



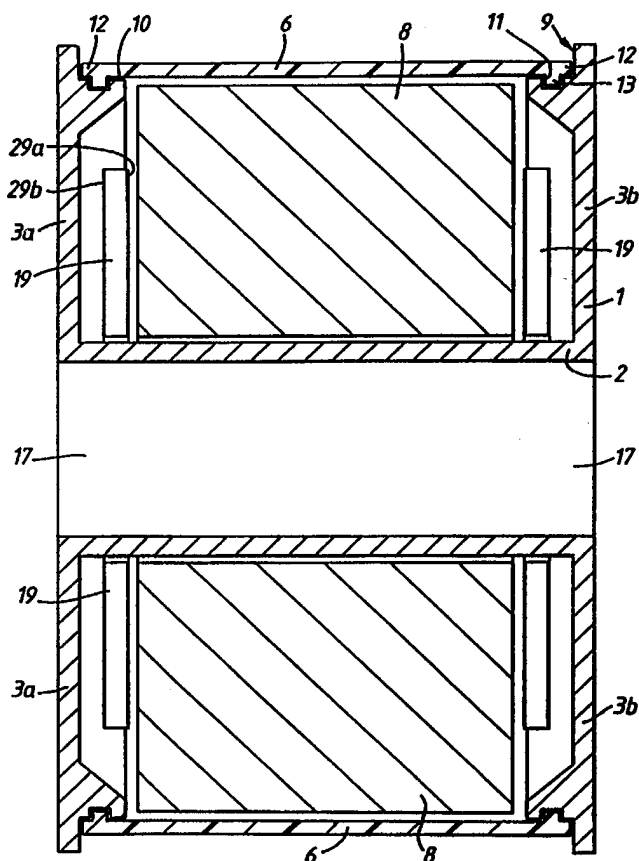
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(71) Applicant (for all designated States except US): GENERAL ENGINEERING SERVICES LIMITED [GB/GB]; 244 Penarth Road, Cardiff CF1 7TU (GB).		Published With international search report.	
(72) Inventors; and			
(75) Inventors/Applicants (for US only): O'HALLORAN, Neil [GB/GB]; "Sunnybank", Duffryn Lane, St. Nicholas, Cardiff, South Wales CF5 6SH (GB). PACKER, Nigel, Thomas [GB/GB]; 17 Auburn Avenue, Port Talbot, South Wales SA12 7RD (GB).			
(74) Agents: BARDO, Julian, Eason et al.; Abel & Imray, Northumberland House, 303-306 High Holborn, London WC1V 7LH (GB).			

(54) Title: GOODS CONTAINER AND METHOD FOR CONTAINING GOODS

(57) Abstract

A method of and a container for containing sheet metal (8), especially high value sheet metal wound in a coil with a mass greater than two tonnes. The method comprises the steps of providing a bobbin assembly comprising a core member (2) and two end pieces (3a, 3b), providing sheet metal (8) with a mass of greater than two tonnes, winding the sheet metal (8) in a coil around the core member (2) and assembling the bobbin (1) by securing each of the end pieces (3a, 3b) to opposite ends of the core member (2). A cover (6) may be provided that covers the bobbin, thereby forming a closed container.



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Goods container and method for containing goods

This invention relates to a container and a method for containing goods, in particular, sheet metal wound into a large and heavy coil. For example, the invention is of particular application to containing high value sheet metal, for example tin-plate, in the form of a strip of sheet material wound into a coil, the coil having a mass greater than two tonnes.

Bulk sheet metal is commonly stored at the place of manufacture and then transported, by the manufacturer, in coils, a single sheet forming each respective coil. Generally, coils are transported to a place of further processing, for example a canning factory or an automotive manufacturer where they are again stored. Such coils are generally large and heavy, commonly having a mass greater than a few tonnes, the heavier coils having a mass of about 25 tonnes. The sheet metal wound on the coils generally has a thickness in the range of 0.15 mm to 10 mm. In such coils, it is usual for each layer of the coil of sheet metal to be in direct contact with the adjacent layers. The overall density of the coil (excluding the volume of the central bore) is similar to that of the metal that forms the coil.

In the, sometimes lengthy, time between manufacture and being processed further (usually at a location remote from the place of manufacture) the metal may suffer damage including both physical and chemical damage.

Physical damage can arise when coils of sheet metal are knocked during transportation. After production of the coil, the coil is generally moved by suitable load handling equipment, into temporary storage. The load handling equipment usually lifts a coil by engaging the interior surface of the coil with two arms, the two arms each extending into the central bore of the coil from opposite sides of the coil. As mentioned above, a coil of a strip of steel may weigh up to as much

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as 25 tonnes (the width of the strip may be as great as 1.6m and the coil may have a diameter of up to about 2.0m). It is therefore common for damage to occur to a coil of sheet metal especially on the sides of the coil adjacent to the inner and outer extremities thereof.

Chemical damage can arise through corrosion, thereby causing undesirable deterioration in the surface of the sheet metal. It is common when storing or transporting sheet metal, especially high value sheet metal when stored as a stack of separate sheets, to wrap the sheet metal in a protective layer, for example paper and/or cardboard, to reduce the amount of moisture in contact with the surface of the metal and therefore mitigate corrosion and deterioration of the metal. Wrapping a coil of sheet metal in such a manner is difficult and time consuming.

Coils are usually stored on the factory floor between blocks that prevent the coil from rolling. Storing the coils in such a manner is time consuming. The blocks should be placed in position even if a coil is to be stored for as little as a few minutes. Once a coil is put in position, it is relatively time consuming to move the coil to a different position, even if the coil is only to be moved a very small distance, because the blocks have to be moved to a new position. Moving coils is also time consuming because it is often necessary, owing to the massive nature of the coils, to use suitable load handling equipment.

It is an object of the present invention to provide a means for and a method of protecting sheet metal when being stored or transported that mitigates at least some of the above-mentioned disadvantages of the known methods.

Accordingly the present invention provides a method of containing sheet metal with a mass greater than two tonnes, the method comprising the steps of

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providing a bobbin assembly comprising a core member and two end pieces,

providing sheet metal with a mass of greater than two tonnes,

5 winding the sheet metal in a coil around the core member and

assembling the bobbin by securing each of the end pieces to opposite ends of the core member.

10 The coil of sheet metal wound on the bobbin may then be further processed in the same factory, stored, or transported to a different location.

It is preferred, though not necessary, that the step of winding the sheet metal onto the core member is completed before the step of assembling the bobbin is started. For example, it would be possible to assemble the bobbin once and then perform the process of winding sheet metal on and off the bobbin many times.

The use of bobbins with end pieces, such as reels, is well known for purposes such as supporting a length of cotton or string or, on a larger scale an electric cable, a flexible pipe or the like. In those cases, however, the material is generally filamentary, and is equally flexible in all directions perpendicular to its axis. When containing filamentary material it is necessary to ensure that the material is stored in an ordered fashion and for that purpose it is convenient to wind the material into a coil. The bobbin can also play a part in facilitating unwinding of the material when it is to be used. When winding successive layers of flexible filamentary material onto a supporting member there is a tendency for the material to spread axially. The supporting member is therefore generally provided with side flanges and the material is commonly in contact with the inner surfaces of the side flanges.

35 As mentioned above, it is common in the field of manufacturing sheet metal, either to store the metal as a stack of separate sheets or as a coil and then to secure

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and protect the product by wrapping it with protective packaging. The coil once wrapped is self supporting, owing to the resilience provided by the sheet metal once coiled. The metal once coiled does not have a tendency to spread axially.

Thus in the case of a coil of sheet metal there is not the same need for a supporting member and end pieces for mounting the coil, as there is in the case of a coil of filamentary material. Once a coil of sheet metal is produced, it is the standard practice in the industry to transport and store it without any such supporting member or end pieces.

Furthermore, there are additional problems that apply to providing a bobbin including a supporting member and end pieces in the case of a coil of sheet metal. A way has to be found to wind the sheet metal onto the bobbin in a manner that is compatible with existing production lines for producing sheet metal; also, the bobbin generally has to be very strong in order to accommodate the severe stresses that can be imposed upon it when carrying a full load of sheet metal, especially if the end pieces are to be required to take the full weight of the wound bobbin. At the same time, the bobbin should preferably not add unduly to the storage space occupied by the coil.

Thus there are immediately apparent reasons for not wishing to use a bobbin to accommodate a heavy coil of sheet metal.

We have found, however, that despite the apparent problems of employing a bobbin, there are sufficient benefits in doing so to make its use advantageous. The end pieces of the bobbin provide protection of the sides of a coil of sheet metal, which is especially advantageous since damage to an edge of the sheet may make the entire width of sheet unusable in that region. Although the use of the bobbin involves extra cost in one sense, the bobbin can be reused many times whereas

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conventional packaging is used just once and then disposed of.

Advantageously, the method further comprises the steps of

5 providing a cover for covering the bobbin to form a closed container, and

after the step of winding the sheet metal in a coil around the core member, covering the bobbin with the cover, thereby forming a closed container for the coil of
10 sheet metal. Containing the sheet metal in a closed container may protect the metal from all kinds of physical damage. The cover also reduces the amount of contact of substances, which would otherwise come into direct contact with the exposed sheet metal, and which
15 might cause or aid deterioration to the sheet metal.

A bobbin according to the invention which is not provided with a cover, may be open around its circumference that is defined between the perimeters of the end pieces of the bobbin. Even when no cover is
20 provided the sheet metal coil is contained within the space enveloped by the end pieces and it is appropriate to refer to the bobbin as a "container".

The method of the invention is of particular application to containing high value metals, for
25 example, high quality steel, tin-plate, aluminium, copper, titanium or alloys thereof. The potential financial losses caused by damage to high value sheet metal can be much greater than the cost of providing a suitable container that may be reused many times.

30 Advantageously, the bobbin and the cover are sealingly engagable and the step of covering the bobbin with the cover forms an air-tight container. Movement of oxygen and moisture into the container can be practically prevented when the container is air-tight, thereby
35 further reducing the likelihood and extent of corrosion.

Since oxygen aids corrosion of sheet metal the method preferably further comprises the step of removing

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substantially all of the gaseous oxygen in the container. Oxygen may be removed from the sealed container by providing in the container a substance that removes oxygen. The substance may remove gaseous oxygen from the container by chemical reaction with the oxygen or by absorption and/or adsorption of the oxygen.

The method may further comprise the step of purging the container with a gas, preferably an inert gas. By purging the container with a suitable gas, for example carbon dioxide, moisture in the form of water vapour and any other gaseous substances that might affect the quality of the sheet metal, such as oxygen, are also removed, thereby even further reducing the likelihood and extent of corrosion. Carbon dioxide is a particularly suitable choice of gas, because it has the appropriate properties and is readily available.

The method preferably further comprises the step of stacking the container on top of another container, the longitudinal axes of the two containers being horizontal. Thus storage space can be utilised effectively. So that a container, containing a coil, may be stacked on top of a further container, each container must be able to support its own weight including that of a coil and that of at least one further container and coil.

If the weight of each container is supported by the end pieces of the bobbin, then to enable two containers to be stacked, each end piece might have to be able to support a load greater than 25 tonnes (for example, in the case of each coil weighing 25 tonnes, the total weight of two loaded containers stacked one on top of the other would be over 50 tonnes and that load would be shared between the two end pieces). In some circumstances the number of containers that can be safely stacked one on top of another may be limited to two. Providing containers that can only be double stacked almost halves the amount of storage space required for a given number of containers, and given the high cost of

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storage space, is beneficial, despite the extra costs in manufacturing the end pieces to be sufficiently strong.

The end pieces of the bobbin are preferably spaced apart from one another by a distance great enough to
5 avoid contact with the sheet metal when winding or unwinding the sheet metal on or off the core member of the bobbin. Such contact could cause undesirable damage to the sheet metal. Advantageously, the core member of the bobbin comprises a cylindrical member extending
10 between the two end pieces and is provided with securing means slidably mounted on the cylindrical member and the method further comprises the step of securing the securing means on the cylindrical member at a position intermediate the coil and the end piece, thereby
15 restricting axial movement of the coil along the cylindrical member. Since it is preferable to have a significant gap between the end pieces of the bobbin and the coil and it is advantageous to be able to contain coils of different widths with the same container,
20 without such securing means a coil is able to move axially along the cylindrical member; coils of lesser widths would be able to move axially by greater distances. Such movement is undesirable, because it is liable to cause damage to the sheet metal and possibly to
25 the end pieces, especially if the coil impacts heavily onto the end pieces.

The bobbin is advantageously arranged for mounting on a shaft of a machine at the downstream end of a line for producing sheet metal or at the upstream end of a
30 line for processing sheet metal; in practice, it is common for such shafts to be of different diameters. For example, at one place of manufacture of sheet metal, the bobbin may have to be mounted on a spindle having a diameter of 0.6m, but at another place the spindle may
35 have a diameter of 0.4m. Advantageously, the bobbin has an opening in at least one of its ends for receiving a first shaft of a given diameter and the method further

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comprises securing a hollow sleeve in the opening to allow the bobbin to be mounted on a second shaft with a smaller diameter than that of the first shaft. The hollow sleeve is preferably cylindrical, being ring
5 shaped in cross-section. The interior cross-sectional shape will of course be dependent on the shape of the shaft on which the bobbin is to be arranged.

According to the invention there is also provided a container containing a coil of sheet metal having a mass
10 greater than two tonnes, the container including a bobbin comprising

a core member and two end pieces, each end piece being located at a respective end of the core member, and

15 the coil of sheet metal being arranged on the core member.

According to the invention there is also provided a container suitable for containing a coil of sheet metal having a mass greater than two tonnes, the container
20 including

a bobbin around which a coil of sheet metal can be arranged, the bobbin comprising a core member and two end pieces, and

25 the volume of the notional cylindrical surface that envelopes the two end pieces being greater than one cubic metre.

The core member is preferably cylindrical, preferably with a circular cross-section.

The end pieces are preferably fixed in position in
30 relation to the core member.

Preferably, at least one of the end pieces is removably fixable to the core member. For example, a flange may be provided on each end piece, the flange extending around an end of the core member. The end piece may then
35 be fixed to the core member by securing the flange to the end of the core member, for example, by means of a multiplicity of equiangularly spaced apart bolts.

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The end pieces preferably support the weight of the bobbin when a coil is arranged on the core member.

Preferably, at least one of the end pieces has a central aperture. The central aperture may be able to
5 receive the core member.

Advantageously, the bobbin and coil are so shaped that they cannot be placed on a flat surface in such a way that the coil contacts the surface. In that case when the container, on which a coil of sheet metal is
10 arranged, is placed, intentionally or otherwise, on a flat surface, such as a factory floor, the coil can not be physically damaged by contact with the surface, irrespective of the orientation of the bobbin relative to the surface.

15 Advantageously, the container includes a cover, which is able to cover the bobbin, thereby forming a closed container.

The cover is advantageously able to sealingly engage the bobbin to form an air-tight seal, thereby forming an
20 air-tight container.

The cover may be substantially flexible. The cover when flexible may be substantially of one piece construction. The cover may then be wrapped around the bobbin and attached to itself thereby covering the
25 bobbin. A single flexible cover has the advantage that only one item is necessary to cover the bobbin. It is preferable that the cover is reusable; however, the cover could take a variety of forms and could for example be similar to the conventional wrapping used to cover
30 coils of sheet metal.

As an alternative, the cover may be formed from a plurality of cover pieces. The cover pieces may be rigid which assists in providing effective protection against physical damage.

35 The two end pieces and cover are advantageously so shaped that when the bobbin is covered with the cover, the container can not be placed on a flat surface so that

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the cover is in contact with that surface. In that case when the assembled container is placed, on a flat surface the cover and therefore the coil can not be physically damaged by contact with the surface. That
5 result can be achieved by each end piece having a recess for accommodating the cover. The cover does not need to support any substantial weight and it can therefore be less massive and as a result be easier to move and arrange manually. The cover when in place is preferably
10 substantially cylindrical, but need not necessarily have a circular cross-section.

Each end piece preferably has an endless groove formed around its periphery for receiving an endless rib formed on the cover. The cover may then be easily and
15 simply placed securely in the correct position on the bobbin. The groove and/or recess may include a seal, for example a rubber sealing strip, to enable the container once sealed to be air-tight.

Preferably, an end piece includes a substantially
20 plate-like part which extends radially inwardly from the periphery of the end piece and a plurality of reinforcing beams which extend over a face of the plate-like part. The reinforcing beams are able to provide the end pieces with the strength necessary to support the loaded bobbin
25 and the plate-like part is able to provide protection for the sides of the coil in the assembled loaded bobbin.

Preferably, each end piece has a bottom portion, so arranged as to enable the container to be placed on a flat surface with each bottom portion contacting the flat
30 surface, and a top portion, so arranged as to enable a further similar container to be stacked on top of the container.

The end pieces are advantageously reinforced, to enable a weight of 10kN to be supported by each end
35 piece. Preferably, each end piece comprises a first plurality of load supporting members that extend from the bottom portion to the top portion. Those load supporting

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members may bear much of the vertical stresses imposed on the end pieces, especially when one loaded container is stacked on top of another. A further load supporting member may extend between a pair of the first plurality
5 of load supporting members. The provision of a further load supporting member can provide further structural strength to the reinforced end piece. Preferably, the first plurality of load supporting members are substantially vertical when the container is placed with
10 the bottom portion on a flat horizontal surface.

Advantageously, each end piece comprises a multiplicity of circumferential load supporting members that extend substantially circumferentially around the periphery of the end piece. The further load supporting
15 member mentioned above may be one of the circumferential load supporting members.

Preferably, when an end piece has a central aperture, that aperture is reinforced with an inner circumferential load supporting member that extends
20 substantially circumferentially around the central aperture. The inner circumferential load supporting member may be made of a multiplicity of load supporting members fixed together.

Preferably, each end piece comprises a multiplicity
25 of radial load supporting members that extend radially from the periphery of the end piece towards the centre of the end piece. Preferably, a transverse load supporting member extends between each of a plurality of pairs of adjacent radial load supporting members. Any of the
30 transverse load supporting member may be one of the circumferential load supporting members, may be near the centre of the end piece or may form a part of the inner circumferential load supporting member.

One or more of any of the load supporting members
35 may be fixed to another load supporting member by, for example, welding.

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Advantageously, the top portion comprises a formation that is able to engage with a corresponding formation formed on the bottom portion of a further similar container. Thus a container may be securely
5 stacked on top of another similar container. Either the formation on the top portion or the corresponding formation on the bottom portion may be a recess. Preferably, the recess is at least partly defined by surfaces inclined to the vertical. The recess therefore
10 provides a guiding means which aids correct location of one container on top of another for safe and secure stacking. The part of the portion that is receivable by the recess may be a foot, which is at least partly defined by surfaces inclined to the vertical. The foot
15 further aids correct location of one container on top of another. Preferably, the recess is surrounded by the portion in which it is provided, so that when the part of the portion that is received by the recess is only partially inserted into the recess, accidental movement
20 of that portion in a substantially horizontal direction does not result in the part of that portion being removed from the recess, but instead merely contacting the interior surface that defines the recess.

As an alternative to the container having a top and
25 bottom so shaped that the top of the container directly interlockingly engages with the bottom of a further similar container to aid stacking, there may be provided a locating means, wherein the locating means has an upper surface and a lower surface, the lower surface being so
30 shaped that it is able to receive the top portion of the end piece and the upper surface being so shaped that it is able to receive the bottom portion of a further similar container. Preferably, the locating means is of one-piece construction and a single locating means is
35 sufficient to enable a further similar container to be stacked on top of the container. The upper surface and/or the lower surface of the locating means may have

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surfaces inclined to the vertical to aid correct location of the locating means in relation to the container and/or the further container. It would, of course, be possible to use two separate locating means to aid stacking, one for the end pieces on one side and one for the end pieces on the other side.

Preferably, the core member is a cylindrical member and the container further comprises a securing means slidably mounted on the cylindrical member for restricting axial movement of the coil along the cylindrical member. The securing means is preferably securable at any one of a multiplicity of positions along the cylindrical member. The means for securing the securing means is preferably a clamping means and preferably secures the securing means in position by friction.

Preferably, the securing means comprises at least two securing members, wherein each securing member has a portion that is engagable with the cylindrical member, and the securing members are movable from a position in which they engage the cylindrical member to a position in which the securing means is able to slide freely along the cylindrical member. The securing members may be movable to a position that allows the securing means to be removed from the cylindrical member. Preferably, there are a pair of securing members pivotably connected to each other.

The clamping means may comprise a lever pivotably mounted on a first securing member and movable to urge the first securing member towards a second securing member.

The lever may form part of an over-centre fastening mechanism comprising a tensioning means able to provide a force that acts between the first and second securing members. When the lever is pivoted from a position in which the securing means is freely slidable, through a position at which the force urging the first and second

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securing members together provided by the tensioning means is at a maximum, it then is prevented from moving further in the same rotational direction by, for example, the cylindrical member. At the position at which the lever is stopped, the securing members remain urged together by the force applied by the tensioning means and clamp the securing means to the cylindrical member. The means for stopping the lever need not, of course, be the cylindrical member, but may instead be a separate means such as a stud which engages with a part of the lever. A handle may be provided as an extension to the lever to enable the securing means to be manually secured to and released from the cylindrical member. It may be necessary for the clamping means to be removed or partially detached from one or more of the securing members to allow the securing means to be removed from the cylindrical member.

Each securing member may comprise two parallel spaced apart walls that are fixed in relation to each other by members extending between the walls.

A valve means is preferably provided in the container. The valve means allows gases to be removed or passed into the container and also enables the pressure in the container to be maintained at below or above atmospheric pressure, if so desired.

The bobbin may be made wholly or partly from any one of the group of materials including steel, aluminium and plastic.

Advantageously, the bobbin and coil are so shaped that they cannot be placed on a flat surface in such a way that the coil contacts the surface, and the end pieces are so shaped that the bobbin and coil may be placed on a flat surface with both end pieces in contact with the flat surface and with the bobbin resisting rotational movement about its axis.

Since the bobbin may be placed on a flat surface in such a way that rotational movement of the bobbin about

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its axis is resisted, there is no need to provide blocks for the same purpose.

Each of the end pieces preferably has at least one flat surface. The bobbin may then be placed on a planar surface so that a flat surface of at least one end piece is in contact with the planar surface.

The end pieces are preferably polygonal. There are then a plurality of rotational positions in which the bobbin can be placed securely on a flat surface.

The cross-sectional shape of the end pieces is preferably a polygon with 6 or more sides. In the examples of the invention described below the number of sides are 8 and 10, respectively.

The bobbin advantageously has an opening at each of its opposite ends. The openings are advantageously so arranged to allow load handling equipment to handle the container. The openings at the opposite ends of the bobbin preferably join so that the bobbin has a central bore.

According to a further aspect of the invention there is provided an assembly comprising a container as described above, wherein the bobbin has an opening at each of its opposite ends and a hollow sleeve, wherein each opening is so shaped to receive a first shaft of a given diameter, the exterior diameter of the hollow sleeve is such that it fits into the opening, and the interior diameter of the sleeve is such that it enables the bobbin to be mounted on a second shaft of smaller diameter than that of the first shaft.

Preferably, the assembly comprises fixing means for removably fixing the sleeve in the opening.

Preferably, the fixing means passes through a bore in the sleeve and into the bobbin.

Advantageously, the assembly comprises a further hollow sleeve, the exterior diameter of the further hollow sleeve being such that it fits into the interior

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of the hollow sleeve that fits into the opening of the bobbin, and the interior diameter of the further hollow sleeve is such that it enables the bobbin to be mounted on a third shaft of smaller diameter than that of the second shaft.

The container according to the invention described above is required to be able to contain a coil that weighs two tonnes, but of course such a container may also be used to contain a coil that is less massive than two tonnes. Furthermore, certain aspects of the invention that have been made in order to suit a container capable of containing a coil that weighs two tonnes can also be advantageous for smaller and/or less strong containers.

According to a further aspect of the invention, there is also provided a bobbin on which a coil of sheet metal is wound comprising

a cylindrical member on which the coil of sheet metal is arranged, and

two end pieces, each being located at a respective end of the cylindrical member, wherein

the bobbin and coil are so shaped that they cannot be placed on a flat surface in such a way that the coil contacts the surface, and

the end pieces are so shaped that the bobbin and coil may be placed on a flat surface with both end pieces in contact with the flat surface and with the bobbin resisting rotational movement about its axis.

Since the bobbin may be placed on a flat surface in such a way that rotational movement of the bobbin about its axis is resisted, there is no need to provide blocks for the same purpose.

The present invention also provides a method of manufacturing a coil of sheet metal, the method including the steps of manufacturing the sheet metal and feeding the sheet metal onto the core member of the bobbin of a container as described above.

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After the sheet metal has been wound on the core member, the resulting coil of sheet metal may be further treated at the place of manufacture. When treating of the coil in the factory has been completed the coil can
5 be prepared for storage and/or transportation. If either of the end pieces are not fixed to the core member they are then fixed in place. The bobbin may then be covered to form a closed container. The bobbin can be transported, either immediately or after a period of
10 storage, to a factory that processes sheet metal. The cover is then removed and the sheet metal can then be removed from the bobbin and processed. The sheet metal may be removed by unwinding it from the core member (with or without the end pieces attached), or
15 alternatively, by removing an end piece and sliding the coil off the core member. The bobbin and cover can then be returned to the place of manufacture and be used again and again.

According to a further aspect of the invention there
20 is provided a method of containing sheet metal, the method comprising the steps of

providing a bobbin comprising a core member and two end pieces, and a cover for covering the bobbin to form a closed container,

25 winding the sheet metal in a coil around the core member and

covering the bobbin with the cover, thereby forming a closed container for the coil of sheet metal.

According to that aspect of the invention there is
30 also provided a container for a coil of sheet metal, the container including

a bobbin around which the coil of sheet metal can be arranged, the bobbin comprising a core member and two end pieces, and

35 a cover, which is able to cover the bobbin, thereby forming a closed container.

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Any of the features described above in relation to a method of containing sheet metal can, where appropriate, be incorporated into the method of this aspect of the invention. Similarly any of the features described above
5 in relation to a container for a coil of sheet metal can, where appropriate, be incorporated into the bobbin of this aspect of the invention. Of those features, especially important features that may be incorporated are those which enable a loaded bobbin to be stacked on
10 top of another bobbin.

Methods and apparatuses for containing sheet metal will now be described, by way of example, with reference to the partly schematic drawings (which are also not drawn to scale), of which

- 15 Figure 1 is a perspective view of a bobbin on which the sheet metal may be wound;
 Figure 2 is a perspective view of the assembled container including the bobbin shown in Figure 1;
20 Figure 3 is a cross-sectional view of the container shown in Figure 2, the axis of the bobbin being perpendicular to the plane of the cross-section;
 Figure 4 is a schematic sectional view of the
25 assembled container shown in Figure 2, the plane of the cross-section containing the axis of the bobbin;
 Figure 5 is an enlarged view of a part of
 Figure 4 showing the seal between the
30 bobbin and the cover;
 Figure 6 is a cross-sectional view of an end piece of the bobbin shown in Figure 1;
 Figure 7 is a side view of a collar mounted on the bobbin shown in Figure 4;
35 Figure 8a is a detailed cross-sectional view of a part of an end piece of the bobbin

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- shown in Figure 4 showing the parts that aid stacking of the containers;
- Figure 8b is a side view of the part of the end piece shown in Figure 8a;
- 5 Figure 8c is a partial plan view of a part of an end piece of the bobbin shown in Figure 4 including the part shown in Figures 8a and 8b;
- 10 Figure 9 is a detailed partial cross-sectional view of the bottom of the end piece shown in Fig 4;
- Figure 10 is a cross-sectional view of a bobbin with two sleeves inserted into the central opening of the bobbin;
- 15 Figure 11 is a perspective view of one half of a two piece cover;
- Figure 12 is a cross-sectional view of a bobbin and a locating tray that aids stacking of the containers according to a second embodiment of the invention;
- 20 Figure 13 is a perspective view of a bobbin on which the sheet metal may be supported according to a third embodiment of the invention;
- 25 Figure 14 is a cross-sectional view of an end piece of a bobbin according to a fourth embodiment of the invention;
- Figure 15a is a view of an end piece of a bobbin for a container according to a fifth embodiment of the invention;
- 30 Figure 15b is a perspective view of one half of a two-piece cover for a container according to the fifth embodiment of the invention;
- 35 Figures 16a and 16b are a cross-sectional view and a view from below, respectively, of a lower end insert for the end piece

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shown in Figure 15 that aids stacking of the containers;

Figures 17a and 17b are a cross-sectional view and a view from above, respectively, of an upper end insert for the end piece shown in Figure 15a aids stacking of the containers;

Figures 18a and 18b are a side view and a view from above of a foot for the end piece shown in Figure 15a that aids stacking of the containers; and

Figure 19 is a cross-sectional view of the components shown in Figures 16a, 17a and 18a assembled together.

Figure 1 shows a bobbin 1 comprising a cylindrical member 2, on which sheet metal may be wound, and two end pieces 3a, 3b. The cylindrical member has a length of about 1.6m and a diameter of about 0.6m. The end pieces have a diameter of about 2.0m. An inlet valve 4a is mounted inside a protective rim 5a in the end piece 3a. Three further rims 5a', similar in shape to the protective rim 5a, are provided on the end piece 3a, which together with the protective rim 5a act as feet if the bobbin 1 is stored in an upright position (its axis being vertical). Similarly, an outlet valve (not shown) is mounted in the other end piece 3b inside a protective rim and three further rims are mounted on the other end piece. Each end piece is polygonal in shape.

In production sheet metal manufactured in a conventional manner is, as the final stage of manufacture, fed onto the cylindrical member 2 to form a coil. The bobbin 1 is mounted on a mandrel so that the bobbin, and therefore the cylindrical member 2, may rotate as the sheet metal is fed onto the cylindrical member. As in a conventional process, guides (not shown in the Figures) may be so placed in relation to the cylindrical member 2 that the sheet metal winds around

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the cylindrical member and back onto itself to form a coil 8 (not shown in Figure 1). Once the sheet metal has been coiled on the bobbin 1, the outer layer of the coil 8 is secured, to prevent the coil from unwinding. The outer layer may be tied down by passing iron or plastic securing straps around the coil 8. Two collars 19 (not shown in Figs. 1 to 3) slidably mounted on the cylindrical member 2 are then secured to the cylindrical member 2, one to either side of and adjacent to the coil 8. A cover 6 (not shown in Figure 1) is then mounted on the bobbin 1.

Figure 2 shows the bobbin 1 and a cover 6 assembled to form a container 7 for the coil 8 of sheet metal (hidden from view in Figure 2 by the cover). The interior volume contained by the container is about 4.6m^3 . The cover 6 is a plastic one-piece flexible cover. One end of the cover is sealingly joined to the other end by a suitable means, for example, a clasp. Figure 3 shows a cross-sectional view of the container 7 shown in Figure 2, showing the coil 8 arranged on the cylindrical member 2 and covered by the cover 6 (parts of the end piece 3b have been omitted for the sake of clarity). The cover 6, once in place, is generally cylindrical and has a cross-section in the form of a ring.

Figures 4 and 5 show, as schematic cross-sectional views, the assembled container shown in Figures 2 and 3 (Figure 4 does not show the rims 5a, 5a' shown in Figure 2). The cover 6 sealingly engages the bobbin 1 to form an air-tight sealed container. The end pieces 3a, 3b of the bobbin 1 each have an endless recess. The recess on an end piece 3a, 3b is defined by the peripheral interior surface 9 of the end piece and a ridge 10 that extends the length of the peripheral interior surface 9 of the end piece (see Figure 1 also). When the cover 6 is mounted on the bobbin 1, the side edges 12 of the cover are received in the recess. The cover 6, being

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cylindrical, need not therefore support any weight apart from its own, all of the weight of the container being supported by the end pieces 3a, 3b. The end pieces 3a, 3b are large and round enough to prevent contact of the coil 8 or cover 6 with the factory floor.

The end pieces are reinforced internally with reinforcing beams to enable them to support the mass of the loaded bobbin 1. Figure 6 shows a cross-sectional view of an end piece 3b (parts of the end piece 3b have been omitted for the sake of clarity). Two vertical beams 21 extend from the top 18 of the end piece 3b to the bottom 20 of the end piece. Six radial beams 22 extend from the periphery of the end piece 3b to the periphery of the central opening 23 in the end piece 3b. Six circumferential beams 24 extend around the periphery of the end piece, each circumferential beam extending between a pair of radial beams 22. The top and bottom circumferential beams 24a, 24b also extend between the vertical beams 21.

Referring to Figures 1, 4 and 5, the ridge 10 has an endless groove 11, which receives an endless rib 13 on the cover 6. A rubber sealing strip 14 is provided in the groove 11 so that the cover 6 and bobbin 1 can engage each other to form an air tight seal. A sealing strip could also be provided on rib 13 of the cover as well as or instead of the sealing strip provided in the groove 11.

Figure 7 shows the container of Figure 4 in partial cross-section, showing the collar 19 on the left in Figure 4 as viewed from the left (the coil 8, the cover 6 and end piece 3b have been omitted for the sake of clarity). The collar is formed from two collar members 26a, 26b which are pivotally connected together by a hinge 27. Each collar member 26a, 26b is made from two spaced apart walls 29a, 29b (only wall 29a can be seen in Figure 7) that are fixed together by members 28 that extend between the walls. The collars are able to clamp

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the cylindrical member 2 by means of an over-centre fastening mechanism 30.

The fastening mechanism 30 includes a lever 31 pivotally mounted about an axis 32 on one collar member 26b. A tension member 33 connects the other collar member 26a, to the lever 31 at a position 35 spaced apart from the axis 32. A handle 34 is provided on the lever so that it can be rotated manually. Rotation of the lever from the position shown in Figure 7 in a clockwise direction urges the two collar members 26a, 26b together, until they engage the cylindrical member 2. Further movement of the lever tensions the member 33 and increases the force with which the collar members engage the cylindrical member. The force reaches a maximum as the lever passes over the centre point (the position at which the positions 35, 36 of attachment of the member 33 to the lever 31 and the collar member 26a are aligned with the axis 32). As the lever 31 passes over the centre point, the force on the lever urges it clockwise. At a position, at which the collar members are urged together and the lever is urged clockwise, a stop is provided (not shown) to prevent the lever from rotating further clockwise. When the lever 31 is moved to that position, the collar members 26a, 26b engage the cylindrical member 2 with a force sufficient to provide a friction grip, holding the collar 19 in position on the cylindrical member 2. When the collars 19 are fixed in position either side of a coil mounted on the cylindrical member 2, axial movement of the coil is reduced.

The collar members 26a, 26b are so shaped that, if the fastening mechanism 30 is removed, once opened fully they can be removed from the cylindrical member 2.

Once the cover 6 has been arranged on the bobbin 1 to provide a sealed container 7, the container may be purged with carbon dioxide. A supply of carbon dioxide is connected to the inlet valve 4a, and a suction pump is connected to the outlet valve (not shown). The air in

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the container 7 flows out of the outlet valve and carbon dioxide flows into the container through inlet valve 4a. The container 7 is thereby purged with carbon dioxide.

The gas flowing out of the outlet valve is
5 monitored so that the point at which the container 7 has been substantially completely filled with carbon dioxide can be determined. It is convenient to assess the percentage of oxygen in the gas exiting the container 7. Once the percentage of oxygen detected is minimal or
10 zero, it is assumed that the container has been completely filled with carbon dioxide. The supply of carbon dioxide and the suction pump are switched off and the inlet valve 4a and the outlet valve are closed. The valves may alternatively be provided in the same end
15 face, or in the cover.

Additionally, or as an alternative to purging the container 7 with an inert gas, a substance may be placed in the container which removes the oxygen in the atmosphere of the container.

20 Since the container is air tight, the sheet metal can be stored at above or below atmospheric pressure, by suitable operation of the inlet valve 4a, the outlet valve, and a pump. Having an internal pressure different from atmospheric pressure can aid the sealing
25 of the container and can also enable detection of a break in the seal.

Once the container 7 has been assembled, appropriate load handling equipment may be used to move the container into storage, from where the container 7 may then be
30 transported. The load handling equipment (not shown) has two arms that are arranged on the same axis and are movable towards each other and movable together to lift and put down objects. The arms are inserted into the respective openings 17 (see Figures 1 and 4) at each end
35 of the bobbin 1. The container may then be lifted and moved.

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It is possible to stack the assembled containers 7 or bobbins 1 one on top of another (with their axes being horizontal). When the containers are empty it is possible to stack the containers on top of one another in a variety of rotational positions, since the end pieces 3a, 3b are in the shape of regular polygons with an even number of sides. However, when the containers are loaded with coils, each weighing about 25 tonnes, one container is stacked on top of another container, both being orientated in the upright position (with the vertical beams 21 being vertical), so that the vertical beams 21 of the container at the bottom support the weight of the container above.

To aid the stacking of the bobbins there are provided on the bottom 20 of each of the end pieces 3a, 3b a formation that can engage with at least one corresponding formation formed on the top 18 of an end piece of another bobbin. Figures 8a to 8c show a recess 37 formed on one side of the top 18 of an end piece 3a. A similar recess 37' is formed on the other side of the end piece 3a and further similar recesses are formed on the top of the other end piece 3b (not shown in Figures 8a to 8c). The recess 37 is defined by three surfaces 38 that are inclined to the vertical and a vertical surface 39. At the bottom of the recess there is a cuboidal hole 40. The bottom 20 of each end piece 3a, 3b has a pair of feet 41, which are positioned beneath the vertical load supporting members (not shown in Figure 9) and which are so shaped and arranged to fit into the recesses 37, 37' on the top of a further similar container. The sloped surfaces aid correct location of the feet of one container into the recesses of another similar container. Since each bobbin has four feet on which it stands, the bobbin resists rotational movement about its longitudinal axis when placed on a flat surface.

Figure 10 shows a partial cross-section of the cylindrical member 2 taken at one end of the bobbin 1

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near an end piece. A cylindrical sleeve 42 of annular cross-section has been inserted in the opening 17 of the bobbin. The cylindrical member 2 of the bobbin has a circular cylindrical recess 44 formed in its interior surface. The sleeve has a bore 45 which extends from the interior surface of the sleeve 42 to its exterior surface. The recess 44 is provided with a screw thread (not shown). The recess 44 and bore 45 are so arranged and shaped that when the sleeve is inserted and aligned in the cylindrical member 2 in the correct position a countersunk threaded bolt 46 can be inserted through the bore 45 and secured into the recess 44, thereby securing the sleeve 42 in the opening of the cylindrical member 2. The sleeve 42 once secured in position allows the bobbin to be mounted on a mandrel of a diameter smaller than that of the opening 17. One recess 44, one bore 45 and one bolt 46 is sufficient to aid correct axial (and rotational) positioning of the sleeve 42 in the opening 17 of the cylindrical member 2 but more may be provided.

Figure 10 also shows a further sleeve 43 that has been secured in the opening provided by the sleeve 42. The further sleeve 43 has a bore 48, which is aligned with a recess 47 in the sleeve 42 and is similarly secured to the sleeve 42 by means of a bolt 49. The threads provided in the recesses 44, 47 are formed by drilling a suitably sized hole in the appropriate position and then securing a cylindrical insert in the hole, for example, by means of adhesive, the cylindrical insert having a suitable preformed internal thread. The sleeves 42, 43 are inserted and removed as and when required.

Unloaded bobbins or containers can also be stored with their axes vertical. Since storage space is usually expensive and therefore relatively limited, it is preferable for the end pieces of the bobbins to be so shaped that they tessellate, thereby making efficient use

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of the available space. A convenient shape for that purpose is a regular hexagon.

As an alternative to having a flexible cover, the cover is rigid and is formed from two cover pieces, one of which is shown schematically in perspective in Figure 11. The cover piece 15 is in the shape of half an annular cylinder. Once the sheet metal has been coiled on the bobbin 1, each of the two cover pieces are arranged on the bobbin. Suitable means, such as a clasping means (not shown), for joining the two cover pieces may be provided at the regions 16 at which the two pieces join each other. If the container is to be air tight, a suitable seal is provided at the regions at which the cover pieces join.

As an alternative to having recesses formed in the tops of the end pieces to receive the feet of a further similar container to aid stacking, a locating tray may be provided. Figure 12 shows a locating tray 50 and a bobbin according to a second alternative embodiment of a container according to the invention (the rest of the container may be similar to that described with reference to the embodiments illustrated in Figures 1 to 11). The locating tray 50 has recesses 51 formed in its lower surface 52 to receive, as an interference or friction fit, the tops 118 of the end pieces 103a, 103b of the bobbin. The upper surface 53 of the locating tray 50 has recesses 54 for receiving the feet of a further similar container. The side walls 55a, 55b of the upper surface 53 are inclined to the vertical to aid the correct location of the feet of the further similar container to be placed on top of the container. Although it is not shown in the schematic drawing of Figure 12, the lower surface 52 of the locating tray 50 may also be inclined to the vertical to aid location of the locating tray on top of the container.

The bobbins described above with reference to Figures 1 to 12 can be used independently of their

covers and indeed need not be arranged to have covers, especially when it is unlikely that the goods to be arranged thereon will suffer from chemical damage.

Figure 13 shows a bobbin 201 of a container according to a third embodiment of the invention. The bobbin 201 may support a coil of, for example, a sheet of coated steel for use in the manufacture of domestic appliances, for example, enamelled steel (a coil is not shown in Figure 13). The bobbin 201 comprises a cylindrical member 202, on which the sheet steel may be wound, and two end pieces 203a, 203b. The cylindrical member 202 and end pieces 203 are manufactured as separate pieces and are assembled to form the bobbin 201 as and when required. Each of the end pieces is in the shape of an octagon.

The sheet steel with which the bobbin 201 of Figure 13 is used has a width of about 1.4m, that therefore being equal to the length of the wound coil. The cylindrical member 202, which is necessarily of greater length, has a length of about 1.6m. The internal diameter of the coil of sheet steel is preferred to be about 0.61m and therefore the diameter of the cylindrical member is about 0.61m. Coils are commonly manufactured and supplied in standard sizes. Two commonly supplied sizes of steel coil are coils with an exterior diameter of about 1.0m and coils with an exterior diameter of about 1.4m. The bobbin 202, which can be used with coils of either of those two sizes, therefore has end pieces with a minimum diameter of greater than 1.4m.

Since the larger sized coils (with an exterior diameter of about 1.4m) have a mass of about 15 tonnes, the bobbin 201 is relatively massive owing to the amount of material required so that the bobbin is sufficiently strong to sustain the large forces involved. It is likely that either or both of the cylindrical member and the end parts of the bobbin, will each be too massive for them to be manipulated manually. Suitable load

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handling equipment is therefore employed to manoeuvre the cylindrical member and the end pieces.

In production sheet steel manufactured in a conventional manner is, as the final stage of manufacture, fed onto the cylindrical member 202 to form a coil. The cylindrical member 202 is mounted on a mandrel so that it may rotate as the sheet metal is fed onto it. As in a conventional process, guides (not shown in the Figures) may be so placed in relation to the cylindrical member 202 that the sheet steel winds around the cylindrical member and back onto itself to form a coil (not shown in Figure 13). Once the sheet steel has been coiled on the cylindrical member 202, the outer layer of the coil is secured in a conventional manner, to prevent the coil from unwinding. The loaded cylindrical member 202 is then removed from the mandrel with suitable load handling equipment and the end pieces 203a, 203b are secured, one at each end, to the cylindrical member to form the bobbin 201.

If the use of the bobbin were to be limited to coils of the smaller size (exterior diameter of 1.0m) only, it would of course be possible to use a bobbin with end pieces with a minimum diameter of greater than 1.0m.

Figure 14 shows a cross-sectional view of an end piece 303b (parts of the end piece 303b have been omitted for the sake of clarity) of a bobbin of a container according to a fourth embodiment of the invention. The bobbin is similar in shape to the shape of the bobbin shown in Figure 13. The configuration of reinforcement shown in Figure 14 could be incorporated into the bobbin shown in Figure 13. Two vertical beams 321 extend from the top 318 of the end piece 303b to the bottom 320 of the end piece. An inner ring shaped supporting member 356 extends around the circumference of the central opening 323 in the end piece 303b. The inner ring shaped supporting member is formed from six straight beams 356a. Eight circumferential beams 324 extend around the

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periphery of the end piece. Four radial beams 322 extend between respective beams 356a and respective junctions of the beams 324 with the beams 321. The top and bottom circumferential beams 324a, 324b each extend between a pair of radial beams 322 and also between the vertical beams 321. All the beams are standard sections (for example, hollow square section or I section) of a suitable metal, for example aluminium or stainless steel and are welded together. The end piece 303b comprises the reinforcing structure shown in Figure 14, a panel with a central aperture, welded to the side of the reinforcing structure that in the assembled bobbin would be the inner side, and a central support ring (not shown) welded to the end piece on the side opposite to the panel. The inner diameter of the support ring is such that it is able to be fitted over the end of the core member. An outwardly facing abutment surface is provided on the core member (formed for example by a circumferential flange on the core member) and bolts (not shown) put through the end piece and into threaded holes in the abutment surface to releasably secure the end piece to the core member.

Figures 15a to 19 show various aspects of a fifth embodiment of a container according to the invention. The container according to the fifth embodiment comprises a bobbin having a cylindrical member, on which sheet metal may be wound, two end pieces and a rigid cover formed from two cover pieces.

Figure 15a shows a view of an end piece 403b of a bobbin of a container according to the fifth embodiment (the cylindrical member of the bobbin and parts of the end piece 403b have been omitted for the sake of clarity).

Figure 15b shows one of the two rigid cover pieces in perspective. The cover piece 415 differs from that shown in Figure 11 in that it is provided with two side walls 457 (only one of which can be seen in Figure 15b)

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each defining a semi-circular recess for accommodating the cylindrical member. Once the sheet metal has been coiled on the cylindrical member of the bobbin, each of the two cover pieces 415 are arranged on the bobbin.

5 Each cover piece is provided with suitable means (not shown), such as a clasping means, for joining the two cover pieces.

The semi-circular edge 458 of the part of the wall 457, shown in Figure 15b, that defines the semi-
10 circular recess, sealingly engages with the periphery of the cylindrical member. The semi-circular edge at the opposite end of the cover piece 415 and the semi-circular edges of the other cover piece also sealingly engage with the cylindrical member. The cover piece 415 sealingly
15 engages at the regions 416 at which it joins the other cover piece. Thus the coil is contained in an airtight environment.

The end piece 403b shown in Figure 15a differs from those shown in the other Figures in that it is not
20 provided with any panels, over or between the beams of the end piece. In the other embodiments the end pieces are provided with panels so that, in use, a coil on the bobbin may be protected from physical damage from foreign objects that might otherwise be able to pass between the
25 beams of the end piece and so that the container formed when the cover is in place may be airtight. The cover of the fifth embodiment may form a closed container with only the cylindrical member. There is therefore no need to provide panels in the end pieces of the container
30 according to the fifth embodiment.

The end piece has a central flanged member 460 provided with a cylindrical flange 459 that defines a central opening 423 which accommodates the end of the cylindrical member (not shown) of the bobbin. The
35 flanged member 460 is provided with eight bolt holes 461 so that the end piece 403b may be bolted to (and unbolted from) the cylindrical member, which is provided with a

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flange having similarly configured bolt holes. The flange of the cylindrical member abuts with the rear surface (as shown in Figure 15a) of the central flanged member 460.

5 The end piece 403b comprises two vertical beams 421 that are provided to give the bobbin its structural strength, necessary to facilitate stacking of loaded containers. Six radial beams 422 extend from the cylindrical flange 459.

10 Arcuate circumferential beams 424 extend around the periphery of the end pieces along the line of a notional circle. All the beams are tubular and annular in cross-section.

 Figures 16a, 17a and 18a show various components that facilitate the stacking of a container according to the fifth embodiment (the corresponding plan views being shown by Figures 16b, 17b and 18b). Figure 16a shows a steel lower end insert 462 that is fitted into the hollow end of the bottom 420a of the left-hand (as shown in Figure 15a) vertical beam 421. Another similar insert is fitted into the bottom 420b of the right-hand vertical beam 421 of the end piece 403b and two further similar inserts are fitted into the vertical beams of the other end piece of the bobbin. Similarly, four steel upper end inserts 463 (see Figures 17a and 17b) are fitted into the tops 418a, 418b of the four vertical beams 421 of the two end pieces. Each lower end insert 462 receives a nylon foot 464. A screw-threaded boss 465 is provided on the lower end insert 462 which enables the nylon foot 464 that is provided with an appropriately threaded recess 466 to be screwed onto the lower end insert 462 (the screw threads are not shown in Figures 16a and 18a). The nylon foot 464 is provided with two further cylindrical recesses 467 (hidden from view in Figure 18b) to enable it to be rotated with a suitably shaped tool (not illustrated). The bobbins once assembled and fitted with the inserts 462, 463 and 464 can then be easily

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stacked one on top of another. Each upper end insert 463 has a recess defined by a frustoconically shaped sloping surface 468 that aids the correct location of each nylon foot 464 in each recess of each respective upper end

5 insert 463.

Figure 19 shows in cross-section how the components of Figures 16a, 17a and 18a engage with each other when one bobbin is stacked on top of another.

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CLAIMS:

1. A method of containing sheet metal with a mass greater than two tonnes, the method comprising the steps of

5 providing a bobbin assembly comprising a core member and two end pieces,

providing sheet metal with a mass of greater than two tonnes,

winding the sheet metal in a coil around the core member and

10 assembling the bobbin by securing each of the end pieces to opposite ends of the core member.

2. A method according to claim 1 further comprising the steps of

15 providing a cover for covering the bobbin to form a closed container, and

after the step of winding the sheet metal in a coil around the core member, covering the bobbin with the cover, thereby forming a closed container for the coil of sheet metal.

3. A method according to claim 1 or claim 2, wherein the metal is a high value metal.

4. A method according to claim 3, wherein the metal is any one selected from the group comprising high quality steel, tin-plate, aluminium, copper, titanium and alloys thereof.

5. A method according to claim 2 or claim 3 or 4 when dependent on claim 2, wherein the bobbin and the cover are sealingly engagable and the step of covering the bobbin with the cover forms an air-tight container.

6. A method according to claim 5, wherein the method further comprises the step of removing substantially all of the gaseous oxygen in the container.

7. A method according to claim 5 or claim 6, wherein the method further comprises the step of purging the container with a gas.

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8. A method as claimed in any one of the preceding claims, wherein the method further comprises the step of stacking the container on top of another container, the longitudinal axes of the two containers being horizontal.

5 9. A method as claimed in any one of the preceding claims, wherein the core member of the bobbin comprises a cylindrical member extending between the two end pieces and is provided with securing means slidably mounted on the cylindrical member and the method further comprises
10 the step of securing the securing means on the cylindrical member at a position intermediate the coil and the end piece, thereby restricting axial movement of the coil along the cylindrical member.

15 10. A method as claimed in any one of the preceding claims, wherein the bobbin has an opening in at least one of its ends for receiving a first shaft of a given diameter and the method further comprises securing a hollow sleeve in the opening to allow the bobbin to be mounted on a second shaft with a smaller diameter than
20 that of the first shaft.

11. A container containing a coil of sheet metal having a mass greater than two tonnes, the container including a bobbin comprising

25 a core member and two end pieces, each end piece being located at a respective end of the core member, and

the coil of sheet metal being arranged on the core member.

30 12. A container suitable for containing a coil of sheet metal having a mass greater than two tonnes, the container including

a bobbin around which a coil of sheet metal can be arranged, the bobbin comprising a core member and two end pieces, and

35 the volume of the notional cylindrical surface that envelopes the two end pieces being greater than one cubic metre.

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13. A container according to claim 11 or claim 12, wherein the end pieces support the weight of the bobbin when a coil is arranged on the core member.

14. A container according to any one of claims 11 to 5 13, wherein at least one of the end pieces has a central aperture.

15. A container according to claim 11, wherein the bobbin and coil are so shaped that they cannot be placed on a flat surface in such a way that the coil contacts 10 the surface.

16. A container according to any one of claims 11 to 15, wherein the container includes a cover, which is able to cover the bobbin, thereby forming a closed container.

17. A container according to claim 16, wherein the cover 15 is able to sealingly engage the bobbin to form an air-tight seal, thereby forming an air-tight container.

18. A container according to claim 16 or claim 17, wherein the cover is substantially flexible.

19. A container according to claim 18, wherein the cover 20 is substantially of one piece construction.

20. A container according to any one of claims 16 to 19, wherein the two end pieces and cover are so shaped that when the bobbin is covered with the cover, the container can not be placed on a flat surface so that the cover is 25 in contact with that surface.

21. A container according to claim 20, wherein each end piece has a recess for accommodating the cover.

22. A container according to any one of claims 16 to 21, wherein each end piece has an endless groove formed 30 around its periphery for receiving an endless rib formed on the cover.

23. A container according to any one of claims 11 to 22, wherein an end piece includes a substantially plate-like part which extends radially inwardly from the periphery 35 of the end piece and a plurality of reinforcing beams which extend over a face of the plate-like part.

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24. A container according to any one of claims 11 to 23, wherein each end piece has

a bottom portion, so arranged as to enable the container to be placed on a flat surface with each bottom portion contacting the flat surface, and

a top portion, so arranged as to enable a further similar container to be stacked on top of the container.

25. A container according to any one of claims 11 to 24, wherein the end pieces are reinforced, to enable a weight of 10kN to be supported by each end piece.

26. A container according to claim 25 when dependent on claim 24, wherein each end piece comprises a first plurality of load supporting members that extend from the bottom portion to the top portion.

27. A container according to claim 26, wherein a further load supporting member extends between a pair of the first plurality of load supporting members.

28. A container according to claim 26 or claim 27, wherein the first plurality of load supporting members are substantially vertical when the container is placed with the bottom portion on a flat horizontal surface.

29. A container according to any one of claims 25 to 28, wherein each end piece comprises a multiplicity of circumferential load supporting members that extend substantially circumferentially around the periphery of the end piece.

30. A container according to any one of claims 25 to 29 when dependent on claim 14, wherein the central aperture of an end piece is reinforced with an inner circumferential load supporting member that extends substantially circumferentially around the central aperture.

31. A container according to any one of claims 25 to 30, wherein each end piece comprises a multiplicity of radial load supporting members that extend radially from the periphery of the end piece towards the centre of the end piece.

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32. A container according to claim 31, wherein a transverse load supporting member extends between each of a plurality of pairs of adjacent radial load supporting members.

5 33. A container according to claim 24 or any one of claims 25 to 32 when dependent on claim 24, wherein either the top portion or bottom portion comprises a recess that is able to receive a part of either the bottom portion or top portion, respectively, of a further
10 similar container.

34. A container according to claim 33, wherein the recess is at least partly defined by surfaces inclined to the vertical.

35. A container according to claim 34 or claim 33,
15 wherein the part of the portion that is receivable by the recess is a foot which is at least partly defined by surfaces inclined to the vertical.

36. A container according to any one of claims 32 to 35,
20 wherein the recess is surrounded by the portion in which it is provided.

37. A container according to claim 24 or any one of claims 25 to 32 when dependent on claim 24, and a locating means, wherein the locating means has an upper surface and a lower surface, the lower surface being so
25 shaped that it is able to receive the top portion of the end piece and the upper surface being so shaped that it is able to receive the bottom portion of a further similar container.

38. A container and a locating means according to claim
30 37, wherein the locating means is of one-piece construction and a single locating means is sufficient to enable a further similar container to be stacked on top of the container.

39. A container according to any one of claims 11 to 38,
35 wherein the core member comprises a cylindrical member and the container further comprises a securing means slidably mounted on the cylindrical member for

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restricting axial movement of the coil along the cylindrical member.

40. A container according to claim 39, wherein the securing means comprises clamping means for securing the
5 securing means at any one of a multiplicity of positions along the cylindrical member.

41. A container according to claim 39 or claim 40, wherein the securing means comprises at least two securing members, wherein each securing member has a
10 portion that is engagable with the cylindrical member, and the securing members are movable from a position in which they engage the cylindrical member to a position in which the securing means is able to slide freely along the cylindrical member.

15 42. A container according to claim 41, wherein the securing members are movable to a position that allows the securing means to be removed from the cylindrical member.

43. A container according to claim 41 or claim 42,
20 wherein a pair of the securing members are pivotally connected to each other.

44. A container according to claim 43 when dependent on claim 40, wherein the clamping means comprises a lever pivotally mounted on a first securing member and movable
25 to urge the first securing member towards a second securing member.

45. A container according to claim 44, wherein the clamping means is an over-centre fastening mechanism.

46. A container according to any one of claims 41 to 45,
30 wherein each securing member comprises two parallel spaced apart walls that are fixed in relation to each other by members extending between the walls.

47. A container according to claim 17 or any one of claims 18 to 46 when dependent on claim 17, wherein a
35 valve means is provided in the container.

48. A container according to any one of claims 11 to 47, wherein the bobbin is made wholly or partly from any one

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of the group of materials including steel, aluminium and plastic.

49. A container according to claim 13 or any one of claims 14 to 48 when dependent on claim 13, wherein

5 the bobbin and coil are so shaped that they cannot be placed on a flat surface in such a way that the coil contacts the surface, and

10 the end pieces are so shaped that the bobbin and coil may be placed on a flat surface with both end pieces in contact with the flat surface and with the bobbin resisting rotational movement about its axis.

50. A container according to claim 49, wherein each of the end pieces has at least one flat surface.

15 51. A container according to claim 49 or claim 50, wherein the end pieces have a cross-sectional shape of a polygon.

52. A container according to any one of claims 11 to 51, wherein the bobbin has an opening at each of its opposite ends.

20 53. An assembly comprising a container as claimed in claim 52 and a hollow sleeve, wherein each opening is so shaped to receive a first shaft of a given diameter, the exterior diameter of the hollow sleeve is such that it fits into the opening, and the interior diameter of the sleeve is such that it enables the bobbin to be mounted
25 on a second shaft of smaller diameter than that of the first shaft.

30 54. An assembly according to claim 53, wherein the assembly comprises fixing means for removably fixing the sleeve in the opening.

55. An assembly according to claim 54, wherein the fixing means passes through a bore in the sleeve and into the bobbin.

35 56. An assembly according to any one of claims 53 to 55, wherein the assembly comprises a further hollow sleeve, the exterior diameter of the further hollow sleeve being such that it fits into the interior of the hollow sleeve

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that fits into the opening of the bobbin, and the interior diameter of the further hollow sleeve is such that it enables the bobbin to be mounted on a third shaft of smaller diameter than that of the second shaft.

5 57. A method of manufacturing a coil of sheet metal, the method including the steps of manufacturing the sheet metal and feeding the sheet metal onto the core member of the bobbin of a container as claimed in one of claims 11 to 52.

10 58. A method according to claim 57, wherein the method further comprises the steps of covering the bobbin with a cover, thereby forming a closed container, and transporting the container from the place of manufacture to a factory at which sheet metal is processed further.

15 59. A method according to claim 58, wherein the method further comprises the steps of removing the cover from the bobbin, removing the sheet metal from the bobbin, and processing the removed sheet metal.

20 60. A method according to claim 59, wherein the method further comprises the step of returning the bobbin and cover to the place of manufacture for reuse.

61. A method of containing sheet metal, the method comprising the steps of

25 providing a bobbin comprising a core member and two end pieces, and a cover for covering the bobbin to form a closed container,

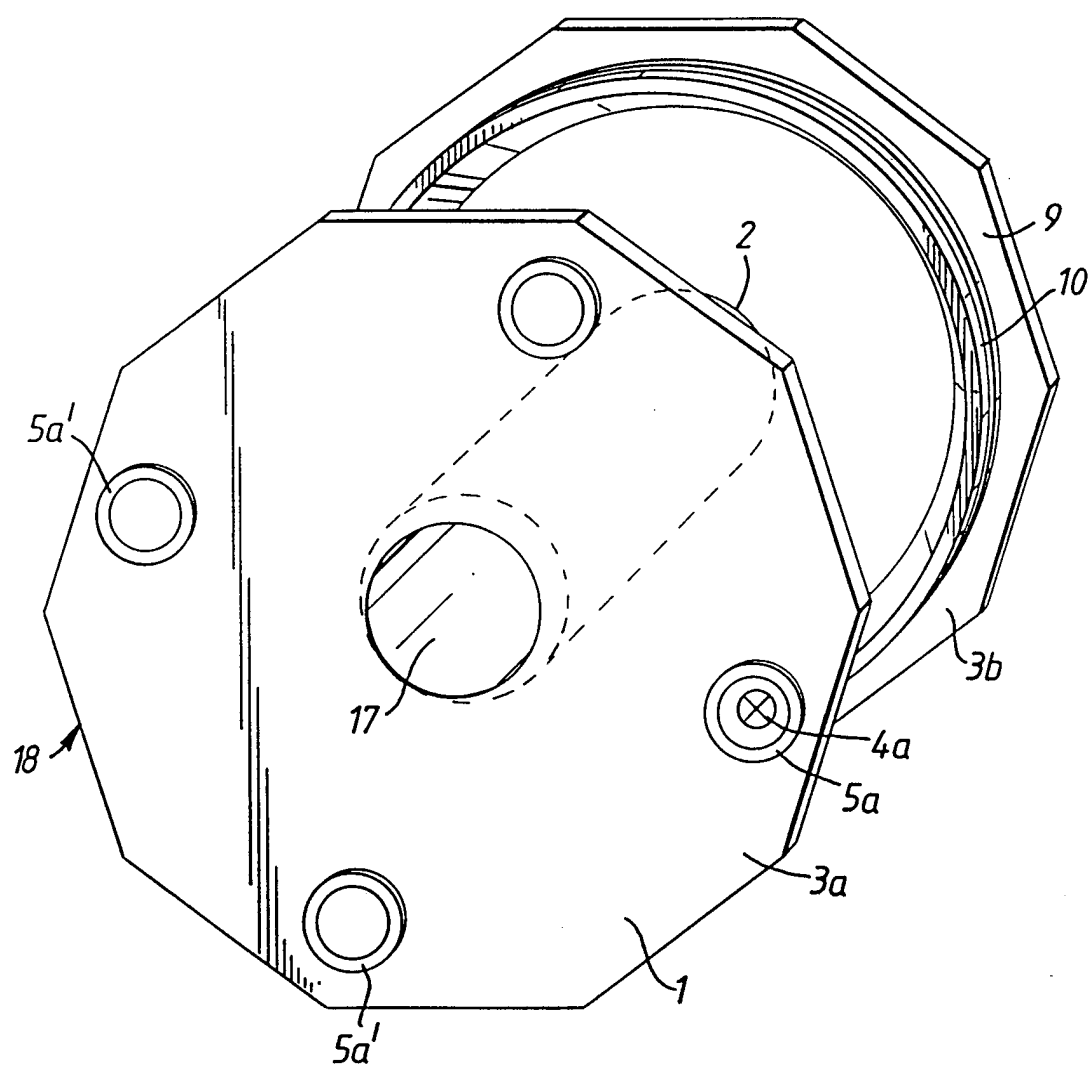
winding the sheet metal in a coil around the core member and

30 covering the bobbin with the cover, thereby forming a closed container for the coil of sheet metal.

62. A container for a coil of sheet metal, the container including

35 a bobbin around which the coil of sheet metal can be arranged, the bobbin comprising a core member and two end pieces, and

a cover, which is able to cover the bobbin, thereby forming a closed container.

*Fig.1*

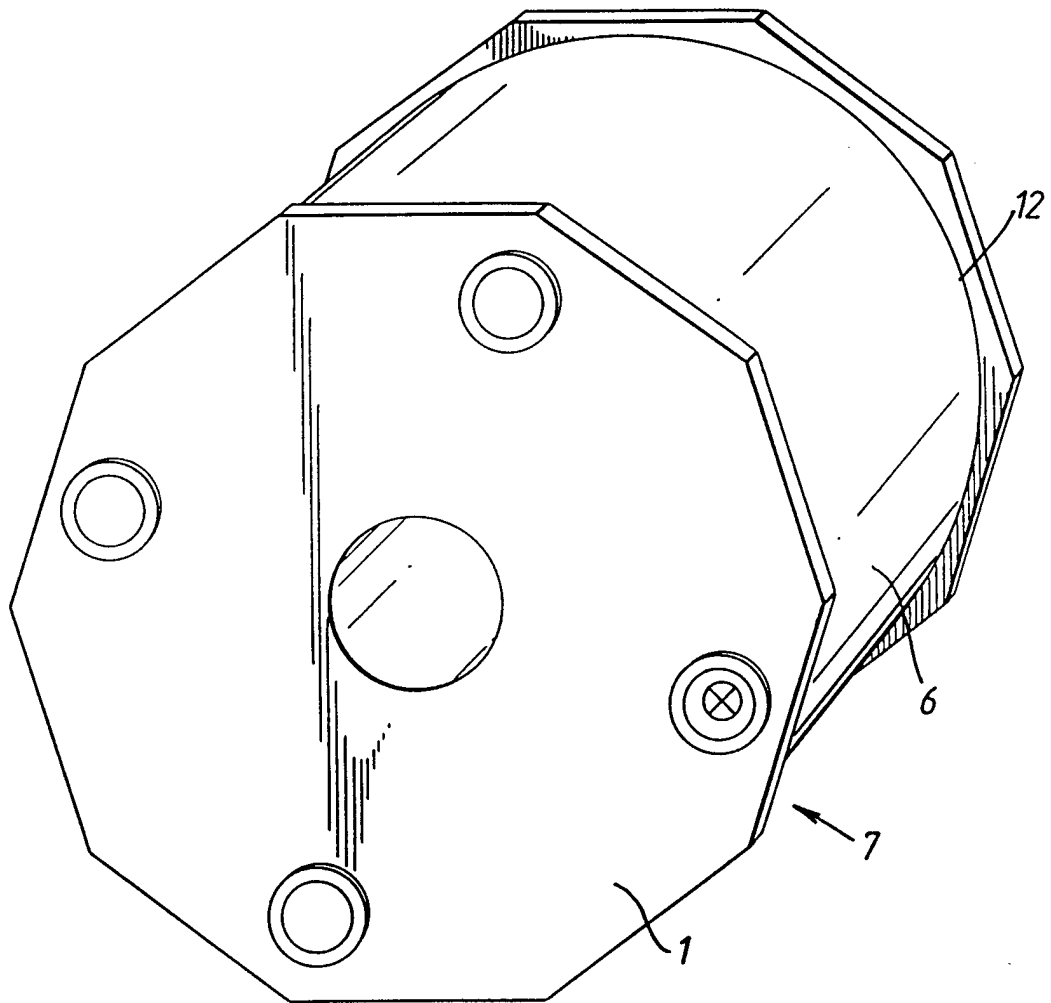


Fig.2

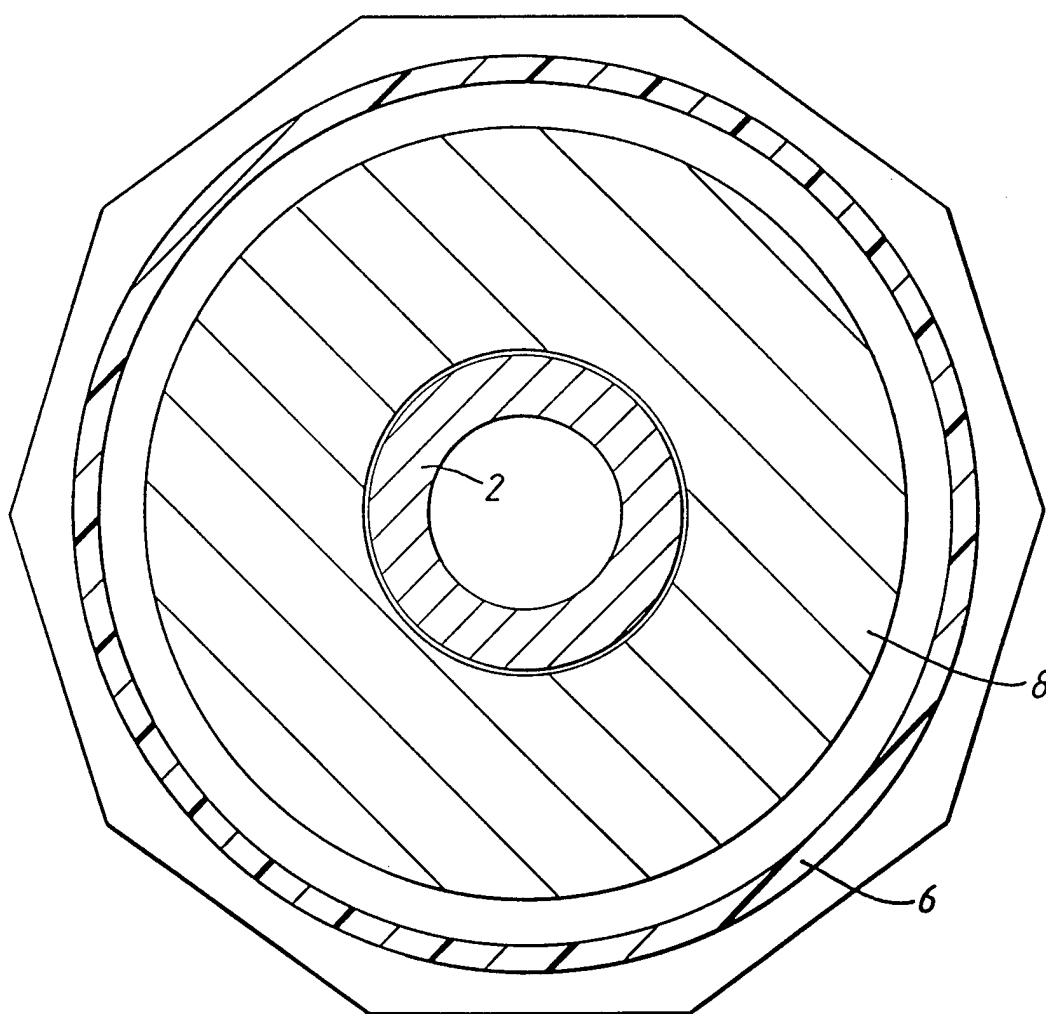


Fig.3

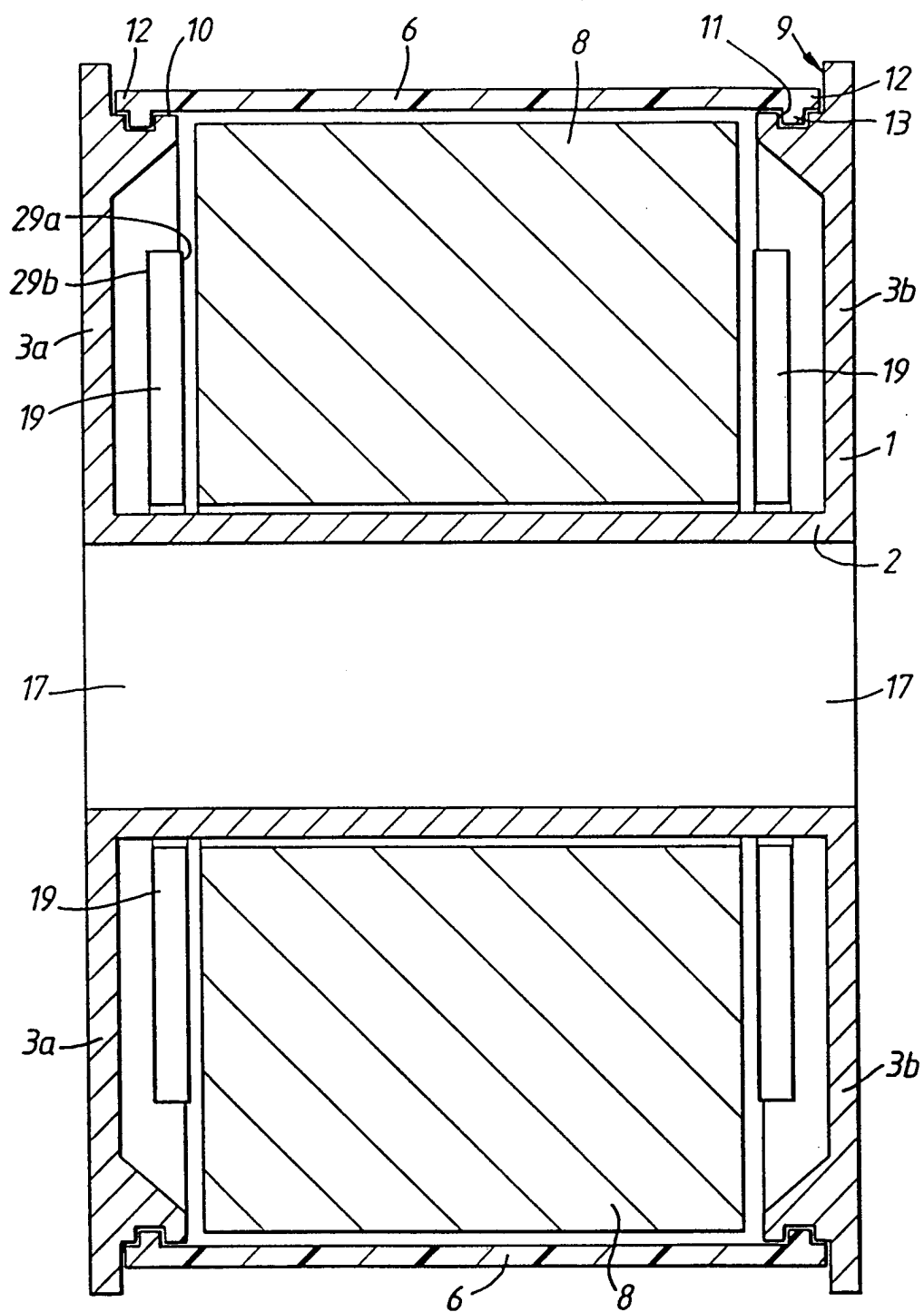
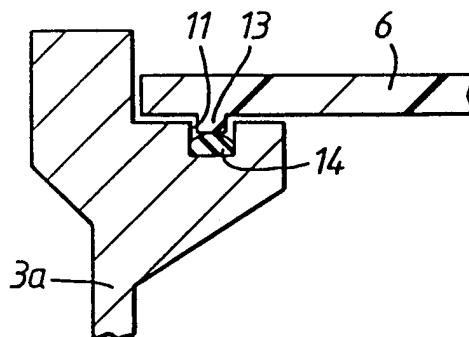
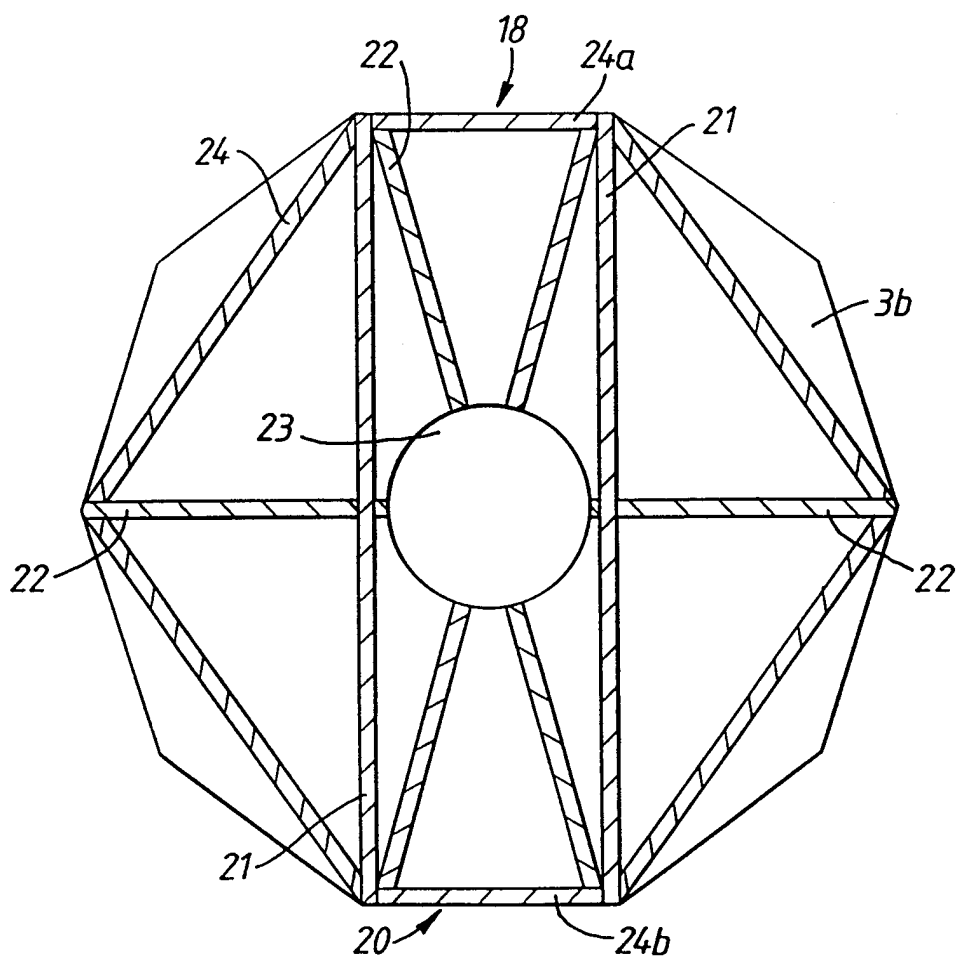
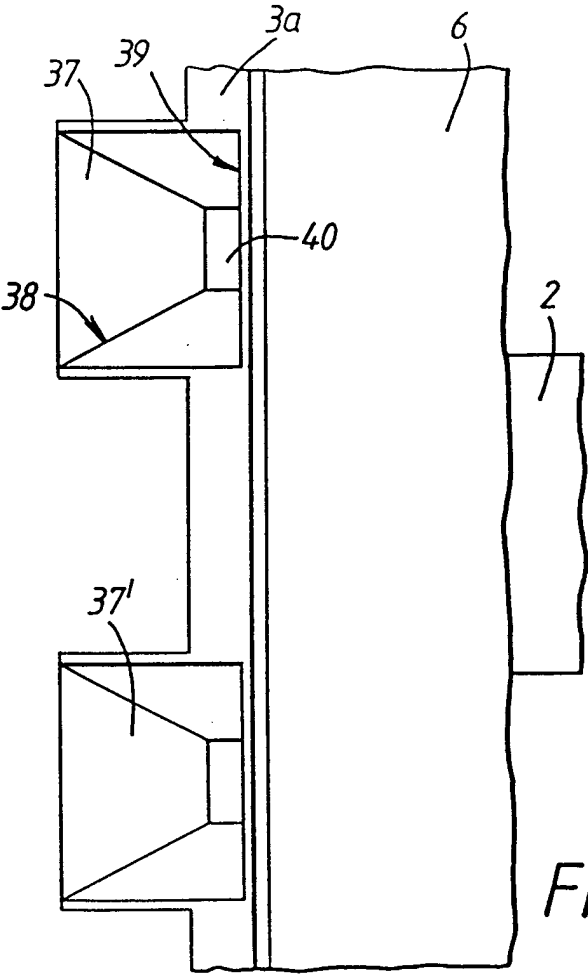
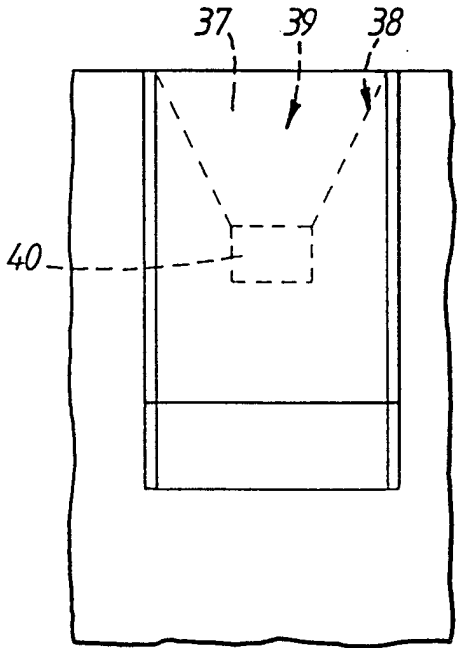
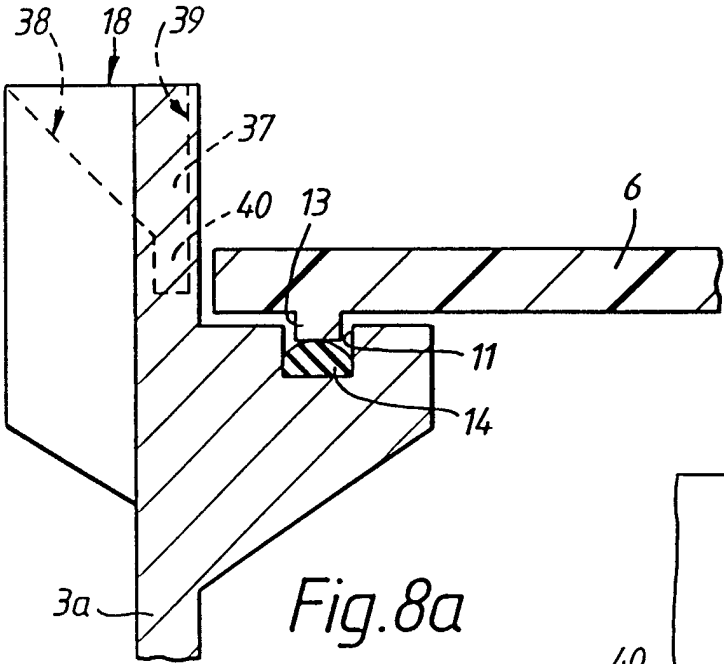


Fig.4

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*Fig. 5**Fig. 6*



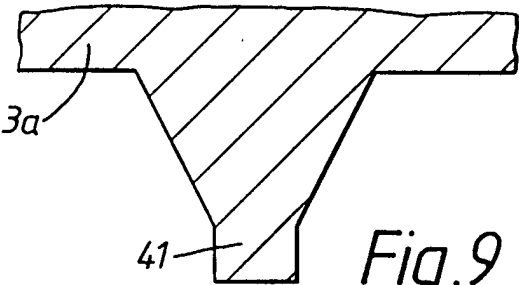


Fig.9

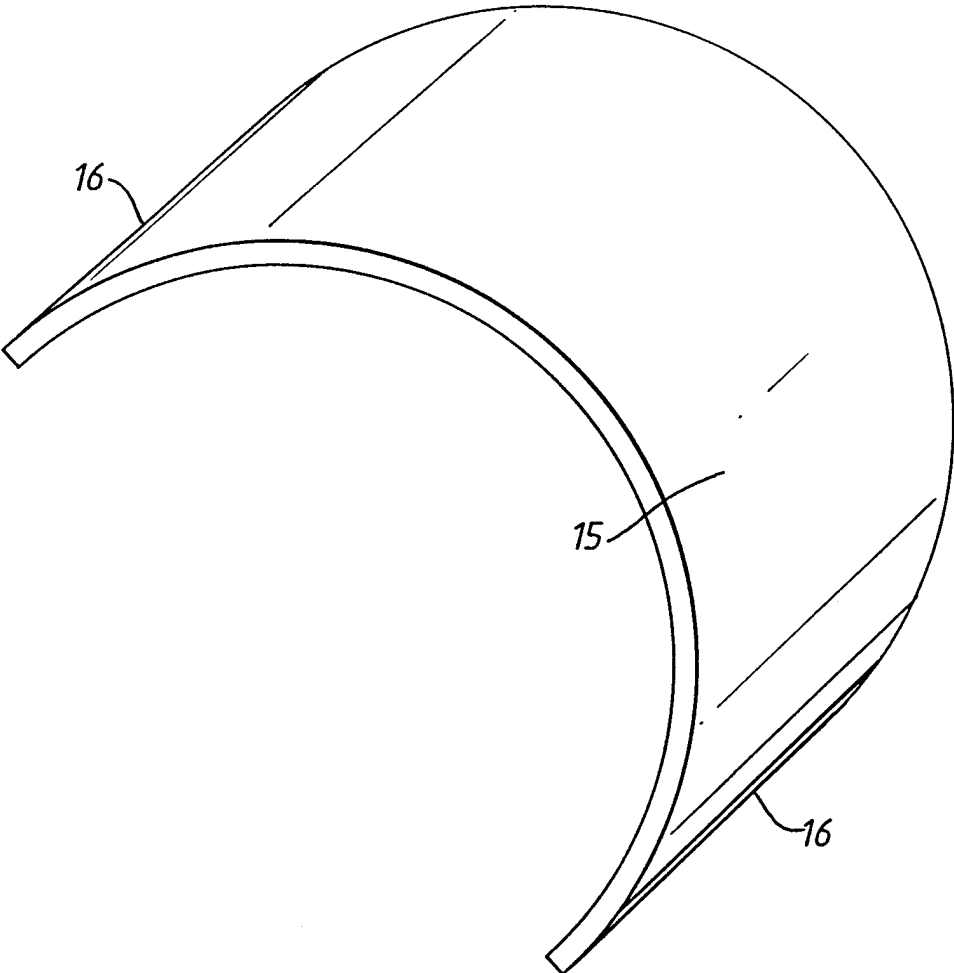


Fig.11

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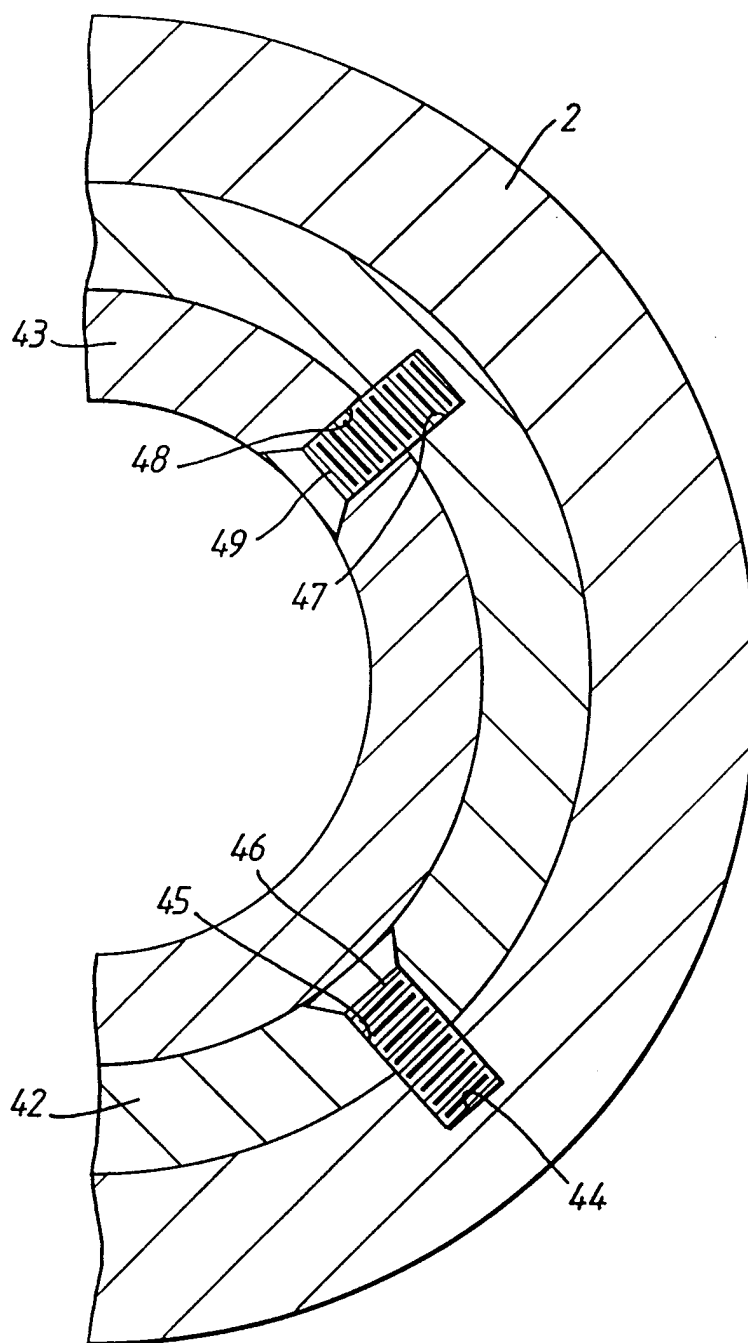


Fig.10

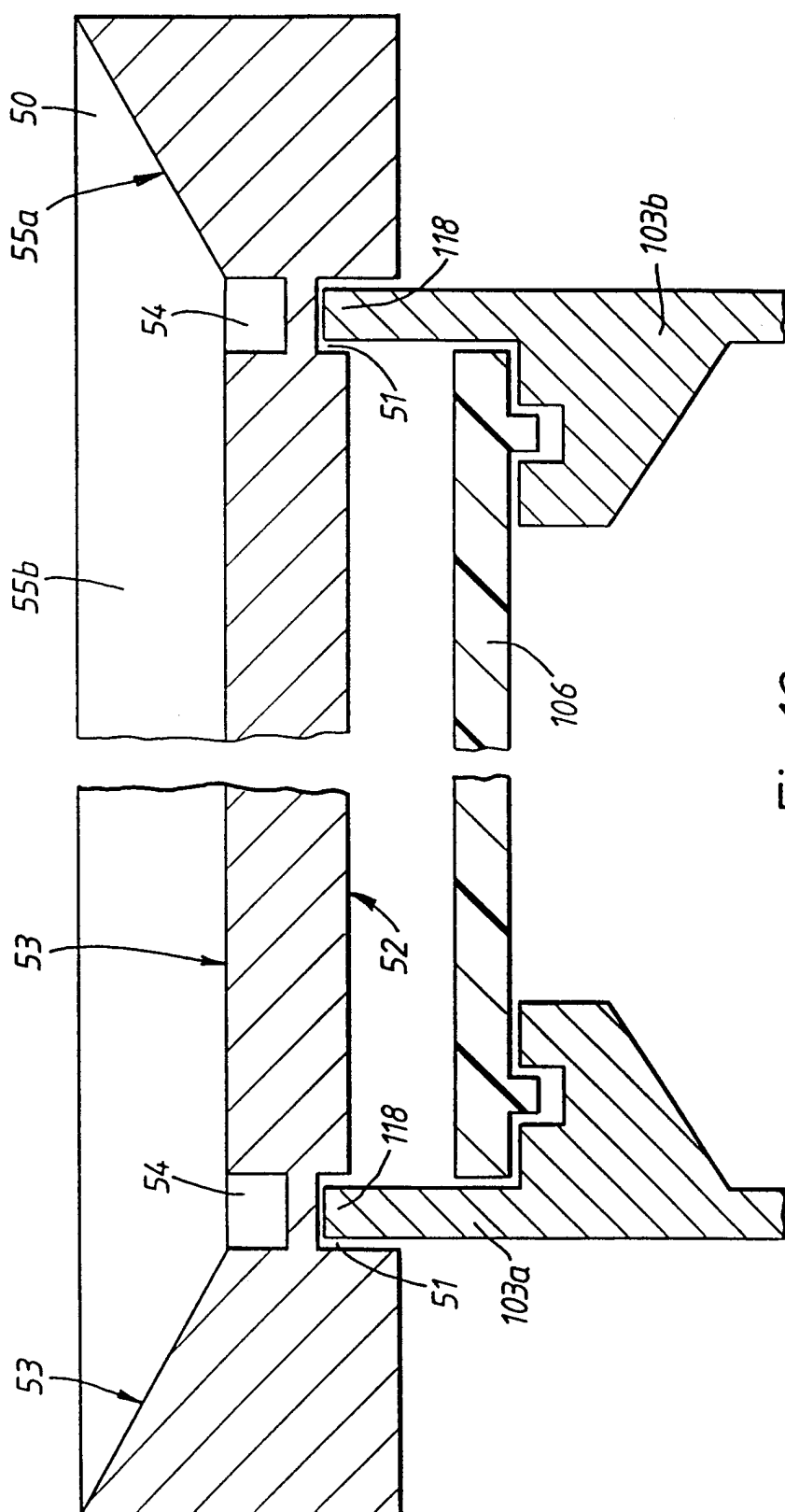
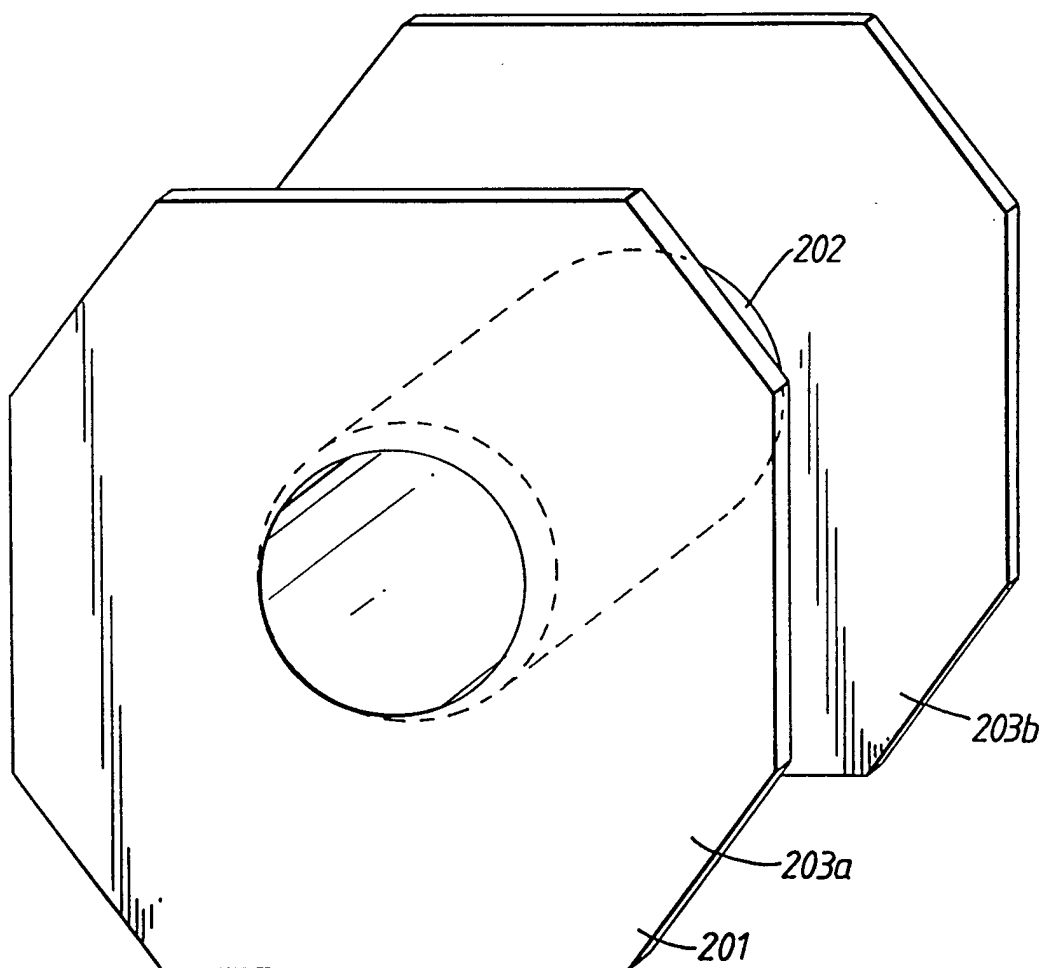
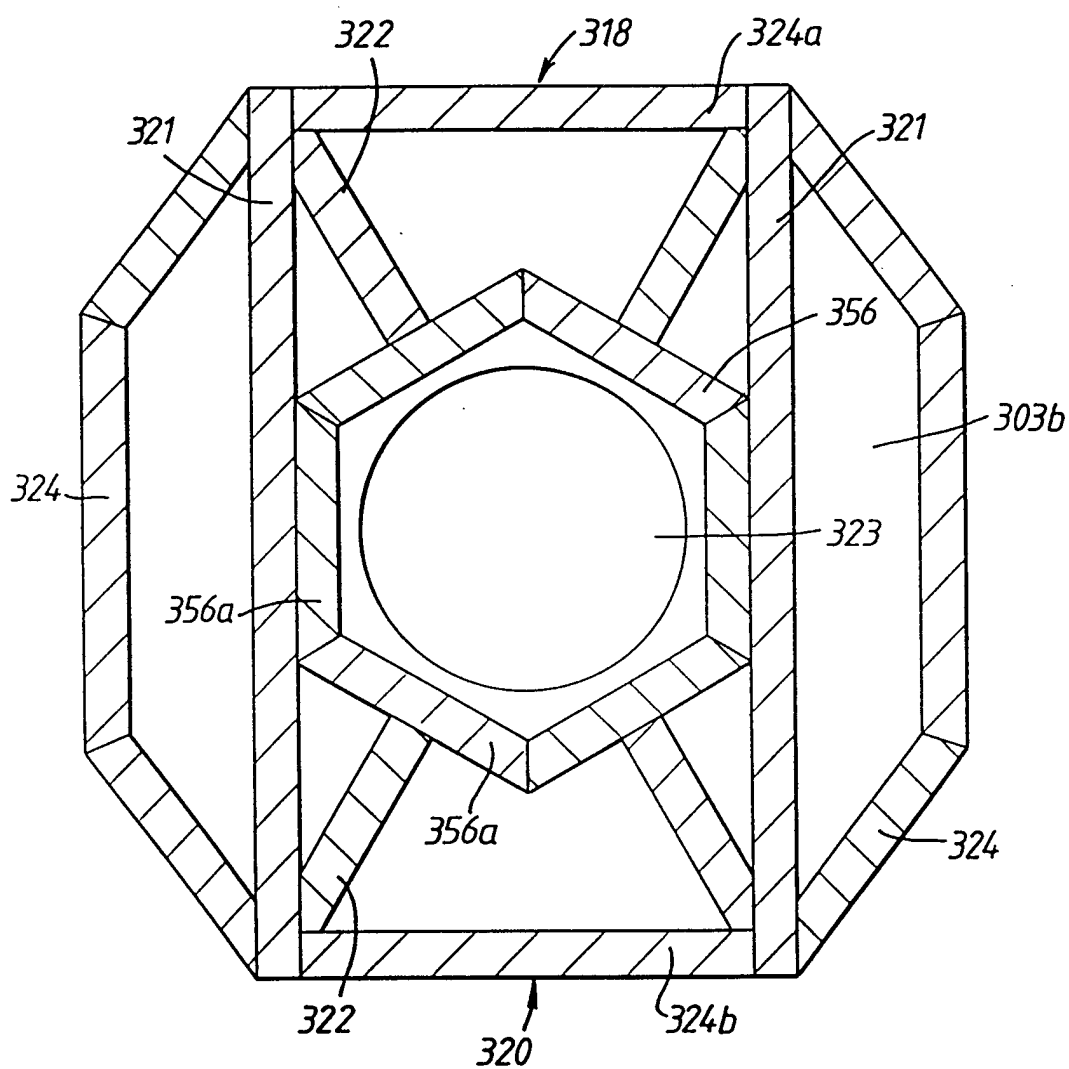


Fig.12

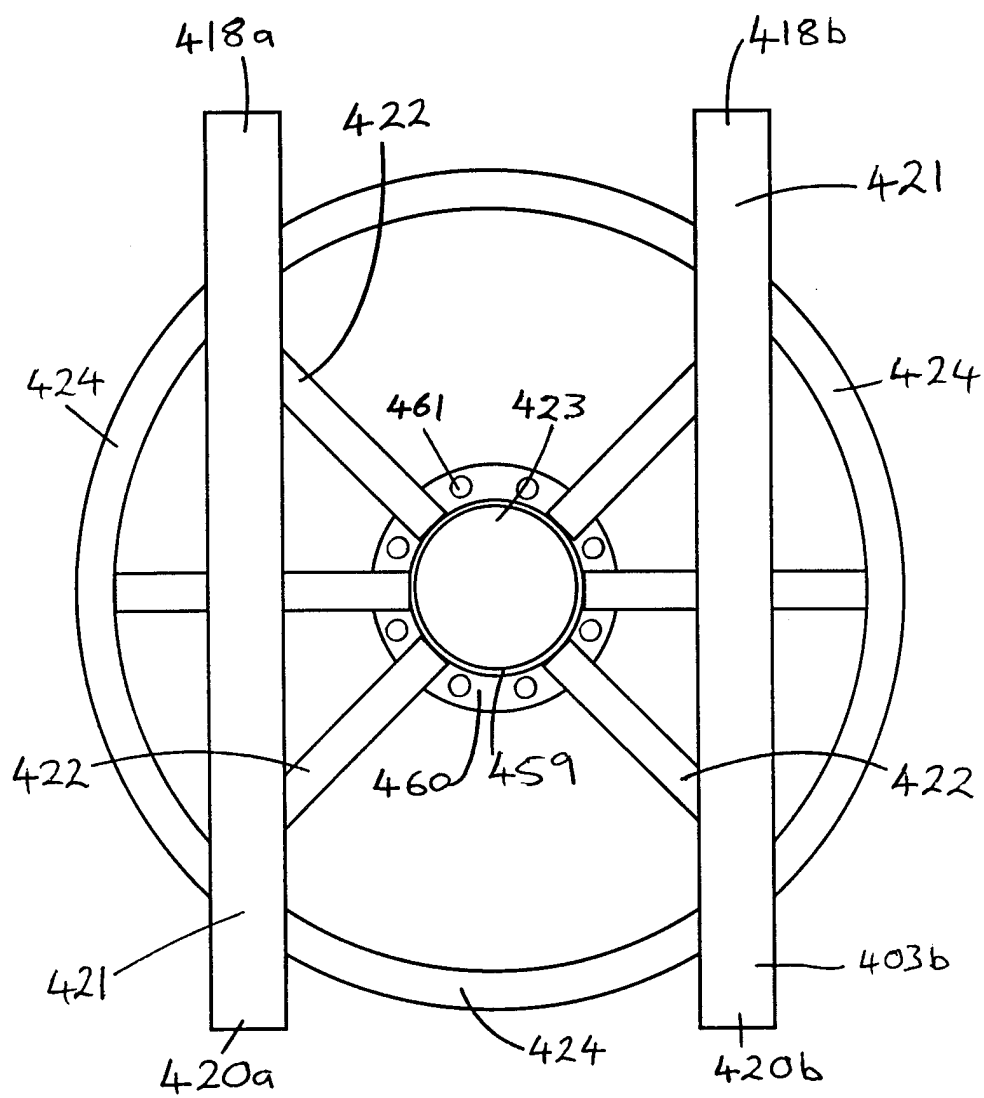
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*Fig.13*

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*Fig.14*

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*Fig. 15a*

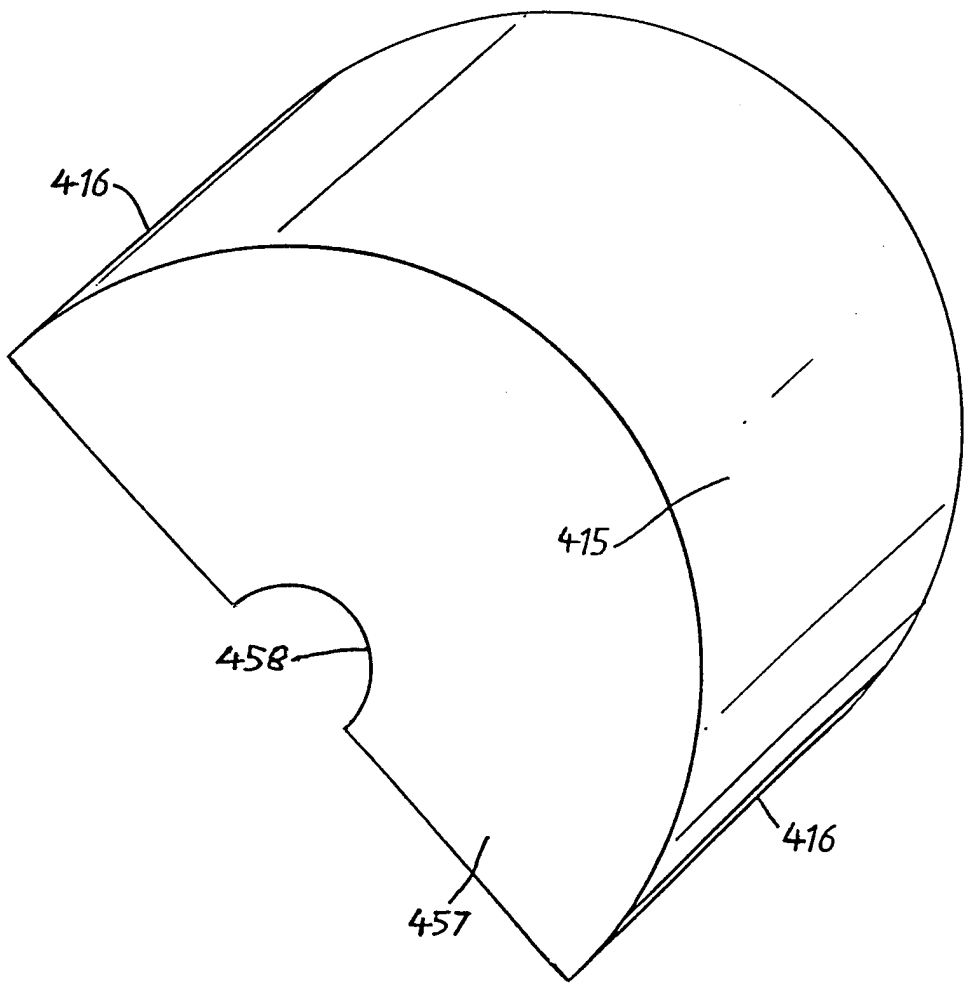


Fig. 15b

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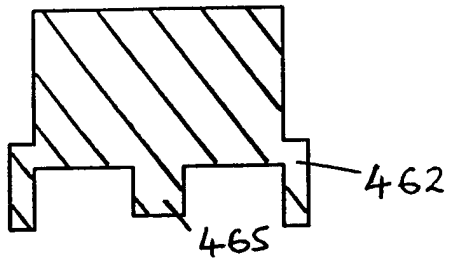


Fig. 16a

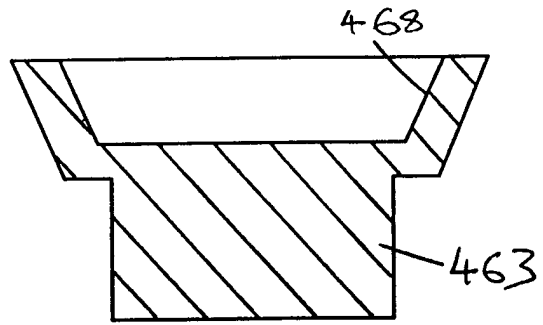


Fig. 17a

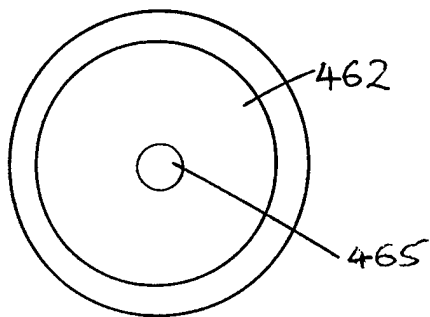


Fig. 16b

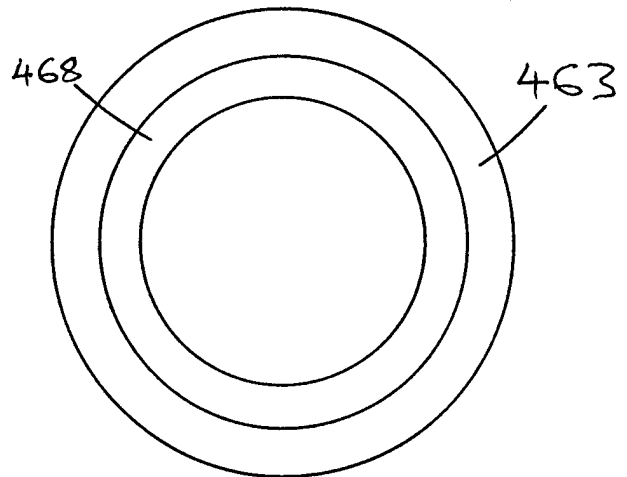


Fig. 17b

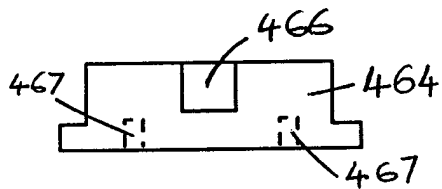


Fig. 18a

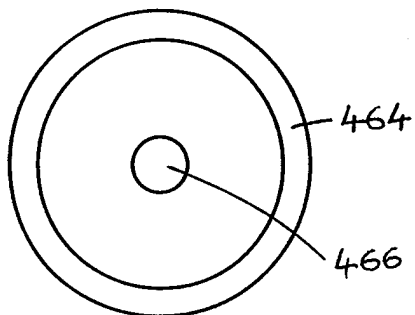


Fig. 18b

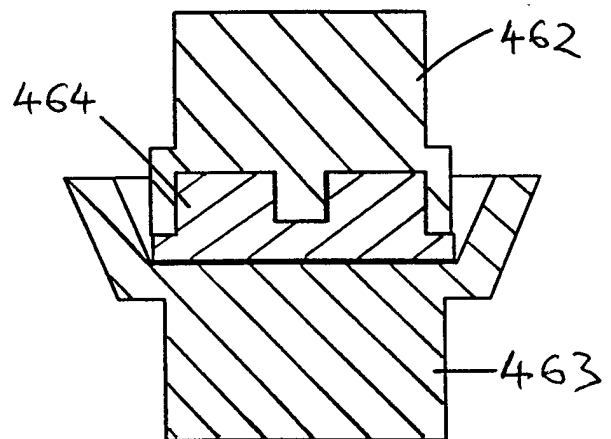


Fig. 19

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 98/00765

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B21C47/28 B65H75/14 B65D85/672 B65D81/20

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)

IPC 6 B21C B65H B65D

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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 138 449 A (LECONTE HENRI) 5 January 1973	1, 3, 4, 12-15, 48, 49, 57
Y	see page 6, line 30 - line 36 see page 7, line 40 - page 8, line 7; figures ---	2, 5, 58-62
X	GB 1 100 126 A (ACHENBACH SOHNE GMBH) 24 January 1968	1, 3, 4, 8, 12-15, 24, 25, 31, 33-38, 48-51, 57
A	see page 2, line 29 - line 84; figures --- -/--	23



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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"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

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Date of the actual completion of the international search

17 June 1998

Date of mailing of the international search report

02/07/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Barrow, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/00765

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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