Oct. 21, 1969 J. G. BAKER ET AL 3,473,573

WELL CAP AND SEAL THEREFOR

Filed Oct. 6, 1966 2 Sheets-Sheet 1

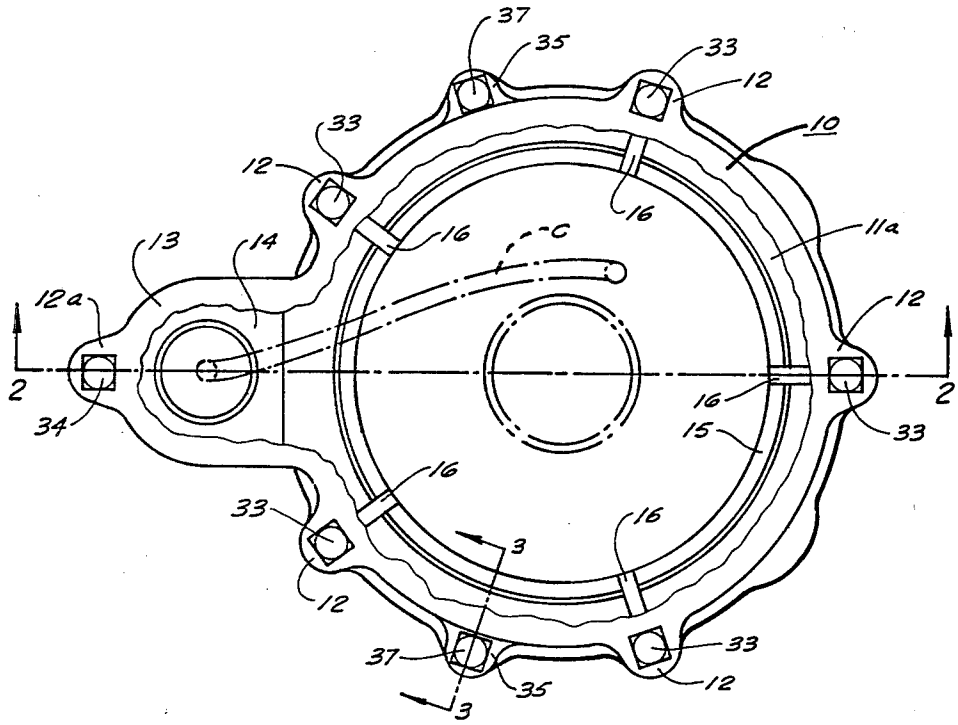


FIG 1.

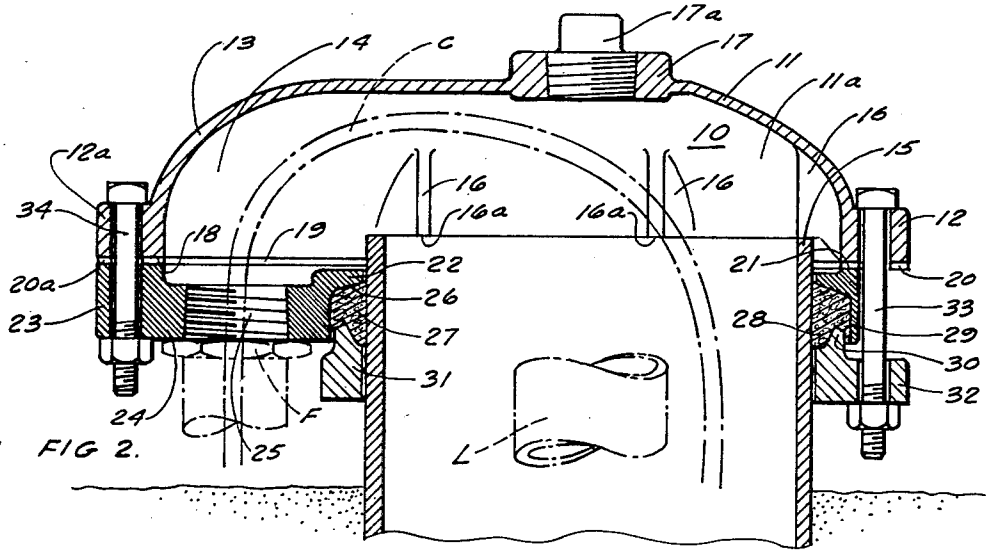


FIG 2.

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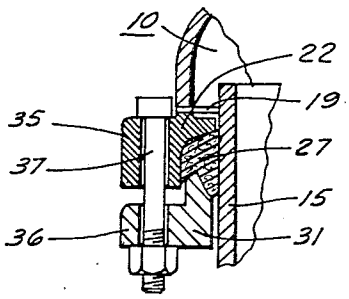


FIG. 3

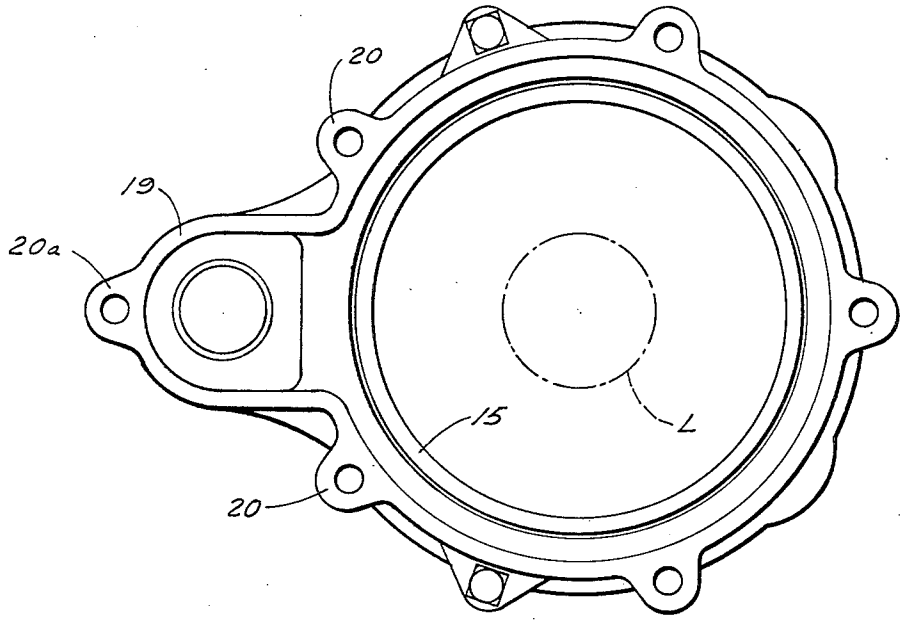


FIG. 4

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WELL CAP AND SEAL THEREFOR

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ABSTRACT OF THE DISCLOSURE

The cap and seal structure here disclosed is adapted for use on a plain-end well case or casing. The assembly comprises three principal members, a cap, an intermediate ring, and a follower, with a gasket between cap and ring and a second gasket between ring and follower, the latter for sealing around the outside of the case. Bolts extending between cap and follower serve to draw the parts together, sealing both gaskets simultaneously. Auxiliary bolts extending between the intermediate ring and the follower serve to sustain a temporary seal around the case, holding the subassembly in place when the through bolts are removed or loosened for removal of the cap member. The temporary hold also is useful in assembly. In either case, the subassembly parts will not drop from its prescribed position, facilitating assembly or disassembly, not only for initial installation, but for servicing the well from time to time.

This application relates to a cap and arrangement for sealing same, of the type particularly suitable for capping water wells. The invention is primarily intended for use with pitless units in association with submersible pump installations, although not limited thereto.

Caps and seals of the general class here involved are generally used to exclude surface water, sewage, debris and other contaminants from the well casing. Many types of caps have heretofore been proposed for this purpose, such as flanged, screwed or butted caps, internal bushings, and the like. Some of the prior art caps and seals serve the protective function with reasonable satisfaction, but have been found inadequate for use with pitless units, submersible pumps and similar installations wherewith it is necessary to provide for cable entrances, pump and valve supports, hangers, lift-outs, service access openings and the like, at the top of the well, severally or in combination. Various proposals have been made for accommodating such requirements, but prior art devices are generally unsatisfactory for one or more of the following reasons:

(1) Complexity.
(2) Excessive cost.
(3) Difficulty of installation and servicing.
(4) Special finish or treatment of the casing or case end required.
(5) Not readily adaptable to varying installation conditions, or accommodation of various appurtenances.

It is a general object of this invention to provide a novel well cap and seal arrangement which overcomes or minimizes the foregoing and other objections to the prior art devices of the general class involved.

It is a more specific object of this invention to provide a well cap which can be dependably sealed on regular plain-end pipe or casing of commercially available sizes and tolerances, without special preparation thereof.

It is a further object of this invention to provide a simple ararngement for accommodating cable entrance or similar openigns through the cap in a simple manner, using conventional fittings or connectors for such purpose.

A still further object of this invention is to provide

seal arrangements such that the cap portion of the assemblage may be removed without removing other major portions of the assemblage, to facilitate servicing the well, pump and appurtenances therein, more particularly for the removal and placement of pumps, valves and fittings used in association with pitless units.

The foregoing and other objects and advantages are accomplished by a novel construction and arrangement, which may be generally described as constituting a "duplex" cap. That is, the cap and seal assemblage includes a cap member, an intermediate ring, follower ring and two seal rings, one of which constitutes a seal between the cap and intermediate ring and the other of which constitutes the primary seal for the entire unit with respect to the case or casing. The parts are so arranged that the entire assemblage can be made tight by means of a single series of bolts, screws or like fasteners, with auxiliary retaining fasteners to hold the intermediate, follower and casing seal rings in position, if the cap need be removed for servicing the well. The cable entrance or other accessory opening is provided in the intermediate ring, the cap member being readily removable without disturbing entrance fittings or connections, thus greatly facilitating and simplifying installation and servicing operations. The primary seal of the assemblage is effected on the exterior of the case or casing, thus permitting the use of a given cap assembly with a given nominal casing or pipe size, but in various thicknesses, it being understood that, in common practice, pipes or casings of a given nominal size have the same outside diameter, thickness variation being achieved by varying the inside diameter. By fitting the cap assembly to the outside of the case or casing, it is unnecessary to interchange an assortment of seals or other parts to secure satisfactory fits on the widely variant inside diameters of pipes or casings available in given nominal size. Also, when furnishing new or replacement caps for existing installations, it is unnecessary to dismantle the existing unit to determine the actual inside diameter of the case or casing to which the new cap is to be fitted.

The construction, operation, objects and advantages of this invention will be best understood from the ensuing description, read with reference to the accompanying drawings, wherein:

FIGURE 1 is a top plan view of one form of the novel cap assembly installation, with the dome of the cap member cut away to expose the interior structure;

FIGURE 2 is a vertical section on line 2—2 of FIG. 1;

FIGURE 3 is a partial vertical section on line 3—3 of FIG. 1, showing the retainer bolt arrangement in association with the intermedmiate and follower rings;

FIGURE 4 is a plan view of the well head and cap assemblage with the cap member removed, exposing the face of the upper gasket.

Refering now particularly to FIGS. 1 and 2, reference numeral **10** indicates the cap member, which has a dome **11** and a series of bolt lugs **12** around its periphery. The number of bolt lugs **12** thus provided will vary with the diameter of the unit, five such lugs being shown in this example, which has been found a suitable number for a cap to be applied to a 6-inch OD casing.

Between one pair of lugs **12**, cap **10** has domed radial extension **13**, defining a chamber **14**, communicating with the chamber **11***a* defined by the main dome **11**. From FIG. 2 it will be seen that the principal chamber **11***a* overlies casing **15**, while extension chamber **14** opens downward on the outside of casing **15**, so that a service line such as cable C passes up through chamber **14**, across through chamber **11***a* and thence down into casing **15**. Dome **11** and its extension **13** are of such proportions as to facilitate locating the cable C, or similar service line,

in position to reach the appropriate connections with related appurtenances in the well below, while avoiding other appurtenances of the installation, such as the lift-out pipe L, generally used in association with pitless well units. Bolt lug 12*a*, similar to lugs 12, is provided at the radial extremity of extension 13. A series of ribs 16, preferably in line with lugs 12, supports the cap and associated parts, later to be described, on top of the casing 15 in proper axial position. A boss 17 and plug 17*a* are provided for venting, or boss 17 may be used for accessory connections or support.

Referring now more particularly to FIG. 2, the lower rim of cap 10 constitutes a flange face 18 surrounding chambers 11*a* and 14, interiorly of lugs 12 and 12*a*. A sheet ring gasket 19 is coextensively opposed to rim face 18. Gasket 19 has tabs 20 and 20*a* corresponding to lugs 12 and 12*a* respectively of the cap member 10, as best seen in FIG. 4.

Against the face of gasket 19, opposite from rim face 18, is a matching rim face 21 of intermediate ring 22, which also has a lug 23 on projection 24 opposing the corresponding portions 12*a* and 13 respectively of cap 10. An opening 25 is provided in extension 24, in position to communicate with chamber 14 of extension 13. Opening 25 may be tapped as shown, for example to receive conduit fitting F, through which to pass a well or pump service line such as cable C.

The face of ring 22 remote from cap 10 is provided with an annular recess 26 to receive ring gasket 27, the preferred form of which is that generally known in the art as of "fishtail" cross-section. That is, on its face remote from the bottom of recess 26, gasket 27 is provided with lips 28 and 29 defining an angular recess to receive tongue 30 of follower ring 31. While other forms of gasket and follower ring may be used, the arrangement shown is preferred because of its self-centering characteristic, the double-wedge action for applying compressive force components to the gasket radially inward and outward simultaneously, and because of the compactness of the arrangement, particularly in the axial direction. The last-named feature is salutary, because of frequent necessity for installing caps on cases or casings which extend only a short distance above ground, so that assembly clearance for installation of the cap may be in such cases rather limited. Furthermore, it is usually desirable to maintain as low a silhouette on the well head as feasible.

It will be seen that gasket 27 surrounds case 15 a short distance from its upper end, in an axial position determined by ribs 16 of cap 10 resting on case 15, when fully assembled. The bottom edges 16*a* of ribs 16 are in a plane at a somewhat higher elevation than the plane of cap rim face 18, so that gasket 19 lies in a plane below the top of case 15. In this position, gasket 19 is less exposed to damage while servicing the well with cap member 10 removed.

Follower ring 31 is provided with a series of lugs 32, corresponding in number and spacing to lugs 12 of cap 10. Bolts 33 extend from lugs 12 to lugs 32. A shorter bolt 34 extends between lugs 12*a* and 23. The bolts are preferably inserted with the nuts down, as shown, to provide maximum radial nut clearance with minimum bolt circle, as well as to insure against the bolts dropping out while the cap is being installed or removed.

Tightening bolts 33 draws follower ring 31 toward cap 10, compressing gasket 27 in recess 26 and against case 15 and simultaneously compressing gasket 19 between faces 18 and 21. Bolt 34 provides auxiliary compression for gasket 19 along the rims of projections 13 and 24, obviating deficiency of gasket pressure due to possible cantilever strains in the projections. With the arrangement described, the top of case 15 is uniformly and tightly sealed from the atmosphere, opening 25 being sealed by a suitable fitting such as F. Should no cable or similar service line be required through opening 25, the opening may be plugged.

To install the cap assembly, follower ring 31, gasket 27 and intermediate ring 22 are slipped over the end of casing 15. Assuming the case of a drop assembly with submersible pump, power cable C is brought through the opening 25 and connected to the pump (not shown), whereupon the drop assembly of which lift-out pipe L is indicated in broken lines, and which is suspended over the well in readiness for installation, is lowered into the well through the open end of case 15. The drop assembly is supported in or on the case or casing in any manner suited to the particular type of installation, the drop assembly or its manner of support not forming part of the invention as illustrated in FIGS. 1 to 3. After the drop assembly installation has been completed, cap 10 is placed in position on top of case 15, gasket 19 is laid on ring face 21, the ring and gasket sub-assembly is raised into position, bolts 33 and 34 are then inserted and tightened and the conduit fitting F is made up to complete the installation. If desired, gasket 19 may be factory-cemented to face 18, as an added convenience and precaution against damage in shipment or handling.

Subsequent access to the well for servicing or removal of the pump or other parts of the drop assembly is obtained merely by unscrewing the nuts of bolts 33 and 34 and lifting cap 10 from the top of case 15. As an added convenience for shipping, handling and installing the cap assembly and for subsequent servicing of the well, the ring and gasket subassembly are provided with auxiliary bolts, as best seen by reference to FIGS. 1 and 3. For this purpose, ring 22 is provided with auxiliary lugs 35 and ring 31 with auxiliary lugs 36 opposite to lugs 35. Lugs 35 and 36 are preferably two or more in number of pairs, angularly positioned to lie in spaces between pairs of lugs 12 and 32. Bolts 37, associated with pairs of lugs 35 and 36, hold the ring and gasket subassembly 22, 27, 31 in preliminary assembly position, independently of cap 10. Thus, if desired, the subassembly may be shipped and installed as a unit, being slipped over casing 15, ready for fastening and tightening to the cap, speeding the installation on the well, minimizing fumbling with numerous loose parts, and better assuring correct positioning of the several parts in the subassembly for proper compression of gasket 26. Furthermore, if cap 10 is to be removed for servicing the well, bolts 37 may be snugged sufficiently to maintain such compression on gasket 27 as will obviate the subassembly parts sliding down case 15 when bolts 33 and 34 are removed, so that the subassembly remains in correct position for reception of cap 10 and bolts 33, 34, when the well is restored to service. Such auxiliary fastening of the subassembly also dispenses with the necessity of unmaking service conduit connection F, the same not generally being suitable for supporting the subassembly or ring 22, particularly in view of the cantilever load which would be thus imposed.

Gasket 27 is preferably made of one of those compounds or materials, such as a rubber compound for example, suitable for use in above-ground flexible pipe joints. It will be seen that the gasket is so confined and positioned in the assembly as to minimize exposure to air, light, heat, oil and other deleterious effects generally encountered in installations such as that here involved. Natural or synthetic polymers of the preferred type will usually remain tight and retain their sealing properties for many years and will not ordinarily require replacement during the normal life of the installation as a whole. However, should it be necessary or desirable to replace gasket 27, same may be readily accomplished without completely removing the cap assembly, by unfastening bolts 33, lowering follower ring 31, pulling out existing gasket 27, cutting and removing same, and replacing with a new split and skived gasket. This procedure for repacking or regasketing pipe and similar joints has been successfully practiced with gaskets or packings of comparable size and cross section. Such facility for gasket renewal constitutes an added advantage of this invention as compared with de-

signs employing face or bushing seals. With the latter types of caps, it has generally been necessary to use the cap to support most or all the weight of drop assemblies or appurtenances thereof, or to provide relatively complicated support and locating means associated with special preparation of the case or casing top. If the cap is required to support a substantial weight, the cap must be of quite heavy construction. Further, where the cap is associated directly with support structures, the installation and servicing of the well structures will usually require a somewhat involved and time-consuming procedure. As previously indicated, the novel cap assembly above described facilitates supporting drop assemblies and appurtenances directly from the unmodified casing or case, independently of the cap, the inside and top edge of the casing being unobstructed by the cap assembly, other than the narrow support or positioning ribs.

From the foregoing description and the drawings, it will be seen that the cap and seal arrangement of this invention may be easily and quickly installed, providing a highly effective seal for the top of the well, that same is readily adaptable to a wide variety of applications with standard casing or pitless unit cases and is an economical adjunct of completing, protecting, maintaining and servicing water wells and the like.

The drawings and foregoing description represent preferred forms and arrangements of the novel cap and seal constituting this invention. Those skilled in the art will be enabled to devise other forms and arrangements for various applications.

What we claim and desire to secure by Letters Patent is

1. A cap and seal structure for a well case or the like, comprising in combination: a cap member, an intermediate ring, a follower ring, said cap member and said follower ring being opposed to opposite faces of said intermediate ring, a first gasket between said cap member and said intermediate ring, a second gasket between said intermediate ring and said follower ring, said second gasket fitting closely around the exterior of said case, and a plurality of first bolts engaging said cap member and said follower ring, for drawing said follower ring toward said cap member, simultaneously compressing said first gasket between said cap member and said intermediate ring and said second gasket upon said case.

2. The combination according to claim 1, wherein said cap member includes a dome defining a first chamber over said case and a first projection defining a second chamber laterally of said first chamber, in communication therewith, said first gasket continuously surrounding both said chambers, said intermediate ring having a lateral second projection with a passage therethrough communicating with said second chamber, and at least one second bolt engages said projections, whereby to apply auxiliary compressive force to said first gasket.

3. The combination according to claim 1, further including at least two auxiliary bolts engaging said intermediate ring and said follower ring, whereby to hold said intermediate ring and said follower ring in assembled relationship upon loosening said first bolts.

4. The combination according to claim 1, wherein said first gasket is a sheet gasket abutting rim faces of said cap member and said intermediate member.

5. The combination according to claim 4, wherein said intermediate ring has an annular first recess surrounding said case, said first recess telescoping with an annular tongue of said follower ring, said second gasket being confined in said first recess, said second gasket having a second recess defined by lips, said second recess telescoping with said tongue.

6. The combination according to claim 1, wherein said cap member has internal, radially extending ribs resting upon said case, said cap member having a gasket face in a first plane at right angles to the axis of said case, bearing surfaces of said ribs upon said case lying in a second plane above said first plane.

7. The combination according to claim 1, wherein said cap member includes a dome and a first projection extending laterally from said dome, further including a second projection extending laterally from said intermediate ring, said cap member having a first rim face continuously surrounding said dome and said first projection, said intermediate ring having a second rim face congruently opposed to said first rim face, said first gasket being substantially congruent with said rim faces, and at least one second bolt extending between said projections, whereby to apply auxiliary compressive force to said first gasket.

8. The combination according to claim 7, wherein at least two auxiliary bolts engage said intermediate ring and said follower ring, whereby to hold said intermediate ring and said follower ring in assembled relation independently of said cap member.

9. The combination according to claim 8, wherein said first gasket is generally planar, said second gasket having angularly disposed annular lips telescoping an opposed tongue of said follower ring.

10. The combination according to claim 9, wherein said cap member includes internal radial ribs resting upon the rim of said case, said first gasket lying in a plane below the plane of said rim.

References Cited

UNITED STATES PATENTS

2,512,041	6/1960	Steele	138—89 X
3,051,200	8/1962	Berington	138—89

FOREIGN PATENTS

1,256,364	2/1961	France.

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