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(71) Applicant: **CARNAUDMETALBOX SA**
153, rue de Courcelles
F-75015 Paris (FR)

(72) Inventor: **Desruelle, Jean Barnard**
63 Rue des Ebissoires
78370 Plaisir (FR)
Inventor: **Gorgeon, Pierre**
6 Rue de Chateaufort
91400 Orsay (FR)

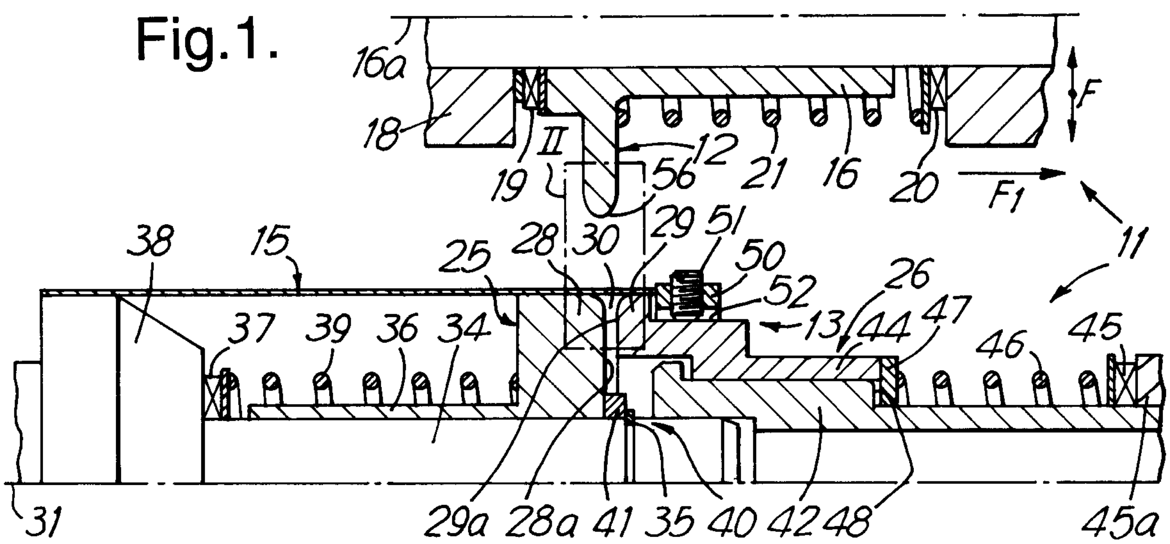
(74) Representative: **Gadsden, Robert Edward**
Group Intellectual Property Department
Carnaudmetalbox Technology plc
Downsview Road
Wantage,
Oxon OX12 9BP (GB)

(54) Machine for annular beading.

(57) Beading machine comprising an external roll (12) and a core-support (13) comprising two internal rolls (28,29), the leading edge (56) of the external roll being approximately elliptical.

This machine is thus suitable for forming a deep bead on a metal cylindrical element such as a can body.

Fig.1.



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The invention relates to annular beading of a metal cylindrical element. In particular the invention relates to the annular beading of a can body formed from sheet metal, more particularly from a sheet of double reduced thin steel.

The invention also concerns a beading machine for forming such a metal cylinder.

Patent Application FR 88 15 548 describes a process for forming an internal annular flange in a can body. This annular flange, situtated slightly axially spaced from the open end of the can body, allows a flexible cover hermetically closing the opening to be sealed, until the first removal of the product contained in the can. This annular flange is the result of two operations. First of all one makes an annular beading, at a slight axial distance from the opening and one then carries out an appropriate flattening of this bead. The bead has to be relatively deep in order subsequently to give rise to an annular flange sufficient for the heat-sealing of the cover. This can pose problems with certain metals or alloys, such as in particular the "double reduced" steel, used more and more, with which one makes metal cans of low thickness and high mechanical strength.

The invention in particular allows these objectives to be attained and these problems to be solved.

According to a first embodiment of the invention, there is provided a machine for annular beading of a metal cylindrical element such as for example a can body, the machine comprising an external roll, characterised in that the machine further comprises a core-support comprising two internal rolls designed to hold the cylindrical element and to support it on both sides of a beading zone, the external roll and the core-holder having parallel respective axes of rotation and one of them being displaceable in the direction of the other in order to make the beading, and in that the leading edge of the external roll has a profile approximately elliptical in section in a plane containing its axis of rotation.

Thus, the beading machine as defined above, although suitable for all types of beading, can be used advantagously for carrying out the first stage, as described above, of the formation of an internal annular flange in a can body of a metal container with a flexible cover, especially where this can body is made from a thin sheet of "double reduced" steel.

Preferably, the edges of the internal rolls situated in the vicinity of the beading zone are rounded.

Advantageously, at least one of these edges has a profile approximately elliptical in section in a plane containing the axis of rotation of the corresponding internal roll. Preferably, the two edges of the internal rolls situated in the vicinity of the beading zone each have an approximately elliptical profile. These two edges advantageously have the same profile which is approximately elliptical. Finally, the profile of these two edges is preferably the same as that of the external roll.

A preferred embodiment of the present invention will now be described by way of example only with reference to the drawings, in which:

Figure 1 is partial sectional view of a beading machine according to the invention, in a plane containing the parallel axes of rotation of the external roll and of the core-support;

Figure 2 is an enlarged of the insert II of Figure 1;

Figure 3 is a partial sectional schematic view of the profile of the bead obtained in the can body; and

Figure 4 represents the same can body in which the bead of Figure 3 has been flattened axially to form an internal flange onto which a cover may be heat sealed.

The beading machine 11 shown in figure 1 comprises two sub-assemblies: an external roll 12 and a core-support 13, onto which a can body 15, made of "double reduced" steel, is placed. The external roll 12, in the form of a disc, is in one piece with a rotating shaft 16, mounted in free rotation around an axis 16a in a frame 18. The latter (and consequently the roll 12) can be displaced in a strictly controlled way along the direction perpendicular to the axis of rotation 16a as indicated by the double arrow F.

The shaft 16 is tubular and is mounted so as to be movable along the direction of its longitudinal axis between two extreme positions defined by needle bearings 19, 20.

When no beading operation is carried out, one of the ends of the shaft 16 is in contact with one of the needle bearings, here the bearing 19, and is biassed against the latter by the force of a spring 21 mounted with initial compression between the roll 12 and the other needle bearing 20. Thus, the position of the external roll along the axis 16a vis-a-vis the core-support 13 is defined and stabilised with precision in the absence of a beading operation. On the other hand, during the beading, the external roll 12 may be displaced a few millimetres along its own axis of rotation 16a in the direction of the arrow F1.

Moreover, the core-support 13 is composed of two coaxial parts 25, 26 respectively carrying two internal rolls 28, 29, of the same diameter, designed to hold the can body 15 and to support it on both sides of a beading zone 30 delimited between the opposing front faces 28a, 29a of these internal rolls.

The common axis of rotation 31, of the two coaxial parts 25, 26 is parallel to the axis of rotation 16a of the external roll 12. In the example, it is the external roll 12 which is movable in the direction of the core-support 13. Alternatively, or in addition, the core-support 13 may be movable in the direction of the external roll 12.

The part 25 comprises a shaft 34 whose axis is coincident with the axis 31 and on which a sleeve 36 is slideably mounted. A first internal roll 28 (which is axially the deepest within the cylindrical element 15) is formed in a single piece with the sleeve 36, at one end of the sleeve. The first internal roll 28 is thus mounted with the possibility of axial displacement. The first internal roll 28 is urged by a spring 39 towards the second internal roll 29 which is that roll which is nearest to a circular edge of the can body 15.

At a certain axial distance from the roll 28, the shaft 34 is in one piece with a centering piece 38 of which a cylindrical part 29 has the same diameter as that of the rolls 28 and 29, corresponding to the inside diameter of the cylindrical element 15 forming the can body. This centering piece 38 comprises a fixing system, not represented, which is applied against the inner wall of the cylindrical element 15, in order to connect it firmly to the core-support 13. Stopping means 40 in the form of a ring 41 mounted on the shaft 34 and supported against a circlip 35, itself immobilised in a groove of the shaft 34, stabilise the axial position of the first internal roll 28, in the absence of beading. Thus, the position of this roll 28 in relation to that of the external roll 12 is predetermined by construction, in the absence of beading. A spring 39 is mounted with initial compression between the internal roll 28 and the centering piece 38, with interposition of a needle bearing 37.

The part 26 comprises a hollow shaft 42 whose axis is coincident with the axis 31 and at the outside of which slides a sleeve 44. The second internal roll 29 is provided at the end of this sleeve. A spring 46 is mounted with prestress between a needle bearing 45 supported at the back against a ring 45a firmly connected to the shaft 42 and the sleeve 26. A sliding ring 47 is inserted between the spring 46 and the sleeve 44. This ring 47 is likewise capable of entering into contact with a shoulder 48 of the hollow shaft 42, which limits the extension of the spring 46. Thus, the said second internal roll 29 is urged elastically by the spring towards the first internal roll.

The second internal roll 29 carries stopping means adapted to enter into contact with a circular edge of the said can body 15. In the example, the stopping means comprises cylindrical tubular ring 50, encircling an enlarged part of the sleeve 44, in the vicinity of the roll 29. The diameter of this ring is larger than that of the roll 29. The ring 50 is firmly connected to the sleeve 44, in an axially adjustable way, by means of a screw 51 engaged radially in a threaded screw of the ring 50 and supported against a flat surface 52 of the sleeve 44. In this way, the ring 50 with adjustable axial positioning allows the position of the bead on the can body 15 to be determined, at a certain distance from the circular edge of the latter. The shaft 34 is engaged sliding axially in the hollow shaft 42, which ensures their alignment. The two parts 25, 26 of the core-support 13 are driven into rotation at the same speed by driving means not visible on the drawings. The speed of rotation can be, for example, between 200 and 300 revolutions/minute.

In this embodiment, the leading edge 56 of the outer roll 12 has an approximately elliptical profile, the profile being seen in section in a plane containing the axis of rotation of the roll in figures 1 and 2.

In addition, the edges 28b and 29b of these internal rolls 28, 29 situated in the vicinity of the beading zone 30 are rounded. Preferably, at least one of these edges has a profile approximately elliptical in section in a plane containing the axis of rotation 31 of the corresponding internal roll. According to the example and for preference, the two aforesaid edges 28b and 29b each have an approximately elliptical profile. The elliptical profile (figure 2) is preferably the same for each edge 28b, 29b and preferably, the same for the external roll 12.

In figure 2, the ellipses which are partly identical to the edges of the external roll, on the one hand, and those of the two internal seaming rolls, on the other hand, are shown. One thus sees that the profile of the external roll is identical to half the ellipse situated entirely on the same side of the minor axis of the latter, while the profile of the edge of each internal roll is identical to a quarter of the ellipse extending between the minor axis and the major axis of the latter. These minor axes of the ellipses are parallel to the axes 16a and 16b.

The dimensions of the ellipse depend on the bead which one wishes to obtain and on the type of metal cylindrical element on which one wishes to make it. By way of example, for a tube with a diameter of between 70 and 80 mm made from a sheet of "double reduced" steel of low thickness (0.12 to 0.18mm, typically 0.14mm) the characteristics of the elliptical profile defined above both for the external roll and for the two internal rolls, may be 8mm for the major axis and 6mm for the minor axis.

The metal cylindrical element 15 may be rotated at a speed of the order of 250 revolutions/minute and the penetration of the external roll may be between 0.3 and 0.4mm per revolution, typically 0.335mm per revolution. In such a case, the bead will be obtained in ten revolutions.

Of course, the above numerical values simply illustrate one embodiment and one satisfactory operating method. Other combinations of profile, speed of rotation and penetration, can be equally effective.

Finally, according to another advanteagous characteristic, the median plane Po of the external roll 12 passing through the aforesaid leading edge is offset axially, in the disengaged beading position (as represented in figure 2), in relation to the plane of the front face 28a of the first internal seaming roll. This face 28a is situated in the vicinity of the beading zone 30. The leading edge 56 is thus nearer to the rounded edge 28b of the first roll 28 than to the rounded edge 29b of the second roll 29.

In operation, the cylindrical element 15 forming the can body is engaged on the core-support from the centering piece 38 (that is to say on the left looking at figure 1). The cylindrical element 15 whose length is known is thus engaged axially on the two internal rolls until slightly pushing back the sleeve 44 when it enters into contact with the ring 50. From this monent, a beading zone 30 appears between the two internal rolls, but its position and its dimensions will evolve as the beading proceeds. In fact, it can be seen from the previous description that all the seaming rolls are mounted "floating" axially, that is to say that they can be displaced axially during the beading to adapt themselve better to the evolution of the shape of the bead without risking any deformation, or any shearing of the wall of the cylindrical element.

As the penetration of the external roll proceeds, the metal is gradually deformed in the immediate vicinity of the rounded edge 28b with elliptical profile, due to the axial offsetting noted above. Due to this fact, it is essentially the metal situated between this zone of deformation and the circular edge in contact with the ring 50 which is "displaced" to form the groove. The floating assembly of the rolls facilitates the deformation of the metal and one can obtain a deeper beed 55 as shown in figure 3 than is possible with the known techniques. Following formation of the bead, an axial flattening of the bead as described in the document FR 88 15 548 allows an internal annular flange to be obtained of the type illustrated in figure 4, of sufficient width to allow the heat-sealing of a flexible cover.

Claims

1. Machine for annular beading of a metal cylindrical (15), the machine comprising an external roll (12),
characterised in that:
the machine further comprises a core-support (13) comprising two internal rolls (28, 29) adapted to hold the cylindrical element and to support the cylindrical element on both sides of a beading zone (30);
in which the external roll (12) and the core-support (13) have parallel axes of rotation, one of the roll (12) and the core-support (13) being displacable towards the other in order to form the beading;
and characterised in that the leading edge (56) of the external roll (12) has a profile approximately elliptical in section in a plane containing its axis of rotation.

2. Machine according to Claim 1, characterised in that the core-support (13) comprises two coaxial parts (25, 26) respectively carrying the internal rolls and at least one of which is mounted so as to be axially displaceable and is elastically urged towards the other coaxial part and in that the edges (28b, 29b) of the internal rolls (28, 29) situated in the vicinity of the beading zone (30) are rounded.

3. Machine according to Claim 2, characterised in that at least one of the edges (28b, 29b) has a profile approximately elliptical in section in a plane containing the axis of rotation of the corresponding internal roll.

4. Machine according to Claim 3, characterised in that the edges (28b, 29b) of the internal rolls situated in the beading zone (30) each have an approximately elliptical profile.

5. Machine according to Claim 4, characterised in that the two edges have the same approximately elliptical profile.

6. Machine according to Claim 5, characterised in that the approximately elliptical profile of the two edges (28b, 29b) is the same as that of the external roll (12).

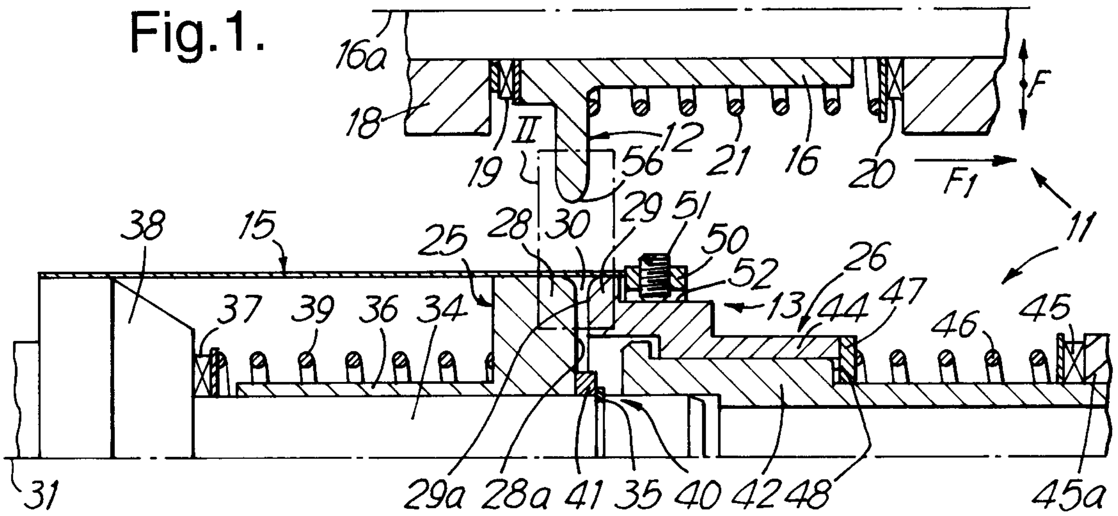
7. Machine according to any one of Claims 2 to 6, characterised in that the median plane (P_o) of the external roll (12) passing through the leading edge (56) is offset axially, in the disengaged beading position, in relation to the plane of the front face (28a) of a first internal roll (28).

8. Machine according to any one of Claims 1 to 7, characterised in that the first internal roll (28) is mounted so as to be axially displaceable and is biassed by a spring (39) towards

the second internal roll (29) and in that the axial position in the absence of beading is stabilised by stopping means (40).

9. Machine according to Claim 8, characterised in that the second internal roll (29) is biassed by a spring (46) towards the first internal roll and in that the machine further comprises stopping means (50) adapted to enter into contact with a circular edge of the cylindrical element (15) in order to determine the position of the roll (29) on the cylindrical element.

Fig.1.



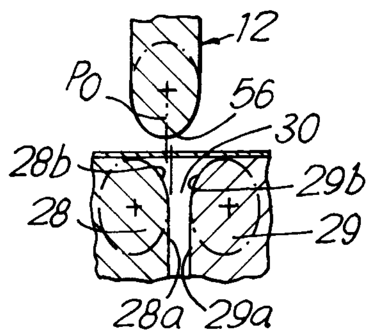


Fig.2.

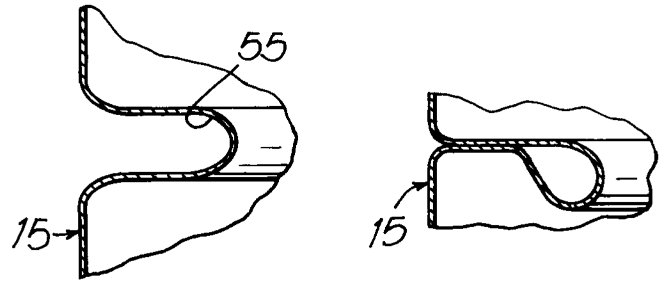


Fig.3. Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 94 30 7015

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE-A-28 31 202 (WILHELM SCHÄFER MASCHINENBAU) * claim 1; figures 1,2 * ---	1-9	B21D15/06
A,D	FR-A-2 639 561 (CARNAUD S.A.) * claims 1,2,6,7; figures 1-8 * -----	1-6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	10 January 1995	Cuny, J-M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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