April 29, 1958 H. S. V. JÄRUND 2,832,271

APPARATUS FOR THE CONTINUOUS SHAPING OF TUBES FROM A WEB OF PAPER OR THE LIKE

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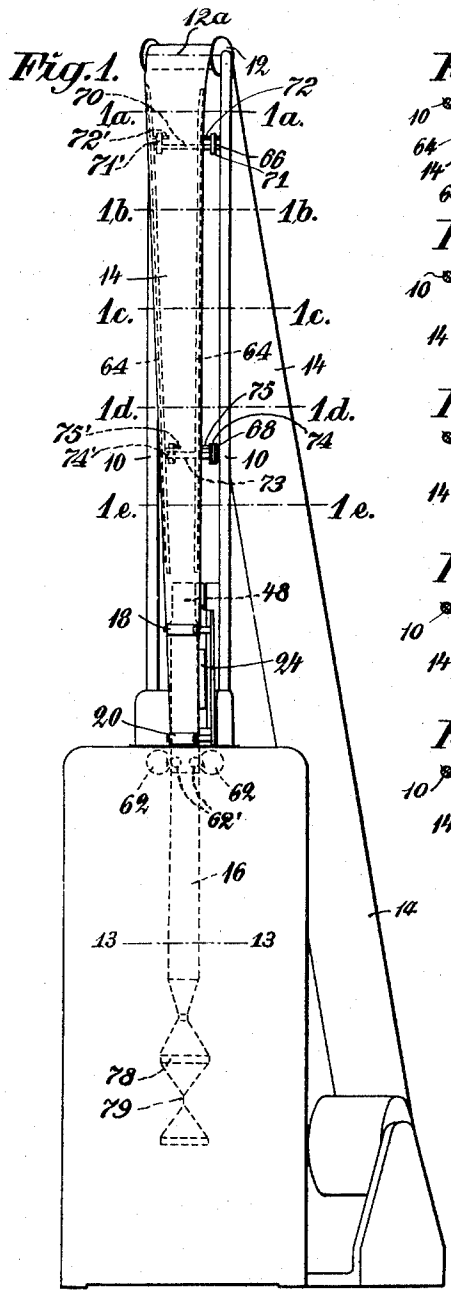

Fig. 1.

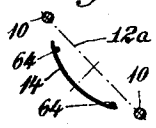

Fig. 1a.

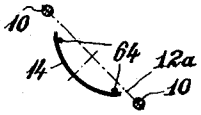

Fig. 1b.

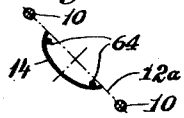

Fig. 1c.

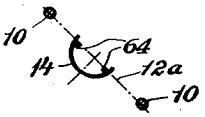

Fig. 1d.

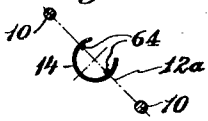

Fig. 1e.

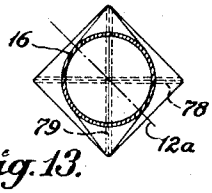

Fig. 13.

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Fig. 2.

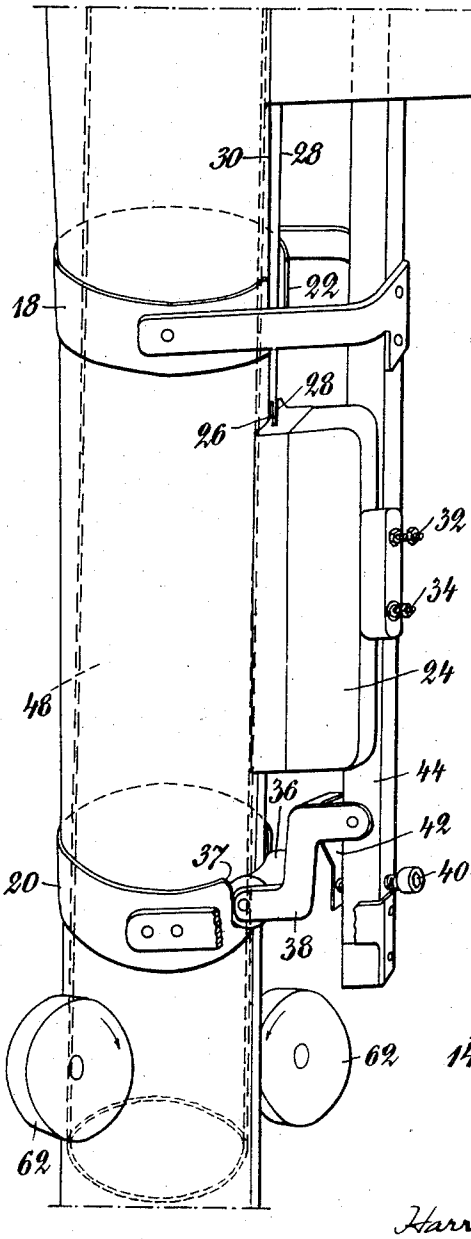

Fig. 3.

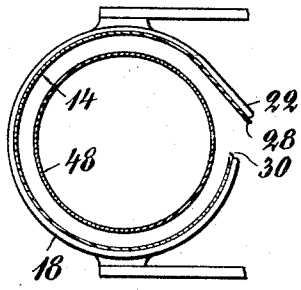

Fig. 4.

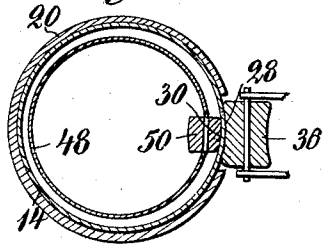

Fig. 5.

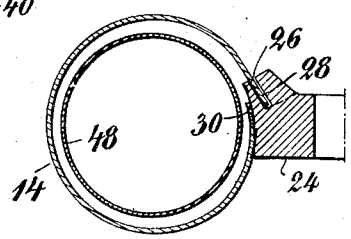

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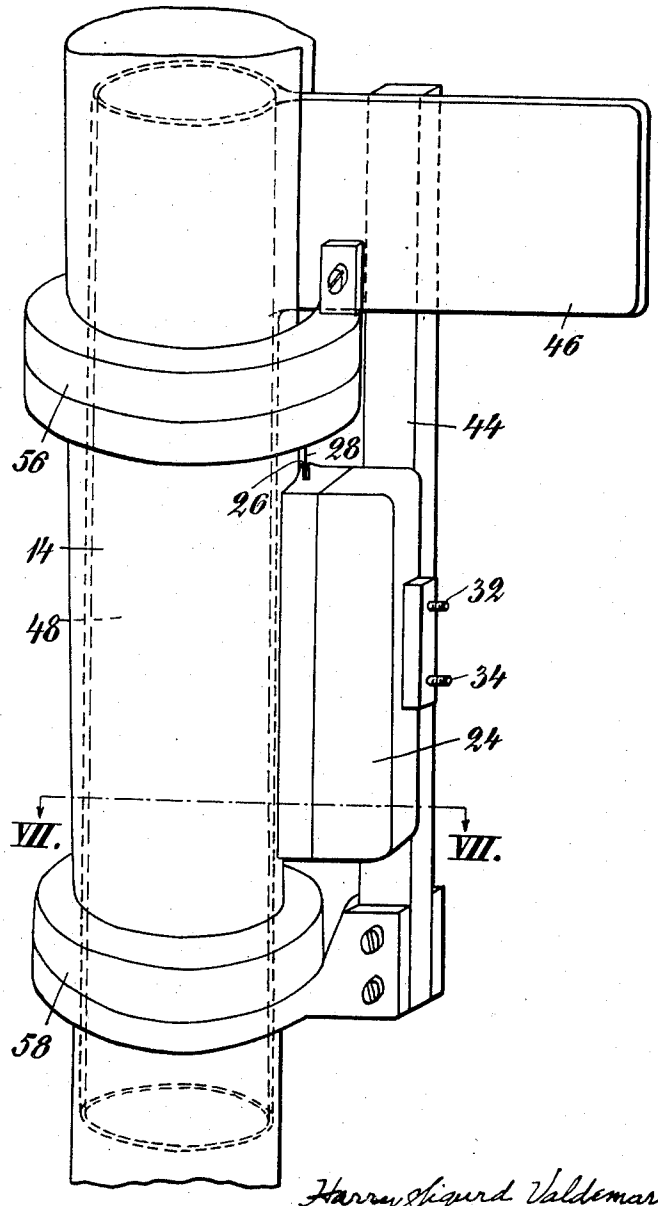
Fig. 6.



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APPARATUS FOR THE CONTINUOUS SHAPING OF TUBES FROM A WEB OF PAPER OR THE LIKE

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Fig. 7.

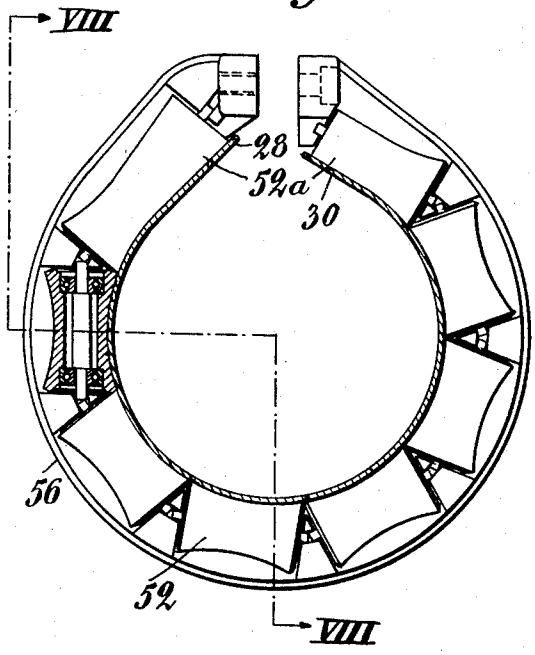

Fig. 8.

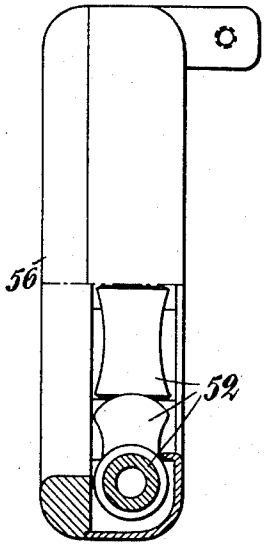

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Fig. 9.

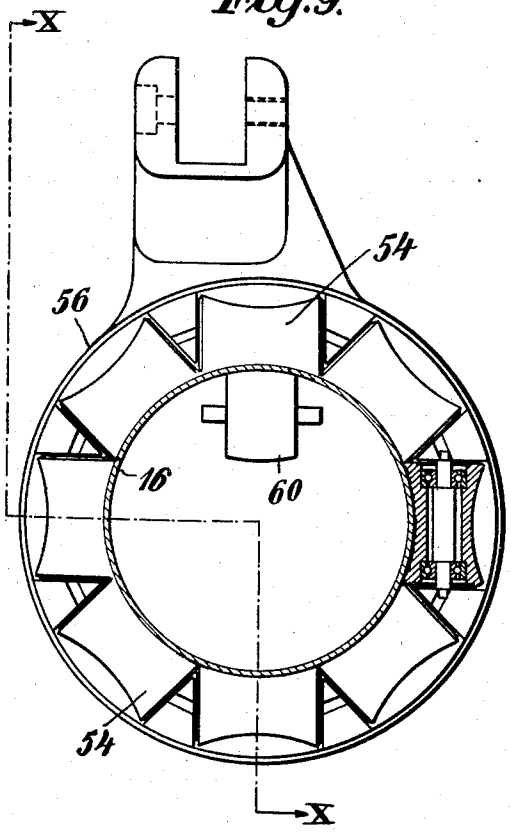

Fig. 10.

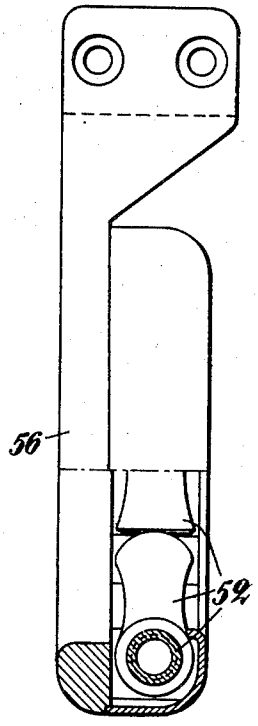

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Fig. 11.

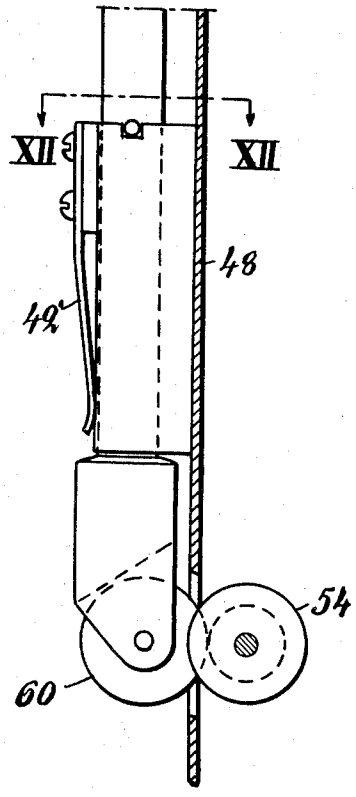
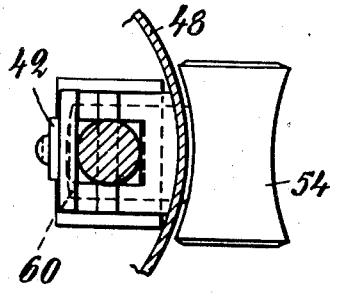


Fig. 12.



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United States Patent Office 2,832,271
Patented Apr. 29, 1958

2,832,271

APPARATUS FOR THE CONTINUOUS SHAPING OF TUBES FROM A WEB OF PAPER OR THE LIKE

Harry S. V. Järund, Lund, Sweden, assignor, by mesne assignments, to Hermorion Ltd., Toronto, Canada

Application December 26, 1951, Serial No. 263,358

Claims priority, application Sweden December 30, 1950

5 Claims. (Cl. 93—82)

The present invention relates to an apparatus for continuously converting a web of a suitable fiber or foil material, e. g. paper, textile material, metal or artificial resin foils or the like, into a substantially cylindrical tube or sleeve.

Apparatus of this kind is particularly useful in the packing industry, e. g. in connection with the production of bags having a straight bottom, pillow shaped or tetrahedral packages etc. Thus, an apparatus of the kind referred to may advantageously be used in combination with a tetrahedron shaping machine, for instance according to my copending patent application Serial No. 263,357 filed December 26, 1951, which issued as Patent No. 2,738,631.

The primary object of the invention is thus an apparatus for so bending a web as it is continuously withdrawn from a roll as to form a tube or sleeve and simultaneously sealing together the borders of the shaped open tube to form a longitudinal joint.

Another object of the invention is to guide the web during shaping in such a manner that the formation of creases, particularly in the longitudinal joint, is substantially avoided, since otherwise such creases would jeopardize the tightness of a package thereafter produced.

For attaining the above-mentioned objects and other advantages which will be obvious from the following description, the apparatus according to the invention consists in its principal parts of a turning-over or guide roller mounted in a machine frame and provided for the web to be bent to form a tube and, in spaced relation to said guide roller, an outer shaping sleeve in the form of a ring split along a generatrix and somewhat flattened along one of the cut-open edges, said shaping sleeve being so orientated relatively to the web being shaped that the outer overlapping border of the latter will be guided along the flat edge portion of the shaping sleeve. Further, provided below the shaping sleeve are a gluing or heating device for applying glue or bringing adhesive contained in the web to a suitable sealing temperature, a device for pressing together the border zones overlapping each other and provided with glue or brought to gluing temperature, and finally devices for feeding the web and the shaped tube through the machine.

Particularly in cases where the material from which the tube is to be produced has an insufficient stiffness or resilience, it may be suitable either to provide a brake acting on the web before it passes over the guide roller, so that the web will continually be under a tension increasing the stiffness or the resilience, or to provide guiding rods or a guide surface adjusted for the desired shape of the web and disposed between the guide roller and the shaping sleeve situated next to the guide roller. In certain cases, also a combination of these two expedients may be suitable.

In order to render possible the step of pressing together the border zones overlapping each other a counter-pressure device within the shaped tube is also required. Such a device, preferably in the form of a pressure or

counter-pressure roller, is suitably mounted in an inner sleeve carried by a holder arm fastened to the machine frame and passing through the wedge shaped opening between the longitudinal borders of the web being shaped, before these borders are brought into the overlapping position.

The invention will be described more in detail in the following with reference to the accompanying drawings, which by way of example, but not in a limiting sense, illustrate one embodiment in which the web material employed is assumed to consist of thermoplastic material or of a web of paper impregnated with a thermoplastic adhesive.

In the drawings:

Fig. 1 is a perspective view of an apparatus according to the invention;

Figs. 1*a*–1*e* are sections taken on correspondingly numbered lines in Fig. 1;

Fig. 2 shows a detail of the lower shaping elements as well as heating and compressing devices for the longitudinal joint;

Fig. 3 shows the upper sleeve-like shaping element, as viewed from above;

Fig. 4 is a section through the lower shaping element with mounted pressure rollers;

Fig. 5 is a section through the heating element;

Fig. 6 is a fragmentary perspective view, similar to Fig. 2, of an alternative construction for the shaping elements, and the heating and sealing elements;

Fig. 7 is a plan view of the upper shaping member of Fig. 6 as seen with the cover ring removed and turned counterclockwise by 90° from the position shown in Fig. 6, the web being shown in horizontal section;

Fig. 8 is a side elevation of the shaping element as seen partly in section on the line VIII—VIII of Fig. 7;

Figs. 9 and 10 are similar plan and side elevations, respectively, of the lower shaping element, the section of Fig. 10 being taken on line X—X of Fig. 9;

Fig. 11 is a fragmentary vertical section showing the sealing mechanism of the Fig. 6 construction;

Fig. 12 is a fragmentary horizontal section on line XII—XII of Fig. 11; and

Fig. 13 is a view taken on line 13—13 of Fig. 1 but drawn to a somewhat larger scale and showing the angular relationship between the sealing zones and the axis of the guide roller for the web material.

In the embodiment shown in Fig. 1, reference numeral **10** designates a vertical machine frame which at the top carries a guide roll **12** for the web, e. g. a web of paper **14**, from which a continuous tube **16** is to be shaped through a bending of the web to a cylindrical shape. Preferably, the guide roller **12** is adjustably secured to the frame **10** in order to render possible a correct orientation of the longitudinal joint of the shaped tube **16** relatively to the shaping, heating and compressing members which are described more fully in the following.

Provided for the shaping proper are, in the embodiment illustrated in Fig. 2, two external shaping sleeves **18** and **20**, of which the upper one **18** is in the form of a cylindrical ring split along a generatrix, one edge **22** of which is somewhat straightened or tangential, see Fig. 3, whereas the lower edge preferably is entirely cylindrical and of the diameter of the tube shaped to a completion. In order to reduce the friction during the shaping work, the sleeve **20** may suitably be somewhat turned off internally so that the engagement with the paper tube takes place only along a narrow border.

Disposed between the two shaping sleeves **18** and **20** is a heating element **24**, as shown in Fig. 5, formed with a slot **26** through which the outer overlapping border **28** of the paper web passes while being heated from both sides, whereas the inner joint border **30** rubs against that surface

of the heating element which is turned inwards, and is only heated from the outside. The slot **26** extends longitudinally of the tube axis and is co-linear, i. e. it is aligned with the tangentially extending edge portion **22** of the upper shaping element **18**. Preferably, the heating of the heating element **24** takes place electrically by means of resistance elements inserted in the same and connectable to a suitable source of current or to the supply network via terminal screws **32, 34**.

Below the heating body **24** there is provided a pressure roller **36** which, in the embodiment according to Fig. 2, is fitted in a recess **37** in the lower shaping sleeve **20**. The pressure roller **36** is mounted on a lever **38** and is subjected to an urging pressure adjustable by means of a screw **40** and a spring **42** or the like. The shaping sleeves **18, 20** as well as heating element **24** and the lever **38** are carried by a rod **44** which is secured to an attachment **46** extending from the machine frame **10**.

The attachment **46** extends inwards through the wedge shaped opening between the borders **28** and **30** of the paper web, before said borders have been brought into the overlapping position, and carries a sleeve **48** extending downwardly into the formed tube, which sleeve may serve both as an inner guide and as a carrying member for an inner counter-pressure roller **50** (Fig. 4) cooperating with the outer pressure roller **36**.

In the embodiment shown in Figs. 6 to 12, each of the shaping sleeves **18** and **20** of the embodiment above described has been replaced by a series of concavely spherical rollers **52, 54** carried by annular roller holders **56, 58**, respectively. In the upper shaping element, the two rollers **52***a* situated next to the joint opening are not symmetrical but cylindrical, or approximately cylindrical, at their ends towards the joint opening in order appropriately to shape and guide the edges of the web which do not yet entirely overlie each other. Of course it is, however, also possible, by suitably proportioning the size of the rollers, to give the rollers situated next to the joint opening an entirely cylindrical shape, in which event they are so arranged that their generatrix along which the engagement with the web takes place, coincides with the tangent to the curved generatrix along which the next adjacent concave rollers contact the web.

In the embodiment of the lower shaping element as shown in Figs. 9, 10, 11 and 12, it is suitable to provide an inner spherical pressure roller **60** convexly rounded to the curvature of the corresponding outer roller **54** to apply a sealing pressure over the entire width of the overlapped side edges of the web. The inner pressure roller **60** is carried by the sleeve **48** extending downwardly into the tube and is preferably yieldingly urged by a spring **42'**, in conformity to the outer pressure roller **36** of the embodiment previously described. Neither the pressure roller nor the counter-pressure roller is driven, but preferably both are mounted in ball bearings in order to reduce friction.

For feeding the web and later the tube through the machine there may be provided a number of driven feed rolls **62**, e. g. cooperating with abutment rollers **62'** mounted in the lower end of the depending sleeve **48**, in a manner similar to the mounting of the inner pressure roller **60** of Fig. 11 and preferably by means of ball bearings, see Fig. 1. The web **14** is drawn over the guide roller **12** and through the shaping elements by the feed rollers, and the upper shaping element is spaced a substantial distance below the guide roller to preclude heavy lateral stresses in the web as it is progressively bent from a linear to a circular cross-section. To avoid tearing or creasing of the web, the upper shaping member should be spaced from the guide roller by a distance equal to several times the width of the web, for example about eight times the width of the web as shown in Fig. 1.

Particularly in cases where the web in itself has not a sufficient elasticity or stiffness and where no brake is applied to the same to give it a tension for increasing the elasticity and the springiness, it is necessary to provide guiding means for the web between the guide roller **12** and the upper shaping element **18** of Fig. 2, the members **52, 56** of Fig. 6, respectively. This guiding means, which also serves to pre-form the web from a substantially flat surface into one which is arcuate in transverse section, may be in the form of a guide surface obtained by slitting a cylinder along a generatrix, the cylinder having the diameter of the shaped tube and a length approximately corresponding to the distance between the guide roll **12** and the upper shaping element, the cylinder being then flattened at the top to receive the web as it leaves the guide roll **12**, whereas the lower end retains its cylindrical shape. However, this guide surface need not be uninterrupted but may be provided with longitudinal recesses or even, in most cases, may be replaced by two guiding rods **64** extending from points near the borders of the web immediately below the guide roller **12** to points more distant from the borders of the bent web at a level somewhat above the upper guide **18** or **56**. For each guiding rod **64** there is provided an upper and a lower adjustable fixing device **66** and **68**, respectively, as a means of fastening the guiding rods to the machine frame and rendering possible an adjustment of their positions relatively to the web. As shown in Fig. 1, the upper fixing device **66** comprises a horizontal rod **70** extending between the upright frame members **10** which supports laterally extending fixed arms **71, 71'**. A pin **72** connected to one of the guide rods **64** is transversely adjustable in the arm **71** so as to make possible a lateral adjustment of this guide rod. In a similar manner a pin **72'** connected to the other guide rod **64** is transversely adjustable in the fixed arm **71'** so as to effect a lateral adjustment of this guide rod. The lower fixing device **68** is similarly constructed, there being a horizontal rod **73** extending between the upright frame members **10, 10'**, arms **74, 74'**, secured to rod **73** and pins **75, 75'** secured to guide rods **64** and adjustably positioned in the arms **74, 74'**.

On account of the shape which the web will assume between the guide roller **12** and the shaping elements, this web part obtains a certain stiffness which, through a relative lateral displacement of the guide roll and the shaping elements in relation to each other may be utilized to control the contact pressure between the web and the guide roller. This contributes to retain that part of the web which is being shaped in place so that the path of the longitudinal joint through the machine is determined. As is evident from Fig. 1 the tube after leaving the lower shaping element such as sleeve **20** is sealed at longitudinally spaced intervals along zones transverse to the axis of the tube, the successive seals being disposed in mutually perpendicular planes so as to establish packages having the shape of a tetrahedron. An apparatus for forming such seals is described and illustrated in my copending application Serial No. 263,357, filed December 26, 1951. The mutually perpendicular sealing zones are indicated by numerals **78** and **79** in Figs. 1 and 13, and a comparison between Fig. 13 and Figs. 1*a*–1*e* shows that the axis **12***a* of the guide roller **12** which extends between the upright frame posts **10** is disposed at an angle to each of the sealing planes for the purpose of locating the longitudinal joint of the tube intermediate the ends of each sealing zone. If, for some reason, it is desirable to relocate the longitudinal joint, this may simply be effected by swinging the guide roller in the lateral direction. Preferably, the mounting devices of the guide roller are so designed that such a swinging motion becomes possible, while in addition either of the guide roller or the shaping elements are so mounted in means, not shown, as to be displaceable in the lateral direction for bringing about the contacting pressure of the web upon the guide roller.

I claim:

1. An apparatus for shaping a tube from a continuous web of flexible sealable material and sealing the tube

along a continuous longitudinal joint comprising, an upright machine frame, a guide roller for the continuous web mounted at the upper end of said frame and in contact with that face of the web which is to form the inside surface of the tube, a pair of axially spaced shaping elements supported on said frame, said upper shaping element being spaced below said guide roller by a distance equal to at least several times the width of the web and having the form of a circumferentially split ring with one end extending tangentially to provide a guide for the outer edge of the web which overlaps the other edge below said upper shaping element thus to form the tube, said lower shaping element being of annular form with an internal diameter equal to the external diameter of the shaped tube, said web at said upper shaping element and said tube at said lower shaping element being in sliding contact with the inner surfaces of said shaping elements, means located between said upper and lower shaping elements to condition the overlapped edges of said tube for subsequent sealing together comprising a heatable body member provided with a slot extending longitudinally of the tube axis, said slot being arranged generally co-linear with said tangentially extending end of said split ring and serving as a guide means to receive the outer overlapping web edge and to effect heating of the same from both sides, the other edge of the web contacting the inner surface of said heatable body as it moves longitudinally therealong, and pressure means located at said lower shaping element for bringing the overlapped edges of said tube into contact with each other under pressure to effect the sealing thereof.

2. Apparatus as defined in claim 1 wherein each of said shaping elements comprises an arcuate array of rollers and a holder therefor, each said array of rollers establishing a continuous line of contact with the outside surface of the tube material throughout the width thereof.

3. Apparatus as defined in claim 2 wherein said pressure means comprises an inner pressure roller and one of said rollers of said lower shaping element acting as a

counter-pressure roller for bringing the overlapped edges of the tube into pressure contact with each other.

4. Apparatus as defined in claim 3 and which further includes a holder extending inwardly from the machine frame through the acutely angular opening formed between the edges of the web above said upper shaping element, and a sleeve carried by said holder and extending downwardly within the tube being formed, said sleeve supporting said inner roller.

5. Apparatus as defined in claim 1 wherein said pressure means at said lower shaping element comprises an inner pressure roller located within said tube and contacting the overlapped edges thereof and an outer counter-pressure roller located outside of said tube and contacting the overlapped edges of said tube, and which further includes a holder extending inwardly from the machine frame through the acutely angular opening formed between the edges of the web above said upper shaping element, and a sleeve carried by said holder and extending downwardly with the tube being formed, said sleeve supporting said inner pressure roller.

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