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[54] **HAMMER DRILL**

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[51] **Int. Cl.**[2] **B23B 45/00**; B25D 11/00

[58] **Field of Search** ..... 173/109, 116, 118, 105, 173/DIG. 3; 74/467, 468, 606 R

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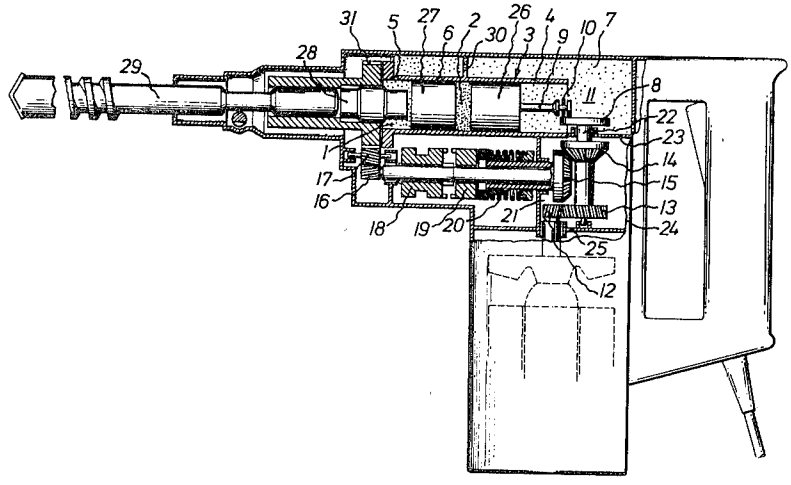
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[57] **ABSTRACT**

A hammer drill has a drive motor; a gearing driven by the drive motor; a first chamber for accommodating the gearing; a cylinder defining an inner cylinder chamber; a work piston disposed in the cylinder chamber and connected with the gearing for effecting a reciprocation thereof in the cylinder; a striker body freely slidable in the cylinder chamber and driven by the work piston; a spindle sleeve connected to the gearing to be rotated by the latter; a tool bit inserted in the spindle sleeve and operatively connected with the striker body; a second chamber adjoining the first chamber and at least partially surrounding the cylinder; and ports in the cylinder for maintaining communication between the cylinder chamber and the second chamber. The cylinder chamber and the second chamber are isolated from the first chamber in a lubricant-tight manner.

8 Claims, 2 Drawing Figures



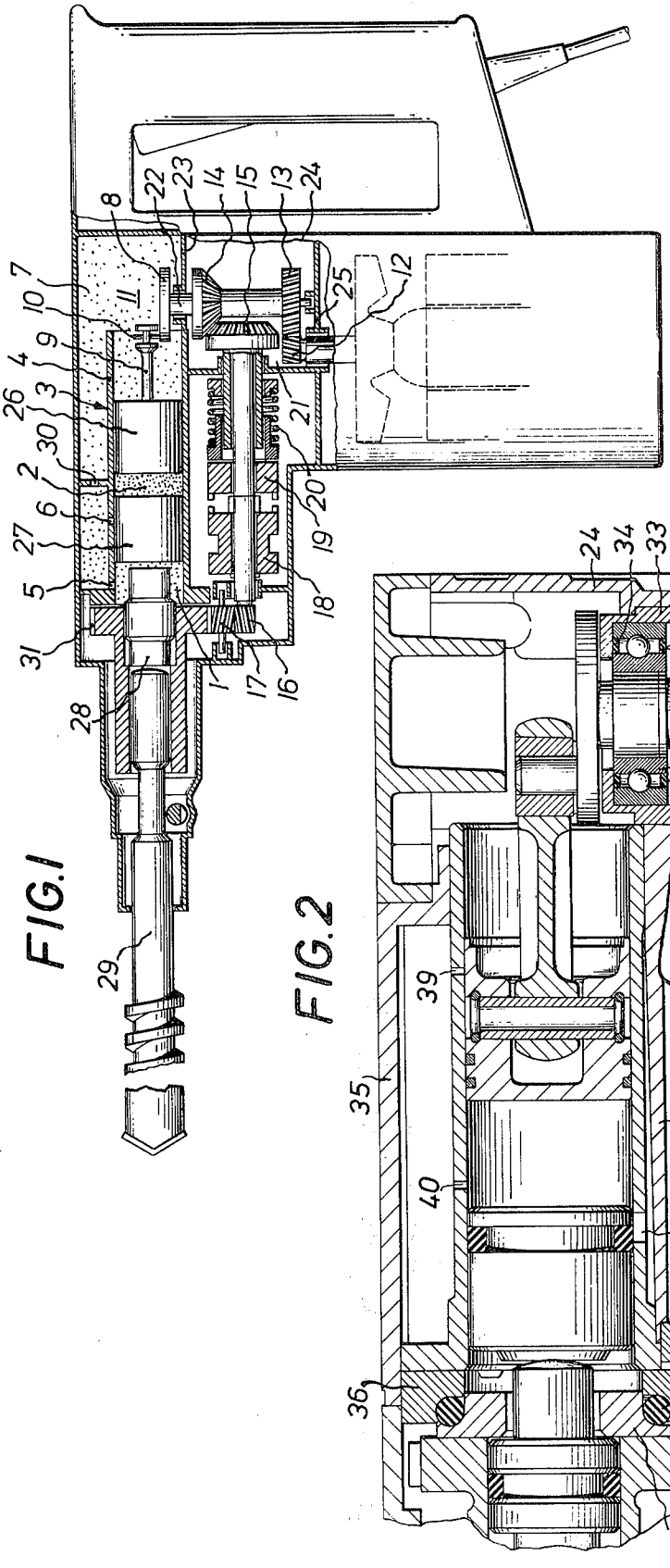

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FIG. 1

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FIG. 2

HAMMER DRILL

BACKGROUND OF THE INVENTION

This invention relates to a hammer drill of the type that includes a striker body which works as a freely movable shuttle piston and which is disposed in a cylinder which, in turn, communicates through ports with a chamber that at least partially surrounds a cylinder and that is situated in the hammer housing. The striker body is caused to reciprocate by a work piston which is actuated by a drive motor through a gearing disposed in a gearing chamber and a crank which, in turn, is situated in the chamber (crank chamber) that surrounds the cylinder. The work piston acts on the striker body through an interposed air cushion. The striker body is connected directly or indirectly with a tool bit which is inserted into a spindle sleeve rotated by the gearing.

Known pneumatic hammer drills of the above-outlined type are disadvantageous in that the gearing chamber, the crank chamber and also the cylinder chamber constitute a unit with regard to the lubricant which is capable of passing practically unhindered through all these spaces in a more or less defined circular flow cycle. As a result, fragments due to the wear of the gearing and possibly also the clutch mechanism may be introduced into the traveling path of the piston and thus, among other drawbacks, cause a premature wear. Further, in lubricating arrangements of this type, a sufficiently uniform distribution of the lubricant to critical lubricating points is not ensured with sufficient reliability for a longer period of time so that regular maintainance (such as resupply of lubricant, etc.) is necessary. Such prior art structures are disclosed for example, in German Laid Open Application (Offenlegungsschrift) No. 1,964,083 or German Published Pat. Application (Auslegeschrift) No. 1,628,056.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an electrically driven hammer drill which, compared to hammer drills of the prior art, is more advantageous with regard to maintainance, efficiency of lubrication, structural dimensions and manufacturing costs.

These objects and others to become apparent as the specification progresses, are accomplished by the invention, according to which, briefly stated, the housing chamber which at least partially surrounds the cylinder and the chamber of the cylinder are separated in a lubricant-tight manner from the housing chamber that accommodates the drive mechanisms.

The above-outlined separation of the lubricant zones may be effected in a simple manner by surrounding the crank drive shaft in the zone of the crank which, for example, may constitute the drive for the work piston, by a barrier which seals the space surrounding the cylinder and accommodating the crank from the housing chamber accommodating the gearing. The housing chamber which is disposed below the cylinder is separated in a lubricanttight manner from the cylinder chamber and from the space surrounding the same, by the cylinder wall in cooperation with the spindle sleeve.

BRIEF DESCRIPTION OF THE DRAWING

The FIGS. **1** and **2** illustrate a preferred embodiment of the invention in schematic longitudinal sections.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to the FIGS. the chambers **1** and **2** of a cylinder generally indicated at **3** are, by virtue of ports **5** and **6** provided in the cylinder wall, in communication with the chamber **7** which at least partially surrounds the cylinder **3** and into which extends a crank **8** having a crank pin **10** connected to a piston rod **9.** The lubricant **11** present in the cylinder chambers **1** and **2** and in the chamber **7** is separated from a chamber **21** (containing the drive mechanisms such as a pinion **12,** a spur gear **13** meshing with the pinion **12,** meshing bevel gears **14, 15,** a pinion **16,** a spur gear **17** meshing with the pinion **16** and driving a spindle sleeve **31** as well as clutch components **18, 19** and **20**) by means of a barrier **23** which is expediently constituted by a bearing assembly for the drive shaft **22.** The bearing assembly **23** includes the bearing support, the bearing proper and bearing components such as protective covers and the like.

As shown in FIG. **2,** the barrier **23** consists of a tight bearing **32** located in a bush **33** which is built in tight fitting in the drive housing **24.** The bearing **32** is packed in well known manner by means of gaskets **34.**

A further isolation of the chamber **21** from the space **7** is effected either by the cylinder wall **4** proper, or by a casing or the like enclosing the cylinder **3,** in conjunction with the sleevelike spindle sleeve **31** which is arranged adjacent to and in axial alignment with the cylinder **3** and which rotatable by the gearing accommodated in the housing chamber **21.** The drive housing **24** and the motor bearing shield **25** oriented towards the gearing constitute a structural unit. This measure has been found to be particularly economical.

A periodic lubricating cycle is ensured by the fact that during the return stroke of the work piston **26** air and thus also lubricant are drawn into the cylinder chambers **1** and **2** through the ports **5** and **6.** The flow rate of the air-lubricant mixture introduced into the chamber **1** may be controlled by additional measures such as a throttle gate **30** disposed between the cylinder chamber **2** and the housing chamber **7.** In this manner it is possible to affect the course of movement of the striker body and thus control the impact force.

FIG. **2** illustrates a casing enclosing the cylinder **3** more in detail.

The casing is embodied by the housing **35,** the centre-disk **36,** the starting-disk **37,** and the O-shaped ring seal **38.** The vent ports are denoted by **39, 40** and **41.** During the forward stroke of the work piston **26** and the striker body **27** there is generated at the drive side of the cylinder a vacuum which causes a flow resulting in lubricant particles to be admitted to the rear cylinder zone. This vacuum is aided by the displacement of air in the zone between the striker body **27** and the hammer pin **28.**

The lubricant-tight separation of the housing chamber **7** from the drive chamber **21** makes possible the use of different types of lubricants. Thus, the most effective lubricant may be used for the piston and cylinder system on the one hand, and for the drive mechanism on the other hand.

In order to prevent an escape of the lubricant from the cylinder chamber **1** in the direction of the tool bit **29,** between the spindle sleeve **31** and the tool shaft a seal may be provided. Such seal is constituted in the illustrated embodiment by the hammer pin **28.**

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

We claim:

1. In a hammer drill having a drive motor; a gearing driven by the drive motor; housing means defining a first chamber for accommodating the gearing; a cylinder defining an inner cylinder chamber; a work piston disposed in the cylinder chamber and connected with the gearing for effecting a reciprocation thereof in the cylinder; a striker body freely slidable in the cylinder chamber and driven by the work piston; a spindle sleeve connected to the gearing to be rotated thereby; a tool bit inserted in the spindle sleeve and operatively connected with the striker body; housing means defining a second chamber adjoining the first chamber and at least partially surrounding the cylinder; and means defining ports in the cylinder for maintaining communication between the cylinder chamber and the second chamber; the improvement comprising means for maintaining a permanent, lubricant-tight isolation of said second chamber and said cylinder chamber from said first chamber.

2. A hammer drill as defined in claim **1,** said cylinder being formed by a cylinder wall; further including a crank shaft connecting said gearing with said work cylinder and extending from said first chamber into said second chamber; and a bearing assembly supporting said crank shaft, said bearing assembly and said

cylinder wall together constituting said means for said lubricant-tight isolation.

3. A hammer drill as defined in claim **1,** including a crank shaft connecting said gearing with said work piston and extending from said first chamber into said second chamber; a casing enclosing said cylinder; and a bearing assembly supporting said crank shaft, said bearing assembly and said casing together constituting said means for said lubricant-tight isolation.

4. A hammer drill as defined in claim **1,** including a seal disposed and effective between said tool bit and said cylinder chamber.

5. A hammer drill as defined in claim **4,** including a hammer pin disposed between said tool bit and said striker body, said hammer pin constituting said seal disposed and effective between said tool bit and said cylinder chamber.

6. A hammer drill as defined in claim **1,** including control means for regulating the admission of air or an air-lubricant mixture through said ports into said cylinder chamber.

7. A hammer drill as defined in claim **6,** wherein said control means includes a throttle gate disposed between said second chamber and said cylinder chamber.

8. A hammer drill as defined in claim **1,** said housing means defining said first chamber including a gearing housing; further comprising a bearing shield for said motor; said gearing housing and said bearing shield constituting a structural unit.

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