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JUNK BASKET FOR WELL BORES

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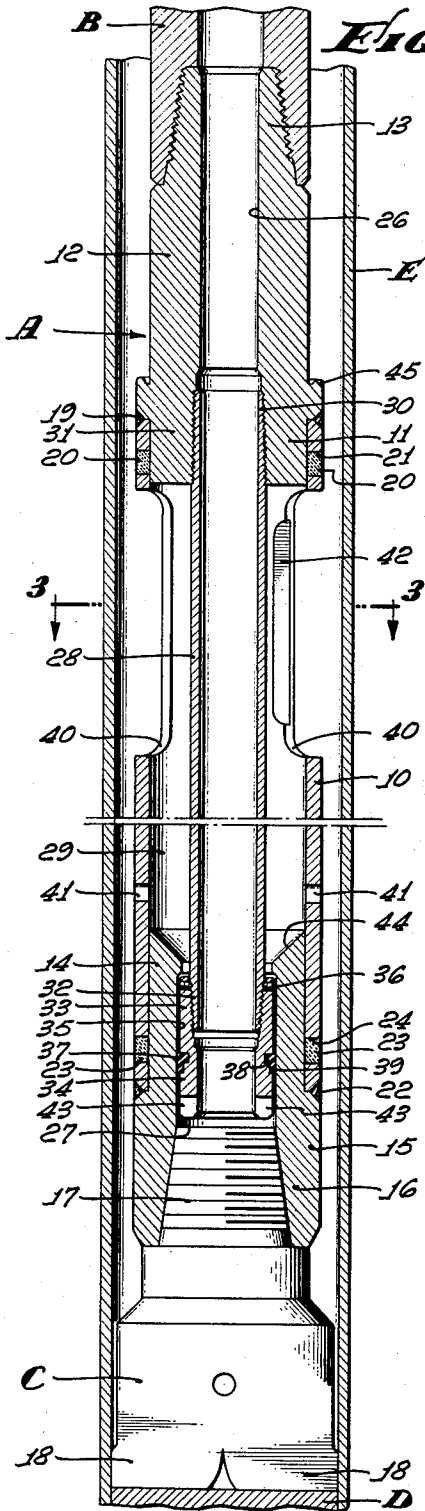


FIG. 1.

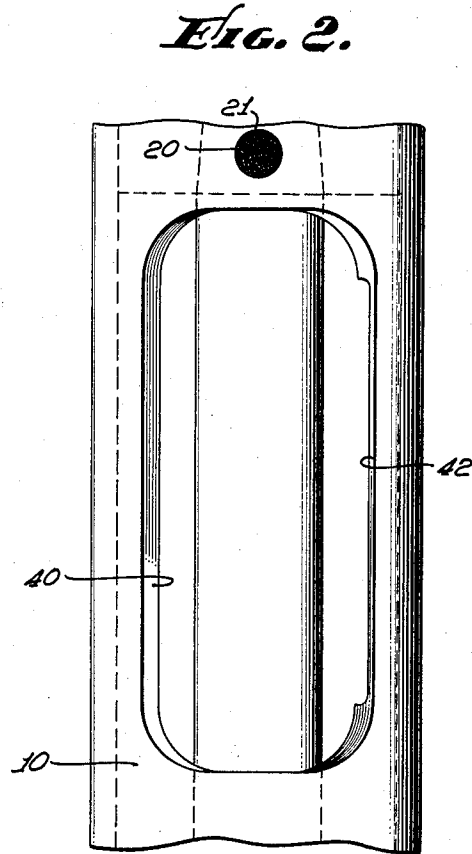


FIG. 2.

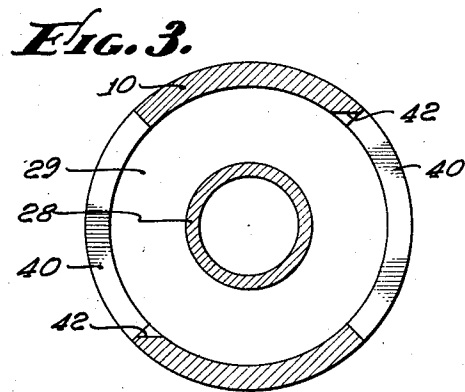


FIG. 3.

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JUNK BASKET FOR WELL BORES

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2 Claims. (Cl. 255—28)

The present invention relates to subsurface equipment for facilitating the drilling up and removal of devices and debris in well bores.

An object of the invention is to provide an improved junk basket adapted to be disposed in a drill string, which is capable of withstanding and transmitting comparatively high drilling torques without twisting off or failing from other cause.

Another object of the invention is to provide a junk basket to be disposed in a drill string, which has greater effectiveness in entrapping and holding metallic and other cuttings resulting from the operation of a drill bit below the basket.

A further object of the invention is to provide a junk basket for incorporation in a drill string that can be dismantled easily for the purpose of dumping its contents upon elevation of the basket to the top of the well bore.

An additional object of the invention is to provide a junk basket for incorporation in a drill string, in which the tendency for the basket to hang up or become caught in the well bore is greatly minimized, insuring its elevation and removal from the well bore when desired.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a longitudinal section through a junk basket disposed in a well casing;

Fig. 2 is a fragmentary side elevational view of the apparatus disclosed in Fig. 1;

Fig. 3 is an enlarged cross-section, taken along the line 3—3 on Fig. 1.

As shown in the drawings, a junk basket A is secured to a string of drill pipe B extending to the top of a well bore, this junk basket actually constituting part of the drill string. Its lower end may be secured directly or indirectly to a drill bit C which is to operate upon a device or material D disposed in the well bore, such as a well packer or mass of cement that has previously been firmly anchored in a well casing E in the well bore and extending to the top thereof. The junk basket A has the purpose of catching and retaining pieces that have been disintegrated by the drill bit C, as such pieces are being flushed by the drilling fluid, such as drilling mud, upwardly around the exterior of the junk basket to its upper portion.

As shown in the drawings, the junk basket includes an outer cylinder 10 having its upper portion disposed over the lower reduced diameter portion 11 of an upper sub or upper tubular member 12, that has an upper threaded pin 13 for attachment to the string of drill pipe B thereabove, or to a drill collar that forms the lower portion of the drill pipe string. The lower portion of the outer cylinder is disposed over a reduced diameter upper portion

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14 of a lower sub or lower tubular member 15, which may have a threaded box 16 for attaching the junk basket to the upper pin 17 of the drill bit C disposed in the well bore, the latter having cutters 18 for operating upon the packer D or other device that is to be disintegrated by the drill bit.

The upper end of the cylinder or housing 10 is secured to the upper sub 12 by circumferentially continuous welding material 19 integrating the two parts together.

This weld may be supplemented by a plurality of circumferentially spaced plug welds 20 deposited in holes: 21 in the housing 10 and integrated to the reduced diameter portion 11 of the upper sub. The lower portion of the housing 10 is attached to the lower sub 15 by a circumferentially continuous annulus of welding material 22, and this weld may be supplemented by a plurality of circumferentially spaced plug welds 23 deposited in holes 24 in the lower portion of the housing and integrated to the reduced diameter portion 14 of the lower sub. The maximum diameters of the upper and lower subs 12, 15 and the outside diameter of the housing 10 may be the same, so as to avoid the presence of shoulders, or the like, between the ends of the housing or cylinder 10 and the adjacent portions of the upper and lower subs 12, 15.

The housing, cylinder or container 10 may be made of drill pipe of a suitable diameter and weight per foot, which will provide a structure having a great degree of strength in transmitting the torque from the upper sub 12 to the lower sub 15, and from the latter to the drill bit C. In the basket disclosed, the drilling torque is transmitted entirely through the outer housing or cylinder 10, which has a minimum cross-section of material therein that is more than necessary for the transmission of high torque loads without danger of twist-off, or other failure.

The upper and lower subs 12, 15 have coaxial passages 26, 27 therethrough, these passages being interconnected by a conductor tube or pipe 28, which may have an internal diameter substantially equal to the passage diameter through the sub 12, and which has an external diameter that is much less than the internal diameter of the outer housing 10, to provide an annular space or chamber 29 therebetween of comparatively large radial dimension. The upper end of the conductor tube or pipe 28 may be constituted as a threaded pin 30 threadedly connected to a threaded box 31 in the upper sub 12; whereas the lower portion of the conductor tube may be constituted as a lower threaded pin 32 threadedly received within a companion box 33 of a tubular head 34 disposed within a counterbore 35 in the lower sub 15. Unthreading between the head 34 and the conductor tube 28 is prevented by a set screw 36 threaded through the head and pressed into the conductor tube 28. Fluid leakage in an upward direction around the head 34 is prevented by a suitable side seal 37, in the form of a rubber ring, disposed within a ring groove 38 in the head and having a downwardly facing lip portion 39 adapted to seal against the wall of the counterbore 35.

During the drilling operation, the drilling fluid is pumped down the drill string and will pass through the upper sub 12 and conductor tube 28 into the lower sub 15, flowing through the drill bit C for discharge into the well bore in the region of the cutters 18, to flush the cuttings in an upward direction around the drill bit C and the housing or cylinder 10. Such cuttings are to be allowed to drop into the annular space 29 between the outer housing 10 and the conductor tube 28 by passing inwardly into one or a plurality of relatively large openings or windows 40 provided in the upper portion of the housing, the cuttings dropping downwardly through

the annulus toward the lower sub 15, which coacts with the tubular head 34 to form a bottom closure for the annular chamber 29 between the conductor tube 28 and the outer housing 10. For the purpose of allowing the cuttings to readily displace drilling fluid in the chamber 29, one or a plurality of bleeder holes 41 may be provided in the housing immediately above the lower sub 15.

During the operation of the apparatus, the drill pipe B is rotated, its turning effort being transmitted through the upper sub 12 and the housing 10 to the lower sub 15, from where it is transferred to the drill bit C. While the bit C is being rotated, and appropriate drilling weight imposed thereon, fluid is circulated down through the drill pipe B and through the passages in the upper sub 12, conductor tube 28 and lower sub 15, passing into and through the drill bit C for discharge from the latter. Drilling fluid carries the cuttings upwardly around the drill bit C and the housing 10, and when the drilling fluid and the cuttings come alongside the relatively large openings 40 in the upper portion of the housing, the cuttings drop out of the fluid passing through the openings 40 and into the annular chamber 29, the cuttings gravitating downwardly in the chamber toward its lower end. Such inward movement of the cuttings is facilitated by the engagement of the trailing side edge 42 of each opening 40 with the cuttings themselves. To facilitate the inward feeding of the cuttings into the chamber, such trailing edge 42 may be beveled in an inward and rearward direction, so as to guide the cuttings into the chamber.

After the well packer D, or other device, has been disintegrated, the drill pipe B, junk basket A and drill bit C combination can be elevated to the top of the hole, whereupon the junk basket is disconnected from the drill bit and the drill pipe or collar section thereabove. A suitable tool (not shown) may be connected to the tubular head 34, as by being fitted within radial slots 43 in the lower portion of the latter, the tubular head then being rotated to unscrew the conductor tube 28 from the upper sub 12, this conductor tube and head then being withdrawn in a downward direction from the junk basket. The cuttings that have accumulated in the annular chamber 29 will then drop out of the chamber through the lower sub 15, the removal being facilitated by tapering the upper end 44 of the lower sub or closure 15 in a downward and inward direction.

As above stated, the openings or windows 40 may be of relatively large size, to facilitate entry of the cuttings into the annular chamber 29. Despite such large size, there is ample cross-sectional area of housing material in the region of the windows to transmit the maximum drilling torque that would be imposed on the drill bit C during the operation of disintegrating the material or device D anchored in the well casing E. It is to be noted that the wall thickness of the housing 10 is relatively great. The welds 19, 20, 22, 23 that integrate the housing 10 to the upper and lower subs 12, 15 are also capable of transmitting very great drilling torques without danger of failure.

To insure the free upward movement of the apparatus A in the well casing E after the drilling operation has been completed, the upper sub 12 has an upwardly facing shoulder 45 which preferably is not tapered in an upward and inward direction, since such tapered portion might cause cuttings in the drilling fluid above the openings or windows 40 to wedge between the sub 12 and the well casing E, which could be of such pronounced extent as to prevent elevation of the apparatus in the well casing. Instead of the shoulder 45 being tapered, it preferably is disposed normal to the axis of the apparatus, or at a downward and inward taper relative thereto, as shown. Thus, any cuttings that might settle on top of the shoulder 45 would not be urged

outwardly and be wedged against the well casing E as a result of elevating the apparatus.

The apparatus disclosed not only has a very high torque transmitting capacity, but it possesses a large capacity for storing cuttings entering through the windows 40. Entry through the windows is free and unobstructed by any portions interiorly of the drill pipe itself. The annular chamber 29 is continuous from the upper sub 12 to the lower sub 15, enabling the cuttings to drop readily toward the bottom of the junk basket chamber. Moreover, by the simple expedient of removing the conductor pipe or tube 28 from the confines of the outer housing or cylinder 10, the contents of the latter are readily removed therefrom.

15 The inventor claims:

1. In a junk basket: a rotatable upper tubular member adapted to be connected to a rotary drill string to be disposed in a well bore; a lower tubular member adapted to be connected to a rotary drill bit; a cylinder extending between and secured to said tubular members; the upper and lower portions of said cylinder being disposed over said upper and lower tubular members, respectively; a conductor pipe disposed within said tubular members and spaced laterally inwardly from said cylinder to provide an annular chamber therewith; said cylinder having an elongated opening through the wall of its upper portion providing communication between its exterior and said chamber; means threadedly securing said conductor pipe to said upper tubular member; said lower tubular member having a central passage greater in diameter than the external diameter of said conductor pipe to permit withdrawal of said conductor pipe in a downward direction through said passage; said conductor pipe having an enlarged lower head secured thereto and disposed in said central passage sealingly engaging said lower tubular member; said lower tubular member constituting a lower closure for said chamber, the upper end of said lower tubular member within said chamber being tapered in an inward and downward direction to said passage.

2. In a junk basket: a rotatable upper tubular member adapted to be connected to a rotary drill string to be disposed in a well bore; a lower tubular member adapted to be connected to a rotary drill bit; a cylinder extending between and secured to said tubular members, the upper and lower portions of said cylinder being disposed over said upper and lower tubular members, respectively; a conductor pipe disposed within said tubular members and spaced laterally inwardly from said cylinder to provide an annular chamber therewith; said cylinder having an elongated opening through the wall of its upper portion providing communication between its exterior and said chamber; means threadedly securing said conductor pipe to said upper tubular member; said lower tubular member having a central passage greater in diameter than the external diameter of said conductor pipe to permit withdrawal of said conductor pipe in a downward direction through said passage; said conductor pipe having an enlarged lower head secured thereto and disposed in said central passage sealingly engaging said lower tubular member; said lower tubular member constituting a lower closure for said chamber, the upper end of said lower tubular member within said chamber being tapered in an inward and downward direction to said passage; the portion of said cylinder defining said opening having a leading side and a trailing side, said trailing side being beveled in an inward and trailing direction.

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