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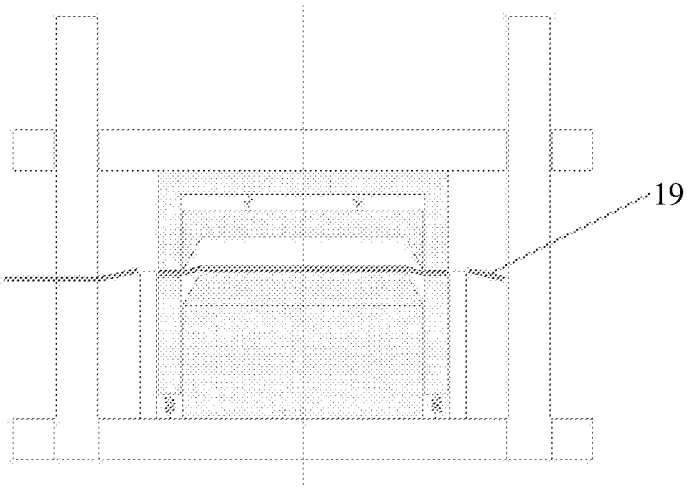

FIG. 4A

(57) Abstract: Method and apparatus (1) for realization of an aluminium circular cake pan. The method comprises a step of cold molding of an aluminium foil (10) performed by pressing said foil between a counter-mold (3) and a corresponding punch (2), and the cake pan has a thickness equal to or greater than about 250 pm. The method is realized by means of an automated production plant (200) comprising a molding apparatus (1) formed by: ■ the counter-mold (3) and the punch (2), selectively joinable to one another for pressing the foil of aluminium material (10) therebetween so as to realize a cold molding; ■ relative moving means of the above mentioned molding bodies; ■ a die punch body (4) of the foil (10) of metallic material; and ■ forming means (6) of a peripheral edge of the container.

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METHOD AND APPARATUS FOR THE PRODUCTION OF METAL BAKEWARE

DESCRIPTION

Technical field of the invention

The present invention is referred to a method for the production of metallic cake pan, in particular of circular shape, of re-usable type and to a relative apparatus for production thereof.

Background

The metallic cake pan of circular shape are consumer goods, because they are employed for cooking cakes in the oven (especially “pastiere”), pies and many other types of food. Among these, the cake pans of reusable type – i.e. non-disposable – generally have a thickness greater than 250 μm.

At the state of the art, the realization of this type of cake pans is based on a spin-forming process called "metal spinning." This process involves the progressive deformation of a circular metal plate, which is worked gradually until it takes the shape of a spindle.

A prior art apparatus which implements said spin-forming process is shown schematically in Figure 1. Such apparatus, denoted by 100, comprises a contrast or tailstock (follower block) 102, a spindle (mandrel) 104 opposite to the contrast 102 and levers or poles (lever arms) 103, the latter equipped with a rotating head (roller head) 107. The spindle 104 has a shape corresponding to that to be obtained for the final product.

The first phase of the process consists in anchoring the raw material (blank), in the form of a disk of metal sheet 101, to the tailstock 102, and the spindle 104

to the respective lathe.

While the disk 101 rotates at high speed, it is pressed on the spindle 104 by means of the rotating heads 107 of the poles 103, which precisely approach successive circumferential portions of the disk 101 to the spindle 104. In this manner, the disc 101 is deformed up to trace the contour of spindle 104, acquiring the desired shape.

The metal spinning is a process that provides execution of more steps, during each of which is realized a gradual deformation of the metal disk 101 and a limited reduction of its thickness.

The prior art process just described is affected by an important productivity limit, tied to its high overall duration. The latter is affected by three main factors, namely:

- the execution of the preliminary operations of anchoring the disk to the tailstock and the spindle to the lathe;
- the need to operate the above-mentioned plurality of successive steps;
- the operations of extraction of the finished product from the machine.

Overall, the time of a metal spinning cycle, defined as the time interval that elapses between the production of two successive containers, is about the order of tens of seconds.

Moreover, the traditional metal spinning production cycle requires, in the preliminary and final stages of the process, the employment of an operator, who must manually perform the mounting operations of the disc and the spindle and then withdrawal of the finished product. Moreover, during the execution of these operations, the contacts of the operator's hands with metal cake pan are numerous and prolonged, this at the expense of the hygiene of the proceeding.

A further disadvantage of the known process is the use of lubricating and / or adjuvants which are not "food grade". This circumstance, coupled with the contact with the hands above mentioned, makes mandatory the washing of the cake pan to perform use. Obviously this is problematic and expensive however

in the case of industrial applications of the product.

Furthermore, the metal cake pans obtained by spinning have high thickness, generally higher than those necessary for obtaining the desired properties of mechanical resistance.

In fact, the metal spinning process implies a significant reduction of the thickness of the machined plate with respect to the original one, reduction that can be also equal to 50%, in particular at the side walls of the container. Consequently, if for the purpose of obtaining certain characteristics of resistance is sufficient that the thickness of the container is equal to 250 μm, it is necessary in any case starting from a disk of thickness of at least 500 μm. This is to avoid an excessive thinning of the walls of the container, which would result in collapse of the resistance characteristics. This results in a waste of material, with a resulting negative impact on costs.

As a consequence of the drawback just mentioned, the prior art provides for the production of containers, even in the smaller sizes, from plates of high thickness, equal to about 500 μm, with increases up to more than 550 μm for the largest sizes. In fact, the known containers have a substantially constant thickness regardless of the diameter. Therefore, the stiffness of containers of different diameters is different, in particular increases with decreasing of size.

Finally, the products obtained by means of the metal spinning process are never identical.

In fact, in this type of processing, the pressure and the accuracy with which the operator handles the tool - in addition to the form and type of the latter - determine the properties of the circumferential streaks on the cake pan walls (indices of the subsequent phases of advancement of the deformation).

In addition to that, the external flange of the cake pan, i.e. the upper edge, is freely formed without any kind of support, and therefore its specific conformation varies depending on the accuracy and sensitivity of the operator.

So in conclusion, the aesthetic characteristics of the product, as well as some

details of the geometry of the cake pan, are destined to vary from one manufacturer to another, from one operator to another, and even the containers produced in sequence by the same operator will never be identical to each other.

Summary of the invention

The technical problem posed and solved by the present invention is therefore to provide a method and a relative apparatus for the realization of metal containers for oven, in particular trays or circular cake pans, of reusable type, which allow to overcome the drawbacks mentioned above with reference to known art.

This problem is solved by a method according to claim 1 and by an apparatus according to claim 10.

Preferred features of the present invention are object of the dependent claims.

The invention provides a method of cold molding of the aforesaid metal baking containers of reusable type. The containers produced with the method of the invention typically have a thickness of 250 μm or higher, in particular comprised in a range of 250-500 μm.

The use of cold-molding technology for the above mentioned containers allows to reduce the times of the production cycle up to 1-1.5 s per piece, with considerable increase in productivity. This is possible mainly thanks to some aspects of the method described below.

First, the process of deformation of the metallic raw material is not progressive, but takes place simultaneously over the entire width of the workpiece, preferably in a fraction of a second, thanks to the coupling of a forming mold with a counter.

Moreover, the production cycle is executable in continuous, starting from a reel of metallic material.

The different phases of the cycle, both singly and in sequence, are fully automatable and executable simultaneously.

In addition, in the cold-molding process does not take place any type of contact between the operator's hands and surfaces of the product. In fact, the only manual operation of the production cycle could be the closure of the finished product in cardboard boxes, which can take place when the containers have been already packaged with automated operations.

Furthermore, in the cold-molding process there is no addition of lubricant during the step of deformation of the material. The unique lubricants used are that for pre-lubrication of metal, present in small amounts (100-200 mg per m^2 of metal). These lubricants - eventually added as "processing aids" within the meaning of the "*Regulations of the hygiene control of aluminium materials and objects and aluminium alloys intended to come into contact with foodstuffs*" (Ministerial Decree of 18 April 2007, n . 76, published in the Official Gazette No. 141 of 20 June 2007 by the Ministry of Health) - have a formulation which respects national, European and international laws, and are suitable for direct contact with food. Therefore, in addition to the savings in terms of costs of lubricants, in principle there is no need to wash the cake pan before use.

Another important advantage consists in the fact that in the cold-molding process geometry of the product is entirely determinate by design of the work surfaces of the mold and the counter and is reproduced with precision on the cake pan. Therefore, the product obtained has a highly repeatable geometry. This repeatability is critical to the management of containers in automatic production lines.

In addition, taking advantage of cold molding, reusable containers are realized that have on average thickness lower than those obtained by metal spinning.

In fact, during the molding process, the thickness remains actually constant in all areas of the container, allowing to adapt it (the thickness) to the size of each format and to maintain high-strength properties while using a smaller amount of material. In this way, you save on raw material and none of functional performance of the cake pan is lost, and each different size format can have the same stiffness. For example, in this optimization logic, larger sizes will have thicknesses next to 500 μm, while for the little ones thicknesses will gradually reduce up to about 250 μm.

Taking account of the above and of various formats into production, you can calculate that a cake pan produced with embodiments of the method of the invention weights on average 15% less with respect to one, of equal size, produced through metal spinning, for example 89 g instead of 105 g.

The reduction of the thickness, and then the weights of the containers that can be achieved with the cold-molding process is equivalent to a decrease of the amount of metal used to obtain a cake pan of known art of equal size and performance.

It is important to decrease the amount of metal used, because it can be obtained, indirectly, a reduction of environmental impact caused by the production process of the metal used, in terms of energy expenditure and consumption of raw materials.

For example, for producing 1 kg of primary aluminium about 2.0 kg of CO_2 are emitted into the atmosphere, while for producing 1 kg of recycled aluminium 0.25 kg of CO_2 are emitted into the atmosphere. Assuming, at present, to use a mix comprising 50% of raw and 50% of recycled material, the average amount of CO_2 produced is equal to about 1,12 kg per kg of aluminium. In the light of what is illustrated above, the cold-molding process allows to reduce the consumption of aluminium of about 17 kg for every 1000 containers produced. This, in terms of environmental impact, means a reduction of emission of CO_2 in the atmosphere equal to 15 kg for every 1000 containers produced. Extending the reasoning for millions of pieces, this data assume a significant importance in view of a sustainable development.

As regards the apparatus of the invention, it is simpler, from the constructive and functional point of view, compared to that traditionally employed in similar processes.

Other advantages, features and the modes of employ of the present invention will become apparent from the following detailed description of some embodiments thereof, given by way of example and non-limitative purpose.

Brief description of figures

Reference will be made to figures of attached drawings, wherein:

- Figure 1, already introduced above, shows a metal spinning apparatus for the realization of reusable metal cake pans according to the known art;
- Figure 2 shows a block diagram of example of a production plant of circular metallic cake pans according to a preferred embodiment of the present invention;
- Figure 3 shows a schematic side view of a molding apparatus, in particular of press type, according to a preferred embodiment of the present invention;
- Figures 4A, 4B and 4C each shows a side view of the apparatus of Figure 3 in a respective stage of realization of a cake pan, in particular a blanking step of the material accessing to the press, a descent phase of a body of stamping punch and a phase of starting material deformation;
- Figure 4D shows an enlarged detail of the apparatus of Figure 3 in a phase of deformation of the base material;
- Figure 4E shows another enlarged detail of the apparatus of Figure 3 in a

step of forming an edge;

- Figures 5A, 5BE 5C each shows a side view of the apparatus of Figure 3 in successive stages of production of the cake pan, in particular a phase of removal of the body of a molding punch by a concave counter-mold, a step of extraction of the finished cake pan from the molding body and a step of expulsion of the latter; and
- Figure 6 shows a flow diagram illustrative of a manufacturing process implemented by the apparatus of Figure 3 and according to one embodiment of the preferred embodiment.

The elements represented in the figures introduced above are to be understood as purely exemplary and are not necessarily shown in proportion.

Detailed description of preferred embodiments

With reference initially to Figure 2, a production plant of a baking metal container of reusable type, in particular a baking pan or cake pan preferably circular, is generally denoted with 200. The plant 200 is based on a continuous production line which comprises, in sequence, components and units described below.

In a first unit 201, which we will say of housing of the metallic material, a laminate of aluminium (foil) 10 is provided in the form of a continuous strip wrapped in a coil 11. This unit 201 includes for example an unwinder reel on which the coil 11 is precisely wrapped.

The laminate 10 may be bare aluminium, internally and / or externally pre-treated with paints, films, sprays, or coating in general that confer it specific properties dependent on the the destination of application of the container ("coil coating" technology). Typical examples are an internal non-stick coating or a coating with "meat release effect": both guarantee that the food will not stick to the container surface during cooking. Another example of a coating is the coating of the outer surface of the container with high temperature resistant

paints, even resistant to direct flame.

Such coatings may be neutral, transparent or coloured with special color effects or customized with logo obtained also with heat-resistant inks.

The plant 200 further comprises feeding means (foil feeder) 203 of the foil material towards the subsequent units. Such means 203 comprises, for example, a pair of rollers which engage one end of the foil 10 and drag it towards a molding apparatus 1. Preferably, the feeding means 203 is associated with regulation means 202 of the laminate 10 speed (i.e. regulation of feed of the raw material), for example one or more sensors and / or transducers. Similar means may also be provided to control the speed of unroll of reel and in general of the material in the coil 11. The regulation means can also work as foil accumulating station 10, so as to synchronize the continuous flow of the feeding means 203 with the discrete processing of apparatus 1.

The feeding means 203 are configured in such a way as to provide a continuous feeding of material to apparatus 1.

The apparatus 1, or press, preferably automatic and of continuous working cycle, realizes a cold molding and will be described in greater detail shortly.

The feeding means 203 precisely guarantee the advancement of the material upstream of the press 1, for the subsequent molding. The approach of the material to apparatus 1 for the formation of a subsequent container takes place parallel to the extraction and ejection of the previously formed container.

The containers successively produced are transported by transport means 204 and ranked in stacks, placing them one above the other, into a collection or stacking unit 205.

Downstream of the unit 205, means 206 of packaging and transportation of the stacks of containers are provided. Each container of the stack is packaged according to pre-selected packaging specifications, for example bagged. The so packaged containers are then conveyed to a storage or collection unit 207.

Depending on the requests for distribution, the containers may then be

conveyed to a collection belt which transports them to a boxing station 208, where they can be manually enclosed in cardboard boxes.

The molding apparatus 1 will now be described in greater detail with initial reference to Figure 3.

The apparatus 1 comprises a first and a second molding body, respectively 2 and 3. In particular, the first molding body 2 (forming punch) is a convex body, or male, substantially shaped like a punch or piston. The second body 3 (forming die) is a concave body, or female, which we can also call counter. The punch 2 and the die 3 have respective molding or forming surfaces, respectively 20 and 30, respectively convex and concave, which reproduce the desired shape of the final container.

The punch 2 is associated to a support body 8 (punch holder) fixed or integral with it.

In the embodiment here considered, the counter-mold 3 is movable, in particular slidable, with respect to the punch 2 so as to be able to attest on the latter with interposition of the raw material to be printed.

For this purpose, dedicated means for moving the counter 3 with respect to the punch 2 are provided, not represented for simplicity. In the present example, the direction of movement D, i.e. of approaching / distancing of the bodies 2 and 3, is a vertical direction. Also in the present example, the counter 3 is arranged above the punch 2, and then the approach motion of the two bodies is a downward translation of the counter 3. The punch 2 and the relative support body 8 are integral with a base of apparatus 1, in particular with a fixed lower die holder associated to columns integral with it, namely to a frame 15 of the apparatus.

The counter 3 is associated with a die punch 4 (blank punch), circumscribed to the same counter and movable integrally with the latter. Additionally, between die punch 4 and counter 3, elastic elements 5 of contrast are interposed, usually pneumatic cylinders or, in some cases, springs.

Correspondingly, the punch 2 is associated, in particular circumscribed, with a contrast body 6 (pressure plate), or pressure element, suitable to be coupled in abutment with the die punch 4. Between contrast body 6 and frame 15, contrast elastic elements 7 are arranged, usually pneumatic cylinders or, in some cases, springs. Therefore, the contrast body 6 can translate, along the same direction D of approaching / spacing of the bodies 2 and 3, when pushed by the die punch 4.

As shown in the detail of Figure 4D, the die punch 4 has a break-wrinkles means 40 in the form of protrusion, i.e. of coast, protuberance or projection, in particular with rounded profile or rectangular profile and chamfered edges. In the present example, the means 40 is integral with the die punch 4 and engages, when the punch 2 and counter-mold 3 are in abutment one on one another, a corresponding seat 60 of the contrast body 6. The means 40 avoids wrinkling in the walls of the container during the phase of the plastic sliding of material (denoted by 23 in Figure 4D) caused by the pressure between the two bodies 2 and 3.

The means 40 determines the level of wrinkling, i.e. the number and depth of folds or radial grooves of the walls of the container. At constant geometry, the more effective is the job of the break-wrinkles means, the smaller is the number and size of wrinkles, and the wall of the container tends to have a substantially smooth surface.

With reference again to Figure 3, the apparatus 1 also comprises a blanking body 9 (blank die), in particular limited to the contrast body 6 and preferably fixed with the frame 15. The blanking body 9 assists the function of the die punch 4.

In the present embodiment, the punch 2, the counter 3, the punching 4, the contrast body 6 and the blanking body 9 each presents a circular configuration in plan.

In the configuration shown in Figure 3, the punch 2 and the counter 3 are located in an input configuration of a portion of foil 10 to be subjected to molding and have the maximum mutual distance. The height reached by the counter-die 3 in this configuration is defined as upper dead point of the press 1.

We will now describe the operational mode of the apparatus 1, starting from the above mentioned configuration of introduction of a new portion of metal foil between the molding bodies 2 and 3.

The end of the foil 10 dragged into the press 1 partially rests against a portion of the molding surface 20 of the punch 2, and also is in contact with the contrast body 6 and with the blanking body 9.

The punching 4 associated with the counter 3, actuated by the above mentioned dedicated movement means, in particular a bat of the press to which is constrained, moves from the upper dead point position and begins a vertical translational motion downwards.

During the motion of descent along the movement direction D, the die punch 4 is coupled in abutment with the engagement body 6. Between the two elements there is the interposition of the foil 10. The die punch 4 pushes the contrast body 6 on the frame 15, by exerting a compression force on the elastic contrast elements 7. Continuing in its downward movement, the die punch 4 comes to be in a relative configuration of interference with respect to the blanking element 9.

As shown in Figure 4A, the sliding of the die punch 4 with respect to the blanking body 9 determines the blanking of the foil 10 at the contact surface between the two bodies.

In other words, the portion of material to be formed is separated by shearing of the portion of excess material 19, called swarf or processing waste (material scrap), intended precisely to be discarded. This sheared portion of foil 10, intended for molding, has a circular profile in plan by virtue of the shape of the die punch 4 and of the blanking body 9.

With reference to Figures 4B and 4C, the die punch 4 continues in its motion downward, while the peripheral area of the material to be formed is gripped between the die punch 4 and the contrast body 6.

Meanwhile, the counter-die 3, integral with the puncher 4 in its downward movement, closes on the punch 2. While the puncher 4 continues to descend, compresses the contrast elastic elements 5 of connection with the counter die 3, which stood on the punch 2. The disc of material interposed between the two respective molding surfaces 20 and 30 is pressed in such a way as to make it assume the shape of these surfaces, which is that desired for the final container.

At the same time, the peripheral material clamped between the die punch 4 and the contrast body 6 plastically flows towards the central part of the disc, forced to occupy a larger area than that of departure, to 'feed' the forming between the two molding surfaces 20 and 30.

In this phase of the process the presence of the break-wrinkles means 40, integral to the die punch 4, prevents the formation of wrinkles on the container walls.

During this molding step, the contrast body 6 serves as abutment body to the die punch element 4.

The descent of the punch 4 continues up to stopping in correspondence of the so-called lower dead point of the press 1, i.e. the position of maximum closing of the molding apparatus (Figure 4B). Arrived in this position, the direction of motion of the die punch 4 and of the counter 3 is reversed, and the mold opens.

At this point, the shape of the container is completed, except for the outer edge.

The realization of this edge is performed concurrently with a return motion of contrast body 6 in a rest position.

Said body 6 is free to return in the rest position at the end of the molding step, when the die punch 4 reverses the direction of motion and starts to translate upwards, progressively downloading the elastic elements 7 of contrast.

During this ascent phase, the contrast body 6 moves progressively upward,

pushed by the force of elastic return of the underlying contrast elements 7. During the execution of this movement, the contrast body 6 lifts the peripheral part of the container, which was gripped between the die punch 4 and the same contrast body 6, forming the outer edge of the cake pan (Figure 4C). In particular, as shown in Figure 4E, on the inner end of the contrast body 6, a groove, seat or furrow 61 may be provided, which invites the material to wind during the ascent phase of the body itself.

As shown in Figure 5A, the cake pan initially remains adherent to the surface 30 of the counter 3, following the puncher 4 in its ascent motion. After a few moments, due to its own weight, the container is detached from the mold (Figure 5B).

After the extraction step, it remains instantaneously suspended, in a free fall, between the counter die 3 and the punch 2.

Preferably, the molding apparatus 1 further comprises means for producing a jet of compressed air 21. Said jet is arranged to invest the container while it is still free falling in the air, in order to realize its expulsion in a direction opposite to that of feeding of the raw material to the press 1 (Figure 5C).

The molding apparatus 1 is extremely simple, even in comparison with similar apparatus employed in different applications.

In particular, it will be appreciated that the cake pan detaches from the mold by effect of its own weight. Therefore, strictly speaking, in many applications of the invention it is not necessary to provide any movable plate (or equivalent means) at the counter die 3 which favors said detachment.

Also the formation of the edge by the same contrast body 6 avoids the necessity of providing dedicated means.

With reference to Figure 6, a manufacturing method for the realization of metallic cake pans with a thickness over 250 μm by means of cold stamping according to a preferred embodiment of the present invention comprises several steps, to be executed in succession. These phases have already been

considered above with reference to the structure and operating modes of the apparatus 1 and the plant 200.

The first operation of the production cycle consists in the storage of a determined quantity of raw material, destined to the continuous feeding of an automatic machine 1 in a continuous cycle, in particular inserted in the plan 200 already described above. The raw material is then moved and transported, animated by a given rate of feed, to the apparatus 1. Once positioned on it, the material is subjected to a series of rapid operations, that preferred embodiments of the invention allow to perform in fractions of a second.

In a first phase, a punching is executed, which separates the waste material from the portion of raw material intended for molding. The immediately next operation is a cold-molding, during which the raw material is instantly compressed between two molding bodies, to make the material assume a determined shape. Finally, the outer edge of the cake pan so formed is realized. The cake pan remains adherent to the mold for a moment, but then it is extracted by virtue of its own weight and it is ejected from the machine. Finished products produced in this way are stored and packaged.

As already mentioned, features and preferred modes of the method of the invention have already been described above with reference to the plant 200 and apparatus 1.

The present invention has hereto been described with reference to preferred embodiments. It is to be understood that there may be other embodiments afferent to the same inventive core, as defined by the scope of protection of the claims set out below.

CLAIMS

1. A method of making a re-usable metallic container for oven, in particular a baking pan or cake pan preferably of circular shape,

   which method comprises a cold molding step of a metallic foil (10) performed by pressing the foil between a concave molding body (3), or female body, and a corresponding convex molding body (2), or male body,

   wherein said container has a thickness equal to or greater than about 250 μm, preferably comprised in a range of about 250-500 μm.

2. The method according to claim 1, which provides a line of continuous feeding of said metallic foil (10), preferably unwound from a coil (11), between said molding bodies (2, 3).

3. The method according to claim 1 or 2, wherein said cold molding step is performed by moving said concave body (3) towards said convex body (2), preferably according to a translation motion, such translation motion being in particular performed in a vertical direction.

4. The method according to any one of the preceding claims, comprising a punching step of said foil (10) performed in such a way to isolate a useful portion of the foil to be subjected to said molding step, which punching step preferably immediately precedes said cold molding step.

5. The method according to the preceding claim, wherein said punching step is performed by means of a punching body (4) movable integrally with said concave molding body (3).

6. The method according to any one of the preceding claims, comprising a forming step of a peripheral edge of said container, preferably performed downstream of said cold molding step.

7. The method according to the preceding claim, wherein said forming step of a peripheral edge is performed by means of a forming element (6) arranged alongside said convex molding body (2), which forming element (6) is preferably an elastic contrast body for said punching body (4).

8. The method according to the preceding claim, wherein said forming step is performed during a stroke of said contrast body (6) towards its rest position.

9. The method according to any one of the preceding claims, wherein said metallic material (10) is or includes aluminium.

10. An apparatus (1) for making a reusable metallic container for oven, in particular a baking pan or cake pan preferably of a circular shape, which apparatus comprises:

- a concave molding body (3), or female body, and a corresponding convex molding body (2), or male body, selectively approachable one to another in order to press a metallic foil (10) therebetween in such a way to make a cold molding of the material; and
- relative moving means of said molding bodies,

wherein the overall configuration is such to allow the production of finished containers having a thickness equal to or greater than about 250 μm, preferably comprised in a range of about 250-500 μm.

11. The apparatus (1) according to claim 10, wherein said moving means are configured to move said concave body (3) towards said convex body (2), preferably according to a translation motion, such translation motion being in particular performed in a vertical direction.

12. The apparatus (1) according to claim 10 or 11, comprising a punching body (4) of the metallic foil (10).

13. The apparatus (1) according to the preceding claim, wherein said punching body (4) is movable integrally with said concave molding body (3).

14. The apparatus (1) according to any of claims 10 to 13, comprising forming means (6) of a peripheral container edge.

15. The apparatus (1) according to the preceding claim, wherein said forming means (6) comprise a forming element (6) arranged alongside said convex molding body (2), which forming element (6) is preferably an elastic contrast body for said punching body (4).

16. A plant (200) for making a reusable metallic container for oven, in particular a baking pan or cake pan preferably of a circular shape, which plant comprises an apparatus (1) according to any one of claims 10 to 15, inserted in a continuous feed line of the metallic foil (10), such metallic foil being preferably unwound from a coil (11), between said molding bodies (2, 3).

17. The plant (200) according to the preceding claim, comprising regulation means (202) of metallic material feeding speed, configured to synchronize a continuous flow of feeding means (203) with a discrete working in said molding apparatus (1).

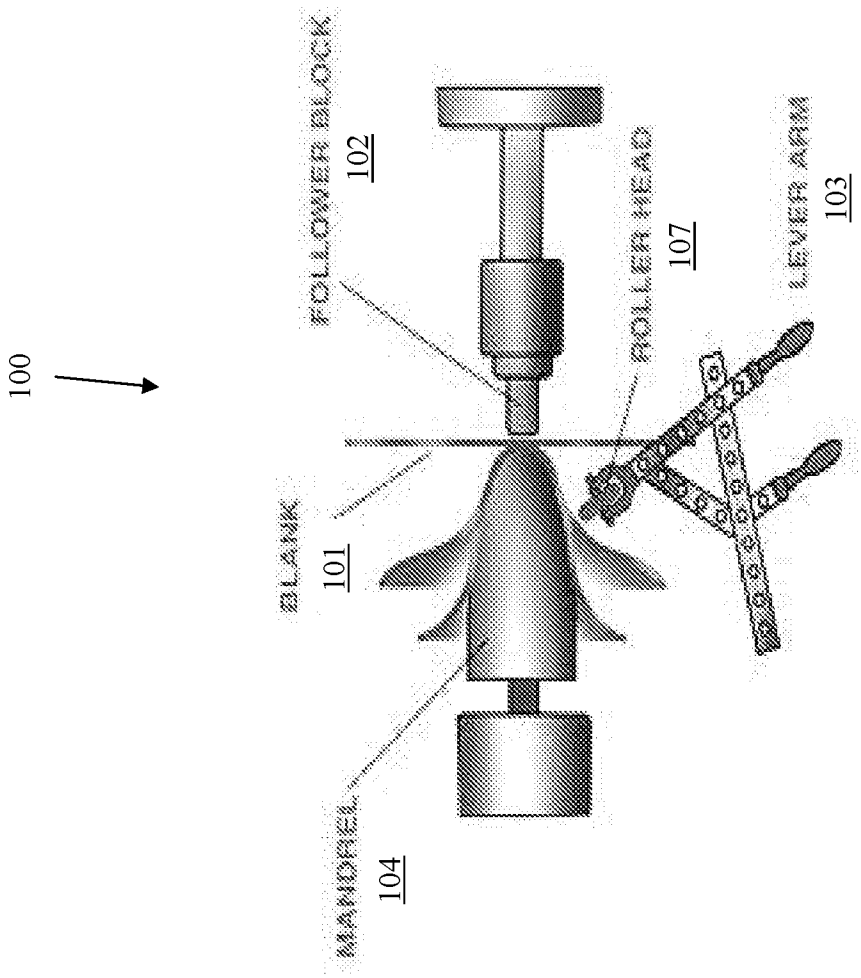
100
FOLLOWER BLOCK
102
ROLLER HEAD
107
LEVER ARM
103
BLANK
101
MANDREL
104

FIG. 1

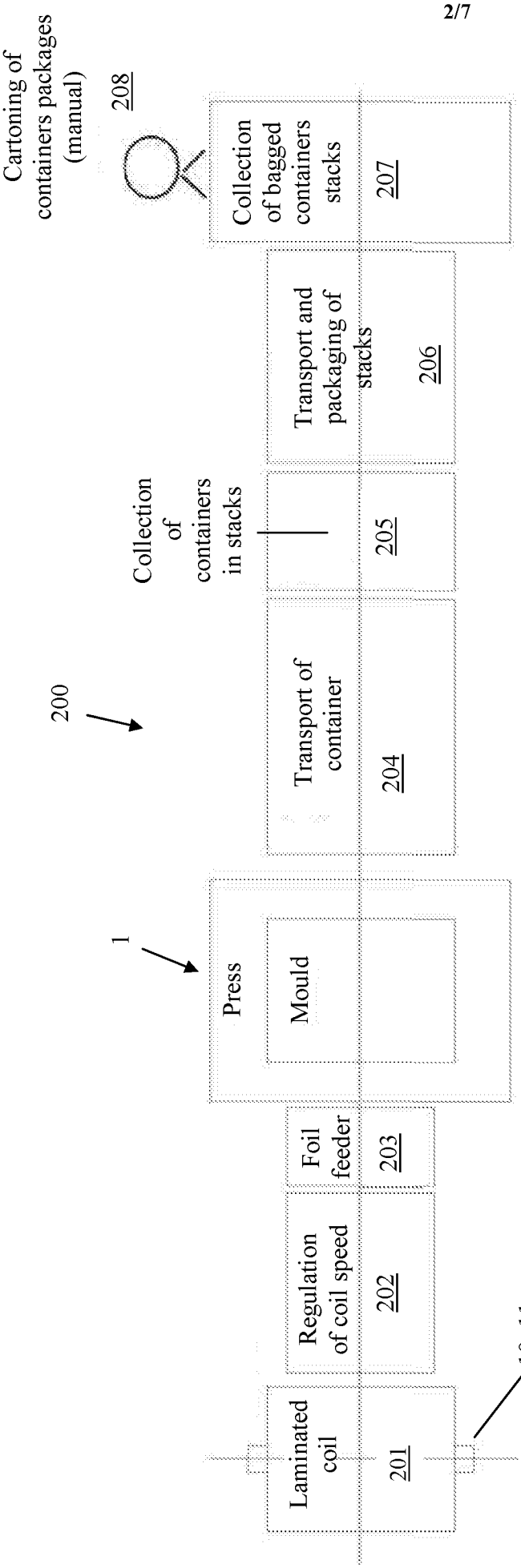
Cartoning of containers packages (manual)
208
Collection of bagged containers stacks
207
Transport and packaging of stacks
206
Collection of containers in stacks
205
Transport of container
204
200
1
Press
Mould
Foil feeder
203
Regulation of coil speed
202
Laminated coil
201
10, 11

FIG. 2

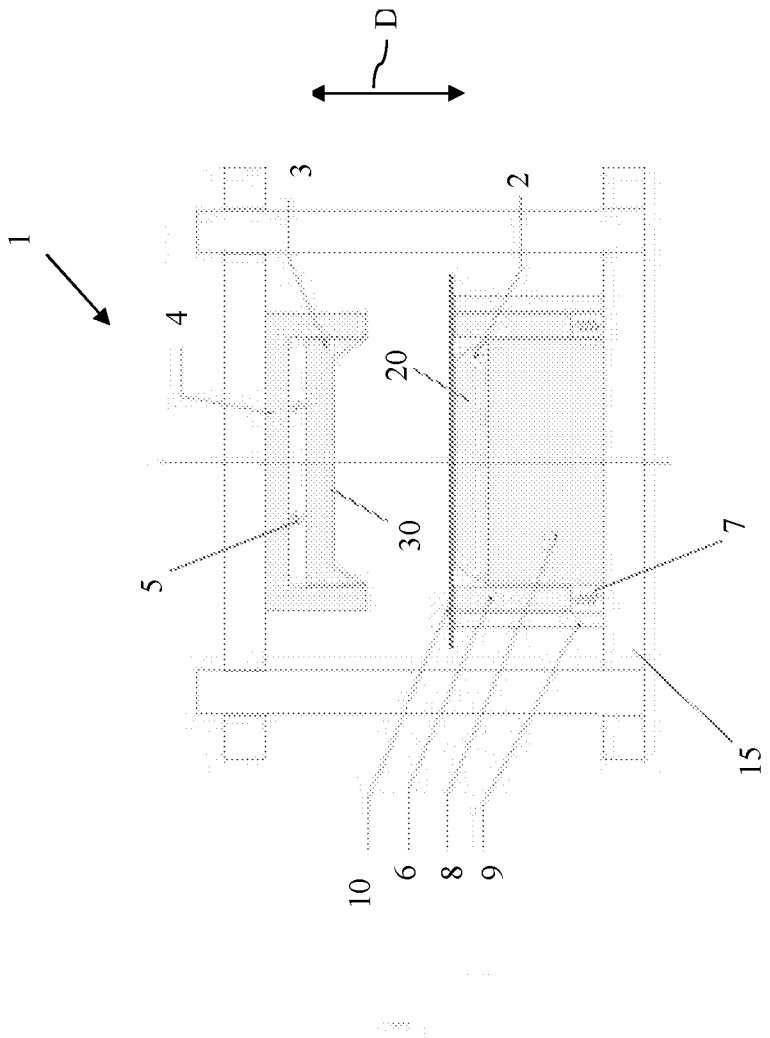

FIG. 3

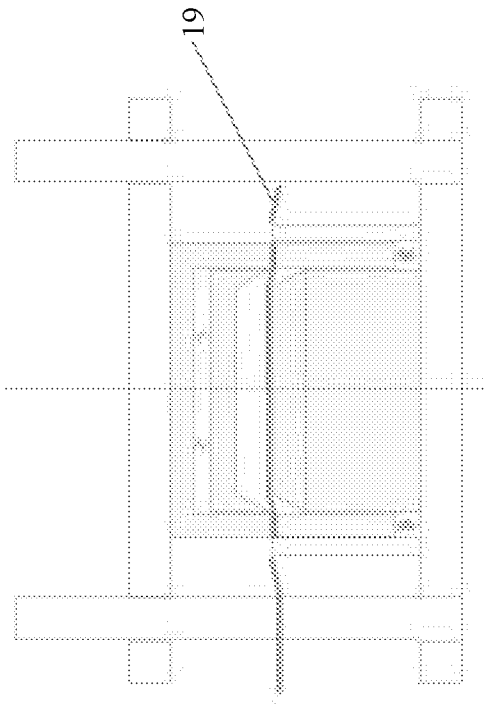

FIG. 4A

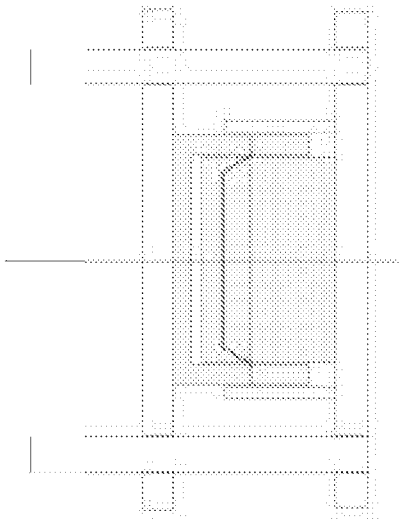

FIG. 4C

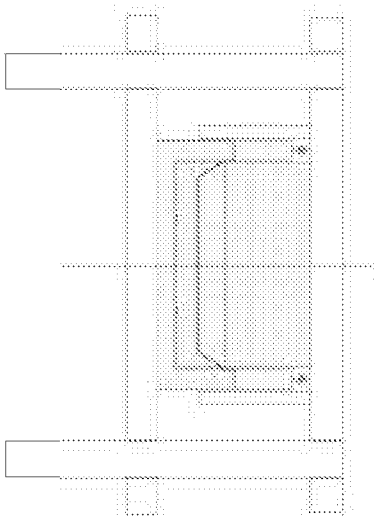

FIG. 4B

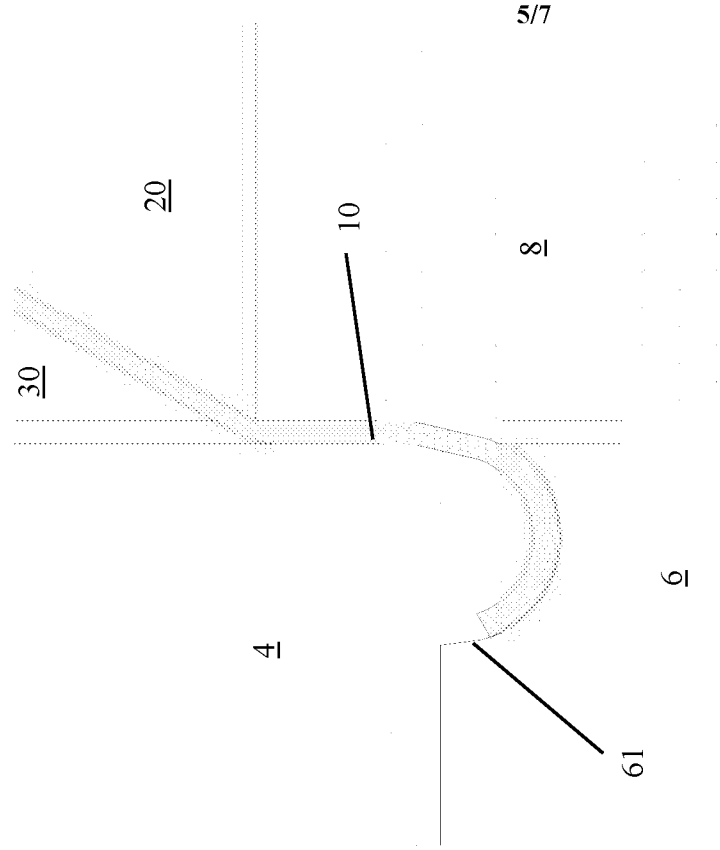

FIG. 4E

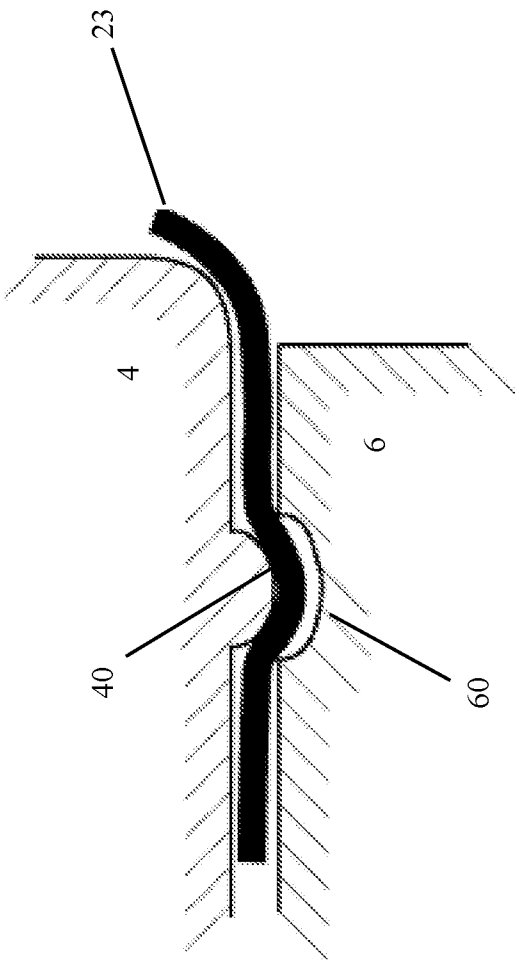

FIG. 4D

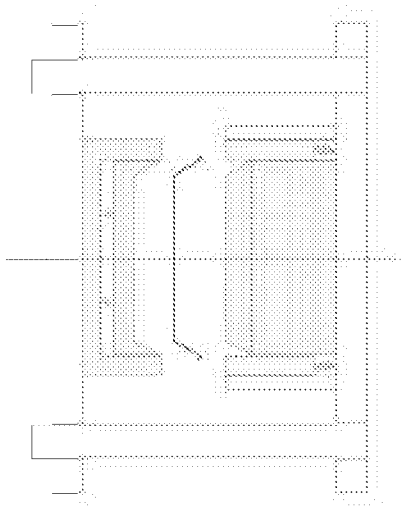

FIG. 5B

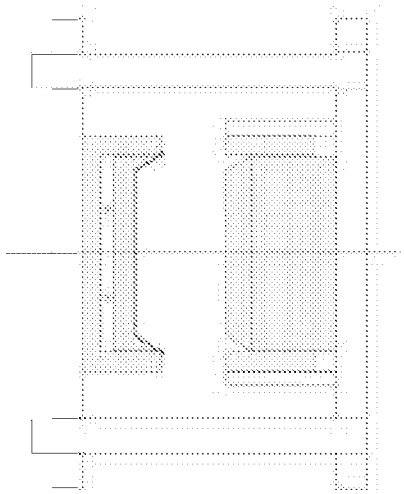

FIG. 5A

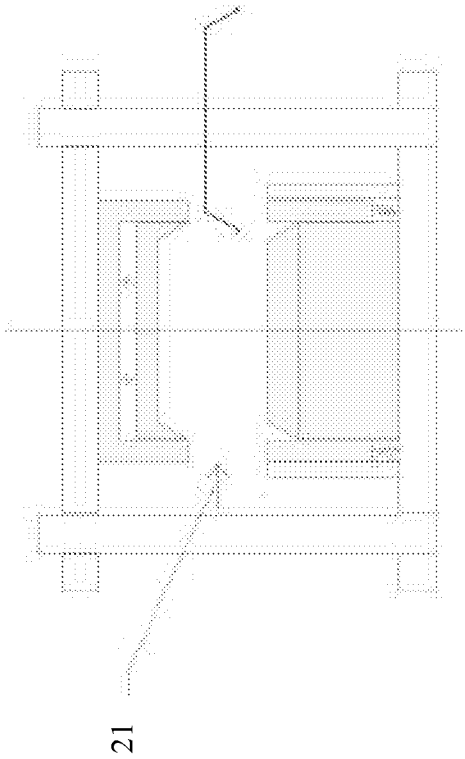

FIG. 5C

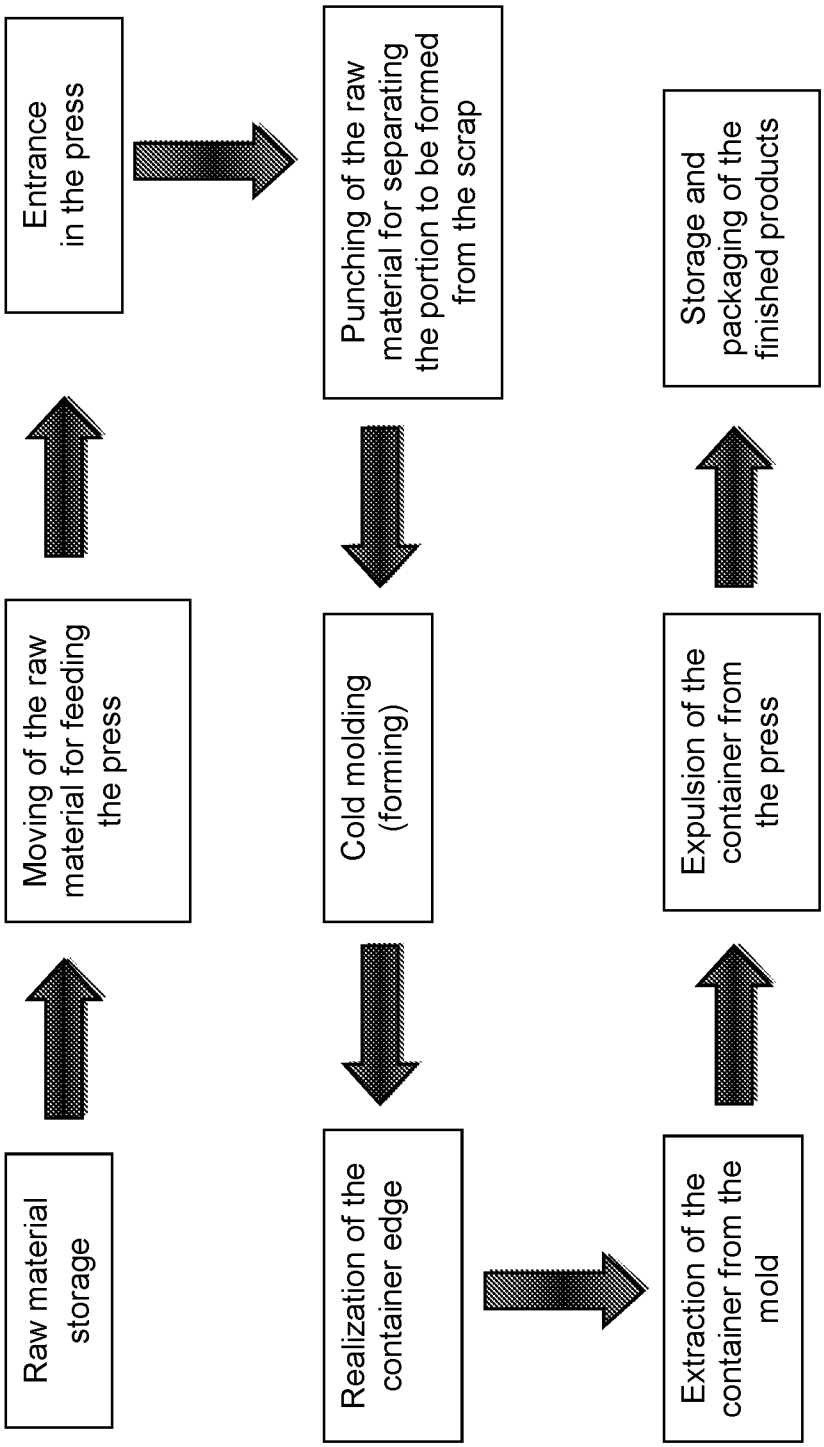
Raw material storage
Moving of the raw material for feeding the press
Entrance in the press
Punching of the raw material for separating the portion to be formed from the scrap
Cold molding (forming)
Realization of the container edge
Extraction of the container from the mold
Expulsion of the container from the press
Storage and packaging of the finished products

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/052771

A. CLASSIFICATION OF SUBJECT MATTER
INV. B21D51/22
ADD.

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)
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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 554 080 A1 (SEB SA [FR]) 6 February 2013 (2013-02-06)	1-5, 9-13,16, 17
A	paragraph [0021] - paragraph [0021]; claims 1,3,5,10; figures 1-6	6-8,14, 15

X	US 3 064 112 A (HANZEL RICHARD W) 13 November 1962 (1962-11-13)	1-5, 9-13,16, 17
A	column 4, paragraph 14 - column 4, paragraph 63; figures 1-3	6-8,14, 15

X	US 2005/205646 A1 (CHENG STANLEY K S [US]) 22 September 2005 (2005-09-22)	1-5, 9-13,16, 17
A	paragraph [0018] - paragraph [0019]; figures 1,2a-2e,3	6-8,14, 15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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	Date of mailing of the international search report
28 July 2016	05/08/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Vinci, Vincenzo

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/052771

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 080 806 A2 (LAGOSTINA SPA [IT]) 7 March 2001 (2001-03-07)	1,3-5, 9-13,16, 17
A	paragraph [0022] - paragraph [0022]; figures 2,3	6-8,14, 15

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2016/052771

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2554080 A1	06-02-2013	CN 102908041 A	06-02-2013
		EP 2554080 A1	06-02-2013
		FR 2978651 A1	08-02-2013
		KR 20130016104 A	14-02-2013
US 3064112 A	13-11-1962	NONE	
US 2005205646 A1	22-09-2005	US 2005205646 A1	22-09-2005
		WO 2005089053 A2	29-09-2005
EP 1080806 A2	07-03-2001	AT 334764 T	15-08-2006
		CA 2316515 A1	26-02-2001
		DE 60029703 T2	02-08-2007
		EP 1080806 A2	07-03-2001
		ES 2269046 T3	01-04-2007
		IT MI991842 A1	26-02-2001