Fig. 1

INVENTOR
Harald George Swede

BY
Eule R. Mader

ATTORNEYS
MOTION MECHANISM OF PACKAGING MACHINE

INVENTOR

Harald George Swede

BY

Earl R. Mather

ATTORNEYS
MOTION MECHANISM OF PACKAGING MACHINE

Harald George Swedlund, Malmo, Sweden, assignor to AB Triat Pak, Lund, Sweden, a Swedish company

Continuation of application Ser. No. 192,616, Apr. 18, 1962. This application Aug. 13, 1965, Ser. No. 479,488

5 Claims. (Cl. 53—180)

This application is a continuation of U.S. application Ser. No. 192,616, filed Apr. 18, 1962, now abandoned.

The present invention relates to packaging machines of the kind, wherein, by means of at least one pair of cooperating clamping jaws, a tube of packaging material in connection with the forming thereof, one one hand, is flat-pressed and sealed along narrow zones transverse to the tube axis, thereby to be divided into sealed packages, and, on the other hand, is advanced in the direction of the tube axis a distance corresponding to the package length, and particularly to a device for effecting the reciprocating tube feed motion of the clamping jaws along the tube axis.

Thus, in packaging machines of the kind in question, to the cooperating clamping jaws there is imparted, in addition to their mutually opposite reciprocating clamping or sealing motion substantially perpendicular to the tube axis, a further reciprocating unison feed motion along the tube axis. The two motions are of such a timed relationship that the two cooperating clamping jaws will start deforming and releasing the tube, respectively, substantially at the two feed motion dead-centres of the advancing motion. Thus, during the advance stroke of the feed motion the clamping jaws are to complete their deformation work as well as to commence and complete the sealing-off of the tube along the corresponding sealing zone. In addition, in the interval between two successive sealing-off operations the filling of the individual package being formed takes place. This will imply that the filling operation may be involved in the advance stroke as well as in the return stroke of the clamping jaw feed motion.

From the above it is obvious that one requirement on the means for effecting the clamping jaw advancing motion will be that the same reduce the time ratio of the clamping jaw return stroke along the tube axis and the advance stroke since the return stroke is to be considered more or less a "lost motion" adversely encumbering the machine cycle.

In this connection a further requirement is that the machine, at an unchanged clamping jaw motion characteristic, allow for easy variation of the tube advance stroke and, thus, of the package length.

The present invention provides a device meeting both said requirements, viz. ensuring a return stroke time substantially shorter than the tube advance stroke time as well as an advance stroke continuously variable without changing the feed motion characteristic.

Hence, the device according to the invention is characterized substantially therein that the clamping jaw pair is movable in unison parallel to the tube axis by a double-armed rocking lever having its two arms slidable linked to a crank pin constantly rotatable about a crank shaft axis perpendicular to a plane through the tube axis and to a pivot secured to the clamping jaw pair, respectively, and being rockable about a pivot parallel to the crank shaft axis and stationary in relation thereto.

In the following the invention will be described in greater detail reference being made to the attached drawings.

FIGURE 1 is a simplified diagrammatic view illustrating the principles of the device according to the invention.

FIGURE 2 is a diagrammatic view in perspective of a packaging machine of the kind in question having two pairs of co-operating clamping jaws the tube feed motion of which is effected by the invention.

FIGURE 3 is an exploded view in perspective of the invention as applied to the packaging machine according to FIGURE 2.

In FIGURE 1 there are illustrated the principles of the device according to the invention as applied to a rectilinear reciprocating displacement of a pusher rod S. The rod is slidable in stationary bearings L and carries a dowel T, turnably and slidably engaging in a link motion groove of one arm K1 of a straight double-armed lever K rockable about a pivot O2 perpendicular to a plane through the rod S, the other rocking lever arm K2 by a link motion groove pivotably and slidably engaging a crank pin T. The latter rotates in counter-clockwise direction at a constant angular speed and at the crank radius R about a crank shaft axis O3 parallel to the pivot O2. It is obvious from a study of the figure in question that the pusher rod S during the rotation of the crank pin T will perform a reciprocating displacement in its bearings L between two dead-centres corresponding to those two positions of the lever K in which the arm K2 thereof will fall tangent to the circle described by the crank pin T. Likewise it is appreciated that at finite values of spacing of the pivot O2 and the crank shaft axis O3, the displacement stroke of the pusher rod S toward one dead-centre (here the lower one) will require a longer time than the return stroke toward the other (upper) dead-centre.

While maintaining the spacing of the pivot O2 and the crank shaft axis O3, the pusher rod displacement stroke is variable through varying the spacing of the pusher rod S and the pivot O2 without otherwise modifying the motion characteristic. Varying the spacing O2—O3, however, will result in a modified motion characteristic among other things with respect to the time ratio of the two displacement strokes.

Although, for natural reasons, the motion mechanism diagrammatically illustrated will inevitably result in a motion characteristic of substantially sinusoidal shape when depicting the length of travel as a function of time, an approximate linearity may be imparted to the downward working stroke portion through suitably selecting the crank radius R, the spacing of pivot O2 and crank shaft axis O3, and the spacing of pusher rod S and pivot O2. In case of higher requirements on this kind of motion linearity, the mechanism, in addition, will allow for a corresponding rather easy compensation by designing either the crank pin T or the dowel T, carried by the pusher rod S as an eccentric and causing it during its motion to perform a reciprocating turning for modifying the motion characteristic of one of or both working strokes.

A device of the kind diagrammatically illustrated in FIGURE 1 may be employed for effecting the tube feed motion in packaging machines of the present kind. In such case, the direction of growth of the tube in question is assumed to be parallel to the downward pusher rod stroke, the pusher rod S, in addition, carrying a pair of clamping jaws the closing and opening motion of which is suitably in a timed relationship to the displacement motion of the pusher rod S.

For complete utilization of the pusher rod motion, the clamping jaw pair should operatively engage the tube and release same, respectively, in the dead-centre positions of the reciprocating motion of the pusher rod S. This will assign the upward stroke of said motion to the deformation of the tube into the package shape and the sealing-off of the tube, the shorter return stroke being
3,332,205 3. effected without any operative contact between the clamping jaws and the tube.

Of course, a packaging machine equipped with said device as applied to one single pair of clamping jaws will always have an intermittent mode of operation, since the return stroke of the pusher rod motion will be purely an idle stroke, during which the packaging material tube remains stationary.

On the other hand, a continuous tube feed may be realized by two pairs of clamping jaws to each of which the reciprocating tube feed motion is imparted by a motion device of the type suggested. In that case the two crank pins are rotatable about one and the same crank shaft axis but angularly displaced 180° thereabout. Principally, a twin clamping jaw pair arrangement will necessitate a corresponding twin arrangement of the motion device so as to make the composite motion device comprise of two identical motion devices, one for each pair of clamping jaws, having a common crank shaft axis, the crank pins, however, being angularly displaced 180° about said shaft.

From a mathematical analysis of the composite motion device it is obvious that the interconnection of the two motion device sections will cause the maximum spacing of the two clamping jaw pairs, viz., the spacing corresponding to the package length, to be obtained when one pair of jaws has past one of its dead-centres and the other pair of jaws has not yet reached its corresponding second dead-centre. For the machine to operate with a continuous tube feed and to secure the largest possible package length one clamping jaw pair must effectively clamp the tube the very moment when the other jaw pair releases it. Thus, to take advantage of the inherent symmetry properties of the device such shifting from one clamping jaw pair to the other in the present case should take place when one crank pin is in its uppermost position (see FIGURE 1), the other one being in its lowermost position.

In that case the time interval between tube release and tube engagement of each clamping jaw pair would amount to half the machine cycle. On the other hand, if one clamping jaw pair is allowed to clamp the tube earlier and the other clamping jaw pair to release the tube later, a continuous tube feed is still secured and, in addition, a greater part of the machine cycle is assigned for deforming and sealing-off the tube. Of course, this will introduce an error as regards the characteristic of operation of the coupled motion involved as the clamping jaw pair spacing along the tube will not remain completely constant for the whole of the time interval during which the two clamping jaw pairs engage the tube. Said error, however, may be kept within such limits as to be negligible for all practical purposes, and can, furthermore, if desired, wholly or partly be compensated for by eccentric link joint dowels or pins slidably pivoted said rod lever to the pusher rod or the crank, respectively, as previously mentioned, and being turnable in response to the motion.

In FIGURES 2 and 3 a twin motion device of the kind shown in FIGURE 1 has been illustrated as applied to a packaging machine for producing tetrahedron-shaped packages from a tube continuously fed in the machine.

A packaging web material 1, doubled upon itself is carried over a pulley drum 2 and is drawn substantially vertically downwards into a horizontal tube forming annulus 3 imparting a tubular shape to it. That side of the packaging web material 1 to form the tube inside is assumed to be heat-sealable, and therefore, the two web edges of the tube 4 being formed will be sealed to each other below the tube forming annulus 3 by means of a heat-sealing strip.

The lower end of the tube 4 enters a package shaping and sealing unit comprising two clamping jaw pairs 6 and 7 which are adapted by flat-pressing and heat-sealing the tube 4 along narrow zones transverse to the tube axis and in perpendicular planes to divide the tube 4 into sealed tetrahedron-shaped packages 8. In connection with their production said packages are filled with a filling material supplied into the interior of the tube 4 through a filling pipe 9 which is inserted in between the two plies of the doubled packaging web material just below the pulley drum 2 and extends downward through the forming annulus 3 to open out above the package forming and sealing-off unit.

The clamping jaw pairs 6 and 7 are each positioned in a yoke 10 and 11, respectively, the one yoke 10 reciprocating vertically within the other yoke 11. Each yoke is secured to the lower end of two vertical pusher rods 12, 13 and 14, 15 respectively, displacably supported in the machine frame 16. The two pusher rods 12, 13 and 14, 15 pertaining to the respective yokes 10 and 11, respectively, are interconnected by means of horizontal h-shaped cross bars 17 and 18, respectively, at a distance above their lower bearing.

On a common horizontal main shaft 19 there are secured two cams 20 and 21 each carrying a crank pin 22 and 23, respectively, at equal crank radius. The crank pins 22 and 23 are angularly displaced 180° to each other about the main shaft 19 and engage each in a link motion groove of a double-armed straight lever 24 and 25, respectively, which is rockable in a vertical plane about a horizontal pivot 26 and 27, respectively, and which, by a similar link motion groove on that side of the pivot 26 and 27, respectively, opposite to the crank pin 22 and 23, respectively, is slidably pivoted on a link dowel 28 and 29, respectively, secured to the pusher rod pair 12, 13 and 14, 15, respectively, pertaining to one yoke 10 and 11, respectively. The pivots 26 and 27 are in each other’s extensions, and hence are equally spaced from the main shaft 19. Furthermore, the vertical paths of the link dowe 28 and 29 are equally spaced from the pivots 26 and 27.

Thus, the clock-wise rotation of the main shaft 19 (in FIGURE 3) will displace the yoke 10 from the angular cam position shown in FIGURE 3 downward toward the lower dead-centre thereof while displacing the yoke 11 upward toward its upper dead-centre.

The main shaft 19 and the two pivots 26 and 27 are journaled in a carriage 30, which, along horizontal guides 31 and 32, is movable from the common plane of the vertical motion of the link dowe 28 and 29. Moving the carriage 30 along the guides 31 and 32 will vary the length of the stroke of the vertical motion of the yokes 10 and 11, and such movement is effected by an adjusting nob 33 secured to one end of a control shaft 34 journaled in the machine frame 16, the other end of said control shaft being screwed into a corresponding internal thread 35 of the carriage 30. Turning the nob 33 in such a direction as to displace the carriage 30 toward the pusher rods 13 and 15 will increase the stroke of the vertical reciprocating motion of the yokes 10 and 11, and vice versa.

The clamping jaw closing and opening transverse to the tube 4 is also controlled from the main shaft 19, viz., by means of one cam 20 co-operating with two diametrically opposite cam followers 35 and 36 each by a rocker 37 and 38, respectively, pivoted to the carriage 30 and a Bowden wire 39 and 40, respectively, transmitting the radial cam follower motion due to the cam shape to the clamping jaw pairs 6 and 7, thereby to impart thereto a corresponding transverse motion to and from the tube 4. To accommodate the Bowden wires 39 and 40 the pusher rods 13 and 14 are hollow.

By means of a similar transmission comprising cam followers, rockers and Bowden wires a similar transverse motion to and from the tube 4 is transmitted from the other cam to built-in severing means in each clamping jaw pair for severing from the tube 4 the filled and sealed packages in direct connection with the production thereof, viz., in connection with the sealing-off of the tube effected by the clamping jaw pair 6 or 7 in question.

In the embodiment shown, the axes of the main shaft 19 and the pivots 26 and 27 are in one and the same horizontal plane, and hence, applying the previous dis-
cussion of the relationships of the twin motion device, the two clamping jaw pairs 6 and 7 should effectively clamp and release the tube 4, respectively, at the latest positions along the tube axis in which the axes of the crank pairs 22 and 23 are contained in one and the same vertical plane, in order to obtain a continuous tube feed and the largest possible package length. However, this implies that for each clamping jaw pair 6 or 7 the effective tube advance and return strokes each will include half the machine cycle. For obtaining a more favorable time ratio of the tube advance stroke and the return stroke in the example shown and described the closing and opening motion of the clamping jaw pairs 6 and 7 has been synchronized with the motion of the pusher rods 12, 13 and 14, 15 in such a way that a clamping jaw pair 6 or 7 in an upper position effectively clamps the tube 4 about 15° of a crank revolution ahead of the passage of the axis of the corresponding crank pin 22 or 23 through the just mentioned vertical plane and that a clamping jaw pair 7 or 6 in a lower position will release the tube 4 about 15° of the crank revolution after the time when the axis of the corresponding crank pin 23 or 22 past through the vertical plane in question. Through this there will be gained that to the deformation, sealing-off and severing of the tube 4 effected by the clamping jaw pairs 6 and 7 there will be assigned a greater portion of the crank revolution. It is true that this will be at the expense of the clamping jaw pairs 6 and 7 not being maintained at an exactly constant spacing along the tube axis during the period of time when both pairs simultaneously engage the tube 4. However, the error is negligible for all practical purposes and is outweighed by the advantages of the present motion device such as positive control during the whole working cycle, gently smooth transition from acceleration of one sign to that of the opposite sign, easy variation of the effective feed length, etc.

For illustrating the principle of modifying the motion characteristic by means of an eccentric link dowel or crank pin in FIGURE 3 the pivot 29 has been shown reciprocatory rotatable about an eccentric shaft. Thus, the pivot 29 between its ends is journaled for rotation, its end opposite to the end co-operating with the link motion lever 25 being provided with a sprocket 41 around which is laid a chain 42 to one end of which pull impulses are assumed to be imparted by a Bowden wire 43 from a mechanism, e.g. a cam mechanism co-operating with the main shaft 19, a tension spring biasing its other end in direction opposite to the pull impulses.

That which is claimed is:

1. In a machine for forming liquid filled sealed packages having means for guiding and for advancing a flexible web vertically downwardly along a filling pipe, means for forming the web into tubular shape, means for laterally sealing the edges of the tubular shaped web in a direction parallel to the tube axis, sealing means including a pair of clamping jaws mounted in a plane substantially perpendicular to said first mentioned pair of clamping jaws, each of the double arm levers, the two arms of each of which are formed from fixed pivotal connections between the two ends of the respective lever and about which connections each of the levers is rockable, the first arm of each of said levers being operatively connected with an independently mounted and movable carriage for movement therewith and for effecting vertical reciprocation of said carriage upon the rocking of either of said levers about its pivotal connection, the second arm of each of said levers being affixed via followers angularly displaced 180° one from the other, measured from a plane passing through each of the followers, upon separate parallelly spaced rotatable members at a radial distance from said axis in which lies and is affixed said drive shaft for uniformly angularly rotating each follower about the shaft to reciprocate upwardly and downwardly the second arm and first arm with its carriage, of each of the double arm levers, respectively, and such that as a first arm attains its maximum downstroke and then moves upwardly to attain its maximum upstroke there is defined between its second arm and rotatable member to which it is affixed two locations of tangency which locations define a smaller arc segment than the remaining arc segment on the locus generated by the circular path of the rotatable member whereby the first arm, and consequently the carriage to which said first arm is affixed move more rapidly from its location of maximum downward movement toward the location of its maximum upward movement than it moves in the reverse direction and wherein as one of the carriages moves upwardly the other carriage moves less rapidly in the reverse direction.

2. In a machine for forming liquid filled sealed packages having means for guiding and for advancing a flexible web vertically downwardly along a filling pipe, means for forming the web into tubular shape, means for laterally sealing the edges of the tubular shaped web in a direction parallel to the tube axis, sealing means including a pair of clamping jaws mounted within a vertically reciprocable carriage, the jaws for grasping, pressing and sealing the tube along relatively narrow zones transverse to the tube axis and for advancing the tube vertically downwardly along its axis as the jaws move in union with the carriage, and driving means operatively communicated with a drive shaft for transmitting power for reciprocation and vertical movement of a carriage, the improvement comprising a carriage reciprocating and feed motion assembly including two spaced apart double arm levers, the two arms of each of which are formed from fixed pivotal connections between the two ends of the respective lever and about which connections each of the levers is rockable, the first arm of each of said levers being operatively connected with an independently mounted and movable carriage for movement therewith and for effecting vertical reciprocation of said carriage upon the rocking of either of said levers about its pivotal connection, said independently mounted and movable carriage including a second pair of heat sealing clamping jaws, the second arm of each of said levers being affixed via followers angularly displaced 180° one from the other, measured from a plane passing through each of the followers, upon separate parallelly spaced rotatable members at a radial distance from an axis at which lies and is affixed said drive shaft for uniformly angularly rotating each follower about the shaft to reciprocate upwardly and downwardly the second arm and first arm with its carriage, of each of the double arm levers, respectively, and such that as a first arm attains its maximum downstroke and then moves upwardly to attain its maximum upstroke there is defined between its second arm and rotatable member to which it is affixed two locations of tangency which locations define a smaller arc segment than the remaining arc segment on the locus generated by the circular path of the rotatable member whereby the first arm, and consequently the carriage to which said first arm is affixed move more rapidly from its location of maximum downward movement toward the location of its maximum upward movement than it moves in the reverse direction and wherein as one of the carriages moves upwardly the other carriage moves less rapidly in the reverse direction.

3. The structure of claim 2 wherein said second pair of heat sealing jaws are mounted in plane substantially perpendicular to said first mentioned pair of clamping jaws.
4. A machine for forming liquid filled sealed packages comprising means for guiding and advancing a flexible web vertically downwardly along a filling pipe, means for forming the web into tubular shape, means for laterally sealing the edges of the tubular shaped web in a direction parallel to the tube axis, a first pair of heat sealing jaws reciprocally mounted on said machine, a second pair of heat sealing jaws reciprocally mounted on said machine and being movable vertically relative to said first pair of heat sealing jaws, means for moving the pairs of jaws into and out of engagement with the tube and means connected to said first and second pairs of heat sealing jaws to cause said pairs of jaws to move slowly on the downstroke and rapidly on the upstroke to provide a longer time to seal said web on the downstroke.

5. The structure of claim 4 wherein said first pair of jaws are in a plane which is substantially perpendicular to the second set of heat sealing jaws.

References Cited

UNITED STATES PATENTS

877,276 1/1908 Whitmer 74—45
2,169,493 8/1939 Humphrey 74—45
2,619,133 11/1952 Vulliet-Durand 74—45
2,741,079 4/1956 Ransing 53—180
3,026,658 3/1962 Schneider et al. 53—182X

TRAVIS S. McGEHEE, Primary Examiner.
S. ABEND, N. ABRAMS, Assistant Examiners.