

Aug. 11, 1942.

R. PYZEL
TREATING CHAMBER

2,292,716

Filed Oct. 20, 1938

4 Sheets-Sheet 1

Fig. 1.

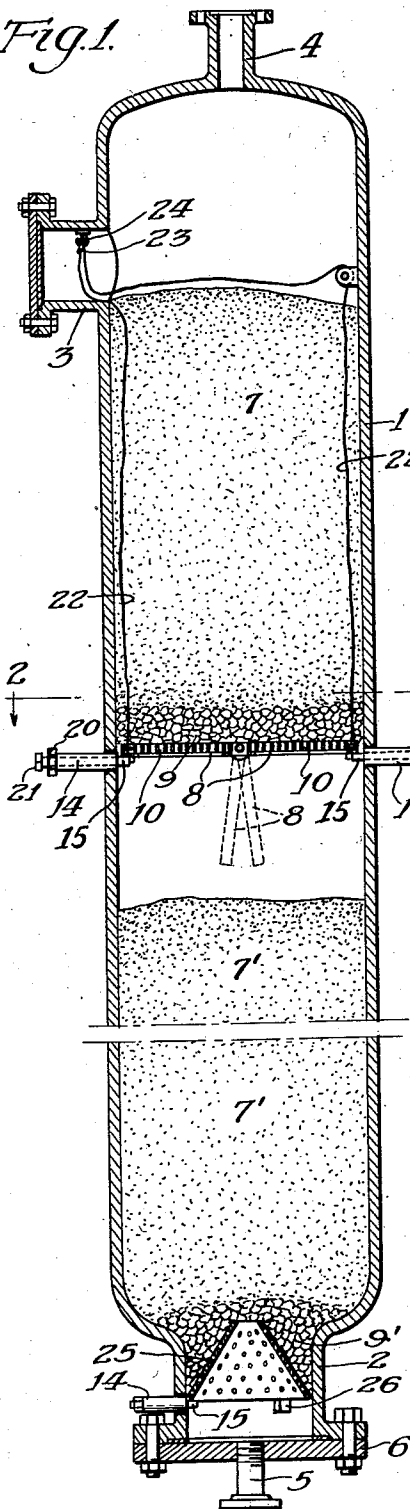


Fig. 2.

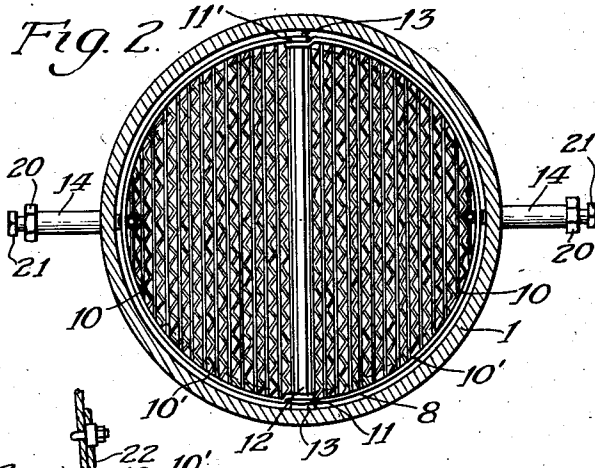


Fig. 3.

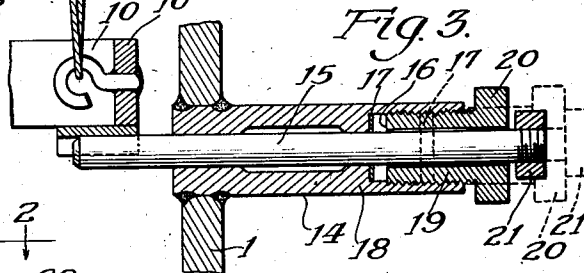


Fig. 4.

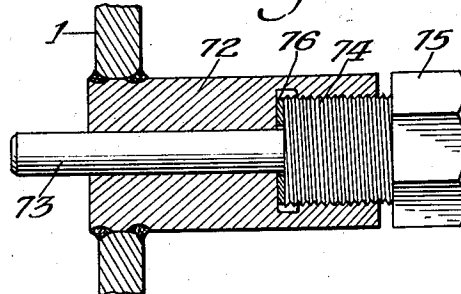
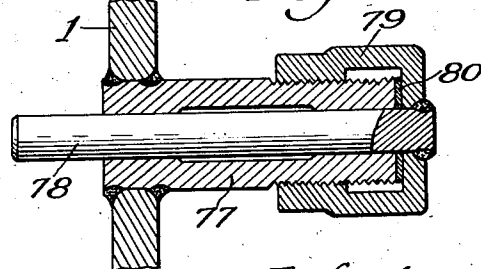


Fig. 5.



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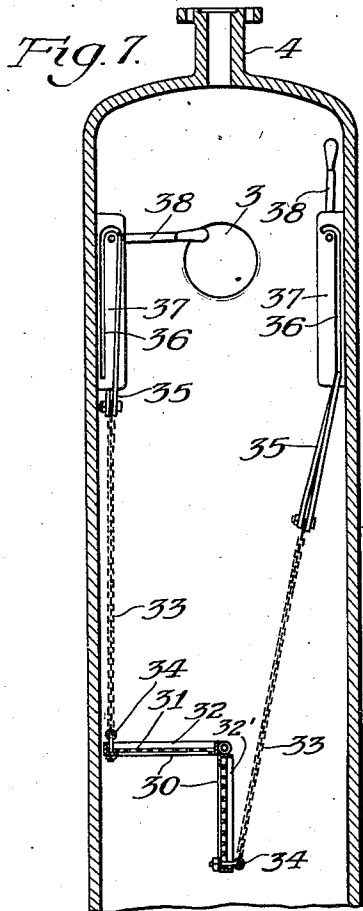
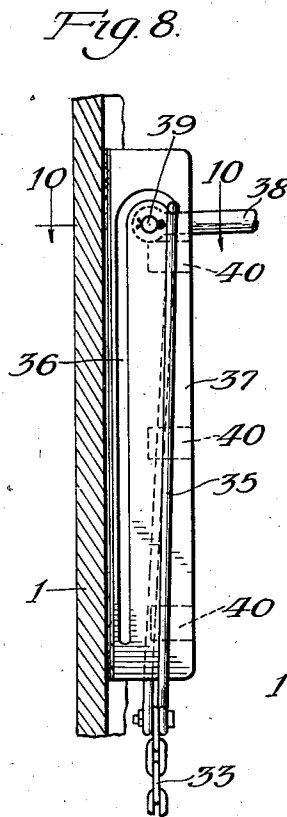
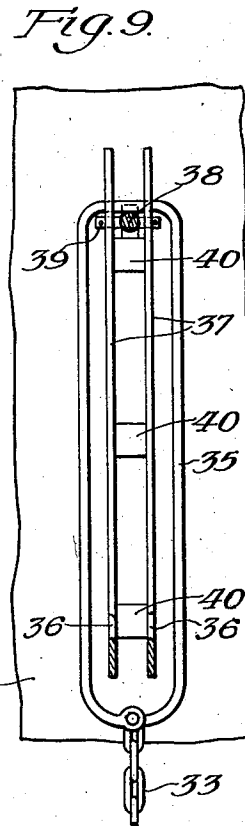
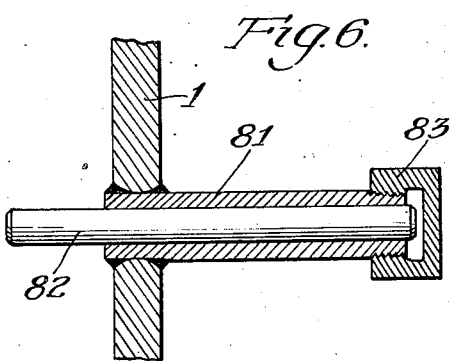
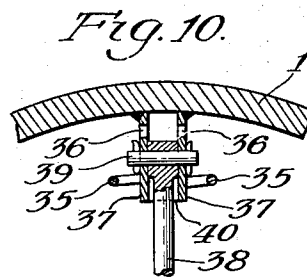
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4 Sheets-Sheet 2



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Fig. 11.

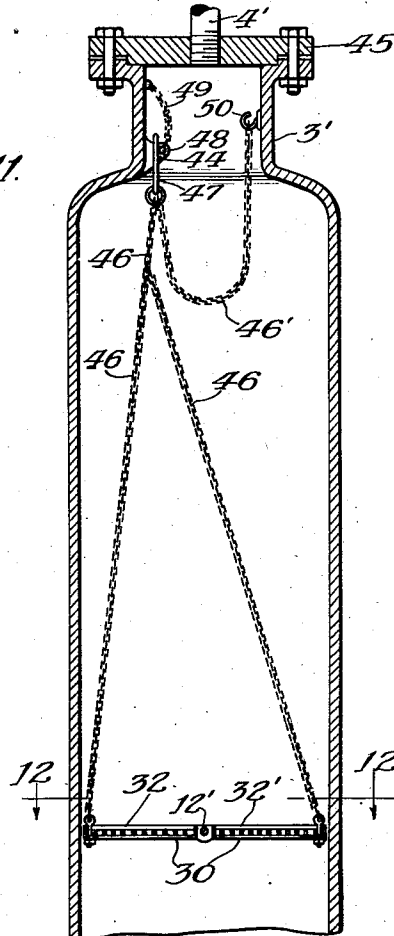
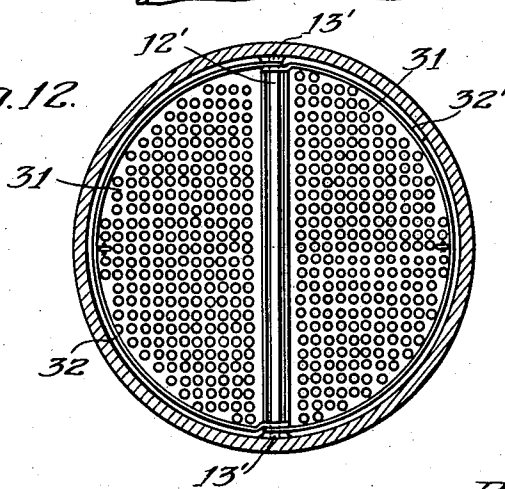


Fig. 12.



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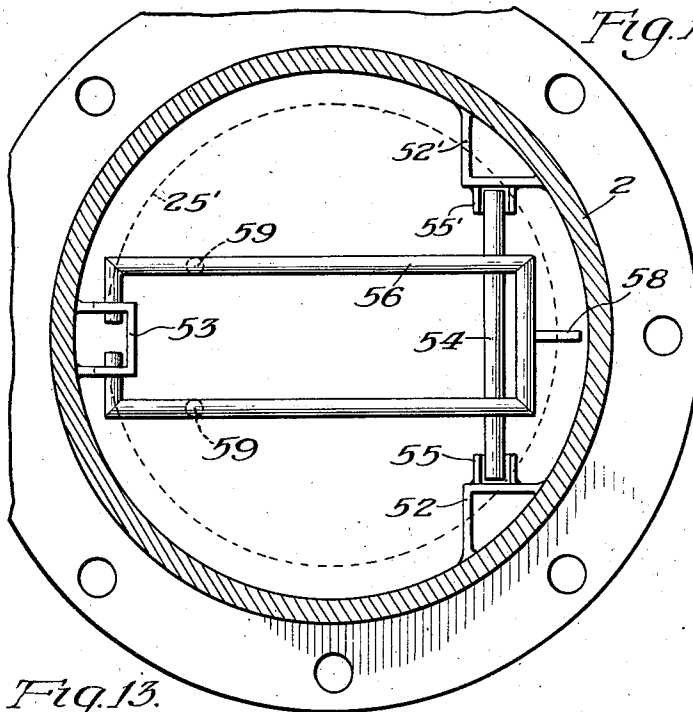
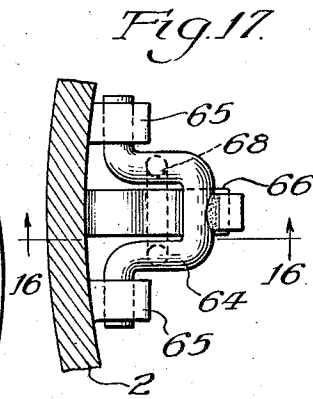
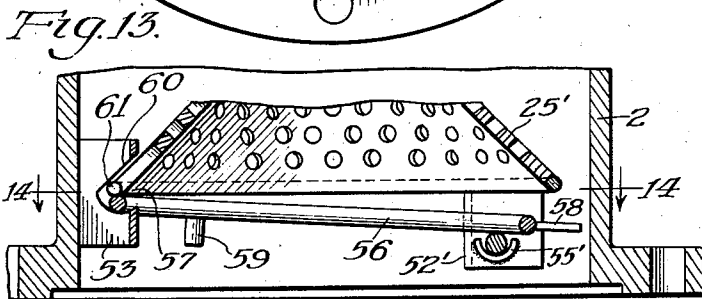
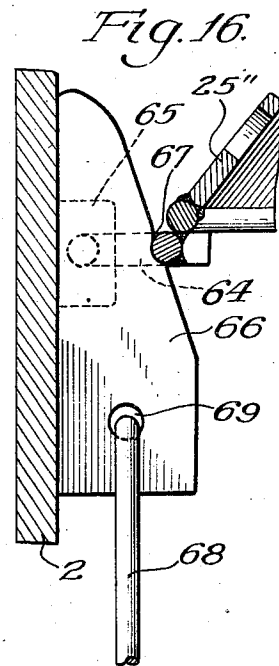
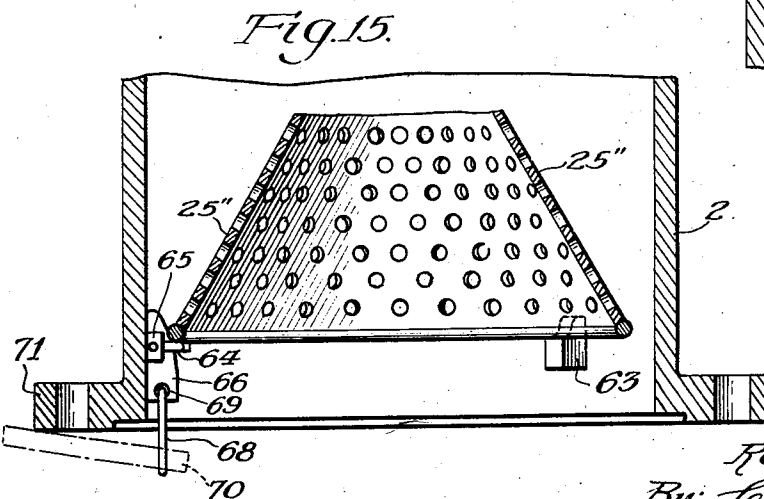
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,292,716

TREATING CHAMBER

Robert Pýzel, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill., a corporation of Delaware

Application October 20, 1938, Serial No. 236,043

9 Claims. (Cl. 210—134)

The invention particularly relates to a means for releasably supporting beds of finely divided solid or semi-solid materials such as catalyst, filtering material and the like in treating vessels such as catalytic reaction chambers, filtration or treating chambers and the like.

Many processes now employed in the refining treatment and/or catalytic conversion of hydrocarbon oils, as well as in other industries, involve the use of beds of substantially solid materials such as diatomaceous earth, filtration clays, fullers' earth, granular or extruded or pelleted catalytic material and the like. The efficiency of such materials frequently depends to a great extent upon the porous structure of the particles and the extended contract surface which the pores provide. In most cases, such porous materials are rather weak structurally and tend to disintegrate or become powdered in use, whereby their activity is materially decreased or destroyed. This is particularly true when relatively deep beds are used, since the weight of the material in the bed itself often exceeds the structural strength of the porous solid particles which compose the bed. Destruction of the particle structure by crushing is particularly pronounced when the process is conducted at super-atmospheric pressure and the vaporous, gaseous or liquid materials undergoing treatment are passed downwardly through a relatively deep bed of the treating or catalytic material, since there will be a material pressure drop between the top and bottom of the bed due to the resistance to flow offered by the bed.

Catalytic and treating materials of the character above mentioned become poisoned, contaminated or spent upon continued use and must be periodically removed from the chamber and replaced with new or revived material. This is usually accomplished by dumping the material from the lower portion of the vessel through a man-way opening or the like provided in the lower portion thereof and equipped with a removable cover plate or flange. When the bed is supported upon this removable cover plate or flange, the material composing the bed will, of course, be discharged from the vessel upon the removal of the cover plate or flange therefrom. It is frequently desirable to remove the cover plate or flange from the vessel without discharging the bed; for example, in case leaks develop at the joint where the flange or cover plate joins and the main body or man-way nozzle of the vessel, in order to remedy the leak by renewing a

gasket or regrinding a joint at this point in the vessel.

The present invention provides means of overcoming both of the difficulties above mentioned.

5 The use of an excessively deep bed of catalytic or treating material is avoided by providing one or more intermediate supporting decks or the like in the chamber upon which separate shallower beds of the material may rest. In order to permit dumping the material which com-
10 poses the bed, the supporting decks or the like are preferably made removable or collapsible by releasably securing them to the walls of the vessel. Preferably, the support for the lower-
15 most bed in the vessel does not comprise and is not supported on the removable cover plate or flange, but is releasably secured to the walls of the vessel or the walls of the man-way opening whereby the cover plate or flange may be
20 removed without disturbing the bed.

The accompanying diagrammatic drawings comprising Figs. 1 to 17, inclusive, illustrate several specific means contemplated by the in-
25 vention for overcoming the difficulties above mentioned, in the manner described.

Figure 1 of the drawings is a cross-sectional elevation of a vessel containing beds of finely divided solid treating or catalytic material, with means for independently supporting each of the
30 beds from the walls of the vessel and means for releasing each of said supporting means whereby the material comprising said beds may be discharged from the lower portion of the chamber.

35 Figure 2 is a plan view of the folding deck of Fig. 1 taken along a plane indicated by line 2—2 in Fig. 1.

Figure 3 is an enlarged cross-sectional detail of the securing mechanism 14 of Figure 1.

40 Figures 4, 5, and 6 illustrate modified forms of the securing mechanism shown in Figure 3.

Figure 7 is a cross-sectional elevation of the upper portion of a vessel such as a reaction or treating chamber illustrating another specific
45 means of releasably securing a folding deck to the walls of the vessel.

Figures 8, 9 and 10 are, respectively, a side elevation, a front elevation and a sectional plan view of elements of Figure 2 which releasably
50 secure the folding section of deck 30 to the walls of the vessel. The section of Figure 10 is taken along the plane indicated by the line 10—10 in Figure 8.

Figure 11 is a cross-sectional elevation of the upper portion of a chamber illustrating another

specific manner of releasably securing a folding upper deck, which supports the upper bed of catalyst or treating material, to the walls of the vessel.

Figure 12 is a plan view of collapsible deck 30 of Figures 7 and 11 showing the deck in place in the chamber and taken along a plane indicated by line 12—12 in Figure 11.

Figure 13 is a sectional elevation of the lower portion of a vessel such as a reaction or treating chamber illustrating another specific manner of releasably supporting a perforated cone, similar to that indicated at 25 in Figure 1, from the walls of the vessel.

Figure 14 is a plan view of the mechanism illustrated in Figure 10.

Figure 15 is a sectional elevation of the lower portion of the vessel, such as a reaction or treating chamber, illustrating another specific manner of releasably supporting a conical member, similar to that indicated at 25 in Figure 1 from the walls of the vessel.

Figures 16 and 17 are, respectively, an enlarged elevational view, and an enlarged plan view of the locking and releasing mechanism shown in Figure 15. Figure 16 is shown partially in cross section, the section being taken along a plane indicated by line 16—16 in Figure 17.

Referring to Figure 1, the main body of the cylindrical chamber is indicated in cross-section at 1. It is provided with a lower man-way nozzle 2, a man-way nozzle 3, entering the side of the chamber adjacent its upper end and an inlet nozzle 4 at the top of the chamber through which vaporous, gaseous or liquid material to be treated is admitted. The treated products are discharged from the lower portion of the chamber through outlet connection 5 in removable flange 6 of man-way 2.

A bed 7 of relatively small solid particles such as catalyst, treating material, filtering material or the like is disposed within the upper portion of the chamber and supported upon a perforate collapsible deck 8 disposed at an intermediate point in the length of the chamber. A bed 9 of relatively coarse material such as crushed stone or gravel, for example, is provided between the collapsible deck 8 and bed 7 in order that relatively large openings may be provided through deck 8 for the passage of materials undergoing treatment and still retain the relatively small solid materials, which compose bed 7, in place above the deck.

Collapsible deck 8, in the particular case here illustrated, comprises two semi-circular sections 10 of grating or the like. This is more clearly illustrated in Figure 2 and, as shown in this figure, the semi-circular sections are hinged at 11 and 11' by means of rod 12 which is mounted in suitable lugs 13 which are welded or otherwise secured in any desired manner to the cylindrical side wall 1 of the chamber at opposite ends of a diametral line passing through the chamber. Sections 10 and 10' of the grating are bound along their edges by metal bars 10' or the like, the ends of the circumferential binding bars acting as hinge members at 11 and 11'.

Referring now to Figures 1 and 2, sections 10 of the grating are each supported in a substantially horizontal position by a member 14 which extends through wall 1 of the chamber at a point substantially 90° from lugs 13 and is attached to the chamber walls by welding or any other suitable manner.

A retractable rod or bar 15 is provided in mem-

bers 14, which bar or rod is normally held in an engagement with the lower edge of the adjacent section of the collapsible deck to furnish support for the same. In its normal position, flanged section 16 of member 15 bears against a gasket 17 provided in the outer shell 18 of member 14 to prevent leakage to or from the vessel, the bar being retained in a position such that member 16 bears against gasket 17 and the inner end of the bar supports the deck section by means of member 19 which is screwed into outer shell 18. A hexagonal nut 20 or the like is provided at the outer end of member 19. When this nut is turned to back member 19 out of the housing, it bears against a suitable collar or head 21 provided at the outer end of bar 15 and forces the inner end of bar 16 out of engagement with the adjacent deck section. Bar 15 and member 20 assume the position indicated by the dotted lines in Figure 3 when member 19 is partially unscrewed from the housing and the deck sections drop to the approximate position indicated by the dotted lines in Figure 1, thereby releasing the materials which compose beds 9 and 7 and allowing them to drop out of the chamber through lower man-way 2.

Suitable cables or light chains indicated at 22 in Figure 1 may be attached, at one end of each, to one side of the sections of the collapsible deck 8 and attached at their opposite ends by means of link or loop 23 to a suitable hook or the like 24 attached, for example, to the walls of man-way nozzle 3. This permits raising the folding sections of the collapsible deck 8 to a horizontal position after they have been released from 14, whereafter bars 15 are re-engaged with the sections of the deck to hold the latter in position, permitting beds 9 and 7 to be replaced. As indicated in Figure 1, sufficient slack may be provided in members 22 to allow the deck sections to drop upon retraction of bars 15.

As indicated in Figure 1, beds 7' and 9', similar to beds 7 and 9, are provided in the lower portion of the chamber and these beds, as here indicated, are preferably supported independently of flange 6. This is accomplished, in the case here illustrated, by means of a supporting structure such as perforated cone 25, for example, which in turn, is supported from the walls of the chamber, its lower edge resting at two spaced points on its circumference on lugs such as indicated at 26 which are welded or otherwise rigidly attached to the walls of man-way nozzle 2 and at a third spaced point on its circumference by bar 15 of another member 14, such as previously described.

After flange 6 is unbolted from the man-way nozzle, beds 9' and 7' may be discharged through the man-way opening, when desired, by retracting bar 15 of the member 14 associated with cone 25. This allows cone 25 to slip from lugs 24 and drop out of the chamber. The base of cone 25 is somewhat smaller in diameter than the inside of man-way opening 2 so that it will readily slip from lugs 26 and pass through man-way 2 when bar 15 is retracted and so that it may be readily replaced on the lugs 26 and held in position by engaging it with bar 15 of the adjacent member 14.

It will, of course, be understood that beds 7 and 9 may be dropped upon bed 7' and the mass of materials comprising beds 7, 9, 7' and 9' dumped from the chamber by removing flange 6 and cone 25. Preferably, however, beds 7' and 9' are first dumped by removing flange 6 and cone 25 while

the folding sections of deck 8 are retained in a horizontal position and beds 7 and 9 are subsequently dumped by releasing the sections of deck 8 from the supporting bars 16 of the adjacent members 14.

The modified form of the retractable securing device shown in Figure 4 comprises a shell 72 which may be welded, as shown, or otherwise attached to wall 1 of the vessel in the same position as device 14 of Figure 1 is attached. Rod 73, which engages the lower edge of the foldable deck sections, is attached to or integral with plug 75, the threaded portion 74 of which engages a threaded recess in the outer end of shell 72. As here illustrated, machine threads are employed at 74 and a gasket 76 is interposed between a threaded end of the plug 75 and the bottom of the recess in member 72 to prevent leakage. In Figure 4, rod 73 is retracted to release the foldable deck section by unscrewing plug 75.

The modified form of retractable securing device shown in Figure 5 comprises a shell 77 which is attached, by welding, as illustrated, or in any other suitable manner, to the wall 1 of the vessel in the same position as member 14 of Figure 1. The inner end of rod 78 engages the foldable deck section and is attached at its outer end by welding or any other suitable manner to a cap 79 which is threaded onto the outer end of shell 77. In the particular case here illustrated, machine threads are employed in the cap and on the shell and a gasket 80 is interposed between the outer end of the shell and the head of the cap to prevent leakage. By unscrewing cap 79 from shell 77, rod 78 is retracted and the foldable deck section, which it supports, is released.

The modified form of deck securing device shown in Figure 6 comprises a shell 81 which is welded or attached in any other suitable manner to shell 1 of the vessel in the same position as device 14 in Figure 1. Rod 82 extends through the bore of shell 81 to engage the foldable deck section within the vessel and the device is sealed from leakage by cap 83 which, in this particular case, is provided with a tapered pipe thread corresponding to the threaded outer end of shell 81. With the device shown in Figure 6, the foldable deck section is released by removing cap 83 from shell 81 and driving rod 82 through the shell into the chamber by means of a smaller rod, drift-pin or the like, not illustrated.

In Figure 7 the cylindrical walls of the reaction or treating chamber are again indicated at 1 and the collapsible deck 30, similar to deck 9 of Figure 1, is provided in the central portion of the chamber.

Although omitted from Figure 4, beds the same or similar to beds 7 and 9 of Figure 1 may be disposed above deck 30 and retained in place thereby when the latter is held in a horizontal position. Suitable perforated plates, grating or the like indicated at 31 are provided as a part of deck 30 for retaining relatively coarse materials such as that of bed 9 in Figure 1.

The construction of deck 30 is more clearly indicated in Figure 12. It comprises two substantially semi-circular frames 32 and 32', each of which is constructed of metal angles and supports a perforated semi-circular plate or grating 31. The ends of the semi-circular framing members overlap and engage hinge bar 12' which, like bar 12 of Figure 1, is disposed at its opposite ends on the supporting lugs 13' attached to the walls of the chamber.

Suitable elongated relatively flexible members, indicated at 33 in Figure 7 and here shown as chains, serve as a means of supporting the collapsible sections of deck 30 in a horizontal position from the walls of the chamber. Metal cable or bars with suitable flexible joints may be employed instead of chains 33, when desired. One end of each of the chains 33 is attached by suitable means such as eyebolt 34 to one section of deck 30 and is retained at its opposite end by means of an elongated link or the like 35 in slot 36 of member 37 which, in turn, is attached by welding or in any other suitable manner to the walls of the vessel.

Referring now to Figures 8, 9 and 10, slot 36 of member 37, as shown in Figure 8, is hook-shaped at its upper end and when the upper end of link 35 is retained in this hook-shaped upper end of slot 36 the sections of deck 30 are retained in a horizontal position. To collapse the deck, lever 38, which is hinged, as indicated at 39 to member 37, is raised from a horizontal to a substantially vertical position, lifting the upper end of link 35 out of the hook-shaped section of slot 36 and allowing it to drop to the bottom of the slot.

Member 37, as indicated in Figures 8 and 9, comprises two metal plates spaced a sufficient distance apart to accommodate the end of level 38 by means of members 40, the upper one of which serves as a stop for lever 38 to retain it in a position at which it may be readily grasped through man-way opening 3' (see Figure 7).

The position to which lever 38 is moved to allow link 35 to drop to the lower end of slot 36 and the position of link 35, chain 33 and the folding section of deck 30, when released, is indicated on the right-hand side of Figure 7. The position of the various members when the deck is retained in horizontal position is indicated on the left-hand side of Figure 7.

In Figure 11 another specific manner of releasably supporting collapsible deck 30 from the walls of the vessel is illustrated. It is much the same as that illustrated in Figure 7, except that the mechanism illustrated in Figures 8, 9 and 10 is omitted, being replaced, in part, by lug 44. The chamber illustrated in Figure 11 is similar to that of Figures 1 and 7, except that the upper man-way nozzle 3' is attached to the upper head of the vessel and inlet connection 4' is attached to removable flange 45 of man-way 3'.

In Figure 11, chain 46 has two legs, one of which is attached to section 32 of deck 30 and the other of which is attached to section 32' of deck 30. A link 47 engages chain 46 with lug 44 in such a manner that sections 32 and 32' of deck 30 are held in a horizontal position. Link 47 is prevented from slipping from lug 46 by means of removable pin 48 inserted through an opening provided in the lug and, in the particular case here illustrated, pin 48 is attached by means of chain 49 or the like to the walls of the vessel so that it will not be lost when removed from the opening. Upon the removal of pin 48 from chain 46, lug 47 may be forced from the latter by inserting a suitable bar or lever, not illustrated, between the link and the walls of the vessel and prying the link from the lug. This releases the sides of deck 30, allowing sections 32 and 32' to drop to a substantially vertical position. Preferably, chain 46 has a section 46' attached to link 47 and to a suitable hook or the like 50 which is attached to the walls of the vessel at the upper man-way opening. This section 46' of the chain is of sufficient length to per-

mit collapse of the grating when link 47 is removed from lug 46 and by attaching the chain to hook 50, its end is retained in a position such that it may be readily grasped through man-way 3 to lift the collapsed sections of the grating to a horizontal position and re-engage link 47 with lug 46.

Referring now to Figures 13 and 14, another specific form of mechanism for releasably retaining a perforated cone 25', similar to that indicated at 25 in Figure 1, is here shown. The walls of the lower man-way nozzle are again indicated at 2. The position of cone 25' is shown in Figure 14 by dotted lines.

Three lugs 52, 52' and 53 are provided and attached by welding or any other suitable manner to the walls of the man-way opening at spaced points about its circumference. A rod or bar 54 extending between lugs 52 and 52' is supported thereby at its opposite ends in semi-cylindrical sockets 55 and 55'.

A link or substantially C-shaped member 56 is hingedly supported at one end in an open notch 57 provided in member 53 and the opposite end of member 56 rests upon bar 54.

The position of cone 25' is indicated in Figure 14 by the dotted lines 25' and the bottom of this cone rests upon lugs 52 and 52' and upon the end of C-shaped member 56 which is adjacent lug 53.

Member 56 is provided with a handle 58 and fulcrum lugs 59. To release the cone and dump the material which it supports from the chamber, the end of member 56 which rests on rod 54 is lifted by handle 58 and rod 54 lifted from sockets 55 and removed from the assembly. Fulcrum lugs 59 of member 56 are then brought back against the adjacent side walls of the man-way nozzle and member 56 is used as a lever whereby the ends thereof disposed in notch 57 are retracted therefrom. When this is done, the side of cone 25' which rests upon member 56 is released and slips down past lug 53 by virtue of slot 60 provided in the cone. This causes the opposite side of the cone to slip from lugs 52 and 52' and fall from the chamber. The method of replacing the various members of the assembly will be apparent and is virtually the reverse of that whereby the cone is released.

As indicated in Figure 13, the lower edge of cone 25 is reinforced by circumferential rod 61 which is also slotted to correspond to slot 60 of the cone. Neither rod 61, handle 58 nor lugs 59 are essential.

Referring now to Figure 15, wherein the walls of the lower man-way nozzle are again indicated at 2 and the cone which supports the lower bed of treating or polymerizing material is indicated at 25'', spaced lugs, one of which is shown at 63, support one side of cone 25''. Releasable mechanism for supporting the other side of the cone is substituted for that shown in Figures 13 and 14. This mechanism comprises a substantially U-shaped link 64 hinged at its ends to members 65 which are attached by welding or any other suitable manner to wall 2 of the man-way nozzle. Link 64 is normally held in a substantially horizontal position by means of a wedge 66 and, when so held, the outer end of link 64 supports one side of cone 25''.

Preferably, as a safety measure, the sloping face of wedge 66 is slightly recessed as indicated at 67, wherein it engages link 64 when the latter is in a substantially horizontal position. Normally, the weight of the material carried by the cone will prevent unintentional removal or slip-

page of wedge 66 but the slightly recessed portion 67 provides additional security. Preferably, the upper edge of depression 67 is well rounded so that by supplying a substantial downward force to wedge 66, it will be removed. This is accomplished, in the case here illustrated, by providing a link 68 passing through a hole 69 provided in the lower portion of wedge 66 and extending beneath the face of the lower man-way nozzle when the removable flange is detached therefrom. By inserting a pry bar or the like, indicated by dotted lines 70, in the lower end of link 68 and using the adjacent lower edge of a flange 71 as a fulcrum, wedge 66 may be pried downward and released from the assembly, allowing link 64 to drop to a substantially vertical position. This causes that side of cone 25 which is supported by link 67 to drop and causes the opposite side of the cone to slip from lugs 63, whereby the cone drops from the chamber and the material which it supports is dumped through the man-way opening.

I claim:

1. An apparatus for contacting fluids with a solid refining or catalytic agent comprising a treating vessel containing a bed of relatively small solid particles of said agent, upper and lower openings in said vessel, a perforate member at the base of said bed which is supported from the walls of the vessel, in part, by members rigidly attached to said walls and, in part, by a member releasably engaged with said walls adjacent said upper opening.

2. In combination with a treating vessel for contacting fluid with a solid refining or catalytic agent having a relatively large discharge opening at one end, a cover plate for said opening releasably secured to the vessel, a perforate member within said vessel, means supporting said perforate member from the walls of the vessel in a position to retain a bed of relatively small solid particles of said agent in the vessel when said cover plate is removed, fluid inlet and outlet means on opposite sides of said bed and means, independent of said cover plate and independent of the releasable securing means for the cover plate, for releasing said perforate member from the walls of the vessel, whereby to dump said bed said releasing means being detachably secured adjacent said inlet.

3. In combination with a treating vessel for passing fluid through a bed of relatively small solid particles of refining or catalytic agent, fluid inlet and outlet means on opposite sides of said bed, a perforate-retaining member for said bed within the vessel supported, in part, by members rigidly attached to the walls of the vessel and, in part, by a member movably engaged with said walls, and means including said movable member for releasing said retaining member from a position at which it supports said bed said means being located at a point adjacent said inlet.

5. An apparatus for contacting fluids with a solid refining or catalytic agent comprising an elongated substantially cylindrical treating vessel containing a mass of relatively small solid particles of said agent, fluid inlet and outlet means on opposite sides of said mass; means dividing said mass into a plurality of spaced beds, whereby to divide the weight of said mass and prevent crushing of said particles, said means comprising a perforate deck disposed at an intermediate point in the vessel and supported from the walls of the vessel, in part, by members rigidly attached to said walls and, in part, by a mem-

ber movably engaged with said walls and means comprising said movable member for releasing said deck from a position at which it supports the superimposed bed said latter means being releasably secured to said vessel at a point adjacent said fluid inlet.

5. An apparatus for contacting fluids with a solid refining or catalytic agent comprising a treating vessel containing a bed of relatively small particles of said agent, fluid inlet and outlet means on opposite sides of said bed, a perforate supporting deck for said bed composed of foldable sections, means for supporting said foldable sections from the walls of the vessel in a position to retain said bed, and means for releasing certain of said supporting means to permit collapse of the deck by folding under the weight of said bed said latter means being releasably secured to said vessel at a point adjacent said fluid inlet.

6. An apparatus for contacting fluids with a solid refining or catalytic agent comprising an elongated substantially cylindrical treating vessel containing a mass of relatively small solid particles of said agent, fluid inlet and outlet means on opposite sides of said mass, means dividing said mass into a plurality of spaced beds, whereby to divide the weight of said mass and prevent crushing of said particles, said means comprising a perforate deck disposed at an intermediate point in the vessel, said deck comprising foldable sections hinged to the adjacent walls of the vessel and means releasably supported from

a point adjacent said inlet opening adapted to retain said superimposed bed.

7. The apparatus defined in claim 6, wherein the releasable supporting means for said deck comprise elongated flexible members secured at one end to said foldable sections adjacent the outer edges of the latter and releasably secured at the opposite end to a portion of the vessel above said bed.

8. The apparatus defined in claim 6, wherein the releasable supporting means for said deck comprise slidable members such as bars or rods movably engaged with said foldable sections of the deck adjacent the outer edges of the latter and movably engaged with the walls of the vessel said members being releasably attached to said vessel at a point adjacent said inlet.

9. In combination with a treating vessel for contacting fluid with a solid refining or catalytic agent, having an inlet opening and a relatively large discharge opening at one end and fluid inlet and outlet means, a cover plate for said discharge opening releasably secured to the vessel, a perforate member within said vessel, means supporting said perforate member from the walls of the vessel in a position to retain a bed of relatively small solid particles of said agent in the vessel and remotely controlled means adjacent said inlet opening independent of said cover plate and independent of the releasable securing means for the cover plate for releasing said perforate member from the walls of the vessel.

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