A. H. WOUTERS.

COIL FORMING MACHINE.

APPLICATION FILED FEB. 28, 1907. RENEWED APR. 6, 1911.

1,005,915. **Patented Oct. 17, 1911.**

2 SHEETS—SHEET 1.

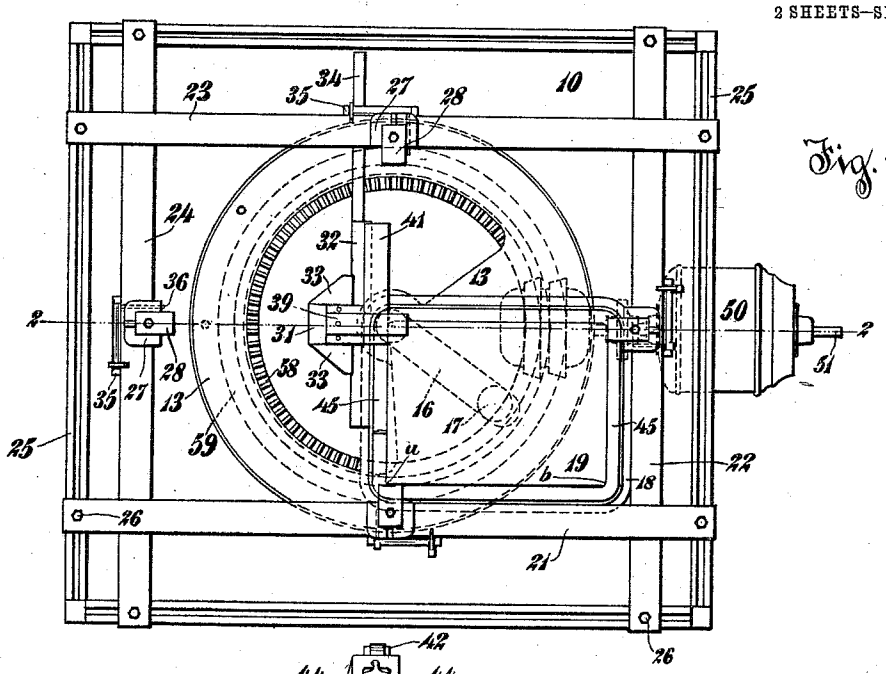

Fig. 1

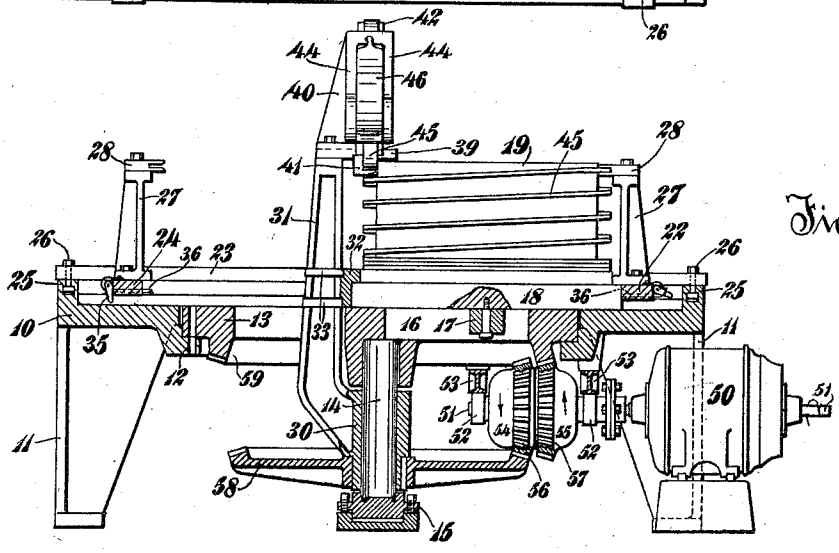

Fig. 2

Witnesses

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Fig. 3

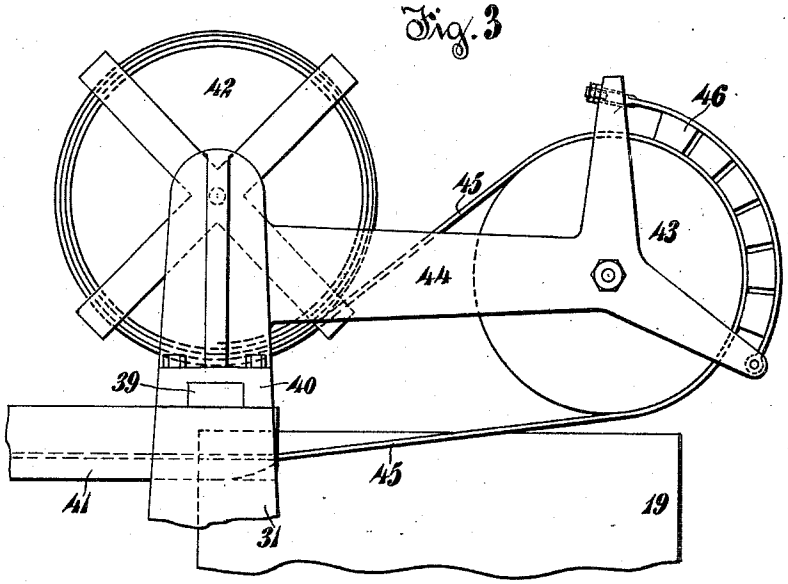
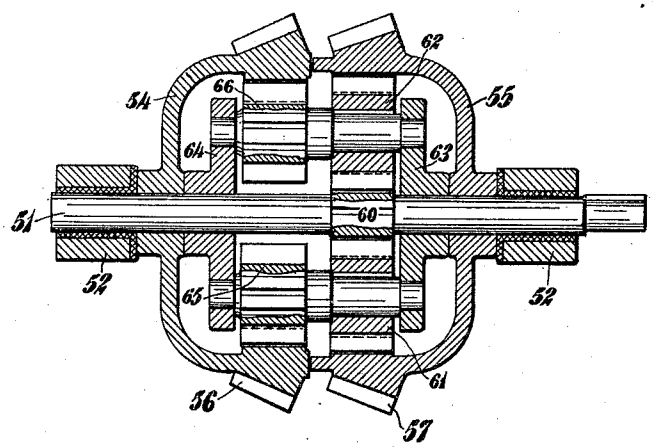


Fig. 4



Witnesses

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UNITED STATES PATENT OFFICE.

ALFRED H. WOUTERS, OF NORWOOD, OHIO, ASSIGNOR TO ALLIS-CHALMERS COMPANY, A CORPORATION OF NEW JERSEY, AND THE BULLOCK ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF OHIO.

COIL-FORMING MACHINE.

1,005,915. Specification of Letters Patent. **Patented Oct. 17, 1911.**

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To all whom it may concern:

Be it known that I, ALFRED H. WOUTERS, belonging to the Kingdom of the Netherlands, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Coil-Forming Machines, of which the following is a full, clear, and exact specification.

My invention relates to coil-forming machines and especially to machines for forming coils of metallic ribbon wound edgewise.

The machines which have heretofore been generally used in winding non-circular coils edgewise have had to be stopped every quarter or half turn in order to shift certain bending levers. Two or more operators have also usually been needed. On account of the time and labor thus required these coils have been very expensive.

It is the object of my invention to provide a simple machine in which coils of this sort may be wound automatically without other attention than in starting and stopping the machine. With my invention the machine does not need to be stopped at all during the operation of winding a coil, while one attendant can easily operate it.

To this end my invention comprises the combination in a winding machine, of a former, bending means, and means for alternately moving said former and said bending means.

Somewhat more specifically my invention comprises the combination in an edgewise winding machine, of a former having a plurality of bending centers, a rotatable bending bar, and means for moving said former to bring its bending centers successively to the center of rotation of said bending bar, and for turning said bending bar through a predetermined angle as each of said bending centers is brought to said center of rotation.

Other novel features of my invention will appear from the description and drawings and will be particularly pointed out in the claims.

Figure 1 is a plan view of my invention with some of the parts removed; Fig. 2 is a partial section on the line 2—2 of Fig. 1, with the rotatable table turned to bring its slot on said line; Fig. 3 is an enlarged view of the apparatus for feeding the metallic strip to be wound and, Fig. 4 is a section of the gear between the driving source and the two driven parts of the machine.

The stationary platform 10, supported by legs 11, has a central circular opening provided with a downwardly and inwardly extending flange 12 for supporting and guiding a rotatable table 13, the upper surface of said table being on a level with the upper surface of the platform 10. The table 13 is fixed on the upper end of a shaft 14, the lower end of which rests in an adjustable bearing 15. The table 13 is preferably cut away as shown in Fig. 1, leaving the rim and center joined by a sector. Along the middle of this sector is a slot 16 into which extends a roller 17 mounted at the center of the base 18 of the coil former 19. This former is supported upon the table 13 and the platform 10 and may be of any desired shape, but is here shown arranged for substantially rectangular coils having rounded corners, *i. e.*, its outline is the locus of all points outside of and at a given distance from a certain rectangle, or is equidistant at all points from such rectangle. The base 18 is preferably somewhat larger than the body of the coil former 19 and in outline is equidistant to the same rectangle to which the outline of the coil former is equidistant. This rectangle is the one formed by joining the different bending centers of the former. Stationary guides 21, 22, 23 and 24 are supported by the upturned outer flanges 25 of the platform 10 and are adjustably attached to these flanges by bolts 26 engaging grooves therein. The guides 22 and 24 are slidable under the guides 21 and 23, there being a slight space left between the guides 22 and 24 and the platform 10 for a purpose hereinafter explained. Each of the guides 21 to 24 inclusive supports a pedestal 27, at the upper end of which is a slotted member 28 for guiding and holding in place the half turn which has last been wound. In effect the guides form the sides of a box along which sides the former 19 successively slides.

Loosely mounted on the shaft 14 is a sleeve 30, from which an arm 31 extends upwardly through the opening in the table 13. This arm supports a guide 32 braced

by brackets 33 and engaging the base 18 of the coil-former as shown. An extension 34 of this movable guide slides under the stationary guides 21 to 24 inclusive as the sleeve 30 is rotated, and coöperates with latches 35, which are movable by sliding rods 36 and supported by said stationary guides, to normally prevent rotation of the movable guide 32 and its associated parts past them in a counter-clockwise direction. The extension 34 is arranged to be released from said latches under conditions hereafter set forth. Bolted to the upper end of the arm 31 are carriers 39 and 40, the former carrying a longitudinally slotted guide bar 41, and the latter a reel 42 for the ribbon or strip 45 of copper or other material to be formed into the desired coil and a disk 43 around which said band or strip 45 travels when passing from the reel 42 to the slot in the bar 41. Coöperating with the disk 43 is an adjustable brake 46 for giving the desired tension to the strip as it is being bent edgewise. The disk 43 and brake 46 are supported between lateral arms 44 from the arm 31.

A motor 50 is arranged to drive a shaft 51, which rotates in bearings 52 supported in any desired manner from the platform 10, as by means of cross-beams 53. Between the bearings 52 are two housings 54 and 55. On the outside of these two housings are bevel gears 56 and 57 respectively, meshing with bevel gears 58 and 59 respectively on the collar 30 and the table 13 respectively, as shown. Fixed on the shaft 51 within the housings 54 and 55 is a pinion 60, meshing with like planet gears 61 and 62 supported by collars 63 and 64 loose on the shaft 51. The planet gears 61 and 62 mesh with an internal gear on the housing 55. Other like planet gears 65 and 66 are arranged to turn with the gears 61 and 62 respectively, and mesh with an internal gear on the housing 54. The diameter of the like gears 61 and 62 is different from that of the other like gears 65 and 66. In this case the gears 65 and 66 are slightly smaller than the gears 61 and 62 so that the internal gear on the housing 54 is also slightly smaller than that on the housing 55. Therefore, if the housing 55 is held stationary while the shaft 51 is rotated, the housing 54 will rotate in the same direction as the shaft 51, while if the housing 54 is held stationary while said shaft is rotated, the housing 55 will move in the opposite direction. Thus as the gears 58 and 59 are respectively below and above the shaft 51, rotation of said shaft tends to drive both the collar 30 and the table 13 in the same direction, which, in case the shaft 51 is rotated in the direction of the arrow, is counter-clockwise.

The operation of the device is as follows:—With the parts in the position shown in Fig. 1, the guide 32 is bearing against the base 18 in such a manner that counter-clockwise movement of said guide is prevented. The latch 35 on guide 23 also serves to prevent counter-clockwise movement of this guide. Thus the housing 54 and bending mechanism are locked against movement, while the housing 55 and the table 13 are free to move. As the table 13 is moved counter-clockwise by the rotation of the motor 50 it drives the coil former 19 toward the guide 23 because of the engagement of the slot 16 and roller 17. In this movement the former 19 moves in a straight line, being constrained to do so by the guides 22 and 32. The former 19 continues to move in this manner until it reaches the guide 23, which prevents it from moving farther in this direction while the guide 32 prevents it from moving to the left (Fig. 1). Thus the table 13 and housing 55 become temporarily locked against further movement. In the movement of the former 19 just described, the copper strip 45 is unwound from the reel 42 and drawn around the disk 43 under the brake 46 and into the slot in the bar 41.

When the former 19 reaches the fixed guide 23 it releases the movable guide 32 both by itself getting out of the way of the counter-clockwise movement of said guide and also by pushing in the rod 36 to raise the latch 35. Thus the housing 54 and its connected mechanism are released and the housing 55 and its connected mechanism are locked simultaneously. Continued movement of the motor 50 now drives the housing 54 and its associated parts counter-clockwise around the axis of the shaft 14, the slotted bar 41 both bending the copper strip around the corner *a* of the former 19 and preventing said strip from buckling. It also unwinds enough copper from the reel 42 to form this corner. In this case there is a bend of 90° at this corner, and so when the bending mechanism has moved through a quarter of a rotation the guide 32 strikes the side of the base 18 toward the guide 21 and also the left hand latch 35, both of these serving to stop said guide 32 and lock the housing 54 and the bending mechanism driven thereby. At the same time that these parts are locked the guide 32 has become parallel with the guide 23, thereby opening the way for the former 19 to be moved rectilinearly to the left, (Fig. 1) by means of housing 55, bevel gear 59, table 13, slot 16 and roller 17. This movement to the left draws more of the copper strip from the reel 42 into the slot in the bar 41, and continues until the guide 24 is reached. Upon this the guide 32 and the bending mechanism are again released for another rotation through 90°, bending the copper

strip about the corner *b* of the former 19. Thus alternately the former 19 is moved by translation to bring its different bending centers successively in line with the axis of the shaft 14 and to unwind from the reel 42 enough copper strip 45 to form one side of the coil, and the bending mechanism is rotated to bend the strip edgewise around the said centers and to unwind enough copper to form one corner of the coil. This action will automatically continue as long as desired. The slotted members 28 serve to guide and support the last finished half turn of the coil as the former 19 is being moved by translation and as the bending bar 41 is rotated, thus preventing any sagging of the wound coil directly from the bar 41. After the next one or two sides of the coil have been formed, each side is allowed to slide down on the former 19.

When the entire coil is completed it may be removed after first moving outward one of the adjustable stationary guides, say 23, and swinging around member 28 on said guide. This permits the former to move farther than usual when it next approaches said guide, so that upon the rotation of the guide 32 and bar 41 there is enough space for the removal of the coil. Any desired means for preventing movement of the former 19 as the guide 32 moves away from it may be used, such, for instance, as a pin dropped through registering holes in the table 13 and flange 12. After the coil is removed the motor 50 may be started to drive the former along the guide which was set outward, and then along the guide adjacent thereto in a counter-clockwise direction, whereupon the guide which was set outward may be set back again to its proper position. Or, if desired, the finished coil may be removed after first removing the carriers 39 and 40 and the parts carried thereby. By substituting other coil formers 19 and properly adjusting the guides 21 to 24 inclusive, coils of any desired size may be wound. By substituting other bending bars 41 and slotted members 28 any size strip may be bent. Instead of having the guides 21 to 24 inclusive arranged to form a rectangle, they may form any other desired figure, a rectangle being shown merely because it is the simplest. The former 19 will move in any path determined by the stationary guides 21 to 24 and the movable guide 32. The latches 35 are not absolutely necessary and may often be omitted. They are additional locks merely and serve to prevent "creeping" of the bending mechanism as the former 19 in its rectangular movement approaches the different guides 21 to 24 inclusive.

Many other modifications may be made in the precise arrangements herein shown and described and all such as do not involve a departure from the spirit and scope of my invention I aim to cover in the following claims.

What I claim as new is:—

1. In a winding machine, a former, bending means, and means for alternately moving said former and said bending means in the same plane.

2. In a winding machine, a former having a plurality of bending centers, bending means, and means for moving one of the aforesaid elements to bring the bending centers of the former successively into a predetermined relation to the bending means and for turning the other of said elements about each of said bending centers as it is reached.

3. In a winding machine, a former having a plurality of bending centers, bending means, means, for moving one of the aforesaid elements to bring the bending centers of the former successively into a predetermined relation to the bending means and for turning the other of said elements about each of said bending centers as it is reached, and a material-supplying device movable with the bending means.

4. In a winding machine, a former, bending means, and means for moving said former in a polygonal path and for turning said bending means.

5. In a winding machine, a former movable in a polygonal path, rotatable bending means, and means for successively moving said former along a side of its path and turning said bending means through an angle equal to the angle formed by two adjacent sides of said path.

6. In a winding machine, a former, a bending bar, and means for moving said former along a plurality of rectilinear paths successively and for turning said bending bar intermediately.

7. In a winding machine, a former movable by translation in a substantially rectangular path, a rotatable bending bar, and means for moving said former intermittently along its path, and for rotating the bending bar during the intermissions in the movements of the former.

8. In a winding machine, a former movable in a substantially rectangular path, rotatable bending means, and means for moving said former along its path, and for turning said bending means through substantially a right angle after a movement of the former along one side of its path.

9. In a winding machine, a former, a bending bar, and means for translating said former successively along the different sides of a rectangular path, and for rotating said bending bar through a right angle after the former has traversed each side of its path.

10. In a winding machine, a polygonal box, a former, bending means, and means for sliding said former along the sides of the

box and for turning said bending means about the former.

11. In a winding machine, a former, a rotatable bending member, and means for moving the former by translation about the center of rotation of the bending member, and for rotating said bending member so that its bending side always faces the former.

12. In a winding machine, a rectangular box, a former within said box, bending means rotatable about the center of said box, and means for sliding said former along each side of said box successively and for turning said bending means partially about the former after said former has been moved along each side of the box.

13. In a winding machine, a former, rotatable bending means, means for successively moving the former by translation partially around the center of rotation of the bending means, and the bending means by rotation partially around the former.

14. In a winding machine, a former, bending means, and means for alternately moving the former by translation along the bending means, and moving the bending means by rotation partially around the former.

15. In a winding machine, a former having a plurality of bending centers, a rotatable bending bar, and means for moving said former to bring its different bending centers successively to the point about which said bending bar rotates, and to turn said bending bar about said point when each of said bending centers reaches it.

16. In a winding machine, a former having a plurality of bending centers, a rotatable bending bar, means for moving said former to bring its different bending centers successively to the point about which said bending bar rotates, and to turn said bending bar about said point when each of said bending centers reaches it, and a material-supplying device rotatable with said bending bar.

17. In a winding machine, a former having a plurality of bending centers, a rotatable bending bar, and means for moving said former to bring one of its bending centers to the center of rotation of said bending bar, and for turning said bending bar a predetermined angle about its center of rotation alternately.

18. In combination, two rotatable members, a single means tending to drive both of said members, and mechanism for locking said members alternately.

19. In combination, two rotatable members, a single means tending to drive both of said members, and mechanism for automatically locking said members alternately.

20. In combination, two rotatable members, a single means tending to drive both of said members in the same direction, and mechanism whereby said members alternately lock each other against movement.

21. In a winding machine, a former, a bending bar, and means for automatically rotating one of said parts and translating the other.

22. In a winding machine, a former, bending means, and means for automatically translating one of said parts and rotating the other alternately.

23. In a winding machine, a former, bending means, and means for moving said former different distances rectilinearly, and for intermediately rotating said bending means.

24. The combination with a former, of means for moving it longitudinally to draw in fresh portions of a metallic strip to be bent edgewise, a member for holding the strip against the edge of the former, and means for revolving said member about the former.

25. In a winding machine, a former, a rotatable member on which said former is supported, a pin and slot connection between said former and said member, a plurality of adjustable stationary guides and a single movable guide for constraining said former to move by translation in a straight line when said member is rotated, a bending bar movable with said movable guide, and means for alternately rotating said rotatable member and turning said guide and bending bar.

26. In an edgewise-winding machine, the combination with a former, guides for causing said former to move in straight lines, a bending bar rotatable about the former, and driving means tending to drive both said former and said bending bar, said former and said bending bar being so interrelated that when either one is movable forward it locks the other one.

27. In an edgewise-winding machine, the combination with a former, guides for causing said former to move in straight lines, a bending bar rotatable about the former, and driving means tending to drive both said former and said bending bar, said former and said bending bar being so interrelated that each locks and unlocks the other as it is unlocked and locked respectively by the other.

28. In an edgewise-winding machine, the combination with a former, guides for causing said former to move in straight lines, a bending bar rotatable about the former, and driving means tending to drive both said former and said bending bar, said former and said bending bar being so interrelated that the members are movable alternately, each locking and unlocking the other at the beginning and end respectively of its own movement.

29. In an edgewise-winding machine, the combination with a former, guides for causing said former to move in straight lines, a bending bar rotatable about the former, and driving means tending to drive both said former and said bending bar, said former and said bending bar being so interrelated that each alternately locks and unlocks the other and is movable intermediately.

30. In combination, a former, bending means, rotatable members for driving said former and said bending means respectively, and means for automatically actuating said rotatable members alternately.

31. In combination, a former, bending means, and a single means tending to translate one of said elements and to rotate the other about that one.

32. In combination, a former, bending means, a single means tending to translate one of said elements and to rotate the other about that one, and means for locking said elements alternately.

33. In a winding machine, a former, a bending member, and means for rotating one of said elements intermittently and for translating the other in the intermissions of the movement of the one.

34. In a winding machine, a former, a bending member, means for rotating one of said elements intermittently and for translating the other in the intermissions of the movement of the one, and means for locking the rotatable member during the translation of the other.

In testimony whereof I affix my signature, in the presence of two witnesses.

ALFRED H. WOUTERS.

Witnesses:
GEO. B. SCHLEY,
FRED J. KINSEY.