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AUTOMATIC ANNULAR VALVE

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Fig. 1

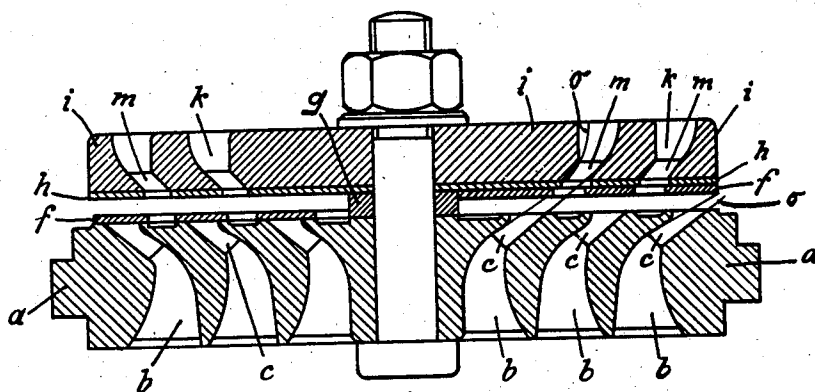
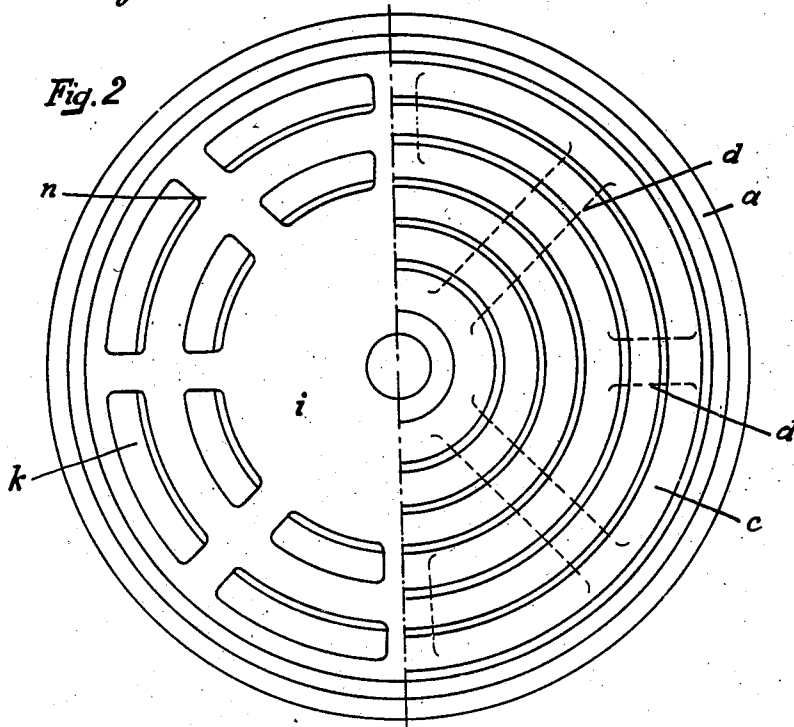


Fig. 2



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AUTOMATIC ANNULAR VALVE

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4 Claims. (Cl. 251-119)

In known automatic annular valves the working medium when flowing out of the annular slots or ports in the valve seat strikes perpendicularly against the valve plate and, therefore, bears with considerable pressure on the valve plate adjacent the trap plate. Underneath the valve plate, the medium flows outwardly towards both sides and undergoes a change in direction of 90°. In automatic annular valves constructed with a plurality of slots or ports and having a flat valve plate, there is the disadvantage that the individual divided streams of the medium will strike against one another rectilinearly and then only flow away through the slots in the trap plate after a further change in direction of 90°.

The above mentioned valves offer a considerable resistance to the medium flowing through the valves, the resistance being due to the friction on the walls, to eddying resulting from the jets striking the valve plate perpendicularly and to the deflected streams from two adjacent slots or ports striking perpendicularly against one another.

One object of the present invention is to provide an automatic valve having a flat valve plate and one or more annular slots, and which will offer a considerably reduced resistance to the medium flowing through the valve. In accordance with the invention, the upper or outer parts of the ports in the seat and the lower or inner parts of the ports in the valve trap are staggered relatively to one another and are in substantially the same inclined position, so that after the working medium has emerged from the seat and whilst retaining its direction of movement, it flows through the gap between the valve seat and the valve plate and enters the ports in the trap plate without hindrance.

Single-ring valve plates have already been proposed in which the slots or ports in the valve seat are arranged in such a manner that they are directed outwardly at an inclination, so that with the valve plate open, the medium flowed out past the plate and the trap plate approximately radially. In this construction, however, the medium did not pass freely into the guiding conduits of the trap plate, which diverted the medium so that it flowed outwards in an axial direction.

Moreover, it has also been proposed to make the slots or ports of the valve seat and of the trap plate in the form of nozzles. The only purpose of this construction, however, was to reduce the friction of the medium when it entered or emerged from the slots or ports and not, on the contrary, to concentrate the jets of the medium

in such a manner that they flowed through the gap between the seat and the displaced valve plate without appreciable eddy losses, in order then to be received in the nozzle-like slots of the trap plate, as far as possible without striking the sides of the latter.

One constructional form of the invention is shown by way of example, on the accompanying drawing, whereon:—

Fig. 1 is a vertical section through a valve, the valve plate being shown in the closed position on the left-hand side and in the open position on the right-hand side; and

Fig. 2 shows, on the left-hand side, a plan view of the trap plate and, on the right-hand side, a plan view of the valve seat.

The valve seat *a* is provided with three concentric passages or ports *b*, the upper parts *c* of which, however, do not open perpendicularly on to the upper plane or side of the seat but at an angle smaller than 90°. The channels *c* are preferably inclined outwardly and they are advantageously constructed in the form of nozzles, by being narrowed somewhat from the underside of the seating in an upward direction. The individual rings of the seat *a* are connected together in known manner by means of radial ribs *d*.

Arranged above the seat *a* is a valve plate *f* which, is shown in Fig. 1, is slidably guided on a sleeve *g* surrounding the central pin of the valve. Any other guiding means however may be used for the valve plate for example, links or roller elements, this being of no importance as concerns the present invention.

The opening movement of the valve plate is limited by a damping plate *h* which abuts against the underside of the trap plate *i*, but if necessary, however, the damping plate can also be omitted.

The trap plate *i* is provided with annular slots *k*, the lower portions *m* of which i. e. the portions nearest to the valve plate, deviate from the perpendicular and are disposed approximately in the direction of the upper, nozzle-like portions *c* of the slots *b* in the valve seat. The inclination of the slot portions *m* of the trap relatively to the perpendicular on the seating surface is somewhat less than that of the nozzle-like opening *c* of the seat.

The annular rings of the trap plate *i* are connected together in known manner by radial ribs *n*.

The above described valve construction operates as follows:—

The medium flowing through the valve issues from the outwardly-inclined, nozzle-like openings *c* of the valve seat *a* in the form of dense com-

pressed jets *o*, which flow rectilinearly through the gap between the seat *a* and the damping plate *h* in which the valve plate *f* operates and enter the lower portions *m* of the slots *k* in the trap plate. According to the shape of the slots *k*, the direction of the flow is again changed in the trap plate, in such a manner that the medium emerges from the valve again parallel, or substantially parallel, to the central pin of the valve in the same way as in known valves.

Whereas, therefore, in the valves at present in use, the medium undergoes a double change in direction of 90° within the valve, according to the present invention, by means of the specially constructed guiding members, it is deviated through a considerably smaller angle from the inlet direction and is again returned to the original direction in the trap plate with minimum losses by means of a similar guiding means. More particularly, however, no change in the direction of the medium takes place in the gap between the valve seat and the trap plate and, further, the gap is traversed by the full jet of the medium. In this way, the nozzle-like shape of the outlet openings *c* of the valve seat *a* offers security against expansion losses arising in the gap.

Finally, a particular advantage of the novel valve construction should be noted, viz., that the springs (not shown) acting on the valve plate *f* in the closing direction are calculated for considerably smaller forces. The valve plate *f* is only struck by the jets of the flowing medium during the period of opening and then only at an angle smaller than 90°. The jet pressure is, therefore, substantially smaller than if the medium came into contact with the plate perpendicularly. When open, the valve plate *f* is not touched by the jet *o* at all, as can easily be seen from Fig. 1. The result of this is that the opening stroke is less than in the prior valves, so that under certain circumstances, the different damping members such, for example, as the damping plate *h* and any other such buffer devices can be entirely omitted.

The travel of the valve plate *f* need not be increased beyond a definite amount, which is given by the full jet diameter. In any case, an increase of the stroke would not result in any widening of the flow cross-section. Consequently, a valve constructed according to the invention can have a relatively small travel, whereby it can be used with advantage, especially with piston engines having a higher number of revolutions.

Finally, a greater flow velocity is possible with valves constructed in accordance with the invention than with the constructions already known, since the flow of the medium takes place in the form of smooth, dense jets without obstruction. Consequently, the valve can be of smaller dimensions than the usual constructions for the same output whereby, in addition to the other advantages mentioned, the invention also represents an economy.

I claim:

1. An annular valve assembly wherein the in- and out-flowing stream of a medium is directed substantially parallel to its axis, comprising a flat valve plate, a valve trap, and a valve seat, each having passages therethrough, each of said pas-

sages of said valve seat including a portion inclined toward the face thereof opposing said valve plate, each of said passages of said valve trap including a portion inclined toward the face thereof opposing said valve plate, the end portion of each passage opposite the inclined portion in said seat and said trap being substantially parallel to the axis of said valve assembly, said inclined portions substantially in alignment with each other and in communication through said passages of said valve plate when said valve assembly is in operative position.

2. An annular valve assembly wherein the in- and out-flowing stream of a medium is directed substantially parallel to its axis, comprising a flat valve plate, a valve trap, and a valve seat, each having passages therethrough, each of said passages of said valve seat including a portion outwardly inclined toward the outer face thereof, each of said passages of said valve trap including a portion inwardly inclined toward the inner face thereof, the end portion of each passage opposite the inclined portion thereof in said seat and said trap being substantially parallel to the axis of said valve assembly, said inclined portions forming nozzles and being substantially in alignment with each other and in communication through respective passages of said valve plate when said valve assembly is in operative position.

3. An annular valve assembly wherein the in- and out-flowing stream of a medium is directed substantially parallel to its axis, comprising a flat valve plate, a valve trap, and a valve seat, each having passages therethrough, each of said passages of said seat including a portion forming an outwardly inclined nozzle, each of said passages of said trap including a portion forming an inwardly inclined nozzle, the end portion of each passage opposite the inclined portion thereof in said seat and said trap being substantially parallel to the axis of said valve assembly, said inclined portions arranged in staggered relation with respect to each other in a direction parallel to the axis of the valve assembly and being substantially in axial alignment with each other and in communication through respective passages of said valve plate when said valve assembly is in operative position.

4. An annular valve assembly wherein the in- and out-flowing stream of a medium is directed substantially parallel to its axis, comprising a flat valve plate, a valve trap, and a valve seat, each having passages therethrough, said valve trap and said valve seat in spaced relation with each other forming a gap therebetween, each of said passages of said seat including a portion substantially outwardly inclined toward the outer face thereof, each of said passages of said trap including a portion substantially inwardly inclined toward a face of said trap adjacent said outer face of said seat, the end portion of each passage opposite the inclined portion thereof in said seat and said trap being substantially parallel to the axis of said valve assembly, said inclined portions in communication through said passages of said valve plate and through said gap, when said valve assembly is in operative position.

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