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PNEUMATIC PERCUSSION TOOLS

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Fig. 1

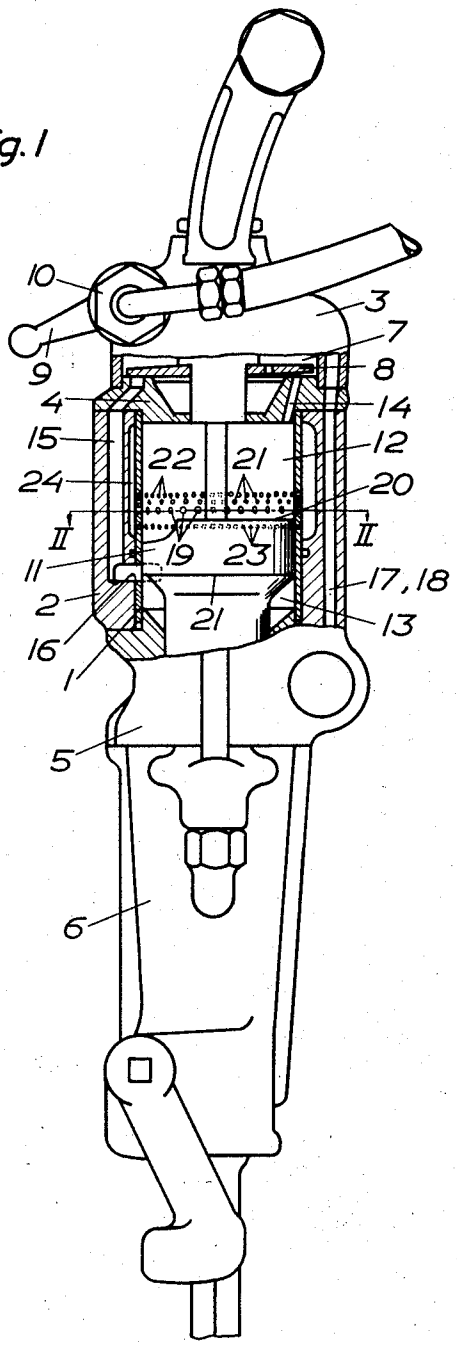



Fig. 2

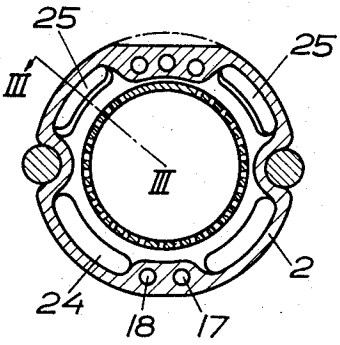
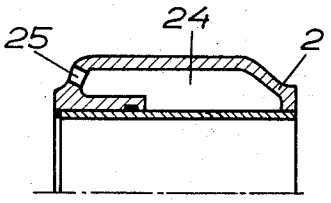



Fig. 3




INVENTOR
Jan Kristian Holdo
BY Jarvis C. Marble
His ATTORNEY

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# PNEUMATIC PERCUSSION TOOLS

Jan Kristian Holdo, Stockholm, Sweden, assignor to Atlas Copco Aktiebolag, Nacka, Sweden, a corporation of Sweden

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7 Claims. (Cl. 121—35)

This invention relates to pneumatic percussion tools and more particularly to means for reducing the noise produced by the exhaust air from such tools. For this purpose silencers which have been fitted to the exhaust ports of such tools or mufflers have been provided with noise dampening jackets around the cylinders. These silencers are cumbersome and subject to damage.

One object of this invention is to provide a pneumatic percussion tool in which silencing means are built into the tool in such a manner that they do not materially increase the dimensions or the weight of the tool. A further object of the invention is to produce a silencing means in a pneumatic percussion tool which is simple to manufacture. A still further object of the invention is to produce silencing means in a pneumatic percussion tool which does not materially reduce the power of the tool. For these and other purposes I provide in a pneumatic percussion tool a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a piston controlled main outlet in the cylinder wall of the first working chamber, and a piston controlled auxiliary outlet in the cylinder wall of the first working chamber of less area than said main outlet and disposed so as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet.

In the accompanying drawings a pneumatic rock drill according to the invention is illustrated by way of example. Fig. 1 is a side view and partial longitudinal section of the compressed air driven rock drill. Fig. 2 is a transverse section of the rock drill shown in Fig. 1 taken on line II—II of Fig. 1. Fig. 3 is a partial longitudinal section of the cylinder casing of the rock drill, according to Figs. 1 and 2, taken on lines III—III of Fig. 2.

The compressed air driven rock drill illustrated in Figs. 1–3 consists of a cylinder casing **1**, **2**, a back head **3**, a valve casing **4**, an intermediate casing **5** and a front head **6**. The back head **3** and the valve casing **4** together form a valve chamber **7** in which a distributing valve member is provided for controlling the distribution of compressed air for producing the working stroke and the return stroke, respectively, of the hammer piston. In the embodiment illustrated in Fig. 1 the distributing valve member **8** is of the conventional flapper type but the invention is naturally not confined to the use of such a valve and the drill may be provided with any suitable distribution valve, such as a tubular valve, a flat disc valve, a piston valve, double valves or other known distributing valves suitable for controlling the supply of compressed air to the working chambers of the drill. Compressed air is supplied to the drill through a pipe **9** and a main valve **10** from which it is admitted to the valve chamber **7**.



The intermediate casing **5** and the front head **6** of the drill enclose a drill turning mechanism of conventional design (not illustrated). The cylinder casing consists of a tubular steel body **1**, which forms a working cylinder and is press fitted in an aluminium casting **2**. A differential hammer piston **11** is reciprocable under the action of compressed air in the working cylinder, a first working chamber **12** being formed in the cylinder at the rear end of the hammer piston **11** and a second annular working chamber **13** in the cylinder in front of the head of the hammer piston **11**. Compressed air supplied to the first working chamber **12** moves the hammer piston **11** forward to produce the percussion stroke of the piston, said compressed air being admitted by the valve **8** through inlet passages **14**. Compressed air for the return stroke of the piston is supplied to the second working chamber through passages **15** in the casing **2** and a port **16** when said port is uncovered by the piston and the valve **8** is in proper position. The casing **2** also contains passages **17** and **18** through which compressed air may be supplied to or vented from a feed leg (not illustrated).

The tubular body **1** is provided with a number of radial openings **19**, which form the main outlet for the air from the working chambers **12** and **13** through which air is exhausted from said working chambers when the upper edge **20** or the lower edge **21**, respectively, of the hammer piston head uncovers the openings **19** behind or in front, respectively, of the piston head. The openings **19** are disposed in one transverse plane of the working cylinder but may also be disposed in two transverse planes or in any other way. The main outlet may be common for the first and second working chambers as illustrated, or separate main outlets may be provided for the first and second working chambers. Auxiliary outlets are formed in the cylinder walls of the working chambers **12** and **13** by series of holes **21**, **22** and **23** which outlets each have less total area than the series of holes **19** forming the main outlet. The auxiliary outlet **21**, **22** is disposed in the cylinder wall in such a manner that it is uncovered by the hammer piston **11** during the working stroke before the hammer piston uncovers the main outlet **19**. The series of holes **23** provided for forming the auxiliary outlet from the second working chamber **13** is uncovered by the hammer piston head during the return stroke before the piston head during said stroke uncovers the main outlet **19**. The openings **19**, **21**, **22**, **23** in the tubular body **1** open into a chamber **24** formed in the casing **2** between said casing and the tubular body **1**. The openings **23** also serve to reduce the energy involved in the return stroke of the piston, and thus also prevent the piston from hitting the valve casing **4**. The openings **21**, **22**, **23** are of less diameter than the openings **19**. The chamber **24** communicates with the atmosphere through two outlet ports **25**.

The arrangement of the auxiliary outlets **21**, **22**, **23** results in such equalization of the exhaust pulses that the noise produced by the exhaust of air from the tool may be reduced with as much as six decibels, which means that the exhaust noise of the tool is reduced to only a fraction of the normal exhaust noise.

The embodiment of the invention above described and illustrated in the drawings should be considered only as an example and the invention may be modified in several different ways within the scope of the claims. For instance, the number of holes in the various series of holes **19**, **21**, **22**, **23** may be greater or lesser than those illustrated, and in some cases a satisfactory result may be obtained also with an auxiliary outlet comprising one series of holes only in the working chamber **12**. The holes of the outlets may be evenly distributed

around the periphery of the cylinder but they may be distributed also in an uneven manner on zig-zag lines or in any other way in order to produce the desired interference of the exhaust jets from the various holes which appears to be the cause of the reduction of the noise obtained by the invention.

What I claim is:

1. In a pneumatic percussion tool, a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a piston controlled main outlet in the cylinder wall of the first working chamber, and a piston controlled auxiliary outlet in the cylinder wall of the first working chamber of less area than said main outlet and disposed so as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet.

2. In a pneumatic percussion tool, a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a first series of openings in the cylinder wall forming a main outlet from the first working chamber and controlled by the piston, and a second series of openings in the cylinder wall of the first working chamber of less area than said first series of openings and disposed so as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet.

3. A pneumatic percussion tool according to claim 2, in which said openings are circular and the openings of the second series have less diameter than the diameter of the openings of the first series of openings.

4. In a pneumatic percussion tool, a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a piston controlled main outlet in the cylinder wall of the first working chamber, and two series of holes in the wall of the first working chamber of less area than said main outlet and disposed in two transverse planes so as to be uncovered by the piston during the working stroke one before the other and both before the piston uncovers the main outlet.

5. In a pneumatic percussion tool, a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a piston controlled main outlet in the cylinder wall of the first working chamber, a series of holes in the cylinder wall forming an auxiliary outlet from the first working chamber of less area than said outlet and controlled by the piston and disposed so as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet, a piston controlled main outlet in the cylinder wall of said second working chamber, and a series of openings in the cylinder wall of the second working chamber of less area than said main outlet and disposed so as to be uncovered by the piston during the return stroke of the piston before the piston uncovers the main outlet.

6. In a pneumatic percussion tool, a tubular body forming a cylinder, a casing enclosing said tubular body and forming around said tubular body an exhaust chamber, ports in said casing forming a communication between said chamber and the atmosphere for the exhaust of air from the tool, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of the piston, a second working chamber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, means for admitting compressed air to said second working chamber, a series of openings in the tubular body forming a piston controlled main outlet from the first and second working chambers, a series of openings in the cylinder wall forming an auxiliary outlet to the exhaust chamber from the first working chamber of less total area than the total area of said main outlet and disposed so as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet, and a series of openings in the tubular body forming an auxiliary outlet from the second working chamber to the exhaust chamber of less total area than that of said main outlet and disposed so as to be uncovered by the piston during the return stroke before the piston uncovers the main outlet.

7. In a pneumatic tool, a casing forming a cylinder, a hammer piston reciprocable in said cylinder, a first working chamber for compressed air in said cylinder for producing the working stroke of said piston, a second working chmaber for compressed air in the cylinder for producing the return stroke of the piston, means for admitting compressed air to said first working chamber, a first series of openings in the cylinder wall forming a main outlet from the first working chamber and controlled by the piston, and a second series of openings in the cylinder wall of the first working chamber of less diameter than said main outlet openings and of such total area and so positioned as to be uncovered by the piston during the working stroke before the piston uncovers the main outlet and to permit air escape from the first working chamber to such an extent that a subsonic flow of air is obtained from the main outlet openings.

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