April 7, 1931. K. KIEFER 1,799,590

EXCAVATOR

Original Filed Dec. 18, 1922

Fig. 1.

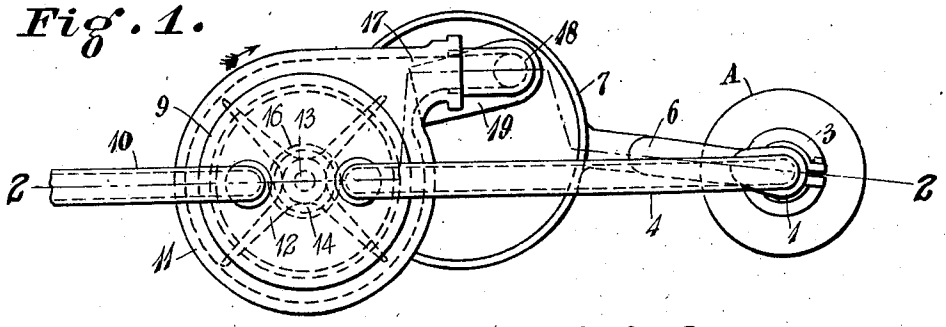
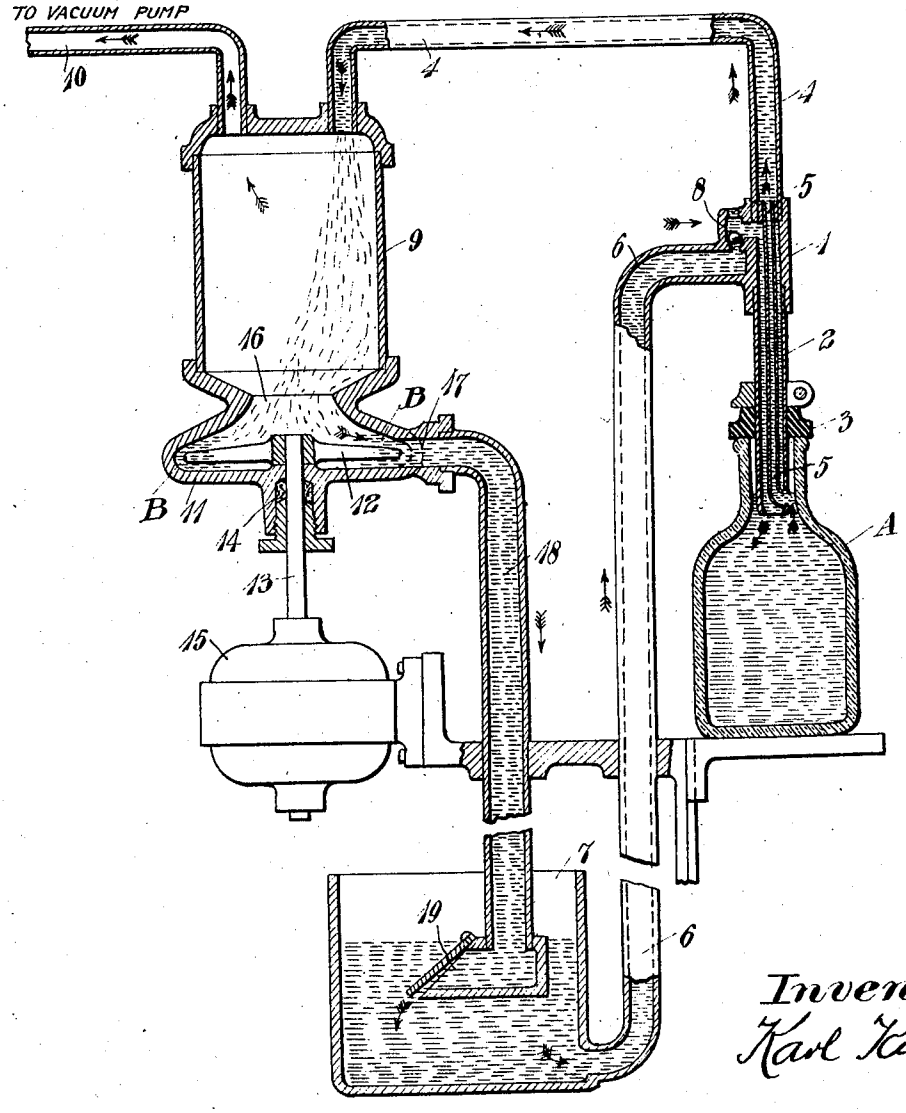


Fig. 2.



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UNITED STATES PATENT OFFICE

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EVACUATOR

Continuation of application Serial No. 607,757, filed December 18, 1922. This application filed January 7, 1928. Serial No. 245,235.

This case is a continuation of co-pending case No. 607,757.

My invention relates to devices for removing liquid from systems closed to the atmosphere, especially from vacuum systems used in filling liquids into containers, wherein the overflow is drawn into the system and must be evacuated therefrom back to the liquid supply.

The object of my invention is to simplify and increase the reliability of devices of this character. Other objects will appear in the course of the ensuing description.

I attain these objects by the device illustrated, for example, in the accompanying drawing, in which—

Figure 1 is a plan view of the device in connection with a vacuum-operated filling apparatus; and

Fig. 2 is a vertical section on the planes of the broken line 2—2 of Fig. 1.

The filling apparatus shown is similar to that disclosed and claimed in my co-pending application, Serial No. 544,236, filed March 16, 1922. The filling head 1 has a filling tube 2 projected into the container A with a gasket or seal 3 around it against the container top. The vacuum pipe 4 leads from the top of this head, and a small overflow tube 5 leads into the vacuum pipe 4 from an opening out through the side of the filling tube 2 just above the lower open end in the container. The supply pipe 6 leads from the lower part of the reservoir 7 up into the side of the filling head 1 to the annular space around the overflow tube therein, whence the liquid is discharged through the filling tube 2 into the container. A check valve 8 prevents backflow from the head to the reservoir. As air is exhausted from the container A through the vacuum pipe 4, atmospheric pressure on the liquid in the reservoir 7 forces the liquid up through the supply pipe 6, past the check valve 8, into the container. When the liquid has risen in the container to the mouth of the overflow tube 5, further inflow of liquid is drawn out through the vacuum pipe 4 until the container is removed, whereupon the pressure is balanced at the open end of the filling tube, by the atmosphere, holding the liquid up that remains in the tube; and the check valve 8 closes, avoiding emptying of the filling tube and supply pipe back into the reservoir. This description of this filling device is given merely to exemplify a use of my improved evacuator, which removes from the vacuum pipe 4 the liquid thus overflowing while the container is left on the filling device after filling to the desired height. Fig. 2 shows the disposition of the liquid at this stage of the operation, filling the container, the filling tube, the supply pipe, the overflow tube, and the vacuum pipe, and flowing therefrom into the evacuator.

This evacuator comprises the casing 9, down through the top of which leads the vacuum pipe 4. A continuation 10 of this vacuum pipe 4 leads out through this top, and will be understood to communicate with suitable apparatus for maintaining a desired degree of vacuum in the pipe 4, casing or chamber 9, and continuation of the vacuum pipe 10.

The bottom of the chamber 9 consists of a centrifugal-pump casing 11 in which the rotor or impeller 12 rotates on a vertical axis, having a shaft 13 projected down through a stuffing box 14 to a suitable motor 15. The inlet to this centrifugal pump is a central opening 16 in the bottom of the chamber 9, and the outlet 17 it as one peripheral side of the pump casing 11, preferably tangential thereto (Fig. 1) as is common in centrifugal pumps. This outlet leads, by a pipe 18, down into the reservoir 7 from which the filling apparatus is supplied; extending far enough down into the reservoir for the liquid contents of the reservoir to form a liquid seal around the lower end of this pipe 18, which preferably also has a check valve 19 closing against atmospheric inflow on disturbance of the liquid level in the reservoir 7. However, there is barometric retention of liquid up in the outlet pipe 18, and the check valve 19 may be omitted in some cases.

This barometric pressure inwardly of the evacuator is balanced by the centrifugal effect of the impeller 12 on the liquid coming down from the chamber 9; resulting in the liquid being disposed in the pump casing 11 out around the peripheral interior thereof, as

indicated at B, B in Fig. 2, continuous with the liquid in the outlet pipe 18 and reservoir 7. As more liquid enters the chamber 9 from the vacuum pipe 4, it drops to the bottom of the chambers and flows into the pump casing 11, where the impeller 12, acting with greater centrifugal effect on the heavy liquid than on the air of the partial vacuum in the enclosure, forces this liquid out to the periphery, separating it from the air which is to be drawn out through the pipe 10, and thus thoroughly preventing accumulation of liquid in the vacuum pump and its connections. The liquid thus thrown out displaces an equal amount of liquid out into the reservoir 7, against atmospheric pressure.

The centrifugal pump, on an upright axis with its central inlet opening upward is self priming, because the air is separated, and rises through the inlet, by the difference of centrifugal effect before noted, instead of accumulating in a peripheral part of the pump, as it can, for example, in the upper part of such a pump operating on a horizontal axis, or throughout the upper annular part of a casing where the pump, although on an upright axis, has its inlet opening downward. The air thus cannot form a pocket as it does in the above instances, excluding liquid from part of the casing peripheral interior and thus delaying full effective operation of the pump, on starting. This is of advantage in any use of a centrifugal pump; and especially so in its use for evacuation of a vacuum system in my present invention. Upon starting the vacuum apparatus and this pump, the impeller 12 quickly fills the peripheral part of the casing with the first overflowing liquid, to meet with liquid forced up from the reservoir 7 through the outlet pipe 18 as soon as the pressure begins to fall in the vacuum chamber 9.

The separation of the liquid from the air in the vacuum system, and the removal of this liquid from the system, is thorough and continuous as long as the impeller is rotated while there is overflow from the filling device. In intervals between overflows, the continued rotation keeps the liquid out away from the main body of air of the partial vacuum being maintained; and at the beginning of overflow there is immediate separation and outflow of the overflowed liquid as soon as it has dropped into the pump casing. The device is extremely simple, having but one moving interior part, the impeller 12; and its operation is continuous and positive, as distinguished from intermittent operations, usually depending upon differences of pneumatic or hydraulic pressure, in prior evacuators, traps and the like. This advantage is especially realized when the liquid overflowing into the system is heavy, viscid or sticky, as in filling syrups or other sugary liquids with apparatus such as illustrated herein, and which causes sticking of valves that must be controlled by the differences in pressure, as above alluded to.

The device is illustrated in conjunction with a filling apparatus, but is will be understood that other uses of it may occur; and while a peculiar use and certain constructional details have been described specifically herein, I do not wish to be understood as being limited to such precise showing and description, but having thus fully described my invention, as is required,

What I claim as new and desire to secure by Letters Patent is:

In a vacuum filling system, in combination with a filling tube having an outlet to discharge into a container, a reservoir open to the atmosphere and below the outlet, a separating chamber to receive the overflow from the container, vacuum-inducing means to create a partial vacuum in said separating chamber, and of constantly running centrifugal means for freeing the overflow from air, and transporting only liquid to the atmospheric supply reservoir.

KARL KIEFER.