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APPARATUS FOR PACKAGING ARTICLES IN A TUBE

Original Filed Sept. 29, 1961

2 Sheets-Sheet 1

FIG. 1

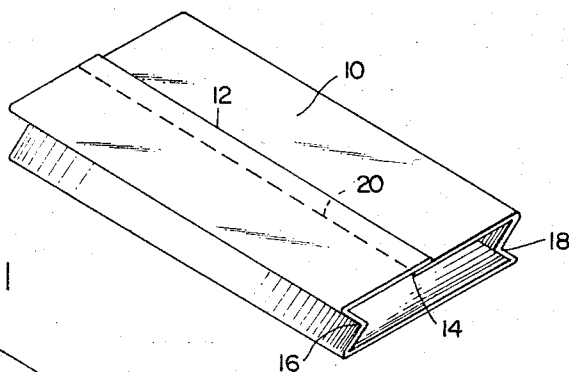


FIG. 2

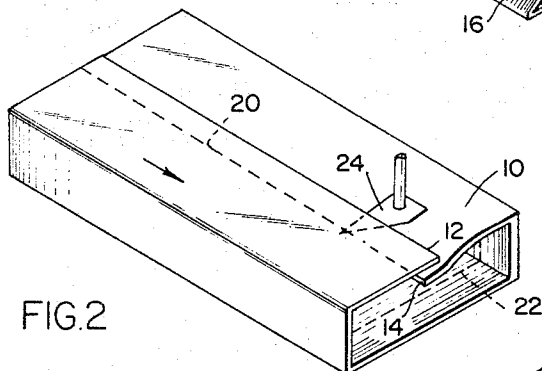


FIG. 3

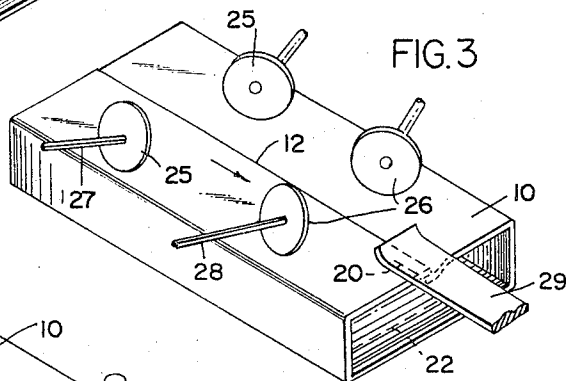
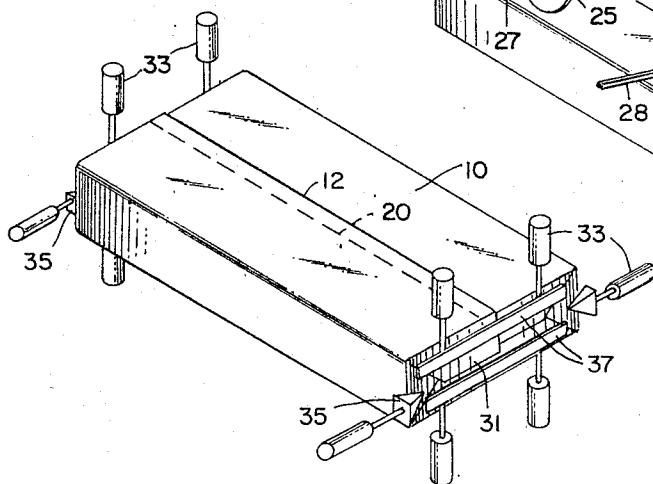


FIG. 4



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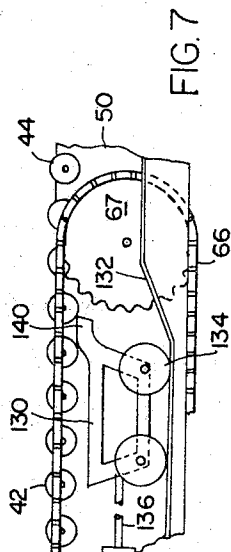
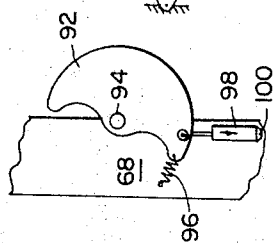
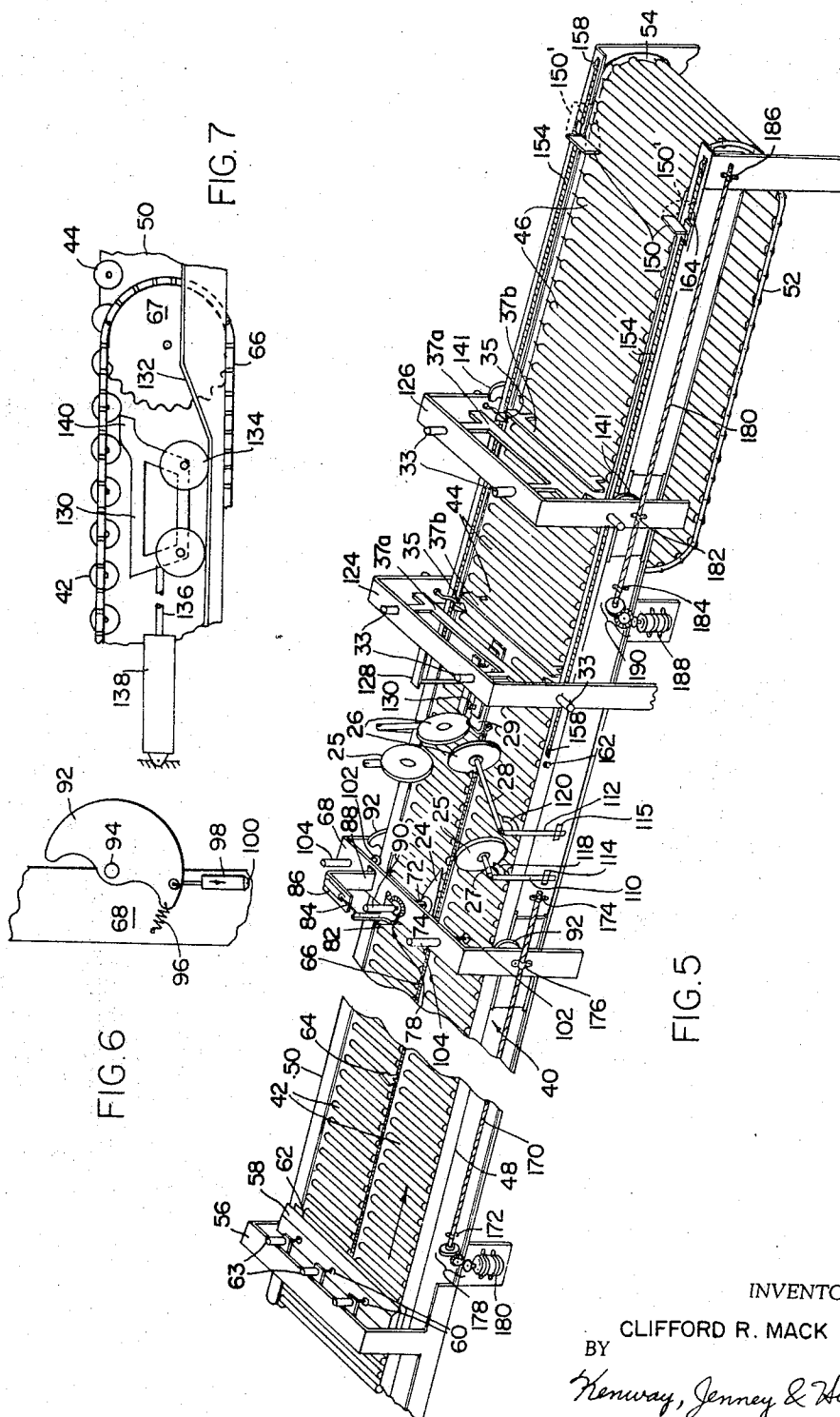
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APPARATUS FOR PACKAGING ARTICLES IN A TUBE

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Original application Sept. 29, 1961, Ser. No. 141,807, now
Patent No. 3,237,364, dated Mar. 1, 1966. Divided and
this application Feb. 28, 1966, Ser. No. 549,076
4 Claims. (Cl. 53—381)

This application is a division of Ser. No. 141,807, filed
Sept. 29, 1961 and now Patent No. 3,237,364.

This invention relates to packaging tubes and more particularly to an improved tube, and a method and apparatus for packaging materials.

Packaging tubes are commonly used for the shipment of bulky articles of a finished nature requiring protection against abrasion or other accidental injury. It is convenient to preform such tubes prior to the insertion of the articles to be packaged therein, and to store the tubes in a flat condition pending their use. However, ease of insertion of an article in such a tube requires that there be considerable clearance space about the article within the tube. Consequently, the article may shift about to a substantial extent during handling and shipment, and damage frequently results, particularly in the case of heavy and brittle articles such as tiles. Furthermore, the looseness of the package permits flexing and crushing of the tube to take place.

It is an object of the present invention to afford an improved packaging tube and method of packaging which provides for the tube to be tightened about enclosed articles after their insertion therein, to form a snugly-fitting protective package.

It is a further object of the invention to provide an improved packaging tube and method of packaging articles therein, which allows a completed tube, initially of a size to loosely and freely receive predetermined articles therein, to be subsequently tightened about the enclosed articles.

It is a further object of the invention to provide an improved packaging apparatus for performing the packaging method of the invention.

It is still another object of the invention to afford an improved method and means for tightening a previously-completed tube about an article inserted therein, and for sealing the tube in the tightened condition.

Briefly stated, my improved packaging method may be carried out in a preferred manner by the initial step of preparing a packaging tube by forming a sheet of suitable packaging material into a tubular form having overlapping longitudinally-extending edges, and by adhesively securing or "tacking" these edges along longitudinally-spaced areas thereof, to form a seamed tube of sufficiently large size to freely receive a predetermined article longitudinally inserted therein. I prefer that the overlapping edges be secured by a resealable material of sufficient strength to firmly retain the seam, and also that this material be heat-sealable; such sealing agents include polyethylene, polyvinyl chloride, polypropylene, and other thermoplastic materials such as paraffin. However, other adhesives such as glue or casein may be used alternatively. A desired article is subsequently loaded in the tube, and the adhesively-secured tacked seam is then slit longitudinally to break the adhesive bond. The tube is next tightened about the packaged article by drawing the longitudinal edges together, after which the seam is resealed in the tightened condition. The ends of the tubes are finally tucked about the ends of the article to form closures which are then sealed to complete the package.

My invention further contemplates the provision of an improved apparatus for carrying on the aforementioned

process of loading the tube, slitting the seam, subsequently tightening the package and resealing the seam. The apparatus preferably includes conveyor means for supporting the tube for loading, and for transporting the loaded tube through a series of work stations which are arranged to operate sequentially. At a first work station, means are provided for expanding a previously-flattened tube for loading. A second work station has means including a knife extending transversely to the path of movement of the tube in such juxtaposition as to slit the tacked seam. The tube is then carried to a third station having a set of rolls mounted for rotation on axes parallel to the plane of tube movement, but skew to the longitudinal extent of the tube. These rolls serve to tighten the loosened tube about the article and to pass the tube to another work station at which heat and/or pressure sealing means, (according to the nature of the resealable adhesive used; or adhesive applying means, in the event that a resealable adhesive is not employed) reseat the longitudinal seam in the tightened condition of the tube. The tube is carried thence to a final work station in which two sets of conventional tucker and folding blades are operated to fold both ends of the tube about the article, and to seal these end closures by means of heat and/or pressure, or by the application of adhesive or other fastening means, as desired.

According to a further feature, the improved machine incorporates means for adjusting the position of the slitting knife work station along the bed to accommodate packages of various lengths, and for automatically and simultaneously adjusting the spacing between the two sets of tucker and folding blades correspondingly, for simultaneous engagement with the opposite ends of the package. According to an additional feature, a conveyor for carrying the tube through the station comprises a series of rolls whose corresponding ends are connected by flexible chains or the like, for simultaneous movement about closed oval tracks upon relative adjusting movement of the two sets of tucker and folding blades along the path of tube movement; by these means, a group of the rolls are positioned to maintain continuous tube support along the path of the conveyor, in spite of the adjusting movement along the same path of the blades, which project between adjacent rolls.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter of the invention, it is believed that a clearer understanding may be gained from the following detailed description of preferred embodiments, referring to the accompanying drawings, in which:

FIG. 1 is a pictorial view of a packaging tube prepared according to the invention;

FIG. 2 illustrates the slitting of a seam of the tube;

FIG. 3 illustrates tightening the tube about an inserted article and resealing the seam;

FIG. 4 illustrates the formation of end closures in the completed package;

FIG. 5 is a pictorial view of improved apparatus for carrying out the process of the invention;

FIG. 6 is a sectional view of a fragmentary portion of the apparatus, showing a tube-stop mechanism; and

FIG. 7 is a sectional view of another fragmentary portion of the apparatus, showing a tube-positioning mechanism.

Referring to FIG. 1, an improved packaging tube 10 adapted for use in my improved packaging process is shown flattened for temporary storage prior to use. The tube is formed of a sheet of suitable packaging material, such as corrugated paper, folded into a tubular form having longitudinally-extending marginal edges 12 and 14 overlapping on one of its faces, and indented with gussets 16 and 18 along its side surfaces. I prepare the tube with

a tacked seam 20, by applying suitable adhesive material to longitudinally spaced-apart areas of the edges 12 or 14. The adhesive material must be of sufficient strength to firmly secure the seam, and according to a preferred practice, is selected to be resealable by means of heat and/or pressure; suitable materials include polyethylene, polyvinyl chloride, polypropylene, and other thermoplastic materials such as paraffin or wax. However, my packing method may alternatively be practiced with other types of adhesives, such as glue or casein.

For packaging an article in a tube of this nature, it is necessary that substantial clearance be provided for longitudinal insertion of the article. However, a loose package is undesirable because of the flexing of the tube and shifting of the article which looseness will permit during handling and shipment. In FIG. 2, an article 22 is shown inserted in the tube 10, which has been initially expanded to permit the article to be loaded. In conventional practice, the ends of the tube would then be folded and sealed to form closures to complete the package. According to my improved process, however, I longitudinally slit and open the seam 20 by inserting a suitable knife 24 between the marginal edges 12 and 14, and move the package relative to the knife in the direction shown by the arrow. I then tighten the package about the enclosed article by drawing the marginal edges transversely. While this step may be carried out by hand, I prefer to utilize opposed pairs of tightening rolls schematically illustrated at 26 and 27 in FIG. 3, which are arranged to engage the opposite margins of the packaging sheet, and are rotatably mounted by axles 28 and 29, respectively, on axes which are parallel to the major surface of the package and skew to the longitudinal extent thereof. The rolls slidably engage the surface of the package to produce a drag which is a function of the horizontal angle defined between the axles and the longitudinal extent of the package. It will be understood that if the axles are arranged normal to the longitudinal extent of the tube, no tightening effect will be produced, since the rolls will rotate without drag. As the included angle decreases, however, the lateral drag force exerted on the packaging sheet will increase correspondingly, so that a tightening effect is produced which may be closely controlled by adjusting this angle. The pairs of rolls 26, which first act upon the tube, are preferably spaced a greater distance from the marginal edges 12 and 14 than a subsequently-acting pair of rolls 27, so that slack gathered by the first-acting rolls is passed to the more closely spaced pair and thence to the region of the seam. In this manner, the tube is drawn tightly about the article 22 to a controlled extent.

While the tube is held in the tightened condition by the rolls 26 and 27, I reseal the seam by suitable means, such as a heated shoe 30, pressed against the upper surface of the edge 12. In the preferred practice in which heat-resealable adhesives are employed, heating means (not shown) for the shoe are selected which afford sufficient heat to firmly reseal the seam, with due consideration given to the speed of movement of the package, and the thickness and rate of heat transfer of the packaging material. Suitable pressure is applied to secure firm contact between the edges 12 and 14 to obtain a firm bond. However it will be understood that non-resealable adhesives or fasteners may alternatively be applied to the seam to the same end.

To complete the package, I fold the ends in a conventional manner to form overlapping flap closures 31 at either end. As shown in FIG. 4, this step is preferably carried out by two sets of blades actuated by means such as air cylinders 33, each set including an opposed pair of tucker blades 35 which are first actuated to form lateral tucks, and a pair of folding blades 37, which are subsequently extended toward one another to form overlapping flaps overlying the tucks. Adhesive material is preferably applied to suitable areas of the ends of the tube during its initial preparation to seal these closures, and one or more of each of the sets of folding blades may be

heated in a well-known manner to seal the flaps. Alternatively, suitable adhesives or fasteners may be applied concurrently with the folding operation.

While the process which has been described may be carried out manually, I prefer to utilize an apparatus which forms a portion of the subject matter of this invention, and of which a preferred embodiment is illustrated in FIGS. 5-7. This apparatus generally comprises conveyor means for transporting a packaging tube through a series of work stations adapted to sequentially perform the steps of the process. The conveyor includes a supporting frame 40, in which are rotatably mounted a series of rolls 42 each of which extends partially across the width of the frame, and further series of rolls 44 and 46 which extend fully across the frame. The confronting ends of rolls 42 at the center of the frame are supported upon a suitable longitudinal member (not shown) in roller bearings or the like, and the outer ends of each roll 42 and 44 are supported in longitudinal rails 48 and 50 by means of similar bearings. The rolls 46 are rotatably supported in oval tracks 52 and 54 in a manner and for a purpose to be more fully explained hereinafter. The rolls cooperate to form a substantially horizontal plane support for movement of a packaging tube in the direction shown by the arrow in FIG. 5.

A first work station is organized about an arch 56 mounted over the frame 40, and comprises means for opening a flattened packaging tube of the type previously described, for convenience in inserting a desired article. These means include a duck bill 58 extending transversely over the conveyor and mounted in the arch 56, and a plurality of suction clamps 60, suspended in vertically-spaced relation to the duck bill. The duck bill has a beveled leading edge 62, which an operator first introduces into the trailing end of a flattened tube placed upon the rolls 42. The suction clamps 60 are connected to a suitable vacuum source through a series of cooperating air cylinders 63, which are then elevated to raise the clamps for expanding the tube for loading. Suitable operator-actuated control means (not shown) are provided for energizing the air cylinders 63; however, such means may be of any type well known in the art, and in themselves form no part of the present invention. The operator then inserts a desired article longitudinally into the tube, which is selected of such a size that the article fits freely therein, with horizontal and vertical clearances of fractions of an inch.

For propelling the loaded tube to a second work stage, a pusher plate 64 is carried upon an endless chain 66 which extends intermediate the rolls 42 over the full length of their run, and is drivingly supported upon suitable sprockets, one of which is shown at 67 in FIG. 7.

A second work stage comprises means for slitting the longitudinal seam of the tube, as previously described in connection with FIG. 2, and is organized about an arch 68 supported over the conveyor. This stage includes a knife 24, which is rotatably supported in the center of the arch upon a vertical shaft 72 having a beveled gear 74 engaged in axially-slidable relation thereon by means of a key (not shown) slidably received in a keyway. The knife, which normally extends longitudinally of the conveyor path as shown, is rotatable to a transversely-extending position by means of a gear sector 78 pivotally mounted upon a member 82 affixed to the arch, and connected to an actuating rod 84 of a pneumatic motor 86 supported upon a bracket 88 affixed to the arch. A further pneumatic motor 90 is mounted upon the arch, and drivingly engages the shaft 72 to elevate the knife 24 when the station is not in operation, as when an empty tube is being positioned on the conveyor prior to loading, and to locate the knife vertically in alignment with the seams of tubes of various sizes.

The seam-slitting station further includes a stop mechanism for precisely positioning the loaded tube prior to insertion of the knife 24 into the seam. This mechanism, more fully shown in FIG. 6, comprises a pair of mutilated disks 92 which may be extended upwardly to engage the

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leading edge of the tube. The disks 92 are rotatably supported upon a suitable transverse shaft 94 in the arch 68, and are normally urged toward a retracted position by means of tension springs 96 secured to the arch and to the lower extremities of the disks. A pair of air motors 98 are each pivotally supported at 100 on the legs of the arch, and are arranged to drive the disks into the extended position shown for engaging the tube. Limit switches (not shown) are positioned in the arch to engage the leading edge of a tube to actuate the air motors 98 to extend the disks 92 upwardly, and concurrently to actuate a pair of suction clamps 102 to grip the upper surface of the tube. Air cylinders 104 are supported in the arch and arranged to raise the suction clamps to open the support end of the tube to allow entrance of the stop disks 92, and to hold the leading edge of the seam in alignment with the knife 24 for entrance of the knife into the seam. The air cylinder 86 is then actuated to rotate the knife transversely of the seam, to the position shown in FIG. 2. The drive of the pusher plate 64 is interrupted during the interval of these operations. Upon actuation of the air motor 86, operation of the air motor 98 is discontinued, and the pusher 64 is re-actuated, so that the tube is released by the stops and driven forwardly to effect slitting of the seam by the knife 24.

The tube passes thence to a third work station in which pairs of tightening rolls 25 and 26 engage the loose margins of the tube to tighten them transversely about the enclosed article. The tightening rolls 25 and 26 are rotatably supported on shafts 27 and 28, respectively, which are supported by standards 110 and 112 mounted in brackets 114 and 115 upon the rails 48 and 50. The shafts 28 and 29 are pivotally supported on the upper ends of the standards 110 and 112, respectively, so that they are urged downwardly against the upper surface of a tube by their own weight and that of the shafts. Rests 118 and 120 are secured to the standards to limit the downward movement of the rolls against engagement with the conveyor. The standards are angularly adjustable in the brackets 114 and 115, so that the axes of rotation of the rolls may be adjusted to give a desired degree of tightening to the package. It will be understood that the tightening effect will be related to the cosine of the horizontal angle included between the axes and the longitudinal extent of the tube. The rolls 25 are spaced apart laterally a greater distance than the rolls 26, so that the upper surfaces of the tube are first engaged adjacent to the lateral edges of the package, and subsequently in the vicinity of the marginal edges 12 and 14.

Upon passing through the tightening rolls, the package is received by a work station organized about an arch 124, which carries means 29 for resealing the seam in the tightened condition, and also carries a set of tucker blades 35 and folding blades 37a and 37b, which serve to form a trailing end closure in the package. A final work station is organized about an arch 126, and carries a further set of tucker blades 35 and folding blades 37a and 37b for forming a leading end closure in the package, concurrently with the operation of the first set of tucker blades and folding blades.

For carrying out the process in a preferred manner in which heat and/or pressure resealable adhesives are employed, the resealing means comprises a heated shoe 29 suspended from the arch 124 by a bracket 128, and biased by means of springs 130 downwardly against the seam.

The tube is carried through the sealing stage by the pusher plate 64, whose conveyor chain terminates in such a position that the trailing end of the package lies just ahead of the folding blades carried by the arch 124. In order to position the leading and trailing ends of the package for cooperation with the tucker blades and folding blades of the final work stations, a positioning truck 130 shown in FIG. 7 is supported upon an inclined track 132 upon wheels 134, and is connected by

an actuating rod 136 to a pneumatic ram 138. The ram is actuated by suitable limit switches (not shown) upon the passage of the trailing edge of the package, to drive the truck up the inclined ramp. The truck is formed with a fork 140 which engages the trailing edge of the package, and drives it forwardly toward a pair of stop discs 141 mounted in the arch 126. These stop discs and their actuating mechanism are similar to those of FIG. 6, previously described, and stop the tube in predetermined juxtaposition with the blades of the arches 124 and 126. As the tube arrives in this position, limit switches of suitable control circuitry (not shown) first reverse the ram 138 to withdraw the truck 130, and then actuate pairs of air motors 33 to drive the tucker blades 35 inwardly to form tucks in the lateral edges of the tube, as previously described and shown in FIG. 4. Subsequently, the control mechanism energizes further pairs of air motors 33 to actuate the folding blades 37a downwardly and 37b upwardly to form overlapped flaps in a manner also shown in FIG. 4. I prefer to provide suitable heating elements (not shown) in the lower folding blades 37b for sealing the end closures by means of pre-applied heat-sealable adhesive.

For transporting the completed package from the final work stations to a delivery point at the end of the run of rolls 46, I provide a pair of additional pusher plates 150 mounted upon a pair of endless chains 154, each of which is drivingly engaged with a pair of sprockets 158 supported in frame 48 or 50. The chains 154 are arranged to reciprocate the pusher plates 150 longitudinally of the conveyor rolls. The plates are pivotable to positions overlying the rolls as shown in solid lines, or to retracted positions shown in dotted lines at 150'. Pairs of stops 162 and 164 are secured along the run of the blades in the rails 48 and 50 to reverse the positions of the plates at the ends of their runs. As the plates strike the stops 164, they are pivoted to the retracted positions 150', and suitable limit switches (not shown) reverse the direction of travel of the chains 154 to carry the plates to the left as viewed in FIG. 5. Upon striking the stops 162, the plates are rotated to the extended position 150 for engaging the rear end of a completed package, which is then carried thereby over the rolls 46 to the end of the conveyor for discharge.

According to an ancillary feature of the apparatus, the arches 68 and 126 are arranged to be concurrently adjusted in longitudinal position to accommodate tubes of various lengths. To this end, the arch 68 is mounted upon a pair of longitudinally-extending jack screws 170 rotatably supported upon the rails 48 and 50 by means of pairs of brackets 172 and 174. A pair of brackets 176 threadedly engage each jack screw and are secured to the arch, and the jack screws are drivingly connected by suitable gearing 178 to reversible motors 180 mounted upon the frames 48 and 50. In a similar manner, the arch 126 is threadedly engaged upon a pair of jack screws 180 by means of threaded brackets 182. The jack screws 180 are rotatably supported in brackets 184 and 186, and a pair of reversible motors 188 are drivingly connected with the jack screws by suitable gearing 190. The motors 180 and 188 are connected for synchronous actuation of the jack screws 170 and 180, so that arches 68 and 126 are concurrently and precisely adjustable to accommodate packages of various lengths.

The longitudinal movement of the arch 126 with its lower folding blade 37b, which projects between adjacent ones of the rolls 46, requires that means be provided for shifting the rolls longitudinally, in order to maintain a continuous run ahead of the arch for supporting packages. To this end, I rotatably mount the ends of the rolls 46 in oval tracks 52 and 54, and connect the ends of the rolls by means of continuous chains or the like (not shown), which are drivingly connected with the arch 126, so that as the arch is adjusted longitudinally

by the jack screws 180, the rolls 46 are correspondingly adjusted about the oval tracks to maintain a continuous run.

While I have described preferred embodiments of my improved packaging tube and apparatus, and a preferred mode of carrying out the packaging method of the invention, it will be readily understood by those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the invention. I therefore intend to define the invention in the appended claims without limitation to specific details herein described by way of illustration.

What I claim is:

1. A packaging apparatus for tightly enclosing an article in a tube having overlapping longitudinally-extending marginal edges secured by a seam comprising adhesive material applied to longitudinally-extending areas of the edges, comprising, in combination; means for supporting a tube for loading an article therein and for transporting the tube in a longitudinal direction along a plane path between a series of work stations, said work stations comprising in serial arrangement, means including a slitting knife for opening said seam, a plurality of rotatable means mounted for rotation about axes parallel to said plane path and skew to said longitudinal direction for urging the marginal edges of said tube transversely in directions to tighten the tube about the enclosed article, and resealing means for closing and securing said seam.

2. A packaging apparatus for tightly enclosing an article in a tube having overlapping longitudinally-extending marginal edges secured by resealable adhesive material applied to longitudinally-extending areas of the edges, comprising, in combination: conveyor means comprising a plurality of rolls for supporting a tube for loading an article therein and pusher means for transporting the tube longitudinally on said rolls; and a plurality of work stations in serial arrangement along said conveyor means, said work stations comprising; means including a slitting knife for opening said seam, rolls rotatably mounted on axes parallel to a plane of tube movement and skew

to the direction of tube movement for urging the marginal edges of said tube transversely in directions to tighten the tube about the enclosed article, resealing means comprising a shoe arranged to engage said marginal edges for closing and securing said seam, and means for forming end closures in said package.

3. A packaging apparatus as recited in claim 2, in which said means for forming end closures comprise a pair of stations having closure-forming blade means, said pair of stations being movable relative to one another along said conveyor means for positioning to simultaneously form closures in both ends of tubes of predetermined sizes, said means for opening said seam being movable along said conveyor means for selective positioning to operate on tubes of predetermined sizes, and means for jointly and synchronously adjusting the position of said opening means and the relative positions of said pair of stations.

4. A packaging apparatus as recited in claim 2, in which said means for forming end closures comprise a pair of stations having closure-forming relatively-movable blade means, at least one of said pair of stations being movable along said conveyor means for positioning to simultaneously form closures in both ends of tubes of predetermined sizes, at least a portion of said blade means of said one station being interposed between adjacent ones of a group of said rolls, oval tracks rotatably supporting the ends of said group of rolls in oval-shaped relation thereabout, and means drivingly connecting said group of rolls for joint movement about said oval tracks as said one station is moved along said conveyor means, to prevent interference of said blade means with said adjacent rolls while maintaining a continuous run of said rolls along said conveyor means.

References Cited

UNITED STATES PATENTS

2,887,834	5/1959	Guyer	53—32
2,916,859	12/1959	Klein	53—50 X

TRAVIS S. McGEHEE, *Primary Examiner*.