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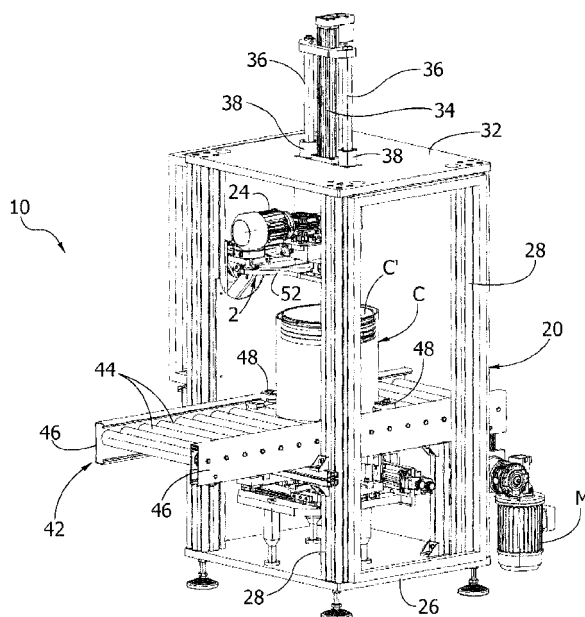
Device for perforating the lid of a container comprising a circularly mobile perforating tool

(57) A device for perforating the lid (C') of a container pre-filled with a base of paint or similar liquid material (C), of the type comprising:

- a perforating tool (2A); and
- means (34, 36, 38) designed to bring about a relative movement between said perforating tool and said container, said movement comprising at least one component along an axis orthogonal to the lid (C'), so that said

tool traverses said lid;

 said device being characterized in that it has as perforating tool a cutting blade (2A) and in that it comprises rotation means (12, 14, 16, 18, 22, 24) designed to bring about a circular relative movement between said cutting blade and said lid, so that said cutting blade makes a circular cut on said lid.



Description

TEXT OF THE DESCRIPTION

[0001] The present invention relates to a device for perforating the lid of a pre-filled container, of the type comprising:

- a perforating tool; and
- means designed to bring about a relative movement between said perforating tool and said container, said movement comprising at least one component parallel to an axis orthogonal to the lid, so that said tool traverses said lid.

[0002] A device of this sort is generally used in the field of processes of colouring of paints. As is known in the art, said processes envisage a step of dosage of one or more colouring products into containers pre-filled with a neutral or white base paint, and subsequently a step of stirring of the container so as to obtain a homogeneous mixture of the desired colour. The device in question is normally used to make, in the lid of containers of paint to be coloured, a hole through which the colouring products may be dosed. Such a device is, for example, described in the documents Nos. EP 0779241 A1 and FR 2867768 A1. As emerges from said documents, in known devices of the type referred to herein perforation of the lid consists in punching using a punch. The present applicant has, however, noted that said mode of perforation presents a series of drawbacks and disadvantages. In the first place, said mode of perforation cannot be performed on containers having lids made of plastic in so far as, as the present applicant has been able to verify, the action of punching breaks the lids into a number of parts, or in any case causes on these cracks such as to render them no longer usable. Moreover, in this specific type of application, punching does not enable in a technologically simple and inexpensive way disposal of the waste material obtained by perforation. Since it is not possible to get it to drop into the container in so far as it would contaminate the contents, usually the part of lid to be perforated is then cut away only partially, and bent towards the inside of the container so that it remains connected to the lid. However, said solution is evidently not an ideal solution in so far as it is possible, in normal management and handling of the container, for its contents to end up in contact with the cut material and so get contaminated; moreover, said material has sharp parts that constitute a danger for the user.

[0003] The object of the present invention is to overcome one or more of the drawbacks referred to above. With a view to achieving said purpose, the subject of the invention is a device of the type referred to at the start, **characterized in that** it has as perforating tool a cutting blade and comprises means designed to bring about a circular relative movement between said cutting blade and said lid so that said cutting blade makes a circular

cut on said lid.

[0004] The claims form an integral part of the technical teaching provided in relation to the invention.

[0005] Further characteristics and advantages of the invention will emerge from the ensuing description with reference to the annexed drawings, which are provided purely by way of non-limiting example and in which:

- Figure 1 is a perspective view of an embodiment of the device described herein;
- Figure 2 is a side view of the device of Figure 1;
- Figure 3 illustrates a top plan view of the device of Figure 1;
- Figures 4A-4E represent successive steps of operation of the device of Figure 1; and
- Figure 5 is a cross-sectional view of a cutting unit of the device of Figure 1.

[0006] Illustrated in the ensuing description are various specific details aimed at an in-depth understanding of the embodiments. The embodiments may be obtained without one or more of the specific details, or with other methods, components, materials, etc. In other cases, known structures, materials, or operations are not described in detail so that various aspects of the embodiments will not be obscured.

[0007] The references are used merely for convenience and hence do not define the sphere of protection of the embodiments.

[0008] With reference to the figures, designated by number 10 is a device for perforating the lid C' of a container C containing paint.

[0009] In general, the device 10 comprises a perforating tool 2A, and means designed to bring about a relative movement between the perforating tool and the container, said movement comprising at least one component parallel to an axis orthogonal to the lid so that said tool penetrates into the lid and traverses it.

[0010] According to an important characteristic of the device described herein, the device 10 has as perforating tool a cutting blade, and further comprises means designed to bring about a circular relative movement between the cutting blade and the lid so that said cutting blade makes on the lid a circular cut designed to define a hole. By "cut" is meant herein the line of separation, produced by the cutting action with the blade, which separates the cut portion of lid from the remaining part of the lid. In the device described herein, perforation of the lid is consequently not obtained with an action of punching, but through a cutting action proper along a line of cut that comes to define the desired hole. In particular, as will be seen on the other hand also hereinafter, the cutting blade acts like a knife, penetrating the lid with a segment of small extension - with respect to the cut to be made - and moving said segment in the plane of the lid, along the aforesaid line of cut, to make the desired hole.

[0011] Thanks to the characteristics referred to above, the device 10 is able to make holes in any type of con-

tainer, whether they are made of plastic material or of metal, via an operation that is in any case simple and fast, just as a punching operation.

[0012] The cutting blade can be of any one known type suited for penetrating the lid, through a relative movement of translation having at least one component along an axis orthogonal to the lid, and for cutting it as a result of a relative movement of translation having at least one component parallel to the plane of the lid. Preferably, the cutting blade comprises a first cutting edge at a bottom edge thereof, which is designed to penetrate the lid, and a second cutting edge at a front edge thereof - thus defined with reference to the direction of advance of the cutting blade in the plane of the lid, which is designed to make the cut referred to above. Preferred modes of operation of the device envisage that the circular relative movement between the cutting blade and the container is started already during the penetration of the lid in order to reduce the stresses to which the lid is subjected. Further preferred modes of operation moreover envisage that, during the entire cutting step, together with the circular relative movement between the cutting blade and the container, there is simultaneously obtained also their relative movement along the axis orthogonal to the lid.

[0013] In general, the relative movements referred to above, between the cutting blade and the container, can be obtained via means designed to move just the cutting blade or just the container, or else both of said elements. For example, with reference to the circular relative movement, it can be obtained by moving the cutting blade in circular motion, whilst the container remains stationary in a predetermined position, or else, otherwise, by moving in circular motion - or by turning - the container, whilst the cutting blade remains fixed in position.

[0014] In various embodiments, the device 10 further comprises means designed to grip a portion of the lid, and the aforesaid means designed to bring about the circular relative movement are such that the cutting blade makes a closed cut, which surrounds said gripped portion of lid. As will be seen in what follows, such a configuration of the device enables complete cutting-away of the material that is to be removed to make the hole, and disposal thereof as waste material.

[0015] With reference now to the embodiment illustrated in Figures 1 to 5, the device 10 comprises a cutting unit 2 (see Figure 5), which has a cutting blade 2A and means designed to move it in circular motion, is provided with the aforesaid means designed to grip a portion of the lid, and is mobile between a raised resting position and a lowered operative position. In various embodiments, as in the one illustrated, the cutting unit 2 comprises, in particular, a supporting plate 6 that carries a rod 4, fixed at the bottom end of which is a gripping member 8. In preferred embodiments, as in the one illustrated, the gripping member is formed by a suction-pad element 8 associated to suction means (not illustrated) in fluid connection with the suction-pad element, designed to govern operation thereof. The cutting unit further com-

prises a rotating body 12, which is mounted on the rod 4 via interposition of a bearing member 14, and on which the cutting blade 2A is fixed so as to project downwards. In various embodiments, as in the one illustrated, the rotating body 12 is engaged by a drive belt 16, which is governed by a pulley 18, in turn driven by a motor-reducer assembly 24 carried by the supporting plate 6.

[0016] In various embodiments, as in the ones illustrated, the relative movement between the cutting blade 2A and the container, in the direction orthogonal to the lid, is obtained via means designed to move the entire cutting unit 2. In various embodiments, as in the one illustrated in Figures 1 to 4, the device 10 comprises a supporting structure 20, having a platform 26, resting on the vertices of which are columns 28, which support a top surface 32. Fixed on the surface 32 is a linear actuator 34, connected to the bottom end of which is the supporting plate 6 of the cutting unit 2 and which is designed to move said cutting unit vertically between a raised position and a lowered position. Two sliding rods 36 are fixedly connected to the cutting unit 2 so as to translate together with this, and slide within two tubular guides 38 fixed to the top surface 32, which co-operate with said rods in order to limit the vibrations and at the same time guarantee fluidity of the movements.

[0017] In the embodiments referred to above, the relative movements between the cutting blade and the container are determined by the movement of the blade itself, in the ways that have been described above; in said embodiments it is then envisaged that, during the operation of perforation, the container will remain stationary in a predetermined position, supported, for example, by a fixed supporting surface. Preferred embodiments of the device envisage clamping means designed to keep the container clamped in said predetermined position.

[0018] In various embodiments, as in the one illustrated, the device 10 has, as supporting surface, a conveying surface 42, which extends underneath the cutting unit 2 and is designed to carry automatically, underneath said unit, a series of containers one after another. In the embodiment illustrated, the conveying surface is defined by a series of conveying rollers 44, mounted rotatable about their own axis on two opposed sectional elements 46 carried by the structure 20 and driven in rotation all by a single motor M, via appropriate transmission members (not illustrated). In various embodiments, as in the one illustrated, provided on the aforesaid conveying surface are centring means designed to position each container precisely and correctly underneath the cutting unit 2. In various embodiments, as in the one illustrated, the centring means comprise two gripping elements 48, which are mobile with respect to one another in a direction transverse to the direction of advance of the containers along the conveying surface, between a position where they are set at some distance apart, which is such as to allow the containers to advance along the conveying surface, and a position where they are set close to one another, where said elements grip between them the container

that has been brought underneath the cutting unit, clamping it in the correct predetermined position. In various embodiments, as in the one illustrated, said elements are each formed by a slider element, which has, in each of two regions thereof set apart from one another in the aforesaid direction of advance, one or more wheels 48' that can turn freely about their own axis, which are designed to engage the side wall of the container. In this way, as may be seen in the example illustrated, the container is engaged by the gripping elements in four distinct portions, mutually symmetrical in pairs both with respect to the aforesaid direction of advance and with respect to the corresponding direction perpendicular thereto so as to be clamped with respect to any movement on the conveying surface. In various embodiments, the two gripping elements are governed by a single horizontal lever, set underneath the conveying surface, which can be driven in rotation about a central axis thereof by means of an appropriate motor.

[0019] The conveying surface 42 described above renders the device particularly suited to industrial use, in plants for the production and colouring of paints, rendering it on the other hand readily adaptable to plants of different types, given that the conveying surface can be easily integrated in the lines of the various plants for conveying containers.

[0020] In various embodiments, as in the one illustrated, the device 10 further comprises means for collection of the cut portions of lid. In this connection, in various embodiments, as in the one illustrated, the structure 20 carries a collection element 52, designed to receive the cut portions of lid, which can be driven in rotation about a vertical axis of rotation, between a collection position, underneath the cutting unit 2 and above the conveying surface 42, and an unloading position, where it is, instead, with respect to a top plan view, out of the plane of the conveying surface 42 and above a collection tank 54. The collection element 52 can moreover be inclined downwards, via a rotation thereof about a horizontal axis so as to enable unloading of the cut portions into the aforesaid collection tank.

[0021] In what follows there will now be described operation of the perforation device illustrated above. With reference to Figure 4A, the conveying surface 42 of the device causes the container C to advance until it is brought into a position underlying the cutting unit 2, and, once this position is reached, the gripping elements 48 close so as to clamp the container in the predetermined correct position; up to that moment, the cutting unit 2 is in its raised resting position, and the collection element 52 is in its collection position, underneath the cutting unit 2. At start of the cutting operations, the collection element 52 is brought in its unloading position, and the cutting unit 2 is then lowered (Figure 4B). As soon as the cutting blade comes into contact with the lid, it immediately starts to be moved in circular motion, whilst, in the meantime, the cutting unit continues to drop down so that the cutting blade 2A penetrates the entire lid and the suction-pad

element 8 comes into contact therewith. The cutting blade is moved through at least 360° so as to make a closed cut, which separates a disk portion C" from the remaining part of the lid, thus making a hole in the latter.

5 Whilst the cutting blade moves in circular motion, the suction-pad element 8 remains stationary with respect thereto it and gripping the portion of lid being cut so that, when the disk portion is completely cut, it will remain attached to the suction-pad element (Figure 4C). In preferred modes of operation, during execution of the cut, the cutting unit 2 continues to be lowered, subjecting the cutting blade 2 to a substantially helical motion so as to render more effective its cutting action on the lid. At the end of cutting, the unit 2 is again brought back into its raised position, drawing along with it the disk portion C" (Figure 4D), and immediately after the collection element 52 is brought into its collection position to receive the disk portion from the suction-pad element 8 (Figure 4E). The collection element is then brought into the unloading position, where it unloads the disk portion into the tank 54.

[0022] It should be noted that operation of the device 10 described herein can also vary from the modalities illustrated above. For example, the cutting blade can perform a circular motion through an angle of less than 360° in order to leave the cut material connected to the lid so that it can then be bent towards the inside of the container.

[0023] The various steps of operation described above can be governed by control means of any type in itself known to a person skilled in the branch. In various embodiments, the device 10 has control means designed to govern simultaneously lowering of the cutting unit 2 and circular movement of the blade, thus linking in a predetermined way the speed of rotation of the blade to the speed of translation of the cutting unit, and controlling said circular movement on the basis of the vertical position of said cutting unit. For this purpose, said control means comprise sensor means designed to detect the variation in position of the cutting unit 2 with respect to the lid. In various embodiments, as in the one illustrated (see again in this connection Figure 5), said sensor means comprise a tubular feeler element 56, which is set around the rotating body 12 of the perforation unit, and is connected to the cutting unit so as to be vertically mobile between a lowered position governed by elastic means 58 and a raised position. Anchored to said element is a metal strip 62 provided for interacting with a sensor 64, which is fixedly connected to the cutting unit 2 and is designed to detect the distance between itself and the metal strip. In operation, once the feeler element 56 comes into contact with the lid C', following upon lowering of the cutting unit 2, the further lowering of said unit causes raising of the element 56 with respect thereto. The sensor 64, by detecting the variation of position between the feeler element and the cutting unit, in the same way detects the variation of position between the cutting unit and the lid. The control means can hence envisage an operating mode in which:

- the cutting blade 2A is set in rotation at the end of a predetermined stroke of the actuator 34, through which the cutting unit 2 is brought into a position where the cutting blade is in contact with the lid;
- the cutting blade moves in circular motion, carrying out cutting of the lid, and at the same time the cutting unit 2 is lowered;
- the circular movement of the blade is stopped when the sensor 64 detects that a predetermined relative position is reached between the cutting unit and the lid, which corresponds to completion of the cut by the cutting blade.

[0024] As already mentioned previously, the device described herein enables automatic perforation of containers of a plastic type. In this connection, it is to be noted that currently in the field of plastic containers the processes of production and colouring of paint envisage, in order to be able to dose the colouring products in the containers, removal of the lids and, subsequently - since the lids, in order to be removed, undergo deformation and consequently can no longer be re-used - replacement with new lids. The device described herein will instead enable adoption of a process of colouring and, in general, of addition of substances in pre-filled containers, similar to what is already used for metal containers, where the lids are perforated and then closed automatically, so as to obtain the following advantages:

- avoid the need for an operator for removing the lid;
- eliminate the problem of disposal of the lids that have been removed;
- reduce the possibility of contamination of the product in the container (considering that the lid is not removed, and the hole is made directly in the proximity of the area of colouring and is of small dimensions);
- perforate containers of randomly different height and geometrical shape.

[0025] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments may vary, even significantly, with respect to what has been illustrated herein purely by way of non-limiting example, without thereby departing from the scope of the invention, as defined by the annexed claims.

Claims

1. A device for perforating the lid (C') of a container pre-filled with a base of paint or similar liquid material (C), of the type comprising:
 - a perforating tool (2A); and
 - means (34, 36, 38) designed to bring about a relative movement between said perforating tool and said container, said movement comprising at least one component along an axis orthogonal

to the lid (C') so that said tool traverses said lid; said device being **characterized in that** it has as perforating tool a cutting blade (2A) and **in that** it comprises rotation means (12, 14, 16, 18, 22, 24) designed to bring about a circular relative movement between said cutting blade and said lid so that said cutting blade makes a circular cut on said lid.

2. The device according to Claim 1, comprising means (4, 8) designed to grip a portion of said lid, and wherein said rotation means (12, 14, 16, 18, 22, 24) are designed to perform a circular relative motion such that said blade makes a closed cut that surrounds said gripped portion of lid.
3. The device according to any one of the preceding claims, wherein said rotation means are designed to move said cutting blade in circular motion.
4. The device according to Claim 2, wherein said gripping means (4, 8) comprise a rod (4) bearing at its bottom end a gripping member (8), and wherein said device comprises a body (12) rotatably mounted on said rod (4) via interposition of a bearing member (14), on which said cutting blade (2A) is fixed so as to project at the bottom.
5. The device according to Claim 4, wherein said gripping member (8) is a suction-pad element.
6. The device according to Claim 4, wherein said rotating body (12) is driven by a belt-drive system (16, 18, 22, 24).
7. The device according to any one of the preceding claims, comprising a conveying surface (42) designed to carry one after another a series of containers underneath said perforating tool, there being provided on said conveying surface centring means (48) designed to position precisely and correctly each container underneath said perforating tool.
8. The device according to Claim 7, wherein said centring means comprise two gripping elements (48), mobile with respect to one another in a direction transverse to the direction of advance of the containers on said conveying surface, between a position where they are set at some distance apart, which is such as to allow the containers to advance along said conveying surface, and a position where they are set close to one another, where said elements grip between them the container that has been brought underneath the perforating tool, clamping it in the predetermined correct position.
9. The device according to Claim 2, comprising a cutting unit (2) mobile between a raised position and a

lowered position, said cutting unit comprising said cutting blade (2A), said rotation means (12, 14, 16, 18, 22, 24), and said gripping means (8).

10. The device according to Claim 2, comprising an element (52) for the collection of the cut portion of lid, which can be displaced between a first position underneath said gripping means (8) and a second position above a collection tank (54), said element (54) being switchable into an unloading configuration, for unloading said cut portion of lid into said tank (54).

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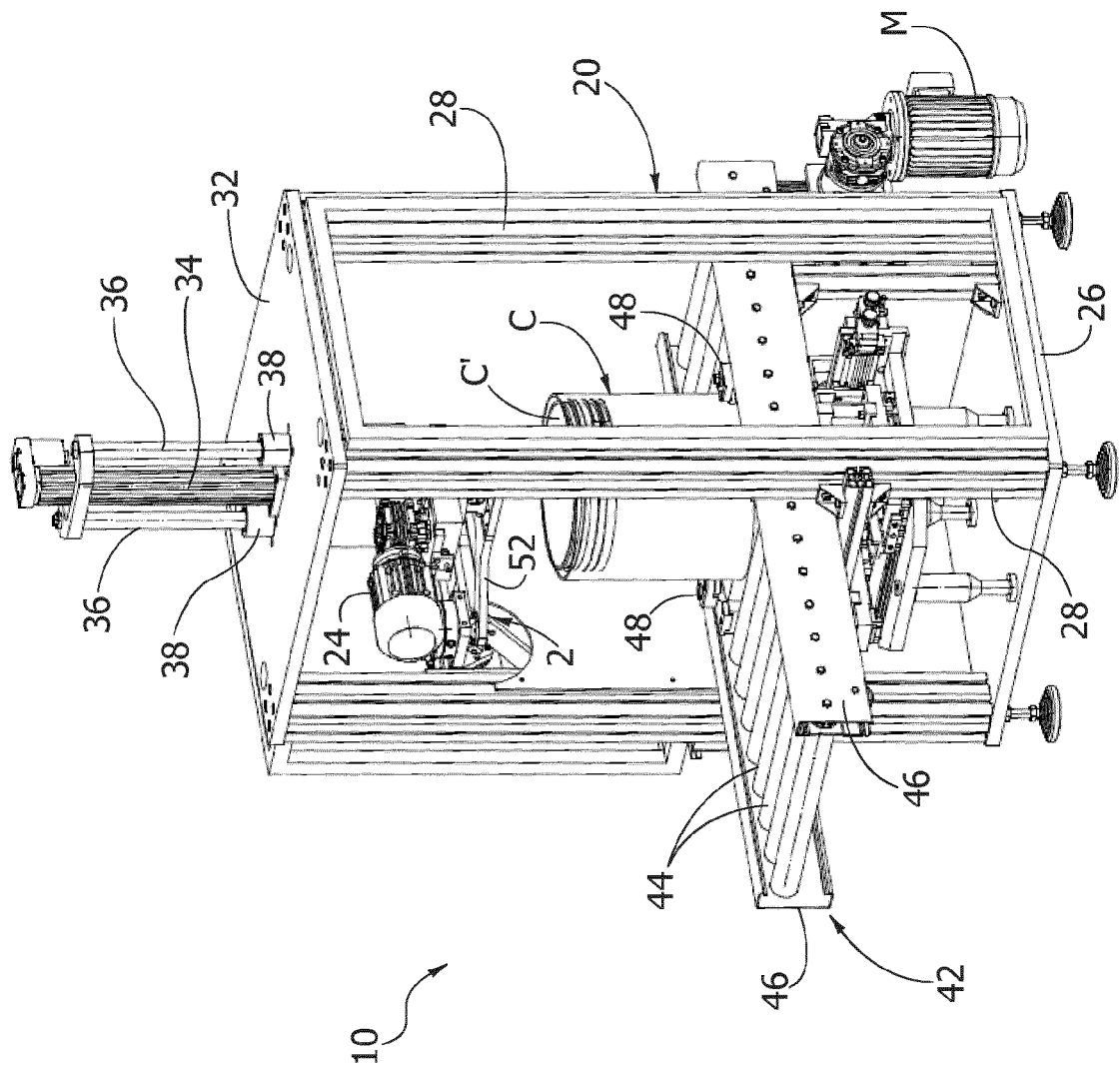
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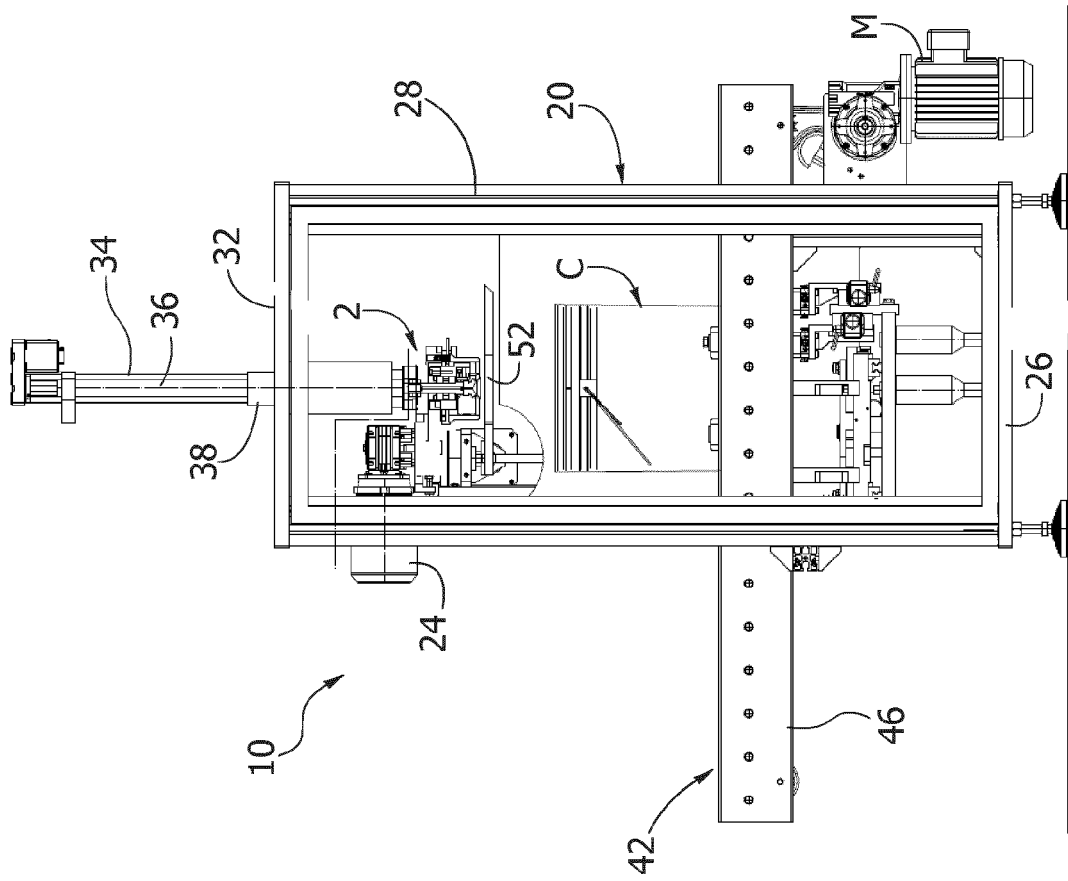
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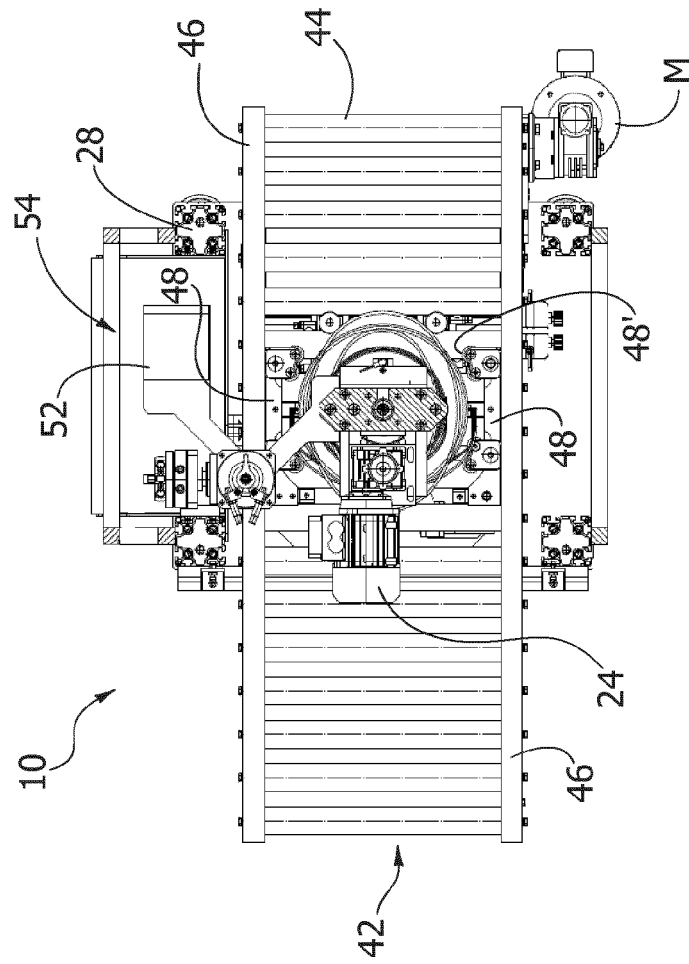
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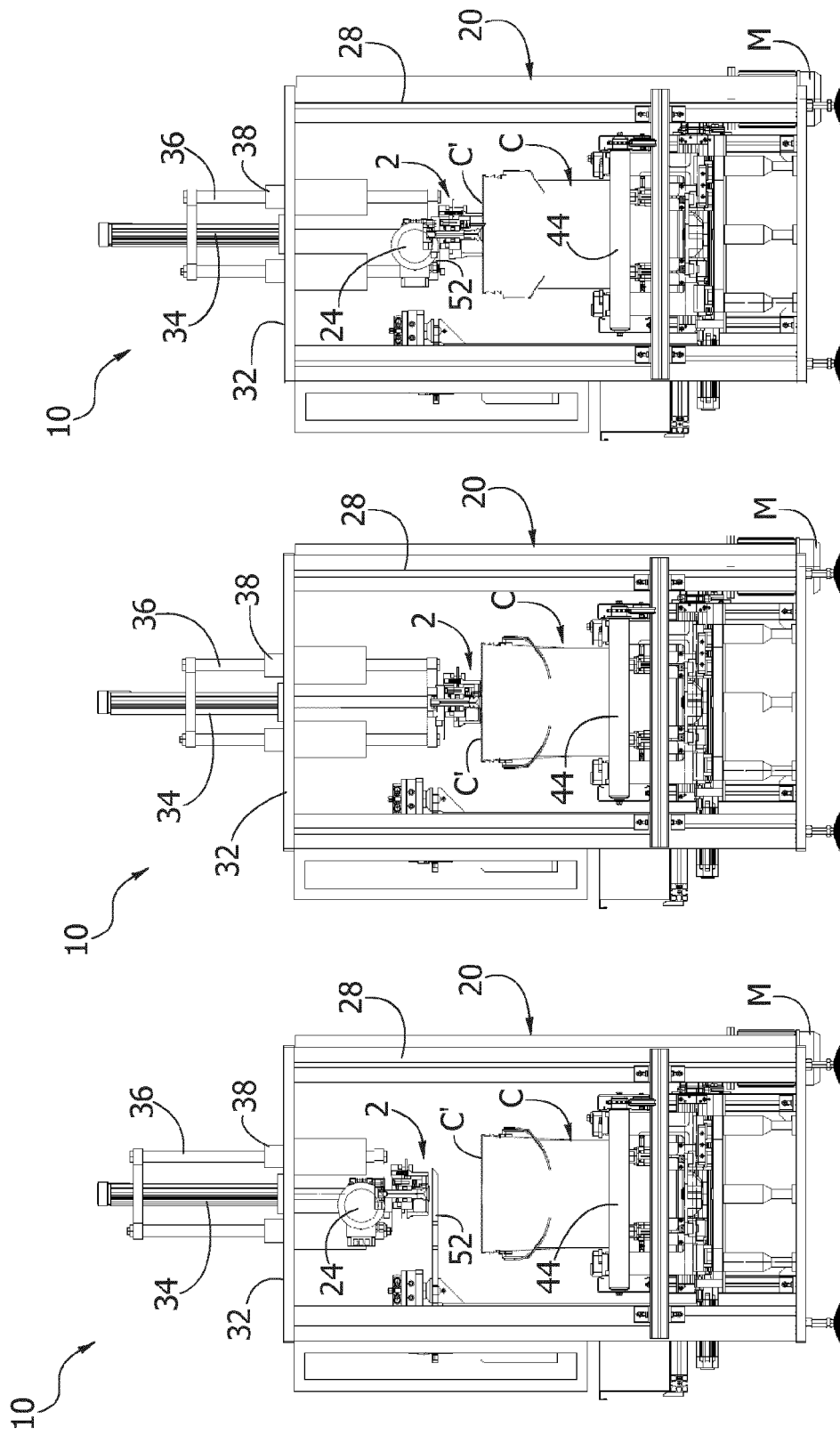
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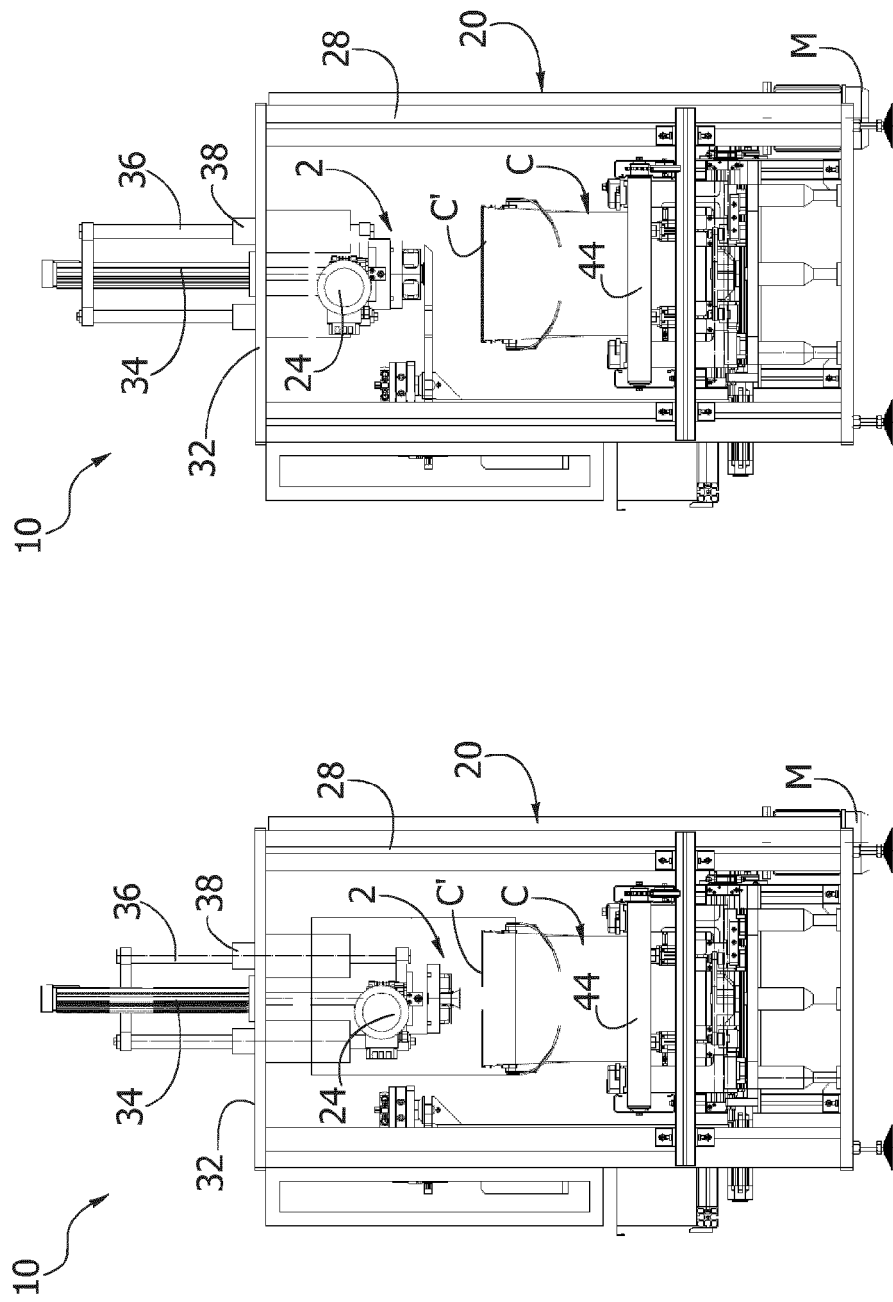
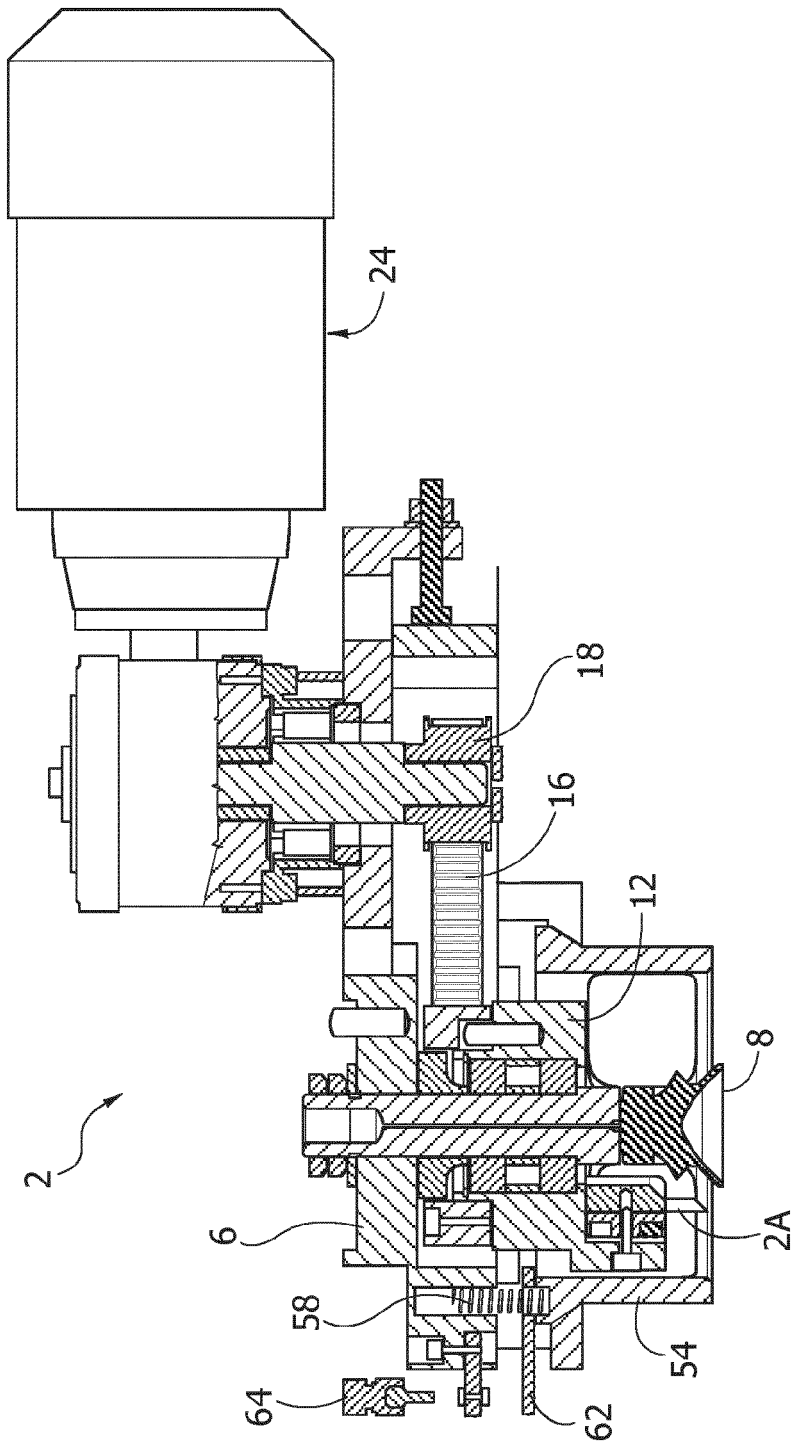


FIG. 5





EUROPEAN SEARCH REPORT

Application Number
EP 12 18 2820

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 1 November 2012	Examiner Wartenhorst, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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