April 10, 1956 R. RAUSING 2,741,079

APPARATUS FOR CONTINUOUS PRODUCTION OF FILLED AND SEALED TETRAHEDRAL PACKAGES OF PAPER OR THE LIKE

Original Filed Sept. 28, 1945 6 Sheets-Sheet 1

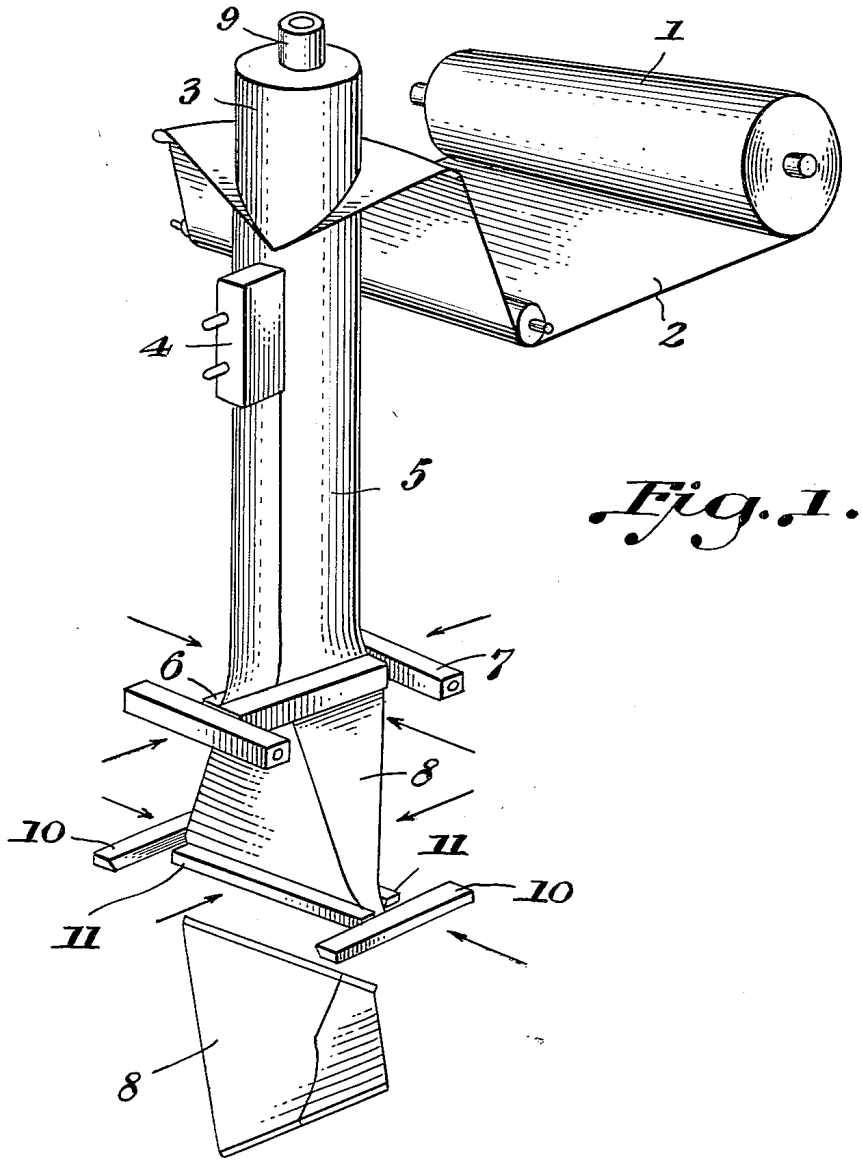

Fig. 1.

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Original Filed Sept. 28, 1945 6 Sheets-Sheet 2

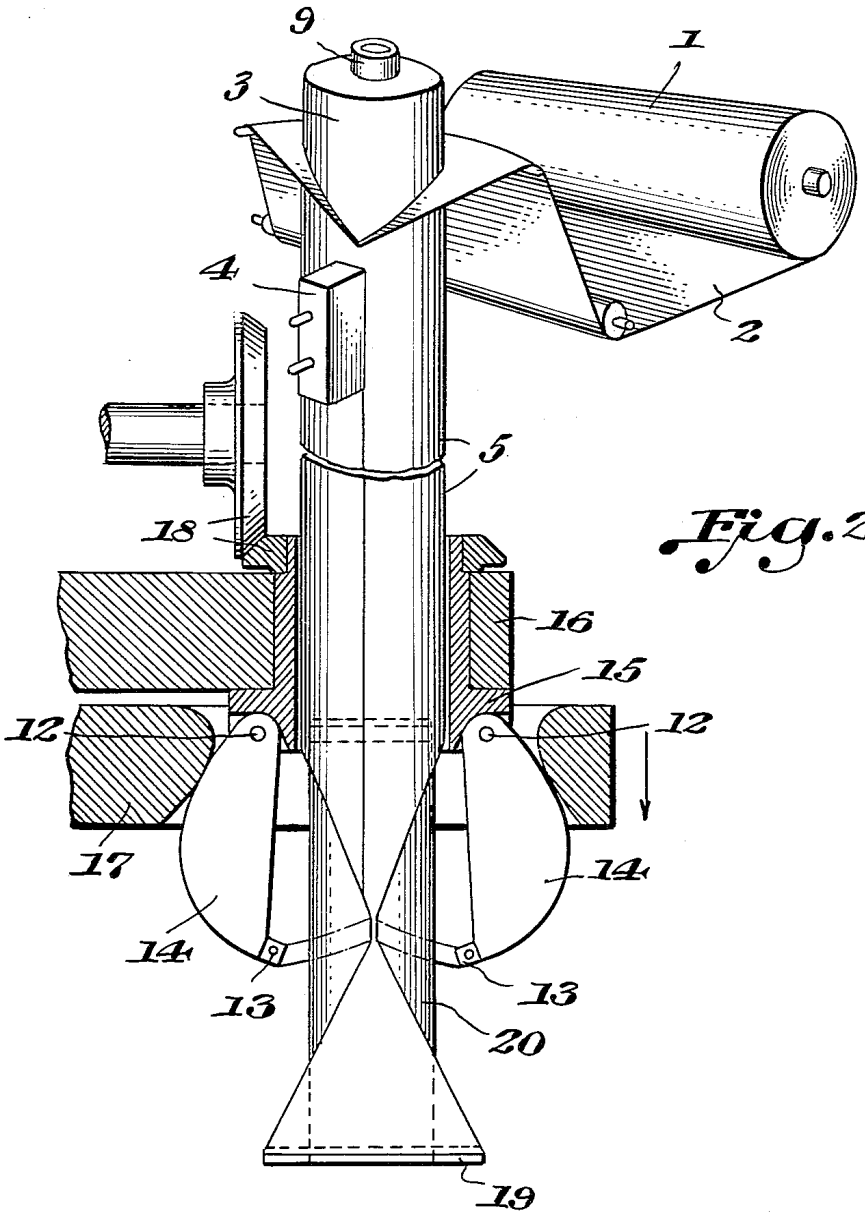

Fig. 2.

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Fig. 3.

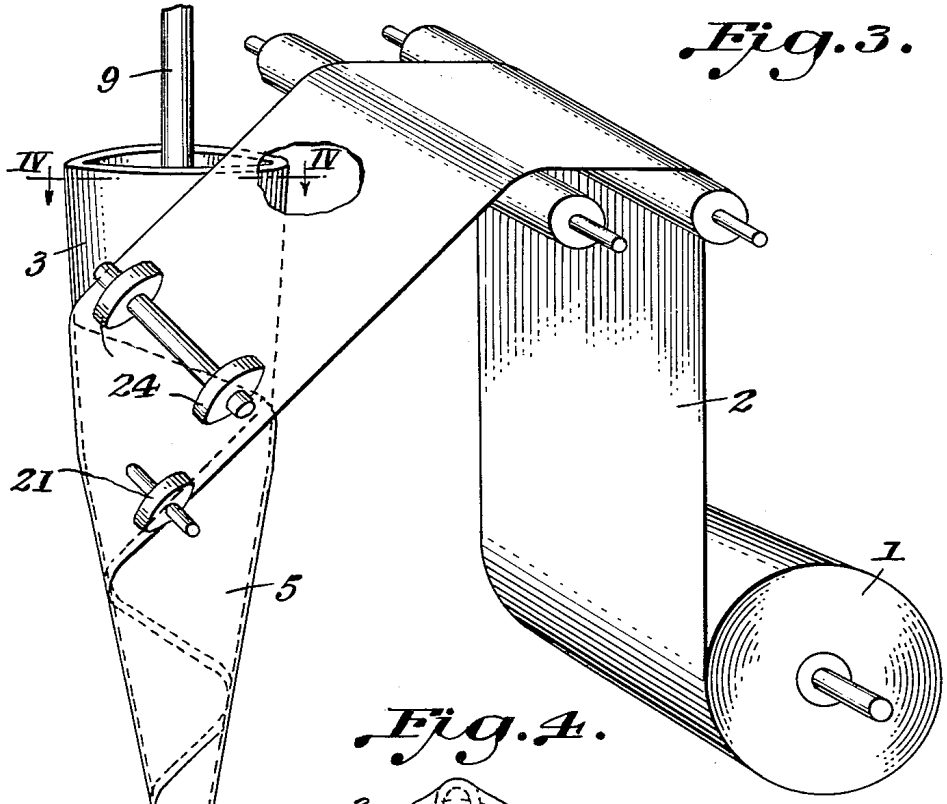
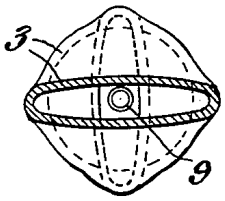
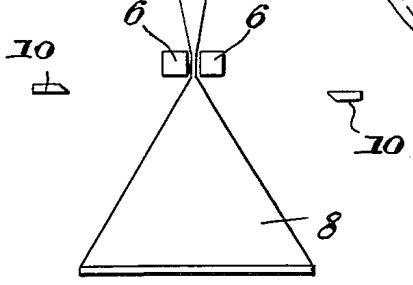


Fig. 4.





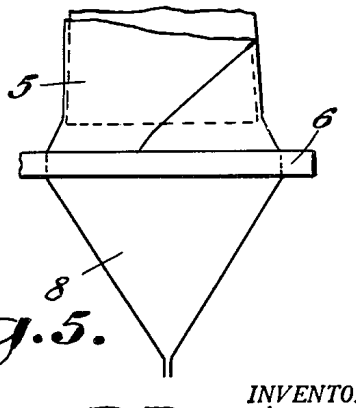


Fig. 5.

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Original Filed Sept. 28, 1945 6 Sheets-Sheet 4

Fig. 6.

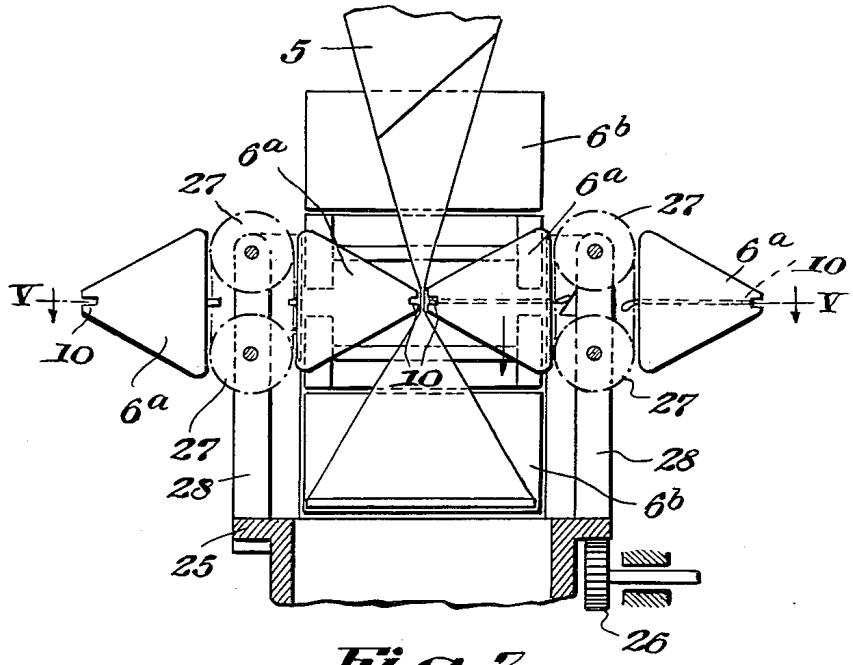
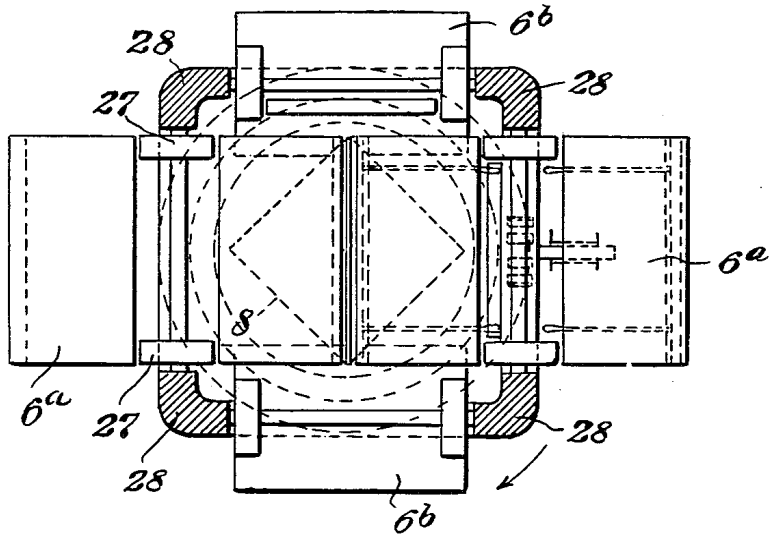


Fig. 7.



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Original Filed Sept. 28, 1945 6 Sheets-Sheet 5

Fig. 8.

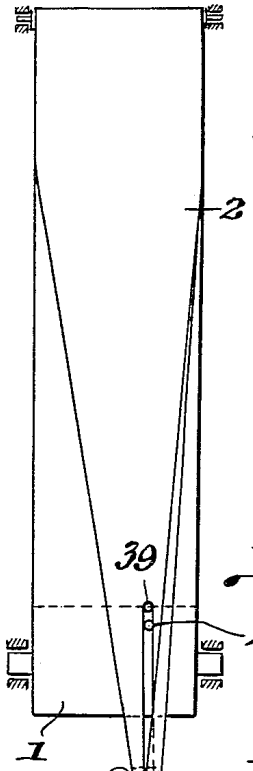
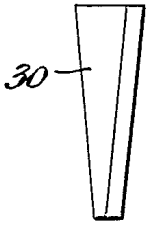


Fig. 13.



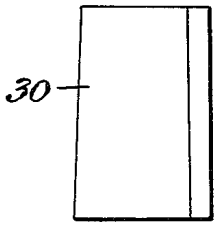
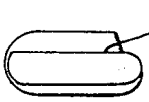


Fig. 14.



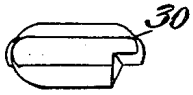


Fig. 15. Fig. 16.

Fig. 9.

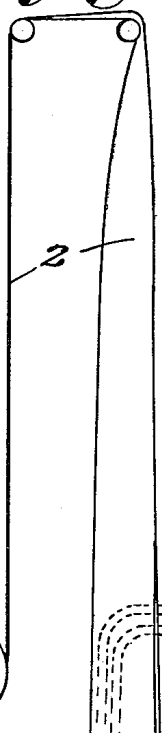


Fig. 12.

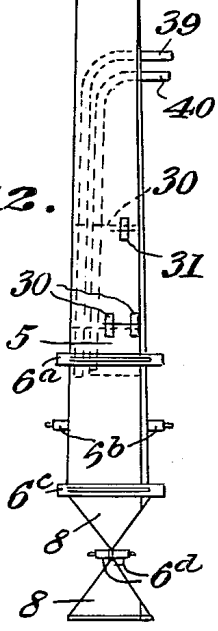
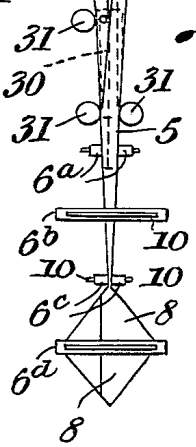
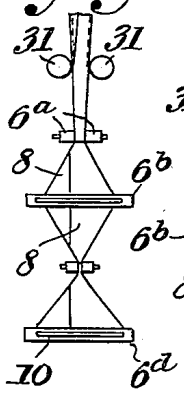
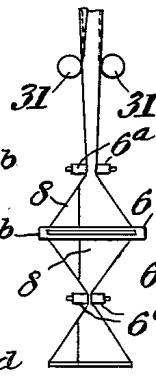


Fig. 10.







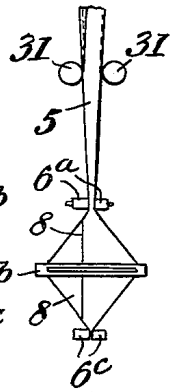


Fig. 11.

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Original Filed Sept. 28, 1945 6 Sheets-Sheet 6

Fig. 17.

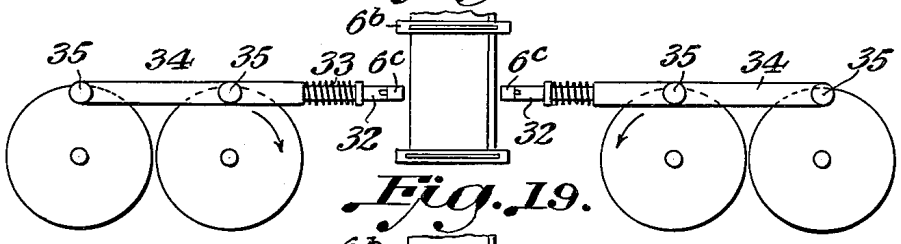


Fig. 19.

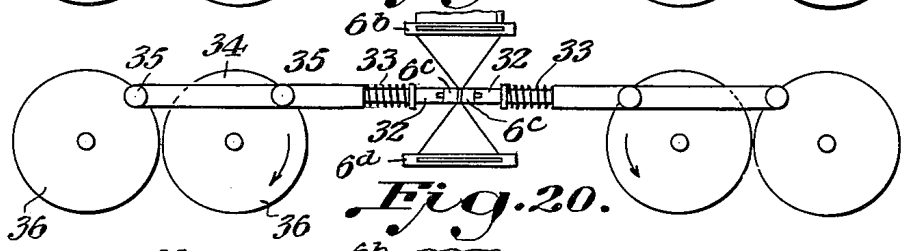


Fig. 20.

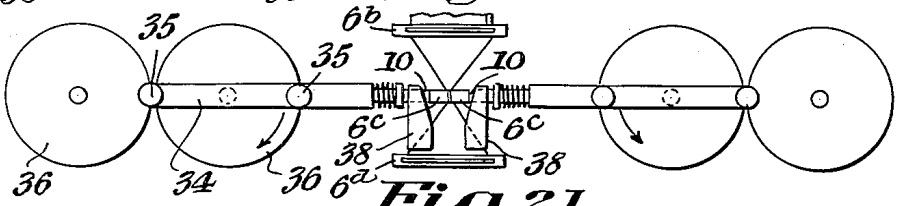


Fig. 21.

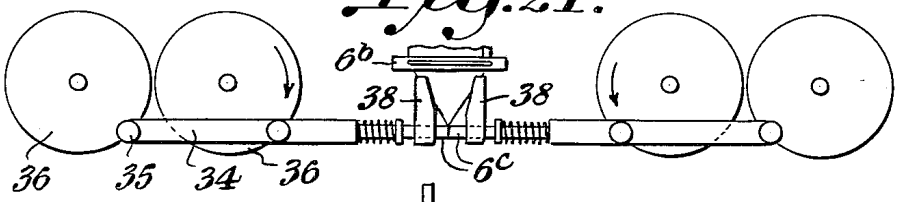
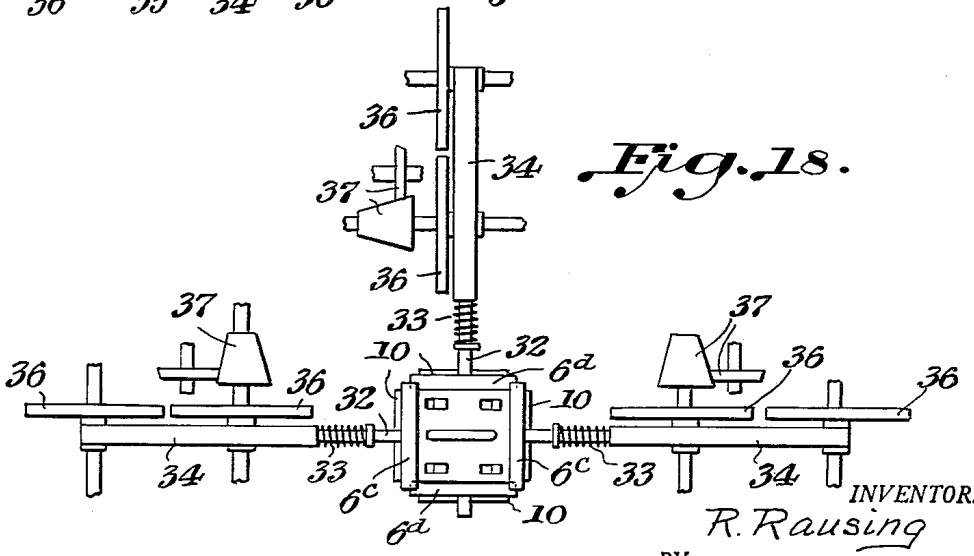


Fig. 18.



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United States Patent Office 2,741,079 Patented Apr. 10, 1956

2,741,079

APPARATUS FOR CONTINUOUS PRODUCTION OF FILLED AND SEALED TETRAHEDRAL PACKAGES OF PAPER OR THE LIKE

Ruben Rausing, Lund, Sweden, assignor to Hermorion Ltd., Toronto, Ontario, Canada, a corporation of Canada

Original application September 28, 1945, Serial No. 619,227. Divided and this application December 6, 1950, Serial No. 199,400

6 Claims. (Cl. 53—180)

This application is a division out of my copending abandoned application Serial No. 619,227, filed September 28, 1945.

It has already been proposed to produce a package of paper or the like in the form of a tetrahedron by shaping the paper or the like into the form of a hollow cylinder of appropriate ratio between length and circumference and by flattening and sealing the two ends of the cylinder in two planes at right angles to each other. Such packages in the form of approximately regular tetrahedrons of paper or the like have been found very suitable for many kinds of goods, especially fluid goods.

The present invention has for its object to provide an apparatus for continuous production of filled and sealed packages in the form of approximately regular tetrahedrons of paper or the like.

Machines are already known for producing, filling and sealing packages in the form of bags or the like of paper or the like in the following manner. A web of paper or the like fed from a roll is formed during downward movement around a tubular former into a tube with a seam formed by adhesively uniting the longitudinal edges of the web, and this tube is compressed and cut off transversely at successive places, so that each section of the tube between two such successive places forms a bag-like separate package, which by the compressions of the tube at the two said places is sealed first at the lower end and, after it has been filled through the tubular tube former, also at the top end before being separated from the tube.

One novel feature essentially and clearly distinguishing an apparatus constructed in accordance with the invention from the aforesaid known types of machines for producing, filling and sealing bag-like packages, consists in the provision of means operating to compress and seal the tube, during downward movement, alternately in the one and the other of two relatively perpendicular planes at places so spaced apart that the formed packages obtain the form of an approximately regular tetrahedron.

According to a further important feature of the invention the aforesaid means for compressing and sealing the tube in the one and the other of two relatively perpendicular planes are of such a nature as to permit the web of paper or the like to be fed onto the tube former, and the forming tube to be moved downwardly around the tube former continuously at substantially constant speed both during the successive compressions of the tube alternately in the one end and the other of two relatively perpendicular planes and during the intervals of time between the said successive compressions. One important advantage gained by this feature is that it makes possible a relatively high speed of the web of paper or the like on feeding same onto the tube former, and of the downward movement of the tube on forming it of the web around the tube former and on successively compressing it alternately in the one and the other of two relatively perpendicular planes. A further advantage gained by this feature is a relatively smooth operation of the apparatus, which is especially important in combination with a further feature of the

invention, in accordance with which the tetrahedrons during the formation of them are filled by means comprising a supply pipe for supplying a liquid to the formed tube during the continuous downward movement thereof in an amount sufficient for keeping the formed tube filled with the liquid to a level above the tetrahedrons being formed.

Further and more specific features and advantages of the invention will appear from the following description in which for a full understanding of the invention reference will be had to the accompanying drawings which more or less diagrammatically illustrate various forms of the invention.

In the drawings:

Fig. 1 is a perspective view of an apparatus for producing, filling and sealing tetrahedral packages.

Fig. 2 is a perspective view of another form of the apparatus.

Fig. 3 is a perspective view of a third form of the apparatus.

Fig. 4 is a sectional view on the line IV—IV of Fig. 3.

Fig. 5 is a side view of a detail at right angles to Fig. 3.

Figs. 6 and 7 are side and top views, respectively, partly in section, of a fourth form of the apparatus.

Figs. 8 and 9 are elevations at right angles to one another of a fifth form of the apparatus, and

Figs. 10, 11 and 12 show, in the same way as Fig. 8, parts of this apparatus in different positions for illustrating its operation.

Figs. 13 and 14 are elevations at right angles to each other of the tube former used in the form according to Figs. 8 and 9, and

Figs. 15 and 16 are lower and upper end views, respectively, of this tube former.

Figs. 17 and 18 are side and plan views, respectively, of an example of the driving mechanism for the pressing members and the severing knives in the form according to Figs. 8 and 9, and

Figs. 19, 20 and 21 show in the same way as Fig. 17 this driving mechanism in different positions for illustrating its operation.

According to the form shown in Fig. 1, a tube is formed from a web 2 of paper or the like fed from a roll 1 by forming the web around a cylindrical former 3 and by uniting the longitudinal edges of the web, e. g. by adhesion, folding or the like. When adhesion is employed, the uniting of the two longitudinal edges of the web is effected by providing them beforehand with some sort of adhesive means, whereafter they are caused to overlap one another and then subjected to compression by means of a heated roller, plate 4 or the like. After having left the former 3, the formed tube 5 is transversely flattened at vertically spaced places alternately between the one and the other of two sets of pressing members 6 and 7 working at right angles to one another. The pressing members 6 and 7, which may be driven by any suitable means, work alternately, and before every new stroke of any of the two sets of pressing members 6 and 7 the formed tube 5 is fed down a certain amount. The feeding of the formed tube may be effected at constant speed, e. g. if the pressing members in every set are adapted to move not only to and from one another in a direction at right angles to the longitudinal direction of the tube but also to reciprocate in this last-mentioned direction in such a way that they will, on every stroke, follow the tube for the short period of time during which they compress the tube between them, and thereafter return to their starting position. By means of the two sets of pressing members 6 and 7 the tube is flattened transversely at successive places alternately in the one and the other of two relatively perpendicular planes, and the space between these successive places is such that, as a result of the compressions, every section between two

such successive flattenings of the tube assumes the form of an approximately regular tetrahedron 8. At every place where the tube is flattened by any of the two sets of pressing members 6 and 7 it is secured in this flattened condition, e. g. by the fastening together of the contiguous flattened walls of the tube by adhesives or the like. This fastening together may be effected by the compression, if the web of paper is beforehand provided with transverse adhesive stripes or the like on the interior of the tube at those places where the tube is to be flattened. For facilitating the flattening and sealing process, the pressing members may be adapted to be heated. Every tetrahedron 8 forms an individual package, which, after it has been pressed by means of one of the sets of pressing members 6 and 7 and thereby sealed at its lower end, is filled in the known manner through a filling tube 9 extending through the tubular former 3, before it is sealed also at the upper end by a subsequent flattening of the tube by means of the other set of pressing members. After the package has been sealed first at one end, filled and thereafter sealed at the other end, it is cut off at the last-mentioned end from the tube 5 by means of a cutting device comprising knives 10 and 11 adapted to work in the same manner as the pressing members 6 and 7 and in relatively perpendicular directions. The two pairs of severing knives work alternately with one another. A filled and separated tetrahedral package 8 is shown at the bottom of Fig. 1.

According to the form shown in Fig. 2, the successive compressions of the tube 5 at relatively spaced places alternately in the one and the other of two relatively perpendicular planes is effected by means of one and the same set of coacting pressing members 13, which for this purpose are rotated through 90° in one direction or the other about the former 3, and consequently about the tube 5, before every new stroke. According to the form shown, the pressing members 13 are mounted on arms 14 pivoted at 12 to a sleeve 15, which is in turn rotatably mounted about the former 3 and the formed tube 5 in a frame part 16. The pressing members 13 are actuated by means of a ring 17 movable up and down and coacting with the pivoted arms 14. Before every new stroke of the pressing members the sleeve 15 carrying the pressing members 13 is rotated through 90° in one direction or the other about the tube 5 by means of a suitable driving means comprising, for instance, a bevel gear 18. The cutting off of every tetrahedral package from the tube 5 after the package has first been sealed at one end and filled through the filling tube 9 extending through the tubular former 3 and thereafter sealed also at the other end, may be effected by means of a single pair of coacting severing knives 19, which may be carried by supports 20 which depend from the sleeve 15 and together with the latter rotate 90° about the tube 5 before cutting off every new filled and finished package from the tube 5.

In the form according to Fig. 3, the web of paper 2 coming from the roll 1 is fed obliquely onto the former 3 and is wound helically about the latter, so that the seam of the formed tube 5 is helical. The compression of the helical adhesive seam of the tube 5 is effected by means of a roller 21. The former 3 has the form of a cylinder gradually flattened from its middle in relatively perpendicular planes towards its opposite ends. Possibly, this cylinder need be gradually flattened from about its middle towards but one end, to wit, the lower end where the formed tube 5 leaves the former. As a result of the flattening of the former 3 towards this end, the tube 5 will assume a correspondingly flattened form where it leaves the former. This initial flattening of the tube 5 already by the action of the former 3 facilitates the subsequent complete flattening or compression of the tube transversely by means of the pressing members 6. The possible flattening of the former from about its middle gradually towards the upper end in a plane perpendicular to the plane in which the former is gradually flattened from its middle towards the lower end, has for its object to permit the tube to form at will on the upper part of the former under the action of the tensions arising therein. The formed tube 5 rotates about the stationary former 3 during its downward movement along the same, and this rotation of the tube is so adjusted in relation to the axial feeding movement of the tube that the rotation amounts to 90° per every axial feeding distance corresponding to the distance between two successive flattenings of the tube in relatively perpendicular planes. For the successive flattenings of the tube, but one single set of pressing members movable to and from one another is required by these pressing members being adapted to partake in the feeding movement of the tube as well as the rotation of the tube during the flattening of the same. The feeding of the web 2 and the formed tube 5 may be effected by means of suitable feeding rollers 24. The feeding may be facilitated and possibly effected wholly by means of the pressing members 6 and the severing knives 10 which latter are adapted, on the cutting off of the finished package 8, to partake in the axial feeding movement and rotation of the tube. Preferably the arrangement may be made in such a way that the pressing members 6, as well as the severing knives 10, are actuated positively by means of suitable driving and guiding means, so that, for every package produced, they are carried from an upper end position down to a lower end position and at the same time rotated through 90°, and then returned to the upper end position during rotation through 90° in the same or opposite direction. During the former part of the downward stroke corresponding to a rotation of 45°, the pressing members engage the tube 5 and impart a feeding movement thereto, while the feeding of the tube during the latter part of the downward stroke is undertaken by the severing knives 10 or by special clamping means combined therewith.

Many modifications are conceivable. For instance, it is possible to make the arrangement such that the former is rotated in the formed tube through 90° for every package produced instead of the formed tube being rotated about the former, as described above. It is possible to use the downwardly gradually flattened form of the former and thereby attain the intended advantage also in case the tube is formed with a longitudinal instead of a helical seam.

The sealing or securing of the tube in the flattened condition at those places where it is transversely flattened may be performed in many different ways, e. g. by adhesion, folding, etc. If the material of which the packages are made is impregnated or coated with thermoplastic material of some suitable kind, the securing or sealing may be effected by using heated pressing members for performing the flattening of the tube.

In the form according to Figs. 6 and 7, the tube 5 is produced in the same way as in the preceding form, but for flattening the tube at successive places alternately in the one and the other of two perpendicular planes for forming the tetrahedral containers, two sets of coacting pressing members *6a* and *6b*, respectively, working in two relatively perpendicular planes are employed, which are mounted on a rotatable support 25 rotated by means of a cog-wheel 26 or the like at the same speed as the tube 5 leaving its former. The pressing members thus partake in the rotation of the tube, and they are operated by being secured to endless chains or the like running over suitably driven rollers 27 journalled in suitable bearings 28 projecting upwardly from the support 25. Thus it will be seen that as the endless chains travel around their upper and lower spaced rollers 27, the pairs of cooperating pressing members will be caused to first move into engagement with the opposite sides of the tube to press the same inwardly until the seal is formed and then after travelling for some distance longitudinally of the tube axis to move away from the tube. Moreover, it will be self-evident from Figs. 6 and 7 that

each pair of pressing members *6a* will maintain engagement with the tube until the following pair of pressing members *6b* engage the tube thereby maintaining a continuous feed of the tube. The severing knives **10** are in this case movably arranged in the pressing members *6a*, *6b* and adapted to be actuated by abutments or the like at the right moment for separating the filled and sealed tetrahedron **8** from the tube **5**.

In the form according to Figs. 8–21, the web of paper **2** coming from the roll **1** is formed into a tube with longitudinal adhesive seam over a stationary former **30** of bent sheet metal of the construction shown on a larger scale in Figs. 13–16. For guiding the paper, in the forming of it into a tube over the former, and for pressing the longitudinal adhesive seam of the tube, suitable rollers **31** are provided. As will be apparent from the drawing, the former **30** is so shaped that the tube **5** formed on the same is flat where it leaves the former. The most distinguishing feature in the form according to Figs. 8–21 as compared with the preceding forms is that the flat tube **5** leaving the former, just as the stationary former, does not rotate about its axis, and that the tetrahedrons **8** are formed and filled two at a time. It is hereby possible to effect the flattenings of the tube at successive places alternately in the one and the other of two relatively perpendicular planes by means of pressing members which are not rotated about the axis of the tube. According to the form shown, an even number of sets of pressing members *6a*, *6b*, *6c*, *6d* are employed, working alternately in one and the other of two relatively perpendicular planes. Each set of pressing members is so arranged that, while the pressing members approach one another and compress the tube between them, they partake in the downward movement of the tube until the flattening is completed, and then move away from one another and at the same time return to the position they were occupying at the beginning of the cycle. In Fig. 8, the sets of pressing members *6a* and *6b* are on the point of starting to flatten the tube between them in one of two relatively perpendicular planes each, while the sets of pressing members *6c* and *6d* have just completed the flattening of the tube in one of two relatively perpendicular planes each, so that two substantially regular tetrahedral packages **8** are formed from the tube. In Fig. 10, all the pressing members have moved down a distance together with the tube, and during this downward movement the pressing members *6a* and *6b* have begun to flatten the tube and thereby to form two new tetrahedral packages **8**, while the package **8** shown at the foot of Fig. 8 has already been cut off. As in the form according to Figs. 6 and 7, the severing knives **10** cutting off the filled and sealed packages from the tube, are arranged in the pressing members and adapted to be actuated by means of abutments or the like at the right moments. Figs. 17–21 show an example of a driving mechanism for the pressing members and the severing knives. Each pressing member in each set of pressing members is mounted on a bar **32**, which is arranged in a bar **34** so as to be displaceable against the action of a spring **33**. This bar **34** receives a circling parallel movement by being mounted on crank pins **35** on a pair of crank discs **36**, which may be driven at variable speed, e. g. by means of a friction gear with conical friction rollers **37**. Fixed abutments or cams **38** (Figs. 20 and 21) are provided to actuate the severing knives **10** at the right moment.

The form of the invention illustrated in Figs. 8–21 is especially adapted for packing milk or other liquid. The liquid is supplied, as shown in Figs. 8 and 9, through a pipe **39** to the tube **5** formed over the former **30**, and the supply of liquid to the tube is controlled by means of a float valve or in any other suitable manner, so that the formed tube will be constantly filled with liquid up to a level which is permitted to fluctuate within certain limits. In this manner the tetrahedrons are completely filled as they are formed. It will be understood that the tetrahedral package formed and sealed is hereby a measure of the liquid goods packed therein. This manner of automatically filling the tetrahedral packages as they are formed may be used also in the other forms of the invention.

What I claim and desire to secure by Letters Patent is:

1. In a machine of the class described, the combination comprising a tube former for continuously forming a tube of flexible material, means for continuously forming in said tube a column of liquid to be packaged, a first pair of travelling means carrying at least one pair of cooperating sealing means for sealing said tube below said former and below the top level of said liquid column transversely to the longitudinal axis of said tube, a second pair of travelling means carrying a pair of cooperating sealing means for sealing said tube below said former and below the top level of said liquid column transversely to the longitudinal axis of said tube, said pairs of cooperating sealing means being so located on their respective travelling means as to engage opposite sides of the tube to effect successive equidistant sealings in alternate planes at right angles to each other, and means for driving said travelling means longitudinally of the tube in a path of sufficient length to cause said pair of cooperating sealing means carried by said first travelling means to maintain engagement with the tube until said pair of cooperating sealing means carried by said second pair of travelling means engage the tube thereby to effect continuous feeding of the tube.

2. A machine as defined in claim 1, wherein said tube former includes means for continuously forming a helically wound tube rotating about said former, and which further includes means mounting said first and second pairs of travelling means for rotation about the axis of said helically wound tube at the rotational speed of said tube.

3. A machine as defined in claim 1, wherein said first and second pairs of travelling means each carry a plurality of pairs of cooperating sealing means, and wherein a pair of cooperating sealing means on each pair of travelling means engage and compress said tube simultaneously in directions at right angles to each other.

4. A machine as defined in claim 1, wherein said first and second pairs of travelling means are constituted by endless chains and said cooperating sealing means are constituted by pressing members mounted on said chains.

5. A machine as defined in claim 1, wherein each of said first and second pairs of travelling means are constituted by a pair of crank pins mounted respectively on discs located on opposite sides of said tube, said sealing means being mounted on said crank pins, and means for rotating said discs and hence said crank pins so as to cause said sealing means to move towards and away from and also longitudinally of said tube.

6. A machine as defined in claim 1 wherein the distance between successive sealings as measured along the axis of said tube is such as to form substantially regular tetrahedrons.

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