Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 1

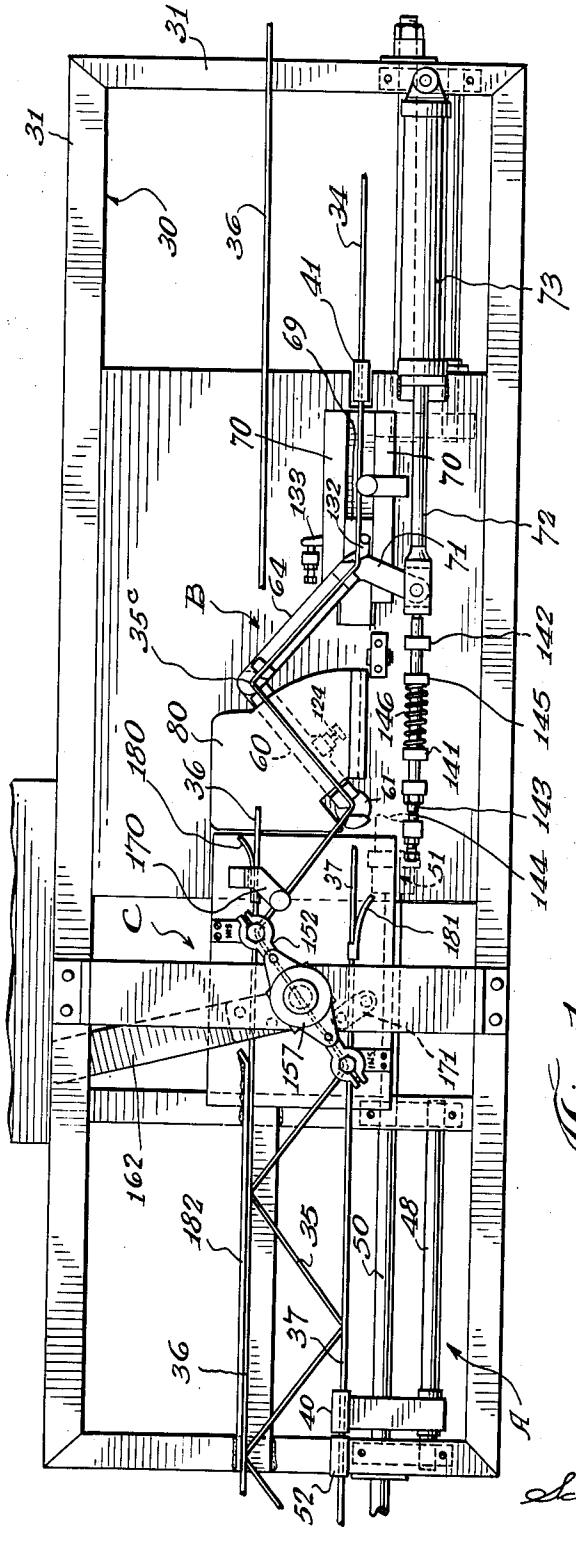


Fig. 1.

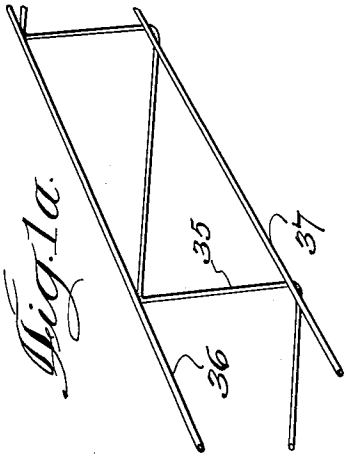


Fig. 1a.

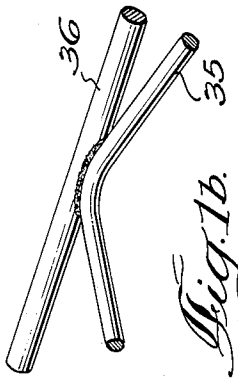


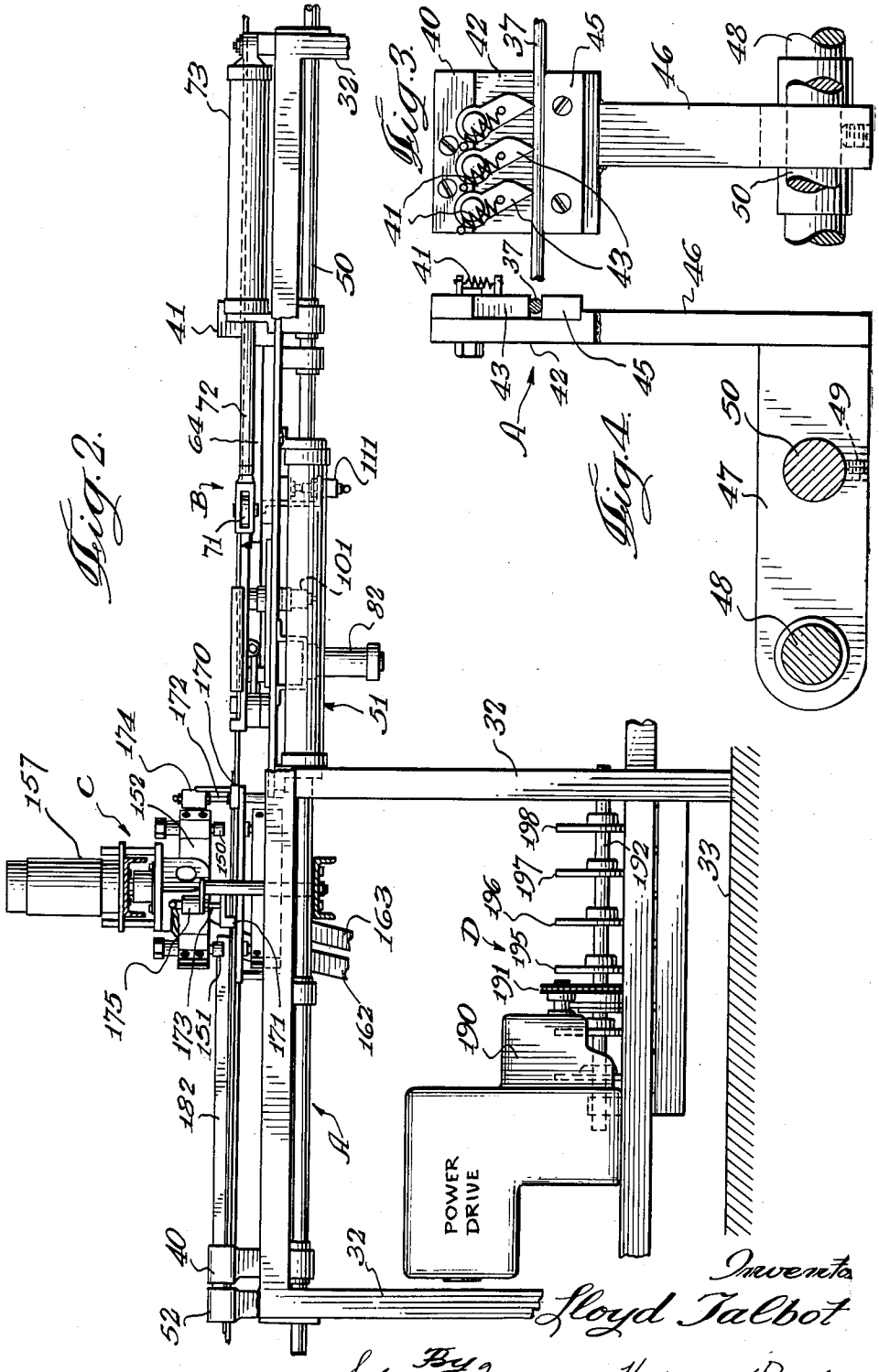
Fig. 1b.

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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 2



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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 3

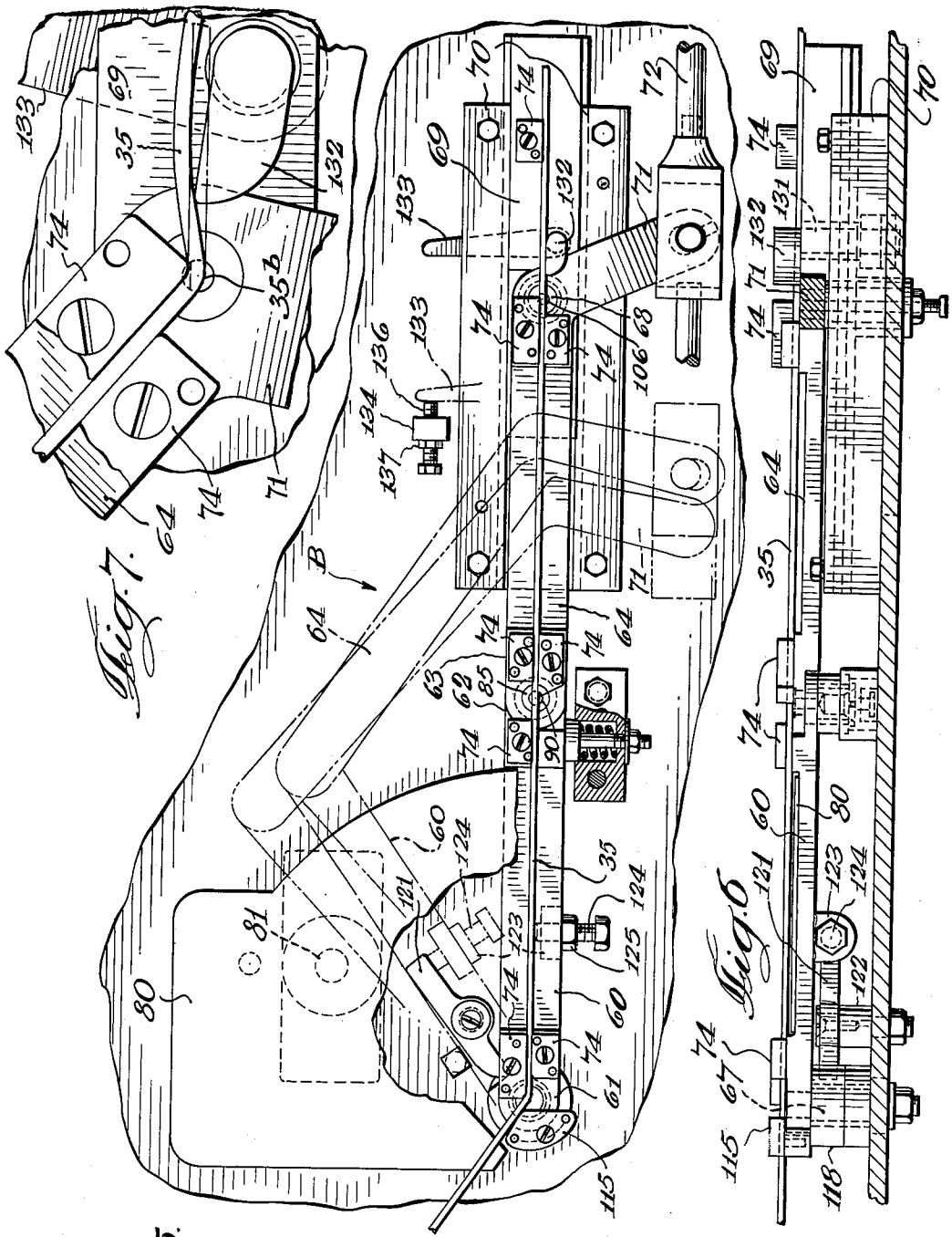


Fig. 7.

Fig. 5.

Fig. 6.

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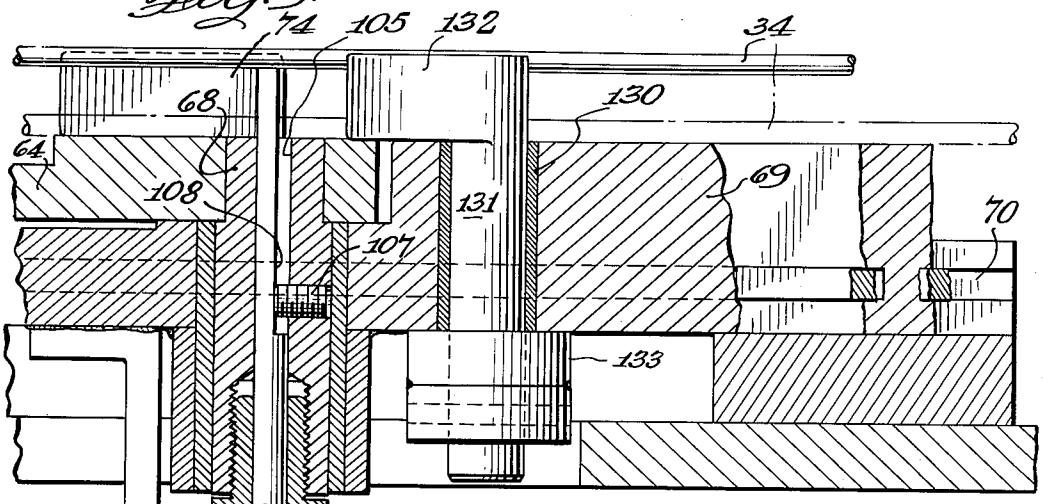
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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 4

Fig. 9.



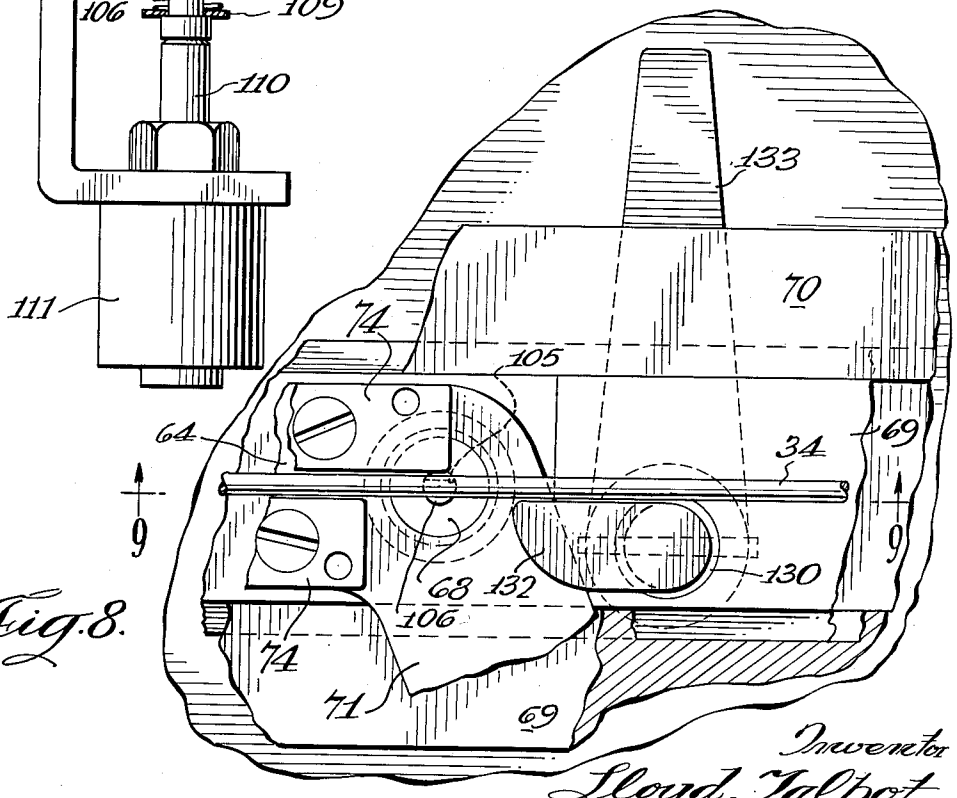


Fig. 8.

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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 5

Fig. 11.

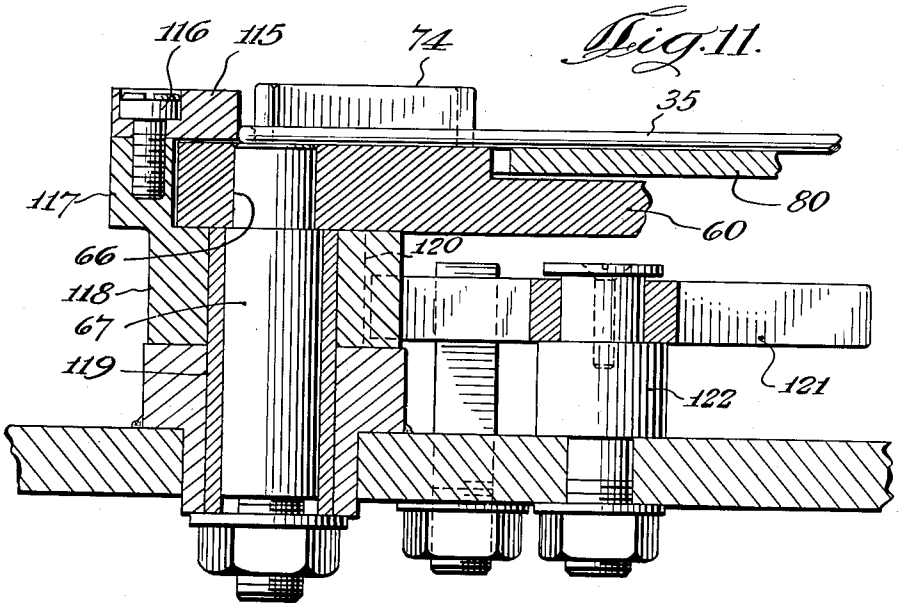
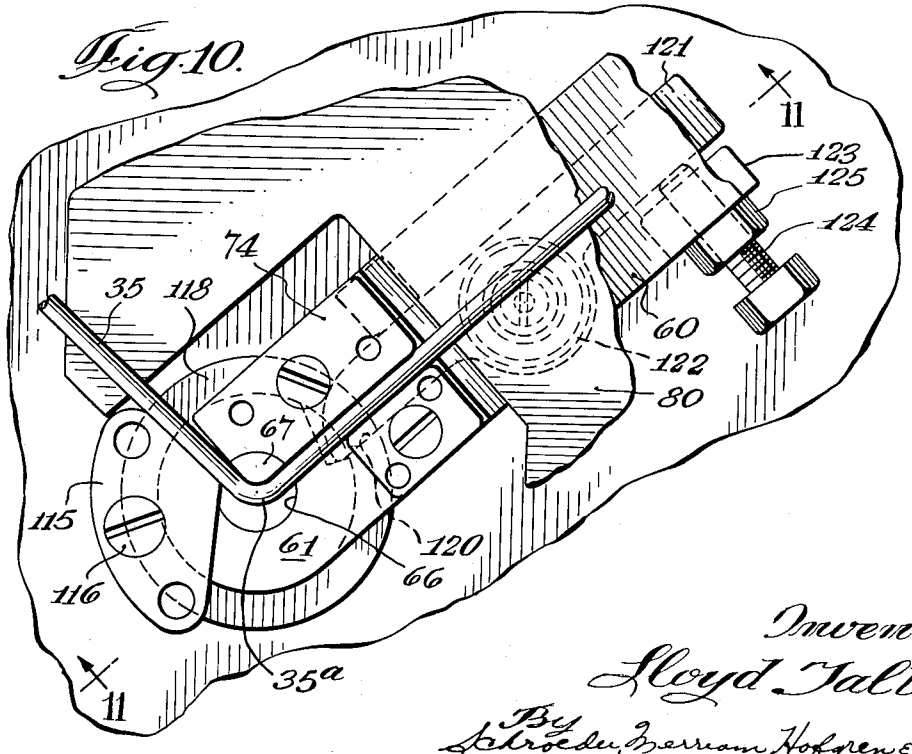


Fig. 10.



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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 6

Fig. 13.

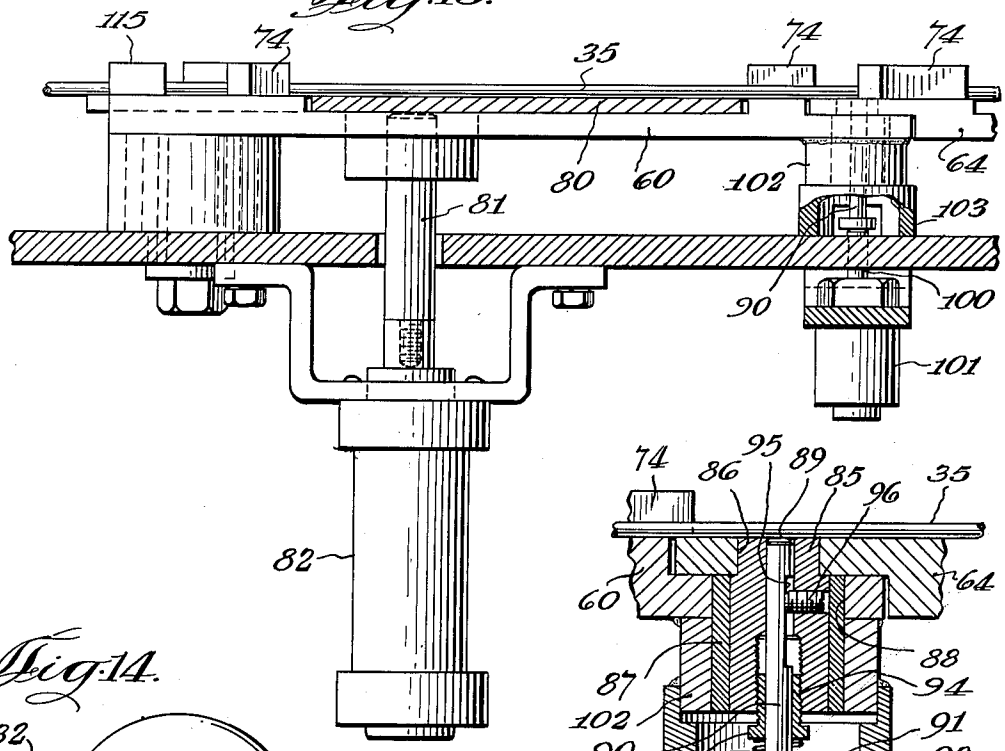


Fig. 14.

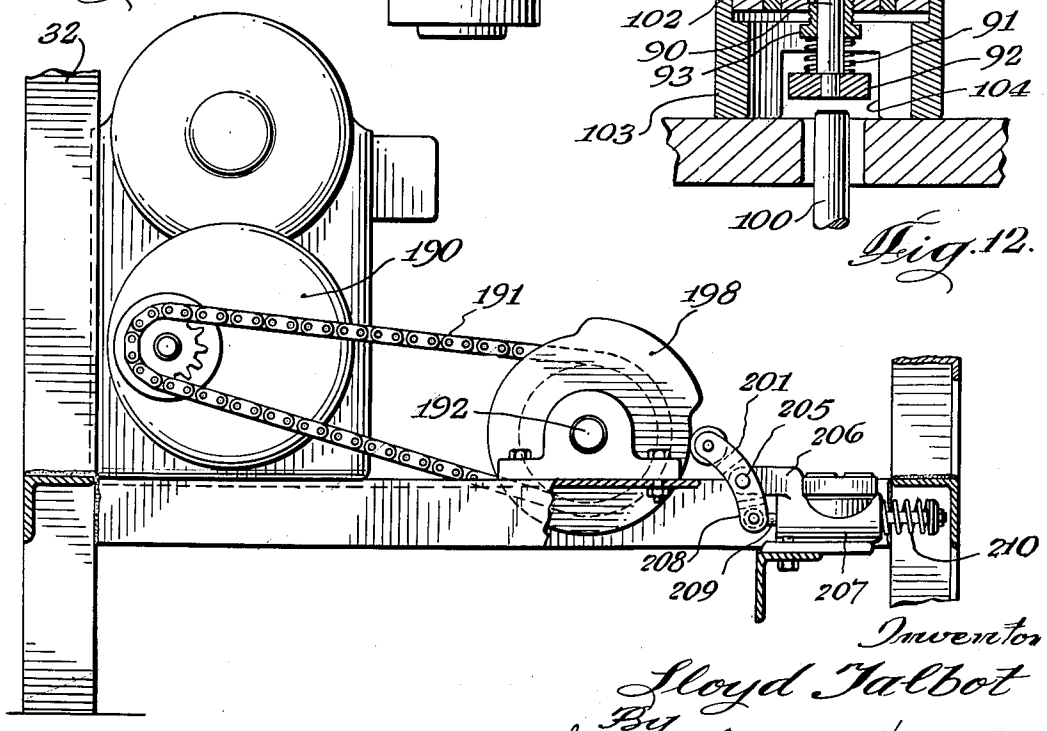


Fig. 12.

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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 7

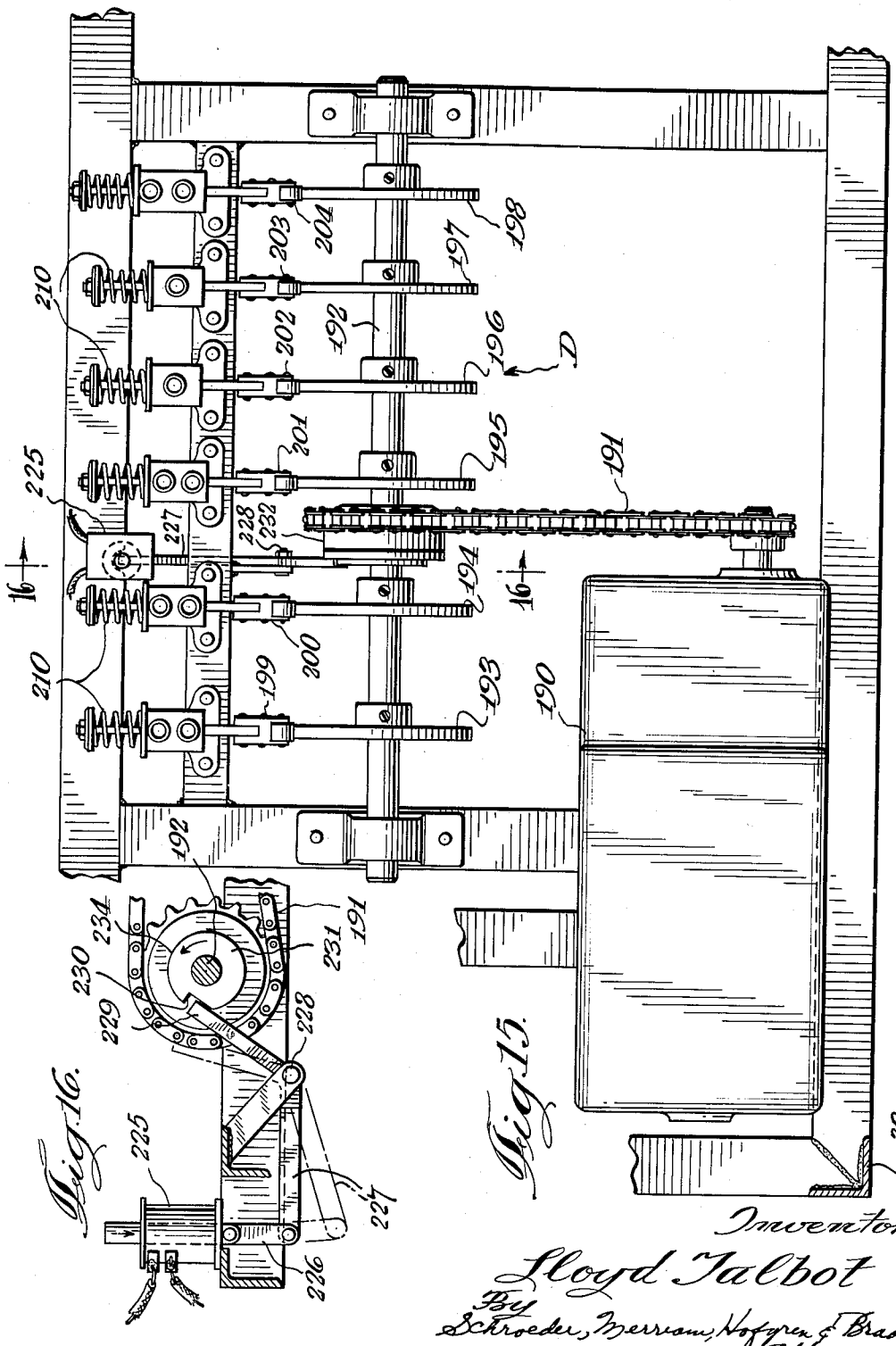


Fig. 16.

Fig. 15.

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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 8

Fig. 17.

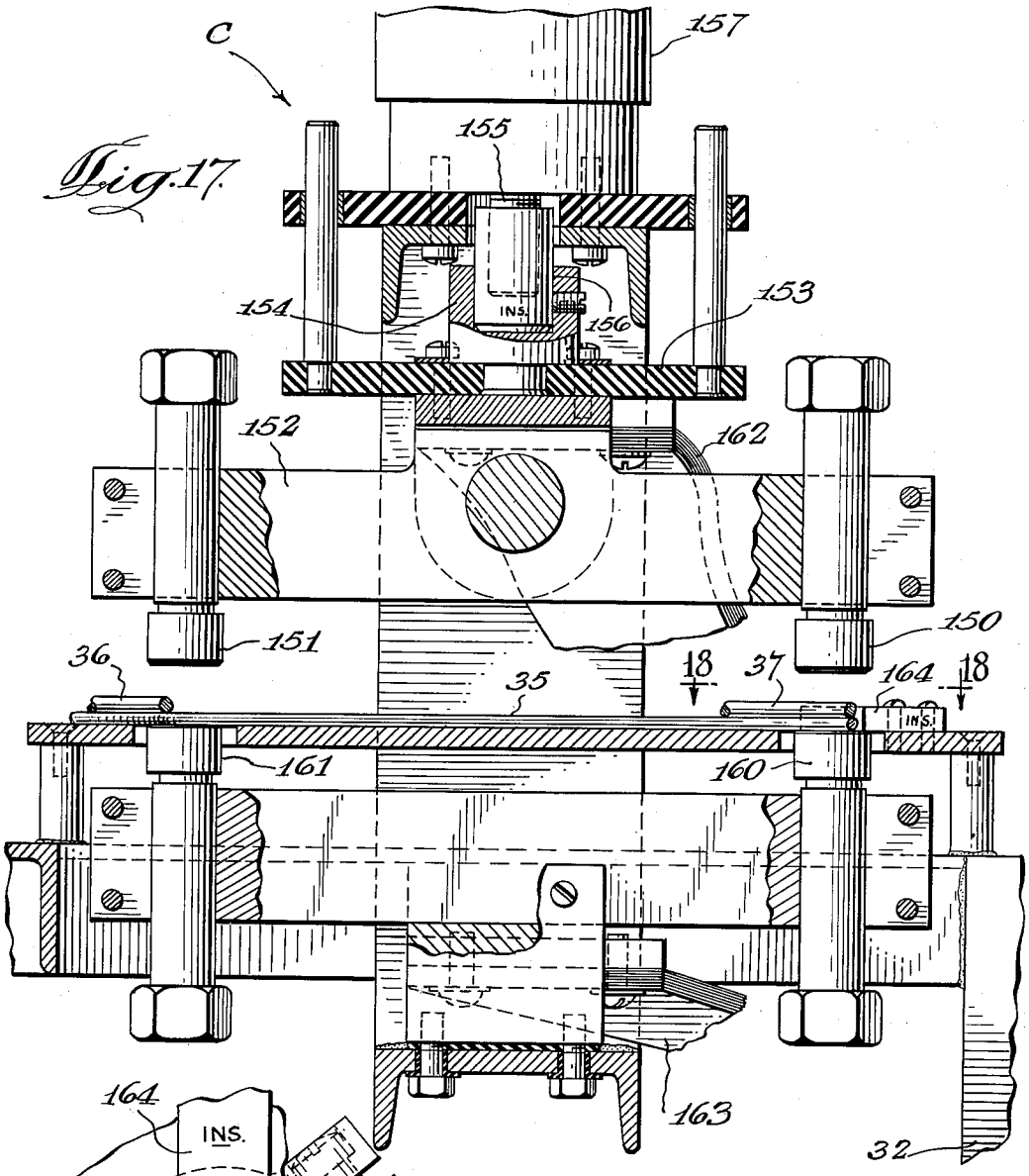
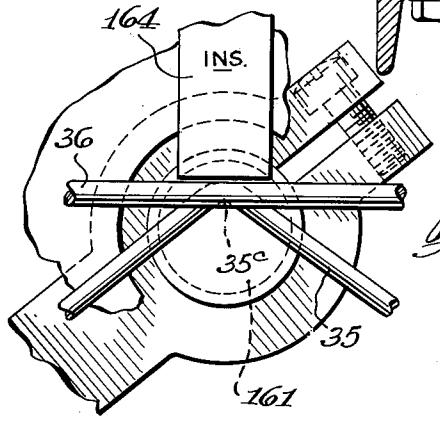


Fig. 18.



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Nov. 1, 1955 L. TALBOT 2,722,242

WIRE FORMING APPARATUS

Filed Oct. 26, 1951 9 Sheets-Sheet 9

Fig. 19.

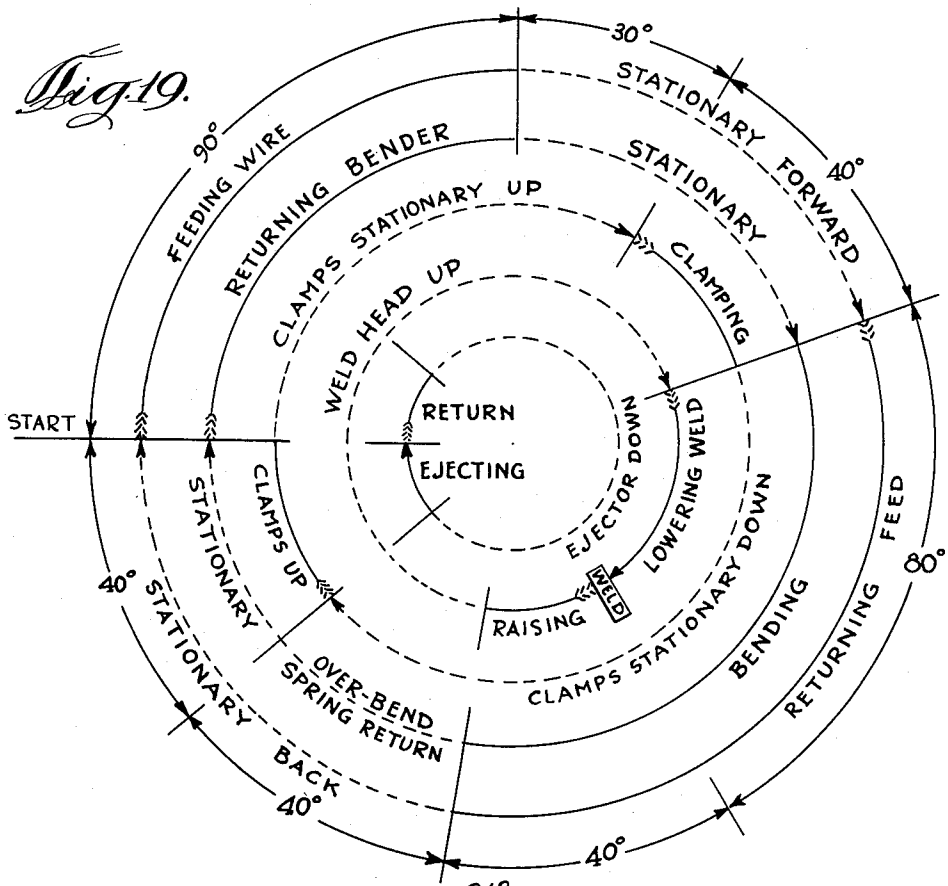
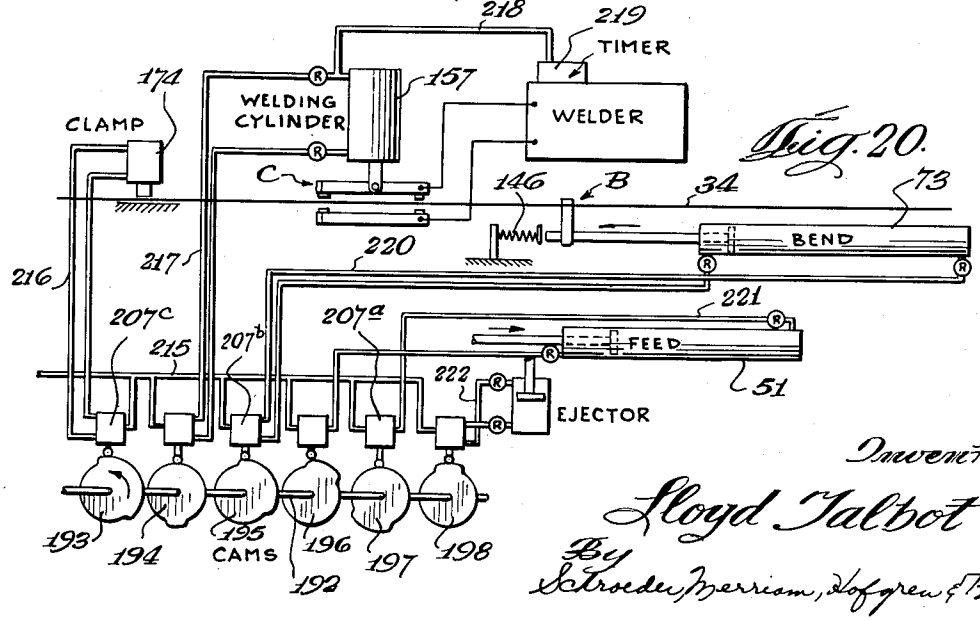


Fig. 20.



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United States Patent Office 2,722,242 Patented Nov. 1, 1955

2,722,242

WIRE FORMING APPARATUS

Lloyd Talbot, Chicago, Ill., assignor to Cedar Rapids Block Co., a corporation of Iowa

Application October 26, 1951, Serial No. 253,271

10 Claims. (Cl. 140—71)

This invention relates to a wire forming apparatus and more particularly to an apparatus for forming wire into a pattern and securing such patterned wire to at least one other wire, said apparatus being so constructed and arranged as to be automatically operable in predetermined cycles progressively to form a continuous length of wire into a pattern and to secure the formed wire to at least one other continuous length of wire.

It is the general object of this invention to produce a new and improved wire forming apparatus.

It is a more specific object of this invention to produce a wire forming apparatus which includes means for bending a first continuous length of wire into a pattern and then guiding the bent wire into contact with a second wire and to provide such an apparatus with means for securing the two wires together at their point of contact.

A feature of this invention is the provision of a wire forming apparatus which is provided with guide means for guiding two continuous lengths of wire in spaced parallel relationship across the apparatus and to provide bending means on such apparatus adapted to bend a third length of wire into a pattern having a diameter at least equal to the space between said parallel wires and to provide such apparatus with means for securing the bent wire to each of the two spaced wires at their points of contact.

A further feature of the invention is the provision in a wire forming apparatus of the type described in the preceding paragraphs with means for feeding wire to the bending means and the securing means and means for operating the bending and securing means in cyclical relationship to the operation of the feeding means to provide an apparatus capable of automatic continuous operation.

An additional feature of the invention is the provision of bending means for bending a continuous length of substantially straight wire into a pattern, the bending means including a pair of arms pivotally connected together at their ends and provided with means for retaining a length of wire thereon, together with power-operated means for moving the arms from a first position in which they are linearly aligned to a second position in which they are angularly aligned whereby to bend a length of wire held in the retaining means thereon into substantially the shape of a V.

A further feature of the invention is to provide bending means of the type described in the preceding paragraph with means for overbending the wire at each angle of the V to an extent whereby the natural resiliency of the wire will spring the bent wire back into the desired V shape.

A further feature of the invention is the provision of power-operated release means for releasing wire from the bending means at the termination of the bending operation.

Another feature of the invention is the provision of release means of the type described in the preceding paragraph which may take the form of plungers located substantially at the pivotal axis of the arms together with a

device for operating the plungers to lift the bent wire from the retaining means on the arms at the conclusion of the bending operation.

Other and further features of the invention will be readily apparent from the following description and drawings, in which:

Fig. 1 is a top plan view of an apparatus embodying the invention;

Fig. 1A is a detail view of the completed wire reinforcing device produced by the machine;

Fig. 1B is an enlarged detail view of the underside of the wires shown in Fig. 1A;

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

Fig. 3 is a side elevation of a portion of the feed mechanism;

Fig. 4 is an end view of the feed mechanism shown in Fig. 3;

Fig. 5 is an enlarged detail view of a portion of Fig. 1 showing the bending means in two positions;

Fig. 6 is a side elevation, partially in section, of the apparatus shown in Fig. 5;

Fig. 7 is an enlarged detail view of one end of the bending mechanism shown in Fig. 5;

Fig. 8 is a view like Fig. 7 showing the bending mechanism in another position;

Fig. 9 is a vertical section along line 9—9 of Fig. 8;

Fig. 10 is an enlarged detail view of the other end of the bending mechanism;

Fig. 11 is a vertical section taken along line 11—11 of Fig. 10;

Fig. 12 is a vertical section taken through the central portion of the bending mechanism showing the release means located at the point of connection of the two bending arms to each other;

Fig. 13 is a side elevation, partially in section, of one end of the bending mechanism showing the release means located thereat;

Fig. 14 is a view showing certain details of the timing and synchronizing mechanism;

Fig. 15 is a side elevation of the lower portion of the apparatus showing further details of the timing mechanism;

Fig. 16 is a side elevation showing the shut-off mechanism for the apparatus;

Fig. 17 is a vertical section taken through the welding means provided on the top of the apparatus;

Fig. 18 is a horizontal plan view substantially along line 18—18 of Fig. 17;

Fig. 19 is a diagrammatic view of the cycles of the apparatus; and

Fig. 20 is a schematic diagram of the timing and power means for operating the various devices of the apparatus.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail one specific embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring now to Figs. 1 and 2, the bending apparatus of this invention comprises generally a framework 30 which may consist of angle irons 31 welded together at their junctures to form a table-like support having legs 32 for supporting the same above a base or floor 33. Mounted on the top of the framework are the wire forming means of the apparatus which include feed means generally designated A for feeding a continuous length of wire 34 in to a bending means generally designated B and for leading the bent wire (which, for the purpose of distinguishing it from the unbent wire is designated 35)

to means generally designated C for securing the bent wire to two continuous lengths of substantially straight wire **36** and **37**. Means generally designated D are provided for synchronizing the operation of various means just described in predetermined cyclical relationship to provide for continuous operation of the apparatus. Thus one of the features of the present apparatus is the provision of means whereby the two continuous lengths of wire **36** and **37** are guided in spaced parallel relationship across the top of the frame to a position beneath the securing means C (which may take the form of the welding apparatus illustrated) there to be welded to contacting portions of a third wire **35** which has been bent into the form illustrated by the bending means B.

While in the embodiment of the invention chosen for illustration, the final product of the apparatus is a reinforcing wire member adapted for use in the construction of masonry walls using cement blocks as shown in U. S. Patent 2,300,181 issued to Harold L. Spaight on October 27, 1942, it will be readily apparent to those skilled in the art that the general principles of the invention may be applied to the construction of bendable materials taking other forms, and hence it is not intended that the invention be limited to an apparatus for forming the particular type of wire device disclosed.

As best shown in Figs. 1 to 4, the feed means A include a pair of feed dogs designated **40** and **41**, which are substantially identical in design. Thus the feed dog **40** is provided with a vertical plate **42** to which are pivotally secured a plurality of uni-directional dog teeth **43** urged into engagement with the wire **37** by springs **44**. The dog teeth **43** engage the wire as it rests upon a horizontal block **45** secured to the plate **42**. The feed dogs **40** and **41** are each mounted on a vertically upstanding arm, such as the arm **46** (Fig. 4), which is secured to a horizontal arm **47** slidably mounted upon a rod **48** which extends longitudinally under the top of the frame. The arm **47** is adjustably secured by means of a set screw **49** to a rod **50** which extends horizontally substantially across the entire frame and which is secured intermediate its ends to the piston in a pneumatic piston and cylinder motor **51**. Thus operation of the motor **51** serves to reciprocate the rod **50** and hence the feed dogs **40** and **41** longitudinally of the machine.

The feed dog **40** serves intermittently to advance the wire **37** and hence the wires **35** and **36** as they are secured to that wire while the feed dog **41** moves the wire **34**, the wire which ultimately becomes the bent wire **35**, into the bending means B.

In order to prevent the wires from moving oppositely to the feeding direction when the feed dogs **40** and **41** are moved on their return strokes, a fixed dog **52** constructed similarly to the dogs **40** and **41** is provided at the left-hand end (as seen in Fig. 1) of the frame and engages the wire **37** to prevent back-slippage of the wires.

As best seen in Figs. 1, 5, 6 and 7, the bending means B includes a first arm **60** pivoted at one end **61** to the frame of the machine and pivotally connected at its other end **62** to the end **63** of a second arm **64**.

To provide such pivotal mounting for the arms, the arm **60** (see Figs. 10 and 11) is provided at its end **61** with an opening **66** rotatably engaging a bearing post **67** fixed in the framework. The arm **64** (see Figs. 8 and 9) is rotatably mounted about a bearing post **68** provided in a block **69** slidably supported in guides **70** secured to the frame.

Integrally secured to the arm **64** is a power arm **71** pivotally secured to a piston rod **72** secured to the piston in a pneumatic piston and cylinder device **73**. Reciprocation of the piston within the piston and cylinder device **73** serves to flex the bending knee formed by the arms **60** and **64** from the position shown in solid lines in Fig. 4 to the position shown in dotted lines to bend a length of wire held therein into substantially the shape of a V.

Means are provided on each arm for retaining a length of wire therein during the bending operation, the means taking the form of spaced blocks, all indicated by the reference numeral **74**, provided on each of the arms, the spacing of the blocks being such as to retain the wire therebetween and on the arms during the bending operation.

Means are provided for releasing or ejecting a bent wire from the bending means at the completion of the bending operation so that the bent wire is free of the retaining means to be advanced with reciprocation of the feed means. The release means for the arm **60** takes the form of a flat horizontal plate **80** which, as best shown in Fig. 13, is positioned as to overlie the arm **60** and to carry the wire **35** thereon during the bending operation. The plate is so proportioned as to lie intermediate the wire and the arm at all positions of the arm during the bending operation. The plate **80** is mounted for vertical movement upon a piston rod **81** secured to the piston in a pneumatic piston and cylinder device **82** so that introduction of compressed air into the pneumatic motor **82** serves to move the plate vertically to lift a length of wire **35** out of the space between the blocks **74**.

A second ejector or release mechanism is provided at the pivotal juncture of the arms **60** and **64**, this latter device being shown in section in Fig. 12. Inspection of that figure reveals that the post **85**, which is rotatably received in an opening **86** formed in one end of the arm **64** and which supports about its outer surface a bearing **87** rotatably received in an opening **88** in the arm **60**, is provided with a central vertical cylinder **89** in which a plunger **90** is reciprocable. The plunger is constantly urged downwardly by a compression spring **91** which bears against a head **92** secured to the lower end of the plunger **90** and against a head **93** formed on a guide member **94** threadably secured in the post **85**. The plunger is provided with an elongated notch **95**, the ends of which are adapted to be engaged by a pin **96** to prevent the plunger **90** from dropping out of the opening **89**. A rod **100** is positioned vertically beneath the location of the head **92** when the arms are in the flexed position and is secured to a piston in a piston and cylinder device **101** so as to be projected upwardly by the introduction of air into the device to strike the head **92** and hence to move the plunger **90** upwardly into contact with the bent wire **35** at the pivot point between the arms **60** and **64**. The head **92** is made somewhat enlarged to insure that the rod **100** will strike it even though slight variations occur in the location of the plunger **90** as the arms are flexed. An annular retainer housing **102** surrounds the post **85** and is welded to that portion of the arm **60** in which the opening **88** is provided. A second annular housing **103** is welded to the outer surface of the housing **102** and is provided with an opening **104** in one side thereof to permit the housing to slide over the pin **100** as the arms are flexed.

To release the bent wire from the retaining means provided at the right-hand end (as seen in Fig. 1) of the arm **64**, the post **68** is provided with a central vertical cylinder **105** in which an ejector pin **106** is reciprocably retained by a stop **107** which protrudes into a slot **108** formed in the pin **106**. The lower end of the pin is provided with a head portion **109** adapted to be engaged by an ejector rod **110** secured to the piston in another piston and cylinder device **111**. The function of this latter device is the same as the device **101** and the similarity in the mounting of the pins **90** and **106** is believed apparent from the drawings.

Inasmuch as the wire to be bent possesses considerable resiliency it is necessary that it be bent beyond the ultimately desired form in order that upon release of the tension of the bending machine it may assume the final desired shape or pattern. Such overbending means must be provided for each angle of the pattern. In the exemplary embodiment chosen for illustration, the wire is bent into a series of Vs and hence overbending means for over-

bending the wire at three places, namely at each angle of the V, are provided.

Referring now to Figs. 10 and 11, the overbending means for the end **61** of the arm **60** includes a small substantially triangularly shaped block **115** secured by a screw device **116** to a projection **117** formed on a collar **118** which surrounds the pin **67**, the collar being rotatably mounted on the outer surface of a sleeve bearing **119**. Means are provided for rotating the collar **118** at the end of the bending operation so as to overbend the wire at the angle **35***a*. To this end the collar **118** is provided with a shoulder portion **120** adapted to be engaged by one end of a lever **121** rotatably mounted on a post **122** fixed to the frame of the machine. The arm **60** is provided with a threaded lug **123** which carries a bolt **124** positioned as to contact one end of the lever **121** so as to rotate the lever about the post **122** to cause the other end thereof to contact the shoulder **120** and rotate the collar **118**. A lock nut **125** is provided on the bolt **124** so that the position thereof may be adjusted to fit the needs of the operation. Thus as the bending knee formed by the arms **60** and **64** approaches the end of its bending stroke the lever **121** is rotated into contact with the shoulder on the collar to rotate the same, the rotation serving to bring the block **115** into contact with the portion of the wire closely adjacent the end **61** to overbend the wire at the angle **35***a*.

Overbending means are also provided at the opposite end of the arm **64**. As best shown in Figs. 7, 8 and 9, the sliding block **69** is provided with a vertical sleeve bearing **130** which rotatably supports a post **131** which is integrally formed at its upper end into a crank having a first arm **132**, positioned to lie closely adjacent the wire **34**, and a second arm **133** extending substantially at right angles therefrom. Threadably received in a block **134** (Fig. 5) mounted on the frame is a bolt **136** positioned to contact the free end of the arm **133** as the bending knee is flexed to the position shown in the dotted lines in that figure.

Contact between the arm **133** and the bolt **136** rotates the crank to bring the arm **132** into contact with the wire to overbend the same at the angle **35***b* of the V. A lock nut **137** is provided for the bolt **136** so that minor adjustments in position thereof may be made.

An overbend at the apex of the V is obtained by flexing the bending knee formed by the arms **60** and **64** beyond the desired final shape of the wire and then releasing the same. The means provided for the overbending at the apex of the V are best illustrated in Fig. 1 and include a rod **140** slidably held on the frame in bearings **141** and **142**. As the rod **72** is reciprocated under the influence of the motor **73**, the end thereof contacts one end of the rod **140** to slide the same in its bearings until its left-hand end **143** contacts an adjustable stop **144** secured to the frame. Such contact with the stop limits the travel of the rod **170** and hence the degree of flexing of the bending knee. During the travel of the rod **140** as it is moved by the rod **72** a collar **145** secured to the rod contacts one end of a compression spring **146** whose other end bears against the bearing **141** and serves to compress the same. When power is released from the piston and cylinder device **73**, the spring **146** moves the rod **140** and hence the rod **72** a short distance in the direction of the return stroke to reduce the degree of flex of the bending knee and thus to permit release or ejection of the wire held therein. The degree of overbending at the apex **35** or of the wire is, of course, determined by the position of the adjustable stop **144**.

As previously noted, means C are provided for securing the bent wire **35** to each of the wires **36** and **37**. In the embodiment illustrated of the invention, the securing means takes the form of a welding device adapted to weld the wires together at their points of contact.

As best seen in Fig. 17, the welding device includes a pair of welding electrodes **150** and **151** mounted upon a crossbar **152** secured to an insulating plate **153** of hard rubber or other dielectric material. The plate **153** is secured at its center to a metal collar **154** which in turn is secured to a rod **155** through the medium of an insulating sleeve **156**. The rod **155** secured to the piston of a piston and cylinder device **157** is adapted upon reciprocation of the piston therein to raise and lower the electrodes **150** and **151**.

Mounted in the frame beneath the electrodes **150** and **151** is a second pair of electrodes **160** and **161**. Suitable electrical connections **162** and **163** for each pair of electrodes are provided as illustrated. Insulating material **164** is provided on the frame adjacent each of the lower electrodes to maintain the electrodes separated from each other in the event no wire is in position to be welded at the time the upper pair of electrodes **150** and **151** are lowered. Such condition may occur on the start-up of the machine during which start-up these electrodes are raised and lowered in timed sequential relationship to the operation of the feed and bending means as hereinafter described. The insulating material **164** extends partially over the lower electrodes and is of sufficient thickness to maintain the electrodes separated in the event no wire is present but insufficient to prevent contact between the electrodes and the wire should the operation of the machine have progressed to such a point as to position the wires under the welding apparatus.

Clamping means are provided to maintain the wire in proper position during the welding operation to maintain the spaced parallel wires **36** and **37** in correct position overlying the bent wire **35** and in contact therewith as illustrated in Fig. 1A. As best seen in Figs. 1 and 2, the clamping means includes a pair of clamps **170** and **171** located adjacent the welding means and positioned to contact the wires and hold them in the relationship described. Each of the clamps include a foot portion adapted to contact the wire, the foot portions being secured to vertically upstanding posts **172** and **173** respectively with each post being connected to a piston in a pneumatic piston and cylinder device **174** and **175**. Air introduced into the piston and cylinder devices just described serves to depress the foot portions of the clamp and hold the same against the wires to maintain the wires stationary during the welding operation. Upon completion of the welding operation the clamps are lifted to permit further feeding of the wires.

Immediately adjacent each of the clamps **170** and **171** are guide means **180** and **181** in the form of arcuately curved members which serve to insure that the wires **36** and **37** are properly spaced as they are fed into the clamping means and into the welding device. Additional guide means **182** is provided on the frame to the left of the welding means to hold the welded wires in proper position as they are fed off the left-hand end of the machine.

The timing means D which are located on the lower portion of the frame comprise a drive motor **190** connected by a chain and sprocket arrangement **191** to a rotatably mounted timing shaft **192** which carries a plurality of timing cams **193**—**198**. Each of the timing cams is contacted by a cam follower **199**—**204** riding on the surface thereof. Each cam follower is mounted in the manner illustrated in Fig. 14 which shows the cam follower arrangement for the cam **195**. Thus the follower **201** is pivotally mounted at **205** upon an arm **206** provided in a valve mechanism **207**. The opposite end **208** of the cam follower is connected to a valve actuating rod **209** adapted to open a pneumatic valve to direct compressed air into one of the several operating piston and cylinder devices previously described. A spring **210** is provided for the valve to constantly urge the valve toward closed position.

As shown in Figs. 19 and 20, the timing mechanism is so arranged as to permit continuous bending, welding and feeding operations so that the entire apparatus operates substantially automatically to fabricate the wire

forms described. The cam **203** in operating its valve **207** directs air under pressure from a conduit **215** connected to a source of compressed air into a conduit **216** and thence into the clamp cylinders **174** and **175**. The cam **194** through its associated valve directs air under pressure into a conduit **217** and thence into the piston and cylinder device **157** to lower the welding head. As the welding head is lowered and the pressure builds up within the cylinder **157** after contact has been made with the wires, the pressure is conducted from the cylinder **157** through a conduit **218** to a pressure responsive switch mechanism **219** which is equipped with a timer for timing the duration of current application to the electrodes of the welder. Thus when sufficient pressure has been built up within the cylinder **157** so that firm contact between the electrodes and the wires is assured the pressure responsive switch **219** is actuated to apply electric current to the electrodes for a period sufficient to effect the weld.

The valve associated with the cam **195** is connected by means of the conduit **220** to the bend cylinder **73** to effect the bend of the wire **34** and the valve associated with the cam **197** is connected by means of a conduit **221** to the feed cylinder **51** for effecting the feed. The various ejector or releasing piston and cylinder devices previously described are connected by a plurality of suitable conduits, one of which is indicated at **222** to the valve associated with the cam **198** to provide for the ejection of the wires from the retaining means at the end of the bending operation.

The cams are so constructed and arranged on the shaft **192** as to operate the apparatus in the cycle shown in Fig. 19. At the start of the operation the welding head and the clamps are in the up position and the cam **197** operates the valve **207***a* to introduce air into the feed cylinder to feed wire to the bending means and to the welding apparatus. At the same time the valve **207***b* is operated by its cam **195** to return the bending knee to the position illustrated in solid lines in Fig. 5, that is with the arms linearly aligned for the reception of an additional length of wire to be bent. When the cams have rotated approximately 90° the bender is in the straight position and feeding has been accomplished.

At this time air is introduced to the other end of the feed cylinder to move the feed dogs on their return stroke preparatory to feeding an additional length of wire. The bender is stationary at this time but after 30° more of rotation of the shaft **192** the cam **193** associated with the valve **207***c* operates that valve as to introduce air into the clamping cylinders **174** and **175** to bring the clamps down and hold the wire in stationary position. When the shaft has rotated 160° from its starting position the cam **197** associated with the feed cylinder valve is operated to introduce air into the opposite end of the feed cylinder to move the feed dogs on their return stroke. Simultaneously the valve **207***b* associated with the bending cylinder is operated by its cam **195** to introduce air into the other end of the bending cylinder to flex the bending knee from its wire receiving position in which the arms are linearly aligned to wire bending position where the arms are angularly aligned to bend, and finally to overbend, the wire as previously described. As one portion of the wire is being bent in the bending mechanism, air is introduced into the welding cylinder to lower the welding head to perform the welding operation on a previously bent portion of the wire and after the welding has been completed the welding head is again raised. The final step is to raise the clamps through the operation of the cam **193** and its associated valve which completes one cycle of operation. It is, of course, understood that the timing motor continues to drive so that a second cycle immediately follows the first cycle just described and so on until the machine is shut off.

It will be clear that it would be inconvenient to shut off the machine at certain points in the cycle of operations. Thus it would be inconvenient to stop the operation of the machine when the clamping cylinders are down inasmuch as it would be difficult to remove wire from the apparatus. To this end there is provided means for permitting the machine to be shut off only at the conclusion of a complete cycle.

Referring to Figs. 15 and 16, there is shown a shut-off solenoid **225** which is provided with a stem **226** pivotally connected to a bell crank arm **227** pivoted at **228** to a portion of the frame of the machine. The other end **229** of the bell crank is adapted to be moved from the position shown in dotted lines in Fig. 16 to the position shown in solid lines upon energization of the solenoid **225**. When it is desired to shut off the machine the solenoid is energized through the electrical connection shown to move the arm **227** to the position shown in solid lines wherein the arm **229** is adapted to engage a shoulder portion **230** provided on a brake wheel **231** forming a part of a slip clutch assembly **232** through which the chain drive **191** is connected to the timing shaft **192**.

Thus if the solenoid **225** is energized at any time during the cycle of operations of the machine the arm **229** is brought into contact with the outer portion **233** of the brake wheel **231** and rides thereon as the same rotates in the direction indicated by the arrow until it engages the shoulder **230**. The shoulder is so located as to engage the arm at the end of a complete cycle of the machine. This engagement between the shoulder and the arm stops the rotation of the shaft **192** and thus prevents the initiation of an ensuing cycle of the machine. The drive motor **190** will continue to operate through the slip clutch arrangement **232** which permits such operation until such time as the drive motor shall be shut off by the operator.

Inasmuch as the bending and feeding means of this invention are so constructed as to operate continuously in successive cycles, it is contemplated that means will be provided adjacent the machine for cutting the continuous length of welded wire into sections of desired length. For this purpose a wire cutter, which may be in the form of a punch press type cutter, may be employed, and if the desired sections are not multiples of the length of each of the V's two such cutters may be employed and used alternately to secure the desired length and to facilitate stacking of the cut sections.

I claim:

1. An automatically operated wire shaping machine for forming a reinforcing material comprising a base having a horizontal top, guides on the top for guiding two continuous lengths of wire in spaced parallel relationship across the top, reciprocable feed means on the base including a device for engaging one of said wires to move the wire across the top, bending means on said top, said bending means including a pair of arms pivotally secured together at an end thereof with the other end of one of the arms being rotatably secured to the top to form a bending knee and including a motor on the base and connected to the other end of the other arm to flex the knee from a first position in which the arms are substantially linearly aligned to a second position in which the arms are angularly aligned to bend wire therein into substantially the shape of a V having a height substantially equal to the space between said parallel wires, another guide on the top for guiding a third continuous length of wire into the knee when the arms thereof are substantially linearly aligned, a welding device on the top, a motor for moving the welding means into welding relationship with the spaced parallel wires at their points of contact with the bent wire, and timing means for cyclically operating said motors and said feed means.

2. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the frame, a second arm pivoted at one end to the other end

of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means operating upon the flexure of said knee to overbend the wire at each angle of the V, means for feeding a continuous length of wire to the bending means when the arms are linearly aligned, guide means on the frame for guiding two continuous lengths of wire in spaced parallel relationship across the frame with the space between said two wires being substantially equal to the height of said V, said guide means locating said two wires on either side of the bending knee whereby the bent portions of the first mentioned wire are contacted by each parallel wire, means on the frame for securing the bent wire to the parallel wires at the points of contact therewith, and means for continuously operating the flexing means, the feeding means and the securing means in cyclical relationship to bend a continuous length of wire into a series of V's and to secure the bent wire to the parallel wires at each angle of each of the V's.

3. An automatically operated wire shaping machine for forming a reinforcing material comprising a base having a horizontal top, guides on the top for guiding two continuous lengths of wire in spaced parallel relationship across the top, reciprocable feed means on the base including a device for engaging one of said wires to move the wire across the top, bending means on said top, said bending means including a pair of arms pivotally secured together at an end thereof with the other end of one of the arms being rotatably secured to the top to form a bending knee and including a motor on the base and connected to the other end of the other arm to flex the knee from a first position in which the arms are substantially linearly aligned to a second position in which the arms are angularly aligned to bend wire therein into substantially the shape of a V having a diameter substantially equal to the space between said parallel wires, another guide on the top for guiding a third continuous length of wire into the knee when the arms thereof are substantially linearly aligned, a welding device on the top intermediate the bending means and the feed means, a motor for moving the welding means into welding relationship with the spaced parallel wires at their points of contact with the bent wire, clamping means including a plurality of clamps for holding the parallel wires in position in contact with the bent wire, a motor for moving the clamps against the wires, and timing means for cyclically operating said motors and said feed means.

4. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the base, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means for overbending the wire including a crank carried by said other end of the second arm and positioned as to have one leg thereof closely adjacent a portion of the wire, a stop on the frame adapted to contact the other leg of the crank as the knee is flexed to rotate the crank to overbend said portion of the wire, a lug mounted on the frame for rotation about the pivotal axis of said first named end of the first arm, means on the first named arm for rotating the lug to bring the same into contact with another portion of the wire at said first named end to overbend the same as the knee is flexed, and means for operating the flexing means to flex the knee beyond the desired V shape to overbend the wire at the apex of the V.

5. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the base, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means for overbending the wire including a crank movable with said other end of the second arm and positioned as to have one leg thereof closely adjacent a portion of the wire, a stop on the frame adapted to contact the other leg of the crank as the knee is flexed to rotate the crank to overbend said portion of the wire, a sleeve rotatably mounted on the frame and surrounding the pivotal axis of said first named end of the first arm, a lug on the sleeve, means on the first arm positioned to rotate the sleeve as the knee is flexed to bring the lug into contact with another portion of the wire at said first named end to overbend the same as the sleeve is rotated, means for operating the flexing means to flex the knee beyond the desired V shape to overbend the wire at the apex of the V, resilient means for returning the knee to the desired V shape to relieve the overbending means, and means for releasing a bent wire from the retaining means.

6. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the base, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, and means for overbending the wire including a crank movable with said other end of the second arm and positioned as to have one leg thereof closely adjacent a portion of the wire, a stop on the frame adapted to contact the other leg of the crank as the knee is flexed to rotate the crank to overbend said portion of the wire, a lug mounted on the frame for rotation about the pivotal axis of said first named end of the first arm, and means for rotating the lug to bring the same into contact with another portion of the wire at said first named end to overbend the same as the knee is flexed.

7. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the base, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means for feeding wire to the bending means, means operating upon each flexure of said knee to overbend the wire at each angle of the V, and automatic means for operating the flexing means and feeding means in sequential relationship to bend a continuous length of wire into a series of V's.

8. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the frame, a second arm pivoted at one end to the other end

of the first arm to form a bending knee, means on the ends of each arm for retaining a length of wire thereon, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means operating upon the flexure of said knee to overbend the wire at each angle of the V, a guide plate overlying the first arm and normally positioned below the retaining means thereon whereby said plate is positioned intermediate the first arm and a length of wire held in the last mentioned retaining means, and means for moving the plate outwardly of the arm to release a bent wire from said retaining means.

9. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the frame, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the frame for feeding three lengths of wire including means for feeding one of said lengths to the bending knee, means on the ends of each arm for retaining thereon a length of wire fed thereto, power operated means for flexing the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by moving the other end of the second arm toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means operating upon the flexure of said knee to overbend the wire at each angle of the V, a guide plate overlying the first arm and mounted for movement outwardly of the arm, said plate being normally positioned below the retaining means thereon whereby said plate is positioned intermediate the first arm and a length of wire held in the last-mentioned retaining means, said guide plate also being positioned below at least one of the other wires fed by said feeding means, a plunger at each end of the second arm and movable to eject wire held in the retaining means thereon, and a plurality of piston and cylinder devices for moving the plate and the plungers.

10. In a wire shaping machine having a frame, bending means comprising a first arm pivoted at one end to the frame, a second arm pivoted at one end to the other end of the first arm to form a bending knee, means on the frame for feeding three lengths of wire including

means for feeding one of said lengths to the bending knee, means on the ends of each arm for retaining thereon a length of wire fed thereto, a block slidably mounted on the frame and rotatably carrying the other end of the second arm, a pneumatic piston and cylinder device for sliding the block to flex the knee from a first position wherein the arms are substantially linearly aligned to a second position in which the arms are angularly aligned by sliding the block toward the first named end of the first arm whereby to bend a length of wire retained thereon into substantially the shape of a V, means operating upon the flexure of said knee to overbend the wire at each angle of the V, a guide plate overlying the first arm and mounted for movement outwardly of the arm, said plate being normally positioned below the retaining means thereon whereby said plate is positioned intermediate the first arm and a length of wire held in the last-mentioned retaining means, said guide plate also being positioned below at least one of the other wires fed by said feeding means, a plunger at each end of the second arm and movable to eject wire held in the retaining means thereon, a plurality of pneumatic piston and cylinder devices for moving the plate and the plungers, and timing means for sequentially directing air under pressure into the first named piston and cylinder devices to flex the knee to bend a length of wire retained thereon and then to direct compressed air to the last named piston and cylinder devices to eject a length of bent wire from the bending means.

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