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FLASH DISTILLATION BOILER FOR TREATING MINERAL WATERS INCLUDING TEMPERATURE RESPONSIVE MEANS

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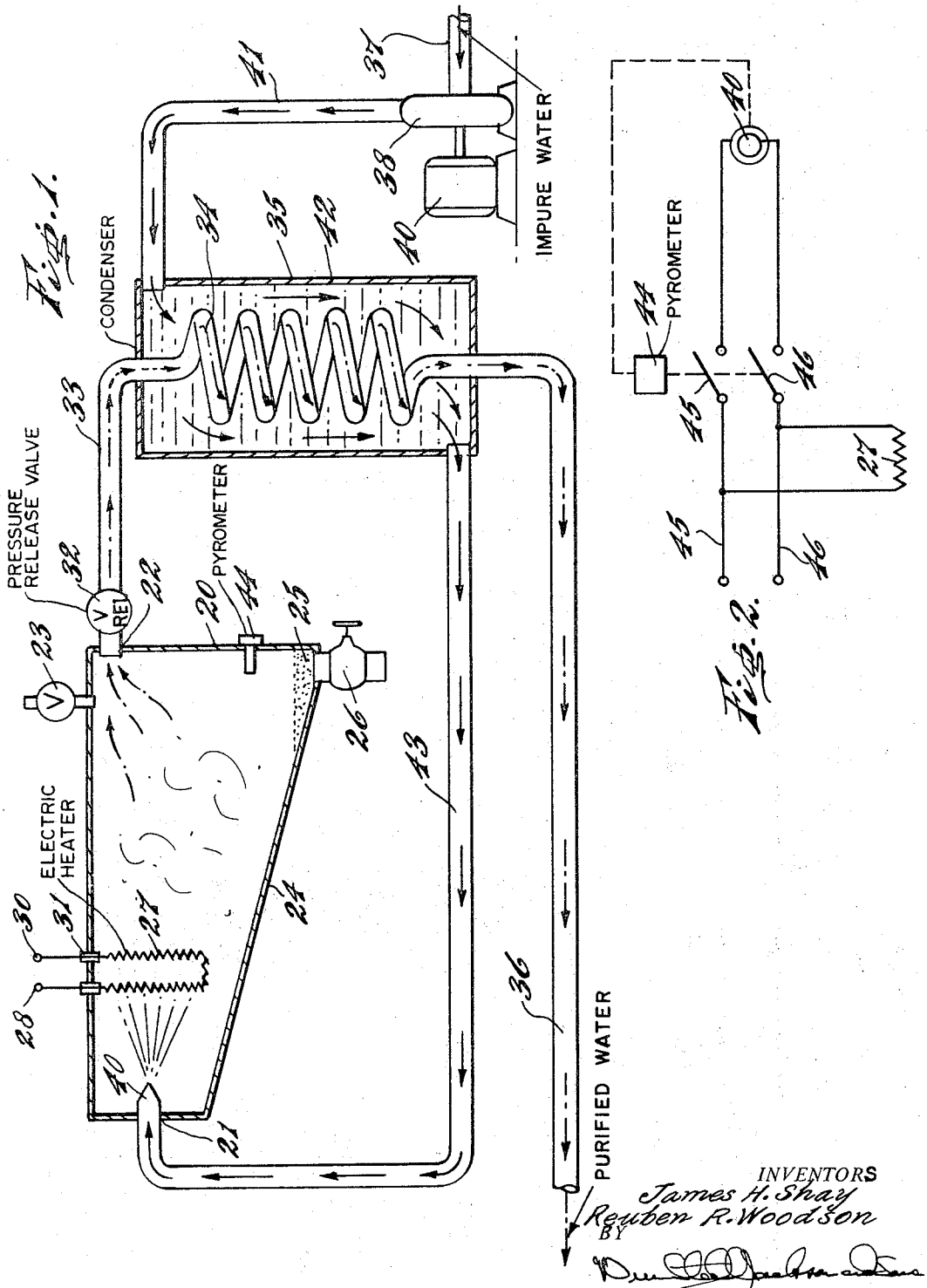

Fig. 1.

Fig. 2.

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ABSTRACT OF THE DISCLOSURE

In summary the invention involves a system for removing minerals such as salt from water and producing purified water. Impure water is pumped by a feed water pump through feed water passages of a condenser and thus preheated. It is then discharged under pressure through a spray nozzle or nozzles into a flash boiler heated by an electric heater. Salt is removed from the boiler by blowdown. Steam from the boiler is carried through steam passages of the same condenser and then removed by a purified water discharge.

The feed water pump is controlled by a pyrometer in the boiler so that operation of the feed water pump ceases when a minimum boiler temperature is reached.

Description of invention

The present invention relates to a system for purifying water by removing minerals such as salt from it.

A purpose of the invention is to produce a very simple and inexpensive system for purifying water in which the feed water in the impure feed water passages of a condenser is heated and then is sprayed into a flash boiler where it instantaneously forms steam, the steam passing through steam passages of the condenser and there being condensed to produce purified water.

A further purpose is to use the impure feed water to condense the steam and provide purified water from the flash boiler.

Further purposes appear in the specification and in the claims.

In the drawings we have chosen to illustrate one only of the numerous embodiments in which the invention may appear, selecting the form shown from the standpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

FIGURE 1 is a diagrammatic vertical section of the device of the invention.

FIGURE 2 is an electrical diagram.

Many highly developed and relatively complicated evaporative systems for desalting water are available, as for example, that shown in Wilson U.S. Patent 3,147,598, granted Sept. 8, 1964, for Apparatus for Evaporating Impure Water.

The present invention is concerned with the production of very inexpensive equipment for distilling water to purify it. In the mechanism of the invention a flash boiler is used in which the steam is almost instantaneously generated from a spray of water, and the steam is condensed by the cooling effect of the feed water which is shortly to be sprayed into the boiler.

Considering the drawing in detail, we there show a flash boiler **20** having an inlet **21** and a discharge **22**. An emergency blow-off valve is provided at **23**.

The bottom of the boiler slopes at **24** to a sump **25** in which salt collects, and the salt is removed by opening normally closed blowdown valve **26**. If there is difficulty through excessive dryness of the mineral, this can be corrected by introducing additional water in the boiler before blowdown.

The boiler is heated by an internal electric heater **27** connected to external terminals **28** and **30** through insulating seals **31** well known in the art.

At the outlet **22** there is preferably provided a pressure release valve **32**, although this is not necessary, and the system will often be operated as an open system. From the pressure release valve **32** steam passes by pipe **33** to steam passages **34**, suitably a steam coil, in the interior of a condenser **35**. Cooling applied by the condenser condenses the steam, and it discharges through a purified water discharge **36**.

The water to be purified enters at **37** at the inlet end of a feed water pump **38** driven by an electric motor **40**. Discharge from the pump passes by pipe **41** to the cooling water jacket portion **42** of the condenser **35**, surrounding the steam coil **34**. Feed water is removed from the cooling jacket portion **42** suitably at the bottom by pipe **43** which connects at the inlet **21** to the boiler **20** with spray nozzle or nozzles **40** which introduce a spray of water into the boiler preferably upon the heater **27**.

As shown in FIGURE 2, power lines **45** and **46** are connected to the electric motor **40** for driving the pump through pyrometer switches **45** and **46** controlled by a pyrometer **44**, which are open when the temperature is too low for injection of water into the boiler and cut off water from the boiler. The heater **27** is in continuous operation when the device is functioning.

In operation, starting with the boiler **20** cold and the device not in operation, the power lines **45** and **46** are connected to the device, energizing the heater **27** in the boiler.

Prior to injection of water into the boiler, the boiler is heated up suitably to a temperature of 450 to 500° F. In the preliminary test boiler this took about 15 minutes. When the boiler reaches a temperature of 450° F. or the temperature at which the pyrometer **44** is set to operate, the pyrometer closes the switches **45** and **46** energizing motor **40** to drive pump **38**. This pumps impure water from pipe **37** through pipe **41** and the cooling water portion of condenser **35** and then through pipe **43** into the spray nozzle or nozzles **40** for spraying a fine stream of water into the boiler and preferably onto the heater **27**. Steam is almost instantaneously formed and evolves through the outlet **22** and the pipe **33** assuming that the valve **32** is constantly open. If the valve **32** is closed, steam does not evolve until a pressure is reached such as 50 p.s.i. which opens valve **32**. The steam is condensed in steam coil **34** of the condenser and forms purified water which passes out of the system through discharge pipe **36**, which may if desired flow to a distribution system or to a storage tank.

Periodically, depending on the mineral content of the water, the blowdown valve **26** is operated to discharge the mineral deposit **25** to waste. If the mineral content is heavy, blowdown should be operated at least once each day, and if the mineral content is extremely heavy, blowdown should be operated every few hours.

If necessary, to render the mineral content liquid or dispersible, prior to blowdown excess water can be introduced into the boiler, as by disconnecting the pyrometer temporarily and closing the switches **45** and **46**.

It will be evident that in normal operation, if excessive water is introduced, the temperature of the boiler will lower and the pyrometer will open switches **45** to **46**, cutting off the operation of the pump drive motor **40** and avoiding introduction of water until such time as all water in the boiler has been converted to steam.

Unlike the usual type of boiler, which is likely to explode if it runs dry, the boiler of the present invention is capable of operating without burning out the heater **27** notwithstanding that the boiler is dry.

If there is a problem of excessive boiler temperature, electrical fuses can be employed which are responsive to boiler temperature and will disconnect the heater in case the temperature of the heater rises excessively far beyond the desired temperature range.

In view of our invention and disclosure, variations and modifications to meet individual whim or partciular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of our invention without copying the mechanism shown, and we therefore claim all such insofar as they fall within the reasonable spirit and scope of our invention.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. In a system for removing minerals from water, a flash boiler having an inlet and an outlet, blowdown means for removing minerals from the boiler, electric heating means for heating the boiler, a condenser having feed water passages and steam passages in heat transfer relationship with one another, piping connecting the steam passages of the condenser at one end with the outlet from the boiler, a feed water pump connected to one end of the feed water passages of the condenser, electric motor means for driving the feed water pump, electrical switch means in circuit with electric motor means, a spray nozzle in the boiler connected to the other end of the feed water passages of the condenser, a purified water discharge connected to the other end of the steam passages in the condenser, a pyrometer disposed in said boiler which is operatively connected with said electrical switch means to start and stop the electric motor means, said electric motor means being operatively responsive to the temperature measurement of the pyrometer to open said electrical switch means and stop the operation of the feed water pump when the temperature in the boiler is below a minimum low setting.

2. A system of claim **1**, in combination with a pressure release valve at the outlet of the boiler.

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