

# PATENT SPECIFICATION

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## (54) A METHOD AND DEVICE FOR MAKING CONFECTIONERY LOLLIPOPS

(71) I, HENRICUS ANTONIUS JACOBUS MARIA DERCKX, of St. Antoniusstraat 31, Weert, Holland, a Dutch Subject, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be performed, to be particularly described in and by the following statement:

The invention relates to a method for making confectionery lollipops consisting of the supply of a strand of confectionery, the separation of pieces of confectionery from the strand, the prepressing of the pieces, the supply of small sticks, the insertion of the sticks into the prepressed pieces of confectionery, the subsequent pressing of the stick-provided pieces of confectionery lollipops and the further conveyance of the lollipops. The invention also relates to apparatus for making confectionery lollipops.

The most elementary method for making confectionery lollipops consists of the supply of a strand of confectionery into a moulding cavity, the cutting of a small piece from the confectionery strand by a lower stamp moving through a cylinder which lower stamp presses the piece of confectionery against an upper stamp, whereupon these stamps move together to a supply station for the sticks in which a stick is inserted, the upper stamp then starting to move quicker so that the cutting stamp or lower stamp is able to press the lollipop from the cylinder. With this method a production of 120 confectionery lollipops per minute is possible.

Higher productions are possible with a device according to Netherlands Patent Specification No. 91,633 in which the strand of confectionery is supplied tangentially to a drum, the pressing of the confectionery lollipops taking place by means of moulding dies which are slidable parallel to the centre line of the drum. Herewith a production of 1,000 confectionery lollipops per minute is possible.

It appears that higher production speeds are yet possible with another known method and device but the device which is to be used for such a method is very compli-

cated, because, e.g. separate cutting stamps are necessary to sub-divide the strand of confectionery into pieces. Moreover, because of this, the number of moving parts is very great, it being especially noticeable that the upper cutting stamps have to move along with the drum. Should such a device be required to make lollipops of a different appearance, a very great number of parts will therefore have to be replaced. Consequently, it is important to be able to make the device with as few moving parts as possible and to be able to separate the pieces of confectionery from the sugar strand quickly without being obliged to make use of the influence of gravity, because dependence on gravity would restrict the production speed too much.

According to the present invention there is provided a method of making confectionery lollipops from a strand of the confectionery, the method comprising severing a piece of the confectionery from the strand with a cutting head which is angularly fixed and radially movable relative to the axis of a cylindrical body having a plurality of radially inwardly extending passages therein and introducing said piece into one of the passages by means of the cutting head, where the cutting head co-operates with a die head in the passage to prepress the piece of confectionery on to a lollipop stick inserted into the passage, rotating the cylindrical body relative to the cutting head to align said passage including the prepressed and stick-inserted piece of confectionery with a forming head which is angularly fixed and radially movable relative to the axis of the cylindrical body to co-operate with the die head in the passage and thereby define the desired shape of the lollipop, and discharging the formed lollipop from the passage on further rotation of the cylindrical body relative to the cutting and forming heads.

Further according to the present invention there is provided a confectionery lollipop when made by the method described in the immediately preceding paragraph.

Preferably, the stick is urged further into

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the prepressed piece of confectionery during rotation of the cylindrical body to displace said one passage from alignment with the cutting head to alignment with the forming head, and the stick may be still further urged into the piece of confectionery when said one passage is aligned with the forming head.

Conveniently, the cylindrical body is rotated in stepped manner, each step comprising rotation through an angle of  $60^\circ$  in which case the radii along which the cutting head and the forming head are respectively movable may be angularly spaced by  $120^\circ$ . The cylindrical body may thus have six equally angularly spaced passages. The radius along which the cutting head is movable is preferably vertical and conveniently the formed lollipop is discharged from the passage when the passage extends substantially in the vertical plane in which the cutting head is movable, i.e. when the respective passage is angularly displaced by  $180^\circ$  from said radius.

Still further according to the present invention there is provided apparatus for making confectionery lollipops from a strand of the confectionery, the apparatus comprising a cylindrical body which is axially rotatable and has a plurality of passages extending radially inwardly from the periphery at equal angular spacings, and a die head supported for radial movement in each passage; the apparatus further comprising severing and prepressing means which is angularly fixed relative to the cylindrical body and comprises a cutting head which is supported for radial movement relative to the axis of the cylindrical body to sever a piece of the confectionery from the strand and when aligned with one of the passages to introduce said piece into the passage and to co-operate with the respective die head to define a die in which the piece of confectionery is prepressed; stick supply means adapted to insert a lollipop stick into said passage prior to said introduction of the piece of confectionery thereinto; forming means which is angularly fixed relative to the cylindrical body and is angularly spaced from the severing and prepressing means, the forming means comprising a forming head which is supported for radial movement relative to the axis of the cylindrical body and when aligned with said passage on rotation of the cylindrical body to co-operate with the respective die head to define a further die in which the prepressed piece of the confectionery is formed into the desired shape of the lollipop; and discharge means capable of ejecting the formed lollipop from said passage.

The cylindrical body will usually be rotatable by means of a drive shaft and

conveniently the stick supply means comprises a stick drum, which is adapted to receive the sticks and to support them during the forming of the lollipops, is rotatable with the cylindrical body and is mounted on the drive shaft. The stick drum may comprise a cylinder with a respective peripheral groove therein aligned with each passage in the cylindrical body, each said groove extending parallel to the axis of rotation of the cylindrical body and stick drum, and the stick supply means may further comprise a cam surface, and a cam follower associated with the end of each groove remote from the cylindrical body which is adapted to engage the cam surface and the adjacent end of a respective stick in the groove such that on displacement of the associated passage in the cylindrical body into radial alignment with the cutting head the stick is inserted slightly into the passage and such that on further displacement of the associated passage towards radial alignment with the forming head, the cam surface and cam follower act to insert the stick further into the passage. Injections means may be located adjacent to the first-mentioned cam surface and at a position to engage the cam follower of a groove associated with a passage aligned with the forming head to still further insert a stick in said groove into the passage.

Each die head may have a cam follower at its radially inner end and cam means may be provided within the cylindrical body and radially aligned with the severing and prepressing means and the forming means, with which the respective cam follower engages to displace the die head radially outwardly in the passage. The cam means preferably comprise respective rollers which may be eccentrically mounted on respective parallel shafts which are rotatable about their lengths by common means to simultaneously adjust the position of the rollers. Accordingly, the length of the lollipops may be readily varied without having to change the cylindrical body for another one. The parallel shafts may have respective toothed portions in which case the common means may comprise a toothed wheel which engages the toothed portions.

It is preferable that the positions of the stroke of each of the cutting head and forming head is adjustable so that the sticks can always be inserted to the centre of each lollipop even when the length of the latter is adjusted as aforementioned. Where each of the cutting head and forming head is pivotably connected to a bifurcated lever which rigidly engages an angularly displaceable shaft to move the respective head radially inwardly and outwardly, such stroke adjustment can be provided by ad-

justing the position of the bifurcated lever relative to the angularly displaceable shaft. It is also very desirable that the pressing force applied by each of the cutting head and forming head to the confectionery is variable in order to allow for the properties of the particular strand of confectionery, and conveniently the displacement force applied to each of the cutting head and forming head is applied via a compression spring whose active length is adjustable to vary the pressing force.

One embodiment of apparatus in accordance with the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

FIGURE 1 is a part-sectional view of the apparatus illustrating inter alia the cylindrical body in which the confectionery lollipops are made;

FIGURE 2 is a section on the line II-II of FIGURE 1;

FIGURE 3 is a section on the line III-III of FIGURE 1;

FIGURE 4 is a section of the cylindrical body on the line IV-IV of FIGURE 5;

FIGURE 5 is a view in the direction of the arrow A shown in FIGURE 4;

FIGURE 6 is a side view of means shown in FIGURE 1 permitting the adjustment of the die heads in the cylindrical body;

FIGURE 7 is a view in the direction of the arrow B of FIGURE 6;

FIGURE 8 is a view of one eccentric shaft which can be used together with the frame of FIGURES 6 and 7, and

FIGURE 9 is a view, for the greater part in section, on the line IX-IX of FIGURE 2 in which a detail is represented of the means for adjusting the pressing force of a cutting head, and which can be used also by the forming head.

The embodiment of the invention will first be described with reference to FIGURES 1 to 3, and subsequently a few constructive details of the apparatus will be elaborated further.

In FIGURES 1 and 2 a cutting head 1 is represented which is movable towards a die head 2 which is mounted in a cylindrical body 3. A piece of confectionery is cut off from a strand of confectionery 4 by the cutting head 1 during movement of the die head 2 towards it. The strand is supplied (as shown in FIGURE 2) between an upper equalising roller 5 and a lower equalising roller 6 to a severing and prepressing station which includes the cutting head 1. The surfaces facing each other of the cutting and die heads 1 and 2 are hollowed out (as shown in dotted lines in FIGURE 1) to prepare the piece of confectionery for the finally desired shape. The heads 1 and

2 have a circular section in this embodiment, but may have other cross-sections in different embodiments of the invention. The cutting head 1 is attached to a fastening block 33, and there are provisions which will be described hereinafter for the accurate adjustment of the stroke of the cutting head 1 and of the force it can exert on the confectionery during the combined severing and prepressing operation. Similar adjustment may be provided for a forming head 36 at a forming station when the final shaping of the lollipop is performed by the forming head 36 and an aligned die head 2, the forming head 36 corresponding closely with the cutting head 1.

In FIGURES 1 and 3 a supply of sticks 7 is shown. A stock of these sticks is present in a stick hopper 8 which is located in such a way that a stick drum 9 which is fixedly connected with the cylindrical body 3 can provide for the giving of the correct direction of movement to these sticks. The stick drum 9 further includes peripheral grooves (shown in FIGURE 1) which have the purpose of achieving some saving in weight, which is beneficial in the case of rapidly intermittently driven parts. The sticks are moved by a pin 10 in such a way that during the severing of the piece of confectionery they already extend a few millimeters in one of a plurality of radial passages 40 in the cylindrical body 3 which is aligned with the cutting head 1; during rotation of the cylindrical body to move said passage 40 towards the forming station the insert depth of the stick in the passage increases in a way too to be further elucidated below and at the forming station additional subsequent pressing of the stick takes place with an injection member 11 diagrammatically represented in FIGURE 1.

With reference to FIGURE 2, the finished lollipops 12 are discharged from the cylindrical body 3 at the lower side because the die heads 2 are urged radially outwards during rotation of the cylindrical body 3 by a curved camway 13. Also means (not shown) may be provided which exerts a radially outwardly directed force on the stick of the lollipop 12 in order to assist in the finished lollipop being rapidly ejected in its entirety from the apparatus, since with the desired high production speeds, the influence of gravity is not necessarily sufficient.

In the embodiment described the cylindrical body 3 rotates through an angle of 120° between the severing and prepressing station and the forming station. In principle, however, a smaller angle, of say 90°, could be used, but what is essential is that the cutting, prepressing and subsequent forming are performed through radial movement of the heads relative to the longi-

tudinal centre line of the cylindrical body 3.

The cylindrical body construction and operation will now be further illustrated with particular reference to FIGURE 1.

A driving shaft 14 is connected with the outlet of a drive means (not shown) and can be caused to rotate thereby. The driving shaft 14 rotates in a bearing box which is positioned in a fixed cylindrical bracket 16. Radially outwardly of this bracket 16 bearings 17 rotatably support the stick drum 9. On its side remote from the cylindrical body 3 the stick drum 9 is further connected with a bearing ring 18 carrying guide pins 19 which carry for axial sliding movement respective cam followers 20 that are arranged to abut a curved stick pin cam surface 21 which is mounted on the bracket 16. The cam followers 20 carry pins 10 which engage respective sticks 7 to urge them into associated passages 40 through the cam surface 21. The bracket 16 also carries a curved return cam surface 22 which returns the cam followers 20 with the pins 10 to a start position. At a position between the cam surfaces 21 and 22 corresponding with the position of the forming of the lollipops at the forming station (in this case 120° from the severing and prepressing station), a member 23 of injection means 11 capable of engaging the cam followers 20 is movable to and fro in a sleeve 24. The member 23 is driven by an axially rotatable member 25 having a peripheral and inclined groove in which is located a follower 26 on the member 23. The member 25 rotates to urge the member 23 forwardly, with the follower 20, pin 10 and stick 7, at the correct moment. In FIGURE 3 it is further illustrated, in respect of the guiding of the sticks 7, that a curved stick guide 27 overlies the stick drum 9 to ensure that the sticks 7 remain in receiving grooves 28 (which are equally angularly spaced by 60° from each other and extend in the axial direction) between the severing and prepressing station and the position at which the finished lollipops are discharged with the associated stroke from the apparatus. The receiving grooves 28 have a bevelled leading edge to ensure that a stick 7 is picked up by each groove as it moves through the stick hopper 8.

In FIGURES 1 and 2 pressure rollers 29 are shown which urge the die heads 2 into the correct position in the cylindrical body 3 during the severing and prepressing and during the subsequent forming stage. The die heads have slots 30 in which studs 31 are located to support and limit radial movement of the die heads, particularly during mounting.

The cutting head 1 is driven by an ang-

ularly displaceable shaft 32 rotating to and fro, on which a fastening block 33 is mounted to move the cutting head up and down in a sleeve 35 through a bifurcated lever 48 and pivot connection 34. The forming head 36 moves in a similar way through a sleeve 35 under the influence of a bifurcated lever 48 with a pivot connection 34 and a fastening block 33. Between the two sleeves 35 (i.e. between the severing and prepressing station and the forming station) a protective cover 37 is positioned as an additional safeguard against pieces of confectionery in the passages 40 flying outwards under the influence of centrifugal force. Since the rectilinear movement of the heads 1 and 36 is derived from a to and fro rotating movement of the levers 48 around the shafts 32 each time that the cylindrical body 3 stops after a rotation of 60°, the pivot connections 34 are provided, as represented in FIGURE 2, with so-called slob holes. The position of the stroke of each of the cutting and forming heads 1 and 36 can be adjusted to ensure that the sticks 7 are always introduced centrally into the dies formed by the heads 1 and 36 and the heads 2. Such adjustment is provided for by loosening the block 33 and displacing it relative to the shaft 32 before retightening the block. Further features of the drive of the heads 1 and 36 will be described hereinafter with reference to FIGURE 9.

FIGURES 4 and 5 the cylindrical body 3 is shown on its own and in the view of FIGURE 5 six axially directed recesses 38 are visible having holes 39 through which bolts 58 (FIGURE 1) extend to connect the cylindrical body 3 and the stick drum 9. This provides the possibility for a rapid exchange for another cylindrical body when lollipops having another cross-section are to be produced. In FIGURE 5, furthermore, six radially extending and equally angularly spaced passages 40 are represented in each of which provision is made, in the way indicated in FIGURE 4, to allow location of the studs 31.

The position of the pressure rollers 29 and therefore of the actuated die heads 2, can be adjusted by the construction described below with reference to FIGURES 6 to 8, which construction mainly consists of a frame 41 which is fixed and connected by bolts 42 with the sleeve 35 of the cutting head 1 (FIGURE 1), the bolts extending through holes 43 shown in FIGURE 7. Bores 44 in FIGURE 7 have centre lines which are angularly spaced about centre point H of the frame by 120°, which angle corresponds with the angle between the radii along which the cutting and forming heads 1 and 36 are movable. Through the bores 44 extend parallel adjusting shafts 57,

represented in detail in FIGURE 8, having eccentric parts 59 on which the pressure rollers 29 are rotatably mounted. On the parts of the adjusting shafts 57 with a key-way 45, toothed portions 47 (FIGURE 1) are provided which can be collectively adjusted by rotation of a toothed wheel (not shown) the shaft of which is located in screw-threaded bore 46 shown in FIGURE 7.

The drive of the various parts of the device comprises a known distribution box and will not be described further.

FIGURE 9 illustrates the manner in which the pressing force of the cutting and/or forming heads can be adjusted, such adjustment being described for convenience with reference to the cutting head 1 only.

Essentially, a spring cylinder 49 is provided between the pivot connections 34 and the cutting head 1, in which spring cylinder 49 a spring 50 is located which can be given a longer or shorter stroke by means of a cylinder lid 51 adjustable relative to the cylinder. This construction further includes a rod 53 extending axially through the spring 50 and provided with a shoulder 52, the rod 53 being connected with the cutting head 1 by means of a screw connection 56, the adjustment of the pressing force being achieved by rotation of the lid 51 relative to the spring cylinder 49. The connection 56 also has the result that when the device is used to produce lollipops of other dimensions only a few parts require replacing as well as permitting adjustment of the position of the rod 53 relative to the cutting head 1. In order to achieve strength whilst giving as little risk as possible of jamming the cutting head 1, it is further preferable to guide support shaft 54 additionally rectilinearly in brackets 55 provided with guide slots and located at both sides on the sleeve 35.

It will be clear that few parts need to be replaced with the apparatus described when the lollipops are to be given a different appearance in a subsequent phase of production and therefore technical progress has been achieved with respect to the device according to United States Patent No. 2, 637,281 which only has a production speed of about 200 confectionery lollipops per minute and in which for the reconstruction of the device in order to make lollipops of another shape, twelve dies, twelve upper heads and twelve lower heads are to be replaced.

According to a variation not shown, the line along which the cutting head 1 is movable makes a small acute angle with a perpendicular situated in the vertical plane.

#### WHAT I CLAIM IS:—

1. A method of making confectionery lollipops from a strand of the confectionery,

the method comprising severing a piece of the confectionery from the strand with a cutting head which is angularly fixed and radially movable relative to the axis of a cylindrical body having a plurality of radially inwardly extending passages therein and introducing said piece into one of the passages by means of the cutting head, where the cutting head co-operates with a die head in the passage to prepress the piece of confectionery on to a lollipop stick inserted into the passage, rotating the cylindrical body relative to the cutting head to align said passage including the prepressed and stick-inserted piece of confectionery with a forming head which is angularly fixed and radially movable relative to the axis of the cylindrical body to co-operate with the die head in the passage and thereby define the desired shape of lollipop from the passage on further rotation of the cylindrical body relative to the cutting and forming heads.

2. A method as claimed in Claim 1 in which the stick is urged further into the prepressed piece of confectionery during rotation of the cylindrical body to displace said one passage from alignment with the cutting head to alignment with the forming head.

3. A method as claimed in Claim 1 or Claim 2 in which the cylindrical body is rotated in stepped manner, each step comprising rotation through an angle of 60°.

4. A method as claimed in Claim 3 in which the radii along which the cutting head and the forming head are respectively movable are angularly spaced by 120°.

5. A method as claimed in any one of the preceding claims in which the radius along which the cutting head is movable is vertical.

6. A method as claimed in Claim 5 in which the formed lollipop is discharged from the passage when the passage extends substantially in the vertical plane in which the cutting head is movable.

7. A method of making confectionery lollipops from a strand of the confectionery substantially as herein described with reference to the accompanying drawings.

8. A confectionery lollipop when made by the method claimed in any one of the preceding claims.

9. Apparatus for making confectionery lollipops from a strand of the confectionery, the apparatus comprising a cylindrical body which is axially rotatable and has a plurality of passages extending radially inwardly from the periphery at equal angular spacings, and a die head supported for radial movement in each passage; the apparatus further comprising severing and prepressing means which is angularly fixed relative to the cylindrical body and comprises a cutting

- head which is supported for radial movement relative to the axis of the cylindrical body to sever a piece of the confectionery from the strand and when aligned with one of the passages to introduce said piece into the passage and to co-operate with the respective die head to define a die in which the piece of confectionery is prepressed; stick supply means adapted to insert a lollipop stick into said passage prior to said introduction of the piece of confectionery therewith; forming means which is angularly fixed relative to the cylindrical body and is angularly spaced from the severing and prepressing means, the forming means comprising a forming head which is supported for radial movement relative to the axis of the cylindrical body and when aligned with said passage on rotation of the cylindrical body to co-operate with the respective die head to define a further die in which the prepressed piece of the confectionery is formed into the desired shape of the lollipop; and discharge means capable of ejecting the formed lollipop from said passage.
10. Apparatus as claimed in Claim 9 in which the cylindrical body is rotatable by a drive shaft and wherein the stick supply means comprises a stick drum which is adapted to receive the sticks and to support them during the forming of the lollipops, is rotatable with the cylindrical body and is mounted on the drive shaft.
11. Apparatus as claimed in Claim 10 in which the stick drum comprises a cylinder with a respective peripheral groove therein aligned with each passage in the cylindrical body, each said groove extending parallel to the axis of rotation of the cylindrical body and stick drum.
12. Apparatus as claimed in Claim 11 in which the stick supply means further comprises a cam surface, and a cam follower associated with the end of each groove remote from the cylindrical body which is adapted to engage the cam surface and the adjacent end of a respective stick in the groove such that on displacement of the associated passage in the cylindrical body into radial alignment with the cutting head the stick is inserted slightly into the passage and such that on further displacement of the associated passage towards radial alignment with the forming head, the cam surface and cam follower act to insert the stick further into the passage.
13. Apparatus as claimed in Claim 12 in which a further cam surface is provided to displace each cam follower in the opposite direction to the action of the first-mentioned cam surface after discharge of the lollipop from the associated passage.
14. Apparatus as claimed in Claim 12 or Claim 13 in which the stick supply means further comprises injection means located adjacent to the first-mentioned cam surface and at a position to engage the cam follower of a groove associated with a passage aligned with the forming head to still further insert a stick in said groove into the passage.
15. Apparatus as claimed in Claim 14 in which the injection means comprises a piston member slidable parallel to the axis of the drive shaft to engage the cam follower and displaceable by an axially rotatable member having a peripheral groove therein in which is located a follower on the piston member.
16. Apparatus as claimed in any one of Claims 10 to 15 in which the stick supply means further comprises a stick hopper adapted to supply one stick at a time to each groove in the stick drum.
17. Apparatus as claimed in any one of Claims 11 to 16 in which a curved member is positioned around the periphery of the stick drum to ensure retention of the sticks in respective grooves during rotation of the stick drum and the cylindrical body to the discharge position of the lollipops.
18. Apparatus as claimed in any one of Claims 9 to 17 in which a cover member is provided around the periphery of the cylindrical body between the severing and prepressing means and the forming means.
19. Apparatus as claimed in any one of Claims 9 to 18 in which six passages with associated die heads are equally angularly spaced about the cylindrical body.
20. Apparatus as claimed in Claim 19 in which the radii along which the cutting head and forming head are respectively movable are angularly displaced by 12°.
21. Apparatus as claimed in any one of Claims 9 to 20 in which each die head has a cam follower at its radially inner end and wherein cam means are provided within the cylindrical body and radially aligned with the severing and prepressing means and the forming means, with which the respective cam follower engages to displace the die head radially outwardly in the passage.
22. Apparatus as claimed in Claim 21 in which said cam means comprise respective rollers.
23. Apparatus as claimed in Claim 22 in which the rollers are eccentrically mounted on respective parallel shafts which are rotatable about their lengths by common means to simultaneously adjust the position of the rollers.
24. Apparatus as claimed in Claim 23 in which the shafts have respective toothed portions and wherein the common means comprises a toothed wheel which engages said toothed portions.
25. Apparatus as claimed in any one of Claims 21 to 24 in which the discharge

means comprises a cam surface with which the cam follower on each die head is engageable to displace the die head radially outwardly in its passage and thereby discharge a lollipop from the passage.

26. Apparatus as claimed in Claim 25 in which the downstream end of the cam surface in the direction of rotation of the cylindrical body is angularly displaced from the radius along which the cutting head is movable by 180°.

27. Apparatus as claimed in any one of Claims 9 to 26 in which the radius along which the cutting head is movable is vertical.

28. Apparatus as claimed in any one of Claims 9 to 27 in which each of the cutting head and forming head is pivotably connected to a bifurcated lever which rigidly engages an angularly displaceable shaft to move the respective head radially inwardly and outwardly.

29. Apparatus as claimed in any one of Claims 9 to 28 in which the position of the stroke of each of the cutting head and forming head is adjustable.

30. Apparatus as claimed in Claim 29 when dependent from Claim 28 in which said adjustment is made by adjusting the

position of the bifurcated lever relative to the angularly displaceable shaft.

31. Apparatus as claimed in any one of Claims 9 to 30 in which the pressing force applied by each of the cutting head and forming head to the confectionery is variable.

32. Apparatus as claimed in Claim 31 in which the displacement force applied to each of the cutting head and forming head is applied via a compression spring whose active length is adjustable to vary the pressing force.

33. Apparatus for making confectionery lollipops from a strand of the confectionery, substantially as herein described with reference to the accompanying drawings.

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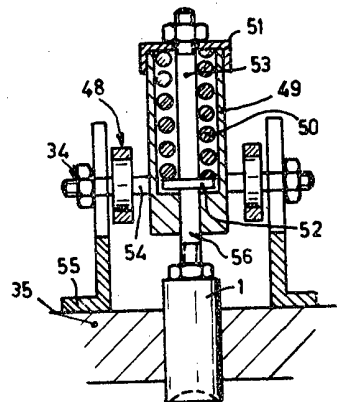
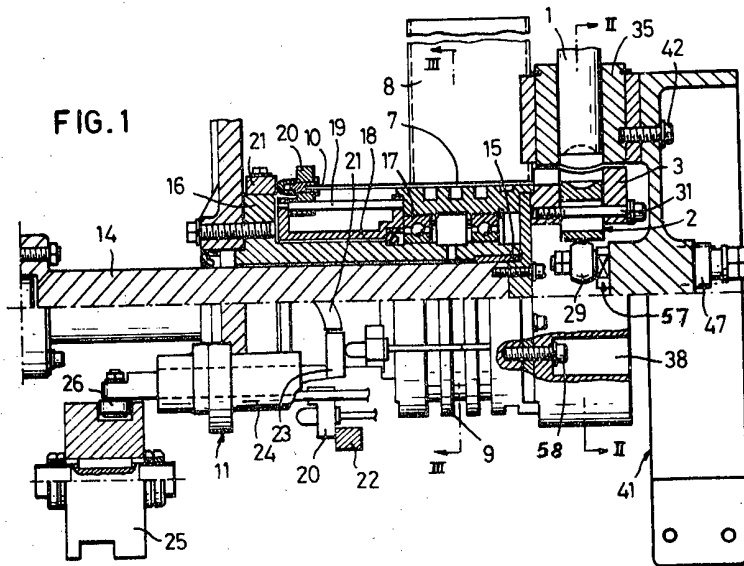


FIG. 9



FIG. 2

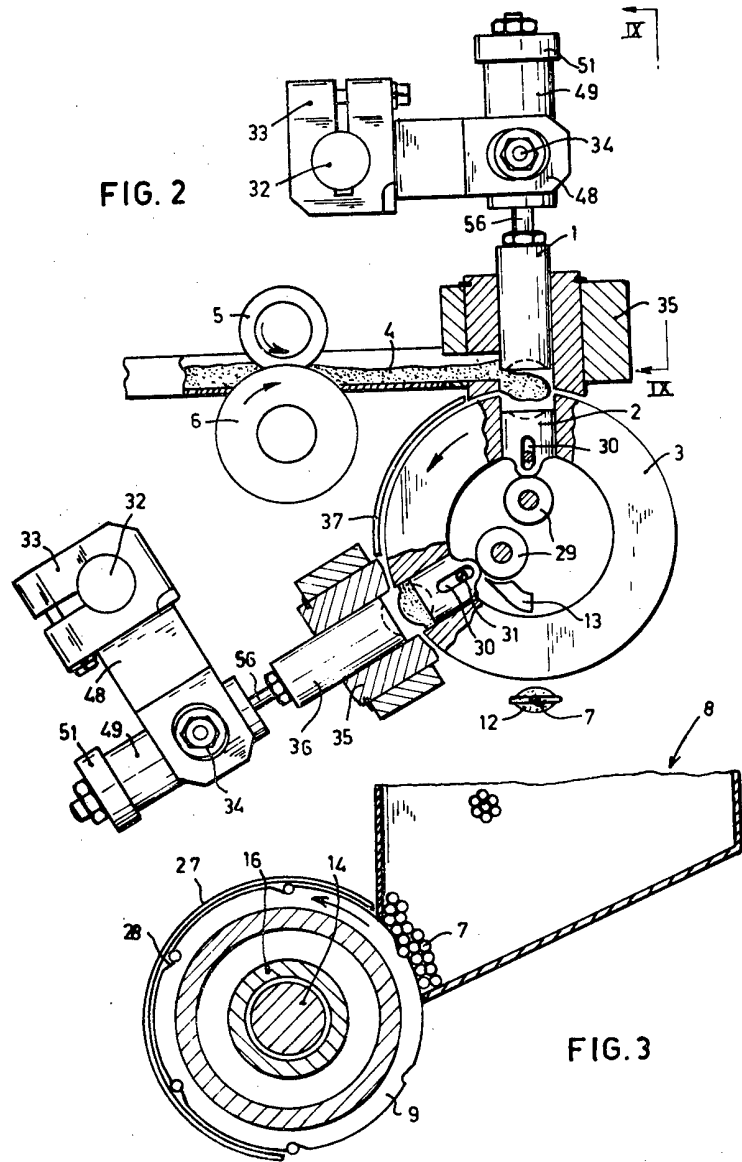
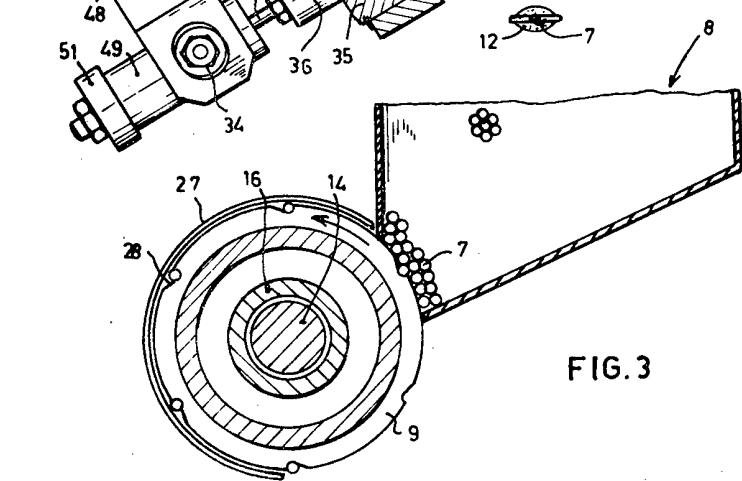


FIG. 3



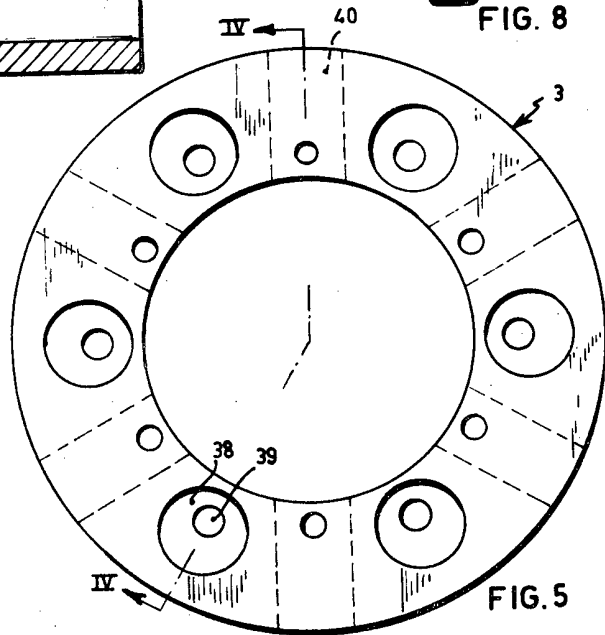
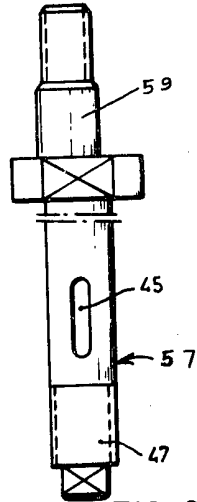
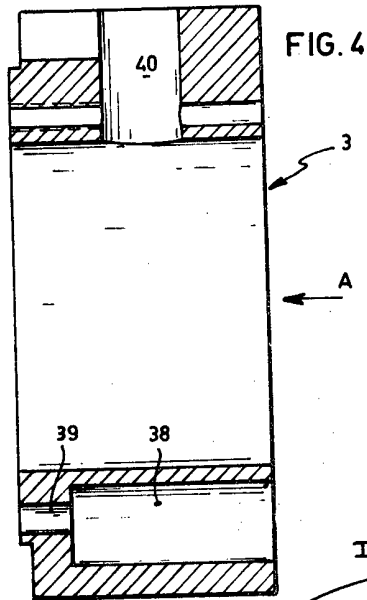


FIG. 4

FIG. 8

FIG. 5

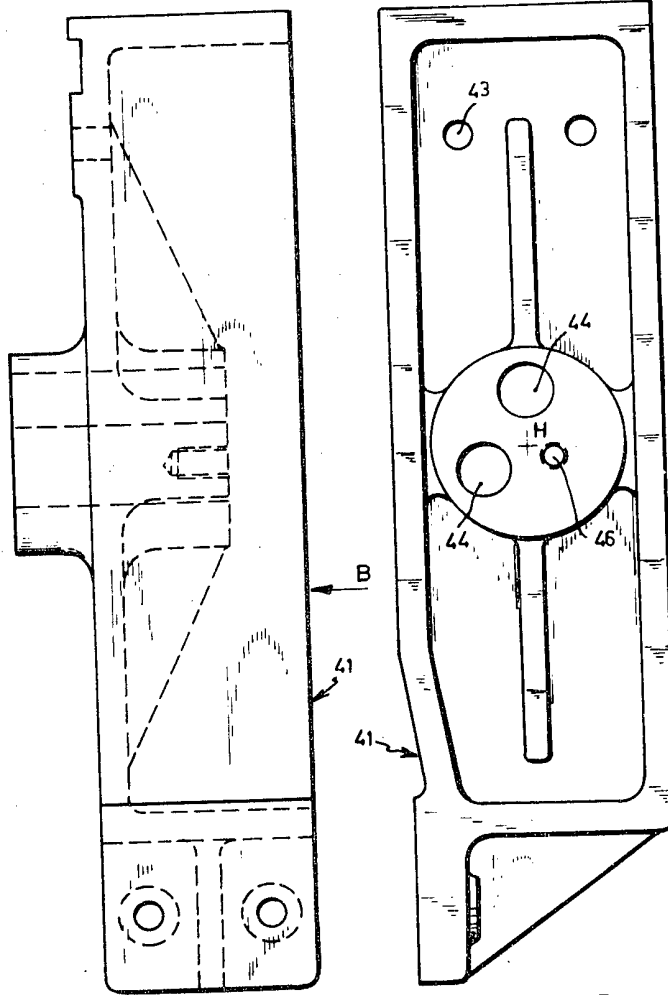


FIG. 6

FIG. 7