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(54) Machine and method for shaping containers

(57) A machine for shaping metal cylinders, comprising:

a turntable (1) configured to receive metal cylinders (100) with one open end, and to rotate step-wise, such that the cylinders go through a plurality of shaping positions (32); and
a tool-rack table (2) carrying a plurality of shaping tools (21), the machine being provided with means for axially shifting the tool-rack table between a standstill position, in which the tools (21) are separated from the cylinders (100) on the turntable, and a contact position, in which the tools (21) come into contact with the cylinders (100).

At least a plurality of the tools (21) are provided with means for axially shifting the tool with regard to the tool-rack table (2), such that the total shifting (X + Y) of the tool towards the turntable corresponds to the sum of the shifting of the tool-rack table (X) from the standstill position and the shifting (Y) of the tool (21) with regard to the tool-rack table (2).

The invention also refers to a method.

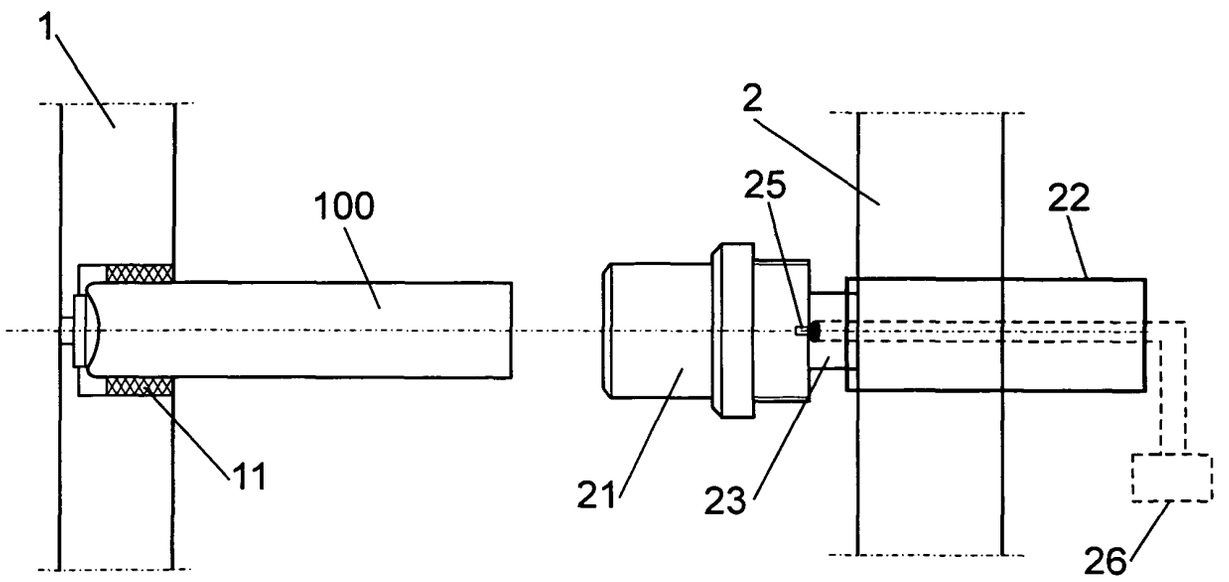

FIG. 3A

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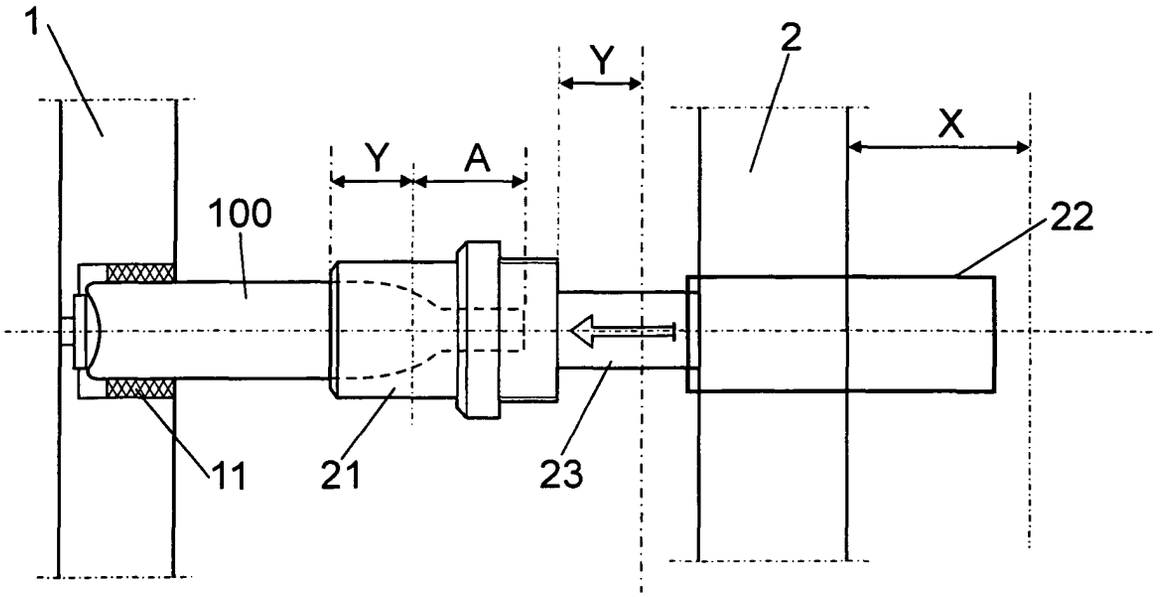


FIG. 3B

Description

FIELD OF THE INVENTION

[0001] The invention is related to machines for shaping metal containers, specifically, to automatic machines receiving metal cylinders with one open end and which form or shape said cylinders by means of one or several shaping tools or instruments; this type of machines are known as necking machines.

BACKGROUND OF THE INVENTION

[0002] Processes are known for manufacturing metal cylindrical containers in which, starting from a metal cylinder with one open end, said open end is shaped or formed to establish a "neck" of the container. The neck has a shape which is established during the shaping process of the open end, and ends in an opening in which a cover, a nozzle, a sprayer or another type of device for discharging and applying the product contained in the container, will be placed. Thus, a container can be obtained constituted of a single piece of metal, without weldings, to which an element for dispensing the contents is attached, such as a nozzle, generally manufactured in a metal, plastic material or the like.

[0003] Figures 1A and 1B schematically show a known system in which the shaping of the open part of the container is carried out in several successive steps, carried out sequentially. The system comprises a necking machine comprising a turntable 1 receiving, from a drum or feed mechanism 200, metal cylinders 100 having, at least, one open end. The turntable 1 comprises securing means 11 for securing the cylinders 100 received; said securing means 11 can consist of grips, clips or the like.

[0004] The turntable 1 is arranged such that it can rotate around a spin shaft 12 parallel to the longitudinal axis of the cylinders 100 secured by the securing means 11. When the turntable 1 rotates, each cylinder 100 goes, step-wise, from a loading position 31, which is the position in which the turntable receives the cylinder, going through a series of shaping positions 32 for shaping the open part of the container, in which the neck of the container is formed, until an unloading position 33 in which the metal cylinder (now with the neck formed) is unloaded by an unloading mechanism 201 and moved to a conveyor.

[0005] On the other hand, the machine comprises a tool-rack table 2 with forward and backward movement which a plurality of shaping tools 21 are fixed to which, when applied on the open end of a cylinder 100, modify the profile or shape of said end by means of deforming the metal in said area of the cylinder.

[0006] The turntable 1 and the tool-rack table 2 are opposite to one another and the tools 21 are coupled or fixed to the tool-rack table opposite the shaping positions 32 in which the cylinders 100 on the turntable 1 are located. Each tool 21 is selected such that, when applied on the cylinder which is in the shaping position 32 opposite to the tool, it deforms or shapes the open end of the cylinder by a measurement corresponding to part of the total deformation or shaping to which the open end of the cylinder must be subjected during the shaping process, between the loading position 31 and unloading position 33.

[0007] Application of the tools 21 on the open ends of the cylinders is conventionally carried out by means of axially shifting the tool-rack table 2 with regard to the turntable 1 with the cylinders 100. The most usual manner is for the tool-rack table 2 to shift a fixed distance X (see figures 2A and 2B) towards the turntable 1, from a standstill position (figure 2A) to a maximum turntable approach position (figure 2B).

[0008] The axial movement of the tool-rack table 2 is synchronized with the rotational movement of the turntable 1, such that the turntable 1 intermittently rotates, moving the cylinders from one shaping position 32 to the next shaping position, and after each step, i.e. each time the cylinders reach a new shaping position, the tool-rack table 2 shifts a distance X towards the cylinders 100, such that the tools 21 come into contact with the cylinders 100 and carry out their corresponding parts of the total shaping of the open parts of the cylinders.

[0009] In other words, the axial movement and rotational movement are carried out step-wise and in a sequential and synchronized manner, such that the neck of the container is successively formed or shaped along the run of the cylinder from the loading position 31 to the unloading position 33. In turn, the rotational movements of the turntable and the axial movements (forwards and backwards) of the tool-rack table are coordinated with the feed mechanism 200 and with the unloading mechanism 201 such that in each work cycle (corresponding to the shifting of a cylinder 100 from one shaping position 32 to the next), the drum 1 is fed with a cylinder in the loading position 31, and a cylinder is unloaded (with its open end shaped) in the unloaded position 33, from which the cylinders (now with their necks shaped and finished) are led to a packaging machine and palletizer in order to be sent to the recipient.

[0010] Once the cylinder has gone from the loading position 31 to the unloading position 33, the cylinder has been shaped by all the tools, and the open end has a neck with the desired features.

[0011] EP-A-0 275 369 discloses a system substantially according to these features. Another type of container shaping machine is disclosed in US-A-3,913,366.

[0012] In machines of the type described above, the axial movement of the tool-rack table 2 has a fixed forward and backward run X, therefore the length of the neck formed on the cylinder is related to this run and limited by the synchronization of the movements of the respective turntable and tool-rack table.

[0013] Figures 2A and 2B schematically show the turntable 1 and the tool-rack table 2 in a conventional

machine, before and after an axial shifting of the tool-rack table. Figure 2A shows part of the turntable 1 with the securing means 11 securing a "virgin" cylinder 100, i.e. with the open end yet to be shaped. The tool-rack table 2 is also shown, with one tool 21 (the remaining tools are not shown in the figure). The fixed distance or run X of the axial shifting of the tool-rack table 2 is also indicated.

[0014] Figure 2B shows the same elements, but after the tool-rack table 2 has been shifted a fixed distance X in an axial direction, towards the turntable 1. As can be seen, the tool 21 affects the open end of the cylinder, along distance A in an axial direction, from the open end. This means that the tool 21 can contribute to forming or shaping a neck having a length substantially equal to said distance A (from the beginning of the neck and to the open end) (in figure 2B, an already formed neck is shown; however, in reality, the neck is not formed in a single step, i.e. in a single shifting of the rack, but rather in successive shifts, during which the successive tools 21, little by little, form the neck as the cylinder shifts from the loading position to the unloading position).

[0015] Now, with the system disclosed above, distance A is limited, at the beginning, by distance X traveled by the tool-rack table 2. Distance X which the tool-rack table 2 travels is usually fixed and is carried out, for example, by means of a crank-rod mechanism. Movement of the turntable is usually a movement indexed with that of the tool-rack table such that only part of the time the tool-rack table 2 uses in shifting can be used for the deformation of the cylinder, i.e. the turntable is only stopped in front of the tool-rack table a part of the forward and backward movement time of the tool-rack table. Therefore, it is usual for A<X (sometimes, A<<X).

[0016] Therefore, the axial run "X" of the tool-rack table sets a maximum limit of the length (in an axial direction) of the necks of the containers being formed in the machine and, as a result, implies a limitation of the container design possibilities and, therefore, a limitation on the presentation possibilities on the market of the packaged product in an original design container.

DESCRIPTION OF THE INVENTION

[0017] A first aspect of the invention refers to a machine for shaping metal cylinders, comprising:

a turntable configured so as to receive, in at least one loading position, metal cylinders with (at least) one open end, the machine being provided with step-wise rotation means of the turntable such that the received cylinders, due to the rotation of the turntable, go from said loading position, through a plurality of shaping positions, to an unloading position; and

a tool-rack table carrying a plurality of shaping tools, the tool-rack table with the tools being located axially opposite to the turntable, such that each tool is opposite to a shaping position, the machine being provided with means for axially shifting the tool-rack table between an initial standstill position, in which the tools are separated from the cylinders on the turntable, and a contact position in which the tools are in contact with the cylinders in, at least, a plurality of shaping positions, acting on said cylinders (from their open ends). Thus, each time the cylinders reach a new shaping position, the tool-rack table shifts towards the cylinders and the tools come into contact with the corresponding cylinders, acting on them, deforming or shaping the metal. Thus, as a cylinder goes from the loading position to the unloading position, the cylinder is being shaped.

[0018] According to the invention, at least a plurality of the tools (in many cases, all the tools) are provided with means for axially shifting the tool with regard to the tool-rack table, said means for axially shifting the tool with regard to the tool-rack table being synchronized with the means for axially shifting the tool-rack table, such that when the tool-rack table axially shifts towards the turntable, from the standstill position, said plurality of tools shifts towards the turntable with regard to the tool-rack table, such that the total shifting (X + Y) of the tool towards the turntable corresponds to the sum of the shifting of the tool-rack table (X) from the standstill position and the shifting (Y) of the tool with regard to the tool-rack table.

[0019] Increasing the total shifting distance of the tool in the conventional machine type is thus achieved and without the use of specially designed machines with runs of the tool-rack table greater than said distance X.

[0020] The design of the machine which achieves greater axial shifting runs of the tool-rack table would increase the shifting speed of that tool-rack table in order to maintain the cycle time (cadence) of the machine, which is integrated in a manufacturing line.

[0021] Significantly increasing the speed of the tool-rack table can be a drawback, since it requires faster actuation elements which can increase the stresses that the components of the machine intervening in the shifting of the tool-rack table can be subjected to, generate more vibrations, etc. On the other hand, shifting the tool-rack table more than what is the "original run" without increasing the speed implies a certain delay in the shaping process in the machine (since each cycle would require more time), something which can especially be a drawback in a chain container production system.

[0022] On the other hand, the invention allows increasing the total run of the tools in conventional machines existing on the market or already installed in factory, by simply adding to the conventional machines the means for axially shifting the tools with regard to the tool-rack table, and without having to significantly modify the original design of the machines. This allows obtaining longer necks with a minimum adaptation cost of

conventional machines.

[0023] Another possible advantage of the invention is that it allows controlling in an independent manner the shifting of some tools, since in addition to the shifting of the tool-rack table, each tool can be shifted a certain distance with regard to said tool-rack table, this distance not necessarily being the same distance for all the tools.

[0024] The means for shifting the tool with regard to the tool-rack table can comprise a telescopic assembly by means of which the tool is attached to the tool-rack table and which has individual forward and backward movement.

[0025] On the other hand, the means for shifting the tool with regard to the tool-rack table can comprise pneumatic, hydraulic, electric shifting means, or any other type of shifting means suitable for the machine.

[0026] The means for shifting the tool with regard to the tool-rack table can be chosen such that they are the same type as those means for shifting the tool-rack table itself. In other words, if the tool-rack table shifts with pneumatic shifting means, the means for shifting the tool with regard to the tool-rack table can preferably be pneumatic means, etc., this having the purpose of simplifying system configuration and maintenance, being able to use a single pressure source, etc.

[0027] A plurality of said means for axially shifting the tool with regard to the tool-rack table can be means for individually shifting a single tool with regard to the tool-rack table. In other words, each tool can be provided with its own means for shifting with regard to the tool-rack table (for example, an independent telescopic assembly, etc.).

[0028] On the other hand, it is not necessary for all the tools to be provided with means for shifting with regards to the tool-rack table: there is the possibility of using these means for relative shifting with regard to the tool-rack table only for those tools corresponding to a phase of the cylinder shaping cycle in which a shifting (X +Y) greater than that provided by the tool-rack table (X) itself is needed.

[0029] To increase even more the relative axial shifting between tools and cylinders, there is also the possibility of axially shifting the turntable towards the tool-rack table in each shaping cycle.

[0030] Since extensive surfaces are going to be formed, the drawback does exist that the cylinder can be trapped by the shaping tool with a force that can exceed the force with which the cylinder is retained on the turntable. This can cause the cylinder to be released from the securing means (grips or the like), interrupting the work cycle and making the manufacture impossible since, if it were released and trapped in the tool, it would collide with the following cylinder in the subsequent cycle. For this reason, to prevent this from occurring, a compressed air point can be introduced in the tool which aids in securing the container on the turntable.

[0031] In other words, the machine can include a compressed air expulsion system including at least one compressed air outlet associated to, at least, one of the tools (for example, located "inside" the tool, in the piston of the telescopic assembly which the tool is assembled on, which usually has a "hollow" configuration), said compressed air system being configured to discharge compressed air towards the cylinder opposite to said, at least one, tool during at least one part of the axial shifting cycle of the tool with regard to the cylinder (preferably, during the initial part of the backward movement phase of the tool with regard to the turntable and cylinder, from the contact position), for the purpose of preventing the cylinder from being retained in the tool when the tool moves backwards.

[0032] Logically, there can be a compressed air outlet associated to each tool.

[0033] Another aspect of the invention refers to a method for shaping metal cylinders, comprising the steps of:

shifting metal cylinders with at least one open end, step-wise, from a loading position, going through a plurality of shaping positions, to an unloading position;

shifting a tool-rack table carrying a plurality of shaping tools in an axial direction, between a standstill position, in which the tools are separated from the cylinders, and a contact position, in which the tools come into contact with the cylinders in, at least, a plurality of the shaping positions, acting on said cylinders (from their open ends);

carrying out the shifting of the cylinders and the axial shifting of the tool-rack table in a synchronized and sequential manner, such that after the shifting of a cylinder from one shaping position to the next shaping position, an axial shifting of the tool-rack table follows, such that a tool acts on the cylinder in said next shaping position;

characterized in that

additionally, at least a plurality of the tools shift with regard to the tool-rack table in an axial direction and in a manner synchronized with the axial shifting of the tool-rack table, such that when the tool-rack table axially shifts towards the cylinders, from the standstill position, said plurality of tools shift towards the cylinders with regard to the tool-rack table, such that the total shifting (X + Y) of each tool towards the corresponding cylinder corresponds to the sum of the shifting (X) of the tool-rack table from the standstill position and the shifting (Y) of the tool with regard to the tool-rack table.

[0034] Shifting of the tool with regard to the tool-rack table can be carried out by means of a telescopic assembly by means of which the tool is attached to the tool-rack table.

[0035] Shifting of the tool with regard to the tool-rack table can be carried out with pneumatic, hydraulic, mechanical, electric shifting means or any other type of means suitable for the machine.

[0036] Some or all of the tools shifting with regard to the tool-rack table can be shifted with shifting means independent from those shifting means used for shifting other tools.

[0037] To prevent the cylinders from being retained in the corresponding tools when the tools move backwards towards the standstill position, i.e. with regard to the turntable, during at least part of each shifting cycle of the tools with regard to the cylinders, compressed air can be discharged on at least one of the cylinders.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] A series of drawings are very briefly described below which help to better understand the invention and which are expressly related to one embodiment of said invention presented as an illustrative and non-limiting example thereof.

Figure 1A shows a front elevational schematic view of the turntable for receiving containers of a container neck shaping or formation machine.

Figure 1B shows a sectional side schematic view of a container neck shaping machine.

Figures 2A and 2B schematically show some of the elements intervening in the shaping of a container, in two phases of a shaping cycle, according to the state of the art.

Figures 3A and 3B schematically show some of the elements intervening in the shaping of a container, in two phases of a shaping cycle, according to a preferred embodiment of the invention.

Figure 4 shows a comparison of a neck obtained in the conventional machine and a neck obtained in the machine according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

[0039] A machine according to a preferred embodiment of the invention can include a conventional machine, comprising all the elements described above and which is shown in figures 1A-2B. This part of the machine does not require a more detailed description; it is a type of machine very well known in the field.

[0040] According to a preferred embodiment of the invention, for each tool 21 to be provided with a larger run, a telescopic assembly is coupled to the tool-rack table 2, which assembly comprises a cylinder 22, which is fixed on the tool-rack table 2, and a piston 23 which can axially shift in the cylinder and having one end projecting from the cylinder and on which end the tool 21 is coupled.

[0041] Figures 3A and 3B show this configuration. Specifically, one part of the tool-rack table 2 can be schematically seen with one of the tools 21 connected to the outer end of the piston 23, which can be shifted in the cylinder 22. The cylinder can be a pneumatic or hydraulic cylinder. (As an alternative to the configuration with a cylinder and piston, the piston can be replaced by a spindle and the cylinder with a motor configured for shifting the spindle in an axial direction; there are many alternatives and the choice of the optimal alternative in each case can be made according to the other features of the machine in which the invention is to be implemented.)

[0042] In figure 3A, both the tool-rack table and the telescopic assembly are in standstill position, i.e. in a position distant from the cylinders 100 on the turntable 1. It can be seen how the tool 21 is facing a cylinder 100 yet to be shaped.

[0043] Figure 3B shows the tool-rack table 2 and the tool 21 after the axial shifting of both. As can be seen, the tool acts on a cylinder already shaped or formed by the tool (as mentioned in relation to figure 2B, logically, in reality, the shaping is not usually carried out in a single step, but rather in a series of steps during which the cylinder goes from one shaping position to another, in each one of which positions it receives the impact of a tool corresponding to said position). As can be schematically seen in the figure, the tool-rack table has shifted a distance X from its standstill position, whereas the tool 21 has shifted a distance Y with regard to the tool-rack table. In other words, the tool has shifted a total distance X +Y with regard to the original standstill position.

[0044] As a result, if the tool in the conventional machine (without the relative shifting of the tool and tool-rack table) affected a range of the cylinder with length A, with this new system, the tool can affect a range with the same length plus the relative shifting distance of the tool and tool-rack table, i.e. a range with a total length of A + Y.

[0045] This allows manufacturing containers with longer shaped ranges (for example, necks), without modifying the basic design of the machine.

[0046] Figure 4 schematically shows a cylinder 100 with a closed end 101 and with an open end 102 shaped or modified with a machine. In the lower half, a neck with length A formed by the conventional machine is schematically shown. In the upper part, a neck with length A + Y formed by a machine according to the invention is shown.

[0047] Figure 3 schematically shows an additional aspect of a preferred embodiment of the invention:

[0048] Since extensive surfaces (with a length A + Y) are going to be deformed, there is the drawback that the cylinder 100 may be trapped by the shaping tool 21 with a force that may exceed the force with which the cylinder is retained on the turntable. This can cause the cylinder 100 to be released from the securing means (grips or the like) 11, interrupting the work cycle and making the manufacture impossible (since if it were released and trapped in the tool, it would collide with the next container in the following cycle). To prevent this from occurring, the machine can comprise a plurality of compressed air outlets 25, for example, a compressed air outlet 25 lo-

cated in each piston 23 and directed towards the turntable. Said compressed air outlet is part of a compressed air discharge system 26 configured to discharge compressed air towards the cylinders in a manner synchronized with the shifting of the tools and with the work cycles of the machine. Thus, when the tools (normally having a hollow configuration) are in contact with the cylinders, prior to beginning the backward movement of the tools with regard to the cylinders, a compressed air discharge through the nozzles or outlets 25 begins, such that said air exerts pressure on the cylinders in a direction towards the turntable 1. The discharge of air can last until the tools have moved backwards enough to no longer be in contact with the cylinders. The average person skilled in the art can easily adjust the operation of the compressed air discharge system to the circumstances and conditions of each case.

[0049] The materials, size, shape and arrangement of the elements will be susceptible to variation, as long as this does not imply an alteration of the basic concept of the invention.

[0050] Throughout the present description and claims, the word "comprises" and variations thereof, such as "comprising", does not intend to exclude other steps or components.

Claims

1. A machine for shaping metal cylinders, comprising:

a turntable (1) configured to receive, in at least one loading position (31), metal cylinders (100) with an open end, the machine being provided with step-wise rotation means of the turntable such that the received cylinders go, from said loading position (31), through a plurality of shaping positions (32), to an unloading position (33);

a tool-rack table (2) carrying a plurality of shaping tools (21), the tool-rack table (2) with the tools being placed axially opposite to the turntable (1) such that each tool (21) is opposite to a shaping position (32), the machine being provided with means for axially shifting the tool-rack table (2) between a standstill position, in which the tools (21) are separated from the cylinders (100) on the turntable (1), and a contact position, in which the tools (21) are in contact with the cylinders (100) in, at least, a plurality of the shaping positions (32), acting on said cylinders;

characterized in that

at least a plurality of the tools (21) are provided with means for axially shifting (22, 23) the tool with regard to the tool-rack table (2), said means for axially shifting the tool with regard to the tool-rack table being synchronized with the means for axially shifting the tool-rack table, such that when the tool-rack table (2) axially shifts towards the turntable, from the standstill position, said plurality of tools shift towards the turntable with regard to the tool-rack table (2), such that the total shifting (X + Y) of the tool towards the turntable corresponds to the sum of the shifting (X) of the tool-rack table (2) from the standstill position and the shifting (Y) of the tool (21) with regard to the tool-rack table (2).

2. A machine according to claim 1, **characterized in that** the means for shifting the tool (21) with regard to the tool-rack table (2) comprise a telescopic assembly (22, 23) by means of which the tool (21) is attached to the tool-rack table (2).

3. A machine according to any of the previous claims, **characterized in that** the means for shifting the tool with regard to the tool-rack table comprise pneumatic shifting means of the tool.

4. A machine according to any of claims 1-2, **characterized in that** the means for shifting the tool with regard to the tool-rack table comprise hydraulic shifting means of the tool.

5. A machine according to any of claims 1-2, **characterized in that** the means for shifting the tool with regard to the tool-rack table comprise electric or mechanical shifting means of the tool.

6. A machine according to any of the previous claims, **characterized in that** at least a plurality of said means for axially shifting the tool (21) with regard to the tool-rack table (2) are means for individually shifting a single tool with regard to the tool-rack table.

7. A machine according to any of the previous claims, **characterized in that** the machine also includes a compressed air discharge system (26) including at least one compressed air outlet (25) associated to, at least, one of the tools (21), the compressed air system being configured to discharge compressed air towards the cylinder (100) opposite to said, at least one, tool (21) during at least one part of an axial shifting cycle of the tool with regard to the cylinder, for the purpose of preventing the cylinder from being retained in the tool when the tool moves backwards with regard to the turntable.

8. A method for shaping metal cylinders, comprising the steps of:

shifting metal cylinders with at least one open end, step-wise, from a loading position (31), go-

ing through a plurality of shaping positions (32), to an unloading position (33);
shifting a tool-rack table (2) carrying a plurality of shaping tools (21) in an axial direction between a standstill position, in which the tools (21) are separated form the cylinders (100), and a contact position, in which the tools (21) come into contact with the cylinders (100) in, at least, a plurality of the shaping positions (32), acting on said cylinders;
carrying out the shifting of the cylinders (100) and the axial shifting of the tool-rack table (2) in a synchronized and sequential manner, such that after the shifting of a cylinder from one shaping position (32) to the next shaping position, an axial shifting of the tool-rack table follows, such that a tool (21) acts on the cylinder in said next shaping position;

characterized in that

additionally, at least a plurality of the tools (21) shift with regard to the tool-rack table in an axial direction and in a manner synchronized with the axial shifting of the tool-rack table, such that when the tool-rack table (2) axially shifts towards the cylinders (100), from the standstill position, said plurality of tools shift towards the cylinders (100) with regard to the tool-rack table (2), such that the total shifting (X + Y) of each tool towards the corresponding cylinder (100) corresponds to the sum of the shifting (X) of the tool-rack table from the standstill position and the shifting (Y) of the tool (21) with regard to the tool-rack table (2).

9. A method according to claim 8, **characterized in that** the shifting of the tool with regard to the tool-rack table is carried out by means of a telescopic assembly (22, 23) by means of which the tool is attached to the tool-rack table.

10. A method according to any of claims 8 and 9, **characterized in that** the shifting of the tool with regard to the tool-rack table is carried out with pneumatic shifting means of the tool.

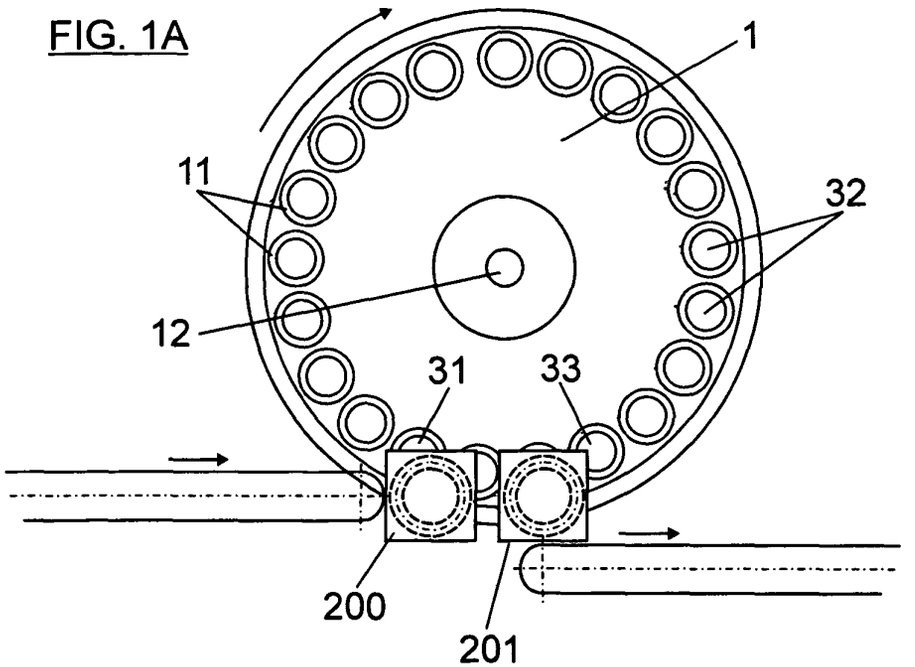
11. A method according to any of claims 8 and 9, **characterized in that** the shifting of the tool with regard to the tool-rack table is carried out with hydraulic shifting means of the tool.

12. A method according to any of claims 8 and 9, **characterized in that** the shifting of the tool with regard to the tool-rack table is carried out with electric or mechanical shifting means of the tool.

13. A method according to any of claims 8-12, **characterized in that** at least a plurality of the tools (21) shifting with regard to the tool-rack table shift with shifting means independent from those shifting means used for shifting the other tools.

14. A method according to any of claims 8-13, **characterized in that** during at least one part of each shifting cycle of the tools (21) with regard to the cylinders (100), compressed air is discharged on at least one of the cylinders (100) for the purpose of preventing the cylinder from being retained in the corresponding tool (21) when said tool moves backwards with regard to the turntable.

FIG. 1A



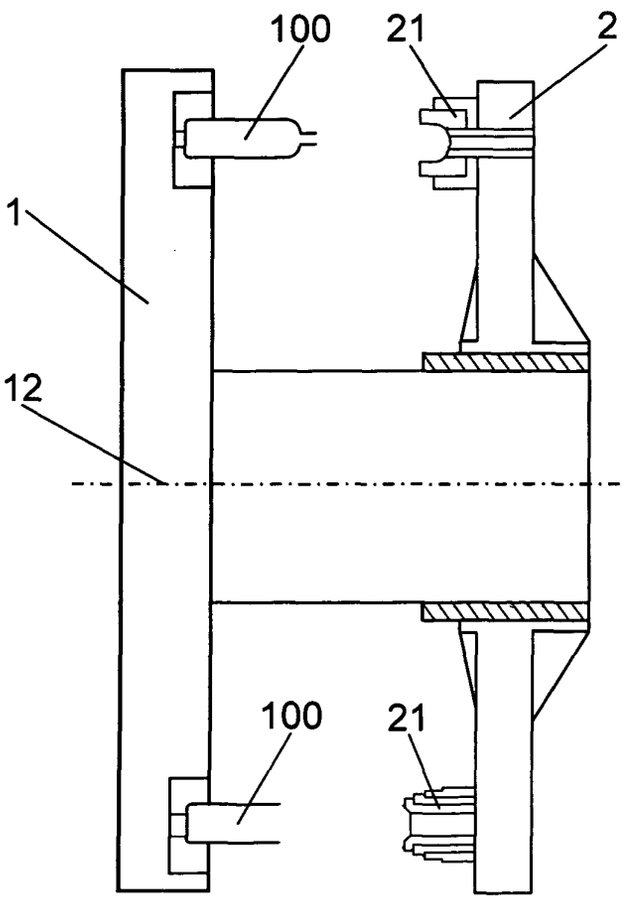


FIG. 1B

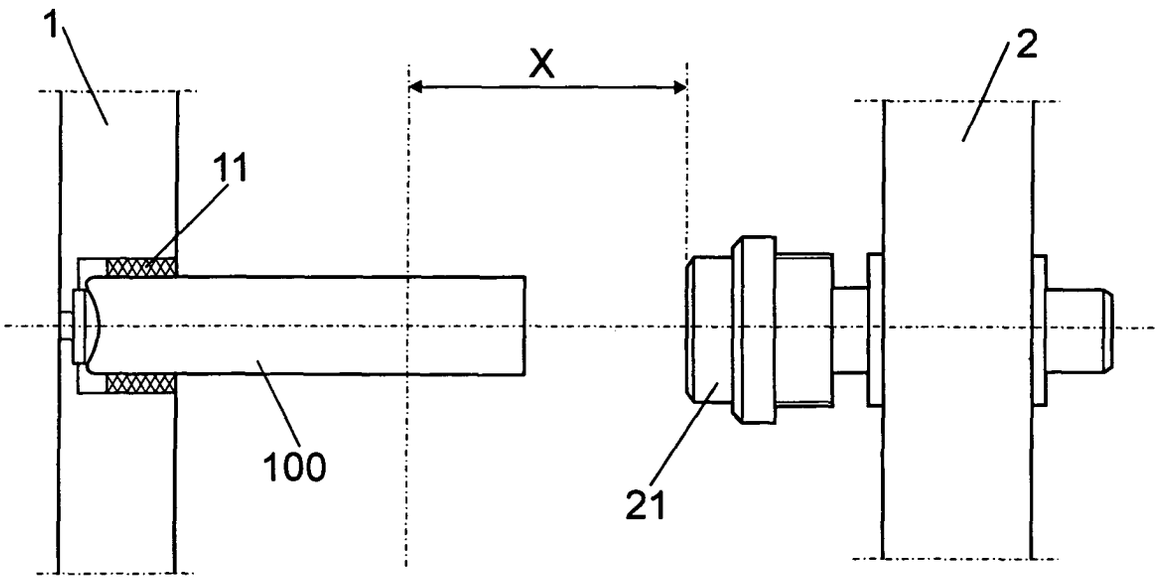


FIG. 2A

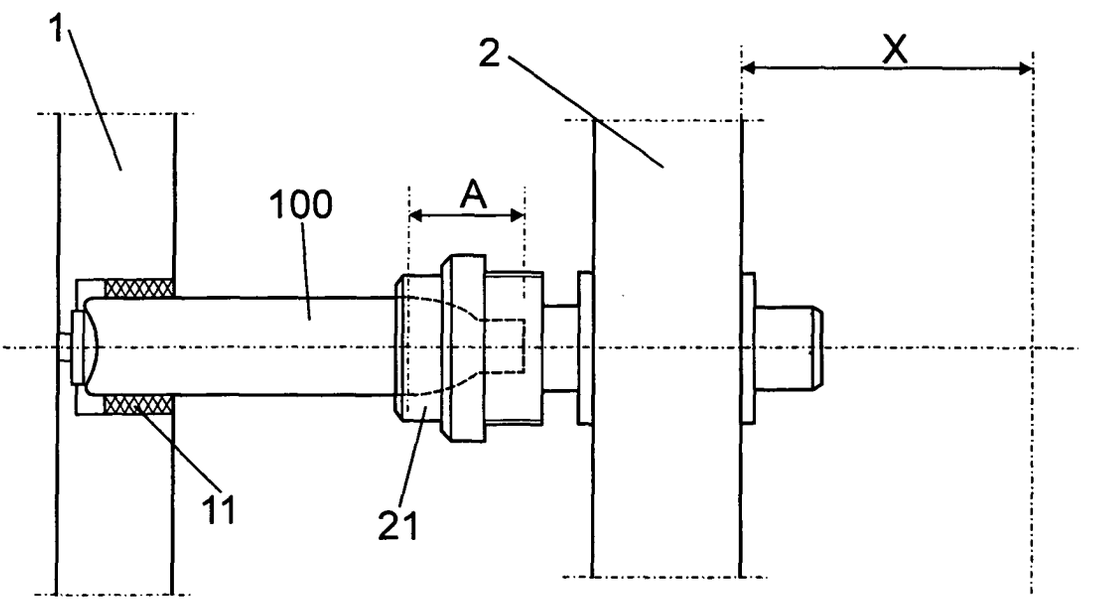


FIG. 2B

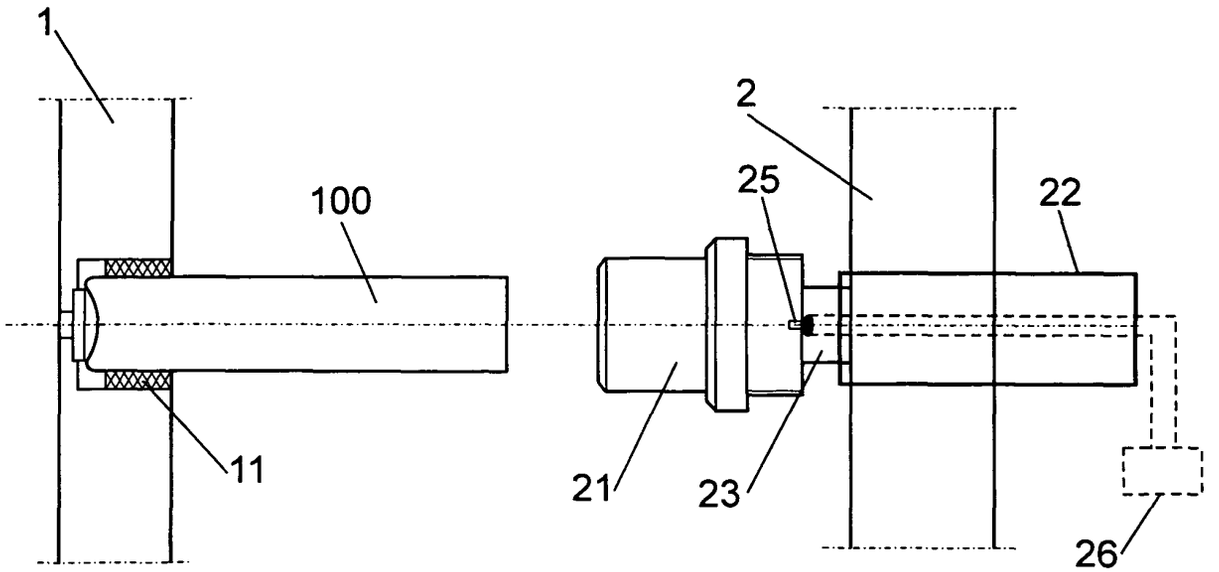


FIG. 3A

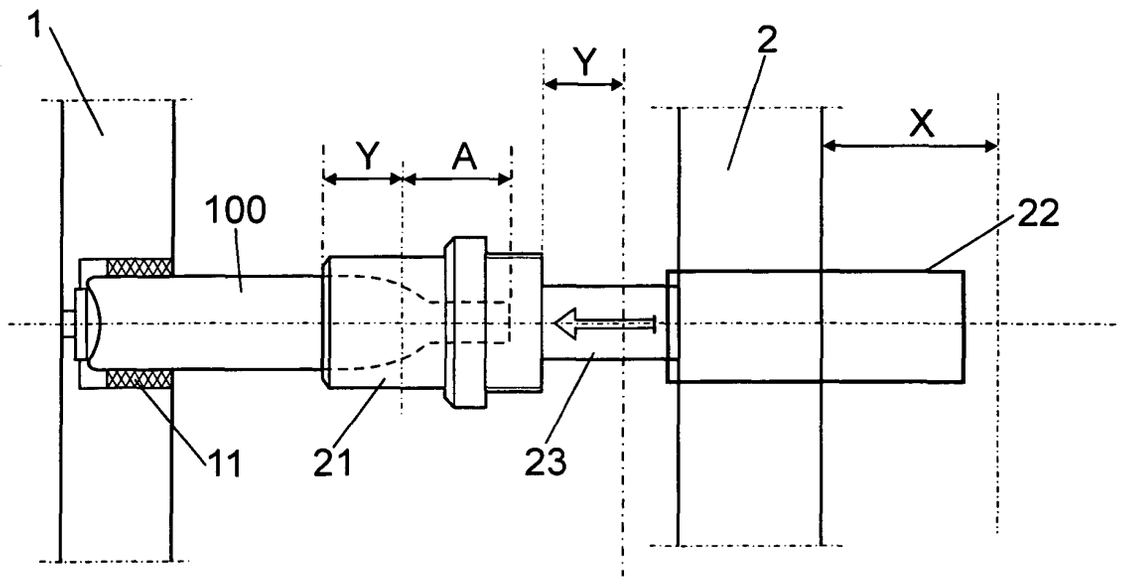


FIG. 3B

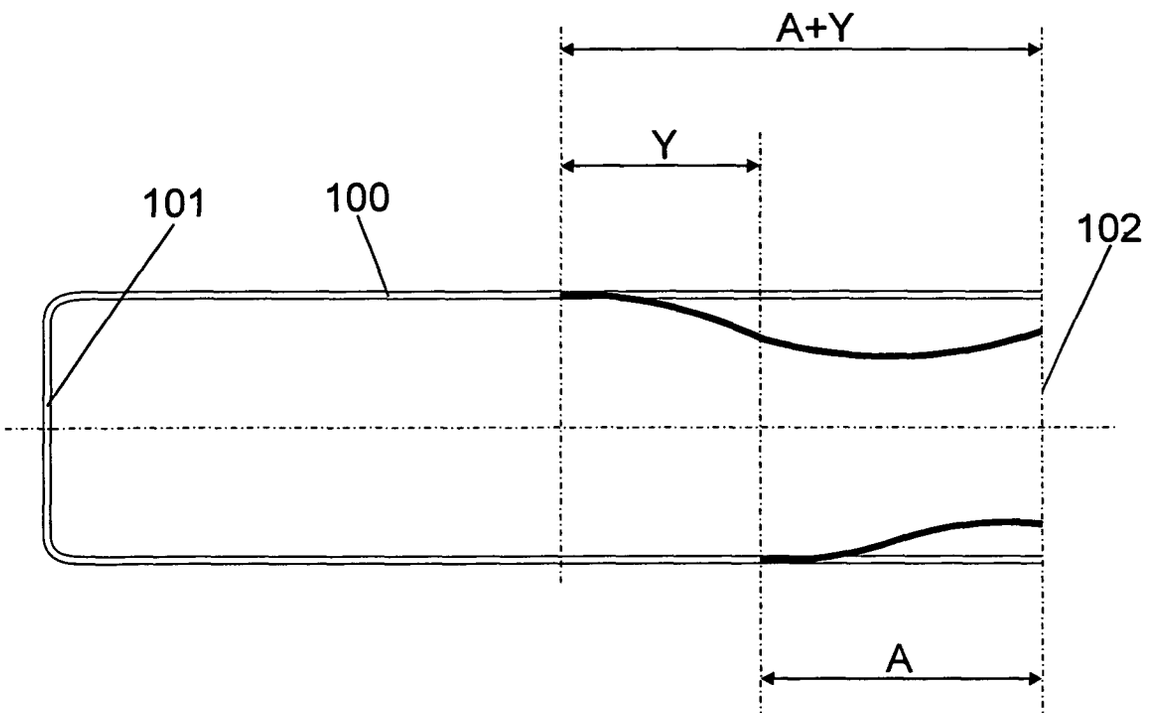


FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	19 March 2004	Vinci, V

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