(No Model.) 2 Sheets—Sheet 1.

M. WARREN.

SAFETY CHECK VALVE.

No. 365,656. Patented June 28, 1887.

Fig. 1.

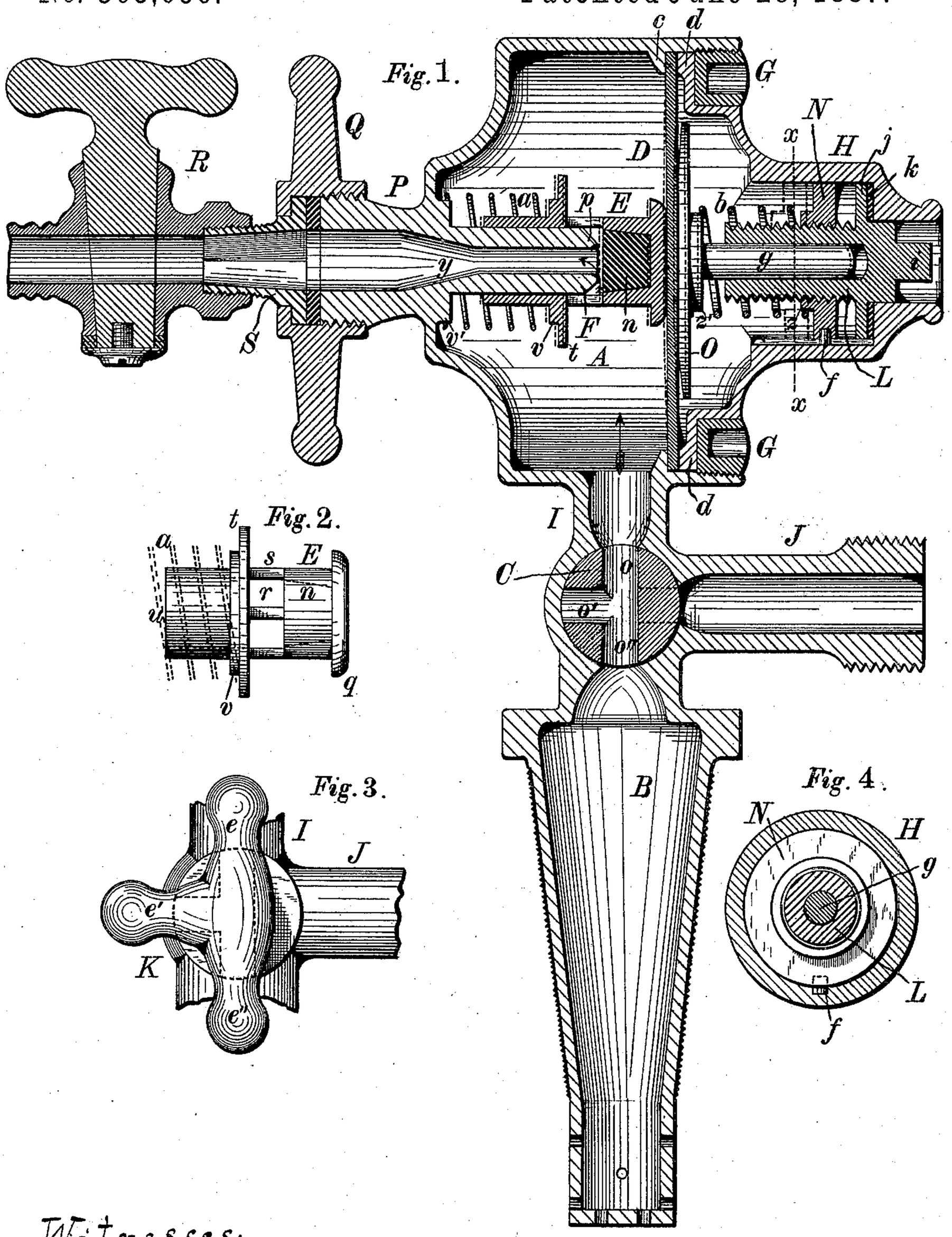

Fig. 2.

Fig. 3.

Fig. 4.

Witnesses:
H. G. Phillips.
C. G. Cranwell

Inventor;
Marion Warren,
by Geo. B. Selden,
atty.

(No Model.)

2 Sheets—Sheet 2.

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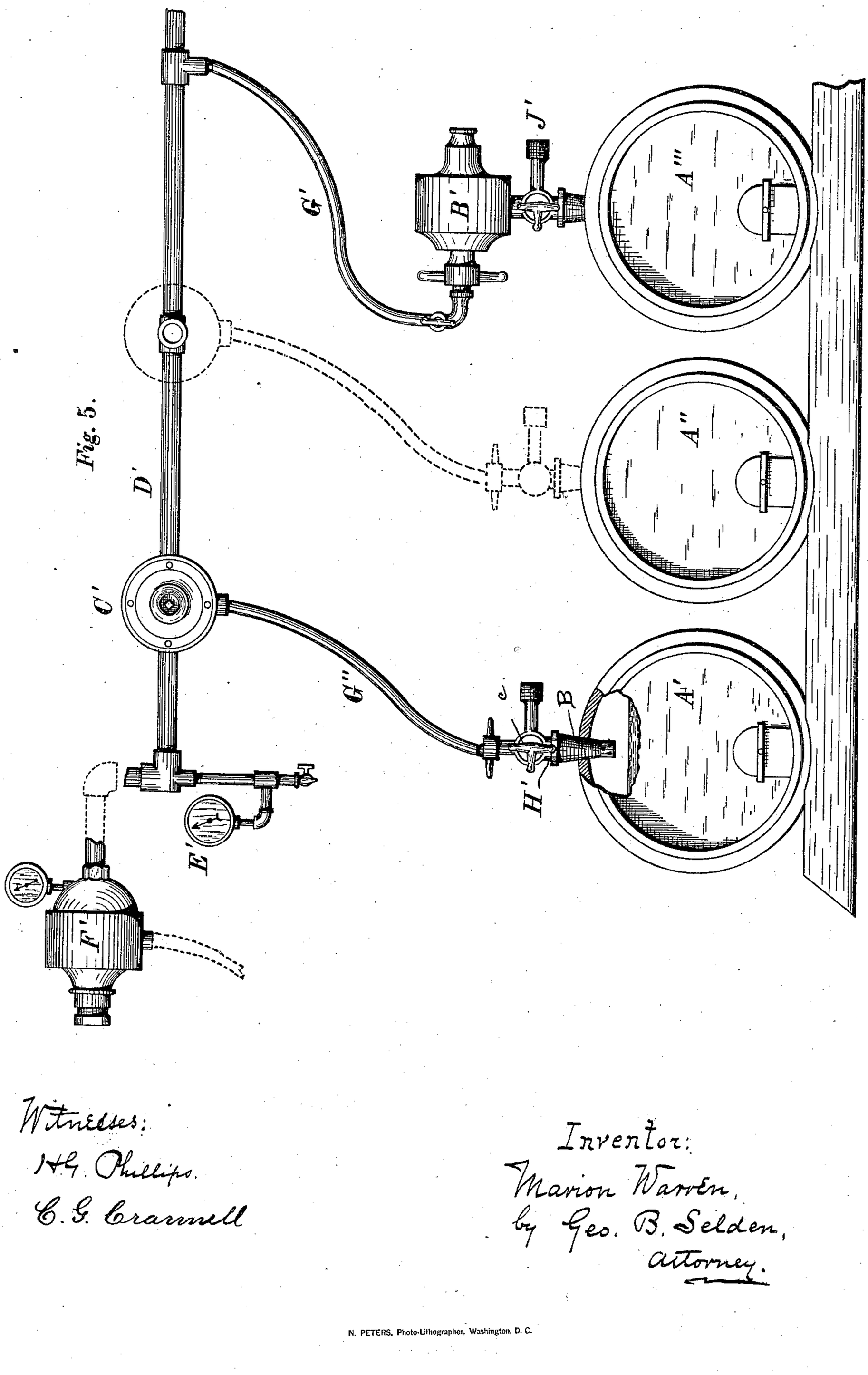

Fig. 5.

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UNITED STATES PATENT OFFICE.

MARION WARREN, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE EUREKA SPUND APPARATUS COMPANY, OF SAME PLACE.

SAFETY CHECK-VALVE.

SPECIFICATION forming part of Letters Patent No. 365,656, dated June 28, 1887.

Application filed November 4, 1886. Serial No. 217,923. (No model.)

To all whom it may concern:

Be it known that I, MARION WARREN, a citizen of the United States, residing at Rochester, New York, have invented an Improved Safety Check-Valve for Regulating Fermenting Liquids, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to a safety check-valve designed to be used in the process of carrying on the fermentation of beer under a regulated pressure in a series of closed connected casks, and to certain combinations, including a check-valve.

My invention is fully described and illustrated in the following specification and accompanying drawings, and the novel features thereof specified in the claims annexed to the said specification.

My improved safety check-valve is represented in the accompanying drawings, in which—

Figure 1 is a central vertical section. Fig. 2 represents the valve in side elevation. Fig. 3 shows the handle for the three-way cock. Fig. 4 is a section on the line *x x*, Fig. 1. Fig. 5 represents my invention as applied to a series of fermentation-casks, showing also modifications.

The construction described in this specification, to which a part of my improvement relates, embracing the parts necessary to intercept the flow of gas in certain contingencies, it may be denominated a "safety check-valve;" or, since the valve is constructed and arranged to close when the pressure falls below a predetermined limit on either side of the valve—that is, either in the piping or in a cask (or pressure-chamber) and to open when the pressure exceeds said limit either in the pressure-chamber or in the piping—it may properly be styled a "double-acting safety check-valve." It is not thereby intended to indicate that a total arrest of a fluid current is its sole function. Devices of this general character have been variously styled, reference being had to one or more of several functions.

It will be understood from the present description that my device, under certain conditions to be fully herein set forth entirely arrests the escape of gas either from a cask or under other conditions from the described system of pipes, and in view of these functions it may be called a "safety check-valve."

It consists, essentially, of the body or pressure-chamber A, provided with the threaded stem or screw-plug B, having in it a conduit, diaphragm D, and valve E, the position of which relative to the valve-seat F is controlled by the diaphragm and the springs *a* and *b*, so that when the pressure in the cask to which the apparatus is attached becomes lower than the desired pressure the valve will close and prevent communication between the cask and the connecting piping, and when the pressure rises above the desired limit the valve will be opened by a spring. When the pressure in the fermenting-cask into which the stem B is screwed becomes less than the desired pressure, the valve E is forced onto the valve-seat F by the spring *b*. The valve is usually held open by the pressure of the gases in the chamber A. This pressure, acting on the diaphragm D and co operating with the spring *a*, compresses spring *b*, the tension of the two springs being originally adapted and the tension of spring *b* being regulated with reference to the desired gas-pressure, so that while said pressure exists in the cask and the pipe system the valve is held open, as stated. When, however, the pressure in chamber A falls below the predetermined degree, either because of the slacking of fermentation or because of an escape of gas due to a break or accident in a cask or pipe, the spring *b* closes the valve and checks the escape of gas either from the piping into the cask or from the latter into the piping, as the case may be, dependent on the location of the cause of the reduction in pressure. It will be understood that the gas-pressure in chamber A and in the piping or in a cask must become less than the difference between the pressures of the springs *a b*, so that spring *b* will move the diaphragm and valve, the spring *a* under such a condition not having sufficient aid from gas-pressure to hold the valve open. It will also be understood that in case of reduction of pressure in a cask below the predetermined limit, and by consequence in chamber A and to a limited extent in the adjacent passage, *y*, and connecting-conduit, the valve will nor-

mally remain closed until the pressure rises above said limit. If the reduced pressure continues in the cask, the valve will be opened whenever the pressure in the pipe system exceeds the said limit, and gas will be discharged into the particular cask. The particular valve in such case acts as a relief-valve and discharges toward the particular cask. If the reduction of pressure below the predetermined limit occurs in the main pipe, and consequently in all the chambers A and to some extent in the casks, then the valves are all closed until the pressure in any or all of the chambers A rises above said limit, whereupon the particular valve or valves operate as discharge-valves, whether they discharge into a broken main or into a complete main having a properly-working blow-off valve. The body or pressure-chamber A is made of a size and shape (preferably cylindrical) adapted to receive the diaphragm D, which is secured in place by being clamped around its edges by the screw-ring G. The inside of the diaphragm rests against a projecting ledge, *c*, against which it is pressed by the flange *d* and the cap H when the ring G is screwed home. The stem B is attached to the body A by the neck I, which contains the three-way plug C, which serves at will to cut off the communication between the cask into which the stem is inserted and the chamber, and to permit the application of air-pressure on the liquid in the cask through the pipe J in racking off.

As indicated in Fig. 3, the three-way valve C is provided with the three-pronged handle K, the prongs *e e' e''* of which indicate by their position whether the valve is open or closed. The prongs *e e' e''* correspond in position with the passages *o o' o''* in the valve, so that the operator is always certain from observing the handle, how the valve stands. The valve C may be set so that the passage *o'* connects with the pipe J, while the passages *o o''* form communication between the chamber A and the cask, in which position the apparatus may be cleansed by forcing water through the pipe J. The valve C is of the ordinary tapering or plug form. This part of my invention may be usefully employed in connection with any suitable form of escape-valve. The cap H is made of a shape adapted to receive the screw L and follower-nut N, which is prevented from turning by the pin *f*, Figs. 1 and 4, fitting a groove in the cap. The spring *b* bears at one end against the follower-nut N and at the other against the follower O, which presses against the diaphragm, being guided by the stem *g*, inserted in a central hole in the screw L. The screw is provided at its outer end with a lug or projection, *i*, Fig. 1, to which a suitable wrench may be applied to shift the nut, as indicated by the full and dotted lines, to vary the tension of the spring *b*, and thus vary the pressure in the chamber and cask. The end of the cap is left open to permit access to the lug *i*. The screw L is provided with a flange, *j*, which bears against a suitable surface on the inside of the cap, a ring of packing being inserted at *k*, if desired. It will be observed that the ends of the spring *b* fit over shoulders on the follower O and the screw L, so that the spring cannot become displaced and produce friction by coming in contact with the threads of the screw. These shoulders are represented at *z z'*, Fig. 1. The surface of the follower O next the diaphragm is rounded or spherical. The diaphragm is made of rubber or metal.

As indicated in Figs. 1 and 2, the valve E is hollow and fits over the valve-seat *p*, so as to slide freely thereon. The inner end of the tube F, which may be made in one piece with the chamber A, is beveled nearly to an edge, and the valve E is provided with a rubber disk or block, *n*, which bears against the valve-seat when the valve is closed. The valve is provided with a flange, *t*, having a shoulder, *v*, which serves to guide the inner end of the spring *a*, the other end of the spring fitting over a corresponding shoulder, *v'*, on the inside of the casing of the chamber. Around the valve-seat *p* the valve is open, as indicated at *r*, Fig. 2, the two parts of the valve being connected together by the bars *s*. The openings *r* permit the free access of the gases in the chamber to the valve-seat. The valve-stem F is hollow, the passage *y* through it extending outward through the boss P, which may be fitted in any desired manner for the attachment of piping—as, for instance, by the coupling Q and faucet R.

In the practical operation of my improved safety check-valve each fermenting-cask is provided with an apparatus of the construction herein shown, which may be attached to the cask either directly by the screw-plug B or by suitable piping in place of the neck I, and either with or without an ordinary faucet or the three-way cock C.

Where it is the practice to pile ice on the fermenting-casks, I separate the apparatus from the cask by suitable piping. The passages *y* in all of the check-valves are put in communication with each other by suitable pipes and connections, and a blow-off or discharge valve, such as F', is attached to the pipe in any convenient situation and arranged to permit the escape of the gases of fermentation wherever they rise above the desired pressure. In such a system it is necessary, in order to secure the best results, to provide against the blowing off of the pressure in all the casks, either by a leak in any one of them, or by a leak in or breakage of the connecting-piping, and this is effectually accomplished by my invention. Thus, in case of the bursting of a cask or a leak occurring therein, the pressure in the chamber A will be reduced and the valves E will be closed by the spring *b*, thus cutting off the leaky cask from the rest of the series of casks, and in case a leak occurs in the piping, or the pressure therein should be reduced by accident to the blow-off relief-valve on the piping or to the pipes themselves, the valves E will close and hold the pressure

in each of the casks until the piping has been repaired. At the same time the valve herein described will operate to permit the escape of the gases in the cask whenever they accumulate in excess of the desired pressure, each check-valve operating independently to regulate its own cask, whether the connected system be employed or not. A pressure-gage may be applied to the pipe J to indicate the pressure in each cask.

In Fig. 5 I have represented my improved safety check-valve as applied to a connected system of three fermentation-casks. A′ A″ A‴ are the casks. The improved valve is represented as attached directly to cask A‴ and in connection with casks A″ and A′. The valve is attached to the piping, as indicated by dotted lines in one case and in full lines in the other. The pipe D′ is provided with a pressure-indicating gage, E′, and an escape or blow-off valve, F′, of any preferred construction—such, for instance, as that shown in the patent of Bigelow, No. 324,642, dated August 18, 1885.

The escape valve F′ may be located in the office of the brewery, or in any other suitable locality where it is readily accessible by the superintendent or foreman. In case the check-valve is applied directly to the cask, it is preferably connected to the main pipe D′ by the flexible hose or conduit G′, or the cask provided with a faucet, H′, is connected with the check-valve C′ attached to the pipe D′ by the hose G″. By this construction, as will be understood, the body A is not connected directly with a neck that contains the three-way cock and with stem B, but a pipe or hose, G^2, is interposed between the body or pressure-chamber A and the three-way cock C and the stem B. By this means the body A can be removed sufficiently far from the cask to allow it to be seated on the pipe, which is effected in any well-known manner—as by screwing a faucet, R, into a threaded boss or pipe-connection formed on the pipe—or the boss P may be screwed into an internally-threaded boss formed on the pipe. In either case the operation of the check-valve is the same, preventing the loss of pressure on the whole system in case one of the casks leaks, and holding the pressure in the casks in case of accident to the main pipe or the discharge-valve. There can be no communication from one cask to another until each cask has generated within itself the desired pressure, thereby avoiding any pressure on the surface of the liquid in any of the casks which is not due to the fermentation going on within that cask. Thus a desirable uniformity in the quality of beer produced in the several casks is secured.

A check-valve has heretofore been described which would automatically close when the pressure was sufficiently decreased in a diaphragm-chamber, the diaphragm itself acting as a valve, being caused by a spring to move to a seat upon the end of an exit-pipe when the pressure was sufficiently reduced. Such construction has serious defects. The end of the pipe constituting the valve-seat upon which diaphragm closes and acts as a valve has in practice been found to injure the diaphragm, wearing through one or more thicknesses of the materials composing it. The diaphragm and valve-seat also are liable at times to adhere, and it has been found that a force of several pounds (in some instances twelve pounds or more) has been necessary to overcome this adhesion. In the present construction the diaphragm is not used as a valve. The outer end of the valve E has a wide bearing on the diaphragm and cannot cut or injure it and is not liable to adhere to it, and the connected parts, including the valve, are so made and arranged that it is immaterial whether or not this enlarged end of the valve E adheres to the diaphragm. A method of rigidly securing the valve to the diaphragm heretofore practiced is also objectionable, for the reason that the latter is liable to be broken along the line of connection between the parts. In the present construction, there being no means employed for fastening the valve to the diaphragm, the danger of breaking the latter is obviated; and it may be noted that the diaphragm and valve are capable of an independent movement, the latter being opened solely by the action of spring *a*. Such a construction is obviously more certain in its movements and more sensitive to variations of pressure than those in which gas-pressure is relied upon to open the valve as well as to compress a spring, as *g*, and especially so in that form wherein the diaphragm is used as a valve, and in which the valve and diaphragm frequently adhere, as before stated. It will of course be understood that the spring *a* opposes the spring *g* whenever the diaphragm which is in contact with valve E is moved to close it, and that the adjustment of the tension of spring *g* is to be made with reference to this action of spring *a*. It is further obvious that the particular form of the springs and the mode of securing them can be varied without changing the substantial nature of the construction and its operation, and it is also clear that the form of valve E can be varied by mechanical skill.

In the use of check-valves heretofore it has been customary to place them in such manner as to allow free communication between several casks, one valve being relied upon to maintain the pressure in said casks, it being supposed desirable to equalize the pressure in the system by transmission of pressure and gas from those in which there might occur an excess to others in which there exists a lower degree of pressure. Such a system provides no safeguard against leakage, there being always a liability of an escape of gas in the system sufficient to destroy the gas-pressure and entail injurious consequences in all the connected casks. By my system this danger is obviated, as there is no communication between the several casks.

Check-valves have heretofore been applied to single casks, but not in the combination described by me, which embraces a series of casks each provided with a check-valve and connected to a main pipe, which is also provided with a relief or check valve. By this combination the pressure in the whole system is maintained, and can be indicated and observed by means of the relief-valve on the main pipe, located at any convenient point; but should an accident occur to this valve or to the main pipe each cask would be protected by its individual valve against injurious reduction of pressure. This combination of a main pipe and a relief-valve with a series of casks each having an independent relief or check valve has never before been used or described, it having been either considered essential that the several casks should freely communicate with each other, or, in case a valve was provided for each, it having been regarded as not essential to provide a common gas-main provided with a relief-valve.

My combination provides for indicating and regulating at one convenient point the pressure in a main pipe common to a series of casks, and while securing this advantage it provides for regulating and maintaining the pressure in each cask and guarding all from the evil effects of leakage, either in the main pipe or in a cask.

A series of casks have heretofore been combined with a common pipe and a reservoir or producer of gas under compression, a valve being placed between each cask and the common pipe communicating with the reservoir, the design being to automatically maintain a desired pressure in each cask by the opening of the valve to admit gas to the cask whenever its pressure fell below the desired limit. The scope of my invention does not include such a combination. It embraces the matters described in the foregoing specification, and hereinafter particularly pointed out, and so far as relates to the valve and diaphragm the particular feature of novelty relates to the doing away with the connection between the valve and diaphragm and the substitution of an independent source of power for the gas-pressure depended upon as the means for opening the valve in devices of the same general character as constructed prior to my invention.

I claim—

1. For regulating pressure in the process of fermentation, the combination embracing a casing, an outlet-tube, a valve, a spring normally adapted in co-operation with the pressure of gas to open the valve, a diaphragm, and a spring adapted to move the diaphragm and close the valve upon a reduction of the pressure below a predetermined limit, substantially as set forth.

2. For regulating pressure in the process of fermentation, the combination embracing a casing, an outlet-tube, a sliding valve, a spring adapted in co-operation with the pressure of the gas to open said sliding valve, a diaphragm, and a spring adapted to move said diaphragm and close the sliding valve upon a reduction of pressure below a predetermined limit, substantially as set forth.

3. For regulating pressure in the process of fermentation, the combination embracing the casing, diaphragm D, outlet-pipe F, forming a valve-seat, the sliding valve E, provided with elastic disk *n*, and the oppositely-acting springs *a* and *b*, arranged substantially as set forth, whereby when the pressure rises above a predetermined limit the valve will be closed.

4. For regulating pressure in the process of fermentation, a casing having a diaphragm dividing it into two compartments, a spring having a bearing upon one side of said diaphragm, and upon the opposite side a pipe serving as a gas inlet and outlet, a valve, and means tending to force said valve from said pipe, all combined substantially as specified, and without any attachment of the valve to the diaphragm, whereby when the pressure in the valve-compartment is sufficiently decreased the spring moves the diaphragm toward and against the valve to close it, and whereby when the pressure is sufficiently increased in said compartment the diaphragm-spring is compressed and the diaphragm moved from the valve to allow it to open.

5. The combination of a series of two or more casks, a main pipe, a relief-valve, as F′, and a series of conduits and double-acting safety check-valves, substantially such as described, one of each being interposed between each cask and the main, as specified.

6. The combination of a series of two or more casks, a main pipe, a relief-valve, as F′, a gage or pressure-indicator, and a series of conduits and double acting safety check-valves, substantially such as described, one of each being interposed between each cask and the main, as set forth.

7. The combination of a series of two or more casks, a main pipe, a relief-valve at the end of the main, and a double-acting safety check-valve, substantially such as described, interposed between each cask and the main, as set forth.

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