March 6, 1951

B. A. PETERSON

2,543,931

BOBBIN WINDING MACHINE

Filed May 26, 1945

6 Sheets-Sheet 1

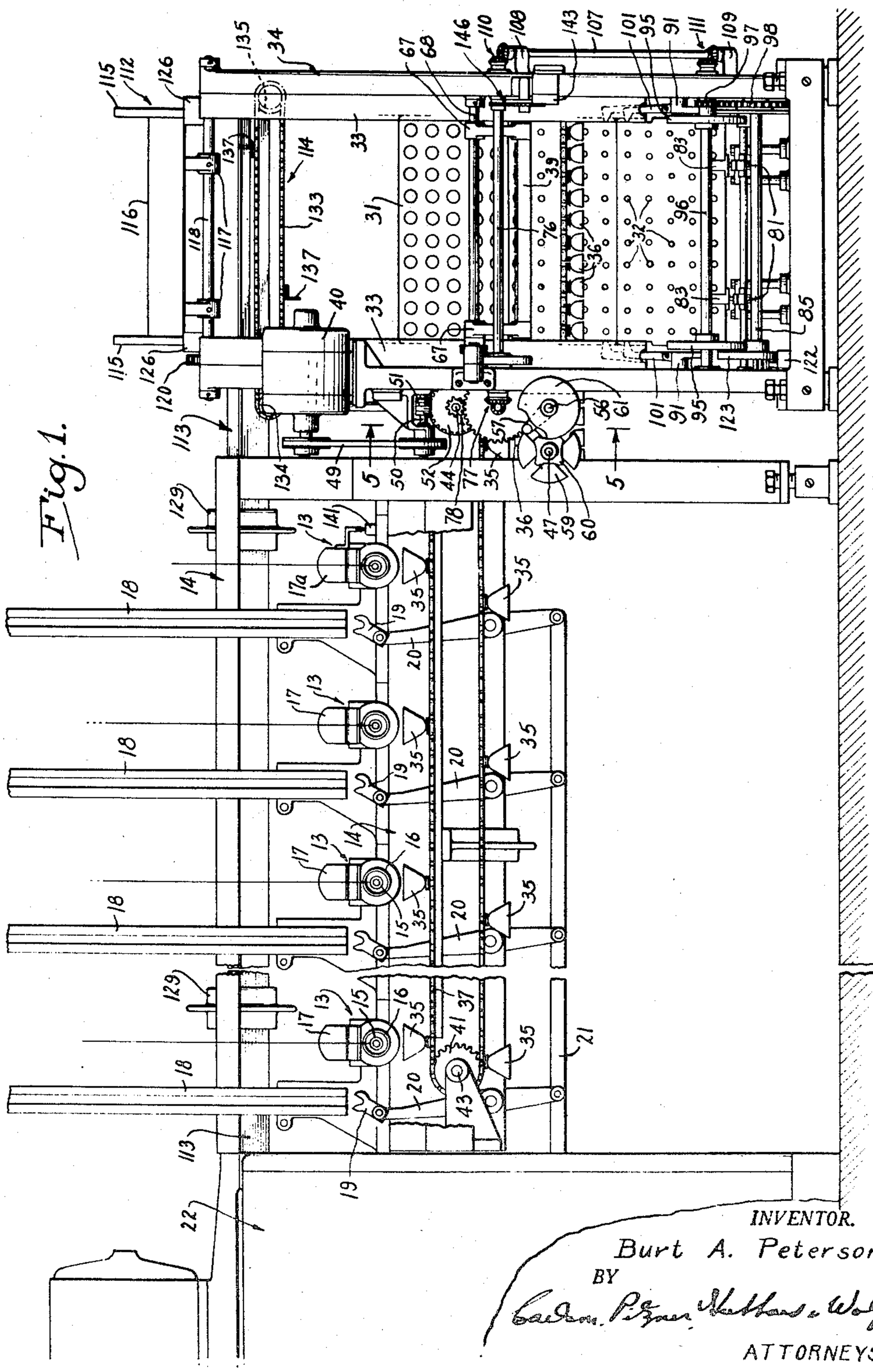

Fig. 1.

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BOBBIN WINDING MACHINE

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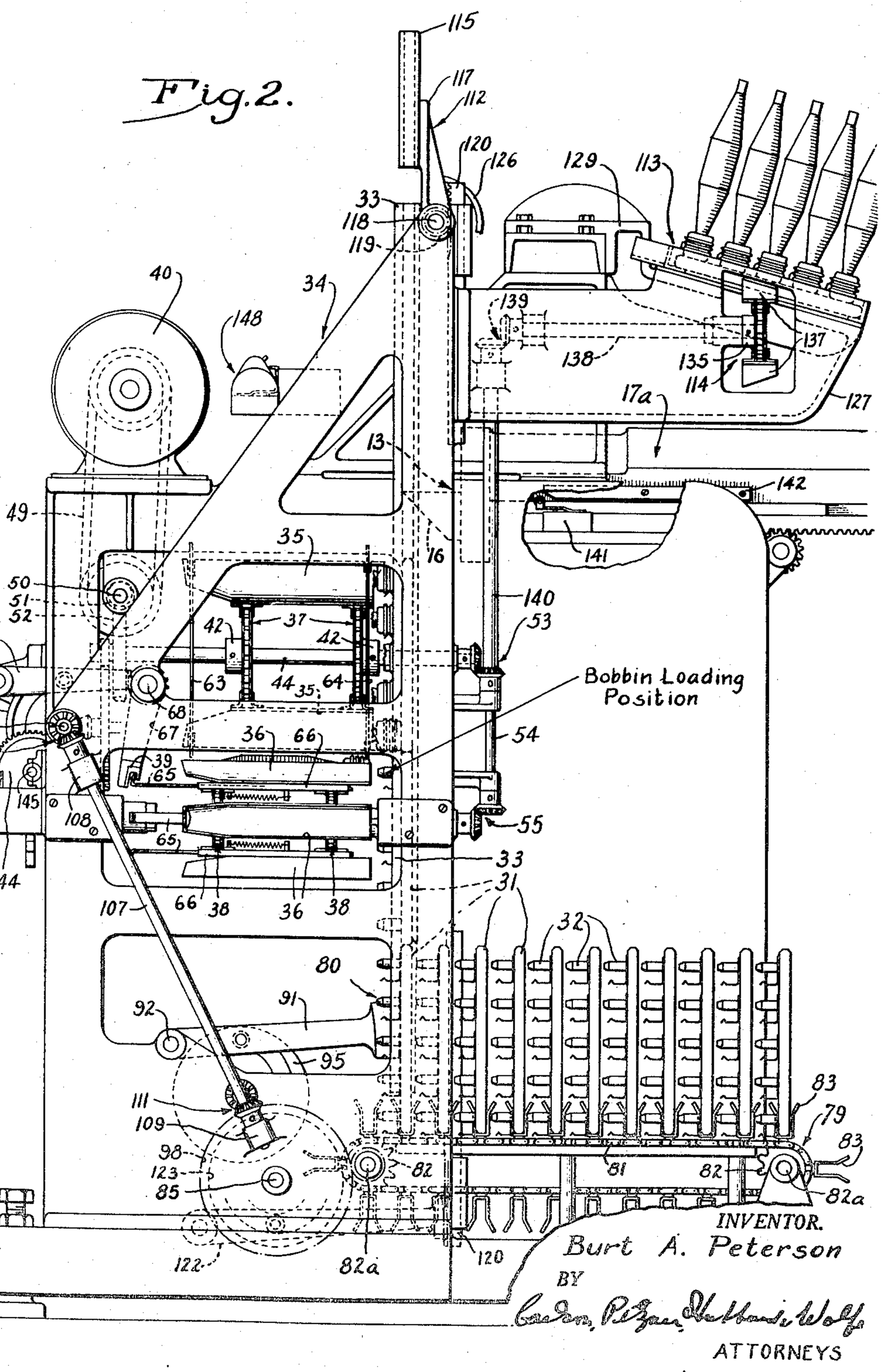
6 Sheets-Sheet 2

Fig. 2.



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March 6, 1951 B. A. PETERSON 2,543,931

BOBBIN WINDING MACHINE

Filed May 26, 1945 6 Sheets-Sheet 3

Fig. 3.

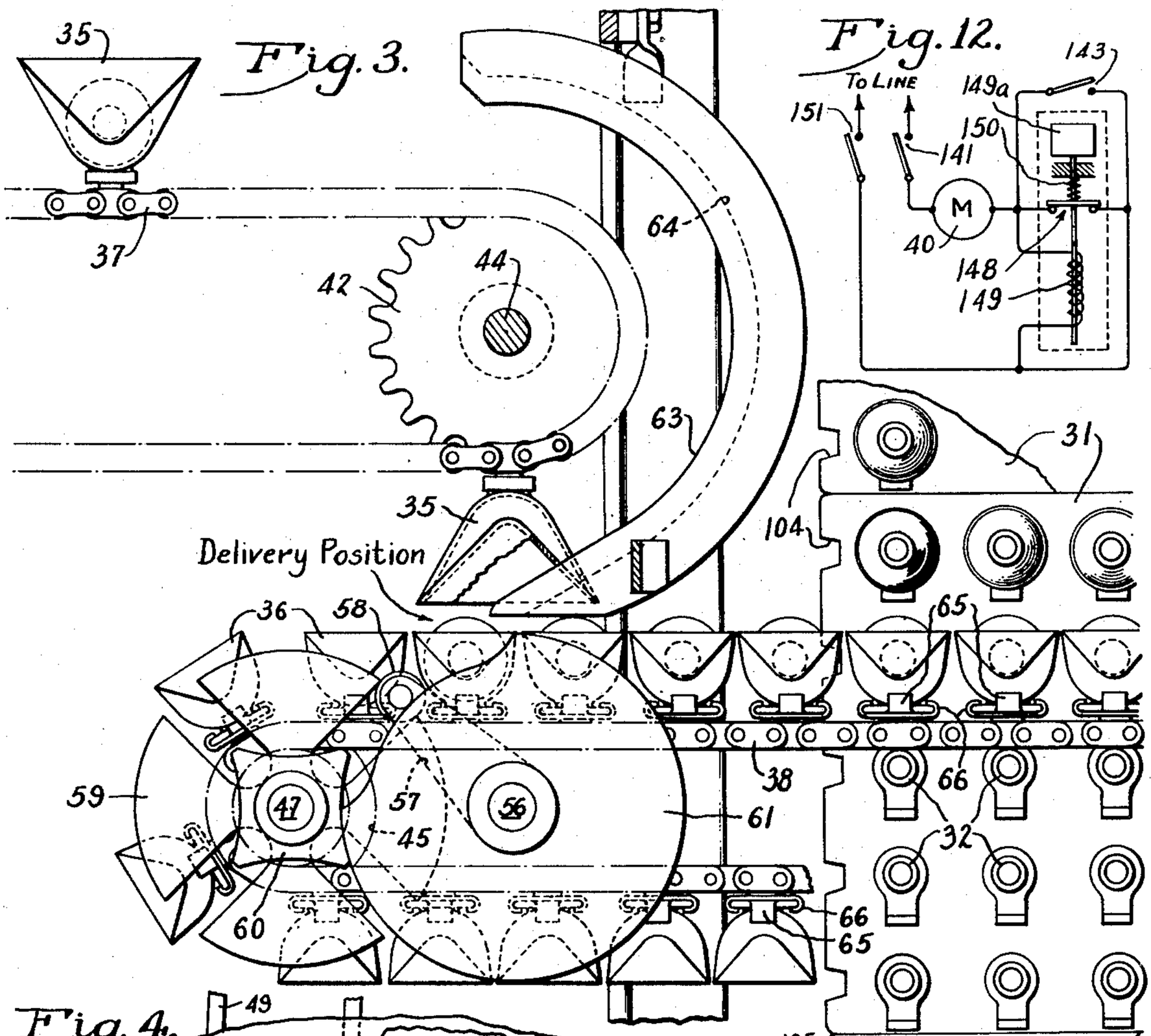
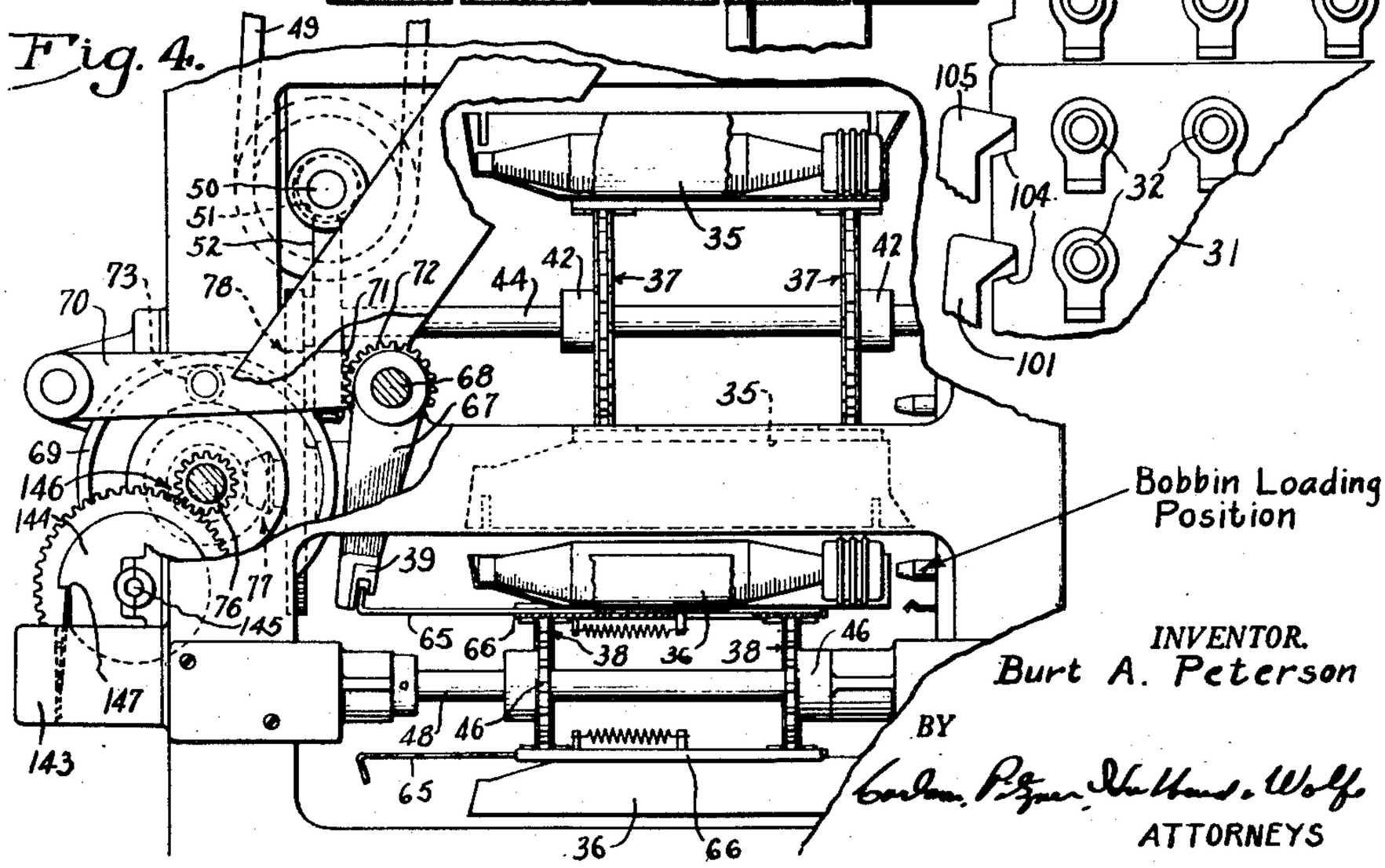


Fig. 12.

Fig. 4.



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March 6, 1951 B. A. PETERSON 2,543,931

BOBBIN WINDING MACHINE

Filed May 26, 1945 6 Sheets-Sheet 4

Fig. 5.

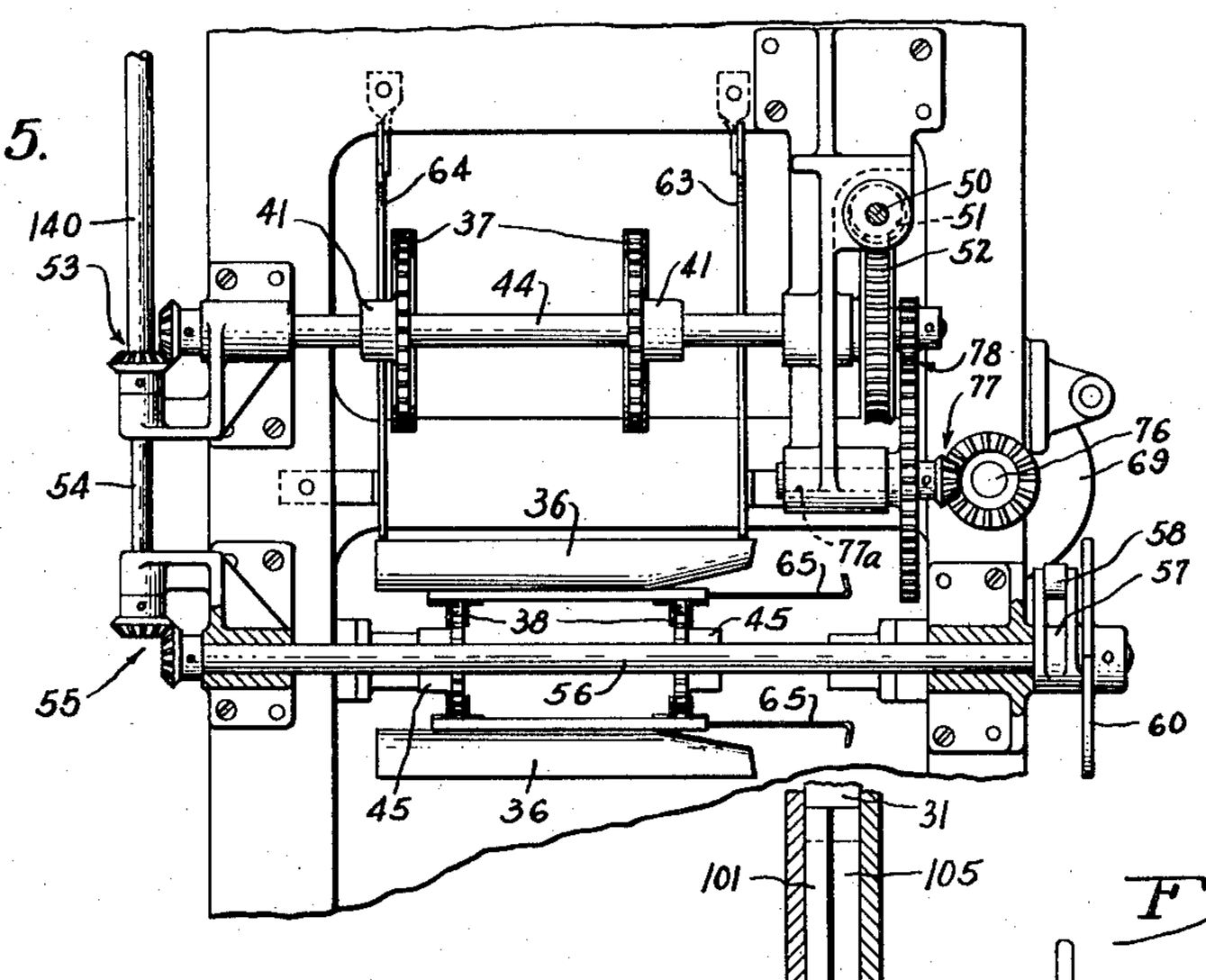

Fig. 7.

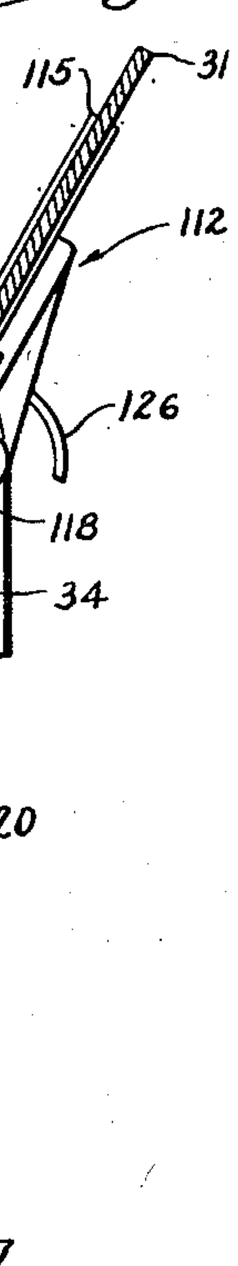

Fig. 6.

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March 6, 1951 B. A. PETERSON 2,543,931

BOBBIN WINDING MACHINE

Filed May 26, 1945 6 Sheets-Sheet 5

Fig. 8.

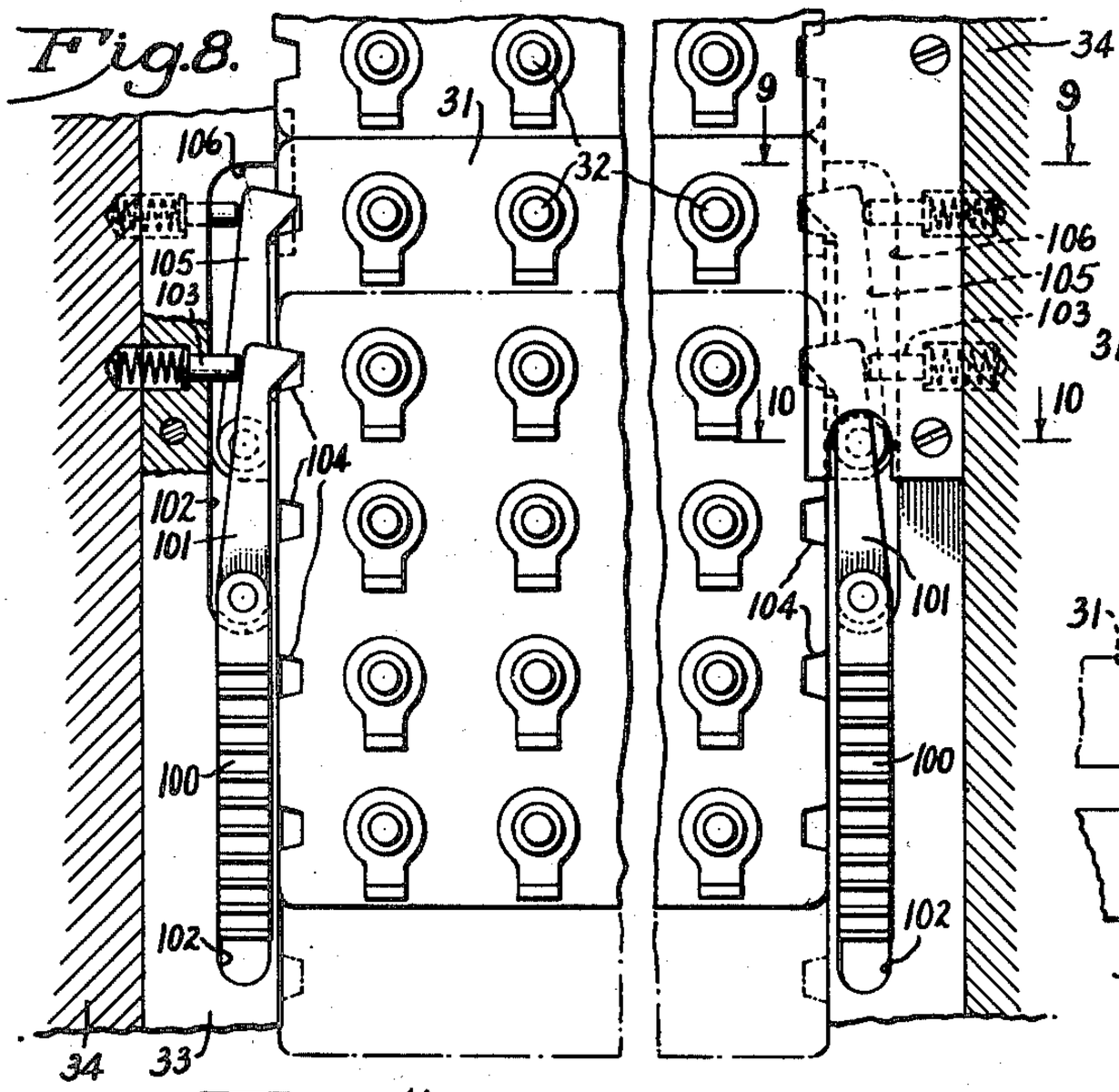


Fig. 9.

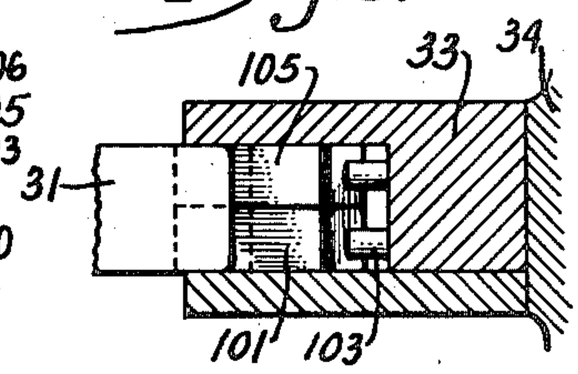


Fig. 10.

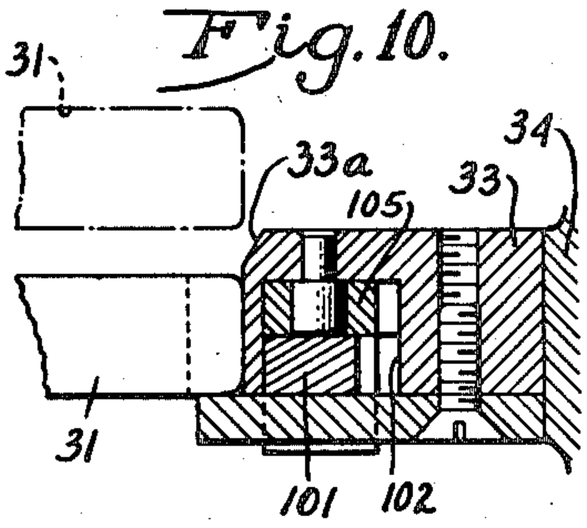
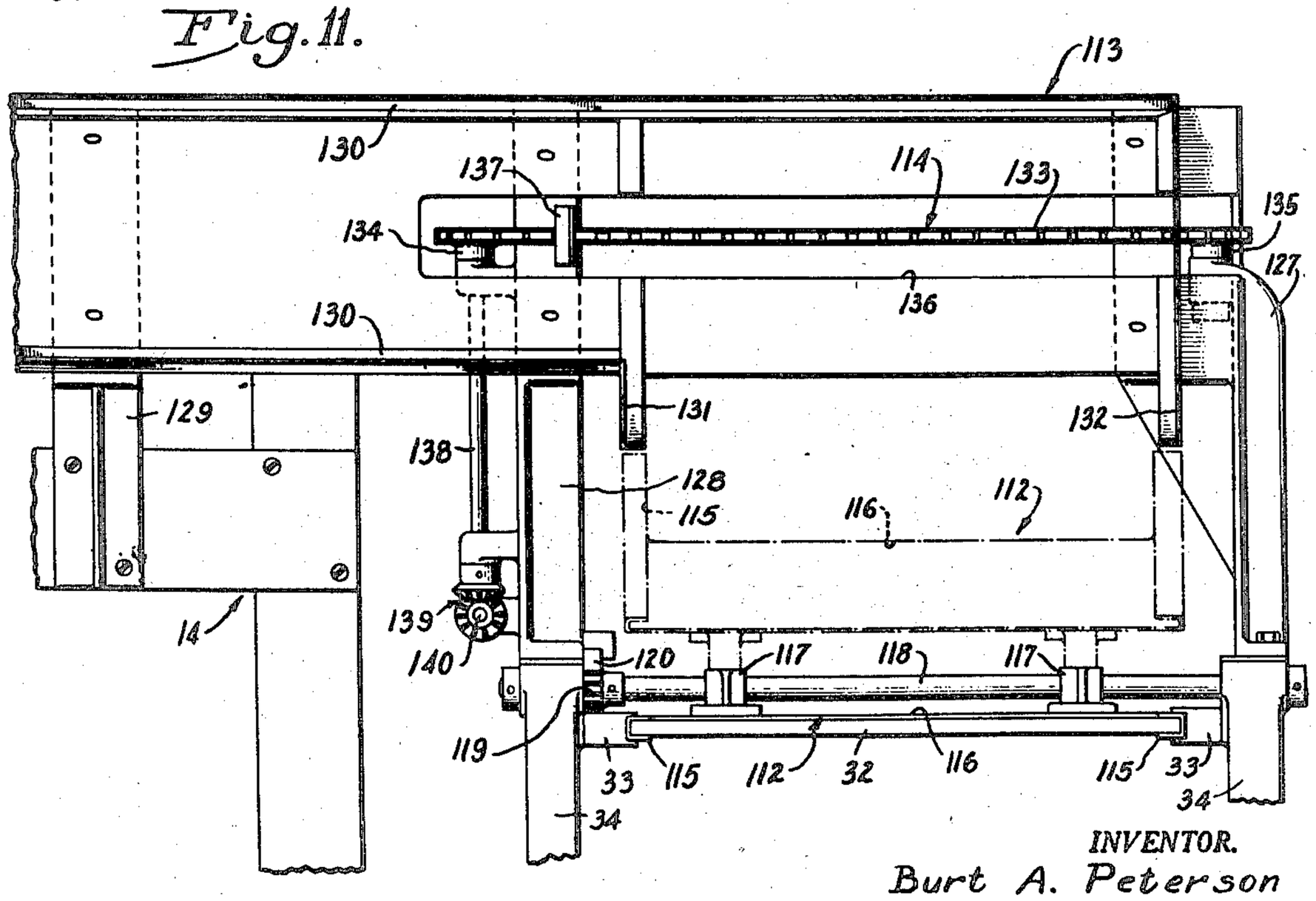


Fig. 11.



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BOBBIN WINDING MACHINE

Filed May 26, 1945 6 Sheets-Sheet 6

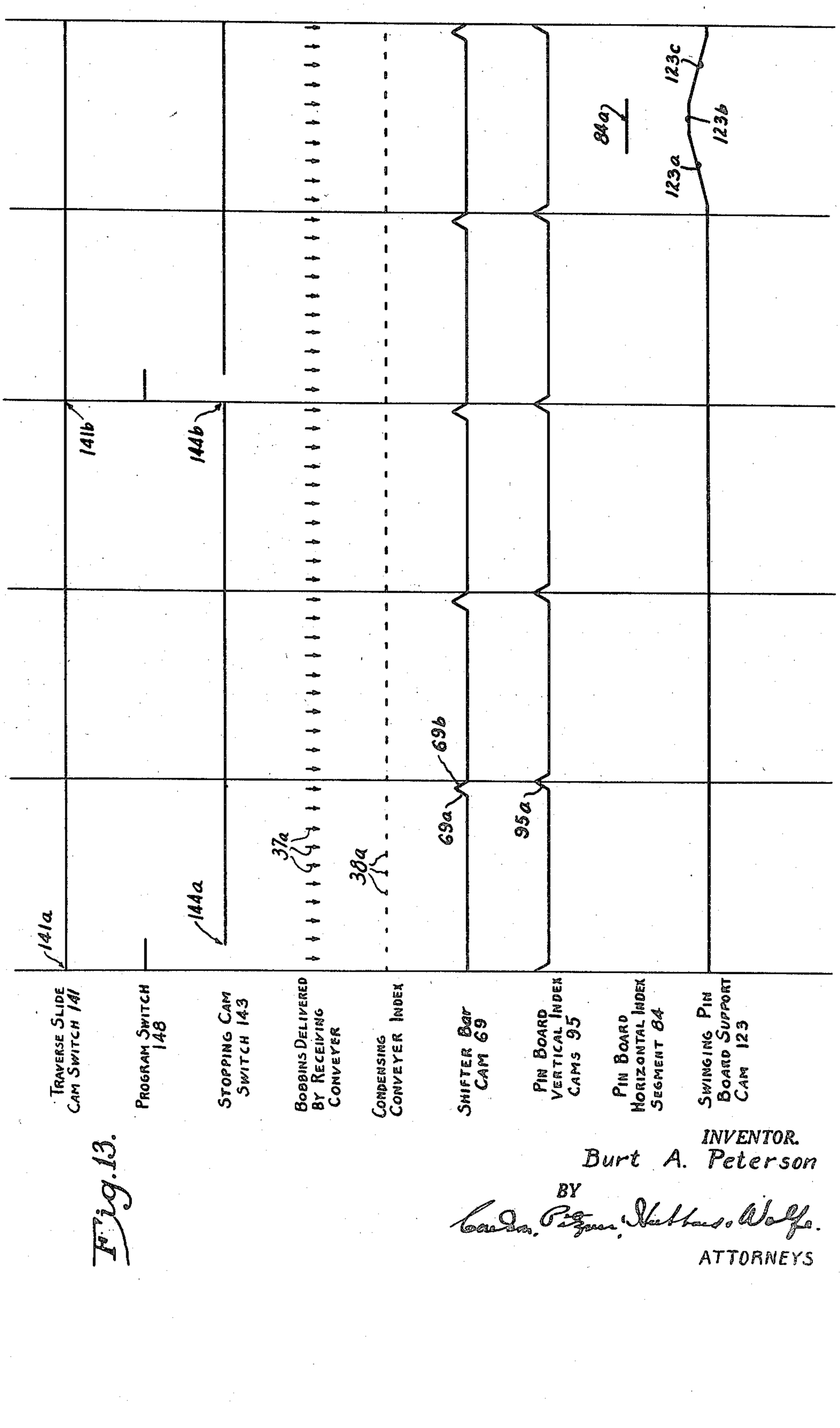

Fig. 13.

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Patented Mar. 6, 1951

2,543,931

UNITED STATES PATENT OFFICE

2,543,931

BOBBIN WINDING MACHINE

Burt A. Peterson, Rockford, Ill., assignor to Barber-Colman Company, Rockford, Ill., a corporation of Illinois

Application May 26, 1945, Serial No. 595,971

30 Claims. (Cl. 242—35.5)

1

The invention pertains to high speed bobbin winding machines of the multiple unit type, and has more especial reference to machines of this character intended for use in winding delicate filament yarns requiring the exercise of special precautions in the handling of wound bobbins to avoid injury to the yarn.

The invention has for its general object the provision of a bobbin handling mechanism of novel and advantageous character so coordinated with the machine cycle that the bobbins produced by the several units in one cycle of the machine are in the next or succeeding cycle automatically delivered to individual supporting elements.

Another object is to provide in a bobbin winding machine of the multiple unit type a bobbin handling mechanism which is common to the several units, thereby reducing the manufacturing cost of the machine.

Another object is to provide a bobbin handling mechanism of the character indicated in which the bobbins discharged from the several winding units and spaced apart according to the spacing of the units are condensed into a compact relationship corresponding to the spacing of the individual supports of a pin board or the like.

A further object is to provide means of an advantageous character for presenting rows of bobbin supporting elements in position to receive wound bobbins in successive groups each of a number corresponding to the number of supporting elements in each row.

Another object is to correlate the movement into a predetermined loading position of successive groups of bobbins and supporting elements therefor.

Another object is to provide means of an advantageous character for automatically maintaining a supply of bobbin carriers of the pin board type for advance into bobbin loading position.

Still another object is to provide means for receiving and storing the loaded bobbin carriers for convenient removal by an attendant.

The objects of the invention, thus generally set forth, together with other and ancillary advantages, are attained by the construction and arrangement shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a fragmentary front elevational view of a bobbin winding machine having associated therewith the improved bobbin handling mechanism.

Fig. 2 is a fragmentary elevational view of the right-hand end of the machine, as shown in Fig. 1.

2

Fig. 3 is a fragmentary longitudinal sectional view of two conveyor mechanisms utilized in the operation of condensing the wound bobbins from the spacing determined by the spacing of the winding units to that determined by the spacing of the elements on the bobbin carriers to which the bobbins are to be transferred.

Fig. 4 is a fragmentary elevational view of the right-hand end of the machine.

Fig. 5 is a vertical sectional view taken approximately in the plane of line 5—5 of Fig. 1.

Fig. 6 is a fragmentary vertical sectional view on an enlarged scale showing details of various operating mechanisms.

Fig. 7 is a fragmentary vertical sectional view illustrating the construction of a swinging support utilized in delivering loaded pin boards to a storage table.

Fig. 8 is a fragmentary longitudinal sectional view of an indexing mechanism for the bobbin carriers.

Figs. 9 and 10 are sectional views taken approximately in the plane of lines 9—9 and 10—10, respectively, of Fig. 8, and showing details of construction.

Fig. 11 is a fragmentary plan view of the receiving table for loaded bobbin carriers and associated means for advancing the carriers along the table.

Fig. 12 is a wiring diagram showing the control circuit for the driving motor.

Fig. 13 is a time chart.

The improved bobbin handling mechanism is especially adapted for use in a multiple unit winding machine disclosed and claimed in copending application Serial No. 450,129, filed July 8, 1942, by Brooks Marcellus, now Patent No. 2,409,639 dated October 22, 1946, and copending application Serial No. 553,507, filed September 11, 1944, by Russell P. Drake, now Patent No. 2,445,998 dated July 27, 1948. The machine, generally shown in Fig. 1, comprises briefly a series of winding units 13 arranged in uniformly spaced relation upon a suitable horizontally elongated framework 14. Each unit comprises a winding spindle 15 with a unidirectionally rotated traversing cam 16 encircling the spindle and mounted upon a slide 17 for movement in a direction axially of the spindle so that the yarn is wound in successive conical layers progressing gradually from one end of the bobbin to the other to produce filling wound bobbins. In the embodiment of the invention illustrated

in Fig. 1, empty bobbins are received from magazines 18 (there being one for each unit) by cradles 19 forming part of a donning mechanism particularly disclosed in said Drake application. The respective cradles are mounted upon levers 20 connected for swinging movement in unison by means of a link 21 for the purpose of carrying empty bobbins into operative relation to the spindles 15.

The several units operate simultaneously and the various functions incident to the winding operations are performed automatically under the control of a common driving and control mechanism 22 enclosed within a suitable housing and forming the subject of said Marcellus application, said housing being located in the present instance at the left-hand end of the framework 14. The number of bobbins wound in each cycle of the machine may, of course, vary as may be desired. Although only a relatively small number of winding units are shown, the machine of the present embodiment is designed to produce thirty completely wound bobbins in each operating cycle.

The bobbin handling mechanism forming the subject of this invention is common to all of the winding units of the machine and is arranged for operation concurrently with each winding cycle to effect the disposal of bobbins wound in the preceding cycle of the machine. This means ultimately receiving and storing the wound bobbins may take various forms. In the present instance the bobbins are placed upon carriers 31 (Figs. 1 and 2) of the type commonly called pin boards and consisting of a generally rectangular frame or "board" equipped with individual supporting devices 32, usually in the form of pins projecting from one face of the frame and arranged in closely spaced relation and in straight rows. For the purpose of receiving the bobbins, the pin boards are arranged to be indexed step-by-step with respect to a predetermined loading position (indicated by a legend in Fig. 2), successive rows of pins being moved into and out of such position in successive cycles. As shown, the pin boards are slidable in a vertical guideway formed by opposed guides 33 provided in upright supporting frame 34 located at the end of the winding machine opposite the drive and control mechanism 22.

Upon the completion of each winding cycle, the wound bobbins released from the several winding spindles are deposited in a series of bobbin holders in the form of pockets 35. Although the winding units are arranged in the machine with reasonable compactness, they are of necessity spaced apart a distance substantially greater than the spacing of the pins on the pin boards, and in order that the bobbins may be loaded upon the boards in successive groups each corresponding to one row of pins on the pin board, it is necessary that the spacing of the bobbins be reduced or condensed from that determined by the spacing of the units to that determined by the spacing of the pins. Accordingly, provision is made for the transfer of the bobbins received by the individual holder pockets 35 to a second series of holders in the form of troughs 36. Each series of carriers forms a part of a conveyor. Thus, the pockets 35 are mounted upon endless chains 37, the troughs being spaced apart thereon according to the spacing units 13; and the troughs 36 are mounted upon endless chains 38, the troughs being spaced apart according to the spacing of the pins on the pin board.

The two conveyors are advanced in timed relation to each other, the receiving conveyor with a continuous motion and the condensing conveyor with a step-by-step motion until all of the bobbins wound in one cycle are, in the succeeding cycle, transferred in groups to successively presented rows of pins 32 on the pin boards 31. It is thus the function of the condensing conveyor not only to arrange the wound bobbins in properly spaced relation according to the spacing of the pins on the pin board, but to carry the same in successive groups to the loading position where they are acted upon by a shifter bar 39 for effecting transfer to the pin board.

As set forth in the aforesaid Marcellus application, the mechanism for controlling the various functions of the bobbin winding machine includes a cam shaft (not shown) which is at rest during the winding cycle. Since it is during such cycle that the bobbin handling mechanism operates to effect proper disposal of the bobbins wound in the preceding cycle, I employ a separate power drive coordinated with the operation of the winder proper. Herein, the power source is an electric motor 40 (Figs. 1 and 3) mounted on the frame 34.

The receiving conveyor extends generally horizontally beneath the winding spindles 15, with one end projecting into overlapping relation to the condensing conveyor. As shown, the receiving conveyor has two spaced parallel chains 37 (Figs. 1 and 3) operating over sprockets 41 and 42 on shafts 43 and 44. The pockets 35 are suitably supported at opposite ends upon the two chains (Fig. 2), and are shaped so as to support the tip and butt ends only of the bobbins, with the yarn mass proper out of contact with the bottom of the pocket.

The condensing conveyor likewise extends generally horizontally with one end (the left in Fig. 1) underlying the projecting end of the receiving conveyor. Here, too, the conveyor has two chains 38. These run over sprockets 45 and 46, respectively mounted on shafts 47 and 48. The troughs 36 extend transversely of the chains 38 and like the pockets 35 are shaped to support the bobbins at the tip and butt ends only so as to avoid injury to the yarn.

The receiving conveyor is arranged to be driven continuously in the operation of transferring wound bobbins to the condensing conveyor, while the latter is actuated by a step-by-step movement. For this purpose, the sprocket shaft 44 of the receiving conveyor has a belt and pulley connection 49 (Figs. 1 and 2) with a stub shaft 50, and the latter has a worm 51 meshing with a worm wheel 52 on a sprocket shaft 44. As seen in Figs. 2 and 5, the worm wheel is fast on the forward end of the sprocket shaft 44 and the rear end of the shaft has a bevel gear connection 53 with an upright shaft 54 which in turn has a bevel gear connection 55 with a drive shaft 56 for the condensing conveyor. This latter shaft (Fig. 3) is mounted in laterally spaced parallel relation to the sprocket shaft 47 and is operatively connected with the shaft 56 by means of a Geneva stop motion. For this purpose, the shaft 56 carries an arm 57 with a roller 58 on its free end for coaction with a notched disk 59 on the sprocket shaft 47. Coacting locking disks 60 and 61 on the shafts 47 and 56 maintain the two shafts in proper relation to each other.

At the end of each winding cycle, the wound bobbins are released from their respective winding spindles and deposited in the underlying

pockets 35 of the receiving conveyor. Thereupon, the circuit to the drive motor 40 is closed in response to the initiation of a new winding cycle as hereinafter described. As the receiving conveyor is actuated, the wound bobbins are carried successively (Fig. 3) to a predetermined delivery position in which the pockets 35 successively occupy an inverted position in opposed relation to successively presented troughs 36 of the condensing conveyor, which is being advanced by the Geneva gear 57, 59. In the present embodiment of the invention the troughs 36 move into a receiving position directly below the delivery position of the pockets 35. To hold the bobbins in the pockets 35 while the latter are moved around the ends of the conveyor to the delivery position, two arcuate guide arms 63 and 64 are supported at the right-hand end of the conveyor in front-to-rear spaced relation so as to be engageable respectively by the tip and butt ends of the bobbins.

From the condensing conveyor the wound bobbins are transferred to the pins 32 on the pin boards in groups of ten, there being in the present instance five rows of pins on each pin board and ten pins in each row. For this purpose, the troughs 36 are supported for endwise sliding movement by means of elongated slide bars 65 mounted in guides 66 on the chains 38 and providing opposed channels for engaging opposite edges of the bars.

Actuation of the slide bars to effect transfer of the bobbins to the pins is accomplished by the shifter bar 39 timed for operation following the advance into the loading position of successive groups of ten bobbins, and the concurrent movement of successive rows of pins 32 into such position. The shifter bar 39 is mounted on a pair of arms 67 fast on the rockshaft 68 (Figs. 1 and 4) and is shaped for engagement with forwardly projecting ends of the slide bars 65 as shown in Fig. 4. Rocking motion is imparted to the shaft 68 by means of a cam 69 acting upon a lever 70. The lever has a gear segment 71 on its rear end meshing with a pinion 72 fast on the rockshaft 68. Between its ends the lever 70 carries the roller 73 engaging in a cam groove 74 in one face of the cam 69.

The cam 69 is fast upon a slow speed shaft 76 having a bevel gear connection 77 (Fig. 5) with a stub shaft 77*a* driven from the sprocket shaft 44 of the receiving conveyor at an appropriately reduced speed. As herein shown, the driving connection comprises spur gearing 78. By this construction, the shifter bar 39 is actuated once for each advance of ten pins into the loading position.

Pin boards are supplied to the lower ends of the guide 33 (Fig. 2) and then indexed vertically to carry successive rows of pins into the loading position, by means including a pin board conveyor 79 and an indexing mechanism 80 (Figs. 2, 6 and 8), both being driven from the slow speed shaft 76 and operating in timed relation to the shifter bar 39.

The pin board conveyor 79 comprises two parallel chains 81 (Figs. 1 and 2) supported by sprockets 82 and respectively carrying retaining devices 83 yieldably engaging the lower edge portions of the pin boards. The devices 83 are in the form of U-shaped clips and these are uniformly spaced apart along the chain a distance slightly in excess of that necessary to accommodate the pins 32.

The conveyor 79 is advanced step-by-step to

carry the pin boards into alinement with the guides 33 by suitable means, preferably comprising an actuating gear segment 84 (Fig. 6) fast on a continuously rotating shaft 85 and operative once in each revolution of said shaft to engage a pinion 87 rigid with one of the chain sprocket shafts 82*a*. Fast on the respective shafts 82*a* and 85 are coacting locking disks 88 and 89. The disk 89 is generally rectangular in form and the disk 88 has a recess 90 in its peripheral edge in the region of the actuating segment 84, adapted to receive the successive corner portions of the disk 89 as the gear segment moves into engagement with the pinion 87. It will be seen that an advancing or stepping movement is imparted to the pin board conveyor once for each revolution of the disk 88, and that between successive actuations the chain is positively held against movement, the arrangement being such that with each movement of the conveyor the pin board is moved into alinement with and positively held with respect to the guides 33. In order that the pin boards may be moved into position in the guides 33, the lower ends thereof open laterally as at 33*a* (Fig. 10).

The indexing means 80 whereby the pin boards presented to the guides 33 are advanced vertically step-by-step to present successive rows of pins to the loading position comprises in the present embodiment of the invention two arms 91 (Figs. 2 and 6) pivoted at 92 and respectively carrying followers 93 engaging in grooves 94 of two identical face cams 95. These cams are mounted on a shaft 96 (Fig. 1) carrying a pinion 97 at one end meshing with a gear 98 on the shaft 85 so as to be timed with the pin board indexing mechanism.

Rocking motion imparted to the arms 91 is transmitted to the pin boards to advance them vertically by means of gear segments 99 on the arms meshing with racks 100 upon which are mounted pawls 101 (Fig. 8) for coaction directly with the pin boards. As best shown in Figs. 6 and 8, the racks 100 are slidable in suitable guideways 102 and the pawls are pivotally supported upon the racks so as to swing inwardly under the force of spring pressed pins 103 so as to engage with notches 104 in the opposite side edges of the pin boards. As seen in Fig. 8, the notches 104 are spaced apart according to the spacing of the rows of pins 32. To retain the boards in advanced position against the action of gravity, spring pressed retaining pawls 105 are pivoted on the guide members 33, the latter being appropriately recessed as at 106 to accommodate the pawls.

As previously indicated, the presentation of the pin boards to the guides and the indexing of the boards along the guides is timed with respect to the operation of the shifter bar 39 by which the bobbins are transferred in groups to the rows of pins on the pin boards. In the present instance the pin boards are advanced horizontally into operative association with the guides 33 once for each five vertical indexing movements, there being in the present instance five rows of pins on each pin board.

The drive for the two indexing mechanisms is herein derived from the shifter bar cam shaft 76. As shown, it comprises an inclined shaft 107 (Figs. 1 and 2) mounted in brackets 108 and 109 and having bevel gearing connections 110 and 111 with the cam shafts 76 and 96 respectively. These two shafts being driven at the same speed cause a vertical indexing movement to be im-

parted to the pin boards once for each reciprocation of the shifter bar 39. On the other hand, the ratio between the gears 97 and 98 (Fig. 6) is such as to advance the pin boards horizontally one step for each five vertical steps of the pin board. It will be understood that the pin board guides 33 are of sufficient length vertically to accommodate simultaneously a number of pin boards arranged in edge-to-edge relation, all of the pin boards being advanced in unison by the indexing of the lowermost board.

Upon reaching the top of the guides 33 the uppermost pin board may be removed manually, but preferably means is provided whereby they are delivered automatically by means of a swinging support 112 to a receiving table. The latter provides a horizontally elongated slideway or shelf 113 (Figs. 1, 7 and 11) having associated therewith a conveyor mechanism 114 whereby the pin boards are advanced along the table or slideway.

The operations of the swinging support 112 and the conveyor mechanism 114 are of course timed with respect to the vertical indexing of the pin boards. The support provides a pair of guides 115 respectively constituting extensions of the guides 33 when the support is in its vertical position (Figs. 2 and 7). As shown, these guides 115 are mounted upon the ends of the plate 116 which in turn is carried by arms 117 on a rockshaft 118.

Actuation of the rockshaft following the indexing of the pin boards vertically a plurality of times (herein five) is effected through an operative connection with the pin board supply mechanism and more particularly the driving means therefor. Thus, as shown in Figs. 2 and 11, the rockshaft 118 of the swinging support has a pinion 119 with which meshes a rack bar 120 mounted for vertical sliding movement in the frame members 34 rearwardly of the guides 33. At its lower end, the bar 120 is toothed for engagement with a gear segment 121 (Fig. 6) carried on an arm 122 which is arranged for actuation by a face cam 123 on the shaft 85, the cam having a groove 124 receiving a follower 125 on the lever arm 122. Since the shaft 85 makes one revolution for each forward movement of the pin boards by the pin board supply conveyor, a corresponding swinging movement is imparted to the support 112 to deliver the uppermost pin board to the receiving table 113.

The extent of swinging movement of the support 112 is such as to cause the support to be inclined rearwardly and somewhat downwardly so that the pin board will slide rearwardly by gravity onto the receiving table 113, the latter being correspondingly inclined (Fig. 2). To support the pin board against downward movement relative to the support during swinging movement of the latter, I employ a pair of arcuate slide members 126 suitably attached to the upright frame members 34.

The receiving table 113 may be supported in any suitable or preferred manner. As shown, it is carried by brackets 127 and 128 on the frame members 34 (Figs. 2 and 11) and by an auxiliary bracket 129 carried by the framework 14. The table is formed with longitudinal edge flanges 130 and transverse flanges 131 and 132, the latter serving to guide the pin boards as they are received from the carrier 112, and the former serving to guide the pin boards along the table.

For advancing the pin boards along the table 113 a feed chain 133 is mounted upon sprockets 134 and 135 so that its upper run travels in a slot

136 on the table. Lugs 137 carried by the chain engage with one end of the pin board upon delivery to the table (Fig. 2) for the purpose of advancing the same together with preceding pin boards. One of the sprockets 134 is fast on a horizontal shaft 138 connected by bevel gearing 139 to a vertical shaft 140 (Fig. 2) rigid with the shaft 54 so as to be driven from the shaft 44 by the bevel gearing 53. It will be understood that the arrangement is such that upon delivery of a filled pin board to the receiving table 113 it is engaged by a lug 137 and advanced along the table a distance corresponding to the length of the pin board while the succeeding pin board is being carried upwardly into the swinging support 112 and swung rearwardly therewith for delivery onto the table.

The operation of the bobbin handling mechanism is initiated in the advance of one of the traverse slides 17, herein the extreme right-hand slide in Fig. 1 designated 17*a*. This occurs at the beginning of the winding cycle through the closure of a switch 141 (Figs. 2 and 12) by a cam bar 142. It is stopped upon the transfer to one or more pin boards of all of the bobbins wound in the preceding cycle, by means of a switch 143 controlled by a rotary cam 144, the latter being mounted on a stub shaft 145 which in turn is driven from the shaft 76 through reducing spur gearing 146 (Figs. 1, 2 and 4). The cam 144 has a notch 147 receiving the movable contact of the switch 143 so as to permit opening of the same to interrupt the circuit to the drive motor 40.

Referring to the wiring diagram (Fig. 12), as the traverse slide 17*a* is advanced at the beginning of the winding cycle, it closes switch 141. Since the stopping switch 143 is open at this time, having been opened during the preceding mechanism cycle, the motor circuit is temporarily established through a time delay switch 148 in shunt with the switch 143. This latter switch is of a well known character, being shown only diagrammatically in Fig. 12. It includes a solenoid 149 which is operatively connected with the movable contact member of switch 148 and with a dashpot 149*a*, the arrangement being such that when the solenoid is energized, the switch 148 remains closed for a predetermined time interval sufficient to permit of the closure of the switch 143 by the cam 144. Thereafter, the switch 148 is opened so as to place the cam switch 143 in control of the motor circuit for the purpose of stopping the mechanism at the end of the mechanism cycle. The solenoid 149, however, remains energized until switch 141 is opened by the return to its initial position of the traverse slide 17*a* following completion of the winding cycle under the control of the driving and control mechanism 22 of the winder. Opening of switch 141, deenergizing solenoid 149, permits closure of switch 148 by the action of a spring 150, thereby conditioning the motor circuit for the next mechanism cycle. 151 designates a manually controlled switch in the motor circuit for emergency purposes.

Summary of operation.—Referring now to the time chart, Fig. 13, the operation may be summarized briefly as follows: Upon the completion of a winding cycle, wound bobbins are released by their respective winding units in the manner set forth in said Marcellus application Serial No. 450,129, and drop by gravity into the awaiting pockets 35 of the receiving conveyor 37. Upon the initiation of the next winding cycle, the traversing cam slide 17*a* moves forwardly and

closes switch 141 as indicated at 141*a* in the time chart. Time delay switch 148 being closed, the circuit to the motor is established, first through this switch and then through switch 143 closed as indicated at 144*a* by the rotation of cam disk 144.

Immediately upon closure of the motor circuit the receiving and condensing conveyors are actuated to effect the transfer successively of the wound bobbins in the pockets 35 to the troughs 36, this occurring at intervals indicated at 37*a*. In this operation, the receiving conveyor is advanced continuously at high speed through a direct driving connection with the motor including worm gearing 51, 52. The condensing conveyor is advanced with a step-by-step movement through the medium of the Geneva gear 58, 59 as indicated at 38*a*.

Upon the presentation of successive groups of ten bobbins each to the loading position, the shifter bar 39 is actuated by the cam 69 as indicated at 69*a* in the time chart. Successive groups of bobbin holding troughs 36 are thus slid rearwardly so as to force successive groups of bobbins onto rows of bobbin supporting elements or pins 32 successively presented to the loading position, the shifter bar being immediately retracted after each advance, as indicated at 69*b*. There being ten pins in each row, the actuation of the shifter bar is repeated three times in each mechanism cycle until thirty bobbins have been transferred to three rows of pins.

In timed relation to each actuation of the shifter bar 39 and occurring immediately after the retraction of the bar, the cams 95 operate to impart an upward indexing movement to the lowermost pin board 31 and therefore to those above it, as indicated at 95*a*. In this movement, the cams operate upon the lever arm 91 to actuate the slide rack members 100 carrying indexing pawls 101, the pin board being retained in advanced position by the retaining pawls 105.

Upon the elevation of the lowermost pin board a distance equal to its length measured vertically, a new pin board is supplied to the lower ends of the guides 33 by the operation of the supply conveyor 79 actuated by the rotating gear segment 84 in cooperation with the pinion 87. Stepping movements are imparted to this conveyor once for each five vertical indexing movements of the pin boards, as indicated at 84*a*, the advancing movement occurring at a point approximately midway between the two vertical indexing movements.

Upon arrival of each pin board into its uppermost position within the extensions 115 of the guides 33, the swinging support 112 is swung into a downwardly and rearwardly inclined position by the cam 123 as indicated at 123*a*. After a short dwell 123*b* in this position, provided to allow the pin board to slide rearwardly onto the slideway or table 113, the support is returned to vertical position by the cam as indicated at 123*c*. The pin board is then engaged by one of the lugs 137 of the conveyor chain 133, this chain being operated continuously during the mechanism cycle through its connection with the sprocket shaft 44 of the receiving conveyor.

When all of the bobbins wound in one cycle, herein 30, have been delivered to three successively presented rows of pins 32, the mechanism cycle is terminated by the operation of the cam 144 opening switch 143 at 144*b*. Switch 148, however, remains open pending closure by the spring 150 upon the opening of switch 141 at 141*b* by the return of the traverse cam slide 17*a*.

It will be seen that the bobbin handling mechanism is initiated by the advance of the traversing cam slide closing switch 141, is stopped by cam switch 143, and is conditioned for the next cycle by the return of the traverse slide. Thus, while one set of bobbins is being wound, rapid and effectual disposition is made of the bobbins wound in the preceding cycle of the winding machine.

I claim as my invention:

1. In a bobbin winding machine having a series of uniformly spaced winding units, a bobbin handling mechanism for delivering doffed bobbins from the winding units onto carriers providing a plurality of bobbin supporting elements arranged in a plurality of rows and spaced apart in each row a distance less than the spacing of said winding units, said mechanism comprising a receiving conveyor having a first series of bobbin holders spaced apart according to the spacing of the winding units and each adapted to receive a wound bobbin from one of the winding units, a condensing conveyor having a second series of bobbin holders spaced apart according to the spacing of the bobbin supporting elements on said carriers, means for causing the transfer of the wound bobbins successively from the holders of the first series to the holders of the second series, and means for delivering bobbins from said second series of holders onto the supporting elements of the carrier.

2. In a bobbin winding machine having a series of uniformly spaced winding units, a bobbin handling mechanism for delivering doffed bobbins from the winding units onto carriers providing a plurality of bobbin supporting elements arranged in a plurality of rows and spaced apart in each row a distance less than the spacing of said winding units, said mechanism comprising a receiving conveyor having a first series of bobbin holders spaced apart according to the spacing of the winding units and each adapted to receive a wound bobbin from one of the winding units, a condensing conveyor having a second series of bobbin holders spaced apart according to the spacing of the bobbin supporting elements on said carriers, means for causing the transfer of the wound bobbins successively from the holders of the first series to the holders of the second series, means driven in timed relation to said condensing conveyor for successively advancing rows of supporting elements to a predetermined loading position, and means for delivering a group of bobbins from said second series of holders onto the supporting elements of the carrier when in said loading position.

3. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising means for advancing into and out of a predetermined loading position successively a plurality of groups of bobbin supporting elements arranged in rows, means carrying successive groups of wound bobbins from said winding units to said loading position with the bobbins spaced apart according to the spacing of said elements in their respective rows, and means acting upon the successive groups of bobbins in such loading position to deliver the same to successive rows of supporting elements.

4. A bobbin winding machine having a plu-

rality of winding units uniformly spaced apart horizontally, a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of said winding units and underlying the same for the reception of a series of wound bobbins, a horizontally disposed condensing conveyor having one end portion disposed in juxtaposed relation to the receiving conveyor, said condensing conveyor having a series of bobbin holders, means for driving the two conveyors in timed relation to each other, means operative in the actuation of the conveyors to cause the successive transfer of wound bobbins from the bobbin holders of the receiving conveyor to the bobbin holders of the condensing conveyor, and means operatively associated with the condensing conveyor for removing wound bobbins therefrom in successive groups.

5. A bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of said winding units and underlying the same for the reception of a series of wound bobbins, a horizontally disposed condensing conveyor having one end portion disposed in juxtaposed relation to the receiving conveyor, said condensing conveyor having a series of bobbin holders, means for driving the two conveyors in timed relation to each other, means operative in the actuation of the conveyors to cause the successive transfer of a group of wound bobbins from the bobbin holders of the receiving conveyor to the bobbin holders of the condensing conveyor, means actuated in timed relation to the condensing conveyor presenting a group of bobbin supporting elements in a predetermined loading position, and means operatively associated with the condensing conveyor for transferring said group of wound bobbins therefrom to said group of supporting elements.

6. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of the winding units and underlying the same for the reception of a series of wound bobbins, a horizontally disposed condensing conveyor positioned with one end adjacent to an end of the receiving conveyor and having a second series of bobbin holders spaced apart a relatively shorter distance than the holders of the receiving conveyor, and means for driving the two conveyors at relative speeds such as to carry the successive bobbin holders of the receiving conveyor in delivering relation to the successive holders of the condensing conveyor successively.

7. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of the winding units and underlying the same for the reception of a series of wound bobbins, a horizontally disposed condensing conveyor positioned with one end in underlying relation to an end of the receiving conveyor and having a second series of bobbin holders spaced apart a relatively shorter distance than the holders of the receiving conveyor, means for driving the two conveyors at relative speeds such as to position the successive bobbin holders of the condensing conveyor opposite the holders of the condensing conveyor successively, said bobbin holders of the receiving conveyor moving through an arcuate path from a normal receiving to an inverted delivery position, and means retaining the bobbins in the receiving conveyor during such arcuate movement thereof.

8. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of the winding units and underlying the same for the reception of a series of wound bobbins, a horizontally disposed condensing conveyor positioned with one end adjacent to an end of the receiving conveyor and having a second series of bobbin holders spaced apart a relatively shorter distance than the holders of the receiving conveyor, means for driving the receiving conveyor with a continuous motion and the condensing conveyor with a step-by-step motion, and means operative upon the bobbins successively as they approach the end of the receiving conveyor for delivering the same to the condensing conveyor whereby the bobbin holders of the latter conveyor are presented successively into opposed relation to the successive holders of the receiving conveyor.

9. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a horizontally disposed receiving conveyor having a series of bobbin holders spaced apart according to the spacing of the winding units for receiving wound bobbins therefrom, means for driving the receiving conveyor with a continuous motion to carry the bobbin holders thereon to a predetermined delivery position at one end of the conveyor, a condensing conveyor having a second series of bobbin holders thereon uniformly spaced apart a distance less than the spacing of the first bobbin holders and supported for movement to said delivery position successively, means for actuating the condensing conveyor with a step-by-step motion and in timed relation to the receiving conveyor, and means for effecting the delivery of the bobbins from the successive holders of the receiving conveyor to successive holders of the condensing conveyor.

10. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a series of bobbin holders spaced apart according to the spacing of the winding units to receive wound bobbins therefrom and supported for movement successively to a predetermined delivery position, a second series of bobbin holders uniformly spaced apart a distance different from the spacing of the first series of bobbin holders and supported for movement successively into a receiving position, and means for advancing the two series of bobbin holders so as to correlate the arrival of the bobbin holders thereof into said delivery and receiving positions.

11. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism comprising a series of bobbin holders spaced according to the spacing of the winding units to receive wound bobbins therefrom and supported for movement successively to a predetermined delivery position, a second series of bobbin holders uniformly spaced a distance less than the spac-

ing of the first series of holders and also supported for movement into a predetermined position relative to said delivery position, means for advancing the first series of holders with a continuous motion, means for advancing the second series of holders with a step-by-step motion correlated with the continuous motion of the first series of holders to effect the simultaneous arrival of successive holders of each of said series to their said positions respectively.

12. In a bobbin winding machine having a plurality of winding units uniformly spaced apart horizontally, a bobbin handling mechanism for transferring a group of wound bobbins from the winding units simultaneously to a bobbin carrier having a row of closely spaced supporting elements, said mechanism comprising a series of bobbin holders spaced according to the spacing of the winding units and supported for movement successively to a predetermined delivery position, a second series of bobbin holders uniformly spaced a distance corresponding to the spacing of said supporting elements and also supported for movement to a predetermined position relative to said delivery position, means for advancing the first series of holders with a continuous motion, means for advancing the second series of holders with a step-by-step motion correlated with the continuous motion of the first series of holders to effect the simultaneous arrival in their respective predetermined positions of successive holders of each of said series, and means operative upon a group of wound bobbins in said second series of holders to transfer the same to a corresponding group of said supporting elements.

13. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising means for advancing with a step-by-step motion successive rows of bobbin supporting elements into a predetermined loading position, means for delivering successive groups of wound bobbins to said loading position including a series of bobbin holders spaced apart according to the spacing of said supporting elements in their respective rows and means for advancing the bobbin holders with a step-by-step motion, and means timed with respect to the advancing movements of the groups of supporting elements and bobbins to transfer the latter to the supporting elements.

14. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising means for advancing successive rows of supporting elements into a predetermined loading position, means for delivering successive groups of wound bobbins to said loading position including a series of bobbin holders spaced apart according to the spacing of said supporting elements in their respective rows, and means timed with respect to the advancing movements of the groups of supporting elements and bobbins to transfer the latter to the supporting elements.

15. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mech-

anism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising means for advancing with a step-by-step motion successive rows of supporting elements into a predetermined loading position, means for successively delivering successive groups of wound bobbins to said loading position including a conveyor having a series of bobbin holders spaced according to the spacing of the supporting elements and mounted for movement in a direction transversely of the conveyor, said supporting elements being disposed while in said loading position at one side of said conveyor, and means operating in timed relation to the arrival of the supporting elements and bobbins in said loading position to shift the bobbin holders whereby to transfer the bobbins therein to said supporting elements.

16. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising means for advancing successive rows of supporting elements into a predetermined loading position, means for successively delivering successive groups of wound bobbins to said loading position including a conveyor having a series of bobbin holders spaced according to the spacing of the supporting elements and mounted for movement in a direction transversely of the conveyor, said supporting elements being disposed while in said loading position at one side of said conveyor, and means operating in timed relation to the arrival of groups of supporting elements and bobbins in said loading position to shift the bobbin holders whereby to transfer the bobbins therein to said supporting elements.

17. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, comprising a frame providing guideways for slidably receiving opposite edges of pin boards having rows of bobbin supporting elements thereon with the boards in end-to-end relation, means for imparting indexing movements to the pin boards to present successive rows of supporting elements to a predetermined loading position, a conveyor having a series of bobbin holders spaced apart according to the spacing of the supporting elements in each row, means for delivering wound bobbins to said holders, means for advancing the conveyor to present successive rows of bobbins to said loading position, and means operating in timed relation to the movement of the supporting elements and bobbins into said loading position to transfer the bobbins to the supporting elements.

18. A bobbin handling mechanism for bobbin winding machines comprising, in combination, an upright frame providing a guideway for bobbin carriers having individual supporting elements arranged in horizontal rows, indexing means for advancing bobbin carriers along the guideway, means operative at a predetermined point in the travel of the carriers to deliver groups of wound bobbins to successive rows of supporting elements, and means timed with respect to said indexing means for supplying additional bobbin carriers to the guideways at the lower end of said frame, a

horizontally disposed slideway mounted near the upper end of said frame at one side thereof, a swinging support normally constituting an extension of said guideway, and means timed with said indexing means for swinging said support to transfer a loaded carrier onto said slideway.

19. A bobbin handling mechanism for bobbin winding machines comprising, in combination, an upright frame providing a guideway for bobbin carriers having individual supporting elements arranged in horizontal rows, indexing means for advancing bobbin carriers along the guideway, means operative at a predetermined point in the travel of the carriers to deliver groups of wound bobbins to successive rows of supporting elements, means timed with respect to said indexing means for supplying additional bobbin carriers to the guideways at the lower end of said frame, a horizontally disposed slideway mounted near the upper end of said frame at one side thereof, a swinging support normally constituting an extension of said guideway, and means timed with said indexing means for swinging said support to transfer a loaded carrier onto said slideway, said slideway being inclined downwardly with respect to the guideway, and said swinging support being movable into an inclined position corresponding with the inclination of the slideway.

20. A bobbin handling mechanism for bobbin winding machines comprising, in combination, an upright frame providing a guideway for bobbin carriers having individual supporting elements arranged in horizontal rows, indexing means for advancing bobbin carriers along the guideway, means operative at a predetermined point in the travel of the carriers to deliver groups of wound bobbins to successive rows of supporting elements, means timed with respect to said indexing means for supplying additional bobbin carriers to the guideways at the lower end of said frame, storage means at the upper end of said frame for receiving loaded carriers, a swinging support normally constituting an extension of said guideway, and means timed with said indexing means for swinging said support to transfer a loaded carrier to said storage means, said storage means including an elongated table providing a slideway for filled carriers, and a conveyor operatively associated with said table and timed with respect to said indexing means for advancing filled carriers along the table.

21. A bobbin winding machine having a plurality of winding units each including a winding spindle and operating in successive winding cycles to produce a set of wound bobbins, bobbin storage means including a plurality of bobbin holders for individually supporting wound bobbins, and a transfer mechanism operative automatically as an incident to the initiation of one winding cycle to deliver to holders of said storage means the bobbins wound in the preceding cycle.

22. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, a bobbin handling mechanism common to all of said winding units and operative in one cycle of the machine to receive and store the bobbins wound in the preceding cycle, said mechanism having drive means independent of that of the winding machine including a motor, a control circuit for the motor having a starting switch closed as an incident to the commencement of each winding cycle, a stopping switch automatically operated upon the completion of a predetermined operating cycle of said mechanism, and a time delay switch in shunt with said stopping switch and automatically closed upon the completion of each winding cycle to condition said circuit for the next cycle of said mechanism.

23. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, a bobbin handling mechanism common to all of said winding units and operative in one cycle of the machine to receive and store the bobbins wound in the preceding cycle, said mechanism having drive means independent of that of the winding machine including a motor, a control circuit for the motor, means operative as an incident to the initiation of each winding cycle to close said circuit, means including a driven member for opening the motor circuit to stop the motor upon the completion of an operating cycle of said mechanism, and means responsive to the completion of each winding cycle for conditioning said circuit for starting of said motor notwithstanding the interruption thereof by said stopping means.

24. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, a bobbin handling mechanism common to all of said winding units and operative in one cycle of the machine to receive and store the bobbins wound in the preceding cycle, said mechanism having drive means independent of that of the winding machine including a motor, a control circuit for the motor, means including a member driven by said motor for opening said circuit to stop the motor, and means responsive to the completion of each winding cycle for conditioning said circuit for the starting of said motor notwithstanding the interruption thereof by said stopping means.

25. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, a bobbin handling mechanism common to all of said winding units and operative in one cycle of the machine to receive and store the bobbins wound in the preceding cycle, said mechanism having drive means independent of that of the winding machine including a motor, a control circuit for the motor having a starting switch closed as an incident to the commencement of each winding cycle, and a stopping switch for the motor automatically operated upon the completion of a predetermined operating cycle of said mechanism.

26. In a bobbin winding machine having a plurality of winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring winding cycles, a bobbin handling mechanism common to all of said winding units and operative in one cycle of the machine to receive and store the bobbins wound in the preceding cycle, said mechanism having drive means independent of that of the winding machine including a motor, a control circuit for the motor, and means operative as an incident to the initiation of each winding cycle to close said circuit to start said motor.

27. In a bobbin winding machine having a plurality of spaced winding units operative simultaneously to wind a plurality of bobbins in each of a series of automatically recurring wind-

ing cycles, mechanism operative in one cycle for transporting and storing the bobbins wound in the preceding cycle, said mechanism comprising a conveyor operative to advance successive groups of bobbin supporting elements into a predetermined loading position with the elements in predetermined spaced relation, means including a second conveyor for receiving wound bobbins wound by said units with the bobbins arranged in spaced relation according to the spacing of said bobbin supporting elements, means for advancing the second conveyor to present successive groups of bobbins to said loading position, and means operating in timed relation to said conveyors for transferring the bobbins of each group thus presented to the loading position to said supporting elements simultaneously.

28. A bobbin winding machine having a plurality of winding units arranged in uniformly spaced relation and operative in each of a series of recurring winding cycles to produce a set of wound bobbins, bobbin storage means providing a plurality of spaced bobbin holders for individually supporting wound bobbins, and a transfer mechanism operative automatically as an incident to the initiation of one winding cycle to deliver to said storage means the set of bobbins wound in the preceding cycle, said mechanism including a conveyor having bobbin carriers spaced apart according to the spacing of the holders of said storage means, a second conveyor having bobbin carriers spaced apart in accordance with the spacing of said winding units and operable to transfer the wound bobbins therefrom to the first conveyor, and means operative in timed relation to said second conveyor for transferring the wound bobbins thereon to said holders of the storage means.

29. The combination with a bobbin winding machine having a plurality of winding units operative in a series of automatically recurring winding cycles to wind and doff groups of bobbins, mechanism operative in one cycle for storing the group of bobbins wound in the preceding cycle comprising means for supporting for movement in a predetermined path a series of bobbin carriers having rows of individual bobbin supporting elements thereon, means for indexing the bobbin carriers to present successive rows of supporting elements to a predetermined loading position in said path, a conveyor having a series of bobbin holders spaced apart according to the spacing of the supporting elements in each row, means for advancing the conveyor to present successive rows of bobbins to said loading position, and means operating in timed relation to the movement of the supporting elements and bobbins into said loading position to transfer the bobbins from the conveyor to the supporting elements.

30. The combination with a bobbin winding machine having a plurality of winding units operative simultaneously to wind a group of bobbins in each of a series of automatically recurring winding cycles, mechanism operative in one cycle for storing the bobbins wound in the preceding cycle comprising means for supporting for movement in a predetermined path bobbin carriers having rows of individual bobbin supporting elements thereon projecting to one side of said path, means for indexing the bobbin carriers to present successive rows of supporting elements to a predetermined loading position in said path, a conveyor having a series of bobbin holders spaced apart according to the spacing of the supporting elements in each row and disposed at one side of said path, means for advancing the conveyor to present successive rows of bobbins to said loading position, means operating in timed relation to the movement of the supporting elements and bobbins into said loading position to transfer the bobbins into said loading position to transfer the bobbins from the conveyor to the supporting elements, and means for automatically delivering bobbin carriers to said supporting means in operative association with said indexing means including a second conveyor having a plurality of carrier holders mounted for movement in a direction perpendicular to said path, and drive means for said second conveyor operative to advance the carriers step by step toward said supporting means.

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