(No Model.) 2 Sheets—Sheet 1.

E. FLEISCHER.

MANUFACTURE OF SUGAR.

No. 245,809. Patented Aug. 16, 1881.

Fig 1.

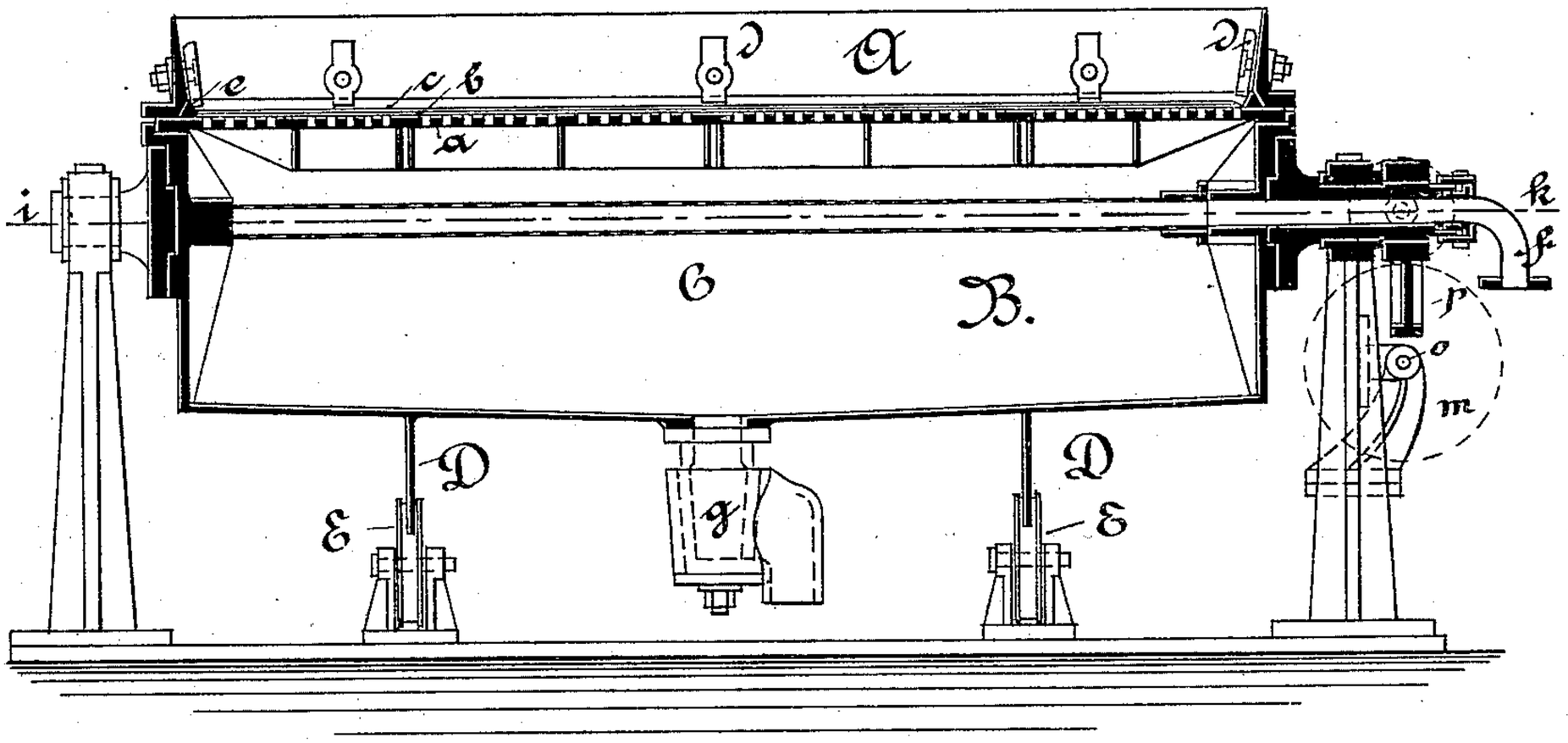
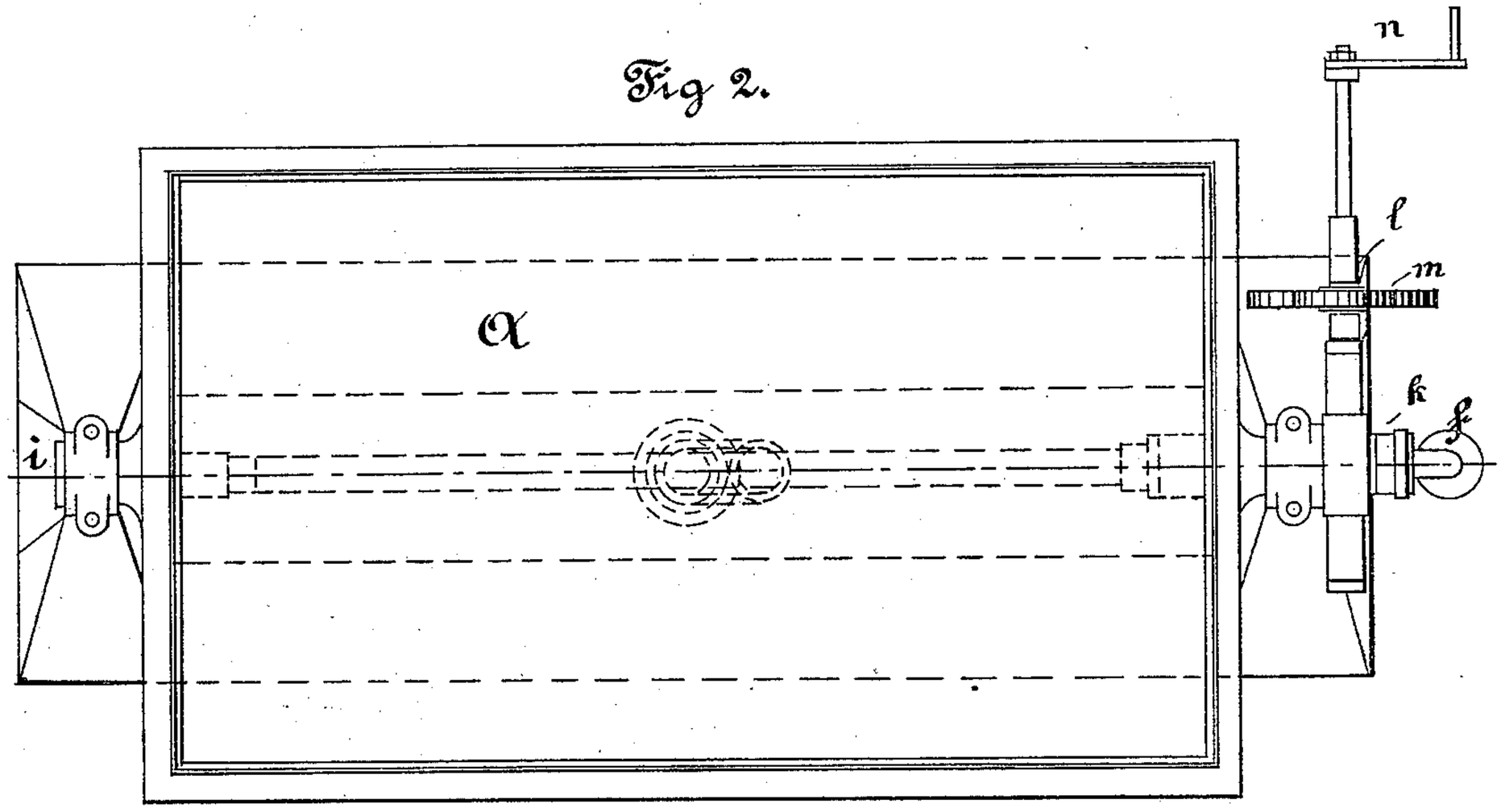


Fig 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

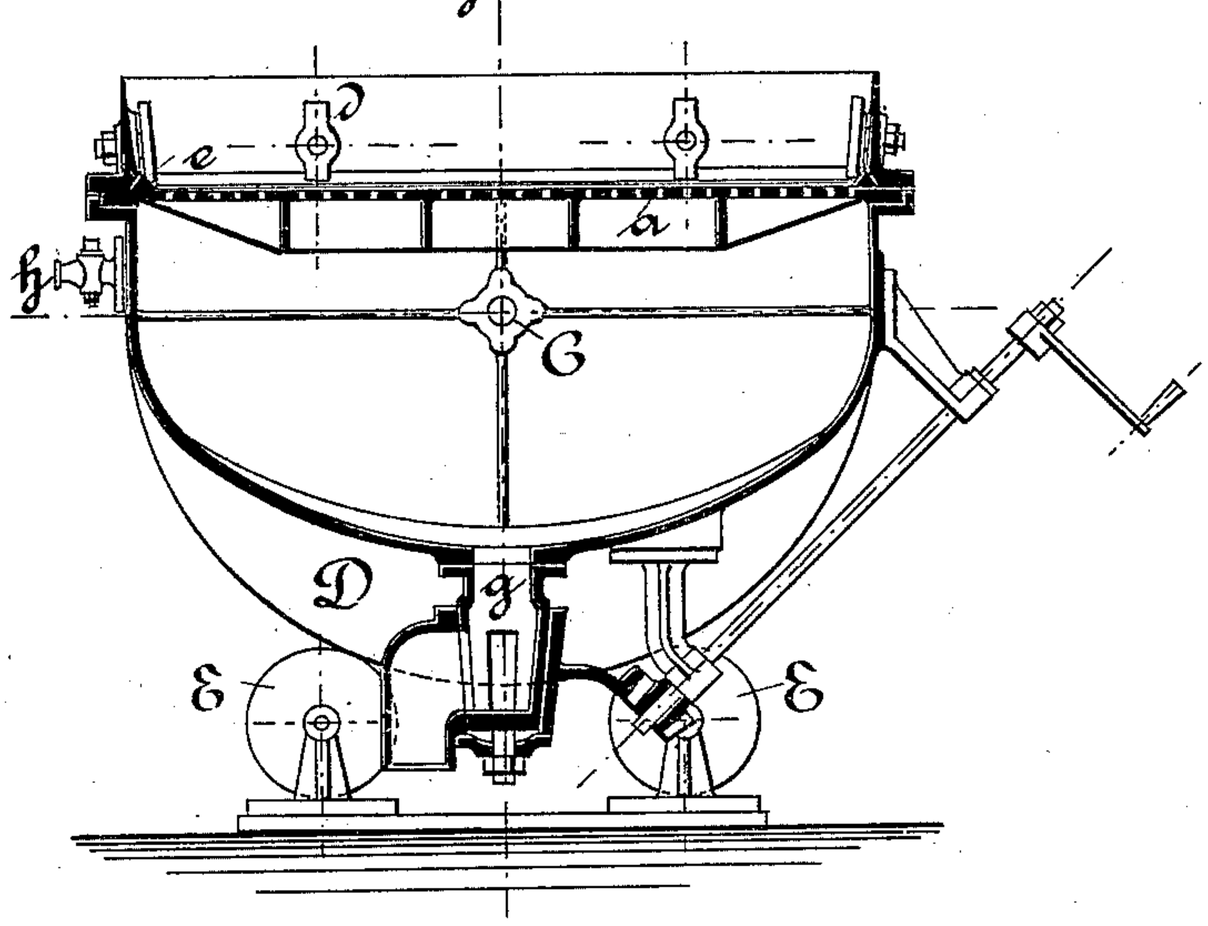
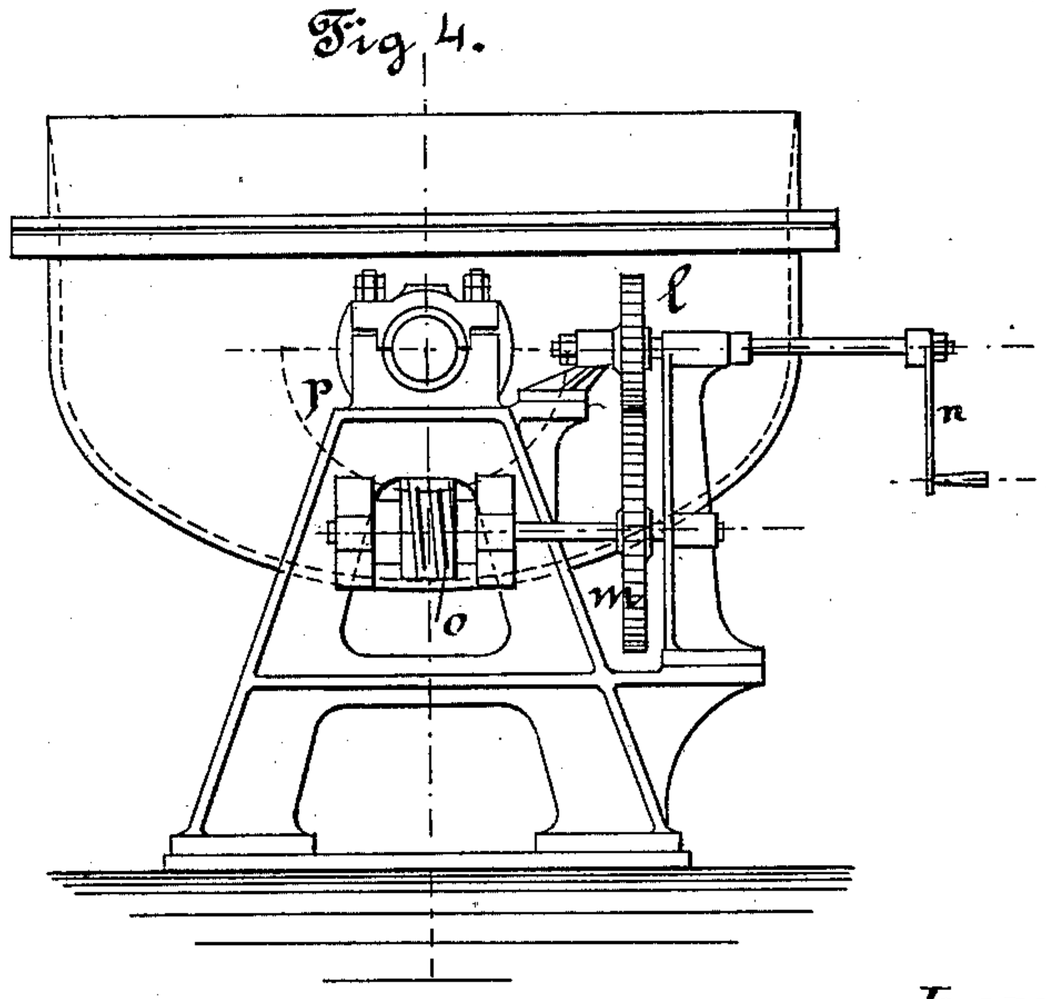


Fig. 4.



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UNITED STATES PATENT OFFICE.

EMIL FLEISCHER, OF DRESDEN, ASSIGNOR TO DESSAUER AKTIEN ZUCKER RAFFINERIE, OF DESSAU, GERMANY.

MANUFACTURE OF SUGAR.

SPECIFICATION forming part of Letters Patent No. 245,809, dated August 16, 1881.

Application filed January 10, 1881. (No model.)

To all whom it may concern:

Be it known that I, EMIL FLEISCHER, of Dresden, in the Empire of Germany, have invented new and useful Improvements in the Manufacture of Sugar, of which the following is a specification.

This invention relates to certain new and useful improvements in the manufacture of sugar from saccharine solutions, such as sirup, treacle, &c., by means of a bibasic saccharate of strontia, and in the apparatus in which the strontia-sugar that has been formed is separated from the non-saccharine liquid.

The invention consists in producing a bibasic saccharate of strontia, which is separated from the non-saccharine liquid and placed into cold chambers, in which the strontia crystallizes and is separated from the sugar.

The invention further consists in a flat perforated pan resting above a vessel connected with an air-exhausting pump, the bibasic saccharate of strontia, which has the consistency of mud or semi-liquid, being placed upon the perforated floor, and the non-saccharine liquid passes through the perforated floor into the chamber below, as a vacuum is formed in this chamber by the air-exhausting pump.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation of the apparatus for separating the saccharate from the non-saccharine or mother liquid. Fig. 2 is a plan view of the same. Fig. 3 is a cross-sectional elevation, and Fig. 4 is an end elevation.

Similar letters of reference indicate corresponding parts.

Before describing the process for obtaining the sugar it will be necessary to describe the nature of the bibasic saccharate of strontia—$C_{12}H_{22}O_{11}+2SrO$.

Bibasic saccharate of strontia is either obtained by adding oxide of strontium (strontia) to a saccharine solution, or by adding saccharine matter to a concentrated solution of strontia, and in either case the bibasic saccharate, which has a muddy consistency, will only be precipitated if these solutions are heated to the boiling-point and sufficient quantities of strontia are present not only to form a bibasic saccharate, but also a ten-per-cent. solution of crystallized hydrate of strontia. The dilution is independent, but the proportion of the sugar to the water should not be below 1:5 and not above 1:10, as very large quantities of hydrate of strontia would be required. The saccharate thus precipitated is almost insoluble in hot solution of strontia, is only slightly soluble in diluted hot solution of strontia, but is soluble to about five per cent. in hot water. It is very difficult to free this bibasic saccharate from the surplus of strontia, but by repeated washings with boiling water, which slightly dissolves but does not decompose it, it can be obtained pure and almost entirely freed from the surplus of strontia.

Various and numerous attempts have been made in vain to produce a saccharate of strontia containing more of the base than the bibasic saccharate of strontia does. If it did show a greater quantity of strontia than the formula of the bibasic saccharate indicated, this quantity was mixed with it mechanically, but not chemically. Besides this bibasic saccharate of strontia a monobasic saccharate, $C_{12}H_{22}O_{11}+SrO$, is also known. The same is formed if cold aqueous solutions of sugar and strontia are brought together, and has the appearance of coagulated milk. This monobasic combination is soluble to about six per cent. in cold water, but is dissolved entirely in warm water. The bibasic saccharate of strontia is separated into crystallized hydrate of strontia and sugar if sufficient water to form the strontia crystals and a sugar solution of about twenty per cent. is added at a low temperature, for strontia, like lime, is dissolved in greater quantities by a saccharine solution than by water.

Having described the nature of the bibasic saccharate of strontia, I will now describe the apparatus for separating the same from the sugar.

A flat pan or vessel, A, is provided with a perforated bottom, *a*, and upon this bottom a layer, *b*, of wire-netting, and *c*, of some vegetable-fiber fabric, are held by the strips *e*, which are held in place by the clamps *d*, held to the sides of the pan or vessel A by bolts and nuts. The pan or vessel A rests upon a semi-cylin-

drical or like vessel, B, provided with the pivots *i* and *k* at the ends, thus permitting the vessel to swing on its longitudinal axis. The vessel B is provided with a longitudinally-perforated air-tube, C, connected with the tube *f*, passing through the pivot *k*, and connected with a tube leading to an air-pump. The vessel B is provided with two circular or like tracks, D D, resting upon rollers E E, to permit the variation of the inclination of the transverse axis, which is accomplished by means of the crank *n*, the geared wheels *l* and *m*, the worm *o*, and the semicircular worm-wheel *p*. The apparatus is provided with the devices for changing its position for convenience in filling it and removing the matter after the operation. The vessel B is provided with a large cock, *g*, near the middle of the bottom, which is preferably inclined toward this cock. *h* is an air-cock.

The operation is as follows: The strontia required to produce the bibasic saccharate may be used in the form of caustic strontia or as the hydrate of strontia, but crystallized strontia is the best. Sulphide of strontium, (SrS,) which is obtained from celestine (sulphate of strontia) by heating it with substances containing carbon, or this sulphide of strontium dissolved in water, ($SrH_2O_2 + SrH_2S_2$,) may be used to form the bibasic saccharate; but it is not as advantageous as the strontia crystals or the caustic strontia.

The saccharate may be produced in two different ways—

First. By adding a hot solution of strontia to the saccharine liquid, which is stirred and heated continually. The saccharate will be precipitated a few seconds after the first ebullition, providing a sufficient quantity of strontia is contained in the solution. If this is not the case, strontia crystals can be added until the solution corresponds to the given formula. In practice this method is of great importance, as it does not require great quantities of strontia solutions before the operation begins, as the strontia crystals can be added later.

Second. A certain quantity of strontia can be dissolved in a saccharine liquid the temperature of which is below the boiling-point, and the saccharate will be precipitated by the ebullition of the solution.

In order to keep the solution or mother liquid in which the non-saccharine matter is dissolved as concentrated as possible, it is always advisable to dissolve strontia crystals in the same, and then add fresh saccharine solution in order to obtain repeated precipitations of the bibasic saccharate. These repeated precipitations can take place without removing the prior precipitates, which all have the consistency of mud, but the saccharate can only be precipitated if the liquid is heated.

The saccharate thus produced can be separated from the non-saccharine liquid in various different ways, and I prefer to use the apparatus described above and shown in the annexed drawings.

The precipitated saccharate is placed upon the floor of the pan or vessel A, and the air is exhausted from the vessel B by means of the air-pump above mentioned. The consequence is that all the liquid contained in the precipitate will pass through the layer of fabric *c*, the sieve *b*, and the perforated floor *a*, and will collect in the vessel B, from which it can be drawn through the cock *g* at suitable intervals. The precipitate is purified in the same apparatus by pouring hot strontia solution upon it, and drawing the liquid through the precipitate by means of the air-pump in the manner described. Hot water might be used in place of hot strontia solution, but the latter does not dissolve any of the saccharate, whereas the former dissolves about ten per cent. The liquids used in purifying the precipitate are used for producing the next fresh precipitate.

The precipitate, after having been separated from the liquids and purified, consists of almost entirely pure saccharate of strontia, and for the purpose of separating the strontia and the sugar the saccharate and a corresponding quantity of water are placed into tanks, in which they remain for some time at a low temperature. This separation will take place most rapidly and effectually at about 0° centigrade; but this low temperature is not absolutely necessary, for the separation will also take place at a temperature of from 12° to 15° centigrade, but it requires considerable time. This low temperature will have to be produced artificially in summer, and I prefer to force air that has been cooled by ice or water into the separating-chambers. During this process of separation, especially if the bibasic saccharates have been in the vats or tanks for some time, the above-described monobasic saccharate of strontia is sometimes formed; but this must be avoided as much as possible. After the separation the strontia crystals are taken out of the solution of sugar and dried in a centrifugal apparatus, and are then again used for producing the bibasic saccharate of strontia. The liquid which contains some strontia is saturated with carbonic acid, and the carbonate of strontia is separated from the saccharine liquid in filter-presses, and this liquid is then treated to obtain crystallized sugar in the well-known manner. The mud ($SrCO_3$) which remains in the filter-press is mixed with sawdust, or some other material containing carbon, and is formed into bricks, which are burned in a suitable furnace to produce caustic strontia.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The method, substantially as herein shown and described, of extracting sugar from saccharine liquids, such as sirup, treacle, &c., consisting in producing a bibasic saccharate of strontia, and then separating the sugar and strontia by crystallization, as set forth.

2. The method, substantially as herein described, of producing bibasic saccharate of strontia ($C_{12}H_{22}O_{11} + 2SrO$) by making a solution of saccharine matter and of strontia, and

then raising the temperature of this solution to the boiling-point, as set forth.

3. The method, substantially as herein described, of purifying the bibasic saccharate of strontia by pouring a hot solution of strontia over and drawing this solution through it in some suitable manner, as set forth.

4. The method, substantially as herein described, of repeatedly precipitating the bibasic saccharate of strontia in the same mother liquid, and adding fresh strontia and fresh saccharine liquid after each precipitation for the purpose of obtaining a concentrated mother liquid, as set forth.

5. As a new chemical product, bibasic saccharate of strontia, ($C_{12}H_{22}O_{11}+2SrO$,) made, as herein described, by mixing saccharine matter and strontia in solution, and boiling this solution, as set forth.

6. An apparatus for separating precipitated sugar from the mother liquid, made substantially as herein shown and described, and consisting of a flat vessel with a perforated or like bottom resting upon a vessel connected with an air-exhaust pump, the precipitated sugar being placed upon the perforated floor and a vacuum created in the lower vessel, causing the liquids to pass from the precipitated sugar through the perforated floor into the lower vessel, as set forth.

7. In an apparatus for the manufacture of sugar, the combination, with the vessel A, of the perforated floor *a*, the wire-netting *b*, the fabric *c*, the strips *e*, and the clamps *d*, substantially as herein shown and described, and for the purpose set forth.

This specification signed by me this 26th day of November, 1880.

EMIL FLEISCHER.

Witnesses:

Dr. HERMANN BERCHART,

MARKUS RUTTEN.