May 27, 1969

E. A. BAILEY ETAL

3,446,294

PERCUSSION TOOL

Filed March 14, 1966

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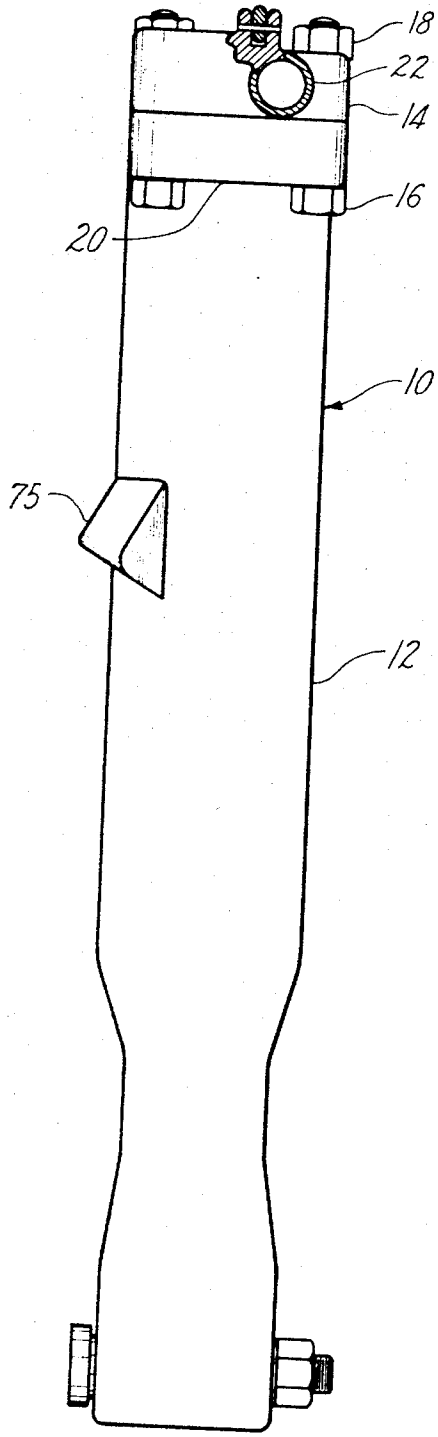
Fig. 2



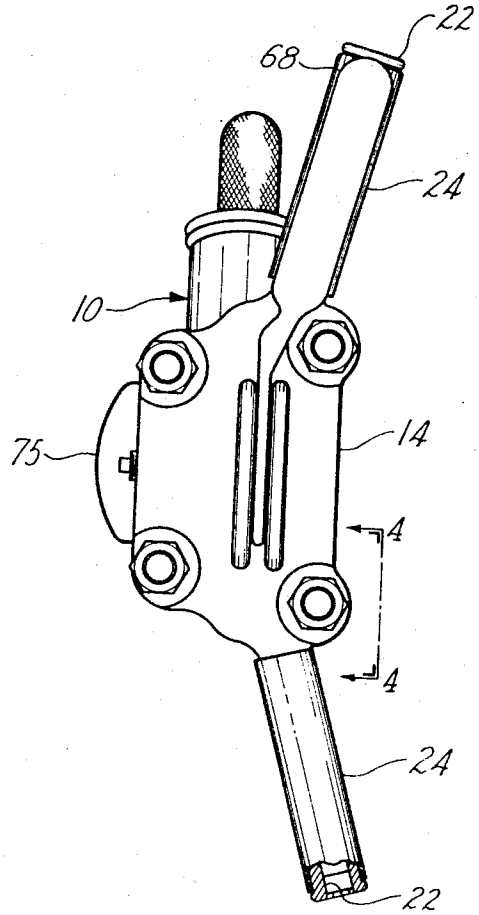


Fig. 1

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Fig. 3

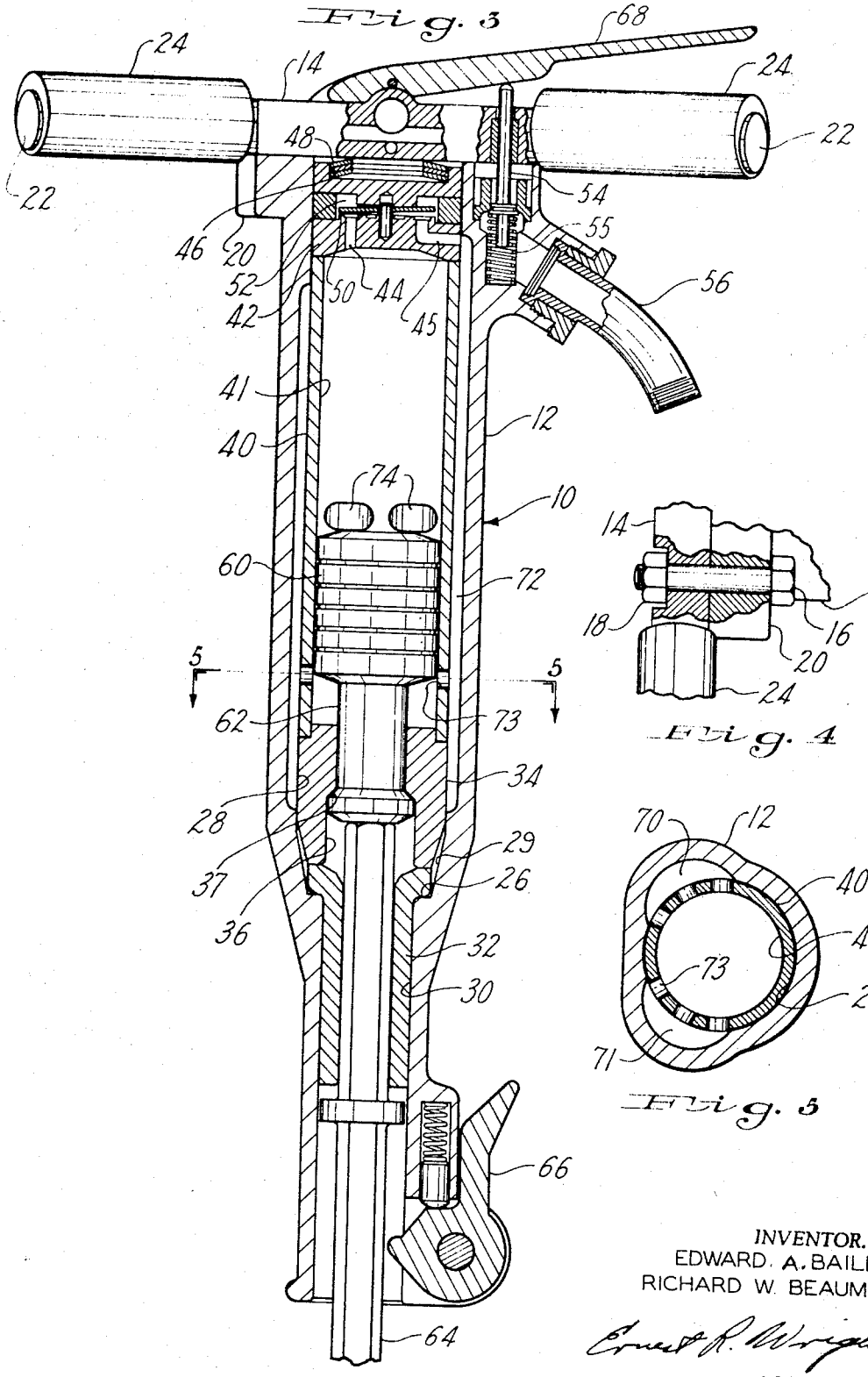

Fig. 4

Fig. 5

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PERCUSSION TOOL

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U.S. Cl. 173—138
6 Claims

This invention relates to a percussion tool and more particularly to a hand held pneumatic paving breaker, rock drill or the like.

The percussion tool of this invention is a paving breaker or a rock drill having a unitary housing of smooth outline, generally cylindrical in shape and provided with an internal sleeve to maintain the relative positioning of non-moving elements within the percussion tool. The internal sleeve is a hollow cylinder while the internal cross section of the housing has a modified trefoil shape so that the relationship of the sleeve and housing forms recompression pockets, expansion chambers and supply passages between these two elements without the necessity for intricate coring or machining encountered in producing housing for similar devices of the prior art. The internal sleeve is also provided on its interior surface with a coating or impregnation of fluoro carbon sold under the trademark Teflon or other dry lubricant to provide for non-lubricated operation of a piston within the cylindrical sleeve.

Alternatively, the exterior surface of the piston can be thus treated in place of or in addition to the coating or impregnation of the cylindrical sleeve.

The percussion tool of this invention is further provided with outwardly extending handles so positioned relative to each other and relative to the axis of the tool as to provide an improved control of the positioning of the device relative to the ground. It is to be particularly noted that the handles of this device are not coaxial but rather have axes forming an obtuse angle lying in a plane normal to the axis of the tool and extending outwardly and backwardly from the axis of the tool toward the operator to provide leverage for improved positioning control and to translate a forward and downward push from the operator into the desired straight down force needed for most efficient operation of the device.

FIG. 1 is a top plan view of a paving breaker constructed according to the principles of this invention;

FIG. 2 is a side elevational view, partially in section of the paving breaker of FIG. 1;

FIG. 3 is a generally sectional view of the paving breaker of FIG. 1 taken substantially on the longitudinal axis of the paving breaker;

FIG. 4 is a partially sectional fragmentary view taken substantially along the line 4—4 of FIG. 1;

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 3.

In FIGS. 1 and 2 there is shown a paving breaker constructed according to the principles of this invention and generally indicated at **10** comprising an elongated, generally cylindrical one piece housing member **12** with a laterally extending head portion **20** at the upper end. A head member **14** is mated to the head portion **20** and rigidly removably secured thereto by retaining means such as the nuts **18** and through bolts **16** extending through mated bores in the head member **14** and the head portion **20** of the housing **12** (see FIG. 4).

The head member **14** completely covers the top end of the housing **12** including the head portion **20** and is in turn provided with elongated tubular members **22** still

further laterally extended and provided with resilient covering elements or grips **24** to provide handles for holding the machine in position during operation. It is to be noted that the longitudinal axes of the tubular elements **22** form an obtuse angle lying in a plane normal to the axis of the housing **12** with the tubular elements **22** slanting backwardly (to the right as viewed in FIG. 1) and the axes intersecting at a point somewhat to the rear of the axis of the housing **12**. It is further to be noted that the point of the intersection of the axes of the tubular members **22** is not necessarily to the rear of the axis of the housing **12** but that the grip portions **24** must be to the rear of the axis of the housing **12** to apply the principles of this invention and that the plane of these axes is not necessarily normal to the housing axis.

With the grips **24** positioned as above described, a downward force applied to the handles by the operator of the device will have a backward component tending to rotate the upper end of the machine toward the operator. This backward component is readily overcome by the operator leaning forward slightly and applying his force in a forward as well as a downward direction which is easier to do than applying a force straight downward from an operator position at the rear of the machine as is necessary in paving breakers of the prior art. Furthermore, when the machine is lifted by grasping the handles the positioning of the handles back of the center line of the housing **12** will cause the bottom end of the housing **12** to swing toward the operator into a new position nearer the operator as desired for a subsequent cut by the paving breaker.

As seen in FIGS. 3 and 5 the housing **12** is hollow and internally has a modified trefoil cross section with an axial body cavity **28** having an interior surface formed in part by portions of 3 intersecting cylindrical surfaces having parallel axes, wherein two circumferentially spaced portions of said surface have respective cross sections which are portions of a common circle. Progressing downwardly from the second line 5—5 on which FIGURE 5 was taken the interior of the housing member **12** becomes an inwardly stepped axial cylindrical bore **29** wherein a shoulder portion **26** communicates between the main bore portion **29** and a smaller bore portion **30**. Within the small bore portion **30** there is positioned a hollow cylindrical chuck bushing **32** having a radially enlarged portion seated on the shoulder **26** and pressed in or secured in place by downward pressure from an anvil block seat **34** having a stepped cylindrical bore **36** with a downwardly facing shoulder **37** for a purpose to be described.

Within the body cavity **28** and mated to the portions having common circle cross sections is positioned an elongated hollow cylindrical sleeve or liner **40**, preferably made of steel and having at least its inner surface **41** thoroughly impregnated or thinly coated with a low friction or dry lubricant material such as Teflon or the like so that the device of this invention can be operated without lubrication being supplied to the inner surface **41** or the liner **40**.

Within the upper end of the body cavity **28** and abutting the upper end of the liner **40** is a valve cage assembly **42** of generally cylindrical form and provided with suitable passageways **44** and **45** communicating with the upper and lower portions of the cylindrical space within the liner **40**. The upper surface of the valve cage assembly **42** is spaced slightly downwardly from the bottom surface of the head member **14** and is provided with a large shallow blind bore **46** in which is positioned a plurality of spring members such as Belleville washers **48** heavily pre-loaded by drawing the head member **14**

downwardly upon the top surface of the housing member by tightening the nuts **18** on the through bolts **16** so that the washers **48** bias the valve cage assembly **42** against the liner **40** which is in turn forced against the block seat **34** to hold the chuck bushing **32** solidly against the shoulder **26** thus providing for rigid assembly of the non-moving parts of the paving breaker **10** by the use of a few relatively short bolts having their lower-most headed portions so high up on the machine and so near the handles that any interference with the clothing of an operator is nearly impossible.

Within the valve cage assembly **42** there is provided a suitable valve mechanism such as a tipping valve **50** which alternately establishes communication of supply passages **44** and **45**, respectively, with another passageway **52** which in turn communicates by way of a control valve **54** with a supply member **56** such as a flexible hose suitably connected to a source of compressed air or other pressure fluid (not shown) to provide energy for the operation of the paving breaker in a manner well known in the art.

Fitted to the inner surface **41** is a cylindrical hammer piston **60** slidably received by the inner surface **41** so that on the downward strokes it delivers impacts against an anvil block **62** slidably positioned within the stepped bore **36** and having an enlarged head portion engageable alternately with the shoulder **37** and the upper end of the chuck bushing **32** to prevent the end of the block **62** from moving too far in on either direction.

It is to be noted that the surface of the piston **60** may be coated or impregnated with dry lubricant in addition to or instead of the liner **40**. An elongated tool **64** received by the chuck bushing **32** extends from a working surface (not shown) through the chuck bushing **32** into contact with the end of block **62** to receive the impact from the piston **60** and transfer it to the working surface in a manner well known in the art. Any suitable mechanism such as that shown at **66** may be used to prevent the tool **64** from dropping out of the paving breaker when the device is lifted out of contact with the working surface.

Suitably, pivotally mounted upon the top of the head member **14** is an elongated lever **68** extending out to the right as seen in FIG. 3 and engaging the top end of an elongated portion of the control valve **54** so that when the lever **68** is depressed, the valve **54** is opened against a valve closing spring **55** which in the absence of such downward pressure maintains valve **54** in the normal closed position. The lever **68** is generally parallel to and overlying the right hand grip **24** as seen in FIG. 3 so that it can be grasped with the same hand and at the same time as the hand grip **24** is engaged by the operator's hand.

As seen in FIG. 5 the relationship of the cylindrical outline of the liner **40** to the modified trefoil section of the body cavity **28** forms recompression pockets **70**, expansion chambers **71** and supply passage such as elongated passage **72** (see FIG. 3) entending from the valve cage assembly **42** along the outer surface of the liner **40** to a plurality of front supply ports **73** communicating between the pockets **70**, chambers **71** or passage **72** and the front end of the cylinder.

Intermediate the axial length of the liner **40** and the housing member **12** respectively, there has been provided a pair of exhaust ports **74** communicating between the cylinder and the outer atmosphere by way of an exhaust shield **75** extending outwardly and downwardly from the forward intermediate portion of the housing member **12**, spaced outwardly from the exhaust ports **74** but overlying those ports to prevent objects and unwanted matter from entering the cylinder and to direct the exhaust gases downwardly along the body member **12** in a well known manner.

It is to be noted that some of the advantages resident in the paving breaker **10** over similar devices of the prior art are provided by the handles **24** being at an angle to each other resulting in improved control of the position of the paving breaker **10** in that leverage is provided so that by tipping of the operator's hands the machine position can be varied, rather than by twisting on the grips as is necessary with handles aligned on the same axis; further, the positioning of the grips **24** on the side of the machine axis toward the operator provides that a forward and downward push by the operator will be translated by the handle positioning into a straight downward push on the tool; the backward sweep of the handles also keeps the operator farther from the machine to help prevent interference between the operator's clothing and the exterior of the machine.

Other such advantages of the device of this invention reside in the use of a unitary housing of smooth outline with no protuberances to catch on the operator's clothing at any point below the head portion **20** of the body member **12** at a level so near the handles as to prevent interference with the operator's clothing. The use of the unitary housing is made possible by the liner **40** which holds the anvil block seat **34** and chuck bushing **32** together in the lower end of the housing **12**, again without the necessity for external flanges as found in machines of the prior art. The use of liner **40** also makes it possible to have a cylinder surface covered with a thin coating of anti-friction material such as Teflon, molybdenum sulfide, molybdenum disilicide or the like baked on the surface under pressure to provide for non-lubricated operation of the piston with the advantages of less servicing required, no smoking of the exhaust, less likelihood of scoring the piston because of lubrication failure, easier starting in cool weather and reduced cost of operation since oil need not be supplied to the cylinder.

A preferred embodiment of this invention having been hereinabove described and illustrated it is to be recognized that other embodiments of the principles of this invention are envisioned. It is therefore respectfully requested that the claims appended hereto be interperted as broadly as possible, limited only by the prior art.

What is claimed is:

1. In a hand held percussion tool of the type which comprises an elongated body portion with a through body cavity therein having an elongated hollow cylindrical sleeve insertable from one end thereof, said sleeve forming a cylinder wherein a piston is supported and guided for reciprocal motion therein, the improvement comprising: said sleeve having at least the inner surface thereof treated with a friction reducing solid material having a lower coefficient of friction with respect to said piston than the coefficient of friction of the material of said sleeve with respect to said piston.

2. A hand held tool as specified in claim **1** wherein said friction reducing solid material is chosen from the group consisting of fluorocarbons, molybdenum sulfides and molybdenum disilicides.

3. A hand held tool as specified in claim **2** wherein said piston member has an exterior surface treated with said friction reducing solid material.

4. In a hand held percussive tool wherein a piston is reciprocable within an elongate body and said piston is adapted to impact on an elongate tool extending longitudinally outwardly from one end of said body with handle means at the other end of said body, the improvement comprising; said handle means having a pair of oppositely disposed elongated portions extending laterally beyond the outline of said body and with said handle portions constituting in part the sides of an obtuse angle lying in a plane substantially normal to the longitudinal axis of said body with the apex of said obtuse angle lying in a plane containing said longitudinal axis and bisecting said obtuse angle.

5. In a hand held percussive tool as specified in claim **4** the further improvement wherein there is a laterally outward extending head portion at said other end of said body, and said body is of one piece construction from said one end through said head portion at said other end.

6. In a hand held percussion tool of the type which comprises an elongated generally cylindrical body portion with a partially cylindrical through body cavity therein having an elongated hollow cylindrical sleeve insertable from one end thereof, said sleeve forming a cylinder wherein a piston is supported and guided for reciprocal motion therein, the improvement comprising: said sleeve having at least the inner surface thereof treated with a friction reducing solid material having a lower coefficient of friction with respect to said piston than the coefficient of friction of the material of said sleeve with respect to said piston and said piston member having at least the exterior surface treated with said friction reducing solid material.

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