

April 16, 1929.

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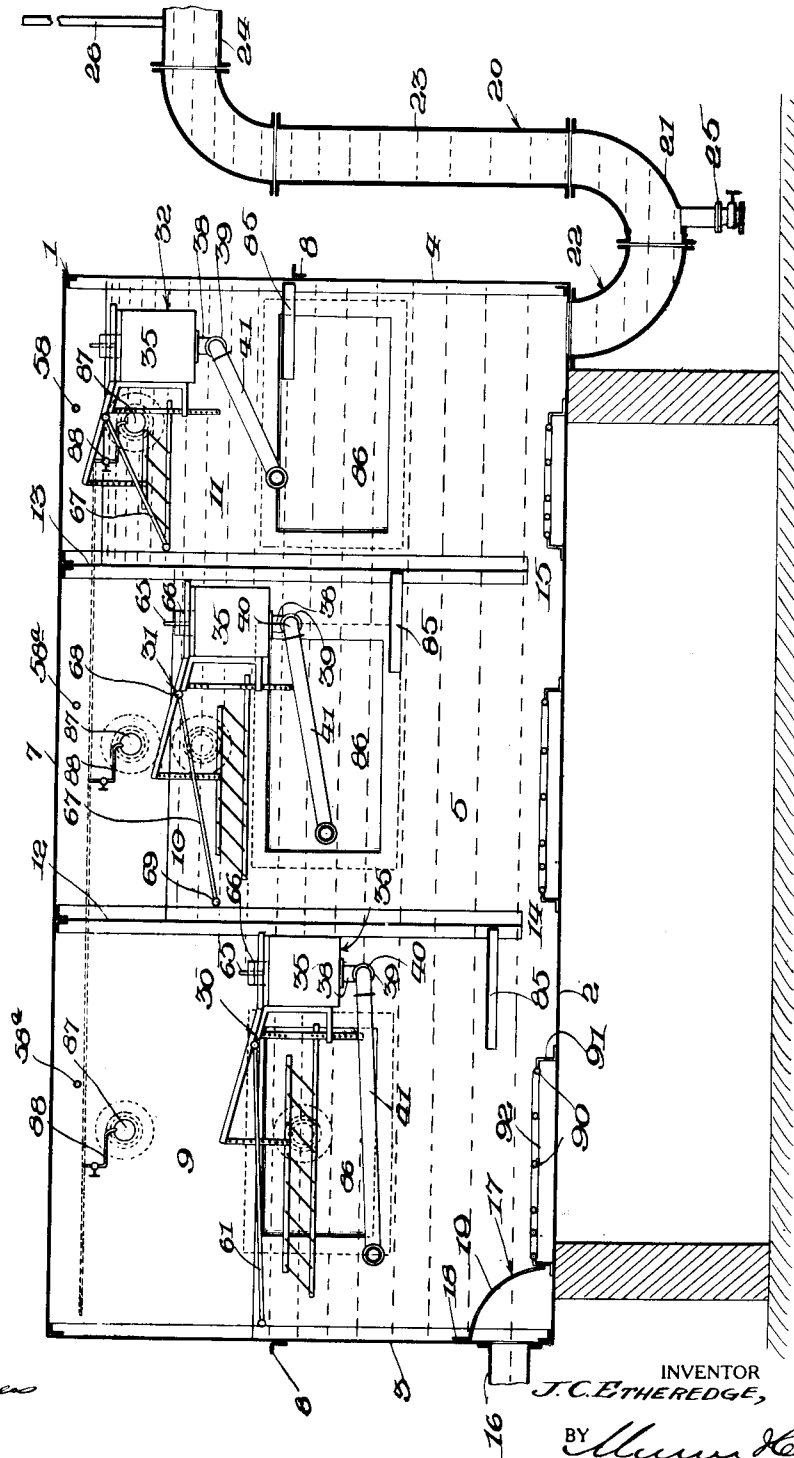
1,709,783

SCUM ELIMINATOR

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4 Sheets-Sheet 1

Fig. 1.



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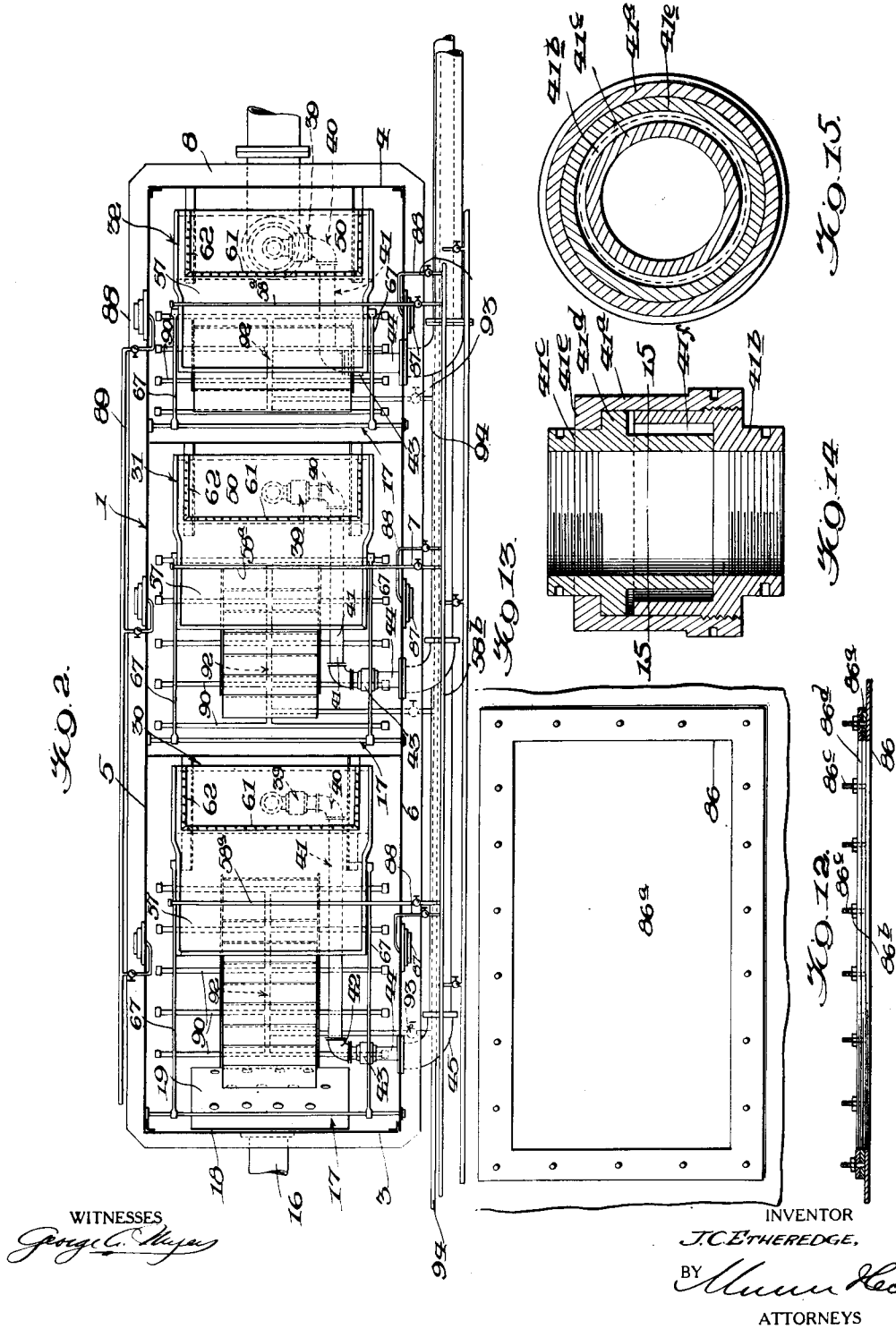
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SCUM ELIMINATOR

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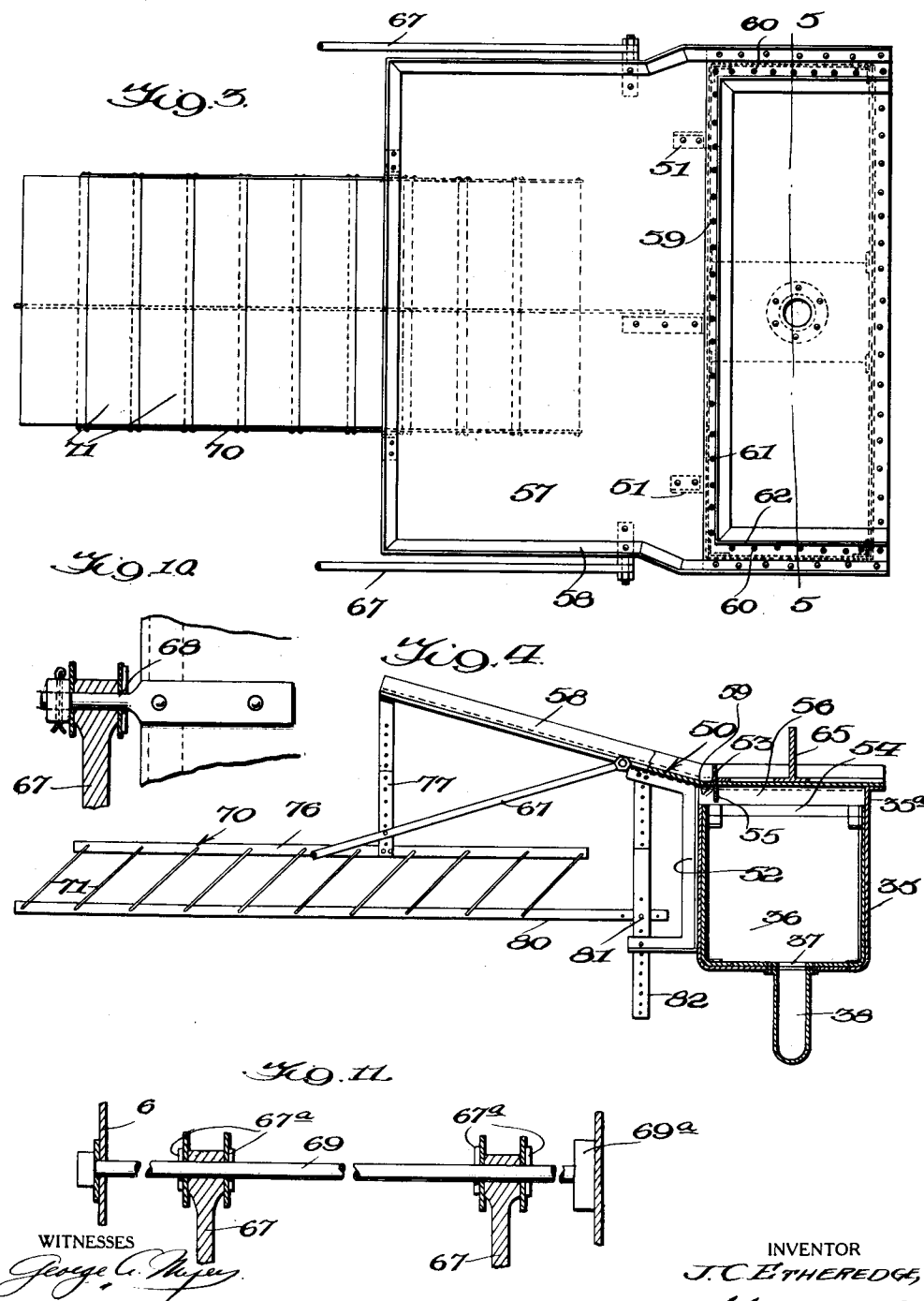
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

Fig. 5.

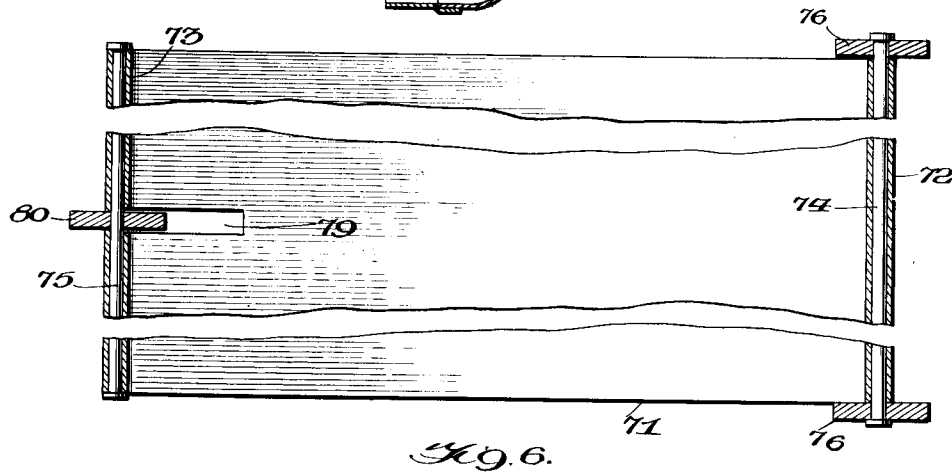
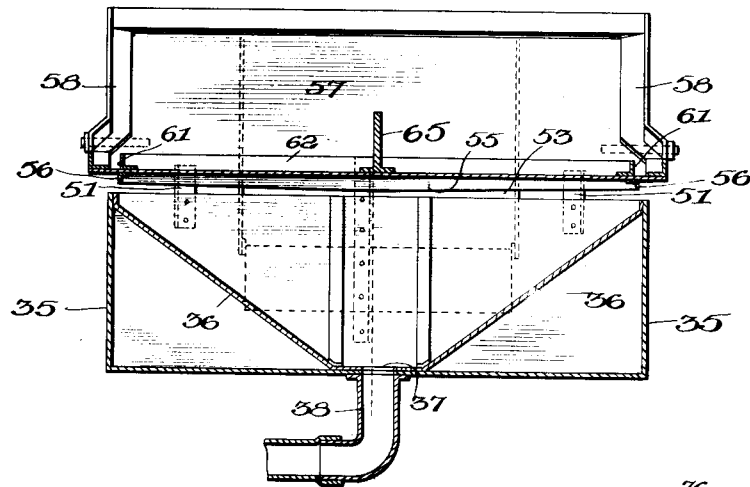


Fig. 7.

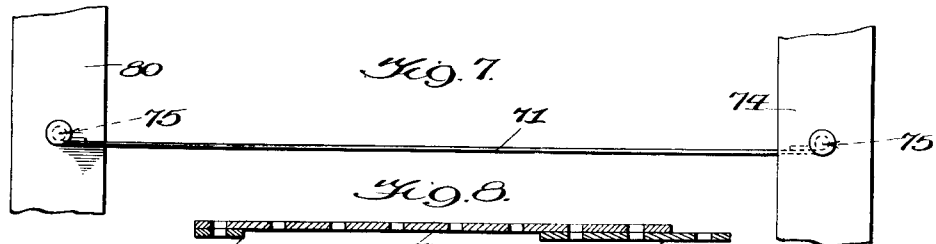


Fig. 8.

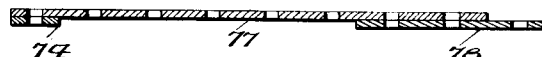


Fig. 9.



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SCUM ELIMINATOR.

Application filed April 2, 1926. Serial No. 99,354.

This invention relates to a scum eliminator especially adapted for use in the manufacture of cane sugar but it is also well adapted for use in other industrial processes where it is desirable to eliminate suspended matter from liquids under similar conditions.

The object of the invention is primarily to aid in separating from sugar cane juices that portion of the suspended matter or precipitated matter in suspension which is lighter than the juice. Among the former substances is bagacillo and cane wax; substances formed by the action of lime, or lime and sulphurous acid, and heat, (or lime, or lime and sulphurous acid without heat) on the juice.

The common method of removing suspended matter from the juice in the process of sugar manufacture today is by some form of settling, either continuous or intermittent. The presence in the suspended matter of substances lighter than the juice retards the rate of settling, because the heavier substances have to drag down those substances lighter than juice against the buoyant action of the liquid. The process is further aggravated by the breaking away from the main bulk of the precipitate of some of the fine particles of light matter, such as the fine particles of bagasse; these particles rise and are drawn off with the clear juice. As it is the common practice to subject the clear juice to no further clarification, these suspended impurities remain in the juice as it is evaporated, and cause fouling of the heating surface of the evaporators and vacuum pans, more especially the former. According to leading authorities in sugar manufacture this suspended matter also increases the viscosity of the sugar solutions, which retards the rate of evaporation and thus decreases the capacity of evaporating equipment. An increase in viscosity also decreases the capacity of the centrifugals as well as the quality of the sugar, because massecuite of high viscosity purges slowly, and makes it more difficult to wash the film of molasses from the surface of the sugar crystals.

Another object resides in the provision of a scum eliminator which effects a more complete removal of the suspended matter from the cane juices and this has the advantage of increasing the evaporating capacity realized in the evaporators and vacuum pans as well as increasing the capacity of the cen-

trifugals, of improving the quality of the sugar and also in obtaining a greater yield of sugar and a smaller loss of sucrose in the final molasses by virtue of the fact that the viscosity of the massecuites and of the molasses will be lower and a higher percentage of the sucrose in the juices can be crystallized out.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:—

Figure 1 is a view showing the operating parts of the scum eliminator in side elevation,

Figure 2 is a plan view of the scum eliminator with the top of the tank removed,

Figure 3 is a fragmentary plan view of one of the scum collecting floats and its associated deflector,

Figure 4 is a view thereof partly in side elevation and partly in vertical section,

Figure 5 is a sectional view on the line 5—5 of Figure 3,

Figure 6 is a fragmentary detail view, partly in elevation and partly in section, showing the mounting of one of the vanes of the deflector,

Figure 7 is an enlarged view in elevation of one of the vanes and associated parts as seen from the side of Figure 6,

Figures 8 and 9 are sectional views illustrating the supporting and adjusting means employed for the deflectors,

Figures 10 and 11 are sectional views showing the mounting of the radius rods controlling the movements of the floats,

Figures 12 and 13 are detail views of one of the man holes,

Figure 14 is a detail sectional view of one of the unions, and

Figure 15 is a view in section taken on the line 15—15 of Figure 14.

Referring to the drawings it will be seen that the scum eliminator embodying the present invention comprises a closed tank, designated generally at 1, and having a bottom wall 2, a front end wall 3, a rear end wall 4, side walls 5 and 6 and a top wall 7. The tank is preferably constructed of sheet iron and is braced externally with steel angles 8. Internally the tank 1 is divided into

three compartments, designated at 9, 10 and 11, by means of partitions or baffle walls 12 and 13 which extend between and are secured to the sides of the tank and which extend from the top wall of the tank down to within a short distance of the bottom thereof. By reason of the fact that the baffles or partition walls 13 terminate at their lower ends in spaced relation to the bottom wall of the tank, the lower portions of the compartments 9, 10 and 11 communicate through these spaces 14 and 15 below the baffles 12 and 13. Except for communication afforded through the spaces 14 and 15 the compartments 12 and 13 are entirely isolated.

Means is provided for supplying juices to the tank 1 from the heaters and consists of a supply pipe 16 connected to the front end wall 3 of the tank and discharging into the lower portion of the compartment 9 of the tank beneath the curved baffle 17 having a flange 18 fastened to the front wall 3 and having a perforated body portion 19 which extends from a point over the supply pipe 16 down to within a short distance of the bottom 2 of the tank. The baffle 17 extends for a substantial distance on each side of the supply pipe and serves to distribute the incoming juices across the compartment 9 and to arrest their velocity to some extent. At the opposite end of the tank from the supply pipe 16 an outlet, designated generally at 20, is provided, the outlet having a U-shaped portion 21 including a leg 22 coupled to the bottom of the tank adjacent the end wall 4 and communicating with the compartment 11. The outlet 20 also includes a stand pipe 23 leading up to a lateral off-take 24. The U-shaped portion 21 is provided with a wash-out fitting 25 and the lateral off-take 24 is provided with a vent 26 to prevent siphoning. The U-shaped portion 21 provides a seal or trap which, together with the column of juices or liquid in the stand pipe 23 prevents undesirable blow-off of the juices as will hereinafter more clearly appear.

Automatically operable scum collecting means are provided in the several compartments, the automatic scum collecting means of the compartment 9 being designated generally at 30, that of the compartment 10 being designated generally at 31 and that of the compartment 11 being designated generally at 32. These automatically operable scum-collecting means are all of identical construction and a common description will serve for all.

Each of the scum-collecting means 30, 31 and 32 includes a scum collector in the form of a box-like float 35 illustrated in detail in Figures 3, 4 and 5. Each float 35 has a false bottom therein made up of sloping walls 36 which lead down to the discharge opening 37 of the collector. An elbow 38

is coupled to the bottom of the collector and communicates with the discharge opening 37 and the lateral arm of this elbow connects with a union 39 coupled by means of an elbow 40 to one end of a pipe 41, the opposite end of which pipe 41 is connected to an elbow 42 which has connection with a union 43, the union 43 being connected to a lateral pipe 44 which leads through the side of a tank and which connects with the scum line 45. By means of this arrangement the scum is carried off from the collector in all of its positions. The unions 40 and 43 may be of any desirable construction but one preferred form of union is illustrated in Figures 14 and 15 and consists of an outer casing 41^a having a nipple 41^b threadedly connected thereto and confining therein a swivel nipple 41^c, the nipple 41^c having an annular flange 41^d co-acting with an annular flange 41^e on the casing 41^a. Between the swivel nipple 41^c and the fixed nipple 41^b a packing space 41^f is provided. Each collector 35 has an open top although a cover, designated generally at 50, overlies the open top, the cover 50 being supported above the top by being secured to an extension 35^a of one of the walls of the collector and by virtue of its mounting on the opposite wall of the collector by means of a pair of spaced angle brackets 51 and an intermediate supporting bracket 52. The extension 35^a of one of the walls of the collector serves to close the rear side of the collector but inlet spaces or openings 53 and 54 are provided in the opposite side of the collector and at the ends thereof, said spaces being defined by the overlying portions of the top and the upper edges of the side wall and end walls.

A baffle 55 is provided for the inlet space 53 and decreases in size from its center to its ends as shown in Figure 5. Baffles 56 are provided for the inlet spaces 54 and consist simply of angle irons of uniform size throughout their length. These baffles are spaced inwardly of the inlet openings, as illustrated in Figs. 4 and 5.

The cover 50 is provided with an upwardly inclined extension 57 around the marginal edges of which upstanding angle irons 58 are secured. Water is delivered onto the extensions 57 of the covers by means of transversely extending water supply pipes 58^a provided in the upper portion of each compartment and receiving water from a main water supply pipe 58^b, the water supply pipes being perforated in their under portions so as to spray water onto the extensions 57 of the covers. The water so sprayed runs down the extensions 57 of the covers and passes through series of openings, designated at 59 and 60, the series of openings 59 extending transversely of the cover above though just inwardly of the

inlet space 53, the series of openings 60 extending above though inwardly of the inlet spaces 54. Upstanding angle irons 61 and 62 insure the flow of the water through the openings 59 and 60, and in this way the edges of the box-like float making up the collector and co-acting with the cover to define the inlet spaces are kept clear of scum and deposits of the same are prevented from building up thereon. The water flowing through the openings 59 and 60 is directed onto these edges by the action of the baffles 55 and 56.

It may be desirable to weight the floats and for this purpose an upstanding pin 63 is provided on the cover of each float or collector and is adapted to receive any desirable number of weights 66, as shown in Fig. 1.

Each float or collector is constrained in its movements and maintained upright in all positions by means of a pair of radius rods 67 pivotally connected, as at 68 in Fig. 10, to the float and also pivotally mounted on a transverse shaft 69 mounted in one of the side walls of the casing and in a lug 69^a provided on the opposite side wall. As illustrated in Figs. 10 and 11 the radius rods have free pivotal connections with their floats and with their shafts but are prevented from transverse displacement by pins or keys 67^a. The radius rods are of the same length as the pipe 41 connected with their float and describe parallel arcs with respect to said pipe so that all of these parts move up and down at the same rate and thereby maintain the floats upright in all phases of the operation.

A deflector, designated generally at 70 is provided in connection with each collector for the purpose of deflecting the scum, steam and air into the box-like float making up the collector. Each deflector includes a plurality of plate-like vane 71 which are illustrated in Figs. 6 and 7 as having sleeve-like bearings 72 and 73 at their ends to receive pivot rods 74 and 75. The pivot rods 74 are pivotally connected to longitudinally extending supporting bars 76 which extend along the sides of the vane and which are suspended from the extension 57 of the cover by means of hanger bars 77 connected to the bars 74 and adjustably connected by suitable bolts and nuts to brackets 78 fastened to the extension 57. The vanes have centrally located and longitudinally aligned slots 79 in their lower portions to permit a lower adjusting rod 80 to pivotally receive the rods 75. The bar 80 is adjustably connected, as at 81, to a vertically adjustable fastening member 82 which has sections 82^a and 82^b adjustably connected to each other and releasably fastened to portions of the bracket 52 secured on the collector. The inclination of the vane 71 may be varied by

adjusting the bar 80 and the mounting member or fastening member 82.

When the liquid or juice falls below a certain level in the tank the floats are supported on supporting brackets or rests 85 suitably mounted and secured to the partitions 12 and 13 and to the end wall 4.

Man holes 86 are provided to facilitate access to the interior of each compartment and are normally closed by covers 86^a held to the tank by nuts 86^b threaded on studs 86^c welded to the tank. A marginal reinforce 86^d may be welded to the tank around each manhole.

Each compartment also has a window 87 to permit of an observation of the process going on therein and in order that the window may be maintained clear valve controlled spray pipes 88 are provided for the windows and receive a supply of clear water from a water supply pipe 89.

Means is provided for producing uprising jets of air through the compartments 9, 10 and 11 when this is desirable and in the illustration shown such means consists of a plurality of air jet supply pipes 90 supported by brackets 91 on the bottom wall 2 below each compartment, the pipes 90 receiving a supply of air from a manifold 92 which in turn receives compressed air from valve-controlled branch pipes 93 leading from a main compressed air supply pipe 94.

The operation of the eliminator is as follows: Juice from the juice heaters enters the closed tank, striking the perforated baffle plate. The purpose of the baffle is to decrease the velocity of the juice and to deflect portions of it to the right and to the left of the inlet, thus resulting in a more uniform flow of the juice across the first compartment. The incoming juice flows across the first compartment into the second and third compartments until the juice level rises to the lower edges of the baffles between the compartments. The temperature of the incoming juice is, we will assume, 215 degrees Fahrenheit. The pressure inside of the eliminator upon starting is atmospheric. Now, when average cane juice at 215 degrees F. is released at atmospheric pressure, a flash of steam occurs; the steam continues to be given off until the juice cools to the boiling point. At the same time, air, which has been entrapped in the juice before it is pumped to the heaters, having risen in temperature along with the juice, rises from the juice more rapidly than it would rise from cold juice; because, having been unable to escape in the heaters, the volume of air in the hot juice is practically the same as it was before being heated. Thus its pressure has increased to above that of the atmosphere, and it will rise and escape from the surface of the juice. This mixture of escaping steam and air will build up a pressure in

compartments 9, 10 and 11. When the level of the juice rises above the lower edge of the first baffle, the vapor space in compartment 9 will be shut off from that of the second compartment. Then, the rate of juice inflow still being about the same and the vapor space to receive the flash of steam and air having been cut down to that of one compartment, saturation of this vapor space will proceed more rapidly than before, and the pressure will soon become greater than the pressure in the vapor space of compartment 10. As this occurs the level of the juice in the first compartment will become lower than in the second compartment, because the greater pressure in the compartment 9 will force juice into compartment 10 more rapidly. In like manner the juice entering compartment 10 will give off more steam and air, raising the vapor pressure to a greater value than obtains in compartment 11. Thus, when the pressure in compartment 10 increases to much above that in compartment 11 the level of the juice in 10 will be forced down lower than in No. 11. Or, vice versa, the juice level will be highest in the third compartment, lower in the second, and lowest in the first compartment.

The rising juice in each compartment will carry up the floats. By construction the radius arm, being a radius of the same length as that constituted by the movable piping serving union immediately below outlet of float, the pin attached to its movable end describes an arc identical to that described by this union, and all portions of the float and float cover rise at the same rate; thus the floats remain in upright positions.

In the meantime a portion of the air and steam in the first compartment escapes through the opening into the float, thence through the movable pipe and unions and scum line to the scum, or mud tank. But in rising to the surface of the juice in compartment No. 9 the air and steam carries with it a considerable amount of suspended matter. Most of that matter which is lighter than the juice will remain on the surface, forming a scum. The current of steam and air, passing under the extended portion of the top of the float, will produce a current in the scum toward the entrance to the float. The production of this current is aided by the work of the scum deflectors which deflect the scum and rising steam and air towards the floats. When the blanket of scum builds up to a sufficient depth to reach the inlet to the float the pressure of the steam and air will force the top portion of it into the float; and thence it will be carried through the movable pipe to the scum line and thence to the scum tank.

The same operation occurs in the second and third compartments. The juice, having

given up a portion of its heat in compartment No. 9 will enter compartment No. 10 at a lower temperature; but the scum outlet pipe of compartment No. 9 is designed so that it has not sufficient capacity to carry away the scums and the flash obtained from a temperature drop of from 215 degrees F. down to the atmospheric boiling temperature of the juice. Therefore the temperature of the juice cannot drop to atmospheric boiling temperature in compartment No. 9. But a temperature still obtaining in the juice entering compartment No. 10 which is higher than it could be in the open atmosphere, a flash must occur in compartment No. 10, and continue, to reach and maintain a saturated condition in the vapor space of compartment No. 10. This flash of steam and air escapes through the float and connecting piping as described above for compartment No. 9, carrying with it scums which have risen to the surface.

The same operation occurs in the third compartment.

The scum lines are inclined toward the scum tank (this tank not shown in drawing) in order to facilitate their flow. They should each have a valve near the scum tank to permit closing the scum line from any compartment should for any reason a float be swamped and sink, although this is not an essential part of the invention.

The juice outlet of the eliminator is curved upward to give a seal in the last compartment of a minimum of 5 ft. so that if there is about 2 lbs. pressure per square inch difference in the vapor spaces of the first and last compartments, still the juice level in compartment No. 9 will be above the lower edge of the first baffle and steam will not blow under the baffle into the second compartment. If this difference of pressure increases to much more than 2 lbs. per square inch then steam will blow from the first compartment under the baffle into the second and will disturb the even working of the apparatus. For working under higher pressure the eliminator should have a greater height and the height of the seal at the last compartment should be increased by extending the juice outlet further up.

When it is desired to force more air through the juice, in addition to the amount it normally contains, and thus carry a greater amount of the suspended matter to the surface, compressed air is turned into the perforated coils in the bottom of the eliminator. This air will rise through the juice, carrying with it additional suspended matter and at the same time will cause an increase in pressure in the vapor spaces of the compartments, thus increasing the scum-carrying capacity of the scum lines.

While designed primarily for use in the manufacture of cane sugar, this eliminator

may also be used in other industrial processes should its use be of benefit in said processes. Again it may be used for the removal of suspended matter from cold liquids by the use of compressed air in the air coils. In operating with cold liquids, the pressures in the vapor spaces of the various compartments is formed by the air rising from the surface of the juice, instead of a mixture of air and steam. Otherwise the operation is the same as with hot liquids.

It is obvious that the present invention involves a method which consists in forcing the heated juices under pressure greater than atmospheric into one end of a closed tank having a series of compartments communicating at their lower ends only and in which the pressure of the atmosphere exists, withdrawing the juices from the other end of the tank through a liquid seal and causing the steam and air rising from the surface of the juices in the several compartments to carry off the scum and suspended matter.

I claim:—

1. A scum eliminator comprising a closed tank having a plurality of compartments therein, said compartments having their lower portions communicating, a scum collecting float in each compartment having an inlet opening for the scum, means for carrying off the scum from the floats, and a deflector associated with each float.

2. A scum eliminator comprising a closed tank having a plurality of compartments therein, said compartments being arranged in tandem and having their lower portions communicating, means whereby heated liquid to be treated may be introduced into an end compartment, a scum collecting and discharge means for each compartment adapted to collect and discharge a limited amount of scum in a manner to control the heat of the liquid as the same passes to each compartment.

3. A scum eliminator comprising a closed tank having a plurality of compartments therein, said compartments having their lower portions communicating, a scum collecting float in each compartment having an inlet opening for the scum, means for carrying off the scum from the floats, means for constraining the floats to proper movements and consisting of radius rods pivotally mounted on the tank and pivotally connected to the floats, and means for positively supporting the floats in their lowermost positions.

4. A scum eliminator comprising a tank, a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, and means for carrying off the scum from the scum collector in all positions thereof.

5. A scum eliminator comprising a tank,

a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, and means for carrying off the scum from the scum collector in all positions thereof and comprising a pipe having swivel connection with the float and with the tank.

6. A scum eliminator comprising a tank, a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, means for carrying off the scum from the scum collector in all positions thereof, said cover having an upwardly inclined extension, and a deflector co-acting with the extension for deflecting the scum into the float.

7. A scum eliminator comprising a tank, a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, means for carrying off the scum from the scum collector in all positions thereof, said cover having an upwardly inclined extension, a deflector co-acting with the extension for deflecting the scum into the float and consisting of a plurality of vanes, and means for angularly adjusting the vanes and supporting them in adjusted position.

8. A scum eliminator comprising a tank, a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, means for carrying off the scum from the scum collector in all positions thereof, said cover having an upwardly inclined extension, a deflector co-acting with the extension for deflecting the scum into the float and consisting of a plurality of vanes, means for angularly adjusting the vanes and supporting them in adjusted position and comprising longitudinally extending bars pivotally connected to the vanes, hanger bars adjustably supporting certain of said longitudinal bars on the extension of the cover, and means co-acting with the other longitudinal bar for holding it in any one of a plurality of adjustments whereby to maintain the vanes in proper adjustment.

9. A scum eliminator comprising a tank, a scum collector in said tank and comprising a box-like float having an open top, a cover overlying the top and supported thereon and co-acting with the float to define the inlet openings, and means for carrying off the scum from the scum collector in all positions thereof, said cover having perforations overlying the portions of the float which co-act with the cover to define the inlet openings, and means for supplying water to said per-

forations whereby to wash the said edges clear of deposits and accumulations of scum.

10. A scum eliminator comprising a closed tank including a bottom wall, side walls, and
5 a top wall, baffles within the tank and extending between the side walls and connected to the top wall, said baffles terminating short of the bottom wall whereby said baffles define
10 compartments within the tank which communicate with each other at their lower portions only, means for supplying heated liquid to one of the compartments, a scum collecting float in each compartment having an
15 inlet opening for the scum, means for carrying off the scum and the heated air and steam rising up above the level of the liquid of each compartment and flowing into the scum collecting float therein, and means for
20 carrying off the liquid from the compartment remote from the inlet and comprising an outlet having a trap and a column.

11. A scum eliminator comprising a closed tank including a bottom wall, side walls, and
25 a top wall, baffles within the tank and extending between the side walls and connected to the top wall, said baffles terminating short of the bottom wall whereby said baffles

define compartments within the tank which communicate with each other at their lower portions only, means for supplying heated
30 liquid to one of the compartments, a scum collecting float in each compartment having an inlet opening for the scum, means for carrying off the scum and the heated air and steam rising up above the level of the liquid
35 of each compartment and flowing into the scum collecting float therein, means for carrying off the liquid from the compartment remote from the inlet and comprising an outlet having a trap and a column, and also
40 having a vent to prevent siphoning.

12. A scum eliminator comprising a closed tank having a plurality of compartments therein, said compartments having their lower portions communicating, a scum collecting
45 float in each compartment having an inlet opening for the scum, means for carrying off the scum from the floats, and means for constraining the floats to proper movements and consisting of radius rods pivotally
50 mounted on the tank and pivotally connected to the floats.

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