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# MACHINE FOR WINDING PIRNS

Filed March 13, 1950

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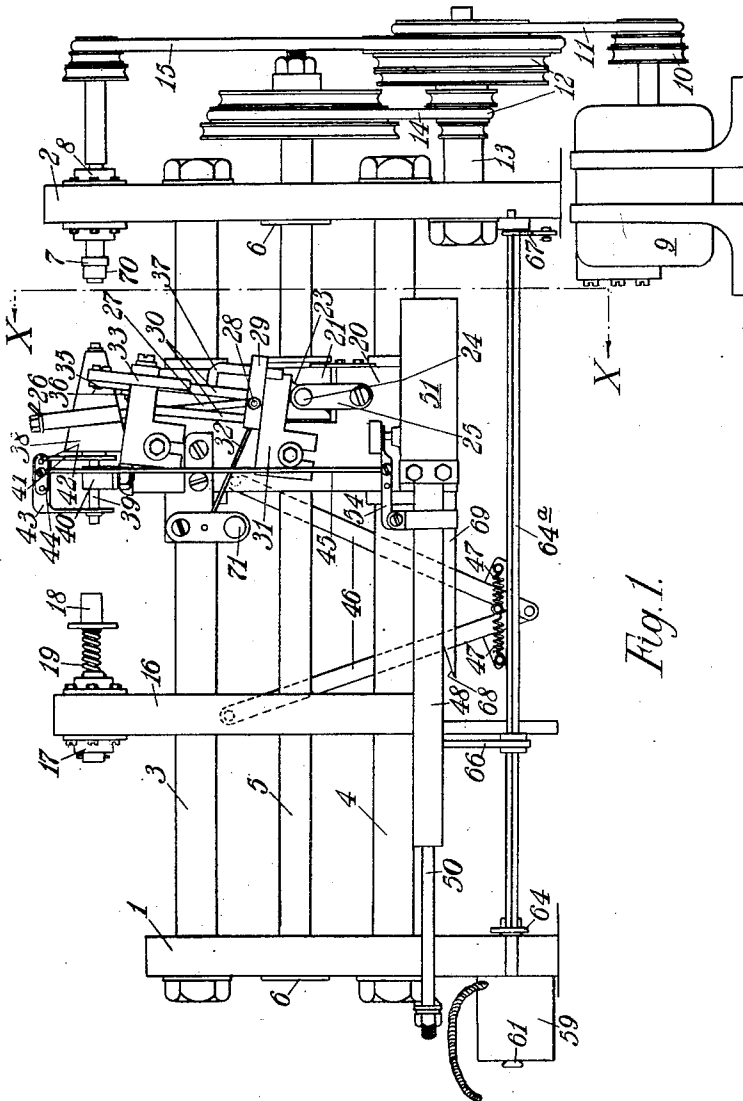


Fig. 1.

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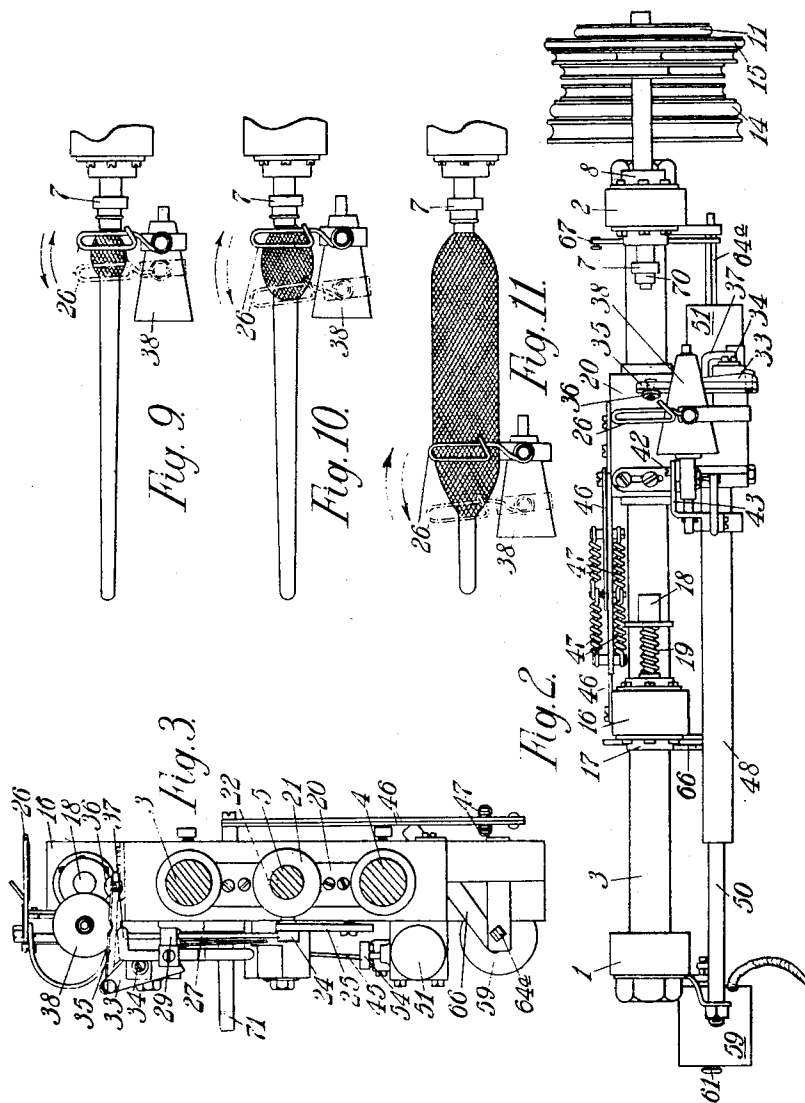
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3 Sheets-Sheet 2



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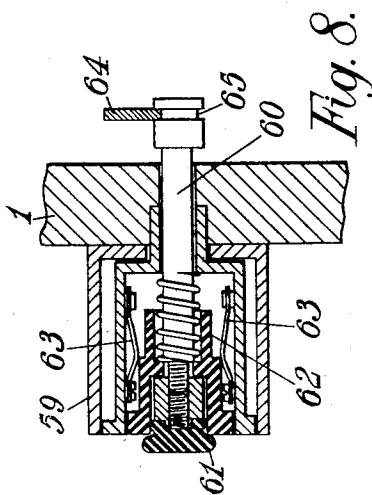
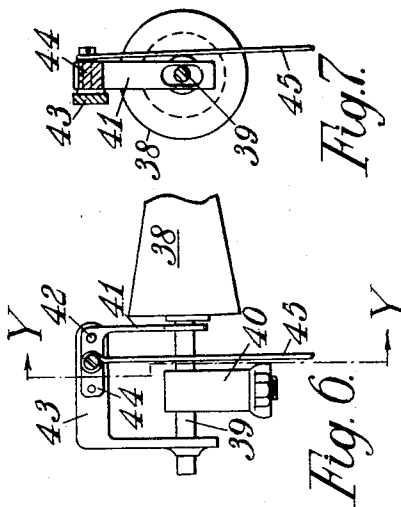
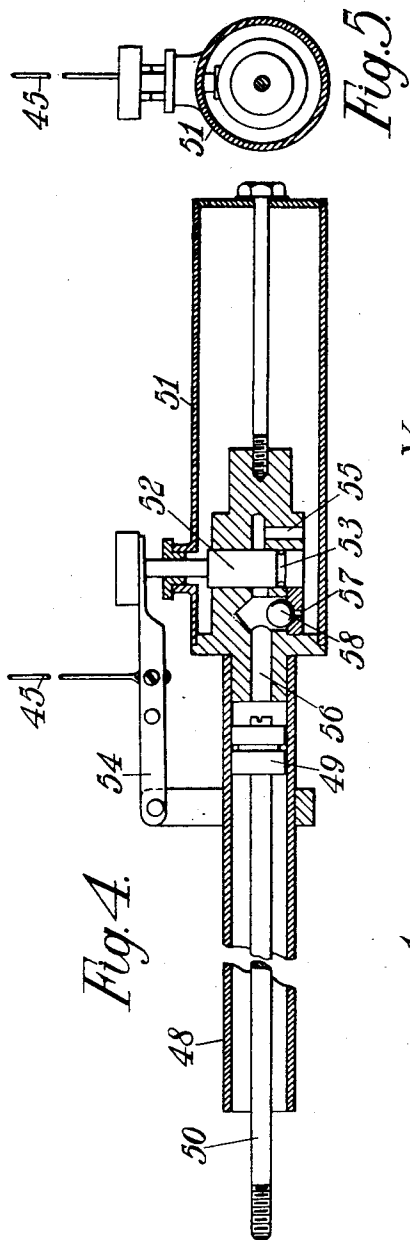
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MACHINE FOR WINDING PIRNS

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,603,424

## MACHINE FOR WINDING PIRNS

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28 Claims. (Cl. 242—31)

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This invention relates to machines for winding yarn or like material upon pirns, or tubes which are adapted to be placed in the shuttles of looms, in layers at an angle to the axis of the pirn or tube so that the finished pirn has a tapered end or ends.

The object of the invention is to provide an improved machine for the above purpose which is capable of winding a pirn of any predetermined diameter, and a further object is to enable the said predetermined diameter to be maintained irrespective of the varying thickness of the yarn, wool or other material being wound.

The invention comprises heads or centres for rotatably carrying and driving a pirn, a slidable support or carriage carrying a displaceable thread guide and means for effecting reciprocation of the guide for winding, and means for effecting progressive displacement of the carriage relative to the pirn in accordance with the built up diameter of the material wound thereon.

The invention also comprises a machine for the purpose described, comprising heads of centres for rotatably carrying and driving a pirn, a slidable support or carriage carrying a displaceable thread guide and means for effecting reciprocation of the guide for winding, and hydraulic means for effecting or controlling progressive displacement of the support or carriage relative to the pirn in accordance with the built up diameter of the material wound thereon.

The invention further comprises an arrangement according to either of the two preceding paragraphs, including a former adapted to be engaged by the material built up on the pirn and displaceable with respect thereto, and means actuated by such displacement for effecting progressive displacement of the support or carriage. According to a further feature of the invention, the former is of conical or similar shape and is displaceable axially in a direction parallel with the axis of the pirn when engaged by the material wound thereon.

The invention also comprises the feature of hydraulic means for controlling the progressive displacement of the support or carriage, said control being effected by a valve actuated in accordance with the diameter of the material wound upon the pirn. According to a further feature of the invention, the hydraulic device comprises a piston and cylinder containing hydraulic medium arranged to resist displacement of the carriage against loading spring means, and a control valve actuated by displaceable means such as a former for detecting the diameter of the wound material and for opening

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the valve when a predetermined diameter is reached to permit progressive displacement of the carriage. Preferably the detecting means comprises a former of conical or similar shape arranged to be displaced parallel with the axis of the pirn by the built up material for actuating the valve, and arranged to be returned to its initial position for closing the valve by the movement of the carriage. The carriage is thus advanced in a series of steps as the winding proceeds.

According to a further feature of the invention, means is provided for forming a reserve or bunch of yarn at the commencement of winding, comprising a displaceable fulcrum for an oscillating thread guide whereby the travel of the guide can be reduced for forming the bunch, means for holding the fulcrum in bunch forming position, and means for releasing said fulcrum to permit its return to full travel position when the bunch reaches a predetermined diameter. Preferably the thread guide is carried on an oscillating arm actuated by a rotary cam on the carriage, the fulcrum for the arm being slidable on guides and adapted to be held in bunch forming position by a catch which is released by means engageable by the bunch.

According to a further feature of the invention, the machine is driven by an electric motor having a control switch arranged to be opened by trip means when the carriage reaches the end of its travel, i. e. when the pirn is fully wound. The trip means conveniently comprises a catch engageable with a spring loaded switch actuating member and a member on the carriage engageable with the catch to release it, such member conveniently comprising a push rod having an inclined or cam surface for operating the catch.

In the accompanying drawings,

Figure 1 is a side elevation of a pirn winding machine constructed in accordance with the invention;

Figure 2 is a plan of the machine;

Figure 3 is a cross section of the machine taken on the line X—X of Figure 1;

Figure 4 is a longitudinal sectional elevation of the hydraulic cylinder and control valve;

Figure 5 is an end view of the cylinder with the cover removed;

Figure 6 is an elevation of a part of the former which engages the pirn during winding, showing the operating lever;

Figure 7 is a section taken on the line Y—Y of Figure 6;

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Figure 8 is a sectional elevation of the electrical limit switch arrangement;

Figures 9, 10 and 11 are diagrammatic views showing successive stages in the winding of a pirn.

In carrying the invention into effect according to one convenient mode as illustrated in the drawings, there are provided two spaced vertical frame members, 1 and 2 mounted on a suitable base (not shown) and between which extend a pair of horizontal guide bars 3 and 4, conveniently of circular cross section arranged one above the other. A horizontal driving shaft 5 is carried in bearings 6, preferably of the ball type, mounted in the vertical frame members 1 and 2 so that the shaft lies between the guide bars 3 and 4. A pirn driving head 7 is rotatably mounted in a suitable bearing 8 in the frame member 2 above the guide bar 3. Suitable means is provided for driving the shaft 5 and the driving head 7 from a motor or other convenient source of power. In a convenient arrangement as illustrated an electric motor 9 is connected by a pulley 10 and belt 11 to an intermediate pulley assembly 12 carried on a spindle 13 fixed to the frame member 2. The shaft 5 is driven by a belt 14 and the head 7 is driven by a belt 15 from the pulley assembly 12. Preferably pulleys of graduated sizes as shown are provided so that the speeds can be varied by shifting the belts. A tailstock member 16 is adjustably slidable on the guide bars 3 and 4 and carries a bearing 17 for a running head 18 which is aligned with the pirn driving head 7, the adjustment being for the purpose of varying the distance between the running and driving centres to accommodate pirns of different length. The running head 18 is axially slidable under the loading of a spring 19. A support or carriage 20 is slidable upon the guide bars between the tailstock member 16 and the vertical frame member 2 carrying the driving head 7. The carriage 20 carries a rotatable cylindrical cam 21 which is slidable upon the driving shaft 5 and has a key 22 which engages in a keyway extending the full length of the latter. The cam has a continuous slot 23 inclined to the cam axis and in this slot is engaged a pin 24 on an arm 25 pivoted to the carriage so that as the cam revolves the arm is oscillated. A thread guide, which may comprise an elongated wire loop or gate 26 is carried at the upper end of an arm 27, the lower end of which is engaged by the aforesaid pivoted arm 25. The thread guide arm 27 passes through a fulcrum joint 28 in a slide 29 which can have an up and down movement on guides 30, its lowest position being determined by a stop 31, preferably adjustable. In the lowest position of the slide as seen in Figure 1, the thread guide 26 is given its maximum movement alongside a pirn to be wound, and by moving the slide up the aforesaid guides, the fulcrum of the arm 27 is altered and the guide movement is reduced. A spring steel rod 32 fixed to handle 71 is free at its lower end to engage the under side of fulcrum point 28 so that when the completed pirn has been removed the carriage 20 is pushed forward to starting position by hand pressure on handle 71, the first part of the travel of handle 71 forces the rod 32 under fulcrum 28 causing slide 29 to rise on guides 30 until trapped by latch lever 33 thereby setting the buncher device. A latch lever 33 is pivotally mounted at 34 at the upper end of the carriage 20 and its lower end is adapted to engage the aforesaid slide 29 to hold the latter in its upper position when the slide is moved upwardly to engage the latch as

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shown in Figure 3. Pivotally secured to the other end of the latch lever is a second lever 35 carrying at its end a roller 36. This roller lever 35 rests upon a fulcrum bar 37 which is adjustably mounted in the slide 29 and is disposed so that when the slide is held in its upper position by the latch as seen in Figure 3, the roller 36 occupies a determined position laterally relative to the pirn being wound, this position being variable by adjusting the fulcrum bar 37. The arrangement is such that when the build-up of yarn on the pirn reaches a predetermined diameter, the roller 36 will be engaged and will move the latch to release the slide 29 which returns to its lowest position. Also mounted at the upper end of the carriage is a former 38 comprising a cone or similarly shaped member disposed with its axis parallel to that of the pirn being wound and slidable axially upon a spindle 39 secured in a bracket 40. The former 38 is capable of being displaced axially by engagement with the taper of the yarn which is being wound when the diameter of the taper is sufficient. Such axial displacement of the former tilts a lever 41 pivoted at 42 on a fixed bracket 43. The lever 41 is preferably of bell crank form and one arm 44 is connected by a link 45 to means for effecting a progressive displacement of the carriage upon its guides. This arrangement is shown in detail in Figures 6 and 7. The bracket 40 carrying the former is adjustable transversely with respect to the axis of the pirn. The former is preferably freely rotatable upon its spindle 39.

The means for displacing the carriage 20 comprise a pair of pivoted levers 46 in V formation, the outer ends of which are pivoted respectively to the carriage and the tailstock 16. Springs 47 connect the lower ends of the levers so that these tend to close and thus there is provided a resilient force constantly drawing the carriage towards the tailstock. Other means for providing a resilient displacing force may of course be employed. The movement of the carriage under this spring action is controlled by a hydraulic device, comprising a cylinder 48 attached to the carriage 20 and a piston 49 and piston rod 50 secured to the end frame member 1 opposite to the driving head 7. The cylinder 48 is closed at one end and the closed end carries an extension 51 forming a closed reservoir for oil or other hydraulic medium. Communication between the closed cylinder end and the reservoir is controlled by a valve 52 which can be actuated by the above mentioned link 45 operated by the displaceable former 38. The valve is preferably of piston form having a control groove 53 and is connected to a pivoted lever 54, the lever being connected intermediately to the link 45. The valve 52 controls a passage 55, 56. A second passage 57 controlled by a non-return ball valve 58 permits liquid to pass from the reservoir 51 to the cylinder 48 but not vice versa. The arrangement is such that with the valve 52 closed, the liquid is trapped between the piston 49 and the cylinder and the carriage 20 is held against the pull of the loading spring arrangement. When the former 38 is displaced by the increase in diameter of the wound pirn, the valve 52 is opened by the mechanism described and the carriage 20 is moved by the spring loaded levers 46 towards the tailstock 1. This movement causes the former 38 to return to its previous position and the valve 52 is closed, the sequence of movements being repeated when the diameter of the wound yarn is again sufficient to displace the former 38.

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The electric motor 9 for operating the machine is controlled by a switch 59, the details of which are illustrated in Figure 8. The switch actuating member is a spring loaded rod 60 having a push button 61 at one end thereof. By depressing the button 61 the rod is moved axially and an insulated sleeve 62 associated therewith causes a pair of contact strips 63 to move outwardly and close the motor circuit. The switch is held in closed position by a catch 64 engageable in a groove 65 in the rod 60. The catch 64 is connected with a square operating bar 64a which extends over the length of the machine and carries two arms 66 and 67. Actuation of either of these arms rotates the square bar 64a and releases the aforesaid catch 64 from the switch rod, thus enabling the switch to open under its loading spring. The first of said arms 66 is referred to as a trip arm and is engageable by an inclined or cam formation 68 on a push rod 69 attached to the carriage 20, causing the switch to open when the carriage has completed the travel required to wind the pirn to the desired length. The second of said arms 67 is referred to as a knock-off arm and is connected by means of a light rod or wire (not shown) to an overhead tensioning arm or device which may be of a known kind. The arrangement is such that should the thread break during the winding, the knock-off arm 67 is actuated and the switch is opened, thus bringing the machine to rest.

In the operation of the machine, the empty pirn is placed in position to be wound by applying the metal end thereof to the driving centre 7 and depressing the spring loaded running centre 18 to engage the small end of the pirn. The driving head 7 carries a pad or ring 70 of rubber or like material and the thread from the overhead tensioning device (not shown) is trapped between the pad 70 and the metal end of the pirn. The yarn is then passed through the loop or gate of the thread guide 26. The carriage 20 is moved by hand to the starting position, i. e. as far as possible towards the driving head 7, and a suitable finger piece or handle 71 may be provided for this purpose. This movement is permitted by the non-return ball valve 57 between the reservoir 51 and hydraulic cylinder 48, allowing the liquid to flow freely into the latter but locking the carriage against movement in the opposite direction. If the pirn being wound is intended for use in an automatic loom, a reserve quantity or bunch of yarn is required at the start of the pirn. This is provided for by moving the buncher slide 29 up its guides 30 until it is held by the latch 33 as seen in Figure 3, thus giving the thread guide 26 a restricted travel as previously described. The roller lever 35 on the latch lever is then adjusted, by adjusting the fulcrum bar 37 on the slide, so that it will be engaged by the bunch of yarn when this has been wound to the required and predetermined diameter. The machine is then started by closing the switch 59 and will commence to wind a short bunch of yarn which will have a generally rounded outline, its length corresponding to the restricted travel of the thread guide. The winding of the bunch is illustrated in Figure 9. When this bunch reaches the predetermined diameter, the roller lever 35 is engaged by the bunch and releases the buncher slide 29 which returns to its lower position under gravity assisted by spring action. The thread guide will now be given its full range of movement as illustrated in Figure 10 and will wind a series of layers on the pirn corresponding thereto. As the

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yarn is built up in tapered or rounded formation as seen in the above figure, when the formation reaches a predetermined diameter it engages the face of the former 38 which is thereby displaced axially until it engages the lever 41 actuating the valve 52 of the hydraulic control device. The said diameter is determined by the lateral distance between the axis of the former and the pirn axis and this is adjustable. Opening of the valve 52 allows the carriage to move towards the tailstock under the action of the spring loaded levers 46 and this movement causes the former 38 to be moved back to its initial position and closes the valve 52 so that the carriage is again brought to rest. Winding then continues until the former is again engaged by the built up yarn and a further movement of the carriage is effected, this procedure continuing until the pirn is fully wound as illustrated in Figure 11. When this point is reached, the push rod 69 attached to the carriage actuates the trip arm 66 on the operating bar 65 and opens the switch 59, thus stopping the drive of the machine. The machine will also be stopped if the thread should break, as this causes the light rod or wire associated with the thread tensioning device (not shown) to fall and thereby actuates the knock-off arm 67 to open the switch. The fully wound pirn will have a body portion of approximately cylindrical form with tapered or reduced ends, the section of which may be somewhat rounded.

By this invention a machine is provided capable of winding a pirn of any predetermined diameter, this diameter being maintained irrespective of varying thickness of the yarn, wool or other material being wound. Thus the finished pirn will always have the diameter to which the machine is set, this setting being obtained by varying the lateral distance between the former and the pirn by means of the adjustable bracket carrying the former.

The invention is not restricted to the example described, since constructional details may be varied to suit particular circumstances.

I claim:

1. A winding machine comprising heads for rotatably carrying and driving a pirn or tube, a carriage slidable relative to the pirn or tube, a displaceable thread guide mounted on said carriage, means for effecting reciprocation of said thread guide for winding, means for effecting displacement of the carriage under resilient pressure, and hydraulic means constituting an adjustable stop for opposing said carriage displacement, said hydraulic means being controlled in accordance with the built-up diameter of the material wound upon the pirn or tube to afford the required progressive displacement of the carriage.

2. A winding machine according to claim 1, comprising a valve for controlling the hydraulic means, and means responsive to the diameter of the built-up material for actuating the said valve.

3. A winding machine comprising heads for rotatably carrying and driving a pirn or tube, a carriage slidable relative to the pirn or tube, a displaceable thread guide mounted on said carriage means for effecting reciprocation of said thread guide for winding, means for effecting displacement of the support under resilient pressure, a piston and cylinder containing hydraulic medium constituting an adjustable stop opposing said carriage displacement, a valve controlling an outlet from said cylinder arranged so that

when the valve is closed the carriage is held sta-

tionary by the hydraulic medium, and displaceable means arranged to be engaged by the built-up material wound on the pirn or tube to open the said valve when a predetermined diameter is reached and thereby to permit limited displacement of the carriage whereby the latter is afforded the required progressive displacement during winding.

4. A winding machine according to claim 3, comprising means arranged to be engaged by the built-up material wound on the pirn or tube and displaceable parallel to the axis of the pirn or tube for actuating the valve to open it, the said means being arranged to be returned to its initial position for closing the valve by the displacement of the carriage.

5. A winding machine according to claim 3, comprising a closed reservoir communicating by a passage with the cylinder and the communicating passage being controlled by the said valve so that on opening of the valve, liquid can pass to the reservoir and permit displacement of the carriage.

6. A winding machine according to claim 3, comprising a closed reservoir communicating by a passage with the cylinder and the communicating passage being controlled by the said valve so that on opening of the valve, liquid can pass to the reservoir and permit displacement of the carriage, an additional passage affording communication between the cylinder and the reservoir, and a non-return valve controlling said additional passage to permit the carriage to be returned to its initial position after the winding has been completed.

7. A winding machine according to claim 3, comprising a cylinder mounted on the carriage with its axis parallel to the direction of displacement thereof, a piston slidable in the cylinder and carried by a fixed rod, a closed reservoir communicating by a passage with the cylinder, a piston valve for controlling said communicating passage, and an operative connection between said piston valve and the displaceable means arranged to be engaged by the built-up material on the pirn or tube, so that the valve will be opened when a predetermined diameter of said material is reached.

8. A winding machine according to claim 1, comprising a former of cone-like shape arranged to be engaged by the material built-up on the pirn or tube and displaceable axially in a direction parallel to the axis of the pirn or tube when engaged by the material wound thereon, and valve means actuated by such displacement for controlling the hydraulic means opposing displacement of the carriage to permit limited movement of the latter.

9. A winding machine according to claim 1, comprising a former of cone-like shape rotatably mounted and arranged to be engaged by the material built-up on the pirn or tube, said former being mounted for limited axial displacement in a direction parallel with the axis of the pirn or tube when engaged by the material wound thereon, and valve means actuated by such displacement for controlling the hydraulic means opposing displacement of the carriage to permit limited movement of the latter, the arrangement being such that the movement of the carriage causes the former to be returned axially to its initial position to actuate the valve means for stopping the movement of the carriage.

10. A winding machine according to claim 1, comprising spring means for effecting progressive

displacement of the carriage as permitted by the opposing hydraulic means.

11. A winding machine according to claim 1, including means for forming a reserve or bunch of yarn at the commencement of winding, comprising a displaceable fulcrum for an oscillating thread guide whereby the travel of the guide can be reduced for forming the bunch, means for holding the fulcrum in bunch forming position, and means for releasing said fulcrum to permit its return to full travel position when the bunch reaches a predetermined diameter.

12. A winding machine according to claim 1, including means for forming a reserve or bunch of yarn at the commencement of winding, comprising a thread guide carried on an oscillating arm actuated by a rotary cam on the carriage, a fulcrum for the arm slidable in guides whereby the travel of the thread guide can be reduced for forming the bunch, a catch for holding the fulcrum in bunch forming position and means engageable by the bunch for releasing the catch to permit the fulcrum to return to full travel position of the thread guide when the bunch reaches a predetermined diameter.

13. A winding machine according to claim 1, including means for forming a reserve or bunch of yarn at the commencement of winding, comprising a thread guide carried on an oscillating arm actuated by a rotary cam on the carriage, a fulcrum for the arm slidable in guides whereby the travel of the thread guide can be reduced for forming the bunch, a catch for holding the fulcrum in bunch forming position, and a lever for releasing the catch, said lever carrying a roller engageable by the bunch and arranged to release the latter to permit the fulcrum to return by gravity to full travel position of the thread guide when the bunch reaches a predetermined diameter.

14. A winding machine according to claim 1, comprising an electric motor for driving the pirn or tube, a control switch for said motor, and trip means for opening the switch when the pirn or tube is fully wound.

15. A winding machine according to claim 1, comprising an electric motor for driving the pirn or tube, a control switch for said motor, a spring loaded switch actuating member, a catch engageable with said member to hold the switch closed, and a member on the carriage engageable with the catch to release it when the carriage reaches the end of its predetermined travel.

16. A winding machine according to claim 1, comprising an electric motor for driving the pirn or tube, a control switch for said motor, a spring loaded switch actuating member, a rotatable bar extending over the length of the machine, a catch carried by said bar and engageable with the said member to hold the switch closed, an arm mounted on said bar, and a push rod having an inclined surface mounted on the carriage for engaging the arm to release the catch when the carriage reaches the end of its predetermined travel.

17. A winding machine according to claim 1, comprising a former of cone-like shape arranged with its axis parallel to the pirn or tube axis so that the exterior surface of the former can be engaged by the material built-up on the pirn or tube, a bracket supporting the former rotatably about its axis and also displaceable in the direction of its axis, said bracket being adjustable so that its spacing from the pirn axis can be varied, and valve means actuated by the axial

displacement of the former for controlling the hydraulic means opposing displacement of the carriage to permit limited movement of the latter, the diameter of the finished pirn or tube being variable by varying the setting of the adjustable bracket carrying the former.

18. A winding machine comprising heads for rotatably carrying and driving a pirn or tube, a carriage slidable relative to the pirn or tube, a displaceable thread guide mounted on said carriage, means for effecting reciprocation of said thread guide for winding, hydraulic means for controlling progressive displacement of the carriage during the winding of the pirn or tube, and means for controlling the operation of said hydraulic means in accordance with the built-up diameter of the wound material during the winding thereof.

19. A winding machine comprising heads for rotatably carrying and driving a pirn or tube, a carriage slidable relative to the pirn or tube, a displaceable thread guide mounted on said carriage, means for effecting reciprocation of said thread guide for winding, resilient means for slidably displacing the carriage relative to the pirn or tube during winding, and adjustable stop means opposing said displacement and controlled in accordance with the built-up diameter of the material wound upon the pirn or tube so that the carriage is progressively displaced during winding in accordance with said built-up diameter.

20. A winding machine according to claim 19, comprising spring means for effecting progressive displacement of the carriage as permitted by the opposing adjustable stop means.

21. A winding machine according to claim 19, in which the means for slidably displacing the carriage comprise a pair of pivoted levers in V formation, the outer ends of the levers being pivotally connected to the carriage and to a fixed tailstock and springs connecting the levers so as to urge them towards closed position.

22. A winding machine according to claim 19, including means for forming a reserve or bunch of yarn at the commencement of winding, comprising a thread guide carried on an oscillating arm actuated by a rotary cam on the carriage, a fulcrum for the arm slidable in guides whereby the travel of the thread guide can be reduced for forming the bunch, a catch for holding the fulcrum in bunch forming position and means engageable by the bunch for releasing the catch to permit the fulcrum to return to full travel position of the thread guide when the bunch reaches a predetermined diameter.

23. A winding machine according to claim 19, including means for forming a reserve or bunch of yarn at the commencement of winding, comprising a thread guide carried on an oscillating arm actuated by a rotary cam on the carriage, a fulcrum for the arm slidable in guides whereby the travel of the thread guide can be reduced for forming the bunch, a catch for holding the fulcrum in bunch forming position, and a lever for releasing the catch, said lever carrying a roller engageable by the bunch and arranged to release the latter to permit the fulcrum to return by grav-

ity to full travel position of the thread guide when the bunch reaches a predetermined diameter.

24. A winding machine according to claim 19, comprising an electric motor for driving the pirn or tube, a control switch for said motor, and trip means for opening the switch when the pirn or tube is fully wound.

25. A winding machine according to claim 19, comprising an electric motor for driving the pirn or tube, a control switch for said motor, a spring loaded switch actuating member, a catch engageable with said member to hold the switch closed, and a member on the carriage engageable with the catch to release it when the carriage reaches the end of its predetermined travel.

26. A winding machine according to claim 19, comprising an electric motor for driving the pirn or tube, a control switch for said motor, a spring loaded switch actuating member, a rotatable bar extending over the length of the machine, a catch carried by said bar and engageable with the said member to hold the switch closed, an arm mounted on said bar, and a push rod having an inclined surface mounted on the carriage for engaging the arm to release the catch when the carriage reaches the end of its predetermined travel.

27. A winding machine according to claim 19, comprising a former of cone-like shape arranged to be engaged by the material built-up on the pirn or tube and displaceable axially in a direction parallel to the axis of the pirn or tube when engaged by the material wound thereon, said displacement actuating the adjustable stop means to permit limited movement of the carriage.

28. A winding machine according to claim 19, comprising a former of cone-like shape arranged with its axis parallel to the pirn or tube axis so that the exterior surface of the former can be engaged by the material built up on the pirn or tube, a bracket supporting the former rotatably about its axis and also displaceable in the direction of its axis, said bracket being adjustable so that its spacing from the pirn axis can be varied, the axial displacement of the former being arranged to actuate the adjustable stop means to permit limited movement of the carriage, the diameter of the finished wound material being variable by varying the setting of the adjustable bracket carrying the said former.

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