March 9, 1965 E. A. VOLIVA 3,172,476

WATER WELL SEAL

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Fig. 1

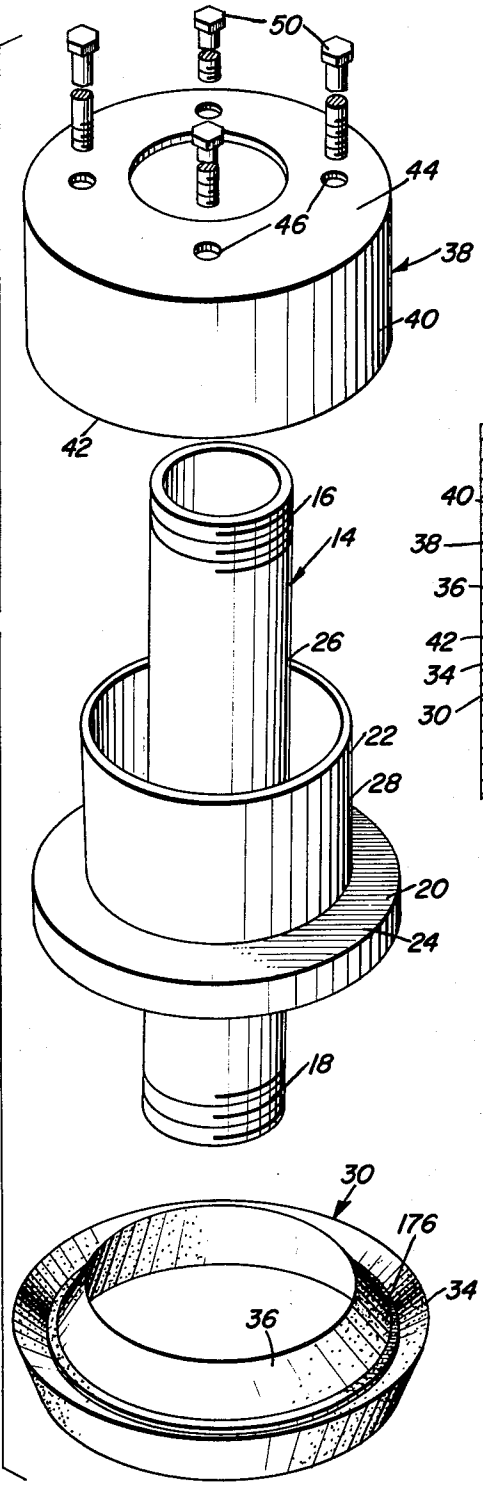
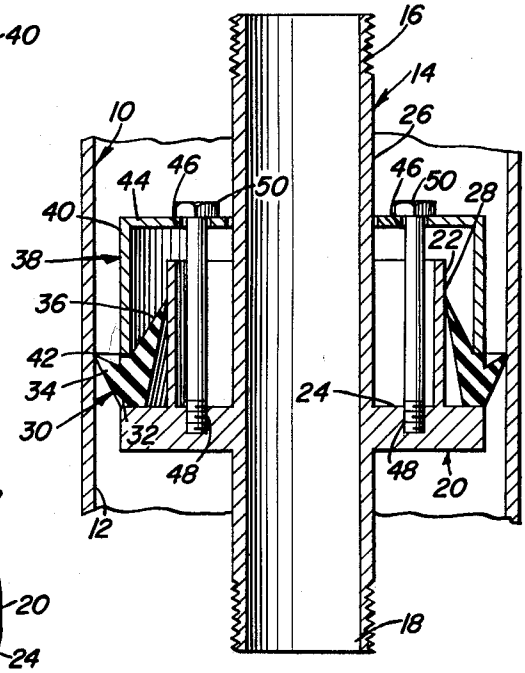


Fig. 2



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Fig. 3

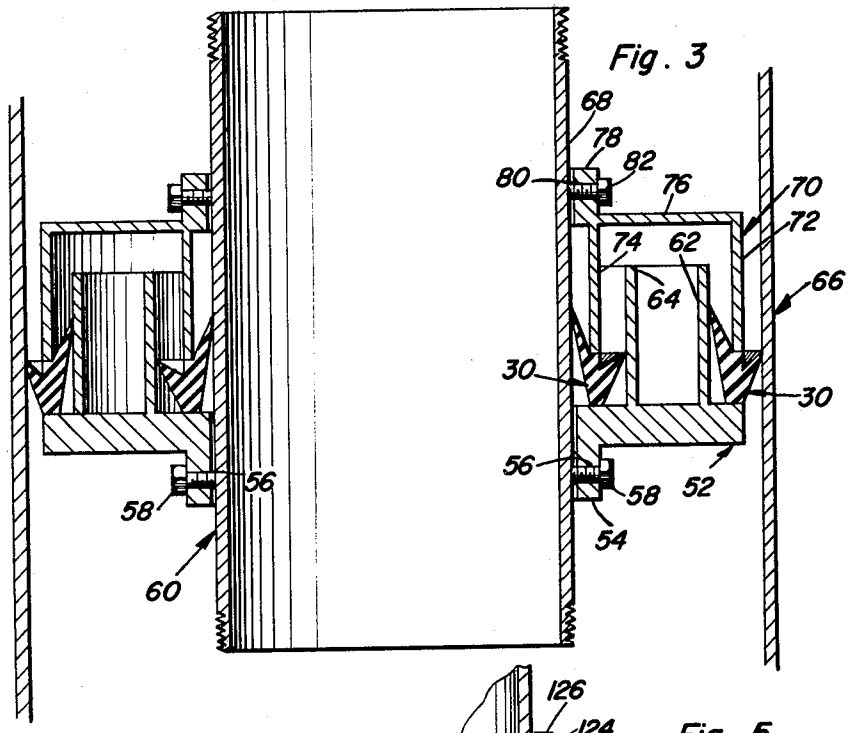


Fig. 4

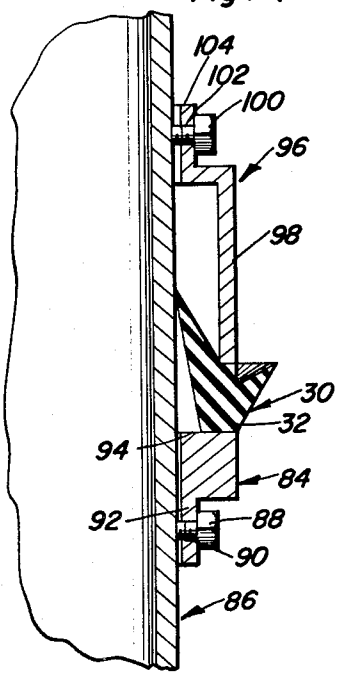
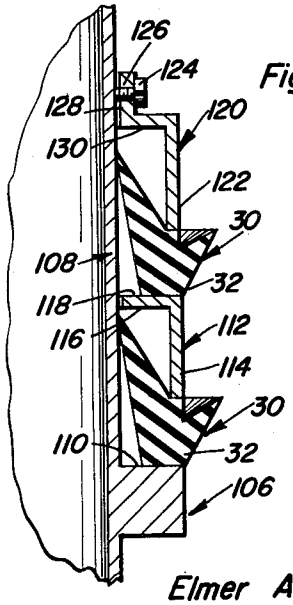


Fig. 5



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WATER WELL SEAL

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Fig. 6

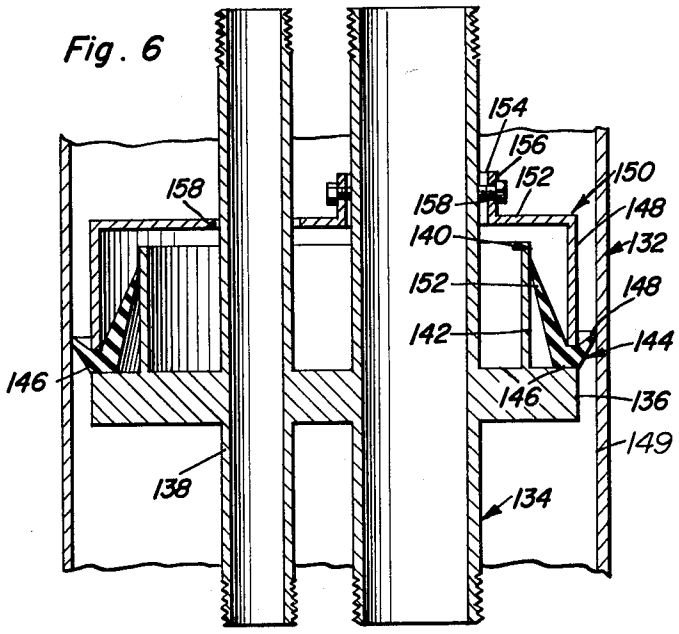


Fig. 7

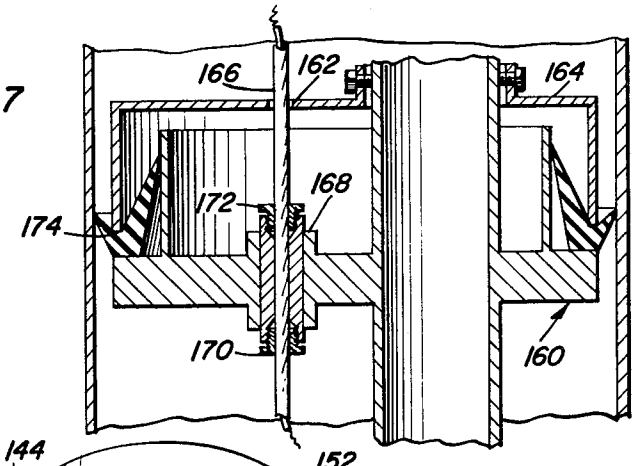
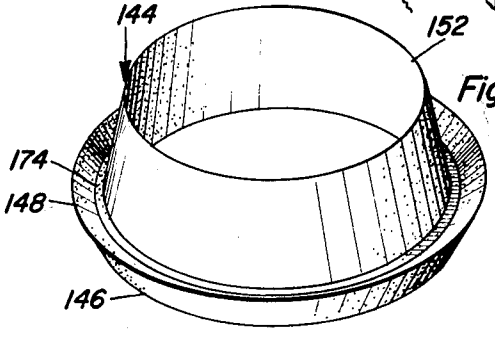


Fig. 8



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3,172,476

WATER WELL SEAL

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Filed Dec. 29, 1961, Ser. No. 163,598
13 Claims. (Cl. 166—189)

This invention relates to a novel and useful water well seal and is primarily designed to produce more water from any given water-bearing strata.

A well which is provided with a casing string lining and has a tubular pipe column section disposed therein for carrying the water from the well to the surface thereof has the outlet of a pump structure communicated with the lower end of the tubular pipe column section. However, the entrance of air from the top of the well to the bottom of the well between the outer well casing and the tubular pipe column section has a tendency to replace the fluid which is being pumped from the well. Accordingly, the output of the well is appreciably reduced and it is the main object of this invention to provide a water well seal which will establish a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enable the passage of air upwardly between the casing and the pipe column section when the pump of the well is inactive.

By preventing air from moving downwardly in the well between the well casing and the tubular pipe column section, operation of the pump at the lower end of the well creates a partial vacuum in the bottom end of the well below the well seal and accordingly, more water is drawn from the water-bearing strata. When the pump is turned off any accumulated air from the surrounding strata will be capable of passing upwardly in the well between the well casing and the pipe column section disposed therein past the well seal of the instant invention.

A further object of this invention, in accordance with the immediately preceding object, is to provide a well seal which may be used in various types of wells including those utilizing sucker rod pumps, jet pumps and submersible pumps.

Still another object of this invention is to provide a water well seal which may be readily constructed in accordance with different size casing strings and pipe column sections.

Yet another object of this invention is to provide a water well seal which may be readily removably secured to various types of water well pipe column sections.

A final object to be specifically enumerated herein is to provide a water well seal in accordance with the preceding objects which will conform to conventional forms of manufacture, be of simple construction and easy to use so as to provide a device that will be economically feasible, long lasting and relatively trouble free in operation.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an exploded perspective view of a portion of tubular pipe column section of a water well shown with the water well seal of the instant invention operatively associated therewith;

FIGURE 2 is a longitudinal sectional view taken substantially upon a plane passing through the longitudinal center-line of a well casing string having the tubular pipe column section and water well seal illustrated in FIGURE 1 disposed therein;

FIGURE 3 is an enlarged longitudinal sectional view similar to that of FIGURE 2 but showing a modified form of well seal;

FIGURES 4 and 5 are fragmentary longitudinal sectional views similar to that of FIGURE 3 but showing two further modifications of water well seals;

FIGURES 6 and 7 are fragmentary longitudinal sectional views similar to that of FIGURE 3 and each showing a further modified form of water well seal; and

FIGURE 8 is a perspective view of a modified form of annular resilient sealing ring.

Referring now more specifically to the drawings the numeral **10** generally designates a well casing string which includes a smooth and generally cylindrical inner surface **12**. The well casing string is utilized to line the water well bore and a tubular pipe column section generally referred to by the reference numeral **14** extends downwardly through the casing string **10**. It is to be noted that the section **14** comprises only one portion of the pipe column and that the upper and lower ends of the pipe column section **14** are externally threaded as at **16** and **18** respectively for threaded engagement with adjacent pipe column sections (not shown).

The pipe column section **14** includes an annular radially outwardly projecting support flange generally referred to by the reference numeral **20** which is formed integrally with the pipe section **14**.

Means defining an outwardly facing cylindrical sealing surface and in the form of a cylindrical member **22** which projects upwardly from the upper face **24** of the support flange **20**. The upstanding cylindrical member **22** is disposed between the cylindrical outer surfaces **26** of the tubular pipe column section **14** and the outer end of the support flange **20**. The outer surface **28** of the cylindrical member **22** defines an outwardly facing generally cylindrical sealing surface.

A sealing ring generally referred to by the reference numeral **30** is provided and includes a lower base portion **32** whose lower surface abuts the upper surface **24** of the support flange **20** adjacent its outermost edge. The outer surface of the sealing ring **30** includes a lower upwardly and outwardly tapering and inclined sealing lip **34** whose upper major diameter end is disposed in tight sealing engagement with the inner surfaces of the casing string **10**.

The sealing ring **30** also includes an upper inwardly and upwardly inclined second sealing lip **36** whose upper surfaces are disposed in tight sealing engagement with the outer surface **28** of the cylindrical member **22**.

A cylindrical element generally referred to by the reference numeral **38** is provided and includes a cylindrical body portion **40** whose lower end is disposed in tight frictional engagement with the seat **42** of the well ring **30** between the sealing lips **34** and **36**. The upper end of the cylindrical portion **40** terminates in a radially and inwardly directed annular flange **44** which encircles the pipe column section **14** and is provided with a plurality of apertures **46** which are registrable with threaded blind bores **48** formed in the support flange **20**. Headed fasteners **50** are secured through the apertures **46** and have their lower ends threadedly engaged in the blind bores **48** and are thus utilized to effect axial compression of the annular sealing ring **30** between the cylindrical portion **40** and the support flange **20**.

With attention now directed to FIGURE 3 of the drawings there will be seen a modified form of support flange generally referred to by the reference numeral **52** which includes an inner downwardly directed cylindrical portion **54** that is provided with a plurality of threaded bores **56**. A plurality of setscrews **58** are threadedly engaged in the bores **56** and mount the support flange

52 on the tubular pipe column section generally referred to by the reference numeral 60. It will be noted that the support flange 52 includes a pair of upstanding and concentric cylindrical elements 62 and 64 and that a sealing ring 30 is disposed between the cylindrical element 62 and the casing string 66 while a second sealing ring 30 is disposed between the cylindrical element 64 and the external surfaces 68 of the pipe column section 60.

The cylindrical member generally referred to by the reference numeral 70 includes an outer cylindrical portion 72 and an inner cylindrical portion 74 and the lower ends of the cylindrical portions 72 and 74 abut against the sealing rings 30. The cylindrical portions 72 and 74 are interconnected at their upper ends by means of the annular flange 76 and it will be noted that the inner end of the annular flange 76 terminates in an upwardly directed mounting portion 78 which is provided with a plurality of threaded bores 80 in which setscrews 82 are threadedly engaged for engagement with the outer surface 68 of the tubular pipe column section 60.

With attention now directed to FIGURE 4 of the drawings there will be seen a still further modified form of support flange generally referred to by the reference numeral 84 which extends radially outwardly of the pipe column section generally referred to by the reference numeral 86 and is secured to the latter by means of threaded fasteners 88 secured in bores 90 formed in the cylindrical mounting base portion 92 of the support flange 84. The base portion 32 of the sealing ring 30 abuts against the upper surface 94 of the support flange 84 and a cylindrical element generally referred to by the reference numeral 96 and including a cylindrical portion 98 which has its lower end disposed in tight frictional engagement with the corresponding sealing ring 30 is secured to the tubular pipe column section 86 by means of setscrews 100 threadedly engaged in threaded bores 102 formed in the upper cylindrical mounting portion 104. Accordingly, it may be seen that the embodiment illustrated in FIGURE 4 is similar to both the embodiments illustrated in FIGURES 2 and 3 but is much simpler in construction than the latter.

With attention now directed to FIGURE 5 of the drawings, there will be seen a support flange generally referred to by the reference numeral 106 which is formed integrally with the tubular pipe column section generally referred to by the reference numeral 108. A first sealing ring 30 has its base portion 32 in seated engagement with the upper surface 110 of the support flange 106 and a first cylindrical element generally referred to by the reference numeral 112 has the lower end of its cylindrical portion 114 disposed in engagement with the sealing ring 30. However, the inwardly directed annular flange 116 of the cylindrical element 112 comprises a seat for the upper sealing ring generally referred to by the reference numeral 30 which has its base portion 32 disposed in tight frictional engagement with the upper surface 118 of the inwardly directed annular flange 116. A second cylindrical element generally referred to by the reference numeral 120 has the lower end of its cylindrical portion 122 disposed in tight frictional engagement with the upper portion of the upper sealing ring 30 and is secured to the tubular pipe column section 108 by means of setscrews 124 secured through threaded bores 126 formed in the cylindrical mounting portion 128 carried by the inner end of the inwardly directed annular flange 130 of the upper cylindrical element 120.

With attention now directed to FIGURE 6 of the drawings there will be seen a well casing string generally referred to by the reference numeral 132 and a tubular pipe column section generally referred to by the reference numeral 134. The tubular pipe column section includes a radially outwardly projecting annular support flange 136 but also includes a fluid conduit or water injection pipe 138. An upstanding cylindrical member generally referred to by the reference numeral 140 is carried by the support flange 136 and encircles both the tubular pipe column section 134 and fluid conduit 138. The outer surface 142 of the cylindrical member 140 defines an outwardly facing annular seating or sealing surface and a sealing ring generally referred to by the reference numeral 144 has its base portion 146 disposed in tight frictional engagement with the upper surface 147 of the support flange 136 between the cylindrical member 140 and the well casing string 132. The outwardly and upwardly inclined sealing lip 148 has its upper end disposed in tight sealing engagement with the inner surface 149 of the casing string 132 and the upper end of the inwardly and upwardly inclined sealing lip 152 has its upper end disposed in tight sealing engagement with the outer surface 142 of the cylindrical member 140.

The upper end of the cylindrical portion 148 of the cylindrical element generally referred to by the reference numeral 150 also includes an inwardly directed annular flange 152 which terminates at its inner end in an upwardly directed cylindrical mounting base portion 154 provided with a plurailty of bores 156 in which fasteners 158 in the form of setscrews are secured for securing the cylindrical element 150 in adjusted positions axially of the tubular pipe column section 134. However, it will be noted that the annular flange 152 includes an opening or bore 158 which receives therethrough the upper end of the fluid conduit 138. It is to be noted that the fluid conduit 138 may be used as a water injection pipe for a jet pump whose outlet is communicated with the lower end of the tubular pipe column section 134.

In FIGURE 7 of the drawings there will be seen a modified form of support flange generally referred to by the reference numeral 160. The support flange 160 and associated parts of the water well seal are substantially identical to the water well seal illustrated in FIGURE 6 with the exception that the opening 162 formed in the inwardly directed annular flange 164 is smaller in diameter than the opening 158 and receives therethrough an insulated conductor 166 for connecting a submersible pump to a suitable source of electrical potential. In addition, instead of being provided with a fluid conduit 138, the support flange 160 is provided with passage defining means 168 for receiving therethrough the insulated conductor 166. In addition, the passage defining means 168 is included with means 170 and 172 for frictionally gripping the electrical conductor 166.

From a comparison of the sealing ring illustrated in FIGURES 1 through 5 and the sealing ring illustrated in FIGURES 6–8 it will be noted that the sealing ring 30 differs slightly from the sealing ring 144 illustrated in FIGURES 6–8. While the sealing ring 144 is provided with an outwardly and upwardly projecting sealing lip 148 similar to sealing lip 34 and an inwardly and upwardly directed sealing lip 152 similar to sealing lip 36, the seat 174 defined by the upper portion of the base portion 146 of the sealing ring 144 is substantially horizontally alined with the lower ends of both of the sealing lips 148 and 152. However, it will be noted that the seat 176 of the sealing ring 30 is elevated above the lower end of the sealing lip 34. In this manner, axial compression of the base portion 32 of the sealing ring 30 will not have a tendency to deflect the outwardly and upwardly inclined sealing lip 34 downwardly at its free edge whereas axial compression of the base portion 146 of the sealing ring 144 will have a tendency to downwardly and outwardly deflect the upper free end of the upwardly and outwardly inclined sealing lip 148.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention

to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seat urging the latter toward said flange, said support flange being removably secured to said pipe column section, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said sealing ring, said sealing ring also including an upwardly and inwardly inclined sealing lip having its upper end portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said support flange also including means defining an inwardly facing cylindrical sealing surface disposed generally radially inwardly of the first mentioned surface defining means and radially outwardly of said pipe column section, a second annular sealing ring similar to the first mentioned ring having the upper end of its inwardly and upwardly projecting lip disposed in tight sealing engagement with the outer surfaces of said pipe column section and the upper end of its upwardly and outwardly projecting lip disposed in tight sealing engagement with said inwardly facing cylindrical sealing surface.

2. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, and fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section.

3. The combination of claim 2 wherein said support flange and pipe column are of one piece construction.

4. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its major diameter upper end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major diameter end portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, and fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section.

5. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its major diameter upper end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major diameter end portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, a conduit section carried by and passing through said support flange.

6. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the pasage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly

and outwardly inclined sealing lip carried by said base and having its major diameter upper end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major diameter end portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, a passage extending through said support flange having means operatively associated therewith adapted to frictionally grip an insulated electrical conductor extending through said passage.

7. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section, a conduit section carried by and passing through said support flange, said inwardly directed annular flange having an opening formed therethrough through which said conduit section extends.

8. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, and fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section, a passage extending through said support flange having means operatively associated therewith adapted to frictionally grip an insulated electrical conductor extending through said passage, said inwardly directed annular flange having an opening formed therethrough in substantial alinement with said passage.

9. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, said support flange having a plurality of threaded bores formed therein opening upwardly and a plurality of apertures formed through said inwardly directed flange alined with said bores, a plurality of fasteners passed through said apertures and threadedly engaged in said bores.

10. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing

surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, and fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section, said support flange terminating inwardly in a cylindrical mounting base, a plurality of generally radial threaded bores formed in said mounting base, and fasteners comprising setscrews threadedly engaged in said bores and engaged with the outer surfaces of said pipe column section.

11. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, a second cylindrical element carried by said inwardly directed flange and disposed about said pipe column section, a second sealing ring disposed above the first mentioned cylindrical element and having its base portion supported by said inwardly directed flange, the lower end of said second cylindrical element disposed in abutting relation with the upper surface of said second sealing ring between the sealing lips thereof, the upper end of said second cylindrical element terminating in an inwardly directed second annular flange encircling said pipe column section, and fastening means secured through portions of the last mentioned inwardly directed annular flange and engaged with portions of said pipe column section.

12. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between said casing and pipe column section, said well seal comprising an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material including a lower base portion seated on the upper face of said support flange and an upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surfaces of said casing, means securing said ring to said support flange and effecting an axial thrust on said seal urging the latter toward said flange, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said seal, said seal also including an upwardly and inwardly inclined sealing lip having its upper major portion disposed in tight sealing engagement with the outer surfaces of said cylindrical sealing surface, said cylindrical sealing surface defining means including an upstanding cylindrical member carried by the upper face of said flange, said securing means including a cylindrical element disposed about said pipe column section whose lower end is disposed in abutting relation with the upper surface of said sealing ring between said sealing lips, the upper end of said cylindrical element including an inwardly directed annular flange encircling said pipe column section, and fastening means secured through portions of said inwardly directed annular flange and engaged with portions of said pipe column section, said support flange being removably secured to said pipe column and slidably along and including means securing said flange to said column in adjusted position therealong.

13. In combination with a well casing string having a tubular pipe column section disposed therein and adapted at its lower end for communication with the discharge of a well pump body, a well seal for establishing a barrier to the passage of air down the well casing between the casing and the pipe column section and yet enabling the passage of air upwardly between the casing and the pipe column section, said well seal including an annular radially outwardly projecting support flange carried by said pipe column section, an annular sealing ring of resilient waterproof material, said ring, including a lower base portion seated on the upper surface of said support flange and an outer marginal upwardly and outwardly inclined sealing lip carried by said base and having its upper major diameter end portion disposed in tight sealing engagement with the inner surface of said casing, said pipe column section including means defining an outwardly facing cylindrical sealing surface disposed generally radially inwardly of said sealing ring, said sealing ring, also including an inner marginal upwardly and inwardly inclined sealing lip spaced radially inwardly of said outer marginal lip and having its upper end portion disposed in tight sealing engagement with said outwardly facing cylindrical sealing surface, and means effecting an axial thrust on said sealing ring urging the latter toward said flange, the last-mentioned means including an annular member supported from and disposed about said pipe column section and engaged with the upper surface of said lower base portion intermediate said sealing lips, said annular member being spaced radially inwardly and outwardly from the free marginal edge portions of said outer and inner lips, respectively and applying a downward axial thrust on said ring.

References Cited by the Examiner

UNITED STATES PATENTS

87,670	3/69	Heinz	166—202
746,184	12/03	Smith et al.	166—202
1,301,597	4/19	Paulsmeier	103—102
1,842,116	1/32	Rasmussen	166—202 X
2,079,835	5/37	Bradley	166—75
2,267,459	12/41	Hait	103—102
2,723,721	11/55	Corsette	166—202 X

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