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[54] **GAS COMPRESSOR**
16 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **417/542,** 137/338, 137/375
[51] **Int. Cl.** **F04b 39/00,** F16k 49/00
[50] **Field of Search** 230/172, 227, 208; 417/542, 71, 571; 137/338, 375

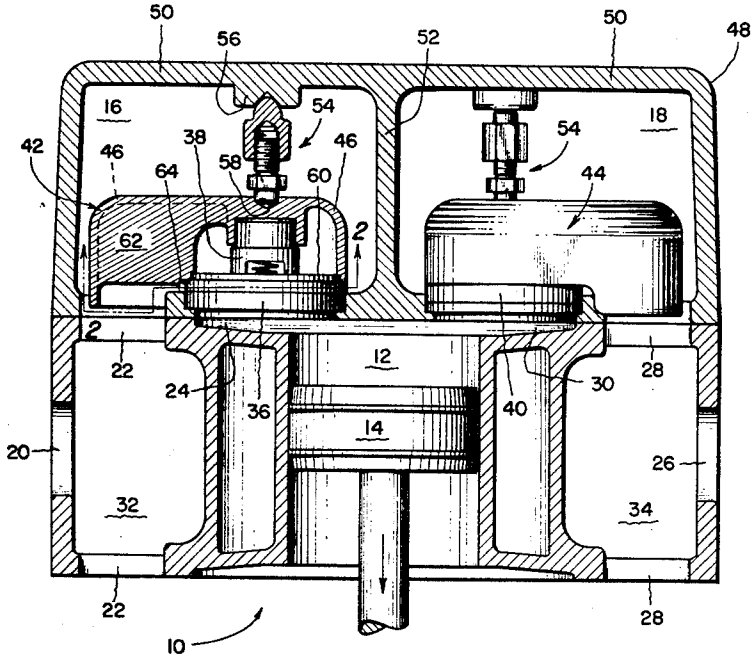
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ABSTRACT: A compressor having a gas-compressing cylinder-and-piston arrangement with inlet and discharge plenum chambers in flow communication with inlet and discharge ports and with the cylinder. The chambers are side-by-side, sharing a common wall which wall radiates heat from the discharge plenum chamber into the inlet plenum chamber. Troughs are arranged in the chambers more positively to direct gas flow, especially away from the commonly shared wall and all other heat-radiating walls, to inhibit gas turbulence and to reduce preheating, thereby to enhance compressor efficiency.



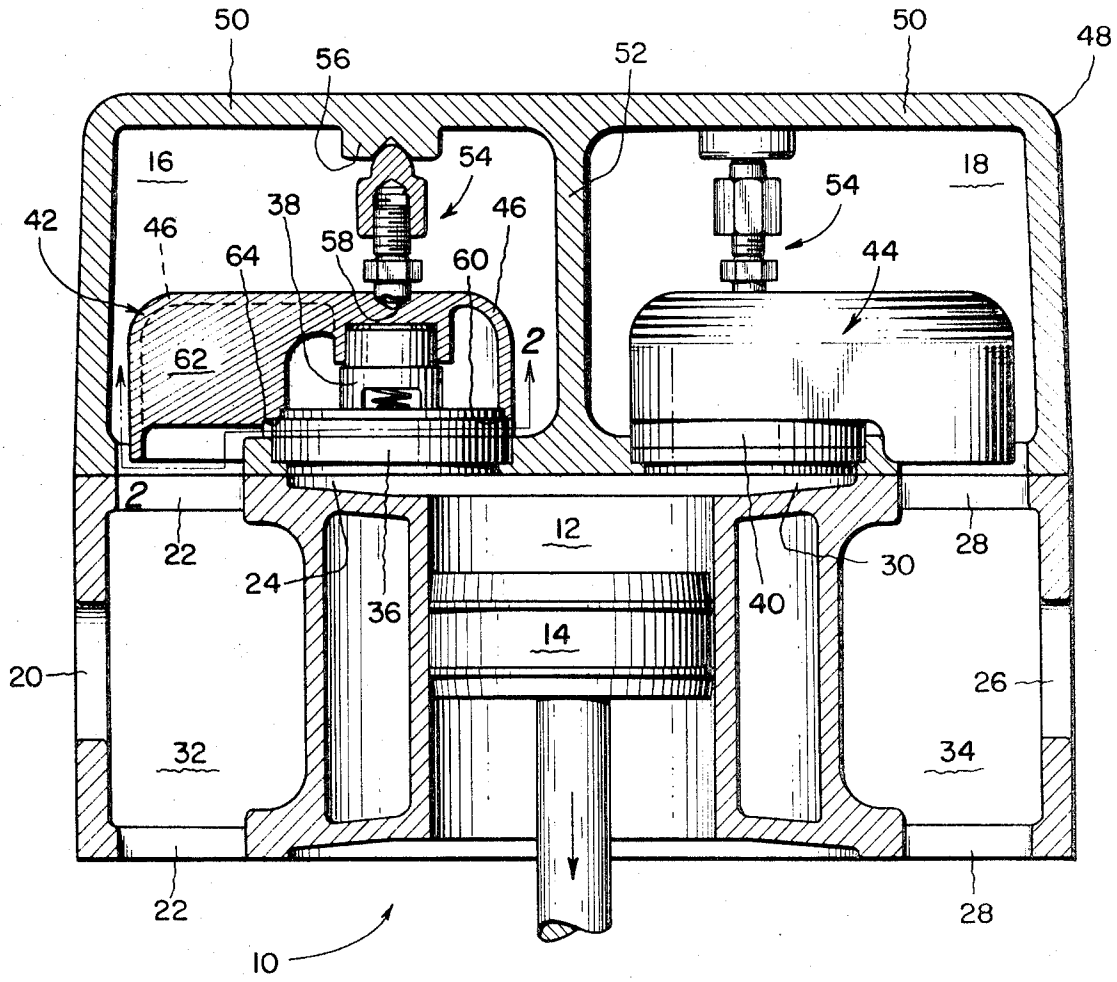


FIG. 1

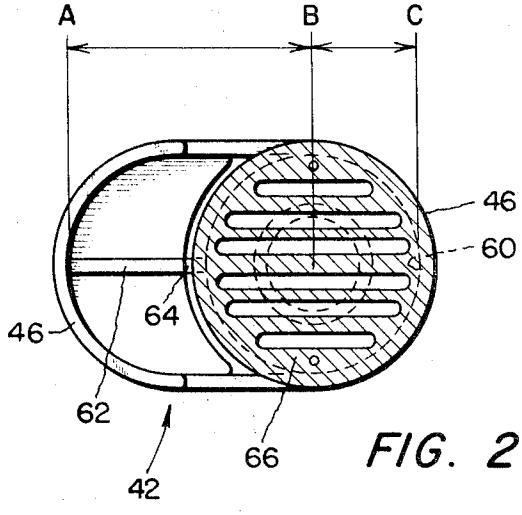


FIG. 2

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GAS COMPRESSOR

This invention pertains to gas compressors, and in particular to gas compressors having means designed to control gas flow turbulence therewithin, and inlet gas preheating.

In the prior art it is known to control gas flow turbulence by positively ducting inlet gas and discharging, compressed gas to and from the compression cylinder or chamber. However, such ducting is of limited cross-sectional dimension, being provisioned for unidirectionally conveying gas therethrough. In no way can it function as a plenum chamber in which to damp gas pulsations.

On the other hand, prior art compressors which employ pulsation-damping plenum chambers, between the inlet and outlet ports and the compression chamber, must sustain the inefficiency proceeding from gas flow turbulence occurring in these plenum chambers.

The plenum chamber-type of compressors, in order to delimit the gross dimensions of the apparatus, necessarily have the plenum chambers in apposition or juxtaposition. However, in this, the chambers are commonly in a heat exchange relationship, the outlet plenum chamber-radiating heat therefrom—via proximate or common walls—into the inlet plenum chamber. Then, to avoid inordinate preheating of the inlet gas, it has been necessary that the heat-radiating walls be cored for circulating coolant, or insulated, to inhibit the heat radiation. These heat-radiation control means are both complex and expensive to fabricate and maintain and, however effective, they nonetheless in no way mitigate the turbulence unavoidably proceeding from the plenum chambers. What is especially to be desired is a gas compressor which provisions plenum chambers for damping pulsations therewithin, with means mitigating the chambers-induced turbulence, and simple and inexpensive means for largely avoiding inlet gas preheating and the deleterious or inefficient effects thereof.

It is an object of this invention, therefore, to teach a gas compressor having juxtapositioned, pulsation-damping plenum chambers with means for mitigating the chambers-induced turbulence.

It is another object of this invention to teach a gas compressor having juxtapositioned, pulsation-damping plenum chambers with means for largely avoiding inlet gas preheating.

A feature of this invention comprises the use of troughs in the plenum chambers more positively, i.e., with negligible turbulence, to direct gas flow, and significantly to direct gas flow away from the chambers' heat radiating walls.

Further objects and features of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying figures, in which:

FIG. 1 is a vertical illustration of a portion of a gas compressor, in partial cross section, showing inlet and discharge troughs in association with inlet and discharge porting and valves, in accordance with the invention;

FIG. 2 is a bottom view of the inlet trough, and a portion of the inlet valve, taken along section 2–2 of FIG. 1.

As shown in FIG. 1 a gas compressor **10** comprises a piston chamber or a compression cylinder **12** in which is disposed a piston **14** for reciprocation therewithin to compress gas within said chamber. The compressor further comprises an inlet plenum chamber **16** and a discharge plenum chamber **18**. The plenum chambers are provisioned to accommodate for gas pulsations.

An external inlet port **20**, a first internal inlet port **22** and a second internal inlet port **24** provide for the conduction of gas from a source thereof to chamber **12**. An external discharge port **26** and first and second internal discharge ports **28** and **30**, respectively, provide for the conduct of compressed gas from chamber **12**. The gas is conducted to and from ports **20** and **26** by way of inlet and discharge cavities **32** and **34** respectively.

An inlet valve **36** is sealingly disposed in second internal inlet port **24** and has associated therewith an unloading device **38**. A port (not shown) communicates with device **38** to cause unloading of inlet valve **36** in a manner well-known and practiced in the prior art. A discharge valve **40** is sealingly disposed in second internal discharge port **30**.

Two troughs, inlet trough **42** and discharge trough **44**, are disposed, respectively, over valves **36** and **40** and in adjacency to ports **22** and **28**. The troughs are defined by enveloping walls **46**. The walls **46** are provided for more positively directing the gas through the plenum chambers **16** and **18** and into and out of the piston chamber **12**.

It is to be noted that the housing **48** in which all the priorly described components are formed or disposed comprises an external wall **50** and an internal wall **52**. Internal wall **52** partitions between plenum chambers **16** and **18**. Accordingly, the gas which is compressed by piston **14** in chamber **12** is admitted to discharge plenum chamber **18** and, because of the heat generated in the compression of the gas, wall **52** becomes heated and radiates the heat therefrom into inlet plenum chamber **16**. As a consequence of this, the inlet gas would be preheated, contributing to inefficiency of the compressor. For this reason, I have provisioned the troughs **42** and **44** to provide for the passage of the gas through plenum chambers **16** and **18** in a manner avoiding contact with walls **50** and **52**.

An adjustable strut **54** is arranged between a recessed boss **56** extending internally from wall **50** and a recess **58** formed in the outer surface of troughs **42** and **44**. An inner termination **60** of each of the troughs defines a semicircular lip and engages a half portion of each respective valve **36** or **40**. Also a web **62** is formed within and extends from the center of each of the troughs, and the web has a right-angular termination **64** for engaging said valves. Therefore, the terminations **60** and **64**, in cooperation with the adjustable strut **54**, serve both to position the troughs relative to the valves and to restrain the valves in position in ports **24** and **30**.

As shown in FIG. 2, the portion of each trough extending between points A and B is fully open, and comprises the troughway, and said portion is not in contacting engagement with any other members or components of the gas compressor. Within this portion or area only web **62** makes any contact engagement with a member, notably the valves **36** or **40**. Accordingly, gas can freely flow over and about the walls **46**, in this A to B portion, for purposes of pulsation. However, the major constituent of the inlet gas is less turbulently, i.e., more positively directed from port **22** to port **24**, and from port **30** to port **28**, in spaced relation from walls **50** and **52**. The portion of the troughs **42** and **44** extending between points B and C is the only portion closed about and fully in engagement with the valves, a portion **66** of valve **36** being shown therein.

In operation, gas is drawn sequentially through ports **20**, **22** and **24**, the last via valve **36**, when the piston is moved in the direction of the arrow shown in FIG. 1. The air is more positively confined by the trough **42**, thereby being conducted to chamber **12** with a minimum of turbulence, and shielded against preheating thereof by radiation from walls **50** and especially wall **52**. When piston **14** moves in the opposite direction, the gas is compressed in chamber **12**, admitted through valve **40** and port **30** into trough **44**, and out of ports **28** and **26**. Accordingly, it is a teaching of my invention to provide means disposed within gas-pulsation-accommodating plenum chambers for directing the gas more positively through limited portions of said chambers, with a minimum of turbulence and also to avoid preheating.

Prior to my invention, as I have noted, it was desirable to provision plenum chambers to accommodate for gas pulsations, but this required that unwanted gas turbulence therein had to be sustained. Again, it was known priorly positively to conduct gas through uniform-diameter conduits, but this required that provisions for gas pulsations be sacrificed. Heretofore it has been incumbent to choose whichever was considered to be the less disadvantaged approach for a given application. It was not known how to structure a gas compressor to benefit from the advantages of both while avoiding the disadvantages of each, until my present teaching. My teaching

provides these advantages of reducing turbulence, and more positively conducting flow, while accommodating for gas pulsations, and further, probably most significantly, avoids inlet gas preheating. Very early testing of my invention has already proved a 20 to 30° (Fahrenheit) difference in inlet gas preheating, a difference which offers savings in power input, minimizing of valve failures, and better cylinder lubrication.

While I have described my invention in connection with a specific embodiment thereof, it is to be clearly understood that this is done only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A gas compressor comprising:
chamber means for receiving gas therewithin;
means movable within said chamber means for compressing chamber-received gas;
inlet porting and discharge porting, respectively, for conducting inlet gas to, and for discharging compressed gas from said chamber means;
means, having a given volumetric area, arranged between said porting and said chamber means for channeling gas flow therebetween; and
means disposed in said channeling means for directing said gas flow only through a limited portion of said area; wherein
said chamber means comprises a gas compression chamber;
said compressing means comprises a partition in sealing engagement with walls of said compression chamber;
said channeling means comprises insular plenum chambers each of which has an aperture formed therein opening on said compression chamber;
each of said porting comprises a walled cavity having a first port formed in a wall thereof for conducting gas therethrough, and at least a second port formed in a wall thereof, and opening on one of said plenum chambers, facilitating flow communication between said cavity and said one plenum chamber; and wherein
said cavity has a third port formed in a wall thereof facilitating a flow communication between said cavity and still another plenum chamber.

2. A gas compressor, according to claim 1, wherein:
said channeling means comprises means for damping gas pulsations therewithin.

3. A gas compressor, according to claim 1, wherein:
at least one of said chambers channels said inlet gas therethrough;
at least another of said chambers channels said discharge gas therethrough; and
said chambers are juxtapositioned causing a heat exchange relationship to be established therebetween.

4. A gas compressor, according to claim 3, wherein:
said chambers commonly share a given wall member which radiates heat, a heat induced in said wall member by said discharge gas in said another chamber, into said one chamber.

5. A gas compressor, according to claim 1, wherein:
said directing means comprises troughways having either ends thereof disposed in adjacency to said porting and said chamber means, respectively.

6. A gas compressor, according to claim 5, wherein:
said troughways each have one end thereof in sealed through-going engagement with said chamber means, and the other end thereof disposed in proximately spaced relationship with said porting to facilitate a communication of said porting with said channeling means about said other end.

7. A gas compressor, according to claim 1, wherein:
said walls of at least one of said plenum chambers are contiguous, and thereby have a heat exchange relationship, with said walls of at least another of said plenum chambers.

8. A gas compressor, according to claim 1, wherein:
said directing means comprises troughlike components having throughways formed therein and extending along an axis, one end of each of said troughways being in sealed, flow-through engagement with said compression chamber, and the other end of each of said troughways being disposed in proximately spaced adjacency to one of said ports.

9. A gas compressor, according to claim 1, further including means disposed in said apertures for controlling gas flow therethrough.

10. A gas compressor, according to claim 8, further including:
means disposed in said one end for controlling gas flow therethrough.

11. A gas compressor, according to claim 10, wherein:
said controlling means comprises a valve; and
wherein each of said components have a web, extending along said axis, having a terminal surface thereof in contacting engagement with said valve securely to constrain

12. A gas compressor, comprising:
chamber means for receiving gas therewithin;
means movable within said gas chamber means for compressing chamber-received gas;
inlet porting and discharge porting, respectively, for conducting inlet gas to, and for discharging compressed gas from said chamber means;
means, having a given volumetric area, arranged between said porting and said chamber means for channeling gas flow therebetween; and
means disposed in said channeling means for directing said gas flow only through a limited portion of said area; wherein
said channeling means comprises a plurality of insular plenum chambers;
each of said plenum chambers has walls, defining the volume thereof, and openings in gas-flow communication with said chamber means and one of said inlet and discharge portings; and
said directing means comprises troughs, supported within said plenum chambers, having troughways for directing said gas flow therethrough in spaced relation from said walls; and further including
adjustable strut means, interposed between said walls and each of said troughs, for securing said troughs in said chambers.

13. A gas compressor, comprising:
chamber means for receiving gas therewithin;
means movable within said chamber means for compressing chamber-received gas;
inlet porting and discharge porting, respectively, for conducting inlet gas to, and for discharging compressed gas from said chamber means;
means, having a given volumetric area, arranged between said porting and said chamber means for channeling gas flow therebetween; and
means disposed in said channeling means for directing said gas flow only through a limited portion of said area; and wherein
said porting comprises means for conducting said gas to said chamber means in a first direction along an initial, given flow path, and from said chamber means in a second direction along another, given flow path, respectively;
said channeling means has means effective for terminating said given flow paths at a given distance from said chamber means, in being disposed to cause impingement thereupon, and flow redirection therefrom, of said gas; and
said directing means comprises means disposed between said porting and said terminating means effective for foreshortening said given distance.

14. A gas compressor, according to claim 13, wherein:
said terminating means comprises a wall disposed transverse to said flow paths; and

said foreshortening means comprises troughways extending along an axis which parallels said wall.

15. A gas compressor, comprising:

chamber means for receiving gas therewithin;

means movable within said chamber means for compressing chamber-received gas;

inlet porting and discharge porting, respectively, for conducting inlet gas to, and for discharging compressed gas from said chamber means;

means, having a given volumetric area, arranged between said porting and said chamber means for channeling gas flow therebetween; and

means disposed in said channeling means for directing said gas flow only through a limited portion of said area; and

wherein

said channeling means include means disposed for initially channeling gas thereinto in a first direction along given flow paths, and means effective for turbulently redirecting said gas from said paths; and

said directing means include means for turning said gas from said given flow paths and composing same into at least another predetermined flow path.

16. A gas compressor, according to claim 15, wherein:

said turning means include means for turning said gas from said another flow path and composing same into a further predetermined flow path.