Sept. 16, 1952 G. M. BEATTY 2,610,690

MUD BOX

Filed Aug. 10, 1950

Fig. 1.

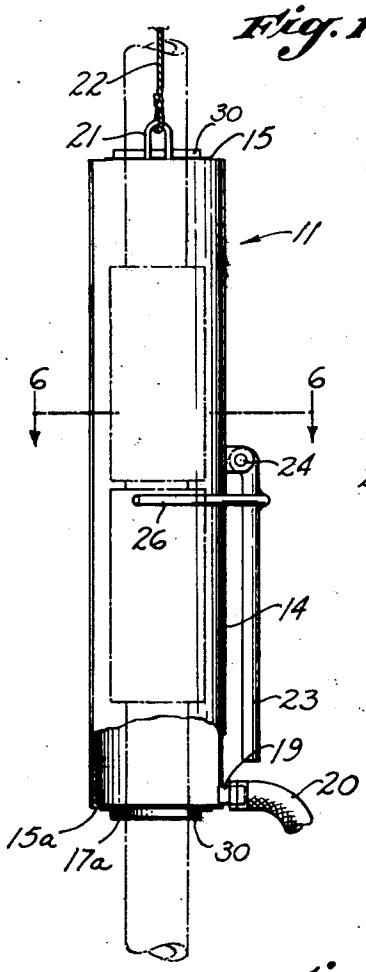


Fig. 2.

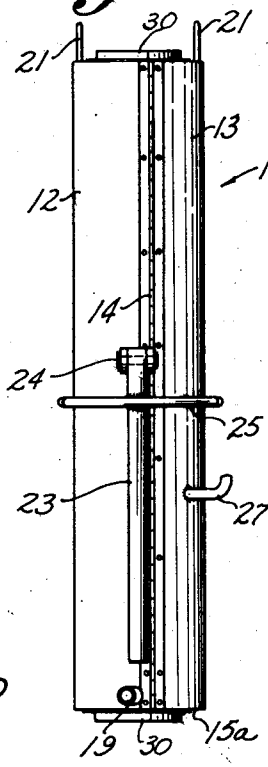


Fig. 3.

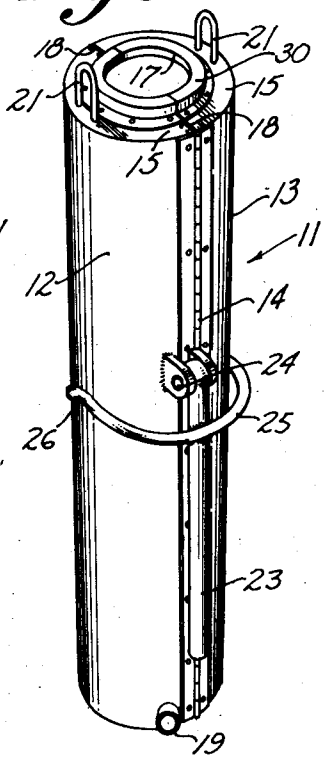


Fig. 4.

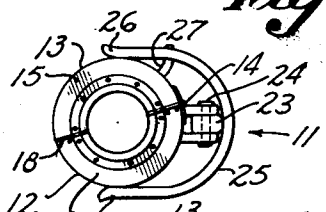


Fig. 5.

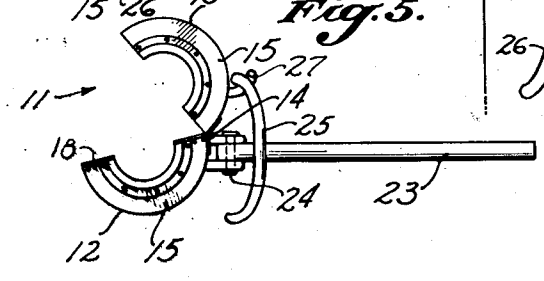


Fig. 6.

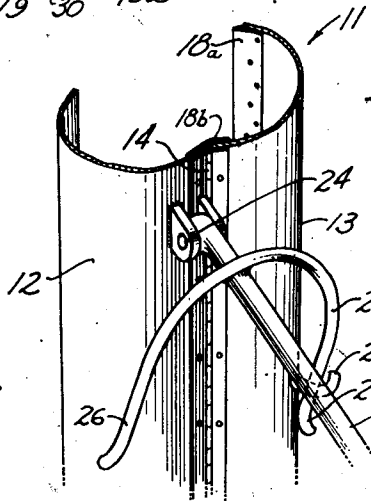
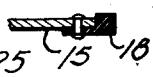


Fig. 7.



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MUD BOX

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6 Claims. (Cl. 166—16)

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This invention relates to mud boxes for use in preventing the uncontrolled flow of drilling mud from the joints of a string of drill pipe when the pipe lengths are being disconnected at the surface of the ground.

In drilling oil wells by the rotary method, the rotating bit or other rotating tool is suspended in the well hole by a string of drilling pipe. The string of drilling pipe is made up of pipe lengths or sections connected by couplings at the joints, and the string hangs at its upper end from a traveling block, the cable passing over the pulleys of the crown block in the derrick and thence to the winding drum of the draw works.

The drilling pipe string is rotated by means of a power driven table just above the work platform or rig floor. This table is provided with a central square opening, through which slides the kelly rod. The kelly rod is coupled at its lower end to the uppermost pipe length, and suspended at its upper closed end by hooks from the traveling block. Thus rotation of the table effects rotation of the pipe string and the cutting bit at the lower end of the string.

A flexible hose feeds drilling mud into the upper end of the kelly rod, and this mud flows down through the drill pipe to the drilling tool, acting as a lubricant for the tool, and keeping it cool. It then mingles with any water or other liquid which may be present in the well and carries away with it up the cylindrical space between the outside of the drilling string and the well wall, the material removed by the cutting tool. The finer solid components of the mud may enter openings in the well wall, and form a relatively impervious facing. The mud liquid upon rising to the well surface is drained to storage facilities and treated to remove large solid material, and otherwise prepared to be pumped back into the kelly. The drilling mud is variously constituted, depending upon the drilling conditions. As will be appreciated from the above recital of its several functions, this mud fluid is a necessary feature of a rotary well drilling operation.

It will be evident that during the drilling operation the column of mud liquid outside the drill pipe usually stands at the surface of the well, and that the column within the drill pipe stands above the ground level extending up into the kelly, this level within the drill pipe depending upon the rapidity of the feed of the mud liquid into the kelly, and the conditions at the cutting tool which affect the flow of the mud liquid from the inside column to the outside column.

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In the operation of the drilling equipment there are several occasions when the pipe lengths must be uncoupled at the surface. For example, as the bit goes deeper, the string must be pulled at intervals until the kelly is entirely above ground, the kelly uncoupled and a new stand of two or three pipe lengths inserted between the kelly and the top of the string in the well. Also, the entire string must be elevated, pulled and uncoupled in stands of two or three lengths in order to change bits. The same operation must be done before and after placing a core barrel at the lower end of the string for sampling the material at the bottom of the well. Again this operation is required when the well is sealed off at a particular level and the string is elevated for a formation test.

Bearing in mind, then, that the liquid level in the drill pipe string is at nearly all times at least at the ground level and usually higher than the ground level, and that the joint between the pipe lengths which is being uncoupled is not far above the ground level, it is apparent that as the joint is broken, the drilling mud will flow over the work platform, splattering the workmen and making their footing dangerously slippery. As the drilling mud is sometimes expensive, particularly the oil base type of mud, the uncontrolled escape of the mud from the joints during the uncoupling operation should be reduced to a minimum. It is extremely hazardous from the fire standpoint when the liquid in the drill pipe has a high oil content, and escapes at the joints as they are uncoupled. Gas entrained in the drilling liquid increases the fire hazard, and may be under some pressure, raising the liquid level in the pipe string.

If after the string is raised until a joint is above ground, the drill crew delays uncoupling to permit the liquid level to drop below the level of the joint to avoid spilling of the liquid on the work platform and to conserve it for reuse, an expensive loss of time results. Some tools at the bottom of the string may by their nature provide no passage of liquid from the drill pipe column to the outside column. Bits may become clogged, with the same result. Or the conditions at the bottom of the drill pipe string may so retard the drawing of the drill liquid that it becomes impracticable to wait for the liquid level to drop below the joint to be uncoupled.

The present invention has as its primary object to provide an improved liquid tight longitudinally split box consisting of a pair of semi-cylindrical shells, hinged at one edge and dis-

engageably secured together at their other edge, to be positioned around the pipe joint while it is being uncoupled, so as to divert the mud from spraying on the drilling crew. The box halves are placed in open position around the joint to be uncoupled, and then closed and fastened together on the drill pipe, so as to enclose the joint. The box completely entraps the escaping mud liquid and prevents it from being scattered over the persons of the crew and over the floor upon which they are working. It further preferably provides for delivery of the mud without loss through a conduit opening in the otherwise liquid tight walls of the mud box. From this opening the liquid is conducted to a storage facility from which it may again be propelled by slush pumps into the kelly at the upper end of the string.

Another object is to provide a mud box of the split type which may be readily positioned and securely clamped about drill pipes of different diameters at a joint coupling and as readily removed from the pipe, with a minimum of effort and time.

Another object is to provide a mud box which may be manipulated by the operator standing on the opposite side of the box from the vertical split joint of the box, so that he is protected from any jets of liquid issuing from leaks in this vertical joint due to possible wear or deformation of the box edges or due to play in the clamping mechanism which might develop after long use.

While one embodiment of the invention is herein set forth, it will be understood that the invention is not limited to this one disclosure, but includes all devices employing the principles of the invention and coming within the scope and sprit of the appended claims.

In the drawings which illustrate this one embodiment of the invention,

Figure 1 is an elevational view of the box;

Figure 2 shows an elevation of the box looking toward the hinged joint between its two halves;

Figure 3 is a perspective elevational view;

Figure 4 is a top plan view of the box;

Figure 5 is a top plan view of the box in open position;

Figure 6 is a perspective cross-sectional view of the box in open position taken along the line 6—6 of Figure 1; and

Figure 7 is a detail section through the edge of a box end showing a rubber seal.

The mud box, indicated as a whole by the numeral **11**, has two semi-cylindrical shells **12**, **13** hinged at **14**, along what may be termed their rear vertical meeting edges. The shells are movable relative to each other on strip hinge **14** to spread apart their front edges to the open position as shown in Figures 5 and 6, or to bring their front edges together in closed position as shown in the other figures of the drawing. Split annular ends **15**, **15***a* are welded into the ends of the shell halves, with their meeting joints in the same vertical plane as the meeting joints of the shell halves.

Split rubber type bushings **17**, **17***a* are placed in diametrically split housing rings **30** to seal the circular openings of the ends **15**, **15***a*, these bushings having outside and inside diameters such that when the shell halves are in closed position the bushing halves are slightly compressed to form fluid tight joints between the end plates **15**, **15***a* and the drilling pipe. Bushings **17** and **17***a* are provided with different inside diameters for selective accommodation to drill pipe lengths of corresponding outside diameter. The split edges of the end plates **15**, **15***a* are made fluid tight when the shell halves are closed by rubber type sealing strips **18** secured to one of the meeting edges. The longitudinal joint between the opening edges of the shell halves are made fluid tight when the shell halves are closed by a flap **18***a* secured to one of the meeting edges and shaped to sealingly engage with the other. A rubber packing or sealing strip **18***b* is fastened to the inside of the box over the hinged joint **14**.

An outlet conduit connection **19** is provided at the bottom of the box for draining the trapped mud from the box, and preferably has connected thereto a hose **20** or other conduit leading to a mud storage facility.

The upper plate **15** of the mud box is provided with hanging lugs **21** by which it may be suspended by a cable **22** from a pulley placed high in the derrick, the other end of the cable being attached to a counterweight, so that the mud box may be moved horizontally and vertically with little effort.

The mud box is manipulated by a handle **23** in the form of a bar horizontally hinged at **24** about midway of the length of the box to hinge lugs welded to the shell half **12** near the hinge axis **14**. A U-shaped clamping yoke **25** is welded to this handle near the hinge, in such position that it lies in a plane generally perpendicular to the handle, with its two arms **26** extending downwardly when the handle is in the horizontal position. To close the box, the handle is moved downward from the horizontal position, which causes the yoke arms **26** to gather and engage around the two halves of the cylindrical shell and move them to closed position. This yoke **25** is made of spring material, and when the handle is at its lowermost position as shown in Figures 1 to 4, the yoke is generally horizontal, and its arms tightly engage the sides of the box. Because of its elastic character, and because the normal span of its arms **26** is slightly less than the diameter of the closed box (each arm extending laterally from the bar to swing in a vertical plane of interference with the corresponding side of the closed box), the yoke not only holds the two halves of the box together, but flexes slightly and exerts spring closing pressure on the several packings of the box joints, effecting a fluid tight seal between the box and pipe and between the two halves of the box. It will be noted that the operator has a mechanical advantage in closing the box, in that the handle is longer than the yoke arms, and in that in the closing operation he is pushing the handle downward.

A lug or finger **27**, which is welded to the shell half **13**, is positioned to be engaged by the adjacent yoke arm **26** as the yoke is moved outwardly from the pipe upon raising the arm **23**. The yoke arm **26** by its engagement with finger **27** swings shell half **13** outwardly and rearwardly with respect to shell half **12**, permitting the box to be swung away from the pipe length and placed in a standby position ready for application to the next joint to be uncoupled. The one handle is utilized by the operator to place the open box in position, close the shell halves, open the shell halves, and move the box away from the pipe, with little effort on the part of the workman, who at all times stands to the rear of the box, protected from jets or sprays of leaking mud fluid. The horizontal position of the handle when the box is open lends itself well to easy movement horizontally of the box.

In the use of the mud box, the drill string is pulled upward by the draw works until the joint between the kelly and the first pipe section is just above the work table, or if the kelly rod has been removed, elevator clamps are applied to the upper end of the string for connecting it to the traveling block, and the string is pulled until the first joint to be uncoupled is in good working position above the work platform. Wedging slips are then placed between the pipe and the rotating table, below the joint to be broken. The string is then lowered slightly to get the slips into wedging position. Usually after the kelly is removed, the pipe is removed in stands of two or three singles, so that as the men begin the uncoupling operation, three single lengths will be suspended from the traveling block, and the rest of the string will hang from the drive table. The joint will be high enough above the work platform for conveniently working to uncouple the joint.

Tongs are next placed above and below the pipe joint and turned in opposite directions to break the joint and unscrew it a portion of a turn. Backup tongs are placed well above the joint, for turning the pipe above the joint in a loosening direction of rotation. While these backup tongs are held stationary the mud box is swung into position and closed around the pipe at the joint. This is accomplished by a single workman seizing the horizontally disposed handle **23** of the opened box, swinging the box by this handle onto the drill pipe with a "stabbing" motion, and then closing and latching the two halves of the box by depressing the handle.

During this operation, the workman remains behind the box, protected thereby from any mud that might be sprayed from the joint. It is especially to be noted that the workman does not have to move around to the front of the box either to latch it closed, or subsequently to open it up, and hence can remain at all times in a position protected from mud spray, either from the joint, or from a crack between the meeting edges of the box. The rotary table is then turned until the joint is entirely unscrewed, after which the stand attached to the traveling block is raised a few inches to allow the mud fluid to freely enter the mud box and be drained through conduit **20** to the ditches or other storage facility for re-use.

Following the escape of the liquid, the box is unlatched, by an upward movement of the handle, and swung by the same handle to a standby position. The backup tongs are then of course removed and the stand racked ready for the next assembling of the string. This procedure is repeated during the breaking of each joint until the entire string is racked or so much of it as is required for the occasion. The manipulation of the mud box of the invention is readily handled by a single workman using the single handle **23**.

The box remains open when not in use, because of the frictional contact of the finger **27** with the adjacent shell half **13**, which maintains the relative position of the shell halves until the handle **23** is pushed downward. Friction of the yoke arms on the shell halves also assures the box remaining in the closed position until the handle is again forced upwards. It should be noted that the latching is of such a nature that considerable wear can occur in the operating parts thereof without detracting from the tight mud seal effected thereby.

The box is readily and conveniently manipulated by a single operator, saving both time and effort, and reducing crew fatigue. The possibility of accidental opening of the box is virtually eliminated. The box of the invention is of great value and utility even without the provision of the conduit **20** for leading the mud liquid back to storage, in that its convenience of operation, and the protection it affords the drilling crew, are features of great benefit even if the mud liquid were to be allowed to spill from drain openings in the bottom of the box. However, in view of the advantage of maintaining a clean floor, and of the economic loss of spilled mud liquid, particularly of the oil base type, the use of the drain conduit **20** will usually be preferred.

The invention has been described with particular reference to drilling operations. However, while the invention has its chief application in the field of drilling, it also has application to various well maintenance operations in which a fluid filled tubing must be pulled from the well and tubing stands uncoupled above ground.

I claim:

1. In a mud box for use to control the issue of liquid from a joint between two pipe sections while being uncoupled, the combination of: a pair of mating box halves hinged together along a pair of vertically disposed meeting edges, said box halves being formed to fit at top and bottom about a pipe section to enclose a chamber surrounding a joint in said pipe, the vertical edges of said box halves opposite to said hinged edges being adapted to close with one another to prevent issue of liquid therebetween, a handle bar horizontally pivoted to one of the box halves near the hinged edge thereof, said handle bar having a normal position extending outwardly from said box half, a gathering arm rigidly mounted on said handle bar extending from said bar in a direction to be engageable with the outer side of said other box half to close the same with said first box half as said handle bar is swung away from said normal position, said gathering arm retracting from said other box half to release it for opening movement when said bar is returned to said normal position, and means on said other box half engaged by said gathering arm during retraction of said arm for moving said other box half to open position.

2. In a mud box for use to control the issue of liquid from a joint between two pipe sections while being uncoupled, the combination of: a pair of mating box halves hinged together along a pair of vertically disposed meeting edges, said box halves being formed to fit at top and bottom about a pipe section to enclose a chamber surrounding a joint in said pipe, the vertical edges of said box halves opposite to said hinged edges being adapted to close with one another to prevent issue of liquid therebetween, a handle bar horizontally pivoted to one of the box halves near the hinged edge thereof, said handle bar having a normal position extending outwardly from said box half, and a spring gathering arm rigidly mounted on said bar near the pivot axis thereof and extending laterally from the vertical swinging plane of said bar to a plane of engagement with the outer side of said other box half to engage and swing said other box half to closed position with the first mentioned box half when the handle bar is vertically swung away from its said normal position to a closed-box position.

3. In a mud box for use to control the issue of liquid from a joint between two pipe sections while being uncoupled, the combination of: a pair of mating box halves hinged together along

a pair of vertically disposed meeting edges, said box halves being formed to fit at top and bottom about a pipe section to enclose a chamber surrounding a joint in said pipe, the vertical edges of said box halves opposite to said hinged edges being adapted to close with one another to prevent issue of liquid therebetween, a handle bar horizontally pivoted to one of the box halves near the hinged edge thereof, said handle bar having a normal position extending outwardly from said box half, and a pair of spring yoke arms mounted on said bar near the pivot axis thereof and extending laterally from said bar to vertical planes of interfering engagement with the outer sides of said box halves, said arms being formed to yieldingly engage said box halves and to swing said other box half closed upon said first mentioned box half when said handle bar is vertically swung away from its said normal position and into a closed-box position.

4. In a mud box for use to control the issue of liquid from a joint between two pipe sections while being uncoupled, the combination of: a pair of mating box halves hinged together along a pair of vertically disposed meeting edges, said box halves being formed to fit at top and bottom about a pipe section to enclose a chamber surrounding a joint in said pipe, the vertical edges of said box halves opposite to said hinged edges being adapted to close with one another to prevent issue of liquid therebetween, a handle bar horizontally pivoted to one of the box halves near the hinged edge thereof, said handle bar having a normal position extending outwardly from said box half, a pair of spring yoke arms mounted on said bar near the pivot axis thereof and extending laterally from said bar to vertical planes of interfering engagement with the outer sides of said box halves, said arms being formed to yieldingly engage said box halves and to swing said other box half closed upon said first mentioned box half when said handle bar is vertically swung away from its said normal position and into a closed-box position, and a lug on said other box half in the path of movement of the corresponding yoke arm to be engaged by said arm to pull said other box half to open position as said handle bar is moved from its box-closed position to its normally outwardly extended position.

5. In a mud box for use to control the issue of liquid from a joint between two pipe sections while being uncoupled, the combination of: a pair of vertically disposed substantially semi-cylindrical mating box halves hinged to one another along a pair of longitudinal meeting edges, said box halves being formed to fit at top and bottom about a pipe section to enclose a chamber surrounding a joint in said pipe, the vertical edges of said box halves opposite to said hinged edges being adapted to close with one another to prevent issue of liquid therebetween, a handle bar horizontally pivoted to one of the box halves near the hinge axis therefrom, said handle bar having a normal position extending outwardly substantially horizontally from said box half, a pair of spring yoke arms mounted on said bar near the pivot axis thereof, said yoke arms extending transversely of the handle bar, and extending horizontally to vertical planes of interfering engagement with the outer cylindric sides of said box halves, said arms being formed to yieldingly engage said box halves and to swing said other box half closed upon said first mentioned box half when said handle bar is vertically moving from its substantially horizontal position to a substantially vertical position, and a lug on said other box half in the path of movement of the corresponding yoke arm to be engaged by said arm to pull said other box half to open position as said handle bar is moved from its vertical position to horizontal position.

6. A combination as defined in claim 5, in which said yoke arms extend generally downward from said handle bar when the latter is in its horizontal position, and in which the handle bar is swung downward from its horizontal position to a depending vertical position to engage said yoke arms with the box halves.

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