Jan. 21, 1958 H. T. PYK **2,820,433**

HAMMER PISTONS FOR PERCUSSION MACHINES AND TOOLS

Filed July 1, 1952 2 Sheets-Sheet 1

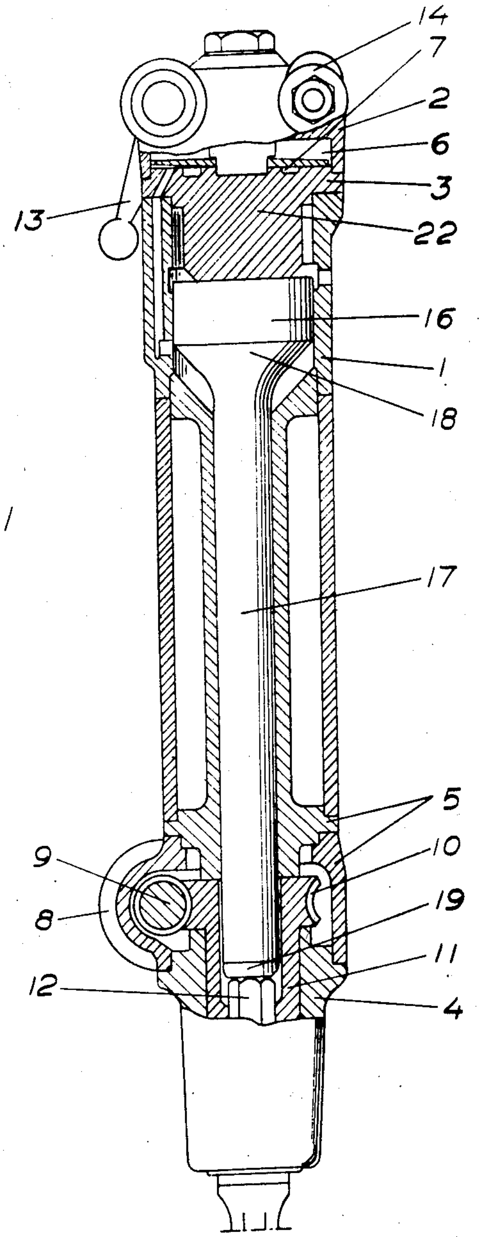

Fig. 1

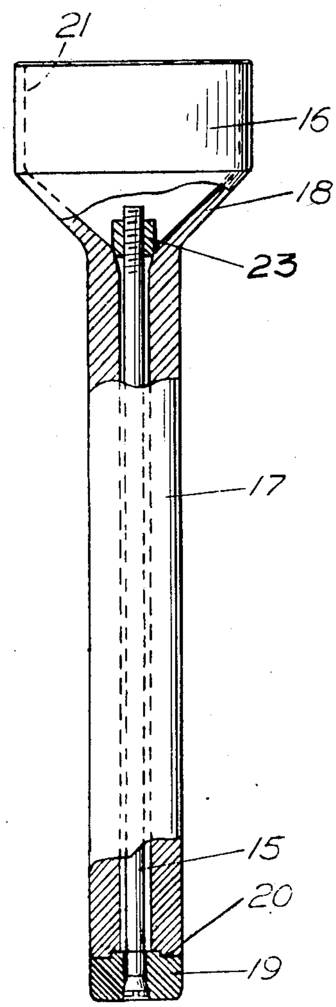

Fig. 2

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HAMMER PISTONS FOR PERCUSSION MACHINES AND TOOLS

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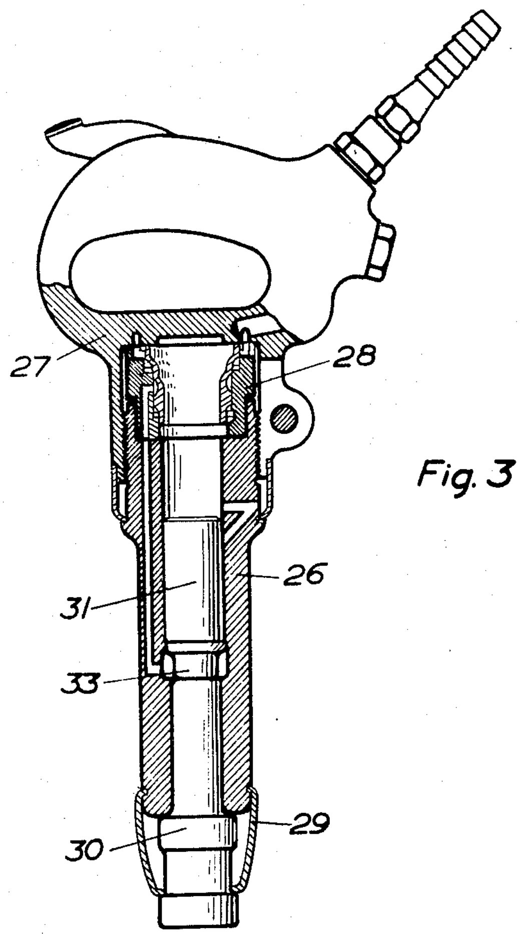

Fig. 3

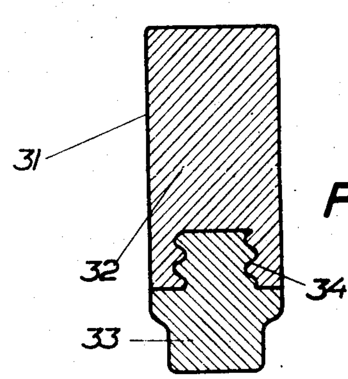

Fig. 4

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HAMMER PISTONS FOR PERCUSSION MACHINES AND TOOLS

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Claims priority, application Sweden July 2, 1951

4 Claims. (Cl. 121—31)

This invention relates to free motion hammer pistons for percussion machines or tools driven by an elastic pressure fluid and to percussion machines and tools, respectively, provided with such hammer pistons. One object of the invention is to provide an improved hammer piston for such machines or tools which permits transmission at each blow of a greater quantity of energy to a working implement, such as a rock drill rod, a chisel, a riveting tool, or the like than hammer pistons of conventional design without increasing the maximum stresses in the working implement. This may be achieved by the provision of a hammer piston which without increasing the amplitude of the percussion wave in the impact receiving member increases the length of the wave or the duration of the maximum amplitude of the wave.

The expression "elastic flexing" used in the following specification and in the claims is intended to indicate such flexing in a body or a material which does not produce a permanent change of the shape of the body or the material.

According to my copending application Ser. No. 272,475, filed February 19, 1952 (now matured into U. S. Patent No. 2,812,745, granted November 12, 1957), I provide a hammer piston which is carried out in such a way that it is capable of flexing elastically in the direction of the blows in a manner which materially differs from the corresponding flexing of a solid cylindrical steel piston with circular cross section and the same weight and length as the piston. According to the present invention I produce similar results by providing a free motion hammer piston for a percussion machine or tool driven by an elastic pressure fluid, a portion in said piston of a material with great resistance to impacts desgined for delivering blows, and a portion in the piston forming the main part of the mass of the piston being carried out by a bronze which is capable of being hardened and which is capable of flexing elastically upon delivery of a blow to a member through said blow delivering portion materially more than the elastic flexing upon an equivalent impact of a solid cylindrical steel piston with the same length and weight as the hammer piston. Such a piston may preferably be carried out substantially by a bronze comprising copper, beryllium and nickel or cobalt or other suitable substances.

The invention also includes percussion machines or tools provided with hammer pistons according to the invention and with means for imparting a reciprocating motion to said hammer piston with the aid of an elastic pressure fluid, such as compressed air, pressure gas or the like.

In the accompanying drawings two embodiments of hammer pistons and hammer tools according to the invention are illustrated by way of example. Fig. 1 is a side elevation and partial section of a compressed air driven hammer rock drill provided with a differential hammer piston according to the invention. Fig. 2 is a side view and partial section of the hammer piston for the drill according to Fig. 1 on a larger scale. Fig. 3

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is a side view and partial section of a compressed air driven riveting hammer according to the invention, and Fig. 4 is a longitudinal section of a hammer piston for said riveting 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 valves 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 is not provided with water flushing means but naturally the drill may be designed with conventional means for conveying flushing water or other flushing fluid either through a tube carried through the piston to the drill steel or through a flushing water connection at the front end of the drill.

The cylinder **1** contains a reciprocable differential hammer piston which is illustrated in detail in Fig. 2 and which comprises a piston head **16** which is sealed and guided in the cylinder **1** and a cylindrical piston shank **17** which is sealed and guided in the intermediate casing **5** and which is connected to the piston head by a substantially frustoconical intermediate portion **18**. The piston head, the piston shank and the intermediate portion of the piston are carried out by a hardened copper-beryllium bronze preferably comprising about 97 percentum copper, 2 percentum beryllium and 1 percentum nickel. The piston shank **17** has an end portion **19** designed for delivering blows and made from hard steel or other suitable impact resisting material which may be welded or soldered to the beryllium bronze of the piston shank at **20**. The diameter of the piston head **16** of the illustrated piston is materially larger than the diameter of the piston shank and in the illustrated embodiment the diameter of the piston head is about 2½ times the diameter of the piston shank which is only a little larger than the diameter of the shank **12** of the drill rod. The piston is carried out in such a way that the total length of the piston is more than eight times the diameter of the piston shank **17**. The piston illustrated in Fig. 2 has a recess **21** in the piston head **16** and the intermediate portion **18** and the drill is provided with a filler body **22** which corresponds to the recess **21**. Apart from the soldering at **20** the blow delivering portion **19** is secured to the piston shank **17** by means of a long steel bolt **15** extending through a central bore in the piston shank **17** and provided at the piston head end of the bolt with a nut **23** having a conical seat. The bolt may sometimes be displaced by a tube through which a flushing water tube is carried in conventional manner.

The compressed air driven riveting hammer illustrated in Fig. 3 consists of a cylinder **26** and a back head **27** forming a handle and provided with an admission valve of the tubular type. A valve casing **28** is interposed between the cylinder **26** and the back head **27**. A retainer **29** for a riveting tool **30** is provided at the front end of the cylinder **26**. A substantially cylindrical piston **31** is reciprocable in the cylinder **26**, said piston being illustrated on a larger scale in Fig. 4. The hammer piston **31** consists of a cylindrical body **32** of a copper-beryllium bronze capable of being hardened and a foot portion **33** of hard steel designed for delivering blows and forged into the body **32** as indicated at **34**.

The pistons and percussion tools above described and illustrated in the drawings should only be considered as examples and the details of the invention may be modified in various different ways within the scope of the claims. The portion **19** or **33**, respectively, may for instance be screw threaded, press-fitted or otherwise fixed to the piston portion carried out by the beryllium bronze or other hardenable bronze having greater elasticity than steel.

What I claim is:

1. A free motion hammer piston for elastic pressure fluid actuated percussion devices comprising a first blow-delivering portion consisting of material having high resistance to impact and a second portion providing the major part of the mass of the piston, said second portion consisting of a hardenable bronze capable, upon delivery of a blow to a blow-receiving element through said first portion of the piston, of elastic flexure materially greater than the elastic flexure resulting from an equivalent impact delivered by a solid cylindrical steel piston having the same weight and length.

2. A free motion hammer piston for elastic pressure fluid actuated percussion devices, said piston being of the type including a cylindrical piston head part and comprising a first blow-delivering portion consisting of material having high resistance to impact and a second portion providing the major part of the mass of the piston, said second portion consisting of a hardenable bronze capable, upon delivery of a blow to a blow-receiving element through said first portion of the piston, of elastic flexure materially greater than the elastic flexure resulting from an equivalent impact delivered by a solid cylindrical steel piston having the same weight and length.

3. A free motion hammer piston for elastic pressure fluid actuated percussion devices comprising a first blow-delivering end portion consisting of impact resisting steel and a second portion providing the major part of the mass of the piston, said second portion consisting of a hardenable bronze capable, upon delivery of a blow to a blow-receiving element through said first portion of the piston, of elastic flexure materially greater than the elastic flexure resulting from an equivalent impact delivered by a solid cylindrical steel piston having the same weight and length.

4. A free motion hammer piston for elastic pressure fluid actuated percussion devices comprising a first blow-delivering portion consisting of material having high resistance to impact and a second portion providing the major part of the mass of the piston, said second portion consisting of a beryllium bronze and said portions being forged together to provide an integral hammer unit.

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