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(54) Title: DEVICE FOR THE PRODUCTION OF PLASTIC CONTAINERS

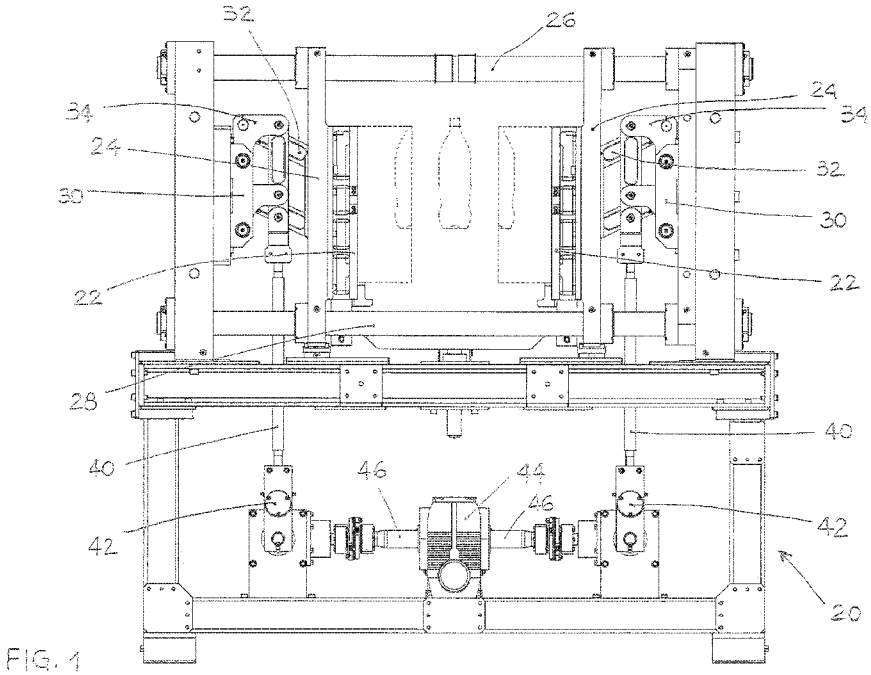

FIG. 1

(57) Abstract: Machine for the production of containers of plastic material, such as bottles, by the stretch-blow moulding method, comprising substantially: a section for inserting the so- called "parisons"; a heating section for the parisons, and a bottle moulding section. The bottle moulding section has a support structure (20) on which is installed at least one mould having two half shells (22), in which is enclosed a parison for the blow-moulding process; said half shells (22) being vertically opposite to each other and being suitable to be displaced in a horizontal direction. The means for operating the opening/closing of the two half shells (22) of the mould consist of toggle joints (30), each joint (30) being controlled by a respective rotating cam (42), said cams being driven by a motor (44) synchronized with each other and rotated in opposite directions of rotation.

[Continued on next page]

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DEVICE FOR THE PRODUCTION OF PLASTIC CONTAINERS

DESCRIPTION

TECHNICAL FIELD OF INVENTION

[001] The present invention concerns a device for the production of containers of plastic material, such as for example PET (polyethylene terephthalate) bottles for beverages, using a stretch-blow moulding method.

PRIOR ART

[002] Various types of machines are known from the prior art for the production of plastic containers through the stretch-blow moulding process. Essentially, these machines include: a charging section for the so-called “parisons”; a heating section for said parisons; and a bottle-moulding section. This latter section consists of a press with one or more moulds, each of which is made up of two half shells that are movable with respect to each other between an open position for inserting the parisons and a closed position for moulding the containers. The opening/closing of the moulds is controlled for example by motorized driving cams.

[003] The moulding of the containers is carried out in the moulds through a mechanical stretching action and by blowing in compressed air up to 40 bar.

[004] The parisons are moved through the heating section by means of a chain conveyor moving in a rectilinear path.

[005] The parisons are then collected from the chain conveyor in the heating section and are transferred into the mould in the press and extracted from there by means of tongs gripping the necks of the bottles, following a circular path (rotating blowers) or a rectilinear path (linear blowers).

[006] The current blow-moulding machines achieve high bottle production rates that depend in particular on the methods and times of opening/closing the moulds.

TECHNICAL PROBLEM TO SOLVE

[007] The present invention refers to blow-moulding machines of linear type for the production of containers made of plastic materials, such as PET (polyethylene terephthalate) bottles for beverages.

[008] In particular, the present invention refers to the device for opening/closing the moulds of these machines.

[009] These machines currently operate in a sequentially discontinuous manner, meaning that between the end of each processing phase and the beginning of the next

step there is a dead time that affects the length of the processing cycle and limits the productivity of the machine. The dead times depend on the necessity of managing and controlling the exact sequence of the different operating phases, that is, the opening/closing of the moulds on the press, inserting the parisons, and discharging the bottles. Further, every stoppage and resumption of the operating process requires a consumption of energy that depends on the masses in motion; this problem is greater in the steps at the end of the mould opening cycle and at the beginning of the mould closing cycle for moulding the bottles.

The discontinuity of the operating phases also generates considerable vibrations, which eventually could damage the machine, and the consequent noise that represents a significant nuisance for the operators.

[0010] The main technical problem that is to be solved with the present invention is substantially to create a linear blow-moulding machine provided with a moulding device that operates with a continuous process, that is, without stopping between the different operating steps, so as to eliminate, or considerably reduce, the energy consumption of the device. In particular, in this regard, it is considered necessary to operate on the device for opening/closing the moulds in which the parisons are inserted and wherein the bottles are moulded by blowing in compressed air.

[0011] Moreover, with a continuous processing method are eliminated, or considerably reduced, the harmful vibrations that negatively affect the machine and the operator.

SUMMARY OF THE INVENTION

[0012] The objective of the invention is achieved with a linear blow-moulding machine in which the means that operate the opening/closing of the two half shells forming the mould for creating the containers are made up of toggle joints that are driven, in synchronism with each other but in opposite directions of rotation, by a motorized rotating cam, as specified in claim 1 of the present patent.

[0013] Further details are specified in the successive dependent claims.

[0014] Characteristics and advantages of the invention will become evident from the description which follows, given by way of non-limiting example, with reference to the enclosed drawings, in which:

- Figure 1 is a partial schematic view of a press according to the invention with a mould in the open position;
- Figure 2 illustrates in a schematic view the press of Figure 1 with the mould in the closed position;
- Figures from 3 to 8 illustrate in a front view a component of the press of Figure 1 in

subsequent operating positions;

- Figure 9 illustrates the angular diagram of the cam that drives the displacement of the mould holder;
- Figure 10 illustrates the linear diagram of the displacement of the mould holder;
- Figure 11 illustrates the angular diagram of the displacement speed of the mould holder;
- Figure 12 illustrates the linear diagram of the displacement speed of the mould holder.

DETAILED DESCRIPTION OF THE INVENTION

[0015] With reference to Figures 1 and 2, the blow-moulding machine according to the present invention comprises a support structure 20 on which is installed at least one mould for moulding plastic bottles. The outline of a bottle to be moulded is shown in the figures with a broken line.

[0016] The mould consists substantially of two half shells 22 that are hollowed so as to define the shape of the bottles to produce. The two half shells 22 are arranged in a vertical position and are driven to slide in a horizontal direction for their opening/closing movement.

[0017] The sliding of the two half shells 22 is guided by respective mould holders 24 that move along upper 26 and lower bars 28 of the support structure 20. The displacement of each half shell 22 is driven through a toggle joint 30 that connects the respective mould holder 24 to the support structure 20. Each toggle joint 30 is rotatably connected to the support structure 20.

[0018] According to a first characteristic of the invention, each toggle joint 30 is formed by at least one pair of arms, hinged to each other, each pair of arms forming a connecting rod 32 and a crank 34. The connecting rod 32 connects the mould holder 24 with the crank 34. The crank 34 is rotatable around a fixed pin on the support structure 20.

[0019] The connecting rod 32 and the crank 34 of each toggle joint 30 have different lengths. Advantageously, the ratio of the length of the connecting rod 32 to the length of the crank 34 is greater than 2.

[0020] Each toggle joint 30 is connected to a rod 40, at the upper end of which is rotatably hinged the connecting rod 32. The lower end of each rod 40 is driven by a cam device 42, that is connected to a motor 44 through a drive shaft 46. Thus, the two half shells 22 are driven through the respective kinematic linkwork made up of: motor 44, shaft 46, cam 42, rod 40, toggle joint 30.

[0021] It should be noted that the motor 44 drives, through the shafts 46, the cams 42 in

synchronized motion but with opposite directions of rotation, to determine the opening/closing of the half shells 22.

[0022] The result is that this obtains a continuous opening/closing movement of the mould, with variable and adjustable speeds so as to optimize the process for moulding the containers, also on the basis of their different dimensions.

[0023] Figures 3 to 8 illustrate a toggle joint 30 and the relative cam device 42 in different and successive phases of operation, or of rotation of the motorized cam, for the opening/closing cycle of the half shells 22. For the purpose of guaranteeing the best balancing of the moulding device, each mould holder 24 is connected to the support structure 20 through a double toggle joint 30, driven by the same rod 40; the two toggle joints 30 are arranged superimposed one one another and spaced apart in the vertical direction (Figures 1 and 2).

[0024] Figure 3 corresponds to the position of half shells 22 completely closed (see Figure 2), during the blowing-in phase for moulding the bottle. In this phase, the cam device 42 is in the lowest position (angle of 0°), and the rod 40 holds the toggle joint 30 with the connecting rods 32 and the cranks 34 with their horizontal axes aligned with each other, that is, in their maximum extension.

[0025] Figure 4 corresponds to an open position of the half shells 22 to start the discharge of the bottles. In this phase, the cam device 42 is in a rotated position (angle of 90°), with the consequent rotation of the rod 40 and the toggle joint 30. The connecting rods 32 and the cranks 34 are rotated at a maximum angle with respect to each other.

[0026] Figure 5 corresponds to a successive position of the half shells 22 in a further opening phase; the cam device 42 is in a further rotated position (angle of 124°). The connecting rods 32 and the cranks 34 are rotated, but aligned with each other.

[0027] Figure 6 corresponds to the position of the half shells 22 completely open (see Figure 1), to allow the ejection of the moulded bottle and the insertion of the next parison. In this phase, the cam device 42 is at its highest position (angle of 180°), and the rod 40 holds the toggle joint 30 with the connecting rods 32 and the cranks 34 respectively rotated in their position of minimum extension.

[0028] Figure 7 corresponds to the position of the half shells 22 in the closure start phase, after the parison has been inserted. The cam device 42, the rod 40 and the toggle joint 30 are in a substantially symmetrical and opposite position with respect to the one of Figure 5. The angle of the cam device 42 is 247°.

[0029] Figure 8 corresponds to the position of the half shells 22 in the closing phase. The cam device 42, the rod 40 and the toggle joint 30 are in a position substantially

symmetrical and opposite with respect to the one of Figure 4. The angle of the cam device 42 is 270°.

[0030] Figures 9 to 12 are diagrams that describe the complete rotation of the cam device 42 and show the continuity of the mould opening/closing movement, with variable and adjustable speeds so as to optimize the container moulding process, also on the basis of their different dimensions.

[0031] Figure 9 illustrates the angular diagram of the cam 42 that controls the displacement of the mould holder 24, while Figure 10 illustrates the linear diagram of the displacement of the mould holder 24, based on the angle of the cam 42.

[0032] Figures 9 and 10 illustrate the continuity of the movement of the device that controls the opening/closing of the half shells 22.

[0033] Figure 11 illustrates the angular diagram of the displacement speed of the mould holder 24, while Figure 12 illustrates the linear diagram of the displacement speed of the mould holder 24.

[0034] Similarly to Figures 9 and 10, Figures 11 and 12 also show the continuity of movement of the device that controls the opening/closing of the half shells 22.

[0035] In conclusion, the device according to the present invention makes it possible to achieve the desired objective, that is, to create a linear blow-moulding machine for the production of containers of plastic material provided with a moulding device that operates with a continuous process, in other words without stops between the different operating stages, so as to eliminate, or considerably reduce, the energy consumption of the machine.

* * * * *

CLAIMS

1. Device for producing containers in plastic material, like bottles, through stretch-blow moulding, substantially comprising: a charging section for so-called parisons; a heating section for said parisons; and a moulding section to form the bottles, said moulding section having a support structure (20) on which a mold with two half-shells (22) is assembled, wherein a parison to be blow moulded is closed; said half-shells (22) being vertically opposed and horizontally movable,

   wherein operating means for opening/closing said half-shells are made by toggle joints (30), each toggle joint (30) being actuated by a respective rotating cam (42), said cams being activated by a motor (44) in synchronism with each other and with rotation in the opposite direction.

2. Device for producing containers in plastic material according to claim 1, wherein each half-shell (22) of the mould is associated with a mould-holder (24) connected with a respective toggle joint (30) and sliding driven on bars (26,28) of the support structure (20).

3. Device for producing containers in plastic material according to claim 1, wherein the motor (44) drives the toggle joints (30) through drive shafts (46) able to rotate the respective cams (42) and connecting rods (40) which connect said rotating cams (42) with the toggle joints (30).

4. Device for producing containers in plastic material according to any of the preceding claims, wherein each motorized rotating cam (42) which drives the relative toggle joint (30) is able to define the drive angles for opening/closing said half-shells (22) of the mould.

5. Device for producing containers in plastic material according to any of the preceding claims, wherein each motorized rotating cam (42) driving said toggle joints (30) is able to define the opening/closing speeds for the half-shells (22) of the mould.

6. Device for producing containers in plastic material according to any of the preceding claims, wherein each toggle joint (30) is connected with the respective half-shell (22) of the mould through a linkage whose arms (32,34) have different lengths.

7. Device for producing containers in plastic material according to claim 6, wherein the ratio between the lengths of the arms (32,34) of the linkages which drive said half-shell (22) of the mould is equal to or greater than two.

8. Device for producing containers in plastic material according to any of the

preceding claims, wherein each half-shell (22) is driven by a pair of toggle joints (30) connected through a single rod (40) which the respective motorized rotating cam (42).

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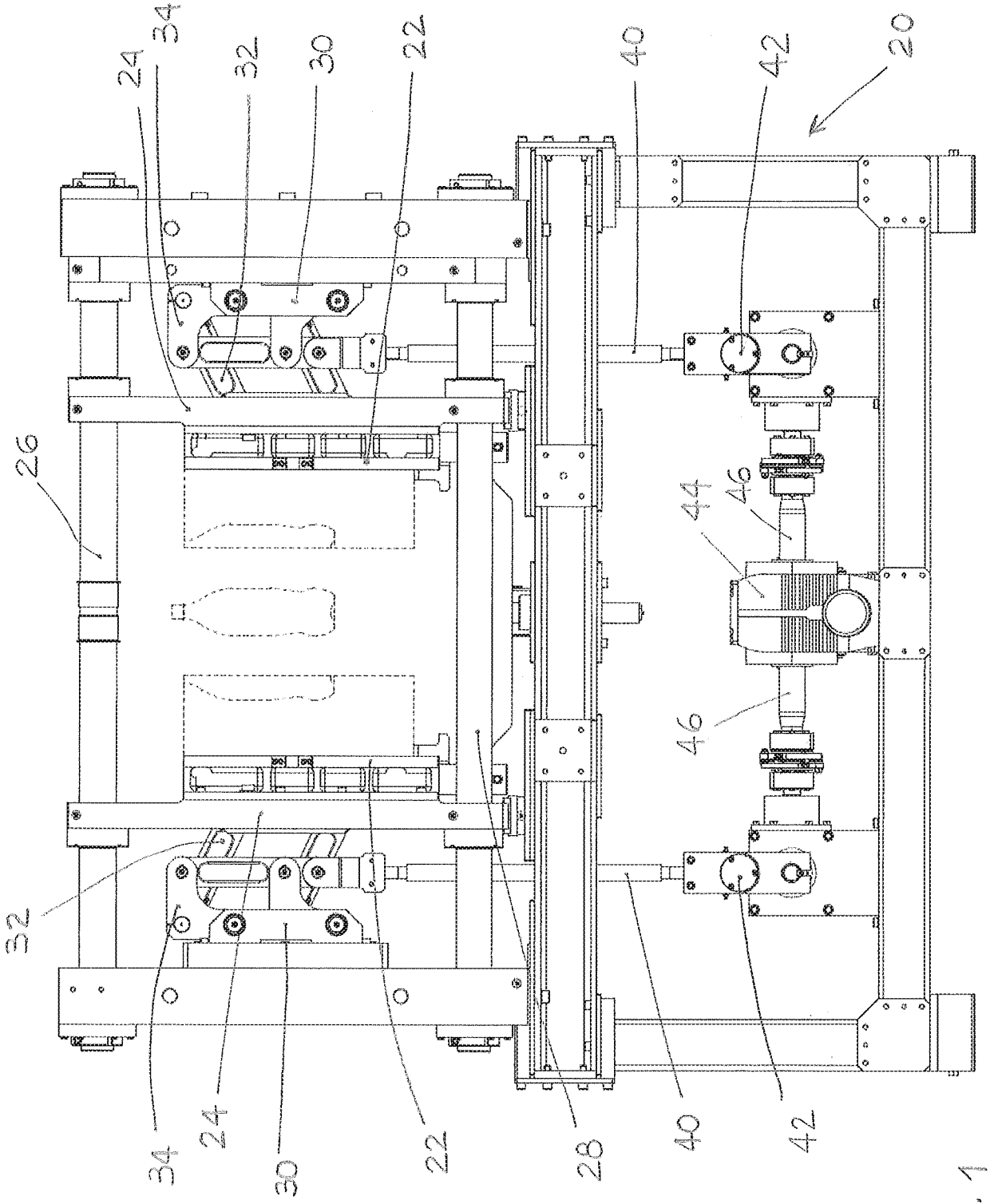

FIG. 1

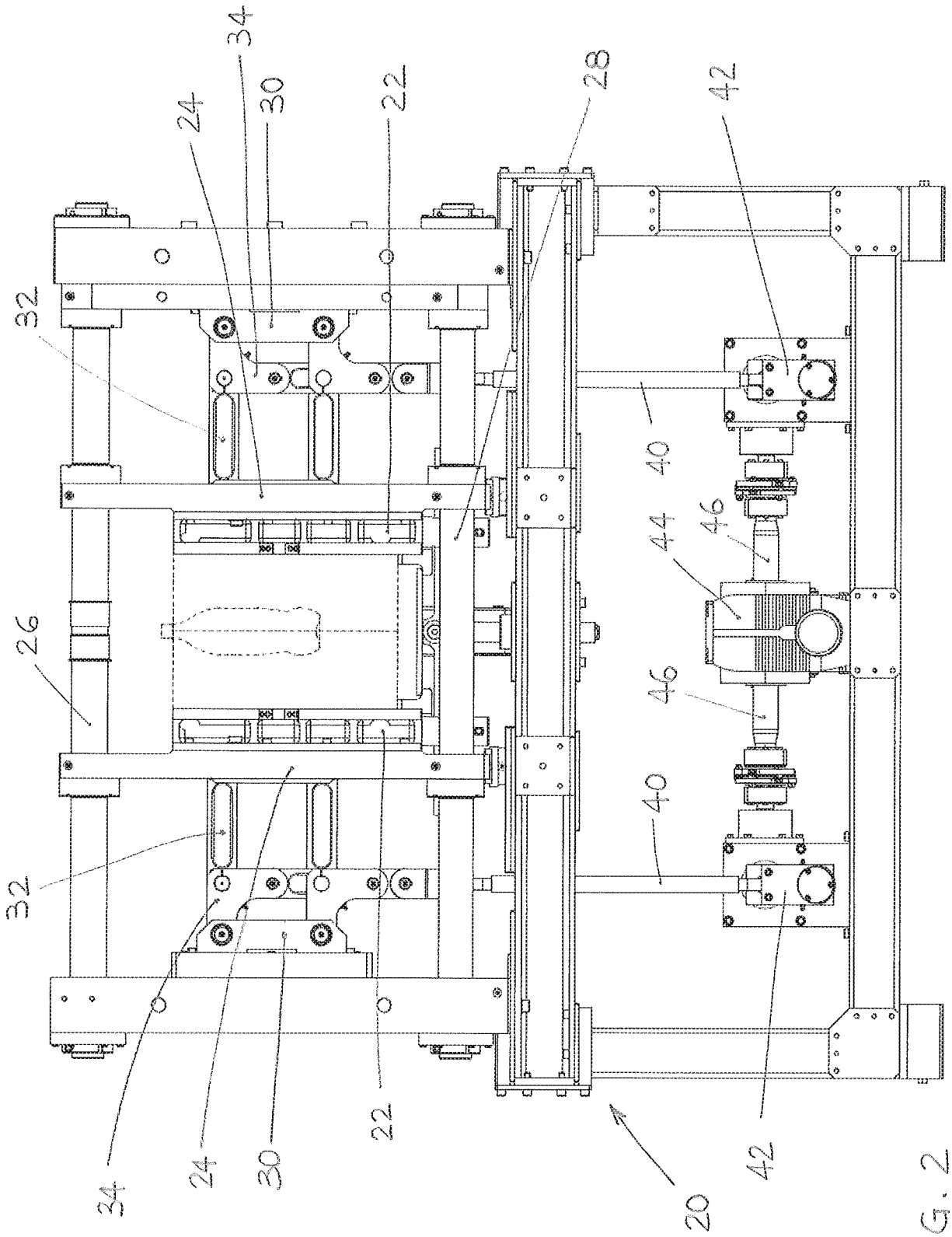

FIG. 2

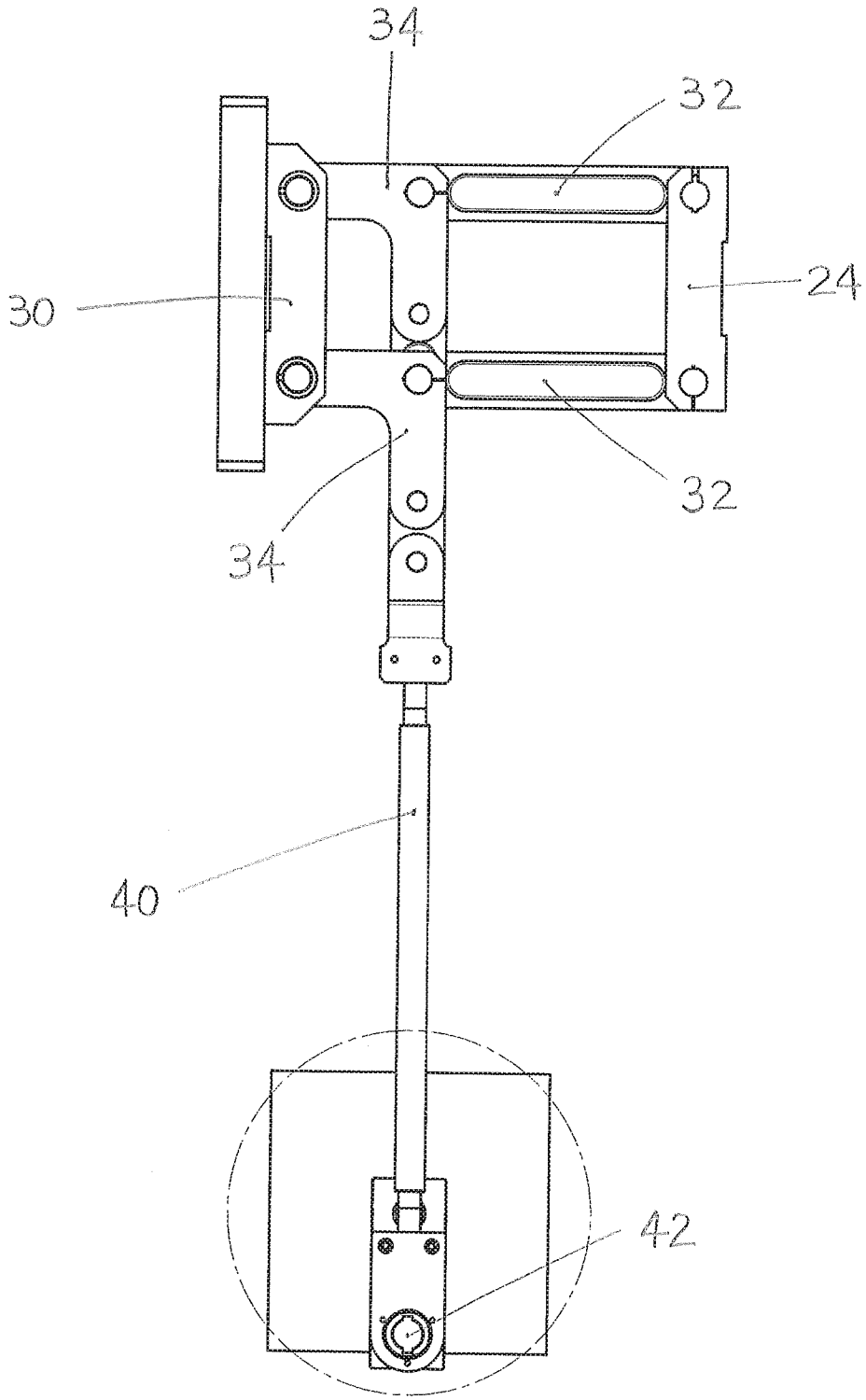

FIG. 3

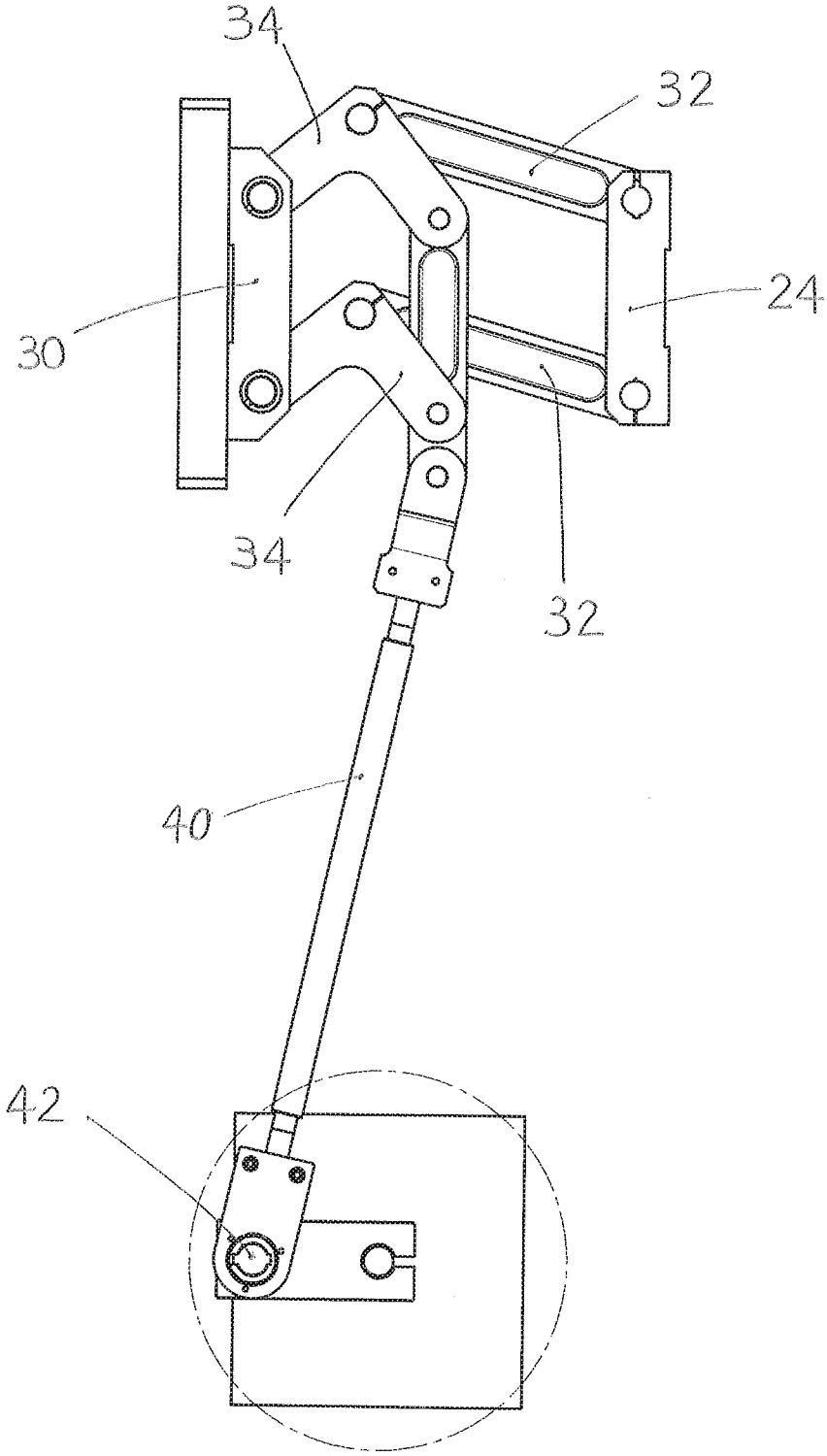

FIG. 4

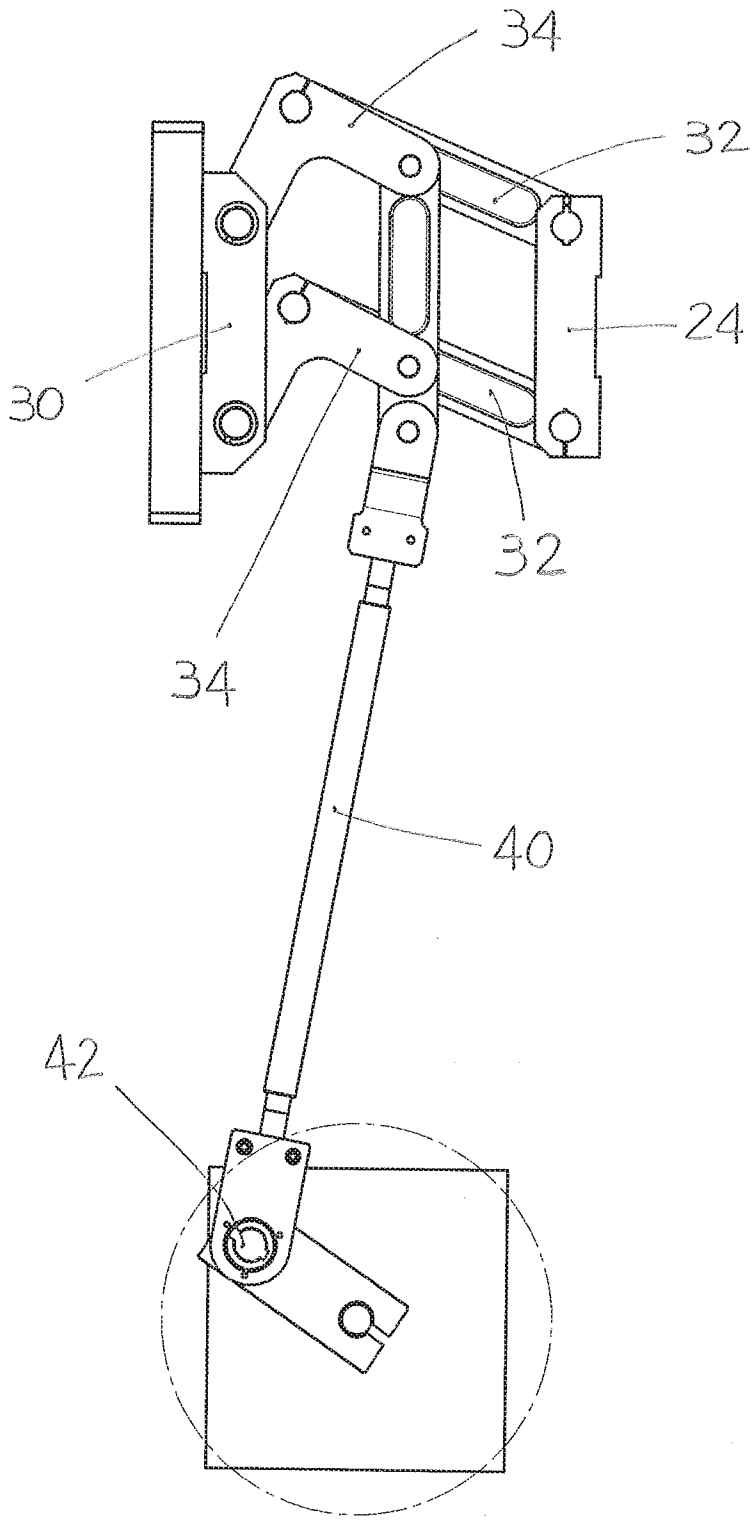

FIG. 5

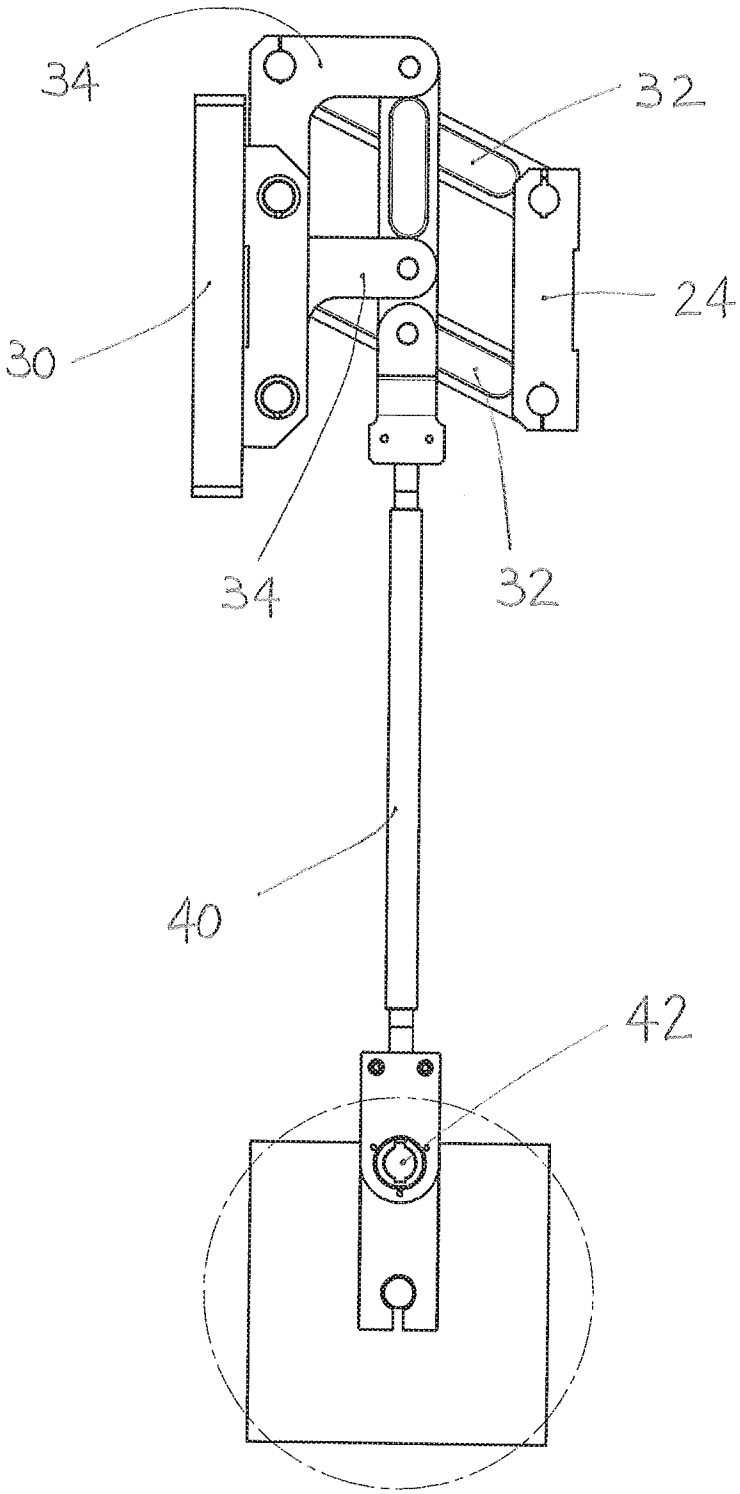

FIG. 6

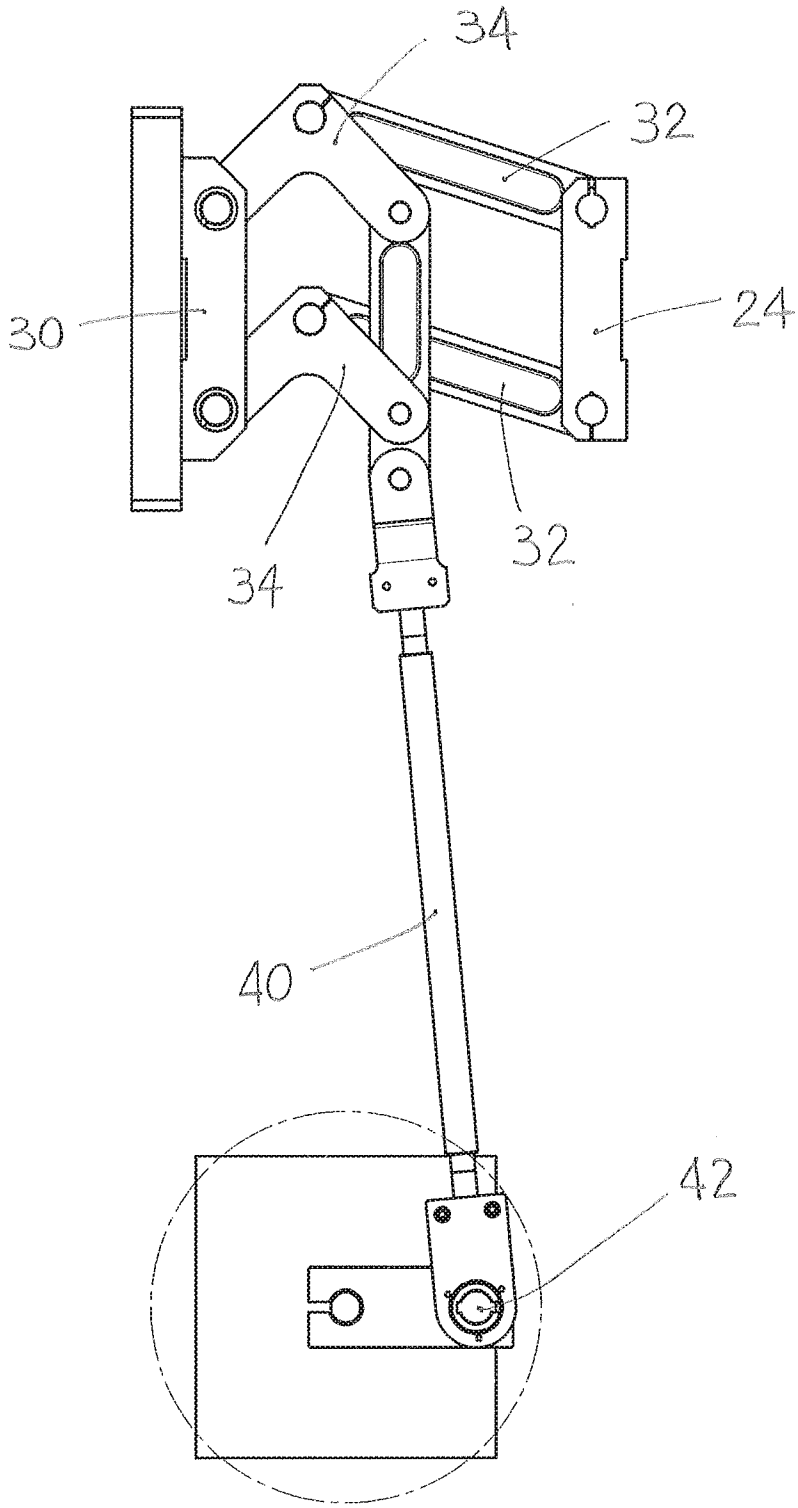

FIG. 7

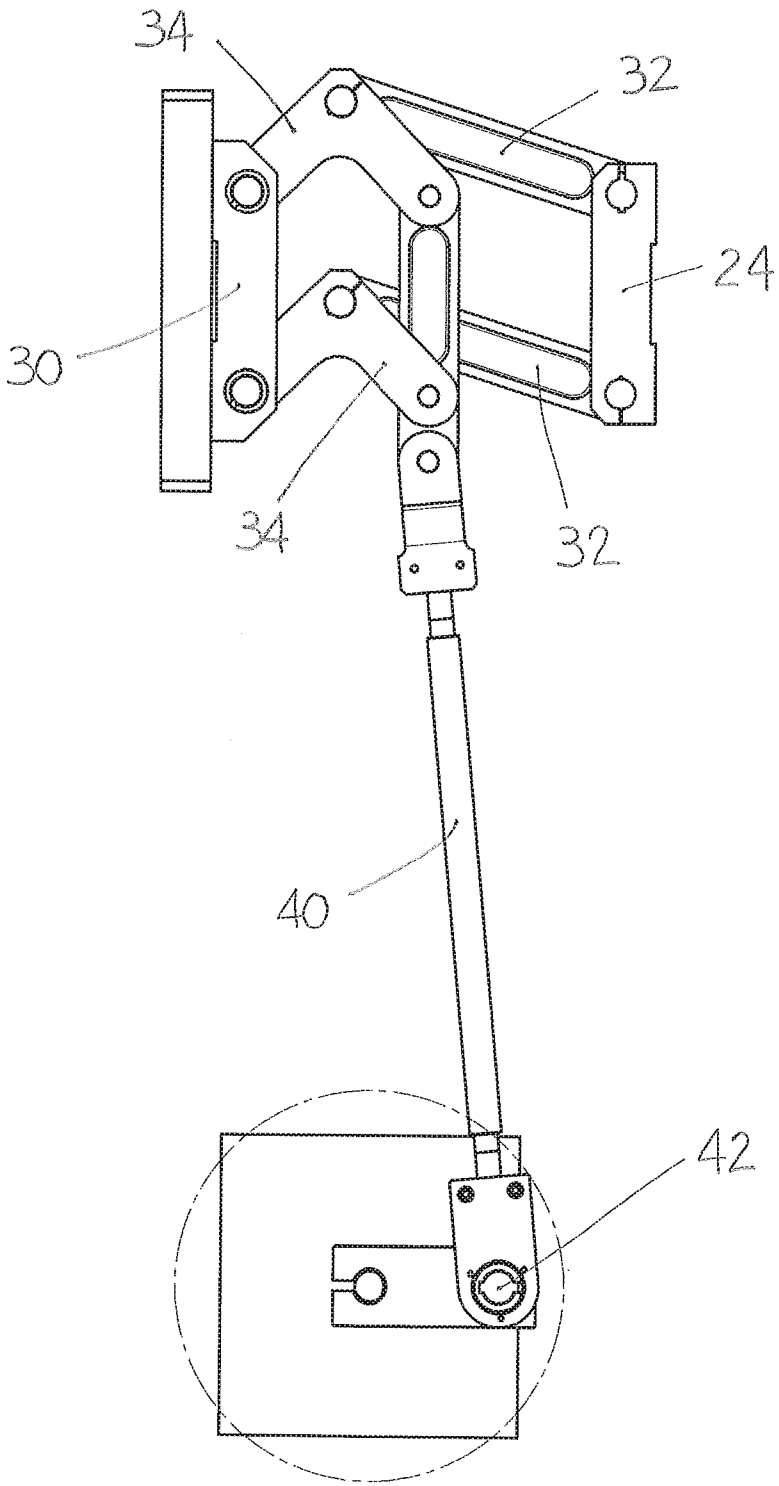

FIG. 8

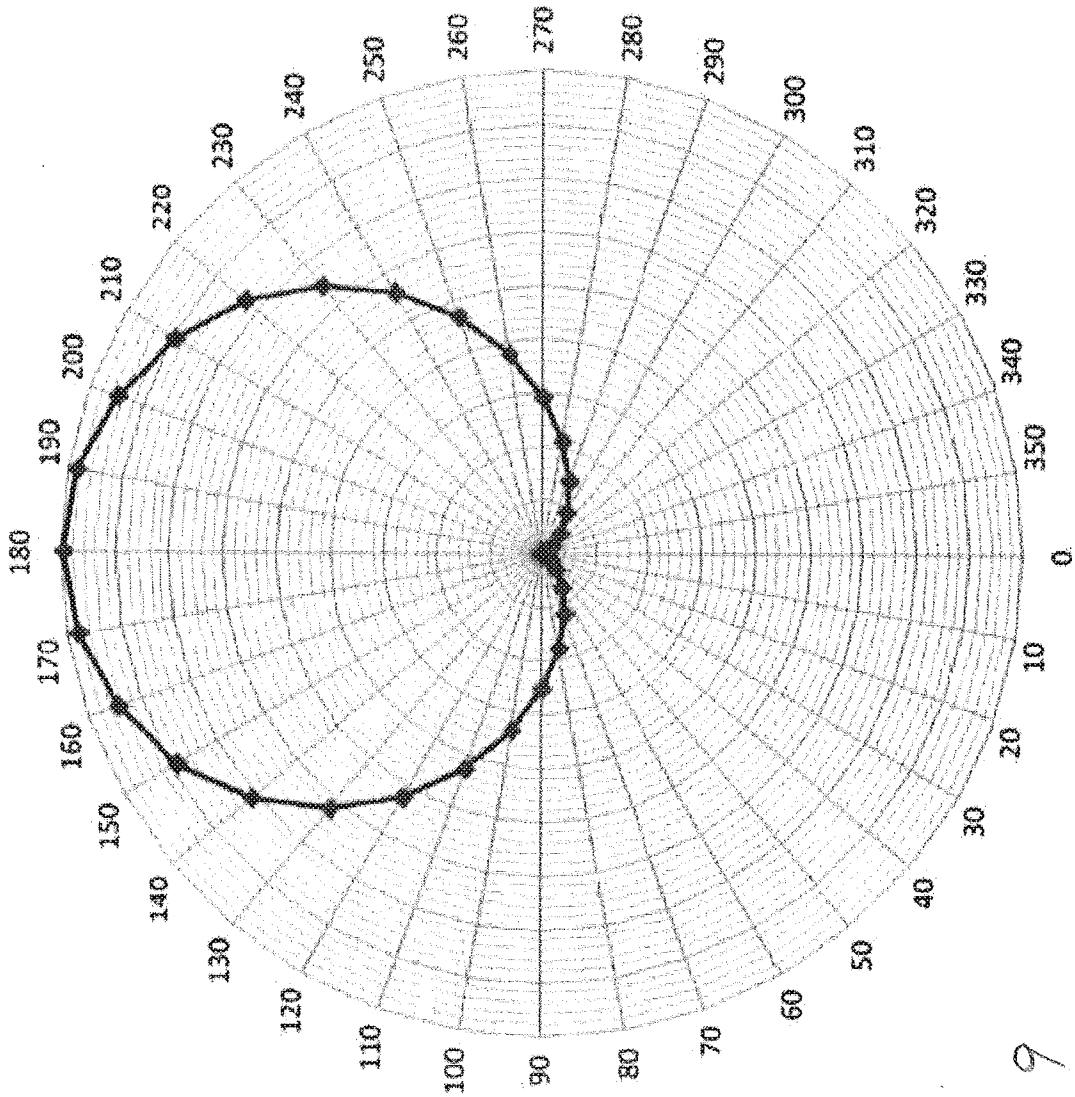
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FIG. 9

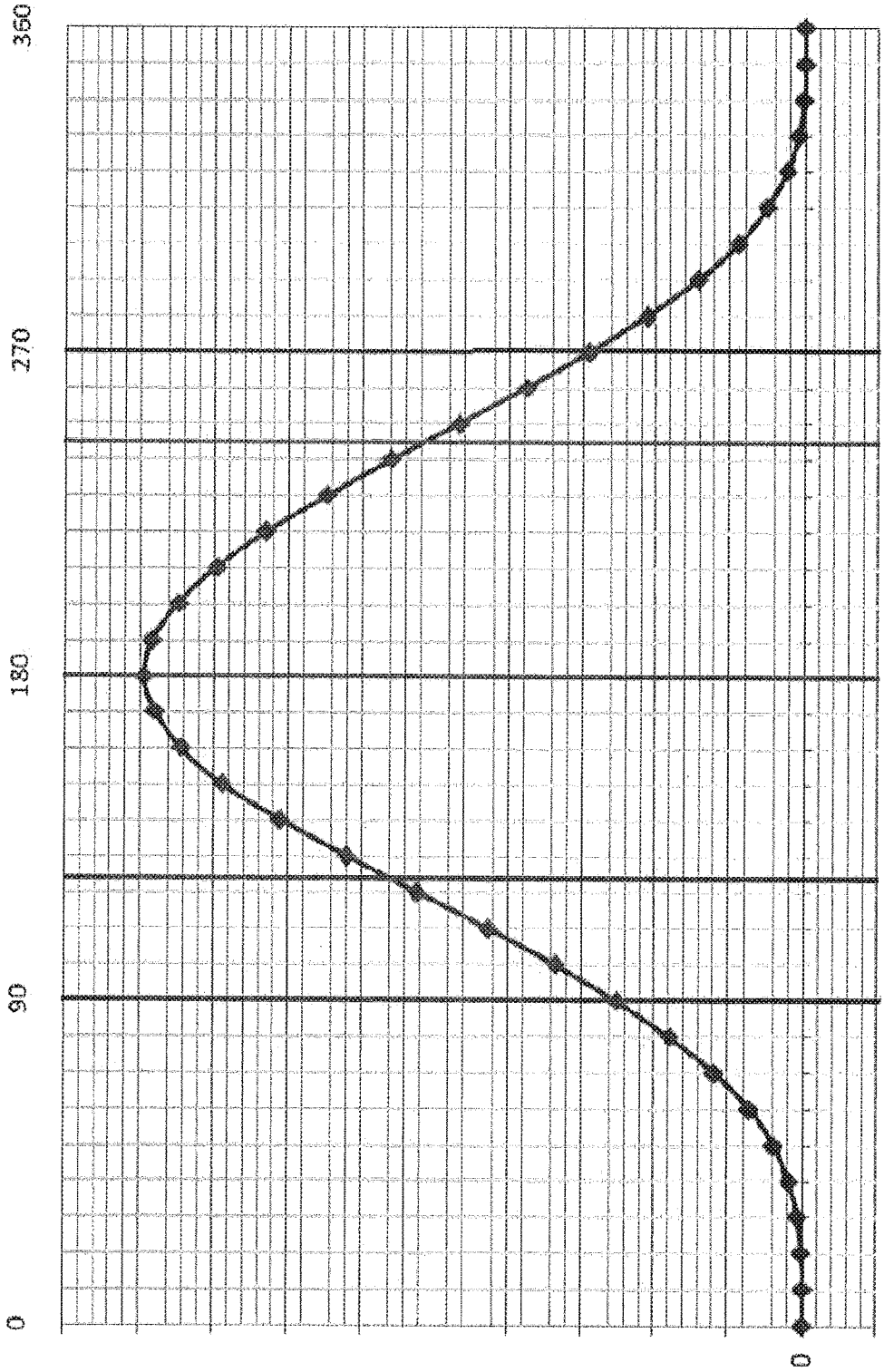

FIG.10

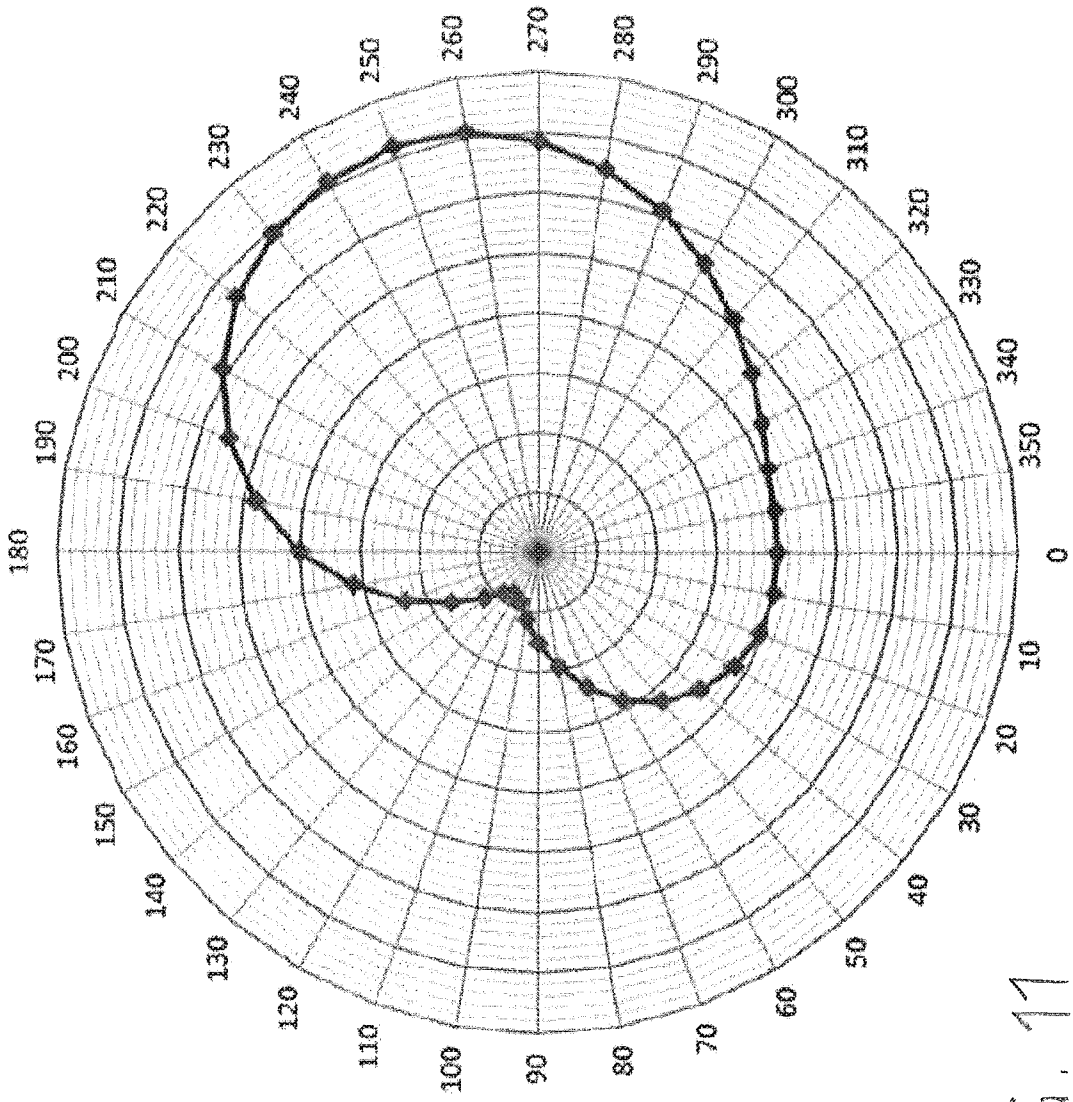
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FIG. 11

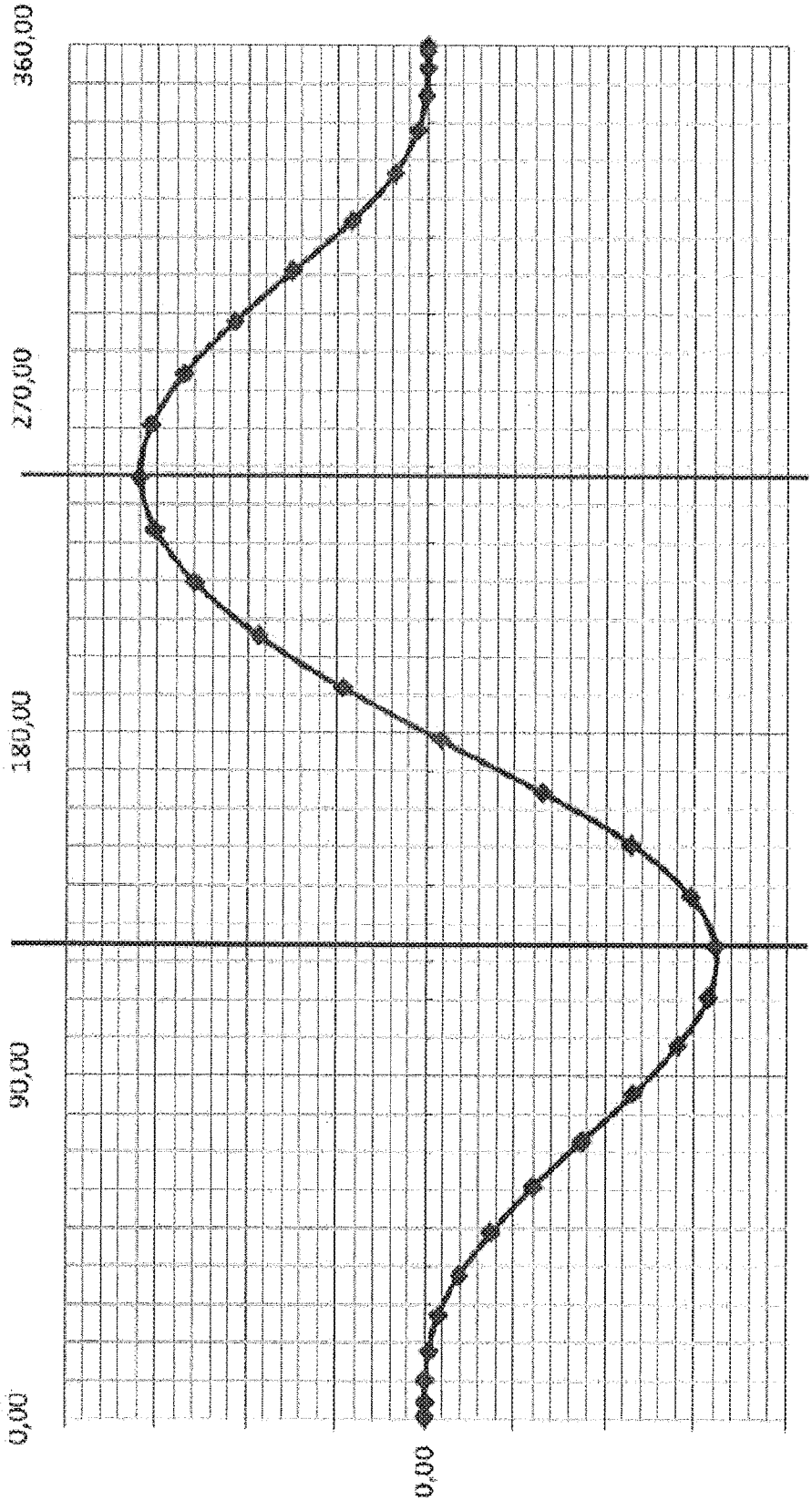

FIG. 12