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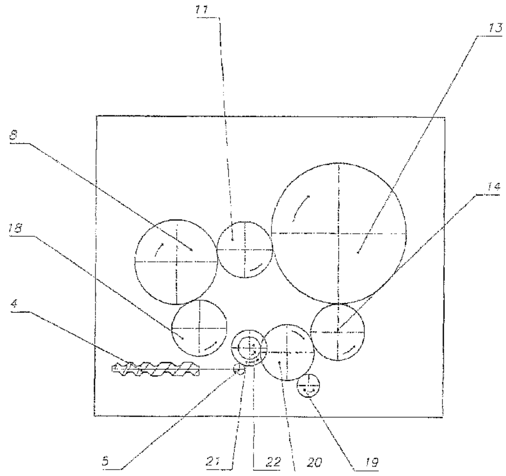

FIG. 9

(57) Abstract: It is understood as being preferably intended for the manufacture of cans through spinning, molding the can bodies (1) in the most varied shapes, also enabling the attainment of deep necking or die-necking in the can bodies (1), it may be use for the several purposes, from food and beverage cans, to chemicals and others, and they may be manufactured in several materials such as tin foil, chromed sheet and black plate, using the spinning process molding the can bodies (1), being able to be used in several types of cans, from those which use metallic, plastic or mixed lids (compound plastic + metallic), clamped such as those using metallic, plastic or mixed (compound + metallic) lid system and undamped, provided with sealing gaskets and vacuum closure.

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SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING

APPLICATION FIELD

This descriptive report refers to a **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING**, which are intended more specifically, to the production of cans having multiple bodies' shapes also enabling the formation of a deep necking in their ends.

INVENTION SUMMARY

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed hereby, may be used in the production of cans intended to multiple purposes, such as: food, beverages, chemicals and others, and it may use different materials, such as: tin plate, chromed sheets or black plate.

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed hereby, may also be used in the production of cans which use metallic, plastic or mixed closure means, sealing gasket or also vacuum closure.

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-

FLAP FORMING proposed hereby, enables the can body's pre-expansion allowing forming of a pre-flap previously to its expansion, while the equipment for its accomplishment makes feasible the use of the different expansion processes existing in the market, as it is able to neutralize the irregular loss effect of the can body's height as a function of its expansion, which harmed the flap formation, which being designed in an irregular form, used to exceed the tolerance measures, which consequently, would impair the forming of the bottom and the lid, compromising their tightness and hermetics, to the point of creating leaks.

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed hereby, also enables the use of the can body spinning and molding device, object of the Patent BR PI 9905474-4 document, owned by *Metalgrafica Rojek Ltda.*

INVENTION BACKGROUND

Several types of processes to obtain expanded can bodies with or without necking of their ends, are already known by the state of the technology, such as for example, die-necking, spin-flow, stretching type processes and others; however, all processes presently used have, as the main nuisance, the non-optimization in the utilization of raw material, which creates an expressive material waste, due to the dimensions used in the can body's formation, and moreover, the usual processes also use an excessive number of processing stages, which requires the use of a larger number of machines, creating a higher quantity of scrap.

Also known to the state of technique are the processes which use jaws, rulers or tongs which are introduced in the can body, through cams, which expand it, until the desired shape is achieved, always with an increase of the initial can body diameter, aiming to increase the can volumetric capacity.

The deep necking processes are already known in the production of cans, aiming to achieve an area whose section, taken in the can body's radial direction, has a diameter smaller than the can body's nominal diameter, generally comprised close to its ends; that is, close to the lid or the bottom, which consists of, starting from the can body's nominal diameter, decreasing one of its ends, and this necking is accomplished with the intent of saving raw material in the lid or in the bottom, and also to make their stacking easier, being accomplished by half plugs process (die-necking), for small reductions, or by means of forming rollers process (spin-flow) for large reductions; however, one of the major nuisances of the cans with necking which use low thickness foils, is the occurrence of pinholes in the necking area, close to the can body welding, which compromises considerably the cans assembly line efficiency, as well as the metallic package image.

After performing the necking and the flaps the bottom are re-spiked and only after those operations, the can is expanded by the process of jaws, rulers or tongs, which are introduced in the can body through cams which expand until the desired shape is achieved; however, since the bottom has already been re-spiked, the expansion only occurs from the top of the can; that is, the can body's height is only decreased in its top, which causes the can internal varnish to become damaged, leaving the metal exposed, which shall interfere in the canned products quality, mainly foods.

When the can expansion occurs in the above mentioned processes, there is a reduction in the can body's height, and that reduction occurs in the two sides on an irregular basis, impairing the flap making and the can forming, jeopardizing the tightness and hermetics of the can, to the point of creating leaks.

The height decrease in an irregular form occurs for several reasons, such as: difference of hardness points of the plate making up the can body and the area in which it receives the electric welding, considering that the plate is less hard in the middle than it is the ends, and depending on the area used to form the can body, it may have different hardness points, which related to the area influenced by the welding, may turn the can body's ends totally irregular after its expansion.

INVENTION PRINCIPLES:

In order to overcome all nuisances from the techniques used, this **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** was imagined, which refers to an extremely simple, efficient and economic process, and with more productivity if compared to the usual processes employed for that purpose.

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** presented hereby consists of offering a can body with a smaller necking diameter and in its expansion up to the desired nominal diameter; an expansion which taking as basis a 62.4mm diameter to form the can body, which may be expanded up to the diameter of 73mm, which corresponds to an expansion factor in the order of approximately 16%, which corresponds to the expansion in the nominal value of approximately 10mm regarding the initial diameter.

Among the innovating characteristics of this **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** we point out the *possibility of its accomplishment in two operations*, where in the first one, a pre-expansion or invitation for the final expansion shall be performed, with the resultant obtaining of the can body's flap, and with this invitation, one may obtain the suppression of employing a machine in the production line, thus reducing the space occupied by the line, the scrap rate is decreased and the productive efficiency, being then in the second operation, obtained the total expansion of the can body, considering that the accomplishment of the process in two operations prevents irregularities in the flaps dimensions, differently of what occurs in the conventional processes, which use an operation for the can body expansion, and which, therefore, create irregularities in the flaps dimensions, which makes the forming of the can bottom more difficult, and which also impair the lid tightness; *moreover, in the known expansion processes*, the can body expansion only occurs after the placement of the bottom, *because without this stage it is impossible to achieve the expansion* as a whole and without irregularities in the flap; besides, in the *conventional systems, the expansion occurs in the can's central* part, which assumes a concave forming; however, when transported, the expanded bodies tend to touch each other, and they may damage their lithography and in more extreme cases, they may be crushed or even break the can's body.

In the **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed herein, there is no need for placing the *can bottom to start its expansion, since its body is expanded from its* ends, and its central part, which is under the highest pressure, is *unchanged in what concerns its nominal diameter, and the final can* body assumes a convex forming, so that when they are transported, they do not touch each other, and the contact area among the cans restricted solely to the top and base areas, their lithography remaining unchanged, as well as the cans bodies' structures.

Among the advantages offered by this **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING,** we point out the following:

a) material economy, because it allows to start from a smaller diameter of the can body and expand it by molding the can body up to the wanted diameter, taking as a basis a can body having a 62.4mm diameter, which may be expanded by molding up to the 73mm diameter, which corresponds to an expansion of *approximately 10mm of initial diameter, significantly increasing the* can volume.

b) reduction in the assembly line steps, because the flaps forming operation is performed in the first station along with the pre-expansion or invitation, which enables the suppression of the use of a machine in the cans assembly line.

c) Productivity increase in the assembly line, due to the decrease in the steps and to the expansion system simplification.

d) Productivity increase in the sheets varnishing and lithography line because the number of can bodies extracted from a sheet is 25% higher.

The **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed herein may be adapted for any type of expansion process, and it may use an operation station which is isolated from or integrated to the conventional expansion process production line, and foresees the top and bottom flaps forming by spinning before the expansion operation, and it may be used for the most different formats and dimensions of can bodies, independently of the expansion process that shall be applied, and consists of starting with the necking diameter of the can body smaller and expand the pre-flap up to the nominal diameter, locking the can body, leaving it ready for the expansion proper, without allowing the formation of irregularities in the flaps, due to the reduction of the can body's height, consequently not allowing interference in the bottom forming, preserving the can tightness and hermetics.

Among the innovating characteristics of the **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC**

PACKAGES FORMING WITH PRE-FLAP FORMING proposed herein for the forming by spinning of the pre-flap before the can body expansion, the fact that the process is accomplished in two operations is highlighted, where in the first pre-expansion the top and bottom pre-flaps is performed, for locking the can body, and in the second, the total expansion of the can body is made, by the expansion process selected so that, next, the flaps calibration is made, avoiding irregularities in their dimensions.

SUMMARY DRAWINGS DESCRIPTION

In order to allow the clear visualization of the differentiation among the several types of conventional processes of cans forming, regarding the **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed herein, reference is made to the enclosed figures, in which the de-necking or spin-flow type process for the forming of the can body with necking of one of its ends, expanded by rulers, jaws or tongs, after the forming of the bottom, is represented by letter "**A**"; the die-necking or spin-flow type process to form the can body with the necking of one of its ends, expanded by rulers, jaws or tongs, with forming of the flap before the can body expansion, is represented by letter "**B**"; the process to form the can body expanded by rulers, jaws or tongs is represented by letter "**C**"; the process to form the can body expanded by rulers, jaws or tongs with forming of the pre-flap before the can body's expansion, is represented by letter "**D**"; the stretching type process for the forming of the can body is represented by letter "**E**", and the stretching type process for the forming of the can body with forming of the pre-flap before the can body's expansion, is represented by letter "**F**".

Figure 1A – shows a plate with the markings of the can bodies which can be cut;

Figure 2A –shows the forming stage of the 73mm diameter can body;

Figure 3A - shows the forming stage of the can body's bottom end *necking, obtained by the die-necking process*, where the diameter is reduced from 73mm to 70mm;

Figure 4A - *shows the conforming stage of the bottom and top* flaps;

Figure 5A - shows the forming stage of the can bottom;

Figure 6A - shows the expansion stage of the can body, through its top end;

Figure 1B - shows a plate with the markings of the can bodies which may be cut;

Figure 2B - shows the 62.4mm diameter can body formation;

Figure 3B - shows the pre-expansion stage of the can body's top end, whose diameter goes from 70mm to 73mm, the diameter of the rest of the can body remaining unchanged, and the top and bottom pre-flaps also being conformed;

Figure 4B - shows the last forming stage of the can body, from the ends, whose top end remains with a 73mm diameter, the bottom end remains with a 70mm diameter, and its expanded area reaches the 85mm *diameter*;

Figure 5B –shows the flaps calibration stage;

Figure 6B - *shows the can bottom formation stage*;

Figure 1C - shows the plate with the markings of the can body which may be cut;

Figure 2C - shows the can body formation with 73mm diameter;

Figure 3C - shows the forming stage of the can body where its height is decreased to 80.8mm, its top end diameter goes from 68mm to 70mm, its bottom end diameter goes from 68mm to 73mm, the largest expanded area diameter becomes 78.5mm and the can body center remains with a 68mm diameter;

Figure 4C - shows the forming stage of the top and bottom flaps, which decreases the can body height to 78.8mm;

Figure 5C - shows the bottom clamping stage, which decreases the can body's height to 78.6mm;

Figure 1D - shows a plate with the markings of the can bodies which can be cut;

Figure 2D - shows the 62.4mm diameter can body's formation;

Figure 3D - shows the pre-expansion stage of the can body's top end whose diameter goes from 68mm to 73mm, the can body center remaining with a 68mm diameter, and decreasing the can body height to 89mm, the bottom and top pre-flaps also being conformed;

Figure 4D - shows the expansion stage of the can body where the height is decreased to 79.2mm, the top end diameter remains with 70mm, the bottom end diameter remains 73mm, the diameter of the largest expanded area becomes 78.5mm and the can body center diameter remains 68mm;

Figure 5D - shows the calibration stage of the flaps with the decrease of the can body height to 78.8mm;

Figure 6D - shows the can bottom clamping state with the decrease of its height to 78.6mm;

Figure 1E - shows a plate with markings of the can bodies which may be cut;

Figure 2E - shows the can body formation with 62.4mm diameter and 109mm height;

Figure 3E - shows the forming stage of the invitation at the can body bottom end, which causes its diameter go from 62.4mm to 72mm,*and the can body height is decreased to 106.5mm*;

Figure 4E - shows the expansion stage of the can body, with *the decrease of its height to 97mm, the top end diameter remains* 62.4mm and the expanded area diameter becomes 73mm;

Figure 5E - shows the forming stage of the top and bottom flaps, with the decrease of the can body height to 95mm;

Figure 6E - shows the stage in which the can body is ribbed;

Figure 7E - shows the can body's clamping stage;

Figure 1F - shows a plate with the markings of the can bodies which can be cut;

Figure 2F - shows the formation of the can body with 62.4mm diameter and 109mm height;

Figure 3F - shows the pre-expansion stage of the can body's bottom end, whose diameter goes from 62.4mm to 73mm, the can body's central diameter remains 62.4mm and its height is reduced o 104mm, and forming of the top and bottom pre-flaps;

Figure 4F - shows the expansion stage of the can body, which *decreases its height to 96mm, the top end diameter remains* 62.4mm and the expanded area's diameter becomes 73mm;

Figure 5F - shows the calibration stage of the top and bottom flaps, which reduces the can body's height to 95mm;

Figure 6F - shows the stage in which the can body is ribbed;

Figure 7F - shows the can bottom clamping stage;

Figure 8 - shows a top view of the gears accountable for displacing the can body along the forming station;

Figure 9 – shows a top view of the gears axles' synchronism shown in figure 8;

Figure 10 - shows a detailed view of the worm conveyor of the first forming station;

Figure 11 - shows a cross section view of the first pre-expansion station of the can body;

Figure 12 - shows a cross section view of the second full expansion station of the can body;

Figure 13 - shows a top view and a cross-section view of the cans bodies' follower device;

Figure 24 - shows a longitudinal section view of the cans bodies' follower device.

PREFERRED INVENTION FABRICATION

Figures **1A-6A**, **1C-5C** and **1E-7E** show the stages of the usual processes already known of the state of the technique, while the figures **1B-6B**, **1D-6D** and **1F-7F** show usual processes which adopt the **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** proposed herein, where the savings achieved with the adoption of the process shown in figures **1B-6B** can be evidenced, when compared to the process shown in figures **1A-6A** in what concerns the utilization of the raw material, which is significant, if the absolute number of produced cans is assessed, considering that this savings is due to the dimensions of the can bodies or "pipes", which in the process shown in figures **1A-6A** have a 73mm diameter, while in the process shown in figures **1B-6B**, that diameter is only 70mm.

The process shown in figures **1A-6A** uses an expansion system by means of jaws, rulers or tongs, where the attainment of the expanded can is performed in six operations or stages, and it is required to use a specific machine to make the two flaps, while in the process shown in figures **1B-6B**, using the same expansion system by means of jaws, rulers or tongs to obtain the expanded can, but adopting in the starting stage of the process for the forming of the pre-flap, by spinning before the expansion and with the calibration of the flaps, after the definitive expansion, which is also made in six stages or operations, and in that case, the equalization of the stages or operation numbers results from the fact that the process **1A-6A** uses a specific machine to conform the flaps, while in process **1B-6B** the flaps forming is made along with the pre-expansion and pre-flaps operation which locks the can, besides eliminating also the formation stage of the die-necking; that is, the neck forming in the can body's bottom end which is made in the third stage of the process **1A-6A** (fig. 3A).

The forming of the can body (figs. 2A, 2B, 2C, 2D, 2E and 2F) is equal for all processes, and they are obtained through electrical welding, and after that stage, they are distinguished; that is, in process **1A-6A** third stage requires the decrease of the can body's bottom diameter, in process **1B-6B**, third stage, named "pre-flap", the forming of the pre-flap occurs, by spinning, before the can body expansion, and during that stage the pre-expansion of its top end is also performed, whose diameter increases from 70mm to 73mm, and the making of the top and bottom pre-flaps, which lock the can body, preventing that the can height decrease occurs in an irregular form during the expansion act (fig. 3B).

The forming of the top and bottom flaps occurs in the fourth *stage of process* **1A-6A**, *by means of a specific machine to form the* said flaps (fig. 4A), while the expansion proper of the can body *occurs in the fourth stage of process* **1B-6B** *through its ends*, by conventional mandrel expansion process (fig. 4B), whereas the can body top end diameter remains 73mm, and the bottom diameter 70mm, while the expanded area diameter reaches 85mm, and in that stage, the can body's height decrease occurs equally, without irregularities which impair the flap forming and the can clamping.

The clamping of the can bottom occurs during the stage of process **1A-6A** (fig. 5A), while the flap calibration is made during the fifth stage of process **1B-6B**; that is, the adjustment of the flap's measurements, (fig. 5B), which is not foreseen in process **1A-6A**.

The can body's expansion occurs in the sixth stage of process **1A-6A** by the conventional mandrel expansion process, through its top end, since its bottom was already clamped (fig. 6A), decreasing the can body's height only on one side, which creates the nuisance of scratches on the internal varnish, leaving the metal exposed, *jeopardizing the quality of the product to be canned.*

In process **1C-5C** the third stage is dedicated to the can *expansion by the conventional mandrel expansion process, where* its height is decreased to 80.8mm, its top end diameter goes from

68mm to 70mm and its bottom end diameter increases from 68mm to 73mm, the largest expanded area diameter reaches 78.5mm and the body center remains with the 68mm diameter (fig. 3C), considering that the can body's height decrease on both sides, occurs on an irregular basis, which impairs the future stages of flap forming and bottom clamping.

The pre-flap forming occurs in the third stage of process **1D-6D**, *known as "pre-flap" by spinning, before the expansion, and the* can body top end pre-expansion is made in that stage, whose diameter *moves from 68mm to 70mm, the bottom end diameter* increases from 68mm to 73mm, and the center diameter remains at 68mm, and the can body height is decreased to 89mm, the bottom and top pre-flaps also being formed, which lock the can body, preventing an irregular expansion to occur with its height decrease (fig. 3D).

The bottom and top flaps are made during the fourth stage of process **1C-5C** (fig. 4C), while the can body expansion proper occurs in the fourth stage of process **1D-6D**, by means of rulers, jaws or tongs, where its height is decreased to 79.2mm, the top end diameter remains 70mm, the bottom end diameter remains 73mm, the largest expanded area becomes 78.5mm, and the center diameter remains 68mm (fig. 4D).

The can bottom clamping occurs in the fifth stage of process **1C-6C** (fig. 5C), while the flap calibration occurs in the fifth stage of process **1D-6D** *(fig. 5D); this operation is not foreseen in process* 1C-6C, and finally, the can bottom clamping occurs in the sixth stage of process **1D-6D** (fig. 6D).

An invitation is formed in the can body's bottom end during the third stage of process **1E-7E**, preparing for the next stage which is expansion, and in that stage, its height is decreased from 109mm to 106.5mm and the bottom end diameter goes from 62.4mm to 72mm (fig. 3E);

The pre-flap forming by spinning occurs in the third stage of process **1F-7F**, named pre-flap, before the expansion, and the bottom end pre-expansion is made in that stage, whose diameter goes from 62.4mm to 73mm, decreasing its height to 104mm, being also formed the bottom and top pre-flaps which lock the can body, to prevent the expansion from occurring on an irregular form with its height decrease (fig. 3F).

The can body's expansion proper occurs in the fourth stage of process **1E-7E**, the bottom end diameter remaining 62.4mm, the bottom end diameter goes from 72mm to 73mm, and its height is decreased from 106.5mm to 97mm, while the height decrease on both sides occurs in an irregular form, which impairs the future stages of flap formation and bottom clamping,

The can body's expansion proper also occurs in the fourth stage of process **1F-7F**, where the top end diameter remains 62.4mm, the bottom end diameter remains 73mm, and its height is decreased from 104mm to 96mm.

The top and bottom flaps are formed in the fifth stage of process **1E-7E** decreasing its height from 97mm to 95mm.

The flap calibration occurs in the fifth stage of process **1F-7F** (fig. 5F); this operation is not foreseen in process **1E-7E**;

The can body is ribbed in the sixth stage of processes **1E-7E** and **1F-7F**, and the can bottom clamping is made in the seventh and last stage of processes **1E-7E** and **1F-7F**.

After the sheets cutting and can body forming operations (1), and their longitudinal welding with necking diameter, it shall be vertically conveyed by means of conveyor roll-drives (2) to the equipment's input (3).

From this stage on, the spinning process of the can body is started (1), when the can enters the machine in the vertical position, by means of a worm conveyor system (4) which turns on a synchronized form by means of gears (5), with the input star (6) through the cardan shaft (34) and angle gear box (35) and through this synchronism, the can body (1) shall be transferred from the worm (4) to the input star (6) which shall be aligned and in the vertical position, being admitted one by one by the machine, and through this very synchronism, by means of gears (fig. 20), the can body (1) is moved to the first station (7) with accuracy, and they both turn around their own axle in vertical position, but in opposed directions movements (fig. 20), which allows the can body's admission in a continuing and individual form, while the invitation in the can body is made in this first station (7), that is, the body pre-expansion and the bottom and top flaps is made, while this first station (7) is synchronized, by means of gears (8) with the immediate star (9), which is intended to convey the can body with the pre-expansion for the second spinning station (10), while the transfer of the can body from the first station (7) to the second station (10) by means of the intermediate star (9) occurs in a synchronized way through the intermediate gear (11) and in the vertical position, while the intermediate star (9) has the function to transfer the can body to the second station (10), in an accurate way, but in a direction opposed to the one of the first and second stations, which enables the can body's admission in a continuous and individual form, while in the referred second station (10) the second spinning stage occurs, where the can body acquires its final form, which may vary due to the tool types used (12) and through this very type of synchronism, by means of gears (13 and 14), the already expanded can body is transferred from the second station (10) to a withdrawing conveyor belt (15), by means of an output star (16) which turns around its own axle in vertical position, but in a direction opposed to that of the second station (10), which enables the withdrawal of the can body, already formed on a continuous and individual form, transferring them to chain conveyors (17), continuing the cans manufacturing process, through successive stages.

The synchronism system used in the equipment is comprised of gears located in the lower part of each one of the corresponding shafts, and for the worm (4) corresponds the gear (5); for the input star (6) the gear (18); for the first station (7) the gear (8); for the intermediate star (9) the gear (11); for the second station (10) the gear (13) and for the output star (16) the gear (14) which are driven by means of an electric gear motor which couples the gear (19) in its shaft, transmits movements through the intermediate gears (20, 21 and 22), which are located in the bottom part of the machine base; this synchronism works immersed in an oil bath, which lubricates the whole equipment by means of an oil pump on a cyclical form.

As demonstrated, the first station (7) is accountable for the invitation forming; that is, by the can body pre-expansion and the top and bottom flaps forming, which occur by means of piston sets (23) provided with specific tools(24) for that purpose.

The internal part of the first station consists of a gear (8) located in its base, which transmits movement to a bottom round drum (25) which is mechanically coupled to the top round drum (27) by means of the coupling column (26); the bottom round drum, coupling column and the top round drum turn around a central column (28) which remains stopped and fixed to the machine base (29), while two circular cams named top came (30) and bottom came (31), mechanically fastened to the central column (28) are located inside the bottom drum (25) and top drum (27); these round cams have specific shapes in their perimeters, which enable follower rollers (32) connected by means of supports (33) to the shafts (23) are moved in each other, causing them to come closer or to become apart from each other, according to the profile determined by the cams (30 and 31), having in those shafts (23) ends specific tools (24) installed, which shall perform the flaps pre-expansion and forming during the can body turning in that station.

This whole system works as a set of pistons (23) which go up and down, and this station may have several piston sets (23), depending on the number of can bodies/hours that one wishes to produce.

The can body's expansion proper occurs in the second spinning station (10), giving it the final form, which may vary according to the tools used (12) used in the piston systems (36), and this second station has the same basic operation as the first station (7), that is, consists of a gear (13) located in its base which transmits movement to a bottom round drum (37) which is mechanically coupled, by means of a connection column (38) to the top round drum (39) while he bottom round drum, the connection column and the top round drum turn around a central column (40) which remains stopped and fixed to the machine base (29), having two circular cams mechanically fastened to the central column (40), named top cam (41) and bottom cam (42) inside the bottom drum (37) and top drum (39); such round cams have specific shapes in their perimeters which enable follower rollers (43), connected by means of supports (44) to shafts (36) move in each other, causing them to come closer or become apart, as per the profile determined by the cams, while specific tools (12) are installed on those shafts (36) ends; the tools shall perform the final expansion, that is, the final spinning which may vary as a function of the used tools (12).

The quantities of those sets simply referred to as pistons or shafts (36) may vary as a function of the desired can bodies' numbers/hour

The basic operation of the second station (10) is practically identical to that of the first station (7), but this second station is provided with a can follower device, which is intended to receive the can body from the intermediate star (9) and remove it after its course through the second station (10), placing it on the output star(16).

When the can body leaves the first station (7), is already pre-expanded and with the flaps, having a diameter and a shape type, and when this very body can leaves the second station (10) after the final spinning operation, its shape and diameter are others.

During this transfer process of the can body from one station to another, the utilization of the can follower device is essential, whose purpose is to assure a perfect stability of the cans, as to falls as well as the positioning accuracy during the spinning process, taking into account the difference between the can body's diameter at the input and the can body's diameter at the output of the second station (10).

The can follower device is fixed at the central column (10) and connection column (38) of the second station (10), which is fastened and mechanically coupled by its bore to the central column (40) which remains static and fixed to the machine base (29) during its route, while the top face of that cam (43) is provided with a specific groove (44); a follower roller (45) runs through the internal part of that groove thus describing a circular path around the central column (40) corresponding to the cam groove (44) during the machine run, and this follower roller (45) is coupled to a shaft (46), which is positioned in the radial direction of the cam; the moving of that roller in the cam groove circumference allows back and forth movements of the shaft in the radial direction of the cam, and shaft (46) is guided during its course through the hexagonal hole existing inside a round bushing (47) fastened to the coupling column (38) having a half-moon shaped part (48) fixed at the outer end of the shaft which is intended to catch the can body; the geometry of the internal part of this half-moon (48) is designed to accommodate the can body in the pre-expansion stage and after its full expansion, which in its turn, also performs back and forth movement by the action of the shaft (46), which occurs as a result of the cam (44) groove course along its extension, corresponds to the difference of the can body's diameter, allowing the claw (48) to house it, before and after the expansion, and for a better adjustment of this shaft

(46) course and consequently of the claw (48) this shaft is provided, along its length, with a fine tuning system (49) comprised of a pair of symmetric threads (right/left) and a coupling nut existing in its length, which allows the millimetric approximation or separation of the half-moon (48) to/from the can body.

The quantity of that can follower device is in the same ratio as the piston systems (36) which comprise the station (10) and which by its turn, may vary as a function of the wanted quantity of can bodies/hour, which shall be previously set upon the machine construction.

One of the basic characteristics of this can follower device is that it is able to operate in any can conveyor system, not being restricted to the can expansion processes.

As a relevant characteristic, we also point out the fact that this device may be operated in any can conveyor system or machines/equipment for manufacturing cans, both in the horizontal and in the vertical position; besides, it may be used in the steel cans manufacturing processes, as well as in aluminum cans.

We point out that all sets and devices existing in this equipment may be arranged both in the vertical and in the horizontal position, which allows the whole processing of the can body, from its conveyance, to occur in the vertical or horizontal position.

CLAIMS

1º) **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** which shall be intended preferably to the manufacture of cans through the spinning or the cans bodies in the most varied shapes, also enabling the attainment of the deep necking or die-necking in the can bodies, being also used for the most varied purposes, from food and beverage cans, as well as cans for chemicals and others, and they may be manufactured in several materials such as tin foils, chromed sheet or black plate, using the spinning process forming the cans bodies; it may be used in the different types of cans, from those which use metallic, plastic or mixed lids (compound metallic + plastic), clamped such as those using metallic, plastic or mixed lids (compound metallic + plastic), unclamped, provided with sealing and vacuum closure gaskets, which might make the use of the can bodies' object of the patent no. PI 9905474-4 spinning and forming device feasible, **characterized by** the fact that this package forming process starts from a smaller diameter of the can body through its spinning, which is the necking diameter and expand it forming the can body up to the final diameter or starting from the smaller diameter of the body and expanded in the most different geometric shapes.

2º) A **PROCESS**, according to claim 1, **characterized** by the fact of creating material saving, because it allows with the smaller can body diameter, to expand it forming it up to the desired diameter; this expansion, taking as basis a 62.4mm diameter can body, may be expanded forming the can body to the 73mm diameter, which corresponds to an expansion factor of approximately sixteen per cent (16%) which corresponds to an expansion of approximately 10mm of the initial diameter, increasing by sixteen per cent (16%) the can volume and the material saving.

3º) A **PROCESS**, according to claims 1 and 2, **characterized** by the fact of creating savings in the metallic sheets utilization of approximately twenty-five per cent (25%), because the number of can bodies withdrawn from a foil to a conventional can is of the *order of thirty-two (32) bodies against forty (40) bodies withdrawn* from a sheet for the can through the formed spinning process.

4º) A **PROCESS**, *according to claims* 1, 2 *and* 3, **characterized** by the fact of creating savings and a production increase in the varnishing/lithography line, because the number of can bodies extracted from a sheet is twenty-five per cent (25%) higher than in the conventional process, which creates an increase in the line velocity of twenty-five per cent (25%) and a savings of the sheets passes of twenty-five per cent (25%) as well.

5º) A **PROCESS**, according to claims 1 and 2, **characterized** by the fact that the can body spinning and forming process is performed in two operations, where the first operation (7) accomplishes the pre-expansion (1A and 1B), the invitation, with the attainment of the can flap and in the second operation (10) the full expansion of the can body (1C and 1D), which removes irregularities in the flaps dimensions, making the clamping of the can bottom and its closure easier, preventing the can leakage.

6º) A **PROCESS**, *according to claim 5*, **characterized** by the fact that by reducing a step in the cans assembly line, because the *top and bottom flaps in the can body are also accomplished in the* making operation of the pre-expansion – invitation, removing a specific machine in the assembly line, increasing the production line efficiency and velocity.

7º) A **PROCESS**, according to claim 1, **characterized** by the fact that the pipes (1) are conveyed vertically by means of conveyors of the "conveyor-roll drive" type (2) up to the equipment input point (3), where there is a worm conveyor system (4), which *turns around its own axle in horizontal position and in synchronized* form, by means of gears (5) with input star (6) which turns around its *own axle in the vertical position.*

8º) **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING** which is intended preferably to form the flap through spinning, forming and locking the can body before the expansion proper, intended to form the pre-flap in the can bodies for the expansion of the most varied shapes, also enabling the attainment of a deep necking or die-necking in the can bodies, and it may be used for the most different purposes, from food and beverage cans, to chemicals and other cans; the cans may be manufactured in several materials such as tin foils, chromed sheets and black plate, being able to be used in several expansion processes such as by means of a mandrel or by the stretching process, being also used in several types of cans, from those using metallic, *plastic or mixed (compound metallic + plastic) lids, clamped* as those using metallic, plastic or mixed lid (compound metallic + plastic), *unclamped, provided with sealing and vacuum closure* gaskets, which make the can bodies' object of the patent no. PI

9905474-4 spinning and forming device use feasible, characterized by the fact that this process the pre-flap forming by spinning, molding and locking the can body before the expansion, starting from the smaller can body's diameter, necking diameter and pre-expanding, molding the top and bottom ends of the body and forming the pre-flap, locking the can body, enabling its expansion by the several known expansion processes by means of mandrel or by the STRETCHING process, expanded in the most different geometric shapes.

9°) A **PROCESS**, according to claim 8, **characterized** by the fact of creating material saving because it allows to start with a smaller diameter of the can body the forming of the pre-flap by spinning, molding and locking the can body before the expansion, starting with the smaller can body's diameter, necking and pre-expanded diameter, molding the body's top and bottom ends and forming the pre-flap, locking the can body before the expansion.

10°) A **PROCESS**, according to claims 8 and 9, **characterized** by the fact of the pre-flap forming process by spinning molding and locking the can body before the expansion, allowing the expansion to be accomplished in two different operations, where the first operation (7) accomplishes the pre-expansion (1A and 1B), with the attainment of the two pre-flaps and in the second operation the full expansion of the can body by the selected expansion process, which removes irregularities in the flaps dimensions, preventing the can tightness and hermetics exposure.

11°) A **PROCESS**, according to claim 10, **characterized** by the fact of reducing a stage in the cans assembly line, because in he operation of the top and bottom flap making and the can body locking, removing a specific machine from the assembly line, increasing the production line efficiency and velocity.

12º) **SPINNING PROCESS FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING AND SPINNING EQUIPMENT FOR METALLIC PACKAGES FORMING WITH PRE-FLAP FORMING,** characterized by the fact that the pipes (1) are conveyed vertically by means of conveyors of the "conveyor-roll drive" type (2) up to the equipment input point (3), where there is a worm conveyor system (4), which turns around its own axle in horizontal position and in synchronized form, by means of gears (5) with input star (6) which turns around its own axle in the vertical position.

13º) An **EQUIPMENT**, according to claim 12, ***characterized*** by the fact that the pipe (1) is moved from the worm conveyor (4) to the input star (6), through a synchronized system which are aligned and in the vertical position, being admitted by the machine one by one.

14º) An **EQUIPMENT**, according to claim 13, ***characterized*** by the fact that through this same synchronism type, by means of gears (18), the said pipe (1) – in the vertical position – is transferred for the station (7) of the pre-flap forming by spinning, molding and locking the can body by means of an input star (6), and both turn around their own axles in vertical position, but with opposed directions movements, which enables an admission of the pipe in a continuous and individual form, that is, one by one.

15º) An **EQUIPMENT**, according to claim 14, ***characterized*** by the fact that the pre-expansion of the pipe (1A and 1B) is made in that station (7), that is, the pre-flap and the can body locking are made.

16º) An **EQUIPMENT**, according to claim 15, ***characterized*** by the fact that the station (7) is synchronized by means of gears (8), the output star (9) which is intended to convey the can body (1A and 1B) continuing the can manufacturing process through successive stages of expansion by the several existing expansion processes.

17º) An **EQUIPMENT**, according to claim 16, ***characterized*** by the fact that the can body transfer (1A and 1B) from the station to the next stages, occurs in a synchronized way, by means of gears (11) and in the vertical position, by means of the output star (9) which turns around its own axle in vertical position, but with movements in opposite directions to the station's, which enables the admission of the can body in a continuous and individual form.

18º) An **EQUIPMENT**, according to claims 12, 13, 14, 16 and 17, ***characterized*** by the fact that the synchronism system is comprised of gears located in the lower part of each one corresponding axles, where the worm (4) is related to the gear (5); input star (6) with the gear (18); station (7) with the gear (8); output star (9) with the gear (11), which are driven by means of an electric gear motor; these gears work immersed in an oil bath, which lubricates the whole equipment in a cyclic form, through an oil pump.

19º) An **EQUIPMENT**, according to claim 15, ***characterized*** by the fact that the station (7) is accountable for the pre-flap formation and the can body locking (1A and 1B), which occurs by means of pistons sets (23) provided with specific tools (24) for that purpose.

20°) An **EQUIPMENT**, according to claims 14, 15 and 16 ***characterized*** by the fact that the inner part of the station is comprised of a gear (8) located in its base, which transmits movement to a bottom circular drum (25), which in its turn, is mechanically coupled by means of the coupling column (26) to the top circular drum (27); these elements (top/bottom circular drum and coupling column) turn around a central column (28), which remains static and fixed to the machine base (29).

21°) An **EQUIPMENT**, *according to claim 20* ***characterized*** by the fact that there are two circular cams named top cam (30) and *bottom cam (31) inside the bottom drum (25) and top drum (27) and* mechanically fastened to the coupling column (26), which have in their perimeters specific shapes which allow follower rollers (32), coupled by means of supports (33) to shafts (23) to move each other, making these to come closer or to become apart according to the shape determined by the cams.

22°) An **EQUIPMENT**, according to claims 19, 20 and 21, ***characterized*** by the fact that specific tools (24) are provided in those shafts (pistons) ends (23) which shall perform the pre-flap and the can body locking (1A and 1B) during the can body turning in that station.

23°) An **EQUIPMENT**, according to claim 21, ***characterized*** by the fact that the follower rollers (32) coupled by means of supports (33) to shafts (23) which move in each other, work as a piston set which goes up and down, and the quantity of pistons sets *depend on the desired numbers of can bodies/hours.*

24°) An **EQUIPMENT**, according to claims 8 on, ***characterized*** *by the fact that all sets of devices existing in this* equipment may be arranged both in the vertical and in the horizontal positions, enabling the whole processing of the can body, from its starting to the final conveyance occur in the vertical or horizontal position; this equipment may also be operated in an isolated form or coupled to the production line of several known expansion processes.

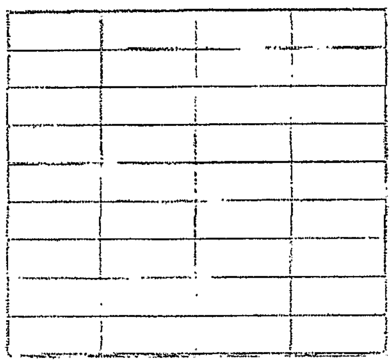

FIG. 1 A

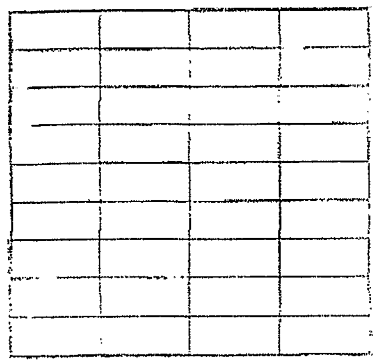

FIG. 1 B

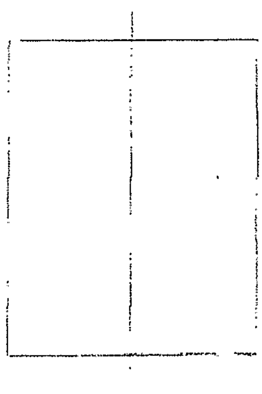

FIG. 2 A

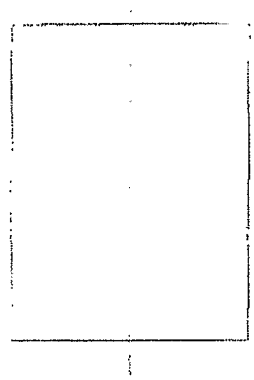

FIG. 2 B

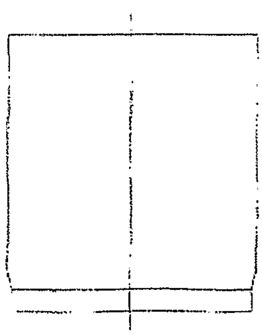

FIG. 3 A

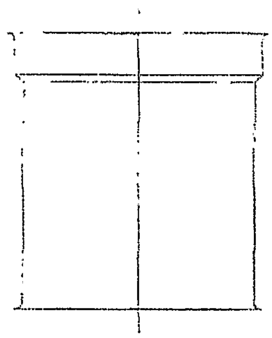

FIG. 3 B

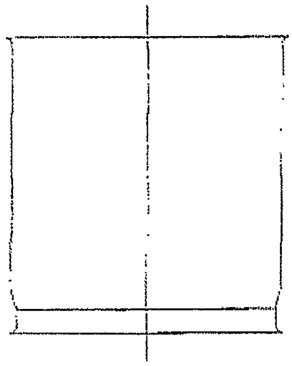
FIG. 4 A

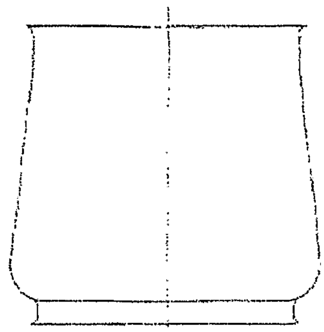
FIG. 4 B

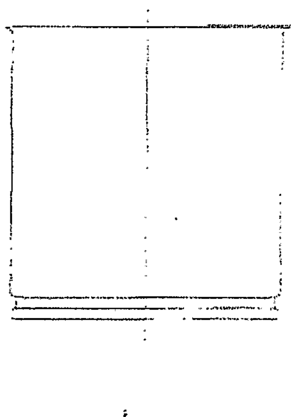
FIG. 5 A

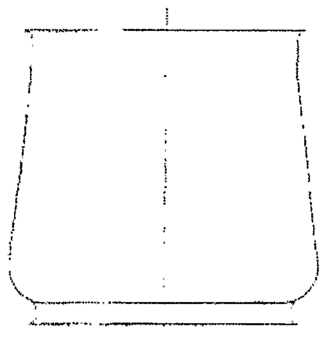
FIG. 5 B

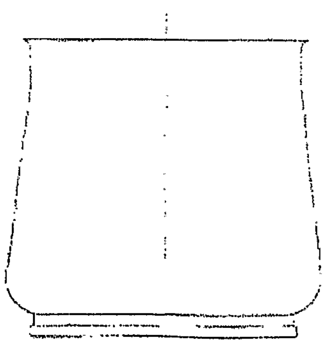
FIG. 6 A

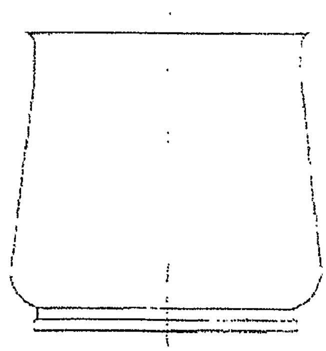
FIG. 6 B

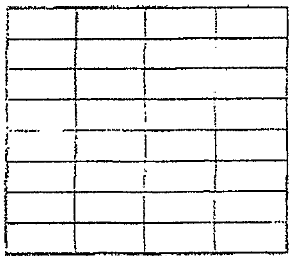

FIG.1 C

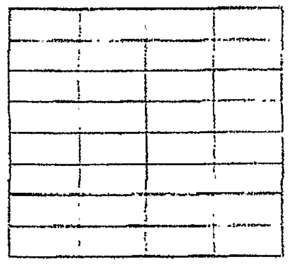

FIG.1 D

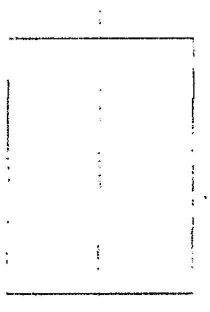

FIG. 2 C

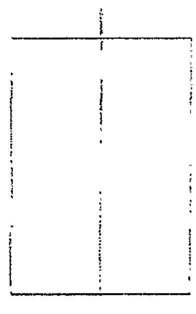

FIG. 2 D

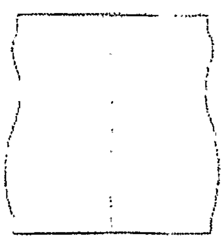

FIG. 3 C

FIG. 3 D

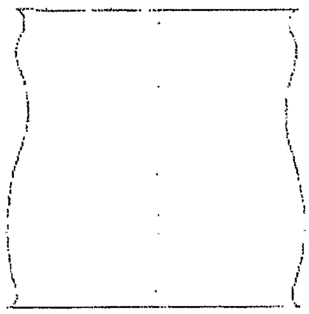

FIG. 4 C

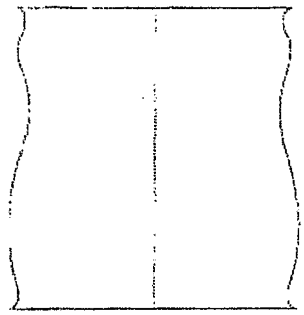

FIG. 4 D

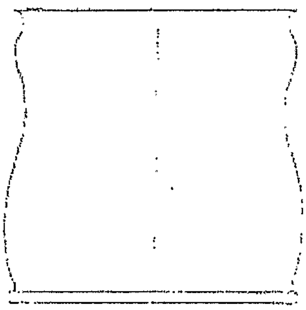

FIG. 5 C

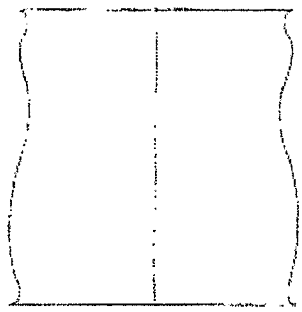

FIG. 5 D

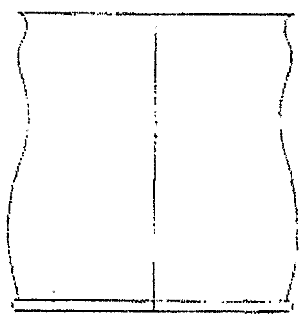

FIG. 6 D

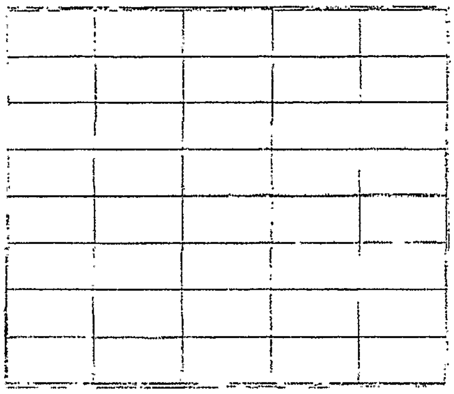

FIG. 1 E

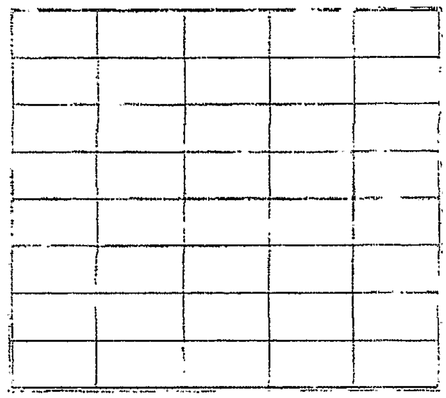

FIG. 1 F

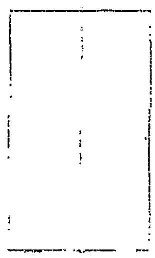

FIG. 2 E

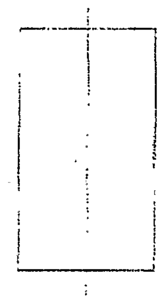

FIG. 2 F

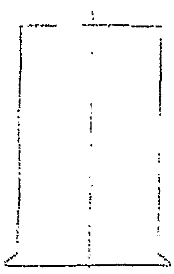

FIG. 3 F

FIG. 3 F

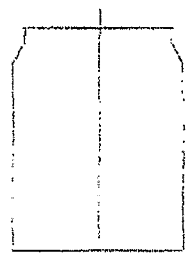

FIG. 4 E

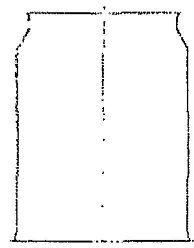

FIG. 4 F

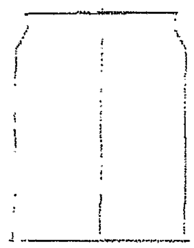

FIG. 5 E

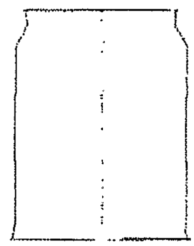

FIG. 5 F

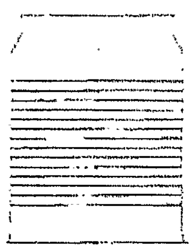

FIG. 6 E

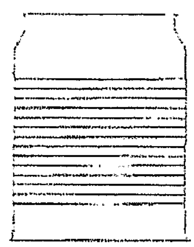

FIG. 6 F

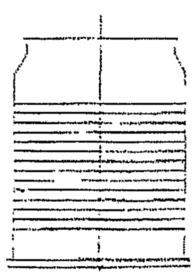

FIG. 7 E

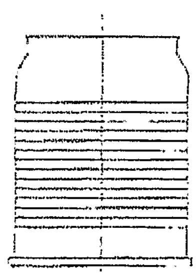

FIG. 7 F

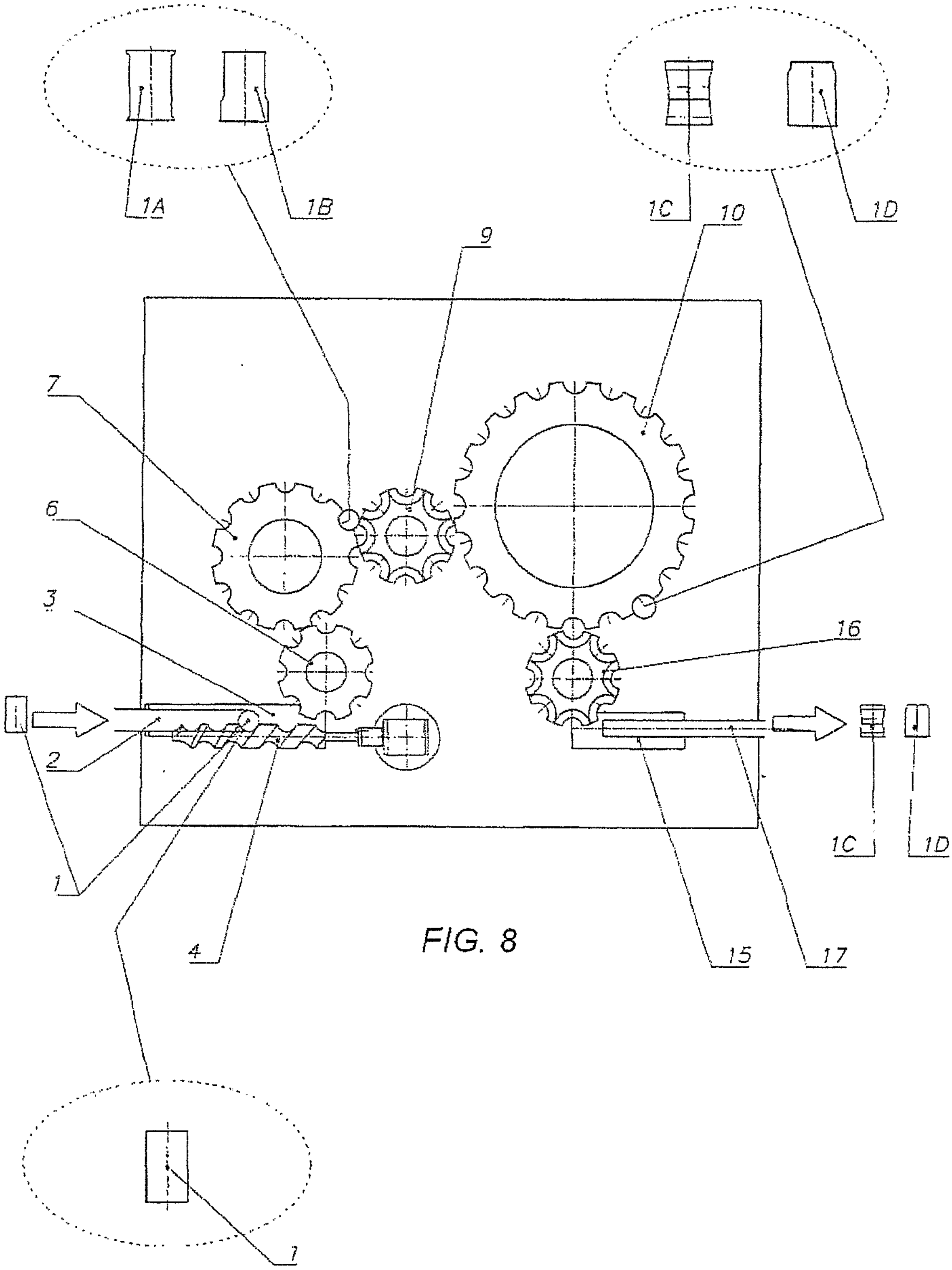

FIG. 8

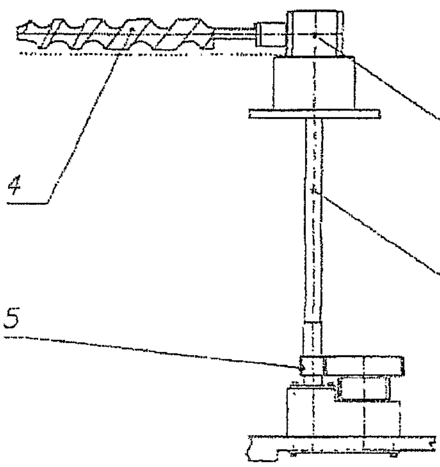

FIG. 10

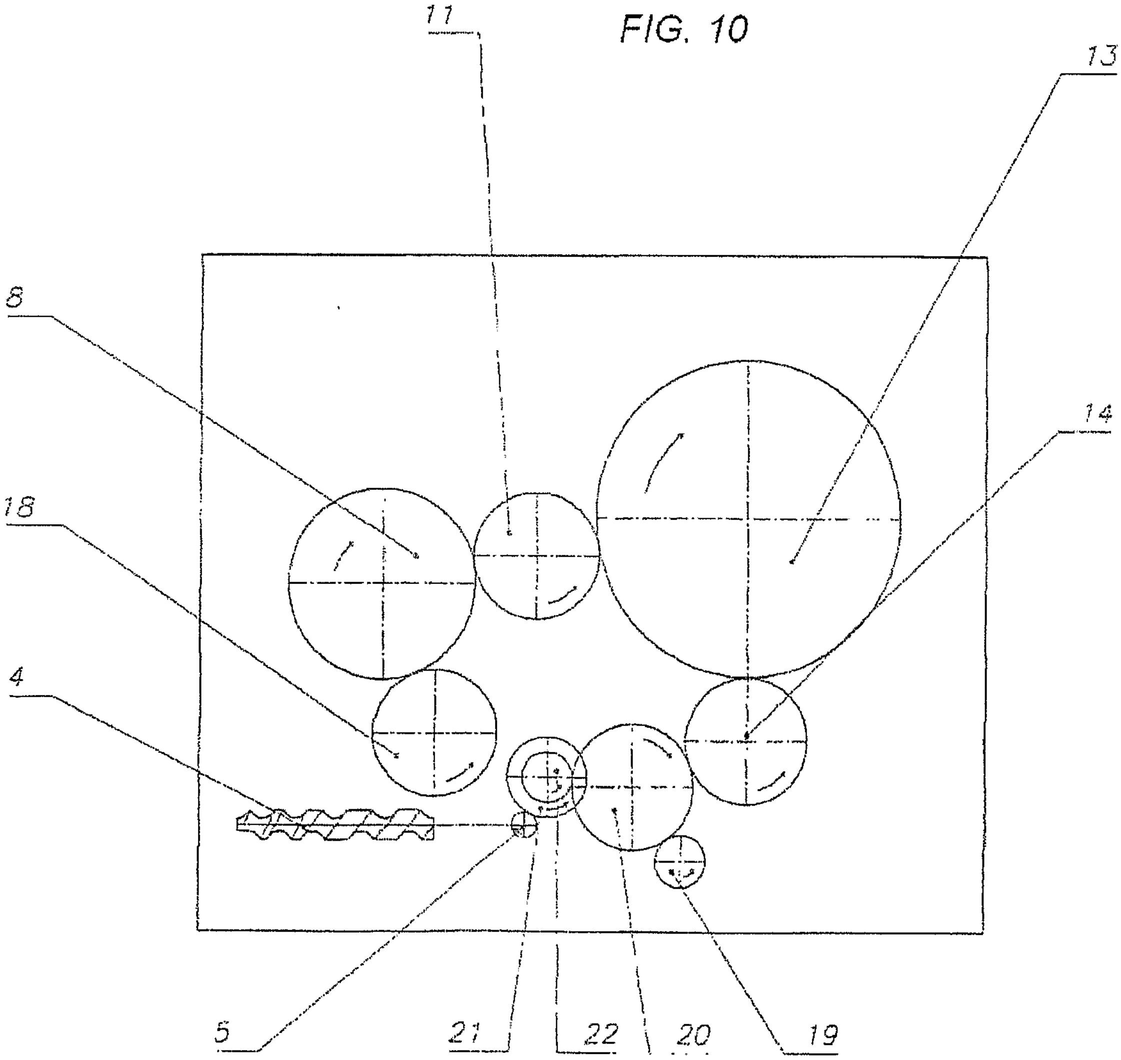

FIG. 9

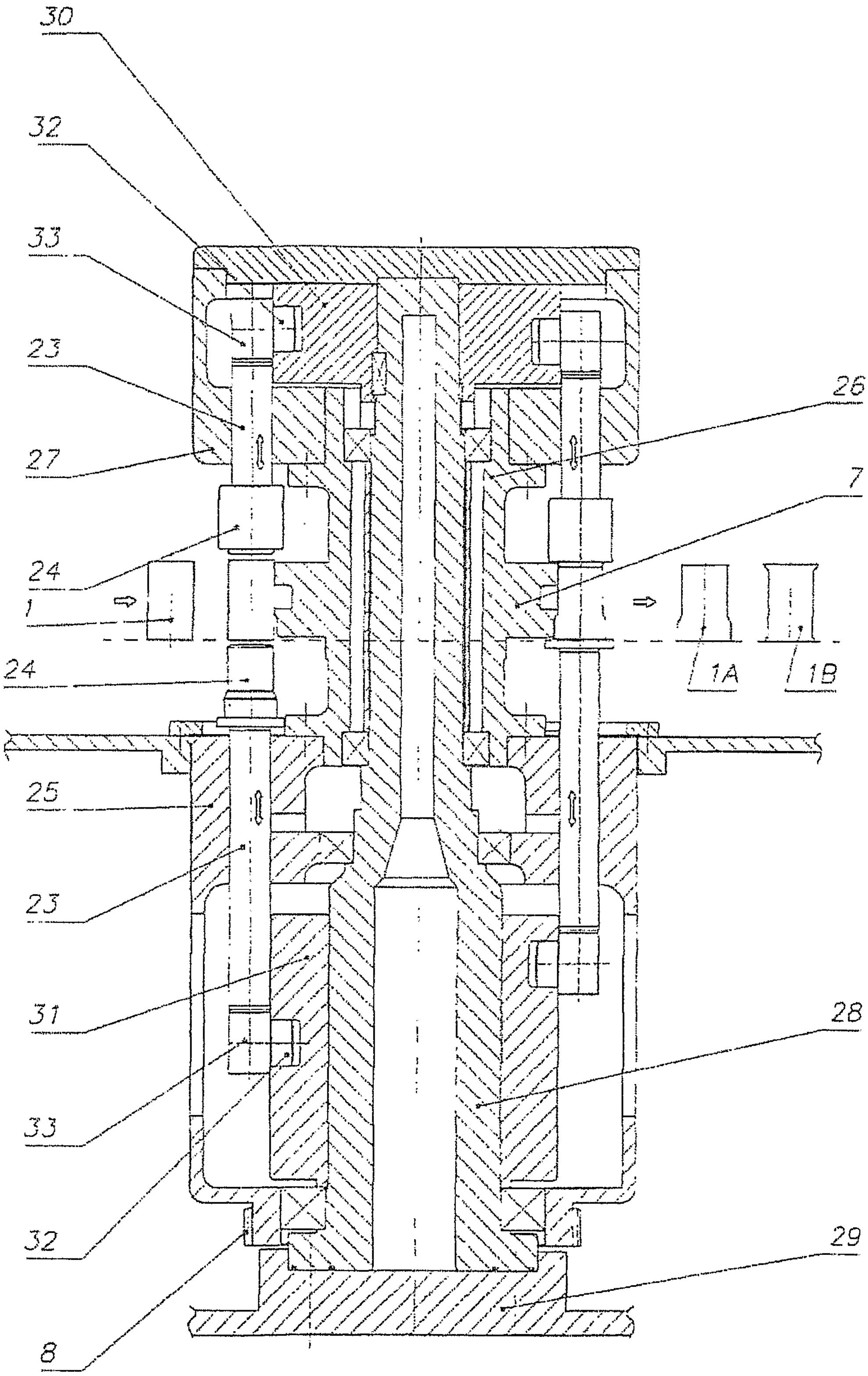

FIG. 11

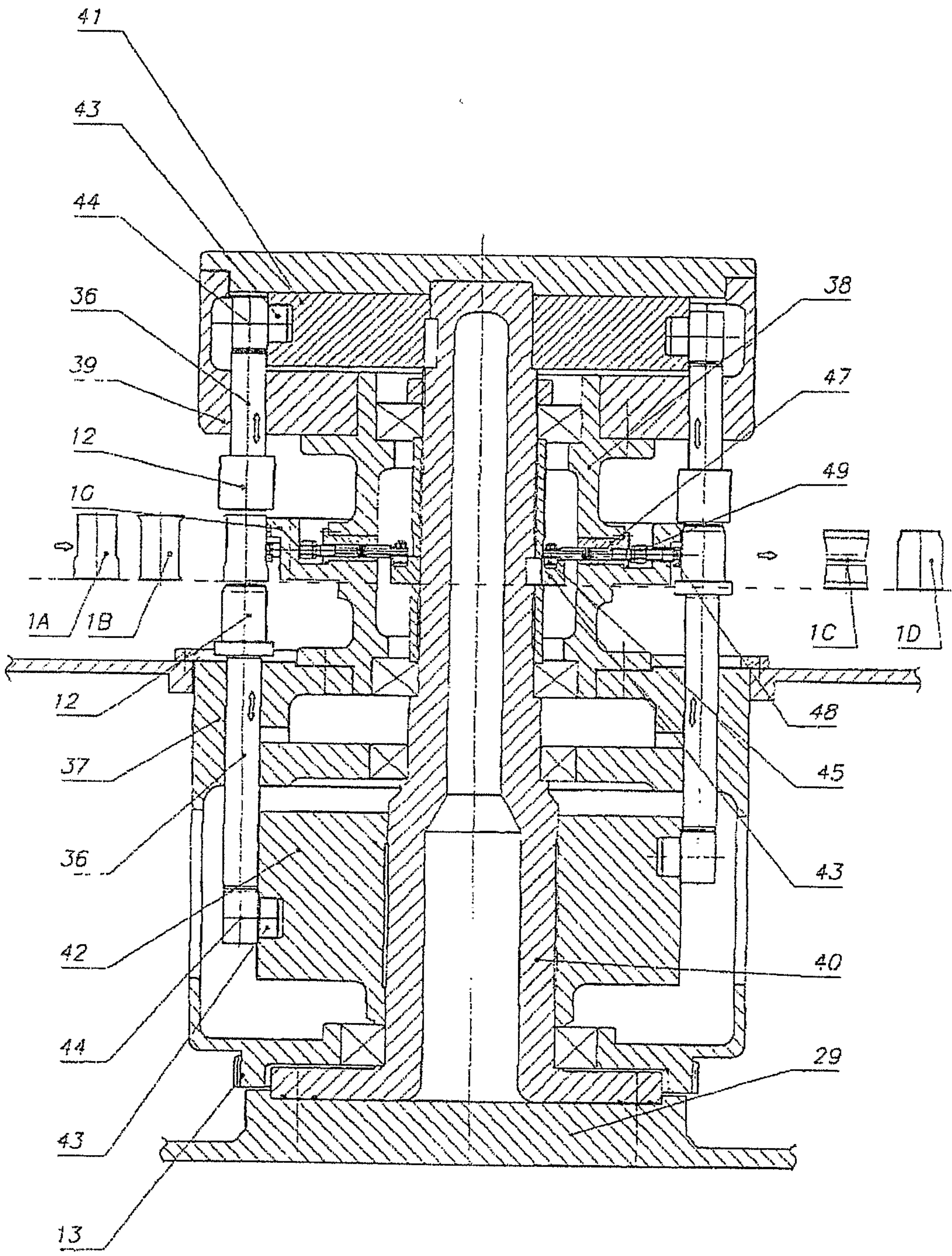
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FIG. 12

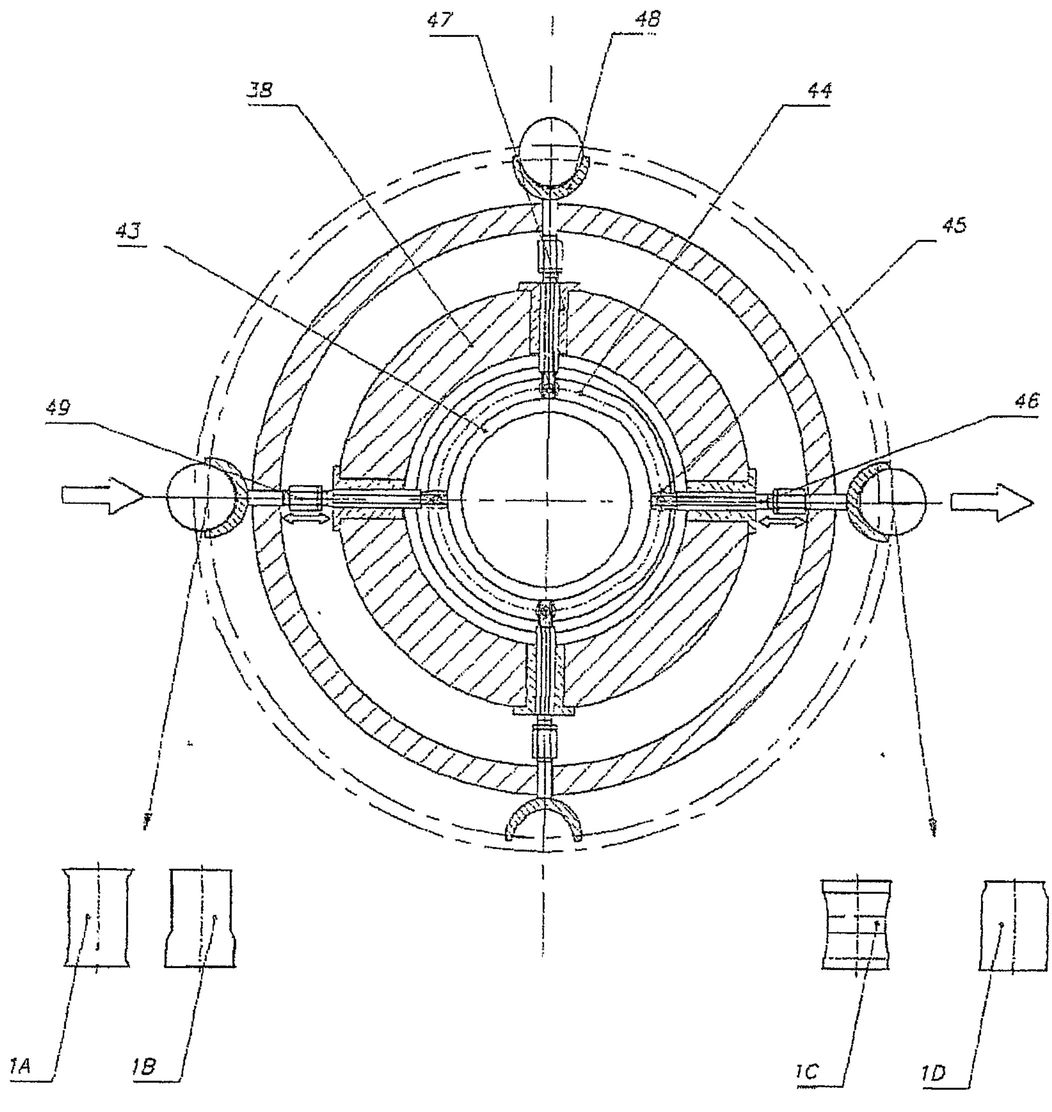

FIG. 13

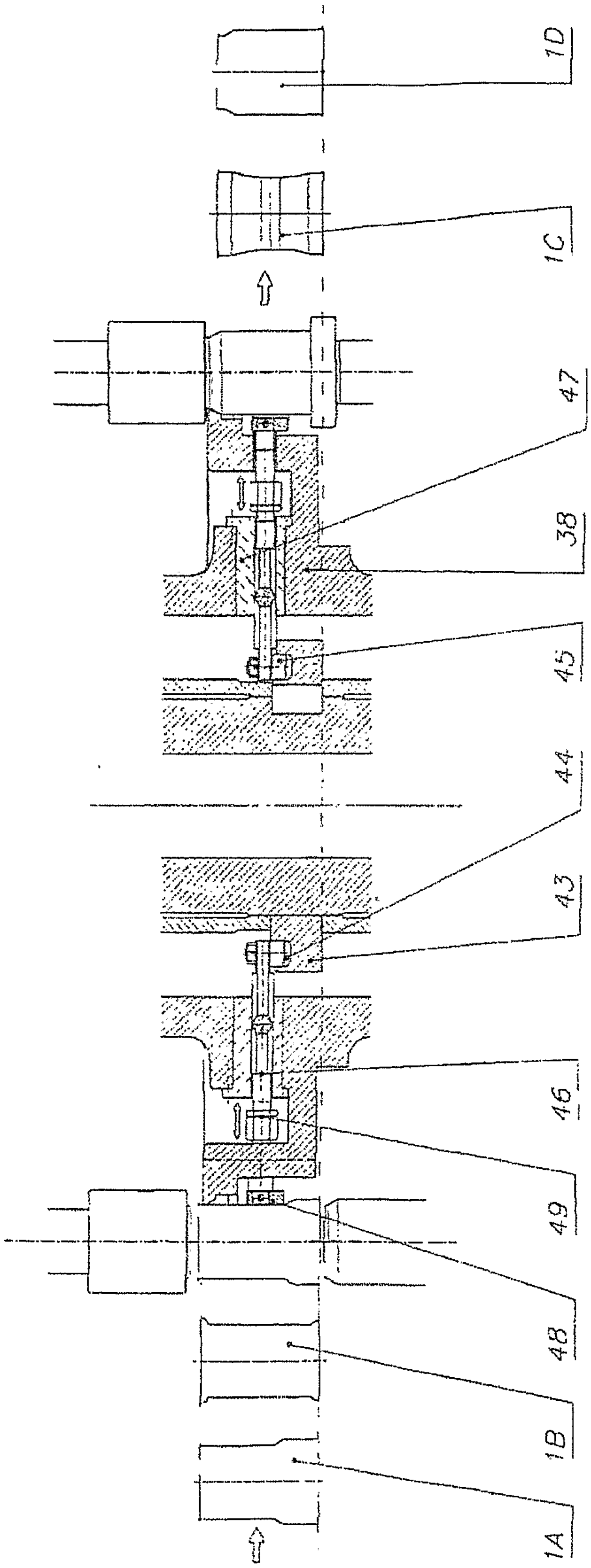

FIG. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/BR 2007/000153

A. CLASSIFICATION OF SUBJECT MATTER
IPC[8]: ***B21D 51/06*** (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC[8]: B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Epodoc, WPI, cl txte, cl cxtg

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE2257210 A (METAL BOX CO LTD) 30 May 1974 (30.05.1974) *figs. 1a-17* --	1-24
X	JP7032073 A (NIPPON OXYGEN CO LTD) 3 February 1995 (03.02.1995) *abstract, figs. 1-5* --	1-24
X	DE3716176 A1 (PRAEZISIONS WERKZEUGE AG) 8 September 1988 (08.09.1988) *abstract, figs. 1-7* --	1-24

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
17 January 2008 (17.01.2008)

Date of mailing of the international search report
13 February 2008 (13.02.2008)

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BABUREK G.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	DE1602412 A (E W BLISS CO) 26 August 1971 (26.08.1971) *figs. 1-8* --	1-24
X	US3953994 A (BRAWNER ET AL) 4 May 1976 (04.05.1976) *abstract, figs. 1-14* --	1-24
X	US3344647 A (BERGER) 3 October 1967 (03.10.1967) *figs. 1-5* --	1-24
X	GB2204520 A (BARRETT) 16 November 1988 (16.11.1988) *abstract, figs. 1-30* ----	1-24

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCTBR2007/000153

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