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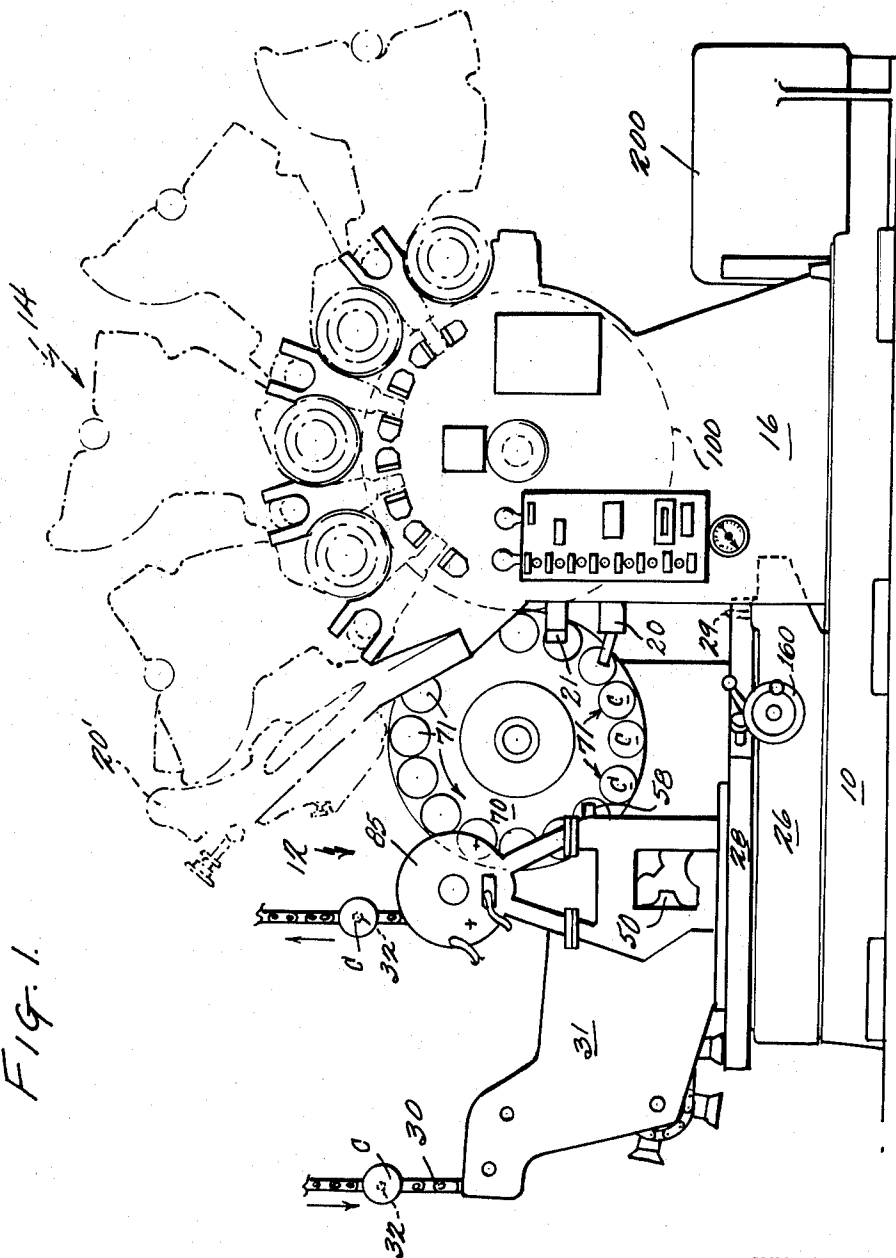
W. E. BRIGHAM ETAL

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16 Sheets-Sheet 1



INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE
Fisher, Christen, Sabol & Caldwell
ATTORNEYS

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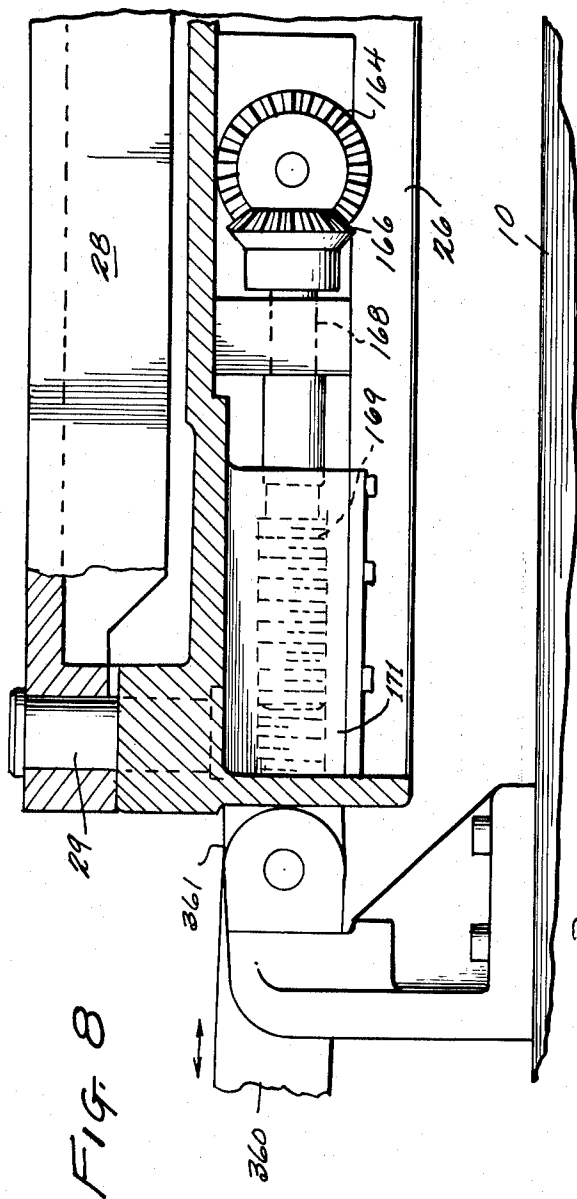


FIG. 8

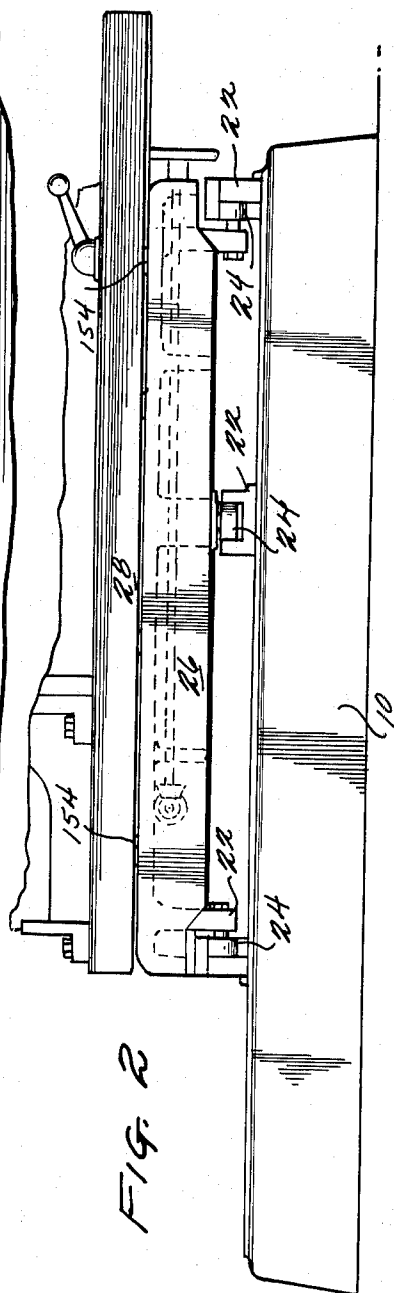


FIG. 9

INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE

Forster, Christensen, Sabot & Caldwell
ATTORNEYS

Jan. 4, 1966

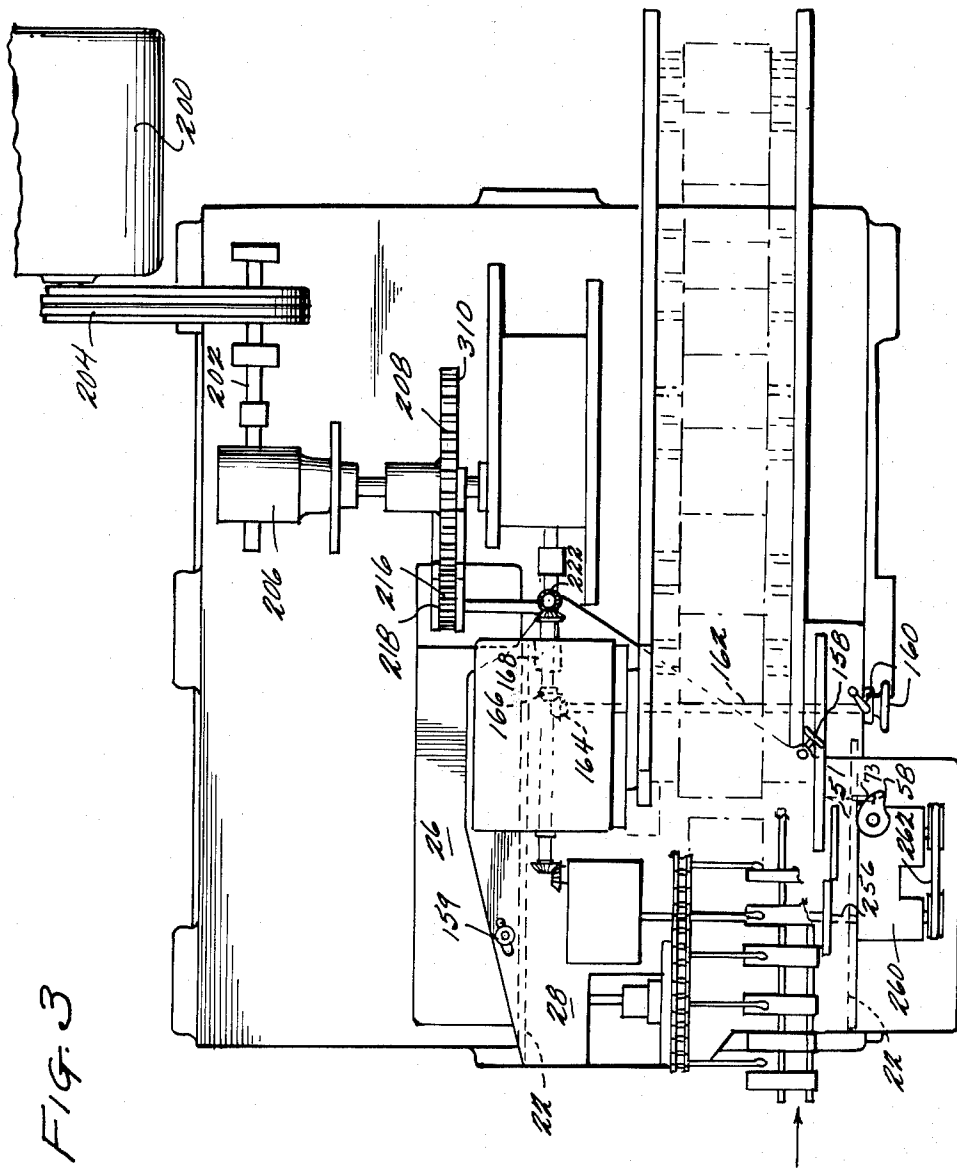
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16 Sheets-Sheet 5



INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE

Fisher, Brewster, Sabel & Muldrew
ATTORNEYS

Jan. 4, 1966

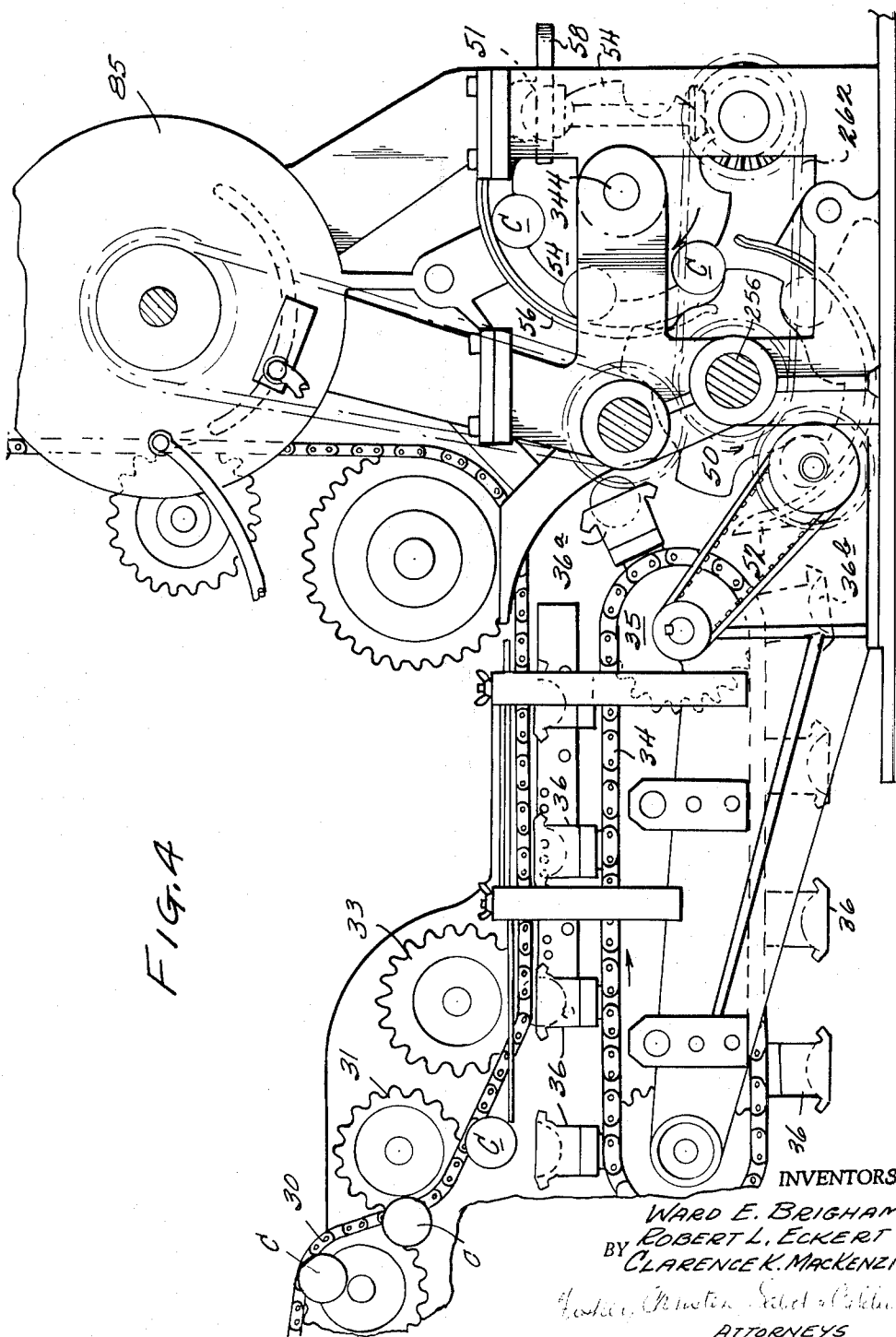
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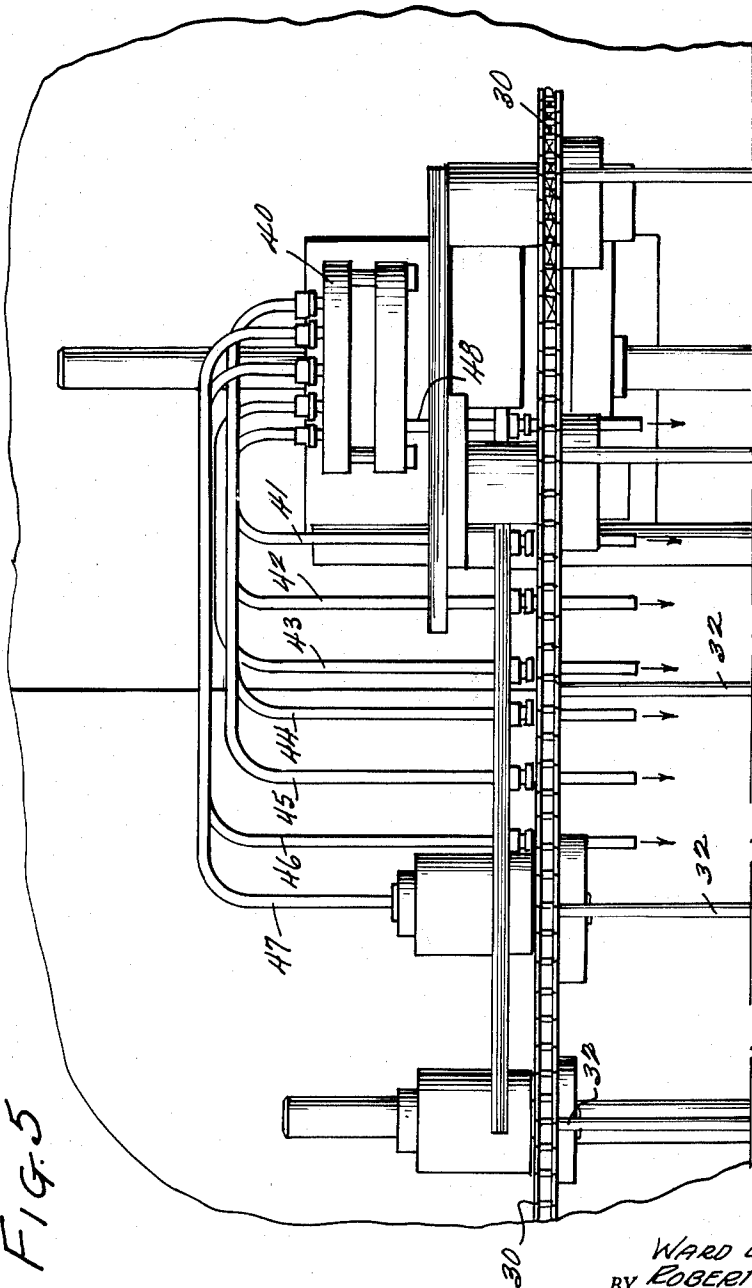


Fig. 5

INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE

Fischer, Christen, Sabala, Caldwell
ATTORNEYS

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W. E. BRIGHAM ETAL

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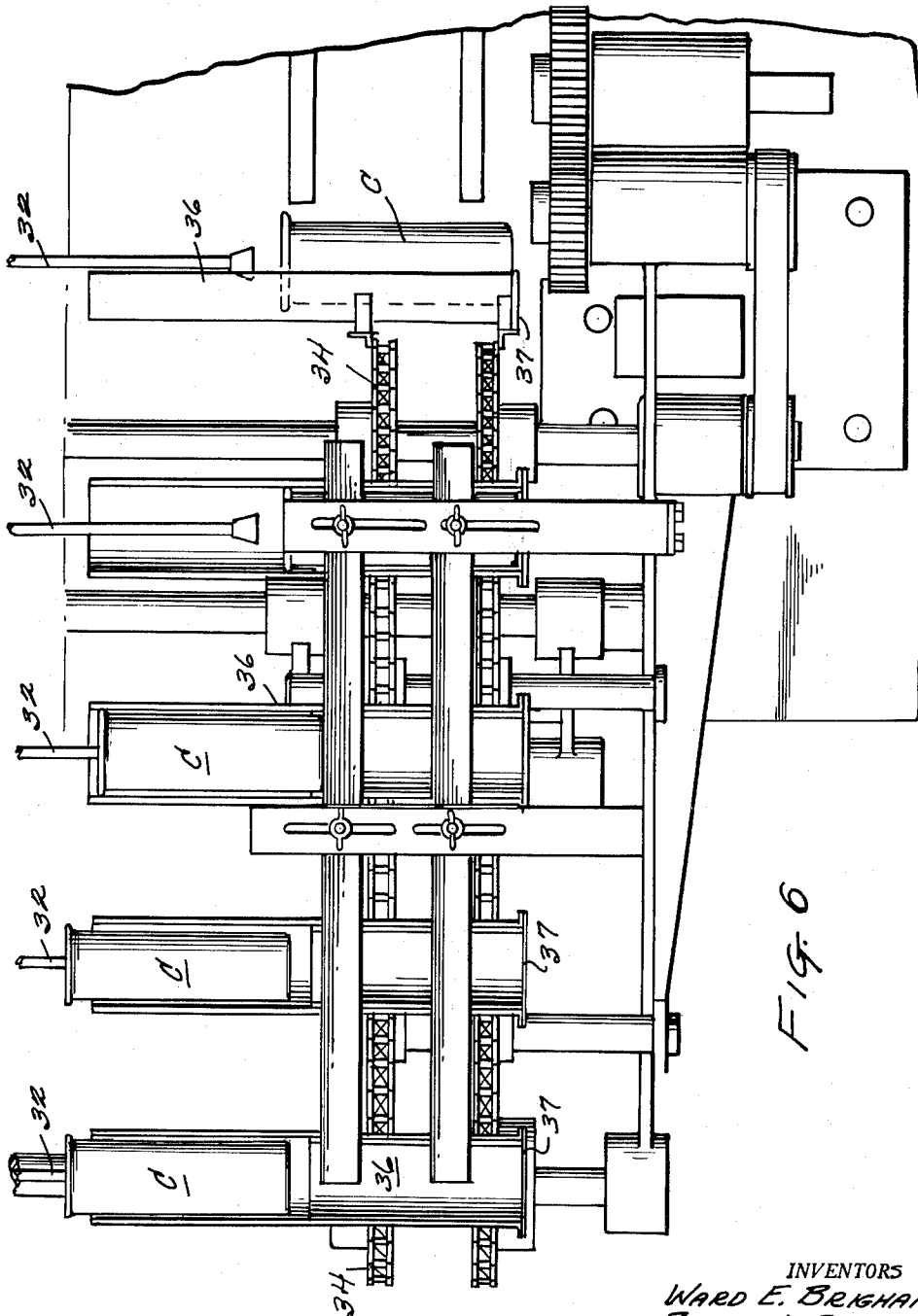


FIG. 6

INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE
Foster, Christy, Seibel & Caldwell
ATTORNEYS

Jan. 4, 1966

W. E. BRIGHAM ETAL

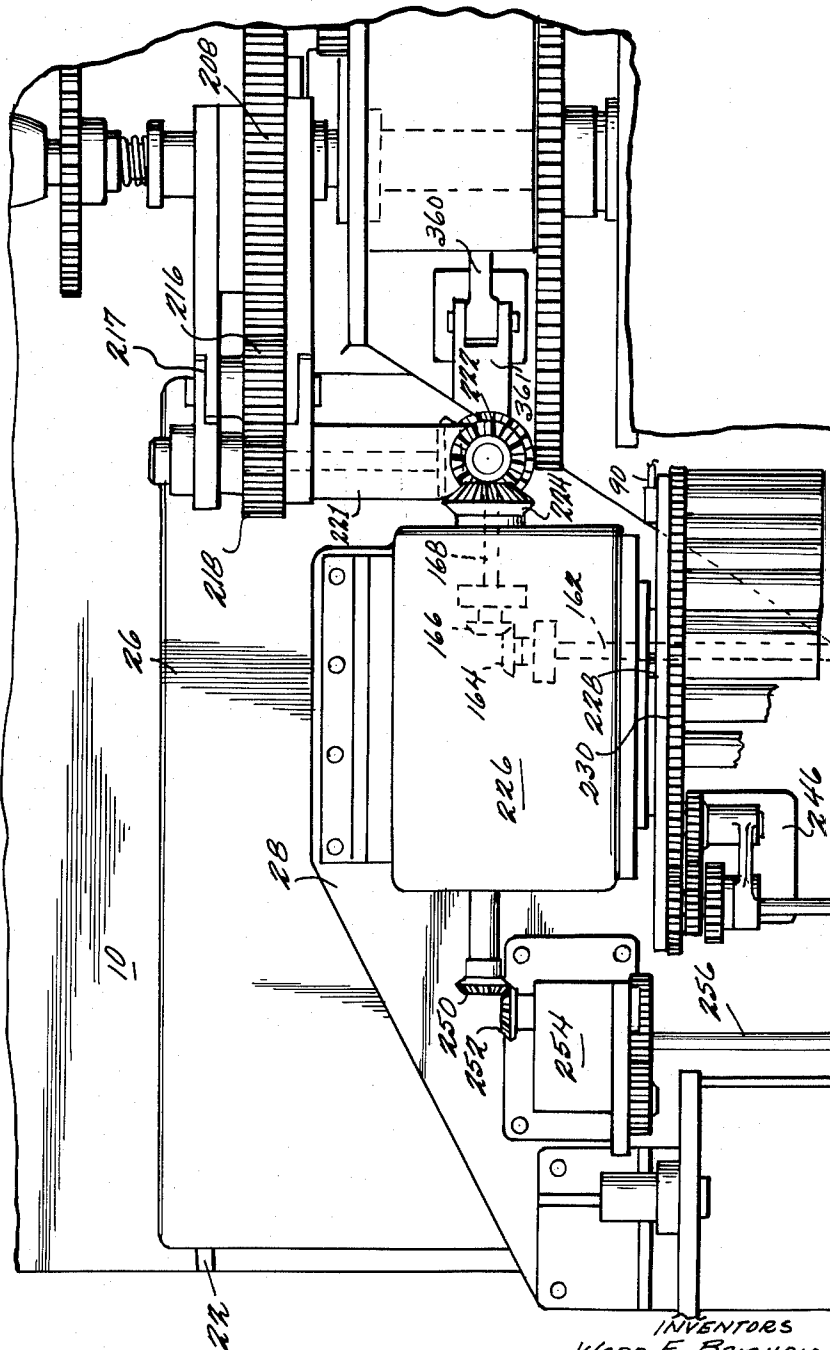
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FIG. 7



INVENTORS
WARD E. BRIGHAM
ROBERT L. ECKERT
BY CLARENCE K. MACKENZIE
ATTORNEYS

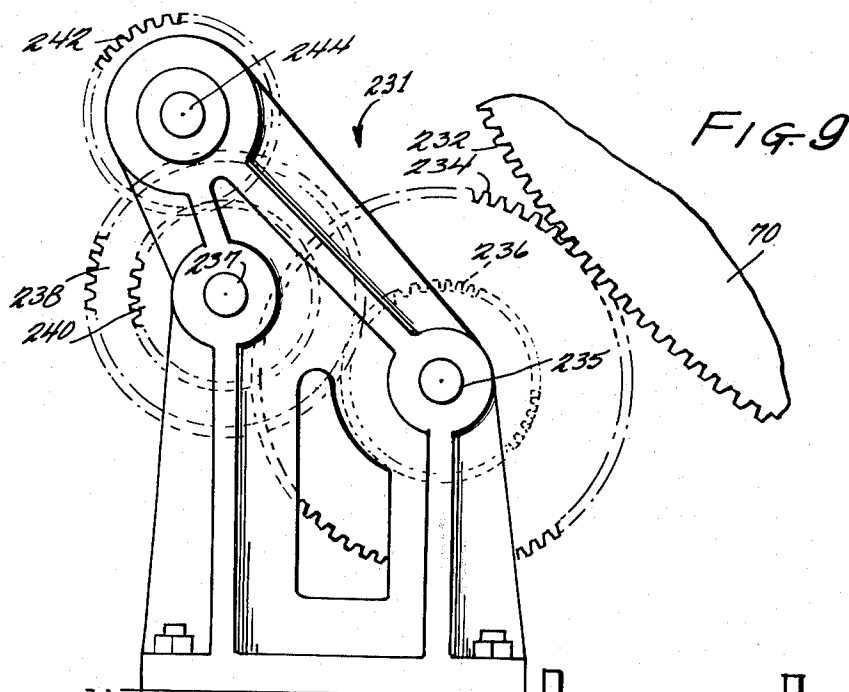
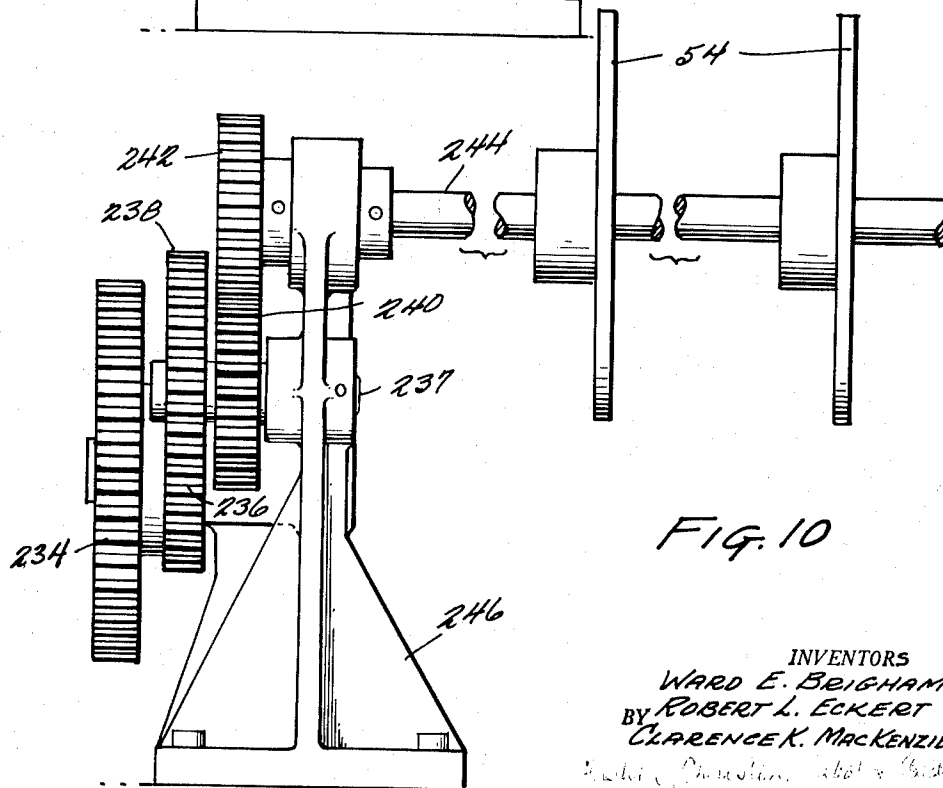
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INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE

Attorneys

Jan. 4, 1966

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FIG. 11

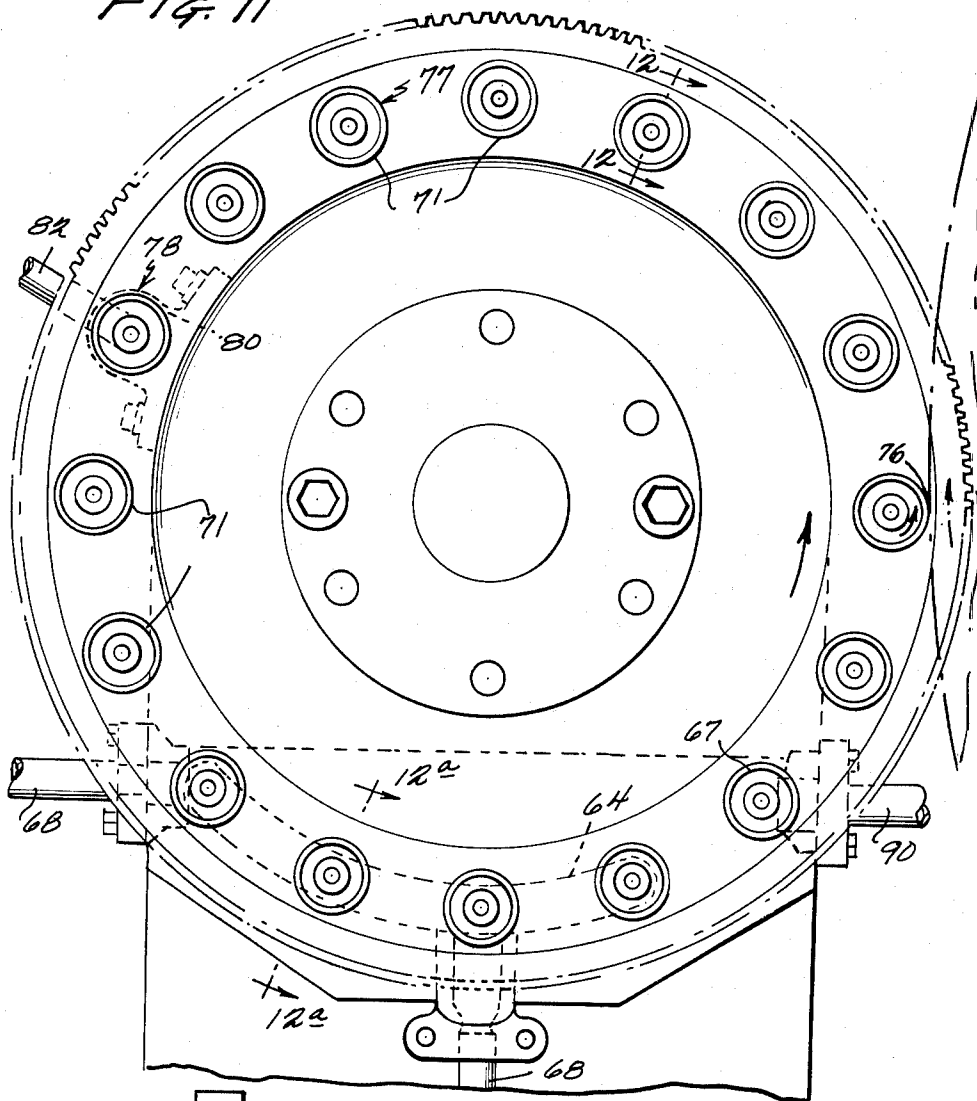
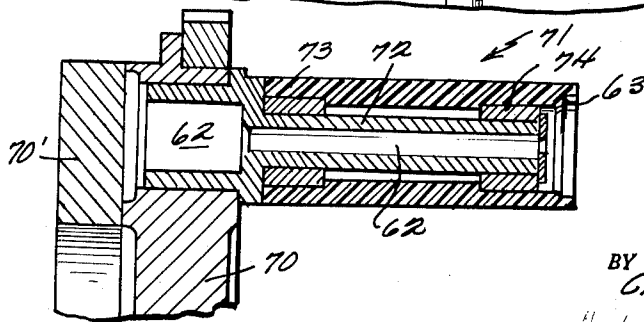


FIG. 12

INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE
Attorneys

Jan. 4, 1966

W. E. BRIGHAM ETAL
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FIG. 11A

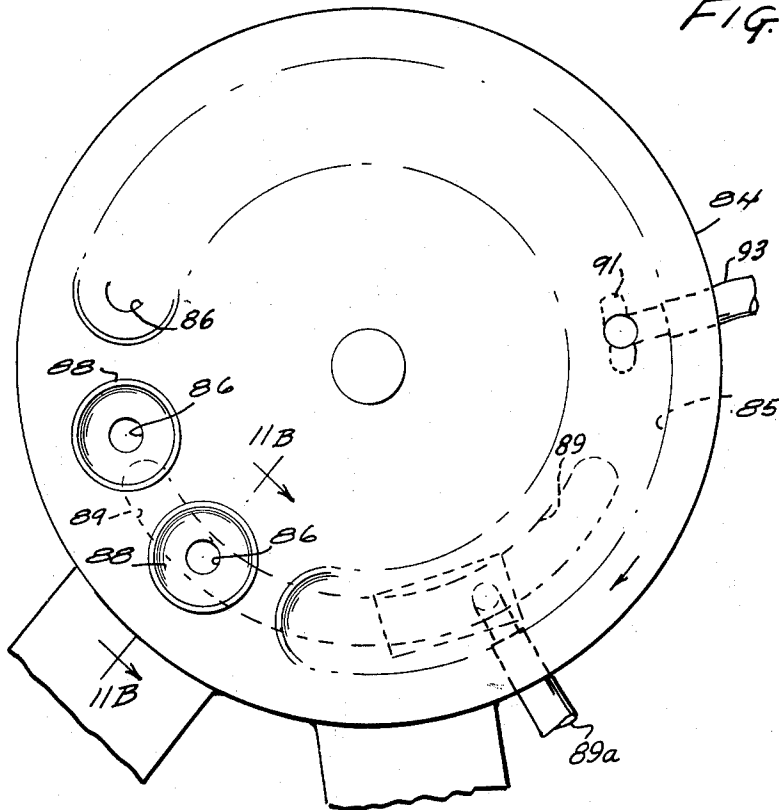
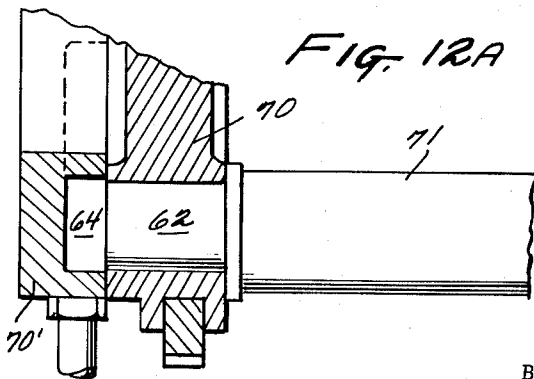
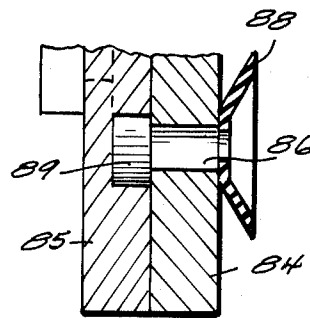


FIG. 11B

INVENTORS
WARD E. BRIGHAM
ROBERT L. ECKERT
CLARENCE K. MACKENZIE

BY *[Signature]*
ATTORNEYS

Jan. 4, 1966

W. E. BRIGHAM ETAL

3,227,070

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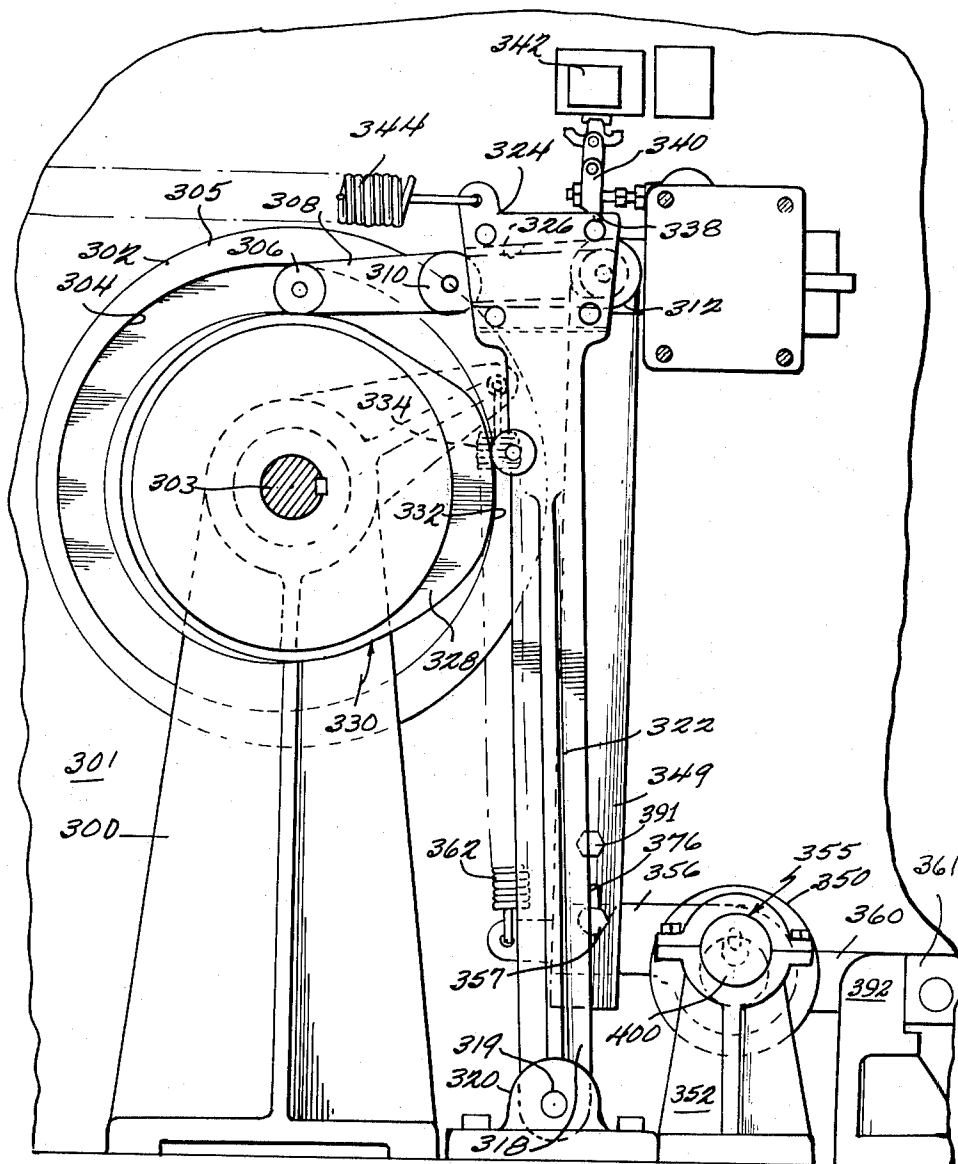


FIG. 13

INVENTORS
WARD E. BRIGHAM
BY ROBERT L. ECKERT
CLARENCE K. MACKENZIE

ATTORNEYS

Jan. 4, 1966

W. E. BRIGHAM ETAL

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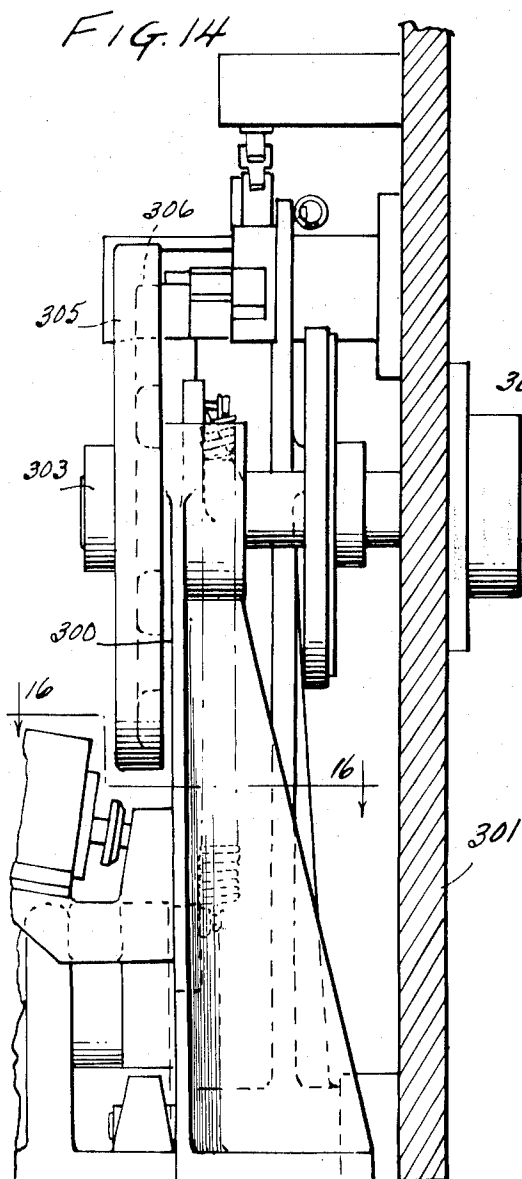
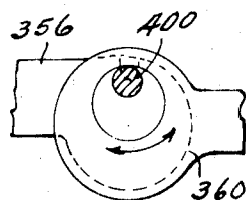


FIG. 17

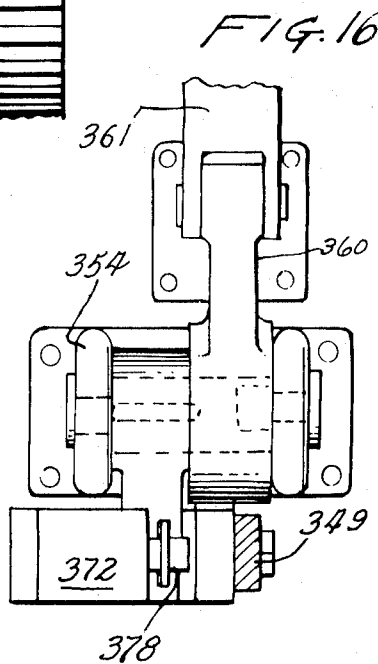
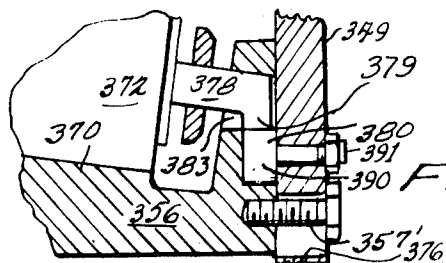


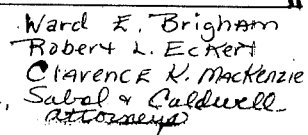
FIG. 15

INVENTOR
Ward E. Brigham
Robert L. Eckert
BY Clarence K. Mackenzie
Fischer, Christen, Selval & Caldwell
Attorneys

W. E. BRIGHAM ETAL

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W. E. BRIGHAM ET AL
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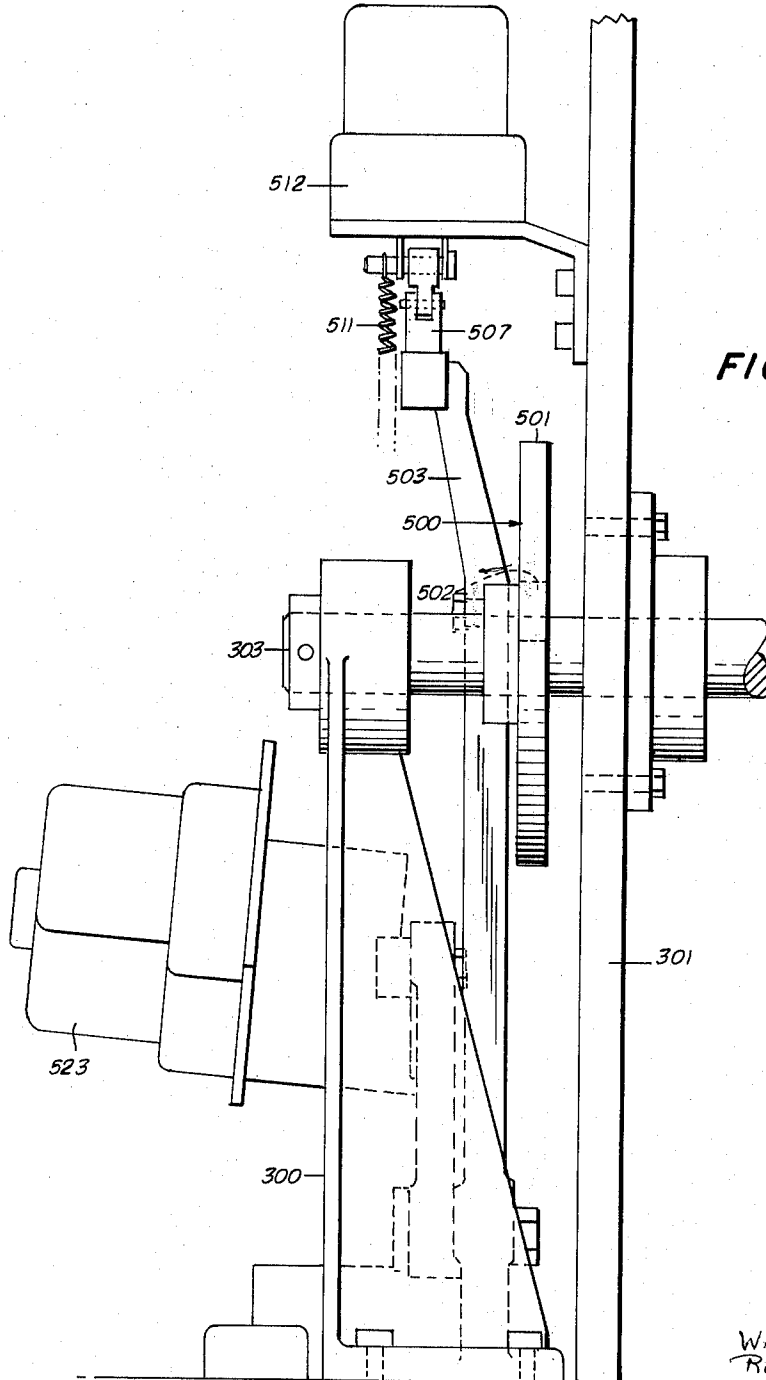


FIG. 19

INVENTOR

Ward E. Brigham
Robert L. Eckert
Clarence K. Macken

BY *Fisher, Christen, Sabol & Caldwell*

ATTORNEY

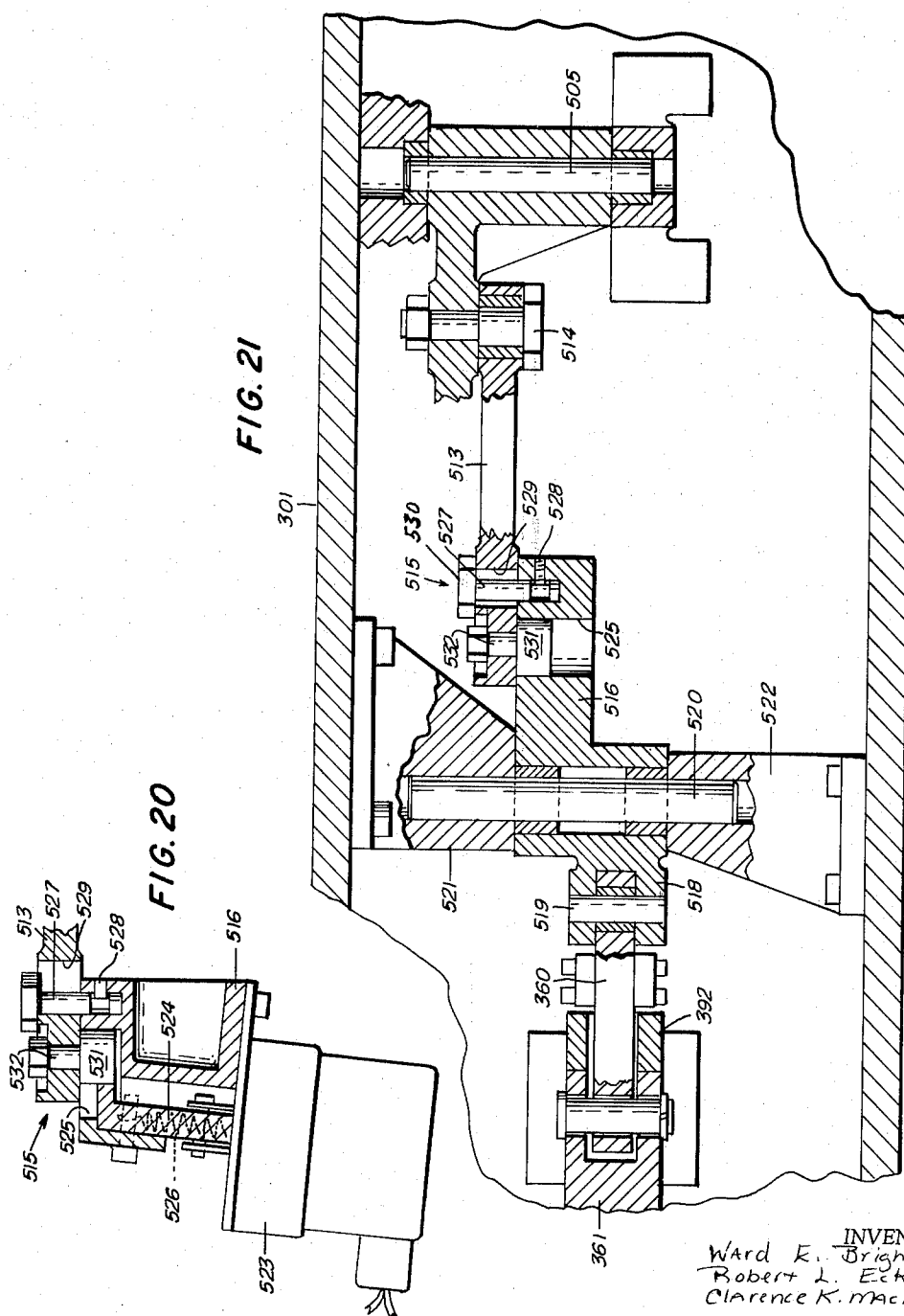
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Filed Sept. 4, 1964

16 Sheets-Sheet 15



INVENTOR
Ward K. Brigham
Robert L. Eckert
Clarence K. MacKenzie

BY Fisher, Christen, Salvo Caldwell

ATTORNEY

Jan. 4, 1966

W. E. BRIGHAM ETAL

3,227,070

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Filed Sept. 4, 1964

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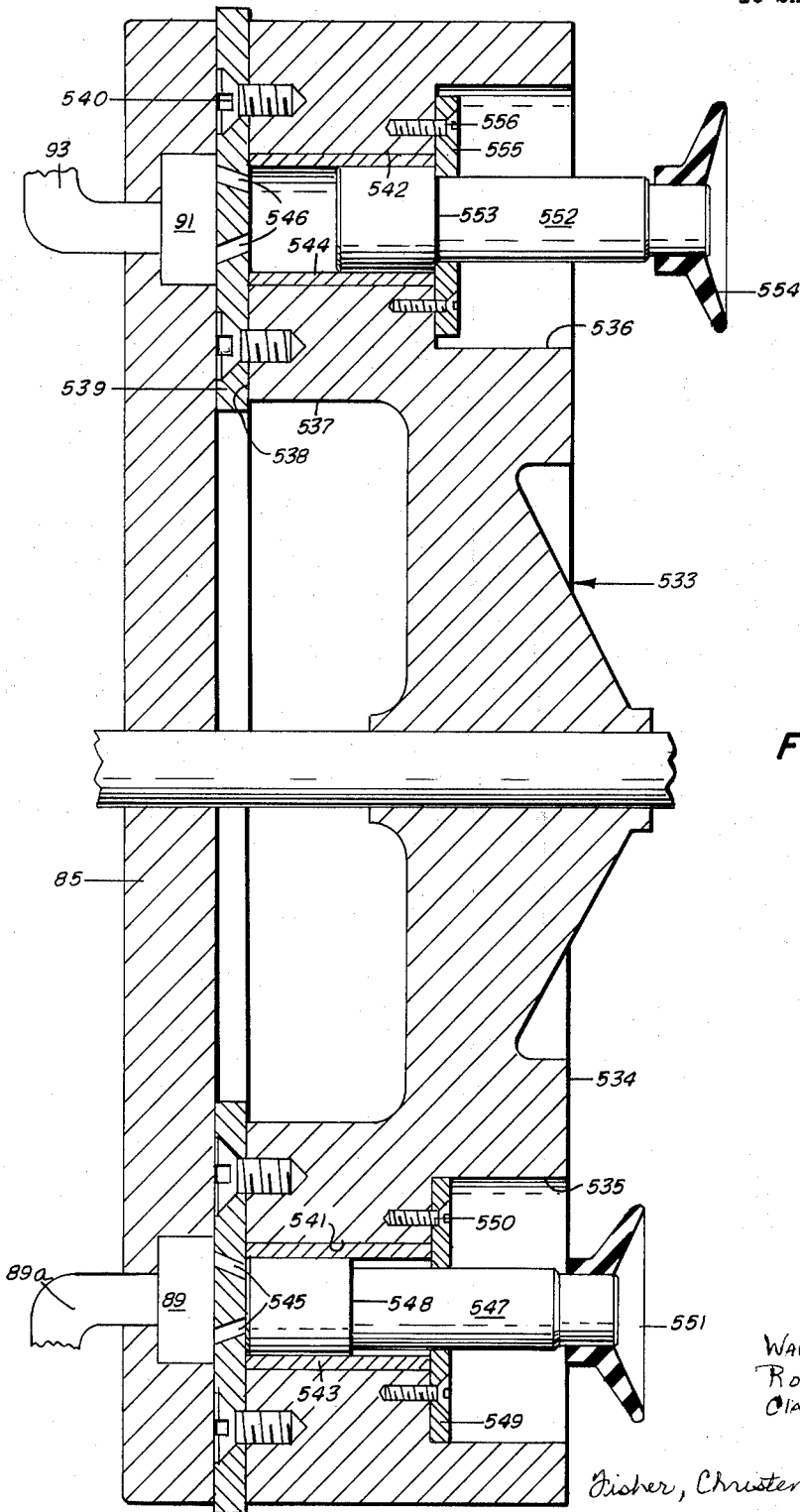


FIG. 22

Ward E. Brigham
Robert L. Eckert
Clarence K. Mackenzie

Fisher, Christen, Sabo & Caldwell

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HIGH SPEED CAN PRINTING PRESS

Ward E. Brigham, 250 Springfield Ave., Rutherford, N.J.;
Robert L. Eckert, 7 Stephens Ave., Lincoln Park, N.J.;
and Clarence K. MacKenzie, 85 Montross Ave., Rutherford, N.J.

Filed Sept. 4, 1964, Ser. No. 395,113

20 Claims. (Cl. 191-40)

This is a continuation-in-part of our prior application, Serial Number 56,437, filed September 16, 1960, now abandoned.

This invention relates to a machine for printing, coating or otherwise decorating the exterior surface of a cylindrical container, and is particularly directed to apparatus which performs these functions at very high speeds.

It has been, for many years, the objective of workers in the cylindrical container printing art to develop a machine which could accurately decorate containers of this type at high speeds. In the development of machines of this class there are many problems which must be solved. The can making industry is constantly developing thinner and lighter containers, particularly in the plastic and aluminum fields, which are difficult to handle at high speeds due to their relative lightness and thinness. Therefore, it is a particularly important objective of this invention to provide a container printing machine capable of printing cans in excess of 200 per minute.

The can making industry also is constantly developing new and varied sizes and shapes for containers. This invention provides structure adaptable for printing many sizes and shapes of such containers.

Still further the invention provides, as one of its objectives, a novel means to feed cans from a source of supply to the can handling assembly. This objective is obtained partially through the use of trough-shaped cups with air pressure positively positioning the cans therein.

Another important objective of the invention is the structure embodying the means by which the container feeding and handling apparatus is smoothly moved into and out of its normal operating position.

The invention utilizes a disc having container carrying spindles about its surface to present the containers to the printing cylinder. An objective of this invention is the provision of a novel spindle which permits the rapid acceptance, rejection, or removal of a container.

Another important objective of this invention is to provide a container feeding and handling apparatus which is separably mounted with respect to a printing assembly, such that the entire container handling and feeding apparatus is immediately thrown out of contact with the printing assembly when a malfunction or no-can condition is detected. This objective, in the embodiment described, is obtained by mounting the heavy container feeding apparatus on rails so that an eccentric mechanism, having a great mechanical advantage ratio, may disengage and return the two assemblies in several tenths of a second. As a result, minor malfunctions do not interrupt the coating and printing procedures.

In high speed handling apparatus of the type disclosed, there are many coordinated fast moving parts traveling at different speeds, and still other parts that are coordinated therewith but move intermittently. This invention has as one of its objectives the attainment of such coordination through the use of a common drive to obtain all movements.

For commercial consideration, it is necessary for machines of this type to be capable of printing containers having various diameters and lengths. It is, therefore, a still further objective of this invention to provide an as-

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sembly wherein the can handling apparatus with respect to the printing cylinder is adjustable longitudinally for can size, and pivotally to obtain uniform printing along the outer walls of the cylindrical containers. This objective is obtained without disturbing the common drive apparatus mentioned in the previous paragraph.

Another important objective of this invention is to provide novel vacuum and pressure type air handling aids so that containers of very thin and light construction may be conveniently handled, transferred and positioned at high speeds.

The high speed handling procedures become especially difficult after the entire outer cylindrical surface has been coated, or printed. This invention provides air vacuum and pressure takeoffs which are timed with the other mechanism to perform this function.

These and other objectives of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings in which:

FIG. 1 is a simplified elevational view showing the principal assemblies of the invention;

FIG. 2 is a fragmentary elevational view from the left of FIG. 1 showing the support structures;

FIG. 3 is a plan view of FIG. 1 with parts of the superstructure removed for clarity;

FIG. 4 is partial enlarged elevational view of a section of the container feed assembly;

FIG. 5 is a fragmentary plan view of FIG. 4 showing air pressure means for can transfer;

FIG. 6 is another fragmentary plan view of FIG. 4 showing the several stages of can transfer;

FIG. 7 is a partial plan view with parts broken away so that the power train and portions of the carriage adjustment may be traced;

FIG. 8 is a fragmentary sectional view showing the means to laterally adjust the two major assemblies with each other;

FIG. 9 is a fragmentary side view showing the power transfer to portions of the feed assembly;

FIG. 10 is a fragmentary view from the left of FIG. 9; FIG. 11 is an enlarged elevational view of the spindle disc;

FIG. 11a is an inner face fragmentary elevational view of the takeoff disc;

FIG. 11b is a cross-sectional view along line 11b-11b of 11a;

FIG. 12 is a sectional view of one of the individual spindles along the line 12-12 of FIG. 11;

FIG. 12a is a cross-sectional view along the line 12a-12a of FIG. 11;

FIG. 13 is a fragmentary elevational view of the throw-out mechanism;

FIG. 14 is a view from the right of FIG. 13;

FIG. 15 is a sectional view of the solenoid stop for the hold out of the throw-out mechanism;

FIG. 16 is a sectional view along the line 16-16 of FIG. 14;

FIG. 17 is a schematic view of the throw-out eccentric;

FIG. 18 is a fragmentary elevational view of a modified form of throw-out mechanism, but taken from the opposite side of the machine as compared with the throw-out mechanism shown in FIG. 13;

FIG. 19 is an end view of the mechanism shown in FIG. 18 and viewed from the right hand side;

FIG. 20 is a fragmentary cross-section taken on the line 20-20 of FIG. 18;

FIG. 21 is a cross-section taken on the line 21-21 of FIG. 18, and;

FIG. 22 is a horizontal cross-section of a modified form of spindle disc.

The general operation of the entire assembly may be understood by a reference to FIG. 1 where the major components of the apparatus are indicated. The machine is basically comprised of a can handling and feeding assembly 12 and a can printing assembly 14. Both assemblies are mounted on a common base 10. The printing assembly is fixedly secured to the base 10 by the heavy frame member 16.

While the printing assembly remains stationary with respect to base 10, the separately mounted feed assembly 12 is arranged so that it is capable of lateral and angular adjustment with respect to the printed assembly. This is accomplished by a three-tiered mounting consisting of a main base, a carriage, and a platform. The main base 10 is provided with tracks 22 (FIG. 2) which receive guide members 24 therein. Guide members 24 depend from a carriage 26. The track and guide members are anti-friction devices permitting the carriage 26 to readily reciprocate inwardly and outwardly with respect to the printing assembly 14. The controls and means for causing this reciprocation will be explained hereinbelow. Mounted on carriage 26 is a platform 28 which is pivoted about a vertical pin 29, whereby the platform's angular relationship and the superstructure supported thereby may be varied with respect to the can printing assembly 14. The vertical pin 29 is affixed to and extends upwardly from the secondary base or carriage 26.

A brief description of the path followed by the containers and of the operation of the major elements will facilitate an understanding of the details of the entire machine. Referring to FIG. 1, the cans C, which are to be printed, enter the machine via a pin carrying conveyor 30. The cans are supported on pins 32 and transferred to a feed mechanism 31. From the feed mechanism they are further transferred to a constantly rotating star feed-wheel 50 (see FIG. 4). The feed-wheel 50 receives the individual cans from the feed mechanism and delivers them to a second intermittent moving feed-wheel 54 at a point of transfer. Several stations later the can carrying pocket of star wheel 54 is disposed opposite an intermittently operated spindle disc 70. A feed cam 53 (seen best in FIGS. 1 and 4) contacts the cans C and forces them from the second star feed-wheel to one of the spindles 71 of disc 70. The drive mechanism is so arranged that the cam will rotate upon each instance of a can presentation by wheel 54, and a spindle presentation by disc 70.

The spindle disc rotates in a counter-clockwise (as viewed in FIG. 1) direction and presents each can carrying spindle intermittently to engagement with a constantly rotating printing turret 100 which is mounted in assembly 14.

In the event there is no container on the spindle, or in the event there is an improperly seated one, means are provided to move that spindle out of an engagement with the printed cylinder, while permitting the very next can-carrying spindle to engage the cylinder.

The disc 70 continues past the turret and presents the then printed cans to a take-off position opposite a clockwise rotating take-off disc 84. At the take-off positions, the cans are blown from the spindles onto suction cups, or the like, spaced about the inner surface one inch in from the periphery of the disc 84. The cans are again transferred from the take-off disc to pins 32 on conveyor chain 30 where they are subsequently taken to a drying oven.

The principal assemblies will now be discussed in detail.

The can feed assembly

For the purpose of this disclosure, the can feed assembly will be termed as that structure which transmits the cans from the conveyor 30 to the spindle disc 70.

The cans enter the system via the pin-carrying link chain 30. At a station prior to the instant printing station, the cans have been placed on the pins with their bottom

(normally closed) ends adjacent the free or outer ends of their respective pins.

The path followed by the cans during this stage can best be seen by referring to FIGS. 4, 5 and 6. FIG. 4 shows most of the structure hidden from view by the plate 31 in FIG. 1. The chain 30 travels at any desired angle until changed into a gentle decline by sprocket gears 31 and 33. As the cans (and their pins 32) move along this gentle decline they come adjacent and parallel to a second conveyor 34 which is offset horizontally and vertically lower than chain 30. The conveyor chain 34 travels at the same speed as chain 30 and supports a plurality of elongated trough type can receivers 36 at identical spacings as pins 32 are spaced on chain 30.

The pins and receivers are so coordinated that their paths will travel and mate vertically during their respective periods of horizontal travel.

FIGS. 5 and 6 disclose the horizontal relationships of the conveyors and their depending elements. As seen in FIG. 5 a conventional air pressure distribution block 40 has a plurality of air hoses 41-48 to blow air-jets against the cans and thus transfer them from the support pins to the receivers 36.

The receivers 36 are elongated half-cylinders and have a closed end 37 which will act as a stop for the cans received therein. The plurality of air-jets are used, rather than a single ejection blast, so that over the horizontal length of travel the cans will have sufficient time to be accurately positioned adjacent the ends 37 and remain there. This accurate positioning facilitates subsequent transfer operations.

As the can carrying receivers approach the end of their respective horizontal paths of travel, they are inverted as shown by the positions of receivers 36a and 36b in FIG. 4. As the receivers are inverted by passing over a sprocket 35, they each deposit a can in one of four pockets of the counter-clockwise rotating star-wheel 50. A guide 52 maintains the can in that particular pocket of the star-wheel for a movement of approximately 180°-270°.

At the end of their arcuate travel the cans are removed from star wheel 50 by feed-wheel 54. The feed-wheel 54 has a dwell each time one of its pockets mesh with one of the pockets of star-wheel 50. The cans are lifted from the star-wheel 50 and intermittently travel another amount until they are presented to a dwell take-off station. This take-off station is opposite a point of dwell of the spindles on the spindle disc. The spindle disc has a dwell in its movement at the same instant as the star-wheel 54. This is accomplished by gearing star-wheel 54 to the intermittently rotating spindle disc 70 in a manner to be described in detail hereinafter. A second guide 56 cooperates with the feed wheels to secure the cans therein until the take-off position, labeled 51, is reached.

Mounted adjacent the dwell or can take-off position 51 is a constantly rotating cam 53 which is geared to star-wheel 50. As best seen in FIGS. 1 and 4, the cam rotates at each presentation of a can to the spindle disc. The cam design (FIG. 3) having a gentle taper 59 permits it to gently engage the bottom of each can by swiping across the bottom thereof and gradually, although swiftly, urging the can to the individual spindle member presented to the takeoff point 51.

Spindle disc assembly

The construction of the disc assembly can best be seen by referring to FIGS. 11 and 12. The rotatable disc 70 mates with a stationary plate, such as annular plate 70'. The plate 70' has a plurality of grooves or slots 64, 67, and 80 to which the interiors of the spindles will communicate in a manner to be described. The disc 70 and plate 70' provide a split construction permitting 70 to rotate relative to 70' and their mating surfaces have a sufficiently close tolerance so that sufficient air pressures and vacuums can be maintained in the slots.

In some instances, cam 53 only partially seats the cans

C on the spindle members 71 and for this reason auxiliary seating means are provided. These auxiliary seating means are a combination of a vacuum developed in the nose section of each spindle as it traverses its can take-on position, and a corresponding air blast 73 directed toward the spindle from a position slightly behind the cam. This last mentioned air blast is of most importance in handling cans not having closed bottoms where the spindle vacuum loses some of its effectiveness.

A cross-sectional view of an individual spindle is shown in FIGS. 12 and 12a. FIG. 12a shows the spindle as it traverses one of the slots, and FIG. 12 when it is not. Each spindle 71 has an interior channel 62 throughout its length. These channels are in communication with the slots 64, 67, and 80 behind the disc during various sectors of its circumferential travel. A vacuum in slot 64 is provided through conduits 68 in any conventional manner. Referring to FIG. 11, it can be seen that due to the arcuate length of slot 64, the vacuum in channel 62 is applied for a time and distance at and after the can take-on position 51. The channel 62 is enlarged or directed at the outer end of the spindle by an end plate shown by the numeral 63.

The outer surfaces of the spindles 71 are comprised of a hard plastic sleeve 73 which is mounted for free rotation on a fixed shaft 72 by bearings 74.

The cans have a free fit on the spindles but will frictionally rotate during printing with the sleeves 70 due to pressure applied by the printing cylinder. As the can engages the printing cylinder at point 76, the can (and spindle sleeve) will rotate through friction with the printing cylinder and be printed throughout its cylindrical surface. This is conventional and will be apparent to those skilled in the can-printing art.

This spindle disc continues in its intermittent counter-clockwise rotation until position 77 where it receives a varnish overcoat and continues on until a take-off position 78 is reached. At position 78 the spindle disc is provided with another slot 80 which receives air pressure from conduit 82. As the channel 62 comes in communication with the slot 80, the can is ejected from the spindle onto a synchronized disc 84 which has means thereon (described below) to receive the cans and retransfer them to chain 30 during its upward vertical travel.

A front view of disc 84, mounted on the reverse side of plate 85, as seen in FIG. 4 is shown in FIG. 11a.

Disc 84 is also of split construction as is spindle disc 70. The disc 84 has a plurality of apertures 86 (FIG. 11b) about the periphery of its surface facing the spindle disc 70. Spaced over each of these apertures, respectively, are a plurality of suction cups 88. On the surface opposite the suction cups is an annular plate 85 having arcuate grooves 89 and 91 which come in communication with the apertures as they move therepast.

The groove 89 is evacuated via conduit 89a which provides suction for the cups at a point opposite where the cans are ejected from the spindle disc (i.e., opposite slot 78). The disc 84 is timed so that a suction cup is opposite a spindle each time a spindle is opposite slot 78.

Slot 91, which is under air pressure via tube 93, ejects the containers from the disc 84 into pins 31 as they move past. Since each of these elements are driven from a common drive, the synchronization of which will be apparent to those skilled in the art.

Sensing means

Shown diagrammatically in FIG. 1 is a can-sensing device 29. This device may be any highly sensitive detecting device such as a sensitive spring connected to a micro-switch.

The leaf spring of the switch is positioned to rest just outside the ends of spindles 71 as they move past. If the cans are properly seated, no contact is made, if the can is not fully seated, the switch will be contacted

and the can blown off. It is very important that the cans be fully seated.

Working in cooperation with the micro-switch is an electric eye 21, shown diagrammatically on FIG. 1. The eye will determine the presence or absence of a can. The eye is adjusted so that the difference in light reflected from a can and that reflected from an empty spindle is discernible. One of the important functions of device 20, besides the prevention of improper printing is to ensure proper operation of the electric eye.

As mentioned heretofore, there is structure available to move the entire can handling assembly out of engagement with the printing assembly. The switches operated by the electric eye 21 activate this throw-out structure. The throw-out mechanism for accomplishing this will be explained in detail.

Switch 20, when activated, controls mechanism to eject the can from the spindle. Referring to FIG. 11, there is shown a conduit 90 for supplying air pressure to a slot 67 of the spindle disc. If the vacuum applied in space 64 does not seat the can properly because of a damaged can, the switch 20 controls apparatus to supply momentarily air pressure to space 67. The can will be ejected as the space 67 comes in communication with channel 62 of the spindle disc during its travel therepast.

As the disc is rotated further the electric eye will detect this or any other no-can condition and the throw-out mechanism will be activated. In other words, if the switch 20 is activated, the switch 21 will always be activated; although switch 20 will not always be activated on each instance of switch 21 being activated. The importance of this will become apparent during a discussion of the throw-out mechanism.

Of course, if switch 20 is not tripped, only room pressure is in space 67. A conventional control to supply or shut off air to conduit 90 in response to switch 20 is well within the capabilities of a skilled worker.

An overcoat varnish attachment 20, shown in dotted lines in FIG. 1, also has a similar throw-out mechanism.

Throw-out mechanism

As described earlier, in the event of a malfunction or no-can condition, all structure, including the can handling and feeding mechanism, which is mounted on carriage 26, will move into or out of engagement with the blanket cylinder. This is important because if the printing operation continues uninterrupted, printing ink will be applied to the plastic sleeves of the spindles 71 and each subsequent can placed on such a spindle will have its interior contaminated. It is also important that the spindles be promptly returned to engagement with the printing cylinder so that the high-speed operation may continue.

The throw-out mechanism for accomplishing this operation is disclosed in FIGS. 13-17. The structure shown has as its objective, a slight rearward reciprocation of the mechanism supported by carriage 26 in rails 22, as the empty spindle traverses its normal printing area.

Referring now to FIG. 13, there is shown a standard 300, fixedly secured to the base 10, and a framing member 301 (FIG. 14), rotatably supporting shaft 303 between them. The shaft is driven by the gear train which includes gears 203 and 310. The power is transferred via gear 310 so that the shaft 303 will rotate each time a can is presented to the printing cylinder. A box cam 305 is mounted on shaft 303 and is driven therewith. The box cam 305 is formed with an eccentric cam groove 304 about one surface which receives the cam follower 306.

The follower 306, best observed in FIG. 13, is fastened to one end of link 308. The link 308 has two additional cam followers, an intermediate cam follower 310, and an end cam follower 312. The importance and operation of these followers will best be understood after referring to some of their associated structure.

The base 10 supports a second standard 313 which is pivotally secured thereto at 319 by yoke 320. The stand-

ard 318 is comprised generally of an upright 322 and a box cam 324. The box cam 324 has a cam groove 326 which in its operating position receives cam follower 312. As viewed in FIG. 13, link 308 will oscillate about follower 312 as cam 306 follows the eccentricity of groove 304.

An exteriorly contoured cam 328 (offset laterally from box cam 324) is also rotated by shaft 303. The cam is comprised of a generally circular surface 330 and a rise 332. The upright 322 has a cylindrical cam follower 334 mounted intermediate its length. The follower 334 is positioned so that it is in slight tangential contact with rise 332 when the upright 322 is in its normal or operating position; that is, when cam follower 312 is received in groove 326 as shown in FIG. 13.

Along the upper surface of box cam 324 there is a detent 338. This detent receives a latch 340 which is controlled by the solenoid 342. The solenoid is under the control of the previously described electric eye 21 (FIG. 1) in a conventional manner. The latch 340 maintains the standard 322 in the operating position even though it is urged to the left (as seen in FIG. 13) by spring 344.

When the abnormal or no-can situation is sensed by eye 21, the latch 340 is withdrawn. The spring 344 will then urge and retain the standard 322 toward the cam 328. Cam follower 334 will permit the standard to move to the left as it leaves contact with surface 332 and engages surface 330 of the cam 328. This causes groove 326 to engage the middle cam follower 310 and free the cam follower 312 of link 308 for movement. The link 308 will now oscillate about follower 310 as a fulcrum as cam 306 follows the groove 304. This causes an up and down oscillating movement in follower 312. Follower 312 is also attached to an arm 349 which will follow its up and down movement.

It is this up and down oscillating movement of follower 312 which is utilized to move the can handling assembly out of engagement with the printing assembly.

The upright arm 349 connected to the follower 312 transfers the oscillating movement to a linkage system 350 which provides the connection between the can handling apparatus and the printing assembly. Basically the system converts this up and down motion to a lateral back and forth motion to move carriage 26.

The linkage system 350 is supported by the frame member 352 which is attached to base 10. The frame member has a removable split saddle member 354 at the upper end thereof. Rotatably mounted in said saddle is an eccentric 355 integrally or fixedly secured to an arm 356 which is connected to the arm 349.

Surrounding eccentric 355, is a steel eccentric strap 360, which is connected to the carriage 26 (not shown) by a pivotal connection with member 361 as seen in FIG. 16. Since the strap closely engages the eccentric, and since the eccentric is pivoted about point 400, a pivotal movement about point 400 causes a longitudinal movement in arm 361.

Therefore, as arm 356 is lowered by member 349, the eccentric will move arm 360 to the right (as viewed in FIG. 13) and as a result the entire can handling assembly is moved to the right, which removes the empty spindle out of engagement with the printing cylinder.

The link 349 and eccentric 356 will return when the cam 330 and followers 334 will allow it to, which returns the can handling assembly to printing position.

As cam 330 rotates the rise 332 will again contact cam follower 334 and return arm 322 to (the right) its normal position, where latch 340 will again engage detent 338 to retain the arm until another no-can condition is sensed.

In actual position, it often occurs that the supply of cans for printing is exhausted for a period of time due to one reason or the other. At high speeds of operation, the constant reciprocating of carriage 26 is very undesirable. An important function of this invention is the means for overcoming this reciprocation.

This means includes a solenoid 372 supported on a strap 370 which extends rearwardly from the arm 356, as shown in FIGS. 15 and 16.

The solenoid arm 378 can be projected into, and retracted from, the vertically elongated slot 380. Also received in the slot is a cam follower 390 which is secured to the vertical arm 349 by a bolt 391. The eccentric arm 356 is loosely secured to arm 349 by a pin 357 which moves up and down in a slot 376. It will thus be seen that when the solenoid arm 378 is retracted (toward the left in FIG. 15) the arm 349 will have no effect on arm 356 because pin 357 will move loosely in slot 376 and follower 390 will move up and down in slot 380. During such movement, arm 349 is urged in an upward direction by spring 362.

When the solenoid arm 378 is projected into the slot above follower 390, the movement of arm 349 will be transmitted to arm 356, and on the down stroke, the carriage 26 will be moved from its printing position and, conversely, when arm 349 is moved upwardly under the influence of cam link 308, the carriage will be returned to printing position with arm 361 abutting against stop 392. When the enlarged portion 379 of the arm 378 is allowed to return to the enlarged portion of the slot, the pin 357 will ride up and down in the slot and not transmit motion to the linkage 350. During this up and down riding the spindles are held away from their printing position.

The solenoid 372 is controlled by a convenient counting device which can sense each missing can. The solenoid is then connected so that arm 378 will be withdrawn if, for instance, four succeeding spindles are without cans. After the fourth signal is given, the arm 378 is withdrawn and the carriage 26 will remain in its retracted position until the machine again receives a supply of containers. This operation can also be performed by a conventional time delay device.

Adjustment mechanism

For proper operation, and for flexibility of use, the distance and angular relationship between the printing cylinder and the individual spindles must be adjustable and capable of being accurately determined. For instance, a slight toe-in of the spindles with respect to the blanket cylinder is advisable because of spindle deflection due to its cantilever mounting. Since the blanket is constantly working against this toe-in, angular adjustment becomes important.

Likewise, when it is necessary to change spindles to accommodate a different size can, a longitudinal adjustment is necessary between the two major assemblies so that they will accurately mate with each other, and an appropriate toe-in adjustment must accompany this longitudinal adjustment.

The angular adjustment is accomplished by pivoting platform 28 with respect to carriage 26. As previously mentioned the platform pivots about the pin 29 which pin is fixedly secured to the carriage and is directly in line with the driving gear. There is a fine adjustment 160 and locks 159 which secures the upper platform on the carriage when the adjustments are accomplished. There are a plurality of friction reducing bosses 154 spaced about the upper surface of carriage 26 upon which the platform rests. The weight of the assembly is normally enough to hold the platform in position, however conventional cam locking devices are also provided.

The power for the printer assembly is obtained from gear 208 via the take-off gear 310 (FIG. 3). Gearing (not shown) associated with 208 is utilized to drive the inking units of assembly 14 directly in order that they will be coordinated with the can feeding apparatus.

The power for the can feeding mechanism is taken from gear 208 (FIG. 7) by way of idler 216, planetary gear 218, shaft 221 and pinion 222.

At pinion 224 power is transferred to the can handling carriage. The pinion 224 mates with the pinion 222

and transfers the motion to a conventional intermittent drive unit 226. (Note in FIGS. 7 and 8 that the adjustment gears 164 and 166 shown in phantom are actually below the intermittent drive and form no part of it.)

The intermittent drive unit 226 may be of the well known Ferguson type. Any unit capable of obtaining a coordinated intermittent movement from a rotary movement while preserving the rotary is satisfactory.

The constant rotary motion from gear 224 passes through the Ferguson unit 226 and is transferred to a bevel gear 250. A mating bevel gear 252 transfers the motion to a gear reduction unit 254. From reduction unit 254, a constant speed rotary motion is transferred, via shaft 256 to the star-wheel 50 shown in FIG. 4.

The intermittent drive, on the other hand, comes out of the Ferguson unit via the spindle disc shaft 228, which, in turn, rotates the disc intermittently. A gear 232 (FIGS. 7 and 9) about the periphery of the spindle disc drives the reduction gear train 231 shown in FIGS. 9 and 10. The intermittent motion is transmitted from the disc through the train of gears 234 and intermediate gears 236, 238, exterior 240 and 242, in that order. As seen in FIG. 10, the shaft 244 drives star-wheel 54 by way of this gear train intermittently at four times the revolutions per minute as that of the spindle disc 70. Gears 234 and 236 are common to stub shaft 235, and gears 238 and 240 are common to stub shaft 237. The gears are mounted on a support 246.

The gearing is reduced in a manner so that star-wheel 50 will rotate at an average speed one and one half times as great as star-wheel 54. This will cause the four pocketed star-wheel 50 to mate with the six pocketed feed wheel 54.

As best seen in FIG. 3 the shaft 256 extends beyond feed wheel 50 to a conventional gear assembly 260 and to a drive belt 262. This mechanism is to constantly rotate the cam 58 each time feed wheel 54 presents a can to the spindle disc 30. Therefore, there is a one-and-one-half gain in revolutions per time than that of shaft 256.

The angular adjustment described does not effect the power train to the can assembly. This is accomplished by having pivot pin 29 immediately below and axial with the center of the bevel gear 222. This bevel gear is the power link between the assemblies and its importance will become apparent.

The longitudinal adjustment is accomplished by way of a control wheel 160 (FIG. 1) near the midpoint of the machine convenient to an operator. The wheel is connected to a shaft 162 (FIGS. 7 and 8) which terminates in a bevel gear 164. A mating bevel gear 166 is connected to a shaft 168 running perpendicular to shaft 162. Shaft 168 is threaded at its opposite end 169 (FIG. 8) and is received by a threaded nut block 171 which is affixed to the throw-out mechanism which will be described hereinafter. The longitudinal adjustment adjusts the machine to accommodate various sizes of cans and the pressure of the blanket cylinder for printing.

Power drive

In transferring and handling cans at these high speeds, it is imperative that the timing of all moving parts be extremely accurate. This is accomplished in the instant invention by having all parts of the printing assembly and can-feeding assembly driven from a common power source. This is accomplished even though the can feed carriage is movable both pivotally and longitudinally with respect to the can printing assembly, and portions of the drive are intermittently driven and others constantly.

Referring to FIGS. 3 and 7, the common power unit is represented as a motor 200 which drives a continuous speed shaft 202 via belt drive 204. The shaft 202 delivers the power to an angle gearing unit 206 which is of a type which drives the gear 208, at very accurately con-

trolled speeds. As described previously, the power junction at bevel gears 222 and 224 is not disturbed by angular adjustment because the platform pivot point (pin 29) is substantially coaxial with gear 222. Therefore, any angular movement of platform 28 merely causes gear 224 to ride around gear 222. However, the power train must also not be interrupted during longitudinal adjustment or throw-out. This is accomplished by causing planetary gear 218 to ride about gear 216 through linkage 217. Therefore as carriage 26 moves back and forth planetary gear 218 merely rides about the surface of gear 216. There, of course, is no lateral movement in gear 216.

Modified form of throw-out mechanism

In the modified form of throw-out mechanism shown in FIGS. 18-21, the shaft 303 carries only a single eccentric 500 having an exterior circumferential cam surface 501, to coact with the roller 502 mounted on the upright arm 503. The lower end of this arm has an L-shaped extension 504, the further end of this extension having a pivotal connection 505 with a mounting 506 attached to the base 10.

As in the previously described modification the coil spring 344 is arranged to urge the arm 503 in one direction (towards the right in FIG. 18). An adjustable latch 507 is pivotally mounted at 508 on a bracket 509 for vertical movement into, and out of, engagement with a detent 510 formed in the top of the arm 503. The latch is urged downwardly by a spring 511 acting against the pull of a solenoid mechanism 512.

One end of arm 513 has a pivotal connection with a pin 514 which is secured to the lower end of the upright arm 503 at a point spaced from the pivot 505. The other end of arm 513 has a lost-motion connection, indicated generally by numeral 515, with one end 516 of a bell crank lever 517. This lost-motion connection is shown in FIGS. 20 and 21 and will be described later. The other arm 518 of the bell crank lever is split to receive loosely one end of the link 360 connected with the can handling assembly at its other end, as in the previously described mechanism. A pivot pin 519 connects the arm 360 with the split portion of arm 518. The bell crank 517 is pivotally supported on a stub shaft 520, one end of which is carried by a bracket 521 mounted on the wall 301, the other end being carried on a bracket 522 secured to the center wall of the machine.

The lost motion mechanism 515 will now be described. An electrically operated solenoid 523 is attached to one side of the arm 516 and has an armature 524 movable laterally of the arm into, and out of, a recess 525 provided therein. A coil spring 526 carried within the armature urges the armature into the recess into its extended position, but when the solenoid is energized the armature will be retracted or withdrawn from the interior of the recess. The arm 516 also supports a stud 527 which is secured in place by set screw 528. The stud is loosely received within a slot 529 at the upper arm 513 which extends in a direction longitudinally thereof. The stud is provided with an enlarged head 530 to retain the arm 513 in position. A roller 531 is also disposed within the recess 525 adjacent the end of the armature 524 when in the extended position this roller being supported on one end of a bolt 532 which is fixedly attached to the arm 513.

The arrangement of these last named parts is such that the slot 529, roller 531 and the end of the armature 524 are all disposed in alignment in a plane passing through the longitudinal axis of the arm 513 and, during normal operation of the machine, when the end of the armature is within the recess, the lost motion mechanism is deactivated so that any longitudinal movement of the arm 513 would be transmitted to arm 516 and vice versa.

During the printing operation the upright arm 503 is held by the latch 507 in the position shown in FIG. 18

and, since the lost motion mechanism 515 is deactivated, there is a positive connection between the bell crank 517 and arm 513, and the carriage 26 will be in the printing position with the element 361 in abutment against the stop 392. Under these conditions the position of the cam roller 502 is such that it will barely contact the rise in the cam surface 501 during each revolution of the shaft 303. As in the case of the previously described throw-out mechanism the solenoid 512 is actuated by the can sensing electric eye 21 and thus if this sensing mechanism detects the absence of a can on one of the spindles as it approaches the printing blanket, the solenoid 512 will be energized to lift the latch 507 out of engagement with the detent 510, immediately causing the spring 344 to urge the arm 503 to the right.

Depending on the position of the cam 501, movement of the arm 503 will be transmitted to the arm 513 to the bell crank 517 and the elements 360 and 361 to move the carriage 26 out of its printing position. As seen in FIG. 18 the elements 360 and 361 will thus move towards the left. Since the movement of the arm 503 is limited by the cam 501 the carriage will not be fully moved to its non-printing position until the low side of the cam has moved around into contact with the roller 502. Continued rotation of the cam during the remainder of a single revolution of the shaft 303 will, of course, return the upright arm to the position shown in FIG. 18 which movement will have returned the carriage 26 to the printing position. At this point if the can sensing means has not detected another empty spindle the latch 507 will again move into the detent 510 under the influence of spring 511 since the solenoid 512 will not longer be energized. If, on the other hand, the can sensing means detects the absence of a can on the next spindle the latch will remain in its upper position and, the upright arm 503 being not restrained, the spring 344 will repeat the cycle of moving the carriage 26 out of the printing position during the next half revolution of shaft 303.

Continued reciprocation of the carriage 26 into and out of printing position during the absence of a large number of cans in succession would be desirable and therefore the can counting mechanism (previously described) or a time delay means, is connected with the solenoid 523 so that if, say four successive cans are missing, this solenoid will be energized to retract the armature from the recess 525 to activate the lost motion mechanism. In this connection it should be noted that the position of the upper end of slot 529 is such that when arm 503 is moved fully to the right by spring 344, the arm 513 will turn the bell crank 517 in a clockwise direction to move the carriage out of the printing position. However, the latch of the slot 529 is such that when the arm 513 is returned in the upward direction as a result of movement of the arm 503 to the left by the cam 501, the stud 527 merely slides in the slot while the roller 531 slides in the recess 525 into the space normally occupied by the end of the armature 524 when the lost motion means is deactivated.

Modified form of can take-off device

In the modified form of take-off mechanism, as shown in FIG. 22, the disc 84 has been replaced by a take-off wheel indicated generally by a numeral 533 which is rotated in the same manner as the disc 84 so as to receive imprinted cans from the printing spindles and to discharge them onto the pins 31 of the delivery conveyor. The front face 534 of the wheel is provided with a series of circular recesses, only two of which are shown in FIG. 22, identified by numerals 535 and 536. These recesses are arranged in the same pattern as the suction cups 88 shown in FIG. 11a and the recess 535 is shown in a position opposite the slot 89 while the recess 536 is shown in a position opposite slot 91. The rear of the wheel is provided with a circular annulus 537, having a flat rear surface 538 preferably covered with a circular

wear plate 539 formed from a wear resistant material, and attached to the rear of the wheel by means of counter sunk screws 540.

Co-axial with the recesses 535 and 536 are the circular passage ways 541 and 542, respectively, of smaller diameter than the recesses which extend between the rear face 538 and the bottom of the recesses. Similar passages are provided for each of the remaining recesses (not shown). These passages are preferably provided with tubular liners 543 and 544. Openings 545 in the wear plate permit communication between the interior of the liner 543 and the slot 89 while openings 546 in the wear plate provide communication within the interior of liner 544 and the slot 91. A hollow plunger 547, fabricated of some wear resistant and self-lubricating material such as Teflon, and having an outwardly directed angular flange 548 is received within the liner 543, the diameter of the flange being such that it will form a substantially air tight seal with the liner. The remainder of the length of the plunger is of somewhat less diameter than the liner and is therefore slidably supported by a flat ring-shaped retainer plate 549 secured to the bottom of the recess by screws 550. Since the central opening in the retainer is slightly smaller than the inside diameter of the liner 543 the retainer will act as a stop to limit movement of the plunger in one direction, namely to the right as viewed in FIG. 22, when the flange 548 comes into contact with its underside. The other end of the plunger 547 is provided with a flexible suction cup 551, similar to the suction cups 88 shown in the previously described take-off device. A hollow Teflon plunger 552 having a flanged portion 553 at one end and a flexible suction cup 554 at the other end is similarly received in the liner 544 and held in place by a similar ring-shaped retainer plate 555 secured to the bottom of the recess 536 by means of the screws 556.

In operation, the cans are received by the suction cup 551 while in its retracted position under the influence of the vacuum existing in line 89a as they are blown off the printing spindles. Cans remain on the suction cup until they reach the position opposite the slot 91 where, under the influence of air under pressure in line 93 the plunger 552, with a can held by the suction cup 554, is pushed forwardly until the flange 553 hits the retainer plate 555 at which point the can will not only be blown forward onto a pin of the conveyor but will have been additionally propelled towards the conveyor by the movement of the plunger itself.

In a general manner, while we have, in the above description, disclosed what we deem to be practical and efficient embodiments of our invention, it should be well understood that we do not wish to be limited thereto, as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

We claim:

1. A machine for decorating the surface of cylindrical articles comprising, a base, a revoluble printing cylinder mounted on said base, a can feed assembly for presenting said articles to said cylinder at a printing station, a rotatable disc, a plurality of freely rotatable article carrying spindles mounted on said disc means for rotating said disc and said cylinder for sequentially bringing said article carrying spindles into rolling engagement with said printing cylinder, detection means for recognizing an improperly seated container on said spindle, and means to eject said container from said spindle in response to a signal from said detection means.

2. The machine as defined in claim 1, wherein there are throw-out means to back said assembly out of contact with said printing cylinder for one printing sequence, sensing means between said detection means and said printing station to recognize a spindle not having a container thereon and activating said throw-out mechanism.

3. The machine as defined in claim 1, wherein said spindles are hollow and in communication with a source air under pressure, and said means to eject includes valve means for releasing air from said source to a spindle prior to approaching the printing cylinder.

4. The machine as defined in claim 1, wherein said spindles are hollow and are in communication with a source of vacuum for holding articles in place during printing.

5. The machine as defined in claim 1, wherein said spindles are hollow and are in communication with a source of air under pressure for discharging successive articles.

6. The machine as defined in claim 1, wherein said spindles are hollow and in communication with a source of vacuum for holding articles in place during printing and are in communication with a source of air under pressure for discharging successive articles.

7. In mechanisms for decorating the surface of a plurality of cylindrical articles in succession, a base, a revoluble printing element mounted on said base, feed assembly means including a plurality of revolubly mounted article carrying spindles and means for sequentially moving said spindles through said printing station and holding them individually at said printing station, said feed assembly means being movable on said base between a first position for printing engagement between said printing element and an article carried by a spindle and a second position for holding an empty spindle out of printing engagement, sensing means for detecting an article improperly seated on a spindle, means to eject said article from said spindle in response to a signal from said sensing means, throw-out means for moving said feed assembly means between said first and second positions and including means for moving said assembly to said second position before said empty spindle is moved to said printing station.

8. The invention as defined in claim 7, wherein said throw-out means also includes means for returning said feed assembly means to said first position before the next succeeding spindle is moved to said printing station.

9. The invention as defined in claim 8, wherein said throw-out means includes means for holding said feed assembly means at said second position after a predetermined number of successively empty spindles have been moved through said printing station.

10. The invention as defined in claim 9, wherein said throw-out means includes means for returning said feed assembly means to said first position before a spindle carrying a properly seated article is moved to said printing station.

11. The invention as defined in claim 7, wherein said feed assembly means includes carriage means movable on said base, and said throw-out means includes power operated cam-and-lever means including linkage means connected for reciprocating said carriage.

12. The invention as defined in claim 11, wherein said cam-and-lever means includes a pivotally mounted arm movable between first and second positions for said reciprocating movement of the carriage, biasing means urging said arm toward said second position, and latch means for holding said arm in said first position to hold the carriage in the first position.

13. The invention as defined in claim 12, wherein said cam-and-lever means includes means for moving said arm in opposition to said biasing means for latching the arm in the first position.

14. The invention as defined in claim 12, wherein said sensing means includes means for disconnecting said latch means in response to said signal.

15. The invention as defined in claim 14, wherein said arm completes a cycle of movement between said first and second positions during each successive movement of

a spindle through said printing station, and said cam-and-lever means includes lost-motion means for moving said carriage to said second position only, in response to reciprocatory movement of said arm.

16. The invention as defined in claim 15, wherein said linkage means includes a pair of arms operatively joined by pivotal connecting means, said connecting means including a pivot pin fixed on one of the arms and slidably received in a slot provided in the other arm, said lost-motion means including a member movable into and out of said slot to prevent slidable movement of the pivot pin.

17. The invention as defined in claim 16, wherein solenoid means responsive to said signal is mounted on one of said arms to actuate said movable member.

18. In mechanisms for accepting a succession of articles at a first location and discharging them successively at a second location, comprising a plurality of hollow plungers having a suction cup at one end, support means for moving the plungers in an orbital path between said two locations and for axially retracting each plunger successively to accept an article at one of said locations and for axially extending each plunger successively at the other location to discharge an article, said support means including a cylindrical chamber for each plunger within which said plungers are slidably received, and conduit means and valving means communicating with a rear portion of the interior of each said cylindrical chamber for successively placing each chamber and the interior of its associated plunger under vacuum to retract the plunger and accept an article and for successively placing each chamber and the interior of its associated plunger under pressure to extend the plunger and discharge an article.

19. The invention as defined in claim 18, wherein said support means includes a rotatable element and the axes of said chambers for the plungers are arranged in a circular path concentrically spaced and parallel with respect to the axis of the rotatable element.

20. The invention as defined in claim 18, wherein said orbital path is circular, and the support means includes a rotatable element and a fixed member, said element and member having mating surfaces concentric to the axis of rotation, each cylindrical chamber being carried by the rotatable element in communication with an opening in the rotatable mating surface, said openings being circularly arranged, the other of the mating surfaces being fixed and having an annular passage in communication with said vacuum supply and in alignment with said circularly arranged openings while the suction cups are moving from the first location to the second location, said fixed surface also having an opening at the second location in communication with the pressured air and in alignment with the circularly arranged openings.

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DAVID KLEIN, *Primary Examiner.*

70 WILLIAM B. PENN, ROBERT E. PULFREY,
Examiners.

NATHANIEL A. HUMPHRIES, *Assistant Examiner.*