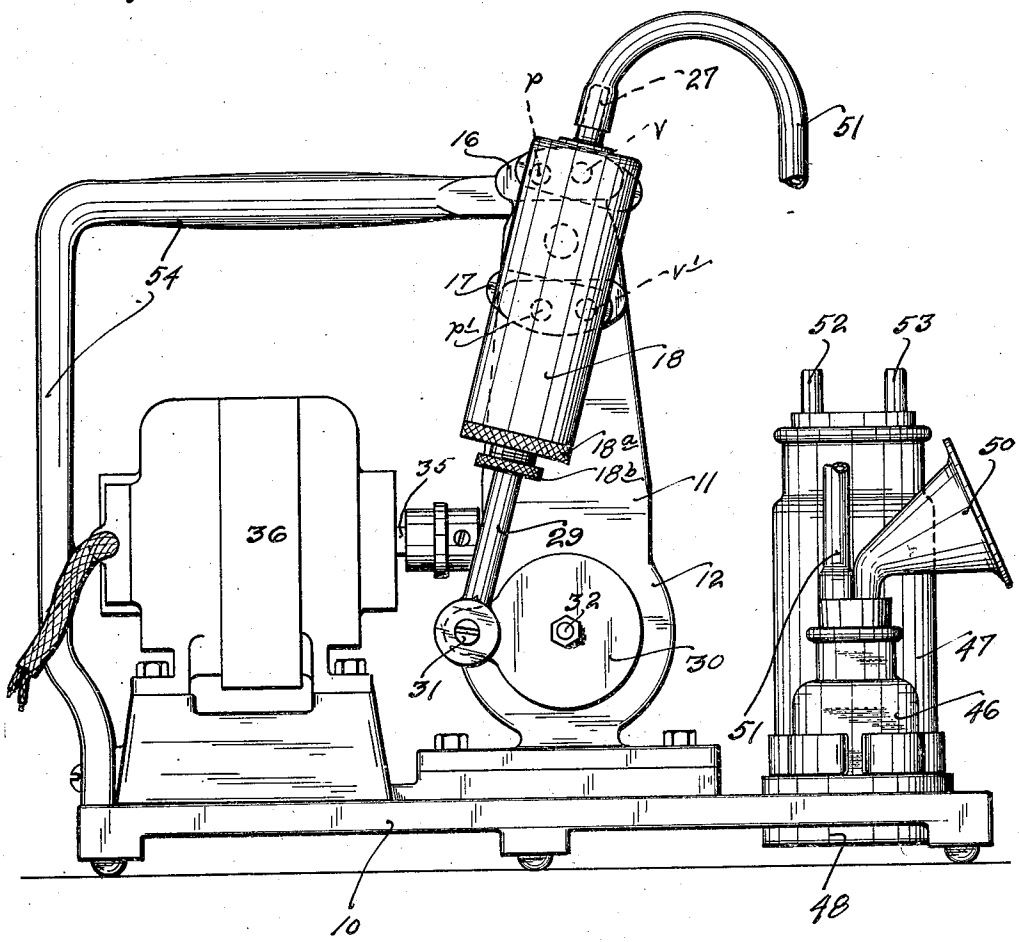
April 22, 1930. L. DINESEN 1,755,318

VACUUM PUMP OR PULSATOR

Filed July 6, 1926 3 Sheets-Sheet 1

Fig. 1



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VACUUM PUMP OR PULSATOR

Filed July 6, 1926 3 Sheets-Sheet 2

Fig. 2

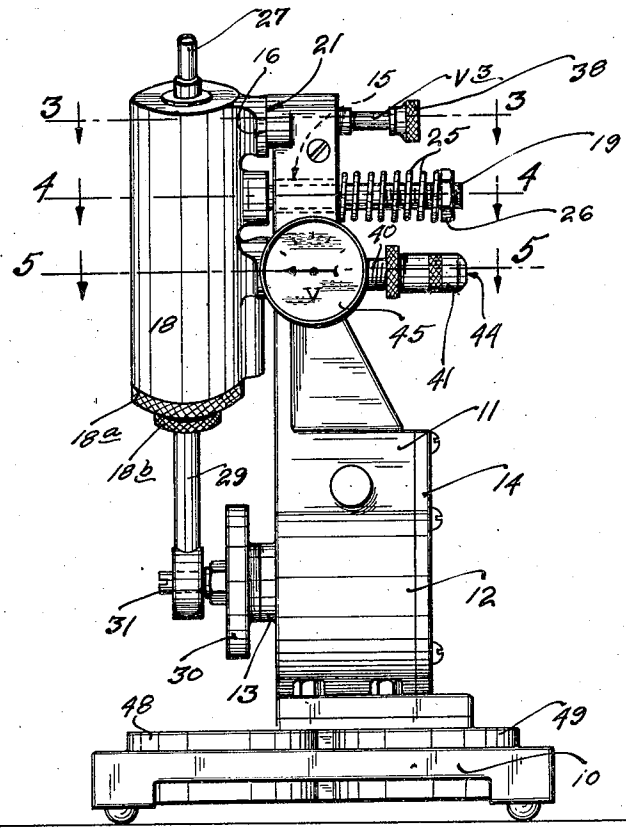


Fig. 3

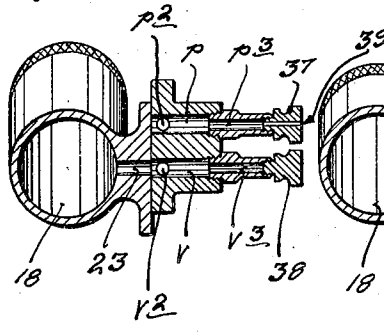


Fig. 4

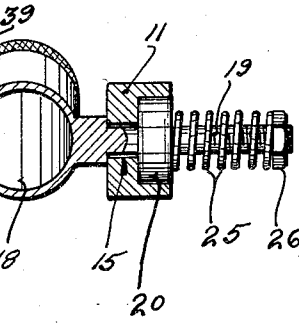
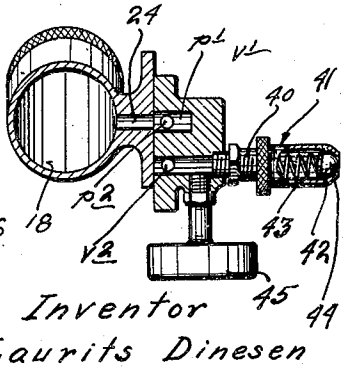


Fig. 5



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VACUUM PUMP OR PULSATOR

Filed July 6, 1926 3 Sheets-Sheet 3

Fig. 6

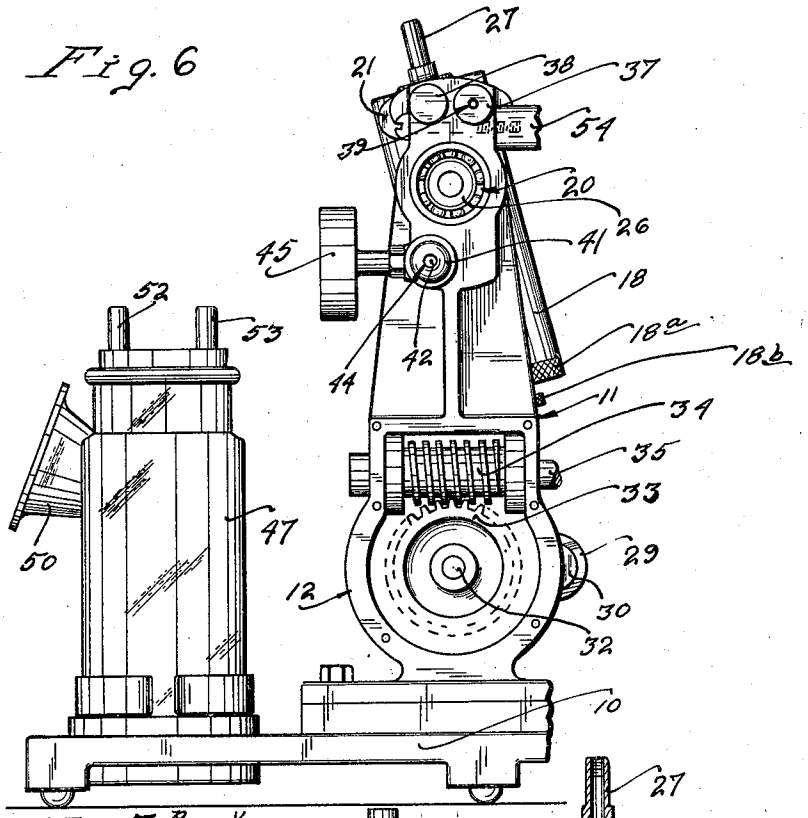
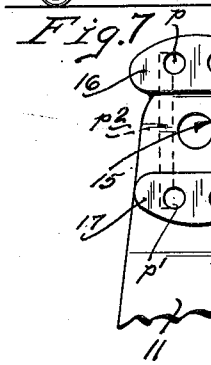


Fig. 7



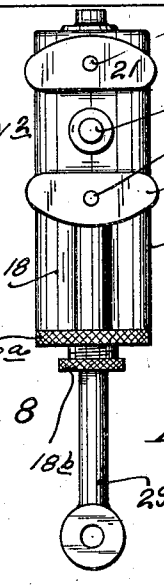


Fig. 8

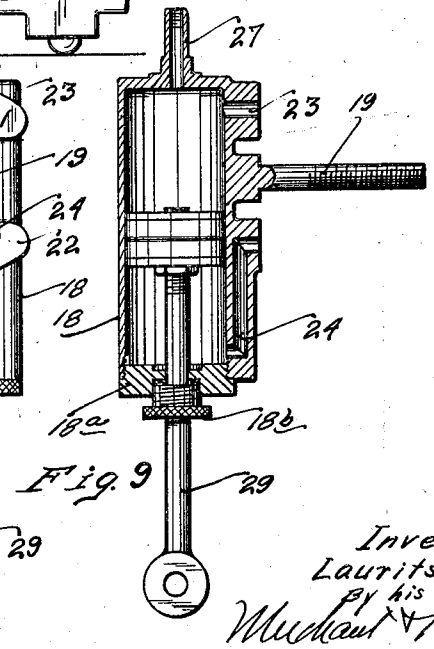


Fig. 9

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UNITED STATES PATENT OFFICE

LAURITS DINESEN, OF MINNEAPOLIS, MINNESOTA

VACUUM PUMP OR PULSATOR

Application filed July 6, 1926. Serial No. 120,626.

My present invention is in the nature of a pumping device adapted for various different uses, but particularly designed for use in hospitals and sick rooms, or physicians' offices. The pump has devices adapting it to operate at will as a vacuum pump, as a pressure pump, or as a pulsator or device for producing pressure pulsations. When adjusted to act as a pressure pulsator, the device is adapted for use as a breast pump; when adjusted for action as a vacuum pump, it is adapted for use generally for the production of vacuum or for drawing fluids such as surplus blood during operations; and when adjusted for action as a pressure pump, it is adapted for use generally wherever pressure or an air-blowing action is desired.

A commercial form of the device is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a left side elevation showing the improved device in connection with auxiliary devices adapting it for use as a vacuum pump and as a pulsator;

Fig. 2 is a front elevation of the improved device with the receptacles removed;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

Fig. 4 is a section taken on the line 4—4 of Fig. 2;

Fig. 5 is a section taken on the line 5—5 of Fig. 2;

Fig. 6 is a right side elevation of the device, with some parts broken away and the head plate of a gearing housing therein shown removed;

Fig. 7 is a fragmentary view in left side elevation, looking at the face of the pump valve seat, the pump being removed;

Fig. 8 is a right side elevation of the pump, showing the valve faces and ports thereof that cooperate with the port-equipped valve seat shown in Fig. 7; and

Fig. 9 is an axial section of the pump piston, the piston being shown in elevation.

The various parts of the complete apparatus are preferably mounted on a common base 10 so that they constitute a portable self-contained device. Rigidly secured on and extending vertically upward from the base 10 is a pedestal-like casting 11, which, in its lower portion, has a cylindrical structure 12 that affords a gear housing. This gear housing is closed at one side and provided with an axial bearing hub 13 and at its other side it is provided with a removable head plate 14.

The upper portion of the pedestal casting 11 is formed with a pintle passage 15 and on its left-hand face with flat valve faces 16 and 17. The valve face 16 is provided with laterally spaced ports p and v, and the lower face 17 is formed with laterally spaced ports p' and v'. The ports p and p' are connected by a conduit p^2, and the ports v and v' are connected by a conduit v^2, all as best shown in Fig. 7.

The pump cylinder 18 is mounted to oscillate, and for that purpose, is provided with a laterally projecting pintle 19 that is passed freely through the pintle passage 15 and is journaled to the pedestal 11 preferably by a self-aligning ballbearing 20 that is countersunk into the pedestal, as best shown in Figs. 4 and 6. The cylinder 18 is formed with valve faces 21 and 22 that engage, respectively, with the valve faces 16 and 17 of the pedestal. The cylinder 18 has an upper port 23 located in its valve face 21 and arranged to engage alternately with the ports p and v of the valve seat 16; and said cylinder is provided with a lower port 24 in its valve face 22, arranged to engage alternately with the ports p' and v' of the valve face 17. To hold the valve faces 21 and 22 tightly engaged with the cooperating valve faces 16 and 17, a coiled spring 25 is applied around the pintle 19 and arranged to react against a nut 26 on the outer end of said pintle and against the hub of the ballbearing, thereby holding said ballbearing in position. By adjustments of the nut 26, the tension of the spring 25 may be varied, at will.

The lower port 24, it will be noted, extends from the lower end of the cylinder to a point approximately the same distance from the axis of the pintle 19, as is the upper cylinder port 23. In its upper head, the cylinder 18 is shown as provided with a nipple 27

that will be closed when the pump is used as a vacuum pump or as a pressure pump, but will be opened when the pump is used as a pressure pulsator. As shown, the cylinder 18 is provided in its lower end with a removable head 18^a equipped with a stuffing box 18^b. Working in the cylinder 18 is a pump piston 28 provided with a depending stem 29 that works through the head 18^a and stuffing box 18^b.

For oscillating the pump cylinder and for reciprocating the pump piston therein, there is provided a crank 30 carrying a wrist pin 31 to which the lower end of the piston rod 29 is connected. This crank 30 is secured to the outer end of a shaft 32 journaled in the hub 13 of the housing 12 and, within said housing, secured to a worm gear 33. The worm gear 33 is driven by a worm 34 carried by a driving shaft 35 that is journaled in the housing 12 and, as shown, is extended therefrom and directly connected to the rotor of a small electric motor 36 mounted on the base 10. The worm 34 and the worm gear 33 are enclosed within the housing 12 and arranged to be run in oil or grease.

The ports p and v, as best shown in Fig. 3, are provided with projecting nipples or extension tubes p^3 and v^3. The outer surfaces of these nipples are arranged to be telescoped into flexible rubber tubes and they are internally threaded to receive plugs 37 and 38. The plug 37 has a very small or capillary air escape passage 39, for a purpose that will hereinafter appear.

The pump may be operated by rotation of the crank 30 in either direction, but the adjustments hereinafter described assume that the said crank is to be rotated in a counter-clockwise direction in respect to Fig. 1, and under such direction of rotation, the ports p and p' become pressure ports and the ports v and v' become vacuum ports. Hence, in this arrangement, a vacuum safety valve is connected to the vacuum ports v and v'. As shown, this vacuum safety valve includes an externally threaded tubular stem 40, a cap 41 screwed onto said stem, and a valve 42 that is subject to a spring 43 and normally closes an intake port 44 in the outer end of said cap. The stem 40, as shown, is screwed into the lower vacuum port v', and the spring 43 is compressed between the valve 42 and the outer end of the sleeve 40, so that its tension may be varied by adjustments of the cap on said stem. The numeral 45 indicates a vacuum gauge, the stem of which, as shown, is connected to the lower vacuum port v', but is indirectly connected to the upper vacuum port v by the conduit v^2.

For use in connection with the pumping device above described, there may be provided various different devices or receptacles. As shown, there are provided two receptacles 46 and 47, both being in the form illustrated as glass bottles mounted in clip-equipped seats 48 and 49 provided on the base 10. The receptacle 46 is provided with a teat cup 50 and, by a rubber 51, is adapted to be connected to the nipple 27 on the upper end of the pump cylinder. The receptacle 47 is shown as provided with nipples 52 and 53 that are adapted to be connected by one rubber tube to the pump nipple 27 or either of the nipples p^3 and v^3. To afford convenient means for carrying the device from place to place, there is provided an L-shaped handle 54 rigidly secured at its lower end to the base 10 and at its upper end to the top of the pedestal casting 11.

The pump device described is capable of many different uses, several of which are as follows:

When the device is to be used as a breast pump, a pulsating action, rather than continuous suction, is required and, moreover, the pressure pulsations produced in the teat cup should be somewhat less than the vacuum pulsations. Hence, for this action, the tube 51 is used to connect the receptacle 46 to the pump nipple 27, the vacuum nipple v^3 is completely closed by the plug 38, and the pressure nipple p^3 is partially closed by the plug 37. With this adjustment, when the piston is being moved downward as shown in Fig. 1, the upper cylinder port 23 will be in registration with the upper vacuum port v, while the lower cylinder port 24 will be in registration with the lower pressure port p'. Partial vacuum produced in the upper end of the cylinder will be effective in the receptacle 46 and cup 50. When the piston is moved upward, the cylinder will be moved to the opposite angle and the upper cylinder port 23 will then be in registration with the pressure port p, while the lower cylinder port 24 will be in registration with the lower vacuum port v', and under upward movements of the piston, pressure will be produced in the upper end of the cylinder, thereby producing a pressure pulsation in the receptacle 46 and cup 50. This pressure pulsation, however, will deliver less air to the cup 50 than was drawn therefrom by the previous downward suction stroke of the piston, for the reason that under the above noted upward movement of the piston, air compressed in the upper end of the cylinder finds a restricted and partial escape through the restricted passage 39 of the plug 37. This is just the kind of an action that is desired when the device is used as a breast pump. Otherwise stated, the pulsating action produced in the cup 50 is slightly stronger in vacuum than in pressure, so that the repeated pulsations produce a slight progressive suction from the cup 50 toward the receptacle 46, such as required to produce the proper flow of milk. Here it should be further noted that the vacuum safety valve 40—41, which may be set for any desired maximum suc-

tion, will open up whenever a vacuum in excess of the maximum desired vacuum is produced and this is true whether the vacuum be produced by any one impulse or by a progressively increasing suction due to repeated vacuum pulsations.

Here it should be stated that when the pump is used as a pulsator, the lower portion of the cylinder is not used. Under upward movements of the piston, the suction produced in the lower end of the cylinder will simply draw in air by causing the valve 42 to open, and under downward movements of the piston, the air compressed in the lower end of the cylinder will be slightly compressed and more or less of the compressed air discharged through the restricted passage 39 of the plug 37.

When the pump is to be used either as a straight air compressor or as a vacuum pump, the piston will be operative under both movements, and under both of such uses, the nipple 27 should be closed by applying the plug 38 or a suitable substitute device thereto. Moreover, the plug 37 should also be removed when the pump is used either for pressure or for vacuum.

If the pump is to be used as a pressure pump, an air tube should be applied to the nipple p^3, but if the pump is to be used as a vacuum pump, such tube should be applied to the nipple v^3. Of course, either a vacuum tube or a pressure tube may be connected to one of the nipples of the receptacle 47 or to any other suitable device, according to the character of the work to be done.

It has probably already been noted but is now here specifically stated that, under downward movements of the piston, the upper cylinder port 23 registers with the upper vacuum port v, and lower cylinder port 24 registers with the lower pressure port p', while under upward movements of the piston, the upper cylinder port 23 registers with the upper pressure port p, while the lower cylinder port 24 registers with the lower vacuum port v', assuming that, as already stated, the crank 30 rotates in a counterclockwise direction in respect to Fig. 1. This produces pressure in the pressure ports p, p', and vacuum in the vacuum ports v, v', under both movements of the piston. The oscillatory movements of the cylinder produce the above described alternating valve action.

What I claim is:

1. In a device of the kind described, the combination of a base, a pedestal secured on said base and formed with connected upper and lower pressure ports and connected upper and lower vacuum ports, a pump cylinder pivoted to said pedestal and having upper and lower ports engageable alternately with the pressure and vacuum ports of said pedestal, a motor-driven crank mounted on the lower portion of said pedestal, a piston working in said cylinder and having a projecting rod connected to said crank, a nipple on the upper end of said cylinder to which a flexible tube may be connected, means for opening and closing said nipple at will, and means for connecting a flexible tube at will to the pressure and vacuum ports of said pedestal.

2. The structure defined in claim 1 in further combination with means for closing the vacuum port of said pedestal at will, and other means for partially closing or restricting the pressure ports of said pedestal.

In testimony whereof I affix my signature.

LAURITS DINESEN.