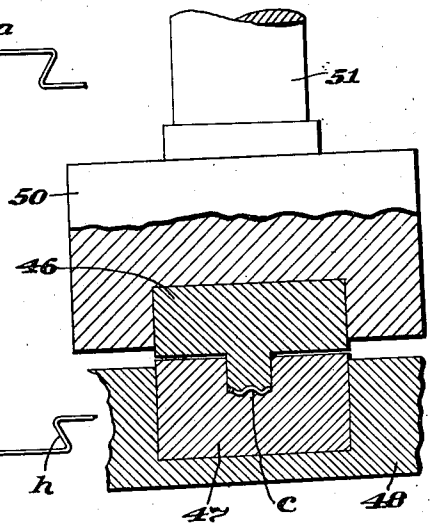


Fig. 7



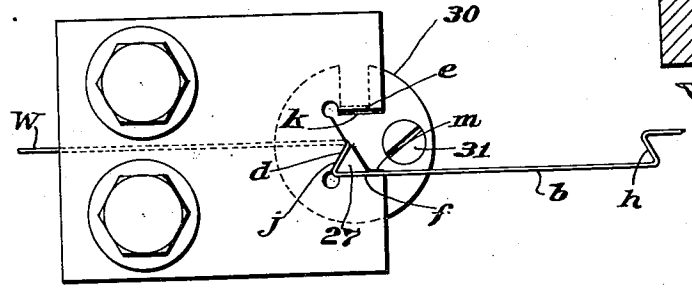


Fig. 6

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UNITED STATES PATENT OFFICE

2,001,273

WIRE BENDING MACHINE

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Application October 28, 1932, Serial No. 639,983

12 Claims. (Cl. 140—105)

In one type of confectionery coating machine the coating material is flowed on to the confectionery centers while the latter are supported on an open mesh conveyor belt or apron through which the surplus coating material can readily drain. One form of such belt or apron consists of a multiplicity of wire elements extending transversely across the apron from one edge to the other, these wires being so bent that they are interlaced with each other and thus form a belt structure having substantial strength and considerable transverse rigidity while being flexible longitudinally and affording a relatively flat but reticulated supporting surface for the confectionery centers.

The present invention aims to devise a machine for making the wire elements or units from which such belts are composed, although it is contemplated that novel features of the machine can also be used for other purposes. The invention provides a machine which will perform the peculiar wire bending operations required to produce these units rapidly and accurately and so reduces the expense of manufacture of such units that an important economy in the cost of production of the belts can be realized.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a perspective view of a machine constructed in accordance with this invention;

Fig. 1*a* is a perspective view of a portion of one of the wire belt elements or units above mentioned also illustrating in broken lines the manner in which such a unit is connected with another similar unit in producing a belt;

Fig. 2 is a side elevation of a portion of the machine shown in Fig. 1;

Fig. 3 is a perspective view illustrating parts of the bending die structure, the bending finger, however, and its support being shown somewhat in front of their normal positions;

Fig. 4 is a plan view of certain parts of the machine shown in Fig. 1;

Figs. 5 and 6 are plan views of the bending die shown in Fig. 3; and

Fig. 7 is a vertical, sectional view of the crimping die structure used in the machine.

Referring first to Fig. 1*a* which shows in full lines a part of a short length of one of the wire belt elements or units, it will be observed that this element consists of a length of wire so bent as to provide alternate parallel sections *a* and *b* which are offset in opposite directions from the longitudinal median line of the unit. Also, that these sections are connected by relatively short laterally extending portions *c* which are bent or crimped transversely. The portions *c*, instead of lying at right angles to the sections *a* and *b*, converge somewhat so that adjacent ends of any two successive sections are separated from each other by a distance less than the length of the intervening offset section. Consequently, two units can be interlaced with each other in the manner illustrated in Fig. 1*a*, and a belt or apron of any desired length can thus be built up. The machine shown in the drawings bends the wire automatically into the form shown in full lines in Fig. 1*a* and makes this product in indefinite lengths.

Briefly stated, the method practiced in this machine, comprises the steps of making oppositely directed bends in a continuous length of wire to produce the portions *c*, Fig. 1*a*, feeding the wire a predetermined distance between successive bending operations and thereby producing oppositely offset parallel sections *a* and *b*, subsequently crimping the transverse lengths *c*, feeding the wire from the bending die to the crimping die, and repeating these operations continuously.

Referring more particularly to Figs. 1, 2 and 4, it will be seen that the supply roll 2, Fig. 1, of wire is mounted on a reel so that it can revolve readily as the strand W is unwound from it. The wire is first led through a revolving straightening device 3 of a well known form, the sections of this wire straightener being driven by small motors 4—4, Fig. 2. It is drawn through this device by means of upper and lower grooved feed rolls 5 and 6, respectively, which are driven by a chain 7 from the main shaft 8 of the machine. This feeding mechanism is of a known construction and as here shown is operated continuously.

From the feeding mechanism just described the wire forms a loop in which some slack accumulates and it then passes between two feed rolls 9 and 10, similar to the rolls 5 and 6, but driven intermittently. For this purpose the shaft on which the lower of these rolls is mounted carries a pinion 12 meshing with a gear 13 secured fast on one end of a cross shaft 14. A ratchet wheel 15 is secured on the opposite end of this shaft and is driven intermittently by means of a spring actuated feed dog or pawl 16 carried by a lever 17 which is fulcrumed on a shaft 18. A constantly revolving cam 20 on the main shaft 8 operates through a roll 21 carried by said lever

to swing the lever up and down and thus to give the ratchet wheel 15 a step by step rotative movement. This movement is transmitted to the feed rolls 9 and 10 and causes them to advance the wire a predetermined distance in each cycle of operations of the machine.

The extent of the feeding movement so imparted to the wire may be varied by changing the gears 12 and 13 and substituting others of a different ratio. With this arrangement, therefore, the wire may be fed intermittently across the top of the machine frame, and the length of the feeding movements may be adjusted within relatively wide limits. In the particular arrangement shown the feeding movements are of uniform length. This is not always the case, however. In fact, it is very common to have a short feed at each end of one of the units, such a feeding movement being produced by proper spacing of the teeth of the ratchet wheel 15 in combination with the use of a suitable ratio between the gears 12 and 13, as will readily be understood by those skilled in this art.

Shortly after leaving the feed rolls 9 and 10 the wire is fed through a die structure which operates on it to make successive bends in opposite directions and thus to form the offset sections *a* and *b*. This bending die is best shown in Figs. 5 and 6. It comprises a stationary die 24 which is removably secured by bolts 25 in a groove formed in a boss 26 integral with the top of the machine frame. In this particular machine the die is supported horizontally. Extending through it is a hole or aperture for the passage of the wire W. This hole lies substantially in the center line of the die and opens at the front face of the die through a nose piece *d* which, in plan, has the form of an obtuse angle. The die also includes two faces *e* and *f* extending parallel to the center line and cooperating, respectively, with the two faces of the nose piece to form angular wire engaging faces disposed at opposite sides of the path of travel of the wire.

Cooperating with the die 24 is a movable die member consisting of a finger 27 which is mounted on the upper end of a vertical shaft 28, Fig. 2. Preferably this finger is secured rigidly in a disk 30 having a shank that extends downwardly into a socket formed in the shaft 28, and it is held in place partly by said shank and partly by a screw 31. Consequently, the finger is compelled to rotate with the shaft. It should also be noted that as shown in Figs. 5 and 6, the axis of rotation of the shaft 28, and consequently of the finger 27, extends vertically past the end of the wire guiding aperture in the die and is located immediately in front of the apex of the nose portion *d* of the die 24. Also, that the finger 27 has substantially the cross-sectional outline of an equilateral triangle, and that one apex of the triangle lies approximately in the axis of the disk 30 and shaft 28.

Referring to Figs. 5 and 6 it will be seen that if the finger 27 is swung in a counter-clockwise direction into the position shown in Fig. 5, it will bend the wire W against the angular wire engaging face at one side of the center line of the die and will produce the Z-shaped bend *h* in the wire. If, now, the finger 27 is moved downwardly far enough to permit the forward feeding movement of the wire, so that the bent portion *h*, Fig. 5, is transferred to the position shown in Fig. 6, and the finger 27 then is raised and swung in a clockwise direction into the position illustrated in the latter figure, it will cooperate with the angular die face at the opposite side of the center line of the die to make an oppositely directed Z-shaped bend *j*, Fig. 6. If the finger 27 next is moved downwardly again far enough to clear the wire, the wire is given another feeding movement, at the end of which the finger is raised and is swung into the position shown in Fig. 5, and the operations just described are repeated, the wire will be bent to produce a series of offset portions *a* and *b*, as shown in Fig. 1*a*, adjacent offsets being connected by the short transverse bends made by the finger 27.

For the purpose of operating the finger 27 in the manner just described, the shaft 28 has a pinion 32, Figs. 2 and 4, secured on it, said pinion meshing with an oscillating sector 33 which is operatively supported on an upright rock shaft 34. Mounted on the shaft 34 below the sector is a collar 35 in which are secured two horizontally projecting arms 36 and 37. These arms are arranged to be engaged, respectively, by rods or arms 38 and 39 carried by collars on the main shaft and projecting radially from said shaft. In Fig. 4 the sector 33 is shown in its central position. Assuming that the shaft 8 is revolving in a clockwise direction, the arm 39, at a certain point in its rotation, will strike the arm 37 and swing the latter, and consequently the sector 33, in a counter-clockwise direction about the axis of the shaft 34. The extent of this swinging movement will depend upon the length of the arc of travel of the arm 37 which is intersected by the path of the arm 39. Consequently, the amplitude of this movement can be varied by adjusting the arms 38 and 39 toward and from the axis of the shaft 34 and this is accomplished in the machine by mounting the collars which carry these arms for sliding adjustment lengthwise of the shaft 8. The same is true of the cooperating arms 36 and 38 which produce the reverse swinging movement of the sector 33. The oscillations of the sector 33 produced in this manner are transmitted to the finger 27 and swing it from the position shown in Fig. 5 to that illustrated in Fig. 6, and vice versa.

The lowering movement of the finger 27 which occurs immediately after it is swung to either limit of its oscillation, and which immediately precedes the feeding movement of the wire, and the rising movement of said finger which occurs at the end of said feeding movement and preparatory to the next bending operation, is produced by raising and lowering the shaft 28. This shaft is splined to the pinion 32 so as to slide freely through it and its lower end is grooved circumferentially to receive pins or rolls carried by a lever 40, Fig. 2, that is fulcrumed on the machine frame at 41 and carries a roll 42 running on the periphery of the cam 43 secured on the main shaft 8. A spring 44 acts on the lever 40 to hold the roll constantly in engagement with the cam. The cam is so designed as to move the finger down at the desired points in each cycle of operations of the machine and to allow the spring 44 to lift the finger 27 again at the proper times.

As the finger moves down immediately after bending the wire, it tends to carry the wire with it, and in order to support the wire against this movement the face *e* of the die is provided with a ledge *k*, Figs. 5 and 6, which is located immediately under the wire when the latter is in engagement with the face *e* and which effectually prevents any downward movement of the wire with the finger. The opposite face *f* is provided

with a similar ledge *m*. These ledges or shoulders may also be seen in Fig. 3.

The wire now having been bent to produce the lateral, oppositely offset sections *a* and *b*, it is next fed forward between upper and lower dies 46 and 47, Figs. 4 and 7, which act on the transversely bent sections *c*, Fig. 1*a*, to bend or crimp them to the desired shape. The lower of these dies is removably supported in a stationary die block 43, while the upper die 47 is similarly mounted in a movable die block 50. A stem 51 rigid with the upper die block carries a roll 52, Fig. 2, which is arranged to be engaged by the cam 53 of a cam disk 54 on the shaft 55. Two coiled springs 56—56, Fig. 2, are connected with the die block 50 to lift it and serve to hold it constantly in an elevated position except when the die block is depressed momentarily by the cam 53. This movement occurs between successive feeding movements of the wire and gives the crimping die 46 its operative stroke.

As the wire moves from the die 24 toward the crimping die it is guided through a relatively shallow channel having tapered edges, as shown in dotted lines in Fig. 4, which lead it into the relatively long and narrow channel formed in the lower crimping die 47. The complemental die surfaces of the parts 46 and 47 are made several inches long so that no very accurate positioning of the transverse portions *c* longitudinally of the die is necessary.

The driving mechanism for the main shaft 8 and the crimping die shaft 55 is best shown in Fig. 2. It comprises an electric motor 58, or any other convenient source of power, belted to a pulley 59 fast on a shaft 60. This shaft is chain connected to the shaft 18 on which a pinion 61 is secured, the pinion meshing with and driving a gear 62 on the main drive shaft 8. The shaft 18 also has a sprocket chain connection with another shaft 63 carrying a pinion 64 which drives a gear 65 fast on the shaft 55.

The operation of the machine has been explained so completely in connection with the foregoing description of structure that any further statement as to operation is believed to be unnecessary. It will be appreciated, however, that this invention provides a simple and compact machine for bending wire automatically into the shape required for making the belts or aprons of the character above described. The nature of the machine is such that it requires relatively little attention and it is not liable to get out of order. Moreover, the dies can be quickly removed and new ones substituted for them when they become worn or when such changes are necessary because of the nature of the product.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a machine for making wire belt sections, the combination of means for making, in a length of wire, oppositely disposed offset sections connected by transversely bent portions of the wire, and means for crimping said transverse portions.

2. In a machine for making wire belt sections, the combination of means for making, in a length of wire, oppositely directed abrupt transverse bends, mechanism for feeding said wire longitudinally for predetermined distances between successive bending operations, whereby oppositely offset sections are formed in the wire and are connected to each other by the transversely bent portions, and means for crimping said bent portions, said feeding mechanism being operative to advance the wire from said bending means to said crimping means.

3. In a machine for making wire belt sections, the combination of bending mechanism for making relatively short abrupt bends in opposite directions in a length of wire while the sections of the wire connected by the parts so bent are kept generally parallel to each other, mechanism for feeding said wire intermittently through said bending mechanism, whereby said bending mechanism forms in the wire oppositely disposed offset sections connected by transverse portions, crimping die members between which the wire so bent is fed by said feeding mechanism, and means for operating said die members to cause them to make additional bends in said transverse portions.

4. In a machine of the character described, the combination of a die provided with a wire guiding aperture and with angular wire bending faces at opposite sides of said aperture, a finger of angular cross-sectional form for engaging the wire, and mechanism for swinging said finger in opposite directions to bend a portion of said wire against one of said faces and then to bend another portion against the opposite face.

5. In a machine of the character described, the combination of a die provided with a wire guiding aperture and with angular wire bending faces beside said aperture, a finger of angular cross-sectional form for engaging the wire projecting through said aperture, means supporting said finger for swinging movement about an axis substantially intersecting the path of travel of the wire, mechanism for swinging said finger in opposite directions about said axis, and means for raising and lowering said finger between its successive swinging movements.

6. In a machine of the character described, the combination of a die provided with a wire guiding aperture, angular wire bending faces at opposite sides of said aperture, a finger of angular cross-sectional form for engaging the wire, means supporting said finger for oscillating movement about an axis substantially intersecting the path of travel of the wire immediately in front of said aperture, mechanism for swinging said finger about its axis, and means for raising and lowering said finger, said finger operating means being constructed and arranged to cause said finger to bend a portion of said wire into engagement with one of said faces, and subsequently to bend another portion of the wire against the opposite face.

7. In a machine of the character described, the combination of a die having a nose provided with a wire guiding aperture and having wire bending faces at opposite sides of said aperture, a finger for engaging said wire and bending it alternately into engagement with said faces, and supporting and operating mechanism for raising and lowering said finger and for oscillating said finger about an axis extending transversely to said aperture and located immediately in front of it.

8. In a machine of the character described, the combination of a die having a nose provided with a wire guiding aperture and having wire bending faces at opposite sides of said aperture, a finger for engaging said wire and bending it alternately into engagement with said faces, supporting and operating mechanism for raising and

lowering said finger and for oscillating said finger about an axis extending transversely to said aperture and located immediately in front of it, and mechanism for feeding predetermined lengths of said wire through said aperture between successive bending operations.

9. In a machine of the character described, the combination of a die having a nose provided with a wire guiding aperture and having wire bending faces at opposite sides of said aperture, a finger for engaging said wire and bending it alternately into engagement with said faces, supporting and operating mechanism for raising and lowering said finger and for oscillating said finger about an axis extending transversely to said aperture and located immediately in front of it, mechanism for feeding predetermined lengths of said wire through said aperture between successive bending operations, whereby said finger will bend said wire alternately in opposite directions and will produce oppositely offset sections in the wire connected by transversely bent portions, and a crimping mechanism to which the wire so bent is fed by said feeding mechanism, said crimping mechanism being constructed and arranged to crimp said transversely bent portions of the wire.

10. In a machine of the character described, the combination of mechanism for making in a length of wire oppositely disposed offset sections connected by transversely bent portions of the wire, cooperating dies for crimping said transversely bent portions, means for feeding the wire from said mechanism to said dies, and a tapered guideway through which said bent wire is guided into operative position between said crimping dies.

11. In a machine of the character described, the combination of a die including a nose having a wire guiding aperture therethrough and provided with angular wire bending faces at opposite sides of said nose, a finger of triangular form in cross-section for engaging said wire and bending it alternately into engagement with said faces, said faces being approximately complemental in shape to the angular cross-sectional form of said finger, supporting and operating mechanism for said finger constructed and arranged to oscillate the finger about an axis extending transversely to said aperture and located immediately in front of it to give said finger its wire bending movements and for lowering and raising said finger between successive wire bending operations, and mechanism for feeding predetermined lengths of said wire through said aperture between successive wire bending operations of said finger.

12. In a machine according to preceding claim 11, the provision of shoulders in said wire bending faces to support the wire against the drag of said finger after the finger has bent the wire against said respective faces.

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