No. 801,375. PATENTED OCT. 10, 1905.

F. W. GLADING.

COIL FORMING APPARATUS.

APPLICATION FILED APR. 23, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

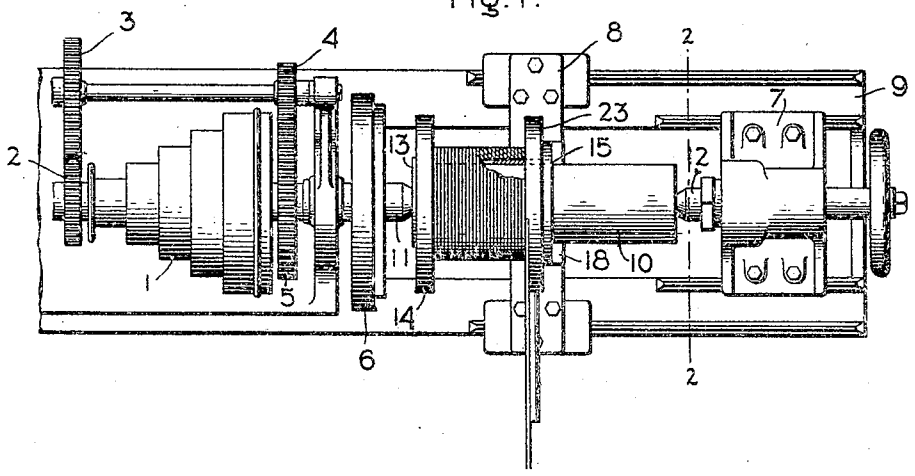


Fig. 2.

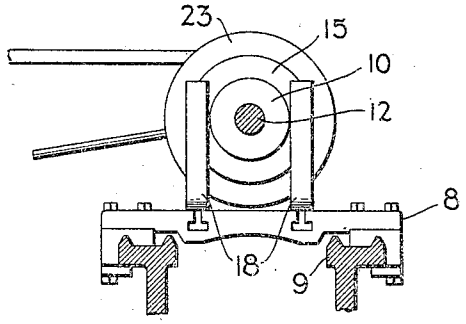
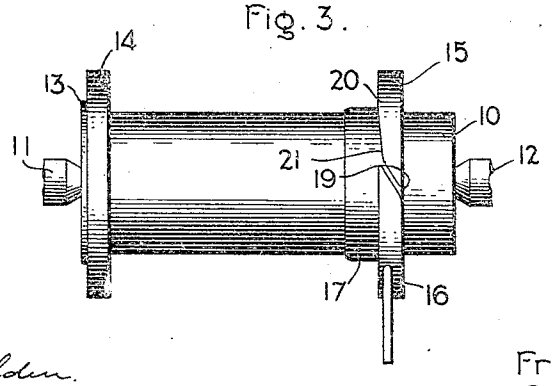


Fig. 3.



Witnesses

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2 SHEETS—SHEET 2.

Fig.4.

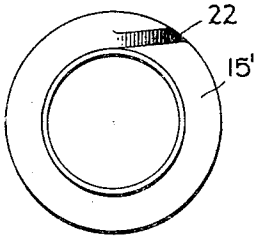


Fig.5.

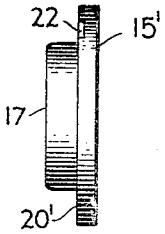


Fig.6.

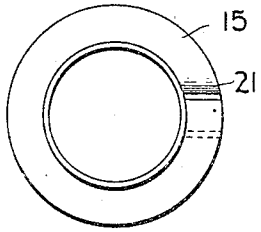


Fig.7

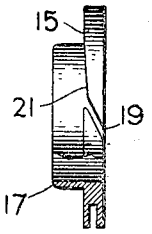


Fig.8.

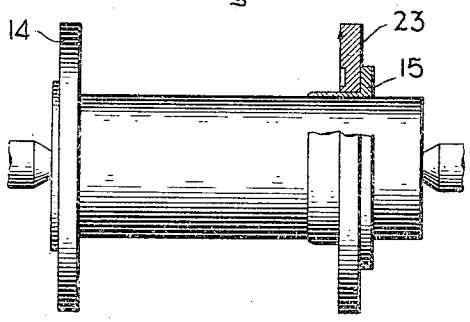


Fig.9

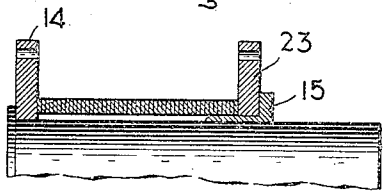


Fig.11

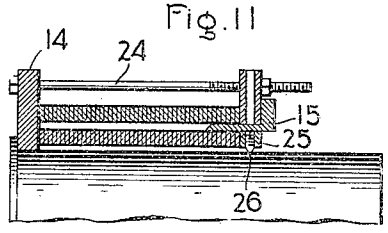


Fig.10

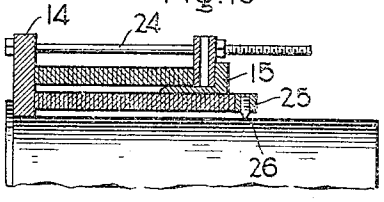


Fig.12

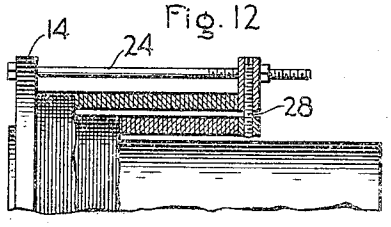
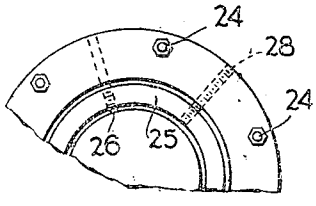


Fig.13



Witnesses.

Nancy N. Tilden

Helen Orford

Inventor.

Frank W. Glading.

by Albert G. Davis

Atty

UNITED STATES PATENT OFFICE.

FRANK W. GLADING, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

COIL-FORMING APPARATUS.

No. 801,375. Specification of Letters Patent. Patented Oct. 10, 1905.

Application filed April 23, 1904. Serial No. 204,530.

To all whom it may concern:

Be it known that I, FRANK W. GLADING, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Coil-Forming Apparatus, of which the following is a specification.

The present invention relates to apparatus for forming edge-wound coils of flat conductor strips for use as magnet-windings in electrical apparatus.

Magnet-coils made from thin ribbons of conducting metal have become very popular in the electrical arts during the past few years on account of their extreme compactness and the facility with which they conduct heat outwardly to their exposed or radiating surfaces. Their use, however, has been restricted heretofore to the larger sizes on account of the mechanical difficulties in the manufacture of such coils with a large number of conductor turns per inch length of coil. These mechanical difficulties have been due largely to the inability to hold the strips in the radial plane during the bending operation and also to the tendency of the strip to crowd off at its bottom edge and work between the mandrel and the follower.

The object of my invention is to provide means whereby metal strips of extreme attenuation may be successfully and economically bent into accurately-formed coils and securely sustained against displacement.

The invention will be readily understood upon reference to the following detailed specification and the accompanying drawings, forming a part thereof, in which—

Figure 1 is a top plan of a winding-lathe with a mandrel and coil-forming attachment embodying one form of my invention. Fig. 2 is a vertical section on line 2 2 of Fig. 1. Fig. 3 is a top plan of a mandrel and follower-ring, drawn to a larger scale. Figs. 4 to 7 show front and side elevations of modified forms of follower-rings. Fig. 8 shows a follower-ring with detachable collar or clamping-ring. Figs. 9 to 12 show, in sections of coils and rings, the method of securing the respective windings in the formation of a compound coil; and Fig. 13 shows a fragmentary end elevation of a compound coil with the clamping-rings secured together.

The winding-lathe is of any well-known construction, having a cone-pulley 1, power-gears 2, 3, 4, and 5, face-plate 6, tail-stock 7, and a carriage 8 movable longitudinally of the bed 9.

The winding-mandrel 10 is supported by the lathe-centers 11 and 12 and is provided at its left-hand end with a projecting shoulder 13, against which a head-ring 14 normally thrusts. The drum of the mandrel 10 is made cylindrical and is surrounded by a follower-ring 15, which, as shown in Figs. 3, 6, and 7, consists of a heavy flange 16, with a thin cylindrical crown 17 projecting from the left side thereof, with an internal diameter just large enough to permit free longitudinal movement thereof relatively to the mandrel-drum. The follower is normally pressed toward the ring 14 by arms 18, extending upwardly from the carriage 8 and engaging the right-hand end of the follower. The follower is provided with a diagonal slot 19 through its flange for the passage of the strip, and in order to permit the strip to receive its initial bend before the full transverse pressure of the coil is brought to bear thereon a part of the working face 20 just to the rear of the exit end of the slot 19 is cut away on a bevel 21.

In Figs. 4 and 5 the follower-ring 15′ instead of being provided with a diagonal slot has a longitudinal groove 22 in its working face 20′, through which the metal strip is fed.

In the construction shown in Figs. 1, 2, 8, to 13 the follower-ring 15 carries a detachable clamping-ring 23, which may be provided with either the diagonal slot 19 or the tangential groove 22 for the passage of the metal strip, so that it is adapted to operate as a part of the follower-ring 15 during the formation of the coil, and when the latter is completed it may be connected by rods or bolts 24 to the head-ring 14 and the follower-ring 15 removed therefrom.

When a compound coil is to be wound, the clamping-ring is made up of concentric sections with outside diameters corresponding to the outside diameters of the respective coil-sections. As shown in Figs. 10 to 13, the inner section 25 is temporarily secured to the drum of the mandrel upon the completion of the first or inner section by pointed set-screws 26 and a second section wound about the first as a drum. Upon completion of the last section of the coil the outer section of the clamping-ring is secured to the inner sections by screws 28 and the several sections clamped in place against longitudinal strain of the coil by the

bolts 24 engaging the outer section and the head-ring 14. As shown in Fig. 13, the alternate screw-holes in the outer section of the clamping-ring 23 are left vacant, so that a screw-driver may be inserted to remove the short screws 26 from engagement with the drum of the mandrel 10.

It is to be noted in the present construction that there is no loose joint between drum and follower-ring into which the thin strips may work, that when a section of coil has been completed it is slightly separated from the drum or inner section and accordingly may be readily removed without injury, and that when the strip is covered with a tender insulation there is no liability of injury thereto by reason of the wedging or binding action of the edges of the convolutions upon each other as they come together in different sections of the coil.

I do not desire to restrict myself to the particular form or construction of parts herein shown and described, since it is apparent that they may be changed and modified without departing from my invention.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination with a mandrel, of a follower-ring surrounding said mandrel and having a radial flange, and a crown projection from the working face of said ring.

2. The combination with a mandrel, of a follower-ring having a radial flange provided with a passage for the material operated upon, and a crown-flange at its inner periphery.

3. The combination with a cylindrical mandrel, of a follower-ring having a flange provided with a slot for the passage of the metal operated upon, and a rigidly-connected crown projection extending from the working face of said flange.

4. The combination with a mandrel, of a detachable head-ring, a follower having a radial flange and a crown projection, and a clamping-ring mounted on said follower and adapted to be connected to said head-ring or to said mandrel.

5. The combination of a mandrel, a detachable head-ring, a follower, and a sectional clamping-ring adapted to be connected to said head-ring or to said mandrel.

6. The combination of a mandrel, a head-ring, a follower having radial and crown flanges, a sectional clamping-ring, and means for clamping one or more of said sections to said mandrel and for connecting said sections to each other.

In witness whereof I have hereunto set my hand this 21st day of April, 1904.

FRANK W. GLADING.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.