No. 666,008. Patented Jan. 15, 1901.

H. GEISENHÖNER.

EDGEWISE WINDING APPARATUS.

(Application filed Sept. 29, 1900.)

(No Model.)

Fig. 1.

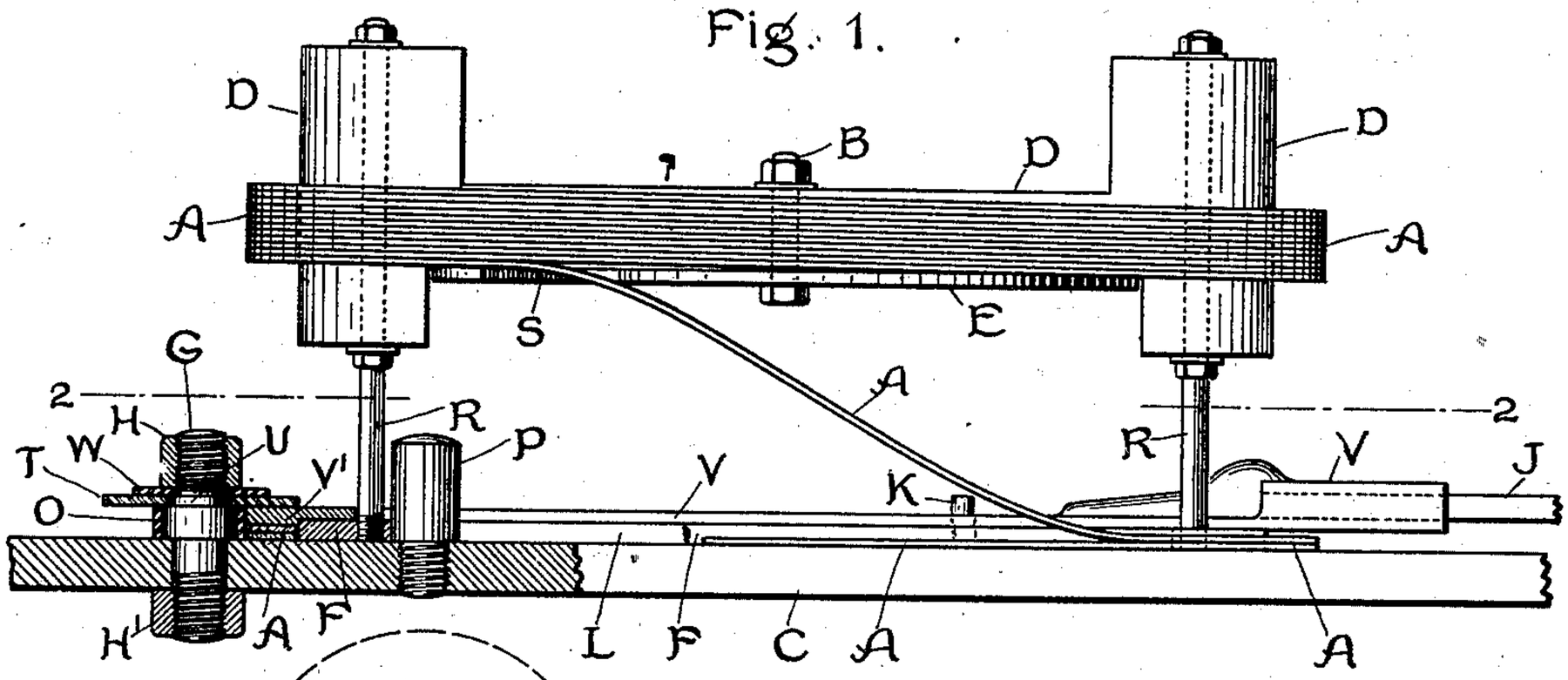

Fig. 2.

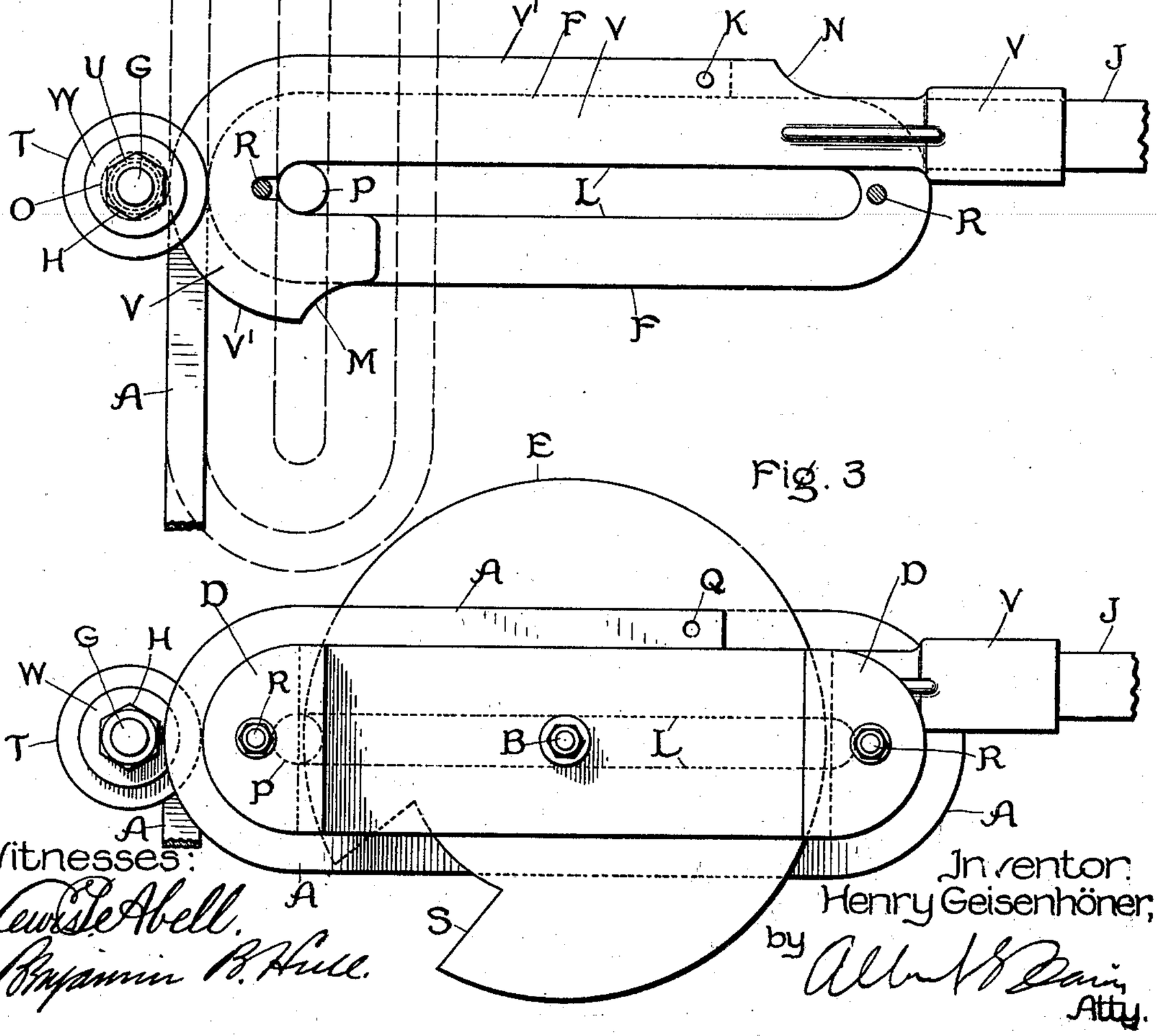

Fig. 3

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UNITED STATES PATENT OFFICE.

HENRY GEISENHÖNER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

EDGEWISE-WINDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 666,008, dated January 15, 1901.

Application filed September 29, 1900. Serial No. 31,474. (No model.)

To all whom it may concern:

Be it known that I, HENRY GEISENHÖNER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Edgewise-Winding Apparatus, (Case No. 1,651,) of which the following is a specification.

This invention relates to the edgewise winding or bending of strips or ribbons of metal, such as copper, into oblong or otherwise-shaped field-coils for electric machines, the great advantages of which are now well-known to those skilled in the electrical art.

The invention is an improvement on the method of winding the coils, which formerly consisted in winding the strip edgewise into cylindrical form while preventing buckling and then flattening the cylinder, so that two of the sides are straight and parallel and connected by curved ends. The disadvantages of such method are obvious, as it is clear that the greater part of the operation of winding is unnecessary with respect to the final shape desired and that the operation of flattening is solely for the purpose of restoring large portions of the strip to the shape which it had before the operation of winding or bending.

With the apparatus, which is constructed in accordance with the invention herein, a metallic strip can be wound edgewise directly into a coil of the desired shape, and the apparatus effectively carries out the process, which consists in successively bending edgewise in the desired direction portions of the strip which are of the requisite distance apart to form a coil of the desired shape. For example, in winding an oblong coil with curved ends for a field structure a portion of the strip or ribbon is bent edgewise until it is parallel with the main portion of the strip. Then a portion further along the ribbon is bent edgewise in the same direction until it is parallel to the rest of the main portion, the first bent portion being now carried to a portion adjacent to the main portion. Thus is made one complete turn, with a tailpiece, of the coil, which has curved ends and straight sides. The other turns of the coil are formed in a similar manner.

Coils of other shapes than the one just described can be produced by apparatus which does not differ substantially from that herein disclosed, as will be clear from the description of the latter hereinafter.

In addition to the means for winding the strip directly into its final shape an important feature of the invention is the means for guiding the formed strip away from the winding means, so that it is supported independently of the portion of the strip which is being bent.

Of the drawings, Figure 1 is an elevation, partly in section, showing a strip in process of winding, of an apparatus in which the invention is embodied. Fig. 2 is a section along the line 2 2 of Fig. 1, showing in plan the means for winding the strip, the upper supporting-spool not being shown; and Fig. 3 is a plan of the entire apparatus shown in elevation in Fig. 1.

The winding-former F is adapted in the apparatus shown to produce oblong coils having straight parallel sides and curved ends, which are particularly adapted for use as field-coils for electric machines.

It should be understood that the invention is capable of embodiment in apparatus which will produce coils of any desired configuration.

This is the first apparatus ever built by which flat strips of metal could be wound edgewise into any desired shape.

In Fig. 1, C is a base upon which the apparatus is mounted. A bolt or winding-standard G is secured to the base C by nuts H H'. A steel roller O is mounted on a central enlarged portion of the bolt, and a rotatable disk T is mounted on a shoulder U of the bolt, and upon the upper end of the roller a washer W beneath the nut H prevents vertical movement of the rotatable disk T and roller O. A pin P is also secured to the base C. A link-shaped former F (shown in Fig. 2) is adapted to be revolved and reciprocated with respect to the pin P. The metallic strip A is drawn to the winding operation between the roller H and an adjacent surface of the former F, as shown in Fig. 1. During the operation of winding the strip is prevented from buckling by the base C, on which it rests, and

by the shoulder V′ of the lever V, between which shoulder and the base is a space sufficient for two thicknesses of the strip A. The lever V is held in this position by the rotatable disk T. The link-shaped former is moved in this particular apparatus by a hook-shaped lever V, which removably fits the former by its depending shoulder V′ of the same configuration as the outer edge of the former. Although the winding-former F is irregular in shape its movement is such that its edge in proximity to the roller H is always separated therefrom by a distance which is equal to the width of the strip A.

In Fig. 2 the portion in broken lines indicates the winding-former F, with a portion of the strip wound thereon at the central point of its vertical reciprocation, and the full lines represent the winding-former at one-quarter revolution from the highest vertical point to which it is reciprocated, the lever V being shown in its operative position. The end of the strip A, upon which the operation of winding has just commenced, is shown attached to the lower surface of the lever by the pin K, which extends up through the upper surface of the lever.

Since, as shown in Fig. 1, the rectangular space between the roller, the edge of the former F, the lower surface of the shoulder V′ of the lever V, and the upper surface of the base C is sufficiently large to contain two thicknesses of the strip A, it is necessary in starting the operation of winding the coil to attach to the pin K on the bottom of the shoulder of the lever an auxiliary strip, which is bent in the same shape as the configuration of the former F and extends from the pin K around the left-hand end of the former F to the curved end portion M of the lever.

As described above, the lever V has been moved in Fig. 2 to move the former F a quarter-revolution about the pin P as a center, thus partially bending the first portion of the strip A, the end of which is attached to the portion of the pin K which extends from the lower side of the shoulder V′ of the lever V. To complete one curved end of the coil, the lever V is moved down until it is at right angles to the position shown in Fig. 2. One curved end of the coil is now completed, and the end of the strip is removed from the pin K in order that the lever V may be temporarily removed from the former F. This removal is readily accomplished, because in the vertical position to which the lever has been moved in completing the formation of the curved end the curved portion M of the lever, which is an arc of the circle of the rotating disk T, has been carried to the edge of the said disk, so that the lever V is freed from the disk and can be lifted up from the former F. At this stage it will be clear by reference to Fig. 2 that the former F hangs vertically on the pin P, carrying the bent portion of the strip A on its upper end and that the free end of the strip extends down vertically along the right-hand side of the former F and parallel to the main portion of the strip. The lever V having been removed is again placed on the former F in a reversed position, so that its handle J extends upward from the left-hand side of the former F. This attachment is accomplished by reason of the curved portion N of the lever, which, like the curved portion M, is an arc of a circle of the diameter of the disk T, so that the shoulder V′ of the lever at its curved terminal N can be inserted beneath the disk T, the main surface of the lever resting on the former F. The lever is then lifted, so that its hook-shaped end engages the lower end of the former F. The lever V is now further raised, lifting with it the former F, which is permitted by the longitudinal central slot or groove in the former F in which the pin P engages. Thus the main portion of the strip A is drawn between the roller O, the shoulder V′ of the lever V, the edge of the former F, and the upper surface of the base C, until the pin P engages with the lower end of the slot L, the portion of the strip thus drawn forming a straight side of the coil. The lever V is now moved down clockwise, as before, to the position shown in Fig. 2, but in its second revolution about the pin P. The auxiliary strip in this operation still remains attached to the pin K on the lower surface of the shoulder of the lever V, as there are not yet two thicknesses of the strip at the point where the strip is now being wound. However, soon after the lever V is moved below its horizontal position (shown in Fig. 2) the auxiliary strip passes from the bending-space between the roller O and the proximate edge of the former F, and there immediately follows it through that space the end of the strip which in the first revolution of the former F was attached to the pin K, but which is now free. The lever V is further carried down into a vertical position, as before, thus completing the bending of a second curved end of the coil. The lever is then removed from the former F, as before, and the operation repeated twice more, until with two thicknesses of the strip in the bending-space adjacent to the roller O there is a free end of the formed strip which must be taken care of. The apparatus for this purpose may be most clearly understood with reference to Figs. 1 and 3. Rods R are secured to and carried by the former F. These rods support at their ends a spool D of the shape of the coil. Secured to the lower side of the spool D by a suitable bolt B is an independently-rotatable disk E. This disk is provided with a slot S, (shown in Figs. 1 and 3,) and through this slot is inserted the free end of the strip A, to which reference has just been made. It should be noted here that the spool on which the disk is mounted is secured to and moved synchronously with the former F, and that therefore the formed strip is not carried automatically to the spool; but when the lever V has caused a half-revo-

lution of the former F and a new half-turn of the coil has been wound the lever is removed and the disk E is rotated in the direction opposite to the direction of movement of the hands of a clock, so that the edges of the slot S guide and raise up the formed strip A, so that it lies against the spool D and is supported upon the part of the disk E which projects beyond the sides of the spool D. This rotation of the disk E is continued until near the right-hand portion of the spool the strip is released from the slot S, which is carried beyond the inner end of the right-hand portion of the spool to the other side thereof, where it engages with a portion of the strip which has been more recently wound and which now extends downward from right to left to the former F instead of downward from left to right, as in Fig. 1. The lever V is then operated again in the direction of movement of the hands of a clock, as described, to form another turn of the coil, and then the disk E is again rotated in an opposite direction to guide a new portion of the formed strip to the spool D.

In Fig. 3 the end of the strip A, provided with the perforation Q, by which it is attached to the pin K of the lever V, is represented as being carried by the spool D and resting on the top of the disk E, having been carried into that position by a previous left-handed rotation of the disk E. At the right-hand portion of the figure is shown a part of the strip A which has been wound, but which has not yet been raised to the spool. It now lies about the edge of the former F and a portion of it is hidden by the lever V, which has not completed its half-revolution and therefore is still in position on the former F. If now the lever V is moved down to its vertical position, the former, spool, and disk will be in the same relative positions as in Fig. 3. Then as the lever V is at that time removed we may assume that it is removed in Fig. 3, and upon a left-handed rotation of the disk E the strip will be carried through the slot S and the slot will be carried out of engagement with the strip at the right-hand end of the spool D, will pass beneath the horizontal portion of the spool, and will engage the portion of the strip which now hangs from the right-hand portion of the spool down to the left-hand end of the former in an opposite position to that shown in Fig. 1.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for preventing the strip from buckling at the portion where it is being bent, and a non-circular former which is capable of movements of revolution and reciprocation.

2. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises a former, a spool for the formed coil, and a slotted disk which guides the formed strip from said former to the spool.

3. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for preventing the ribbon or strip from buckling at the portion where it is being bent, a non-circular former having a groove, a pin, and means for revolving and reciprocating said former with respect to the pin.

4. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for preventing the strip from buckling at the portion where it is being bent, a former, a spool for the formed coil, and a slotted disk which guides the formed strip from said former to the spool.

5. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises fixed means for preventing buckling, a movable winding-former coöperating therewith, a spool movable with the former, and a slotted disk which guides the formed ribbon to the spool.

6. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises a former, and means coöperating with said former to entirely inclose the portion of the strip which is being bent by the movement of the former.

7. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises a rotatable winding-surface acting on one edge of the strip, and a movable former of the same shape as that desired for the coil and to which one end of the strip is attached, and which is adapted to be so moved that its edge is always as far distant from the rotatable surface as the width of the strip, said edge therefore acting on the opposite edge of the strip.

8. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises a winding-standard, a former coöperating therewith on the edges of the strip, to which former one end of the strip is attached, and means for moving said former to maintain constant distance between its edge and the standard.

9. An apparatus for winding edgewise a flat metallic strip or ribbon, which comprises a pivoted roller acting on one edge of the strip, and a former of the desired shape of the coil, which acts on the opposite edge of the strip, and to which one end of the strip is attached, means for moving said former so that a constant distance is maintained between its edge and the surface of the roller, and means for preventing the buckling of the strip.

10. An apparatus for winding a flat metallic strip or ribbon edgewise into oblong coils having curved ends and straight sides, which comprises a winding-standard, an oblong former having curved ends and straight sides, and adapted to act on an edge of the strip, means for imparting revolutionary and reciprocatory motion to said former to maintain its edge in engagement with the edge of the strip, and means for preventing buckling of the strip.

11. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for winding or bending the strip edgewise, a spool for holding the coil, and a slot through which the strip passes to the spool after it has been wound or bent.

12. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises a former for winding the strip edgewise, a spool movable therewith for holding the wound strip, and a slot through which the strip passes to the spool after it has been wound.

13. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for winding the strip edgewise, and independent means for moving the wound strip away from the winding means.

14. An apparatus for winding edgewise a flat metallic strip or ribbon, which comprises means for winding the strip edgewise, means for holding the strip to prevent buckling, and means for guiding the wound strip away from said holding means.

In witness whereof I have hereunto set my hand this 27th day of September, 1900.

HENRY GEISENHÖNER.

Witnesses:
BENJAMIN B. HULL,
CAROLYN L. HAYNES.