(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 254 778 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.12.2017 Bulletin 2017/50

(51) Int Cl.:
B21D 22/22 *(2006.01)* ***B21D 24/04*** *(2006.01)*

(21) Application number: **17174450.1**

(22) Date of filing: **05.06.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **07.06.2016 PL 41744916**

(71) Applicant: **CAN - PACK S.A.**
31-358 Kraków (PL)

(72) Inventors:
- **Budzyn, Robert**
  32-800 Jasien (PL)
- **Furman, Andrzej**
  32-800 Brzesko (PL)
- **Baran, Robert**
  32-765 Rzezawa (PL)
- **Kociolek, Maciej**
  32-800 Brzesko (PL)
- **Styrna, Tadeusz**
  32-825 Borzecin (PL)
- **Brodawka, Lukasz**
  27-660 Koprzywnica (PL)
- **Siedlik, Micha**
  32-700 Bochnia (PL)
- **Rekas, Artur**
  30-133 Krakow (PL)
- **Latos, Tomasz**
  28-362 Naglowice (PL)
- **Kurek, Magdalena**
  34-130 Kalwaria Zebrzydowska (PL)

(74) Representative: **Krekora, Magdalena**
ul. Gorna 95
PL-32-091 Michalowice (PL)

(54) TOOLS AND A MACHINE FOR MANUFACTURING OF PACKAGES FROM SHEET METAL

(57) A tool for preforming cups for manufacturing of packages from sheet metal, composed of a preforming die (1), a blankholder (2) and a sheet preforming punch (3), where the differences of: preforming die's outer diameter Dm1 and inner diameter dm1, preforming blankholder outer diameter Ddl and inner diameter ddl are not less than 20% of the diameter Ddl or/and Dm1, wherein the blankholder (2) surface and the die (1) surface, in the place where the die and the blankholder are touching each other, are shaped the way to hold still the material during the operation of preforming.

The object of the present invention is also a tool for drawing cups, machine with installed tools, and a technological line composed of such machines.

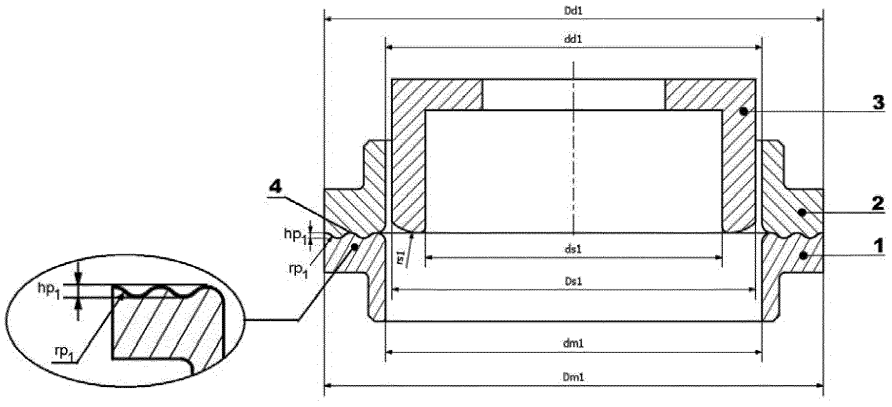

Fig. 1.

EP 3 254 778 A1

Description

[0001] The object of the present invention is a tool for preforming and a tool for cups drawing, both for manufacturing of packages from sheet metal, as well as a machine, in which those tools are installed, and a technological line comprising such machines. All these inventions are especially useful for manufacturing of metal cans, in particular aluminium cans.

[0002] Patent specification EP16000613 discloses a method of shaping metal cups for making packages, in which in the first phase preforms are formed in a metal strip, and the strip is held during the process of preforms forming, and then the blanks with preforms are sheared from the strip. From those blanks cups are formed, wherein preforms formed in the first phase in metal strip have at least one surface situated in the plane essentially parallel to the plane of the sheet, where the surface is subjected to uniform stretching, and then a blank is sheared, then a cup is drawn from the sheared portion, wherein the bottom of the cup is formed from the upper surface of the preform, and the walls of the cup are made of the slanted walls of the preform, and the flange of the blank.

[0003] A tool for preforming cups, for manufacturing of packages from sheet metal in accordance with the invention, is characterised by the fact, that it is composed of a preforming die, a blankholder and a sheet preforming punch, where the differences: of preforming die outer diameter Dm1 and of preforming die's inner diameter dm1, and of preforming blankholder outer diameter Dd1 and of preforming blankholder inner diameter dd1 are not less than 20% of the diameter Dd1 or/and Dm1, wherein the blankholder surface and the die surface in the place where the die and the blankholder are touching each other, are shaped in such a way to hold still the material during the operation of preforming.

[0004] At least one recess of heights hp1 smaller then 10-fold of starting material thickness is applied in the surfaces of the die and the blankholder.

[0005] Radius length rp1 of the recess is from 5 to 30 of starting material thickness.

[0006] Ratio of preforming punch outer diameter Ds1 to preforming die outer diameter Dm1 is not less than 0,6.

[0007] Preforming punch radius rs1 is between 5-30 mm.

[0008] A tool for drawing cups for manufacturing packages of sheet metal is composed of a drawing die, a blankholder and a drawing punch, wherein the blankholder surface and the die surface, in the place where the die and the blankholder are touching each other, are shaped in such a way to create resistance, which results in controlled movement of the material during operation of drawing.

[0009] The tool according to claim 6, characterized in that, there is applied at least one recess of height hp2 smaller then 10-fold of starting material thickness in the surfaces of the die and the blankholder.

[0010] Radius length rp2 of the recess is from 5 to 30 of starting material thickness.

[0011] A conic front of the die with a drawing edge is inclined at angle β concordant with the angle of inclination of the preform sidewall.

[0012] Height of the die hm conforms to the preform height, which is a distance between the surface of the preform bottom and the surface of the preform flange.

[0013] Punch radius rs2 is bigger than 5 thicknesses of the starting material.

[0014] Difference of drawing punch outer diameter Ds2 and drawing punch inner diameter ds2 is not smaller than 10% of diameter Ds2.

[0015] A machine for manufacturing of cups for production of packages from sheet metal in accordance with the invention is characterized by that at least one tool for preforming cups for manufacturing of packages from sheet metal in accordance with the invention or/and at least one tool for drawing cups for manufacturing of packages from sheet metal in accordance with the invention is installed in it.

[0016] A technological line for manufacturing of cups for production of packages from sheet metal characterized in that it comprises at least one machine with tools for preforming cups for manufacturing of packages from sheet metal in accordance with the invention, or/and at least one machine with tools for drawing cups for manufacturing of packages from sheet metal in accordance with the invention.

[0017] The tool for preforming forms a preliminary cup, called "preform" from flat material, that has thinned bottom The tool for drawing draws a cup, having flat bottom, from the preform for manufacturing of metal packages. A flat bottom of the cup is crucial for transport process on manufacturing line. Shaped preforms have one surface situated in the plane essentially parallel to sheet plane P1. Forming takes place during the process of drawing on a press, while the strip is held during the process of forming. Preforms get shape close to a cut cone without base in sheet plane, where the upper surface is essentially parallel to this plane. The walls of the cone are essentially straight. Then from such formed preforms blanks are sheared, preferably having circular shape or contoured shape based on a circle, wherein the blank extends over at least this part of the sheet, where the preform was previously formed. Consecutively, from the blanks obtained in such a way, cups are formed, having shape of a cylindrical cup, where forming of the cups is carried out in such a way, that the upper essentially flat surface of the preform essentially as a whole forms bottom of the cup, while side surface of the cup is formed from the material from side surface of the preform having shape of a cut cone and additionally from material of the flange being a part of the sheared sheet outside the base of the cut cone.

[0018] Tools for preforming and drawing the cups in accordance with the invention allow for thinning of the bottom area of the preform, while maintaining or improv-

ing resistance parameters of the cup bottom, from which a bottom of a can is then formed. That allows to use a smaller volume of sheet in the process of cans production, because mechanical strength of drawn sheet is essentially increased as a result of deformation strengthening effect. Using of a cut cone shape guarantees essentially uniform stretching of the upper plane of the preform

[0019] Manufacturing of cups for cans forming, may be carried out on one machine, where there are concurrently installed both types of the tools, or on technological line comprising at least one machine with a tool for preforming, and at least one machine with a tool for drawing.

[0020] Preferably the tools are installed in a tool assembly. Such a tool assembly is composed of three main plates: upper, middle, and bottom. Upper plate is movable, and the punch is fixed to it. The holdfast system is fixed to the middle plate. The die is fixed to the bottom plate.

[0021] Preforms may be shaped from sheared disks or directly on the strip, then the shearing will take place during drawing operation on shearing tools.

[0022] The object of the invention is disclosed at the drawings, where fig. 1 depicts a preforming tool, fig. 2 depicts a drawing tool, fig. 3 depicts an assembly with tools, fig. 4 and 5 depict a machine with tools installed, fig. 6 depicts a technological line, and fig. 7 depicts cup manufacturing process.

Example

[0023] A tool for preforming (fig. 1) is composed of a preforming die 1, a blankholder 2 and a preforming punch 3. In order to enlarge the surface of active holding recesses (drawbeads) 4 are applied in the surface of the blankholder 2, and the die 1. Geometry of the recess 4 must ensure holding of the material in a flange part without possibility of its move in radial direction. Two recesses 4 are applied having height hp1 not exceeding 10 thicknesses of starting material and having radius rp 1 on recesses 4 from 5 to 30 thicknesses of the material. Differences between the diameters: outer die diameter Dm1 and inner die diameter dm1 and outer blankholder diameter Dd1 and inner blankholder diameter dd1 shall not be smaller than 20% of the diameter Dd1 or/and Dm1, while difference between the outer punch diameter Ds1 and the inner punch diameter ds1 is minimum 10% of diameter Dd1 or/and Dm1. Punch radius rs1 is between 5-30mm.

[0024] A tool for drawing (fig. 2) is composed of a drawing die 5, a blankholder 6 and a drawing punch 7. In order to enlarge the surface of active holding recesses (drawbeads) 8 are applied in the surface of the blankholder 6, and the die 5. Geometry of the recess 8 must enable movement of a flange part of the preform in radial direction. Two recesses 8 are applied having height hp2 not exceeding 10 thicknesses of starting material and having radius rp 2 on recesses 8 from 5 to 30 thicknesses of the material. Drawing blankholder outer diameter Dd2 and drawing die outer diameter Dm2 correspond to preforming blankholder outer diameter Dd1 or/and preforming die outer diameter Dm1. Height of the drawing die hm corresponds to height of the preform, i.e. to distance between plane P1 and P2 (fig. 7). The conic front of the die with drawing edge is inclined at angle β concordant with angle of inclination of the preform sidewall - angle β (fig. 2) is equal to angle α (fig. 7).

[0025] Punch radius rs2 cannot be smaller than 5 thicknesses of the sheet. Drawing blankholder inner diameter dd2 and drawing die inner diameter dm2 cannot be bigger than preforming die inner diameter dm1 or/and preforming blankholder inner diameter dd1. Difference between drawing punch outer diameter Ds2 and inner diameter ds2 cannot be smaller than 20% of Ds2 diameter.

[0026] Tools assembly (fig. 3) is composed of three main plates 32, 10, 11: upper 32, middle 10, and bottom 11. The upper plate 32 and the middle plate 10 are connected by four columns 12 fixed on one side on the upper plate 32 in a permanent socket 13, in the middle plate in a leading sleeve 14. The middle plate 10 is connected with the bottom plate 11 by four columns 15 permanently fixed by rims 16 from both sides. A handle of the punch 17 with additional punch adaptor 18 is affixed to the movable upper plate. To the middle plate 10 it is affixed the system of pneumatic holdfast composed of an inner sleeve 19, an outer housing 20, a feed stop 21 and a feed system 22 fixed on rubber seals 23. To the feed system 22 it is affixed a limiting return rim 22, a blankholder fixing insert 28, a protecting ring 26, and a blankholder. To the bottom plate 11 are fixed: a leading sleeve 27, a die fixing base 28, a die holder 29, a die, a bottom positioning ring 30, and an upper positioning ring 31. Additional drawbeads allow for adequate immobilization of the flange part during preforming. The assembly was designed in such a way, to make it possible to install in it a preforming tool (fig. 1), as well as a drawing tool (fig. 2).

[0027] In the machine for manufacturing cups (fig. 4 and 5) a preforming tool 33 and a drawing tool 34 are installed. Those tools are installed in assemblies 35.

[0028] A technological line for manufacturing cups (fig. 6) is composed of two machines. In machine 36 preforming tools are installed, and in machine 37 drawing tools are installed. Preforms manufactured in the machine 36 are moved to the machine 37, where they are drawn.

[0029] Preforming and drawing process (fig. 7) is carried out in such a way, that in the first phase from a metal strip 38 profiles 39 are formed having at least one surface 40 situated in the plane P2 parallel to the plane of sheet P1, where the strip 38 is held during process of forming, and the surface 40 undergoes uniform stretching, then a blank 41 is sheared, from which a cup 42 is drawn, whose bottom is created from a surface 40, and walls 45 are made of inclined planes 43, and a flange 44.

Claims

1. A tool for preforming cups for manufacturing of packages of sheet metal, **characterized in that** it is composed of a preforming die (1), a blankholder (2) and a sheet preforming punch (3), where the differences: of preforming die outer diameter Dm1 and inner diameter dm1, and of preforming blankholder outer diameter Dd1 and inner diameter dd1 are not less than 20% of the diameter Dd1 or/and Dm1, wherein the blankholder (2) surface and the die (1) surface, in the place where the die and the blankholder are touching each other, are shaped the way to hold still the material during the operation of preforming.

2. The tool according to claim 1, **characterized in that**, there is applied at least one recess (4) of height hp1 smaller then 10-fold of starting material thickness in the surfaces of the die and the blankholder.

3. The tool according to claim 2, **characterized in that** radius length rp1 of the recess (4) is from 5 to 30 of starting material thickness.

4. The tool according to claim 1 or 2 or 3, **characterized in that** ratio of preforming punch inner diameter Ds1 to preforming die outer diameter Dm1 is not less than 0,6.

5. The tool according to any of above claims, **characterized in that** preforming punch radius rs1 is between 5-30 mm.

6. A tool for drawing cups for making packages of sheet metal, **characterized in that** it is composed of a drawing die (5), a blankholder (6) and a sheet drawing punch (7), wherein the blankholder (6) surface and the die (5) surface, in the place where the die (5) and the blankholder (6) are touching each other, are shaped the way to create resistance, which results in controlled movement of the material during operation of cup drawing.

7. The tool according to claim 6, **characterized in that** there is applied at least one recess (8) of height hp2 smaller then 10-fold of starting material thickness in the surfaces of the blankholder (6) and the die (5).

8. The tool according to claim 7, **characterized in that** radius length rp2 of the recess (8) is from 5 to 30 of starting material thickness.

9. The tool according to claim 6 or 7 or 8, **characterized in that** a conic front of the die (9) with a drawing edge is inclined at angle β concordant with angle of inclination of the preform sidewall.

10. The tool according to any of the claims from 6 to 9, **characterized in that** height of the die (5) hm conforms to the preform height, which is a distance between the surface of the preform bottom (40) and the surface of the preform flange (44).

11. The tool according to any of the claims 6 - 10, **characterized in that** punch radius rs2 is bigger than 5 thicknesses of the starting material.

12. The tool according to any of the claims 6-11, **characterized in that** difference of drawing punch outer diameter Ds2 and drawing punch inner diameter ds2 is not smaller than 10% of diameter Ds2.

13. A machine for manufacturing of cups for production of packages from sheet metal **characterized in that** at least one tool made in accordance any of the claims from 1 to 5 or/and at least one tool made in accordance with any of the claims from 6 to 12 is installed in it.

14. A technological line for manufacturing of cups for production of packages from sheet metal **characterized in that** it comprises at least one machine with installed tools made in accordance any of the claims from 1 to 5 or/and at least at least one machine with installed tools made in accordance any of the claims from 6 to 12.

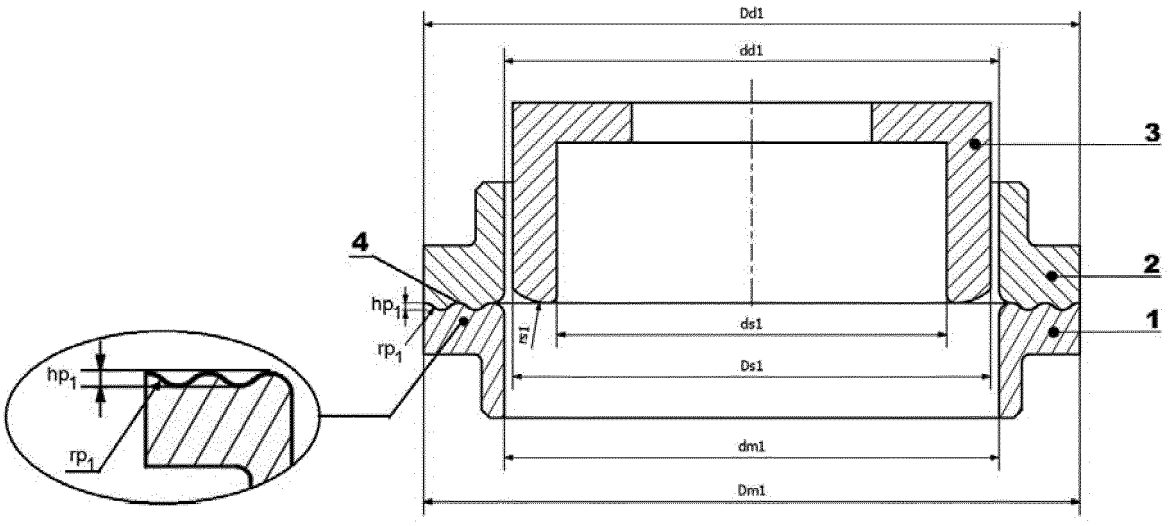
Dd1
dd1
3
4
2
hp1
rs1
1
rp1
ds1
Ds1
dm1
Dm1

Fig. 1.

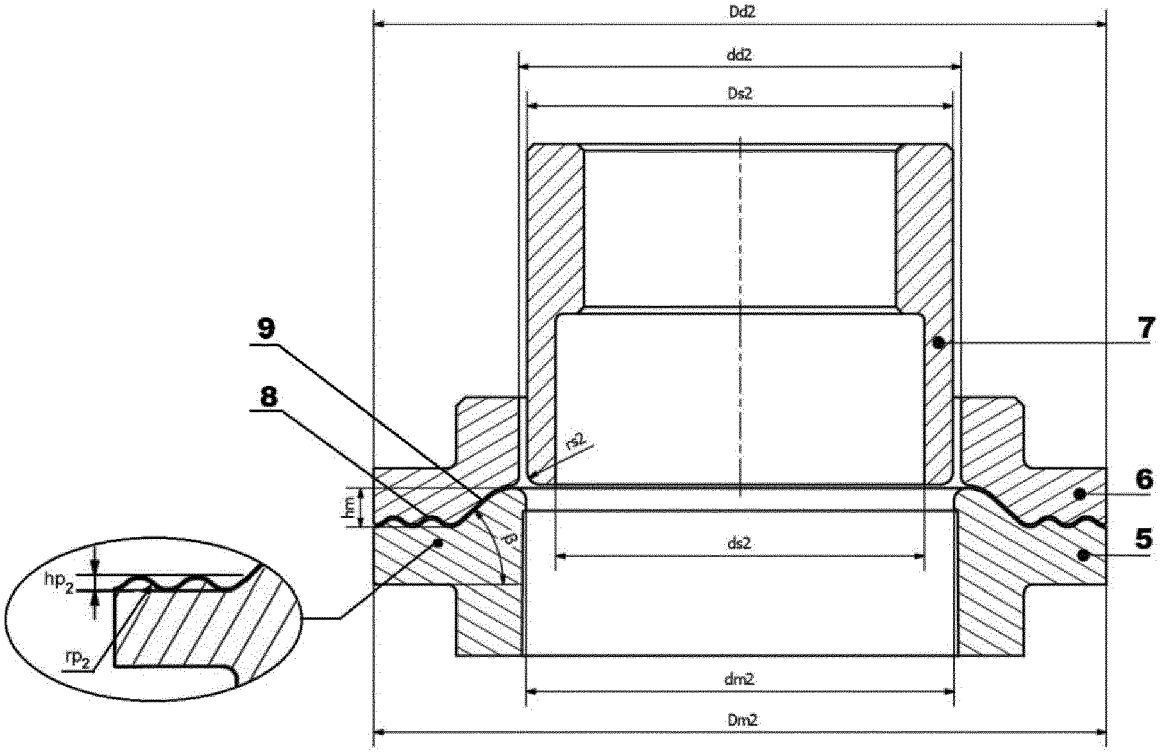
Dd2
dd2
Ds2
9
7
8
rs2
6
hm
β
5
ds2
hp2
rp2
dm2
Dm2

Fig. 2.

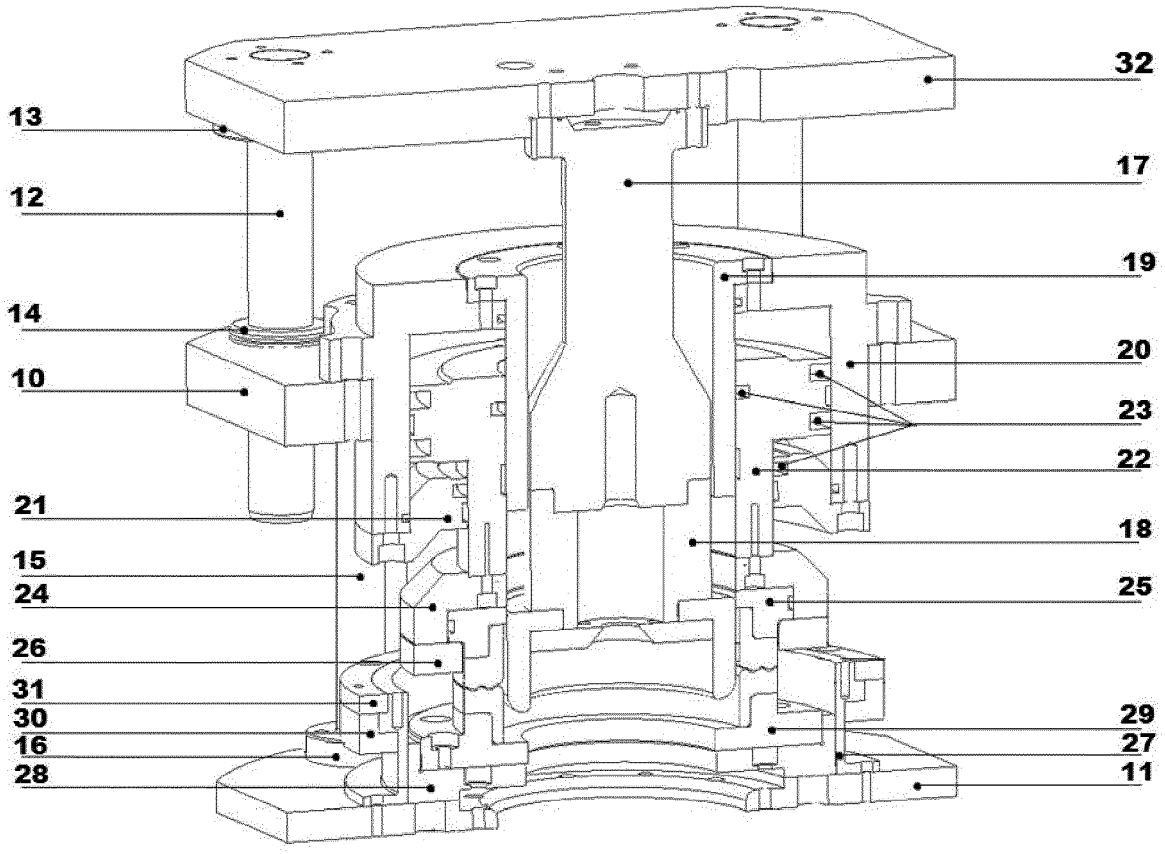
32
13
17
12
19
14
20
10
23
22
21
18
15
25
24
26
31
29
30
27
16
11
28

Fig.3.

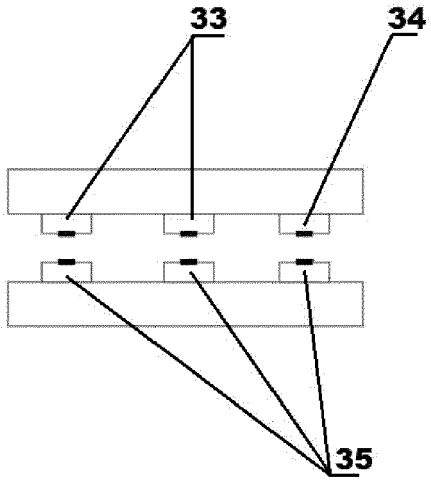
33
34
35

Fig. 4.

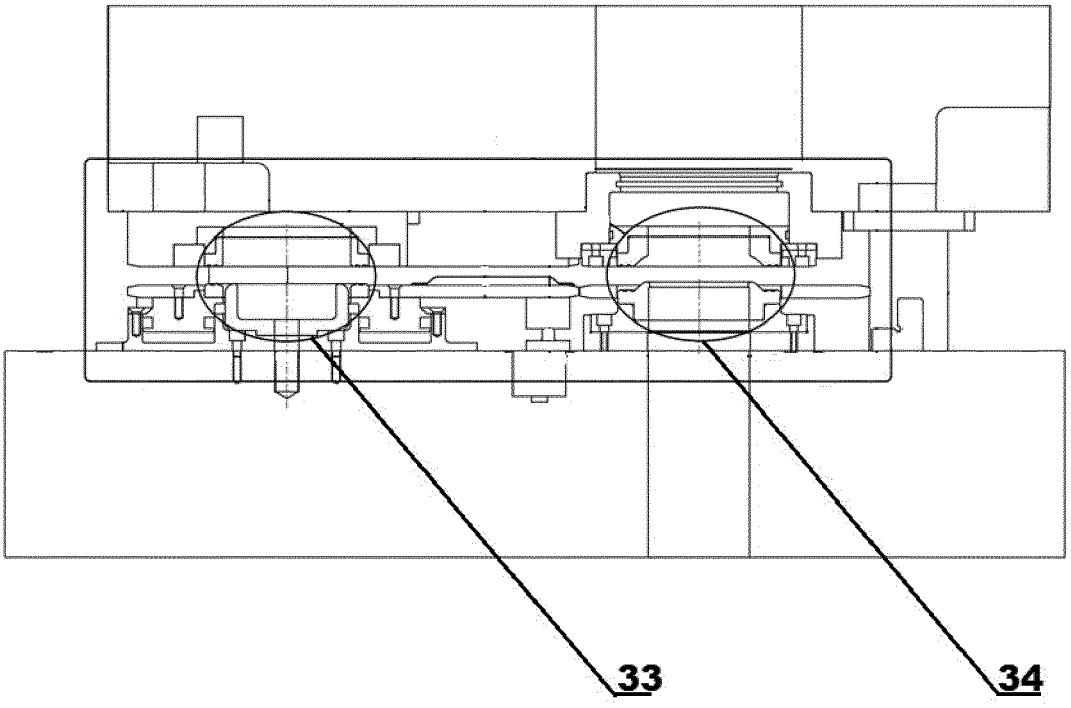

Fig. 5.

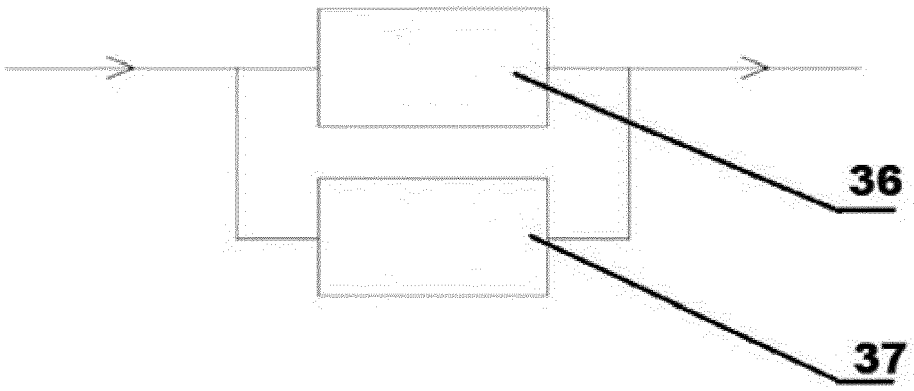

Fig. 6.

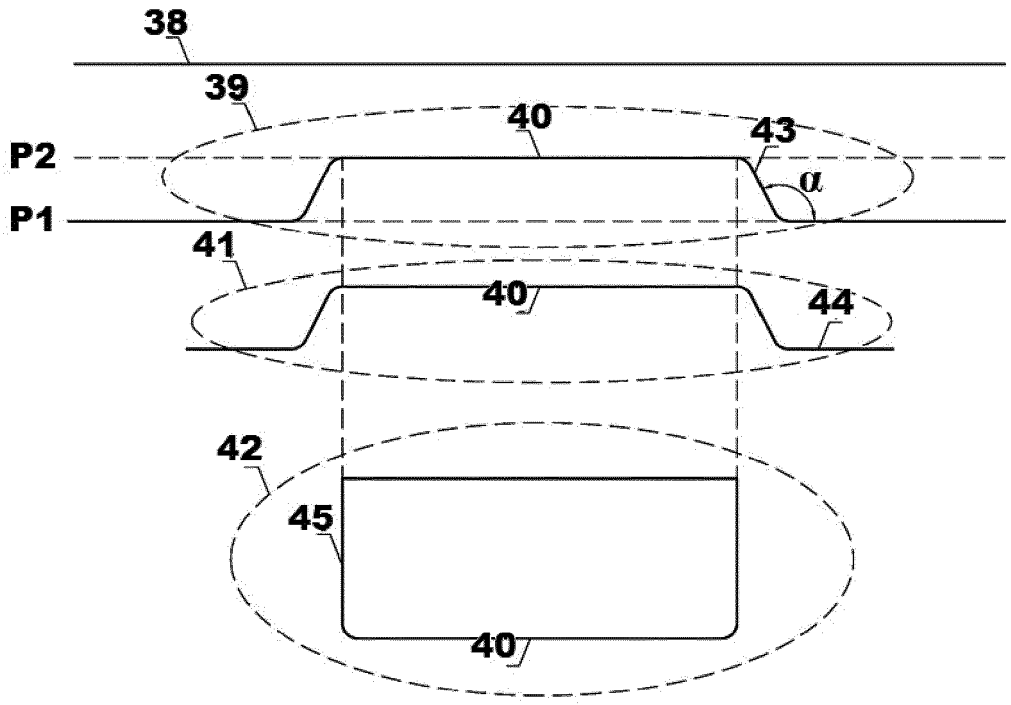

Fig. 7.

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 17 4450

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 3 664 172 A (CVACHO DANIEL S) 23 May 1972 (1972-05-23) * column 3, line 20 - line 29 * * column 4, line 67 - column 6, line 37; figures *	1-14	INV. B21D22/22 B21D24/04
X	US 3 789 649 A (CLOWES E) 5 February 1974 (1974-02-05) * column 2, line 4 - column 3, line 46; figures *	1-14	
X	DE 666 565 C (AUGUSTE ALBERTINI) 22 October 1938 (1938-10-22) * the whole document *	1-14	
A	DE 195 04 264 A1 (DAIMLER BENZ AG [DE]) 14 August 1996 (1996-08-14) * claim 1; figures 1,2 *	1,6	

TECHNICAL FIELDS SEARCHED (IPC)

B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 October 2017	Pieracci, Andrea

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 17 4450

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-10-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3664172 A	23-05-1972	NONE	
US 3789649 A	05-02-1974	JP S49102553 A	27-09-1974
		US 3789649 A	05-02-1974
DE 666565 C	22-10-1938	NONE	
DE 19504264 A1	14-08-1996	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 16000613 A **[0002]**