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TWO PIECE STABILIZING AND REAMING TOOL FOR BORE HOLES

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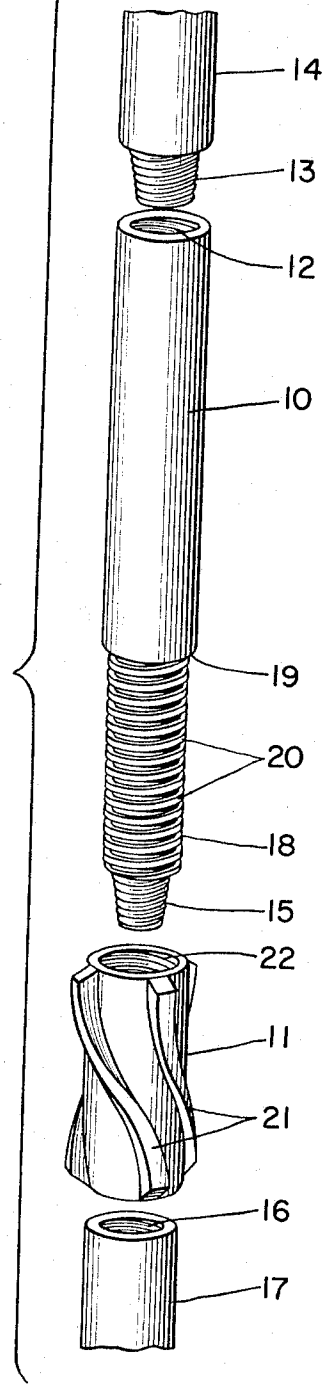

FIG. 1.

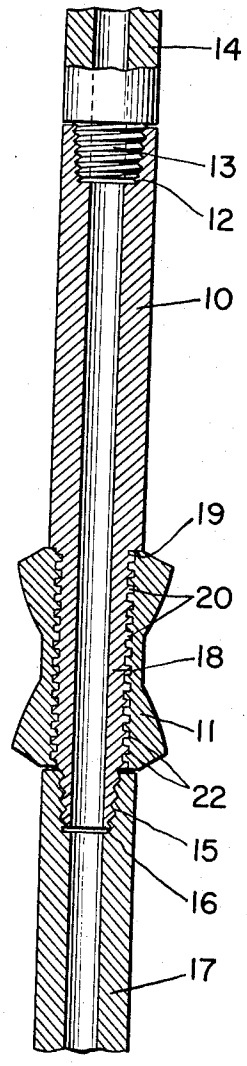

FIG. 2.

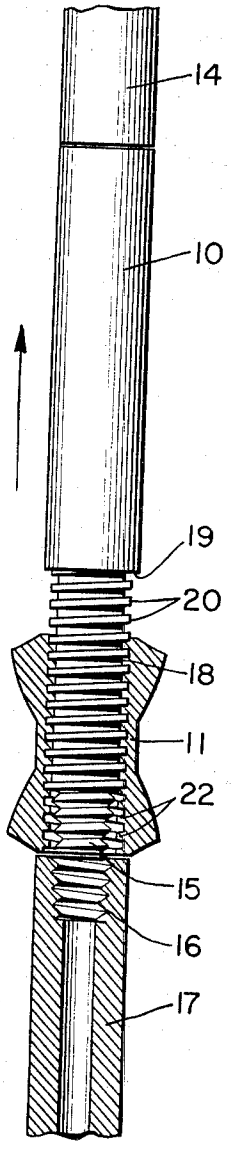

FIG. 3.

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TWO PIECE STABILIZING AND REAMING TOOL FOR BORE HOLES

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ABSTRACT OF THE DISCLOSURE

This disclosure relates to a mandrel in combination with a threaded stabilizing sleeve for insertion in a drill pipe string. The mandrel is provided with external threads over a given length for threadedly receiving the sleeve. The lower end of the mandrel is also provided with lower end threads of exactly the same pitch of the external threads, the lower end threads being receivable in one pipe of the drill pipe string. The overall length of the external threads is greater than the overall length of the lower end threads received in the pipe of the drill string and all of the threads are of the same hand. By this arrangement, if the sleeve which constitutes the reaming portion of the tool becomes "frozen" in the bore hole, the mandrel may be unthreaded from the drill pipe string without completely unthreading the mandrel from the sleeve so that both the mandrel and sleeve may be removed. Also, as a consequence of the threaded engagement of the sleeve with the mandrel, the two parts may be separated at the surface for separate shipping or for replacement of either one part for cooperation with the other should the one part be damaged.

This invention relates generally to well drilling tools and more particularly to an improved stabilizer and reaming tool for insertion in a drill pipe string for reaming bore holes as well as maintaining the string substantially concentrically positioned within the bore hole.

In my United States Patent No. 3,075,590 there is shown a stabilizing and reaming tool for performing functions of the type under consideration. However in this tool, as well as other prior art tools, the stabilizing sleeve and mandrel portion are formed as a coupled structure so that the stabilizing sleeve cannot be separated from the mandrel without actually destroying the mandrel. Thus, while the specific apparatus disclosed in the above mentioned United States patent incorporates unique features wherein the stabilizing sleeve may move longitudinally along a section of the mandrel in order to enable a jarring operation to take place, it is not possible to separate the sleeve itself from the mandrel.

As a consequence of the foregoing, when the stabilizing sleeve blades or fins become worn or broken, the entire sleeve and mandrel section must be replaced. This means that the mandrel itself must be removed from the rig. As a further consequence, in shipping units to various parts of the world, the sleeve and mandrel in their coupled relationship must be shipped together with the result that the weight of the entire tool is involved in the shipping costs.

With the foregoing considerations in mind, it is a primary object of this invention to provide an improved stablizing and reaming apparatus similar to the structure shown in my above-referred-to patent but which overcomes the aforementioned difficulties.

More particularly, it is an object to provide an improved stabilizing and reaming tool in which the stabilizing sleeve may be easily separated from the mandrel without damaging the mandrel to the end that the stabilizing sleeve itself may be replaced while the mandrel is still on the rig.

Another object is to provide a two piece stabilizing and reaming tool wherein if only the stabilizer portion is damaged it is only necessary to ship a new stabilizing sleeve rather than a complete new assembly or combination of stabilizing sleeve and mandrel.

Another object is to provide an improved stabilizing and reaming apparatus which is designed such that in the event the sleeve should become "frozen" in the bore hole as a consequence of key seating, a breaking away of the structure from the drill pipe string can be achieved and both the stabilizing sleeve and mandrel recovered.

Other objects of the invention are to provide an improved stabilizing and reaming tool which is very rugged and simple in construction and thus is more economical to manufacture and use than has characterized prior art tools for performing similar functions.

Briefly, these and other objects and advantages of this invention are attained by providing an elongated integral mandrel having threaded ends for insertion in a drill pipe string and including external threads along its body portion for a given length. This given length is greater than the length of the lower end threads on the mandrel. The pitch of the external threads, however, is made exactly equal to the pitch of the lower end threads. Cooperating with the mandrel is a stabilizing sleeve having a central internally threaded bore for threaded engagement with the external threads of the mandrel so that the stabilizing sleeve may be inserted over one end of the mandrel and simply threaded onto the external threads into position.

With the foregoing arrangement, and as a consequence of the longer external threads supporting the stabilizing sleeve as compared to the lower end threads, the mandrel may be unthreaded from the drill pipe string when the stabilizing sleeve is in position on the mandrel and "frozen" against rotational movement within a bore hole without complete unthreading of the sleeve itself. Thus, both the mandrel and sleeve may be recovered after separation of the lower end of the mandrel from the drill pipe string.

As a further consequence of the foregoing design, the mandrel and stabilizing sleeve may be shipped as separate units with resulting economy in the event that only a new stabilizing sleeve or mandrel is required for replacement.

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

FIGURE 1 is an exploded perspective view of the basic components making up the improved stabilizing and reaming tool of this invention preparatory to insertion in a drill pipe string;

FIGURE 2 is a cross-section of the stabilizing and reaming tool in assembled position within a drill pipe string; and

FIGURE 3 illustrates the relative position of the parts after separation of the lower end of the tool from the drill pipe string for recovering the mandrel and stabilizer.

Referring first to FIGURE 1, the two piece stabilizing and reaming tool comprises an elongated mandrel 10 and a stabilizing sleeve 11. The mandrel 10 includes upper threads 12 for threaded connection to threads 13 on one end of a pipe 14 of a drill pipe string and lower threads 15 for connection to internal threads 16 on the upper end of a normally successive pipe 17 in a drill pipe string. The upper and lower threads 12 and 15 respectively are preferably internally and externally tapered for direct connection to the threads on conventional drill pipes. It is possible, however, that other types of threads may be employed with suitable adapters for connecting the mandrel into the drill pipe string if desired.

The mandrel includes a reduced diameter lower portion 18 defining an annular shoulder 19 intermediate the

upper and lower threads 12 and 15. The reduced diameter portion is of a given length between the shoulder 19 and lower end threads 15 and includes external threads 20 over this given length. In accordance with an important feature of this invention the pitch or number of threads per unit length of the external threads 20 is exactly equal to the pitch or number of threads per unit length of the lower end threads 15. However, the given length of the reduced diameter portion and external threads 20 is greater than the length of the lower threads 15. Also, the diameter of the external threads 20 is at least as great as the diameter of the largest of the lower end tapered threads 15.

The stabilizing sleeve 11 includes external fins or blades 21 which extend radially outwardly to define an overall diameter greater than the diameter of the upper portion of the mandrel 10 for effecting the desired stabilizing and/or reaming function. As shown in FIGURE 1, the sleeve 11 also includes an internal bore having internal threads 22 of a pitch and diameter for threaded engagement with the external threads 20 on the mandrel 10.

In assembling the tool, the sleeve 11 is intially passed over the lower end threads 15 and threaded onto the external threads 20 up to the shoulder 19. The lower end threads 15 will then pass through the lower end of the sleeve 11 for threaded connection into the drill pipe 17. The upper threads 12 of the mandrel 10 are threaded onto the drill pipe 14.

The foregoing assembled relationship is illustrated in FIGURE 2 wherein it will be noted that the sleeve 11 is properly disposed in the drill pipe string for performing the usual stabilizing and reaming operations.

All of the threads described are right hand threads so that rotation of the drill pipe string in a clockwise direction will tend to tighten the threaded joints as well as the threaded connection of the sleeve 11 on the mandrel 10.

In operation, should the stabilizing sleeve become "frozen" in the bore hole as a consequence of key seating or other difficulty encountered during a drilling or reaming operation, a string of shot is lowered through the drill pipe to a position adjacent the lower threads 15 and pipe threads 16. Firing of this shot will jar the threads loose so that counter rotation of the drill pipe string to rotate the mandrel 10 in a counterclockwise direction will enable unthreading of the lower end of the mandrel from the drill pipe 17. However, since the stabilizing sleeve 11 is "frozen"' or held rotationally stationary in the bore hole, the mandrel 10 will also be partially unthreaded from the sleeve 11.

Since the length of the external threads 20 of the mandrel is greater than the length of the lower end threads 15, the mandrel may be separated from the lower drill pipe 17 prior to the complete unthreading of the stabilizing sleeve 11 from the mandrel 10. As a consequence, the sleeve 11 is still coupled to the mandrel 10 and may be withdrawn as a unit with the mandrel 10 to the surface of the bore hole.

From the foregoing, it will thus be evident that the stabilizing sleeve may be recovered along with the mandrel 10.

As a further consequence of the foregoing, it will be evident that the mandrel and stabilizing sleeve may be reused if not appreciably damaged since both have been recovered and therefore substitution of a new mandrel and stabilizing sleeve is unnecessary. On the other hand, should the stabilizing sleeve 11 become damaged itself a new sleeve may be substituted without having to remove the mandrel 10 from the rig. Further, if either the mandrel or sleeve is damaged, either one may be replaced separately so that rather than ship an entire new tool, it is only necessary to ship a new stabilizing sleeve or mandrel as the case may be.

From the foregoing description, it will thus be evident that the invention has provided a greatly improved stabilizing and reaming tool structure in which the various objects set forth herein are fully realized.

What is claimed is:

1. A two piece stabilizing tool comprising, in combination: a mandrel including lower end threads for connection in a drill pipe string and having external threads of a pitch equal to the pitch of said lower threads along a portion of its body for a given length greater than the length of said lower threads; and a stabilizing sleeve having spiral blades formed on its external surface and including a threaded bore for threaded engagement with said eternal threads, all of said threads being of the same hand, whereby said mandrel may be counter rotated when said sleeve is in threaded position on said external threads and held rotationally stationary in said bore hole to separate said lower threads from their connection to said drill pipe string prior to complete unthreading of said sleeve from said external threads, the diameter of said external threads being at least as large as the largest diameter of said lower threads, so that said sleeve may be completely unthreaded and separated from said mandrel.

2. A two piece stabilizing and reaming tool, comprising, in combination: an elongated mandrel having upper and lower threads at its ends of given pitch for enabling connection of said mandrel in a drill pipe string, said mandrel including a reduced diameter portion defining an annular shoulder, said reduced diameter portion being intermediate said upper and lower threads and extending a given length to said lower threads, said reduced diameter portion having external threads over said given length, said external threads being of constant diameter at least equal to the diameter of the largest of said lower threads and of a pitch equal to said given pitch, said given length being greater than the length of said lower threads; and a stabilizing sleeve having spiral blades formed on its external surface defining a diameter greater than the diameter of said mandrel above said shoulder and including a central bore having internal threads of constant diameter and of a pitch equal to said given pitch for threaded engagement with said external threads, all of said threads being of the same hand, whereby said stabilizing sleeve may be inserted over said lower threads and threaded onto said external threads of said mandrel up to said shoulder, and whereby unthreading and separation of said lower threads from their connection to said drill pipe by counter rotation of said mandrel when said sleeve is in position on said mandrel and frozen in a stationary position in said bore hole, can take place without said sleeve becoming completely unthreaded from said mandrel so that said mandrel and sleeve may be removed from said bore hole as a unit after such separation of said lower threads.

3. A tool according to claim 2, in which said upper and lower threads comprise internally and externally tapered threads respectively for direct threaded connection into said drill pipe string.

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