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R. SCHULZ.

FEED WATER APPARATUS.

No. 537,724. Patented Apr. 16, 1895.

Fig. 1.

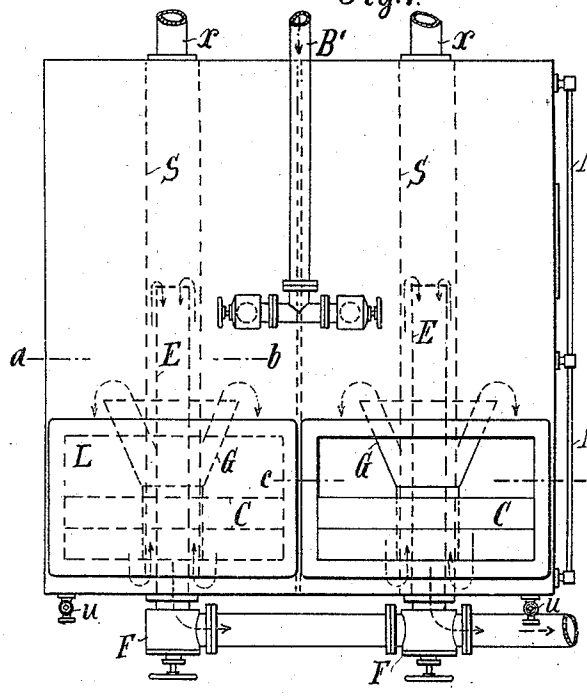


Fig. 3.

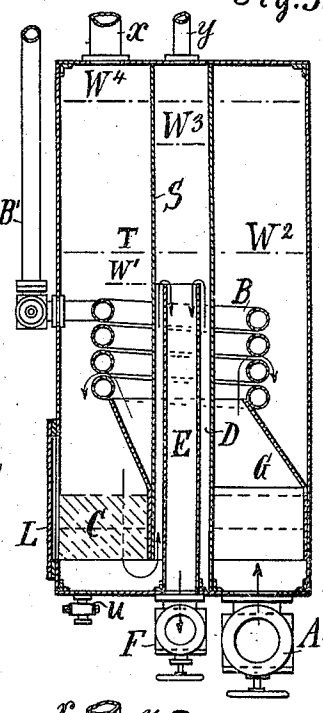


Fig. 4.

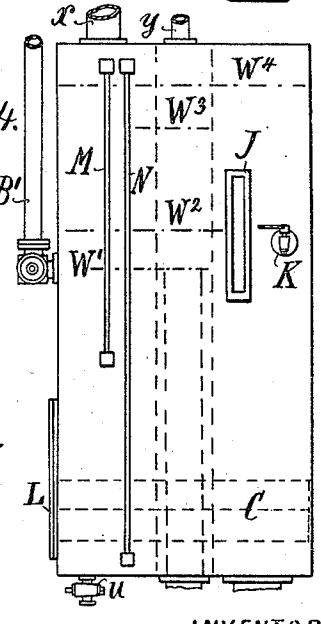
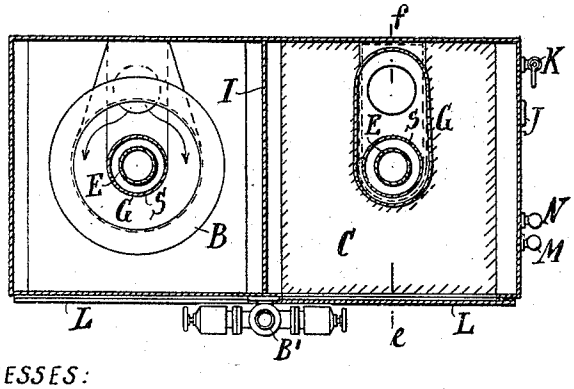


Fig. 2.



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FEED WATER APPARATUS.

No. 537,724. Patented Apr. 16, 1895.

Fig. 3a.

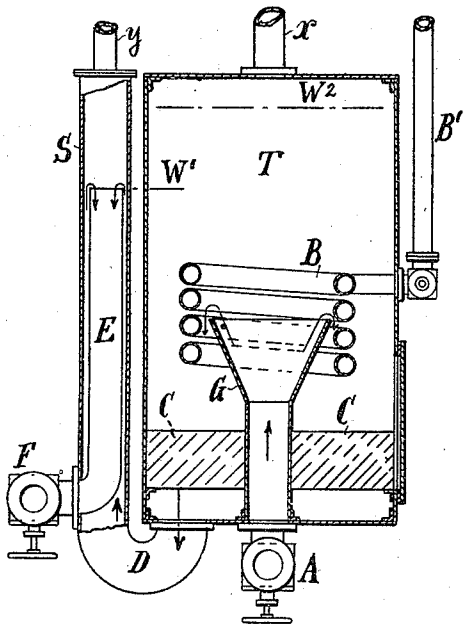

Fig. 3c.

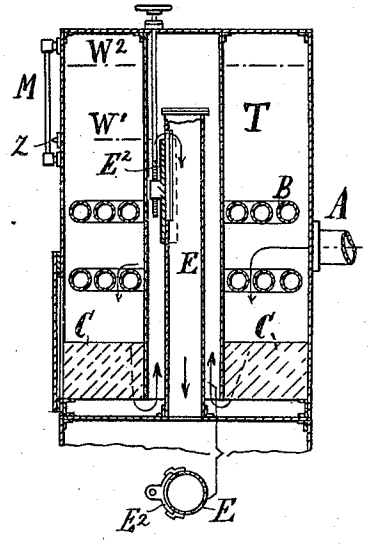

Fig. 3b.

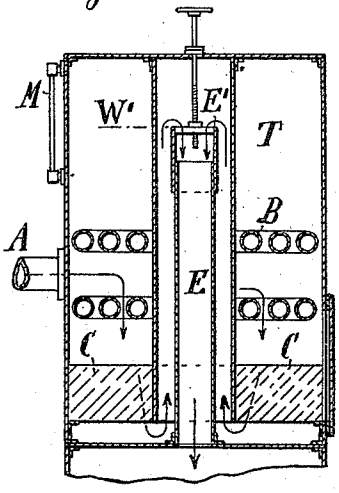

Fig. 3d.

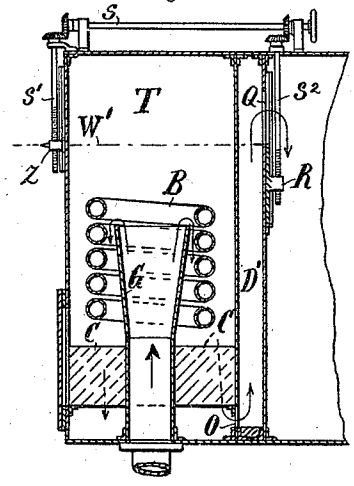

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Fig. 5.

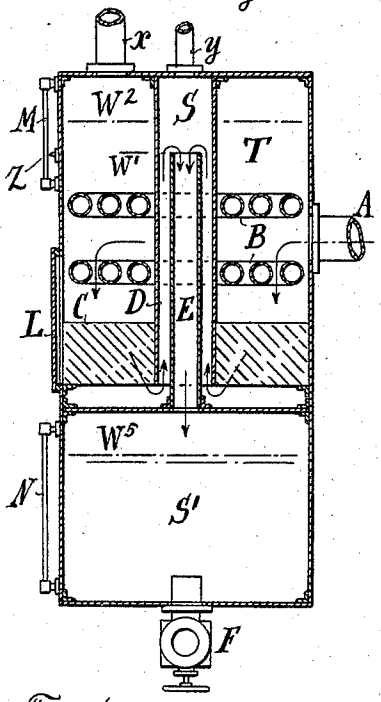

Fig. 7.

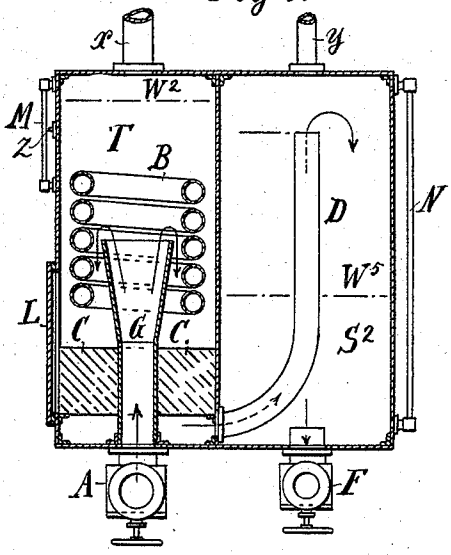

Fig. 6.

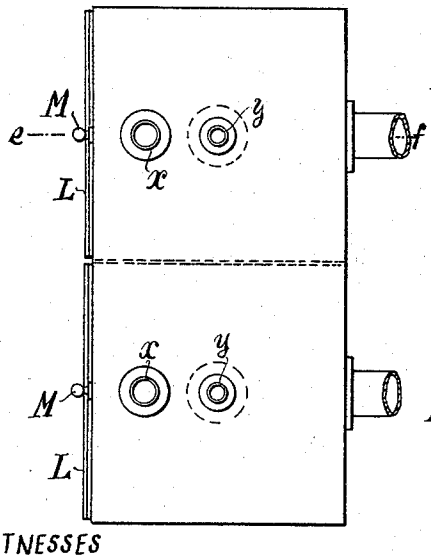

Fig. 8.

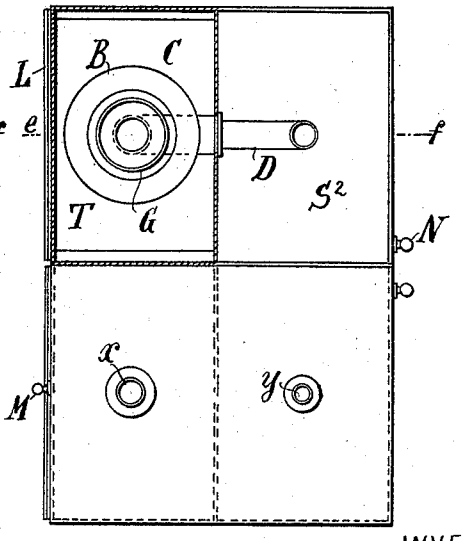

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Fig. 9.

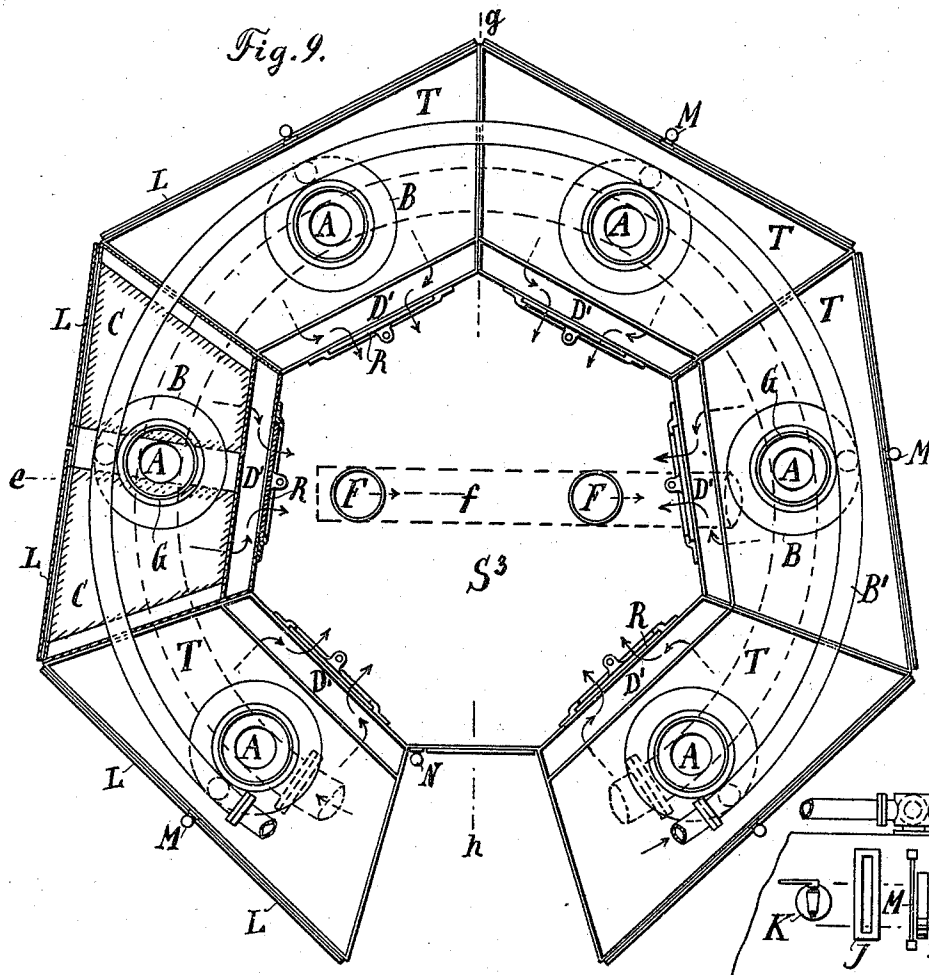

Fig. 12.

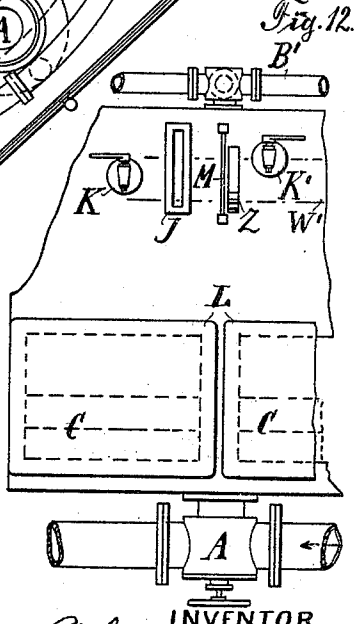

Fig. 13.

S^3			
D'	D'	D'	D'
T	T	T	T

Fig. 14.

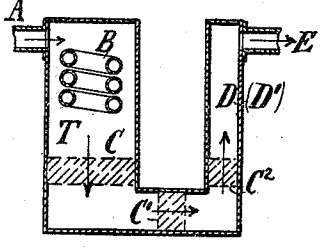

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Fig. 10.

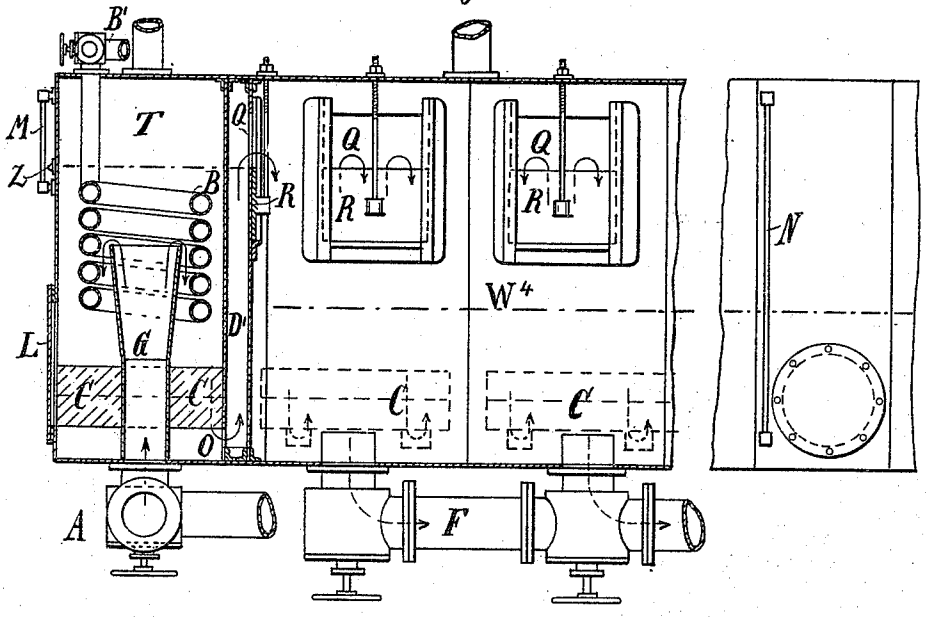
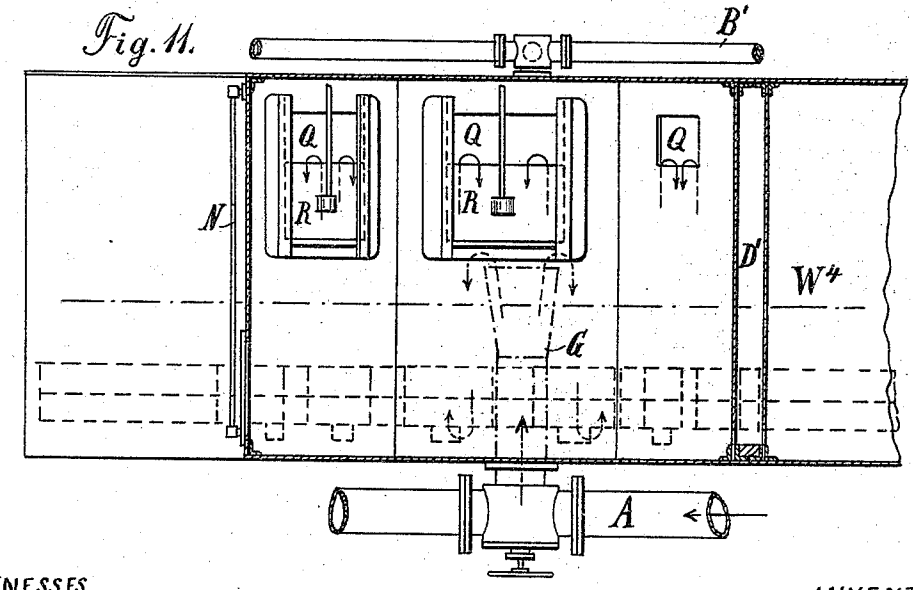


Fig. 11.



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UNITED STATES PATENT OFFICE.

RICHARD SCHULZ, OF BERLIN, GERMANY.

FEED-WATER APPARATUS.

SPECIFICATION forming part of Letters Patent No. 537,724, dated April 16, 1895.

Application filed February 21, 1893. Serial No. 463,189. (No model.) Patented in Germany July 10, 1891, No. 62,579, and in England December 29, 1891, No. 22,681.

To all whom it may concern:

Be it known that I, RICHARD SCHULZ, a subject of the King of Prussia, residing at 28 Schlegelstrasse, Berlin, Germany, have invented certain new and useful Improvements in Feed-Water Apparatus, (for which I have obtained Letters Patent in Germany, No. 62,579, dated July 10, 1891, and in Great Britain, No. 22,681, dated December 29, 1891,) of which the following is a specification.

The water supplied from the surface condensers and employed for feeding the boiler, contains, besides air, the oil removed by the steam during the lubrication, and also other impurities, and must further be warmed previous to its being employed. Apparatus hitherto invented for this purpose consists of special reservoirs for freeing the water from air, and further of filters and preliminary warming apparatus. Such apparatus takes up much room because of its being in separate parts, which is very disadvantageous for machinery, especially for sea steam engines, as it frequently hinders the introduction of such apparatus.

By this invention the feed water tank is simultaneously employed for the heating, purification and air separation of the condensed water. It is for this purpose provided with an apparatus for warming and with a filter in such a way that the condensed water is warmed before being filtered, while the oil carried along with it may be so collected that it does not need to pass through the filter, but may be run off by itself. The separation of the air and oil is assisted by the heating, while the peculiar arrangement of the filter obviates any choking of the same by the oil. In order to prevent any interruption in the working of the filter, the device is so arranged, that the filtration takes place under a certain pressure of liquid, the degree of which may be ascertained by means of water gage glasses, and affords a guarantee for the good working of the filter.

Various modifications of an apparatus in accordance with my invention are shown on the accompanying drawings, in which—

Figure 1 shows a front view of one pattern of the apparatus; Fig. 2, a horizontal section on *a—b* and *c—d* of Fig. 1. Fig. 3 is a vertical section on *e—f* of Fig. 2; and Fig. 4 is a side view. Figs. 3^a, 3^b, 3^c, 3^d are sectional views of modifications. Fig. 5 is a section on line *e—f*, of Fig. 6; and Fig. 6 is a plan of a modified form of apparatus. Fig. 7 is a section on line *e—f* of Fig. 8; and Fig. 8 is a plan partly in section of another modification. Fig. 9 is plan view of another form of the apparatus. Fig. 10 is a vertical section on the line *e—f;* Fig. 11, a similar one on *g—h;* Fig. 12, an elevation of a portion of the apparatus. Fig. 13 is a diagrammatic view of another form. Fig. 14 is a sectional view of another modification.

The apparatus shown in Figs. 1 to 8 is divided into two equal parts, one of which may be shut off separately when a cleansing or renewal of the filter is necessary. The working of the other division is not thereby interrupted. A vertical partition I, Fig. 2, divides the tank into the above named two compartments into which condensed water may be conveyed by means of a valve A, Fig. 3, suitably arranged for each compartment. This condensed water passes in the direction of the arrow, Fig. 3, by means of a plate G, which is in the shape of a funnel, into the middle portion of the tank and flows between the tubing of a heating coil B (which has a steam supply pipe B'). The water then passes into the space T above the body of the filter C through which latter it filters from top to bottom. The space beneath the filter C is connected with a vertical pipe D, Fig. 3, which forms a reservoir for purified and warmed feed water. The feed water is conveyed from any compartment of the apparatus to the boiler supply pump by means of an exit pipe E having a valve F. The upper orifice of the pipe E is arranged at such a height, that the lowest water level W' outside the reservoir tube D is sufficiently high above the filter C that the oil or fat brought by the water may be separated from off the surface of the same in the space T outside the reservoir tube D. The separation of this oil or fat is aided by the water being heated by means of the heating coil B. The separation of the air is similarly aided and the liberated air may escape through a pipe *x* at the top of the tank. The separated oil swims on the water in the chamber T and by means

of a glass window J, Fig. 4, it can be seen when it is necessary to let off some of the oil, which may be done by means of a cock K. The filtration through the part C takes place only after the removal of the oil. By means of the filtration, the water is freed from the various impurities. The water thus purified rises to the top of the reservoir tube D and passes into the exit pipe E. The air which is still free in this pipe may escape to the outside through a pipe *y*. If the feed pump be not working, the upper part S of the reservoir tube D serves to contain the purified water. A water gage glass M is attached to the tank T above the filter, and another N from the space under the filter. These two water gage glasses allow the level of the liquid in the tank T to be compared at any time with the level of the liquid in the reservoir pipe D or S. In consequence of the resistance existing in the filter C while the apparatus is at work, the liquid in the tank T will always stand somewhat higher,—approximately at W^2,—than in the tube D. This difference increases with the length of time the apparatus has been in use and as the filter becomes more foul. If W′ be the level of the liquid in the reservoir S, the difference between that and the height W^2 will give a basis for ascertaining the resistance of the filter. If this difference exceed a certain degree it is a sign that the apparatus must be cleaned and the filter C changed, which may conveniently be done after closing the valves A and F leading to the compartment in question and emptying the same by means of a run off cock *u* and by removing lids L at their sides.

Both the tank T and reservoir tube S of the apparatus allow of the liquid rising to W^3 and W^4 if the feed pump should be arrested and condensed water be continued to be supplied.

The pipes E and D may also be arranged outside of the apparatus as shown in Fig. 3^a, and one or both of them may be made cellular. The apparatus as shown in Figs. 5 and 6, for instance, may be provided with a special collecting chamber S′ beneath the bottom of the ordinary tank T. If the level W^5 of the liquid in this special chamber S′ remain below the lid of the same, the distance of the surface W^2 of the liquid in the ordinary tank T from a fixed mark Z made on the gage glass M at the level W′ of the upper edge of the exit tube E affords a basis for ascertaining the resistance of the filter. In this case, the inflow pipe A is arranged at the side.

In the apparatus shown in Figs. 7 and 8, the exit pipe E and reservoir S′ are replaced by a vessel S^2 arranged adjacent to the tank T, while the reservoir tube D runs sidewise from the tank T and simply projects into the vessel S^2. The purified liquid flows in this case therefore from the upper orifice of the reservoir tube D. In this case also the difference between the level W^2 of the liquid and the mark Z of the gage glass M shows the resistance of the filter, so long as the lower level W^5 remains below the upper edge of the reservoir tube D.

The tubes B for warming the water may naturally be arranged in different ways to the one shown on the drawing. For instance, a group of straight tubes or the like may be made use of.

In another form of the apparatus, shown in Figs. 9 to 12, six compartments T are arranged round a common collecting chamber S^3. The reservoir tubes D, belonging to the compartments T, Fig. 7, are replaced by narrow chambers D′ which are connected with the space underneath the filter C by means of apertures O and with the collecting chamber S^3 by means of further apertures which may be formed by a valve R which may be adjusted so as to regulate the lowest level of the liquid in the respective compartment. A similar arrangement may also be provided for the pipes D, Fig. 7, and E, Figs. 1 to 6. The upper end of the pipe E, Figs. 1 to 6, may, for instance, as shown in Fig. 3^b, be made movable and adjustable by means of a sleeve E′ or provided with a slot, intersection or side orifice, which may be closed by means of an adjustable valve E^2 as shown in Fig. 3^c. In this manner the extreme level W′ of the surface of the liquid may be regulated, at which the purified water runs out, and therewith the zone where the oil and fat are separated out, or such may be altered while the apparatus is at work. In this latter form of apparatus also, a mark Z on the gage glass shows the height of the upper surface of the aperture Q aforesaid. These marks, when a valve R is employed for the apertures in connection with the collecting chamber, must be adjusted to correspond with the adjustment of such valve R, which may be done by means of a suitable mechanism, such, for instance, as the moving up and down of marks Z by means of a screw spindle *s′*, the nut of which is actuated by the same axles as the spindle s^2 of the valve R, as shown in Fig. 3^d.

Two cocks K K′, Fig. 12 may be arranged on the outer wall of the tanks at different heights corresponding to the alteration of the level W′ of the water, for the purpose of running off the grease. By so connecting several vessels for removing the grease and filtering the water with a common reservoir for the purified water, the apparatus is considerably simplified when such is a consideration as in the case of specially large machinery. The compartments T may, of course, also be arranged in a row side by side as shown for instance in Fig. 13.

For small apparatus which is not driven continuously, and in which consequently the filter may be changed during the intervals of working, an apparatus with a single chamber T will naturally suffice. In all cases the water in the apparatus traverses during its cleansing a U-shaped course as shown in Fig. 14, for instance. The heating apparatus B is placed in one bend T above the filter C and the separation of the oil takes place above

this latter. The second bend D consists in Figs. 1 to 8 of a tube, but in Figs. 9 to 14 of a vessel D′ acting as a reservoir. From this figure it may be seen that without essentially altering the object of the apparatus, the filter C may also be arranged in the overflow of the chamber T to the tube D as shown in dotted lines at C′ or even in the lower part of the reservoir tube D or of the part D′ as shown at C^2, Fig. 14.

I claim as my invention—

1. The improvements in feed water apparatus having a U-shaped course for the water consisting in a tank provided with a filtering medium near the lowest part thereof, an inlet passage to the space above the filtering medium, an outlet passage leading from beneath the filtering medium and extending upwardly its upper overflow orifice keeping the water level sufficiently high above the filtering medium and a heating tubing in the space above said filtering medium in the commencement of the water course and below the water level, substantially as and for the purpose set forth.

2. In an apparatus for purifying feed water, and freeing the same from air, the combination of a tank provided with a filter at its lower part and a heating medium in the space above the filter with an inlet passage to the space above the filter, and an outlet passage leading from beneath the filter, the height of the end of the outlet passage being adjustable, substantially as and for the purposes set forth.

3. In an apparatus for purifying feed water and freeing the same from air, the combination of a tank provided with a filtering medium at its lower part, a heating medium in the space above the filter with an inlet passage to the space above the filter, and an outlet passage leading from beneath the filter, and extending upwardly, and indicating means to show the difference in the level of the water in the space above the filter, and that of the water in the outlet passage to ascertain the resistance of the said filtering medium, substantially as and for the purposes set forth.

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