Oct. 9, 1956 H. T. PYK 2,765,776

HAMMER PISTONS FOR PERCUSSION APPARATUSES

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Fig. 1.

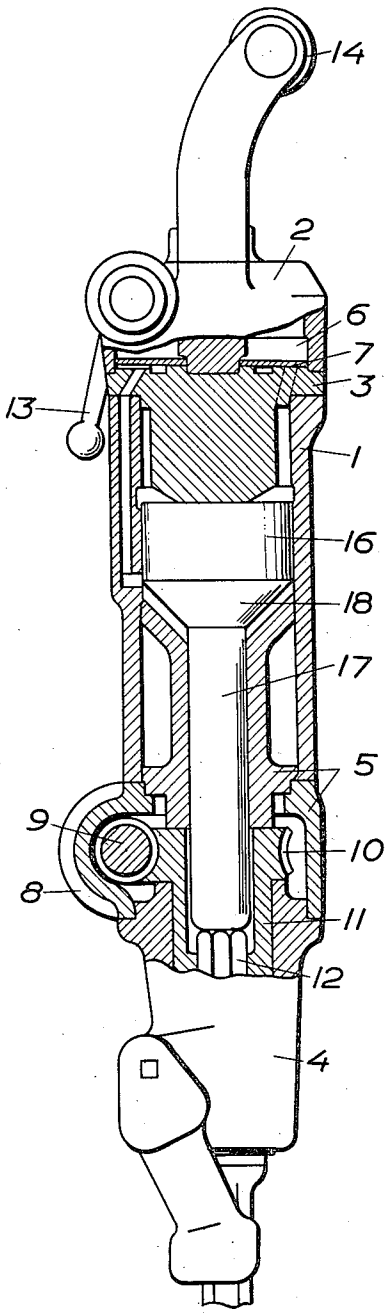
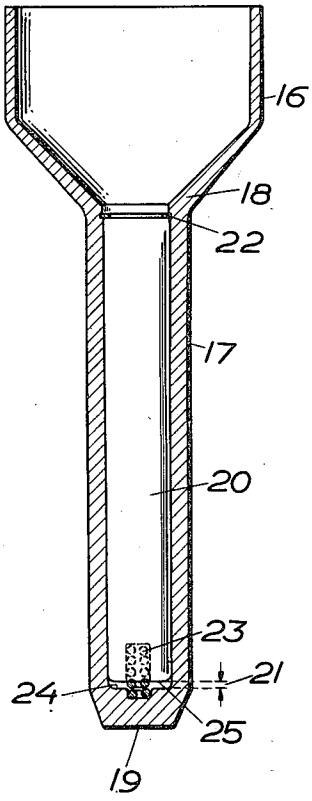


Fig. 2



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Fig. 3.

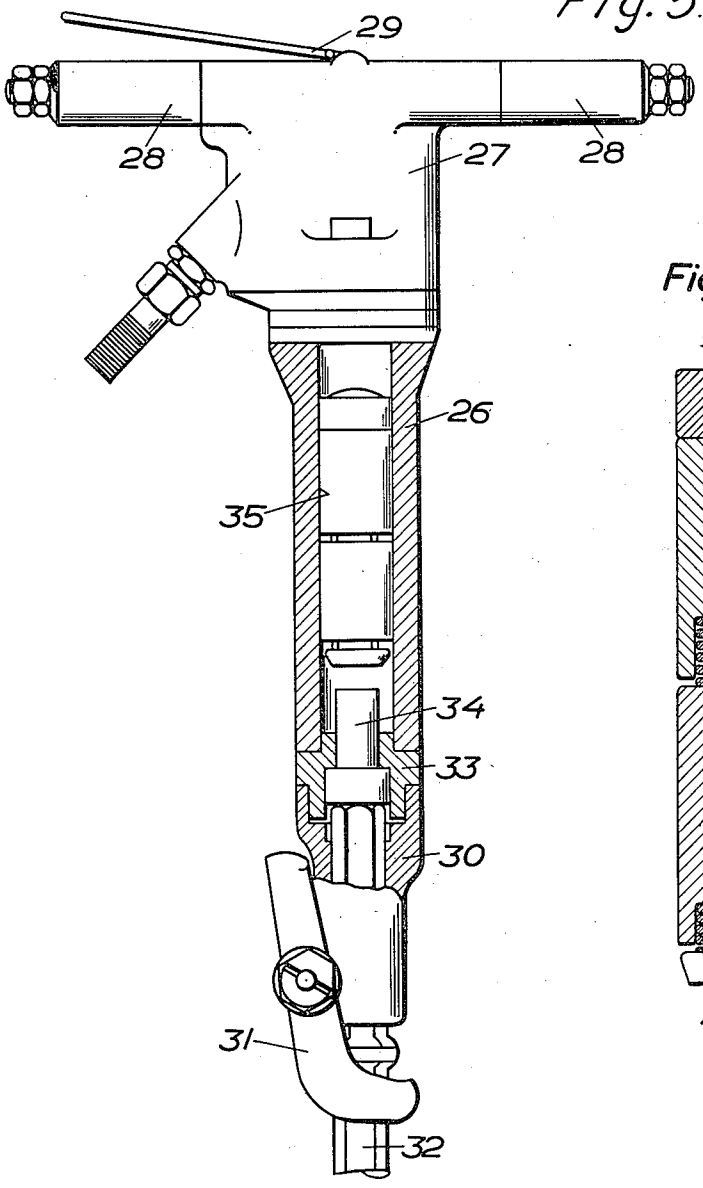
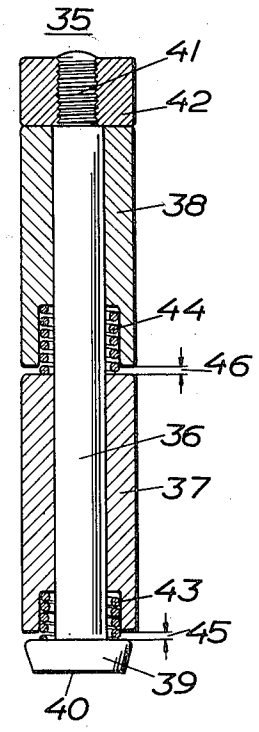


Fig. 4



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Fig.5

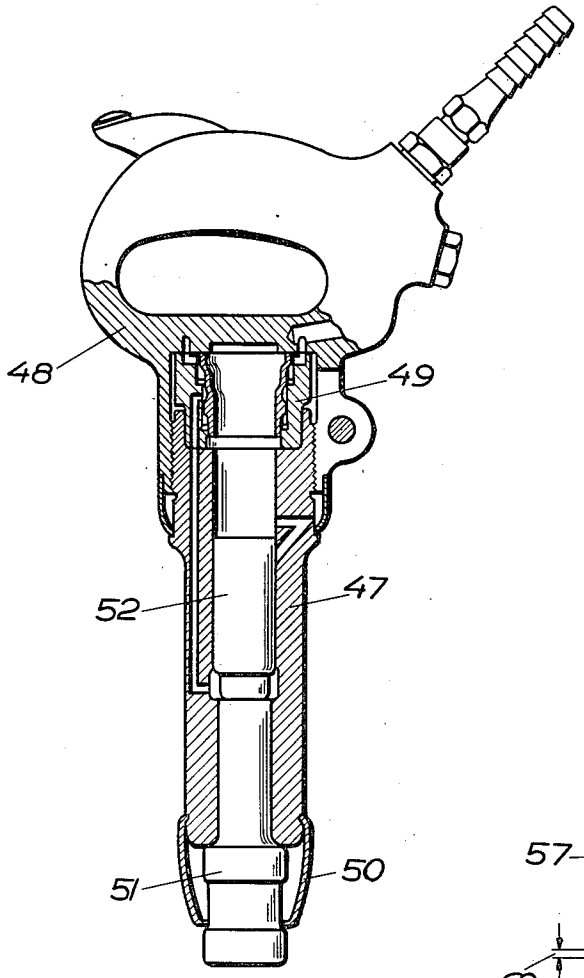
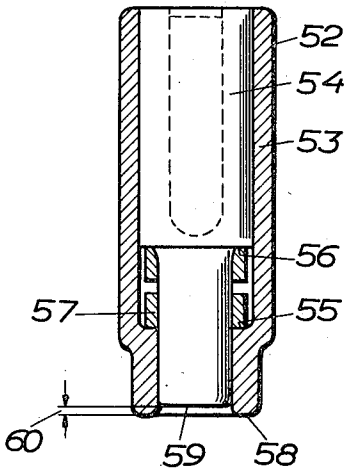


Fig.6



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HAMMER PISTONS FOR PERCUSSION APPARATUSES

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Claims priority, application Sweden July 4, 1951

1 Claim. (Cl. 121—31)

This invention relates to hammer pistons for percussion machines and tools and similar percussion apparatuses particularly but not exclusively of the type having a free flying hammer piston driven by a pressure fluid, such as compressed air, pressure gas, or the like. The invention also relates to machines and tools and similar apparatuses provided with such hammer pistons, such as rock drills, concrete breakers, riveting hammers or the like. One object of the invention is to provide a hammer piston for a percussion apparatus which permits the supply of an increased quantity of percussive energy to a working implement, such as a rock drill bit, a drill rod, a concrete breaking tool, a riveting tool, a chisel, or the like, without increasing the maximum stresses in said working implement. This may be achieved by providing a hammer piston which without increasing the amplitude of the percussion wave produced in the working implement increases the length of the percussion wave or produces two or more percussion waves with the same amplitude following closely one after the other. It has previously been suggested to improve the transmission of energy to a working implement of the type indicated hereinabove by provision of a hammer piston which has great length relative to the diameter of the portion of the hammer piston designed for delivering blows. However, such a long hammer piston has the disadvantage that the apparatus in which the piston is provided becomes rather long. Said disadvantage may be avoided according to the invention by the provision of a hammer piston which replaces the long hammer piston and produces percussion waves similar to those produced by the long hammer piston. For these and other purposes I provide a hammer piston for a percussion apparatus, at least two portions in said hammer piston movable one relative to the other in the direction of blows, and an end portion on at least one of said piston portions designed for delivering blows, said piston portions being so arranged and disposed that they deliver their kinetic energy one after the other in such close sequence that the percussion waves produced thereby follow one after the other practically without interruption. I also provide a percussion apparatus provided with such a hammer piston.

In the accompanying drawings a rock drill, a riveting hammer, and a concrete breaker according to the invention are illustrated by way of example together with pistons for said tools. Fig. 1 is a side view and partial section of a compressed air driven rock drill according to the invention with a differential hammer piston. Fig. 2 is an axial section of the hammer piston of the rock drill according to Fig. 1 on a larger scale. Fig. 3 is a side view and partial section of a concrete breaker according to the invention. Fig. 4 is a side view and partial section of a hammer piston for said concrete breaker. Fig. 5 is a side view and partial section of a riveting hammer, and Fig. 6 a section of a piston for said hammer.

The compressed air driven rock drill illustrated in Fig. 1 consists of a cylinder 1, a back head 2, a valve casing 3, a front head 4, and an intermediate casing 5. The

back head 2 and the valve casing 3 form together a valve chamber 6, in which a valve member controlling the distribution of compressed air for producing the working stroke and the return stroke, respectively, of the hammer piston is arranged in conventional manner. In the embodiment illustrated in Fig. 1 the valve member comprises an oscillating disc valve 7, but the invention is naturally not confined to the use of such a valve and the drill may be provided with a tubular valve, a flat disc valve, a piston valve, double valves, or other known valve designs fit for controlling the supply of compressed air to the working chambers of the drill and sometimes also for controlling the exhaust of the air therefrom.

The front head 4 of the drill and the intermediate casing 5 enclose a drill turning mechanism which may be of any conventional design and which in the illustrated embodiment consists of a motor 8 which drives a shaft 9 carrying a screw which engages a worm wheel 10 formed on a drill chuck 11 for a drill rod 12. 13 is the main admission valve of the drill which controls the supply of compressed air to the valve chamber 6 and the turning motor 8, and 14 is a handle secured to the back head 2 of the drill. The illustrated drill has no means for flushing water supply to the drill rod but the drill may naturally be provided with a flushing water tube extending through the drill and the piston or with a separate flushing water supply means connected at the front end of the drill or directly to the drill rod in conventional manner.

The cylinder 1 contains a reciprocable differential hammer piston which is of a design illustrated in detail in Fig. 2 and which comprises two piston portions, one of which forms a cylindrical piston head 16 which is guided and forms a seal in the large diameter cylindrical portion of the cylinder 1. The piston head is connected to a cylindrical shank 17 sealed and guided in the intermediate casing 5 by means of a substantially frusto-conical intermediate portion 18. The piston shank is provided with an end portion 19 designed for delivering blows to the drill rod 12. A cylindrical piston portion 20 is disposed within the piston shank and is displaceable in the direction of blows a small amount indicated by 21 in Fig. 2 on an exaggerated scale and which is usually of the size 0.1–2.0 mm. in a piston of about 200 mm. length, i. e. less or about one per centum of the total length of the piston. The piston portion 20 may if it is made of the same material as the rest of the piston preferably have a weight which is about half the weight of the whole piston. The cross sectional area of the two piston portions may in such a case preferably be substantially the same along the main part of the length of the piston. One of the piston portions, for instance the piston portion 20, may be made of a different material, such as copper-beryllium bronze. A ring 22 is press fitted or rolled into the rear end of the piston shank 17 and prevents the portion 20 from moving out of the piston shank. Consequently, the piston portion 20 is only movable a short limited distance relative to the piston portion 16—18. A spring 23 is interposed between the piston portion 20 and the end portion 19 and keeps the distance 21 substantially constant as long as the piston moves freely in the drill. The portion 19 forms at the inside an impact receiving surface 24 for receiving the blows from the end face 25 of the piston portion 20.

When the piston delivers a blow to the end face of the drill rod 12 percussive energy is at first transmitted from the piston portion 16, 17, 18 in the form of a percussion wave to the drill rod 12 and closely thereafter the piston portion 20 delivers a blow on the surface 24 and sends a second percussion wave to the drill rod. The distance 21 may preferably be chosen as large as one per centum of the total length of the piston.

The concrete breaker illustrated in Fig. 3 consists of a cylinder 26, a back head 27 provided with handles 28 and an admission valve manipulated with a trigger 29, a front head 30 with a tool retainer 31 for a working tool 32, and an intermediate casing 33 which forms a cover for the lower end of the working cylinder and in which an anvil block 34 is slidable and forms a seal. A substantially cylindrical hammer piston is reciprocable in the cylinder 26 which hammer piston in Fig. 3 is indicated generally by the reference numeral 35. The hammer piston 35 is illustrated on a larger scale in Fig. 4 and consists of three piston portions, i. e. a central rod 36, and two sleeve type piston portions 37 and 38. The piston portions 36, 37 and 38 may preferably all be of about the same weight. The rod 36 is provided with a foot portion 39 having an end face 40 designed for delivering blows to the anvil block 34 of the concrete breaker at the end opposite the end providing the foot portion 39, the piston portion 36 has a screw threaded portion 41 on which a cylindrical body 42 is fitted. Said cylindrical body may be made of such size that it forms a seal and is guided in the working cylinder of the concrete breaker and consequently forms the driving means for the piston. A spring 43 is provided in a recess in the piston portion 37 between the end portion 39 and the piston portion 37. In similar manner a spring 44 is provided in a recess in the piston portion 38 between the bottom of said recess and the piston portion 37. The springs 43 and 44 keep the piston portions 36, 37, 38 in substantially the positions illustrated in Fig. 4 as long as the piston moves freely in the working cylinder. A small space 45 then exists between the foot portion 39 and the piston portion 37 and a small space 46 between the piston portions 37 and 38. Said spaces which in the drawing have been illustrated on an exaggerated scale are of size 0.05–2 mm. in pistons having a total length of 200 mm.

When the piston according to Fig. 4 hits the anvil block 34 the piston portion 36 delivers its kinetic energy to the working tool 32 in the form of a blow, thereafter the piston portion 37 hits the portion 39 and delivers its kinetic energy through the piston portion 39 to the working tool 32, and finally the piston portion 38 delivers its kinetic energy in the form of a blow through the piston portion 37 and the portion 39 to the working tool 32. In this manner three partial percussion waves are produced in the working tool 32 which add to each other and form an extended percussion wave having relatively low amplitude and great length. The stresses in the shank of the working tool 32 may in this way be reduced or alternatively the energy delivered through the tool 32 may be increased with maintained stresses.

The compressed air driven riveting hammer illustrated in Fig. 5 consists of a cylinder 47 and a back head 48 forming a handle and provided with an admission valve. A valve casing 49 is interposed between the cylinder 47 and the back head 48. A retainer 50 for a riveting tool 51 is provided at the front end of the cylinder 47. A substantially cylindrical piston 52 is reciprocable in the cylinder 47, said piston being illustrated on a larger scale in Fig. 6.

The hammer piston 52 consists of two body portions 53 and 54 which may have substantially the same weight and which are arranged concentrically one within the other. The portion 53 is formed as a tubular sleeve having an internal annular abutment or shoulder 55. The portion 54 has a head and a shank of less diameter than the head so that an external annular abutment or shoulder 56 is formed on said portion. The portion 54 fits in the portion 53 with a sliding fit permitting small quantities of air to pass the piston between the portions

in order to carry lubrication oil to the frictional surfaces in the piston. A stiff helical spring 57 is interposed between the abutments or shoulders 55 and 56. The portion 53 has an annular end face 58 and the portion 54 an end face 59 both designed for delivering blows to the shank of the riveting tool 51. The spring 57 is so dimensioned and the portions 53 and 54 are so arranged that when the piston hits the shank of the tool 51 said shank is hit first by the end face 58 of the portion 53 and immediately thereafter is hit by the end face 59 of the portion 54 so that two percussion waves are produced in the tool 51 which follow so closely that they form a practically continuous percussion wave. For this purpose the portion 53 is a small distance 60 ahead of the portion 54 at the moment when the piston delivers the blow. The distance 60 may amount to one per centum of the piston length. The head of the portion 54 has larger cross section than the rear end of the portion 53 so that the air pressure acting on the piston during the working stroke acts to force the portion 54 towards the portion 53. Similarly the front end of the portion 53 has larger cross sectional area than the front end of the portion 54 so that the air pressure below the piston acts to force the portion 53 towards the portion 54 during the return stroke of the piston. Naturally the piston 52 may be made in such a way that the portion 54 hits the tool shank before the portion 53 and in such a case the spring 57 may be dispensed with.

The above described hammer pistons may be made in such a manner that a continuous percussion wave is obtained in the implement or tool to which the hammer piston delivers percussion energy, said percussion wave having lower amplitude than the amplitude of a percussion wave produced by a piston made with the same weight and other dimensions as the illustrated pistons but being of one piece construction. The pistons according to the invention may also be made in such a way that the percussion waves produced by the separate piston portions follow closely one after the other.

The embodiments of the invention above described and illustrated in the drawings should only be considered as examples and the invention may be modified in several different ways within the scope of the claim. Hammer pistons according to the invention may for instance be made in such a way that they consist of more than two concentrically disposed portions which all deliver percussion energy directly or indirectly to an anvil block in a percussion machine or tool or to a shank of a working implement in a certain sequence.

What I claim is:

A hammer piston for a percussion apparatus having at least two piston portions movable one relative to the other in the direction of blows a distance corresponding to at the most one per centum of the total length of the piston, a spring interposed between said piston portions for maintaining said distance during the unobstructed movement of the piston so that one piston portion delivers its blow in advance of the other piston portion and so that said other piston portion delivers the blow after travelling said distance relative to said first piston portion, and an end portion designed for delivering blows at least on said one of said piston portions delivering the blow in advance of said other piston portion.

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