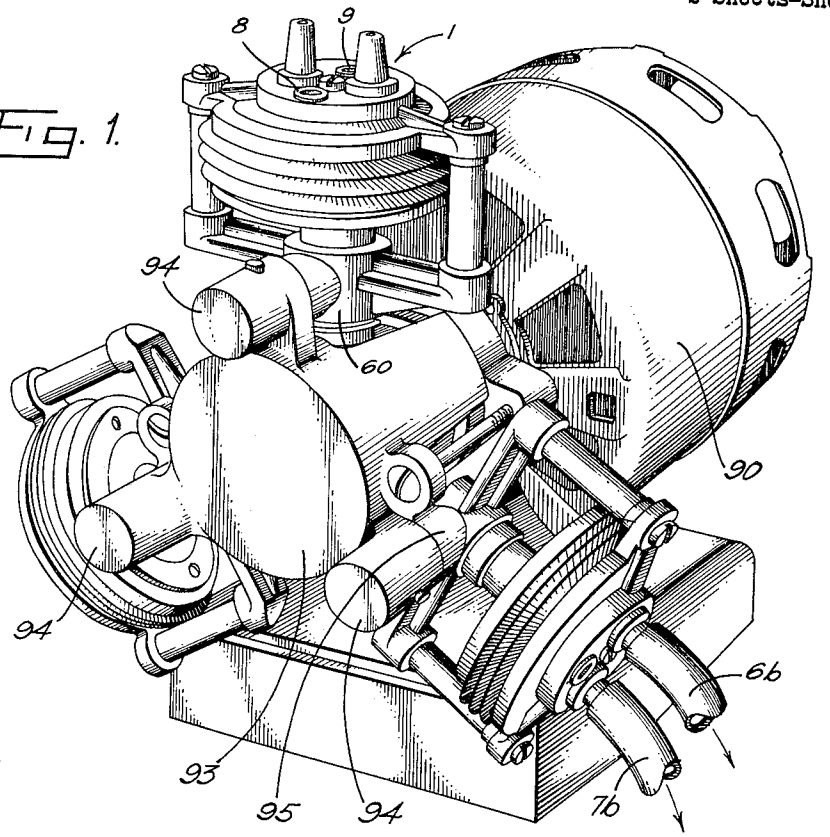
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Fig. 1.



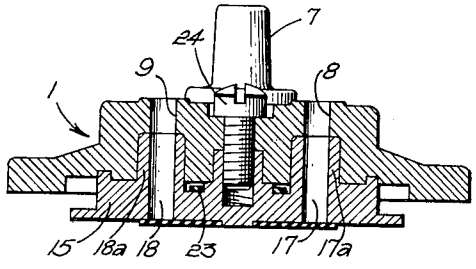


Fig. 6.

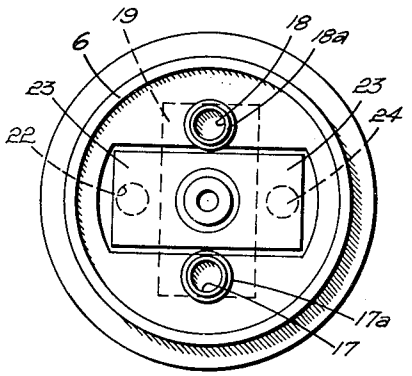


Fig. 5.

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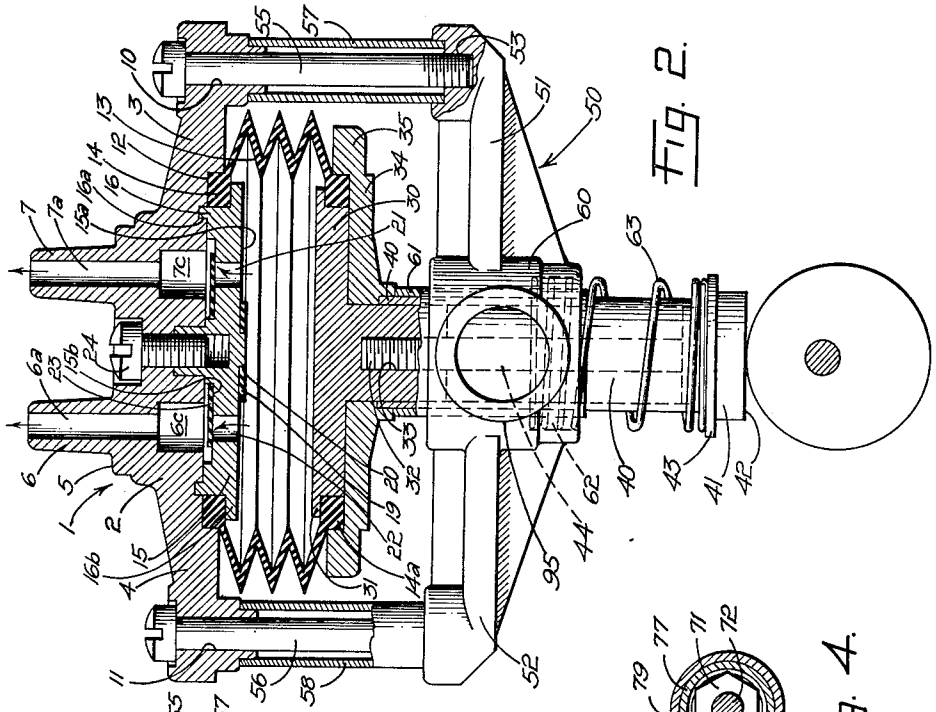


Fig. 2.

Fig. 4.

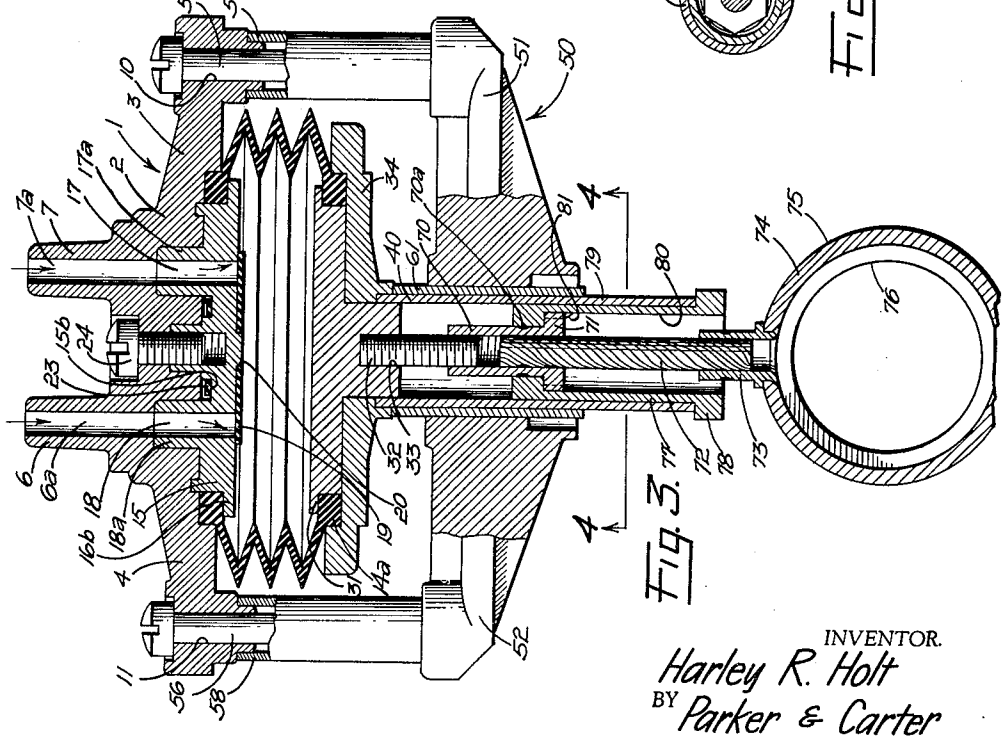


Fig. 3.

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10 Claims. (Cl. 230—160)

This invention relates to pumps and has particular relation to air and vacuum pumps.

One purpose of the invention is to provide an air pressure pump of maximum simplicity in construction.

Another purpose of the invention is to provide an air pressure pump of maximum economy in manufacture.

Another purpose is to provide an air pressure pumping assembly whereby a plurality of pump elements are operated by a single means.

Another purpose is to provide a pump which, by minor modification, may be converted from an air pressure pump into a vacuum pump.

Another purpose is to provide an air pressure pump of minimum weight.

Another purpose is to provide an air pump-vacuum pump of maximum quietness in operation.

Another purpose is to provide a vacuum pump of minimum weight.

Another purpose is to provide an air pressure pump which may, by minor modification, be converted to a vacuum pump.

Other purposes will appear from time to time during the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings, wherein:

FIGURE 1 is an assembly view in perspective;

FIGURE 2 is a side elevation, on an enlarged scale, with parts broken away, and illustrating the pump of the invention employed as a pressure pump;

FIGURE 3 is a view similar to that of FIGURE 2 and illustrating the pump of the invention employed as a vacuum pump;

FIGURE 4 is a view taken on the line 4—4 of FIGURE 3;

FIGURE 5 is a detail view illustrating a valve plate element of the invention; and

FIGURE 6 is a detail view of a portion of the invention.

Like parts are indicated by like numerals throughout the specification and claims.

Referring now to the drawings, the numeral 1 indicates a cap member. The cap member 1 has a circular central portion 2 and a pair of diametrically, oppositely extending arms indicated by the numerals 3, 4. Upstanding from the top surface 5 of the member 1 is a pair of diametrically, oppositely positioned air outlet cones indicated by the numerals 6, 7. Passages 6*a*, 7*a* extend, respectively, through the cones 6, 7 and the member 1. Passages 8, 9 are positioned 90 degrees from passages 6*a*, 7*a* and extend through the portion 2 of cover 1. Adjacent the outer ends of arms 3, 4, apertures 10, 11 are formed, respectively.

An annular downwardly depending flange surface 12 is formed on the under surface of circular portion 2 of cover 1. A flexible bellows 13 has an upwardly extending annular flange 14 surrounding one of its open ends for seating within the flange 12 of cover 1.

A valve plate 15 has an upwardly extending annular flange 16 for reception within a groove 16*a* in cover 1 and an annular perimeter surface 16*b* which clamps the bellows flange 14 of bellows 13 against cover 1. The circular valve plate 15 has a pair of inlet passages 17, 18 diametrically oppositely positioned therein. The passages 17, 18 extend through uprising tubular segments 17*a*, 18*a*, respectively. It will be observed (FIGURE 6) that the segments 17*a*, 18*a* are dimensioned for seating within the openings 8, 9 of cover portion 2.

Secured to the under surface 15*a* of valve plate 15 is a flapper valve element 19. The element 19 is of generally rectilinear configuration and is composed of flexible material secured to the under surface 15*a* of plate 15 only at the central portion of element 19, as indicated at 20. The outwardly extending portions of element 19 overlie the passages 17, 18 for purposes which will appear hereinbelow.

Positioned at 90 degrees from the passages 17, 18 in valve plate 15 and in alignment with passages 6*a*, 7*a* of cover 1, are passages 21, 22. A second flapper valve element 23 is secured to the upper surface 15*b* of valve plate 15. The member 23 is substantially identical to element 19 and is secured to upper surface 15*b* of valve plate 15 only adjacent the center of element 23. The outer ends of element 23 overlie the passages 21, 22.

A fastener element 24 secures valve plate 15 to the underside of cover 1.

An attaching or clamping plate 30 is substantially circular in over-all configuration and carries the outwardly extending annular flange 31 for clamping flange or enlargement 14*a* surrounding the opposite open end of bellows 13. The member 30 has a threaded extension or bolt portion 32 extending downwardly from substantially the center thereof through an aperture 33 formed in a bottom closure plate 34. The closure plate 34 has an upwardly extending annular perimeter flange portion 35 for reception therewithin of the flange portion 14*a* surrounding the bottom opening of bellows 13.

A piston or sleeve member 40 is held against the under surface of member 34 at the center thereof by a cap member 41. The cap member 41 has a substantially flat outer end surface 42 and an annular flange 43 which receives that end of sleeve 40 opposite from that which is in contact with plate 34. A central extension 44 of cap member 41 extends upwardly through sleeve 40 and threadably engages the bolt 32. The member 41 may conveniently be formed of a suitable plastic material.

A bearing member 50 has a pair of diametrically opposed, outwardly extending arm portions 51, 52 each having threaded sockets 53 formed respectively therein and upwardly open from the outer ends thereof for reception of fastener elements 55, 56, respectively, which fastener elements extend from a point above the cover 1, through the apertures 10, 11 into the sockets 53. For accurate positioning, the fasteners 55, 56 may compress sleeves 57, 58, respectively, between the members 1, 50.

The member 50 at its center has an enlargement 60 which is axially apertured to receive and secure therewithin a bearing sleeve 61 through which the movable piston sleeve 40 is positioned. The enlargement 60 is molded about bearing sleeve 61.

A yielding means, such as the coil spring 63, is operative against the annular bottom edge of a downwardly open socket 62 in enlargement 60 on member 50 and against the outwardly extending annular flange 43 of cap 41. The spring 63 may conveniently surround the sleeve 40.

Referring now to FIGURES 3 and 4, I illustrate a vacuum pump wherein the valve plate 15 has been rotated 90 degrees from the position in which it is illustrated in FIGURE 2, for example. It will be understood that cones 6, 7 are provided for attachment of suitable conduits, such as flexible hoses and the like, an example thereof being illustrated at 6*b*, 7*b* in FIGURE 1. When the pump of the invention is employed as an air pressure pump, the passages 6*a*, 7*a* are outlet passages positioned to deliver air to such conduits. The passages 8, 9 and

17, 18 are, accordingly, air inlet passages. By rotating the valve plate 15 90 degrees, it will be observed that the segments 17*a*, 18*a* are seated in sockets 6*c*, 7*c* which are actually enlargements of passages 6*a*, 7*a* and that the passages 6*a*, 7*a* are converted to inlet passages and the passages 8, 9 are converted to exhaust passages.

Since many of the parts illustrated in FIGURES 2 and 3 are identical with those previously described, they have been given identical numerals and will not be further described herein. In the vacuum pump version of the invention, the bolt 32 is secured to a fitting 70 which has, at its opposite end from bolt 32, a hexagonal outwardly extending flange 71. Secured, as indicated at 70*a*, to the fitting 70 is a flexible, preferably bidirectional, shaft element 72. Secured to the opposite end of member 72 from fitting 70 is a fitting 73 to which in turn is secured a circular eccentric strap 74. The strap 74 has a circumferential portion 75 for engagement with the perimeter of an eccentric operating element below described, and an annular end flange portion 76.

An attaching sleeve 77 is hollow for reception of the member 72 with substantial circumferential space thereabout. An outwardly extending annular flange 78 is formed at one end of sleeve 77. A sleeve 79 has one of its ends seated upon the upper surface of flange 78 and its opposite end in contact with the under surface of member 34. At its end opposite from the flange 78, the sleeve 77 has an opening through which passes the major elongated circumferential portion of the fitting 70. The inner circumferential wall of sleeve 77 has recesses, grooves or notches 81 formed to engage the hexagonal surface of member 71 for the purposes described below.

Referring now to FIGURE 1, I illustrate a power means such as an electric motor 90 having an operating shaft (not shown) extending outwardly therefrom and carrying at its outer end an eccentric surface (not shown). It will be understood that the eccentric operatively engages the end surfaces 42 of cap members 41 and operatively engages the strap 74 when the vacuum pump version of the invention is employed with the said operating means. A mounting element 93 is secured to the housing of motor 90 and has formed therewithin a plurality of socket housings 94. Extending from the enlargement 60 is a cylindrical mounting abutment member 95. The member 95 seats within the socket 94 to mount and retain the pump in position for operation by the operating shaft of motor 90.

The use and operation of my invention are as follows:

I provide an air pressure pump of minimum weight and maximum simplicity in manufacture and operation. When the end surface 42 is moved by the cam or eccentric surface on the shaft of motor 90, the sleeve 40 is moved in its bearing 61 toward the cover member 1 against the action of spring 63. Thus, the bellows 13 is compressed and any air therewithin is evacuated through passages 21, 22 of valve plate member 15. The flapper valve member 23 is raised by the passage of such air and does not impede the same. The flapper valve 19 is held closed by the air pressure in bellows 13. The air then is directed through pasages 6*a*, 7*a* and cones 6, 7 into appropriate conduits such as those illustrated at 6*b*, 7*b*, for delivery to a place of use. When the eccentric surface on the shaft of motor 90 has turned its high portion beyond the surface 42, the spring 63 is effective to return the elements 30, 34, and to open the bellows 13. Thus air is drawn through inlet openings 8, 9 in the cover portion 2 and through passages 17, 18 in valve plate 15, the flapper valve 19 being moved away from said passages by such entering air and the bellows is filled for a repeated expulsion of air, as above described, the flapper valve 23 being held closed by the opening of bellows 13. It will be observed that the flapper valve element 19 is effective to prevent outward movement of air through passages 17, 18 when the bellows is compressed, the flapper valve member 23 is effective to prevent inward movement of air through the passages 6*a*, 7*a* when the bellows is opened. The employment of plastic member 41 having a plastic end surface 42 and the extended longitudinal sleeve bearing 61 are effective to prevent side motions of sleeve 40 and to provide a substantially noiseless operation of the air pressure pump of the invention.

When it is desired that the pump of the invention be operated as a vacuum pump, the valve plate 15 is rotated 90 degrees to reverse the action of the flapper valve elements 19, 23, and the inlet and outlet passages in cover 1 and valve plate 15. In order to provide for a substantially noiseless operation of the vacuum pump and for some flexing of the drive shaft element thereof, I provide a bi-directional flexible cable element 72. An eccentric strap 74 is circular in configuration and surrounds the eccentric surface of the shaft of motor 90. To avoid twisting action of member 72 in assembling and disassembling the vacuum pump of the invention, I provide sleeve 77 having an operating engagement with the hexagonal flange 71 of fitting 70. The outwardly extending annular flange 78 may be grasped by any suitable tool to rotate the sleeve 77 and thus to rotate the fitting 70 to secure the same to bolt 32 of member 30 and to separate the same.

By employment of the mounting bracket member 93, with its circumferentially spaced, rearwardly directed sockets 94 in association with the laterally extending abutments 95 on the pumps of the invention, it will be observed that a plurality of said pumps may be driven by a single operating means.

Whereas I have shown and described a preferred embodiment of my invention, it will be understood that further modifications will suggest themselves to those skilled in the art upon a reading of the foregoing specification. Accordingly, the foregoing description should be taken as merely illustrative and not definitive, and the scope of the invention should be limited only by the following appended claims.

I claim:

1. An air pressure pump comprising a cover plate, an inlet passage in said plate, an outlet passage in said plate, a valve plate, an inlet passage in said valve plate aligned with said inlet passage in said cover plate, an outlet passage in said valve plate aligned with said outlet passage in said cover plate, a flapper valve element secured to one surface of said valve plate and overlying said inlet passage, a second flapper valve element secured to the opposite surface of said valve plate and overlying said outlet passage in said valve plate, a bellows having one of its ends clamped between said cover plate and said valve plate, a bottom plate, an attaching plate, the opposite end of said bellows being clamped between said bottom plate and said attaching plate, a piston sleeve extending from said bottom plate, a cap member at the outer end of said piston sleeve, means securing said attaching plate to said cap through said piston sleeve, a bearing member surrounding said sleeve and means securing said bearing member to said cover plate, yielding means operative between said bearing member and said cap element, to urge said bottom and attaching plates away from said cover plate and to open said bellows.

2. A vacuum pump comprising a cover plate having an inlet passage and an outlet passage, a valve plate having an inlet passage aligned with the inlet passage of said cover plate, said valve plate having an outlet passage aligned with said outlet passage of said cover plate, a flapper valve element secured to one surface of said valve plate and overlying said inlet passage in said valve plate, a second flapper valve element secured to the opposite surface of said valve plate and overlying said outlet passage in said valve plate, a bellows having one of its ends clamped between said valve plate and said cover plate, a bottom plate, a clamping plate, the opposite end of said bellows being compressed between said bottom plate and said clamping plate, a fitting secured to said clamping plate beyond said bottom plate, a flexible cable secured

at one of its ends to said fitting, an eccentric strap secured to the opposite end of said cable, a piston sleeve surrounding said cable in circumferentially spaced relationship therewith, a bearing member surrounding said sleeve, said bearing member being secured to said cover plate.

3. A pump including a cover member, inlet and outlet passages in said cover member, a plate secured to said cover member and having inlet and outlet passages aligned with corresponding passages in said cover member, valve elements associated with said inlet and outlet passages in said plate, a bellows having one of its ends clamped between said cover member and said plate, a piston, a bearing member for said piston, said bearing member being secured to said cover member in spaced relationship therewith, said piston being secured to the opposite end of said bellows within the space between said bearing member and said cover member, said piston having a portion extending outwardly from said bearing member in a direction away from said cover member.

4. The structure of claim 3 characterized by and including yielding means operative against said bearing member and said piston to urge said piston in a direction away from said cover member.

5. The structure of claim 3 characterized by and including a flexible element secured to said piston and an eccentric strap secured to said flexible member.

6. A pump comprising a cover, inlet and outlet passages in said cover, a plate secured to said cover, inlet and outlet passages in said plate, flapper valve elements on opposite sides of said plate and effective to permit passage of fluid pressure in one direction only through each of said inlet and outlet passages, said inlet and outlet passages in said plate being selectively, alternatively alignable with said inlet and outlet passages in said cover and said outlet and inlet passages in said cover, a bellows having one of its ends clamped between said cover and said plate, a piston secured to the opposite end of said bellows, a bearing member secured to said cover and surrounding said piston beyond said bellows from said cover.

7. The structure of claim 6 wherein the inlet and outlet passages of said plate are aligned with the inlet and outlet passages of said cover and characterized by and including yielding means urging said piston in a direction away from said cover, and an eccentric abutment surface on said piston beyond said bearing member from said cover.

8. The structure of claim 6 wherein the inlet and outlet passages of said plate are aligned with the outlet and inlet passages of said cover and characterized by and including a flexible member secured to said piston and an eccentric strap secured to said flexible member beyond said bearing member from said cover.

9. A pump comprising a cover member, fluid pressure passages in said cover member, means on said cover member for attaching conduits for communication with said fluid pressure passages, openings in said cover communicating with the atmosphere, a valve plate secured to said cover, inlet and outlet passages in said valve plate, valve elements positioned to control the passage of fluid pressure through said inlet and outlet passages in said valve plate, said valve plate inlet and outlet passages being selectively, alternatively alignable with said fluid pressure passages and said openings within said cover, a bellows having one of its ends secured to said valve plate, a piston secured to the opposite end of said bellows and a bearing member for said piston.

10. A pump comprising a cover, inlet and outlet passages in said cover, a plate secured to said cover, inlet and outlet passages in said plate, flapper valve elements on opposite sides of said plate and effective to permit passage of fluid pressure in one direction only through each of said inlet and outlet passages, said inlet and outlet passages in said plate being selectively, alternatively alignable with said inlet and outlet passages in said cover and said outlet and inlet passages in said cover, a bellows having one of its ends secured to said plate, a piston member secured to the opposite end of said bellows, a bearing member for said piston member, said bearing member being secured to said cover at a point beyond said bellows from said cover.

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