**Title:** PROCESS AND APPARATUS FOR CONTINUOUS PRODUCTION OF LENGTH PORTIONS FROM A STRAND OF FLUID-ABSORBING MATERIAL

**Abstract**

Process for the production of longitudinally extending pressed absorption bodies from an endless nonwoven web which is transported continuously in the direction of advance by pressing elements drivable in the direction of rotation and belonging to a pressing station and which is provided simultaneously with at least three longitudinal grooves arranged at equal angular spacings, whereupon the nonwoven web forming a pressed strand is subdivided into portions of specific length, characterized in that the nonwoven web (140) is driven in the conveying direction (x), by means of the pressing elements drivable in the direction of rotation, in a plane extending transversely relative to its longitudinal direction and simultaneously is pressed radially at least to the final cross section of a pressed strand (240) and, at the same time, is provided with longitudinal grooves (131).
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PROCESS AND APPARATUS FOR CONTINUOUS PRODUCTION OF LENGTH PORTIONS FROM A STRAND OF FLUID-ABSORBING MATERIAL

The invention relates to a process and an apparatus for the continuous production of length portions from a strand of fluid-absorbing material, the material strand being shaped into a pressed strand by the pressing in of longitudinal grooves at equal circumferential angular spacings by means of press elements drivable in the direction of rotation and simultaneously being transported in the run-through direction as well as subsequently being subdivided into length portions by movable severing elements.

A process and an apparatus of the abovementioned generic type are known from WO 90/07314. According to this document, a multi-layer fibre-material web is folded on itself by means of a plurality of longitudinal folds and is rounded in cross-section. The fibre-material web is thereafter surrounded with a wrapping band, the longitudinal edges of which are sealed. The fibre-material web is subsequently rolled down in steps, at least to the cross-section of an absorption body, in a roller frame by means of a multiplicity of pairs of rollers offset relative to one another in the circumferential direction, and a nonwoven strand is formed. During this reduction in cross-section of the fibre-material web by means of the said pairs of rollers, the nonwoven strand is provided with four longitudinal grooves. The nonwoven strand can be heated during the press-rolling. Length portions corresponding to the absorption bodies are subsequently pre-severed, with the exception of the thin connecting web, by nip-rolling, the ends of these length portions acquiring the form of a hump and
a dip respectively, before they are separated completely. Thereafter, a recovery tape can be fastened to the rear end of the absorption body, in order to complete a tampon for feminine hygiene.

Swiss Patent Specification 261,771 discloses a process and a machine for the production of a wrapped tampon consisting of a plurality of angular fluid-absorbing disks, such as cotton wadding, which, stacked centrically, are folded up to form a cup and are pressed into the form of a peg. The disk stack is pressed by means of a ram into a tube which tapers conically at the start and which is mounted fixedly on a table. Provided on the tube circumference is a plurality of longitudinal slots, through each of which projects the circumference of a freely rotatable disk fastened to supporting arms screwed to the table. During the piercing of the cup by the tube, these disks are rotated, and folds or flutes are formed. Subsequently, a heatable cylindrical die, having inner longitudinal ribs which are aligned with the disks and which further indent the flutes, is used. Thereafter, the die has to be removed from the table and placed over a pressing member, the convex surface of which projects, in this position, into the lower end of the die. An axially acting pressing member having a concave surface is then pressed into the upper end of the die, so that, in the course of the dwell time in the die, the peg is provided on the one hand with a finger dip and on the other hand with a round hump.

Swiss Patent Specification 355 255 describes a longitudinally stretchable menstruation tampon with recovery tape as well as a fully automatic process and apparatus for the production of this, the absorbent tampon body being surrounded completely by a wrapping made of moisture-permeable material. The tampon consists of a length portion of a multi-layer wadding web folded in the longitudinal centre, the folding point forming the rear end of the tampon body. The tampon body is surrounded
by a hydrophilic gauze, of which the two ends projecting above
the folding point serve as recovery means. The gauze is
fastened to the end of the tampon by means of a binder. The
tampon body is pressed laterally to form a cylindrical tampon
in a press die having a stationary and a movable press mould,
each semi-cylindrical, and is subsequently provided with a
round hump at the front end by axial pressing. The known
apparatus contains a curved guide channel for folding the
wadding web round to half width, an advancing and shaping
wheel projecting from above into the folding channel and
pressing the folding point of the web onto the channel bottom.
For laying on and folding the gauze web above the guide
channel, there are provided a guide roller and a double-flange
wheel, the flanges of which engage over the guide channel
closed at this point. The wadding web together with the gauze
web fastened to it is rotated through 90° on a table by means
of two folding-round rollers and is subsequently fed by two
driven press rollers to a circular knife for severing tampon
blanks which are thereafter transported to the tampon press.

The object on which the invention is based is to improve the
process and apparatus according to the pre-characterizing
clause of the present independent patent claims relating
respectively to them, in such a way that absorption bodies
made of a multi-layer web of absorbent material being folded
or wound about its longitudinal axis can be produced
continuously and reliably at a comparatively low outlay and at
a high production speed.

The invention achieves this object by means of the
characterizing clause of the present independent patent claims
relating respectively to the process and to the apparatus.

It was found, surprisingly, that such a strand of a multi-
layer web, in a single operation, can be pressed, at least to
the final dimension of the absorption body, in only one plane
transverse to its direction of transport, merely by exerting a linear radial pressing force on generatrices of the nonwoven strand and, at the same time, synchronous motive forces by which said web can be continuously further transported simultaneously as a finished pressed strand at an extremely high speed and be processed to the desired final product in further stations.

The apparatus according to the invention for carrying out the process according to the invention for the production of absorption bodies accordingly consists of a disk press having at least three essentially circular press disks which are arranged on a supporting stand essentially radially to the axis of the disk press in a common plane oriented perpendicularly to the direction of transport of the disk press, the press disks being connected to a drive motor and to a device by means of which the press disks are adjustable radially to the axis of the disk press and in the direction of the press-disk axes.

The invention is explained in more detail below by means of the diagrammatic drawing of an exemplary embodiment of a high-speed apparatus for the continuous production of length portions from a pressed nonwoven strand. In this:

Fig. 1 shows a perspective, partially diagrammatic view of the apparatus according to the invention, with folding, wrapping-band attachment, pressing and severing stations;

Fig. 2 shows a top view of the folding pattern of the nonwoven web;

Fig. 3 shows a cross-section along the line 3-3 in Figure 2, which shows the first folding of the nonwoven web;
Fig. 4 shows a cross-section along the line 4-4 in Figure 2, which shows the second folding of the nonwoven web;

Fig. 5 shows a cross-section along the line 5-5 in Figure 2, which shows the third folding of the nonwoven web;

Fig. 6 shows a cross-section along the line 6-6 in Figure 2, which shows the folded nonwoven web after a side edge has been folded round onto the top side of the folded part of the nonwoven web;

Fig. 7 shows a perspective front view of the wrapping-band attachment station;

Fig. 8 shows a diagrammatic view of the exit side of a disk press according to the invention;

Fig. 9 shows a view of the exit side of the disk press;

Fig. 10 shows a cutout from the disk press shown in Figure 8, with a press-disk holder and with a press disk fastened rotatably to it;

Fig. 11 shows a middle longitudinal section through a press disk and a bevel-wheel drive;

Fig. 12 shows a view of the entry side of the disk press, with a drive motor for a toothed ring synchronously driving the press disks;

Fig. 13 shows a partially cutaway view of a device for the simultaneous adjustment of the press-disk holders by means of a rotatable control ring;
Fig. 14 shows a sectional view along the line 14-14 in Figure 13;

Fig. 15 shows a sectional view along the line 15-15 in Figure 13;

Fig. 16 and 17 show two different press-disk transverse profiles;

Fig. 18 shows a view of a partially cutaway press disk having a corrugated circumferential profile;

Fig. 19 shows a view of two press disks located opposite one another in a diametral plane and having a supply nozzle and a catch nozzle, in longitudinal section;

Fig. 20 shows a cross-section of the disk-press gap with a press strand compressed by eight press disks;

Fig. 21 shows a representation of the angle of engagement of the press disks into the fibre-material strand;

Fig. 22 shows a diagram of the transfer of the linearly produced absorption bodies onto a continuously rotating conveyor belt;

Fig. 23 shows a diagram of a rotary system for shaping the front and rear ends of absorption bodies;

Fig. 24 shows a top view of an absorption body provided with a pre-pierced hole;

Fig. 25 shows a diagrammatic representation of a device for the pre-piercing of a diametral hole in absorption bodies for the attachment of a recovery tape;
Fig. 26, 27, 28 and 29 show four different work phases of a device for drawing in the recovery tape through the pre-drilled hole in the absorption body;

Fig. 30 and 31 show an apparatus for the packaging of absorption bodies; and

Fig. 32 shows a finished absorption body in perspective view.

The drawings illustrate a high-speed apparatus for the continuous production, machining and packaging of absorption bodies made from a pressed nonwoven web, which, in particular, allows the processing of compressible, biologically degradable natural materials, such as natural fibre material, for example consisting of cotton fibres or other cellulose-containing fibres, sponge, etc. Articles of this type are, for example, absorption bodies for hygienic purposes, especially for feminine hygiene, cleaning purposes, for example for cleaning appliances which are used industrially or domestically, or for sealing-off purposes, for example in windows or doors which, if appropriate, are impregnated with a biologically degradable sealing agent.

Fig. 1 shows an apparatus for the continuous production of absorption bodies 130, in the present case of tampon blanks, from each of which there is formed a tampon 132 for feminine hygiene which, as shown in Fig. 32, is provided at its front end with a round hump 135, on the circumference with eight longitudinal grooves 131 and eight longitudinal ribs 139 and at its rear end 134 with a finger dip 133 as an introduction aid, and finally with a recovery tape 136, the ends of which are connected by means of a knot 137.

According to Fig. 1, the apparatus consists of a stock roll 38 for a nonwoven web 40 which is processed continuously in stations connected in series, namely a folding station A, a
wrapping-band attachment station B, a pressing station C and a severing station D which, with the exception of the pressing station C, are described essentially in WO 90/07314.

**Folding Station**

It is evident from Figure 1 that, in the direction of advance of an arrow x of the nonwoven web 40, a stationary guide plate 42 for the endless nonwoven web 40 is arranged behind the stock roll 38. Mounted above the guide plate 42 at a distance is an endless conveyor belt 44 which is preferably vertically adjustable and which, by means of frictional connection, causes the nonwoven web 40 to be conveyed continuously in the direction of the arrow x. In contrast to the embodiment shown, an endless conveyor belt can also be provided instead of the guide plate 42, in which case at least one of the conveyor belts is drivable. These devices as well as the stations described below and the devices associated with them are arranged on a stand, of which only stand parts 46 and 48 are indicated. Furthermore, it goes without saying that the guide plate 42 extends at least over a substantial part of the underside of the folding station A and is merely indicated in Figure 1 for the sake of clarity.

Arranged above the nonwoven web 40, behind the conveyor belt 44 in the direction of advance x, is a baffle plate 50, behind which is located a folding plate 52 followed by a rotatable folding disk 54. By means of this first folding plate 52, a longitudinal side 56 of the nonwoven web 40 on the right in the direction of movement x is subjected, according to Fig. 2, to a first folding operation I. At the same time, the longitudinal side 56 of the nonwoven web 40 on the right in the direction of movement x is folded round upwards parallel to the longitudinal direction of the nonwoven web 40 in the direction of an arrow a and is laid onto the top side of the nonwoven web 40. It is evident from Fig. 2 and 3 that, after the folding operation I, a right-hand longitudinal edge 58
assumes a greater distance from a left-hand longitudinal edge 60 than the longitudinal mid-axis of the nonwoven web 40. In the present exemplary embodiment, the nonwoven web 40 has a width of 25 cm. In this case, the width of a first fold 62 expediently amounts to 9 cm. Depending on the intended use of the particular absorption bodies 130 produced, the dimensions of the nonwoven web 40 can be made to vary greatly. As a rule, however, the width of the nonwoven web 40 will be in the range between 15 and 40 cm.

With further reference to Fig. 1, 2 and 4, it is evident that the first folding operation I is followed by a second folding operation II which, again, is carried out by means of suitable folding plates and folding rollers, although these are not shown in detail for the sake of clarity in the drawing. In this folding operation II, the right-hand longitudinal edge 58 formed by the first fold 62 is folded round in the direction of an arrow b onto the folded-round right-hand longitudinal side 56 about a longitudinal fold 64 onto the top side of the longitudinal side 56 and is laid approximately onto the middle third of the width of the longitudinal side 56. With the said width of the nonwoven web 40, this second folding takes place over a width of approximately 2 cm.

As is evident from Fig. 1, 2, 4 and 5, there follows a folding operation III, in which a four-layer bundle 66 is folded round in the direction of an arrow c onto a still uncovered part 68 of the right-hand longitudinal side 56, to the left according to Fig. 5, as seen in the direction of movement x of the nonwoven web 40, so that the nonwoven web 40 is now limited by a six-layer bundle 69 on its right-hand side in the direction of movement x. With the said width of the nonwoven web 40, this folding operation III extends over approximately 3.5 cm.

A left-hand longitudinal side 70 of the nonwoven web 40, still remaining according to Fig. 5, is then folded round the left-
hand edge of the six-layer bundle 69 onto the top side of the latter in the opposite direction according to arrow d in Fig. 1, 2 and 6, as seen in the direction of movement x of the nonwoven web 40, so that this folding operation IV forms a seven-layer nonwoven web 72 which is surrounded completely by the remaining left-hand longitudinal side 70 of the nonwoven web 40. Provided at the end of the folding station A are profiled rollers which impart the round cross-section according to Fig. 6 to the seven-layer nonwoven web 72. Press rollers of this type are known and are therefore not shown. Before the execution of the folding operation IV, the left-hand longitudinal side 70 of the nonwoven web 40 has approximately a width of 6 cm. Depending on the particular intended use of the absorption body, of course, another type of longitudinal folding or layering of the nonwoven web 40 can also be carried out.

Wrapping-band attachment station

It can be seen from Fig. 1 that the wrapping-band attachment station B has a stock roll 80 for a wrapping band 82 in the region of the completely layered and rounded nonwoven web 72. The wrapping band 82 is fluid-permeable, and may have a hydrophobic finish. The wrapping band 82 may be an apertured plastic film, a reticulated plastic film, a nonwoven fabric, a knitted fabric, or the like. The wrapping band 82 preferably possesses, at least partially, thermoplastic constituents to enable it to be thermally bonded. The thermoplastic constituents may be fibrous or powdered. The wrapping band 82 may also be adhesively bonded, ultrasonically bonded, and the like. Useful wrapping band 82 materials and bonding mechanisms will be recognized by those ordinarily skilled in the art.

Preferably, the wrapping band 82 consists of a nonwoven fibre layer (nonwoven) which has thermoplastic constituents. This wrapping band 82 is made wider than the circumference of the nonwoven web 72. A guide roller 84 is arranged transversely to
the direction of movement x behind the stock roll 80 and at a short distance underneath the nonwoven web 72. According to Fig. 7, this guide roller 84 has the function of guiding the wrapping band 82, supplied from the stock roll 80 in the direction of arrow d into a direction e approximately parallel to the nonwoven web 72, and under a guide tube 86.

The guide tube 86 is provided on the underside with a longitudinal slot 88 which can be seen in Fig. 7. Arranged on the underside of the guide tube 86 is an endless conveyor belt 90 which is made narrower than the longitudinal slot 88. It is thereby possible to guide an upper side 92 of the conveyor belt 90 in the region of the longitudinal slot 88 of the guide tube 86 by means of a support plate 91, in such a way that the nonwoven web 72 is taken up by frictional connection. The endless conveyor belt 90 is guided in the usual way around a driving roller 94 and a deflecting roller 96 and is driven in the direction of an arrow f, so that the upper side 92 can be driven in the direction of movement x of the nonwoven web 72 at a speed which corresponds to the conveying speed of the nonwoven web 72.

The wrapping band 82 is guided by means of the guide roller 84 between the top face of the upper side 92 of the conveyor belt 90 and the underside of the nonwoven web 72 in the region of the longitudinal slot 88 and is taken up by means of the frictional connection thereby occurring between the upper side 92 and nonwoven web 72.

The guide tube 86 is provided, on the sides on the left and right in the direction of movement x of the nonwoven web 72, with respective introduction slots 98, 100 which are formed by successively arranged segments 102, 104 and 106 of the guide tube 86. It is evident that the two introduction slots 98, 100 are offset in the axial direction of the guide tube 86. At the same time, the segment 104 is of a shape twisted in such a way
that a rear edge 108 of the first segment 102, the said rear edge 108 forming an acute angle to the core of the guide tube 86 and extending in a similar way to a helix, assumes a shorter radial distance from the tube core than a front edge 110 of the segment 104, the said front edge 110 likewise limiting the introduction slot 98.

In a similar way, the radius of an edge 112 of the segment 104 at the rear in the direction of movement x is made smaller than the radius of a front edge 114 of the rear segment 106 of the guide tube 86, the said front edge 114 likewise limiting the right-hand introduction slot 100.

For reasons of clarity in the drawing, Fig. 7 does not show the wrapping band 82 in its complete width which ensures that the wrapping band has left-hand and right-hand side tabs 116, 118 which are folded upwards round the guide tube 86 by guide rollers, known per se and therefore not shown, and which slide along on the said guide tube 86. However, Fig. 7 shows the left-hand side tab 116 of the wrapping band 82, such as it is introduced into the left-hand introduction slot 98 in the direction of an arrow g beyond the outer surface of the segment 102 and is laid by means of the segment 104 onto the rounded, essentially cylindrical surface of the nonwoven web 72. In a similar way, the right-hand side tab 118 of the wrapping band 82 is subsequently likewise laid onto the surface of the rounded nonwoven web 72 by means of the segment 106 in the direction of an arrow h via the outside of the segment 104 through the right-hand introduction slot 100. At the same time, an outer longitudinal edge 124 of the right-hand side tab 118 overlaps a longitudinal edge 126 of the left-hand side tab 116 of the wrapping band 82, the said longitudinal edge 126 being laid first onto the top side of the nonwoven web 72.

Fig. 7 shows, furthermore, that the guide tube 86 is likewise
provided on the top side, in the region of the rear segment 106, with a middle longitudinal slot 120 for a closing device 122 which serves for connecting the longitudinal edges 124, 126 of the side tabs 116, 118 of the wrapping band 82 to one another. In the present exemplary embodiment, the closing device 122 consists of a heat-sealing roller 128 which is made narrower than the longitudinal slot 120 and which consequently bears through the longitudinal slot on the overlapping edges 124, 126 and seals these to one another as a result of the softening of thermoplastic constituents of the wrapping band 82. The heat-sealing roller 128 can be heated in a way known per se by electrical resistance heating and can be driven in the direction of rotation of an arrow i at the conveying speed of a rounded wrapped nonwoven web 140 which leaves the guide tube 86 at the end of the latter.

Pressing Station
Fig. 8 and 9 show a perspective view and an orthogonal view of the exit side of a disk press 150 according to the invention. This disk press 150 consists of a vertically arranged carrier plate 151, on the exit side of which eight press disks 160 are arranged at equal circumferential angular spacings about a middle passage orifice 152 of the carrier plate 151 or a press axis 153 (Fig. 9). To produce absorption bodies for tampons of normal dimensions for feminine hygiene with a final diameter of approximately 13 mm, said eight press disks 160 having a diameter of at least 280 mm, preferably 300 mm, proved the best possible. In principle, at least three press disks 160 are required, so that a nonwoven strand can be pressed continuously to its final dimension in a single operation. However, the number of press disks and their dimension depend primarily on the composition and dimensions of the nonwoven strand to be pressed and on the desired extent of its pressing as well as on the intended use of the absorption bodies. The number of press disks 160 can therefore also be larger or smaller than eight and also be even or odd. As a rule of
thumb, it may be considered that, the smaller the cross-
section of the nonwoven strand and of the pressed strand
obtained from this by pressing, the fewer press disks should
be used, although this rule allows or necessitates
modifications, depending on the form of the press disks and on
the depth of their feed setting during the pressing.

The press disks 160 are fastened rotatably to respective
press-disk holders 164 which are mounted on the carrier plate
151 so as to be radially adjustable relative to the passage
orifice 152 of the carrier plate 151 or to the press axis 153.
The press-disk holders 164 are respectively provided at their
radially inner end with supporting arms 162, on the radially
inner end of each of which one of the essentially circular
press disks 160 is mounted so as to be drivable about its axis
190 in the direction of rotation. All eight press-disk holders
164 are positioned, together with their supporting arms 162
and the press disks 160, on the carrier plate 151 in a plane
which is directed perpendicularly to the core of the passage
orifice 152 or to the press axis 153. Furthermore, all the
press disks 160 can be driven synchronously with the effect of
a simultaneous conveyance and pressing of the nonwoven strand,
as explained in more detail further below.

The supporting arms 162 are respectively fastened axially
adjustably on the press-disk holders 164, so that a fine
adjustment to each press disk 160 radially to the press axis
153 is possible. Moreover, according to Figs. 13 and 14 the
supporting arms 162 are adjustable on bearing blocks 161 of
the press-disk holders 164 about an axis parallel to the press
axis 153, in such a way that the press disks 160 can be
adjusted parallel to themselves out of their plane radial to
the press axis 153, but also into another angular position
relative to the radial plane (inclination). This adjustability
of the supporting arms 162 and of the press disks 160
connected to them makes it possible, during pressing, to
control or adjust the important straight run-out and the rectilinear profiling of the pressed strand during the pressing of the latter.

In particular, it is evident from Fig. 9 and 10 that each press-disk holder 164 is provided with screw bolts 166, by means of which the associated supporting arm 162 can be fixed in a desired angular position by means of screw nuts 168.

According to Figs. 8, 9 and 10 each supporting arm 162 bears with a guide face 170 in the form of a cylinder cutout against a correspondingly shaped stop face 172 of the press-disk holder 164. The centre of curvature of the said faces 170, 172 is located in the middle of the press disk 160.

Furthermore, Fig. 8, 9 and 10 reveal an actuating device 174 for the press-disk holder 164, by means of which each press-disk holder 164 is radially adjustable individually. In the present case, the actuating device 174 comprises eight holding plates 171 (Fig. 10) which are fastened on the rear side of the carrier plate 151 perpendicularly to the press axis at equal angular spacings and in which actuating bolts 176 are mounted rotatably, but non-adjustably axially. These actuating bolts 176 are each connected to a press-disk holder 164 by means of a screw thread not shown, so that, as a result of the rotation of the actuating bolts 176, each press-disk holder 164 can be moved to and fro and therefore the radial distance of the press disk 160 from the press axis and consequently the depth of penetration of the press disks 160 into the nonwoven material can be set exactly.

The drive of each press disk 160 can be seen in more detail from Fig. 10 and 11. According to Figure 11, a spur wheel 178 is fastened on a transmission shaft 179 which is rotatably mounted axis-parallel to the press disk 160 in a bearing 180 and which is provided at its radially inner end with a driving
bevel wheel 182. This driving bevel wheel 182 meshes with a bevel-wheel disk 184 which is fastened to one end face of a press-disk body 186 by means of screws not shown. The press-disk body 186 is mounted rotatably by means of a roller bearing 188 on the axis 190 which is axially adjustable in a bore 192 of the supporting arm 162.

The press-disk body 186 is provided, on its outer end face facing away from the supporting arm 162, with an outer stepped annular face 194 for receiving a press-ring disk 196 which can be clamped firmly against the annular face 194 of the press-disk body 186 by means of a correspondingly shaped clamping ring 198. This construction allows an economical use of valuable materials for the overall construction of the press disks 160 and a rapid exchange of their press-ring disks 196.

In each press-disk body 186, electrical resistance-heating elements 200 are arranged at equal circumferential angular spacings in radial bores 202 of the press-disk bodies 186 and are connected via an electrical line 204 to a slip ring 206 which is located on the inner end face of the press-disk body 186 and against which a stationary wiper contact 208 bears. A heating of the press disks 160 by means of the resistance-heating elements 200 can be desirable, for example when only natural-fibre material is to be subjected to a pressing operation. In contrast, a heating of the press disks 160 can, as a rule, be forgone or even be inexpedient if the fibre material to be pressed contains fibres which consist completely or partially of thermoplastic material.

A drive motor 210, which is supported on a bracket 212 fastened to the carrier plate 151, can be seen from the view of the entry side of the carrier plate 151 in Fig. 12. Connected to the drive motor 210 via a reduction gear 213 is a driving spur wheel 214 which cooperates with an internal toothing 216 of a toothed ring 218. The toothed ring 218 is
rotatably mounted concentrically to the press axis 153 on the
carrier plate 151, parallel to the main plane of the latter,
on three bearing rollers 220 which are fastened freely
rotatably to the carrier plate 151 at equal angular spacings
relative to and at equal radial distances from the press axis
153. The internal toothing 216 of the toothed ring 218 meshes
respectively with the spur wheel 178, shown in Fig. 11, of
each press-disk holder 164, so that each press disk 160 can be
driven synchronously by the toothed ring 218 by means of the
drive motor 210. This ensures that the nonwoven strand to be
pressed is uniformly and exactly conveyed coaxially relative
to the press axis 153.

Figures 13, 14 and 15 show a device, by means of which the
press-disk holders 164 are synchronously adjustable radially
to the press axis 153. For this purpose, the carrier plate 151
has, on its entry side, eight guides 252 which are parallel to
the radial press-disk planes and which are arranged at a
distance from and parallel to the radial planes of the press
disks 160 in Figure 13. The bearing blocks 161 of the press-
disk holders 164 engage by means of guide tongues 253 into
these guides 252 in the manner of a tongue-and-groove
connection. In the bottom of each guide 252, four long holes
254 limiting a rectangle are arranged in pairs symmetrically
and parallel to a longitudinal mid-axis 242 of each guide 252
as well as parallel to the axis 190 of the associated press
disk 160 (Figures 13 and 14). Fastened to the underside of the
guide tongue 253 of each bearing block 161 are screw bolts,
not shown, which engage into the said long holes 254 and which
fix the bearing block 161 of each press-disk holder 164 to the
carrier plate 151 by means of screw nuts or allow a radial
adjustment of the press-disk holders 164 to the extent limited
by the long holes 254, as can be taken from Figures 13 and 14.

A device 230 for the synchronous radial adjustment of the
press-disk holders 164 for the press disks 160 is illustrated
in Fig. 14. This adjustment device 230 consists of a control ring 232 which is rotatably mounted concentrically to the press axis 153 in a circular groove 233 on the entry side of the carrier plate 151 in a plane parallel to the main plane of the latter. Furthermore, the control ring 232 is provided, on its front side facing away from the carrier plate 151, with a number of control bolts 234 corresponding to the number of press-disk holders 164 (Fig. 13 and 14), the said control bolts 234 of course, once again, being fastened to the control ring 232 at equal circumferential angular spacings and projecting outwards perpendicularly to the main plane of the latter. These control bolts 234 each engage into a control groove 236 which is arranged, in a direction perpendicular to the longitudinal direction and direction of adjustment of each press-disk holder 164, in a supporting face 238 of the bearing block 161 of each press-disk holder 164, the said supporting face 238 facing the control ring 232. It is evident from Fig. 13 that the control grooves 236 in bearing blocks 161 of each press-disk holder 164 consequently form, with a tangent drawn to the control ring 232 along a longitudinal mid-axis of the control bolt 234, an acute angle which ensures that the press-disk holders 164 can be synchronously adjusted radially inwards in the event of a rotation of the control ring 232 in the clockwise direction and correspondingly radially outwards in the event of a rotation in the anti-clockwise direction. An extremely accurate synchronous feed setting of the press disks 160 and adaptation of these to the particular nonwoven strand to be pressed, in particular to its fibre-material density and diameter, are thereby possible.

Furthermore, Fig. 15 shows an arrangement 241 of particular importance for a precision adjustment of the supporting arms 162 in the direction of the axis 190 of each of the press disks 160 as shown in Fig. 13, 14 and 15. This arrangement 241 consists of two countersunk bores 244 in the supporting arm 162 of each of the press-disk holders 164 (Fig. 15), which are
arranged symmetrically to the longitudinal mid-axis 242 of the guide 252 and which open out into threaded bores 246, into which adjusting screws 248 are screwed. The adjusting screws 248 are provided with cone tips 250 at their front end.

According to Fig. 13, 14 and 15, the supporting arm 162 is mounted adjustably parallel to the axis 190 of the press disk 160, on the outside of the bearing block 161 facing away from the carrier plate 151, by means of a tongue-and-groove guide 255 and is fastened releasably by means of four screw connections 259 merely indicated by dot-and-dash lines in Fig. 13 and 14. For this purpose, there are provided in a supporting face 257 of the bearing blocks 161 for the supporting arms 162 transverse grooves 256 of small length which have a V-shaped cross-section and which are arranged at a distance from and parallel to one another in a plane perpendicular to the longitudinal mid-axis 242 of the guides 252. According to Fig. 15, longitudinal mid-axes 258 coinciding with the vertex point of the V-profile of the transverse grooves 256 are offset laterally inwards relative to the cone tips 250 of each pair of adjusting screws 248. Since the cone angle of each cone tip 250 of the adjusting screws 248 corresponds to the angle of the V-shape transverse profile of the transverse grooves 256, the cone tip 250 of the adjusting screws 248 therefore bears respectively against one of the two groove walls of the transverse grooves 256 facing away from one another. It is therefore understandable that, depending on the screw-in depth of the adjusting screws 248 into the transverse grooves 256, each press-disk holder 164, together with the press disk 160 fastened to it, can be adjusted extremely finely parallel to the axis 190 of the press disk 160 in the direction of the tongue-and-groove guide 255. This adjustability of the press disks 160 parallel to themselves out of their plane radial to the press axis 153 makes it possible, depending on the type of material used, for the nonwoven strand to be pressed and on the depth of
penetration of the press disks 160 into the nonwoven strand, to achieve an exact straight run-out of the press strand during and after the pressing of the longitudinal grooves 131 into the fibre material.

In Fig. 15, the countersunk bore 244, together with the adjusting screw 248 and the V-shaped transverse groove 256, is shown shifted into the sectional plane, from which it is evident that the adjusting screws 248 engage free of play into the transverse grooves in the direction of the tongue-and-groove guide 255.

Fig. 16 shows a transverse profile 260 of a press-ring disk 196 made of steel, the diameter of which is expediently in the range of 280 to 300 mm for the pressing of absorption bodies, especially for feminine hygiene, and the outer, rounded pressing edge 262 of which has a width of approximately 0.723 mm. A transverse profile 260 widens radially inwards in a V-shaped manner, profile flanks 261 forming an acute angle of 22.5° and merging into parallel side faces 263 at a radial distance of 5.543 mm from the pressing edge 262. These parallel side faces 263 run out, at a radial distance of 12.332 mm from the pressing edge 262, into parallel end faces 265, between which the press-ring disks 196 are 5.0 mm wide. This profile of the press-ring disk 196 proves appropriate particularly in respect of a fibre material which has a smooth surface and which therefore generates relatively little friction relative to the press-ring disk 196 during the pressing.

For materials which have a less smooth surface or which are to be carried to the core of the press strand to a lesser extent during the pressing, under some circumstances it can be advantageous to have a transverse profile 222, shown in Fig. 17, of a press-ring disk 224, in which, as can be seen, profile flanks 226 possess, in contrast to the transverse
profile 260 shown in Fig. 16, annular grooves 228 of arcuate cross-section which are arranged at a distance from one another concentrically to the mid-axis of the press-ring disk 224 and which generate reduced friction and consequently reduced heating relative to the material of the strand to be pressed and therefore also compact the material to be pressed to a lesser extent in the direction of the longitudinal mid-axis of the nonwoven strand. If appropriate, the angle-forming profile flanks of the transverse profile of the press-ring disks can also be roughened by knurling, knobs, projecting annular beads or an enamelling, depending on the material of which the strand to be pressed is composed and which compaction and conveying speed of the material during the pressing are desired.

Since the press disks 160 are all driven, in order to convey the nonwoven strand simultaneously, during the pressing, towards the exit side of the disk press 150, to one of the downstream machining stations, it can be desirable to provide one or more or all press disks 160 with an irregular pressing edge. Thus, Fig. 18 shows a pressing edge 229 of a press-ring disk 227 which has corrugations 231 in the circumferential direction. This corrugated pressing edge 229 allows a varying compaction of the fibre material in the core of a pressed strand 240 and, at the same time, can assist the conveyance of the pressed strand.

Depending on the fibre material used for the strand to be pressed, the pressed edge can, if appropriate, also have a type of toothing and/or knurling, in contrast to the exemplary embodiment shown in Fig. 18. The foregoing statements illustrate the importance of the surface nature and thickness of the press-ring disks, a particular roughness or depth of roughness of, for example, 8-10 microns proving advantageous, so that the task of simultaneous conveyance and pressing of the nonwoven strand can be mastered. Furthermore, it is
necessary to ensure a high bending resistance of the press-disk bodies and of the press-ring disks clamped in them, with regard to the considerable forces to which they are exposed during the pressing and conveyance of the nonwoven strand.

Fig. 19 shows, on the entry side of the disk press 150, a tubular piece 154, the free cross-section of which is narrowed in the form of a supply nozzle 268 at the front end. As regards the production of absorption bodies of normal size for feminine hygiene, a reduction in cross-section of the supply nozzle 268 in relation to the cross-section of the tubular piece 154 of approximately 9% or in a ratio of 8:7 proves appropriate. This cross-sectional ratio can, of course, be varied in dependence on parameters to be taken into account. The tubular piece 154 is arranged coaxially to the press axis 153 or a press-disk gap 219 and serves for supplying the nonwoven strand 140 consisting of a compressible material, preferably natural, biologically degradable fibre material, such as cotton fibres. By means of the supply nozzle 268, the round cross-section of the nonwoven strand 140 is compressed and subsequently is guided freely into the press-disk gap 219 between the eight press disks 160 located diametrically opposite one another in pairs. In the present exemplary embodiment of the production of absorption bodies for feminine-hygiene tampons, the nonwoven strand 140 is compressed to form a pressed strand 240 having a cross-sectional diameter of 15 mm. At the same time, as shown in Fig. 20, eight longitudinal grooves 131 and eight longitudinal ribs 139 are formed. In a narrowest press-disk gap 219 shown in Fig. 19, the pressing edges of the eight press disks 160 form said pressed strand 240, the core of which has a diameter of approximately 4 mm in the present exemplary embodiment.

Furthermore, in Fig. 19, a catch nozzle 270 for the pressed strand 240 is arranged at a distance behind the narrowest press-disk gap 219 in the conveying direction x. This axial
distance can, for example, be 10 to 15 mm from the press-disk gap 219. A widened entry orifice 156 of this catch nozzle 270 is dimensioned somewhat larger than the cross-section which the pressed strand 240 assumes behind the narrowest cross-section of the press-disk gap 219. Thus, the entry cross-section of the catch nozzle 270 can have a diameter of, for example, 18 mm. The catch nozzle 270 is provided with a number of longitudinal slots 158, namely eight, having the same length and width and corresponding to the number of press disks, the said longitudinal slots 158 extending at equal angular spacings over the circumference of the catch nozzle 270 in the planes of the respective associated press disk 160, and each engaging radially and with free play into one of the eight press disks 160. The longitudinal slots 158 extend, for example, over a length of 30 mm. The free cross-section of the catch nozzle 270 narrows behind the longitudinal slots 158 over a middle length portion 274 at least to the narrowest cross-section of the press-disk gap 219. This middle length portion 274 can have a length of 10 mm and a clear, circular-cylindrical cross-section with a diameter of 11 mm. That is to say, the cross-section of the pressed strand 240 is reduced appreciably in the middle length portion 274 of the catch nozzle 270 in relation to the cross-section of the pressed strand 240 in the press-disk gap 219. This reduction in cross-section of the catch nozzle 270 serves for closing the pressed-in, open longitudinal grooves 131 by an abutment of the radially outer ends of adjacent ribs 139 of the pressed strand 240 to provide a substantially cylindrical outer surface of the pressed strand 240 having longitudinal open channels inside of said closed grooves. In contrast thereto, it is also possible to provide the middle length portion 274 of the catch nozzle 270 with a clear cross-section by which the cross-section of the catch nozzle 270 serves for maintaining the pressed-in open longitudinal grooves 131 of the pressed strand 240. Thus, the final diameter of the pressed strand 240 and the characteristic and structure of its
surface, f.i. also its open longitudinal grooves 131 as shown in Fig. 20, can be strongly affected by varying the inside diameter of the middle length portion 274 of a catch nozzle 270.

The catch nozzle 270 is widened over an end portion 276 in the conveying direction of the arrow x. The end portion 276 is reinforced in a flange-like manner and is provided with electrical resistance-heating elements 278, by means of which the catch nozzle 270 can be heated to an ironing temperature in the range of 70 to 90°C for the pressed strand 240. As a result, if desired, a smoothing or ironing effect can be exerted on the surface of the pressed strand 240. This ironing effect can be employed advantageously when a nonwoven web 140 consists solely of natural or cellulose-containing fibres, that is to say contains no thermoplastic fibres or constituents. In contrast, heating may be inexpedient, for example when the nonwoven web 140 is wrapped in a non-woven material which consists at least partially of thermoplastic material, such as polyethylene or polypropylene, in order to improve the capillary action relative to the inside of the absorption body. A conical widening 273 of the clear cross-section at the exit end of the catch nozzle 270 allows some expansion of the pressed strand 240 as a result of the inherent elasticity of its fibre material. This cross-sectional widening 273 can, for example, have a clear diameter of 12 to 12.5 mm. A cylindrical end portion 275 of the cross-sectional widening 273 serves for the reception of and as a stop for a plastic tube of corresponding diameter which is not shown and which is mounted in a floating manner in the end portion.

Fig. 20 shows the press-disk gap 219 in cross-section, the eight press disks 160 each pressing into the pressed strand 240 one of the eight longitudinal grooves 131 extending in the longitudinal direction of the pressed strand, and at the same...
time forming a central pressed-strand core 282 of greater compaction of the material. Formed between the flanks of the adjacent press disks 160 are eight longitudinal ribs 139, in which the material is radially outwardly subjected to increasingly lower compaction. The greater capillary action achieved thereby can be utilized in an advantageous way for the absorption of fluids, depending on the intended use of the pressed strand 240 and of the articles produced from it.

If it is desired to achieve an essentially cylindrical circumferential face of the pressed strand 240, this can be attained by a greater or lesser reduction of the cross-section in the middle length portion 274, shown in Fig. 19, of the catch nozzle 270, in conjunction with the ironing effect provided there for the outer circumference of the pressed strand 240 as mentioned above.

Fig. 21 shows an engagement angle $\beta$ of 20° to 25° of a press disk 160, which was determined as the best possible for the pressing of the nonwoven strand 140, when a pressed strand 240 for the production of absorption bodies for feminine hygiene is to be produced from the folded nonwoven strand 140 consisting of natural fibres in Fig. 1.

The pressed strand 240 can be impregnated with a medium before the separation of absorption bodies 130. The liquid impregnation medium can be applied to the pressed strand 240 by spraying or by a dipping method. The liquid impregnation medium can be a water-repellant, like glycerine as a water-repellant impregnation medium. But, the impregnation medium can also be powdery. In this connection it should be understandable, that impregnated length portions of said pressed strand 240 can be used as sealing material.

Severing Station
The severing station D in Fig. 1 consists of at least two
pairs of nip rollers 330, 332 which are arranged offset at 90° and can be respectively driven in opposition and which are arranged on both sides of the pressed strand 240. The nip rollers of the two pairs of nip rollers 330, 332 are each provided with a nipping boss 334, 336 and 338, 340. The nipping bosses 334, 336 reduce the cross-section between successive length portions of the pressed strand 240, which correspond approximately to the length of the absorption body 130, with the exception of a thin, axial connecting web not shown. This connecting web is severed by the last pair of nip rollers 332 and, as a result of the relatively high circumferential speed of the nip rollers 338, 340, corresponding to the conveying speed of the pressed strand 240, is ejected by means of a relatively strong axial momentum. During the nipping-off of the absorption body 130 by the pairs of nip rollers 330, 332, a front end 342 of the absorption body 130 is simultaneously preformed in a crude shape of a round hump 135, as can be seen from Fig. 1. In contrast, the rear end face of the absorption body 130 already has a preformed crude shape of a round finger dip 133. Said round humps 135 and round finger dips 133 can be moistened slightly after the severance of the connecting webs between successive absorption bodies 130 to add to finally smoothing at least said round humps 135 and, if desired, also said finger dips 133 of each absorption body 130 separated from the pressed strand 240.

If a wrapping band 82 is used, it is recommended to arrange at least one pair of cutting rollers as a cutting device at the end and/or at the start of the severing station D, so that the wrapping band 82 surrounding the pressed strand 240 and/or the thin, axial connecting web between successive portions of the pressed strand 240 can be cut through. The cutting rollers are not shown because they are generally known in the art.

Fig. 1 shows that, after severance, the absorption body 130 is
transferred into an endless driving belt 344 which is continuously movable transversely to the direction of the arrow X and which is made narrower than the length of the absorption bodies 130. For receiving the absorption bodies 130, the driving belt 344 is provided with a multiplicity of U-shaped transverse grooves 346 which are each closed at the top by means of a driving cover 348 after the reception of the absorption body 130. The means for transferring the absorption bodies into the drivers belong to the state of the art and are therefore not shown.

The transfer of the absorption bodies 130 out of the linear production of these according to Fig. 1 via the driving belt 344 onto a conveyor belt 356 is illustrated diagrammatically in Fig. 22. As already indicated in Fig. 1, the absorption bodies 130 are fed successively to the driving belt 344 which is driven continuously in the direction of the arrow N and which has the U-shaped transverse grooves 346, the width of which is made substantially larger than the diameter of the absorption bodies 130. Parallely arranged on the right of the driving belt 344 in Fig. 22 is the continuously drivable conveyor belt 356 provided with receptacles 357, the width of which is made only a little larger than the diameter of the absorption bodies 130. Arranged on the side of the driving belt 344 facing away from the conveyor belt 356 are accompanying pushing-over devices which are known per se and are therefore not shown and which are arranged coaxially to the transverse grooves 346 of the driving belt 344 and serve for transferring the absorption bodies 130 arranged in the transverse grooves 346 into the receptacles 357 of the conveyor belt 356, as shown in Fig. 22 with the aid of an absorption body 130 which is on the point of being transferred completely to a receptacle 357 of the conveyor belt 356.

The conveyor belt 356 has the job of feeding the absorption bodies to a hump-forming and finger-dip-forming station which
is described below with reference to Fig. 23.

**Hump-forming and finger-dip-forming station**

The conveyor belt 356 movable in the direction of the arrow n, with absorption bodies 130 arranged on it, can be seen in Fig. 23. A rotary system 290 for smoothing humps 135 at the front end of the absorption bodies 130 constituting tampon blanks is provided on the side of this conveyor belt 356 which is on the left in the direction n. A further rotary system 300 for smoothing said finger dips 133 at the rear end of the absorption bodies 130 is arranged on the right-hand side of the conveyor belt 356 located opposite the rotary system 290 in the direction of the arrow n.

Although, the finally smoothing of the round humps 135 at the front end and, if it is desired, the round finger dips 133 at the rear end of each absorption body 130 separated from the pressed strand 240 may taken place by ultrasonic means or by ironing.

In both cases, the rotary system 290 can consist of an endless flexible member 292 which rotates in the direction of an arrow in the anti-clockwise direction in a plane directed parallel to the plane of movement of the conveyor belt 356. A working side 294 forms, with the direction of movement n of the conveyor belt 356, an acute angle which closes in the direction n. In the present embodiment ironing means are used, which are rotating heatable forming dies 296 being fastened to the outside of the endless member 292. Said heatable forming dies 296 extend outwards from the conveyor belt 356 in the plane of movement of the conveyor belt 356 and are provided at their free ends, on the end face, with concave hemispherical forming heads 298 for the forming of convex hemispherical humps 135 at the front end of the absorption bodies 130. The forming dies 296 are fastened at equal spacings from one another corresponding to the spacings of the absorption bodies.
130 which are arranged on the conveyor belt 356 at a distance from and parallel to one another transversely to the longitudinal direction of the latter. The forming dies 296 form, at least with the working side 294 of the conveyor belt 356, an acute angle opening in the direction of movement n of the conveyor belt 356, in such a way that each forming die 296 is located coaxially opposite the front end of an associated absorption body 130 on the conveyor belt 356. Fig. 23 shows that the working side 294 approaches the conveyor belt 356 in its direction of movement n in such a way that the spacing between the forming heads 298 and the front end of the absorption bodies 130 diminishes increasingly, until the forming heads 298 meet the front ends of the absorption bodies 130 and deform these into a round hump 135.

The rotary system 300 for forming finger dips 133 at the rear end of the absorption bodies 130 likewise consists of an endless flexible member 302 rotating in the clockwise direction s in a plane which is parallel to the direction of movement n of the conveyor belt 356. As is evident, the rotary system 300 is arranged mirror-symmetrically relative to the rotary system 290. Accordingly, at least one working side 299 of the member 302 is arranged at an acute angle to the conveyor belt 356 which, once again, closes in the direction n. Fastened to the outside of the endless member 302 are forming dies 304 which extend outwards in the plane of rotation of the endless member 302 and which, at their free ends, carry forming heads 305 having a convex forming face for forming the finger dips 133 in the rear end of each absorption body 130. For this purpose, here too, the forming dies 304 are respectively aligned coaxially, in the region of the working side 298, with the absorption bodies 130 transversely arranged in succession at a distance from one another on the conveyor belt 356. The arrangement of the forming dies 304 is such that these come to bear on the rear end of an absorption body 130 at the moment when a forming die 296 for forming the round
hump 135 also comes to bear on the front end of the same absorption body 130. Consequently, the forming dies 296, 304 of the two rotary systems 290, 300 at the same time form abutments for one another, so that, even after the forming of the round hump 135 and of the finger dip 133, the absorption bodies 130 maintain their position on the conveyor belt 356.

Recovery-tape attachment station
Fig. 24 to 29 illustrate the operations which are carried out in the recovery-tape attachment station. Fig. 24 shows an absorption body 130 which is shaped to form a tampon and which, after the smoothing or ironing of the round hump 135 at the front end and of the finger dip 133 at the rear end of the absorption body 130, has been fed by means of the conveyor belt 356 to a recovery-tape attachment station. In this station, as mentioned, the tampon is provided with a hole 308 which, according to Fig. 24, extends at a distance of, for example, 6 mm from the rear end 134 of the absorption body 130 diametrically through the latter. According to Fig. 25, the attachment of this continuous hole 308 extending diametrically through the absorption body 130 is made by means of a rotating awl 310 which is movable to and fro diametrically relative to the absorption body 130 and which is driven in the direction of rotation. The tip, as a result of its rotation, at the same time forces the individual fibres in the absorption body 130 apart from one another carefully, without severing them. The diameter of the continuous pre-pierced hole 308 amounts, for example, to 0.6 mm.

Fig. 26 to 29 show individual work phases of the drawing of a recovery tape 136 into the hole 308 in the absorption body 130. In Fig. 26, the recovery tape 136 is guided from a stock reel 312 through an eye 314 of a needle 316 which is movable to and fro axially and which is a component of a rotary system, not shown, which is similar to that in Fig. 23 and by means of which the needle 316 is carried along synchronously.
with the movement of the absorption body 130 in the direction of movement of the conveyor belt 356. Consequently, during the continuous conveying movement of the needle 316 and the absorption body 130, the needle 316 can, according to Fig. 27, be guided through the hole 308 together with the recovery tape 136, a loose end 136a of the recovery tape 136 hanging down out of the needle eye 314 and, if appropriate, being brought into the effective range of a clamping device 318 by a suction device.

The clamping device 318 is, once again, a component of a rotary system and consists of two clamping jaws 320, 322 which are movable coaxially to and fro and which, in Fig. 27, are arranged at a distance from one another or form an interspace, into which the loose end 136a of the recovery tape 136 hangs down. In Fig. 28, the clamping jaws 320, 322 have been moved up against one another and have clamped the loose end 136a of the recovery tape 136 between them. As soon as this clamping operation has taken place, the needle 316 is drawn out of the absorption body 130. As Fig. 28 also shows, there is provided above the direction of movement of the absorption bodies 130 a severing device 324 which takes effect in a horizontal plane and which is likewise a component of the rotary system. After the needle 316 has been drawn back out of the absorption body 130, this severing device 324 is actuated, so that, according to Fig. 29, the recovery tape 136 is severed between the needle 316 and the absorption body 130. Thereafter, each absorption body 130, together with its recovery tape 136 drawn through the hole 308, is fed to a pneumatic knotting device known per se and therefore not shown. Simultaneously, the recovery tape 136 leading to the reel 312 is ready with its loose end 136a in the needle eye 314 for a renewed drawing-in operation.

Packaging Station
Fig. 30 illustrates a device for producing packaging pouches
350 from two plastic film strips 331, 333 which are each drawn off from a stock roll 335 and 337 in the direction of an arrow z. The two stock rolls 335, 337 are followed by two heated welding rollers 339, 341 which are drivable in the direction of rotation and which are arranged one above the other in a cross-sectional plane relative to the direction of transport z of the plastic film strips 331, 333. Each of the welding rollers 339, 341 is provided with welding ribs 343, 345 extending parallel to their axes, in such a way that, in the event of a synchronous rotational movement of the arrows g and h in opposite directions, the welding ribs 343, 345 of the two welding rollers 339, 341 are located respectively opposite one another and weld the film strips 331, 333 to one another along parallel seals 306. The welding ribs 343, 345 are, of course, separated from one another by equal circumferential angles of 60° in the present case, the interspaces between the successive welding ribs 343 and 345 having indentations 347, 349 which make it possible, by means of the two film strips 331, 333, to form the pouches 350, the cross-section of which is made somewhat larger than the cross-section of the absorption bodies 130.

Fig. 31 illustrates diagrammatically the packaging of the absorption bodies 130. The web welded together from the upper film strip 331 and the lower film strip 333 to form pouches 350 of a blister strip 351 is continuously driven parallel to and synchronously with a row of absorption bodies 130 in the direction of the arrows p, q parallel to one another, in such a way that the absorption bodies 130 come to rest coaxially to the pouches 350, of which the ends or bottoms 352 facing away from the absorption bodies 130 are closed by welding. Subsequently, the absorption bodies 130 produced as finished tampons 132 for feminine hygiene with a recovery tape 136 are pushed into the pouches 350 in the direction of an arrow q. Thereafter, the recovery tape 136 is attached in the form of a coil or spiral to the rear end 134 of each tampon 132.
whereupon the projecting pouch edges 353 are folded against the rear ends 134 of the absorption bodies 130 positioned in the pouches 350 and are welded to one another in an air-tight manner. The blister pack produced in this way can, if required, be severed in the form of individual packs 355 by severance from the subsequent packs in the region of the welding seams 306 separating the packs, as indicated by the scissors shown in Fig. 31, or blister packs can be brought onto the market as multiple packs, from which the user can separate a pack in the region of the welding seams 306 each time as required, and for this case the welding seams 306 can have perforations.
List of Reference Symbols

a   arrow
b   arrow
c   arrow
d   arrow
e   arrow
f   arrow
g   arrow
h   arrow
i   arrow
n   arrow
o   arrow
p   arrow
q   arrow
r   arrow
s   clockwise direction
x   direction of advance
z   arrow

A   Folding station
B   Wrapping-band attachment station
C   Pressing station
D   Severing station

α   acute angle
β   angle of action

I   First folding operation
II  Second folding operation
III Third folding operation
IV  Fourth folding operation

38  stock roll
40  Nonwoven web
42 Guide plate
44 Endless conveyor belt
46 Stand part
48 Stand part
50 Baffle plate
52 Folding plate
54 Folding disk
56 Right-hand longitudinal side (nonwoven web 40)
58 Right-hand longitudinal edge
60 Left-hand longitudinal edge
62 First fold
64 Longitudinal fold
66 Four-layer bundle
68 Uncovered part (right-hand longitudinal side 56)
69 Six-layer bundle
70 Left-hand longitudinal side (nonwoven web 40)
72 Seven-layer nonwoven web
80 Stock roll
82 Wrapping band
84 Guide roller
86 Guide tube
88 Longitudinal slot (guide tube 86)
90 Endless conveyor belt
91 Support plate
92 Upper side
94 Driving roller
96 Deflecting roller
98 Introduction slot (guide tube 86)
dto.
102 Segment (guide tube 86)
dto.
106 dto.
108 Rear edge (segment 102)
110 Front edge (segment 104)
112 Rear edge (segment 104)
114 Front edge (segment 106)
Side tab (Wrapping band 82)
dto.
Middle longitudinal slot (guide tube 86)
Closing device
Outer longitudinal edge (side tab 118)
Longitudinal edge (side tab 116)
Heat-sealing roller
Absorption body
Longitudinal grooves
Tampon
Finger dip
Rear end (tampon)
Round hump
Recovery tape
Loose end (recovery tape 136)
Knot
Longitudinal ribs
Nonwoven web (rounded, wrapped)
Disk press
Carrier plate (or bearing plate)
Passage orifice
Press axis
Tubular piece
Widened entry orifice
Longitudinal slots (catch nozzle 270)
Press disks
Bearing blocks
Supporting arms
Press-disk holders
Screw bolts
Screw nuts
Guide face in the form of a cylinder cutout
Holding plates
Stop face
Actuating device
Actuating bolt
178 Spur wheel
179 Transmission shaft
180 Bearing
182 Driving bevel wheel
184 Bevel-wheel disk
186 Press-disk body
188 Roller bearing
190 Axis
192 Bore (supporting arm 162)
194 Stepped annular face
196 Press-ring disk
198 Clamping ring
200 Electrical resistance-heating elements
202 Radial bores
204 Electrical line
206 Slip ring
208 Stationary sliding contact
210 Drive motor
212 Bracket
213 Reduction gear
214 Driving spur wheel
216 Internal toothing
218 Toothed ring
219 Press-disk gap
220 Bearing rollers
222 Transverse profile
224 Press-ring disk
226 Profile flanks
227 Press-ring disk
228 Annular grooves
229 Pressing edge (press-ring disk 227)
230 Adjusting device
231 Corrugations
232 Control ring
233 Circular groove
234 Control bolt
236  Control groove
238  Supporting face
240  Pressed strand
241  Arrangement
242  Longitudinal mid-axis
244  Countersunk bore
246  Threaded bores
248  Adjusting screws
250  Cone tips
252  Guides
253  Guide tongues
254  Long holes
255  Tongue-and-groove connection
256  V-shaped transverse groove
257  Supporting face
258  Longitudinal mid-axis
259  Screw connection
260  Transverse profile
261  Profile flanks
262  Pressing edge (press-ring disk 196)
263  Side faces
265  End faces
268  Supply nozzle
270  Catch nozzle
273  Conical widening
274  Middle length portion
275  Cylindrical end portion
276  End portion
278  Resistance-heating element
282  Pressed-strand core
290  Rotary system
292  Flexible member (rotary system 290)
294  Working side
296  Forming dies
298  Forming heads
299  Working side
300  Rotary system
302  Endless flexible member (rotary system 300)
304  Forming dies
305  Forming heads
306  welding seam
308  Hole
310  Awl
312  Stock reel
314  Eye
316  Needle
318  Clamping device
320  Clamping jaw
322  Clamping jaw
324  Severing device
330  Pair of nip rollers
331  Film strip
332  Pair of nip rollers
333  Film strip
334  Nipping boss
335  Stock rolls
336  Nipping boss
337  Stock rolls
338  Nipping boss
339  Welding rollers
340  Nipping boss
341  Welding rollers
342  Front end (absorption body 130)
343  Welding ribs
344  Carrier belt
345  Welding ribs
346  Transverse grooves
347  Indentations
348  Driving cover
349  Indentations
350  Packaging pouches
351  Blister strip
352 Ends or bottoms (packaging pouches 350)
353 Nipping groove
355 Individual packs
356 Conveyor belt
357 Receptacles (conveyor belt 356)
Patent Claims

1. Process for the production of longitudinally extending pressed absorption bodies from an endless nonwoven web which is transported continuously in the direction of advance by pressing elements drivable in the direction of rotation and belonging to a pressing station and which is provided simultaneously with at least three longitudinal grooves arranged at equal angular spacings, whereupon the nonwoven web forming a pressed strand is subdivided into portions of specific length, characterized in that the nonwoven web (140) is driven in the conveying direction (x), by means of the pressing elements drivable in the direction of rotation, in a plane extending transversely relative to its longitudinal direction and simultaneously is pressed radially at least to the final cross-section of a pressed strand (240) and, at the same time, is provided with longitudinal grooves (131).

2. Process according to claim 1 characterized in that the nonwoven web (140) is simultaneously transported and compressed in only one single plane being vertically directed to the press axis (153).

3. Process according to Claim 1 or 2, characterized in that the nonwoven web (140) is guided positively before the pressing and the pressed strand (240) is guided positively after the pressing.

4. Process according to one of Claims 1 to 3, characterized in that longitudinal grooves (131) of differing depth are pressed into the nonwoven web (140).

5. Process according to Claim 4, characterized in that, as seen in the circumferential direction of the
nonwoven web (140), the longitudinal grooves (131) are alternately pressed radially to a differing depth.

6. Process according to Claim 4, characterized in that at least two diametrically opposite longitudinal grooves (131) of the nonwoven web (140) are successively pressed to a differing depth in the longitudinal direction.

7. Process according to Claim 1, characterized in that the nonwoven web (140) is pressed radially to a cross-section which is made smaller than the final cross-section of the pressed strand (240).

8. Process according to claim 7, characterized in that the nonwoven web (140) is pressed to impart a substantially cylindrical surface by closing the radial outer portions of the grooves (130).

9. Process according to one of Claims 1 to 8, characterized in that the nonwoven web (140) is provided with four pairs of diametrically opposite longitudinal grooves which are separated from one another by equal circumferential angles.

10. Process according to one of Claims 1 to 9, characterized in that the nonwoven web (140) is heated.

11. Process according to Claim 10, characterized in that the heating of the nonwoven web (140) takes place during the pressing.

12. Process according to one or more of Claims 1 to 11, characterized in that the pressed strand (240) is heated.
13. Process according to one of Claims 1 to 12, characterized in that length portions of the pressed strand (240) which serve as absorption bodies (130) are precut, with the exception of an axial connecting web between the portions, by a diametral nip-rolling of the pressed strand (240), the said nip-rolling being offset in steps at 90°.

14. Process according to Claim 13, in which length portions separated from a pressed strand serve for the production of tampons for feminine hygiene, characterized in that, during the nipping-off of the absorption bodies (130) from the pressed strand (240), the front end of each absorption body (130) is preformed as a round hump (135) and the rear end of the preceding absorption body (130) is preformed as a finger dip (133), simultaneously in each case.

15. Process according to Claim 13 or 14, characterized in that the individual absorption bodies (130) of the pressed strand (240) are severed in the region of the thin connecting web.

16. Process according to Claim 15, characterized in that at least the preformed crude shape of the round humps (135) at the front end of the absorption bodies (130) are moistened slightly after the severance of the connecting webs between successive absorption bodies (130).

17. Process according to one of Claims 13 to 16, characterized in that at least the round humps (135) at the front end of each absorption body (130) separated from the pressed strand (240) are finally formed by smoothing.
18. Process according to Claim 17, characterized in that the smoothing of at least the round hump (135) at the front end of each separated absorption body (130) takes place by ultrasonic means.

19. Process according to Claim 17, characterized in that the smoothing of at least the round hump (135) at the front end of each absorption body (130) takes place by ironing.

20. Process according to one of Claims 13 to 19, characterized in that the rear end of the absorption body (130) forming a tampon (132) is provided, during its conveyance, with a recovery tape (136).

21. Process according to Claim 20, characterized in that, before the recovery tape (136) is attached, the rear end (134) of the tampon is pierced transversely to form a continuous hole (308) for receiving the recovery tape (136).

22. Process according to Claim 20 or 21, characterized in that the recovery tape (136) is drawn in through the pre-pierced hole (308) by means of a needle (316) having a closed eye (314), the loose end (136a) of the recovery tape (136) is clamped, and subsequently the needle (316) is drawn back, whereupon, to draw in a recovery-tape length completely, the recovery tape (136) is severed in an adjustable position above the tampon (132), whilst a sufficiently long and simultaneously remains threaded through the needle (316) so as to be ready for the next tampon (132).

23. Process according to one of Claims 20 to 22, characterized in that the ends of the recovery tape (136) are knotted.
24. Process according to Claim 23, characterized in that a vacuum knotter is used for knotting the ends of the recovery tape (136).

25. Process according to one of Claims 1 to 13, characterized in that the pressed strand (240) is impregnated with a medium before the separation of absorption bodies (130).

26. Process according to Claim 25, characterized in that the impregnation medium is liquid.

27. Process according to Claim 26, characterized in that the liquid impregnation medium is applied to the pressed strand (240) by spraying.

28. Process according to Claim 26, characterized in that the pressed strand (240) is impregnated with the liquid impregnation medium by the dipping method.

29. Process according to Claim 26, characterized in that the liquid impregnation medium is water-repellant.

30. Process according to Claim 25, characterized in that glycerine is used as a water-repellant impregnation medium.

31. Process according to Claim 25, characterized in that the medium is powdery.

32. Use of the impregnated length portions according to one of Claims 25 to 31 as sealing material.

33. Process according to Claim 1, characterized in that the nonwoven web (140) is formed from at least one fibre-material web.
34. Process according to Claim 33, characterized in that, before the pressing of the grooves, the nonwoven web (40) is folded round several times onto itself, parallel to the longitudinal direction, from one longitudinal edge (58), before the other longitudinal edge (60) is folded round onto the multi-layer nonwoven web (40) in the opposite direction.

35. Process according to Claim 33 or 34, characterized in that a nonwoven web (40) having a width of 15-40 cm is used.

36. Process according to one of Claims 33 to 35, characterized in that the cross-section of the multi-layer nonwoven web (40) is rounded.

37. Process according to Claim 36, characterized in that, before the pressing of the grooves, the rounded nonwoven web (40) is surrounded by a fluid-permeable wrapping band (82).

38. Process according to Claim 37, characterized in that the connection of the longitudinal edges of the wrapping band is made by the welding together of thermoplastic constituents of the wrapping band (82).

39. Process according to Claims 37 or 38, characterized by the use of a nonwoven wrapping band (82).

40. Apparatus for carrying out the process according to Claim 1 or one of the following claims, with a carrier plate provided with a passage orifice, in which is arranged a tubular piece having a widened entry orifice and provided with a plurality of slots extending in the longitudinal direction, with a disk press having a plurality of circular press disks, the
circumference of which projects respectively through a slot into the interior of the tubular piece, the press disks being mounted rotatably on axles fastened on press-disk holders which are arranged on the carrier plate at angular spacings in a common plane perpendicular to the tubular piece and which are adjustable radially relative to the tubular piece, characterized in that an apparatus (A, B) for forming an endless nonwoven web (140) precedes the tubular piece (154), the exit orifice of which is arranged at a distance in front of a gap (219) formed by the press disks (160), there being provided for the press disks (160) a drive device (210), by means of which the press disks (160) can be driven synchronously, so that the nonwoven web (140) can be drawn by the press disks (160) into the press-disk gap (219) and can simultaneously be pressed radially at least to the final diameter of a pressed strand (240).

41. Apparatus of claim 40, characterized in that the disk press (150) consists of a vertically positioned carrier plate (151), on the exit side of which eight or more press disks (160) are arranged at equal circumferential angular spacings about a press axis (153).

42. Apparatus of claim 40, characterized by the press-disk holders (164) being respectively provided at their radially inner end with supporting arms (162), on the radially inner end of each of which one of the essentially circular press disks (160) is mounted so as to be drivable about its axis (190) in the direction of rotation.

43. Apparatus of claim 40 to 42, characterized by the supporting arms (162) being respectively fastened
axially adjustably on the press-disks holders (164), so that a fine adjustment to each press disk (160) radially to the press axis is possible.

44. Apparatus of claim 43, characterized by said supporting arms (162) being adjustable on bearing block (161) of the press-disk holders (164) about an axis parallel to the press axis (153) in such a way that the press disks (160) can be adjusted parallel to themselves out of their plane radial to the press axis (153), but also into another angular position relative to the radial plane.

45. Apparatus of claim 44, characterized by each of said supporting arms (162) being provided with screw bolts (166) by means of which said associated supporting arm (162) can be fixed in a desired angular position by means of screw nuts (168).

46. Apparatus of claim 44 or 45, characterized by each supporting arm (162) bearing with a guide face (170) in the form of a cylinder cutout against a correspondingly shaped stop face (172) of the bearing block (161), the centre of curvature of said guide faces (170, 172) being located in the middle of the press disk (160).

47. Apparatus of claim 43, characterized by an actuating device (174) for the press-disk holder (164), by means of which each press-disk holder (164) being radially adjustable individually.

48. Apparatus of claim 47, characterized by the actuating device (174) comprising holding plates (171) corresponding in number of press disks which are fastened on the rear side of the carrier plate (151)
perpendicularly to the press axis (153) at equal angular spacings and in which actuating bolts (176) being mounted rotatably, but non-adjustably axially within each of said radially movable bearing blocks (161).

49. Apparatus of claim 48, characterized by the drive for each of said press disks (160) comprising a spurwheel (178) being fastened on a transmission shaft (179) which is rotatably mounted axis-parallel to the press disk (160) in a bearing (180) and which is provided at its radially inner end with a driving bevel wheel (182).

50. Apparatus of claims 42 to 49, characterized by said driving bevel wheel (182) meshing with a bevel-wheel disk (184) which is fastened to one end face of a press-disk body (186) being mounted rotatably by means of a bearing (188) on the axis (190) which is axially adjustable in a bore (192) of the supporting arm (162).

51. Apparatus of claim 50, characterized by said press-disk body (186) being provided, on its outer end face facing away from the supporting arm (162), with an outer stepped annular face (194) for receiving a press-ring disk (196) which can be clamped firmly against the annular face (194) of the press-disk body (186) by means of a correspondingly shaped clamping ring (198).

52. Apparatus of claim 50 or 51, characterized by electrical resistance-heating elements (200) being arranged at equal circumferential angular spacings in radial bores (202) of the press-disk bodies (186) and being connected via an electrical line (204) to a slip
ring (206) which located on the inner end face of the press-disk body (186) and against which a stationary wiper contact (208) bears.

53. Apparatus of claim 40 or 49, characterized by a drive motor (210) being mounted at the entry side of the carrier plate (151) and being connected via a reduction gear (213) to a driving spur wheel (214) cooperating with an internal toothing (216) of a toothed ring (218).

54. Apparatus of claim 53, characterized by said toothed ring (218) being rotatably mounted concentrically to the press axis (153) on the carrier plate (151) parallel to the main plane of the latter, on three bearing rollers (220) which are fastened freely rotatably to the carrier plate (151) at at equal angular spacings relative to and at equal radial distances from the press axis (153).

55. Apparatus of claim 54, characterized in that said internal toothing (216) of the toothed ring (218) meshes respectively with the spur wheel (178) of each press-disk holder (164), so that each press disk (160) can be driven synchronously by the toothed ring (218) by means of the drive motor (210).

56. Apparatus of anyone of claims 40 to 55, characterized by said carrier plate (151) being provided, on its entry side, with guides (252) which are parallel to the radial press-disk planes and which are arranged at a distance from and parallel to the radial planes of the press disks (160).

57. Apparatus of claims 42 and 56, characterized by said bearing blocks (161) of the press disk holders (164)
engaging by means of guide tongues (253) into guides (252) in the manner of a tongue-and-groove connection.

58. Apparatus of claims 56 and 57, characterized by, in the bottom of each guide (252), four long holes (254) limiting a rectangle and being arranged in pairs symmetrically and parallel to a longitudinal mid-axis (242) of each guide (252) as well as parallel to the axis (190) of the associated press disk (160).

59. Apparatus of claims 57 and 58, characterized by screw bolts being fastened to the underside of the guide tongue (253) of each bearing block (161), said screw bolts engage into said long holes (254) and fix adjustably the bearing block (161) of each press-disk holder (164) to the carrier plate (151) by means of screw nuts.

60. Apparatus of any one of claims 56 to 59, characterized by a device (230) for the synchronous radial adjustment of the press-disk holders (164) consisting of a control ring (232) being rotatably mounted concentrically to the press axis (153) in a circular groove (233) on the entry side of the carrier plate (151) in a plane parallel to the main plane of the latter.

61. Apparatus of claim 60, characterized by said control ring (232) being provided, on its front side facing away from the carrier plate (151), with a number of control bolts (234) corresponding to the number of press-disk holders (164), said control bolts (234) being fastened to the control ring (232) at equal circumferential angular spacings and projecting outwards perpendicularly to the main plane of the latter.
Apparatus of claim 62, characterized by said control bolts (234) each engaging into a control groove (236) which is arranged, in a direction of adjustment of each press-disk holder (164), in a supporting face (238) of the bearing block (161) of each press-disk holder (164), said supporting face (238) facing the control ring (232).

Apparatus of claim 63, characterized by said control grooves (236) in the bearing blocks (161) of each press-disk holder (164) forming with a tangent drawn to the control ring (232) along a longitudinal mid-axis of the control bolt (234), an acute angle (alpha) such, that the press-disk holders (164) can be synchronously adjusted radially inwards and outwards.

Apparatus of claim 64, characterized by an arrangement (241) for a precision adjustment of the supporting arms (162) relative to the axis (190) of each of the press disks (160).

Apparatus of claim 65, characterized by said arrangement (241) consisting of two countersunk bores (244) in the supporting arm (162) of each press-disk holder (164), said countersunk bores (244) being arranged symmetrically to the longitudinal mid-axis (242) of the guide (252) and opened out into threaded bores (246), into which adjusting screws (248) being screwed, which are provided with cone tips (250) at their front end.

Apparatus of claim 66, characterized by each supporting arm (162) being mounted adjustably parallel to the axis (190) of the press disk (160), on the outside of the bearing block (161) facing away from the carrier plate (151), by means of a tongue-and-
groove guide (255) and being fastened releasably by means of four screw connections (259).

67. Apparatus of claim 65, characterized by transverse grooves (256) which have a V-shaped cross-section and which are arranged at a distance from and parallel to one another in a plane perpendicular to the longitudinal mid-axis (242) of the guides (252) being provided in a supporting face (257) of the bearing block (161) for the supporting arms (162).

68. Apparatus of claims 64 to 67, characterized by longitudinal mid-axes (258) of said V-shaped grooves (256) coinciding with the vertex point of the V-profile of the transverse grooves (256) being offset laterally inwards relative to the cone tips (250) of each pair of adjusting screws (248).

69. Apparatus of claims 64 to 68, characterized by the cone angle of each cone tip (250) of the adjusting screws (248) corresponding to the angle of the V-shaped transverse profile of the transverse grooves (256), so that the cone tip (250) of the adjusting screws (248) bears respectively against one of the two groove walls of the transverse grooves (256) facing away from one another, and, depending on the screw-in depth of the adjusting screws (248) into the transverse grooves (356), each supporting arm (162), together with the press disk (160) fastened to it, being adjustable extremely finely parallel to the axis (190) of the press disk (160) in the direction of the tongue-and-groove guide (255).

70. Apparatus of one of claims 40 to 69, characterized by the diameter of said press disks (160) being in the range of 280 to 300 mm for the pressing of absorption
bodies (130), especially for feminine hygiene, and the outer, rounded pressing edge (262) of which having a width of approximately 0.723 mm.

71. Apparatus of claim 70, characterized by a transverse profile (260) of each press disk (160) being widened radially inwards in a V-shaped manner, profile flanks (261) forming an acute angle of 22.5° and merging into parallel side faces (263) at a radial distance of 5.543 mm from the pressing edge (262).

72. Apparatus of claims 70 or 71, characterized in that said parallel side faces (263) run out, at a radial distance of 12.332 mm from the pressing edge (262), into parallel end faces (265), between which the press disks (160) being 5.0 mm wide.

73. Apparatus of any one of claims 70 to 72, characterized by a transverse profile (222) of a press disk (160) having profile flanks (226) which possess annular grooves (228) of arcuate cross-section being arranged at a distance from one another concentrically to the mid-axis of the press disk (160).

74. Apparatus of any one of claims 70 to 73, characterized by angle-forming profile flanks being roughened.

75. Apparatus of claim 40, characterized by the press-disks (160) being provided with an irregular pressing edge.

76. Apparatus of claim 75, characterized by said pressing edge (229) of the press disks (160) having corrugations (231).

77. Apparatus of any one of claims 70 to 76, characterized
by the pressing edge (229) of said press disks (160) having a depth of roughness of 8-10 micron.

78. Apparatus of any one of claims 40 to 77, characterized by mounting said tubular piece on the entry side of the disk press (150), the free cross-section of said tubular piece (154) being narrowed in the form of a supply nozzle (268) at the front end.

79. Apparatus of claim 78, characterized by a reduction in cross-section of the supply nozzle (268) in relation to the cross-section of the tubular piece (154) of approximately 9%.

80. Apparatus of claim 79, characterized by the cross-section of said supply nozzle (268) being dimensioned such, that the round cross-section of the nonwoven strand (140) being compressed and subsequently guided freely into the press-disk gap (219) between the eight press disks (160).

81. Apparatus of any one of claims 40 to 80, characterized by a catch nozzle (270) for the pressed strand (240) being arranged at a distance behind the narrowest press-disk gap (219) in the conveying direction (x).

82. Apparatus of claim 81, characterized by an axial distance of 10 to 15 mm of the catch nozzle (270) from the press-disk gap (219).

83. Apparatus of claim 80 or 81, characterized by a widened entry orifice (156) of the catch nozzle (270) being dimensioned somewhat larger than the cross-section which the pressed strand (240) assumes behind the narrowest cross-section of the press-disk gap (219).
84. **Apparatus of any one of claims 81 to 83, characterized by said free cross section of the catch nozzle (270) being narrowed behind the longitudinal slots (158) over a middle length portion (274) at least to the narrowest cross-section which the pressed strand (240) assumes behind the narrowest cross-section of the press-disk gap (219).**

85. **Apparatus of any one of claims 81 to 84, characterized in that the middle length portion (274) of said catch nozzle (270) has a length of 10 mm and a clear, circular-cylindrical cross-section with a diameter of 11 mm.**

86. **Apparatus of any one of claims 81 to 85, characterized by a diameter of 18 mm of the entry cross-section of the catch nozzle (270).**

87. **Apparatus of claims 81 to 86, characterized by the catch nozzle (270) being provided with a number of longitudinal slots (158) of the same length and width and corresponding to the number of press disks, said longitudinal slots (158) extending at equal angular spacings over the circumference of the catch nozzle (270) in the planes of the respective associated press disks (160), and each receiving radially and with free play one of the eight press disks (160).**

88. **Apparatus of claim 87, characterized by said longitudinal slots (158) being extended over a length of 30 mm.**

89. **Apparatus of any one of claims 80 to 87, characterized by said catch nozzle (270) being widened over an end portion (276) in the conveying direction (x) of the disk press (150).**

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90. Apparatus of claim 89, characterized by the end portion (275) being reinforced in a flange-like manner and being provided with electrical resistance-heating elements (278), by means of which the catch nozzle (270) can be heated to an ironing temperature in the range of 70 to 90°C for the pressed strand (240).

91. Apparatus of claim 89, characterized by a conical widening (273) of the clear cross-section diameter of 12 to 12.5 mm at the exit end of the catch nozzle (270).

92. Apparatus of claim 91, characterized by a cylindrical end portion (275) of the cross-sectional widening (273) serving for the reception of and as a stop for a plastic tube of corresponding diameter being mounted in a floating manner in said end portion (275).

93. Apparatus of any of claims 81 to 92, characterized by an engagement angle (beta) of 20 to 25° of a press disk (160) for the pressing of the nonwoven strand (140).

94. Apparatus of any one of claims 40 to 93, characterized by a severing station (D) consisting of at least two pairs of nip rollers (330, 332) which are arranged offset at 90° at both sides of the pressed strand (240) and respectively drivable in opposition.

95. Apparatus of claim 94, characterized by the nip rollers of said two pairs of nip rollers (330, 332) being each provided with a nipping boss (334, 336; 338, 340) to reduce the cross-section between successive length portions of the pressed strand (240) with the exception of a thin, axial connecting web.
96. Apparatus of claim 95, characterized by the last pair of nip rollers (332) being provided as severing device for said connecting web between successive absorption bodies (130) of the pressed strand (240).

97. Apparatus of claim 95, characterized by the nip rollers (330, 332) being formed to simultaneously preshaping a front end (342) of an absorption body (130) and a rear end face of the absorption body (130) with a depression.

98. Apparatus of any one of claims 94 to 97, characterized in that, if a wrapping band (82) is used, at least one pair of cutting rollers being arranged at the end and/or at the start of the severing station (D) to be cut through the wrapping band (82) surrounding the pressed strand (240) and/or a thin, axial connecting web between successive absorption bodies (130) of the pressed strand (240).

99. Apparatus of any one of claims 40 to 98, characterized by a rotary system (290) for forming humps (135) at the front end of the absorption bodies (130) constituting tampon blanks being provided on one side of the conveyor belt (356), a further rotary system (300) for forming finger dips (133) at the rear end of the absorption bodies (130) being arranged on the other side of a conveyor belt (356) located opposite the rotary system (290) in the direction of arrow (n).

100. Apparatus of claim 99, characterized by said rotary system (290) consisting of an endless flexible member (292) which rotates in the direction of an arrow (r) in the anti-clockwise direction in a plane directed parallel to the plane of movement of the conveyor belt (356), a working side (294) of said endless flexible
member (292) forming, with the direction of movement (n) of the conveyor belt (356), an acute angle closing in the direction (n), rotating heatable forming dies (296) which extend outwards from the conveyor belt (356) in the plane of movement of the conveyor belt (356) being provided at their free ends, on the end face, with concave hemispherical forming heads (298) for the forming of said convex hemispherical humps (135) at the front end of the absorption bodies (130).

101. Apparatus of claim 99, characterized by the rotary system (300) for forming finger dips (133) at the rear end of the absorption bodies (130) consisting of an endless flexible member (302) rotating in the clockwise direction (s) in a plane which is parallel to the direction of movement (n) of the conveyor belt (356).

102. Apparatus of claims 99 to 101, characterized by said rotary systems (290; 300) being arranged mirror-symmetrically relative to each other such that at least one working side (299) of the member (302) of the rotary system (300) being arranged at an acute angle to the conveyor belt (356) of the rotary system (290) closing in the direction (n).

103. Apparatus of claims 101 or 102, characterized by forming dies (304) being fastened to the outside of the endless member (302) and extending outwards in the plane of rotation of the endless member (302), said forming dies (304) carrying, at their free ends, forming heads (305) having a convex forming face for forming the finger dips (133) in the rear end of each absorption body (130).

104. Apparatus of claims 101 or 102, characterized in that
the forming dies (296) are fastened spaced apart from each other in equal distances corresponding to the distances of the absorption bodies (130) being arranged on the conveyor belt (356) transverse to its longitudinal direction and parallely spaced apart from each other.

105. Apparatus of claim 103, characterized by the forming dies (304) being respectively aligned coaxially, in the region of the working side (298), with the absorption bodies (130) transversely arranged in succession at a distance from one another on the conveyor belt (356).

106. Apparatus of any one of claims 101 to 105, characterized by an arrangement of the forming dies (304) such that these come to bear on the rear side of an absorption body (130) at the moment when a forming die (296) for forming a round hump (135) also comes to bear on the front end of the same absorption body (130), so that the forming dies (296; 304) of the two rotary systems (290; 300) at the same time form abutments for one another and, even after the forming of the round hump (135) and of the finger dip (133), the absorption bodies (130) maintain their position on the conveyor belt (356).

107. Apparatus of any one of claims 101 to 103, characterized by the recovery-tape attachment station being associated with the conveyor belt (356) and comprising a rotating awl (310) which is movable to and fro diametrically relative to the absorption body (130) for piercing a diametrical hole (308) in the rear end of each absorption body (130).

108. Apparatus of claim 107, characterized by a needle
(316) being movable to and fro and being a component of a rotary system carrying the needle (316) along synchronously with the movement of the absorption body (130) in the direction of movement of the conveyor belt (356), so that the needle (316) can be guided through the hole (308) of the absorption body (130) together with the recovery tape (136), of which a loose end (136a) hanging down out of the needle eye (314) and, if appropriate, being brought into the effective range of a clamping device (318) by a suction device.

109. Apparatus of claim 108, characterized by the clamping device (318) being a component of a further rotary system and consisting of two clamping jaws (320, 322) for the loose end (136a) of the recovery tape (136).

110. Apparatus of claim 108, characterized in that, when the loose end (136a) of the recovery tape (136) has been clamped, the needle (316) being drawn out of the absorption body (130).

111. Apparatus of any one of claims 106 to 110, characterized by a severing device (324) being provided above the direction of movement of the absorption bodies (130) and effective in a horizontal plane and which is likewise a component of a rotary system, said severing device (324) being actuable, when the needle (316) has been drawn back out of the absorption body (130) to sever the recovery tape (136) between needle (316) and absorption body (130).

112. Apparatus of any one of claims 40 to 111, characterized by a device for producing packaging pouches (350) from two film strips (331, 333) which are each drawn off from a stock roll (335; 337) being
followed by two heated welding rollers (339, 341) which are drivable in the direction of rotation and which are arranged one above the other in a cross-sectional plane relative to the direction of transport (z) of the film strips (331, 333).

113. Apparatus of claim 112, characterized in that each of the welding rollers (339, 341) being provided with welding ribs (343, 345) extending parallel to their axes such that, in the event of a synchronous rotational movement in opposite directions, the welding ribs (343, 345) of said two welding rollers (339, 341) being located respectively opposite one another and weld the film strips (331, 333) to one another along parallel seals (306).

114. Apparatus of claim 113, characterized by said welding ribs (343, 345) being separated from one another by equal circumferential angles, the interspaces between the successive welding ribs (343, 345) having indentations (347, 349) which make it possible, by means of the two film strips (331, 333) to form the pouches (350), the cross-section of which being made somewhat larger than the cross-section of the absorption body (130).

115. Apparatus of claims 113 or 114, characterized by said welding ribs (343, 345) being separated from one another by equal circumferential angles, the interspaces between the successive welding ribs (343, 345) having indentations (237, 349) which make it possible, by means of the two film strips (331, 333), to form the pouches (350), the cross-section of which is made somewhat larger than the cross-section of the absorption bodies (130).
Fig. 12
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION OF SUBJECT MATTER

| IPC   | A61F13/20 |

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

| IPC   | A61F   |

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practical, search terms used)

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search: 20 August 1996

Date of mailing of the international search report: 27.08.96

Name and mailing address of the ISA:

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Authorized officer:

Soederberg, J

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## INTERNATIONAL SEARCH REPORT

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