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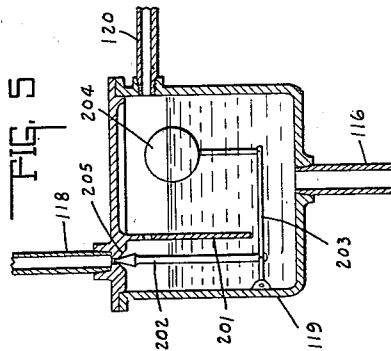
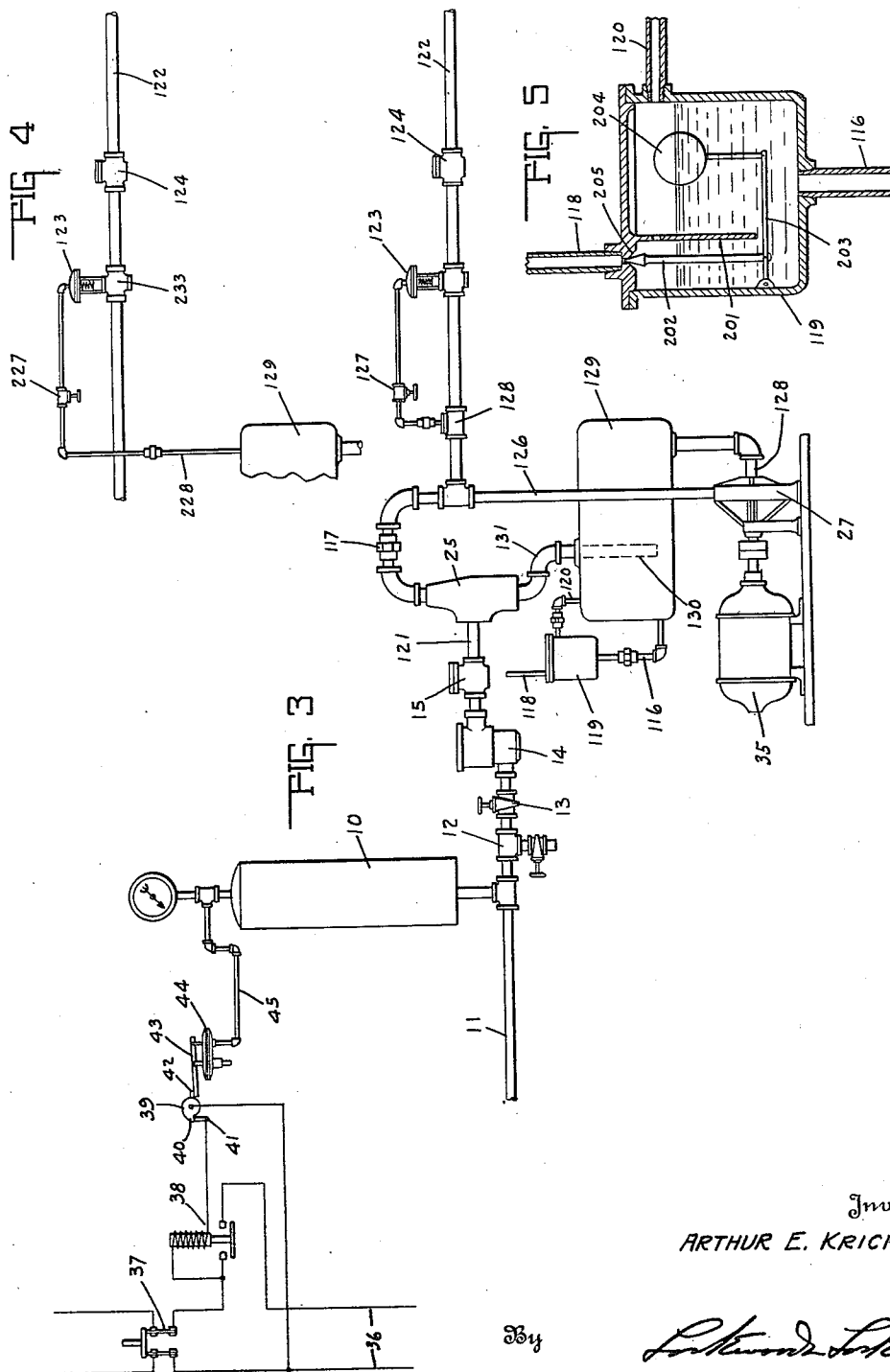
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VACUUM PUMP

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UNITED STATES PATENT OFFICE.

ARTHUR E. KRICK, OF INDIANAPOLIS, INDIANA.

VACUUM PUMP.

Application filed March 12, 1921. Serial No. 451,714.

To all whom it may concern:

Be it known that I, ARTHUR E. KRICK, a citizen of the United States, and a resident of Indianapolis, county of Marion, and State of Indiana, have invented a certain new and useful Vacuum Pump; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like numerals refer to like parts.

This invention relates particularly to a vacuum pump construction such as may be associated with a vacuum system associated with a steam heating system or the like with the advantages resultant therefrom.

The chief object of this invention is to improve the construction of vacuum pump constructions by associating a combining tube with the ejector thereof.

The chief feature of the invention consists in associating with a pump an ejector and a closed surge tank in an improved manner.

Another feature of the invention consists in associating the vacuum pump construction with a pressure pump, which pump is automatically controlled by the amount of vacuum.

Still a further feature of the invention consists in associating the vacuum pump construction with the vacuum system of a steam heating system in an improved manner whereby a staging effect is secured.

Another feature of the invention consists in interposing said vacuum pump construction into a heating system ahead of the air vent means, so that the latter vents the entire system.

Still a further feature of the invention consists in associating relief valve means with the vacuum pump construction, so that only the amount of water is retained in the system which is necessary to operate the ejector and supply the pump.

The full nature of this invention will be understood from the accompanying drawings and the following description and claims.

In the drawings Fig. 1 is a diagrammatic view of the vacuum pump construction showing the same associated with a portion of a steam heating system. Fig. 2 is an enlarged central sectional view of the ejector shown in Fig. 1. Fig. 3 is a diagrammatic view of another arrangement of the vacuum pump construction and a differ-

ent association with a steam heating system. Fig. 4 is a diagrammatic view of a portion of a modified form of the invention. Fig. 5 is an enlarged sectional view of an air eliminator.

In the drawings there is shown a vacuum accumulator 10 suitably connected to a return line 11 from a heating or similar steam pressure system. Said return line 11 is provided with the usual drain valve means 12, control valve 13 and suitable straining means 14, as well as the check valve 15. To secure proper drainage in a steam heating system a suitable vacuum ejector is provided to increase the efficiency of the heating system. While the invention is herein shown associated with a heating system it is to be understood that the use of the same is not restricted thereto but may be otherwise applied. Associated with the return line 11 is a suitable boiler return 16 connected by means of the conduit 17 to the vacuum pump construction. Said boiler return 16 and 17 includes the vent 18 associated with the air eliminator 19, which may be of the usual or preferred construction, see Fig. 5, and may contain a float operated valve controlling the discharge of air from the boiler return line, said air eliminator being connected to said line by means of the equalizer conduit 20. A suitable valve 21 is provided near the junction of the conduit 17 with the discharge line 22 and in said line 22 is a similar valve 23 which controls the discharge of fluid from the line 22 to a tank and return trap system herein not shown. When the valve 23 is closed and the valve 21 is open the fluid is discharged into the conduit 17 and boiler return conduit 16.

The return from the heating system or other similar system 11 connects with the vacuum pump construction by means of the conduit 24 and the discharge conduit 22 also connect with said system. The vacuum pump construction comprises an ejector herein indicated by the numeral 25, connected by means of the conduit 26 with the discharge outlet of the pump 27. The intake of the pump 27 is connected by means of the conduit 28 to the lowermost point of a closed surge tank 29. The surge tank 29 in Fig. 1 is provided with two other openings, one of which is adapted to receive an elongated discharge pipe 30, which extends into said surge tank to a level below the other opening which is near the top thereof and which

connects with the conduit 22. The other end of the conduit 30 is connected to the discharge end of the ejector 25 by means of an offset combining tube such as two opposite L's 31 which provide an offset in the discharge channel from the ejector 25 to the surge tank 29. This offset construction acts as a check or baffle and serves to combine the circulating fluid and the ejected fluid through the conduit 24, and thereby permits the pump to operate more effectively by reason of the staging effect secured by the use of said check and a closed tank. Means for operating the pump 27 comprises an electric motor 35 which motor is energized by means of the wires 36 controlled by suitable switch means. The wires 36 are provided with a main switch 37 and a control switch 38, which control switch includes a relay, as shown. The relay 38 is magnetically operated and the control circuit is herein shown connected with the supply mains and a suitable switch 39, having a movable contact 40 and a fixed contact 41, which controls the remote control circuit. The switch 39 is provided with the projection 42 with which is associated a lever 43, operated by a diaphragm 44 in communication with a vacuum accumulator by means of the conduit 45. Thus, when the vacuum is decreased by means of the accumulation of the condensate of the heating system, said decrease is adapted to register on the diaphragm and tilt the lever 43 to close the switch 39, which in turn actuates the relay to close the switch 38 and, therefore, the motor circuit. The motor 35 is thus energized and operates the pump 27. The pump 27 takes fluid from the closed surge tank 29 and circulates the same through the pump 27, conduit 26 and through the ejector 25 and the offset or baffled conduit 30 until said fluid again discharges into the surge tank. The vacuum pump construction thus is adapted to draw fluid automatically such as the condensate and air from the line 11 and eject the same into the tank associated with the discharge conduit 22. Other automatic arrangements may be provided but each includes a source of pressure and vacuum controlled operating means.

One type of the ejector is shown clearly in Fig. 2. The ejector 25 is provided with an inlet nozzle 50 and an annular chamber 51 into which said nozzle projects. The chamber 51 is provided with an end wall or partition 52 and upon the opposite side of the partition 52 is an annular chamber 53, which annular chamber is provided with a restricted mouth 54, which communicates with the conduit 30, or L 31. Herein the chamber 51 and 53 are shown in communication with each other by means of a tubular tapering nozzle or venturi construction which preferably is integral with the partition 52.

Said venturi construction discharge includes the widest portion 154 which extends into the chamber 53 and terminates adjacent and only a short distance from the outlet 54 of said chamber 53. The opposite end 55 of said venturi passage extends in an opposite direction and into close proximity to the inwardly extending tapered nozzle 50. It is to be understood that the nozzle 50 and discharge portions 55 and 54 constitute a venturi construction which is open to the annular chamber 51 at one point of its smallest cross sectional area. The conduit 24 also discharges into the chamber 51 and in such a manner that the force of said discharge is broken by the tubular venturi construction and the fluid drawn into said passage 154 and 55 collects in the chamber 51 and is sucked into the venturi passage 55 by the jet action of the fluid forced through the conduit 26 and nozzle 50 into the venturi channel 55 by the pump 27. It is to be noted that as illustrated in Fig. 1 the lower end of the conduit 30 is provided with a water seal in the closed surge tank, as shown.

In Fig. 3 of the drawings a modified and the preferred form of the invention is illustrated and in said invention there is shown the usual accessories associated with the heating system and the operating means such as motor 35, said motor being supplied with energy from the lines 36, all as hereinbefore described in the preceding paragraphs. In Fig. 3 the identical parts are similarly numbered. In said figure the vacuum pump construction is connected to the heating system by means of the usual intake 121 which is associated with the ejector 25, the detailed construction of which is shown clearly in Fig. 2. The ejector is provided with another intake which supplies pressure to the ejector, and said intake is indicated by the numeral 117. The ejector 25 is provided with combining tube means 131 which discharges into a sealing tube 130, shown dotted in said figure. The conduit 126 connects the pump 27, driven by the motor 35, with the conduit 117 and said pump is also connected with the surge tank at the bottom thereof. The connections hereinbefore described are slightly different from that described with reference to Fig. 1 and in addition to these differences it is to be noted that the surge tank 129 is now of a closed construction and communicating therewith is a pair of conduits 120 and 116 which communicate with the air eliminator 119 provided with an air vent 118, which air eliminator may be of the usual or any preferred construction. Such an ejector is shown in Fig. 5 wherein the housing 119 contains a perforated, baffling partition 201, a valve 202, a lever 203 controlling the same and a float 204 operable by the liquid level in said air eliminator.

Thus, when the liquid level falls, due to the accumulation of air in the air eliminator 119, the float 204 follows said liquid level and thereupon through the lever 203 opens the valve 205 so that air in the housing is permitted to escape to the atmosphere through the vent 118.

The aforesaid construction also differs from that shown in Fig. 1 by the addition of a relief valve means 123 which is interposed in a discharge, or if desired a boiler return line 122 which line also is provided with a check valve 124. The relief valve 123 is provided with a by-pass construction 128 controlled by a valve 127 and said relief valve operates in the usual manner.

In Fig. 4 the construction illustrated in Fig. 3 is duplicated, but the relief valve construction is otherwise connected to the system. Herein the relief valve construction 223 is connected directly by means of a conduit 228 to the surge tank 129 and said connection is controlled by means of the valve 227. The last mentioned connection provides for more sensitive operation since the surge tank pressure and the pump pressure 27 is the determining factor controlling the operation of the relief valve.

In the two last mentioned modifications of the invention better results have been obtained than from the construction shown in Fig. 1. The operation of these modifications are substantially similar.

The operation of the apparatus shown in Fig. 3 is as follows: As the condensate forms and accumulates in the heating system or the like, the vacuum decreases and the gauge on the tank 10 registers the vacuum as well as the diaphragm 44, which as heretofore explained, energizes the motor 35 to operate the pump 27 when the desired limit of the vacuum is reached. The system shown in Fig. 3 is such that sufficient water is held in the tank 129, and only such an amount necessary to operate the ejector 25 is retained therein. As the ejector is operated by the pump, the same pulls on the line 11 and removes the air accumulated therein, as well as the condensate. Both are collected in the tank 129 from which the air escapes to the air relief valve 119, from which it is discharged automatically as the same is collected, as heretofore described. The condensate is retained in the tank, and due to the closed tank construction the staging effect is secured; or in other words, the pump head is increased, thereby increasing the pressure both in the line 126 and the tank 129. In the system shown in Fig. 3 the increased pressure through the connections 127—128 is transmitted to the relief valve 123, which is operated by the rise in pressure when the pressure limit is attained. The pump then not only operates the ejector, but also discharges the requisite amount of

condensate necessary to relieve the surge tank, and this by way of the pipe 122 to a waste line, or to the boiler return, or the feed water heater, as desired. The relief valve 123 closes the line 122 when the pressure is reduced to that necessary to actuate said valve, and this pressure limit is so adjusted that only sufficient condensate necessary to operate the ejector is retained in the closed surge tank 129. In the modification shown in Fig. 4 the same effect is secured, for line 228 is subject to tank pressure instead of pump pressure, as described for the apparatus shown in Fig. 3. Of course, the tank pressure and the pump pressure bear certain relation to each other, so that one system is substantially the same as the other.

While the invention has been described in great detail, and several modifications have been described herein, it will be understood that various other modifications thereof will readily suggest themselves to those skilled in the art to which this invention applies, and the foregoing specifications and drawings are to be considered illustrative rather than restrictive in character.

The invention claimed is:

1. A vacuum pump construction including an ejector, a closed surge tank, pressure means for operating said ejector, intake and discharge means connected with said vacuum pump construction, and pressure responsive means operable by the contents contained in the intake for automatically controlling the operation of the pressure means to maintain the contents in said intake at a predetermined condition.

2. A vacuum construction for a steam heating system, including an air eliminator and a vacuum pump construction, said pump construction including an ejector, a surge tank, a pressure means suitably connected to said ejector and surge tank to provide a circulatory system, and means operable by the fluid conditions in said heating system for automatically controlling the operation of said pressure means.

3. In a vacuum pump construction including an intake and a discharge the combination of electric motor means, means for supplying energy to said motor means, switch means controlling said energy supply, and means in the intake and operable by the condition of the contents therein for controlling said switch means to automatically control the supply of energy to said motor means, and a vacuum pump construction including a pump operable by said motor means, an ejector, and a surge tank.

4. An ejector for a vacuum pump comprising a pair of chambers separated from each other, a nozzle extending into one chamber and terminating within the same,

a tubular passage extending from one chamber to the other and extending into both, one end of said passage terminating adjacent the nozzle but in spaced relation thereto, the other end of said passage extending within and terminating within the other chamber, said other chamber having a discharge opening in alignment with the nozzle and the tubular passage, and an intake in communication with said first mentioned chamber, said nozzle being adapted to be associated with the source of pressure for operating the ejector, said first mentioned chamber taperingly converging toward the nozzle, said other chamber taperingly converging toward the discharge opening to form a restricted mouth.

5. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means associated with the discharge means of said pump construction, combining tube means interposed between the ejector and surge tank, and a fluid seal between said tube means and said tank.

6. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means directly connected with the surge tank, combining tube means interposed between the ejector and surge tank, and a fluid seal between said tube means and said tank.

7. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means associated

with the discharge means of said pump construction, and an air eliminator means directly connected to the surge tank for venting the latter.

8. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means directly connected with the surge tank, and an air eliminator means directly connected to the surge tank for venting the latter.

9. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means associated with the discharge means of said pump construction, combining tube means interposed between the ejector and surge tank, and an air eliminator means directly connected to the surge tank for venting the latter.

10. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, relief valve means directly connected with the surge tank, combining tube means interposed between the ejector and surge tank, and an air eliminator means directly connected to a surge tank for venting the latter.

11. A vacuum pump construction including a surge tank, an ejector discharging therein, a source of pressure for operating said ejector, and air eliminating means having its inlet and outlet connected directly to the surge tank for venting the same.

In witness whereof, I have hereunto affixed my signature.

ARTHUR E. KRICK.