Aug. 29, 1967 A. BILLI 3,338,026

PACKAGING MACHINES

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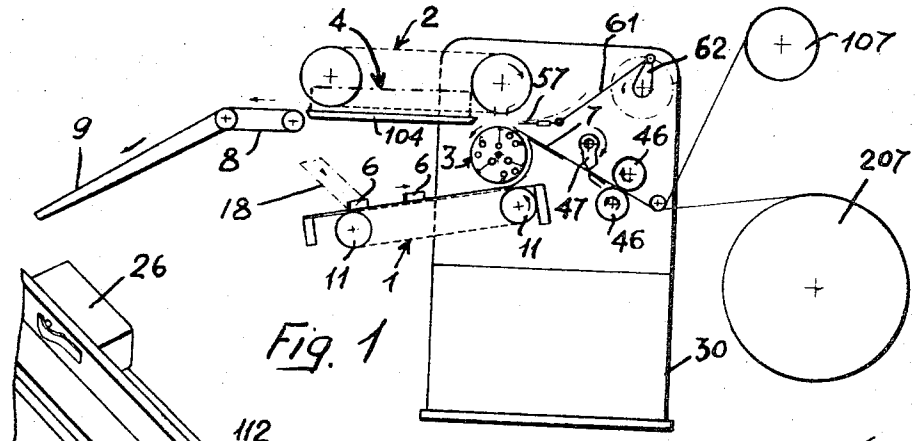


Fig. 1

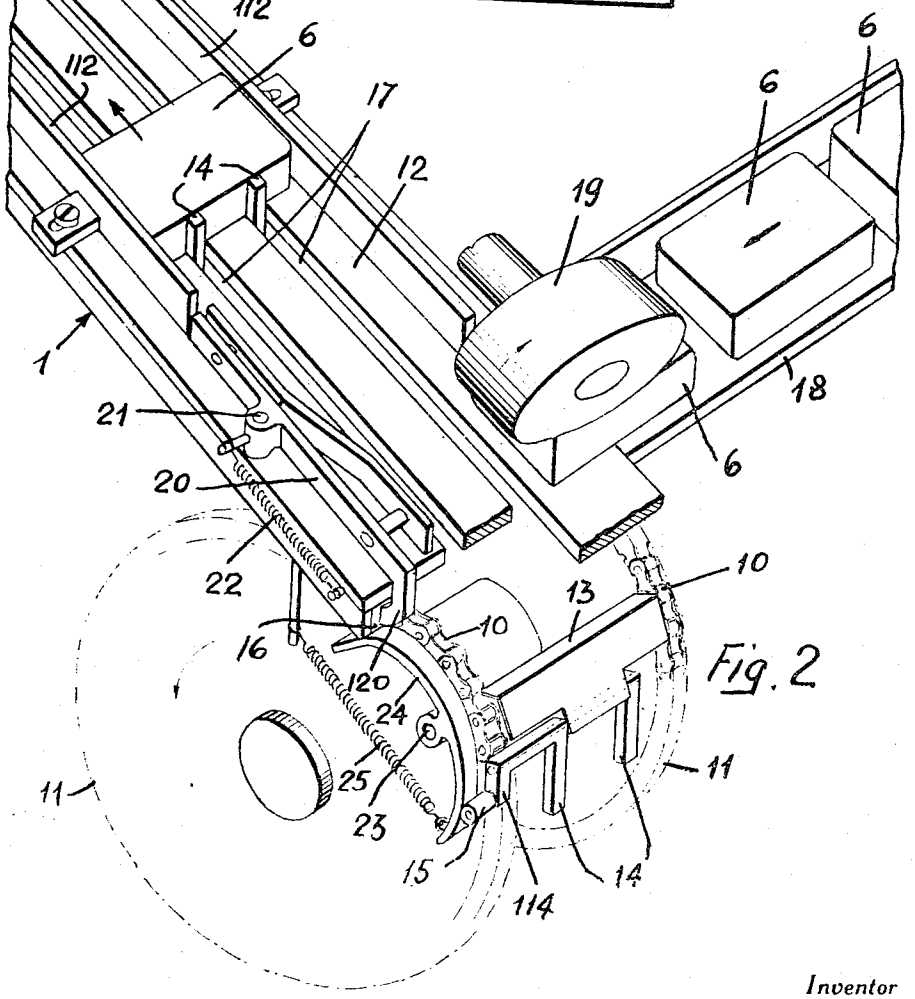


Fig. 2

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Aug. 29, 1967 A. BILLI 3,338,026

PACKAGING MACHINES

Filed Sept. 29, 1964 5 Sheets-Sheet 2

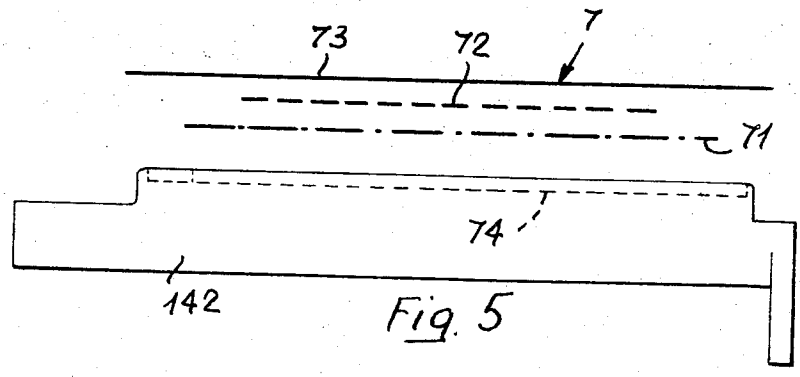


Fig. 5

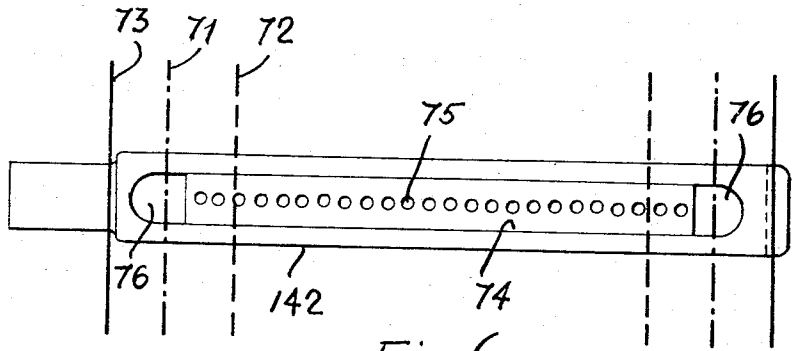


Fig. 6

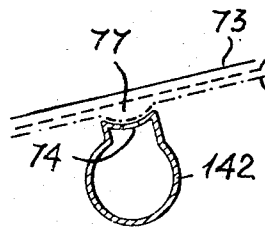


Fig. 7

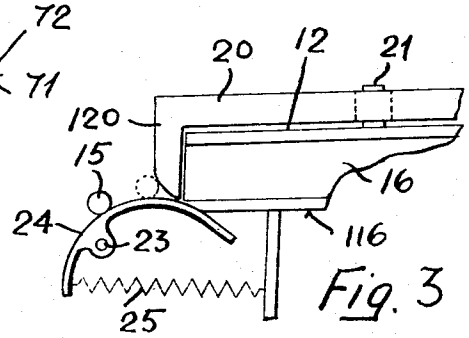


Fig. 3

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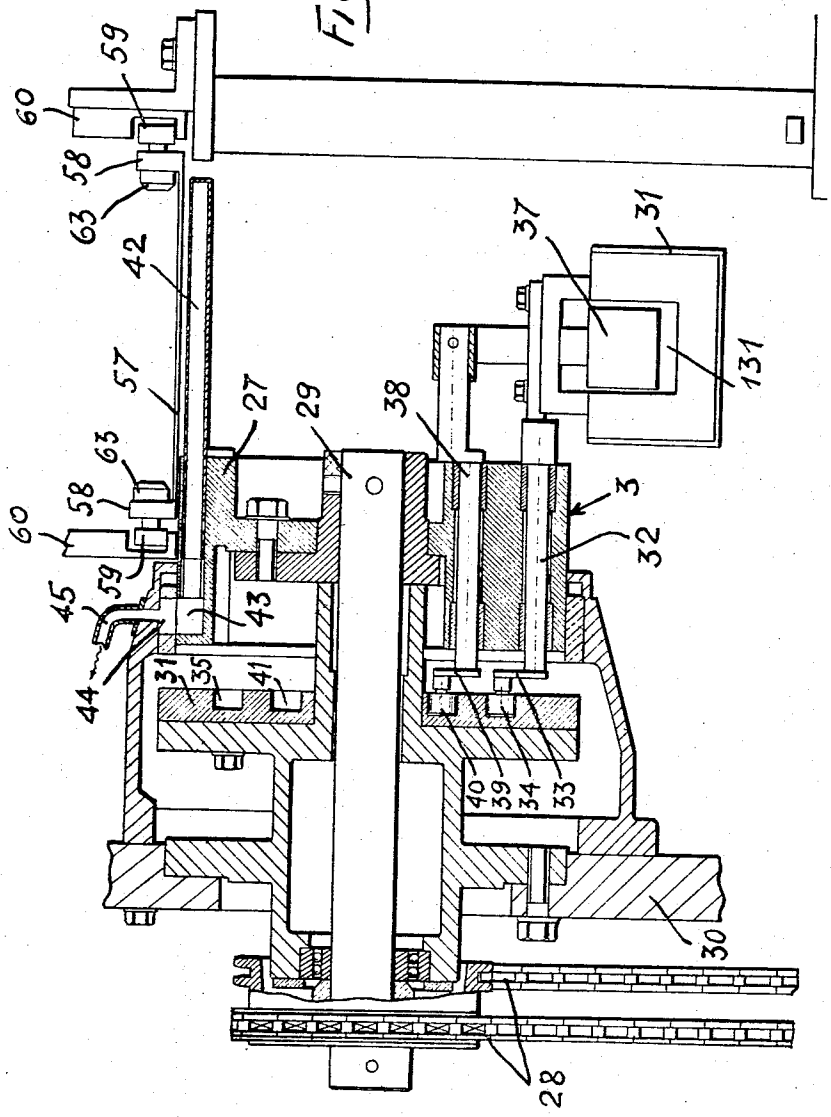
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Aug. 29, 1967 A. BILLI 3,338,026

PACKAGING MACHINES

Filed Sept. 29, 1964 5 Sheets-Sheet 3

Fig. 4



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Aug. 29, 1967 A. BILLI 3,338,026

PACKAGING MACHINES

Filed Sept. 29, 1964 5 Sheets-Sheet 4

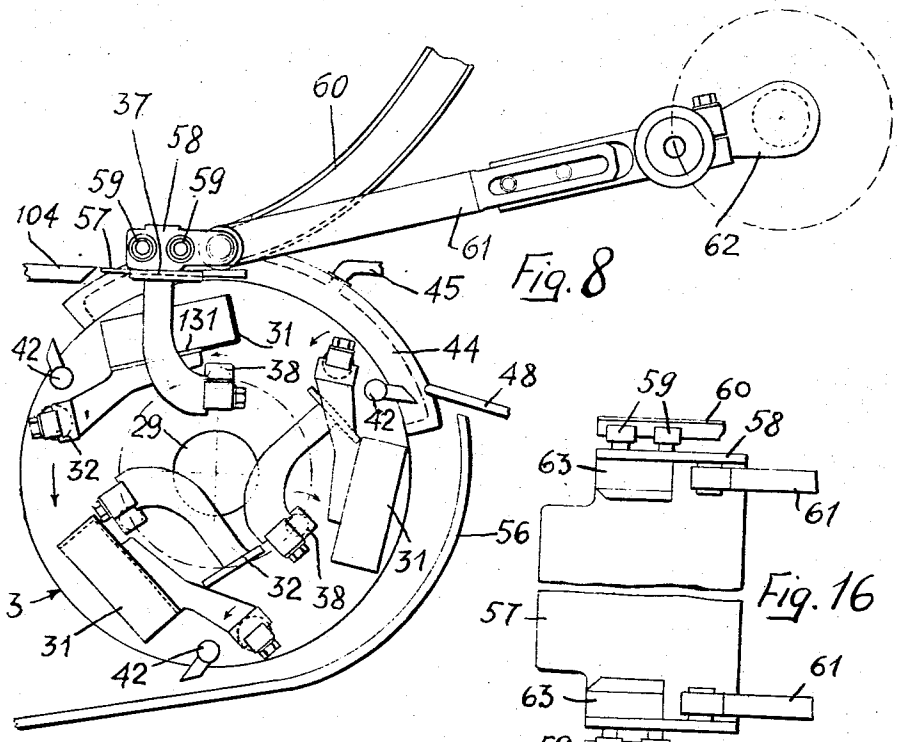


Fig. 8

Fig. 16

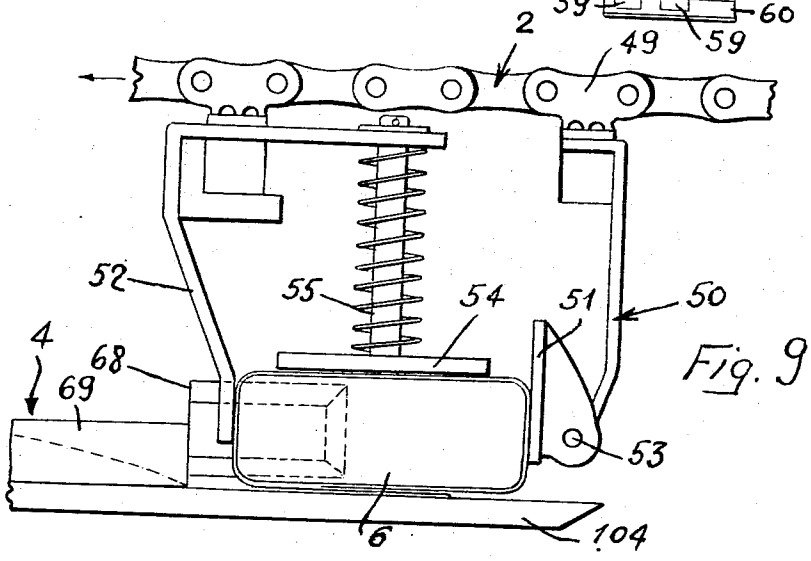


Fig. 9

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Aug. 29, 1967 A. BILLI 3,338,026

PACKAGING MACHINES

Filed Sept. 29, 1964 5 Sheets-Sheet 5

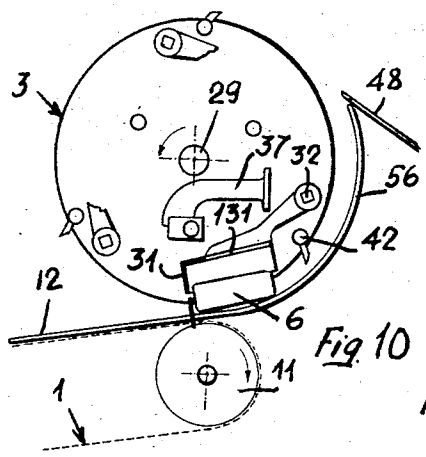


Fig. 10

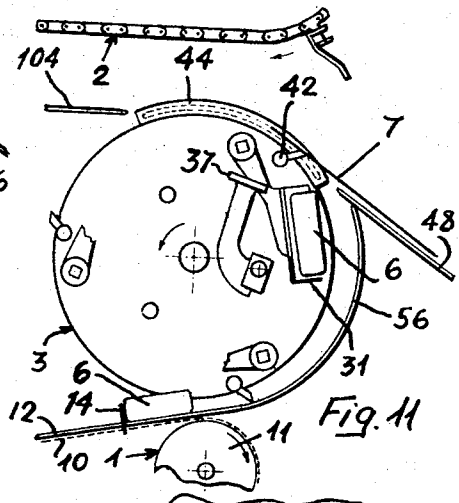


Fig. 11

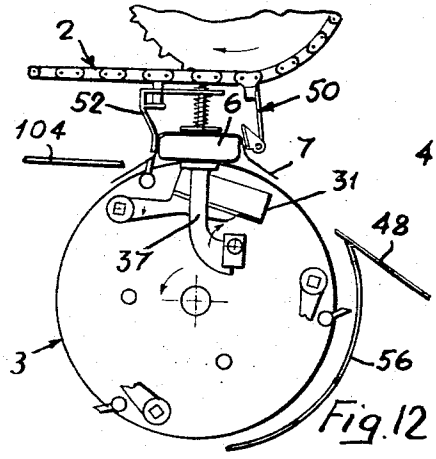


Fig. 12

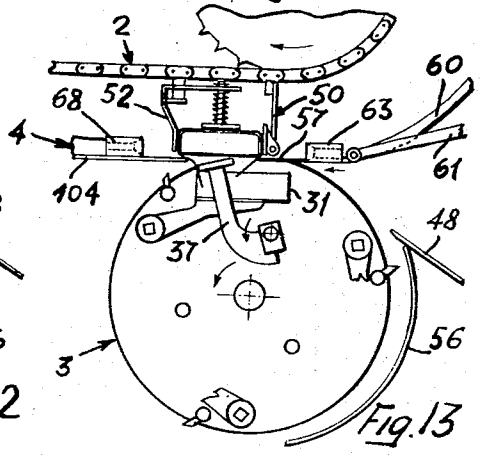


Fig. 13

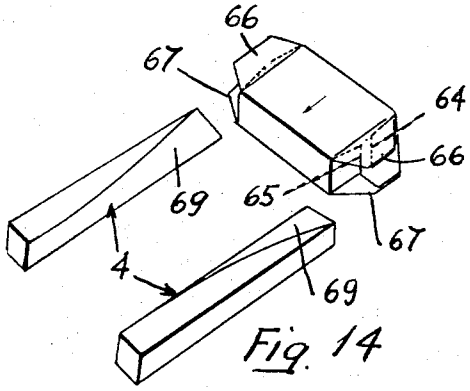


Fig. 14

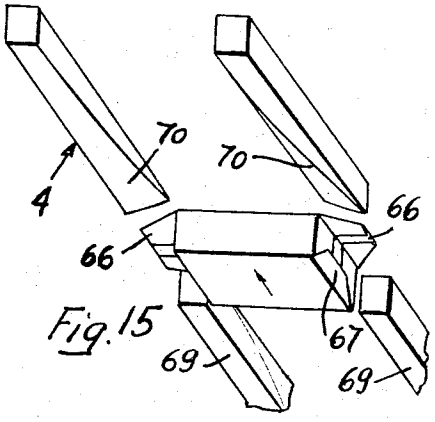


Fig. 15

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United States Patent Office 3,338,026 Patented Aug. 29, 1967

3,338,026

PACKAGING MACHINES

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Claims priority, application Italy, Oct. 16, 1963, 21,361/63
16 Claims. (Cl. 53—233)

ABSTRACT OF THE DISCLOSURE

Packaging machine comprising a rotatable drum interposed between a first conveyor for the articles, and an endless conveyor movable through a wrapper folding device; a pair of folding jaws movable with said second conveyor and spaced apart lengthwise thereof; said drum comprising at least one article receiving pocket, a suction device for positioning a wrapper relative to an article in said pocket and a plunger to transfer an article and wrapper from said pocket between said jaws for movement therewith and for folding of the wrapper thereby into U-form about the article preparatory to further folding of the wrapper about the article by said wrapper folding means.

The invention relates to a packaging machine for articles of substantially parallelepipedal, cubical or ovoid shape, such as for examples cakes of soap or the like.

It is an object of the invention to provide a packaging machine capable of packing articles at a high rate of output using simple and relatively inexpensive devices, and to ensure unobjectionable packaging of articles the edges of which are considerably rounded off.

According to the invention there is provided a machine for articles of substantially parallelepiped, cubical, or ovoid shape, comprising a first endless conveyor adapted to move articles in succession and in spaced relation, wrapper folding means, a second endless conveyor operable to move articles with wrappers partly applied thereto relative to said wrapper folding means, a plurality of pairs of folding jaws movable with the second conveyor and spaced apart lengthwise thereof, the jaws of each pair being spaced apart lengthwise of the second conveyor and extending therefrom in a direction transverse to the direction of movement of the conveyor, a rotatable drum interposed between said first and second conveyors and including at least one pocket adapted to move an article from the first conveyor to a position at which it is transferred to the second conveyor, a suction device cooperating with said pocket and operable to position a wrapper relative to an article located in the pocket for transfer with the article to a pair of jaws carried by the second conveyor, and a plunger movable with and relative to said drum and operable to transfer an article and wrapper from said pocket into and between a pair of said jaws for movement therewith and for folding of the wrapper thereby into U-form about the article preparatory to further folding of the wrapper about the article by said wrapper folding means.

In one embodiment of the invention the first and second conveyors are continuously movable and the drum is continuously rotatable thus resulting in a high working speed, since it eliminates the intermittent step-by-step motions and the corresponding reciprocating components of some known kinds of packaging machines. It is possible with a packaging machine according to the invention to package articles having extensively rounded off or chamfered edges because the plunger which transfers the article from the packet to the second conveyor can be arranged to support the article until the article and wrapper are moved on to a bottom folder by the jaws. By this

means it is possible to avoid undesirable slewing of the article as it is moved by the second conveyor to the wrapper folding means.

In order that the invention may be clearly understood one embodiment thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic side elevation of a packaging machine according to the invention,

FIG. 2 is a pictorial view of the charging end of the machine,

FIG. 3 is an elevation of a part of feed device embodied in the machine,

FIG. 4 is a longitudinal section through a conveyor drum,

FIGS. 5, 6 and 7 illustrate a suction device employed with the conveyor drum, the figures being respectively an elevation, a top plan, and a cross-section,

FIG. 8 is an end elevation of the conveyor drum,

FIG. 9 is an elevation of a folding device embodied in the machine,

FIGS. 10 to 15 show consecutive operations during the packaging of an article by the machine, and

FIG. 16 is a top plan of a part of the folding device shown in FIG. 9.

Referring to the drawings, the packaging machine comprises a first continuously movable endless conveyor device **1**, and a second continuously movable endless conveyor device **2** mounted above the device **1** for movement in the opposite direction. A continuously rotatable conveyor drum **3** is mounted between first conveyor device **1** and second conveyor device **2**. The second conveyor device **2** moves between wrapper folding means **4**, known per se, shown in broken lines in FIG. 1. A wrapper feeding device **5** supplies paper or like wrappers for the packaging of individual articles. The articles to be packaged, for example cakes of soap **6** or the like, are fed to the conveyor drum **3** in spaced succession by the first conveyor device **1** and are transferred by the drum **3**, together with a wrapper **7**, to the second conveyor device **2** which moves the article and the wrapper through the wrapper folding means **4**. The folding of the wrapper **7** about an article **6** is partly performed during the transfer of the article from the conveyor drum **3** to the second conveyor device **2**, and the folding is completed during movement of the article and wrapper past the wrapper folding means **4**. Sealing of the wrapper, for example by adhesive or heat-sealing, is also effected during movement of the article and wrapper by the second conveyor device **2**. The packaged articles leave the machine on a belt conveyor **8** or the like and are delivered to a chute **9**.

Hereinafter, for ease of description, the article **6** to be packaged will be referred to as a soap cake. The wrapper **7** may be of paper or of any other suitable material such as plastics foil, cellophane, or the like. The wrapper **7** may consist of one or more layers and when layered the layers may be of different materials.

The first conveyor device **1** comprises two endless parallel chains **10** (FIG. 2) each of which run round a sprocket **11** and beneath a flat guide track **12** which preferably slopes upwards in the direction of movement of the conveyor and has two lateral walls **112**. Cross bars **13** which extend between the two chains **10** and are secured thereto at regular spaced intervals each have a forked pusher element **14** pivoted thereto. Each pusher element **14** has a control limb **114** which extends radially from the pivotal axis of the pusher element and is provided with a guide roller **15**. The guide roller **15** is arranged to co-operate with a channel or U-shaped guide **16**, see FIG. 3, which extend lengthwise beneath the guide track **12**, see FIG. 2. When the guide roller **15** is engaged in the guide **16**, the pusher element associated therewith is raised to

be approximately at right angles to the plane of the upper run of the chains **10** and the two forks of the pusher element project beyond the upper face of the guided track **12** through longitudinal slots **17** formed in the guide track **12**. Should the guide roller **15** not be engaged in the U-shaped guide **16**, but run on the underside **116**, FIG. 3, thereof, the pusher element **14** lies approximately in the plane of the upper run of the pair of chains **10** and runs beneath the guide track **12** without projecting beyond the upper face thereof.

The soap cakes **6** to be packaged are delivered, for example from a chute **18**, to the first conveyor device **1**, and are pushed on to the guide track **12** by means of a driven feed roller **19**, FIG. 2. At the side of the guide track **12** opposite from the feed roller **19** a feeler arm **20**, FIGS. 2 and 3, is pivoted about a pin **21** and has a free extremity **120** which is bent downwards over the edge of the guide track **12** to close off the inlet end of the channel guide **16**. The feeler arm **20** is held in this channel closing position by a spring **22**. In front of the inlet end of the guide **16** there is also a curved guide lever **24** pivoted about a pin **23**, the guide lever **24**, under the action of a spring **25** being arranged to bear against the underside of the guide **16** to form therewith an even path into the guide channel.

The feed roller **19** presses each incoming soap cake **6** against the feeler arm **20**, the latter thereby being rotated against the action of the spring **22**, clockwise as viewed in FIG. 2, so that its extremity **120** uncovers the inlet end of the channel guide **16**. The guide roller **15** of the next pusher element **14** runs on to the curved guide lever **24** is guided thereby into the channel guide **16**, and raises the forks of the pusher element **14** so that the forks engage the soap cake **6** and moves it along the guide track **12** towards the conveyor drum **3**. In doing so, the soap cake **6** actuates a control switch **26**, FIG. 2, which switches on the operating sequence of the machine for the packaging of the soap cake.

Should the soap cake **6** be not completely pushed on to the guide track **12** by the feed roller **19**, the feeler arm **20** remains in its inoperative position, in which its extremity **120** covers the inlet end of the guide **16**.

In these circumstances the guide roller **15** of the approaching pusher element **14** impinges on the chamfered end of the extremity **120**, as shown in dotted lines in FIG. 5, and is thereby deflected downwards, thus turning the guide lever **24** against the force of the spring **25** and causing the roller **15** to pass beneath the guide **16** to roll along the underside **116** thereof. The pusher element is accordingly rotated to an inactive position thereof so that it cannot engage the improperly located soap cake **6**.

The conveyor drum **3** comprises a cylindrical drum barrel **27**, FIG. 4, which is secured on a shaft **29** mounted in the machine frame **30** and is driven by a double chain drive **28**, (FIGS. 4 and 8). On the outer end of the drum barrel **27** a plurality of pockets **31** are pivoted at equispaced intervals. Each pocket **31** is intended to receive one soap cake **6** and is secured on a pin **32** which is pivoted in the drum barrel and projects beyond the opposite, that is the inner end, side of the barrel. The protruding inner end of the pin **32** has secured thereto a radial control lever **33** which carries a follower roll **34** located in a groove **35** in a stationary camp late **36** secured on the machine frame **30**.

Each pocket **31** has associated therewith a plunger **37** which is secured to a pin **38** pivotally mounted in the drum barrel **27**. The inner end of the pin **38** projects beyond the inner end face of the drum barrel **27** and has a radial control lever **39** which carries a follower roller **40** located in another groove **41** of the cam plate **36**.

A tubular suction device **42**, FIGS. 4 and 8, is associated with each pocket **31**, and is secured in the drum barrel **27** to project beyond the outer end face thereof. Each suction device **42** is provided with a longitudinally extending suction slot, or with a row of suction holes,

and is in communication with a peripheral recess **43** on the drum barrel **27**. During the rotation of the drum barrel **27**, the recess **43** is intermittently moved into communication with an arc-shaped suction box **44** mounted to be stationary on the machine frame **30**. The suction box is mounted externally around the drum barrel **27** and extends along a predetermined portion of the path of the periphery of the barrel **27**. The suction box **44** is connected to a suction pipe **45** and has the open side thereof facing towards the drum barrel **27** and disposed in sealing contact with the drum barrel **27**.

In machine being described, the soap cakes **6** are to be wrapped in a two-layer wrapper **7**, for example a wrapper comprising an outer paper sheet and an inner waxed paper sheet or the like. The two layers of paper are unreeled from appropriate rolls **107**, **207**, FIG. 1, by a pair of drawing rollers **46**, are superimposed one on the other, and are cut to the required wrapper size by a cutting mechanism **47**. The severed, two-layer wrapper **7** is fed over a guide plate **48** to the conveyor drum **3** to be engaged by a suction device **42**.

The gripping of the wrapper **7** by the suction device does not entail any difficulty if this sheet has one layer, or if it consists of several layers increasing in width towards the top. It is however, frequently necessary to employ a wrapper **7** having for example, three layers, the middle layer **72**, FIGS. 5 to 7, of which has a smaller width than the bottom layer **71**, whereas the top layer **73** is the widest. This is the case, for example, with soap packs wherein the middle layer **72** is of stronger paper or thin board, and is merely wound around the piece of soap but is not folded at the sides. In a case of this kind, the middle layer **72** cannot be grasped by a conventional suction device **42**.

To accommodate this form of wrapper, provision is made for a tubular suction device **142**, FIGS. 5 to 7, which on its suction side has a longitudinal trough-shaped depression **74** wherein the suction holes **75** are formed. At the opposite ends of this trough-shaped depression **74** the suction orifices **76** are of larger diameter. The sizes of the orifices are so chosen that the bottom layer **71** of the composite wrapper does not, or only partially, cover the lateral suction orifices **76**, whereas the widest top layer **73** extends over these suction orifices **76** and preferably also beyond both extremities of the trough-shaped depression **74**, as shown in FIG. 6.

With this arrangement, the application of negative air pressure to the suction device **142** draws the bottom layer **71** of the paper sheet **7** into the trough-shaped depression **74** and deforms it accordingly (FIG. 7). The intermediate space **77** formed by this deflection between the bottom layer **71** and the middle layer **72** is in communication at both extremities with the lateral suction orifices **76** and is closed off from the surrounding atmosphere by the top layer **73**. The negative air pressure accordingly also becomes effective in the said intermediate space **77** and holds fast the middle layer **72**. The top layer **73** is held fast direct by the part of the lateral suction orifices **76** it covers.

The second conveyor device **2** extends over the conveyor drum **3** and comprises either a simple endless chain **49**, FIG. 9, or a pair of such chains. Secured to the chain **49** at regular predetermined spaced intervals are folding members **50** of approximately U-shaped and each comprising two folder jaws **51** and **52** which extend transversely to the direction of travel of the conveyor chain **49**. The folder jaw **52** precedes the jaw **51** in the direction of travel of the chain and is rigidly mounted on the chain whereas the trailing folder jaw **51** is mounted for pivotal movement about a pin **53**. The distance between the two jaws **51**, **52** is so selected that a soap cake **6** fits conveniently between them.

A resilient ram **54**, or the like shown in FIG. 9 as a plate loaded by a spring **55** (downwards in FIG. 9), is

mounted moreover between the jaws **51**, **52** of each pair **50** of jaws.

Each soap cake **6** fed to the conveyor drum **3** by the feed device is received by a pocket **31** and is moved thereby over a stationary arc-shaped guide surface **56**, FIG. 8, to extend around the drum **3** in extension of the guide track **12**, as shown in FIG. 10. It should be understood that for clarity only a single pocket **31** and associated plunger **37** is shown in FIGS. 10 to 13.

During rotation of the conveyor drum **3**, the soap cake **6** leaves the guide surface **56** and is then carried only by the pocket **31**. The recess **43** of the drum **3**, which is connected to the suction device **42**, comes within range of the suction box **44** and is thereby connected to the source, not shown, of negative air pressure. The suction device **42** thus grips the extremity of the wrapper **7** projecting from the support face **48** and during continued rotation of the drum **3** draws the same over the pocket **31**, as shown in FIG. 11. The take-off of the soap cake **6** from the first conveyor device **1** and its insertion into the pocket **31**, are performed by appropriate swinging motions of the pocket **31** controlled by the cam plate **36**.

When the pocket **31** carrying the soap cake **6** has approximately reached the top of the vertical diameter of the drum **3**, it arrives in horizontal position beneath a pair **50** of jaws **51**, **52** carried by the second conveyor device **2** and synchronised with the drum **3**. The plunger **37** previously situated outside the pocket **31** is now rotated upwards, FIG. 12, by the action of the cam plate **36** through an aperture **131** in the base of the pocket **31** and presses the soap cake **6** together with the wrapper **7** upwards between the jaws **51**, **52** as shown in FIG. 12. This operation folds the wrapper **7** in U-shape about the soap cake, and the wrapper is released at the same time by the suction device **42**, since the connection orifice **43** of the suction device **42** leaves the suction box **44** and comes into communication with the surrounding atmosphere.

A folding plate **57**, FIGS. 1, 8 and 13, is reciprocable in the direction of travel of the second conveyor device **2** and is disposed at the insertion point of the soap cake **6** between the jaws **51**, **52** (FIGS. 8, 13 and 16). The folding plate **57** is secured to two lateral slides **58**, FIG. 4, carrying rollers **59** running in partially curved guides **60**. The two slides **58** are hingedly secured to the limbs of a fork-shaped connecting rod **61** which is driven by a crank **62**, FIG. 1. Two folding members **63**, FIG. 4, are secured on the inner sides of the slices **58**.

After the insertion of the soap cake **6** between the jaws **51**, **52**, the folding plate **57** is pushed forward in the direction indicated by the arrow, FIG. 13, at a higher speed than the running speed of the second conveyor device, and thereby folds the rear end of the wrapper **7** upwards about the rear end of the soap cake **6**, as illustrated in FIG. 13. The folding members **63** subsequently press the wrapper **7** against the soap cake **6** and thereby form the first end fold **64** for the formation of the lateral or outer flaps **66**, **67** of the package (FIG. 14).

The soap cake **6** is pushed into the folding means **4** and is moved therethrough by the jaws **51**, **52** of the second conveyor device **2**. During movement through the folding means **4**, the rear unattached extremity of the wrapper **7** is initially folded rearwards by the leading edge of the bottom folder **104** on to the underside of the soap cake **6**, as shown in FIG. 13. The soap cake **6** is supported by the plunger **37** as a result of the rotation of the drum **3**, or is slightly raised, until a substantial part of its length lies on the bottom folder **104**. This ensures proper insertion of the soap cake **6** into the folding means **4** and reliable support thereof by the bottom folder **104** even if the soap cake has considerably rounded edges or if it is of oval shape. Without this support by the plunger **37** the rounded edged soap cake **6** would drop prematurely and strike the leading edge of the bottom folder **104**.

During movement of the soap cake **6** through the folding means **4** the second lateral fold **65**, FIG. 14, of the wrapper and the formation of the lateral flaps **66**, **67** of the package (FIG. 14) is effected in known manner by means of lateral folding members **68** (FIGS. 9 and 13). The lateral flaps **66**, **67** also in known manner, are subsequently folded down on to the corresponding lateral faces of the soap of cake **6** by means of longitudinally extending folder guides **69**, **70**, as shown in FIGURES 14 and 15.

It will be understood that adhesive applying means, not shown, may be provided, in known manner, to apply adhesive to overlying flaps of the folded wrapper to retain the flaps in the folded positions thereof.

I claim:

1. A packaging machine for articles of substantially parallelepiped, cubical, or ovoid shape, comprising a first endless conveyor adapted to move articles in succession and in spaced relation, wrapper folding means, a second endless conveyor operable to move articles with wrappers partly applied thereto relative to said wrapper folding means, a plurality of pairs of folding jaws movable with the second conveyor and spaced apart lengthwise thereof, the jaws of each pair being spaced apart lengthwise of the second conveyor and extending therefrom in a direction transverse to the direction of movement of the conveyor, a rotatable drum interposed between said first and second conveyors and including at least one pocket adapted to move an article from the first conveyor to a position at which it is transferred to the second conveyor, a suction device co-operating with said pocket and operable to position a wrapper relative to an article located in the pocket for transfer with the article to a pair of jaws carried by the second conveyor, and a plunger movable with and relative to said drum and operable to transfer an article and wrapper from said pocket into and between a pair of said jaws for movement therewith and for folding of the wrapper thereby into U-form about the article preparatory to further folding of the wrapper about the article by said wrapper folding means.

2. A machine according to claim **1**, wherein the first and second conveyors are disposed one above the other in spaced relation and are movable in opposite directions and wherein the rotatable drum is located between said conveyors at a position adjacent to overlying ends thereof.

3. A machine according to claim **2**, wherein the first and second conveyors are continuously movable and the drum is continuously rotatable.

4. A machine according to claim **1**, wherein the wrapper folding means includes a bottom folder and said plunger supports an article and wrapper transferred thereby from the pocket until the article and wrapper are moved on to the bottom folder by said jaws.

5. A machine according to claim **4**, wherein the wrapper folding means includes a folding plate reciprocable lengthwise of the direction of movement of the second conveyor, said folding plate being operable following location of an article and wrapper between said jaws to move towards said jaws at a speed greater than the linear speed of the second conveyor to fold the trailing limb of the U-folded wrapper beneath the article.

6. A machine according to claim **5** wherein the wrapper folding means include folding members movable with said folding plate and operable to form the first end folds of the wrapper.

7. A machine according to claim **1**, wherein the pocket and the plunger co-operating therewith are each pivotally mounted on the drum, and wherein pivotal movement of the pocket and plunger relative to the drum is effected by control levers connected with said pocket and plunger and co-operating with a stationary cam, said pocket having an opening in the bottom thereof through which the plunger is moved on pivotal movement thereof.

8. A machine according to claim 1 in which a wrapper consists of three overlying sheets of wrapping material, the bottom sheet having a width greater than that of the middle sheet but less than that of the top sheet, wherein said suction device is provided with a longitudinal trough-shaped depression including a row of suction holes extending lengthwise of the trough with the holes at the ends of the row being larger than the others of the holes and positioned to be entirely covered by said top sheet but not more than partly covered by said bottom sheet.

9. A machine according to claim 1, wherein at least one of said jaws is pivotally mounted on the second conveyor for movement towards and away from the other of the jaws, and wherein a ram is resiliently mounted between the jaws for movement in a direction transverse to the direction of movement of the second conveyor.

10. A machine according to claim 1, wherein the second conveyor comprises a pair of endless chains and pusher elements extending there between and pivoted thereto, each said pusher element including two forks extending radially from the pivotal axis of the pusher element, a guide track disposed above the upper run of said chains, sloping upwards in the direction of movement of said upper run, and having slots extending lengthwise thereof through which said forks can project to move an article over the upper surface of said guide track, a channel guide extending lengthwise of the guide track on the underside thereof, a roller carried by the pusher element and movable through said guide channel to retain the forks in the article-feeding positions thereof, and switching means cooperating with said roller to permit movement thereof through said channel guide and engagement of an article on said guide track by the forks of the pusher element or to cause the roller to be moved beneath said channel guide and the forks of the pusher element to be moved beneath the guide track, said switching means being operable to cause entry of the roller into the channel guide by an article properly positioned on the guide track for engagement by said forks.

11. A machine according to claim 10, wherein the switching means comprises an arcuate guide supported for pivotal movement towards and away from the entrance to said channel guide and spring-urged to a position thereof at which it will be engaged by said roller to raise the forks of the pusher element into the article-engaging position thereof and guide the roller into the channel guide, and a spring-loaded feeler engageable by an article properly positioned on the guide track for engagement by the forks of the pusher element, said feeler including a projection normally obturating the entrance to the channel guide for engagement by said roller thereby to cause movement of the arcuate guide away from the channel guide and permit the roller to pass beneath the channel guide and the forks of the pusher element beneath said guide track.

12. A machine according to claim 6, wherein the pocket and the plunger co-operating therewith are each pivotally mounted on the drum, and wherein pivotal movement of the pocket and plunger relative to the drum is effected by control levers connected with said pocket and plunger and co-operating with a stationary cam, said pocket having an opening in the bottom thereof through which the plunger is moved on pivotal movement thereof.

13. A machine according to claim 6, in which a wrapper consists of three overlying sheets of wrapping material, the bottom sheet having a width greater than that of the middle sheet but less than that of the top sheet, wherein said suction device is provided with a longitudinal trough-shaped depression including a row of suction holes extending lengthwise of the trough with the holes at the ends of the row being larger than the others of the holes and positioned to be entirely covered by said top sheet but not more than partly covered by said bottom sheet.

14. A machine according to claim 6, wherein at least one of said jaws is pivotally mounted on the second conveyor for movement towards and away from the other of the jaws, and wherein a ram is resiliently mounted between the jaws for movement in a direction transverse to the direction of movement of the second conveyor.

15. A machine according to claim 6, wherein the second conveyor comprises a pair of endless chains and pusher elements extending therebetween and pivoted thereto, each said pusher element including two forks extending radially from the pivotal axis of the pusher element, a guide track disposed above the upper run of said chains, sloping upwards in the direction of movement of said upper run, and having slots extending lengthwise thereof through which said forks can project to move an article over the upper surface of said guide track, a channel guide extending lengthwise of the guide track on the underside thereof, a roller carried by the pusher element and movable through said guide channel to retain the forks in the article-feeding positions thereof, and switching means co-operating with said roller to permit movement thereof through said channel guide and engagement of an article on said guide track by the forks of the pusher element or to cause the roller to be moved beneath said channel guide and the forks of the pusher element to be moved beneath the guide track, said switching means being operable to cause entry of the roller into the channel guide by an article properly positioned on the guide track for engagement by said forks.

16. A machine according to claim 15, wherein the switching means comprises an arcuate guide supported for pivotal movement towards and away from the entrance to said channel guide and spring-urged to a position thereof at which it will be engaged by said roller to raise the forks of the pusher element into the article-engaging position thereof and guide the roller into the channel guide, and a spring-loaded feeler engageable by an article properly positioned on the guide track for engagement by the forks of the pusher element, said feeler including a projection normally obturating the entrance to the channel guide for engagement by said roller thereby to cause movement of the arcuate guide away from the channel guide and permit the roller to pass beneath the channel guide and the forks of the pusher element beneath said guide track.

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