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(54) **Apparatus for making a metal can and method for making said can**

(57) Apparatus (10) for making a metal tin by assembling a lid (13) and a bottom (14) to the ends of a tubular shaped shell (12). The apparatus comprises at least coupling members (31, 45) by means of which the shell (12) is able to be coupled to the lid (13) and to the bottom (14) in correspondence with respective joining zones (27, 30), pressure members (36, 46) able to achieve, in corre-

spondence with the joining zones (27, 30), at least an interpenetration (138, 149) both between the shell (12) and the lid (13), and also between the shell (12) and the bottom (14), and welding members (41, 51) able to weld the shell (12) to the lid (13) and to the bottom (14) in proximity to or in correspondence with the interpenetration (138, 149).

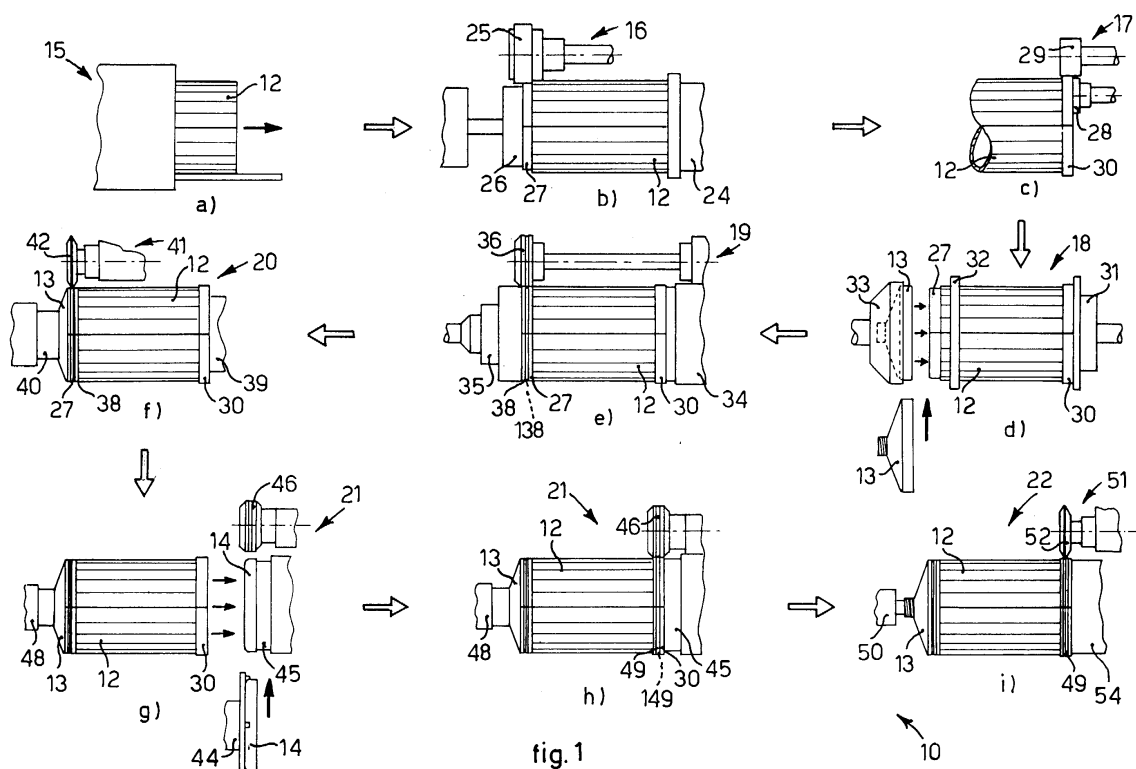


fig. 1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns an apparatus and a method for making a metal tin, advantageously of the pressurized type, for containing coffee grains.

BACKGROUND OF THE INVENTION

[0002] Pressurized metal tins used to contain coffee grains are known, comprising a cylindrical shaped shell, or central body, associated at the two ends respectively with a bottom and a lid provided centrally with an opening in turn closed by a removable cap.

[0003] In such cans, in order to guarantee the right conditions for preserving the coffee, a non-toxic gas is introduced, whose pressure adds to the pressure of the gasses which are released naturally by the coffee, so that the internal pressure of the tin might reach the value of 5-7 bar if there was not a regulating valve, or safety valve, on the cap, cooperating with a threading made on the lid.

[0004] The tin is made by preparing the components (shell, or central body, bottom and lid) and then assembling them together.

[0005] In the state of the art the assembling of components is usually performed mainly by crimping the relative sides, however this solution does not allow to obtain an effective sealing of the tin and implies a complex and costly production process.

[0006] One purpose of the present invention is to achieve an apparatus and a method that allow to produce, in a completely automatic manner and with limited costs, an airtight metal tin whose components are welded together.

[0007] A further purpose of the invention is to make an airtight metal tin with a surface as regular as possible and without protruding edges.

[0008] The Applicant has devised and embodied the present invention to overcome the shortcomings of the state of the art in order to achieve these purposes and obtain other advantages.

SUMMARY OF THE INVENTION

[0009] The present invention is set forth and characterized essentially in the main claims, while the dependent claims describe other innovative characteristics of the invention.

[0010] In accordance with the purposes above, the apparatus according to the present invention, for making a metal tin by assembling a lid and a bottom to the ends of a tubular shaped shell, comprises at least coupling means, by means of which the shell is coupled by means of overlapping and interference with the lid and the bottom in correspondence with respective joining zones, pressure means able to achieve, in correspondence with

said joining zones, at least one interpenetration between the lid and the shell and between the shell and the bottom, and welding means able to weld, with continuous welding, the shell to the lid and the bottom in proximity to or in correspondence with said interpenetration.

[0011] Advantageously, the apparatus according to the present invention also comprises calender means, able to shape a substantially flat metal sheet into a tubular shape, and welding means able to weld said metal sheet along two longitudinal sides coupled with respect to one another, so as to determine the shaping of the shell.

[0012] According to a variant, the apparatus according to the invention also comprises edging means able to determine a variation of the section, that is, a narrowing or a widening, of the shell so as to define the joining zones in correspondence with which the lid and the bottom have to be coupled.

[0013] In a preferential form of embodiment of the apparatus according to the invention, at least a part of the welding means is of the type with rollers.

[0014] According to a variant, at least a part of the welding means is able to weld with the addition of weld material.

[0015] According to a further variant, at least some of the coupling means cooperate with a centering device able to keep the shell in the desired shape and position during coupling with the lid and/or the bottom.

[0016] In a preferential form of embodiment, the pressure means is formed by knurling rollers able to achieve, along the joining zones, a groove whose section narrows towards the inside, for example substantially semicircular, and defining the interpenetration of the lid with the shell and the shell with the bottom.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematic representation of the apparatus for making a metal tin according to the present invention;
- fig. 2 shows a schematic lateral view of the method for making a metal tin according to the present invention;
- fig. 3 shows the development of the shell of the tin according to the invention in a first form of embodiment;
- fig. 4 shows a front view with an enlarged detail of the shell of the solution in fig. 3;
- figs. 5, 7 and 9 are variants of fig. 3;
- figs. 6, 8 and 10 are variants of fig. 4;
- figs. 11 and 13 show the longitudinal section of the rollers of a knurling station of the apparatus according to the present invention;

- figs. 12 and 14 show a front view of the rollers of figs. 11 and 13;
- fig. 15 shows, with a detail in section, the working sequence for assembling the lid to the shell of the metal tin according to the present invention;
- fig. 16 shows, with a detail in section, the working sequence for assembling the bottom to the shell of the metal tin according to the present invention;
- fig. 17 shows a variant of the welding methods of the lid in fig. 15;
- figs. 18 and 19 show two variants of the welding methods of the bottom in fig. 16.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0018] Fig. 1 schematically shows an apparatus according to the present invention, by means of which it is possible to make, in a completely automatic manner, a circular based metal tin 11 (fig. 2g) that contains about 3 kg of coffee grains.

[0019] In particular, the apparatus 10 is able to make a metal tin 11 by assembling a lid 13, for example of the type made according to the patent application filed concomitantly by the Applicant, and a concave bottom 14 made with a metal sheet with a thickness of between 0.2 mm and 0.4 mm, advantageously about 0.3 mm, to the two ends of a cylindrical shaped shell, or central body, 12.

[0020] The apparatus 10 comprises, in order: a station 15 for shaping the shell 12, a first edging station 16, a second edging station 17, a coupling station 18 for shell 12 and lid 13, a station 19 for knurling the shell 12 and the lid 13, a first station 20 for welding the shell 12 to the lid 13, a station 21 for coupling and knurling the shell 12 and the bottom 14 and a second station 22 for welding the shell 12 to the bottom 14.

[0021] All the stations are connected to each other by transfer devices such as conveyor belts, chain conveyors, suction belts or similar.

[0022] The shaping station 15 (fig. 1a) integrally comprises a calendaring device, able to give a cylindrical form to a substantially plane metal sheet 23 (fig. 2a), and a welding device able to weld the longitudinal edges of said metal sheet 23 so that it maintains the cylindrical form and thus forms the shell 12.

[0023] The welding device can be of the type able to achieve a welding with addition of weld material or without addition of weld material, as will be explained hereafter.

[0024] The first edging station 16 comprises a support 24, on which the shell 12 is made to rotate, and a shaping roller 25 able to act, in cooperation with a mating contrasting element 26, on the external surface of the shell 12 in correspondence with the coupling edge of the lid 13, so as to achieve a slight annular narrow part 27 (fig. 1b).

[0025] The second edging station 27 (fig. 1c) comprises a relative support for the rotation of the shell 12 and a shaping roller 28 able to act, in cooperation with a mat-

ing contrasting element 29, on the internal surface of the shell 12 in correspondence with the coupling edge of the bottom 14, in order to achieve a slight annular widening 30.

[0026] The coupling station 18 (fig. 1d) comprises a mobile support 31 able to hold, in correspondence with the coupling edge of the bottom 14, and to axially translate the shell 12; a centering device 32 able to maintain the shell 12 in its exact cylindrical shape; and a mobile support 33 able to be fed with a lid 13 at a time, so as to translate it axially in order to couple it to the shell 12.

[0027] Advantageously, the centering device 32 comprises a plurality of jaws able to selectively close on the shell 12, so as to define a circular template which keeps it in its exact cylindrical shape, preventing possible deformations, and in a central position with respect to the lid 13 to which it is to be coupled.

[0028] The knurling station 19 (fig. 1e) comprises a support 34, on which the shell 12 and the lid 13, coupled to each other, are made to rotate, a holding device 35, axially mobile, able to hold the lid 13, and a pair of knurling rollers, respectively external 36 and internal 37.

[0029] The external knurling roller 36 has a relief 36a on its circumference, in this case with a semi-circular section (figs. 11 and 12), while the internal knurling roller 37, able to be disposed inside the shell 12, has a groove mating in section with said relief 36a (figs. 13 and 14).

[0030] As will be described hereafter, the external knurling roller 36 is able to put pressure in correspondence with the annular narrow part 27 in order to achieve, in cooperation with the internal knurling roller 37, a circumferential groove 38 which determines an interpenetration 138 of the lid 13 in the shell 12 (fig. 15b).

[0031] The first welding station 20 comprises a support 39 and a holding device 40, analogous to those of the knurling station 19, and a welding device 41 with rollers comprising an external welding roller, or electrode, 42 and an internal welding roller, or electrode, 43 able to come into contact with the lid 13 and the shell 12 respectively, in order to achieve a continuous welding in correspondence with the circumferential groove 38, that is, of the interpenetration 138 (figs. 1f and 15c).

[0032] The coupling and knurling station 21 (figs. 1g and 1h) comprises a transfer arm 44 able to take one bottom 14 at a time and bring it in correspondence with a support 45 able to make it rotate, a holding device 48 able to hold the lid 13 and translate it axially, together with the shell 12, so as to couple it with the bottom 14, and a pair of knurling rollers, respectively external 46 and internal 47 (fig. 16b) which, in this case, have the same shape as the knurling rollers 36, 37 of the knurling station 19.

[0033] The external knurling roller 46 is able to exert pressure in correspondence with the annular widening 30 in order to achieve, in cooperation with the internal knurling roller 47, disposed inside the shell 12, a circumferential groove 49 that determines an interpenetration 149 of the shell 12 on the bottom 14.

[0034] The second welding station 22 comprises a support 54, a holding device 50, and a welding device with rollers 51, comprising an external welding roller, or electrode, 52 and an internal welding roller, or electrode, 53, analogous to those of the first welding station 20; the two welding rollers 52 and 53 are able to come into contact with the shell 12 and the bottom 14 respectively, so as to achieve a continuous welding in correspondence with the interpenetration 49 (figs. 1i and 16c).

[0035] The method for making the tin 11 by means of the apparatus 10 is as follows (fig. 2).

[0036] A plane metal sheet 23, with a thickness comprised between 0.2 mm and 0.4 mm, advantageously about 0.25 mm, is fed to the shaping station 15 where the calendaring device gives it a cylindrical form and the welding device performs the welding of the longitudinal edges.

[0037] As shown in figures from 3 to 10, such welding can be achieved with a very low addition of weld material (figs. 3 and 4), or without adding any weld material, by overlapping the longitudinal edges (figs. 5-10).

[0038] In the case of welding with overlapping of the longitudinal edges, a small lip (55) is created on one of said edges which, when the metal sheet 23 is curved, moves to a position inside (fig. 6) or outside (fig. 7) the shell 12.

[0039] According to the variant shown in figs. 9 and 10, two lips 55 are created, of a lower height, on the two edges to overlap, which are disposed one inside and one outside the cylinder that defines the shell 12.

[0040] The shell 12 thus achieved, which in this case has a diameter comprised between 210 mm and 230 mm, advantageously 220 mm, is transferred to the first edging station 16, where it is made to rotate on the support 24, while the shaping roller 25, in cooperation with the contrasting element 26, determines the formation of the annular narrow part 27 for the subsequent coupling of the lid 13 (fig. 1b).

[0041] The shell 12 is then transferred to the second edging station 17, where the shaping roller 28, in cooperation with the contrasting element 29, determines the formation of the annular widening 30 for the subsequent coupling of the bottom 14 (fig. 1c).

[0042] The shell 12 is then transferred to the coupling station 18, where the mobile support 31 pushes it towards the centering device 32 whose jaws are open; these jaws then close in order to maintain the shell 12 in a perfectly cylindrical shape and in a centered position with respect to the mobile support 32, which in the meantime is fed with a lid 13.

[0043] The subsequent drive of the mobile support 32 takes the lid 13 to overlap over the annular narrow part 27, determining the coupling by interference of the lid 13 and the shell 12 (figs. 1d and 15a).

[0044] The shell 12 and the lid 13 thus coupled are transferred to the knurling station 19 where the holding device 35 holds them in contact with the support 34, bringing the internal knurling roller 37 into the shell 12;

in this condition, while the shell 12 and the lid 13 rotate, the knurling rollers 36 and 37 achieve the circumferential groove 38 that defines the interpenetration 138 in correspondence with the annular narrow part 27 (figs. 15b and 15c).

[0045] The semicircular section, converging towards the inside, of the circumferential groove 38 promotes the hold of the coupling between the shell 12 and the lid 13, substantially preventing the reciprocal longitudinal sliding thereof.

[0046] In a preferential form of embodiment, the circumferential groove 38 has a diameter "D" comprised between about 2 mm and 4 mm, advantageously about 3.5 mm, and a depth "P" comprised therefore between about 1 mm and 2 mm, advantageously about 1.8 mm.

[0047] The shell 12 and the lid 13 are then transferred to the first welding station 20, where the holding device 40 pushes them into contact with the support 39, making the internal welding roller 43 enter the shell 12, in contrast with the external welding roller 42, disposed inside the circumferential groove 38 (figs. 1f and 15c); the shell 12 and the lid 13 are then made to rotate on the support 39 and the welding rollers 42 and 43 are activated in order to perform the continuous welding along the circumferential groove 38.

[0048] According to the variant shown in fig. 17, the association between the shell 12 and the lid 13 is achieved along the edge of the latter with a slight addition of material.

[0049] Upon exiting the first welding station 20, the shell 12 and the lid 13 are taken to the coupling and knurling station 21 where, by means of the holding device 48, they are kept at a distance from the support 45 while the transfer arm 44 disposes a bottom 14 in correspondence with the support 45 (fig. 1g) so that the internal knurling roller 47 is positioned inside it.

[0050] The holding device 48 is then made to advance axially towards the support 45, so that the bottom 14 penetrates the annular widening 30, determining the coupling through interference between the bottom 14 and the shell 12 (fig. 16a).

[0051] In this condition, the shell 12, the lid 13 and the bottom 14 are made to rotate, while the knurling rollers 46 and 47 achieve the circumferential groove 49, geometrically equivalent to the circumferential groove 38, in correspondence with the annular widening 30 (figs. 16b and 16c).

[0052] In this case too the interpenetration 149, defined by the circumferential groove 49, improves the coupling conditions due to interference between the shell 12 and the bottom 14, substantially preventing reciprocal longitudinal sliding.

[0053] The shell 12 and the bottom 14 are then taken to the second welding station 22, where they are welded together, by means of welding rollers 52 and 53, in correspondence with the circumferential groove 49, in a manner analogous to that of the first welding station 20.

[0054] According to the variants in figs. 18 and 19, the

welding of the shell 12 and the bottom 14 is performed in correspondence with their edges, with a slight addition of material.

[0055] The contemporary presence of the coupling through interference, the interpenetrations 138 and 149 and the continuous welding of the components of the tin 11 thus achieved, give the tin 11 a considerable mechanical resistance and a perfect air-tightness.

[0056] It is clear, however, that modifications and/or additions of parts may be made to the apparatus 10 and to the method for making the metal tin 11 as described heretofore, without departing from the field and scope of the present invention.

[0057] For example, the welding stations 20 and 22 may provide other welding members instead of the rollers 42, 43, 52 and 53.

[0058] The apparatus 10 may also not have the second edging station 30, if the bottom 14 has a diameter smaller than the shell 12, so that it can be inserted into it without needing to make the annular widening 30.

Claims

1. Apparatus for making a metal tin by assembling a lid (13) and a bottom (14) to the ends of a tubular shaped shell (12), **characterized in that** it comprises: at least coupling means (31, 33, 45, 48) by means of which said shell (12) is able to be coupled with said lid (13) and with said bottom (14) in correspondence with respective joining zones (27, 30); pressure means (36, 37, 46, 47) able to achieve, in correspondence with said joining zones (27, 30), at least an interpenetration (138, 149) both between said shell (12) and said lid (13), and between said shell (12) and said bottom (14); and welding means (41, 51) able to weld said shell (12) to said lid (13) and said bottom (14) in proximity or in correspondence with said interpenetration (138, 149).
2. Apparatus as in claim 1, **characterized in that** said coupling means (31, 33, 45, 48) is able to couple said shell (12) with said lid (13) and said bottom (14) by means of overlapping and interference.
3. Apparatus as in claim 1 or 2, **characterized in that** it further comprises edging means (25, 26, 28, 29) able to determine a variation in the section of said shell (12) so as to define said joining zones (27, 30).
4. Apparatus as in any claim from 1 to 3, **characterized in that** it further comprises calender means able to shape a substantially plane metal sheet (23) into a tubular shape and welding means able to weld said metal sheet (23) along two longitudinal edges coupled to each other, so as to define the formation of said shell (12).
5. Apparatus as in claims 1 to 4, **characterized in that** it further comprises a shaping station (15) for said shell (12), a first edging station (16) for making a first joining zone (27), a second edging station (17) for making a second joining zone (30), a coupling station (18), for the coupling of said lid (13) with said shell (12) in correspondence with said first joining zone (27), a knurling station (19), for the formation of said interpenetration (138) in correspondence with said first joining zone (27), a first welding station (20), to weld said lid (13) and said shell (12) together, a coupling and knurling station (21), for the coupling of said shell (12) and said bottom (14) in correspondence with said second joining zone (30) and for making said interpenetration (149) on said joining zone, and a second welding station (22) to weld said shell (12) and said bottom (14) together.
6. Apparatus as in any claim hereinbefore, **characterized in that** at least some of said welding means (41, 51) is of the type with rollers (42, 43, 52, 53).
7. Apparatus as in any claim hereinbefore, **characterized in that** at least some of said welding means is able to weld with addition of weld material.
8. Apparatus as in any claim hereinbefore, **characterized in that** said pressure means (36, 37, 46, 47) comprises relative pairs of rollers provided with complementary shapings (36a, 37a) able to cooperate with each other so as to achieve said interpenetration (138, 149).
9. Apparatus as in claim 8, **characterized in that** said shapings (36a, 37a) have a semicircular section.
10. Apparatus as in any claim hereinbefore, **characterized in that** at least some of said coupling means (31, 33, 45, 48) cooperate with a centering device (32) able to maintain the desired conformation and position of said shell (12) during its coupling with said lid (14) or said bottom (14).
11. Apparatus as in claim 10, **characterized in that** said centering device (32) comprises jaw means able to selectively close on said shell (12) in order to hold it in the desired conformation and coupling position.
12. Apparatus as in any claim from 2 to 11, **characterized in that** said edging means comprises at least a shaping roller (25, 28) able to act on the external or internal surface of said shell (12), in cooperation with a mating contrasting element (26, 29), in order to determine respectively a narrowing or a widening of the section of said shell (12) in correspondence with its ends, and thus define said joining zones (27, 30).

13. Method for making a metal tin by assembling a lid (13) and a bottom (14) to the ends of a tubular shaped shell (12), **characterized in that** it comprises at least the following steps:

- coupling said lid (13) to said shell (12) in correspondence with a first joining zone (27);
- achieving a first interpenetration (138), by means of deformation, between said lid (13) and said shell (12) in correspondence with said first joining zone (27);
- welding said lid (13) and said shell (12) to each other in correspondence with or in proximity of said first interpenetration (138);
- coupling said bottom (14) to said shell (12) in correspondence with a second joining zone (30);
- achieving a second interpenetration (149), by means of deformation, between said shell (12) and said bottom (14) in correspondence with said second joining zone (30);
- welding said bottom (14) and said shell (12) to each other in correspondence with or in proximity of said second interpenetration (149).

14. Method as in claim 13, **characterized in that** said shell (12) is coupled to said lid (13) and said bottom (14) by means of overlapping and interference.

15. Method as in claim 13 or 14, **characterized in that** it comprises at least a step of forming said shell (12) in which a substantially plane metal sheet (23) is shaped and welded along two of its longitudinal edges in order to give said shell (12) a tubular shape.

16. Method as in claim 15, **characterized in that** said metal sheet (23) is shaped by calendering.

17. Method as in claim 15 or 16, **characterized in that** said metal sheet (23) is welded by placing said longitudinal edges adjacent, with addition of weld material.

18. Method as in claim 15 or 16, **characterized in that** said metal sheet (23) is welded with overlapping of said longitudinal edges.

19. Method as in any claim from 15 to 18, **characterized in that** said metal sheet (23) has a thickness comprised between 0.2 mm and 0.4 mm, advantageously about 0.25 mm.

20. Method as in any claim from 13 to 19, **characterized in that** it comprises at least a step in which a variation in section of said shell (12) is achieved in correspondence with its ends in order to define said first (27) and said second (30) joining zones.

21. Method as in claim 20, **characterized in that** said first joining zone (27) is defined by a narrowing in section of said shell (12) and said second joining zone (30) is defined by a widening in section of said shell (12).

22. Method as in any claim from 13 to 21, **characterized in that** said interpenetrations (138, 149) are achieved by means of knurling.

23. Method as in any claim from 13 to 22, **characterized in that** said interpenetrations (138, 149) are defined by respective grooves (38, 49) with a section that narrows towards the inside.

24. Method as in claim 23, **characterized in that** said grooves (38, 49) have a substantially semicircular section, with a diameter "D" comprised between about 2 mm and about 4 mm.

25. Method as in any claim from 13 to 24, **characterized in that** the welding of said shell (12) to said lid (13) and said bottom (14) is of the continuous type and is achieved in correspondence with said interpenetrations (138, 149).

26. Method as in any claim from 13 to 24, **characterized in that** the welding of said shell (12) to said lid (13) and said bottom (14) is achieved along the edges of said lid (13) and said shell (12) with addition of weld material.

27. Metal tin comprising a tubular shaped shell (12) with the ends of which a lid (13) and a bottom (14) are respectively associated, **characterized in that** said lid (13) and said bottom (14) are coupled by interference and welded to said shell (12) with continuous welding.

28. Metal tin as in claim 27, **characterized in that** said lid (13) and said bottom (14) are coupled by interference and welded to said shell (12) in correspondence with respective interpenetrations (138, 149).

29. Metal tin as in claim 28, **characterized in that** said interpenetrations (138, 149) are defined by respective grooves (38, 39) with a section that narrows towards the inside.

30. Metal tin as in any claim from 27 to 29, wherein said shell (12) has a circular section, **characterized in that** said shell (12) has a thickness comprised between 0.2 mm and 0.4 mm, advantageously about 0.25 mm, and a diameter comprised between 210 mm and 230 mm, advantageously 220 mm.

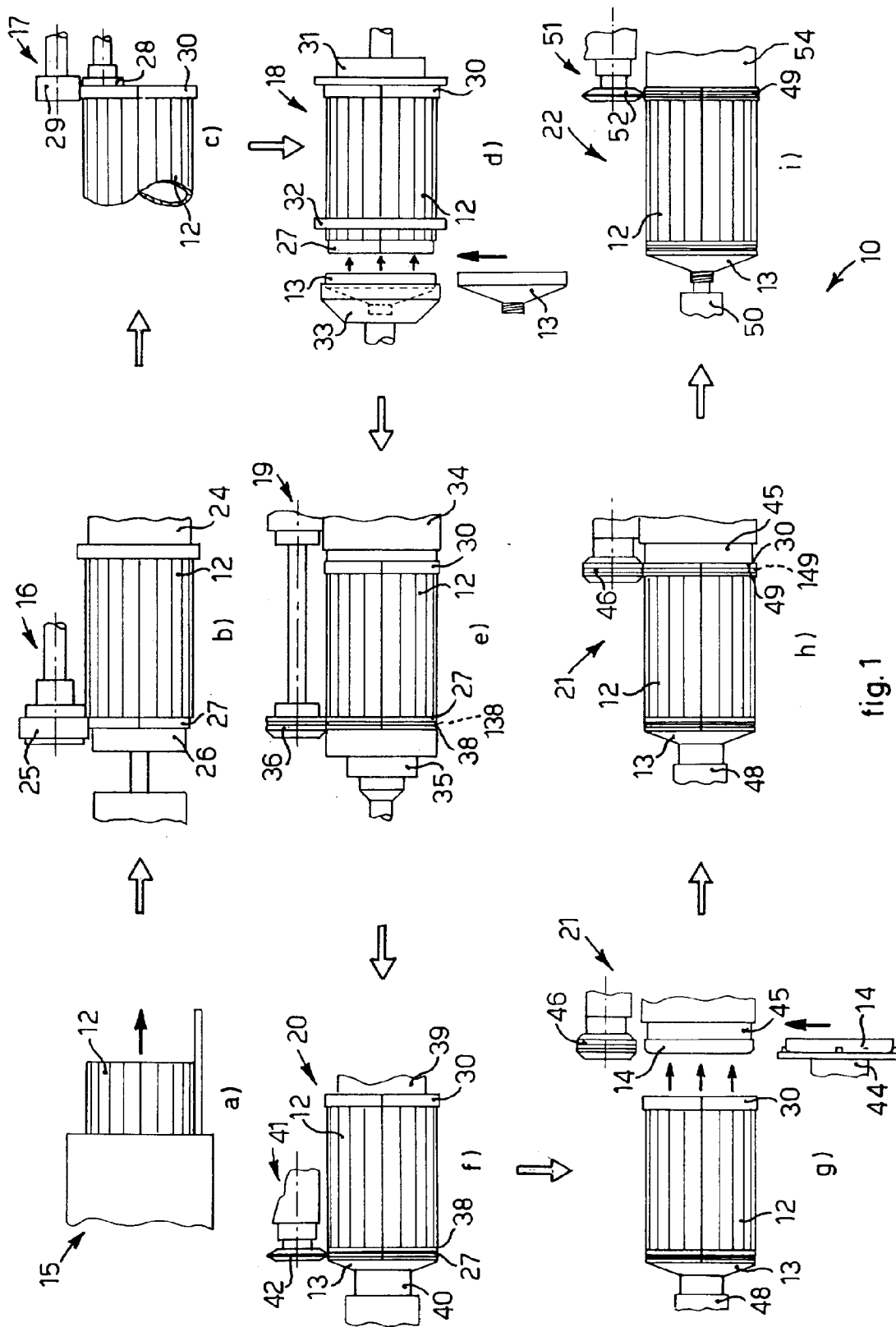


fig.1

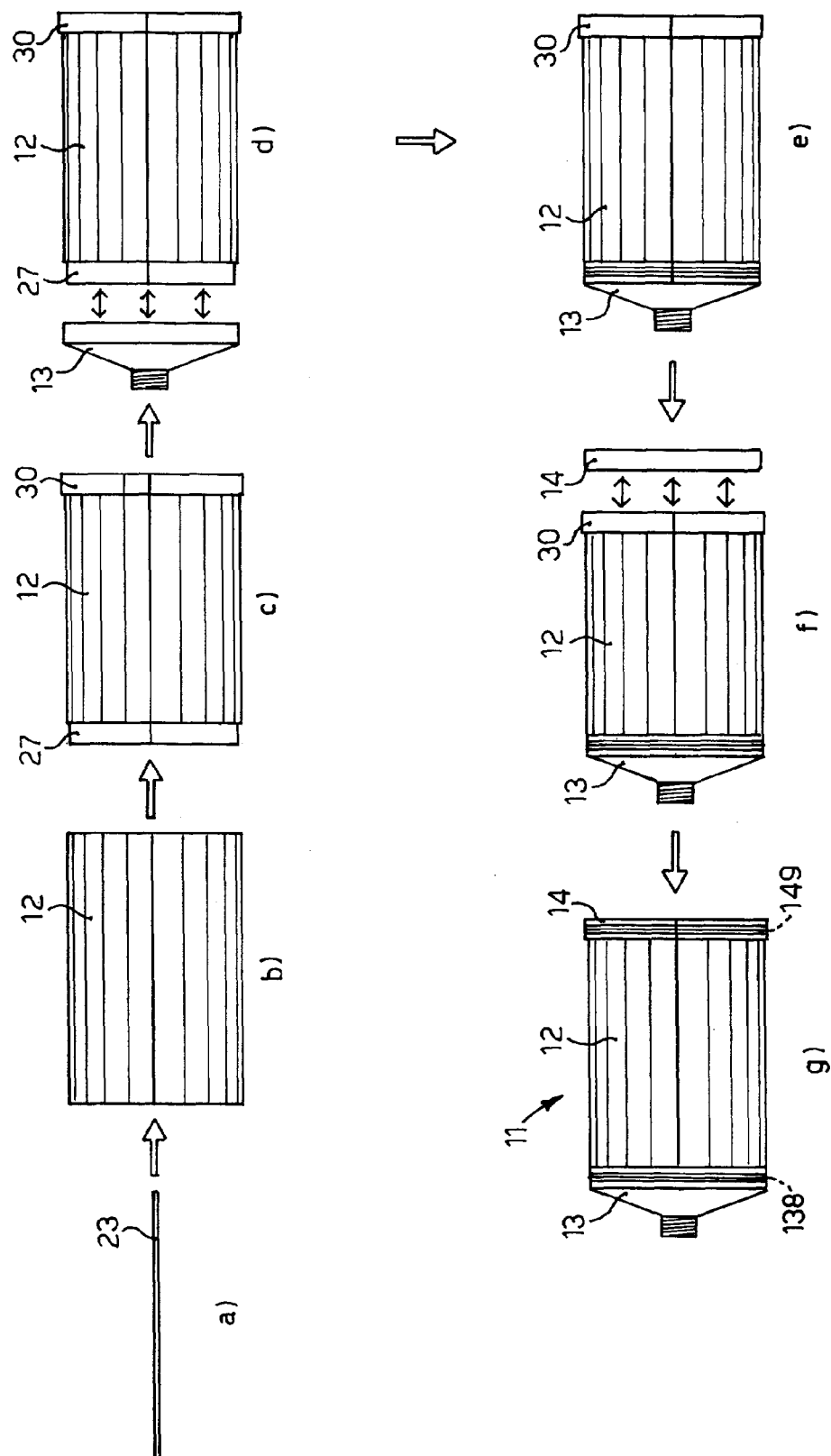
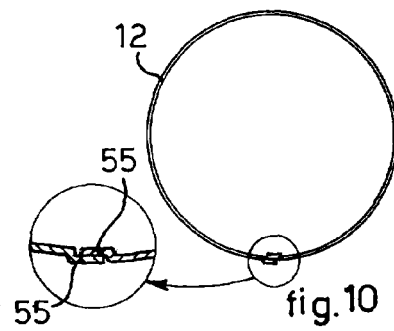
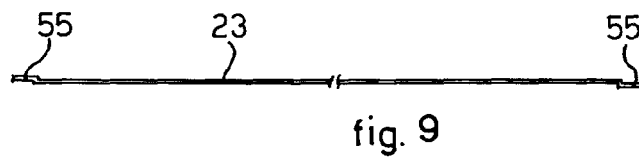
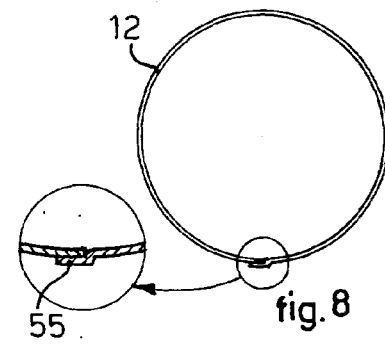
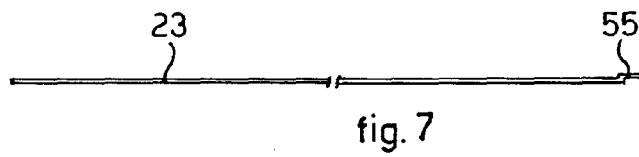
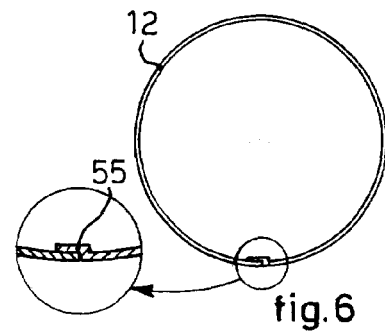
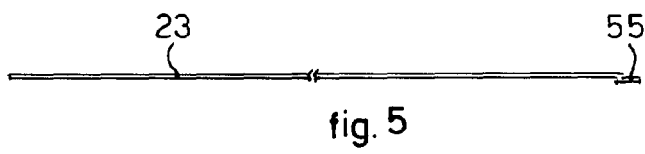
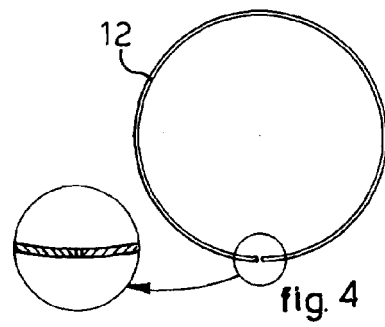
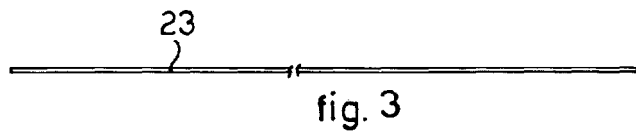
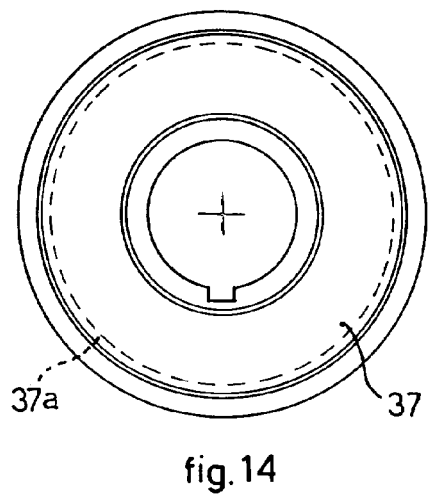
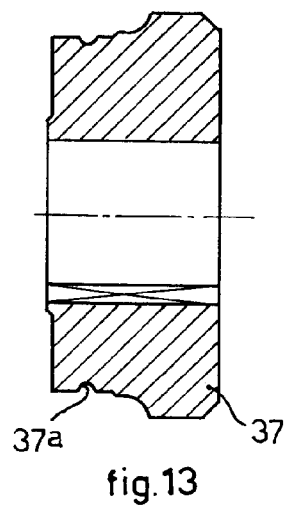
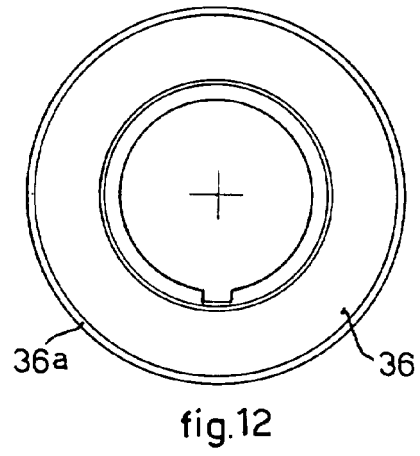
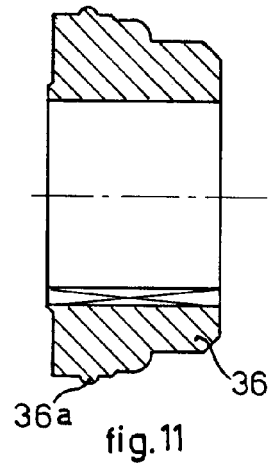


fig. 2





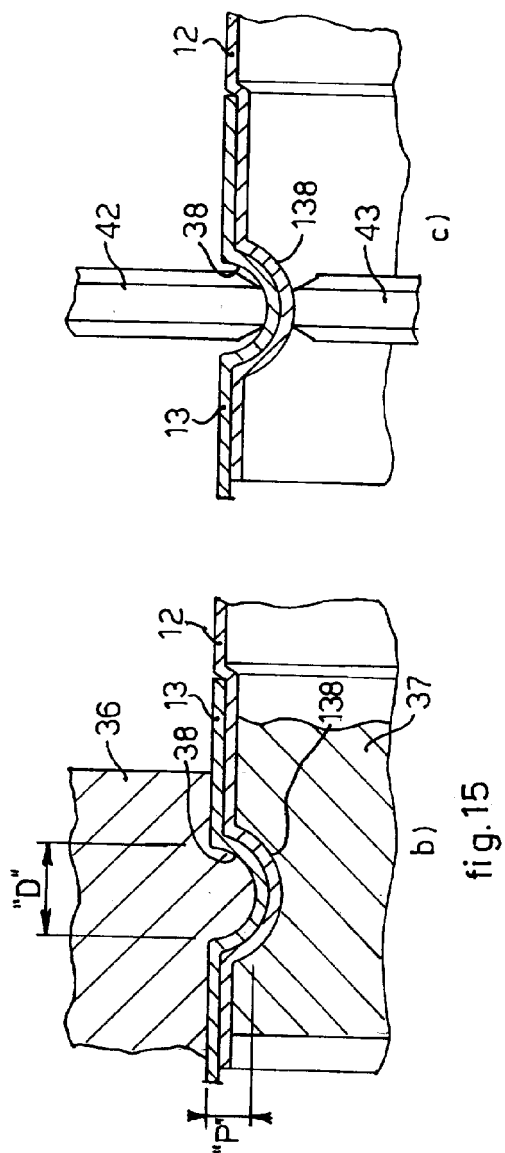


fig. 15

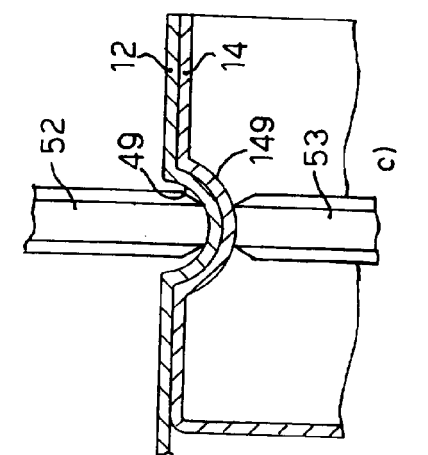


fig. 16

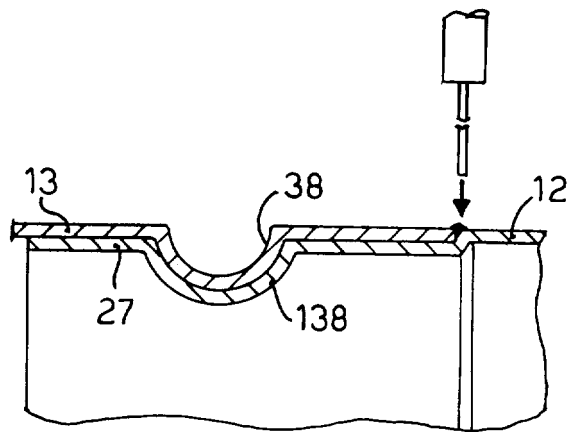


fig.17

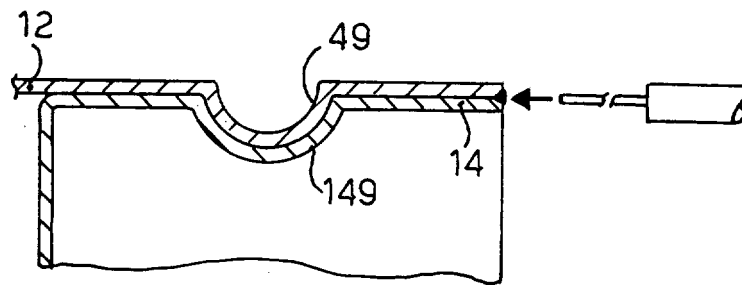


fig.18

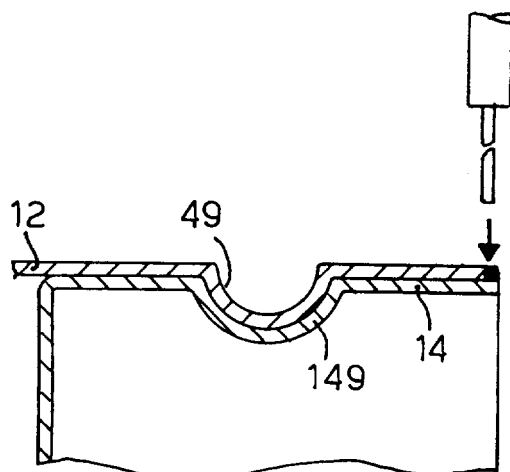


fig.19