(No Model.) 2 Sheets—Sheet 1.

G. E. DOW.

SINGLE ACTING CRANK PUMP.

No. 566,895. Patented Sept. 1, 1896.

Fig. 1.

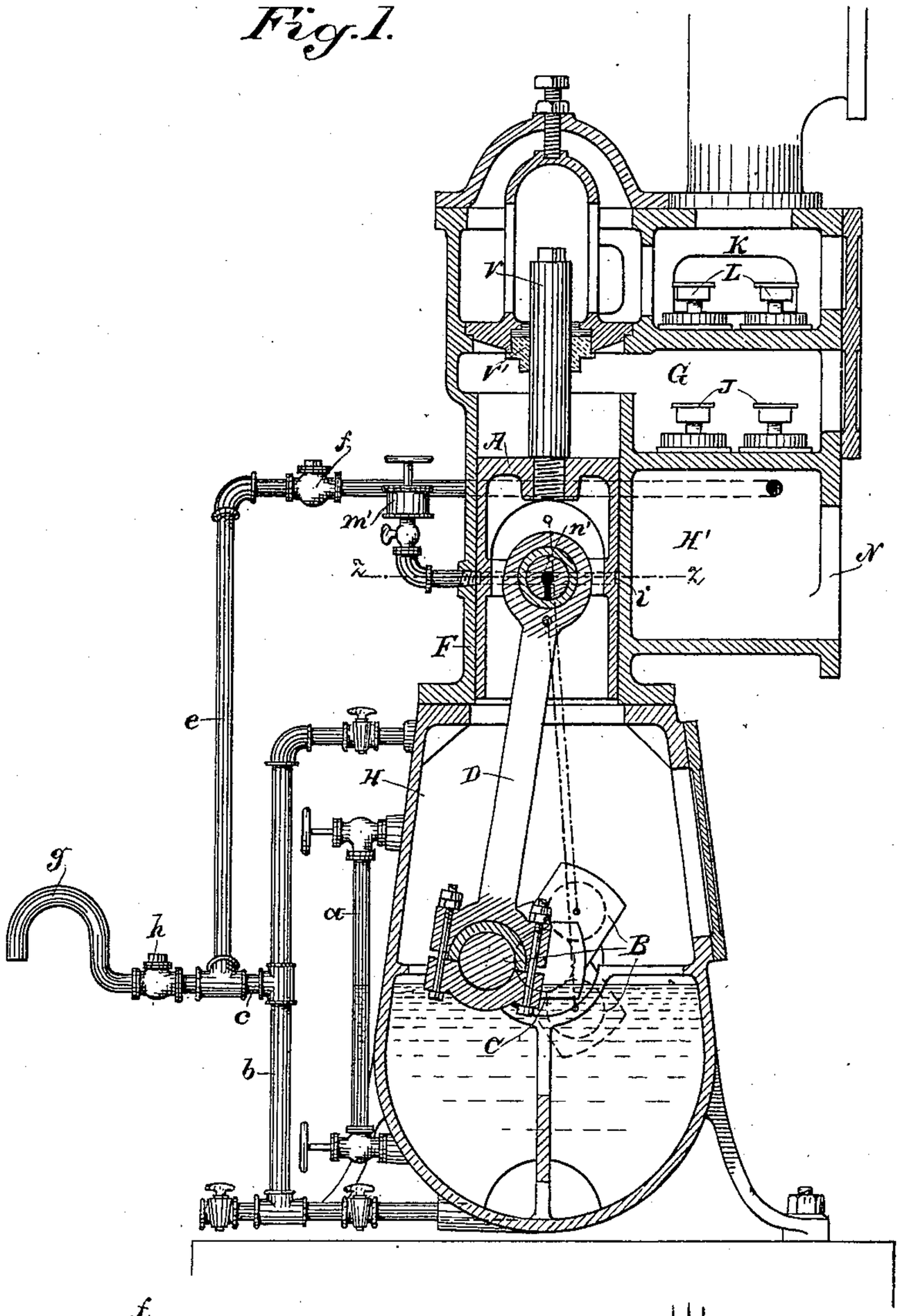
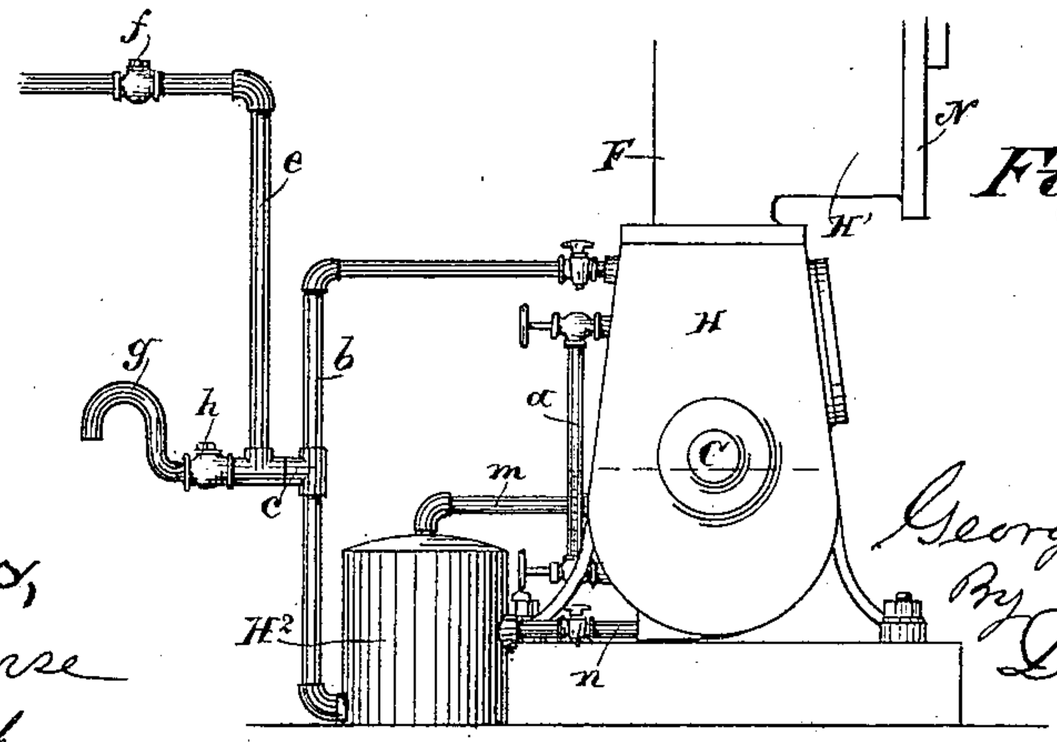


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

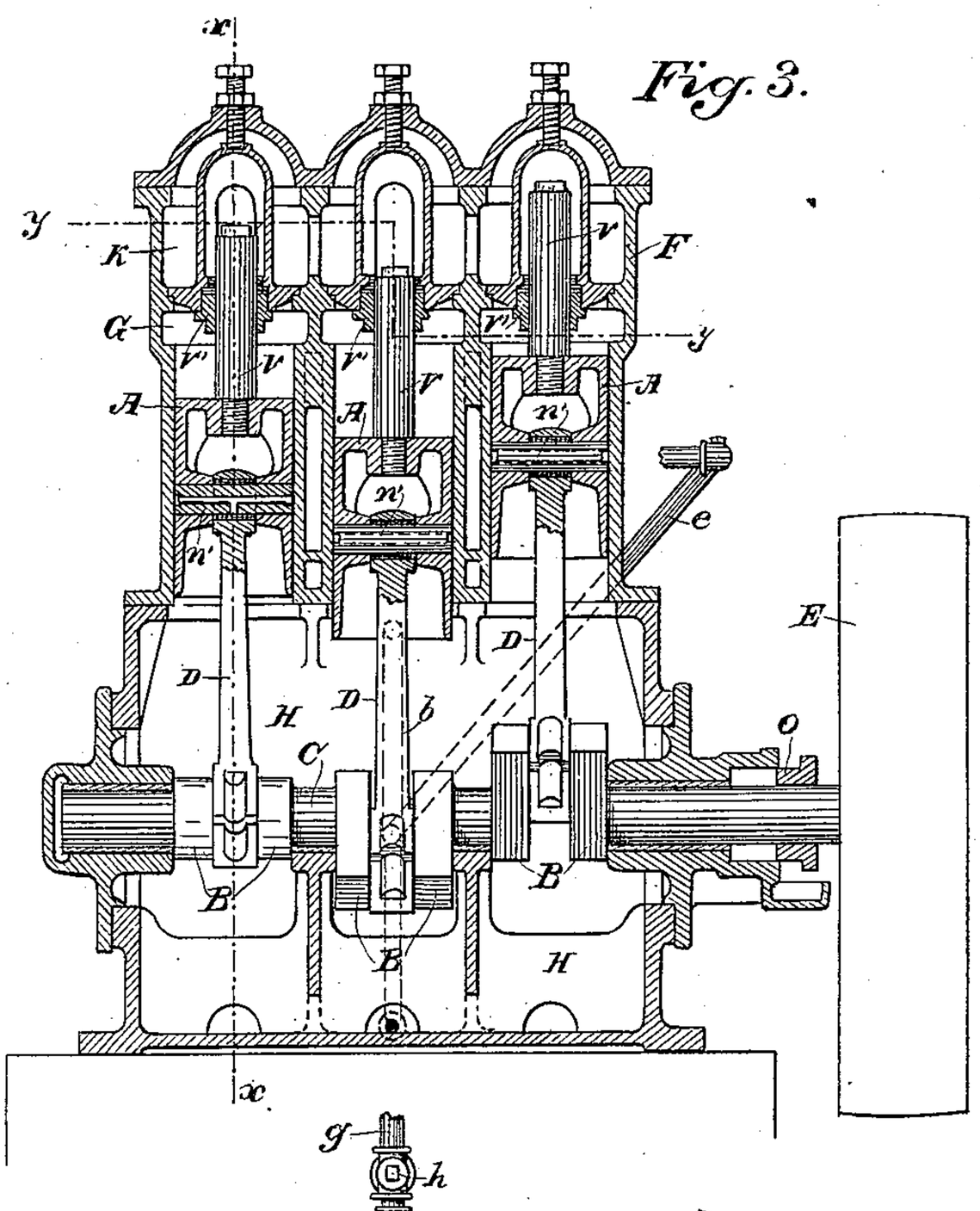


Fig. 4.

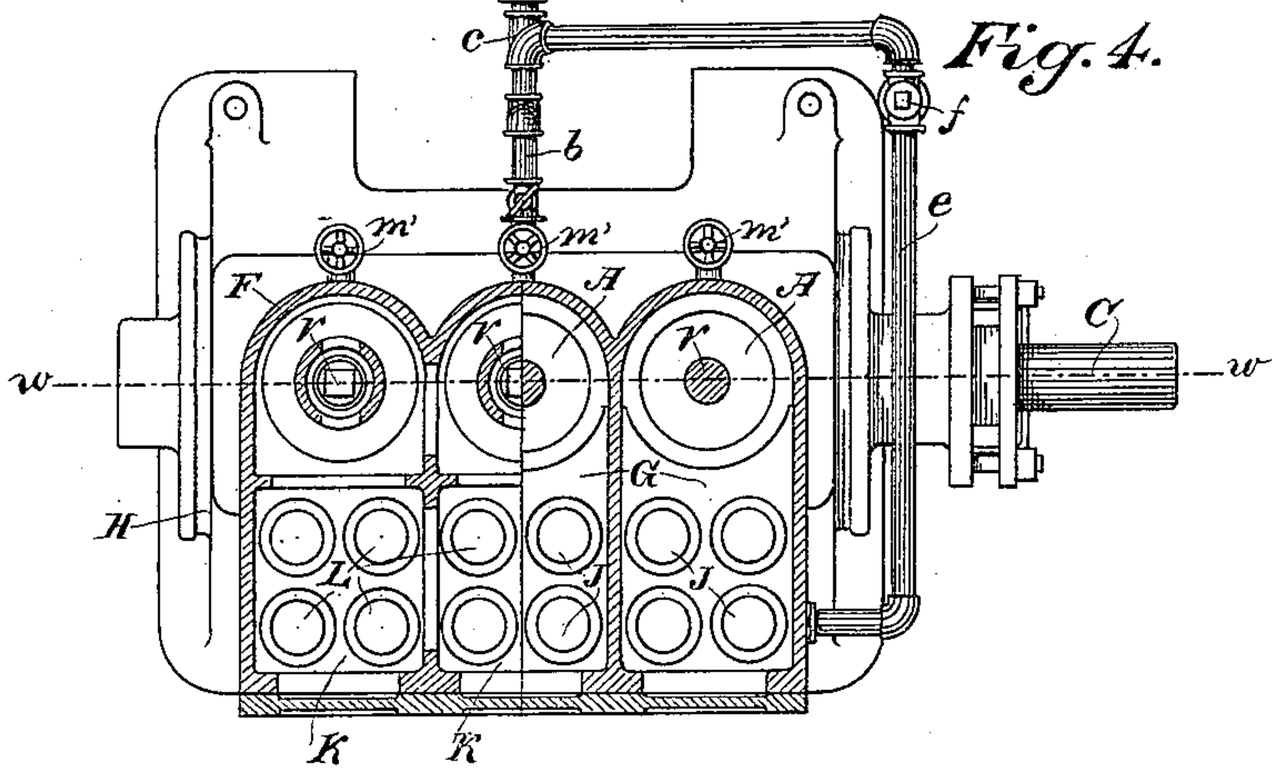
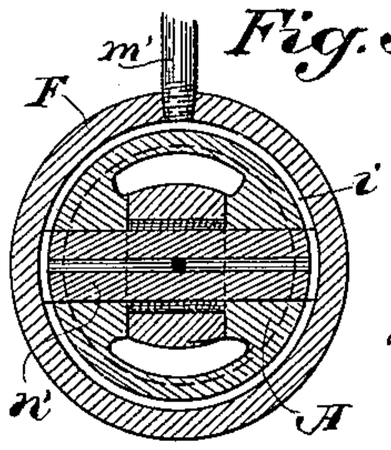


Fig. 5.



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UNITED STATES PATENT OFFICE.

GEORGE E. DOW, OF SAN FRANCISCO, CALIFORNIA.

SINGLE-ACTING CRANK-PUMP.

SPECIFICATION forming part of Letters Patent No. 566,895, dated September 1, 1896.

Application filed February 1, 1895. Serial No. 537,005. (No model.)

To all whom it may concern:

Be it known that I, GEORGE E. DOW, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Single-Acting Crank-Pumps; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to that class of pumps having a number of plungers known as "multiplex plunger-pumps."

It consists in the novel construction and combination of several parts and in details of construction, which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section transverse of the crank-shaft, taken through *x x* of Fig. 3. Fig. 2 shows the connection of a supplemental chamber with the crank-chamber. Fig. 3 is a vertical section taken through *w w* of Fig. 4. Fig. 4 is a horizontal section taken through *y y* of Fig. 3. Fig. 5 is a horizontal section on line *z z* of Fig. 1.

The object of my present invention is to provide a system of lubrication combined with automatic means for draining and preventing accumulation of water in the crank-case and maintaining the oil level or surface of the lubricant below the cranks, so that each crank will dip into the same, but that the pump-plunger shall not come in contact with the body of lubricating liquid within the case, and generally to simplify the construction and improve the general efficiency of the machine.

A A are plungers which are here shown as acting vertically and not less than three in number to maintain an even balance and pressure. It will be understood that the cylinders may be set at any angle with the vertical which will prevent the plungers from dipping into or acting upon the liquid in the crank-case. These plungers are driven from cranks B upon the crank-shaft C, which is journaled in the lower part of the containing-case, and the upper ends of the plungers are closed, so that there is no communication through them with the crank-case. This case H incloses all the operating parts of the pump. The cranks are set at equal distances apart upon the circle which represents their throw, and have a uniform throw or stroke. The plungers are connected with the cranks by connecting-rods D, and by means of a pulley E upon the end of the shaft or other mechanical equivalent power is transmitted to drive it, and through it the plungers. The plungers A are in the form of hollow cylindrical shells fitting the casings or sleeves F, within which they reciprocate. In the present case I have shown the suction-chamber H′ situated at one side of the plungers, and the liquid to be pumped is admitted into the suction-chamber through the inlet-passage N. The valves J open upwardly into the valve-chambers G, and these valve-chambers are connected with the upper open ends of the plunger-chambers above the closed plungers, so that the downward movement of each plunger will produce a sufficient vacuum within the valve-chambers to open the valves and allow the liquid to pass into the valve-chambers. Above the valve-chambers G are the discharge-chambers K, and delivery-valves L are fitted to open so as to allow the liquid to pass from the valve-chambers G into the delivery chamber or chambers, from which the liquid passes out through any suitable discharge-pipe. The plungers have vertical stems or extensions V, extending upwardly from their centers and passing through guides V′, which serve to steady the movements of the plungers, and as their upper ends enter the delivery-chamber they are subjected to such a pressure that they press down upon the crank and plunger pin connections and prevent pounding when running at high speed. It will be understood that the extensions V are not essential at low speeds, and can be omitted when a vacuum is maintained in the crank-case. Under such conditions the weight of the plunger and rods alone will keep the journals in contact.

The crank-chamber contains water and lubricant which is maintained at such a level that the cranks dash into it as they revolve, and my present invention is in part designed to automatically regulate the level of the lubricant, so that it will not rise so high as to be sucked into the pump-chambers and thus become lost by mingling with the water which is being pumped. A simple drain from the bottom of the chamber could be employed

and adjusted by hand without the vacuum in the case, but with a vacuum the operation becomes automatic.

a is a glass gage connected at top and bottom with the crank-chamber, and through this the level of the liquid or lubricant may be observed at any time.

b is a pipe or column connecting the top and bottom of the crank-case in such a manner that the liquid will be maintained in the pipe at the same mean level as that within the case H. At a point corresponding with this level a branch *c* connects the pipe or column *b* with a pipe *e*, which can be connected with one of the valve-chambers G or with the suction-chamber H′, so that a partial vacuum is formed in the case H corresponding to that found in the suction-chamber H′ of the pump, or in some cases this pipe may be connected with an independent pump, as will be hereinafter described.

f is a check-valve fixed in the pipe *e*, opening toward the pump-suction and closing so as to prevent a backward flow of liquid from any cause into the crank-case H.

g is a pipe opening outwardly from the pipe *b*, and *h* is a check-valve opening outwardly, which serves as a relief-valve for draining the accumulation of water when from any cause there is no vacuum in the case H. As the relative location of the pump suction-chamber H′ is above that of the crank-base H, it is evident that in order to force the water up the pipe *e* from H to H′ there must be an excess of pressure in H, and although the difference of levels is a matter of hardly more than a foot a difference of pressure or vacuum will be thus produced which is sufficient to perform the functions of removing the leakage of water and maintaining a vacuum in the case H approximating that of the suction-chamber H′.

The operation is best described as follows: Before the pump is started, *i. e.*, after being erected in working order, the crank-case is filled with water nearly up to the shaft-bearings. Then a few inches of oil is added, bringing the liquid-level up to a little above the pipe connection *c*, attached to column *b*. This is done through the hand-hole by removing a plate provided for that purpose. The pump is started and a vacuum formed in the suction-chamber H′ sufficient to lift the water from the source of supply. With the first motions of the pump the surplus water is drawn up the column *b* and pipe *c* to the suction-chamber H′ until it has been reduced to a level in the crank-case H corresponding to the top of the branch *c* in column *b*. Then the air will be drawn out from the crank-case down through the upper end of the column *b* and regurgitate up the pipe *e* against the head of water there sustained by slight excess of pressure necessarily retained in the crank-case H, which cannot escape. Thus the vacuum or pressure corresponds to the difference of levels, as before stated, and as the leakage from the plungers tends to raise the level of the liquid it at once escapes up the pipe *e* from the bottom of case H automatically as long as the pump is running and without further attention. It will thus be seen that when the apparatus is in operation the level of the liquid within the crank-case will rise to a line with the pipe *c*, and if at any time it rises beyond this point the vacuum within the suction-chamber H′ will act to draw off any surplus liquid and discharge it through the pump-valves with the other liquid. As this liquid is drawn from the bottom of the crank-case and as the oil used as a lubricant is lighter than the water, and consequently remains essentially at or near the surface of the latter within the crank-case, any surplus which accumulates in the crank-case, being drawn from the bottom, will be essentially the water and not the lubricant. Should it not be advisable from any cause to allow the water so drained from the crank-case to mingle with the water or other liquid being pumped, a separate pump may be employed to maintain a vacuum in the case and to which pump the crank drainage may flow. This would be advisable if the water was being pumped for domestic purposes or if any liquid was to be pumped which must be kept from the contamination of the oil.

If desired, the crank-case may be extended below the bottom or connected with a supplemental chamber H^2, as represented in Fig. 2, so as to provide for a larger accumulation of liquid within the crank-case, and the pipe *b*, connecting therewith instead of connecting directly with the crank-chamber, will draw off the surplus from this chamber.

m and *n* are pipes or passages connecting the top and bottom of this chamber with the crank-chamber, and any oil which may be so mixed with the water as to be carried into the chamber H^2 will return to the crank-chamber through the upper pipe *m*. By this construction a more effective separation of oil is effected because there is no agitation in this lower chamber. If by any reason when the pumps are at rest, or for other cause, the liquid within the crank-case rises above the level of the discharge-pipe *c*, it will flow outwardly through the check-valve *h*, and discharge through the pipe *g* until it again reaches the desired level.

In order to properly lubricate the plungers A, I have shown them grooved, as at *i*, and an oil-cup *m′*, containing lubricant, is connected by a suitable pipe through the side of the plunger case or chamber, so that oil may flow into this groove during the reciprocation of the plunger and thus lubricate its periphery. Openings are also made through the connecting-rod pins *n′* and communicate with grooves *i*, so that these are also lubricated from the same source. Any excess of oil received at this point will gradually work down through the plunger-case and drop into the crank-case below, and any water leakage

around the plunger will be received into the same case, the surplus being drawn off, as heretofore described.

The casing or sleeve in which each of the plungers works forms one continuous chamber, with the upper end communicating with the pump-chamber and the lower end communicating with the lubricant-containing chamber, and the construction and relative arrangements of the parts are such that as the plunger is acting upwardly and expelling liquid from the pump-chamber a small leakage film of the liquid being acted on tends to pass down around the plunger and drip into the lubricant-chamber in the crank-case, but on the opposite or descending movement of the plunger, when a partial vacuum has to be formed in the pump-chamber in order for the liquid to enter therein, lubricant is permitted to pass from the oil-cup *m'*, this action being largely because of the slight vacuum which exists during the downward reciprocation of the plunger. This oil from cup *m'* is drawn in in small but constant quantities, and entering the grooves and holes lubricate perfectly both the plunger and the connecting-rod pins *n'*. As the downward film of leaking induced by the forcing action of the pump-plunger far exceeds that of the suction action, there is, substantially, a downward flow communicating and delivering directly into the crank-case both oil and water in whatever proportion or combination they may be required for lubricating purposes. This system of lubrication and the construction which enables the desired result to be reached depends on the plungers being inclined above the horizontal to prevent the oil from the lubricant-chamber mingling with the liquid being pumped, also the practically constant downward leakage around the plunger, whereby a practically perfect lubrication, which greatly lessens the power to drive the pump, is obtained, and the lubricating material is prevented from coming in contact with the water being pumped and thereby rendering the water unfit for domestic and other purposes.

The main shaft C has a stuffing-box *o*, which prevents air from leaking in or liquid from passing out.

By maintaining a vacuum in the case H equal to that of the pump-suction it is evident that the plungers will be practically in equilibrium on the downward or suction stroke, so that the strains caused by the suction work or inertia of the plungers at high speed will not cause pounding in the parts, but the crank and plunger pins will be held in close contact, first, by the weight, and, second, by the discharge-pressure of the pump acting upon the upper ends of the guide-stems V, which, as before described, pass through stuffing-boxes into the discharge-chambers above, where they will receive this pressure.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A pump having an inclosed crank-case adapted to contain a lubricating liquid, a crank-shaft having cranks rotating within the case, plungers connected with the cranks and reciprocating in plunger-chambers at such an angle above the horizontal as to prevent the plungers from coming in contact with the liquid in the crank-case, suction and discharge chambers with intermediate valve-chambers connecting with the upper part of the plunger-chambers so that a vacuum is produced and the liquid moved through the valve-chambers by the reciprocation of the plungers, and pipes connecting with the top and bottom of the crank-case and with the suction-chamber.

2. A pump having a closed crank-case adapted to contain a lubricating liquid, a crank-shaft with cranks situated within the crank-case, plungers reciprocating at an angle above the horizontal and connected with said cranks, suction and discharge chambers, with intermediate valve-chambers connected with the upper part of the plunger-chambers so that the vacuum is produced and the liquid moved through the valve-chambers by the reciprocation of the plungers, a pipe connecting with the suction-chamber and with a pipe which unites the top and bottom of the crank-case, said pipe having a check-valve opening toward the suction-chamber and closing in the opposite direction whereby any surplus within the crank-case is removed through the suction-chamber.

3. In a pump, an inclosed case, a crank-shaft passing through it and having a stuffing-box to make a tight joint, plungers reciprocating in plunger-chambers at an angle above the horizontal, and connected with the cranks on the crank-shaft within the case, suction and discharge chambers and intermediate valve-chambers connected with the upper part of the plunger-chambers so that a vacuum is produced to move the liquid by the reciprocation of the plungers, a pipe having one end connected with a suction-chamber, a check-valve opening toward said chamber and closing in the opposite direction, a second pipe with which this pipe is connected, said second pipe connecting the top and bottom of the crank-case and a discharge-pipe leading outwardly from the point of connection having an outwardly-opened check-valve whereby any surplus liquid in the crank-case is discharged by gravitation when it rises beyond the desired point.

4. In a pump, a closed crank-case, plunger-chambers situated above and having plungers adapted to reciprocate therein, a crank-shaft with cranks within the crank-case and connected with the plungers, suction and discharge chambers and valve-chambers intermediate between them, and connected with the upper part of the suction-chambers, a pipe connected with the top and bottom of

the crank-case whereby the level of the liquid in the latter is maintained at the same level in said pipe, a second pipe connecting with this pipe at the level of the liquid having the opposite end connected with a suction-chamber whereby any surplus liquid will be drawn out from the crank-case and discharged while the pump is in motion, and means for lubricating the plungers and supplying lubricant to the crank-case, consisting of an oil-cup having a pipe communicating with the interior of the plunger-chambers, and plungers having grooved channels extending around the outside, adapted to receive the oil from the oil-cup, any surplus of which passes down the outside of the plungers and escapes into the crank-case.

5. A pump consisting of a lubricant-containing case, a crank-shaft journaled across said case, closed plungers connected with said cranks and reciprocating in plunger-chambers at an angle above the horizontal which prevents the plungers dipping into the liquid contained in the case below, pump-chambers with which the upper ends of the plunger-chambers connect, suction-chambers connecting directly with the pump-chambers and cut off from direct connection with the plunger-chambers, and suction and discharge pipes and valves.

6. A pump consisting of pump-chambers, suction and discharge chambers connecting therewith and intermediate valves, a lubricant-containing case below the pump-chamber, with a crank-shaft journaled across it, plunger-chambers connecting the lubricant-case with the pump-chamber at an angle above the level of the liquid in the lubricant-case, and having no connection with the suction-chamber and closed plungers connected with the crank-shaft and reciprocating in the plunger-chambers.

7. In a pump, an air-tight lubricant-containing crank-case with a crank-shaft journaled to revolve therein, valve-chambers above the crank-chamber, plunger-chambers, and closed plungers fitting therein and connected with the crank-shaft, a supplemental chamber having the top and bottom connected with the crank-case below the level of the contained fluid, a pipe or column connecting the top of the crank-case with the bottom of the supplemental chamber, and a branch pipe having one end connected with the column at the level of the liquid in the crank-chamber, and the other end with a vacuum-producing device whereby water and lubricant are separated, and the surplus water removed.

8. In a pump, a closed crank-case containing lubricant and water into which the cranks dash as they revolve, a vacuum-producing device and pipes connecting it with the crank-case, and an intermediate chamber connected at top and bottom with the crank-case below the level of the contained fluid, whereby surplus water passes into the supplemental chamber and is separated from the lighter oil by gravitation and removed by the vacuum apparatus.

In witness whereof I have hereunto set my hand.

GEORGE E. DOW.

Witnesses:
S. H. NOURSE,
H. F. ASCHECK.