A drill bit having a body segmented for convenient disassembly and transportation through underground passages and for subsequent assembly to drill large diameter holes. A stem serves as the driving means and has a threaded connector for attachment to drill pipe that rotates and forces the bit through the earth. A first, segmented cutter support means extends laterally from the stem. A bridge or collar is assembled coaxially over the stem and is secured to a second, segmented cutter support means. Pockets are formed in the first cutter means to receive the second cutter support means, each having surfaces to transmit torques and thrusts. This construction avoids large drilling induced stresses on the fastener means used to hold the separate cutter support means together in operation. For final and more rigid angular alignment of the segments, shims are received in machined grooves in the walls of the pockets to eliminate the necessity for accurately machining the entire surfaces of the walls. Fasteners then secure the shims and the segments in the assembled relationship.

6 Claims, 2 Drawing Figures
SEGMENTED EARTH BORING DRILL BIT

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates in general to earth boring drill bits, particularly to those which may be partially disassembled or collapsed for lowering into a relatively small passage for subsequent assembly and expansion to drill a large diameter hole.

2. Description of the Prior Art
One phase of the earth boring industry is concerned with drilling holes that intersect other passages. It is common to drill a small diameter pilot hole between passages. The pilot bit is then removed and replaced with a larger diameter bit which is pulled and rotated to form a hole of larger diameter.

It is difficult to transport a large diameter bit underground. The passages are usually small. It is therefore common in the prior art to provide a bit body that may be disassembled at the surface of the earth, transported in separate pieces, and then reassembled underground for the subsequent drilling of a larger diameter hole.

The prior art devices known to applicant have significant disadvantages. The prior art construction known to applicants incorporates a large number of fasteners heavily loaded during drilling, often causing them to lose effectiveness in operation. It would be advantageous to provide a segmented bit constructed in a manner to minimize the fastener loads imposed during operation.

SUMMARY OF THE INVENTION

It is therefore the general object of the invention to provide improved, segmented earth boring drill bits.

Another object is to provide an improved, segmented earth boring drill bit that utilizes a stem and bridge or collar means for axial alignment of two segments, cutter support means having wings that extend laterally and respectively from the stem and the collar means.

Another object of the invention is to provide, in addition to a stem and a collar means for the axial alignment of two winged, lateral cutter support means, pockets with longitudinal shoulders to angularly align the segments.

Another object of the invention is to provide in at least one pocket between the two winged, segmented cutter support means, a shim in an accurately formed groove to achieve rigid angular alignment between the segments.

Another object of the invention is to provide a means of engaging winged, segmented cutter support means to transmit forces and stresses between the segments in a manner to minimize drilling loads in the fastener means.

The invention may be summarized as one in which a stem serves as a driving means for a first, segmented cutter support means having pocket means to receive a second, segmented cutter support means secured to a collar assembled upon the stem. The pocket means defines longitudinal and transverse surfaces to align the segments and transmit torque and thrust from said first cutter support means to said second cutter support means. In the preferred form of the invention machinery between the segments forms a groove to receive a shim through which extend fastener means. As a consequence, the shim controls rigid angular alignment and transmits torque between the segments. The fastener means simply retains the shim and are not subjected to drilling forces.

The above as well as other objects, features and advantages of the invention will become more fully apparent in the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of a segmented earth boring drill bit that embodies the principles of the invention.

FIG. 2 is an exploded, perspective view of a disassembled bit body of the type shown supporting cutter assemblies in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference initially to FIG. 2, the numeral 11 designates a stem that forms the central portion of the bit body. Connection means 13, such as threads, are included on the upper end of the stem 11 for attachment to a drill pipe (not shown) used in conjunction with rotary drilling machinery (not shown) for pulling the bit through the earth along a pilot hole.

Rigidly secured to the sleeve 17 on the opposite or lower end of the stem 11 is a laterally extending base plate 15 which preferably extends radially or perpendicularly from the stem. The sleeve, stem and base plate may be connected as shown in U.S. Pat. No. 3,750,767.

Rigidly secured to the sleeve 17 and to the laterally extending base plate 15 by suitable means such as welding is a first cutter support means 19 having two oppositely and laterally extending wings 21, 23. The wings 21, 23 are spaced apart radially to define two oppositely extending pocket means having a bottom surface 25 defined by the laterally extending base plate 15. The walls of each pocket are formed by a shoulder 27, another shoulder 31 and the annular exterior surface of the sleeve 17. A similar pocket means is located on the opposite side of the bit body shown in FIG. 2.

A collar or bridge means 35 is adapted for assembly over the connection means 13 and around the stem 11 such that its lower radial shoulder 37 clears slightly the upper radial shoulder 38 of the previously described sleeve 17. The collar 35 and stem are closely fitted such that they become coaxially aligned upon assembly.

A second segmented cutter support means 39 extends laterally from the collar 35, having oppositely extending wings 41, 43 with configurations enabling insertion within the previously described pockets of the first segmented cutter support means 19. When so assembled, the surfaces 45, 47 of wings 41, 43 of the second cutter support means 39 are preferably planar with the surfaces 29, 33 of the wings 21, 23 of the first cutter support means 19. Consequently, when cutter assemblies 49 are positioned along the dotted lines 50 as seen in FIG. 1, the rotatable cutter 51 extremities engage during rotation in a common plane which defines the borehole bottom. The invention is not limited in its broader aspects, however, to any particular cutter arrangement or cutter configuration.

When assembled as shown in FIG. 1, the wings 21, 23 of the first cutter support means 19 and the wings 41, 43 of the second cutter support means 39 have in the embodiment shown in FIG. 1 a parallel clearance separating their vertical shoulders. A portion of each clearance is enlarged to form a groove 52 machined to receive a shim 53 (see FIG. 2) having a plurality of
holes 34 that are aligned with mating holes 55 in opposite wings of the first and second cutter support means. The grooves and the shims may be accurately machined to insure adequate surface contact to provide rigid assembly and improve load transmission. Suitable forms of fastener means 57 are conventional nuts and bolts with lock washers and/or cotter pins as shown in FIG. 2. Other forms of fastener means may be utilized to secure the shims between the first and second cutter support means.

In operation, the first and second segmented cutter support means 19, 39 may be disassembled for transportation through narrow passages. After drilling a pilot hole, the bit body segments may be readied for enlarging the pilot hole. The cutter support means 19 and 39 are assembled by inserting the stem 11 within the collar 35 such that the wings 41, 43 of the second cutter support means 39 are aligned with the pockets located between the wings 21, 23 of the first cutter support means 19. This produces only an initial or loose fitting arrangement of the segments since a clearance c exists between them as previously described. The final or rigid assembly is controlled by inserting the shims 53 in the grooves 52, the shims being retained in this position by the fastener means 57. Then the connection means 13 may be secured to the drill pipe (not shown) for rotatably urging the bit body into the earth.

It should be apparent from the foregoing description that an invention having significant advantages has been provided.

Upon disassembly, the cutter support means 19, 39 have relatively narrow overall dimensions to enable convenient transportation through narrow passages. The utilization of a bridge or collar means 35 and a stem 11 enables accurate, coaxial alignment of the segmented cutter support means. In addition, utilization of pocket means between the segments enables the transmission of torque and thrust between these segments to minimize operationally induced stresses on the fasteners. The use of a shim in a groove accurately formed between the segments enables rigid assembly and minimizes large localized stresses between the mating longitudinal surfaces between the shims and the segments.

While the invention has been shown in only one of its forms, it should be apparent to those skilled in the art that it is not so limited but is susceptible to various changes and modifications without departing from the spirit thereof.

We claim:

1. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:
   a stem having connection means for attachment to a drill pipe;
   a first segmented cutter support means extending laterally from the stem to define a substantially planar surface for supporting cutter means;
   a second segmented cutter support means defining another substantially planar surface for supporting additional cutter means;
   a bridge means connecting the second segmented cutter support means to said stem;
   pocket means between said cutter support means for orientation and having surfaces to transmit torques and thrusts;
   fastener means to mutually secure said support means.

2. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:
   an upwardly facing stem having connection means for attachment to a drill pipe;
   a first segmented cutter support means extending laterally and rigidly from the stem to define a cutter means supporting surface facing upwardly;
   a collar means adapted for assembly with the stem;
   a second segmented cutter support means extending laterally from the collar means to define another cutter means supporting surface facing upwardly;
   a collar means adapted for assembly with the stem;
   a second segmented cutter support means extending laterally from the collar means to define another cutter means supporting surface facing upwardly;
   pocket means between said cutter support means for orientation and having surfaces to transmit torques and thrusts;
   fastener means to mutually secure said segments and to minimize stresses since torque and thrusts are transmitted through said pocket means.

3. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:
   i a stem having connection means for attachment to a drill pipe;
   a first segmented cutter support means extending laterally from the stem;
   a collar means adapted for assembly and axial alignment with the stem;
   a second segmented cutter support segment extending laterally from the collar means;
   pocket means formed between longitudinally extending shoulders of the cutter support means for orientation and having surfaces to transmit torques and thrusts;
   a shim received by the pocket means between the cutter support means;
   fastener means to mutually secure the shim between the first and second cutter support means.

4. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:
   an upwardly facing stem having connection means for attachment to a drill pipe;
   a laterally extending base plate secured to the stem;
   a collar adapted for assembly around the stem for coaxial alignment therewith;
   a first cutter support means secured to the base plate and to the collar and having two wings oppositely and laterally extending from the stem defining a cutter means supporting surface facing upwardly, said wings defining two oppositely extending pockets with longitudinal shoulders;
   a second cutter support means secured to the collar with oppositely and laterally extending wings defining a cutter means supporting surface facing upwardly, said wings including longitudinal shoulders to assemble and lock with said shoulders in the pockets between the wings of the first cutter support means;
   fastener means to mutually secure the first and second cutter support means in the assembled relationship.
5. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:

- a stem having connection means for attachment to a drill pipe;
- a laterally extending base plate secured to the stem;
- a collar adapted for assembly around the stem of coaxial alignment therewith;
- a first cutter support means secured to the base plate and to the collar and having two wings oppositely and laterally extending from the stem to define two oppositely extending pocket means with longitudinal shoulders;
- a second cutter support means secured to the collar with oppositely and laterally extending wings that include longitudinal shoulders to assemble and lock with said shoulders in the pocket means between the wings of the first cutter support segment; at least one alignment shim received by a groove formed between opposed shoulders of the first and second support means; and
- fastener means to mutually secure the first and second segments in the assembled relationship.

6. A drill bit with cutter means adapted for earth boring and including an improved segmented bit body which comprises:

- an upwardly facing stem having connection means for attachment to a drill pipe;
- a laterally extending base plate secured to the stem;
- a collar adapted for assembly around the stem for coaxial alignment therewith;
- a first cutter support means secured to the base plate and to the collar and having two wings oppositely and laterally extending from the stem defining a cutter means supporting surface facing upwardly, said wings defining two oppositely extending pockets with longitudinal shoulders;
- a second cutter support means secured to the collar with oppositely and laterally extending wings defining a cutter means supporting surface facing upwardly, said wings including longitudinal shoulders to assemble and lock with said shoulders in the pockets between the wings of the first cutter support means;
- at least one cutter positioned on the supporting surface of said first and second supporting means;
- fastener means to mutually secure the first and second cutter support means in the assembled relationship.