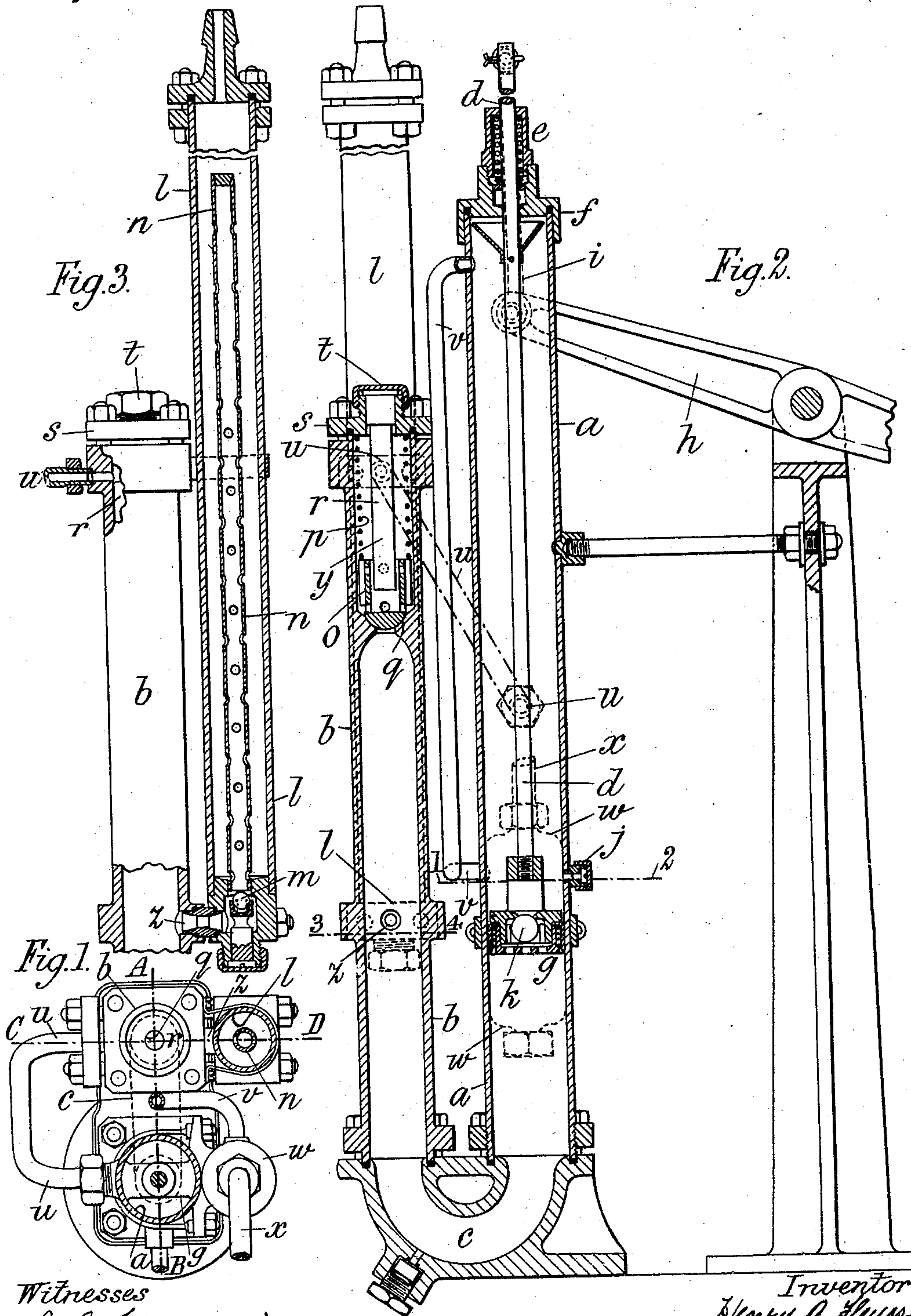


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MERCURY VACUUM PUMP.
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991,493.



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MERCURY VACUUM-PUMP.

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To all whom it may concern:

Be it known that I, HENRY ALBERT FLEUSS, a subject of the King of Great Britain, residing at Dunstan Lodge, Thatcham, Berkshire, England, have invented new and useful Improvements in Mercury Vacuum-Pumps, of which the following is a specification.

My improvements relate to that class of mercury pumps in which mercury is alternately caused to flow downward from a vertical tube or chamber into which air can then enter through an air inlet near the bottom and then caused to flow upward and fill the tube or chamber and in doing so cause all air to be driven from this tube or chamber past an outlet valve at its upper end into an upper chamber and in which some mercury is at the end of the upward rise of the mercury also caused to pass the valve.

My improvements are hereinafter described with reference to the drawings annexed and are specifically claimed at the end of this specification.

Figure 1 is a horizontal section, Fig. 2 a vertical section through the line A—B Fig. 1, and Fig. 3 a vertical section through the line C—D of parts of a pump in which all my improvements are embodied.

a b are two vertical tubes connected one with the other at the bottom by a curved passage c .

d is a piston rod passing downward through a stuffing box e carried by a cap f which closes the upper end of the tube a .

g is a piston on the lower end of the piston rod.

h is an oscillating lever arm coupled at its end by links i to the upper end of the piston rod and by which this rod has an up and down movement given to it or other means might be adopted for giving an up and down movement to the piston.

In Fig. 2 the piston is shown at the top of its stroke. k is a floating valve closing a passage formed through the piston and preventing mercury from passing upward through this passage but which if it drops from its seat allows mercury to pass downward to fill any space which may be left between the upper surface of the mercury in the tube a and the underside of the piston when the piston is at the top of its stroke. j is a plug closing the overflow outlet from the tube a but which is removed when filling the lower parts of the tubes a b and the pas-

sage c with mercury. z is a passage from the side of the tube b into the lower end of the pipe l which at its upper end is connected with the vessel to be exhausted. m a valve for preventing mercury from passing upward into this pipe. n an inner tube closed at top but with perforations in its sides to serve as a baffle by which should there be any sudden upward rush of mercury and should any mercury pass the valve before it closes, the upward rush of the mercury which so passes the valve is stopped. o is a valve pressed downward by a coiled spring p against a valve seat q at the upper part of the tube b . r is a chamber above this valve seat. s is a cap by which the top of the chamber is closed. The cap has a central passage formed through it closed at the top by a cap t . u is an overflow pipe passing from the upper end of the chamber r to the tube a at a level above the mercury in this tube. In Fig. 2 this tube is shown in dotted lines as it would have been cut away in making the section. v is a pipe led downward from the upper part of the tube a to a mercury trap or catch pit w (see Fig. 1 and in dotted lines in Fig. 2) from which a pipe x extends to the suction inlet of a secondary air pump which may be of any ordinary construction.

When filling the lower part of the tubes a and b and the passage c with mercury the piston is brought to the top of its stroke, the cap t is taken off and the rod y is taken out. The plug j which closes the overflow outlet from the tube a is also removed. Mercury is then poured into the chamber r through the central passage in the cap s , the valve o remaining closed by the pressure of the spring upon it. The mercury first fills the chamber r and then flows down through the overflow pipe u to the interior of the tube a and passing downward through the piston fills the lower parts of the tubes a and b until the mercury has risen in the tube a high enough to float and close the valve k . When this takes place the level of the column of mercury in the tube b will be just below its suction inlet passage z . As more mercury is poured in it rises above the piston until it reaches the overflow outlet from which the plug j has been removed.

When mercury flows out from the overflow outlet the mercury in the tube a will be at the level of the dotted line 1—2 in Fig. 2 while in the tube b it will be at the

level indicated by the dotted line 3—4. The plug *j* and cap *t* are then replaced and closed airtight.

By causing the valve *o* to be normally pressed down against its seat so that no mercury can pass back from the chamber *r* to the tube *b* and by carrying an overflow pipe downward from this chamber to the tube *a* above the level of the mercury therein not only is the valve always kept covered with mercury and air excluded from passing back through it but in addition any dross floating on the surface of the mercury in the tube *b* will at the end of its upward rise in this tube be carried past the valve *o* and will then float on the surface of the mercury in the chamber *r* and as more mercury passes into the lower part of this chamber the dross together with mercury will pass down through the overflow pipe *u* into the tube *a* above the level of mercury therein and the dross then floats on the surface of the body of mercury which always remains above the piston which works in this tube and is thereby kept from again becoming mixed with the main body of the mercury.

From time to time the dross may be withdrawn either through the overflow outlet from the tube *a* which normally is closed by the plug *j* or by opening some other outlet provided for the purpose at a somewhat lower level at a time when the piston is held at the upper end of its upstroke.

If the pump be made of sufficient height a secondary vacuum pump may be dispensed with.

The action of the pump is as follows:—
When the piston *g* is forced downward mercury is caused to rise in the tube *b*, when it rises in this tube to above the level of the air inlet *z* it floats upward the valve *m* and mercury is thereby stopped from passing upward into the air inlet pipe *l*. As the mercury continues to rise it sweeps upward all air that is above it and discharges it past the valve *o* into the chamber *r*, some of the mercury being also caused to rise up into this chamber. A quantity of mercury equal to that which has been so caused to rise up into the chamber *r* flows down from the chamber through the overflow pipe *u* to the tube *a* above the level of the mercury therein. There is therefore always a column of mercury above the valve *o*. There is also always more than sufficient mercury above the piston *g* ready to flow downward through the piston past the valve *k* when the piston comes to the end of its upward stroke and fill any space which there may then be between the bottom of the piston and the surface of the mercury which is below the piston. At the end of each upward stroke of the piston there will always be a space below the piston to be thus filled with mercury from above the piston by rea-

son of some mercury on the previous down stroke of the piston having been driven past the valve *o* and conducted back to above the piston by the overflow pipe *u*.

In the above way I not only insure that a uniform quantity of mercury shall be forced past the valve *o* on each downward stroke of the piston but also insure that when the piston commences each downward stroke its under side shall be in close contact with the mercury below it so that when the down stroke commences the mercury below it will be started into motion without any blow or shock.

What I claim is:—

1. In a mercury vacuum pump the combination of a vertical tube or pump barrel, an air inlet pipe opening into the lower part of this tube or pump barrel, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, means for causing mercury to alternately flow downward from the tube or pump barrel to below the level of the air inlet and to rise up past this air inlet and to fill the tube or barrel and cause some mercury to pass the outlet valve into the upper chamber and an overflow passing from this chamber at a higher level than the valve.

2. In a mercury vacuum pump the combination of a vertical tube or pump barrel, a descending vertical air inlet pipe opening at its lower end into the lower part of this tube or pump barrel, a valve at the lower end of the vertical inlet pipe to prevent mercury from pressing up from the pump barrel into this pipe, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, means for causing mercury to alternately flow downward from the tube or pump barrel to below the level of the air inlet and to rise up past this air inlet and to fill the tube or barrel and cause some mercury to pass the outlet valve into the upper chamber and an overflow passing from this chamber at a higher level than the valve.

3. In a mercury vacuum pump the combination of a vertical tube or pump barrel, an air inlet pipe opening into the lower part of this tube or pump barrel, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, a second tube connected with the lower end of the first, a body of mercury filling the lower part of both tubes and the connection between them, a piston immersed in the mercury in the second tube, means for giving a to and fro reciprocating movement to this piston and an overflow passing from the upper chamber at a higher level than the outlet valve to the upper part of the second tube.

4. In a mercury vacuum pump the combination of a vertical tube or pump barrel, an air inlet pipe opening into the lower part of this tube or pump barrel, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, a second tube connected with the lower end of the first, a body of mercury filling the lower part of both tubes and the connection between them, a piston immersed in the mercury in the second tube, means for giving a to and fro reciprocating movement to this piston and an overflow passing from the upper chamber at a higher level than the outlet valve to the upper part of the second tube, a passage through the piston and a valve closing upward flow of mercury through this passage.

5. In a mercury vacuum pump the combination of a vertical tube or pump barrel, an air inlet pipe opening into the lower part of this tube or pump barrel, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, a second tube connected with the lower end of the first, a body of mercury filling the lower part of both tubes and the connection between them, a piston immersed in the mercury in the second tube, means for giving a to and fro reciprocating movement to this piston and an overflow passing from the upper chamber at a higher level than the outlet valve to the upper part of the second tube, a passage through the piston and a valve closing upward flow of mercury through this passage, a pipe carried downward from the upper

end of the second tube, a catch pit or mercury-trap at the lower end of this pipe and the suction pipe of a secondary pump passing from the upper part of the catch pit or trap.

6. In a mercury vacuum pump the combination of a vertical tube or pump barrel, an air inlet pipe opening into the lower part of this tube or pump barrel, an outlet valve at the top of the pump barrel always pressed downward toward its seat, an upper chamber into which the valve opens, a descending air inlet pipe opening at its lower end into the lower part of this tube or pump barrel, a valve at the lower end of the air inlet pipe, a second tube connected with the lower end of the first tube or pump barrel, a body of mercury filling the lower end of both tubes and the connection between them, a piston immersed in the mercury in the second tube, a stuffing box at the upper end of this second tube, a rod extending upward from the piston through this stuffing box, an overflow passing from the chamber above the pump barrel to the second tube at a level above the level of the mercury therein, a passage through the piston and a valve closing upward flow of mercury through this passage, a pipe carried downward from the upper part of the second tube, a catch pit or mercury trap at the lower end of this pipe and the suction pipe of a secondary pump passing from the upper part of the catch pit or trap.

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Witnesses:

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