and which is preferably comprised of an elastomer resilient material that is slightly compressed when in the assembled position shown so that its outer peripheral surface is in sliding frictional and sealing engagement with surface **46** on cones **13** and the inner portions provide a sealing non-rotating contact with the bottom and sides of seal groove **20** in journals **15**. The outer seal is indicated generally by reference character **64** and is preferably comprised of a continuous metallic ring of material that is in non-sliding engagement with seal surface **46** on cones **13** and is in sliding frictional engagement with the sides of seal groove **21** in journals **15**. It may thus be observed and understood that seal **60** provides a form of pressure responsive seal while seal **64** provides a labyrinth type of seal. The combination of seals **60** and **64** serves to prevent the escape of lubricant from the inside of cones **13** and the inner ends of journals **15** while providing an adequate barrier to prevent the entry of any foreign material, such as drilling debris, into the lubricant containing portions of journals **15** and cones **13**.

FIG. **3** illustrates a further embodiment of my invention in which inner seal **60** is shown comprised of a large O-ring **61** that extends outwardly of inner groove **20** and a pair of smaller O-rings **62** and **63** that are disposed adjacent the bottom sides of groove **20**. O-rings **62** and **63** may be of lesser hardness with respect to O-ring **61**. FIG. **3** further indicates a relocation of lubricant fitting **29** for adding lubricant to the inside of cones **13**, as may be required.

It may be noted that the radius of ball-retainer race groove **18** in journals **15** may be related to the radius of retainer-ball bearings **52** whereby the radius of groove **18** is 0.52 times the radius of retainer-balls **52**.

The combination and sub-combinations of elements set forth above provide an improved drill bit of the anti-friction bearing type in which the individual elements may be dimensioned to closer tolerances to thereby allow the use of larger carbide, or the like, cutting elements on cones **13** as well at to provide a vastly increased life and economic advantage.

OPERATION OF THE ILLUSTRATED EMBODIMENTS

With the above elements in mind, and assuming that legs **12**, having cones **13** in operative disposition, have been assembled to form a body **11**, a drill bit **10** is assembled to the end of a drill string. Lubrication is applied to lubricant fitting **29** disposed in air duct **22**, extending through the side of legs **12**, and is supplied to the interior of cones **13** around journals **15** until the pressure relief valve allows lubricant to flow through duct **30** and seal groove **21** and to appear at the outer periphery of recess **40** in cones **13** adjacent legs **12**. The appropriate drive mechanism for the rotary drill stem is started and air is supplied through the interior of the drill stem to air ducts **22** in journals **12**. Part of the air flows through duct **22**, over lubricant fitting **29**, and outwardly through the outer periphery of legs **12** and through branch **23** to radial air groove **47** in cones **13** and therefrom radially outwardly through the interface between legs **12** and the outer surface of cones **13** the rest flows through jet nozzles. As downward pressure is applied to the drill stem, drill bit **10** comes into contact with the earth's formation and commences to drill by rolling cones **13** over the substances encountered. The work performed in breaking up the earth, rock and the like, generates a substantial amount of heat and causes the lubricant on the interior of cones **13** to expand and thereby increase its pressure. It may be appreciated that part of the heat generated is carried out and emitted laterally of legs **12** as the air under pressure circulates through the ducts and nozzles in body **11**.

As the temperature of the grease increases, the pressure within cones **13** increases to a level, determined by the characteristics of relief valves **31** in relief duct **30** in journals **15**. When the predetermined pressure is exceeded, lubricant is allowed to escape and is conducted outwardly through duct **30** to the bottom of seal groove **21** in journals **15**. This provides a lubrication function for outer seal **64** as well as to prevent the application of undue destructive pressure forces to inner seal **60**.

The air under pressure supplied to the interface between the outer end of cones **13** or radial air groove **47** in cones **13** is allowed to expand radially outwardly between journals **15** and the outer end of cones **13** to inhibit the flow of drilling debris into cones **13**.

It may also be noted that the tapered thrust roller bearings **51** illustrated in FIG. **2** will provide a "true-line" rolling contact that may contribute further to the longevity of the drill bit under working conditions. Similarly, the larger radius of ball bearing retainer race groove **18** over the size of retainer ball bearings **52** provides a further longevity of effective life of drill bit **10**.

When it becomes necessary to supply additional lubricant to the interior of cones **13**, it may be appreciated that the flow of the cooling and cleaning air through air duct **22**, over lubricant fitting **29**, prevents the accumulation of drilling debris so as to allow ready access to the fitting.

I claim:

1. In a lubricated rotary drill bit, comprising in combination;

a plurality of vertically disposed leg members, each of said leg members having a downwardly depending, circular, cutter receiving journal, said journal having a cylindrical outer end of reduced diameter and including a radially extending roller bearing surface and a ball bearing receiving groove adjacent said surface;

a like plurality of circular cutter means, each of said cutter means having an outer cutting surface and including a recess of complementary configuration rotatably disposed on said journals, said recess including a complementary disposed radially extending roller bearing surface intermediate the inner and outer ends, a ball bearing receiving groove adjacent the radially extending bearing surface, said surface and said groove being complementary disposed with respect to the corresponding portions of said journal;

a plurality of ball bearings disposed intermediate the ball bearing grooves; and

a plurality of roller bearings radially disposed intermediate the radial bearing surfaces on said journal and in said cutter.

2. The apparatus of claim **1** and an axially extending roller bearing receiving groove is disposed in the portion of the journal of reduced diameter and a complementary disposed axially extending roller bearing surface in the recess in the cutter and a plurality of roller bearings are disposed therebetween.

3. The apparatus of claim **2** in which the roller bearings disposed in the radial bearing surfaces are of lesser diameter than the others of the roller bearings.