

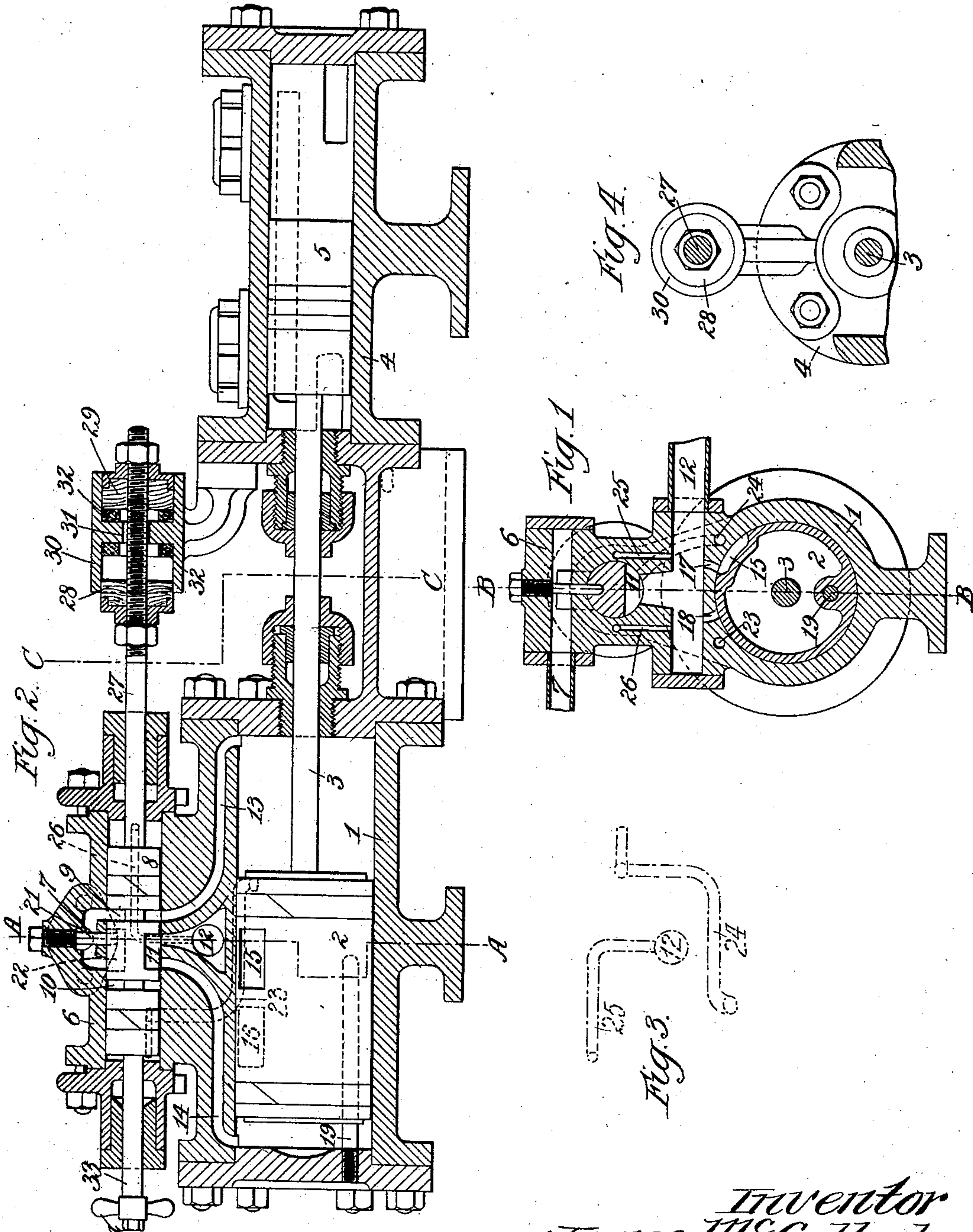
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Patented June 3, 1902.

J. McCULLOCH.  
FLUID PRESSURE PUMP.

(Application filed Feb. 23, 1901.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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TO GEORGE JOHN SMITH, OF TRELISKE, KENWYN, CORNWALL, ENGLAND.

## FLUID-PRESSURE PUMP.

SPECIFICATION forming part of Letters Patent No. 701,813, dated June 3, 1902.

Application filed February 23, 1901. Serial No. 48,540. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES McCULLOCH, engineer, a subject of the King of Great Britain, residing at Portreath, in the parish of Illogan, Cornwall, England, have invented certain new and useful Improvements Relating to Fluid-Pressure Pumps, of which the following is a specification.

This invention relates to improvements in fluid-pressure pumps of the kind described in the specification of prior patent, No. 629,386, dated July 25, 1899, in which a single distributing-valve is directly controlled by the working piston, the ends of the single distributing-valve chamber communicating, respectively, by means of crossed passages with the opposite sides of the working cylinder and the working piston being of such length and so provided with annular recesses that as it nears the end of its stroke in either direction it is adapted to uncover one of said passages, so as to admit the fluid-pressure from the working cylinder to one end of the valve-chamber and to put the other of said passages to exhaust.

This invention has for its object to increase the efficiency of the working and to improve the cushioning of the distributing-valve and to reduce wear and leakage of the working piston.

According to this invention the ends of the distributing-valve chamber are connected with the opposite sides of the working cylinder, as described in the aforesaid prior specification. The fluid-pressure admitted from the working cylinder to the valve-chamber for operating the said valve is allowed to exhaust through passages which are uncovered by the said valve before it completes its full stroke for the purpose of reducing shock. The working piston is of considerable length and is provided with recesses situated on one side of its periphery. These recesses are adapted to open one of the passages which connect the opposite sides of the working cylinder to the valve-chamber, with an exhaust-outlet from said cylinder when the other of said passages is open to the fluid-pressure from the said cylinder. A suitable guide is provided to prevent any angular movement of the working piston about its longitudinal axis. The

valve-stem passes fluid-tight through the end cover of the valve-chamber and carries disks adapted to reciprocate within a cylinder carried by the pump. Within this cylinder is a partition which carries india-rubber or other elastic substance, with which the said disks coöperate to cushion the valve.

Referring to the accompanying drawings, Figure 1 is a cross-section of the apparatus on line A A, Fig. 2, looking toward the right. Fig. 2 is a longitudinal section on line B B, Fig. 1. Fig. 3 is a diagram of the crossed passage leading from the right end of the valve-chamber to the left side of the working cylinder and of the exhaust-passage leading from the left end of the valve-chamber to the exhaust-outlet, these passages being formed in that part of valve-casing and working cylinder which is removed from the figure. Fig. 4 is a part-sectional end view of the pump on line C C, Fig. 2.

1 is the working cylinder, in which the working piston 2 is adapted to reciprocate. The rod 3 of the working piston extends through the end of the working cylinder and into the pump-cylinder 4, where it carries the pump-piston 5.

6 is the valve-casing, provided with a fluid-pressure inlet 7.

8 is the distributing slide-valve. This slide-valve is provided with annular passages 9 and 10 and a recess 11, adapted to coöperate with an exhaust-outlet 12 and passages 13 and 14, communicating with the ends of the working cylinder to drive the working piston, as is well understood. The upper face of the piston 2 is provided with recesses 15 and 16, adapted to respectively communicate with the exhaust-outlet 12 through passages 17 18 as the piston nears the end of each stroke, as hereinafter described.

19 is a guide-pin carried by the end cover of the cylinder 1 and engaging a guideway or channel 20 in the piston 2 for the purpose of preventing angular movement of the said piston about its longitudinal axis, and thus insuring that the recesses 15 16 will coöperate with the passages 17 18.

21 is a pin which engages a recess 22 in the valve 8 to prevent the said valve moving angularly about its longitudinal axis. The



lower surface of the piston, upon which most of the wear usually occurs, remains unbroken, and wear and leakage are thereby reduced.

23 is a passage formed in the working cylinder and valve-casings and connecting the left end of the valve-chamber with the right side of the working cylinder. 24 is a similar passage connecting the right end of the valve-chamber with the left side of the working cylinder.

25 is a passage formed in the valve-casing and connecting the left end of the valve-chamber directly to the exhaust-outlet 12. 26 is a similar passage to 25 and connects the right-hand end of the valve-chamber directly to the exhaust-outlet 12. The passage 25 is closed by the valve 8 when it nearly reaches the end of its stroke to the left, and the passage 26 is closed by the said valve when it nearly reaches the end of its stroke to the right.

The valve 8 is provided with a stem or rod 27, which passes fluid-tight through one of the end covers of the valve-chamber and carries disks 28 29, which may be of wood, metal, or other suitable substance. The disks 28 29 are adapted to reciprocate in a cylinder 30, carried by a bracket connected to the pump-cylinder. The cylinder 30 has a transverse partition 31, which is faced on both sides with india-rubber or other elastic material 32 and through which the rod 27 is adapted to freely pass. As the valve 8 reaches the end of its stroke in either direction one of the disks 28 or 29 comes into contact with a rubber facing 32, and thus coöperates in cushioning the said valve. It is obvious that instead of the partition 31 carrying the rubber facings 32, such facings might be carried by the disks 28 and 29. By thus mounting the cylinder 30 upon the pump-cylinder it may be removed a sufficient distance from the distributing-valve and working cylinder to prevent the india-rubber facings 32 being injuriously affected by heat.

33 is a rod carried by the end of the valve 8 opposite to the rod 27 and passing fluid-tight through the valve-casing. The free end of the rod 33 carries a handle 34 for operating the valve by hand, if required.

When the various working parts of the apparatus are in the position shown in the drawings, the right-hand end of the working cylinder is open to fluid-pressure and the left-hand end of said cylinder is open to exhaust. As the piston 2 completes its stroke toward the left it opens the passage 23 to the fluid-pressure in the working cylinder and the recess 15 simultaneously opens the passage 24 to the exhaust. Motive fluid then passes from the right side of the cylinder 1 to the left end of the valve-chamber and propels the valve 8 toward the right. Shortly after the valve 8 has commenced to move toward the right it uncovers the passage 25, and thus permits the motive fluid to escape from the left end of the valve-chamber directly to

exhaust, the valve completing its stroke to the right by virtue of the momentum it has received. As the valve completes its stroke to the right it closes the passage 26, but (when working with steam) any water of condensation can then escape from the right end of the valve-chamber to exhaust through the passage 24, recess 15, and passage 17. The left end of the working cylinder is then open to fluid-pressure, and the right end of said cylinder is open to exhaust. As the piston 2 nears the end of its stroke toward the right it uncovers the passage 24 to the fluid-pressure in the cylinder and the recess 16 simultaneously opens the passage 23 to exhaust, the valve 8 then moving to the left and uncovering the passage 26 shortly after the commencement of such movement. By virtue of the passages 25 and 26 the valve 8 is prevented from receiving a shock at each end of its stroke, and a very efficient valve action is thus secured.

When working with dry steam or compressed air, the recesses 15 and 16 in the piston and the exhaust-passages 17 and 18 need not be employed. The small amount of air or dry steam which would then be imprisoned in the valve-chamber at the end of every stroke would assist in cushioning the valve.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, passages which respectively connect the ends of the valve-chamber directly with the opposite side of the working cylinder, a working piston of such length as to uncover one or other of said passages as it nears the end of each stroke, and passages respectively connecting the ends of the valve-chamber directly to an exhaust-opening common to both of said last-mentioned passages and adapted to be opened by said valve before completing its stroke, substantially as and for the purpose specified.

2. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port having a central opening into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses in its upper face to coöperate with said passages and central exhaust-opening, and means for preventing angular movement of the working piston, substantially as described.

3. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port opening centrally into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses adapted to coöperate with said passages and central exhaust-opening, and passages respectively connecting the ends



of the valve-chamber directly to exhaust and adapted to be opened by said valve before completing its stroke, substantially as described.

5 4. In a pump, the combination of the working cylinder, a guide-pin carried by the end cover of said cylinder, the piston-valve, the valve-chamber, an exhaust-port opening centrally into the working cylinder, passages  
10 which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, and a working piston provided with a guideway for said guide-pin and having recesses in its upper face to cooperate with said  
15 passages and central exhaust-opening, substantially as described.

5. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port opening centrally into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses in its upper face adapted to cooperate with said passages and central exhaust-opening, means for preventing angular movement of the working piston, and passages respectively connecting the ends of  
25 the valve-chamber directly to exhaust and adapted to be opened by said valve before completing its stroke substantially as described.

6. In a pump, the combination of the working cylinder, a guide-pin carried by the end cover of said cylinder, the piston-valve, the valve-chamber, an exhaust-port opening centrally into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having a guideway for said guide-pin and provided with recesses in its upper face to cooperate with said passages  
40 and the central exhaust-opening, and passages respectively connecting the ends of the valve-chamber directly to exhaust and adapted to be opened by said valve before completing its stroke, substantially as described.

50 7. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, passages which respectively connect the ends of the valve-chamber directly with the opposite sides of the working cylinder, a working piston of such length as to uncover one or other of said passages as it nears the end of each stroke, passages respectively connect-

ing the ends of the valve-chamber directly to exhaust and adapted to be opened by said valve before completing its stroke, a rod carried by the piston-valve, disks carried by said rod, and means carried by the pump-casing for cooperating with said disks to cushion the said valve, substantially as described.

8. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port having a central opening into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses to cooperate with said passages and central exhaust-opening, a rod carried by the piston-valve, disks carried by said rod, and means carried by the pump-casing for cooperating with said disks to cushion the said valve, substantially as described.

9. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port having a central opening into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses to cooperate with said passages and central exhaust-opening, a rod carried by the piston valve, disks carried by said rod, a cylinder carried by the pump-casing and a central partition in said cylinder with which the said disks cooperate to cushion the valve, substantially as described.

10. In a pump, the combination of the working cylinder, the piston-valve, the valve-chamber, an exhaust-port having a central opening into the working cylinder, passages which respectively connect the ends of the valve-chamber with the working cylinder on opposite sides of the central exhaust-opening, a working piston having recesses to cooperate with said passages and central exhaust-opening, a rod carried by the piston-valve, disks carried by said rod, a cylinder carried by the pump-casing, a central partition in said cylinder with which the said disks cooperate to cushion the valve, and elastic substance interposed between the disks and the said central partition, substantially as described.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 11th day of February, 1901.

JAMES McCULLOCH.

Witnesses:

F. C. POLGLASE,  
F. S. NEW.