(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 648 701 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94307571.3**

(22) Date of filing : **14.10.94**

(51) Int. Cl.[6] : **B65H 63/036,** B65H 63/00, B65H 54/553, B65H 63/08

(30) Priority : **19.10.93 JP 260928/93**
20.10.93 JP 261974/93

(43) Date of publication of application :
19.04.95 Bulletin 95/16

(84) Designated Contracting States :
DE FR GB IT

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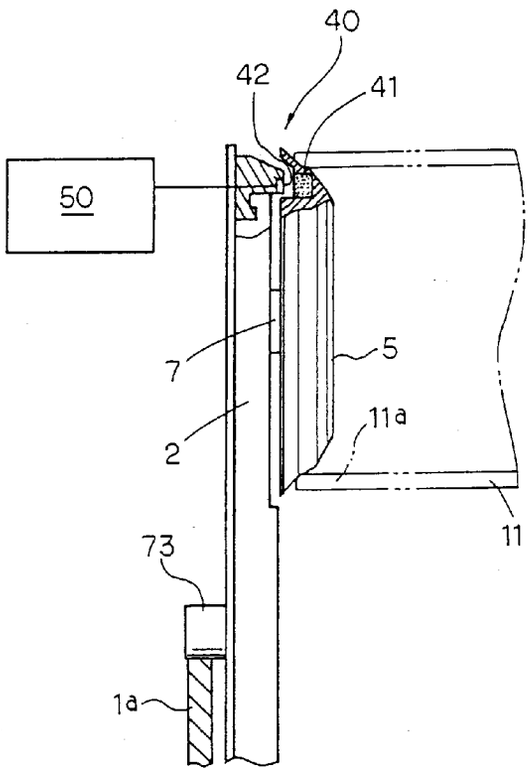
(54) Yarn winding machine.

(57) A yarn winding machine for winding a yarn (12) on a bobbin (11) to form a yarn package (10) on the bobbin (11), comprises : a pair of bobbin holders (5, 6) having the bobbin (11) retained thereon, a pair of support arms (2, 3) swingably mounted on a stationary frame structure (1) and rotatably supporting the bobbin holders (5, 6), a friction roller (20) driven to rotate and held in frictional contact with the yarn (12) to be wound on the bobbin (11) until the yarn (12) is formed into a full yarn package (10), bobbin revolutions detecting means (40) for detecting revolutions of the bobbin (11), the revolutions detecting means (40) comprising a magnet element (41) securely fastened to a predetermined position on the peripheral portion of one of the bobbin holders (5, 6) and having a circumferential path on which the magnet element (41) revolves upon rotation of the bobbin holders (5, 6), and a detecting element (42) securely mounted on one of the support arms (2, 3), the detecting element (42) being in opposing relationship to the circumferential path of the magnet element (41) to detect the magnetic flux of the magnet element (41) and to output signals commensurate to the revolutions of the bobbin (11) for enabling determination of normal and abnormal rotational conditions of the bobbin (11).

FIG. 1



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FIELD OF THE INVENTION

The present invention relates to a frictional contact driving type of yarn winding machine provided in a yarn drawing and false-twisting apparatus, and in particular to an apparatus suitable for detecting the revolutions of a bobbin to enable determination as to whether rotation of the bobbin is on normal or abnormal conditions.

The present invention also relates to a frictional contact driving type of yarn winding machine provided in a yarn drawing and false-twisting apparatus, in particular to an apparatus for detecting a yarn abnormally wound around a friction roller which is adapted to rotate a bobbin and a yarn package wound on the bobbin in frictional contact with the bobbin and the package.

BACKGROUND OF THE INVENTION

As prior-art yarn winding machines for winding a yarn treated in the yarn drawing and false-twisting machines, there have so far been a wide variety of machines represented by a frictional contact driving type of yarn winding machine which comprises a pair of bobbin holders for holding a bobbin, a pair of cradle arms swingably mounted on a stationary frame structure and having respective free end portions rotatably supporting the bobbin holders in coaxial relationship with each other, and a friction roller driven to rotate, the cradle arms being swingable between a first angular position where the bobbin is held in frictional contact with the friction roller to have the yarn wound thereon until the yarn is fully wound to be formed into a full yarn package on the bobbin and a second angular position where the yarn package is held out of frictional contact with the friction roller.

The bobbin with the full yarn package thus wound is then exchanged by a new bobbin in a doffing operation which is carried out by a package doffing apparatus. In recent years, there have been developed numerous package doffing apparatus which are all designed to be automatically operated to perform such the doffing operation.

In the conventional package doffing apparatus, there have frequently been encountered such drawbacks that all the yarn packages continuously doffed by the package doffing apparatus cannot be put into a cardboard box in succession when some of the yarn packages are of a size exceeding the limit of its predetermined measurement. The excessively large yarn packages sometimes entail malfunction of a brake system which is assembled in and operated in synchronism with the package doffing apparatus, with the result that the packages are readily damaged if the packages are thrown to package receiving means from the package doffing apparatus before they are stopped by the brake system.

In order to overcome such the drawbacks inherent to the conventional package doffing apparatus, there have been proposed another apparatus which is adapted to detect the revolution conditions of the bobbin and package, thereby preventing the packages from being produced on the bobbin in excess of the limit of its predetermined measurement. As the apparatus for detecting the revolution conditions of the bobbin and package, there have been proposed a couple of switches and a light sensor unit the former of which is prone to be expensive and the latter of which has such a problem as low reliability stemming from deteriorated detection accuracy caused by dusts and dews fixed to the light sensor switch unit.

The conventional yarn winding machine of this type is constituted by a friction roller which is adapted to be held in frictional contact with the bobbin and the package to have the yarn wound on the bobbin as a package formed by a predetermined length of yarn. In the yarn winding machine of this type, an empty bobbin is initially brought into frictional contact with the friction roller to be driven for rotation by the friction roller and then has the yarn wound thereon while the yarn is being traversed by a yarn traversing guide after the leading end portion of a traveling yarn fed from the yarn drawing and false-twisting apparatus is caught by an annular groove formed in the longitudinally end portion of the bobbin. Failure in having the leading end portion of the traversing yarn caught by the annular groove in the conventional yarn winding machine resulting from some reason causes the leading end portion of the traversing yarn to be wound around the friction roller through the bobbin and the friction roller instead of around the bobbin. In this instance, such an abnormal situation is required to be promptly found for having the winding operation restored to the normal situation. Especially for the case in which the yarn continues to be wound around the friction roller to be formed into an abnormal yarn package, this yarn package is likely to cause some troubles not only as having adjacent parts and elements of the yarn winding machine to be damaged but also as having the electric motor for driving the friction roller suddenly stopped due to its overload.

On the other hand, the conventional yarn winding machine sometimes encounters such a chance that the yarn package is instantly move out of frictional contact with the friction roller if the yarn winding machine happens to be vibrated and shocked resulting from some external force exerted on the yarn winding machine, thereby bringing the yarn abnormally wound around the friction roller. This causes the electric motor of the friction roller to be suddenly stopped due to its overload for a similar reason to the previously mentioned. The above sudden stop of the electric motor provokes reduction in production efficiency for the yarn packages.

It will be understood that the aforesaid drawbacks

leads the fact that the package doffing apparatus of the yarn winding machine of this type cannot. be put into a completely automatic doffing operation which includes a yarn hooking step for hooking the leading end portion of the yarn to the annular groove of the bobbin so that the leading end of the yarn is caught by the annular groove of the bobbin, a yarn winding step for winding the yarn on the bobbin to form a yarn package, and a bobbin replacing step for releasing the yarn package from the bobbin holders to exchange the full yarn package with a succeeding empty bobbin.

The present invention contemplates provision of an improved yarn winding machine overcoming the aforesaid drawbacks of the prior-art yarn winding machine of the described general natures.

It is therefore a first object of the present invention to provide a yarn winding machine which is inexpensive and suitable for putting into the completely automatic doffing operation.

It is a second object of the present invention to provide a yarn winding machine which is not readily deteriorated in detection accuracy even under a deteriorated environment surrounding the yarn winding machine.

It is a third object of the present invention to provide a yarn winding machine which is constructed of a frictionally driven type designed to reliably detect the revolution conditions of the bobbin.

It is a fourth object of the present invention to provide a yarn winding machine which is adapted to detect the revolution conditions of the bobbin, thereby preventing the packages from being formed on the bobbin in excess of the limit of its predetermined measurement.

It is a fifth object of the present invention to provide a yarn winding machine which is adapted to detect the malfunction of the brake system stemming from the abnormal revolution condition of the bobbin so that the packages are by no means thrown to package receiving means from the package doffing apparatus before they are stopped by the brake system.

It is a sixth object of the present invention to provide a yarn winding machine which is designed to promptly detect an abnormal revolution condition of the bobbin by calculating radius of the yarn package on the basis of the rotational speeds of the bobbin and the winding speed of the yarn, thereby eliminating troubles emanated in the subsequent process such as for example a packaging process of the yarn package.

It is a seventh object of the present invention to provide a yarn winding machine which makes the operator to be able to promptly realize the fact that the yarn has been wound around the friction roller, thereby making it possible to give rise to no damages on the mechanical parts and elements of the yarn winding machine and simultaneously preventing reduction in production efficiency for the yarn package.

It is an eighth object of the present invention to provide a yarn winding machine which is adapted to sever the yarn abnormally wound around the friction roller from the yarn on its traveling path, thereby making it possible to give rise to no damages on the mechanical parts and elements of the yarn winding machine.

SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a yarn winding machine for winding a yarn on a bobbin to form a yarn package on the bobbin, including a stationary frame structure including a support arm, a bobbin holder having its own rotation axis and supported on the support arm with its own rotation axis extending toward the support arm, the bobbin having a rotation axis being held in coaxial relationship with the rotation axis of the bobbin holder when the bobbin is retained by the bobbin holder, a friction roller having a rotation axis in parallel with the rotation axis of the bobbin holder and held in frictional contact with the yarn to be wound on the bobbin until the yarn is formed into a full yarn package, and the bobbin holder and the friction roller being respectively movable to allow the bobbin to be moved together with the bobbin holder with respect to the friction roller to assume a winding position where the bobbin is held in frictional contact with the friction roller and driven to rotate by the friction roller to have a yarn wound thereon and a package releasing position where the yarn package is held out of frictional contact with the friction roller for releasing the yarn package from the bobbin holder, comprising: bobbin revolutions detecting means for detecting revolutions of the bobbin, the revolutions detecting means comprising a magnet element securely fastened to a predetermined position on the peripheral portion of the bobbin holder and having a circumferential path on which the magnet element revolves upon rotation of the bobbin holder, and a detecting element securely mounted on the support arm in opposing relationship to the circumferential path of the magnet element to detect the magnetic flux of the magnet element and to output signals commensurate to the revolutions of the bobbin.

According to a second aspect of the present invention there is provided a yarn winding machine for winding a yarn on a bobbin to form a yarn package on the bobbin, including a stationary frame structure including a pair of swingable support arms spaced apart from each other and having their own swing axes, a pair of bobbin holders having their own rotation axes and each rotatably supported on each of the swingable support arms with their own rotation axes extending toward the swingable support arms, the bobbin having a rotation axis being held in coaxial re-

lationship with the rotation axes of the bobbin holders when the bobbin is retained by the bobbin holders, a friction roller having a rotation axis in parallel with the rotation axis of the bobbin and held in frictional contact with the yarn to be wound on the bobbin until the yarn is formed into a full yarn package, and the swingable support arms being swingable around their swing axes to allow the bobbin to be moved together with the bobbin holders with respect to the friction roller to assume a winding position where the bobbin is held in frictional contact with the friction roller and driven to rotate by the friction roller to have a yarn wound thereon and a package releasing position where the yarn package is held out of frictional contact with the friction roller for releasing the yarn package from the bobbin holders, comprising: bobbin revolutions detecting means for detecting revolutions of the bobbin to output signals commensurate to the revolutions of the bobbin, braking means for selectively braking the bobbin holders when the bobbin is moved away from the friction roller by the swingable support arms to be held out of frictional contact with the friction roller, bobbin holders shifting means for selectively shifting the bobbin holders toward and away from each other with respect to the bobbin to assume a bobbin retaining position where the bobbin is retained by the bobbin holders with the longitudinal end portions of the bobbin being respectively engaged with the bobbin holders and a bobbin releasing position where the bobbin is released from the bobbin holders with the longitudinal end portions of the bobbin being respectively disengaged from the bobbin holders, brake conditions determination means for checking brake conditions of the braking means on the basis of the output signals from the bobbin revolutions detecting means to determine whether the bobbin is stopped or not within a predetermined time period after the bobbin holders are braked by the braking means, and package releasing control means for controlling the bobbin shifting means on the basis of the output signals from the brake conditions determination means to selectively release the bobbin from the bobbin holders when the swingable support arms are swung to assume the package releasing position of the swingable support arms.

According to a third aspect of the present invention there is provided a yarn winding machine for winding a yarn on a bobbin to form a yarn package on the bobbin, including a stationary frame structure including a support arm, a bobbin holder having its own rotation axis and supported on the support arm with its own rotation axis extending toward the support arm, the bobbin having a rotation axis being held in coaxial relationship with the rotation axis of the bobbin holder when the bobbin is retained by the bobbin holder, a friction roller having a rotation axis in parallel with the rotation axis of the bobbin holder and held in frictional contact with the yarn to be wound on the bobbin until the yarn is formed into a full yarn package, and the bobbin holder and the friction roller being respectively movable to allow the bobbin to be moved together with the bobbin holder with respect to the friction roller to assume a winding position where the bobbin is held in frictional contact with the friction roller and driven to rotate by the friction roller to have a yarn wound thereon and a package releasing position where the yarn package is held out of frictional contact with the friction roller for releasing the yarn package from the bobbin holder, the yarn winding machine comprising detecting means for detecting a yarn abnormally wound around the friction roller, the detecting means comprising: a light projector positioned in the vicinity of the friction roller to project a light on the peripheral surface of the friction roller, a light receiver positioned in the vicinity of the friction roller and the light projector to receive the light projected from the light projector and reflected by the yarn wound around the friction roller, and determination means for determining whether the yarn is wound or not around the friction roller on the basis of the amount of the light received by the light receiver to output an abnormal condition signal when a predetermined amount of the yarn is wound around the friction roller.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention will become apparent as the description proceeds when taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary cross-sectional view of a bobbin holder, one of a pair of support arms, and a detection circuit forming part of a first embodiment of a yarn winding machine according to the present invention,

Fig. 2 is a schematic side elevational view of the first embodiment of the yarn winding machine,

Fig. 3 is a fragmentary side view of one of the support arms shown in Fig. 1,

Fig. 4 is an enlarged front view of the other of the support arms forming part of the first embodiment of the yarn winding machine,

Fig. 5 is a side view of the other of the support arms shown in Fig. 4,

Fig. 6 is a schematic side elevational view of a second embodiment of the yarn winding machine according to the present invention,

Fig. 7 is a schematic side elevational view of a third embodiment of the yarn winding machine according to the present invention,

Fig. 8 is a schematic plan view of a friction roller, a light projector and a light receiver forming part of the yarn winding machine shown in Fig. 7, and

Fig. 9 is a schematic plan view of a friction roller, a light projector and a light receiver forming part of a fourth embodiment of the yarn winding ma-

chine according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first embodiment of the yarn winding machine according to the present invention will now be described in detail in accordance with the accompanying drawings. The yarn winding machine is designed to act as one of a plurality of yarn winding machines provided in a yarn drawing and false-twisting apparatus.

The yarn winding machine is shown in Figs. 1 to 5 as being adapted to wind a yarn on a bobbin and comprising a stationary frame structure 1 including a pair of swingable support arms 2 and 3 spaced apart from each other, a pair of bobbin holders 5 and 6 having their own rotation axes. Each of the bobbin holders 5 and 6 is supported through a rotation shaft 7 on each of the swingable support arms 2 and 3 with their own rotation axes extending toward the swingable support arms 2 and 3 and rotatable around their own axes. The bobbin holders 5 and 6 are adapted to be selectively shiftable toward and away from each other with respect to the bobbin 11 to assume a bobbin retaining position where the bobbin 11 is retained by the bobbin holders 5 and 6 with the longitudinal end portions lla and llb of the bobbin 11 being respectively engaged with the bobbin holders 5 and 6, and a bobbin releasing position where the bobbin 11 is released from the bobbin holders 5 and 6 with the longitudinal end portions 11a and 11b of the bobbin 11 being respectively disengaged from the bobbin holders 5 and 6. The bobbin 11 is illustrated as dot-and-dash lines to have a rotation axis held in coaxial relationship with the rotation axes of the bobbin holders 5 and 6 when the bobbin 11 is retained by the bobbin holders 5 and 6.

The support arms 2 and 3 are designed to be swingable around their swing axes to allow the bobbin 11 to be moved together with the bobbin holders 5 and 6 with respect to a friction roller 20 which has a rotation axis in parallel with the rotation axes of the bobbin holders 5 and 6. The friction roller 20 is held in frictional contact with the yarn 12 to be wound on the bobbin 11 until the yarn 12 is formed into a full yarn package 10. When the yarn 12 is formed into the yarn package 10, the bobbin holders 5 and 6 are moved by the swingable support arms 2 and 3 to allow the bobbin 11 to be moved together with the bobbin holders 5 and 6 with respect to the friction roller 20 to assume a winding position where the bobbin 11 is held in frictional contact with the friction roller 20 and driven to rotate by the friction roller 20 to have the yarn 12 wound thereon and a package releasing position where the yarn package 10 is held out of frictional contact with the friction roller 20 for releasing the yarn package 10 from the bobbin holders 5 and 6. The swingable support arms 2 and 3 are swung to assume the yarn winding position and the package releasing position by support arms swinging means not shown in the drawings in a similar manner to the conventional support arms swinging means.

The yarn winding machine further comprises bobbin holders shifting means 15 for selectively shifting the bobbin holders 5 and 6 toward and away from each other with respect to the bobbin 11. As shown in Fig. 5, the bobbin holders shifting means 15 includes a tilt arm 31 having one end 31a adapted to support the bobbin holder 6 through the bobbin holder 6, a cradle arm 32 connected to the swingable support arm 2 through a cradle shaft 36 forming part of the stationary frame structure 1 to be rotatable around the cradle shaft 36 with respect to the stationary frame structure 1, and a cam follower 34 rollably supported on the other end 31b of the tilt arm 31. The tilt arm 31 is supported by the cradle arm 32 at its longitudinally intermediate portion 31c to be tiltable around a pivot pin 33 forming part of the cradle arm 32. The cam follower 34 is adapted to rollably engage with a shifting cam portion Ib forming part of the stationary frame structure 1 and to have the tilt arm 31 tilt around the pivot pin 33 so that the bobbin holders 2 and 3 are relatively moved toward and away from each other by the swingable support arms 2 and 3 to assume the bobbin holding position and the bobbin releasing position when the swingable support arms 2 and 3 are swung around their swing axes with respect to the stationary frame structure 1.

The yarn winding machine further comprises a friction roller 20 having a rotation axis in parallel with the rotation axis of the bobbin 11.

The yarn winding machine further comprises bobbin revolutions detecting means 40 for detecting revolutions of the bobbin 11. The revolutions detecting means 40 comprises a magnet element 41 securely fastened to a predetermined position on the peripheral portion of one of the bobbin holders 5 and 6 to have a circumferential path on which the magnet element 41 revolves upon rotation of the bobbin holders 5 and 6, and a detecting element 42 securely mounted on one of the swingable support arms 2 and 3 in opposing relationship to the circumferential path of the magnet element 41 to detect the magnetic flux of the magnet element 41 and to output signals commensurate to the revolutions of the bobbin 11 for enabling determination of normal and abnormal rotational conditions of the bobbin 11. The magnet element 41 is embedded in one of the bobbin holders 5 and 6, and the detecting element 42 is embedded in one of the swingable support arms 2 and 3 held in opposing and spaced relationship with the one of bobbin holders 5 and 6.

The detecting element 42 is constituted by a Hall effect element which is well known in the art to generate signals in each in the form of a voltage level at times when the magnet element 41 is brought into op-

posing relationship to the Hall effect element to allow the Hall effect element to detect the magnetic flux of the magnet element 41. The signals thus generated by the detecting element 41 are outputted to a detecting circuit 50 represented by an abnormal brake detecting circuit. The detecting circuit 50 may be constituted by a series of electric circuits which comprises an electric power supply circuit, an amplifying circuit, a calculating circuit having a timer, and a logic circuit not shown in the drawings. The periodical signals are processed by the above mentioned series of electric circuits to ensure that a multiplicity of rotation pulses commensurate to the revolutions of the bobbin holders 5 and 6 are generated and exactly monitored in number by a pulse counter forming part of the above detecting circuits 50 within a certain time period from the start of the winding operation of the yarn winding machine, thereby making it possible to count the number of revolutions of the bobbin 11 within the certain time period, e.g., revolutions per minute (r.p.m.).

The bobbin revolutions detecting means 40 may include a plurality of magnets angularly spaced apart from each other and revolved by one of the bobbin holders 5 and 6 on a circumferential path in spaced and opposing relationship to the detecting element 42.

The yarn winding machine further comprises braking means 60 for braking the bobbin holders 5 and 6. As shown in Figs. 3 to 5, the braking means 60 includes a first braking unit 61 for braking the bobbin holder 5 and a second braking unit 61' for braking the bobbin holder 6.

The braking unit 61 comprises an annular brake drum, not shown in the drawing, securely mounted on the inner peripheral surface of the bobbin holder 5 in opposing relationship to the swingable support arm 2, a pair of brake arms 62 and 63 supported on the swingable support arm 2 through an anchor pin 64 in opposing relationship to each other and respectively having a brake pad portion 62a and 63a roughly finished, a pair of toggle links 65 and 66 each having one end portion pivotably connected through a pivotal pin 67 to the free end portion of each of the brake arms 62 and 63, a connector link 68 having one end portion pivotably connected through a pivotal pin 69 to the other end portions of the toggle links 65 and 66, a rocker arm 70 having an intermediate portion rockable supported through a pivotal pin 71 on the swingable support arm 2 and one end portion pivotably connected through a pivotal pin 72 to the other end portion of the connector link 68, a cam follower 73 rotatably supported on the other end portion of the rocker arm 70 and rotatable around its own axis with respect to the rocker arm 70, a stationary cam la, forming part of the stationary frame structure 1, held in engagement with the cam follower 73 to have the cam follower 73 subjected to the contour of the stationary cam la and to have the rocker arm 70 rocked when the swingable support arms 2 and 3 are swung toward and away from the yarn winding position of the swingable support arms 2 and 3, and resiliently urging means 74 for resiliently urging the rocker arm 70 to have the cam follower 73 engaged with the stationary cam la through the rocker arm 70.

The brake arms 62 and 63 are swingable to assume a braked position where the brake arms 62 and 63 are held in frictional contact with the annular brake drum and a released position where the brake arms 62 and 63 are released from frictional contact with the annular brake drum. The rocker arm 70 is rockable to have the brake arms 62 and 63 to assume the braked position and the released position through the connector link 68 and the toggle links 65 and 66. The resilient means may be constructed by a tensile coil spring according to the present invention. The yarn winding machine further comprises a package stocker 80 for stopping and retaining the full yarn package 10 doffed from the yarn winding machine.

The second braking unit 61' of the braking means 60 includes an additional rocker arm 76 rockably supported on the longitudinally intermediate portion 31c of the tilt arm 31 and connected to the rocker arm 70' similar to the rocker arm 70 of the first braking unit 61 through a connecter link 77, a cam follower 78 rollably supported on the other end of the additional rocker arm 76, a stationary cam lc forming part of the stationary frame structure 1 and held in engagement with the cam follower 78 to have the cam follower 78 subjected to the contour of the stationary cam 1c and to have the rocker arm 70' and the additional rocker arm 76 rocked when the swingable support arms 2 and 3 are swung toward and away from the yarn winding position of the swingable support arms 2 and 3, and resiliently urging means 79 for resiliently urging the additional rocker arm 76 to have the cam follower 78 engaged with the stationary cam lc of the stationary frame structure 1 through the additional rocker arm 76. The second braking unit 61' further includes a series of members driven by the rocker arm 70' in the similar manner to the series of members 62 to 68 of the first braking unit 61 of the braking means 60. More particularly, the aforesaid series of members of the second braking unit 61' include an annular brake drum, not shown in the drawing, securely mounted on the inner peripheral surface of the bobbin holder 6 in opposing relationship to the swingable support arm 3, a pair of brake arms 62' and 63' supported on the swingable support arm 3 through an anchor pin 64' in opposing relationship to each other, a pair of toggle links 65' and 66' each having one end portion pivotably connected to the free end portion of each of the brake arms 62' and 63', a connector link 68' having one end portion pivotably connected to the other end portions of the toggle links 65' and 66', and the other end portion pivotably connected to the rocker arm 70'.

The above braking means 60 is designed to brake

the bobbin holders 5 and 6 when the yarn package 10 is moved together with the bobbin holders 5 and 6 to be held out of frictional contact with the friction roller 20. The brake condition of the braking means 60 is checked by the detecting circuit 50 on the basis of the output signals from the detecting element 41. Particularly, the number of the rotation pulses counted by the pulse counter of the detecting circuit 50 is outputted to brake conditions determination means, not shown in the drawings and forming part of the detection circuit 50, for checking brake conditions of the braking means 60 on the basis of the output signals from the bobbin revolutions detecting means 40 to determine whether the bobbin 11 is stopped or not within a predetermined time period after the bobbin holders 5 and 6 are braked by the braking means 60. A brake normal signal is outputted from the brake conditions determination means when the bobbin 11 is stopped within a predetermined time period after the bobbin holders 5 and 6 are braked by the braking means 60, while a brake abnormal signal is outputted from the brake conditions determination means when the bobbin 11 is by contrary not stopped within the predetermined time period after the bobbin holders 5 and 6 are braked by the braking means 60. The brake normal and abnormal signals are respectively inputted to package releasing control means, not shown in the drawings, forming part of the control circuit of the yarn winding machine. The package releasing control means is adapted to control the bobbin holders shifting means 15 to selectively release the bobbin 11 with the full yarn package 10 from the bobbin holders 5 and 6 when the swingable support arms 2 and 3 are swung away from the friction roller 20 to assume the package releasing position of the swingable support arms 2 and 3. In the present embodiment, the bobbin holders shifting means 15 is controlled by the package releasing control means to shift the bobbin holders 5 and 6 to assume the bobbin releasing position when the bobbin 11 is stopped within the predetermined time period after the bobbin holders 5 and 6 are braked by the braking means 60.

The operation of the first embodiment of the yarn winding machine according to the present invention thus constructed will now be described hereinafter.

The empty bobbin 11 retained by the bobbin holders 5 and 6 is initially brought into frictional contact with the friction roller 20 when the swingable support arms 2 and 3 are swung in a direction shown by an arrow B in Fig. 2. Under these conditions, the empty bobbin 11 is driven to rotate by the friction roller 20 and the bobbin holders 5 and 6 are simultaneously rotated together with the bobbin 11 to have yarn 12 wound on the bobbin 11. The magnet element 41 securely fastened to the predetermined position on the peripheral portion of the bobbin holder 5 is revolved on the circumferential path of the magnet element 41 to periodically pass over the detecting element 42. At every time when the magnet element 41 passes over the detecting-element 42, the magnetic flux of the magnet element 41 comes to influence the detecting element 42 and is detected by the detecting element 42. The magnetic flux of the magnet element 41 influenced on the detecting element 42 is fluctuated depending upon distance between the magnet element 41 and the detecting element 42 to have the detecting element 42 produce a peaked detection signal during one turn of the bobbin holder 5. The detection circuit 50 is then driven to determine whether the peaked detection signal exceeds a predetermined level or not. When the peaked detection signal exceeds a predetermined level, the detection circuit 50 produces a rotation pulse commensurate to one turn of the bobbin holder 5. When the peaked detection signal contrarily does not exceed a predetermined level, the detection circuit 50 does not produce a rotation pulse commensurate to one turn of the bobbin holder 5. The rotation pulses in response to the revolutions of the bobbin holder 5 are counted by the pulse counter of the detection circuit 50 within a predetermined time interval.

According to the present invention, the revolutions of the bobbin holder 5 can accurately be detected by the detecting element 42 thus constructed in the above and counted by the pulse counter of the detection circuit 50 even if the detecting element 42 is located under such a deteriorated environment that the detecting element 42 is subject to fine fiber dust and dew. More advantageous effect can be expected in the event that the detecting element 42 is constituted by a Hall effect element since the peaked detection signals are each generated in the form of a voltage level at times when the magnet element 41 is brought into opposing relationship to the Hall effect element to allow the Hall effect element to detect the magnetic flux of the magnet element 41. Furthermore, the bobbin revolutions detecting means 40 constructed according to the present invention for detecting revolutions of the bobbin 11 can also be manufactured at a low cost.

The yarn 12 continues to be wound on the bobbin 11 to form a yarn package 10 until the diameter of the package reaches a predetermined diameter defined by a full yarn package 10 on the bobbin 11 and commensurate to the predetermined revolutions of the bobbin holder 5. When the full yarn package 10 completed on the bobbin 11 is detected by the detection circuit 50 with the revolutions of the bobbin holder 5 reaching the predetermined level, the yarn 12 is severed from the full yarn package 10 by a yarn cutter not shown in the drawings. The swingable support arms 2 and 3 are then swung in a direction shown by an arrow A in Fig. 2 to have the full yarn package 10 moved away from the friction roller 20 until the full yarn package 10 reaches a non-winding area where the rocker arm 70 is rocked in a direction shown by an arrow C in Fig. 3 with the cam follower 73 being rel-

atively moved with respect to the swingable support arm 2 by the stationary cam la under the resilient force of the resiliently urging means 74. This results in the fact that the brake arms 62 and 63 are brought into frictional contact with the brake drum on the inner peripheral portion of the bobbin holder 5 to cause the bobbin holder 5 to be braked until the bobbin 11 and the full yarn package 10 are stopped. At the same time, the bobbin 6 is braked by the second braking unit 61' of the braking means 60 in a similar manner to the bobbin holder 5.

The swing angle of the swingable support arms 2 and 3 swung in the direction shown by the arrow A to have the full yarn package 10 moved away from the friction roller 20 to the non-winding area is detected by a limit switch not shown in the drawings. The signal of the limit switch is then supplied to the detection circuit 50 which is then driven to determine whether the peaked detection signal exceeds a predetermined level or not and to count the rotation pulses in response to the revolutions of the bobbin holder 5 within a predetermined time interval. When the number of the rotation pulses counted by the pulse counter of the detection circuit 50 are determined as not exceeding the predetermined level within the predetermined time interval by the detection circuit 50 to produce a normal brake signal, the braking means 60 is judged by the detection circuit 50 as being normally operated. More particularly, the number of revolutions of the yarn package 10 within the predetermined time interval is reduced by the braking means 60 through the bobbin holders 5 and 6 while the bobbin holders 5 and 6 are braked by the braking means 60 under the normal brake condition. Under these conditions, the detecting circuit 50 checks the number of rotation pulses counted by the pulse counter of the detection circuit 50 within the predetermined time interval to produce normal brake signal when the number of the rotation pulses counted by the pulse counter does not exceed the predetermined number, e.g., zero in the present embodiment. At the same time when the normal brake signal is produced, the braking means 60 is judged by the detection circuit 50 as being normally operated. The normal brake signal of the detection circuit 50 is fed to the above control circuit of the yarn winding machine to have the full yarn package 10 doffed to and wait at a package stocker 80 until the full yarn package 10 is transferred to a following process. When the full yarn package 10 is doffed to the package stocker 80, the swingable support arms 2 and 3 are swung toward the package releasing position to allow the tilt arm 31 to be tilt by the bobbin holders shifting means 15 so that the full yarn package 10 is released from the bobbin holders 5 and 6.

If, on the other hand, the braking means 60 becomes out of order resulting from some reason, the bobbin holder 5 comes to be not braked by the braking means 60 before the full yarn package 10 is doffed to and guided by the package stocker 80. In this case, the abnormal brake signal is produced by the detection circuit 50 when the numbers of the rotation pulses counted by the pulse counter of the detection circuit 50 during the certain time for normally braking are respectively determined as exceeding the predetermined level, e.g., zero within the predetermined time interval. At this time, the braking means 60 is judged by the detection circuit 50 as being abnormally operated. In this case, the abnormal brake signal of the detection circuit 50 is fed to the control circuit forming part of the yarn winding machine to have the full yarn package 10 not doffed to the package stocker 80. In other words, the bobbin 11 with the full yarn package 10 is not released from the bobbin holders 5 and 6 when the bobbin 11 is not stopped within the predetermined time period after the bobbin holders 5 and 6 are braked by the braking means 60. The full yarn package 10 is therefore by no means collapsed nor damaged. The operator can instantly realize the abnormal condition of the braking means 60, since the alarm is suddenly operated.

According to the present invention as described in the above, the yarn winding machine can be of simple construction and produced at a low-cast. The revolution conditions of the bobbin holder can be detected by the yarn winding machine at high accuracy and with high reliability even under a deteriorated environment of fine dusts and dews surrounding the yarn winding machine, thereby preventing the packages from being formed on the bobbin in excess of the limit of its predetermined measurement. Additionally, the yarn winding machine according to the present invention is so constructed as to detect the malfunction of the braking means 60 stemming from the abnormal revolution condition of the bobbin holders 5 and 6 so that the full yarn packages 10 are by no means thrown to package stocker 80 from the package doffing apparatus of the yarn winding machine before they are stopped by the braking means 60. Consequently, the yarn winding machine according to the present invention can be put into an automatic doffing operation for automatically moving and doffing the full yarn package 10 to the non-winding area wherein the yarn package is held out of frictional contact with the friction roller 20 to replace the full yarn package 10 with a succeeding empty bobbin 11.

A second embodiment of the yarn winding machine according to the present invention will now be described in detail in accordance with the accompanying drawing.

The second embodiment of the yarn winding machine according to the present invention is shown in Fig. 6. The yarn winding machine further comprises a calculating circuit 91 for calculating revolution speeds of the bobbin holder 5 on the basis of the outputted signals from the detecting element 42, a winding speeds detecting circuit 92 for detecting yarn

winding speeds of the yarn 12 to be wound on the bobbin 11, and a yarn package diameter detecting circuit 93 for calculating the diameter of the yarn package 10 on the basis of the revolution speeds calculated by the calculating circuit 91 and the yarn winding speeds detected by the winding speeds detecting circuit 92 to have yarn package diameter signals outputted when the yarn package 10 is formed on the bobbin 11 with its diameter exceeding the predetermined range of the yarn package diameter. Each of the above circuits 91 to 93 includes a power supply circuit, an amplifying circuit, a calculating circuit having a timer and a counter, and a logic circuit which will not be described hereinlater.

In the present embodiment of the yarn winding machine according to the present invention, the revolution speeds of the bobbin holder 5, i.e., the revolution speeds of the bobbin 11 and the yarn package 10 are calculated by the revolution speeds calculating circuit 91 on the basis of the outputted signals from the detecting element 42. The data concerning the traveling speeds of the yarn 12 is then fed to the winding speeds detecting circuit 92 from a control circuit forming part of the yarn drawing and false-twisting apparatus to have the winding speeds detecting circuit 92 detect yarn winding speeds of the yarn 12 to be wound on the bobbin 11. The yarn package diameter detecting circuit 93 then calculates the diameter of the yarn package 10 on the basis of the revolution speeds calculated by the calculating circuit 91 and the yarn winding speeds calculated by the winding speeds detecting circuit 92. The diameter of the yarn package 10 is calculated by the yarn package diameter detecting circuit 93 on the basis of the yarn length calculated for one turn of the bobbin 11.

In general, the tensile strength is fluctuated while the yarn 12 is being wound on the bobbin 11 for a predetermined time interval and to a predetermined yarn length, thereby causing the yarn package 10 to be unevenly formed on the bobbin 11. For this reason, the yarn winding machine according to the present invention is designed to comprise a yarn package diameter detecting circuit 93 for calculating the diameter of the yarn package 10 on the basis of the revolution speeds calculated by the calculating circuit 91 and the yarn winding speeds calculated by the winding speeds detecting circuit 92. The above revolution speeds calculating circuit 91, the winding speeds detecting circuit 92 and the yarn package diameter detecting circuit 93 constitute as a whole yarn package diameter detecting means 90.

When the diameter of the yarn package 10 is thus determined by the yarn package diameter detecting means 90 as remaining within its predetermined range, the yarn 12 is to be severed at the leading end by a suitable yarn cutter not shown in the drawings. If, on the other hand, the diameter of the yarn package 10 is determined by the yarn package diameter detecting means 90 as exceeding its predetermined range, the yarn package diameter abnormal signal is outputted to the control circuit of the yarn winding machine to produce an alarm or the like. Therefore, the yarn package 10 determined as being irregular can be found out before being contained in the cardboard box, thereby overcoming a trouble liable to be caused in the process of having the yarn package 10 contained in the cardboard box.

The yarn winding machine according to the second embodiment of the present invention is so designed as to promptly detect an abnormal- revolution condition of the bobbin 11 by calculating diameter of the yarn package 10 on the basis of the rotational speeds of the bobbin 11 and the winding speed of the yarn 12, with the result that troubles can readily be eliminated in the subsequent process such as for example a packaging process of the full yarn package 10.

The third embodiment of the yarn winding machine according to the present invention will be described in detail hereinafter in accordance with the drawings.

The yarn winding machine is shown in Figs. 6 and 7 as being provided with detecting means for detecting the yarn wound around the friction roller.

In Figs. 6 and 7, the reference numeral 101 designates a yarn such as for example a synthetic fiber false-twisted by and fed from the yarn drawing and false-twisting machine not shown in the drawings. The yarn 101 is shown to be wound on a bobbin 102 by the winding machine after being guided by a guide bar 104. The yarn winding machine comprises a stationary frame structure 110 including a pair of swingable support arms 111 spaced apart from each other, a pair of bobbin holders 115 rotatable around their own axes and each supported on each of the swingable support arms 111 with their own rotation axes extending toward the swingable support arms 111, bobbin holders shifting means, not shown, for selectively shifting the bobbin holders 115 toward and away from each other, and a friction roller 120 having a rotation axis in parallel with the rotation axis of the bobbin 102 and a peripheral surface 121 to be held in frictional contact with the yarn 101 to be wound on the bobbin 102.

The swingable support arms 111 are designed to be swingable around their swing axes to allow the bobbin 102 to be moved together with the bobbin holders 102 with respect to the friction roller 120 to assume a yarn winding position where the bobbin 102 is held in frictional contact with the frict-ion roller 120 and driven to rotate by the friction roller 120 to have the yarn 101 wound thereon until the yarn 12 is formed into a full yarn package 103 and a package releasing position where the bobbin 102 is held out of frictional contact with the friction roller 120 for releasing the yarn package 103 from the bobbin holders

111. The swingable support arms 111 are swung to assume the yarn winding position and the package releasing position by support arms swinging means 116 in a similar manner to the conventional support arms swinging means.

The bobbin holders 115 are selectively shiftable toward and away from each other with respect to the bobbin 102 to assume a bobbin retaining position where the bobbin 102 is retained by the bobbin holders 115 with the longitudinal end portions of the bobbin 102 being respectively engaged with the bobbin holders 115 and a bobbin releasing position where the bobbin 102 is released from the bobbin holders 115 with the longitudinal end portions of the bobbin 102 being respectively disengaged from the bobbin holders 115. The bobbin 102 has a rotation axis being held in coaxial relationship with the rotation axes of the bobbin holders 115 when the bobbin 102 is retained by the bobbin holders 115. The friction roller 120 is designed to be driven by a drive motor 125.

Between the friction roller 120 and the guide bar 104 is provided a yarn traversing guide 127 which is traversable between a first position shown in solid line in Fig. 8 and a second position shown in phantom line in Fig. 8 to have the yarn 101 traversed between the first and second positions before being wound on the bobbin 102 and after being guided by the guide bar 104. The yarn traversing guide 127 has a guide slit portion 127a with which the yarn 101 passing over the guide bar 104 is engaged.

The yarn winding machine further comprises detecting means 130 for detecting a yarn abnormally wound around the friction roller 120. The detecting means 130 comprises a light projector 131 positioned in the vicinity of the friction roller 120 to project a light on the peripheral surface 121 of the friction roller 120, a light receiver 132 positioned in the vicinity of the friction roller 120 and the light projector 131 to receive the light projected from the light projector 131 and reflected by the yarn 101 wound around the friction roller 120, a control circuit 135 of the yarn winding machine, and determination means, forming part of the control circuit 135, for determining whether the yarn 101 is wound or not around the friction roller 120 on the basis of the amount of the light received by the light receiver 132.

The friction roller 120 is finished with its surface color difficult for light to be reflected by the surface 121 of the friction roller 120. The yarn winding machine according to the present invention may comprise a friction roller 120 which is finished with its black surface 121 difficult for light to be reflected by the surface 121 of the friction roller 120. The light projector 131 and the receiver 132 are housed in a common container 133 positioned in the vicinity of the friction roller 120 and electrically connected with a detection circuit 134 forming part of the control circuit 135. The detection circuit 134 is constructed to output an electric signal for projecting a light on the peripheral surface 121 of the friction roller 120 and to input an electric signal with the light projected from the light projector 131 and received by the light receiver 132 after being reflected by the yarn 101 wound around the friction roller 120. The detection circuit 134 is designed to incorporate with the determination means for determining whether the yarn 101 is wound or not around the friction roller 120 on the basis of the amount of the light received by the light receiver 132. The reason why the friction roller 120 is finished with its black surface 121 is such that the light is difficult to be reflected by the surface 121 of the friction roller 120 to make it impossible to input the electric signal with the light received by the light receiver 132. In the event that the amount of the light received by the light receiver 132 does exceed a predetermined level, the effective electric signal is not inputted to the detection circuit 134, whereas the electric signal is inversely inputted to the detection circuit 134 to produce an abnormal condition signal if the amount of the light received by the light receiver 132 exceeds the predetermined level. The abnormal condition signal is fed to the determination means of the control circuit 135 to determine the normal and abnormal winding condition. For this reason, the determination means of the control circuit 135 is provided for determining whether the yarn 101 is abnormally wound or not around the friction roller 120 on the basis of the amount of the light received by the light receiver 132. The amount of the light received by the light receiver 132 is set at such a predetermined level that the friction roller 120 is wound with plural turns of yarn 101 thereon in the present embodiment of the yarn winding machine according to the present invention. This makes it no need for the light receiver 132 to be of high sensitivity to the degree that the light receiver 132 is sensitive to only one turn of yarn 101 on the friction roller 120.

The yarn winding machine further comprises a yarn cutter, not shown in the drawings, adapted to cut the yarn 101 at a predetermined position on a traveling path of the yarn 101 through which the yarn 101 is fed to the bobbin 102, and yarn cutter operating means ,forming part of the control circuit 135, for operating the yarn cutter on the basis of the abnormal condition signal from the determination means forming part of the detection circuit 134 to sever the leading end portion of the yarn 101 from the yarn 101 abnormally wound around the friction roller 120 when the yarn 101 is abnormally wound around the friction roller 120.

The yarn winding machine frequently encounters such a problem that the operator fails to hook the leading end of the yarn 101 to the bobbin 102 before the yarn 101 begins to be wound on the bobbin 102, thereby resulting in the leading end of the yarn 101 being likely traveled through the friction roller 120 and the bobbin 102 to be wound around the friction

roller 120 instead of being wound on the bobbin 102. This problem is similarly arisen for the yarn wind-ing machine failing to be operated to have the leading end of the yarn 101 automatically hooked on the bobbin 102. In another case, the yarn package 103 is likely to instantly move out of frictional contact with the friction roller 120 if the yarn winding machine happens to be vibrated and shocked resulting from some external force exerted to the yarn winding machine, thereby bringing about the yarn 101 wound around the friction roller 120. The yarn 101 is immediately wound on the friction roller 120 initially in a rough mesh form as shown in phantom line in Fig. 8 and subsequently in a thickened mesh form as the bobbin 102 is being rotated at a high speed. Finally, there may be wound on the friction roller 120 a large yarn package which is possibly to cause the electric motor 125 for the friction roller 120 to be stopped due to its excessive load or to cause the yarn package on the friction roller 120 to collide with some parts in the neighborhood of the friction roller 120.

The yarn cutter operating means forming part of the control circuit 135 therefore operates the yarn cutter on the basis of the abnormal condition signal from the determination means of the detection circuit 134 to sever the leading end portion of the yarn 101 from the yarn 101 abnormally wound around the friction roller 120 when the yarn winding machine is determined as being under the abnormal condition that the yarn 101 is wound around the friction roller 120. The abnormal yarn package on the friction roller cannot be thickened when the yarn cutter is operated to cut the yarn 101 since the leading end portion of the yarn 101 severed from the yarn wound around the friction roller cannot be wound around the friction roller, thereby making it possible to give rise to no damages on the mechanical parts of the yarn winding machine.

On the other hand, the control circuit 135 of yarn winding machine therefore stops the drive motor 125 so as not to drive the friction roller 120 when the yarn winding machine is determined as being under the abnormal condition that the yarn 101 is wound around the friction roller 120. If the yarn winding machine is provided with a warning instrument such as for example a warning lamp and an alarm, the operator can promptly realize the fact that the yarn 101 has been wound around the friction roller 120. It is to be thus understood that the yarn winding machine can easily avert such problems as previously mentioned.

The determination means of the control circuit 135 thus determines whether the yarn 101 is abnormally wound or not around the friction roller 120 on the basis of the amount of the light received by the light receiver 132, and the yarn cutter is operated by the yarn cutter operating means to have the yarn severed from the yarn wound around the friction roller 120 when a predetermined amount of the yarn 101 is wound around the friction roller 120. Therefore, the yarn winding machine can be put into an automatic doffing operation which includes a yarn hooking step for hooking the leading end portion of the yarn 101 to an annular groove of the bobbin 102 so that the leading end of the yarn 101 is caught by the annular groove of the bobbin 102, and a bobbin replacing step for releasing the full yarn package 103 from the bobbin holders 115 to replace the full yarn package 103 with a succeeding empty bobbin 102.

Further, the detecting means 130 is initiated to produce a signal to cut the yarn 101 when plural turns of yarn 101, i.e., a predetermined amount of the yarn 101 is wound around the friction roller 120. In consequence, there is no error in operation of detecting the yarn 101 wound around the friction roller 120, thereby enabling the detecting means 130 to be made at a relatively low-cost.

The fourth embodiment of the yarn winding machine according to the present invention will be described hereinlater in accordance with Fig. 9 showing merely essential constitutional elements or parts forming part of the yarn winding machine without other remaining parts constituting the yarn winding machine being omitted for avoiding tedious repetition of the description. The reference numerals representing the same parts as those forming the second embodiment of the yarn winding machine shown in Figs. 6 and 7 are given to the constitutional parts in Fig. 9.

The winding machine comprises a friction roller 140 which is finished with its peripheral surface 141 metal-plated for light to be reflected by the peripheral surface 141 of the friction roller 140. A combination of light projector and receiver 130 is arranged at an angle with respect to the rotation axis of the friction roller 140 in such a manner that the light projected from the light projector 131 is reflected by the peripheral surface 141 of the friction roller 140 in a direction away from the light projector 131 and the light receiver 132 so that the light from the light projector 131 is not received by the light receiver 132 as shown in a solid line arrow in Fig. 9. When a predetermined turns of yarn 101 are wound around the friction roller 140 to cause the light projected from the light projector 131 to be reflected and scattered by the yarn 101 wound around the peripheral surface 141 of the friction roller 140 so that the light projected from the light projector 131 can be received by the light receiver 132 as shown in a chain line arrow in Fig. 9. The scattered and reflected light from the yarn 101 wound on the friction roller 140 results in a part of light being received by the light receiver 132. In the fourth embodiment of the yarn winding machine, the arrangement of the light projector 131 and the light receiver 132 causes a predetermined amount of light reduced from the total amount of light projected from the light projector 131 to be received by the light receiver 132. In a similar manner, the predetermined amount of light

received by the light receiver 132 is detected by the detection circuit 134 to have the friction roller 140 stopped.

In the event that the yarn 101 has been wound around the friction roller 140 in the fourth embodiment of the yarn winding machine, the operator can also promptly deal with the abnormal condition, thereby making it possible to give rise to no damages on the mechanical parts of the yarn winding machine. It is to be thus understood that the yarn winding machine can easily dodge such problems in the same fashion as previously mentioned.

According to the present invention as described in the above, the yarn winding machine can be of simple construction and produced at a low-cast. The revolution conditions of the friction roller 140 can be detected by the yarn winding machine at high accuracy and with high reliability. Further, the winding machine according to the present invention makes the operator to be able to promptly realize the fact that the yarn 101 has been wound around the friction roller 140, thereby making it possible to give rise to no damages on the mechanical parts and elements of the yarn winding machine and simultaneously preventing reduction in production efficiency for the yarn package 103.

In the embodiments of the present invention thus described in the foregoing description there are provided a pair of support arms 2, 3 and 111 swingably mounted on a stationary frame structure 1 and 110 and rotatably supporting the bobbin holders 5, 6 and 115, however, the pair of support arms may be replaced by a support arm which is mounted on a stationary frame structure in a cantilever fashion to rotatably support a bobbin holder according to the present invention.

While there have been described about the preferred embodiments of the yarn winding machine constructed in accordance with the present invention in the foregoing description, various modifications and adaptations thereof may be made within the spirit of the present invention as set forth in the following claims.

Claims

1. A yarn winding machine for winding a yarn (12) on a bobbin (11) to form a yarn package (10) on said bobbin (11), including a stationary frame structure (1) including a support arm (2, 3), a bobbin holder (5, 6) having its own rotation axis and supported on said support arm (2, 3) with its own rotation axis extending toward said support arm (2, 3), said bobbin (11) having a rotation axis being held in coaxial relationship with said rotation axis of said bobbin holder (5, 6) when said bobbin (11) is retained by said bobbin holder (5, 6), a friction roller (20) having a rotation axis in parallel with said rotation axis of said bobbin holder (5, 6) and held in frictional contact with said yarn (12) to be wound on said bobbin (11) until said yarn (12) is formed into a full yarn package (10), and said bobbin holder (5, 6) and said friction roller (20) being respectively movable to allow said bobbin (11) to be moved together with said bobbin holder (5, 6) with respect to said friction roller (20) to assume a winding position where said bobbin (11) is held in frictional contact with said friction roller (20) and driven to rotate by said friction roller (20) to have said yarn (12) wound thereon and a package releasing position where said yarn package (10) is held out of frictional contact with said friction roller (20) for releasing said yarn package (10) from said bobbin holder (5, 6),

comprising: bobbin revolutions detecting means (40) for detecting revolutions of said bobbin (11), said revolutions detecting means (40) comprising a magnet element (41) securely fastened to a predetermined position on the peripheral portion of said bobbin holder (5, 6) and having a circumferential path on which said magnet element (41) revolves upon rotation of said bobbin holder (5, 6), and a detecting element (42) securely mounted on said support arm (2, 3) in opposing relationship to said circumferential path of said magnet element (41) to detect the magnetic flux of said magnet element (41) and to output signals commensurate to the revolutions of said bobbin (11).

2. A yarn winding machine as set forth in claim 1, which further comprises a detection circuit (50) for detecting the number of revolutions of said bobbin (11) within a certain time period on the basis of the output signals from said detecting element (42).

3. A yarn winding machine as set forth in claim 1, which further comprises braking means (60) for braking said bobbin holder (5, 6) when said yarn package (10) is moved together with said bobbin holder (5, 6) to be held out of frictional contact with said friction roller (20), and brake conditions checking means for checking brake conditions of said braking means (60) on the basis of the output signals from said detecting element (42) to output a brake abnormal signal when said bobbin (11) is not stopped within a predetermined time period after said bobbin holder (5, 6) is braked by said braking means (60).

4. A yarn winding machine as set forth in claim 1, which further comprises calculating means (91) for calculating revolution speeds of said bobbin holder (5, 6) on the basis of said outputted signals

from said detecting element (42), winding speeds detecting means (92) for detecting yarn winding speeds of said yarn (12) to be wound on said bobbin (11), and yarn package diameter detecting means (93) for calculating the diameter of said yarn package (10) on the basis of said revolution speeds calculated by said calculating means (91) and said yarn winding speeds detected by said winding speeds detecting means (92) to have a yarn package diameter abnormal signal outputted when said yarn package (10) is formed on said bobbin (11) with its diameter exceeding the predetermined range of said yarn package diameter.

5. A yarn winding machine for winding a yarn on a bobbin (11) to form a yarn package (10) on said bobbin (11), including a stationary frame structure (1) including a pair of swingable support arms (2, 3) spaced apart from each other and having their own swing axes, a pair of bobbin holders (5, 6) having their own rotation axes and each rotatably supported on each of said swingable support arms (2, 3) with their own rotation axes extending toward said swingable support arms (2, 3), said bobbin (11) having a rotation axis being held in coaxial relationship with said rotation axes of said bobbin holders (5, 6) when said bobbin (11) is retained by said bobbin holders (5, 6), a friction roller (20) having a rotation axis in parallel with the rotation axis of said bobbin (11) and held in frictional contact with said yarn (12) to be wound on said bobbin (11) until said yarn (12) is formed into a full yarn- package (10), and said swingable support arms (2, 3) being swingable around their swing axes to allow said bobbin (11) to be moved together with said bobbin holders (5, 6) with respect to said friction roller (20) to assume a winding position where said bobbin (11) is held in frictional contact with said friction roller (20) and driven to rotate by said friction roller (20) to have said yarn (12) wound thereon and a package releasing position where said full yarn package (10) is held out of frictional contact with said friction roller (20) for releasing said yarn package (10) from said bobbin holders (5, 6),

comprising: bobbin revolutions detecting means (40) for detecting revolutions of said bobbin (11) to output signals commensurate to the revolutions of said bobbin (11),

braking means (60) for selectively braking said bobbin holders (5, 6) when said bobbin (11) is moved away from said friction roller (20) by said swingable support arms (2, 3) to be held out of frictional contact with said friction roller (20),

bobbin holders shifting means (15) for selectively shifting said bobbin holders (5, 6) toward and away from each other with respect to said bobbin (11) to assume a bobbin retaining position where said bobbin (11) is retained by said bobbin holders (5, 6) with the longitudinal end portions (11a, 11b) of said bobbin (11) being respectively engaged with said bobbin holders (5, 6) and a bobbin releasing position where said bobbin (11) is released from said bobbin holders (5, 6) with the longitudinal end portions (11a, 11b) of said bobbin (11) being respectively disengaged from said bobbin holders (5, 6),

brake conditions determination means (50) for checking brake conditions of said braking means (60) on the basis of the output signals from said bobbin revolutions detecting means (40) to determine whether said bobbin (11) is stopped or not within a predetermined time period after said bobbin holders (5, 6) are braked by said braking means (60), and

package releasing control means for controlling the bobbin holders shifting means (15) on the basis of the output signal from said brake conditions determination means (50) to selectively release said bobbin (11) from said bobbin holders (5, 6) when said swingable support arms (2, 3) are swung away from said friction roller (20) to assume said package releasing position of said swingable support arms (2, 3).

6. A yarn winding machine as set forth in claim 5, in which said revolutions detecting means (40) comprises a magnet element (41) securely fastened to a predetermined position on the peripheral portion of one of said bobbin holders (5, 6) and having a circumferential path on which said magnet element (41) revolves upon rotation of said bobbin holders (5, 6), and a detecting element (42) securely mounted on one of said support arms (2, 3) in opposing relationship to said circumferential path of said magnet element (41) to detect the magnetic flux of said magnet element (41) and to output signals commensurate to the revolutions of said bobbin (11).

7. A yarn winding machine for winding a yarn (101) on a bobbin (102) to form a yarn package (103) on said bobbin (102), including a stationary frame structure (110) including a support arm (111), a bobbin holder (102) having its own rotation axis and supported on said support arm (111) with its own rotation axis extending toward said support arm (111), said bobbin (102) having a rotation axis being held in coaxial relationship with said rotation axis of said bobbin holder (115) when said bobbin (102) is retained by said bobbin holder (115), a friction roller (120) having a rotation axis in parallel with said rotation axis of said bobbin holder (115) and held in frictional contact with said yarn (101) to be wound on said bobbin (102)

until said yarn (101) is formed into a full yarn package (103), and said bobbin holder (102) and said friction roller (120) being respectively movable to allow said bobbin (102) to be moved together with said bobbin holder (102) with respect to said friction roller (120) to assume a winding position where said bobbin (102) is held in frictional contact with said friction roller (120) and driven to rotate by said friction roller (120) to have said yarn (101) wound thereon and a package releasing position where said yarn package (103) is held out of frictional contact with said friction roller (120) for releasing said yarn package (103) from said bobbin holder (102),

said yarn winding machine comprising detecting means (130) for detecting a yarn (101) abnormally wound around said friction roller (120), said detecting means comprising:

a light projector (131) positioned in the vicinity of said friction roller (120) to project a light on the peripheral surface (121) of said friction roller (120),

a light receiver (132) positioned in the vicinity of said friction roller (120) and said light projector (131) to receive said light projected from said light projector (131) and reflected by said yarn (101) wound around said friction roller (120), and

determination means (134) for determining whether said yarn (101) is wound or not around said friction roller (120) on the basis of the amount of said light received by said light receiver (132) to output an abnormal condition signal when a predetermined amount of said yarn (101) is wound around said friction roller (120).

8. A yarn winding machine as set forth in claim 7, in which said friction roller (120) is finished with its surface (121) difficult for light to be reflected toward said light receiver (132) by said surface of said friction roller (120).

9. A yarn winding machine as set forth in claim 7, in which said light receiver (132) is arranged at an angle with respect to the rotation axis of said friction roller (140) in such a manner that the light projected from said light projector (131) is reflected by the peripheral surface (141) of said friction roller (140) in a direction away from said light receiver (132) so that the light from the light projector (131) is difficult to be received by said light receiver (132).

10. A yarn winding machine as set forth in claim 7 or 9, which further comprises a yarn cutter adapted to cut the yarn (101) at a predetermined position on a yarn traveling path through which said yarn (101) is fed to the bobbin (102), and yarn cutter operating means (135) for operating the yarn cutter on the basis of the abnormal condition signal from said determination means (134) to sever the leading end portion of said yarn (101) from the yarn (101) abnormally wound around said friction roller (120, or 140) when said yarn (101) is wound around said friction roller (120, or 140).

FIG. 1

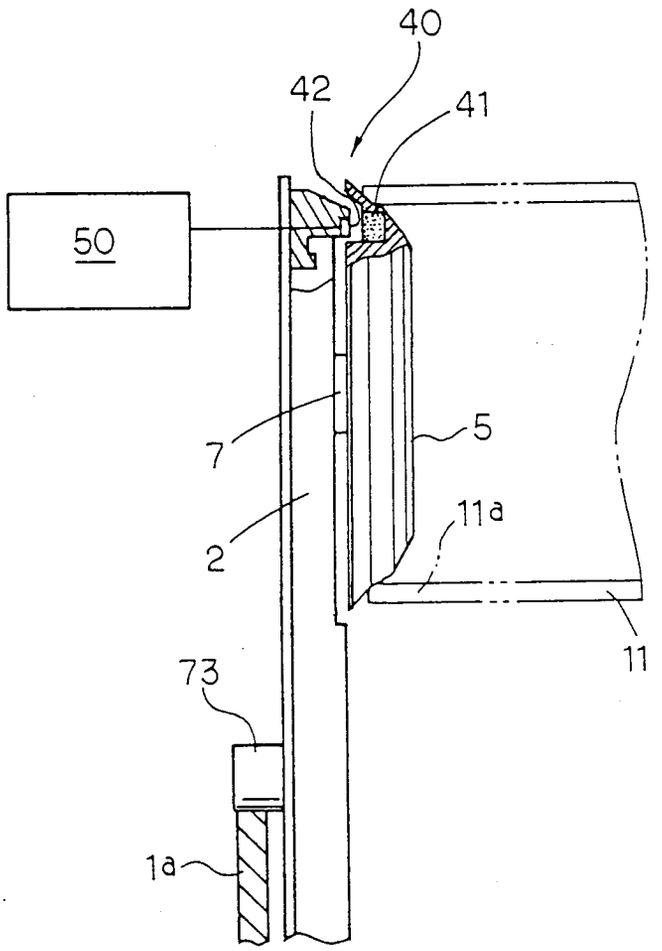


FIG. 2

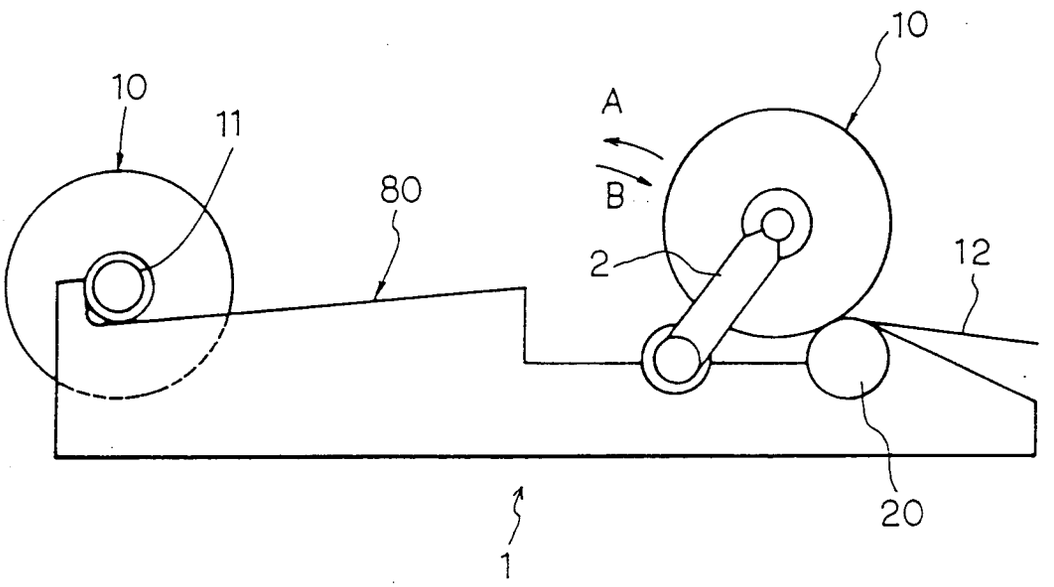


FIG. 3

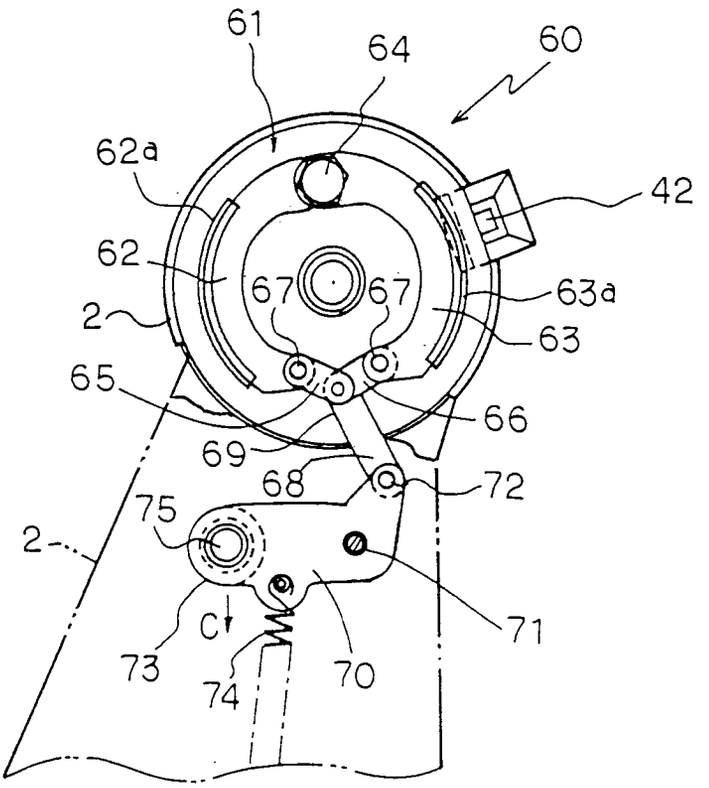


FIG. 4

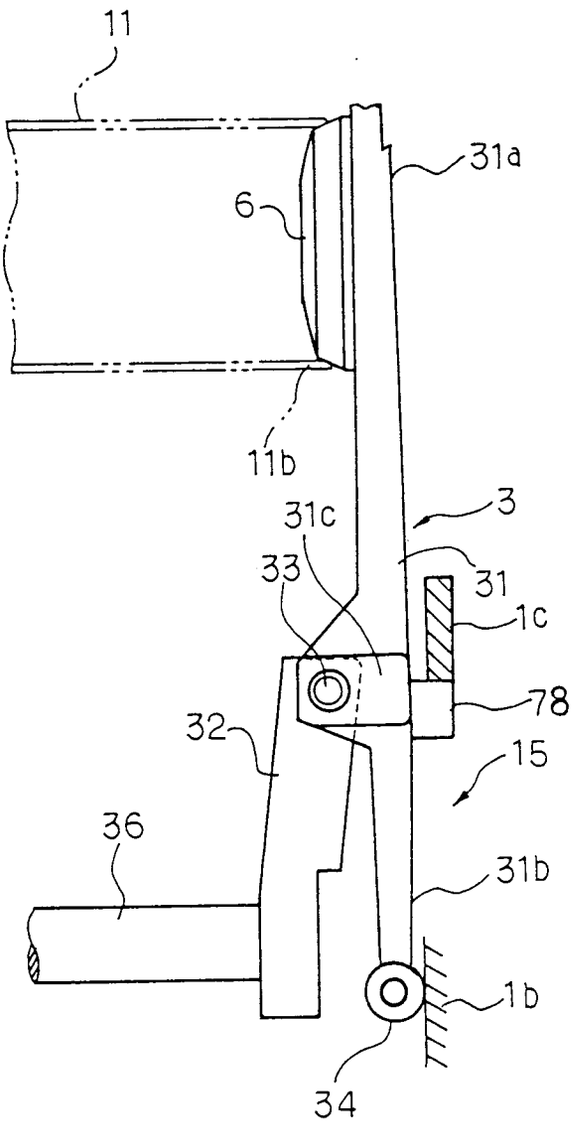


FIG. 5

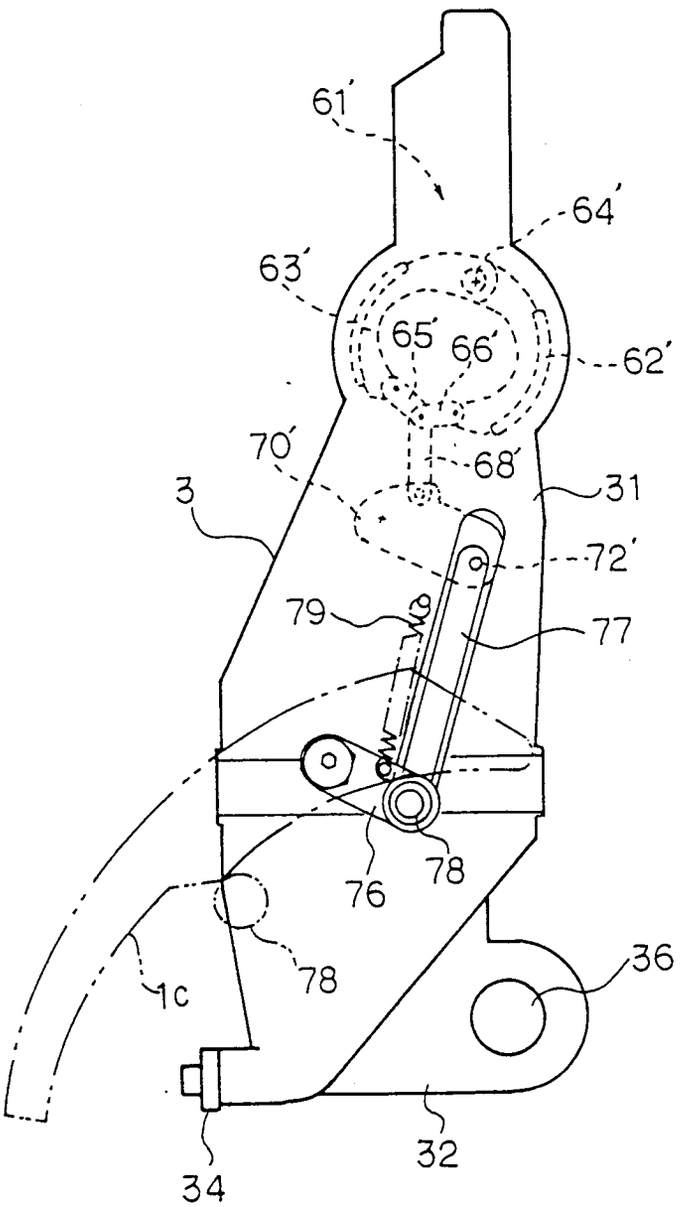


FIG. 6

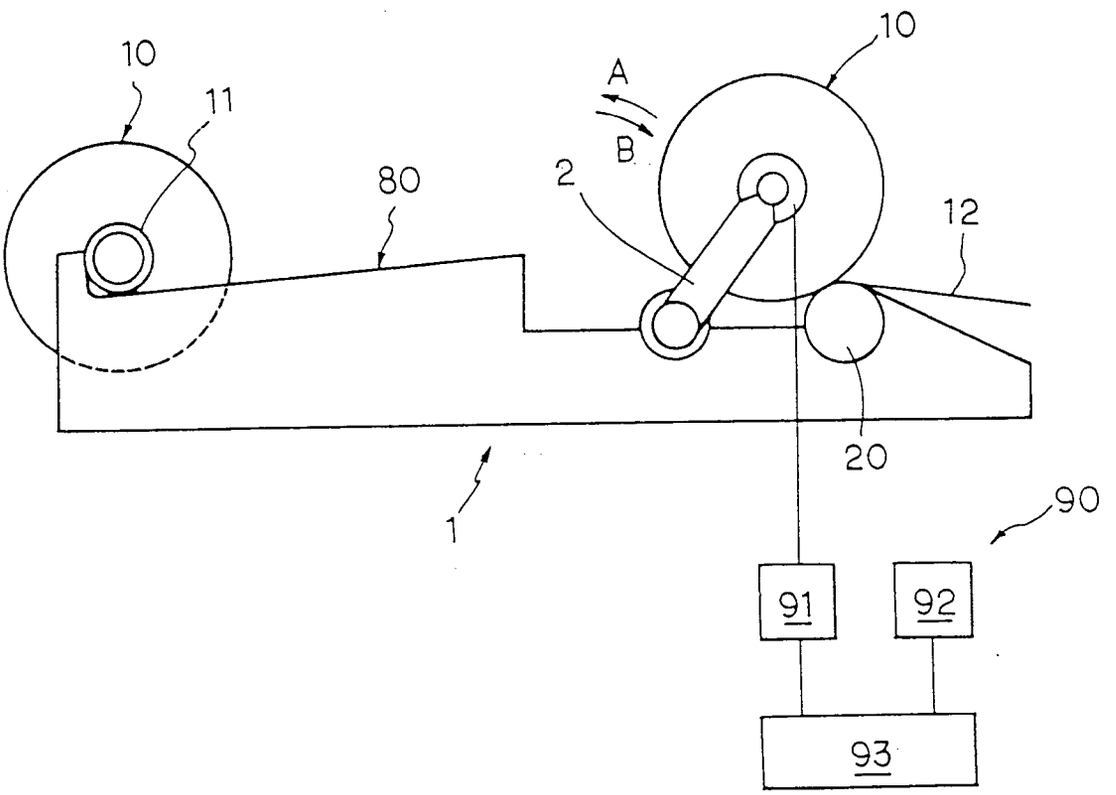


FIG. 7

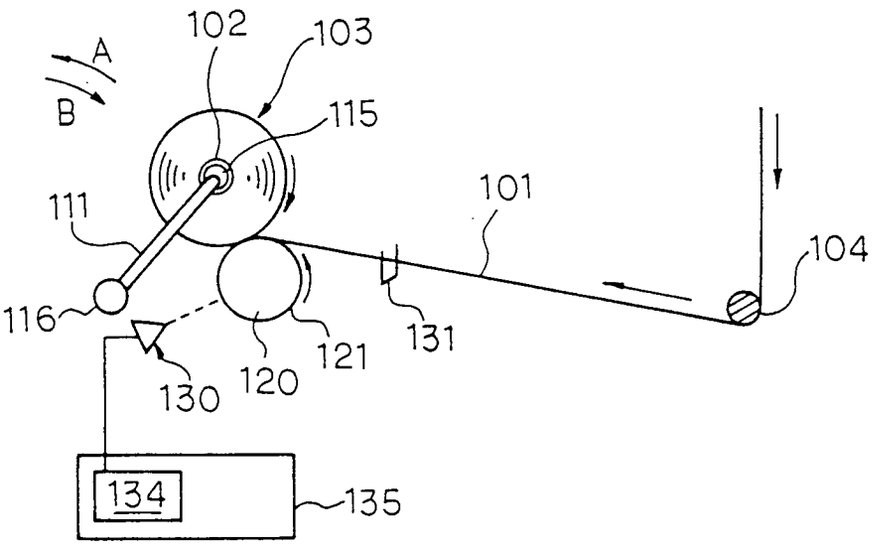


FIG. 8

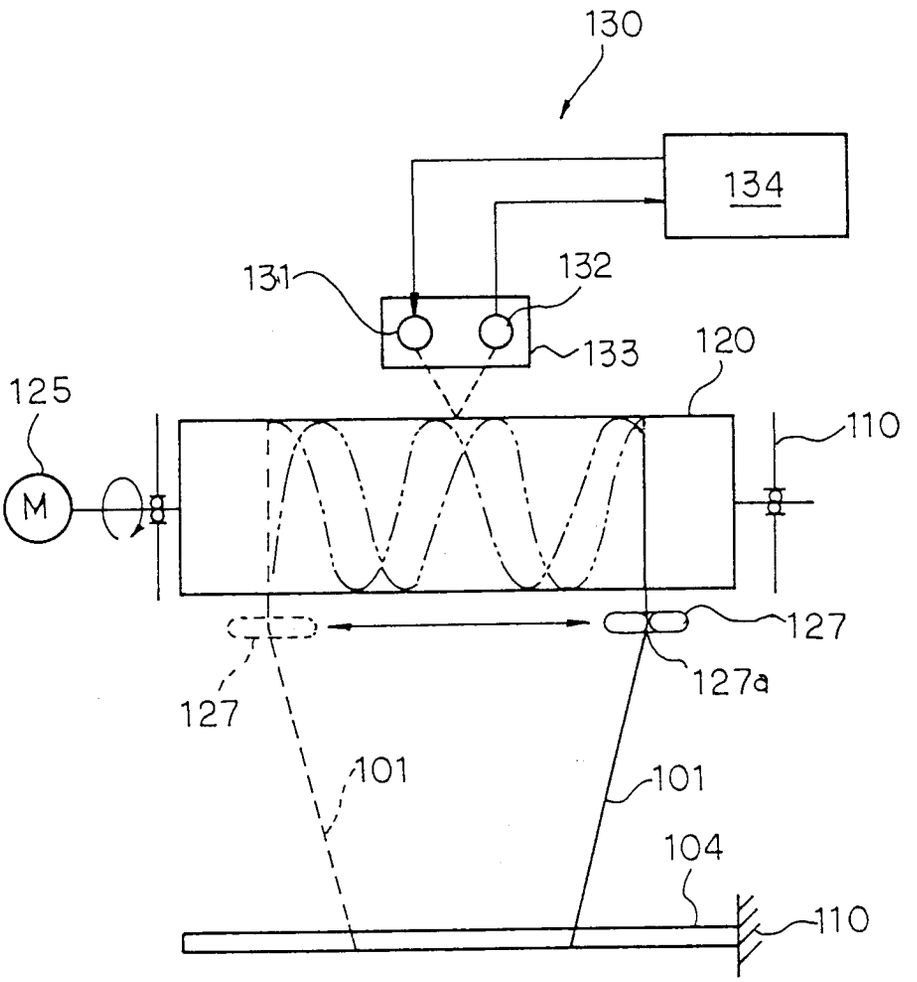
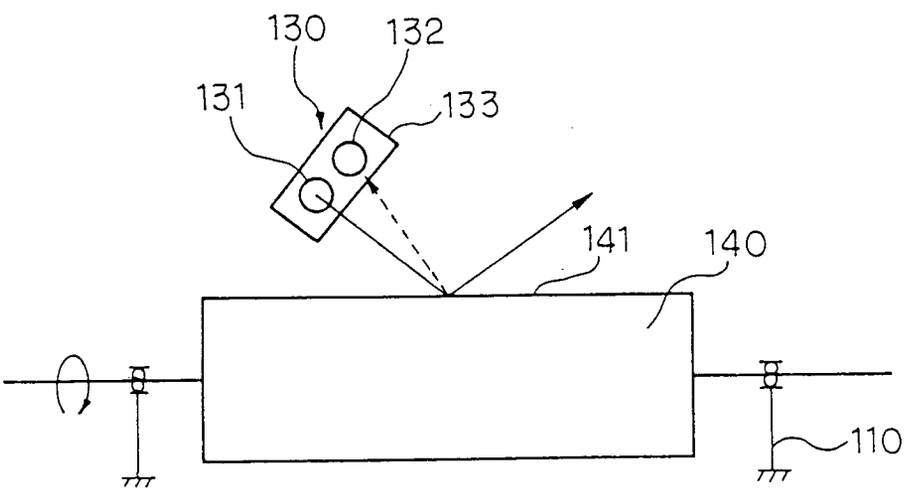


FIG. 9



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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7571

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	DE-A-41 31 179 (RIETER INGOLSTADT SPINNEREIMASCHINENBAU AG) * column 10, line 66 - column 12, line 62 * ---	1-3,5,6 4	B65H63/036 B65H63/00 B65H54/553 B65H63/08
Y	EP-A-0 335 080 (W. SCHLAFHORST & CO) * claim 1 * ---	4	
A	DE-A-39 04 065 (MURATA KIKAI K.K.) * claim 1 * ---	1,4	
X A	US-A-3 844 498 (E. LOEPFE) * column 2, line 60 - column 3, line 45 * * column 4, line 13 - line 29 * * column 4, line 60 - column 5, line 30 * * column 7, line 52 - column 8, line 24 * ---	1,6 2-5	
X	US-A-4 188 545 (A.J. MCCLEAN) * the whole document * ---	7-10	
X	DE-C-885 908 (BOBINGEN AKTIENGESELLSCHAFT FÜR TEXTIL-FASER) * the whole document * ---	7-10	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B65H
A	DE-A-29 51 552 (P. GOETSCHES) ---		
A	EP-A-0 307 644 (ZELLWEGER USTER A.G.) -----		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 January 1995	D Hulster, E

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