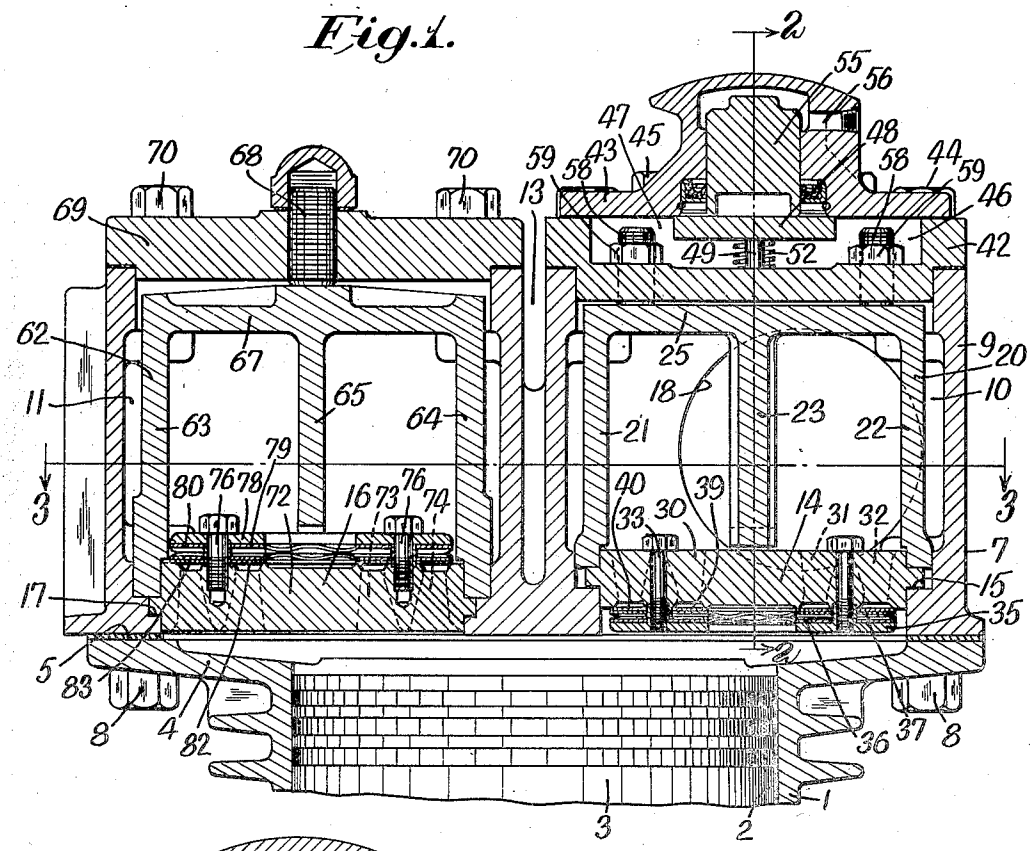
Aug. 28, 1951 R. E. LAMBERTON 2,565,564

PUMPING APPARATUS

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Fig. 1.



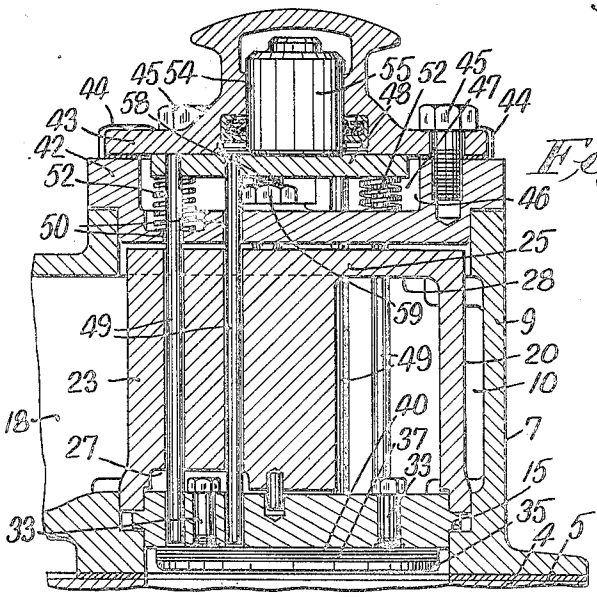


Fig. 2.

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Fig. 3.

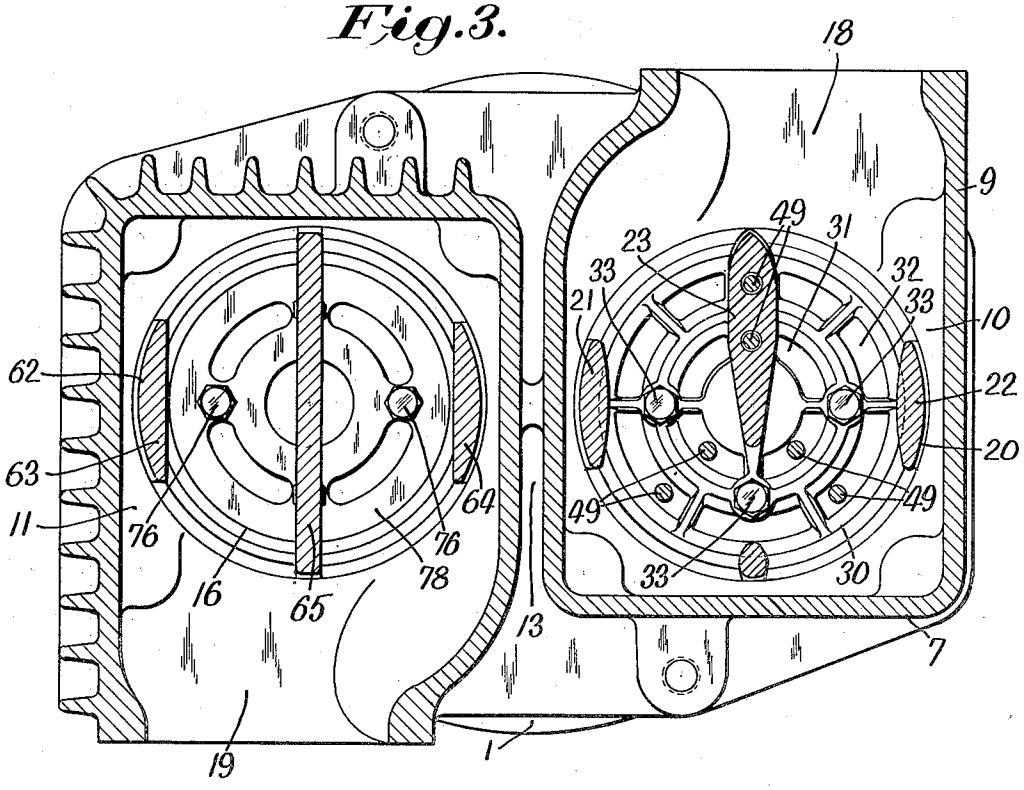
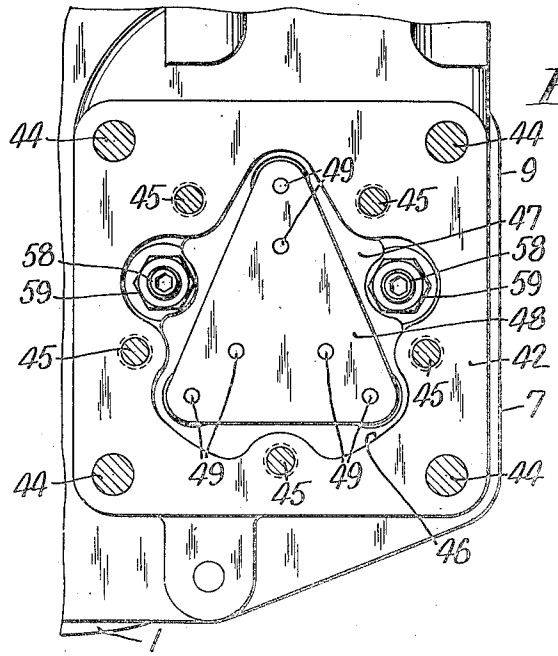


Fig. 4.



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PUMPING APPARATUS

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Application April 10, 1944, Serial No. 530,259

12 Claims. (Cl. 230—24)

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My invention relates to pumping apparatus, and more particularly to cylinder head structures having an improved arrangement of parts and adapted especially for use with compressors.

It is important in the design of compressors to provide means for directing fluid to and from the compressor in smooth flowing streams, and precaution should be taken to avoid as much as possible the transfer of heat from the stream of compressed fluid to the stream of fluid being taken into the compressor. It is desirable that the intake and discharge chambers in the cylinder head be of such size and arrangement that the valve mechanism, the fluid flow directing means, a valve unseating means for effecting unloading, and any other necessary equipment may be readily received and easily accessible for replacement or repair while at the same time providing adequate space for the flow of fluid.

An object of my invention is to provide an improved cylinder head for a pump or a compressor. It is another object of my invention to provide in an improved cylinder head an intake chamber and a discharge chamber, and means for directing and controlling the flow of fluid through the chambers in an improved manner. Still another object is to provide an improved cylinder head for a pump or a compressor, said head having an improved arrangement of parts for directing and controlling the flow of fluid relative to a cylinder. Yet another object is to provide, in a cylinder head chamber containing a valve mechanism, improved means for holding the valve mechanism in place and for directing the flow of fluid relative to the valve mechanism. A still further object of my invention is to provide an improved and simplified means for unloading the pumping apparatus. These and other objects of the invention will appear more fully in the course of the following description.

In the accompanying drawings, in which one embodiment which my invention may assume in practice has been shown for purposes of illustration:

Fig. 1 is a central vertical section through the top of a compressor cylinder, the cylinder head, and the inlet and discharge valve mechanisms.

Fig. 2 is a vertical sectional view taken on the plane of the line 2—2 of Fig. 1.

Fig. 3 is a horizontal sectional view of the cylinder head taken on the plane of the line 3—3 of Fig. 1.

Fig. 4 is a plan view of the intake portion of the cylinder head with the top cover plate removed.

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In the illustrative embodiment of the invention there is shown a compressor cylinder 1 having a bore 2 containing a piston 3 which is adapted to be reciprocated by suitable means, not shown. The upper end of the cylinder is flared outwardly at 4 and provides at the outer edge of the flared portion a plane annular surface 5 on which a cylinder head 7 rests and is held in position as by bolts 8. The cylinder head includes a housing 9 having an intake chamber 10 and a discharge chamber 11, these chambers being disposed at opposite sides of a plane extending chordally—as shown, diametrically—of said cylinder bore and the inner walls of these chambers being separated by a space 13 so as to reduce the transfer of heat from the fluid in the discharge chamber to the fluid in the intake chamber, and so as to provide a space within which air from the atmosphere may circulate for conducting away heat transferred from the fluid in the discharge chamber through the walls of the latter. The intake and discharge chambers open through the bottom of the housing 9 into communication with the cylinder bore, and arranged within the lower portion of the intake chamber is an inlet valve mechanism 14 resting upon a shoulder 15 of the housing, while a discharge valve mechanism 16 is supported on a shoulder 17 in the lower portion of the discharge chamber. Opening into the chambers 10 and 11, respectively, through the side walls of the latter are an intake port 18 and a discharge port 19.

Received within the intake chamber above the inlet valve mechanism is a frame member 20 having plate-like portions 21 and 22 engaging the outer edges of the inlet valve mechanism at diametrically opposite points, and a plate-like portion 23 arranged between the portions 21 and 22 and engaging the inlet valve mechanism, as shown in Fig. 2, at its opposite edges between the points of engagement of the portions 21 and 22 with the valve mechanism. The portions 21, 22 and 23 are shown herein as being formed integral with an upper plate portion 25. The frame member 20 is arranged within the intake chamber so that the portions 21, 22 and 23 present edges to the incoming fluid for distributing the latter uniformly to the inlet valve mechanism. The surfaces of the portions are curved, as shown in Fig. 3, so as to assure a smooth flow of fluid through the chamber 10. The portion 23 is cut away at 27 and 28, as shown in Fig. 2, to permit a free flow of fluid to the portions of the inlet valve mechanism underlying that portion of the frame member.

The inlet valve mechanism, as shown herein, comprises a valve plate 30 resting on the shoulder 15 and having concentric annular inlet passages 31 and 32 opening therethrough. Attached to the lower side of the valve plate, as by bolts 33, is a valve guard 35 having oppositely projecting ledge portions supporting valve springs 36 and 37 which operate to hold inlet valves 38 and 40 normally in engagement with valve seats surrounding the intake ports 31 and 32.

At the upper end of the housing 9 are cover plates 42 and 43. The plate 42 is attached to the housing, as by bolts 44, and the plate 43 is attached to the plate 42, as by bolts 45. The cover plate 42 is provided with a recess 46 which cooperates with the plate 43 to form a chamber 47 receiving a member 48 which carries rods 49 extending through openings 50 in the plate 42 and through the intake chamber into the intake passages 31 and 32 where they are adapted to engage the inlet valves 38 and 40. Springs 52 surrounding a number of the rods 49 and acting between the plate 42 and the member 48 tend to support the latter in an upper position to hold the rods 49 free from engagement with the inlet valves. Formed in the plate 43 is a bore 54 containing a plunger 55 which is adapted to engage the member 48 for forcing the latter downwardly to move the rods 49 into positions unseating the inlet valves. A passage 56 opens into the bore 54 adjacent the upper end of the plunger 55 for conducting pressure fluid relative to the plunger. Extending through the plate 42 are screws 58 which are adapted to engage the upper portion of the frame 20 for holding the latter firmly against the inlet valve mechanism, and lock nuts 59 are provided for holding the screws 58 in their adjusted positions.

Arranged within the discharge chamber 11 is a frame member 62 similar to the frame member 20, and having projecting portions 63, 64 and 65 engageable with the discharge valve mechanism in a manner like that in which the portions 21, 22 and 23 of the frame member 20 engage the inlet valve mechanism. The frame member 62 is provided with an upper portion 67 which is engaged by a bolt 68 extending through a cover plate 69 for holding the frame member 62 firmly in engagement with the discharge valve mechanism. The cover plate 69 is secured to the housing 9 over the chamber 11 as by bolts 70.

The discharge valve mechanism comprises a valve plate 72 resting upon the shoulder 17 and having concentric annular discharge ports 73 and 74 opening through the plate. Secured to the upper side of the valve plate 72, as by bolts 76, is a guard member 78 which provides a backing for valve springs 79 and 80 operating to urge discharge valves 82 and 83 into engagement with valve seats surrounding the discharge ports. The projecting portions 63, 64 and 65 on the frame member 62 are arranged, as shown in Fig. 3, so as to direct fluid discharged from the compressor cylinder to the discharge port 19.

In the operation of the mechanism described, fluid is taken into the cylinder bore 2 during the suction stroke of the piston 3 through the intake port 18, the chamber 10, the intake passages 31 and 32, and past the inlet valves 39 and 40. On compression of fluid within the cylinder bore, the inlet valves 39 and 40 are seated by their respective valve springs, and the discharge valves 82 and 83 are forced open so that fluid passes from the cylinder bore through the discharge passages 73, 74, and through the discharge

chamber 11 to the port 19. When it is desired to unload the compressor, fluid under pressure is supplied through the passage 56 to the bore 54 above the plunger 55 forcing the latter against the member 48 and moving the rods 49 against the inlet valves to unseat the latter. It will be noted, with respect to both the frame member 20 and the frame member 62, that their contacts with the valve mechanism which they aid in clamping are only at points in a narrow diametric band and along generally tangentially extending strips essentially parallel to such diametric band. The contacts with the valve mechanisms are only adjacent the edges of the latter. The contacts provided by the central plate portions are contacts at diametrically opposite points and the other contacts include contacts at points diametrically opposite each other and at least substantially midway between the first mentioned contacts. It will further be noted that the rods 49 which extend through the openings in the plate element 23, through the extended guidance which they thereby receive, aid in determining the paths of movement of the other rod elements 49 which do not pass through any guiding means below the plate 42.

As a result of my invention, there is provided improved means for directing the flow of fluid through the intake and discharge chambers and for holding the valve mechanisms in their assembled positions. It will be seen that replacement of any of the parts of the valve mechanisms is facilitated by the arrangement of the inlet and discharge valves in separate chambers. By reason of the provision of separate intake and discharge chambers, the inlet and discharge valve mechanisms may be made identical so that one may be used interchangeably for the other. The arrangement of the chambers in the manner shown and described permits the making of flow passages of sufficient size to avoid any restriction of the flow of fluid, and makes the parts readily accessible for replacement or repair. The location of the bores for the rods 49 in the portion 23 and the location in the several pairs of rods 49 with respect to the plate 48 makes it certain that the several pairs of rods will have access to the inlet valves in a proper manner.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having an intake chamber and a discharge chamber disposed respectively wholly at opposite sides of a plane extending diametrically of said cylinder, said intake and discharge chambers opening at one end into said cylinder, intake and discharge ports opening through the side walls of said intake and discharge chambers respectively, inlet and discharge valve mechanisms for controlling the flow of fluid through said intake and discharge chambers, frame members having spaced apart plate portions arranged in substantial parallelism and extending transversely of said intake and discharge chambers in the direction of said ports for directing the flow of fluid through said chambers, said plate portions engageable

with said valve mechanisms for holding the latter in place, and means engageable with said frame members for holding said plate portions firmly in engagement with said valve mechanisms.

2. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having an intake chamber and a discharge chamber disposed respectively wholly at opposite sides of a plane extending diametrically of said cylinder, said intake and discharge chambers opening at one end into said cylinder, intake and discharge ports opening through the side walls of said intake and discharge chambers respectively, inlet and discharge valve mechanisms for controlling the flow of fluid through said intake and discharge chambers, frame members having spaced apart plate portions arranged in substantial parallelism and extending transversely of said intake and discharge chambers in the direction of said ports for directing the flow of fluid through said chambers, said plate portions engageable with said valve mechanisms for holding the latter in place, independent cover plates for said intake and discharge chambers, and means operatively connected to said cover plates and engageable with said frame members for holding said plate portions firmly in engagement with said valve mechanisms.

3. In a compressor, in combination, a valve cage traversed by passages completely laterally offset from each other, valves opposite said passages and controlling the flow through the same, a flow directing element extending radially with respect to the valve cage, and means for unseating said valves to effect unloading of the compressor including a member having a plurality of groups of elements adapted to extend through said passages to unseat said valves, said flow directing element providing means for coacting with one group only of said elements for guiding said several elements for movement into contact with said valves.

4. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having a chamber therein opening into said cylinder, a port opening through a side wall of said chamber, a valve mechanism for controlling the flow of fluid through said chamber, a frame member having plate portions extending transversely of said chamber in the direction of said port for directing the flow of fluid through said chamber, one of said plate portions extending diametrically of said valve mechanism and others of said plate portions extending tangential to said valve mechanism at opposite sides of said diametrically extending portion, said plate portions engaging said valve mechanism only at points spaced about the periphery of the latter, and means engageable with said frame member for holding said plate portions firmly in engagement with said valve mechanism.

5. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having a chamber therein opening into said cylinder, a port opening through a side wall of said chamber, a multi-valve valve mechanism for controlling the flow of fluid through said chamber, a frame member having plate portions extending transversely of said chamber in the direction of said port for directing the flow of fluid through said chamber, one of said plate portions extending diametrically of said valve mechanism and others of said plate portions extending tangential to said valve mechanism at opposite sides

of said diametrically extending portion, said plate portions engaging said valve mechanism for holding the latter in place, means for unseating the valves of said valve mechanism to effect unloading of the compressor including a member having a plurality of groups of elements adapted to unseat said valves, said diametrically extending plate portion having openings for guiding one group of said elements for movement into contact with said valves and the elements of the other groups being guided wholly through the guiding of the first group as aforesaid.

6. In a compressor, in combination, a cylinder containing a piston, a cylinder head having a fluid chamber and a lateral flow passage, a valve mechanism in said chamber for controlling fluid flow with respect to said cylinder and embodying a ported valve unit, and a holding member for securing said valve unit in position in said head chamber, said holding member having spaced apart holding portions contacting said valve unit only at the edges thereof and extending transversely of said chamber in substantial parallelism to each other and in the direction of fluid flow relative to said passage for directing the flow of fluid through said chamber between said flow passage and the ports of said valve unit.

7. In a compressor, in combination, a cylinder containing a piston, a cylinder head having a fluid chamber and a lateral flow passage, a valve mechanism in said chamber for controlling fluid flow with respect to said cylinder and embodying a ported valve unit, and a holding member for securing said valve unit in position in said head chamber, said holding member having spaced apart holding portions extending transversely of said chamber in the direction of fluid flow relative to said passage, said holding portions being arranged in substantial parallelism and substantially elliptical in cross section, and said holding portions being arranged to direct the flow of fluid through said chamber between said flow passage and the ports of said valve unit.

8. In a compressor, in combination, a cylinder containing a piston, a cylinder head, a valve mechanism positioned within said head for controlling fluid flow with respect to said cylinder and embodying a valve element, a holding member having spaced apart holding portions for holding said valve mechanism in place, one of said holding portions being intermediate others thereof, and valve unseating means to effect unloading of the compressor including a plate having rodlike elements engageable with said valve element to unseat the latter, said intermediate one of said spaced holding portions having thereon means for guiding certain of said rodlike elements and the others of said rodlike elements being guided by an element of said valve mechanism independently of said holding member, and a fluid actuated piston engaging said plate for moving said rodlike elements into valve unseating position.

9. In a compressor, in combination, a cylinder containing a piston, a cylinder head having a chamber, a fluid connection communicating with said chamber and through which fluid flows relative to said chamber, a valve mechanism for controlling fluid flow between said cylinder and said chamber, a clamping member arranged in said chamber and having spaced apart plate portions arranged in substantial parallelism and including a diametric portion and portions at opposite sides of said diametric portion and spaced from

the latter by nearly the radius of said valve mechanism, all of said portions extending in the direction of fluid flow with respect to said fluid connection for directing the flow of fluid through said chamber, said plate portions engaging said valve mechanism for holding the latter in place, and means engageable with said clamping member for holding said plate portions firmly in clamping engagement with said valve mechanism.

10. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having an intake chamber and a discharge chamber disposed respectively wholly at opposite sides of a plane extending chordally of said cylinder, passage means for conducting fluid to said intake chamber and from said discharge chamber, means for controlling the flow of fluid through said chambers including inlet and discharge valve mechanisms associated respectively with said intake and discharge chambers, frame members having spaced apart plate portions, arranged in substantial parallelism and disposed generally edgewise to said passage means, extending in the direction of fluid flow for directing the flow of fluid through said chambers, said plate portions engageable with said valve mechanisms at widely spaced points for holding the latter in place, and means engageable with said frame members for holding said plate portions firmly in engagement with said valve mechanisms.

11. In a compressor, in combination, a valve cage traversed by coaxially arranged passages, valves arranged opposite said passages, one controlling the flow through each of the same, a flow-directing element extending radially with respect to the valve cage, and means for unseating said valves to effect unloading of the compressor including a member having projecting therefrom a plurality of groups of elements adapted to extend through said passages to unseat said valves, each of said groups of elements including a valve-unseating element individual to each valve, and said flow-directing element providing guiding means for the elements of one of said groups only, for guiding the latter elements into contact with said valves and cooperating in maintaining each valve-unseating element of said other groups in a position to contact one of said valves.

12. In a compressor, in combination, a cylinder containing a reciprocatory piston, a cylinder head having an intake chamber and a discharge chamber, said chambers disposed respectively wholly at opposite sides of a plane extending chordally of said cylinder, passage means for conducting fluid to said intake chamber and from said discharge chamber, an inlet valve mechanism associated with said intake chamber and a discharge valve mechanism associated with said discharge chamber, said cylinder head providing seats for supporting said valve mechanisms, and means engageable with the edges of said valve mechanisms for holding said valve mechanisms on said seats including frame members, one associated with each of said valve mechanisms and each having contact with the one of said valve mechanisms with which it is associated including contacts at diametrically opposite points and contacts at other points diametrically opposite each other and at least substantially midway between said first mentioned contacts, said frame members each having generally parallel portions one providing said first mentioned contacts with the valve mechanism with which it is associated, and others each providing one of said second mentioned contacts, said plate portions arranged substantially edgewise with respect to said passage means to minimize interference with flow, and means for holding said frame members with the plate portions thereof pressed against said valve mechanisms.

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