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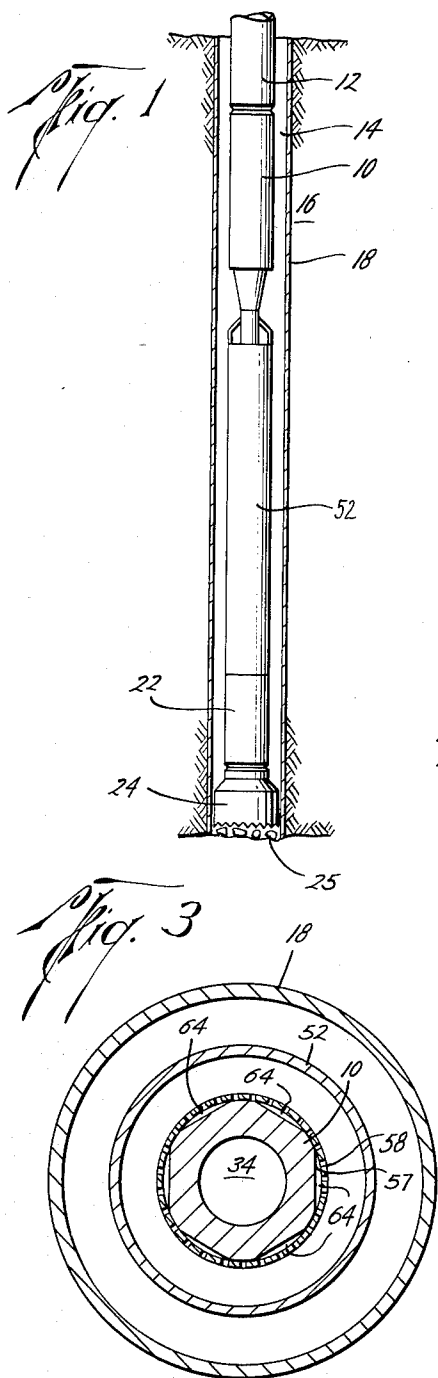
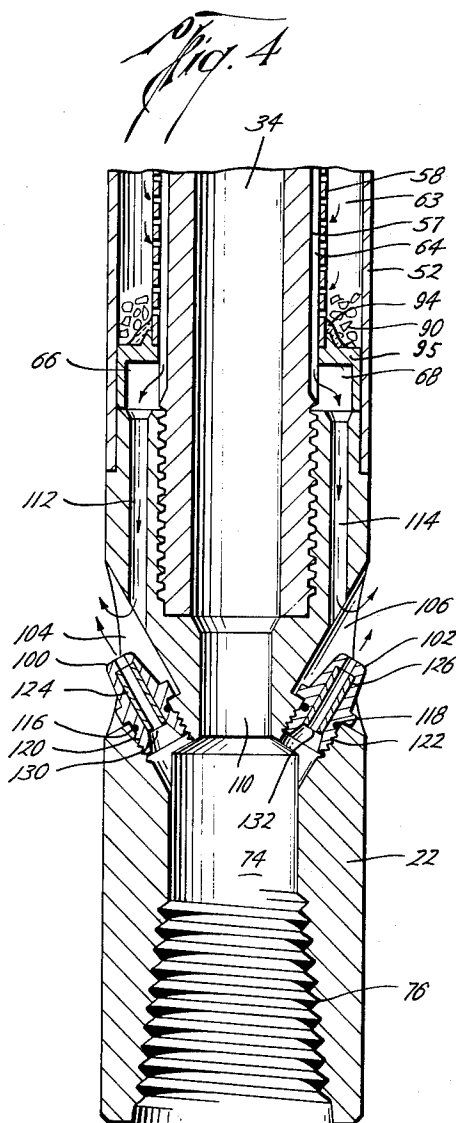
J. H. KIRBY II

3,198,256

JET JUNK BASKET

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3 Sheets-Sheet 1



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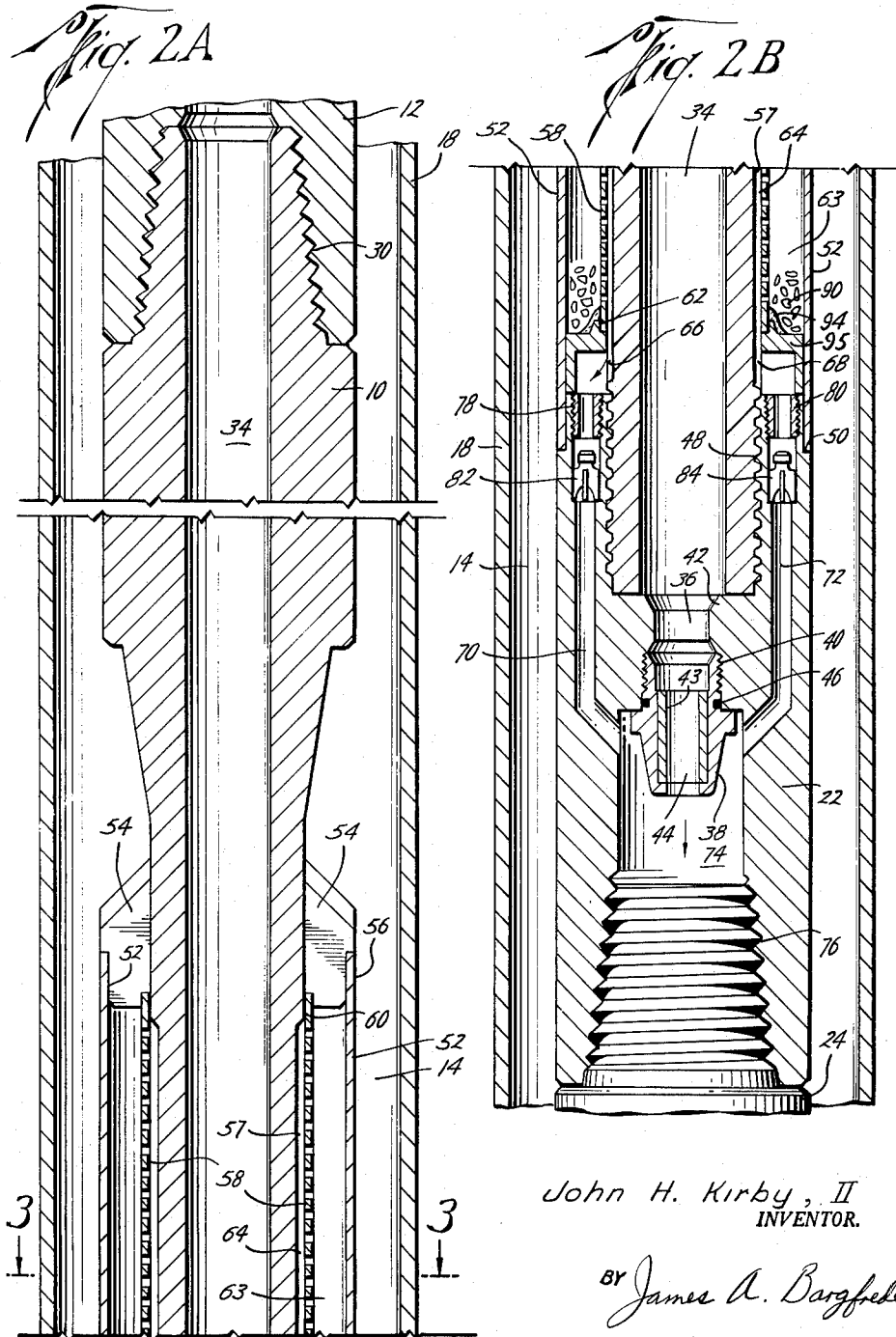
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3 Sheets-Sheet 2



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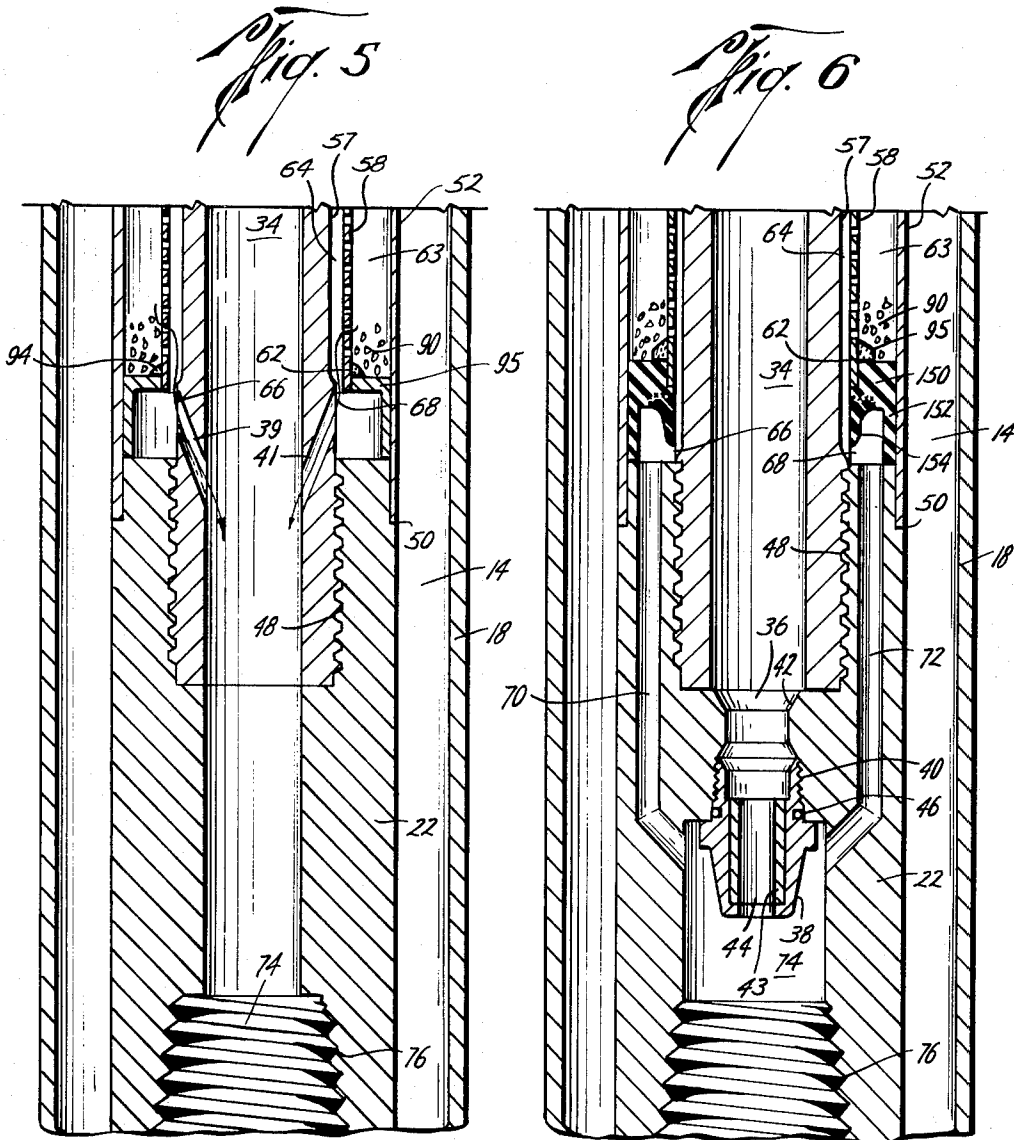
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3 Sheets-Sheet 3



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3,198,256

JET JUNK BASKET

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5 Claims. (Cl. 166-99)

This invention pertains generally to well apparatus and particularly to well apparatus which catches cuttings and other undesirable material from a well bore.

Well apparatus which remove foreign material from a well bore are known, such well apparatus being called junk baskets. These junk baskets are installed in the string of drill tubing just above the rotary drill bit or mill. The flow of drilling mud through an inner aperture in the junk basket allows circulation of the drilling mud between the junk basket and the wall of the well bore. During such circulation, pieces of foreign objects such as segments of drill bit teeth or other junk which is in the hole, are circulated upwardly in suspension in the drilling mud and because of reduced diameter of the upper part of the junk basket, the velocity of the drilling fluid is reduced and the foreign objects drop out of suspension in the drilling mud into a junk chamber in the junk basket. These known junk baskets however have been ineffective and unreliable in operation. Furthermore, the construction of known junk baskets has left much to be desired since such construction is not adapted for using the junk basket at the optimum location in the drill tubing string. Also, known junk basket construction has not allowed interchangeability of component parts with minimum disassembly time required.

Thus, it is an object of the present invention to provide simple, improved well apparatus for removing foreign matter from a well bore.

Another object of the present invention is to provide well apparatus which removes foreign objects suspended in drilling fluid in a well bore through an improved circulation passage in such well apparatus.

A further object of the present invention is to provide well apparatus of the junk basket type which is not dependent on a particular type of drill bit or mill for successful operation.

A still further object of the present invention is to provide well apparatus of the junk basket type which is easily disassembled to allow removal of accumulated junk or interchanging of component parts.

Yet a further object of the present invention is to provide a junk basket which utilizes improved construction of the inner screen and mandrel member thereby increasing the effectiveness of operation of such junk basket.

In the drawings, FIGURE 1 is an elevational view of the apparatus of the subject invention positioned in a well bore;

FIGURE 2A is a sectional elevational view of the upper portion of an embodiment of the invention;

FIGURE 2B is a sectional elevational view of the lower portion of the embodiment of the invention of FIGURE 2A;

FIGURE 3 is a sectional plan view taken along line 3-3 of FIGURE 2A;

FIGURE 4 is a sectional elevation view of the lower part of another embodiment of the invention;

FIGURE 5 is a sectional elevation view of the lower part of another embodiment of the invention; and

FIGURE 6 is a sectional elevation view of the lower part of still another embodiment of the invention.

Briefly stated, the invention incorporates an upper mandrel, a cylindrical boot with an inner screen around the upper mandrel, and a lower jet member thereby comprising well apparatus for removing foreign objects from

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a well bore. The well apparatus is positioned in the drilling string above a drill bit or mill and the drilling liquid or gas used for drilling the hole is circulated through a central bore in the upper mandrel, through the lower jet member and through the drill bit or mill. The lower jet member includes means for providing a jetting action and part of the drilling liquid or gas is recirculated through the cylindrical boot. Suction is created at the top of the cylindrical boot or sleeve housing and cuttings from the return drilling liquid or gas stream are pulled into the boot or sleeve housing. The screen allows the liquid or gas in the boot or sleeve housing to be recirculated downward through the lower jet member as cuttings and foreign matter are trapped in the boot or sleeve housing.

Referring now to the drawings in detail, FIGURE 1 shows upper mandrel 10 coupled to a drill pipe collar assembly 12 in a well bore 14 which penetrates the earth 16. Well bore 14 may be uncased or cased with casing 18 as shown in FIGURE 1. Cylindrical sleeve housing or boot 52 and lower member 22 comprise the remainder of the well apparatus incorporating the invention and a drill bit or mill 24 is coupled thereto. Foreign matter 25 is shown at the bottom of the well bore for removal therefrom.

FIGURE 2A is a sectional elevation view of the upper part of the well apparatus showing the drill pipe collar assembly 12 threadedly coupled by threads 30 to upper mandrel 10. FIGURE 2B is a sectional elevation view of the lower part of the well apparatus including the lower jet member 22. FIGURES 2A and 2B will be explained jointly.

Passing through the well apparatus is a central bore 34 which has a reduced diameter section 36 in the lower jet member 22. A nozzle 38 may be threadedly engaged by threads 40 to the inner section 42 of the lower jet member 22. Nozzle 38 may have a liner 43 in the central bore 44. Seal 46 prevents fluid leakage through threads 40.

Lower jet member 22 is coupled to upper mandrel 10 by threads 48, for example. Lower jet member 22 has a recess 50 which provides lower support for cylindrical boot or sleeve housing 52. Sleeve housing 52 is positioned at its upper portion by a plurality of centering vanes 54 which are fixed to a section of the upper mandrel 10 at its reduced diameter portion. Sleeve housing 52 may have a plurality of recesses 56 to allow the sleeve housing 52 to be supported by vanes 54. Sleeve housing 52 may be constructed of any suitable material, preferably steel or other ferrous composition.

Disposed intermediate the outer wall surfaces 57 of mandrel 10 and sleeve housing 52 is sleeve screen 58. Shoulder 60 at the upper portion of the mandrel 10 and recess 62 in the lower portion position the sleeve screen 58 with the corners of the mandrel (as shown in FIGURE 3) to provide a plurality of chambers or fluid surfaces which when taken together will be designated as space 64. The function of space 64 will be explained subsequently.

Apertures 66 and 68 connect space 64 with fluid ports 70 and 72 which connect with bore 74. Bore 74 extends into the upper portion of a drill bit or mill 24 which is coupled by threads 76 to lower jet member 22. Valve seats 78 and 80 are positioned in fluid ports 70 and 72, respectively, for operation with check valves 82 and 84.

FIGURE 3 taken along line 3-3 of FIGURE 2A shows the relationship of casing 18, sleeve housing 52, sleeve screen 58, and mandrel 10 having central bore 34. Mandrel 10 may have a hexagon configuration thereby providing six chambers which comprise space 64. Although a hexagon configuration is shown, any configuration which allows fluid drainage is satisfactory. Space

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64 allows fluid to drain along each panel of the hexagon-shaped mandrel thereby insuring adequate drainage even though one or several of the chambers become clogged.

When the well apparatus is coupled to the drill-pipe string during a drilling or milling operation to remove junk from the well bore, drilling fluid is pumped through central bore 34, reduced diameter section 36, and central bore 44 of nozzle 38 into bore 74. Bore 74 connects with the bit or mill 24 to provide drilling fluid during the drilling or cutting operation in a manner well known in the art. If desired, nozzle 38 and fluid ports 70 and 72 may be positioned to provide jetting action of the drilling fluid.

As the drilling fluid is returned out of the well bore via annulus 14, the reduced diameter of mandrel 10 near vanes 54 causes a reduction in velocity of the drilling fluid and part of the drilling fluid which contains foreign material is sucked into the junk chamber 63. Junk particles 90 accumulate in the lower portion of junk chamber 63 as the drilling fluid passes through sleeve screen 58 into space 64, through apertures 66 and 68, through fluid ports 70 and 72 into bore 74. In the event back pressure builds up in fluid ports 70 and 72, check valves 82 and 84 prevent the drilling fluid from flowing upwardly in space 64, thereby preventing "washing out" back into the well bore of the junk which may have accumulated in junk chamber 63.

It is to be emphasized that although a venturi arrangement is shown for incorporating nozzle 38, such nozzle is not absolutely essential for effective operation of the well apparatus. In the embodiment shown in FIGURE 5, for example, a plurality of fluid ports such as ports 39 and 41 could be utilized instead of nozzle 38. One port might be used along each panel or side of upper mandrel 10. Thus, a hexagon mandrel as shown might incorporate six ports instead of nozzle 38. If ports such as 39 and 41 are used instead of a nozzle, the fluid ports 70 and 72 shown in the other embodiments of the invention may be eliminated as were the check valves.

When the well apparatus is removed from the well bore, lower jet member 22 is uncoupled from mandrel 10 thereby allowing the sleeve housing 52 to be removed and junk 90 to be removed. Sleeve screen 58 may also be removed from mandrel 10 thereby allowing outer wall surfaces or panels 57 to be cleaned. If desired, sleeve screen 58 may be welded with weld 94 to ring 95.

The embodiment of the invention shown in FIGURE 4 is similar to the embodiment shown in FIGURES 2A and 2B except that nozzles 100 and 102 have been positioned in ports 104 and 106, respectively, to provide jet action when the drilling fluid is circulated through central bore 34, restricted bore 110, and into bore 74. The embodiment of the invention shown in FIGURE 4 is for use with drill bits or mills having restricted water courses.

As part of the drilling fluid is discharged through nozzles 100 and 102, the drilling fluid from fluid ports 112 and 114 causes the velocity of the drilling fluid passing through nozzles 100 and 102 to be reduced. As the velocity of the drilling fluid is reduced, the foreign matter in suspension in such fluid is accumulated in junk chamber 63 as explained previously. Nozzles 100 and 102 are positioned so that the fluid flow through ports 112 and 114 is always downward, thereby preventing reverse circulation which would cause the matter in junk chamber 63 to be "flushed out" at the top of the chamber. Seals 116 and 118 prevent leakage around threads 120 and 122 of nozzles 100 and 102, respectively. Nozzles 100 and 102 may be of any type construction with durable material such as ceramic sleeves 124 and 126 being positioned in passages 130 and 132. The embodiment shown in FIGURE 4 is cleaned in a manner similar to that described previously.

Still another embodiment of the invention is shown in FIGURE 6 where combined valve means and collector 150 is utilized. Valve means and collector 150 includes

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a substantially rigid portion 152 which may be constructed of hard rubber, for example, and a resilient portion 154 which may be constructed of soft rubber. A retainer ring 95 may be coupled as by brazing to the screen 58 thereby properly positioning the screen and the valve means and collector. In the event back pressure builds up in ports 70 and 72, the resilient portion 154 acts as a valve by engaging wall surfaces 57 and thereby preventing "washing out" of the junk which has accumulated in chamber 63. The resilient portion 154 "seals off" the space 64 to prevent back-flow. Operation and cleaning of the embodiment of the invention shown in FIGURE 6 is the same as explained previously.

Thus, the invention provides improved well apparatus of the junk-basket type. Such apparatus does not depend on special drill bit or mill construction for effective operation and the apparatus may be easily installed and easily removed for cleaning or for replacing component parts.

Although preferred embodiments of the invention have been shown and described, the invention is defined by the following claims.

I claim:

1. A junk basket adapted for coupling to a string of drill pipe above the cutting tool, said junk basket including in combination an upper mandrel having a bore therethrough, said upper mandrel having increased diameter in its upper portion, a plurality of vanes coupled to a portion of said upper mandrel, a lower assembly coupled to said upper mandrel, said lower assembly having a reduced diameter bore therethrough in axial alignment with the bore in said upper mandrel, said lower assembly including first and second fluid ports positioned near the outer diameter of said upper mandrel and communicating near the reduced diameter bore, a sleeve disposed around said upper mandrel and positioned intermediate said plurality of vanes and said lower assembly to form a junk chamber, and a screen disposed around said upper mandrel intermediate said sleeve and intermediate said plurality of vanes and said lower assembly thereby providing a passageway between the outer diameter of said upper mandrel and said first and second fluid ports, drilling fluid passing through the bores of said upper mandrel and said lower assembly and upwardly in the well bore, a portion of the drilling fluid being diverted through the junk chamber and through said fluid ports with junk being removed from the drilling fluid and accumulated in the junk chamber.

2. An upper mandrel adapted for use with a junk basket, said upper mandrel having a bore of substantially constant diameter throughout the axial length thereof with the outer periphery of said upper mandrel being greater in the upper portion than the lower portion, and a plurality of vanes coupled to said upper mandrel near the point of change in outer periphery, the reduced periphery section having a polygonal shaped cross-section to provide a plurality of chambers when a cylindrical, circular member is positioned around the reduced periphery section.

3. An upper section of a junk basket including in combination an elongated mandrel having a bore therethrough and having at least three outside peripheral dimensions, the portion having the smallest periphery having a polygonal shaped cross-section, a plurality of vanes coupled to said mandrel near a peripheral dimension change, a screen positioned around the smallest portion of said mandrel to form a plurality of space chambers, and a sleeve positioned around said screen and coupled to said plurality of vanes thereby providing a junk chamber, fluid flow through the bore in said mandrel and upward on the outside of said sleeve causing foreign matter in the fluid to settle in the junk chamber as the velocity of the fluid is reduced near the upper part of the mandrel having the largest periphery.

4. An upper mandrel adapted for use with a junk

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basket, said upper mandrel having a bore of substantially constant diameter throughout the axial length thereof with the outer periphery of said upper mandrel being greater in the upper portion than the lower portion, and a plurality of vanes coupled to said upper mandrel near the point of change in outer periphery, the reduced periphery section being of hexagonal configuration to provide a plurality of chambers when a cylindrical, circular member is disposed around the reduced periphery section.

5. An upper section of a junk basket including in combination

an elongated mandrel having a bore therethrough and having at least three outside peripheral dimensions, the smallest peripheral section having a hexagon configuration,

a plurality of vanes coupled to said mandrel near a peripheral dimension change,

a screen positioned around the smallest peripheral section of said mandrel to form a plurality of space chambers, and

a sleeve positioned around said screen and coupled to said plurality of vanes thereby providing a junk chamber, fluid flow through the bore in said mandrel and upward on the outside of said sleeve causing foreign matter in the fluid to settle in the junk

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chamber as the velocity of the fluid is reduced near the upper part of the mandrel having the largest periphery.

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