A mandrel designed for insertion in an oil pipe string includes a plurality of ring members surrounding the mandrel in a stacked array the upper and lower ends of the mandrel threadedly receiving end members for squeezing the ring members together in a longitudinal direction. A plurality of brush elements extend radially from between adjacent circumferential edges of the ring members, the squeezing force on the ring members holding the brushes in their set position. The sets of brushes from between two adjacent ring members are circumferentially staggered relative to the sets of brushes from the next adjacent ring member so that 360° engagement of the oil well casing takes place when the mandrel is moved through the casing. Either brushes in the form of bunches of stiff wires may be used or rigid block members constituting cutting blades may be substituted for the brushes to thereby enable the casing to be gauged or broached to a given diameter determined by the radial extent of the cutters.

4 Claims, 4 Drawing Figures
OIL WELL BRUSH TOOL

This invention relates generally to oil tools and more particularly to an improved oil well brush designed to enable cleaning and, if desired, actual gauging or broaching of an oil well casing or pipe.

BACKGROUND OF THE INVENTION

Brushing tools for oil wells are well known in the art. Generally, these devices comprise a mandrel having radially extending brushes which may take the form of stiff bundles of wire which engage the interior walls of an oil well casing or other pipe to be brushed or cleaned. A major problem associated with such devices is to assure that the radially extending brush elements are properly secured to the mandrel. In the event hard incrustations are encountered in the casing, the brushes can become bent or broken off or in some other manner disconnected from the mandrel itself and become lost in the bore hole.

Some proposed solutions to the above problem is to provide a solid mandrel with diametric holes passing therethrough, the bundles of stiff wires in turn simply diametrically passing through the solid mandrel and extending radially from each end. Such a construction provides a very secure support for the wire brushes. On the other hand, the brushes are very difficult to replace if they become worn. A more serious problem is the fact that a solid mandrel will not permit circulation to be maintained during a brushing operation. The circulation problem can be alleviated by providing a central bore in the mandrel for permitting circulation. However, the wire elements of the brushes diametrically crisscrossing the central bore impede the flow of such circulation.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing in mind, the present invention contemplates a vastly improved oil well brush tool so constructed as to overcome many of the foregoing problems associated with the prior art.

More particularly, the present tool is so designed that the brush elements are secured to the mandrel in a manner minimizing the risk of losing the brushes and yet permitting easy disassembly so that new brushes or other elements can readily be substituted. Further the design is such that full bore circulation can be maintained through the tool during a brushing operation.

In accord with the invention, a mandrel is provided for insertion in an oil pipe string and includes a central bore of sufficient diameter for maintaining complete circulation. The lower end of the mandrel includes an increased exterior diameter portion to define an upwardly facing annular shoulder. A plurality of ring members in turn surround the mandrel in a stacked array, the bottom ring member resting on the annular shoulder. Brush elements are positioned to extend radially from between adjacent circumferential edges of the ring members. An upper end member is threadedly receivable on the upper end of the mandrel such that threading of the end member downwardly exerts a longitudinal squeezing force on the ring members to lock the radially extending elements in their set positions.

With the foregoing arrangement, the brush elements can readily be replaced by simply separating the rings. Further, in the preferred embodiment of the invention, the ring members are constructed to key the brush elements against outward radial movement so that additional securement is assured in addition to the squeezing pressure on the elements.

Because of the ease with which the device may be assembled and disassembled, it is a simple matter to substitute different types of brush elements such as rigid block shaped cutters so that a well casing may be gauged or effectively broached by the tool if desired.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by referring to a preferred embodiment as illustrated in the accompanying drawings in which:

FIG. 1 is a fragmentary view partly in cross section showing the oil well brush tool of this invention in an oil well casing;

FIG. 2 is a cross section of the tool of FIG. 1;

FIG. 3 is an exploded perspective view of two of the ring members forming part of the tool of FIG. 1 for supporting brush elements;

FIG. 4 is a perspective view of two slightly modified ring members for supporting cutting blades to effect a gauging operation in accord with the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. 1 there is shown an oil well bore hole 10 with the usual casing 11. The casing 11 can become incrusted with paraffin, scale and other debris and it is normal practice to periodically brush or clean the interior walls of the casing. For this purpose, there is provided an oil well brush tool in accord with the invention which may be inserted in a pipe string as by coupling between pipe members 13 and 14. For this purpose, the tool includes upper and lower threaded end members 15 and 16. The upper end member 15 may include a separate threaded nut portion 17 serving as a lock nut.

Between the end members 15 and 16 there are provided a plurality of ring members including upper and lower end rings 18 and 19 and intermediate rings 20. The rings form a stacked array between the end members and serve to secure a plurality of elements 21 radially extending from between adjacent circumferential edges of the ring members. By threading down the lock nut 17 and cooperating upper end member 15, a longitudinal squeezing force is applied to the ring members to secure the brushes or elements 21 in their set positions.

Referring now to FIG. 2, further details of the tool will be evident. As shown, once the upper end member 15 including as a part the lock nut 17, have been tightened, they can be locked in place as by suitable set screws 22 and 23 respectively. The tool itself includes an integral mandrel 24 having exteriorly threaded ends 25 and 26 and a central longitudinal bore 27 for maintaining circulation through the well pipe string. Essentially, the upper end member 15 including the lock nut 17 and the lower end member 16 are of larger exterior diameter than the mandrel 24 so that when they are threaded to the ends of the mandrel, they define opposing annular shoulders 15' and 16' between which the end rings 18 and 19 and the intermediate rings 20 are sandwiched.

Each of the intermediate ring members 20 is of identical construction and thus a detailed description of one will suffice for all. Referring to the exploded perspec-
tive view of FIG. 3, there are shown two of the intermediate rings 20, each including an interior reduced diameter portion 8 defining upwardly and downwardly facing annular ledges 29 and 30. The upper and lower circumferential ends are provided with small semicircular cut-outs 31a and 31b respectively. It will be noted that the lower cut-outs are circumferentially staggered relative to the upper cut-outs.

The lower ring member of FIG. 3 has its corresponding structural portions designated by the same numerals as for the upper member followed by a prime. The arrangement is such that when the elements are stacked one on top of the other, they may be rotationally positioned such that the lower cut-outs such as 31b of the upper ring member register with the upper cut-outs 31a' of the next adjacent lower ring member so that effectively there are defined radial circular openings.

As also illustrated in FIG. 3, a bunch of radially extending elements 21 is shown extending from a foot portion 32 dimensioned to be received between the opposed annular ledges 30 and 29'. Essentially, the brush structure is thus keyed between the adjacent rings to provide further securement in addition to the squeezing force applied on the brush elements 21 themselves as a consequence of extending through the radial opening defined by the cut-outs.

Referring now to FIG. 4 there is shown a modified ring structure wherein each of the rings designated 33 again include an interior reduced diameter portion 34 defining upwardly and downwardly facing annular ledges 35 and 36. The rings, however, include square shaped cut-outs 37 staggered in a manner corresponding to the semi-circular cut-outs for the rings of FIG. 3. When the rings are stacked, square cross section radial openings are defined between adjacent rings for receiving modified types or radially extending elements. One such element is shown in FIG. 4 as comprising an integral block member including a foot portion 38 arranged to be received between opposing annular ledges and a radially extending portion 39 terminating in a rounded surface 40 of curvature corresponding to that of the interior casing or pipe wall. The end portion further includes a cutting edge 41.

In FIG. 4, the lower ring member has its structural components designated by the same numerals used for the upper ring member followed by a prime. It will also be clear that the foot portion 38 of the block 39 may be received between the opposed annular ledges 36 and 35' to key the block between adjacent rings.

**OPERATION**

In making up the oil well brush tool of this invention, the integral mandrel has threaded on its lower end the end member 16 as shown in FIG. 2. Essentially, this end member serves to define the upwardly facing annular shoulder 16'. It should be understood that the mandrel itself could be manufactured with a larger diameter portion at its lower end to define an equivalent upwardly facing annular shoulder 16'. As matter of convenience, however, it is simpler to simply thread on the larger diameter end member 16. Preferably, once this end member has been threaded to the lower end of the mandrel, it is welded in place as indicated by the annular weld W.

With the lower end member 16 in place, the various annular rings may be successively passed over the upper end of the mandrel prior to threading on of the lock nut 17 and upper end member 15. Thus, the lower end ring 19 will seat on the annular shoulder 16' and brushes such as indicated in FIG. 3 may have their foot portions disposed between the annular ledges defined by the reduced diameter interior portions of the rings, the radially extending brush elements in the form of stiff wires extending through the defined circular radial openings all as described in FIG. 3. In this respect, the staggering of the defined radial openings is such as to assure complete 360° engagement of an interior wall by the brushes over the longitudinal length of the brush assembly. With the brushes and rings in place, the lock nut 17 can then be threaded onto the mandrel and locked down tightly against the upper ring member 18 and thereafter the end member 15 threaded tightly onto the lock nut 17 thereby placing the exterior upper threads 25 of the mandrel in tension and assuring a very secure attachment of the upper end structure to the mandrel. The threading of these members exerts a longitudinal squeezing force on the annular rings as described heretofore to lock the radially extending brush elements securely in their set positions. As also mentioned, the provision of the foot portions of the bundles of brushes additionally keep the brushes between adjacent rings.

With the above assembly completed, the tool may then be disposed in a pipe string, the upper and lower end members 15 and 16 having internal threads for this purpose. The radial extent of the various brush elements 21 is such as to engage the interior wall of the casing or pipe through which the mandrel is moved to thereby effect a thorough brushing action.

Should any of the brushes become damaged, the upper end member and lock nut assembly can be removed and the ring separated to remove the damaged brushes.

In addition, the tool can be disassembled to provide ring members of the type shown in FIG. 4 for supporting cutting blocks. When the tool is used in this manner, a bore hole casing or pipe may actually be gauged or broughed to a given diameter determined by the radial extent of the cutting blocks.

When the tool is used either for brushing or gauging or broaching, full circulation can be maintained as a consequence of the central bore 27 in the mandrel, there being no obstructions to this flow by diametrically extending brushing elements and the like as has characterized some prior art devices.

From the foregoing description, it will be evident that the present invention has accordingly provided a greatly improved oil well brush tool which is easy to assemble and disassemble, enables flow or circulation to be maintained, and wherein the brush elements themselves are secured to the tool in such a manner as to minimize risk of losing the brushes in the bore hole.

What is claimed is:

1. An oil well brush tool comprising, in combination:
   a. a mandrel for insertion in an oil pipe string and including a central bore for maintaining circulation, the lower end of the mandrel including an increased exterior diameter portion to define an upwardly facing annular shoulder;
   b. a plurality of ring members surrounding the mandrel in a stacked array, the bottom ring member resting on said annular shoulder;
c. a plurality of elements radially extending from between adjacent circumferential edges of the ring members;

and,

d. an upper end member threadedly receivable on the upper end of the mandrel such that threading the end member downwardly exerts a longitudinal squeezing force on said ring members to lock the radially extending elements in their set positions each element comprising a block member having a radially extending portion terminating in a cutting edge, the radially extending blocks secured between adjacent rings being circumferentially staggered relative to the next set of radially extending blocks extending from between the next adjacent ring members so that 360° contact with an oil well casing is provided, whereby an oil well casing can be gauged to a given diameter by moving the mandrel through the casing.

2. An oil well brush tool for brushing the interior walls of a pipe comprising, in combination:

a. an elongated integral mandrel having threaded ends and a central longitudinal bore;

b. upper and lower members of larger diameter than said mandrel received on the threaded ends of the mandrel to define annular opposed upper and lower shoulders;

c. a plurality of ring members surrounding the central portion of the mandrel between said shoulders, the ring members being in a stacked array one above the other to fill the longitudinal distance between the opposed upper and lower shoulders so that they may be squeezed in a longitudinal direction together by threading the upper threaded end member in a direction towards the lower threaded end member; and

d. a plurality of elements extending radially from between adjacent circumferential edges of said ring members, the squeezing force on the ring members locking the radially extended elements in their set circumferential positions between adjacent ring members, the radially extending elements from between two adjacent ring members being circumferentially staggered relative to the radially extending elements from between the next adjacent ring members, and the elements themselves extending a sufficient radial extent to engage the interior walls of a pipe to provide for 360° cleaning of the interior wall of the pipe upon longitudinal movement of the tool through the pipe, the plurality of ring members including upper and lower end ring members engaging the upper and lower opposed shoulders, respectively, the remaining ring members between the upper and lower ring members all being identical in construction and each including an interior reduced diameter portion defining upwardly and downwardly facing annular ledges, the upper and lower circumferential ends having small cut-outs, the lower cut-outs being circumferentially staggered relative to the upper cut-outs whereby when any two of the ring members are stacked one above the other and rotated so that the lower cut-outs of one register with the upper cut-outs of the other, there are defined radial openings through which said elements extend to pass between opposed annular ledges; and foot means positioned between the opposed annular ledges secured to the inwardly extending ends of the elements to thereby key the elements between adjacent ring members and yet permit their easy removal by longitudinally separating the adjacent ring members.

3. A tool according to claim 2, in which said elements are in the form of individual brushes of stiff wires passing into the radial opening so that the interior wall of a pipe is brushed.

4. A tool according to claim 2, in which said elements each comprise a rigid block member secured to and integral with a foot for keying the block member between adjacent ring members, the radially extending portion of the block member terminating in a rounded surface of curvature corresponding to that of the interior pipe wall and including a cutting edge whereby a pipe through which the tool is passed is gauged to a given diameter determined by the radial extent of the elements.