Jan. 17, 1967 C. M. SCHOTT, JR 3,298,624

WINDER

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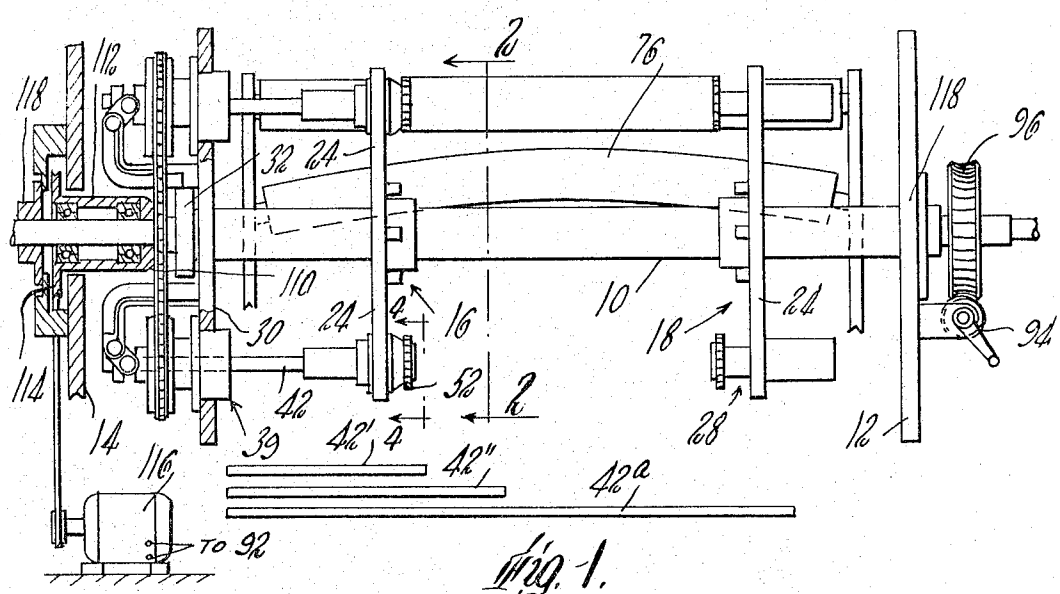


Fig. 1.

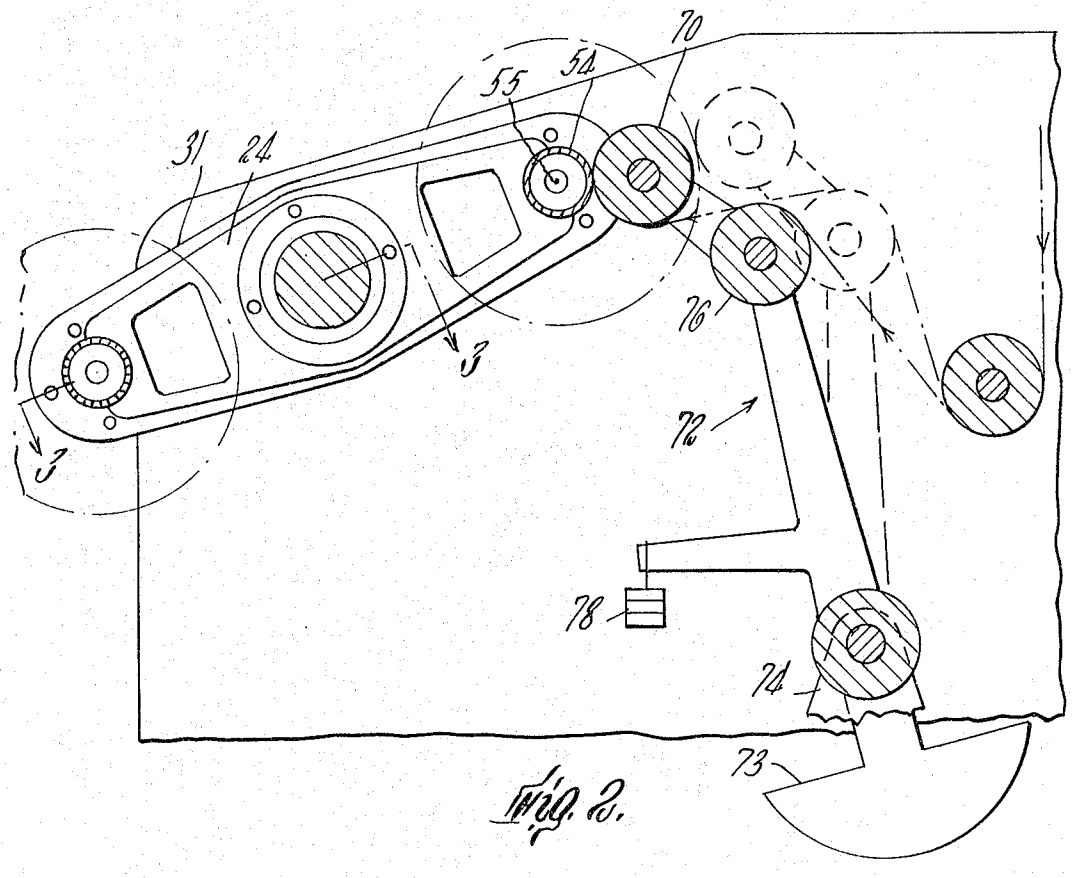


Fig. 2.

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Fig. 4.

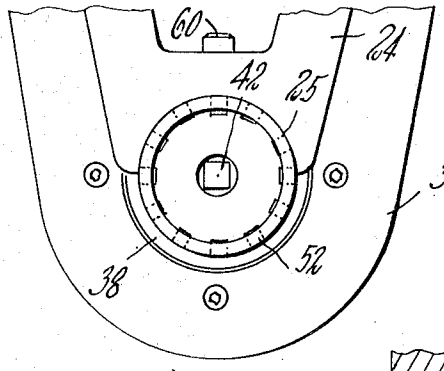
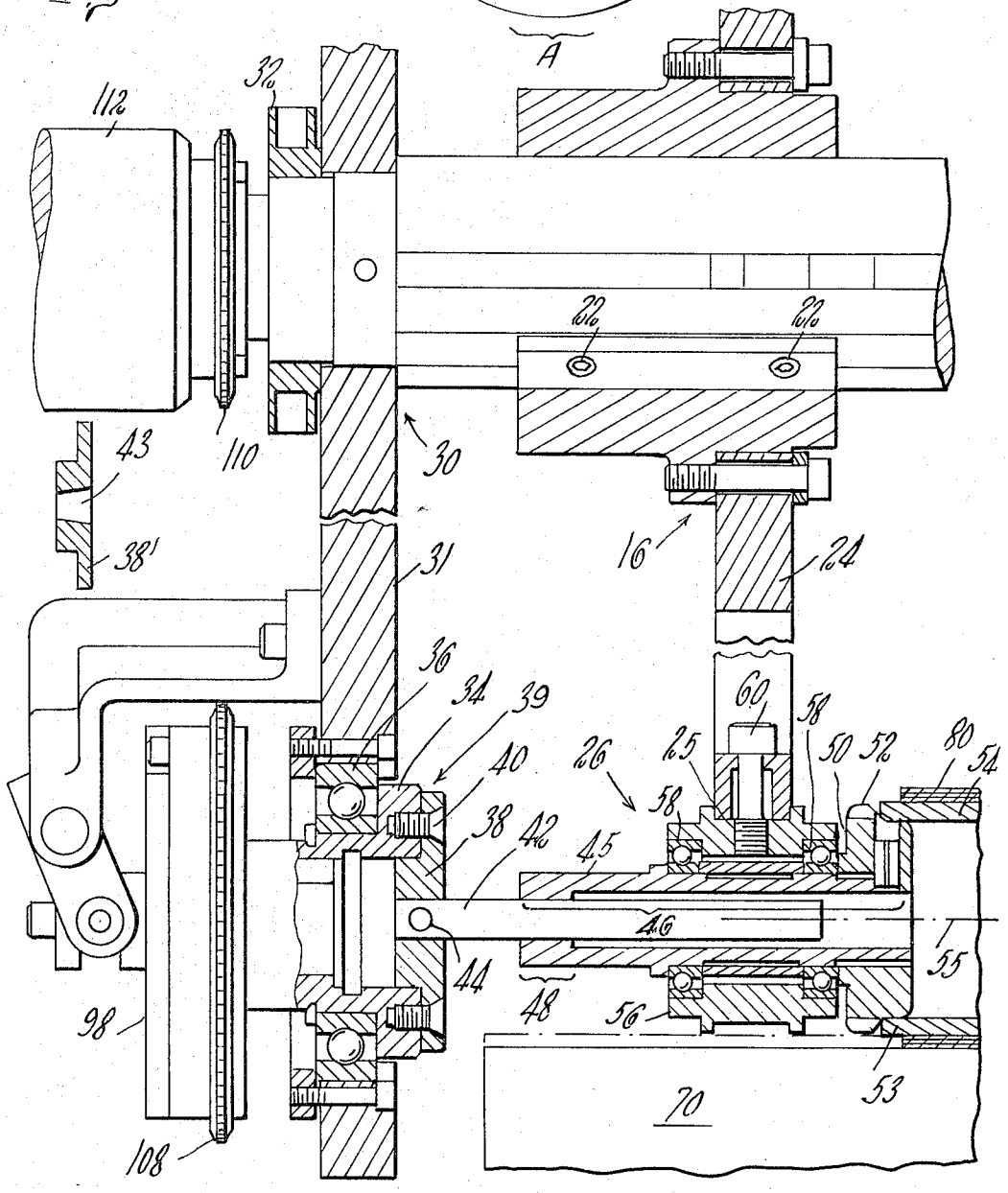


Fig. 3.

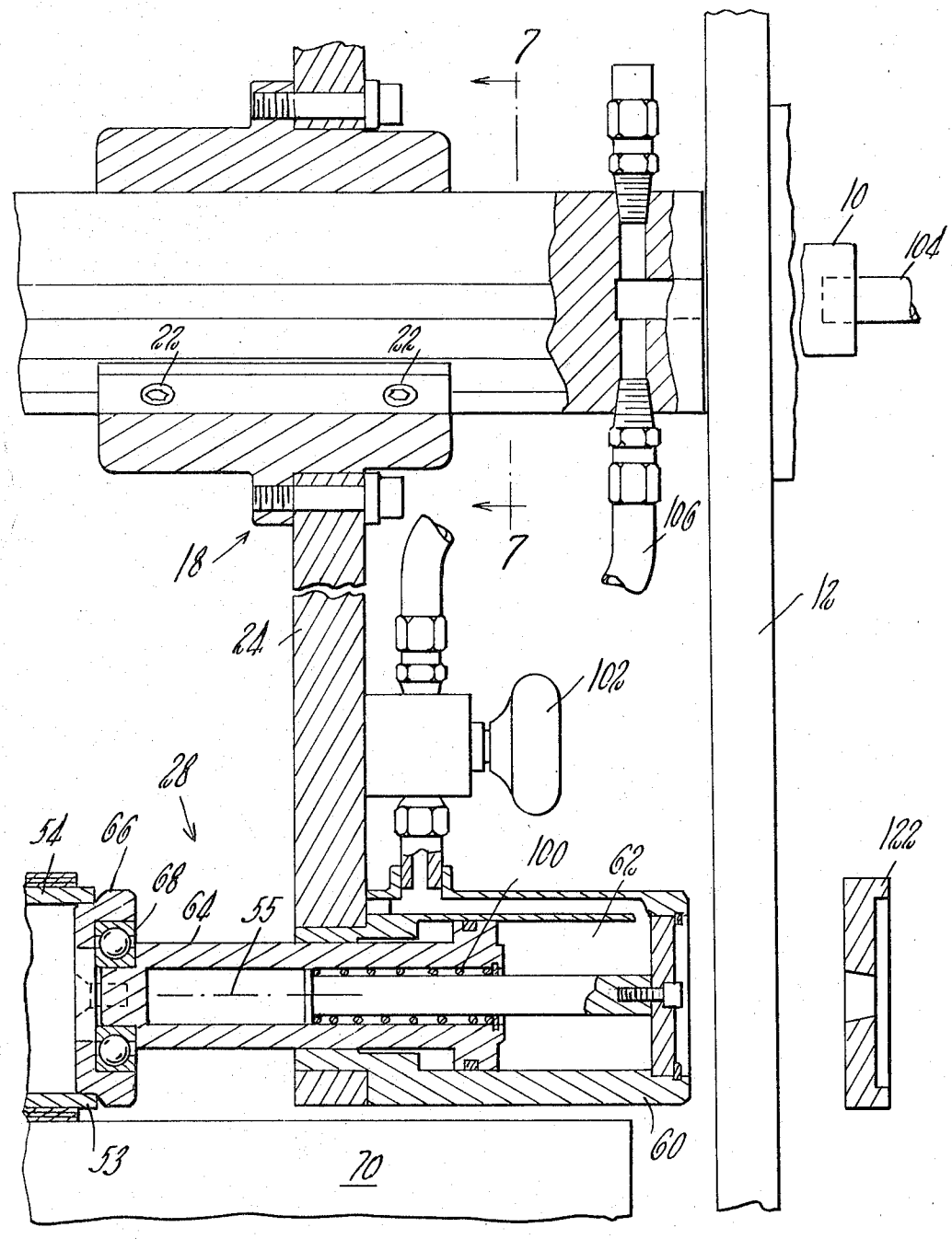


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Fig. 5.



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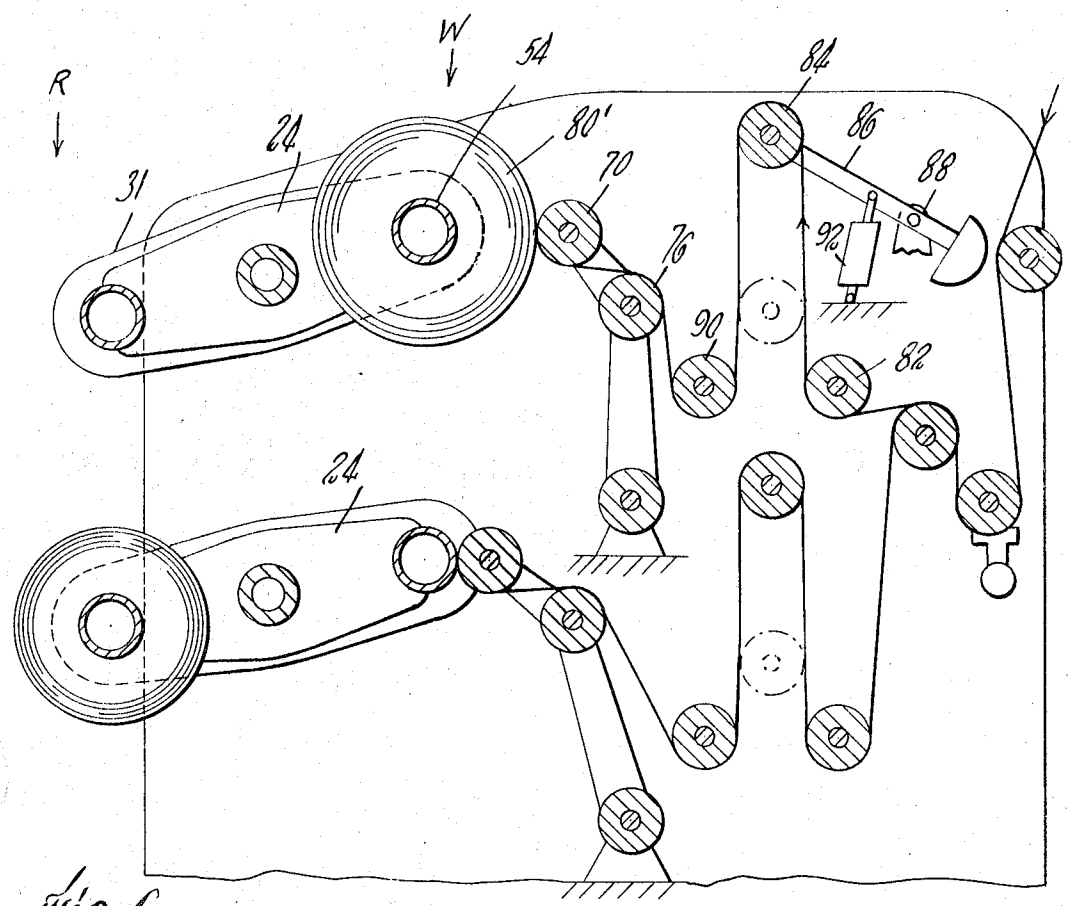


Fig. 6.

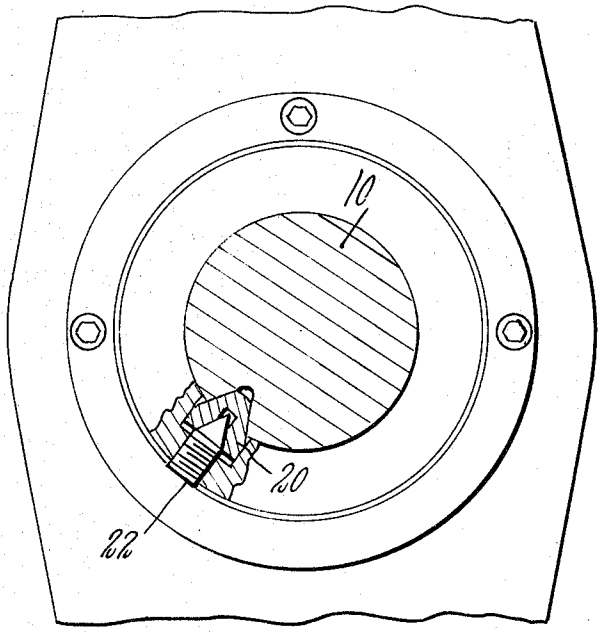


Fig. 7.

United States Patent Office 3,298,624 Patented Jan. 17, 1967

3,298,624

WINDER

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12 Claims. (Cl. 242—64)

This invention relates to winding devices for winding webs into rolls, and in particular plastic films as they are produced.

In one type of winding device a main shaft is rotatably supported by two spaced apart pedestals and a pair of supporting members are mounted on the shaft in an axially adjustable relationship to receive standard diameter winding cores of various lengths so that the same winding machine can be used with various widths of webs being produced or operated upon. In such winders, if, as preferred, they are of the multiple roll, turret type, the supporting members have a matched plurality of supporting arms to handle a like plurality of rolls and the turret winder is adapted to be rotatably indexed, and the tail stocks independently adjustable, so that a completed roll can be removed from one set of arms while a new roll is being formed upon another set.

With such winding devices it is convenient for the winding to be performed on a so-called "arborless" basis in which a core, e.g. the standard paper core, to become a permanent part of the roll being formed, is supported by a head stock and a tail stock mounted on opposed supporting arms with no steel arbor extending through the roll. The advantage of this arrangement lies particularly in the freedom with which a roll may be removed, merely, for instance, by moving the tail stock away from the head stock.

According to the invention a machine-wide lay-on roll is provided for operating upon the web as it is rolled upon the core, regardless of the position of the supporting members, and capable of commencing operation immediately upon the start of winding upon the core. Lay-on rolls per se and some of their advantages have previously been recognized, but the lay-on roll in this special combination of arborless winders, and with certain new structural features to be described, are considered a substantial improvement in the art.

According to the invention it is now possible to obtain simultaneously with the advantages of arborless winding, the best quality of rolls of various lengths in which the web is not wrinkled and is wound to the buyer's specified tightness and all with a minimum requirement of horsepower. The lay-on roll nips the web against the core as winding commences, and moves away from the core as the roll builds up in diameter, continually pressing the web against the forming roll. Also, in combination with such lay-on roll in an arborless winder, a bent axis roll, i.e. a spreader roll, is advantageously employed in a fixed relation to the lay-on roll for the purpose of stretching the web as it reaches the winder for removing wrinkles and pressing it neatly to the winder.

Another desirable function of the lay-on roll has to do with the degree of tightness with which the web is wound. The lay-on roll is capable, by selecting the force with which it presses towards the core, not only to provide selected degrees of tightness but also to provide very high degrees of tightness. This has a very significant advantage in connection with arborless winding. Arborless winding takes advantage of the self-supporting character of the roll, the roll becoming stronger as it becomes heavier, due to increased diameter. But the strength of the roll depends a great deal upon the tightness of winding, a tightly wound roll being far stronger than a loosely wound one. Because, in practice, prior art arborless

winders have not been able to economically achieve very tightly wound rolls over a full range of widths, such winders have to some degree been limited as to their range of roll lengths produced, and have had problems particularly in producing long rolls. This is of particularly great significance in view of the fact that it is desired to make very wide arborless winding devices capable of handling all widths produced in a web forming line; the present invention enables this to be realized in a practical and efficient manner.

Furthermore, according to the invention, a provision is made for converting from arborless to arbor type of winding, in a single but effective arrangement, so that even loosely wound, long length rolls can be produced, and a wider range of conditions accommodated.

It is, therefore, a principal object of the invention to provide an arborless winder of the adjustable supporting member type wherein the advantages of a lay-on roll can be obtained regardless of the width setting of the supporting members.

Another object of the invention is to provide the advantages of the combination of a spreader roll and lay-on roll in such an arborless winding device; and the combination of a lay-on roll and a dancer for tensioning, as well as other functions for low horsepower, tightly wound rolls.

Another object is to provide an improved driving arrangement for turret winding devices of the arborless type and still another object of the invention is to provide a turret winding device capable of operating in both the arborless and the arbor type modes with only simple adjustments required.

And still another object of the invention is to provide a winding device of improved design with regard to simplicity of structure, ease of operation and low cost.

According to one aspect of the invention the pairs of head and tail stock means and the corresponding parts of their arms, at least in one circumferential location, have a special relationship in that they extend radially outwardly from the respective winding axis a pre-determined maximum distance, a distance no greater than the predetermined outer diameter of the core, e.g. 1¾" in the case of the standard 3½" diameter paper cores. Similarly, the means for driving the head stock means has an outward extent from the winding axis no greater than that of said core at said one circumferential location. A cylindrical lay-on roll is provided having a substantially uniform diameter throughout its length, and mounted on lay-on roll support means on an axis parallel to the winding axes. The lay-on roll support means is adapted when a given pair of tail and head stock means is in position for one winding, to carry the lay-on roll toward the core at the predetermined location where the head and tail stack means and their arms extend outwardly from the winding axis a distance less than the predetermined outer diameter of the core. The lay-on roll extends substantially the full width capable of being handled by the winding device and when the supporting members are adjusted towards each other to accommodate a core of less length than the maximum that can be accommodated by the turret winder, the ends of the lay-on roll encounter no interference, due to the special head stock, tail stock, support and drive structure, and the lay-on roll therefore remains capable, at start-up, to lie against the core, so that all web wound thereon will have the benefit of the lay-on roll.

Another aspect of the invention lies in the means whereby the turret winding device is driven, including a turret plate means mounted to turn with the main shaft means, and the turret plate means rotatably supporting a plurality of drive shaft gripping means, one for each head stock means. Means, preferably located beyond the turret plate means, cooperates therewith to drive each head

stock means through a drive shaft that extends to the adjusted position of the head stock means. A related aspect of the invention is that the head stock means is provided with an elongated passage to accommodate various lengths of the drive shaft depending upon its adjusted position, and another related aspect is that the drive shaft means comprises a plurality of drive shafts, one usable at a time, of various lengths to accommodate gross changes in the adjusted position of the supporting members.

Still other important aspects of the invention involve the combination of the aforementioned lay-on roll with a spreader roll for achieving maximum quality windings with minimum horsepower; the use of a single drive means, in conjunction with the aforementioned turret plate means, which drives each of the drive shafts, and simultaneously enabling indexing movement of the main shaft means, and in particular the rotatable mounting of a main drive sprocket on the main shaft means, all preferably in conjunction with a dancer roll controlling the winding speed, take-up of web during indexing, and tension control. Still other important aspects of the invention involve the drive train employed by the arborless winder as defined above in combination with a lay-on roll, and the convertability of the arborless winder into arbor winding through simple and efficient means.

In the drawings, FIG. 1 is a plain view of the preferred embodiment of a turret for a turret winding device according to the invention;

FIG. 2 is a sectional view of the turret arrangement of FIG. 1, taken on line 2—2, showing the lay-on roll;

FIG. 3 is a cross-sectional view taken on line 3—3 of FIG. 2 of the head stock portion of the turret arrangement according to FIGS. 1 and 2;

FIG. 4 is an end view taken on line 4—4 of FIG. 1;

FIG. 5 is a view similar to FIG. 3 of the tail stock portion of the turret of FIGS. 1 and 2;

FIG. 6 is a partially diagrammatic view of the web path through the winding device of FIGS. 1 and 2;

FIG. 7 is a cross-sectional view taken on line 7—7 of FIG. 5 showing the means by which the supporting members are secured to the main shaft.

Referring to FIG. 1 the turret mechanism according to the preferred embodiment comprises a main shaft **10** rotatably supported between spaced apart pedestals **12** and **14**. Upon the main shaft are adjustably mounted two supporting members **16** and **18** for the head stock and tail stock systems, respectively. Referring to FIG. 7 each supporting member is adjustably secured to main shaft **10** by means of a key member **20**, insuring that the supporting member does not rotate relative to the shaft, and set-screws **22** enabling the axial adjustment of the supporting member relative to the shaft.

Each of the supporting members (**16**, **18**) is provided with a plurality of supporting arms **24**, in the case of the present embodiment two of them. As shown in FIGS. 2 and 6. preferably the arms **24** extend to opposite sides of the axis of main shaft **10**. To the ends of the arms on supporting member **16** are secured head stock means **26**, and to the ends, of the arms **24** of the supporting member **18** are secured tail stock means **28**.

Referring to FIGS. 1, 2 and 3 near the pedestal **14** on the head stock side of the device a turret plate **30** is rigidly mounted to shaft **10** by nut **32**. The turret plate **30** has arms **31** corresponding in direction to the supporting arms **24** of supporting member **16**. These arms **31** support, in alignment with the two head stock means **26**, driving and support means **39** for drive shafts **42**.

Referring in particular to FIGS. 3 and 4 a sleeve **34** is rotatably mounted by bearings **36** to turret plate arm **31**, and a drive plate **38** is secured by bolts **40** to sleeve **34**. Drive plate **38** is provided with a square hole adapted to grip and support a square cross-sectional drive shaft **42** and releasable lock means **44** e.g. a spring loaded detent, are provided to engage the drive shaft **42** and secure it with respect to drive plate **38**.

By means, to be described later, the sleeve **34**, drive plate **38**, and drive shaft **42** are driven, and in turn drive head stock **26**. Head stock **26** includes an elongated passage **46** defined by means **45** aligned with the square hole in drive plate **38** and adapted to receive and grip the drive shaft **42**. Advantageously a square hold gripping means **48** is provided at the end of the elongated passage **46** closest to the turret plate **30**. Secured to the means defining passage **46** at the head stock **26** is a chuck **50**. This head stock chuck **50** is provided with circumferentially spaced apart core gripping teeth **52** (FIG. 1) adapted to grip the inside surface of a standard paper core **54** for driving purposes. A mounting ring **56** is provided for rotatably supporting the means **45** that defines passage **46** through two sets of bearings **58**. The mounting ring **56** is mounted by a captive bolt **60** to the supporting arm **24** and hence to the main shaft **10**.

Referring to FIG. 3, the paper core **54** is of standard construction, i.e. 3½" diameter O.D. The mounting ring **56** and the chuck **50** are specially constructed to have a diameter no greater than that of the outer surface **53** of the core **54** as shown, in at least one circumferential location A, and indeed, in this preferred embodiment, about a substantial portion of the circumference is about the winding axis **55**. Also, as can be observed from FIG. 3, no portion of the supporting arm **24** extends beyond the winding axis **55** in at least the one location, indeed, as can be observed from FIG. 4, the supporting arm **24** forming a substantially semi-circular receiving saddle **25** into which the mounting ring **56** is seated. Also the drive shaft **42** is axially aligned with the winding axis **55** and has a lesser radial extent than the core **54** at least in the region between the two pedestals in which web, up to maximum width, is to be received. These special size relationships, as indicated above, are of critical importance with respect to the lay-on roll **70** as will be more fully described after the tail stock is described.

Referring to FIGS. 1 and 5, each tail stock **28** comprises an elongated housing **60** mounted to arm **24** of supporting member **18**, and defines an elongated chamber **62** co-axially with the winding axis **55**. Into this passage is fitted a piston member **64** carrying on its inner end a tail chuck **66** mounted by bearings **68**.

As with the head stock, the tail stock chuck **66** and the housing **60**, in at least one circumferential location relative to the winding axis **55** has a radial extent relative to the winding axis less than the outer surface **53** of the core **54**, these locations for the head stock and tail stock corresponding to enable the lay-on roll **70** to closely approach and engage the core **54** to achieve the beneficial effects of "lay-on" throughout the make-up of the roll being formed.

Referring to FIG. 2 as well as to FIGS. 3 and 5 the lay-on roll **70** is shown contacting the core **54**. This lay-on roll is rotatably supported by a support arm **72**, the arm pivotally mounted by bracket **74**, a substantial distance away from winding axis **55**, the bracket spaced substantially away from the winding axis **55** to enable the forming roll to move in virtually a radial line away from winding axis **55** as the roll of web builds up. Also mounted on pivoted supported arm **72** is a bowed axis spreader roll **76** positioned to engage the web before it reaches the lay-on roll **70**. This arm and the rolls carried thereby is counter-balanced by weight **73**. Referring still to FIG. 2, a weighting means **78** is provided to urge the lay-on roll **70** toward the paper core **54** with substantially constant force throughout the build up of the roll, this weighting means being selectively adjustable to vary the winding tightness, in conjunction with a dancer roll now to be described.

Referring to FIG. 6 the web after entering the winding device, and passed about a number of rolls whose functions are not of importance for the present purposes, passes under stationary axis idler roll **82** over dancer roll **84** (rotatably mounted on arm **86** which in turn is

pivotally mounted on bracket 88) thence under stationary axis idler roll 90, thence over the spreader roll 76, thence under the lay-on roll 70, where it is pressed against the core 54 on the roll 80' being formed.

Potentiometer control means 92 shown diagrammatically in FIG. 6 senses the arcuate position of the pivoted arm 86, and, by means well known, thereby controls the speed of the winding drive means to be described further on.

When a roll is almost completely formed on a core supported by one pair of head stock and tail stock means the main shaft 10 is indexed by appropriate means e.g. by hand wheel 94 and index drive train 96, carrying the completed roll to take-off removal position R of FIG. 6, and bringing a fresh core into winding position W, FIG. 6. During the indexing, by means to be described further on, the nearly completed roll is kept turning by the drive means. As soon as the fresh core is in position, the web is cut and immediately wrapped about the fresh core 54. In this preferred embodiment both head stocks are moving at the same r.p.m. hence the fresh core, because of its smaller diameter, initially takes up less web. Accordingly, the dancer roll 84 moves up under the influence of weight 85 extending the web path and in effect storing the excess web arriving at the winder. This movement, through potentiometer 92 causes the drive means to increase speed so that the core soon speeds up, takes up the excess web, and except for normal hunting movement, a stable condition is reached in which the web, at the same rate it arrives, is wound upon the fresh core.

Referring to FIG. 3 as soon as the web is being wound upon the fresh core, the completed roll at removal position R can be removed. For this purpose clutch 98 is actuated to declutch the drive shaft 42 from the main drive, and the completed roll is stopped.

Referring to FIG. 5, the tail chuck 66 is then moved to the right whereby the completed roll is released and removed and a new core inserted, the tail chuck 66 returned to its operating position, and the clutch 98 returned to operating position, turning the fresh core, whereby the device is again ready for indexing whenever needed.

To achieve the release movement of the tail stock, a spring 100 is provided to bias the piston member 64 to the release position to the right. However, pressurized fluid, introduced into chamber 62 in operating position, overcomes the force of spring 100 and biases the piston member 64 to the left, into position where it will hold the core. When it is desired to move the tail stock to the right and remove the core, valve 102 is operated to release the pressurized fluid from chamber 62, thus allowing the spring to move the piston member 64 to the right.

For accommodating the indexing action, the source of pressurized fluid is introduced through main shaft 10 by conduit 104, then passed through flexible hose 106 to valve 102 and thence to the chamber 62.

With regard to the winder drive train, referring to FIGS. 1 and 3, each sleeve 34, aligned with its head stock and rotatably supported by turret plate 31 is connected through clutch 98, previously described, to a sprocket 108 (the term "sprocket" being used in the generic sense to describe chain sprockets, belt pulleys, or, indeed, the equivalent gear train). The sprocket is illustrated for use with a chain. A number of sprockets 108 are provided corresponding to the number of head stocks 26. The sprockets 108 are aligned with appropriate take-up sprockets, not shown, with a main sprocket 110 which, as shown in FIG. 1, is rotatably mounted upon main shaft 10. A main sprocket drive sleeve 112 connected to main sprocket 110 extends outwardly through two sets of bearings to a pulley 114 aligned with a winding drive motor 16 whose speed is controlled by the potentiometer control means 92 previously described in connection with FIG. 6. The shaft 10 extends through sleeve 112 to a main bearing 118. As thus illustrated, it will be seen that the main shaft 10 while rotatably supporting the main sprocket 110 and sleeve 112, can itself be rotated by hand wheel 94 for purposes of indexing without interfering with the winding drive train.

Referring to FIGS. 3 and 5 the position of the supporting members 16 and 18 can be adjusted to match the length of the core and the width of web being produced or operated upon. For this purpose the set screws 22 (see also FIG. 7) are released and re-tightened. Should the adjusted position of the supporting member 16 for the head stock 26 be carried inwardly beyond the position where the end of the drive shaft 42 can adequately drive chuck 50 through gripping means 48, then a releasable lock means 44 such as spring detent, held by the drive plate 38 can be released, drive shaft 42 removed e.g. by pushing through the passage 46 and a new drive shaft 42', or 42'' (see FIG. 1) of longer length than drive shaft 42 can be inserted. It is advantageous to furnish such a plurality of drive shafts, the particular number depending upon the selected width of the device. Advantageously, the drive shafts are provided with incremental lengths of 5''. Adjustments for smaller amounts are readily enabled by means of the elongated passage 46 which can accommodate the excess length of the drive shaft, it being preferred not to allow the drive shaft to extend to the right beyond passage 46 as this would interfere with the removal of the completed roll.

Accordingly, it would be observed that regardless of the positions of the supporting members a drive is provided which does not interfere with the lay-on roll 70, and because of the special construction of the head stock and tail stock means, the lay-on roll is enabled to press against the core in all such positions of the supporting members, and accordingly the invention provides substantial improvement in arborless winding.

However, according to the invention it is also possible to perform arbor type winding. For this purpose, referring to FIG. 3, the captive bolt 60 is loosened, removing as an entire assembly, the mounting ring 56, the bearings 58, the means 45 defining the elongated passage 46 and the chuck 50. Previously, the drive shaft 42 can be removed. Then, it is only necessary to support an arbor 42*a* between the drive shaft support means 39 mounted on the turret plate 31, and the tail stock. While this may be possible with no further changes whatsoever, it is desirable to replace a drive plate 38 with drive plate 38' having a slightly tapered hole 43 for releasably receiving the arbor 42*a* and also it is desired to provide an adapter 122 for the tail stock, to receive the arbor 42*a*, the arbor 42*a* being shown in FIG. 1. The adaptor 122 is mounted over the end of tail chuck 66 and held in this position by means for instance of screws not shown.

Accordingly, it will be observed that the invention enables the use of a single winding device, primarily designed for arborless winding, to receive the entire range of widths produced e.g. by a plastic film extrusion line up to extremely long widths and to provide any degree of roll tightness as desired.

What is claimed is:

1. In a winding device for use with winding cores of a predetermined diameter and variable length comprising a main support extending between two spaced apart pedestals, a pair of opposed supporting members mounted upon said main support, means associated with said supporting members to enable lengthwise adjustable movement of said supporting members relative to said main support to receive winding cores of variable length, core chuck means permanently secured during the winding operation to the ends of each of said supporting members, a winding core, said core chuck means aligned on a winding axis to receive said winding core, and means adapted to cause web to be wound on said core while supported by said core chuck means, the improvement wherein said pair of core chuck means and the corre-

sponding parts of their supporting members, at least in one circumferential location, extend radially outwardly from the respective winding axis a distance less than the outer surface of said core, and said means for causing said web to be wound on said core including a lay-on device capable of applying pressure uniformly to a cylindrical core throughout the maximum effective width of the machine, said lay-on device adapted to press web into engagement with said core to improve the quality of the roll being formed thereon, said lay-on device mounted on lay-on support means to move outwardly as said roll increases in diameter, said lay-on device support means adapted to carry said lay-on device against said core at the location where said core chuck means and their support members extend outwardly less than said core from said winding axis, whereby ends of said lay-on device will lie beyond the supporting members when the supporting members are adjusted towards each other to accommodate a core of less length than the maximum length that can be accommodated by said winding device, whereby said lay-on device is adapted to lay web onto the core supported between said supporting members regardless of the adjusted distance between said supporting members and the length of the core received therebetween.

2. The winding device of claim 1 wherein said core chuck means are adapted to engage and support a roll core at its ends, without intermediate support, whereby said winding device is capable of arborless type operation.

3. The winding device of claim 1 wherein said main support means comprises a main shaft means rotatably mounted upon said pedestals for indexing between roll winding and roll removal positions, and each of said supporting members has a plurality of support arms extending outwardly from said main shaft means, said arms, for each supporting member, being spaced a substantial arc about the axis of rotation of said main shaft means from each other, the arcuate spacing of the arms of the two supporting members being the same, and said supporting arms being secured to said main shaft means so that the ends of said arms of said supporting members are aligned to form opposed pairs, with a pair of said core chuck means secured in axial alignment to each pair of said arms, said means to cause web to be wound on cores supported by said core chuck means including a driven head stock means for at least one of said core chuck means of each pair, and means for driving said head stock means, said head stock means and said driving means, within the limits of the maximum effective length of the lay-on device having an outward extent from the respective winding axis, at least in said one circumferential location relative to said winding axis, less than the outer surface of said corresponding core and at least one of said core chuck means of each pair being movable relatively to the other, and independently of the chucks of the other pair, for the purpose of removing a completed roll and inserting a fresh core.

4. The winding device of claim 3 wherein said head stock means for all of said pairs are located at the same side of the device, said means for driving said head stock means including a turret plate means rigidly supported on said main shaft means, said turret plate means extending radially from said main shaft means in directions corresponding with the directions of said arms of said supporting members, said means for driving said head stock means also including a plurality of drive shaft drive and supporting means mounted on said turret means, one axially aligned with each head stock means, each head stock means adapted to receive and be driven by a drive shaft extending from the corresponding drive-shaft-drive-and-supporting means in said turret plate means, each head stock means being adapted, when adjustably located along said main shaft means, to move axially relative to said turret plate means without interference with said drive shafts.

5. The turret winding device of claim 4 wherein each of said drive shaft drive and supporting means associated with said turret plate means is adapted to lockably receive its corresponding drive shaft, the corresponding head stock means having an elongated drive-shaft-receiving-passage, and means at least at the portion of said passage closest to said turret plate means adapted, for being driven, to grip said drive shaft means at various locations along the length of said shaft, depending upon the adjusted position of said supporting member, whereby said head stock means can be adjusted relative to said turret plate means, the length of the portion of said drive shaft means extending into said passage being adjustable without affecting the driving of said head stock means.

6. The apparatus of claim 4 including means to release a given drive shaft and receive another of different length when the location of said head stock means is changed.

7. The turret winding device of claim 4 wherein a single drive means is axially aligned with said main shaft means and drive transmission means extend from said head stock drive means to each of said drive shaft supporting means on said turret plate means aligned with a said head stock means.

8. The turret winding device of claim 7 wherein said single drive means comprises a drive sprocket, an electric drive motor drivingly associated with said sprocket, a driven sprocket associated with each of said drive shaft support means on said turret plate means, clutch means enabling the engagement and dis-engagement of said driven sprocket relative to said drive shaft support means, and an endless drive means threaded about said drive sprocket and said driven sprockets, said sprocket system constructed and arranged to enable said main shaft means, together with said turret plate means, and said supporting members mounted on said main shaft means to turn for indexing from one to another winding position without interference with the driving relationship between said drive sprocket and said driven sprockets.

9. The turret winding device of claim 8 wherein said main shaft means comprises a single shaft, said shaft mounted by said pedestals for rotation about its own axis, and said drive sprocket rotatably mounted on said main shaft.

10. The winding device of claim 1 in combination with a spreader means arranged to engage web arriving at the winder before said web reaches said core, said lay-on device adapted to engage said web after it leaves said spreader means, and adapted to cooperate with the core to hold the web in the stretched condition as provided by said spreader means so that said core will wind said web in said stretched condition.

11. The turret winding device of claim 4 wherein said head stock means are removably mounted on said arms of said supporting member, said drive-shaft-driving-and-supporting means supported on said turret plate means for each head stock means being removable, and a chuck means adapted to receive an arbor extending the full width of the machine adapted to be mounted on said turret plate means in place of said drive shaft means, tail stock means at the opposite side of the winding device adaptable to receive said arbor, whereby said turret winding device is adaptable to wind web in the arbor type winding procedure over the full width of the device.

12. The turret winding device of claim 11 wherein said drive shaft driving and support means comprises a drive plate member bolted to a sleeve, said sleeve mounted by rotatable bearings to said turret plate means, said drive plate having an aperture shaped to grip a drive shaft inserted therein, said drive plate being removable, and replaceable by another ring having a tapered hole, adapted to receive the shank of an arbor during full width arbor type winding.

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