No. 769,792. PATENTED SEPT. 13, 1904.

# W. DOUGHERTY.

## FEED WATER PURIFIER AND FILTER.

APPLICATION FILED OCT. 17, 1903.

NO MODEL.

Fig. 1

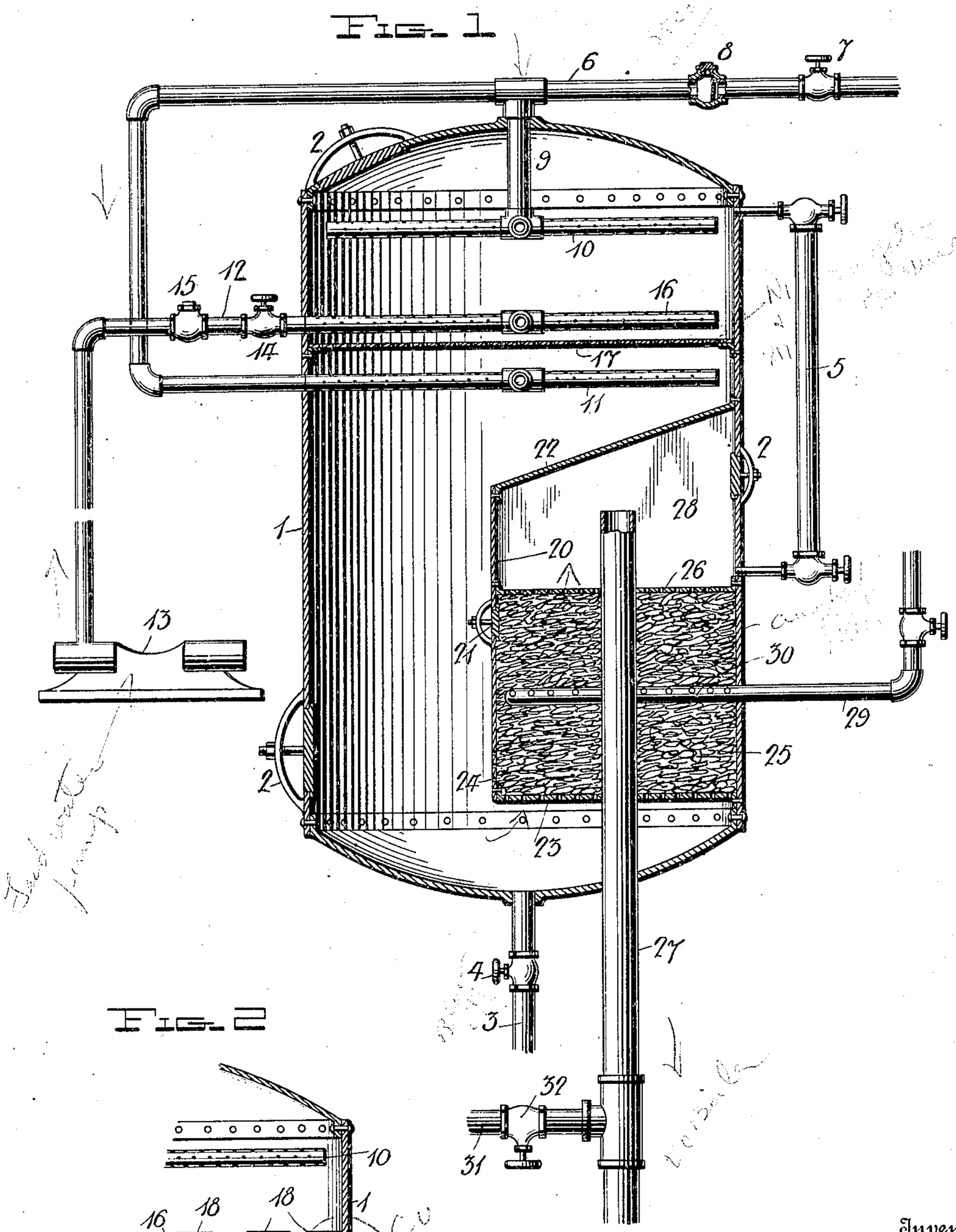


Fig. 2




Witnesses

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No. 769,792. Patented September 13, 1904.

# UNITED STATES PATENT OFFICE.

WILLIAM DOUGHERTY, OF CHESTER, PENNSYLVANIA.

## FEED-WATER PURIFIER AND FILTER.

SPECIFICATION forming part of Letters Patent No. 769,792, dated September 13, 1904.

Application filed October 17, 1903. Serial No. 177,428. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM DOUGHERTY, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Feed-Water Purifiers and Filters, of which the following is a specification.

My invention relates to feed-water purifiers and filters; and its object is to improve the construction and arrangement of the apparatus patented to me in the United States July 5, 1898, No. 607,004.

A further object of my present invention is to provide a feed-water purifier and filter including two or more parts made of different metals and arranged beneath the surface of the water, whereby a galvanic action is added to that of the heat of the entering steam, which is found to considerably increase the deposition of the solids held in solution or carried mechanically in the feed-water.

I accomplish the objects stated by employing and associating the parts, as illustrated in the accompanying drawings, of which—

Figure 1 represents a vertical section of the drum of the invention, showing the interior elements. The various tributary pipes and connections also appear in this figure. Fig. 2 shows a modified construction for supporting the electropositive or zinc element.

Like numerals are used to refer to like parts in both the views.

The drum or closed cylindrical envelop in which the feed-water is purified and filtered is marked 1. It possesses any number of hand-holes 2, suitably located to afford access to the interior. A blow-off pipe 3 is connected with the bottom of the drum and includes a valve 4. Through the blow-off the deposited solid matter collected at the lowest part of the drum is expelled as often as necessary.

To show the water-level in the drum, a glass gage 5 of ordinary construction and operation is employed.

Numeral 6 designates the main steam-pipe, which includes the valve 7 and check-valve 8 and is continued into the drum at the top by the short pipe 9, that is connected, as shown, to the upper perforated pipe-cross or spray-head 10. It is not essential that the steam-pipe should lead to the pipe-cross 10 through the middle of the top of the drum, as illustrated, and I occasionally pass the steam-pipe through the side of the drum and connect it directly with the upper cross 10 in the same manner as the bend of the main steam-pipe 6 is shown as passing through the left-hand side of the drum in Fig. 1 and joined to the lower peforated pipe-cross 11.

Feed-water reaches the drum by way of the pipe 12, leading to the pump 13. A valve 14 and check-valve 15 are included in pipe 12, and the pipe terminates within the drum in an intermediate perforated pipe-cross 16, located immediately beneath the upper cross 10 and just above the perforated diaphragm 17. Feed-water pipe 12 outside the drum is an ordinary iron pipe; but the intermediate perforated cross 16, to which it is connected within the drum, is either entirely of copper or of iron coated exteriorly with copper. Copper cross 16 is presented directly to the diaphragm 17. I usually make the diaphragm 17 of equal parts of nickel and zinc, the former metal preventing too rapid waste of the zinc. Any other metal may be employed in place of the nickel; but nickel gives the best results. Diaphragm 17 may be made of galvanized iron or woven wire heavily coated with zinc. In thus forming diaphragm 17 of relatively oxidizable metal the galvanic action—that is to say, the molecular disassociation and recombination taking place in the fluid—which aids the heat in throwing down the solid matter is spread over practically the entire extent of the diaphragm. It will be understood, further, that as the diaphragm is a comparatively thin sheet of metal when corroded to such a degree as to render it unserviceable it may be removed through the upper hand-hole 2 and a new diaphragm substituted. Copper cross 16, which would be expensive to renew, is not attacked and is, generally speaking, permanent.

In Fig. 2 I have shown receptacles 18 suspended on the inside of the drum. Such receptacles are usually made of copper and contain lumps of zinc 19, thus increasing the amount of galvanic action going on in the

drum. It will be observed that the copper cross 16 is separated by a portion of the fluid from the diaphragm, and it therefore assumes a negative electrical state with respect to the diaphragm. Sufficient chemical action occurs, by reason of the heat and various substances ordinarily found in the water of many localities, commonly the salts of magnesium, calcium, and sodium, to create feeble galvanic currents through the fluid from the diaphragm to the feed-water cross and returning by way of the metal skin of drum 1, to which both diaphragm and cross are connected, as illustrated.

Number 20 marks the filter-box supported upon the inside of the drum and provided with a hand-hole 21, affording access to its interior from inside the drum. One of the hand-holes 2 of the drum opens into the filter-box, admitting the hand for cleaning purposes from the exterior of the drum. The top of the filter-box is closed by the plate 22, and the water must reach the interior of the filter-box through its perforated bottom plate 23. It will be noted also that the lower portion of the side walls of the filter-box are provided with the perforations 24. Crushed flint or other non-absorbent filtering material 25 is confined between the perforated bottom 23 and the perforated or wire-gage top plate 26, and the boiler feed-pipe 27 passes upwardly through the perforated bottom, the filtering stratum, and top plate 26 into the pure-water chamber 28 at the top of the filter-box, from which filtered and purified water is conducted by the feed-pipe into the boiler.

When the filtering material has become clogged by impurities, it may be cleaned and agitated by means of the steam-flushing pipe 29, which enters through the side of drum 1 and terminates in a spray-head or perforated pipe 30, located in the filtering material. The impurities are forced up through the gauze top with the feed-water flow and are carried off downwardly by way of the boiler feed-pipe 27, being finally expelled through the branch pipe 31 and valve 32 or in some other manner discharged outside of the boiler.

In operation the normal pressure in drum 1 is the boiler-pressure while the pump works. My invention is constructed in each instance with reference to the amount of purified feed-water it is expected to supply. It is supported in an elevated position and delivers pure water to the boiler by gravity. About the steam-serving pipe-crosses 10 and 11 are enveloping areas of local condensation into which steam from the boiler sprays constantly and mixes intimately with the entering feed-water spray. This relatively cooler mixture descends slowly into the lower portion of the drum, which constitutes a settling-chamber, and by reason of the heating, agitation, and mixing caused by the spraying devices and perforated diaphragm 17, together with the galvanic effect of the parts composed of different metals, the solid matter contained in the water originally is freely deposited and further purification results from filtration before the boiler is reached.

Having thus described my invention and the manner of its operation, what I claim is—

1. In a feed-water purifier, the combination with a drum, of means for serving steam within the drum, devices adapted to serve feed-water within said drum and constituting one member of a galvanic couple, elements arranged near said devices and constituting the other member of the couple whereby said feed-water is subjected to galvanic action, and a boiler feed-pipe.

2. In a feed-water purifier, the combination with a drum, of means for serving steam within the drum, devices adapted to serve feed-water within said drum and constituting one member of a galvanic couple, elements arranged near said devices and constituting the other member of the couple whereby said feed-water is subjected to galvanic action, a boiler feed-pipe, and a filter arranged about the mouth of said pipe within the boiler through which water must pass to enter said pipe.

3. In a feed-water purifier, the combination with a drum, of means for spraying steam within the drum, devices adapted to spray feed-water within the drum and constituting one member of a galvanic couple, a perforated diaphragm arranged near said devices and constituting the other member of the couple whereby said feed-water is subjected to galvanic action, and a boiler feed-pipe.

4. In a feed-water purifier, the combination with a drum, of means for spraying steam within the drum, devices adapted to spray feed-water within the drum and constituting one member of a galvanic couple, a perforated diaphragm arranged near said devices and constituting the other member of the couple whereby said feed-water is subjected to galvanic action, a boiler feed-pipe, and a filter arranged about the mouth of said pipe within the boiler through which water must pass to enter said pipe.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM DOUGHERTY.

Witnesses:

FRANK L. RANDEL,

HENRY MÜLLER.