No. 662,838. Patented Nov. 27, 1900.

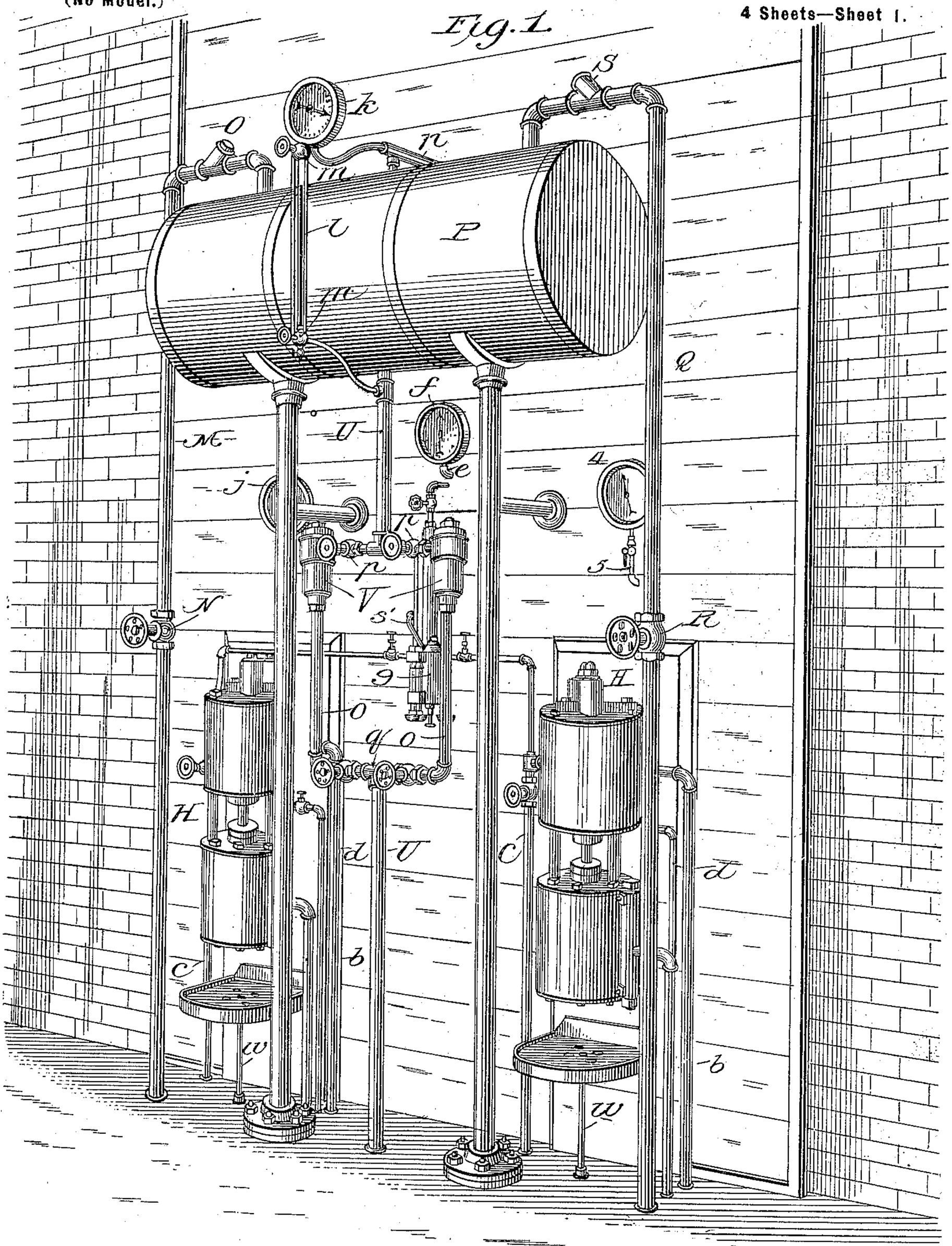
E. L. VANDRESAR & J. L. PILLING.

PNEUMATIC LUBRICATING SYSTEM.

(Application filed Mar. 19, 1898.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



Witnesses
Harry L. Robinson.
Wm. O. Dyer.

Inventors
Elmer L. Vandresar
James L. Pilling
by F. W. Rollins Jr. Attorney

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4 Sheets—Sheet 2.

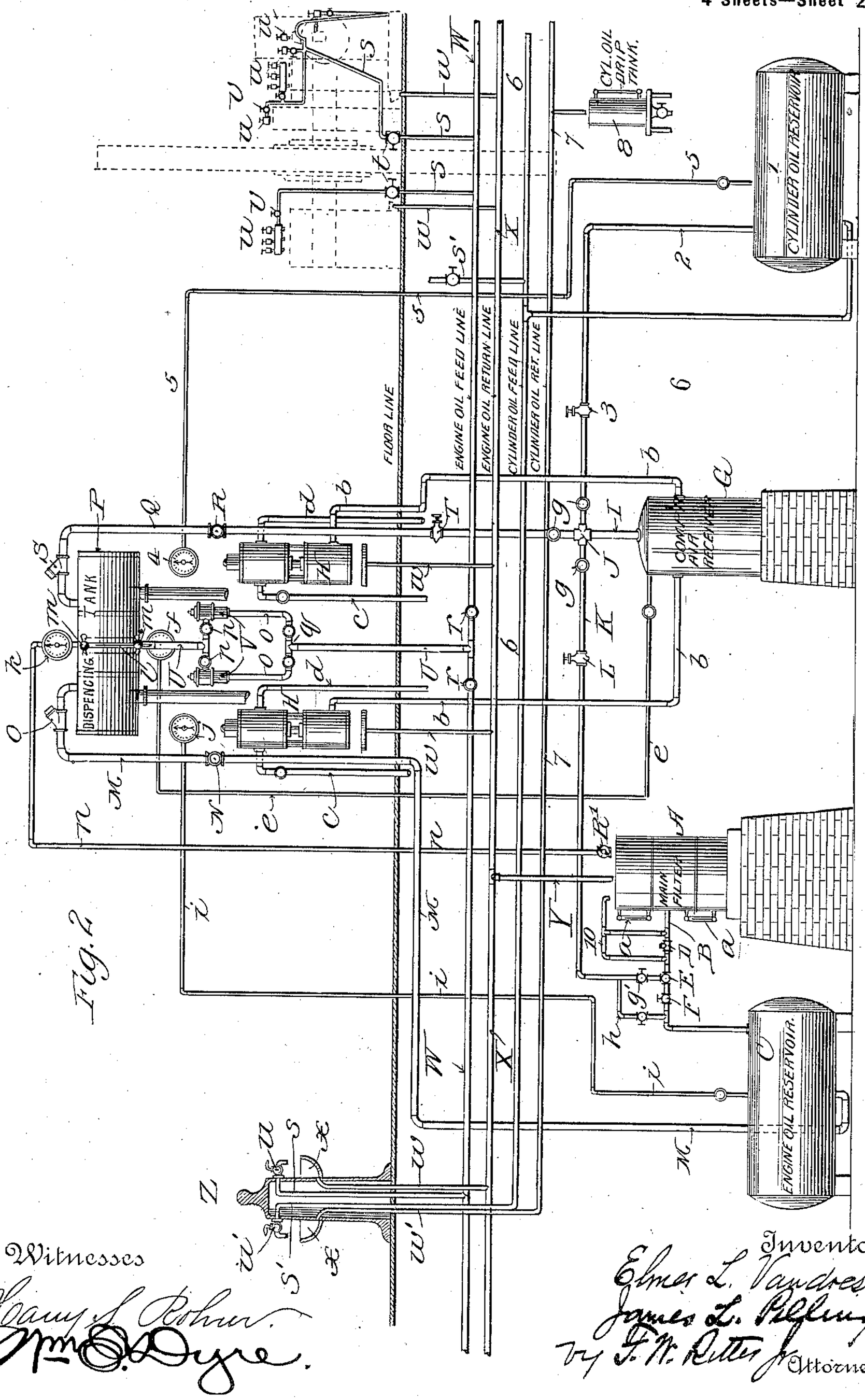


Fig. 2.

Witnesses
Harry L. Bohner.
Wm. O. Dyer.

Inventors
Elmer L. Vandresar
James L. Pilling
by F. N. Ritter Jr.
Attorney

No. 662,838.

Patented Nov. 27, 1900.

E. L. VANDRESAR & J. L. PILLING.

PNEUMATIC LUBRICATING SYSTEM.

(No Model.)

(Application filed Mar. 19, 1898.)

4 Sheets—Sheet 3.

Fig. 3.

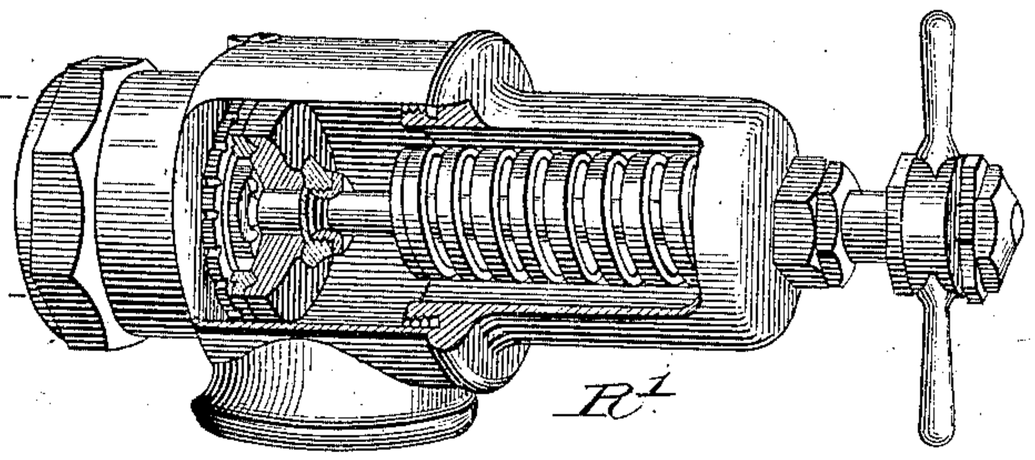


Fig. 4.

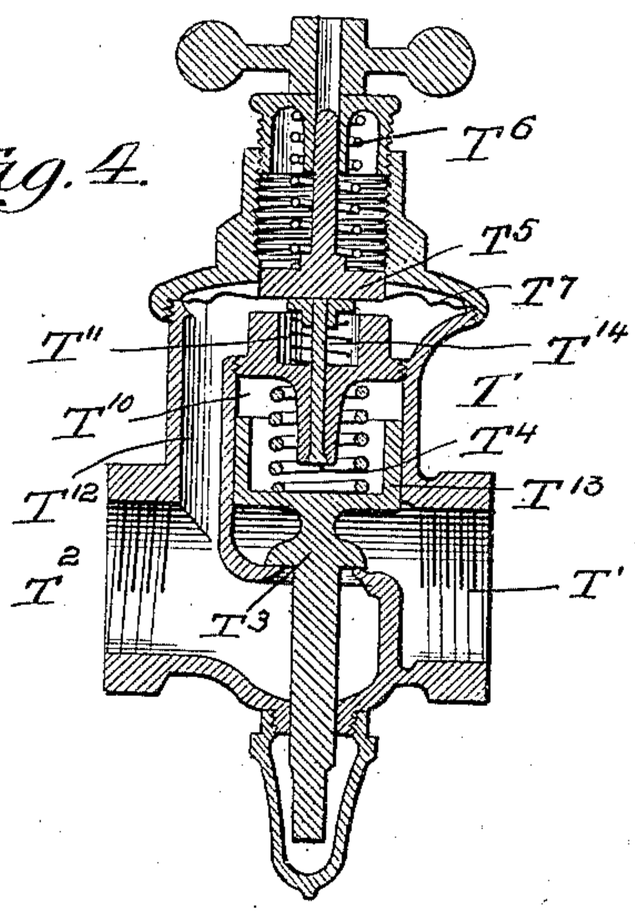


Fig. 5.

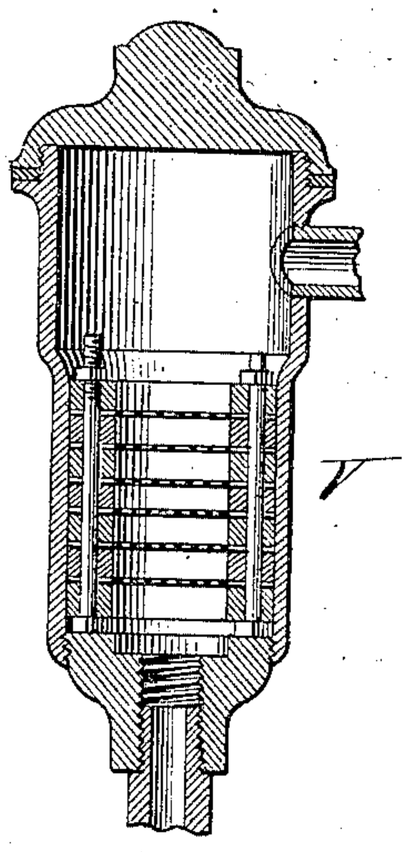


Fig. 6.

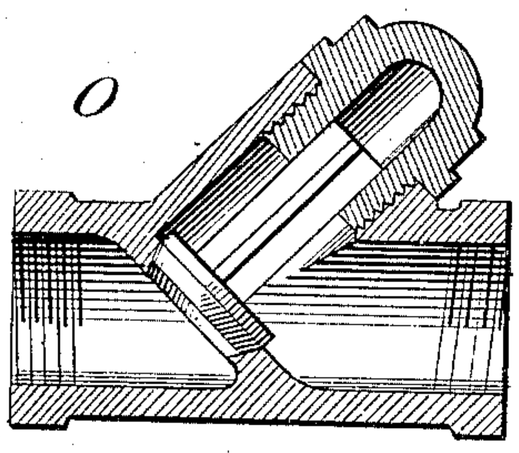
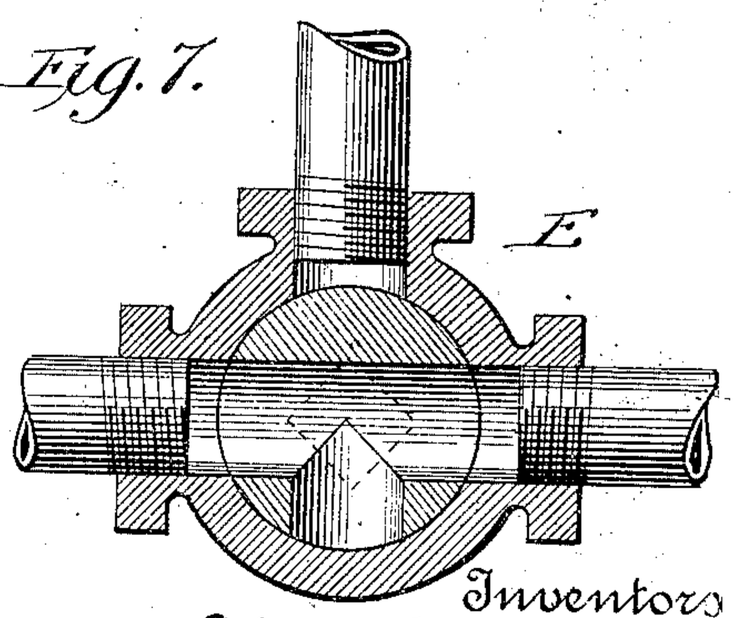


Fig. 7.



Witnesses

Harry S. Robertson.

Wm. C. Dyer.

Inventors

Elmer L. Vandresar

James L. Pilling

by F. W. Butler, Jr. Attorney

No. 662,838.

Patented Nov. 27, 1900.

E. L. VANDRESAR & J. L. PILLING

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4 Sheets—Sheet 4.

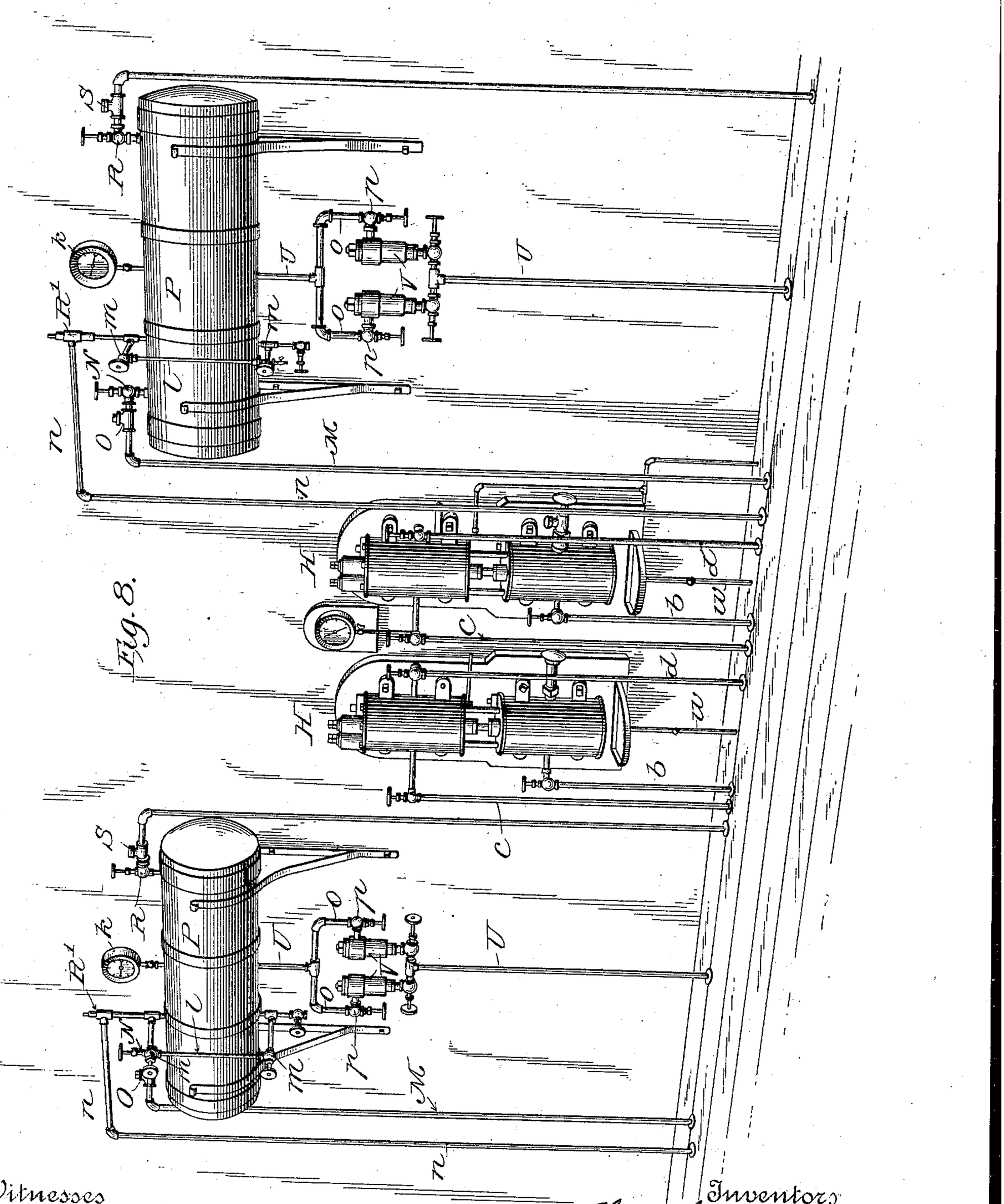

Fig. 8.

Witnesses

Harry S. Robson

Wm. O. Dyre.

Inventors

Elmer L. Vandresar

James L. Pilling

by F. N. Keller Jr Attorney.

UNITED STATES PATENT OFFICE.

ELMER L. VANDRESAR AND JAMES L. PILLING, OF CHICAGO, ILLINOIS.

PNEUMATIC LUBRICATING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 662,838, dated November 27, 1900.

Application filed March 19, 1898. Serial No. 674,502. (No model.)

To all whom it may concern:

Be it known that we, ELMER L. VANDRESAR and JAMES L. PILLING, citizens of the United States, residing at Chicago, in the county of Cook, State of Illinois, have invented certain new and useful Improvements in Pneumatic Lubricating Systems; and we hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to construct and use the same.

Our invention relates to improvements in lubricating systems; and it consists in an organized mechanical method and apparatus for feeding to the wearing parts of an engine or series of engines lubricants under pressure and subsequently saving or collecting such lubricants, also purifying and returning them to the system for further and continuous use.

For one of its objects our invention contemplates the employment of an oiling system in no wise dependent upon surrounding conditions, such as the height of a building or the rolling and tossing of a ship; a system which can be operated from above the machinery, below the machinery, or on a level with the machinery to be lubricated; a system which is compact in all essential parts and can be readily controlled from one central point of distribution, and a system which will insure a uniform, even, and steady supply of lubricants to the machinery under all conditions of service, feeding slowly upon one bearing, rapidly upon another immediately adjoining, or flooding all bearings throughout an entire plant, if necessary, without in the least detracting from the efficiency or economy of the apparatus.

As a further object this invention contemplates a systematic arrangement and combination of filters, storage and dispensing reservoirs, valved pipe-lines, and parts designed, arranged, and adapted to accomplish the purposes and objects above enumerated in manner and form as will later appear.

Heretofore various attempts have been made to supply the bearings and wearing parts of large steam and electric plants, steamships, or factories with a lubricant, such as mineral oil, from one central source of supply through the agency of suitable piping in direct communication with fixed oil cups or lubricators. To deliver the oil from such central source of supply, however, through said piping to the cups in a steady uniform manner required an unvarying motive power applied to the oil, and to meet this requirement various expedients have been resorted to with greater or less dissatisfaction. Steam-pressure has been tried, likewise water-pressure, ammonia, and the air-pump, and compressed air also has been employed, though in a system differing materially from the present. Steam-pressure and ammonia were soon abandoned because of their injurious effect upon the oil; water because of the difficulty in obtaining uniform pressure and its tendency to fill the tanks, pipes, &c., and the pump because of its intermittent uneven delivery, thus leaving only gravity and compressed air available for the purpose. Of these the former was found objectionable in the fact that it is limited to such places as could afford ample height above machinery for elevation of the feed-tank, while at the same time insuring to the elevated tank and intermediate pipe the same atmospheric temperature as at the oil-cups. Again, a large amount of oil was necessarily tied up in a gravity system at all times, and this would feed down with varying speed and pressure as the quantity of oil in the dispensing-tank diminished. To overcome these objections and to remedy these insufficiencies, then, is the purpose of the present invention, comprising the hereinafter-described arrangement and combination of parts, the general efficiency whereof may be said to reside, primarily, in the employment of an air-reduction valve interposed between the sources of air and oil supply or of equivalent means for regulating and controlling the effect of the former upon the later as a motive power.

The invention will now be particularly described and finally pointed out by the claims following.

In the accompanying drawings, which form part of this specification, and whereon the reference-letters employed indicate the same or corresponding features in the several views, Figure 1 represents in perspective the central point of distribution, embracing an elevated dispensing-tank or "fountain-head," valved oil and air pipes communicating therewith,

upright air-compressors, main oil-feed pipe, pressure-filters, and a headboard upon which are mounted the necessary pressure-gages. Fig. 2 is a diagrammatic view illustrating the principal features of the lubricating system, connected together by feed and return lines of piping, as applied to the wearing parts of a power-engine, of which but one is shown in dotted lines for purposes of illustration. In addition to parts shown and described in connection with Fig. 1 this sheet illustrates a main filter, an engine-oil-receiving reservoir, also a cylinder-oil-receiving reservoir, a compressed-air receiver, an oil-stand in controllable communication with said reservoirs, and a small drip-tank for returned cylinder-oil. Fig. 3 is a perspective view, partly in section, of a pop-valve for automatically relieving the oil-dispensing tank when pressure therein becomes greater than the maximum used for feeding purposes. Fig. 4 is a central longitudinal section of a reduction-valve, such as interposed between the main air-receiver, the dispensing-tank, and the oil-reservoirs. Fig. 5 is a central vertical section of one pressure-filter, on a reduced scale, showing its inlet-port, outlet-port, and intermediate removable screens or sieves. Fig. 6 is a sectional view of one check-valve as located in the oil and air supply pipes on either side of the oil-dispensing tank. Fig. 7 is also a vertical section illustrating an ordinary three-way cock (shown by Fig. 2) in the oil-discharge pipe adjacent to main filter. Fig. 8 represents in perspective a modified or double form of the invention, there being shown a dispensing-tank for cylinder-oil as well as for engine-oil, the arrangement of valves, pipes, connections, pressure-filters, and air-compressors being substantially the same as in Fig. 1.

Reference being had to Fig. 2 of the drawings and letters thereon, A indicates the main filter, into which engine-oil is delivered from a tank-wagon, barrels, or original packages. This filter is provided with suitable sight-gages *a a* for showing the depth of its contents, and discharges through pipe B, leading directly into an engine-oil reservoir C, while interposed between said filter and reservoir said pipe is equipped with a check-valve D to prevent back pressure upon the contents of filter A, a three-way cock E, through which flows the filtered oil, and a gate-valve F for cutting off all communication with the filter should occasion arise.

G represents a compressed-air receiver of liberal proportions, tapped by suitable air tubes or pipes *b b*, which latter in turn are in direct communication with duplicate air pumps or compressors H H above. These compressors are of well-known construction and may be actuated conjointly or independently by any well-known means, steam as a motive force being preferred, and, as illustrated, they are provided with inlet-ports *c c* and with exhaust-ports *d d*, connecting, respectively, with suitable steam supply and exhaust pipes. (Not shown.)

Leading from the top of the air-receiver G is a small pipe *e*, equipped with a suitable gage *f* for indicating the pressure in said receiver, and a second or delivery pipe I, fitted with a crow's-foot coupling J, to which may be connected a series of lateral air-pressure pipes, according to requirements. One air-pipe K thus connected to the coupling J has its opposite end threaded into the three-way cock E aforesaid and at each end is guarded by small emergency gate-valves *g g'*, while between these is interposed a reducing-valve L for regulating the air-pressure upon contents of engine-oil reservoir C by way of pipe B when the position of three-way cock E will permit. At the intersection of pipes B and K is a by-pass or valved cut-out pipe *h* for emergency or temporary use, and the valve L may be of any well-known construction capable of performing the functions for which intended, that illustrated by Fig. 4 of the drawings being selected merely for purposes of illustration.

Engine-oil reservoir C is provided with a small air-pipe *i*, terminating in gage *j*, and from below same reservoir is taken the main oil-supply line M, provided with a cut-off valve N and a check-valve O, both of ordinary construction and communicating above with the main dispensing-tank P, as shown by Figs. 1 and 2.

It will be seen that the compressed-air receiver G is directly connected with the oil-dispensing tank P by means of a vertically-arranged air-supply line Q, which, like the oil-line M, is equipped with cut-off and check valves R S, respectively, an emergency gate-valve *g*, of ordinary construction, and in addition is provided with an all-important air-reducing valve T, as shown by Fig. 2. By "reduction-valve" in this connection is meant one which will at all times give and maintain a predetermined pressure at points of utilization, regardless of variations in pressure at the source of supply. Applying this definition to the present invention we will presume the initial pressure in air-receiver G to be eighty pounds and that required to properly feed oil to and through the various cups and points of utilization to be twenty pounds. Reduction-valve T is positively set at twenty pounds, and this predetermined pressure will be uniformly maintained whether pressure in receiver G is increased beyond eighty pounds or decreased as low as twenty pounds, though, obviously, if the pressure in receiver G is allowed to fall below twenty pounds there will be no reduction, there being nothing to reduce. In like manner the action of valve T may be varied within a wide range to meet the requirements of existing conditions—such as consistency of the oils employed, climatic conditions, the number of lubricators in circuit, and their distance from the source of supply; but in

all cases the pressure will be constant and uniform after the reduction-valve is once set to the predetermined requisite pressure. The particular reduction-valve herein shown for purposes of illustration comprises a valve-casing T, pressure-chambers therein T^{10} T^{11}, inlet and outlet ports T' T^2, respectively, main and auxiliary valves T^3 T^4, each normally spring-seated, an adjusting-piston T^5, cushioned upon a surrounding tension-spring T^6, a diaphragm T^7, interposed between said piston and the protruding stem of auxiliary valve T^4, and a low-pressure duct T^{12}, communicating with the outlet-port T^2. With the foregoing arrangement it is quite evident that the variable pressure exerted by tension-spring T^6 is communicated through piston T^5 to the auxiliary valve T^4, the latter being slightly unseated so long as the pressure of said spring T^6 exceeds the back or low pressure in chamber T^{11}. Fluid under high pressure now being admitted to inlet-port T' first lifts main valve T^3 by acting upon its attached piston T^{13} of greater area. A portion of the fluid during this initial movement and at all times escapes around said piston T^{13} into the pressure-chamber T^{10} and may be conducted thence past the conical auxiliary valve T^4 and its reduced valve-stem T^{14} into the pressure-chamber T^{11} and through duct T^{12} to outlet T^2, the auxiliary valve T^4, as stated, being normally open. If now, however, the back or low pressure in duct T^{12} increases beyond the normal, this instantly serves to actuate diaphragm T^7 and project the graduating-piston T^5, set against stem T^{14} of valve T^4, the latter being partially or absolutely seated by the pressure in chamber T^{10}, augmented by that of the reaction-spring in chamber T^{11}. Valve T^4 being thus closed or partially closed it is obvious that the fluid constantly escaping past piston T^{13} into chamber T^{10} at once exerts pressure upon said piston, with the effect of closing or partially closing the main valve T^3, thus entirely shutting off or throttling same.

The dispensing-tank P is equipped with its individual pressure-gage *k*, gage-glass *l*, and cocks *m*. It also has an independent line of pipe *n* leading from its upper portion or air-space to and over the main filter A, where it is guarded by a graduated spring-pressed relief-valve R' of ordinary construction, as shown by Fig. 3. This valve R' works automatically to relieve the main dispensing-tank if perchance pressure therein becomes greater than that required for feeding purposes. Depending from the main tank P is the main oil-feed pipe U, having branches *o o*, in which are located duplicate pressure-filters V V, each flanked by small cut-off valves *p p*, whereby admission of the oil can be denied one or the other or both. An example of said auxiliary pressure-filters V is to be found in Fig. 5 of the drawings, comprising a series of perforated screens or sieves capable of ready removal for purposes of cleansing. This particular construction, however, in itself forms no part of the present invention. At *q* the branch pipes *o o* merge again into the oil-feed pipe U, forming a union below with the engine-oil-feed line W, which latter is capped at its extremities, properly guarded by valves *r r* at its entrance, and leads thence throughout the plant or factory, preferably below its floor-line, to the vicinity of each engine and machine in circuit. Out of this feed-line W are taken reduced lateral supply branches, such as *s*, running through controlling-valves, as *t*, and communicating with suitable oil-cups and batteries, as *u*, adjacent to the wearing parts to be lubricated, which in turn are themselves flanked by small individual valves *v*, as illustrated by Fig. 2.

Communicating with the usual sole or bed plates of engines, the eccentric pans, and other points of collection are branch return-pipes *w*, in open communication with the main engine-oil-return line X, by which the drip from all engines and machines in the system is returned by way of an outlet-pipe Y to the starting-point—the main filter A—as shown by Fig. 2.

Z indicates an oil-stand, of which there may be one or more located at convenient points in the engine-room or factory for supplying small quantities of oil in cases of emergency and for inaccessible squirt-can uses. These stands Z, like other points of utilization, are equipped with lateral supply branch pipes *s s'* from the oil-feed lines W X, respectively, and terminate in cocks *u u'*, from which oil may be drawn. They are also equipped with suitable drip-pockets *x*, communicating with branch return-pipes *w w'*, whereby all overflow is conducted to the oil-return lines X Y and thence to the filter A or drip-tank 8, as the case may be.

Thus far the description of the invention relates to the use of engine-oil as a lubricant; but it is evident that a heavier oil may be similarly employed by the same system and by substantially the same agencies for lubricating engine-cylinders, pumps, or other parts normally containing a low internal pressure. As is usually the case, this is accomplished by the aid of suitable "lubricators," which are substituted for the aforesaid oil-cups and batteries *u*. A main cylinder-oil reservoir 1, however, may be provided, as shown by Fig. 2, and cross-connected to the main compressed-air receiver G by means of the pipe 2, projected from the crow's-foot coupling J and running through a reduction-valve 3 for regulating the degree of air-pressure admitted to said reservoir 1. The numeral 4 represents an air-gage conveniently mounted upon the dispensing-tank headboard and connected with the cylinder-oil reservoir by an intermediate pipe 5 for indicating the pressure therein. Out of the bottom of this reservoir 1 is taken a cylinder-oil-feed line 6, which in this instance leads directly by means of branches to the cock *u'* in the oil-stand Z, previously

referred to, thus rendering accessible at all times a head of heavy oil for the filling of squirt-cans, &c., for hand introduction to cylinders and pumps through the agency of suitable lubricators. (Not shown.) Depending from the drip-pocket *x* of said oil-stand Z is to be seen a branch return-pipe *w'*, in open communication with a cylinder-oil-return line 7, discharging into a small drip-tank located immediately below or at any convenient point in the system, as at 8, for collecting all drip from the cock *u'*, which would otherwise be lost. It is also within the spirit of the invention to extend the cylinder-oil-feed line 6 and to equip it with a series of branch feed-pipes in direct communication with lubricators adjacent to each cylinder or pump to be supplied—as, for example, in Fig. 1 of the drawings, whereon is shown a double sight-feed lubricator 9 for supplying the steam end of air-compressors H H with cylinder-oil. Again, where the volume of work imposed upon the system will justify, cylinder-oil reservoir 1 and the compressed-air receiver G are each connected with a second dispensing-tank corresponding in all essential particulars with that heretofore described, as will be seen upon reference to Fig. 8, illustrating this embodiment of the invention.

Having thus described the general arrangement and construction of apparatus employed for carrying out this invention, we will now proceed to set forth its use and operation, selecting for this purpose the single system illustrated by Fig. 2 of the drawings.

Engine-oil having been introduced into main filter A from tank-wagons or other sources of supply is freed from its original impurities by filtration and flows thence through check-valve D, three-way cock E, and gate-valve F in pipe B to the main engine-oil reservoir C of liberal dimensions. The air-compressors H, one or both, are then called into requisition, forcing air into receiver G by way of interposed air-pipes *b*. Pressure in receiver G having been thus raised to the required degree is indicated upon air-gage *f* through pipe connection *e*, the valves *g g'* in air-line K are opened, and three-way cock E, partially rotated, with the effect of interrupting the flow of oil from filter A and simultaneously establishing connection between receiver G and reservoir C, whereupon contents of the latter are subjected to pressure from the former, as indicated by gage *j* at end of air-pipe *i*. Cut-off valve N in oil-supply line M is now opened, permitting passage of the engine-oil under pressure from reservoir C through check-valve O above and into the central dispensing-tank P, where its depth is at all times indicated by gage-glass *l*, guarded above and below by the cocks *m m*. If during the operation of charging the dispensing-tank P with oil or with air the pressure becomes greater than that required for feeding purposes, relief-valve R' in relief-pipe *n* automatically goes into action to relieve the dispensing-tank, which thereupon discharges back into the filter A, as shown, though it is by no means essential that the valve R' be located at the extremity of pipe *n*. Dispensing-tank P being now filled in the manner described, valve N is again closed and three-way cock E in pipe B returned to its normal position, thus cutting off the flow of air from receiver G to reservoir C and restoring communication between said reservoir and filter A. At this instant the reservoir C is relieved of its air-pressure, no longer needed, by way of the pipe B, in which it encounters check-valve D, and is thereby diverted through port 10, the latter discharging above the top of filter A, so that any particles of oil which may be siphoned from reservoir C during this air-discharging operation will be properly cared for. The oil in dispensing-tank P is now ready for distribution and accordingly valve R in main air-supply line Q is opened, permitting passage of air from receiver G through reduction-valve T, valve R, and check-valve S into the dispensing-tank aforesaid, where it constitutes the necessary motive power for feeding or distributing the oil. In the successful operation of this system as a whole the reduction-valve T performs the most important function of regulating to a nicety the degree of air-pressure admitted to dispensing-tank P, according to the requirements of surrounding conditions, but regardless of the excessive pressure in receiver G. It also establishes a relation between said dispensing-tank and receiver, which insures an unvarying feed of oil in response to an unvarying pressure at all times. Leaving dispensing-tank P by way of central feed-pipe U, the oil is admitted to either or both of the pressure-filters V, where it is cleansed of any foreign particles or matter which may possibly have escaped the main filter A. Continuing in its course, it is next forced through branches *o o*, merging again in pipe U below, and thence into the main engine-oil feed-line W past each engine, machine, or oil-stand to be served. From this feed-line W the oil finds outlets finally through supply branch pipes *s* and their terminal oil-cups and batteries *u*, by which it is delivered to parts requiring lubrication. This accomplished, the oil is next gathered by the sole or bed plates of the engines, the eccentric-pans, oil-pockets, &c., and returned by means of branch pipes *w* to the engine-oil return-line X, and thence by the depending outlet Y back to the main filter A, where it is cleansed and again circulated in like manner as before.

In the matter of supplying cylinder-oil under pressure to suitable lubricators and through these to the interior of cylinders or pumps irrespective of whether the supply be direct from the reservoir 1 to such lubricators, from said reservoir through an independent dispensing tank, as indicated by Fig. 8, or from the reservoir to oil-stands, as shown

in connection with Fig. 2, in either event the cylinder-oil reservoir 1 must first be partially filled with a suitable grade of lubricant. Valve *g* in pipe 2 is then opened, permitting passage of compressed air from receiver G through reduction-valve 3, whereby it is drawn down to the required degree of pressure before entering reservoir 1. The internal pressure of said reservoir 1 may now be read upon gage 4 at end of pipe 5 and serves to force contents of this cylinder-oil reservoir by way of the cylinder-oil feed-line 6 to point of utilization, which in Fig. 2 is the oil-stand Z, equipped with oil-cock *u'*. Any drip from this cock *u'* which may occur is promptly gathered by the drip-pocket *x* and conducted along the cylinder-oil return-line 7 to the small drip-tank 8, provided to receive and collect it.

In practicing or operating this improved system we by no means limit ourselves to the precise construction, location, or arrangement of parts herein shown and described, as various changes and modifications may be resorted to without departing from the spirit of our invention. The location of filters, reservoirs, receivers, controlling apparatus, and intermediate connections may be varied indefinitely according to requirements of various plants, steam ships, and buildings wherein the system is to be installed, and regardless of the relative location of parts to be lubricated, whether above or below the apparatus in part or in whole.

Having thus described our invention, its use and operation, what we claim, and desire to secure by Letters Patent, is—

1. In a lubricating system the combination with a dispensing-tank and a compressed-air receiver, of a reduction-valve and a check-valve interposed between said dispensing-tank and receiver for establishing a predetermined constant and uniform pressure in the dispensing-tank, substantially as described.

2. In a lubricating system the combination with a dispensing-tank and a compressed-air receiver, of a reduction-valve and a relief-valve for establishing and maintaining a predetermined constant and uniform pressure in said dispensing-tank, substantially as described.

3. In a lubricating system the combination with a dispensing-tank and a compressed-air receiver, of a relief-valve communicating with the dispensing-tank, and a reduction-valve interposed between said dispensing-tank and receiver for establishing a predetermined constant and uniform pressure in said dispensing-tank, substantially as described.

4. In a lubricating system the combination with a dispensing-tank and a compressed-air receiver, of an air-supply line connecting the two, a reduction-valve and a check-valve for governing the supply of compressed air, and a relief-valve communicating with the dispensing-tank, substantially as described.

5. In a lubricating system the combination with a dispensing-tank and a compressed-air receiver, of an air-compressor for charging said receiver, an air-supply line connecting receiver and dispensing-tank, a reduction-valve in the supply-line, and a relief-valve communicating directly with the dispensing-tank, substantially as described.

6. In a lubricating system the combination with an oil-reservoir, a dispensing-tank and an air-receiver, of interposed air and oil pipe connections, a relief-valve communicating directly with said dispensing-tank, and reduction-valves for governing the constant uniform delivery of compressed air from said air-receiver to the reservoir and dispensing-tank, substantially as described.

7. In a lubricating system the combination with an oil-reservoir, an oil-supply line containing a check-valve, a dispensing-tank, and a compressed-air receiver, of air-supply lines connecting the latter receiver with said dispensing-tank and reservoir, a reduction-valve interposed between the receiver and dispensing-tank for maintaining a constant uniform pressure in the latter, and a three-way cock between said receiver and oil-reservoir, substantially as described.

8. In a lubricating system the combination with a main filter, an oil-reservoir, a dispensing-tank and a compressed-air receiver, of a discharge-pipe between said filter and oil-reservoir, an oil-supply line containing a check-valve between the latter and the dispensing-tank, an air-supply line equipped with a reduction-valve between the air-receiver and dispensing-tank for maintaining a constant uniform pressure in the latter, and a valved air-pipe from the air-receiver to said oil-reservoir, substantially as described.

9. In a lubricating system the combination with a main filter, an oil-reservoir, a dispensing-tank and a compressed-air receiver, of a discharge-pipe connecting said filter and oil-reservoir, a check-valve, a three-way cock and an air-port in said filter discharge-pipe, an oil-supply line between said reservoir and the dispensing-tank, an air-supply line running through a reduction-valve between the dispensing-tank and air-receiver, and an air-pipe from the latter receiver terminating in the three-way cock aforesaid in filter discharge-pipe, substantially as described.

10. In a lubricating system the combination with a main filter, an oil-reservoir, a dispensing-tank and a compressed-air receiver, of air and oil pipe connections between said filter, reservoir, dispensing-tank and receiver, reduction-valves for controlling deliveries from said receiver, an oil-feed pipe leading from the dispensing-tank through a secondary filter, a main oil-feed line, and an oil-return line, the latter discharging into the main filter aforesaid, substantially as described.

11. In a lubricating system the combination with a main filter, an oil-reservoir, a dispensing-tank and a compressed-air receiver, of air and oil pipe connections between said filter,

reservoir, dispensing-tank and receiver, a reduction-valve located in each of the air-pipes for controlling deliveries from said receiver, an oil-feed pipe leading from the dispensing-tank, oppositely-disposed branches in the latter running through secondary pressure-filters, a main oil-feed line, and an oil-return line the latter discharging into the main filter aforesaid, substantially as described.

In testimony whereof we affix our signatures, in presence of two witnesses, this 17th day of February, 1898.

ELMER L. VANDRESAR.
JAMES L. PILLING.

Witnesses:
HORACE A. DODGE,
WM. E. DYRE.