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2,387,103

STEAM BOILER

Filed Feb. 22, 1944

2 Sheets-Sheet 1

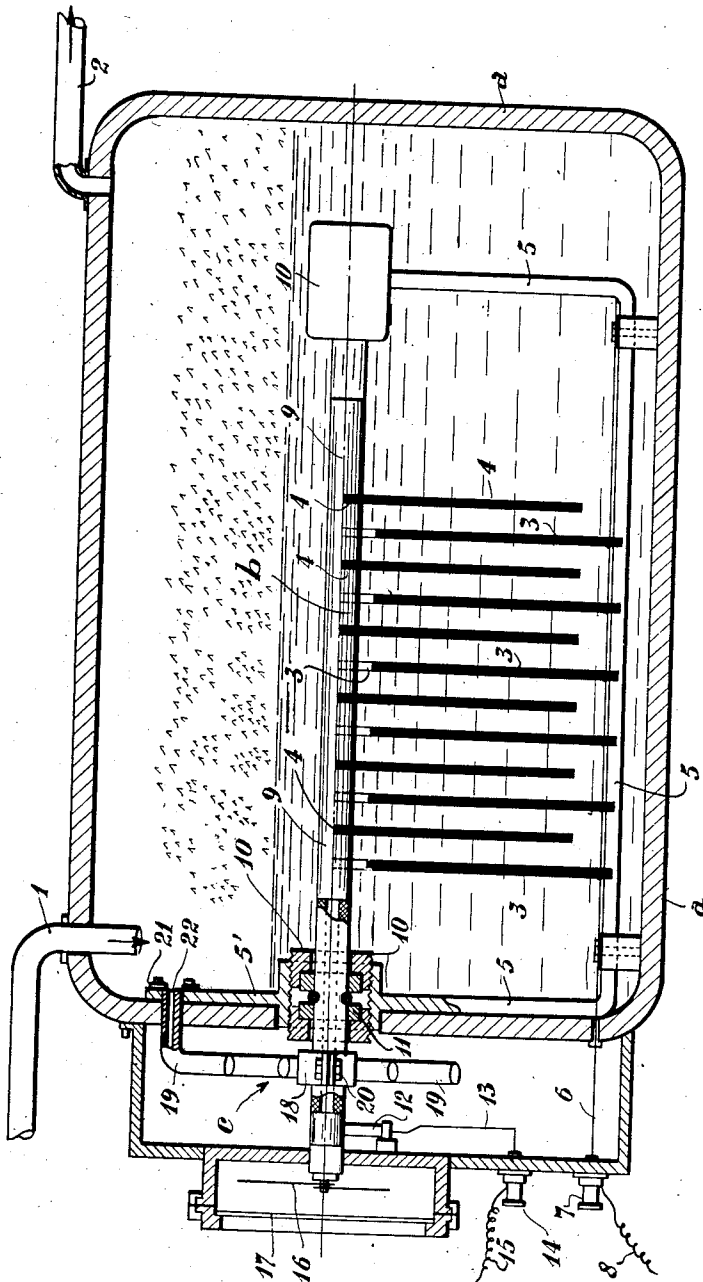


Fig. 1

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[Signature]

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2 Sheets-Sheet 2

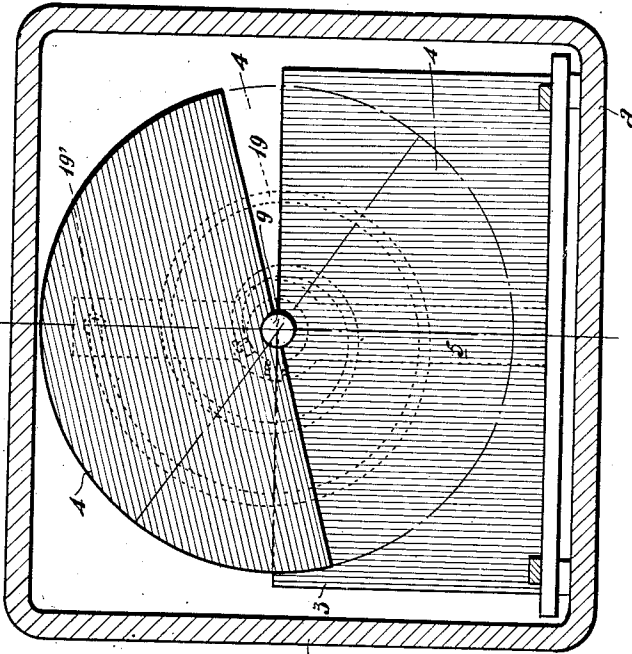


Fig. 3

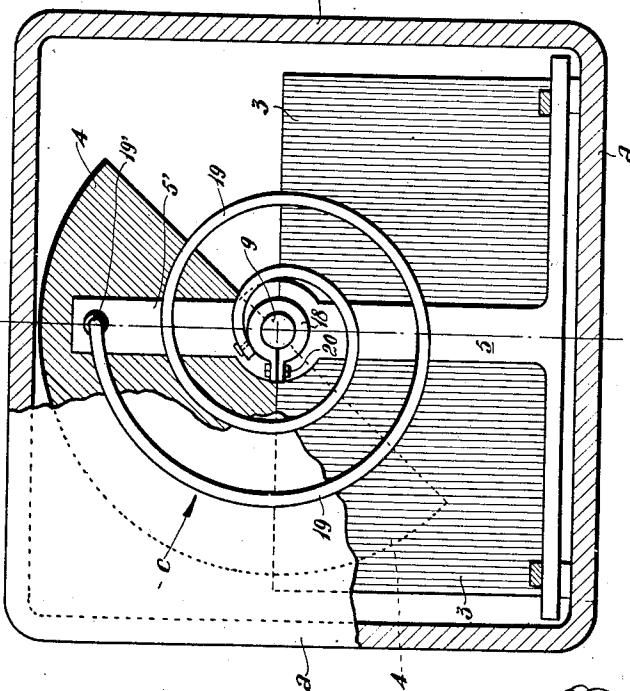


Fig. 2

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UNITED STATES PATENT OFFICE

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STEAM BOILER

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In Argentina May 7, 1943

5 Claims. (Cl. 219—40)

This invention relates to a steam boiler and substantially has for object to provide a self-generating unity embodying features of such a nature that while being of a most simple and practical construction, said unity may be regarded as an ideal element for all kinds of industries and even adapted for the substitution of large boilers of the usual type.

As is well known, the boilers of the usual type, besides the serious problems encountered in the construction owing to the present lack of materials, operate in general with a rather low relative yield, in view of the inconstancy in the consumption of steam supplied to each operative unity, so that frequently a superproduction of steam occurs which notwithstanding must be maintained for the event of any possible requirement in the general service, to which end each boiler is estimated for supplying steam in excess of the amount regularly required.

It will not be necessary to comment about the cost and maintenance of an industrial boiler, as besides the fuel for heating, it requires the attention of a skilled operator, with a strict control, all of which means a considerable increase in service expenses with the consequent rise in general costs.

A most convenient and adequate way of resolving said difficulties would consist in providing every machine or apparatus with a special boiler, adapted to supply the steam necessary for a maximum service, but with means for maintaining a condition of equilibrium and for strictly adjusting to any decrease in consumption. These particular conditions are satisfactorily attained by using the boiler unit in accordance with this invention which in view of the convenient results obtained in the experiments performed, will doubtlessly meet with an immediate and general adoption in practice.

In consequence, this invention has for object a small boiler, provided with means for feeding the water and supplying the steam to the unity to be served, its operation being performed by electric heating under conditions which render the same entirely automatic, not by simple thermostatic action but by a combination of means which control the heater within micrometric variations.

To that end, the heater consists of armatures or plates which, being connected to different polarities and arranged alternately and regularly spaced from each other, are opposed in a varying manner by the relative motion or displacement of one armature with respect to the other,

their operation being controlled by a device consisting of an element sensitive to the fluid or aeriform pressure existing in the interior of the boiler, so that the steam pressure of the same, by influencing said sensitive element, will cause a corresponding controlling effect for establishing a greater or lesser relation between said armatures, and as these latter are submerged in the water of the boiler, they will operate as electrodes, causing the liquid to behave as an ohmic resistance.

A further object of this invention consists in the provision of means whereby the generation of steam and the pressure of the same will be strictly adjusted to the requirements of the service, so as to entirely avoid any superproduction as well as any deficiency of steam in the service.

The invention also has for object to avoid the necessity of controlling and handling or attending the boiler, its control being performed in an entirely automatic manner, depending on the pressure existing in the steam generated therein.

Another object of the invention is to simplify the equipment, by avoiding the use of steam distributing lines which heretofore have encumbered the locals of factories and industrial plants in general, as the boiler in accordance with my invention is individually and directly applied to the machines or devices to be operated.

A further object is to avoid the danger of boiler explosion, as the work is performed with the aid of elements of reduced proportions and with an entirely automatic control.

The invention further views the economic generation of steam in small industrial shops and public services in general, such as laundry shops, barber shops, etc.

Other objects of the invention will appear in the course of the following specification, accompanied, for a better understanding, by several illustrative drawings which show by way of example a preferred embodiment of the improved boiler and wherein:

Fig. 1 is a longitudinal section of the boiler in condition ready for operation, illustrating the manner of operating of the automatic device for performing the control of the heater, in accordance with the requirements.

Fig. 2 shows a side view of the boiler with parts broken away to show otherwise hidden parts, and

Fig. 3 illustrates the operation of the electric heater with its automatic control device.

Similar numbers and letters of reference have been used to indicate like or corresponding parts in the several views.

With reference to the drawings, *a* indicates a boiler, fed with water in the usual way by a pipe 1, and this being a steam generator, a pipe 2 is provided for leading the steam to the machine or apparatus to be supplied.

The heater *b* is of an electrically operated type, in which the water operates as an ohmic resistance for heating the same, to which end said heater is formed by electrode armatures 3 and 4, both connected to a lead of different polarity.

The armature 3 consists of a plurality of plates mounted on a frame member 5 and connected to a lead 6, provided for the entrance of the current, with a terminal 7 for connection to the lead 8.

Between the plates which form the armature 3, are inserted the plates of the armature 4, similar to those of the armature 3, but preferably of semicircular or other appropriate shape, to adapt the same for use as movable elements. For that purpose, the plates 4, arranged at a certain distance with regard to the plates of the armature 3, are secured to a shaft 9, mounted in bearings 10 of the frame 5 and adapted to perform a partial rotation, in order that, according to the position occupied by said plates, the relation between the areas of the plates of the armature 4 and those of the armature 3 may be varied, thus causing the device to operate after the manner of a variable condenser, but with a different effect, owing to the plates acting as electrodes, so that the water occupying the gaps between said plates, may act as an ohmic resistance and become heated to the temperature necessary for vaporization.

To that end, the shaft 9, arranged to operate as a conductor, extends through the wall of the boiler *a*, where it is provided with a suitable packing 11, and engages beyond said wall with a brush 12, connected by means of the lead 13 and terminal 14 to the inlet lead 15 in circuit with the lead 8.

Said shaft 9 is provided, outside of the boiler *a*, with a pointer 16, arranged on a dial 17 for determining the position of the armature 4 with regard to the armature 3 and thus indicate the condition of operation of the adjustable electric heater *b*.

The shaft 9 is connected to a central hub member of a spiral spring 19 of the controlling device *c*; said hub member 18 being formed by a clamp or collar secured in a convenient position by means of a stud 20 to the shaft 9. Thus, said clamp or hub member 18 constitutes one end of the spring element 19 to which it is rigidly connected.

The spiral spring 19 is sensitive to aeriform or fluid pressure, being formed by a tubular member of elliptic cross section, wound as a spiral or scroll and ending with a knee 19', secured by means of a suitable flange 21 to a support 5' extending from the frame member 5. The elliptic tube which forms the spiral spring 19 is in free communication by means of its opened end or mouth 22 with the inner space of the boiler *a*, so that the steam pressure existing in the same will act on the spiral 19 and cause alterations in the convolutions of the scroll, because, like all the devices sensitive to aeriform pressure, the pressure of the steam tends to unwind the tubular scroll, and in consequence, the central hub member 18 of the same will be submitted to an effect of partial rotation, causing a corresponding rotation of the shaft 9 to which it is rigidly secured.

In consequence, as the shaft 9 performs such partial rotation, the armature 4 will be submitted to an angular displacement so as to penetrate to a greater or lesser depth into the gaps between the plates of the armature 3 and thereby vary the relation of area of the plates of the armature 4 to the area of the plates of the armature 3.

The device *c* or spiral member 19, when occupying its normal position, without being influenced by the pressure of the steam within the boiler *a*, will hold the plates of the armature 4 inserted to their total depth between the plates of the armature, 3, so that in this position, the electric heater *b* will operate to its maximum capacity for heating the water which performs the function of an ohmic resistance and as the pressure within the boiler will increase as steam is being generated, said pressure will act on the tubular spiral or scroll and cause a partial rotation of its hub member 18 and shaft 9, whereby the plates of the armature 4 will be angularly displaced and gradually withdraw from the armature 3, so as to reduce the relation between their areas and in consequence, the heating power of the conjoint. In this way, the mutual relation between the plates of said armatures will finally be nil in case that the pressure of the steam should reach a predetermined critical point, so that the pressure of the steam will be automatically controlled.

When under these conditions the steam existing in the boiler is released by supplies through the pipe 2, the pressure will of course descend and its influence on the spiral or scroll, thus rendered less, will allow the same to react and tend to regain its normal condition, thereby causing again a progressive increase in the relation of the armature 4 to the armature 3, whereby, owing to the increase in heating power, the generation of steam will reestablish the pressure and thus again act on the tubular scroll for performing its self-compensation.

From the foregoing it will be understood that the controlling operation of the device for stabilizing the pressure of the steam in the boiler *a* is entirely automatical.

As the electric heater *b* will only operate when conditions require it, its consumption of current will be strictly limited to its full or partial operation, with the possibility of maintaining a stable recess without any consumption, viz: when the normal maximum of steam pressure in the boiler is attained, which, as before stated, will cause the displacement and disconnection of the armature 4 with regard to the armature 3.

This invention, therefore, consists of a boiler *a* in which the heater *b*, of the type in which the water acts as an ohmic resistance, comprises at least two armatures 3 and 4, connected to different polarities, related one to another in variable condition by means of the relative displacement of one armature with respect to the other, said relative motion being controlled by a device *c* formed by a resilient element sensitive to aeriform pressure and operating in communication with the internal space of the boiler *a*, in order that the pressure of the steam generated and accumulated within the same, may act on said sensitive element to cause the displacement of the movable armature self-controlling and stabilizing the pressure of the steam within the boiler.

It will be evident that when carrying this invention into practice, several modifications of construction, shape and other details might be introduced into the boiler as above described, within

the scope of the invention as clearly set forth in the following claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim and desire to secure by Letters Patent, is:

1. In a steam boiler having a boiler chamber, a first series of mutually spaced electrode plates stationary in said boiler chamber, a shaft rotatably mounted in said chamber alongside said first series of electrode plates and having one end thereof projecting from said chamber, a second series of mutually spaced electrode plates mounted on said shaft inside said chamber for displacement, upon rotation of said shaft, between several positions in which the plates of said second series are alternately interposed to a greater or lesser extent between the plates of said first series, and means to connect said two series of electrode plates to opposite terminals, respectively, of a source of electric current, the combination of means for adjusting the angular position of said shaft in dependence upon the steam pressure prevailing in said boiler chamber, said means including a multi-turn tubular spiral spring arranged outside of said

boiler concentrically around the projecting end of said shaft, said spiral spring having a closed end secured to said projecting end of said shaft and an open end secured to said boiler chamber and in communication with the interior thereof.

2. The combination, as claimed in claim 1, in which said multi-turn tubular spiral spring has a uniformly increasing diameter and its inner closed end is secured to said projecting end of said shaft while its outer open end is in communication with said boiler chamber.

3. The combination, as claimed in claim 1, in which said multi-turn tubular spiral spring is provided at its closed end with a hub-shaped clamp member secured to said projecting end of said shaft.

4. The combination, as claimed in claim 1, in which said multi-turn tubular spiral spring is of elliptical cross-section.

5. The combination, as claimed in claim 1, in which said means for connecting said second series of electrode plates to one of the terminals of a source of current includes a stationary brush mounted outside of said boiler chamber for co-operation with said projecting end of said shaft.

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