

Feb. 14, 1928.

1,658,837

W. V. DERBY

APPARATUS FOR FEEDING ARTICLES

Filed Jan. 16, 1926

5 Sheets-Sheet 1

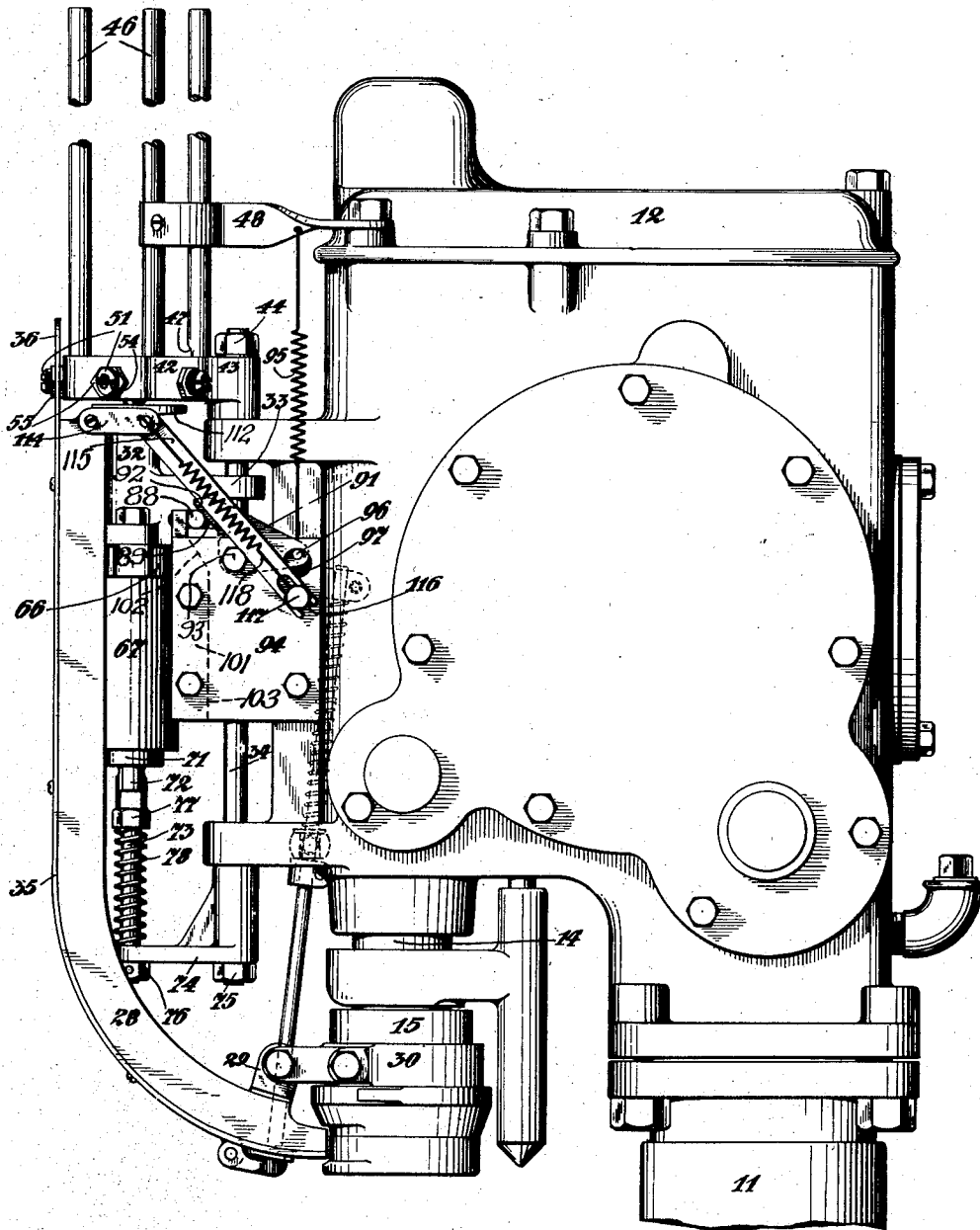


Fig. 1.

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5 Sheets-Sheet 2

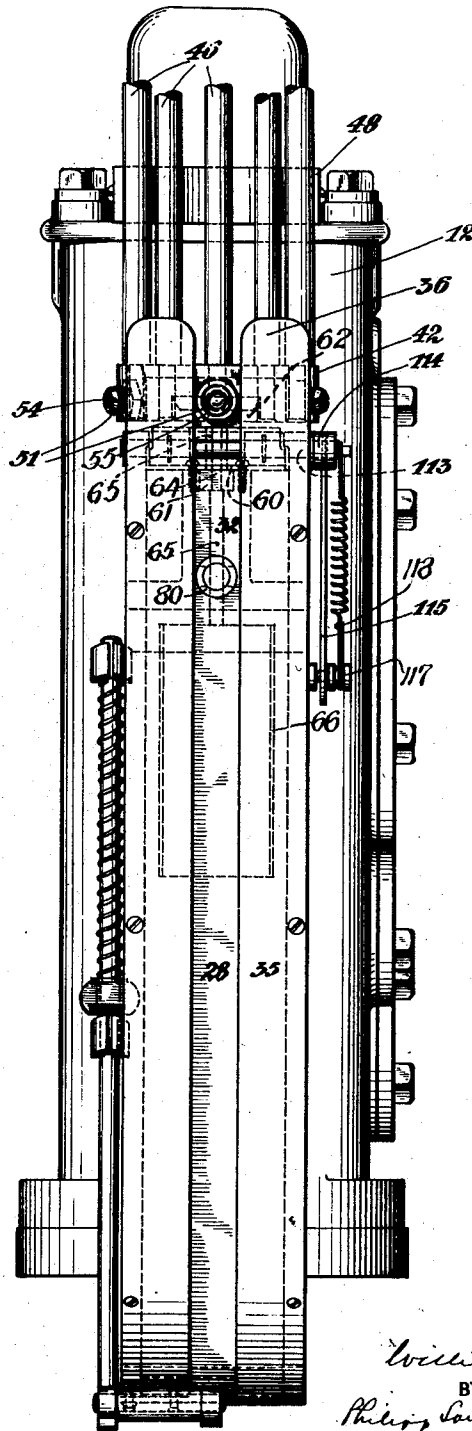


Fig. 2.

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5 Sheets-Sheet 3

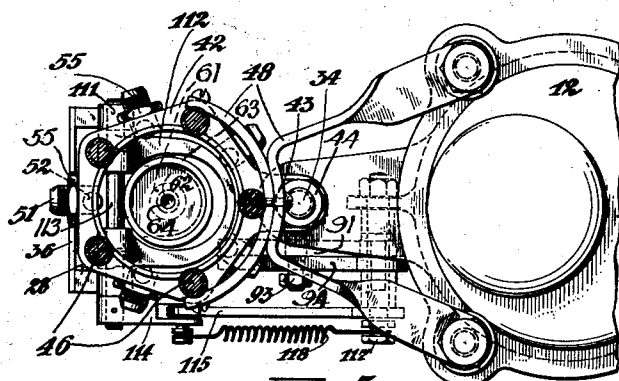


Fig. 3.

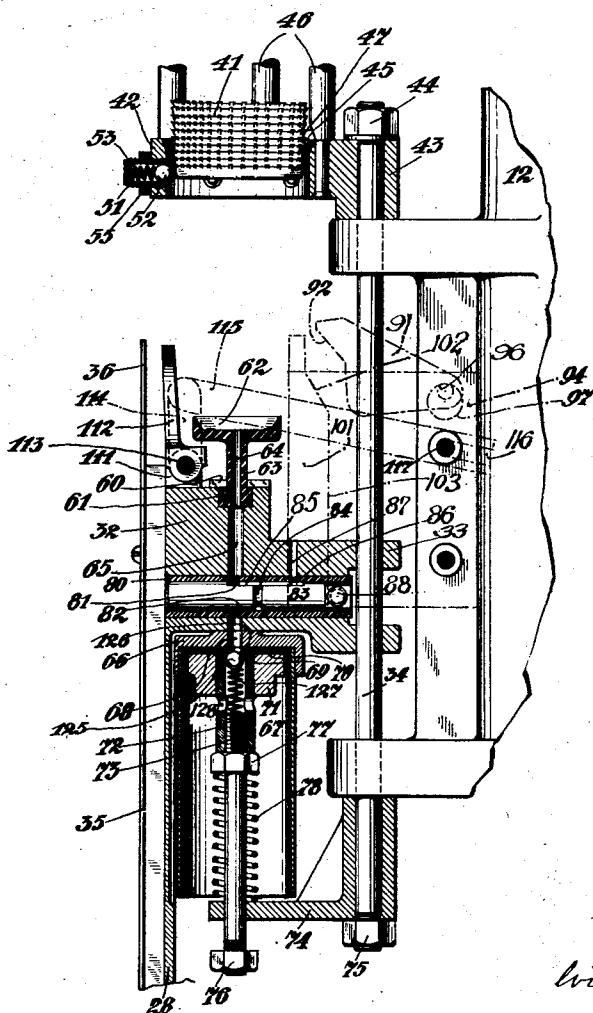


Fig. 4.

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5 Sheets-Sheet 4

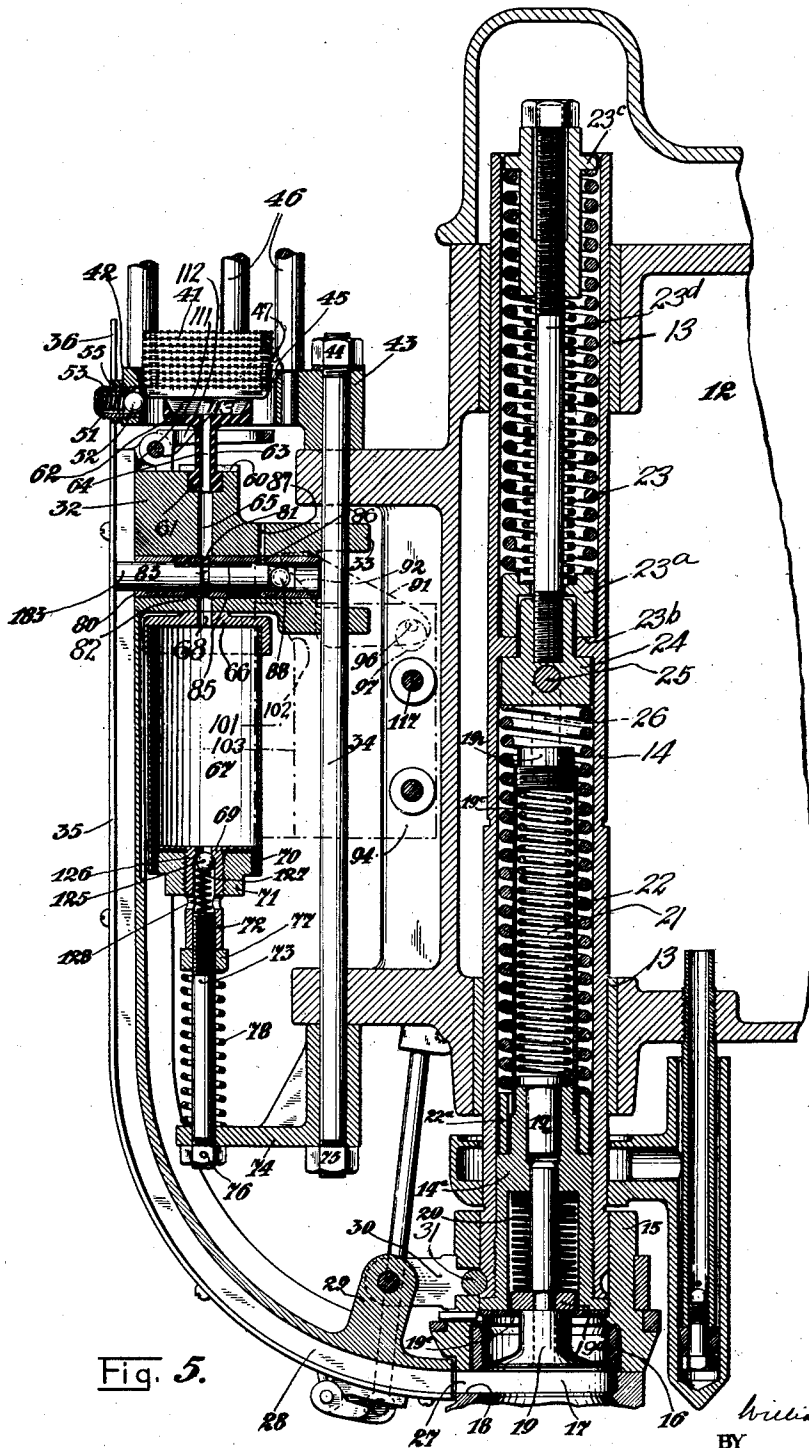


Fig. 5.

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5 Sheets-Sheet 5

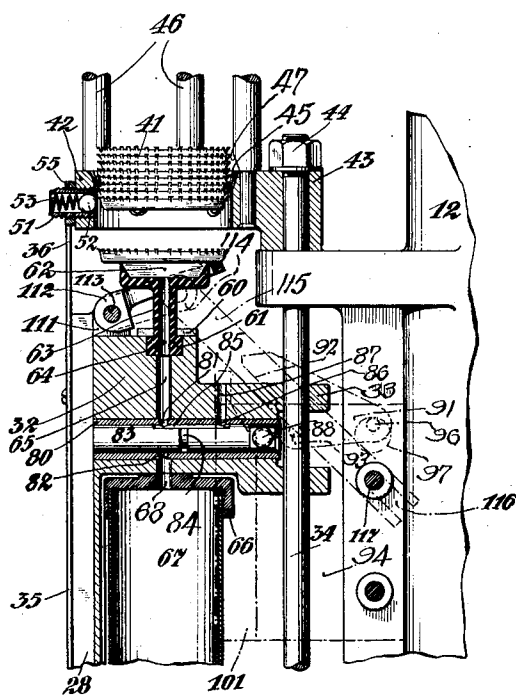


Fig. 6.

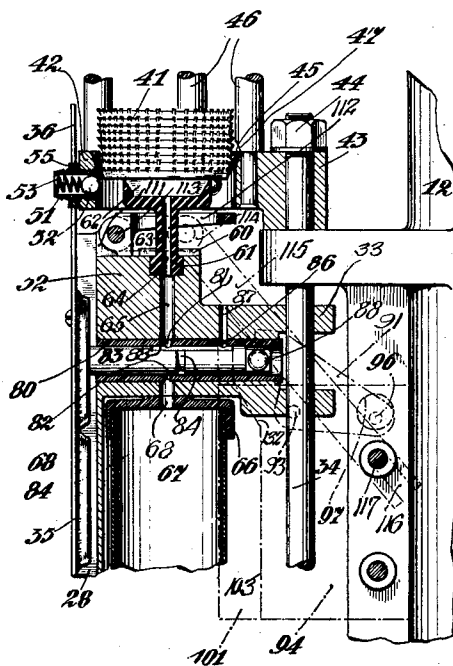


Fig. 7.

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UNITED STATES PATENT OFFICE.

WILLIAM V. DERBY, OF BALTIMORE, MARYLAND, ASSIGNOR TO THE CROWN CORK AND SEAL COMPANY OF BALTIMORE CITY, OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

APPARATUS FOR FEEDING ARTICLES.

Application filed January 16, 1926. Serial No. 81,827.

This invention relates to apparatus for feeding articles and more particularly to apparatus for feeding closures of the crown cork type to the throats of capping machines.

5 In capping ordinary bottles with crown corks, the customary size of crown is approximately 1" in diameter and various forms of apparatus have been devised for automatically feeding such crowns to the throat of the capping machine. It is frequently desired to cap large mouthed receptacles with closures of the crown cork type, for example, with crowns 3" in diameter. It has been found, however, that 10 the known means of crown feeding are not practicable with crowns of these larger sizes and heretofore these large crowns have been fed to the capping throat by hand.

It is an object of the present invention 15 to provide an apparatus for effecting an automatic feed of large size crowns. It is a further object of the invention to provide an apparatus for effectively and economically feeding individual articles, of various kinds, from a stack.

With these general objects in view the invention consists in the combinations, features, details of construction and arrangements of parts that will first be described 20 in connection with the accompanying drawings and then more particularly pointed out.

In the drawings—

Figure 1 is a view in side elevation of a capping machine having associated therewith a crown feeding mechanism constructed 25 in accordance with the invention;

Figure 2 is a view of the same in front elevation;

Figure 3 is a top plan view with parts in 30 section;

Figure 4 is a vertical sectional view of part of the apparatus;

Figure 5 is a vertical sectional view of the apparatus showing a different position of 35 the parts;

Figure 6 is a view similar to Fig. 4 showing a different position of the parts; and

Figure 7 is a view similar to Fig. 6 showing another position.

While the invention in general is appli-

cable to feeding articles of various kinds, it is particularly adapted to feeding large size closures of the well known crown cork type and it is here illustrated as embodied in a feed for such closures.

Referring to the drawings, 11 indicates 55 the frame-work of an exemplifying capping machine having a head casing 12 provided with bearings 13 in which slides a reciprocating capping head including a tubular 60 plunger 14. On the lower end of this plunger is a throat carrier 15 having a throat ring or capping die 16, a crown chamber 17 and a crown platform 18. Above the crown chamber is a presser foot 19. Secured to the 65 lower end of plunger 14 is a housing 14^a within which is a presser foot spring 20. Above the stem of the presser foot and slidable in the housing 14^a is a headed pin 19^a which forms, in effect, a continuation of 70 the presser foot. Bearing against the head of this pin 19^a is a supplementary presser foot spring 21, the other end of which bears against a threaded plug 19^b adjustably mounted in the end of a tubular sleeve 19^c 75 carried by housing 14^a. It will be seen that the presser foot is normally urged downwardly with respect to the head by the two springs 20, 21. The normal downward position of pin 19^a is limited by the engagement 80 of its head with housing 14^a, and the normal downward position of the main presser foot is limited by the engagement of a collar 19^d with a shouldered plate 19^e on the capping head.

While the capping plunger may be reciprocated in various ways, in the type of machine here illustrated, an actuating mechanism tends to lower the plunger with a given stroke but the effective stroke varies to 85 compensate for variations in bottled heights. To this end, as here shown as an example, housed within the tubular plunger 14 are two compensating springs 22, 23. The lower spring bears at its lower end against a collar 22^a seated on the housing 14^a, and at its upper end against a slidable abutment block 24. The upper compensating spring 23 bears 90 at its lower end against a collar 23^a seated on an internal shoulder 23^b formed on the

plunger 14. At its upper end this spring 23 bears against a collar 23^c carried by a bolt 23^d, the other end of which is threaded into block 24. The block 24 carries a pin 25 extending through a slot 26 in the plunger 14 and this block and pin are reciprocated with a given stroke. When the block 24 moves downwardly from the position of Fig. 5, as long as a predetermined resistance to the capping head is not exceeded, the entire capping head moves down with the pin by virtue of the springs 22, 23. When, however, this predetermined resistance, due to the engagement of the head with the receptacle to be capped, is exceeded, the head yields against springs 22 and 23 and ceases its downward movement, block 24 with its bolt 23^d continuing the stroke alone. During this final part of the stroke of the block 24 springs 22 and 23 are compressed and the pin 25 rides down its slot 26. When the block 24 reverses to move upwardly, in case compensation as above described has taken place, the block and bolt first move up alone, the springs re-expanding to normal condition, and thereafter the entire head moves up with the block as a unit.

While the block 24 may be reciprocated in any suitable manner, this may be accomplished conveniently by mechanism such as disclosed in Patent No. 1,463,257, dated July 31, 1923, to William V. Derby. It will be apparent that the block 24 and pin 25 correspond to the abutment block 32 and pin 31 of the machine described in the patent mentioned.

It will be seen, from the above description, that while the downward or capping stroke of the head varies in accordance with the height of the bottle presented, the head always returns to a given starting position. It will be understood, moreover, that the parts are arranged for a given standard size of receptacle and the compensation referred to is to take care of only slight manufacturing variations in the receptacles presented.

By the downward or capping stroke of the head the closure is forced into sealing contact with the receptacle and the skirt of the closure is crimped around the bottle mouth in the manner well known to those skilled in the art.

In the present embodiment a gravity feed chute moves with the head. To this end, registering with the open port 27 of the crown chamber is the end of a curved chute 28. The chute has a lug 29 pinned to a clamp collar 30 embracing the throat carrier, a bolt 31 serving to support both the clamp collar and throat carrier upon the plunger 14. Near the upper end of the vertical part of the chute is an enlargement or block 32 forming a carrier and having apertured lugs 33 through which passes a stationary guide rod 34 carried by the head casing. This rod

serves as a guide and support for the upper end of the chute in its reciprocating movement, lugs 33 sliding on the rod. The chute is closed in by a cover plate 35 which has an extension 36 above the upper or receiving mouth of the chute, for a purpose hereinafter referred to.

For convenience, the head, chute and carrier block, which move together, are referred to as the reciprocating unit.

There is provided means for withdrawing successive articles from a stack and depositing them one by one in the chute, and in structures embodying the invention to the best advantage, the articles will be stacked vertically in a stationary magazine, the lowermost article being withdrawn by a reciprocating suction cup. While the magazine may vary in construction it may conveniently include a support for the stack automatically displaceable by the pull of the suction cup on the lowermost article. Although capable of various constructions, in that here shown as an example, the magazine holds a vertical stack of crowns 41 stacked skirt up. The magazine includes a ring-like base 42 having a lug 43 secured to a portion of the head casing 12 by an extension of guide rod 34 and a nut 44. The inner diameter of the annular base 42 is slightly larger than the diameter of the articles to be fed and the upper edge is flared or beveled off, as at 45, to insure free movement of the crowns. Set in the base 42 are a plurality of vertical rods 46 equally spaced about the bore of the base and inscribing a circle of substantially the same diameter as that of the bore. That portion of each rod 45 that sets into the base is of reduced diameter to offset it from the wall of the bore and the corresponding shoulders are beveled off, as at 47, where they would otherwise overlap bevels 45. The rods 46 are further supported by a brace 48 from the head casing 12.

Threaded into the wall of the magazine base 42 are a number of equally spaced, radially disposed, tubular holders 51, the inner ends of which are substantially flush with the inner wall of base 42. Each end of each holder 51 is turned in slightly to constrict the end openings. Movable in the inner end of each holder 51 is hardened ball 52 normally projecting into the bore of the base 42 but retained in the holder by the constriction of the inner end. The balls 52 are yieldably held in normal position by springs 53 housed in holders 51, their outer ends bearing against the abutments formed by the constricted outer ends of the holders. The outer ends of tubular holders 51 are provided with screw driver slots 54 (Fig. 2), whereby the holders may be adjusted in the base to adjust the position of balls 52. The holders are secured

in adjusted position by lock nuts 55. Normally the stack of closures in the magazine is supported by the balls 52 on which the lowermost closure rests. But the balls are displaced outwardly against their springs, when a withdrawing pull is applied to the bottom closure, to permit such closure to pass.

While the suction cup and its reciprocating means for withdrawing a closure may vary in construction, as here shown as an example, secured in a recess in the top of carrier block 32 by a split washer 60 is the base 61 of a rubber suction cup 62 having a relatively slender, flexible stem 63. The cup element is provided with a central bore 64 communicating with a vertical conduit 65 in carrier block 32, later referred to. It will be apparent that the suction cup, which is centrally located with respect to the magazine, is reciprocated to and from the magazine by the movement of carrier block 32, which is part of the reciprocating unit. In this connection, it is noted that the parts are so arranged that the up stroke of the cup is sufficient to lift the stack of closures slightly from their supports so that contact is insured at all points of the circumference of the rim of the cup. Further, the cup can adapt itself to any slight canted position which the lowermost closure may assume, by a slight flexing of the stem 63.

While the suction cup may derive its vacuum in various ways, in structures embodying the invention according to the best advantage, the vacuum will be derived by means of a suction pump operated by the movement of the reciprocating unit. In this connection it is noted that the word "vacuum" is used in the present specification and claims in its more or less commonly adopted sense, it being understood that it describes a partial vacuum or minus pressure sufficient for the purpose in view. Moreover, the word "atmosphere" is used in a comprehensive sense to mean a relative plus pressure.

While the pump means is capable of various constructions, in that here illustrated as an example, moving with the reciprocating unit is a pump cylinder 67, secured to a cylinder head 66 which is bolted to the underside of the carrier block 32. In the lower part of the block and the cylinder head is a passage or conduit 68. This conduit is in alinement with conduit 65 and communicates therewith through a valve chamber later described.

Working in the pump cylinder is a pump piston 69 having a leather cup 70 held in place by a nut 71 screwed onto the tubular stem 72 of the piston. Means is provided for anchoring the piston so as to effect a suction action on the up stroke of the cylinder and an exhausting action on the down

stroke of the cylinder. As above described, the stroke of the reciprocating unit varies in accordance with the height of the receptacle presented. In constructions embodying the invention in its entirety, the piston is so anchored that uniform suction and exhaust actions are obtained regardless of the length of the down stroke of the unit. This may be accomplished, for example, by means of a compensating anchoring connection between the piston and a stationary part of the apparatus. Although capable of various constructions, in that here shown as an example, threaded into the tubular piston stem 72 is a rod 73 which passes freely through a hole in a stationary bracket 74 secured to the head casing 12 by an extension of guide rod 34 and a nut 75. Below the bracket 74 the rod 73 has a stop nut 76 and between the bracket and an upper nut 77 on the rod is a spring 78. This spring tends to move the piston upwardly, such movement being limited by the engagement of stop nut 76 with the underside of bracket 74.

Assuming the parts to be in the position of Fig. 4, with the reciprocating unit at the end of its down stroke, as the cylinder moves upwardly the force of spring 78 causes the piston to follow until stop nut 76 engages bracket 74. This anchors the piston against further upward movement and thereafter the cylinder moves away from the now stationary piston to effect the suction stroke of the pump. Fig. 5 shows the parts at the top of the up stroke. This sets up a vacuum in the cylinder with which the cup is connected, as later described. As the cylinder returns downwardly, and assuming the head and its associated parts to make the maximum down stroke, the cylinder moves relatively to the piston until the cylinder head engages the piston. Thereafter, further movement of the cylinder forces the piston down with it, rod 73 sliding in its bracket against spring 78. Should an over size receptacle present itself, thus causing a reduction in the down stroke of the reciprocating unit, the piston will be displaced downwardly by the cylinder by a correspondingly less amount. It follows that stop nut 76 will be displaced from bracket 74 a shorter distance and will have less distance to travel, on the up stroke, before anchoring the piston. Should the compensation required by an over size receptacle equal the normal separation between stop nut 76 and bracket 74, the cylinder ends its down stroke at substantially the time it engages the piston and there will be substantially no piston movement either on this down stroke or on the next up stroke.

In other words, the distance separating the cylinder head and piston when the cylinder is at the end of its up stroke (Fig.

5) is less the maximum stroke of the cylinder, i. e. for the shortest receptacle, by the amount of separation possible between the stop nut 76 and the bracket 74. Consequently, regardless of the length of the down stroke of the cylinder, the cylinder head and piston will come together and so exhaust the cylinder of any contained air. It follows that the successive suction strokes are alike regardless of the starting position of the cylinder.

There is provided an exhaust or relief valve for the suction pump. Although capable of various constructions, in that here illustrated as an example, in the hollow piston stem 72 is a loaded check valve in the form of a ball 125 normally seating against a valve seat 126 formed by a shoulder on the inner wall of the stem 72. This ball is normally held against its seat by a spring 127, the other end of which bears against the end of rod 73. Beyond nut 71 the hollow stem 72 has a cross bore 128 by which air passing the ball valve 125 can escape. When the suction pump makes its exhaust stroke, i. e. upon the down stroke of the cylinder, ball valve 125 will be displaced against its spring by any entrapped air, and this air escapes past the open valve and out via cross bore 128. This exhaust valve is provided primarily in view of the fact that the pump will draw in air in case the machine is operated without any articles in the stack. As a matter of fact, however, there is usually a small amount of air taken in on each cycle, which air is exhausted through the valve on the exhaust stroke.

The invention in its entirety includes valve means for connecting the suction cup with a source of vacuum, e. g. the pump described, on the withdrawing stroke of the cup and with atmosphere, to relieve the vacuum, after the cup has withdrawn an article, and means operated in timed relation with the cup movement for operating such valve means. In constructions of the type above described, the valve may set up communication between conduits 65 and 68 to connect the cup with the pump cylinder and, at the proper time, cutting off such communication, set up communication between conduit 65 and atmosphere to relieve the vacuum. The valve may conveniently be operated by the movement of the reciprocating unit.

While the valve means may vary, in the construction here shown as an example, the carrier block 32 has a horizontal bore lined with a bushing 80 which encloses a valve chamber crossing the line of conduits 65, 68. The bushing has a slot 81 forming, in effect, a continuation of conduit 65 and a slot 82 forming, in effect, a continuation of conduit 68. Sliding in bushing 80 with a close fit is a valve member in the form of a cylindrical

block 83 having a circumferential groove 84 adapted to afford communication between slots 81, 82 when the valve is in one position, i. e. the position of Fig. 5. This may, for convenience, be termed the suction position of the valve. The valve also has a longitudinal or axial groove 85 adapted to span and afford communication between the slot 81 and a relief slot 86 in the bushing 80 and which registers with a conduit 87 in block 32, leading to atmosphere, when the valve is in another position, i. e. the position of Figs. 6 and 7. This may, for convenience, be termed the relief position of the valve. In this relief position the cup is cut off from the cylinder, which is closed.

While the valve may be operated in various ways, in the embodiment here shown as an example, the cylindrical valve block 83 has a flattened end which carries a cam-riding pin 88. This pin, at its cam-engaging portion is cylindrical. At its inner end it is flattened to have a bearing on the sides of a longitudinal slot 89 formed in bushing 80 and block 82. The valve is moved into suction position, i. e. from the position of Fig. 4 to the position of Fig. 5, by a cam element 91 having a slanting cam edge 92 for engaging pin 88 as the reciprocating unit approaches the top of its up stroke. This cam 91 is mounted to yield for a purpose later described. To this end, as here shown as an example, the cam is pivoted by a pin 93 to a bracket plate 94 secured to the head casing 12. The cam is held in a normal position (Fig. 1) by a spring 95 connected between brace 48 and a pin 96 on the cam. Pin 96 extends through a hole 97 in the bracket plate 94 and normal position of the cam, under the force of spring 95, is fixed by the engagement of pin 96 with the upper edge of hole 97. The hole is large enough to permit movement of pin 96 as the cam rocks on its pivot. For the present, the yieldable mounting of cam 91 may be disregarded, as under normal conditions its spring causes it to operate the valve as if it were rigidly mounted.

The valve is moved in the opposite direction, i. e. to relief position (Fig. 4) by a cam element 101 rigidly fixed to bracket plate 94 and having a slanting cam edge 102 which engages pin 88 on the valve as the reciprocating unit moves downwardly. This cam also has a vertical cam edge 103 extending downwardly from slanting cam edge 102 for engaging pin 88 and retaining the valve in relief position during the latter and major part of the down stroke and the first and major part of the up stroke of the reciprocating unit.

The slanting cam edge 92 of cam element 91 is so arranged as to engage pin 88 of the valve element 83 at approximately the time at which the rim of the vacuum cup

engages the lowermost closure of the stack and to cause the valve to reach suction position (Fig. 5) at approximately the time the reciprocating unit reaches the top of its up stroke. In this position of the valve, the passage to atmosphere is cut off and communication is established between the pump cylinder and the cup, the top of which is now closed by virtue of the fact that the rim of the cup engages the face of the lowermost closure. Consequently, a vacuum is set up in the cup and when the reciprocating unit begins its down stroke the cup exerts a suction action on the lowermost closure and pulls the same past the retaining balls 52, which are displaced against their springs to allow the closure to pass. As soon as this closure has passed, springs 53 return the balls 52 to initial position to receive the next lowermost closure of the stack.

The slanting cam edge 102 of cam 101 is so arranged as to engage pin 88 and reverse the valve only after the reciprocating unit has moved the suction cup far enough to withdraw a closure from the stack. As pin 88 rides down this cam edge 102, the valve is reversed from the suction position of Fig. 5 to the relief position of Figs. 4 and 6. In this relief position, communication between the cup and the pump cylinder is cut off, the cylinder is closed, and the cup is placed in communication with atmosphere, thus relieving the vacuum in the cup. This releases the hold of the cup on the withdrawn closure which now rests freely on the cup and is held thereon merely by its own weight.

The invention in its entirety includes means operated in timed relation with the cup movement and the valve movement for transferring the withdrawn and suction-released crown from the support of the cup into a position to be received by the chute. This may be accomplished conveniently by a tipper for tipping the crown so that it may drop into the chute by gravity.

Although capable of various constructions, in that here illustrated as an example, pivoted between lugs 111 on the carrier block 32 is a skeleton tipper 112. This tipper, as will be apparent from Figs. 5-7, has a central opening through which the stem of the cup passes and which is of a diameter to permit the tipper to move up past the cup as shown in Fig. 6. When the tipper 112 is swung upwardly on its pivot, its rim, at a point opposite the pivot, is raised into contact with that part of the closure which is diametrically opposite the mouth of the chute. The tipper picks up the freely supported closure and tilts it toward a vertical position so that it can drop edgewise, by gravity, into the receiving mouth of the chute.

There is provided guide means for coop-

erating with the tipper in transferring the crown from the cup to the chute. Although capable of various constructions, in that here shown as an example, the extension 36 of the chute cover, above referred to, acts as a guide. As the crown is tipped toward the vertical sufficiently to slide off the suction cup, its skirt engages the guiding extension 36 and it is thereby guided into a vertical position for reception by the chute mouth.

While the tipper 112 may be operated by various means, as here shown as an example, the pivot pin 113, on which the tipper is mounted, has an extension to which is pinned rocker arm 114. Pivoted to the free end of this arm is a link 115 having at its other end an open slot 116 which embraces a stationary shouldered screw 117. This screw may conveniently be one of the securing devices for the bracket plate 94. In order to hold the tipper 112 normally in a horizontal position there is provided a spring 118 which is connected between the screw 117 and the pivot between link 115 and arm 114. When the reciprocating unit is at the top of its stroke the end of slot 116 is displaced away from screw 117 (Fig. 1). But as the unit moves down, link 115 is also moved down until the end of the slot engages screw 117. Upon further downward movement of the reciprocating unit this engagement of the link with the stationary screw causes link 115 to swing arm 114 on its pivot, thus causing the tipper to be swung upwardly as above described. As the reciprocating unit moves upwardly again, the tipper is returned to normal horizontal position, by spring 118, enough prior to the end of the up stroke to prevent any interference between the tipper and the magazine base.

As above described, under normal conditions each cycle of the reciprocating unit causes the withdrawal of a crown and its delivery to the chute. It sometimes happens that the machine will run temporarily without any receptacles being capped. This results in crowns piling up in the chute. Means is provided for interrupting the normal cycle of the withdrawing means in the event of a predetermined accumulation of crowns in the chute. This may be accomplished, for example, by preventing movement of the valve element 83 into its normal suction position, so that no vacuum is set up in the cup. Although capable of various constructions, in that here shown as an example, there is provided a detector connected with the valve and arranged to extend into and across the chute passage when the valve is in suction position. As shown, this detector is an integral extension 183 of the valve element 83. In other words, the cylindrical block 83 is made long enough so that when the valve is in suction position,

the end of the block extends across the chute passage, as appears in Fig. 5. This detector is withdrawn from the chute, so that the received crown may pass, when the valve is moved to relief position (Fig. 4).

As long as the crowns deposited in the chute flow through the same and are removed by being applied to receptacles, or otherwise, the valve operates in the normal manner above described. But should crowns accumulate in the chute up to a point opposite the valve block, the detector extension 183 cannot fully enter the chute passage because it is blocked off by a crown, as appears in Fig. 7. Consequently, as the reciprocating unit moves up and cam edge 92 engages pin 85 on the valve, the valve can be moved only far enough for the detector to strike the interfering crown, and cannot be moved far enough to take suction position. Thereafter, cam 91 yields on its pivot against its spring, this being the purpose of the yieldable mounting hereinbefore described. The throw of the valve from relief position to suction position is so related to the thickness of the articles being fed, e. g. crowns, that the interposition of an article in the path of detector 183 prevents the valve from taking suction position. As a result, the cup is not placed in communication with the vacuum source, e. g. the pump cylinder, and as no vacuum is set up in the cup, the cup cannot withdraw a crown but makes an idle stroke. The cup will continue to make idle strokes as long as the column of accumulated crowns in the chute is high enough to block off the detector. When the accumulation is relieved and the column drops below the point opposite the detector, the detector can, on the next up stroke, fully enter the chute passage again. Consequently, the valve can again take suction position and the suction means again functions normally to withdraw a crown on each cycle.

While the operation of the apparatus will be clear from the above description, to review the same: The suction cup is reciprocated toward and from the stack of crowns 41 by its movement with the reciprocating unit comprising carrier 32, chute 28 and capping head 22, the capping head being reciprocated by a force applied to block 24. Figure 4 illustrates the parts at the end of the down stroke of the reciprocating unit. The valve is in relief position and the cylinder has been exhausted by the engagement of the cylinder head and piston. The tipper 112 is still in tipping position. As the reciprocating unit moves upwardly the piston follows the cylinder, due to spring 78, until stop nut 76 engages bracket 74, whereupon the piston is anchored and the cylinder moves upwardly alone, thereby effecting a suction stroke of the pump which sets up a vacuum therein. During this

movement the valve is held in its relief position, cutting off the cylinder from the cup, by the vertical edge 103 of cam 101. As soon as the reciprocating unit has advanced far enough to displace the end of slot 116 away from nut 117, the tipper 112 returns to normal horizontal position under the action of its spring 118. By the time the suction cup has engaged the lowermost closure and lifted the stack slightly from its supports, cam edge 92 has engaged pin 88 and moved valve 83 from the relief position of Fig. 4 into the suction position of Fig. 5. In this position the cup is cut off from atmosphere and is in communication with the pump cylinder so that a vacuum is set up in the cup, the top of which is now closed by the engaged crown.

The reciprocating unit now starts its downward or withdrawing stroke and the suction action of the cup withdraws the lowermost crown from the stack, the supporting balls being displaced against their springs to pass this crown and returning to normal position to receive the next lowermost crown of the stack. As the unit continues downwardly, valve pin 88 is engaged by cam edge 102 of cam 101 and the valve is returned to relief position (Fig. 4), in which position it is retained during the remainder of the down stroke by cam edge 103. By this movement of the valve the pump cylinder is again cut off and the suction cup is placed in communication with atmosphere. This relieves the vacuum in the cup so that the withdrawn crown now rests freely on the cup by its own weight.

As the unit continues downwardly the end of slot 116 in link 115 strikes nut 117, whereby the link actuates rocker arm 114 to swing the tipper on its pivot. Figure 6 illustrates the partly displaced tipper just at the point of engaging the freely supported crown. This stroke of the tipper dislodges the crown from the cup and tips it toward a vertical position. As the crown slides off the cup its skirt engages extension 36 of the chute cover which guides the crown into the mouth of the chute. The crown thus received by the chute eventually passes down the same and enters port 27 in the head to take up its position for capping on crown platform 18.

Meanwhile, during this withdrawing stroke of the reciprocating unit, the pump cylinder moves downwardly with its head approaching the piston and any contained air is forced out past relief valve 125. At or near the end of this stroke the cylinder head engages the piston and forces the piston downward slightly, rod 73 sliding in bracket 74 against its spring. The amount of this downward displacement of the piston depends, as above described, on the length of the down stroke of the reciprocating unit.

This completes the cycle and the parts are now again in the position of Fig. 4, except as to possible variation in the length of the stroke of the unit.

5 In the normal operation above described the throw of the valve 83 by cam edge 92 in placing the valve in suction position is such as to cause the detector extension 183 to enter and extend across the passage of the chute
10 (Fig. 5). Should the crowns delivered to the chute accumulate to a point opposite the valve 83, the normal operation is interrupted because of the fact that the valve cannot take suction position. In other words, on the up-
15 stroke of the reciprocating unit, when the pin 88 engages cam edge 92, a crown is interposed in the path of the valve block and the valve cannot move far enough to take suction position, the cam 91 yielding against its spring to compensate for this interrupted
20 stroke. As a result, during this cycle the cup is not placed in communication with the pump cylinder so that no suction action is applied to the crown and the cup makes its
25 stroke idly. Such idle cycles continue until the accumulation is relieved sufficiently for the column of crowns in the chute to drop below a point where a crown can interfere with the movement of valve block 83.
30 Thereafter the parts operate normally again until crowns again accumulate to the predetermined point.

What is claimed is:

1. In an apparatus for feeding articles,
35 and in combination, a magazine for a stack of horizontally disposed articles and including a displaceable support, suction means for withdrawing the lowermost article in said stack and including a horizontally dis-
40 posed article-engaging cup, a substantially vertical feed chute, and means including a guide for transferring the withdrawn article from the cup into a position to drop into said chute.

45 2. In an apparatus for feeding articles, and in combination, a magazine for a stack of horizontally disposed articles and including a displaceable support, suction means for withdrawing the lowermost article in said
50 stack and including a horizontally disposed suction cup, a substantially vertical feed chute, and a tipper for tipping the withdrawn article from its position on the cup into a position to drop into said chute.

55 3. In an apparatus for feeding articles, and in combination, a magazine for a stack of horizontally disposed articles and including a displaceable support, suction means for withdrawing the lowermost article in said
60 stack and including a horizontally disposed article-engaging cup, a substantially vertical feed chute comprising a cover plate, said plate having an extension beyond the receiving mouth of said chute, and a tipper for
65 tipping the withdrawn article toward the

chute mouth, whereby it may drop thereinto by gravity, said extension serving as a guide for directing the article into the chute mouth.

4. In an apparatus for feeding articles, and in combination, a magazine for a stack
70 of horizontally arranged articles, a suction cup, means for reciprocating the suction cup toward and away from the stack, whereby the rim of the cup makes contact with the lower-
75 most article in the stack on the advance stroke of the cup, a substantially vertical feed chute, valve means for connecting the cup with a source of vacuum on the withdrawing stroke of the cup and with atmos-
80 phere, to relieve the vacuum, after the cup has withdrawn an article, a tipper for tipping the withdrawn article, after relief of the vacuum, from its position on the cup into a position to be received by said chute, and
85 means operating in timed relation with the cup movement for operating said valve.

5. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for
90 moving the carrier toward and away from the holder, whereby contact is made between the rim of the cup and the lowermost article in the stack upon the advance stroke of the carrier, a suction pump including a cylinder,
95 mounted on the carrier, and a piston, and valve means for placing the cup in communication with the cylinder after the cup rim has made engagement with the lowermost article in the stack and for placing the cup in
100 communication with atmosphere after the cup has withdrawn such article from the stack.

6. In an apparatus for feeding articles, and in combination, a magazine for a stack
105 of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for moving the carrier toward and away from the holder, whereby contact is made between the rim of the cup and the lowermost article
110 in the stack upon the advance stroke of the carrier, a suction pump including a cylinder, mounted on the carrier, and a piston, a conduit leading from the cup to said cylinder, a conduit leading from the cup to atmosphere,
115 valve means associated with said conduits and arranged to connect the cup with the cylinder when in one position and with atmosphere when in another position, and means for operating said valve to place it in
120 the first of said positions after the cup rim has engaged the lowermost article of the stack and into the other of said positions after the cup has withdrawn such article.

7. In an apparatus for feeding articles,
125 and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for moving the carrier toward and away from the magazine, whereby contact is made be-
130

tween the rim of the cup and the lowermost article in the stack upon the advance stroke of the carrier, a suction pump including a cylinder, mounted on the carrier, and a piston, a conduit leading from the cup to said cylinder, a conduit leading from the cup to atmosphere, valve means associated with said conduits and arrange to connect the cup with the cylinder when in one position and with atmosphere when in another position, means for operating said valve to place it in the first of said positions after the cup rim has engaged the lowermost article of the stack and into the other of said positions after the cup has withdrawn such article, transfer means for transferring the withdrawn article from the cup, and means for operating said transfer means in timed relation with said valve operating means, whereby the transfer means is operated after the cup is connected with atmosphere.

8. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, means for advancing the cup a sufficient distance toward the magazine to cause the cup to engage the lowermost article of the stack and raise the stack slightly from its support and for withdrawing the cup away from the magazine, valve means for connecting the cup with a source of vacuum after the rim of the cup has made engagement with the lowermost article of the stack and for connecting it with atmosphere, to relieve such vacuum, after the cup has withdrawn such article, and transferring means for transferring the withdrawn article from the cup after relief of the vacuum.

9. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for moving the carrier toward and away from the magazine, whereby contact is made between the rim of the cup and the lowermost article in the stack upon the advance stroke of the carrier, a suction pump including a cylinder mounted on the carrier, and a piston, and means including a relatively stationary part of the apparatus for anchoring the piston.

10. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for moving the carrier toward and away from the magazine, whereby contact is made between the rim of the cup and the lowermost article in the stack upon the advance stroke of the carrier, a suction pump including a cylinder mounted on the carrier, and a piston, and a compensating anchorage connection between the piston and a stationary part of the apparatus.

11. In an apparatus for feeding articles,

and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for moving the carrier toward and away from the magazine, whereby contact is made between the rim of the cup and the lowermost article in the stack upon the advance stroke of the carrier, a suction pump including a cylinder mounted on the carrier, and a piston, valve means for controlling communication between the cylinder and cup, means for anchoring the piston against movement toward the magazine beyond a predetermined point, the piston being movable in the opposite direction, on the withdrawing stroke of the cylinder, by the engagement of the cylinder head with the piston, and means normally tending to hold the piston in its anchor-position.

12. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, means for reciprocating the carrier with respect to the magazine, a suction pump including a cylinder, mounted on the carrier, and a piston, means for controlling communication between the cylinder and the cup, a stationary bracket, a piston rod slidable in said bracket, a stop element on the piston rod beyond the bracket for limiting the movement of the piston toward the magazine, and a spring tending to cause the piston to move to the limit permitted by said stop element.

13. In a capping machine, and in combination, a stationary head casing, a capping head reciprocable with respect thereto, a throat carrier on said head having a crown chamber provided with a crown entrance port, a feed chute communicating with said port and secured to the head to move therewith, a stationary magazine for a stack of crowns, suction means including a suction cup and operated by the movement of said head, for withdrawing the successively lowermost crowns of the stack from the magazine, and means operated by the movement of said head for transferring the withdrawn crown into a position to drop into said chute.

14. In a capping machine, and in combination, a stationary head casing, a capping head reciprocating with respect thereto, a throat carrier on said head having a crown chamber provided with a crown entrance port, a feed chute communicating with said port and secured to the head to move therewith, a stationary magazine for a stack of crowns, a carrier moving with said chute, a suction cup mounted on the carrier for withdrawing the successively lowermost crowns of the stack, a suction pump, including a cylinder and piston, operated by the movement of said head, valve means operated by the movement of said head for connecting the cup with said cylinder upon the withdraw-

ing stroke of the cup and with atmosphere, to relieve the vacuum, after the withdrawal of a crown, and a tipper operated by the movement of said head for tipping the withdrawn crown into the chute.

15. In a capping machine, and in combination, a stationary head casing, a capping head reciprocable with respect thereto, a throat carrier on said head having a crown chamber provided with a crown entrance port, a feed chute communicating with said port and secured to the head to move therewith, a stationary magazine for holding a vertical stack of horizontally arranged crowns, the chute having a vertical portion for receiving crowns singly and in edgewise position, and means for withdrawing the successively lowermost crowns from the stack and moving them into a position to be received by said chute.

16. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a reciprocating carrier, a suction cup mounted on said carrier, means for moving the carrier, a suction pump including a cylinder secured to the carrier, and a piston, the carrier having a transverse bore forming a valve chamber, there being aligning conduits connecting said chamber with the cylinder and cup respectively, the carrier having a relief conduit connecting said chamber with atmosphere, a cylindrical valve element slidable endwise in said valve chamber and having a circumferential groove for connecting said aligning conduits when the valve is in one position and having an axial groove for connecting the cup with atmosphere through one of said conduits and said relief conduit when the valve is in another position, and means for moving said valve into one of said positions or the other.

17. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup for withdrawing the lowermost article from the stack, a reciprocating carrier on which said cup is mounted, a valve chamber in said carrier having communication with the cup, with atmosphere and with a conduit adapted to communicate with a source of vacuum, a valve movable in said valve chamber for controlling communication between the cup and said conduit and the cup and atmosphere, and means dependent on the position of said carrier for operating said valve.

18. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup for withdrawing the lowermost article from the stack; a reciprocating carrier on which said cup is mounted, a valve chamber in said carrier having communication with the cup, with atmosphere and with a conduit adapted to

communicate with a source of vacuum, a valve movable in said valve chamber for controlling communication between the cup and said conduit and the cup and atmosphere, a cam riding element on said valve, and cam means mounted on a stationary part of the apparatus for engaging said element to operate the valve.

19. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup for withdrawing the lowermost article from the stack, a reciprocating carrier on which said cup is mounted, a valve chamber in said carrier having communication with the cup, with atmosphere and with a conduit adapted to communicate with a source of vacuum, a valve movable in said valve chamber for controlling communication between the cup and said conduit and the cup and atmosphere, a cam riding element on said valve, a normally stationary cam for engaging said element on the latter part of the up stroke of the carrier to cause the valve to move into a position to set up communication between the cup and said conduit, and a normally stationary cam for engaging said element on the withdrawing stroke of the carrier to cause the valve to move into a position to set up communication between the cup and atmosphere and for holding the valve in such position until the carrier has completed its withdrawing stroke and approached the end of its advance stroke.

20. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup for withdrawing the lowermost article from the stack, a reciprocating carrier on which said cup is mounted, means for moving said carrier with a sufficient stroke to cause the cup to lift the stack of articles away from its support, a valve chamber in said carrier having communication with the cup, with atmosphere and with a conduit adapted to communicate with a source of vacuum, a valve movable in said valve chamber for controlling communication between the cup and said conduit and the cup and atmosphere, a cam riding element on said valve, a normally stationary cam for engaging said element on the latter part of the up stroke of the carrier to cause the valve to move into a position to set up communication between the cup and said conduit, and a normally stationary cam for engaging said element on the withdrawing stroke of the carrier to cause the valve to move into a position to set up communication between the cup and atmosphere and for holding the valve in such position until the carrier has completed its withdrawing stroke and approached the end of its advance stroke, the first named cam being arranged to effect such position of the

valve at substantially the time the carrier attains the top of its advancing stroke.

21. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a feed chute, a suction cup, a reciprocating carrier on which said cup is mounted, means for setting up communication between the cup and a source of vacuum on the withdrawing stroke of the carrier and between the cup and atmosphere after the cup has withdrawn an article, a tipper pivoted on said carrier for tipping a withdrawn article into a position to be received by said chute, and means dependent on the position of the carrier for operating said tipper.

22. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a feed chute, a suction cup, a reciprocating carrier on which said cup is mounted, means for setting up communication between the cup and a source of vacuum on the withdrawing stroke of the carrier and between the cup and atmosphere after the cup has withdrawn an article, a tipper for tipping a withdrawn article into a position to be received by said chute, a pivot pin carried by the carrier and on which said tipper is mounted, a rocker arm mounted on the pivot pin, a link pivoted to the free end of said rocker arm, a pin and slot connection between the other end of said link and a stationary part of the apparatus, whereby engagement of such pin with the end of such slot causes operation of the tipper after a given withdrawing movement of the carrier, and a spring for returning the tipper to normal position.

23. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a reciprocating carrier, a suction cup mounted on said carrier and having a slender flexible stem, and means for connecting said cup with a source of vacuum upon the withdrawing stroke of the carrier.

24. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a receiver into which the articles are to be fed successively, means including an operating element having recurrent cycles for normally exerting a suction action on the lowermost closure of the stack for each cycle of said element, and means dependent on a predetermined accumulation of articles in said receiver whereby no substantial suction action is exerted during a given cycle of said element.

25. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a receiver into which the articles are to be fed successively, a suction cup, means for reciprocating the cup to and from the stack, means for normally setting up communication between said cup and a

source of vacuum upon the withdrawing stroke of the cup, and means dependent on the extent of accumulation of articles in said receiver for rendering said last named means inoperative.

26. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a receiver into which the articles are to be fed successively, a suction cup, means for reciprocating the cup to and from the stack, valve means for controlling communication between the cup and a source of vacuum, yieldable means tending to operate said valve to open communication between the source and cup on the withdrawing stroke of the cup, and means for preventing such movement of the valve upon a predetermined accumulation of articles in the receiver.

27. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a feed chute into which the articles are to be fed successively, a suction cup, means for reciprocating the cup to and from the stack, a sliding valve for controlling communication between the cup and a source of vacuum, yieldable means tending to move said valve into a position to open communication between the source and cup on the withdrawing stroke of the cup, and a detector extension on the valve arranged to extend across the passage of the chute when the valve is in such communicating position, whereby the valve is prevented from taking such position when the chute is filled with accumulated articles up to a point opposite said extension.

28. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a reciprocating carrier, a suction cup mounted on said carrier, means for moving the carrier, a suction pump including a cylinder secured to the carrier, and a piston, the carrier having a transverse bore forming a valve chamber, there being alining conduits connecting said chamber with the cylinder and cup respectively, the carrier having a relief conduit connecting said chamber with atmosphere, a cylindrical valve element slidable endwise in said valve chamber and having a circumferential groove for connecting said alining conduits when the valve is in one position and having an axial groove for connecting the cup with atmosphere through one of said conduits and said relief conduit when the valve is in another position, a cam riding element on said valve, a yieldably mounted, spring-pressed cam for engaging said element on the advance stroke of the carrier and tending to move the valve into the first of said positions, means for moving the valve into the other of said positions on the withdrawing stroke of the carrier, and means for prevent-

ing the movement of the valve into the first of said positions under predetermined conditions.

29. In an apparatus for feeding articles, and in combination, a magazine for a stack of articles, a suction cup, a reciprocating carrier on which said cup is mounted, a suction pump including a cylinder mounted on

the carrier, and a piston, valve means for setting up communication between the cup and the cylinder during part of each cycle of said carrier, and a loaded check valve in said pump for the outlet of contained air. 10

In testimony whereof, I have hereunto set my hand.

WILLIAM V. DERBY.