Sept. 15, 1942. E. J. ABBOTT 2,295,535

WINDING MACHINE

Filed March 9, 1940 4 Sheets-Sheet 1

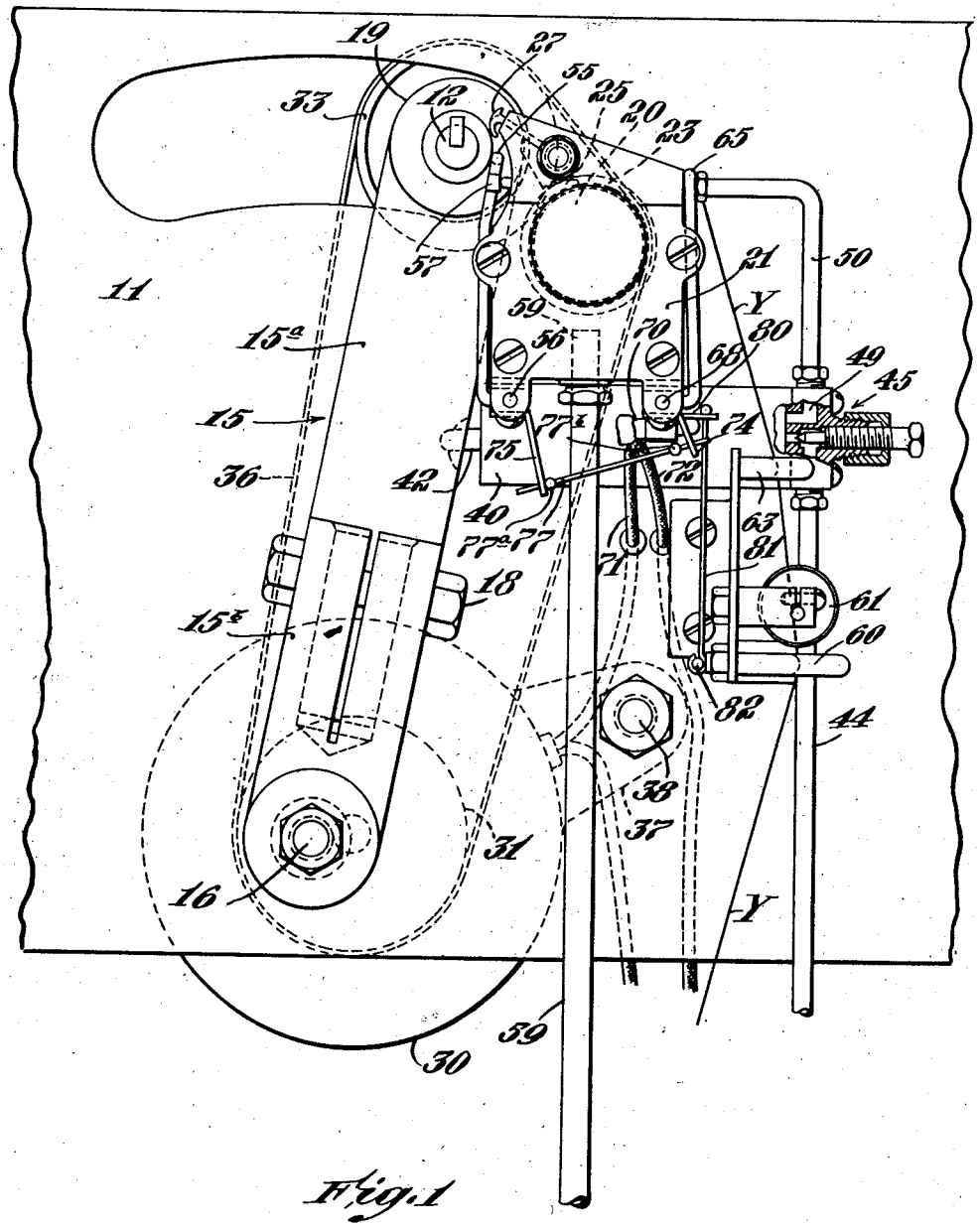


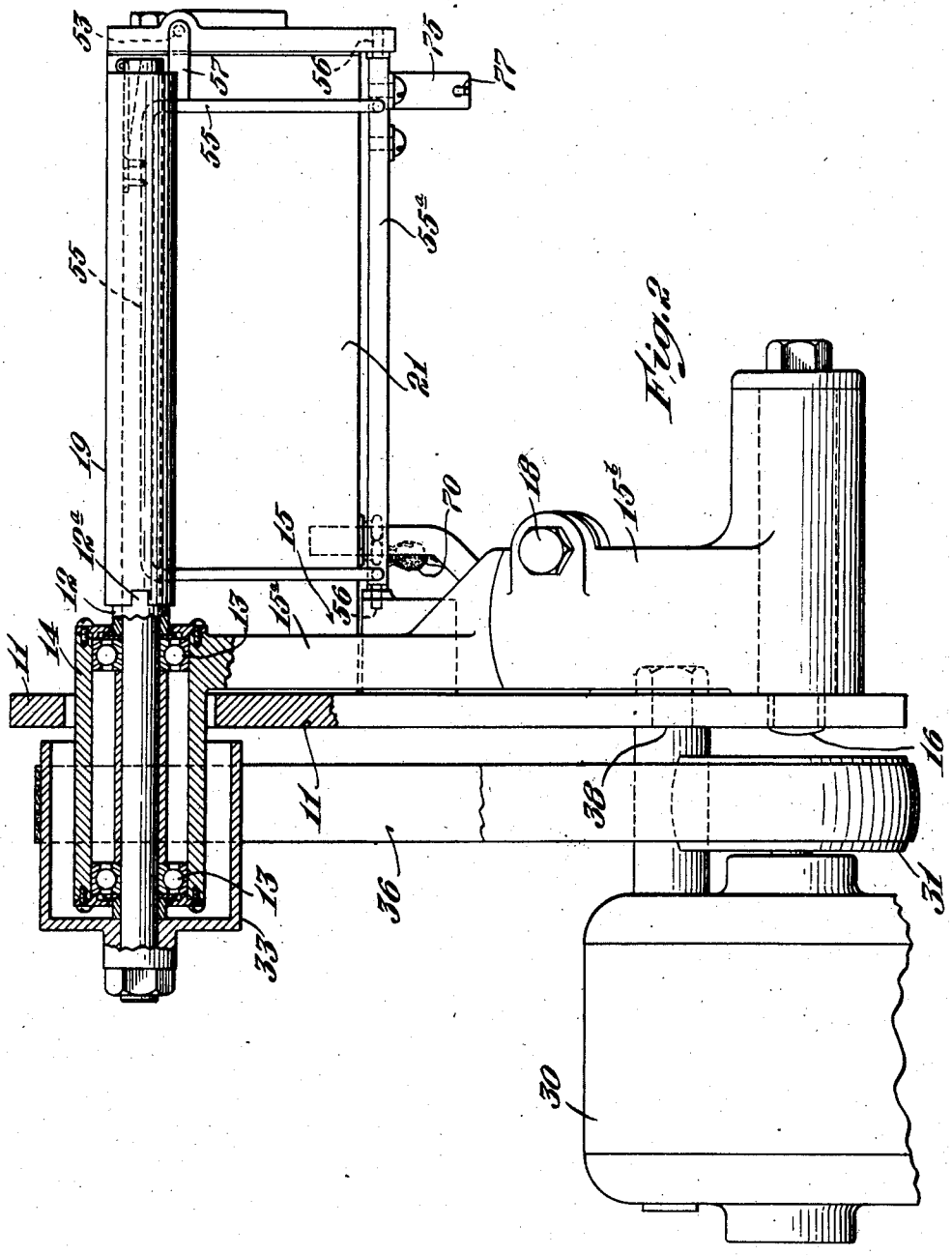
Fig. 1

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WINDING MACHINE

Filed March 9, 1940 4 Sheets-Sheet 3

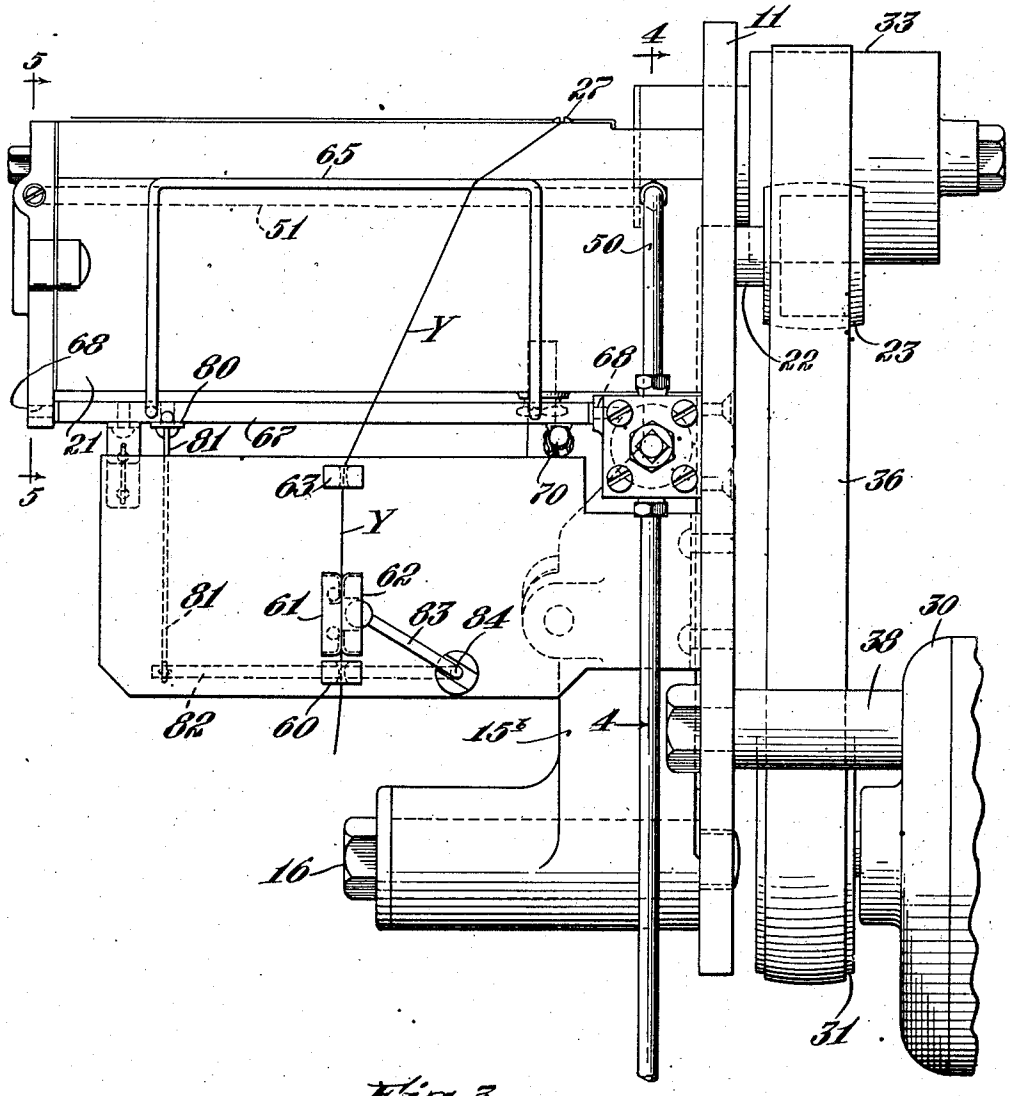


Fig. 3

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WINDING MACHINE

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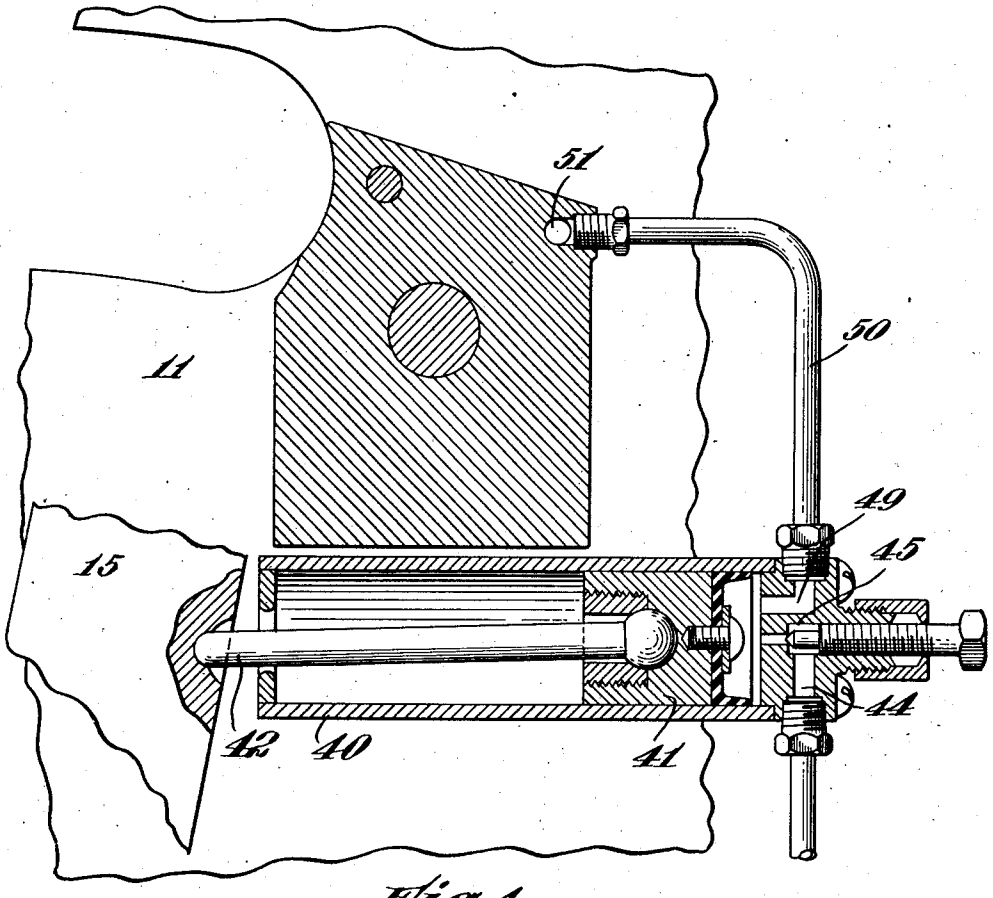


Fig. 4

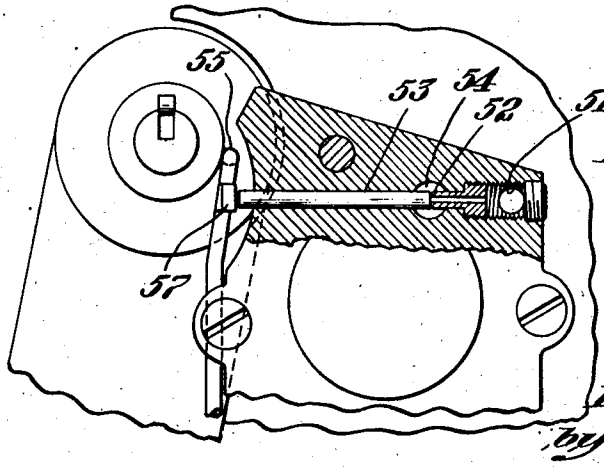


Fig. 5

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UNITED STATES PATENT OFFICE

2,295,535

WINDING MACHINE

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Application March 9, 1940, Serial No. 323,203

23 Claims. (Cl. 242—37)

This invention relates to winding machines and has for its principal objects to control the stopping and starting of the machine in a more efficient manner, to provide improved mechanism for automatically bringing the winding package and the traversing device into and out of cooperative relation at the starting and stopping of winding respectively, to control more effectively and accurately the position of the winding package with relation to the traversing yarn guide during growth of the winding package, and to control and regulate in a simple and more effective manner the tension in the winding yarn. A further object of the invention is to provide an improved driving mechanism for a winding unit and to provide an improved and simplified support for the winding package. In its preferred and illustrated embodiment, the invention is applied to a winding machine of the so-called "precision" type in which there is a practically constant ratio between the speed of the traversing yarn guide and the angular speed of the rotating package, although features of the invention are applicable to winding machines of other types.

Other objects of invention and features of advantage and utility will be apparent from this specification and its drawings wherein the invention is explained by way of example.

In the drawings:

Fig. 1 is a side elevation of a winding machine according to the invention;

Fig. 2 is a left elevation partly in section of the unit of Fig. 1;

Fig. 3 is a right elevation of the unit of Fig. 1;

Fig. 4 is a vertical sectional view on the line 4—4 of Fig. 3 showing the cylinder and piston of motor mechanism for controlling the position of the winding package relatively to the traversing device; and

Fig. 5 is a vertical sectional view on the line 5—5 of Fig. 3 showing the nozzle and plunger which control the motor mechanism of Fig. 4.

The machine may have any suitable frame of which an upright plate-like portion is indicated at 11 in the drawings, this upright portion serving to support one or more of the winding units.

The illustrated embodiment of the invention includes provision for the winding package holder such as a spindle and the yarn traversing device to separate progressively as the winding package grows in diameter, and to separate fully upon failure of the winding yarn. This relative movement of the package holder and traversing device is accomplished by movement of the package holder in the illustrated machine, although in certain aspects of the invention the necessary relative movement could be secured by movement of the traversing device.

The winding spindle 12, which is a preferred form of means for holding and rotating the winding package, is rotatably mounted in ball bearings 13 in a hub 14 carried at the upper end of an arm 15 that is pivotally mounted at 16 on the plate 11. The arm indicated generally by the reference character 15 preferably consists of an upper portion 15a fitted into and detachably secured to a lower portion 15b by a clamp 18 so that by loosening the clamp 18 the upper portion 15a and the spindle may be set at any desired angle to the lower portion 15b. Thus in addition to winding cylindrical packages, cones of any desired taper may be wound. The winding package core 19, which is illustrated as bare as at the beginning of winding, is driven by the spindle by any suitable connection such for example as projections 12a which extend from the spindle into notches in the end of the core.

The traversing mechanism in its preferred form includes a small-diameter crossed-groove traverse cam 20 rotatably mounted in a casing 21 of which one end may consist of the plate 11. The traverse cam shaft 22 (Fig. 3) extends through an opening in the plate 11 and carries outside of the plate a suitable belt pulley 23. Any suitable form of traverse cam slider 25 may be employed to run in the groove of the traverse cam and reciprocate the traversing yarn guide 27 which extends out of the casing 21 through a narrow slot.

A preferred form of driving means for both the spindle 12 and the traverse cam 20 includes an individual electric motor 30. The motor shaft carries a pulley 31, and there is attached to the spindle 12 a cup-shaped pulley 33, the pulleys 31 and 33 being in alignment with the pulley 23 on the head of the cam shaft. As best shown in Fig. 1, the belt 36 runs around the pulleys 31, 33 and 23, driving these at constant angular velocity determined by the speed of the motor 30. The motor 30 is held by a bracket 37 (Fig. 1) which is pivotally mounted at 38 on the plate 11 so that the weight of the motor tends to tighten the belt and moreover tends to draw the spindle pulley 33 over to the right in Fig. 1 toward the traverse cam pulley 23. The belt 36 thus sets up a restoring force tending at all times to urge the winding package toward the trav-

ersing means. Preferably further mechanism is provided to act in opposition to this restoring force to control the positions of the package during its growth and during the starting and stopping of winding. In this connection, in some aspects of the invention, the restoring force instead of depending on the action of the belt, may be secured by mounting the package-holding means in such manner that gravity or a spring exerts the desired restoring force.

Provision is made for causing the winding spindle 12 to move away from the reciprocating traverse eye 27 against the restoring action of the belt and in accordance with the amount of yarn wound on the winding package, so as to keep the surface of the winding package either in very light contact with the traversing yarn guide or at a definite distance therefrom, preferably only slightly out of contact. In this connection the downward pull of the motor on the belt 36 is relied upon to oppose the movement of the winding spindle away from the yarn guide and is also useful in restoring the spindle automatically to starting position near the yarn guide when winding is begun on a new bare core or upon an unfinished package following an interruption to the winding.

The mechanism for moving the winding spindle away from the traversing yarn guide at a controlled rate preferably is actuated from a secondary source of power, such as a motor, and preferably this secondary source of power is a variable-force fluid motor, such as will now be described. Thus as shown in Figs. 1 and 4, there is provided a cylinder 40 fitted with a piston 41 which latter is connected by a connecting rod 42 with the spindle-carrying arm 15. For actuating the piston 41 to shift the arm 15 to the left in Fig. 1, there is provided an oil conduit 44 leading from an oil pump, not shown, and discharging through a needle valve 45 into the cylinder 40 and in the rear of the piston. The effective force of the piston as urged to the left by the oil pressure is sufficient to move the arm 15 to the left in opposition to the restoring force set up by the belt 36. To control the operation of the piston 41, the cylinder 40 is provided at its right end with a leak passage 49 communicating through a tube 50 and a drilled hole 51 (Fig. 3) in the casing 21 with a nozzle 52 (Fig. 5) adapted to discharge into the interior of the casing 21. The nozzle 52 is adapted to be closed by the end of a plunger 53 when the plunger is pushed to the right, as described below. In the absence of a force pushing the plunger to the right, the pressure of oil within the nozzle 52 pushes the plunger to the left, thus opening the nozzle. In this manner the valve composed of the nozzle 52 and plunger 53 controls the oil pressure in the rear of the piston 41 and when open allows enough leakage of oil from behind the piston 41 so that the oil pressure working on the piston is not sufficient to counterbalance the restoring force set up by the belt. On the other hand, when the nozzle 52 is sufficiently closed, the oil pressure builds up behind the piston 41 sufficiently to move the piston and the spindle arm 15.

A feeler or package-position detector in the form of a U-shaped wire 55 fastened at its ends in a rod 55a that is pivotally mounted at 56 is located in position to contact with the surface of the winding package close to the path of the traversing yarn guide 27 and is provided with an extension 57 (Fig. 2) adapted to contact with the end of the plunger 53. The horizontal portion of the feeler wire 55 thus rides in contact with the surface of the winding package. By a suitable adjustment of the nozzle 52 or plunger 53 and of the needle valve 45, this mechanism can be so adjusted that when the package clears the path of travel of the traverse eye 27 precisely by a predetermined amount, the nozzle 52 will be open sufficiently to prevent the piston 41 from moving the arm 15 any further to the left. Then further winding on the package and consequent increase in thickness forces the feeler 55 and plunger 53 to the right in Fig. 1, closing the nozzle 52, allowing the oil pressure behind piston 41 to increase and correspondingly shifting the winding package away from the traverse eye. The adjustment of this mechanism may either be such that the traverse eye bears lightly on the winding package, or clears the winding package by any predetermined amount (as in Fig. 1).

The oil discharged from nozzle 52 passes through a hole 54 (Fig. 5) into the interior of the casing 21 and these serves to lubricate the traverse cam and its associated slider. An oil discharge return line 59 having its entrance located somewhat above the bottom of the casing 21 serves to return excess oil to the pump previously mentioned.

The winding yarn Y, coming from any suitable supply bobbin below the winding unit, runs upwardly as indicated through a guide 60, hence between tension disks 61 and 62 and a further guide 63 which if desired may be a slub catcher and hence over a pivoted wire yarn detector 65 to the traversing yarn guide 27. The detector wire 65 which is shown as U-shaped is fastened at its bottom ends to a horizontal rod 67 which is pivotally supported at 68, 68 at its two ends; thus the detector wire 65 tends to swing outwardly or to the right (Fig. 1) upon failure of the yarn such as breakage or exhaustion.

A mercury switch 70 mounted on the rod 67 is normally in a closed position when the yarn detector wire 65 is upright as in Fig. 1, but becomes tilted to an open position when the detector swings outwardly upon breakage or exhaustion of the yarn. This mercury switch is connected by wires 71 and 72 with the electric motor and the source of electric power so as to be in circuit with the motor, thus stopping the motor when the detector wire swings outwardly.

The operator can readily start the motor and begin the winding operation by raising the yarn detector wire 65 to its upright position as in Fig. 1 and holding it there until the machine is winding normally.

Upon breakage or exhaustion of the yarn, the motor thus stops. Preferably there is also provision for automatically shifting the package and spindle to their extreme left hand position or away from the yarn guide so as to facilitate finding the end of yarn on the package or changing the bobbin if necessary. For this purpose, the yarn detector wire 65 is interconnected with the package position-detector or feeler wire 55 by a loose linkage consisting of a depending extension 74 on the detector rod 67, a depending extension 75 on the rod 55a of the package position-detector, and a connecting wire 77. The connecting wire 77 extends loosely through holes in the extensions 74 and 75 and is held in place by two enlargements 77a and 77b fast thereon, these enlargements being near enough together so that the detector wire 65 and extension 74 have some freedom of movement before extension

4 acts through the rod 77 to move extension 75. These parts are arranged so that when detector wire 65 moves outwardly or to the right in Fig. 1 sufficiently, the linkage 74, 77, 75 will act to urge the package position-detector wire 55 to the right in Fig. 1 and cause the extension 57 of the wire 55 to press the plunger 53 inwardly, thus closing the nozzle 52 and causing the piston 41 and spindle arm 15 to move quickly to the left.

Thus upon failure of the winding yarn, the yarn detector 65 overrides the affect of the package position-detector 55, and causes the fluid motor to effect a quick and full separation of the package and traversing device.

Upon repairing the break or exhaustion and changing the bobbin if necessary, the operator manually restores the yarn detector wire 65 to its upright position as in Fig. 1. The linkage 77, 75 is thus no longer forced to the left by the detector wire and the feeler wire 55 is free to swing outwardly to the left, disengage the plunger 53 and thus allow the oil pressure behind piston 41 to drop. The restoring force set up by the belt 36 then draws the winding spindle and package to the right into winding position, but relatively slowly due to the cushioning effect of the piston 41 caused by the necessity for leakage of oil out through the nozzle 52 in order to permit such movement. When the winding package has been thus restored to winding position and the yarn has been put under the tension of winding, the operator can then release the detector wire 65. The machine thus embodies manually operable control means for causing the fluid motor to permit the winding package to return to a position close to the traversing device.

Due to the rotation of the winding spindle at a constant velocity, the linear speed of the winding of the yarn increases progressively as the package grows, and because of this fact which would normally progressively increase the yarn tension, it is desirable to provide for equalizing the tension on the yarn at the various stages of winding. For this purpose the detector wire 65 is preferably caused to operate also as a detector of the tension in the winding yarn and through suitable linkage to regulate the tension applied by the disks 61 and 62. Referring to Figs. 1 and 3 a horizontal extension 80 on the rod 67 carries a lifter link 81 which is attached to the outer end of an arm 82 of a bell crank 82, 83 of which the arm 83 bears against the movable tension disk 62, the bell crank being pivoted at 84.

As the arm 82 is lifted by the rod 81, the other arm 83 moves away from the plane of passage of the yarn, thus relieving the tension. This effect occurs when the detector wire 65 is in its uppermost position as shown in Fig. 1 and to a lesser extent as the wire 65 moves outwardly or to the right in Fig. 1. Thus when for any reason such for example as a relatively slow winding speed at the beginning of winding, the yarn tension between the disks 61, 62 and the winding package would otherwise be too small, the slack tension in the yarn allows the detector wire to swing outwardly, thus allowing the bell crank 82, 83 to turn in a counterclockwise direction in Fig. 3 and apply more pressure to the disk 62. Then as the winding speed increases and the tension in the yarn accordingly tends to increase, the detector wire and associated linkage act to relieve correspondingly the amount of tension applied by the disks 61, 62 with the result of maintaining a substantially constant tension under all conditions.

I claim:

1. A winding machine having therein a winding package holder and a yarn traversing device, motor means for controlling the relative positions of the package holder and traversing device with respect to each other in a direction transverse of the length of the winding package as the winding package grows in diameter and a detector responsive to the position of the surface of the winding package, said detector controlling said motor means.

2. A winding machine having therein a winding package holder and a yarn traversing device, means including a fluid motor for controlling the relative positions of the package holder and traversing device with respect to each other in a direction transverse of the length of the winding package as the winding package grows in diameter, a valve adapted to control the fluid motor, and a detector responsive to the position of the surface of the winding package, said detector controlling said valve.

3. A winding machine having therein a winding package holder and a yarn traversing device, means including a fluid motor for controlling the relative positions of the package holder and traversing device, a valve adapted to control the fluid motor, and a detector responsive to failure of the winding yarn, said detector controlling said valve.

4. A winding machine having therein a winding package holder and a yarn traversing device, motor means for controlling the relative positions of the package holder and traversing device, a detector responsive to the position of the surface of the winding package, and a detector responsive to failure of the unwinding yarn, both of said detectors being adapted to control the motor.

5. A winding machine having therein a winding package holder and a yarn traversing device, motor means for controlling the relative positions of the package holder and traversing device, means for causing the motor to separate the package holder and traversing device progressively as the winding package grows while maintaining the surface of the package in proximity to the traversing device, and means for causing the motor to effect a full separation of the package and traversing device upon failure of the winding yarn.

6. A winding machine having therein a winding package holder and a yarn traversing device, motor means for controlling the relative positions of the package holder and traversing device, means for causing the motor to separate the package holder and traversing device progressively as the winding package grows, while maintaining the surface of the package in proximity to the traversing device, and means operative upon failure of the winding yarn to cause the motor to effect a full separation of the package and traversing device and operable manually to cause the motor to effect a restoration of the surface of the package into proximity to the traversing device.

7. A winding yarn having therein a winding package holder and a yarn-traversing device, motor means for controlling the relative positions of the package holder and traversing device, a detector controlling the motor and responsive to the position of the surface of the

winding package, a yarn detector responsive to failure of the winding yarn, and means connecting the yarn detector and the motor in such manner that upon detection of failure of the winding yarn, the yarn detector overrides the effect of the first-named detector and causes the motor to effect a full separation of the package and traversing device.

8. A winding machine having therein a winding package rotating means, a yarn-traversing device, there being relative movement between the package-rotating means and the traversing device, a driving means, and a belt connecting the driving means with the package-rotating means and the traversing device and urging one of them toward the other.

9. A winding machine having therein a yarn-traversing device and a package-rotating means mounted for movement toward and away from the traversing device, a driving means, and a belt connecting the driving means with the package-rotating means and traversing device, and urging the package-rotating means toward the traversing device.

10. A winding machine having therein a yarn-traversing device including a yarn guiding element movable back and forth along the winding package and a package-rotating means mounted for movement toward and away from the path of the yarn guiding element of the traversing device, a driving means, and a belt connecting the driving means with the package-rotating means, and urging the package-rotating means toward the path of the yarn guiding element of the traversing device.

11. A winding machine having therein a yarn-traversing device and a package-rotating means, there being relative movement between the package-rotating means and the traversing device, a driving means, a belt connecting the driving means with the package-rotating means and the traversing device, and urging the package-rotating means and traversing device one toward the other, and a variable-force motor arranged to urge the package-rotating means and traversing device apart in opposition to the force of the belt.

12. A winding machine having therein a yarn-traversing means and a winding package-rotating means, means for mounting one of said means for movement away from the other of said means against a restoring force tending to urge said means together, and a variable-force motor adapted to move said means apart in opposition to said restoring force.

13. A winding machine having therein a yarn-traversing means and a winding package-rotating means, means for mounting one of said means for movement away from the other of said means against a restoring force tending to urge said means together, a variable-force motor adapted to move said means apart in opposition to said restoring force and a detector responsive to the position of the surface of the winding package, said detector controlling said variable-force motor.

14. A winding machine having therein a yarn-traversing means and a winding package-rotating means, means for mounting one of said means for movement away from the other of said means against a restoring force tending to urge said means together, a variable-force motor adapted to move said means apart in opposition to said restoring force and a detector responsive to failure of the winding yarn, said detector controlling said variable-force motor.

15. A winding machine having therein a winding package holder and a yarn-traversing device, and motor means effective upon stopping of winding to retain the winding package holder and the traversing device farther separated than during usual winding, the machine including manually operable control means for causing the motor means to become ineffective in thus retaining such farther separated relation, thereby to permit relative approach of the package holder and traversing device.

16. A winding machine having therein a winding package holder and a yarn traversing device, a yarn detector, a motor means effective upon detection of yarn failure by said detector, to retain the winding package holder and the traversing device farther separated than during usual winding, the machine including manually operable control means for causing the motor means to become ineffective in thus retaining such farther separated relation, thereby to permit relative approach of the package holder and traversing device.

17. A winding machine having therein a winding package holder and a yarn-traversing device, means including a fluid motor for effecting separation of the winding package holder and the traversing device, a valve controlling the motor, a yarn detector; and a connection between the yarn detector and the valve, whereby movement of the detector resulting from failure of the yarn supply permits the motor to effect separation of the package holder and traversing device farther than in normal winding and movement of the detector in the opposite direction causes the motor to permit relative approach of the package holder and traversing device.

18. A winding machine having therein means for rotating a winding package at approximately a constant angular velocity and hence with progressively increasing winding speed as the package grows, a tension device arranged to act frictionally on the yarn approaching the winding package, said tension device being adjustable as to its tensioning effect on the yarn, a yarn detector acted on by the yarn between the tension device and the winding package, and responsive to the tension in said yarn, and a connection between the detector and the tension device whereby increase in the tension of the yarn at the detector adjusts the tension device to have less tensioning effect.

19. A winding machine having therein means for rotating a winding package at approximately a constant angular velocity and hence with progressively increasing winding speed as the package grows, a tension device adjustable as to its tensioning effect on the yarn, winding stop means including a yarn detector controlling the stop means and acted on by the yarn between the tension device and the winding package, said detector being movable in response to the tension in said yarn, and a connection between the detector and the tension device whereby increase in the tension of the yarn at the detector adjusts the tension device to have less tensioning effect.

20. A winding machine having therein a winding package holder, a yarn-traversing device, and means including a fluid motor for separating the package holder and traversing device upon failure of the winding yarn, said motor having the characteristics of causing relatively quick move-

ment in the direction to separate the package holder and traversing device and permitting only a slower return movement.

21. A winding machine having therein a winding package holder, a yarn-traversing device, and means including a fluid motor for separating the package holder and traversing device upon failure of the winding yarn, said motor being actuated by fluid under pressure, a leak passage normally rendering the motor ineffective to cause relative separating movement of the package holder and the traversing device, and means for controlling the flow through the leak passage and hence the action of the motor, the leak passage serving to cushion return movement of the fluid motor.

22. A winding machine having therein a winding package holder and a yarn traversing element, a detector responsive to the position of the surface of the package, power driven means for shifting the relative positions of the package holder and traversing device in a direction transverse to the path of the yarn traversing element, means other than the detector for supplying power to the said power driven shifting means, and means whereby the detector controls said power driven shifting means in accordance with the growth of yarn on the surface of the package.

23. A winding machine having therein a winding package holder and a yarn traversing element, a detector responsive to the position of the surface of the package, means including a fluid motor for shifting the relative positions of the package holder and traversing device, means for supplying actuating fluid to the motor, and means whereby the detector controls said fluid motor in accordance with the growth of yarn on the surface of the package.

EDWARD J. ABBOTT.

CERTIFICATE OF CORRECTION.

Patent No. 2,295,535. September 15, 1942.

EDWARD J. ABBOTT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 70, claim 7, for the word "yarn" read --machine--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of October, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.