

METHOD OF REMANUFACTURING A ROCK DRILL BIT

DESCRIPTION

1. Technical Field

The present invention relates generally to methods for manufacturing drill bits of the type used in the petroleum industry and, in particular, to a method of whereby a rock drill bit can be either reconditioned for reuse or originally manufactured.

2. Background Art

Rock drill bits with rolling cone type cutters have enjoyed widespread use in the petroleum industry for over seventy years. Although many improvements have been made in rock drill bits since their introduction to prolong drill bit life, rock drill bits remain today a "throw-away" item. Once a drill bit no longer functions effectively, it must be removed from the well drill string and replaced with a new drill bit. The entire drill bit is then discarded, although a large portion of it is generally still in good condition. The rolling cone cutters and those portions of the drill bit body which support the cutters and are constantly in contact with the rock formations being drilled are typically the only drill bit parts which are worn. However, since there is currently no practical method for rebuilding a worn rock drill bit, the entire drill bit, which can cost the drill operator at least \$3,000 and \$4,000, must be discarded.

Considerable effort has been directed toward improving various features of the rolling cone cutter type of rock drill bit as well as toward methods of originally manufacturing such drill bits. There is no prior art, however, directed to methods for rebuilding or reconditioning worn rock drill bits so that only the worn out portions need to be discarded and those drill bit portions which are still usable can be reused.

A reconditioned or remanufactured rock drill bit which is not as strong as an originally manufactured bit could present problems for the drill operator which could ultimately negate any cost savings that might be achieved by the reconditioning process. If, for example, a failure of the reconditioned rock drill bit requires that drilling be stopped to pull the inoperative drill bit up from the bottom of the well so that it can be replaced, the expense associated with the interruption of drilling operations is likely to exceed any savings achieved by employing a reconditioned bit. Consequently, any method of reconditioning or remanufacturing a rock drill bit must produce a bit which is as reliable as an originally manufactured bit. The bit body must be free from weak areas which could cause the bit body to crack or break when subjected to stresses during the drilling process. In addition, a successful remanufacturing process must produce a rock drill bit with cone cutters which are accurately aligned to avoid premature and uneven wear of the bit teeth.

Prior art methods of originally manufacturing rock drill bits are not readily adaptable to the reconditioning or remanufacturing of the bits. These methods are not directed toward salvaging a substantial portion of the drill bit body and building the additional components to fit on the salvaged body to produce an integral whole. The method of manufacture of a rock bit disclosed in U.S. Pat. No. 4,187,743 to Thomas illustrates the problems encountered in attempting to apply known original equipment manufacturing methods to reconditioning. The method described in this patent includes the weld-

ing together of three separate rock bit leg assemblies, each of which includes a cutter cone which has been preassembled to its supporting structure on the leg assembly. A used rock drill bit would have to be cut along its vertical axis into three sections before these methods could be used, thereby unnecessarily creating surfaces to be rejoined which could weaken the integrity of the bit body.

Similar techniques of rock drill bit assembly are described in U.S. Pat. Nos. 4,127,043; 4,249,621; 4,258,807 and 4,414,734. The method of manufacture disclosed in each of these patents is premised essentially on forming a segment including part of the bit body and cutting cone support structure and then assembling two or three such segments into a complete bit. While such a method can be employed with good results in the original manufacture of a rock bit, it is a costly and potentially ineffective reconditioning procedure. As discussed above, the introduction of multiple joints in a previously manufactured structure could create weakened areas which could cause breakage of the bit body when the bit is subjected to the stresses of drilling. Consequently, the prior art methods of rock bit manufacture which relate to the assembly of multi-segment bits, although well suited to original equipment manufacture where each segment can be formed to proper tolerances and assembled securely to form a strong, unitary structure, cannot be effectively employed in bit remanufacture.

A method of making a non-segmented, one piece rock bit body is disclosed in U.S. Pat. Nos. 4,266,622 and 4,350,060 to Vezirian. The one piece rock bit body described in these patents includes at least two integral leg portions which extend beyond the bit body. Cone cutter subassemblies must be positioned within each of the legs in their operative positions and then secured to the legs. However, while the rock drill bit is in use, the outer surfaces of the leg portions of the bit body are in almost constant contact with the rock formation being drilled. Therefore, these surfaces can experience significant wear and generally should not be reused. Moreover, the removal of the worn cone cutter subassemblies from the legs of one of these bit bodies to permit the substitution of new ones can be a difficult, time-consuming procedure.

The prior art, consequently, has failed to disclose a method whereby a used, worn rock drill bit can be economically and effectively reconditioned or remanufactured to produce a reusable bit capable of functioning reliably during drilling operations.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of the present invention to provide a method for remanufacturing or reconditioning a used rock drill bit to produce a bit which will function as reliably as an originally manufactured bit.

It is another object of the present invention to provide a method for remanufacturing or reconditioning a used rock drill bit which salvages a maximum amount of the unworn, reusable portion of the bit and requires the replacement of a minimum amount of the used bit.

It is a further object of the present invention to provide a method for remanufacturing or reconditioning a used rock drill bit which is economical and produces a supply of reusable bits at a significant cost savings over the cost of obtaining originally manufactured bits.