

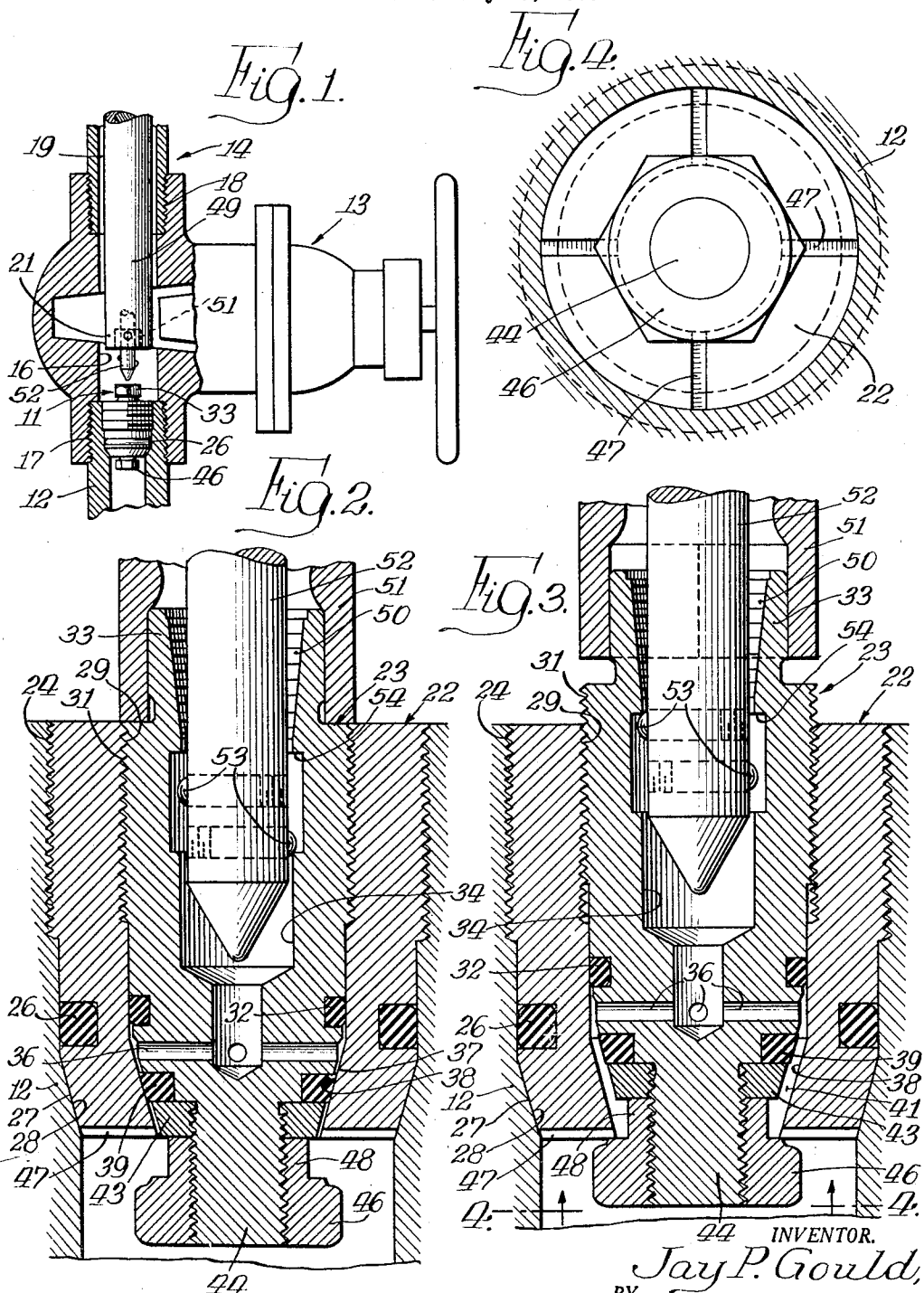
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ACCESS PLUG

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ACCESS PLUG

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This invention relates to pressure containers and more specifically to an access plug for such containers.

It has long been a problem to gain access to the interior of pressure containers for high pressure fluids such as oil well casing heads, fluid pipe lines and the like, without disruption of the pressure or of fluid flow in the container, if flow is in progress. To overcome the problem I have developed an adapter comprising a plug and nipple described and claimed in my copending application Serial No. 160,222 filed May 5, 1950, now Patent No. 2,804,279. That device effectively renders the interior of pressure containers accessible for such purposes as testing, sampling and the like, and when a special pressure confining tool, such as described and claimed in my application Serial No. 247,005 filed September 17, 1951, now Patent No. 2,744,310 issued May 8, 1956, is applied thereto, the plug may be removed and replaced while the fluid therein is under pressure and even when flow exists therein, without disruption of either pressure or flow.

Briefly stated, the plug above referred to, affords access to the interior of the container through an internally threaded nipple, or other appropriate portion of the container. Normally, the nipple or portion of the container is closed by the externally threaded access plug, and access is gained by removing the plug, with the pressure confining tool, above referred to, in the manner described in the above applications. The diameter of the plug determines the degree of access that is afforded and, necessarily limits the size of any device that may be introduced into the container. For smaller openings in the container the above described plugs are entirely adequate, but in the event that the pressure difference between the interior and the exterior of the container is relatively large and a relatively large opening into the interior of the container is required, difficulty will be encountered in initially turning a plug of such size to effect its removal.

It is therefore a primary object of this invention to provide an access plug for pressure containers for high pressure fluid, which may be of relatively large diameter and yet which is easily removed from the container.

Another object is to provide an access plug for pressure containers for high pressure fluid that will by-pass fluid from one to the other end thereof for balancing the forces thereon and thus reduce the effort required to remove the plug.

Other objects and advantages of the invention will become apparent from the subsequent description taken in conjunction with the appended drawing wherein:

Fig. 1 is a fragmentary sectional view on a reduced scale of an installation provided with one embodiment of the plug mounted in a pressure container or nipple and illustrating the relative locations of accessory elements used for installation and removal of the plug.

Fig. 2 is a sectional view of the plug illustrating the relative positions of its element when in plugging relation.

Fig. 3 is a view similar to Fig. 2 illustrating the rela-

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tive position of its elements during removal of the plug, and

Fig. 4 is an end view of the plug taken along line 4—4 of Fig. 3.

In general, the objects of the invention are accomplished by providing an access plug that may be threadedly inserted and sealed in an opening in a pressure container for high pressure fluid, but which has means that is shiftable therein to open a passage through the plug. Upon being opened, the passage by-passes fluid from one end of the plug to its opposite end, if a pressure differential exists there-between. By properly confining any by-passed fluid with an appropriate tool, as described herein-after, the forces exerted by the fluid on the opposite ends of the plug are balanced, and the plug may be unscrewed and removed without additional effort being required to overcome the huge resisting resultant force caused by the pressure differential that would otherwise exist.

Referring to the drawing, Fig. 1 shows one embodiment of the plug, indicated generally at 11, installed in an internally threaded portion of a pressure container 12, such as a nipple attached to a pipe line, an oil well casing head or any other container for high pressure fluid. The function of the instant plug 11 is in principle the same as the plug described in my aforementioned application Serial No. 160,222. It is installed and removed from the container in substantially the same manner, and it requires the same accessories for installation and removal under pressure. When installed, as shown in Fig. 1, plug 11 seals the container, and may carry appropriate equipment as will be hereinafter described.

Effecting installation or removal of the plug 11, requires the cooperation between a valve, such as that indicated generally at 13, and a special pressure confining tool, shown generally at 14. Valve 13 must be such that when open, it provides a passage 16 sufficient to permit insertion or withdrawal of plug 11 therethrough. It must also be capable of cooperation with the container to form a pressure tight seal therewith, such as by means of the threaded connection 17 between valve 13 and container 12. Further, it must be capable of cooperation with the tool to form a pressure tight seal therewith, such as by means of the threaded connection 18 between valve 13 and tool 14. Tool 14 must provide a passage of sufficient size to accommodate plug 11 and permit it to be moved clear of the outer end of valve 13, such as into passage 19 of the tool. It must also be sealed so as to retain any fluid coming from the container, and must have a suitable plug grasping and manipulating head that may extend from, and be withdrawn into, passage 19, such as head 21. In general, the plug 11 is installed by first loading it into tool 14. Thereafter tool 14 is attached to the valve 13 which had been previously attached to container 12. Valve 13 is then opened, the plug 11 is inserted through passage 16 and screwed into the container 12. When the plug is so installed, tool 14 and valve 13 may be removed. In general, removal of the plug 11 from container 12 is accomplished by a reversal of the aforesaid steps. The procedures just described are in common with those used to effect installation and removal of the plug described in the aforementioned application Serial No. 160,222. A more detailed description of the removal of the instant plug will be described hereinafter.

As previously indicated the instant plug is adapted for use in situations involving a high pressure differential where relatively large diameter plugs are required. As shown in Figs. 2 and 3, this embodiment comprises a tubular outer plug member 22 adapted to be screwed into the threaded portion of the container 12, and an inner

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plug member 23 disposed within the outer plug member 22 and cooperable therewith to provide a fluid by-passing passage through the plug.

To receive the plug 11, container 12 is internally threaded, as at 24, and outer plug member 22 is externally threaded to cooperate with the threaded portion 24. Although any type threads may serve, it is preferable that machine threads be used, since it is contemplated that the plug 11 may be repeatedly removed and reinserted in portion 12. Since machine threads are not self sealing, independent sealing means is required to seal the junction between outer plug member 22 and container 12. To that end, a sealing ring 26 such as an O ring is provided, and in the instant embodiment, it is mounted in a groove in the surface of outer plug member 22 and located inwardly from the threaded portions 24 so that fluid is sealed therefrom to prevent fouling the threads thereby. In addition, the outer plug member 22 is externally tapered adjacent its inner end, as at 27, to cooperate with a corresponding taper 28 in the portion 12. When plug 11 is properly seated in container 12, their tapered portions 27 and 28 engage and prevent undue insertion of plug 11. The outer plug 22 may of course be made straight at its lower end if desired.

As shown in Figs. 2, 3 and 4, the inner plug member 23 is, in the preferred embodiment, generally cylindrical and is disposed within the axial inner bore of the outer plug member 22. The inner plug member 23 is also movable axially relative to the outer plug member to open and close a passage through the plug.

To this end, outer plug member 22 is internally threaded, as at 29, to cooperate with external threads 31 on inner plug member 23. Again, preferably, these are machine threads, and the juncture between members 22 and 23 is sealed against fluid by a seal such as an O ring 32, positioned in this instance on the inner plug member 23 to cooperate with the inner wall of outer plug member 22 inwardly of the threads 31. In addition, threads 31 are of the same hand as threads 24. Rotation of the inner plug member 23 may be effected by any appropriate tool, and to provide means for engagement with such tool the inner plug is provided with a hexagonal head 33 positioned on its outer end.

To provide a passage for fluid through the plug, and for other purposes hereinafter described, inner plug member 23 has an axial bore 34 extending from its outer end through head 33 to a point inwardly of the sealing ring 32. At its inner end it is provided with at least one port or passage 36. In the instant case four such ports 36 are shown.

The plug members 22 and 23 cooperate to open and close the passage through plug 11, upon movement of inner plug member 23 between an open position and a closed position relative to outer plug member 22. Fig. 2 illustrates the plug 11 as it appears when inner plug member is in closed position and Fig. 3 illustrates the plug 11 as it appears when inner plug member is in fully opened position. Inner plug member 23 is externally tapered from the ports 36, as at 37, to cooperate with the inner wall of plug member 22 which is provided with a tapered seat 38. The tapered end 37 of plug 23 has a packing ring 39 positioned against a shoulder thereon to engage the seat 38, of outer plug member 22 to provide a seal therebetween, closing ports 36, when the inner plug member is in closed position. Inner plug member 23 is moved to open position by being rotated to axially shift it outwardly. By virtue of the tapered character of the members 22 and 23, the outward shifting of inner plug member 23 relative to outer plug member 22, creates a space or passage 41, shown in Fig. 3, that interconnects ports 36 and the interior of container 12, and thus establishes flow communication therethrough to by-pass the fluid under pressure through the plug. The packing ring 39 is held in position on inner plug member 23 by a packing nut 43 on a threaded projection 44.

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The pressure on opposite ends of the plug is thus equalized. The cooperating threads at 24 thus are relieved of pressure and the resistance due to friction therebetween is thereby reduced. The outer plug member 22 can therefore be readily rotated to remove it.

To effect the removal of plug 11, rotation of outer plug member 22 can be accomplished in several ways. However, in the instant embodiment, such rotation is effected through continued rotation of the inner plug member 23 after it has been shifted to open position. This is accomplished by providing shoulder means that frictionally engages outer plug member 22 when the inner plug member 23 is in the fully open position. In the embodiment illustrated that shoulder means comprises a hexagonal nut 46 dimensioned across its flats to be at least equal to the diameter of the axial bore at the inner end of outer plug member 22. Nut 46 has a neck portion 48 that projects into the bore of the inner end of outer plug member 22 and abuts against packing nut 43. Nut 46, like packing nut 43, is screwed on the threaded projection 44, and in order that nut 46 will not loosen upon rotation of inner plug member 23, the threads of projection 44 are of opposite hand to threads 31. Upon shifting of the inner plug member 23 to the fully open position, nut 46 frictionally engages the inner end of outer plug member 22, preventing further shifting of the inner plug member 23 relative to the outer plug member 22. Any further rotation of inner plug member 23 will, through nut 46, cause the outer plug member 22 to rotate and in as much as the threads 31 and the threads 24 are of the same hand, such further rotation will withdraw the entire plug 11 from the container 12. In order to prevent nut 46 from closing the passage through the plug, a plurality of radial slots 47, extending under the nut 46 to the passage, are provided in the end of outer plug member 22.

It is contemplated that the tool 14, described fully in my application Serial No. 247,005 and fragmentarily shown herein, will be used to install and remove the plug. As previously stated, tool 14 is a pressure confining tool, and, as illustrated in the drawing, has an extendable barrel portion 49 that includes head 21 provided with a socket portion 51 adapted to engage the hexagonal head 33. From the center of the socket projects a pilot element 52. The pilot element 52 is adapted to be inserted in bore 34 for centering the tool over the plug. A pair of spring actuated detents 53 are carried by the pilot element 52 and are adapted to engage behind a shoulder 54, formed in bore 34, as shown in Fig. 3. Such engagement is utilized only after the plug 11 has been screwed out of portion 12 and threads 24 are no longer in engagement so that the plug can be withdrawn through the valve 13 into the body of the tool 14.

To effect the removal of plug 11 from the container 12, valve 13 is connected to container 12 over the plug as shown, and tool 14 is, in turn, connected to the valve. Since tool 14 is properly sealed to confine any fluid conducted to it from the plug, valve 13 may be opened, and the barrel portion 49 of tool 14 may be projected through the valve so that socket portion 51 may be seated on head 33. Tool 14 is then manipulated to rotate plug 11 to effect its removal. In as much as the inner plug member 23 is substantially smaller in diameter than is outer plug member 22, it will commence to rotate first. Rotation of the inner plug member 23 to move it axially outwardly relative to the outer plug member 22 opens the passage through the plug. Upon opening of the passage, fluid is by-passed through the plug into the valve 13 and tool 14. The by-passed fluid, confined by the valve 13 and tool 14, quickly equalizes the pressure upon the opposite ends of plug 11. Rotation of the inner plug member 23 moves the nut 46 into engagement with the lower end of outer plug member 22 and, in as much as the pressure is in balance on opposite sides of the plug, a relatively small turning force is required to screw the outer plug member 22 out of

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the container 12. Upon disengagement of the threads 24, plug 11 is withdrawn through the valve 13 into the barrel of tool 14. The valve 13 is then closed, pressure is relieved in the tool 14, and the tool 14 disconnected from the valve 13. The plug 11 may then be removed from the tool.

From the foregoing it is seen that this invention provides a novel access plug for pressure containers for high pressure fluid that will by pass pressure from one end to the other thereof before withdrawal thereof has commenced. The by-passed fluid, confined in an appropriate tool, balances the forces on opposite ends of the plug and thus reduces the turning effort necessary to effect removal of the plug. Thus, a plug incorporating the features of the invention can be of relatively large diameter without requiring excessive effort to remove it.

Although the invention has been described in connection with a certain specific structural embodiment of the invention, it is to be understood that various modifications and alternative structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member externally threaded for engagement with said threaded portion of the container, and an inner plug member mounted in said outer plug member and shiftable relative thereto, shifting of said inner plug member in one direction opening a passage through said outer plug member to by-pass pressure fluid from the inner end to the outer end of said plug, said inner plug member having means engageable with the outer plug member for effecting rotation thereof when the inner member is shifted after said passage is opened, whereby said plug may be disengaged from the container when under pressure.

2. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member externally threaded for engagement with said threaded portion of the container, and an inner plug member extending into said outer plug member and rotatable in one direction relative to said outer plug member to open a passage through said outer plug member to by-pass pressure fluid from the inner end to the outer end of said plug, said inner plug member having means engageable with the outer plug member, after said passage is open for effecting rotation of said outer plug member upon continued rotation of said inner plug member, whereby said plug may be disengaged from the container when under pressure.

3. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member externally threaded for engagement with said threaded portion of the container, and a generally cylindrical inner plug member extending into said outer plug member and axially shiftable in one direction therein and thereby opening a passage through said outer plug member to by-pass pressure fluid from the inner end to the outer end of said plug, said inner plug member having means engageable with the outer plug member for effecting rotation of said outer plug member when the inner plug member is shifted in said one direction after said passage is open, whereby said plug may be disengaged from the container when under pressure.

4. An access plug according to claim 1 and further characterized in that said outer plug member is externally threaded adjacent its outer end and is provided with pressure sealing means positioned inwardly from said threads for sealing the juncture between said outer plug member and the container, whereby to prevent fouling of said threads by the pressure fluid.

5. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid,

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said plug comprising a tubular outer plug member externally threaded for engagement with said threaded portion of the container and having an internally threaded portion, and a generally cylindrical inner plug member extending axially into said outer plug member and having threads engaging said internally threaded portion for axially shifting said inner plug member relative to said outer plug member between a closed and an open position upon rotation of said inner plug member, said plug members having cooperating portions that move apart and open a passage through said plug for by-passing fluid from the inner end to the outer end of said plug when said inner plug member is shifted to said open position and that move together and seal said passage when said inner plug member is shifted to said closed position, said inner plug member having means engageable with the outer plug member for effecting rotation thereof upon continued rotation of said inner plug member after its having been shifted to open position, whereby said plug may be disengaged from the container when under pressure.

6. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member externally threaded for engagement with said threaded portion of the container and having an axial bore therethrough tapered adjacent the inner end of said outer plug member and internal threads therein adjacent the outer end of said outer plug member, and an inner plug member extending through said bore and having threads engaging said internal threads for axially shifting said inner plug member relative to said outer plug member by rotation of said inner plug member, said inner plug member having a passage opening radially at a point inwardly of said threads and having a tapered portion located inwardly of said point and cooperating with the taper in said outer plug member for closing said passage when said inner plug member is shifted inwardly and to open said passage when said inner plug member is shifted outwardly, said inner plug member also having means engageable with said outer plug member for effecting rotation thereof upon continued rotation of said inner plug member after its having been shifted to open said passage, whereby said plug may be disengaged from the container under pressure.

7. An access plug according to claim 6 and further characterized in that said inner plug is provided with a circumferential pressure sealing ring positioned between its threads and its tapered portion to prevent fouling of said threads and is also provided with circumferential packing positioned in said tapered portion of said inner plug member to cooperate with the taper in said outer plug member when the inner plug member is in closed position to seal the juncture therebetween.

8. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member having external threads for engagement with said threaded portion of the container and having a bore therethrough with internal threads therein adjacent the outer end of said outer plug member, and a generally cylindrical inner plug member extending axially into said bore and having threads engaging said internal threads for axially shifting said inner plug member relative to said outer plug member, the shifting of said inner plug member in one direction opening a passage through said plug to by-pass pressure fluid from the inner end to the outer end of said plug, said passage comprising in part the bore in said outer plug member, said inner plug member also having shoulder means on one end thereof engageable with said outer plug member for effecting rotation of said outer plug member upon continued rotation of said inner plug member after said passage has been opened, whereby said plug may be disengaged from the container under pressure.

9. An access plug according to claim 8 and further

characterized in that said internal threads in said outer plug member are of the same hand as the external threads thereon.

10. An access plug for use in an internally threaded portion of a pressure container for high pressure fluid, said plug comprising an outer plug member having external threads for engagement with said threaded portion of the container and having a bore therethrough with internal threads therein of the same hand as said external threads and positioned adjacent the outer end of said outer plug member, and a generally cylindrical inner plug member extending axially into said bore through said outer plug member and having threads engaging said internal threads for axially shifting said inner plug member relative to said outer plug member, axial shifting of said inner plug member outwardly relative to said outer plug member opening a passage through said plug to by-pass pressure fluid from the inner to the outer end of said plug, said passage comprising in part the bore in said outer plug member, said inner plug having a pro-

jection on its inner end and a nut threaded thereon and adapted to frictionally engage the inner end of said outer plug member to effect rotation of said outer plug member upon continued rotation of said inner plug member after its having been shifted to open said passage, the threads of said nut being of the opposite hand of said external threads, whereby said plug may be disengaged from the container under pressure.

11. An access plug according to claim 10 and further characterized in that the inner end of said outer plug member is slotted to provide a communicating channel under said nut to said passage upon engagement of said nut with said end.

References Cited in the file of this patent

UNITED STATES PATENTS

2,425,313	Hammerstein	Aug. 12, 1947
2,712,829	Whitaker	July 12, 1955
2,769,566	Thompson	Nov. 6, 1956