

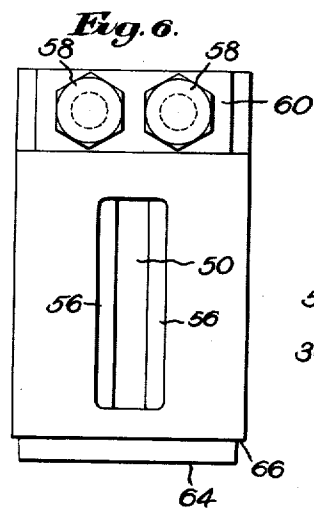
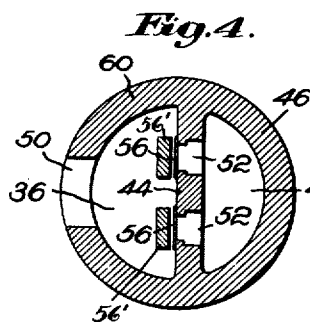
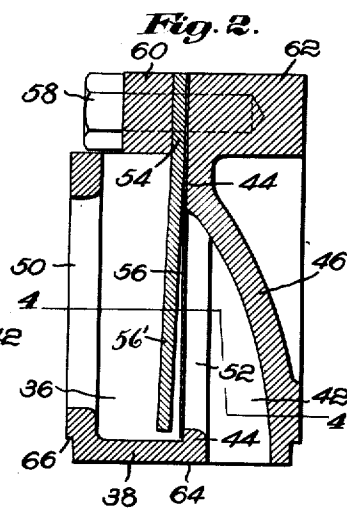
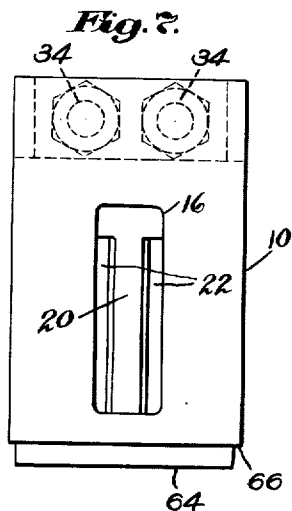
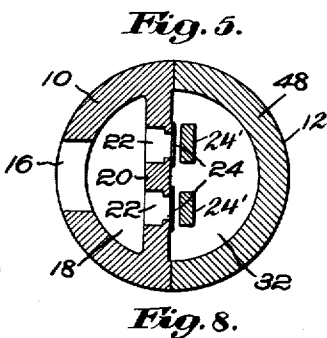
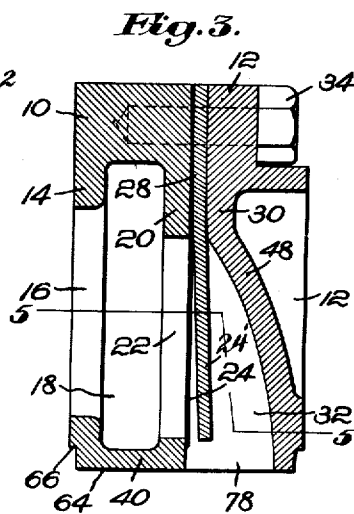
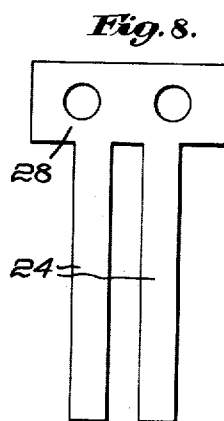
Sept. 16, 1924.

S. T. NELSON

1,508,568

VALVE

Original Filed May 17, 1915 2 Sheets-Sheet 2



Inventor:
Sven T. Nelson,
by *Mary Booth Janner Vane*
Attys

UNITED STATES PATENT OFFICE.

SVEN T. NELSON, OF CHICAGO, ILLINOIS, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

VALVE.

Application filed May 17, 1915, Serial No. 28,756. Renewed December 27, 1920. Serial No. 433,430.

To all whom it may concern:

Be it known that I, SVEN T. NELSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented an Improvement in Valves, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to improvements in valves, and more particularly to automatically acting intake and discharge valves for gaseous fluid compressors. The invention will be best understood from the following description taken in connection with the accompanying drawings of a portion of a compressor equipped with intake and discharge valves embodying my invention.

In the drawings:

Fig. 1 is a longitudinal section of a compressor cylinder provided with intake and discharge valves embodying my invention;

Fig. 2 is a longitudinal sectional elevation, on an enlarged scale, of a discharge valve and its cage embodying the present invention;

Fig. 3 is a longitudinal sectional elevation on an enlarged scale of an intake valve and its cage embodying the present invention;

Fig. 4 is a transverse horizontal section on line 4-4 of Fig. 2;

Fig. 5 is a transverse horizontal section on line 5-5 of Fig. 3;

Fig. 6 is a side elevation of the construction shown in Fig. 2 seen from the left of the latter figure;

Fig. 7 is a side elevation of the construction shown in Fig. 3 seen from the left of the latter figure;

Fig. 8 is a detail of the valve member.

Referring more particularly to Fig. 1 of the drawings, I have there shown an embodiment of my invention, selected for illustrative purposes, in its application to a cylinder of a gaseous fluid compressor. In this figure, the cylinder 2 is provided with a piston 4 working in said cylinder in the customary manner. The cylinder is provided with two cylinder heads 6-6 secured in any suitable manner, one at either end of the cylinder 2. In accordance with the present invention, the intake and discharge valves will preferably be disposed in said heads.

In the case of some machines, and more particularly of some compressors, especially those of the vertical type, there is very little room at the cylinder head (and in the case of vertical cylinder heads particularly, at the lower cylinder head) for the location of a plate valve. In fact, in the case of vertical compressors, in order to provide room for the location of an ordinary plate valve in position, it would be necessary to add a special intermediate head, whereby the height of the compressor as a whole would be considerably increased.

The present invention, amongst other objects, aims to provide for the insertion of a plate valve into the cylinder head preferably from the side, and the use to this end of a special valve construction involving the use of a so-called cage containing the valve seat and valve, in a manner somewhat analogous to that in which poppet valves have been heretofore used as discharge valves. The invention renders possible the substitution for the poppet valve construction heretofore used for the discharge valve and for the rolling so-called "Corliss" type of intake valve, of a plate valve, a type of valve that is far more efficient and advantageous, and at the same time saves considerable space.

Referring more particularly to Fig. 1, the compressor cylinder therein shown may be of the double acting type and either a high pressure or low pressure cylinder. If a high pressure cylinder, the air enters an inner chamber 8 through suitable connections (not shown) with the low pressure cylinder, while if a low pressure cylinder, the air enters the chamber 8 through a suitable inlet port or ports (not shown), directly from the outer air.

As already stated, the intake and discharge valves embodying the present invention are preferably inserted, with their cages, in ports or pockets arranged radially in the air cylinder heads, with their major dimensions substantially perpendicular to the length of the cylinder, and are sufficient in number to provide ample area for the entrance of the air into and the escape of the compressed air from the cylinder. In the drawings, only two intake and two discharge valves, one each at either end of the cylinder, are shown, but it will be under-

stood that any suitable number can be provided.

The intake and discharge valves embodying the present invention may be, and herein are, quite similar to each other, although they differ in some respects. The intake valve construction will first be described.

The cage of the intake valve preferably consists of two parts 10 and 12. One of these parts, part 10 for example, is hollow and of generally semi-cylindrical shape, as shown more particularly in Fig. 5. It is closed at the top and bottom, and the curved wall 14 thereof is provided with an opening 16, see Fig. 3, opening into the semi-cylindrical chamber 18 of said part. The flat wall 20 of the part 10 is provided with one or more, herein two, longitudinal openings 22 and constitutes the valve seat, said openings being closed by valve members 24, 24 in the form of tongues, projecting from a plate 28. The part 12 is of general semi-cylindrical shape and is provided in its flat front surface 30 with a substantially niche-shaped recess 32. The two parts 10 and 12 of said cage are clamped together by screws 34 extending through suitable openings provided in the part 12 and plate 28 of the valve member, and screwed into screw-threaded openings provided in the flat face of the part 10, said screws thus also serving to clamp the valve plate 28 in position between said parts with the tongues or valve members 24, 24 in position to cooperate with the valve openings 22 which they normally close. When the parts are assembled the wall 20 constitutes a longitudinal partition between the chamber 18 and the recess 32, the ports 22 in said partition being controlled by the valve members 24. For the purpose of limiting the opening of the valve and preventing breakage due to localizing of the shearing effect at the edge of the valve clamping means, suitable laterally bent guard members 24' are provided. The valve members 24, while shown herein as projecting from a plate 28, operate wholly independently of each other and might obviously be formed separately without the slightest change in their mode of operation.

The discharge valve cage is of exactly the same shape and construction as the intake valve cage above described, with the exception that it is constructed in one piece instead of two and that the chamber 36, corresponding to the chamber 18 of the intake valve, is open at the top, and the lower wall 38 of said chamber, corresponding to the lower wall 40 of the intake valve, extends within the niche-shaped recess 42 of the discharge valve cage, the valve seat wall 44, corresponding to the wall 20 of the intake valve, being thus joined at its upper end to the upper extremity of the wall 46 which forms said niche-like recess 42 and which corre-

sponds to the wall 48 of the intake valve construction. The discharge valve cage is provided with the openings 50 and 52, 52 corresponding to the openings 16 and 22, 22, respectively of the intake valve cage. In the discharge valve the valve plate 54 corresponding to the valve plate 28 of the intake valve is provided with tongues 56, 56 which normally cover the valve openings 52, 52, and said plate is secured to the valve seat 44 by screws 58, 58 passing through a clamping block 60 and screwed into the part 62 of the discharge valve cage, see Fig. 2. The part of the valve plate 54 from which the tongues project is preferably somewhat deeper than the corresponding part of the valve plate 28 of the intake valve. As in the previous construction, a suitable guard and limit member, here designated as 56', is provided. The tongues 56, 56 operate entirely independently of each other and might obviously be formed separately if desired.

The intake valve cage and discharge valve cage are both of cylindrical contour exteriorly and are received, Figure 1, in cylindrical pockets disposed with their axes substantially perpendicular to the axis of the cylinder and extending radially inward around the cylinder head, and within which said cages have a close fit. The lower ends of the cages are provided with a reduced portion 64, 64, thus forming an abutment 66 which engages a corresponding abutment formed on the interior wall of the cage receiving pocket at the latter's inner extremity.

The cage receiving pockets 68 are closed by caps 70 secured to the cylinder in any suitable manner, as by screws 72, each cap being provided with a central screw-threaded opening with which a bolt 74 carrying a check nut 76 has screw-threaded engagement. The bolt 74 extends completely through the cap 70 and engages the outer end surface of the valve cage which is thus securely seated and held in place in its pocket 68, see Fig. 1.

As already stated, the intake valve cage is preferably made in two halves or parts 10 and 12 to facilitate machining of the valve seat, which owing to the location of the latter would otherwise be difficult. The location of the valve seat in the case of the discharge valve enables said seat to be machined from the end, which makes it unnecessary to construct the discharge valve cage in two parts, and said cage is herein accordingly preferably made in a single piece.

The cages are preferably made of bronze and the valves of cold rolled sheet steel, but it will be apparent that any other suitable material may be used if desired. The valves are preferably of relatively light weight.

In the use of a valve of the type shown in Fig. 8, it is desirable that said valve be clamped up to a point or points at least as far forward as, and preferably in front of, the junction of the tongues 24 with the body or marginal portion 28 in the tongues. By comparison of Figs. 3 and 8 it will be seen that the width of the parts between which the body or marginal portion 28 is clamped is considerably greater than that of said body portion, so as securely to clamp the same and also to clamp the bases of the tongues 24 at points well in advance of their junction with said body portion.

It is believed that the operation of the valves will be readily understood from the above description, taken in connection with the accompanying drawings, and it will therefore not be more fully described except to state, with reference to Fig. 1, that as the piston 4 travels upwardly, the discharge valve, from which the piston is moving away (lower right-hand corner, Fig. 1), will naturally remain seated, while the intake valve at the same side of the piston (lower left-hand corner, Fig. 1) will be opened, by reason of the resultant rarification of the gaseous fluid within the cylinder as opposed to the relatively higher pressure of gaseous fluid in the intake chamber 8. Gaseous fluid will accordingly pass from said intake chamber 8 through the opening 16 of the intake valve cage, past the valve and out through the opening 78 of said intake valve cage into the cylinder.

On the other hand, Fig. 1, the intake valve, toward which the piston is moving (upper left-hand corner, Fig. 1), will naturally be seated, by the pressure of the gaseous fluid exerted against said valve from within the piston chamber, and the compressed fluid will cause the discharge valve at the same side of the piston (upper right-hand corner, Fig. 1), to open and permit the fluid to flow from the cylinder chamber into the discharge valve cage through the opening 82, past the discharge valve and out of said cage through the opening 50 into the discharge chamber 84, from whence it will pass through suitable connections, not shown, to the usual receiver (not shown).

When the piston moves downwardly (Fig. 1) the intake valve from which it is moving away will be opened, and the discharge valve at that same side of the piston will be closed, while the intake valve toward which the piston is moving, will be closed and the discharge valve of that same side of the piston opened. It will be understood that in this description of the operation of the valves, the expressions "upwardly" and "downwardly" are used with reference to Fig. 1, more particularly, and are to be taken in a relative sense as including move-

ment in any other suitable direction, as determined by the position of the cylinder in any given case.

An important feature of my improved construction consists in the construction of the recesses or flow chambers 32 and 42 of tapering form and in arranging the valves 24 and 56 relative to these chambers so that maximum valve opening occurs adjacent maximum area of flow passage. It will thus be evident that there will be very free flow of air or other compressed fluid through these passages or recesses and accordingly a high efficiency of the valve as a whole.

It will be apparent to those skilled in the art that valves constructed and arranged in accordance with the present invention possess many advantages other than those already specifically referred to. It will also be understood that while the invention is herein described as embodied in the details illustrated, the invention is not to be considered as circumscribed by or limited to those details, or any of them, but that the said details may be variously modified within the true scope of the invention which is definitely set forth by the claims.

Claims:

1. In a valve mechanism, in combination, a valve cage having a closed end and an open end and a lateral opening communicating with the opening in its end, and a flexible valve member within said cage fixed at one end and having its free end adjacent the opening in the end of the cage and normally disposed over said lateral opening and moving towards the center of the end opening on opening movement.

2. In a valve mechanism, in combination, a valve cage having a lateral opening and an opening in its end and provided with a fluid deflecting surface substantially opposite said lateral opening, and a flexible valve member fixed at one end and having its free end extending toward the opening in the end of the cage and its body portion normally closing said lateral opening but bending towards said deflecting surface on opening movement.

3. In a valve, the combination with a valve cage having a closed end, an open end, a lateral opening, and a longitudinal partition having one or more ports communicating with said lateral opening and with said open end, of a flexible valve member fixed at one end adjacent the closed end of said cage and having its free end adjacent the opening in the end of the cage and normally disposed over said ports.

4. In a valve, the combination with a valve cage having a closed end, an open end, and a plurality of lateral openings communicating with the opening in its end, of a flexible valve member comprising a body portion fixed adjacent the closed end of said cage,

and a plurality of flexible tongues projecting from said body portion and having their free ends adjacent the opening in the end of said cage, said tongues normally closing

5 said lateral openings.
5. In a valve, the combination with a valve cage having a closed end, an open end, a lateral opening, and a longitudinal partition having a plurality of ports communicating
10 with said lateral opening and said open end, of a flexible valve member comprising a body portion fixed adjacent the closed end of said cage and a plurality of flexible tongues projecting from said body portion
15 and having their free ends adjacent the opening in the end of said cage, said tongues normally closing the ports in said partition.

6. In a valve mechanism, the combination, with a valve cage having a closed end, a
20 longitudinal partition dividing the interior thereof into a plurality of chambers, said cage having a lateral opening communicating with one of said chambers and said partition having one or more ports communicating with said same chamber, and said cage
25 also having an opening in the other end thereof communicating with the other of said chambers, and said last mentioned chamber having a fluid deflecting surface
30 disposed opposite said ports and sloping towards the same, of a flexible valve member fixed at its end adjacent the closed end of said cage and having its free end extending
35 toward the opening in the end of said cage, the body portion of said valve normally closing said ports.

7. In a valve mechanism, the combination with a valve cage having a closed end, a longitudinal partition dividing the interior
40 thereof into a plurality of chambers, said cage having a lateral opening communicating with one of said chambers and said partition having one or more ports communicating with said same chamber, and said cage
45 also having an opening in the other end thereof communicating with the other of said chambers, and said last mentioned chamber having a fluid deflecting surface
50 disposed opposite said ports and sloping towards the same, of a flexible valve member fixed at its end adjacent the closed end of said cage and having its free end extending
55 toward the opening in the end of said cage, the body portion of said valve normally closing said ports, and the free end thereof moving on opening of said valve towards said fluid deflecting surface.

8. In a valve, in combination, a valve cage having a plurality of lateral openings therein and a single opening in its end provided
60 with a curved fluid deflecting surface extending substantially throughout the length of said lateral openings, and a flexible valve member comprising fingers normally disposed
65 over said lateral openings and having

their free ends extending toward the mouth of the opening in the end of said cage.

9. In a valve, in combination, a valve cage formed in two parts and provided with a lateral opening and an opening in its end
70 provided with a fluid deflecting surface extending substantially throughout the length of said lateral opening, and a flexible valve member normally disposed over said lateral opening and having one end disposed between
75 the parts of said valve cage and its free end extending toward the opening in the end of said cage, and means for clamping the elements together.

10. In combination, a cylinder, a cylinder head having chambers communicating with
80 said cylinder removable valve cages carried in said chambers and radially disposed with respect to said cylinder, each of said cages having an inlet and an outlet, and oppositely acting laterally movable plate valves
85 disposed horizontally of said cages between said inlets and outlets, one of said valves forming an intake valve and the other a discharge valve.

11. In combination, a cylinder, a cylinder head having chambers communicating there-
90 with, removable valve cages carried in said chambers and disposed with their major dimensions substantially perpendicular to the length of said cylinder, each of said cages having an inlet and an outlet, and oppositely acting laterally movable plate valves
95 carried longitudinally in said cages between said inlets and outlets, one of said valves forming an intake valve and the other a discharge valve.

12. In combination, a cylinder, a cylinder head having chambers communicating there-
105 with, removable cylindrical valve cages carried in said chambers and disposed with their axes substantially perpendicular to the axis of said cylinder, each of said cages having an inlet, an outlet, and a ported partition between said inlet and outlet, and oppositely acting plate valves carried in said cages
110 and cooperating with the ports in said partitions, one of said valves forming an intake valve and the other a discharge valve.

13. In combination, a cylinder, a cylinder head having inlet and discharge spaces and
115 chambers communicating with the interior of said cylinder and with said inlet and discharge spaces, respectively, valve cages in said chambers each having a closed end, an open end communicating with the interior
120 of said cylinder, and a lateral opening communicating with the opening in its end and with the corresponding cylinder head space, and oppositely acting flexible valve members in said cages, each of said valve members being fixed at one end and having its
125 free end adjacent the opening in the end of the cage and normally disposed over the lateral opening therein, one of said valve
130

members forming an intake valve and the other a discharge valve.

14. In combination, a cylinder, a cylinder head having inlet and discharge spaces and chambers communicating with the interior of said cylinder and with said inlet and discharge spaces, respectively, radially arranged removable valve cages carried in said chambers and disposed with their major dimensions substantially perpendicular to the length of said cylinder, each of said cages having a closed end, an open end communicating with the interior of said cylinder, a lateral opening communicating with the corresponding cylinder head space, and a longitudinal partition having one or more ports communicating with said lateral opening and with said open end, and oppositely acting flexible valve members in said cages, each of said valve members being fixed at one end and having its free end adjacent the opening in the end of the cage and normally disposed over said ports, one of said valve members forming an intake valve and the other a discharge valve.

15. In a valve, in combination, a valve cage having a closed end, an open end, and a lateral opening communicating with the opening in the end, and a flexible valve member within said cage, said valve member being fixed at one end and having its free portion disposed over said lateral opening to close the same.

16. In a valve, in combination, a valve cage having a closed end, an open end, and a lateral opening communicating with the opening in the end, and a flexible valve member within said cage, said valve member being fixed at one end and having its free end adjacent the opening in the end of the cage, and being disposed over said lateral opening to close the same.

17. In combination, a cylinder, a cylinder head having chambers communicating with said cylinder, removable valve cages in said chambers disposed with their major dimensions substantially perpendicular to the length of said cylinder, each of said cages having an inlet and an outlet, and laterally movable plate valves carried longitudinally in said cages between the inlets and outlets thereof respectively.

18. In combination, a cylinder having a cylinder head, a plurality of valve cages carried by said head and disposed radially thereof with their major dimensions substantially perpendicular to the axis of said cylinder, and plate valves disposed longitudinally in said cages, each of said valves being movable in a direction transverse to the length of its respective cage.

19. In a valve, in combination, a valve cage having walls bounding a tapering flow chamber, inlet and discharge openings communicating with said chamber through ad-

jacent walls thereof, a valve fixed at one end of said cage and disposed over one of said openings and having its free end adjacent the other thereof, whereby the maximum valve opening is adjacent the greatest flow area of said flow chamber, said valve lying within said flow chamber and having its free end moving towards the middle thereof on opening movement.

20. A valve comprising a casing having inlet and discharge ports, a fluid conducting chamber connecting said ports, a valve cooperating with one of said ports, said valve lying within said fluid conducting chamber, and means cooperating with said valve to cause certain portions of said valve to move away from said port a greater distance than other portions thereof, said conducting chamber being formed with maximum flow area adjacent points of maximum port opening.

21. In combination, means providing the bounding walls for a pump cylinder chamber and also providing valve cage receiving chambers in communication with said cylinder chamber, a piston movable in the cylinder chamber, and valve mechanisms disposed in said valve cage receiving chambers and comprising removable valve cages carried in said chambers and radially disposed with respect to said cylinder chamber, each of said cages having an inlet and an outlet, and oppositely acting laterally movable plate valves disposed longitudinally of said cages between said inlets and outlets, one of said valve mechanisms constituting an inlet valve mechanism and the other a discharge valve mechanism.

22. In combination, means providing the bounding walls for a pump cylinder chamber and also providing valve cage receiving chambers arranged in spaced relation with respect to each other and communicating with said cylinder chamber, a piston movable in the cylinder chamber, and valve mechanisms disposed in said valve cage receiving chambers and comprising removable valve cages carried in said chambers, each of said cages having an inlet and an outlet, and oppositely acting laterally movable plate valves disposed longitudinally of said cages between said inlets and outlets, one of said valve mechanisms constituting an inlet valve mechanism and the other a discharge valve mechanism.

23. In combination, means providing the bounding walls for a pump cylinder chamber and also providing valve cage receiving chambers in communication with said cylinder chamber, a piston movable in the cylinder chamber, and valve mechanisms comprising removable valve cages carried in said valve cage receiving chambers, each of said cages having an inlet and an outlet, and laterally movable plate valves disposed lon-

gitudinally of said cages between said inlets and outlets.

24. In combination, means providing the bounding walls for a pump cylinder chamber and also providing valve cage receiving chambers in communication with said cylinder chamber, a piston movable in the cylinder chamber, and valve mechanisms comprising removable valve cages mounted in said valve cage receiving chambers and insertable and removable by movement in directions parallel to a plane transverse to said cylinder chamber, and plate valve elements in said cages disposed when in closed position parallel to said plane.

25. In combination, means providing the bounding walls for a pump cylinder chamber and also providing at least one cage receiving chamber spaced radially from the axis of said cylinder chamber, a piston reciprocable in said cylinder chamber, and a valve device including a cage insertable in said cage receiving chamber and having a port communicating with said cylinder chamber and a plate valve element disposed within said cage and controlling the flow of fluid through said cage, said valve element when closed lying in parallelism with the plane to which the axis of said cylinder chamber is perpendicular.

26. In a compressor, the combination of a fixed element having a cylindrical bore formed therein, said bore being in communication with the compressor cylinder, a valve casing fitting said bore, said casing having an opening therein communicating with the compressor cylinder, a septum communicating with said opening and a port therein surrounded by a valve seating surface, and a valve overlying said port and controlling the flow therethrough.

27. In a compressor, the combination of a fixed element having a bore formed there-

in, said bore being in communication with the compressor cylinder, a valve casing seated in said bore and having ports therein communicating with the cylinder and with a fluid conducting passage, partition forming means in said valve casing disposed substantially parallel to the axis of said bore, said partition having at least one port formed therein and surrounded by a valve seat surface, and valve means cooperating with said valve seat surface.

28. In a compressor, the combination of a fixed element having a cylindrical bore formed therein, said bore being in communication with the compressor cylinder, a valve casing fitting said bore, said casing having an opening communicating with the compressor cylinder, and at least one other opening therein surrounded by a valve seating surface, said valve seating surface being substantially parallel to the axis of said bore, and valve means cooperating with said valve seating surface.

29. In a compressor, the combination of a fixed element having a cylindrical bore formed therein, said bore being in communication with the compressor cylinder; a cylindrical-shaped structure composed of a plurality of elements and forming a valve casing adapted to fit within the cylindrical bore, said structure having a plurality of ports, flow slots, and valve seats, one for each slot, formed therein; and a series of valves, one for each valve seat, mounted in the structure aforesaid.

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

SVEN T. NELSON.

Witnesses:

H. B. HALVORSEN,
HJALMAR BLOM.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,508,568, granted September 16, 1924, upon the application of Sven T. Nelson, of Chicago, Illinois, for an improvement in "Valves," errors appear in the printed specification requiring correction as follows: Page 4, line 82, claim 10, after the word "cylinder" insert a comma; same page and claim, line 87, for the word "horizontally" read *longitudinally*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 4th day of November, A. D. 1924.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.