June 6, 1967 R. W. PETERS 3,323,734

STATOR CORE WINDING MACHINE

Filed April 2, 1965 3 Sheets-Sheet 1

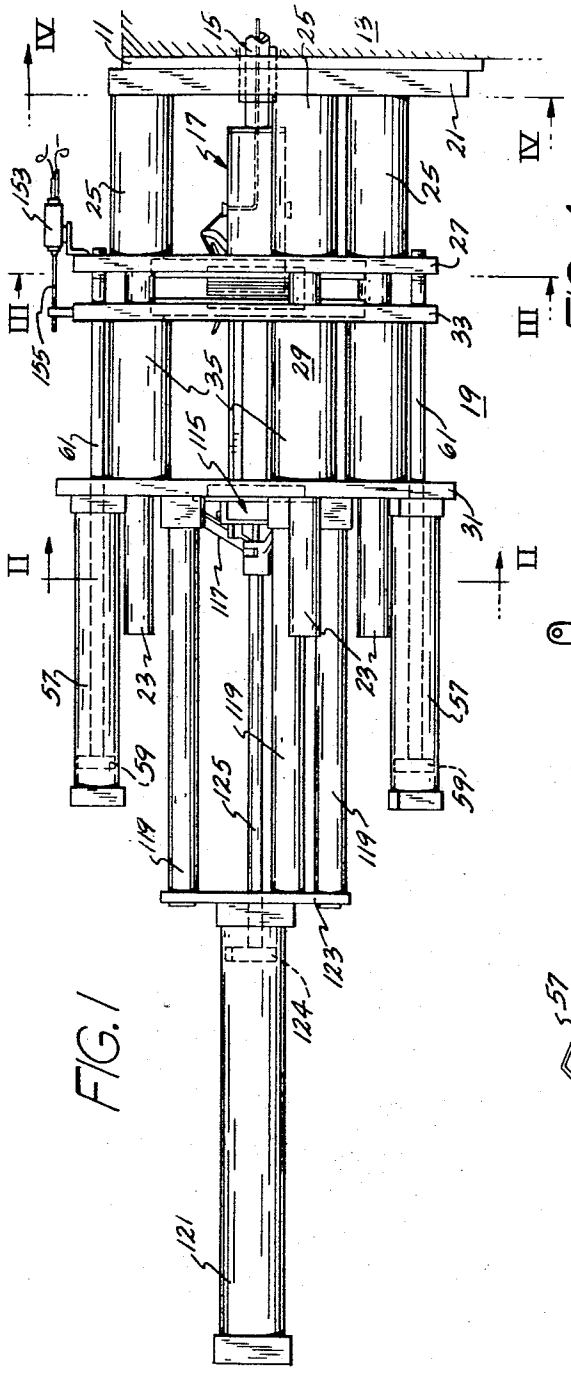

FIG. 1

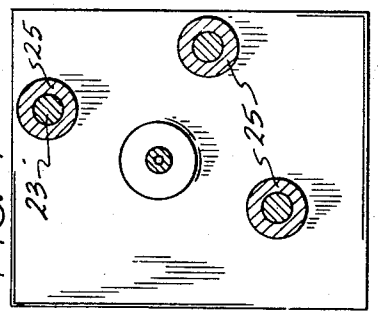

FIG. 4

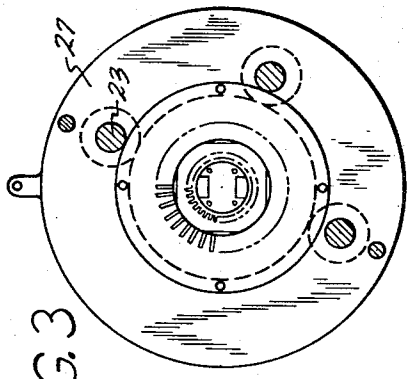

FIG. 3

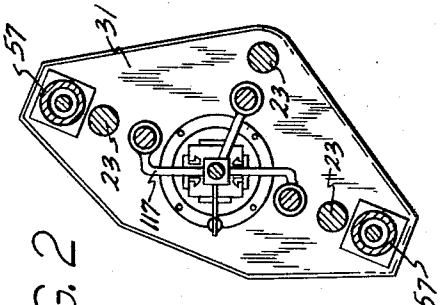

FIG. 2

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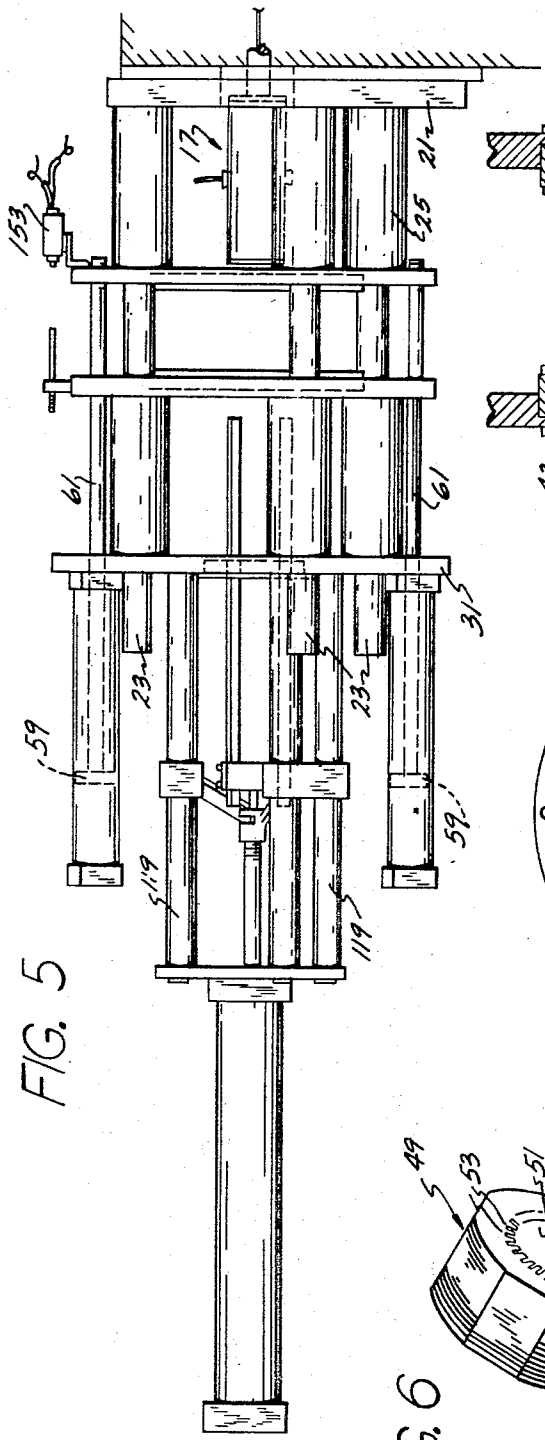

FIG. 5

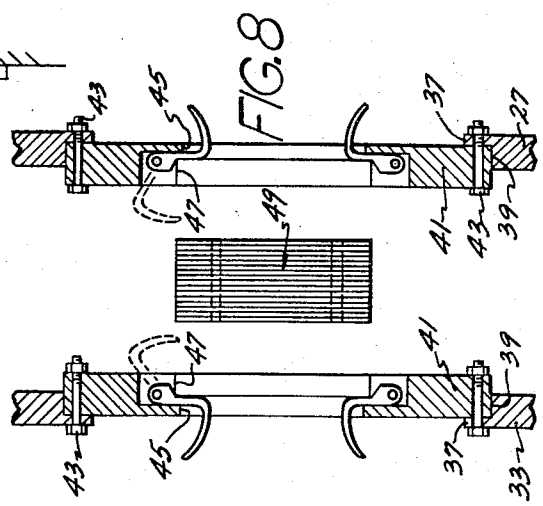

FIG. 8

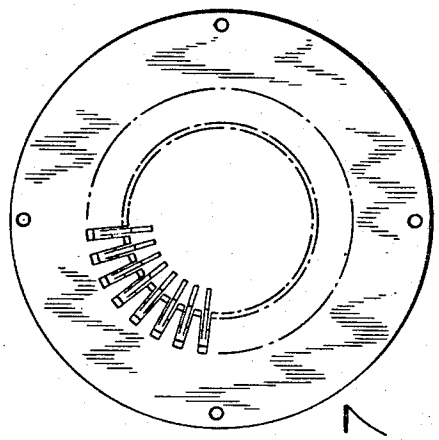

FIG. 7

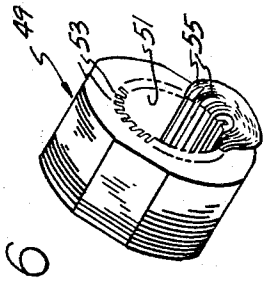

FIG. 6

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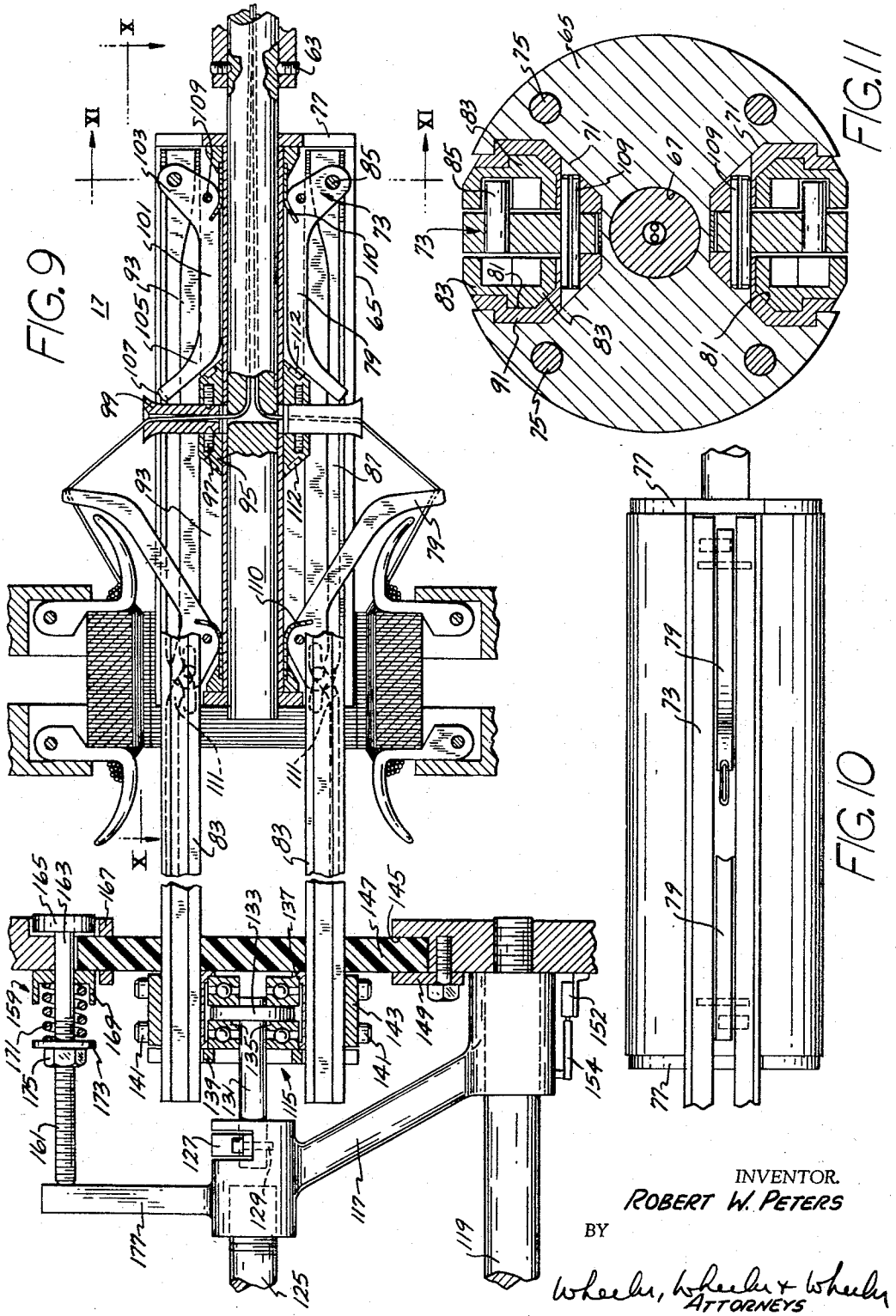

FIG. 9

FIG. 11

FIG. 10

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United States Patent Office 3,323,734 Patented June 6, 1967

3,323,734

STATOR CORE WINDING MACHINE

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Filed Apr. 2, 1965, Ser. No. 445,010
15 Claims. (Cl. 242—1.1)

The invention relates generally to coil winding apparatus and more particularly to apparatus for winding stator coils with machines such as disclosed in the Gorski et al. Patent No. 3,052,418. The machine disclosed in the Gorski patent is designed to effect reciprocation and oscillation of a winding head about a common axis.

In application Ser. No. 340,302, filed Jan. 27, 1964, and assigned to the assignee of this invention, there is provided a winding head which includes one or more lift levers having wire guiding means, which lift levers are operated to radially outwardly displace such wire guiding means as the head approaches the limits of its reciprocatory movement. During oscillation, the wire guiding means is retained in its radially outwardly located position. Operation of the lift levers is afforded by plungers carried by the head and operable against abutments supported by the machine.

The invention disclosed herein provides another arrangement for pivotally operating such lift levers in response to reciprocatory head movement and generally affords the advantages noted in said application Ser. No. 340,302. Specifically, in accordance with the invention, each lift lever is operated in response to head reciprocation by action of a follower which is mounted on the lever and which is received in a cam slot formed in a cam bar relative to which the winding head reciprocates. In the specifically disclosed construction, the head is provided with guideways which receive the cam bar and which afford reciprocation of the head relative to the cam bar. In addition, the cam bars are mounted by means affording oscillation thereof in unison with oscillation of the head and by means affording linear adjustment of the cam bars relative to the head to afford coordination with adjustment of the stroke length of the head, whereby the lift levers may be operated in response to approach of the head to the limits of its reciprocatory movement notwithstanding variation in the length of the reciprocatory movement.

In addition to the foregoing, the invention also provides for withdrawal of the cam bars from the head to afford loading and unloading of the apparatus, for a brake which prevents oscillation of the cam bars from a position in registry with the guideways on the head when the cam bars are withdrawn from the head, and for an interlock which prevents machine operation to effect head oscillation whenever the cam bars are withdrawn from the head.

Other objects and advantages of the invention will become known by reference to the following description and the accompanying drawings of one embodiment of the invention.

In the drawings:

FIGURE 1 is a fragmentary view of a coil winding machine including a coil winding attachment which is in accordance with the invention and which is shown in its closed or stator winding position;

FIGURE 2 is a sectional view taken generally along line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken generally along line 3—3 of FIGURE 1;

FIGURE 4 is a sectional view taken generally along line 4—4 of FIGURE 1;

FIGURE 5 is a view similar to FIGURE 1 showing the coil winding attachment in its open position affording stator loading and unloading;

FIGURE 6 is a fragmentary perspective view of a stator adapted for winding by the machine shown in FIGURES 1 and 5;

FIGURE 7 is an enlarged view of a portion of the tooling employed during stator winding;

FIGURE 8 is an enlarged fragmentary view, partially in section, illustrating the cooperation between the stator holding plates and the stator;

FIGURE 9 is an enlarged fragmentary view, partially schematic and partially enlarged and in section, of the arrangement shown in FIGURE 1;

FIGURE 10 is a view taken generally along line **10—10** of FIGURE 9; and

FIGURE 11 is a sectional view taken generally along line **11—11** of FIGURE 9.

Shown in the drawings is a mounting plate **11** which forms a part of a coil winding machine **13**, such as shown in the Gorski et al., Patent 3,052,418. Said machine **13** includes a hollow shuttle **15** adapted to support a winding head **17** and is operable to reciprocate and oscillate the the shuttle **15** relative to the mounting plate **11**. Said machine also includes a brake, (not shown), for preventing shuttle movement.

Suitably fixed to the mounting plate **11** is an attachment **19** including a support plate **21** which has extending therefrom three support rods **23**. Surrounding the support rods **23** are respective collars **25**. Spaced from the support plate **21** by the collars **25** and fixedly mounted on the support rods **23** is a fixed tool or stator holding plate **27**. Slidably carried on the support rods **23** is a movable tool supporting assembly **29** including a stator supporting or mounting plate **31**, a movable tool holding plate **33**, and spacers or collars **35** interconnecting the movable mounting plate **31** and the movable tool holding plate **33**.

The tool holding plates **27** and **33** each respectively include (see FIGURE 8) central apertures **37** through which the winding head **17** is movable, together with facing annular recesses or counterbores **39**, which provides seats for respective tooling rings **41**. Specifically, as shown in FIGURE 8, the tooling rings **41** are generally identical, except for being left and right handed, and are attached to the tool holding plates **27** and **33** by bolts **43**. The tooling rings **41** are also each centrally apertured at **45** and include facing annular recesses or seats **47**, which receive and support a stator **49** to be wound.

In conventional construction, as shown in FIGURE 6, the stator **49** includes a central bore **51** through which the winding head **17** passes and a plurality of slots **53** which extend radially outwardly of the bore **51** and which receive the wire coils **55** laid by the winding head **17**.

Means are provided for displacing the tool holding assembly **29** toward and away from the fixed tool holding plate **27** between a closed or stator supporting position and a relatively open position affording loading and unloading of the stator **49** with respect to the tooling rings **41**. While various arrangements can be employed, in the disclosed construction, there is fixed on the mounting plate **31** a pair of double acting fluid cylinders **57**, each having a piston **59** and a piston rod **61** which extends through the mounting plate **31**, and through the movable tool holding plate **33** to a fixed connection with the fixed tool holding plate **27**. Accordingly, upon introduction of fluid to the left of the pistons **59** as shown in FIGURE 1, the assembly **29** moves to the open position shown in FIGURE 5. Introduction of fluid to the right of the pistons **59** when the assembly is located as shown in FIGURE 5,

will displace the assembly **29** to the closed stator supporting position shown in FIGURE 1.

The winding head **17** is mounted or connected to the shuttle **15** for reciprocation and oscillation therewith by suitable means such as the set screw **63** (see FIGURE 9). The winding head **17** can be constructed in various ways. In the disclosed construction, the winding head comprises a generally cylindrical member or main body **65** having therein a central aperture or bore **67** which communicates with the hollow interior of the shuttle **15** to afford passage of the wire which is laid in the slots **53** to form the coils **55**. The main body **65** also includes therein one or more axially extending recesses **71** adapted to receive a lift lever assembly **73**. At its ends, the main body has fixed thereto, as by the bolts **75**, rings or stops **77** which prevent axial displacement of the lift lever assemblies **73**.

Each lift lever assembly **73** includes a pair of axially aligned lift levers **79**, means mounting the lift levers for pivotal movement outwardly from generally recessed positions within the head **17**, and means defining a pair of axially and linearly extending cam tracks or guideways **81** which are located on opposite sides of the lift levers and which receive respective cam bars **83** supported by the movable assembly **29**. Extending from the lift levers are respective followers **85** which are respectively received in cam slots **87** in the respective cam bars **83**, whereby pivotal lift lever movement is provided in response to winding head reciprocation.

More specifically, each lift lever assembly **73** includes a housing **91** which is removably retained in one of the recesses **71** by the rings **77**. Each housing includes a pair of recesses **93** extending axially from a transverse central hub or wall **95**. Mounted in the central wall by suitable means, such as screws **97**, is a radially projecting hollow needle **99** communicating with the winding head bore **67**.

Respectively located in each recess **93** is one of the lift levers **79**. Each lift lever is generally of identical construction and includes a main part **101** having, at one end, a leg portion **103** and, at the other end, an arm portion **105**, which leg and arm portions extend in outwardly diverging relation from the ends of the main part **101**. The arm portion **105** terminates in wire guiding means **107**, which can take various forms and which, in the disclosed construction, is in the form of a smooth surfaced slot.

Means are provided for movably mounting the lift lever to afford radially outward movement of the wire guiding means in response to winding head reciprocation. In the specifically disclosed construction, means in the form of a pin **109** extends between the lift lever leg portion **103** and the housing **91** to pivotally mount the lift lever for oscillation about an axis transverse to the associated cam track and relative to a retracted position in the associated one of the recesses **93** and with the cam follower **85** extending into the cam track **81** for receipt in the associated slot **87**. The lift levers **79** are respectively mounted in the recesses **93** so that the leg portions **103** are adjacent the ends of the head **17** and so that the wire guiding means **107** travels in an arc terminating in adjacent relation to the needle **99**, whereby wire is received in the slot and guided in response to pivotal movement of the lift lever from the head as the head **17** approaches the ends of its stroke. Means in the form of a spring **110** is provided in association with each lift lever **79** to cushion return of the lift lever to its retracted position in accordance with cooperation between the followers **85** and the cam bars **83**. In addition, if desired, magnet buttons **112** or other releasable means can be employed to aid in retaining the lift levers in their retracted positions during reciprocation of the head. Also carried by the leg portion **103** of each lift lever is the before-mentioned follower **85**.

The cam slots **87** which cooperate to pivot the lift levers **79** as the head **17** approaches the end of its stroke each include an inclined portion or surface **111** which cooperates with the associated lift lever follower **85** to cause lift lever pivotal movement from retracted position and to aid in lift lever return to retracted position during head reciprocation.

Means are provided to support the cam bars **83** externally or independently of the head **17** while also affording cam bar retraction and insertion relative to the head **17**, cam bar rotation or oscillation in unison with the head **17** when inserted in the head, and cam bar adjustment relative to the head **17** in the direction of head reciprocation to vary the time of lift lever actuation in accordance with variation in the stroke length of the winding head, thereby accommodating operation to stators of differing thickness.

While various arrangements can be employed, in the disclosed construction, the cam bar supporting means includes a clamp assembly or fixture **115** (see FIGURES 1 and 9) which clampingly engages the cam bars **83** and which is rotatably carried on a movable carriage or means **117** supported by a series of support rods **119** extending from the mounting plate **31** of the movable assembly **29**. The carriage **117** is displaceable relative to the mounting plate **31** between an operating position affording extension of the cam bars **83** beyond the movable tool holding plate **33** toward the fixed tool holding plate **27** and into the winding head, and a retracted position wherein the cam bars **83** are withdrawn from the winding head and do not extend beyond the movable tool holding plate **33**, thereby facilitating stator loading and removal.

While various arrangements can be employed to displace the carriage **117** between its two positions, in the disclosed construction, such means is in the form of a fluid cylinder **121** (see FIGURE 1) which is carried on a plate **123** fixed to the ends of the support rods **119** and which contains a piston **124** connected to a piston rod **125** connected to the carriage **117**.

Considering now the clamping assembly **115** and its connection to the carriage **117** in greater detail (see FIGURE 9), the carriage **117** has detachably connected thereto, by means of a clamping block **127** and bolt **129**, a stud **131** which extends in alignment with the piston rod **125**. Adjacent its outer end, the stud **131** includes a head or disk **133**. Rotatably carried by the stud **131** is the clamping assembly **115**. While various arrangements can be employed to rotatably mount the clamping assembly **115**, in the disclosed construction, combination radial and thrust bearings **135** are engaged with the stud **131** and with both sides of the disk **133** and are carried in a cage or clamping member **137**. A ring or plate **139** is bolted or otherwise connected to the cage **137** to retain the bearings **135** in the cage **137**. Fixed to the cage **137**, as by a series of bolts **141**, are a series of clamps **143**, each fixably securing one of the camming bars **83** to the cage **137**. Rotation of the cam bars **83** relative to the carriage **117** is thereby afforded while providing for lengthwise movement of the cam bars **83** with the carriage **117** and while also affording lengthwise adjustment of the cam bars **83** with respect to the carriage **117**.

Means are also provided on the movable mounting plate **31** for affording and guiding oscillation of the cam bars **83** in concert with oscillation of the head **17**, while permitting lengthwise movement of the cam bars **83** relative to the plate **31** in accordance with carriage movement. In the disclosed construction, such means is in the form of a counterbored aperture **145** in the mounting plate **31**, and a disk **147** which is rotatably received in the counterbore **145**, and which is fabricated of brass to include a bearing or guideway for each cam bar **83**. The disk can be fabricated from a plastic material such as is sold under the trademarks "Teflon" or "Nylon." The disk **147** is retained in the counterbore **145** by a retaining ring **149** which is bolted to the mounting plate **31**. Accordingly, when the cam bars **83** oscillate in response to head oscillation, the disk **147** rotates relative to the mounting plate **31**.

In order to retain the cam bars **83** and the head **17** in registry for insertion of the cam bars **83** into the head **17**, means are provided for preventing rotation of both the cam bars **83** and the head **17** whenever the cam bars

83 are withdrawn from the head 17. While various arrangements can be employed, in the disclosed construction, the means preventing head oscillation comprises a normally open switch 152 (see FIGURE 9) which is mounted on the plate 31 and which is closed by an actuator 154 carried by the carriage 117 when the carriage is located most proximate to the mounting plate 21. When open, the switch 152 serves to effect operation of the brake which prevents shuttle movement.

If desired, a second switch 153 (see FIGURE 1) can be mounted on the fixed mounting plate 27 and adapted to be closed by a button or actuator 155 carried by the movable mounting plate 31 when the movable mounting plate 31 is in its closed or stator holding position. When open, the switch 153 also serves to actuate the brake which prevents shuttle movement. Whenever the mounting plate 31 is withdrawn from its stator holding position to its open position, the button 155 is disengaged from the switch 153, thereby interrupting a circuit controlling driving or movement of the head 17. As a result, head movement is prevented when the switch 153 is open.

Various means or arrangements can be employed to prevent rotation of the cam bars 83 when the bars 83 are withdrawn from the head 17. In the disclosed construction, such means is in the form of a brake 159 (see FIGURE 9) which is operable to prevent rotation of the disk 147, and therefore camming bar rotation, whenever the carriage 117 is displaced from its position effecting full insertion of the cam bars 83 relative to the head 17.

More specifically, the brake 159 comprises a threaded shaft 161 which passes through an aperture 163 in the movable mounting plate 31. The shaft 161 includes an enlarged head 165 which is received in a counterbored recess 167 in the mounting plate 31 and which is adapted to at least partially engage the disk 147. Extending from a seat 169 surrounding the shaft 161 on the spposite side of the mounting plate 31 from the recess 167 is a spring 171 which engages another seat in the form of a washer 173 retained on the shaft 161 by a nut 175. The spring 171 normally serves to displace the washer 173 away from the mounting plate 31 to thereby engage the head 165 with the disk 147 to prevent disk rotation.

Means are provided for relieving the braking engagement of the head 165 with the disk 147 when the carriage 117 is in its position affording full insertion of the cam bars 83 in the head 17. Such means is in the form of an arm 177 engaging the end of the shaft 161 to axially displace the shaft to the right as shown in FIGURE 5 against the action of the spring 171, thereby disengaging the head 165 from the disk 147 and thereby releasing the disk for rotation.

In operation, the carriage 117 and then the movable assembly 29 are first actuated sequentially by their respective cylinders 121 and 57 for movement to their open positions. Subsequently, the stator 49 is placed between the tooling rings 41 and the movable assembly 29 is displaced to the right as shown in the drawings to its closed position to retain the stator 49 between the mounting plates 27 and 31. Such movement closes the switch 153. The carriage 117 is then displaced toward the stator 49 to insert the cam bars 83 into the winding head 17. Such movement closes the switch 152 and releases the brake 159 to afford movement of the winding head 17 and rotation of the disk 147. Subsequent operation of the winding machine 13 affords winding head 17 reciprocation and oscillation. During winding head reciprocation, travel of the followers 85 relative to the cam slots 87 in the engaged cam bars 83 is effective to pivot the lift levers 79 to their raised or elevated positions as the winding head approaches the ends of its reciprocating stroke, to retain the lift levers in elevated position during windnig head oscillation, and to return the lift levers to their retracted positions in response to winding head movement from the ends of its reciprocatory stroke.

Various of the features of the invention are set forth in the following claims.

What is claimed is:

1. In a winding machine, the combination of a winding head including therein a cam track, a lift lever having a cam follower, and means movably mounting said lift lever with said follower extending into said cam track, means mounting said winding head for reciprocation and for oscillation, a cam bar extending into said cam track and having therein a cam surface engageable with said follower, said cam surface being proportioned to effect movement of said lift lever in response to reciprocation of said head, and mounting means supporting said cam bar independently of said head and affording oscillation of said cam bar in unison with said head.

2. In a winding machine, the combination of a winding head including therein a linearly extending cam track, a lift lever having a cam follower, and means pivotally mounting said lift lever about an axis transverse to said cam track and with said follower extending into said cam track, means mounting said winding head for reciprocation in a direction parallel to said cam track, a cam bar extending into said cam track and having therein a cam surface engageable with said follower, said cam surface being proportioned to effect movement of said lift lever about said pivotal mounting means in response to relative reciprocation between said head and said cam bar, and mounting means supporting said cam bar independently of said head and affording oscillation of said cam bar in unison with said head.

3. In a winding machine, the combination of a winding head including a main body having therein a linearly extending cam track and a recess adjacent to said cam track, said winding head also including a lift lever having a cam follower and wire guiding means, said winding head also including means in said recess pivotally mounting said lift lever with said follower extending into said cam track and about an axis transverse to said cam track for lift lever movement between a retracted position substantially in said recess and an extended position wherein said wire guiding means is located outwardly of said recess, means mounting said winding head for reciprocation in a direction parallel to said cam track and for oscillation about an axis parallel to said cam track, a cam bar extending into said cam track and having therein a cam surface engageable with said follower, said cam surface being proportioned to effect movement of said lift lever about said pivotal mounting means in response to relative reciprocation between said head and said cam bar and approach of said winding head to one limit of its reciprocation, and mounting means supporting said cam bar independently of said head and affording relative reciprocation therebetween in response to head reciprocation, oscillation of said cam bar in unison with said head, and withdrawal of said cam bar from said cam track.

4. In a winding machine, the combination of a winding head including therein a pair of adjacent cam tracks, a pair of lift levers each having a cam follower, and means pivotally mounting said lift levers with one of said followers extending into one of said cam tracks and with the other of said followers extending into the other of said cam tracks, means mounting said winding head for reciprocation and for oscillation, cam bars respectively extending into said cam tracks, each cam bar having therein a cam surface engageable with the associated one of said followers, said cam surface being proportioned to effect pivotal lift lever movement in response to reciprocation of said head, and mounting means supporting said cam bars independently of said head and affording oscillation of said cam bars in unison with said head.

5. In a winding machine, the combination of a winding head including therein a plurality of pairs of adjacent cam tracks, a like plurality of pairs of lift levers

each having a cam follower, and means pivotally mounting said lift lever with a separate one of said followers extending into each of said cam tracks, means mounting said winding head for reciprocation and for oscillation, a like plurality of cam bars extending into said cam tracks, each cam bar having therein a cam surface engageable with the associated one of said followers, said cam surface being proportioned to effect pivotal lift lever movement in response to reciprocation of said head, and mounting means supporting said cam bars independently of said head and affording oscillation of said cam bars in unison with said head.

6. In a winding machine, the combination of a winding head including an elongated main body having therein a pair of adjacent cam tracks etxending lengthwise of said main body and a pair of recesses located between said cam tracks and extending in lengthwise alignment, said winding head also including a needle located between said cam tracks and said recesses, a pair of lift levers each having a cam follower and wire guiding means, and said winding head also including means in one of said recesses pivotally mounting one of said lift levers and means in the other of said recesses pivotally mounting the other of said lift levers, said lift levers being mounted with said wire guiding means being located adjacent to said needle, with said follower on one of said lift levers extending into one of said cam tracks and with said follower on the other of said lift levers extending into the other of said cam tracks, and about axes transverse to said cam tracks for lift lever movement between retracted positions substantially in said recesses and extended positions wherein said wire guiding means are located outwardly of said recesses, means mounting said winding head for reciprocation and for oscillation, cam bars extending respectively into said cam tracks, each cam bar having therein a cam surface engageable with the associated one of said followers, said cam surface being proportioned to effect pivotal lift lever movement in response to reciprocation of said head, and mounting means supporting said cam bars independently of said head and affording oscillation of said cam bars in unison with said head.

7. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track, and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate, support means extending from said mounting plate, a stator supporting plate mounted on said support means extending from said mounting plate for movement toward and away from a stator supporting position, support means extending from said stator supporting plate, and a member carried by said support means extending from said stator supporting plate for rotation about an axis coinciding with the oscillatory axis of said head, said member having bearing means receiving said cam bar.

8. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track, and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means for movement toward and away from said mounting plate, said assembly including a member carried for rotation about an axis coinciding with the oscillatory axis of said head, said member having bearing means receiving said cam bar, said assembly also including another support means extending away from said mounting plate, and means movable on said other support means and connected to said cam bar for affording oscillation of said cam bar with said head and for displacing said cam bar so as to afford withdrawal of said cam bar from said head.

9. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar removably received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means extending from said mounting plate for movement toward and away from said mounting plate, said assembly including another support means extending away from said mounting plate, means movable on said other support means between a first position relatively proximate to said mounting plate and a second position relatively remote from said mounting plate, and means connecting said cam bar and said movable means to afford receipt of said cam bar in said cam track when said movable means is in said first position, withdrawal of said cam bar from said cam track when said movable means is in said second position, and oscillation of said cam bar is common with said head when said cam bar is received in said head.

10. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar removably received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means extending from said mounting plate for movement toward and away from said mounting plate, said assembly including another support means extending away from said mounting plate, means movable on said other support means between a first position relatively proximate to said mounting plate and a second position relatively remote from said mounting plate, means connecting said cam bar and said movable means to afford receipt of said cam bar in said cam track when said movable means is in said first position, withdrawal of said cam bar from said cam track when said movable means is in said second position, and oscillation of said cam bar in common with said head when said cam bar is received in said head, and means on said movable assembly for preventing cam bar oscillation and for preventing movement of said head in response to movement of said movable means from said first position.

11. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar removably received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means extending from said mounting plate for movement between a first, stator supporting position relatively proximate to said mounting plate and a second position relatively remote from said mounting plate, said assembly including another support means extending away from said mounting plate, means movable on said other support means between a first position relatively proximate to said mounting plate and a second position relatively

remote from said mounting plate, means connecting said cam bar and said movable means to afford receipt of said cam bar in said cam track when said movable means is in said first position, withdrawal of said cam bar from said cam track when said movable means is in said second position, and oscillation of said cam bar in common with said head when said cam bar is received in said head, means on said movable assembly for preventing cam bar oscillation and for preventing movement of said head in response to movement of said movable means from said first position, and means for sequentially displacing said movable means from said first position and said movable assembly from said first position to afford stator withdrawal.

12. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including therein a cam track and a pivotally mounted lift lever having a follower extending into said cam track, a cam bar removably received in said cam track and having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means extending from said mounting plate for movement between a first position relatively proximate to said mounting plate and a second position relatively remote from said mounting plate, said assembly including another support means extending away from said mounting plate, means movable on said other support means between a first position relatively proximate to said mounting plate and a second position relatively remote from said mounting plate, means connecting said cam bar and said movable means to afford receipt, when said movable assembly is in said first position, of said cam bar in said cam track when said movable means is in said first position, withdrawal of said cam bar from said cam track when said movable means is in said second position, and oscillation of said cam bar in common with said head when said cam bar is received in said head, a member carried by said movable means for rotation about an axis coinciding with the oscillatory axis of said head and located between said mounting plate and said connecting means, said member having bearing means receiving said cam bar, means on said movable assembly for preventing rotation of said member in response to movement of said movable means from said first position, and means on said movable assembly for preventing movement of said head in response to movement of said movable means from said first position.

13. In a winding machine, the combination of a winding head including a lift lever having a cam follower and means pivotally mounting said lift lever, means mounting said winding head for reciprocation and for oscillation, a

cam bar having a cam slot engageable with said follower, said cam slot being proportioned to effect movement of said lift lever about said pivotal mounting means in response to reciprocation of said head, and mounting means supporting said cam bar independently of said head and affording oscillation of said cam bar in unison with said head.

14. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including a pivotally mounted lift lever having a follower, a cam bar having therein a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate, support means extending from said mounting plate, a stator supporting plate mounted on said support means extending from said mounting plate for movement toward and away from a stator supporting position, support means extending from said stator supporting plate, and a member carried by said support means extending from said stator supporting plate for rotation about an axis coinciding with the oscillatory axis of said head, said member having bearing means receiving said cam bar.

15. The combination in a winding machine of a winding head mounted for reciprocating and oscillating movement and including a pivotally mounted lift lever having a follower, a cam bar having a cam slot receiving said follower, said cam slot being proportioned to effect pivotal movement of said lift lever in response to reciprocation of said head, a mounting plate having support means extending therefrom, an assembly mounted on said support means for movement toward and away from said mounting plate, said assembly including a member carried for rotation about an axis coinciding with the oscillatory axis of said head, said member having means receiving said cam bar, said assembly also including another support means extending away from said mounting plate, and means movable on said other support means and connected to said cam bar for affording oscillation of said cam bar with said head and for displacing said cam bar relative to said head.

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