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PNEUMATIC FEEDING MECHANISM FOR MACHINE TOOLS

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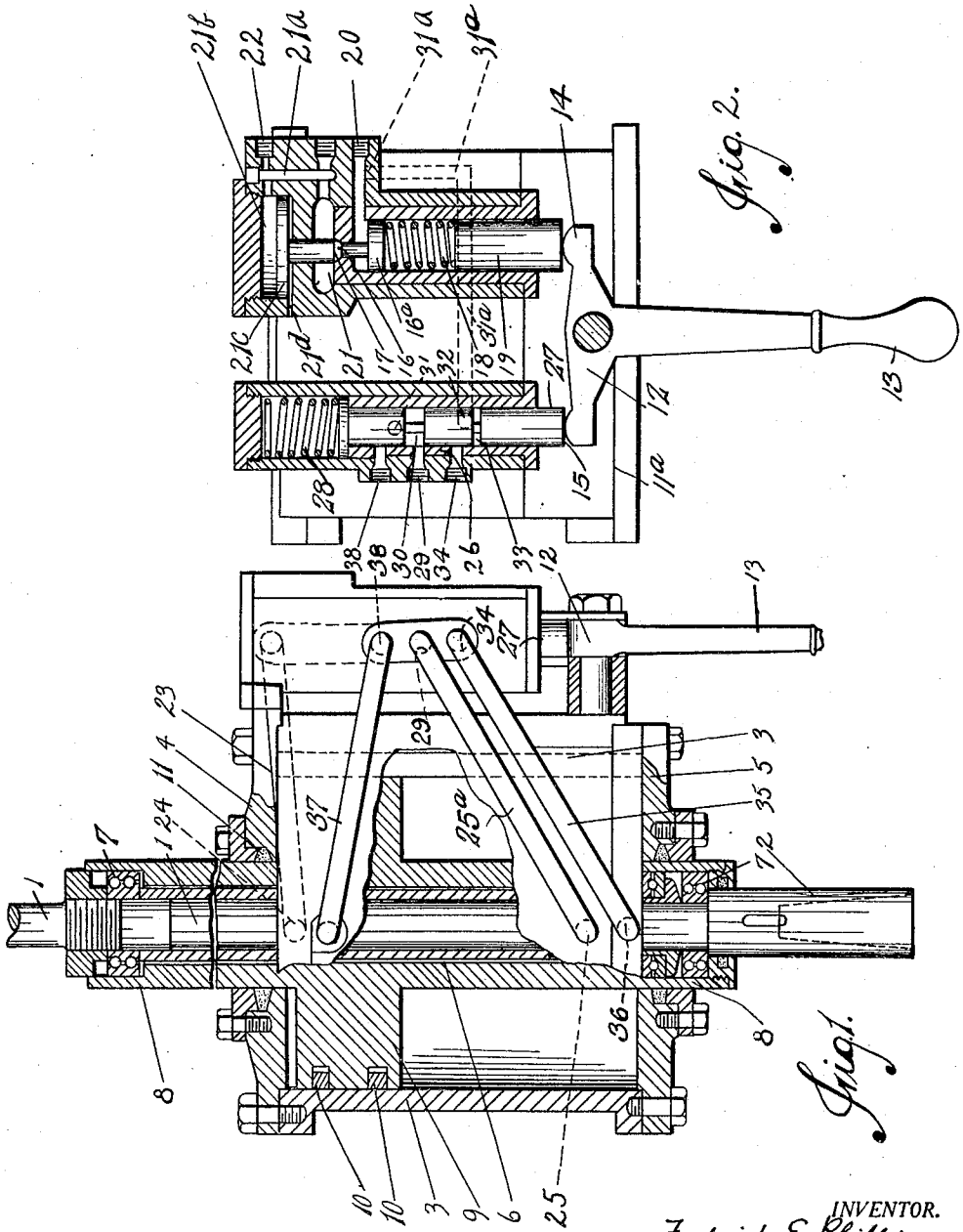


Fig. 2.

Fig. 1.

INVENTOR.
Frederick E. Phillips

BY

ATTORNEYS

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FREDERICK E. PHILLIPS, OF NEWPORT, KENTUCKY, ASSIGNOR OF ONE-FOURTH TO ALLEN & ALLEN, A FIRM COMPOSED OF ALFRED M. ALLEN AND MARSTON ALLEN, OF CINCINNATI, OHIO

PNEUMATIC FEEDING MECHANISM FOR MACHINE TOOLS

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My invention relates broadly to the general class of machine tools, and to pneumatic mechanism for feeding either the tools or the work. The particular embodiment disclosed in the ensuing application, relates to feeding mechanism for high speed drills and the like.

It is the object of my invention in the combination with a high speed drill, to provide means for feeding the rotatable tool carrying shaft pneumatically, and in combination with this pneumatic means to provide a valve mechanism for the supply of air for actuating the said means which will be positive in operation, and which may be readily controlled by a manually movable member.

Referring to the drawings in which I have illustrated a preferred embodiment illustrating the principle involved in the application of my invention to a high speed drill:

Figure 1 is a side elevation with parts in section showing the pneumatic cylinder with the connecting pipes to the valve mechanism.

Figure 2 is a vertical section of the valve control mechanism, with a preferred type of control handle.

Generally indicated at 1 is the shaft of the drill, which is rotated by suitable mechanism which is not shown, as it forms no part of this invention. Reference is made to the patent to Kirby, 971,679, as an example of a simple type of mechanical means of controlling the feed of a rotatable shaft carrying a drilling tool. The shaft 1 is rotatable and also movable longitudinally, so that the feeding means for the shaft is of necessity some movable member which applies force longitudinally without impairing the rotation of the shaft. The tool holding end of the rotatable shaft is indicated at 2. I have shown a cylinder having walls 3 and an upper head 4 and a lower head 5. A sleeve 6 is mounted on the shaft 1, and bearings 7 preferably of the ball type, provide a freely rotatable connection between the shaft and the piston hub 8, which extends through the top and bottom head. The piston head 9 has rings 10, or other suitable means of preventing leakage between the outer periphery of the head and the cylinder walls, and packing glands 11 are provided for the hubs 8 to prevent air leakage in the openings in the heads through which the hub passes.

With downward movement of the piston within the cylinder, the shaft 1 carrying the drilling tool is lowered, and with upward movement of the piston, the shaft is raised. For controlling the supply of air, and regulating the pressure of the air, I have provided a valve mechanism which is best illustrated in Figure 3. The casing 11*a* has a rocker arm 12 pivotally mounted therein, and a handle 13 is extended from the rocker. The handle may be manually manipulated by movement in a counter and clockwise direction as illustrated. The rocker arm 12 has a rounded bearing portion 14 at one end, and a rounded bearing portion 15 at the other. The admission of air to either end of the cylinder is regulated and controlled by a conical valve 16, which has a lower head 16*a* connected therewith, which is resiliently held away from its seat 17 by a spring 18 which is engaged at one end by a plunger rod 19. The plunger rod 19 is movable upwardly by engagement with the rounded end 14 of the rocker. Air pressure is admitted beneath the valve seat from a port 20, connected with some convenient source of air pressure. The air presses the head of the valve seat toward shut position, so that there is a counterbalanced control which determines the seating and the unseating of the valve seat dependent on the proportional force exerted downwardly by the air pressure against the head 16*a* and the pressure of the spring upwardly against the other face of the head 16*a*.

The pressure which is exerted by counterclockwise movement of the handle 13 raises the conical valve 16, and admits air from the high pressure side of the valve into the air passage 21, which is connected by a passage 21*a*, into the chamber 21*b* above a head 21*c*, which is also connected with the conical valve 16. Should the handle 13 be moved too suddenly, the air pressure will build up sufficiently against the head 21*c*, which will move downward as indicated exhausting through a port 21*d*, and thus force the valve 16 against its seat. Thus, I have provided

means of gradually admitting air to the pneumatic cylinder so that variations and jerky operation is avoided. The chamber 21*b* has at least one port 22 or threaded outlet passage into which is threaded the pipe 23. The pipe 23 extends to a port 24 above the piston head in the pneumatic cylinder. In-as-much as gradually increasing pressure for moving the shaft 1 carrying the tool into the work is primarily required during the downward movement of the drill, no provision is made for returning the piston head 9 under counterbalanced pressure.

For exhausting the pressure on the under side of the head, a port 25 is connected by a pipe 25*a* to a cylindrical chamber 26, in which is mounted for slidable movement a plunger 27. The plunger is pressed downwardly by a spring 28, so that as the handle 13 is moved in a counterclockwise direction, the port 29 into which the pipe 25*a* discharges is registered with an annular groove 30 in the plunger 27. When the annular groove 30 is in registry with the port 29, the air is exhausted to the atmosphere through a port 31 extending into the cylindrical chamber.

The return stroke is accomplished by the direct introduction of compressed air from a pipe source such as the pipe indicated at 31*a*, through a port 32 into the cylindrical chamber. With the plunger 27 in return position, the port 32 registers with a groove 33 in the plunger 27. In this position, a port 34 is also in alignment, which is connected with a pipe 35, which extends to an orifice 36 below the piston, so as to cause the piston to be elevated, and thus carry the shaft 1 with the drilling tool out of the work. In the return position, the air from above the piston is exhausted through the pipe 37, which extends to the return exhaust port 38 in the cylindrical chamber. In the return position, the groove 30 is aligned with both the ports 38 and the atmospheric discharge port 31, so that the air from above the piston is thereby exhausted.

Modifications in which the exposed piping will be integrally formed with the casing walls, and in which different shapes and sizes of parts are employed, will readily occur to those skilled in the art, without departing from the principle involved.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In combination with a movable member in a machine tool, a cylinder having a piston operatively connected with said member, a source of air pressure and means for introducing air therefrom into said cylinder, said means comprising a valve and a control handle resiliently connected therewith, an air passage connected into said cylinder, and said valve having two heads of different surface area connected therewith, the smaller of said heads being exposed to the source of air pressure, and the larger of said heads exposed to the pressure in said air passage, the said heads so arranged that air pressure against said smaller head will move the valve to closing position, and the air pressure against said larger head will also move said valve to closing position, whereby the introduction of air into the passage is regulated by the excess of the pressure of the resilient connection over that of the smaller head, with the pressure of the larger head directed so as to compensate for excessive introduction of air into said air passage.

2. In combination with a movable member in a machine tool, a cylinder having a piston operatively connected with said member, a source of air pressure and means for introducing air therefrom into said cylinder, said means comprising a valve and a control handle resiliently connected therewith, an air passage connected into said cylinder, and said valve having two heads of different surface area connected therewith, the smaller of said heads being exposed to the source of air pressure, and the larger of said heads exposed to the pressure in said air passage, the said heads so arranged that air pressure against said smaller head will move the valve to closing position, and the air pressure against said larger head will also move said valve to closing position, whereby the introduction of air into the passage is regulated by the excess of the pressure of the resilient connection over that of the smaller head, with the pressure of the larger head directed so as to compensate for excessive introduction of air into said air passage, and exhaust ports connected with said cylinder with operative connections from said control handle for openings ports from said cylinder on the side of the piston opposite that which is open to said air passage.

FREDERICK E. PHILLIPS.