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Description

This invention relates to metal deformation and particularly but not exclusively to a method of forming a cylindrical, internally threaded opening in an end wall of a metal, preferably mild steel, container drum.

It is known to provide cylindrical openings in the end walls of container drums by fitting a pre-fabricated insert into the end wall. This is disadvantageous because of the additional costs involved in pre-fabricating and fitting the insert.

It is also known from US-A-2493933 to provide a method of forming a cylindrical opening in a metal sheet, comprising piercing, pressing and drawing the metal sheet to provide a raised cylindrical section having an axis and partly closed at one end by an annular flange, and bending the flange into the cylindrical section while rolling the flange so as to permit the requisite enlargement thereof. Such subject matter is also known from U.S.-A-2460721.

According to the present invention there is provided a method of forming a cylindrical opening in a metal sheet, comprising piercing, pressing and drawing the metal sheet to provide a raised cylindrical section having an axis and partly closed at one end by an annular flange, and bending the flange into the cylindrical section while rolling the flange so as to permit the requisite enlargement thereof, characterised in that said bending and enlargement of the flange is achieved by orbiting a tool in engagement with said flange about said cylindrical section axis and rolling the tool along the flange about a second axis offset from said cylindrical section axis.

The invention will now be further described by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a partly cut-away view of one end of a container drum with the end wall in section through the closure opening;

Fig. 2 is a detail of Fig. 1 to an enlarged scale, and

Figs. 3 to 6 illustrate successive stages in the manufacture of the closure opening shown in Fig. 2.

Referring now to the drawings, Fig. 1 shows part of a cylindrical container drum made of mild steel having an end wall provided with a closure opening further illustrated in Fig. 2 as comprising a raised cylindrical section 1 of double thickness with a screw thread 2 on the cylindrical inner surface of the inner metal skin. The outer end of the cylindrical section 1 is thickened to provide a sealing surface 3 which is engaged by a sealing ring 4 of a conventional externally threaded bung 5 having an internal handle 6.

The closure opening illustrated in Fig. 2 is made by first piercing, pressing and drawing the metal sheet constituted by the drum end wall (prior to fixing to the drum end in conventional manner) to form a cylindrical section 7 raised out of the plane of the end wall by a step 8 and terminating at its outer end in an annular flange 9 which partly closes the cylindrical section leaving a circular opening 10 around a central axis 11 (Fig. 3).

The raised cylindrical section 7 is then surrounded by clamping supports 12 and a tool 13 is progressively introduced into the opening 10 so as to bend the flange 9 inwardly. Such deformation of the flange 9 requires a corresponding enlargement of the opening 10 which cannot be achieved without extension of the flange 9 along its circumferential dimension. Such extension is achieved by orbiting the tool 13 about the axis 11 while simultaneously rolling the frusto-conical tool surface on the flange 9 to achieve the necessary thinning of the metal in this region. When the flange 9 has been bent inwardly to an extent conforming to the shape of the tool 13, the tool 13 is replaced by a tool 14 which has a cylindrical working surface which, using the same rolling action as the tool 13, completes the inward deformation of the flange 9 and the attendant enlargement of the hole 10. The tool 14 also creates the shoulder 3 by pressing metal into a circular recess 15 in the clamping segments 12.

The cylindrical section 1 is then completed by using a thread forming tool 16 which has an orbiting and rolling action like tool 14 but in this case is provided with a thread formation on its outer cylindrical periphery, the action of the tool 16 serving to impress said thread formation onto the internal surface of the cylindrical section.

When internal thread forming, it is necessary to adjust for pitch error originating from the difference in peripheral length between the outer tube diameter being formed and the thread rolling tool diameter.

This difference, when the tool rolls on the component without slipping, causes a relative angular positional displacement of the two thread forms (forming and generated).

Compensation for this difference may be accomplished by axial displacement of the tool amounting to the pitch of the thread times the ratio of the two diameters.

As the depth of thread form increases during the rolling process this ratio varies with the instantaneous root diameter of the generated thread form.

The axial displacement of the forming tool may be achieved by allowing the tool to float freely or by providing an incremental movement of the tool spindle relative to tool rotation.

Alternatively, the accumulative effects may be avoided by alternating the direction of rotation of the forming tool after each full revolution of the tool spindle.

Claims

1. A method of forming a cylindrical opening in a metal sheet, comprising piercing, pressing and drawing the metal sheet to provide a raised cylindrical section (1) having an axis (11) and partly closed at one end by an annular flange (9), and bending the flange (9) into the cylindrical section (1) while rolling the flange (9) so as to permit the requisite enlargement thereof, characterised in that said bending and enlargement of the flange (9) is achieved by orbiting a tool (13, 14) in engagement with said flange (9) about said cylindrical section axis (11) and rolling the tool (13, 14) along the flange (9) about a second axis offset from said cylindrical section axis. 10 15 20
2. A method as claimed in claim 1, characterised in that the metal sheet is a container drum end wall. 25
3. A method as claimed in claim 1 or 2, characterised in that the raised cylindrical section (1) is externally supported during the bending and rolling operation. 30
4. A method as claimed in any one of the preceding claims, characterised in that the outer end of the cylindrical section (1) is deformed radially outwardly during the bending and rolling operation so as to provide a sealing surface (3) for engagement by a sealing ring (4) of a bung (5). 35 40
5. A method as claimed in any one of the preceding claims, characterised in that the inwardly bent flange (9) is provided with an internal screw thread by rolling a peripherally screw-threaded cylindrical roller (16) of diameter less than the flange (9) continuously over the flange surface in orbital relationship with the flange cylinder axis (11) until the surface is deformed into a complementary screw configuration. 45 50
6. A method as claimed in claim 5, characterised in that the screw threaded roller (16) is moved or permitted to move axially so as to compensate for the difference in pitch between the forming and the generated threads. 55

Patentansprüche

1. Verfahren zur Bildung einer zylindrischen Öffnung in einer Blechtafel, welches folgende Schritte umfaßt: Durchbohren, Pressen und Ziehen der Blechtafel zur Bereitstellung eines erhobenen zylindrischen Abschnitts (1), der eine Achse (11) aufweist und an einem Ende durch einen Ringflansch (9) teilweise geschlossen ist, Biegen des Flansches (9) in den zylindrischen Abschnitt (1), während der Flansch (9) gerollt wird, um die erforderliche Vergrößerung desselben zu ermöglichen, dadurch gekennzeichnet, daß das Biegen und Vergrößern des Flansches (9) durch ein Umlaufen eines mit dem Flansch (9) in Eingriff befindlichen Werkzeugs (13, 14) in einer satellitenähnlichen Bahn um die Achse (11) des zylindrischen Abschnitts und ein Rollen des Werkzeugs (13, 14) entlang dem Flansch (9) um eine zweite, von der Achse des zylindrischen Abschnitts versetzte Achse, erreicht wird.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß die Blechtafel eine Stirnwand eines Behälterfasses ist.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der erhobene zylindrische Abschnitt (1) während des Biege- und Rollvorgangs von außen gestützt wird.
4. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das äußere Ende des zylindrischen Abschnitts (1) während des Biege- und Rollvorgangs radial nach außen verformt ist, um eine Dichtungsfläche (3) zum Eingriff durch einen Dichtungsring (4) eines Spundzapfens (5) bereitzustellen.
5. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der nach innen gebogene Flansch (9) mit einem inneren Schraubengewinde dadurch versehen wird, daß ein kontinuierliches Rollen einer am Umfang mit einem Schraubengewinde versehenen, einen geringeren Durchmesser als der Flansch (9) aufweisenden zylindrischen Rolle (16) über die Flanschoberfläche durchgeführt wird, und zwar in einer satellitenähnlichen Bahn im Verhältnis zur Zylinderachse (11) des Flansches, bis die Oberfläche in eine komplementäre Schraubenkonfiguration verformt ist.
6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß die mit einem Schraubengewinde versehene Rolle (16) axial bewegt wird, bzw. ihr eine axiale Bewegung ermöglicht wird,

um den Steigungsunterschied zwischen dem formenden und dem erzeugten Gewinde auszugleichen.

entre les filets de filetage et de taraudage.

Revendications

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1. Procédé de formation d'une ouverture cylindrique dans une feuille de tôle, comprenant les étapes de percer, presser et étirer la feuille de tôle afin de fournir une section cylindrique surélevée (1) possédant un axe (11) et partiellement fermée à une extrémité par une bride annulaire (9), et de courber la bride (9) en la section cylindrique (1) tout en passant la bride (9) au rouleau de manière à permettre l'agrandissement nécessaire de celle-ci, caractérisé en ce que la courbure et l'agrandissement de la bride (9) sont obtenus par la mise en orbite d'un outil (13, 14) en engagement avec ladite bride (9) autour dudit axe (11) de la section cylindrique (11) et faisant rouler l'outil (13, 14) le long de la bride (9) autour d'un second axe décalé dudit axe de la section cylindrique. 10 15 20
2. Procédé selon la revendication 1, caractérisé en ce que la feuille de tôle est une paroi d'extrémité d'un fût réservoir. 25
3. Procédé selon la revendication 1 ou 2, caractérisé en ce que la section cylindrique surélevée (1) est supportée à l'extérieur pendant l'opération de courbure et de passage au rouleau. 30
4. Procédé selon l'une quelconque des revendications précédentes, caractérise en ce que l'extrémité externe de la section cylindrique (1) est déformée radialement vers l'extérieur pendant l'opération de courbure et de passage au rouleau de manière à fournir une surface d'étanchéité (3) pour engagement par une bague d'étanchéité (4) d'un bondon (5). 35 40
5. Procédé selon l'une quelconque des revendications précédentes, caractérisé en ce que la bride (9) courbée vers l'intérieur est pourvue d'un taraudage en faisant rouler un rouleau (16) cylindrique à filetage périphérique de diamètre inférieur à celui de la bride (9) de manière continue sur la surface de la bride en relation orbitale avec l'axe (11) de cylindre de la bride jusqu'à ce que la surface soit déformée en une configuration complémentaire à taraudage. 45 50
6. Procédé selon la revendication 5, caractérisé en ce que le rouleau (16) à filetage est déplacé ou permis d'être déplacé axialement de manière à compenser la différence de pas 55

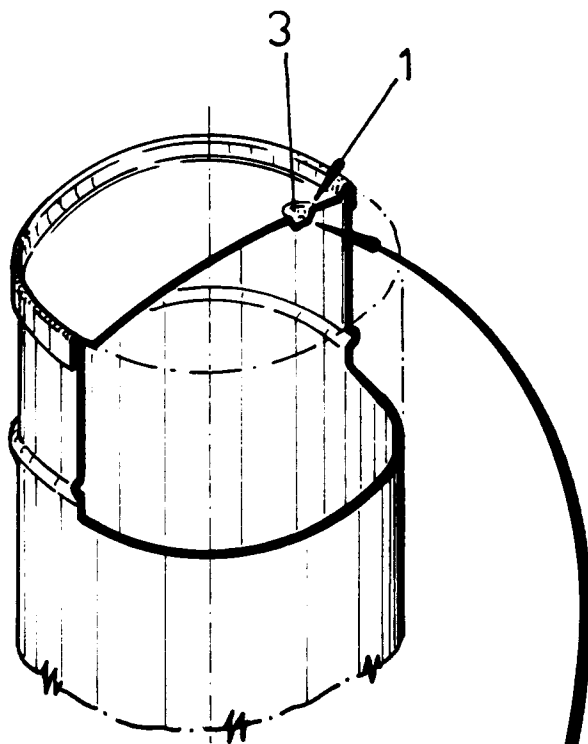


FIG. 1

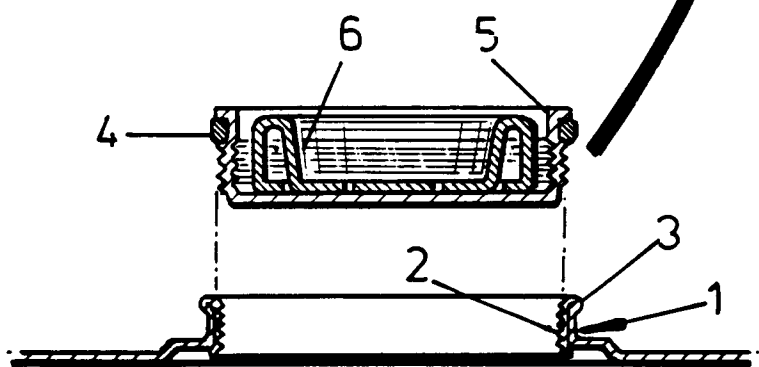


FIG. 2

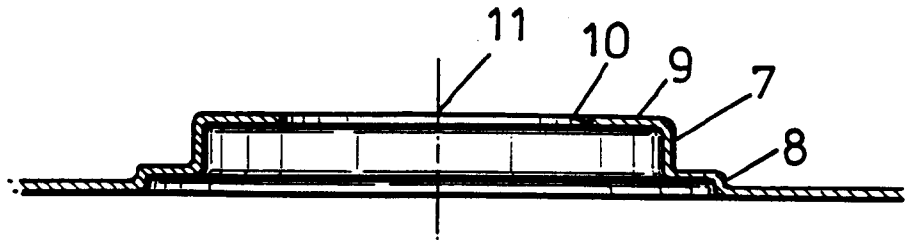


FIG. 3

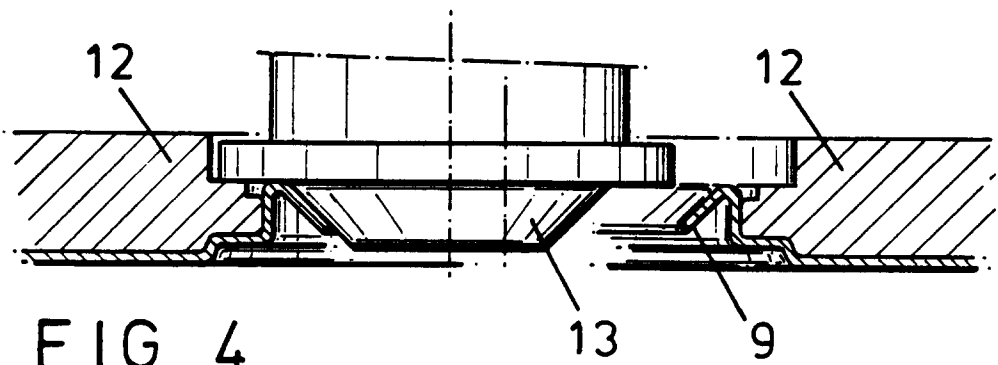


FIG. 4

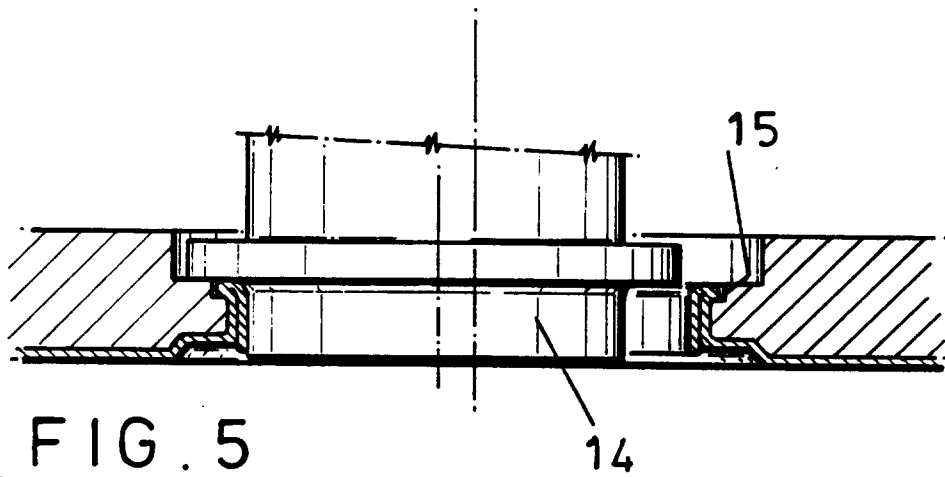


FIG. 5

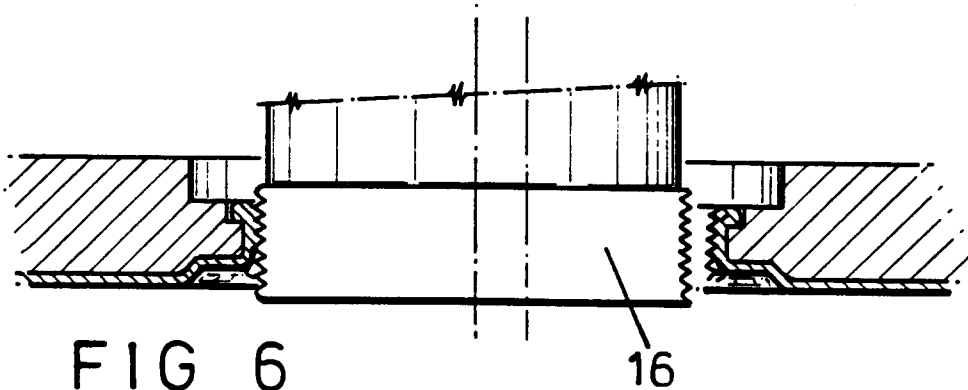


FIG. 6