A retrieving tool including extensible and retractable means for positive engagement with a wear bushing used in the oil-drilling industry, and capable of disengaging and removing such a wear bushing from its casing head.

10 Claims, 7 Drawing Figures
1 RETRIEVING TOOL AND METHOD

During the process of drilling an oil well, a casing head such as a tubing head, a bradhead or intermediate head, may be subject to wear by the drilling pipe. If the drilling pipe is not vertical, i.e., if the drilling rig is leaning unintentionally or the well being drilled is a directional well, wear can become severe. If that worn casing head is not replaced before the well is brought in, leaks are likely to occur resulting in a blowout that could cause pollution and loss of life.

The most common procedure for protecting the interior of the casing head from such wear is to insert a wear bushing in the casing head so that it is disposed between the drilling pipe and the casing head. This wear bushing is usually a sleeve of iron that rests loosely in the casing head and takes the wear caused by the drilling pipe.

As mud is usually being circulated through the system during drilling to flush the system free from cutting bits, this mud tends to settle between the wear bushing and the sides of the casing head, forming a cement bonding effect between them. This bonding effect makes the wear bushing very difficult to remove from the casing head.

It is necessary to remove the wear bushing from the casing head to periodically test the blowout preventers, to hang additional casing and to replace a wornout wear bushing.

Previously, tools designed to retrieve bushings have had numerous disadvantages. One type of retrieving tool is coarsely threaded along its exterior rim or periphery to mate with threads disposed along the interior surfaces of a wear bushing. This type has proved unsatisfactory because the threads are difficult to align and the rotating action of the drilling pipe at various speeds easily wears the starting threads.

A second type of retrieving tool has a plurality of fixed studs or lugs disposed around its circumference designed to mate with "J" or "L" slots in the interior surface of the wear bushing located near the rim of the bushing. This type has proved unsatisfactory because the drill bit, when inserted into the well, will strike the rim of the wear bushing with sufficient force to close or damage the slots, keeping the studs or lugs from mating. This occurs frequently because of the recurring need to replace wornout drill bits.

A third type of retrieving tool is attached around the circumference of the drill pipe and includes a plurality of spring-loaded fingers that will ride down through the wear bushing along its interior surface and spring out to engage the bottom periphery of the wear bushing. This type has proved unsatisfactory because it often is inserted through the wear bushing directly or indirectly to the well and engages some member of the system other than the wear bushing. When this occurs, it cannot be retracted, thereby causing considerable damage to the casing, the retrieving tool, or both. When this third type of retrieving tool engages a wear bushing or other member of the system, it cannot be released and will consequently break if the wear bushing is stuck, dropping the retrieving tool into the well and causing considerable delay in drilling and much added expense.

I have solved these problems by the present invention. My retrieving tool eliminates the need for slots, threads or other modifications to the wear bushing that might weaken its structural integrity and are easily damaged by the retrieving tool.

And, my retrieving tool includes positive protection against hooking onto or engaging any member of the drilling system other than the wear bushing.

I have invented a retrieving tool that can be inserted through a wear bushing without damage that could interfere with retrieving that wear bushing. My retrieving tool includes positive means to engage the wear bushing that is retained from contact with the wear bushing during its insertion into the casing head, the engagement being complete engagement with that wear bushing, and that can be retracted from contact with any member of the drilling system, including the wear bushing.

This invention can be better understood by reference to the drawings.

2 FIG. 2 is a side view of my retrieving tool fully inserted through the wear bushing shown in FIG. 1 in sectional view and supported by that wear bushing.

FIG. 3 is a sectional view of my retrieving tool taken at lines 3-3 of FIG. 2.

FIG. 4 is a section view of my retrieving tool inserted through a wear bushing within a casing head.

FIG. 5 is a side view of my retrieving tool depicting that tool engaged with a wear bushing shown in sectional view within a casing head and extracting that wear bushing from that casing head.

FIG. 6 is a side view of a leg of my retrieving tool engaged with the interior surface of a wear bushing shown in sectional view within a casing head.

FIG. 7 is a detail view of an engaging plate attached to one leg of my retrieving tool.

When the need arises to remove a wear bushing from its casing head, drilling pipe segment 1 is withdrawn from the well until its attachment to drilling pipe segment 2 is above ground and drilling pipe segment 2 can be secured to prevent its dropping back into the well. Drilling pipe segment 1 is unscrewed from drilling pipe segment 2, and lifted above drilling pipe segment 2 to a distance slightly greater than the length of the retrieving tool.

Retrieving tool collar 3 is integral with retrieving tool shaft 4 and retrieving tool base 5. Retrieving tool base 5 is screwed into drilling pipe segment 2 by means of mating right-handed threads supplied each of these members. Drilling pipe segment 1 is screwed into retrieving tool collar 3 by means of mating right-handed threads supplied each of these members.

Once these threads are tight, drilling pipe segment 2 is released from its securing means, and lowered back down into the well as shown in FIG. 1, until the retrieving tool plate 6 rests on wear bushing 7.

Retrieving tool plate 6 is shown in detail in FIG. 3 as having a plurality of slots 24 to provide limited rotation of legs 12. Slots are shown as 1-inch wide, but can be of any convenient width to accommodate legs of requisite strength. Pins 13 retain legs 12 in slots 24. Pins 13 are shown as seventeeths inch thick, but can be of any thickness sufficient to withstand the stress of legs 12 pulling against wear bushing 7.

Retrieving tool plate 6 can be fitted with any adapter of the requisite strength concentric to its periphery that will enable it to rest on larger diameter wear bushings.

The weight of the retrieving tool, drilling pipe segment 2 and all other members of the drilling system attached to it directly or indirectly to the well, maintains a frictional engagement between the bottom surface of retrieving tool plate 6 and its adjacent surface of wear bushing 7.

Drilling pipe segment 1 is rotated in its normal clockwise (looking down into the well) direction with its normal drilling force urging drilling pipe segment 1 down into the well. This force urging drilling pipe segment 1 down into the well, together with the weight of the drilling rod and bit, assure firm frictional contact between the lower surface of retrieving tool plate 6 and the upper surface of wear bushing 7. This frictional contact causes retrieving tool plate 6 to resist accompanying drilling tool segment 1 and retrieving tool rod 4 as they are rotated in a clockwise direction. As the upper portion of retrieving tool rod 4 is threaded with left-handed threads designed to mate with left-handed threads around the interior surface of retrieving tool plate 6 as shown in FIG. 4, this rotation screws retrieving tool rod 4 through retrieving tool plate 6, lifting flange 9 and retrieving tool collar 3 out of engagement with the upper surface of retrieving tool plate 6.

As flange 9 of retrieving tool collar 3 is lifted out of engagement with the upper surface of retrieving tool plate 6, angled rim 10 of flange 9 is lifted out of engagement with node 11 of leg 12 of the retrieving tool. Upon disengagement of angled rim 10 from node 11, the weight of leg 12 causes it to rotate about pin 13 in slot 24 and out of contact with retrieving tool rod 4. Pin 13 is secured in place by screw 25. The angle of rim 10 is shown as 45° from the plane of the lower surface of retrieving tool collar 3, but can be as varied as necessary to accomplish the purpose of controlling the position of node 11.
As retrieving tool rod 4 continues to be screwed clockwise and rides up through retrieving tool plate 6, sloping surface 14 of retrieving tool base 5 comes into contact with heel 15 of leg 12 as shown in FIG. 4. As this clockwise screwing continues, heel 15 rides down slope 14 urging toe 16 toward extension from a position inside an imaginary circle coaxial with surface 17 of retrieving tool base 5 to a position outside that imaginary circle. This process continues until shin 18 of leg 12 makes contact with the interior surface of wear bushing 7.

When all the shins 18 of each respective leg 12 have made contact with the interior surface of wear bushing 7, pipe segment 3 cannot be turned further. By lifting on drilling pipe segment 1, to 16 of legs 12 engage the lower periphery of wear bushing 7 and lift it out of casing head 8 as shown in FIG. 5, removing it from the well.

If the retrieving tool is to be used for extracting a wear bushing that is longer than shin 18 of leg 12, toe 16 cannot be inserted beneath the lower periphery of wear bushing 7. I have provided an alternative means for engaging wear bushing 7 in this circumstance.

FIG. 7 shows an engaging plate 19 attached to shin 18 at aperture 26 by screw 21 so that ridges 20 of that engaging plate 19 extend above surface 22 of toe 16 and the base of engaging plate 19 rests on surface 23 of toe 16.

As shown in FIG. 6, as heel 15 of leg 12 rides down slope 14, ridges 20 engage the interior surface of wear bushing 7. After ridges 20 of all the engaging plates 19 have engaged the interior surface of wear bushing 7, drilling pipe segment 1 cannot be turned further without turning wear bushing 7. When wear bushing 7 breaks loose, it can be easily lifted out of casing head 8 and removed from the well.

Any time during this procedure, should legs 12 engage any member of the system other than wear bushing 7, drilling pipe segment 1 can be rotated in a counterclockwise direction until surface 10 of flange 9 engages nodes 11, rotating legs 12 toward retrieving tool rod 4 and toe 16 into a position within the imaginary circle coaxial with surface 17 of retrieving tool base 5. The retrieving tool can then be withdrawn through casing head 8 without damage to any member of the drilling system.

I claim:
1. A well tool for retrieving a wear bushing comprising a shaft, engaging means movably attached to said shaft, means integral with said shaft and contacting said engaging means for retracting said engaging means from engagement with said wear bushing, and means integral with said shaft for urging said engaging means into engagement with said wear bushing.
2. A well tool for retrieving a wear bushing as described in claim 1 wherein the means for retracting said engaging means is capable of retaining said engaging means from engagement with said wear bushing.
3. A well tool for retrieving a wear bushing as described in claim 1 wherein said retracting means comprises a collar integral with said shaft, a plate movably attached to said shaft said engaging means pivotally mounted on said plate, said collar capable of retracting said engaging means by urging said engaging means toward said shaft.
4. A well tool for retrieving a wear bushing as described in claim 1 wherein said means for urging said engaging means into engagement with said wear bushing comprises an inclined base integral with said shaft.
5. A well tool for retrieving a wear bushing as described in claim 1 wherein said engaging means comprises a plurality of legs mechanically extensible toward said wear bushing.
6. A well tool for retrieving a wear bushing as described in claim 1 wherein said engaging means comprises a plurality of legs mechanically extensible toward said wear bushing, said means for retracting said engaging means comprises a collar integral with said shaft, a plate movably attached to said shaft, said engaging means pivotally mounted on said plate, said collar capable of retracting said engaging means by urging said engaging means toward said shaft, and said means for urging said engaging means comprises an inclined base integral with said shaft.
7. A method for retrieving a wear bushing from the casing head of a well comprising inserting a well tool including releasable engaging means for retrieving said wear bushing through the head of said casing, lowering said well tool inside said casing to a position where it is retained from further insertion beyond said wear bushing, retaining against rotation means to engage said wear bushing, rotating the drilling pipe to mechanically release and extend said means to engage said wear bushing, engaging said wear bushing with said extended means, and retrieving said wear bushing by extracting said retrieving tool through the head of said casing.
8. A method for retrieving a wear bushing from the casing head of a well as described in claim 7 wherein engaging said wear bushing with said extended means is accomplished by gripping the surface of said wear bushing by said extended means.
9. A method for retrieving a wear bushing from the casing head of a well as described in claim 7 wherein engaging said wear bushing with said extended means is accomplished by gripping the surface of said wear bushing by said extended means at its lower periphery.
10. A method for retrieving a wear bushing from the casing head of a well as described in claim 7 wherein said engaging means is mechanically retained against rotation while the drilling pipe is rotated to mechanically extend said means to engage said wear bushing.