

(No Model.)

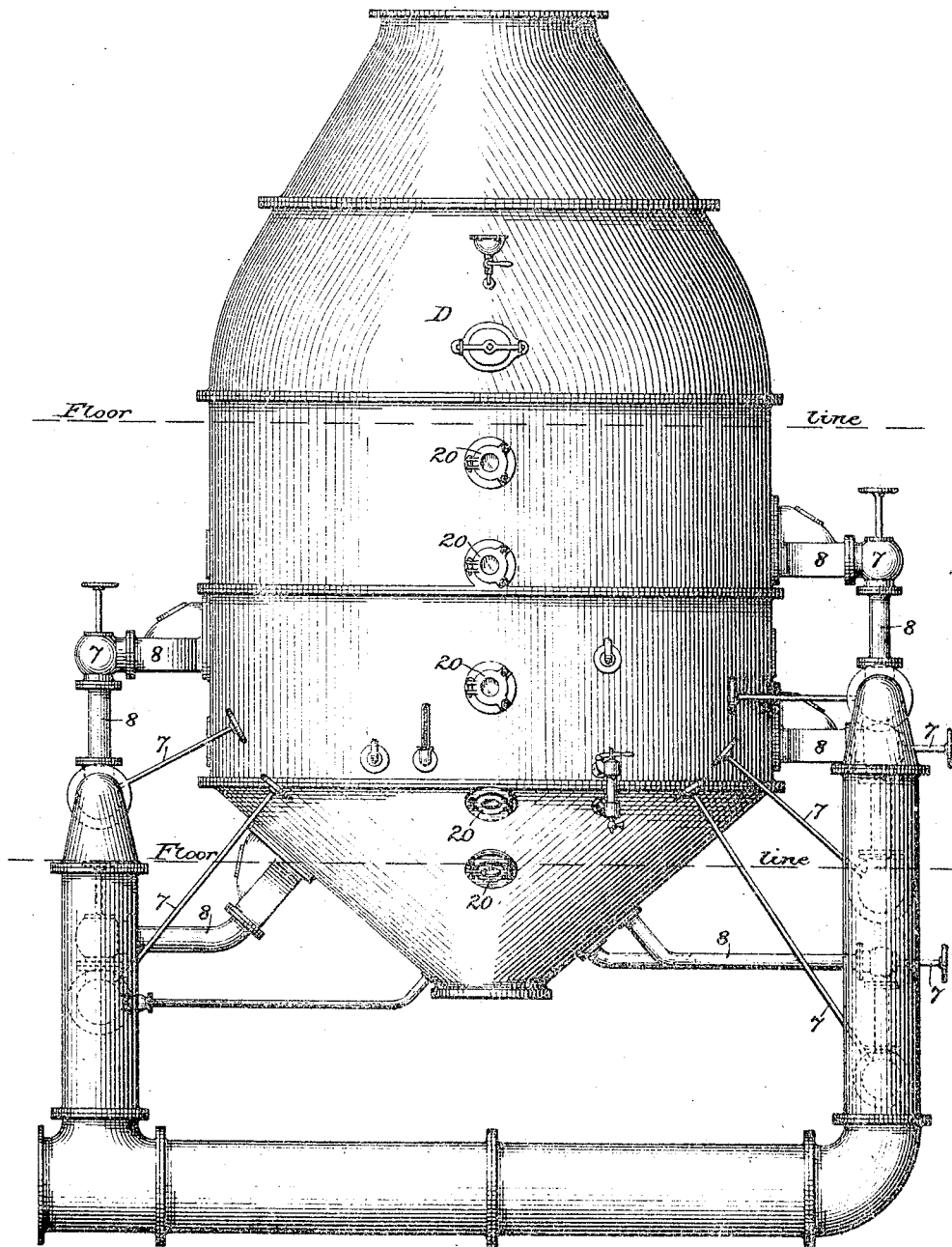
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G. ENGEL
VACUUM PAN.

No. 386,579

Patented July 24, 1888.

Fig. 1.



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JUL 25

(No Model.)

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Fig. 2.

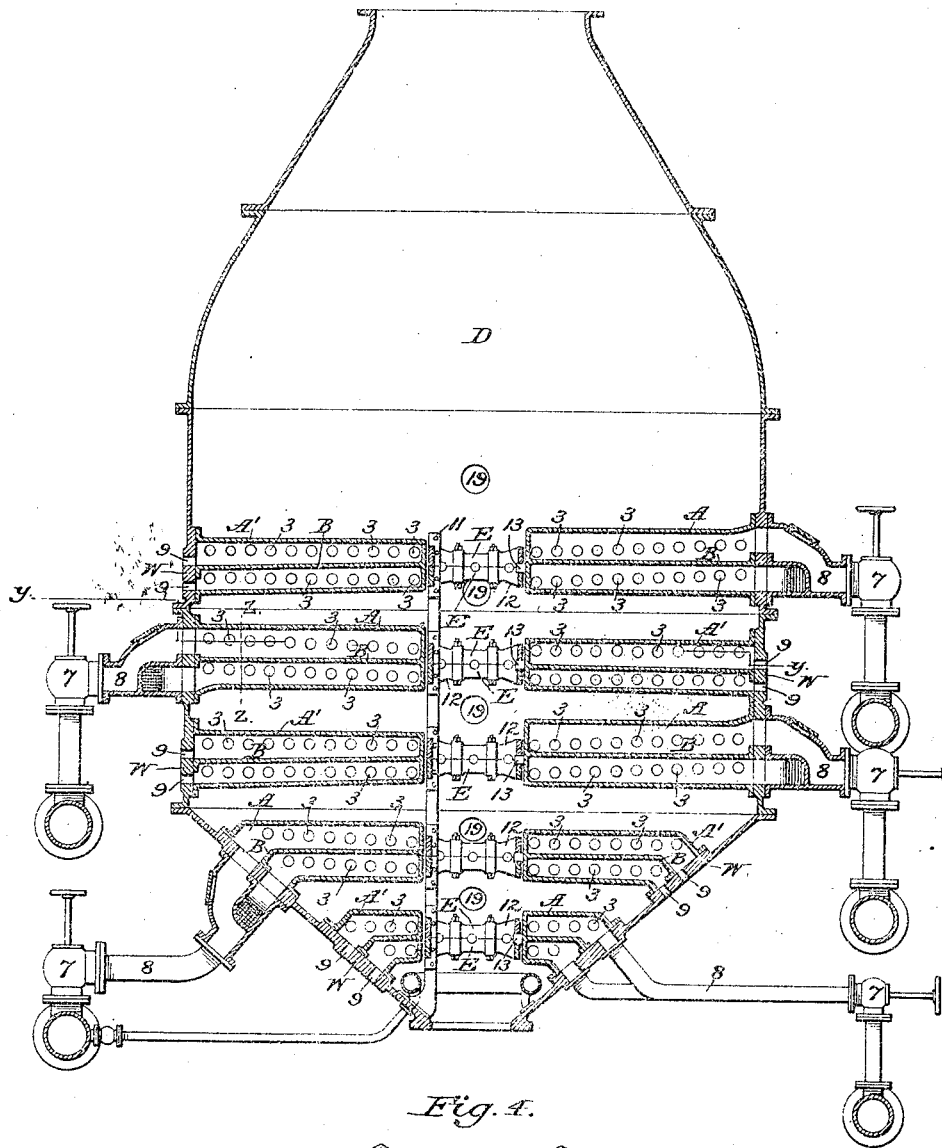
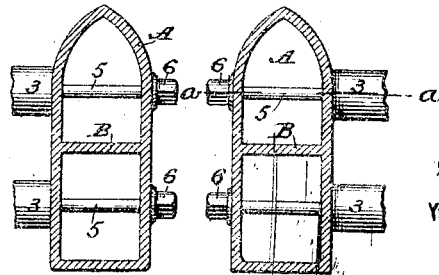


Fig. 4.



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Fig. 3.

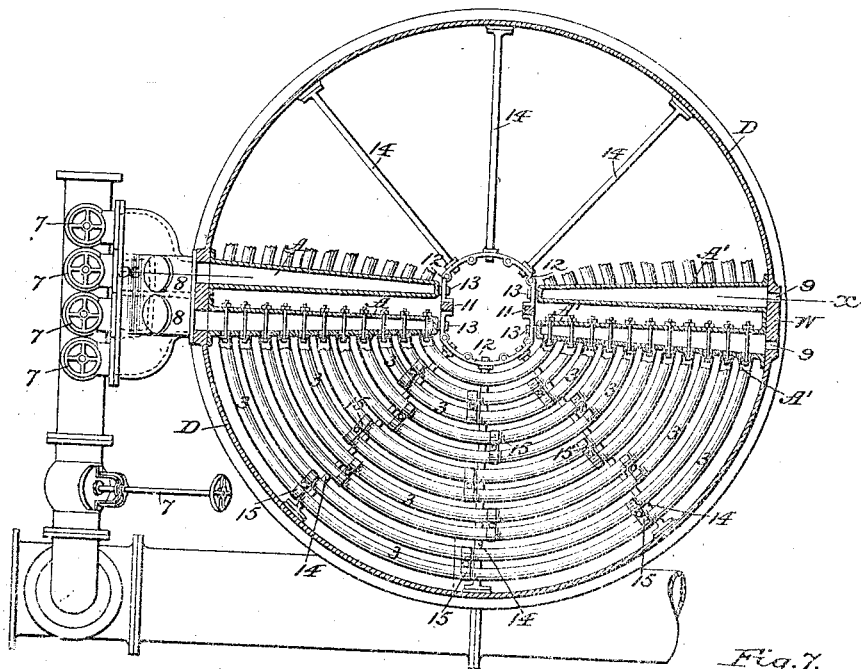


Fig. 6.

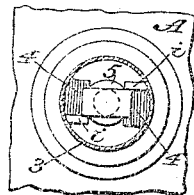


Fig. 5.

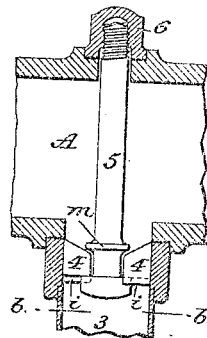


Fig. 7.

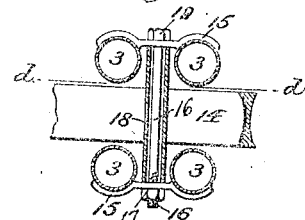
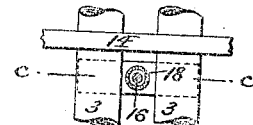


Fig. 8.



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Fig. 11.

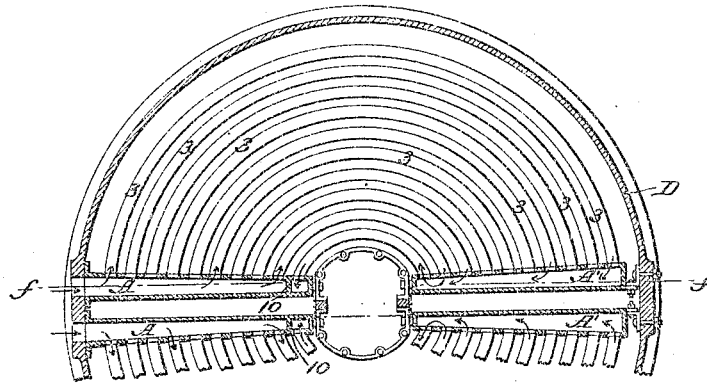


Fig. 12.

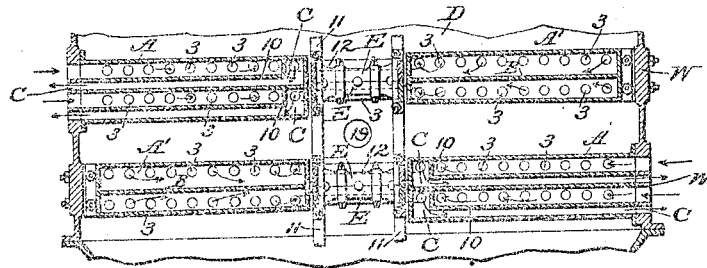


Fig. 9.

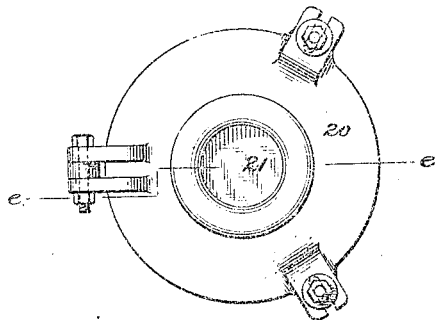
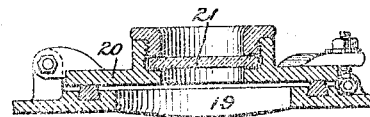


Fig. 10.



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UNITED STATES PATENT OFFICE.

GOTTFRIED ENGEL, OF BROOKLYN, NEW YORK, ASSIGNOR TO HENRY F. ENGEL, OF SAME PLACE.

VACUUM-PAN.

SPECIFICATION forming part of Letters Patent No. 386,579, dated July 24, 1889.

Application filed November 10, 1887. Serial No. 254,776. (No model.)

To all whom it may concern:

Be it known that I, GOTTFRIED ENGEL, of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Vacuum-Pans; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification, in which—

Figure 1 is an elevation of a vacuum-pan fitted with my improvements; Fig. 2, a vertical central section thereof in line *x x* of Fig. 3; Fig. 3, a transverse section thereof in line *y y* of Fig. 2; Fig. 4, a detached transverse section, on an enlarged scale, in line *z z* of Fig. 2, illustrating the form of the heads to which the heating-tubes are secured; Fig. 5, a detached transverse section, on an enlarged scale, in line *a a* of Fig. 4; Fig. 6, a section in line *b b* of Fig. 5, showing the end of the bolt in elevation; Fig. 7, a transverse vertical section, on an enlarged scale, through two of the superimposed tiers in a section of the heating-tubes and their tie-pieces and stay-sleeves in line *c c* of Fig. 8, said Fig. 8 being a horizontal section in line *d d* of Fig. 7; Fig. 9, an elevation, on an enlarged scale, of one of the port-hole doors and its eyeglass, Fig. 10 being a transverse section thereof in line *e e* of Fig. 9. Fig. 11 is a transverse section similar to Fig. 3, illustrating a modification in the arrangement of the inlets and outlets in a section of heating-tubes, the tie-plates and supports for the tubes being omitted; and Fig. 12 is a transverse section in line *f f* of Fig. 11, enough of the pan only being shown to present four steam-heads.

Similar letters indicate like parts in all of the figures.

My invention has for its object to simplify and improve the construction and arrangement of the heating-surface contained in a vacuum-pan for the manufacture of sugar, whereby means are provided for producing various degrees of temperature in different portions or on different sides of the pan to promote the circulation therein, the amount of heating-surface in a given space is largely increased, thereby increasing correspondingly the evaporation in the pan, the downward discharge of sugar facilitated, a free expan-

sion and contraction of the heating-pipes permitted without affecting the joints, and said joints made fast by bolts, which are not exposed to the action of the contents of the pan.

It has also for its object to facilitate ready access to each of the pipes and to provide means for the removal and replacement of any one of them without disturbing the others.

These advantages are attained by the devices hereinafter fully described, and which are illustrated in the drawings.

The vacuum-pan D may be of the usual form and construction and be mounted and connected in the customary manner.

The pan is heated as required by means of independent sectional segmental radiators, each radiator consisting of two radial heads, A and A', connected on one side only by a series of curved tubes bent to form arcs of different radii, and which are arranged concentrically at uniform distances apart and in a plane deviating sufficiently from the horizontal plane embracing the two heads to allow an automatic drainage therefrom of the water of condensation therein.

Vacuum-pans have heretofore been fitted with radiators constructed of two radial heads placed diametrically opposite each other and connected on both sides by curved semicircular or segmental tubes communicating freely with each other through said interposed heads, so as to form in fact a series of circular passages intersected by the two radial channels formed by the heads. My invention differs therefrom in that my radiators are segmental, and the two radial heads in which the tubes for each radiator terminate are fitted with but one set of lateral tubes, which communicate with the respective heads on one side thereof only, whereby there are no circular passages created therein. The arcs formed by the several tubes 3 3 3 in each radiator are described from a common center, so that the open intervals between them are uniform in width throughout their entire length. A sufficient number of these independent segmental radiators are fitted in the same horizontal plane to form a single tier, filling the entire circle. In most cases it is preferable to use semicircular radiators, as shown in Fig. 3; but I contemplate making them quadrantal or of lesser seg-

mental forms, thereby increasing the number required to complete any one tier thereof. By making the segmental radiators independent of each other and with tubes of small diameter, I am enabled to regulate the heating of the pan with great precision, and am also enabled to admit steam into the radiators on one side of the pan at a higher temperature than upon the other, so as to force the circulation in the pan when required.

The radiating-tubes 3 3 3 may be expanded in the respective openings provided for them in the heads A A' by an expander passed through corresponding openings on the opposite side of the head, which openings will finally be blanked or closed up. I prefer, however, to facilitate the connection and disconnection of the tubes 3 3 3 with and from the heads A A' by forming internal lugs, 4 4, at diametrically-opposite points within a head fitted to the end of each tube to engage a T-headed bolt, 5, inserted transversely through the head and into the end of the tube, as shown in detail in Fig. 5, and by means of which the tube is drawn against the opening in the head to which it is fitted, to make a close joint therewith.

The opening between the lugs 4 4 is so restricted as to admit of the passage of the narrow portion only of the T-head between them, so that after the head has been passed through between them it will, upon being turned at a right angle with said opening, engage the lugs, as shown in Fig. 5. Stops *ii* are formed respectively on the upper edge of one lug and on the lower edge of the opposite lug, to arrest the rotary movement of the bolt when its head has been brought to a right angle with the opening between the lugs. A flange or collar, *m*, is also formed about the bolt near to its head, to arrest its longitudinal inward movement when its head has passed in beyond the offset far enough to permit it to be turned. These devices facilitate entering and securing the bolt in the end of the tube and prevent its accidental withdrawal. After the bolt has thus been attached to the tube the end of the tube is seated in a recess encircling the opening formed to receive it in the head A, and the projecting end of the bolt, being passed through a bolt-hole in the opposite side of the head, is caught and drawn up by means of a nut, 6, on the outer side, as shown in said Fig. 5.

By this device any one of the tubes 3 may be readily disconnected without disturbing the others by simply removing the nuts 6, and thereby freeing the bolt 5 at each end thereof.

The radiators may be constructed with a single set of concentric radiating tubes, but are preferably constructed with two sets of concentric tubes, one above the other, as shown in Figs. 2, 4, and 12. Where there are two sets of tubes in a radiator each head is divided longitudinally by a horizontal partition, B, into two compartments, as shown in Figs. 2 and 4 of the drawings, so that while commu-

nication will be established between the ends of all the tubes in one set through their connection with the one head there shall be no communication between the tubes in the several sets, but each set will be kept independent of the other.

Each compartment in one of the heads, A, of each independent radiator is fitted at its outer end with a valve, 7, and connecting-pipe 8 for a supply of steam thereto, and each compartment in the opposite head, A', of the same radiator is provided at its outer head with an exhaust-opening, 9, which may be made to communicate with an exhaust-pipe, although such an exhaust-pipe is not shown in the drawings. Steam admitted to the one head, A, will thus be made to pass equally through the curved connecting pipes 3 3 3 to the opposite head, A', 85 and thence be discharged.

Instead of forming the exhaust pipe 9 for each set of tubes in the radiator in the outer end of the second or exhaust head, A', thereof, I contemplate connecting the innermost tube or tubes of each series with an exhaust-passage, C, formed in the first head, A, (see Fig. 12,) and cutting off the remainder of the tubes from direct connection with said inner tube in the steam-supply head A by means of a transverse partition, 10, at the inner end of said head, as shown in Figs. 11 and 12.

Different methods may be employed in taking off the exhaust without departing from the nature of this feature of my invention, which is to form a circulation through the tube-heads A A' and tubes 3 3 3 irrespective of where the exhaust or the inlet may be. These independent semicircular or segmental radiators formed of sets of tubes 3 3 3, united at their ends to steam-heads A A', are mounted within the vacuum-pan D in horizontal tiers W W W, one above the other, as shown in Fig. 2, each tier being made of two or more independent segmental radiators arranged in two horizontal sections, (see Figs. 2 and 12,) sufficient space being left between the several tiers to allow the free passage of a man therein for access to each and all of the tubes.

The outer ends of the radial heads A and A' of each segmental radiator are supported in suitable bearings against the outer wall of the vacuum-pan, and suitable openings are formed for the connection of the steam and exhaust pipes to said heads by means of properly-packed joints, in the usual manner, which need not herein be described.

The inner end of each head A and A' of each segmental radiator is supported by means of two vertical standards, 11 11, Figs. 2, 3, and 12, secured on each side of the vertical axis of the pan D, to which are bolted a series of segmental horizontal brackets, 12 12. (See Fig. 3.) These segmental brackets are each formed in two divisions, E E, (see Figs. 2 and 12,) which are united by transverse bolts and are flanged at their ends to fit against the standards 11 11, as shown in Fig. 3. The inner head of each head A and A' is formed with a

lug, 13, (see Figs. 2 and 3,) adapted to fit into an opening between the two horizontal divisions of the segmental bracket, so as to be supported thereby.

In mounting the several independent radiators within the vacuum-pan D the lug 13 at the inner end of each head is fitted and left to rest loosely in the recess in the edge of the lower division of its appropriate bracket, 12, and the upper division of the bracket is then fitted in place upon the lower division and the two bolted together, so as to confine the lug between them and yet permit a free longitudinal play thereof in its seat. A secure support is thus provided for the inner end of the head, which will, however, admit of ready disconnection for the removal, if need be, of any one radiator without disturbing the others.

The interval between the vertical standards 11 11 is wide enough and the radius of the segmental brackets 12 12 large enough to inclose between them a central space (see Fig. 3) or vertical passage-way which will permit of the passage of a man up and down therein, and thereby facilitate access to the horizontal spaces between the several tiers W W of radiators.

Radial brace and supported bars 14 14 (see Fig. 3) are fitted horizontally to extend between the two sets of tubes in each radiator where the radiator is made double, or under the one set of tubes if the radiator be single, and are supported at their inner ends by the brackets 12 12 and at their outer ends by suitable bearing-plates or brackets secured to the wall of the pan. To prevent any displacement or bending of the tubes 3 3 3 intermediate their ends, they are clamped loosely to the radial bars 14 by means of tie-pieces 15 15, (see Figs. 3 and 7.) curved to fit over and embrace two adjacent tubes, and by transverse bolts 16, each made to pass centrally through a tie-piece placed on the upper set of tubes and a corresponding tie-piece placed under the lower set of tubes in the radiator, the tie-pieces and the tubes which they clasp being drawn toward each other and bound closely upon the radial bar 14 by means of a nut, 17, upon the end of the bolt. (See Fig. 7.) To prevent the tubes from being thus bound so closely as to interfere with their due expansion and contraction, a sleeve, 18, is slipped over each bolt 16 between the tie-pieces 15 15, so as to preserve a proper interval between them, and the nut 17 operates with bolt 16 and head 19 to bind the tie-pieces closely against the ends of this interposed sleeve.

The removal or insertion of any one of the radiator-tubes 3 3 3 within the vacuum-pan D is facilitated by means of port-holes 19 19, (see Figs. 2 and 10,) formed in the outer wall of the vacuum-pan between each two tiers W W of the radiators. These port-holes 19 are closed by suitable doors, 20, in which are fitted the customary eyeglasses, 21, as shown in Figs. 9 and 10, by which the contents of the pan are inspected and the level thereof determined.

In the use of a vacuum-pan fitted with my improved sectional segmental heaters or radiators, constructed as described, the uniformity of the open spaces between the several tubes and the freedom of said spaces from obstructions of any kind will permit of the ready downward discharge of the sugar when the pan is to be emptied and promote a free circulation in the pan. At the same time, by reason of the uniformity of the curves in the pipes and the simplicity of their connections, the tubes in each radiator and tier of radiators may be brought more closely together and a greater area of heating-surface obtained than in any other forms of heaters.

The disposition of the tubes 3 3 3 in semi-circular or quadrantal arcs made fast at their ends only, in connection with the terminal heads A A', which are left loose in their bearings at their inner ends, permits the utmost freedom for an expansion and contraction of the several parts without any strain whatever upon their joints and prevents breaks or leakage from this cause.

The arrangement of the tubes 3 3 3 in independent radiators and the arrangement of said radiators in double horizontal tiers W W, with open spaces between the tiers communicating with an open central shaft between the central supporting-standards, 11 11, permits of ready access to any one of the tubes; and the method of securing the tubes to the heads A A' by means of detachable bolts 5, as described, permits of the ready detachment of any one of them independently of the other, while the port-holes 19 in the side of the pan provide means for an easy withdrawal of the detached tubes from the pan and for the inspection of the contents of the pan through the eyeglass fitted in the door 20 of each port-hole.

By the independent connection of the steam and exhaust pipes with the several independent radiators, steam may be shut off from any one radiator in case of accident thereto without affecting the rest, and by admitting steam at different pressures to the different radiators not only may the circulation within the pan be controlled at pleasure, but the heating of its contents may also be fully regulated as required.

I claim as my invention—

1. The combination, with a vacuum-pan, of two or more independent segmental radiators mounted in the same horizontal plane, each connected separately with steam supply and discharge pipes and each constructed of a pair of separate radial steam-heads or extended boxes, and a series of curved connecting-tubes concentrically disposed and fitted to one side only of each steam-head, substantially in the manner and for the purpose herein set forth.

2. The combination, with a vacuum-pan, of a series of segmental radiators, each constructed of a series of concentrically-arranged segmental tubes fitted to a pair of radial steam-heads, to communicate therewith upon one side thereof only, vertical standards fitted and se-

cured centrally within the pan, and sectional segmental brackets bolted to said standards, to furnish bearings for the inner end of each radial head, substantially in the manner and for the purpose herein set forth.

3. The combination, with the steam-heads A A' and the tubes 3 3, coupled thereto, of offsets 4 4, formed within the end of each tube, a bolt, 5, formed with a T-head adapted to engage said offsets, and a nut, 6, upon the outer end of the bolt, whereby, when the end of the bolt is passed through an aperture in the tubular head opposite the opening to which the end of the tube 3 is to be fitted, the end of this tube may be drawn up by the bolt against its seat encircling said opening to form a joint therewith, substantially in the manner and for the purpose herein set forth.

4. The combination of a tier, W, of curved concentric tubes 3 3 3, arranged in two horizontal sections and all connected at their opposite ends to single steam heads A A', an interposed radial bar, 14, inserted between the two sections of tubes, opposite tie-plates 15 15,

embracing two adjacent tubes in the sections 2, on each side of the bar, and a transverse bolt, 16, coupling the two tie-plates, to draw and clamp the tubes upon the radial bar, substantially in the manner and for the purpose herein set forth.

5. The combination of a tier of curved pipes arranged in double sections, an interposed radial bar, 14, inserted between the two sections of tubes, opposite tie-plates 15 15, embracing two or more adjacent tubes, and a sleeve or separator, 18, interposed between the tie-plates, with a bolt, 16, by which the tie-plates are drawn together upon the separator, substantially in the manner and for the purpose herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GOTTFRIED ENGEL.

Witnesses:

HERMAN ENGEL,
A. N. JESBERA.