F. MUELLER.

COIL WINDING MACHINE.

APPLICATION FILED JAN. 10, 1908.

933,778.

Patented Sept. 14, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

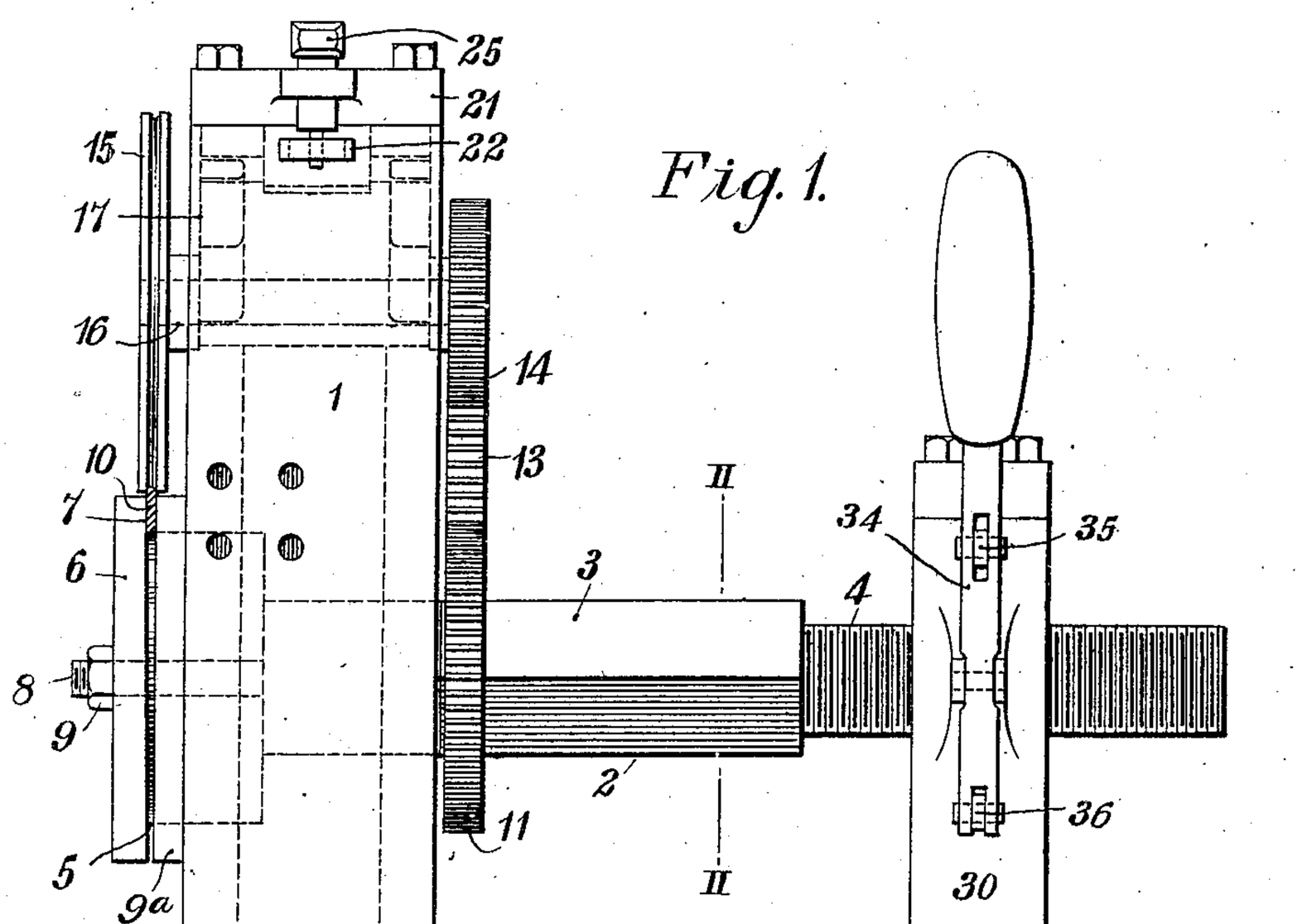
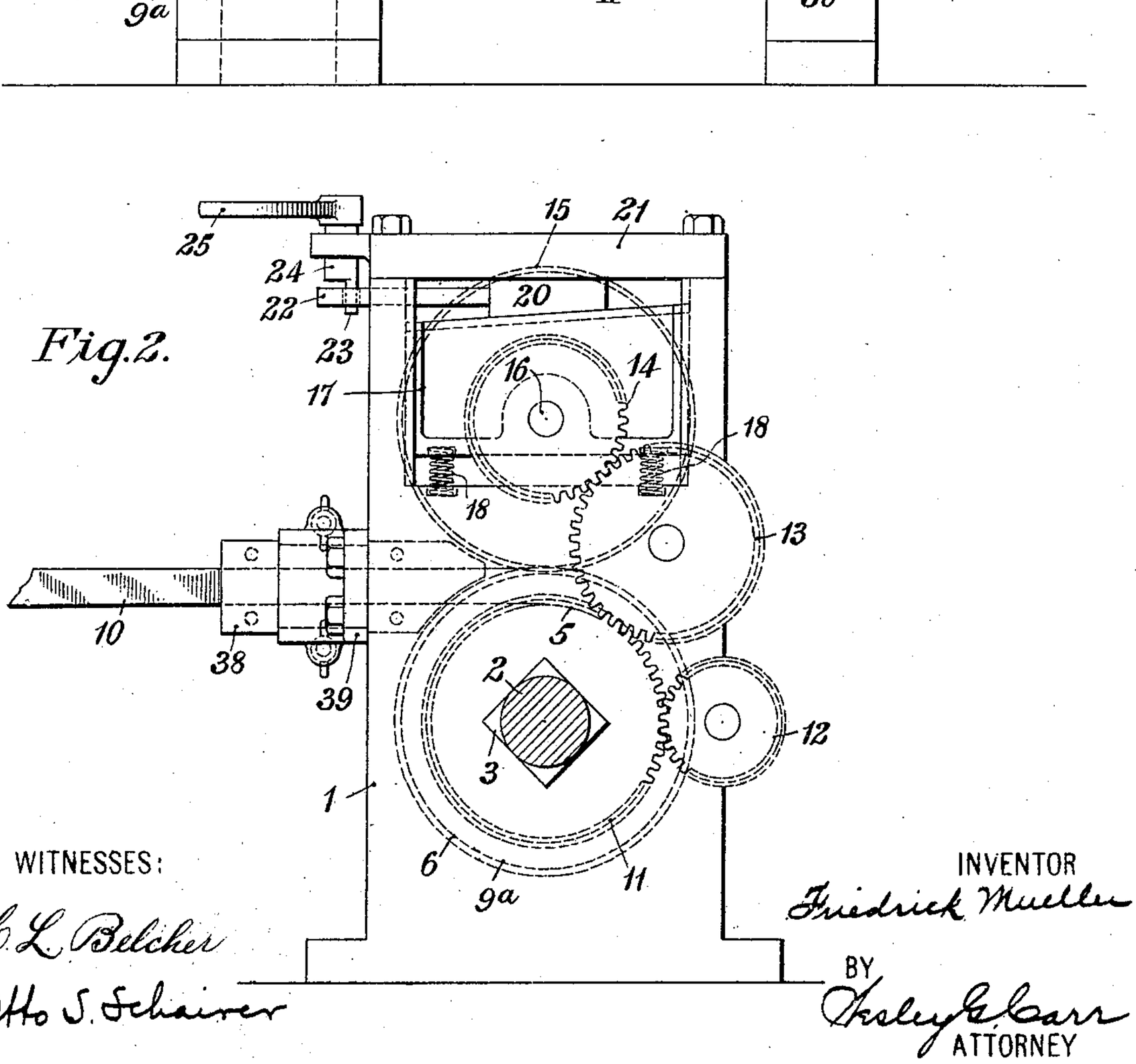


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

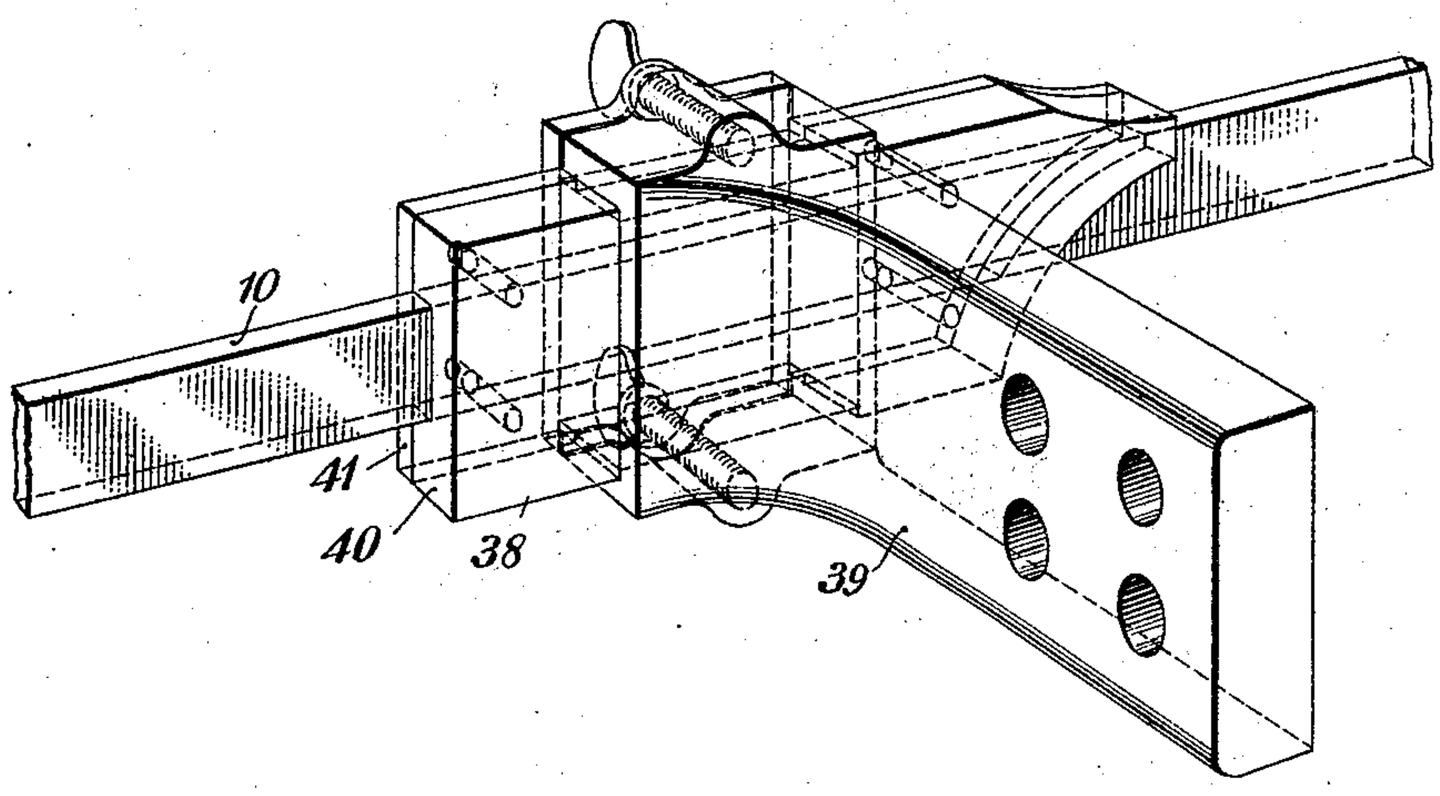


Fig. 5

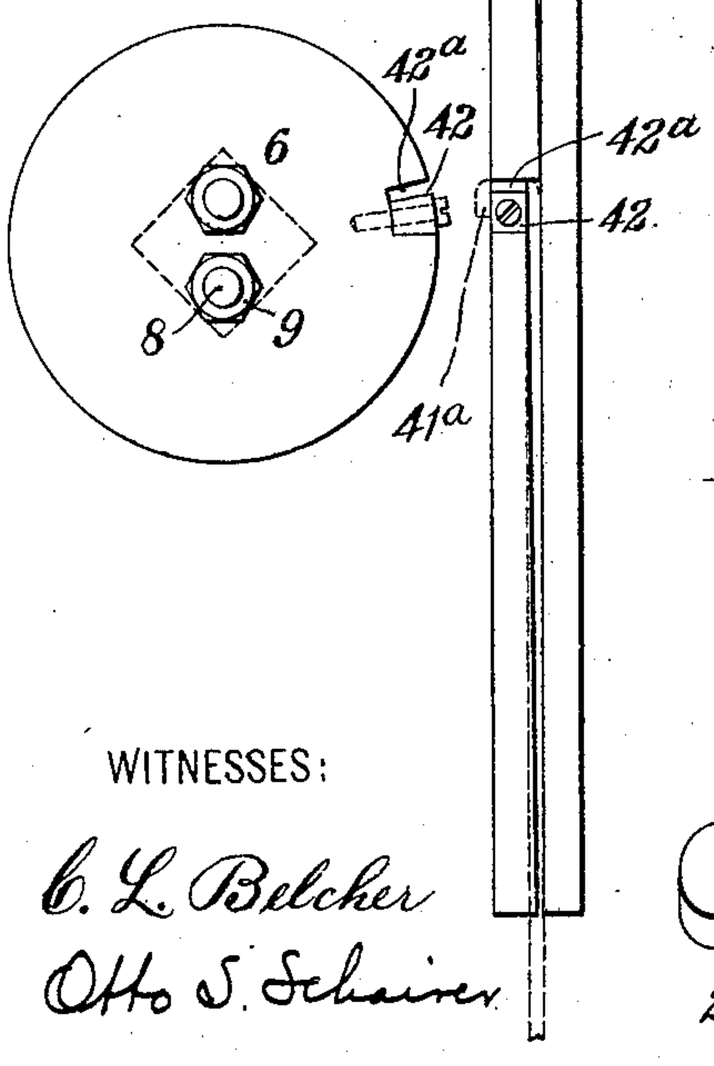


Fig. 4.

Fig. 6.

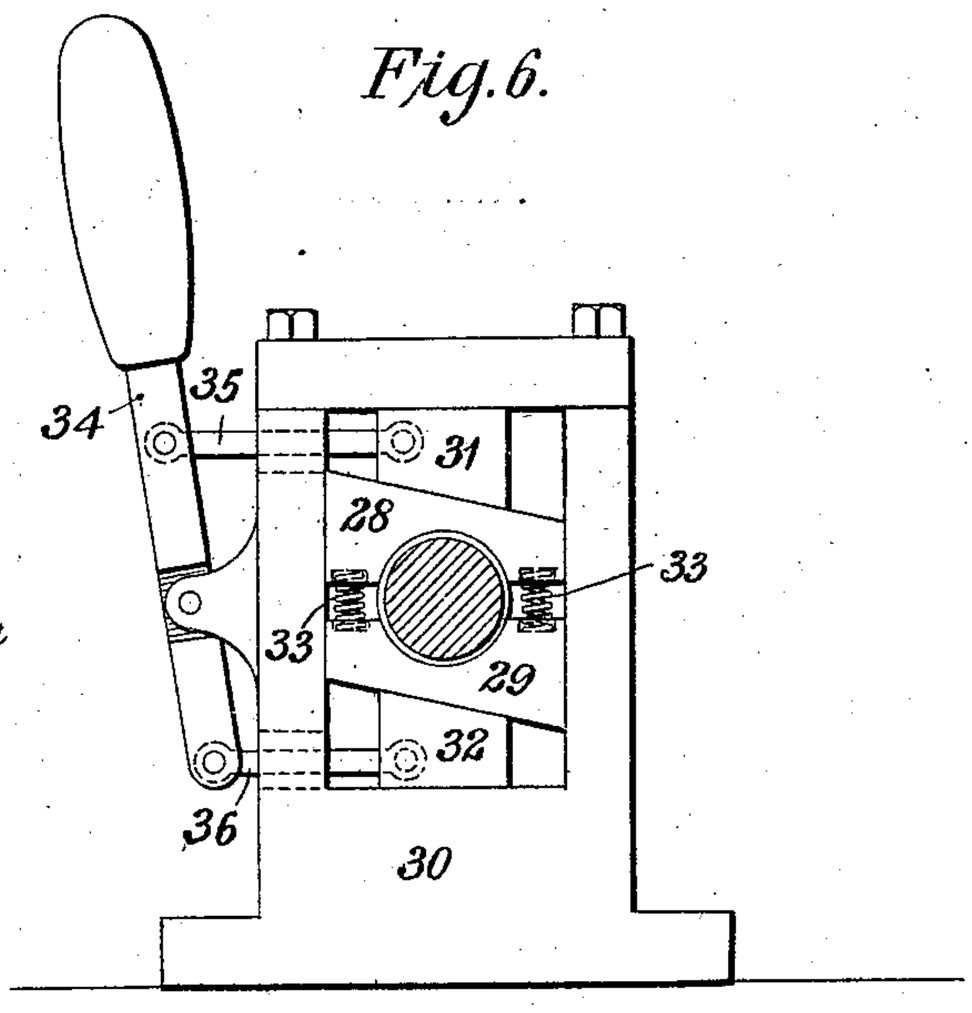
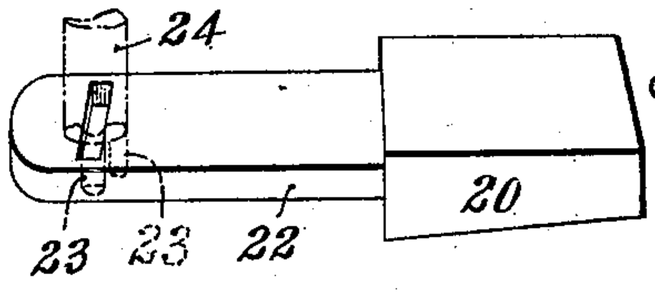


Fig. 7.



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UNITED STATES PATENT OFFICE.

FRIEDRICK MUELLER, OF IRVINGTON, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, OF EAST PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

COIL-WINDING MACHINE.

933,778. Specification of Letters Patent. Patented Sept. 14, 1909.

Application filed January 10, 1908. Serial No. 410,263.

To all whom it may concern:

Be it known that I, FRIEDRICK MUELLER, a citizen of the United States, and a resident of Irvington, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Coil-Winding Machines, of which the following is a specification.

My invention relates to coil-winding machines, and particularly to those whereby flat or ribbon conductors may be wound on edge to form helical coils for use in electrical and other devices.

The object of my invention is to provide simple and effective means whereby strap or ribbon conductors may be wound continuously on edge into compact helices without buckling or cracking thereof.

My invention is illustrated in the accompanying drawings, Figure 1 of which is a view in side elevation of a machine constructed in accordance therewith. Fig. 2 is a view, in end elevation and in section on the line II—II of the Fig. 1. Fig. 3 is a perspective view of the guide that is employed to direct the conductor upon the winding mandrel. Fig. 4 is a view in end elevation of the end plate that is applied to the mandrel upon which the coil is wound. Fig. 5 is a view, in development, of the end plate of Fig. 4 and of a collar that surrounds the winding mandrel. Fig. 6 is a view in end elevation of a stationary head of the machine, and Fig. 7 is a perspective view of a portion of one of the clamping devices of the machine.

The machine comprises a stationary head stock 1 that is provided with a bearing for a mandrel 2 having a square intermediate portion 3 and an end portion 4 having screw threads of approximately the same pitch as the coil to be formed, an extension 5 of the desired form and diameter of the interior of the coil to be wound, and an end plate 6 having an annular face at 7 of the same pitch and diameter as the coil to be formed, being secured to the other end thereof by means of bolts 8 and nuts 9. The extension 5 of the mandrel is surrounded by a collar 9^a that is secured to the head stock 1 and serves as a facing piece therefor, and between the annular face of which and the end plate 6, the conductor 10 of which the coil is formed is applied to the mandrel extension 5.

The mandrel is rotated by means of a gear wheel 11 loosely mounted upon the square portion 3 thereof, the said gear wheel being driven by means of another gear wheel 12 that derives its motion from any suitable source (not shown). The gear wheel 11 serves also, through intermediate gear wheels 13 and 14, to rotate, in the same direction as it is rotated, a circumferentially grooved pressure roll 15 that bears upon the conductor 10 and serves to cause it to conform closely to the shape of the mandrel extension 5 as well as to smooth its edge and prevent cracking thereof.

The gear wheel 14 and the pressure roll 15 are mounted upon opposite ends of a shaft 16 that has bearings in a vertically adjustable block 17 for which guides are provided in the upper end of the head stock. The block 17 may be moved downwardly, against the action of compression springs 18, to bring the pressure roll 15 into engagement with the conductor 10, by the horizontal movement of a wedge 20 that is interposed between the upper inclined face of the block 17 and the top piece 21 of the head stock. The wedge 20 may be moved horizontally by means of a bar 22 that is attached to the wedge 20 and is provided with a slot in its outer end, the bar being actuated by an eccentric extension 23 upon the lower end of a short shaft 24 upon the upper end of which an operating lever 25 is secured.

The screw-threaded portion of the mandrel 2 is engaged by two screw-threaded blocks 28 and 29 that are vertically adjustable in a stationary head or guide-post 30, the upper face of the one block and the lower face of the other being inclined to correspond to the inclined faces of two wedge-shaped blocks 31 and 32 whereby the screw-threaded blocks 28 and 29 may be passed toward each other, against the action of compression springs 33 that are interposed between the screw-threaded blocks. The wedge-shaped blocks 31 and 32 may be adjusted horizontally to effect vertical adjustment of the screw-threaded blocks 28 and 29 by means of a lever 34 that is connected thereto by means of two links 35 and 36.

The conductor 10, of which the coil is to

be formed, is directed into the tapered opening between the end plate 6 and the collar 9^a at its widest portion by means of a guide 38 that is removably clamped in a supporting arm 39 secured to the head stock 1. The said guide comprises a block 40 having a recess of just the size of the conductor 10 for the reception thereof and a plate 41 that is clamped securely against the face of the block 40, the pieces constituting the guide being cut away at one end to form a nose of such shape that it may be located very close to the end plate 6 and the pressure roll 15.

In the operation of the machine, the end of the conductor 10 of which it is proposed to form the coil is first bent to form a hook, as indicated at 41 in Fig. 5, and is clamped between a block 42 and one side of a recess 42^a in the edge of the end plate 6, and the end plate is then secured to the mandrel 2. The conductor is then placed in the guide 38 and the pressure roll 15 is pressed firmly into engagement with its outer edge. Before the machine is started, all of the parts occupy the positions indicated in Figs. 1 and 2. As the mandrel 2 is rotated, it is moved longitudinally at substantially the same rate as the axial length of the coil increases, by reason of the engagement of the screw-threaded blocks 28 and 29 with the screw-threaded portion 4 of the mandrel.

It will be observed that, at the start, the space between the end plate 6 and the collar 9^a is of just sufficient width to receive the conductor 10 at its upper side, and since the mandrel 2 and end plate 6 are moved axially at approximately the same rate as the axial length of the helix increases, the space for the reception of the conductor 10 remains of approximately the same width as the thickness of the conductor. It is, therefore, impossible for the conductor to buckle, while, at the same time, the grooved pressure roll serves to round and smooth the outer edge of the conductor and to prevent it from cracking, and it also serves to press the conductor firmly against the mandrel extension 5. With this machine, it has been found entirely practicable to wind a very thin, wide conductor into a compact helix without injuring the conductor.

It will, of course, be understood that the structural details and the arrangements of the parts may be varied within considerable limits without departing from the spirit of the invention or altering its mode of operation.

I claim as my invention:

1. In a coil-winding machine, the combination with a rotatable mandrel, an end plate having a helically curved face of the same pitch as the coil to be wound, and means for detachably clamping said plate to one end of the mandrel, of means for moving the mandrel axially at a rate substantially equal to that at which the axial length of the coil increases.

2. In a coil-winding machine, the combination with a rotatable mandrel and an end plate removably secured thereto and having a helically curved face of the same pitch as the coil to be wound, of means for moving the mandrel axially at a rate substantially equal to that at which the axial length of the coil increases, and an adjustable pressure roll adapted to bear upon the conductor of which the coil is formed, as it is applied to the mandrel, and means for rotating the mandrel and the pressure roll in the same direction.

3. In a coil-winding machine, the combination with a rotatable mandrel and an end plate removably secured thereto and having a helically curved face of the same pitch as the coil to be wound, of means for moving the mandrel axially at a rate substantially equal to that at which the axial length of the coil increases, and an adjustable pressure roll adapted to bear upon the conductor of which the coil is formed, as it is applied to the mandrel, and means for rotating the mandrel and the pressure roll in the same direction.

4. In a coil-winding machine, the combination with a mandrel having a screw-threaded portion, and an end plate removably secured thereto and having a helically curved face of the same pitch as the coil to be wound, of means for rotating the mandrel, a stationary head, and separable screw-threaded blocks mounted in the head and adapted to engage the screw-threaded portion of the mandrel.

5. In a coil-winding machine, the combination with a mandrel having a screw-threaded portion, of an end plate removably secured to one end of said mandrel and having a helically curved face of the same pitch as the coil to be wound, means for rotating the mandrel, a stationary head, separable screw-threaded blocks mounted in the head and adapted to engage the screw threaded portion of the mandrel, an adjustable pressure roll adapted to bear upon the conductor of which the coil is formed, as it is applied to the mandrel, and means for rotating said pressure roll in the same direction as the mandrel.

6. In a coil-winding machine, the combination with a mandrel having a screw-threaded portion, of an end plate removably secured to one end of said mandrel and having a helically curved face of the same pitch as the coil to be wound, means for rotating the mandrel, a stationary head, separable screw-threaded blocks mounted in the head and adapted to engage the screw-threaded portion of the mandrel, and an adjustable pressure roll adapted to bear upon the conductor of which the coil is formed as it is applied to the mandrel.

7. In a coil-winding machine, the combination with a rotatable mandrel, an end plate having a helically curved face of the same pitch as the coil to be wound, and means for detachably clamping said plate to one end of the mandrel, of means for moving the mandrel axially at a rate substantially equal to that at which the axial length of the coil increases, and a stationary device located adjacent to the mandrel to guide the conductor of which the coil is to be formed to said mandrel.

8. In a coil-winding machine, the combination with a mandrel having a screw-threaded portion, of an end plate removably secured to one end of the mandrel and having a helically curved face of the same pitch as the coil to be wound, means for rotating the mandrel, a stationary head, separable screw-threaded blocks mounted in the head and adapted to engage the screw-threaded portion of the mandrel, and a stationary device located adjacent to the mandrel to guide the conductor of which the coil is to be formed to said mandrel.

In testimony whereof, I have hereunto subscribed my name this twenty third day of December, 1907.

FRIEDRICK MUELLER.

Witnesses:
H. MILLER,
CHAS. SVENSON,
EDWD. W. CAMPBELL.