July 4, 1967 K. D. SCHWEERS 3,328,873

AUTOMATIC CAP LINER INSERTING MACHINE

Filed Aug. 25, 1964 6 Sheets-Sheet 1

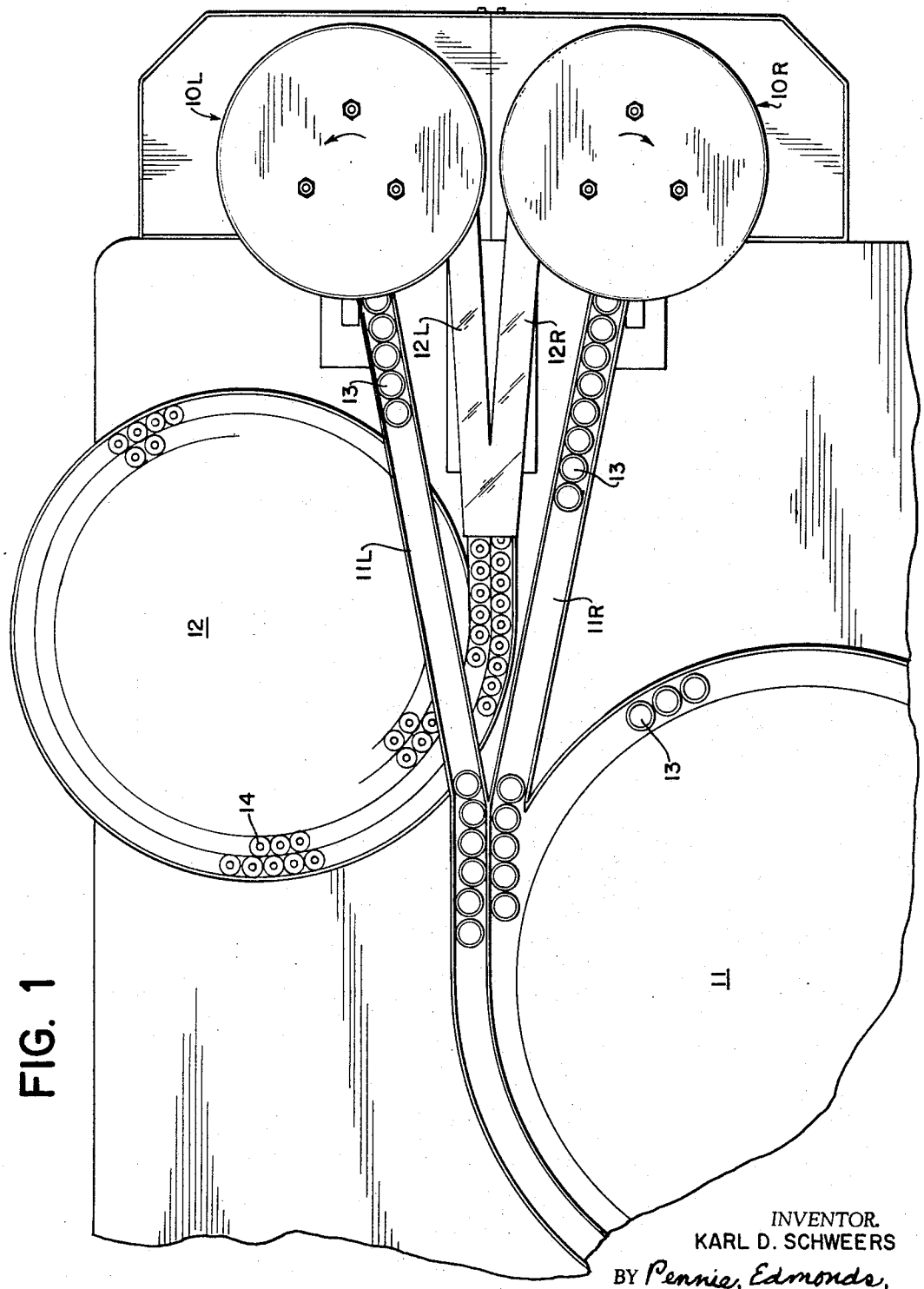


FIG. 1

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FIG. 2

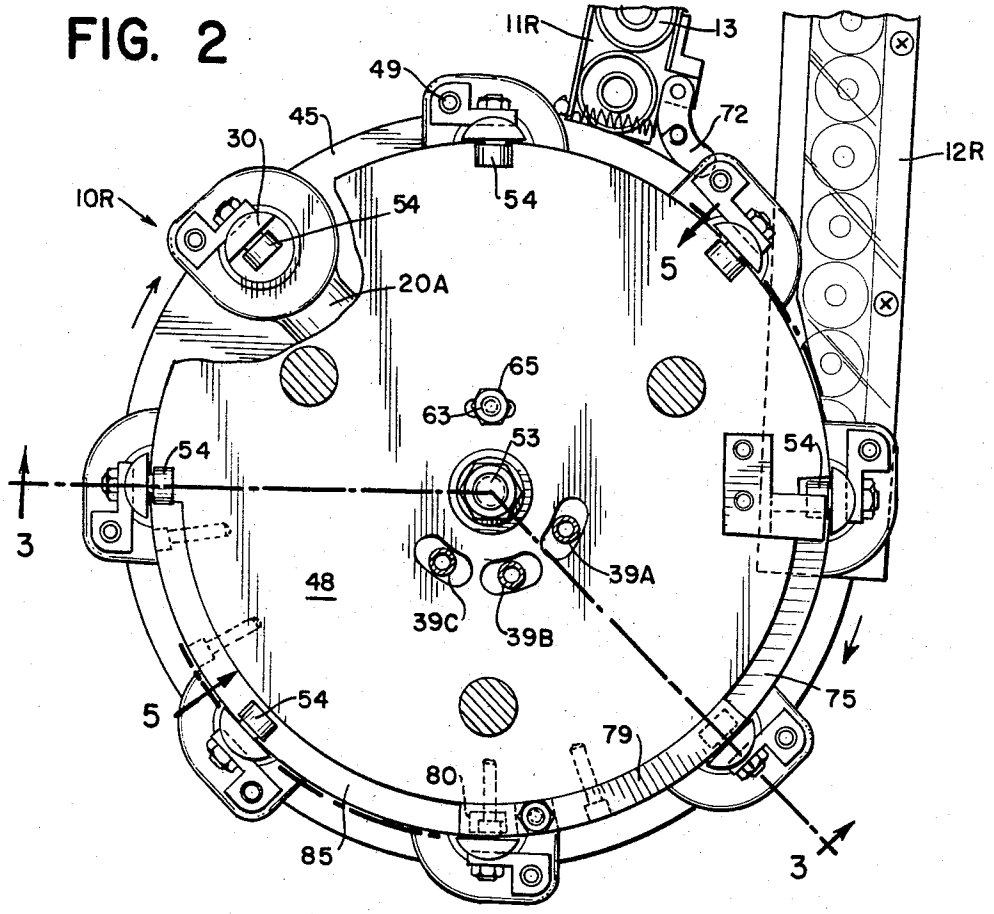
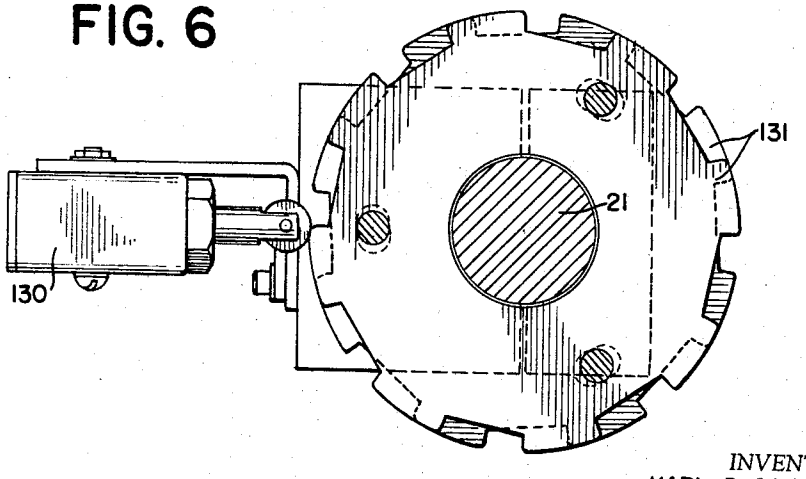


FIG. 6



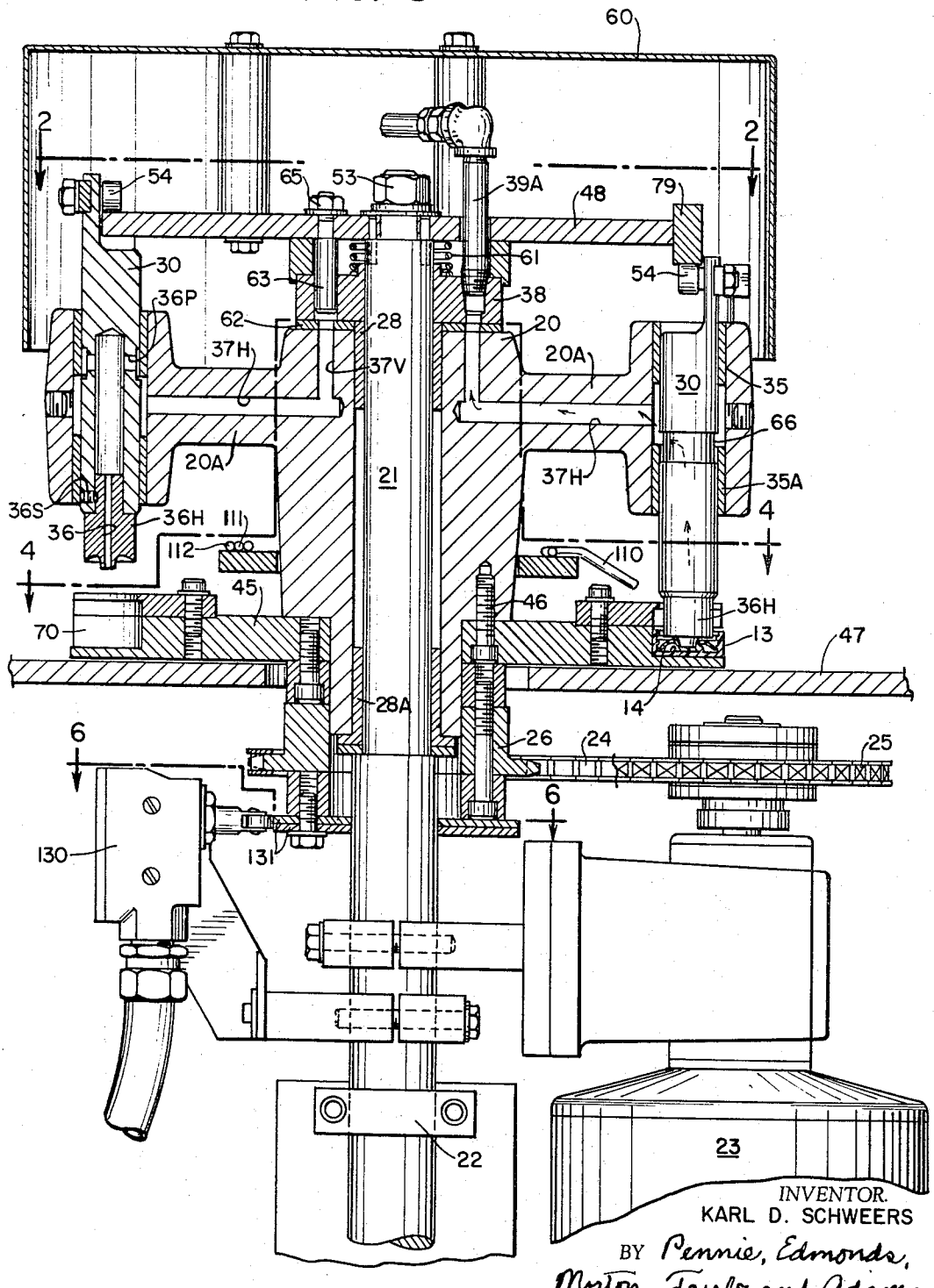
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AUTOMATIC CAP LINER INSERTING MACHINE

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FIG. 3



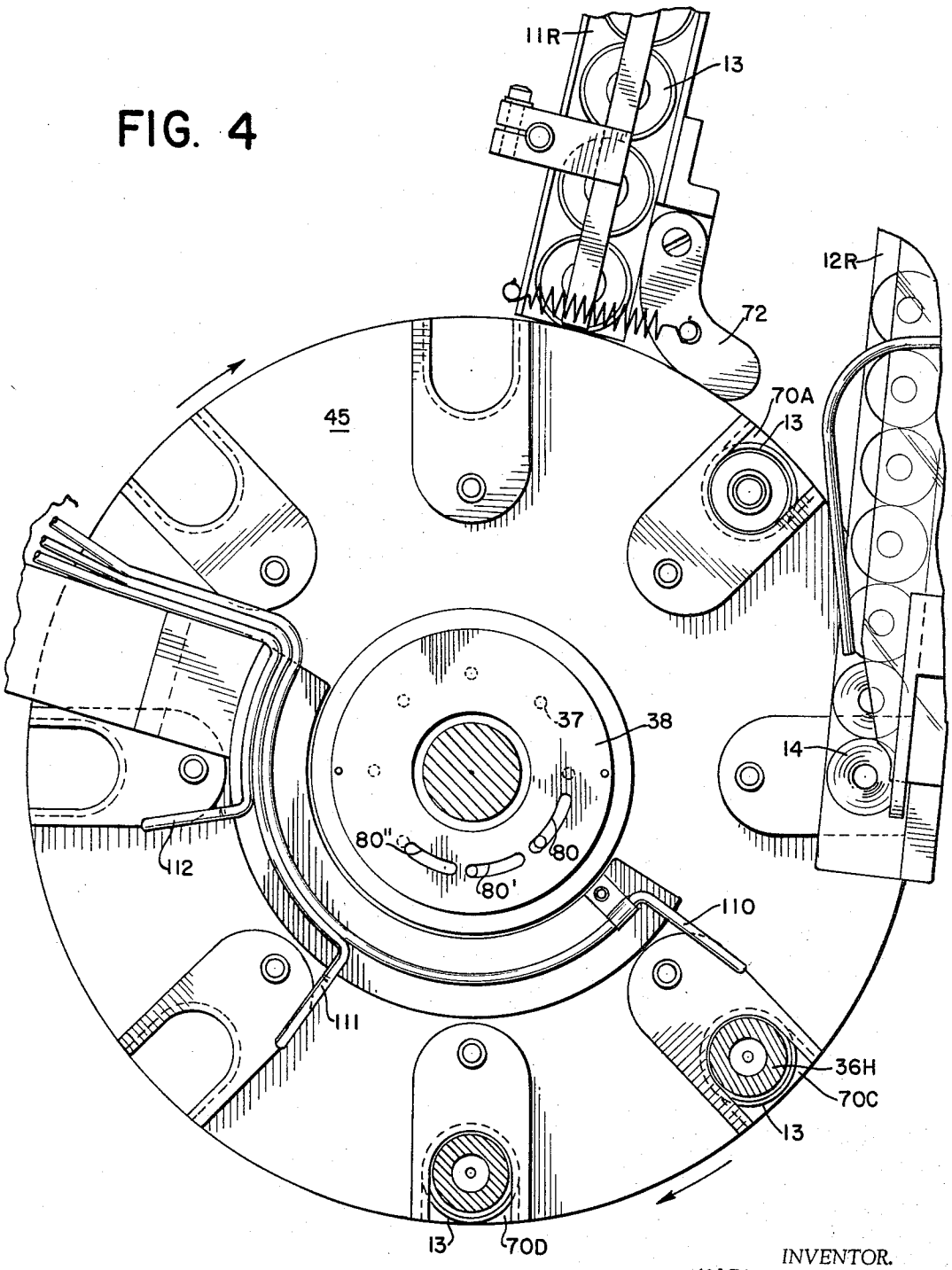
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AUTOMATIC CAP LINER INSERTING MACHINE

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FIG. 4



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AUTOMATIC CAP LINER INSERTING MACHINE

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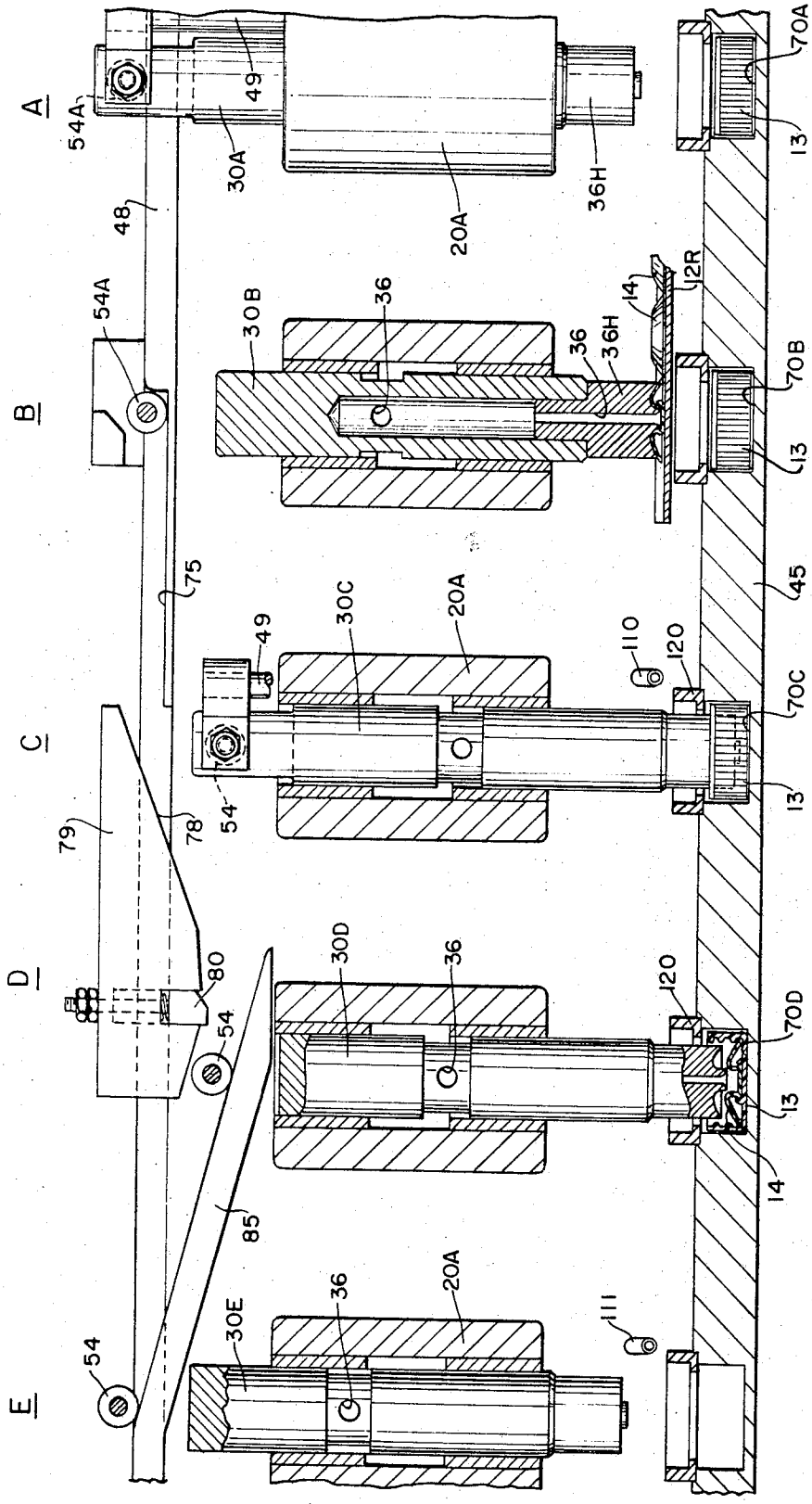


FIG. 5

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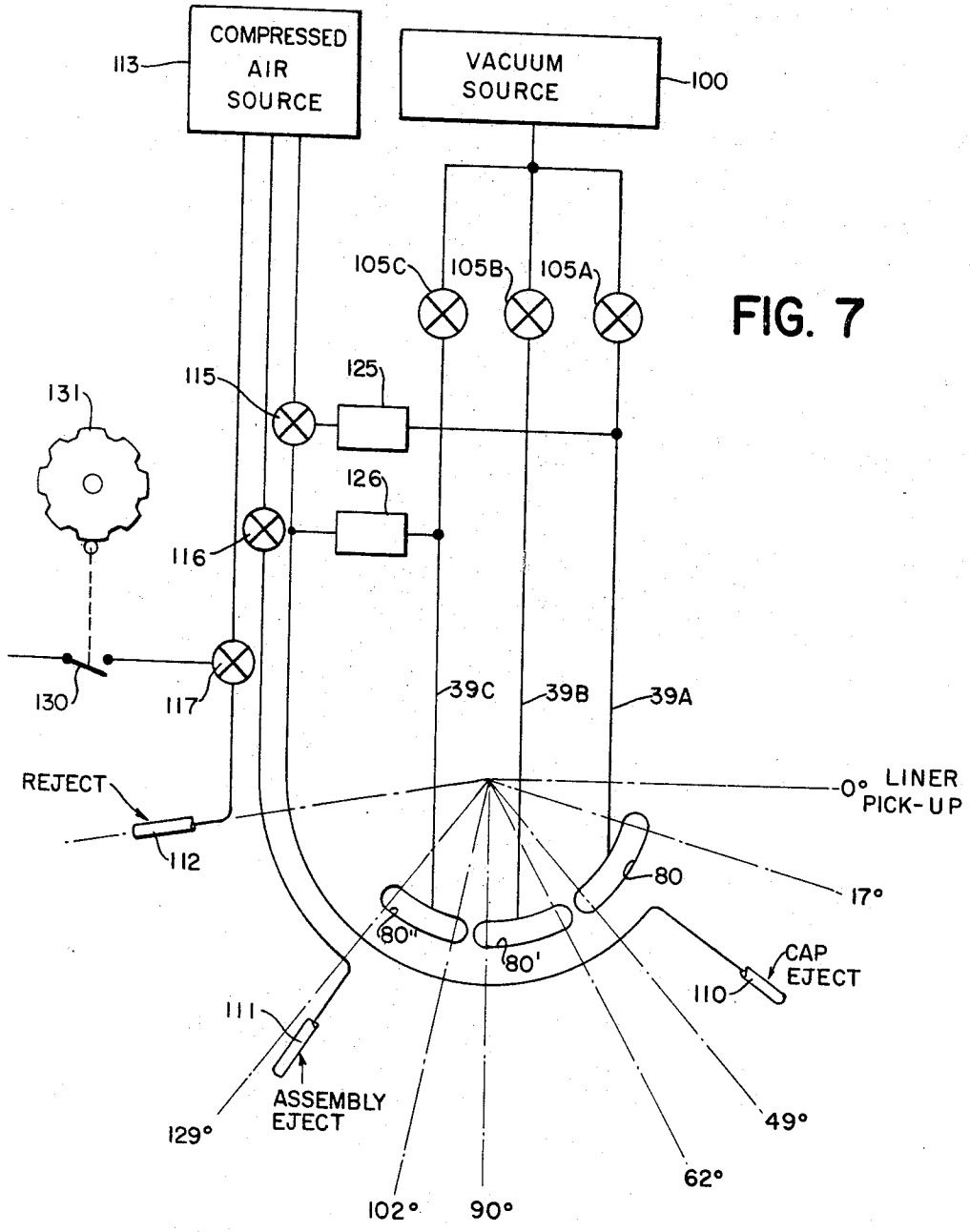


FIG. 7

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United States Patent Office 3,328,873 Patented July 4, 1967

3,328,873

AUTOMATIC CAP LINER INSERTING MACHINE

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Filed Aug. 25, 1964, Ser. No. 391,970
5 Claims. (Cl. 29—208)

The present invention relates to apparatus for assembling container closures and more particularly to apparatus for automatically inserting sealing liners in removable cap type container closures.

In the assembly of the well-known type container caps having an inserted sealing liner, it has been customary production practice to insert the liners either manually or with simple manually operated presses. Although such manually assembled caps are generally of good quality, production rates are low and costs are high. On the other hand, previous efforts to automate this production assembly operation have generally met with failure in that the percentage of damaged or improperly assembled caps has been unacceptably high.

It is a principal object of the present invention to provide apparatus which will not only continuously and automatically insert sealing liners in container caps at a very high rate of speed but will also continuously and automatically inspect various stages of the assembly operation and reject all caps that are either broken or have missing or improperly positioned liners or reject all liners where caps are missing.

Various features and advantages of the present invention will be apparent from the following description of a preferred embodiment thereof as illustrated in the accompanying drawings in which:

FIG. 1 is a simplified plan view of the automatic cap assembly apparatus provided by the present invention;

FIG. 2 is a sectional plan view of a single liner inserting turret shown in FIGS. 1 and 3;

FIG. 3 is a cross sectional view of the turret assembly illustrated in FIG. 2;

FIG. 4 is a lower sectional plan view of the turret assembly illustrated in FIG. 3;

FIG. 5 is a planar elevation view of the turret assembly shown in FIG. 2;

FIG. 6 is a plan view of the cam-actuated reject valve switch control shown in FIG. 3; and

FIG. 7 is a simplified schematic diagram of the vacuum operated cap-liner assembly checking apparatus provided by the invention.

Referring now to FIG. 1, there is shown in plan view a pair of cap liner inserting machines **10**L and **10**R operating cooperatively with vibratory cap feeder **11** supplying oriented caps **13** (open side up) to each machine via feeder rails **11**L and **11**R. Compliant liners **14** are supplied by vibratory feeder **12** via feeder rails **12**L and **12**R to the inserting machines **10**L and **10**R respectively. As shown, the inserting machines **10**L and **10**R advantageously rotate in counterclockwise and clockwise directions respectively. The machines are otherwise identical and for purposes of explanatory simplification, only the operation of machine **10**R will be described hereinafter.

In a preferred embodiment of the invention, as illustrated in sectional drawings FIGS. 2–5, a continuously rotating eight station turret **20** rotatively supported on vertical spindle **21** is provided. Spindle **21** is rigidly supported to the machine base frame by clamp **22**, and turret **20** is rotatably driven on spindle **21** by motor **23**, drive chain **24** and sprocket gears **25** and **26**.

The hub of turret **20** supported by bearings **28** and **28**A comprises eight separate and identical turret head arms **20**A, each of which individually supports for vertical reciprocation a liner inserting ram **30**. Each of the rams **30** is slidably supported for free up and down movement within bearings **35** and **35**A at the end of a given turret arm **20**A. As shown, each ram is cylindrical in shape, having a central bore **36** communicating between the end of the ram head through portholes **36**P, horizontal bore **37**H in arm **20**A, vertical bore **37**V, and finally through a commutator valve distributor **38** to vacuum line **39**A–B–C. Each ram is maintained in a fixed orientation with respect to the peripheral edge of compound cam **48** by antirotation rod **49** which is also slidably supported for free up and down movement in a separate vertical bore adjacent to bearings **35**.

Rotor plate **45** is securely attached to turret **20** by machine screws **46** as illustrated, and the entire turret and rotor base assembly is rotatably supported on spindle **21** as described above. In operation, the entire rotor head assembly is continuously driven in rotation with respect to the table surface **47** and upper cam plate **48** which is fixedly secured to the threaded top end of spindle **21** by nut **53**. Compound cam plate **48** defines at its outer peripheral edges a plurality of cam surfaces which are adapted to drive each of the respective rams **30** in vertical reciprocation through contact with cam followers **54**. Cam plate **48** also supports a protective top cover **60** and the commutator valve distributor **38**. Distributor **38** is loaded by spring **61** against bearing **62**, and the entire distributing valve **38** is secured to **48** by pin **63**, the upper threaded end of which passes through a slotted hole in **48** and which is clamped to **48** by nut **65**. As will be explained in further detail below, the distributing angle of valve **38** may be adjusted over a limited range by loosening **65** and rotating **38** to the desired angle of distribution.

Referring to the ram head **30**, it will be noted that vacuum supply line **39**A–B–C is always connected to the central bore **36** in head **30** so long as distributing valve **38** is in an open position for a given head. Thus, bore **36** in a given head is always connected to line **37** because the outer diameter of ram **30** is reduced at **66** thereby providing a clearance passage between **66** and **35**A.

As shown in FIG. 3, the head **36**H is preferably detachable by loosening set screw **36**S so that a variety of differently shaped heads may be mounted in the rams **30** to match the contours of variously shaped liners and variously shaped caps. For purposes of explaining the present invention, head **36**H is illustrated as having a central end nipple **36**N shaped to fit and be received by a central dimple in a compliant plastic liner **14** (see FIG. 3). Central nipple **36**N defines the terminal end of bore **36**. When the vacuum line is connected to bore **36**, liner **14** is securely held against the nipple end of head **36**H.

In operation, the entire turret head assembly including rotor plate **45** is driven continuously past chute **11**R and each of the nests **70** is loaded with a container cap **13** preoriented with the open end up. The terminal delivery end of chute **11**R is preferably equipped with a curved spring loaded finger **72** as illustrated so that improperly loaded container caps will be positively urged inwardly to a proper seating position as illustarted in nest **70**A (see FIG. 4).

Operation of the liner insertion operation performed by each of the individual rams **30** will now be described with reference to the simplified sectional view of FIG. 5. Prior to the arrival at liner delivery chute **12**R, ram **30**A is maintained in an elevated position by cam follower **54**A which rides on the flat top surface of **48**. At the elevated position, the head of **30**A is high enough to clear delivery track **12**R and the liners **14** supported thereon. At Station B, cam follower **54** is dropped to a lower cam surface **75** and at this level, the head of ram **30**B is brought into contact with a pre-oriented liner on track **12**R as

the liner is moved by head **30B** along the flat upper surface of track **12R** towards the terminal end of that track. Before the head of ram **30B** leaves the terminal end of track **12R**, however, bore **36** on ram **30B** is connected to a vacuum source by slot **80** in distributor valve **38** (see FIG. 4). Thus liner **14** is removed from track **12R** by the suction action of the vacuum pickup head on ram **30B** and is advanced along with the cap in **70B** to Station C where it is inserted therein as illustrated. Ram **30C** at Station C is driven downwardly by the undersurface **78** of cam member **79** which is secured to the peripheral edge of plate **48**. In passing under cam surface **78**, roller **54** forcefully drives liner **14** into its seated position in cap **13** as shown in sectional view at Station D. Cam **79** preferably includes an adjustable spring-loaded insert member **80** which defines the maximum down-drive position for each of the liner-inserting rams.

Following the insertion of liner **14** in cap **13** at Station D, ram **30** is elevated and the head end is removed from the liner and cap by the operation of cam follower **54** riding on the upwardly inclined cam surface **85**.

Thus it will be seen that each of the respective ram heads in traveling through stations A–E picks up a liner, inserts the liner in a cap that has been delivered open side up to a retaining nest **70** immediately below each associated ram and is then elevated back to a normal up position ready for a repeat liner insertion operation.

In accordance with one featured aspect of the present invention, vacuum control sensing apparatus is provided to detect malfunction in the liner insertion operation. The operation of this aspect of the invention is best described by referring initially to FIGS. 4 and 7. As illustrated in FIG. 7, vacuum source **100** is connected to valve slots **80**, **80'** and **80''** in distributing valve **38** via lines **39A**, **39B** and **39C**. In operation, each of the individual ram heads is periodically connected to a vacuum supply source as duct **37** passes under each of the respective slots **80**, **80'** and **80''**. Each of the lines **39A**, **39B** and **39C** is preferably connected to vacuum source **100** through isolation valves **105A**, **105B** and **105C**. A cap eject nozzle **110**, an assembly eject nozzle **111** and a reject nozzle **112** are energized by compressed air source **113** via control valves **115**, **116** and **117** respectively. Control valve **115** is actuated by vacuum sensor **125** which is connected to line **39A**. Sensor **125** may be any one of a variety of well-known conventional type pressure sensing devices. In operation, sensor **125** is arranged to open valve **115** when the pressure in line **39A** exceeds a pre-determined value. Thus, when the head of ram **30** that is connected to valve slot **80** is closed by the presence of a liner **14** for example, the vacuum in line **39A** is maintained and valve **115** is not actuated. Whenever a liner is missing, however, pressure in line **39A** increases because the pickup head is exposed to atmospheric pressure and valve **115** is actuated connecting the compressed air source to cap-eject nozzle **110**. Accordingly, when a liner **14** is missed by a pickup head in its passage over track **12R**, eject-nozzle **110** is energized and the container cap **13** disposed in the nest immediately below the empty head is blown out of the nest into a reject bin, thus precluding the delivery of an empty unlined cap to the final assembly station. If the liner is present throughout the application of vacuum to any one of the given ram heads as it passes under the valve slot **80**, the vacuum is maintained and the cap disposed in the nest immediately below that head is retained in its nest. As described above, the liner is then inserted in the cap with the vacuum being supplied to the head by line **39B** and valve slot **80'** during the seating or inserting operation.

Seating of the liner is checked during the initial period of elevation of a given ram head by cam surface **85**. During this lifting interval, vacuum is supplied to the ram pickup head (associated with the assembly operation to be checked) by supply line **39C** and valve slot **80''**. If the liner in question has been properly seated, the cap and liner will be lifted together until the edges of the cap **14** are restrained from further upward movement by retaining lips **120** (see FIG. 5). The vacuum seal between the pickup head and the properly inserted liner is thereby broken and the pressure in line **39C** is immediately increased. This increase in pressure in **39C** is detected by vacuum sensor **126** which opens valve **116** and supplies compressed air to assembly eject nozzle **111**.

If, on the other hand, a liner was not properly seated in cap **14**, the vacuum would be maintained in line **39C** by the liner which would remain in contact with the ram head as it is lifted by cam surface **85**. Under these circumstances, assembly eject nozzle **111** would not be energized and the unseated liner would be carried by a ram head beyond assembly eject nozzle **111** and rejected or blown clear of the nest by reject nozzle **112**. Nozzle **112** is energized by valve **117** which is electrically controlled by cam actuated microswitch **130** (see FIGS. 3 and 7). Microswitch **130** is physically clamped to spindle **21** and is actuated by an 8-position cam **131** that is coupled to and rotates with the entire turret assembly. Accordingly, a jet of compressed air is directed at each nest as it passes by nozzle **112** thereby assuring that each nest is completely cleared of broken parts, defective caps or defective liners that might have passed through the assembly operation. Thus, each nest is completely cleared before it passes around to receive another cap **13**, and malfunction due to piling up of broken caps and the like is prevented.

It will be appreciated by those skilled in the art that the apparatus provided by the present invention is capable of efficiently and reliably inserting sealing liners in container caps at a rapid rate and at the same time, is capable of self-checking each stage of the operation to assure delivery of only caps having properly seated liners.

While a preferred embodiment of the present invention has been described and illustrated, it will be appreciated by those skilled in the art that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

What is claimed is:

1. An apparatus for automatically inserting sealing liners into container caps which apparatus comprises:

(a) continuously rotating turret,

(b) a rotor plate rotatable with the rotating turret and having at least one cap nest adapted to receive a container cap,

(c) a reciprocating liner inserting ram positioned opposite each cap nest,

(d) a ram head containing a bore communicable with a vacuum source adapted to pick up sealing liners,

(e) means for supplying the sealing liners to the ram head,

(f) means for supplying container caps to the cap nests in open orientation with respect to the ram head,

(g) means for establishing and interrupting communication between said bore and vacuum source, and

(h) a compound cam means for reciprocating the liner ram thereby inserting the ram head carrying one of said sealing liners into a container cap and thereafter withdrawing the ram head.

2. An apparatus for automatically inserting sealing liners into container caps in accordance with claim **1** having in addition (1) at least one air nozzle in communication with a compressed air source and adapted to direct a jet of air into a cap nest thereby ejecting its contents, and (2) sensor means actuated by pressure changes in the vacuum lines and operatively controlling the supply of compressed air to the nozzles.

3. An apparatus for automatically inserting sealing liners into container caps and inspecting the assemblies as the caps pass a series of stations, which apparatus comprises:

(a) a continuously rotating turret,

(b) a rotor plate rotatable with the rotating turret and having at least one cap nest adapted to receive a container cap,

(c) a reciprocating sealing liner inserting ram positioned opposite each cap nest and having a ram head provided with a vacuum means adapted to pick up and retain a sealing liner,

(d) means for supplying the sealing liners to the ram head,

(e) means for supplying the container caps to the cap nests in open orientation with respect to the ram head,

(f) a compound cam means adapted to (1) bring the ram head into contact with a sealing liner at a first station, (2) insert the ram head into a cap nest at a second station, (3) withdraw the ram head at a third station and (4) maintain the ram head in its withdrawn position at a fourth station and until it is rotated again to the first station,

(g) a plurality of vacuum lines in communication with a vacuum source and adapted to communicate with a ram head at the first, second, and third stations,

(h) compressed air nozzles at the second and third

stations adapted to direct a jet of air into a cap nest thereby ejecting its contents,

(i) sensor means adapted to control the air supply to the nozzles at the second and third stations and actuated by an increase in pressure in the vacuum lines when a ram head is at the second and third stations.

4. An apparatus for automatically inserting sealing liners into caps in accordance with claim 3 having in addition a compressed air nozzle at the fourth station.

5. An apparatus for automatically inserting sealing liners into container caps in accordance with claim 4 wherein each cap nest has a retaining collar to prevent the cap from being removed from the nest by the withdrawal of the ram.

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