

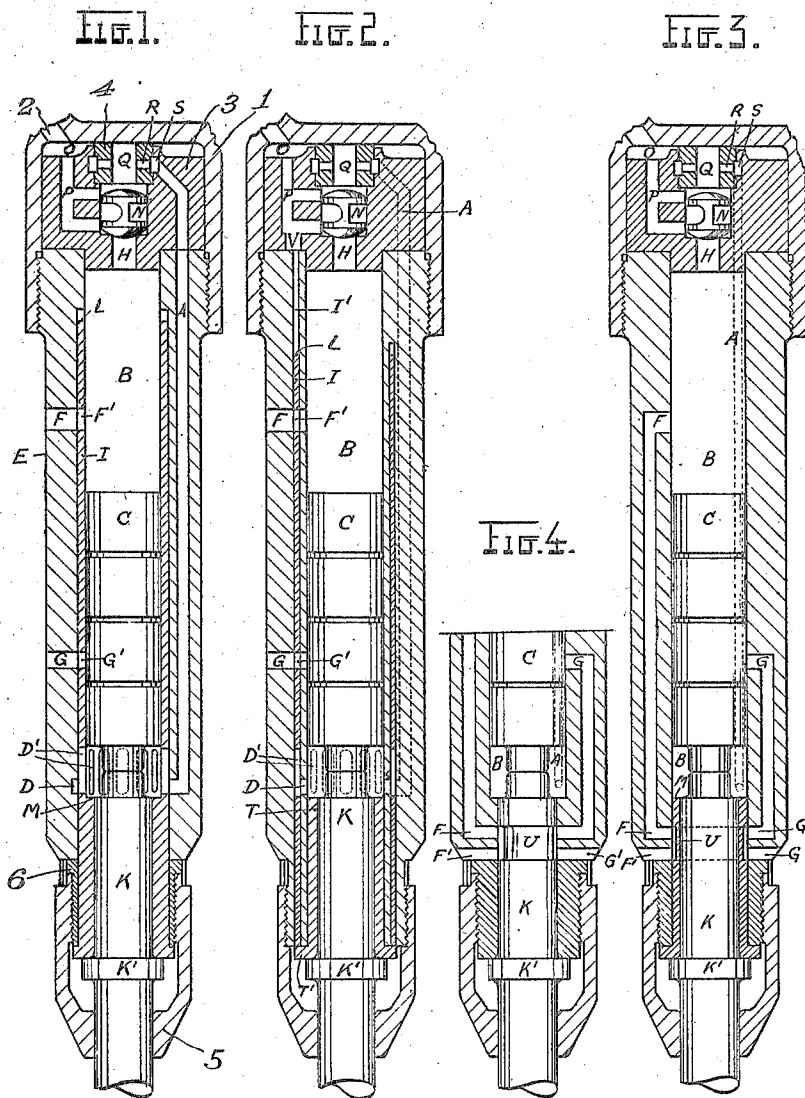
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AUTOMATIC STOPPING DEVICE FOR PNEUMATIC TOOLS

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HIS ATT.

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AUTOMATIC STOPPING DEVICE FOR PNEUMATIC TOOLS.

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To all whom it may concern:

Be it known that I, LEOPOLD RORIVE, a subject of the King of Belgium, residing at Brussels, Belgium, have invented new and useful Improvements in Automatic Stopping Devices for Pneumatic Tools, of which the following is a specification.

This invention relates to pneumatically operated tools, and relates particularly to tools of this character known as "pike" hammers, and it is the object of the invention to provide an automatic stopping device acting under the pressure of the actuating motive fluid and prevent the useless consumption of the actuating fluid pressure.

In tools of this character when the pike no longer meets with the resistance of the work, as by entering a split or as it is moved out of engagement with the work, the hammer continues to operate which causes the pike to become broken, and it is an object of the invention to instantaneously bring the hammer piston to equilibrium under the pressure of the actuating motive fluid as the tool no longer meets with any resistance of the work, and prevent the hammer from re-starting until the tool is again brought into engagement with and resisted by the work.

It is another object of the invention to provide a fluid pressure actuated device in which the tool is slidably carried by a cylinder for a hammer piston reciprocally mounted therein with inlets connected to a source of motive actuating fluid to opposite sides of the piston and exhaust outlets from opposite sides of the piston arranged with means to alternately connect the cylinder at opposite sides of the piston with the actuating motive fluid and exhaust the actuating motive fluid from opposite sides of the piston, and provide means automatically operable as no resistance is offered to the tool to shut off the exhaust ports from the cylinder at opposite sides of the piston and maintain the hammer piston at equilibrium under the pressure of the actuating motive fluid.

In the drawings accompanying and forming a part of this specification, Figure 1 is a longitudinal sectional view of a pneumatically operated tool with an embodiment of my invention applied thereto.

Figure 2 is a view similar to Figure 1 showing a modification.

Figure 3 is a view similar to Figure 1 showing modified means to control the exhaust outlet ports from the cylinder.

Figure 4 is a sectional detail view showing a modification of the means to control the exhaust ports shown in Figure 3.

In the embodiment of the invention shown in Figure 1 a cylinder B has a flanged closure 1 at one end with a port 2 arranged to be connected to the source of motive actuating fluid, with a valve plug 3 interposed between said closure cap and the end of the cylinder.

The motive actuating fluid is connected to one end of the cylinder through a port H in the plug 3 and having a valve N in an enlargement of said port to constitute a valve chamber, the valve having a limited longitudinal or axial movement in said chamber between the shoulder formed by said enlargement and the port H and a plug 4 engaging in said enlargement of the port H and arranged to maintain the plug 3 in spaced relation to the end of the closure 1 to form an annular chamber O with which the port in the closure communicates. The chamber O is connected to the chamber of valve N by a port P having branches leading to opposite ends of the valve. The motive actuating fluid is connected to the end of the cylinder opposite to the valve plug 3 through a bore A extending longitudinally of and having an outlet in the inner wall of the cylinder in communication with an annular recess D, said port A being in register with a bore in the plug 3 communicating with an annular recess S formed in the periphery of the plug 4 and the plug 3, which recess is connected to the chamber for valve N by radial ports R in the plug 4 communicating with an axial port Q therein in communication with the chamber of valve N. To exhaust the motive actuating fluid from the cylinder the cylinder has ports F and G.

An operating tool K, such as a pike, is slidably carried at the end of the cylinder opposite to the valve plug 3 by slidably engaging in a ferrule 5 having screw threaded connection with a bushing 6 connected to the cylinder, and a sleeve I, which is in the nature of a valve, slidably mounted in the bushing and an enlargement of the cylinder to constitute a part of the operating wall of the cylinder with a space L arranged between the end of the sleeve and cylinder enlargement when the sleeve is in normal position. Movement of the sleeve into the cylinder is limited by an annular shoulder at the outer end of the sleeve engaging with

the end of the bushing, and the movement of the tool into and out of the cylinder is limited by a shoulder K' on said tool in a recess formed between the forward end of the cylinder and the ferrule 5. The cylinder I has ports F' and G' to register with the respective exhaust ports F, G of the cylinder and a series of circumferentially disposed elongated ports D' in communication with the annular recess D. A hammer piston C is reciprocally mounted in the cylinder B and is arranged with a reduced portion at one end to co-operate with a similarly reduced portion at the end of the tool to form an annular recess at the end of the piston and tool in alinement with the sleeve ports D' and cylinder recess D for a purpose to be hereinafter set forth.

In operation with the tool engaging the work the parts will be in the position shown in Figure 1 when the tool flange K' will engage the end of the sleeve and the latter engaging the end of the bushing 6 with the ports F' and G' in register with the cylinder ports F, G. With the hammer piston C in the position shown the cylinder at the upper end is open to the atmosphere through the cylinder port F and shut off from the actuating fluid by the valve N being seated to close the port H, the motive actuating fluid being connected with the annular recess D and ports D' in the sleeve and the space formed by the reduced portions of the piston and tool, through bore A, recess S in plug 4, and ports R and Q therein in communication with the chamber for valve N, and the latter in communication with the source of motive actuating fluid and an upward movement about to be imparted to the hammer piston. As the piston moves upward the air at the upper end of the piston will be exhausted from the cylinder through ports F, F' until said ports are covered and closed by the piston, the piston then compressing the air above the piston which will unseat the valve N and open the port H and thereby connect the cylinder at the top of the piston to the source of motive actuating fluid. As the piston moves to position to close the ports F, F' it will uncover the ports G, G' opening the cylinder at the lower end of the piston to the atmosphere, the lower end of the cylinder being shut off from the motive actuating fluid by the valve N being seated against the port Q of the plug 4. In this position of the parts the piston will be moved in the opposite direction from that described until such time as the ports F, F' are uncovered and the ports G, G' covered, and this cycle of operations will be repeated so long as the tool is in engagement with the work and the movement of the hammer piston resisted thereby. Should the tool be moved out of engagement with the work as the hammer piston strikes

against the tool it will be moved to position with the shoulder K' thereon engaging with the ferrule 5, and the motive actuating fluid in the chamber B entering the space L at the end of the sleeve will move the sleeve outward and the ports F', G' therein out of register with the cylinder ports F, G and shutting off said ports from the cylinder. By the arrangement of the elongated ports D' in the sleeve the cylinder at the lower end of the piston is maintained in communication with the cylinder recess D and the bore A and thereby in communication with the source of motive actuating fluid which acts to lift the piston. As the port F is closed by the sleeve compression takes place in the cylinder above the piston and in the port H which will lift the valve N from its seat permitting access of the motive actuating fluid to the cylinder at the upper end of the piston and tending to move the piston forward or downward, but as port G is closed by the sleeve valve compression will also take place at the front end of the piston and the motive actuating fluid entering through the admission ports to both ends of the piston, and the pressure of said fluid on both ends of the piston compensating each other and thereby maintaining the piston in equilibrium with a cushion of the motive actuating fluid at opposite ends of the piston. It will be obvious that as soon as the tool is again placed into engagement with the work the sleeve will be moved to position with the ports F', G' therein in register with the cylinder ports F, G when the pressure will be relieved from the cylinder at one end of the piston and the operation of the piston as hereinbefore described will be repeated.

In the modification shown in Figure 2 instead of the sleeve I being mounted in the cylinder to constitute a part of the cylinder wall, said sleeve is mounted in an annular recess I' in the cylinder wall, which recess is maintained in communication with the source of the motive actuating fluid by a passage V in communication with the port P in the valve plug 3. The tool K instead of being mounted in said sleeve is slidably mounted in a bushing T which is slidably mounted in the cylinder, said bushing having an annular flange at the outer end for engagement by the outer end of the sleeve and thereby retaining the sleeve in position with the ports therein in register with the cylinder ports F, G. The operation of stopping the actuation of the hammer piston when the tool is relieved of the resistance of the work is the same as described in connection with the structure shown in Figure 1, the motive fluid to move the sleeve outward entering an annular space in the recess I' to act upon the end of the sleeve to move the same outward and to position with

the ports F', G' therein out of register with and shutting off the cylinder from the atmosphere through ports F and G.

In the modification shown in Figure 3 instead of the sleeve or slide valve extending into the cylinder to constitute a part of the cylinder wall as shown in Figure 2, and provided with the ports F' and G' to control the opening and closing of the cylinder ports F and G, this sleeve only extends into the cylinder to adjacent the reduced end of the tool in the normal operative position of the latter. The sleeve ports F, G instead of extending directly radially through the cylinder wall are in communication with bores extending longitudinally through the cylinder wall and constituting continuations of said ports with outlets in the inner wall of the cylinder adjacent the outer end in communication with an annular chamber U formed between the wall of the cylinder and an annular recess of the sleeve valve with which ports F'', G'' in the cylinder are in communication to connect the ports F, G with the atmosphere in the normal position of the sleeve. As the tool is relieved of the resistance of the work and moved outward by the hammer piston the sleeve will be moved outward by the pressure of the actuating motive fluid on the end of the sleeve valve I in the space at the reduced end of the piston and thereby moving an unrecessed portion of the sleeve in register with the outlets of the ports F, G and shutting off said ports from the atmosphere, and maintaining the hammer piston in equilibrium in a manner similar to that described in connection with the operation of the structure of Figure 1.

The structure of Figure 4 is the same as that shown in Figure 3 with the exception that sleeve I is omitted, the chamber U being provided by forming an annular recess in the tool itself as clearly shown.

Having thus described my invention, I claim:

1. In a fluid pressure actuated tool, a cylinder, a tool carried at one end of the cylinder to have a limited movement into and out of the cylinder, a reciprocable hammer piston in the cylinder to co-operate with the tool, inlet ports to the cylinder at opposite sides of the piston, a valve to control the entrance of the actuating fluid through said ports to the cylinder controlled by the pressure within the cylinder, exhaust ports from the cylinder at opposite sides of the piston, and a valve operated by the actuating fluid to shut off the exhaust ports from the cylinder when the tool is relieved of the pressure thereof upon the work and place the piston under equilibrium by the actuating fluid for the purpose specified.

2. In a fluid pressure actuated tool; a cylinder, a tool carried at one end of the cylinder to have a limited movement into and out of the cylinder, a reciprocable hammer piston in the cylinder to co-operate with the tool, inlet ports to the cylinder at opposite sides of the piston, a valve to control the entrance of the actuating fluid through said ports to the cylinder controlled by the pressure within the cylinder, exhaust ports from the cylinder at opposite sides of the piston, a sleeve valve mounted to have longitudinal movement in the cylinder and maintained in position with ports therein in register with the exhaust ports by the pressure of the tool when in work engaging position and adapted to be moved to position by actuating fluid to place the ports therein out of register with the exhaust ports and shut off the latter ports from the cylinder when the tool is relieved of the pressure thereof upon the work and place the piston under equilibrium by the actuating fluid.

3. In a fluid pressure actuated tool, a cylinder, a tool carried at one end of the cylinder to have a limited movement into and out of the cylinder, a reciprocable hammer piston in the cylinder to co-operate with the tool, a valve chamber connected to the source of fluid actuating pressure and having a pair of ports, one leading to the cylinder at one end of the piston, a passage in communication with the other port of the valve chamber having an outlet to the cylinder at the opposite end of the cylinder, a valve in said valve chamber operable by the pressures in the cylinder to control the opening and closing of the ports leading from said chamber, exhaust ports from the cylinder at opposite sides of the piston, a sleeve valve mounted to have longitudinal movement in the cylinder and maintained in position with ports therein in register with the exhaust ports by the pressure of the tool when in work engaging position, and adapted to be moved to position by the actuating fluid to place the ports therein out of register with the exhaust ports to shut off the latter from the cylinder when the tool is relieved of the pressure thereof upon the work and having elongated ports to maintain the inlet passage for the actuating fluid to one end of the cylinder open to the cylinder in all positions of the sleeve for the purpose specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEOPOLD RORIVE.

Witnesses:

W. BERGHAUS,
F. Y. BALREUX.