Oct. 10, 1933. E. WILSON 1,929,996

COMPRESSOR

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Fig. 1.

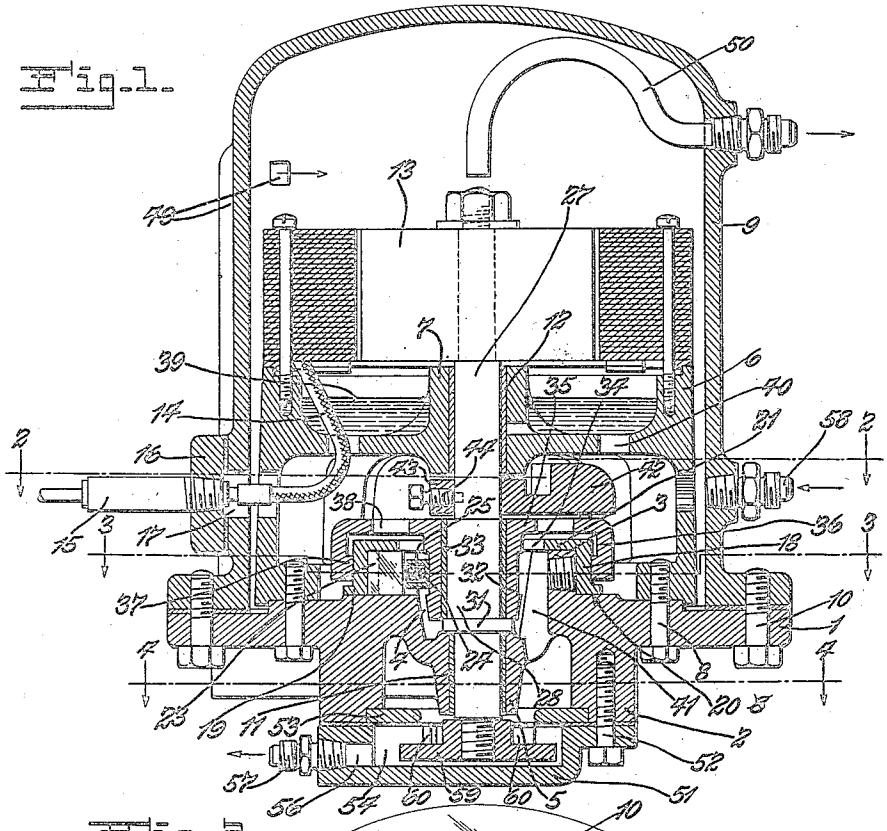
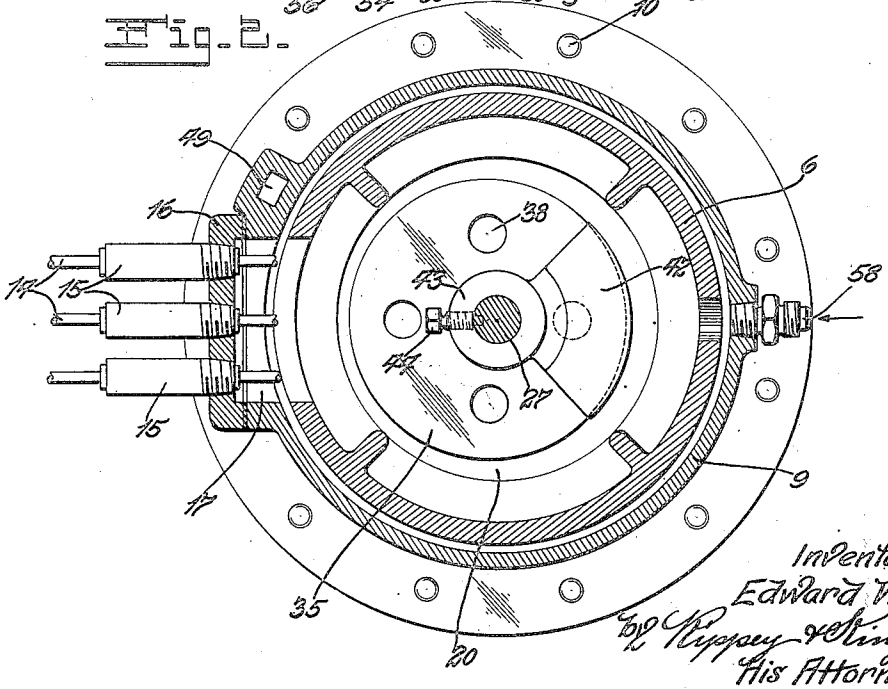


Fig. 2.



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COMPRESSOR

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Fig. 3.

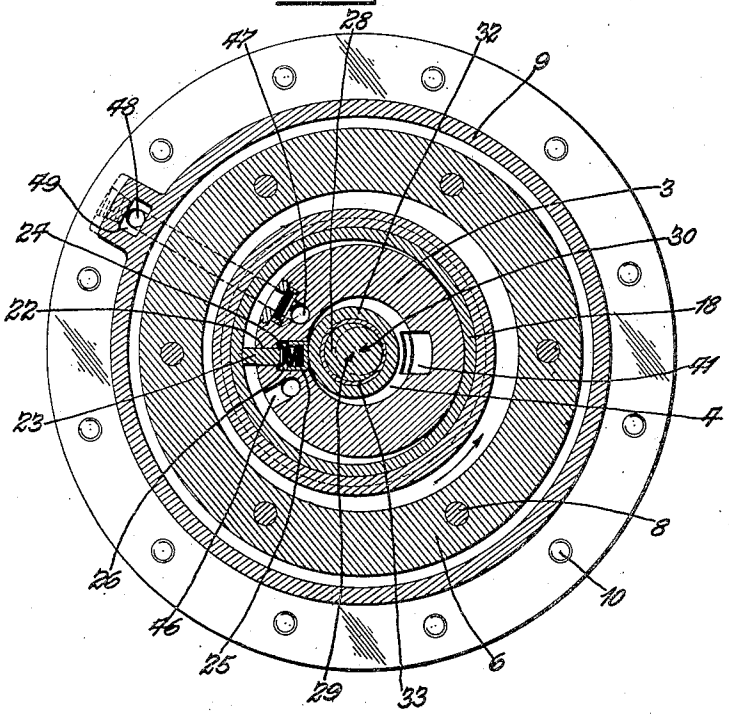
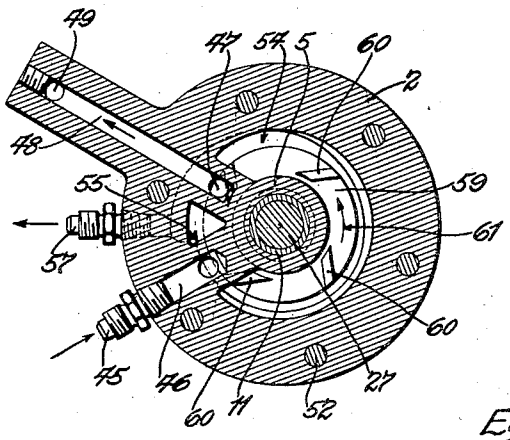


Fig. 4.



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COMPRESSOR

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Fig. 5.

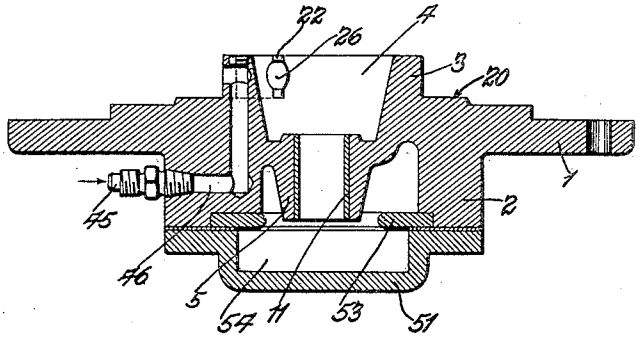


Fig. 6.

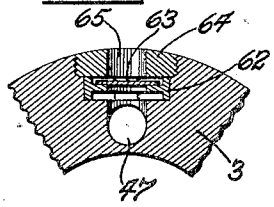


Fig. 7.

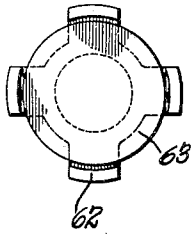
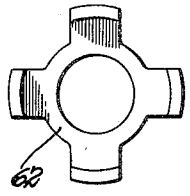


Fig. 8.



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Patented Oct. 10, 1933 1,929,996

UNITED STATES PATENT OFFICE

1,929,996

COMPRESSOR

Edward Wilson, St. Louis, Mo., assignor to Rippey & Kingsland, a firm, St. Louis, Mo.

Application July 2, 1928. Serial No. 289,758

24 Claims. (Cl. 230—145)

This invention relates to compressors, and is designed specially for use in the compression of refrigerant gas, although it is capable of useful application to other purposes.

An object of the invention is to provide a machine for use as a compressor or pump and comprising a rotary shaft equipped with means for operating a cylinder about a stationary head in order to effect compression of the air or gas entering the cylinder.

Another object of the invention is to provide a machine for use as a compressor or pump and comprising a stationary head enclosed by a cylinder, and mechanism for operating the cylinder eccentrically about the head in order to compress the air or gas within the cylinder, although it is not essential that the cylinder be positively rotated to obtain these results.

Other objects will appear from the following description, reference being made to the drawings in which

Fig. 1 is a vertical sectional view of one embodiment of my improved machine.

Fig. 2 is a cross sectional view approximately on the line 2—2 of Fig. 1.

Fig. 3 is a cross sectional view of the machine approximately on the line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view approximately on the line 4—4 of Fig. 1, the baffle plate above the pump chamber being omitted.

Fig. 5 is a cross sectional view of the stationary machine element about which the cylinder operates.

Fig. 6 is a sectional view showing a type of valve capable of use to control the discharge of air or gas from the compressor or pump.

Fig. 7 is a plan view of the valve and the cage in which it is mounted.

Fig. 8 is a plan view of the cage without the valve.

The machine shown comprises a base 1 having an annular depending portion 2 and an upwardly extended portion 3 having a downwardly tapered recess 4 below which a bearing 5 is formed integral with the base 1 within and spaced from the part 2.

A frame comprising a vertical portion 6 which is preferably circular in cross section and a bearing 7 integrally united with the vertical portion 6 is attached to the base 1 by bolts 8, and is enclosed within a housing 9 fastened to the base 1 by bolts 10. The bearing 7 is in vertical axial alinement with the bearing 5. The bearing 5 is lined by a bushing 11 and the bearing 7 by a bushing 12.

An electric motor 13 is attached to the support 6 within the housing 9, the wires 14 for said motor entering the housing through fittings 15 supported by a removable plate 16 forming a closure for an opening 17 into the housing.

A cylinder 18 is mounted around the head 3 and is operative to compress the air or gas entering the space between the cylinder and the head. The internal diameter of the cylinder is greater than the diameter of the head 3. The lower end 19 of the cylinder 18 operates in close contact with a smooth wall 20 formed on the base 1 and extending radially from the head 3. The upper end of the cylinder 18 has an end wall 21 extending radially toward its axis and operating in close contact with the upper end of the head 3.

One side of the head 3 is formed with a radial slot 22 (Fig. 3) extending the fall length of the head from the wall 20 to the wall 21. A blade or plate 23 is mounted for radial sliding movements in said slot, being pressed and actuated outwardly by a spring 24 having its outer end bearing against the inner edge of said blade or plate and its inner end enclosed in a cup-retainer 25 mounted for radial sliding movements in a recess 26 which is in enlargement of the inner portion of the slot 22.

A shaft 27 is connected with the motor 13 for rotation thereby and is journaled for rotation in the bushings 11 and 12. This shaft 27 has an eccentric portion 28 which is concentric with the axis indicated by the point 29 (Fig. 3), while the shaft proper is concentric with the point 30. This eccentric portion 28 of said shaft bears upon a thrust collar 31 supported on the bearing 5, thus supporting the shaft 27 for rotation in its bearings, although said shaft may be otherwise or additionally supported, if desired. A hub 32 having a bushing 33 within it is mounted on the eccentric 28. These parts should be fitted and assembled in such a manner as to permit the shaft 27 and its eccentric 28 to rotate without rotating the hub 32. The eccentric 28 is within the recess 4 and the hub 32 extends downwardly through a central opening 34 in the wall 21. This opening 34 is of sufficient size to permit all the necessary movements of the cylinder 18 without making contact of the inner edge of the wall 21 with any part of the hub 32. And the wall 21 is of sufficient radial width to close the upper end of the space between the cylinder 18 and the head 3 at all times and in all positions of the cylinder 18. The hole 34 is also of sufficient size to permit free circulation of oil therethrough.

The hub 32 extends above the plane of the wall

22 and is formed integral or rigid with a radial wall 35 of greater diameter than the diameter of the cylinder 18 and having a cylindrical portion 36 extending downwardly from its periphery around said cylinder 18. The lower end of the cylinder 36 has an internal flange 37 and the edge of said flange has close contact with the periphery of said cylinder 18 throughout the external circumference of the cylinder and the internal periphery of the flange 37; but the cylinder 36 does not rotate with it the cylinder 18 nor prevent vertical self-adjustment of said cylinder 18. A number of holes 38 through the wall 35 permit free circulation of oil therethrough to fill the spaces between the parts, except the space within the cylinder 18 and around the head 3. The parts are thus cooled and lubricated.

The inner end of the spring-retainer cup 25 abuts against the hub 32 and thereby causes the spring 24 to press the blade or plate 23 outwardly in a radial direction so that the outer edge of said blade or plate is at all times in contact with the inside of the cylinder 18 throughout the entire length of said cylinder and the head 3.

By reference to Fig. 3 it will be observed that when the machine is in operation the radial distance from the inner end of the spring-retainer cup 25 to the outer edge of the plate or blade 23 remains approximately constant because the radii from the hub 32 to the inner periphery of the cylinder 18 remain constant. That is, the point 29 is the axis of the hub 32 and is also the axis of the cylinder 18 which is eccentric with respect to the head 3. So, the spring 24 is under an unvarying compression and is not materially varied by expansion and contraction.

When the machine is ready for use it is filled with oil to about the line 39 Fig. 1, the oil having free circulation through holes 40 in that part of the frame 6 which supports the bearing 7, through the holes 38 in the wall 35, through the hole 34 in the wall 21, and through a passage 41 in the head 3. The hole 34 opens into the recess 4 in the head 3 so that said recess is kept filled with oil, thus lubricating the hub 32 so that it rotates smoothly against the inner end of the retainer cup 25 for the spring 24. The close fitting of the cylinder wall 21 against the upper end of the head 3 and the close fitting of the lower end of the cylinder against the wall 20 prevent oil from passing between said parts into the space between the cylinder 18 and the head 3, but maintain said parts in a lubricated condition. The wall 35 and its cylinder 36 are spaced from the wall 21 and the cylinder 18, respectively, and said space is filled with oil. The passage 41 opens inside the annular depending portion 2 around the bearing 5 so that said space is filled with oil, thus lubricating said parts.

In order to counterbalance the elements which are mounted on the eccentric 28 I provide a counter-balance weight 42 having a hub 43 mounted on the shaft 27 above the eccentric 28 and secured to said shaft by a set screw 44. This counterbalance weight, of course, extends oppositely from the eccentric 28 and functions to maintain the operating mechanism in a balanced condition.

The air or gas to be compressed or pumped enters the machine from a pipe 45 opening into an angular passage 46 through the annular portion 2 of the base 1 and opening through the periphery of the head 3 near the forward side of the plate or blade 23 (Figs. 3 and 5). Near the opposite side of the plate or blade 23 the head 3 is formed with an outlet passage 47 having at its lower end a lateral branch 48 (Fig. 4) having communication through a passage 49 with the inside of the upper portion of the housing 9 above the oil level 39. From the housing 9 compressed air or gas is conducted through a pipe 50 to a condenser (not shown) or elsewhere. Thus, the compressed air or gas obtained by operation of the machine is confined in the housing 9 and exerts a downward pressure against the oil in said housing to hold the cylinder 18 in position in which its lower end is in close contact with the wall 20 and in which its wall 21 is in close contact with the upper end of the head 3. But, in case the cylinder 18 becomes overloaded by excess pressure inside, said cylinder is capable of upward movement to provide an opening to relieve the pressure.

A pump housing 51 is attached to the lower end of the depending annular part 2 of the base by screw bolts 52, an annular baffle 53 being clamped between the end of the part 2 and the pump housing. The wall of the chamber 54 is eccentric, extending spirally from its beginning at the shoulder 55 to communication with an outlet opening 56 on said shoulder. A pipe 57 leads from the outlet opening 56 to a cooler (not shown) and thence through a pipe 58 into the housing 9.

The oil pump within the housing 54 comprises a disc 59 attached to the lower end of the shaft 27 and having on its upper side a number of impeller blades 60 which extend from the periphery of the disc 59 tangentially toward the hub of said disc, but do not extend entirely to the hub. In operation of the machine the disc 59 is rotated in the direction of the arrow 61 (Fig. 4) with the result that the oil is properly circulated. The baffle 53 extends inwardly beyond the vertical plane of the periphery of the disc 59 at which the impeller blades 60 terminate, so that the oil is forced out through the outlet 56.

When the machine is ready for use it contains oil to about the line 39. When the motor 13 is started the shaft 27 is rotated with the result that the eccentric 28 operates the hub 32 and the cylinder 36 operates the cylinder 18 in a manner to create suction through the inlet 46 causing air or gas to enter the cylinder 18 through said inlet. As the cylinder 18 is operated by the cylinder 36 the air or gas is compressed and is forced outwardly through the outlet opening 47. This outlet opening 47 is equipped with a valve comprising a cage 62 confining a valve disc 63 between the cage and a plug 64 having a hole 65 in continuation of the passage 47. During operation of the machine the valve disc 63 is held against the cage 62 (Fig. 6) so that the compressed air or gas passes through the hole 65 around the valve disc 63, through the cage 62 and out through the passages 47, 48 and 49 into the housing 9.

From the foregoing it will be seen that this machine encounters a minimum of resistance in operation; that the oil is maintained in constant circulation automatically and as an incident to the operation of the machine; that the parts are constantly lubricated and cooled by the circulating oil; that all of the operating parts are of strong and durable construction and are easily fitted and assembled in cooperative relationship in the machine; that the spring controlling the plate or blade 23 remains under a constant tension and is not subjected to the undesirable effects of expansion and contraction; that the pressure created by the machine is utilized to hold the

parts in cooperative relationship during operation; and that no unusual or undesirable manufacturing problems are encountered.

The construction, arrangement and relationship of the parts may be varied within equivalent limits without departure from the nature and principle of the invention. I do not restrict myself in these or other unessential particulars, but what I claim and desire to secure by Letters Patent is:

1. A compressor or pump comprising a vertical stationary cylindrical head, a cylinder enclosing and cooperating with said head to form a chamber, an element in said head dividing said chamber into suction and compression portions, respectively, means for admitting air or gas into said suction portion at one side of said element, means for conducting compressed air or gas from said compression portion at the opposite side of said element, a rotary vertical shaft, means for rotating said shaft with respect to said head and said cylinder, means operated by said shaft for operating said cylinder about said head to compress the air or gas entering said suction portion and to discharge the compressed air or gas from said compression portion, a device on said shaft arranged eccentrically with respect to said head and concentrically with respect to said cylinder, a resilient actuator controlled by said eccentric device actuating said element horizontally in contact with the inner periphery of said cylinder, and means for confining a body of oil about all of said parts.

2. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of the head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, mechanism for rotating said shaft with respect to said cylinder and said device, an element in said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder and means for enveloping all of said parts other than said mechanism in a body of oil.

3. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, means for confining a body of oil in contact with all of the aforesaid parts, mechanism for rotating said shaft with respect to said cylinder and said device, an element in said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder, means for admitting air or gas to the space between said head and said cylinder at one side of said element, and means for discharging air or gas from the space between said cylinder and said head at the opposite side of said element.

4. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, mechanism for rotating said shaft with respect to said cylinder and said device, an element in said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder, means for admitting air or gas to the space between said head and said cylinder at one side of said element, means for discharging air or gas from the space between said cylinder and said head at the opposite side of said element, an oil pump housing enclosing a part of said shaft, a centrifugal oil pump wholly supported and operated by said shaft in said housing, means for conducting oil from said oil pump housing, and means for confining the oil to submerge all of the parts aforesaid other than a part of said shaft.

5. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, mechanism for rotating said shaft with respect to said cylinder and said device, an element in said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder, means for admitting air or gas to the space between said head and said cylinder at one side of said element, means for discharging air or gas from the space between said cylinder and said head at the opposite side of said element, and a device wholly supported and operated by said shaft for forcing circulation of oil through said cylinder and said head.

6. A compressor or pump comprising a stationary vertical cylindrical head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and cooperating therewith to form an enclosed space between said cylinder and said head, a vertical shaft extending into said head, means for rotating said shaft about an axis concentrically with the axis of said head, a part in connection with said shaft and which is eccentric with respect to said head and concentric with respect to said cylinder, a device mounted loosely on said part for holding said cylinder in eccentric relationship to the axis of said shaft and to said head and for operating said cylinder to compress air or gas admitted to the space between said cylinder and said head, an element supported by said head and cooperating with said cylinder to enable said cylinder to effect compression of air or gas admitted to said space at one side of said element for compression by said cylinder as aforesaid, means for conducting the compressed air or gas from said space at the opposite side of said element, and means for utilizing the compressed air or gas to hold said cylinder in the position aforesaid.

7. A compressor or pump comprising a stationary cylindrical head, a rigid wall extending radially from one end of said head, a cylinder enclosing said head and cooperating therewith to form

a chamber between said head and said cylinder, said cylinder having one end abutting against said wall, a wall on the opposite end of said cylinder abutting against the end of said head, an annular element encircling said cylinder, a shaft rotative with respect to said annular element, mechanism for operating said annular element for said shaft and thereby said cylinder to slide said cylinder upon said first-named wall and to effect compression of air or gas between said cylinder and said head, and means for utilizing the compressed air or gas to hold said cylinder in the position aforesaid.

8. A compressor or pump comprising a stationary cylindrical head, a radially movable plate or blade in said head, a radial wall at one end of said head, a cylinder encircling said head and having one end abutting against said wall and cooperating with said cylinder to form a chamber between said cylinder and said head, a wall in connection with said cylinder abutting the opposite end of said head, means for admitting air or gas to said chamber at one side of said plate or blade, means for conducting compressed air or gas from said chamber at the opposite side of said plate or blade, and mechanism for forcing a circulation of oil through said cylinder and said head.

9. A compressor or pump comprising a stationary cylindrical head, a cylinder of larger diameter than said head enclosing said head and forming therewith a compression chamber, a rotary shaft concentric with said head, an eccentric on said shaft, an annular element with respect to which said eccentric is rotative, said annular element being operated by said eccentric to impart lateral movements to said cylinder with respect to said head to compress air or gas in said chamber, and means for utilizing the compressed air or gas to hold said cylinder in cooperative relationship to said head.

10. A compressor or pump comprising a stationary cylindrical head, a cylinder enclosing and cooperating with said head to form a chamber between said head and said cylinder, a rotary shaft, an element loose on said shaft and engaging and operating said cylinder with respect to said head to vary the position of said chamber within the cylinder and about the head, an element movable radially in the head to constant contact with the inner periphery of the cylinder, means for admitting air or gas to said chamber at one side of said element, means forming an outlet for the air or gas from said chamber at the opposite side of said element, and mechanism cooperating with the compressed air or gas to lubricate all of said parts.

11. A compressor or pump comprising a stationary cylindrical head, a cylinder enclosing and cooperating with said head to form a space between said head and said cylinder, means dividing said space into suction inlet and outlet portions, means for admitting air or gas to the inlet portion of said space, means for conducting the air or gas from the outlet portion of said space, means for utilizing the compressed air or gas to hold said cylinder in proper position, a circular element surrounding said cylinder, and mechanism having pivotal connection with said circular element for operating said circular element and thereby said cylinder eccentrically about said head to compress the air or gas drawn into said space and to discharge the same through said outlet.

12. A compressor or pump comprising a stationary cylindrical head, a cylinder enclosing and cooperating with said head to form a space between said head and said cylinder, means dividing said space into suction inlet and outlet portions, means for admitting air or gas to the inlet portion of said space, means for conducting the air or gas from the outlet portion of said space, means for utilizing the compressed air or gas to hold said cylinder in proper position, a circular element surrounding said cylinder, a rotary shaft for operating said circular element, and a pump on and driven by said shaft for forcing circulation of oil through said cylinder and said head.

13. A compressor or pump comprising a vertical cylindrical stationary head, a vertical rotary shaft extending axially through said head, a cylinder enclosing and cooperating with said head to form a compression chamber between them and being capable of lateral movements relative to said shaft, a device encircling said cylinder and operated by said shaft for imparting lateral movements to said cylinder with respect to said shaft and to said head to compress air or gas entering said chamber, means for conducting air or gas into said chamber for compression, means for conducting the compressed air or gas from said chamber, and means for utilizing the compressed air or gas to hold said cylinder in proper position.

14. A compressor or pump comprising a vertical stationary cylindrical head, a cylinder enclosing and cooperating with said head to form a compression chamber between them, a shaft extending vertically through said head, means encircling said cylinder and operated by said shaft for imparting lateral movements to said cylinder with respect to said shaft and said head and holding a portion of said cylinder in permanent contact with a portion of the periphery of said head, means for effecting compression of air or gas in said chamber when said cylinder is operated as aforesaid, and means for utilizing the compressed air or gas to hold said cylinder in position for operation.

15. A compressor or pump comprising a rigid cylindrical head, a cylinder enclosing and cooperating with said head to form a compression chamber between said cylinder and said head, means for admitting air or gas to said chamber, means for conducting compressed air or gas from said chamber, a shaft mounted for rotation relative to said head and to said cylinder, a device pivoted on and operated by said shaft for operating said cylinder about said head to cause air or gas to enter said compression chamber and to compress and to discharge said air or gas from said compression chamber, and means for utilizing the compressed air or gas to hold said cylinder in proper position.

16. A compressor or pump comprising a rigid cylindrical head, a cylinder enclosing and together with said head forming a compression chamber between them, a shaft, means for supporting said shaft for rotation relative to said head, and to said cylinder, a device pivoted on and operated by said shaft for operating said cylinder about said head, and means for utilizing the compressed air or gas to hold said cylinder in proper position.

17. A compressor or pump comprising a cylinder, devices cooperating with said cylinder to compress air or gas in said cylinder when said cylinder is operated, a shaft, means for supporting said shaft for rotation relative to said cylinder and said devices, an eccentric in connection with said shaft, a circular device encircling said cylinder, means for operating said circular device

by said eccentric to operate said cylinder, and means for utilizing the compressed air or gas to hold said cylinder in proper position.

18. A compressor or pump comprising a stationary head, a cylinder enclosing said head and forming therewith a compression chamber, mechanism for operating said cylinder, means for utilizing the compressed air or gas to hold said cylinder in proper position for operation, a blade supported in said head, a spring for actuating said blade toward said cylinder, and an eccentric movable in coordination with said cylinder and holding said spring under approximately uniform tension.

19. A compressor or pump comprising a stationary head, a cylinder enclosing said head and forming therewith a compression chamber, means for utilizing the compressed air or gas to hold said cylinder in proper position, a shaft supported for rotation relative to said head and to said cylinder, and devices having pivoted connection with and operated by said shaft for operating said cylinder about said head.

20. A compressor or pump comprising a vertical head, a vertical cylinder enclosing and cooperating with said head to form a compression chamber, means for admitting air or gas to said chamber, means for conducting compressed air or gas from said chamber, means for utilizing the compressed air or gas to hold said cylinder in proper position, an element supported by said head between said admitting and conducting means dividing said chamber into inlet and outlet portions, a spring actuating said element to effective position, and an eccentric maintaining said spring under approximately unvarying tension.

21. A compressor or pump comprising a vertical head, a vertical cylinder enclosing and cooperating with said head to form a compression chamber, means for admitting air or gas to said chamber, means for conducting compressed air or gas from said chamber, means for utilizing the compressed air or gas to hold said cylinder in proper position, an element supported by said head between said admitting and conducting means dividing said chamber into inlet and outlet portions, a spring actuating said element to effective position, an eccentric maintaining said spring under approximately unvarying tension, and means operated by said eccentric for operating said cylinder.

22. A compressor or pump comprising a rigid head having a central recess, a cylinder enclosing and cooperating with said head to form a compression chamber, an element mounted in said head for radial movements, a spring for actuating said element radially into contact with the inner periphery of the cylinder, a rotary shaft, a device pivoted on said shaft for operating said cylinder, means for confining oil about the aforesaid devices under pressure created by operation of the compressor or pump, and means for admitting said oil against the inner side of said element to subject said element to the outward pressure of said oil.

23. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, mechanism for rotating said shaft with respect to said cylinder and said device, an element within said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder, means for admitting air or gas to the space between said head and said cylinder at one side of said element, means for discharging air or gas from the space between said cylinder and said head at the opposite side of said element, a housing defining a chamber enveloping the cylinder and head, and a device wholly supported and operated by said shaft for forcing a circulation of oil through said chamber.

24. A machine of the character described comprising a cylindrical head, a shaft extending axially into said head, a cylinder enclosing said head and having an internal diameter greater than the diameter of said head and forming an enclosed space between said cylinder and said head, an eccentric in connection with said shaft, a device mounted on said eccentric holding said cylinder concentric with said eccentric and in eccentric relationship to said head and for operating said cylinder about said head, mechanism for rotating said shaft with respect to said cylinder and said device, an element in said cylinder controlled by said shaft and held in permanent contact with the inner periphery of said cylinder, means for admitting air or gas to the space between said head and said cylinder at one side of said element, means for discharging air or gas from the space between said cylinder and said head at the opposite side of said element, an oil pump housing enclosing a part of said shaft, an oil pump wholly supported and operated by said shaft in said housing, means for conducting oil from said oil pump housing, and means for confining the oil to submerge all of the parts aforesaid other than a part of said shaft.

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