July 18, 1933. L. J. CLAPP 1,918,247

COMPRESSOR MECHANISM

Filed March 28, 1930 2 Sheets-Sheet 1

Fig. 1.

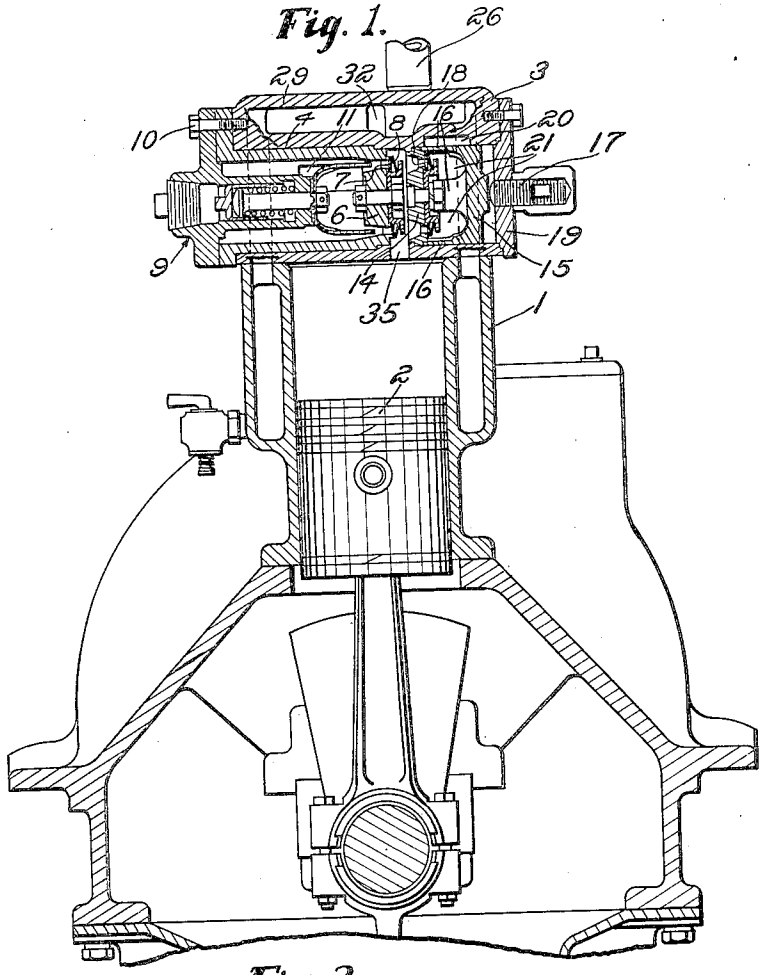
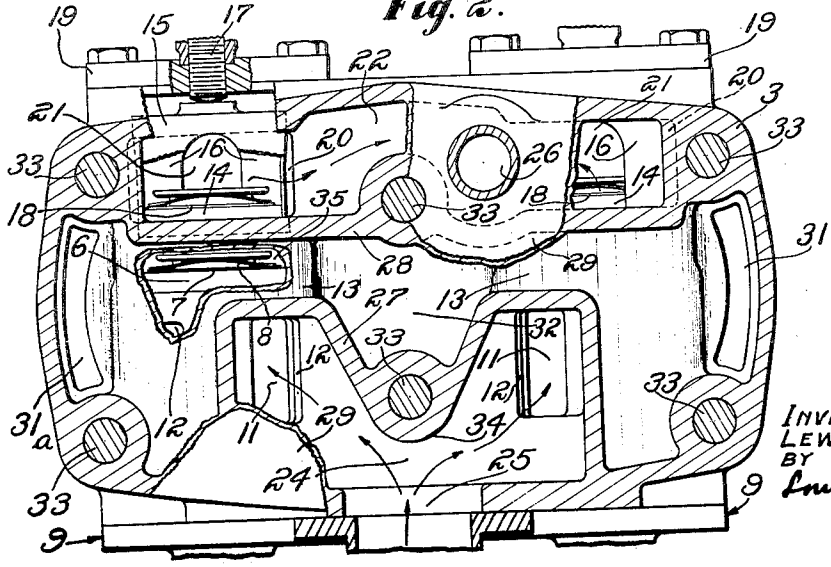


Fig. 2.



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Fig. 3.

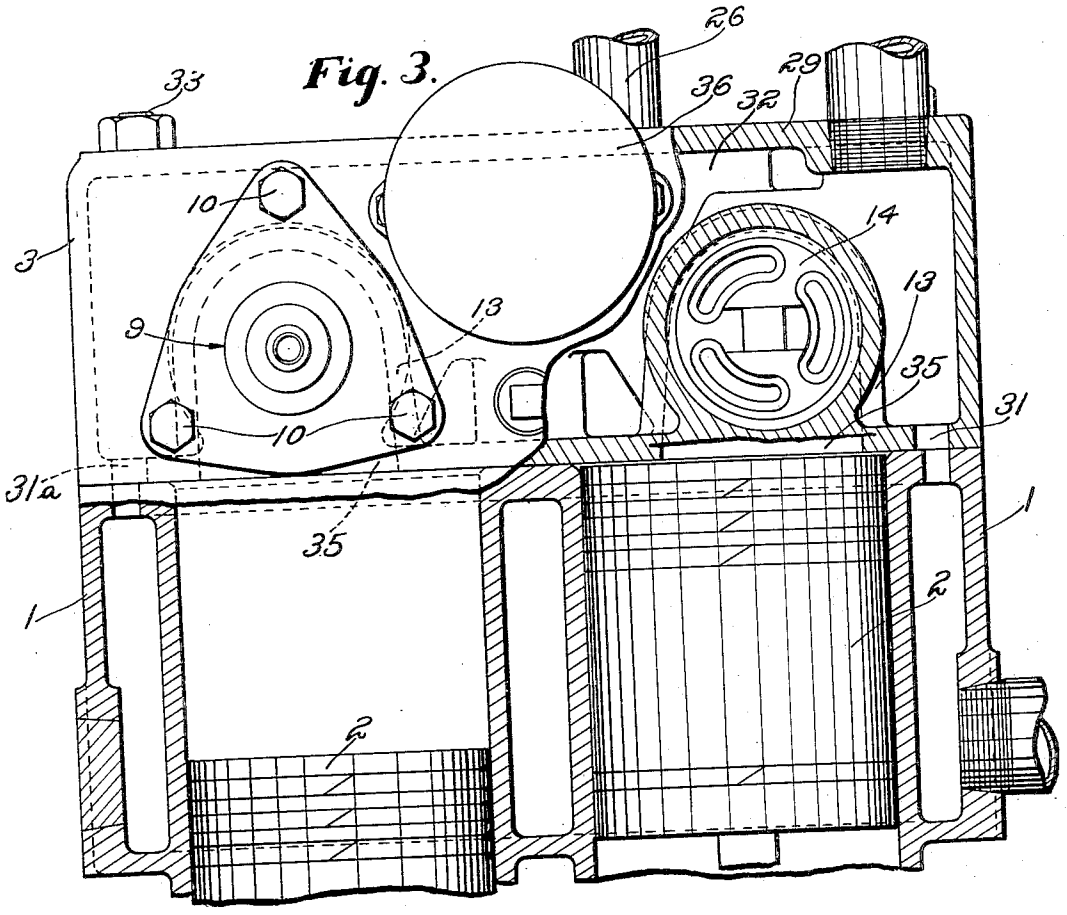
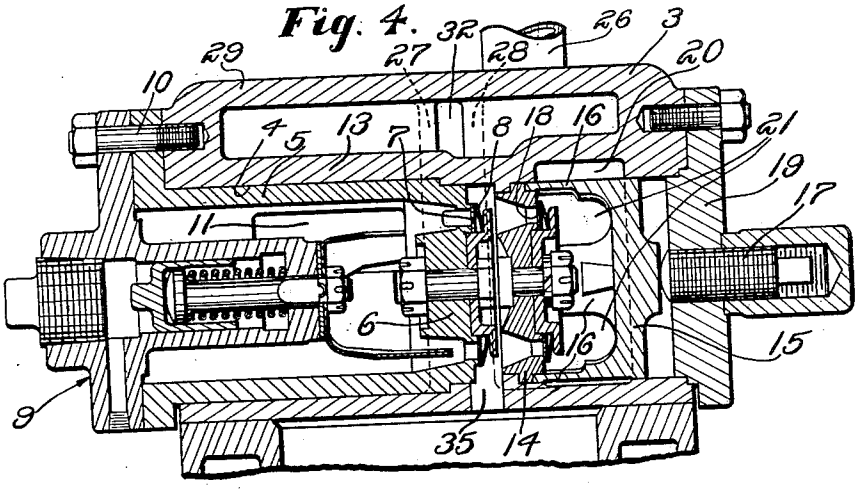


Fig. 4.



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UNITED STATES PATENT OFFICE

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COMPRESSOR MECHANISM

Application filed March 28, 1930. Serial No. 439,597.

This invention relates to compressor mechanisms and more particularly to an improved valve mechanism and an improved combined cylinder head and valve arrangement.

Various valve arrangements have heretofore been proposed in compressors using inlet and exhaust valves especially of the plate valve type, but they have disadvantages which it is desired to overcome by my improved arrangement. These difficulties have been particularly peculiar in the plate type of valve mechanism having concentric annular valve seats lying in the same plane normal to the valve axis, for it is necessary to avoid distortion of the valve seats from said plane, otherwise the annular plate valve element will not seat properly to form an air tight valve. There is also the difficulty that the exhaust valve is subjected to more severe conditions of operation than the inlet valve because any lubricant leaking past the piston is pumped through the exhaust valve and, as is well-known, becomes carbonized and causes valve trouble.

It is an object of my invention to provide an improved arrangement between the inlet and exhaust valves whereby the exhaust valve is firmly held relatively close to and independently of the inlet valve without introducing any distortion between the concentric valve seats and at the same time to permit ready access to, or removal of, the exhaust valve mechanism without disturbing the inlet valve mechanism which is relatively free from oil carbonization troubles due to the fact that only relatively cool fresh air flows therethrough.

It is a further object of my invention to provide an improved water cooling arrangement between the valve mechanism and its casing for reducing the possibility of oil carbonization to a minimum and to provide an improved air passage arrangement leading to and from the valve mechanisms and cylinder or cylinders whereby the air flow will not only be efficiently conducted but will be obtained with a relatively compact and simple structure. A further and more specific object is to provide an improved unitary cylinder head for a plurality of cylinders adapted to house the valve mechanisms for each of the cylinders, with improved water cooling passages and also improved air passage arrangements to permit efficient flow of air particularly from each of the exhaust valve mechanisms to the common discharge passage. As the air flow through a plate valve has a large radial component it will be seen that in my improved arrangement, with the axes of the valve mechanisms parallel to each other and with a common discharge passage normal thereto, the fluid will be discharged substantially directly into the common passage with less turning of the air than is usual in constructions wherein the axes of the valves of the respective cylinders are disposed in a different angular relation to each other. Such prior combinations have necessitated a relatively tortuous passageway connecting the two exhaust valves with the discharge outlet or outlets. Such a passageway is not only more costly to make but also less efficient.

Other objects and advantages of my improved arrangement will be more apparent to those skilled in the art from the following description of the accompanying drawings in which,—

Fig. 1 is a transverse section of one compressor cylinder with my improved cylinder and valve head mounted thereon and part of the crank case being omitted.

Fig. 2 is an enlarged plan view of the improved unitary cylinder head, parts being broken away to show details of construction and passage arrangements.

Fig. 3 is an enlarged longitudinal vertical view of the cylinder head, the upper portion of the cylinders and part of the head being broken away to show details of construction.

Fig. 4 is an enlarged vertical section of the valve mechanism as shown in Fig. 1.

For purposes of illustration I have shown my invention in connection with a conventional type of compressor having a pair of cylinders 1 and pistons 2 which are driven in any usual manner by a crank shaft. The cylinders are provided with suitable water jackets which have communication with my improved unitary cylinder head. While the

compressor is shown of the two-cylinder vertical type, it will of course be understood that a greater number of cylinders may be also employed, in which case each cylinder block might be provided with its own cylinder head and valve mechanism as though it constituted a vertical compressor of the type herein shown, and a different cylinder arrangement would, of course, be possible. Mounted upon and common to each of the cylinders, is a unitary cylinder head 3 preferably bolted in any usual manner to the cylinder end and having provision for housing the valve mechanisms for each cylinder in substantially parallel relation to each other. The description of one side of the head and its valves, will suffice, as the sides are substantially the same except as otherwise noted. As is seen in Fig. 4, the head has a bore 4 to receive an elongated sleeve 5 carrying at its front end an inlet valve mechanism 6, this valve mechanism having an annular plate valve member 7 adapted to seat upon a pair of concentric seats lying in the same plane and with ported air passages therebetween. The valve mechanism is normally held to its seat by a spring 8 resting against a suitable valve guard, the guard and valve seat body 6 being bolted together. This unit is well-known. There is also provided a piston type of unloading valve mechanism generally designated 9, carried in a suitable removable cover which together with the sleeve 5 is secured to the cylinder head as by bolts 10. Suitable ports 11 formed in the periphery of the sleeve 5 are placed in register with cooperating ports 12 formed in the wall 13 of the bore which receives sleeve 5. Opposed to the inlet valve mechanism is an exhaust valve 14 also of the annular plate valve type substantially identical to the inlet valve mechanism except that it is separable from a holding member 15 which has a series of prongs 16 pressed against a suitable flange on the valve mechanism as by a central screw 17. It will be seen from the construction thus shown that irrespective of the pressure applied to the holding screw 17, the prongs 16 will uniformly bear upon the exhaust valve and thus not in any way distort the pair of concentric valve seats engaged by the plate valve 18. It is also seen that by the provision of a removable cover 19, in which the screw 17 is secured, the exhaust valve mechanism and holding member 15 can be readily removed without in any way interfering with the inlet valve mechanism and without any sacrifice of clearance space between the inlet and exhaust valves. The bore in which the exhaust valve mechanism is disposed is provided with a suitable annular recess 20 surrounding the legs 16 thus permitting flow of discharge fluid from the exhaust valve mechanism through the openings 21 between the legs 16 and into the annular passage 20 which at one side extends radially with respect to the valve axis into a common transversely disposed discharge passage 22 (Fig. 2). The valve mechanism and air passage arrangement for the other cylinder being substantially identical to the valve mechanism just described similar reference numbers for similar parts are used. It is thus seen that the inlet ports 12, 12 are connected by a common transverse inlet passage 24 provided with a suitable inlet opening 25 while the common transverse discharge passage 22 is provided preferably with a single central outlet 26, although it will of course be understood that the provision of the transverse passage would permit as many outlets as is desirable or convenient. It will also be noted that the inlet passage 24 and outlet passage 22 are separated by individual vertical partitions 27 and 28 extending upwardly to merge with a common cover portion 29 which extends over the entire top of the unitary cylinder head. the result being that improved means are provided for effecting cooling of the cylinder head in that cooling liquid may flow from the cylinder jacket as shown in Fig. 3, through suitable openings 31 in the cylinder head upwardly across the right-hand valve casing wall 13 through a central passage portion 32 and thence over the left-hand valve casing wall 13 to the other outlet passage 31*a* which communicates with the other cylinder water jacket. It will of course be understood that the cooling flow may be in the other direction and if there is no forced circulation the water will then flow through the various passages in accordance with thermal conditions.

The cylinder head is secured to the cylinder by bolts 33 passing through a series of suitable openings formed in bosses cast integrally with the cylinder head.

The air flow in my improved construction is believed to be clear from the above description but briefly stated, the air or other fluid flows, in the path shown by the arrows in Fig. 2, through inlet opening 25 into common passage 24 where it is divided by the V-shaped partition 34 and directed to the ports 12, 12. Flow is then through the sleeve port 11 axially through the ports between the concentric valve seats and thence radially downwardly through the central passage 35 into the cylinder from which the fluid flows upon compression, through exhaust valve 14 thence radially through openings 21 between holding prongs 16 to the common transverse discharge passage 22 to the outlet 26. The flow through the other valve mechanism is the same, except that the flow from the discharge valve is in the opposite direction toward the outlet 26. It is thus seen that a very efficient flow passage arrangement has been provided and one which is most conducive to a high degree of cooperation with a

plate valve mechanism wherein the fluid discharges with a substantial radial component, while at the same time ample cooling water surface is provided for the valve housings thereby to reduce carbonization to a minimum. The general passage arrangement is thus seen to involve a plurality of substantially parallel passages, specifically three in number, with the intermediate passage containing cooling water.

It will of course be understood that any suitable air cleaning devices may be used in connection with the inlet 25 one form of such cleaner being shown diagrammatically at 36, Fig. 3. The cleaner is omitted from the other figures for simplicity.

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. A compressor having a plurality of cylinders having piston receiving bores and arranged with their axes lying in a common plane, a common unitary detachable cylinder head seated on said cylinders and closing the cylinder bores, and valve mechanisms for each cylinder, disposed in said head and with their respective axes in substantially parallel relation, the valve mechanisms individual to each cylinder being spaced from each other only a small fraction of the cylinder diameter.

2. The combination set forth in claim 1 further characterized in that the valve mechanisms include a discharge valve, one for each cylinder, and a common transverse discharge passage connecting said valves.

3. The combination set forth in claim 1 further characterized in that the valve mechanisms include an inlet valve, one for each cylinder, and a common transversely disposed inlet passage for said inlet valve mechanisms.

4. The combination set forth in claim 1 further characterized in that the valve mechanisms for each cylinder include an inlet and discharge valve mechanism, a common transversely disposed inlet passage for the inlet valve mechanisms, and a common transversely disposed discharge passage for each of said discharge valve mechanisms.

5. The combination set forth in claim 1 further characterized in that the valve mechanisms for each cylinder include an inlet and discharge valve, a common transversely disposed inlet passage for said inlet valves, and a common transversely disposed discharge passage for each of said discharge valves, said common passages being disposed substantially parallel to each other.

6. A compressor having a plurality of cylinders with their axes lying in a common plane, a common unitary cylinder head for said cylinders, and valve mechanisms for each cylinder disposed in said head and with their respective axes in substantially parallel relation, the valve mechanism for each cylinder including an inlet valve and said compressor having an inlet passage common to each of the inlet valves and provided with a member for deflecting the inflowing air toward the respective inlet valves.

7. A compressor having a plurality of cylinders with their axes lying in a common plane, a common unitary cylinder head for said cylinders, and valve mechanisms for each cylinder disposed in said head with their respective axes in substantially parallel relation, said valve mechanisms including inlet and discharge valves and said cylinder head providing substantially parallel inlet and discharge passages each of which communicates with a plurality of valves, said head also providing a cooling water passage intermediate said inlet and discharge passages and cooling the valve mechanisms for a plurality of cylinders.

8. In a compressor having a cylinder and cylinder head, said head having substantially coaxial communicating bores and an annular shoulder at the inner end of one of said bores, inlet and discharge valve mechanisms of the plate type in said bores insertable through the remote ends of the latter, said discharge valve mechanism seating upon said shoulder and comprising a unitary structure including a plurality of cooperating elements secured together in assembled relation, and means for holding said mechanisms in position including a multiple pronged member separate from said discharge valve unit and engaging the discharge valve unit only in the circumferential zone opposite to and defined by said shoulder and a single central threaded member for clamping said pronged member and valve unit in position.

9. A cylinder head and valve casing for a compressor having a pair of communicating substantially coaxial bores, a plate valve type of inlet valve having a sleeve insertable in one of said bores, a discharge valve mechanism of the plate valve type insertable within the other of said bores in a direction opposite to that of said inlet valve mechanism, said discharge valve having a valve seat body provided with a peripheral annular flange, and a multiple spaced pronged member insertable within the discharge valve bore, said prongs being engageable with said annular flange whereby the discharge valve is supported entirely at its periphery.

10. In a compressor valve mechanism, in combination, a cylinder head having a trans-

versely extending bore provided with shoulders between its ends and with a port slot opening into said bore, of valve mechanisms in said bore in engagement with said shoulders and comprising cage members providing surfaces at least as close to each other as the opposite walls of said slot, one of said valve mechanisms having its valve seat, valve and guard disposed in the space which would be comprised between the opposite walls of said slot extended.

11. In a compressor valve mechanism, in combination, a cylinder head having a transversely extending bore provided with shoulders between its ends and with a port slot opening into said bore, of inlet and discharge valve mechanisms in said bore in engagement with said shoulders and comprising cage members providing surfaces at least as close to each other as the opposite walls of said slot, said inlet valve mechanism having its valve seat, valve and guard disposed in the space which would be comprised between the opposite walls of said slot extended.

12. A common cylinder head for a multi-cylinder compressor, having an inlet and discharge flow conducting structure formed therein including bores formed in said head for receiving an inlet and a discharge valve mechanism for each cylinder, a common inlet passage formed in said head and having branched passages leading to the inlet valve mechanisms for said cylinders, and a common discharge passage formed in said head and having branched passages leading to the discharge valve mechanisms for said cylinders.

13. A common cylinder head for a multi-cylinder compressor, having an inlet and discharge flow conducting structure formed therein including parallel bores formed in said head and arranged with their axes lying in a common plane, said bores receiving an inlet and a discharge valve mechanism for each cylinder, a common inlet passage formed in said head and having branched passages communicating with the bores receiving said inlet valve mechanisms, and a common discharge passage formed in said head and having branched passages communicating with the bores receiving said discharge valve mechanisms.

14. A cylinder head for a compressor, having formed therein an inlet and discharge flow conducting structure including parallel bores formed in said head for receiving the inlet valve mechanisms, parallel bores formed in said head for receiving the discharge valve mechanisms, a common inlet having branched passages communicating with the bores receiving the inlet valve mechanisms, and a common discharge having branched passages communicating with the bores receiving the discharge valve mechanisms.

15. A compressor having parallel cylinders and a common cylinder head for said cylinders, an inlet and discharge flow conducting structure formed in said head and having alined bores for receiving the inlet and discharge valve mechanisms for one cylinder and alined bores for receiving the inlet and discharge valve mechanisms for the other cylinder, a common inlet formed in said head having branched passages communicating with the bores receiving the inlet valve mechanisms, a common discharge having branched passages communicating with the bores receiving the discharge valve mechanisms, and a common flow passage communicating with the alined bores for each cylinder through which the inlet and discharge fluid for the cylinder flows.

16. A compressor having a cylinder and a cylinder head, said head having a bore terminating at its inner end in a shoulder at opposite sides of said shoulder, and said head having passages communicating with said bore laterally respectively, a valve unit arranged within said bore and seated against said shoulder, a pronged member having a cylindrical portion slidably fitting said bore at a point in the latter more remote from said shoulder than the more adjacent one of said passages and having prongs engaging the periphery of said valve unit to hold said unit in seated position, and an adjustable element engaging said pronged member for maintaining the latter in its holding position.

17. A compressor having a cylinder and a cylinder head, said head having a bore terminating in a shoulder, a valve unit arranged within said bore and including a valve seat having an elongated integral sleeve-like portion slidably fitting said bore substantially throughout its length, said sleeve-like portion having an integral flange seated against the cylinder head at the outer end of said bore, and means engaging said flange for clamping the valve seat against said shoulder.

LEWIS J. CLAPP.

CERTIFICATE OF CORRECTION.

Patent No. 1,918,247. July 18, 1933.

LEWIS J. CLAPP.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, lines 95, 96 and 97, claim 16, strike out the words" and said head having passages communicating with said bore laterally respectively" and insert the same after "shoulder" in line 94, of said claim; and in line 97, strike out the comma; 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 19th day of February, A. D. 1935.

Leslie Frazer
Acting Commissioner of Patents.

(Seal)