March 27, 1962 W. S. SCHNEIDER ET AL 3,026,658

PACKAGING MACHINE

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FIG. 1.

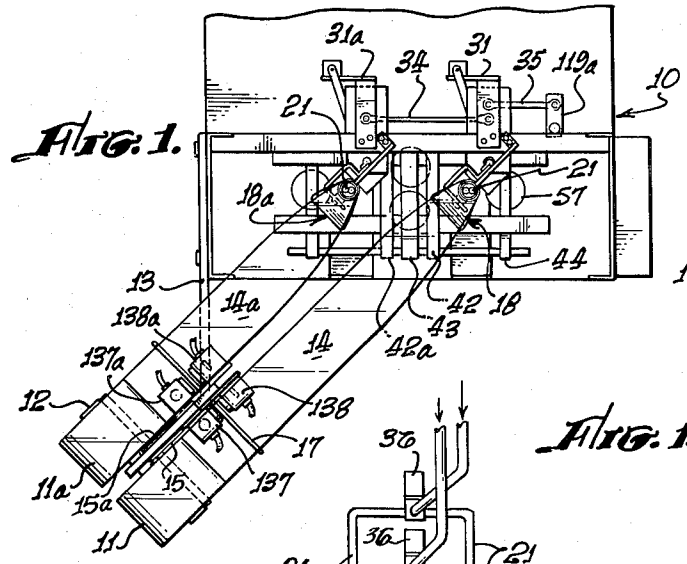


FIG. 13.

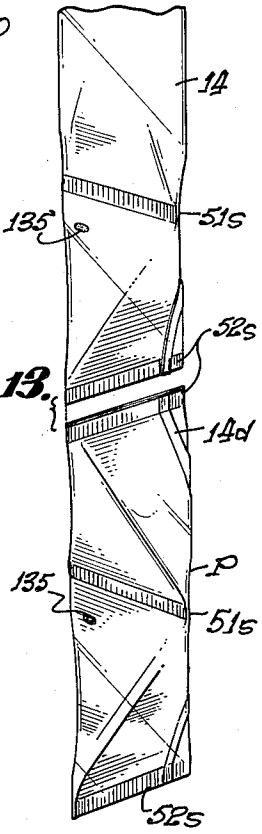
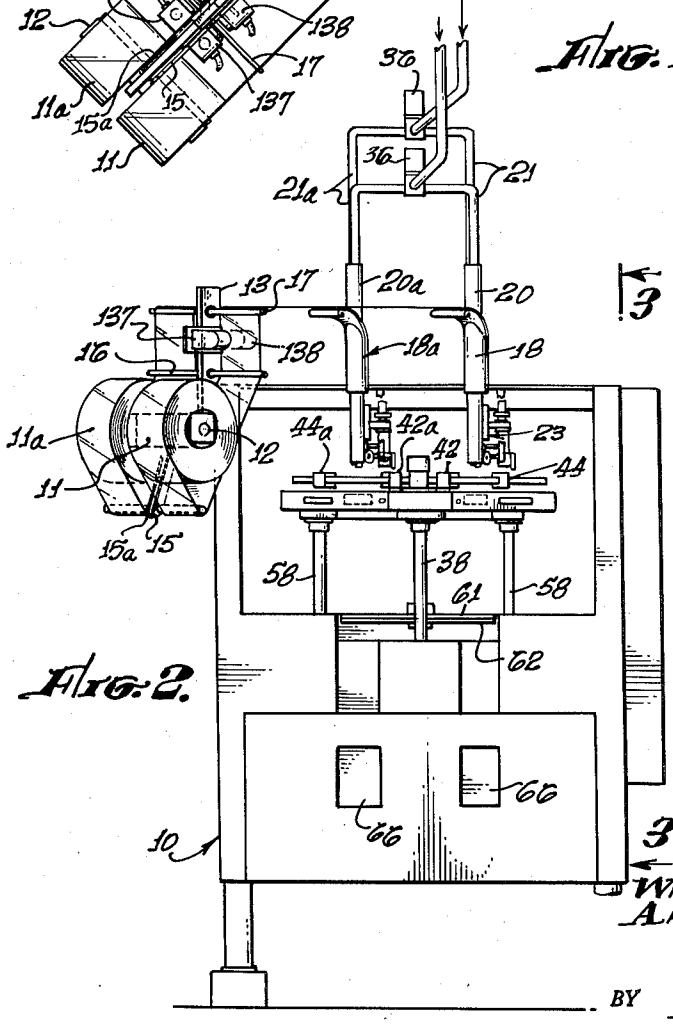


FIG. 2.



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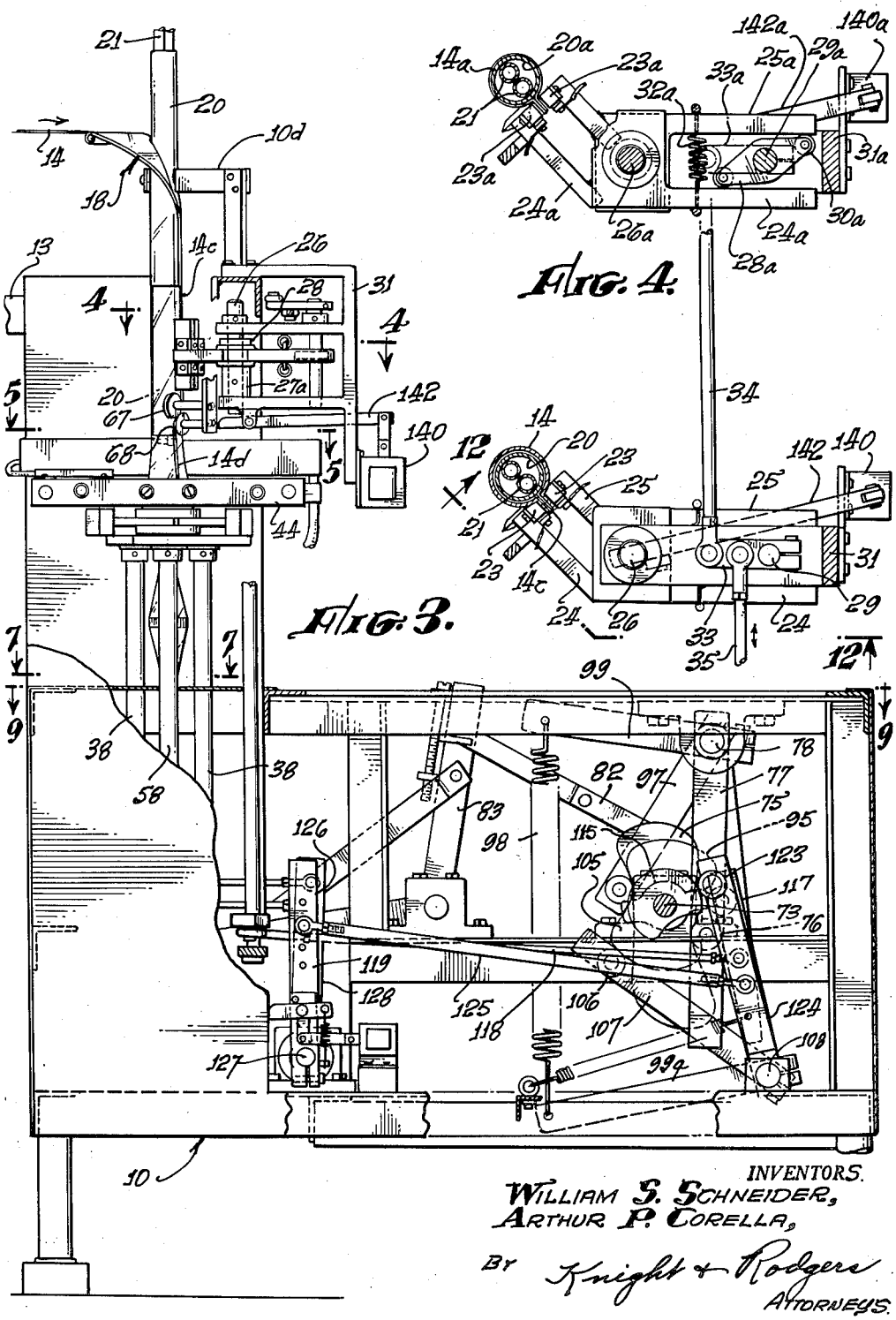


FIG. 4.

FIG. 3.

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PACKAGING MACHINE

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FIG. 5.

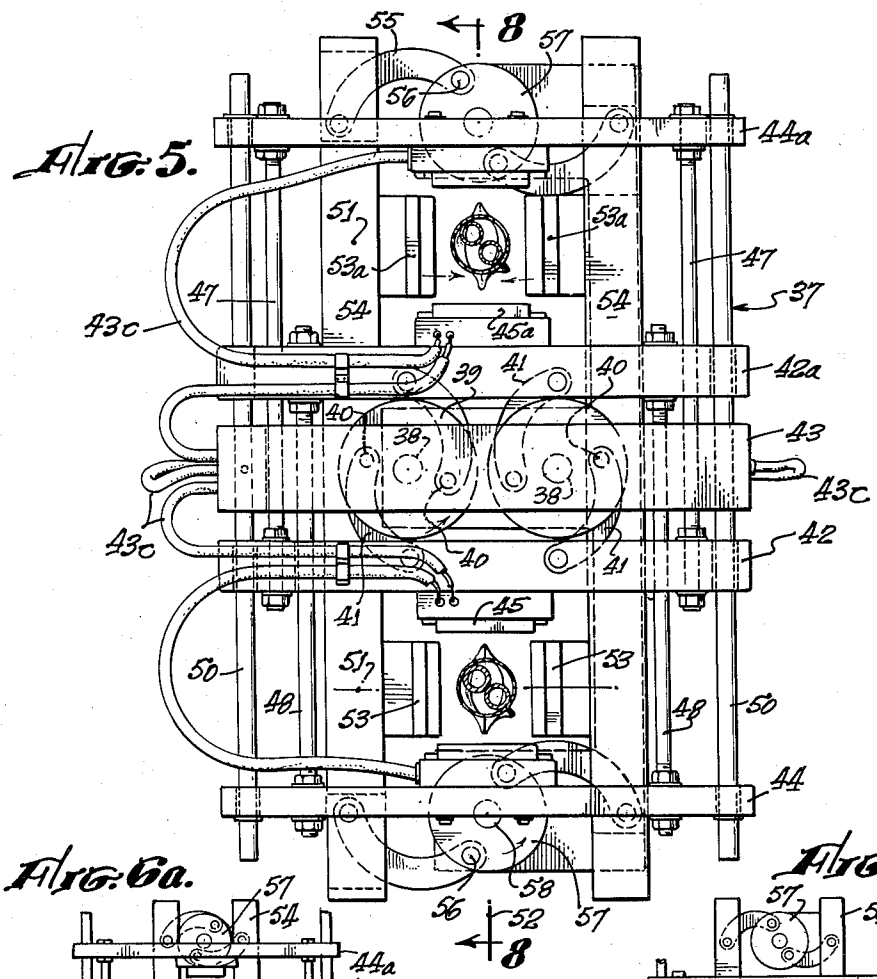


FIG. 6a.

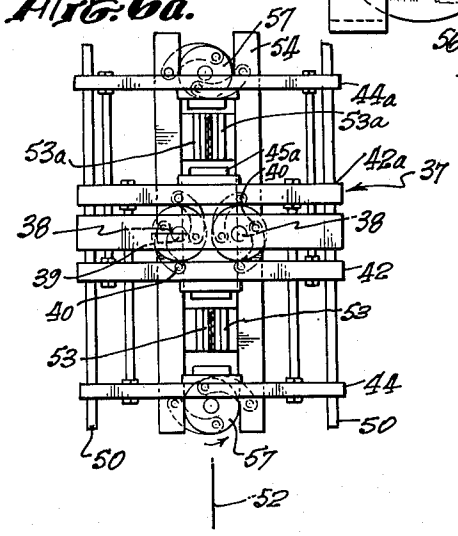
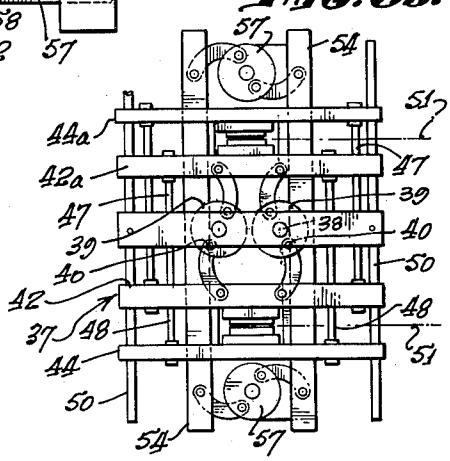


FIG. 6b.



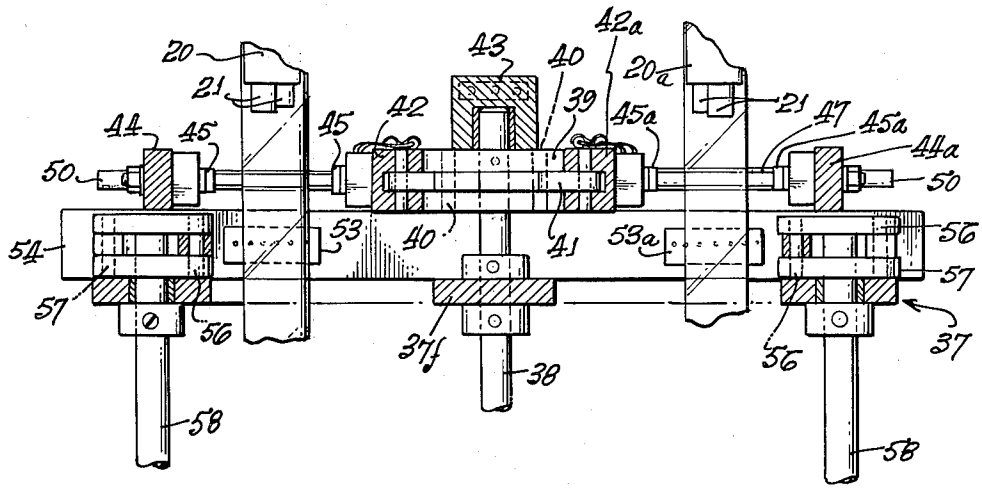
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PACKAGING MACHINE

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FIG. 8.



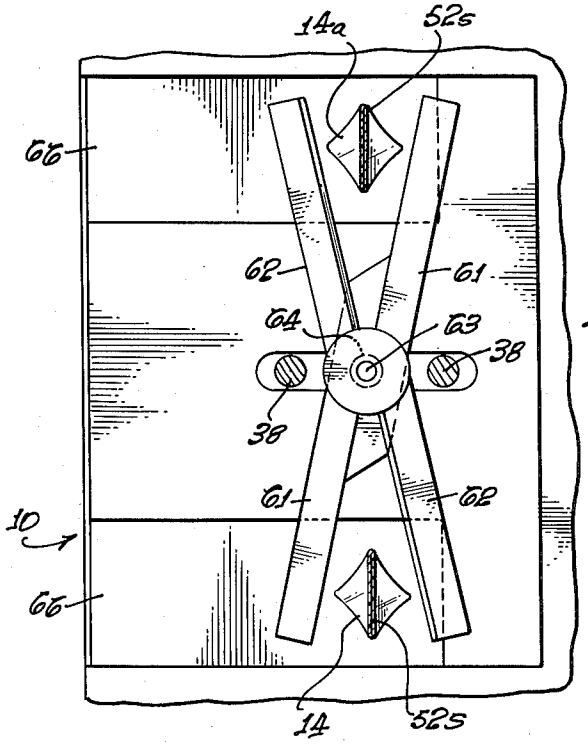


FIG. 7.

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PACKAGING MACHINE

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FIG. 9.

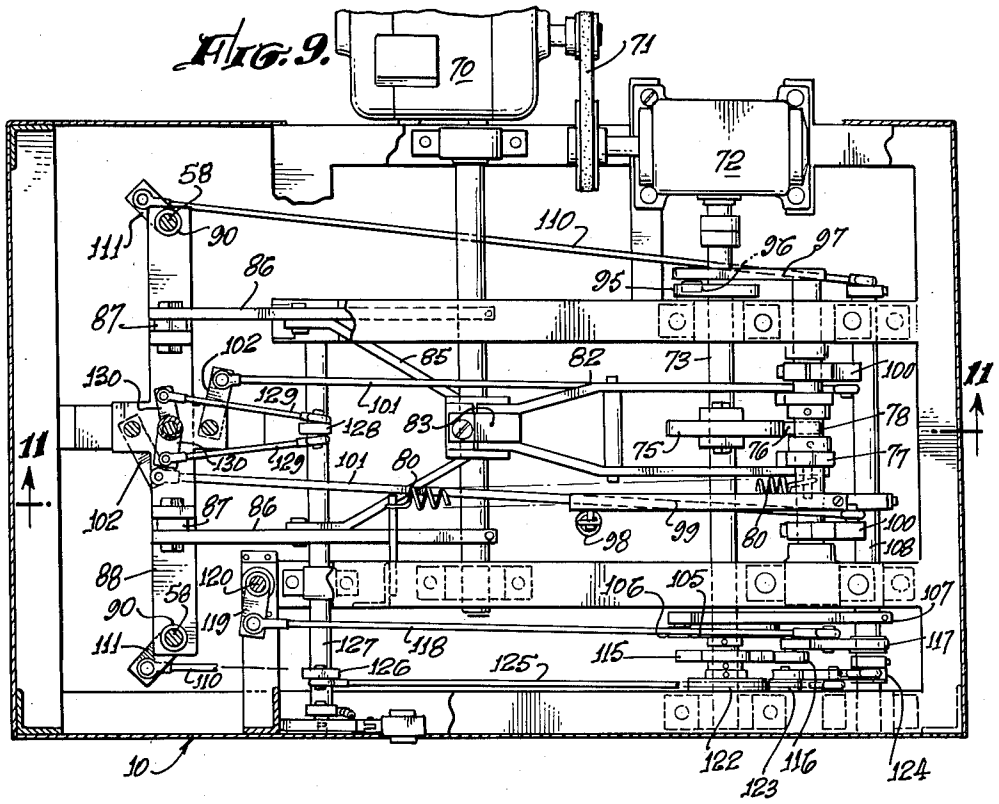
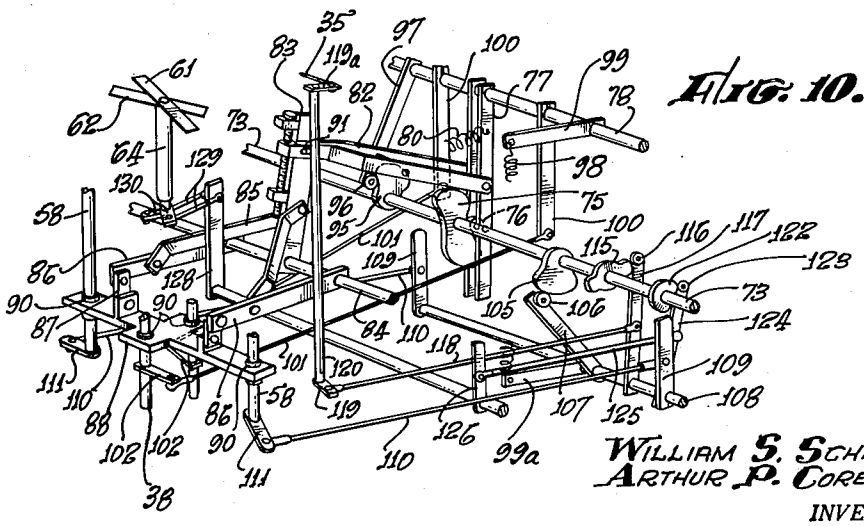


FIG. 10.



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PACKAGING MACHINE

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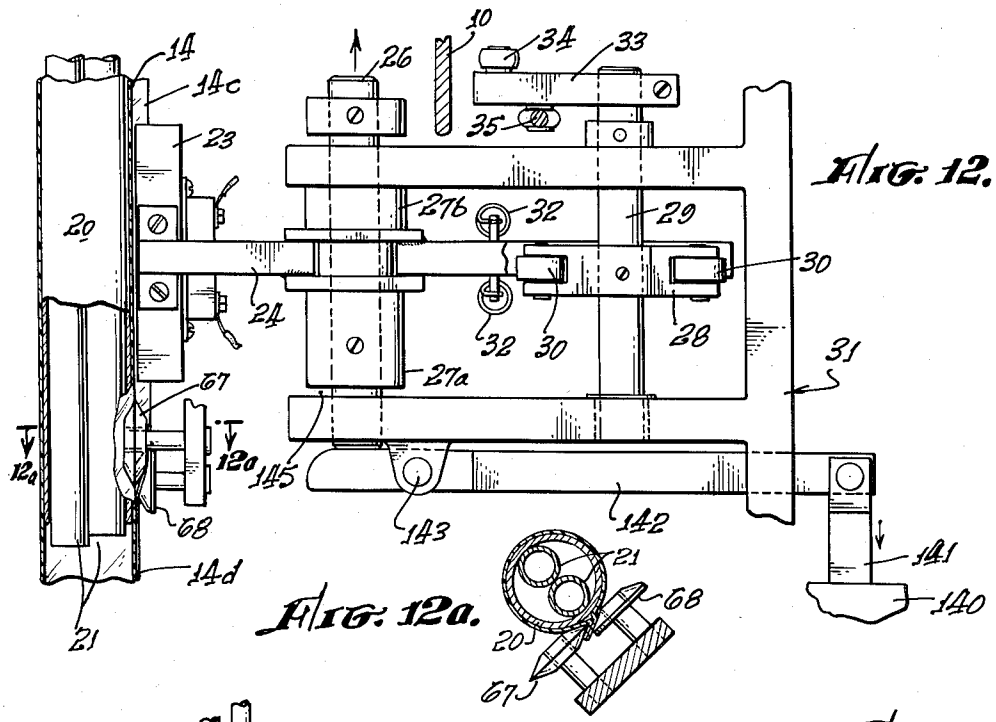


FIG. 12.

FIG. 12a.

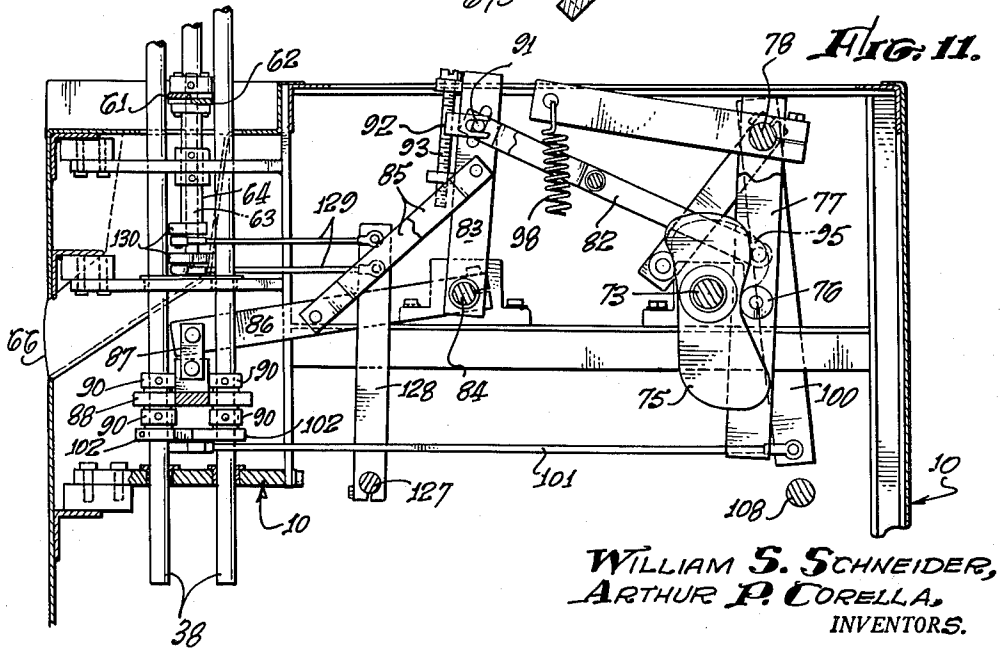


FIG. 11.

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United States Patent Office 3,026,658
Patented Mar. 27, 1962

3,026,658
PACKAGING MACHINE

William S. Schneider, Glendale, and Arthur P. Corella, North Hollywood, Calif., assignors to Packaging Frontiers Inc., Boston, Mass., a corporation of Delaware

Filed Feb. 18, 1959, Ser. No. 794,007
32 Claims. (Cl. 53—28)

The present invention relates generally to packaging machines, and more particularly to a machine for producing from a continuous web of sheet material filled packages which have the shape of a tetrahedron. As will be explained, there are various advantages in the package of this configuration and accordingly in a preferred embodiment the packaging machine is designed to produce packages in the shape of a tetrahedron. However, it will also be understood that in some of its broader aspects, the invention is not necessarily limited to a machine producing packages of this shape.

Packaging machines of this general character have been designed to form, fill, and, finally, to close the packages by sealing them, starting with paper or other sheet materials in a flat form. The web of sheet material is drawn from a roll and is first shaped around a filling mandrel into a tubular shape. The longitudinal edges of the web are sealed together in a suitable manner to produce a continuous tube which is filled with suitable charges of materials through the mandrel. This tube is next compressed and sealed at areas extending transversely across the tube and located at successive spaced positions along the tube which is then cut off within areas where the tube is compressed and sealed. When two successive seals are in a common plane and they define the two ends of a package, the package is relatively flat and shaped somewhat like a cushion or pillow. If the two seals at the ends of the package are located in mutually perpendicular planes, the package thus formed has the shape of a tetrahedron.

Known designs of machines for producing this latter type of package have various shortcomings from a practical or commercial viewpoint. For example, they do not have sufficient flexibility to be designed to produce packages of different lengths so that packages of different capacities can be produced on the same machine.

Another difficulty is found in known machines incorporating pairs of reciprocating heated sealing heads that place transverse seals on two separate webs to produce two packages simultaneously, which machines are designed to reciprocate these respective pairs of heads over independently produced paths that may be independently controlled in response to an electric eye at each web. On several types of machines one pair of heads is moving upward while the other pair of heads is moving downward. These independent non-identical paths require duplication of many costly parts that add to the weight of the reciprocating assemblies. This added weight prevents higher speed operation and a corresponding higher rate of packaging.

Thus it becomes a general object of the invention to provide a low cost machine of minimum parts wherein a common carriage reciprocates all the transverse sealing heads for multiple webs over identical paths.

Another object is to provide means indepedent of the reciprocating transverse sealing means to correct the rate of feed individually of each one of two or more webs in order to insure that printing on each web is properly positioned on the finished package.

Another object of this invention is to provide a simple, efficient arrangement of transverse sealing heads to produce the two successive 90° transverse seals on the package. The placement of one pair of transverse sealing heads above the other on a unitary reciprocating carriage permits easy mechanical activation of both pairs without the interference that exists when both pairs are in the same plane.

Previous tetrahedron producing machines formed a flat sheet into a tube with a longitudinal seam by overlapping the edges of the web. This prevents the use of the vast majority of standard laminations of web material that are heat sealable on one side only. Another object is therefore to provide a machine that forms a flat longitudinal seam from a web of stock that is heat sealable on one side only.

Previous tetrahedron producing machines have formed their transverse seals by sealing through the contents of the package. They were therefore unable to package the many liquids, pastes, and powders that cannot be sealed through satisfactorily. One of the objects of this invention therefore is to provide a machine that produces a package containing a maximum volume of product per square inch of web in the package without contaminating the seal areas.

It would be very desirable in a transparent tetrahedron package containing powders, creams, liquids, etc. to print on the web a graduated scale in grams, ounces, or other units, to indicate the amount of product remaining after the package is partly emptied. It is therefore another object of this invention to provide a tetrahedron forming machine that intermittently feeds these products which cannot be sealed through into a tube formed from printed web material with the printing positioned in relation to the end seals and liquid level.

Another object is to provide a machine for producing filled tetrahedral packages from a continuous web of sheet stock, the machine being designed to vary the spacing between successive transverse seals.

A further object of the present invention is to produce a novel machine of this character in which successive packages may be of different lengths while alternate packages are of the same length, whereby two different substances can be packaged in different quantities at the same time by one machine, and by leaving two successive packages connected together, these two substances are associated with each other in a single ultimate package having dual compartments.

These and other objects have been attained in a machine constructed according to our invention for producing filled tetrahedral packages from each one of a plurality of continuous webs of sheet material. Two mandrels are arranged side-by-side with their longitudinal axes upright and parallel, there being forming means at each mandrel to receive and shape one web about the mandrel into a tubular shape. Each mandrel has two separate filling ducts. Side sealing means is provided at each mandrel for sealing together the longitudinal edges of the associated web to complete formation of the web into a tube prior to withdrawal from the lower end of the mandrel. The forming means is preferably one that brings marginal areas along the longitudinal edges of the web together in face-to-face relation producing a seal that extends outwardly from the tube. This longitudinal seal is then folded over against the tube prior to forming the transverse seals at the ends of the package.

Transverse sealing means is provided for compressing and sealing together the walls of each tube at areas that extend transversely across the tube and are spaced along the length of the tube to form between each two seals a complete package. The sealing means for each tube includes two pairs of sealing heads, one pair spaced above the other. The sealing heads for both tubes are mounted upon a single vertically reciprocating carriage which moves all of the pairs of sealing means simultaneously over reciprocating paths of the same length and character.

Suitable driving means are provided for vertically reciprocating the carriage and includes means to raise the carriage different distances on successive strokes to compensate for the difference in elevation on the carriage of the two pairs of heads for each tube. The drive means also includes means for operating the sealing heads and other elements of the machine in timed relation with each other.

Our invention also includes a novel method of controlling the feed of the web not only to control the length of packages formed but to insure that indicia printed on the web appear at a predetermined position on the packages. Broadly speaking, the web is withdrawn in lengths differing by a constant amount from the distance between indicia appearing at regular intervals, and then the leading end of each web is re-positioned periodically by means other than the means withdrawing the web. Preferably, the web is withdrawn in lengths longer than required and the leading end is then periodically retracted.

This action not only controls the length of the package as such, but keeps indicia properly positioned relative to the transverse sealing means to appear at a predetermined position on each completed package. In conjunction with this step, a measured amount of product is discharged into each tube segment, establishing a desired degree of cooperation between positioning of the web and measuring the contents to make practical graduations on the package indicating the amount of the contents in the package when less than full.

The machine includes means for producing a limited corrective travel of one web independent of the other web whereby the amount of web being fed through each channel can be independently corrected as may be required to insure proper position of printing on the final package. Such means is conveniently and preferably incorporated in the side sealing means and is operated in response to an electric eye which is controlled by the position of indicia on the web to move the web axially of the associated mandrel.

How the above objects and advantages of our invention, as well as others not particularly referred to herein are attained, will be better understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a fragmentary plan view of a packaging machine constructed according to the invention showing the web feed and the several sealing means.

FIG. 2 is a front elevation of the packaging machine illustrating the part of the machine shown in FIG. 1.

FIG. 3 is a side elevation of the entire machine with the side cover plate partly broken away.

FIG. 4 is an enlarged fragmentary section on line 4—4 of FIG. 3 illustrating the means for making the longitudinal seals.

FIG. 5 is an enlarged fragmentary plan on line 5—5 of FIG. 3 of the means for making the transverse seals.

FIGS. 6*a* and 6*b* are views similar to FIG. 5 but at reduced scale showing alternate sealing positions of the sealing heads.

FIG. 7 is an enlarged fragmentary section on line 7—7 of FIG. 3 showing the cutters for severing completed packages from the webs.

FIG. 8 is a vertical section on line 8—8 of FIG. 5.

FIG. 9 is a combination plan and section on line 9—9 of FIG. 3 illustrating the entire driving means.

FIG. 10 is a fragmentary perspective view illustrating the various cams and connecting linkages of the driving means which is seen in FIGS. 3 and 9.

FIG. 11 is a fragmentary vertical section through the driving means on line 11—11 of FIG. 9.

FIG. 12 is an enlarged fragmentary section and side elevation of the means for making a longitudinal seal taken on line 12—12 in FIG. 4.

FIG. 12*a* is a fragmentary plan and section on line 12*a*—12*a* of FIG. 12.

FIG. 13 is a perspective view illustrating the packages formed by the machine.

Referring now to the drawing, there is shown in FIGS. 1, 2, and 3 an open framework, indicated generally at **10**, upon which the various components of the machine are supported directly or by means of suitable brackets, bearings, etc. Frame **10** may be of any suitable construction and shape to provide a stationary supporting member at the various positions required by the operating mechanisms which are later described.

At the front side of frame **10** there are two rolls **11** and **11***a* of sheet material which are unrolled individually to provide webs from which the packages are formed. These two rolls are mounted on a common axle **12** supported by bracket **13** attached to the frame. The two webs **14** and **14***a* may be made of material of any suitable character or type; but in order to disclose fully the advantages of a packaging machine according to the invention, both webs may be assumed to be sheet material that is heat-sealable on one side only. This type of material is not necessarily limitative upon the machine since it may likewise be used with materials that are heat-sealable on both sides; and certain features of the machine may be used with materials that are sealed together by the use of glue, pressure-sensitive adhesives or other sealing means rather than being sealable by the application of heat and pressure.

The machine is characterized by a plurality—here two—of paths or channels through which a web **14** or 14a passes in producing filled packages, the same steps in the operation being carried on independently in each channel. In many instances the same steps are performed simultaneously in both channels. The machine is not limited to two channels but an even number is preferred to balance dynamic forces. To permit simultaneous operation, duplicate parts are provided at both channels, and these are generally designated by the same reference number but parts associated with one channel have the reference number followed by "*a*" to distinguish one channel from the other.

From the rolls **11** and **11***a* each web presses downwardly under a pivoted tensioning bar **15** and **15***a* respectively, around a pair of vertically spaced guide pins or rollers **16** and **17**, and then to separate forming means **18** and **18***a* respectively where processing or handling of each web to form packages starts.

Each of the two formers **18** and **18***a* is associated with a mandrel **20** or **20***a* respectively supported on elements **10***d* of the frame. Mandrels **20** and **20***a* are cylindrical tubes with their axes parallel and preferably vertical. Inside each mandrel is a pair of filler pipes **21**. Alternatively, mandrel **20** may itself be the filler duct; and two ducts can be provided by dividing the interior of the mandrel by a web or the like. If the packages are to be filled with only one substance, then a single filling duct in each mandrel is sufficient; but as will become apparent later, a feature of the present invention is packaging alternately two different products and for this reason two separate filler pipes or ducts **21** are shown.

Each of the formers **18** and **18***a* receives a web of sheet material in a flat condition, and wraps it around the outside of a cylindrical mandrel, thus giving to the web a tubular shape. Because of this shape, the web from here on is often referred to as a tube.

Former **18** wraps web **14** around the cylindrical mandrel **20**. Since the width of the web is greater than the circumference of the mandrel, the former brings the marginal portions along the two longitudinal edges of the web into parallel, substantially radial positions with respect to the mandrel, as may be seen particularly at 14*c* in FIG. 4. These marginal portions of the web are brought together in inside-face-to-inside-face relation. That is, the surface of the web which constitutes the inside face of the tube into which the web is shaped is the side of the web providing mutually engaging sur-

faces at the projecting marginal areas. If the web material is sealable on one side only, the sealable side is made the inside surface of the tube so that the mutually engaging surfaces at these projecting longitudinal edges can now be sealed together by the application thereto of heat and pressure. When the two marginal portions 14*c* are sealed together they form a longitudinal seam 14*d* along the tube that closes or completes the tube. Web 14*a* is processed in the same way.

For the purpose of forming this longitudinal seal 14*d*, there is provided side sealing means at each mandrel, the means at one mandrel being a duplicate of that at the other, but the two are inter-connected in such a manner that they operate simultaneously. As may be seen particularly in FIGS. 4 and 12, the sealing means at mandrel 20 comprises a pair of sealing heads 23 which are heated by electrical resistance elements inside the heads. The two sealing heads 23 are located externally of the mandrel and are mounted one on each of a pair of arms 24 and 25 mounted to swing about a common pivot 26 is a scissors-like arrangement. Each arm 24 has attached to it collar 27*a* (see FIG. 11) rigidly mounted upon pivot pin 26 while each arm 25 is similarly attached to an upper collar 27*b* rotatably mounted on pivot pin 26. Pin 26 is mounted for rotational and axial motion on bracket 31 attached to the frame. For reasons that will be apparent later, arms 24 and 25 are angularly shaped when viewed in plan.

Arms 24 and 25 are given a pivotal motion around pin 26 to bring heads 23 together to clamp between them the outstanding longitudinal edges 14*c* of web 14 in order to seal these portions of the web together. After a satisfactory seal has been effected, the arms 24 and 25 are swung in opposite directions to separate sealing heads 23 and free the web so that it may be advanced downwardly along the axis of mandrel 20. The mechanism for producing this oscillating motion of arms 24 and 25 around pivot 26 is best shown in FIGS. 4 and 12. Between the rearwardly extending parallel portions of arms 24 and 25 is a double ended crank arm 28, centrally mounted upon and turning with oscillating shaft 29. Each end of arm 28 preferably carries a roller 30 which is engageable with one of arms 24 and 25. Thus, as crank 28 turns counter-clockwise from the position shown for crank 28 in FIG. 4, the rearward ends of arms 24 and 25 are spread apart causing the two sealing heads 23 to be likewise moved away from each other. As crank arm 28 returns clockwise to the position shown for arm 28*a* in FIG. 4, the rearward ends of arms 24 and 25 are drawn together by the pull of tension spring 32 which has one end connected to each of arms 24 and 25. It is the pull of this spring that brings heat sealing heads 23 together to grip between them the edges of the web for sealing purposes. It is preferred that the heads be brought together resiliently by springs, rather than by positive pressure such as is exerted by crank 28 in order to absorb any inequalities of movement at sealing heads 23 without the danger of breakage of any parts.

The mandrel 20*a* has associated with it a pair of sealing heads 23*a* mounted and operated in a manner duplicating that just described.

The two oscillating shafts 29 and 29*a* are journalled in brackets 31 and 31*a* and are each provided with an operating arm 33 and 33*a* respectively. These two arms are inter-connected by horizontal rod 34 so that shafts 29 and 29*a* are rotated simultaneously and in equal amounts. Thus the two sets of sealing heads 23 and 23*a* operate in unison and in phase with each other. Oscillatory motion of arms 33 and 33*a* is imparted to them by connecting rod 35 pivotally connected at one end to arm 33 (FIG. 4) and to which is given a reciprocating motion by mechanism that will be described later.

When the seal 14*d* leaves sealing heads 23, it is in a generally radial position relative to the web tube. In this position it passes downwardly between a pair of idler rollers 67 and 68 as shown in FIGS. 12 and 12*a*. These rollers are rotatably mounted on a bracket attached to frame 10 to turn about horizontal axes, and they have cooperating beveled surfaces that fold seal 14*d* over toward the unsealed portion of the web tube. Roller 67 is preferably higher to be the first to engage the web. It has a double beveled surface that creases the web at the base of seal 14*d*. The seal then passes over the beveled surface of lower roller 68 to be folded thereby toward the web tube. The ideal position for seal 14*d* is against the tube, but this position may not be fully reached and held until the packages are completed.

Each of the cylindrical mandrels 20 and 20*a* extends downwardly beneath its associated former. It is at this section of the mandrel below the former, that the side sealing heads 23 and 23*a* are located. The web has a tubular configuration by the time that it leaves the former; and before it leaves the lower end of the mandrel the web tube is closed by formation of a longitudinal seam 14*d* in the manner and by the means just described. Thus as the tube is advanced to a position below the mandrel which it surrounds, there is continuously presented beneath the mandrel a segment of a tube in a position to be filled from the filler ducts 21 of the mandrel. Each of these ducts is connected to a reservoir or other suitable source of material to be packaged, such source not being shown in the drawings. Flow of material through each of these filler ducts is intermittent and is controlled by a metering valve 36 of any suitable design which is operated in timed relation with the other parts of the machine. Valves 36 are shown schematically and not described in detail since they are well known in the art.

At a suitable position below the associated mandrel, each web tube is closed at one end by a transverse seal which brings together the walls of the tube in a relatively narrow elongated area extending entirely across the tube. This transverse seal forms one end of each package. A transverse seal is of course completed at the bottom end of the tube prior to discharging material into it, after which a second seal is located at a position spaced along the tube from the first seal to complete formation of an individual package but which is still attached to the web above it.

The means for effecting these transverse seals is shown generally in FIG. 2 and in greater detail in FIGS. 5 and 8.

This mechanism consists of a carriage 37 mounted for vertical reciprocation by the drive mechanism described later. This carriage has mounted upon it four pairs of heated sealing heads which are adapted to be moved together to effect a transverse seal, there being two pairs of sealing heads associated with each of the two package forming channels of the machine and the webs therein which pass downwardly through the carriage. This carriage 37 is mounted upon the upper ends of four, parallel, vertically extending shafts, to which, as will be explained, there is given oscillatory motion. The carriage has a frame 37*f* that is supported by and upon the upper ends of the four shafts 38 and 58. The four shafts move the carriage up and down in a vertical path and are themselves mounted for axial and angular motion in suitable guide bushings in members of frame 10. The mechanism for vertically reciprocating these shafts and the carriage will be explained later.

At the upper end of each shaft 38, there is attached to the shaft to rotate therewith, a crank 39 in the form of a pair of spaced discs which are connected by a pair of diametrically spaced crank pins 40. Pivotally connected to each one of these pins 40 is one end of a bent or arcuate connecting link 41. The other end of each link 41 is pivotally connected to one of two bars 42 and 42*a* which extend across the carriage parallel to each other. Bars 42 and 42*a* are located at the upper portion of the carriage and are positioned one on either side of a stationary frame member 43 which is also a terminal

strip for electrical conductors 43*c* supplying electricity to the sealing heads mentioned below. Spaced outwardly from each of bars 42 and 42*a* are two other bars 44 and 44*a*, all parallel to each other.

On each of bars 42 and 44 is mounted one heated sealing head 45 which is a member of a cooperating pair of sealing heads adapted to effect a transverse seal when brought together to clamp the web between them. A similar pair of heated sealing heads 45*a* are mounted upon the two bars 42*a* and 44*a*. To effect the proper relative motion of the sealing heads toward and away from each other, bars 42 and 44*a* are interconnected by horizontally extending rods 47 at either side of the carriage while a similar pair of horizontally extending rods 48 interconnect bar 42*a* and bar 44. All four of the bars 47 and 48 are slideably mounted near their ends upon horizontally extending guides 50 which are rigidly attached to the ends of central frame member 43.

By means yet to be described, the two vertically extending shafts 38 are oscillated simultaneously in opposite directions through arcs that are somewhat greater than a fourth of a revolution, typically about 120°. One extreme position is shown in FIG. 5 and the other extreme position in FIG. 6*b*. As the two shafts are rotated from the position of FIG. 5, in the direction such as indicated by an arrow in FIG. 5, pins 40 on the disc cranks 39 produce movement of arcuate connecting links 41 that moves the bars 42 and 42*a* outwardly away from the positions shown in FIG. 5. At the same time, by virtue of their connection through rods 47 and 48, the outside bars 44 and 44*a* are moved in the opposite direction to approach respectively bars 42 and 42*a*. As a result, the pair of heads 45 are brought together to clamp between their heated surfaces the tubularly shaped web 14 passing down between them. At the same time a seal is made by heads 45*a* on web 14*a*. The pressure of the pair of sealing heads brings the inside surfaces of the web together and produces a seal extending transversely across the web for its full width, thus closing the upper end of one package and the lower end of the adjoining package above it. Thus both webs are sealed simultaneously and the two seals 51*s* (FIG. 13) are formed in parallel planes 51 as indicated in FIG. 6*b*.

Located at a lower elevation on the carriage are the two other pairs of transverse sealing heads 53 and 53*a*, one pair for each package forming channel. These heads are so located with respect to heads 45 and 45*a* so as to form similar transverse seals on the web tubes but rotated 90° about a vertical axis from the seals formed by the upper pairs of heads first described. It is thus possible, and preferable, to have the two seals formed on webs 14 and 14*a* by the two pairs of heads 53 and 53*a* lie in a common plane 52 which is perpendicular to planes 51. One head of each pair of heads 53 and 53*a* is mounted upon one of two horizontally movable, parallel bars 54. At each end of each bar 54 is an arcuate link 55 pivotally connected at one end to the bar 54 and at the other end to crank 57. Each crank 57 comprises a pair of vertically spaced discs connected by two pins 56 at diametrically opposite positions upon the discs. Each disc crank 57 is non-rotatably attached to the upper end of a vertically extending shaft 58. The two shafts 58 are located one near each end of the carriage and are adapted to be oscillated in opposite directions simultaneously through arcs of approximately a quarter of a circle or more, typically about 120°. As a result of this oscillation of shafts 58 and crank discs 57, arcuate links 55 cause the two bars 54 to be moved toward and away from each other. One extreme spaced or open position is shown in FIG. 5. The closed position of the sealing heads 53 and 53*a* is shown in FIG. 6*a* as the bars are brought toward each other to bring the sealing heads into position at median plane 52 to clamp between the heads of each pair one of the tubular webs passing downwardly through a forming channel to effect a transverse seal 52*s* (FIG. 13) as described.

Each transverse seal completes what may become a single compartment package. If desired, each such package could be cut loose from the web and be itself a complete production unit. However, this machine is characterized by the ability to produce a package containing two different substances in separate compartments so that the ultimate unit produced is the equivalent of two individual packages connected together at their ends. Accordingly, the production unit P (FIG. 13) consisting of a double-compartment package extends between alternate transverse seals 52*s* and the completed unit is severed from the web behind it only at alternate transverse seals; and for this purpose it is elected to cut the seals 52*s* which lie in the common plane 52 as severing the web may be accomplished most simply here. The shear for severing the completed units from the web is illustrated in FIGS. 2, 7 and 11. The shear consists of a pair of blades 61, 62 in a scissors-like arrangement. Upper blades 61 are secured at their midpoint to vertically extending shaft 63 while the lower blades 62 are attached at their midpoint to sleeve 64 which surrounds and is concentric with shaft 63. The two blades thus rotate with the shaft and sleeve respectively and the shear assembly is rotatably mounted in a suitable bearing in frame 10. By means which will be later described, shaft 63 and sleeve 64 are simultaneously and equally oscillated in opposite directions, bringing the shear blades together to engage and cut the two webs 14, 14*a* which pass downwardly between the pairs of blades, as shown in FIG. 7. When a completed unit consisting of a double-compartment package is severed from the web above it, it falls by gravity down into a chute 66 from which it is discharged by gravity into any suitable hopper, conveyor, other receptacle, not shown.

So far there has been described elements of the machine which engage the web to form it, to seal it, to fill the packages, and to cut off the completed packages, together with the necessary motions of the parts performing these functions. There will now be described the various drive means which produce these motions in timed relation with each other to carry on the complete operation. Many of the parts already described have been substantial duplicates of each other in order to provide for processing two or more webs at the same time. However, there is but a single drive means for actuating these elements.

The drive means is shown particularly in FIGS. 3, 9, 10 and 11. It comprises motor 70 or any other suitable prime mover. The output shaft of the motor is connected by belt 71 to the input shaft of speed reducer 72. The output of the speed reducer is connected to the horizontally extending main drive shaft 73 which, as shown diagrammatically in FIG. 10, has non-rotatably mounted upon it, five operating cams. The shapes and relative angular position of these cams about shaft 73 are fundamental to the amount and timed relation of the several motions of the operating parts derived from these cams. These motions will now be described taking one cam at a time.

The first of these cams to be described is cam 75 which controls the vertical reciprocation of the carriage 37 with the transverse sealing elements. Cam 75 has two lobes of similar shape but different size and located approximately 180° apart around shaft 73. The follower which bears against cam 75 is roller 76 between a pair of arms 77 which depend from shaft 78, the two arms being rotatable with respect to shaft 78. Follower 76 is held always in engagement with cam 75 by the pull exerted on arms 77 by spring 80 which is a relatively heavy spring connected at one end to arms 77 and at the other end to a stationary anchor on the machine frame 10.

At a point between follower 76 and shaft 78, the two arms 77 are pivotally connected to the rear end of a forwardly extending yoke 82 which is connected at its for-

ward end to lever 83 rotatably mounted at one end on horizontal shaft 84. From lever 83 a second yoke 85 extends forwardly to a pivotal connection at the forward end of its arms with a pair of generally horizontal, forwardly extending levers 86. At their rear ends these two levers 86 are pivotally connected to shaft 84 to pivot thereabout. It will be noted that the lever 83, yoke 85 and levers 86 constitute a system of links similar to a bell crank rocking about an axis established by shaft 84.

The forward ends of the two levers 86 are each pivotally connected by a short swinging link 87 to a plate-like lifting frame 88 which is beneath carriage 37 with the transverse sealing means. At opposite ends of frame 88 are bushings which receive the two vertically extending shafts 58 permitting the shafts to turn relative to the lifting frame which moves the shafts 58 and 38 up and down. Near the center of the lifting frames are two openings through which vertically extending shafts 38 pass. As may be best seen in FIG. 11 on each shaft 38 and 58 there is attached a pair of collars 90 located one above and one below lifting frame 88. These collars 90 are pinned or otherwise firmly secured to the shafts whereby vertical motion of lifting frame 88 is transmitted to the four shafts which in turn transmit vertical reciprocating motion to carriage 37 and the sealing heads mounted thereon.

As may also be seen by reference to FIG. 11, the preferred connection between yoke 82 and lever 83 is of an adjustable nature. These two members are connected together by pin 91 which passes through the forward end of yoke 82 and a slot in lever 83. The exact position of pin 91 relative to axis 84 is controlled by a block 92 and lead screw 93, the block being movable along lever 83 by rotation of lead screw 93 and having a forked end which engages pin 91. In this way the mechanical advantage of the system can be varied to control with a high degree of precision the amount of vertical travel imparted to the transverse sealing means for a given rise of the lobes of cam 75. This means is used only for fine adjustment of travel since the length of the vertical stroke of carriage 37 is determined primarily by the rise of each of the two lobes of cam 75.

The upper sealing heads 45 and 45*a* are actuated from cam 95 which is non-rotatably secured to drive shaft 73. The surface of cam 95 is engaged by follower roller 96 attached to one end of lever arm 97, the other end of arm 97 being rigidly connected to rock shaft 78. Contact between the cam surface and follower 96 is maintained by the pull of coil spring 98 one end of which is connected to arm 99 rigidly connected to rock shaft 78. Spring 98 tends to rotate shaft 78 in a direction (counter-clockwise viewed in FIG. 10) to keep cam 95 and its follower 96 always engaged.

Shaft 78 also carries two spaced arms 100 rigidly attached at one end to the rock shaft and at the other end to a connecting rod 101 which each extend forwardly (see FIG. 10) to a pivotal connection at the end of an operating arm 102. The two arms 102 are attached one to each of the two vertically extending shafts 38. Oscillation of rock shaft 78 caused by rotation of cam 95 produces simultaneous movement of both connecting rods 101 and arms 102, which latter are rigidly connected to shafts 38. Equal oscillating motion in opposite directions is thus produced in the two shafts 38. This motion, as already explained, causes the upper sealing heads 45 and 45*a* to move toward and away from each other. The drive mechanism is preferably designed so that the movement of the heads towards each other is accomplished in response to the pull of spring 98 while the motion of the heads away from each other is accomplished in response to movement produced by cam 95 in opposition to spring 98.

The third cam 105 is attached to drive shaft 73. This cam is generally similar in shape to cam 95 but oriented 180° with respect thereto. The operating surface of cam 105 is engaged by follower 106, carried on the outer end of arm 107 which is in turn connected rigidly at its other end to rock shaft 108. Shaft 108 also has attached to it a pair of lever arms 109 to each of which is pivotally connected one end of a connecting rod 110. The two connecting rods extend forwardly to a pivotal connection at their other end with an operating arm 111 rigidly secured to the lower end of a shaft 58. Oscillating motion of rock shaft 108 is produced by cam 105 riding against follower 106, and this motion is transmitted through arms 109, connecting rods 110, and arms 111 to produce an oscillatory motion in the two shafts 58. The linkage to shafts 58 is such that the motion of these two shafts is equal but in opposite directions, and, as previously described, produces a movement of sealing heads 53 and 53*a*, toward and away from each other. The lower end of spring 98 is connected to arm 99*a* rigidly attached at one end to rock shaft 108. The pull of the spring is in a direction to bias the sealing heads toward each other, the heads being moved away from each other in opposition to the force of the spring as a result of movement imparted by cam 105.

Motion for operating the sealing heads 23 which form the longitudinal seal for the web is derived from cam 115 which is secured to shaft 73. This cam is engaged by roller follower 116 carried on the upper end of arm 117 which is loosely mounted on shaft 108 in order to pivot about the axis established by the shaft independently of movement of the shaft. Connecting rod 118 is fastened at one end to lever arm 117 and at the other end to arm 119 which is secured non-rotatably to the lower end of vertically extending shaft 120. Shaft 120 is rotatably mounted in suitable bearings in the machine frame 10, as may be seen in FIG. 9. At the upper end of shaft 120 is a second arm 119*a* to the outer end of which is pivotally connected pull rod 35 which is shown in FIG. 4 as connected to lever arm 33. Oscillation of arm 117 caused by cam 115 is transmitted through the linkage just described to oscillate levers 33 and 33*a* and cause the two pairs of sealing heads 23 and 23*a* to move toward and away from each other as described already.

It will be noted that cam 115, like cam 75 has two lobes or rises. These are so oriented with respect to cam 75 that they move the sealing heads 23 and 23*a* to sealing position during the interval of time following separation of the transverse sealing heads at the bottom of their vertical travel and continuing until the heads have reached the uppermost position on the rise of carriage 37.

The last of the five cams rotated by drive shaft 73 is cam 122. This cam is engaged by a roller follower 123 carried on the upper end of arm 124 which is loosely mounted on shaft 108 to pivot about the axis of the shaft independently of movement of the shaft.

Pivotally connected to arm 124 and extending forwardly therefrom is connecting rod 125 which is connected at its other end to arm 126 fixed on rock shaft 127. Shaft 127 has rigidly attached to it a second upright arm 128 which is connected at its upper end to a pair of connecting rods 129. The other end of each of these connecting rods 129 is connected to one of two arms 130. One arm 130 is rigidly secured to the shaft 63 and the other arm to sleeve 64 at the lower ends of these two members. This linkage imparts motion derived from the rotation of cam 122 to the two arms 130 to produce oscillatory movement of shaft 63 and sleeve 64 in equal amounts but in opposite directions. As previously mentioned, this motion of the shaft and surrounding sleeve causes the two shear blades 61 and 62 to pivot to come together to cut completed packages from the web and then to separate to allow the web to pass down between them.

The main drive shaft 73 is designed to rotate one full revolution for each complete unit filled and severed from the web following it. This unit is a double-compartment

package and is therefore the equivalent in machine operations to two single packages. As explained above the final product of this machine is essentially packages connected in pairs making a double-compartment package. Cams 75 and 115 have each two lobes or rises and therefore have two operating periods per revolution of drive shaft 73. On the other hand cams 95, 105 and 122 each have only one lobe or rise and therefore only one operating period per revolution. In this way certain of the described operations are repeated twice as often as are others. Operations produced by the cams are performed in timed relation to one another, the timing being regulated by the shape of the cams and their relative angular positions about the axis of drive shaft 73.

There is one other motion in the machine which does not originate with the drive means just described, since this motion is necessarily independent of the other motions although its occurrence is necessarily synchronized with the movements of sealing heads 23 and 23*a*, as will become apparent. This motion is designed to correct the rate of web feed in order to insure that printing on the web is always correctly positioned on the completed packages produced. The web is advanced intermittently by the downward movement of the transverse sealing means while gripping the web to effect a transverse seal at the same time the carriage is moved down. The construction of the machine causes both webs to be advanced simultaneously and equally. The amount of this advance at each pull down is purposely established as being slightly greater by a fixed amount than the desired advance as determined by the length of the packages produced. As a result the web is continuously over-traveling its correct amount of advance and is therefore normally accumulating a certain excess of travel. It is the object of the mechanism about to be described to reposition the web to eliminate this accumulated excess.

In order to determine the position of the web relative to the sealing heads or any other known datum, suitable indicia are printed or otherwise placed on the web at regular intervals. Such indicia are indicated at 135 in FIG. 13 where they appear at the same position on each completed package and are therefore spaced apart along the web at exactly the desired length of each package. In this case the package length is the length of unit P consisting of a pair of individual tetrahedral packages. It may be desired to repeat the indicia 135 on each tetrahedral package so that it appears between each two transverse seals, spaced according to the spacing between said seals.

Web scanning means is provided for web 14 in the form of a lamp housing 137 and a photo-electric cell 138 located on opposite sides of the web at the vertical run between pins 16 and 17. A similar lamp 137*a* and photocell 138*a* are provided for web 14*a*. Since web 14 is usually transparent, light reaches cell 138 by passing through the web. Each mark 135 on the web is opaque to light. Consequently if the web comes to rest with one of these marks in front of an opening in a wall of lamp housing 137, the light ray is shut off which would otherwise pass from the lamp to activate photo-electric cell 138. When the web is properly positioned relative to the sealing heads 45 and 53, at the end of each advance movement caused by a down stroke of carriage 37 a mark 135 stops in a position to interrupt the light beam. However successive marks are pulled slightly beyond this position as a result of the continued over-travel of the web.

As a result of the increasing excess of travel of the web, eventually the condition is reached in which a mark 135 is no longer registered with the opening in lamp 137 when the web is stopped. This fact is determined by the scanning means since light is allowed to pass to photocell 138. The cell is thereby activated and as a result solenoid 140 is energized, drawing downwardly the solenoid armature 141. This armature is connected pivotally to one end of lever 142 which is pivotally mounted at 143 to frame 31 supporting sealing heads 23. As a result of the downward movement of armature 141 the other end of lever 142 is moved upwardly, engaging and lifting the shaft 26 upon which is mounted collars 27*a* and 27*b*. Since lower collar 27*a* is pinned or otherwise fastened to shaft 26, arms 24 and 25 and the attached sealing heads 23 travel up with the shaft for a distance indicated at 145 in FIG. 12. This upward movement of the sealing heads is effected during the time that the sealing heads are together in clamping relation with respect to the outstanding marginal portion 14*d* of web 14. As a result, the sealing heads raise or retract the web at mandrel 20 by a short distance equal to the upward travel permitted of shaft 26, which is indicated in FIG. 12 by the gap 145 between the lower end of collar 27 and the frame member beneath it.

The dimension of gap 145 is such as substantially to eliminate the accumulated over-travel of the web and restore indicia 135 to proper registration with the light beam at cell 138. The solenoid is energized until sealing heads 23 are separated. After the heads are separated, solenoid 140 is de-energized and the assembly of shaft 26, the collars in it and the sealing heads drops by gravity or by a spring (not shown) to bring collar 27*a* into contact with the frame member below it. The two heads 23 are now returned to their normal operating position.

Light beam at cell 138 is a convenient datum with respect to which the web is inspected to determine its position and with respect to which its position is corrected. However, the light beam has a known fixed position relative to the transverse sealing heads 45 and 53, which are fixed vertically relative to each other, since it is the position of the web relative to the transverse seals that is of ultimate concern. Accordingly, the web and indicia thereon may be said to be positioned relative to the transverse sealing means, or either of them. Generally speaking the corrective motion of the web takes place between placing the seals at each end of a tetrahedral package as then the transverse sealing heads do not engage the web.

Scanning means 137—138 inspects the web while at rest. It is de-activated by any suitable means during the time the web is in motion. Such means are well known in the art and so are not described here. It is also within the scope of our invention to provide means to scan the web while in motion, such means also being well known in the packaging art.

Similar elements are provided for producing a similar motion of sealing heads 23*a*, which latter elements are separately raised by solenoid 140a. Thus each of the two webs 14 and 14*a* can be independently corrected as to the amount of its forward travel. This allows the two webs to be advanced at the same time and in the same amount by down strokes of the carriage 37 with the transverse sealing means and provides means for separate and independent correction of the travel of each web by the correcting motion of sealing heads 23 or 23*a*.

It will be evident from the above description that it is also within the scope of the present invention to reverse the direction of corrective movement of the web. If each advance movement of the web is short of the exact package length, indicia 135 are similarly moved out of registry with the light beam at cell 138 after a number of advances. Since the corrective movement now must be in the reverse direction to remove the accumulated error in web position, the web is repositioned by movement in the advance direction. This is accomplished by moving sealing heads down instead of up from their normal operating position.

Having described a preferred embodiment of our invention, the methods carried out by the machine will be briefly summarized.

Two webs are withdrawn, one from each of rollers 11 and 11*a*. Each web is passed through and processed in a separate forming channel to produce packages, similar

operations being carried out simultaneously in both forming channels to enable production of two completed units at a time. Except for a common drive means, this involves duplication of parts in each of the two channels. Accordingly, description of operations in one channel applies equally to both.

The continuous web 14 passes through forming means 18 which form the web around mandrel 20 into a tube. This tube is completed by sealing together in inside-face-to-inside-face relation marginal portions of the web along the longitudinal edges thereof. The seal 14*d* thus produced is folded over against the web tube by rollers 67 and 68. The completed tube now projects below the mandrel in a position to receive a measured charge of product through filling ducts 21 within the mandrel.

However, before discharging product into the tube a first transverse seal is made below the mandrel to close the open end of the tube. While making this seal a predetermined length of tube is withdrawn as the means for making the first retracts. Then one of the metering valves is actuated to discharge a measured quantity of product through a filling duct into the tube. This product is adequate to substantially fill a segment of predetermined size at the end of the tube adjoining the first transverse seal.

Next, a second transverse seal closing the tube segment is made above the level of the product in the tube, at substantially 90° to the first transverse seal. By locating the two transverse seals in planes at an angle of 60° or more with respect to each other, stresses are produced in the walls of the tube segment that has just been filled that hold the segment walls apart as the second seal is made. This is highly desirable because it permits the product to fill the maximum possible percentage of the interior space of the completed package and also avoids collapsing the package walls to the extent that the product is thereby squeezed up into the area of the second transverse seal. This latter condition is to be avoided because contamination of the sealed area by the product generally results in a poor seal, especially in the case of finely divided solid products.

It may be desired in the case of transparent webs to include in the indicia printed or otherwise applied to the surface of the web a scale graduated in units of volume, as ounces or grams, or in fractions of the total contents to indicate how much of the original contents remains after some has been used. Indicia of this character are useful or reliable when three conditions are satisfied. First a measured amount of product is delivered into the tube segment being filled. Second the total volume and shape of the final package are known within reasonable limits. Finally the scale or graduations printed on the web appear at a predetermined location on the package. Hence their position with respect to the end seals 51*s* and 52 is closely controlled. This is accomplished by the web correcting mechanism described which also controls the package size. Since each web can be corrected independently, the various conditions named can all be maintained within allowable limits of accuracy and cooperation in the final result of measuring the contents of a package. Of course this feature is of most utility when each package is a single tetrahedron.

During the time that each transverse seal is being made, the carriage on which the transverse sealing means is mounted is drawn downwardly to advance the web. Since all transverse sealing means are mounted on the same carriage and are therefore fixed in vertical spacing relative to each other, both webs are advanced the same distance for a given stroke of the carriage. The length of this downstroke determines the length of the packages produced. If all downstrokes are equal in length, all packages are the same size. If alternate down strokes are the same length but successive strokes are of different lengths, then successive packages are of different sizes as described. Under these conditions, the quantity of product metered by each valve 36 is different in proportion to the package sizes.

The length of the down strokes and the up strokes of the carriage 37 is controlled by the shape of cam 75. Successive up strokes differ in length to compensate for the vertical spacing between the two sets of sealing heads producing the first and second transverse seals. As a consequence, the lower heads are raised sufficiently to engage the tube at the same level as the upper heads at the beginning of each down stroke.

As seen in FIG. 1, the web 14 is fed to former 18 along an axis which lies between sealing planes 51 and 52. As a consequence longitudinal seal 14*d* crosses both transverse seals 51*s* and 52*s* at a position intermediate the lateral edges of these transverse seals to produce an individual package between each two successive transverse seals having the characteristics of the package disclosed in the copending application of William S. Schneider, Serial No. 606,349 filed August 27, 1956, on "Dispensing Container," issued as U.S. Patent No. 2,942,760, June 28, 1960. More exactly, the longitudinal seal 14*d* is located the same distance from one of the lateral edges at each of the transverse seals because of the fact that the axis of feed preferably bisects the angle between planes 51 and 52. The longitudinal seal also passes over a corner of the package midway of the length thus producing natural stresses in the seal which cause it to lie flat against the exterior surface of the completed package.

As shown the web is cut at alternate transverse seals, preferably the seals in plane 52, to produce a two-compartment package. It will be realized that it is within the scope of our invention to cut the web at each successive seal 51 and 52 to sever individual packages of tetrahedral shape from the web. This would involve addition of a second shear operating in a plane 90° tc the one illustrated.

From the foregoing description it will be understood that various changes may be made in the design and construction of the machine described above as embodying our invention but without departing from the spirit or scope of our invention. Accordingly it is to be understood that the above description is considered to be illustrative of rather than limitative upon the invention as defined by the appended claims.

We claim:

1. In a machine for producing filled four-sided packages in tandem relation from a continuous web of sheet material, the combination comprising:

a filling mandrel with its longitudinal axis upright;

forming means at the mandrel shaping the web about the mandrel into a tube;

side sealing means at the mandrel sealing together the longitudinal edges of the web to complete the tube prior to withdrawal from the end of the mandrel;

transverse sealing means below the mandrel sealing the walls of the tube together across the tube, said sealing means comprising a vertically reciprocating carriage and two pairs of relatively movable sealing heads mounted at different levels on the carriage at said tube with one pair of heads above the other pair, the plane of the seal made by one pair of heads being rotated about the axis of the mandrel approximately 90° to the plane of the seal made by the other pair of heads, the carriage moving the two pairs of sealing heads simultaneously over identical reciprocating paths;

and drive means for vertically reciprocating the carriage and for moving the pairs of transverse sealing heads alternately into sealing position in timed relation therewith to grip the tube and advance the web during each down stroke of the carriage.

2. In a machine for producing filled packages in tan-

dem relation from a continuous web of sheet material, the combination comprising:

a filling mandrel with its longitudinal axis upright;

forming means at the mandrel shaping the web about the mandrel into a tube;

side sealing means at the mandrel sealing together marginal areas along the longitudinal edges of the associated web in inside-face-to-inside-face relation to form a longitudinal seal closing the tube along the side thereof prior to withdrawal from the mandrel, said side sealing means comprising a pair of relatively movable sealing heads adapted to grip the marginal areas of the web between them;

transverse sealing means below the mandrels sealing the walls of the tube together across the tube, said sealing means comprising a reciprocating carriage and at least one pair of relatively movable sealing heads mounted on the carriage at said tube;

drive means for vertically reciprocating the carriage and for moving the transverse sealing heads into sealing position in timed relation to carriage movement to grip the tube and advance the web during each down stroke of the carriage;

and means for effecting limited movement of the side sealing means independently of the carriage movement while the heads of the side sealing means are gripping the web to move the side sealing means and web axially of the mandrel.

3. In a machine for producing filled four-sided packages in tandem relation in each of two forming channels through each of which passes a continuous web of sheet material, the combination comprising:

two filling mandrels, arranged side-by-side with their longitudinal axes parallel;

forming means at each mandrel shaping one web about the mandrel into a tube;

side sealing means at each mandrel sealing together the longitudinal edges of the associated web to complete the tube prior to withdrawal from the end of the mandrel;

transverse sealing means below the mandrels sealing the walls of each tube together across the tube, said sealing means comprising a vertically reciprocating carriage and a plurality of pairs of relatively movable sealing heads mounted alternately on the carriage, two pairs of heads being associated with each tube and arranged with one of said two pairs above the other pair and making a seal in a plane about 90° from the plane of the seal made by the other pair, the carriage moving the pairs of sealing heads at both tubes simultaneously over identical reciprocating paths;

and drive means for vertically reciprocating the carriage and for moving the pairs of transverse sealing heads into sealing position in timed relation therewith to grip the tubes and advance both webs equally during each down stroke of the carriage.

4. A machine as claimed in claim 3 in which each forming means includes means bringing the longitudinal edges of the associated web together in inside-face-to-inside-face relation and the side sealing means seals the longitudinal edges of each web together in said face-to-face relation.

5. In a machine for producing filled packages as claimed in claim 3, the combination that also includes:

means movably mounting the side sealing means relative to and independently of the transverse sealing means to grip each web independently to move it to correct the total travel of the web produced by the transverse sealing means;

and means moving the side sealing means at each web separately in a direction parallel to the axis of the mandrel, in response to the position of the respective webs occupied after each advance movement by the transverse sealing means.

6. In a machine for producing filled packages in tandem relation in each of two forming channels through each of which passes a continuous web of sheet material, the combination comprising:

two filling mandrels arranged side by side with their longitudinal axes parallel;

forming means at each mandrel shaping one web about the mandrel into a tube;

side sealing means at each mandrel sealing together marginal areas along the longitudinal edges of the associated web in inside-face-to-inside-face relation to form a longitudinal seal closing the tube along the side thereof prior to withdrawal from the mandrel; said side sealing means comprising a pair of relatively movable sealing heads adapted to grip the marginal areas of the web between them;

transverse sealing means below the mandrels sealing the walls of each tube together across the tube, said sealing means comprising a reciprocating carriage and a plurality of pairs of relatively movable sealing heads mounted on the carriage, at least one pair being associated with each tube, the carriage moving the pairs of sealing heads at both tubes simultaneously over identical reciprocating paths;

drive means for vertically reciprocating the carriage and for moving the pairs of transverse sealing heads into sealing position in timed relation to carriage movement to grip the tubes and advance both webs equally during each down stroke of the carriage;

and means for effecting limited movement of either side sealing means independently of the other while gripping the web to move the side sealing means and the associated web axially of the mandrel.

7. In a machine for producing filled packages in tandem relation in each of two forming channels through each of which passes a continuous web of sheet material, the combination comprising:

two filling mandrels arranged side-by-side with their longitudinal axes upright;

forming means around each mandrel shaping one web about the mandrel into a tube;

side sealing means at each mandrel forming a longitudinal seal closing the tube;

transverse sealing means sealing the walls of each tube together across the tube, said sealing means comprising a vertically reciprocable carriage and a plurality of pairs of relatively movable sealing heads mounted on the carriage with two pairs of heads associated with each tube of which one pair of heads is spaced above the other pair and is disposed to seal at about 90° to the seal made by the other pair of heads, the carriage moving all pairs of sealing heads at both forming channels simultaneously over identical reciprocating paths;

drive means for vertically reciprocating the carriage; including means to reciprocate the carriage with successive upward strokes of different lengths and alternate strokes of the same length whereby two vertically spaced pairs of heads both engage the tube at substantially the same elevation at the beginning of each down stroke of the carriage.

8. A machine as claimed in claim 7 in which the drive means includes a drive shaft and a cam rotated thereby having two lobes of unequal rise angularly spaced approximately equally around the shaft.

9. A machine as claimed in claim 7 which also comprises shear means for severing the filled packages from the web, and in which the drive means includes means to operate the shear means in timed relation with the carriage to sever both webs simultaneously at alternate transverse seals whereby each package produced has two compartments separated by a transverse seal at 90° to the seals at the ends of the package.

10. A machine as claimed in claim 7 in which each forming means includes means bringing longitudinal edges

of the associated web together in inside-face-to-inside-face relation and the side sealing means at each mandrel comprises a pair of relatively movable sealing heads adapted to grip the marginal areas of the web between them to effect a seal.

11. In a machine for producing filled tetrahedral packages in tandem relation from a continuous web of sheet material, the combination comprising:

a filling mandrel; forming means at the mandrel shaping the web into a tube around the mandrel with marginal areas along the longitudinal edges of the web brought together in inside-face-to-face relation;

web feed means supplying web to the forming means;

side sealing means comprising a pair of relatively movable members located externally of the mandrel and intermittently gripping said marginal areas along the longitudinal edges of the web to seal them together in said inside-face-to-inside-face relation to complete the tube;

transverse sealing means sealing the walls of the tube together across the tube, alternate seals being substantially in planes at 90° to each other to form tetrahedral packages;

said web feed means directing the web to the forming means along an axis lying between the planes of the transverse seals whereby the longitudinal seal crosses all transverse seals at a position intermediate two opposite edges of the transverse seals;

and drive means for reciprocating the transverse sealing means to advance the web and for moving both the transverse and the side sealing means into sealing position in timed relation to such reciprocation.

12. A machine as claimed in claim 11 that also includes means located between the side sealing means and the transverse sealing means for folding over the sealed longitudinal edges of the web to lie flat against the tube.

13. A machine as claimed in claim 11 in which the side sealing means is angularly displaced from the planes of the transverse seals whereby the longitudinal edges of the web are sealed together at a position angularly substantially midway between the planes of the transverse seals.

14. In a machine for producing filled packages in tandem relation from continuous web material, the combination comprising:

a filling mandrel having two separate filling ducts each adapted to handle one of two different substances;

valve means regulating flow of said substances in each of the filling ducts;

forming means at the mandrel shaping the web material into a tube around the mandrel;

means sealing the longitudinal edges of the web material together to form a longitudinal seal closing the tube;

transverse sealing means adapted to seal the walls of the tube together across the tube at longitudinally spaced positions;

drive means operating the transverse sealing means and reciprocating the sealing means while gripping the tube to advance the tube intermittently;

and means to operate the valve means to cause flow in said ducts alternately in timed relation to the tube advance whereby successive packages are filled with different substances.

15. A machine as claimed in claim 14 in which the transverse sealing means includes two pairs of sealing heads, one pair being adapted to locate transverse seals substantially in planes 90° from the other pair.

16. A machine as claimed in claim 14 in which the drive means includes means producing varying reciprocating movement of the transverse sealing means advancing the web by different lengths for successive advances whereby successive packages have different lengths and capacities.

17. In a machine for producing filled packages in tandem relation in each of two forming channels through each of which passes a continuous web of sheet material, the combination comprising:

two filling mandrels arranged side by side with their longitudinal axes upright, each mandrel having two separate filling ducts each adapted to handle one of two different substances; valve means regulating flow of said substances in each of the filling ducts;

forming means around each mandrel shaping one web about the mandrel into a tube;

side sealing means at each mandrel forming a longitudinal seal closing the tube;

transverse sealing means sealing the walls of each tube together across the tube, said sealing means comprising a vertically reciprocable carriage and a plurality of pairs of relatively movable sealing heads mounted on the carriage with two pairs of heads associated with each tube of which one pair of heads is spaced above the other pair and is disposed to seal at about 90° to the seal made by the other pair of heads, the carriage moving all pairs of sealing heads at both forming channels simultaneously over identical reciprocating paths;

drive means for moving the transverse sealing heads periodically to sealing position engaging the web and for vertically reciprocating the carriage, including means to reciprocate the carriage with successive downward strokes of different lengths and alternate downward strokes of the same length whereby successive advances of the web are of different lengths; and

means operating the valve means to cause flow alternately in the ducts of each mandrel in timed relation to the web advance whereby successive packages in each channel are filled with different substances.

18. In a package forming machine of the character described, means for effecting axially spaced transverse seals on a pair of tubes of heat sealable material, comprising:

a frame; a first pair of parallel bars slidably mounted thereon for movement toward and away from each other;

a pair of heated sealing heads on each bar, the heads being arranged in two cooperating opposed pairs;

a first pair of oscillating double cranks midway between said bars, each double crank being connected to each bar by a separate link;

two pairs of parallel bars spaced vertically from the first mentioned pair of bars and slidably mounted on the frame for movement of the bars of each pair toward and away from each other in a direction at a substantial angle to the direction of movement of the first pair of bars;

a heated sealing head on each of the last mentioned bars, the heads being arranged in two pairs of cooperating opposed heads;

a second pair of oscillating double cranks between two of the last mentioned bars, each double crank of the second pair being connected to each one of said two bars by a separate link; and

means for oscillating the first pair of double cranks simultaneously and separate means for oscillating the second pair of double cranks simultaneously and in timed relation with oscillation of the first pair of two double cranks.

19. In a package forming machine as claimed in claim 18, the combination that also includes drive means for reciprocating the frame and all the sealing heads.

20. The method of producing a filled package having a plurality of separate compartments from flexible continuous web material, that includes the steps of forming the web material into a tube about an upwardly extending filling mandrel;

making a transverse seal to close the open lower end of the tube beyond the mandrel;

discharging a measured quantity of one substance into the upper end of the tube through the mandrel from a first source;
making a second transverse seal to seal off a first compartment containing the first substance;
moving the tube downwardly to lower the first compartment relative to the mandrel;
discharging a measured quantity of a second substance into the upper end of the tube through the mandrel from a second source separate from the first source;
and making a third transverse seal to seal off a second compartment containing the second substance; and severing the tube at the third seal.

21. The method of producing a filled package as claimed in claim 20 which includes the step of advancing the web a greater distance between one pair of successive seals than between the other pair of seals to produce a larger compartment, and discharging a larger quantity of material into said larger compartment than into the other comparement.

22. The method of producing a filled package as claimed in claim 20 that produces compartments of tetrahedral shape, in which the successive transverse seals are made substantially at 90° to each other.

23. The method of controlling the length of packages formed from a continuous web having indicia thereon repeated at constant intervals, that includes the steps of withdrawing the web in lengths having a substantially constant difference from the intervals between indicia, and periodically gripping the web at the longitudinal edges to move the web to reposition the leading end of the web for a distance sufficient to correct for substantially the accumulated amount of said difference.

24. The method of packaging liquids, powders, or other fluent substances into a tube segment to increase the percent of product fill without contaminating seal areas of the tube that includes the steps of:
forming into a tube a continuous web of sheet material having indicia thereon;
making a first transverse seal to close one end of the tube;
feeding a measured amount of a product into the tube through the open end to fill a segment of the tube adjoining the first seal;
inspecting the web to determine the position of the indicia on the web with reference to a fixed datum;
correcting the position of the web to correct the position of said indicia;
and subsequently producing stresses in the side walls of the segment to hold apart the side walls during placement of a second transverse seal at a position above the product predetermined with respect to the indicia on the segment, by locating the second seal in a plane at an angle in excess of 60° to the plane of the first transverse seal.

25. In a machine for producing tetrahedral packages from a tubular web, the combination comprising:
a first pair of sealing heads for making a first transverse seal across the tube;
a second pair of sealing heads for making a second transverse seal across the tube spaced from the first seal and at an angle thereto;
scanning means to inspect the web to determine its position, said means being operative during the interval of time between closing the first pair of sealing heads and closing the second pair of sealing heads;
and web correction means responsive to said scanning means to correct the position of said web relative to said sealing means during the interval of time between placement of the first and the second transverse seals.

26. In a machine for packaging liquids, powders, or other fluent products in a tube segment, means for increasing the percent of product fill without contaminating sealed areas of the tube that comprises:
a mandrel having a filling duct;
means forming a continuous web of thin flexible material having indicia thereon, around the mandrel into a tube which extends below the mandrel to be filled from the mandrel;
means for making a first transverse seal across the tube;
means for intermittently feeding a measured amount of a product through the mandrel into a terminal segment of the tube below the mandrel to fill the segment of the tube;
means for making a second transverse seal across the tube above the level of the product and at a predetermined position relative to the indicia on the tube such that stresses are produced in the side walls of the tube segment to hold said side walls apart during placement of the second seal;
scanning means inspecting the web to determine its position relative to the transverse sealing means; and
web correction means responsive to said scanning means to correct the position of said web and the indicia thereon relative to the sealing means during the interval of time between placement of the first and second transverse seals.

27. In a machine for producing filled packages in tandem relation from a continuous web of sheet material, the combination comprising:
a filling mandrel with its longitudinal axis upright;
forming means at the mandrel shaping the web about the mandrel into a tube, said forming means including means bringing marginal areas along the longitudinal edges of the web together in inside-face-to-inside-face relation;
side sealing means at the mandrel sealing together the longitudinal edges of the web in said inside-face-to-inside-face relation to complete the tube prior to withdrawal from the end of the mandrel;
means mounting the side sealing means for movement relative to and independently of the transverse sealing means to move the web gripped by the side sealing means to correct the total travel of the web;
transverse sealing means below the mandrel sealing the walls of the tube together across the tube, said sealing means comprising a vertically reciprocating carriage and two pairs of relatively movable sealing heads mounted on the carriage at said tube, the plane of the seal made by one pair of heads being about 90° to the plane of the seal made by the other pair of heads, the carriage moving the two pairs of sealing heads simultaneously over identical reciprocating paths;
means moving the side sealing means relative to the transverse sealing means while the transverse sealing heads are disengaged from the web and in response to the position of the web occupied after each advance movement produced by the transverse sealing means;
and drive means for vertically reciprocating the carriage and for moving the pairs of transverse sealing heads into sealing position in timed relation therewith to grip the tube and advance the web during each down stroke of the carriage.

28. In a machine for producing filled tetrahedral packages in tandem relation from a continuous web of sheet material, the combination comprising:
a filling mandrel; forming means at the mandrel shaping the web into a tube around the mandrel with marginal areas along the longitudinal edges of the web brought together in inside-face-to-inside-face relation;
web feed means supplying web to the forming means;
side sealing means comprising a pair of relatively movable members located externally of the mandrel and intermittently gripping said marginal areas along the

longitudinal edges of the web to seal them together in said inside-face-to-inside-face relation to complete the tube;

transverse sealing means sealing the walls of the tube together across the tube, alternate seals being substantially in planes at 90° to each other to form tetrahedral packages;

said web feed means directing the web to the forming means along an axis lying between the planes of the transverse seals whereby the longitudinal seal crosses all transverse seals at a position intermediate two opposite edges of the transverse seals;

drive means for reciprocating the transverse sealing means to advance the web and for moving both the transverse and the side sealing means into sealing position in timed relation to such reciprocation;

and shear means operated by the drive means in timed relation to reciprocation of the transverse sealing means to sever the web at alternate transverse seals, whereby each production unit consists of two filled tetrahedral packages joined together at a transverse seal.

29. A machine for producing filled tetrahedron-shaped shaped packages from a tube of flexible packaging material, the tube being heat-sealable on the inside, comprising a generally vertical tubular mandrel adapted for passage of the tube on the outside thereof with the tube surrounding the mandrel and extending below the lower end of the mandrel and adapted to be fed downward off the lower end of the mandrel, carriage means linearly movable upward and downward toward and away from the lower end of the mandrel, a first pair of sealing heads movable upward and downward by the carriage means for forming first transverse heat seals across the tube in a first generally vertical plane, a second pair of sealing heads movable upward and downward by the carriage means for forming second transverse heat seals across the tube in a second generally vertical plane at an angle to said first generally vertical plane, the sealing heads of each pair being movable laterally inward relative to the carriage means from an open position clear of the tube to a tube-sealing position closed on the tube and laterally outward back to open position, the sealing heads of each pair being adapted on downward movement thereof by the carriage means and with said heads in tube-sealing position to grip the tube and pull down a length of the tube off the lower end of the mandrel, means for linearly moving said carriage means upward and downward and effecting alternate actuation of the first and second pairs of sealing heads to form transverse seals across the tube spaced at intervals lengthwise of the tube with successive transverse seals alternately in said first and second generally vertical planes thereby to form a tetrahedron-shaped package from each length of tube pulled down off the lower end of the mandrel, and means for intermittently delivering measured charges of a product with which the packages are to be filled through the mandrel into the lower end of the tube with each delivery timed to occur during the intervals between formation of successive transverse seals.

30. A machine as set forth in claim 29 wherein said first and second pairs of sealing heads are arranged substantially at 90° to one another, whereby said first and second generally vertical planes are substantially at 90° to one another, and further comprising means for forming the tube from a web of flexible packaging material, the web being heat-sealable on one side, said tube-forming means including means for guiding the web to the mandrel and forming it into a tube around the mandrel with the heat-sealable side of the web on the inside and with the longitudinal margins of the web in inside-face-to-inside-face engagement and projecting outward from the tube in a third generally vertical plane which is positioned diagonally as regards both said first and second generally vertical planes, said tube-forming means further comprising means for heat-sealing together said margins to form an inside-face-to-inside-face longitudinal seam and for folding said longitudinal seam over on the tube.

31. A machine as set forth in claim 30 for producing filled tetrahedron-shaped packages from a web having matter thereon as to which longitudinal registration relative to the transverse seals is desired, wherein said means for heat-sealing the margins of the web comprises a pair of grippers for gripping the longitudinal margins of the web, said grippers being movable into and out of engagement with said margins, and means for moving said grippers into engagement with said margins during intervals in which both pairs of sealing heads are in open position, said grippers also being movable longitudinally relative to the mandrel, and wherein means is provided for scanning the web to detect any out-of-registration condition of said matter relative to the sealing heads and moving said grippers longitudinally to move the tube during intervals in which both pairs of sealing heads are in open position and said grippers grip said margins to correct for any such out-of-registration conditions.

32. A machine for producing filled tetrahedron-shaped packages from a tube of flexible packaging material, the tube being seat-sealable on the inside, comprising a generally vertical tubular mandrel adapted for passage of the tube on the outside thereof with the tube surrounding the mandrel and extending below the lower end of the mandrel and adapted to be fed downward off the lower end of the mandrel, a carriage reciprocable upward and downward toward and away from the lower end of the mandrel, a first pair of sealing heads carried by the carriage for forming first transverse heat seals across the tube in a first generally vertical plane, a second pair of sealing heads carried by the carriage for forming second transverse heat seals across the tube in a second generally vertical plane at an angle to said first generally vertical plane, one pair of sealing heads being located above the other pair, the sealing heads of each pair being movable laterally inward on the carriage from an open position clear of the tube to a tube-sealing position closed on the tube and laterally outward back to open position, means for reciprocating the carriage with successive upstrokes of different length to bring first one and then the other of the pairs of sealing heads substantially to the same elevation on successive upstrokes and with successive downstrokes of the same length and for closing first one and then the other of the pairs of sealing heads at the beginning of successive downstrokes and opening both pairs on upstrokes, whereby the first and second pairs of sealing heads pull down equal lengths of the tube off the lower end of the mandrel and form transverse seals across the tube spaced at equal intervals lengthwise of the tube with successive transverse seals alternately in said first and second generally vertical planes thereby to form a tetrahedron-shaped package from each length of tube pulled down off the lower end of the mandrel, and means for intermittently delivering measured charges of a product with which the packages are to be filled through the mandrel into the lower end of the tube with each delivery timed to occur during the intervals between formation of successive transverse seals.

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