United States Patent [19]

Brush et al.

[11] **3,903,674**

[45] **Sept. 9, 1975**

[54] **PACKAGING APPARATUS**

[75] Inventors: **John Burke Brush**, North College Hill; **Leonard Cecil Hooper**, Cincinnati, both of Ohio

[73] Assignee: **The Procter & Gamble Company**, Cincinnati, Ohio

[22] Filed: **Apr. 15, 1974**

[21] Appl. No.: **461,322**

[52] **U.S. Cl.** **53/188**; 53/253; 53/266; 53/386

[51] **Int. Cl.**[2] **B65B 5/06**; B65B 23/00; B65B 43/30; B65B 43/60

[58] **Field of Search** 53/187, 188, 190, 253, 53/266, 384, 385, 386

[56] **References Cited**

UNITED STATES PATENTS

2,601,480	6/1952	Williams	53/188 X
3,465,499	9/1969	Nelson et al.	53/386
3,618,286	11/1971	Membrino	53/384 X

Primary Examiner—Robert L. Spruill
Attorney, Agent, or Firm—Thomas J. Slone; John V. Gorman; Richard C. Witte

[57] **ABSTRACT**

An apparatus for forming substantially uniform packages wherein a metered plurality of articles of substantially uniform shape are disposed in a stacked array within a sealed bag. The apparatus comprises a turret head, a bag opening station, a bag filling station, and a bag sealing and package removal station. A bag is opened and inserted into the turret head at the bag opening station. Then, after indexing the turret to advance the opened bag to the bag filling station, a metered plurality of articles are advanced into the bag. Then, upon indexing the turret to advance the filled bag to the bag sealing and package removal station, the bag is sealed and the package just completed is removed from the apparatus. In operation, while a bag is being opened and inserted into the turret head at the bag opening and insertion station, the next preceding bag is being filled at the bag filling station, and the second preceding bag is being sealed and the package completed by sealing the bag is removed from the apparatus at the bag sealing and package removal station.

9 Claims, 37 Drawing Figures

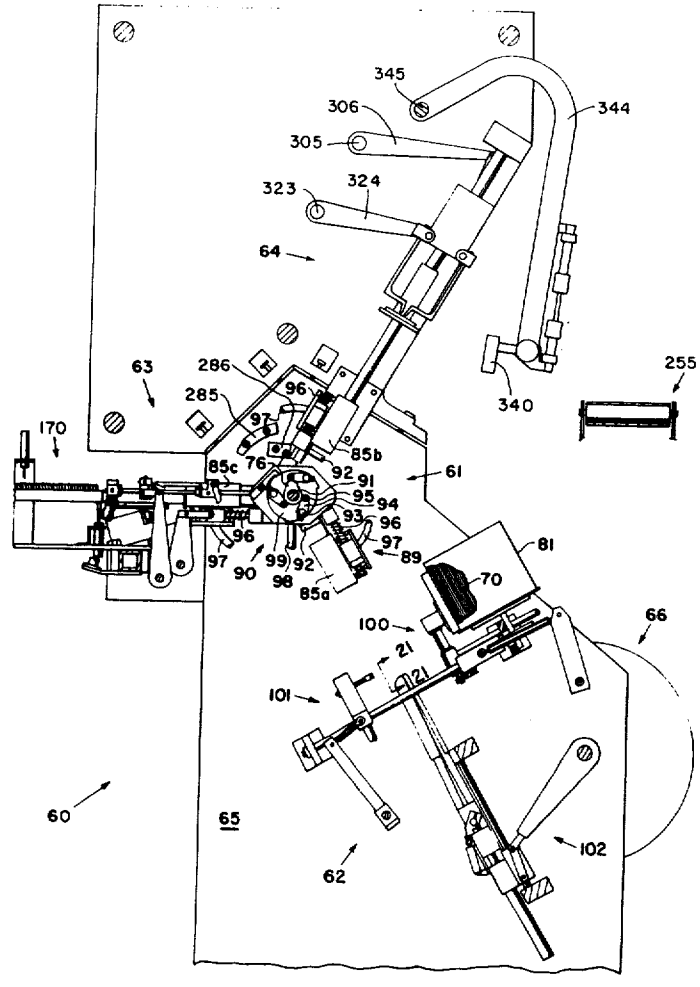
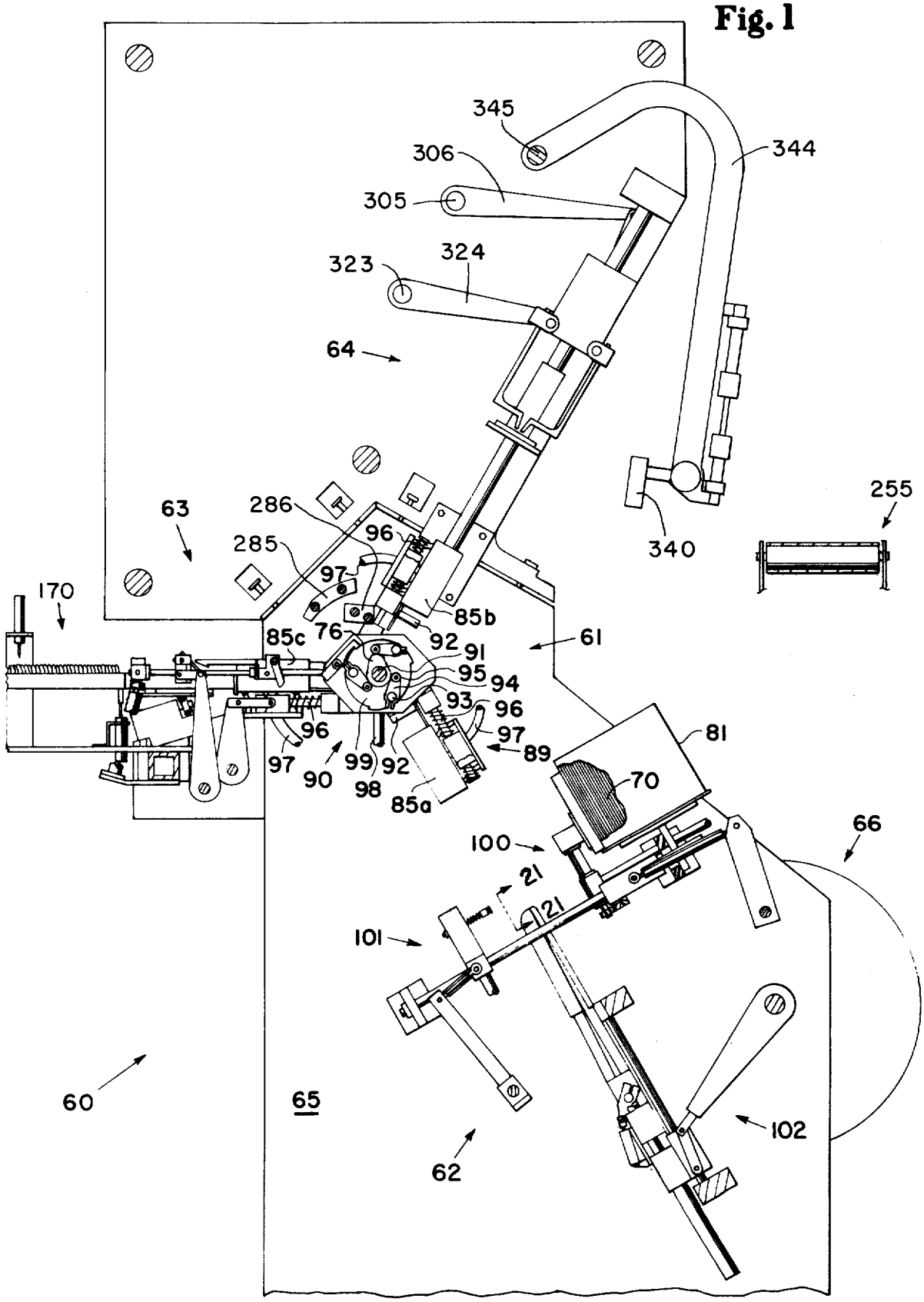


Fig. 1


345
306
305
344
323
324
64
63
286
285
96
97
85b
85c
76
92
91
95
94
93
96
97
89
99
90
98
85a
170
61
340
255
81
70
66
100
21
21
101
102
60
65
62

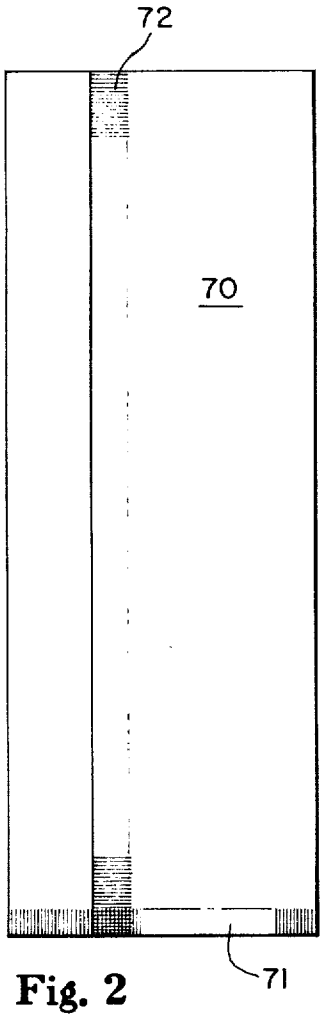


Fig. 2

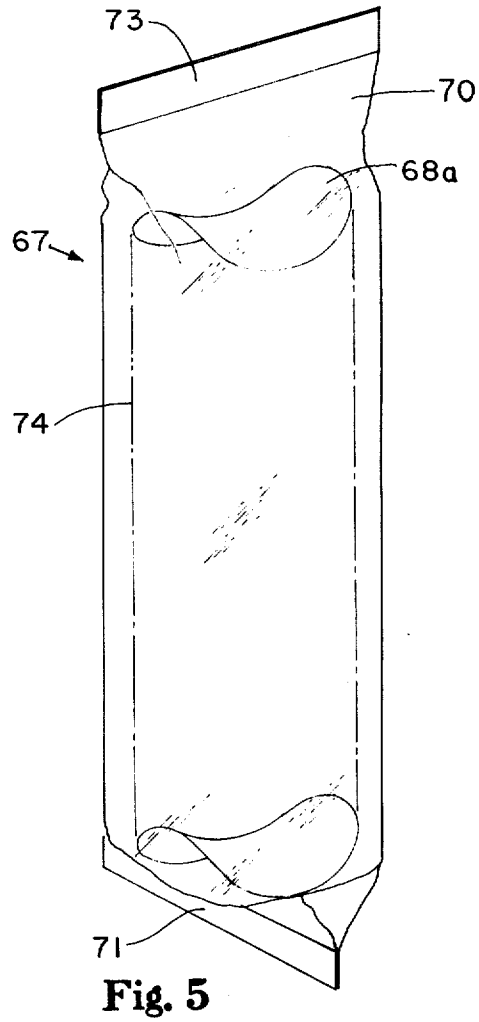


Fig. 5

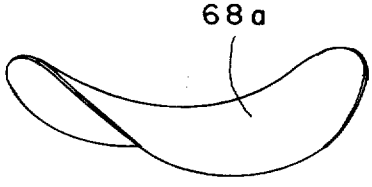


Fig. 3

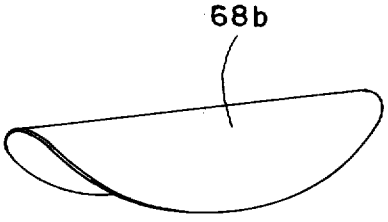


Fig. 4

Fig. 6a

OPERATING SEQUENCES OF BAG OPENIN AND INSERTION STATION 62 WITH RESPECT TO INDEXING TURRET HEAD 61

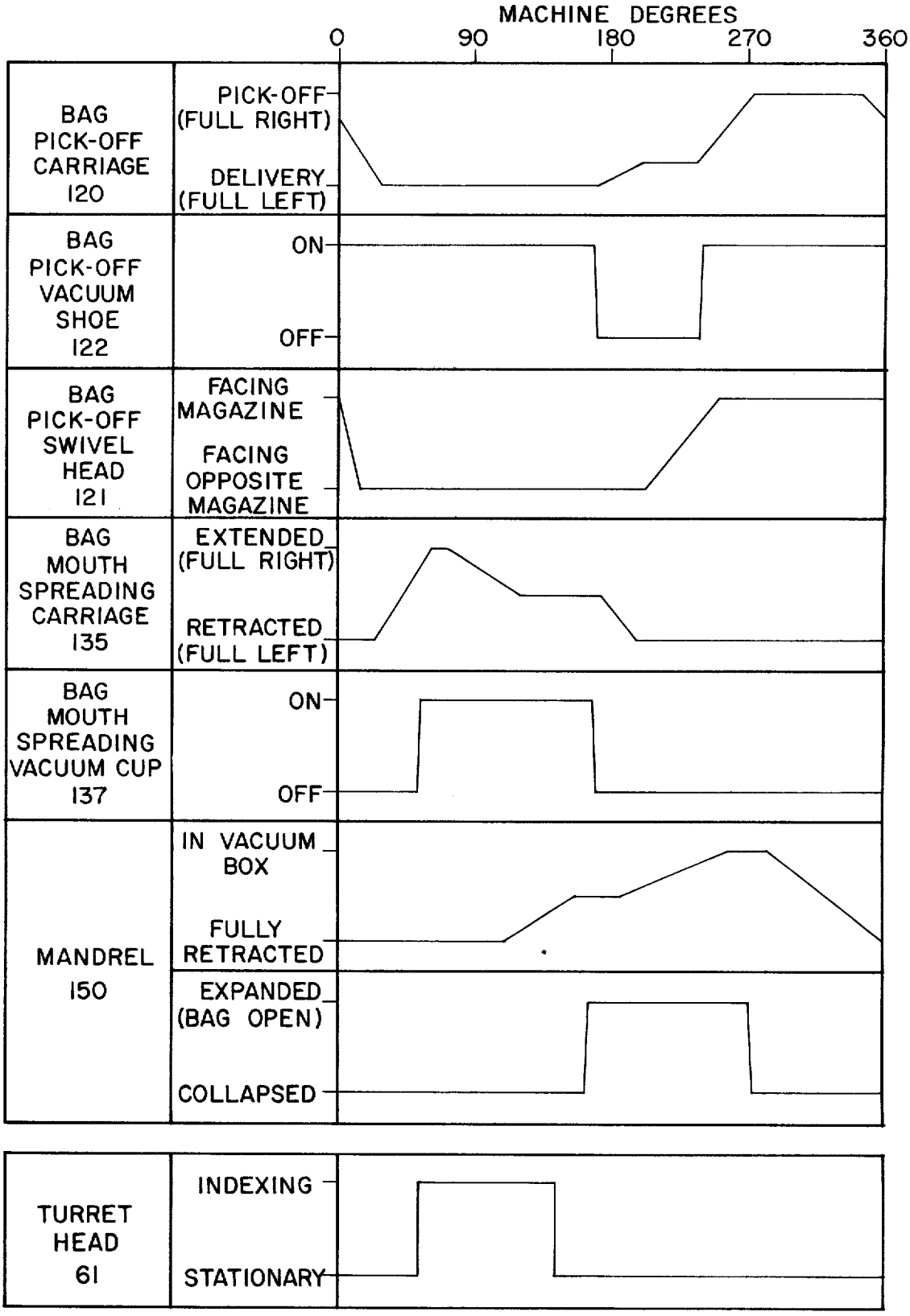


Fig. 6b

OPERATING SEQUENCES OF BAG FILLING STATION 63 WITH RESPECT TO INDEXING TURRET HEAD 61

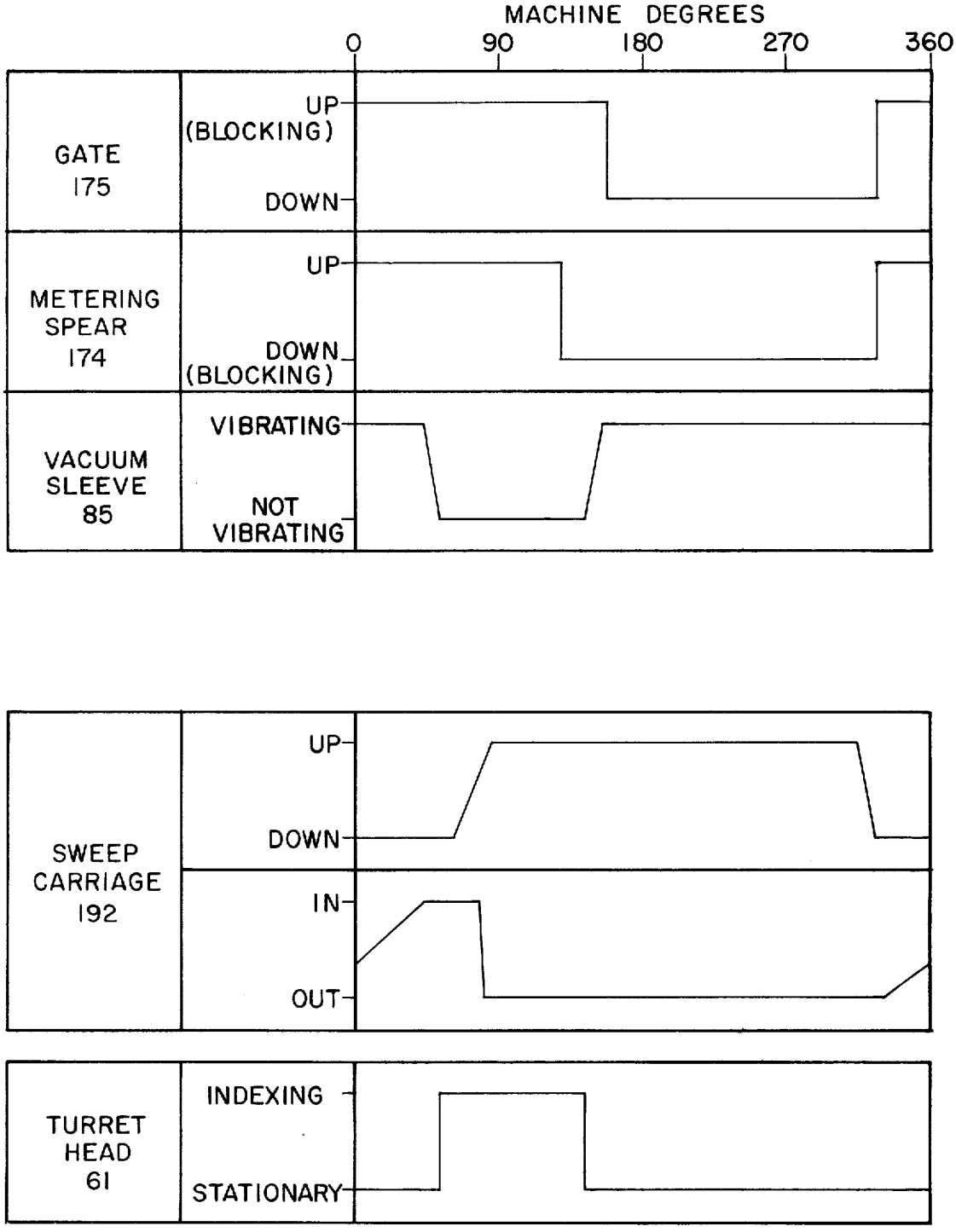
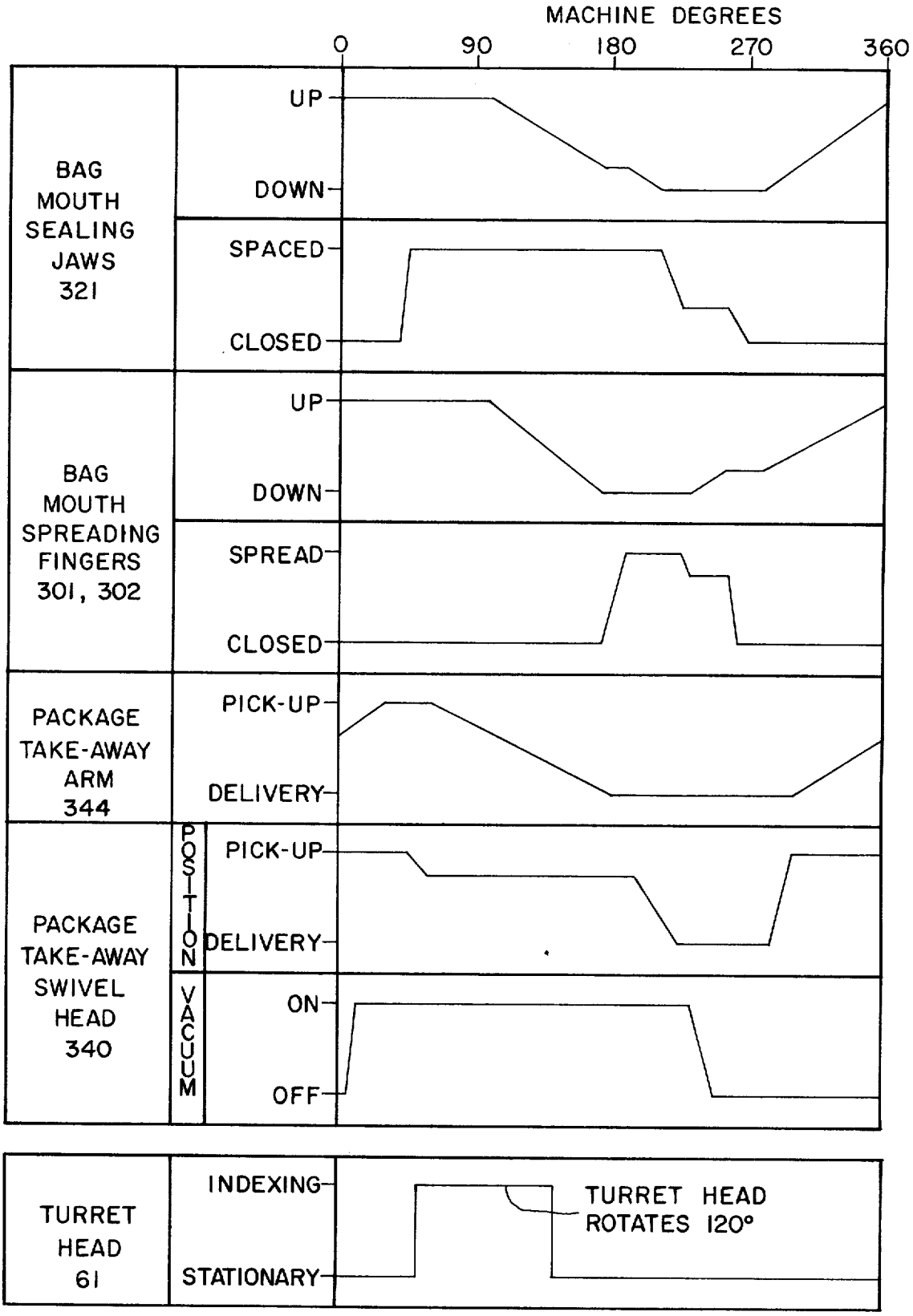


Fig. 6c

OPERATING SEQUENCES OF BAG SEALING AND REMOVAL STATION 64 WITH RESPECT TO INDEXING TURRET HEAD 61



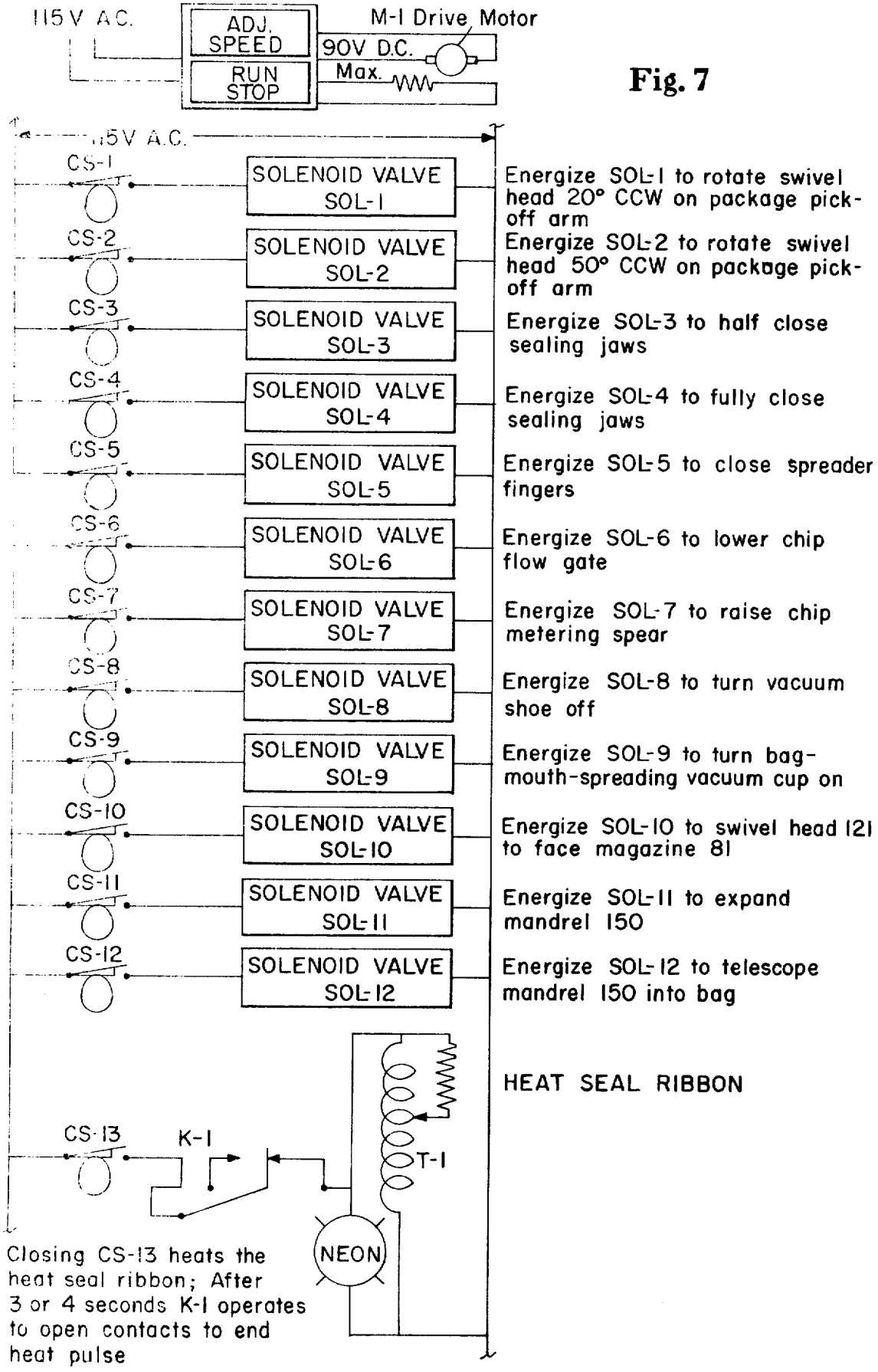

115 V A.C.
ADJ. SPEED
RUN STOP
M-1 Drive Motor
90V D.C.
Max.
115V A.C.
CS-1
SOLENOID VALVE SOL-1
Energize SOL-1 to rotate swivel head 20° CCW on package pick-off arm
CS-2
SOLENOID VALVE SOL-2
Energize SOL-2 to rotate swivel head 50° CCW on package pick-off arm
CS-3
SOLENOID VALVE SOL-3
Energize SOL-3 to half close sealing jaws
CS-4
SOLENOID VALVE SOL-4
Energize SOL-4 to fully close sealing jaws
CS-5
SOLENOID VALVE SOL-5
Energize SOL-5 to close spreader fingers
CS-6
SOLENOID VALVE SOL-6
Energize SOL-6 to lower chip flow gate
CS-7
SOLENOID VALVE SOL-7
Energize SOL-7 to raise chip metering spear
CS-8
SOLENOID VALVE SOL-8
Energize SOL-8 to turn vacuum shoe off
CS-9
SOLENOID VALVE SOL-9
Energize SOL-9 to turn bag-mouth-spreading vacuum cup on
CS-10
SOLENOID VALVE SOL-10
Energize SOL-10 to swivel head 121 to face magazine 81
CS-11
SOLENOID VALVE SOL-11
Energize SOL-11 to expand mandrel 150
CS-12
SOLENOID VALVE SOL-12
Energize SOL-12 to telescope mandrel 150 into bag
HEAT SEAL RIBBON
CS-13
K-1
T-1
NEON
Closing CS-13 heats the heat seal ribbon; After 3 or 4 seconds K-1 operates to open contacts to end heat pulse

Fig. 7

Fig. 25

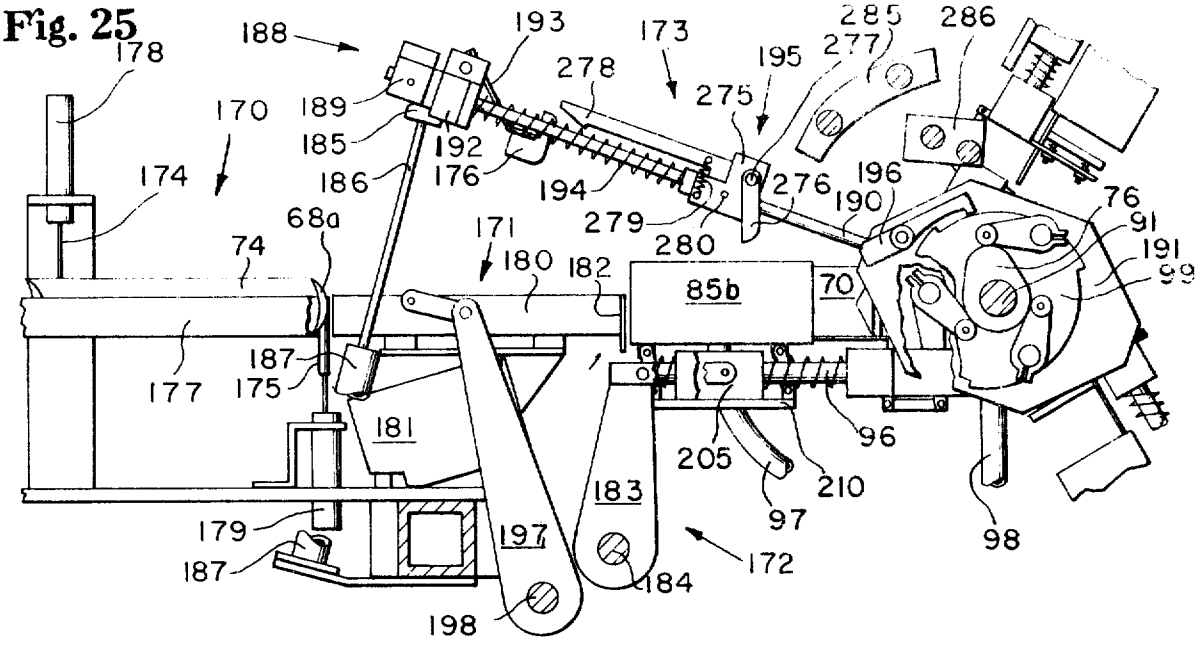


Fig. 26

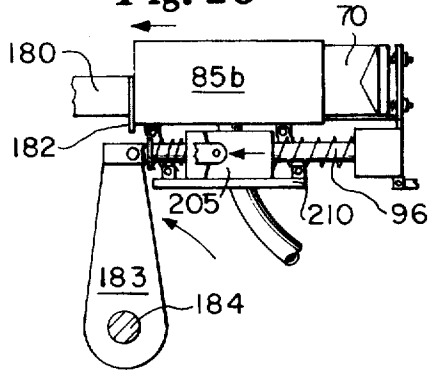


Fig. 27

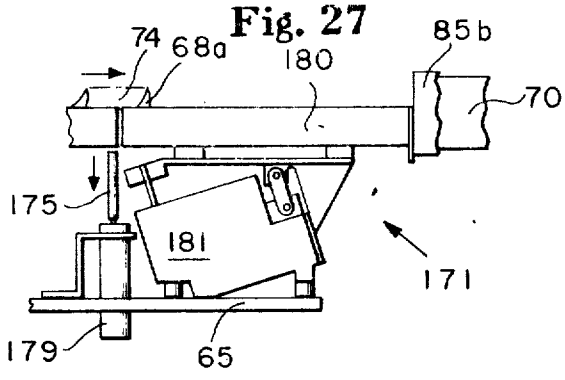
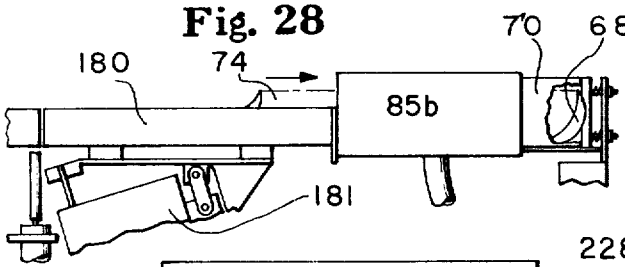


Fig. 28



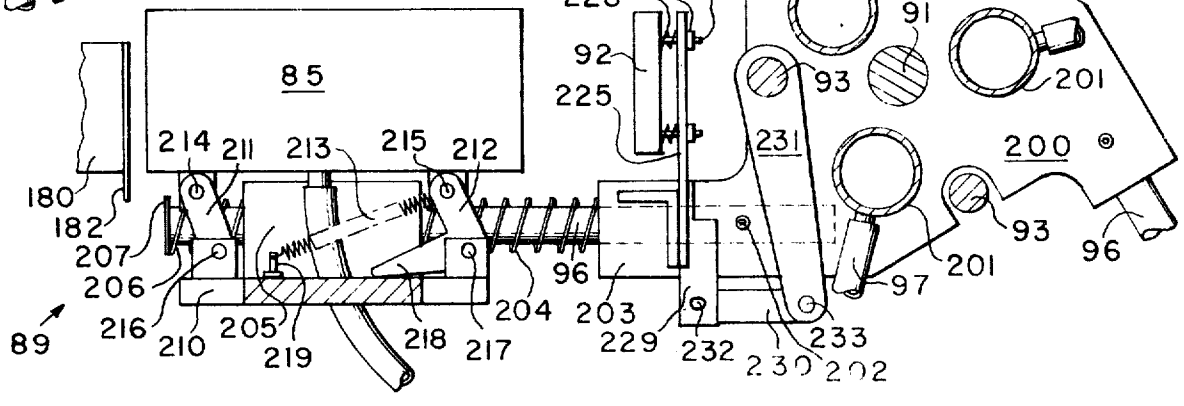


Fig. 8

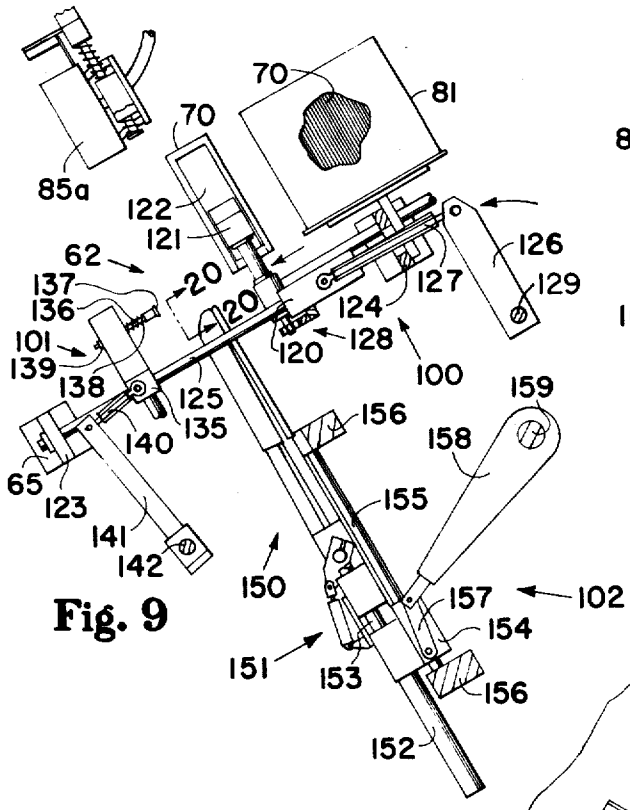


Fig. 9

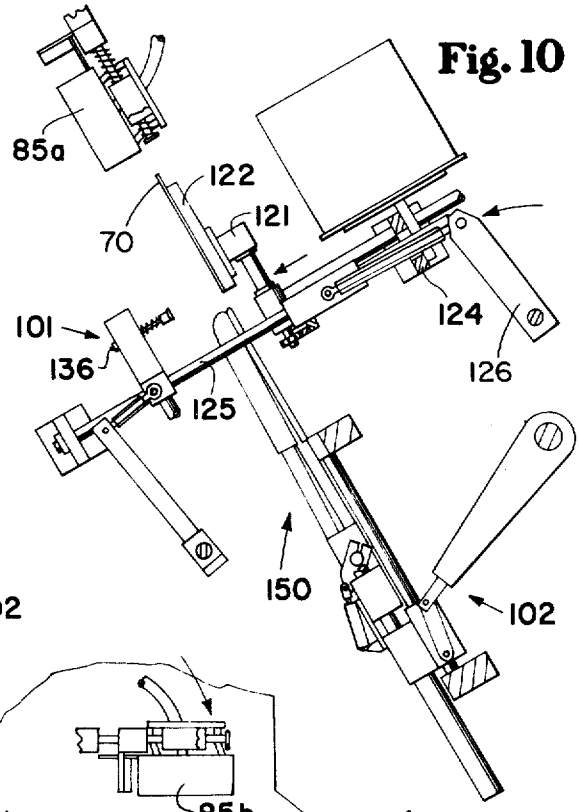


Fig. 10

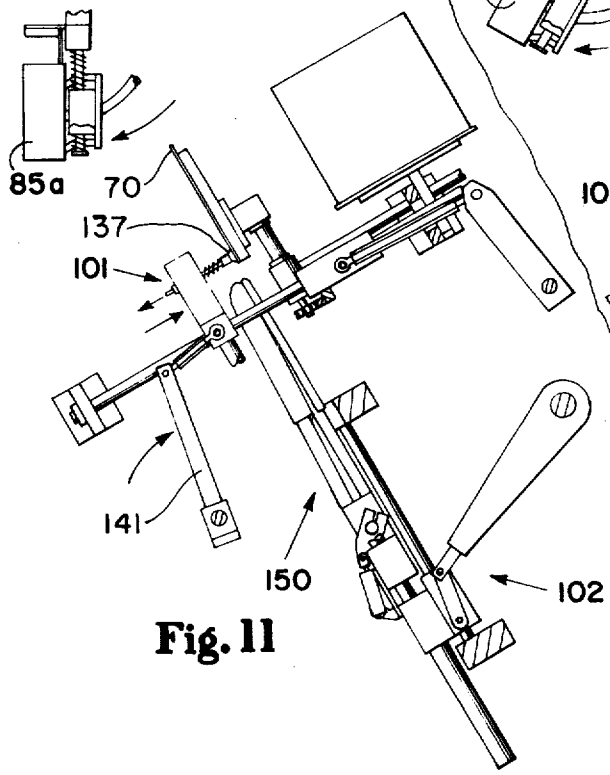


Fig. 11

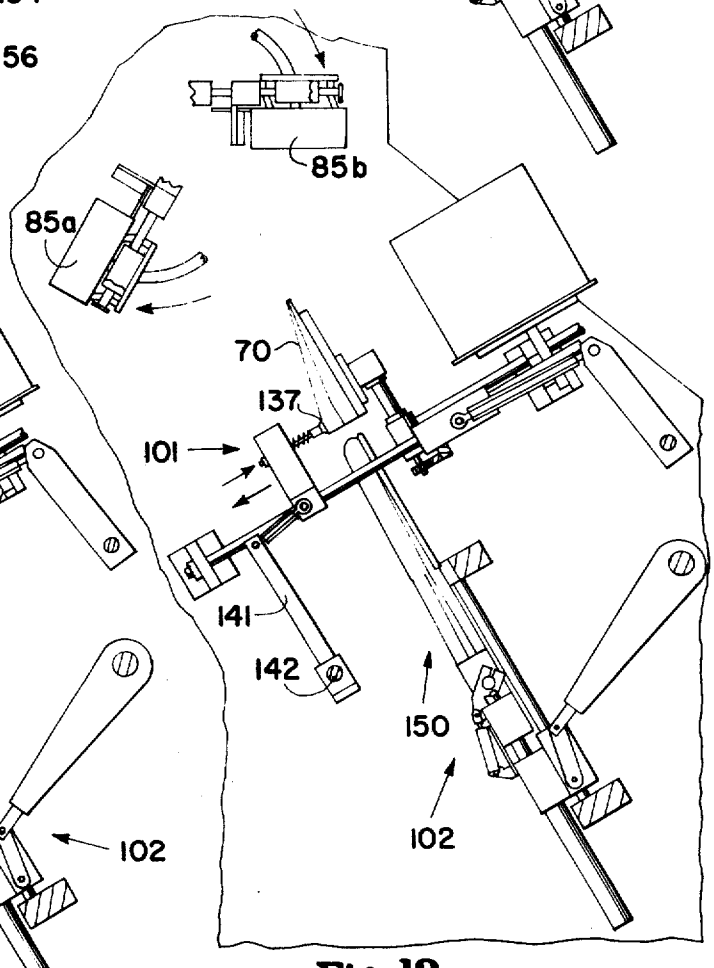


Fig. 12

Fig. 13

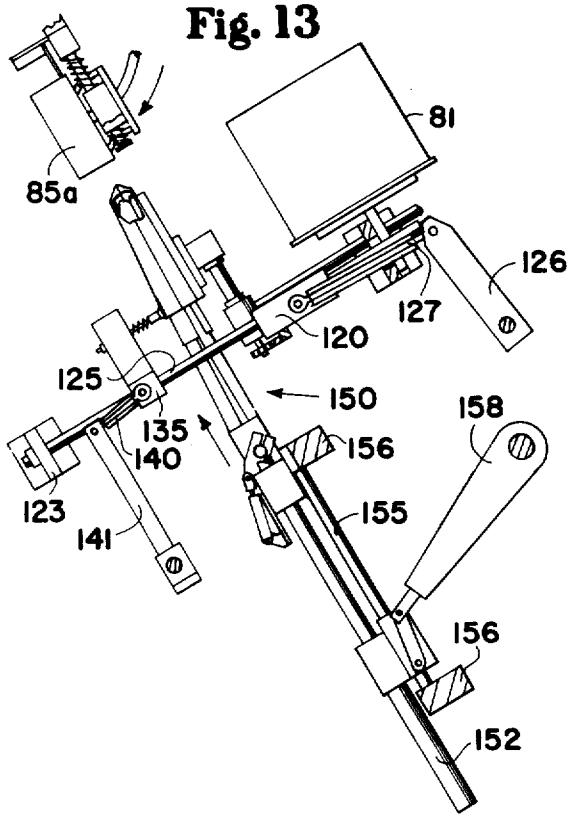
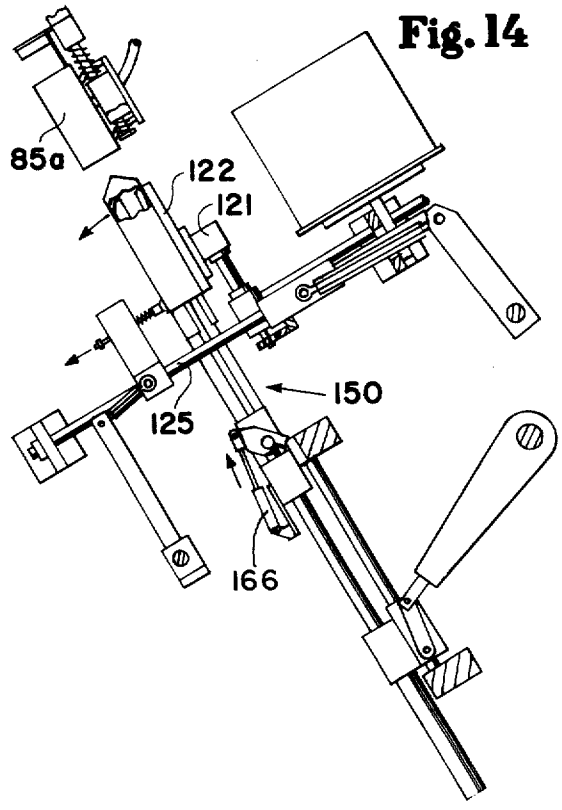


Fig. 14



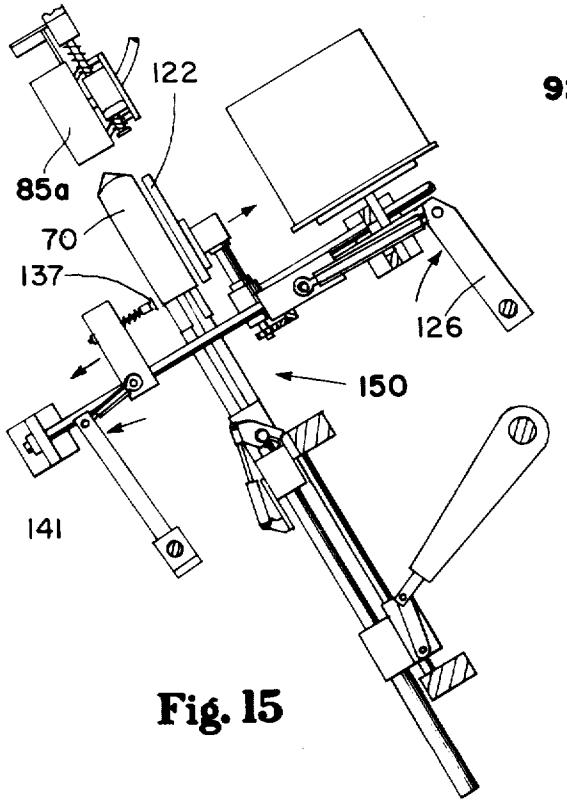


Fig. 15

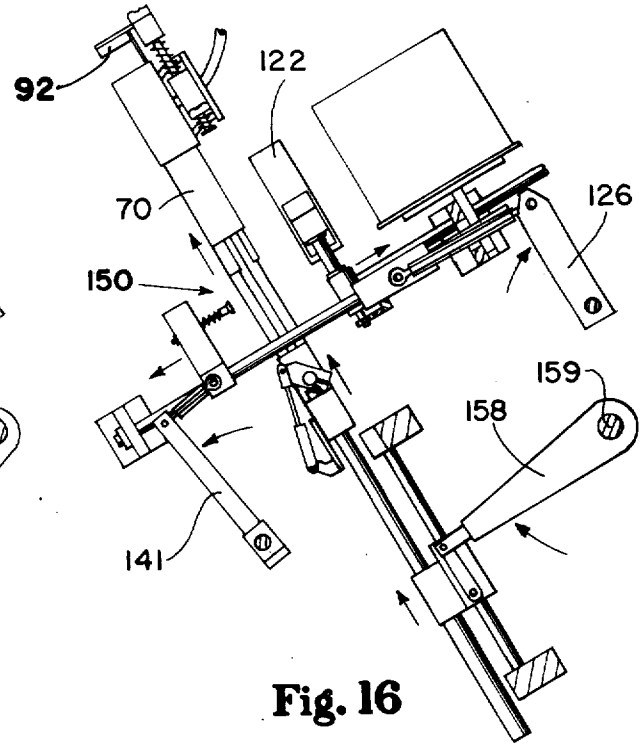


Fig. 16

Fig. 17

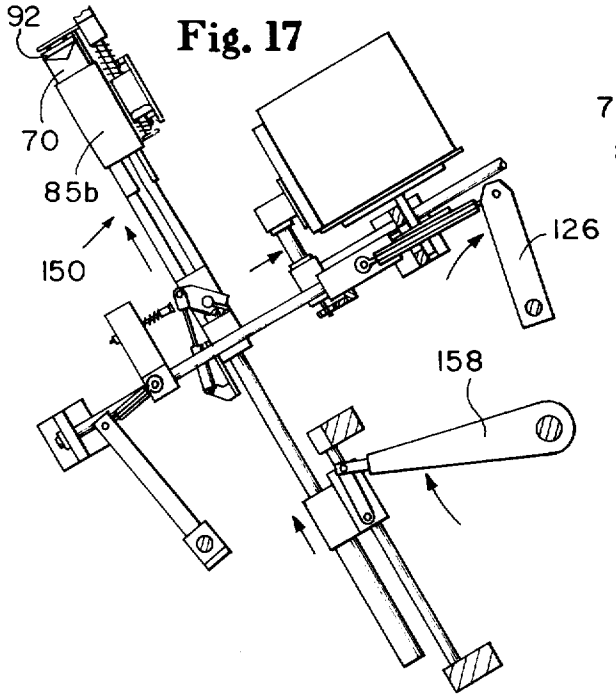


Fig. 18

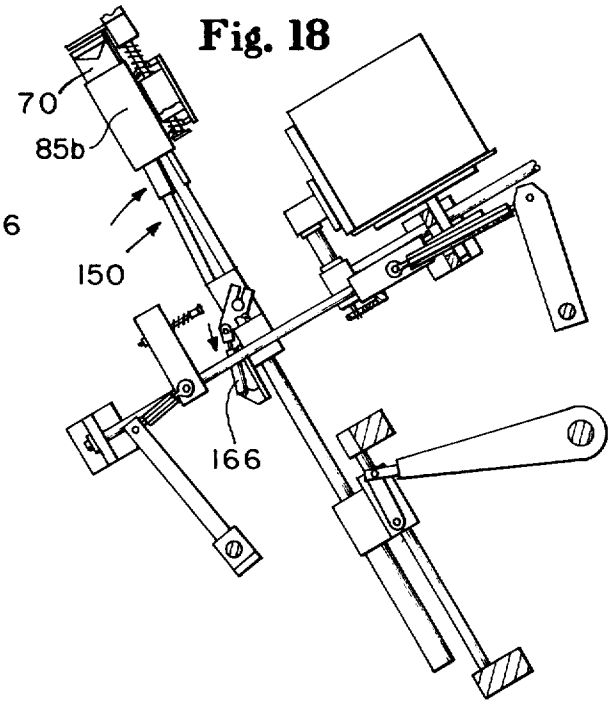


Fig. 19

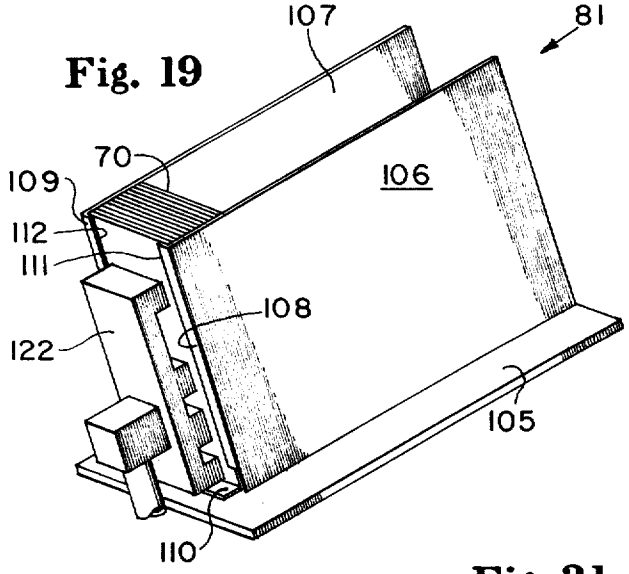


Fig. 20

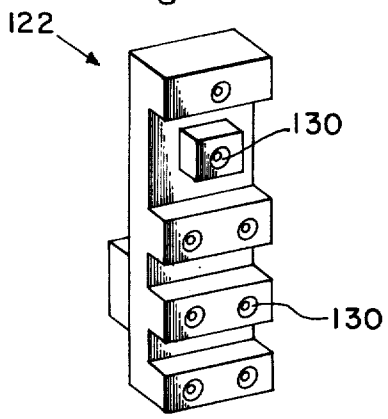
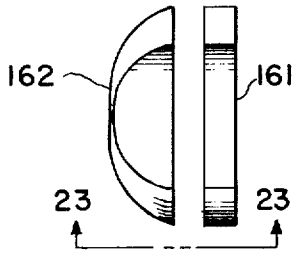


Fig. 21

Fig. 22



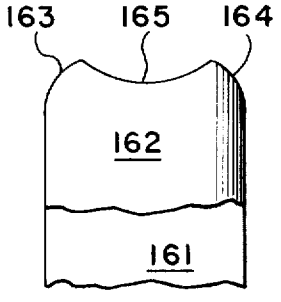


Fig. 23

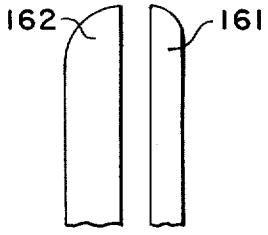


Fig. 29

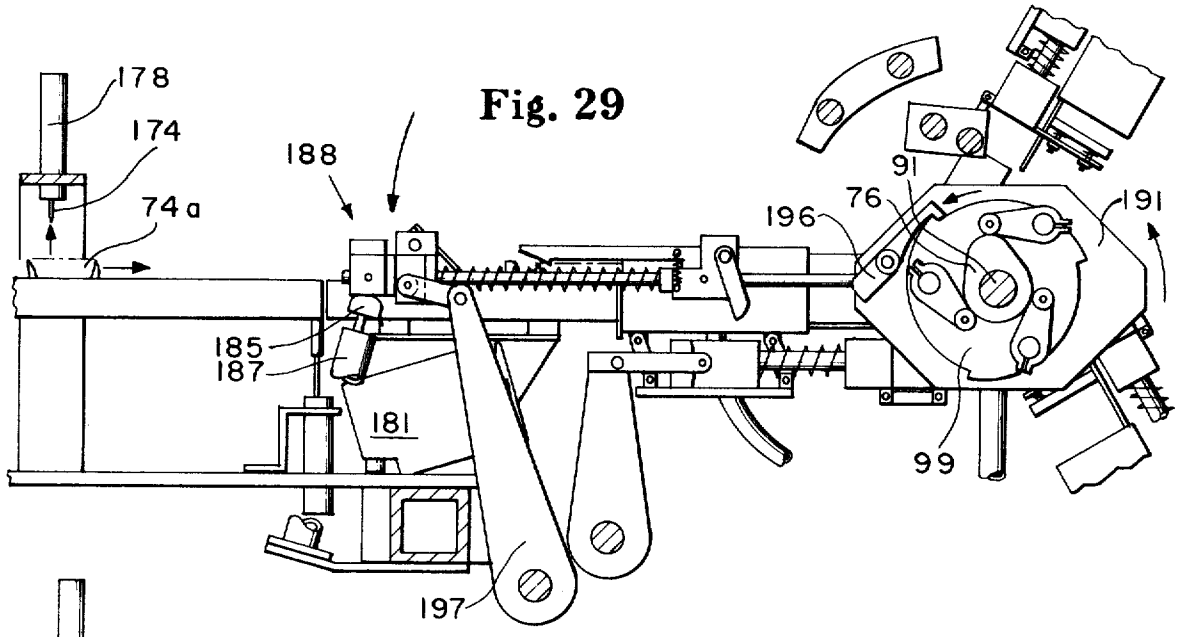
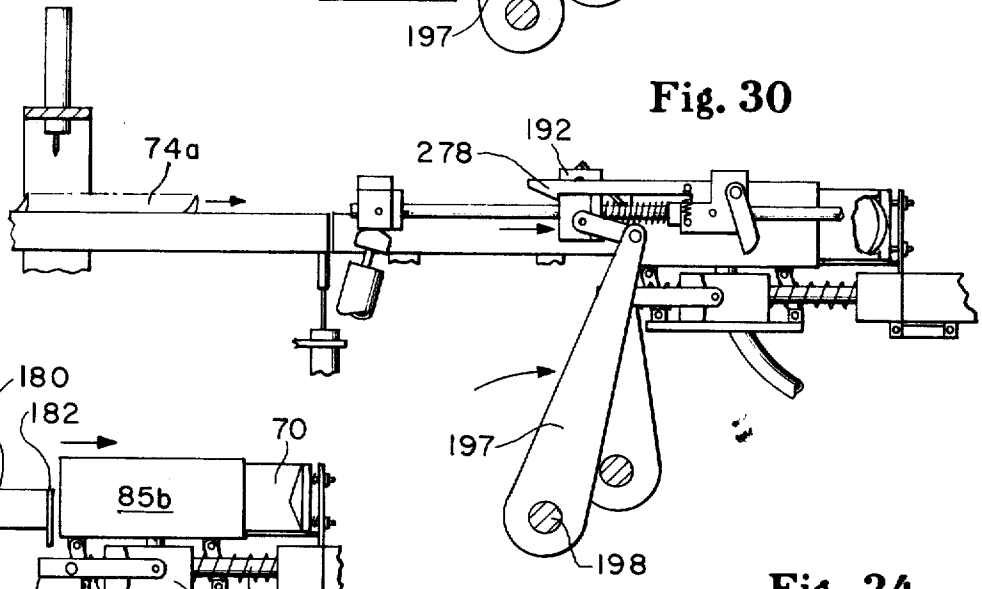


Fig. 30



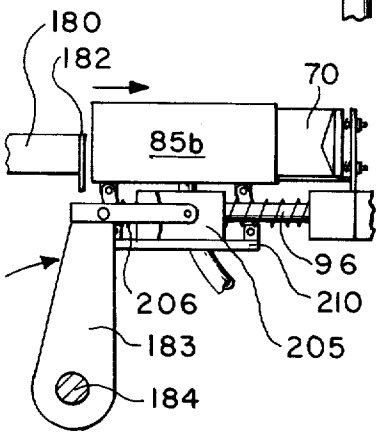
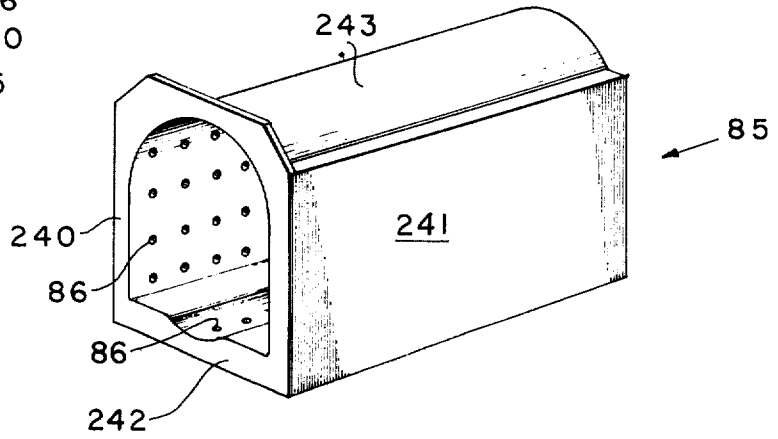


Fig. 31

Fig. 24



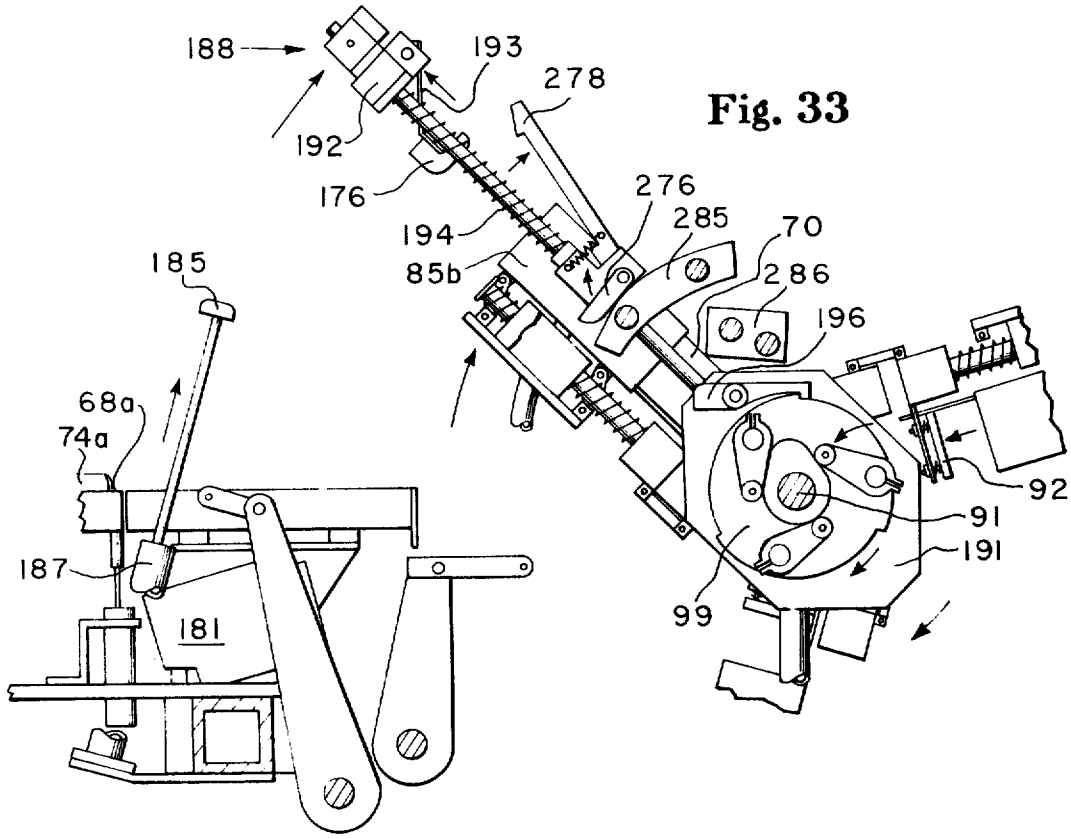

188
193
278
192
176
276
285
70
194
85b
286
185
196
68a
74a
92
91
187
191
181
99

Fig. 33

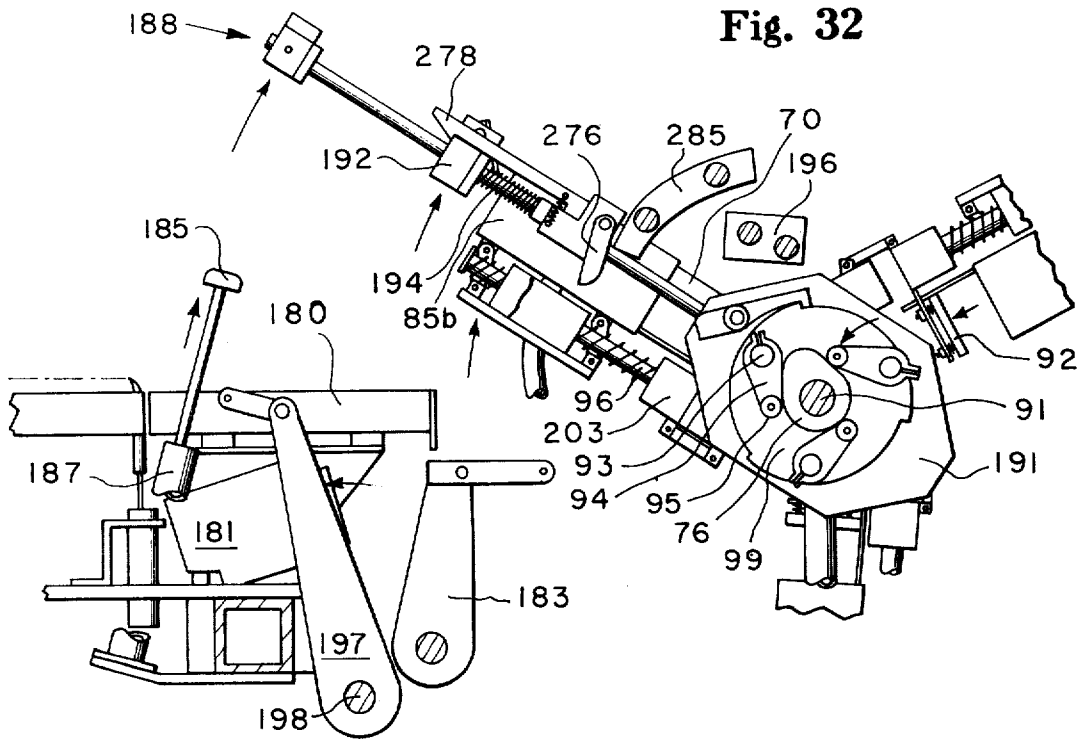

188
278
276
285
70
192
196
185
194
180
85b
92
96
91
203
93
187
191
94
95
181
76
99
183
197
198

Fig. 32

Fig. 34

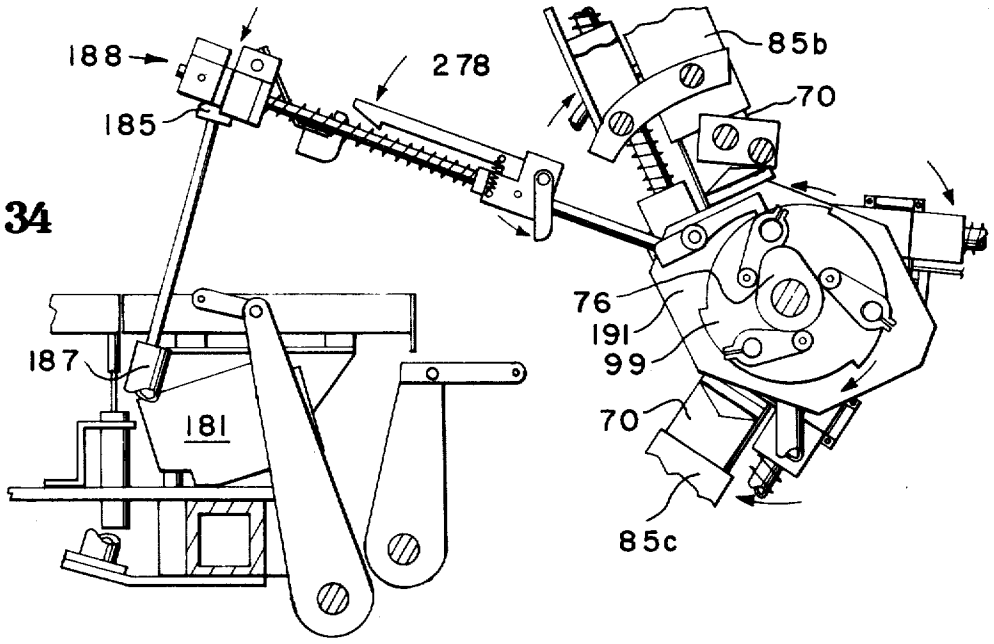
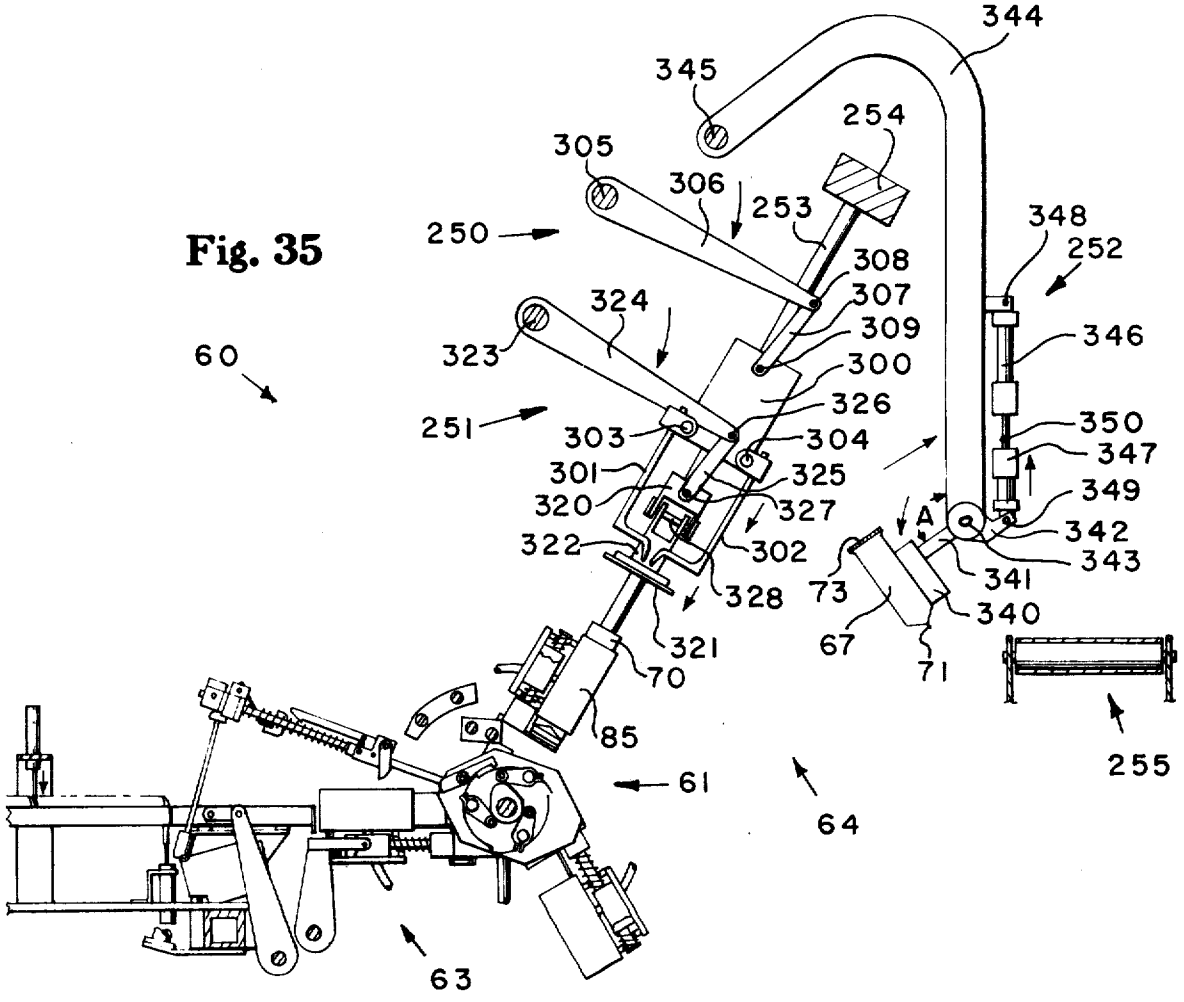

188
185
278
85b
70
76
191
99
70
85c
187
181

Fig. 35


344
345
254
305
306
253
250
348
252
308
307
324
309
346
323
300
60
326
350
251
303
304
347
301
325
349
320
327
A
342
322
302
343
73
341
328
340
67
71
321
70
85
255
61
64
63

PACKAGING APPARATUS

FIELD OF THE INVENTION

This invention relates generally to machines for packaging articles in bags. More specifically, the invention is directed towards packaging metered pluralities of frangible articles of uniform non-planar shape so that the plurality of articles are disposed within a sealed bag in a stacked nested array.

BACKGROUND OF THE INVENTION

In order to preserve the freshness and appearance of frangible comestible products such as potato chip-type snack food products emerging from a processor, it is highly desirable to package them forthwith in bags or containers having freshness preserving barrier properties and sufficient strength to protect the structural integrity of the products. Moreover, for marketing purposes, it is highly desirable to have a predetermined metered amount of such products in unit packages. It is also desirable, to conserve shipping and warehousing expense, to package such products so that the packages have relatively high weight-to-volume ratios.

U.S. Pat. No. **3,609,939** issued Oct. **5, 1971** to L. C. Hooper et al. discloses an apparatus for the metering and packaging of fragile articles of substantially uniform size and non-planar shape in cylindrical tubular containers so that the articles are disposed within the containers in nested, stacked arrays. Such packages comprising nested stacked arrays are disclosed in U.S. Pat. No. **3,498,798** issued Mar. **3, 1970** to F. J. Baur et al.

The present invention is a relatively high speed turret-type apparatus for packaging metered stacked arrays of articles of uniform non-planar shape within sealed bags having good freshness preserving barrier properties.

A consideration of prior art apparatus for opening, filling, and sealing bags to product substantially uniform bag-packages indicated a lack of suitable apparatus for high speed bag-packaging of fragile articles such as potato chips without excessive breakage.

Prior art turret type-bag filling apparatuses are disclosed in U.S. Pat. No. **2,834,166** issued May **13, 1958** to Joseph W. Fogwell et al., and U.S. Pat. No. **2,964,892** issued Dec. **20, 1960** to Henri Grosjean. Representative prior art apparatuses for opening and filling bags are disclosed in U.S. Pat. No. **2,975,568** issued Mar. **21, 1961** to D. W. Garnett, U.S. Pat. No. **3,363,397** issued Jan. **16, 1968** to Bernard Abel Lespeau, U.S. Pat. No. **3,468,102** issued Sept. **23, 1969** to Malone H. Farrar, U.S. Pat. No. **3,527,021** issued Sept. **8, 1970** to Robert W. Pitts et al., and U.S. Pat. No. **3,545,175** issued Dec. **8, 1970** to Nils A. Lillund. However, none of the discovered prior art apparatuses has solved all of the problems associated with relatively high speed bag-packaging in the manner of nor to the degree of the present invention.

SUMMARY OF THE INVENTION

The nature and substance of the invention will be more readily appreciated after giving consideration to its major aims and purposes. The principal objects of the invention are recited in the ensuing paragraphs in order to provide a better appreciation of its important aspects prior to describing the details of a preferred embodiment in later portions of this description.

A principal object of the present invention is providing a packaging apparatus for filling and sealing bags with metered pluralities of articles of uniform non-planar shape disposed in nested arrays.

Another object of the present invention is providing a packaging apparatus as described in the preceding paragraph wherein no bag opening forces are imposed on the articles being packaged so that fragile and frangible articles can be packaged in bags composed of relatively stiff sheet materials without excessive breakage of the articles.

Yet another object of the present invention is providing a turret-type bag-packaging apparatus in which bags are fully opened prior to being indexed to a filling position or station.

Still another object of the present invention is providing a turret-type bag-packaging apparatus which comprises means for receiving an endless stream of articles of uniform non-planar shape, means for forming metered stacked arrays of such articles within each bag of a succession of bags, and means for sealing and removing the packages thus formed from the apparatus.

Yet still another object of the present invention is providing a multi-lane turret-type bag-packaging apparatus comprising bag opening means, and bag sealing means wherein the major dimensions of the components and their movements for each lane are arranged so that the apparatus has a reasonable total width.

A still further object of the present invention is providing an apparatus for producing packages wherein metered stacked arrays of articles of uniform non-planar shape are disposed in substantially tetrahedral-shape, sealed bags.

These and other objects of the present invention are achieved by providing a turret-type apparatus for filling and sealing bags with metered pluralities of articles of uniform non-planar shape which apparatus includes a frame, a turret head having three circumferentially spaced radially extending bag-accommodating vacuum sleeves, means for sequentially indexing each sleeve to a bag insertion position, a bag filling position, and a bag sealing and removal position. The apparatus further includes means disposed adjacent the bag insertion position for fully opening a bag and inserting it into a vacuum sleeve, and means for filling, and for sealing and removing bags sequentially indexed to the filling, and the sealing and removal positions respectively.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawings in which:

FIG. **1** is a fragmentary, side elevational view of a preferred embodiment packaging apparatus having the near side plate removed to more clearly show the functional elements of the apparatus.

FIG. **2** is a frontal view of a type of gussetless bag having one sealed end which type of bag is suitable for being opened, filled, and sealed in the apparatus shown in FIG. **1** to form tetrahedral-shape packages.

FIG. **3** is a perspective view of a saddle shape, non-planar article which is suitable for being packaged in metered nested arrays by the apparatus shown in FIG. **1**.

FIG. 4 is a perspective view of an alternate non-planar shape article which is suitable for being packaged in metered nested arrays.

FIG. 5 is a perspective view of a tetrahedral-shape package comprising a bag of the type shown in FIG. 2 and a stacked nested array of uniform articles having the saddle-shape shown in FIG. 3.

FIG. 6*a* is a chart showing the operating sequences of the Bag Opening and Insertion Station with respect to indexing of the turret head of the apparatus shown in FIG. 1.

FIG. 6*b* is a chart showing the operating sequences of the Bag Filling Station with respect to indexing the turret head of the apparatus shown in FIG. 1.

FIG. 6*c* is a chart showing the operating sequences of the Bag Sealing and Package Removal Station with respect to indexing the turret head of the apparatus shown in FIG. 1.

FIG. 7 is an electrical schematic showing cam controlled elements for achieving, in combination with directly driven members, the apparatus sequences shown in FIGS. 6*a*, 6*b*, and 6*c* in predetermined timed relation.

FIG. 8, sheet 10, is an enlarged scale, fragmentary sectional side elevational view of the turret head of the apparatus of FIG. 1 sectioned by a medial plane perpendicular to shaft 91 with a vacuum sleeve indexed at the bag filling position adjacent to and aligned with a horizontally extending vibratory feed trough.

FIGS. 9 through 18 inclusive are sequential, fragmentary side elevational views of the bag opening and insertion station of the apparatus shown in FIG. 1 which views show, in conjunction with FIG. 1, withdrawing a bag from a magazine, fully opening the bag, and inserting the fully opened bag into an indexed vacuum sleeve mounted on the turret head of the apparatus.

FIG. 19 is an enlarged scale, fragmentary perspective view of the bag magazine and the bag pick-off swivel head of the apparatus shown in FIG. 1.

FIG. 20 is an enlarged scale fragmentary perspective view taken in the direction of the face of the bag pick-off vacuum shoe of the apparatus shown in FIG. 1.

FIG. 21 is an enlarged scale fragmentary view of the distal portion of the bag opening mandrel taken along line 21—21 of FIG. 1.

FIG. 22 is a fragmentary end view of the distal portion of the mandrel shown in FIG. 21 after the mandrel has been operated to its expanded state.

FIG. 23 is a fragmentary side elevational view of the distal portion of the mandrel shown in FIG. 22 which view is taken along line 23—23 of FIG. 22.

FIG. 24, sheet 11, is an enlarged scale, fragmentary perspective view facing the radially outwardly disposed end of a turret mounted vacuum sleeve of the apparatus shown in FIG. 1.

FIGS. 25 through 34 inclusive are fragmentary side elevational views of portions of the bag filling station of the apparatus shown in FIG. 1 which views show filling a bag, and then rotating the turret head to advance the filled bag towards the bag sealing and package removal station of the apparatus.

FIG. 35 is a fragmentary sectional side elevational view of the bag sealing and package removal station of the apparatus shown in FIG. 1 at the point in the cycle of the apparatus that a filled bag has just arrived at the bag sealing and removal station.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention, packaging apparatus 60, is shown, FIG. 1, to include a turret head 61, a bag opening and insertion station 62, a bag filling station 63, a bag sealing and package removal station 64, a frame 65, and drive and synchronization means 66 only part of which is shown in FIG. 1.

Briefly, a bag 70, FIG. 2, is withdrawn from magazine 81, FIGS. 1, 9 and 10, opened, FIGS. 11 through 14, and inserted, FIGS. 16 and 17, into a vacuum sleeve 85 on turret head 61. Upon indexing the turret head 120 degrees clockwise, bag 70 is filled at the bag filling station with articles 68 such as article 68*a*, FIG. 3, or article 68*b*, FIG. 4, and, upon indexing turret head 61 another 120° clockwise, bag 70 is disposed at the bag sealing and package removal position where it is sealed at its top end 73, FIG. 5, and package 67, FIG. 5, is removed from apparatus 60. Package 67, FIG. 5, comprises a nested array 74 of articles 68*a* sealed within bag 70. For convenience, the remainder of the description of the preferred embodiment apparatus 60 will be limited to its use with saddle-shape articles 68*a*, FIG. 3 which articles are hereinafter designated chips.

The ensuing description details the sequences, FIGS. 6*a*, 6*b* and 6*c*, of opening a bag 70 and inserting it into a vacuum sleeve 85, and then filling, sealing the bag, and removing the package 67 thus formed from apparatus 60. It is to be understood, however, that when apparatus 60 is in operation, stations 62, 63, and 64 perform operations concurrently. That is, while a bag 70 is being withdrawn from magazine 71, opened, and inserted into a vacuum sleeve 85 on turret head 61, the next preceding bag is advanced to and filled at the bag filling station 63, and, the second preceding bag is advanced to and sealed and removed from apparatus 60 at the bag sealing and removal station 64.

Bags 70, FIG. 2, prior to being opened, filled, and sealed, are flat and gussetless, and have one end 71 sealed. Bags 70 also have a side seam 72, FIG. 2. Bags 70 composed of relatively stiff, heat sealable glassine have been used in apparatus 60, FIG. 1, and are preferred for packaging uniform frangible comestible articles 68 of such non-planar configurations as shown in FIGS. 3 and 4 in nested arrays 74 as shown in package 67, FIG. 5. As used above, glassine is "relatively stiff" with respect to one-half-mil or one-mil polyethylene.

For clarity, some of the driving mechanism of apparatus 60 is not shown in the figures. It is to be understood, however, throughout the following description that drive and synchronization means 66, FIG. 1, includes means such as cranks, gears, chains and cams for directly operating some members of apparatus 60, and, through suitable camming means, FIG. 7, for controlling pneumatically operated machine members whereby the operations indicated in FIGS. 6*a*, 6*b* and 6*c* are cyclically performed in the indicated timed relationships. The directly driven members and the cam controlled pneumatically operated members will be delineated hereinafter as such become relevant.

TURRET HEAD

Turret head 61, FIG. 1, of the preferred embodiment apparatus 60 comprises three radially extending vacuum sleeves 85 which are identified for convenience on FIG. 1 as 85*a*, 85*b*, and 85*c*. The vacuum sleeves 85 are

spaced circumferentially 120° apart on turret head 61 about shaft 91. As shown in FIG. 1, turret head 61 is indexed with vacuum sleeve 85*a* at the bag insertion position, vacuum sleeve 85*b* at the bag filling position, and vacuum sleeve 85*c* at the bag sealing and package removal position. Drive and synchronization means 66 periodically rotates the turret head 61 120° whereby the vacuum sleeves 85 are periodically advanced from position to position; reference FIGS. 6*a*, 6*b*, and 6*c*. The period between the arrival of a vacuum sleeve at one position and the next position is hereby defined as 360 machine degrees as that term is used on FIGS. 6*a*, 6*b*, and 6*c*.

Each vacuum sleeve 85 is secured by means 89, FIG. 8, sheet 10, on turret head 61 which is rotatably mounted in apparatus 60 on shaft 91. Turret head 61, FIG. 1, further comprises three camming blocks 92, three shafts 93, three arms 94, three cam follower rollers 95 secured to the distal ends of arms 94, ratchet wheel 99, and means not shown in the figures for connecting and valving a vacuum source to each vacuum sleeve 85 through tubes 97 which rotate with turret head 61, and tube 98 which is stationary.

Ratchet wheel 99 is affixed to shaft 91, and shafts 93 are affixed to ratchet wheel 99 in circumferentially spaced and parallel relation thereto so that shafts 93 extend transverse apparatus 60 and describe circular paths about the axis of turret 61 as turret 61 is periodically indexed.

As will hereinafter be described more fully, cam 76, FIG. 1, is non-rotatably secured to frame 65 of apparatus 60. Cam 76 is not affixed to shaft 91.

Referring now to FIG. 8, turret head 61 also comprises two plates 200 (only the far side of which is shown in FIG. 8) which plates 200 are secured in spaced relation to three vacuum conduits 201 which extend parallel to shaft 91 and which are spaced circumferentially thereabout at 120° intervals. Three cylindrical guides 96 are secured by pins 202 to plates 200 so that they extend generally radially therefrom.

Each guide 96, FIG. 8, has a bushing block 203, a first compression spring 204, a pillow block 205, and a second compression spring 206 telescoped thereover in that order and retained on the guide 96 by retainer 207 affixed to the distal end of guide 96. Thus, as shown in FIG. 8, bushing block 203 is slidably biased rightwardly against a shoulder on plate 200 and pillow block 205 is slidably biased to an intermediate position on guide 96.

Means 89, FIG. 8, for securing vacuum sleeve 85 to turret head 61 comprises chassis 210, links 211, 212, tension spring 213, and pivot pins 214 through 217. Briefly, vacuum sleeve 85 is cradled above chassis 210 on an articulable parallelogram comprising links 211 and 212 having their upper ends rotatably secured by pivot pins 214, 215 respectively to bosses depending from vacuum sleeve 85, and which links 211, 212 have their lower ends rotatably secured by pivot pins 216, 217 to upwardly extending bosses on chassis 210. Chassis 210 is secured intermediate two transversely spaced pillow blocks 205 which pillow blocks 205 are slidably mounted on guides 96 as described above.

Link 212, FIG. 8, includes a stop portion 218. Tension spring 213 is disposed under tension intermediate an upstanding boss 219 on chassis 210 and pivot pin 215 whereby vacuum sleeve 85 is biased counterclockwise with respect to chassis 210 until the distal end of stop-portion 218 of link 212 abuts the upwardly facing surface of chassis 210. When the linkage is thus biased to this stop position, links 211, 212 lean 17° counterclockwise from vertical for a reason which is stated hereinafter in conjunction with describing the bag filling station 63, FIG. 1.

Referring back to FIG. 8, bushing block 203 was described as being slidably mounted on guide 96 and biased rightwardly by springs 204, 206 to abut a shoulder on plate 200. Bracket 225 is cantilevered upwardly from bushing block 203. Camming block 92 is affixed to bracket 225 through the use of two pins 226, two retainers 227, and two compression springs 228 so that camming block 92 is biased away from bracket 225 for a purpose explained hereinafter.

Bushing block 203, FIG. 8, also has a bracket 229 depending from it. Bracket 229, link 330, arm 231 affixed to shaft 93, and pivot pins 232, 233 provide articulable means intermediate shaft 93 and bushing block 203 to reciprocate bushing block 203 on guide 96 upon oscillation of shaft 93 as is described more fully hereinafter in conjunction with describing the displacement of filled bags from vacuum sleeves 85.

Referring still to FIG. 8, vacuum is connected to each vacuum sleeve 85 through a flexible tube 97 and an associated vacuum conduit 201. In order to facilitate bag insertion, sealing, and removal, vacuum is applied (by means not shown) to the vacuum conduits in timed relation with the insertion of a bag at the bag opening and insertion station, and each vacuum conduit is vented by means not shown as its associated vacuum sleeve is indexed from the bag filling position to the bag sealing and package removal position.

Vacuum sleeve 85, FIG. 24, comprises side walls 240, 241, bottom wall 242, and an arched top wall 243. Side walls 240, 241 are parallel to each other and perpendicular to bottom wall 242. Bottom wall 242 has a longitudinally extending concave groove 244 in it. Side walls 240, 242 and bottom wall 242 are of double wall construction and are provided with ports 86 whereby vacuum can be applied to the sleeve to secure a bag 70 disposed therein. When vacuum sleeve 85 is indexed at the bag loading position, FIG. 8, bottom wall 242 is substantially horizontal whereby the groove 244 becomes a quasi track to guide a stream of articles from trough 180 into a bag disposal in vacuum sleeve 85, and the orthogonal relationships between the side walls 240, 241 and bottom wall 242 substantially preclude the articles from spiraling into the bag.

BAG OPENING AND INSERTION

Bag opening station 62, FIG. 1, comprises magazine 81, bag pick-off assembly 100, bag spreading assembly 101, and bag opening and insertion assembly 102.

Magazine 81, FIG. 19, comprises a bottom wall 105, side walls 106 and 107, and lips 108, 109, and 110. Side walls 106, 107 extend substantially parallel and vertically, and are spaced sufficiently to provide clearance for a plurality of bags 70 disposed therein in upstanding relation with bottom wall 105. The distal edges 111, 112, of lips 108, 109 respectively are spaced sufficiently close to require folding the vertical edge portions of bags 70 to pass a bag 70 between lips 108, 109, and to clear lip 110. The infeed end 114 and the top of magazine 81 are open to enable inserting more bags into magazine 81 without interrupting the operation of apparatus 60.

Magazine **81** is secured to frame **65**, FIG. **1**, with its bottom wall **105** inclined upwardly and to the right at 30° with respect to horizontal. Thus, bags **70** will gravitate leftwardly and downwardly to the discharge end **113** of magazine **81** and lean against lips **108, 109** from whence they will be picked off one at a time by pick-off assembly **100**, FIGS. **1** and **9**.

Magazine **81** of the preferred embodiment apparatus **60** further includes biasing means not shown to assist the gravitation of bags **70** towards the discharge end **113** of magazine **81** in the event the coefficient of friction between bags **70** and magazine **81** inhibits free gravitation of the bags to the discharge end of the magazine **81**. It is believed that the provision of such biasing means is well within the capabilities of persons having ordinary skill in the dispensing and packaging arts.

Referring now to FIG. **9**, bag pick-off assembly **100** comprises carriage **120**, swivel head **121**, vacuum shoe **122**, transverse beams **123, 124**, two parallel guides **125** (only the nearest one of which is visible in FIG. **9**), crank **126**, and link **127**. Guides **125** have their ends secured in transverse beams **123, 124** which are secured to frame **65** of apparatus **60**. In the preferred embodiment apparatus **60**, guides **125** are inclined upwardly and to the right, FIG. **9**, at 30° above horizontal.

Carriage **120**, FIG. **9**, extends generally transverse apparatus **60**, and is slidably mounted on guides **125**.

Swivel head **121**, FIG. **9**, is rotatably secured to carriage **120** and comprises vacuum shoe **122**, FIG. **20**. An air-actuator-driven rack and pinions **128**, FIG. **9**, is provided to rotate swivel head **121** back and forth through an angle of 180° so that vacuum shoe **122** can face magazine **81**, FIG. **1**, and oppositely therefrom, FIG. **10**.

Vacuum shoe **122**, FIG. **20**, comprises a plurality of vacuum cups **130** and internal passageways whereby a source of vacuum is applied to vacuum cups **130** at the time indicated on the sequence chart, FIG. **6***a*. This enables vacuum shoe **122** to pick-off a bag **70** from magazine **81**, FIGS. **1** and **19**, and hold the bag until it is fully opened as shown in FIG. **14**.

Carriage **120**, FIG. **9**, is connected through articulable link **127** and crank **126** to shaft **129** which is caused to oscillate in a predetermined timed relationship with other members of apparatus **60** by drive and synchronization means **66**, FIG. **1**. When shaft **129** oscillates, carriage **120** is reciprocated between a BAG PICK-OFF position, FIG. **1**, and a BAG OPENING position, FIG. **10**.

In operation, while carriage **120** is being moved from the BAG PICK-OFF position, FIG. **1**, to the BAG OPENING position, FIG. **10**, vacuum is applied to vacuum shoe **122**, and swivel head **121** is rotated 180° whereby a bag **70** is removed from magazine **81** and positioned at the BAG OPENING position. This sequence is shown in FIGS. **1, 9**, and **10**.

After a bag **70** has been opened, FIG. **14**, carriage **120** is backed away as shown in FIG. **15**. Then, swivel head **121** is rotated as shown in FIGS. **16** and **17** while carriage **120** is moved further rightwardly to reposition vacuum shoe **122** adjacent magazine **81** so that bag pick-off assembly **100** can repeat its cycle.

Bag spreading assembly **101**, FIG. **9**, comprises carriage **135**, vacuum plunger **136**, vacuum cup **137**, spring **138**, retainer **139**, link **140**, crank **141**, shaft **142**, and means not shown for porting vacuum to vacuum cup **137** through vacuum plunger **136** in timed relation, FIG. **6***a*, with the movement of carriage **135**.

Bag-spreading carriage **135** is slidably mounted on guides **125** so that it can be reciprocated between a RETRACTED position, FIG. **10**, and an EXTENDED position, FIG. **11**.

Vacuum plunger **136** is slidingly engaged in an upstanding portion of carriage **135**, and is biased rightwardly by spring **138**. Vacuum cup **137** is disposed on the distal end of vacuum plunger **136**. When carriage **135** is moved to its EXTENDED position, FIG. **11**, vacuum cup **137** is biased by spring **138** against the left side of bag **70** disposed at the BAG OPENING position.

Carriage **135** is articulably connected to shaft **142** through link **140** and crank **141** so that oscillation of shaft **142** by drive and synchronization means **66** causes carriage **135** to reciprocate in timed relation with other members of apparatus **60**. As indicated on the sequence chart, FIG. **6***a*, operation of the bag spreading assembly **101** causes the mouth of bag **70** to be spread open as indicated in FIG. **12**. Then, carriage **135** is caused to be partially retraced as shown in FIG. **15** after the bag is opened fully as shown in FIG. **14**.

Bag opening and insertion assembly **102**, FIG. **9**, comprises an expansible/collapsible mandrel **150**, means **151** for expanding and collapsing mandrel **150** as indicated in FIGS. **14** and **18** respectively, pneumatic actuator **152** and mandrel guides **153** for operating the mandrel **150** between a RETRACTED position and an EXTENDED position as shown in FIGS. **12** and **13** respectively, and carriage **154**, guides **155**, blocks **156**, articulable link **157**, crank **158**, and shaft **159**.

Guides **155**, FIG. **9**, are secured intermediate blocks **156** secured to frame **65** of apparatus **60** so that the guides **155** extend parallel to the longitudinal centerline of a vacuum sleeve **85** disposed at the bag insertion position as shown in FIGS. **1** and **9**.

Carriage **154** is slidingly mounted on guides **155** for reciprocation between an UP and a DOWN position as shaft **159** is oscillated by drive and synchronization means **66**. Carriage **154** is drivingly connected to shaft **159** through articulable link **157** and crank **158**.

The upper end of the body of actuator **152**, FIG. **9**, and the lower ends of two transversely spaced mandrel guides **153** (only the nearest one being visible in FIG. **9**) are secured to carriage **154** so that actuator **152** and guide **153** are in parallel relationship to guides **155**. The mandrel assembly **150** is slidingly mounted on mandrel guides **153** and is attached to the distal end of the piston rod of actuator **152** which piston rod is obscured in the figures by the nearest mandrel guide **153**.

THE MANDREL

Mandrel **150**, FIG. **9**, comprises two blades, **161**, 162. As shown in FIG. **21** taken along line **21—21** of FIG. **1**, the tips of blades **161, 162** have rounded corners **163** and **164**, and a concave central portion **165**.

The rounded corners **163, 164** of mandrel blades **161, 162**, enable the sealed end of a bag **70** to be thrust into a vacuum sleeve **85** (as is hereinafter more fully described) without tearing the bag. Rather than tearing, the closed end of the bag folds over the rounded corners **163, 164** of mandrel blades **161, 162**.

The concave central portions **165** of the tips of mandrel blades **161, 162**, FIG. **21**, is provided to enable the sealed end **71** of bag **70**, FIG. **2**, to be wrapped far enough around camming block **92**, FIG. **17**, to enable

using the camming block as a means for orienting articles **68** packaged therewithin as is described more fully hereinafter.

FIG. **22** is an end view of the blades **161, 162** of mandrel **150** in the expanded state. When thus expanded, the mandrel is sufficient size to fully open a bag **70** to provide a slip-fit into a vacuum sleeve **85.** The transverse cross section of an opened bag is made to be sufficiently like the cross section of a tubular vacuum sleeve **85,** FIG. **24,** so that vacuum applied through ports **86** will retain the bag within the vacuum sleeve while the mandrel is collapsed and withdrawn.

In operation, after a bag **70** has been partially opened by the bag spreading assembly **101** as shown in FIG. **12,** the piston rod of actuator **152** is extended, FIG. **13,** to telescope the blades **161, 162** of mandrel **150** into bag **70** while the mandrel is collapsed (blades together). Then, the piston rod of actuator **166** of means **151** for expanding/collapsing mandrel **150** is extended to expand mandrel **150** to fully open bag **70** as indicated in FIG. **14.** After the bag pick-off carriage **120** and the bag spreading carriage **135** are backed-off sufficiently to space vacuum shoe **122** and vacuum cup **137** respectively from the opened bag as shown in FIG. **15,** shaft **159** is rotated clockwise, FIGS. **16** and **17,** to thrust the opened bag into a vacuum sleeve **85** so that the open end of bag **70** is slightly recessed in vacuum sleeve **85** and the closed end of bag **70** is wrapped around camming block **92.** At this point in the sequence of apparatus **60,** FIG. **6***a*, vacuum is applied to vacuum sleeve **85** to secure bag **70** therewithin until after the bag is filled as hereinafter described. Then, mandrel **150** is collapsed, FIG. **18,** and fully retracted to the position shown in FIG. **1.**

To summarize the operation of the bag opening and insertion station **62,** a bag **70** is picked from magazine **81** by vacuum shoe **122,** FIG. **1,** rotated and translated, FIG. **9,** to the BAG OPENING position, FIG. **10.** Then, while turret head **61** is indexing clockwise, the unsealed end of bag **70** is spread open, FIG. **10,** and the bag is fully opened by mandrel **150,** FIG. **14.** Then, after turret head **61** has been indexed, bag **70** is deposited in a vacuum sleeve **85,** reference FIGS. **16** through **18,** and the station **62** is restored to the configuration shown in FIG. **1.**

BAG FILLING STATION

The bag filling station **63,** FIG. **25,** comprises article receiving and metering means **170,** vibrating feed means **171,** means **172** for camming a turret mounted vacuum sleeve **85** into abutting relationship with vibratory feed means **171,** and article sweeping means **173.** As shown in FIG. **25,** the elements of the bag filling station **63** and the associated adjacent portions of turret head **61** are in their respective positions at the point in a cycle of apparatus **60** just after vacuum sleeve **85***b* has been indexed to the bag filling position.

Briefly, articles **68***a* are received at apparatus **60** in shingled relation, metered between speer **174** and gate **175,** advanced by vibratory feed means **171** into an open bag **70** disposed in vacuum sleeve **85***b*, and secured in bag **70** by block **176** of article sweeping means **173** until the turret head **61** rotates far enough to tilt the bag **70** sufficiently upward to cause the articles **68***a* to be retained in bag **70** by gravity.

Articles **68***a*, hereinafter referred to as chips, are received at apparatus **60** in shingled relation which shingling is effected by up-stream apparatus such as disclosed in U.S. Pat. No. **3,677,391** issued July **18, 1972** to Richard A. Schaeffer. A conveyed endless stream of shingled chips is received by article receiving and metering means **170** in a trough or guide **177** and metered into discrete arrays **74** in the manner disclosed in U.S. Pat. No. **3,609,939** issued Oct. **5, 1971** to L. C. Hooper et al.

Article receiving and metering means **170,** FIG. **25,** comprises speer **174,** gate **175,** receiving-trough **177,** speer actuator **178,** gate actuator **179,** means not shown for activating actuators **178, 179** in timed relation with other machine functions, FIG. **6***b*, and vibratory means shown for advancing a metered array of chips **68***a* rightwardly to a forwarding-trough **180** which is a part of vibratory feed means **171.**

To meter an array of chips **68***a*, speer **174** is retracted upwardly to a position above the stream of chips while gate **175** is disposed at its UP position where it will block the advancement of the stream of chips. After the stream of chips reaches gate **175,** speer **174** is moved to its down position by actuator **178** whereby the speer will be disposed between the left end of a metered array **74** of chips and the right end of a surging endless stream of chips. Later, when the gate **175** is retracted to its DOWN position by actuator **179,** the metered array **74** of chips will be advanced rightwardly while the speer **174** continues to block the upstream chips.

Vibratory feed means **171** comprises forwarding-trough **180** mounted on a vibrator **181** such as Model HS **10,** Style **26** manufactured by Eriez Magnetics Division of Eriez Manufacturing Company, Erie, Pennsylvania and which is powered by **115** volt, **60** cycle alternating current.

Vacuum sleeve camming means **172,** FIG. **25,** acts on pillow blocks **205,** FIG. **8,** to move vacuum sleeve **85***b* leftwardly, FIG. **26,** into a spring biased abutting relationship with plastic spacer **182** affixed to trough **180,** at which position it is caused to vibrate synchronously with trough **180** by vibrator **181,** FIG. **27.**

Vibrator **181** acts on trough **180** through the linkage shown in FIG. **27** at an angle of **17°** above horizontal. Thus, vibrator **181** acts tangent to links **211, 212,** FIG. **8,** to cause vacuum sleeve **85** to oscillate on its parallelogram cradle when vacuum sleeve **85** abuts spacer **182.** This oscillation induced by vibrator **181** at an angle **17°** above horizontal essentially causes articles **68***a* to skip along trough **180** and into a bag disposed in vacuum sleeve **85.** That is, upon retraction of gate **175** downwardly to its DOWN position, FIG. **27,** a metered array **74** of chips **68***a* are advanced along trough **180** by the action of vibrator **181** to advance the chips in a skipping manner into the bag **70** as indicated in FIG. **28** until the leading chip reaches the closed end of bag **70** and leans against camming block **92.** The leftwardly facing, vertically extending surface of camming block **92** is convex so that the first saddle shape chip **68***a* wraps somewhat about the camming block whereby the array **74** is stabilized to prevent rotation of the array of chips in the bag which rotation might otherwise be precipitated by the action of vibrator **181.**

Article sweeping means **173,** FIG. **25,** comprises trapeze **188,** sweep carriage **192,** two compression springs **194** (only the near one being visible), latching means **195,** pawl **196,** and sweep arm **197** secured to sweep shaft **198.**

Trapeze **188**, FIG. **25**, is a U-shaped assemblage comprising two transversely spaced rods **190** (only the near one being shown in FIG. **25**), a spreader bar **189**, and two end blocks **191**. The two end blocks **191** are rotatably mounted on shaft **91** of turret head **61** in transversely spaced relation. An end of each rod **190** is secured to an end block and the other ends of rods **190** are secured to opposite ends of spreader bar **189** so that rods **190** are parallel and extend radially intermediate spreader bar **189** and end blocks **191**. Thus trapeze **188** has rotational freedom about shaft **91** of turret **61**.

Sweep carriage **192** extends transverse apparatus **60** and has its ends slidably fitted on rods **190** whereby carriage **192** has a degree of radial freedom on rods **190**.

Sweeping block **176** is cantilevered from a central position on sweep carriage **192** on spring arm **193** so that when the article sweeping means **173** is disposed in the UP position shown in FIG. **25**, an array of articles can be forwarded underneath sweeping block **176**, and when means **173** is disposed in the DOWN position shown in FIG. **24**, sweeping block **176** is disposed in trough **180**.

Sweep carriage latching means **195**, FIG. **25**, comprises latch-block **275**, cam following **276**, shaft **277**, catch **278**, and tension spring **279**. Block **275** is rigidly secured to rod **190** by pin **280**. Shaft **277** is rotatably mounted in block **275** with cam follower **276** rigidly secured to one end and with catch **278** rigidly secured to its opposite end. Catch **278** is normally biased counterclockwise against a portion of block **275** by tension spring **279** so that it is normally in the position shown in FIG. **25**.

Compression spring **194**, FIG. **25**, is telescoped over rod **190** and compressed so that it is disposed intermediate sweep carriage **192** and latch-block **275**. In this manner, spring **194** biases sweep carriage **192** radially outwardly against spreader bar **189**.

Still referring to FIG. **25**, article sweeping means **173** has been supported above trough **180** through the above described portion of the filling cycle. The means **173** was supported on a pair of pads **185** secured to the distal ends of piston rods **186** extended upwardly from a pair of actuators **187** only one of each pair being shown in the figures because they are symmetrically disposed on the opposite sides of trough **180**. As thus supported, sweeping block **176** does not interfere with chips advancing thereunder. However, when the last chip of array **74** has advanced rightwardly past block **176**, FIG. **28**, piston rods **186** are caused, FIGS. **6***b* and **7**, to retract whereby trapeze **188** is lowered to the position indicated in FIG. **29**. This positions block **176** in trough **180** so that rightward movement of carriage **189** will sweep the last chips of array **74** into bag **70**.

After trapeze **188** has been lowered, FIG. **29**, by actuator **187**, sweep shaft **198** is rotated clockwise through a predetermined angle by a camming portion of drive and synchronization means **66** whereby it rotates sweep arm **197** to the position indicated in FIG. **30**. The distal end of sweep arm **197** acts on sweep carriage **192** to move it rightwardly (radially inwardly) until it is latched by catch **195**. During the rightward movement of carriage **192**, sweep block **176** acts on the last chip of array **74** in conjunction with the action of vibrator **181** to cause the chips comprising array **74** to stand upright in bag **70** as indicated in FIG. **30**. The convex-shaped vertically extending surface of camming block **92** described hereinbefore also contributes to causing the array of chips to stand upright.

When an array of chips has thus been arranged in a bag at the bag filling station, FIG. **30**, and the nose of sweeping block **176** is within the mouth of bag **70** and lightly spring biased on spring arm **193** against the left end of the array of chips, shaft **184** of vacuum sleeve camming means **172**, FIG. **31**, is rotated clockwise. This rotates arm **183** secured thereto so that the camming means secured to its distal end moves away from block **205** under vacuum sleeve **85***b*. This enables compression spring **206** to slide block **205** rightwardly on guide **96** whereby the left end of vacuum sleeve **85***b* is spaced from spacer **182** secured to the right end of trough **180**. This uncouples vacuum sleeve from the action of vibrator **181** and provides clearance for the turret head to be indexed by rotating shaft **91**, FIG. **32**, clockwise.

After thus arranging and blocking an array of chips in bag **70**, drive and synchronization means **66** begins to synchronously rotate turret head **61** and trapeze **188** clockwise. More specifically, trapeze **188** is rotated clockwise because ratchet wheel **99** is affixed to and rotates with turret head **61** while trapeze-mounted pawl **196** is engaged with a tooth of ratchet wheel **99**.

As trapeze **188** is rotated clockwise, FIGS. **32**, **33**, the distal end of cam follower **276** is cammed clockwise by cam **285** which cam is rigidly secured to frame **65**. This releases the latch on carriage **192** which then moves radially outwardly under the influence of springs **194**. Still further rotation of the turret head causes the left end of pawl **196** to strike camming block **286** which is secured to frame **65** of apparatus **60**. This causes pawl **196** to be disengaged from ratchel wheel **99**. Trapeze **188** then falls, FIG. **34**, (rotating counterclockwise) onto pads **185** while the turret head **61** continues to rotate to advance the filled bag towards the bag sealing and package removal station **64**. As trapeze **188** falls (rotating clockwise), FIG. **34**, turret **61** rotates clockwise, ratchet wheel **99** is rotating clockwise and end block **191** is rotating counterclockwise.

The purpose for latching and rotating sweep carriage **192** as described above is to keep sweeping block **176** against the array whereby the array is maintained orderly until the bag is tilted upwardly enough for gravity to maintain the array in order.

As indicated in FIGS. **29**, **30**, and **32**, the next succeeding array **74***a* of chips has been formed during the operation of article sweeping means **173**, and piston rods **186** have been extended upwardly by actuators **187** to catch trapeze **188** at the angle of inclination required to permit the next succeeding array of chips to pass under sweeping block **176**.

RADIALLY CAMMING FILLED BAGS

As previously described, when a bag is inserted, FIG. **17**, into a vacuum sleeve **85** at the bag opening and insertion station **62**, its open end is recessed slightly in the radially outwardly disposed end of the vacuum sleeve **85**. Therefore, in order for a bag to be sealed and the package **67** thus formed to be removed by the bag sealing and package removal station **64**, the filled bag must be moved radially outwardly with respect to the vacuum sleeve **85**.

The means for camming a filled bag radially outwardly includes the previously described linkage, FIG.

8, for radially reciprocating block 203 on guide 96 as shaft 93 oscillates, and cam 76, FIGS. 1 and 32, arm 94, and cam follower roller 95. As previously noted, cam 76 is rigidly secured by means not shown to the frame of the apparatus. Cam 76 does not rotate.

Briefly, referring to FIG. 8, springs 204 and 206 bias block 203 to the right which biases shaft 93 counterclockwise which in turn, reference FIG. 32, biases cam follower roller 95 radially inwardly against cam 76. Thus, as turret 61 indexes to forward a filled bag to the bag sealing and package removal station 64, cam follower roller 95, FIG. 32, rolls clockwise about stationary cam 76. This moves roller 95 radially outwardly which rotates shaft 93 clockwise which, reference FIG. 8, moves block 203 radially outwardly on guide 96. This carries camming block 92, FIG. 8, leftwardly because camming block 92 is cantilevered off of block 203.

In operation, after the turret 61 has rotated past the position shown in FIG. 33, the vacuum sleeve is vented by means not shown, and the cut of cam 76 causes camming block 92 to move radially outwardly. This lifts the filled bag 70 in the vacuum sleeve 85 so that the mouth of the bag extends therefrom as indicated in FIG. 35. Thus, the mouth of the bag is accessible for sealing the bag 70 and for removing the completed package 67 from the apparatus.

BAG SEALING AND PACKAGE REMOVAL

The bag sealing and package removal station 64, FIG. 35, comprises bag mouth spreading means 250, bag sealing and withdrawal means 251, bag removal means 252, and two guides 253 (only the far one being visible in FIG. 35) secured to blocks 254 which are in turn secured to the most adjacent side of apparatus 60.

FIG. 35 is a side elevational view of apparatus 60 showing station 64 at the point in a cycle of the apparatus, FIG. 6c, just after turret head 61 has indexed a filled bag 70 to station 64. As further indicated in FIG. 35, the next previously filled bag has been sealed and the package 67 thus completed is being removed by means 252 to take-away conveyor 255.

Briefly, the mouth of the bag is spread by oppositely acting fingers so that the end of the bag can be heat sealed to form a substantially planar seam. This completes a package 67 as shown in FIG. 5. Then, the jaws used to form the seal grip the package, and the package is withdrawn from the turret sleeve by moving the jaws upwardly. Bag removal means 252 then picks the package from the jaws and delivers the package to a take-away conveyor.

The two guides 253 are parallel and are transversely spaced to accommodate means 250, 251 therebetween. Guides 253 extend radially inwardly towards the axis of turret 61 so that they are substantially parallel to the longitudinal centerline of a vacuum sleeve indexed at the bag sealing and package removal position as shown in FIG. 35.

Bag mouth spreading means 250, FIG. 35, comprises a carriage 300, fingers 301, 302, shafts 303, 304, shaft 305, crank 306, link 307, pivot pins 308, 309 and means not shown for rotating shafts 303, 304 through equal angles of opposite hands so that the distal ends of fingers 301, 302 can be spread apart, and then returned to the position shown.

Carriage 300 is slidably mounted on guides 253. Shaft 305 is connected to carriage 300 through crank 306, link 307, and pivot pins 308, 309 so that oscillation of shaft 305 causes carriage 300 to reciprocate between an UP position and a DOWN position. When in the DOWN position, fingers 301, 302 extend into the mouth of bag 70 wherein they are spaced apart to spread the mouth of the bag to enable forming a planar seam. Then, fingers 301, 302 are moved together and moved upwardly out of the bag.

Bag sealing and withdrawal means 251, FIG. 35, comprises carriage 320, two each transversely spaced jaws 321 and arms 322 (only the nearest one of each being visible in FIG. 35), shaft 323, crank 324, link 325, pivot pins 326, 327, 328, and means not shown in the figures for varying the transverse spacing between jaws 321 between an OPEN position and a CLOSED position.

Jaw carriage 320 is slidably mounted on guides 253 below and independently with respect to finger carriage 300. Shaft 323 is connected to carriage 320 through crank 324, link 325 and pivot pins 326, 327 so that oscillation of shaft 323 causes carriage 320 to reciprocate between a DOWN position and an UP position. When at the DOWN position, the jaws 321 are half closed while the fingers are spread apart. Then, after the fingers are closed and retracted, the jaws are completely closed and heated to seal the top end of bag 70 and grip bag 70 so that bag 70 is withdrawn from vacuum sleeve 85 when carriage 320 is moved to its UP position.

Electrical means not shown in the figures is provided to heat jaws 321 to heat seal the end of bag 70; reference schematic FIG. 7.

Bag removal means 252, FIG. 35, comprises a vacuum head 340, tube 341, arm 342, shaft 343, crank 344, shaft 345, actuators 346, 347, and pivot pins 348, 349, and 350.

As shown in FIG. 35, vacuum head 340 is secured to the distal end of tube 341. Tube 341 and arm 342 are rigidly secured together and are rotatably secured to the distal end of crank 344 on shaft 343.

Actuators 346, 347 have their piston rods connected in end-to-end relation by pivot pin 350. The housing of actuator 346 is pivotally connected to crank 344 by pivot pin 348 and the housing of actuator 347 is pivotally connected to the distal end of arm 342 by pivot pin 349. Thus, actuators 346, 347 form an extensible link intermediate arm 342 and crank 344 whereby the angle A, FIG. 35, can be varied.

Crank 344 is secured to shaft 345 whereby the crank can be operated between a package pick-up position and a package delivery or drop-off position by rotating shaft 345 through a predetermined angle.

In operation, when both actuators 346 and 347 are extended, angle A is 90°. When actuator 347 is retracted (as shown in FIG. 35), angle A is 110°, and when actuator 346 is retracted, angle A becomes 160.

To pick a bag from the sealing jaws 321, arm 345 is rotated clockwise with angle A at 90° until the face of vacuum head 340 contacts the package. Then, with vacuum applied to the vacuum head 340 by means not shown, the package 67 is held on vacuum head 340 while the sealing jaws are opened. Arm 341 is then rotated 20° counterclockwise to space the package from the sealing jaws. Then, shaft 345 is rotated 50° counterclockwise to position the distal end of crank 344 above the take-away conveyor 255. Finally, actuator 346 is retracted to pivot tube 341 50° counterclockwise

(angle A becoming 160°) whereby tube 341 extends vertically and the package 67 is immediately above the take-away conveyor 255. At that point in the cycle of apparatus 60, vacuum head 340 is vented whereby package 67 falls onto conveyor 255.

Referring now to FIGS. 6c and 7, shafts 305, 323, and 345 are oscillated in timed relation by drive and synchronization means 66 not shown in the figures while other means not shown cause the movement of fingers 301, 302 and jaws 321, heating of jaws 321, rotation of tube 341, and the application of vacuum to and the venting of vacuum head 340 to sequentially seal bag 70, withdraw the package 67 thus completed from vacuum sleeve 85, and to forward the package to take-away conveyor 255.

Package 67 has a tetrahedral shape because then a bag is inserted into a vacuum sleeve, the initially closed end seam 71, FIG. 2, extends generally parallel to the axis of turret head 61, and the top seam 73, FIG. 5, is formed by sealing jaws which are so oriented that seam 73 is in an imaginary plane perpendicular to the axis of turret head 61. The jaws are so oriented so that the fingers essentially operate in the imaginary plane of the seam whereby the width of the bag sealing and package removal station can be made small. This in turn enables constructing a multi-lane embodiment of the present invention of reasonable total width; that is, an embodiment essentially comprised of a plurality of apparatuses 60 in side-by-side relation with unified frame, drive, and control elements.

While a particular preferred embodiment of the present invention has been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

We claim:

1. A turret type apparatus for filling and sealing bags with metered pluralities of articles of uniform non-planar shapes, said apparatus comprising:

a frame;

a turret head having three radially extending bag accommodating vacuum sleeves uniformly circumferentially spaced about a shaft rotatingly secured to said frame;

means for rotating said shaft to sequentially index each said vacuum sleeve to a bag insertion position, a bag filling position, and a bag sealing and package removal position;

means disposed adjacent said bag insertion position for fully opening a bag and inserting it into a vacuum sleeve disposed at said bag insertion position;

means disposed adjacent said bag filling position for forwarding a metered plurality of said articles into a bag disposed in a vacuum sleeve indexed at the bag filling position; and,

means disposed adjacent said bag sealing and removal position for sealing a filled bag indexed to said position in a said vacuum sleeve, and to remove from said apparatus the package thus completed by sealing said filled bag

whereby a bag is inserted into, filled, sealed and removed from each said vacuum sleeve during each revolution of said turret.

2. The turret type apparatus of claim 1 wherein said turret head shaft extends generally horizontally, said vacuum sleeves extend generally horizontally when disposed at said bag filling position, and wherein filled bags are disposed with their open ends up at the bag sealing and package removal station, said apparatus further comprising means for retaining said articles within a horizontally filled bag until it is rotated in a turret mounted vacuum sleeve to a generally upright orientation as the filled bag is advanced from the filling station to the bag sealing and package removal station.

3. The turret type apparatus of claim 2 wherein said means for forwarding articles into a bag comprises means for oscillating said horizontally extending bag at an angle of about 17° above horizontal.

4. The turret type apparatus of claim 2 wherein said means for forwarding said articles into a bag comprises means for arranging the articles into a nested stacked array within said bag.

5. The turret type apparatus of claim 4 wherein said means for fully opening a bag comprises a mandrel which is operable between an expanded state and a collapsed state and means for so operating said mandrel.

6. The turret type apparatus of claim 5 wherein said mandrel comprises articulated members which enable operating said mandrel between said expanded and collapsed states.

7. An apparatus for non-gravitationally filling bags having relatively stiff side walls with a metered plurality of frangible articles of uniform non-planar shape, said apparatus comprising:

a bag magazine;

means for removing an unopened bag from said bag magazine;

means for opening said bag so that said bag has a predetermined transverse cross-section of a shape and size sufficient to freely advance said articles into said bag;

means for maintaining said predetermined cross-section while said means for opening is being disassociated from said bag and while said bag is being filled;

means for positioning said bag at a filling orientation which substantially precludes gravity induced filling; and,

means for advancing said metered plurality of articles into said opened bag disposed at said filling orientation so that said bag can be filled with said articles without having to impose any bag opening forces on said articles and without dropping said articles.

8. An apparatus for filling bags having relatively stiff side walls with a metered plurality of frangible articles of uniform non-planar shape, said apparatus comprising:

a bag magazine;

means for removing an unopened bag from said bag magazine;

means for opening said bag so that said bag has a predetermined transverse cross-section of a shape and size sufficient to freely advance said articles into said bag;

means for maintaining said predetermined cross-section while said means for opening is being disassociated from said bag and while said bag is being filled, said means for maintaining said predetermined cross-section while said bag is being filled

comprising means for holding said bag substantially horizontally while being filled; and,

means for advancing said metered plurality of articles into said opened bag, said means for advancing including means for oscillating said bag along a line inclined about 17° above horizontal

whereby said bag is filled with said articles without having to impose any bag opening forces on said articles.

9. An apparatus for filling bags having relatively stiff side walls with a metered plurality of frangible articles of uniform non-planar shape, said apparatus comprising:

a bag magazine;

means for removing an unopened bag from said bag magazine;

means for opening said bag so that said bag has a predetermined transverse cross-section of a shape and size sufficient to freely advance said articles into said bag;

means for maintaining said predetermined cross-section while said means for opening is being disassociated from said bag and while said bag is being filled;

means for advancing said metered plurality of articles into said opened bag;

means for rotating filled bags from a horizontal orientation to a generally vertical orientation; and,

means for sealing the bags and for removing the packages thus completed from said apparatus

whereby said bag is filled with said articles without having to impose any bag opening forces on said articles.

* * * * *