

## SEALED HARD-ROCK DRILL BIT

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates generally to drill bits for providing holes in earth formations for wells, blast holes and the like. It is more particularly directed to rotary drill bits for use in relatively hard earth formations which may also be abrasive in nature, such as taconite or the like. One of the problems associated with drill bits of the class of drilling activities in which my invention finds substantial advantageous use, is concerned with economics, not only in the cost of labor for running drilling equipment, but in the cost of the drilling equipment itself, including the expendable drilling bits. My invention provides an improved economic advantage, when considering the factors set forth above, and others, in that it provides a substantially longer life, may be easier to fabricate of available components and is reliable in operation.

## 2. Description of the Prior Art

The following is a list of prior art patents noted in the course of an investigation concerning the subject matter of this application;

U.S. Pat. No.	Inventor	Date of Issue
3,193,028	Radzimovsky	7/6/65
3,251,634	Dareing	5/17/66
3,344,870	Morris	10/3/67
3,461,983	Hudson et al	8/19/69
3,572,452	Winberg	3/30/71
3,628,616	Neilson	12/21/71
3,866,695	Jackson	2/18/75
3,921,735	Dysart	11/25/75
3,952,815	Dysart	4/27/76
2,126,035	Reed	8/9/38
2,126,040	Reed	8/9/38
2,177,333	Reed	10/24/39
2,673,128	Reed	3/23/54
2,664,322	Boice	12/29/53
2,690,935	Alexander	10/5/54
2,719,026	Boice	9/27/55
4,013,325	Rear	3/22/77
4,140,189	Garner	2/20/79
4,183,417	Levefelt	1/15/80

While the above prior art is set forth to disclose the information available to the inventor as a result of a preliminary investigation, it is not believed that any one of the patents listed is more relevant than any of the others and therefore no other comments are believed necessary.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective sketch of a rotary drill bit of the invention;

FIG. 2 is an enlarged fragmentary view of a portion of the illustration of FIG. 1, partly in section, showing a first embodiment of my invention; and

FIG. 3 is a similarly enlarged, fragmentary view, partly in section, of a portion of FIG. 1 showing a second embodiment of my invention.

## DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring to the drawings, a rotary drill bit of the class to which my invention pertains, is indicated generally by reference character 10 and includes a body portion 11, having a top threaded portion for threaded

connection to a drill string pipe. Body 11 is comprised of a plurality of legs 12 that may conveniently be fabricated in sections and then joined together, as by welding, to form body 11, and a like plurality of rotary cone shaped cutters 13 rotatably disposed on journals 15 at the lower inner ends of legs 12.

Legs 12, because of their orientation in an assembled bit, may be thought of as having a top outer end and a journal 15 at the lower inner end in the sense that the lower journal end is directed inwardly of the periphery of the body 11 of a drill bit 10. The lower, or inner end of journals 15 is indicated by reference character 16 and it may be seen that the axis of inner end of journals 15 is preferably disposed, when assembled into a body 11, at an angle of 36° to 45° with respect to a horizontal plane that is perpendicular to the vertical axis of body 11 and thereby to a drill stem to which drill bit 10 may be connected. Proceeding upwardly and outwardly from inner end 16 on journals 15, there is shown an axially extending roller bearing race groove 17, a roller bearing race surface 33, extending radially of the axis of inner end 16, a ball bearing retainer race groove 18, having a radius related to the radius of ball bearings to be positioned therein, an axially extending roller bearing race surface 19, a first seal groove 20 and a second seal groove 21. It may be noted that journals 15 are circular in cross-section and symmetrical about the center axis shown. Legs 12 are also provided with an air duct 22 that extends from the top outer portion of body 11, for receiving air from inside of the drill stem through the top threaded portion of body 11, to the side skirt portions on legs 12. Air duct 22 is also shown connected to a branch air duct 23. Legs 12 are also shown provided with an outer stabilizer portion 25 that may be further provided with carbide inserts 26 and includes a downwardly extending skirt portion 27.

A lubrication duct 28 extends inwardly through journals 15 to the lower inner end and is provided with a lubrication fitting 29 appropriate for a suitable lubricant to be introduced into a completed drill bit 10. A lubrication relief duct 30 is shown extending from the inner end of journals 15 to seal groove 21. A pressure relief valve 31 is shown disposed at an appropriate location in relief duct 30.

Cones 13 are provided with an interior recess indicated generally by reference character 40. Recess 40 is shown having an inner end 41, an axially extending roller bearing race surface 42, a radially extending roller bearing race surface 43, a ball bearing retainer race-groove 44, an axially extending roller race groove 45, an axially extending seal surface 46 and a radially extending outwardly opening air groove 47 adjacent the top or outer end of recess 40.

A plurality of anti-friction roller and ball bearings are disposed intermediate the complementary configured and disposed bearing grooves and surfaces described above in connection with journals 15 and cones 13 and include a plurality of axial roller bearing members 50, a plurality of radially disposed thrust roller bearing members 51, a plurality of retainer-ball bearing members 52 and a plurality of roller bearing members 53. Thrust roller bearings 51 of FIG. 2 are shown having a tapered configuration and it may be noted that a floating spacer ring 54 is disposed at the radially inward periphery of the rollers and that the radially outward ends of rollers 51 are provided with a convex configuration.

The seals to be placed in grooves 20 and 21 are indicated as seal 60 which may be described as an inner seal