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(54) METHOD AND APPARATUS FOR AUTOMATICALLY PACKAGING FOOD

(71) We, TOYO CO., LTD., a Japanese Company, of 5-5, 1 chome, Meishin cho, Amagasaki City, Hyogo Prefecture, Japan, do hereby declare this invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Generally, automatic packaging of food involves making bags with their upper ends open by a bag making machine, charging food into the bags, and sealing said open portions. Other methods involve using a cylindrical forming chute, around which a required amount of ready-made tubular film is mounted, downwardly feeding said tubular film in synchronism with the operation of charging food through the forming chute, and heat sealing the top and bottom of a food-receiving region of the film to confine the food. In any of these methods, the formation of bags or of a tubular film and charging of food thereinto must be performed by separate machines and hence the automatic packaging of food becomes correspondingly ineffective, and also none of such machines include a degassing station to degas the food in the food receiving region prior to sealing.

According to one aspect of the present invention thereis provided a method of automatically packaging food, comprising the steps of feeding out a packaging film from a roll thereof to transfer it to a cylindrical forming chute, imparting a tension to the film during said transfer, progressively cylindrically wrapping the film by means of a forming plate around the outer peripheral surface of said forming chute, vertically heat sealing an overlap of opposed lateral edges of said wrapped film to render it into a tubular form, charging food into a food receiving region of the tubular film adjacent the forming chute, downwardly feeding the tubular film by feed means and forming a pair of upper and lower transversely extending heat seals on the film at positions above the food-receiving region of the film and substantially concurrently severing the film between said upper and lower heat seals wherein a degassing operation on the food receiving region is effected prior to discharge of a food package by lateral displacement from a receiving table.

According to another aspect of the invention there is provided automatic food packaging apparatus, comprising film supplying means for supplying a packaging film from a roll thereof, a forming plate adapted to assist in progressively cylindrically wrapping said film around an upper portion of a cylindrical forming chute, film tension means installed in the path of travel of the film between said forming plate and said film supplying means, bag length transfer detection means installed in said path of travel, a hopper section including means for detecting the discharge of food therefor into the forming chute, vertical heat sealing means for heat sealing an overlap of the opposed lateral edges of said wrapped film to render it into a tubular form, feed roll means installed at the lower end of the forming chute and adapted to downwardly feed the tubular film by an amount corresponding to a bag length after the operation of said vertical heat sealing means, transverse heat sealing and severing means disposed below the lower end of the forming chute and adapted to form a pair of upper and lower parallel heat seals on the film at a position above a feed receiving region of the film and to sever the film between said two heat seals after the film feeding operation has been effected by said feed roll means, and package discharging means disposed below the transverse heat sealing

and severing means and adapted to degas the food receiving region of the film and to laterally displace a package from a package receiving table after the operation of said transverse heat sealing and severing means; and control means therefor whereby food from the hopper section is correctly packaged and discharged from said apparatus.

The invention will now be described in more detail with reference to the accompanying drawings showing a preferred embodiment thereof.

In the drawings:

Figure 1 is a front view of an automatic food packaging apparatus:

Figure 2 is a side view of said apparatus:

Figure 3 is an enlarged sectional view showing the internal arrangement of the apparatus;

Figure 4 is a partly broken-away enlarged plan view of hopper device;

Figure 5 is a side view, in longitudinal section, of the hopper device;

Figure 6 is an enlarged front view of a forming chute;

Figu re 7 is a transverse section of a transverse heat sealing device;

Figure 8 is a transverse section of a desgassing device; and

Figure 9 is a view showing a torque transmitting mechanism.

Referring to the drawings, film supplying means, designated at A, comprises support rolls 3 and 4 journaled between a pair of brackets 5, 5 on one side of a body 1 on the upper part of the apparatus, said support rolls supporting a roll of ribbonlike packaging film 2.

One support roll 3 is rotated by the turning force of a motor 9 transmitted thereto through pulleys 6 and 7 and a belt 8, whereby the roll of packaging film 2 supported on the support rolls 3 and 4 is rotated to progressively pay out the ribbonlike film 10. The film 10 travels to a forming plate 13 via guide rollers 11*a*-11*c* and a dancer roller 12. The functions of the dancer roller 12 and microswitch 14 adapted to be turned on and off by said dancer roller have close connection with the function of feed rolls 15 and 16 to be later described, and hence a description thereof will be given later. The forming plate 13 is disposed outside a cylindrical forming chute 17 to surround the latter so that the film 10 having its direction of travel reversed by a reversing roller 18 can be wrapped around the outer surface of the chute 17. Thus, the forming plate 13, as shown in Figure 6, consists of a skirt plate 13*a* obliquely disposed outside the forming chute 17. The upper surface of the skirt plate, which is a slide surface for the ribbonline film 10, is gradually curved in such a manner that as it approaches the forming chute 17, its curvature approaches the curvature of the outer surface of the forming chute. The upper end portion of the skirt is fitted on the forming chute 17 with a small annular clearance 13*b* defined therebetween to allow the film to pass therethrough. As the film 10 travels sliding on the skirt plate 13*a* after passing around the reversing roller 18, it is progressively cylindrically curved and passing through said annular clearance 13*b* it is wrapped around the forming chute 17.

Designated at B is a hopper device disposed above the chute 17. The hopper device B comprises upper and lower hoppers 19*a* and 19*b*. Disposed inside the upper hopper 19*a* is a shutter plate 21 rotatable around a horizontal shaft 20 through about 90° between a horizontal position and a vertical position. Fized on one end of the horizontal shaft 20 projecting outsidethe hopper 19*a* is a balance arm 22 having a balance weight 23 fitted thereon. The shutter plate 21 is normally in its horizontal position in that one end 22*a* of the balance arm 22 abuts against a stop 24, but only when a predetermined amount of food accumulates on the shutter plate 21, the latter is downwardly turned against the balance weight 23 to allow the food to be charged into the chute 17 through the lower hopper 19*b*. This means that a so-called food measuring section is constituted by the shutter plate 21 and balance weight 23. Thus, the setting of amounts to be measured out is determined by the position of the balance weight 23 on the balance arm 22. Further, the other end of the horizontal shaft 20 has a sector cam plate 26 fixed thereon, and a microswitch 27 is mounted on the outer wall surface of the upper hopper 19*a* so as to be associated with said sector cam plate 26. As the shutter plate 21 is downwardly turned, the sector cam plate 26 kicks the actuator 27*a* of the microswitch 27 to turn on the microswitch, whereby two timers, which are known *per se* and hence not shown, are activated. The first timer is used for driving vertical heat sealing means 28 while the second timer is used for driving the feed rolls 15 and 16.

In addition, in this hopper means B, it is possible to use only the lower hopper 19*b*, with the upper hopper 19*a* omitteed. The hopper 19*a* also serves as measuring means, as described above, and it will be needed when food is to be charged into the forming chute 17 while measuring out the same. However, when premeasured amounts of food are to be successively charged into the hopper device, it is only

necessary to use the lower hopper 19*b* alone. In that case, as shown in Figure 3, a microswitch 81 for detecting the passage of food may be installed inside the lower hopper 19*b*. Such microswitch 81 may, of course, be replaced by a photo tube switch. Such switching element 81 will be connected to said two known timers.

Below the forming chute 17, a pair of parallel rotary shafts 30 and 31 are supported for rotation only, by the apparatus body 1 through bearings 29 (Figure 6). Roll support blocks 32 and 33 are rotatably supported on the outside projecting ends of the rotary shafts 30 and 31 and have the feed rolls 15 and 16 journaled at their free ends. These feed rolls 15 and 16 are located at the lower end of the forming chute 17 on opposite sides thereof and as shown in Figure 6, they are always urged toward the forming chute 17 by the resilient force of a spring member 34 interposed between the support blocks 32 and 33. Under this resilient force, the feed rolls are pressed against small rolls 35 and 36 supported on opposite sides of the forming chute 17. The film 10 is nipped between the feedrolls 15, 16 and the small rolls 35, 36 and it will be downwardly transferred when the feed rolls 15, 16 are driven, as will be later described. Therefore, the feed rolls 15, 16 and the small rolls 35, 36 constitute downward film feeding means C. The rotary shafts 30 and 31 have gears 37 and 38 fixed thereon which mesh with each other, while gears 39 and 40 meshing with said gears 37 and 38, respectively, are integrally fixed to the feed rolls 15 and 16, respectively. Therefore, by imparting a turning force to one of the rotary shafts 30 and 31, the feed rolls 15 and 16 will be rotated.

The feed roll driving mechanism will now be described. As shown in Figure 9, it is so arranged that turing force of a motor 42 is always transmitted to the input side of a magnetic clutch 47 through the output shaft 43 of a speed reducer 41, sprockets 44 and 45 and a chain 46. Upon engagement of the magnetic clutch 47, a shaft 48 is rotated and the turning force of the shaft 48 is transmitted to the rotary shaft 31 through bevel gears 49 and 50. The magnetic clutch 47 is actuated by the previously described second timer with some amount of time lag after the microswitch 27 is turned on, whereby the feed rolls 15 and 16 are rotated and hence the film 10 wrapped around the forming chute 17 is downwardly fed by an amount corresponding to the length of one bag. Means E for detecting the amount of feed of the film 10 corresponding to one bag length comprises a photo tube switch 51 shown in Figure 3 which detects sense marks printed on the film 10 at intervals of one bag length, the resulting detection signal causing the disengagement of the magnetic clutch 47. Thus, the amount of each feed of the film 10 corresponds to the distance between adjacent sense marks.

In order to assure the film feed by the feed rolls 15 and 16, tension means D is provided for imparting a suitable tension to the film 10. The means D comprises the previously described dancer roller 12. Thus, the dancer roller 12 is placed on the film 10 between the guide rollers 11*a* and 11*b*, with its weight utilized to pull the film 10 downwardly thereby imparting a tension thereto. Further, during the operation of the packaging apparatus, if the timing for intermittently feeding the film by the feed rolls 15, 16 happens to fail to agree with the rate of film feed from the roll of packaging film 2 and overfeed of the film results, then the dancer roller 12 falls to its lowermost position, thereby kicking the actuator of the microswitch 14 to turn off the microswitch and stop the rotation of the motor 9. This means that the delivery of the film is stopped. As the film feed operation of the feed rolls 15 and 16 continues with the motor 9 at rest to the extent that the dancer roller 12 leaves the microswitch 14, the motor 9 is restarted.

Vertical heat sealing means 28 is disposed between the forming plate 13 and the feedl rolls 15, 16 and associated with the forming chute 17. More particularly, a heat sealing block 52 made of a heat-resistant material is secured to the outer surface of the forming chute 17 by set-screws, while a vertically extending heating plate 53 is secured to a support bar 54. After the laps of the time set by the first timer activated by the microswitch 27, a solenoid 55 is energized to withdraw a rod 56, whereby the heating plate 53 is brought into intimate contact with the heat sealing block 52 to carry out predetermined heat sealing. The overlap of the opposite lateral edges of the film 10 wrapped around the forming chute 17 with the help of the forming plate 13 has been positioned on the heat sealing block 52, and heat sealing applied to said overlap finishes the film 10 into a tubular form.

A receiver table 57 is fixed at a position about two film bag lengths below the lower end of the forming chute 17, and transverse heat sealing means 58 and product discharging means 59 are installed between the chute 17 and receiver table 57. The transverse heat sealing means 58, as shown in Figures 3 and 7, comprises a pair of transversely extending upper and lower heating plates 61 and 62 and a cutter 63

disposed therebetween which are fixed to the front ends of rods 60, 60, and a transversely extending heat sealing block 64 associated therewith, the arrangement being such that relative movement of them toward each other results in forming a pair of upper and lower heat seals on the film 10 and also in cutting the film between said heat seals. Designated at 65*a* is a support bar for the heating plates 61, 62 and cutter 63; 65*b*, a support bar for the heat sealing block 64; and 66, 66 designate rods serving to guide the support bar 65*b*. The product dicharging means 59, as shown in Figures 3 and 8, comprises a discharge plate 68 secured to the front ends of rods 67, 67 by set-screws, and a clamping body 69 made of an elastic material, such as sponge, associated therewith, the arrangement being such that relative movement of them results in clamping the film 10 to allow the air therein to escape upwardly, a packaged product 70 being then discharged from the receiver table 57. Designated at 71*a* is a support bar for the discharge plate 68; 81*b*, a support bar for the clamping body 69; and 72 designates rods serving to guide the support bar 71*b*.

The driving of said transverse heat sealing means 58 and product discharging means 59 is effected by cam plates. Thus, referring to Figure 9, a cylindrical cam unit 77 having cam plates 73-76 fixed thereon is fitted on the speed reducer output shaft 43, and a magnetic clutch 78 is installed between said cam unit 77 and the output shaft 43 and is adapted to drive the cam unit 77. The cam plates 73 and 74 are associated with the product discharging means 59 and have levers (not shown) pressed thereagainst so that they are swung as the cam plates 73 and 74 are rotated, thereby initiating relative movement of the discharge plate 68 and the clamping body 69 toward each other for degassing, followed by relative movement thereof away from each other, whereupon the discharge plate 68 alone is advanced so that the packaged product 70 on the receiver table 57 is discharged. The cam plates 75 and 76 are associated with the transverse heat sealing means 58 and arranged so that just after said degassing by the product discharging means 59 and prior to said packaged product discharging operation, predetermined heat sealing and cutting are effected. As for the application of heat sealing to the overlap of the opposite lateral film edges by the longitudinal heat sealing means 28 previously described, the time delaying action of the first timer may be set so that said heat sealing is effected during the time the film 10 is stationary between the degassing operation and the packaged product discharging operation. Designated at 79 is a cam plate integral with the cam unit 77, adapted so that when the transverse heat sealing means 58 is actuated it actuates a microswitch 80 to energize the magnetic clutch 47 for a very short time to rotate the feed rolls 15 and 16, thereby inching the film 10. This inching drive is necessary in that if heat sealing is applied to the film 10 tensioned under the weight of the food received therein, there would be fear of the film 10 being broken. Thus, the inching drive of the film 10 serves to relieve the film tension.

In operation, food is continuously supplied to the hopper means to accumulate on the shutter plate 21, during which time the overlap of the opposite lateral edges of the film 10 wrapped around the forming chute 17 is heat sealed by the longitudinal heat sealing means 28 to change the film into a tubular form. It is to be understood that the lower end of the film 10 has already been heat sealed by the transverse heat sealing means 58 during the idle running of the packaging apparatus and hence said lower end has been closed. When the amount of food accumulating on the shutter plate reaches a predetermined weight set by the balance weight 23, the shutter plate 21 is downwardly turned to charge the food into the forming chute 17. The microswitch 27, which has been concurrently turned on, activates the first and second timers. The second timer functions so that with a sufficient time lag to allow the food to fall to the lower end of the film 10, the magnetic clutches 47 and 78 are engaged to rotate the feed rolls 15 and 16 and the cam unit 77. The feed rolls 15 and 16 feed the film 10 by an amount corresponding to one bag length, and as soon as the lower end of the film 10 reaches the top of the receiver table 57, the photo tube switch 51 (in Figure 3) detects a sense mark on the film 10 and creates a signal to cause the disengagement of the magnetic clutch 47 shown in Figure 9, with the result that turning force is no longer transmitted to the shaft 48 connected to the rotary shaft 31, thereby bringing the feed rolls 15 and 16 to a halt. Further, the rotating cam unit 77 actuates the product discharging means 59, causing the clamping body 69 and discharge plate 68 to clamp the food-receiving region of the film for degassing. Just after this degassing operation, the transverse heat sealing means 58 is actuated to apply heat sealing and cutting to the upper part of the food-receiving film region. When the transverse heat sealing means 58 is thus actuated, the microswitch 80 is actuated so that the magnetic clutch 47 which has been disengaged by the signal

from the photo tube switch 51 is engaged for a very short time to effect the inching of the film by the feed rolls 15 and 16, as previously described. In this way, the food is packaged to provide a product 70, which is discharged from the receiver table 57 by the forward movement of the discharge plate 68, whereupon the transverse heat sealing means 58 and the product discharging means 59 are restored to their original positions. Of the pair of upper and lower heat seals provided by the transverse heat sealing means 58, the lower heat seal serves to close the upper portion of the product 70, while the upper heat seal serves to close the bag bottom of a product to be subsequetly obtained. Further, by the action of the first timer, the vertical heat sealing means 28 is actuated to act on the next film portion between the degassing time and the product discharging time. By repetition of these operations, continuous automatic food packaging is carried out.

WHAT WE CLAIM IS:

1. A method of automatically packaging food, comprising the steps of feeding out a packaging film from a roll thereof to transfer it to a cylindrical forming chute, imparting a tension to the film during said transfer, progressively cylindrically wrapping the film by means of a forming plate around the outer peripheral surface of said forming chute, vertically heat sealing an overlap of opposed lateral edges of said wrapped film to render it into a tubular form, charging food into a food-receiving region of the tubular film adjacent the forming chute, downwardly feeding the tubular film by feed means, and forming a pair of upper and lower transversely extending heat seals on the film and substantially concurrently severing the film between said upper and lower heat seals, wherein a degassing operation on the food receiving region is effected prior to discharge of a food package by lateral displacement from a receiving table.

2. A method as set forth in claim 1, wherein the film is inched downwardly by said feed means in synchronism with said transverse heat sealing operation.

3. A method as set forth in claim 1 or claim 2, wherein said vertical heat sealing operation is effected after said transverse heat sealing operation.

4. A method as set forth in any one of claims 1 to 3, wherein said degassing is effected by a film clamping action brought about by cooperation between a clamping body and a discharge plate disposed above a food product receiving table as they move toward each other, and wherein after said cutting, the clamping body is retracted while the discharge plate is forwardly moved to discharge a packaged food product from said food product receiving table.

5. A method of packaging food as claimed in claim 1 and substantially as herein described with reference to the accompanying drawings.

6. Automatic food packaging apparatus, comprising film supplying means for supplying a packaging film from a roll thereof, a forming plate adapted to assist in progressively cylindrically wrapping said film around an upper portion of a cylindrical forming chute, film tension means installed in the path of travel of the film between said forming plate and said film supply means, bag length transfer detection means installed in said path of travel, a hopper section including means for detecting the discharge of food therefrom into the forming chute, vertical heat sealing means for heat sealing an overlap of the opposed lateral edges of said wrapped film to render it into a tubular form, feed roll means installed at the lower end of the forming chute and adapted to downwardly feed the tubular film by an amount corresponding to a bag length after the operation of said vertical heat sealing means, transverse heat sealing and severing means disposed below the lower end of the forming chute and adapted to form a pair of upper and lower parallel heat seals on the film at a position above a food-receiving region of the film and to sever the film between said two heat seals after the film feeding operation has been effected by said feed roll means, and package discharging means disposed below the transverse heat sealing and severing means and adapted to degas the food recieving region of the film and to laterally displace a package from a package receiving table after the operation of said transverse heat sealing and severing means; and control means therefor whereby food from the hopper section is correctly packaged and discharged from said apparatus.

7. Apparatus as set forth in claim 6, wherein said film supplying means comprises a pair of support rolls, supporting the roll of packaging film, one support roll being operatively connected to a motor, the rotation of said support roll causing the roll of packaging film to be rotated to pay out the film.

8. Apparatus as set forth in claim 6 or claim 7, wherein said tension means comprises a pair of parallel guide rolls, a dancer roller placed on the film between said guide rolls, and a switch element for detecting the descent of said dancer roller to the lowermost position.

9. Apparatus as set forth in claim 8, wherein said switch element operates to stop said motor by detecting the descent of the dancer roller to the lowermost position.

10. Apparatus as set forth in any one of claims 6 to 9, wherein said bag length transfer detection means stops the operation of said feed roll means feeding the tubular film by detecting with a photo tube switch, a sense mark printed on the film.

11. Apparatus as set forth in any one of claims 6 to 10, wherein said hopper section contains a shutter plate normally forced to a horizontal position but adapted to be downwardly turned against its horizontal position retaining means only when an amount of food having a predetermined weight accumulates thereon, the downward turning of said shutter plate being detected by a switch element.

12. Apparatus as set forth in any one of claims 6 to 11, wherein vertical heat sealing means comprises a heat sealing block secured to the outer surface of the forming chute, and a heating plate mounted so that it can be moved toward and away from the heat sealing block, said heating plate being brought into intimate contact with the heat sealing block upon energisation of a solenoid.

13. Apparatus as set forth in any one of claims 6 to 12, wherein said feed roll means comprises small rolls, journalled on the outer peripheral surface of the forming chute, and feed rolls, always elastically urged against said small rolls, the film being nipped between said small rolls, and the feed rolls, said rolls being driven by a signal from said food charge detecting means.

14. Apparatus as set forth in any one of claims 6 to 13, wherein said transverse heat sealing means includes a pair of support bars with the film disposed therebetween, one support bar carrying a pair of upper and lower heating plates, and a cutter positioned between said heating plates, the other support bar carrying a heat sealing block, said two support bars being adapted to move toward and away from each other.

15. Apparatus as set forth in any one of claims 6 to 14, wherein said product discharging means includes a pair of support bars, with a food-receiving region of the film disposed therebetween, one support bar carrying a discharge plate, the other support bar carrying a clamping body, the relative movement of said two support bars being effective to degas a food-receiving region of the film.

16. Apparatus as set forth in claim 15, wherein the clamping body is an elastic body.

17. Appartus as set forth in claim 15, wherein when the clamping body is retracted after said degassing, the discharge plate is forwardly moved to discharge a product from the product receiving table.

18. Apparatus as claimed in claim 6 and substantially as herein described with reference to and as illustrated in Figures 1 to 9 of the accompanying drawings.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
40-43 Chancery Lane,
London, WC2A 1JQ.

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4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

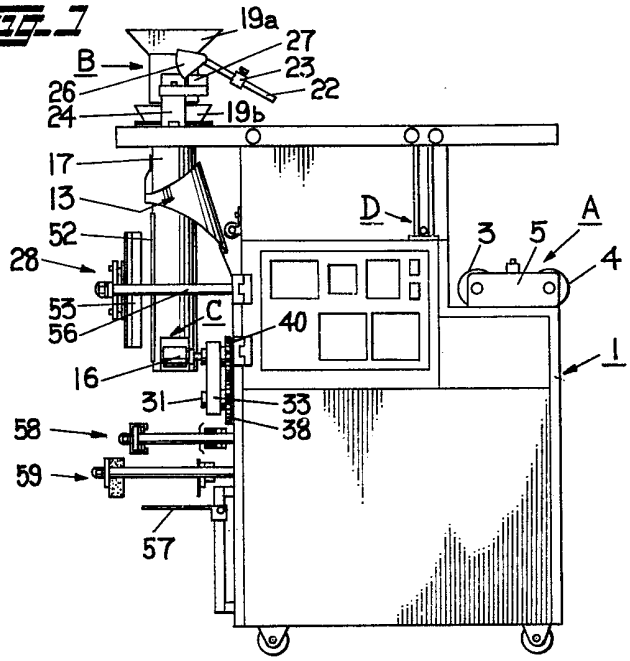


FIG. 4

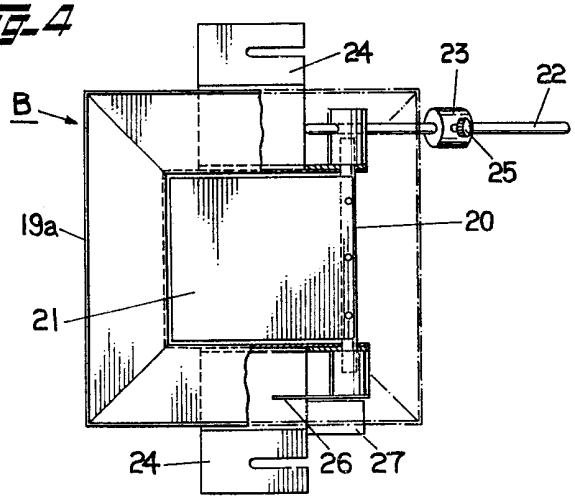
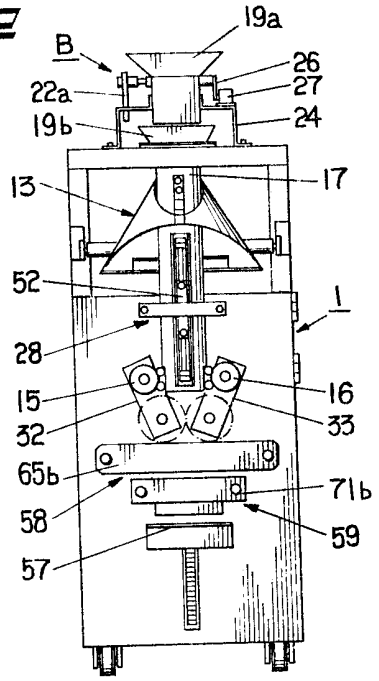


Fig-2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57

Fig-5

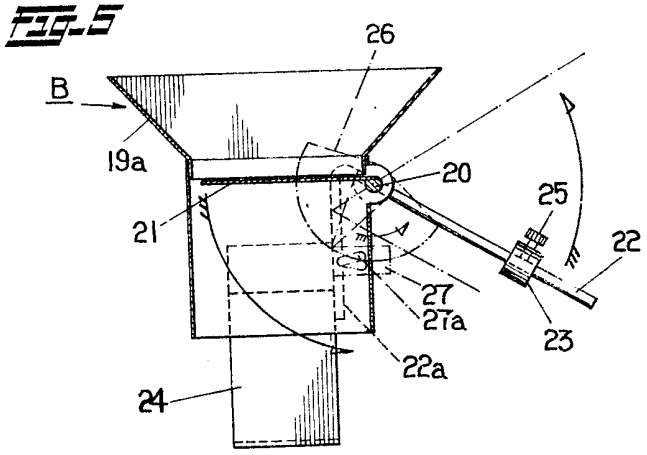
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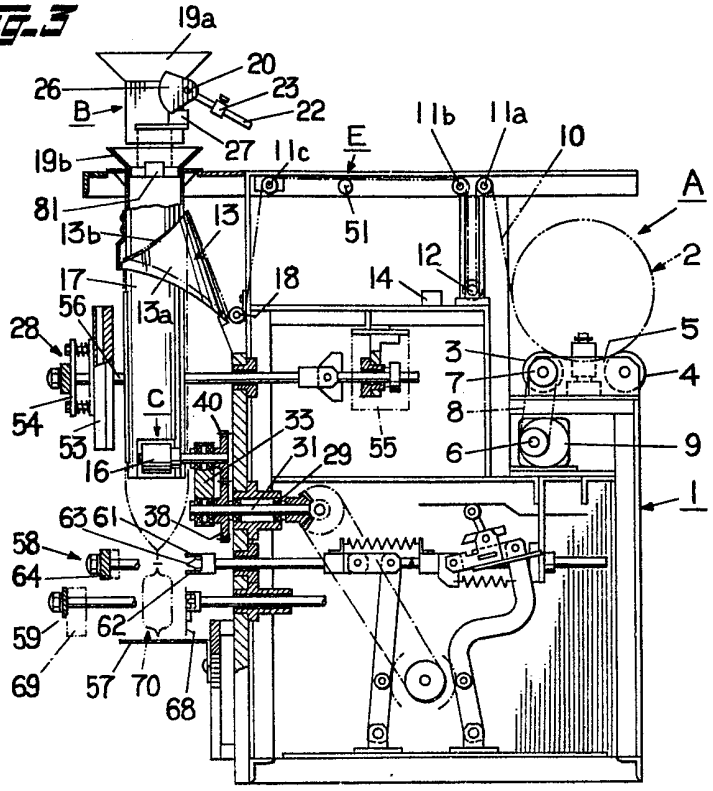
FIG. 3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4
C
40
8
54
33
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FIG. 7

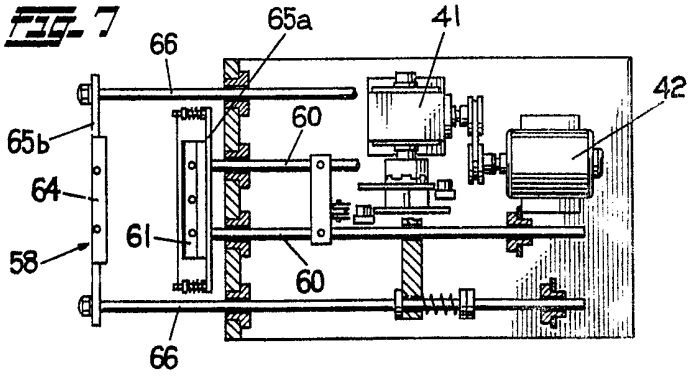
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FIG. 6

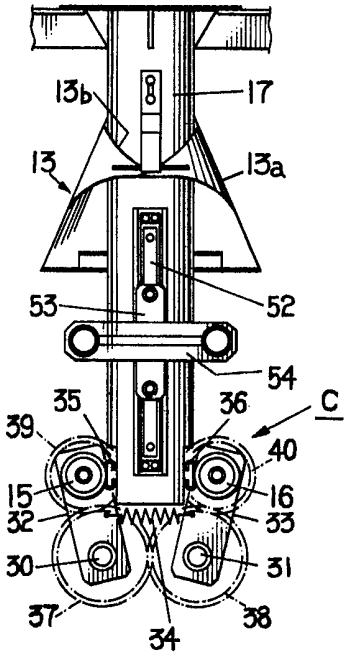

FIG. 9

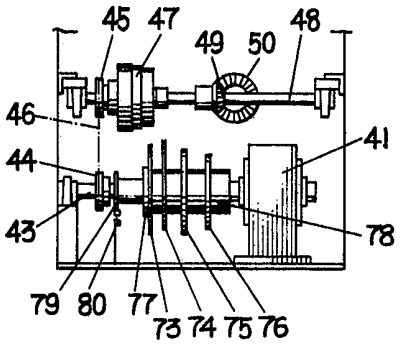

FIG. 8