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C. R. RINGHAM
ADJUSTMENT OF COMPRESSOR CYLINDER CLEARANCE
FOR WIDE RANGE OF CONDITIONS
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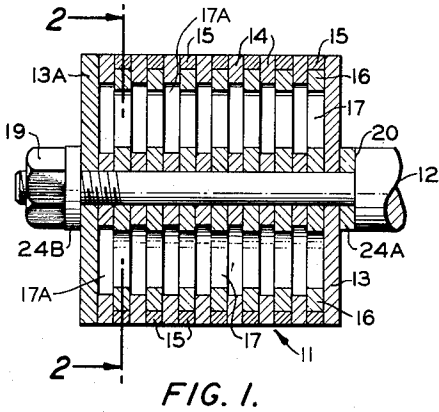


FIG. 1.

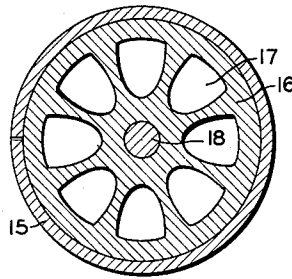


FIG. 2.



FIG. 3.

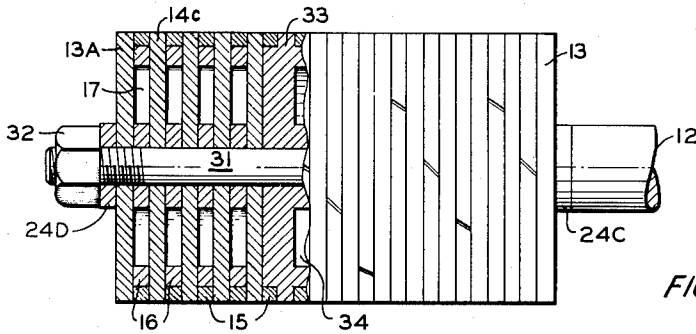


FIG. 4.

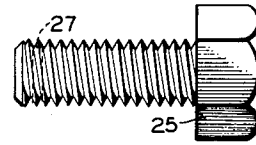


FIG. 5.

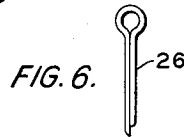


FIG. 6.

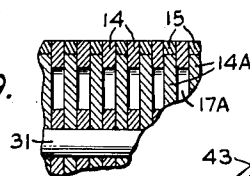


FIG. 9.

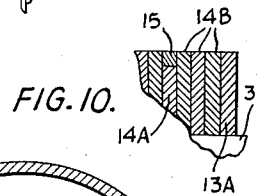


FIG. 10.

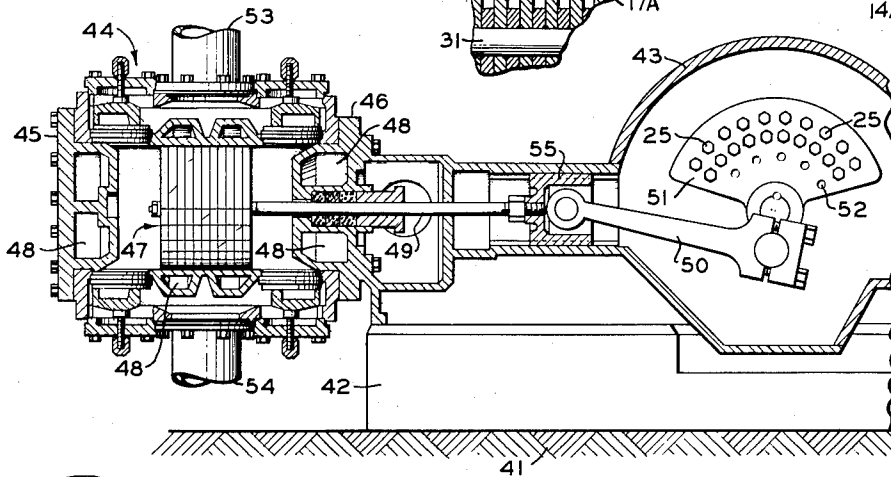


FIG. 7.

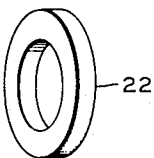


FIG. 8.

INVENTOR.
C. R. RINGHAM

BY *Hudson & Young*

ATTORNEYS

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ADJUSTMENT OF COMPRESSOR CYLINDER CLEARANCE FOR WIDE RANGE OF CONDITIONS

Clarence R. Ringham, Bartlesville, Okla., assignor to Phillips Petroleum Company, a corporation of Delaware

Application December 8, 1950, Serial No. 199,879

19 Claims. (Cl. 230—188)

This invention relates to reciprocating compressors. In one aspect, it relates to reciprocating compressor pistons which provide means for varying the clearance to most effectively load the engine driving the compressor.

The petroleum industry in general, and specifically the natural gas and gasoline industry, uses large numbers of reciprocating or piston type compressors. This industry uses these compressors for, among other things, compressing hydrocarbon gases prior to extraction of condensable or gasoline boiling range hydrocarbons.

Power units for operating reciprocating gas compressors are usually selected to operate at or very nearly at capacity for maximum operating efficiency and for savings in capital investment. And, further, these power units are selected to operate at capacity for compressing gas from an available intake pressure to a desired outlet pressure. For example, a compressor installation may be designed for compressing gas from a newly drilled field, from which a small amount of gas may be available for compression at a relatively low pressure. After the field is fully developed or the gas/oil ratio increases, the pressure of the gas frequently starts to increase. This increase in field pressure often causes an increase in pressure in the suction manifold of the compressor system. Such a pressure rise means that the compressor cylinders will receive an increased quantity of gas on each suction or intake stroke. Since the compressor is discharging against a constant pressure, the compression of this increased quantity of gas will increase the horsepower demand on the power unit which was originally operating at its full rated power output. This increased horsepower demand will therefore overload the power unit.

Another compressor installation may be designed for compressing gas from a newly drilled field which is in a flush period of production. During this initial period the gas pressure available in the suction manifold of the compressor installation is relatively high. However, it is known that this gas pressure will decline and that the field will subsequently produce at lower pressures and over a long period of time.

In either type of production compressor cylinders are usually selected so that the power units will be fully loaded when the compressors are operating at the expected lower inlet pressure. The compressor cylinders so selected will overload the power units during the higher pressure production period because of the higher inlet pressure. Thus, it is necessary to adjust the volumetric efficiency of the compressor cylinders so as to load fully but not overload the power unit during these high pressure production periods.

Several methods have heretofore been available for solving such an engine overload problem; first, installation of larger power engines; second, replacement of the compressor unit with one having a smaller cylinder; third, replacement of the original compressor cylinder and piston with a smaller cylinder and piston which procedure may sometimes be followed since many compressors are

adapted for such alterations; and, fourth, installations of external clearance pockets, a clearance pocket being defined as an attached gas receiving space in direct connection with the compressor cylinder such that there is an increase in residual gas volume at the end of the compression stroke. The first two of these methods involves considerable investment, while the third involves less, yet appreciable, expense. The last method requires the least expenditure, but its range of application is somewhat limited.

The installation of external clearance pockets on the side wall of a cylinder is possible only when connections or passageways were provided by the manufacturer in the original casting of the cylinder. Frequently a compressor cylinder head is fitted with suitable connections; and if not, they may be provided later in many instances if no water jacket is involved. However, the installation of external clearance pockets on the head end only is an undesirable means of adjusting the volumetric efficiency of a double-acting compressor cylinder. If it becomes necessary to reduce the volumetric efficiency of such a cylinder by the installation of external pockets on the head end, approximately twice as much clearance must be installed on the head end because ordinarily no connection is available on the rod or crank end of the cylinder for installation of clearance pockets. This procedure will reduce the total power demand or requirement of the compressor cylinder but power requirement on each stroke will not be equal. It is well recognized that such an unbalanced condition is harmful to bearing as well as other parts of the machine.

The third method mentioned above for solving such an engine overload problem, that is, changing to a smaller cylinder, may involve changing cylinders on compressors having 17-inch diameter cylinders and pistons to 16, 15, or even 14-inch cylinders and pistons. Thus, a supply of such cylinders and pistons would need be kept available. Stock of this type runs into expense.

I have found that clearance in compressor cylinders may be provided for by construction of the compressor pistons in such a manner that one or more plates may be added to or removed from one or from both ends of a piston.

One object of my invention is to provide a piston with means for varying the volumetric efficiency of gas compressors.

Another object of my invention is to provide apparatus and methods for adjusting the volumetric efficiency of gas compressors to keep the compression load within the rated horsepower of the power cylinders driving such compressors.

Still another object of my invention is to provide a method for decreasing the volumetric efficiency of reciprocating gas compressors when compressor suction pressure has become increased, in order to maintain the compressor load within the rated horsepower output of the prime mover driving such compressor.

Yet another object of my invention is to provide a method for adding clearance volume for reducing the volumetric efficiency of a reciprocating gas compressor wherein provision for added clearance volume in no way adversely affects structure or rigidity of the compressor cylinders.

Many other objects and advantages of my invention will be apparent to those skilled in the art upon reading the following disclosure and attached drawing which respectively describes and illustrates preferred embodiments of my invention.

In the drawing Figure 1 is a longitudinal view, partly in section, of a reciprocating compressor piston embodying the concept of my invention.

Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a perspective of one portion of my apparatus.

Figure 4 is a longitudinal view, partly in section, of a second embodiment of my invention.

Figure 5 is a side view of one portion of the apparatus of my invention.

Figure 6 is a side view of another portion of my apparatus.

Figure 7 is an elevational view, partly in section, of a compressor assembly embodying the apparatus of my invention.

Figure 8 is a perspective of a component part of Figure 1 and Figure 4.

Figure 9 is a longitudinal view, partly in section, of another embodiment of my invention.

Figure 10 is a longitudinal view, partly in section, of still another embodiment of my invention.

Referring now to the drawing, and specifically to Figure 1, numeral 11 identifies a piston of my invention built up of plates and conventional piston rings. Reference numeral 12 identifies a more or less conventional piston rod such as is used in reciprocating compressors. A collar or ring 24A is provided against a shoulder 20 on the piston rod 12. Positioned next to this ring or collar 24A is a head plate 13. This head plate 13 is a nonperforate plate, excepting for the opening in its center provided for installation upon the piston rod 12. Positioned next to the head or end plate 13 is a plate 16, the diameter of which is somewhat smaller than the diameter of the end plate 13. Positioned circumferentially around this small diameter plate 16 is a piston ring 15. Next to this small diameter plate 16 is a spacer plate 14, the diameter of which is the same as that of the end plate 13. In like manner, the small diameter or ring plates 16 and spacer plates 14 are arranged alternatively from one end of this piston assembly to the other end. On the other end of this assembly is an end or head plate 13A similar in all details to the end plate 13. Between this end plate 13A and a nut 19 is a collar or ring 24B. This ring or collar 24B is similar to the ring or collar 24A. In the construction of this plate piston assembly, it is more or less immaterial which type of plate is positioned adjacent the end plates 13 and 13A. Thus, a ring plate 16 having a piston ring therearound may be positioned adjacent the end plate 13. In Figure 1, I have shown a ring plate 16 and ring 15 adjacent the end plate 13 and a spacer plate 14 adjacent the end plate 13A.

The end plates 13 and 13A, as illustrated in Figure 1, are simple circular plates and are provided with centrally disposed openings for insertion of the small diameter end of the piston rod 12.

When the pressure of the gas being compressed is increased or, in other words, when the suction pressure increases and more gas is drawn into either end of the cylinder to be compressed, this condition tends to overload the power unit driving the compressor. When this overload condition presents itself, it is merely necessary to stop the compressor, remove the head of the compressor cylinder, remove nut 19 and ring 24B, remove head plate 13A and remove one or more of the spacer plates, and/or ring plates and rings. If, for example, one spacer plate and one ring plate and ring are removed from the piston assembly, then the effective length of the piston is shortened by the amount equivalent to the thickness of these two removed plates. In order to center the remaining piston on the piston rod it is necessary to place a second collar or ring similar to ring 24A which has a thickness equal to one of the removed plates in a position on the piston rod between plate 13 and the ring 24A shown in Figure 1, and a second ring similar to ring 24B on the opposite end between plate 13A and nut 19. Nut 19 is then tightened. By this operation either end of the piston at the respective ends of its stroke will provide a clear-

ance between the end of the piston and the end of the cylinder and if the overloading has not been too severe this small adjustment in the piston may compensate for the overload conditions.

In case the overloading is greater than would be compensated for by removing only two of the plates it may be necessary to remove more than two of these plates, under which conditions more than two spacer plates and/or ring plates and rings may be removed. Under such conditions, longer or more collars or rings similar to rings 24A and 24B must be positioned on the piston rod so that when nut 19 is positioned and tightened the remaining piston assembly will be a rigid and centered assembly.

For fine adjustments of clearance it may be advisable under some conditions to remove only one spacer plate or one ring plate and ring. Under this condition, the rings 24A and 24B should each be one-half the thickness of the plate removed, as ring 22, illustrated in Figure 8, so as to center the remaining piston assembly. In Figure 1, the spacer plates and ring plates are illustrated as having a common thickness, that is, they are all of the same thickness. This limitation is not necessary since it may be desirable to provide some of the spacer plates 14 having either greater thickness than the remaining spacer and ring plates, or one or more may have a smaller thickness than the remaining spacer and ring plates. Any number of rings 23, 24A and 24B as needed may be used, the number depending, of course, upon the number of ring and spacer plates withdrawn from the body of the piston to increase clearance.

Figure 2 shows a cross sectional view of the piston assembly taken on the line 2—2 of Figure 1. This figure shows a cross section of a small diameter ring plate 16 surrounded by a ring 15. Ring plates 16 are shown with perforations 17. An opening which is in the center of these plates is for insertion of the small diameter end 18 of the piston rod 12 for assembly of the piston. The openings or perforations 17 are intended to cut away approximately one-half of the weight of a ring plate 16.

This particular provision of openings 17 is for the purpose of maintaining the piston assembly 11 at a constant weight regardless of the number of plates remaining in the piston assembly. One of the points which should be considered in such an assembly is the weight of the piston. To compensate for the weight of a rapidly moving piston a counterbalance on the crank shaft is ordinarily provided. In the case of such a piston as I have herein illustrated, if the weight of the piston is decreased then the weight of the counterbalance on the crank shaft is correspondingly too great and provision should be made for removing some of this counterbalance weight. Figure 5 illustrates a threaded bolt adapted to be inserted into threaded openings 52 in counterbalance 51 of the compressor assembly illustrated in Figure 7. When the piston 11 is of its maximum weight all or nearly all of the openings 52 should be provided with bolts 25 as shown in Figure 5. A cotter key 26 illustrated in Figure 6 is provided for insertion through hole 27 in the end of bolts 25 for making certain that the bolts cannot become removed during operation. Thus, when one or more of the plates of the piston assembly are removed then a corresponding number of counterbalance bolts 25 should be removed from the openings 52 to compensate for this decrease in piston weight. Likewise, if more plates are inserted into the piston 11 then some additional bolts 25 should be inserted into the openings 52 to compensate for the increased piston weight.

I have provided, as a preferred embodiment of a piston, a self-compensating piston, the use of which requires none of these counterbalance bolts 25 as just described or a fixed number. This self-compensating piston consists of the perforated plates 14 and 16 as illustrated in Figure 1. In order to keep the piston the same weight after having removed one or more plates as before the removal of the plates, some plugs 21 may be inserted into the perfora-

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tions 17, illustrated in Figure 3. If a plate 16 is perforated in such a manner that the area of the perforations 17 is equal to the remaining metallic area of one side of the plate, then when plugs 21 which have the same thickness as that of the plate 16 are inserted into the openings 17 such a plate will have double its original weight. One plate can be removed when one remaining similar plate is plugged with plugs 21. If a spacer plate 14 is removed, plugs similar to plugs 21 are inserted in one remaining space plate to keep the piston weight constant.

Since the diameters of the spacer plates are a little larger than the diameters of the ring plates, the perforations 17A in the spacer plates are correspondingly larger than the perforations 17 in the ring plates and also the size or area of the plugs 21 for insertion into the openings 17A in the spacer plates are also correspondingly larger than the plugs for insertion in the openings 17 of the ring plates. Thus, when one or two ring plates or one or two spacer plates are removed plugs are then inserted into the openings of one or two of the corresponding plates remaining. Since the plugs 21 for the spacer plates are larger than the openings in the ring plates, the spacer plate plugs are held firmly in place by adjacent ring plates. If plugs 21 are inserted in the openings 17 of a ring plate, the spacer plates adjacent either side of the plugged ring plate must also be plugged to hold the ring plate plugs in place since they are smaller than the openings 17A in the adjacent spacer plates. In Figure 4, the piston assembly is illustrated with only the ring plates 16 perforated for accommodation of counterbalance plugs 21. The spacer plates only may be perforated with openings 17A in place of only the ring plates as shown in Figure 4. Ring plates 14A of Figure 9 are solid except for a central piston rod opening. In Figure 10, all plates, i. e. end plates 13A, ring plate 14A and spacer plates 14B are solid except for a centered opening for a piston rod. In this manner rigid holding of plugs 21 in place is effected merely by positioning a plugged plate between two non-perforated plates.

In the piston embodiment illustrated in Figure 4, the piston structure is somewhat different from that illustrated in the embodiment of Figure 1. The operation of the piston of Figure 4 is the same, however, as the operation of the piston illustrated in Figure 1.

The piston of Figure 4 is composed of a piston element 33 which is provided with some rings 15 similar to those of Figure 1. At either end of this piston element 33 is an assembly of ring plates with rings and spacer plates similar to those which make up the piston of Figure 1. When it is desired to increase the clearance volume in either end of the cylinder, it is merely necessary to remove the cylinder head, remove nut 32, ring 24D and one or more spacer plates 14C and/or ring plates 16 and rings 15 from either end of this piston assembly. Upon re-assembly of the piston elements, rings 24C and 24D are provided in a manner similar to that described above in relation to Figure 1. These rings are placed on either end of the piston in order that the piston of smaller length may be centered with respect to the cylinder.

One advantage in using the built-up piston assembly of Figure 1 is that the piston rings 15 do not need to be expanded in order to assemble them into the groove in which they normally operate. The rings 15 on the piston body 33 of Figure 4 need to be expanded for installation into their corresponding grooves while the rings surrounding the ring plates do not need to be expanded during installation.

Figure 7 illustrates a compressor assembly embodying the piston assembly of my invention. In this figure, reference numeral 47 identifies the double-acting piston assembly. Water cooling jackets for cooling the compressor cylinder are identified by reference numeral 48. Head 45 is bolted to the head end of the sidewall

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assembly 44 while the head 46 is bolted to the crank end of the cylinder. Gases for compression enter the cylinder through suction line 53 and compressed gases are discharged through discharge line 54. On the crank end the compressor is provided with the cross head 55, and the crank 50 which is enclosed within the case 43. The cross head is, in turn, attached to one end of the piston rod 49 while the other end of the piston rod carries the piston assembly 47. Supporting this entire structure is the compressor frame 42 which, in turn, is supported by the base 41. All portions of this assembly shown in Figure 7 are conventional compressor parts except the piston assembly 47.

I claim:

1. A variable clearance piston for use with reciprocating gas compressors, said piston having a cylindrical body assembly, a head plate attached to one end of said body assembly, said cylindrical body assembly comprising a plurality of body plates of diameter equal to that of said head plate, a separate plate of smaller diameter than that of said plurality of plates separating each plate of said plurality of plates from the next adjacent plate of said plurality of plates, a piston ring surrounding circumferentially each plate of said smaller diameter and a centered opening in said plates for insertion of a piston rod.

2. A variable clearance piston for use in conjunction with reciprocating gas compressors comprising a plurality of plates having a common diameter, a separate plate of smaller diameter than that of said plurality of plates separating each plate of said plurality of plates from the next adjacent plate of said plurality of plates, a piston ring surrounding circumferentially each plate of smaller diameter, one plate of said plurality of plates forming one end of said piston and another plate of said plurality of plates forming the other end, and a central opening in said plates for insertion of a piston rod.

3. A variable clearance piston for use with reciprocating gas compressors, said piston having a head plate, a cylindrical body assembly separable from said head plate, said cylindrical body assembly comprising a plurality of circular plates of diameters equal to that of said head plate, a separate plate of smaller diameter than that of said plurality of plates separating each plate of said plurality of plates from the next adjacent plate of said plurality of plates, a piston ring surrounding circumferentially each plate of said smaller diameter, each of said circular plates of diameter equal to that of said head plate being perforated and each perforation being adapted to receive a weighting plug, and a centered opening in said plates and in said head plate for insertion of a piston rod.

4. A variable clearance piston for use with reciprocating gas compressors, said piston having a pair of imperforate head plates, a separable cylindrical body member assembly comprising a plurality of perforate body plates of diameter equal to that of said imperforate head plates and disposed therebetween, a separate perforate body plate of smaller diameter than that of said plurality of perforate body plates separating each plate of said plurality of perforate body plates from the next adjacent plate of said plurality of perforate body plates, a piston ring having the same outer diameter as that of each plate of said pair of plates surrounding circumferentially each plate of smaller diameter and a centered opening in said plates for insertion of a piston rod, said perforations in said plates being for reducing the weight of the piston.

5. A variable clearance constant weight piston for use with reciprocating gas compressors comprising a pair of imperforate head plates, a plurality of circular plates having the same diameter as that of said head plates and disposed therebetween, a pair of successive circular plates separated by a circular plate of smaller diameter than that of said pair of plates, a piston ring circum-

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ferentially surrounding said plate of smaller diameter, each of said circular plates being perforated, each of the perforations being adapted to receive a plug member, each plugged plate being heavier than a plate in which the perforations are unplugged, and a centered opening in said plates for insertion of a piston rod.

6. A double-acting variable clearance constant weight piston for use with reciprocating gas compressors comprising, in combination, a plurality of circular plates of uniform diameter, a pair of successive plates of said plurality of plates separated by a circular plate of diameter smaller than the diameter of the first mentioned plates, a piston ring circumferentially surrounding said plate of smaller diameter, a non-perforate head plate at either end of the above described assembly of circular plates, a centered opening in each of the aforesaid plates for assembling on a piston rod, each of said circular plates being perforated, each perforation being adapted to receive a plug and a completely plugged circular plate possessing double the weight of an unplugged plate so that the piston providing increased clearance will possess the same weight as the piston providing less clearance.

7. A variable clearance constant weight piston for use with reciprocating gas compressors comprising, in combination, a plurality of circular plates of uniform diameter, a pair of successive plates of said plurality of plates separated by a circular plate of diameter smaller than the diameter of the first mentioned plates, a piston ring circumferentially surrounding said plate of smaller diameter, a non-perforate head plate at the head end of the piston assembly, a centered opening in each of the aforesaid plates for assembly on a piston rod, each of said circular plates being perforated, each perforation being adapted to receive a plug and a completely plugged circular plate possessing double the weight of an unplugged plate so that the piston providing increased clearance will possess the same weight as the piston providing less clearance.

8. A variable clearance piston for use with reciprocating gas compressors, said piston having a head plate, a cylindrical body assembly separable from said head plate, said cylindrical body assembly comprising a plurality of circular plates of diameters equal to that of said head plate, a separate plate of smaller diameter than that of said plurality of plates separating each plate of said plurality of plates from the next adjacent plate of said plurality of plates, a piston ring surrounding circumferentially each plate of said smaller diameter, each plate of said smaller diameter being perforated and each perforation being adapted to receive a weighting plug, and a centered opening in said plates and said head for insertion of a piston rod.

9. An adjustable clearance piston assembly for use in reciprocating gas compressors comprising, in combination, a cylindrical piston body, a plurality of circular plates of diameters equal to that of said piston body adjacent either end of said piston body, a circular plate of diameter smaller than the diameters of the aforesaid plates disposed between a pair of first mentioned plates at either end of said body, a piston ring disposed circumferentially around each of said smaller diameter plates, each of said circular plates being perforated and said perforations being adapted to receive weighting plugs, a plugged plate being double the weight of an unplugged plate, a non-perforate head plate at each end of said assembly and a centered opening in each plate and in said piston body for insertion of a piston rod.

10. A gas compressor comprising, in combination, a cylinder having a removable closed end, valve openings in said cylinder near said closed end, valves removably mounted in said valve openings, an axially movable variable clearance piston fitting said cylinder, means to move said piston, said variable clearance piston comprising a piston head plate movable to a point adjacent said closed end of said cylinder to compress gas between said piston

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head plate and said closed end, a cylindrical piston body assembly separable from said head plate, said cylindrical body assembly including a plurality of circular plate of diameter equal to that of said head plate, a successive pair of said circular plates separated by a circular plate of diameter smaller than the diameter of a plate of said pair of plates, a piston ring surrounding circumferentially said plate of said smaller diameter, and a centered opening in said plates and in said head plate for insertion of said piston rod.

11. In the compressor assembly of claim 10 wherein the valve openings are disposed in said removable closed end.

12. A reciprocating gas compressor having, in combination, a cylinder having both ends closed by removable closures, a variable clearance double-acting piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end extending through one cylinder end to a source of motive power, valve openings in the cylinder adjacent said closed ends, valves in said openings for inlet and outlet of gas, said variable clearance piston assembly comprising a pair of piston head plates movable with said piston assembly to points adjacent said closed ends of said cylinder to compress gas between said head plates and their respective closed cylinder ends, a plurality of circular plates having a common diameter disposed intermediate said piston head plates, a successive pair of said circular plates separated by a circular plate of diameter smaller than the diameter of a plate of said pair of plates, a piston ring having the same outer diameter as that of the first mentioned circular plates surrounding circumferentially said plate of smaller diameter, and a centered opening in said plates for insertion of said piston rod.

13. A gas compressor comprising, in combination, a cylinder having both ends closed and removable closures, a variable clearance double-acting piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end extending through one cylinder end to a source of motive power, valve openings in the cylinder adjacent said closed ends, valves in said openings for inlet and outlet of gas, said variable clearance piston assembly comprising, in combination, a plurality of circular plates of uniform diameter, a pair of successive plates of said plurality of plates separated by a circular plate of diameter smaller than the diameter of the first mentioned plates, a piston ring circumferentially surrounding said plate of smaller diameter, a non-perforate head plate at either end of the above described assembly of circular plates, a centered opening in each of the aforesaid plates for assembling on said piston rod, each of said circular plates being perforated, each perforation being adapted to receive a plug and a completely plugged circular plate possessing double the weight of an unplugged plate so that the piston providing increased clearance will possess the same weight as the piston providing less clearance.

14. A gas compressor comprising, in combination, a cylinder having a removable closed end, valve openings in said cylinder near said closed end, valves removably mounted in said valve openings, an axially movable variable clearance piston fitting said cylinder, a piston rod attached at one end to said piston and the other end extending to a source of motive power, said variable clearance piston comprising, in combination, a plurality of circular plates of uniform diameter, a pair of successive plates of said plurality of plates separated by a circular plate of diameter smaller than the diameter of the first mentioned plates, a piston ring circumferentially surrounding said plate of smaller diameter, a non-perforate head plate at either end of the above described assembly of circular plates, a centered opening in each of the aforesaid plates for assembly on said piston rod, each of said circular plates being perforated, each perforation being

adapted to receive a plug and a completely plugged circular plate possessing double the weight of an unplugged plate so that the piston providing increased clearance will possess the same weight as the piston providing less clearance.

15. A reciprocating gas compressor having in combination a cylinder, and one end closed with a removable closure, a piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end attached to a source of motive power, valve openings in said cylinder adjacent said closed end, valves in said openings for inlet and outlet of gas, said adjustable clearance piston assembly comprising, in combination, a cylindrical piston body member provided with a piston ring, a plurality of circular plates of diameter equal to that of said piston body member adjacent one end of said piston body member, a circular plate of diameter smaller than the diameter of the aforesaid plates disposed between a pair of the first mentioned plates, a piston ring disposed circumferentially around said smaller diameter plate, each of said circular plates of smaller diameter being perforated and said perforations being adapted to receive weighting plugs, a plugged plate being double the weight of a plate not plugged, and a centered opening in each plate and in said piston body for insertion of a piston rod.

16. A reciprocating gas compressor comprising, in combination, a cylinder having both ends closed by removable closures, a double-acting adjustable clearance piston movable axially within said cylinder, a piston rod attached at one end to said piston and the other end extending through one cylinder end to a source of motive power, valve openings in said cylinder adjacent said closed ends, valves in said openings for inlet and outlet of gas, said adjustable clearance piston including a cylindrical piston body provided with a piston ring, a plurality of circular plates of diameter equal to that of said piston body adjacent the ends of said piston body, a circular plate of diameter smaller than the diameter of the aforesaid plates disposed between a pair of the first mentioned plates at either end of said piston body, a piston ring disposed circumferentially around each of said smaller diameter plates, the circular plates at the ends of said piston serving as piston heads, and a centered opening in each plate and in said piston body for insertion of said piston rod.

17. A reciprocating gas compressor having, in combination, a cylinder having both ends closed with removable closures, a double-acting adjustable clearance piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end extending through one cylinder end to a source of motive power, valve openings in said cylinder adjacent said closed ends, removable valves in said openings for inlet and outlet of gas, said piston assembly having a cylindrical piston body member provided with a piston ring, a plurality of circular plates of diameter equal to that of said piston body adjacent either end of said piston body, a circular plate of smaller diameter than the diameter of the aforesaid plates disposed between a pair of the first mentioned plates at either end of said piston body, a piston ring disposed circumferentially around each of said smaller diameter plates, each of said circular plates of smaller diameter being perforated and said perforations being adapted to receive weighting plugs, a plugged plate being double the weight of a similar plate

not plugged, and a centered opening in each plate and in said piston body for insertion of said piston rod.

18. A reciprocating gas compressor having, in combination, a cylinder having both ends closed with removable closures, a double-acting adjustable clearance piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end extending through one cylinder end to a source of motive power, valve openings in said cylinder adjacent said closed ends, removable valves in said openings for inlet and outlet of gas, said piston assembly having a cylindrical piston body member provided with a piston ring, a plurality of circular plates of diameter equal to that of said piston body adjacent either end of said piston body, a circular plate of smaller diameter than the diameter of the aforesaid plates disposed between a pair of the first mentioned plates at their ends of said piston body, a piston ring disposed circumferentially around each of said circular plates of diameter equal to that of said piston body being perforated and said perforations being adapted to receive weighting plugs, a plugged plate being double the weight of a similar plate not plugged, and a centered opening in each plate and in said piston body for insertion of said piston rod.

19. A reciprocating gas compressor having, in combination, a cylinder, and one end closed with a removable closure, a piston assembly movable axially within said cylinder, a piston rod attached at one end to said piston assembly and the other end attached to a source of motive power, valve openings in said cylinder adjacent said closed end, valves in said openings for inlet and outlet of gas, said adjustable clearance piston assembly comprising, in combination, a cylindrical piston body member provided with a piston ring, a plurality of circular plates of diameter equal to that of said piston body member adjacent one end of said piston body member, a circular plate of diameter smaller than the diameter of the aforesaid plates disposed between a pair of the first mentioned plates, a piston ring disposed circumferentially around said smaller diameter plate, each of said circular plates of diameter equal to that of said piston body member being perforated and said perforations being adapted to receive weighting plugs, a plugged plate being double the weight of a plate not plugged, and a centered opening in each plate and in said piston body for insertion of a piston rod.

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