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A. HUET

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FEED WATER ARRANGEMENTS FOR MARINE BOILERS

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FIG. 1

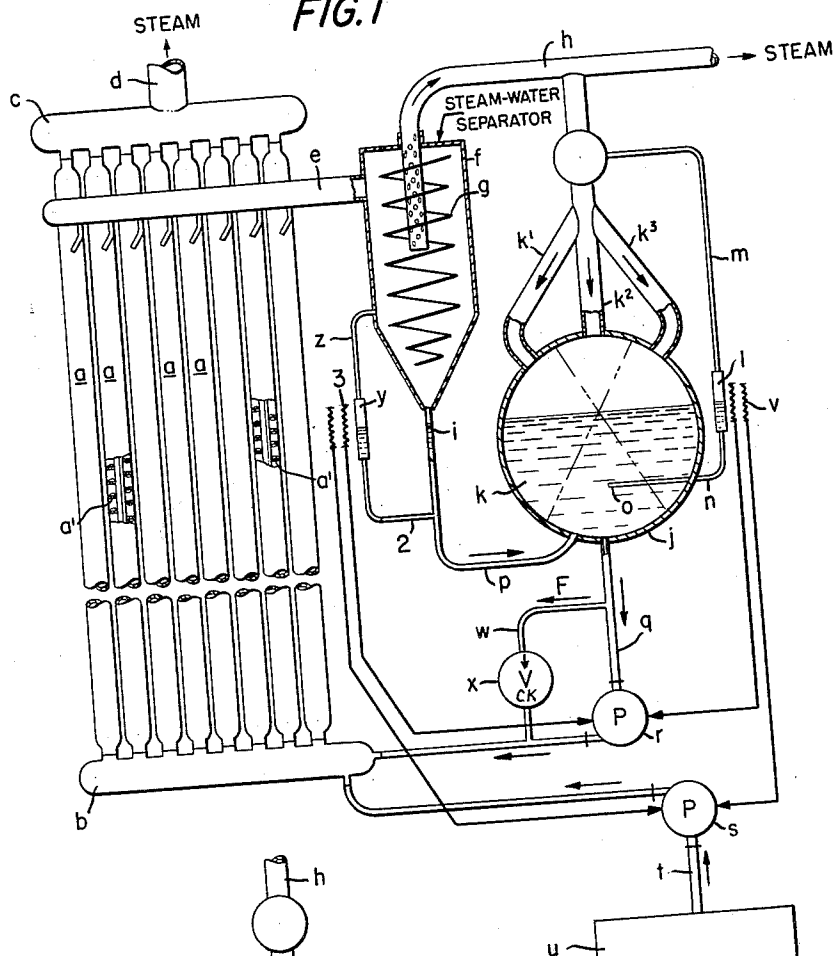


FIG. 2

INVENTOR.
ANDRÉ HUET

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FEED WATER ARRANGEMENTS FOR MARINE BOILERS

André Huet, 48 Ave. du President Wilson,
Paris XVI, France

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4 Claims. (Cl. 122-451)

This invention relates to feed water arrangements for marine boilers.

In my prior application Serial No. 749,505, now Patent No. 2,993,480, dated July 25, 1961, I have described marine boilers which essentially comprise an assembly of evaporator tubes, in each of which the separation of water and steam is effected by gyratory motion on a helical ramp. Each of these water and steam separators is supplied with water at its bottom end and comprises at its upper end a separate water and steam separator. The mixture of water and steam which is still found at the upper end of the tube is directed into a separator header or drum which is common to the tube assembly forming the boiler, and a supplementary separation takes place in said separator.

The present invention is concerned with methods of regulating the supply of water to boilers of this type, and is characterized by the fact that a quantity of water which forms a reserve supply is provided in an independent drum, this drum being in communication with the steam zone and the water zone of the common separator and comprising a water-level gauge. The readings of this water-level gauge control a pump which supplies water to the tubes of the boiler from the water of the condenser, and a second pump provided in the water circuit connects the independent drum to the base of the boiler tubes. This latter pump can be bypassed to ensure water supply by natural circulation.

Finally, a level gauge situated adjacent the common water and steam separator also makes it possible for the two feed pumps to be controlled according to the readings of this gauge. In this way, means are provided with which it is possible to regulate the water supply according to the reserve water volume contained in the drum, according to the water level in the separator, and finally by natural circulation.

Other features of the invention will be referred to in the following description, in conjunction with the accompanying drawing which is given by way of example and in which:

FIG. 1 is a diagrammatic view showing the regulating means forming the subject of the invention; and

FIG. 2 is a diagrammatic view showing the drum containing the water forming the reserve supply with a modified tube arrangement differing from that of FIG. 1 by an angle of 90°.

Referring now to the drawing, a marine boiler is formed by evaporator tubes *a* disposed in groups, as shown in FIG. 1, and supplied with water at their lower ends through a header *b*, while the steam produced and collected in a header *c* discharges through conduit *d*. Each of these tubes comprises a helical internal ramp *a'* on which the steam produced is released axially from the water and steam mixture which is given a gyratory movement. At the upper end of each tube *a* where the steam is discharged, the water and steam mixture which still exists is fed through pipe *e* into a common separator *f* which can, if necessary, contain a helical ramp or surface *g*, the resulting centrifugal force discharging the steam through pipe line *h* while the water accumulates at the lower end at *i*.

According to the invention, a drum or tank *j* is provided independently of the boiler proper and contains a

2

quantity of reserve water *k*. The steam side of the independent tank *j* is connected to the pipe line *h* of the separator *g* by tubes *k*¹, *k*², *k*³ which are arranged fanwise and which open, as illustrated, at spaced points on the periphery of the tank *j*. The water level inside the tank *j* can assume various degrees of inclination, as indicated by broken lines, while the communication of the steam zone of the tank with the steam zone of the separator *f* is nevertheless assured.

A similar arrangement is adopted at 90°, as shown in FIG. 2, and pipelines *k*⁴, *k*⁵ arranged fanwise connect the pipe *h* to the ends of the drum *j*, so that in spite of the inclination of the level of the water inside the drum, constant communication is assured between the steam zone of the drum and the separator *f*.

Provided on the drum *j* is a water-level gauge *l* connected on one side at *m* to the steam pipe *h* and on the other side by the pipe *n* to a point *o* disposed at the center of the mass of water *k* contained in the tank *j*, so that in spite of variations in inclination, a mean indication of the level inside the drum is obtained. In a state of rest, i.e. when the marine boiler is not undergoing any movement due to the rolling or pitching of the ship, the water level gauge *l* indicates a level of water which is in general an extension of the level of the water contained in the tank *j*. However, when rolling and pitching of the ship causes rapid displacement of the water level in the tank *j*, it is apparent that the level of the water in the water level gauge *l* does not immediately follow the changes of the water level in the tank *j*. Further, it is necessary that the orifice *o* of the pipe *n* always be immersed in the body of water in the tank *j* despite the movements of the ship and of the tank *j*. When the orifice *o* is in a position such as that shown in FIG. 1, it will always be in a zone in which it will be in communication with the water in the tank *j*, whatever may be the displacements of the water level in the tank, e.g. to positions such as indicated by the broken lines in the drawing. The base of the separator *f* is connected to the water zone of the tank *j* by a pipe *p* which may be provided with a valve permitting circulation only in the direction of the arrow. Similarly, the water zone of the tank *j* is connected by a pipe *q* to the header *b* for supplying water to tubes *a* of the boiler.

A feed pump *r* is provided in the pipe *q* and a feed pump *s* is provided in the pipe *t* supplying the water from the condenser *u* to the header *b* which feeds water to the tubes.

A device *v*, which is shown diagrammatically, enables the pumps *r* and *s* to be controlled from the readings of the water gauge *l*. The pump *r* is bypassed by a pipe *w*, in which is provided a check valve *x* permitting circulation to be established in the bypass only in the direction of the arrow *F*. Thus, in the event of breakdown of the pump *r*, natural water circulation is established through the circuit *w*.

A second regulating means can be provided by means of a gauge *y* on the water and steam separator *f*. The gauge *y* is connected by the pipes *z* and *2* to the steam and water zones of the separator *f*. A device *3* enables the two pumps *r* and *s* to be controlled according to the changes in water level at *y*, in addition to their control by the readings of the gauge *l*. The devices *3* and *v* are all known construction and operate in known manner corresponding to the regulator element 24A disclosed in La Mont U.S. Patent 2,201,618, except that electrical contacts are employed in indicating the liquid level. These devices comprise solenoids, the resistance of which is varied in response to the height of the water level in the water gauges *l* and *y*. Since a lowering of the water levels in the gauges will indicate a need for more water in the boiler, the pump will of course be actuated upon falling of the water level.

By such an arrangement, it is possible:

(1) To make the readings of the gauge *l* controlling the feed pumps independent of the variations in the water level in the tank *j* resulting from rolling and pitching.

(2) To have a regulating means such that the supply of water to the boiler tubes is controlled on the one hand from the level of reserve water in the independent drum or tank *j* and on the other hand from the water level in the common separator *f*.

(3) Finally, to permit a natural water circulation through the bypass *w* to be established in the boiler in the event of failure of the pumps.

What I claim is:

1. In a marine boiler defined by an assembly of evaporator tubes in which a separation of water and steam is effected, said tubes being supplied at their lower ends with water from a condenser under the action of a first pump, and the mixture of water and steam present at the upper end of the tubes being directed into a separator common to the tube assembly, wherein a supplementary separation of water and steam is carried out, the combination of regulating means for the supply of feed water to said evaporator tubes of said boiler, said regulating means comprising a tank independent of the boiler and adapted to contain a body of water forming a reserve water supply, means connecting said tank to the steam and water zones of the common separator, means including a second pump connecting the water zone of the tank to the lower ends of said evaporator tubes of the boiler, a first water level gauge provided on said tank, first means responsive to the water level in said first gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and second means responsive to the water level in said first gauge to control the first pump supplying water from the condenser to the evaporator tubes, said first means and said second means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said first gauge, a second water gauge provided on said common separator, third means responsive to the water level in said second gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and fourth means responsive to the water level in said second gauge to control the first pump supplying water from the condenser to the evaporator tubes, said third means and said fourth means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in second gauge.

2. In a marine boiler defined by an assembly of evaporator tubes in which a separation of water and steam is effected, said tubes being supplied at their lower ends with water from a condenser under the action of a first pump, and the mixture of water and steam present at the upper end of the tubes being directed into a separator common to the tube assembly, wherein a supplementary separation of water and steam is carried out, the combination of regulating means for the supply of feed water to said evaporator tubes of said boiler, said regulating means comprising a tank independent of the boiler and adapted to contain a body of water forming a reserve water supply, means connecting said tank to the steam and water zones of the common separator, said last-named means comprising a plurality of tubes disposed in fan-wise relationship and communicating at spaced-apart points along the periphery of said tank with the interior of said tank, means including a second pump connecting the water zone of the tank to the lower ends of said evaporator tubes of the boiler, a water level gauge provided on said tank, first means responsive to the water level in said first gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and second means responsive to the water level in said first gauge to control the first pump supplying water from the condenser to the evaporator tubes, said first means

and said second means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said gauge.

3. In a marine boiler defined by an assembly of evaporator tubes in which a separation of water and steam is effected, said tubes being supplied at their lower ends with water from a condenser under the action of a first pump, and the mixture of water and steam present at the upper end of the tubes being directed into a separator common to the tube assembly, wherein a supplementary separation of water and steam is carried out, the combination of regulating means for the supply of feed water to said evaporator tubes of said boiler, said regulating means comprising a tank independent of the boiler and adapted to contain a body of water forming a reserve water supply, means connecting said tank to the steam and water zones of the common separator, said last-named means comprising a plurality of tubes disposed in fan-wise relationship and communicating at spaced-apart points along the periphery of said tank with the interior of said tank, means including a second pump connecting the water zone of the tank to the lower ends of said evaporator tubes of the boiler, a first water level gauge provided on said tank, first means responsive to the water level in said first gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and second means responsive to the water level in said first gauge to control the first pump supplying water from the condenser to the evaporator tubes, said first means and said second means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said first gauge, a second water gauge provided on said common separator, third means responsive to the water level in said second gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and fourth means responsive to the water level in said second gauge to control the first pump supplying water from the condenser to the evaporator tubes, said third means and said fourth means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said second gauge.

4. In a marine boiler defined by an assembly of evaporator tubes in which a separation of water and steam is effected, said tubes being supplied at their lower end with water from a condenser under the action of a first pump, and the mixture of water and steam present at the upper end of the tubes being directed into a separator common to the tube assembly, wherein a supplementary separation of water and steam is carried out, the combination of regulating means for the supply of feed water to said evaporator tubes of said boiler, said regulating means comprising a tank independent of the boiler and adapted to contain a body of water forming a reserve water supply, means connecting said tank to the steam and water zones of the common separator, said last-named means comprising a plurality of tubes disposed in fan-wise relationship and communicating at spaced-apart points along the periphery of said tank with the interior of said tank, means including a second pump connecting the water zone of the tank to the lower ends of said evaporator tubes of the boiler, a first water level gauge provided on said tank, first means responsive to the water level in said first gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and second means responsive to the water level in said first gauge to control the first pump supplying water from the condenser to the evaporator tubes, said first means and said second means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said first gauge, a second water gauge provided on said common separator, third means responsive to the water level in said second gauge to control the second pump supplying water from the independent tank to the evaporator tubes, and fourth means responsive to the water level in

5

said second gauge to control the first pump supplying water from the condenser to the evaporator tubes, said third means and said fourth means being effective to actuate the second pump and the first pump respectively upon lowering of said water level in said second gauge, a by-pass to short-circuit the second pump supplying water from the independent tank to the evaporator tubes, and a check valve on the by-pass for natural circulation of the water from said tank to said evaporator tubes.

5

6

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,070,077

December 25, 1962

André Huet

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 7, for "Mar. 9, 1959" read -- Apr. 8, 1958 --.

Signed and sealed this 27th day of August 1963.

EAL)

test:

WEST W. SWIDER
esting Officer

DAVID L. LADD
Commissioner of Patents