(No Model.)

A. RIEDLER.

VALVE GEAR.

No. 561,342. Patented June 2, 1896.

Fig. 1.

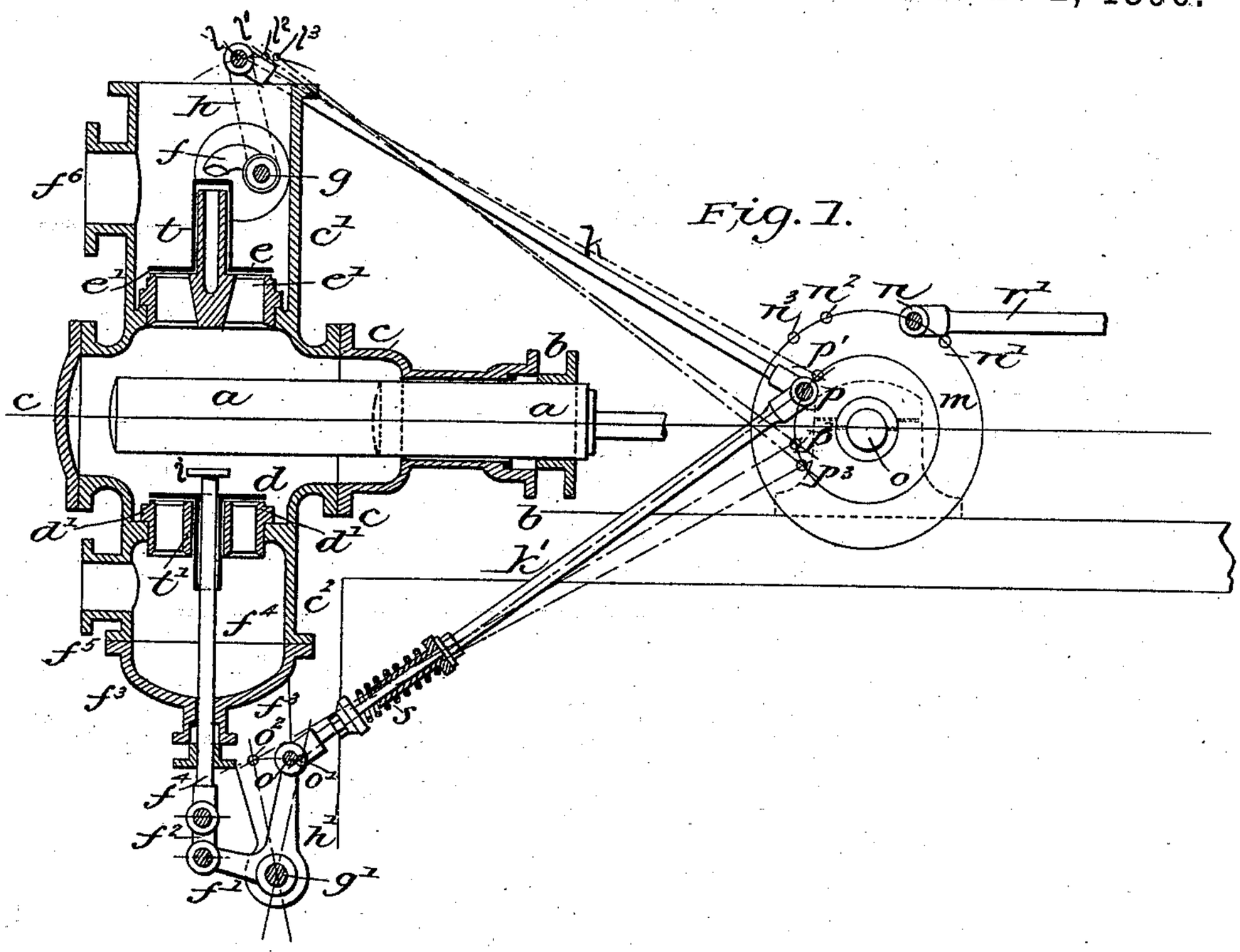


Fig. 2.

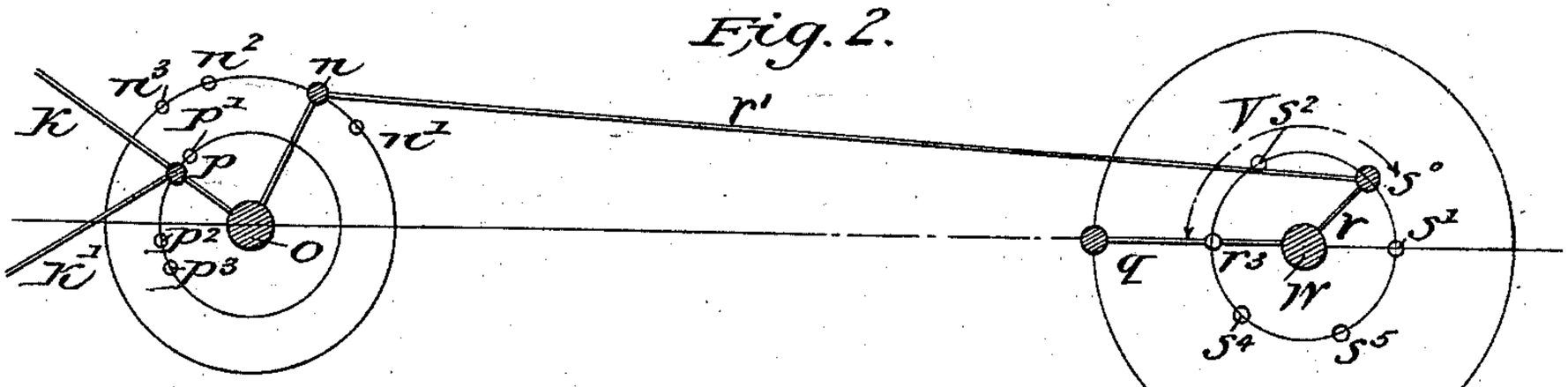
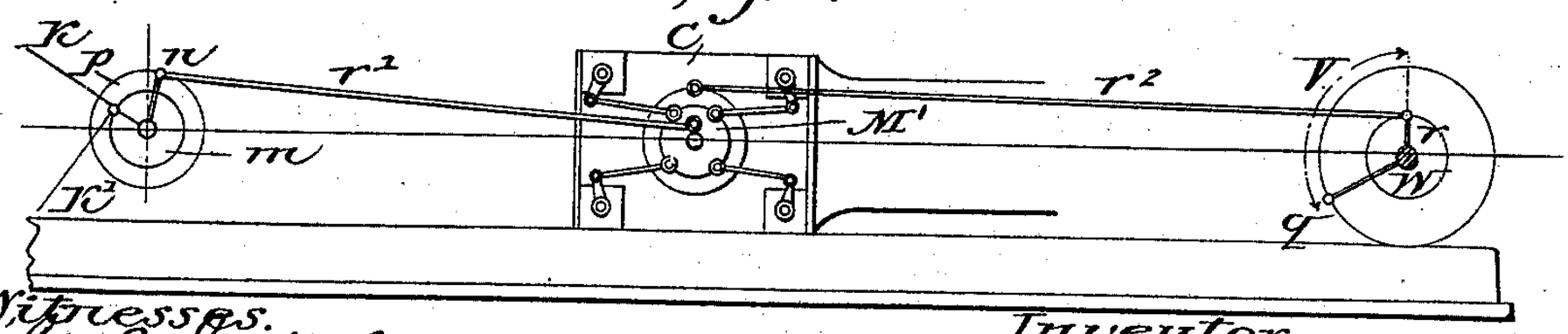


Fig. 3.



Witnesses.
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UNITED STATES PATENT OFFICE.

ALOIS RIEDLER, OF BERLIN, GERMANY.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 561,342, dated June 2, 1896.

Application filed June 13, 1893. Serial No. 477,488. (No model.) Patented in Germany March 11, 1888, No. 45,614, and March 27, 1892, No. 64,772, and in England September 5, 1889, No. 14,022.

To all whom it may concern:

Be it known that I, ALOIS RIEDLER, a subject of the King of Prussia, German Emperor, residing at Berlin, Germany, have invented certain new and useful Improvements in Valve-Gears, (for which Letters Patent were granted to me in Great Britain, No. 14,022, dated September 5, 1889, and in Germany, No. 45,614, dated March 11, 1888, and by and with my consent by Carl Müller in Germany, No. 64,772, dated March 27, 1892,) of which the following is a specification.

This invention relates to an improved valve-gear for pumps, compressors, blowing-engines, &c., by which the valves are controlled by mechanical means in such a manner that the shock of the valves at the moment when they are closing is obviated and thereby the noiseless and effective working of the valves obtained.

The invention consists of a valve-gear, which will be fully described hereinafter, and the novel features of which will be finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section of a plunger-pump, the suction and delivery valves of which are operated by my improved valve-gear. Fig. 2 is a diagram showing the connection of a wrist-plate operating the valve-gear with the crank-shaft of the driving-engine; and Fig. 3 is a diagram showing the connection of the wrist-plate for operating the valve-gear of the pump with the wrist-plate of a Corliss engine, both wrist-plates being driven by one common eccentric on the engine-shaft.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, *a* in Fig. 1 represents the plunger of a single-acting pump; *b*, the stuffing-box for the same; *c*, the pump-cylinder, which is provided with valve-chambers c' c^2, that extend at right angles in opposite direction to the pump-cylinder *c*. The valve-chamber c^2 of the suction-valve is closed by a head f^3 and provided with the suction-pipe neck f^5, while the chamber c' for the delivery-valve is provided in a similar manner with the delivery-pipe neck f^6. In the valve-chambers c^2 c' are arranged, respectively, the suction-valve *d* with its seat d' and the delivery-valve *e* with its seat e'. The valves *d* and *e* are shown in Fig. 1 and are made either in the shape of flat valves, which are guided in the ordinary way concentrically on guides t' and *t*, forming parts of the valve-seats d' and e', or any other shape of valve may be used and the valves be guided in any other suitable manner.

The valves *d* and *e* are operated by a suitable transmitting-gear so as to open and close at the proper time. The transmitting-gear is so arranged that the valves are closed by the levers of the transmitting-gear at the end of the respective pump-stroke, but which levers are withdrawn from the valves before the next stroke of the plunger commences when the valves are to open automatically. For this purpose the lever *f*, Fig. 1, of the delivery-valve *e* is keyed to a shaft *g*, projecting into the valve-chamber c', which shaft *g* carries a second lever *h* outside the valve-chamber c', said lever being extended in upward direction, its upper end being connected by a rod *k* with the wrist-pin *p* of a wrist-plate *m*, or with an oscillating lever carrying a wrist-pin *p*. The transmitting-lever *f* is located inside of the valve-chamber c', and adapted to act directly on the head of the valve *e*.

For the suction-valve transmitting-gear, another construction is shown, which is adapted for the same purpose as that of the delivery-valve, but in which the lever f' is arranged outside of the valve-chamber c^2, and connected by means of a pivot-link f^2 with a spindle f^4, that passes through a stuffing-box in the head f^3 of the suction-valve chamber c^2, and through the hollow stem of the suction-valve *d*, the spindle f^4 being provided with a head *i* above the suction-valve *d*, so as to close the valve when the spindle f^4 is drawn in downward direction by the lever f'. The transmitting-lever f' is keyed to a shaft g', to which a lever-arm h' is keyed, which is pivoted to a connecting-rod k', that is pivoted at its other end also to the wrist-pin *p* of the wrist-plate *m*.

The suction-valve *d* is closed at the end of the outward stroke of the plunger *a*, and at the same time the transmitting-lever *f* above

the delivery-valve is withdrawn from the delivery-valve, so that this valve is left free to open automatically at the beginning of the inward stroke. When at the end of the inward stroke of the piston a the lever f presses on the delivery-valve e so as to close the same, the head i of the spindle f^4 is raised above the suction-valve d, so that this valve is free to open automatically in the same manner as described for the delivery-valve.

At the end of each respective stroke of the plunger the valve-gear described produces the closing of one valve, while at the same time the other valve is relieved from the gear by which it was closed at the preceding stroke.

The gear is operated by the same engine which operates the plunger of the pump. This outside gear is clearly shown in Fig. 1, and consists of the oscillating wrist-plate m, or an oscillating lever, which is supported on the bed-plate of the pump. The wrist-plate m is connected by the pin n with a connecting-rod r', which is driven by the crank r on the crank-shaft W of the pumping-engine, as shown in Figs. 2 and 3. It is essential that the wrist-plate m and the rods connected with the same do not change their stroke at the same time as the plunger of the pump, as will be hereinafter described. The eccentric or crank r, which is to drive the connecting-rod r' and the wrist-plate m, is therefore keyed to the crank-shaft W at an angle V to the engine-crank q, like an ordinary eccentric for the gear of a steam-cylinder. Consequently also an ordinary eccentric of a steam-engine can be used for driving the valve-gear of a steam-engine, together with the wrist-plate m and the gear of the pump, as shown in Fig. 3. For this, Fig. 3, the working eccentric r is shown in middle of its stroke, while the crank of the engine has not yet arrived in its dead-center.

The pivot p on the wrist-plate m, Fig. 1, is so arranged that the delivery-valve is closed when the connecting-rod k is in the straight line between the oscillating center o of the wrist-plate m and the center of the pin l, which forms the connection of the connecting-rod k with the lever-arm h. This position of the valve just being closed is shown in Fig. 1. When the center of the wrist-plate, pin p, and pivot l are located in one straight line, o p l, the delivery-valve e is closed and the change in the stroke of the plunger takes place at the end of the inward stroke.

As before stated, the stroke of the wrist-plate m and of the rods connected with it does not change with the stroke of the pump-piston. Consequently after the stroke of the pump-piston is completed the pin p on the wrist-plate m continues its movement to the point p'; but during this oscillation from p to p' the movement cannot be transmitted to the delivery-valve e, as this valve is already closed and the outward stroke of the pump-piston has commenced. During the motion of the pin p to the point p' the transmitting lever-arm h is moved back to the point l' and exerts no influence on the delivery-valve whatsoever, as the working lever f is also drawn back from the valve e corresponding to the oscillation l to l'. When the pin p arrives at the extreme position p', the stroke of the wrist-plate m and of the valve-gear changes, the pin p is first moved from its position p' back to its former position p and then continues its movement until it arrives successively at the points p^2 and p^3, so that the connecting-rod k brings the lever-arm h respectively into the points l^2 and l^3, by which movement the lever f is released from the valve e and the latter thereby free to open automatically at the beginning of the next stroke of the pump. In Fig. 1, n', n^2, and n^3 show the position of the working pin n of the wrist-plate corresponding to the positions p', p^2, and p^3 of the transmitting-pin. The oscillation n to n' corresponds to the rotation S^0 to S' of the engine-crank, Fig. 2.

The same arrangement as described for the delivery-valve e may also be applied for the suction-valve; but in this case it will also be necessary to arrange the pin p so that the rod k' is in a straight line with the same and the center o of the wrist-plate m at the moment when the suction-valve d is closed; but the closing of the valve at the proper time by a movement which is taken from a portion of the engine which does not change its stroke at the same time with the pump-piston can also be obtained by making the connecting-rod k' in two parts, the end of one part being tubular, so as to guide it on the end of the other part, and by arranging a helical spring s around the telescoping parts of the connecting-rod k'. The spring s is then compressed after the valve is closed. This compression begins when the crank q of the engine is in its dead-center, Fig. 2, and the crank r, operating the gear, continues its movement during the oscillation from r^3 to s^2. The entire oscillation from r^3 to s^2 is to be taken up by the spring S.

The movements of the crank r from the point r^3 to the points s^2, s^0, and s' correspond to the oscillations of the wrist-plate m from the point n^3 to the points n^2, n, and n', and to the oscillations of the wrist-pin from the points p^3 to the points p^2, p, and p', as shown in Figs. 2 and 1.

The closing of the suction-valve d takes place when the pivot n of the wrist-plate m arrives at n^2 and the pivot p of the wrist-plate m at p^2. The coil-spring s is compressed while n and p move from n^2 and p^2, respectively, to n^3 and p^3 and back again. When the suction-valve d is closed and the pin p is in position p^2, the change of the piston stroke takes place and no closing movement can be transmitted to the valve any more, as the further motion is taken up by the spring S. The pin p being in the position p^2, the rod k' begins to compress the spring S, and this

compression takes place during the oscillation p^2 to p^3, which is equal to the oscillation r^3 to s^2, as described before and shown in Fig. 2. The suction-valve is thus closed at the beginning of the inward stroke of the pump, at which point the delivery-valve is released from the gear, so as to open automatically. At the beginning of the outward stroke of the pump the suction-valve is released from the gear and permitted to open, while the delivery-valve is closed, as described.

The suction-force of the pump-piston a exerts a lifting action on the suction-valve d, which lifts the spindle f^4 with it against the frictional resistance of its stuffing-box, while the lever f' and lever-arm h' are moved away from the spindle f^4, so as to cause the inward moving of the parts of the telescopic joint against the tension of the spring s. The closing of the suction-valve d is produced by the action of the connecting-rod k' on the spring s of the telescopic joint and by the action of said spring on the lever-arm h', lever f', and spindle f^4.

To permit the automatic opening of the valves the controlling-gears—that is, the lever f and the head i of the spindle f^4—are withdrawn from the delivery and suction-valves, as described before. The spring s, which is interposed between the parts of the connecting-rod k', is made stiff enough for the ordinary resistance of the valve; but this resistance is not sufficient to compress the spring, and the connecting-rod k' will transmit the closing movement in the same manner as if no spring were inserted. The spring has no influence whatever on the action of closing the valve. It transmits the positive closing movement without altering this movement. It only takes up the rest of the movement of the valve-gear, after the valve is closed. When the rod k' arrives at the position p^3, the spring is compressed and the gear changes its stroke.

Instead of a spring any other suitable power can be used—as, for instance, water or air pressure in a cylinder interposed in the rod k'. Any such special power would give the same effect as the tension of the spring, always provided the power to be great enough to overcome the ordinary resistance of the valve.

The motion by which the valve-gear of the pump is operated can be taken directly from the driving-shaft W of the engine, as shown in Fig. 2. The working eccentric r is placed at an angle v which is equal to the angular advance of the eccentric plus ninety degrees away from the crank q on the driving-shaft W of the engine. Owing to this position of the eccentric r it will not change its stroke with the engine-crank, but will change its stroke later on when it is moved from S^0 to S'. When the eccentric r is connected by the connecting-rod r' with the pin n of the wrist-plate m, the required movement is transmitted to the valve-gear. The position of the pin n on the wrist-plate m corresponds then to the dead-center of the crank q of the engine, when the eccentric is in the position r. The position n' of the pin n corresponds to the change of the stroke of the eccentric r and the valve-gear. The extreme position n^3, in Fig. 2, on the other side corresponds to the position r^3 of the eccentric—that is to say, to the change of stroke of the valve-gear on the other side.

The movement for controlling the valve-gear of the suction and delivery valve of a pump can also be taken from the ordinary wrist-plate of a Corliss engine, as shown in Fig. 3, or from any other oscillating part of the gear of a steam-engine. In Fig. 3 a steam-cylinder C is shown, the wrist-plate M' being driven by an eccentric r and connecting-rod r^2. To the same wrist-plate another connecting-rod r' is connected, which drives the wrist-plate m by which the pump-valves are controlled, as before described. In all these different constructions described the essential feature is that a working eccentric moves at a certain angle of advance to the engine-crank, in consequence of which the gear which controls the pump-valves does not change its stroke at the same time when the pump and steam-pistons change their strokes.

In Fig. 1 the valves are shown for a single-acting pump; but it is obvious that a similar arrangement can be used for controlling the two valves of a differential pump or the four valves of a double-acting pump; but in all such cases the essential feature of the valve-gear remains entirely the same. In the case of a double-acting pump there are only two other valves to be controlled on the other side of the wrist-plate m, but otherwise entirely identical and symmetrical. In Fig. 1 the valves are shown in a position to open vertically; but it is obvious that the valves may also be arranged so as to open horizontally in cases where such valves should be preferred—as, for instance, in compressors, where the valves can be arranged in the cylinder-heads.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the valve of a pump, of a mechanically-controlled valve-gear, being independent of and not connected with said valve, an oscillating wrist-plate actuated by the driving-shaft of the pump-piston, and a connecting-rod between the valve-gear and wrist-plate, said rods and wrist-plate being so arranged relatively to each other as to close the valve when the connecting-rod is in line with the axis of the wrist-plate, substantially as set forth.

2. The combination, with the valve of a pump, of mechanically-controlled valve-gear being independent of and not connected with said valve, mechanism for actuating said valve-gear so that its strokes do not take place at the same time as the change of stroke

of the pump-piston, a rod connecting said actuating mechanism with the valve-gear, and a coil-spring interposed between the valve-gear and connecting-rod so that the movement of said rod toward the valve-gear may be continued without influencing the valve, substantially as set forth.

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

ALOIS RIEDLER.

Witnesses:
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W. HAUPT.