

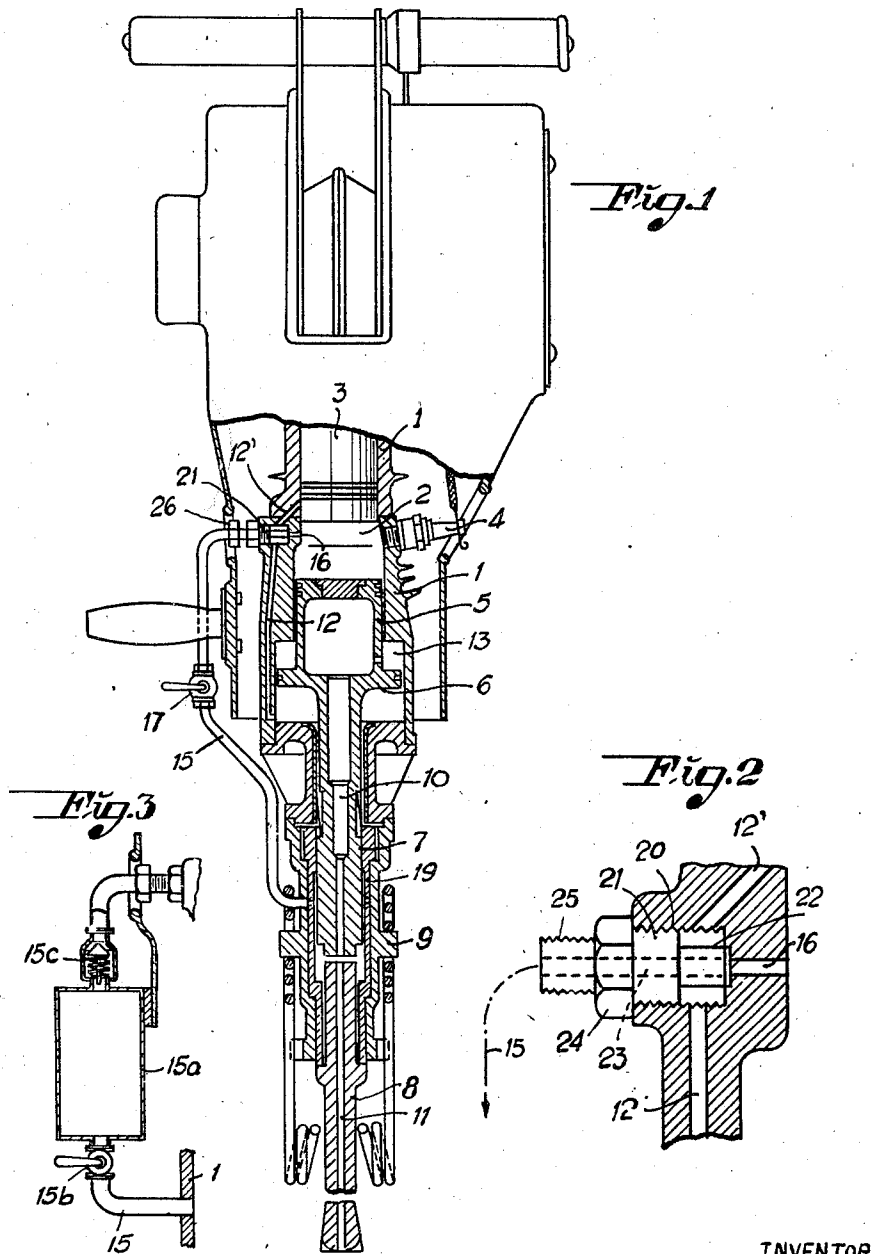
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G. A. BERGMAN

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INTERNAL-COMBUSTION HAMMER

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INVENTOR

Gustav Albert Bergman
by
Pierce & Scheffler
his ATTORNEYS

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INTERNAL-COMBUSTION HAMMER

Gustav Albert Bergman, Stockholm, Sweden

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The present invention relates to improvements in internal combustion hammers of the type used for rock drilling and having an internal combustion engine mounted in the drill machine. In previously known machines of this type gases from the engine are conveyed through a conduit to a longitudinal bore provided in the drill. The primary purpose of the present invention is to arrange this conduit and elements combined therewith so as to insure a more efficient clean blowing of the hole being drilled than in internal combustion hammers heretofore used.

Primarily, the invention is characterized by the fact that the conduit conveying the gases to the drill bore comprises a shut-off valve and extends from a range in the engine cylinder in which the maximum pressure or approximately the maximum pressure prevails during the expansion stroke, and that the conduit is connected to the longitudinal bore of the drill so as to bypass certain parts of the drill operating mechanism.

As a result of said arrangement it is possible to convey to the drill hole, by way of the longitudinal bore in the drill, a pressure of such a strength as to cause the drilled hole to be efficiently blown clean from drill dust which is formed at the bottom of the hole during the drilling operation. Usually, this fine rock dust lies as a cushion at the bottom of the hole and prevents the drill from penetrating into the rock. As a consequence of said fine dust it has been impossible heretofore to penetrate into the rock to a greater depth than 2 meters by continuous operation of drill machines of the type referred to. By supplying the pressure intended for the clean blowing from the range of the engine cylinder where the maximum pressure prevails during the expansion stroke a very efficient clean blowing of the hole being drilled may be effected. Tests have shown that it is possible to drill holes to a depth substantially exceeding 3 meters and up to 4 meters or more without interrupting the drilling operation, which has heretofore been considered impossible by employing my novel clean flowing apparatus.

The generation of the clean blowing pressure requires a relatively large quantity of gas, and therefore the clean blowing cannot occur continuously during the drilling but must be effected at intervals and during such short periods that the internal operation of the engine will not be disturbed essentially or the engine be stopped. The control of the clean blowing operation may simply be effected by a manually operated valve

normally held closed as a valve shut by a spring, which is opened by pressing the hand against a lever, knob or other operating member. The valve should therefore be easily available to the operator during the drilling operation. The valve may be opened during a short interval of time but the intervals should be of such a length and so spaced apart as to keep the engine running and allow the engine to run a plurality of revolutions between intervals. As an alternative a receiver may be coupled to the conduit, said receiver accumulating the gas under pressure from the engine cylinder from which the gas is delivered to the receiver in successive small portions. Advantageously said receiver may be provided with an automatically acting outlet valve which is opened either under control of the pressure in the receiver or under the control of a mechanism operating with the engine shaft or other movable member of the engine. At the inlet side of the engine there should be a non-return valve which opens towards the receiver. Also in the conduit before and/or after the stop valve it may be advantageous to use such a non-return valve.

The invention is more particularly described hereinbelow with reference to the accompanying drawing showing an embodiment by way of example.

Figure 1 is a front elevation partly in section of a rock drill hammer of the type which may be easily held by the operator during the drilling operation.

Figure 2 is a sectional view illustrating a detail on an enlarged scale.

Fig. 3 is a sectional view illustrating a detail of a modification of the hammer of Fig. 1.

In the drawing 1 designates the cylinder casting of the combustion engine forming part of the drill machine. The combustion engine may be a two stroke motor or may be constructed as a four stroke motor. 2 is the cylinder chamber, 3 is the engine piston and 4 is a spark plug. In the embodiment illustrated in the drawing the cylinder head is formed by an auxiliary piston 5 movable in an auxiliary cylinder and constructed as a differential piston (a piston having two different pressure surfaces of different sizes), 6 being the larger piston area. During the expansion stroke the auxiliary piston 5 is forced downward and its piston rod 7 will engage the drill 8. At the range where the piston rod 7 and the drill 8 encounter each other there is a space 9 within the drill guide 9, said space containing certain means for rotating the drill, such means being

well-known per se. This piston rod 7 as well as the drill 8 contain longitudinal passages or bores 10 and 11 respectively. The known device has a passage 12, 12' connecting the space below the differential piston 5, 6 with the cylinder chamber 2 at a portion of the latter where the pressure during the expansion stroke has had time to decrease substantially. This pressure is utilized to return the auxiliary piston 5, 6 to its initial position during the operation and to compress the air in an air cushion existing therein. This compressed air is conveyed through the longitudinal conduits 10 and 11 downward into the drill hole to blow it clean during the drilling and to cool the impact members. The pressure fluid introduced into the space below the piston head 6 from the motor cylinder can be discharged downwards within the drill holder or guide 9. At this instant, however, the pressure has already been utilized to the greatest degree for moving the piston and is decreased to such an extent that it is of no importance for the clean blowing and in any case has no greater effect than the clean blowing described above by the aid of the air cushion in the space 13, which, as mentioned above, is insufficient to keep the hole being drilled so free from rock dust as to allow the production of holes of a greater depth than about 1 meter in continuous drilling.

A conduit 15 is extended from a bore 16 in the wall of the cylinder and situated within the range of the cylinder in which the pressure is maximum or substantially maximum during the expansion stroke. Coupled into the conduit is a stop valve 17 and the conduit opens through the wall of the drill guide 9 into the above mentioned space 19 through which the pressure is transmitted to the bore 11 in the drill 8. Further the pressure comes from a range of the cylinder in which it is higher than at the range in which the passage 12, 12' opens into the cylinder. The pressure transmitted by the conduit 15 thus is not only higher per se than the pressure in the passage 12 but avoids also a further pressure decreasing use such as that to which the fluid conveyed through the passage 12 is subjected for the purpose of returning the auxiliary piston 5, 6. The conduit 15 should have a relatively great passage area so that the pressure from the substantially equally great passage 16 may be transmitted to the space 10 and further to the drill without essential losses. When opening the manually controlled valve 17 an essential discharge of the cylinder 2 will thus occur so that with a long opening time of the valve 17 the operation of the engine would be interfered with or stopped. Thus the valve should have a short opening time but during this short opening time of the valve 17 the hole being drilled will be very efficiently blown clean. The passage area of the passage 16 and/or the conduit 15 should have a diameter falling between 4 and 5 mm. Possibly the passage 16 may have a greater diameter than 5 mm. to prevent stoppage but in such case the conduit 15 should have said limited passage area.

Though, of course, the invention may be applied also to drill machines of other type than that hereinbefore described, it is particularly advantageous in combination with this particular air blowing device which among other things provides that the air fed from the air cushion 13 efficiently cools the operating members and prevents return suction from the drilled hole to the conduit 15.

Figure 2 illustrates on an enlarged scale the

connection between the conduit 15 and the motor cylinder. For the purpose in view there is utilized in the example illustrated a threaded bore 20 which is already provided in the well-known engines described above and to which the branches 12 and 12' in the conduit between the motor cylinder and the cylinder of the auxiliary piston 5, 6 are connected. In order to obtain connection between the conduit 15 and the passage 16 a plug 21 screwed into the bore 20 is provided with an extension 22 having an enlarged diameter and a tight engagement with the mouth of the passage 16 in the bottom of the bore 20, said engagement being suitably effected by way of a packing ring therein. The plug is provided with a hexagon portion 24, and this has a threaded extension 25 for the connection of a coupling nut 26 (Figure 1) by which the conduit 15 is connected to the plug. The passage portions 12 and 12' communicate with each other in the space below the plug 21 and around the extension thereon.

In cases where the threaded bore 20 is already present in the type of machine in question the improved clean blowing may be obtained simply by connecting a tube such as 15 having a valve, and a plug as illustrated in Figure 2. The device may thus be easily mounted in existing drill machines.

The modification illustrated in Figure 3 differs from that of Fig. 1 by the fact that a receiver 15a is mounted in the conduit 15, a shut-off valve 15b, similar to valve 17, is situated after said receiver and a non-return valve 15c opens towards the receiver 15a, in advance of the receiver as counted in the direction of flow of the gases from the internal combustion engine. The receiver serves to accumulate gas under pressure from the engine cylinder and to deliver the gas by way of the valve 15b which may be opened manually or by the pressure in the receiver or under the control of a mechanism operated by the shaft of the engine.

What I claim is:

1. An internal combustion hammer comprising an internal combustion engine cylinder and a piston therein, an auxiliary cylinder communicating at its end with the engine cylinder, a piston in the auxiliary cylinder, a bored drill steel positioned to receive impacts from said latter piston, a conduit passing by the auxiliary piston and connecting a point of the engine cylinder at which substantially maximum pressure prevails during the expansion stroke of the piston with the bore of said drill steel, and a valve in said conduit to control the flow of gases therethrough.

2. An internal combustion hammer as claimed in claim 1, in which the valve mounted in the conduit is manually controllable.

3. An internal combustion hammer as claimed in claim 1, in which the conduit includes a receiver in which the pressure admitted from the engine cylinder is accumulated, and in which said valve controls the outlet of the receiver.

4. An internal combustion hammer as claimed in claim 1, in which the conduit includes a non-return valve closing towards the engine cylinder.

5. An internal combustion hammer comprising a bored drill steel, a main combustion cylinder, a main piston in said main cylinder, an auxiliary cylinder, a differential piston in said auxiliary cylinder, a piston rod on said auxiliary piston adapted to actuate the drill steel, a first bore in the wall of said main cylinder communicating therewith at a point removed from the zone of

maximum pressure during the expansion stroke of the main piston, a second bore in the wall of said main cylinder communicating therewith at the zone of maximum pressure during the expansion stroke, a third bore in the wall of said main cylinder communicating with said first and second bores, a plug in said second bore having an opening therethrough, a conduit connecting said opening directly with the bored drill steel, a sec-

ond conduit communicating with said third bore and with said auxiliary cylinder on the side of said auxiliary piston remote from said combustion cylinder and a space between said plug and the wall of said second bore establishing communication between said first bore and said third conduit.

GUSTAV ALBERT BERGMAN.