

Sept. 2, 1924.

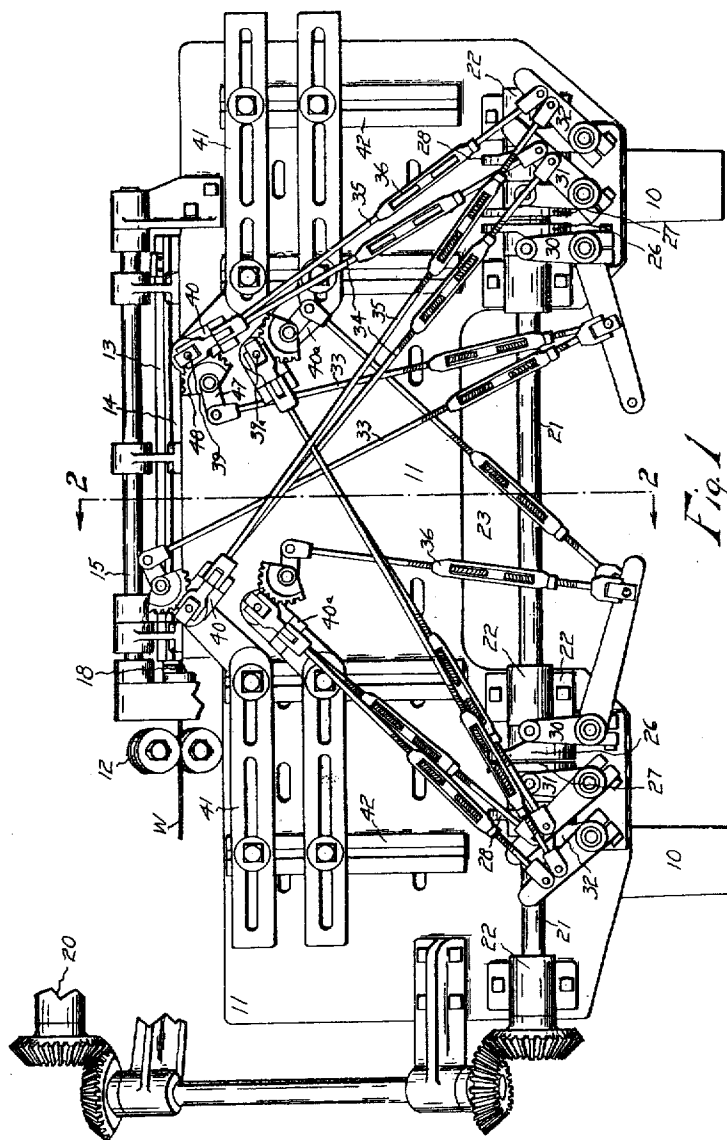
1,507,007

F. H. SLEEPER

WIRE FORMING MACHINE

Filed Jan. 5, 1923

3 Sheets-Sheet 1



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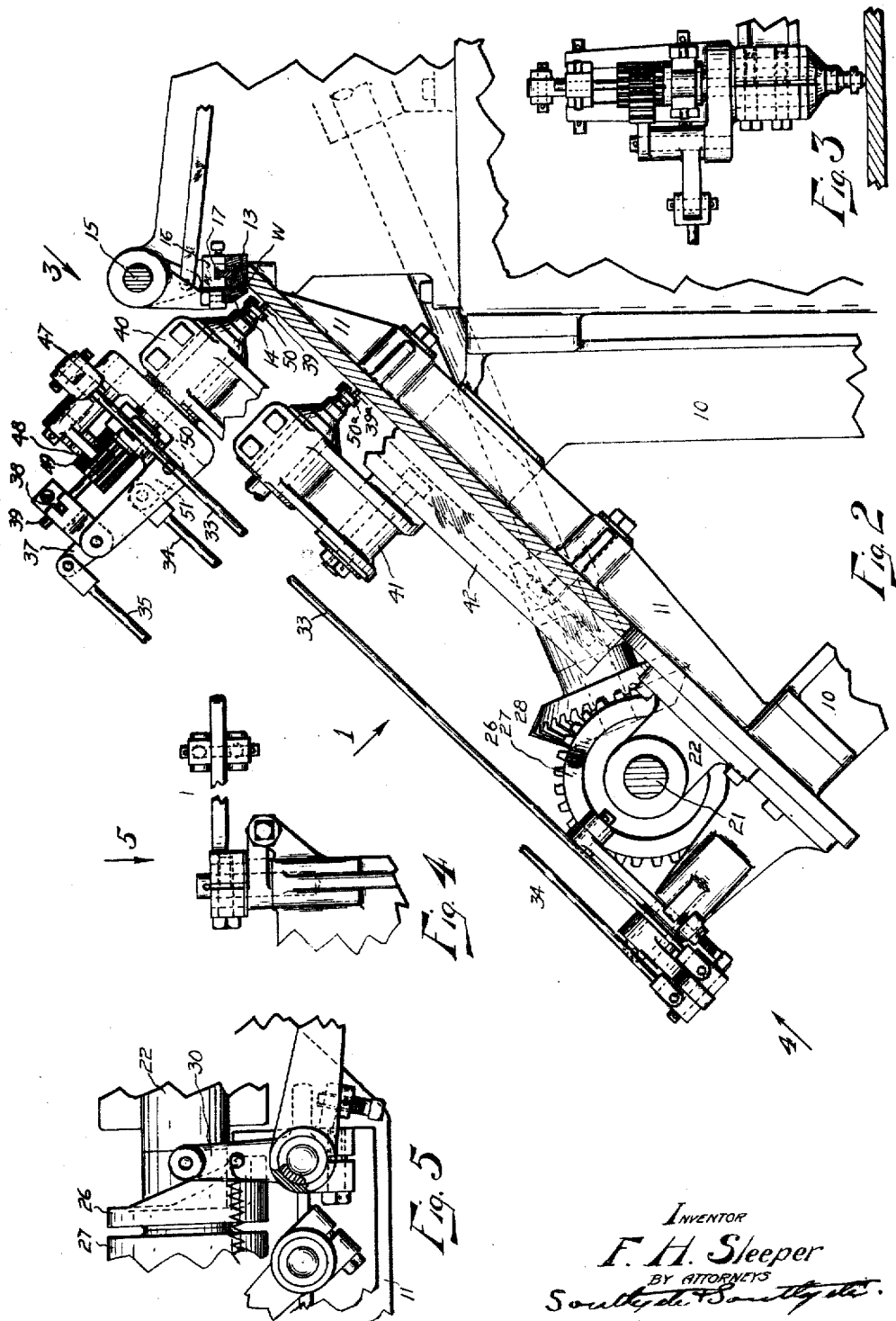
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3 Sheets-Sheet 2



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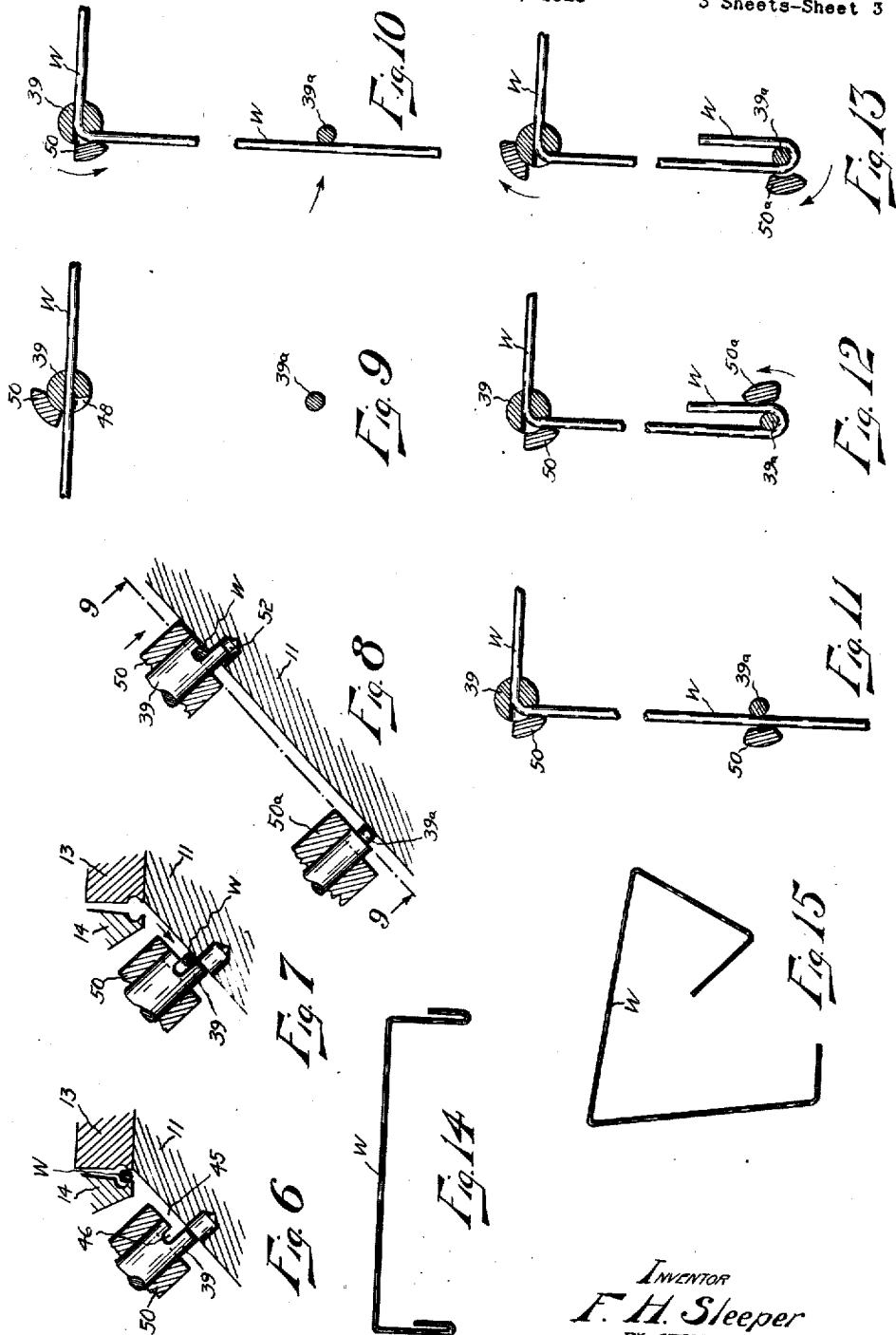
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1,507,007

Filed Jan. 5, 1923

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

FRANK H. SLEEPER, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO SLEEPER & HARTLEY, INC., OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

WIRE-FORMING MACHINE.

Application filed January 5, 1923. Serial No. 610,812.

To all whom it may concern:

Be it known that I, FRANK H. SLEEPER, a citizen of the Dominion of Canada, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Wire-Forming Machine, of which the following is a specification.

This invention relates to a machine for forming wires in various shapes by a series of bending operations or the like.

The principal object of the invention is to provide a machine for this purpose which will be capable of bending wires into forms longer than can be taken care of by the ordinary machines for this general purpose, called four slide machines in the trade. Those machines deliver the article down through a central opening, and they are so arranged that it has to pass out through this opening flatwise so that the diameter of the opening has to be as great as the length of the article in its longest direction. As the size of this opening controls the size of the machine, any increase in this diameter greatly increases the weight and cost of the machine and it has not been practical heretofore to produce articles on them more than a few inches long.

Another object of the invention is to provide a series of bending devices adjustable at will and in all directions over the surface of the table on which the wire is to be bent and all capable of being operated by adjustable pull rods from the same cam shaft.

Another object of the invention is to provide an arrangement by which the straight wire is cut off and delivered to the machine at the top of an inclined table, a pair of the bending devices being simultaneously operated at the proper instant to move close enough to the table to form stops to receive the wire and hold it while the bending operations are being performed upon it.

Another object is to provide co-operating with the bending devices just above mentioned one or more additional bending devices on the inclined table arranged to engage the wire and form it in such a manner as may be desired. These devices, as stated, are all adjustable on the surface of the table and their operating means are adjustable also in order that they may operate in proper sequence. There may be several of them.

I also provide these devices in two sets

or in pairs, operating those of each pair from the same cams preferably so that they will be forced to move in unison and have the same amplitude of motion.

Additional objects and advantages of the invention will appear hereinafter.

Reference is to be had to the accompanying drawings, in which

Fig. 1 is a view of a preferred embodiment of this invention, looking toward the inclined table in a direction perpendicular thereto;

Fig. 2 is a sectional view on the line 2—2 of Fig. 1, showing by the arrow 1 the direction in which Fig. 1 is taken;

Fig. 3 is a top end view, looking in the direction of the arrow 3 in Fig. 2;

Fig. 4 is a bottom end view, looking in the direction of the arrow 4 in Fig. 2;

Fig. 5 is an end view, looking in the direction of the arrow 5 in Fig. 4 showing one of the cams;

Figs. 6, 7 and 8 are sectional views of the inclined table, showing the operation of one of the first winding heads and its relation to some of the other parts and illustrating three steps in the operation of bending the wire through a right angle;

Figs. 9-13 inclusive are sectional views of one set of winding heads taken on a plane parallel to the table and showing successive steps in the operation of bending one end of the wire in accordance with this invention, to produce the product which is shown in Fig. 14; and

Fig. 15 is a view similar to Fig. 14, showing another form in which the wire can be bent with this same machine by changing the location, arrangement and amount of turning motion of the same tools used to make the wire shown in Figs. 13 and 14.

I have provided a machine which comprises a frame 10 suitably supported and a table 11 carried thereby in an inclined position. Co-operating with the machine is a wire feeding device of any desired kind indicated here diagrammatically by a pair of feed rolls 12 located at the top of this table and near one end thereof. These feed rolls, co-operating with the rest of the feeding device, feed the wire into a pair of registering grooves planed in a fixed horizontal bar 13 along the top of the table 11 and a jaw 14 parallel therewith but pivoted on a top horizontal shaft 15. This jaw is capable

of swinging away from the bar 13 as shown in Figs. 6 and 7 to deliver the wire W from this passage. It is caused to swing periodically by a cam on a shaft 20 or any other part that rotates in unison with the cam shaft to be described. On this part of the device there is an adjustable stop 16 carried by the horizontal bar 17 and adapted to stop the feed of the wire into the machine. The wire is also cut off by an automatic cutting blade 18, means for operating which I have not shown herein as it does not constitute a part of this invention.

The power from the machine is taken from any desired source as for example the horizontal shaft 20 above the table and at one end thereof transmitted to a cam shaft 21 which is located horizontally and supported in bearings on brackets 22 bolted to the bottom of the table on the front side thereof. This shaft extends across an open space 23 in the center of the table at the bottom through which the product is adapted to be delivered. It has these bearing brackets 22 on both sides of this space below the part of the table which carries the wire forming mechanism.

On the shaft 21 are three pairs of cams 26, 27 and 28. It is to be noted that there is one cam of each of these pairs on each side of the open space 23, the two cams of each pair being exactly alike. These cams operate three pairs of pivoted arms 30, 31 and 32 also duplicated on the other side of the machine. These arms constitute in each case one arm of a bell crank, the other arm of which extends at any desired angle and has a wide surface in which are provided perforations for two pins connecting them in each case with two pull rods 33, 34 and 35 respectively. It is to be noted that the number is doubled here and there are twelve of these rods, six on each side of the machine. These pull rods are all independently adjustable and this is accomplished by individual turn buckles 36.

The two pull rods 35 connected with the bell crank 32 diverge so that one of them extends to one side of the machine or table and the other to the other side. Each of them is connected with a bell crank 37 provided with a slot at one end for receiving a pin 38 connected with a slidable center pin 39 supported by a stationary head 40. This pin is located perpendicular to the table 11 and the rotation of the cam forces it down substantially into contact with the table once during each revolution of the cam shaft. The end of this center pin constitutes a stop for the wire so that when the wire is dropped from the jaws 13 and 14 it will be stopped by it, as indicated in Fig. 6.

It may be stated at this time that four of these heads 40 are shown here although a different number may be used. Each of

the heads is mounted at the end of a horizontal bracket 41 which is provided with longitudinal slots. By means of bolts these brackets are located in any desired longitudinal adjustment on a pair of slotted vertical brackets 42. The latter are held, by the same or other bolts, in longitudinal adjustment through perforations 43 at the two ends of the table. The brackets 41 can be adjusted longitudinally themselves and they can also be adjusted up and down on the table in the slots in the brackets 42 which also can be adjusted. In fact, they can be adjusted to angular positions or in any desired way and the adjustments are universal and unrestricted except by the size of the machine. These heads are located in this manner at any desired points on the face of the table 11 so as to get the various bends in the wire at the proper distances apart and with proper relations to each other in the plane of the table.

The operation of the pins 39 is limited to a reciprocating motion. They are slidingly keyed to prevent rotation. Each of these pins is provided at the bottom with a slot 45 opening out sideways from the center so that the part beyond the center constitutes the stop referred to above. They also have a deeper diametrical slot 46 perpendicular to the slot 45 for receiving the wire, as indicated in Figs. 8 and 9 and holding it during the bending operation.

The rods 34 extend from their respective bell cranks 31 to the two heads 40 located near the top of the table. They are each connected with a bell crank 51 projecting from a winding head 50, rotatable in the head 40 and surrounding the center pin 39, for giving the winding head a reciprocation each time the cam 27 operates the bell crank 31.

The two rods 33 on the right hand side of the machine are connected with arms 47 fixed to a pair of gear segments 48, each of which meshes with a pinion 49 fixed on the end of the winding sleeve 50. This causes the winding head to oscillate also at the proper time. The effect of these motions will be described in connection with the figures on the last sheet. It is to be observed here that although I have described only half of the mechanism shown, the other half on the other side of the table operates the same way but at a later time in the cycle to actuate the center pins and winding heads of the two lower heads 40.

The operation of the machine when set up in the way shown here is as follows:—

First, the wire is fed in against the stop and cut off automatically. Then the two upper center pins 39 descend to the position shown in Fig. 6 and the jaw 14 opens to let the wire out. The two center pins 39 are at the same level in the adjustment shown

but this is not necessary. However, they should be near enough the same level so that when the wire rolls down against them it will rest against both of them and will not slide in the direction of its length. The ends of these center pins therefore constitute stops. They may come into contact with the table or rest slightly above it or project into openings 52 therein, as desired.

The action of the cam 28 through the bell crank 32 and the two rods 35 and the bell crank 37 is required to bring the center pins down to this position. The parts are now in the position shown in Fig. 7. The cam 28 acts further now to depress the two center pins 39 still further to the position shown in Fig. 8 in the openings 52. Simultaneously the cam 27 operates the bell crank 31 and pull rods 34 lowering the winding sleeve 50, also shown in Fig. 8. This position is again shown in Fig. 9 and in that figure the center pin 39 of the head 40 below is also shown. This is the extreme low position of the center pin 39.

Now the cam 27 acts to turn the bell crank 31 and pull rod 33 to swing the segment 48 and the winding sleeve 50 from the position shown in Fig. 9 to that shown in Fig. 10. As the wire is held in the groove 46 of the two center pins in exact alignment with each other and as this groove is cut out at 48, the wire can be bent around it by this turning motion so as to provide a practically sharp angle. In this case, I have shown it as a right angle but that is not essential.

This operation having taken place, the parts are held in this position while the winding head 50 below comes into action. As stated, the lower center pin 39 has served to engage the wire and limit its motion inwardly at the bottom so as to give exactly the bend desired, in this case 90 degrees. Now, the winding head 50 turns through the desired arc in the same way as described above to bend the wire around the center pin 39 to form whatever shape is desired, in this case a hook with parallel sides. The process of forming this hook is shown in Figs. 11, 12 and 13. These figures just mentioned show the operation of forming one end of the wire structure to be made while Fig. 14 shows the complete article. It is to be noted in this case that the two hooks at the end are shown as offset in the same direction but they can be made to project toward each other from the two ends of the article or at an angle or in any desired way, according to well known wire working operations.

In Fig. 15 I have shown another wire structure that could be made very easily by this machine and which would be accomplished by placing the two upper heads 40 at the required distance apart, one of them

a little higher than the other and placing the two lower heads also one higher than the other, so that one of them is considerably nearer its corresponding upper head than the other and adjusting the rods to control the turning motion in such a way that the angles will be in this case three acute angles and one obtuse angle. It will be obvious that the shape of the article can be varied within wide limits and practically any article can be made in a plant that has five or less sides with four heads. If desired of course the number of heads can be increased for more complicated articles.

In this way, by a series of simple adjustments, a piece of wire can be bent up into a wide range of shapes and after the machine is once adjusted it can be operated at high speeds so as to produce for example two hundred articles per minute and they are delivered down the table by gravity into a receptacle or conveyor below the opening 23 without any supervision except the keeping of the machine working properly and occasionally testing the product. The machine is not limited as to the size of the article produced except by the width of the table and the width of the opening 23.

Although I have illustrated and described only a single form of the machine and of course only one position of the various heads and other parts, I am aware of the fact that numerous modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to all the details of construction herein shown and described or especially to the particular adjustments illustrated, but what I do claim is:—

1. In a machine for forming wire, in combination, with means for feeding a length of wire into a certain position, means for releasing the wire, a table located below the holding means in inclined position, and stops located adjacent to the table, whereby when the wire is released it will roll down the table into contact with said stops and will be held thereby in a predetermined definite position on the table.

2. In a wire forming machine, the combination with means for feeding a wire forward a predetermined distance and cutting it off, of a stationary bar and a movable jaw, said bar and jaw having registering grooves for receiving the wire between them, means for moving the jaw away from the bar to release the wire, an inclined table located below the position in which the wire is held by the bar and jaw to receive the wire therefrom, a stop over the table, and means for moving said stop to a position in which it will prevent the passage of the wire between it and the table to hold it in a definite position.

3. In a wire forming machine, the combination of an inclined table, means for discharging a wire on said table near the top so that the wire will roll down the table, stops located over the table for limiting the rolling motion of the wire and means for operating said stops to move them into and then out of the path of the wire.

4. In a wire forming machine, the combination of a bar and jaw for receiving a wire between them, means for moving the jaw away from the bar to release the wire, a table located below the bar and jaw to receive the wire therefrom, a pair of center pins above the table, means for moving said center pins to a position in which they will prevent the passage of the wire between them and the table, and means for then moving the center pins inwardly toward the table to retain the wire in position, said center pins having grooves across their ends for receiving the wire and positively holding it when the pins are forced inwardly.

5. In a wire forming machine, the combination with a pair of jaws for receiving a wire, means for moving one jaw to release the wire, an inclined table located below the jaws to receive the wire therefrom, a pair of center pins above the table, means for moving said pins to a position in which they will prevent the passage of the wire below and beyond them, means for then moving the center pins inwardly toward the table to retain the wire in position, said center pins having grooves across their ends for receiving the wire and holding it when the pins are forced inwardly, a winding head surrounding each center pin, and means for turning said winding heads around the center pins to bend the wires where they project beyond the pins.

6. In a wire forming machine, the combination of an inclined table with a center pin having a projection at the bottom, whereby a wire rolling along the table will be stopped and held by said projection, the center pin also having a groove across it, whereby when lowered further it will clamp the wire in position and having an slot on its rear side in the plane of said groove, a winding head oscillatably mounted on said center pin, and means for turning said winding head to swing the projecting end of a wire supported by the pin around into said offset slot, whereby a sharp angled bend can be provided.

7. In a wire forming machine, the combination of an inclined table with a pair of center pins each having a projection at the bottom, means for moving said center pins into such position that the projections substantially come into registration with the surface of the table, whereby a wire rolling along the table from above will be stopped and held by said projections,

the center pins also having a diametrical groove across them, whereby when lowered further they will clamp the wire in position and having offset slots on their rear sides in the plane of said grooves, a winding head oscillatably mounted on each center pin, and means for turning said winding heads to swing the projecting ends of a wire supported by the two pins around into said offset slots, whereby two sharp angled bends can be provided.

8. In a wire forming machine, the combination of a table with a center pin having a projection at the end, means for moving said center pin into such position that the projection substantially comes into registration with the surfaces of the table, whereby a wire moving along the table will be stopped and held by said projection, the center pin also having a diametrical groove across it, whereby when lowered further it will clamp the wire in position, a winding head oscillatably mounted on said center pin, means for turning said winding head to swing the projecting end of a wire supported against the pin around to provide a bend in the wire, and means for moving the winding head in the direction of the axis of the center pin and into and out of operative position.

9. In a wire forming machine, the combination of an inclined table with a pair of center pins for stopping a wire rolling down the table from above, a winding head oscillatably mounted on each center pin, means for turning said winding heads to swing the projecting ends of a wire around the pins, an additional winding head located on the table at a point below one of the first mentioned winding heads and center pins and having a center pin located in position to engage the side of the wire when bent around one of the first named center pins and constituting a stop for it, means for turning the last named winding head into a position to engage the wire and turn it about its center pin to form another bend in the wire, and means for thereafter raising the winding heads and center pins to release the bent wire and allow it to slide down the table to be delivered.

10. In a wire forming machine, the combination with an inclined flat table, of a series of brackets carried by said table, each having a winding head and a center pin thereon, means whereby said brackets may be adjusted to bring the center pin into any desired position on the table, two of said center pins being located in position to constitute stops for wires rolling down the table, means cooperating with said center pins for bending the wires about them as centers, means along the table below the said center pins for supporting an additional pair of winding heads and center pins in any de-

sired. adjusted position so that when the ends of the wires are bent around the first pair of center pins they will come into contact with another pair of center pins and the wires will be bent therearound to form a further bend near each end.

11. In a wire forming machine, the combination with an inclined table, of a pair of winding heads adjustably located near the top of the table, having center pins adapted to act as stops for a wire rolling down the table, a cam shaft, a plurality of cams thereon, a pair of longitudinally adjustable rods arranged to be operated by each of said cams, one rod of each pair extending to one of said heads and the other rod of each pair to the other head, means connected with one rod for raising and lowering the center pin, means connected with the second rod on the same side of the machine for raising and lowering the winding head, and means connected with the third rod on the same side of the machine for oscillating the winding head.

12. In a wire forming machine, the combination with an inclined table, of a pair of winding heads adjustably located near the top of the table, having center pins adapted to act as stops for a wire rolling down the table, a cam shaft at the bottom of said table, a plurality of cams thereon, a pair of longitudinally adjustable rods arranged to be operated by each of said cams, one rod of each pair extending to one of said heads and the other rod of each pair to the other head, means connected with one rod for raising and lowering the center pin, means connected with the second rod on the same side of the machine for raising and lowering the winding head, means connected with the third rod on the same side of the machine for oscillating the winding head, the rods extending to the other side of the machine having corresponding connections, additional winding heads and center pins located on said table, a second series of cams located on said shaft, and adjustable rods connected with the cams and with the second series of heads and center pins for operating the same.

13. In a wire forming machine, the combination with a table, of a pair of winding heads located over the table, having center pins adapted to act as stops for a wire on the table, a cam shaft, a plurality of cams thereon, a pair of rods arranged to be operated by each of said cams, one rod of each pair extending to one of said heads and the other rod of each pair to the other head, means connected with one rod for moving the center pin toward and from the table, means connected with the second rod on the same side of the machine for moving the winding head toward and from the table, means connected with the third rod on the

same side of the machine for oscillating the winding head, the rods extending to the other side of the machine having corresponding connections; additional winding heads and center pins located on said table; a second series of cams located on said shaft, and rods connected with the cams and with the second series of heads and center pins for operating the same.

14. In a wire forming machine, the combination with a table, of a pair of winding heads located near the table, having center pins adapted to act as stops for a wire on the table, a cam shaft, a plurality of cams thereon, a pair of rods arranged to be operated by each of said cams, one rod of each pair extending to one of said heads and the other rod of each pair to the other head, means connected with one rod for raising and lowering the center pin, means connected with the second rod on the same side of the machine for raising and lowering the winding head, and means connected with the third rod on the same side of the machine for oscillating the winding head.

15. In a wire forming machine, the combination with a table, of a series of brackets carried by said table, each having a winding head and a center pin thereon, two of said center pins being located in position to constitute stops for wires on the table, means co-operating with said center pins for bending the wires about them as centers, means along the table beyond the said center pins for supporting an additional pair of winding heads and center pins so that when the ends of the wires are bent around the first pair of center pins they will come into contact with another pair of center pins and the wires will be bent therearound to form a further bend near each end.

16. In a wire forming machine, the combination of a table with a pair of center pins, a winding head oscillatably mounted on each center pin, means for turning said winding heads to swing the projecting ends of a wire around the pins, an additional winding head located on the table and having a center pin located in position to engage the side of the wire when bent around one of the first named center pins and constituting a stop for it, means for turning the last named winding head into a position to engage the wire and turn it about its center pin to form another bend in the wire, and means for thereafter raising the winding heads and center pins to release the bent wire.

17. In a wire forming machine, the combination of a table with a pair of center pins each having a projection at the end, means for moving said center pins into such position that the projections substantially come into registration with the surface of the table, whereby a wire on the table will be held by said projections, the center pins

also having diametrical grooves across them, whereby when moved further they will clamp the wire in position and having offset slots on their rear sides in the plane of said grooves, a winding head oscillatably mounted on each center pin, and means for turning said winding heads to swing the projecting ends of a wire supported by the two pins around into said offset slots, whereby two sharp angled bends can be provided.

18. In a wire forming machine, the combination of a table with a center pin having a projection at the end whereby a wire rolling on the table will be held by said projection, the center pin also having a groove across it, whereby when moved further it will clamp the wire in position and having a slot on its rear side in the plane of said groove, a winding head oscillatably mounted on said center pin, and means for turning said winding head to swing the projecting end of a wire supported by the pin around into said offset slot, whereby a sharp angled bend can be provided.

19. In a wire forming machine, the combination with a table, a pair of center pins above the table, of means for moving said

pins to a position in which they will prevent the passage of the wire beyond them, means for then moving the center pins inwardly toward the table to retain the wire in position, said center pins having grooves across their ends for receiving the wire and holding it when the pins are forced inwardly, a winding head surrounding each center pin, and means for turning said winding heads around the center pins to bend the wires where they project beyond the pins.

20. In a wire forming machine, the combination of a table, a pair of center pins above the table, means for moving said center pins to a position in which they will prevent the passage of the wire between them and the table, and means for then moving the center pins inwardly toward the table to retain the wire in position, said center pins having grooves across their ends for receiving the wire and positively holding it when the pins are forced inwardly.

It testimony whereof I have hereunto affixed my signature.

FRANK H. SLEEPER.