

Description

The invention relates to a process for producing a tube portion from a flat web of flexible material, in particular plastics-coated paper, by means of grooving, stamping, cutting and folding operations, wherein the web is drawn from a storage roll and conveyed
5 intermittently, after the operation of folding it over into tube form the longitudinal edges of the web are continuously joined together by adhesive, welding or the like, and the web is cut through.

Processes of the above-indicated kind and also apparatuses for carrying out such a process, to which the invention also relates, for
10 the production of packaging means, in particular for materials which are capable of flow, are known in the form of filling machines, in the production of liquid packs for milk or fruit juices. In that connection, a tube or tubular portion is formed from a flat web of paper which is coated on both sides with plastics material and which
15 is intermittently drawn from a storage roll, after grooved and stamped lines have been formed thereon, the tube or tubular portion is filled with the liquid to be packaged and formed into individual packs by welding devices, whereupon the individual tube portions which are then separated from each other by transverse sealing seams are separated by
20 way of cuts which pass through the stamped lines.

It has been found that the production of packaging means of that kind is already possible with high levels of through-put, wherein most packaging means of the known kind are closed both at the bottom and at the top side thereof, by folding and welding. A disadvantage in that
25 connection however is the amount of space that is required with such production processes and machines because long lengths are necessary in order for a flat web which is drawn from a storage roll to be converted into a tube in a continuous mode of operation, even if driven intermittently, and for the tube to be formed by means of a
30 longitudinal sealing seam. In addition, the known process must use expensive welding installations because after it has been produced,

that is to say after the longitudinal edges of the web are joined together, the tube must be filled with liquid in a subsequent stage. That liquid necessarily applies a certain pressure to the pack which encloses it and thus also to the fresh longitudinal sealing seam so
5 that, without special welding devices, there would be a fear of the fresh welded seam splitting open.

In addition it has already been proposed that a pack may be provided with a cover or a top of plastics material without a carrier material, the pack thereafter being filled and only subsequently
10 closed at the bottom by folding. To produce a pack of that kind, tube portions must be produced, of a cylindrical configuration, and introduced into an injection moulding machine in which the top portion or the cover with an opening is injection moulded on to one side on the cylindrical tube portion. It will be seen that the operation of
15 injection moulding on cylindrical tube portions gives rise to insuperable difficulties from the point of view of the man skilled in the art, when involving high rates of through-put, for it is scarcely possible to envisage a machine with which tube portions can be formed from a flat web with such a degree of precision that it is possible to
20 achieve the desired appropriate internal dimension to which on the one hand a moulding tool and on the other hand the plastics injection moulding can be precisely fitted with exact matching in regard to the dimensions thereof.

The problem of the present invention is now that of providing a
25 process for producing such a tube portion from a flat web and an apparatus for carrying out such a process, as set forth in greater detail in the opening part of this specification, with which, with a high level of through-put, the web of elastic flexible material is formed into a tube and separated off, over a very short distance,
30 while the dimension of the tube portion is highly accurate.

In regard to the process, in accordance with the invention that

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problem is solved in that, prior to the operation of joining the longitudinal edges of the web, the web is at least partially cut into at least from one longitudinal side transversely with respect to the direction of conveying movement, the operation of forming the tube is effected only by way of folding in the side panels which are separated off by the cuts, and the portion of the web which has not been cut is held supported substantially flat and after the operation of joining the longitudinal edges of the web the flat portion thereof is cut through in line with the cuts. The particularly novel concept of the present invention provides that the web of material is left at least in part in web form in one piece until the final severing cut, but prior to the final cut, that is to say before the individual tube portions are separated off, the longitudinal edges of the web are already joined together so as to provide at least a partial tube configuration. That tube is already divided into portions by the above-mentioned cuts extending transversely with respect to the longitudinal side of the web, those portions subsequently forming the length of the tube portion produced. The operation of shaping a tube in a web of material which in part remains in one piece is a working operation which has not been known hitherto and which permits various processing operations which hitherto were not possible when forming a tube.

For example, the novel process according to the invention provides for the formation of a tube portion over a very short distance when considering the web of material which is drawn from the roll. In addition, it is possible to effect a welding operation with very short welding times, using the simplest welding methods. That means however that production of the desired packaging is made substantially cheaper.

So that, in place of a blade which is movable in the direction of conveying movement of the web, referred to as a flying blade, it is possible to use an immobile or stationary blade for producing the

above-mentioned cuts in the web, it is desirable to effect the above-mentioned cuts and the operation of cutting into the web from the outside of the longitudinal edges of the web transversely with respect to the direction of conveying movement of the web towards the centre not by means of a blade in the nature of a shears arrangement so that the cut has practically no width of its own, but it is more desirable for those lines which are generally referred to as the 'cut' to be produced by stamping. In that way it is possible to stamp out surface portions. The configuration of those surface portions is preferably elongate, that is to say instead of the line-like cuts, it is also possible to produce double-line cuts by stamping out a narrow strip.

It is also advantageous in accordance with the invention if the flat web receives cuts of substantially equal length from both longitudinal sides thereof, the inner ends of said cuts extending as far as groove lines which are produced in the web, and if the sum of the areas of the side panels which are separated off by the cuts is greater than the area of the middle flat portion of the web between successive pairs of cuts. The grooving operation can be effected by the paper manufacturer. It is however also possible for the groove lines to be formed with the machine using the process according to the invention at the beginning of the working operation described herein. The groove lines extend longitudinally of the direction of conveying of the web. They serve for folding in the side panels formed by the cuts, on to the central flat portion of the web which is formed thereby. If a portion of the web which later becomes the tube portion is considered, more specifically between the successive pairs of cuts, then the area of the central flat portion can be compared to that of the folded-over side panels. If the sum of the areas of the folded-over side panels is greater than that of the middle flat portion of the web, then it is possible to form a tube cross-section of which one part is flat and another part is curved. The curved part is that with the larger area, in the case of the present example with the folded-

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over side panels. However it has the longitudinal edges of the web which are to be welded together. Welding in that configuration is advantageously effected in a stress-free condition, and that is also the reason why the simplest welding method can be used, with short
5 welding times and without a cooling time, preferably using constant contact heat. More specifically after the welding operation there are no forces in the web of paper or stresses therein which would represent a considerable loading on the fresh sealed seam.

A further embodiment of the present invention advantageously
10 provides that the side panels which are folded in along the groove lines and which are formed into the tube portion are pressed together at the one end beside the cuts to form a cone. It was explained in the opening part of this specification that, when a cover is injection moulded on to the one end of a tube portion, it is necessary to observe
15 precise dimensions, just because of the injection moulding tools. It was also stated that it is extremely difficult to form a tube or a tube portion with precise inside dimensions in such a way that they could for example be pulled precisely on to a mandrel member. However pulling a tube portion on to a mandrel member in that way could be performed
20 if, in accordance with a concept of the invention, the configuration of the tube portion were frustoconical. To produce the frustoconical shape one end of the tube portion must be of smaller diameter than the opposite end. As the groove lines can most easily be formed in the web when they extend parallel to the direction of conveying movement of the
25 web, the above-mentioned step in accordance with the invention must be carried out, namely the side panels must be pressed together at the respective end of the tube portion in the region of the groove line. If that pressing operation is effected immediately prior to or during the welding operation, the sealing seam takes up the reduction in diameter
30 which is produced by the side panels being pressed together beyond the groove line, and immediately fixes that reduction in diameter. That

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however provides in a very simple fashion a slightly conical tube portion which in addition is even still in part unseparated, that is to say, it is still part of a web.

It is therefore advantageous if, in a further embodiment of the invention, the tube portion, after the flat portion of the web has been cut through, is pushed aside individual transversely with respect to the direction of conveying movement of the web, and put into a configuration of circular cross-section. The tube portion was provided with a cross-section which hitherto was not circular, for example approximately with the cross-section of a segment of a circle, by virtue of the middle part of the web which was held in a flat condition. It is therefore desirable if the cross-section of that tube portion, after the separating operation, that is to say after the web has been cut through in line with the previously formed cuts therein, is at least approximately put into the form of the surface of a cylinder, wherein one end thereof, as mentioned above, is of somewhat larger diameter than its other end so that, in an exaggerated form, it would be possible to refer to a truncated cone. If then the injection moulding tool, of the corresponding opposite form, is in the configuration of a tapered mandrel member, it will be seen that a very slightly frustoconical tubular body can be easily pushed on to the mandrel member by means of suitable ejection devices so that, towards the end of the pushing operation, the narrow end of the truncated cone comes to lie on the front side of the mandrel member in a really taut condition, that is to say, fitting thereto with the appropriate dimensions. The last-described side of the mandrel member is then part of the injection moulding mould so that the halves of the tool arrangement can fit very accurately around the end of the tube portion.

In another advantageous embodiment of the process, in accordance with the invention, the operation of cutting into the web is effected by stamping transversely with respect to the direction of conveying movement in such a way that the cuts which extend transversely inwardly

from the longitudinal edges of the web are at least 1 mm in width. While a cut in the most literal sense represents a cut line which has no width of its own, a line of a certain width can be produced by stamping out. In other words, by using a stamping blade along the cut
5 to the desired depth, a strip-shaped portion of the web can be removed, which is of a width of 1 to 5 mm, preferably 2 to 3 mm. The advantage of forming a stamped-out cut, that is to say a stamped-out region in which the cut would otherwise occur, is that the width of the strip or stamped cut, which is in the direction of conveying
10 movement of the web, provides a tolerance or a tolerance range so that in the definitive operation of also cutting through the middle panel of the web, namely the panel between the transversely extending cuts, it is possible to use a stationary blade or a blade which is not movable in the direction of conveying movement of the web. The
15 arrangement and use of such a blade is possibly less expensive than when using a so-called 'flying' blade which is movable in the longitudinal direction of the web.

According to the invention the apparatus for carrying out the process comprises cutting, forward feed and folding means and is
20 characterised in that a flat support plate, extending from the folding-in station to the severing station, is held stationary in the direction of conveying movement of the web in such a way that it is at least partially embraced by the web, that forward feed drive rollers are arranged above and beneath the web in the direction of
25 conveying movement between the welding station which has at least one constant contact heating jaw and the severing station which has a movable blade, and that a distributor station with means for forming the web into a tube portion is disposed downstream thereof. With those features it is possible for the web of flexible elastic
30 material, for example the web of paper which is coated on both sides and which is used herein for the purposes of describing the invention, to be put into the above-mentioned tubular shape of



segment-like cross-section by cutting and folding in. In that operation a part of the web lies beneath the support plate while the two folded-over side panels are arranged above same. That arrangement is achieved in that, in accordance with the invention, the folding-in station has levers which are rotatable about an axis extending in the direction of conveying movement of the web and transverse mandrels which are disposed parallel to the axis and which are secured to said levers. After the operating of cutting into the web transversely with respect to the longitudinal direction thereof for forming the side panels the transverse mandrels are turned and pivoted inwardly over the support plate about the above-mentioned axis by way of the rotatable levers so that the support plate is now almost completely enclosed by the web of material. In the intermittent or gradual forward movement of the continuous web from the folding-in station into the next following welding preheating station, it may be desirable if the co-operating welding jaw is arranged above the support plate and the longitudinal edges of the web which are to be joined together are pushed on to that jaw while the transverse mandrels are still held in the inwardly pivoted position or holding bars maintain the web of paper in that tubular position. Upon further conveying movement of the web into the welding station the longitudinal edges which are to be joined together are disposed directly between the welding jaws in the desired manner so that the tube-forming operation can be effected although a part of the tube in the form of the middle flat region of the web still remains part of the continuous web.

It is further advantageous in accordance with the invention if, disposed upstream of the folding-in station in the direction of conveying movement of the web is an adjustably displaceable cutting-in means with a photocell for controlling the drive rollers. In that way the apparatus can be adjusted to different lengths of tube

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portions. The spacing of the connecting line between the two cuts on the one hand and the photocell on the other hand is kept the same in all embodiments, but the spacing of the cutting means or the photocell from the blades of the severing station can be altered in accordance with the necessary division or number of tube portions to be found therebetween. The apparatus can therefore be converted to different products using simple means.

It is also advantageous in accordance with the invention if, laterally beside the edges of the support plate, the welding station has pressure jaws which are movable relative to the support plate, at a small angle of inclination. That makes it possible to provide for a precise internal dimension for the tube portion without a calibration mandrel. It has already been mentioned hereinbefore in a context relating to the same matters that it is desirable to be able to produce conical tube portions because a truncated cone can be more easily pulled on to a mandrel than a precise cylindrical tube, in particular when it is considered that one end of the tube must be disposed with a precise fit on the end of the mandrel which forms the mould portion. The conical tube portion is now produced by the above-mentioned movable pressure jaws. They are at a small angle of inclination - when looking in the direction of conveying movement of the mandrel - relative to the longitudinal side edges of the support plate. The movement of the pressure jaws is perpendicularly to the direction of conveying movement of the web. By means thereof it is therefore possible for one end of the tube portion, being the respective leading end as considered in the direction of conveying movement, to be pressed against the edge of the support plate while that does not happen on the other side. By virtue of that pressure, the respective side wall panel which is formed by the cuts into the web is pressed against the support plate, beside the groove line provided in the web, so that that practically eliminates stresses in the paper. The pressure jaws are used to press the paper in practice



beyond its stress around the edge of the support plate, that is to say against the resistance of the flat paper, because the folding-over operation is effected in the vicinity of the grooving and not in the groove line itself. As those movable pressure jaws are provided
5 in the region of the welding station, the reduction in diameter of the tube portion at that location is immediately fixed by the welding operation. Practical experience has shown that, using those means, it is very easily possible to provide and produce a conical tube portion in which a part thereof still belongs to continuous webs and a
10 precise internal dimension is achieved without the use of a calibration mandrel after the operations of severing and separating the finished tube portion, for the operation of pressing the web together around the edges of the support plate is effected controlled in such a way that precisely the desired inside dimension of the
15 finished tube portion is ultimately achieved.

It is also desirable in accordance with the invention if at least one forward feed drive roller has a central opening at its periphery. As considered in the direction of conveying movement of the web the forward feed drive rollers are arranged downstream of the
20 welding station. That does not give rise to any disadvantages in regard to the conveying movement of the web for the web is continuously extended to the storage roll. However the advantage of that arrangement of the rollers downstream of the welding station is that the drive rollers hold down the tube portion so that in regard
25 to cross-section in practice the result is the flat tube, while the forward feed drive roller advantageously extends directly over the weld seam. So that the latter is not subjected to a loading in an undesirable fashion, the roller has the above-mentioned central opening. That advantageously eliminates any loading on the seam, for
30 example including the occurrence of undesirable displacement. In addition, what is known as the edge protection means, that is to say

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a thin foil in the region of the longitudinal sealing seam, is protected by the central opening because otherwise excessively high pressures are possibly transmitted to the edge protection foil by virtue of the line contact.

5 In another advantageous embodiment of the invention, mounted in the distributor station are connecting rails which extend transversely with respect to the direction of conveying movement of the web, extending over the width of the support plate, tube shaping members being secured to the ends of the rails, while a slider is
10 guided movably between the rails.

The slider is moved cyclically transversely with respect to the direction of conveying movement towards the right or the left depending on the direction in which the tube portion which has been separated off by the severing station is moved aside. More
15 specifically the through-put or the output of the apparatus according to the invention can be considerably increased if the tube portions which are produced from the web are divided to two processing paths because then each processing path has more time for further processing, in particular when injection moulding a cover or a bottom
20 on to a tube portion. Towards the end of its respective stroke movement the slider is always disposed outside the web and thus outside the width of the support plate which however is not absolutely necessary downstream of the severing station. It is more advantageous for the tube or the tube portion to be internally empty
25 downstream of the severing station in the direction of conveying movement so that the slider can push the tube aside without involving a high level of apparatus expenditure. It desirably pushes it into a tube shaping member which is disposed at the respective side, of a diameter which is of round cross-section and in which the tube
30 portion is then put into the desired shape. The slider in that connection may advantageously assist with the operation of putting

the tube portion into the desired shape by applying a pressure until it is in the final position. Thereupon the next tube portion will be present in a finished condition downstream of the severing station so that the slider can reverse its direction of movement transversely
5 with respect to the direction of conveying movement and can push the next tube portion in the opposite direction into another tube shaping member in which the same shaping operation as that just described above is performed.

The tube portion can be pushed out of the tube shaping member in
10 the direction of its longitudinal axis by ejectors on to the above-mentioned injection moulding mandrel where further processing, initially the operation of injection moulding the cover thereon, can then be carried out.

It is also desirable in accordance with the invention if the
15 blades of the severing station are fixed in the direction of conveying movement of the web. In that case it is possible to construct a simpler severing station because, as in the case of a shears arrangement, two blades are admittedly movable perpendicularly to the direction of conveying movement of the web and make it
20 possible to produce a cut in the web, but there is no need for a flying movement on the part of the two blades or a movement thereof in the longitudinal direction or the direction of conveying movement of the web. So that such a severing station can be used with blades which are immobile in the direction of conveying movement, the cut in
25 the side panels, which in each case extended transversely with respect to the direction of conveying movement of the web, was effected by stamping in such a way that the resulting stamped cut itself is from 1 to 5 mm and preferably from 2 to 3 mm in width. That gives a tolerance range into which the fixed blade falls when
30 severing the middle portion of the web, even when the web is displaced forwardly or rearwardly from the centre of the stamping cut

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by 1 or 2 mm.

It is also desirable in accordance with the invention for the cutting-in means to be a stamping blade which cuts out a portion of the web.

5 It has been stated that the cuts or stamping cuts or stamping panels which extend from the outside inwardly transversely with respect to the direction of conveying movement of the web may go from the outside longitudinal edges right as far as the respective perforated line extending in the direction of conveying movement of
10 the web, or only from that perforated line to a position just prior to reaching the outside edge, depending more specifically on whether the web already receives the cuts or stamped strips previously and is then drawn on to a storage roll, or whether it only receives them in the machine described herein. If the cuts or stamped strips are
15 already produced in the operation of preparing the paper, in which case the cuts or strips may not extend outwardly entirely to the edge, the cutting-in means may also provide the tolerance area required for the stationary severing blade at the outer longitudinal edge if it is a stamping blade which cuts out a portion of the web.

20 Further advantages, features and possible uses of the present invention will be apparent from the following description of preferred embodiments in conjunction with the drawings in which:

Figure 1 is a diagrammatic plan view of a web of paper which is coated with plastics material on both sides for the production of a
25 tube portion for a liquid pack,

Figure 2 is a view in section taken along line II-II through the web in Figure 1,

Figure 3 is a side view of a machine for producing a tube portion or tubular piece from the flat web shown in Figure 1,

30 Figure 4 is a view in section taken along line IV-IV in Figure 3 through the folding-in station,

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Figure 5 is a broken-away and diagrammatic view in section taken along line V-V in Figures 3 and 6, and

Figure 6 is a plan view of the right-hand part of the machine shown in Figure 3.

5 It is assumed that the web 1 of paper is intermittently advanced in the direction indicated by the arrow 2 and already has the stamping area 3 which was produced in the paper making factory. It is also assumed that the groove line 4 is already provided in the web 1 of paper. In contrast, at a spacing a from the area 3, the cuts 6
10 which extend transversely with respect to the longitudinal edges 5 are formed in the web 1 in the machine described herein, more particularly by the blade 7 shown in Figure 3.

It is however certainly possible for both the groove lines 4 and also the stamping area 3 to be produced only in the machine described
15 in the Figures herein. As a further alternative it is possible for the cuts 6 already to be provided in the web by the paper manufacturer. If however the cuts 6 extend continuously as far as the outer edge 5 of the web 1 of paper, it is impossible for it to be rolled up in the storage roll 8. That difficulty can be avoided
20 however by the paper manufacturer leaving a small web portion uncut at the location indicated at top right in Figure 1 by reference numeral 9. The blade 7 shown in Figure 3, instead of the described cuts 6 which extend inwardly as far as the groove lines 4, then only has to form a cut in the web 1 along the line 9 (Figure 1).

25 After the cuts 6 have been formed the web is then moved in the direction indicated by reference numeral 2 from the first right position into the next following second position for effecting the operation of preparation for folding in the side panels which are indicated by 10 and which form a flat middle panel 11 on the web 1.
30 The boundary of the middle panel 11 is formed by the two groove lines 4. The folded-in condition is shown at the third position from the right in Figure 1, in which the web 1 has been made narrower by the

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two side panels 10. In the second position it is possible to see the strip of a width a which forms the subsequent weld seam and which extends transversely with respect to the direction of conveying movement as indicated at 2 from one edge 5 to the other, to the left of and beside the stamping area 3. It will be appreciated that in the third position from the right the closure seam referred to above is shorter because it is laid over double.

The illustration of the folding-in operation moreover is shown in Figure 1 in such a way that firstly folding-in is effected from below upwardly and then a second folding-in operation is effected from above downwardly so that the initially outwardly upwardly disposed edge 5 is shown in the middle as a solid line while the other longitudinal edge 5 is only shown as a broken line.

The web 1 then continues to move from the third position into the fourth position which is associated with the welding station 12 and which represents the preheating region 13. The welding jaw 14 which extends over the middle longitudinal seam can already be seen in diagrammatically indicated form at that point. In the preheating region 13 the welding jaw 14 softens the layers of plastics material which are to be sealed together so that they can then be joined together in the actual welding station 12 to the left of the preheating station 13 in Figure 1.

At the right-hand end of the fifth position from the right, which represents the region of the actual welding station 12, the operation of pressing the web 1 together by means of the pressing jaws 15 which are movable in a direction transverse with respect to the direction 2 of conveying movement of the web 1 as indicated by the arrow 16 is effected. The pressing jaws form the conical shape or frustoconical shape of the tube portion to be produced, by virtue of the fact that they are arranged at a small angle α with respect to the direction 2 of conveying movement of the web. The front end of the pressing jaws 15, as considered in the direction 2 of

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transportation movement of the web 1 is narrower than the rearward end.

The conical formation of the tube portion can be described in particularly clear terms with reference to Figure 2 which is a view
5 in cross-section through the above-described fifth position in the welding station 12, along line II-II. Figure 2 shows the cross-section of the flat support plate 17 which is bevelled at its two longitudinal edges 18 in order better to adapt to the cross-sectional shape of the web 1 which has already been folded over in a tubular
10 configuration. It will be seen that fixed in position above the support plate 17 is the cold co-operating jaw 19 with a step 20 into which the end edge of the firstly folded-in lower side panel 10 can be inserted while the upper, subsequently folded-in side wall panel 10 can be laid over the surface which is then smoother. The flat web
15 portion 11 is arranged on the side which is in opposite relationship to the cold co-operating jaw 19 and the support plate 17 from the side panels 10. Figure 2 shows the sector-shaped cross-section of the tube, the longitudinal edges 21 and 22 of which are disposed under the heated sealing jaw 14. Guide rails 23 are preferably provided for
20 better holding the side panels 10 in the tubular shape shown in Figure 2.

Figure 2 shows the width Y of the support plate 17 which, as can be clearly seen, is smaller than the spacing X (Figure 1) between the groove lines 4. In other words, there is some play at each of the
25 edges 18 with respect to the web 1 with the grooving 4.

Figure 2 also shows in cross-section the pressure jaws 15 which as can be seen therefrom, eliminate the above-mentioned play when they are pressed towards each other, insofar as the side wall panels 10 are folded over somewhat beside the groove line 4, with an
30 increase in the overlapping of the edges 21 and 22. That folding-over operation is effected under light pressure against the resistance

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arising out of the material forming the web, that is to say the paper itself, which must be converted from the flat configuration into a heavily curved configuration.

It will be seen from Figure 1 that the above-indicated
5 reduction in the dimension X almost to the dimension Y is effected only at one end, being the right-hand end, in the fifth position shown in Figure 1 from the right on the web 1. On the opposite end the widthwise dimension X of the web 1 remains unchanged so that at that point the large circle of the truncated cone is subsequently
10 formed after the web has been put into a tubular configuration, while the small circle of the truncated cone is formed at the first-described side.

Shown in the sixth position from the right in Figure 1 are the forward feed drive rollers 24 which, as shown at the right in Figure
15 3, hold down the freshly welded edges 21 and 22 so that no forces can develop, which, in spite of the stress-less condition in the paper, could seek to burst the longitudinal seam 25. At their periphery both forward feed drive rollers 24 have a central opening 26 in which the longitudinal sealing seam 5, which is laid double, extends.

20 Before the tube portion of the length Z is conveyed into the seventh position shown at the extreme left in Figure 1, the operation of severing the flat portion 11 of the web 1 is effected at the location 27, precisely on the line of the cuts 6. The severing cut which is indicated at 28 in Figure 1 extends over the entire width X
25 of the tube portion and separates one tube portion of the length Z from another.

When the severing operation and thus the operation of separating the tube portion from the web has been finished, a slider shown in Figure 5 provides for lateral discharge in the direction
30 indicated by the arrow 30 or 31 into tubular shaping members 32 where the flat tube is put into a round form. The web and the apparatus

processing same are shown in Figure 3 from the side. The web 1 is drawn from the roll 8 in the direction 2 of conveying movement and pulled through grooving rollers 33 and the roll motor 34 with pressure roller 35. The purpose of the grooving rollers 33 is to form the groove lines indicated at 4 in Figure 1, about which the folding-in operations are performed. The motor 30 draws the web of paper 1 from the grooving station 33 by way of a loop 36 to two further direction-changing rollers 38 and 39. The conveying force is transmitted to the web from the motor 34 by way of the pressure roller 35. The motor 34 is controlled by the photocell 37. The loop 36 can assume different positions, for example including the position shown at the top in broken lines and indicated by reference numeral 36'. After it passes out of the lower direction-changing roller 39, the flat web of paper 1 moves in the direction of conveying movement indicated by the arrow 2. It passes over a photocell 40 which controls the forward feed drive rollers 24.

As already described above with reference to the material to be processed, the blades 7 form the transverse cuts 6 (or 9) transversely with respect to the longitudinal edges 5 of the web of paper 1. In this connection Figure 1 also shows the distance d of the cuts 6 from the photocell 40, which should remain the same for all lengths of tube portions, for converting the machine to different lengths of tube portions, a calculated different spacing of the blades 41 and 42 (top blade and bottom blade) of the severing station 33 is used.

After the cut 6 has been formed the web 1 moves into the folding-in station which is generally indicated at 44 and where there are respectively provided levers 46 and 46', which are rotatable about an axis 45 disposed in the direction 2 of conveying movement of the web, for the respective oppositely disposed sides, and transverse mandrels 47 which are secured thereto and which are disposed parallel to the axis 45.

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The structure of the station 44 can also be seen from Figure 4 in which the view is in the direction 2 of conveying movement. When the flat web of paper is in the folding-in station, the transverse mandrel 47 and 47' is pivoted upwardly by way of the respective lever 46 and 46' in the direction indicated by the arrow 48 and 48' respectively so that the transverse mandrel 47 (and also the transverse mandrel provided with the apostrophe) is moved into the position 47". The transverse mandrels remain disposed in that position while the web of material, that is to say the coated paper, embraces the support plate 17 in the manner shown in Figure 2. In the feed movement out of the folding-in station 44 into the welding station 12, the transverse mandrels 47 and 47' remain disposed in the position identified by the two apostrophes in order to provide a better holding effect and coarse guidance for the side panels 10. It is only when the web portion in question has moved into the preheating zone 13 of the welding station 14 that the transverse mandrels 47" move back into the starting position again.

In the welding station 12, after being preheated in the zone 13, the web portion is completely welded by the two strips 21 and 22 shown in Figure 2 being joined together by constant contact heat.

The web is then conveyed further towards the right in Figure 3 by way of the forward feed drive rollers 24 until the cuts 6 and 9 respectively have reached the location 27 (Figure 1) at which the severing blades 41 and 42 are arranged and provide for severing of the web portion 11 which is still in a flat condition, thereby to separate off the tube portion.

By virtue of the multiple stepping movements of the web 1 from one station to another - and finally to the forward feed drive rollers 24 and the rotatably suspended blade 41, 42 - it is to be reckoned on a tolerance at the cutting location 27, which the blades 41 and 42 should follow. The top blade 41 and the lower blade 42 are pivotally connected together at a location 52 and can be pivoted



towards each other with a shears-like motion about the axis 61 (see Figure 6), thereby effecting the severing operation. Shown in Figure 3 to the right of the location 27 is the upwardly projecting tube portion with the side panels 10 as shown in Figure 2 while to the left thereof that tube portion, with the side panels 10, is held down by the forward feed drive rollers 24. That provides an abutment for the top blade 41 which swings from left to right about the axis 52 and which, upon reaching the abutment, at precisely the desired position, can effect the severing operation in alignment with the cuts 6.

Figure 3 shows at the top in the severing station 43 a pneumatic cylinder 50, the piston of which is connected at the pivot location 51 to the short lever of the pivot arm 53 (as far as the pivot point 52). The mode of operation of that 'flying blade' is such that, after the severing operation has been effected at the position 27, the blades 41 and 42, together with the pivotal arm 53, pivot back in the clockwise direction about the pivot point 52, being driven by the pneumatic cylinder 50. When then the web to be cut, that is to say the tube which has been partially cut into, advances into the position shown in Figure 3, the direction of rotary movement of the arm 53 is reversed so that, after the cuts 6 in the web 1 reach their end position at the location 27 when the photocell 40 has given the 'stop' command to the drive rollers 24, the top blade 41 moves to the abutment and can then perform the severing operation.

In the next forward feed movement the web passes into the shaping station which is generally identified by reference numeral 54. That station can be seen in plan view in Figure 6 and in cross-section in Figure 5, taken along line V-V in Figures 3 and 6. At the same time that also involves the distributor station 70 in which the respective separated tube portion, as shown in Figure 1, is moved

(53)

laterally out of the direction 2 of conveying movement of the web 1, in the direction indicated by the arrows 30 or 31. That movement is effected by means of the slider 29 which is respectively disposed in its inoperative position outside the width X of the web, which is again approximately to be found in Figure 5, although after leaving the support plate 17 the tube portion has assumed a somewhat different configuration from that shown in Figure 2. That tube portion is now displaced by the slider 29 for example in the direction indicated by the arrow 71 in Figure 5 towards the right, wherein slider 29 with tube portion move within connecting rails 72. The rails 72 may also be of a plate-like configuration. They are connected at their respective ends to the tube shaping members 32 which have a hollow interior and which have a longitudinal axis parallel to that of the tube portion. On the side opposite to the gap for the slider 29 the tube shaping member 32 is provided on its inside with a notch 73 in which the right-hand edge of the tube portion can be centered, after being pushed thereinto, in the view shown in Figure 5. That ensures that the doubled longitudinal seam, with the edges 21 and 22, remains precisely at the correct location in the shaping member 32. In addition the cross-sectional view in Figure 5, at the right thereof, shows recesses 74 which do not interfere with the operation of putting the tube portion into the form of a slightly tapering truncated cone, but advantageously form guide rails for ejection of the tube portion which has been put into the frustoconical configuration, on to the mandrel 64 respectively shown in Figures 3 and 6.

Figure 6 shows the arrangement of ejectors 63, the front view of which can be seen on the left-hand side in Figure 5. Correspondingly to the recesses 74 in the shaping member 32, the front thrust plate of the ejector 73 has projections 75 into which the tube portion reliably engages in the ejection operation. In that way the



separated tube portion can be pushed out of the tube shaping members 32 on to the mandrels 64.

Although Figure 5 shows two sliders 29 and 29, in actual fact however there is only one slider 29 which moves into respective ones
5 of the two positions illustrated.

Admittedly the cut 6 is already shown in the form of a double line in Figure 1, so that the stamped cut 6 or the stamped strip 6 can already be recognised therein.

In the lower part the stamped strip 6 extends continuously from
10 the outer longitudinal edge to the perforated line 4 which extends in the direction 2 of conveying movement of the web of material. Shown in the upper part is the other alternative embodiment in which the stamped cut 6 does not extend entirely to the upper edge. In the last-mentioned embodiment the stamped cut was already produced in the
15 operation of making the paper, whereupon the web 1 is drawn on to a roll. Then, the machine described herein only has to produce the edge cut 9 which however can also be formed by a stamping blade in such a way that the cut formed thereby itself has width, that is to say it is a stamped strip. Both the cut and the stamped strip 6, as well as
20 the resulting stamped strip 9, are preferably 2 to 3 mm in width.



CLAIMS

1. A process for producing a tube portion from a flat web (1) of flexible material, in particular plastics-coated paper, by means of grooving, stamping, cutting and folding operations, wherein the web (1) is drawn from a storage roll (8) and conveyed intermittently, after the operating of folding it over into tube form the longitudinal edges (21, 22) of the web (1) are continuously joined together by adhesive, welding or the like, and the web is cut through, characterised in that, prior to the operation of joining the longitudinal edges (21, 22) of the web (1) the web is at least partially cut into (6, 9) at least from one longitudinal side transversely with respect to the direction of conveying movement (2), the operation of forming the tube is effected only by way of folding in the side panels (10) which are separated off by the cuts (6) and the portion (11) of the web (10) which has not been cut into is held supported substantially flat and after the operation of joining the longitudinal edges (21, 22) of the web (1) the flat portion (11) thereof is cut through (at 27) in line with the cuts (6).

2. A process according to claim 1 characterised in that the flat web (1) receives cuts (6, 9) of substantially equal length from both longitudinal sides thereof, the inner ends of said cuts (6, 9) extending as far as groove lines (4) which are produced in the web (1), and that the sum of the areas of the side panels (10) which are separated off by the cuts (6) is greater than the area of the middle flat portion (11) of the web (1) between successive pairs of cuts (6).

3. A process according to claim 1 or claim 2 characterised in that the side panels (10) which are folded in along the groove lines (4) and which are formed into the tube portion are pressed together at the



one end besides the cuts (10) to form a cone.

4. A process according to one of claims 1 to 3 characterised in that the tube portion, after the flat portion (11) of the web has been cut through, is pushed aside individually transversely with respect to the direction of conveying movement (2) of the web (1), and put into a configuration of circular cross-section.

5. A process according to one of claims 1 to 4 characterised in that the operation of cutting into the web (1) (at 6, 9) is effected by stamping transversely with respect to the direction of conveying movement (2) in such a way that the cuts (6, 9) which extend transversely inwardly from the longitudinal edges (21, 22) of the web (1) are at least 1 mm in width.

6. Apparatus for carrying out the process according to one of claims 1 to 4 comprising cutting, forward feed and folding means, characterised in that a flat support plate (17), extending from the folding-in station (44) to the severing station (43), is held stationary in the direction of conveying movement (2) of the web (1) in such a way that it is at least partially embraced by the web, that forward feed drive rollers (24) are arranged above and beneath the web (1) in the direction of conveying movement (2) between the welding station (12) which has at least one constant contact heating jaw (19, 14), and the severing station (43) which has a movable blade (41, 42), and that a distributor station (70) with means (54) for forming the web into a tube portion is disposed downstream thereof.

7. Apparatus according to claim 5 characterised in that the folding-in station (44) has levers (46) which are rotatable about an axis (45) extending in the direction of conveying movement (2) of the web, and transverse mandrels (47) which are disposed parallel to the axis (45) and which are secured to said levers.



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8. Apparatus according to claim 5 or claim 6 characterised in that disposed upstream of the folding-in station (44) in the direction of conveying movement (2) of the web is an adjustably displaceable cutting-in means (7) with a photocell (40) for controlling the drive rollers (24).

9. Apparatus according to one of claims 2 to 7 characterised in that the welding station (12), laterally beside the edges (18) of the support plate (17), has pressure jaws (15) which are movable relative to the support plate (17), at a small angle of inclination (α).

10. Apparatus according to one of claims 5 to 8 characterised in that at least one forward feed drive roller (24) has a central opening (26) at its periphery.

11. Apparatus according to one of claims 5 to 9 characterised in that mounted in the distributor station (70) are connecting rails (72) which extend transversely with respect to the direction of conveying movement (2) of the web, extending over the width (Y) of the support plate (17), tube shaping members (32) being secured to the end of the rails and a slider (29) being guided movably between the rails.

12. Apparatus according to one of claims 6 to 11 characterised in that the blades (41, 42) of the severing station (43) are fixed in the direction of conveying movement (2) of the web (1).

13. Apparatus according to claim 8 characterised in that the cutting-in means (7) is a stamping blade which cuts out a portion of the web.