No. 648,820. Patented May 1, 1900.

A. WETZEL.

VALVE GEAR FOR ENGINES.

(Application filed Feb. 12, 1900.)

(No Model.) 2 Sheets—Sheet 1.

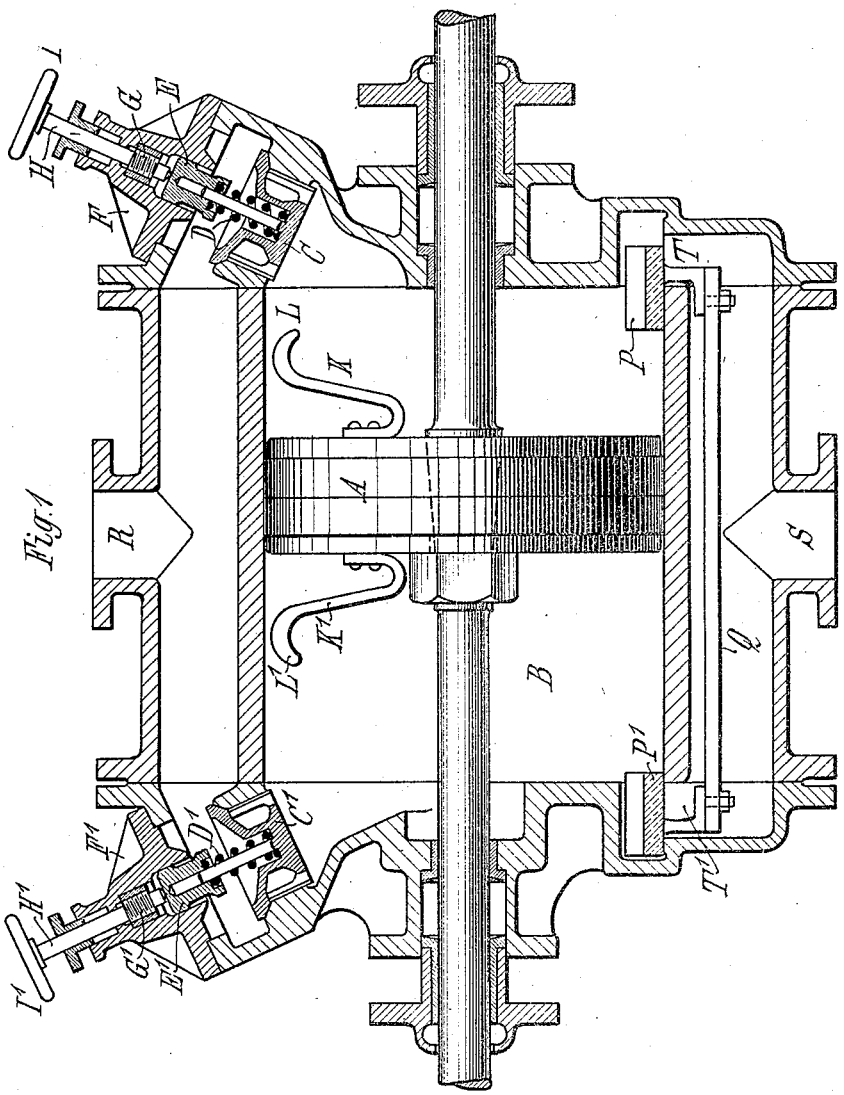

Fig. 1.

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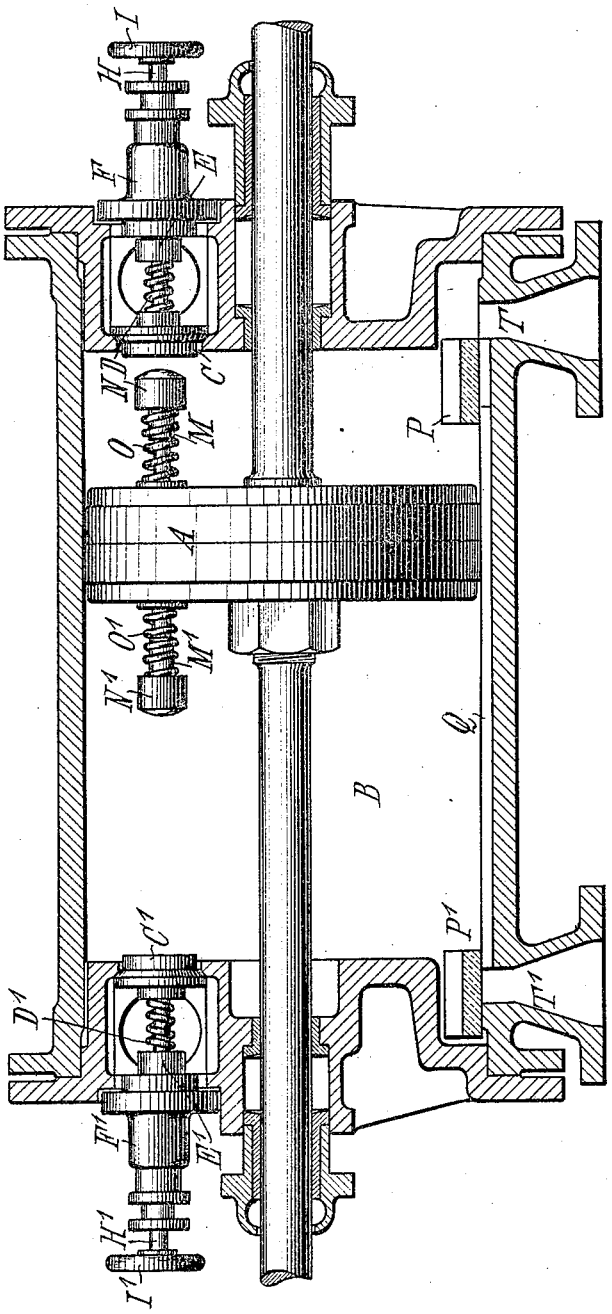
Fig. 2



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UNITED STATES PATENT OFFICE.

ALFRED WETZEL, OF CHARLOTTENBURG, GERMANY.

VALVE-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 648,820, dated May 1, 1900.

Application filed February 12, 1900. Serial No. 4,966. (No model.)

To all whom it may concern:

Be it known that I, ALFRED WETZEL, a subject of the Emperor of Germany, residing at Charlottenburg, in the Kingdom of Prussia, Empire of Germany, have invented a new and useful Valve-Gear for Direct-Acting Steam-Engines and the Like, of which the following is a specification.

My invention consists in a new valve-gear for direct-acting steam-engines and the like in which the steam-inlet valves are actuated by the piston. There are separate channels in the cylinder for the inlet and for the outlet of the steam, and consequently also separate means for opening and closing them. For the inlet of the steam valves are employed. Owing to the absence of bevel-wheels, eccentrics, eccentric-rods, slide-rods, and the necessary stuffing-boxes—*i. e.*, all the valve-gear parts outside the cylinder—not only a great simplification, and hence a cheapening of the manufacture, is obtained, but also the losses arising from the friction and the number of the parts that may occasion repairs and other disturbances in the working of the engine are reduced considerably. For the outlet of the steam slides are employed that are pushed forward and backward by the piston at the ends of the stroke either directly or by means of tappets.

An important feature of my improved valve-gear resides in the fact that the inlet-valves are opened by means of springs secured to the piston and that adjustable springs are employed for pressing the inlet-valves upon their seats for the purpose of regulating the inlet of the steam. The more the tension of the springs pressing the inlet-valves upon their seats is increased the later the valves will be opened and closed, since each spring arranged for opening the respective valve will be highly bent or compressed without opening the valve until it attains a tension equal to the sum of the steam-pressure upon the valve, the adhesion and resistance of the valve and the pressure of the adjustable spring pressing upon the valve. On the piston going back the valve will be closed at a position of the piston farther away from the beginning of the stroke than that at which the valve was opened. The reason for this is that the steam-pressure upon the one side of the valve is counteracted by that upon the other side and that the valve offers a certain resistance. In this manner a greater quantity of steam may be admitted to the cylinder than before on the piston approaching the end of its stroke, and in general the cut-off point may be varied by adjusting the adjustable springs pressing upon the inlet-valves.

The new valve-gear is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of a steam-cylinder provided with the new valve-gear, and Fig. 2 is a similar section of a steam-cylinder provided with a modification of the valve-gear.

A is the piston, arranged to reciprocate in the cylinder B.

C and C′ are the inlet-valves, and P and P′ are the outlet-valves, connected by a rod Q. In Fig. 1 the steam is admitted at R, while the exhaust-steam passes out at S. In Fig. 2 the openings for the inlet and the outlet of the steam are arranged in a different manner. It is, however, quite immaterial in what manner the steam is introduced to the cylinder and what channels are used for the outlet of the steam.

At the external side of the inlet-valves C and C′ spiral springs D and D′, respectively, are arranged to bear on the valves. In the covers F and F′ of the valve-boxes shiftable parts E and E′ or their equivalents bearing on the other ends of the spiral springs D and D′, respectively, are arranged. For regulating the pressure of the spiral springs D and D′ upon the inlet-valves C and C′, respectively, spindles H and H′ are employed, the screw-parts G and G′ of which engage with suitable threads in the covers F and F′, while the hand-wheels I and I′ serve for turning the spindles H and H′, respectively, in either direction, and thereby shifting the parts E and E′, respectively.

For opening the inlet-valves C and C′ bent leaf-springs K and K′, according to Fig. 1, may be secured to the piston A, their ends L and L′ being so formed as to press upon the inner faces of the valves C and C′, respectively, when the piston A approaches the ends of its stroke, or tappets N and N′, with spiral

springs O and O', according to Fig. 2, may be employed for opening the inlet-valves, the stems M and M' of the tappets N and N' being arranged to slide endwise in suitable holes of the piston A and secured against getting off in any approved or well-known manner.

Instead of the bent leaf-springs K K' (shown in Fig. 1) and of the spring-pressed tappets N N' (shown in Fig. 2) other suitable spring devices may be secured to the piston A for opening the inlet-valves C and C'.

In Fig. 1 the outlet-valves P and P' are slides which are connected by a rod Q, reciprocating within the outlet-chamber. In Fig. 2 the connecting-rod Q is arranged to slide in a groove provided in the internal wall of the cylinder B. It is, however, immaterial whether the connecting-rod Q be within or without the cylinder.

The valve-gear works in the following manner: When assuming the piston A in Fig. 1 to proceed from the left-hand side to the right-hand side, then the exhaust-steam contained in the cylinder B on the right-hand side of the piston A will pass out through the channel T to the outlet S, and the piston A on approaching the end of its stroke will push forward the slide P and at the same time, through the rod Q, the slide P', so that the one slide P closes the channel T and cuts off the exhaust-steam, while the other slide P' opens the channel T' and allows the spent steam contained in the cylinder on the left-hand side of the piston A to exhaust. Meanwhile the end L of the spring K will touch the internal face of the inlet-valve C and begin to press upon the same, while the spring K is being gradually put under tension. At a certain position of the piston A, the distance of which from the end of the stroke depends upon the tension of the spiral spring D, bearing upon the inlet-valve C, the tension of the spring K will have attained such a height that the resistance of the inlet-valve is overcome and the latter is opened, whereupon the steam will be admitted to the cylinder. At this moment the steam-pressure upon the external face of the valve C will be counteracted by that upon the internal face of the valve, so that on the piston going back the decreasing tension of the spring K requires to be reduced farther below that point at which the valve C was opened in order to allow the latter to close. The consequence of this is that before the valve C closes the piston A requires to attain a position which is farther away from the beginning of the stroke than that at which the valve C had commenced to open. Thus a sufficient quantity of steam may be admitted to the cylinder. The amount of this quantity may be increased and decreased by adjusting the tension of the springs D and D'. It is obvious that on the piston A approaching the left-hand end of its stroke and then returning the same occurrences will take place with regard to the spring K' and the inlet-valve C', and also that the valve-gear shown in Fig. 2 will work much in the same manner.

For starting the steam-engine only either of the inlet-valves C need be lifted by some suitable device. Since such device, which may be of any kind, forms no part of this invention, it is not shown in the drawings.

The new valve-gear is specially suitable for direct-acting steam-engines and the like where the steam is required to expand to a considerable degree. The chief advantage derived from the bent springs K K' in Fig. 1 or the spring-pressed tappets N N' in Fig. 2 or other elastic members, in combination with the adjustable springs D D', bearing upon the inlet-valves, is that the inlet-valves are opened and closed much later than would be the case if no elastic members were employed.

Having described my invention, I declare that what I claim, and desire to secure by Letters Patent, is—

1. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, and outwardly-opening inlet-valves at the ends of said cylinder and arranged to be opened by said elastic members alternately for admitting the steam or active fluid, substantially as set forth.

2. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, inlet-valves at the ends of said cylinder and arranged to be opened by said elastic members alternately on their elastic tension attaining a certain limit and to be closed when released from said elastic members, adjustable springs bearing on the external faces of said inlet-valves, and means for adjusting the tension of said adjustable springs for the purpose of regulating the inlet of the steam or active fluid, substantially as set forth.

3. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, inlet-valves at the ends of said cylinder and arranged to be opened and closed by the pressure of and by the release from said elastic members respectively on their elastic tension reaching a certain limit and decreasing below a lower limit respectively, adjustable springs bearing on the external faces of said inlet-valves, bearing parts arranged to be shifted in the covers of the inlet-valve boxes and bearing on said adjustable springs, and screw-spindles bearing on said bearing parts and arranged to be turned by hand for regulating the tension of said adjustable springs, substantially as set forth.

4. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, inlet-valves at the ends of said cylinder and arranged to be opened by said elastic members alternately for admitting the steam, outlet-openings at the ends of said cylinder, and slides connected by a rod and arranged for being pushed

forward by said piston at the ends of its stroke to open and close said outlet-openings respectively, substantially as set forth.

5. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, inlet-valves at the ends of said cylinder and arranged to be opened by said elastic members alternately on their elastic tension attaining a certain limit and to be closed when released from said elastic members, adjustable springs bearing on the external faces of said inlet-valves, means for adjusting the tension of said adjustable springs for the purpose of regulating the inlet of the steam, outlet-openings at the ends of said cylinder, and slides connected by a rod and arranged for being pushed forward by said piston at the ends of its stroke to open and close said outlet-openings respectively, substantially as set forth.

6. The combination with a cylinder, of a piston reciprocating therein and provided on both sides with elastic members, inlet-valves at the ends of said cylinder and arranged to be opened and closed by the pressure of and by the release from said elastic members respectively on their elastic tension reaching a certain limit and decreasing below a lower limit respectively, adjustable springs bearing on the external faces of said inlet-valves, bearing parts arranged to be shifted in the covers of the inlet-valve boxes and bearing on said adjustable springs, screw-spindles bearing on said bearing parts and arranged to be turned by hand for regulating the tension of said adjustable springs, outlet-openings at the ends of said cylinder, and slides connected by a rod and arranged for being pushed forward by said piston at the ends of its stroke to open and close said outlet-openings respectively, substantially as set forth.

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