

Sept. 2, 1969

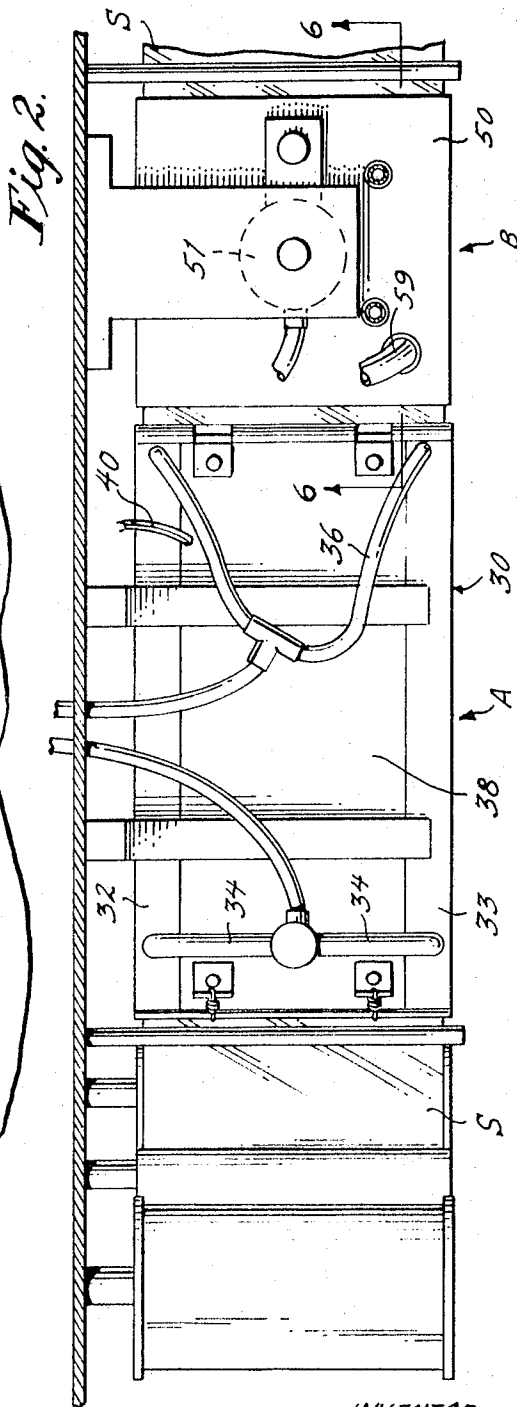
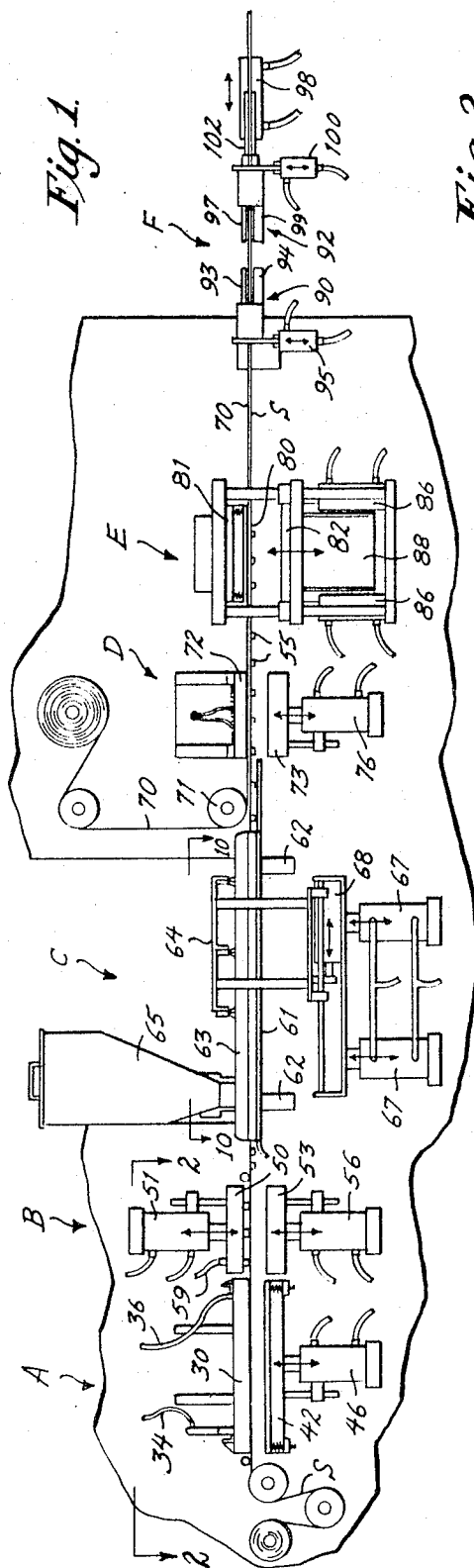
M. NICHOLS

3,464,182

PACKAGING MACHINE

Filed April 7, 1967

8 Sheets-Sheet 1



INVENTOR
MATTHEW NICHOLS
By *Matthew Nichols*
ATTORNEY

Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 2

Fig. 3.

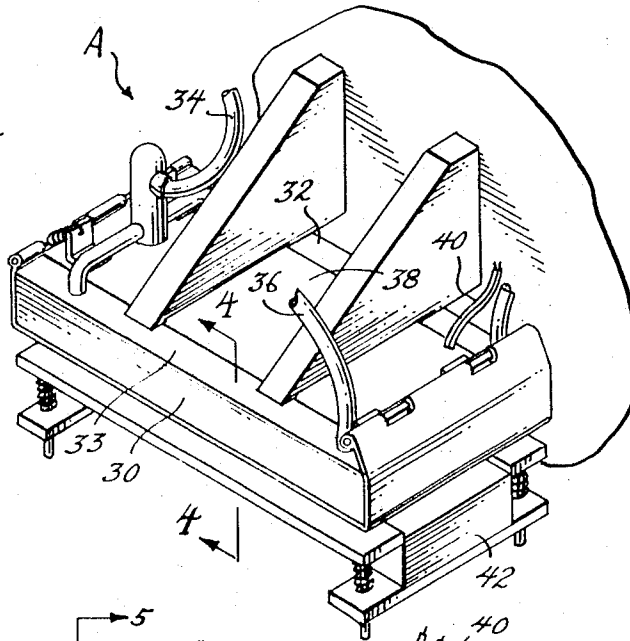


Fig. 4.

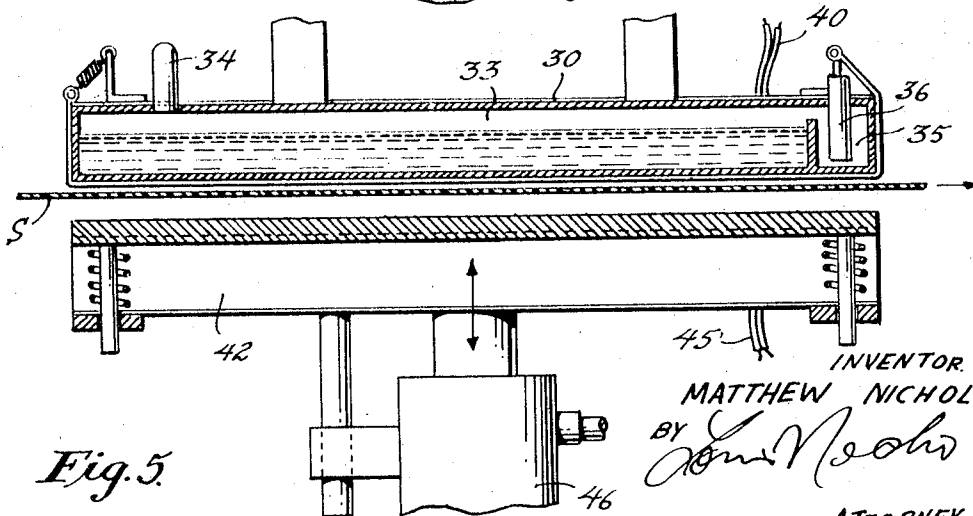
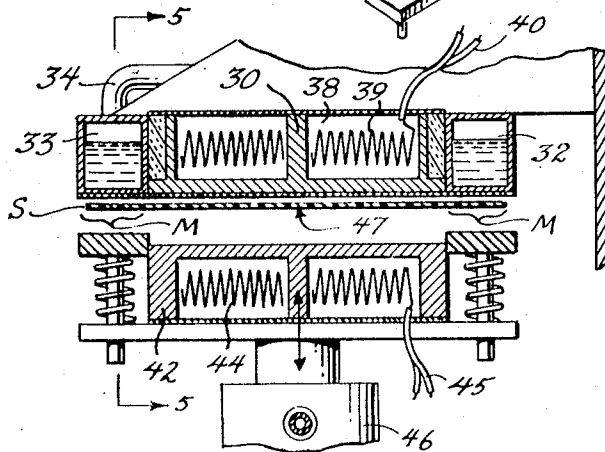


Fig. 5.

INVENTOR.
MATTHEW NICHOLS
BY *John Nichols*
ATTORNEY.

Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 3

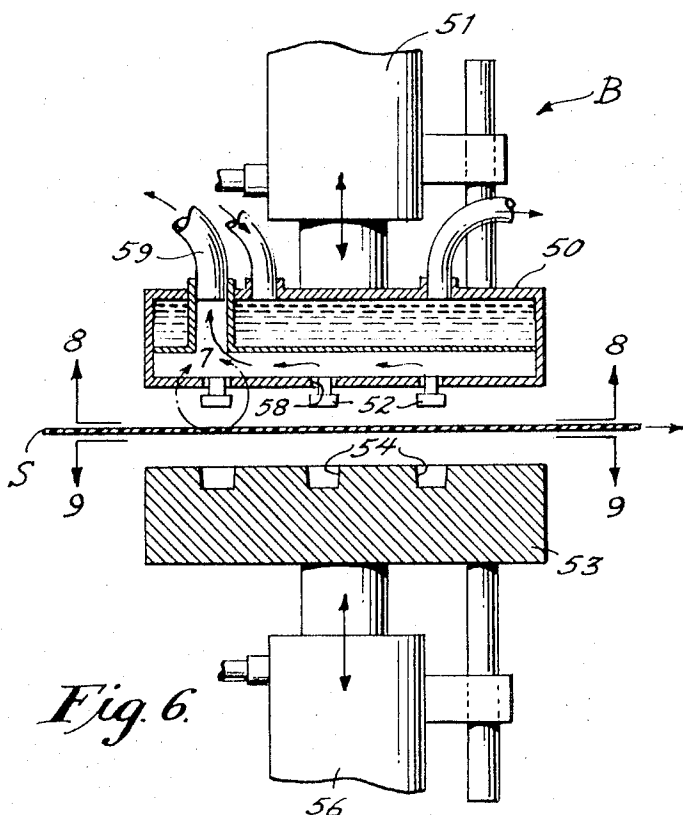


Fig. 6.

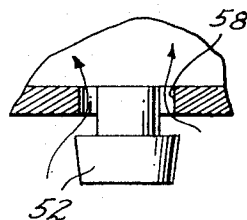


Fig. 7.

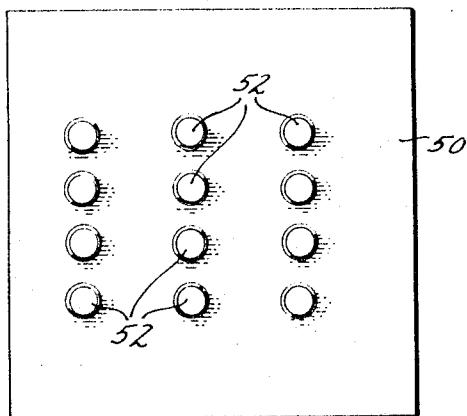


Fig. 8.

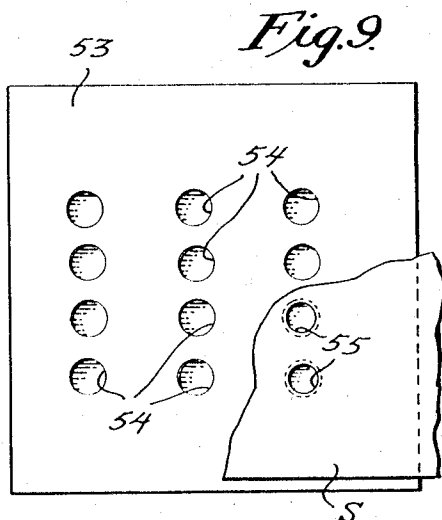


Fig. 9.

INVENTOR
MATTHEW NICHOLS
BY *John Mecho*
ATTORNEY.

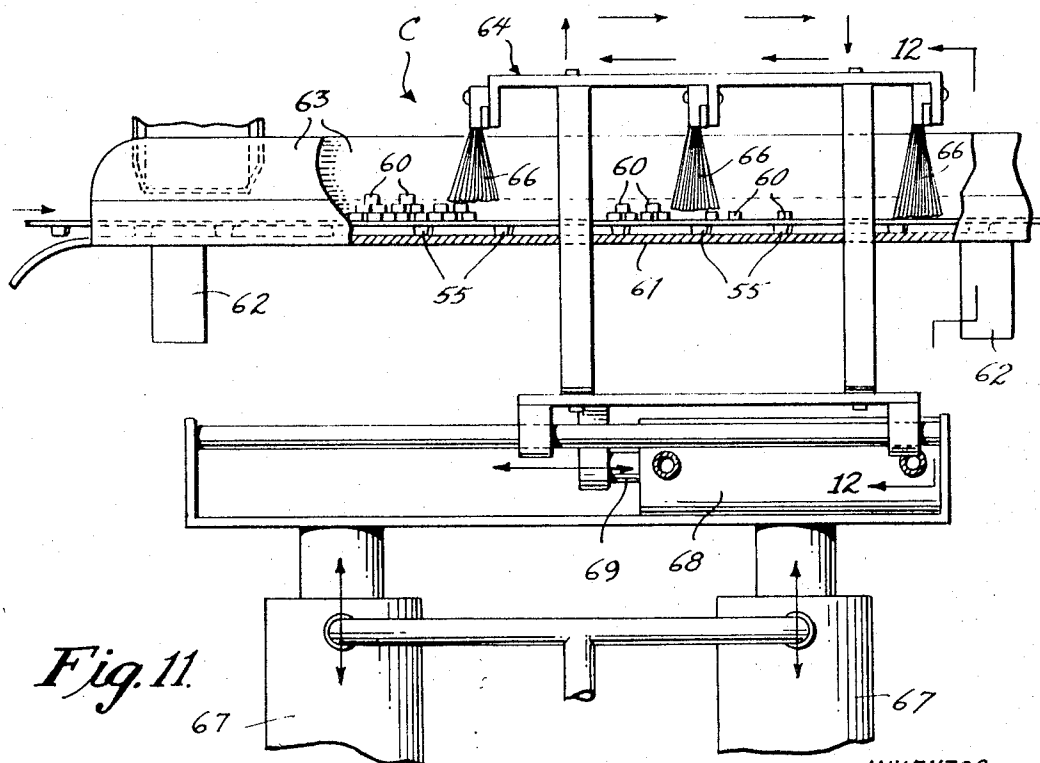
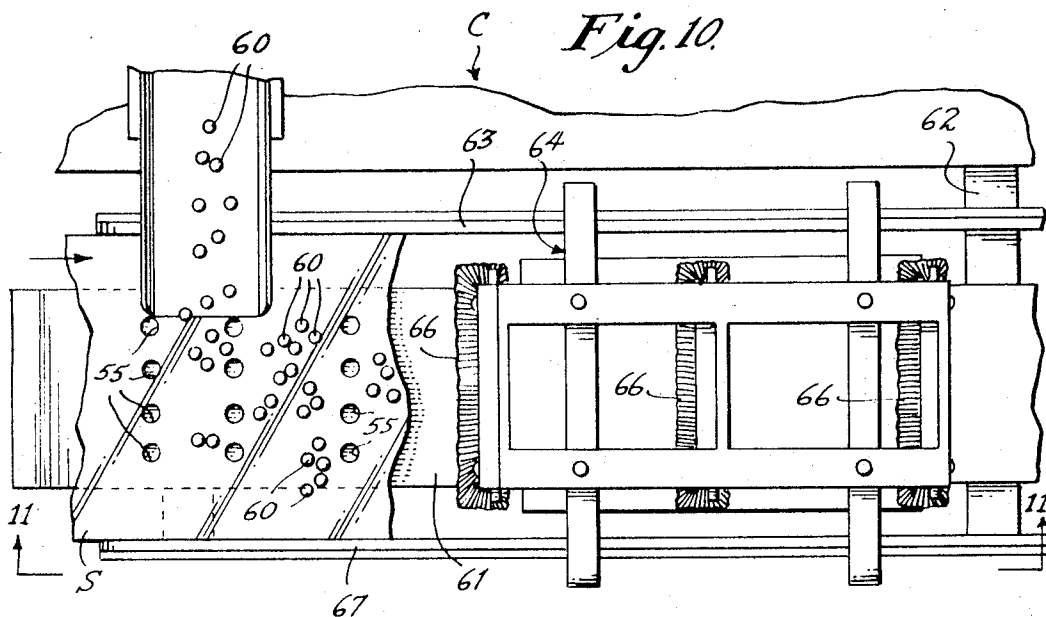
Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 4



INVENTOR.

MATTHEW NICHOLS

BY

John V. Necho

ATTORNEY.

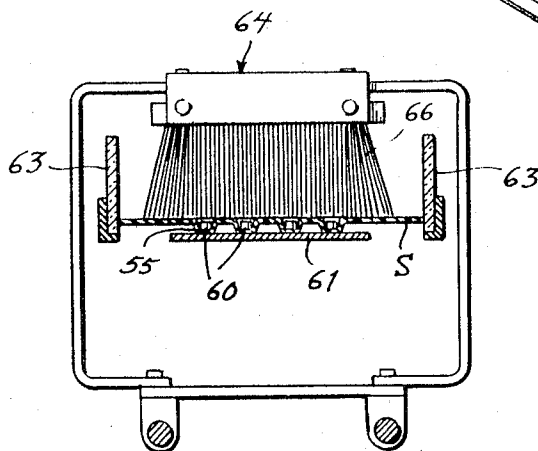
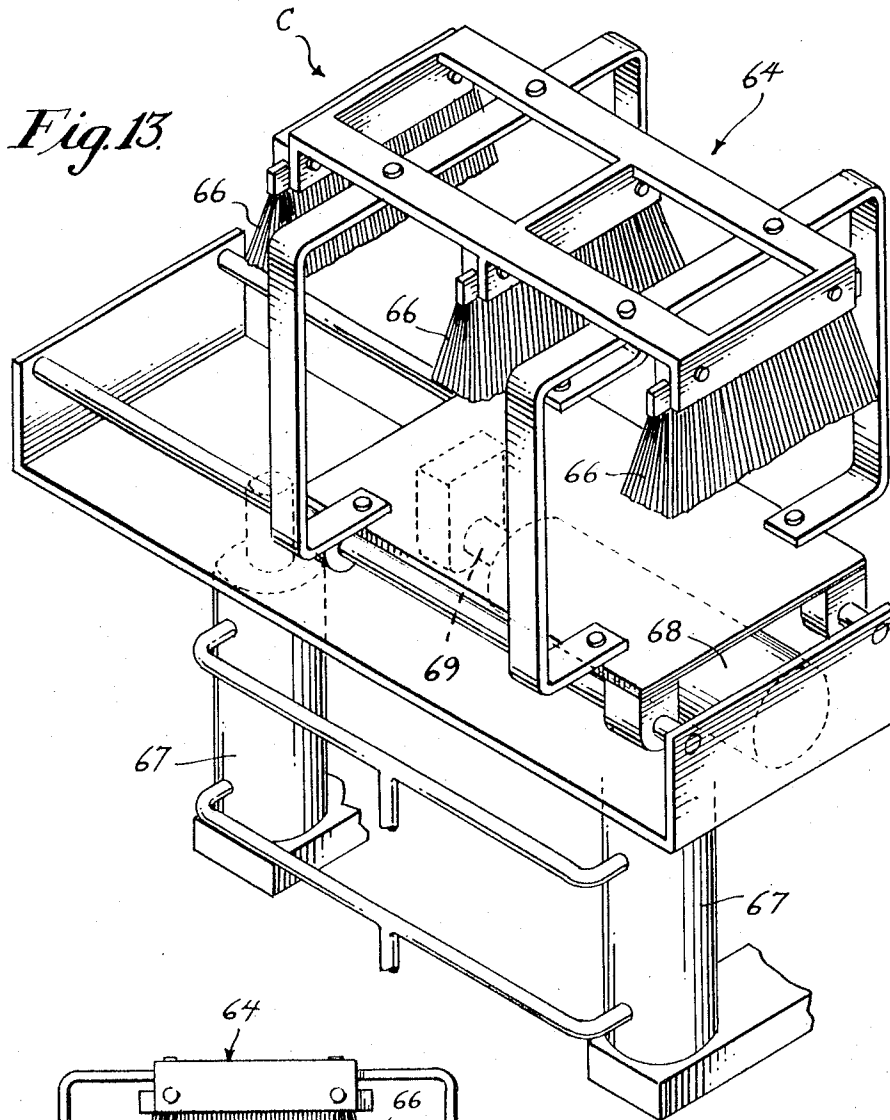
Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 5



INVENTOR
MATTHEW NICHOLS
BY *Matthew Nichols*
ATTORNEY.

Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 6

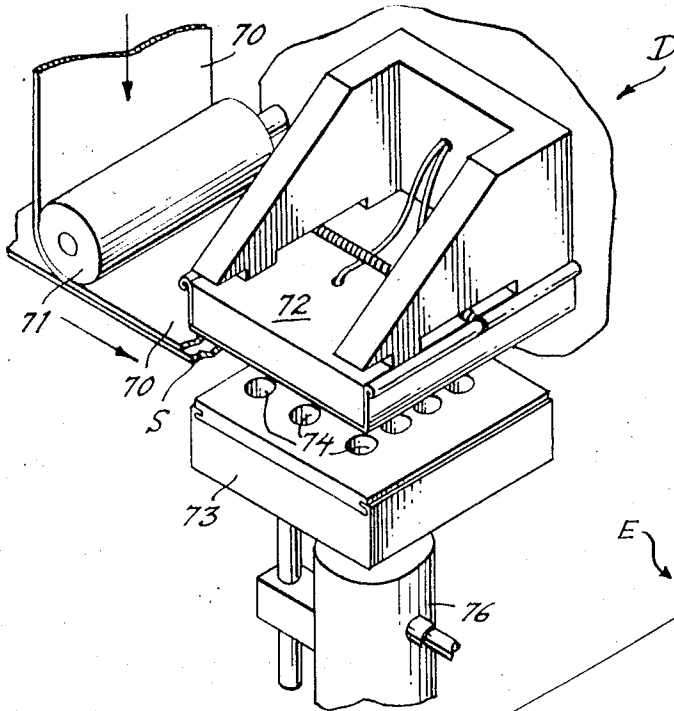


Fig. 14.

Fig. 15.

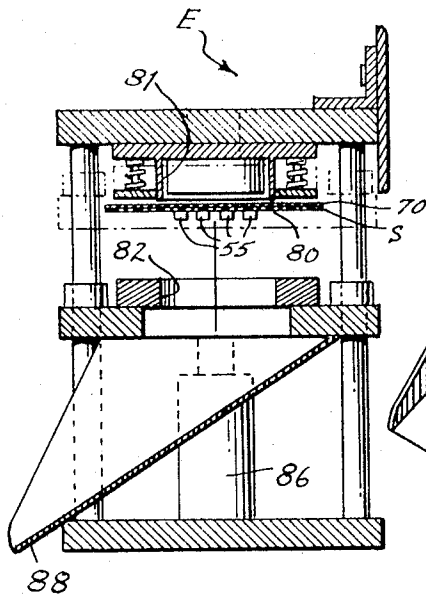
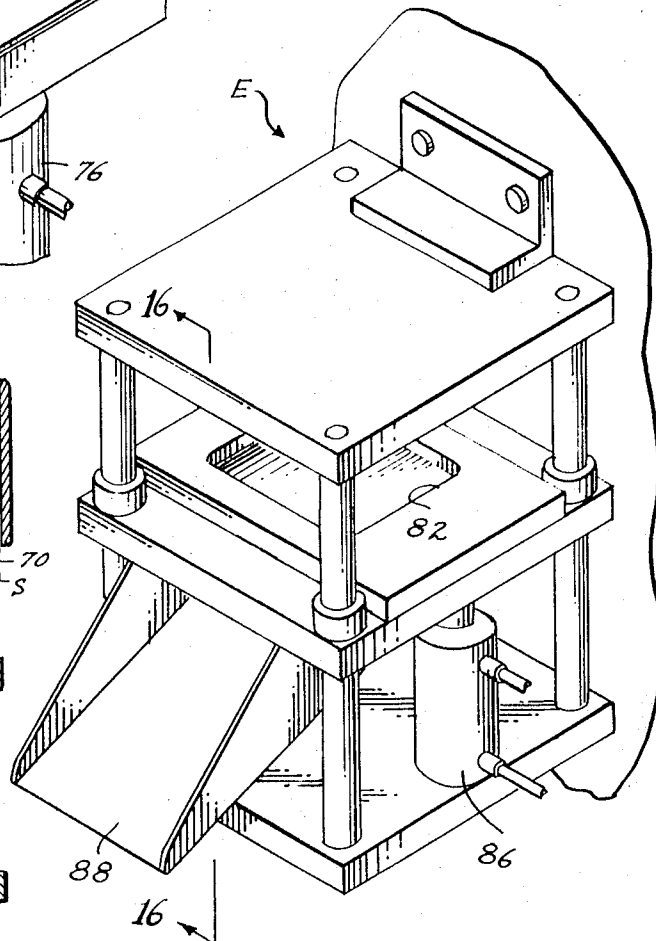


Fig. 16.



INVENTOR
MATTHEW NICHOLS
BY *James Nichols*
ATTORNEY

Sept. 2, 1969

M. NICHOLS

3,464,182

PACKAGING MACHINE

Filed April 7, 1967

8 Sheets--Sheet 7

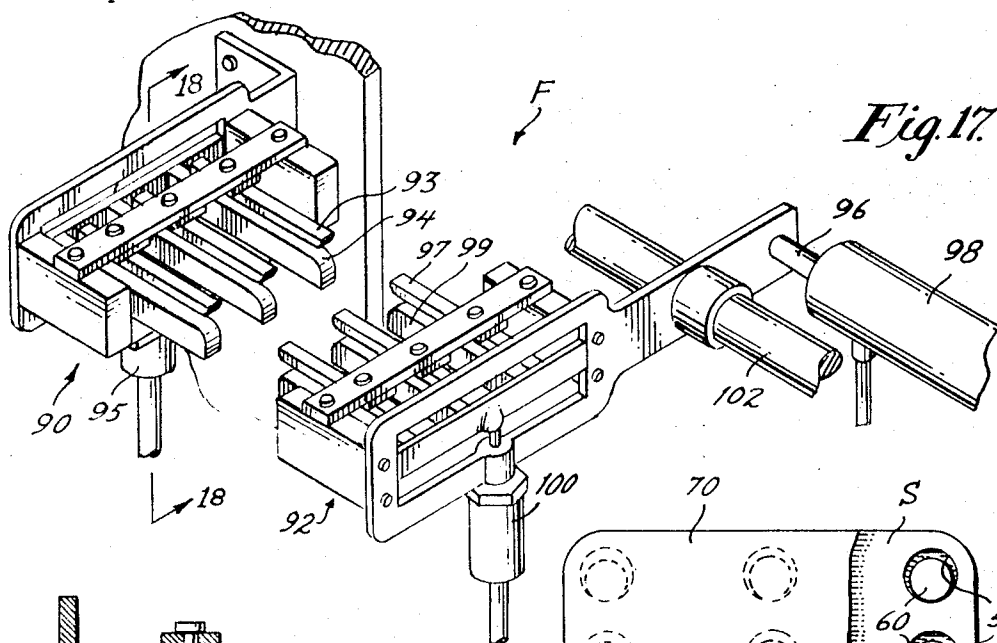


Fig. 17.

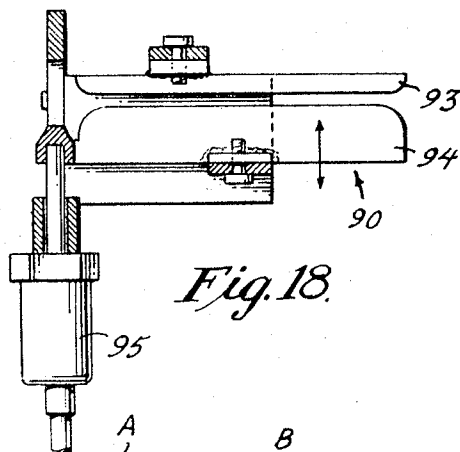


Fig. 18.

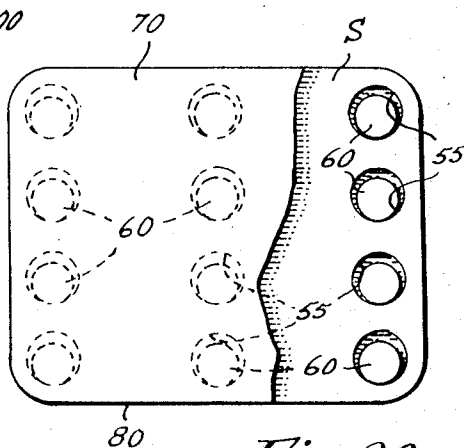


Fig. 20.

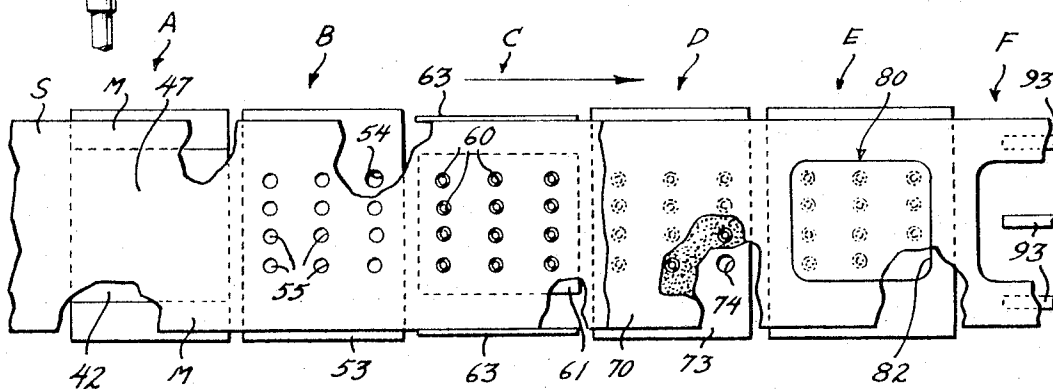


Fig. 19.

INVENTOR.
MATTHEW NICHOLS
BY 
ATTORNEY.

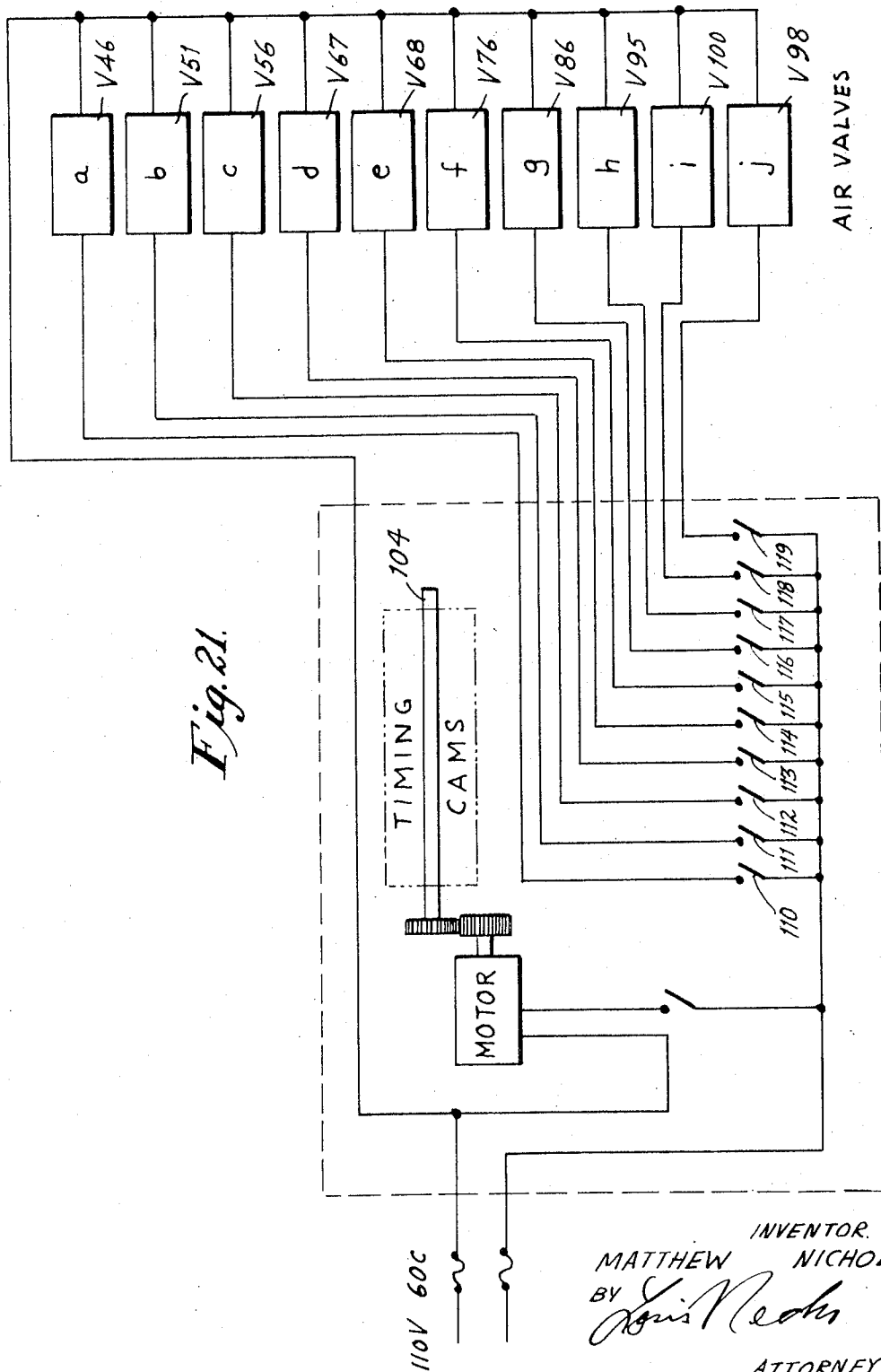
Sept. 2, 1969

M. NICHOLS
PACKAGING MACHINE

3,464,182

Filed April 7, 1967

8 Sheets-Sheet 8



1

3,464,182

PACKAGING MACHINE

Matthew Nichols, Norristown, Pa., assignor to Sauter Packaging Company, Souderton, Pa., a corporation of Pennsylvania

Filed Apr. 7, 1967, Ser. No. 629,143

Int. Cl. B65b 9/04; B29c 1/00

U.S. Cl. 53—184

10 Claims

ABSTRACT OF THE DISCLOSURE

A machine for forming blisters in thermo-plastic material for receiving the object to be packaged, and sealing the object-containing blisters. The machine is particularly designed for packaging medicinal pills or tablets but has other applications.

THE INVENTION

Provides a plurality of stations which operate automatically, continuously, and in synchronous succession, whereby the operator only need thread the ends of upper and lower thermo-plastic sheets and to maintain a supply of the pills, or other objects, to be packaged.

THE DRAWINGS

FIG. 1 is a side elevational view of an apparatus embodying the invention.

FIG. 2 is an enlarged sectional view looking in the direction of line 2—2 on FIG. 1.

FIG. 3 is an enlarged, fragmentary, perspective view of some of the parts shown at the extreme left-hand end of FIG. 1.

FIG. 4 is a sectional view looking in the direction of line 4—4 on FIG. 3.

FIG. 5 is a sectional view looking in the direction of line 5—5 on FIG. 4.

FIG. 6 is a sectional view looking in the direction of line 6—6 on FIG. 2.

FIG. 7 is an enlargement of enclosed area 7 on FIG. 6.

FIG. 8 is a sectional view looking in the direction of line 8—8 on FIG. 6.

FIG. 9 is a sectional view looking in the direction of line 9—9 on FIG. 6.

FIG. 10 is an enlarged section on line 10—10 of FIG. 1.

FIG. 11 is a sectional view looking in the direction of line 11—11 on FIG. 10.

FIG. 12 is a sectional view looking in the direction of line 12—12 on FIG. 11.

FIG. 13 is an enlarged perspective view showing the "loading" mechanism which places pills in the recesses formed in the base sheet.

FIG. 14 is an enlarged perspective view showing the heat-sealing mechanism which seals the pills in the recesses.

FIG. 15 is an enlarged perspective view showing the die-cutting mechanism which cuts out a completed blister package from the material of which the package is formed.

FIG. 16 is a sectional view looking in the direction of line 16—16 on FIG. 15.

FIG. 17 is an enlarged, perspective view of the work pulling mechanism which is shown at the extreme right-hand end of FIG. 1.

FIG. 18 is a sectional view looking in the direction of line 18—18 on FIG. 17.

FIG. 19 is a flow diagram showing the steps of my method and the order in which they are carried out.

FIG. 20 is a top plan view of one form of blister

2

package which can be produced by the apparatus and according to the method of my invention.

FIG. 21 is a diagrammatic representation of the circuitry which controls the operation of the machine.

In the art of blister packaging, it has been the practice to cut the thermo-plastic sheets to the desired size and to feed them, individually, to a heated die which formed the blisters for receiving the pills, the sheets being then moved individually, to a loading station at which the operator placed the requisite number of pills in the recesses. At this, or at another station, a pre-cut, individual, cover sheet was placed over the base sheet and the laminated sheets were subject to heat to adhere the sheets together with the pills therebetween.

The reason for this obviously disadvantageous practice is that the base sheet was heated over its entire surface, and hence, it could not be subjected to any lateral tension, until it had cooled enough to regain its original tensile strength. This slowed down the operation. Furthermore, the practice of heating the base sheet over its entire area also made it impossible to use base sheets of less than a minimal gauge, or thickness, because the pressure exerted to form the recesses in the base sheet also distorted the adjacent and peripheral portions of the base sheet.

It is therefore the object of the invention to produce a new method of, and apparatus for, packaging, whereby base sheets of relatively heavy and of relatively light, gauge can be successfully used.

A further object is to produce a new method and apparatus whereby the steps of providing the base sheet with recesses; the deposit of the pills, or other objects, in the recesses; the application and adhesion of a cover to seal the pills in their recesses, and the cutting-out of the completed package; are carried out rapidly and automatically.

As can be seen from FIGS. 1 and 19, an apparatus embodying my invention includes six interdependent and mutually co-operative units located at stations A to F inclusive, at which the various steps of my method are synchronously and successively carried out.

Generally speaking, the thermo-plastic base sheet is heated to permit the formation therein of pill-receiving blisters, or recesses, at station A; the blisters are formed in the base sheet at station B; the pills are placed in the blisters at station C; the cover, or sealing sheet is applied to the base sheet as it approaches station D where the cover and base sheets are adhered together; and the laminated and adhered base and cover sheets, with the pills therebetween, are cut out at station E; and the remainder of the laminated sheets are pulled at station F, intermittently and in measured increments, to present successive portions of the base and cover sheets to successive stations. The mechanisms at stations A to F are fully described below. At this point it only need be noted that operations A to E are carried out automatically and synchronously whereby, for practical purposes, the operation can be described as continuous.

THE BASE SHEET CONDITIONING MECHANISM AT STATION A

(FIGS. 1 to 6)

The first step in carrying out the invention is the softening of the central portion of base sheet S. This is carried out by the mechanism at station A which includes a hollow, upper, fixed platen 30 which is provided with marginal compartments 32 and 33, which are supplied with cold water or a suitable refrigerant through conduit 34 and with a refrigerant overflow receiving compartment or accumulator 35 from which the spent water, or refrigerant is withdrawn by conduit 36. The central portion 38

3

of upper platen 30 is controllably heated by resistance element 39 which is energized through wire 40.

The base sheet conditioning mechanism at station A also includes a lower vertically reciprocable platen 42, the central portion of which is preferably, but not necessarily, controllably heated by resistance element 44 which is energized by wire 46. Platen 42 is reciprocated by any suitable means such as double acting hydraulic, or pneumatic, cylinder 46 which actuates the lower platen in synchronous relation to subsequent operations in the manner hereinafter set forth. At this point, it is sufficient to say that, when the lower platen is raised into abutment with the upper platen, the heated central portions of the platens soften the central portion 47 of the base sheet while the cooled marginal portions of the platen keep the marginal portions M of the base sheet cool enough to retain the tensile strength necessary to permit the laminated sheets to be intermittently pulled, by the puller mechanism shown at station F, to present successive portions of the sheets to the successive stations without distortion of the softened portion of the sheet. The degree of heat applied to the base sheet at station A can be ascertained from handbooks which give the melting points for various synthetic, transparent, or translucent sheet materials, and for various gauges of the same, or of different materials. But, for convenience, examples of various materials are set forth below.

THE FORMATION OF RECESSES OR BLISTERS AT STATION B

(FIGS. 1, 6 to 9, and 20)

The second step, which is the formation of blisters in the softened central portion 47 of base sheet, is carried out by the mechanism shown at station B. This mechanism includes an upper platen 50 which is reciprocated vertically by a double acting hydraulic, or pneumatic, cylinder 51 and which has pendent lugs 52, and a lower platen 53 which has holes, or recesses 54, and is reciprocated by a double acting cylinder 56, FIG. 6. The size, number, shape, and pattern of the lugs vary with the size, number, shape, and pattern of the blisters, or pockets 55, FIG. 9, it is desired to produce in the base sheet. For the purpose of this disclosure, it is enough to point out that when the upper and lower platens are brought together, lugs 52 and recesses 54 co-operate to form recesses or blisters 55 in the base sheet.

Experience shows that if the blisters 55 are produced by merely mating the male and female dies, the junctions of the blisters with the base sheet will be on an objectionably large radius. Experience also shows that for better sealing, and better appearance, it is desirable that the junction of the upper edges of blisters 55 be squared relative to the plane of base sheet so that a vertical section taken through any part of a blister 55 will show that the vertical wall of the blister is at a sharp angle to the plane of the base sheets.

According to my invention, I overcome this difficulty by applying suction to lugs 52 (FIG. 6). This is accomplished by a conduit 59 which leads from openings 58 which are adjacent lugs 52 to a source of suction, not shown. By this arrangement, the walls of blisters 55 will have sharp, right-angle, junctions with the base sheet. I am not sure, but my theory is that the suction at openings 58 holds the portions of the plasticized base sheet which surround lugs 52 tightly against the flat underside of platen 30 so that the only material stretched to form blisters 55 will be that which snugly encases the lugs.

PLACING PILLS IN THE BLISTERS AT STATION C

(FIGS. 1, 10-13, 19, and 20)

The mechanism for placing pills 60 in the blisters 55 includes a stationary platform 61 over which the base sheet, with blisters 55 formed therein, is intermittently

4

drawn, between guides 63, by the puller mechanism at station F. Platform 61 is supported by suitable legs 62, and above the left or receiving end of station C is a hopper 65, for dispensing a supply of pills to the blisters in the base sheet therebelow.

To insure that all of the blisters in the base sheet are filled, and to insure that no excess pills will be carried over to heat-sealing station D, I provide a sweeping mechanism which pushes pills into blisters and removes from the surface of the base sheet such pills as are not in blisters. This mechanism includes a carriage 64 from which is suspended one or more brushes 66, one of which is near the entrance end, and one of which is near the exit end of station C. It will be noted that the bottom edge of the brush near the exit end of station C is closer to the base sheet than the bottom edge of the other brushes (FIG. 11). Carriage 64 is reciprocated vertically by one or more double acting cylinders 67 and it is reciprocated horizontally by double acting cylinder 68, the piston 69 of which is connected to the carriage frame, FIG. 13. By this arrangement, the carriage is intermittently first moved upwardly, to elevate the brushes; then horizontally, to the right, as viewed in FIGS. 11 and 12; then downwardly to bring the brushes into close proximity to, or into contact with, the base sheet; and then horizontally to the left so that brushes will sweep the pills into empty blisters, if any, and will sweep any pills not seated in blisters 55 off the surface of the portion of the sheet leaving station C to join the supply of pills falling out of hopper onto the oncoming portion of the base sheet.

THE HEAT SEALING OPERATION AT STATION D

(FIGS. 1 and 14)

As the base sheet moves out of station C, it is joined by a cover sheet 70 which is paid out from roll 71 and overlies the base sheet. Cover sheet 70 may be of foil, paper, or other material which can be adhered to the base sheet by the application of heat and pressure. The mechanism for sealing the base and cover sheets includes an upper, stationary platen 72, which is controllably heated by elements such as those which heat the platens at station A and which are shown in FIG. 4; and a lower platen 73 which has recesses 74 for receiving the pill-containing blisters 55 of the base sheet S. Lower platen 73 is vertically reciprocated by a double-acting cylinder 76, into and out of abutment with the upper platen 72 to adhere cover to base sheet S.

STRIPPING THE COMPLETED PACKAGE AT STATION E

(FIGS. 15, 16 and 20)

The pill-containing segment 80, which is shown in FIG. 20, is cut out at station E by means of a cutting die having an upper, stationary male member 81 and a lower, movable female member 82 which has a cavity corresponding to the size and shape of the segment to be severed, and which is vertically reciprocated by cylinder 86. The segments severed at station E fall into a chute 88 which delivers them to a conveyor, or to a receptacle, not shown.

In the illustrated embodiment, the pattern of the pill-receiving blisters 55, is rectangular, FIGS. 8, 9, and 20, but it is to be understood that the pill-receiving blisters can be arranged in any desired pattern.

Cover sheet 70 may be of thermo-plastic material or it may be of paper, or cardboard, with the name of the product, the dosage and the name of the manufacturer, etc., printed thereon.

THE PULLER MECHANISM AT STATION F

(FIGS. 17 and 18)

The base sheet S, with the cover 70 laminated thereto, is pulled from left to right, as viewed in FIG. 1, by a puller mechanism which engages the lateral marginal portions of the sheet, that is, the portions of the laminated

sheets which remain after severance of the pill-bearing portions. This mechanism includes a fixed, gripper 90 and a horizontally movable, gripper 92. The stationary gripper 90 includes a number of spaced pairs of clamps, each having a fixed upper jaw 93 and a movable lower jaw 94, the latter being vertically moved into an upper, gripping, and to a lower, releasing, position by cylinder 95. When jaw 94 is closed against jaw 93, the base sheet S is held against movement. Movable gripper 92 also includes upper fixed jaws 97 and lower movable jaws 99 which are moved upward into engagement with jaws 97 and downwardly out of engagement with said jaws by cylinder 100. In addition, movable gripper 92 is reciprocable horizontally by the piston 96 of cylinder 98. Movable gripper 92 is slidable over guide rail 102, towards, and away from, the fixed gripper 90. The clamping jaws of the movable gripper are out of alignment with the jaws of the fixed gripper so that when the movable gripper is moved to its extreme left-hand position as viewed in FIGS. 1 and 17, the jaws of the movable gripper will be interleaved with the jaws of the fixed gripper. The movements of the fixed and movable grippers are as follows: With its jaws open, the movable gripper 92 is moved, by piston 96, to the left in FIG. 17 to dispose its jaws between the jaws of the fixed gripper 90. At this point, the jaws of the holding gripper 90 are opened by cylinder 95 to release the laminated base and cover sheets and, substantially simultaneously, the jaws of the movable gripper 92 are closed to grasp said sheets. As soon as the jaws of the movable gripper have closed on the sheets, piston 96 pulls the movable gripper 92 to the right, in FIG. 17, to advance the laminated sheets through a distance enough to move conditioned portion of the base sheet from station A to blister-forming station B; to move the blistered portion of the sheet from station B to pill-loading station C; to move the pill-loaded portion of the base sheet and its overlying cover sheets to heat-sealing station D; and to move the loaded, heat-sealed portion of the laminated sheets from station D to stripping station E, where the sealed package is severed.

Since the various cylinders referred to may be pneumatic, or hydraulic, or they may be replaced with solenoids, motors, or any other conventional actuating mechanisms, and since the structure and operations of these cylinders is not claimed, as such, they have not been shown, nor described.

Also, the cylinders and/or other actuating devices can be operated by any well known cam and circuit arrangement which can readily be put together by anyone familiar with this art. But, for convenience, one such arrangement has been diagrammatically illustrated in FIG. 21.

The mechanism illustrated includes a motor which drives a cam shaft 104, which carries a number of cams, not shown, for closing normally open switches to activate the various cylinders in timed relation.

For the machine illustrated, there is provided a valve V46 for operating cylinder 46; valve V51 for operating cylinder 51; valve V56 for operating cylinder 56; valve V67 for operating cylinders 67; valve V68 for operating cylinder 68; valve V76 for operating cylinder 76; valve V86 for operating cylinders 86; valve V95 for operating cylinder 95; valve V100 for cylinder 100, and valve V98 for operating cylinder 98. The valves, in turn, are activated by the closing of corresponding switches 110 to 119 inclusive, which are controlled by the cams on cam shaft 104 of motor M.

It will be understood that the operation of cylinders 67 and 68 must be timed relative to each other and relative to the valves controlling the operations at the other stations, and that the same is true of cylinders 95, 100, and 98. Except for these intra-station requirements, the operation of the remaining cylinders is, for practical purposes, substantially simultaneous.

THE OPERATION

To commence operation, or to resume operation when a roll of base or cover sheets is exhausted, the operator threads the lead end of the base sheet through stations A, B, and C; threads cover sheet at station D; and threads both sheets through stations E and F. Motor M is then turned on to see that all of the stations are operating satisfactorily, and the operator deposits a supply of pills, or the like, in hopper 65.

The machine now operates automatically, in that when a portion of the base sheet S is heated, the puller mechanism draws the sheet to move the heated portion to blistering station B; and again, to move the blistered sheet to pill-receiving station C; and again, to heat-sealing station D; and again, to sealed-package stripping station E to begin a new cycle.

It will be seen from FIGS. 19 and 20 that the greatest dimension of pill-carrying segment is smaller than the width of the laminated base and cover sheets. This leaves substantial blank portions which can be gripped by the jaws of the puller mechanism at station F to pull the sheets intermittently, for the purpose and the manner above set forth.

It is to be noted that at heat sealing station D, the center portions of the laminated sheets are heated and the margins are cooled in the manner shown in FIGS. 3, 4, and 5. Since, in this respect, the structure and operation will be identical with that already described, it is thought unnecessary to repeat the same.

There are many types of plastic sheetings available, and others are being introduced from time to time. Also, these sheets come in different thicknesses and the degree of heat needed to permit the formation of blisters or to adhere the sheets together, will have to be determined from handbooks giving the heat characteristics of the material selected, or by the method of trial and error, which can be carried out by an operator of average skill.

A complete prototype has been successfully tested under actual commercial-type production conditions. In the case of "vinyl" sheets, a temperature of about 220° F. was satisfactory for sheets of from $\frac{3}{1000}$ " to $\frac{29}{1000}$ ". For sheets made of fluorohalocarbon which is sold by Allied Chemical under the trade name Aclar of the same thicknesses, a temperature of about 290° F. was needed.

These are by way of examples, and it is to be noted that the invention resides in the heating of the central portions of the sheets to permit forming and adhesion and simultaneously cooling the marginal portions to preserve the tensile strength of the marginal portions to provide "handles" by which the sheets may be pulled without distortion. The invention also resides in the automated structure disclosed and more particularly, the loading mechanism at station C and the sheet advancing mechanism at station F.

In the claims, the word pill is used to include any object to be packaged; the word cylinder is used to include any actuating mechanism; the word refrigerant is used to include any means for keeping the marginal portion of the platens below the temperature at which the thermoplastic sheets begin to soften; the word sweep is used to designate the brush which pushes pills into the blisters and moves excess pills on the surface of the sheet; the word blisters is used to mean pill-receiving recesses; and the words cover-sheet are used to mean a sheet of any material, such as paper, foil, or the like, to which the base-sheet may adhere.

What I claim is:

1. A machine for enclosing pills in blisters formed in a thermoplastic sheet, said machine including:
 - means, at a first station for forming blisters in said sheet,
 - means at a second station for supplying pills to said sheet as it moves thereto,

7

a sweep disposed above, and mounted for vertical and horizontal movement relative to said sheet, actuating means for moving in sequence said sweep upwardly, then horizontally in the direction of movement of the sheet, then downwardly toward the surface of the sheet, and then opposite the direction of movement of said sheet to move certain of the pills into blisters, and to remove from said sheet all pills not seated in blisters, and moving means for moving said sheet through said first and second stations.

2. The machine according to claim 1 with the addition of a third station at which said pill-laden, blistered sheet is laminated with a cover sheet and said moving means operates to move said sheet through said first and second stations and said laminated sheets through said third station.

3. The machine of claim 2, and means, at a fourth station for severing the blistered, pill-laden portion of the laminated sheets from the remaining portions thereof.

4. A machine for enclosing pills in the sealed blisters formed in a thermoplastic base sheet, said machine including:

a first heat and pressure means for forming blisters in said base sheet without distorting predetermined portions of the sheet,

second means for placing a pill in each of said blisters, said second means including a sweep disposed above, and mounted for vertical and horizontal movement relative to said base sheet, and also including actuating means for moving said sweep in sequence upwardly, then horizontally in the direction of movement of said sheet, then downwardly toward the surface of the sheet and then horizontally opposite the direction of movement of the sheet, and

third means for applying a cover sheet over said base sheet,

fourth, heat and pressure means, for adhering said cover sheet to said base sheet to seal said pills in said blisters,

means for severing said sealed blisters from the remaining portions of said adhered sheets, and means for propelling said sheets.

8

5. The machine of claim 4 wherein:

said sheets are continuous and wherein said actuating means propels said sheets synchronously with the performance of the other operations at said stations.

6. The machine according to claim 1 wherein said means at said first station includes a predetermined number of lugs projecting from suction inlet openings.

7. The machine according to claim 1 wherein said sweep includes a predetermined number of resilient members for engaging pills during their movement over said sheet.

8. The machine according to claim 7 wherein said resilient members are brushes arranged to move at respective predetermined heights over said sheet.

9. In packaging machinery for producing blisters in a thermoplastic sheet, a predetermined portion of which has been heated, blister forming means which comprises:

(a) a female die and

(b) an associated male die, said male die including
(i) a predetermined number of inlet openings, and
(ii) a predetermined number of projections extending from said openings,

(c) means for producing suction at said openings when said male and female dies are brought together on opposite sides of said sheet thereby to produce small radius junctions of the side walls of said blister with the plane of said sheet.

10. In packaging machinery according to claim 9 the blister forming means wherein said projection has a terminal portion which is larger than the other portion thereof and wherein said other portion is substantially surrounded by said inlet opening.

References Cited

UNITED STATES PATENTS

2,546,059	3/1951	Cloud	53—180 X
3,000,157	9/1961	Ollier et al.	53—184

THERON E. CONDON, Primary Examiner

E. F. DESMOND, Assistant Examiner

U.S. Cl. X.R.

53—281; 18—44