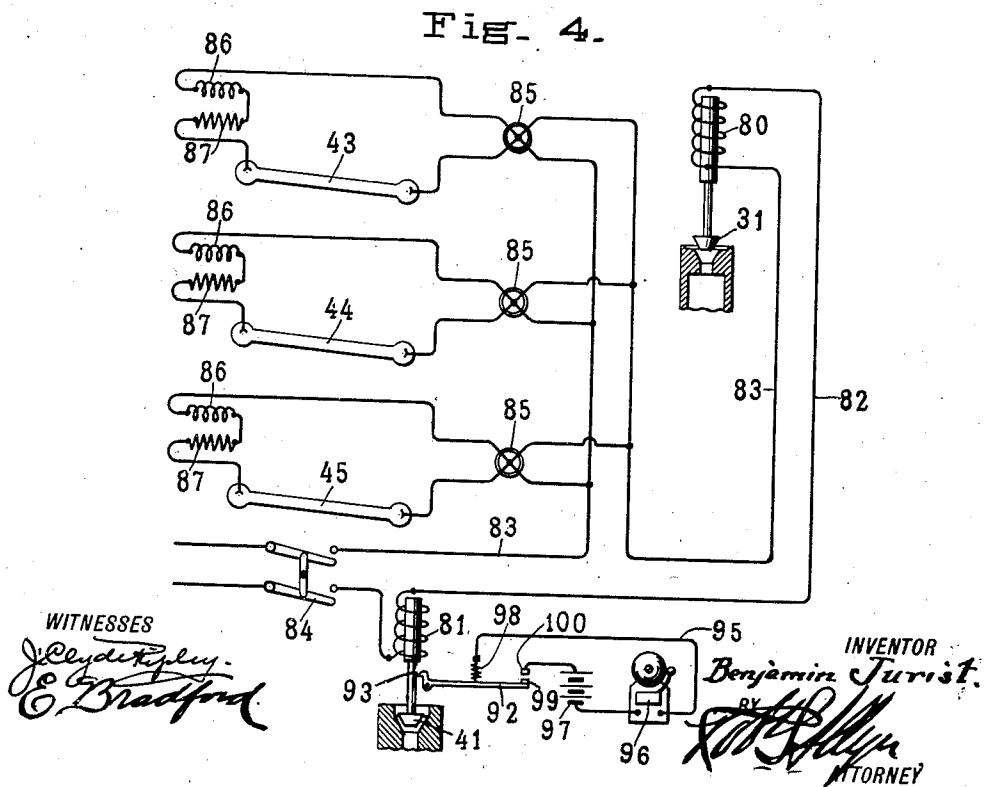
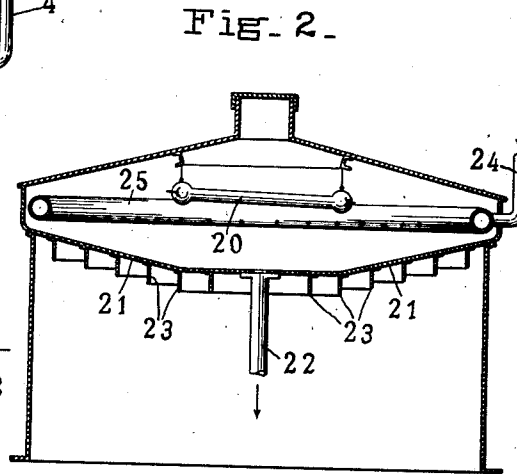
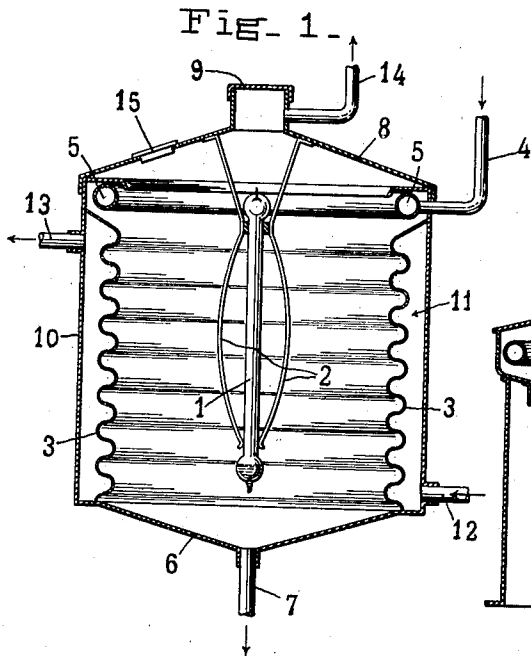


B. JURIST.
 APPARATUS FOR TREATING LIQUIDS.
 APPLICATION FILED NOV. 27, 1911.

1,190,769.

Patented July 11, 1916.
 2 SHEETS—SHEET 1.

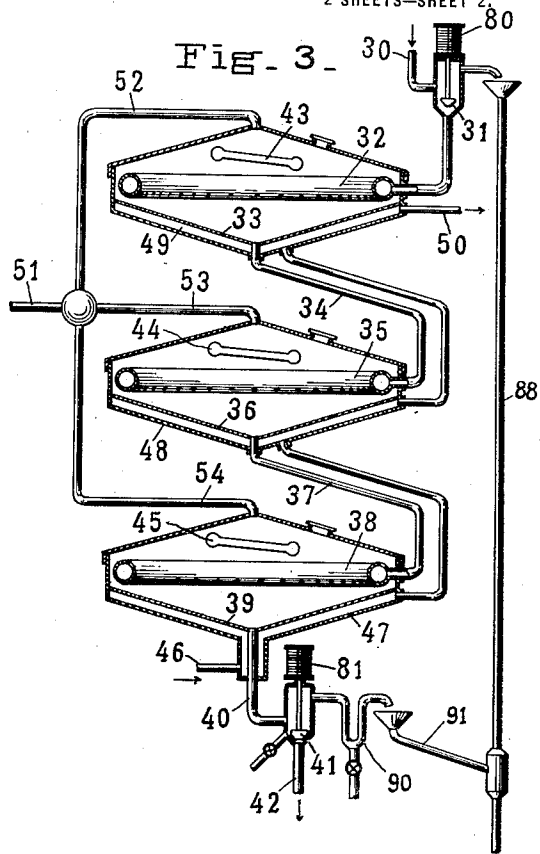
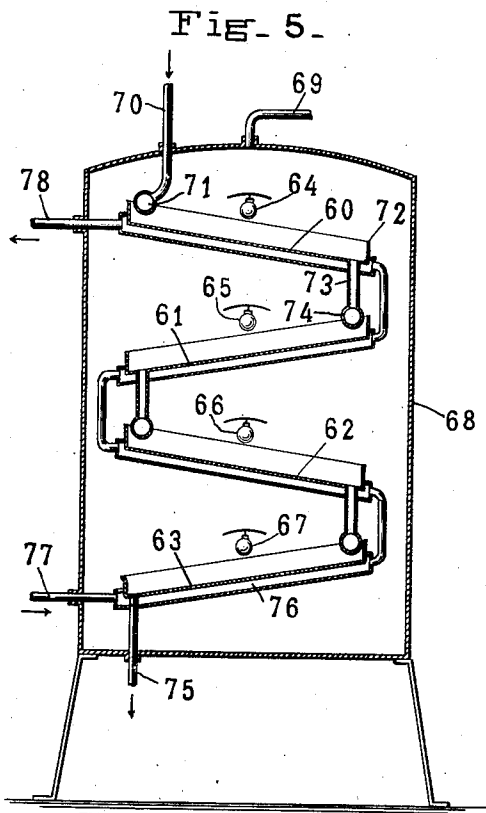


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WITNESSES

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APPARATUS FOR TREATING LIQUIDS.

1,190,769.

Specification of Letters Patent.

Patented July 11, 1916.

Application filed November 27, 1911. Serial No. 662,555.

To all whom it may concern:

Be it known that I, BENJAMIN JURIST, a citizen of the United States, and resident of New York, in the county of Kings and State of New York, have invented certain new and useful Improvements in Apparatus for Treating Liquids, of which the following is a specification.

This invention relates particularly to the treatment of liquids with ultra violet rays.

Ultra violet rays have as is well known, remarkable bactericidal and chemical actinic powers. By reason of the power of destroying and inhibiting the growth of germs it has been proposed to use the ultra violet rays for the sterilization of liquids and by reason of their power to effect chemical changes it has been proposed to use them for certain industries for instance, the treatment and bleaching of oils and in the acceleration of various chemical processes.

The most effective lamps for emitting ultra violet rays at present on the market are vacuum lamps and usually operate most efficiently at a comparatively high temperature and for this reason it is well to avoid having the liquids which are to be treated come in contact with the lamp owing to the cooling effect of the liquid. It has also been found that when the liquid comes in contact with the lamp deposits are likely to be formed on the outer portion of lamp which are more or less opaque and thus interfere with the passage of the rays. Some liquids are themselves more or less opaque to ultra violet rays and in such cases the effects of the rays either bactericidal or merely chemical are limited to the depth of penetration which is determined by the degree of opacity. If an opaque liquid is treated in any considerable mass the effect is unsatisfactory owing to the fact that the penetration is so slight. The liquid is therefore not uniformly treated.

In any continuous process for the treatment of liquids if the lamp at any moment fails to operate it is obvious that a certain quantity of liquid will receive less treatment than it should. If this uncompletely treated liquid is permitted to mingle with the completely treated liquid or any part of it the product will of course be contaminated. In cases of sterilizing processes the effect

might be very dangerous since some germs would be certain to pass into the product. It has also been found desirable in many cases to keep the liquid at a fairly low temperature during its treatment. As the lamps give off more or less heat it is therefore desirable to provide some suitable form of cooling device to prevent an undue rise in the temperature of the liquid. In some cases the ultra violet rays from a lamp produce certain changes in the surrounding air such as the formation of ozone. While this may be valuable in some processes for instance, in treating and bleaching oils, it is objectionable in other processes as for instance, in sterilizing liquid foods such as milk. It is therefore well to provide means if desired for carrying off the gaseous products.

It is the object of this invention to provide a process for the treatment of liquids and also to provide apparatus for carrying out such a process in which the foregoing principles will be properly developed so that liquids may be treated efficiently and completely in a continuous manner uniformly at proper temperatures. It should be understood that any suitable type of lamp emitting ultra violet rays may be employed but as a mercury vapor lamp having a transparent quartz container is thus far the most efficient source of ultra violet light at present on the market, the invention will be described with particular reference to such a lamp.

Briefly considered the invention contemplates treatment of a thin layer of liquid by the rays from a lamp spaced apart from the liquid. The liquid is allowed to flow over a surface a short distance from the lamp at a uniform speed. The shape and design of the liquid guiding surfaces will depend upon the type, design and power of the lamp employed. The guiding surfaces should be such as to allow the liquid the greatest possible exposure with the greatest permissible velocity. For small installation a single lamp may be used but for commercial processes of magnitude a number of lamps may be employed, the liquid supporting or guiding surfaces being designed so as to cause the liquid to pass through the influence of the rays from the different lamps successively. The lamps not being in con-

tact with the liquid operate at their most efficient temperature. The guiding surfaces may be cooled in a suitable manner. To avoid the accumulation of any deleterious gaseous products in the apparatus a suitable form of ventilation may also be provided. In case the current supplying the lamps fails at any time the supply of liquid to the apparatus can be instantly and automatically checked. In case of failure of a lamp or lamps to operate the product from the apparatus can be instantly and automatically prevented from flowing out into the receptacle for treating the liquid. When a number of lamps are used in one apparatus the flow of liquid can be automatically regulated according to the varying power of the lamps to emit ultra violet rays, be it in the case of a fluctuating electric current in the lamp or should one or more of the lamps fail to operate.

In the accompanying two sheets of drawings the principles of the invention are illustrated.

Figure 1, is a vertical cross sectional view of a simple form of apparatus embodying the invention with a vertical type or mercury vapor lamp. Fig. 2, is a vertical sectional view of another form of apparatus with a horizontal type of vacuum lamp. Fig. 3, is a vertical sectional view of a form of the invention made up of a plurality of independent sections so that the liquid is treated in successive stages. Fig. 4, is a diagrammatic view showing the electric circuit for operating the lamps and the valves. Fig. 5, is a vertical sectional view of another form of apparatus embodying the invention, the liquid guiding surfaces being arranged in the form of cascades one below the other.

In the form of apparatus illustrated in Fig. 1 the lamp 1 is supported by holders 2. Surrounding the lamp is the fluted or corrugated cylindrical wall 3 forming the guiding surfaces for the liquid to be treated. 4 is the supply pipe for the liquid which discharges into the annular distributing member 5 above the wall 3. The distributor 5 is provided with perforations so that the liquid is allowed to trickle in fine streams on to the corrugated wall 3. The bottom 6 of the treating chamber is funnel-shaped so that the liquid may collect and run out through the outlet or discharge pipe 7. The upper end of the treating chamber is closed by a cover 8. A cap, window or observation opening 9 may be provided at the upper end. In some cases the corrugated wall 3 may serve to provide all the cooling surfaces necessary or a jacket 10 may be provided outside of it forming a cooling chamber 11 through which air or other cooling fluid may be forced, entering through the pipe 12 and flowing out through the pipe 13. In case it is desired to remove the gases from

the treating chamber a ventilating or suction pipe 14 may be provided. In case it is desired to admit fresh air to the treating chamber, a filtering inlet 15 may be provided if desired. The inside of the treating chamber may have its inner surface formed of white enamel so as to reflect such of the rays as are not completely absorbed in direct passage through the liquid. The observation opening 9 may be provided with colored glass if desired to protect the eyes of the operator. In this form of apparatus the liquid passes with considerable speed over the corrugated wall 3. Owing to the surfaces being corrugated, the liquid is subjected to the rays from the lamp through a suitable period of time, greater of course than would be the case if the wall 3 were smooth or uncorrugated. In some cases the corrugated wall 3 will provide sufficient cooling surfaces, in other cases the cooling jacket 11 may be provided. Ventilation by suction through the pipe 14 will also tend to keep down the temperature of the apparatus.

In the form of apparatus shown in Fig. 2 the lamp 20 is substantially horizontal and the guiding walls 21, 21 are inclined toward each other so as to form a flattened funnel leading to the discharge pipe 22. Cooling vanes 23 may be provided if desired. The liquid to be treated is supplied through the pipe 24 and the distributor 25 so that the liquid is distributed around the upper edges of the guiding walls 21, 21. This construction is particularly adapted to short horizontal lamps with high intrinsic power.

While the apparatus thus far described is suitable for small out-puts and while of course the capacity will be proportional to the size of the apparatus it has not been found practical to increase the capacity by a simple increase of size beyond certain limits. It is believed that the most practical method of increasing the capacity without shortening the time of exposure or excessively increasing the velocity of flow of the liquid is to build the apparatus in several independent sections through which the liquid passes successively as for instance in Figs. 3 and 5. The apparatus of Fig. 3 consists of the combination of three sections such as are shown in Fig. 2. The liquid to be treated is introduced from a suitable reservoir through the pipe 30, past the valve 31 and through the distributing member 32 into the upper chamber. The liquid then flows over the guide surfaces 33 out through the pipe 34 and through the distributing member 35 into the second chamber. It then flows over the surface 36, is collected and flows through the pipe 37 and is distributed by the member 38 into the lower treating chamber. When the liquid has flowed down the incline of the guide surfaces 39, it is collected and passes out through

pipe 40 past the valve 41 and through discharge pipe 42 into a suitable collector or receptacle. The lamps 43, 44 and 45 supply the rays for treating the liquid in successive steps in the three chambers. Obviously any number of these chambers with suitable lamps may be employed. Cooling fluid may be supplied through the pipe 46 and pass upward through the jackets 47, 48 and 49 and out through the outlet 50. When desired, the chambers may be ventilated through the pipe 51 having branches 52, 53 and 54 leading to the three chambers respectively.

but it will be obvious that the automatic regulation can be applied to any form of apparatus as heretofore described.

Valves 31 and 41 have previously been referred to as located in the supply and discharge pipes respectively. These valves are raised by the action of solenoids 80 and 81 respectively which solenoids are connected in series in the power supply circuit of the system. One branch 82 (Fig. 4) of the circuit connects the two solenoids 80 and 81 and the other branch 83 includes the lamps 43, 44 and 45. A switch 84 is provided for controlling the system. Each individual lamp may be controlled by a switch such as 85 and each lamp has in series with it, as is customary with such lamps, an induction coil 86 and a series resistance 87 for steadying and regulating the lamp current. As long as the current is on and the lamps are operating the solenoids hold up the valves so that the liquid is supplied to the apparatus and discharge into a suitable receptacle. As the current in the lamp circuit fluctuates the valve 31 is raised and lowered so that with an increase of current a greater supply of liquid to the apparatus is permitted and with a decrease of current there is a corresponding decrease in the supply of liquid. The result is that the supply of liquid is proportioned to the available current and the available effective power of the lamp or lamps. In case the supply of current fails or the lamps are all shut off, the valve 31 drops and stops the supply of liquid to the apparatus which then overflows into some suitable receptacle through the overflow pipe 88. In case the current is shut off or the lamps fail to operate while the liquid is being treated, the solenoid 81 releases the valve 41 and closes the outlet to the pipe 42 as previously mentioned. The liquid which at this time is in the apparatus is thus prevented from mingling with the properly treated liquid and flows out through the trap 90 into the overflow pipe 91. The trap 90 prevents air from flowing back into the outlet and contaminating the product. This is particularly valuable in sterilization processes.

In the form of apparatus shown in Fig. 5 the liquid guiding members are in the form of inclined planes such as 60, 61, 62 and 63 arranged as cascades and with suitable lamps such as 64, 65, 66 and 67. These are all inclosed in a casing 68 from which the air may be withdrawn through a pipe 69. The liquid to be treated is supplied through pipe 70 and the distributor 71 which discharges fine sprays upon the upper edge of the incline 60. A ledge 72 forms the trough to collect the liquid into the pipe 73 and discharge it through the distributor 74 on to the incline 61. In a similar manner the liquid passes successively over the successive inclines beneath the successive lamps and discharges from the pipe 75 at the bottom. Cooling jackets such as 76 may be provided for the liquid surfaces through which a cooling fluid may be forced through the pipe 77 and out through the outlet pipe 78 at the top.

Multiple chamber treating apparatus in addition to the advantage of great capacity is particularly valuable on account of the uniform results obtained. As the liquid is treated in each chamber of the apparatus it is collected and redistributed into the next chamber and in this manner the liquid is thoroughly mixed so that in the final result there has been practically a perfectly uniform exposure of the entire mass of liquid. When the apparatus has once been installed it is easy to increase the capacity by simply adding one or more treating chambers and increasing the rate of flow of the liquid correspondingly. It is possible to operate one of these multiple unit systems at a fraction of its total capacity by simply shutting off one or more of the lamps. The liquid is then only treated in the other chambers where the lamps are running and the chambers where the lamps are turned off serve simply as mixing chambers.

Other important improvements of this invention reside in the automatic regulation of the supply of liquid to the apparatus and the automatic regulation of the discharge. The principles of this part of the invention are illustrated and described in conjunction with the type of apparatus shown in Fig. 3

On account of the danger which would result from mingling incompletely treated liquid with the completed product it is desirable to prevent the outlet valve 41 from being automatically raised after it has once been closed by failure of the lamps. The lamp or lamps may go out for only a few seconds so that while the supply would be shut off the liquid in the apparatus would not have time to entirely drain out before the valve 41 was again opened. This is particularly dangerous in sterilization processes. Similar difficulties may be encountered with quartz lamps operating under high pressure. The mercury vapor arc does

not reach its highest actinic power until several minutes after starting and the result will be an imperfectly treated liquid if the flow of liquid was permitted before the lamp reached its proper running condition. A self-locking mechanism is therefore provided as indicated in Fig. 4. A pivoted lever 92 has one end adapted to engage in a notch 93 in the stem of the valve 41. When the valve is once closed, the lever engages in the notch 93 and prevents the valve from being opened until the operator manually resets the lever 92.

In order to warn the attendant of interruptions in the operation of the apparatus a signal system may be employed as illustrated in Fig. 4. A local circuit 95 contains a bell 96 or any other suitable form of signal device and a source of current 97. Any suitable form of contacts may be employed and may be conveniently actuated by the lever 92. In this case the lever 92 is pulled upwardly by a spring 98 and one end of the lever has a contact 99 adjacent to the stationary contact 100. When the end of the lever 92 falls into the notch 93 in the stem of the valve 41, the local signal circuit is closed and the signal given calling attention to the condition of the apparatus. Obviously where several treating apparatuses are used in one installation an electric annunciator may be used as a signal device. It is obvious that the supply valve 31 may also be equipped with a self-locking mechanism and signal device as just described. Thus in small apparatus such as those shown in Figs. 1 and 2 the safety valve 41 may be omitted and only a regulating valve 31 provided in the supply pipe. It is obvious that many changes may be made in details of construction and method of operation herein shown and described and it should be understood that the claims are not limited to the specific disclosure herein except so far as required by the prior art.

In the claims where terms such as "lamp", "wall", "surface" etc., are used it should be understood that they are used in a broad sense to cover the use of one or more.

What I claim is:—

1. Apparatus for treating liquids comprising a treating chamber, a lamp, and electro-magnetically controlled means for regulating the supply and discharge of the liquid in accordance with the operation of the lamp.

2. Apparatus for treating liquids comprising a lamp for emitting ultra violet rays, a chamber for treating the liquid and means for automatically checking the discharge of liquid in case the lamp is extinguished.

3. Apparatus for treating liquids comprising a lamp for emitting ultra violet rays, a chamber for treating the liquid,

means for automatically checking the discharge of liquid in case the lamp is extinguished and means for preventing the resumption of discharge in case the lamp is again started.

4. Apparatus for treating liquids comprising a lamp, a liquid treating chamber having a discharge outlet and an electro-magnetic device in series with the lamp for controlling the discharge.

5. Apparatus for treating liquids comprising a lamp, a liquid treating chamber having a discharge outlet, an electro-magnetic device in the lamp circuit operating a controlling valve in the discharge and a latch for automatically locking said valve when said valve has been closed and so preventing a resumption of the operation of said valve after the lamp has been once extinguished and before said automatic locking device is released.

6. Apparatus for treating liquids comprising a plurality of lamps for successively affecting the liquid and means variable with the operation of the lamps for regulating the discharge of liquid.

7. Apparatus for treating liquids comprising a plurality of independently operable sections, each section equipped with a distributor and a collector for the liquid connected so that the liquid flows successively through the series of said sections, in each section an electric lamp emitting ultra violet rays, a source of supply for the liquid to be treated connected to the distributor of the first section, an automatic valve for electro-magnetically regulating the supply of liquid to be treated according to the electric current in all lamps, means for directing the untreated liquid past the distributor of the first section when said valve in said supply is closed, a discharge pipe connected to the last section, an outlet for the perfectly treated liquid, an automatic valve for electro-magnetically controlling the connection between said discharge and said outlet so as to interrupt the connection upon interruption of the electric current in all lamps, means for directing the partly treated liquid in the discharge pipe past the outlet for the perfectly treated liquid when said valve has closed the connection between said discharge and said outlet, means for automatically locking said valve in the discharge pipe after it has been closed and means for signaling the interruption of the electric current.

8. Apparatus for treating liquids comprising a plurality of inclined liquid guiding members arranged in the form of a cascade, a source of ultra violet rays arranged adjacent each of said guiding members, a distributing member at the top of each inclined member, means for collecting the liquid at the bottom of each inclined member and delivering the liquid into the next lower

distributing member, means for supplying liquids to be treated and means for collecting the treated liquid, an electro-magnetically operable valve for controlling the outlet of liquid to be collected and a by-pass for the liquid operable when the said valve has closed the normal outlet, a latch for said

valve and a means for signaling the interruption of the current.

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Witnesses:

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