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MACHINE FOR DEVELOPMENT OF POWER IN A CERTAIN DIRECTION

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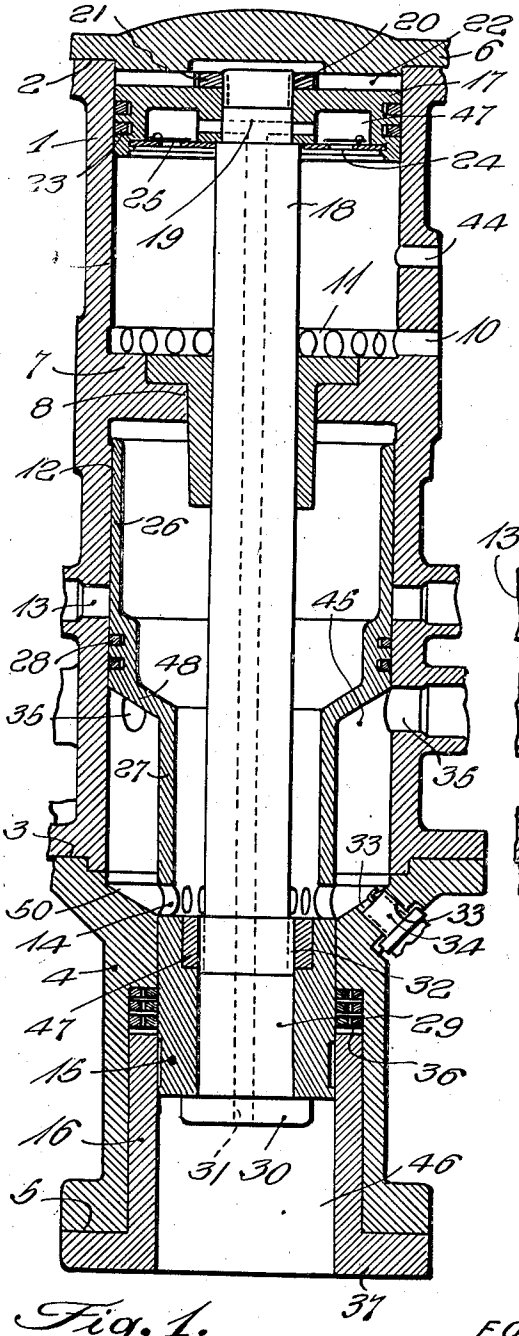
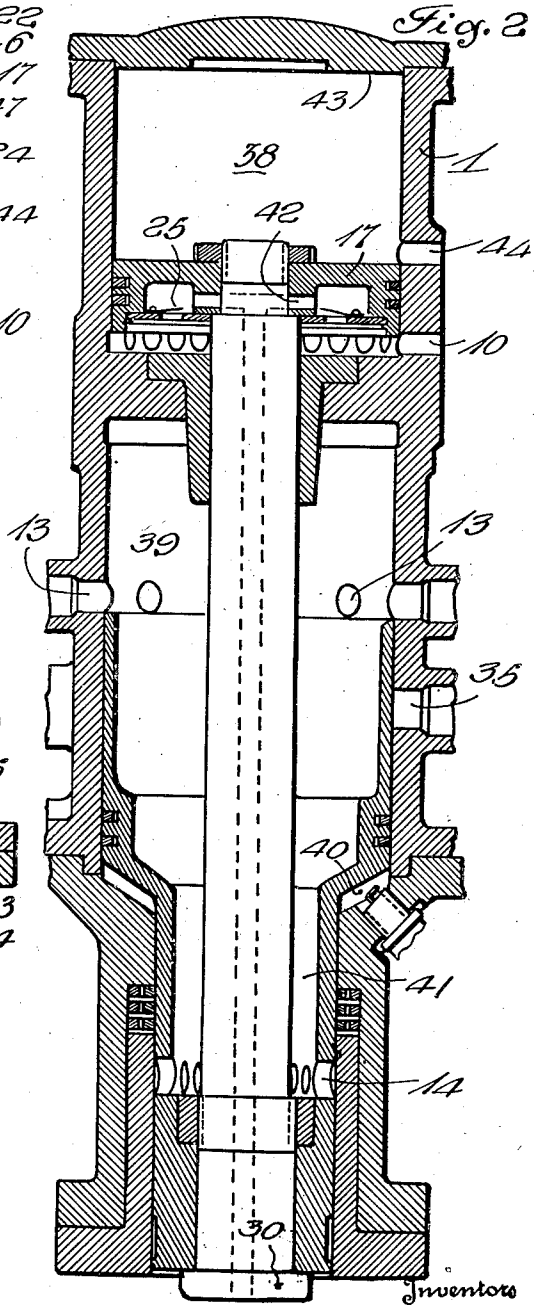


Fig. 1.

Fig. 2.



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MACHINE FOR DEVELOPMENT OF POWER IN A CERTAIN DIRECTION

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1 Claim. (Cl. 123—7)

For the development of power in a certain direction, for instance for rock-boring machines, hammers, mortising machines and riveting machines, use has been made of internal combustion motors having an auxiliary cylinder with different diameters, in which is arranged a mechanically free piston with corresponding different diameters, said piston being arranged, in turn, to actuate a tool or the like during the explosion stroke of the piston, which is returned on having performed its operative stroke. A contrivance of this type absorbs considerable power from the combustion stroke, inasmuch as a large portion of the gas pressure in the cylinder must be used for returning the piston after the blow against the tool has been delivered. Hereby the gas pressure is caused to fall further, and large quantities of the pressure energy are lost by the fact that the gas is severely cooled when passing through channels and pipe conduits, by reason of which a machine constructed on said principle must operate with a large consumption of fuel.

The above stated drawbacks may be entirely eliminated by the present invention, according to which the internal combustion motor operates with a single movable member and in accordance with the two-stroke-cycle principle, the whole of the combustion stroke being then adequately utilized.

The invention may be distinguished so that a machine or the like for the development of power in a certain direction—for instance for portable rock-boring machines—is constructed as an internal combustion motor without crank motion, the power in a certain direction—the beating effect—being produced by the fact that the piston, on having been actuated by the combustion pressure in a direction opposed to the direction of said power, is caused to rebound on having been thrown against a gas or air cushion or some other device acting in a similar manner, such as a spring device.

Secondary features characteristic of the invention will appear from the following description and the annexed drawing, in which Figs. 1 and 2 are sectional views showing the motor parts in different positions of operation.

In the drawing, the invention is exemplified in a portable beating tool adapted for rock-boring or riveting, for example. In the drawing, 1 designates a cylindrical housing provided with two chambers, an upper chamber 38 and a lower chamber 39, which are separated by a partition 7, said housing forming at the top a compression cylinder for air and at the bottom a two-stroke-cycle-motor cylinder. The upper chamber 38 is covered by a cover 6 which tightens against the upper portion of the housing 1 on a surface 2. The lower chamber 39 of the housing 1 is connected along a tightening surface 3 to a lower portion 4 provided with a cylindrical chamber 46, said portion being provided with a cylindrical insertion 16 which is bored to the same diameter as that of the portion 4. The insertion 16 tightens against the housing 1 along a surface 5 in the lowermost portion thereof and by means of inwardly resilient tightening rings 36 along the cylinder surface. Thus the portions 4 and 16 together form a cylindrical guide-way with the cylindrical chamber 46. The lowermost portion of the part 4 forms the bearing surface of the beating tool.

Inserted into the part 7 is a bearing bushing 8 having the piston spindle 18 running therethrough. The air piston 17 is arranged in the chamber 38 at the uppermost portion of the spindle 18, said air piston being provided with valve openings 24 and valves 25 on the lower side thereof, which valves open upwardly into a chamber 47 provided in the piston 17, said chamber communicating in turn with an inner channel 31 in the spindle 18 through openings 42.

The piston 17 is adapted to move downwardly relatively to the housing 1, approximately to the point 11 where its stroke terminates. Provided between the point 11 and the upper edge of the bushing 8 or the wall 7 are air intake openings 10 to effect scavenging about the beating tool and to control automatic suction valves. The spindle 18 is provided at the top with a reduced portion 19, to which the piston 17 is secured by means of a nut 21 arranged beside the threaded portion 20. Provided in the housing 1 is an intake opening 44 for air, said opening being positioned in such manner as to become entirely uncovered when the piston 17 reaches its lowermost position. When the housing 1 is raised—in Fig. 2—relatively to the piston 17, air will be sucked from the openings 10 through the valves 25. When the housing moves downwardly relatively ot the piston 17, this air will be pressed out through the channel 31, scavenging about the tool then taking place. The piston is provided with piston rings 23 sliding along the cylinder bore 9.

Running in the cylindrical bore 12 is a motor piston 26, 27, 15 having different cylinder diameters, said piston being locked by means of a nut engaging a thread 32 to the lower portion 29 of the spindle 18. The portion 29 of the piston terminates at the bottom by a boss 30 beating against

the lowermost portion 15 of the motor piston. The portion 26 of the piston is provided with packing rings 28 tightening against the cylinder. Through the different diameters of the motor piston 26, 27, 15 there will be formed, in a certain position, a combustion space 45 between the portion 27 of the piston and the cylinder wall, said combustion space communicating with gas exhaust openings 35 located on such a level as to become entirely uncovered when the portion 26 of the piston is in its uppermost position. When the motor piston is in its lowermost position, gas and air intakes 13 provided in the cylinder 1 will be uncovered. The junction between the portions 26 and 27 of the motor piston forms an oblique part 48 the surface of which corresponds to a surface 50 in part 4. However, these surfaces will never come nearer to each other than to form a suitable space 40 in which the mixture of fuel and air is ignited by means of a spark plug inserted into the aperture 33. Provided in the lower portion of the piston member 27, 15 are openings 14, which are entirely uncovered when the motor piston is in its uppermost position (compare the drawing). In this position, the piston 17 also takes its uppermost position (compare the drawing), the smallest compression space 22 for the air cushion causing the piston to rebound being then formed between the upper portion of the piston 17 and the lower edge of the cover as at 43.

A mixture of air and petrol is sucked in through the opening 13, said mixture being precompressed in the space 39 to a suitable pressure above atmospheric, and, when the cylinder 1 is manually moved downwards (Fig. 2), the gas mixture is compressed in the space 39, until the apertures 14 are uncovered and the precompressed mixture is flushed in through the apertures 14 into the space 45. Here, the gas mixture is compressed when the cylinder 1 is raised (the space 45 having then been reduced to the space 40), and is ignited by the spark plugs, the explosive power then throwing the motor piston 26, 27, 15 and 17 upwardly, the air in the space 38 being then compressed so as to form an air cushion when the space 38 has been reduced to the space 22, said air cushion throwing the piston back, the boss 30 then delivering its blow against the tool, and so forth. The cycle of operations then goes on continuously. Any air leaking from the air cushion in the space 38 is replaced every time through the openings 44 when the piston 17 is in its lowermost position relatively to the cylinder 1.

Constructions designed in accordance with the invention show very marked advantages over the constructions as hitherto known for the same purpose. Thus, where a beating tool for rock-boring is considered, the following may be stated:

In a machine according to the present invention, the combustion stroke may be used undisturbed to return the beating piston on its having delivered the blow against the tool, whereas in the beating tools as hitherto known a considerable portion of the gas pressure from the cylinder must be used to return the piston on its having delivered the blow against the tool. This gas pressure is generally conveyed through a long and narrow passage from the combustion space for a considerable distance down to the piston which has to take care of the returning of the beating piston. A large portion of the pressure energy is thus being lost. On the other hand, a machine according to the present invention operates with an undisturbed and ideal progress of combustion and should show a fuel consumption not exceeding 0.5 liter of petrol per hour and horse-power.

Furthermore, the construction of a machine according to the invention is much simpler than that of the hitherto known machines for the same purpose, and shows the advantage over the latter that no difficulties are met with in causing the beating piston to operate in time (synchronously) with the motor piston. It is of the utmost importance that the contrivance is not running out of time, inasmuch as this would cause the beating effect to be reduced to a fraction of its maximum value. Thanks to the freely running piston and to the fact that the beating piston for the tool is constituted by the motor piston proper, no running out of time need be feared in connection with the present invention. On the other hand, if in a motor of the ordinary type having a rotary crank shaft the motor piston is rigidly connected to the beating piston or made integral therewith, the stresses on the connecting rod and the bearings will become excessively large.

Hitherto, the returning of the beating piston formed a difficult problem in constructions, wherein the combustion stroke was transformed directly into the beating work, inasmuch as the speed of the beating piston ("kinetic energy") is cancelled when the blow is delivered against the tool. By reason of this, a power would have to be produced to return the piston into the position it should have before the beating movement commences. In the earlier constructions, this would be brought about by causing the beating piston to rebound against an air cushion or against powerful springs, simultaneously with the performing of the beating work of the piston, a considerable portion of the beating power being then lost, however. It is understood that this portion must be stored up in an air cushion or in springs, in order that the return movement shall be established. For this reason, an air cushion or a spring system is an exceedingly awkward means. However, if an air cushion is placed in a position where only a rebounding effect is desired, it becomes efficient to practically 100%.

This circumstance has been utilized in the present invention, which first permits the consumption of the whole beating power in a beating effect on the tool (iron-bar), whereupon the combustion pressure returns the piston against the air cushion, from which it is hurled back against the beating tool at an unreduced speed, after which the combustion pressure again assumes the returning work at full efficiency.

The air cushion may be replaced by a spring effect, entirely or in part.

It is conceivable to utilize the invention with certain modifications in single or double acting 2-stroke-cycle motors operating either on the Diesel-, a semi-Diesel- or the carburetting principle.

The present invention may be used primarily where the power of an explosion cylinder is to be transferred through a beating or similar effect, for instance in portable rock-boring machines and in tools for cutting, pruning and barking of lumber. The arrangement according to the invention many in many instances replace motors where the power is transferred by means of a crank shaft, for instance in compressors, pumps and similar machines.

What we claim is:

A device of the character described comprising in combination a housing having a pair of alined

vertical compression and combustion cylinders formed therein, a partition for separating said cylinders, a bearing arranged within said partition, a spindle slidably mounted within said bearing, air inlet and exhaust ports provided within said compression cylinder, said combustion cylinder having a combustion chamber arranged therein, pistons carried by said spindle and operable within said cylinders, said housing having a chamber formed therein, of less diameter than that of said combustion cylinder, one portion of the piston within said combustion cylinder being of a reduced diameter so as to be operable within said chamber, valve controlled ports arranged within the piston of said compression cylinder, a tool beating boss carried by said spindle and said spindle having a channel-way formed therein establishing a means of communication between said valve controlled ports and said tool beating boss.

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