Feb. 17, 1970 F. J. EBBERS ET AL 3,495,374

APPARATUS FOR PACKAGING A PRODUCT OF UNCONTROLLED HEIGHT

Filed Dec. 21, 1967 6 Sheets-Sheet 1

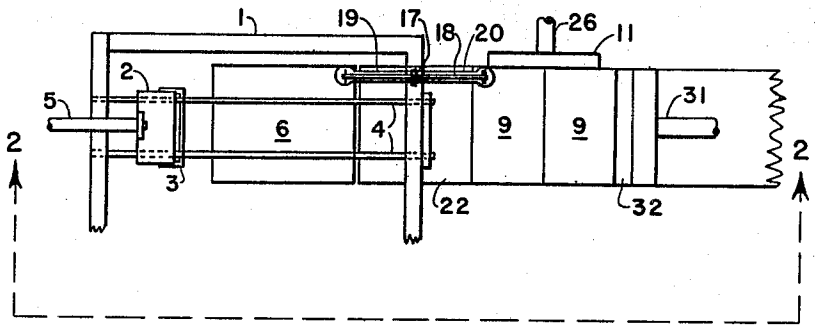



FIG. 1

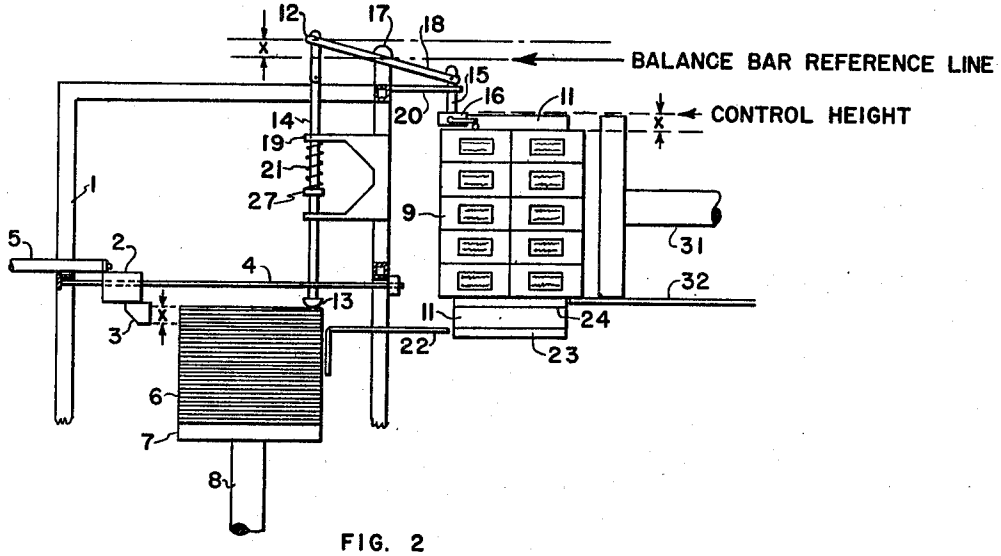



FIG. 2

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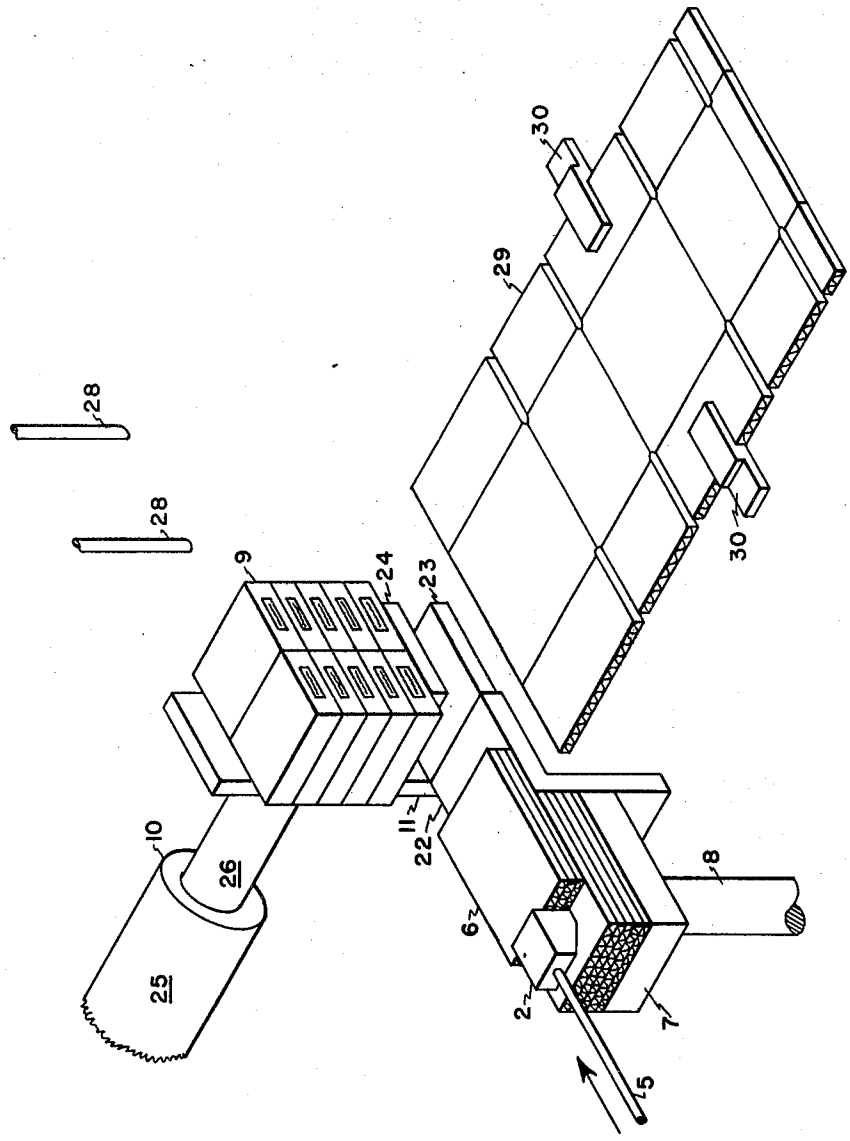



FIG. 3

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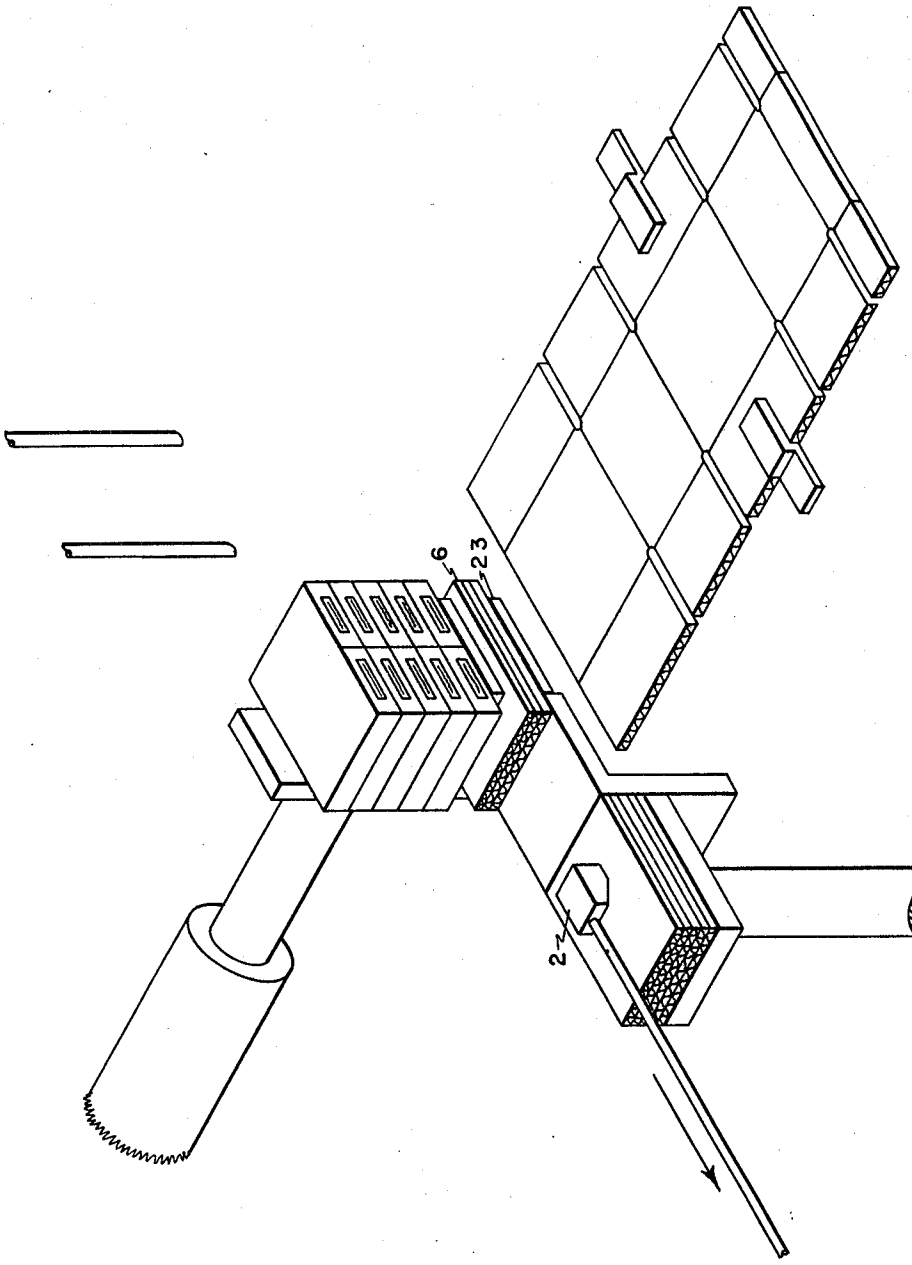



FIG. 4

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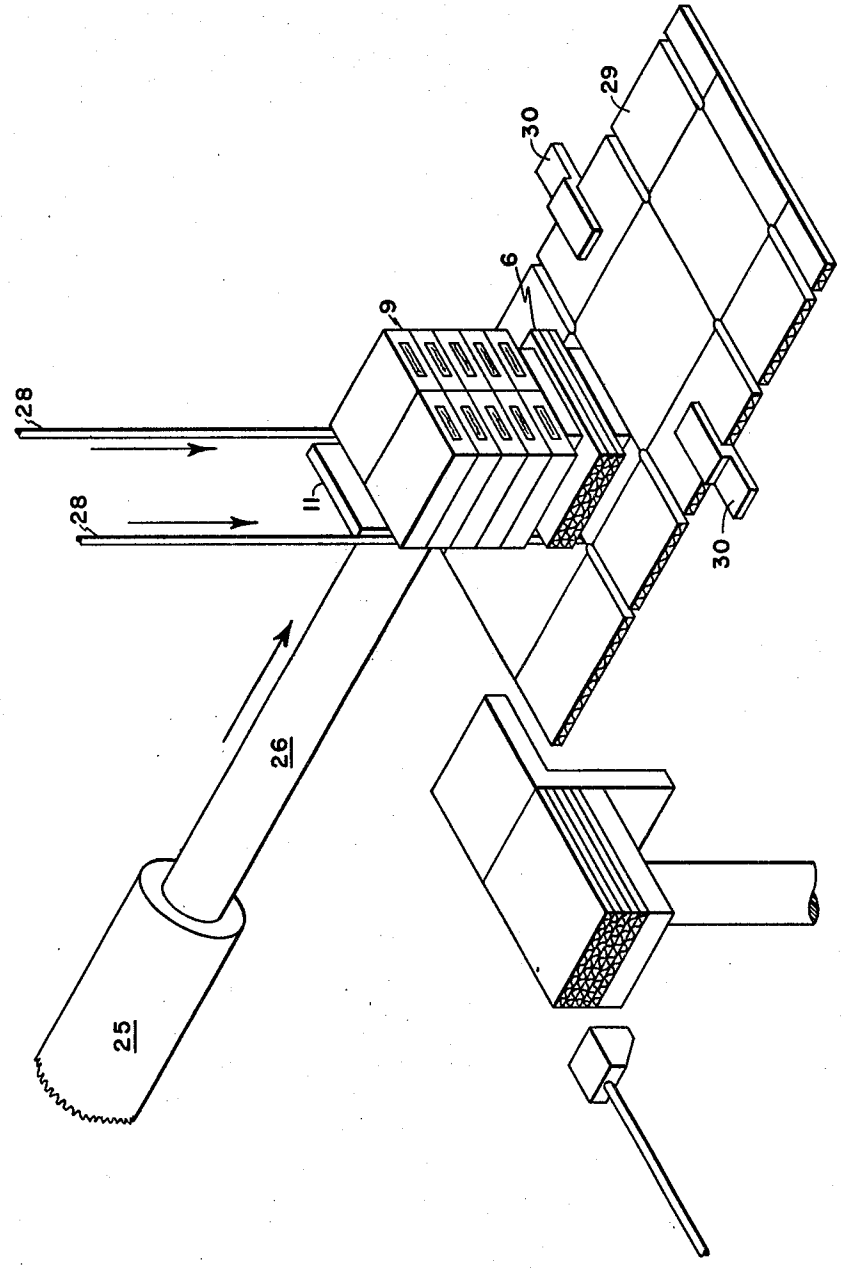



FIG. 5

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APPARATUS FOR PACKAGING A PRODUCT OF UNCONTROLLED HEIGHT

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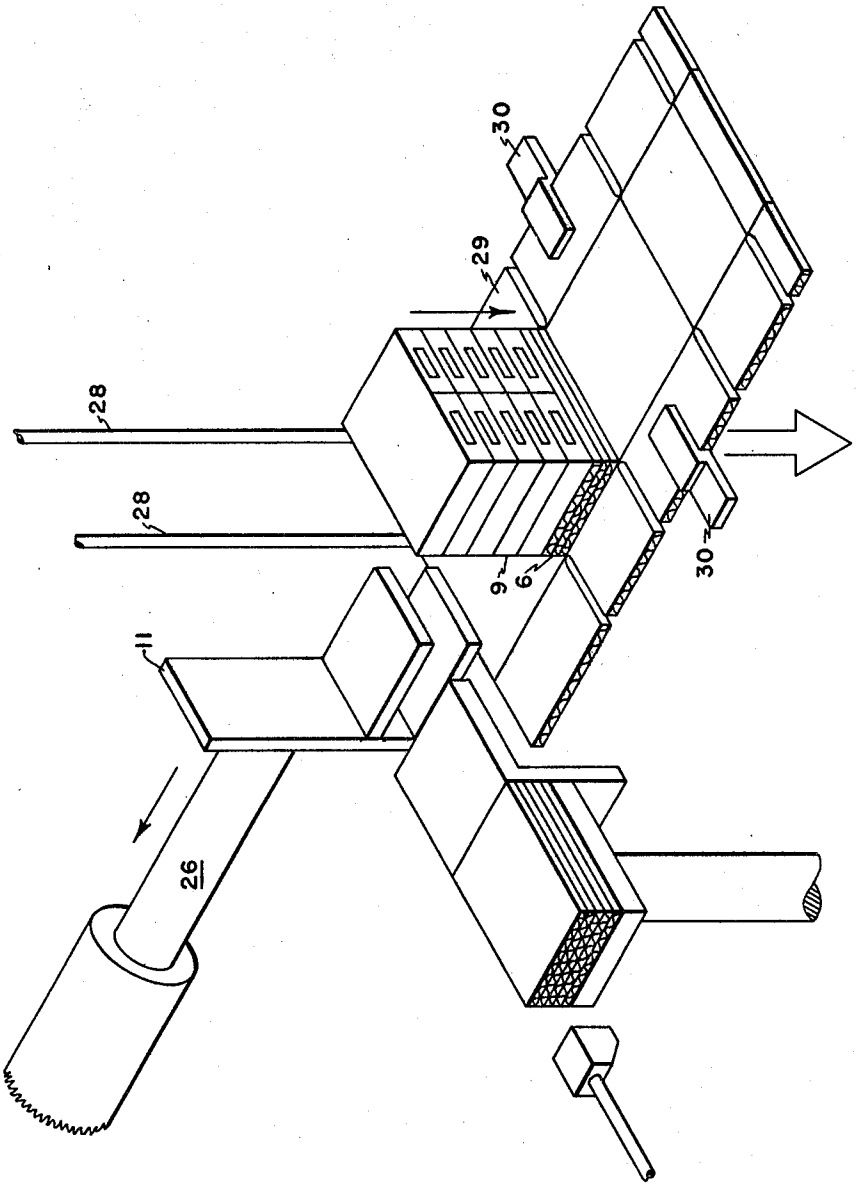



FIG. 6

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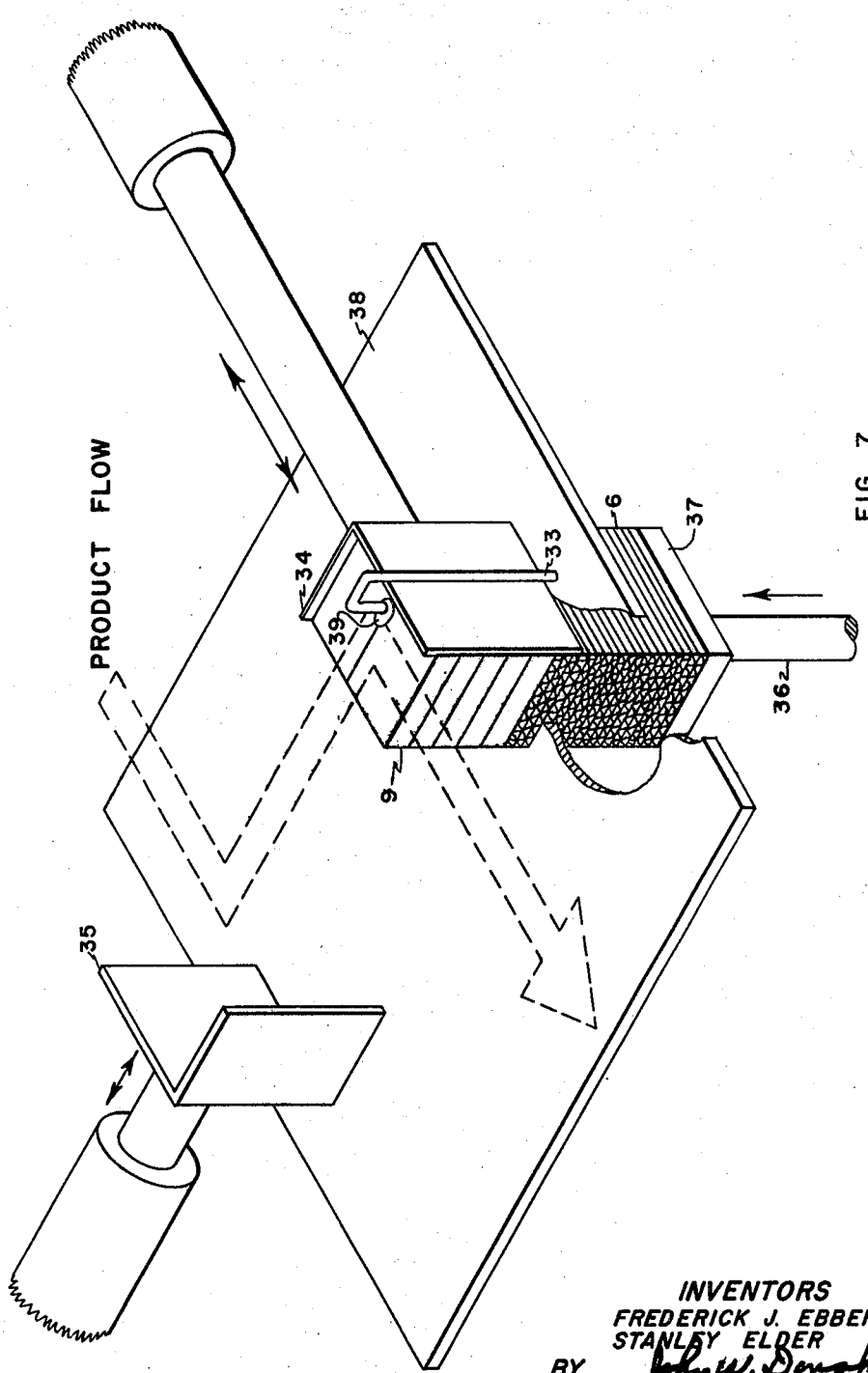



FIG. 7

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United States Patent Office 3,495,374
Patented Feb. 17, 1970



3,495,374

# APPARATUS FOR PACKAGING A PRODUCT OF UNCONTROLLED HEIGHT

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Int. Cl. B65b 35/52, 59/02, 63/00
U.S. Cl. 53—26 17 Claims

## ABSTRACT OF THE DISCLOSURE

A packaging machine for wrapping a pre-cut, pre-scored box blank about a product of uncontrolled height less than the height for which the blank is designed. The machine comprises apparatus for selecting from a parent filler pad stack a filler pad substack for packaging with the product. The selected filler pad substack is separated from its parent stack and stacked in vertical alignment with the product. Thereafter the package is wrapped and sealed in a conventional manner.

## Background of the invention

Our invention relates to machines for packaging an uncontrolled height product in a stiff, fixed height container. It relates further to the selection and insertion of filler pads in such a package and to wrapping a pre-cut, pre-scored box blank about a packaging stack comprising a product and a substack of height-adjusting filler pads. It relates also to the making of a series of controlled height secondary product substacks each having a height related to the height difference between an associated uncontrolled height primary product and a selected control height.

Our novel apparatus was developed in response to a need for elimination of costly hand operations in the packaging of pre-wrapped reams of paper. It is characteristic of this paper to exhibit variations in caliper and thereby produce reams of nonuniform height. This in turn results in a partially empty shipping container which is subject to crushing during handling or storage. In the past this problem has been solved by first filling the shipping container and then manually inserting a number of filler pads as required for a tightly filled package.This has generally been a bottom loading operation so that the paper reams are readily accessible during top unloading.

It will be appreciated that the described process has been tedious and expensive. Furthermore, it is restricted to use with shipping containers which are set up before loading. For wrap-around packaging operations using pre-cut, pre-scored blanks it becomes necessary to determine the required number of filler pads before commencement of the wrapping process. It is further desirable to do this automatically as an initial step in a completely automatic wrapping and sealing sequence. Depending upon the type of packaging operation it is often also desirable to insert the filler pads at the bottom of the article stack thereby avoiding an inverting step at a later stage in the process.

## Summary

Our invention comprises a machine and subcombinations therein for automatically selecting from a parent filler pad stack a filler pad substack of such height as may be required for controlled height adjustment of the product. The selected filler pad substack is separated from its parent stack and stacked in alignment with the product. Thereafter the package is wrapped and sealed in a conventional manner.

Filler pad selection is performed by positioning the product in a spatial zone having a height equal to a selected control height. From the parent filler pad stack there is selected a substack of height equal to the total vertical extent of that region within the said spatial zone which is not occupied by the product. In the preferred embodiment the selected filler pad substack is thereafter separated from the parent stack and transferred to a position in vertical alignment with the product. The product and the filler pad substack are then combined into a single stacked unit for packaging. As will be shown subsequently, the subcombination which comprises the preferred embodiment of our filler pad selection and separation apparatus is useful generally in any application wherein it is desired to make a series of height adjusting substacks each associated with a primary product of uncontrolled height.

In an alternative embodiment of our invention the parent filler pad stack is introduced directly into the above described spatial zone. Filler pad selection is performed implicitly; the selected substack comprising those filler pads which fit in the spatial zone along with the product.

For cooperation with the preferred filler pad selection apparatus we have invented a novel stacking apparatus comprising a movable product support plate and product restraining means. The product is positioned on the product support plate and the selected filler pad substack is placed under said plate in vertical alignment with the product. The product support plate is withdrawn, with the product being laterally restrained. This results in a gravity drop of the product, thereby forming a vertically aligned stack with the filler pad substack on the bottom.

## Brief description of drawings

FIG. 1 is a plan view showing the filler pad selection and separation section of our machine.

FIG. 2 is an elevation view taken along line 2—2 of FIG. 1.

FIG. 3 is a schematic drawing showing our novel stacking apparatus beginning the first step of its stacking sequence.

FIG. 4 follows FIG. 3 and shows the stacking apparatus completing the first stacking step.

FIG. 5 follows FIG. 4 and shows the stacking apparatus completing the second step of the stacking sequence.

FIG. 6 follows FIG. 5 and shows the stacking apparatus completing the third and final step of the stacking sequence.

FIG. 7 shows an alternative embodiment for building a controlled height packaging stack.

## Description of preferred embodiments

Our invention as above summarized comprises a novel packaging machine and certain subcombinations therein. These subcombinations perform the operations of selecting a controlled height substack, separating the selected substack from its parent stack, and stacking the selected substack with the product to be packaged. The following paragraphs describe novel apparatus which perform those operations and which in combination with known wrapping apparatus practice a hitherto unknown packaging process.

The preferred apparatus for selecting and separating a controlled height substack is shown in FIGURES 1 and 2. As illustrated therein a main frame **1** provides general support for the machine. A stack of filler pads **6** rests on a moveable filler pad support plate **7** immediately adjacent to separation plate **22**. Filler pad support plate **7** is driven vertically by filler pad drive shaft **8**. Filler pad pusher **2** with attached plate **3** reciprocates horizontally along a path to push a selected filler pad substack out of vertical alignment with the parent stack and across the horizontal

surface of plate **22**. Driving force for this operation is provided by cylinder shaft **5** and directional alignment by bearing shafts **4, 4**.

A product **9** rests on a carrier **11** comprising a product support plate **24** and filler pad transfer plate **23**. Plate **23** is coplanar with separation plate **22**. Carrier **11** may be horizontally reciprocated and cylinder shaft **26** is provided for this purpose. As illustrated in FIG. 3, cylinder shaft **26** is a part of transfer mechanism **10** which comprises transfer cylinder **25** and cylinder shaft **26**. Our transfer mechanism is mentioned at this point only for purposes of clarity. It is a part of our stacking apparatus which is discussed subsequently.

For relating product height to filler pad height we prefer to use a filler pad selector as best illustrated in FIG. 2 and generally indicated at **12**. The selector as shown comprises a selector foot **13**, selector foot linkage **14** with integral restraining ring **27**, balance bar **18**, adjusting rod **15**, and pressure activated switch **16**. Balance bar **18** is driven by selector foot **13** through linkage **14** and is centrally pivoted about support **17**. Adjusting rod **15** supports switch **16** at the driven end of balance bar **18**. Linkage **14** and adjusting rod **15** are vertically guided by guides **19** and **20**. Return spring **21** is seated between restraining ring **27** and an under surface of guide **19**. Spring **21** returns selector **12** to its start position after pusher **2** has removed a selected filler pad substack off the top of the parent stack and away from its supporting relation to selector foot **13**.

The selection of a controlled height filler pad substack commences with filler pads **6** positioned such that the top pad is level with the horizontal surface of separation plate **22** and balance bar **18** positioned with both ends along the illustrated balance bar reference line. The bottom of selector foot **13** is resting on the top filler pad level with plate **22**.

As a first step in the selection cycle product positioning ram **31** pushes product **9** across product arranging plate **32** into position on product support plate **24** under switch **16**. Rod **15** is adjusted such that when balance bar **18** is centered along the Balance Bar Reference Line the distance between switch **16** and plate **24** is exactly equal to the selected control height. Thus the region between switch **16** and plate **24** constitutes a controlled height spatial zone into which product **9** is introduced. Product **9** as illustrated has a height which fails to meet the control height by an amount X. In general X may have any value within the operating range of the filler pad selection apparatus.

As the cycle progresses the filler pad drive shaft **8** pushes the filler pad support plate upward driving the filler pads past plate **22**. This moves the selector foot **13** upward with a resulting downward movement of pressure activated switch **16**. It will be appreciated that the downward movement of switch **16** exactly equals the upward movement of the filler pads.

After the filler pads have been driven upward for a distance X, switch **16** contacts the upper surface of product **9** and generates a signal stopping the movement of shaft **8**. It is seen that the operation has produced a filler pad advancement such that the number of filler pads raised above the horizontal surface of separation plate **22** is just sufficient to correct a height deficiency X.

The operation is described is carried out in the vertical direction. Obviously, filler pad selection may be performed with the apparatus in any other orientation without departing from the scope of our invention. The directions "vertical" and "horizontal" as well as the dimension "height" are used only for ease of description and are not intended as limitations upon our invention. Furthermore, it will be appreciated that the above described filler pad selection mechanism is not limited narrowly to use with filler pads. It is apparent that the invention could be employed to select controlled height substacks from any type of secondary product stack. Also, when used in conjunction with separating and reset means it may produce a series of controlled height substacks even though modified in numerous obvious ways. For instance, the operation could be reversed by making the filler pad support plate stationary and driving the product support plate; reference for separation being provided by a progressively moveable index.

After filler pad selection, as above described, the stacking operation is begun. Referring still to FIGURES 1 and 2, stacking begins by activating the filler pad pusher **2** to drive the selected filler pads horizontally across separation plate **22** to a resting position upon the filler pad transfer plate **23**. Selector foot **13** is positioned sufficiently far rearward to permit performance of this last operation without physical interference.

The above described step along with the other steps in the stacking operation are schematically illustrated in FIGURES 3 through 6.

FIG. 3 shows three selected filler pads being driven across plate **22** toward a position in alignment under the product. In FIG. 4 the alignment has been achieved and pusher **2** is retreating.

In FIG. 5 transfer cylinder **25** has driven shaft **26** and carrier **11** transversely to a position centered over the bottom panel of a blank **29**. Also, a pair of stripper bars **28** have been lowered to a position adjacent to carrier **11** and immediately behind the overhanging edges of product **9** and filler pads **6**.

FIG. 6 illustrates the final step in the stacking process. As shown therein shaft **26** has pulled carrier **11** back nearly to its initial position. This has caused the lowered stripper bars **28** to engage both the product and the filler pads thereby stripping them off the carrier and causing them to drop on the bottom panel of blank **29**. During translational movement of carrier **11**, blank **29** is held stationary by any convenient means; for instance retractable clips such as clips **30**.

In our machine we follow the above stacking operation by driving a ram downward against the product forcing the packaging stack and the blank down into a forming cavity. This folds the blank up around the stack and commences a wrapping process comprising a series of folding, gluing, and clamping steps. As shown and described, the finished package has the filler pads on the bottom.

The above paragraphs have described preferred apparatus for selecting a variable number of filler pads as required for controlled height packaging, separating the selected pads from a parent filler pad stack to create a height adjusting filler pad substack, and then combining this substack with a variable height product. However, our invention is not limited to apparatus constrained to perform those operations in the stated sequence. FIG. 7, for instance shows alternate apparatus for the practice of our invention. This latter apparatus is like the former in that it positions the product in a spatial zone having a height equal to a given control height and selects from a parent filler pad stack a filler pad substack having a height equal to the total vertical extent of the unoccupied region within the spatial zone.

The apparatus of FIG. 7 operates as follows. A ram not shown pushes the product along the product flow line to stacking carrier **35**. Carrier **35** moves the product transversly for reception by transfer carrier **34**. Carriers **34** and **35** cooperate to product proper positioning and vertical alignment of the product. At commencement of the operation a stack of filler pads **6** rests with the top filler pad protruding into a rectangular aperture in separation plate **38**. Thus when product **9** is positioned as aforesaid within the restraining walls of carrier **34**, it is resting upon and in vertical alignment with the filler pad stack.

After the product is positioned within carrier **34**, filler pad drive shaft **36** drives the filler pad support plate **37** upward elevating the filler pad stack and the product. The upward motion continues until the upper surface of the

product touches pressure activated switch **39** which generates a motion stop signal. The height of switch support rod **33** is adjusted to create between plate **38** and switch **39** a spatial zone of height equal to the selected control height. Thus when the motion stop signal is generated the number of filler pads raised above the horizontal surface of separation plate **38** is just sufficient to correct any height deficiency in the product. In contrast to the previously described embodiment, however, the filler pads advance directly into the controlled height spatial zone, occupying the region not occupied by the product.

When drive shaft **36** stops moving, carrier **34** completes the selecting, separating and stacking operation by pushing the product along the illustrated product flow direction. This motion carries with it the filler pad substack which has been raised above the surface of separation plate **38**.

The operation of the embodiment of FIG. 7 is typical of that of a class of related apparatus wherein filler pads are introduced directly into the control zone; some of the selecting, separating, and stacking operations being combined. For instance, drive shaft **36** could be replaced by a spring and switch **39** by an arresting plate. As another alternative, the filler pads could rest on rectractable clips at the periphery of the separation plate aperture. In this latter embodiment the controlled height spatial zone would be located directly beneath the separation plate. The product would be placed in the zone under the filler pad stack and the retractable clips retracted to drop the required filler pad substack through the aperture into vertical alignment with the product. These and numerous other obvious variations are considered to be within the scope of our invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

**1.** A packaging machine for wrapping a blank about a primary product of uncontrolled height less than the height for which said blank is designed comprising:

support means for a secondary product stack,

substack selection means for selecting from a secondary product stack resting on said support means a substack of height equal to the height deficiency of said primary product,

first restraining means for restraining lateral movement of that portion of said secondary product stack not included within the substack selected as aforesaid,

stack making means operative to move said selected substack laterally out of alignment with its parent stack and to place the substack in alignment with the primary product, thereby making a packaging stack of height equal to the design height for said blank, and

wrapping means for wrapping and sealing said blank about said packaging stack.

**2.** A packaging machine according to claim **1** said means for supporting a secondary product stack comprising a second support plate and said stack making means comprising:

a first support plate for supporting said primary product, said first support plate being parallel to the second support plate and laterally displaced therefrom,

a substack pusher for accomlishing the lateral separation of said selected substack from its parent stack, and moving the substack to a position in vertical alignment under the first support plate,

means for withdrawing the first support plate from its position in vertical alignment over said substack,

second restraining means operative during above said withdrawal to remove a primary product from a position of rest on the first support plate and thereby to cause said primary product to drop upon a height adjusting substack made and positioned as aforesaid.

**3.** For stacking a product and a filler pad substack the combination comprising:

a product support plate for receiving and supporting the product,



means for stacking the filler pad substack in vertical alignment under the product support plate,

means for withdrawing the product plate from its position in vertical alignment over the filler pad substack, and

restraining means operative during above said withdrawal to remove the product from a position of rest on the support plate and thereby to cause the product to drop upon a filler pad substack as aforesaid positioned thereunder.

**4.** A combination according to claim **3** said product support plate being of width less than the width of said product and said restraining means being a pair of vertically moveable stripper bars positioned for lowering adjacent to the product support plate behind the overhanging product edges as the product support plate is withdrawn backward between the stripper bars.

**5.** A combination according to claim **4** and further comprising a filler pad transfer plate for supporting said filler pad substack in vertical alignment under said product, said filler pad transfer plate being connected to the product support plate for simultaneous withdrawal therewith.

**6.** A combination according to claim **5** and further including blank restraining means for holding a pre-cut pre-scored blank in spaced relation to other said means such that upon simultaneous withdrawal of the product support plate and the filter pad transfer plate the product and the said filler pad substack will be dropped upon said blank within a panel defining the bottom for a fully wrapped package.

**7.** In a machine for packaging a product of uncontrolled height less than a selected control height apparatus for building a packaging stack of height equal to said control height comprising:

means defining a spatial zone having a height equal to said control height,

means for positioning said uncontrolled height product within said spatial zone thereby defining an unoccupied region of total vertical extent representing a desired height adjustment for the product,

filler pad support means for receiving, supporting, and laterally restraining a parent filler pad stack in spaced relation to said spatial zone, and

combining means for selecting and laterally separating from a parent filler pad stack as aforesaid supported a filler pad substack of height equal to the total vertical extent of an unoccupied region as aforesaid defined and stacking said filler pad substack together with said product.

**8.** Apparatus according to claim **7**, said filler pad support means comprising a filler pad support plate parallel to the base of a spatial zone as aforesaid defined and moveable in a direction perpendicular thereto.

**9.** Apparatus according to claim **8** said filler pad support plate being located in vertical alignment with the spatial zone as aforesaid defined, and said combining means comprising an elevator for driving said filler pad support plate toward the spatial zone and causing a filler pad substack supported thereon to enter and completely occupy that region not occupied by the product as positioned therein, said filler pad substack being that selected as aforesaid.

**10.** Apparatus according to claim **9** said combining means further comprising pusher means operative along a path through the spatial zone as aforesaid defined and adapted to push therefrom the product as positioned therein together with a filler pad substack as aforesaid selected and positioned thereagainst.

**11.** Apparatus according to claim **10** and further including a separation plate positioned adjacent the spatial zone as aforesaid defined, said separation plate having an aperture therein for passage of a filler pad stack therethrough thereby restraining the parent filler pad stack as

said pusher means moves the said filler pad substack separating it therefrom.

12. Apparatus according to claim 8 said combining means comprising a selector foot moved by filler pads positioned on said moveable filler pad support plate, and connected to and driven by the selector foot a pressure activated switch moveable into an unoccupied region as aforesaid defined, said pressure activated switch being operative to generate a movement stop signal when brought into contact with a product positioned in a spatial zone as aforesaid defined.

13. For selecting from a parent filler pad stack a filler pad substack having a height representing the height difference between an uncontrolled height product and a selected control height, the combination comprising:

a product support plate,

a filler pad support plate parallel to the product support plate and moveable in a direction perpendicular thereto,

a separation plate having a surface parallel to both of above said plates and fixed in spatial relation to the product support plate,

elevating means for moving the filler pad support plate and concomitantly pushing a parent filler pad stack thereon perpendicularly past the separation plate,

a moveable selector foot driven by surface contact against the lead filler pad in said parent filler pad stack,

a bifurcated balance bar having its first end connected to and driven by the selector foot and centrally pivoted about a point in spaced relation to the product support plate such that the balance bar second end is driven toward a product supported thereon, and

a pressure activated switch connected to the balance bar second end and operative to generate a movement stop signal when said switch is moved into contact with a product supported as aforesaid.

14. In a machine for packaging a primary product of uncontrolled height less than a selected control height apparatus to build a regulated height substack for stacking therewith comprising:

a first support plate for supporting the primary product,

means for measuring the difference between the top of a primary product resting on said first support plate and a first predetermined level corresponding to said selected control height,

a second support plate for supporting a secondary product stack, said second support plate being parallel to the first support plate and moveable in a direction perpendicular thereto,

means for raising the second support plate until the top of a secondary product stack supported thereon exceeds a second predetermined level by an amount equal to above said difference,

means to strip off from said secondary product stack that portion above said second predetermined level thereby creating a regulated height substack which when combined with the uncontrolled height product will create a packaging stack equal in height to said control height.

15. For making from a secondary product stack a series of substacks each having a height related to the height difference between an associated uncontrolled height primary product and a selected control height the combination comprising:

a first support plate for supporting a primary product,

a second support late for supporting the secondary product stack,

motive means for producing intermittent linear motion between the first and second support plates, said motion comprising a series of movement steps each associated with the selection and separation of a single substack,

index apparatus adapted for progressive interrupted approach toward the second support plate, the magnitude of the approach steps corresponding to steps in the above said intermittent linear motion,

control means responsive to the presence of the lead surface of a primary product resting on the first support plate and operative to communicate a motion stop signal to said motive means when aforesaid intermittent linear motion has, during a motion period, produced a movement corresponding to the difference between the selected control height and the height of the primary product,

separating means operative upon interruption of said intermittent linear motion to separate from the secondary product stack, as aforesaid positioned on the second support plate, that portion thereof having advanced past the index means during the preceding motion period, said separated portion being the desired substack, and

reset means operative upon completion of above said separation to adjust the control means to an initial condition for commencement of another substack selection cycle; said initial condition being such that for a primary product of height equal to the selected control height the control means will immediately interrupt the succeeding movement period of said intermittent linear motion.

16. A combination according to claim 15 said control means comprising a sensor mounted for closure toward the first support plate during a movement period of said intermittent linear motion; the initial distance between said sensor and the first support plate being adjusted by the reset means to a value equal to the selected control height.

17. A method of making a packaging stack of height equal to a selected control height comprising the steps of:

positioning a primary product in a spatial zone having a height equal to said control height,

measuring the distance between the top of said primary product and the top of said spatial zone,

advancing a secondary product stack past an index marker for a distance equal to above said measured distance,

separating from the secondary product stack that portion thereof having advanced past the index marker, and

transferring said separated portion of the secondary product stack into stacked relationship with the primary product thereby making a controlled height package.

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U.S. Cl. X.R.

53—52, 159, 203; 214—6