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(54) **Title**: DRILL BIT WITH FLUID PULSE AND FLUID COLLISION

(57) **Abstract**: A drill bit and turbine unit apparatus for drilling a bore which can accept one or more pressures of drilling fluid and/or one or more types of drilling fluid wherein it has two or more distinct and separate fluid paths through said bit which provides the intersection of some paired fluid expulsion points and has a rotating turbine unit for the pulsing of fluid at some of its expulsion points for enhanced hole advancement by increased drilling fluid velocity and cutting force to the material to be cut.

Patent Application of

Alan L. Nackerud

For

DRILL BIT WITH FLUID PULSE AND FLUID COLLISION

CROSS REFERENCE TO RELATED APPLICATIONS:

This application claims the benefit of provisional patent application Ser. No. US 61/852,694 filed March 19, 2013 by Alan L. Nackerud, which is incorporated by reference herein.

BACKGROUND AND FIELD OF INVENTION:

The present invention relates to a drill bit which can be used in the drilling of earthen well bores or to advance a bore in hard material.

SUMMARY OF THE INVENTION:

The present invention drill bit and pulse turbine unit provide new and novel features including but not limited to; a fluid system which can receive one or more fluid types and/or fluids with different pressures, a fluid system which has more than one distinct and separate fluid delivery path through the drill bit, a fluid pulse turbine unit which can provide delivery of one or more pulsed fluids to the rock or cutting interface, a fluid path to direct fluid to provide a collision of two or more flow patterns at or near the rock or cutting interface to increase the velocity of the delivered fluid, a fluid delivery pattern system to kerf or etch the rock with the enhanced fluid delivery, and hardened disc rollers or other hardened cutters to track the kerfs and apply pressure to the rock or material to be cut and thereby crack or break the rock. The present invention can be used with a bottom hole assembly or drill string which can deliver either a normal low pressure fluid or more than one type of fluid or both a low and high pressure fluid to the present invention. An example delivery system and apparatus which provides a low and high pressure fluid system is contemplated and referred to in Provisional Patent Application of Alan L. Nackerud for High Pressure Downhole Pump Assembly filed and dated February 26, 2013. There are of course, additional features of the present invention that will be described herein, however it is to be understood that the invention is not limited in its application to the details of construction and to the arrangements of the components set forth in the following description. The invention is capable of other embodiments and of being practiced and carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting. As such, those skilled in art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other embodiments, structures, methods and systems for carrying out the several purposes of the present invention. The above and other advantages and features of the present invention will become more readily appreciated and understood from a consideration of the following detailed description taken together with the accompanying drawings;

DRAWINGS - FIGURES:

Figure 1 is a side view of drill bit and pulse turbine unit;

Figure 2 is a bottom view of drill bit showing roller discs and hidden radial lateral fluid bores;

Figure 3 is a cross section side view of drill bit and pulse turbine unit showing main inner fluid bore, outer angle fluid bores, radial lateral fluid bores and roller discs;

Figure 4 is a cross section side view of drill bit rotated 27 degrees clockwise showing inner angle fluid bores;

Figure 5 is a cross section side view of drill bit rotated 45 degrees clockwise showing main inner fluid bore, outer angle fluid bores, radial lateral fluid bores and roller discs;

Figure 6 is a bottom view of drill bit with rotated 45 degrees clockwise showing roller discs and hidden radial lateral fluid bores;

Figure 7 is a cross section side view of drill bit rotated 32 degrees clockwise showing main inner fluid bore and roller discs;

Figure 8 is a bottom view of drill bit rotated 32 degrees clockwise showing roller discs and hidden radial lateral fluid bores;

Figure 9 is a cross section side view of drill bit rotated 13 degrees clockwise showing main inner fluid bore and roller discs;

Figure 10 is a bottom view of drill bit rotated 13 degrees clockwise showing roller discs and hidden radial lateral fluid bores;

Figure 11 is a top view of pulse turbine unit;

Figure 12 is a side view of pulse turbine unit with hidden turbine lines and pulse slots;

Figure 13 is a top view of drill bit without pulse turbine unit showing main inner fluid bore and outer angle fluid bores;

Figure 14 is a top view of pulse turbine unit and drill bit;

Figure 15 is a top view of drill bit with pulse turbine unit rotated 67.5 degrees clockwise;

Figure 16 is a top view and side view of small ring bearing;

Figure 17 is a top view and side view of large ring bearing;

DRAWINGS – REFERENCE NUMERALS:

1. body
2. pin connection
3. wrench flat
4. gauge insert
5. set screw
6. disc bearing
7. large roller disc
8. small roller disc
9. small fluid nozzle
10. snap ring nozzle retainer
11. fluid nozzle bore
12. radial lateral fluid bore
13. outer angle fluid bore
14. ball bearing hole to pulse turbine
15. ball bearing to pulse turbine
16. main inner fluid bore
17. inner angle fluid bore
18. large fluid nozzle
19. pulse turbine unit
20. turbine
21. pulse turbine slot

22. small ring bearing

23. large ring bearing

24. spring to pulse turbine ring bearing

25. cuttings return slot

DETAILED DESCRIPTION:

The drill bit, pulse turbine unit 19 and various parts described herein are illustrated in Figures 1 through 17. The body 1 of the drill bit has a threaded connection 2 on top to allow connection to a drill string. One or more wrench flats 3 are located on the outside surface perimeter of the drill bit body 1 to assist in holding the drill bit as it is connected to or unconnected from the drill string. A main inner fluid bore 16 proceeds through the pin connection 2 and into the body 1 where it connects to inner angle fluid bores 17, and out the bottom of the body 1 to provide normal fluid circulation out of the drill bit for rock cuttings removal, cooling of the drill bit and drill string and other normal fluid uses in drilling. On top of said drill bit is a pulse turbine unit 19 which is placed on top of the drill bit and inside a recess in a flared sub or pump to be connected above the pulse turbine unit 19 and drill bit. Said pulse turbine unit 19 allows two paths of delivery of fluid through the drill bit; one path provides for fluid delivery down the main inner bore 16 and the other path provides for fluid delivery through numerous outer angle fluid bores 13 located axially around the perimeter of the top of the drill bit. Said outer angle fluid bores 13 direct fluid to radial lateral fluid bores 12 which direct fluid to small fluid nozzles 9, some of which are paired and angled toward each other near the bit bottom to provide a concentrated collision of fluid near the rock interface where an increased fluid velocity is achieved and thereby a greater fluid force to cut the rock or material being removed. A kerf line or etch of the rock or material is obtained. The pulse turbine unit 19 located at the top of the drill bit has opposing and alternating pulse turbine slots 21 which when rotated by the passage of fluid through the center turbine 20 provide for additional cutting force via alternating delivery of pulsed fluid to the small fluid nozzles 9. The other path of fluid is the main inner fluid bore 16 which delivers fluid to inner angle fluid bores 17 which expel fluid out the bottom of the drill bit for additional fluid volume for cuttings removal, cooling of downhole tools and drill string and other normal uses of fluid circulation in a well bore. The two fluid delivery paths; the outer angle fluid bore path, and the inner angle fluid bore path, can receive drill string fluid at one pressure or they can each receive a different fluid type or different fluid pressure provided the down hole assembly above the pulse turbine and drill bit has a high pressure downhole pump, drill pipe or other assembly capable of two flow paths to deliver two distinct fluid types or two distinct fluid levels of fluid pressure to the pulse turbine and drill bit. The preferred form of the drill bit has roller discs 7, 8 that are located such on the bottom of the drill bit to track or align with the kerf lines of the paired and non-paired nozzles so that when drill string weight and rotation is applied to the rock or material being removed, the roller discs 7, 8 are able to crack and break the rock at a weakened point between kerf lines below the top of the rock interface. This is a more efficient method of rock removal and provides an increased rate of hole advancement and a larger percentage of rock removal with each rotation of the drill string compared to less efficient methods of conventional drill bit rock removal by typical crushing or shearing of the rock. The preferred form of the drill bit shows roller discs 7, 8 however tungsten carbide inserts or discs, or polycrystalline diamond compact (PDC) discs or other hardened material could be used. The preferred form of the drill bit has said rollers 7, 8 which are able to rotate or spin on bearings 6. Said bearings 6 are attached to the drill bit by weld or other common attachment method such as a bearing cover or plate and bolts.

It is therefore to be understood that even though numerous characteristics and advantages of the present embodiment have been set forth in the foregoing description, together with the details of the structure and function of the embodiment, the disclosure is illustrative only, and changes may be made within the principles of the embodiment to the full extent indicated by the broad general meaning of the terms in which the claims are expressed and reasonable equivalents thereof and various forms of the present invention can be applied to numerous drilling and completion tools of well bores.

CLAIMS:

I claim:

1. A drill bit and pulse turbine unit apparatus which can receive drilling fluid from a preceding high pressure downhole pump or preceding drill string and provides that said drilling fluid travel through the drill bit in two or more distinct and separate paths of two or more internal fluid bores and subsequent distinct and separate discharge ports to the rock or material being cut comprising:

(a) a drill bit with a threaded pin connection on top with a centered main inner bore intersected by several distinct and separate inner angle fluid bores which deliver fluid to the drill bit leading edge, and

(b) wherein numerous distinct and separate outer angle fluid bores are located radially near the outside perimeter at the top of said threaded pin connection which intersect subsequent radial lateral fluid bores which intersect subsequent small fluid nozzle bores which then deliver fluid to the drill bit leading edge, and

(c) wherein on top of the drill bit threaded pin connection a pulse turbine unit is placed which has an inner bore with angled turbine blades whereby when fluid passes through said turbine blades said pulse turbine unit rotates, and

(d) wherein said pulse turbine unit has two or more outer perimeter slots that align with the outer angle fluid bores in the drill bit threaded pin connection whereby when said pulse turbine unit rotates the fluid is alternatingly delivered and pulsed to one or more of said drill bit outer angle fluid bores and subsequent intersecting radial lateral fluid bores and subsequent small fluid nozzle bores for delivery to the drill bit leading edge, and

2. In an apparatus according to claim 1 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit threaded pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small ring bearing and large ring bearing are placed in said groove on top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump or other downhole equipment, and

3. In an apparatus according to claim 1 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut, and

4. In an apparatus according to claim 1 wherein some of the small fluid nozzle bores are paired and angled toward each other at their discharge points to provide drilling fluid to intersect outside and near the bottom face of the drill bit, and

5. In an apparatus according to claim 4 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit threaded pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small ring bearing and large ring bearing are placed in said groove on

top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump or preceding drill string, and

6. In an apparatus according to claim 4 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut, and

7. A drill bit and pulse turbine unit apparatus which can receive drilling fluids from a preceding high pressure downhole pump or preceding drill string at two or more distinct and separate pressures and provides that said drilling fluids travel through the drill bit in two or more distinct and separate paths of two or more internal fluid bores and subsequent distinct and separate discharge ports to the rock or material being cut comprising:

(a) a drill bit with a threaded pin connection on top with a centered main inner bore intersected by several distinct and separate inner angle fluid bores which deliver fluid to the drill bit leading edge, and

(b) wherein numerous distinct and separate outer angle fluid bores are located radially near the outside perimeter at the top of said threaded pin connection which intersect subsequent radial lateral fluid bores which intersect subsequent small fluid nozzle bores which then deliver fluid to the drill bit leading edge, and

(c) wherein on top of the drill bit threaded pin connection a pulse turbine unit is placed which has an inner bore with angled turbine blades whereby when fluid passes through said turbine blades said pulse turbine unit rotates, and

(d) wherein said pulse turbine unit has two or more outer perimeter slots that align with the outer angle fluid bores in the drill bit threaded pin connection whereby when said pulse turbine unit rotates the fluid is alternatingly delivered and pulsed to one or more of said drill bit outer angle fluid bores and subsequent intersecting radial lateral fluid bores and subsequent small fluid nozzle bores for delivery to the drill bit leading edge, and

8. In an apparatus according to claim 7 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small ring bearing and large ring bearing are placed in said groove on top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump, or preceding drill string, and

9. In an apparatus according to claim 7 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut, and

10. In an apparatus according to claim 7 wherein some of the small fluid nozzle bores are paired and angled toward each other at their discharge points to provide drilling fluid to intersect outside and near the bottom face of the drill bit, and

11. In an apparatus according to claim 10 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small ring bearing and large ring bearing are placed in said groove on top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump or preceding drill string, and

12. In an apparatus according to claim 10 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut, and

13. A drill bit and pulse turbine unit apparatus which can receive from a preceding high pressure downhole pump or preceding drill string, two or more different types of drilling fluid such as a light weight drilling fluid and a heavy weight drilling fluid or a drilling fluid with laden abrasives and a drilling fluid with no laden abrasives whereby said different types of drilling fluids travel through the drill bit in two or more distinct and separate paths of two

or more internal fluid bores to be delivered at subsequent distinct and separate discharge ports to the rock or material being cut comprising:

(a) a drill bit with a threaded pin connection on top with a centered main inner bore intersected by several distinct and separate inner angle fluid bores which deliver fluid to the drill bit leading edge, and

(b) wherein numerous distinct and separate outer angle fluid bores are located radially near the outside perimeter at the top of said threaded pin connection which intersect subsequent radial lateral fluid bores which intersect subsequent small fluid nozzle bores which then deliver fluid to the drill bit leading edge, and

(c) wherein on the top of the drill bit threaded pin connection a pulse turbine unit is placed on top of the drill bit pin connection which has an inner bore with angled turbine blades whereby when fluid passes through said turbine blades said pulse turbine unit rotates, and

(d) wherein said pulse turbine unit has two or more outer perimeter slots that align with the outer angle fluid bores in the drill bit threaded pin connection whereby when said pulse turbine unit rotates the fluid is alternatingly delivered and pulsed to one or more of said drill bit outer angle fluid bores and subsequent intersecting radial lateral fluid bores and subsequent small fluid nozzle bores for delivery to the drill bit leading edge, and

14. In an apparatus according to claim 13 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small

ring bearing and large ring bearing are placed in said groove on top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump or preceding drill string, and

15. In an apparatus according to claim 13 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut.

16. In an apparatus according to claim 13 wherein some of the small fluid nozzle bores are paired and angled toward each other at their discharge points to provide drilling fluid to intersect outside and near the bottom face of the drill bit, and

17. In an apparatus according to claim 16 wherein said pulse turbine unit on its bottom has a small diameter circular groove and a larger diameter circular groove to match the location of ball bearings or similar rotational bearings located on the top of the drill bit pin connection, and wherein said pulse turbine unit on its top has a small diameter deep circular groove and a larger diameter deep circular groove wherein respectively a small ring bearing and large ring bearing are placed in said groove on top of small springs which provide a rotatable bearing which is movable vertically to provide a tight fit or seal against the preceding high pressure downhole pump or preceding drill string, and

18. In an apparatus according to claim 16 wherein the bottom face of the drill bit has roller discs or a similar cutting structure of hardened material welded, brazed or otherwise attached to said bottom face aligned and coinciding with the kerf line

location or rotational circular line of the fluid nozzle bores to assist in cleaning and kerfing the rock or material to be cut.

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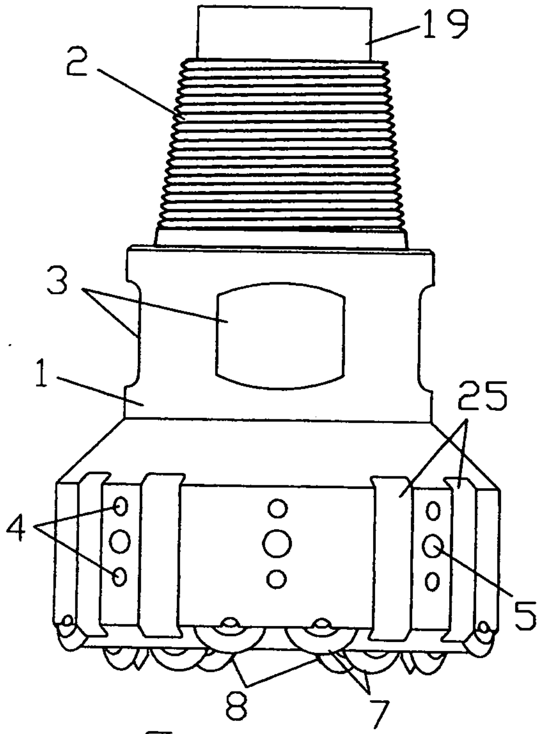

Figure 1

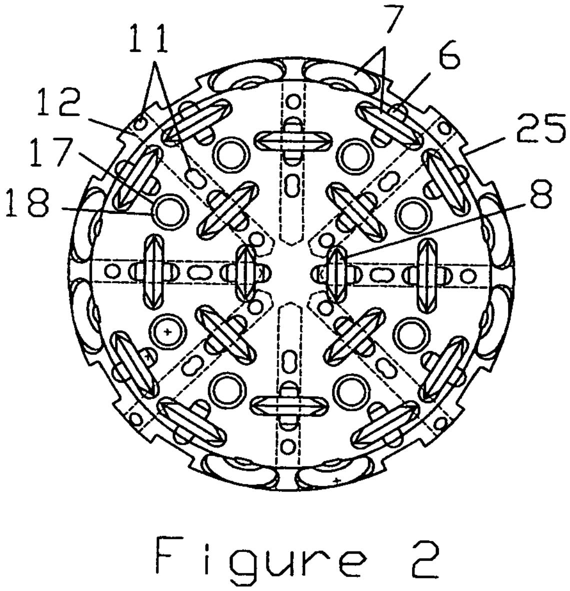

Figure 2

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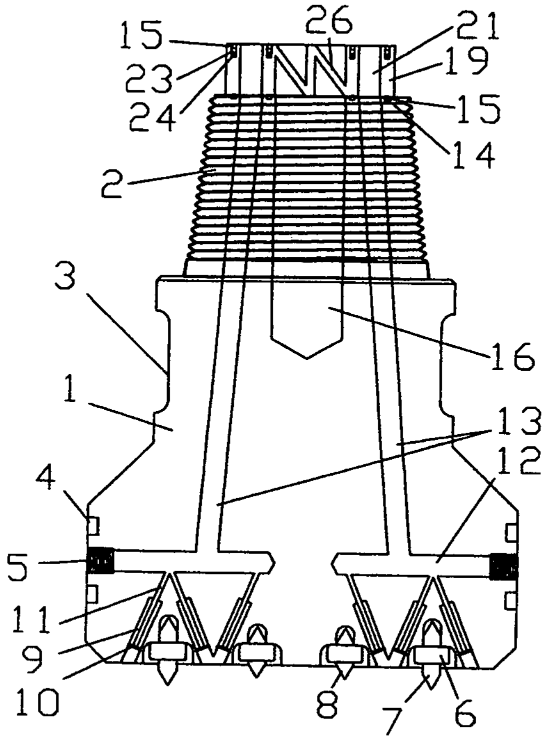

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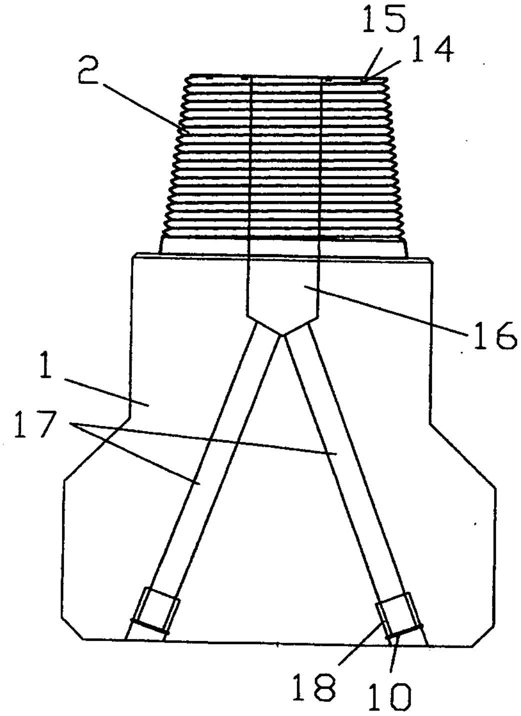

Figure 4

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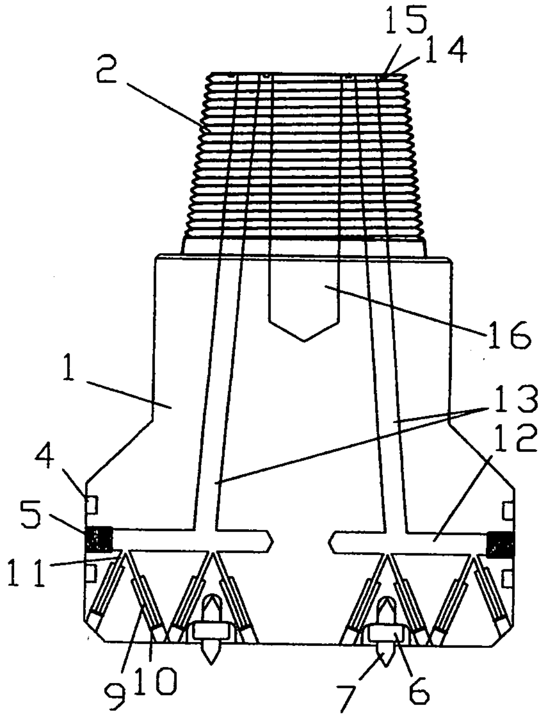

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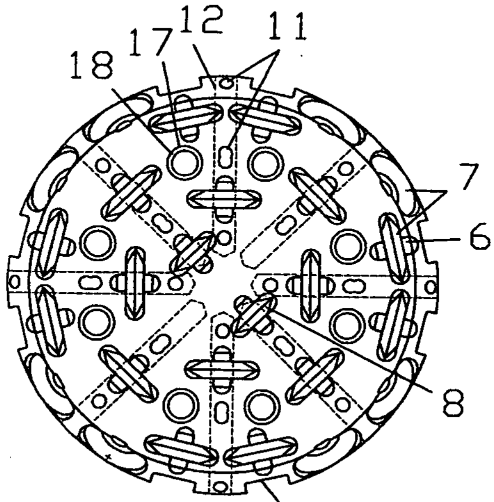

Figure 6

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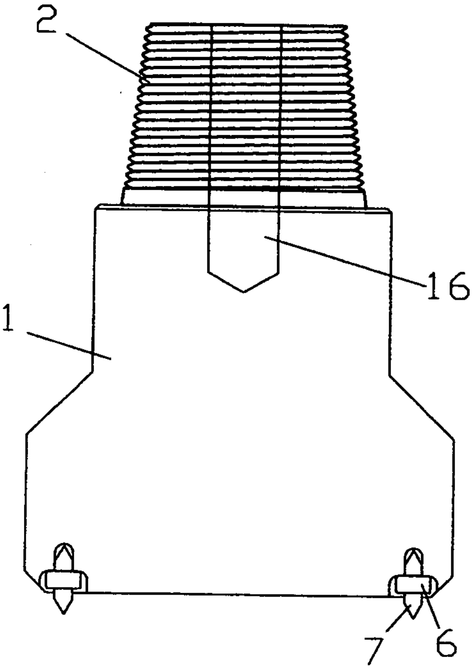

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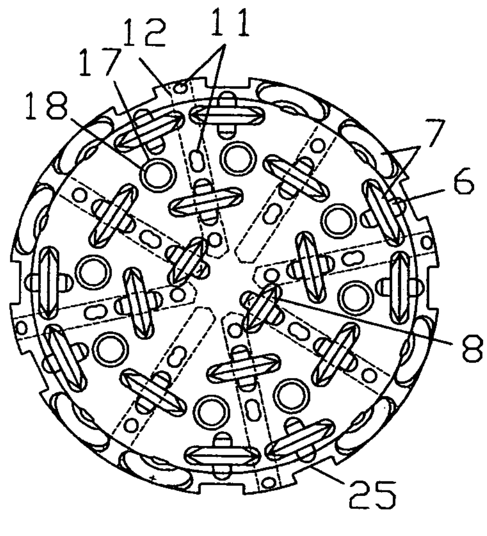

Figure 8

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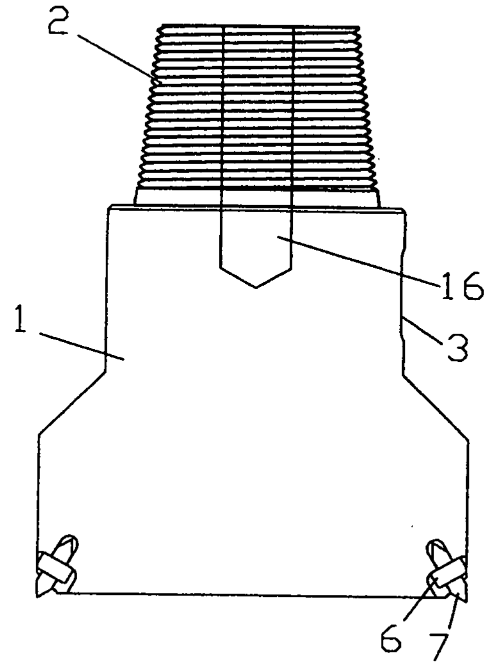

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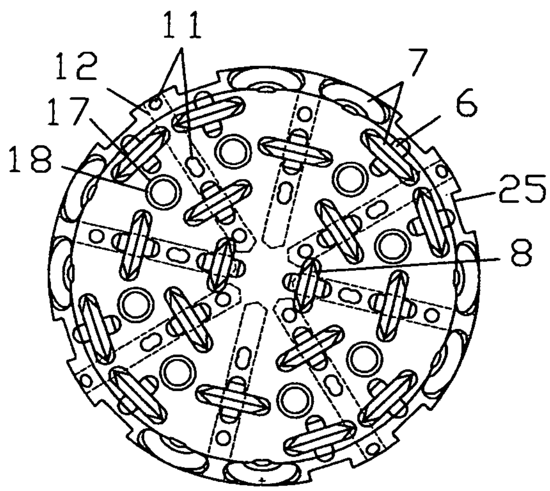

Figure 10

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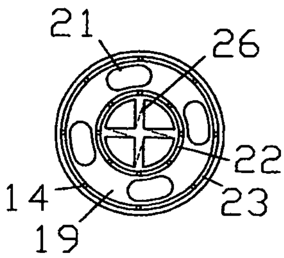

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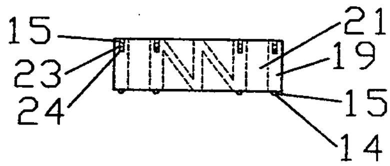

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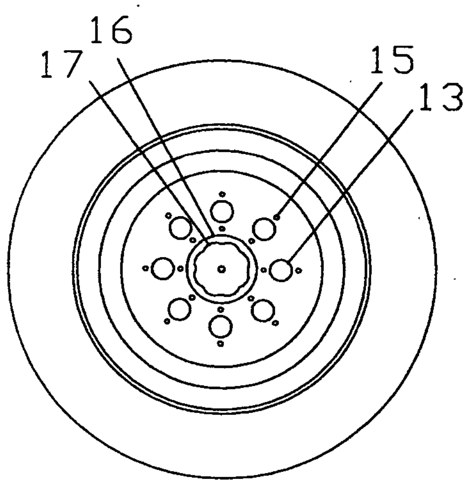

Figure 13

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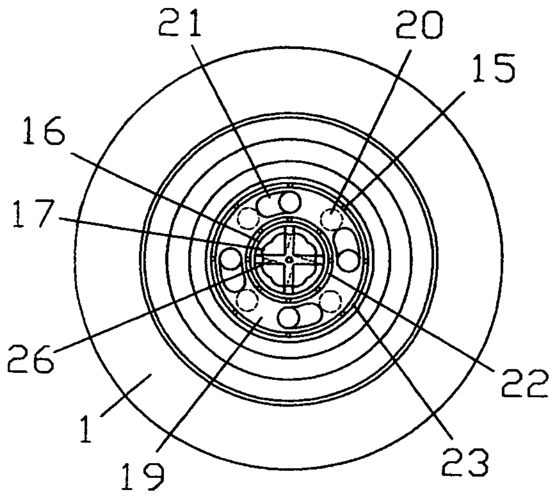

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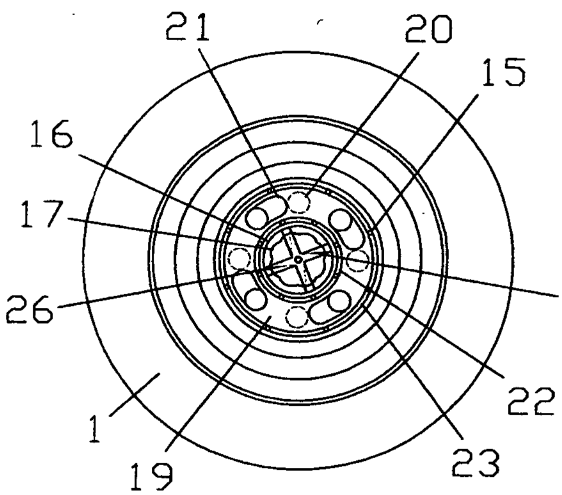

Figure 15

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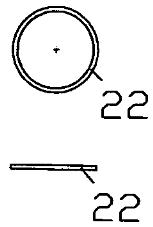

Figure 16

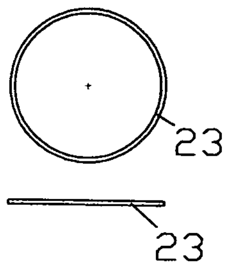

Figure 17