July 18, 1933. O. ENGISCH 1,918,385

EVAPORATOR

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Fig. 1

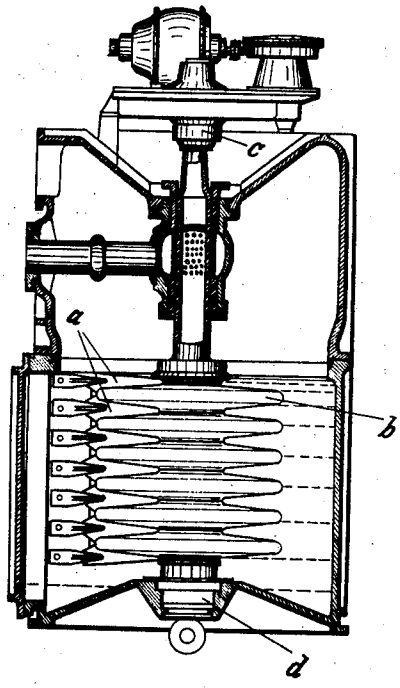


Fig. 2

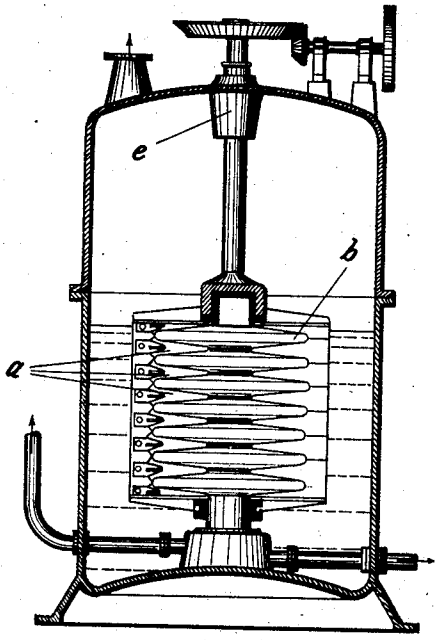
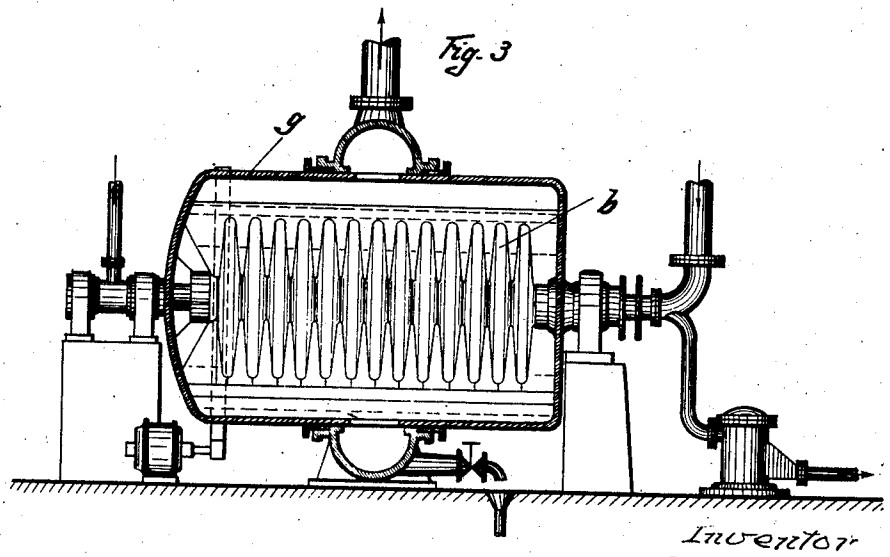


Fig. 3



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Fig. 4

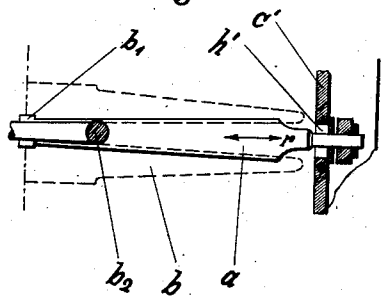


Fig. 5

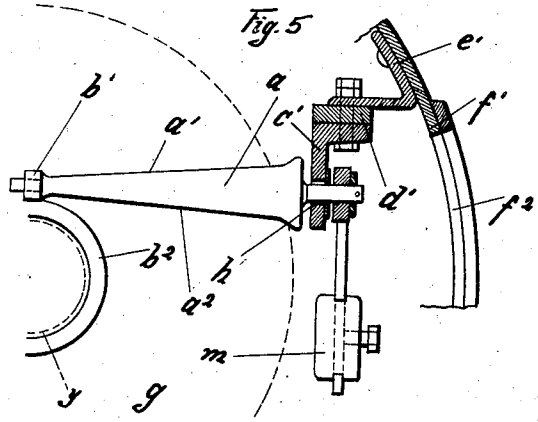


Fig. 6

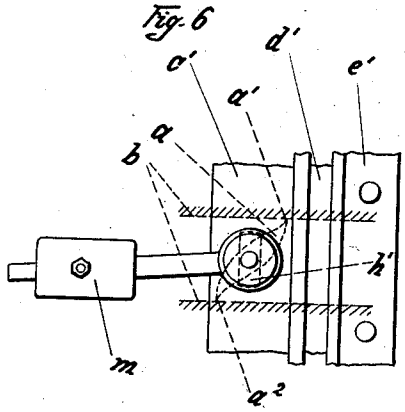


Fig. 7

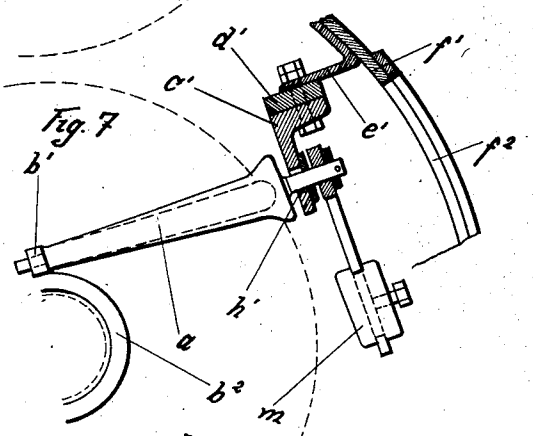
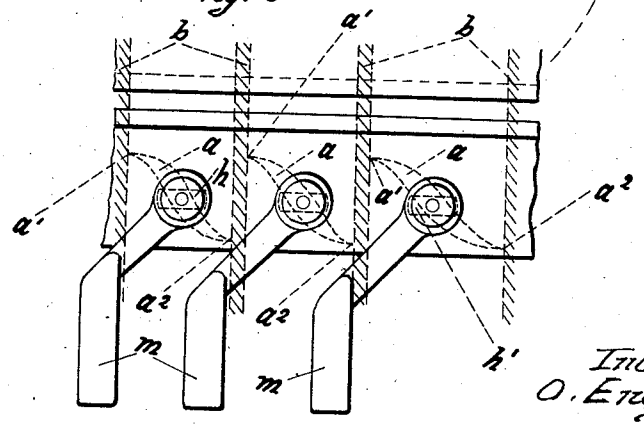


Fig. 8



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Patented July 18, 1933 1,918,385

UNITED STATES PATENT OFFICE

OTTO ENGISCH, OF HAMBURG, GERMANY

EVAPORATOR

Application filed March 24, 1930, Serial No. 438,562, and in Great Britain March 23, 1929.

(GRANTED UNDER SECTION 14, ACT OF MARCH 2, 1927, 357 O. G. 5)

As is known the evaporation of sea water for the purpose of producing boiler feed water and fresh water for other purposes is a difficult process which hitherto has not been capable of continuous operation. In this case the prevention of the transfer of heat and thereby the cessation of the evaporation are caused, not by carbonates and sulphates (which occur in very small quantities in sea water) but by the precipitation of the high content of salt on the heating walls even at comparatively low temperatures.

Hitherto in the evaporation of sea water, it has been necessary to put the evaporator out of commission every few hours to allow of cleaning its heating walls. This great defect and the expenses incurred thereby have made sea water evaporation practically impossible and led to the result that the evaporation of sea water on board ship has been completely abandoned. Ships nowadays are generally fitted with large tanks, wherein the required fresh water for the voyage is carried. Of this water a quantity necessary for the boiler feed is evaporated in evaporators of known construction fitted with nests of heating tubes that can be swung out and is then condensed to provide a distillate, the use of which reduces the incrustations on the heating surfaces in the boiler. Great loss of tonnage and cargo space are the greatest disadvantages due to the practically unworkable evaporation of sea water, whereas the disadvantage of a periodical cleaning of the evaporator and the consequent interruptions of the evaporation process is present in the case of fresh water evaporation.

For the purpose of avoiding these disadvantages, in the cases of salt water especially, and with any water in general, a device has been designed according to the invention which makes it possible to maintain the metallic walls of the evaporating element always in such a clean state, that no heat insulating films or layers can be deposited thereon. This end is achieved according to the invention in arranging any suitable means on the walls of the evaporator, which fit it closely, and which continually remove any incrustration which may possibly be forming.

For this purpose the invention provides either that the evaporator heating element itself moves continuously past the scrapers which lie close against its walls, or that the scrapers themselves rotate, whereas the evaporator heating element is stationary. In this case the formation of any kind of a heat insulating crust on the walls of the evaporator is avoided, so that they always remain in a bright metallic state, and ensure a good heat transfer.

The invention is illustrated by means of a few constructional forms, and in the accompanying drawings.

Fig. 1 shows a cross section through an evaporator installation in which the evaporating element is rotatably suspended,

Fig. 2 shows another constructional form, in which case the means for cleaning are rotatably arranged on the stationary evaporator,

Figure 3 is a longitudinal section showing the outer casing and cleaning means rotating with respect to the evaporator.

Figure 4 is an enlarged elevation, partly in section, showing a single scraping means cooperating with an evaporator section.

Figure 5 is a top plan of the same.

Figure 6 is an end view of the same.

Figure 7 shows an elevation, partly in section, of the scraper cooperating with a horizontal arrangement of evaporator of the type shown in Figure 3.

Figure 8 is an end view of the same.

In the drawings, *a* denotes the scrapers by means of which the walls of the evaporating element between the ribs are to be cleaned. This evaporator element may, according to Fig. 1, be rotatably suspended so that during its rotation it always brushes past the stationary scrapers *a* which are however elastically mounted in the direction of the possible greatest expansion of the rotating heating body, which latter is therefore continually scraped clean by the scrapers. For this purpose the evaporator heating element is suspended from a neck journal bearing *c*

and is rotated by means of the driving arrangement *d*. The thrust bearing *e* is unloaded by means of the method of suspension, which is of importance as regards the output of the device and the reliability.

According to Fig. 2, the reverse takes place, that is to say the scraper arrangement *a* is rotated, being suspended from a bearing *e* whereas the evaporator element *b* is arranged stationary.

In Fig. 3 a further constructional form is shown in which by means of a driving gear *f* the housing *g* is rotated, so that the scrapers *a* which are fixed on the housing rotate around the heating elements of the evaporator, and keep these bright continuously.

It is clearly seen here, how the scrapers lie tightly against the evaporator heating element, according to its profile, and how they are mounted so that they are elastic in the directions concerned, so as to effect thereby the intended cleaning action practically without friction. The scrapers according to the detail figures of the drawings are rotatable under the influence of a weight *m*, the maximum width of the scrapers exceeding the possible distance between two adjacent walls under the maximum expansion of the element *b*. Thus the weight serves to hold the edges of the scrapers in contact with the walls at all times, moving the scraper in one direction as the element *b* expands and permitting it to be moved in the opposite direction as the element contracts. The scraper proper is supported at one end in an eye *b'* of a ring b^2 encircling the juncture between the adjacent evaporator elements and at the opposite end in a bracket *c'* supported from a bracket *e'* through the intermediary of a block *d'* and a bolt uniting the angle iron and bracket through the block. The edges of the scrapers *a* are pressed on the heating walls below a certain angle. Every scraper is rotatably suspended from a bearing on both ends in direction of its center line. If the temperature of the heating walls is rising the scrapers are able to move with same without any resistance in direction of the vertical center line.

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 is:—

1. In combination with a sea water evaporator including an evaporating heating element of bellows form, double-ended scrapers operating between the folds of the evaporating element, the heating elements and scrapers being arranged for relative movement and means to automatically maintain the respective ends of the scrapers in scraping contact with the adjacent walls of the element during element expansion and contraction.

2. The combination with a sea water evaporator including an evaporating element of bellows form, of double-ended scrapers arranged between the folds of the evaporator and mounted for that rotative movement causing the respective edges of each scraper to cooperate with the opposing walls of a fold of the evaporator, the evaporating element and scrapers being mounted for relative movement and means for automatically maintaining the scraper edges in scraping contact with such walls independently of the expansion or contraction of the evaporator in use.

3. The combination with a sea water evaporator including an evaporating element of bellows form, of scrapers arranged between the folds of the evaporator and mounted for that rotative movement causing the respective edges of each scraper to cooperate with the opposing walls of a fold of the evaporator, the evaporating element and scrapers being mounted for relative movement, and a weight directly influencing the scrapers for automatically maintaining the scraper edges in scraping contact with such walls independently of the expansion or contraction of the evaporator in use.

4. The combination with a sea water evaporator including an evaporating element of bellows form, of scrapers arranged between the folds of the evaporator and mounted for that rotative movement causing the respective edges of each scraper to cooperate with the opposing walls of a fold of the evaporator, means for automatically maintaining the scraper edges in scraping contact with such walls independently of the expansion or contraction of the evaporator in use, and means for bodily moving the scrapers as a unit relative to the evaporator.

5. The combination with a sea water evaporator including an evaporating element of bellows form, of scrapers arranged between the folds of the evaporator and mounted for that rotative movement causing the respective edges of each scraper to cooperate with the opposing walls of a fold of the evaporator, the evaporating element and scrapers being mounted for relative movement and means for automatically maintaining the scraper edges in scraping contact with such walls independently of the expansion or contraction of the evaporator in use, the evaporating element being of cylindrical form and mounted for rotation.

OTTO ENGISCH.