No. 684,713. Patented Oct. 15, 1901.

W. PAYTON.

FLUID PRESSURE MOTOR.

(Application filed Feb. 12, 1901.)

(No Model.) 3 Sheets—Sheet I.

Fig. 1.

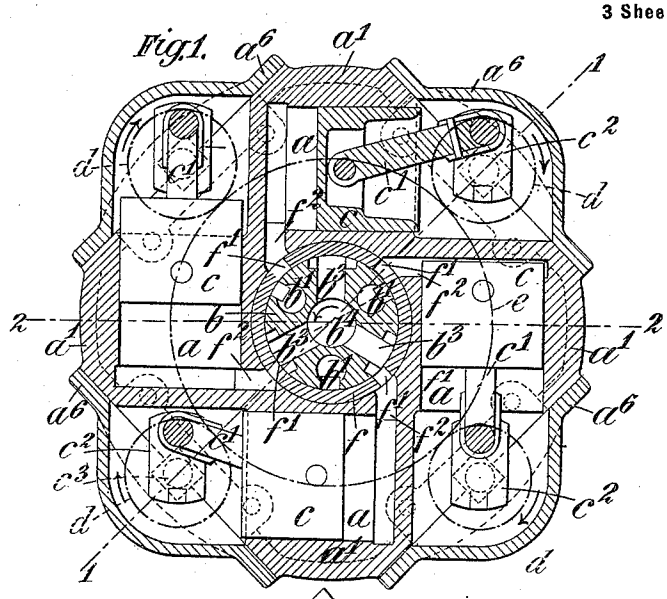


Fig. 2.

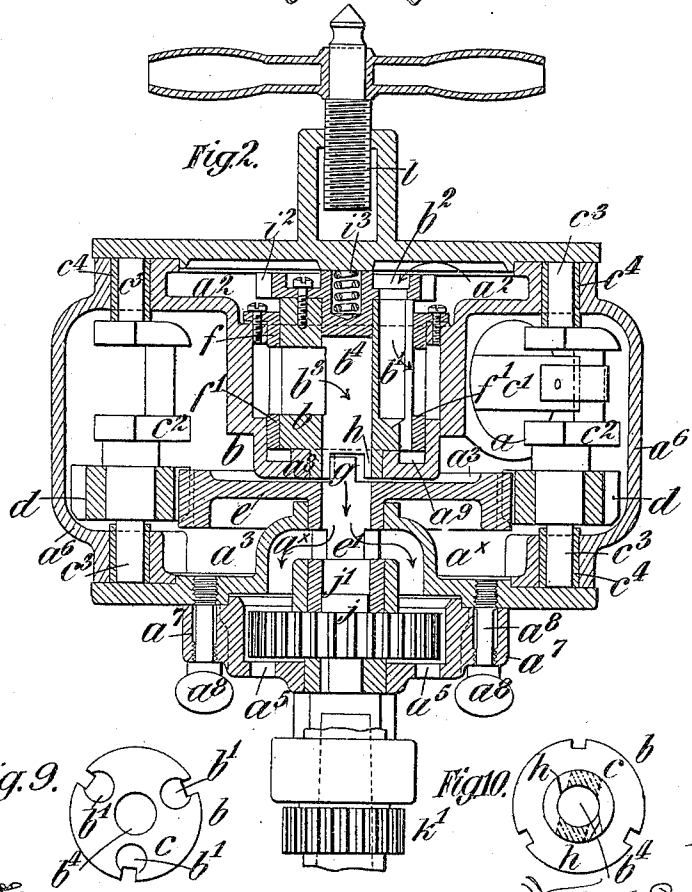


Fig. 9.

Fig. 10.

Witnesses

J. B. Tuttle

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Inventor

Walter Payton

By James L. Norris.

atty

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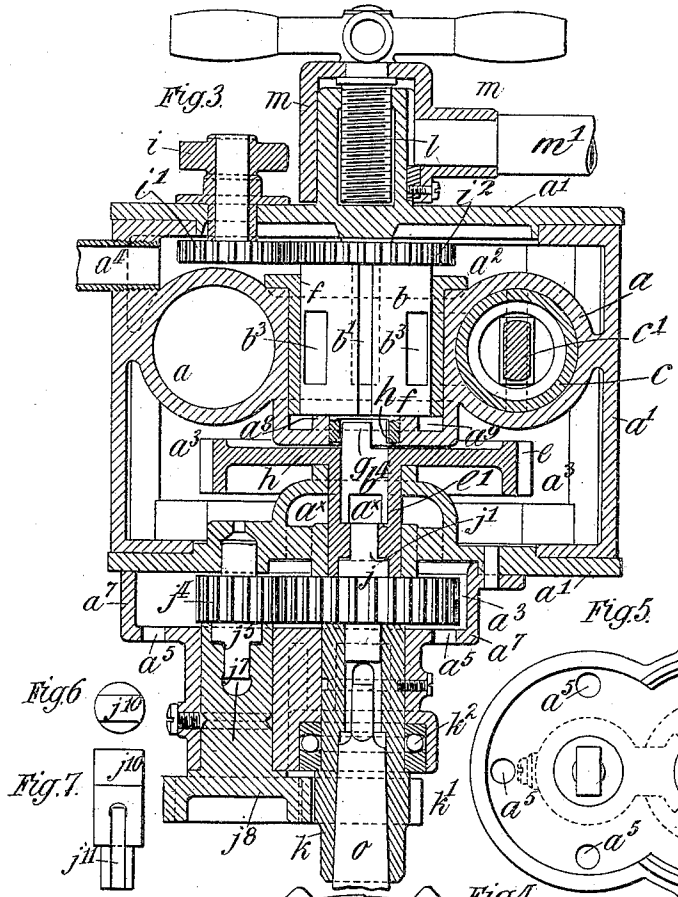
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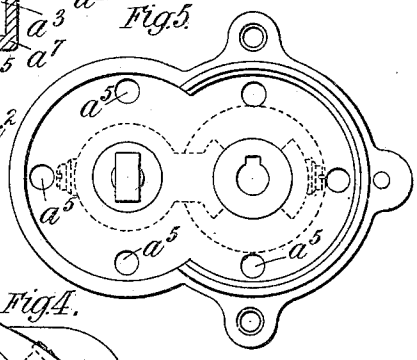
W. PAYTON.

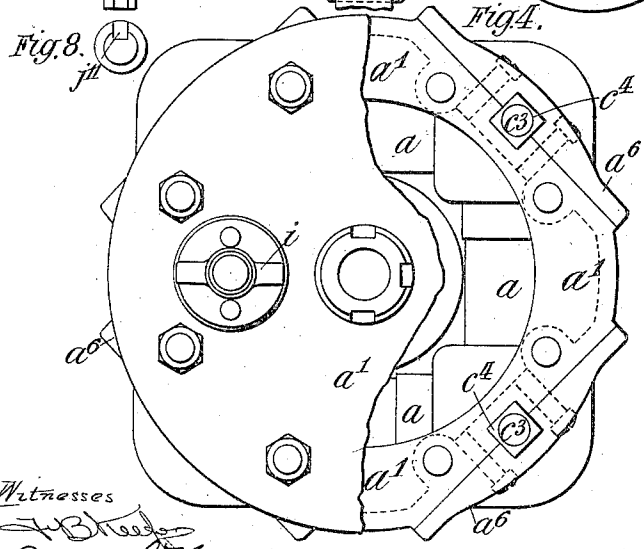
FLUID PRESSURE MOTOR.

(Application filed Feb. 12, 1901.)

(No Model.) 3 Sheets—Sheet 2.







Witnesses
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FLUID PRESSURE MOTOR.

(Application filed Feb. 12, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 11.

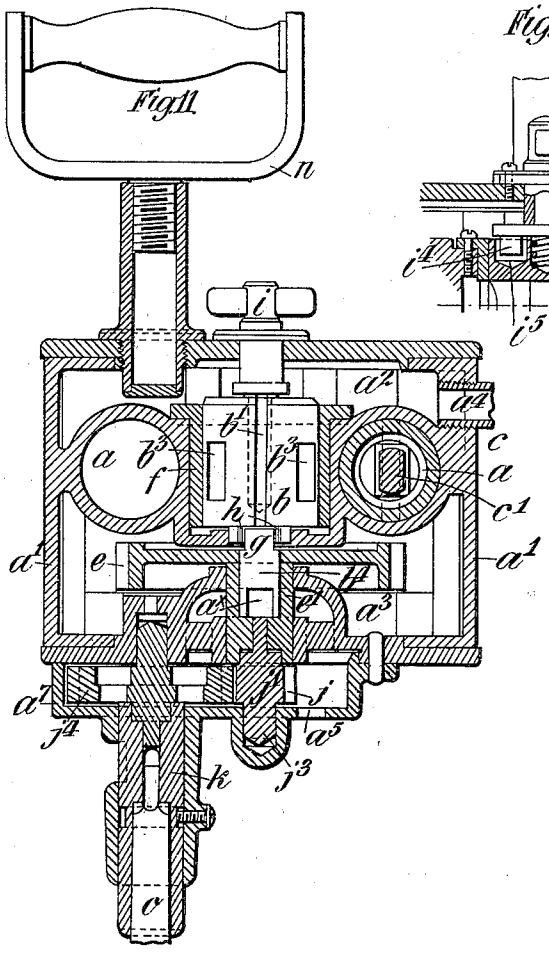
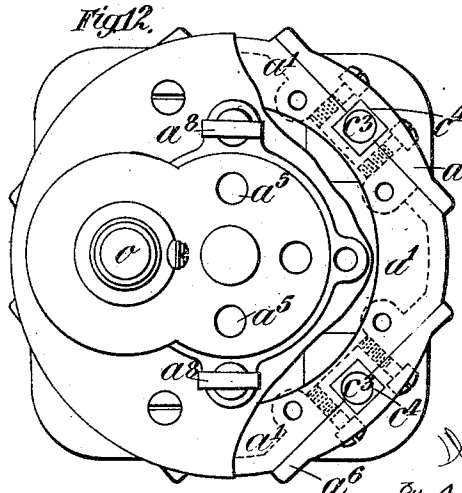


Fig. 13.

Fig. 12.



Witnesses

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UNITED STATES PATENT OFFICE.

WALTER PAYTON, OF RICHMOND, ENGLAND.

FLUID-PRESSURE MOTOR.

SPECIFICATION forming part of Letters Patent No. 684,713, dated October 15, 1901.

Application filed February 12, 1901. Serial No. 47,030. (No model.)

To all whom it may concern:

Be it known that I, WALTER PAYTON, engineer, a subject of the King of Great Britain, residing at 138 Sheen road, Richmond, county of Surrey, England, have invented certain new and useful Improvements Relating to Fluid-Pressure Motors, of which the following is a specification.

This invention relates to fluid-pressure motors of the kind in which a plurality of working cylinders are arranged around and have their pistons connected to a rotary shaft or spindle that may be connected to a drill, screw-tap, reamer, milling or other tool, or may be employed for any other purposes for which the said motor may be suitable.

It is the chief object of this invention to provide a portable motor which shall be extremely compact and powerful in proportion to its weight and dimensions, which shall be well adapted for various purposes for which it may be employed, and in which the speed of the shaft or spindle can be increased or decreased without altering the speed of the pistons.

According to my invention I employ for working cylinders arranged with their longitudinal axes in a horizontal plane in rectangular form around a central vertically-disposed rotary valve controlling the admission and exhaust of the motive fluid to and from the said cylinders, each cylinder being provided with a piston and piston-rod connected to its own crank-shaft, said crank-shafts being situated at the four corners of the rectangle and gearing with a central wheel or pinion connected to the driving-axle. This arrangement of the cylinders in rectangular form enables me to provide the body of the apparatus with detachable doors or covers at its four corners, so that the bearings of the crank-shafts can be readily inspected or replaced when necessary and the interior of the cylinders also be conveniently got at. The aforesaid valve is made cylindrical and fitted within a liner provided with four ports communicating with said cylinders by suitable passages. The valve is formed with three equidistant passages or ports communicating with a chamber located within the body of the apparatus and constantly supplied with motive fluid from any suitable source. The said valve has also three outlet passages or ports which are always in communication with the atmosphere, and by this arrangement of the inlet-ports the pressure of the motive fluid is equally distributed in the valve and maintains it in lateral equilibrium. The valve is rotated in the liner by means of the aforesaid central wheel or pinion at a speed of one-third that of the crank-shafts. This speed is necessary in order to enable the passages in the valve as they pass the ports in the liner to successively admit the motive fluid to and exhaust it from the four cylinders.

To enable the direction of motion of the motor to be reversed, the aforesaid central valve may have a toothed wheel or circular rack on its upper end, which meshes with a toothed wheel or pinion, the axis of which is provided with a thumb-piece for the purpose of turning it, and thereby giving a rotary motion to the valve independently of the aforesaid central wheel, or the thumb-piece may be provided with a crank that engages with a socket in the valve for the purpose of turning it, as aforesaid.

The tool or shaft (as the case may be) which the motor is intended to drive may be connected, by means of a suitable coupling-piece, to the driving-axle carrying the aforesaid gear-wheel, and any thrust upon the axle may be received by a convenient ball-bearing. Interchangeable gear-wheels of varying speeds may be inserted between the said central gear-wheel and the tool or shaft, whereby the speed of the said tool or shaft may be increased or decreased, as desired, without changing the speed of the aforesaid pistons.

In order that my invention may be clearly understood and readily carried into effect, I will proceed to describe the same more fully with reference to the accompanying drawings, in which—

Figure 1 is a sectional plan of a motor constructed according to my invention. Figs. 2 and 3 are sectional elevations on the lines 1 1 and 2 2, respectively. Fig. 4 is a plan of Fig. 3. Fig. 5 is a plan of the gear-case shown in Figs. 2 and 3. Figs. 6 and 8 are opposite end views, and Fig. 7 an elevation, of the coupling-piece. Fig. 9 is a plan, and Fig. 10 an under side view, of the rotary valve. Figs. 11

and 12 are respectively a sectional elevation and an under side view of a modified construction of the motor.

In all the figures like letters of reference indicate similar parts.

a a are the working cylinders.

b is the central rotary valve.

c c are the pistons.

d d are toothed pinions mounted on the crank-shafts c^3, and e is the central toothed wheel, with which said pinions gear.

The motor illustrated in the drawings is intended for use with a drilling or other tool and is provided with four working cylinders located in one plane, with their longitudinal axes parallel with the opposite sides of a rectangle. The said cylinders are mounted in a body or casing a', which is divided into two horizontal chambers a^2 a^3, the upper chamber a^2 being in constant communication with the source of supply of the motive fluid through the opening a^4, Figs. 3 and 11, and the lower chamber a^3 being open to the atmosphere through the ports or openings a^5 a^5. The arrangement of the cylinders in the form of a rectangle, as above stated, has the advantage over a radial or other arrangement in that it permits the use of a fourth cylinder without having to increase the bulk of the motor, and it enables simpler and more accessible connections to be made between the pistons and the cranks. Each of the pistons c has pivoted to it a piston-rod c', which is connected with a crank c^2 on the crank-shaft c^3, each of these crank-shafts carrying, as before stated, the toothed pinion d. The said crank-shafts rotate in bearings c^4, formed of separate blocks, which are interposed in the body or casing of the motor in such a manner that they may be readily removed and replaced when required by detaching the doors a^6.

The aforesaid toothed pinions d d gear with the central toothed wheel e, the diameter of which relatively to the diameter of the said pinions is as three to one.

The doors or covers a^6 a^6 are bolted or otherwise secured to the body or casing a' to protect the pistons and gearing from dust and can readily be removed to permit the pistons or gearing to be examined and for the insertion of new bearings, as above stated, without taking to pieces the other parts of the motor.

The aforesaid central rotary valve b is made cylindrical and is fitted within a liner f, secured in the body of the motor, the said liner being formed with four equidistant ports f' f', Fig. 1, that communicate by passages f^2 f^2 with the inner ends of the cylinders a. The said valve is formed with three equidistant ports or passages b' b', that communicate with the motive fluid in the chamber a^2 by means of the passages b^2 b^2, formed in a toothed wheel i^2, hereinafter referred to, which is secured to the upper end of said rotary valve. The said valve has also formed in it three equidistant outlet passages or ports b^3 b^3, opening into a central passage b^4, which is in constant communication with the atmosphere through the ports a^5 a^5.

The valve b is rotated in the liner by means of projections g g, fixed upon the wheel e and engaging with projections h h, formed at the lower end of the valve. By rotating this valve at a speed of one-third of the speed of the cranks it is operated in a manner to supply motive fluid successively to each of the cylinders and to exhaust the spent fluid therefrom, so that the pistons are reciprocated in the required manner. The inlet-passages of the valve may have lap given to them in the usual manner for the purpose of using the motive fluid expansively.

The direction of revolution of the motor-shaft may be reversed by turning the central valve or advancing it a short distance independently of the wheel e, a sufficient amount of play being left between the projections g and the projections h for this purpose, as will be seen on reference to Fig. 10. To enable the valve to be readily turned, the external thumb-piece i, Fig. 3, is provided, said thumb-piece carrying a toothed pinion i', gearing with the aforesaid toothed wheel i^2 on the rotary valve. The incoming motive fluid presses the said valve firmly against its seat a^8, thereby preventing leakage past the valve to the outlet-ports, and the fluid is allowed to enter a chamber a^9, formed in the motor-casing at the lower end of the valve, from which chamber it passes upwardly to the ports in the liner, thus insuring a regular supply of motive fluid to the cylinders.

i^3, Fig. 2, is a spring interposed between the rotary valve or its toothed wheel i^2 and the upper cover of the motor-casing in order to prevent the said valve leaving its seat when the motor is not working and from becoming dislodged when the motor is moved from one place to another.

Instead of rotating the valve by means of gear-wheels, as above described, the thumb-piece i may be provided with a crank i^4, which enters a recess or socket i^5 in the upper end of the valve and by which the valve may be rotated independently of the central wheel to reverse the motor, as aforesaid.

j is a gear-wheel connected to the axle e' of the toothed wheel e by means of a coupling-piece j', the upper end of which engages with the said axle approximately formed to receive it, and the lower end of said coupling-piece is adapted to turn loosely in a socket in the end of a shaft or spindle k. The said wheel j gears with and imparts rotary motion to a toothed pinion j^4, which is also provided with a coupling-piece j^5, the upper end of which turns loosely in a socket in the casing of the motor, and its lower end engages with a rectangular socket in the upper end of a shaft j^7, carrying a pinion j^8, that gears with a pinion k' on the aforesaid shaft or spindle k, said shaft or spindle k being formed with a socket

to receive the tool *o* or other piece to be driven by the motor.

k^3 is a ball-bearing to receive any thrust that may be put on the gearing by the tool.

The gear-wheels *j* and j^4, which may be of any desired ratio to one another, are made interchangeable, so that by inverting and transferring them in order that the wheel j^4 may be in the place of the wheel *j*, and vice versa, a different ratio of speed between the axle *e'* and the shaft *k* can be obtained. To enable the said wheels to be changed without interfering with the other parts of the motor, the part a^7 of the casing *a*, in which the said wheels are mounted, is made detachable from the body of the motor by means of thumb-screws a^8 a^8, Fig. 2. If, however, it is desired to drive the shaft *k* direct from the axle *e'*, the gear-wheels may be replaced by the coupling-piece illustrated in Figs. 6, 7, and 8, which comprises a pin having a rectangular upper end j^{10} and formed with a feather j^{11}, which is adapted to enter a keyway formed in the interior of the said driving-shaft *k*, the gear-wheels *j* and j^4 operating in this instance in a similar manner to that already described with reference to the previous arrangement, the wheels j^8 and *k*, however, being unnecessary in this case.

In Fig. 2 the motor is shown provided with a hand feed-screw *l* and center bearing, so that it may be connected to an ordinary drill-post and adjusted to the work.

Fig. 3 shows the motor provided with a socket *m*, by means of which it may be connected to the radial arm *m'* of a drill-post.

Fig. 11 shows the motor provided with a handle to enable it to be used without a drill-post. In this view also the shaft *k*, carrying the tool, is shown eccentric with respect to the shaft *e'* and is rotated by means of the coupling-piece j^5, the lower end of the coupling-piece *j'* in this case turning in a socket in the casing.

Although I have shown the motor applied for driving cutting or similar tools, I wish it to be understood that I do not intend to limit myself to its use for that purpose, as it may equally well be employed for any other purposes to which it is applicable.

What I claim, and desire to secure by Letters Patent, is—

1. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with ports for controlling the inlet and outlet of the fluid to and from the cylinders, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of a pinion on each crank-shaft, of a central wheel with which said pinions directly gear, of a driving-axle connected to said central wheel, of means for connecting said rotary valve to said central wheel, and of means for reversing said rotary valve, substantially as and for the purpose specified.

2. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and three outlet ports, of a liner in which said valve works, said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners for enabling the bearings of the crank-shafts and the interior of the cylinders to be inspected or repaired, of a pinion on each crank-shaft, of a central wheel gearing directly with said pinions and being three times their diameter, of a driving-axle connected to said central wheel, of means for connecting said rotary valve to said central wheel, and of means for reversing said rotary valve, substantially as and for the purpose specified.

3. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and outlet ports, of a liner in which said valve works, said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners, of a pinion on each crank-shaft, of a central wheel located in the lower compartment of the casing and gearing directly with said pinions and being three times their diameter, of a driving-axle connected to said central wheel, of projections on the central wheel and the rotary valve loosely engaging with each other, and of means for imparting an independent forward or backward angular movement to said valve in accordance with the direction the motor is to be driven, substantially as described.

4. In a fluid-pressure motor, the combination of four working cylinders arranged in

the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and outlet ports, of a liner in which said valve works, said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners, of a pinion on each crank-shaft, of a central wheel located in the lower compartment of the casing and gearing directly with said pinions and being three times their diameter, of projections on the central wheel and the rotary valve loosely engaging with each other, of means for imparting an independent forward or backward angular movement to said valve in accordance with the direction the motor is to be driven, of a driving-axle connected to said central wheel and of a detachable coupling-piece connecting said axle with the axle to be driven, substantially as described.

5. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and outlet ports, of a liner in which said valve works said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners, of a pinion on each crank-shaft, of a central wheel located in the lower compartment of the casing and gearing directly with said pinions and being three times their diameter, of projections on the central wheel and the rotary valve loosely engaging with each other, of means for imparting an independent forward or backward angular movement to said valve in accordance with the direction the motor is to be driven, of a driving-axle connected to said central wheel, of a detachable coupling-piece provided with a gear-wheel and located between said axle and the axle to be driven, and of speed-gearing interposed between said gear-wheel and the axle to be driven, substantially as described.

6. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and outlet ports, of a liner in which said valve works, said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners, of a pinion on each crank-shaft, of a central wheel located in the lower compartment of the casing and gearing directly with said pinions and being three times their diameter, of projections on the central wheel and the rotary valve loosely engaging with each other, of means for imparting an independent forward or backward angular movement to said valve in accordance with the direction the motor is to be driven, of a driving-axle connected to said central wheel, of a detachable coupling-piece located between said axle and the axle to be driven, of a ball-bearing for said driven axle which bearing forms part of a piece detachably connected with the casing of the motor, of a toothed wheel carried by said coupling-piece, of a toothed pinion carried by a second detachable coupling-piece, of a shaft mounted in the aforesaid detachable part and adapted to be rotated by the last-mentioned coupling-piece, both of the said coupling-pieces being interchangeable for varying the speed, of a toothed wheel on said shaft gearing with a toothed wheel on the axle to be driven, and of means for enabling a tool to be connected with said driven axle, substantially as described.

7. In a fluid-pressure motor, the combination of four working cylinders arranged in the form of a rectangle with their longitudinal axes in a horizontal plane, of a casing inclosing said cylinders and divided by them into two horizontal compartments, the upper one of which is open to the fluid-pressure and the lower one to the atmosphere, of a vertically-disposed cylindrical rotary valve situated centrally with regard to said cylinders and provided with three inlet and outlet ports, of a liner in which said valve works, said liner being provided with ports equal in number to the working cylinders and communicating therewith, of a piston and piston-rod in each cylinder, of vertically-arranged crank-shafts situated one at each corner of the rectangle, of detachable covers at each of said corners, of a pinion on each crank-shaft, of a central wheel located in the lower compartment of the casing and gearing directly with said pinions and being three times their diameter, of projections on the central wheel and the rotary valve loosely engaging with each other, of means for imparting an inde-

pendent forward or backward angular movement to said valve in accordance with the direction the motor is to be driven, of a driving-axle connected to said central wheel, of a detachable coupling-piece provided with a gear-wheel and located between said axle and the axle to be driven, of detachable and interchangeable speed-gearing interposed between the said gear-wheel and said axle to be driven, of a casing carrying said coupling-piece and said gearing, and of means for readily connecting and disconnecting said casing, substantially as described.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 30th day of January, 1901.

WALTER PAYTON.

Witnesses:
THOS. C. WARTH,
WM. J. DOW.