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C. MARKWORT.

APPARATUS FOR CLEANING TUBES OF EVAPORATORS OR LIKE APPARATUS.

(Application filed Dec. 5, 1898.)

(No Model.)

Fig. 1.

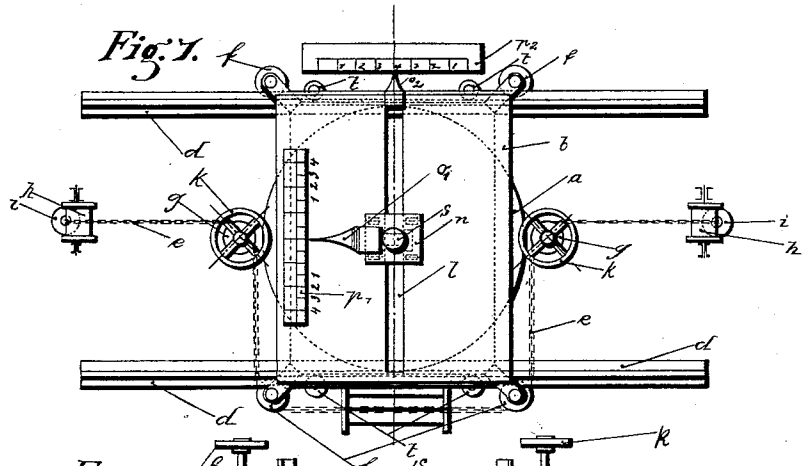


Fig. 2.

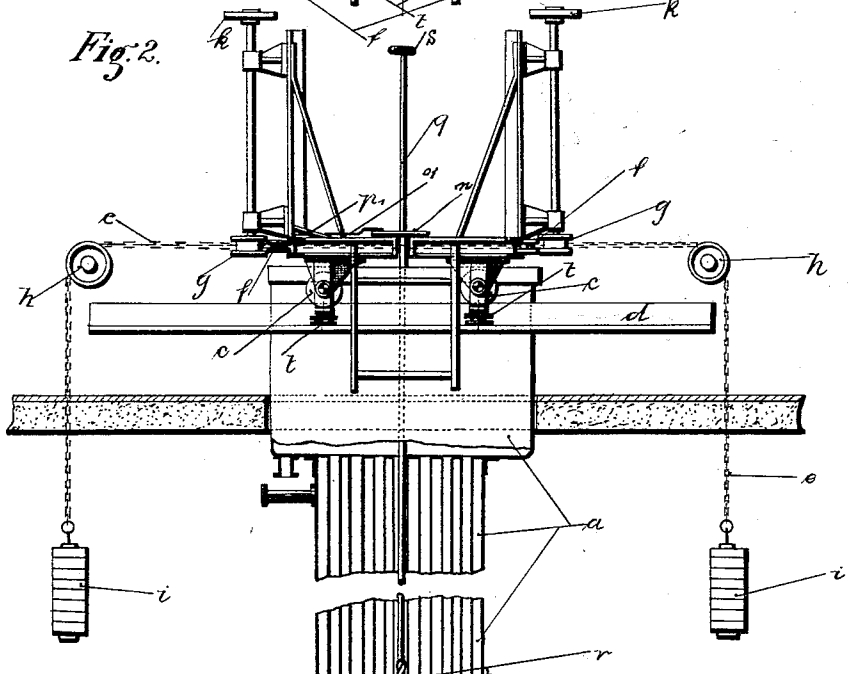
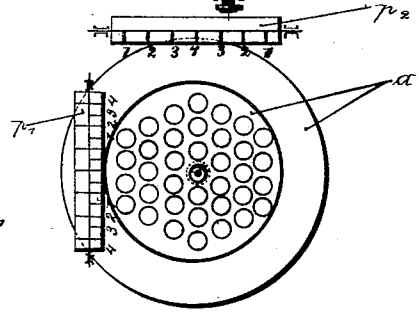


Fig. 3.



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APPARATUS FOR CLEANING TUBES OF EVAPORATORS OR LIKE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 632,532, dated September 5, 1899.

Application filed December 5, 1898. Serial No. 698,257. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN MARKWORT, a subject of the Emperor of Germany, residing at Uelzen, Empire of Germany, have invented new and useful Improvements in Apparatus for Cleaning the Tubes of Evaporators or Like Heating Apparatus; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to a new and improved apparatus for cleaning the tubes of evaporators and like heating apparatus during the heating or the evaporating process, so as to keep the heating-surfaces constantly clean and the evaporator unchanged in working order for any period of operation.

More particularly in heating and evaporating sugar-juice it is of signal importance to keep the inner surfaces of the evaporating-tubes always clean, as there are considerable excretions from the heated juice, so that their adhesion to the inner surfaces of the tubes diminishes the conductivity for heat so considerably in a short time as to leave hardly half of the initial power. Yet this is equivalent not only to an inferior utilization of the heat supplied, but at the same time to a disparagement of all the stages following the preparatory heating—such as saturation, filtration, evaporation, and crystallization. The apparatus hitherto made use of for cleaning the tubes have been insufficient because a high cover of scum at the upper mouths of the tubes obviated the exact hitting of the apertures of the individual tubes. Moreover, the edges of the tubes which are boarded for tightening them are damaged by pushing at random the cleaning instrument. Finally, the workmen intrusted with the cleaning, standing as they do on an unsteady bridge, are in constant danger of life. All these inconveniences are obviated by my invention.

For cleaning the tubes above their mouths from a movable platform there are introduced one or several cleaners corresponding to the directions of the axis of the tubes. By shifting the platform so as to be accommodated to the mouths of the tubes, and likewise by sliding the cleaners on the platform the latter may be moved so that they are exactly above the mouths of the several tubes and need only be pushed down for cleaning them. The cleaners are directed by means of scales, which in accordance to the arrangement of the tubes of the evaporator had been made once for all. This is rendered possible, as the tubes are generally arranged in two rows or two principal directions crossing each other and as the distances between the neighboring tubes are equal.

Having now made clear the object of my invention, I come to the actual construction thereof.

In the accompanying drawings, which form a part of my specification and in which similar letters refer throughout to similar parts, Figure 1 shows a plan view of an evaporator or a like heating apparatus furnished with the cleaner embodying my invention. Fig. 2 shows a side elevation, part in section, of the same. Fig. 3 shows a scheme of the arrangement of the scales corresponding with the tubes of the evaporator.

Above the evaporator or like heating apparatus a there is the movable platform b, the supporting-wheels of which c are running on rails d, arranged parallel to each other on either side of the evaporator. A chain e is wound around guiding-rollers f and regulating-wheels g, either fixed at one end or loosely slung at both ends over tension-rollers h with weights i attached. Each regulating-wheel g is keyed upon a spindle bearing a hand-wheel k, by the rotation of which in either direction the platform may be moved to and fro between the tension-rollers $h\,h$. The platform is provided with a slit l, parallel to one of the chief directions of the rows of the tubes. By this slit l a sliding carriage n is guided on rollers and bears an index o_1, perpendicular to the slit. Another index o_2 has the direction of the axis of the slit. Parallel to the slit—*i.e.*, parallel to one row of the tubes of the evaporator—there is a scale q' on the platform, and another scale p^2 is parallel to the direction in which the platform moves. As the index o_2 and the scale p^2 serve to fix the position of the platform, the index o_2 may

be fixed on its outside, in which case the scale p^2 must be arranged on the platform itself. On the scale p^2 the distances of the axis of the tube-rows and on the scale p' those of the individual tubes within one row are marked by dashes, which drawn out to the points of intersection would give an exact idea of the arrangement of the individual tube-axis.

The tube-cleaner r is guided by its rod q exactly in the point of intersection of the center lines of the pointers o_1 and o_2, so that the axis of the cleaner r is perpendicular to the center line of the slit l and in that point where the center line of the pointer m cuts that line. Supposing the center line of the slit l to be perpendicular to the axis of one row and the point of the cleaner to be in the axis-line of one tube drawn out, then, if the sliding carriage n is moved in the slit l so that the index o_1 successively points to each dash of the scale p', the cleaner will be successively placed above the several mouths of all the tubes of this row, and by pushing down the cleaner the whole row will be cleaned successively. If, then, the platform is moved about one interval of the rows after another, by directing the pointer o_2 to the successive dashes of the scale p^2 the tubes of the different rows may be cleaned in the same manner as described with regard to the tubes within one row. It is evident, providing that the tubes be exactly arranged and the pointers be exactly directed to the correspondent dashes of the scales, that the axis of the cleaner with mathematical exactness must coincide with the axis of each tube, and that any injury of the tightened edges of the tubes will be avoided.

The shifting of the platform by one interval of the scale p^2 may be facilitated by connecting the hand-wheel k with a ratchet-wheel, allowing the rotation of the hand-wheel k only intermittingly and at an amount which corresponds to one interval of the scale p^2.

The cleaner of the tubes by being pushed down into the latter conveniently consists of a rod q, which is conveyed in the direction of the axis of the tubes and is provided at the inferior end with a scraper r or with wire brushes, whereas the upper end bears a handle s. As all the movements of the cleaner for directing it to the tube-axis are performed outside the evaporator and the axis of the cleaner exactly coincides with that of the respective tube even if the tube-mouths are covered with scum, which is always the case in sugar-manufactories, it is evident that the cleaning of the tubes during the evaporation is actually done by this invention.

In order to secure the exact movements of the cleaner, it is sufficient to arrange the chain only on one side, because, as will be seen from the drawings, the guiding-rollers t exclude any irregular shifting of the platform. At the same time it is sufficient to make use of only one regulating-wheel, while the drawings exhibit another, so that one may serve for forward and the other for backward movement.

In order to direct the cleaner to a certain tube-row and just to the first, respectively, to the last tube of that row so that the tubes one after another may be cleaned by successively shifting the sliding carriage bearing the cleaner and lest the cleaner should be directed to such a point of intersection of the dashes drawn out of both the scales where there are no tubes, the marks for the dashes of both the scales are conveniently so chosen that the like marks on both the scales correspond to the outside tubes of each row, as to be seen from Fig. 3 in the drawings. Supposing the tube-rows, which the platform moving from left to right hand passes by one after another, are signed "1," "2," "3," &c., increasing to the middle and from there decreasing by one, so that rows equidistant from the middle bear the same numbers. In this case the dash-marks of the second scale are so chosen that those which correspond to the first and the last tube of the first row, and thus at the same time to the last row, (likewise marked "1,") also bear the number "1." The neighboring dashes (in the direction from top, the bottom in the sense of the drawings, Fig. 3) then bear the numbers "2," "3," &c. As the tube-rows generally are alternating one with the other, one dash of the respective scale must be skipped at each shifting of the slide-carriage—*i. e.*, if the slide-carriage shall be placed above the rows of the even numbers it must be directed to the even dashes of the second scale, and if it shall be placed above the odd rows it must be directed to the odd dashes of the second scale. In order to mark the requisite positions more distinctly, the even and the odd dashes of both the scales may be distinguished by different colors.

In the drawings only one evaporator or like heating apparatus is shown as provided with the cleaner, yet it is evident from the foregoing description that any number of evaporators or like heating apparatus may be worked by one cleaner, it being only necessary to lengthen the rails beyond this evaporator and to lay them over the other. If the tube-rows of the other evaporators have the same distances, the same scales and the same slit of the platform may be made use of for all the evaporators, provided that the direction of the rows is the same, or else for each different position of the tubes of one evaporator special scales, and, if necessary, also special slits, are to be provided, or the platform must be not only movable to and fro, but must also be rotated like a turntable.

The safety of the workmen from danger is warranted partly by covering the evaporator by means of the platform, partly by its fence, and so the other improvement aimed at is actually attained by this invention.

I do not limit the invention to all of the de-

tails and structural features shown in the drawings and described above, since many of the same may be modified within the skill of the mechanic without departing from the spirit of the invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an improved cleaner for the vertical tubes of evaporators and like heating apparatus the combination of a horizontally-movable platform or cover, a slit therein, a sliding carriage mounted to move over the slit, a rod guided vertically in the said sliding carriage, pointers fixed on the platform and sliding carriage and scales arranged opposite the pointers for indicating the position of the cleaning-tool with respect to the different tubes, substantially as set forth.

2. In a cleaner for tubes the combination of a movable platform or cover, a slit therein, a sliding carriage adapted to be moved over the slit, a rod guided in the said sliding carriage, pointers fixed on the platform and sliding carriage, scales arranged opposite said pointers for indicating the position by the said pointers, and having numbers in connection with the scale-marks so arranged that the first and the last tube of a row and the first and last tube of a cross-row are indicated by one and the same number on both the scales, substantially as and for the purpose described.

Signed this 5th day of November at Hanover, Germany.

CHRISTIAN MARKWORT.

Witnesses:

W. K. ANDERSON,

LEONORE RASCH.