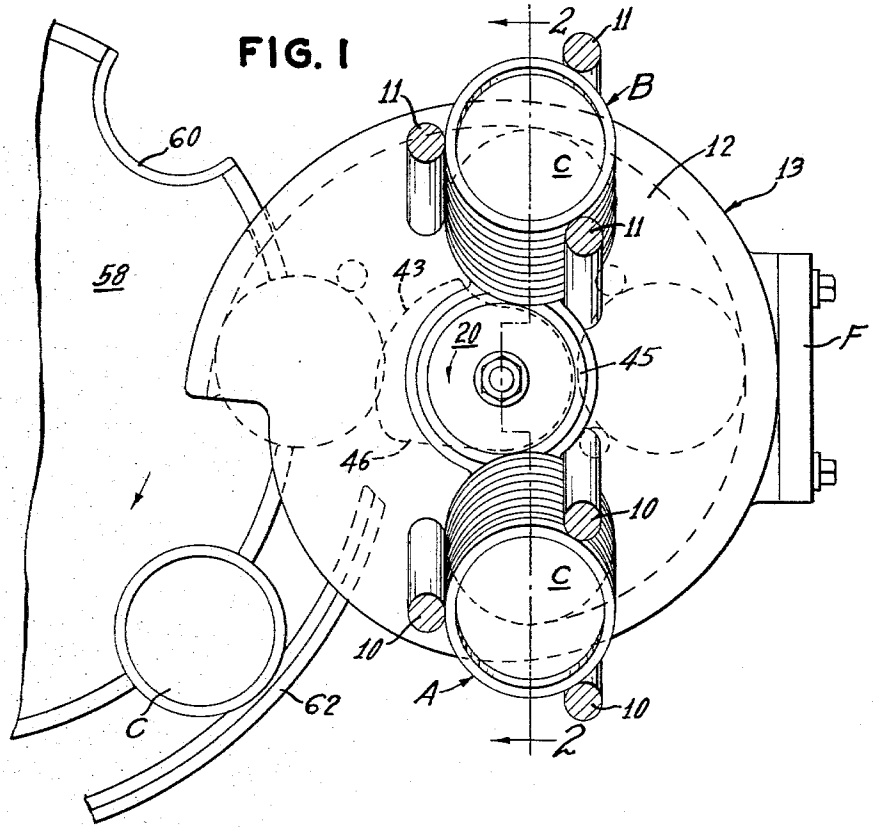
May 31, 1966 E. W. DE GEAR 3,253,722

END CLOSURE FEEDING APPARATUS

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FIG. 1



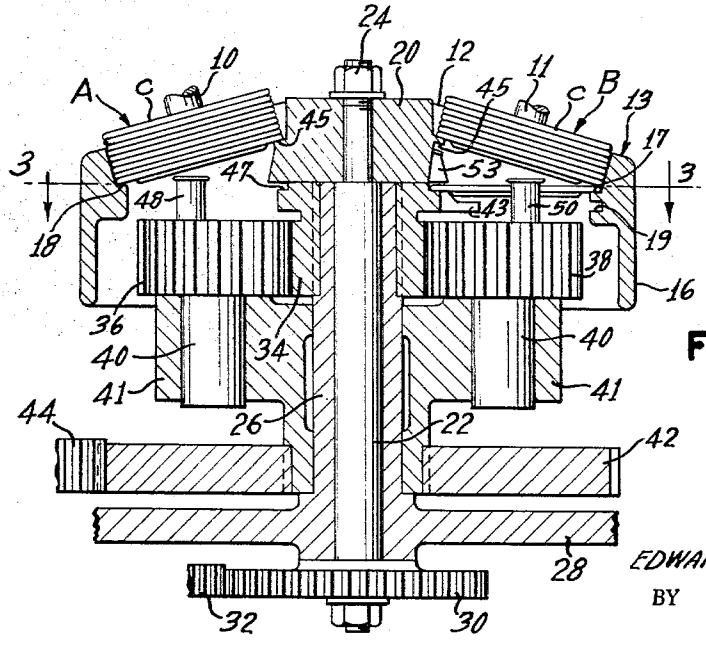


FIG. 2

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FIG. 3

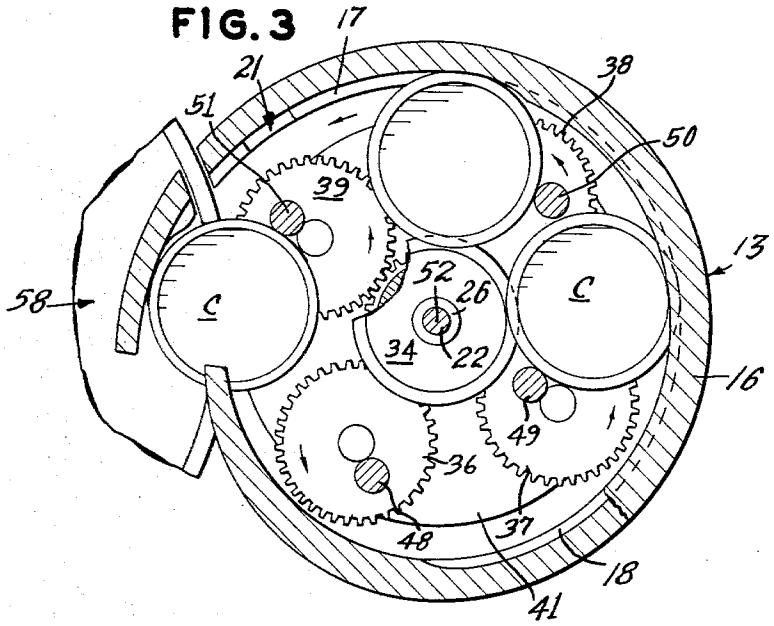


FIG. 4

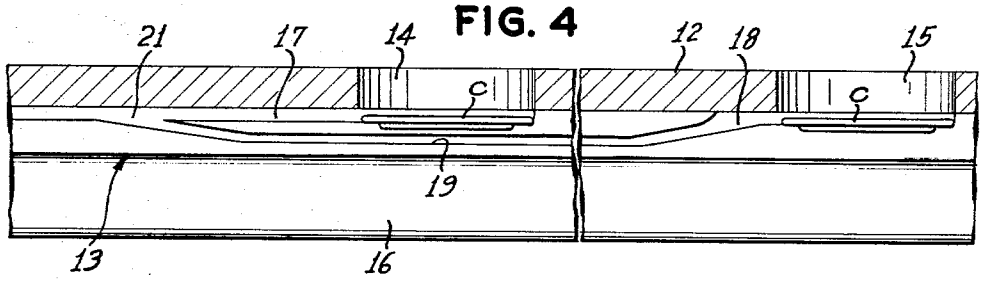


FIG. 5

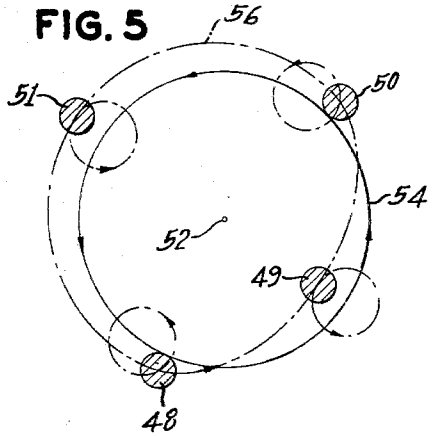
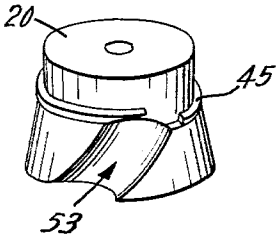


FIG. 6



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3,253,722

END CLOSURE FEEDING APPARATUS

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Filed Dec. 4, 1963, Ser. No. 327,889

5 Claims. (Cl. 214—8.5)

The present invention relates to apparatus for handling end closures for containers or the like and more particularly to apparatus for feeding end closures from a plurality of stacks to a transfer means at high speed and with a minimum of damage thereto.

With the recent development of extremely high speed operation of can closing or end seaming machines, the feeding of end closures at high speeds has become a problem. At the speeds of operation involved, which in some instances substantially exceed 1000 ends/minute, there is the ever present possibility that when the ends are fed from a stack, the high speed contact between moving parts of the feeding apparatus and the stationary end closures will cause nicking or other curl damage to the end closures which will interfere with the seaming operation.

The general purpose of the instant invention, therefore, is to provide an apparatus for feeding end closures at high speeds in a manner such that there is little possibility of damage to the end closures. This is accomplished by utilizing an end feeding mechanism which comprises a pair of end closure supply stacks which are diametrically disposed with respect to a delivery turret. The delivery turret comprises a driven planet carrier carrying a plurality of rotatable planetary gears which mesh with a stationary sun gear. Each of the planetary gears has eccentrically mounted thereon a feed pin or pusher for engaging and removing an end closure from its associated stack and conveying the end closure in an accurate path to subsequently discharge the end into an adjacent transfer means leading to the end seaming or closing station. The epicyclic path of each eccentric feed pin is so arranged relative to the transfer means that the feed pin is moving at a reduced or medial speed when it engages an end closure, and the feed pin and its associated end closure are moving at a maximum velocity at the point of discharge from the delivery turret to the transfer means. Thus, the possibility of damage to the end closures is minimized since they are originally engaged at a reduced speed, and then are accelerated to the highest possible speed just prior to their discharge to the transfer means.

An object of the present invention is to provide an apparatus for feeding end closures at high speeds with little possibility of damage to the end closures.

A further object is to provide an end feeding device wherein the ends are alternately removed from dual stacks by feed pin devices which are carried on a single rotary planet carrier in such manner that the speed of rotation of the carrier need only be half of that which would be required in the event only a single stack were employed, thereby reducing the speed of impact between the feed pins and the ends and thus reducing the possibility of damage to the ends.

Another object is the provision of such an apparatus wherein the end closures are picked up at a speed which

is less than the discharge speed to thereby reduce the initial impact force between the feeding apparatus and the end closures.

A further object is to provide a high speed apparatus for safely engaging and feeding end closures from a plurality of stacks thereof.

A still further object is the provision of such an apparatus wherein the end closures are engaged by eccentrically mounted means at a reduced speed and then are accelerated to a maximum speed at the point of discharge from the feeding apparatus.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

FIG. 1 is a top plan view, with parts broken away and parts in section, of an apparatus constructed according to the principles of the instant invention;

FIG. 2 is a sectional view taken substantially along line 2—2 in FIG. 1;

FIG. 3 is a sectional view, with parts broken away, taken substantially along line 3—3 in FIG. 2;

FIG. 4 is a developed, elevational view of a portion of the depending housing flange and guide channels therein shown in FIGS. 2 and 3, parts being broken away and parts being shown in section;

FIG. 5 is a diagrammatic view showing the paths of both the planetary gears and the eccentric pushers or feed pins mounted thereon, which parts are shown in FIGS. 2 and 3; and

FIG. 6 is a perspective view of the separator screw of the instant mechanism.

As a preferred or exemplary embodiment of the instant invention, FIGS. 1 and 2 illustrate a feeding device which utilizes two stacks A and B of container end closures C which are supported between inclined parallel rods **10** and **11**, respectively. The supporting rods **10** and **11** are supported on the top plate **12** of a generally circular housing **13** which is in turn rigidly attached to a supporting frame F in any suitable manner. The top plate **12** is formed with a pair of circular openings **14**, **15** through which the stacks A and B, respectively, project (see FIG. 4).

The housing **13** also includes a depending flange **16** which is provided with a first guide channel **17** and a second guide channel **18** which are formed in the interior surface thereof.

The first guide channel **17** begins at the base of the stack B and extends around the flange **16** to the area at which the ends C are discharged from the feed mechanism, as will be hereinafter explained.

The second guide channel **18** begins at the base of the stack A at the level of the first channel **17** and is formed with a depressed portion **19** which passes beneath the first guide channel **17** and then inclines upwardly and merges into the latter at **21** as seen in FIG. 4.

As best seen in FIG. 2, the first guide channel **17** provides a support for the outer portion of the lowermost end C in the stack B, while the second guide channel **18** in similar manner supports the outer portion of the lowermost end C in the stack A.

A separator screw **20** extends upwardly through the top plate **12** of the housing **13** and is rigidly mounted on a rotatable shaft **22** by a nut and bolt assembly **24**. The shaft **22** is rotatably mounted in a hollow stationary bearing member **26** having a support bracket **28** integral therewith which is rigidly mounted on a suitable support means (not shown). A gear **30** is rigidly attached to the lower end of the shaft **22** and is in engagement with a driving gear **32** that is driven by any suitable driving means such as a motor (not shown).

A sun gear **34** is rigidly mounted on the outer surface of the stationary bearing member **26** adjacent the upper end thereof. Four identical planetary gears **36, 37, 38** and **39** of the same size as the sun gear **34** are disposed approximately 90° apart and are in engagement with the sun gear **34**. Each of the planetary gears **36** through **39** and the sun gear **34** have a one-to-one gear ratio, with the result that each planetary gear rotates 360° about its own central axis for each complete revolution around the sun gear **34**. Each of the planetary gears **36** through **39** has rigidly attached thereto or integral therewith a downwardly extending shaft **40** which is rotatably mounted on a planet carrier **41** which is in turn rotatably mounted on the outer surface of the stationary bearing member **26** below the sun gear **34**.

A gear **42** is keyed to the lower end of the planet carrier **41** and is in engagement with a driving gear **44** which preferably is driven by the same driving means or motor (not shown) as that for the driving gear **32**, although a separate driving means may be provided for each of the gears **32** and **44**. The relative sizes and ratios of the gears **30, 32** and **42, 44** are such that the shaft **22** rotates through two revolutions for every one revolution of the planet carrier **41**. Thus, the separator screw **20** which is rigidly attached to the shaft **22** travels through two revolutions for every one revolution of the planetary gears **36** through **39** around the stationary sun gear **34**.

As shown in FIG. 2 (and in broken lines in FIG. 1), the upper portion of the stationary sun gear **34** is provided with a radially extending flange **46** which defines an annular support ledge **47** on the upper surface thereof. The flange **46** is provided with a portion **43** which extends radially outwardly a greater distance than the major portion of the flange **46** for a purpose to be described hereinafter.

The separator screw **20** has a helical thread or groove **45** on the outer surface thereof in which the inner portion of the lowest end closure C of each of the stacks A and B is disposed and supported. The helical thread **45** leads into a spiral groove **53** which at its bottom end opens onto the support ledge **47** (see FIG. 6). Thus, each time the separator screw **20** makes a full rotation beneath the stacks A and B, the lowermost end closure C in each stack is cut out from the bottom of the stack and forced into the spiral groove **53**, the momentum of each end closure C and the force of gravity thereafter causing the closure to drop through the spiral groove **53** and onto the ledge **47** in horizontal position, as seen at the right of FIG. 2. The separator screw **20** is of a type which is disclosed in the United States patent to Pechy 2,750,913, issued June 19, 1956.

Each of the planetary gears **36, 37, 38** and **39** has eccentrically mounted thereon an upwardly extending feed pin or pusher **48, 49, 50** and **51**, respectively, as shown in FIGS. 2 and 3. Each of the feed pins **48** through **51** extends upwardly from its respective planetary gear a predetermined distance which allows the pin to engage an end closure C when the inner portion thereof has been lowered onto the support ledge **47** of the sun gear flange **46** by the separator screw **20**, and which permits each feed pin to clear or pass under the lowest end C of each of the stacks A and B when the inner portion of the lowest end C is supported on the helical thread **45** of the separator screw **20** (see FIG. 2).

FIG. 5 illustrates the path **54** of the planetary gears **36** through **39** and the path **56** of the eccentrically mounted feed pins **48** through **51** with respect to the center **52** of the shaft **22**. Since the speed of each of the feed pins **48** through **51** is a function of its radial distance from the center of rotation **52**, each feed pin is traveling at maximum speed when it occupies the position of the feed pin **51**, shown in FIGS. 3 and 5, wherein the feed pin **51** is at the maximum radial distance from the center of rotation **52**. Similarly, when each feed pin reaches the position of the feed pin **49** (FIGS. 3 and 5), it is traveling at minimum speed since it is at the smallest radial distance from the center of rotation **52**. When each of the feed pins **48** through **51** is at the position of the pins **48** and **50**, therefore, it is traveling at a speed which is between the maximum and minimum speeds.

A transfer turret **58** or other means of receiving the end closures C which are removed from the stacks A and B, is disposed adjacent the depending flange portion **14** of the housing **12** at a point where each of the feed pins **48** through **51** reaches maximum velocity, namely, the position of the feed pin **51** in FIGS. 3 and 5. The turret **58** is provided with pockets **60** which are indexed with the feed pins **48** through **51** to receive therein end closures C which are being advanced at maximum velocity by the feed pins **48** through **51**. As shown in FIGS. 1 and 3, a guide member **62** is provided to retain the ends C in the pockets **60**.

In operation, the rotating separator screw **20** makes two revolutions for every one revolution of the planetary gears **36** through **39** around the stationary sun gear **34**, as hereinbefore described. Since the helical thread **45** of the separator screw **20** is so constructed to remove one end closure C from each of the stacks A and B for each revolution of the separator screw **20**, during one revolution of the planetary gears **36** through **39** around the stationary sun gear **34**, the separator screw **20** makes two revolutions and thus removes two ends C from each stack A and B. In addition, owing to the identical size and one-to-one gear ratio of the planetary gears **36** through **39** and the stationary sun gear **34**, each of the eccentrically mounted feed pins **48** through **51** rotates 360° around the center of its respective planetary gear for each revolution of the planetary gear around the stationary sun gear **34**.

As shown in FIGS. 1 through 3, the rotation of the separator screw **20** is timed or indexed with the rotation of the planetary gears **36** through **39** such that an end C is dropped from the stack B onto the supporting ledge **47** of the sun gear flange **46** just pior to the time that each of the feed pins **48** and **50** on the planetary gears **36** and **38**, respectively, reach the stack B. Similarly, the helical thread **45** of the separator screw **20** causes an end C to drop from the stack A onto the supporting ledge **47** of the flange **46** just prior to the time that the feed pins **49** and **51** on the planetary gears **37** and **39**, respectively, reach the stack A. Thus, the feed pin **48** on the planetary gear **36** passes under the stack A, while the feed pin **50** on the diametrically opposed planetary gear **38** engages the separated end closure C from stack B on the support ledge **47** of the sun gear flange **46** (see FIG. 2). At the same time, the feed pin **49** on the planetary gear **37** is in engagement with and is advancing an end C on the support ledge **47** which was previously separated from the stack A by the helical thread **45** of the separator screw **20**, and the feed pin **51** on the diametrically opposed planetary gear **39** is advancing an end C, previously separated from the stack A, into one of the pockets **60** of the transfer turret **58**.

When the planetary gears **36** through **39** have rotated 90° in a counter-clockwise direction from the positions shown in FIG. 3, the separator screw **20** has rotated approximately 180° so that the helical thread **45** thereon causes the bottom end C of the stack A to drop onto the

support ledge **47** of the sun gear flange **46**, and the feed pin **51** is advanced to the position of the feed pin **48** in FIG. 3 wherein the pin **51** engages the end C which has dropped from the stack A onto the support ledge **47**. Also, after the 90° of rotation, the feed pin **48** is advanced to the position of the feed pin **49** in FIG. 3 wherein the pin **48** is without an end closure C since the feed pin **48** has passed under the stack A as shown in FIG. 2; the feed pin **49** is advanced to the position of the feed pin **50** in FIG. 3 wherein the end closure C in engagement with the pin **49** has the outer portion thereof disposed in the depressed portion **19** of the guide channel **18** in the flange portion **16** of the housing **13**, so that the last mentioned end closure C is advanced under the stack B (see FIG. 4); and at the same time, the feed pin **50** is advanced to the position of the feed pin **51** in FIG. 3 wherein its respective end closure C supported on the ledge portion **43** is discharged into a pocket **60** of the transfer turret **58**.

After approximately 180° of counter-clockwise rotation of the planetary gears **36** through **39** from the position shown in FIG. 3, the separator screw **20** has rotated 360° to again cause the lowest end closure C to drop from the stack B onto the support ledge **47** of the sun gear flange **46**, and the feed pin **48** is advanced to the position of the feed pin **50** in FIG. 3 wherein it engages the end C which has dropped from the stack B. Also, the feed pin **49** is advanced to the position of the feed pin **51** in FIG. 3 wherein it discharges its respective end C into a pocket **60** of the transfer turret **58**; the feed pin **50** is in the position of the feed pin **48** shown in FIG. 3 wherein it is disposed adjacent to and below the stack A, and the feed pin **51** is advanced to the position of the feed pin **49** in FIG. 3 wherein it is in engagement with and is advancing an end C from the stack A.

Thus, it will be readily seen that the separator screw **20** continuously separates or drops ends C from the stacks A and B, and that the feed pins **49** and **51** continuously engage and advance the separated ends C from stack A, while the feed pins **48** and **50** continuously engage and advance separated ends C from stack B. Because the ends C from stack A are disposed in the depressed portion **19** of channel **18** rather than in the channel **17** of flange **16** as they pass the stack B, there is no interference between ends from the different stacks A and B.

Since, as hereinbefore described, the radial distance of each of the feed pins **48** through **51** from the center **52** of the shaft **22** varies as the planetary gears **36** through **39** travel around the stationary sun gear **34**, the speed of each of the feed pins **48** through **51** varies in accordance with its radial distance from the center of rotation **52** as it travels thereabout. Thus, when each of the feed pins **48** through **51** is at the position of the feed pin **49** in FIG. 3, it is traveling at minimum speed since it is at the smallest radial distance from the center **52** of the shaft **22**. Similarly, when each of the feed pins **48** through **51** is at the position of the pin **51** in FIG. 3, it is traveling at a maximum speed since it is at the greatest radial distance from the center **52**; and, when each of the feed pins **48** through **51** is at the position of either the pin **48** or the pin **50** in FIG. 3, it is traveling at a speed which is greater than that of the pin **49** but less than that of the pin **51**.

It will be understood, therefore, that the end closures C which are removed from the stack A and engaged by the feed pins **49** and **51**, are initially engaged by these feed pins at a medial speed, then decelerated to the minimum speed and finally accelerated to the maximum speed as they are transferred to the pockets **60** of the transfer turret **58**. Similarly, when the end closures C are removed from the stack B, they are initially engaged by the fed pins **48** and **50** at a medial speed and then they are accelerated in a counter-lockwise direction to the maximum speed, at which latter speed the ends C from stack B are discharged into the pocket **60** of the transfer turret **58**. Since the end closures C from the stacks A and B are initially engaged by their respective feed pins at a speed which is less than the maximum speed, there is less possibility of damage to the end closures from the impact force of the feed pins. Subsequent to the initial engagement of the ends C by the feed pins **48** through **51**, the feed pins then are accelerated to maximum speed as they are adjacent the transfer turret **58**. Thus, the ends C are inserted into the pockets **60** of the transfer turret **58** at maximum speed to thereby provide safe, high speed transfer of the ends C from the stacks A and B to the transfer turret **58**.

The instant apparatus obviously may be used for feeding many types of articles other than end closures for containers, and it may be used for feeding articles from a single stack or from a number of stacks in excess of two, without departing from the scope of the instant invention.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. Apparatus for feeding container end closures at high speed from a pair of substantially diametrically opposed stacks thereof to a predetermined point, comprising a rotatable separator screw having a helical thread on the outer surface thereof on which the lowermost end closure of each stack is partially supported, said thread being so constructed that the lowermost end closure drops from each stack during each revolution of said separator screw, means for supporting said end closures after the dropping thereof from the stacks, and feeding means rotating in a predetermined timed relationship with said separator screw for engaging the dropped end closures on said supporting means at a first speed and for accelerating said dropped end closures to a second and higher speed as they are advanced on said supporting means to said predetermined point, said feeding means comprising four planetary gears in engagement with and equally spaced around a stationary sun gear, each of said planetary gears having end closure engaging means thereon and making one revolution around said sun gear for each two revolutions of said separator screw.

2. The apparatus of claim **1** wherein said end closure engaging means comprises upwardly extending feed pin which is eccentrically mounted on each of said planetary gears, the upper end of each of the feed pins being disposed above said dropped end closure and below said lowest end closures of each of said stacks.

3. The apparatus of claim **2** wherein said supporting means is constructed so that the dropped end closure from one of said stacks passes under the other of said stacks when it is advanced on said supporting means by one of said feed pins.

4. Apparatus for feeding articles at high speed from a stack thereof to article transfer means, comprising a rotatable separator screw having a helical thread on the outer surface thereof in which a portion of the lowermost article in the stack is disposed, a predetermined rotation of said separator screw serving to separate said lowermost article from the stack through said helical thread, and feeding means rotating in a predetermined timed relationship with said separator screw for engaging each separated article at a first speed which avoids damage to the article and for advancing and accelerating the article to a second speed for discharge to the article transfer means, said feeding means comprising a plurality of planetary gears, each of which has a feed pin eccentrically mounted thereon which is adapted to engage a separated article.

5. Apparatus for feeding articles at high speed from a plurality of stacks thereof to article transfer means, comprising rotatable separator means on which the lowermost article of each stack is partially mounted, said separator means causing the lowermost article from each stack to drop therefrom after a predetermined rotation thereof, means for supporting articles after they have dropped from the stacks, and feeding means rotating in a predetermined timed relationship with said separator means for engaging said dropped articles at a first speed and for accelerating said dropped articles to a second and higher speed as they are advanced on said supporting means to the article transfer means, said feeding means comprising a plurality of planetary gears which are in engagement with a stationary sun gear, each of said planetary gears having an upwardly extending feed pin eccentrically mounted thereon which is positioned to engage a dropped article.

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