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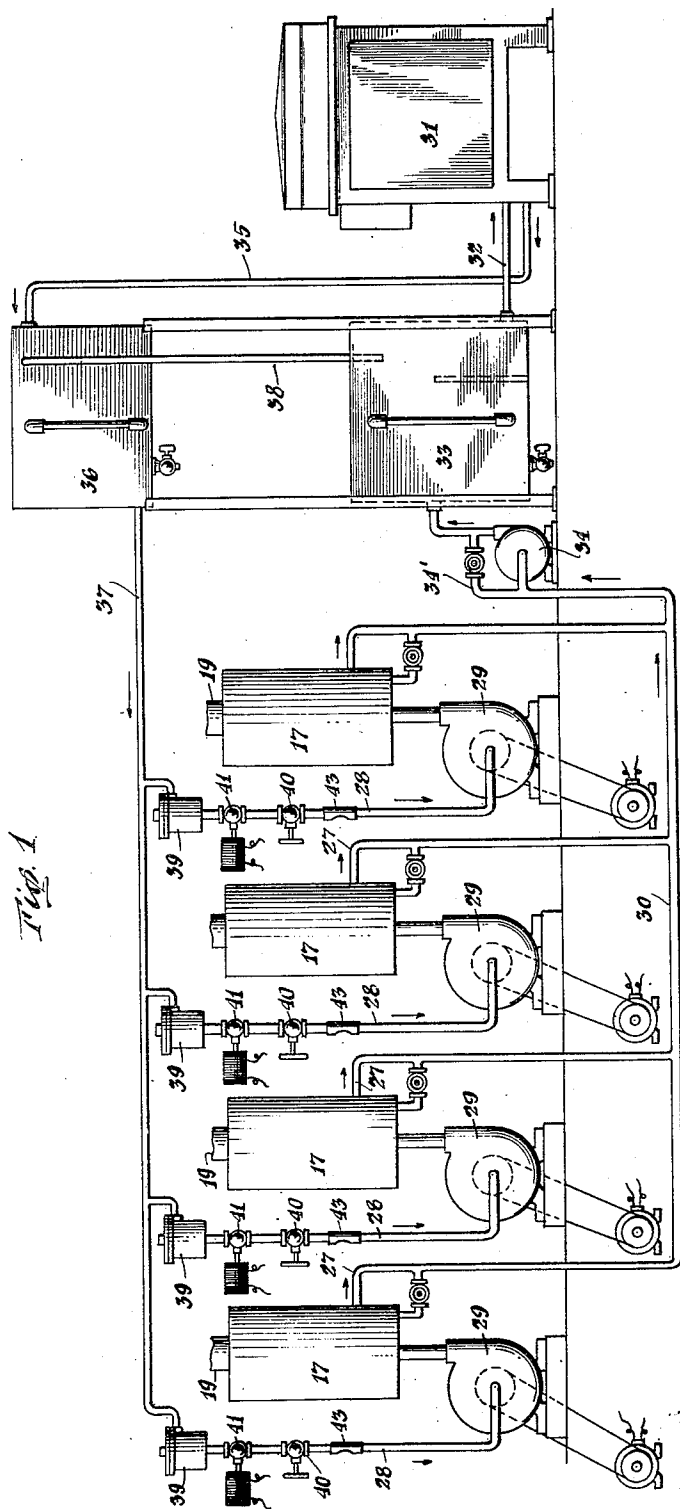
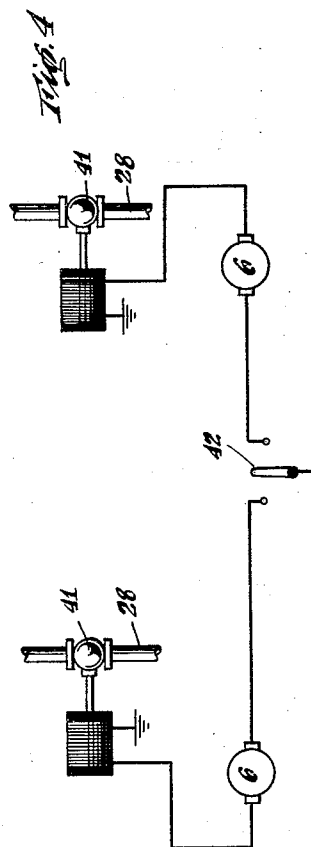
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2,451,098

OIL PURIFYING SYSTEM FOR VACUUM PUMPS

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3 Sheets-Sheet 1



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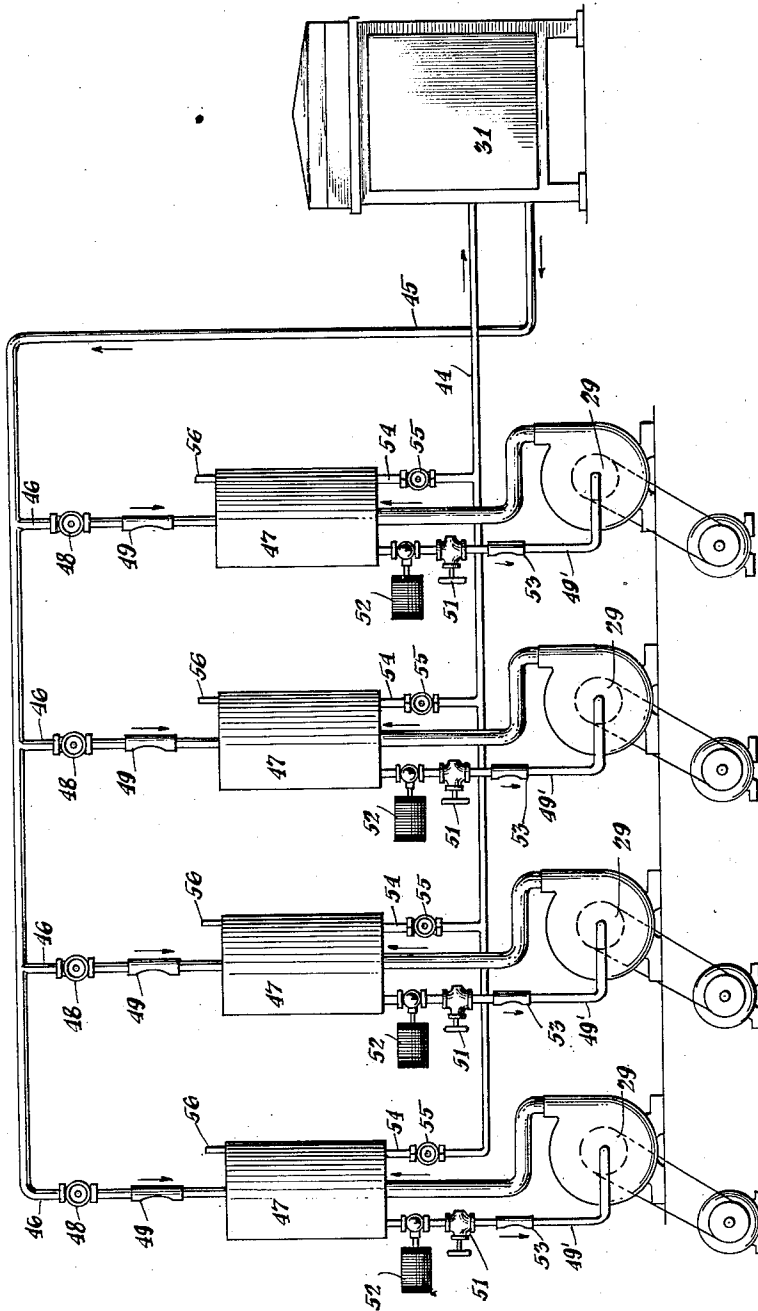


Fig. 2

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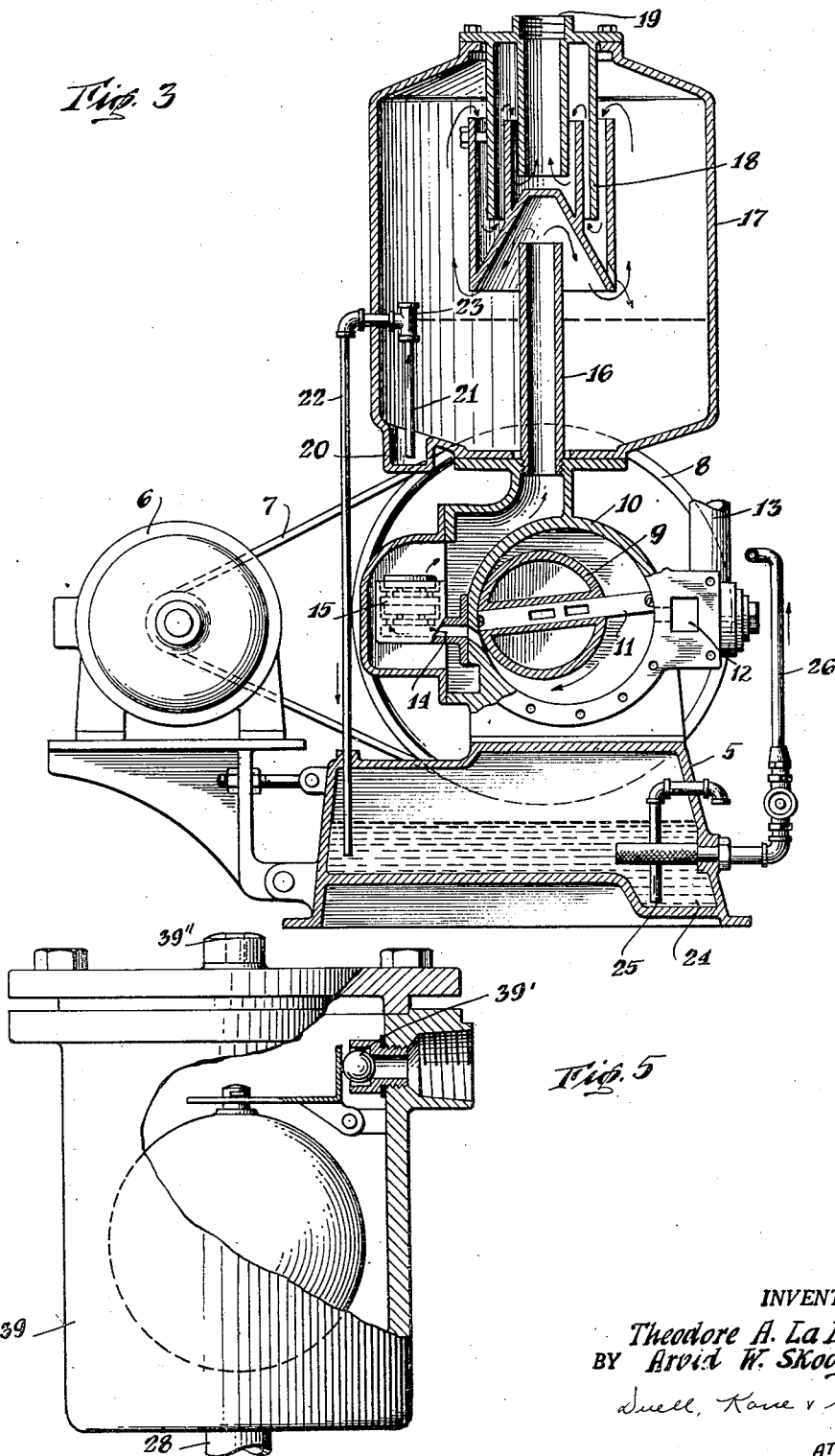
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3 Sheets-Sheet 3

Fig. 3



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UNITED STATES PATENT OFFICE

2,451,098

OIL PURIFYING SYSTEM FOR VACUUM PUMPS

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Application January 13, 1945, Serial No. 572,609

3 Claims. (Cl. 230—205)

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This invention relates to a functionally and structurally improved control system and in its more specific aspects aims to provide a system of this nature which will be of particular utility when employed in connection with oil reclaiming or purifying units.

This application is a continuation in part of the prior application for United States Letters Patent on "Control system" filed in our names on April 22, 1944 and identified under Serial Number 532,286, now abandoned.

By means of the present invention a system is furnished which, while capable of use in numerous different associations, is of primary utility when employed in combination with vacuum pumps. Thus used, it serves to control the purity, character and flow of the oil.

It is well appreciated that where vacuum pumps are employed to maintain a vacuum of high value, the parts should be adequately lubricated so that excessive wear does not occur. Also, oil is preferably utilized to promote a proper seal between the parts. However, in such systems, difficulties have been experienced in that despite attempts to remove from the oil foreign liquid and particles, such attempts have not been commercially successful. Therefore, it has been necessary to frequently change the oil in the pump system. This has, in aggregate, entailed large expense incident to the fact that oil has simply been thrown away. This expense is, of course, in addition to the expense involved in stopping the pump and not having it available for continuous work. Where it has been necessary to completely disassemble the pump and clean the parts thereof, a relatively protracted period of inoperation has been involved with consequent increased expense.

Where, due to the pressure of work or other factors, attempts have been made to continue the operation of the pump despite dilution of the oil and the entraining therein of particles of solid matter, difficulties have arisen incident to the maintenance of a proper vacuum by the pump. This has been most unsatisfactory, particularly where the pump has maintained a high degree of vacuum necessary for the process or treatment of materials and especially in a process where critical steps are involved requiring the maintenance of a substantially unvarying vacuum condition of high value.

By means of the present invention, a control system is furnished such that, without stoppage of the pumps and dismantling of the same, it has been feasible to maintain a high degree and desired value of vacuum for long periods of time.

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This result is achieved by reclaiming the oil either continuously or intermittently so that it will be substantially unnecessary to interrupt the operation of the vacuum pump or other consuming element of which the oil system forms a part. Thus, without waste, it is feasible to use and re-use the oil in the system and with no fear that foreign material will build up in the lubricant to detrimentally affect either the mechanisms of the pumps or the operation thereof.

Accordingly, it is an object of the invention to provide a control system by means of which the foregoing results may be achieved. Additionally, it is an object to furnish a system which may be operated by a relatively unskilled person to produce the desired results and so that the vacuum pumps or other units connected into the system may be operated with minimum shut-down periods.

Another object is that of furnishing a control system, the lay-out of which will be relatively inexpensive and simple aside from the fact that it may be applied to purifiers and reclaimers as heretofore constructed and also to pumps or similar units of accepted design without requiring alterations of these units.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating practical embodiments of the invention, and in which:

Fig. 1 is a somewhat diagrammatic view of a control system of one type;

Fig. 2 is a similar view of a second type of control system;

Fig. 3 is a sectional side view of a type of vacuum pump which may be employed in systems of the type shown in Figs. 1 and 2;

Fig. 4 is a representation of a part of the circuit which may be included in the general lay-out of apparatus herein illustrated; and

Fig. 5 is a side elevation of one of the control units included in the system as shown in Fig. 1 and with certain of the parts broken away to disclose underlying constructions.

As previously brought out, the present control system may be employed in different associations. However, it is primarily intended for use in connection with vacuum pumps and except where otherwise indicated in the annexed claims, the invention is to be considered as part of a fluid pressure differential system. One type of pump suitable for use in such a system has been shown in Fig. 3.

In that view, the reference numeral 5 indi-

cates a base which is preferably hollow and with which there may be associated an electric motor 6. By means of, for example, a belt 7, a pulley or wheel 8 is rotated. Secured to rotate with the latter is a rotor 9 extending within an eccentrically disposed chamber 10. This rotor is slotted and slidably mounts a vane 11. The rotor 9 being disposed to one side of and preferably in substantial contact with an area of the face of chamber 10 and the length of the vane 11 being substantially equal to the diameter of that chamber, it follows that with rotation of the parts the vane or valve will be rotated within the chamber and reciprocate with respect to the slot of the rotor 9.

An intake or suction line 13 connects with the chamber 10 through the inlet port 12 of the valve 11. The chamber 10 is also formed with an outlet 14. Connected to this outlet is a discharge valve 15 which preferably is immersed in oil. Beyond this point, the air passes through a tube 16 disposed within a casing 17. A series of baffles 18 are also arranged within the casing 17 and in advance of the outlet 19 thereof.

The casing 17 may be formed with a sump portion 20 into which the lower end of a tube 21 extends. The latter has heretofore ordinarily been connected with a tube 22 extending into the base 5. A fitting 23 may be furnished to provide a vent. Thus, siphoning is prevented. The base 5 may also be formed with a sump portion 24 from which a tube 25 extends for the purpose of discharging any water or other liquid which may collect in the sump 24. A line or lines 26 may connect with the base 5 and extend to points adjacent the pump bearings (not shown).

As will be apparent, with this mechanism operating to turn the rotor in a clockwise direction, the slide valve or vane will similarly rotate. As a consequence of such movement, it increases the vacuum space drawing the air into the chamber 10 from the inlet 13. Thus, a steady vacuum pull is created on this intake line. Simultaneously, the air space on the discharge side of the vane is steadily reduced forcing the air out through the exhaust port 14. Thence, it flows through the discharge valve 15, the line 16 and so out through the orifice 19 of the casing 17.

As will be apparent, oil will be supplied through the line or lines 26 and be forced (or drawn by suction) so as to be distributed to the several parts which should receive oil. In addition to lubricating these parts, the oil body will create a sealing film between the edges of the vane or valve 11 and the surfaces of the chamber 10. This will provide an effective seal to produce a vacuum of proper value. A great part of the oil will be dispersed throughout the air discharged through the outlet 14 and the tube 16; the oil particles appearing in the form of a "fog." As a consequence of the baffles 18 or their equivalents, this oil entrained within the air flow will be separated and caused to be deposited within the casing 17. When the height of the oil body within that casing reaches a proper point, the oil will flow through the tube or line 22 and so back to the base. This cycle will repeat indefinitely, but it will be observed that no siphoning through the line 22 will occur as a consequence of the vent furnished by the fitting 23.

If a more detailed disclosure of the pump structure is desired, reference may be had to the prior United States patent to Beach No. 2,200,198

on vacuum pump, issued on May 7, 1940. A pump of this type is ideally suited for use in the control system of the present invention. The only changes required are those, for example, hereinafter described and which include basically two factors. The first of these is that the tube 22 extending from the casing 17 does not directly connect with the base 5. The second is that the pipe 26 does not extend from the base 5. Rather, this latter conduit or system of tubes is fed by a source of fresh or clean oil supply.

Now referring to Fig. 1 in which a preferred form of the control system has been illustrated, it will primarily be observed that the pipes 27 correspond to the pipe 22. Likewise, the pipes 28 correspond to the pipe 26 in Fig. 3. A somewhat diagrammatic showing has been resorted to in this figure. Therefore, the illustration is to be regarded as interpretive rather than in a limiting sense. In this connection, it will be noted that only a single branch or lead 28 has been illustrated for each of the pumps 29 in that figure. Actually, these pipes may extend in a number of directions through branches to deliver oil to a plurality of desired and necessary points. Likewise, the pipes 27 have been shown as feeding into a single delivery conduit or tube 30. Actually, a materially different arrangement of the parts might be employed.

With further reference to this figure, the numeral 31 indicates an oil reclaimer and/or purifier. This may take the form of a lay-out of apparatus such as is illustrated, for example, in the prior United States patents to La Brecque 2,161,964 of June 13, 1939 and 2,336,021 of December 7, 1943. Such unit is supplied with oil by a feed line 32.

As will be well understood in the use of vacuum pump systems, it has frequently been found that as the oil is exhausted, there is a tendency to entrain air and sometimes gases in the oil. These gases and air originate from the material which is being processed. Thus, it is apparent that the unit 31 should embody the function of completely removing foreign matter, liquids and gases, so that the oil will be purified and maintain a proper seal, thus allowing the connected pump to produce high vacuum values.

Interposed between the line 30 and the line 32 may be a tank 33. This tank serves the function of an accumulator and receives the oil discharged from the pumps 29. A baffle may be associated with the tank and also various forms of outlets, sight glass and other desirable accessories may likewise be provided. A pump 34 may be disposed in advance of the tank 33 and connected with the line 30. This pump may have associated with it a valve by-pass line 34'.

From the apparatus 31 the cleaned and purified oil is discharged through a line 35. This line or pipe connects with a receiving tank 36 within which a body of clean oil is accumulated. A further line or pipe 37 may extend from the tank 36 and connect with the lines or pipes 28. An overflow pipe 38 acting as a safety line may extend from the tank 36 to, for example, the tank 33. Also, the former tank is preferably provided with a sight glass.

Interposed between the line 37 and the points at which the lines 28 supply oil to the pumps are units 39 and valves 40. The units may take one of several different forms. Conveniently, they are of the type shown in detail in Fig. 5. As therein illustrated, float-controlled valve assemblies 39' are disposed adjacent their inlets

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and their covers are provided with vents 39". Branches of the line 37 are connected to their inlets while the lines 28 are individually connected to their outlets, preferably situated in their base portions.

The valves 40 are preferably of the needle type or otherwise constructed so that a proper flow of oil to the consuming units or pumps may be maintained irrespective of the viscosity or body of the latter. Therefore, the flow of oil will never be excessive. This is to be avoided in that the greater the flow of oil, the greater will be the decrease in vacuum. Just sufficient oil should flow to assure of proper lubrication and sealing effect. Control is assured in this connection by the provision of the units 39 or their functional equivalents. As will be apparent, these units serve to provide a proper head or pressure of liquid which will constantly be maintained.

Thus, with units 39 disposed in properly elevated condition with reference to the pumps with which they are associated, it is apparent that oil will be fed into the same through line 37 until the float-controlled valve mechanism 39' closes. Thereupon, further entrance of oil will be prevented. The vent 39" allows air to flow out of the casing 39 while the latter is being filled with oil through the branches of line 37 and also prevents any air lock being created prior to the opening of the valve mechanism 39' but as liquid feeds from the unit 39 to the line 28.

Preferably interposed between the valves 40 and the units 39 are solenoid controlled valves 41. As especially shown in Fig. 4, the solenoids of these valves should be related to the circuits of the motor 6 by means of a switch or switches 42. As is obvious, when the switch 42 is closed, so that current may flow to a motor to cause operation of a corresponding pump, current will also flow through the coil associated with the valve 41 connected to the line 23 of that pump. Therefore, this valve will open and oil will be free to flow subject only to the control exercised by the adjacent valves 40. As soon as the motor ceases operation as a consequence of opening of the switch 42, the valve 41 will close. Therefore, no further oil flow will occur and a flooding of the parts will be prevented.

Thus, with a system of the type shown in Fig. 1, it is obvious that the oil will be subjected to, for example, only a single passage through the vacuum pump or other consuming unit. Thereupon, the oil will be purified. Only then may it again flow to the units. More particularly, the oil will be discharged through the lines 27 and preferably by gravity to the tank 33. If—as shown in this figure—gravity is not depended upon, then a pump 34 may be employed to cause the desired flow. The use of such a pump will be of particular assistance, especially if the oil be gummy or in chilled condition.

Either continuously or intermittently, the oil will be withdrawn from the tank 33 and passed through unit 31. As it leaves the latter in clean and usable condition, it is caused to flow to tank 36. From this reservoir, it flows through the line 37 back to the vacuum pumps or other units. Sight glasses 43 may, of course, be interposed in each of the lines 28 so that the supply of fresh oil to each pump may be observed. If any increase or decrease in flow is necessary, this may be effected by the valves 40 or their equivalents. However, in no event, will the oil be fed to the pumps under varying conditions of pressure; the units 39 serving to always maintain proper head

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and pressure conditions. This completes the cycle of operation in that immediately the oil flows from the casing 17 it must again pass through the reclaimer or purifier 31 before it may flow through the supplying lines 28.

Thus, no shut-down of any of the units is required to permit a renewal of the oil which flows through them. Rather, they may operate continuously. It has been found as a result of the present system that compared to prior technique the pumps may be continuously operated for remarkably long periods of time without requiring any shut-down for purposes of cleaning. Also, the quality of the seal provided by the fresh and continuous circulation of the oil is such that the degree of vacuum produced and maintained by these pumps is of the desired high order free from any fluctuations. Thus, constant adjustments and compensations in apparatus connected to the intake 13 do not have to be made and the product will be uniform insofar as the vacuum conditions contribute to such a result.

Now referring to the system illustrated in Fig. 2, it will again be seen that the numeral 31 indicates a reclaimer, purifier or equivalent apparatus, preferably of the type shown in the prior patents afore-mentioned. The reference numeral 29 indicates motor driven pump units of the type afore-described. A line 44 extends to the unit 31 and a line 45 extends from the same. Branches 46 extend one to each of the pump units and especially the casings 47. These branches 46 are connected to the line 45. The casings 47 preferably correspond to the casing 17, although it is, of course, obvious that this construction may be varied. Control valves 48 may be interposed one within each of the branches 46. Sight glasses 49 may be disposed between the tanks or casings 47 and the valves 48.

Oil supply lines, including any desirable number of branches 49', may extend between the casings 47 and the pump units 29. Within these lines, manually controlled valves 51 and solenoid controlled valves 52 may be interposed. Further sight glasses 52 may be arranged beyond the valves 51. Branches 54 extend from the casings 47 and have shut-off valves 55 interposed therein. These branches are connected to the supply line 44. Finally, with reference to the system illustrated in Fig. 2, it will be observed that especially if the tanks 47 be in the nature of auxiliary containers rather than corresponding to the tanks 17 vents 56 conveniently extend from them and so that no air locks will occur.

In a system of this type and with the pumps operating, the valves 52 will be open and the operator may adjust the valves 51 to control the flow of oil according to conditions of viscosity, temperature, body, etc. In making this adjustment, he may, for example, observe the oil flow through the sight glasses 53. The valves 48 will normally be closed. The oil, after properly lubricating and providing the seal within the pumps, will be entrained in the discharged air and be deposited within the tanks 47. From these, it will again flow through the lines 49' to repeat the cycle of operation.

Assuming that it is desired to clean the oil within one of the tanks 47, all that will be necessary will be for the operator to cause the unit 31 to function. At the same time, the valve 48 associated with the tank 47 in which the oil is to be renewed is opened. It will be borne in mind that the capacity of the unit 31 is not suffi-

ciently great to immediately exhaust all of the oil from the tank in question. Likewise, this tank will be connected to the tanks of adjacent pumps through its branch 54 and the line 44 with the valves 55 of these tanks open. This should be the normal condition of these valves 55 so that in the event of any free water being present in the oil in tanks 47, this water will settle to the bottom of the tank and pass out through line 54 and finally through the header 44 to the reclaimer 31. Therefore, with the oil seeking its own level, oil will remain within the tank 47 to an extent such that there will be no danger of lubrication and seal failure occurring within the pump connected to that tank.

As the oil is purified and reclaimed within the unit 31, it will be discharged through the line 45. With the valve 48 of the particular branch 46 which is connected to the tank in question open, fresh and clean oil will be discharged into that tank. This clean oil will serve to expel from the tank any remaining old or dirty oil. The latter will be forced through to the unit 31 and as rapidly as such unit may receive the same. Therefore, it is obvious that the tank 47 will eventually be completely filled with clean oil. When this has occurred, the valve 48 in advance of the same should be closed. Thereupon, if desired, the corresponding valve of an adjacent tank may be opened so that the entire operation may be repeated. It must be borne in mind that oil will be displaced from tanks 47 only equal to the quantity delivered into these tanks. Therefore, assuming all valves 55 are open and only one valve 48 is open, if oil is removed from one tank 47 at the rate of 1 gallon per minute and it is returned to the tank at the rate of 1 gallon, then the level in the tank will not change. The other tanks will not be affected, because oil will not be removed or delivered to them. However, if there should be any water present in the oil in any of the other tanks, this water will settle to the bottom and flow out to the reclaimer 31, as described in the foregoing.

While in each of the views only four vacuum pumps have been illustrated, it is apparent that no matter how many of these units are disposed adjacent each other the oil may be effectively cleaned. In the type of system illustrated and described in Fig. 1, the oil will only pass through the mechanism one time. In the type of apparatus shown in Fig. 2, it would, of course, be feasible to constantly replace with clean oil the oil in the tanks 47. However, under normal conditions, the pumps 29 will be permitted to operate for certain lengths of time. Only then will one of these tanks be emptied and the oil cleaned and reclaimed by opening the valve 48 associated with that tank.

In conclusion, it will be understood that various alternative units may be employed in lieu of the particular apparatus shown in the prior La Brecque patents. However, it is preferred that they embody the functional characteristics of the apparatus disclosed in those patents. In this connection, it is to be noted that not alone should the oil have particles of foreign matter and liquid such as water removed from its body but also it should be degasified and deaerated.

Thus, among others, the several objects of the invention as specifically afore-noted are achieved. Obviously, numerous changes in construction and rearrangements of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

We claim:

1. In combination a plurality of motor driven vacuum pumps, each including relatively movable parts sealed and lubricated by oil and each having a port through which air, gases and entrained oil particles are exhausted, means connected to the ports of each pump for removing the entrained oil particles from the exhaust gases and air, means providing a collecting space for such removed particles, a series of conduits connected one to each of said collecting spaces, a single oil reclaimer connected to said conduits, said reclaimer including filtering means, means for removing volatile foreign liquids from the oil and means for passing liquids through said reclaimer, a further series of conduits extending from said reclaimer in an elevated plane and to said pumps, a series of solenoid controlled valves above and individual to said vacuum pumps for controlling the flow of oil from said latter conduits to each of said pumps and said solenoids being connected in circuit with the motors of said pumps to open said valves when said motors are operating.

2. In combination a plurality of motor driven vacuum pumps, each including relatively movable parts sealed and lubricated by oil and each having a port through which air, gases and entrained oil particles are exhausted, means connected to the ports of each pump for removing the entrained oil particles from the exhaust gases and air, means providing a collecting space for such removed particles, a series of conduits connected one to each of said collecting spaces, a single oil reclaimer connected to said conduits, said reclaimer including filtering means, means for removing volatile foreign liquids from the oil and means for passing liquids through said reclaimer, a further series of conduits extending from said reclaimer in an elevated plane and to said pumps, a series of solenoid controlled valves above and individual to said vacuum pumps for controlling the flow of oil from said latter conduits to each of said pumps, said solenoids being connected in circuit with the motors of said pumps to open said valves when said motors are operating and automatically operating units disposed in advance of said valves and functioning to control the amount of oil available for passage through said valves.

3. In combination a plurality of motor driven vacuum pumps, each including relatively movable parts sealed and lubricated by oil and each having a port through which air, gases and entrained oil particles are exhausted, means connected to the ports of each pump for removing the entrained oil particles from the exhaust gases and air, means providing a collecting space for such removed particles, a series of conduits connected one to each of said collecting spaces, a single oil reclaimer connected to said conduits, said reclaimer including filtering means, means for removing volatile foreign liquids from the oil and means for passing liquids through said reclaimer, a further series of conduits extending from said reclaimer in an elevated plane and to said pumps, a series of solenoid controlled valves above and individual to said vacuum pumps for controlling the flow of oil from said latter conduits to each of said pumps, said solenoids being connected in circuit with the motors of said pumps to open said valves when said motors are operating and a tank interposed between said reclaimer and the first-named series of conduits, said tank serving as an accumulator for the oil

discharged from said vacuum pumps and in process of flowing to said reclaimer.

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