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(54) Welding wire container and method of making the same

(57) A container (10) for packaging and unwinding a welding wire (170) having a natural cast that is essentially a straight line. The container (10) including a box (12) with vertical side walls each having an inner wall surface and vertically extending corners between the side walls, a closed bottom, a top opening for removing the welding wire (170). The container (10) further including a first vertically extending cylindrical liner (14) with a first radial outwardly facing surface (120) and a first radial inwardly facing surface (122) wherein the first inward surface (122) has a diameter A and is coaxial with a vertically extending container axis (32) such that the first liner (14) is supported by the side walls. The container (10) further includes a second cylindrical liner (16) having a second radial outwardly facing surface (150) and a second radial inwardly facing surface (152). The second outward surface (150) having a diameter B that is less than diameter A and is coaxial with the axis (32). The second outward surface (150) defining a radial inward extent of an annular wire cavity and the first inward surface (122) defines a radial outward extent of the annular wire cavity. The container (10) also including a wire coil made up of a plurality of convolutions of the wire (170). Each of the convolutions having a similar effective convolution diameter that is greater than fifty percent of diameter A but less than diameter A. The natural cast producing a radially outward force in the each convolution that is supported by the first liner (14) and the coil extending radially between the first (14) and second liners (16).

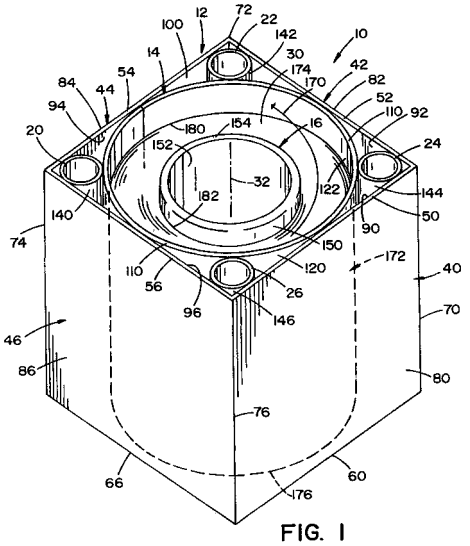


FIG. 1

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Description

[0001] The present invention relates to welding wire packaging and more particularly to converting a square or polygonal package into a welding wire package that functions like a welding wire drum and that can be used in connection with braking devices design for welding wire drums.

INCORPORATION BY REFERENCE

[0002] Welding wire used in high production operations, such as robotic welding stations, is provided in a large package having over 200 pounds of wire. The welding wire, in these packages, is looped into convolutions of wire loops forming a wire coil extending around a central core or a central clearance bore. During transportation a hold-down mechanism can be used to prevent the wire coil from shifting and to prevent the central core from shifting. To control the transportation and payout of the wire, an upper retainer or braking device, such as a braking ring, can be used to help control the unwinding of the wire from the wire coil. One such package is shown in Cooper 5,819,934 which discloses a welding wire drum that utilizes a braking ring to control the unwinding of the welding wire from the wire coil. Cooper is incorporated by reference herein as background material showing the same. Another such packaging is shown in Chung 5,746,380 which also discloses a welding wire drum, however, Chung discloses a different wire flow controlling apparatus for controlling the payout of the welding wire from the drum. Chung is also incorporated by reference herein for showing the same.

BACKGROUND OF INVENTION

[0003] In the welding industry, tremendous numbers of robotic welding stations are operable to draw welding wire from a package as a continuous supply of wire to perform successive welding operations. The advent of this mass use of electric welding wire has created a need for large packages for containing and dispensing large quantities of welding wire. A common package is a drum where looped welding wire is deposited in the drum as a wire stack, or coil, of wire having a top surface with an outer cylindrical surface against the drum and an inner cylindrical surface defining a central bore that is coaxial to a central package axis. The central bore is often occupied by a cardboard cylindrical core, as shown in Cooper 5,819,934, extending about a core axis that is coaxial to the package axis. It is common practice for the drum to have an upper retainer ring that is used in transportation to stabilize the body of welding wire as it settles. This ring, as is shown in Cooper 5,819,934, remains on the top of the welding wire to push downward by its weight so the wire can be pulled from the body of wire between the core and the ring. In addition, a hold-down mechanism can be utilized to increase the downward force.

[0004] The welding wire in the package is in loops or convolutions wrapped about the package axis and form the wire coil having a top and a bottom. The coil further includes radial inner and outer surfaces extending between the top and the bottom of the coil. As the welding wire is removed from the package, the wire is removed from the top coils or convolutions of wire wherein the top of the wire coil moves downwardly into the package. As a result, the top of the wire coil descends within the package and the outer and inner surfaces of the coil become shorter and shorter.

[0005] In order to work in connection with the wire feeder of the welder, the welding wire must be dispensed in a non-twisted, non-distorted and non-canted condition which produces a more uniform weld without human attention. It is well known that wire has a tendency to seek a predetermined natural condition which can adversely affect the welding process. Accordingly, the wire must be sufficiently controlled by the interaction between the welding wire package and the wire feeder. To help in this respect, the manufacturers of welding wire produce a wire having natural cast, wherein, if a segment of the wire was laid on the floor, the natural shape of the wire would be essentially a straight line; however, in order to package large quantities of the wire, the wire is coiled into the package which can produce a significant amount of wire distortion and tangling as the wire is dispensed from the package. As a result, it is important to control the payout of the wire from the package in order to reduce twisting, tangling or canting of the welding wire. This condition is worsened with larger welding wire packages which are favored in automated or semi-automated welding.

[0006] The payout portion of the welding wire package helps control the outflow of the welding wire from the package without introducing additional distortions in the welding wire to ensure the desired continuous smooth flow of welding wire. Both tangling or breaking of the welding wire can cause significant down time while the damaged wire is removed and the wire is re-fed into the wire feeder. In this respect, when the welding wire is payed out of the welding wire package, it is important that the memory or natural cast of the wire be controlled so that the wire does not tangle. The welding wire package comprises a coil of wire having many layers of wire convolutions laid from the bottom to the top of the package. These convolutions together form an inner diameter and an outer diameter wherein the inner diameter is substantially smaller than the width or outer diameter of the welding wire package. In this respect, the convolutions together form the radial inner and outer surface discussed above. The memory or natural cast of the wire causes a constant force in the convolutions of wire which is directed outwardly such that the diameter of the convolutions is under

the influence of force to widen. The walls of the wire welding package prevent such widening. However, when the welding wire payout of the package, the walls of the package lose their influence on the wire and the wire is forced toward its natural cast. This causes the portion of the wire which is being withdrawn from the package to loosen and tend to spring back into the package thereby interfering and possibly becoming tangled with other convolutions of wire. In addition to the natural cast, the wire can have a certain amount of twist which causes the convolutions of welding wire in the coil to spring upwardly.

[0007] Payout devices or retainer rings have been utilized to control the spring back and upward springing of the wire along with controlling the payout of the wire. This is accomplished by positioning the payout or retainer ring on the top of the coil and forcing it downwardly against the natural springing effect of the welding wire. The downward force is either the result of the weight of the retainer ring or a separate force producing member such as an elastic band connected between the retainer ring and the bottom of the package. Further, the optimal downward force during the shipment of the package is different than the optimal downward force for the payout of the welding wire. Accordingly, while elastic bands or other straps are utilized to maintain the position of the payout or retainer ring during shipping, the weight of the retainer ring can be used to maintain the position of the payout relative to the wire coils during the payout or the wire.

[0008] In addition to the braking ring or retainer ring, which helps control the flow of wire from the package, welding wire packages can further include an inner core to help prevent the outgoing wire from looping across the central axis of the package. In this respect, the central core can be positioned in the wire package within the cylindrical inner region defined by the inner surface of the wire coil. The core is coaxial to a core axis in line with the central package axis. The inner core and the outer packaging together form a generally annular coil compartment wherein the wire can only move upwardly, not transversely of the package axis. In general terms, the central core produces an inner barrier for the wire coil to help direct the outgoing wire upwardly and out the top opening of the wire package such that one convolution of wire does not interfere with other convolution of wire.

[0009] The welding wire can also be controlled by other mechanisms such as the packaged beads as is shown in Chung. The packaged beads along with pressing pipes help control the out flowing welding wire as it exits the wire drum.

[0010] While welding wire drums produce effective containers for welding wire, however, the cylindrical configuration is not well suited for transporting and/or storing the container. This can include the transportation from the wire manufacturer to the end user of the wire, movement within the end user's facility, storage of the wire at the wire manufacturer and/or storage of the wire at the end user's facility. As can be appreciated, when multiple drums are positioned next to one another, such as on a pallet or other transportation carrier, the adjacent wire drums engage one another alone a very small contact patch wherein any forces therebetween are focused along the small contact patch. This can cause damage to the drum and potentially damage to the wire coil from minor contact between adjacent drums or other objects. As can also be appreciated, damage to the wire coil can cause deformation of the wire which can have an adverse affect on the welding wire flow out of the package and through the wire feeder and/or the welding wire torch.

STATEMENT OF INVENTION

[0011] In accordance with the present invention, a welding wire package or container for containing and dispensing wire from a wire coii is provided which includes the wire controlling benefit of a wire drum while providing the packability of a polygonally shaped container.

[0012] In this respect, provided is a welding wire container having an outer box with flat vertical side walls, such as a square box, each side wall having an inner wall surface. The outer box further including a corresponding number of vertically extending corners between the side walls. The container includes a first and a second vertically extending cylindrical liner to make the container function like a drum. In this respect, the first liner has a first radial outwardly facing surface and a first radial inwardly facing surface. The first inward surface having a diameter A and being coaxial with a vertically extending container axis such that the first outward surface engages each of the inner wall surfaces. The second cylindrical liner has a second radial outwardly facing surface and a second radial inwardly facing surface wherein the second outward surface has a diameter B that is less than the diameter A. The second liner is also coaxial with the vertical axis such that the second outward surface defines a radial inward extent of an annular wire cavity and the first inward surface defines a radial outward extent of the annular wire cavity. The liner configuration allows the wire coil, which is made up of a plurality of convolutions of the wire, to be encased between the liners even though the outer configuration of the package is not cylindrical. Further, the wire coil has a coil bottom supported by a closed bottom of the outer box and an oppositely facing coil top. Each of the convolutions has a similar effective convolution diameter that is greater than fifty percent of the diameter A but less than the diameter A to help prevent unwanted distortion in the welding wire. As stated above, the wire has a natural cast which produces a radially outward force in the each convolution which is fully supported by the first liner.

[0013] According to another aspect of the present invention, the container can further include a braking ring for controlling the unwinding of the wire from the wire coil. The ring rests on the coil top and descends within the cavity during the unwinding of the wire from the container.

[0014] According to a further aspect of the present invention, the braking ring can be an annular having an inner periphery, an outer periphery, a bottom surface extending between the inner and outer peripheries and a top. The bottom surface rests on the coil top and the inner periphery includes an upwardly curved surface extending from the bottom surface to an inner edge of the ring for guiding the wire from the coil toward the top opening. The ring is sized to allow freely descending movement of the ring within the cavity during the unwinding of the wire from the container.

[0015] According to yet another aspect of the present invention, the container can include a plurality of resistance elements on the coil top. The resistance elements substantially cover the coil top and descend within the cavity during the unwinding of the wire from the container. The first and second liners maintain the resistance elements on the coil top.

[0016] According to yet a further aspect of the present invention, the resistance elements are shaped like nickels.

[0017] According to even another aspect of the present invention, the container can further include vertically extending corner supports adjacent one of the vertically extending corners in the outer box. The corner supports can include cylindrical outer corner support surface such that the corner support surfaces engaged both the first liner and the outer box.

BRIEF DESCRIPTION OF DRAWINGS

[0018] The foregoing, and more, will in part be obvious and in part be pointed out more fully hereinafter in conjunction with a written description of preferred embodiments of the present invention illustrated in the accompanying drawings in which:

[0019] FIG. 1 is a top, side perspective view of a welding wire container according to an aspect of the present invention;

[0020] FIG. 2 is a partially exploded top, side perspective view of the container shown in FIG. 1;

[0021] FIG. 3 is a top partially sectioned view of the container shown in FIG. 1;

[0022] FIG. 4 is an enlarged partial side sectional view of a top portion of another embodiment of the present invention including a wire dispensing hat;

[0023] FIG. 5 is an enlarged sectional view taken along lines 5-5 in FIG. 4 which includes spherical resistance elements;

[0024] FIG. 6 is an enlarged perspective view of a nickel, shaped resistance element according to another aspect of the present invention;

[0025] FIG. 7 is an enlarged perspective view of a cylindrical resistance element according to a further aspect of the present invention;

[0026] FIG. 8 is an enlarged perspective view of an elongated resistance element having a square cross-sectional configuration according to yet another aspect of the present invention;

[0027] FIG. 9 is an enlarged perspective view of a spherical resistance element according to yet a further aspect of the present invention;

[0028] FIG. 10 is a top partially sectioned view of another embodiment of the present invention including a braking ring;

[0029] FIG. 11 is an enlarged partial side sectional view taken along line 11-11 in FIG. 10;

[0030] FIG. 12 is an enlarged top partially sectioned view of yet a further embodiment of the present invention including yet another braking ring; and,

[0031] FIG. 13 is an enlarged partial side sectional view taken along fine 13-13 in FIG. 12.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0032] Referring now in greater detail to the drawing wherein the showings are for the purpose of illustrating preferred embodiments of the invention only, and not for the purpose of limiting the invention, FIGS. 1-3 show a welding wire container 10 having an outer box 12, a first liner 14, a second liner 16 and corner support 20, 22, 24 and 26. By utilizing liners 14 and 16, the square box configuration of outer box 12 can be converted into a drum-like wire containing package having an annular wire receiving cavity 30 that is coaxial with a vertically extending package axis 32.

[0033] Outer box 12 is shown to have a square cross-sectional configuration which can be used to maximize the packability of container 10, however, container 10 can be configured in other cross-sectional configurations including, but not limited to other polygonal cross-sectional configurations. In this respect, by utilizing a square cross-sectional configuration, multiple containers 10 can be packed together such that the large flat sides of adjacent containers engage one-another. This arrangement of packages produces a large contact patch between adjacent containers and creates a nesting of containers. The nested containers are less likely to damage one another and/or the welding wire, by reducing shifting of adjacent containers and increasing the contact patch between containers in the event that there is relative movement which will be discussed in greater detail below.

[0034] In greater detail, outer box 12 includes four planar vertically extending box walls 40, 42, 44 and 46. Each box wall includes a top edge 50, 52, 54 and 56, respectively, and an opposite bottom edge 60, 62, 64 and 66. Outer box 12 further includes vertically extending corners 70, 72, 74 and 76 joining the box walls. Box walls 40, 42, 44 and 46 have an outer wall surface 80, 82, 84 and 86, respectively, and inner wall surfaces 90, 92, 94 and 96.

[0035] Adjacent bottom edges 60, 62, 64 and 66 is a closed bottom 98 that can be configured in any way known in

the art, including, but not limited to, bottom flaps extending from the bottom edges of the box walls. Further, the bottom flaps or other bottom configurations can be secured or closed in any way known in the art, including, but not limited to, gluing, taping and/or stapling the bottom flaps together. Yet even further, closed bottom 98 can further include a bottom insert (not shown) separating the bottom flaps and any fastening devices, such as staples, from the wire cavity. As can be appreciated, it is important to minimize the potential to damage the welding wire which can have adverse effects in the feedability of the welding wire from welding wire container 10 through the wire feeder and the welding torch.

[0036] Top edges 50, 52, 54 and 56 define a top opening 100 in outer box 12 which can be used to remove the welding wire from container 10. As can be appreciated, container 10 includes a top (not shown) to close container 10 when the container is not in use. The top can be any top known in the field, including flaps extending from one or more of the top edges of the outer box. Further, both closed bottom 98 and/or the top can be a component separate from outer box 12 such that the separate component(s) is(are) configured to selectively inter-engage with the outer box to close either the top and/or the bottom opening in the box.

[0037] First liner 14 is cylindrical and is coaxial with vertical axis 32. Liner 14 defines a radial outward extent of annular wire cavity 30. As is stated above, utilizing first liner 14 helps transform the square box configuration of box 12 into a drum-like welding wire container without loosing the beneficial effects of the square outer configuration. First liner 14 includes a top edge 110 and an oppositely facing bottom edge 112 which together define a first liner height that can be the same height as the outer box walls. As can be appreciate, the height of first liner 14 is dictated by the desired height of wire cavity 30. First liner 14 further includes a first radial outwardly facing surface 120 and a first radial inwardly facing surface 122. First liner 14 can be sized such that first inward surface 122 has a diameter 130 and first outer surface 120 engages the inner surfaces of each of the box walls. Obviously, by sizing first liner 14 such that its outer surfaces engages box 12 can maximize the size of the wire cavity, however, spacers could be used between the liner and the box to change the wire cavity and/or to further protect the welding wire.

[0038] As is discussed above, welding wire must be dispensed in a non-twisted, non-distorted and non-canted condition. Accordingly, the welding wire is produced having a natural cast, wherein, if a segment of the wire was laid on the floor, the natural shape of the wire would be essentially a straight line. The result of this technique is that the welding wire, when positioned in a coil, produces significant forces directed radially outwardly from the coil axis. The forces must be supported to maintain the integrity of the wire coil. As a result, it can beneficial to utilize outer box 12 to help support first liner 14. This configuration can be utilized to help reduce the strength requirements of the first liner which, as can be appreciated, can reduce the cost of the first liner. However, first line can be designed to be self supporting wherein the function of outer box 12 primarily for packability and/or coil protection.

[0039] First liner 14 can be supported by outer box 12 in many ways. In this respect, and as is discussed above, first liner 14 can be sized such first outer surface 120 engages the inner surfaces of each of the box walls. This engagement can include, but is not limited to, direct contact between first outer surface 120 and inner wall surfaces 90, 92, 94 and 96. This can also include intermediate structural components between the liner and the outer box to increase the points of support and/or to increase the protective values. In this respect, container 10 can include corner supports 20, 22, 24 and 26 as discussed above. In greater detail, the corner supports are sized and configured to provide support for first liner 14 near the corners of the outer box. Again, the natural cast in the welding wire produces radial outward forces when wrapped into a wire coil wherein support of the first liner is advantageous. The corner support helps support the first liner in the large gaps in the packaging near the box corners.

[0040] Corner supports 20, 22, 24 and 26 support first liner 14 by heiping to translate the radial outward forces to the outer box. As is shown, corner supports 20, 22, 24 and 26 can include cylindrical outer surfaces 140, 142, 144 and 146, respectively. The corner supports are sized and configured such that these outer surfaces engage the inner surfaces of the box walls along with first radial outward facing surface 120 of the first liner. For example, corner support 20 has cylindrical outer surface 140 sized and configured to engage first outward surface 120, inner surface 94 and inner surface 96. Engagement of inner surfaces 94 and 96 are on either surface of corner 74. While cylindrical corner supports are shown, other corner supports can be utilized which translate the radial outward forces of the coiled wire into the corner of the box. As can be appreciated, the tubular or cylindrical configuration of corner supports 20, 22, 24 and 26 are less likely to deform from the radial outward forces of the coiled wire than other corner support configurations. However, other corner support configurations can be utilized without detracting from the invention of this application.

[0041] Yet another corner support that can be used to support liner 14 is a solid corner support (not shown) such as an energy absorbing foam. This can include a pre-made foam insert configured to fill the void between the liner and the outer box or it can be a liquid foam that is injected into the opening between the corner and the liner which then hardens. As can be appreciated, filling these corner gap regions with a material such as, but not limited to, a hardening foam material can provide a more rigid packaging configuration that increases radial support for the wire coil and even increases coil protection. However, it should be noted that the solid style corner support does not need to completely fill the corner region of the box. The solid corner support can include, but is not limited to, a solid cylindrical configuration such as the corner support discusses above and can include internal opening to obtain a desired absorbing factor and/or to reduce costs.

[0042] While the height of the corner supports 20, 22, 24 and 26 do not need to be the same height as the outer box walls or the liners, the corner supports can be configured to be used as stacking supports for stacking multiple packages on top of one another. In this respect, and as can be appreciated, based on the size of container 10, it can be advantageous for container 10 to be a stackable container such that one container can be stacked on the top of another container without damaging the bottom container or the bottom wire coil. The corner supports can be configured to support a load resting on the top of the package and to direct the load away from the wire coil. This can include, but is not limited to, corner supports having a height substantially similar to the height of the outer box such that any upper load that begins to deform the outer box will engage the corner supports. As can be appreciated, like boxes that are stacked on one another can be stacked such that the corner supports are positioned over on another. This situation allows the corner supports to directly support the upper load. However, container 10 can further include upper and/or lower support plates (not shown) that can be used to direct virtually all loads to the corner supports. For example, container 10 can include upper and/or lower plates that are square plates similar to the cross-sectional configuration of box 12 and which are positioned near the closed bottom and/or the top opening.

[0043] Second liner 16 is also cylindrical and is also coaxial with vertical axis 32. Second liner 16 includes a second radial outward surface 150 and a second inward facing surface 152 which are coaxial with axis 32. Second liner 16 has a top edge 154 and an oppositely facing bottom edge (not shown) which, together, define a second liner height. Top edge 154 can be rounded to further help prevent damage to the wire during the unwinding from the coil. Second outward facing surface 150 has a diameter 160 which is smaller than diameter 130 of first liner 14. Liners 14 and 16 can be made from any known materials in the art and by any known manufacturing method in the art. For example, which is best shown in FIG. 2, the liners can be made from a strip or sheet of material that is wrapped into a cylindrical configuration and positioned within the outer box. Further, the liner can be seamless, which includes, but is not limited to, molded liners or even extruded liners. Further, in view of the radial outward forces produced by the coiled wire, the coiled wire exerts more force against liner 14 than liner 16. As a result liner 14 can have different properties than liner 16. This can include different liner configuration, different liner materials and different liner designs. Essentially liner 14 can be constructed to be more robust liner than liner 16.

[0044] As is stated above, liners 14 and 16 define annular wire cavity 30. In greater detail, the wire cavity is defined by first radial inward facing surface 122 of first liner 14 and second outer surface 150 of second liner 16. The surfaces define the radial extent of the annular wire cavity based on the differences between diameters 130 and 160 of the respective surfaces. Further, wire cavity 30 extends vertically between closed bottom 98 and top edges top edges 110 and 154 of the liners. As can be appreciated, the liners can be sized such that their respective heights are similar to the heights of the box walls or the liners can have different heights. Further, the first and the second liners do not have to have equal heights. However, as can be appreciated, the annular wire cavity is limited by the heights of the liners.

[0045] A welding wire 170 is coiled into annular wire cavity 30 thereby forming a wire coil 172. Wire coil 172 has a coil top 174, a coil bottom 176, which together define a coil height that is shorter than at least liner 14. The coil height can also be shorter than liner 16. As is discussed in greater detail above, the natural cast of the welding wire produces significant radial outward forces which must be controlled by the wire container. As a result, it is advantageous to have full radial outward support of the wire coil. While it may be preferred to have full radial inward support too, the function and/or purpose of liner 16 is different than that of liner 14 which will be discussed in greater detail below. Wire coil 172 further includes a radial outer edge 180 and a radial inward edge 182 wherein radial outer edge 180 is supported by first liner 14.

[0046] Welding wire 170 can be coiled wrapped into wire cavity 30 by any known wire wrapping method in the art. As is known in the art, many wire coiling methods include wrapping the wire coil without second liner 16 in position which allows the wire coiling apparatus to extend into the inner coil opening defined by radial inner edge 182 of the coil. Second liner is then positioned in place after the wire is wrapped into coil 172. In view of the radial outward forces produced by the natural cast in the wire, inner supports of the wire coil may not be necessary during the winding process. However, as will be discussed in greater detail below, during the payout or unwinding of the wire, second liner can be utilized to help direct the outgoing wire towards the upper box opening to prevent tangling.

[0047] As discussed above, it is important that the welding wire from container 10 be dispensed such that the wire is free of tangles and the flow of wire to the welding wire operation is uninterrupted. Therefore, the welding wire is looped into wire coil 172 in such a way that the distortions in the wire are minimized. Further, it has been found that it is advantageous to loop the welding wire in convolutions that have an effective diameter which is similar from one convolution to another. In this respect, looping one convolution having an effective diameter similar to diameter 160 while looping another convolution that is similar to diameter 130 could ultimately produce differing distortions from one convolution to the next. Furthermore, as the effective diameter of each convolution is reduced, the potential to distort the natural cast in the wire is increased. As can be appreciated, and for example purposes only, wrapping the welding wire around a pencil will significantly change and/or completely eliminate the natural cast in the wire which should be maintained as close as possible to a straight natural cast. Furthermore, the effect on the natural cast for wire wrapped around a pencil would be significantly different than the effect on the natural cast for the wire wrapped around a drum having a two foot

diameter. Therefore, it is desirous to maintain a consistent effective loop diameter from one cast to another that is as large as possible.

[0048] As a result, it is advantageous to wrap wire 170 such that each effective convolution has a diameter that is greater than 50 percent of diameter 130. Furthermore, since the greater the diameter of the effective loop diameter is preferred that the loop diameter is maximized. Accordingly, loop diameters that are greater than 70 percent of diameter 130, loop diameters that are greater than 80 percent of diameter 130, and loop diameters that are greater than 90 percent of diameter 130 can be utilized to minimize the distortion of the natural cast in the welding wire. As can be appreciated, while the wire coil is coaxial with axis 32, each convolution in the wire coil may not be coaxial with axis 32. However, regardless of the position of the convolution within the wire coil, based on the natural cast, it is ultimately supported, from radial outward expansion, by first liner 14 and first liner 14 can be supported by box 12.

[0049] One method of packaging a wire coil in container 10 can include positioning first liner 14 along with corner supports 20, 22, 24 and 26 within outer box 12 before the wire is coiled into the wire cavity. Then, winding wire 170 into wire coil 172 and subsequently positioning second liner 16 into the inner coil opening. Another method according to the present invention includes the steps of:

[0050] Providing a polygonal container having a plurality of outer planar side walls coaxial with a vertically extending container axis, each of the plurality of planar side walls having a top edge, a bottom edge and an inner wall surface, the spacing between the top and bottom edges defining a container height; a corresponding plurality of vertically extending corners between the each side walls; a closed bottom; and a top opening for removing the welding wire;

[0051] Providing a first liner that is cylindrical, the first liner having a bottom edge and an oppositely facing top edge, the first liner having a height between the bottom edge and the top edge that is approximately equal to the container height, the first liner further including a first radial outwardly facing surface and a first radial inwardly facing surface, the first inward surface having a diameter A;

[0052] Positioning the first liner into the polygonal container such that the first liner is coaxial with the vertical container axis, the bottom edge is adjacent to the closed bottom of the polygonal container, the top edge is near the top opening, and the first radial outward surface is supported by the inner wall surfaces, the first inward surface defining a radial outward extent of a wire cavity;

[0053] Winding a plurality of convolutions of the wire into the wire cavity, the plurality of convolutions forming a wire coil having a coil bottom supported by the closed bottom and an oppositely facing coil top, each the convolution having a similar effective convolution diameter that is greater than fifty percent of the diameter A but less than the diameter A, the natural cast producing a radially outward force in the each convolution that is supported by the first liner, the coil extending radially between the first liner and a central coil opening coaxial with the axis;

[0054] Providing a second cylindrical liner having a second radial outwardly facing surface and a second radial inwardly facing surface, the second outward surface having a diameter B that is less than the diameter A of the first liner;

[0055] Positioning the second liner into the polygonal container and the central coil opening such that the second outward surface is coaxial with the vertical container axis, the second outward surface defines a radial inward extent of the wire cavity.

[0056] By utilizing the liner arrangement of container 10, a welding wire container 10 has all the advantages of a polygonal welding wire container and all of the advantages of a drum-line welding wire container. As is discussed above, a polygonal wire container, such as a square cross-sectionally configured wire container, has substantially advantages in the packability of the packaging. These advantages include, but are not limited to, providing stable packaging configurations for adjacent packages. In this respect, the square outer configuration allows multiple packages to be nested together which result in a stable grouping of packages. As can also be appreciated, several cylindrical items, such as welding wire drums, that are positioned adjacent one another, can rotate relative to one another and produce no nesting effect without utilizing some sort of nesting device such as a spacer which fits between the voids produced between the drums. The rolling style engagement between the drums must be restrained which is not necessary with square packaging.

[0057] Yet another packability advantage of a polygonal or square welding wire container is the stackability of this packaging configuration. In this respect, as is discussed above, the corner supports used in the square packaging configuration can also be utilized to support the weight of containers stacked on one-another which diverts the stacking forces away from the welding wire coil and which allows inexpensive and lightweight materials to be used for the outer box. Cylindrical packages, such as a drum like welding wire container, utilize the outer walls of the container to support the weight of a stacked container. As a result, the out wall of the cylindrical container must be sufficiently strong to fully support a welding wire container and heavy wire coil. This necessitates the use of substantially rigid outer walled drums to support the weight of the stacked package. These drums can include expensive materials that are also expensive to dispose. As can be appreciated, it is advantageous to produce welding wire packages that can be economically disposed in an environmentally friendly manner. As a result of the stackability issues, welding wire drums are often made from more than one material which further makes discarding difficult and costly. In this respect, and as is known in the art, drums often include metal bottoms and metal ring tops with thick fiber outer walls that together prevent easy disposal and/or recycling.

[0058] By utilizing the square cross-sectional configuration, outer boxes can be made from cardboard and can be made from a single material that is easily recycled. Further, the corner supports can be made from a different material based on the structural needs of the corner support, and since these two components are easily separated, they can still be easily be disposed. Further, the liners can also be made of a separate material based on the desired material properties of the liner without detracting from the ability to recycle the package. Yet even further, the use of corner supports, that are separate from the outer box, allows all packaging material to be made from paper products if desired.

[0059] Even though container 10 includes the advantages of a polygonal or square cross-sectionally configured packaging arrangement, the liner arrangement provides the benefit of the drum-like welding wire container for the unwinding of the welding wire when this product is in use. In this respect, as discussed above, the welding wire has a natural cast wherein a segment of the welding wire cut from the wire coil would essentially be straight. While this produces radial outward forces, it also produces an upward, springing effect in the wire coil which must be controlled during the transportation of the wire container and also during the unwinding of the wire from the wire coil when it is used in a welding operation. As a result, it is known in the art that hold-down mechanisms can be utilized during the transport of the wire container to prevent the upward springing of the wire coil and hence, prevent wire tangling before the welding wire is in use. Further, braking or tensioning devices can also be used to help control the unwinding of the wire from the wire coil during the use in a welding operation.

[0060] Over the years, many devices have been utilized for controlling the transport of the coil and the unwinding of the wire for wire drum arrangements. However, these devices are designed for wire drums and many will not function or will not function as effectively if used in a square cross-sectionally configured container or other polygonally configured container. Therefore, while a polygonally configured outer packaging produces many packability advantages over the drum-like container, in operation, the drum-like container is superior.

[0061] With reference to FIGS. 4-9, in one embodiment, container 10 includes resistance elements 200 positioned on coil top 174. Resistance elements 200 are small three dimensional objects having an outer configuration and a weight. The objects are free to move relative to one another and relative to the wire coil. As a result, elements 200 will not work in the traditional square welding wire container in that they would not remain on coil top 174. As can be appreciated, the resistance elements that are free to move relative to one another and the coil, would quickly fall into the corner recesses of the square container an would loose there contact with the outgoing wire from the coil.

[0062] Liners 14 and 16 maintain the proper position of the resistant elements on the coil top and maintained a desired resistant element height or thickness 210 over the coil top. As can be appreciated, height 210 is a general height of the elements which will vary from one position to the next based on the size, configuration and density of resistance elements used.

[0063] Resistance elements 200 can have a structure that is uniformly solid, porous and/or hollow. As can be appreciated, the structure along with the material chosen will control the density of the elements. The size of the elements can also vary from elements that are small granular material to elements that are several inches long. Further, as will be discussed in greater detail below, the elements can have a number of outer configurations without detracting from the invention of this application.

[0064] The proper resistance element height is a function of several factors including, but not limited to, the weight of the resistance elements, the outward configuration of the resistance element and the frictional properties of the outer surfaces of the elements. In this respect, the resistance elements can be used to control the upward springing effect of the wire coil. The resistance elements can also provide a resistance or drag in the wire being unwound from coil.

[0065] With respect to controlling the upward springing of the coil, the resistance elements together have a combined weight. Enough elements can be used such that this combined weight sufficient to overcome the upward springing forces in the wire coil Resistance elements with a lower density will necessitate a greater thickness 210 to have the same effect on the upward springing forces in the coil than denser resistance elements. For example, use of spherical balls 200A made from steel would require less height than spherical balls 200A made from plastic to have the same effect.

[0066] Turning to the use of the resistance elements to create a resistance or drag on the exiting wire, the size, shape, material and density will also have an effect on the ability of the elements to create drag. With respect to the configuration of the resistance elements, the elements can be spherical 200A, cylindrical 200B, elongated with a square cross-sectional configuration 200C and/or disk shaped 200D. These configurations produce similar but different unwinding properties. For example, as the wire passes through spherical resistance elements 200A, the spheres tend to move laterally as the wire passes therearound. Conversely, disk shaped elements 200D are also lifted by the welding wire as it is pulled therethrough. As a result of the lifting action, it has been found that a greater resistance can be produced with the same combined weight of resistance elements. It has also been found that nickels can be used as resistance elements which provide an easy and effective method of controlling the unwinding of the welding wire which, obviously, is environmentally friendly. In this respect, and as can be appreciated, once the welding wire is consumed, the nickels will not be thrown away. Similarly, elongated resistance elements 200B and 200C also produce the lifting resistance arrangement not found in the spherical elements. While several configurations of resistance elements have been shown, other configurations can be utilized in container 10.

[0067] Resistance elements can be made from virtually any material depending on the desire weight of the elements and the desired resistance qualities. These materials include, but are not limited to, metal, glass, polymers, natural materials such as processed agricultural materials. Some examples include foam materials that have goods frictional qualities, marbles, ball bearings, nickels, and even packing materials used in other industries such as packing pellets. However, this list is only an example of elements that can be used and is not exhaustive of the types of elements that can be used.

[0068] With reference to FIGS. 10 and 11, yet another embodiment is shown. In this respect, shown is a wire container 10 utilizing an annular braking ring 250. Braking 250 is also for controlling the unwinding of the welding wire from the wire coil. Ring 250 has an inner periphery 252, an outer periphery 254, a bottom surface 256 between the inner and outer peripheries and a top surface 258. Ring 250 rests on coil top 174 such that bottom surface 256 engages a portion of the coil top. Ring 250 further includes an upwardly curved surface 260 extending from bottom surface 256 to an inner edge 262. Inner edge 262 has a diameter 270 that is greater than diameter 160 thereby producing a wire extraction opening 272 between edge 262 and second outward facing surface 150 of second liner 16. Curved surface 260 provides a distortion minimizing ramp to direct the outgoing wire from the wire coil to the welding operation. Since second liner 16 provides one of the barriers for extraction opening 272, it also helps direct the outgoing wire from the wire coil out of container 10. Further, as stated above, top edge 154 can be rounded to further minimize damage to wire 170. Accordingly, while second liner 16 may have minimal supporting properties, it significantly helps direct the outgoing wire upwardly and helps prevent one convolution of wire from engaging another convolution of wire thereby reducing tangling of the welding wire.

[0069] Braking ring 250 is configured to freely descend within wire cavity 30 as the wire is removed and as the coil height shortens based on the depletion of the welding wire from the container. The descending of ring 250 can be based on the weight of the ring itself or can be assisted by separate weights (not shown). As with the resistance elements discussed above, the weight of the ring and/or the separate weights (not shown) are used to help control the upward springing forces produced by the wire coil.

[0070] In order to control the descent of ring 250 and to prevent convolutions of wire from springing upwardly about the outer periphery of the ring, the ring can include projecting lobes 280, 282, 284, 286 and 288. However, while five lobes are shown, more or less lobes can be used. More particularly, the radial distance between inner edge 262 and outer periphery 254 is greater at the projecting lobes than between the projecting lobes. The projecting lobes are generally disposed in the flat outer portion of the ring and produce generally point contact between the ring and first liner 14 thereby maintaining the position of the ring and preventing convolutions from popping up between the ring and liner 14 while minimizing the frictional engagement between the ring and liner 14. As can be appreciated, increased resistance between liner 14 and ring 250 will require the ring to be heavier and/or include greater additional weights to produce the same downward force on the coil top. Further, increased resistance can cause the ring to become jammed with the first liner. The point contact between the ring and liner 14 further prevents jamming of the ring by making the ring more forging of liner imperfections. As can be appreciated, it is difficult to produce a packaging element that is perfectly cylindrical throughout its entire length. As a result, by utilizing projecting lobe configurations, ring 250 is better adapt to the imperfections and freely descend within wire cavity 30.

[0071] Imperfections in the wire cavity can also be caused by damage to the container during shipping and/or use. As can be appreciated, movement of manufacturing materials is not perfect and is often done as quickly as possible. As a result, packages are often damaged by lift trucks and other mechanism used to move the material. The lobe design discussed above is also more forgiving to this type of damage. Furthermore, the configuration of the package according to the present invent also minimizes this type of damage to the wire cavity by spacing the wire cavity from the outer wall of the packaging.

[0072] With reference to FIGS. 12 and 13, yet even a further embodiment is shown which includes a ring 300. As with the braking ring discussed above, ring 300 also includes inner periphery 252, outer periphery 254, bottom surface 256 between the inner and outer peripheries and top surface 258. Ring 300 rests on coil top 174 such that bottom surface 256 engages a portion of the coil top. Ring 300 can further includes upwardly curved surface 260 extending from bottom surface 256 to inner edge 262. Inner edge 262 can have the same diameter 270 that is greater than diameter 160 thereby producing wire extraction opening 272 between edge 262 and second outward facing surface 150 of second liner 16.

[0073] Braking ring 300 is also configured to freely descend within wire cavity 30 as the wire is removed and as the coil height shortens based on the depletion of the welding wire from the container. The descending of ring 300 can be based on the weight of the ring itself or can be assisted by separate weights (not shown). As with the resistance elements discussed above, the weight of the ring and/or the separate weights (not shown) are used to help control the upward springing forces produced by the wire coil.

[0074] However, n order to control the descent of ring 300 and to prevent convolutions of wire from springing upwardly about the outer periphery of the ring, ring 300 includes a circular outer periphery 310 having flexible tabs 330, 332, 334, 336 and 338 instead of the projecting lobes discussed above. However, wile five tabs are shown, more or less tabs can be used. In this respect, the flexible tabs maintain the engagement between the ring and liner 14 while allowing the ring

to freely descend within wire cavity 30. Again, the flexible tabs help account for distortions in liner 14 and help prevent wire convolutions from popping up between ring 300 and liner 14.

[0075] In addition, while not discussed in detail, any of the embodiments above can include other mechanisms known in the art such as hold-down mechanisms which are utilized to secure the wire coil during the transport of container 10. Further, vapor barriers can also be used to help protect the welding wire from adverse environments such as during the transport of the container by ship across the ocean. Furthermore, other wire controlling mechanisms can be used to control the out flowing welding wire from the container beyond those discussed above. Accordingly, while only two rings were discussed in relation to the invention of this application, the braking ring configuration should not be limited to these two ring configuration. It should be distinctly understood that other drum style rings can be used in the container of this application without detracting from the invention of this application. Again, by utilizing the liner configuration described above, the advantages of a square or polygonal cross-sectional configuration package can be achieved while the control of the welding wire can be the same as a drum-like container.

[0076] While considerable emphasis has been placed on the preferred embodiments of the invention illustrated and described herein, it will be appreciated that other embodiments and/or equivalents thereof can be made and that many changes can be made in the preferred embodiments without departing from the principals of the invention. Accordingly, it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the invention and not as a limitation.

Claims

1. A container for packaging and unwinding a welding wire having a natural cast that is essentially a straight line, said container comprising: an outer box having a plurality of vertical side walls each having an inner wall surface and a corresponding plurality of vertically extending corners between said side walls, a closed bottom, a top opening for removing said welding wire; a first vertically extending cylindrical liner with a first radial outwardly facing surface and a first radial inwardly facing surface, said first inward surface having a diameter A and being coaxial with a vertically extending container axis said first liner being supported radially by said side walls or engaging with its outward surface each said liner wall surface; a second cylindrical liner having a second radial outwardly facing surface and a second radial inwardly facing surface, said second outward surface having a diameter B that is less than said diameter A and is coaxial with said axis such that said second outward surface defines a radial inward extent of an annular wire cavity and said first inward surface defines a radial outward extent of said annular wire cavity; and a wire coil made up of a plurality of convolutions of said wire, each said convolution having a similar effective convolution diameter that is greater than fifty percent of said diameter A but less than said diameter A, said natural cast producing a radially outward force in said each convolution that is supported by said first liner, said coil extending radially between said first and second liners.

2. The container as defined in claim 1, wherein said box is a square box with four vertical side walls and four vertically extending corners.

3. The container as defined in claim 2, further including four vertically extending corner supports, each said corner support being adjacent one of said four vertically extending corners and extending between said first liner and said box.

4. The container as defined in claim 3, wherein said four vertically extending corner supports include a cylindrical outer corner support surface, said corner support surface engaging said first outward surface and two of said four inner wall surfaces.

5. The container as defined in anyone of the claims 1 to 4, further including a braking ring for controlling the unwinding of said wire from said wire coil, said ring resting on a coil top and descending within said cavity during the unwinding of said wire from said container.

6. The container as defined in claim 5, wherein said braking ring is annular having an inner periphery, an outer periphery, a bottom surface extending between said inner and outer peripheries and a top, said bottom surface resting on said coil top, said inner periphery including an upwardly curved surface extending from said bottom surface to an inner edge of said ring for guiding said wire from said coil toward said top opening, said ring being sized to allow freely descending movement of said ring within said cavity during the unwinding of said wire from said container.

7. The container as defined in claim 5 or 6, wherein said braking ring includes a generally flat radial outer portion with

an outer periphery, an inner diameter and a radial distance therebetween, said braking ring containing a number of projecting lobe portions, each said lobe portion generally disposed in said flat outer portion whereby said radial distance from said inner diameter to said outer periphery varies within each said lobe portion and an inner upwardly curved portion defining an innermost wire extraction opening between said braking ring and said second liner, said curved portion curving upward from said inner diameter of said flat portion to said wire extraction opening, said wire extraction opening having a diameter smaller than said inner diameter of said flat portion.

8. The container as defined in anyone of the claims 1 to 7, wherein said wire coil includes a coil top and said container further including a plurality of resistance elements on said coil top, said resistance elements substantially covering said coil top and descending within said cavity during the unwinding of said wire from said container, said first and second liners maintaining said plurality of resistance elements on said coil top.

9. The container as defined in claim 8, wherein said plurality of resistance elements includes spherical resistance elements.

10. The container as defined in claim 8, wherein said plurality of resistance elements includes elongated resistance elements.

11. The container as defined in claim 8, wherein said plurality of resistance elements includes cylindrical resistance elements.

12. The container as defined in claim 8, wherein said plurality of resistance elements includes disc-shaped resistance elements.

13. The container as defined in claim 8, wherein said plurality of resistance elements includes resistance elements shaped like nickels.

14. The container as defined in claim 8, wherein said plurality of resistance elements includes nickels.

15. The container as defined in anyone of the claims 1 to 14 in particular in claims 4 and 8, wherein said first liner is a planar sheet having a top edge, a bottom edge, a first side edge and a second side edge, said first liner wrapped into said box such that said op edge is near said top opening, said bottom edge is near said closed bottom and said first and second side edges facing one another.

16. The container as defined in claim 15, wherein said first liner is a molded article.

17. The container as defined in anyone of the claims 1 to 16, wherein said box is a cardboard box.

18. The container as defined in anyone of the claims 1 to 17, wherein said effective convolution diameter that is greater than seventy percent of said diameter A.

19. The container as defined in anyone of the claims 1 to 17, wherein said effective convolution diameter that is greater than eighty percent of said diameter A.

20. The container as defined in anyone of the claims 1 to 19, wherein said first radial outwardly facing surface is spaced from said inner wall surfaces.

21. The container as defined in anyone of the claims 1 to 19, wherein said first radial outwardly facing surface engages said inner wall surfaces.

22. The container as defined in anyone of the claims 1 to 21, wherein said wire coil having a coil bottom supported by said closed bottom and an oppositely facing coil top, and a plurality of nickel-shaped resistance elements substantially covering said coil top.

23. The container as defined in anyone of the claims 1 to 22, wherein said vertical side walls are flat.

24. The container as defined in anyone of the claims 1 to 21 or 23, wherein said wire coil having a coil bottom supported by said closed bottom and an oppositely facing coil top, and a means for controlling the outflow of said wire from

said coil during the unwinding of said welding wire.

25. The container as defined in claim 24, wherein said control means includes a plurality of resistance elements positioned on said coil top.

26. The container as defined in claim 25, wherein said resistance elements include nickel-shaped resistance elements.

27. The container as defined in claim 24, wherein said control means includes a braking ring, said ring resting on said coil top and descending within said cavity during the unwinding of said wire from said container.

28. The container as defined in claim 27, wherein said braking ring is annular having an inner periphery, an outer periphery, a bottom surface extending between said inner and outer peripheries and a top, said bottom surface resting said coil top, said inner periphery including an upwardly curved surface extending from said bottom surface for guiding said wire from said coil toward said top opening, said ring being sized to allow freely descending movement of said ring within said cavity during the unwinding of said wire from said container.

29. The container as defined in claim 24, wherein said effective convolution diameter that is greater than seventy percent of said diameter A.

30. A method of transforming a polygonal container into a drum-like container for packaging and unwinding a coil of welding wire having a natural cast that is essentially a straight line, said method including the steps of:

providing a polygonal container having a plurality of outer planar side walls coaxial with a vertically extending container axis, each of said plurality of planar side walls having a top edge, a bottom edge and an inner wall surface, the spacing between said top and bottom edges defining a container height; a corresponding plurality of vertically extending corners between said each side walls; a closed bottom; and a top opening for removing said welding wire;

providing a first liner that is cylindrical, said first liner having a bottom edge and an oppositely facing top edge, said first liner having a height between said bottom edge and said top edge that is approximately equal to said container height, said first liner further including a first radial outwardly facing surface and a first radial inwardly facing surface, said first inward surface having a diameter A and defining a radial outward extent of a wire cavity;

positioning said first liner into said polygonal container such that said first liner is coaxial with said vertical container axis, said bottom edge is adjacent to said closed bottom of said polygonal container, said top edge is near said top opening, and said first radial outward surface engages said inner wall surfaces;

winding a plurality of convolutions of said wire into said wire cavity, said plurality of convolutions forming a wire coil having a coil bottom supported by said closed bottom and an oppositely facing coil top, each said convolution having a similar effective convolution diameter that is greater than fifty percent of said diameter A but less than said diameter A, said natural cast producing a radially outward force in said each convolution that is supported by said first liner, said coil extending radially between said first liner and a central coil opening coaxial with said axis;

providing a second cylindrical liner having a second radial outwardly facing surface and a second radial inwardly facing surface, said second outward surface having a diameter B that is less than said diameter A of said first liner; and,

positioning said second liner into said polygonal container and said central coil opening such that said second outward surface is coaxial with said vertical container axis, said second outward surface defines a radial inward extent of the wire cavity.

31. The method as defined in claim 30, further including the steps of providing a plurality of resistance elements and substantially covering said coil top with said elements.

32. The container as defined in claim 31, wherein said plurality of resistance elements includes spherical resistance elements.

33. The container as defined in claim 31, wherein said plurality of resistance elements includes elongated resistance elements.

34. The container as defined in claim 31, wherein said plurality of resistance elements includes cylindrical resistance elements.

35. The container as defined in claim 31, wherein said plurality of resistance elements includes disc-shaped resistance elements.

36. The container as defined in claim 31, wherein said plurality of resistance elements includes resistance elements shaped like nickels.

37. The container as defined in claim 31, wherein said plurality of resistance elements includes nickels.

38. The method as defined in claim 30 or 31, further including the steps of providing a plurality of vertically extending corner supports having a cylindrical outer corner support surface and positioning said corner supports in said polygonal container such that said corner support surface of each support engages said outer liner surface and two of said plurality of inner wall surfaces.

39. The method as defined in claim 38, wherein said positioning step for said plurality of vertically extending corner supports is before said positioning step for said first liner.

40. The method as defined in anyone of the claims 30 to 39, wherein said polygonal container is a square box.

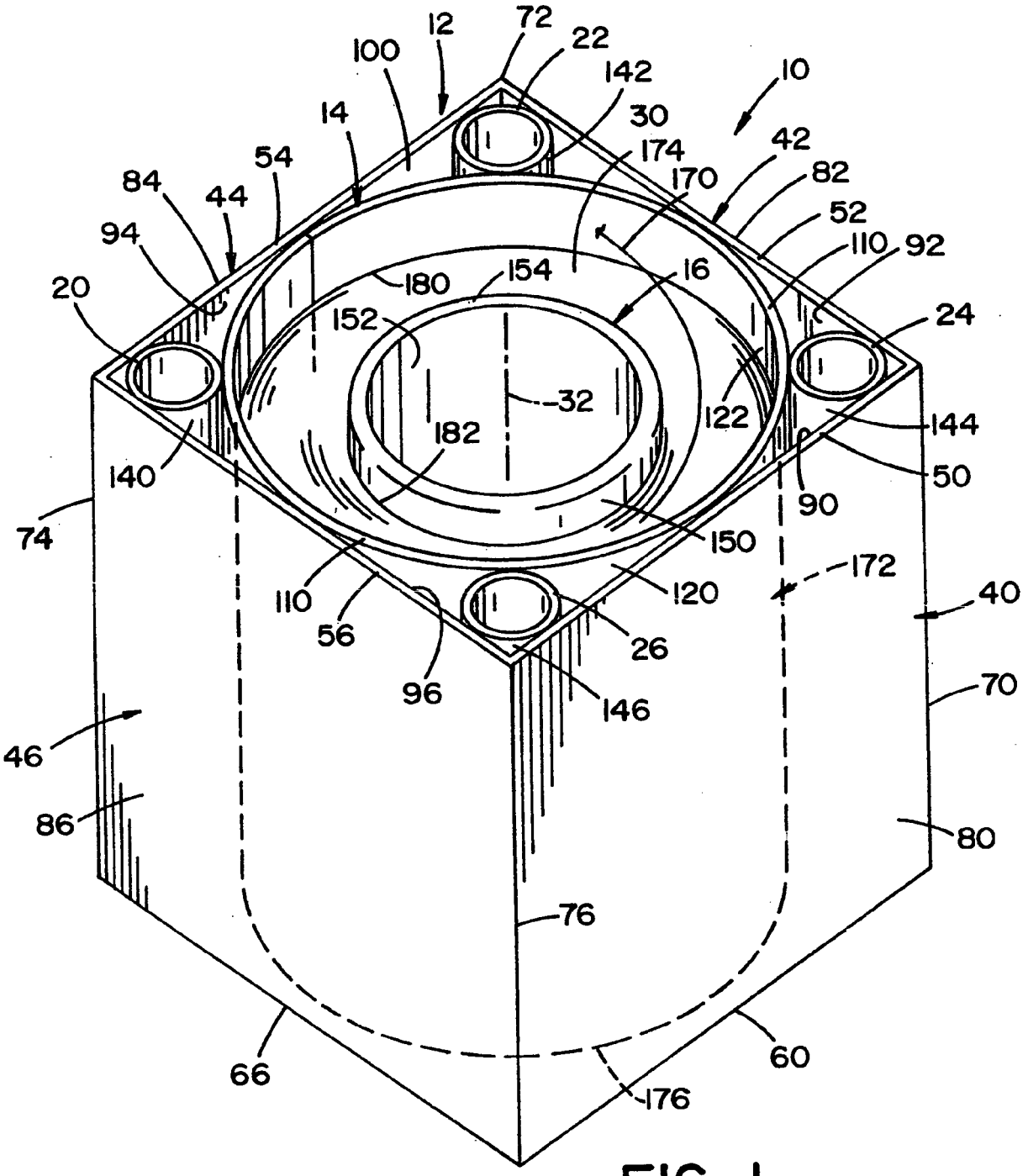

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FIG. 1

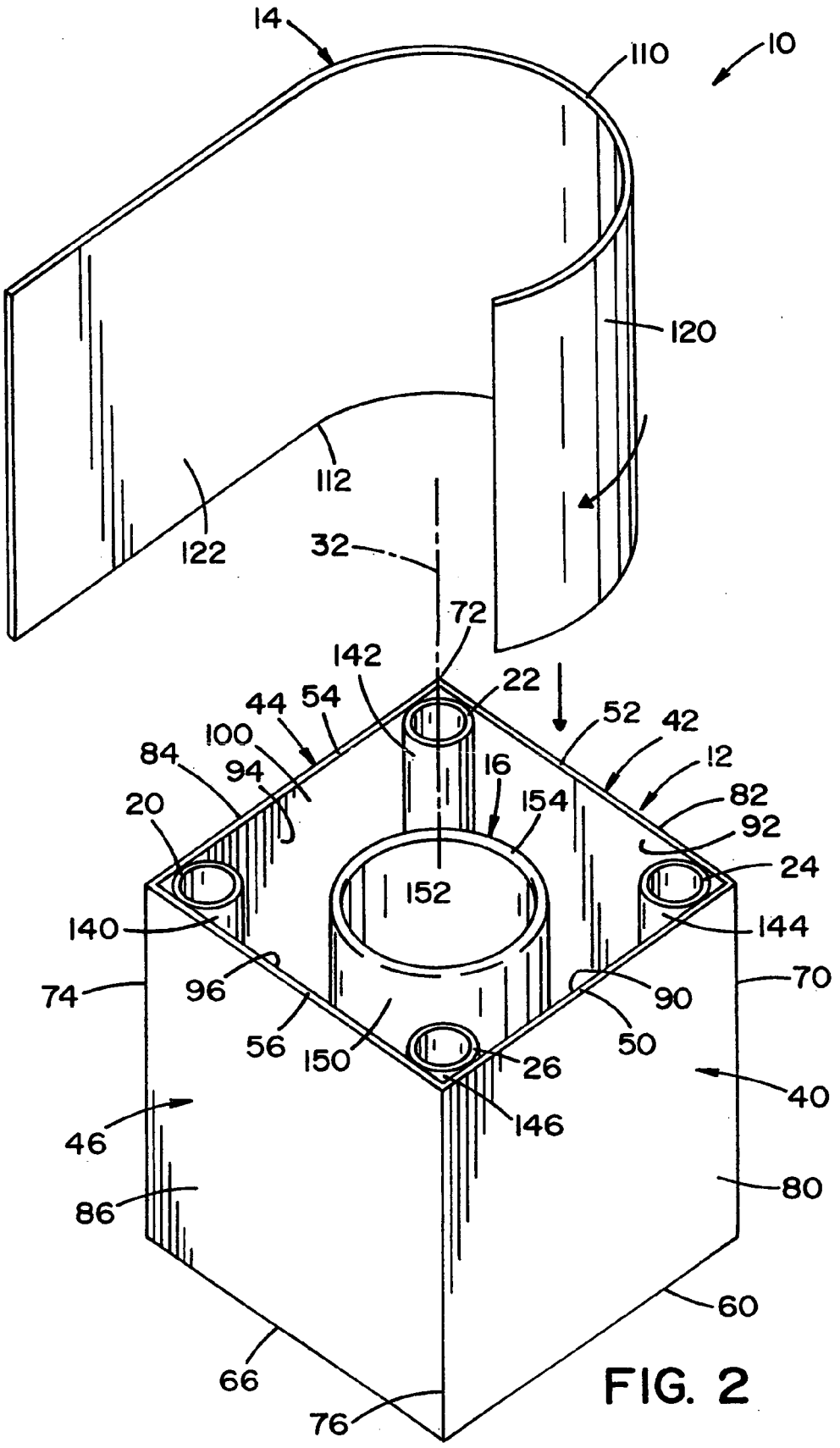

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FIG. 2

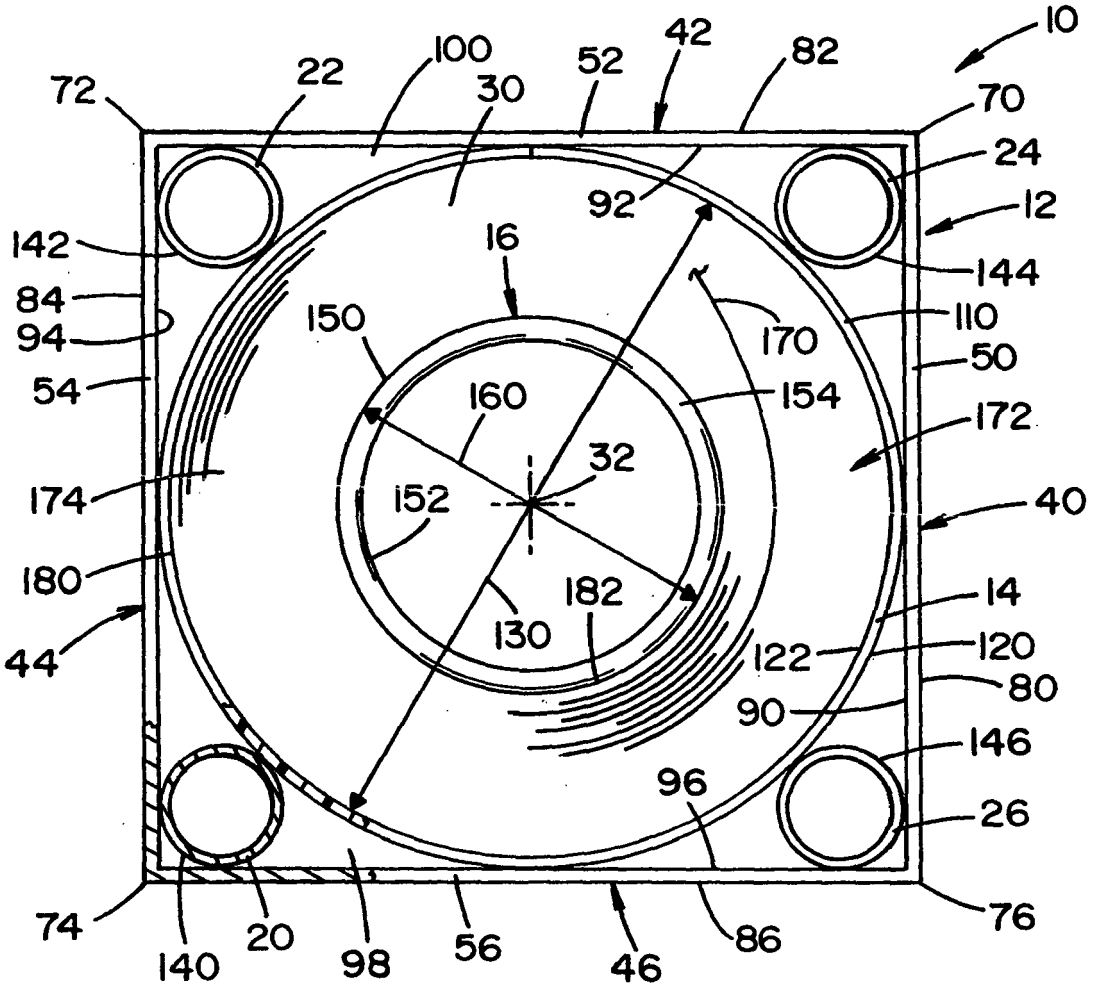

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FIG. 3

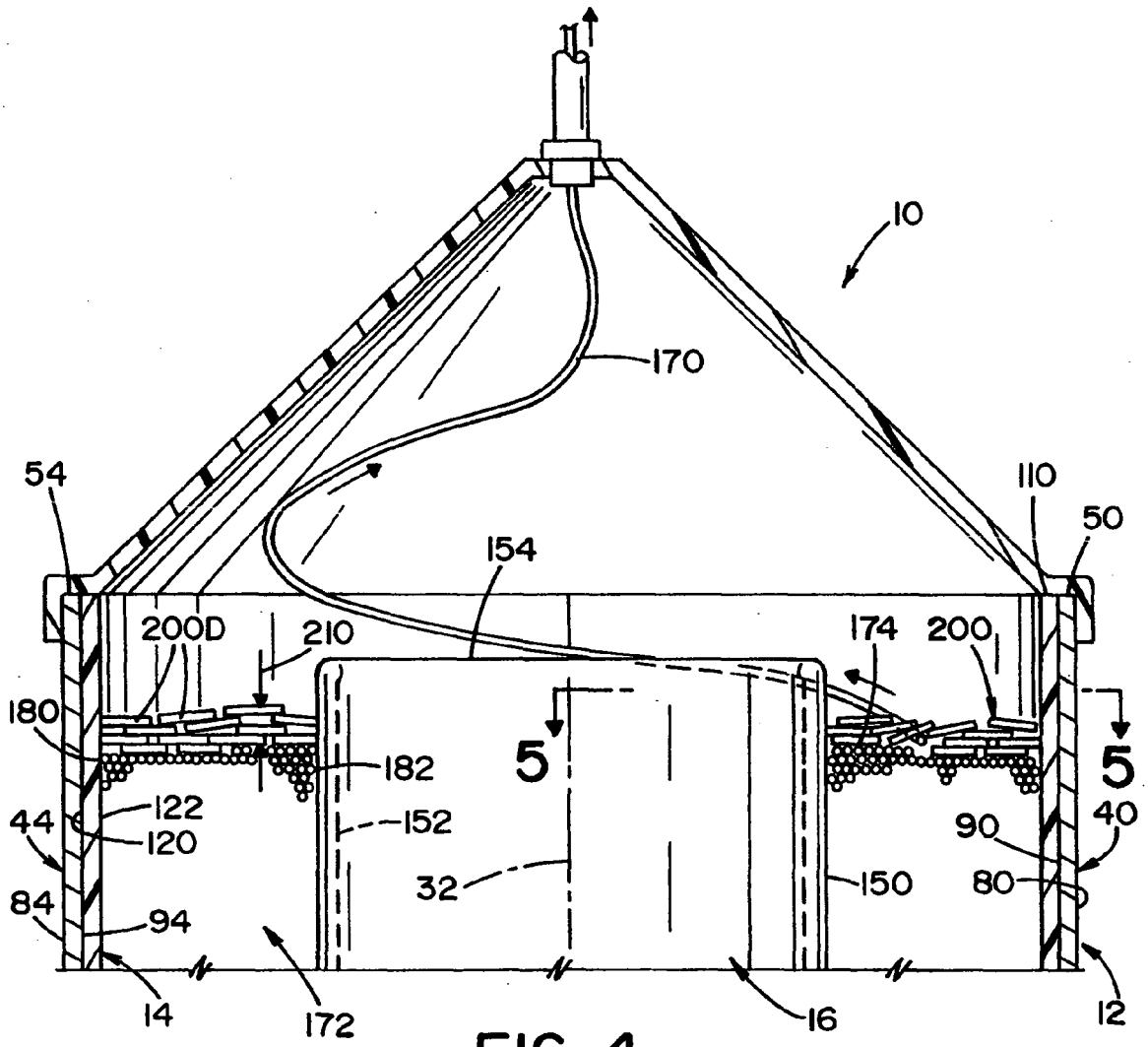

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FIG. 4

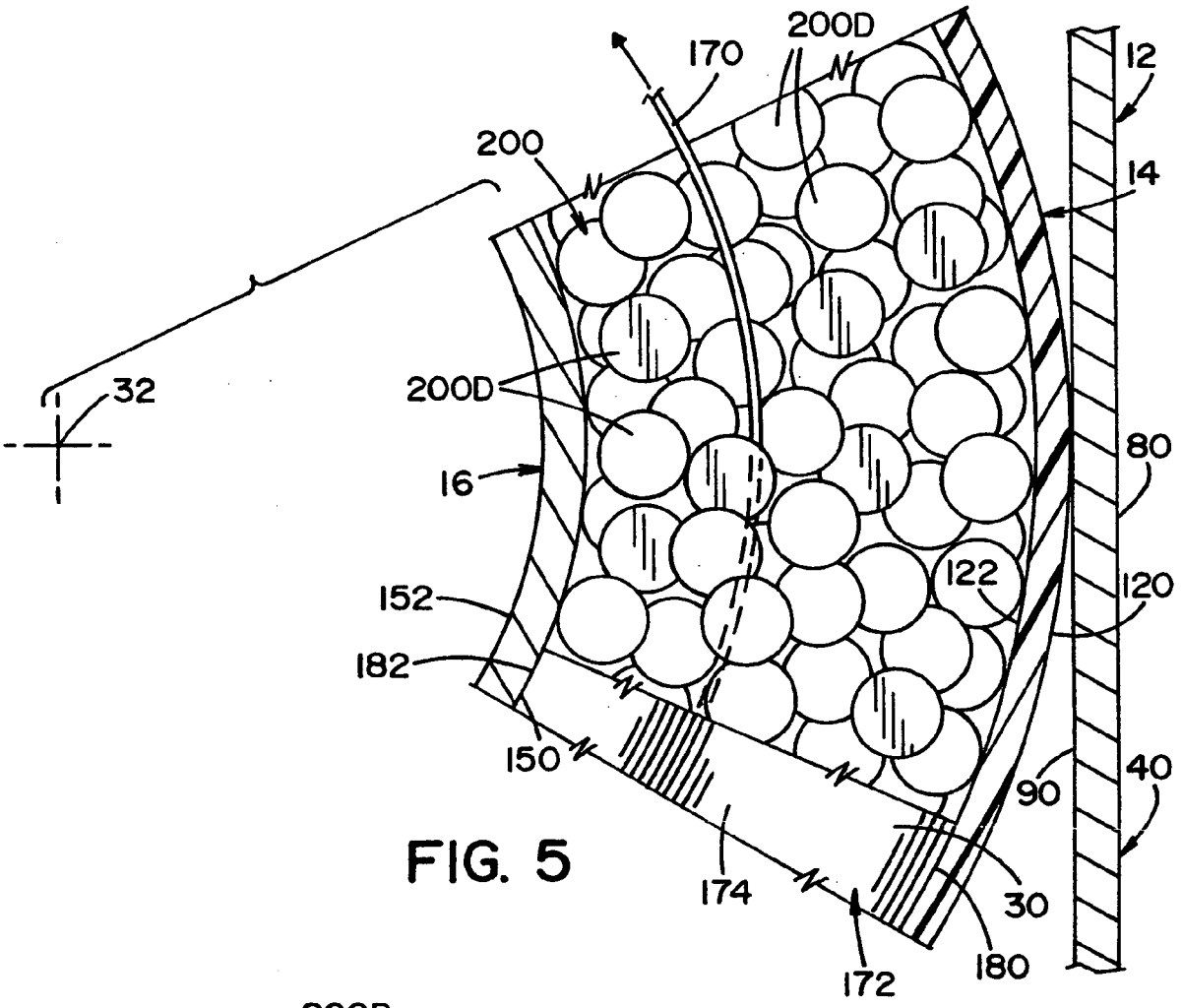


FIG. 5

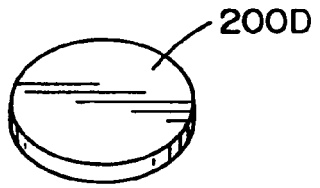


FIG. 6



FIG. 7

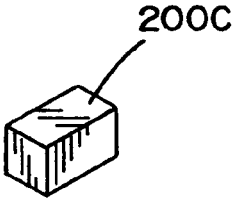


FIG. 8

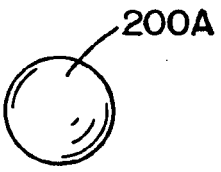


FIG. 9

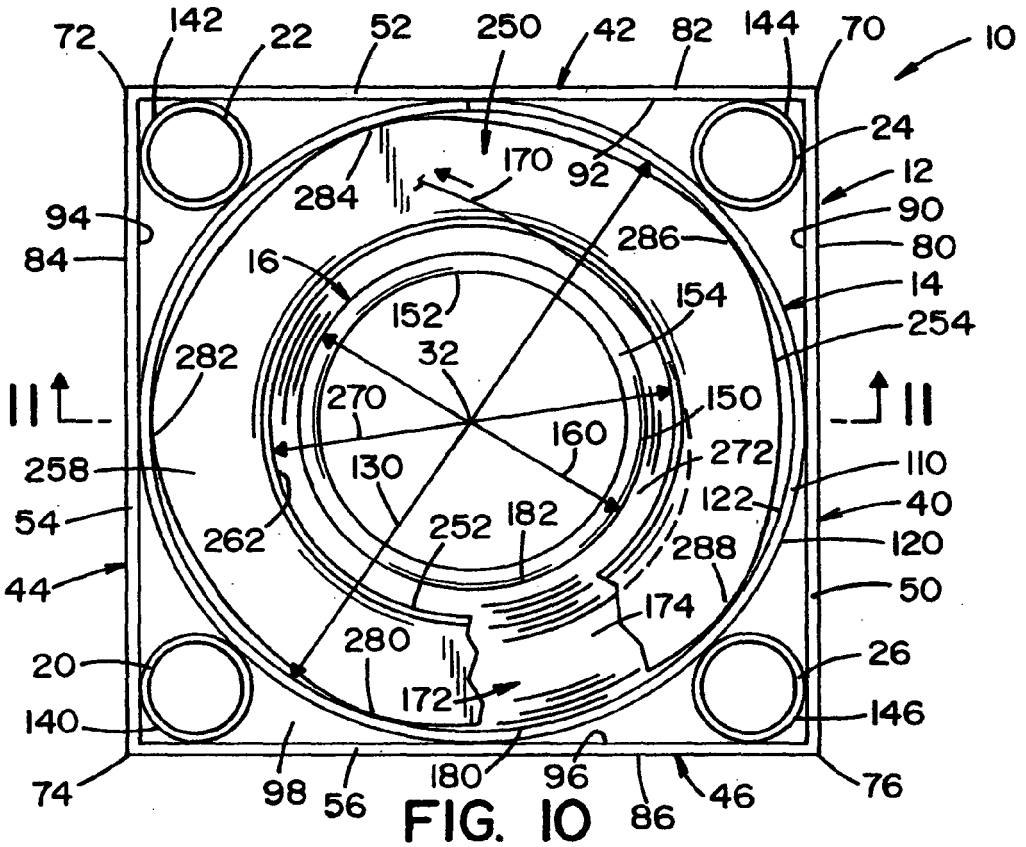

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FIG. 10

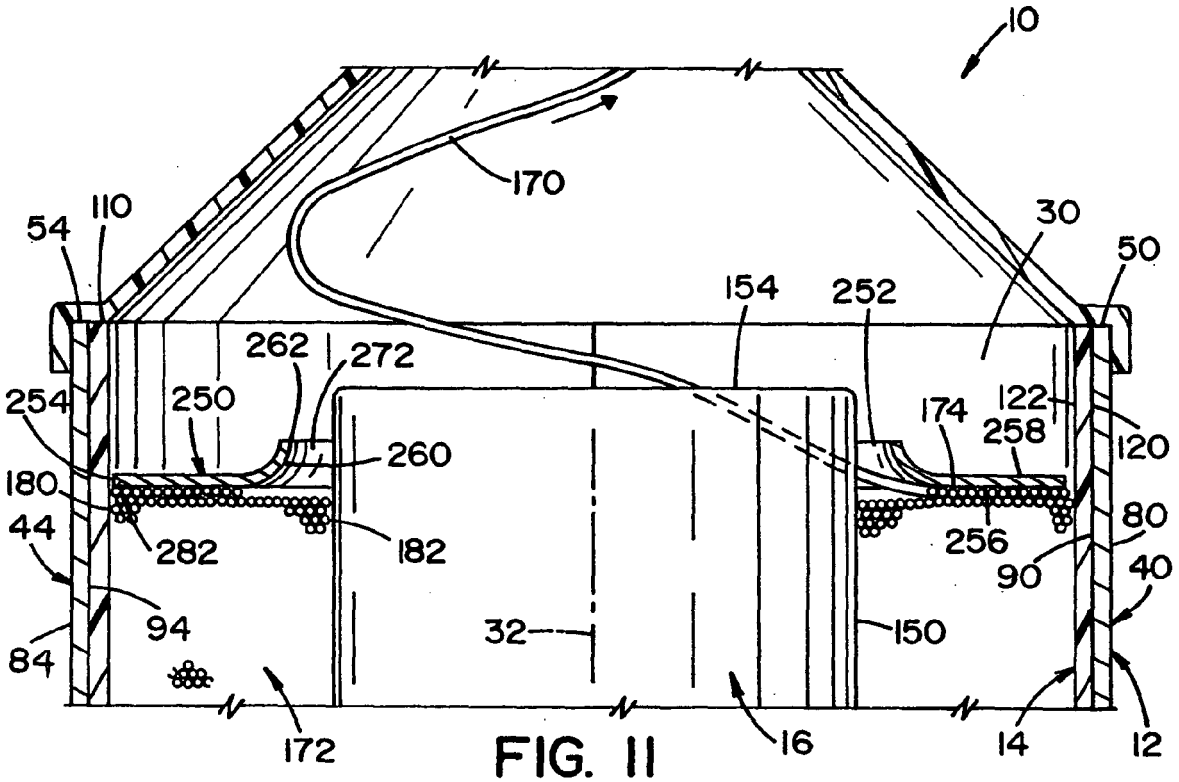

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FIG. 11

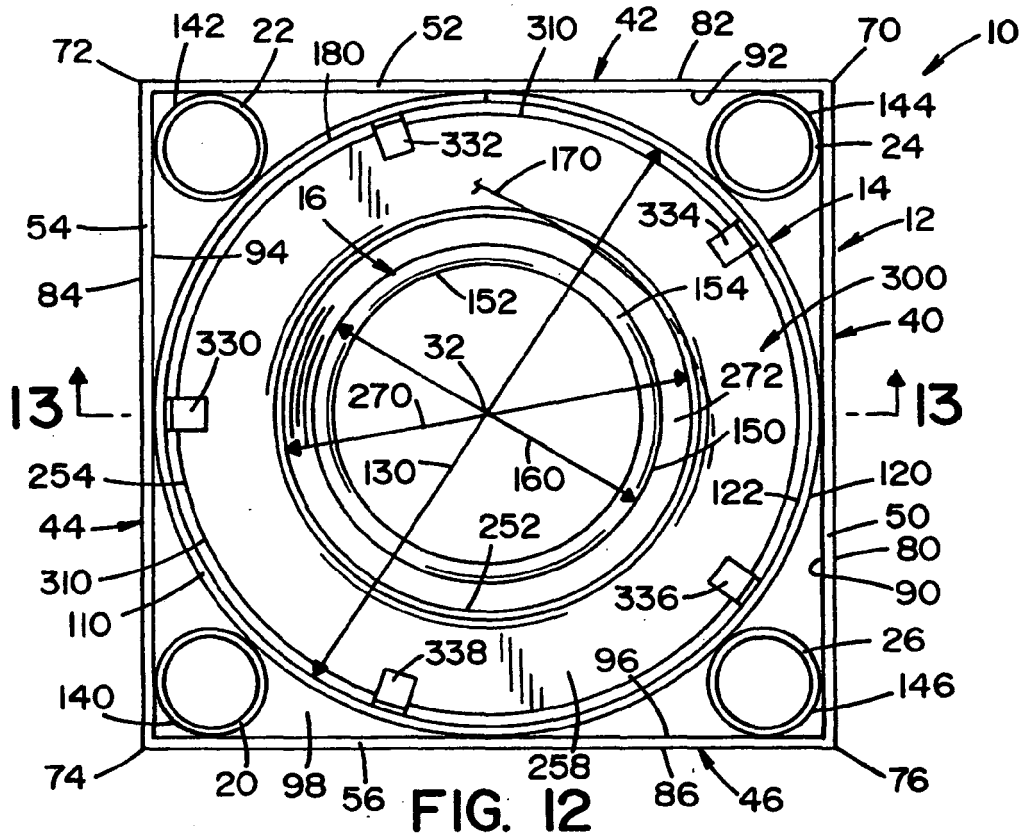

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FIG. 12

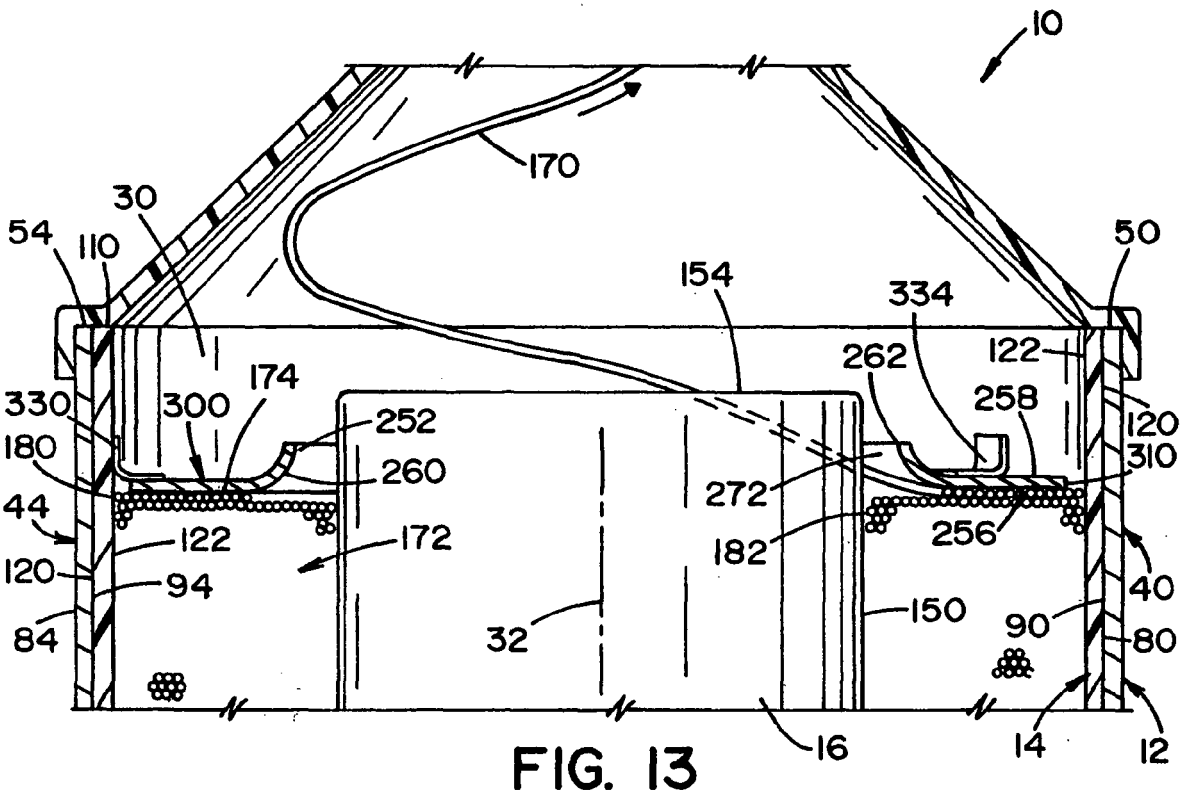

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FIG. 13

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
The Hague	16 May 2006	Barrow, J

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