

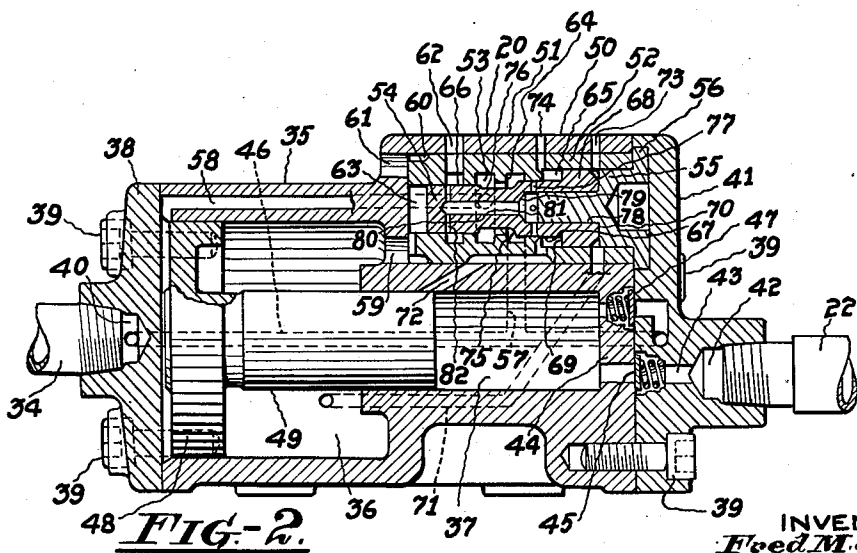
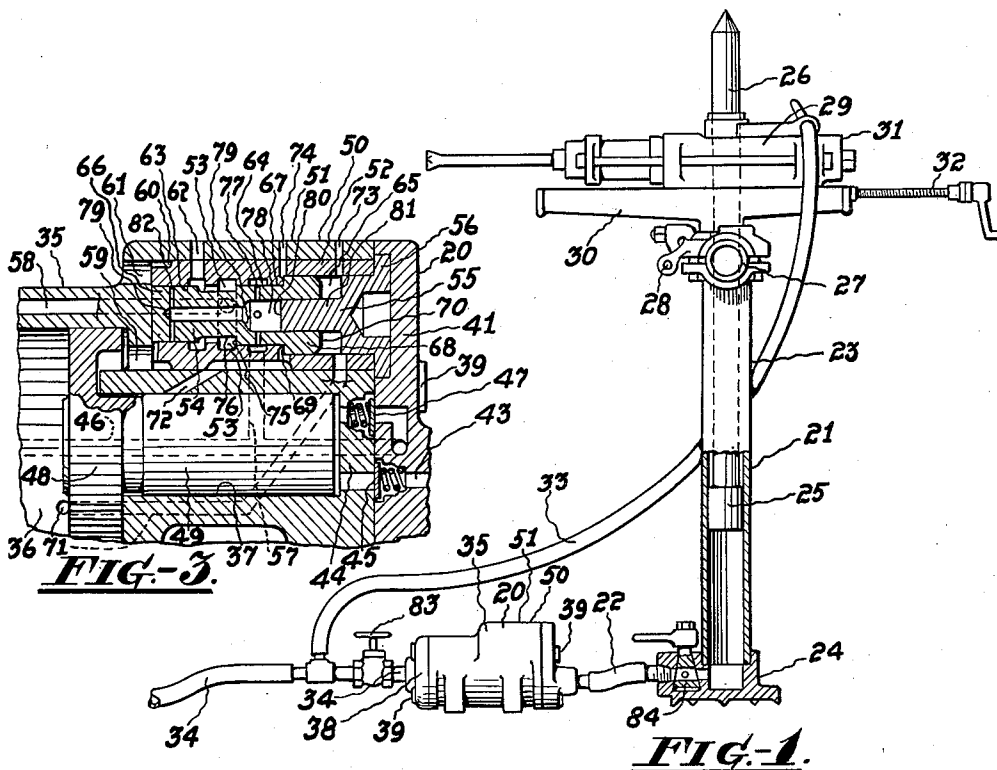
Dec. 5, 1950

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2,532,679

PRESSURE BOOSTER

Filed April 11, 1944



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UNITED STATES PATENT OFFICE

2,532,679

PRESSURE BOOSTER

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Application April 11, 1944, Serial No. 530,525

3 Claims. (Cl. 230—52)

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This invention relates to fluid compressors, and more particularly to a pressure booster the compressing element of which is subjected directly to pressure fluid for actuating it.

One object of the invention is to enable the pressure value of a fluid to be conveniently and expeditiously increased.

Another object is to provide a light weight pressure booster of simplified and rugged construction that is readily transportable and may be operated and maintained with a minimum of expense.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a side elevation of a pressure booster constructed in accordance with the practice of the invention and showing it attached to a drill column, the column being partly broken away,

Figure 2 is a longitudinal elevation, partly broken away, of an enlarged view of the booster showing the movable elements of the booster in certain limiting positions which they may assume in practice, and

Figure 3 is a similar view showing the movable parts of the booster in other limiting positions.

Referring more particularly to the drawings, 20 designates the pressure booster and 21 a drill column to which the discharge end of the booster is connected by a conduit 22.

The drill column 21, which is shown merely as an example of a device requiring pressure fluid of a higher value than associated pressure fluid actuated mechanisms, comprises a cylinder 23 having a foot piece 24 to rest upon a supporting surface (not shown) as for example the floor of a mine tunnel. The cylinder occupies a vertical position and contains a piston 25 the rod 26 of which projects slidably from the upper end of the cylinder 23 and is pointed for engagement with an overlying surface (not shown). The cylinder 23 serves as a support for a column arm 27 which may be secured thereto in any well known manner and carries clamping mechanism 28 commonly employed for securing rock drilling mechanism 29 to the arm 27.

The drilling mechanism is illustrated as being of the drifter type comprising a shell 30 that is gripped by the clamping device 28 and supports, slidably, a rock drill 31 which may be actuated endwise of the shell 30 by a feed screw 32.

The rock drill 31 is of the fluid actuated type and accordingly has a supply conduit 33 that is

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shown connected to a conduit 34 leading from a source of pressure fluid supply (not shown) to the booster 20.

The booster 20, constructed in accordance with the practice of the invention, comprises a cylinder 35 having a bore consisting of an enlarged portion and a reduced portion that, respectively, constitutes a power chamber 36 and a compression chamber 37. The outer end of the power chamber is closed by a head 38 that is secured to the cylinder 35 by screws 39 and has an aperture 40 that is threaded at its outer end to accommodate an end of the conduit 34. Similarly, a plate 41 overlies and is secured to the opposite end of the cylinder by screws 39 and has an aperture 42 the outer end of which is threaded to accommodate an end of the conduit 22.

Communication is afforded between the aperture 42 and the compression chamber 37 by a passage 43 in the plate 41 and an end wall 44 of the chamber 37, and a spring-pressed check valve 45 seated against the outer surface of the wall 44 controls communication between the aperture 42 and the compression chamber.

The fluid intended to be compressed by the booster is of the same pressure value as that used for operating the rock drill 31, and the booster 20 is accordingly provided with a supply passage 46 that leads from the aperture 40 through the head 38, the cylinder 35 and the plate 41 and opens into the end of the compression chamber 37. Communication between the supply passage and the compression chamber is controlled by a spring-pressed check valve 47 arranged in the end wall 44 and seating against the confronting surface of the plate 41.

The admission of pressure fluid to the power chamber 36 to act against the enlarged portion or head 48 of the piston 49 in the chambers is controlled by automatic valve mechanism 50 located adjacent the compression chamber 37. The valve chest 51 of said valve mechanism contains a bushing 52 the interior of which constitutes a valve chamber 53 for the accommodation of a valve 54. The outer end of the bushing 52 lies flush with the adjacent end of the cylinder and is sealed by a plug 55 having an external flange 56 that extends into the plate 41 and overlies the end of the bushing.

The pressure fluid distributed to the power chamber 36 by the valve 54 enters the intermediate portion of the valve chamber 53 from the supply passage 46 through a passage 57 and flows from the valve chamber 53 to the outer end of the power chamber through an inlet pas-

sage 58 in the cylinder 35. Pressure fluid is admitted to only the outer end of the power chamber 36 for actuating the piston, the opposite end of the power chamber being in constant communication with the atmosphere through a port 59, in the end of the cylinder, an annular groove 60 in the outer surface of the bushing 52 and an atmospheric port 61 in the adjacent end of the valve chest 51.

The inlet passage 58 opens into the valve chamber 53 at a point forwardly of the passage 57 and serves also to convey exhaust fluid from the power chamber 36 to the valve chamber. Such exhaust fluid passes from the valve chamber to the atmosphere through an exhaust port 62 located between the inlet passage 58 and the power chamber 36.

The valve chamber 53 consists of three portions 63, 64 and 65 the diameters of which increase in size in the order named, and the valve 54 has corresponding portions 66, 67 and 68 to lie, respectively, within the portions 63, 64 and 65. The opposed ends of the enlarged portion or head 68 constitute actuating surfaces 69 and 70, the latter being located at the end of the valve to be subjected intermittently to pressure fluid conveyed thereto by a kicker passage 71 opening into the power chamber 36 at a point to be uncovered by the piston head 48 at or near the end of its working stroke.

The actuating surface 69, located at the other end of the enlarged portion 68 of the valve, is likewise subjected intermittently to pressure fluid conveyed thereto by a kicker passage 72, leading from the compression chamber 37 through the cylinder, and by a passage in the bushing opening into the inner end of the portion 65 of the valve chamber. The passage 72 opens into the compression chamber 37 at a point to be uncovered by the piston near or at the end of its suction stroke.

Preferably the outer and inner ends of the enlarged portion 65 of the valve chamber are vented to the atmosphere through ports 73 and 74, respectively, of somewhat smaller flow areas than the passages 71 and 72 to permit of the immediate, although restricted, exhaust of fluid from said enlarged portion 65 after the valve has been thrown to its limiting positions.

The valve 54 is held in position for admitting pressure fluid into the inlet passage 58 by the pressure fluid passing through the valve chamber from the passage 57 to the passage 58. Such pressure fluid acts against an external shoulder 75 at the juncture of the portions 66 and 67 of the valve, and in the outer surface of the said portion 66, forwardly of the shoulder 75, is an annular groove 76 to afford communication between the passages 57 and 58.

The valve 54 is held in its other limiting position by pressure fluid flowing from the passage 57 through radial ports 77, in the valve, into a bore 78 extending part way through the valve from the enlarged end thereof. The pressure fluid thus admitted into the bore 78 acts against a holding surface, or surfaces, 79 in the bore and an end surface 80 of a stem 81 on the plug 55 extending into the bore 78. At the inner end of the bore 78 is a port 82 to register with the exhaust port 62 for exhausting fluid from the bore 78.

A suitable manually operable valve device 83 is placed in the conduit 34 to control the supply of pressure fluid to the booster 23, and a throttle valve 84 is shown arranged in the foot piece 24

for controlling the flow of pressure fluid from the conduit 22 into the cylinder 23 of the drill column.

In practice, whenever it is intended to operate the booster and assuming that the movable parts thereof, such as the piston 49 and valves 45, 47 and 54, occupy the positions shown in Figure 3 of the drawings, the valve 83 is opened to communicate the aperture 40 with pressure fluid supply. Pressure fluid then flows through the supply passage 46 past the check valve 47 into the compression chamber 37 against the smaller end of the piston 49 and moves the piston outwardly to the end of its suction stroke. At the same time pressure fluid will flow from the compression chamber through the passage 43 and the conduit 22 into the cylinder 23 and extend the column between the supporting surfaces.

When the piston 49 approaches the end of its suction stroke it uncovers the kicker passage 72 and pressure fluid then flows from the compression chamber 37 through the passage 72 against the actuating surface 69 and moves the valve 54 in the direction of the enlarged end of the valve chamber. In this position of the valve the passage 57 will be in communication with the passage 58 through the annular groove 76 and pressure fluid will then flow through these channels into the power chamber 36 to drive the piston 49 on its compression stroke. During this time the valve will be held stationary by the pressure fluid flowing across the holding surface 75.

When the piston 49 approaches the end of its compression stroke the head 48 uncovers the kicker passage 71 and pressure fluid will flow through said kicker passage from the power chamber against the actuating surface 70 and move the valve 54 in the direction of the small end of the valve chamber 53. In this position the valve will cut-off communication between the passages 57 and 58, and the port 77 will be in direct communication with the passage 57 so that pressure fluid will flow into the bore 78 to hold the valve momentarily stationary.

In this new position of the valve the passage 58 will be in communication with the exhaust port 62 through the annular grooves 76 and fluid will exhaust from the power chamber through these channels to the atmosphere. At the same time the piston will again be returned to the end of its suction stroke by the pressure fluid flowing into the compression chamber 37. This operation may continue until a pressure of the required value has been attained within the cylinder 23 to assure against the shifting of the drill column by the thrust and the vibration of the rock drill during its operation.

In practice the present invention has been found to be particularly desirable for use in instances where one or more of a number of pressure actuated mechanisms require power of a value greater than that required by the other mechanisms. In such case the booster may be quickly connected to the pressure fluid supply line and to the mechanism requiring the higher pressure and be set in operation to perform its boosting function automatically as long as the booster remains in communication with the source of power supply.

I claim:

1. A pressure booster, comprising a casing having a bore to define a power chamber and a compression chamber of smaller diameter than the power chamber, a piston in the chambers, a supply passage in the casing for supplying pressure

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fluid to the compression chamber for compression to a higher value and to actuate the piston in one direction, a discharge passage in the casing for the compression chamber, check valves to control the passages, inlet and exhaust passages in the casing for the power chamber, a valve to control the inlet and exhaust passages and having opposed actuating surfaces, and crossed kicker passages in the casing having their inlet ends covered and uncovered by the piston to valve pressure fluid intermittently to the actuating surfaces for actuating the valve.

2. A pressure booster, comprising a casing having a bore to define a power chamber and a compression chamber of smaller diameter than the power chamber, a piston in the chambers, a supply passage in the casing for supplying pressure fluid to the compression chamber, a discharge passage for the compression chamber, check valves to control the said passages, inlet and exhaust passages in the casing for the power chamber, a valve to control the inlet and exhaust passages and having opposed actuating surfaces, a kicker passage in the casing covered and uncovered by the piston to valve pressure fluid from the power chamber to one actuating surface for moving the valve in one direction, and a second kicker passage in the casing covered and uncovered by the piston to valve pressure fluid from the compression chamber to another actuating surface for moving the valve in an opposite direction.

3. A pressure booster, comprising a casing having a bore to define a power chamber and a compression chamber of smaller diameter than the power chamber, a piston in the compression chamber having a head lying in the power chamber, supply and discharge passages for the com-

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pression chamber, check valves to control the passages, an inlet passage in the casing for conveying pressure fluid into and exhaust fluid from the power chamber, a valve in the casing to control the inlet passage and having a pair of opposed actuating surfaces, a kicker passage in the casing for conveying pressure fluid from the power chamber to one actuating surface to throw the valve to a position to communicate the inlet passage with the atmosphere and opening into the power chamber at a point to be uncovered by the head at the end of the compression stroke of the piston, and another kicker passage in the casing for conveying pressure fluid from the compression chamber to the other actuating surface for throwing the valve to a position to admit pressure fluid into the inlet passage and opening into the compression chamber at a point to be uncovered by the piston at the end of the suction stroke of said piston.

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