Apparatus and method for winding continuous webs.

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This invention relates to the manufacture of webs of material, notably polymer films, and specifically to an improved apparatus and method for winding such webs or films so as to obtain web coils for storage and/or further processing.

Continuous winding machines, notably for winding of paper or polymer webs formed or processed continuously in a preceding production or finishing step are well known in the art, cf. U.S. Patents 1,687,928, 2,915,255, 3,494,566 and Swiss Patent 540,185.

The feature common to all prior art winders is a mechanism for receiving a substantially endless web or film material and for guiding such film or web onto an empty cylinder or tube (core mandrel) so as to form a coil of the web that can be stored or used as a web-source for further processing, e.g. printing.

Prior art winders for a substantially automatic operation further include a mechanism for replacing web-wound core mandrels by empty core mandrels so as to enable continued winding, that is, without interrupting the web stream when a coil is discharged and an empty core mandrel is introduced. The operating sequence of such winders starting with the take-up of a leading edge of the moving web by an empty core mandrel and ending with cutting-off the web from the coil with concurrent formation of the next leading edge will be called a "cycle" herein.

Another characteristic feature of conventional winders is the mode of operation with regard to rotation of the core mandrel: one group of winders operates in a so-called "center winding" fashion, that is, by connecting the core mandrel with a drive that acts substantially centrally upon the core mandrel so that the web is pulled thereon; the other group of winders operates in a so-called "surface winding" fashion, that is, by contacting a generally linear portion of the web surface on top of the core mandrel with a rotating winding drum; the winding drum is driven and the web is "pushed" rather than pulled onto the core mandrel.

Generally, the surface winding fashion or mode of operation is preferred for winding of paper, such as in paper mills; this preference is understood when considering the mechanical properties of paper webs and the advantage of avoiding rupture of such webs due to pulling tension by applying a "pushing" force that frictionally engages the coil surface.

Most winders in the plastics industry operate according to the surface winding mode and many polymer films or webs, such as, typically, polyalkylene films, can be wound on machines for the surface winding mode, either because such films have no or very little blocking tendencies per se, or because their inherent block-

ling tendencies are substantially modified by the use of conventional slip additives.

When attempting to wind polymer films having a substantial blocking tendency on a surface-mode winder, the resulting coils—if they can be obtained at all—tend to lack smoothness of the layer structure within the coil and on its surface. Such lack of smoothness indicates a deformation of the film and such deformed films tend to cause problems upon further processing, e.g. printing.

The blocking tendency of a web or film generally indicates a high coefficient of friction of the film; films with such properties are of growing importance as is the tendency of avoiding use of slip additives.

It would be desirable, and is the object of the invention, to provide for a continuous winding machine of the type disclosed in CH—A—540,185 and US—A—2,915,255, i.e. having two pivotable mandrel supports, a winding drum and a film cutting device for continuous exchange of wound-up mandrels by fresh mandrels, which machine permits operation at a predetermined pressure between coil and winding drum independently from the weight of the coil, and at a winding mode that can be varied between normal surface winding and normal center winding for obtaining smooth and, hence, undeformed layer structures of the coils regardless whether low- or high-friction films and/or films that include no slip additive are being processed.

It has been found according to the invention that merely combining a drive for surface mode winding, i.e. a drive for the winding drum, with a drive for the coil is not sufficient for that purpose and that direct measurement of the force and, hence, the linear pressure exerted by the coil of increasing weight against the winding drum as well as a compensation means acting on the second mandrel support is required to achieve the above object.

Accordingly, the apparatus of the present invention has the features specified in the preamble of claim 1 and is characterized by the features specified in the characterizing clause of claim 1.

US—A—2,915,255 discloses an apparatus with the features of the preamble of claim 1 including a drive for the winding drum and a supplemental drive for the mandrel in the second pivotable support.

However, as specified in that reference patent, winding of the coil is completed in the surface winding mode, and the supplemental drive is provided for the purpose of rotating the full coil in the erect position, that is, after pivoting out of contact with the winding drum; as further specified in US—A—2,915,255 the supplemental drive serves to control web tension when the full coil is retracted and out of
contact with the winding drum; no means are provided in the reference for controlling the force or linear pressure (nip pressure) exerted by the coil against the winding drum.

On the other hand, nip pressure control is disclosed in US—A—4,049,212 for a winder that serves to rewind the slit portions of a web in simultaneous operation onto a plurality of mandrels or cores; the mandrel supports or arms must remain essentially vertical throughout the operation and, in order to compensate for increasing coil diameters, each vertical arm is mounted on a sliding support. Limited oscillation of the arms from the vertical arm position is provided for and a position detector monitors that displacement.

With a strictly vertical support arm, a coil weight increase per se would not have an impact upon the nip pressure; however, when the vertical arm is allowed to pivot to and fro the vertical position as required to activate the position sensor, the coil weight comes to have an impact upon nip pressure control and would require load-controlled compensation in response to sensing the actual weight increase contribution.

In addition, a combination of position control plus positional displacement of the type disclosed in US—A—4,049,212 is not sensitive to a force or pressure but only to a change of force or pressure; as a consequence, nip pressure oscillation results from positional sensing and hydraulic dampers are required to avoid negative feed-back.

Aside from these limitations, the control system of US—A—4,049,212 with its vertical coil support arms is not applicable to a winding apparatus where substantial pivoting of the coil support is required for continuous operation, i.e. both for receiving a partially wound mandrel in a first angular position and for discharging the finished coil in a second angular position, when the difference between the first and the second position is, typically, above 90°.

According to the present invention, at least one force sensor or load cell is used to monitor the force of linear pressure exerted by the coil in the second support arm against the winding drum. As any such sensor is connected with the winding drum via the bearings thereof according to the invention, a pivoting of the coil support is not limited by the pressure control system.

Force sensors or load cells suitable for the invention are known per se.

Preferably, two force sensors are used, one at each bearing end of the winding drum generally supported in a manner to permit limited displacement, e.g. against a spring such as used in commercially available force sensors as explained in more detail before.

In general, each pivotable support includes a pair of arms that are forked so as to be capable of receiving and holding the ends of a core mandrel; each pivotable support is connected with a conventional actuating mechanism so that each core mandrel can be positioned in a first or mandrel-holding position and a second position in which the mandrel is released for transfer or discharge, respectively. Preferably, the actuating mechanism for such movement of the pivotal arms of the second support is also used as compensator means that is connected with the pivotal second support. The uncompensated pressure (in kilograms per meter of the length of the "gap" or "contact line") may be in the range of several hundred kg/m, e.g. from 50 to 500 kg/m, while the compensated pressure may and generally will be substantially lower, e.g. in the range of from Zero to 200 kg/m, preferably from Zero to 50 kg/m. When the pressure is compensated, frictional interaction, that is, the surface driving force, will be reduced commensurately and the supplemental drive provided in the second support will cause a contribution to center winding.

Preferably, when the pressure is compensated to Zero, the surface of the coil in the second support should remain in physical contact with the winding drum.

The invention will now be explained with reference to the annexed drawings, wherein:

Figure 1 is a diagrammatic illustration of a first operating stage of a conventional automatic winding apparatus of the surface winding type;

Figure 2 is a diagrammatic illustration of the second operating stage of the winding apparatus shown in Figure 1;

Figure 3 is a semi-diagrammatic and simplified side view of a winding apparatus according to the invention;

Figure 4 is a perspective view of a force sensor suitable for the purposes of the invention;

Figure 5 is a diagrammatic perspective view showing two sensors of the type illustrated in Figure 4 arranged to support a short portion of the winding drum;

Figure 6 is a circuit diagram for the force sensor of Figure 4;

Figure 7 is a semi-diagrammatic side view of a winding apparatus according to the invention, and

Figure 8 is a partially sectioned view of the connection between a core mandrel end and the corresponding receiving end of the second core mandrel support suitable for a winding apparatus of the invention.

Figures 1 and 2 of the drawings illustrate the operative elements of a prior art surface-mode winding apparatus 10 for continuously winding a web 11 supplied in a continuous manner from an extruder or the like source (not shown). The web 11 is deflected by a roller 12 for subsequent or downstream contact with a winding drum 13, shown in Figure 1 as rotating in counterclockwise direction, and driven by a motor 14.
An empty mandrel 151 is delivered from a mandrel supply 15 into the forked end 161 of a first mandrel support 16 that is movably supported at its other end near or at the rotational axis 131 of winding drum 13. In practice, such support will include a pair of arms. An actuator 165 is connected with support 16 so as to move and hold it in the positions required for winding and transfer. In general, support 16 will rotate together with cutter 17 rather then oscillate when moving from one operating position to the next operating position.

A winding cycle starts when cutter 17 has cut the web 11 on winding drum 13 so as to produce a leading web edge (now shown). The empty mandrel 151 in support 16 is provided with an adhesive so that the contacting web with its leading edge is wound around mandrel 151 due to rotation of the contacting winding drum 13. A partially web-wound mandrel 156 (including mandrel 151 and a number of layers of web 11) is produced. The web length wound on empty mandrel 151 to obtain a partially web-wound mandrel 156 will in general be predetermined, e.g., by continuously measuring the web length supplied after cutting and operating actuator 165 by a signal caused when the predetermined length is achieved.

Upon such signal, actuator 165 pivots support 16 through position 160 indicated in broken lines and until the supporting ends of partially web-wound mandrel 156 come to rest in the forked end member 181 of the second mandrel support 18, which generally comprises another pair of pivotable arms with forked ends. Thus, the partially wound mandrel 156 is transferred from its first winding position in support 16 to its second winding position in second support 18 where winding is continued as shown in Figure 2.

First support 16 then reverts into its first winding position while a coil 159 of web 11 is built up around mandrel 151 in the second winding position maintained by second support 18. Support 18 is pivotably supported at its lower end 182 so that the weight of coil 159 causes a continued frictional contact between a generally linear portion of the coil surface and the adjacent linear surface portion of winding drum 13. Due to continued rotation of drum 13, coil 159 is rotated or sound in the surface winding mode. Again, the length of web 11 fed onto soil 159 will be monitored in a manner known per se, and when a predetermined web length has been reached a signal from the monitoring device (not shown) will cause operation of cutter 17. Upon such operation or shortly before, another empty mandrel will be discharged from mandrel supply 15 to first support 16 as shown in Figure 1 and the next winding cycle begins with formation of another leading web edge that is taken up by adhesive effect of the next empty mandrel.

The trailing edge of web 11 from the preceding cycle is on coil 159 and second support 18 will now be cause to pivot into its discharge position 180 indicated in broken lines in Figure 2. A coil receiving rack (not shown) may be provided as shown in Swiss Patent No. 540,185 or an inclined surface 20 may be used on which the discharged coil may be caused to roll into a storage space or onto a transporting tray.

For reasons explained above, automatic winders operating by surface winding mode, i.e. the operation of the apparatus 10 of Figures 1 and 2, cannot generally be used for winding of webs that have a high coefficient of friction and tend to "block".

It should be noted here that the term "web" or "polymer film" as used herein in connection with the invention is intended to refer to continuous sheets or strata of various types and gauges. Polymeric films or sheets are preferred. Typical examples we polymer films, e.g., produced by melt extrusion or other methods of forming films, foils or sheets from generally thermoplastic polymers, such as polyethylene and other polyalkanes, copolymers, polymer blends and polymer compositions including conventional compounds and additives; other examples of sheet materials include coated materials with different types of substrates including polymer, paper or thin metal substrates coated on one or both surfaces by any suitable coating method with polymers, polymer compositions and the like film forming continuous web materials. The invention is of particular advantage for winding various and possibly varying webs obtained continuously from a given producing or processing plant, such as a blow extruder, regardless of varying frictional properties of the web. Thus, any webs capable of being wound either on conventional surface winders or on conventional center winders can be wound or coiled with the inventive apparatus. The web gauge may generally be in the range of from a few micrometers, e.g. 25 micrometers or less, to several hundred micrometers, say up to 800 micrometers or more.

Typical examples of low-friction webs include those made of, or coated with, polyalkene plus slip additive, cellophane, etc. Typical examples of high-friction webs are those made of, or coated with, hot-melting adhesives including ionomers such as Surylon (Reg. Trade Mark of E. I. Du Pont de Nemours) or other copolymers of acrylic or methacrylic monomers and allylne monomers, etc.

Webs of either type can be wound with an apparatus 30 of the type illustrated in Figure 3 including a winding drum connected with a drive 34 and comprising the other normal operative elements of a surface winder, that is, deflector rolls 32, a core magazine 35 containing empty core mandrels 360, a first pivotable core support 36, a core 37, a second pivotable core support 38, a first actuator 365 for pivoting support 36, and a second actuator 39 for pivoting support 38.

However, apparatus 30 according to the
invention further includes a first sensor 301 operatively connected with winding drum 33 for sensing the force (indicated by vector F shown in a displaced position) that is exerted by the generally linear surface portion of the coil that contacts the adjacent surface portion of winding drum 33.

The control portion 306 of a force-compensator 39 is connected via lines 302 with the force sensor 301. As will be noted, compensator 39 is the same as second actuator 39 for pivoting support 38. Such combination or integration is not critical but preferred for simplified construction only, and a separate compensator (plus control) might be used in addition to actuator 39 for pivoting the second core support 38.

As another essential additional element, the inventive apparatus 30 includes a mandrel drive (e.g. a motor 303, a transmission 304 and a connector or clutch 305) for imparting a rotationally moving force to mandrel 358 of coil 359. The direction of rotation caused by the mandrel drive will generally be that opposed to the rotational direction of the winding drum. Means (not shown) for controlling the rotational speed of coil 359 caused by motor 303, e.g. for synchronization of peripheral speeds of coil 359 surface and the adjacent winding drum 33 surface, may be advantageous but self-controlling means such as a slip-clutch or the like might be used as well to obtain a desired amount of web pull by mandrel drive 303.

When the compensator 39 is not actuated, coil 359 will pressingly engage a contacting line portion of drum 33, that is, will exert a force F against the winding drum and its supporting shaft 331. The shaft is connected with, or supported by, force sensor 301, and load or force F will act with its component forces y and x against a spring provided as a part of sensor 301 in Figure 4.

The output signal from sensor 301 may now act upon control 306 of compensator 39 and, depending upon a desired setting, cause the latter to at least partially compensate force F. For example, compensator 39 may bear upon support 38 so that coil 359 exerts a substantially reduced force or linear pressure against drum 33, e.g. in the range of from Zero to about 200 kg/m of contact length. As mandrel 358 is in engagement with clutch 305 of the transmission 304 of drive 303, coil 359 will continue to rotate in a web-winding manner and web 31 will continue to be built up in successive layers on coil 359 even if force F is compensated to the extent that there would be insufficient pull upon the web for smooth winding. In general, it is preferred that the surface of coil 359 exerts some positive force in the range of up to about 200 kg/m, e.g. in the range of from about 1 to about 50 kg/m and notably 1 to 20 kg/m, as this is generally advantageous for getting smooth coil surfaces, but higher predetermined pressures may be used as well.

Again, as explained in connection with Figures 1 and 2, after a predetermined length of web 31 is on coil 359, an automatic cutter 37 will cut web 31 so as to discontinue further winding of coil 359 and to form another leading edge that will be taken up by the adhesive surface of another empty mandrel 350 from supply 35 in support 36. Actuator 39 will now pivot support 38 into discharge position 380 (shown in broken lines in Figure 3) and coil 359 will roll onto tray 351.

Figure 4 shows a force-sensor 40 (electrical connectors omitted) suitable for use herein. As such sensors are known per se and can be obtained commercially (e.g. from the Reliance Electric Co., Cleveland, Ohio), only a short explanation of its function will be given here for illustration purposes, it being understood that other force-sensors are suitable for the invention.

Generally, sensor 40 includes two yokes 41, 42 and a pair of springs 43, 44 as well as a transducer 45 that converts an elastic bending of the yoke structure 41 into a voltage (output not shown). Yoke 42 rests on a substantially immovable support (not shown), e.g. a frame portion of the winder 30 of Figure 3, while yoke 41 supports an end portion of shaft 331 of winder 30. Now, any force component x, y or z, or any resultant of such components, will act upon springs 43, 44 and actuate transducers 45. While a single sensor 40 or the like device might be used in the invention, it is preferred for simplicity of construction to use a pair of sensors 40 near each end of the winder drum or its shaft. This is depicted diagrammatically in Figure 5, where a roller or shaft 51 rests on two sensors 52, 52a. For example, when the bearings of winder drum 33 of Figure 3 are supported by sensors 52, 52a of Figure 5 in the manner indicated by element 51, each sensor will be capable of signalling half of the force indicated in Figure 3.

Figure 6 shows, for illustration purposes only, a circuit suitable for the transducer 45 of sensor 40 of Figure 4. Bridge circuit 60 includes a pair of variable inductances 61, 62 that will change in proportion to the displacement of the transducer; two constant resistances 63, 64 are provided as well as an oscillator 65 supplying current to circuit 60 via feed lines 851. Two rectifiers 66, 67 are arranged for providing a DC-voltage at the output end 601. A potentiometer 68 serves to compensate the voltage of the bridge circuit or to compensate a pre-existing load. A stabilized feeding voltage of, for example, 12 V at 90 mA would require a 10 kΩ potentiometer and would generate an output signal voltage of from Zero to 12 V.

While mechanical force sensors might be used for the invention, mechanical/electrical transducers are preferred as their output signal
can easily be used to control the force compensator.

Figure 7 shows a semi-diagrammatic side view of an apparatus according to the invention for continuously and simultaneously winding the layers of a web pair onto two mandrel sequences. A pair of superimposed webs 71, e.g., a blown polymer film hose slit at both sides, is fed at production velocity into winder 70 and guided via deflecting rollers 701, 702, 703 to roller 704 where the double layer is separated into two web streams, 711, 712 and the remainder of the apparatus is a twin-structure in that it has two sets of substantially same operating elements, one for each stream, and only some elements, such as the drum drive 705 and the hydraulic motor 706, are not duplicated. Such a twin installation is a preferred embodiment as winding of blown hose films from a conventional blowing extruder for continuous production of blown polymer films is an important film producing method. For simplification, only one set of the duplicated parts of the winder will be explained in more detail, however. Thus, one web 711 will be passed around a pair of deflecting rollers and guided into contact with winding drum 73 rotated by drive 708. Mandrel supply 75, e.g. a chain conveyor operated by motor 751, contains a number of empty core mandrels 750 (in turn supplied from a source not shown) and provides in a step-wise manner one empty mandrel at a time to the first core mandrel support 76 which is pivotable as explained above. The actuator 785 for positioning support 76 as explained above is omitted from the drawing for simplification only. As before, the empty mandrels are provided with adhesive to hold a leading web edge and to start winding of the mandrel in support 76 as soon as cutter 77 has cut the web supplied to coil 759 and a cycle has started.

First support 76 comprises two arms (only one shown) that have forked ends and are pivotable as explained above for movement into the position for start-up (as shown in Figure 71) and the position for transfer of a partially wound mandrel to second support 78. In Figure 7, the second support 78a is shown in the position when just having received a partially wound mandrel; support 78, on the other hand, carries a substantially completed coil 759 that—because of its accumulated weight—would exert a substantial force or linear pressure against winding drum 73. While for some webs such pressure might be acceptable in view of resulting coil quality, many important types of polymer films would either yield low quality or could not be processed at all by a surface winder.

The inventive winder 70 has a force sensor 720 secured on a rigid mounting bracket 721 that is welded or in another way rigidly connected with the frame 722 of winder 70. The top of sensor 720 supports the corresponding bearing end 723 of shaft 724 of winder drum 73. Again, only one sensor at the front side is shown in Figure 7 while the other sensor is arranged at the opposite side to support the other bearing end of shaft 724.

Now, when the force of linear pressure of coil 759 against winder drum 73 surpasses a predetermined value, e.g. 50 kg/m, the output signal from sensor 720 passing through lines 725 will activate control 726 which in turn actuates compensator 727, and the latter will counteract the force exerted by coil 759 against drum 73. Suitable means to operate hydraulic, pneumatic or other devices in response to a control signal are known in the art of automated control.

Also, selection of an optimum specific linear contact pressure including a pressure that is higher than that produced by the weight of the coil, or a program for changing such pressure in accordance with the weight of coil 759 and/or in view of a given web material can be effected as required for optimum winding of a given web material.

Again, as explained above, a means for centrally driving a core mandrel 758 when in the second support is provided and includes a motor 781, a pivotable transmission comprising two belts or chains 782, 783 and a clutch 789. A motor control 785 may be provided to determine the speed of rotation of clutch 789 according to the coiled web length or, again a slip clutch could be used to regulate the amount of pull effective upon the web.

Figure 8 illustrates in a partially broken-away and fragmental view an example of a clutch construction for engagement of the second transmission belt with a mandrel for centrally rotating same when in winding position of second support 78. An end portion of mandrel 85 is supported by the corresponding mandrel receiving end 88 of one arm 80 of the second support. A pivotable outer clutch bracket 81 can be engaged or disengaged by a push-rod 82 operated by a pneumatic actuator (not shown) and supports a rotatable receiving head 84 connected by an arm 86 with bracket 81. When in mandrel-receiving or coil-discharging position, clutch bracket 81 will be caused by push-rod 82 to pivot in an outward direction so that mandrel end 85 will be received by, or disengaged from, end 86. When a partially wound mandrel is transferred from the first mandrel support—e.g. when first support 76 in Figure 7 pivots around shaft 724 towards second support 78—to the arm 80 of the second support bracket 81 will be pivoted outwardly first and will then pivot inwardly into the position shown in Figure 8 for engagement with the corresponding end of core mandrel 85. A gear wheel 89 on head 84 is connected with the transmission (not shown in Figure 8) and will cause mandrel 85 to rotate in accordance with the core mandrel drive (not shown in Figure 8).

It will be understood that one or both arms of
the pivotable second support can be provided with a clutch of the type shown in Figure 8 or an equivalent device. In general, a single clutch will be satisfactory.

It will also be understood that automatic control of the multi-mode winder requires automatic control of a large number of functions, e.g. automatic supply of empty core mandrels to the core supply (38, 78), delivery of an empty core mandrel to first support (36, 78) at the cycle start, synchronization of speed of the winding drum (33, 73) with the speed of the web (31, 71), pivoting of first support (36, 76) for transfer of a partially wound core mandrel to the second support (38, 78), operation of the cutter (37, 77) and pivoting of second support (38, 78) for discharge of the coil. However, such control means and methods are known from the operation of conventional surface winders and suitable installations can be obtained commercially, e.g. from the above mentioned Reliance Electric Co. and the additional controls required for the multi-mode winders according to the invention can be carried out with similar devices. For example, synchronization of the mandrel drive with the web speed can be effected in analogous manner, e.g. using speedometer devices and/or length-metering devices plus timers while pressure means suitable to obtain the desired linear pressure between the coil and the winding drum are known from other web-processing applications, e.g. in the printing field, etc.

Claims

1. An apparatus (30) for continuously winding a web (31, 71) onto a sequence of mandrels (350, 750), comprising a bearing-supported rotatable winding drum (33, 73) for contacting engagement with the web and for guiding it onto a mandrel (350, 750); a pivotable first mandrel support (36, 76) for contacting an empty mandrel (350, 750) with the winding drum to commence winding of the web onto the mandrel; and to produce a partially web-wound mandrel; a pivotable second mandrel support (38, 78) for receiving the partially web-wound mandrel from the first mandrel support and for maintaining said web-wound mandrel (358, 758) in contact with the winding drum until a coil (359, 759) of the web is formed; a first drive (34, 705) associated with the winding drum for rotating same; a second drive (303, 781) associated with the second mandrel support (38, 78) for rotating the web-wound material therein; a means (37, 77) for cutting the web after formation of the coil and for commencing winding of the web onto another empty mandrel (350, 750); a first transfer means (36, 365, 76, 765) for transferring the partially web-wound mandrel from the first mandrel support to the second mandrel support; and a second transfer means (38, 39; 78, 727) for discharging a coil (359, 759) from the second mandrel support (38, 78), characterized in that at least one bearing end of the winding drum (33, 73) is mechanically connected with a force sensor (301, 720) capable of generating an electrical signal indicative of the pressure exerted by the web-wound mandrel (358, 758) on the second support (38, 78) against the winding drum (33, 73), and that a control means (306, 726) is connected with the force sensor for receiving the electrical signal and for actuating a compensator means (39, 727) that is connected with the pivotable second mandrel support (38, 78) for maintaining the pressure between the web-wound mandrel in the second support and the winding drum at a predetermined value that is independent from the weight of the coil.

2. The apparatus of claim 1, characterized in that the winding drum is supported by two beakings and that each of the bearings is mechanically connected with a respective force sensor (52, 52a).

3. The apparatus of claim 1 or 2, characterized in that the compensator means is a hydraulic cylinder (39, 727) that is part of the second transfer means.

4. A method of operating the apparatus of claim 1, characterized in that the pressure between the web-wound mandrel and the winding drum is kept at a positive pressure in the range of from zero to 200 kilograms per meter of contact length.

Patentansprüche

1. Vorrichtung (30) zum kontinuierlichen Aufwickeln einer Bahn (31, 71) auf eine Folge von Kernen (350, 750) mit einer drehbar gelagerten Wickelwalze (33, 73) zur Kontaktverbindung mit der Bahn und zur Führung der Bahn auf einen Kern; einem schwenkbaren ersten Kernhalter (36, 76) zum Kontaktieren eines leeren Korns (350, 750) mit der Wickelwalze, um das Aufwickeln der Bahn auf den Kern einzuleiten und einen teilweise mit der Bahn bewickelten Kern zu bilden; einem schwenkbaren zweiten Kernhalter (38, 78) zum Aufnehmen des teilweise mit der Bahn bewickelten Korns aus dem ersten Kernhalter und zum Halten des mit der Bahn bewickelten Korns (358, 758) in Kontakt mit der Wickelwalze bis zur Bildung eines Bahnwinkels (359, 759); einem ersten Antrieb (34, 705), welcher der Wickelwalze zugeordnet ist und diese dreht; einem zweiten Antrieb (303, 781) der dem zweiten Kernhalter zugeordnet ist und den darin befindlichen, mit der Bahn bewickelten Kern dreht; eine Einrichtung (37, 77) zum Zerschneiden der Bahn nach Bildung des Bahnwinkels und zum Einleiten des Aufwickeln der Bahn auf einen anderen leeren Kern (350, 750); einer ersten Ueberführungsseinrichtung (36, 365; 76, 765) zum Ueberführen des teilweise mit der Bahn bewickelten Korns aus dem ersten Kernhalter in den zweiten Kernhalter; und einer
zweiten Ueberführungseinrichtung (38, 29, 78, 
727) zur Abgabe eines Bahnwickels (359, 759) 
aus dem zweiten Kernhalter (38, 78), dadurch 
gekennzeichnet, dass mindestens ein gelager-
tes Ende der Wickelwalze (33, 73) mechanisch 
mit einem Kraftfühler (301, 720) verbunden ist, 
der zur Erzeugung eines elektrischen Signals 
befähigt ist, welches dem vom mit Bahn 
bewickelten Kern (358, 758) im zweiten Kern-
halter (38, 78) auf die Wickelwalze (33, 73) 
ausgeübten Druck entspricht, und dass eine 
Steuereinrichtung (306, 726) mit dem Kraft-
fühler verbunden ist, um das elektrische Signal 
aufzunehmen und eine Kompensatoreinrich-
tung (39, 727) zu betätigen, die mit dem 
wenkbaren zweiten Kernhalter (38, 78) ver-
bunden ist, um den Druck zwischen dem mit 
Bahn bewickelten Kern im zweiten Kernhalter 
der Wickelwalze auf einem vorbestimmten 
Wert unabhängig vom Gewicht des Bahn-
wickels zu halten.

2. Vorrichtung nach Anspruch 1, dadurch 
gekennzeichnet, dass die Wickelwalze in zwei 
Lagern abgestützt ist und jedes Lager 
mechanisch mit einem entsprechenden Kraft-
fühler (52, 52a) verbunden ist.

3. Vorrichtung nach Anspruch 1 oder 2, 
dadurch gekennzeichnet, dass die Kompensa-
toreinrichtung ein hydraulischer Zylinder (39, 
727) ist, der zur zweiten Ueberführungseinrich-
tung gehört.

4. Verfahren zum Betrieb der Vorrichtung 
gemäß Anspruch 1, dadurch gekennzeichnet, 
dass der Druck zwischen dem mit Bahn 
bewickelten Kern und der Wickelwalze auf 
einem positiven Druckwert im Bereich von Null 
bis 200 Kilogramm pro Meter Kontaktlänge 
gehalten wird.

Reivendications

1. Un appareil (30) pour enrouler en continu 
une nappe (31, 71) sur une suite de mandrins 
(350, 750), comprenant un cylindre bobineur 
tournant (33, 74) monté sur piliers qui est 
destiné à entrer en contact d'engagement avec 
de la nappe et pour guider celle-ci sur un mandrin 
(350, 750); un premier support de mandrin pivotable (36, 76) destiné à 
etre en contact un mandrin vide (350, 750) avec le cylindre 
bobineur pour commencer l'enroulement de la 
nappe sur le mandrin et pour produire un mandrin 
portant un enroulement partiel; un second 
support de mandrin pivotable (38, 78) destiné à 
recevoir le mandrin muni d'un enroulement par-
tiel du premier support de mandrin et pour 
maintenir ce mandrin porteur d'un enroulement 
partiel (358, 758) en contact avec le cylindre 
bobineur jusqu'à ce qu'un rouleau (359, 759) de 
la nappe soit formé; un premier entraînement 
(34, 705) associé au cylindre bobineur pour 
ettre en rotation celui-ci; un second entraîne-
ment (303, 781) associé au second support de 
mandrin (38, 78) pour y entraîner en rotation le 
mandrin porteur d'un enroulement partiel; un 
second support de mandrin (38, 78, 77) pour couper la nappe après la 
formation du rouleau et pour faire débuter 
l'enroulage de la nappe sur un autre mandrin 
vide (350, 750); un premier moyen de transfert 
(36, 365; 76, 765) pour transférer le mandrin 
porteur d'un enroulement partiel du premier 
support de mandrin au second support de man-
drin; et un second moyen de transfert (38, 39, 
78, 727) pour décharger un rouleau (359, 759) 
du second support de mandrin (38, 78), carac-
térisé en ce qu'au moins l'une des extrémités de 
palier du cylindre bobineur (33, 73) est reliée 
mécaniquement à un détecteur de force (301, 
720) capable de produire un signal électrique 
indicatif de la pression exercée par le mandrin 
porteur d'un enroulement partiel (358, 758) 
dans le second support (38, 78) sur le cylindre 
bobineur (33, 73), et en ce qu'un moyen de 
détecteur de force (306, 726) est relié au détecteur 
de force pour recevoir ce signal électrique et pour 
actionner un moyen compensateur (39, 727) 
qui est relié au second support de mandrin pivot-
able (38, 78), pour maintenir à une valeur 
predéterminée linéairement de la poulie du 
rouleau la pression entre le mandrin porteur 
d'un enroulement dans le second support et le 
cylindre bobineur.

2. Appareil selon la revendication 1, caracté-
tisé en ce que le cylindre bobineur est 
supporté par deux piliers et en ce que chacun 
de ces piliers est relié mécaniquement à un 
détecteur de force (52, 52a) respectif.

3. Appareil selon la revendication 1 ou 2, 
caractérisé en ce que le moyen compensateur 
est constitué par un cylindre hydraulique (39, 
727) qui fait partie du second moyen de 
transfert.

4. Un procédé d'opération de l'appareil de 
de la revendication 1, caractérisé en ce que la pre-
ssion entre le mandrin porteur d'enroulement et 
le cylindre bobineur est maintenu à une pre-
sion positive de l'ordre de zéro à 200 kilo-
grammes par mètre de longueur de contact.