

Nov. 20, 1962

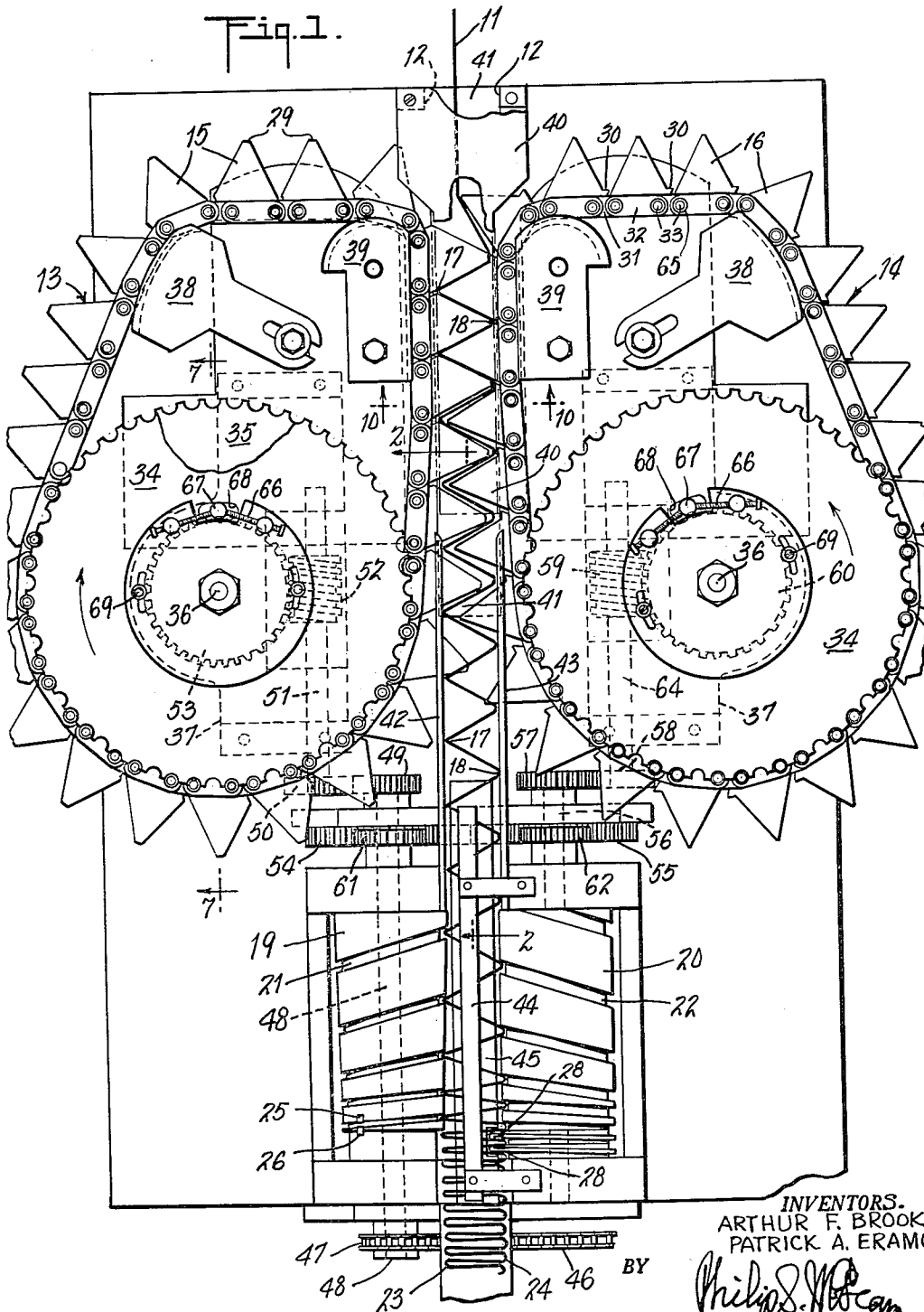
A. F. BROOK ETAL

3,064,694

WIRE FORMING MACHINE

Filed May 3, 1961

3 Sheets-Sheet 1



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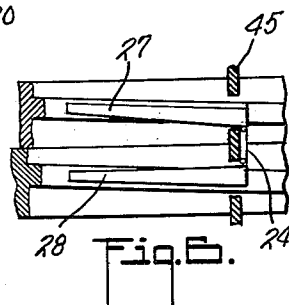
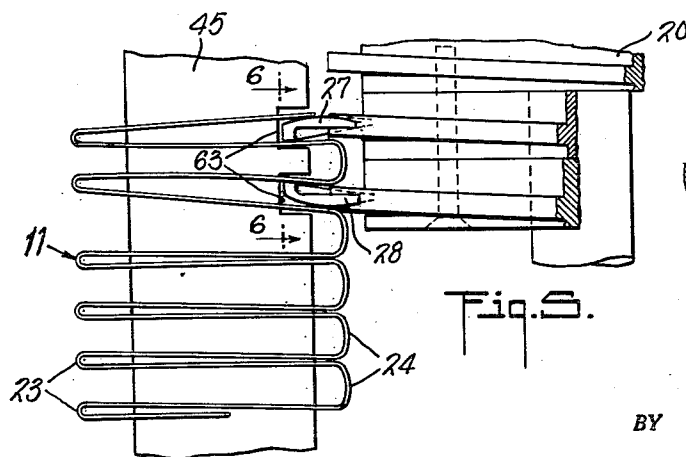
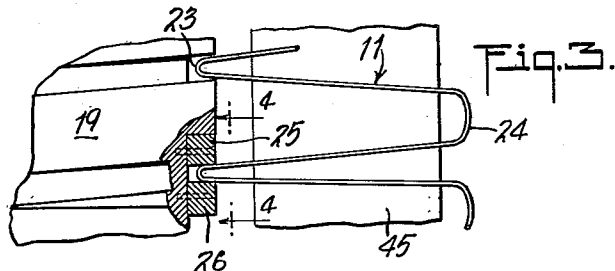
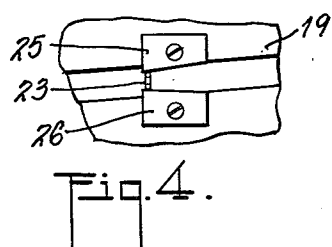
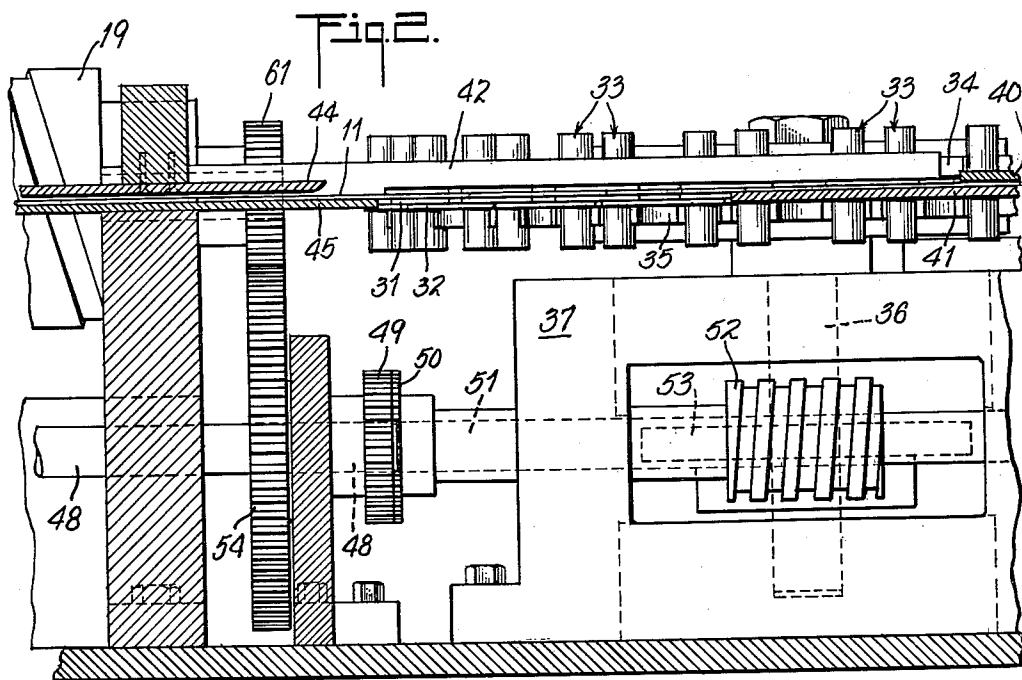
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3 Sheets-Sheet 2



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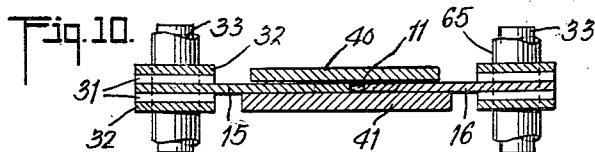
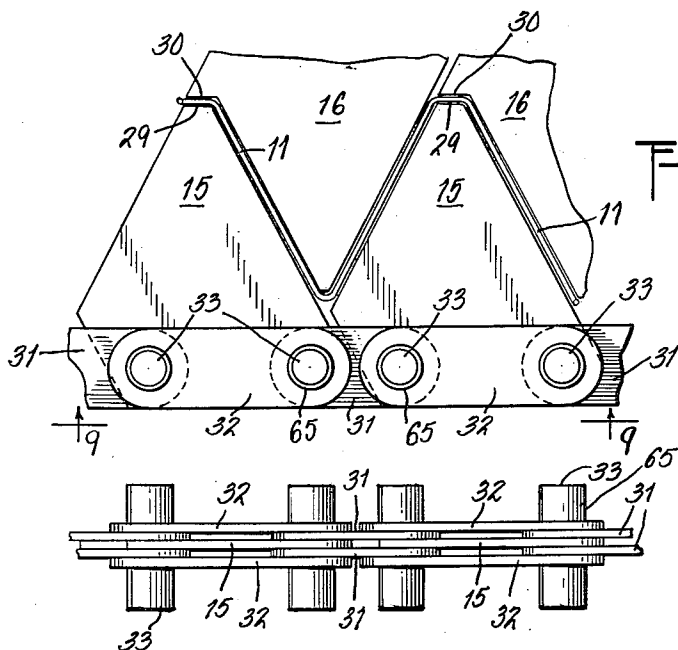
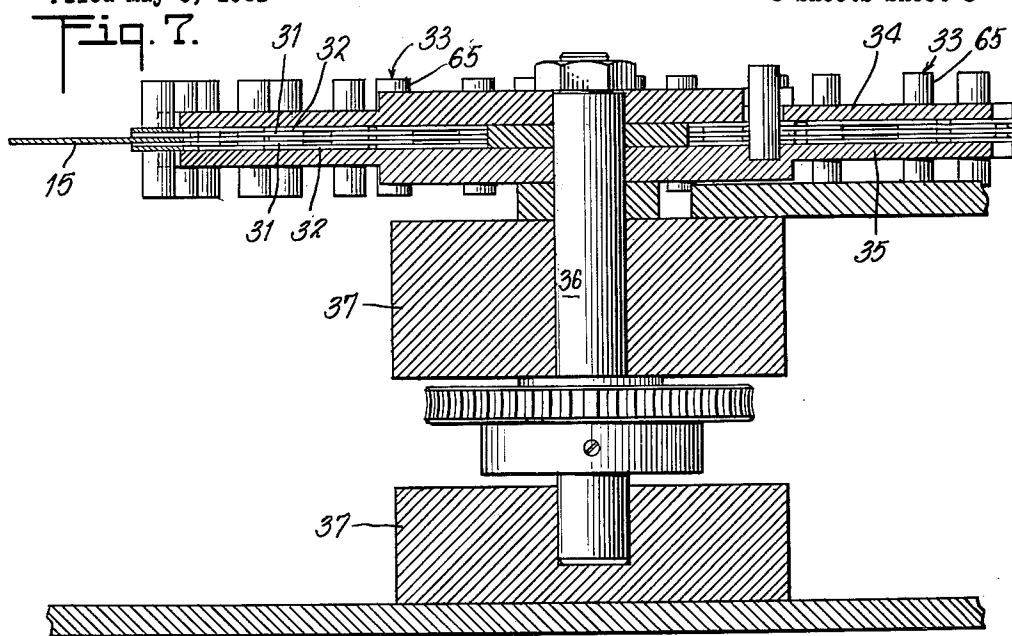
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WIRE FORMING MACHINE

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3 Sheets-Sheet 3



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3,064,694

WIRE FORMING MACHINE

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5 Claims. (Cl. 140—105)

The invention herein disclosed relates to machines for forming wire into predetermined shapes.

Special objects of the invention are to provide a machine which will form wire in a progressive manner into more or less unusual or complicated shapes and accomplish this in a continuous uninterrupted flow of operational steps, with resultant savings in time and power requirements, increase in production rates and other advantages.

Further special objects of the invention are to accomplish these results and obtain such advantages with a simple practical form of construction consisting of relatively few parts and efficient and reliable in its operation.

The drawings accompanying and forming part of this specification illustrate a present practical embodiment of the invention. Structure however may be modified and changed as regards the illustration, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

FIG. 1 in the drawings is a broken plan view of one of these new wire forming machines designed in this particular case for manufacture of ring binders of the type illustrated in Patent No. 2,116,589. In this view the wire is shown entering the machine at the top and first bent into zigzag formation by passage between companion die chains and thereafter entering the grooves in companion die rolls where the bends in the wire are reduced and set to produce the parallel binder ring forming fingers shown issuing from the machine at the bottom.

FIG. 2 is an enlarged longitudinal sectional view on substantially the plane of line 2—2 of FIG. 1.

FIG. 3 is a further enlarged top plan and part sectional view showing a portion of the left hand die roll with the bend closing and setting dies at the end of the groove therein.

FIG. 4 is a broken plan view of the companion dies which pinch the tips of the ring forming finger portions of the wire together into final shape, as on line 4—4, FIG. 3.

FIG. 5 is a broken plan and part sectional view of a portion of the right hand die roll illustrating the die formation for pinching and setting the connecting base portions of the wire.

FIG. 6 is a cross sectional detail view of the latter construction on substantially the plane of line 6—6 of FIG. 5.

FIG. 7 is a broken part sectional view on substantially the plane of line 7—7 of FIG. 1 showing how the die forming chains are carried by companion upper and lower sprockets.

FIG. 8 is a broken plan view of a portion of one of the die chains and showing portions of the mating dies with the wire as it is being bent between them.

FIG. 9 is an edge view of a portion of the left hand die chain.

FIG. 10 is a broken sectional detail through companion dies with the wire therebetween, appearing as on substantially the plane of line 10—10 of FIG. 1.

In the general view, FIG. 1, the wire is indicated at 11 entering one end of the machine through a guide 12 and passing between opposed chains 13, 14 carrying triangular die blades 15, 16 which approach in alternating relation to shape the wire into oppositely projecting relatively pointed and abrupt bends 17, 18.

Leaving the chains in this preliminary zigzag formation the bent wire stock passes between companion die rolls 19, 20 helically grooved at 21, 22 to take the bends 17, 18 in the wire, these grooves decreasing in width and pitch toward the ends of the rolls to squeeze the bends of the zigzag wire into closer formation and to set them into the parallel binder finger formation shown at 23 connected in such spaced parallel relation by the connecting back portions 24, the latter appearing more clearly in FIGS. 3 and 5.

As the ring binder forming stock leaves the grooves in the die rolls companion opposed dies 25, 26 at the end of the groove in the left hand die roll 19 pinch the tips of the ring forming portions 23 into close final position, FIGS. 3 and 4, and companion final forming dies 27, 28, FIGS. 5 and 6, at the end of the groove in the right hand roll 20 impart a desired set to the connecting base portions 24 of the formed wire.

At all points in its travel through the machine the wire is guided and kept under control so as to flow smoothly and continuously through from one stage to another.

The triangular die blades or plates 15 are shown as having relatively abrupt blunt ends 29 to put the ring finger spacing bends 24 in the wire stock and the companion, more pointed blades 16 are shown as shouldered at 30 to in effect "mesh" with the blunt tips of the first blades to give desired spacing formation and set to these bends.

FIGS. 8, 9 and 10 show how the chains are made up with the triangular die blades faced on opposite sides by shorter connecting links 31, overlaid by longer cover links 32, with pivot pins 33 projecting through the assembled blades and links and extending far enough at opposite ends to mesh with the teeth of upper and lower drive sprockets 34, 35, FIG. 7.

The sprockets of each pair are mounted on shafts 36 in spaced relation, as shown in FIG. 7, to receive between them the connecting links 31, 32 of the chains.

Approach of the companion die carrying chains is accurately regulated by riding the chains over curved guides 38 where the chains leave the sprockets and over appropriately curved guides 39 where the chains come together over opposite sides of the wire.

Top and bottom guides 40, 41 for confining and holding the wire in position between the bending dies are shown in FIGS. 1 and 2 and these are continued far enough to insure the zigzag strip clearing the chains and entering properly between the die rolls.

In addition to the top and bottom guides 40, 41, side guides are shown at 42, 43, FIG. 1, for directing the bent wire into proper position between the die rolls. Also a top guide is indicated at 44 in this view for holding the traveling zigzag wire down flat in riding engagement with the grooves, over the bottom support plate 45.

Synchronized drive of the sprockets and die rolls is effected in the illustration by chain 46 to a sprocket pinion 47 on the shaft 48 which drives the left hand die roll, FIG. 1, said shaft carrying a pinion 49 in mesh with pinion 50 on shaft 51 carrying a worm 52 in mesh with worm gear 53 on the left hand sprocket shaft 36; power shaft 48 carrying the gear 54 in mesh with gear 55 on shaft 56 connected by gears 57, 58 with shaft 64 carrying worm 59 for the worm gear 60 of the right hand sprocket shaft 36. The helix rolls 19, 20 carry gears 61, 62 engaged with gears 54, 55 on the parallel power shafts 48, 56.

The wire is drawn into the machine smoothly and continuously by the die carrying chains without stop or interruption and advanced to the final forming rolls which complete the bending operations and set the stock to the final shape. The traveling bending dies effect feeding of the wire, eliminating need for any wire feeding mecha-

nism and may pull the wire through any usual or special wire straighteners.

The dies such as 25, 26 for pinching in and closing the points of the double strand binder ring fingers may be embedded in and lie flush with the surface of the roll 19.

The companion dies 27, 28 for pinching in the sides of the ring forming fingers, as shown in FIG. 5, necessarily reach out from the roll 20 to pass between the strands of adjacent fingers. The bottom support 45 for the zigzag wire strip is therefore notched as shown at 63 to pass the outreaching die elements 27, 28.

The die blades which bend the wire into zigzag formation are shaped and spaced to meet in meshing relation approximately the distance of the wire diameter apart so as to grip while bending the wire to requisite shape.

The extended end portions of the pivot pins of the chains may be fitted with roller forming sleeves as indicated at 65, FIG. 8, so as to reduce friction in passage of the chains about the fixed guides 38, 39 and engagement of the pins with the sprockets.

To effect accurate registration of the sprocket gears of each pair the top gear 34 may be provided with adjusting screws 66, FIG. 1, engageable with a post 67 projecting up from the bottom gear through a slot 68 in the top gear and with bolts or screws 69 for clamping the two gears in angularly adjusted relation.

In the machine illustrated there are two pivot pins 33 on the base line of each triangular die blade, as shown in FIG. 8, and these two pins mesh with two corresponding sockets in the sprocket gears so that the blades are firmly held and carried along by the sprockets.

The preliminary zigzag forming operation and the subsequent bend closing and setting operation are both continuous, with the product of the first flowing smoothly into the second enabling the machine to operate smoothly and quietly at a high rate of production.

While shown designed to produce binder ring wires it will be appreciated that the machine of this invention is well adapted for manufacture of many other different products.

The machine illustrated is of relatively simple construction, consisting of but few, rugged parts, which can be produced and assembled at low cost and this machine has the further advantage that it is compact and takes up small floor space.

What is claimed is:

1. A wire forming machine comprising convergently traveling chains having wire forming dies projecting therefrom and meeting in alternating order at the point of convergence of the chains, spaced apart a distance approximately the diameter of the wire to be operated on and for bending wire between the same to the approximate shape of the meeting dies and companion rolls at one end of said chains having helically extending die grooves positioned to receive the bends put in the wire by the coacting dies of the chains, said helical grooves in the die rolls being of decreasing pitch in the direction away from the chains to apply progressive squeezing action on the bends in the wire, the wire bending dies on one chain being pointed to put relatively sharp bends in the wire and the dies on the other chain being blunt ended to put wider bends in the wire and the grooves in the respective die rolls having relatively narrower and wider reducing grooves respectively to receive the relatively sharper and wider end bends placed in the wire by the chains.

2. In a machine for forming wire, the combination of companion die rolls rotating on parallel axes and having helically progressive die grooves and means for delivering preformed zigzag wire having alternately disposed oppositely extending bends therein into engagement with said

rolls and with the oppositely extending bends entered into said helically progressive die grooves, the die grooves in the two rolls being longitudinally offset one in advance of the other in register with the alternately disposed oppositely extending bends in the wire and said die grooves in the two rolls being of progressively decreasing width to thereby progressively contract the bends in the wire entered therein, said means for delivering the zigzag bent wire including means for forming the bends at one side of the wire wider than the bends at the opposite side of the wire and the die groove in one roll being wider than the die groove in the companion roll to accommodate said wider bends formed at said one side of the wire.

3. A wire forming machine comprising the combination of endless chains composed of companion flat die blades pivotally connected by links at opposite sides of the same and pivot pins extending through said links and blades and projecting at opposite ends beyond the links, companion sprockets spaced apart the thickness of said chains and receiving between them the links of said chains and engaged by the projecting ends of said pivot pins and whereby said chains are supported and confined between and driven by said sprockets, the blades projecting beyond the sprockets in this relation, the sprockets of the companion chains being located to carry the projecting die blades into converging and overlapping relation, stationary wire confining guides over opposite faces of the projecting portions of said converging die blades for maintaining said die blades in alignment and for holding wire confined between the companion die blades and means for driving the sprockets carrying the chains in unison.

4. A machine for progressively feeding and forming wire into a series of narrow, pointed U-shaped loops joined together in spaced parallel relation by substantially straight lengths of the wire connecting the open ends of such loops and comprising companion, opposed generally triangular wire forming dies and means for approaching said dies in alternately disposed overlapping relation spaced apart substantially the distance of the wire diameter and for then separating such dies to thereby draw the wire in between opposing dies, bend it to the formation of the companion dies and then discharge the bent wire from between the dies, said opposed dies comprising a set of relatively sharply pointed dies at one side of the wire line to form sharply angled bends in the wire for the formation of the pointed U-shaped loops and a cooperating set of opposed dies having oppositely facing blunt ends for bending substantially straight lengths of wire connecting the open ends of said bent loops, the more pointed dies having abrupt shoulders on one side of the same registering with said blunt ends of the companion dies in the travel of the opposed dies to thereby form substantially straight lengths of wire connecting adjoining loops of wire in the spaced substantially parallel relation set forth.

5. The invention according to claim 4 with companion die rolls rotating on substantially parallel axes having helically progressive die grooves of progressively decreasing width in the direction of rotation with the die groove in one roll relatively narrow and positioned to receive the ends of the loops bent in the wire and the groove in the other die roll of wider extent and positioned to receive the bent lengths of wire connecting the loops.

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