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D. M. PEARSON

2,776,539

PORTABLE PERCUSSION DEVICE

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2 Sheets-Sheet 1

Fig. 1

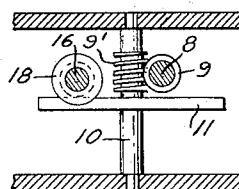
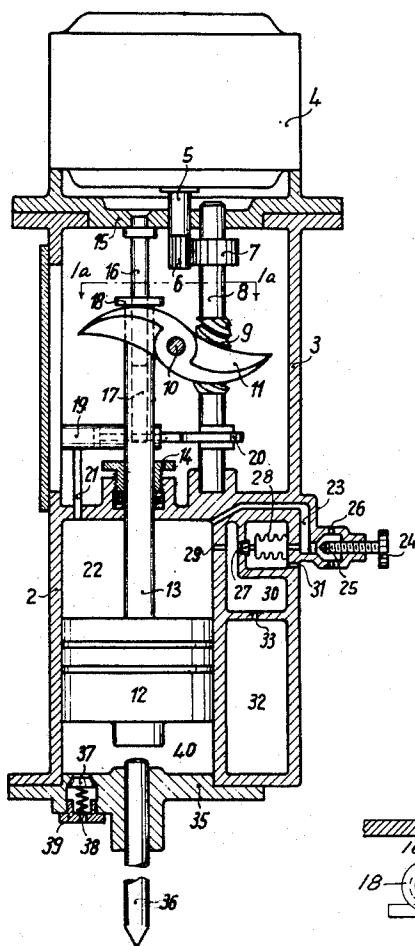


Fig. 1a

INVENTOR:
DONALD M. PEARSON

BY *Leon M. Strauss*
AGT.

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D. M. PEARSON

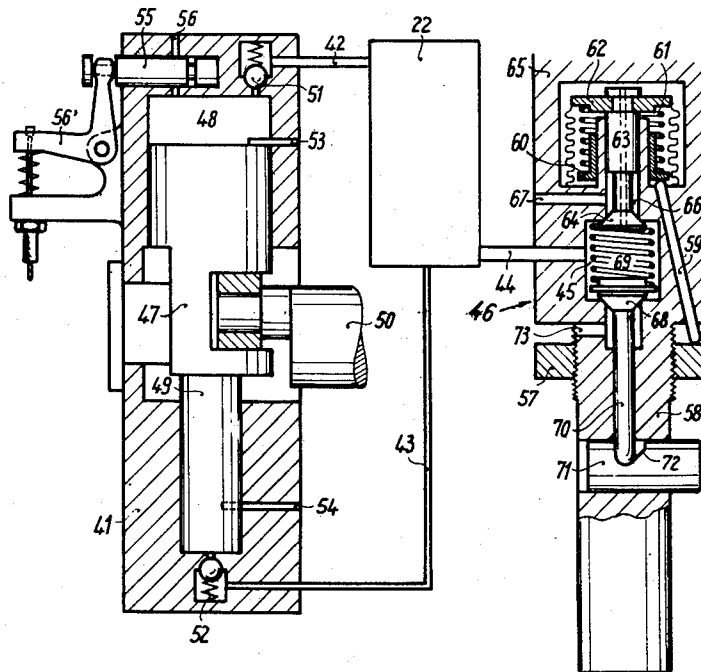
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Fig. 2



INVENTOR:
DONALD M. PEARSON
BY *Leon M. Strauss*
REG.

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PORTABLE PERCUSSION DEVICE

Donald M. Pearson, Oakland, Calif.

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7 Claims. (Cl. 60—62.5)

Mechanical hammers and chisel apparatus are used in the course of the erection and repairing of various structures. Such apparatus are generally referred to as percussion devices. Such devices have been equipped with other tools, such as drills. Stationary, transportable and portable percussion devices of this type are well known. The present invention is directed to a portable percussion device which may also be used as a transportable or a stationary percussion device.

It is of the greatest importance, that portable percussion devices be compact, handy and light. In spite of these characteristics these devices must have a high percussion force, they must be ready for operation quickly, and it must be possible to adjust in advance the strength of the percussion force and to manually regulate the latter in a simple manner. Furthermore, the independence of these devices from stationary driving machines is of considerable importance.

The percussion device according to the invention is provided with electrical motor means for charging the compressed-air drive and the strength of the percussion force of the compressed-air piston is increased by means of a suction chamber placed in front of the piston. In the embodiment of the invention a one-way valve is disposed in the suction chamber and an additional charging device may be provided for the compressed-air drive.

The portable percussion device constructed according to the invention realizes, by means of the above provisions, in a large measure the tasks mentioned above. Particularly favourable working conditions are also provided according to the invention because the pressure of the compressed-air can be regulated, and especially because, between the regulating valve and a hand control equipment, an elastic member consisting of a pressure cell is provided, the back of which is loaded by the maximum pressure in the cylinder by way of a narrow channel, whereby the narrow channel is connected at its exit with the outer air by means of a valve regulated by a hand control equipment.

In known portable percussion devices charged by means of an electric motor in order to increase the strength of the percussion force produced by the compressed-air drive, the space below the compressed-air piston was never used to increase the percussion force. Therefore, the compression chamber had to be correspondingly subjected to higher pressures which, in turn, required the use of a larger compression chamber and of a larger apparatus. Furthermore, heretofore known devices were neither provided with pressure regulating means nor with stabilizing chambers. The operation of these known devices was, therefore, unsatisfactory and unreliable. On the other hand, applicant's portable apparatus is dependable and reliable.

A decisive defect in known percussion devices having a compressed-air charge drive affording the percussion force, by means of an electric motor, resulted from the greatly inferior construction of the gearing mechanism

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which was disposed between the electromotor and the compressed-air equipment. The invention, apart from other characteristics, has corrected this defect by operating the piston rod of the compressed-air drive through a rotary cam by means of an electric motor constructed as a unit with the percussion device.

A specially complete construction according to the invention can be obtained by the addition of a charging device for the compressed-air drive. This last mentioned device permits the development in a minimum of time of the pressure needed for operation of the device so that the full percussion force is reached a few seconds after starting the device. Furthermore, the charging device provides a constant compensation for existing pressure losses and for maintaining the starting percussion force. This is afforded by the use of double-compressor means wherein the pressure contributed by at least one of said compressors can be interrupted. A double-piston system may be substituted for a double-compressor.

This double-piston system includes pistons having unequal diameters and can be made integral so as to be operable through only one drive or may include a cam portion.

The above objects and other advantages of the invention will become apparent from consulting the following detailed description of the invention when taken in conjunction with the drawings, wherein:

Fig. 1 shows schematically a portable percussion device constructed according to the invention;

Fig. 1a is a sectional view taken along the line 1a—1a in Fig. 1; and

Fig. 2 shows schematically and partly in cross-section charging means and pressure regulating and controlling means used in conjunction with the device of Fig. 1.

According to Fig. 1, an electric motor 4 is located on a cylinder 2 having a bracket portion 3. The electric motor 4 is provided with a vertical axle 5 terminating in a pinion 6, engaging a cog wheel 7 on a shaft 8. The shaft 8 is provided with a worm gear 9 which engages the edges of a worm wheel 9' for driving a horizontal shaft 10. Shaft 10 is provided with two opposite cams 11 which are provided with edges shaped approximately like the development of a logarithmic curve.

A hammer piston 12 provided with conventional packing rings is supported within the cylinder 2 and displaceable by a piston rod 13 which moves through a stuffing box 14 and which is provided at one end thereof with an axial bore 17. Rod 16 is fixed on the plate 15 and extends loosely into bore 17 of rod 13 so as to guide the latter. Piston rod 13 is further provided with a flange 18 which abuts against one of the edges of cams 11 so that upon displacement of cams 11 the piston 12 is moved by the engagement between cams 11 and flange 18.

A small air pump 19 is driven by a cam 20 supported on shaft 8 and is effective to continuously pump air into compression chamber 22 of the cylinder 2 through channel 21.

Compression chamber 22 communicates through narrow channel 23 past needle valve 25 and openings 26 with the atmosphere. Needle valve 25 may be adjusted by displacing handle 24 so that maximum pressure in the cylinder is controlled by the needle valve 25. A further regulating valve 27 is provided with pressure responsive diaphragm or bellows 28 adapted to receive pressure from channel 23.

A conduit 29 communicates with compression chamber 22 and with a pressure stabilizing chamber 30 whereby air from the compression chamber 22 controls the position of the regulating valve 27 so that said valve opens

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under extreme pressure and possibly irregular working stresses to permit surplus air to escape through outlets 31. A second compression chamber 32 communicates by means of passage 33 with the stabilizing chamber 30 so as to further equalize the pressure in chamber 30 and to thereby ensure relatively smooth working conditions.

The cylinder 2 is closed at the lower end thereof by a lid 35 within which is arranged a hammer, chisel or drill 36 which is driven by the piston 12 when same is moved downwardly. Lid 35 is further provided with a valve 37 spring loaded by spring 38 and seated in a cap 39 which is adjustably threaded into lid 35. This one-way valve prevents the formation of a braking air cushion within the suction space 40 of cylinder 2 and the vacuum existing within space 40 upon upward stroke of the piston permits additional acceleration of the motion of the piston 12.

Referring more particularly to Fig. 2, the compression chamber 22 of the portable percussion device is very schematically shown, the remaining parts thereof just described being positioned as seen in Fig. 1 above chamber 22. Charging equipment 41 is connected to compression chamber 22 by means of two tubes 42 and 43. Compression chamber 22 is also connected with the valve chamber 45 of a valve 46 through a tube 44. Valve 46 is effective to regulate the percussion force and to decrease the pressure in compression chamber 22. Obviously, compression chamber 22 corresponds to the compression chamber in Fig. 1 and the hammer piston 12 and one-way valve 37 extend at the end of compression chamber 22 opposite that wherein tube 43 is secured. The chamber 22 shown in Fig. 2 represents in substance a top plan view of the cylinder 2 shown in Fig. 1, the latter, of course, having the chamber 22 situated therein at its upper end and above the piston 12. The conduits 42, 43 and 44 communicate with the chamber 22 above the piston 12 (not shown in Fig. 2), the conduit 42 corresponding to the conduit 21 and the conduit 44 corresponding to the conduit 23 in Fig. 1. The conduit 43 has no counterpart in Fig. 1, as the use of this conduit is only suitable for the embodiment of Fig. 2.

A double piston 47 moves in corresponding cylindrical chambers 48 and 49, respectively, within charging equipment 41. Double piston 47 is actuated by the cam shaft 50. The cylinder chamber 48 of the piston having the largest diameter is connected through pressure valve 51 and tube 42 with compression chamber 22. This also applies to the cylinder chamber 49 of the piston provided with the smaller diameter since the pressure valve 52 and the tube 43 are connected with cylinder chamber 49 and with compression chamber 22. Upon predetermined positioning of the piston 47 incoming air enters within charging equipment 41 through inlet slits 53 or 54 and is compressed by the corresponding portion of piston 47. The compressed air is forced into compression chamber 22 through valves 51 and 52, respectively. The amount of compressed air forced into said compression chamber by cylinder chamber 48 is greater than the amount of compressed air forced into compression chamber 22 by cylindrical chamber 49. Therefore, the portion of the piston 47 having the larger diameter charges the compression chamber 22 more rapidly than the portion of the piston having the smaller diameter. Actually, the portion of the piston 47 having the smaller diameter merely compensates any reduction in pressure within compression chamber 22 which results from leakage.

The pressure generated by the portion of the piston 47 having the larger diameter can be regulated through slide means 55 and outlet opening 56 by hand-operated lever 56'. When the pressure in the compression chamber 22 is sufficient, further increase in pressure is prevented by positioning slide 55 so as to permit access by the air under pressure to opening 56. Subsequently, the portion of the piston 47 having a smaller diameter continues to increase the pressure in the compression chamber 22 solely

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in order to compensate in the manner already described for leakage occurring in compression chamber 22.

The percussion force of the device is controlled by positioning the nut 57. According to the position of nut 57 on handle 58, a coil spring 61 is compressed by means of bolt 59 engaging with flange sleeve 60. This causes plate 62 to tension valve 64 which is secured to plate 62 by bolt 63 and urged against its seat within housing 65. Bolt 63 is axially bored in order to permit discharge of fluid under pressure from within valve chamber 45 to the interior of housing 65.

Conduit 44 interconnects valve chamber 45 and compression chamber 22. Pressure from within compression chamber 22 is transferred through the opening within bolt 63 to one side of plate 62. The force exerted by the spring 61 on the plate 62 is thereby balanced by the pressure existing in compression chamber 22. When the pressure in the compression chamber is increased, the pressure exerted on plate 62 overcomes the strength of spring 61 and valve 64 is disengaged from its seat in housing 65 whereupon, pressure within chamber 22 is decreased and leakage to the atmosphere occurs through outlet opening 67.

Valve chamber 45 is closed at one end by a valve 68 spring loaded by means 69. Valve 68 can be adjusted by a bolt 70 by means of a manually operable element or key 71. For instance, the valve 68 can be pushed away from its seat within housing 65 upon guiding of the end of bolt 70 into inclined surface 72 of the key 71. When the operator moves key 71, the force of the percussion force is decreased to a predetermined degree since the pressure from the compression chamber 22 is released to the atmosphere through tube 44 past valve chamber 45 and outlet conduit 73. Upon release of key 71, the charging equipment 41 again promptly increases the pressure within compression chamber 22 up to normal operating range.

The hammer constructed according to the invention may, obviously, be used for ramming, boring or hammering rivets and the like.

Although one specific embodiment of the invention has been described and shown in the drawings, it should be noted that the invention may be realized in modified form and adaptations of the arrangements herein disclosed may be made, as may readily occur to persons skilled in the art without constituting a departure from the spirit and scope of the invention as defined in the objects and in the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. In a portable percussion device having piston means displaceable in opposite directions and adapted to force in one of said directions a tool element; first means for intermittently pressurizing fluid on one side of said piston means to thereby displace said piston means in said one direction, second means operating said first means and operatively connected to said piston means to move the latter in opposite directions and means on the opposite side of said piston means maintaining thereat said fluid below atmospheric pressure upon said displacement of said piston means in said one direction while preventing charging of said fluid upon displacement of said piston means in an opposite direction, whereby said pressurized fluid on said one side of said piston means cooperates with the fluid of less than atmospheric pressure on said opposite side of said piston means to enhance the effect of said piston means during actuation of said tool element.

2. In a portable percussion device according to claim 1, said second means including driven means, and operable means operatively connected to said driven means to thereby displace said piston means in said opposite direction.

3. In a portable percussion device according to claim 2, wherein said operable means is in the form of rotatable cam means, a portion of said cam means being engageable

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with a portion extending from said piston means for moving the latter in said opposite direction.

4. In a portable percussion device according to claim 1, including means for regulating the maximum pressure of said fluid on said one side of said piston means.

5. In a portable percussion device according to claim 4, said regulating means including means responsive to predetermined fluid pressure prevailing on said one side of said piston means for permitting discharge of said pressurized fluid.

6. A percussion device having a cylinder, a piston with a piston rod arranged for movement in said cylinder in opposite directions, and motor drive means for driving said piston in one of said directions; comprising, driven means operatively connected with said motor drive means and including means operatively connecting said driven means with said piston rod to thereby move said piston in one direction, fluid compression means intermittently actuated by said driven means and connected to said cylinder, whereby fluid under pressure from said fluid compression means is admitted to said piston for moving the latter in an opposite direction and against an element to be actuated, and means located in said cylinder maintaining a fluid pressure below atmospheric pressure therein, when said piston is moved in said one direction.

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7. In a portable percussion device having piston means for actuating a tool element and adapted to be displaced by fluid under pressure acting on the high pressure side of said piston means; means for pressurizing said fluid and including reciprocating fluid pump means acting on said high pressure side of said piston means, drive means for actuating said pump means and provided with cam means for reciprocating said pump means and said piston means simultaneously, pressure regulating valve means for controlling the maximum pressure of said fluid, and valve means on the low pressure side of said piston means for permitting the discharge of fluid located at the low pressure side of said piston means and thereby assisting the actuation of said tool element by said piston means.

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