C. H. THORDARSON.

MACHINE FOR WINDING INSULATED COILS AND THE LIKE.

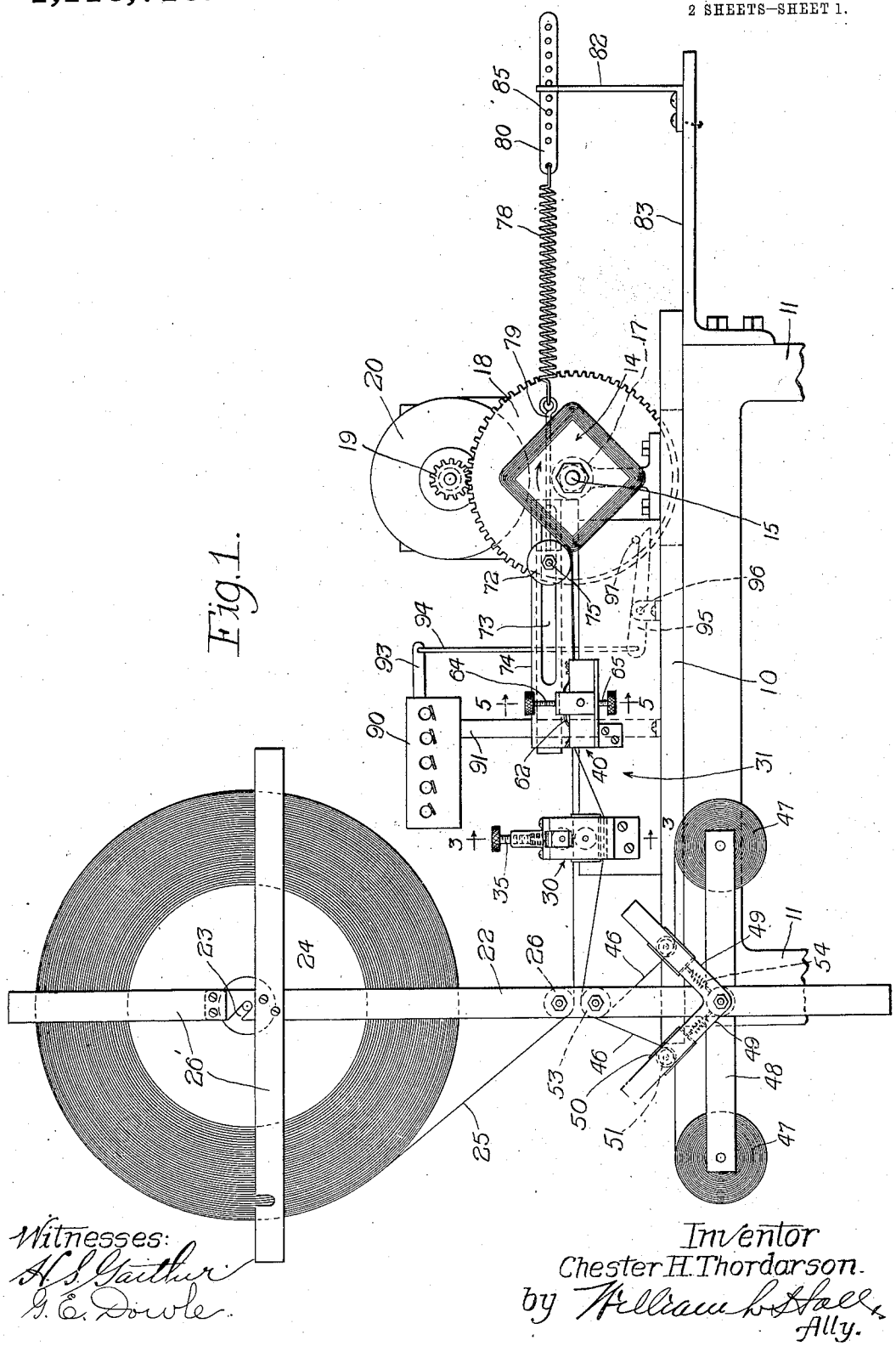
APPLICATION FILED JAN. 24, 1913.

1,113,718.

Patented Oct. 13, 1914

2 SHEETS—SHEET 1.

Fig. 1.



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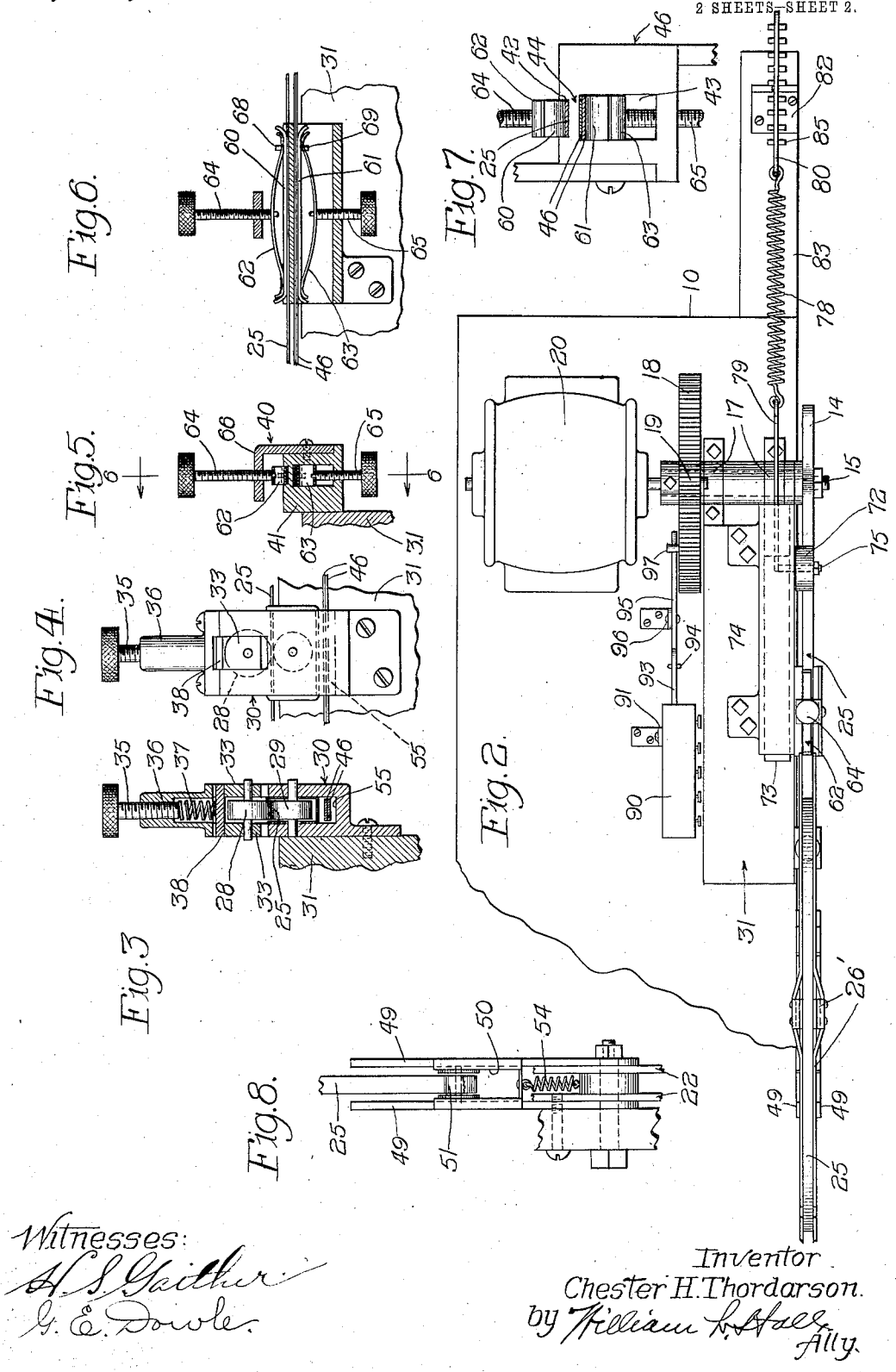

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UNITED STATES PATENT OFFICE.

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MACHINE FOR WINDING INSULATED COILS AND THE LIKE.

1,113,718. Specification of Letters Patent. Patented Oct. 13, 1914.

Application filed January 24, 1913. Serial No. 744,002.

To all whom it may concern:

Be it known that I, CHESTER H. THORDARSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Winding Insulated Coils and the like; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to a novel machine for producing electro-magnetic coil windings made from flat wire, the turns of which are insulated from each other by a thin strip or strips of suitable insulating material as paper. Such a coil structure is shown in my co-pending application for U. S. Letters Patent, Serial No. 744,001 filed on the 24th day of January, 1913.

Among the objects of the invention is to produce a machine by which the alternate layers of wire and insulating strips may be accurately and rapidly wound or formed into a coil or winding unit.

Another object of the invention is to provide means for assembling the wire and insulating strip or strips and for accurately holding them in relative lateral position and in alinement with the winding member.

A further object of the invention is to provide means for directing the insulating strip or strips, usually a very thin paper, to the winding mechanism, in such a way as to delicately produce the required tension to draw the paper from the reels to the winding mechanism and to prevent the paper strips unwinding too rapidly.

Other objects of the invention are to simplify and improve machines of this purpose, and the invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings:—Figure 1 is a side elevation of a machine embodying my invention. Fig. 2 is a partial plan view thereof. Fig. 3 is a section on the line 3—3 of Fig. 1. Fig. 4 is a side view of the parts shown in Fig. 3. Fig. 5 is a section on the line 5—5 of Fig. 1. Fig. 6 is a section on the line 6—6 of Fig. 5. Fig. 7 is an end view of the assembling and guide device, showing the relation of the wire to the insulating strips. Fig. 8 is a detail section illustrating the tension means for the insulating strips.

As shown in the drawings, 10 designates the bed plate of the machine, supported on legs or standards 11. 14 designates a winding form of generally rectangular cross section, as herein shown. It is detachably fixed to a shaft 15 that is mounted in suitable bearings 17 carried by the bed plate of the machine, and it extends slightly beyond the lateral side of the bed plate. Fixed to the shaft 15 is a gear wheel 18 that meshes with a pinion 19 carried by the shaft of an electric motor 20 by which the winding form is rotated at a suitably slow speed.

22 designates a frame bar which rises from one side of the bed plate and is notched at 23 to receive the spindle of a reel or spool 24 on which is wound a roll of the flat wire 25 which constitutes part of the coil winding to be produced. The roll of wire is protected on said reel by horizontal and vertical guides 26′. Said wire is guided from the roll beneath a guide pulley 26, supported on the frame bar 22 between upper and lower presser rollers 28, 29. The said rollers are located in a grooved guide bracket 30 which is removably attached to a block 31 supported on the bed plate. The spindle of the lower roller 29 (Figs. 3 and 4) is rotatably mounted on the fixed side members of the said guide bracket, while the spindle of the upper roller 28 is mounted in sliding plates 33 fitted in notches which open upwardly from the side members of the guide bracket 30. The said upper roller is pressed toward the lower roller by means of an adjusting screw 35 that is screw-threaded into an extension or neck 36 of the guide bracket, and bears at its lower end against a spring 37 which, in turn, bears against the cross plate or bar 38 that lies upon the upper edges of the sliding plates 33. The said rollers 28, 29 are provided to smooth or iron out any irregularities which may occur in the wire.

The wire is carried forwardly from said pressing or ironing rollers into and through an assembling device designated as a whole by 40 where the wire is assembled with the insulating strip or strips preparatory to winding them into a coil or winding unit. It consists of a member 41 having means to removably attach it to the support 31. It is

provided with an upper guide way 42 through which the wire passes and a lower guide way 43 through which the insulating strips pass. The wall 44 between said upper and lower guide ways is a thin wall and constitutes the lower wall for the upper guide way and the upper wall for the lower guide way. It is at this place that the flat wire and the insulating strips are assembled, to be carried to the winding form 14. The insulating strips, designated by 46, 46, are unwound from rolls 47, 47 supported on reels carried by the outer ends of a cross arm 48 attached to the lower end of the frame bar 22. 49, 49 designate diverging slotted members, carried also by the frame bar 22 between the ends of the cross bar 48. In the slots of said members 49 are slidably mounted frames 50, 50 which carry tension spools 51, 51 about which the strips 46, 46 are trained on their way to a directing pulley 53 supported on the frame bar 22 and at which latter pulley the two insulating strips are brought together and directed toward the guide mechanism which guides the same to the winding mechanism. Suitable tension is maintained on the strips 46 between their rolls and the directing pulley, through the medium of said spools 51 and light springs 54 which are attached to and extend between said sliding spool frames 50 and fixed parts of the structure. The said strips 46 are very thin and the springs 54 are, therefore, very light to impose a very delicate tension on the strips.

The two insulating strips thus brought together are carried through a guide groove or way 55 in the lower part of the guide bracket 30 and below the pressing rollers 28, 29. From said guide bracket 30 the two strips are carried together to the upper part of the guideway 43 of the member 40. Both the flat wire and the insulating strips are pressed against the dividing wall 44 between the upper and lower guideways 42, 43 and it is at this point that the wire and strips are assembled, being divided only by the thickness of the wall 44. The said upper and lower slots are made of a width to snugly receive the wire and strips guided thereby, the side walls of the slots constituting fixed lateral guides for the edges of the strips and wire, whereby said wire and strips are maintained in accurate lateral position with respect to each other when brought together, and the said guideways 42, 43 are arranged in accurate alinement with respect to the plane of the winding form 14, so that the wire and the strips are wound upon the form in alternate layers in accurate lateral alinement. The said insulating strips are preferably made wider than the wires so as to project at their sides laterally beyond the wires when formed into the coil or winding structure, and thereby constitute means to insulate the edges of the turns of the coil from each other. The guideway 43 is therefore necessarily made wider than the upper guideway 42 when the strips and wire are of unequal widths.

Means are provided for yieldingly pressing the strips and the wire against the wall 44 with such pressure as will maintain the wire and strips sufficiently taut to be wound closely upon each other in the formation of the coil or winding structure, but with sufficient yielding to prevent undue tension on the thin insulating strips. The means which I have herein shown for effecting this result is made as follows: 60, 61 designate upper and lower presser plates, the former engaging the upper side of the flat wire to press it against the plate or wall 44 and the latter engaging the lower side of the strip to press both strips upwardly against the lower side of the said plate or wall. 62, 63 designate upper and lower bowed springs, the former of which bears at its ends on the upper presser plate 60, and the latter of which bears at its ends upon the lower presser plate 61. Said springs are pressed toward the presser plates by means of screws 64, 65, the upper one of which is screw-threaded through a bracket 66 carried by the member 41, and the lower one is screw-threaded through the lower wall of the lower guideway 43. Said screws are shown as reduced at their ends to engage into openings in the intermediate portions of the bowed springs to constitute a reliable rotative engagement therewith. The said springs constitute means for imparting the required tension to the wire and insulating strips for the purpose described, while avoiding such tension as to tear the strips. The springs may be held in relative position to the presser plates by means of lugs 68, 69 which extend from the ends of the presser plates through suitable openings in the ends of the springs.

The superposed wires and strips are pressed upon the winding form, so as to lay the turns thereof compactly and accurately one upon the other, by means of an ironing roller 72 which is carried by a slide 73 that is slidably mounted in a box 74 that is attached to the block 31, said box being slotted at its side adjacent to the winding form for the passage of the shaft 75 of said roller. The said slide is shown as square to engage a corresponding guideway in the box, but may be otherwise formed to prevent axial rotation thereof in the box.

Inasmuch as the coil or winding produced on the winding form departs from a circle, being herein shown as substantially square, it is necessary to yieldingly press the ironing roller 72 toward the periphery of the winding form and the coil being formed thereon, so as to enable the roller to yield

away from the corners of the form and to follow the straight sides or portions thereof. This is effected in the present instance by means of a tension spring 78, which is attached at one end to a link 79 that is in turn fixed in any suitable manner to the slide 73, and the spring is attached at its rear end to an adjustable bar 80 that is adapted to be adjustably supported in a standard 82 which rises from the bracket 83 attached to the bed plate of the machine. The connection between the standard 82 and adjusting bar consists, in the present instance, in providing the upper end of the standard with an upwardly opening notch to receive the adjusting bar edgewise and providing the adjusting bar with a series of pins 85 spaced longitudinally thereon. Said pins reliably hold the spring while permitting ready adjustment of the tension thereof to be effected.

In order that the coil may be made of the proper number of turns, I have provided a counting attachment which is made as follows: 90 designates a counter of an approved construction that is supported on a standard 91 which rises from the bed plate. The actuating arm 93 of said counter is connected by a link 94 with one end of a lever 95. Said lever is pivoted at 96 to the bed plate and extends at its other end in the path of the pin or tappet 97 carried by the gear wheel 18. Inasmuch as the gear wheel rotates once for each rotation of the winding form, the counting of the rotations of the gear wheel constitutes an accurate counting of the turns on the winding form.

It will be understood that the winding form 14 is removably attached to its shaft 15 so that coils of different dimensions, within certain limits, may be formed on the same machine. Moreover, the wire and strip guiding and assembling devices are also capable of removal from the machine to permit their replacement by others of different sizes, so as to enable the machine to operate on wire and strips of different widths. The range of adjustment of the ironing roller spring 77 permits of the use of winding forms of considerable variation in diameters.

The tension rollers 51 of the thin insulating strips 46 coöperate with the rectangular or other polygonal shaped winding form to prevent parting tension being exerted on the strips, inasmuch as the motion given to said form, due to its polygonal shape, gives a jerky movement to the strips, and the light tension under which the rollers are placed readily yields to the irregular action of the feed mechanism. This is a very important practical feature of the construction, inasmuch as it prevents the thin paper strip or strips from being torn by the irregular feeding action, due to the polygonal shape of the winding form.

It is understood that variations in the structural details of the machine may be made without departure from the spirit of the invention and the invention is not limited to such details except as hereinafter made the subject of specific claims and as imposed by the prior art.

I claim as my invention:—

1. A machine for winding flat wire coils with a thin insulating strip or strips between the turns thereof, comprising wire and strip supporting means, winding means and assembling and guiding means between the supporting and winding means, the guiding means embracing lateral fixed guides for separate engagement by the side edges of the wire and strip or strips.

2. A machine for winding flat wire coils with an insulating strip between the turns thereof, comprising winding means and wire and strip guiding and assembling means, the latter comprising closely spaced guide ways for the wire and strip having lateral fixed guide surfaces for engagement with the edges of the wire and strip for maintaining the wire in accurate lateral alinement relatively to the strip.

3. A machine for winding flat wire coils with an insulating strip or strips between the turns thereof comprising winding means, wire pressing means and wire and strip guiding and assembling means between the wire pressing and the winding means, said guiding means embracing fixed lateral guide surfaces for engagement with the side edges of said wire and the strip or strips.

4. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising winding means, wire pressing means for pressing out inequalities in the wire, with means for varying the pressure on said wire, and wire and strip guiding and assembling means between the wire pressing and winding means.

5. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a rotative winding form, with means to rotate it, and wire and strip guiding and assembling means in alinement with the winding form, the guiding means embracing fixed lateral guide surfaces to maintain the wire and strip in predetermined lateral relation.

6. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a rotative winding form of non-circular cross-section, with means to rotate it, wire and strip lateral guiding, assembling and tensioning means in alinement with the winding form, and a spring pressed roller to bear upon the wire and strip and the form at the point where the wire and strip enter upon the form.

7. A machine for winding flat wire coils with an insulating strip between the

turns thereof comprising wire and strip supporting means, a rotative winding form, with means to rotate it, wire and strip lateral guiding, assembling and tension means to maintain the wire and strip in predetermined lateral relation, and to maintain a light tension thereon, and a spring pressed roller to bear upon the wire and strips and the form at the point where they enter upon the winding form.

8. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a winding form about which the wire and strip are wound in alternate layers, with means to rotate the form, wire pressing means, and wire and strip lateral guiding and assembling means between the pressing means and the winding form and in alinement with said form.

9. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a winding form about which the wire and strip are wound in alternate layers, with means to rotate the form, wire pressing means, wire and strip lateral guiding and assembling means between the pressing means and winding form and in alinement with the said form, and a roller to yieldingly press the wire and strips upon the winding form as they are wound upon the form.

10. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising winding means, wire and strip guiding and assembling means, the latter comprising closely spaced guide ways for the wire and strip for maintaining the wire in accurate lateral alinement relatively to the strip and spring pressed means to hold the wire and strip against their guiding surfaces.

11. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a rotative winding form, with means to rotate it, wire and strip lateral guiding and assembling means in alinement with the winding form, a roller for pressing the wire and strip against the form at the point where the wire and strip enter upon the form, a slide carrying said roller, with means for guiding the same, and a spring connected to said slide to draw said roller toward the winding form.

12. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a rotative winding form, with means to rotate it, wire and strip lateral guiding and assembling means in alinement with the winding form, a roller for pressing the wire and strip against the form at the point where the wire and strip enter upon the form during the rotation of the latter, a slide carrying said roller, with means for guiding the same, a spring connected to said slide to draw said roller toward the winding form, and means to adjust the force of the spring acting on the said roller.

13. A machine for winding flat wire coils with an insulating strip between the turns thereof comprising a rotative winding form, with means to rotate it, wire and strip guiding and assembling means in alinement with the winding form, a roller for pressing the wire and strip against the form during the rotation of the latter, a slide carrying said roller, means for guiding the same, a tension spring connected at one end to the said slide, an adjusting bar connected to the other end of the spring adapted to engage a notched part of the frame and projections spaced longitudinally of the adjusting bar, for the purpose set forth.

14. In a machine for the purpose set forth, the combination with a winding form, of a combined guiding and assembling device for the flat wire and insulating strip comprising guide ways for the wire and strip, separated by a thin wall and dimensioned to hold the wire and strips laterally in place, and means to hold the wire and strips against said wall.

15. In a machine for the purpose set forth, the combination with a winding form, of a combined guiding and assembling device for the flat wire and insulating strip comprising guide ways for the wire and strip, separated by a thin wall and dimensioned to hold the wire and strip laterally in place, presser members engaging said wire and said strips, and spring pressed means engaging said presser members.

16. In a machine for the purpose set forth, the combination with a winding form, of a combined guiding and assembling device for the flat wire and insulating strip comprising guide ways for the wire and strip, separated by a thin wall and dimensioned to hold the wire and strip laterally in place, presser members engaging said wire and said strips, bowed springs engaging at their ends said presser members and screws bearing against the bowed portions of said springs.

17. In a machine for the purpose set forth, the combination with a frame, of a winding device, with means for actuating the same, means for supporting a roll of flat wire, means for separately supporting two rolls of insulating strips, and means to guide the wire and strips and to assemble them flatwise together in advance of said winding means, the guiding means embracing fixed guides to engage the side edges of the wire and strip.

18. In a machine for the purpose set forth, the combination with a frame, of a non-circular winding form, with means to actuate the same, means for supporting a roll of flat wire, means for supporting a roll of in-

sulating strip, means to guide the wire and strip and to assemble them flatwise together in advance of said winding form, embracing fixed lateral guides for engagement with the side edges of the strip and wire, and means to apply delicate tension to the said strip between its roll and said guiding and assembling means.

19. In a machine for the purpose set forth, the combination with a frame, of a non-circular winding form, with means for actuating the same, means for supporting a roll of flat wire, means for separately supporting two rolls of insulating strips, means to guide the wire and strips and to assemble them flatwise together in advance of said winding means, means to apply delicate tension to said strips between their rolls and said guiding and assembling means and a tension means acting on the strips and the wire and coöperating with the guiding and assembling means.

20. In a machine for the purpose set forth, the combination with a frame, of a winding device, with means for actuating the same, means for supporting a roll of wire, and for supporting two rolls of insulating strips, means to guide the wire and strips and to assemble them flatwise together in advance of said winding device, and wire rolling and pressing means between the wire roll and the guiding and assembling means.

In testimony, that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 20th day of January, A. D. 1913.

CHESTER H. THORDARSON.

Witnesses:
W. L. HALL,
G. E. DOWLE.