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CLOSURE FOR USE WITH HIGH PRESSURES

Filed Aug. 4, 1955

2 Sheets-Sheet 1

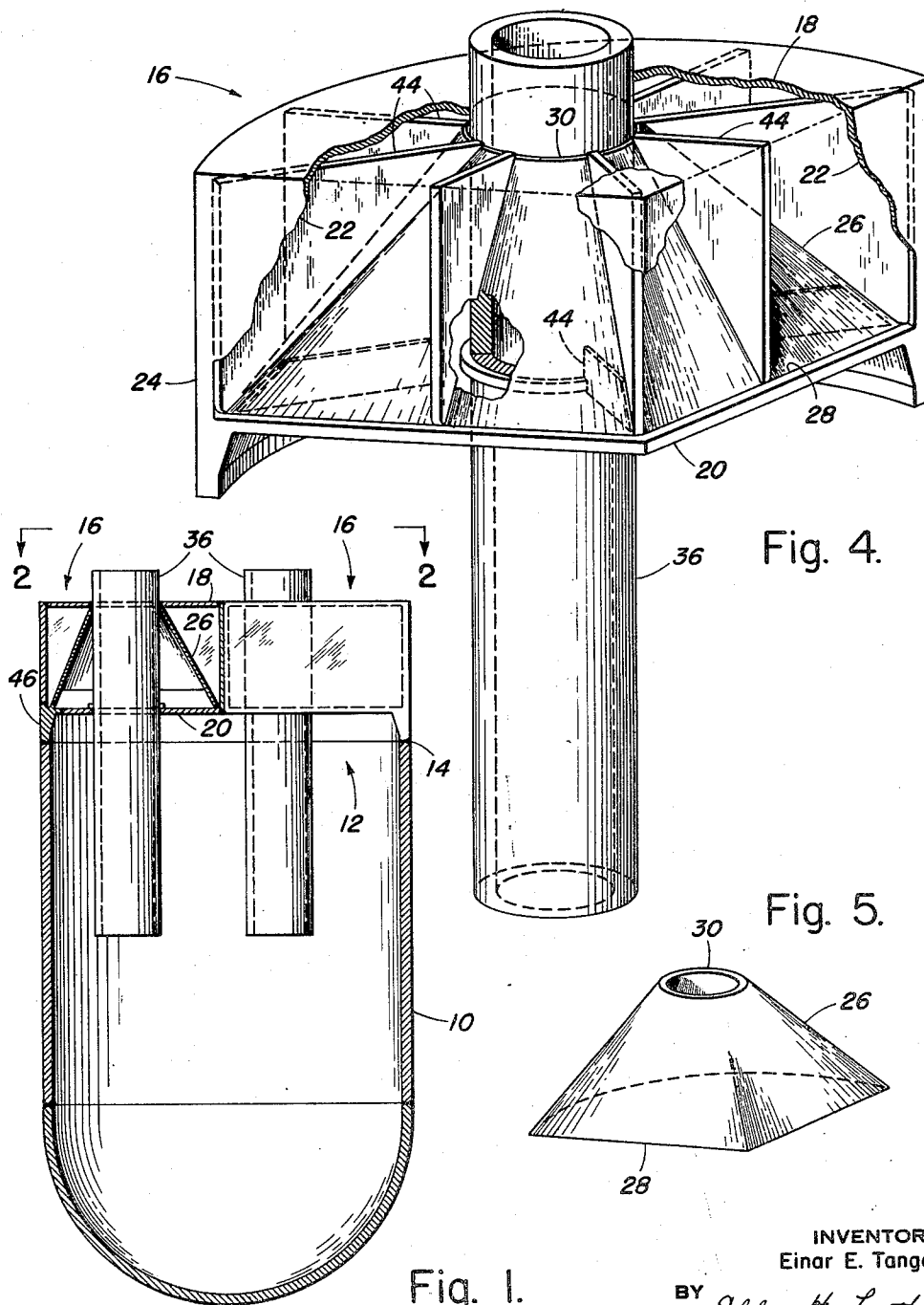


Fig. 4.

Fig. 5.

Fig. 1.

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Fig. 2.

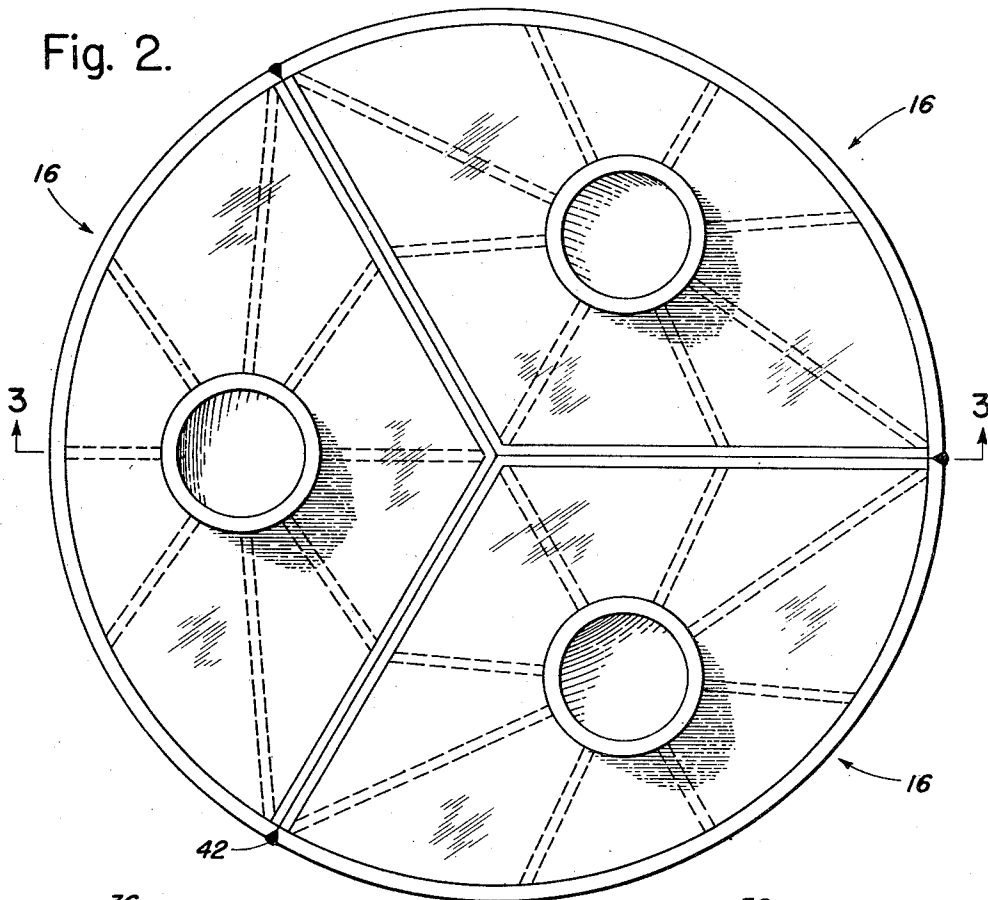
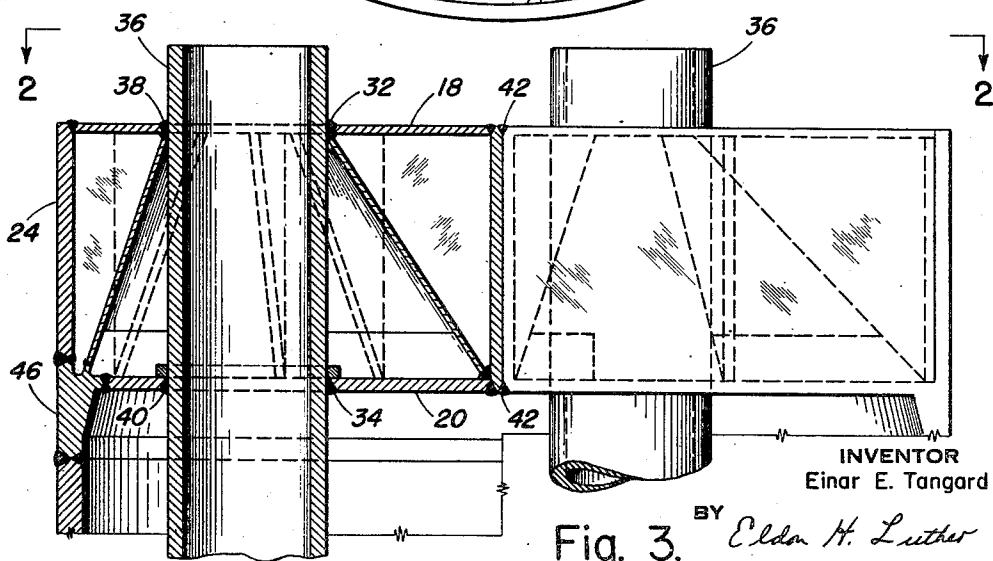


Fig. 3.

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CLOSURE FOR USE WITH HIGH PRESSURES

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4 Claims. (Cl. 220—68)

This invention relates to closures and particularly to closures for withstanding high pressure while providing a number of access openings through the closure with such a closure being adapted for use with a pressure vessel for closing an opening in the vessel while permitting the insertion of various actuating and/or control mechanism through the closure into the vessel.

In various industrial processes that are carried out under very high pressure within suitable pressure vessels, it is necessary to provide closures for one or more openings in these vessels with the closures being constructed and arranged to permit the insertion of various actuating and/or control equipment through the closure into the vessel. It is highly desirable that these closures have a flat working surface, i. e., the outer surface of the closure be flat, in order to facilitate the insertion of this actuating and/or control equipment through the closure and also to provide easy access for workmen to this equipment inserted through the closure. With the very large diameter and pressure now being encountered, with diameters up to 9 ft. and pressures up to 2500 lbs. per square inch being considered, it is impractical to employ a solid metallic flat closure because of the very great thickness that would be required since such a closure would be extremely costly and heavy as well as difficult to manufacture and handle. The present invention overcomes these disadvantages by providing a flat hollow closure constructed with a novel interior support framework capable of withstanding the large forces developed as a result of the application of high pressure to the inner surface of the closure.

In accordance with the present invention there is provided a closure for use with very high pressures and which includes a plurality of hollow metallic shells in the form of sectors of a right circular cylinder with each of the sectors being formed of plates that are welded together with these several sectors being constructed and arranged so that together they form a right circular cylinder with adjacent sectors being welded together along their adjacent outer edges. Within each of the shells there is disposed a hollow frustum of a pyramid, or, in other words, a truncated pyramid, the axis of which is parallel with that of the shell. The lower base of this pyramid corresponds to and overlies one end of the shell while the upper base, which is preferably of circular transverse section, overlies the other end of the shell with the upper and lower bases of the pyramid being welded to the respective end walls of the shell throughout the length of their edges. The ends of each of the hollow metallic shells are provided with an opening coaxial with the frustum of a pyramid and of substantially the same size as the upper base of the pyramid. Received within and extending through these openings is a conduit which is welded to the upper and lower end walls of the shell and which provides an access passageway through the closure. The lower and upper end plates of the shell may be reinforced by gusset plates or ribs provided along the inner surface thereof enabling these plates to be fab-

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ricated of thinner stock and still resist the loads to which they are subjected with the gusset plates or ribs being preferably disposed in planes which contain the axis of the pyramid. With this structural organization the closure is capable of withstanding a very large force as developed by high internal pressures within a vessel provided with the closure and yet the closure is relatively light in weight, has a flat top and provides access passageways into the interior of the vessel.

It is an object of this invention to provide an improved closure for use with pressure vessels and which is capable of withstanding high internal pressures within the vessel while providing a plurality of access passageways into the vessel, with the closure being relatively light in weight.

Other and further objects of the invention will become apparent to those skilled in the art as the description proceeds. With the aforementioned objects in view, the invention comprises an arrangement, construction and combination of the elements of the inventive organization in such a manner as to attain the results desired as hereinafter more particularly set forth in the following detailed description of an illustrative embodiment, said embodiment being shown by the accompanying drawings wherein:

Figure 1 is a vertical sectional view through a pressure vessel provided with the improved closure of this invention.

Figure 2 is a top view of the closure taken generally from line 2—2 of Figs. 1 and 3.

Figure 3 is a vertical section of the closure taken along line 3—3 of Fig. 2 and showing in detail the construction of the internal support framework.

Figure 4 is a perspective view partially broken away and showing in detail one of the cylindrical sectors of which the closure is made and the construction of the internal support of the sector.

Figure 5 is a perspective view to reduced scale, of the frustum of a pyramid which forms a part of the internal support framework of the sector of a cylinder shown in Fig. 4.

Referring now to the drawings, wherein like reference characters are used throughout to designate like elements, there is shown therein a pressure vessel 10 within which some industrial process is to be carried out at a high pressure with the process requiring that some control mechanism or actuating apparatus extend into the vessel from the exterior of the vessel. Positioned on the upper end of vessel 10 is the closure 12 which may be secured to the vessel in any suitable manner as by the annular weld 14.

As embodied, the closure 12 is in the form of a hollow right circular cylinder having a support framework therewithin constructed and arranged so that the closure is capable of withstanding extremely high pressures that may be developed within vessel 10. The closure is made up of a number of metallic shells 16 in the form of sectors of the right cylinder with three such sectors being disclosed in the illustrative organization although it is to be understood that the number of sectors employed may vary. These sectors of a cylinder 16 are preferably formed of plates welded together along their edges and are made up of top and bottom plates 18 and 20, respectively, radial side plates 22 and outer wall plate 24.

Positioned within the shell 16 is the hollow metallic frustum of a pyramid 26 which has its axis parallel with that of the shell 16 with its lower base 28 corresponding with and overlying bottom plate 20 and its upper base 30 overlying top plate 18 and preferably being circular in form. This frustum of a pyramid is welded to bottom plate 20 and top plate 18 throughout the length of the edges of its lower and upper bases respectively.

Coaxial with the frustum of a pyramid 26 and extending through aligned openings 32 and 34 in top plates 18 and bottom plate 20, respectively, is the conduit 36 with this conduit being welded at 38 and 40 to these respective top and bottom plates.

The shells 16 constructed in this manner, i. e., with the frustum of a pyramid 26 and conduit 36 welded into position as previously explained are capable of withstanding very high pressures and it will be observed that the section produced by any plane which contains the axis of the pyramid will be a truss (note the left portion of Fig. 3), with this being the result of the novel construction employed and giving great resistance to the force developed against the lower end of the closure by high pressures within vessel 10.

Should strengthening of the bottom or top plates 20 and 18 be desired or should it be desired to decrease the thickness of the plates somewhat, gusset plates or ribs 44 may be provided, as shown, extending along and secured to the inner surface of these plates and disposed in planes that contain the axis of the frustum of a pyramid 26.

In order to facilitate fabrication of each of the shells 16 there is provided machined arcuate member 46 which forms the outer lower edge of the semicylindrical shell with the shell then being fabricated by first welding bottom plate 20 to this ring and the positioning conduit 36 in place to the bottom plate. Thereafter the frustum of a pyramid 26 is positioned in place over conduit 36 with the edge of the lower base of the pyramid being welded to the bottom plate 20. Next, the outer walls of the shell 16 are positioned in place with radial plate members 22 being welded to bottom plate 20 and outer plate member 24 forming an upward extension of and being welded to arcuate member 46. Thereafter the assemblage is completed by positioning top plate 18 in place and welding it to the outer walls of the shell and to conduit 36. If gusset plates are employed they are welded into place at the point of assembling the mechanism where the welding operation is most convenient.

After each of the shells 16 have been fabricated they are assembled to form the cylindrical closure with adjacent shells being welded together along their outer edges by welds 42 thereby forming a flat closure which is relatively light and yet capable of withstanding a high pressure within vessel 10 while permitting the insertion of control and/or actuating mechanism through the conduits, with this control and/or actuating mechanism of course forming a fluid tight juncture with these conduits to prevent the escape of fluid from the interior of the vessel.

While I have illustrated and described a preferred embodiment of my novel organization it is to be understood that such is merely illustrative and not restrictive and that variations and modifications may be made therein without departing from the spirit and scope of the invention. I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes as fall within the purview of my invention.

What I claim is:

1. In a closure for a pressure vessel, a hollow cylinder closed at its ends by a pair of generally flat plates normal to the axis of the cylinder, a pressure resistant support framework disposed within said cylinder intermediate said plates and comprising a plurality of hollow frustums of a pyramid symmetrically disposed about the axis of the cylinder and with their axes parallel with that of the cylinder, the lower base of each of said frustums overlying a common one of said plates and comprising the sector of a circle whose diameter is substantially equal to the inner diameter of the cylinder with the radii of each sector extending radially from the axis of the cylinder and with the total area of said sectors equalling that of said circle, the upper base of said frustums being circular and overlying the other of said plates, said frustums of a pyramid being secured to said plates throughout the length of the edges of said upper and lower bases, plate members extending radially outward of the center of said cylinder intermediate adjacent frustums and into contact with the wall of the cylinder, said plate members being secured along their respectively adjacent edges to the wall of the cylinder and to said pair of flat plates, a cylindrical conduit coaxial with each of said frustums and having an outside diameter substantially equal to the inside diameter of the upper base thereof, said conduits extending through said frustums and through aligned openings in said plates and being secured thereto.

2. The organization of claim 1 including a plurality of gusset plates interposed between the wall of each of the frustums and the walls disposed about the frustums with the gusset plates associated with each frustum lying in planes containing the axis of the frustum.

3. A closure for withstanding high pressures while providing access passageways through the closure comprising a plurality of metallic shells in the form of sectors of a right circular cylinder, each of said shells having disposed therein a hollow metallic frustum of a pyramid the axis of which is parallel with the axis of the shell with the lower base of the pyramid being adjacent and conforming to one of the ends of the shell and the upper base being adjacent the other end, said pyramid being secured to said shell throughout the edges of the upper and lower bases of the pyramid, the ends of said shells having openings therein coaxial with the pyramid and substantially equal to the upper base of the pyramid, a conduit extending through said openings and secured to the ends of the shell, said shells being of such size and interrelated so that together they form a generally cylindrical structure with adjacent shells being welded together along their outer edges.

4. The organization of claim 3 including a plurality of gusset plates associated with each frustum said plates being interposed between the wall of the frustum and the wall of the shell and lying in planes containing the axes of the frustum.

No references cited.