(No Model.)

F. J. WEISS.

VALVE.

No. 559,316. Patented Apr. 28, 1896.

Fig. 1.

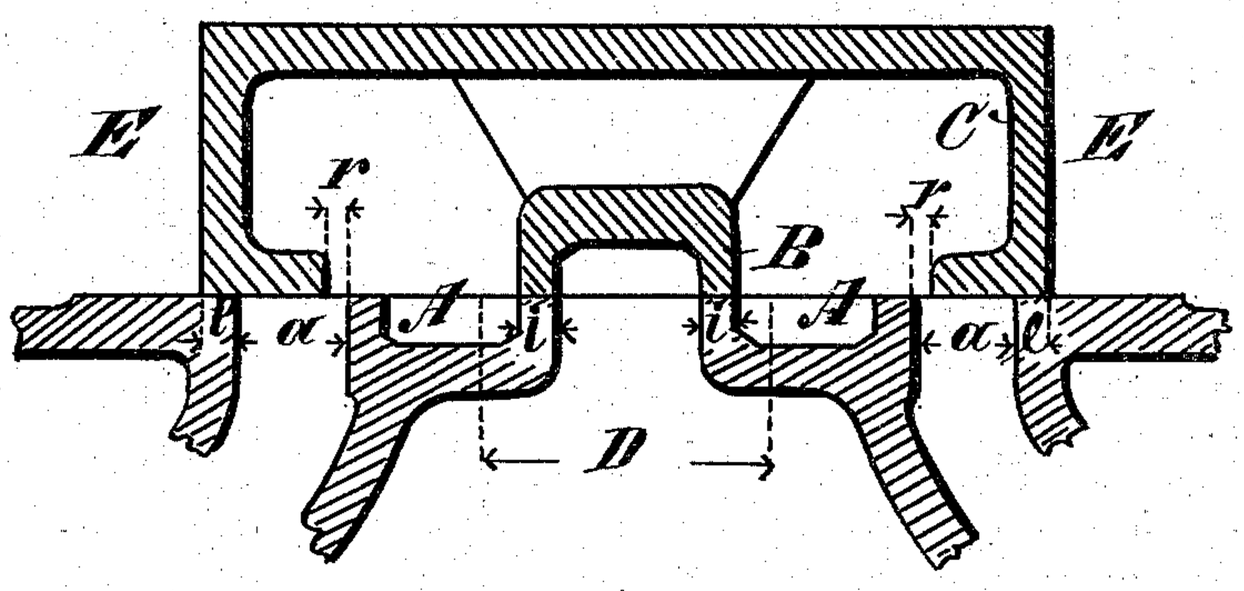
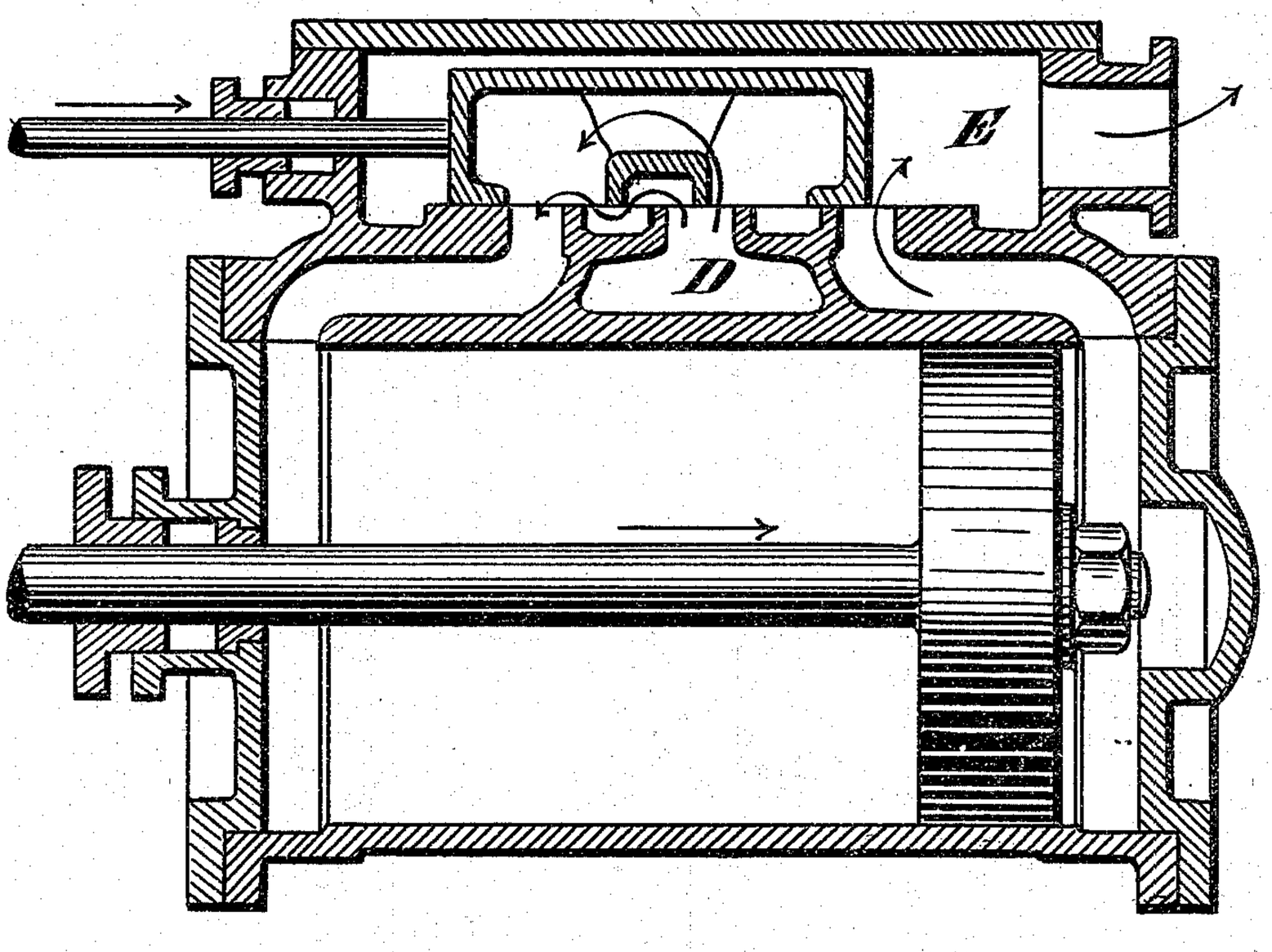


Fig. 2.



Witnesses:
G. N. Rea,
Victor Coombs

Inventor;
Franz J. Weiss
By James L. Norris.
Atty.

UNITED STATES PATENT OFFICE.

FRANZ JOSEPH WEISS, OF BASLE, SWITZERLAND.

VALVE.

SPECIFICATION forming part of Letters Patent No. 559,316, dated April 28, 1896.

Application filed December 11, 1893. Serial No. 493,406. (No model.)

To all whom it may concern:

Be it known that I, FRANZ JOSEPH WEISS, of the city of Basle, in the canton of Basle and Republic of Switzerland, have invented a certain new and useful Improvement in Valves, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to valves for air-pumps and steam-engines, the term "air-pumps" being here understood in the broadest sense—that is to say, as including also vacuum-pumps, compressors, blowers, and all similar machines of this class.

The object of my invention is to provide means whereby, in air-pumps, the sectional area of the suction-port for the air and, in steam-engines, the sectional area of the discharge-port for the steam will at once, upon the respective port being opened, be increased preferably to double the usual size, so that the air being sucked into and the steam escaping from the cylinder, respectively, will be less impeded or throttled in its passage, and consequently, in the case of a steam-engine, the pressure of the steam will at once, upon the discharge-port being opened, be correspondingly reduced—that is to say, in common steam-engines it will be reduced to the pressure of the outer atmosphere and in condensing-engines to the pressure prevailing in the condenser.

My invention consists in the particular arrangement and combination of parts, as hereinafter more fully described with reference to the accompanying drawings.

Figure 1 is a vertical longitudinal section of a slide-valve and its valve-face embodying my improvement. Fig. 2 is a similar section of a cylinder and connected valve-chest, showing my improved valve-gear as applied thereto.

The valve consists of the two connected portions C and B, the latter, hereinafter called the "bridge," being incased in the former and so connected therewith as to provide an intermediate space or channel. The laps on the outer portion C extend inwardly to such a distance only as to leave open spaces *r* at the ends of both cylinder-ports *a* when the slide-valve is in the central position shown in Fig. 1, so that in this position both spaces of the cylinder will be in communication with each other.

The valve-face is of the usual construction, with this exception only, that, according to my present invention, the portions between the ports are formed wider and provided with cup-shaped or hollow recesses A, opening only toward the valve, and the bridge B of the slide-valve is provided on its lower surface with a similar recess A′.

Supposing the slide-valve B C to be, by means of the usual circular eccentric or other equivalent means, moved to the right or left of its usual position shown in Fig. 1, it will then be seen that the space D, which, in the case of an air-pump, is connected with the suction-inlet for the air and, in the case of a steam-engine, with the discharge-outlet for the steam, will thereby be caused to communicate with the one or the other of the two cylinder-ports *a*, while the outer space E will at the same time be caused to communicate with the respective opposite cylinder-port. It will of course be understood that, in the case of an air-pump, the said space E outside of the slide-valve B C forms the pressure-space—that is to say, the space into which the air is pressed—while, in the case of a steam-engine, it is the space into which the steam from the boiler is introduced.

Now it will be seen that while in the movement of the valve, as above referred to, but one communication between the space E and the respective cylinder-port will be formed, the effect of the hollow portions or recesses A on the valve-face, and of the recess A′ in the lower surface of the bridge B of the slide-valve, will be that two communications will be formed simultaneously for connecting the space D with the other cylinder-port, as indicated in Fig. 2 by the two arrows originating from the space D, and that each of the latter communicating passages will be of the same width as the one communicating passage at the opposite cylinder-port. Thus the sectional area of the communicating passages connecting the space D with the one or the other side of the cylinder will actually be doubled.

Supposing the valve-rod in the position shown in Fig. 2 to be moving in the direction of the arrow, and the eccentric for actuating

the valve to be so mounted as to lag behind by ninety degrees in respect of the crank, as required in air-pumps with distributing-valve motion, then the valve will be in about the position shown and will likewise move in the direction indicated by the arrow. Fig. 2 will then illustrate the cylinder of an air-pump, or of a pump generally, wherein the air or the liquid to be pumped will be sucked through the space D and discharged under pressure through the space E. It will be seen that the suction-opening at the port *a*, as well as at the inner valve portion or bridge B, will still correspond in width to the full sectional area of the port, although the piston will have nearly reached the end of its stroke and the outlet-passage for the air at the valve will already have been reduced to about half of the full width of the port *a*. Thus when the cylinder forms part of a compressor or forcing-pump it will, toward the end of the stroke when the speed of the piston has already become reduced, still be capable of being filled with air having the full atmospheric pressure, even if at the middle part of the stroke where the piston moves with its greatest speed the cylinder-space should have become filled with rarefied air only.

In order to adapt the arrangement shown in Fig. 2 to the conditions of a steam-engine, nothing more is required than that the space D be made to connect either with the open air or with a condenser and the space E with a steam-conduit from any suitable boiler, all the parts in every other respect remaining as shown in the drawings and their relative positions not being materially altered. However, the direction of the arrows in Fig. 2 would in that case have to be reversed. Under these conditions the steam-engine here supposed to be provided with the devices shown would run in the opposite direction to that of the air-pump previously referred to. It will thus be seen that in the case of a steam-engine as well the total of the sectional areas of the outlets at their narrowest portion will be doubled, and that the same will almost at the beginning of the stroke have become equal to the width of the port *a*, so that the cylinder will actually at the very beginning of the stroke be capable of discharging the steam which during the previous stroke has served for driving the piston, and that the counter-pressure of the steam will thus as quickly as possible be reduced to the same pressure as that prevailing in the space into which the steam is being discharged.

It will also be seen that in order to really secure the advantage of the double opening of the air-inlet or steam-outlet ports in the valve-gear shown two communicating passages (or "negative laps") *r* must be made to open when the valve is in its central position. For if the laps of the outer valve portion C were extended inwardly, so as to fully cover the ports *a* or even to extend beyond the inner edges of the latter when the valve is in its central position, then the passages at the inner valve portion or bridge B, it is true, would still become doubled; but this would then not be of any practical use, because in that case the openings at the ports *a* would become smaller than the doubled passages at the inner valve portion B. Thus by reason of the necessity of providing the passages *r*, which connect the two cylinder-spaces at the central position of the valve, I obtain as a concomitant feature of this valve an equalization of pressure in the two cylinder-spaces at the time when the valve is in its central position, or, in other words, at the time when the piston is at or near its dead-point. This secures the following advantages—that is to say:

First. In the case of an air-pump the volume effect is increased, because the air, becoming compressed within the noxious space in front of the piston, escapes into what was previously the suction-space, to be thence during the next stroke of the piston carried away with the quantity of air previously sucked into the cylinder.

Second. In the case of a steam-engine a saving of steam is obtained, because at the end of the stroke the steam before being discharged is caused to communicate with the noxious space in the opposite end of the cylinder, thus increasing the pressure or "weight" of the steam therein, so that upon the valve being opened again less steam from the boiler will be required for refilling the said noxious space.

I am aware that such equalization of pressure, although perhaps not practically employed in steam-engines heretofore, is *per se* known, and I therefore do not claim this feature as my invention. The same has been here mentioned merely for this reason, because it presents itself as a necessary concomitant feature of my improved valve.

In constructing for this valve the valve diagram of Zeuner's it will be observed that in the case of an air-pump the side indicating the discharge and in the case of a steam-engine the side corresponding to the admission will not differ in any way from the usual kinds of valves, but that in the case of an air-pump the admission side and in the case of a steam-engine the discharge side will be entirely different from the usual kind, as the ports upon being opened (and also when being closed) are opened to double the width, as compared with the opposite ports, and the conditions may, according to the circumstances of any particular case, be so chosen that the doubling of the sectional areas will continue until the full sectional area of the ports *a* will have been attained.

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

The combination with a cylinder having

ports *a*, *a*, and an intermediate port D, of the slide-valve C provided with a central bridge B having a recess A′ formed in its under side, corresponding recesses A formed in the valve-seat on each side of the port D, the arrangement being such that when the valve is in its central position the ports *a*, *a*, are in communication, and when the valve is moved to one side of its central position the passages through the port D and bridge will be double the area of the port *a* on the opposite side, substantially as described.

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

FRANZ JOSEPH WEISS.

Witnesses:
GEORGE GIFFORD,
THEODORE STAEHELING.