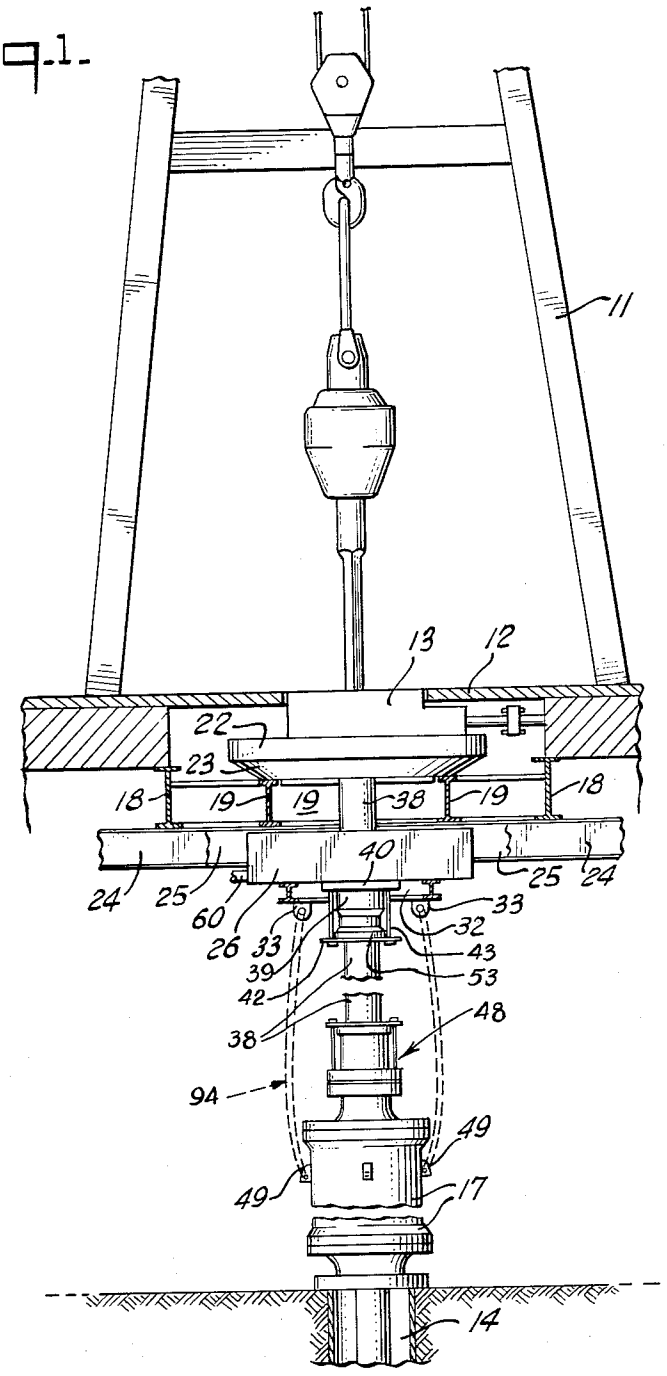
March 6, 1962 O. O. ST. JOHN 3,023,808

DEEP WELL DRILLING APPARATUS

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Fig. 1.



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DEEP WELL DRILLING APPARATUS

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Fig. 2.

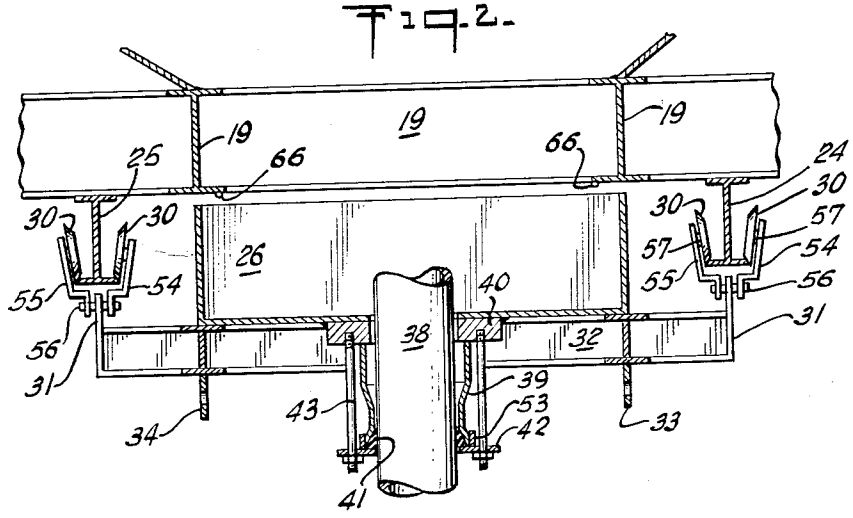


Fig. 3.

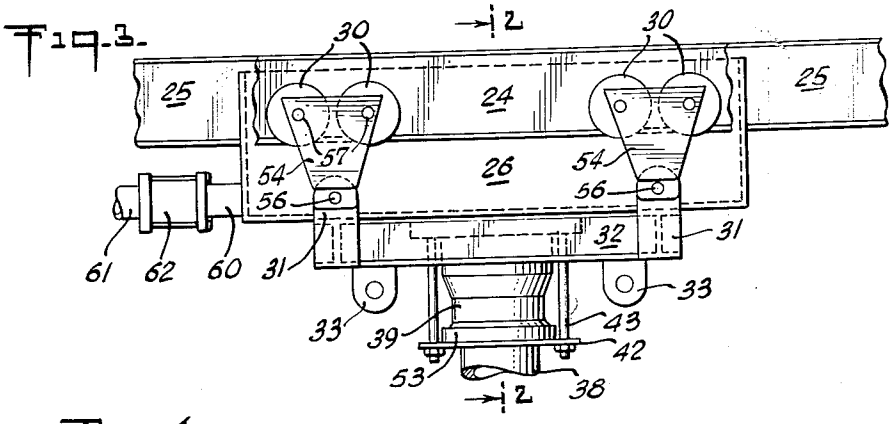


Fig. 4.

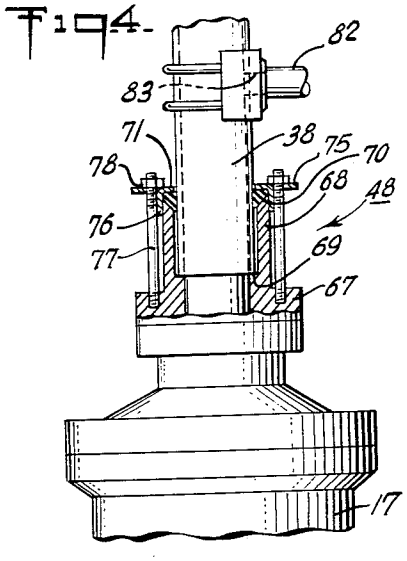
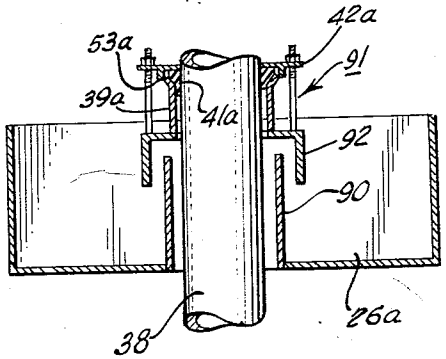


Fig. 5.



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DEEP WELL DRILLING APPARATUS

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8 Claims. (Cl. 166—79)

This invention concerns apparatus that is employed in connection with deep well drilling. More specifically, it is concerned with auxiliary equipment for use in connection with deep well drilling and particularly with deep well drilling in the nature of over-water drilling operations, e.g. wells drilled from drilling barges.

In many deep well drilling operations, but most particularly in drilling from barges where it is particularly important and necessary to keep the rig floor washed off (so as to avoid any slippery footing), the run-down of wash water is particularly damaging to exposed moving parts of the blowout preventers, and the like. This is so because the drilling mud is usually quite caustic, and also the water employed in washing the rig floor is most often saline water taken from the surrounding body of water. For these reasons, it has been heretofore practically impossible to avoid run-down of some wash water and drilling mud, etc., onto the piston rods, and other exposed moving parts of the blowout preventers. These moving parts consequently quickly became pitted and therefore caused rapid wear of the packing in contact therewith.

In addition to the above-indicated difficulties caused by run-down of wash water and drilling mud, there has been (also heretofore) a time-consuming operation involved whenever the blowout preventers, and other heavy elements attached to the well head, must be removed. Such removal heretofore involved numerous trips, one for each of the elements as they were separately uncoupled and raised to the rig floor. This uncoupling was a time-consuming operation for each element since they are securely attached for withstanding high pressures. These operations also involved additional hazards by reason of the numerous trips, lifting these heavy elements.

In view of the above-indicated difficulties involved in deep well drilling operations, it is an object of this invention to provide a means for catching the "run-down" that was above described and directing the same so as to avoid the harmful effects thereof.

Another object of this invention is to provide means which, in addition to carrying out the above-indicated diversion of undesirable run-down, has means for attaching in suspension all of the heavy elements at the well head, as a unit. In this manner, these elements may be handled with a minimum of time and effort as well as a maximum of safety to the drilling personnel.

Briefly, this invention is concerned with deep well drilling apparatus which employs blowout preventers, or the like, that are subject to damage from run-down of drilling mud and the like, from the rig floor. Such apparatus comprises a fluid-tight receptacle means located underneath that area of the rig floor directly above said well, for catching said run-down of drilling mud and the like from the rig floor. The invention also includes an outlet adapted to have a conduit attached thereto for carrying away said run-down, and means for extending the well bore passage upward from the top of said blowout preventers to a height adjacent to the underside of said rig floor. The last named means extends through said receptacle means. The invention additionally includes means for sealing said extending means, where it passes through said receptacle means.

The invention may also be described briefly as concerning deep well drilling apparatus that employs a plu-

rality of heavy well head elements which require periodic detachment from and reattachment to the well head. The invention is concerned with the improvements which comprises a laterally movable heavy load support means, including brackets for attaching a means for suspending said well head elements as a unit, when detached from the well head.

The foregoing and other objects and benefits of the invention will be more fully appreciated in connection with the detailed description which follows, and which is illustrated in the drawings in which:

FIG. 1 is a fragmentary schematic elevation, showing a deep well drilling rig located over the well head;

FIG. 2 is an enlarged detail, transverse cross-section view showing the receptacle, taken along the lines 2—2 of FIG. 3;

FIG. 3 is an enlarged detail, elevational view, showing the receptacle and its suspension rollers;

FIG. 4 is an enlarged detail illustration, partially in cross-section, showing the structure for extending the well bore passage located in place above the blowout preventers; and,

FIG. 5 is an alternative arrangement for providing a seal between the bottom of the receptacle and the well bore passage extending bell nipple pipe, where it passes therethrough.

Referring to FIG. 1, it will be observed that there is illustrated, largely schematically, a deep well drilling rig which includes a derrick **11** that stands above a rig floor **12**. Rig floor **12** lies flush with, and surrounds, the upper surface of a rotary **13**.

The drilling rig is shown in place over a well **14** which has attached thereto, at the well head, a plurality of heavy elements including blowout preventers as well as drilling spools and the like. All of these heavy well head elements are schematically illustrated by a single element **17** (shown broken to indicate greater height) that is attached to the well head at the top of well **14**, in any conventional manner.

The compartment which contains rotary **13** is, of course, located centrally of the rig floor **12**. This compartment includes supporting structure members, such as a plurality of I-beams **18** and **19** illustrated. I-beams **18** and **19** are fastened together in any feasible manner, but preferably by welding, to form a rectangular supporting structure for the rotary **13**.

In connection with this invention, there are sheet metal walls added to the conventional supporting structure for rotary **13**, e.g. a verticle wall **22** and a sloping wall **23** illustrated. As will be more fully explained below, the purpose of providing sheet metal walls **22** and **23** is to make sure that the flow of any wash water or other fluids, down over the rotary **13** from rig floor **12**, will be directed into the rectangular center opening formed underneath rotary **13** (inside of the I-beam elements **18** and **19**).

Securely attached to the bottom edges of, and lying underneath I-beams **18** and **19**, there is a pair of transversely extending I-beams **24** and **25**. These I-beams **24** and **25** must be firmly welded or otherwise adequately attached to the framework of the drilling rig so as to be able to carry a relatively heavy load which includes a rectangular receptacle **26**. The receptacle **26** need not itself be relatively very heavy, but as will appear, it has an additional function which is that of carrying a heavy load attached thereto under certain operating conditions.

Although the receptacle, or open topped box **26** is shown as having a rectangular shape, it will be noted that various other shapes might be employed, so long as there is an opening at least as large as the rectangular center opening, underneath rotary **13** to catch all the run-down from the rig floor **12**.

The receptacle **26** may be supported in many different ways. However, it is preferred that it be held suspended for allowing free lateral translation thereof, by means of roller wheels **30** (FIGS. 2 and 3) which bear upon the lower flanges of I-beams **24** and **25**. These roller wheels **30** are attached in a conventional manner to support the receptacle **26**, e.g. by being pivotally connected to a welded bracket **31** for each pair of wheels **30**. Brackets **31** are integral with a horizontal supporting frame, or cradle **32**, on which the receptacle **26** rests. Securely attached to the cradle **32**, and depending therefrom, there are two pairs of supporting attachment brackets, **33** and **34** that are employed for supporting the heavy elements (indicated by element **17**) when they are detached from the well head of well **14**. This will be explained in more detail hereafter.

It will be appreciated that the roller wheels could be attached directly to the receptacle itself. If this were done, the cradle **32** would be omitted.

When the receptacle **26** is in position as illustrated in FIG. 1, the apparatus is set up for proceeding with actual drilling operations. For this reason, there is included a bell nipple **38**, which takes the form of a pipe having sufficient inside diameter to give clearance for the drill bit or any elements that are to be lowered into the well **14** on the drill string during drilling operations.

In order to maintain receptacle **26** in a fluid-tight condition, with bell nipple **38** extending through the bottom thereof, there is employed a seal that might take various forms but that is illustrated as one-half of a conventional coupling element. This coupling element includes a relatively thin sleeve **39** which is welded to a collar **40** that is in turn welded to the bottom of the receptacle **26**. To complete the seal, there is a resilient ring or gasket **41** (FIG. 2) that is wedged between the lower flared edge of sleeve **39** and the inside of a ring **42** and collar **53**. Ring **42** is held axially against the resilient ring **41** by means of a plurality of bolts **43**.

In order to provide a fluid seal between the lower end of bell nipple **38** and the uppermost one of the heavy elements indicated by element **17**, there is another seal **48** that may take substantially the same form as the seal described above in connection with making a fluid-tight coupling between the bell nipple **38** and the bottom of receptacle **26**.

It is pointed out that there are shown a plurality of lugs **49** around the outside of element **17**. These lugs **49** are employed for the purpose of suspending the entire group of heavy elements (represented by element **17**) from the brackets **33** and **34**. In view of the schematic nature of the element **17** representation, it will be appreciated that many other structures and arrangements could be employed for suspending the heavy blowout preventers, etc. that are represented by the element **17**. For example, a plurality of eye bolts could be used among the flange bolts that hold the top on the uppermost one of the group of heavy elements.

It will be appreciated that any feasible arrangement might be employed for suspending element **17** from the brackets **33** and **34**. For example, a wire-rope sling **94** could be shackled onto the brackets **33** and **34**, employing hooks or shackles also, to connect the sling to the lugs **49** of the element **17**, it being remembered that element **17** represents a plurality of blowout preventers and drill spools and the like, which are employed during well drilling operations.

Referring to FIGS. 2, 3 and 4, some of the details of the elements included in this invention will be described. It will be observed that the ring **42** of the upper seal includes as an integral element thereof the collar **53** that is radially outside of the bottom edge of sleeve **39**. This collar **53** extends in an overlapping manner so as to prevent undue spreading of the free edge of sleeve **39**.

The structural arrangement for attaching wheels **30** may take various forms, but is illustrated as a conventional arrangement such that a pair of wheel bearing plates **54** and **55** each carry shafts **57** for wheels **30**. At the bottom of each pair of plates **54** and **55**, there is a cross shaft **56** which forms a pivotal connection with the brackets **31**, as was indicated in general above.

It will be appreciated that the supporting cradle, or frame **32** which carries receptacle **26**, might be dispensed with if the wheels or rollers **30** were to be directly attached (in any feasible manner) to the receptacle **26**. In such case, it is, of course, clear that the depending brackets **33** and **34** would be directly attached to the receptacle **26**.

The receptacle **26** has a drain at one end thereof in the form of an outlet pipe **60** for carrying off any fluid as it accumulates within the receptacle **26**. The fluid which is thus drained off from receptacle **26** may be directed to any desired location, by any convenient extension tube or the like, e.g. a tube **61** that is coupled to outlet pipe **60** by means of a fluid tight coupling **62**.

At the lower edges of the central opening underneath rotary **13**, there is a depending drip bead **66** (FIG. 2) to insure that all of the run-down from the rig floor **12** and elsewhere, through the compartment for rotary **13**, will fall into the receptacle **26**, including any dripping after the main flow of such drainage fluids has been reduced. Such drip bead **66** may take any feasible form, e.g. a round cross section rod that is welded to the lower inside edges of the flanges of I-beams **18** and **19**, as illustrated in FIG. 2.

In this connection, it is to be noted that receptacle **26** is an open-topped tray-like structure that has the sides thereof located outside of the inner dimensions of the opening under rotary compartment **13**.

In FIG. 4, there is shown details of the lower seal **48** that is adapted to receive the bottom end of the bell nipple **38**.

It will be observed that there is a lower collar **67**, which is adapted for connection to the top flange of the uppermost one of the heavy elements that are represented by element **17**. Integrally connected to collar **67**, there is a sleeve **68** that has a shoulder **69** on the inside near the base thereof, to support the bell nipple **38** thereon. Then in order to provide a fluid tight seal with the bell nipple **38**, there is a beveled edge **70** at the top of sleeve **68**, which acts as a wedge in conjunction with a resilient material ring **71**. Ring **71**, which may be rubber or the like, is pressed into engagement with the outer surface of bell nipple **38** by means of a flat ring **75** which has a depending collar **76** thereon to overlap the free edge of sleeve **68**. The ring **75** is clamped into firm engagement with the resilient sealing ring **71**, by means of a plurality of clamping bolts **77** and nuts **78**.

At a convenient location along the length of bell nipple **38**, there is attached a flow-line pipe **82**, that is clamped in a fluid tight sealing manner over an outlet hole **83** which may have been drilled in the side of bell nipple **38**. This arrangement is to provide for the circulation of drilling fluid, during drilling operations.

FIG. 5 illustrates an alternative structure for providing a fluid tight seal between the bottom of a receptacle **26*a*** and the bell nipple **38**. It is pointed out that the FIG. 5 showing is a transverse cross section similar to FIG. 2 but with all elements other than those necessary for showing the fluid seal between the bell nipple **38** and the receptacle **26*a***, being omitted.

Thus, it will be observed that there is provided an upstanding sleeve **90** that is welded to the bottom of the receptacle **26*a*** and extends upward sufficiently to avoid any overflow of the run-down fluids which are directed into the receptacle **26*a***. The seal arrangement is completed between bell nipple **38**, and the receptacle **26*a***, by providing a seal structure **91** that is substantially the same as the seal structure employed in FIG. 2, except that the structure for holding the sealing gasket **41*a*** is located upside down compared to the FIG. 2 seal structure. There is a flange member **92** that carries a thin sleeve **39*a*** and that surrounds the outside surface of the

bell nipple 38. The depending portion of flange 92 has an inside diameter greater than the outside diameter of the upstanding sleeve 90, and the flange 90 is situated so as to overlap the top edge of sleeve 90. Now in order to avoid repeating the description of the similar elements, it is merely necessary to point out that corresponding reference numbers are employed for corresponding elements, using the subscription (*a*) therewith. By means of this FIG. 5 arrangement, all the run-down fluids are caused to flow out over the outside of flange 92, and then into the receptacle 26*a*, without flowing down the outside of bell nipple 38 into contact with any of the blowout preventer elements, etc.

Operation

It is pointed out that the apparatus according to this invention includes a plurality of functions, and by way of adding clarity to the entire disclosure, a brief resume of the operation of the equipment is given.

When the apparatus is situated in accordance with the illustrations of FIGS. 1–4, things are in position for proceeding with the actual drilling operation. At such time the receptacle 26 is in position for, and acts to prevent, any run-down of fluids from the rig floor through the compartment that contains rotary 13, so that it is prevented from reaching any of the blowout preventers that are situated below. Such wash fluids are particularly harmful in connection with sea water drilling operations, e.g. drilling barges, since usually the water used in washing off all drilling mud accumulations from the floor 12, is saline. Furthermore, the fluid that results from drilling mud accumulations is usually quite strongly caustic by reason of the consistency of the drilling muds that are employed. Consequently, in water drilling operations where it is particularly important to keep the drill floor 12 clean and not slippery, frequent washing of this floor causes run-off of fluids that are very harmful to the exposed moving parts of the blowout preventers. The arrangement of the elements according to this invention, therefore, act to confine all of the fluids caused by such washing operations within the rotary compartment. To be sure this is so, the rotary compartment has been adequately walled up by employing sheet metal walls. Such wash fluids will therefore run down on the inside of the walls 22 and 23 and be confined to the central space formed by the joinder of I-beams 18 and 19, thus providing a suitable wall means for directing flow of run down. Consequently, the fluids will then flow into the top of receptacle 26, being entirely confined thereto by reason of the drip bead 66. All such fluids as they are received by receptacle 26 will then flow out of the drain pipe 60 and be carried via the tube 61 for direction to any desired location such as within the slot of the drilling barge.

Now when it is desired to carry out operations in which the blowout preventers and drill spools, etc. (represented by element 17) are to be removed from the well head, the operation for removing these elements will be carried out as follows:

Bell nipple 38 may be first removed, after the seals connected thereto have been loosened, by first removing the bushing of rotary 13 and then lifting bell nipple 38 directly upward through the rotary. It will be then deposited at any convenient resting place. Following removal of bell nipple 38, the blowout preventers, etc. may be removed as a single unit by merely uncoupling the lowest one of these elements from the well head and then lifting the entire group of elements enough to clear the well head, followed by supporting them on a sling indicated generally at 94. The sling is attached to brackets 33 and 34 by conventional means such as a turnbuckle, and is attached at its lower end to element 17 by being shackled or hooked to lugs 49. Then, the entire unitary group of elements may be transversely displaced by rolling the receptacle 26 to one side along the beams 24 and 25, which form tracks for the roller wheels 30. In this manner, the relatively slow and hazardous operation of removing the blowout preventers and other such elements, individually, may be avoided.

The operation of the FIG. 5 modification of the seal arrangement between the bell nipple 38 and the receptacle 26 is self evident. However, it might be pointed out that as fluid runs down the outside of the bell nipple 38 it is diverted by the seal at gasket ring 41*a*. Therefore it must flow out over the sleeve 39*a* and then the flange 92, to fall into the receptacle around the sleeve 90. The height of sleeve 90 is great enough to prevent any overflow.

While certain embodiments of the invention have been described in some detail in accordance with the applicable statutes, this is not to be taken as in any way limiting the invention, but merely as being descriptive thereof.

It is claimed:

1. In deep well drilling apparatus employing blowout preventers or the like subject to damage from run-down of drilling mud and the like from the rig floor, removable fluid-tight receptacle means underneath that area of the rig floor directly above said well and above said blowout preventers for catching said run down, means carried by said rig for movably supporting said receptacle means to allow temporary lateral displacement thereof to one side of said well, said receptacle means including an outlet adapted to have a conduit attached thereto for carrying away said run-down, means for extending said well upward from the top of said blowout preventers to a height adjacent to the underside of said rig floor and extending through said receptacle means, and means for sealing said extending means where it passes through said receptacle means, comprising an upstanding sleeve integrally attached to said receptacle means and extending upward high enough to prevent any overflow of fluid, resilient seal means surrounding said well passage extending means and located above said upstanding sleeve, relatively rigid ring and collar means surrounding said well passage extending means and contacting said seal means for squeezing same into fluid-tight sealing relation with said passage extending means, a second sleeve having a free end thereof contacting the other side of said seal means, a depending flange integrally attached to said second sleeve and having an inside diameter greater than the outside diameter of said upstanding sleeve, means for supporting said ring and collar means from said depending flange, said means for sealing said extending means all being located so that said flange overlaps the top of said upstanding sleeve whereby fluid must flow into said receptacle means without flowing down the outside of said extending means therebelow.

2. In deep well drilling apparatus employing blowout preventers or the like subject to damage from run-down of drilling mud and the like from the rig floor, fluid-tight receptacle means underneath that area of the rig floor directly above said blowout preventers for catching said run-down, including an outlet adapted to have a conduit attached thereto for carrying away said run-down, means for extending said well upward from the top of said blowout preventers to a height adjacent to the underside of said rig floor and extending through said receptacle means, means for sealing said extending means where it passes through said receptacle means, and support means carried by said rig for supporting said receptacle and permitting movement of said receptacle laterally with respect to said well bore, said support means including laterally extending beams attached to said rig floor and means attached to said receptacle cooperating with said beams to permit movement longitudinally of said beams.

3. In deep well rotary drilling apparatus employing a plurality of blowout preventers and the like, an open top fluid-tight receptacle underneath the rotary and above the blowout preventers to catch run-down of drilling

mud from the rig floor, said receptacle having an outlet adapted to have a conduit attached thereto for carrying away said run-down, means for extending the well bore passage upward from the top of said blowout preventers to a point near the bottom of the rotary, an opening in said receptacle to allow said extending means to pass therethrough, seal means cooperating with said extending means and each of said receptacle and the top of said blowout preventers for providing liquid-tight seals thereat support means carried by said rig for supporting said receptacle and permitting movement thereof horizontally away from said well bore when said extending means is removed, said support means including laterally extending rails attached to said rig structure and rollers connected to said receptacle and cooperating with said rails, and supporting brackets carried with said receptacle for receiving means to suspend said blowout preventers when detached from the well head.

4. In deep well drilling apparatus employing blowout preventers or the like subject to damage from run-down of drilling mud and the like from the rig floor, a removable fluid-tight receptacle means underneath that area of the rig floor directly above said well and above said blowout preventers, means carried by said rig for movably supporting said receptacle means to allow temporary lateral displacement thereof to one side of said well, a drain for said receptacle for carrying off said run-down to a desired disposal location, and means for extending said well upward from the top of said blowout preventers and extending through said receptacle means.

5. In deep well drilling apparatus employing blowout preventers or the like subject to damage from run-down of drilling mud and the like from the rig floor, a removable fluid-tight receptacle means underneath that area of the rig floor directly above said well and above said blowout preventers for catching said run-down, means carried by said rig for movably supporting said receptacle means to allow temporary lateral displacement thereof to one side of said well, said receptacle means including an outlet adapted to have a conduit attached thereto for carrying away said rundown, means for extending said well upward from the top of said blowout preventers to a height adjacent to the underside of said rig floor and extending through said receptacle means, and means for sealing said extending means where it passes through said receptacle means.

6. In a deep well rotary drilling apparatus employing a plurality of blowout preventers and the like, an open top fluid-tight receptacle underneath said rotary to catch run-down of drilling mud from the rig floor, wall means enclosing said rotary for directing said run-down into said receptacle, a drip bead depending from said wall means and surrounding the bottom opening thereof to insure that all drips of said run-down will fall into said receptacle, said receptacle having an outlet adapted to have a conduit attached thereto for carrying away said rundown, a cylindrical pipe adapted for extending said well upward from the top of said blowout preventers and extending upward close to the bottom of said rotary, an opening in said receptacle to allow said pipe to pass therethrough, first seal means cooperating with said pipe and said receptacle for providing a liquid-tight seal thereat, second seal means cooperating with said pipe and the top of said blowout preventers for providing a liquid-tight seal thereat, roller support means for supporting said receptacle and cooperating with load bearing tracks attached to said rig and extending transversely away from said well to permit lateral displacement of said receptacle, and supporting attachment brackets carried with said receptacle for receiving means to suspend said blowout preventers when detached from the well head.

7. In deep well rotary drilling apparatus employing a plurality of blowout preventers and the like, an open top rectangular fluid-tight receptacle adapted to be located underneath said rotary to catch run-down of drilling mud from the rig floor, wall means enclosing said rotary for directing said run-down into said recepatcle, a drip bead depending from said wall means and surrounding the bottom opening thereof to insure that all drips of said rundown will fall into said receptacle, said receptacle having an outlet adapted to have a conduit attached thereto for carrying away said run-down, a cylindrical pipe adapted for extending said well upward from the top of said blowout preventers and extending upward close to the bottom of said rotary, an opening in said receptacle to allow said pipe to pass therethrough, first seal means cooperating with said pipe and said receptacle for providing liquid-tight seal thereat, second seal means cooperating with said pipe and the top of said blowout preventers for providing a liquid-tight seal thereat, roller support means for said receptacle cooperating with load bearing tracks attached to said rig and extending transversely away from said well to permit lateral displacement of said receptacle, support beams under said receptacle attached to said roller means to support said receptacle, and supporting attachment brackets depending from said support beams for receiving means to suspend said blowout preventers as a unit when detached from the well head.

8. In deep well drilling apparatus employing blowout preventers or the like subject to damage from run-down of drilling mud and the like from the rig floor, removable fluid-tight receptacle means underneath that area of the rig floor directly above said well and above said blowout preventers for catching said run-down, means carried by said rig for movably supporting said receptacle means to allow temporary lateral displacement thereof to one side of said well, said receptacle means including an outlet adapted to have a conduit attached thereto for carrying away said run-down, means for extending said well upward from the top of said blowout preventers to a height adjacent to the underside of said rig floor and extending through said receptacle means, and means for sealing said extending means where it passes through said receptacle means comprising a depending sleeve attached to the bottom of said receptacle means and surrounding said extending means, resilient seal means surrounding said extending means and contacting the free end of said depending sleeve, relatively rigid ring and collar means surrounding said extending means and contacting said seal means for squeezing same into fluid-tight sealing relation with said extending means, and means for supporting said rigid ring and collar means from said receptacle means.

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