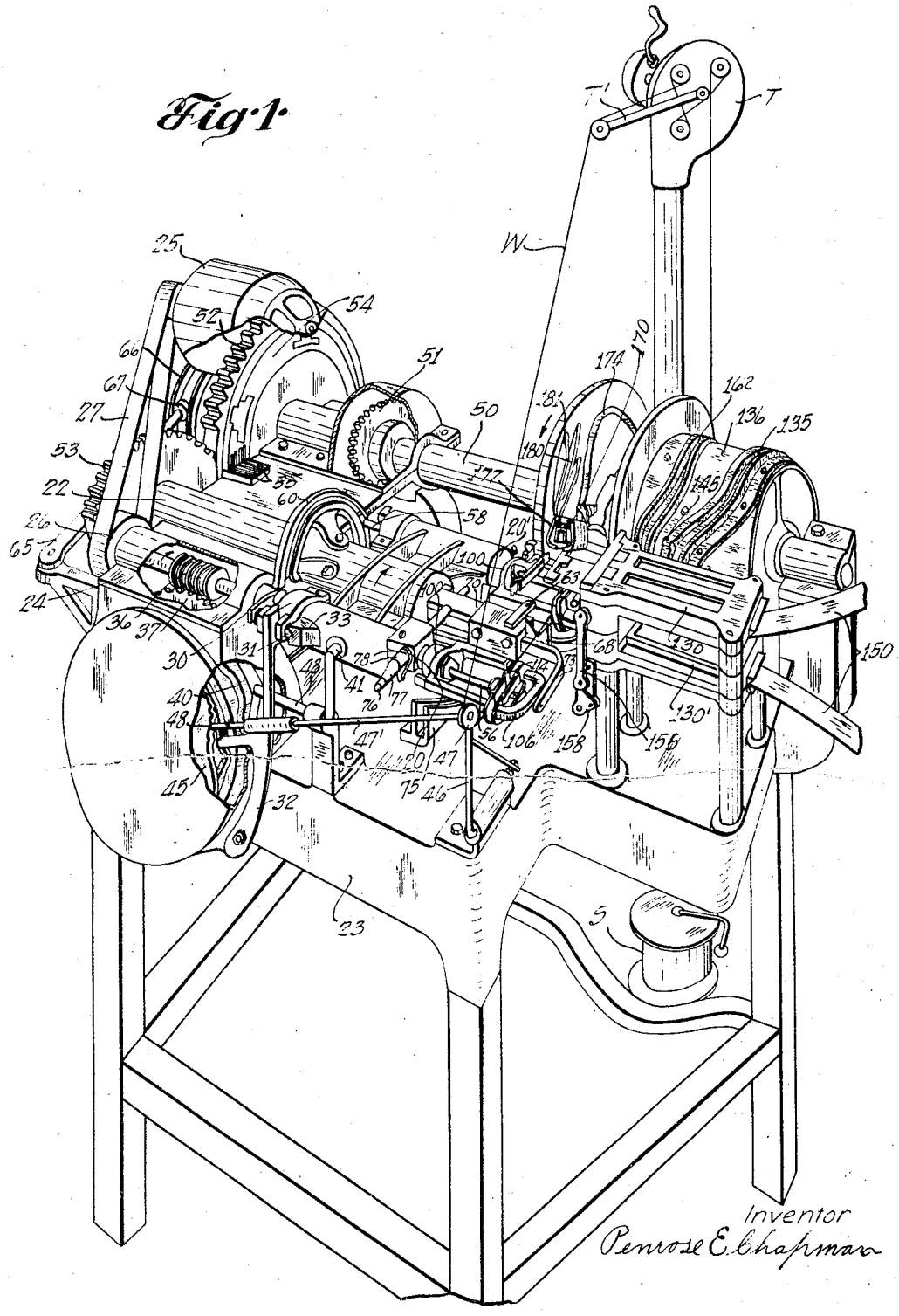
Sept. 8, 1936. P. E. CHAPMAN 2,053,764

WINDING AND COIL BINDING MACHINE

Filed March 2, 1931 4 Sheets-Sheet 1

Fig. 1.



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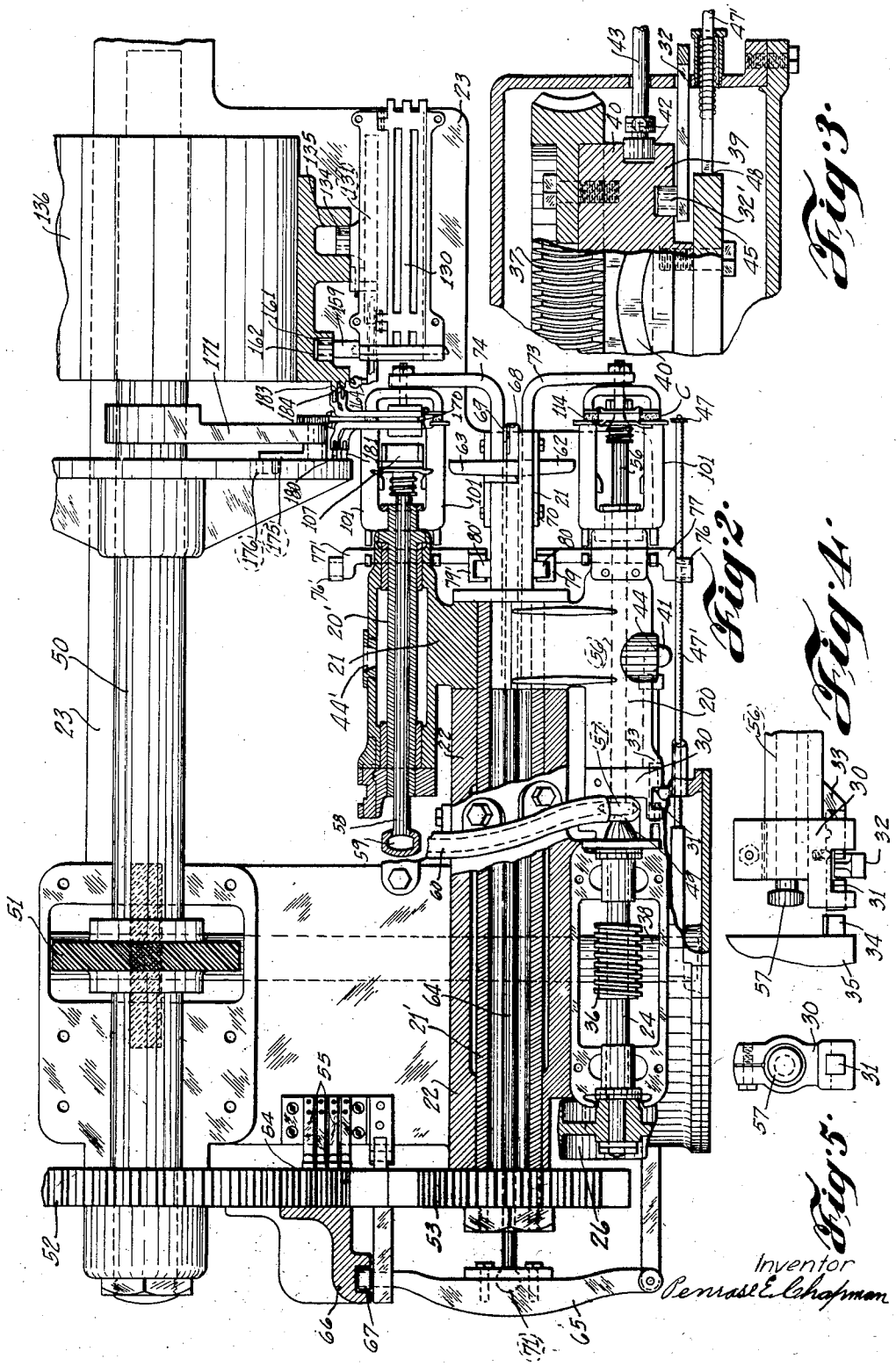


Fig. 3.

Fig. 2.

Fig. 4.

Fig. 5.

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Fig. 7.

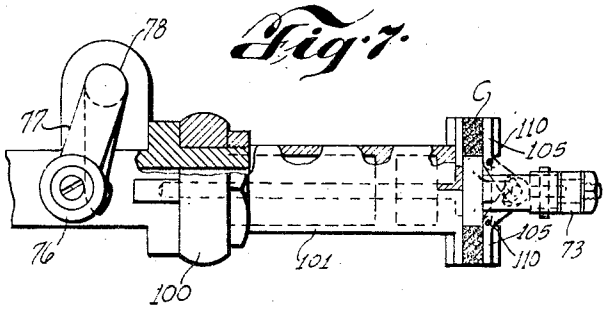
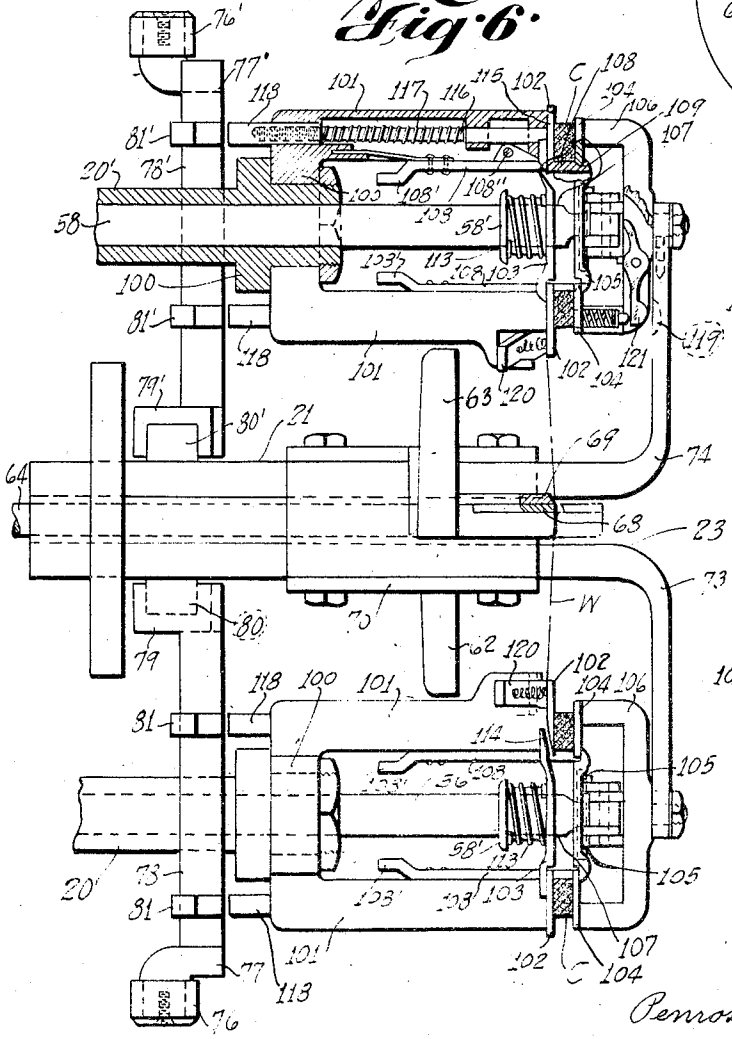


Fig. 6.



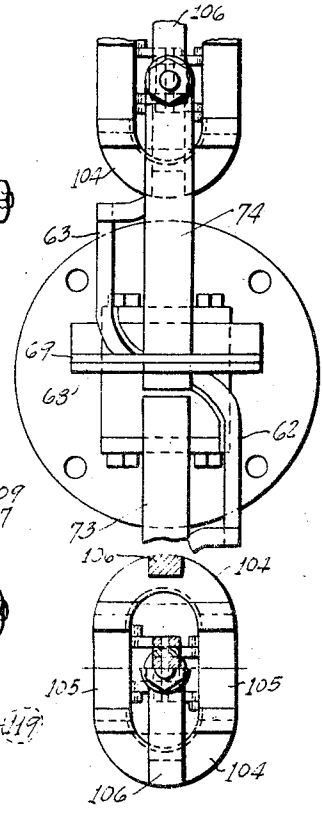


Fig. 8.

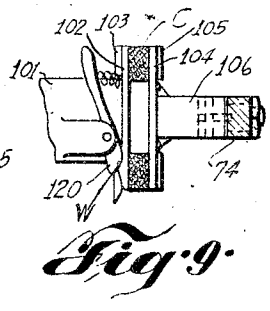


Fig. 9.

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Fig. 10.

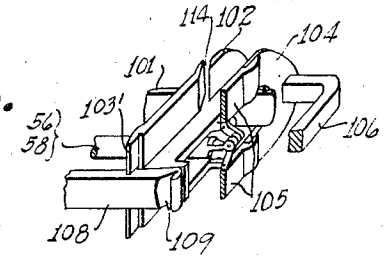


Fig. 11.

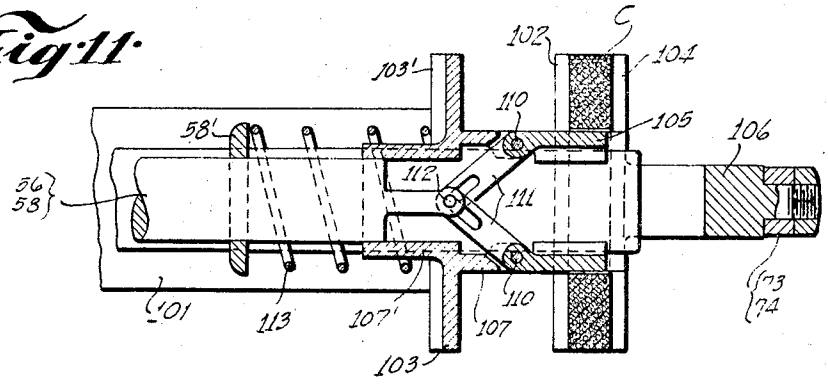
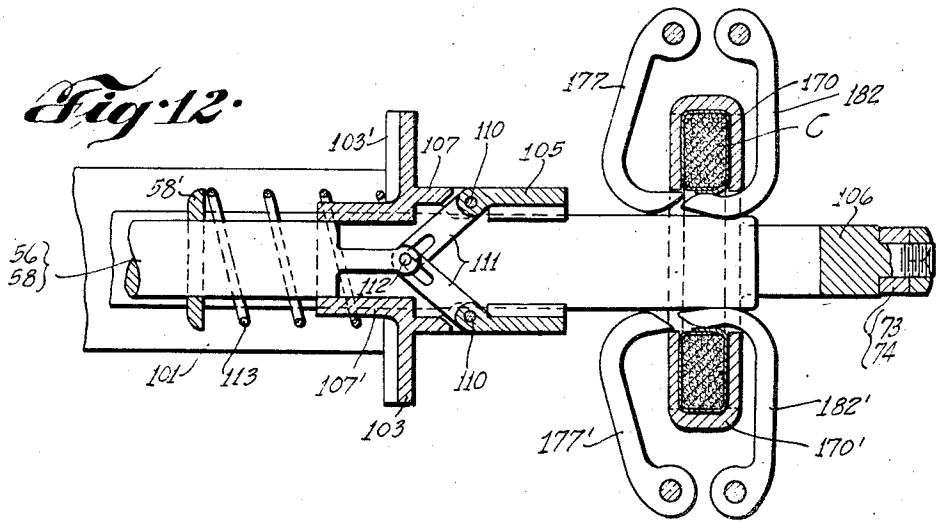


Fig. 12.



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Patented Sept. 8, 1936 2,053,764

UNITED STATES PATENT OFFICE

2,053,764

WINDING AND COIL BINDING MACHINE

Penrose E. Chapman, St. Louis, Mo.

Application March 2, 1931, Serial No. 519,651

14 Claims. (Cl. 140—92.2)

The object of my invention is primarily the production of a winding machine so automatic that it will wind one coil after another without the intervention of an operator.

As division has been required of the coil binding elements of this invention this subject matter has been transferred to application No. 48,200, filed Nov. 4, 1935, which should be considered in connection herewith.

To accomplish this primary object I have the further objects (*a*) providing automatic means whereby the leads of the said coils shall be automatically formed, secured, cut, discharged and otherwise manipulated as may be necessary; (*b*) providing winding forms or jigs on which the material is wound that shall lend themselves to the objects desired; (*c*) providing means for binding or securing such coils and their leads as are neither self-supporting nor self-secured, which are set forth in said divisional application.

In the drawings, Figure 1 is a perspective of such a machine.

Gearing, cams and motor control commutator are provided for for controlling the operating and actuating elements of said machine.

Coil binding elements 170 to 184 are arranged to apply gummed paper to the coils to tie or bind them.

Figure 2 is a plan of the assembled machine.

Figure 3 is a horizontal section of the gearing driving the control elements showing three of the controlling cams.

Figures 4 and 5 are details of the starting, stopping and locking clutch used between the winding spindle 20 or 20' and the driving spindle 24.

Figure 6 is a detail plan showing the head of the indexing turret carrying the collapsible coil forms; Figure 7 is a side elevation and Figure 8 is an end elevation thereof.

Figure 9 is a section of the collapsible coil form showing the lead clamp.

Figure 10 is a perspective detail of the same.

Figure 11 is a sectional detail of same.

Figure 12 is a cross section of the winding form with the removable elements displaced to provide room for binding material enfolding elements.

The object of my invention is accomplished as follows:

I supply a plurality of winding spindles, preferably two, 20 and 20', and mount them on the indexable turret 21. These winding spindles carry any suitable winding forms, jigs, chucks or holders on which to wind the wire, such as parts 100 to 119.

The reason for supplying two sets of winding elements the spindles 20 and 20' of which I mount on a turret 21 is: First, that as the turret is indexed carrying a spindle 20 and its form 100 to 119 around to the second position 20', the wire W leading to the first winding form will be automatically carried across the second form to produce the last lead of the first coil and the first lead of the next coil; Second, that while one coil is being wound another one may be secured, thus having two coils in work at the same time.

The turret 21 is carried on bearings 22 supported by frame work 23, and is arranged to be at rest in two positions. The winding spindles 20 and 20' are arranged to be rotated on their own center only when in the front or winding position. To accomplish this I provide a main driving spindle 24 in alignment with and coupled to a winding spindle when in the winding position by the clutch 30—35. This main spindle 24 may be driven from any suitable source of power as motor 25 through any suitable coupling as pulley 26 and belt 27.

The driving spindle 24 carries any suitable form of gearing for driving the system of control elements including the timing and articulating elements of the machine. I have shown a worm 36 on this spindle 24 driving a worm gear 37 which in turn is mounted on the primary cam shaft 38. Upon this primary cam shaft 38 I prefer to mount a cam 39 for operating any suitable clutch 30—35 between the driving spindle 24 and either of the winding spindles 20—20'. The lever 32 is used to couple said cam and clutch via follower 32'.

Upon said primary cam shaft 38 I also mount a cam 40 for controlling the turret lock 41 used for spotting the winding spindles 20—20' directly in front of the main spindle 24. Said cam 40 and turret lock 41 are coupled by suitable transmission elements, as roller and crank 42, rocker shaft 43, lever and locking member 41, said locking member having mating seats 44, 44' in the turret 21.

Upon this shaft 38 I prefer to mount such cam 45 as may be necessary for feeding the wire back and forth across the winding form and for causing such movements as may be necessary to cause the winding wire W to drop into proper place as lead slot 114 on the form 100—119 for forming the coil leads.

When the nature of the work requires a transverse feed I provide at a proper place in front of the winding forms 100 to 119 an oscillating lever 46 carrying sheave 47 under which the winding wire W passes on its way to the coil C. I connect this oscillating lever 46 to the feeding cam 45 by

means of the connecting rod 47' on the end of which is the cam follower 48.

The clutch 30—35 must be of some form which will provide a positive phase relation between the main spindle 24 and the winding spindle 20, as clutch bolt 31, which is slid back and forth by the lever 32. It is also necessary that the spindle 20 be stopped in definite angular position. On the turret 21 I, therefore, provide a seat or notch 33 into which the back end of the said bolt 31 may seat, locking the spindle 20 in a definite position when said clutch bolt is disengaged.

Secondary cam shaft 50 may be driven direct from the primary cam shaft 38 by any suitable gearing, such as spiral gears 51.

Upon this secondary cam shaft 50 I prefer to mount a driving intermittent gear 52 which in turn by actuating the driven intermittent gear 53 that is carried by the turret spindle 21' indexes said turret 21.

To provide easy starting and stopping of the spindles 20—20' I prefer to alter the speed of the motor 25 and to accomplish this I provide a controller commutator 54 shown mounted on one side of the intermittent gear 52. The controller fingers 55 are mounted on the main frame in any suitable manner.

The center, or withdrawable, elements 103, 105, 107 of the winding forms 100 to 119 are conveniently manipulated through connecting rods 56 or 58 in the winding spindles 20—20' by a stationary cam 60 fastened around the bearing 22. As the turret 21 carrying the winding spindles 20—20' indexes to the rear position said cam engages the heads 57 and 59 on the end of the said connecting rods 56 or 58 and withdraws said form center elements 103, 105, 107.

The lead clamp 120 is actuated by arms 62, 63 that are carried by connecting rod 64 which passes through the turret shaft 21' and is then coupled to the lever 65 by the ball and socket 71 being actuated by cam 66 working against follower roller 67 upon said lever.

This same connecting rod 64 also carries and actuates the live knife 68 of the pair of shears 68—69, stationary knife 69 of said shears being supported by the frame work 70 that is secured to the turret 21.

The lead clamp 120 and shears 68—69 are so placed that the winding wire W will drop into them as the turret 21 is indexed.

In order to discharge the coils and reassemble the forms automatically, I support all or a part of the outer cheek 104 of the form on a yoke 106 which is in turn supported by the tail stock arms 73—74. They in turn are supported by the frame work 70. At a suitable time during the indexing of the turret 21 after the winding form has left the rear position, I open this outer form cheek by means of the stationary cam sector 75. This sector 75 operates said cheek 104 through the follower cranks and rollers 76—77 and 76'—77', the rocker shafts 78—78' and levers 79—79' that play over the actuating pins 80—80' on the tail stock arms 73 and 74. The arms 81, 81' carried by the shafts 78, 78' actuate coil strippers that are more fully described below.

Any device on which elongated material may be wound, as jigs, forms, arbors, sleeves, tubes, spools, magnet and armature cores, or the like, for brevity are herein included by the term "winding forms."

As this machine can be used to wind many types of coils the word "coil" is used herein in its broad sense to include all forms of coils, as helical, spiral, rolls, or equivalent, irrespective of what they may be wound on, as forms, jigs, spools, armature and field cores, etc., wound of any elongated material as wire, thread, string, tape, ribbon, strips or sheets: made of any material, such as metals, textiles, paper, etc. The word wire will be used to include all such elongated material.

For those types that are wound upon and then removed from the jig or form I prefer to equip the machine with forms constructed as shown in Figures 1, 2, 6, 7, 8, 9, 10, 11, 12, characters 100 to 119.

The forms may be mounted upon any convenient base as hub 100 that may be secured to a winding spindle 20 or 20'. Upon this base I may provide arms 101 which carry parts of the rear form cheek 102, the core forming members 108 and the stripper elements 115 to 118.

To facilitate ready removal of the coils the core 107—108 of the form 100—119 is best made collapsible. To do this I divide said core into sections 108, 107, 108. The outer core sections 108 are pivoted at 108''. Between these outer sections I interpose a central key or locking section 107, which holds the end sections 108 in place as well as acts as a part of the form core.

The outer form cheek I also subdivide securing the end pieces 104 by means of the yoke 106.

It is necessary that the form cheeks be rigidly secured together or else as the coil is wound between them they will spring apart and allow the coil to distort. To secure the outer form cheek I extend the tips of the core ends 108 sufficiently to contain a locking notch 109. This notch fits over the inner edges of the outer form cheek 104. When this form is assembled and the key core 107 is in place it will be a rigid structure.

The outer form cheek 104—106 may be supported by any convenient tail member of the winding machine as the tail stock arms 73 or 74.

Where necessary I arrange to remove the central or other elements of the form, as 103, 105, 107, to allow room for the coil binding elements to work in. A convenient method is as follows:— To the key core 107 are attached the central portions of the inner form cheeks 103. Similar or shutter portions of the outer form cheek 105 are hinged at 110 to said key core 107 so that they may fold back sufficiently to pass through the interior of the coil C when the key core 107 is withdrawn.

To actuate these hinged cheek portions I provide arms 111 fastened at a suitable angle to the cheeks 105 and loosely connect at 112 these arms to either of the connecting rods 56 or 58 that extends to actuating cam 60 described elsewhere. These withdrawable parts of the form I prefer to mount on said connecting rod as by the bearing 107' in the key core 107 and to keep them in alignment by any suitable keying arrangement as by forming the flanges 103' of the form cheeks 103 to travel over the arms 101.

To insure that the shutters 105 will open before the form core is withdrawn I supply the connecting rods 56 and 58 with a collar 58' and interpose between it and the key core 107 a suitable spring 113 that will hold said key core in place while the shutters 105 open thus preventing them from dragging against the coil.

At any suitable place in the form cheeks I pro-

vide an opening as lead slot 114 for coil leads to pass through.

In order to insure easy placing and disengaging of the coil lead I prefer to make this lead slot 114 at the junction between the withdrawable coil cheek 103 and some more fixed part of the cheek at 102.

On any suitable point of the winding elements, as the back side of the forms 100—119 I supply a first lead holding device, as the spring clamps 120, that are actuated by the arms 62—63 attached to connecting rod 64.

In order that the core end 108 may be positively actuated both for releasing the coil and unlocking the outer form cheeks 104 I may extend the tail end 108' beyond the pivot 108'' and at an appropriate place on this tail may form the cam surfaces 108', placing them in the path of the key core 107 so that when the said key core is withdrawn to the limit it will strike these cam surfaces 108' and actuate said core ends 108 to release the coil C.

In order to positively discharge the coils off the forms I provide any convenient stripper elements such as the cheese head pins 115—116 that are carried by the frame work 101 of the forms and hold them in the open position by the springs 117 which act against the nuts 118. These strippers are actuated by arms 81 and 81' and the train of mechanism previously described.

As the tail elements of the form such as the outer form cheek 104 and yoke 106 would occasionally move out of place when the form is open I may provide a locking key shown as part of lever 121 that is centrally pivoted so that one end drops into notch 119 in arm 74 the other end contacting some part of the head stock side of the form as the tip end of rod 58 in such a manner that when the form is assembled said key will be in the unlock position.

The operation of this form is as follows:—The outer form cheek 104 is closed by cam 75. Locking notches 109 on the outer core end 108 snap over said cheeks 104 and lock them in place. The key core 107 advances under the influence of cam 60 and slides in between the two core ends 108, securely locking them in place.

In order to allow the lead slot 114 to be wide open at the moment when the wire W falls into it, the removable elements 103, 105, 107 are not completely closed until after the wire W falls into the lead slot 114. They are then closed by the back head 57 of the connecting rod 56 contacting with a suitable button 49 carried by the main driving spindle 24.

As the connecting rod 56 or 58 continues to travel they close the shutters 105 and the form is ready for winding the next coil.

When the coil C is in the binding position the key core 107 is withdrawn up to but not over the cam surfaces 108' and dwells while the binding elements 170 and up, are at work. When the coil is ready for discharge said key core 107 is further withdrawn past the cam surfaces 108', releasing the coil C and unlocking the outer form cheek 104, which is withdrawn by elements described elsewhere. The coil is discharged by the cheese head stripper pins 115—116, falls out and the process is repeated.

The cycle of operation of the complete machine is, starting with winding forms 100 to 119 in the forward position ready for winding, the winding wire W supplied from any convenient package as spool S is threaded through convenient wire handling devices, such as tension device T and take-up lever T', thence under the sheave 47 on the oscillating lever 46 over the forward form 100—119, through the lead notch 114 in the form cheek 102—103 and secured under the lead clamp 120. The machine is then started. As the main driving spindle 24 begins to rotate the worm 36 driving gear 37 actuates the starting and stopping cam 40 which in turn actuates the starting and stopping lever 32 and throws the clutch bolt 31 into running position, simultaneously disengaging the spindle lock 33 on the bolt's rear end and engaging the driving element 35 on the main driving spindle 24, starting the winding spindle 20 and its form 100—119 to rotating.

When the above clutch has been engaged the motor control commutator 54—55 speeds up the motor to full speed.

As it rotates the wire W is fed back and forth over the form 100—119 by the oscillating lever 46 and sheave 47 under the influence of the feeding cam 45 through the connecting rod 47' and follower head 48, said feeding cam 45 also being mounted on the primary cam shaft 38. The machine then rotates until nearly the desired number of turns are wound on the coil C when the motor control commutator 54—55 slows down the motor and at the correct number of turns said clutch bolt 31 is disengaged in the reverse order. As the clutch bolt recedes from the driving position its rear end enters the recess 33 carried by the turret 21 and locks it in a definite fixed angular position.

The turret 21 is then unlocked by the turret locking cam 40 that is also carried by the primary cam shaft 38 through the locking members 41, 42, 43. The pair of intermittent gears 52—53 which are driven through the primary cam shaft 38 by spiral gears 51 and the secondary cam shaft 50 indexes the turret 21 reversing the position of the winding spindles 20 and 20'. When said turret comes to rest it is relocked.

As the turret 21 turns over, the wire W leading to the coil just wound is carried with the said coil and let drop on the on-coming empty form so that the wire extending from the now wound coil to the empty form can be used for leads.

While the turret 21 is indexing as above described, the oscillating lever 46 and sheave 47 actuated by the feeding cam 45 spot the wire at the proper point so that it will drop into the lead slot notch 114 in the cheek of the form.

At a convenient time ahead of or simultaneously with the indexing of said turret the connecting rod 64 in the center of the turret spindle 21' is moved forward by the cam 66 through follower roller 67 carried by the lever 65 and by means of one of the arms 63—64 attached to said rod opens the lead clamp 120 and the cut off knives 68—69 in the path of the said wire W as it comes into place as described. The wire will then in addition to falling into the lead slot 114 also fall into the open jaws of the lead clamp 120 and between the open knives of the shears 68, 69.

The turret is spotted by the turret locking mechanism, the cam 66 reverses the travel of the connecting rod 64 allowing the forward lead clamp 120 to bite the wire, then causing the shears 68—69 to cut it off. The winding process is then repeated.

While the aforesaid indexing of the turret 21 and lead handling are occurring the removable elements 103, 105, 107 of the winding form that has now been indexed to the rear position are withdrawn as the head 57 of the form connecting rod 56 engages with the stationary form actuating

cam 69, as is more fully described in connection with said forms, making room for the coil binding elements.

While the coil C is in the rear position it is bound as is set forth in said divisional application. When the binding elements have secured the coil, which has been done during the winding of the next coil, they recede and when the turret is next indexed the removable form elements 103, 105, 107 complete their travel under the influence of the aforesaid cam 60, releasing the coil from the form core 107—109 as described. The outer form cheek 104 is removed by the stationary cam 75 as previously described. At a proper time said actuating elements also actuate the strippers 115 to 118, pushing the coil completely off of the form and allowing it to fall out of the machine.

As the indexing continues the form closes up in reverse order, again coming to rest in a winding position and the cycle is repeated.

It is, of course, necessary to use a definite device or machine for disclosing my invention, but as my invention can assume many forms, can wind many types of coils on many kinds of coil forms or supports, I do not limit my invention to the exact type of machine or coil depicted or described herein.

I wish to claim:

1. In a winding machine, a turret, means for forming the leads of coils, a plurality of winding elements mounted upon said turret in such relation to each other that as the said turret is indexed, the wire extending between its source of supply and a coil wound by one of said winding elements will be in the indexing path of a succeeding element and come into such a position with said succeeding element that the wire extending between said elements may be used for coil leads.

2. In a winding machine, the combination of a plurality of winding elements so mounted upon a turret that coil leads may be formed between them, and means for feeding the wire longitudinally to the axis of said elements said feeding means being proportioned to spot the lead forming portion of the winding wire at appropriate places upon said winding elements.

3. In a winding machine, an indexable turret, the combination of a plurality of winding elements rotatably mounted thereon, a driving spindle mounted to align with said winding elements as they are brought successively into position by said turret, a clutch for coupling said spindle with said winding elements, means for locking said winding elements in a fixed angular position when stopped.

4. In a winding machine, an indexable turret, the combination of a plurality of winding elements, rotatably mounted thereon, a driving spindle for driving said elements, said spindle being geared to the driver of a pair of intermittent gears, the driven gear of said pair being affixed to said turret for the purpose of indexing said turret.

5. In a winding machine, an indexable turret, the combination of a plurality of winding elements, rotatably mounted thereon, a lead cut off element, a cut off actuating cam, a driving spindle geared thereto, a cam follower carried by said turret connecting said cam with said lead cut off element.

6. In a winding machine, an indexable turret, the combination of a plurality of winding spindles mounted thereon each of said spindles carrying a winding form, an actuating cam and a follower rod, a portion of said forms being removable, said removable parts of said forms being coupled to said actuating cam by said follower rods passing through each of said winding spindles.

7. In a winding machine, a winding form, the combination of a winding spindle carrying said winding form, an outer cheek member of said form, a tail stock element supporting said outer cheek, and a cam to remove and replace said cheek member.

8. In a collapsible winding form, combining a frame work, a core divided into a plurality of sections the end sections of said core being pivotally mounted upon said frame, cam surfaces carried by said end sections, follower surfaces upon the interior core section so as to lock said end sections, said cam surfaces engaging said follower surfaces in winding position when said form is closed and to release when open.

9. In a winding machine, means for forming the leads of coils, combined with a turret, a plurality of winding elements, supported and positioned by said turret, and means attached to said winding elements for holding said leads.

10. In a winding machine, the combination of a plurality of winding elements, an indexable turret rotatably mounting said elements, a spindle for driving said winding elements, a cam geared to said spindle, means for locking said turret in position actuated by said cam.

11. In a winding form, the combination of a frame, a sectional core having end sections, a cam for actuating and locking said core said end sections being pivotally mounted, latching surfaces carried by said end sections, for latching the outer cheek of the form in place.

12. In a winding form, means to permit access to the winding upon said form, comprising sectional elements assembled transversely to its plane of rotation, one of said sections being removable, a carrier supporting said removable section, an outer cheek having a removable section and hinged to said carrier to permit folding back and withdrawal through said winding.

13. In a winding machine, the combination of a winding form having a head portion thereof adapted to be supported by the head stock of a lathe, a tail portion to be supported by the tail stock of said lathe, with a key element pivotally attached to said tail section, a key seat carried by said tail stock for engaging said key and locking said tail element to said tail stock when the form is separated and unlocking when the form is closed.

14. In a winding machine, the combination of a plurality of winding elements, an indexable turret mounting the same, a system of control elements, which control said winding elements, gearing to couple said control and said winding elements, a motor controlling commutator associated with suitable contact fingers, the latter being attached to the frame of said winding machine.

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