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[54] **REVERSIBLE PISTON HAMMER FOR PERCUSSION TOOL**

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[52] **U.S. Cl.** **173/134,** 91/54, 92/59, 173/29

[51] **Int. Cl.** **F01b 29/04**

[58] **Field of Search** 173/105, 115, 134, 173/29; 92/13.41, 59; 91/277, 54

[56] **References Cited**

UNITED STATES PATENTS

1,354,348	9/1920	Smith	173/134 X
1,116,519	11/1914	Wafker	173/29
1,848,340	3/1932	Gilman	173/105 X

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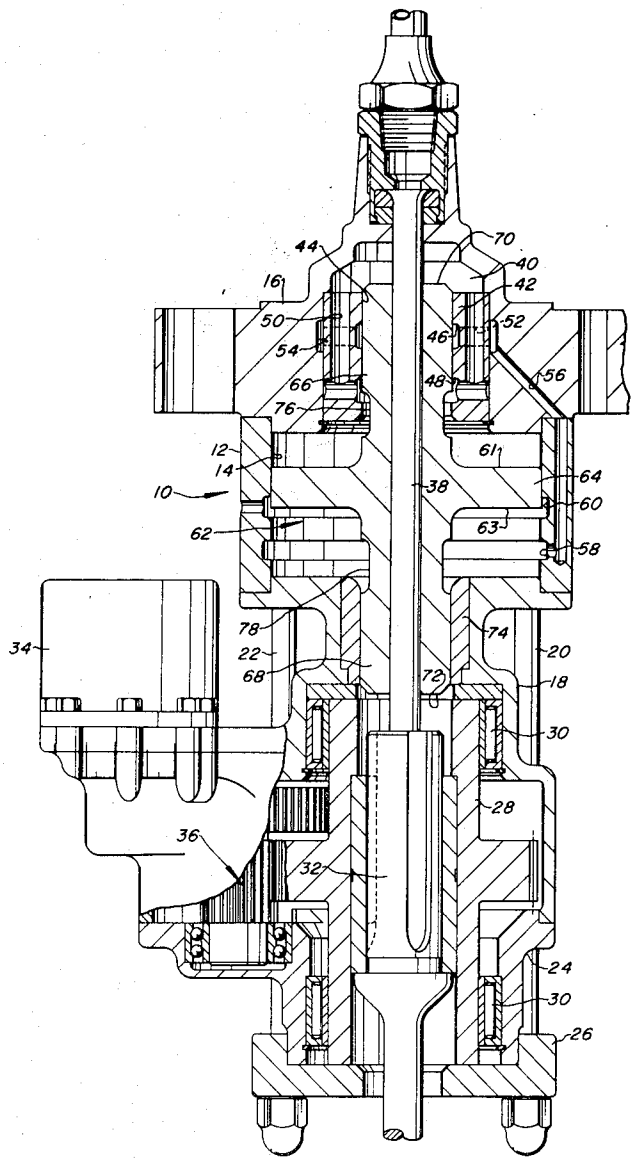
[57] **ABSTRACT**

A pneumatic percussion tool having a reciprocable piston hammer with similar reduced diameter portions extending from opposite sides of an enlarged piston portion. Each reduced diameter portion includes an annular groove cooperable with associated inlet porting for admitting pressure air to act on the piston to deliver a percussion blow. The respective grooves are located at different positions with respect to the opposite impact end faces of the piston hammer and the hammer can be reversibly disposed in the tool cylinder to provide variable impact blow, blow frequency, and air consumption.

5 Claims, 2 Drawing Figures



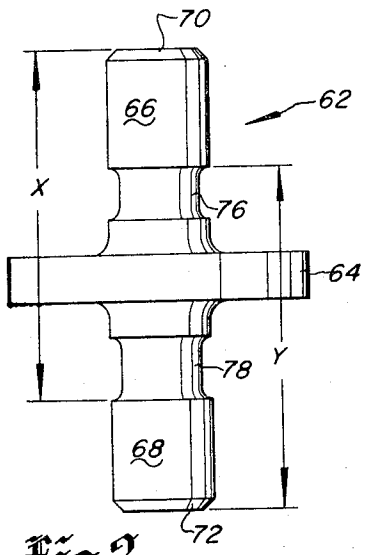

70
66
62
X
76
64
Y
78
68
72

Fig 2

70
44
40
16
42
50
52
46
54
56
48
66
76
61
12
64
14
38
10
60
62
63
58
78
74
20
34
22
68
72
18
30
28
36
32
24
30
26

Fig 1

REVERSIBLE PISTON HAMMER FOR PERCUSSION TOOL

BACKGROUND OF THE INVENTION

Fluid operated percussion tools such as rock drills and the like of the type wherein the reciprocating piston hammer includes passage means for valving fluid to actuate itself are generally well known. An example of such a percussion rock drill is disclosed in U.S. Pat. No. 3,666,024 to R.W. Beaumont. Such types of fluid operated tools are also sometimes characterized by a piston hammer which includes reduced diameter portions having impact striking faces extending axially on opposite sides of an enlarged piston portion. Such piston hammers may be reversibly disposed in the drill cylinder bore in the event that damage to one of the striking faces should be incurred as suggested in U.S. Pat. No. 1,293,225 to W.A. Smith. Heretofore, the abovementioned general type of percussion rock drill has not been capable of convenient adaptation to operate at various blow frequencies or to efficiently utilize the available pressure fluid supply without interchanging internal drill parts. This is not only inconvenient but is costly in terms of requiring extra parts to be kept available when it is desired to change the impact blow, blow frequency, or to more efficiently utilize the available pressure fluid quantity.

SUMMARY OF THE INVENTION

The present invention provides for a pressure fluid operated percussion rock drill characterized by a reversible piston hammer of the type which includes passages for valving pressure fluid to the drill cylinder and which may be reversibly disposed in the drill cylinder to change the percussion blow frequency.

With the fluid operated percussion rock drill of the present invention, variable impact blow, blow frequency, and pressure fluid utilization may be easily attained by reversing the arrangement of the piston hammer in the drill cylinder.

Moreover, with the present invention pneumatic rock drills of the general type disclosed may be easily adapted to operate more efficiently at various altitudes or may be adapted to more efficiently utilize the available supply of pressure air for work purposes.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a longitudinal section view of a fluid operated percussion rock drill in accordance with the present invention.

FIG. 2 is a longitudinal view of the piston hammer of the drill illustrated in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2 of the drawing the present invention is embodied in a fluid operated percussion tool generally designated by the numeral **10**. The tool **10** is commonly known as an independent rotation pneumatic percussion rock drill and includes a cylinder housing **12** having a bore **14**. The cylinder **12** is disposed between a backhead housing portion **16** and a housing portion **18** suitably secured together by elongated side rods **20** and **22**. The side rods **20** and **22** extend forwardly to secure a cover member **24** and a cap **26** in assembly with the previous mentioned drill housing portions. The housing portion **18** includes a chuck member **28** rotatably disposed in suitable bearings **30** and including means for supporting and rotatably driving an impact blow-receiving member **32** commonly known as a shank. The chuck member **28** is rotatably driven by a suitable fluid operated motor **34** which is drivably engaged to the chuck member by gearing **36**. The flow-receiving member **32** includes a longitudinal passage for receiving one end of a cleansing fluid tube **38**.

The backhead portion **16** is characterized by a hollow interior **40** in which is secured a sleeve member **42**. The interior **40** is suitably adapted to be in communication with a source of pressure fluid such as compressed air. The sleeve **42** includes a reduced diameter bore **44** opening into the bore **14** and spaced annular passages **46** and **48** opening to the bore **44**. Longitudinal passages **50** communicate the annular passage **48** with the interior **40**. The annular passage **46** is in communication with radially extending passages **52** which in turn are in communication with an annular passage **54** in the backhead portion **16**. The annular passage **54** in turn is in communication with a passage **56** leading to an annular passage **58** in the cylinder **12**. The cylinder **12** also includes an annular passage **60** forming an exhaust port.

The percussion tool **10** further includes a reciprocable piston hammer generally designated by numeral **62** and characterized by an enlarged piston portion **64** having transverse faces **61** and **63** and closely fitted in the bore **14**. The piston hammer **62** is also characterized by integral cylindrical stem portions **66** and **68** extending axially on opposite sides of the piston portion **64**. The stem portions **66** and **68** are of equal diameter and substantially equal length and are respectively delimited by transverse end faces **70** and **72**. In the arrangement shown in FIG. 1 the stem portion **66** is slidably supported by the sleeve **42** and the stem portion **68** is supported in bearing means formed by a sleeve **74** disposed in the housing portion **18**. The stem portions **66** and **68** include first and second fluid conducting passage means disposed on the periphery thereof and comprising the respective annular grooves **76** and **78**.

As shown by the position of the piston hammer **62** in FIG. 1 the groove **76** cooperates with the passage **48** in the sleeve member **42** to valve pressure fluid to the bore **14** to act on the piston face **61** to drive the piston hammer forwardly on a blow-delivering stroke. Pressure fluid supplied to the interior **40** acts on the end face **70** also. As the piston hammer **62** moves forwardly the end face **70** passes the edge of the annular passage **46** after the groove **76** has moved out of communication with passage **48** and provides for flow of fluid through passages **54** and **56** to act on the piston face **63** to reverse the direction of movement of the piston hammer at the completion of a blow-delivering stroke. As the faces **61** and **63** pass the exhaust port **60** pressure fluid acting thereupon is exhausted from the bore **14**. The aforedescribed operation of the percussion tool **10** is basically well known.

By removing the backhead member **16** from the cylinder **12** the piston hammer **62** may be removed and reversibly disposed in the bore **14** so that the groove **78** cooperates with passage **48** to valve pressure fluid into the bore to act on the face **63**. The face **70** now becomes the striking surface for impacting the member **32**. This provides for a versatile arrangement in the event that one of the striking faces becomes damaged.

Moreover, the axially projecting stem portions **66** and **68** support the piston hammer **62** in the drill and no sliding engagement of the piston portion **64** with the bore **14** is required and accordingly seizing or scoring of the cylinder and piston is substantially eliminated.

The grooves **76** and **78** are proportioned in such a way that the groove **76** is in communication with the passage **48** for a shorter distance of movement of the piston hammer **62** on its forward or blow-delivering stroke and accordingly, at a given pressure, less pressure fluid, such as compressed air, is valved into the cylinder bore **14** than when the piston hammer is disposed for the groove **78** to be cooperable with the passage **48.** The grooves **76** and **78** are so proportioned that the edge of the groove **78** toward the face **72** is an axial distance *x* from the face **70** and the corresponding edge of the groove **76** is an axial distance *y* from the face **72,** as shown in FIG. **2.** The distance *x* is greater than the distance *y*.

The above described arrangement in a percussion tool may be advantageously used to satisfy various operating requirements of percussion rock drills. In a percussion rock drill the elongated drill stem components and the bit portion may limit the work rate or power that may be produced by the drill to penetrate a rock formation or the like. Accordingly, if an adequate air supply is available to operate the drill **10** at a given pressure with the groove **78** cooperable with the passage **48** and it is desired to use smaller diameter drill rods and bits the piston hammer **62** may be reversed to make the groove **76** cooperable with passage **48** whereby a lower blow frequency and work rate input to the drill rods may be obtained to avoid overheating and damage thereto. Moreover, if a maximum available quantity rate of pressure air supplied to the drill at a desired pressure is less than the amount that is consumed with the piston hammer arranged for the groove **78** to be operable, the piston hammer can be reversely arranged in the cylinder so that the groove **76** is cooperable with passage **48** and the drill will consume the lower available air quantity while maintaining the desired operating pressure and concomitant impact blow energy. In this way with a supply of compressed air being derived from a compressor using ambient inlet air the piston hammer may be arranged to use the groove **76** when operating at higher altitudes without a reduction in impact blow energy.

Another advantage of the present invention which may be enjoyed in percussion rock drills is that when the supply rate of pressure air at a predetermined pressure is not sufficient to maintain that pressure regardless of the arrangement of the piston hammer in the cylinder the piston hammer may be arranged to deliver lower impact blow energy and higher blow frequency with the groove **78** operable and a comparatively higher impact blow energy and lower blow frequency with the groove **76** cooperable with passage **48.** In this way the drill **10** may be operated for more efficient rock penetration in accordance with the known condition that hard rock formations are more easily penetrated by comparatively higher impact blow and lower blow frequency.

What is claimed is:

1. In a fluid operated percussion tool:
a housing including a cylinder bore;
a blow-receiving member disposed in said tool;
a piston hammer adapted to be reversibly disposed in said cylinder bore for reciprocation therein to deliver repeated impact blows to said member;
passage means in said tool adapted to be in communication with a fluid pressure source;
said piston hammer including first passage means cooperable with said passage means for valving pressure fluid to said cylinder bore to drive said piston hammer to impact said member, and second passage means cooperable with said passage means upon reversing said piston hammer in said cylinder bore for valving pressure fluid to said cylinder bore to drive said piston hammer to impact said member with greater frequency than when said first passage means and said passage means are cooperable.

2. The invention set forth in claim **1** wherein:
said piston hammer includes a piston portion and reduced diameter stem portions extending axially on opposite sides of said piston portion and including respective transverse end faces delimiting the axial length of said stem portions, said first passage means is disposed on one of said stem portions and said second passage means is disposed on the other of said stem portions.

3. The invention set forth in claim **2** wherein:
said tool includes a reduced diameter bore in said housing, said passage means opening into said reduced diameter bore and one or the other of said stem portions may be reciprocably disposed in said reduced diameter bore for cooperation of said respective first passage means or said second passage means with said passage means.

4. The invention set forth in claim **3** wherein:
said first passage means is disposed at an axial distance from the transverse end face delimiting said other stem portion which is less than the axial distance of said second passage means from said transverse end face delimiting said one stem portion.

5. The invention set forth in claim **4** wherein:
said first and second passage means comprise grooves disposed on the periphery of said stem portions.

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