No. 868,868. PATENTED OCT. 22, 1907.

P. KIEFER.

AIR MOTOR.

APPLICATION FILED APR. 5, 1907.

2 SHEETS—SHEET 1.

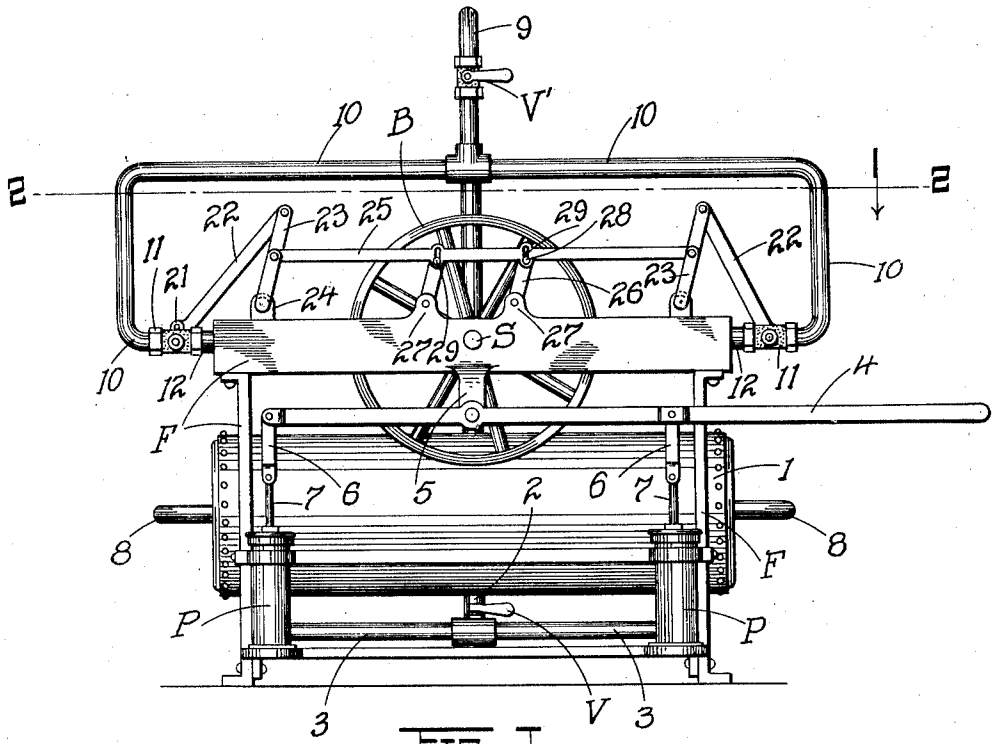


FIG. 1.

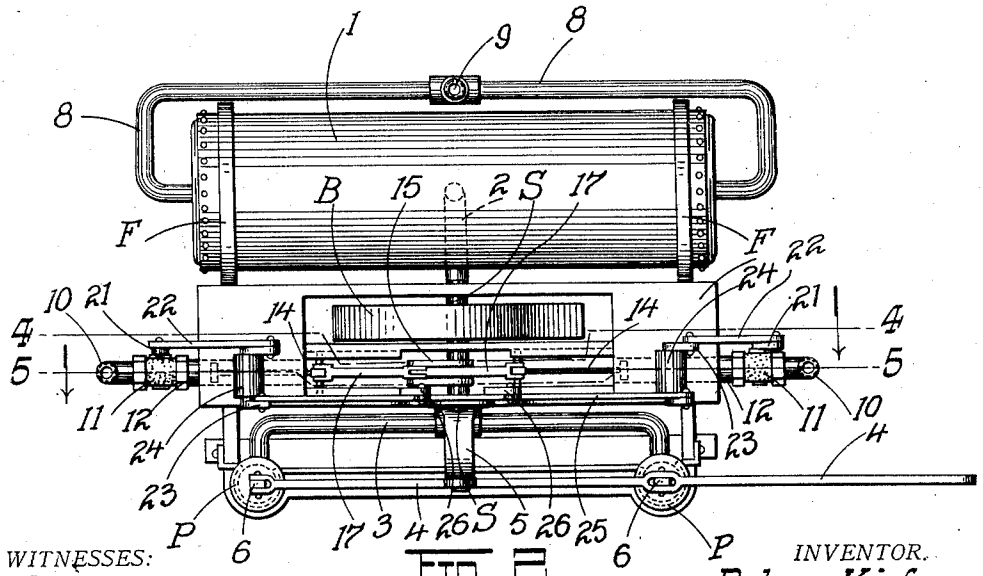


FIG. 2.

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2 SHEETS—SHEET 2.

FIG. 7.

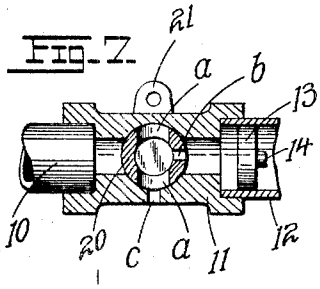


FIG. 8.

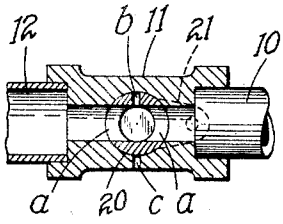


FIG. 3.

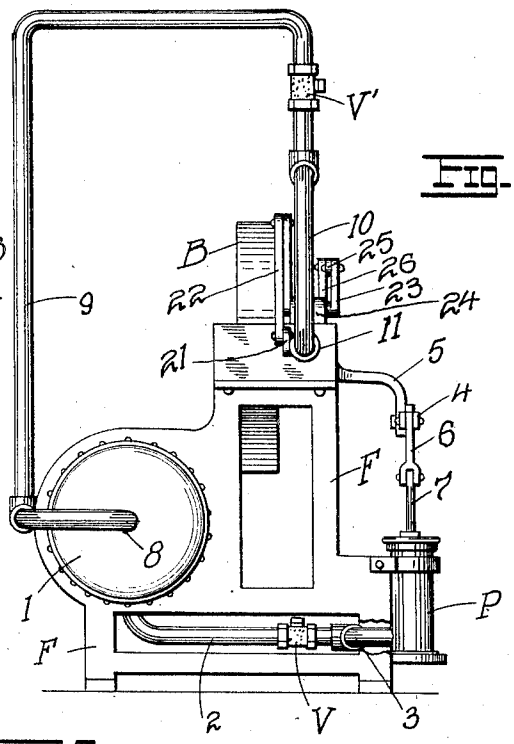


FIG. 4.

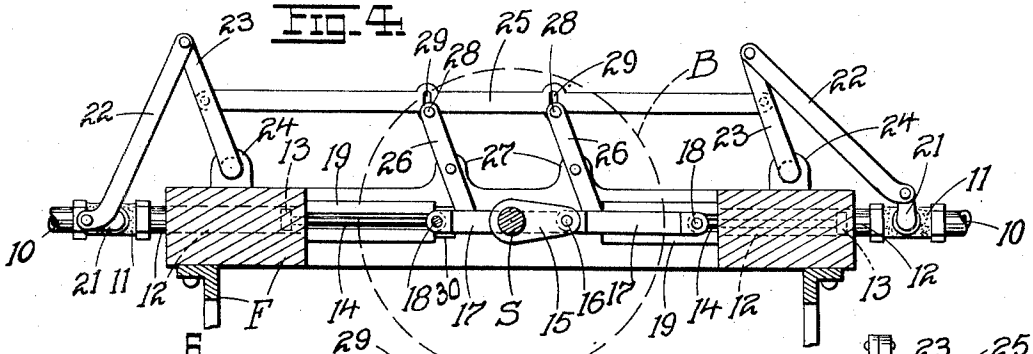


FIG. 5.

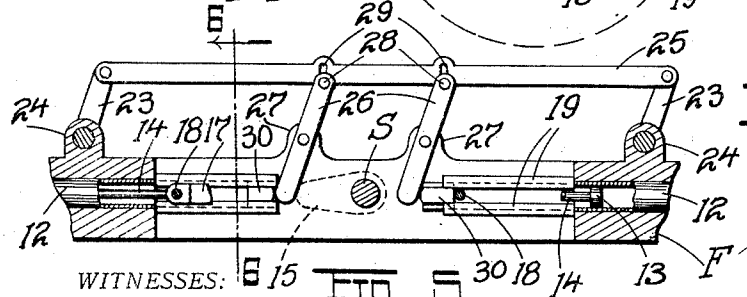
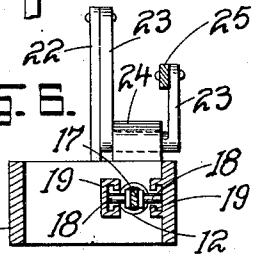


FIG. 6.



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UNITED STATES PATENT OFFICE.

PETER KIEFER, OF ST. LOUIS, MISSOURI.

AIR-MOTOR.

No. 868,868. Specification of Letters Patent. Patented Oct. 22, 1907.

Application filed April 5, 1907. Serial No. 366,525.

To a l whom it may concern:

Be it known that I, PETER KIEFER, a subject of the Emperor of Germany, residing at St. Louis, State of Missouri, have invented certain new and useful Improvements in Air-Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in air motors; and it consists in the novel construction and arrangement of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is front elevation of the motor; Fig. 2 is a horizontal section in the line 2—2 of Fig. 1; Fig. 3 is an end elevation thereof; Fig. 4 is a longitudinal vertical section on line 4—4 of Fig. 2 with parts at end of one stroke; Fig. 5 is a similar section on line 5—5 of Fig. 2 with parts at opposite stroke; Fig. 6 is a cross section on line 6—6 of Fig. 5; Fig. 7 is a sectional detail of air-valve in its closed or exhaust position; and Fig. 8 is a similar detail of the air-valve for its open or driving position.

The object of my invention is to construct a motor which shall operate by air under ordinary atmospheric pressure in connection with a vacuum which shall make such pressure available for the purpose for which it is intended. Instead, therefore, of equipping the motor with a compressed-air tank to supply the driving medium, I substitute in lieu thereof a vacuum tank in conjunction with which the atmospheric air serves as the impelling medium.

The advantages of the invention will be better apparent from a detailed description thereof which is as follows:

Referring to the drawings, F represents a suitable frame in the rear of which is mounted a tank 1, from the base of which leads a pipe 2 having branches 3, 3, connecting with vacuum pumps P, P. These may be operated by hand by means of pitman 4 pivoted to a bracket or arm 5 of the frame, proper link and piston connections 6 and 7 respectively leading from the pitman to the respective pumps. The operation of the pumps exhausts the tank 1 of its air, the pipe 2 being provided with a valve V to cut off the pumps, once the vacuum has been formed in the tank. The tank 1 communicates through pipe 8 and branch 9 with the branches 10, 10 (a valve V′ being provided at a point above the juncture) which terminate at the ends of the valve-casings 11 located at the outer ends of the open ended cylinders 12 in which operate the pistons 13 at the outer ends of the piston rods 14 disposed on opposite sides of the drive-shaft S. The shaft S is mounted transversely of the frame F, and is provided with a belt pulley B from which may lead a belt to any point where the motor is to perform service.

The shaft S is provided with a double-crank arm 15 to the terminal pin 16 of which are pivotally secured the adjacent ends of the connecting rods 17, 17, each rod terminating in a cross-head 18 (shown in the form of two pins, Fig. 6) the cross-head being guided in the grooved or channeled ways 19 of the frame, the adjacent ends of the piston-rods 14 being in turn coupled to the cross-heads as well understood in the art.

Mounted in each valve-casing 11 is a rock-valve 20 having ports *a*, *a* and *b*, one of the former being adapted to communicate when in exhaust position, with a port *c* in the casing whereby communication may be effected between the atmosphere and the cylinder 12 behind the piston 13. To arm 21 of the valve is pivotally coupled one end of a link 22 whose opposite end is pivotally secured to the long arm of a U-shaped rock-frame 23 mounted in bearings 24. The short arms of the frames 23 are connected by a rod 25 whose intermediate portion is coupled to the oscillating tappet-levers 26 pivoted near their middle to ugs or ears 27. To allow for the oscillating movement of the tappet-levers, the connection between them and the connecting rod 25 is effected by means of pins 28 operating in the transverse slots 29 formed in the rod. Against the lower ends of the tappet-levers bear cushioning tappet blocks 30 mounted in the guide-ways 19. As the respective cross-heads 18 in their respective reciprocations strike first one tappet-block and then the other, the levers 26 will reciprocate the rod 25, thus oscillating the frames 23 and rocking the air-valves 20, one valve being in exhaust position (Fig. 7) and the other in open position (Fig. 8).

The operation of the motor is as follows: Supposing the tank 1 to be emptied of its air, the valve V closed, the valve V′ open. The motor can then be started by giving the wheel B a turn by hand after which it will operate under the action of the atmosphere and vacuum combined. It will be seen that the inner adjacent ends of the cylinders 12 are open to the atmosphere. The atmosphere will therefore exert its pressure against the piston 13 whose valve 20 is in open position (Fig. 8), one face of the piston being thus exposed to the atmosphere, and the other to the vacuum in the tank 1, the other piston which has reached the end of the stroke will have both faces exposed to the atmosphere, through the ports *c*, *a*, *b* (Fig. 7) so that no back-pressure will retard said piston in resuming its original position. One piston therefore will always be the driving piston, the driving action being exerted while the piston is moving from the outer to the inner end of its cylinder. At the end of the outward stroke of each piston its corresponding cross-head impinges against the tappet-block 30 thereby tripping the adjacent tappet lever 26, which in turn draws upon the rod 25, the latter rocking the frames 23, 23, one frame rocking its valve 20 to operating or open position, and the other rocking its valve 20 to exhaust position, it being remembered that the connections between the

valve arms 21 and their corresponding links 22 are ninety degrees apart, so that the result referred to is possible. So that in the operation of the motor, one piston is always in position to be driven under the action of atmospheric pressure, while the other piston is exhausting. In such exhaust stroke, some air is of course always admitted into the space between the piston and the valve (Fig. 7), and of course on the direct stroke, when the valve 20 has rocked ninety degrees this quantity is admitted into the vacuum tank so that in time the tank 1 fills with air and the motor comes to a stop. The air is again pumped out of the tank and the operation is repeated. The use of a vacuum tank offers a source of power directly opposite to a compressed-air storage tank, to fill which is attended with not only a development of heat due to compression, but to an extra expenditure of power to overcome the resistance of the compressed air as a result of expansion due to the heat thus generated.

Having described my invention what I claim is

1. In a motor, a vacuum tank, a pair of cylinders, a transversely-disposed drive-shaft between the cylinders, pistons in said cylinders, intermediate connections between the shaft and pistons, pipes for establishing communication between the tank and the adjacent ends of the cylinders, valve-casings interposed between the cylinders and said pipes, rock-valves in said casings, and intermediate connections between the valves and pistons for actuating the valves with the successive reciprocations of the pistons, the adjacent ends of the cylinders being open to expose the pistons to atmospheric pressure, one valve establishing communication between its cylinder and tank and the opposite valve establishing communication between the cylinder and the atmosphere, whereby one piston is always actuated by atmospheric pressure, substantially as set forth.

2. In a motor, a vacuum tank, a pair of open ended cylinders having their inner ends in communication with the tank, a central transversely disposed drive-shaft, pistons in the cylinders, a double crank arm on the shaft, connecting rod, cross-head and piston-rod connections between the shaft and pistons, rock-valves interposed between the cylinders and tank, tappet-levers pivoted on either side of the shaft, a connecting rod for the outer ends of the levers, links connecting the connecting rod with the axes of the rock-valves, said connections being ninety degrees apart, the valves and their casings having ports disposed so as to permit intercommunication between one cylinder and the tank for one stroke of the piston, and between the atmosphere and the cylinder for the opposite or exhaust stroke of the piston, whereby one piston is always exposed to atmospheric pressure on one side and a vacuum on the opposite side, the parts operating substantially as, and for the purpose set forth.

In testimony whereof I affix my signature, in presence of two witnesses.

PETER KIEFER.

Witnesses:
EMIL STAREK,
MARY D. WHITCOMB.