

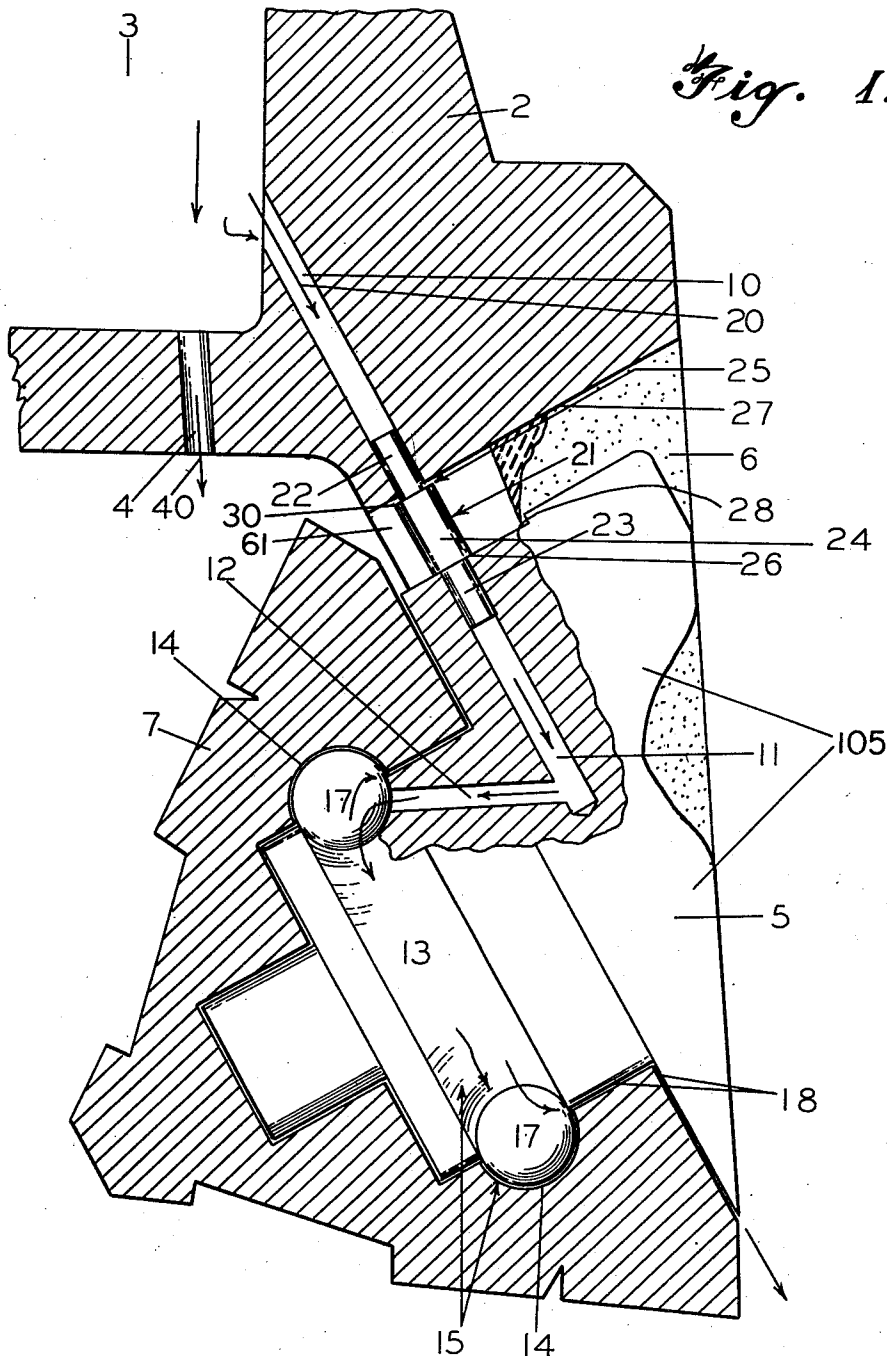
Nov. 26, 1957

C. M. PIKE ET AL
AIR COURSE DRILL BITS

2,814,464

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3 Sheets-Sheet 1



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3 Sheets-Sheet 2

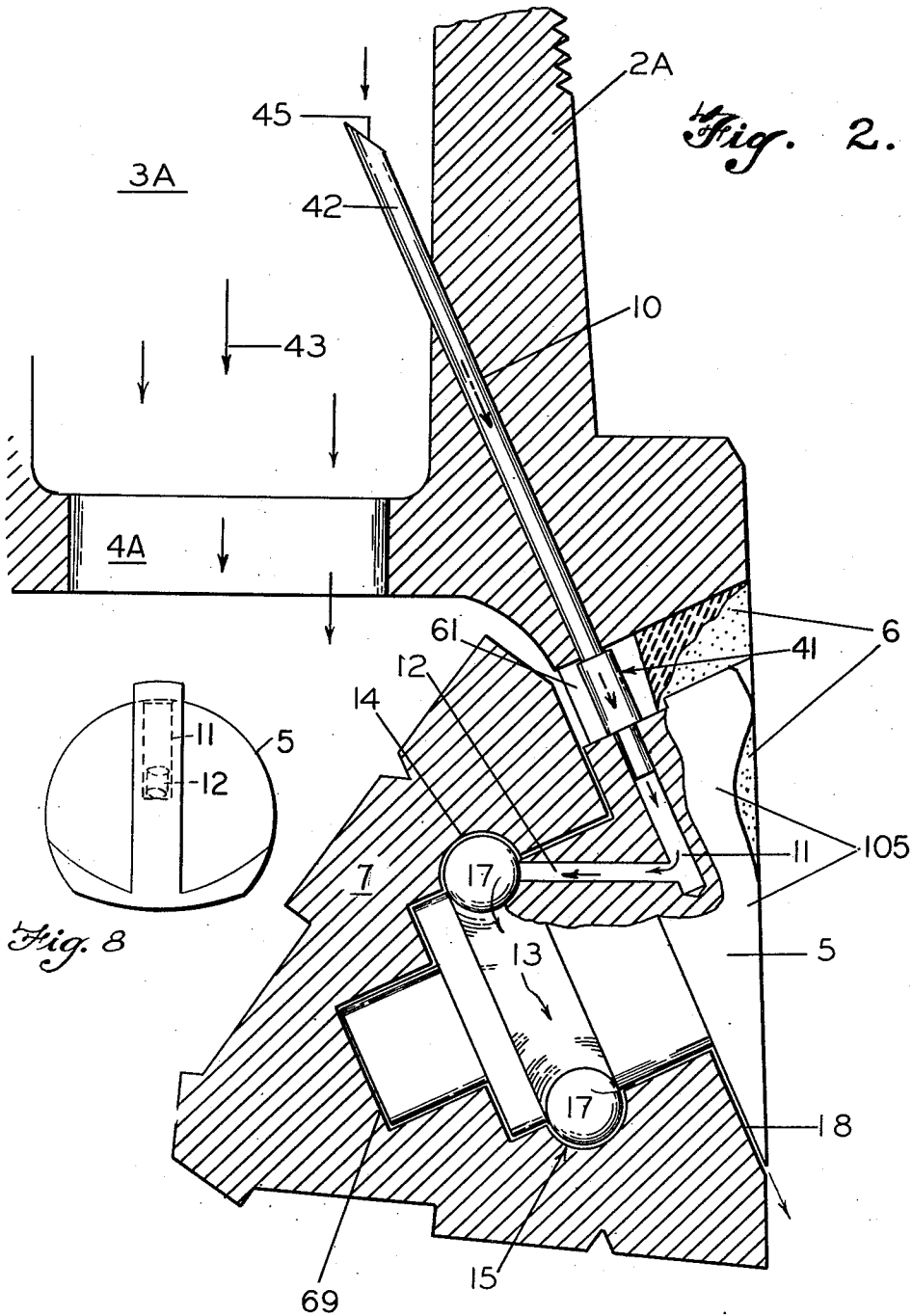


Fig. 8

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Fig. 3.

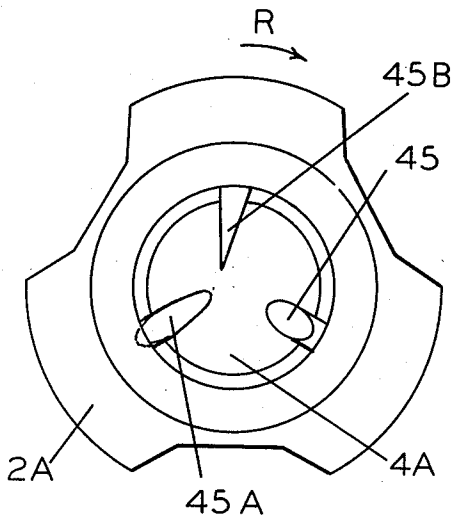


Fig. 5.

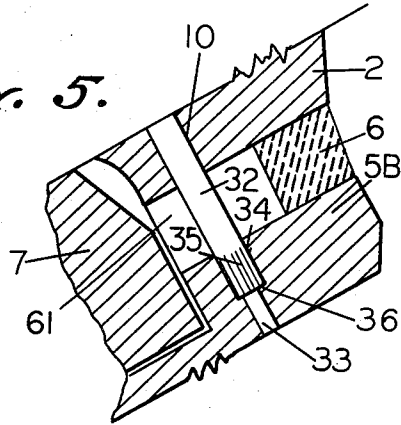


Fig. 6.

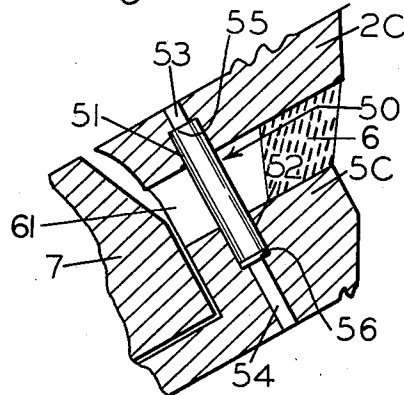


Fig. 7.

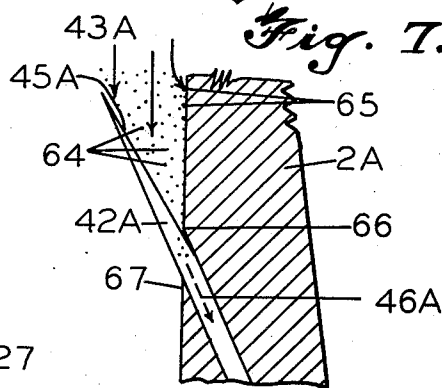
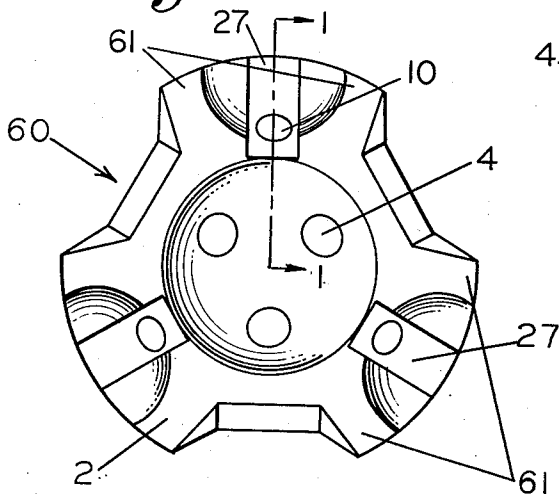


Fig. 4.



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AIR COURSE DRILL BITS

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This invention relates to drill bits and more particularly to a rock bit which is used with an air supply to wash out the cuttings and cool the bearings therein.

The primary object of this invention is to devise a structure to direct air from the central shank opening to the bearings of a cone type rock bit.

A further object is to provide a structure which will be suitable for use with a full opening bit and a similar embodiment made from the same material which will be suitable for a jet type bit.

A still further object of this invention is to provide an air directing member which is economical to manufacture and which may be used with drill bits wherein there would otherwise be a discontinuity between the air passage in the shank and that in the spindle.

These and other objects will be apparent from the following specification and drawing in which:

Fig. 1 represents a cross sectional elevational view of a jet type air course drill bit employing this invention.

Fig. 2 represents a cross sectional elevational view of a full opening air course drill bit employing another embodiment of this invention.

Fig. 3 represents a top view of the drill bit shown in Figs. 2 and 7.

Fig. 4 represents a bottom view of the shank only of the bit in Fig. 1.

Figs. 5 and 6 represent other embodiments of this invention and method for assembling same.

Fig. 7 is a modified structure of the embodiment shown in Fig. 2.

Fig. 8 is a view showing an inner face of one of the spindles of the bit.

Referring now more particularly to the characters of reference on the drawing, in Fig. 1, the drill bit of this invention is seen to consist basically of a threaded shank 2 including a central chamber 3 with jet openings 4, separate piece spindles 5 inserted between tines 61 attached to shank 2 by welding 6 which forms tines 61 and spindle 5 into a single integral part, and a cutter cone 7 journaled to each of the spindles 5. The attaching portion of spindle 5, identified on the drawing as 105 fits between tines 61 so that weld metal 6 fuses the shank 2 and spindle 5 solid at their junction. The inserts 21, 41, etc. being in place at the time of welding are not thereafter readily removable. The majority of the drill bits in use employ three spindles and three cutter cones, but this quantity is not essential to the invention. This general type bit may be used with a water or air course.

When the bit is to be employed in an air course, that is when either compressed air or air at high velocity is sent down the drill stem to flush the cuttings from the hole, it is desirable to take advantages of the cooling effect of the air to cool the bearings. To do this, in Fig. 1 an angularly disposed channel 10 is drilled through stem 2 in line with a channel 11 in spindle 5, and an angularly disposed channel 12 connects air channel 11 with a race 13 of spindle 5. Cutter cone 7 fits over spindle 5 and includes an alinged race 14, whereby race 13 and race

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14 cooperate to form a continuous raceway 15 in which balls 17 may move freely. Between the outer surface of spindle 5 and the matching surface of cone 7 there lies a continuous passage 18 which represents the clearance between these two members. In order to form a continuous passage of air, represented by arrow 20 entering channel 10, through the bearing cooling circuit, an insert 21 is placed in the gap between spindle 5 and shank 2. Insert 21 includes circular ends 22 and 23 of a slightly smaller diameter than channels 10 and 11, and these ends are inserted in their respective channels prior to the application of weld 6. In order to retain insert 21 in its desired position since it is not precision machined (to reduce cost) an enlarged section 24 is included on insert 21 intermediate the ends 22 and 23 and including shoulders 25 and 26 which are adapted to abut either the flat portion 27 of shank 2 or the flat undercut 28 of spindle 5. A gap 30 between one shoulder and one matching flat surface will usually be left due to the tolerances required in this type structure. Insert 21 in this embodiment is made of steel or other rigid material. This insert, however, may be of another material when used in a slightly different fashion as shown in Fig. 5, in this instance the insert 32 is a pliable material such as copper tube and the spindle air channel 33 is of a smaller diameter than the entrance counterbore 34 which is a smaller diameter than tube 32 whereby the tube must be crimped as at 35 to go into counterbore 34 until it strikes shoulder 36 at the juncture of counterbore 34 and channel 33. Shoulder 36 locates the insert 32 at assembly and crimp 35 prevents it from becoming dislodged.

As previously stated the drill bit in Fig. 1 includes jet holes 4 and this bit is used with pressurized air such as air at 40 p. s. i. in chamber 3. Since air in chamber 3 is under pressure it will enter channel 10 from chamber 3. As indicated by arrows 20, the air enters channel 10 and passes through insert 21 (or 32) and through channels 11 and 12 to raceway 15. In raceway 15, the pressure of the air and the rotation of cone 7 and balls 17 serves to distribute the air in the raceway and around the balls and ultimately and through passage 18 between the spindle 5 and cone 7. That portion of the air, indicated at 40, that passes through jet holes 4 acts to clean the teeth of cone 7 and to flush out cuttings from the hole being drilled as is well known in the art.

Referring now to Fig. 2 an embodiment of this invention is shown which is particularly adapted to low pressure high velocity air course drill bits. Numeral 2A represents the shank which includes a large central opening 4A and angularly drilled channel 10 as before. The balance of this drill bit corresponds to that shown in Fig. 1 with the exception of insert 41 which comprises a long tube having an angularly disposed upper end 42 which extends a distance into the air stream in chamber 3A. Insert 41 may extend any desired distance into cavity 3A up to the center thereof. The exposed end 42 is essential when using this drill bit with low pressure air, since the high velocity airstream indicated by arrow 43 would pass right by the opening of channel 10 as seen in Fig. 1. However with a large opening 45 exposed directly in the airstream, an increased quantity of air will be delivered through insert 41 and channels 11 and 12 to raceway 15, where the rotating balls 17 will carry the air around the raceway and eventually out passage 18. It should be observed that insert 41 may be constructed of copper tubing and be utilized in indentially the same installation as shown in Fig. 5.

An additional means of securing the insert in place may be seen by reference to Fig. 6. In this embodiment, the insert 50 is a short straight piece of tubing which is inserted at its ends in counterbore 51 in shank 2C and counterbore 52 in spindle 5C. The air channels 53 and 54 en-

tering the respective counterbores are of a reduced diameter so as to provide shoulders 55 and 56 at the intersection of each channel and counterbore. Insert 50 is slightly shorter than the distance between the shoulders to allow for machining tolerances.

Figs. 3 and 4 illustrate the indentures 60 to permit air and cuttings to proceed up and out of the drilled hole, and Fig. 4 shows tines 61 which support spindle 5 at assembly. The section line 1—1 of Fig. 4 indicates the section of shank 2 which is shown in Fig. 1. Spindle 5 is shown inserted between tines 61 so that its air channel 11 aligns with air channel 10 of shank 2. Welding 6 then permanently attaches portion 105 of spindle 5 in the space adjacent the flats or lands indicated as 27 between tines 61.

It has been found beneficial in employing air as we have to cool the bearings to inject a fine spray of oil into the air stream to lubricate the bearings 17. This is accomplished by means of either a pressure operated or Venturi operated line mist oiler. When employing this method of lubrication it is desirable to form the insert as shown in Fig. 7. The insert identified as 42A includes a long acutely tapered opening 45A which provides a much greater opening to gather an increased number of oil molecules represented by 64 in airstream 43A. Additionally certain of the molecules 65 collect on the inner wall 67 of shank 2A and drop by gravity down the wall to point 66, below which they drop into the interior of tube 42A and recombine with the airstream 46A to the bearings 17. Insert 42A is shown in Fig. 7 to be perpendicularly transverse to the airstream 43A and this position affords a maximum opening to the air from the top. In some instances it is desirable to rotate the insert 42A so that the large opening 45B is facing the direction of rotation of the drill bit whereby it provides a scoop to force air and lubricant into the opening and to raceway 15. It will be observed that some of the air entering raceway 15 from channel 12 under pressure will pass between adjacent balls 17 and carry lubricant on up into passageway 69 (Fig. 2).

From the foregoing description it will be readily seen that there has been produced a device which substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of this invention, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention as defined in the appended claims.

Having thus described the invention, what is claimed as new and useful and is desired to be secured by Letters Patent is:

1. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber including an opening in its lower end to permit passage of air therethrough, downwardly projecting tines at the lower end of said shank, said tines being spaced in pairs about the circumference of said shank, a land between each pair of tines, a spindle inserted between each pair of tines and attached thereto but being spaced from said land, a cutter cone mounted on each spindle and adapted to rotate thereabout, bearing means between said cone and spindle, a channel in said shank leading from said chamber to said land, a channel in each spindle leading to said bearing means, said channels in said shank and spindle being in alignment, and connecting means between said aligned channels, said channels and insert providing a continuous path from said air chamber to said bearing means.

2. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber including an opening in its lower end to permit passage of air therethrough, downwardly projecting tines at the lower end of said shank, said tines being spaced

in pairs about the circumference of said shank, a land between each pair of tines, a spindle inserted between each pair of tines and attached thereto but being spaced from said land, a cutter cone mounted on each spindle and adapted to rotate thereabout, bearing means between said cone and spindle, a channel in said shank leading from said chamber to said land, a channel in each spindle leading to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into and between said aligned channels, said channels and insert providing a continuous path from said air chamber to said bearing means, a shoulder on said insert between said land and the adjacent side of the spindle for preventing longitudinal movement of said insert in said channels.

3. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber including an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle and rotating thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into said air chamber, through said shank channel and into said spindle channel in close fitting relation with said channels, said channels and insert providing a continuous air path from said air chamber to said bearing means.

4. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber including an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle and rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into said air chamber, through said shank channel and into said spindle channel in close fitting relation with said channels said channels and insert providing a continuous air path from said air chamber to said bearing means, the end of said insert exposed to said air chamber being cut on a bias and facing upward to provide a greater exposed opening to air entering said air chamber.

5. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber including an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle and rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into said air chamber, through said shank channel and into said spindle channel in close fitting relation with said channels said channels and insert providing a continuous air path from said air chamber to said bearing means, said aligned channels having the same inside diameter, and said tubular insert having an outside diameter slightly smaller than said channel diameter at a cross section therethrough adjacent its ends and having an outside diameter larger than said channel diameter at a cross section therethrough between said shank and spindle.

6. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said

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chamber having an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, said spindle channel being counterbored with a smaller diameter than said shank channel, a tubular insert including a crimped end, said crimped end being pressed into said counterbore, the other end of said insert extending into said shank channel, said channels and insert providing a continuous passage for air from said air chamber to said bearing means.

7. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber having an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, both said channels being counterbored, and a relatively short length continuous diameter tubular insert extending into and between said counterbores said channels and insert providing a continuous air path from said air chamber to said bearing means.

8. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber having an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle and rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into and between said aligned channels, said channels and insert providing a continuous air path from said air chamber to said bearing means, said insert extending into said air chamber and terminating therein, said terminant end of that portion of said insert extending into said chamber being open in a vertical direction.

9. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber having an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle and rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and a tubular insert extending into and between

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said aligned channels, said channels and insert providing a continuous air path from said air chamber to said bearing means, said insert extending into said air chamber and terminating therein, said terminant end of that portion of said insert extending into said chamber being open in the direction of rotation of said drill bit.

10. A drill bit comprising a shank having an air chamber therein, said chamber being open and registerable with a drill string for flow of air into said air chamber, said chamber having an opening in its lower end to permit passage of air therethrough, spindles attached to said shank, a cutter cone mounted on each spindle rotatable thereabout, bearing means between said cone and said spindle, a channel in said shank leading from said chamber to one surface of said shank, a channel in said spindle leading from a surface of said spindle to said bearing means, said channels in said shank and spindle being in alignment, and connecting means between said aligned channels, said channels and insert providing a continuous air path from said air chamber to said bearing means, said connecting means extending into said air chamber and terminating therein, said terminant end being open and comprising a scoop to force air into said continuous air path.

11. A drill bit comprising a shank having a fluid chamber therein, said chamber including an opening in its lower end to permit passage of fluid therethrough from the chamber, downwardly projecting tines at the lower end of said shank, said tines being arranged in at least one pair and spaced about the circumference of said shank, a land between the pair of tines, a spindle inserted between the pair of tines and attached thereto but being spaced from said land, a cutter mounted on the spindle and adapted to rotate thereabout, bearing means between said cutter and spindle, said shank having a channel therein leading from the opening in the lower end of said chamber to said land, the spindle having a channel therein leading to said bearing means, said channels in the shank and spindle being in alignment, and connecting means between said aligned channels, said channels and connecting means providing a continuous path from said chamber to said bearing means.

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