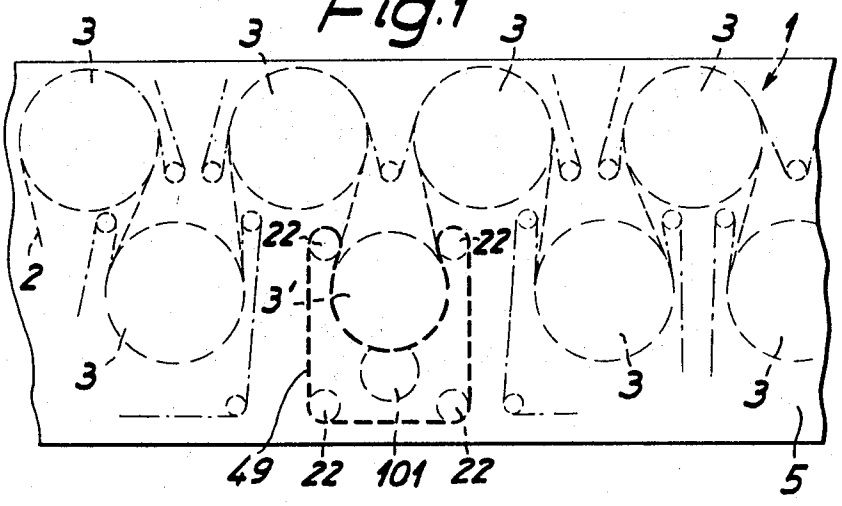
June 22, 1971 A. SCHMIDT 3,586,602

APPARATUS FOR THE TRANSVERSE STRETCHING AND TRANSVERSE SHRINKING OF A CONTINUOUS WEB MATERIAL

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Fig.1



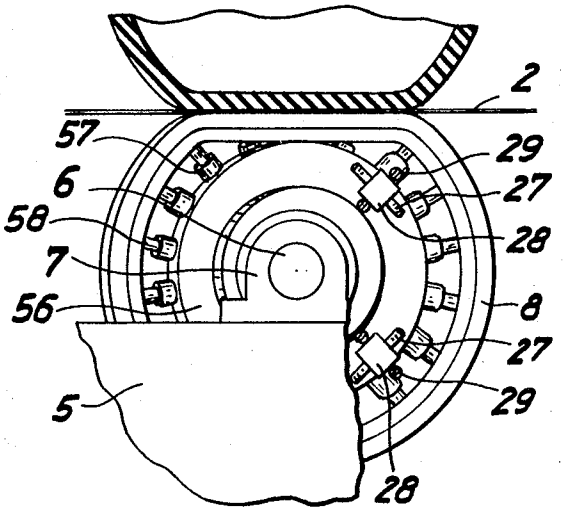


Fig.5

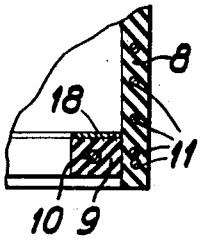


Fig.6

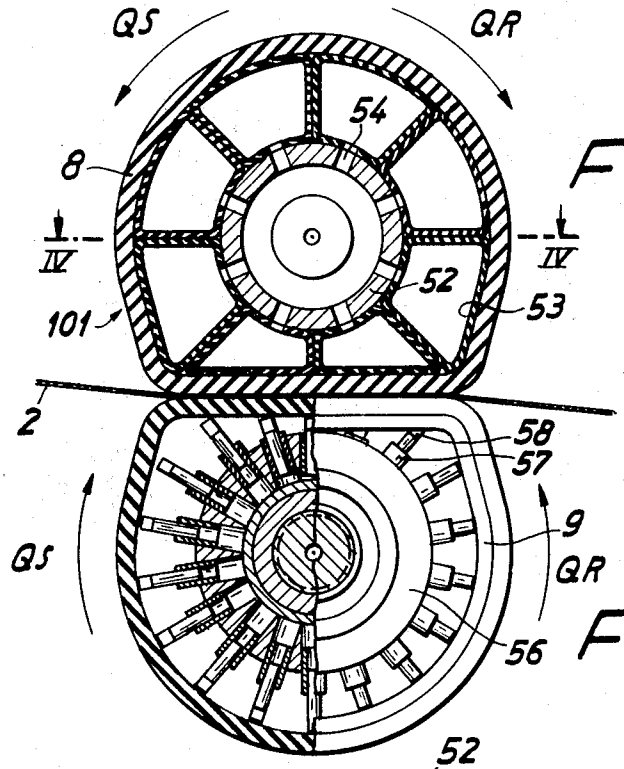


Fig.2

Fig.3

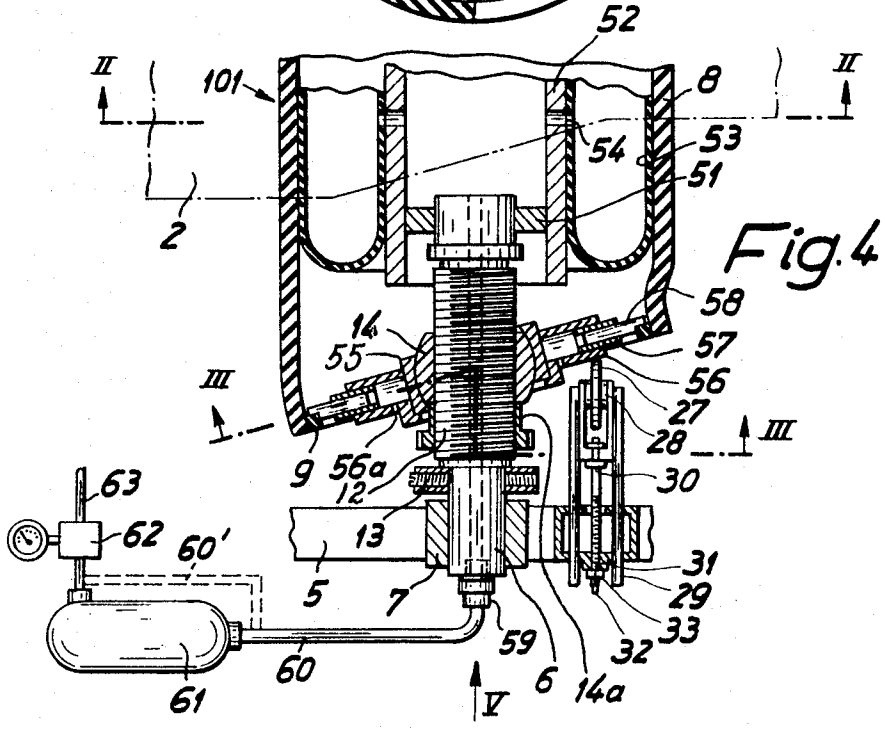


Fig.4

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APPARATUS FOR THE TRANSVERSE STRETCHING AND TRANSVERSE SHRINKING OF A CONTINUOUS WEB MATERIAL

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Fig.7

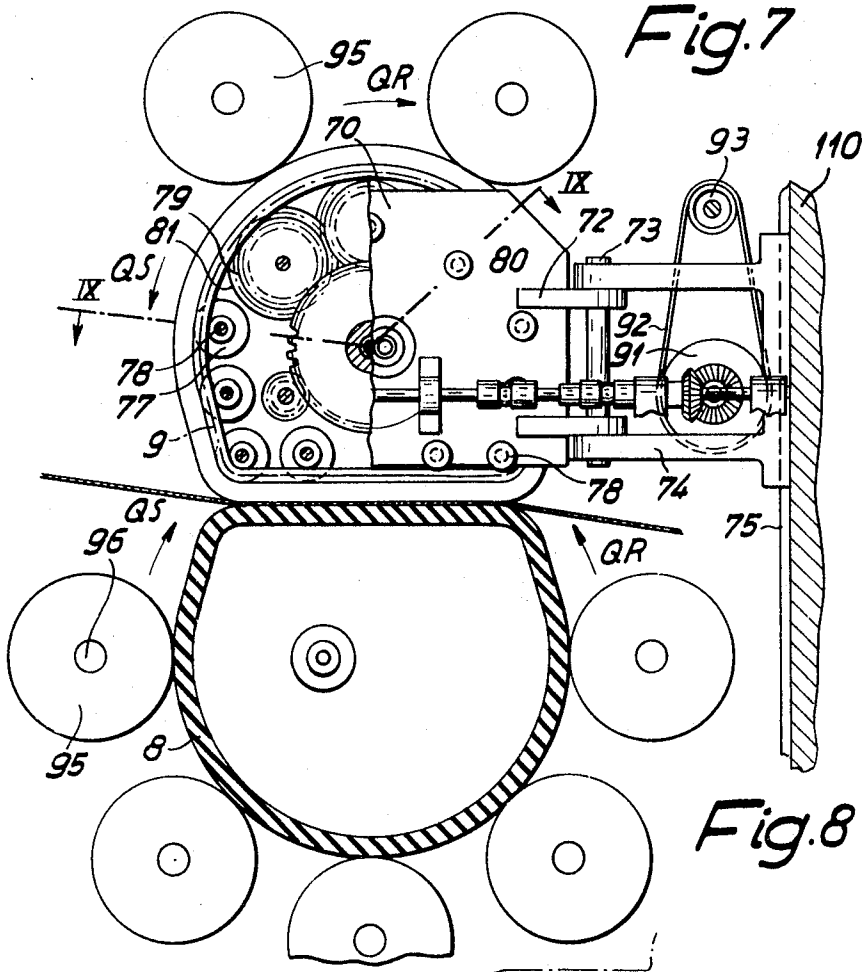


Fig.8

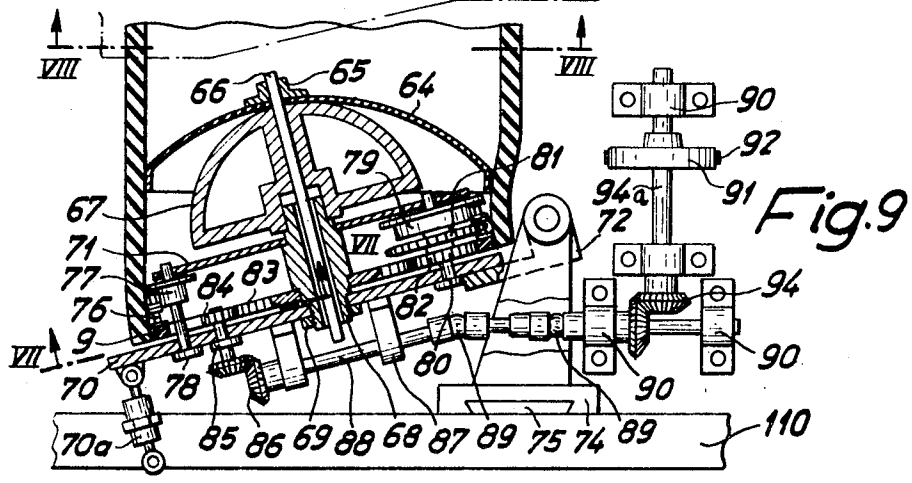


Fig.9

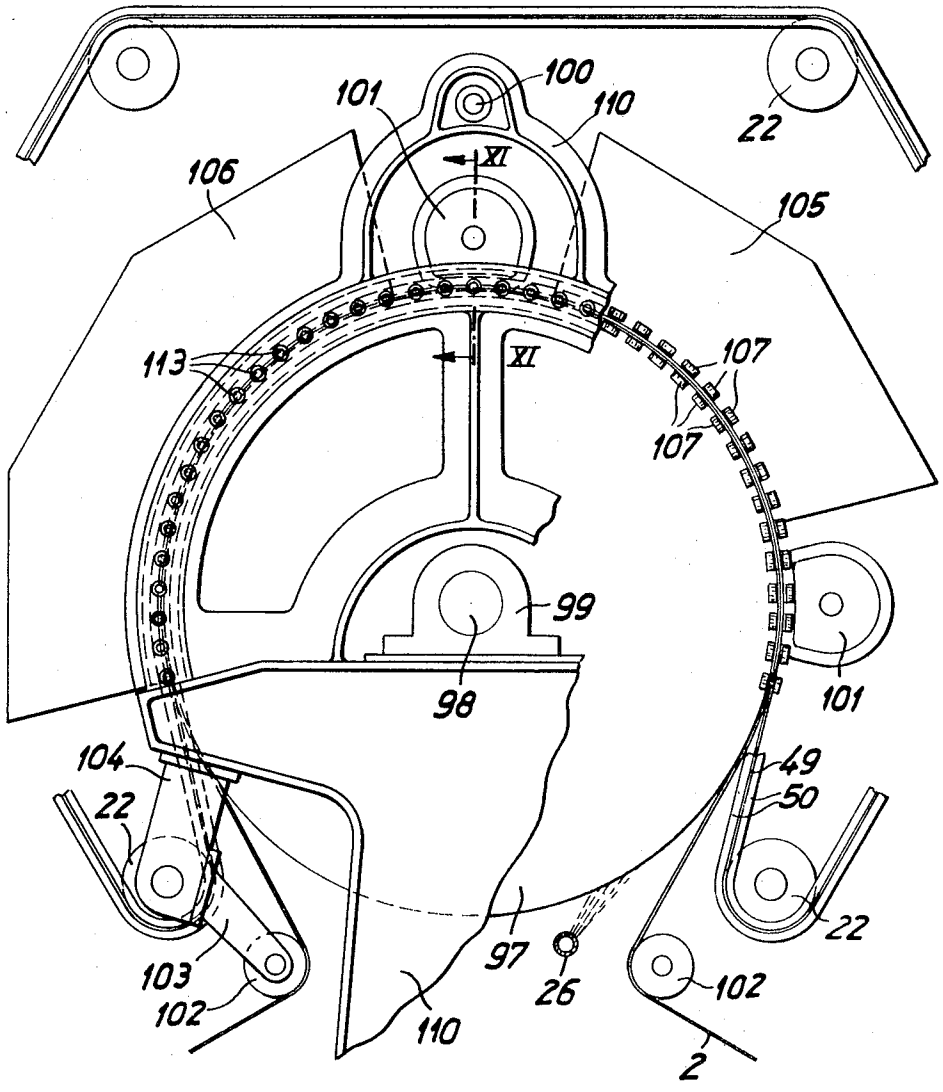
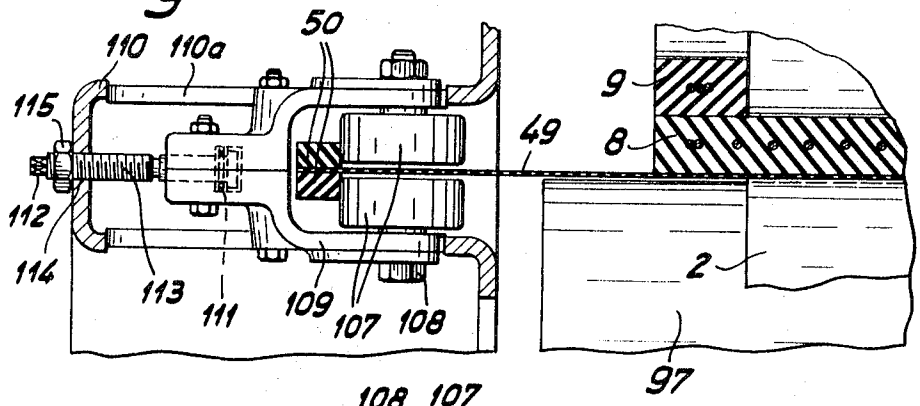

100
101
110
22
106
XI
105
113
XI
107
107
99
98
101
104
22
49
50
22
103
102
97
26
102
110
2

Fig. 10

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Fig.11



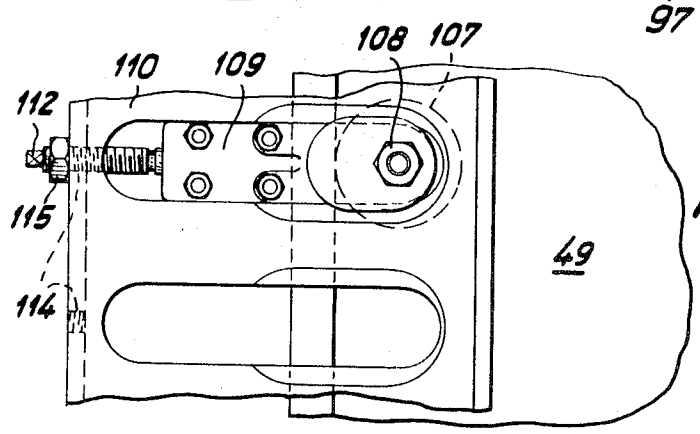


Fig.12

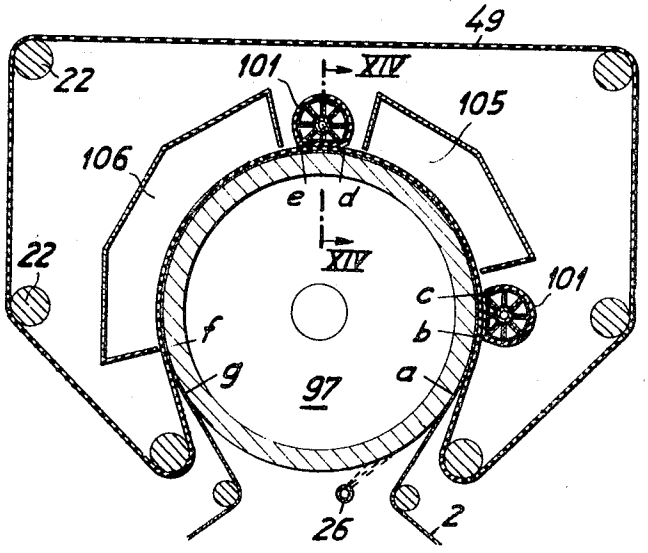


Fig.13

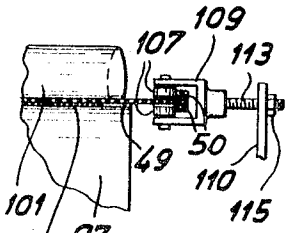
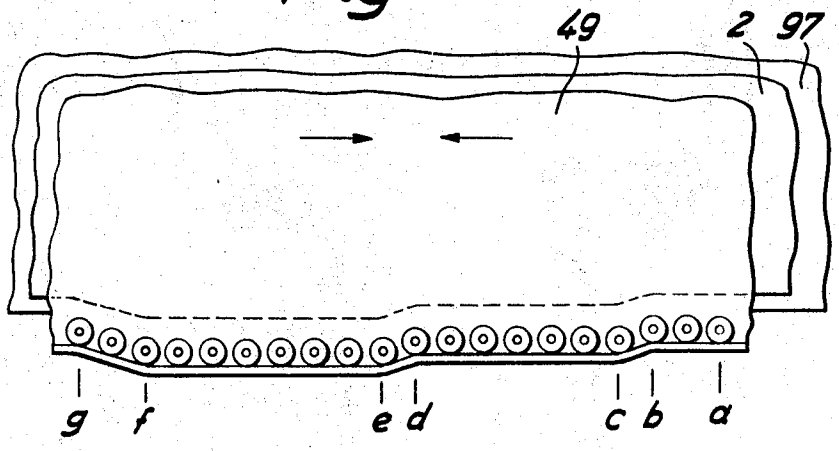


Fig.14

Fig. 15



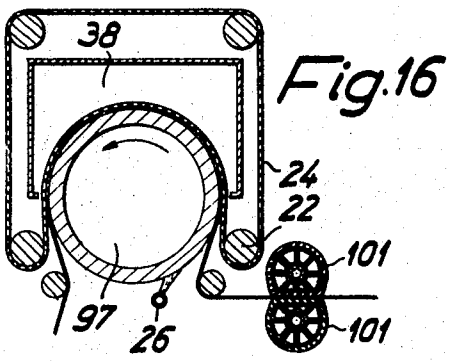


Fig. 16

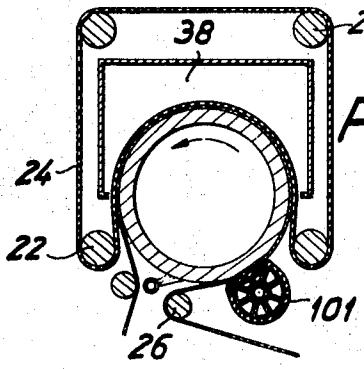


Fig. 17

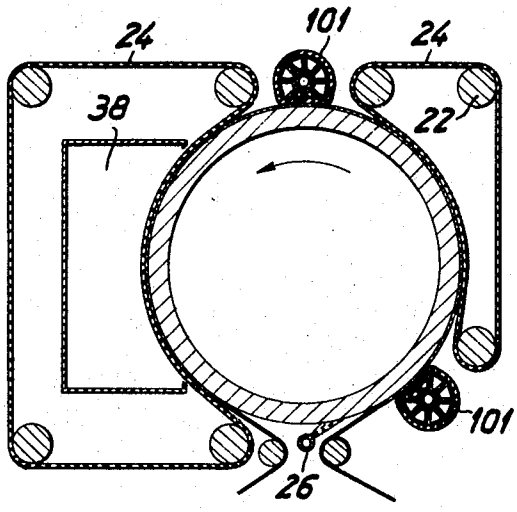


Fig. 18

Fig. 19

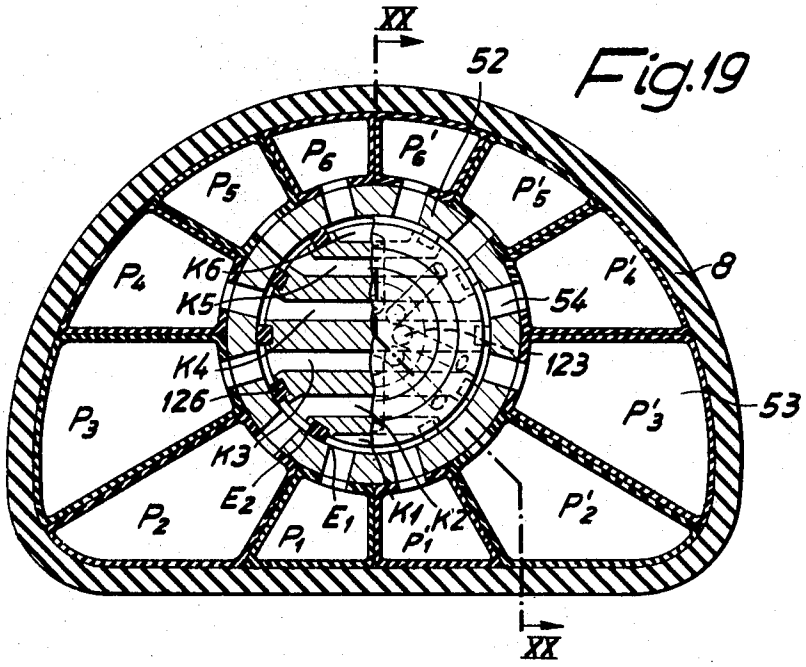
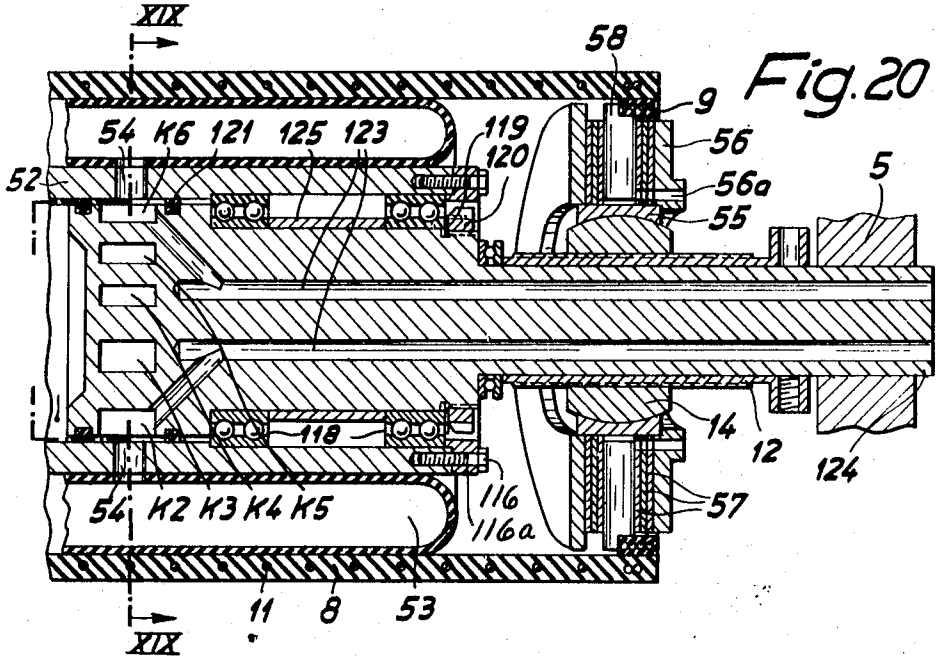
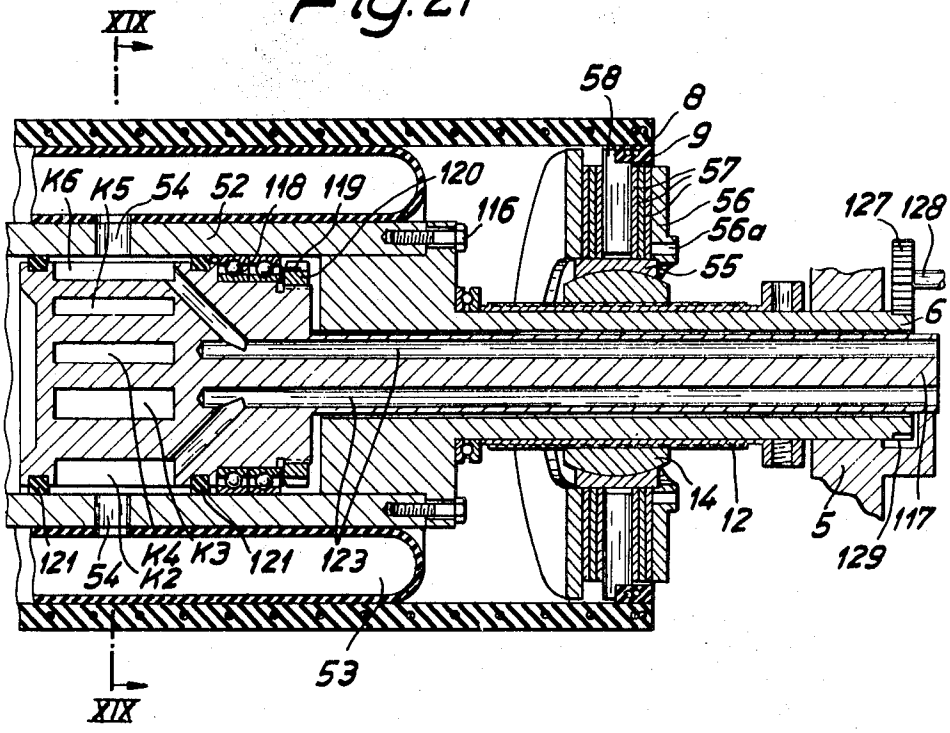

XX
52
P6
P'6
P5
P'5
P4
K6
K5
P'4
8
54
K4
123
126
P3
P'3
53
K3
E2
E1
K1
K2
P2
P1
P'1
P'2
XX

Fig. 20


XIX
58
9
54 K6 121 125 123
119
120
56
56a
55
5
52
118
14
12
124
54 K2 K3 K4 K5
116
116a
57
11
8
53
XIX

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Fig. 21



United States Patent Office 3,586,602 Patented June 22, 1971

3,586,602

APPARATUS FOR THE TRANSVERSE STRETCHING AND TRANSVERSE SHRINKING OF A CONTINUOUS WEB MATERIAL

Adolf Schmidt, 14 Nippesstrasse, Duren, Rhineland, Germany

Filed Oct. 19, 1967, Ser. No. 676,541
Claims priority, application Germany, Oct. 19, 1966, Sch 39,702
Int. Cl. D21f 3/09
U.S. Cl. 162—359 17 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for transversely stretching or transversely shrinking a continuously movable material web, especially a paper web for treatment in a paper machine which includes a rotatable hose roller whose hose is held on its ends at the outer surface of two disks or the like which are adapted to be tilted toward each other in the sense of a change in width of the hose during its rotation and therewith in the sense of the desired transverse stretching or shrinking of the material web which is pressed by a counter surface against an area of the outer surface of the hose roller whereby the hose roller including the disks or the like are either flattened off in a fixed circumferential area determined for the cooperation with the counter surface or are constructed so as to be elastically deformable in the radial direction, and the hose within the contact area with the material web is supported by way of the counter surface which may be a similar hose roller or cylinder, such as a drying cylinder.

The present invention relates to an installation for the transverse stretching (elongation) or transverse shrinking of a continuously conveyed or advanced material web, by means of a rotatable hose roller, the hose of said roller being attached at its ends at the peripheral surfaces of two disks or the like, which are tiltable with respect to each other along the lines of a change in the width of the hose during its rotation and thus along the lines of the desired transverse stretching (elongation) or transverse shrinking of the material web pressed by a counter surface against a zone of the surface area of the hose roller.

With such a known installation of the prior art used for the creping of films in their longitudinal direction, the material web has to be extended around a corresponding circumferential zone of the hose roller and has to be pressed so strongly against the hose of the hose roller that the desired change in width in unison with the deformation of the hose is ensured. By reason of the required considerable contact pressures, it is. however, difficult to find suitable abutment or pressure belts which are able to absorb the corresponding tensional forces for the production of the abutment or pressure force and which in particular during the treatment of paper webs, still more or less damp as a result of the manufacture thereof, are correspondingly permeable in addition thereto.

The present invention is concerned above all with the problem to so complete the aforementioned installation that for the production of the abutment forces for pressing the material web against the hose roller, other means can be used independent of the abutment pressure belt and that the utilization of an abutment band or pressure belt can possibly be completely dispensed with.

The underlying problems are solved in accordance with the present invention essentially in that the hose roller including the disks or the like are flattened off within a fixed circumferential area determined for the cooperation with the counter surface or are constructed so as to be

capable of being elastically pressed-in in the radial direction and the hose is supported within the contact area with the material web by way of the latter at the hose of a similar hose roller or at a cylinder.

By the use of such a support of the hose of the hose roller within its area cooperating with the material web at a similar hose roller or at a cylinder at the same time constructed appropriately as drying cylinder, the use of a separate abutment or pressure belt is obviated. However, if such a pressure belt is necessitated anyhow for the better guidance of the material web which, for example, is still wet and sensitive, then the temporary compression thereof between the hose roller and the counter-surface for the material of the pressure belt can be accepted without objection.

In particular when the hose consists of a particularly far-reachingly deformable, soft elastic material, it is advantageous according to a preferred construction of the present invention if the disks or the like are adjustable in their mutual spacing in the sense of a corresponding axial stretching or stressing of the hose.

According to a further preferred construction of the present invention, the hose of the hose roller is traversed in its circumferential direction by inserted or embedded ring-shaped, closed filaments or cables non-stretchable in their longitudinal direction and arranged in the direction transverse to the hose roller parallel adjacent to and unconnected with one another or is traversed by a filament or a cable non-stretchable in the longitudinal direction and wound within the hose in the transverse direction thereof with a small pitch, which is closed circularly at the ends of the hose. It is assured thereby that the hose is deformed by the abutment pressure only in its width and not possibly also in its circumferential direction—in the sense of an enlargement of its diameter.

According to a further feature of the present invention, rollers, mutually oppositely adjustable parallel to the axis against the disks in the sense of their tilting and each guided in tangential planes to the disks, are arranged within the inlet and/or outlet circumferential area of the hose, by means of which the tilting of the disks and therewith the change in width of the hose is brought about particularly appropriately.

According to still another embodiment of the present invention, a pressure belt guided in conjunction with the material web is transversely elastic and is provided along its edges with a guide belt each, which extends within the area of the hose roller over the associated edge of the hose or over guide rollers. Such a transversely elastic construction of a pressure belt is necessary when the hose roller is pressed against the material web guided over a drying cylinder by means of a pressure belt indirectly by way of the pressure belt.

According to a further, equally preferred constructive embodiment of the present invention in lieu of the aforementioned disks, roller chains are provided with are each guided in a fixedly supported plate pivotal, however, in the sense of the aforementioned tilting movements. According to an associated construction of the present invention, the hose is filled with a pressure medium and the pressure medium is supported at the plate on both sides by way of a sealing plate and of a support body and the roller chain is guided along the circumference of an essentially circularly shaped plate, flattened, however, on one side, whereby support rollers arranged along a circular arc are coordinated to the hose within its circumferential area disposed outside of the working area at the material web. The arrangement of a shaft approximately axially extending through the hose is obviated thereby and the pressure force used within the hose can act very uniformly on the flattened off area of the hose against which abuts the material web to be deformed.

Significant for the success of an undertaken transverse stretching or transverse shrinking is that the material web consisting in particular of paper has no opportunity subsequently to a renewed automatic change of the induced properties which might readily occur with the still damp material by a subsequent freely bridged length of the conveyed material web. For this reason according to a still further feature of the present invention, there are arranged successively along the area of a drying cylinder surrounded by the material web a hose roller, a drying hood, a second hose roller and a further drying hood.

Accordingly, it is an object of the present invention to provide an installation for the transverse shrinking and stretching of material webs which avoids by simple means the aforementioned shortcomings and drawbacks encountered with the prior art constructions.

Another object of the present invention resides in an installation of the type described above which assures the requisite transverse changes in the web material without the need of a pressure belt to produce the hitherto necessary abutment pressures.

A further object of the present invention resides in an installation for transversely stretching or shrinking a material, particularly a paper web which is simple in construction, involves relatively low expenditures and assures the prevention of a return of the material to its original condition while being treated.

These and further objects, features, and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawing which shows, for purposes of illustration only, several embodiments in accordance with the present invention, and wherein:

FIG. 1 is a schematic side elevational view of a conventional paper machine with a drying section having a transverse stretching installation in accordance with the present invention;

FIG. 2 is a cross-sectional view, on an enlarged scale, through the installation of FIG. 1 according to the present invention in the form of a hose roller, taken along line II—II of FIG. 4;

FIG. 3 is a cross-sectional view, taken along line III—III of FIG. 4, through a similar hose roller associated in a mirror-image-like manner to the hose of FIG. 2;

FIG. 4 is a partial longitudinal cross-sectional view, taken along line IV—IV of FIG. 2, through the hose roller of FIG. 2 in conjunction with a schematically illustrated pressure medium supply system;

FIG. 5 is a front elevational view of the same hose roller, taken in the direction of arrow V of FIG. 4, with details of the hose roller illustrated in cross section for purposes of clarity;

FIG. 6 is a partial cross-sectional view, on a still further enlarged scale, of a hose end of the hose roller according to FIG. 4;

FIG. 7 is a partial cross-sectional view, taken along line VII—VII of FIG. 9, through a modified embodiment of a hose roller indicating some of the parts thereof in cross section;

FIG. 8 is a cross-sectional view, similar to FIG. 3, of a hose roller together with support rollers, coordinated in a mirror-image-like manner to the hose roller of FIG. 7, and taken along line VIII—VIII of FIG. 9.

FIG. 9 is a longitudinal cross-sectional view of the installation of FIG. 7, taken along line IX—IX of FIG. 7;

FIG. 10 is a front elevational view of a drying cylinder provided along its circumference with two hose rollers adapted to be elastically pressed-in and additionally with two drying hoods of a drying section (not shown as to the rest thereof) of an otherwise conventional paper machine;

FIG. 11 is a partial longitudinal cross-sectional view, taken along line XI—XI of FIG. 10, showing the parts on a greatly enlarged scale;

FIG. 12 is a top plan view of the parts illustrated in FIG. 11;

FIG. 13 is a schematic front elevational view of a drying cylinder, similar to FIG. 10, but on a reduced scale, which is provided with hose rollers according to the present invention;

FIG. 14 is a partial longitudinal cross-sectional view taken along line XIV–XIV of FIG. 13;

FIG. 15 is a view illustrating the unfolded circumferential area of a hose roller according to FIG. 13 of the present invention, together with a transversely stretched or shrunk paper web and similarly transversely stretched or shrunk drying fabric, the various parts being developed in the plane of the drying;

FIGS. 16 to 18 are schematic front elevational views, similar to FIG. 13, of three further embodiments of a drying cylinder with two hose rollers and with one drying hood in accordance with the present invention;

FIG. 19 is a cross-sectional view, similar to FIG. 2, of another modified embodiment of a hose roller in accordance with the present invention, taken along lines XIX—XIX of FIGS. 20 and 21;

FIG. 20 is a partial longitudinal cross-sectional view of the hose roller of FIG. 19, taken along line XX—XX of FIG. 19; and

FIG. 21 is a corresponding partial longitudinal cross-sectional view, similar to FIG. 20, of a slightly modified embodiment of a hose roller of the present invention.

Referring now to the drawings wherein like reference numerals are used throughout the various views to designate like parts, of the two reference characters QR and QS used in the various views of the drawing, the reference character QR indicates the direction of rotation for the transverse stretching and the reference character QS the direction of rotation for the transverse shrinking. With the arrows for the direction of rotation, which are not specifically characterized, the installation may be used both for transverse stretching and also for transverse shrinking.

According to the embodiment illustrated in FIG. 1, the installation according to the present invention serves for the transverse stretching of a paper web **2** made in a conventional paper machine and passing through the drying section **1** of this machine. Of the several drying cylinders **3** of the drying section **1**, the one designated in FIG. 1 with reference to numeral **3'** cooperates with a transverse stretching arrangement constructed as hose roller generally designated by reference numeral **101** and to be discussed more fully hereinafter with reference to FIGS. 2 and 4.

The hose roller **101** supported at the stationary support part **5** of the drying section **1** according to FIG. 4 by means of the bearing pins **6** and bearings **7** is provided with a hose **8** placed thereon loosely which, in turn, is provided at each of its ends with an inner entrainment ring **9**. A ring **10** which is as non-stretchable as possible, is inserted into the entrainment ring **9** (FIG. 6) and the hose **8** is transversed in its circumferential direction by a filament or cable **11**, wound in the longitudinal direction thereof with a small pitch which is closed at the hose ends in a circularly shaped manner (FIG. 6). A threaded bushing **12** is rotatably supported on a respective one of the two bearing shafts **6** and is adapted to be fixed by set screws **13** (FIG. 4). A ball nut **14** forming at its outer circumference a spherical bearing is supported on each threaded bushing **12**; a stretching disk **56**, constructed of two parts for assembly reasons, is movably supported on the spherical bearing of the ball nut **14** by means of an internally spherical ball ring **55**. The ball nut **14**, which is adjustable along the threaded bushing **12** in a manner to be described more fully hereinafter, can be fixed by a ring nut **14*a*** on the threaded bushing **12**. Both stretching disks **56** engage along their outer edge behind the associated entrainment ring **9** and abut with their engaging surfaces according to FIG. 6 against a respective lining **18** having a large frictional resistance of the coordinated entrainment ring **9**.

Within the circumferential area of the cylinder 3', surrounded by the paper web 2, are arranged four guide rollers 22 (FIG. 1) of which one may be driven and which are surrounded by a pressure belt 49 elastic in the transverse direction and simultaneously constructed as drying fabric which also rotates about the area of the cylinder 3' surrounded by the paper web outside of the paper web 2 with a velocity synchronous thereto. The cooperation of the transversely elastic abutment or pressure belt 49 with the hose roller 101, the paper web 2 and the drying cylinder 3' will be described more fully hereinafter with reference to FIGS. 10 to 15.

As can be seen in particular from FIGS. 4 and 5, guide rollers 27 are arranged in the circumferential area of the hose 8 on the inlet side, which are displaceable mutually oppositely toward the stretching disks 56 parallel to the axis and in the sense of the tilting thereof and which are guided in tangential planes to the stretching disks 56. Each roller 27 is supported in a forked bearing 28 which is longitudinally displaceably supported by way of a guide bolt 29 secured at its legs in parts of the stationary support 5. Each forked bearing 28 can thereby be displaced longitudinally by means of a pressure spindle 30 rotatably supported as its web portion but longitudinally non-displaceably supported thereto; the pressure spindle 30, on the other hand, is threadably guided in a threaded bore 31 of the stationary support part 5. The pressure spindle 30 carries at its free end a quadrangular head 32 permitting its rotation and can be secured in the respective desired position at the fixed support part 5 by means of a counter-nut 33.

In the embodiment illustrated in FIGS. 2 to 6, the hose 8 is transversed by a tubular member 52 of essentially smaller diameter which is rigidly connected with the pin 6 by way of intermediate rings 51 and accommodates along its circumference still on the inside of the 8 a number of profile hoses 53 following one another in the circumferential direction. The thus formed compressible hose roller 101 which is thereby adapted to be pressed-in, is used appropriately in the manner illustrated in conjunction with FIG. 3 together with a similar hose roller arranged in a mirror-image-like manner for the two-sided action on a paper web 2 guided between the two hose rollers. Corresponding to the deformation of the profile hoses 53 during the rotation of the hose rollers 101, the stretching disks 56 exhibit a considerably smaller diameter compared to the hose 8 and each stretching disk 56 is provided along its circumference with radially outwardly projecting prestressed telescopic bushings 57, within which are displaceably supported on the outside thereof clamping bolts 58 which engage with their outer, flattened off ends behind the associated entrainment ring 9 of the hose 8.

A compressed-air or hydraulic line 60 is connected by way of a schematically indicated supply head 59 with one of the pins 6 of the hose roller 101. In case pressure liquid is used, the line 60 starts from a pressure tank 61 in which compressed air is disposed above the liquid level which is supplied by way of a pressure regulator 62 from a line 63. If only compressed air is used, then the pressure tank 61 may be dispensed with and the line 60 can be connected directly with the pressure regulator 62 by way of a line section 60' indicated in dash line in FIG. 4.

OPERATION

The hose rollers according to FIGS. 2 to 6 operate as follows:

The pressure medium is supplied to the pipe 52 by way of the line 63, the pressure regulator 62, which maintains constant the pressure of the pressure medium, by way of the pressure tank 61, the line 60 and the supply head 59, and thereupon reaches the profile hoses 53 by way of apertures 54 (FIG. 4). If a liquid is used as pressure medium, then the entire system is filled, with the hose

rollers pivoted away, to such an extent as corresponds to the volume of the illustrated cross section. The force supplied by way of the pins or shafts 6 either to the upper or lower roller is equal to the interior pressure in the profile hoses 53 which are disposed closest to the pressure zones, multiplied by the abutment surface, but reduced by the inherent weight of the upper hose roller. During the further rotation of the hose roller 101, the lower profile hose 53 illustrated at the left leaves the pressure zone and presses the outer hose 8 (transverse stretching hose) outwardly into any desired form. The indicated form is assumed, however deviations therefrom are insignificant for the function of the installation. Since the hose 8 is dimensionally stable in the conveying or rotational direction, it has to return in the upper, non-abutment area into the circular shape.

During the common rotation of the two hose rollers 101, their width is enlarged in the direction of movement—or as viewed oppositely—depending on whether a transverse stretching or transverse shrinking is desired. Since the lateral guidance has to be changeable in its diameter during the rotation by reason of the surface pressure zones, the stretching disk 56 was kept so small that in the apex of the pressure, it just barely does not contact the associated entrainment ring 9 and its collar disposed on the inside just barely does not contact the hose 8. The telescopic bushings 57 and the stretching bolts 58 disposed in the same slide radially outwardly and inwardly in a plurality of radial bores of the stretching disk 56. Thus, the telescopic bushings including stretching bolts can be radially, outwardly prestressed by a flow medium. The outer abutment of the stretching bolts 58 is assured by the centrifugal force and the frictional contact at the entrainment rings 9 whereas the movement toward the inside is brought about by the compression of the hose 8 and the corresponding deformation of the entertainment ring 9. For purposes of venting, i.e. supply and discharge of air to and from the bore spaces for the telescopic bushings 57 which change during the rotation of the stretching disk 56, venting apertures 56*a* are provided in the end-face portion of the stretching disk 56.

In the embodiment illustrated in FIGS. 7 to 9, a rubber-elastic, end-face sealing plate 64 is provided in the hose 8 at the two ends thereof which is bonded, for example, glued or cemented along its outer circumference with the hose 8 and against which a hemispherically shaped support body 67 is supported with its spherical circumferential part from the outside thereof. The support body 67 is axially transversed by a pipe 66 serving for the introduction of a pressure medium into the inside of the hose. The plate 64 is reinforced by a sleeve 65 at the place of traversal of the pipe 66. The support body 67 is axially supported at its outside on a bushing 68 which replaces the coordinated pin or shaft according to the preceding embodiment and carries at its outer end a ring nut 69 by means of which a plate 70 is securely clamped at the same. A similar plate 71 is also secured at the inner end of the bushing 68. Various shafts 78, 80 and 85, serving in part for the transmission of the drive in a manner to be described more fully hereinafter, are supported at the outer plate 70 and partly also at the inner plate 71, and the outer plate 70 is retained by way of extensions 72 and of a bearing bolt 73 at a bearing mount 74 provided with a dovetail guide means 75. A two-membered roller chain 76 is secured along the side wall facing the hose center of the entrainment ring 9 connected with the hose 8 either by bonding or by chain bolts, which engage in corresponding apertures of the entrainment ring 9.

Pressure rollers 77 and 79 abut against the inner ends of the chain bolts of the roller chains 76 and sprocket wheels 81 engage in the roller chain 76 which are secured on shafts 80 supported within a circularly shaped area of the plate 70. The sprocket wheels 81 are driven from

a drive motor (not shown) or from a drive group (not shown) of the paper machine of conventional construction by way of the pinions **82** secured to their shafts **80**, a central gear **83** rotatably supported on the bushings **68**, a further pinion secured on the shaft **85**, a bevel gear transmission **86**, a shaft **88** supported in bearings **87**, a Cardan drive **89** with two Cardan joints, a further bevel gear transmission **94**, a shaft **94***a* supported in bearings **90** and a belt drive **91**, **92**, and **93**.

The described drive of the hose **8** by way or a roller chain **76** and the entrainment ring **9** is provided similarly and synchronously by way of the shaft **94***a* at both hose ends in a conventional manner not illustrated in detail.

FIG. 10 illustrates the use of two mutually independent hose rollers **101** at different circumferential places of a drying cylinder **97**. The drying cylinder **97** is supported by way of its pins or shafts **98** in bearings **99** of the two mutually oppositely disposed support brackets **110** of the fixed support of a conventional drying section, on which are supported also the hose rollers **101** by way of the bearing mounts or support brackets **74** (FIGS. 7 and 9). An upper cross bearer **100** connects the two brackets or mounts **110**. The hose rollers **101** press against a transversely elastic abutment or pressure belt **49** constructed in the manner of a drying fabric which, in addition to being guided at the drying cylinder **97**, is guided as endless belt in further guide rollers **22** and is provided at both of its two edges with guide belts **50** by means of which the pressure belt **49** can be stretched transversely in a manner to be described more fully hereinafter. The material web **2** constructed as paper web is guided to and away from the drying cylinder **97** by way of guide rollers **102**. The guide rollers **102** are mounted in bearing brackets **103** and **104** of the support mount **110**. The first hose roller **101** is followed along the circumference of the drying cylinder **97** by a drying hood **105** and the second hose roller **101** is followed along the cylinder circumference by a drying hood **106** of conventional construction.

The lateral guidance of the transverse elastic pressure belt **49** can be seen from FIGS. 11 and 12. The drying fabric is reinforced at both of its edges, on both sides thereof, by guide belts **50** consisting, for example, of rubber or the like, with which engage within the transverse stretching or shrinking areas and within the drying area, roller pairs supported at the support mounts **110** in a manner to be described more fully hereinafter whose rollers **107** engage behind the lateral surfaces of the guide belts **50** facing the center of the web.

Each roller pair **107** is supported on bearing pins or shafts **108** which are retained in a fork-shaped carriage **109**. The carriage **109** extends with its forked guide means beyond the edge of the drying fabric **49** and is slidably guided transversely to the drying fabric at a guide track **110***a* of the associated support mount **110** within the track plane. A spindle **113** which is rotatably supported in the web section of the carriage **109** by way of a roller bearing **111** and is provided at its free end with a quadrangular head **112**, extends beyond a threaded bore **114** of the support mount **110** and thus permits, depending on its rotation and fastening by an outer counter nut **115**, the adjustment of the carriage **109** on the guide track **110***a*.

As can be seen further from FIG. 10, a plurality of carriages **109** are arranged at the support mount **110** along the abutment area of the pressure belt **49** of which in FIG. 10, only the spindles **113** are visible. In this manner, the drying fabric **49** can be similarly transversely stretched or transversely shrunk within the area of the two hose rollers **101** and can be guided with the edges parallel within the drying area.

The outer surface of the cylinder **97** (FIG. 10) offers as little as possible a frictional resistance and may additionally be sprayed with a suitable spraying medium, for example, a spray-medium containing a silicon oil, from a conventional spraying nozzle **26** arranged at the fixed support **5** in a manner not illustrated in detail.

With the embodiments according to FIGS. 7 to 12, the single interior space of each hose roller **101** is supplied with the pressure medium by way of the pipe **66** whereby the hose **8** is externally supported within the areas, in which it is not supported at the hose **8** of a counter roller, against support rollers **95** (FIGS. 7 and 8) which are supported by way of pins or shafts **96** at the support mounts **110**. The hose **8** is sealed at the end faces by sealing plates **64** which are supported on the support bodies **67**, from which the interior pressure is supported by way of the bushing **68** and the plate **70**, on the one hand, against the bearing bolts **73** and, on the other, against clamping locks **70***a* which, in turn, are also anchored at the support mounts **110**. As a result thereof, the interior pressure of the hose **8** simultaneously assists the deflection or expansion in its width. Operating conditions may occur in which a tension, a pressure, or no force at all is transmitted by the clamping lock **70***a*.

The transmission of the forces required for the deflection of the hose **8** takes place by way of the collars of the pressure rollers **77** and **79** which abut against the chain bolts of the roller chain **76**. The drive of the hose **8** takes place by way of the gear transmission **84**, **83**, **82** in addition to the sprocket wheel **81** in the manner described already hereinabove, whereby the sprocket wheel **81** engages with the members of the roller chain **76**.

The embodiment described in connection with FIGS. 10 to 12 is provided for those cases in which a great significance is attributed to a fixing of the paper web during the drying relative to the transverse stretching or transverse shrinking purpose. The supplied paper moves together with the drying fabric **49** toward the first hose roller **101**, as is indicated in FIGS. 13 to 15 by the place *a*. Shortly prior thereto, the drying fabric **49** is laterally taken up by the rollers **107** (FIG. 11). During the transverse stretching of the hose roller **101**, the drying fabric **49** is also extended in its width by means of the previously adjusted rollers **107** between the places *b* and *c*. After leaving the hose roller, the adjustment of the lateral guide track is retained so that the drying fabric **49** cannot elastically return in the circumferential area of the drying cylinder **97** following the place *c*. In this circumferential area following the first hose roller **101**, the paper web **2** is dried by means of the drying hood **105** through the drying fabric **49**. If the paper has reached a certain degree of dryness at which the development of further forces in the transverse strength appears appropriate, a second hose roller **101** may follow which according to FIGS. 10 and 13 is arranged at the upper apex of the drying cylinder **97**. The paper web **2** is further stretched transversely by way of this hose roller within the area between the places *d* and *e* whereby the drying fabric **49** also receives a corresponding further widening, whereupon the paper web **2** is subsequently further dried by means of a second drying hood **106** and as simultaneously fixed thereby. Insofar as the stress or stretch in the longitudinal direction of the drying web, i.e., in the direction of movement thereof, and the progressive strengthening of the paper web **2** permit it, a certain, additional transverse stretching of the paper web **2** may also be effected between the two hose rollers **101** by a corresponding widening of the drying fabric **49** by means of the lateral guide tracks thereof. After the separation of the paper web **2**, the drying fabric **49** may again relax into its normal width between the places *f* and *g*.

In the embodiment illustrated in FIG. 16, the paper web **2** passes directly in front of the drying cylinder **97** through a width-stretching press formed by two hose rollers **101** pressed against one another and arranged mirror-image-like to each other whereby the transverse stretched or transversely shrunk paper web is prevented by a pressure belt **24** constituted as drying fabric, which surrounds the drying cylinder **97** and therewith also the paper web **2** under high tension, and by means of a drying hood **38**

from losing again the properties thereof induced by means of the width-stretching press.

According to FIG. 17, a hose roller **101** presses alone against a drying cylinder whereas a pressure belt **24** constructed as drying fabric and a drying hood **38** are provided in a manner similar as in FIG. 16.

According to FIG. 18, after a transverse treatment and following drying underneath a pressure belt **24** constructed as drying fabric, there follows a second transverse stretching or shrinking with subsequent drying under the highly stretched drying fabric and simultaneously under a drying hood **38** provided thereat. In all of these embodiments, in which the paper web abuts directly on the drying cylinder **97**, a spray nozzle **26** may be provided ahead of the first place of contact of the paper web with the drying cylinder **97** as already described in connection with FIG. 10.

The embodiments according to FIGS. 2 to 6 and 7 to 9 offer the advantage that they are constructed in a constructively simple manner, however, it has been found to be desirable in connection with applications, in which higher transverse stretching or transverse shrinking forces and therewith higher abutment pressures are to be produced, to reduce within the hose **8** the stress in the circumferential direction at least along that part which does not carry out the transverse treatment. Therebeyond it is desirable to keep as small as possible the circumferential length of the hose roller not usable for the material treatment with respect to the remainder circumferential length used in the treatment.

The two aforementioned requirements are fulfilled in the embodiment illustrated in FIGS. 19 and 20. A fixed pin or shaft **124** carries the pipe **52** by way of two roller bearings **118**. The anti-friction or roller bearings **118** are kept at a distance by a spacer bushing **125** and are axially secured by a grooved nut **120**. A locking plate **119** secures the nut **120** in a conventional manner against unintentional loosening. Within the pipe **52** the roller bearings **118** and together with the same, the fixed pin **124** are retained by a flange **116***a* which is secured at the pipe **52** by means of bolts **116**. Circularly shaped sealing rings **121** form in the axial direction an annular chamber. Sealing rings **126** (FIG. 19), which extend in axial direction of shaft **124** abut rigidly against the circumferential sealing rings **121** (FIG. 20). As a result thereof, six sealing chambers K_1 to K_6 are produced according to FIG. 19 by means of which the twelve profile hoses **53** are supplied pair-wise with the pressure medium. The supply of the pressure medium takes place for each individual chamber separately by way of bores **123** as is also visible from FIG. 20. Each of the chambers K_1 to K_6 can be kept by way of the associated bore under any desired pneumatic or hydraulic pressure.

With a preferred modification according to FIG. 21, the pin or shaft **6** which rotates along, is provided with a bore for the accommodation of a distributor body **117** serving for the supply and distribution of the pressure medium. The distributor body **117** is supported within the pipe **52** by way of a roller bearing **118** and is externally supported on the support or mount **5** and is secured thereat in a simple, conventional manner, not illustrated in detail herein.

Two chambers each, for example, chambers P_1 and P'_1 are under the same pressure. During its further rotation, the chamber P_1 comes into the illustrated position of the chamber P_2 and thus receives, as soon as the edge E_1 of the supply aperture **54** has passed over the edge E_2 of the axial strip, the pressure prevailing in the chamber K_2 which is preferably adjusted higher than the pressure in the chamber K_1. As a result thereof, the circumferential part of the hose **8** useful for the material web treatment becomes greater in relation to the entire circumference than in the embodiments described above. From P_3 to P_6 the pressure is decreased in a step-wise manner and increases starting from P'_5—by way of P'_4 and P'_3—to P_2 and again reaches in the pressure P_1 in the position P'_1.

While I have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to a person skilled in the art. Thus, for example, in lieu of the wound cable or filament **11**, the hose could be traversed in a circumferential direction by inserted or embedded annularly shaped, closed filaments or cables which are non-stretchable in the longitudinal direction and are arranged parallel adjacent each other and unconnected in the transverse direction thereof or such inserts may be completely dispensed with especially if simultaneously with transverse stretching a more or less large longitudinal stretching of the material web is to be sought.

Thus, it is obvious that the present invention is not limited to the details shown and described herein but is susceptible of numerous changes and modifications as known to a person skilled in the art, and I therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. An apparatus for transversely elongating or transversely shrinking a continuously movable material web, comprising rotating hose roller means including an inflatable hose means, tiltable means operatively connected with the two ends of the hose means to enable tilting with respect to each other along the lines of a change in the width of the hose means during its rotation, thus causing the desired transverse elongation or transverse shrinking of the material web within a predetermined area of the outer surface of the hose roller means, said tiltable means including two stretching disks connected at the outer surfaces thereof with the ends of the hose means, wherein the stretching disks, having a smaller diameter than the hose means in their relaxed condition, are provided with radially outwardly extending telescopic bushings and stretching bolts engaging, at each end of the hose means, the axially inner side of an entrainment ring means fixed within the hose means, said hose means and said tiltable means being sufficiently elastic to provide for deviation from the normal circular configuration in the radial direction, so that by cooperation of the hose roller means with a counter surface within said predetermined circumferential area and within the area of contact with the material web, the hose means including said tiltable means is elastically pressed-in in the radial direction within said predetermined circumferential area, and support means forming said counter surface for supporting said hose means within the contact area with the material web by way of the latter.

2. The apparatus according to claim **1**, wherein said hose means is elastically supported on a considerably smaller pipe means by way of profile hoses distributed along the circumference thereof and each extending in an axial direction and being inflatable approximately into rod shape so as to abut one another in the circumferential direction.

3. The apparatus according to claim **1**, wherein said support means includes a further hose roller means of similar construction as said first-mentioned hose roller means.

4. The apparatus according to claim **1**, wherein the support means includes cylinder means.

5. The apparatus according to claim **4**, wherein said cylinder means is a drying cylinder.

6. The apparatus according to claim **1**, further comprising an essentially non-stretchable ring inserted into the entrainment ring means.

7. The apparatus according to claim **1**, wherein the hose means is traversed in its circumferential direction by filament means substantially non-stretchable in the

longitudinal direction thereof and wound in the hose means in the transverse direction thereof with a small pitch, the filament means being closed at the hose ends in a circular-shaped manner.

8. The apparatus according to claim **1**, further comprising a pipe rotatably supported on bearing pin means, said pipe being surrounded by said hose means and said bearing pin means extending outwardly through the disks, bushing means forming a spherical bearing at the outer circumference thereof and arranged adjustable in the longitudinal direction on the respective bearing pin means, and complementary spherical bearing ring means supported on the spherical bearing of the bushing means, said disks being movably supported on the spherical bearing of the bushing means and engaging along the outer edge thereof behind the associated entrainment ring means.

9. The apparatus according to claim **8**, wherein each bushing means is constructed as a ball-shaped nut and is supported on a threaded bushing which is fixed on the respective bearing pin means.

10. The apparatus according to claim **1**, further comprising additional roller means arranged in at least one of the inlet and outlet circumferential areas of the hose means within the respective tangential planes to the disks, said additional roller means being displaceable parallel to the axis and mutually opposite against the disks in the sense of the tilting thereof.

11. The apparatus according to claim **1**, wherein the entrainment ring means are covered with a material increasing the frictional resistance of the ring.

12. An apparatus according to claim **1**, wherein guide means are provided along the edges of a transversely elastic pressure belt means which is permeable in the manner of a drying fabric and extends between the material web and the hose roller means and presses the material web against the counter surface.

13. The apparatus according to claim **12**, comprising

spray means for spraying a lubrication medium against the side facing the material web of at least one of the two parts consisting of the belt means and the counter surface, which surface includes a drying cylinder.

14. An apparatus according to claim **12**, further comprising drive means for driving said pressure belt means.

15. An apparatus according to claim **2**, further comprising means for inflating the profile hoses to different pressures in dependence on the angular position to the axis of the pipe means.

16. An apparatus according to claim **15**, further comprising stationary distributor body means arranged with the rotating pipe means.

17. An apparatus according to claim **1**, wherein along the circumferential area of a drying cylinder surrounded by the paper web are arranged, in the circumferential direction, successively, a hose roller means, a drying hood means, a second hose roller means and a further drying hood means, through which the paper web is conveyed.

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