To all whom it may concern:

Be it known that I, WALTER H. HERMSDORF, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Hairpin-Forming Machines and Methods of Forming Hairpins, of which the following is a specification.

This invention relates to hairpin forming machines and method of forming hairpins and refers more particularly to an improved machine and method of forming completed hairpins from rolls or other continuous supplies of wire or the like.

Among the salient objects of the invention are to provide an improved construction and method whereby the material from which the hairpin or similar article is to be formed is fed forward and automatically severed and formed into the completed article; to so construct and arrange the mechanism that the hairpins or other articles are accurately formed without the requirement of any particular skill upon the part of the operator of the machine; to provide a machine having a very large capacity so that a large number of hairpins can be formed each minute; to so simplify the mechanism and its various feeds that a single operator can take care of a large number of machines; to provide a construction having a continuous feed, that is, in which the wire is fed forward at the same rate of speed and automatically severed into predetermined lengths; to provide a novel cutting mechanism which is timed in relation to the feed so as to produce blanks of the desired length irrespective of variations in the speed at which the mechanism is driven; to provide a construction which can be readily changed or adjusted to sever the wire or other material into blanks of any particular length within the capacity of the machine; to provide a novel feeding mechanism whereby the rough or uneven severed ends of the blank are automatically rounded and smoothed off as the severed blank is fed forward; to provide a construction in which the blank will be automatically bent to form legs of substantially equal length connected by a perfectly rounded head; to provide a construction in which the feeding mechanism of the pin during its various forming operations is positive in action; to utilize a portion of the feeding mechanism as a co-operating part in the mechanism for forming crimps or other indentations in the pin or other article to be formed; to provide a construction wherein the wire as it is fed forward from the reel or other supply of wire is automatically straightened and the entire straightening, severing, bending, crimping and feeding mechanisms can be controlled by a single lever; to so arrange a grinding and polishing mechanism that it can be driven at a relatively high speed and independent of the other mechanisms if desired; and in general to provide a new and improved machine and method for forming hairpins or other articles of either a simple or complicated form from supplies of wire or the like.

The invention also resides in such details of construction and arrangements and combinations of parts as will more fully hereinafter appear.

In the drawings:

Fig. 1 is an end elevation of part of the mechanism of a machine embodying my invention.

Fig. 2 is a side elevational view of the construction shown in Fig. 1.

Fig. 3 is an enlarged plan view on the line 3-3 of Fig. 1, parts being omitted for the sake of clearness.

Fig. 4 is a cross sectional fragmentary view on the line 4-4 of Fig. 3.

Fig. 5 is an enlarged detail view partly in section and partly in elevation of the cutting and transferring mechanism.

Fig. 6 is an enlarged plan view with parts omitted, of the mechanism for transferring from the disk feed to the chain feed.

Fig. 7 is an enlarged detail view of the guide member mechanism taken on the line 7-7 of Fig. 6, with parts omitted.

Fig. 8 is an enlarged side elevational view showing the manner of bending the pin.

Fig. 9 is an enlarged side elevational view of the crimping mechanism.

Fig. 10 is a sectional view on the line 10-10 of Fig. 9, looking in the direction of the arrows.

Fig. 11 is an enlarged detail view of the final transferring mechanism.

Describing now in detail the particular embodiment of my invention shown in the
drawings and referring first to the general arrangement of the parts, the construction is as follows: 1 designates the bed which is supported upon a suitable frame 2, in which is mounted the main drive shaft 3 driven from a belt shaft 4, to which it can be connected or disengaged by means of a clutch 5 operated by a lever 6 and rock arm mechanism 7. Mounted on the main shaft 3 is a belt wheel 8, over which the belt 9 extends and drives a corresponding belt wheel 10 mounted on a main mechanism operated shaft 11. From this latter shaft, there are driven a plurality of mechanisms as follows:

On the opposite end of the shaft 11, from the belt wheel 10 is a gear 12, the movement of which is transmitted through an idler gear 13, to a gear 14 mounted on the stub shaft 15, which shaft carries the feeding roll 16. The cooperating friction roll 17 presses the wire against the feeding roll 16, thus causing the wire upon the rotation of the feed roll 16 to be drawn upward. The wire thus drawn through the feeding rolls is first passed through a wire straightening mechanism 18, into which it is fed through a conduit 19 from a roll or other suitable source of supply (not shown). As shown in Figs. 1 and 2, the straightening mechanism 18 comprises a plurality of groups of straighteners 20, so distributed around the wire as to straighten it as it is pulled through by the feeding rolls. From the upper end of the feeding rolls, the wire is forced through a conduit 21, having at its upper end a restricted opening 22, at which point the wire is severed by the cutting mechanism, the construction and operation of which cutting mechanism is as follows:

Mounted on the main mechanism operating shaft 11 is a bevelled pinion 23 meshing with a bevelled gear 24 on the vertical shaft 25. Bolted or otherwise secured to the bevelled gear 24 is a gear 26. By means of an idler gear 27, the movement of the gear 26 is transmitted to a small gear 28, cut into the end of the stub shaft 29, which carries the cutter disk 30. The latter has one or more cutting knives 31, arranged to engage the portion of the wire at the restricted opening 22, and thus sever it while it is held in rigid position.

The straightened and severed blank 32 is now ready for the polishing, bending and other operations and is transferred from the point of severation to the bending operation in such a manner as to first carry it past the polishing mechanism. In detail, the feed of the wire after it is severed is as follows: Mounted on the shaft 25 is a pair of disks 33 and 34, secured by suitable mechanism such as the pins 35 and 36 to the shaft 25 and arranged to rotate upon the shaft. On their outer peripheries, the disks 33 and 34, carry a series of pins 37 and 38 which project into the path of the severed blank 32. Between the disks 33 and 34 is positioned a second pair of disks 39 and 40, which are freely rotatable upon the shaft 25 but bolted or otherwise secured to a sprocket wheel 41, driven by a chain 42 in a manner hereinafter described and the speed of the sprocket wheel 41 is so proportioned to the speed of the shaft 25 that the disks 39 and 40 are driven at higher speed than the disks 33 and 34, preferably a three to one drive. It will be noticed in Fig. 5, that the disks 39 and 40 are of slightly greater diameter than the disks 33 and 34 so that while the pins 37 and 38 carry the severed blank 32 forward, they are also operated upon by the surfaces of the disks 39 and 40. Also Figs. 5 and 6 show the manner in which the raised blank 32 has its ends 43 and 44 confined between spacing or positioning plates 45, and frictionally held in upright position by members 46, having felt or other frictional surface 47. After passing beyond the positioning plates 45, the blanks are carried against the plate 48, which by means of springs 49 is spring pressed toward the surface of the rotating disks 39 and 40 and force the pins into tight frictional engagement with the surface of these disks. As the latter are rotating at higher speed than the disk carrying the pins 37 and 38, the pin blank 32 will be rotated about its axis while it is being moved forward.

It is while the pin is thus rotated, that its ends are operated upon by the grinding or abrading rolls 50 and 51, which grind and polish the ends of the blank. While the operating rolls 50 and 51 could be driven from the main operating shaft 11, in the present construction they are shown as driven from an electric motor 52, and driving belt 53 mounted upon a suitable standard 54 and controlled by a switch 55. These operating rolls are preferably driven at a very high rate of speed so that during the short time the pin is passing across their surface, the ends are completely rounded.

After the blank has been straightened, severed and its ends rounded as above described, it is carried forward and transferred to a mechanism which carries it through the bending operations as follows: After leaving the plane of the friction plate 48, the blank 32 is guided by plates 56 and 57 and felt faced are shaped members 58 and 59 to the transferring mechanism shown in detail in Figs. 6 and 7. As shown in Fig. 6, a pair of rock arms 60 having curved surfaces 61, are pivotally mounted on a shaft 62 and normally held in the position shown in Fig. 6, by means of a spring 63 and arm 64. Thus as the pin blank 32 is carried forward, it strikes against the curved surfaces 61 of the arms 60 and rock the latter back against the tension of the 150
spring 63. When, however, the pin blank reaches the end of the guide member 65, the spring actuated arm 60 will force it away from the disk and shaped members which have been carrying it and transfer it into the slot 66. The blank 32 is now so positioned that it will be engaged by the forward pin 67 of a series of pins carried by the traveling belt or carrier 42.

The pin 67 and its co-operating pins 68 are arranged in sets, each of which sets is carried by a block 69. These blocks are provided with projecting ears or rings 70, which are pivotally fastened to a chain 42 by means of bolts 71. These bolts also extend through spacer links 72 and 73, which serve to hold the pin carrying blocks in the proper spaced relation irrespective of the degree of tightness of the chain forming carrier 42. To facilitate the links making the sharp turns necessary to travel around the sprocket wheel, they are preferably provided at one end with slots 74, through which the bolts extend. For accurately positioning the blocks 69, during the period when they are carrying the pin through the bending operation, the blocks 69 are provided with pins 75 and 76 projecting over the opposite sides of the blocks 69, moving in guideways 77 and 78 formed in a guide block 79. The latter is supported upon suitable standards 80 and 81, which are part of the end castings and as the chain is returning on the opposite side, it is supported by a guideway 82. The sprocket chain 42 is formed as an endless belt passing around the sprocket wheel 41 and a sprocket wheel 90 positioning near the other end of the plate. The last mentioned sprocket wheel 83 is keyed or otherwise fixed to a stub shaft 84, which is driven from the main mechanism operating shaft 11, by means of bevelled gears 85 and 86.

After the pin blank 32 has been transferred into the slot 66, and engaged by the pin 67, it is then carried forward by the chain mechanism until it reaches the plane of the inclined surfaces 87 and 88, which serve to center the pin just prior to its bending operation. After the pin has been centered by the inclined surfaces 87 and 88, the further movement of the chain carrier will draw the pin between the arms 89 and 90, which are inclined towards the opening 91, through which the pin is carried after its central portion has been bent over the rounded surfaces of the pin 67 and its ends moved down to form substantial parallel legs 92 and 93, connected by the rounded head portion 94. To insure the leg portions of the pin being moved into proper position at the time of the crimping operation, supplemental guide or holding members 95 and 96 carried by pivoted arms 97 and 98, and normally spring pressed inward by springs 99 and 100 are employed. After passing through the supplemental guides or positioning members 95 and 96, the pin is now in position to have the crimps 101 and 102 formed in the legs 93 and 93 respectively. The pins 68 on the blocks 69 are preferably utilized as part of the crimping mechanism, co-operating with a pair of rolls 103 and 104, mounted upon shafts 105 and 106 and driven from the main mechanism operating shaft 11 by means of sets of bevelled gears 107, 108, 109, 110, 111 and 112 and intermeshing gears 113 and 114. At equidistant points around the periphery of the wheels 103 and 104, are located a plurality of crimping projections 115 and 116, which co-operate with the pins 68 to crimp the legs of the hairpin in the manner shown in detail in Fig. 9. These crimping projections 115 and 116 are carried by a plurality of separate plates 117 and 118 detachably secured to the rolls 103 and 104 respectively so as to permit of the removal of the plates and substitution of plates having different formed and positioned projections, thus allowing variations in the product. The completed pin is now automatically transferred to a discharge carrier or belt chain 119, over which the completed pins are carried to a japanning oven, storage or other suitable device. The detailed construction of the mechanism for transferring the completed pin from the blocks 69 to the hooks 120 of the delivery belt 119, is as follows:

Positioned in the path of the blocks 69 is a stripper member 121, having an inclined edge 122, against which the completed pin 32 strikes, causing the latter to be raised off from the pins 67 and 68 and carrying the head portion onto the hook 120. In order to secure the placing of a hook 120 in proper position to receive the pin removed by the stripper member, means have been provided for driving the final delivery belt 119 in timed relation to the pin forming mechanism. This drive is obtained from the stub shaft 84 by means of a pinion 123, idler gears 124 and a gear 125 on the shaft 126, which carries the delivery chain sprocket wheel 127. Suitable adjusting and guiding sprocket wheels 128 and 129 are provided for the delivery chain or belt 119. This chain 119 is an endless belt and as previously stated is extended to any suitable point of discharge, (not shown).

From the above description, it will be apparent that the entire operations of feeding, straightening, severing, grinding, positioning, crimping and discharging the blank are all automatically performed and the entire operation controlled by a single lever or lever and switch arrangement so that the cost of production is minimized and an accurately formed product obtained. Various changes, however, can be made in the details.
of construction and in the arrangements and combinations and operations of the parts within the scope of my invention.

1. In a machine for forming hairpins or the like, the combination with means for feeding forward a wire blank, including a block having a head forming member adapted to engage the blank substantially midway of its ends and at right angles to the axis of the blank, of two guide members angularly disposed to the travel of the blank, the sides of said guide members adapted to contact with the ends of the blank and bend it about the head forming member while said blank is being fed forward.

2. In a machine for forming hairpins or the like, the combination of feeding and severing mechanism with a rotatable member adapted to receive a length of wire as it comes from the severing mechanism, and a series of members adapted to receive the length of wire advance it through forming operations while in a substantially vertical position.

3. In a machine for making hairpins, the combination with means for continuously feeding forward a wire, of a wire straightener through which the wire is drawn when being fed, a restricted opening through which the wire is fed, and cutting mechanism for cutting the wire into predetermined hairpin lengths, directly adjacent the portion held in the restricted opening.

4. In a machine for making hairpins, the combination with means for continuously feeding forward a wire, of means associated with the feeding mechanism for automatically severing the wire into blanks of predetermined length and means for feeding forward the blank so severed while the blanks are held in a vertical position, and

5. In a machine for making hairpins, the combination with means for continuously feeding forward a wire, of means associated with the feeding mechanism for automatically severing the wire into blanks of predetermined length, means for feeding forward the blank so severed while the same are held in a vertical position, and automatically bending the ends of the blank to produce a partially formed hairpin as it is fed forward.

6. In a machine for making hairpins or the like, the combination with means for continuously feeding a wire, of means associated with the feeding mechanism for automatically severing the wire into blanks of predetermined length, and polishing mechanism for operating on the severed ends of the blanks.

7. In a machine for making hairpins or the like, the combination with means for feeding forward a hairpin blank, of means for grinding the opposite ends of the blank and means for rotating the hairpin blank axially during the grinding operation in such a manner as to produce a predetermined form of rounded end to the end of said blank.

8. In a machine for making hairpins or the like, the combination with means for severing the wire into blanks of predetermined length, of a rotary member for feeding forward the blanks so formed, mechanism for grinding rounded ends on said blanks and a rotary member directly associated with the grinding mechanism operating on the blanks and adapted to rotate it axially in predetermined relation to the grinding mechanism while subjected to the grinding mechanism.

9. In a machine for making hairpins or the like, the combination with means for severing wire into blanks of predetermined length, of a rotary feed member for the blank having projecting peripheral points adapted to engage the severed blank at a plurality of places and feed the blank forward.

10. In a machine for making hairpins, the combination with means for severing a wire into blanks of predetermined length, of feeding mechanism including a rotary member adapted to advance the blanks while the same are held in a vertical position, and co-operating mechanism for fractionally engaging the blank throughout a substantial portion of its length, holding the blanks in position while being advanced.

11. In a machine for making hairpins or the like, the combination with means for severing a wire into blanks of predetermined length, of feeding mechanism including rotary members comprising disks having peripheral projections adapted to engage and advance the blanks, co-operating mechanism for fractionally engaging a substantial portion of the blanks and holding the blanks in position while being advanced, and means for rotating the blanks about their axes while being advanced.

12. In a machine for making hairpins or the like, the combination with means for feeding a blank including a rotary member, peripheral projections adapted to engage said blank and a second rotary member having a frictional engagement with a substantial surface of said blank while the same is being fed forward by the first rotary member and means for operating on the blank while fractionally held by the second rotating member.

13. In a machine for making hairpins or the like, feeding mechanism comprising a rotary feed comprising a pair of rotating disks having peripheral members adapted to engage and to advance the blank to a predetermined position and a second feed for automatically removing the blank from.
the rotary feed and advancing the blank through the bending operation.

14. In a machine for making hairpins or the like, the combination with a plurality of feeds for advancing the blank, of transfer mechanism for transferring the blank from one feed to another comprising a spring actuated member positioned in the path of the blank while in the first feed and adapted to engage the blank in a vertical position and transfer it to an adjacent member in the second feed.

15. In a machine for making hairpins, a combined feeding and forming mechanism including a series of blocks, and pin members carried by said blocks, rotating disks having projecting members adapted to cooperate with the pin members during rotation.

16. In a machine for making hairpins or the like, a combined feeding and forming mechanism including a series of blocks, and pin members carried by said blocks, rotating disks having detachable plates producing projections upon the circumference of said disk, said projections adapted to register with the spaces between the pin members to bend the blank around said pin members.

17. In a machine for making hairpins, the combination with means for severing wire into hairpin blanks of predetermined length, of a movable block having pin members and a rotatable member having co-operating members for forming the blank over said pin members.

18. In a machine for making hairpins or the like, the combination with a belt member, a block carried by said belt, rotating members having detachable peripheral projections thereon positioned in operative relation to said block.

19. In a machine for forming hairpins or the like, forming mechanism for forming the head and legs of the pin including a rotatable member, and a detachable plate carried by said rotatable member and having projections of predetermined configuration, a block having pin members therein adapted to carry the hairpin blanks and cooperate with the rotatable member in the forming operation.

20. In a machine for forming hairpins or the like, means for feeding forward a wire hairpin blank including a belt member, a plurality of blocks carried by said belt member, a guide for said blocks, said blocks having pins extending into the guide.

21. In a machine for forming hairpins or the like, the combination with means for severing the blank into predetermined hairpin lengths, of means for positively centering the blank so formed, means for bending the blank, and means for crimping the blank.

22. In a machine for forming hairpins or the like, the combination with means for severing the blank, of means for positively centering the blank so formed, means for bending the blank, means for crimping the blank, and supplementary means for setting the blank in its bent position.

23. In a machine for forming hairpins or the like, the combination with severing, feeding and forming mechanism, of a synchronously driven delivery mechanism and means for automatically transferring the formed blank from the severing to the forming mechanism and from the forming mechanism to the delivery mechanism.

24. In a machine for forming hairpins or the like, the combination with severing, combined feeding and forming mechanism, of a delivery mechanism, means for automatically transferring the formed blank from the forming mechanism to the delivery mechanism, including a member having an inclined surface positioned in the path of the formed blank, while on the forming mechanism.

25. The method of forming hairpins or the like, which comprises continuously advancing a stock of wire, severing the stock of wire into predetermined lengths without interfering with the continuous feed of the remainder of the stock, advancing the severed lengths, and automatically rounding the ends of the severed lengths while they are being advanced.

26. The method of forming hairpins or the like, which comprises synchronously advancing a wire member, in a vertical position rotating it about a substantially vertical axis and rounding its ends while being advanced and rotated.

WALTER H. HERMSDORF.