L. C. BAYLES.

FLUID OPERATED PERCUSSIVE TOOL.

APPLICATION FILED JAN. 14, 1914.

1,268,081.

Patented June 4, 1918.

2 SHEETS—SHEET 1.

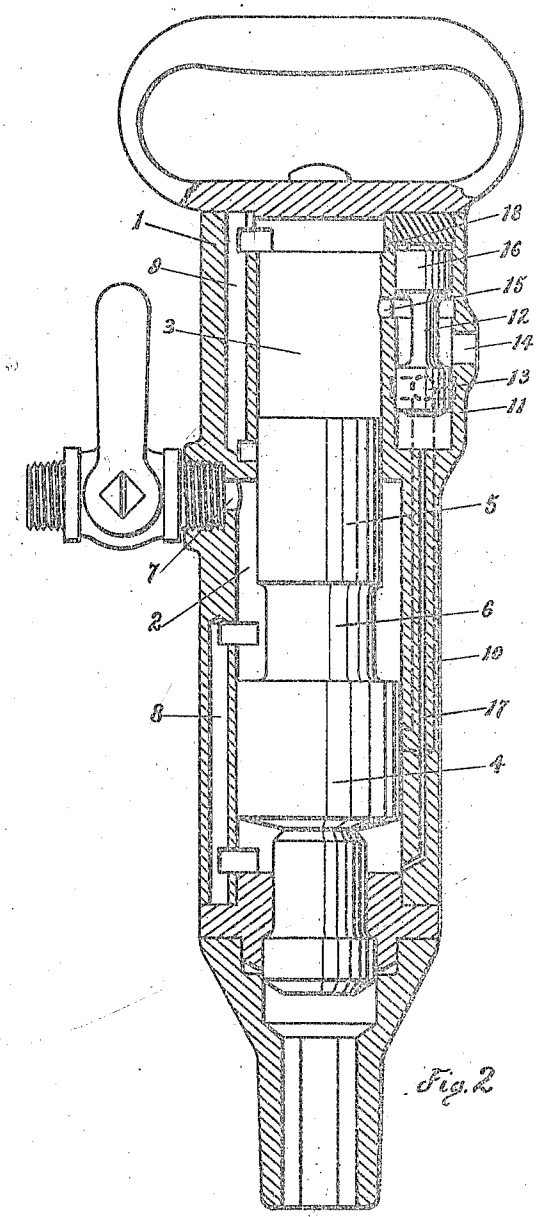

Fig. 2

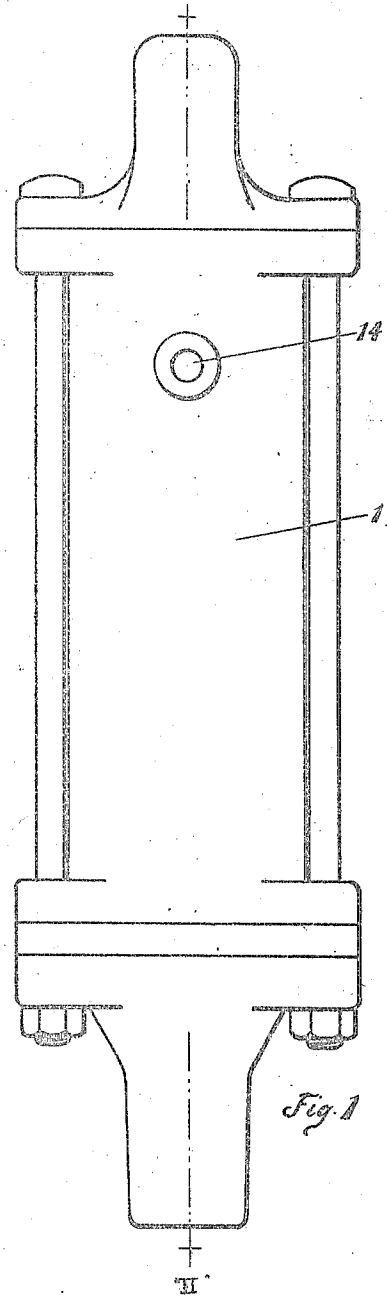

Fig. 1

WITNESSES:

F. M. Slater

Russell H. Wilhelm

INVENTOR

Laura C. Bayles

BY

ATTORNEY

L. C. BAYLES.

FLUID OPERATED PERCUSSIVE TOOL.

APPLICATION FILED JAN. 14, 1914.

1,268,081.

Patented June 4, 1918.

2 SHEETS—SHEET 2.

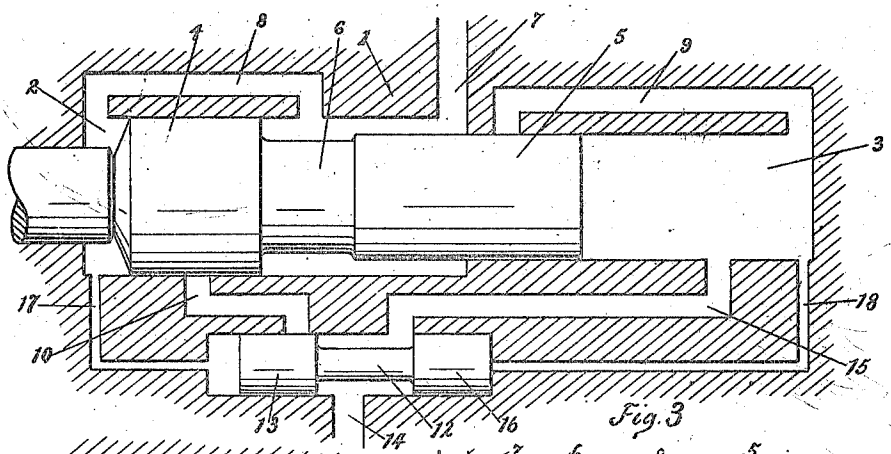

Fig. 3

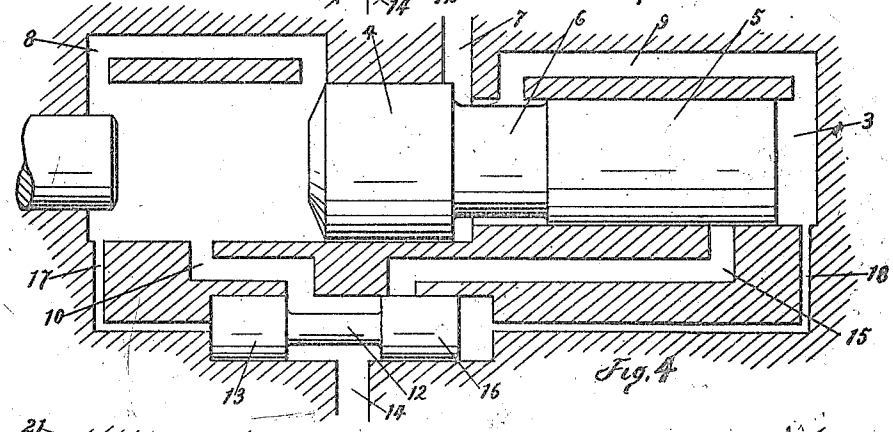

Fig. 4

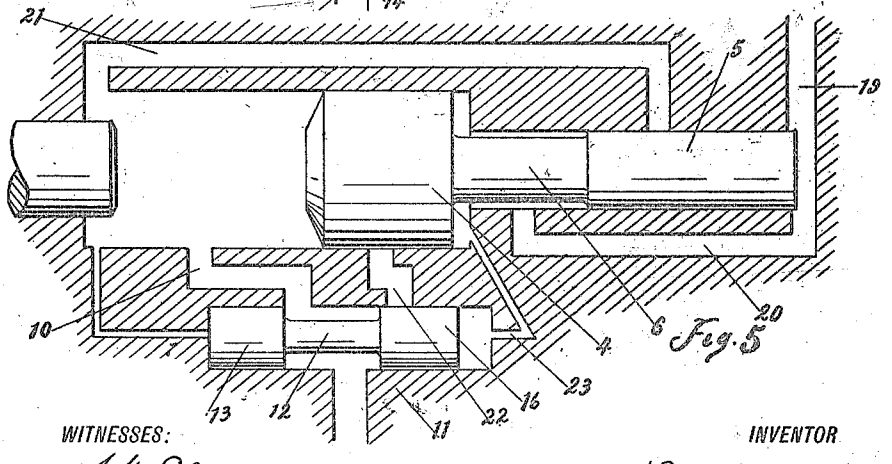

Fig. 5

WITNESSES:

J. M. Slater

Russell H. Wilhelm

INVENTOR

Lewis C. Bayles

BY

Philip Burnside & Goode

ATTORNEY

UNITED STATES PATENT OFFICE.

LEWIS C. BAYLES, OF EASTON, PENNSYLVANIA, ASSIGNOR TO INGERSOLL-RAND COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

FLUID-OPERATED PERCUSSIVE TOOL.

1,268,081. Specification of Letters Patent. Patented June 4, 1918.

Application filed January 14, 1914. Serial No. 811,986.

To all whom it may concern:

Be it known that I, LEWIS C. BAYLES, a citizen of the United States, residing at Easton, in the county of Northampton and State of Pennsylvania, have invented a certain new and useful Improvement in Fluid-Operated Percussive Tools, (Case A,) of which the following is a specification.

This invention relates to fluid operated percussive tools wherein the admission of the operating fluid to the cylinder is controlled by the movement of the piston, and has for its objects the production of a simple and efficient tool of this class, and also the provision of controlling means for the exhaust from the cylinder so that the operating fluid has a longer period of expansion, thus increasing the efficiency and decreasing the power consumption of the tool.

With these objects in view, I have devised a tool practical embodiments of which are shown in the accompanying drawings in which—

Figure 1 shows a side elevation of the tool,

Fig. 2, a longitudinal section on the line II—II of Fig. 1,

Figs. 3 and 4, diagrammatic views of the form shown in Fig. 2 and

Fig. 5, diagrammatic view showing a modified form.

The tool, as shown, comprises a cylinder 1 which has a forward bore, 2, and a rearward bore 3 of smaller diameter joining and meeting the forward bore 2, and forming a direct continuation thereof. In the cylinder reciprocates a differential piston which has a head 4 fitting and sliding in the forward portion and a shank 5, fitting and sliding in the rearward portion, there being a depressed portion or neck 6 between the head 4 and the shank 5. The construction is preferably such, and the stroke of the piston is sufficiently long, as to permit the forward end of the shank 5 to overrun the point of junction of the forward and rearward bores and extend for a substantial distance into the larger forward bore of the cylinder on the working stroke. Operating fluid is admitted to the rearward end of the forward bore 2 by an inlet passage 7 so that there is constant fluid pressure on the rear face of the piston head 4. From an intermediate point in the bore 2 a passage 8 leads to the forward end of the bore 2, the rear opening of this passage 8 being so placed that fluid is admitted from the rear end of the bore 2 to the forward end and the front end of the piston head 4 when the piston is near the forward end of its stroke. From a point near the forward end of the bore 3 a fluid passage 9 leads to the rear end of the bore 3, the forward end of this passage 9 being so placed as to be connected with the rear end of the bore 2 by the depression 6 in the piston when the piston is near the rear end of its stroke. From a point in the bore 2, forward of the rear opening of the passage 8 and so placed as to be closed by the piston head 4 at the forward end of its stroke, an exhaust passage 10 leads to a valve chest 11 in which reciprocates a spool valve 12, the opening of the exhaust passage 10 being so placed as to be closed by the head 13 of the spool valve 12 when this valve is in its rearward position and opening to atmosphere through the port 14 when the spool valve 12 is in its forward position. A similar exhaust passage 15 for the bore 3 is provided which opens from a point in the cylinder forward of the rear opening of the passage 9 and is controlled by the head 16 of the spool valve 12. To the ends of the valve chest 11 valve operating passages 17 and 18 lead respectively from the forward end of the bore 2 and the rearward end of the bore 3.

In operation, supposing the piston and valve to be in positions shown in Fig. 3, fluid will enter through the port 7 and pass by way of the passage 8 to the forward end of the cylinder bore 2 and by reason of the fact, that the forward surface of the piston head 4 is larger than the rearward surface, the piston will be moved rearwardly. Fluid from the bore 3 will be exhausted through passage 15 and port 14 and the exhaust valve 12 be maintained in position by the pressure exerted on the head 13 through the passage 17. As the exhaust passage 10 is closed by the head 13 of the valve 12, the fluid in the forward end of bore 2 will operate expansively after the passage 8 has been cut off by the piston head 4 until the piston nears the end of its rearward stroke, then the depression 6 will allow fluid to pass from the inlet passage 7 through the passage 9 to the back of the cylinder bore 3. The first effect of admission of fluid to the back end of bore 3 will be to drive the valve 12 for-

ward opening the exhaust passage 10 and closing the exhaust passage 15. The fluid pressure on the rear end of the piston shank 5 and the rear face of the piston head 4 will then drive the piston forward, fluid in front of the piston exhausting through the passage 10. The admission of fluid to the rear end of cylinder bore 3 will be cut off shortly after the beginning of the forward stroke of the piston by the closing of the passage 9 by the shank 5 and the remainder of the forward stroke of the piston will be accomplished by the expansion of the fluid in the bore 3 and the direct pressure of the fluid on the rear face of the piston head 4. When the piston nears the end of its forward stroke fluid will again be admitted through passage 8 to the bore 2 throwing the valve 12 rearwardly and repeating the above described cycle of operations.

The valve 12 increases the efficiency of the tool by lengthening the period of expansion of the fluid operating against the alternately supplied pressure areas.

In Fig. 5 a modified form is shown in which the operating fluid is admitted by a passage 19 to the rear end of the bore 3 and for a short portion of the forward stroke to the rear end of the bore 2 through a passage 20 and the depression 6. Fluid for the forward end of the cylinder bore 2 is admitted by a passage 21 which leads from an intermediate point of the bore 3 to the forward end of the bore 2. Exhaust passage 10 is the same as in the first described form but a second exhaust passage 22 leads from the rearward part of the bore 2 being covered by the piston head 4 as it approaches the end of its rearward stroke. In this form a valve operating passage 23 leads from the rear end of the bore 2 to the rear end of the valve chest 11.

It is to be understood that the present showing and description discloses only certain specified modifications of my invention and other forms and modifications are included in the spirit and scope of the invention as expressed in the claims.

What I claim is:

1. In a fluid operated percussive tool, a cylinder, a piston in said cylinder having two pressure areas for driving it forward and a pressure area for driving it rearward, fluid passages arranged to admit fluid pressure constantly to one of said forwardly operating pressure areas, and alternately to the other of said forwardly operating pressure area, and to said rearwardly operating pressure area, passages from said cylinder for alternately exhausting the fluid pressure from said alternately supplied pressure areas, and valve mechanism for controlling said exhaust passages.

2. In a fluid operated percussive tool, a cylinder, a piston in said cylinder having two pressure areas for driving it forward and a pressure area for driving it rearward, fluid passages arranged to admit fluid pressure constantly to a portion of the cylinder to exert pressure on one of said forwardly operating pressure areas, and alternately to portions of the cylinder to exert pressure on the other of said forwardly operating pressure areas and said rearwardly operating pressure area, passages from said cylinder for alternately exhausting the fluid pressure from said alternately supplied cylinder portions and a valve for controlling said exhaust passages, said valve having opposed operating pressure areas in communication with said alternately supplied cylinder portions.

3. In a fluid operated percussive tool, a cylinder, a piston in said cylinder having two pressure areas for driving it forward and a pressure area for driving it rearward, fluid passages arranged to admit fluid pressure constantly to a portion of the cylinder to exert pressure on one of said forwardly operating pressure areas, and alternately to portions of the cylinder to exert pressure on the other of said forwardly operating pressure areas and said rearwardly operating pressure area, exhaust passages leading from the sides of the alternately supplied cylinder portions, a valve for alternately opening said exhaust passages, said valve having opposed operating surfaces, and passages leading from the ends of said alternately supplied cylinder portions to convey fluid to said operating surfaces.

4. In a fluid operated percussive tool, a cylinder having a forward bore and a rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for conveying fluid constantly to the rear face of said shank, passages for conveying fluid alternately to the forward end of said forward bore and to the rear end of said forward bore, exhaust passages from the alternately supplied cylinder portions and a valve mechanism for controlling said exhaust passages.

5. In a fluid operated percussive tool, a cylinder having a larger forward bore and a smaller rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for conveying fluid constantly to the rearward end of said smaller bore, fluid passages for alternately conveying fluid to the ends of said larger bore, exhaust passages for the ends of said larger bore, and valve mechanism for alternately opening and closing said exhaust passages.

6. In a fluid operated percussive tool, a cylinder having a larger forward bore and a smaller rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for con-

veying fluid constantly to the rearward end of said smaller bore, fluid passages controlled by said piston for alternately conveying fluid to the ends of said larger bore, exhaust passages for the ends of said larger bore, and valve mechanism for alternately opening and closing said exhaust passages.

7. In a fluid operated percussive tool, a cylinder having a larger forward bore and a smaller rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for conveying fluid constantly to the rearward end of said smaller bore, fluid passages for alternately conveying fluid to the ends of said larger bore, exhaust passages leading from the sides of the larger bore near the ends thereof and so placed as to be alternately closed by said piston at the ends of the stroke, and valve mechanism for alternately opening and closing said exhaust passages.

8. In a fluid operated percussive tool, a cylinder having a larger forward bore and a smaller rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, means for conveying fluid constantly to the rear end of the rearward bore and alternately to the ends of the forward bore, a valve bore, exhaust passages leading from the side of said larger cylinder bore near the ends thereof to the side of said valve bore, an exhaust port from said valve bore, a valve sliding in said bore and having a depression adapted to alternately connect said cylinder exhaust passages and said atmospheric port, and passages leading from the ends of the larger cylinder bore to the ends of the valve bore to convey fluid to operate said valve.

9. In a fluid operated percussive tool, a cylinder having a forward bore and a communicating rearward bore of smaller diameter, a piston having a head fitting in said forward bore, a shank fitting said rearward bore and a depression between said head and shank, a fluid inlet passage for constantly admitting fluid pressure to the rear end of the rearward bore, a passage for conveying fluid from the forward end of the rearward bore to the forward end of the forward bore at the forward end of the piston stroke, a passage from the rearward end of the rear cylinder bore to the forward end of said rear cylinder bore, so placed as to be connected with said rear end of the forward cylinder bore by said piston depression at the rear end of the piston stroke, exhaust passages for the front and rear ends of said forward cylinder bore and a valve mechanism for controlling said passages.

10. In a fluid operated percussive tool, a cylinder having a forward bore and a communicating rearward bore of smaller diameter, a piston having a head fitting in said forward bore, a shank fitting said rearward bore and a depression between said head and shank, a fluid inlet passage for constantly admitting fluid pressure to the rear end of the rearward bore, a passage for conveying fluid from the forward end of the rearward bore to the forward end of the forward bore at the forward end of the piston stroke, a passage from the rearward end of the rear cylinder bore, to the forward end of said rear cylinder bore, so placed as to be connected with said rear end of the forward cylinder bore by said piston depression at the rear end of the piston stroke, exhaust passages leading from the sides of the forward cylinder bore near the front and rear ends, a valve for opening and closing said passages, and passages leading to opposite surfaces of the valve from the front and rear ends of the forward cylinder bore.

11. In a fluid operated percussive tool, a cylinder, a piston in said cylinder having two pressure areas for driving it forward and a pressure area for driving it rearward, fluid passages arranged to admit fluid pressure constantly to one of said forwardly operating pressure areas, and alternately to the other of said forwardly operating pressure areas, and to said rearwardly operating pressure area, a passage from said cylinder for exhausting an alternately supplied cylinder portion and a valve for controlling said passage.

12. In a fluid operated percussive tool, a cylinder having a forward bore and a rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for conveying fluid constantly to the rear face of said shank, passages for conveying fluid alternately to the forward end of said forward bore and to the rear end of said forward bore, a passage from said cylinder for exhausting an alternately supplied cylinder portion and a valve for controlling said passage.

13. In a fluid operated percussive tool, a cylinder, a piston in said cylinder having two pressure areas for driving it forward and a pressure area for driving it rearward, fluid passages arranged to admit fluid pressure constantly to one of said forwardly operating pressure areas, and alternately to the other of said forwardly operating pressure areas, and to said rearwardly operating pressure area, an exhaust passage for the forward end of said cylinder and a valve for controlling said passage.

14. In a fluid operated percussive tool, a cylinder having a forward bore and a rearward bore, a piston having a head in said forward bore and a shank in said rearward bore, a fluid passage for conveying fluid constantly to the rear face of said shank, passages for conveying fluid alternately to the forward end of said forward bore and

to the rear end of said forward bore, an exhaust passage for the forward end of said cylinder and a valve for controlling said passage.

15. In a fluid operated percussive tool, a cylinder having a forward bore and a rearward bore of smaller diameter joining and meeting the forward bore and thereby forming a direct continuation of said forward bore, a differential piston in said cylinder having a head reciprocating in the forward bore, and a shank reciprocating in the smaller rearward bore, a reduced neck connecting the said shank and head, the rear faces of the head and shank forming pressure areas for driving the piston forward, and the forward surface of the head forming an opposing pressure area for driving the piston rearward, the stroke of the piston being sufficiently long to permit the forward portion of said shank to overrun the point of junction of the forward and rearward bores, and extend for a substantial distance into the larger forward bore of the cylinder on the working stroke, fluid passages arranged to admit fluid pressure constantly to a portion of the cylinder to exert pressure on one of said forwardly operating pressure areas, and alternately to portions of the cylinder to exert pressure on the other of said forwardly operating areas and said opposing rearwardly operating pressure area, passages from said cylinder for alternately exhausting fluid pressure from said alternately supplied cylinder portions, and a valve for controlling said exhaust passages, said valve having opposed operating pressure areas in communication with said alternately supplied cylinder portions.

16. In a fluid operated percussive tool, a cylinder having a forward bore and a rearward bore of smaller diameter joining and meeting the forward bore and thereby forming a direct continuation of said forward bore, a differential piston in said cylinder having a head reciprocating in the forward bore, and a shank reciprocating in the smaller rearward bore, a reduced neck connecting the said shank and head, the rear faces of the head and shank forming pressure areas for driving the piston forward, and the forward surface of the head forming an opposing pressure area for driving the piston rearward, the stroke of the piston being sufficiently long to permit the forward portion of said shank to overrun the point of junction of the forward and rearward bores and extend for a substantial distance into the larger forward bore of the cylinder on the working stroke, fluid passages arranged to constantly admit fluid pressure directly to a rearward portion of one of the cylinder portions to exert pressure on one of said forwardly operating pressure areas, and alternately admit fluid pressure directly to the rearward portion of the other cylinder bore and to the forward portion of the larger bore to exert operating pressure on the other of said forwardly operating pressure areas and said rearwardly operating pressure area, passages from said cylinder for alternately exhausting fluid pressure from said alternately supplied cylinder portions and a valve for controlling said exhaust passages, said valve having opposed operating pressure areas in communication with said alternately supplied cylinder portions.

In testimony whereof I have hereunto set my hand.

LEWIS C. BAYLES

Witnesses:
V. M. SLATER,
RUSSELL H. WILHELM.