J. H. H. VOSS.

HIGH SPEED VALVE.

APPLICATION FILED DEC. 11, 1917.

**1,287,530.** Patented Dec. 10, 1918.

Fig. 1

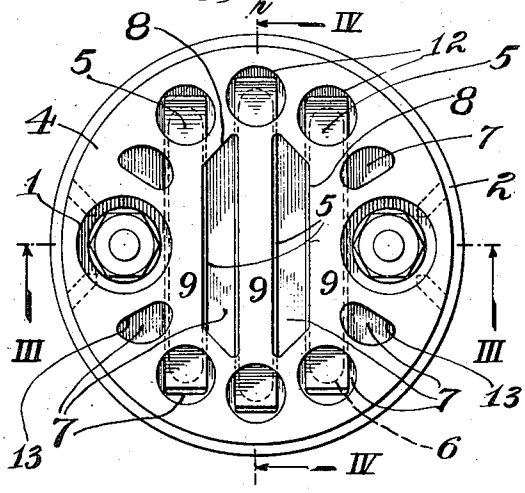



Fig. 2

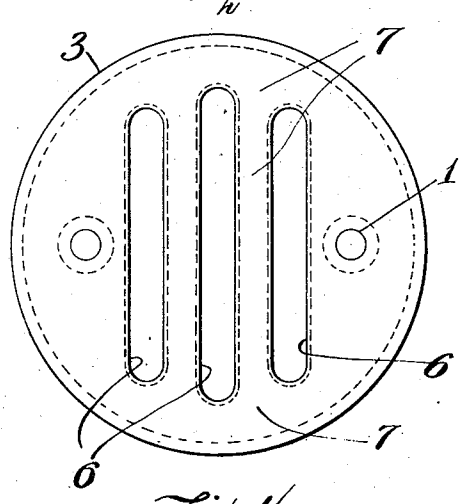



Fig. 3

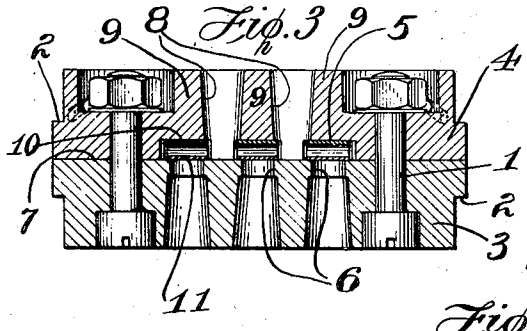



Fig. 4

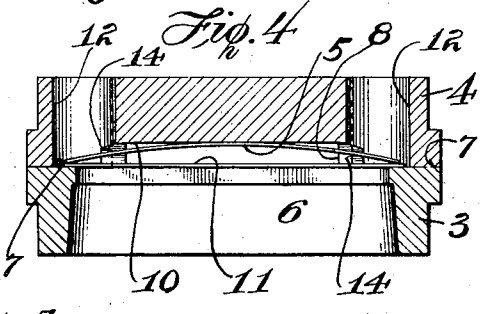
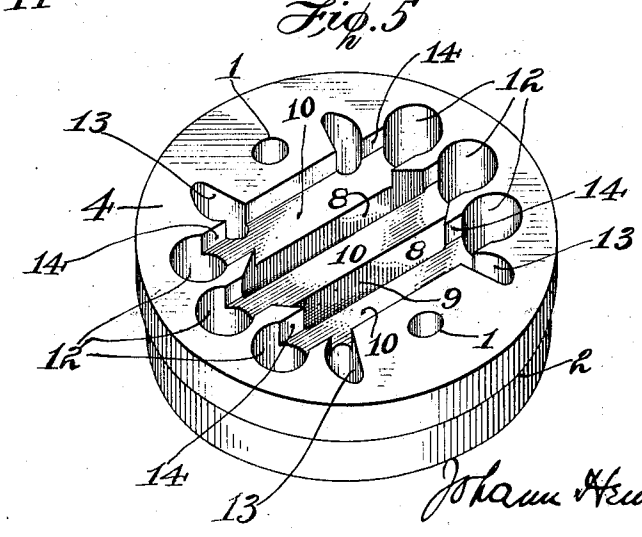



Fig. 5




INVENTOR

Johann Heinrich Hermann Voss.

BY

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# UNITED STATES PATENT OFFICE.

JOHANN HEINRICH HERMANN VOSS, OF WHITE PLAINS, NEW YORK.

## HIGH-SPEED VALVE.

1,287,530. Specification of Letters Patent. Patented Dec. 10, 1918.

Application filed December 11, 1917. Serial No. 206,692.

*To all whom it may concern:*

Be it known that I, JOHANN HEINRICH HERMANN VOSS, a subject of German Emperor, residing at White Plains, New York, have invented the following described Improvements in High-Speed Valves.

The invention relates to automatic plate valves or so-called ribbon valves, for use in high-speed gas and air compressors and the like, and is an improvement over existing valves of this class in the respect that it combines in one structure, the following principal features, to wit, the valve plate and its seating spring are unrestrained and wholly free from localized bending and hence from the crystallization of the metal and early fracture which results therefrom. The housing of the valve plate and its seating spring is so designed as to be devoid of dead gas pockets and hence to be self-cleaning, so that interruptions to service by the presence of foreign matter on the valve seat is eliminated or reduced to the very minimum. And finally, the valve housing is designed to be made by the simplest machining processes—turning, grinding and drilling, and hence can be produced at low cost, the valve plate and also its spring being merely cut lengths of stock material not requiring special preparation, drilling or shaping. The preferred form of my invention, the same being a valve structure possessing the combination of all three of the aforesaid important features, is shown in the accompanying drawings, wherein:

Figure 1 is a plan view of an assembled valve;

Fig. 2 a plan view of the valve seat or lower section;

Fig. 3 a section of Fig. 1 on the line III—III;

Fig. 4 a section of Fig. 1 on the line IV—IV; and

Fig. 5 an inverted view of the cap section of the casing.

The valve casing consists of two sections provided with two or more countersunk bolt-holes 1 by which they may be clamped together with the valve plates 11 and their springs 5 housed between them, and with appropriate external surfaces or shoulders 2 whereby the assembled parts may be clamped in the compressor structure. Both casing sections are, or may be, simple castings, the section marked 3 forming the valve seat and the other, marked 4, being the cap which retains the valve plates in position and forms also the backing or abutment for the springs thereof. For a multi-ported valve of the kind here shown, the seating part 3 is cast with three or more parallel port slots 6 of graded length suited to the circular contour of the structure. The upper or inner ends of all these port slots terminate at a common seat surface 7 which surface is a plane and hence easily produced in its finished form by ordinary tools. The cap section 4 is formed with flow slots 8 in similar, parallel arrangement to the port slots but offset relatively thereto so that when the sections are united the walls or ribs 9 between and at the side of said flow slots are disposed directly opposite to or over the port slots. The faces 10 of these portions of the cap section thus opposed to the port slots form the backing or abutment surfaces for the springs 5 and are conveniently formed by milling away the metal in the central region of the section (Fig. 4) forming a recess or chamber therein deep enough to accommodate the superposed valve plates and springs and afford them an adequate lift. It will be observed that said backing surfaces occupy the same plane and hence can all be readily made in substantially a single operation and that the recess could, if desired, be formed more or less completely in the casting of the section in the first instance. The springs 5 are flat-section, bow springs of well tempered steel ribbon about as wide and about as long as the valve plates 11 and they exert their thrust upon the backing faces 10 on one side and upon the terminal regions of the valve plates on the other, and so as to press the latter upon the seat surface 7. They are otherwise wholly unrestrained being unattached to any part and therefore it will be seen that they yield by bending uniformly throughout their entire length and not locally, these qualities being essential in any form of seating spring within this invention. The valve plates 11, which are closed upon the port slots 6, by the springs 5, are not necessarily thicker than will suffice to withstand the fluid pressure upon them and they may be so thin as to bend when opening although it is desired, in the case illustrated, that the principal bending be done by the springs. Both the springs and valve plates are of light mass being simple lengths

of thin steel ribbon of uniform cross-section manufactured by merely cutting it in proper lengths and tempering.

Each plate 11 and its spring 5 is kept in proper relative position, the one upon the other and the plate upon its port slot 6, by means of two cavities 12 one at each end, and which are formed by the simple process of drilling holes in the cap part 4 at the ends of each surface 10. These drill holes 12 intersect the edge of the milled recess in the cap part and in effect constitute stalls embracing the ends of the springs and plates guiding their vibratory motion and retaining them in proper registry with the port slots without, however, being subject to appreciable wear. The points of contact may be at the corners of the plates, or at the entrances 14 to the stalls, or both, but preferably at the corners only, and the rubbing pressure of such contact is manifestly very slight because of the light mass of the valves and springs. It is found moreover that by cutting the plates with a clearance all around of substantially $\frac{1}{32}$ inch, the wear on the surrounding wall surface is inappreciable even after long periods. As thus housed between the two sections and with their ends in the stalls 12, both valve and spring are unrestrained in respect to their vibratory flexure. Neither is attached to the other nor to any other part and neither is weakened by a perforation or by any abrupt change of cross section, but the spring seats the plate and by its flatwise engagement therewith keeps it at all times from tilting. The flow of gas past and around the ends and edges of each valve plate passes through the holes 12 as well as through the flow slots 8 and thereby keeps the whole seating surface clear of grit or solid matter likely to obstruct tight closing. There are no dead pockets, corners or cavities in which, by eddy current effects, such solid matter can find a resting place within the valve casing or on the seat. At the lateral boundaries of the surfaces 10, the cap section is preferably formed with auxiliary holes 13, which also intersect the milled recess and thereby supplement the function of the holes 12 in insuring a flow of gas at all points in the housing. The several flow passages in the cap section of the casing are obviously capable of different arrangements to produce a gas flow giving the self-cleaning effect above described and still provide the proper backing for the seating springs, and it will be understood that various changes, substitutions and modifications may be made in size and arrangement of the parts without departing from the invention as specified in the following claims.

I claim:

1. A ribbon or plate valve comprising united seat and cap sections loosely confining therebetween an unsecured plate valve of light mass and a closing spring therefor, the cap section being provided with flow passages at both ends of the valve plate serving to guide the vibration thereof and keep the valve seat free from dirt.

2. A ribbon or plate valve comprising united seat and cap sections loosely confining between them an unsecured plate valve of light mass, and an unattached, flat section, bow spring of uniform cross-section for seating the same, the cap section being provided with flow passages at the ends of the valve plate serving to guide the vibration of the plate and spring and to keep the valve seat free from dirt.

3. A ribbon or plate valve comprising united seat and cap sections loosely confining between them an unsecured plate valve of a light mass and a uniformly-flexing seating spring therefor of uniform cross section, the cap section being formed with flow passages at the ends and sides of the valve plate serving to guide the vibration of the plate and spring and to keep the valve seat free from dirt.

4. A ribbon or plate valve comprising a ported seat section having the inner ends of its port slots terminating at a common plane surface, a cap section secured to the seat section and forming a chamber therebetween loosely confining a thin valve plate to close each port slot and an unattached and unrestrained seating spring for each plate and flow passages formed in said cap section communicating with said chamber at the ends and sides of said valve plates, the metal between or adjacent said passages forming backing surfaces for the seating springs.

5. A ribbon or plate valve comprising a casing section having a plane inner surface forming a valve seat, a cap section secured to said surface and having a central recess forming a chamber, a valve plate and a superposed seating spring both loosely confined in said chamber and both being of uniform cross-section and light mass, and flow passages formed in said cap section in positions therein to maintain active gas flow at all points of said valve seat surface.

6. A ribbon or plate valve comprising united seat and cap sections forming a valve chamber between them and provided with port and flow slots respectively opening into said chamber, a thin valve plate of light mass serving to close the port slot, a uniformly flexing plate seating spring loosely interposed between the same and the opposing-surface of the cap section, the said valve plate being unattached to any part and having a clearance of substantially $\frac{1}{32}$ inch from the surrounding chamber walls which confine it to registry with the port slot.

7. A ribbon or plate valve comprising united seat and cap sections, flow passages

in the seat section, flow passages in the cap section offset therefrom, loosely confined valve plates of light mass and seating springs therefor adapted to bend uniformly throughout their lengths, ribs formed between the passages in the cap section forming backing surfaces for the seating springs, and flow passages at the ends of the valve plates communicating with the passages in the seat section, serving to guide the vibration of the plate and spring and keeping the valve seat free from dirt.

8. A ribbon or plate valve comprising united seat and cap sections forming a valve chamber between them and provided with port and flow slots respectively opening into said chamber, a valve plate loosely confined in said chamber and serving to close the port slot, and a flat bowed seating spring loosely interposed between the valve plate and the opposing surface of the cap section.

9. A ribbon or plate valve comprising united seat and cap sections forming a valve chamber between them and provided with port and flow slots respectively opening into said chamber, a valve plate loosely confined in said chamber and serving to close the port slot, and a flat bowed seating spring loosely interposed between the valve plate and the opposing surface of the cap section, said valve plate and seating spring being of substantially equal width and each being of uniform section throughout.

10. A ribbon or plate valve comprising united seat and cap sections forming a valve chamber between them and provided with port and flow slots respectively opening into said chamber, said seat section having a plane inner surface forming the valve seat, a thin valve plate of light mass loosely confined in said chamber and serving to close the port slot, and a seating spring loosely interposed between the valve plate and the opposing surface of the cap section and formed of a plate of light mass, said valve plate and seating spring being of substantially equal width.

11. A ribbon or plate valve comprising united seat and cap sections loosely confining therebetween an unsecured plate valve of light mass, the cap section being provided with flow passages at both ends of the valve plate serving to guide the vibration thereof and keep the valve seat free from dirt.

In testimony whereof, I have signed this specification.

JOHANN HEINRICH HERMANN VOSS.