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S. Schuzenbach.

Manf. Sugar.

No. 103.090. Patented May 17. 1870.

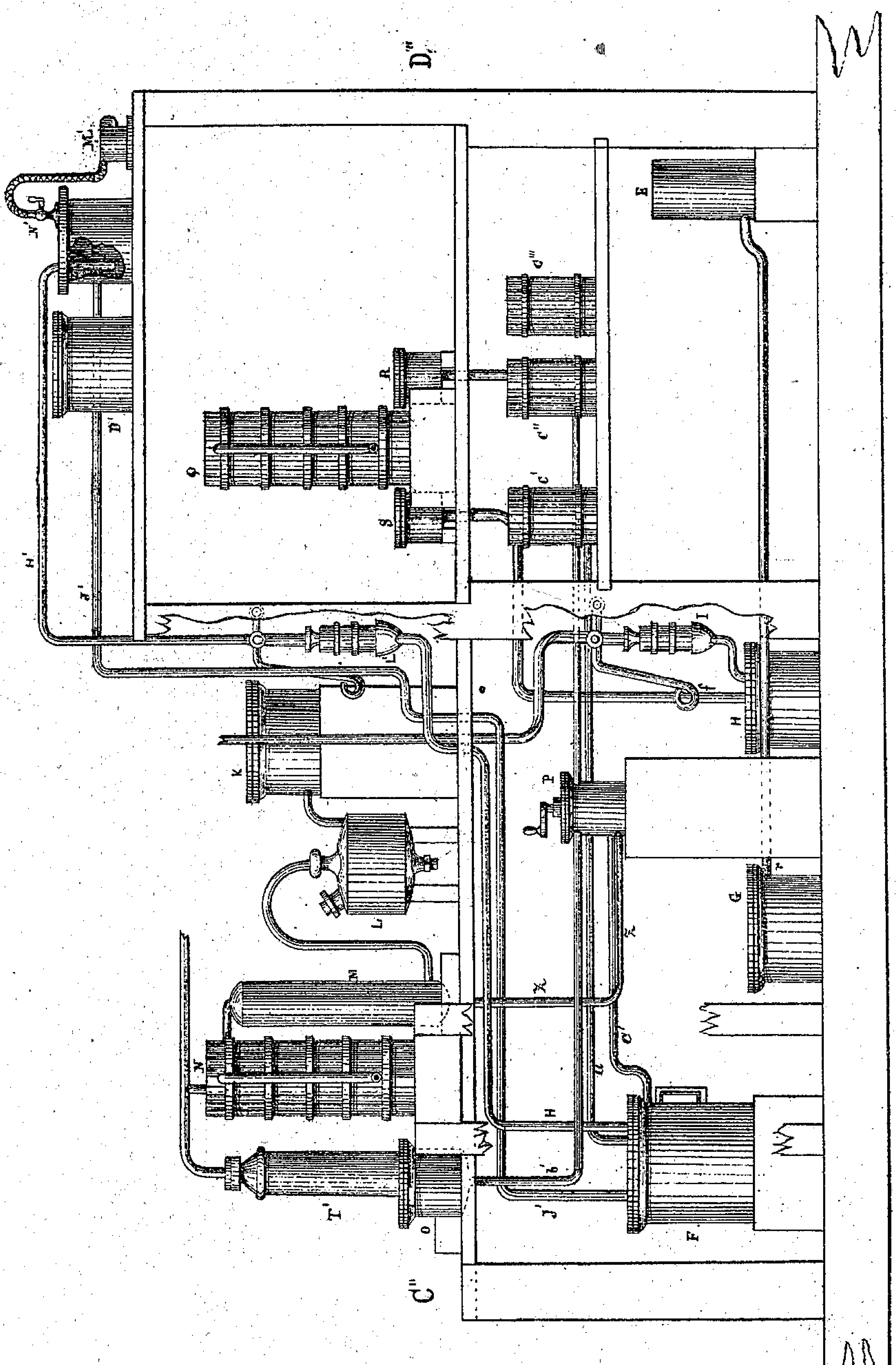

Fig. I.

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Victor Bishop

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Administrator of
Sebastian Schuzenbach
By his Atty

S. Schützenbach,
Mfg. Sugar.
No. 103,090. Patented May 17, 1870.

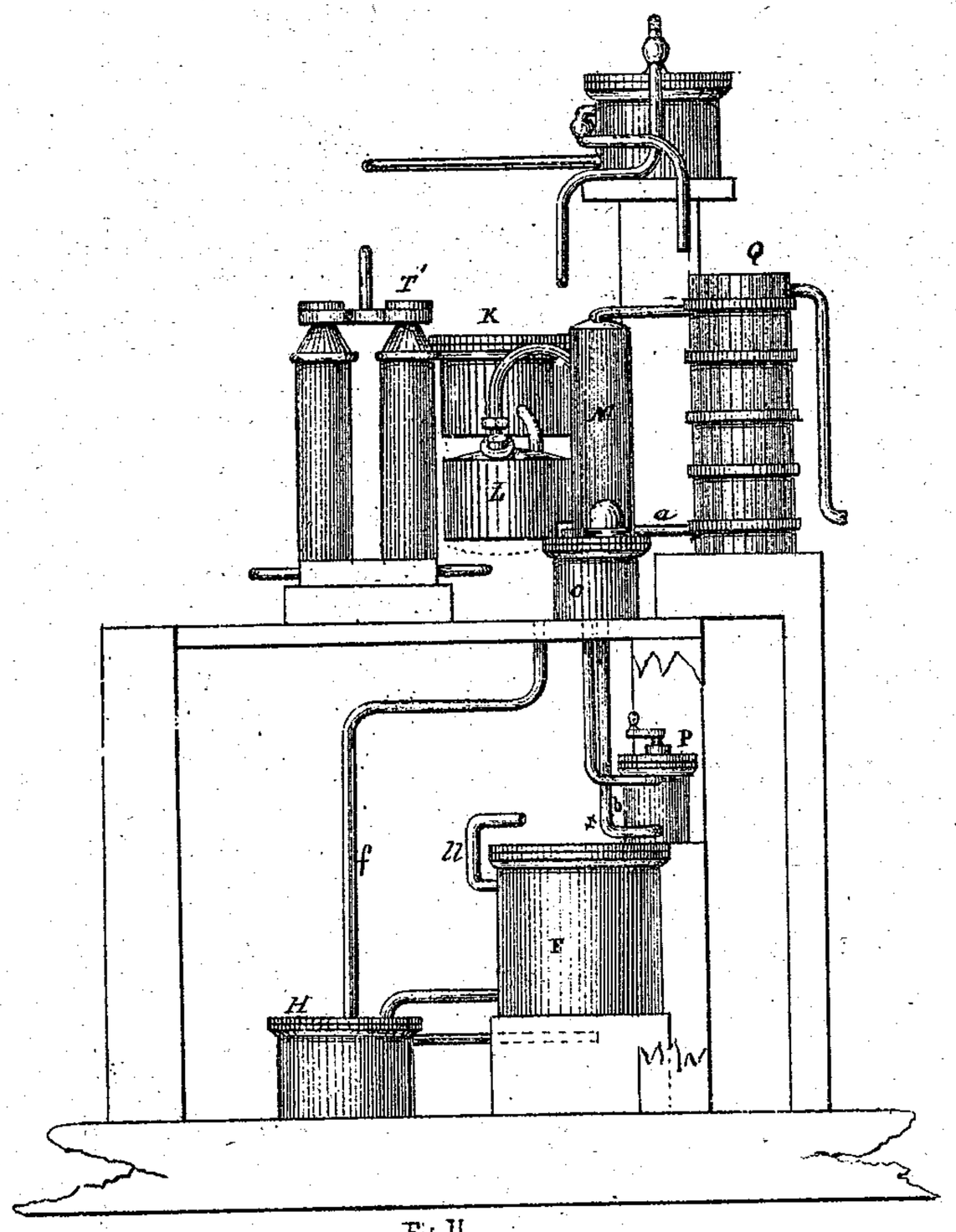

Fig. II.

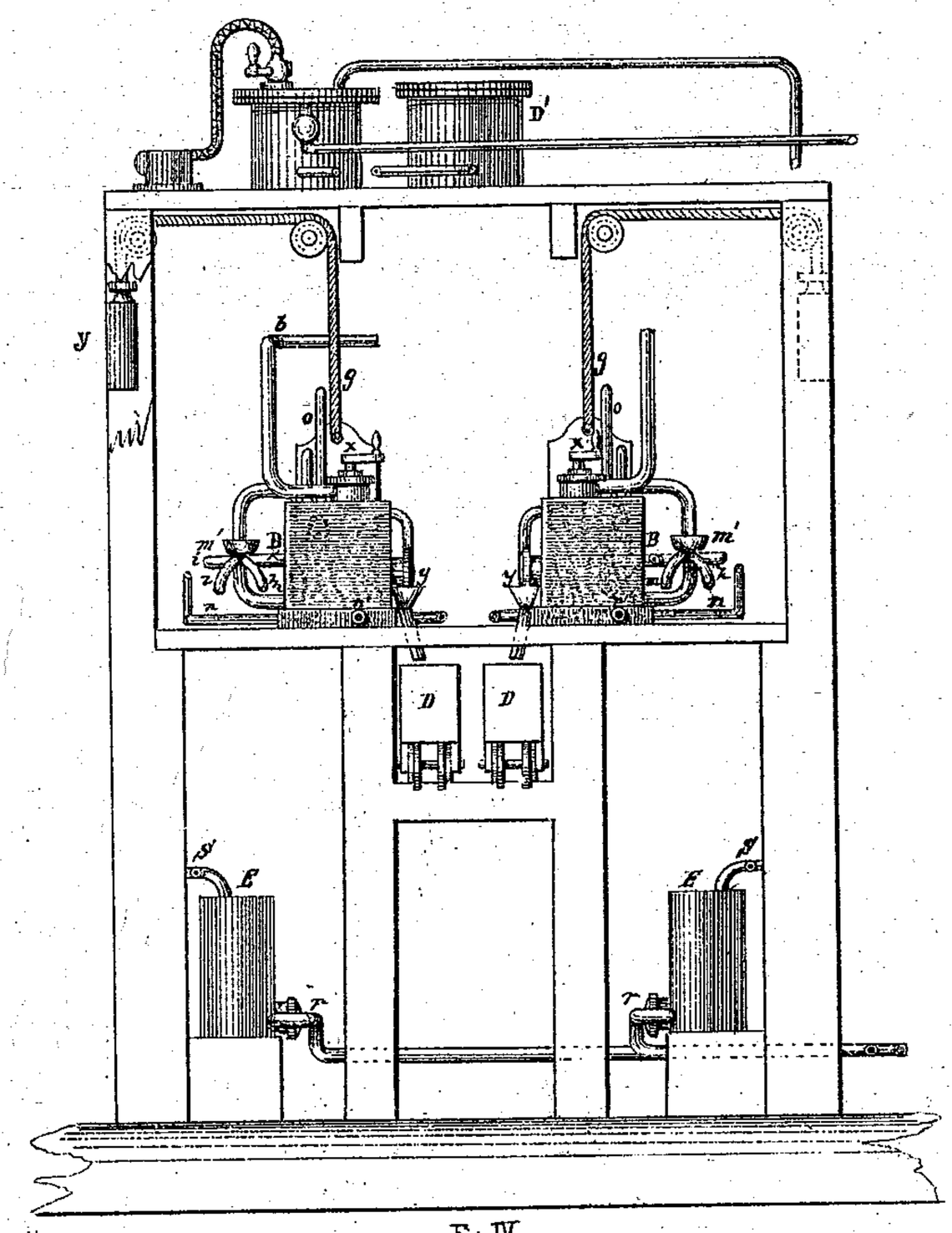

Fig. IV.

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S. Schutzenbach,

Manf. Sugar.

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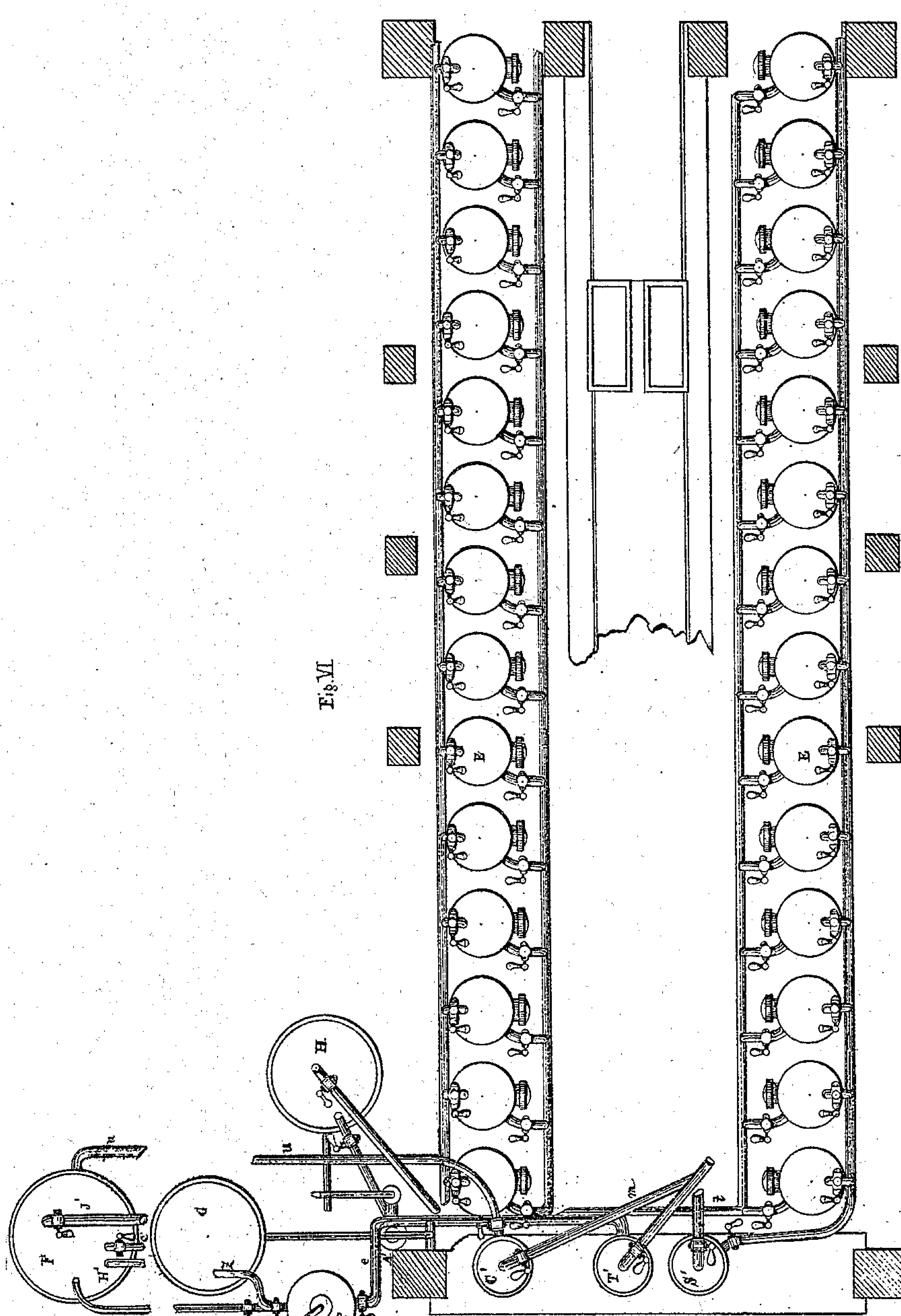

Fig. VI

Constantin Rauwolf
Administrator of Septimus Schutzenbach
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S. Schuzenbach,

Manf. Sugar.

No. 103.090

Patented May 17. 1870.

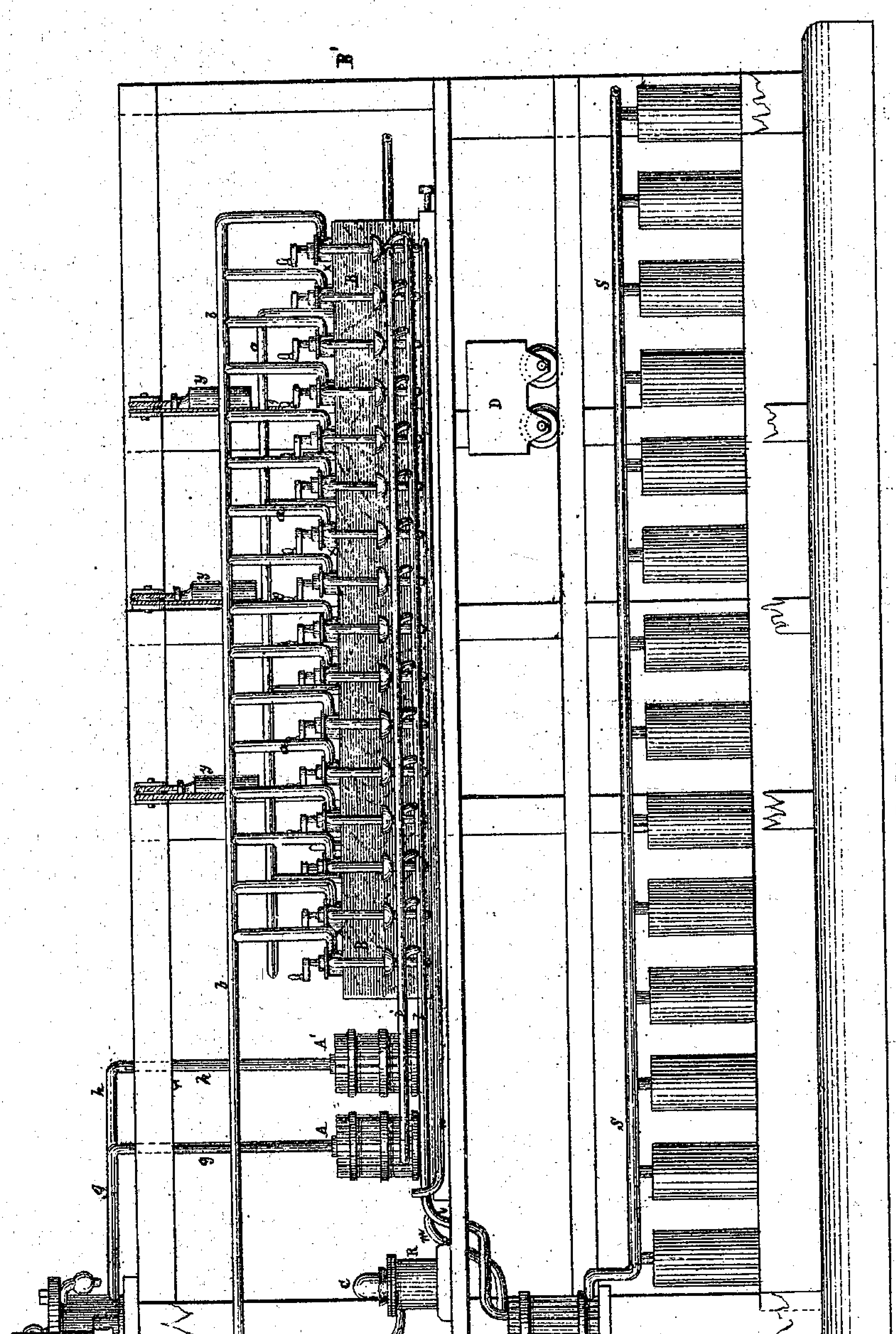

Fig. III

Constantin Rössing
Administrator of
Sebastian Schuzenbach
By his atty Amos Broadnax

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A. Moore

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S. Schuzenbach,

Manf. Sugar.

No. 103,090 Patented May 17. 1870.

Witnesses

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A. Moore

Inventor

S. Schuzenbach

per his Attys Coburn & Brandon

Fig. VII.

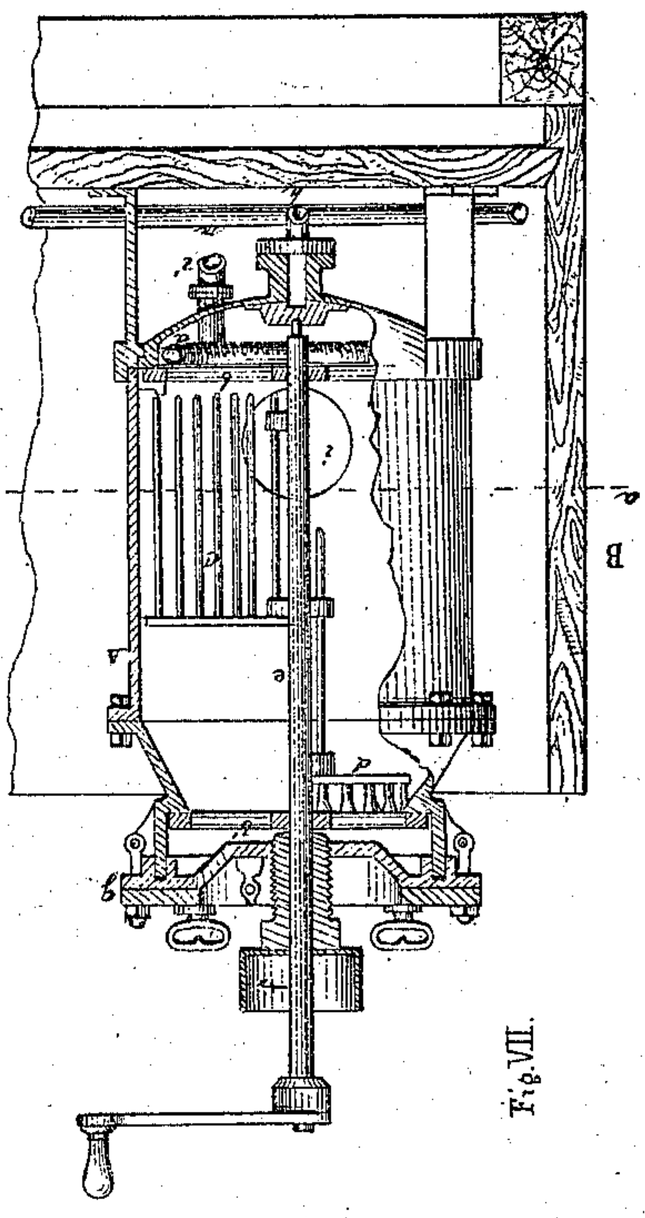


Fig. VIII

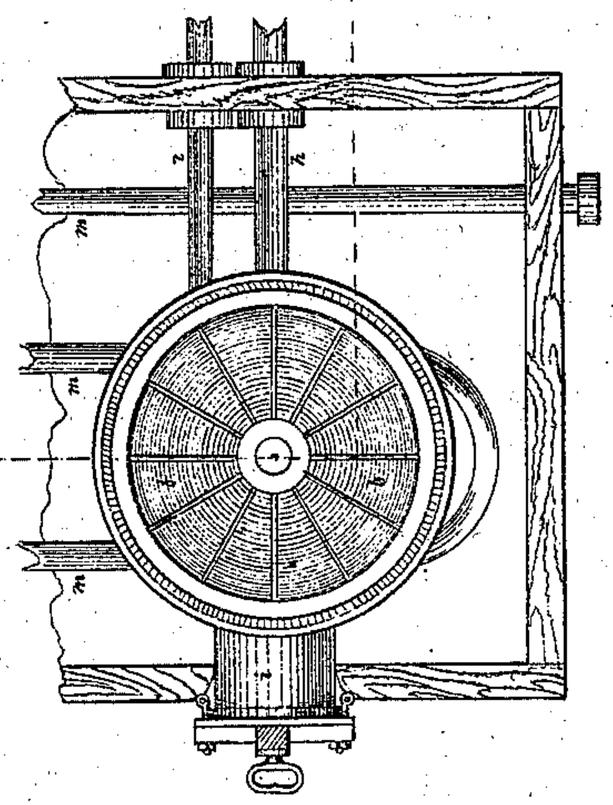


Fig. IX.

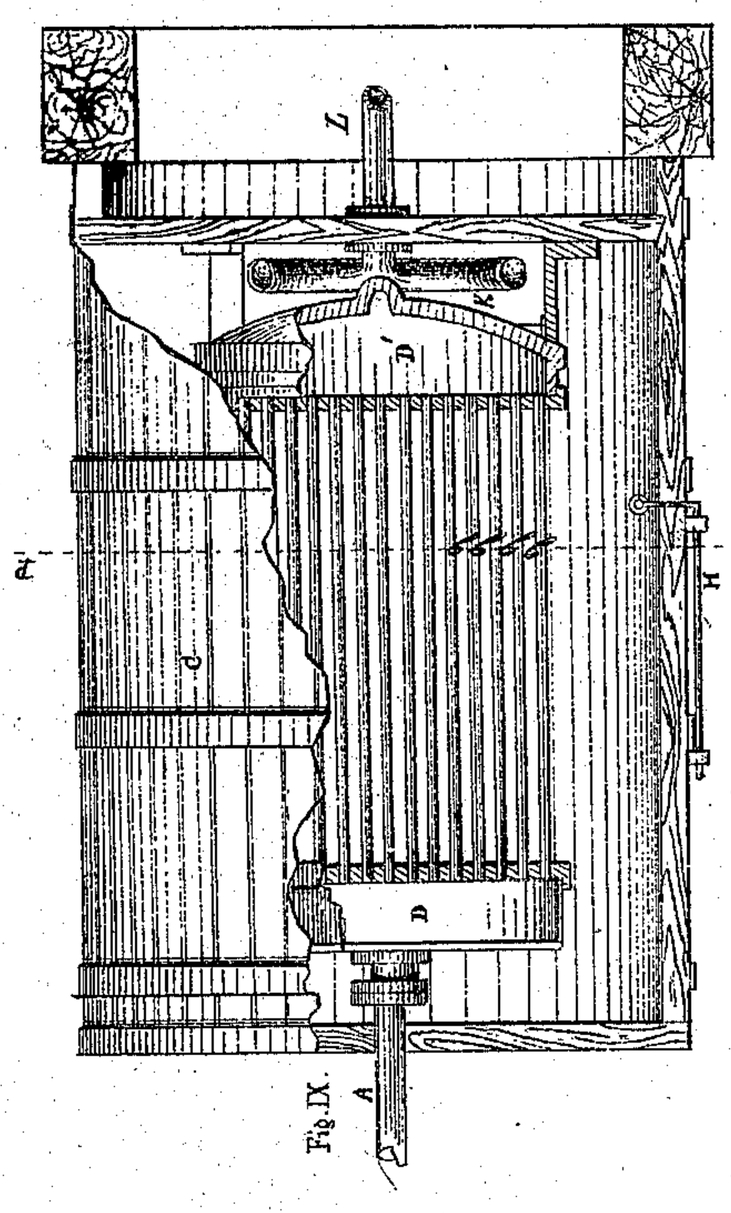
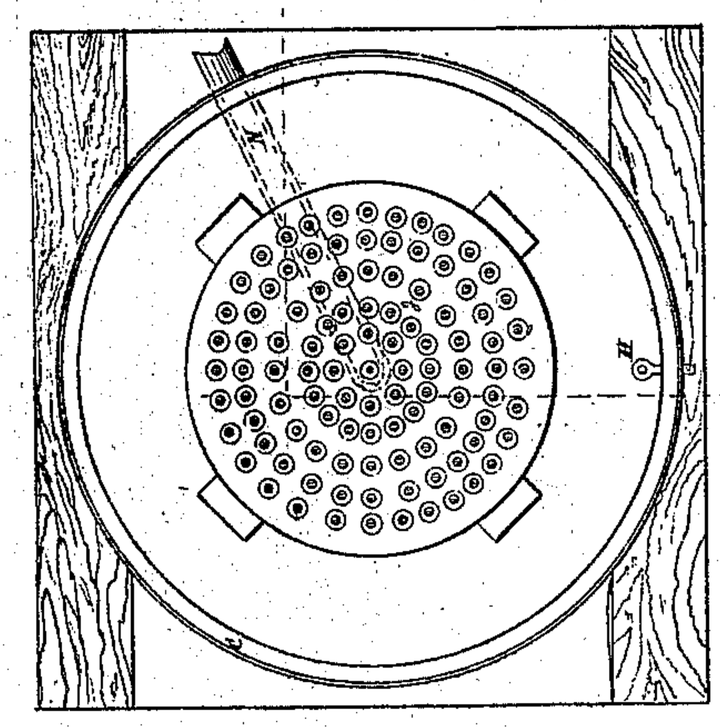


Fig. X.



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Manf. Sugar.
Patented Mar. 8th 1870.
No. 100090.

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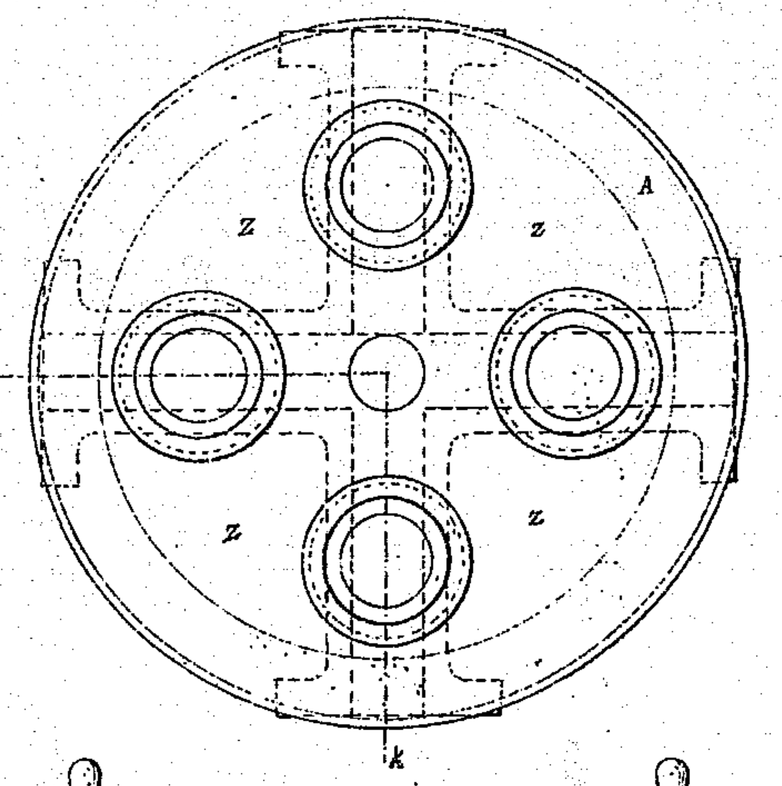
Fig. XII



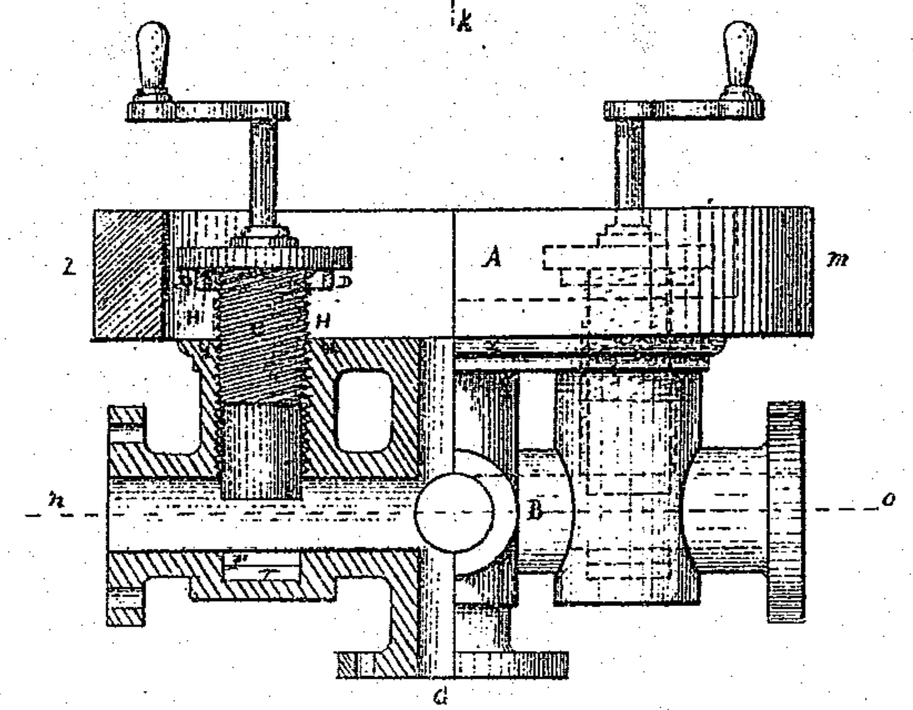


Fig. XI

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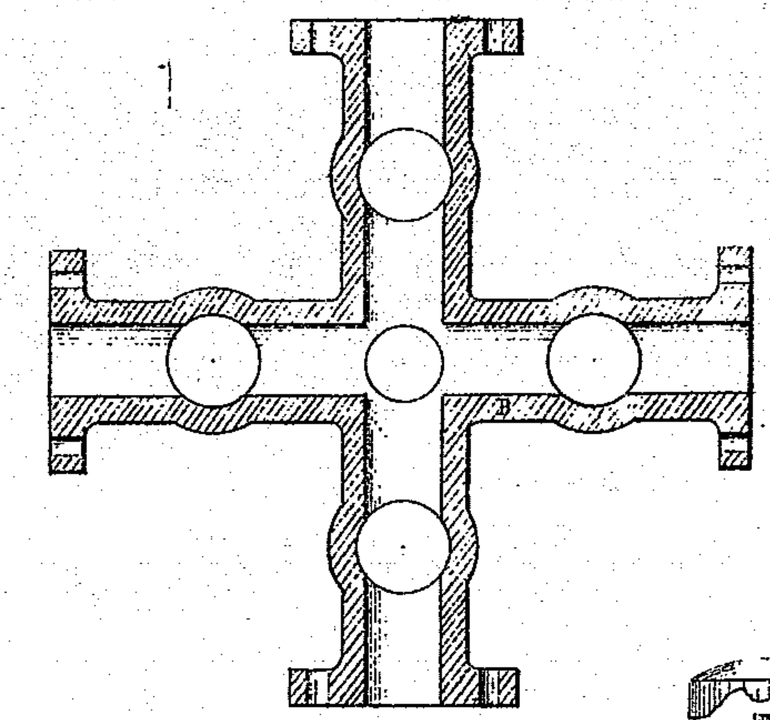
Fig. XIII



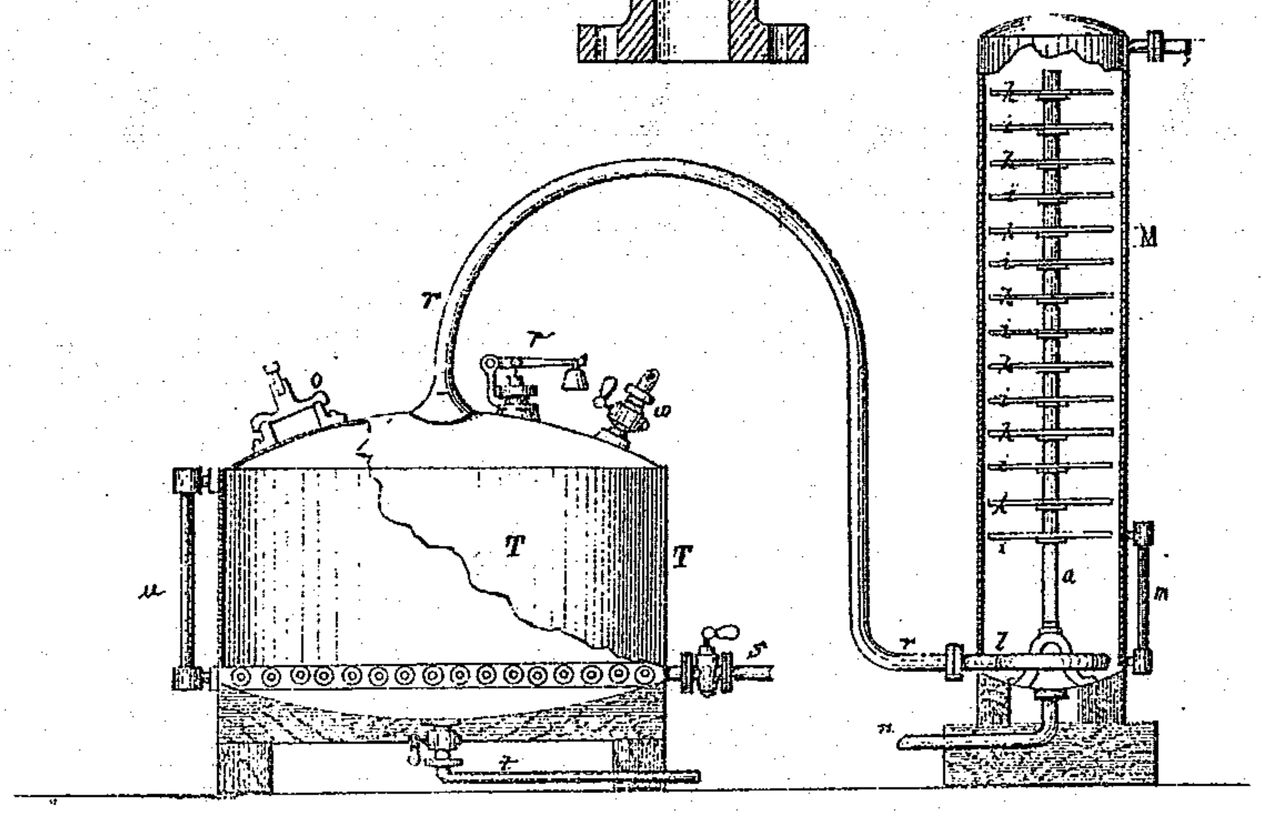


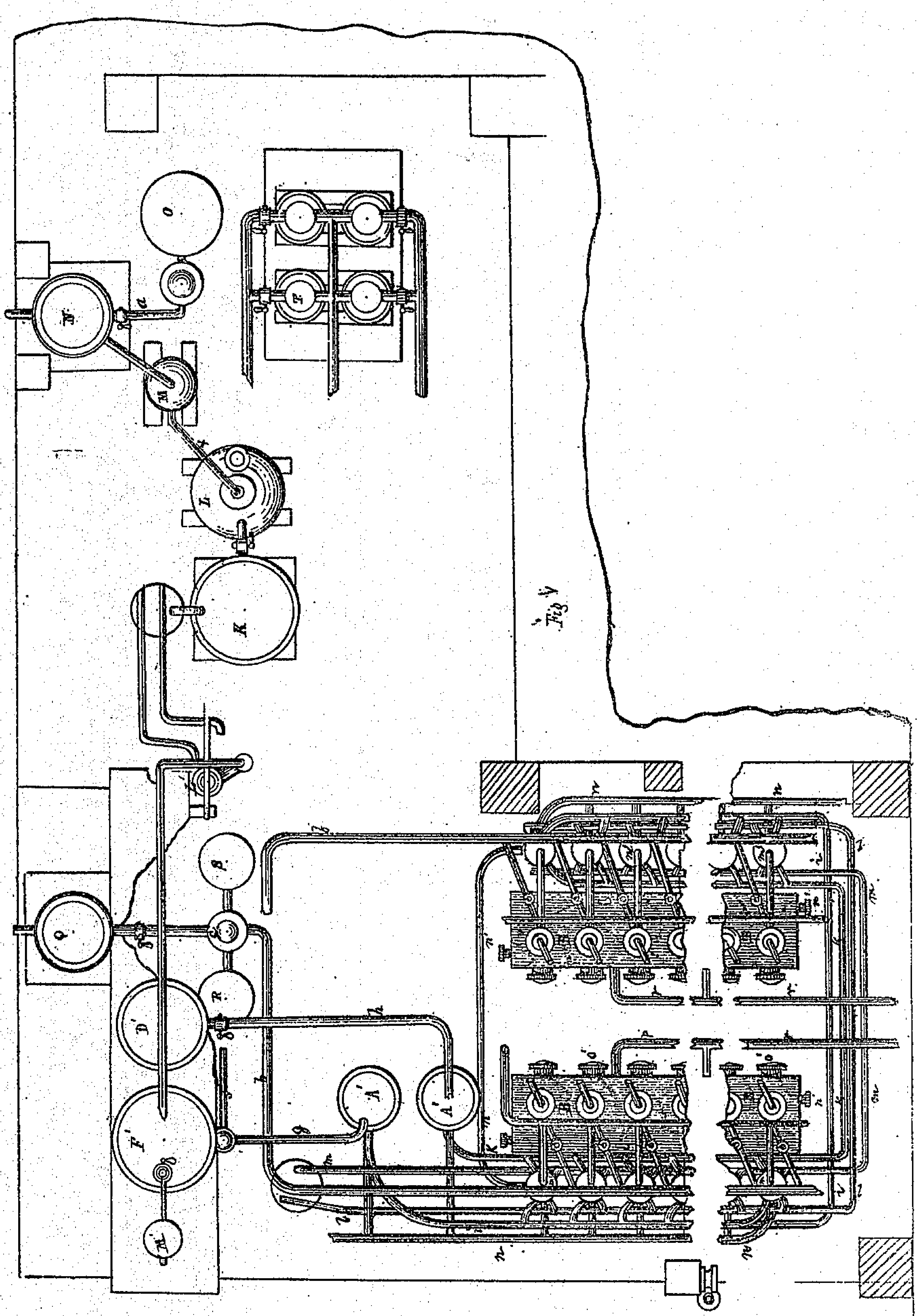
Fig. XIV

Constantin Rossuw
Administrator of
Sebastian Schutzenbach
By his Atty Amos Broadwell

S. Schuzenbach,

Manf. Sugar.

No. 103.090. Patented May 17. 1870.



WITNESSES.

UNITED STATES PATENT OFFICE.

CONSTANTIN ROSSWOG, OF NEW YORK, N. Y., ADMINISTRATOR OF THE ESTATE OF SEBASTIAN SCHÜZENBACH, DECEASED.

IMPROVEMENT IN THE MANUFACTURE OF SUGAR.

Specification forming part of Letters Patent No. **103,090**, dated May 17, 1870.

To all whom it may concern:

Be it known that SEBASTIAN SCHÜZENBACH, late of the city of Baden, in the Grand Duchy of Baden, but now deceased, did, in his lifetime, invent certain new and useful Improvements in the Art of Manufacturing Sugar; that I, CONSTANTIN ROSSWOG, of the city and county and State of New York, am the administrator of the estate of said SCHÜZENBACH, and that the following is a full, clear, and exact description of his said improvement in the art of manufacturing sugar, reference being had to the annexed drawings making part of this specification, in which—

Figure 1 is an end elevation of the apparatus by which said invention is carried into practice; Fig. 2, a rear elevation of a section of said apparatus; Fig. 3, a front elevation of the same; Fig. 4, a view of the end opposite to Fig. 1; Fig. 5, a top view of the whole apparatus; Fig. 6, a horizontal section, showing the top of the crystallizing-jars, together with some of the tanks, coolers, reservoirs, and receivers; and Figs. 7, 8, 9, 10, 11, 12, 13, and 14 are detail parts of said apparatus, to be hereinafter more particularly described.

The object of this invention is to obtain a larger percentage of sugar from the saccharine plant or substance than has heretofore been obtained by any process now in practice, and, at the same time, leave a larger percentage of the nutritious qualities of the plant or substance in the pulp than remains after the extraction of the sugar by the old process. These objects are accomplished by the use of alcohol as an extracting agent, the alcohol being first prepared by reducing it to a certain degree of strength, and by raising it to a certain temperature, and by then applying it to the saccharine substance, previously dried in a desiccating-chamber, until the water is thoroughly eliminated. The effect of the alcohol upon the desiccated saccharine substance is to eliminate the sugar and coagulate the slime, provided the alcohol be of the proper strength and temperature. If the alcohol be too strong, however, it will coagulate the slime, but will eliminate too small a percentage of sugar. If it be too weak, it will eliminate a larger percentage of sugar, but will not coagulate the slime. Again, if the temperature of the alcohol be too low, its power to eliminate the sugar is impaired; if too high, some of the salts will be dissolved. It is, therefore, a matter of the utmost importance to have the alcohol reduced to that degree of strength which will eliminate the largest proportion of sugar consistent with its power to coagulate the slime, and to that degree of temperature which will eliminate the largest proportion of sugar without dissolving any of the salts contained in the pulp.

After much labor and many experiments, continued through a number of years, the said SEBASTIAN SCHÜZENBACH ascertained that the proper degree of strength for the alcohol was 85° of Tralle's alcoholmeter, and that the proper degree of temperature was 60° of Reaumer's thermometer; that the temperature should be very evenly maintained, and in no case allowed to sink below 58° of Reaumer through the entire process of extraction. After the said SCHÜZENBACH had determined the degree of strength, and the degree of heat for the alcohol, and the proper condition of the saccharine substance to receive the alcohol, to insure the proper result, it became necessary to invent and fabricate an apparatus by which the alcohol could be applied to the saccharine substance in such manner as to produce the result above specified without waste by evaporation, or, in other words, to invent a machine by which his improvement in the art of manufacturing sugar could be economically reduced to practice. Such an apparatus the said SCHÜZENBACH did invent. It is shown in the drawing, and is described as follows, that is to say: Said apparatus consists of tanks, receivers, reservoirs, coolers, heaters, extracting-jars, crystallizing-jars, stills, and condensers, all of which are made with reference to the functions they are to perform respectively, and which are located in different parts of a building, and united by means of suitable pipes, fitted with suitable cocks, faucets, joints, &c., the whole of which, when taken together, form the works, with its apparatus for manufacturing sugar upon the plan of this invention.

To convey a clear idea of the works, and of the manner in which the invention of said SCHÜZENBACH is practiced, I will describe the different parts of the apparatus *seriatim*. And

first in order is the large closed tank, marked F in Fig. 1 of the drawing. This tank is located upon the lower floor of the works, and is large enough to contain as much alcohol as the works will consume in a single day. This tank is called the supply-tank. The next in order is a closed distributing-tank, shown in the drawing by F′, Figs. 1 and 5, located in the top of the buildings, from sixty to seventy feet above the supply-tank. These two tanks are connected by means of a pipe leading from the bottom of the supply-tank to the bottom of the distributing-tank, said pipe being fitted with a pump, L′, Fig. 1, to draw the alcohol out of the supply-tank and throw it into the distributing-tank, out of which any vapor that may escape is absorbed or condensed in the chamber M, Fig. 1. From this tank F all the fresh alcohol used in the process is distributed through pipes to the different parts of the apparatus. The next in order is the alcohol-heater, in which all the fresh alcohol used in the process is heated. This heater is shown by A, Fig. 3. It is located upon a floor of the works, forty or fifty feet below the distributing-tank, to which it is connected by means of a pipe, *g*. This heater is shown upon an enlarged scale in Figs. 9 and 10 of the drawing. It consists of a steam-tight wooden tank, in which a tubular heater is arranged, substantially in the manner shown. This tubular heater consists of a top and bottom tube plate or head, in which the tubes are arranged in the manner shown. Above the upper tube-head there is a receiving-chamber, D, formed, and under the bottom head there is a delivering-chamber, D′, formed. In the former of these chambers the alcohol is received through the pipe A into the heater, and out of the bottom it is discharged or delivered through the pipe N to the extracting-jars. The capacity of the wooden tank in which the heater is arranged should be great enough to contain from three to four times as much water as the heater will contain alcohol, the object being to insure an even temperature of the latter by a large bulk of the former, constantly agitated, and maintained at a temperature of 60° Reaumer by a continual flow of steam into the water, through the pipe L, into the circular pipe K, fitted in the bottom of the tank, and perforated in the under side, to insure an equal distribution of the steam through the entire body of water contained in the tank, the temperature of the water being measured by means of a thermometer, shown by H. The next in order are the extracting-jars, of which there are thirty-two, arranged in a pile or battery upon the same floor with the heaters. All of these extracting-jars being constructed exactly alike, a description of one will be a description of them all. They are shown by *x*, in Figs. 3, 4, and 5, arranged in a pile or battery, but in Figs. 7 and 8 the jar is shown upon an enlarged scale, Fig. 7 showing a vertical section of said jar, and Fig. 8 a horizontal section, taken on the line *a z*. The body of this jar is composed of cast-iron, and is in the form of a cylinder, shown by A, with a concave bottom, in which there is fitted a circular steam-pipe, perforated in the bottom side, as shown by *a*. This pipe passes through the bottom of the jar, making a steam-tight joint therein, and connects to the pipe *l*, through which it is supplied with steam to convey over the alcohol left in the residuum, as will be more fully explained in the description of the operation. Immediately over the top of this pipe there is fitted a perforated plate, shown by *b*. The top of this jar is in the form of a horizontal conic section, bolted to the main body by means of flanges, as shown by *j*, and is covered with a steam-tight cover, secured by hinged bracket-bolts, and formed with a stuffing-box in the top, made with a cap thereon, shown by F. In the center of this jar there is arranged a shaft, *e*, fitted with a crank, and supported on a skeleton bearing arranged over the alcohol-pipe in the bottom of the jar. This shaft is supported at the top in the cover of the jar, and is surrounded by the stuffing box and cup, the latter of which is filled with water, to prevent the escape of alcohol in the form of vapor. This shaft is fitted with an agitator in the form of a fork, as shown by *c*, for the purpose of stirring the contents of the jar, and it is also fitted with a brush for the purpose of cleaning the bottom surface of the perforated plate *b′*, fitted in the conic ring *j*, in the manner shown. The bottom plate of this extracting-jar is also provided with a nozzle, to which the pipe *h* is connected, for the admission of the alcohol; and, in the top of said jar, close under the cover *g*, there are arranged two nozzles, to the one of which a pipe is connected, to conduct the alcohol to the succeeding jar; and to the other a pipe is connected, to conduct the alcoholic vapors and steam to a cooler or condenser, when the alcohol is distilled out of the refuse contained in the jar after the sugar has been extracted, as will be hereinafter explained. Neither of these last-mentioned nozzles is shown in Fig. 7 of the drawing, but the pipes are shown by *v v* in Fig. 5. These nozzles are, however, of the usual form for connecting pipe to, and need, therefore, no special description here. In addition to the openings in this jar, already described, there is a large nozzle, *i*, made on the side thereof, opening in the jar immediately above the perforated bottom *b*. This nozzle is fitted with a steam-tight cover, and is styled the man-hole, through which the refuse is removed from the jar at the end of the process. Here ends a description of the construction of what the inventor styles his extraction-jar. Its functions are twofold: In it the saccharine substance is dissolved by the alcohol, and in it the alcohol is distilled out of the refuse after the sugar has been extracted. It has already been stated that there are thirty-two of these extracting-jars arranged in a battery or pile. This pile or battery consists of two horizontal rows of said jars, each row containing six-

teen jars, arranged in a water-bath, B B, as shown in Fig. 5. Each of these water-baths is made wide and deep enough to contain the jars, leaving the cover projecting above the top thereof, and the man-hole nozzle through the side thereof, that the jar may be charged and the refuse discharged without opening the bath. These baths are also divided into compartments, each of which is made long enough to contain four jars, and are separated from each other by means of steam-tight valves or gates, shown by *g*, Fig. 5. Each of these valves is balanced by a weight, *y*, attached to them by means of a cord passing over a pulley, in the manner shown in Figs. 3 and 4. After these jars have been arranged in the bath, as above specified, there is connected to the bottom nozzle of each one (through the agency of the pipe *h*, Fig. 7) what the inventor styles a "four-way cock." This cock is shown in Figs. 11, 12, and 13 of the drawing upon an enlarged scale, Fig. 11 showing at once a side elevation of a section of said cock, and a vertical section of one side or branch thereof, all the sides or branches being the same. Fig. 12 is a top view of said cock; and Fig. 13, a horizontal section through the same, taken on the line *n o* of Fig. 11. The said cock consists of four horizontal branches or nozzles, all converging to a common central vertical pipe or nozzle. Each of the horizontal branches is fitted with a plug screw-valve, C, packed in the bottom with india-rubber, to insure a steam-tight joint, as shown by F, Fig. 11; and the upper ends of all the cock-sockets are embraced in one common flange, Z, which is also surrounded with a vertical flange, forming a reservoir over and around the tops of all the screw-plugs. This reservoir is packed with water to avoid the escape of alcohol in the form of vapor in case the packing or joints around the valve-plugs should not be perfectly tight. The bottom nozzle of this cock, as I have already stated, is connected to the bottom of the extracting-jar, and the top nozzle or vertical pipe of said cock is connected to the top of said jar. Now, we have got the top and bottom of said jar connected to the top and bottom of said jar, so that the alcohol, if admitted, as it is, to one of the horizontal branches of the cock through the pipe *i* from the heater A, will pass (the other valves being properly adjusted) into the bottom of the jar, and out through the upper alcohol-pipe, down through the adjoining four-way cock, into the bottom of the adjoining extracting-jar, and so on through the entire series of jars and cocks, the pipe *i* being, of course, connected, through the agency of branch pipes, to one of the horizontal branches of each one of the four-way cocks, by which the alcohol is continually supplied from the heater to the jars; from whence, after doing its work of dissolving the saccharine matter, extracting the sugar, and coagulating the slime, it passes (taking the extracted sugar along) out through the four-way cock into the pipe *l*, Fig. 3, down into the cooler C′, Fig. 1, and from thence, through the pipe S, to the crystallizing-jar E. The cooler C′, above referred to for cooling the sugar-extract and alcohol, is constructed in every respect precisely the same as the heater above described, differing from that, however, in that the perforated circular pipe is left out, and a water-pipe put in its place, to supply water of the proper temperature to reduce the sugar-extract and alcohol, as it passes from the extracting-jars to the crystallizing-jars, from 60° of Reaumer to 40° of Reaumer.

I have now traced the course of the alcohol from the main tank through the distributing-tank, through the heater, through the extracting-jar, through the four-way cock, into the cooler, and thence to the crystallizing-jars, combined with the sugar-extract; and in thus tracing the course of the alcohol, I have incidentally and in detail described the various parts of the apparatus through which it passed to the crystallizing-jar, where, for the present, I will leave it, until I have described the mode of treating the saccharine substance with the alcohol, and of operating the extracting-jars, which is as follows: The alcohol, as we have seen, after being first reduced to a strength of 85°, comes to the heater from the distributing-tank with a force or pressure due to an elevation of, say, fifty feet, with which force it also leaves the heater after being heated to a temperature of 60° of Reaumer. With this force, and at this temperature, it enters the bottom of the first of the series of the extracting-jars, which has been previously charged, between the two perforated plates, with the desiccated granulated saccharine substance to be treated, covered with a thin sprinkling of powdered calcined lime, to absorb the free acids. When the alcohol is admitted to the jars, all the pipes and openings leading to or from it should be closed, excepting, of course, the one through which the alcohol is admitted, which, for the present, is left open. The alcohol is now left upon the saccharine substance for a period of from ten to twelve minutes, during which time it is occasionally stirred by turning the agitator introduced for that purpose, and described in connection with the construction of the extracting-jars. At the end of ten or twelve minutes, the pipe leading through the four-way cock to the next extracting-jar is opened, and through it the alcohol is forced out of the first extracting-jar into the second, carrying with it a portion of the extracted sugar. In the second jar, the saccharine substance is treated as in the first, and from the second the alcohol, with a larger proportion of the sugar-extract, passes to the third jar, and so on until it reaches the fifteenth one, the pressure, flow, strength, and temperature of the alcohol being constant through all the jars, from the first to the fifteenth, the alcohol, with its ever-increasing proportion of sugar, as it flows from one jar to the other, being instantly replaced by fresh alcohol from the heater. When the alcohol has reached the fifteenth jar, and

that jar has been treated as the preceding ones, the alcohol has become saturated with sugar, and the sugar, if the operation has been properly conducted, has been entirely extracted from the contents of the first jar. The connection, therefore, between the fifteenth jar and the preceding one is closed, and the pipe leading from the fifteenth jar through the four-way cock to the cooler is opened, allowing the liquid sugar and alcohol to flow down through the cooler, where its temperature is rapidly reduced from 60° of Reaumer to 40° of Reaumer, on its way to the crystallizing-jars. As soon as the fifteenth jar has been discharged, the first jar in the series is isolated from the rest and from the heater, and the alcohol, instead of entering the series through the first jar, enters it through the second, and the pipe leading from the first jar through the four-way cock to the cooler C″ is opened, and through it the alcohol escapes from the isolated extracting-jar through the cooler into the main reservoir F, from whence it originally came. The fifteenth jar has now been emptied of its extract in the crystallizing-jar, and the first jar has been isolated and emptied of its alcohol in the main reservoir. The fifteenth jar is now opened, and the saturated alcohol from jar fourteen allowed to enter, and after being agitated and treated for ten or twelve minutes, as before, the alcohol, with its extract, is then admitted in the sixteenth jar, and from that, after remaining there ten or twelve minutes, as before, and after closing the connection between this and the preceding jar, the extract is drawn into the crystallizing-jar, as before, and jar number two is isolated, as before, and emptied of its alcohol through the cooler into the main tank F, after which the alcohol enters the series through the third jar, and so on, the process being repeated in each jar until four jars have been isolated, or those contained in the first compartment of the bath B. The valve or gate that separates this compartment from the rest is then closed, and steam is let in the four isolated extracting-jars, by which the alcohol remaining in the refuse is distilled over into a condenser or cooler, Q, Fig. 5, from which it passes into a receiver, C, Fig. 5, where its strength is ascertained by means of a floating hydrometer, with which the receiver is fitted. If the alcohol proves to be strong enough, it is led at once from the receiver through a pipe, *e*, Fig. 5, to tank R, which merely acts as receiver, and from thence to mixing-tank P. If weak, it is led through pipe *f* into tank S, also a mere receiver, and from thence to tank K, from which it passes into still L, and then to condenser M, Fig. 5, from thence to the mixing-tank, and then into the main tank or reservoir F. Before leaving this part of the process, I will remark here, that the object of the mixing-tank is to concentrate the alcohol in, from the different parts of the works, and at different stages of the process, to the end that its strength may be brought to the proper degree before it is introduced into the main supply-reservoir, from which it is continually drawn as fresh alcohol.

I have already shown that the bath B is divided into compartments separated by valves, each compartment containing four jars. The object of dividing this bath into compartments is to enable the operator to obtain and maintain a different temperature upon different sets of the jars at different stages of the process. Thus upon the jars that are being used for extracting the sugar, the temperature must be maintained at 60° of Reaumer, while upon and in the jars being used to distill the alcohol out of the refuse, the temperature must be raised higher, say 80° Reaumer.

To accomplish this object the bath is fitted with a steam-pipe, in Fig. 8. By means of this pipe the temperature of the water may be raised as high as may be desired in any one of the compartments, while the temperature in the adjoining compartments is kept down to the requisite degree by the admission of cold water from time to time, as occasion may require. During the distillation of the alcohol from the first four jars, the process of extraction in the remaining jars continues until the next four jars in the succeeding compartment are isolated, and the alcohol withdrawn from them, when the process of distillation is applied to them, and so on through the entire series. The process is then repeated—that is, the jars are charged with fresh saccharine substance, and treated with alcohol for about seventy-two hours, in which time the jars will have been charged nine times with fresh saccharine substance, provided the operations have been successfully conducted. At the end of this period of seventy-two hours, the alcohol is drained or drawn out of the crystallizing-jars in the form of mother-water, leaving the crystallized sugar behind. This mother-water consists of the alcohol with the original fifteen per cent. of water, and as much sugar held in solution as that proportion of water will contain. This mother-water, after it has been drawn from the crystallizing-jars, passes to a special chamber or tank, shown by G, Fig. 1. From thence it is pumped up to a special distributing chamber or tank, D, Fig. 1, forty or fifty feet above the extracting-jars. From thence it falls with a force due to that altitude into the special heater A′. From thence it is admitted in the extracting-jars, which have been again charged with fresh saccharine substance, and which is now treated precisely the same with the mother-water as it was previously treated with alcohol; but the mother-water, as it already contains sugar, instead of going to the fifteenth jar before it becomes saturated with sugar, goes only to the eighth jar, at which point the connection between the seventh and eighth jars is closed, and the extract is drawn from the jar to the mother-water cooler C‴, from whence it flows into the crystallizing-jars as before. Jar number one

is now isolated. The mother-water it contains has been drawn to the third cooler, C‴, and from thence to the mother-water reservoir G. Jar number nine is now treated with mother-water, and the extract withdrawn to the crystallizing-jars as before. Jar number two is then isolated and emptied, as before, and so on the process is continued with the mother-water through the entire series, the same as with the alcohol. But in treating the fresh saccharine substance with mother-water, all the sugar is not extracted from the refuse. The mother-water is, therefore, at once followed by fresh alcohol, which is admitted into jar number one upon the same saccharine substance, as soon as the mother-water has been withdrawn. We have now fresh alcohol in jar number one, and mother-water in eight of the succeeding jars, the fresh alcohol taking the place of the mother-water on the same saccharine substance, as fast as the process advances, until the fresh alcohol has reached jar number seventeen, carrying with it the sugar extracted in its progress through the several jars. Jar seventeen is then emptied of its extract in the cooler, from whence it flows to mother-water reservoir G, instead of going to the crystallizing-jars, this extract being weak, having extracted only the sugar remaining in the saccharine substance after being treated with the mother-water. By the time the fresh alcohol has reached jar seventeen, all the sugar will have been extracted out of jar number one, which is again isolated. The alcohol contained in it is drawn out into the cooler, and from thence to the main tank F, as in the initial operation. Now, when jar number seventeen delivers its weak extract, jar number twenty-four delivers its strong extract, the product of the mother-water upon the fresh saccharine substance, in advance of the alcohol, and when jar number twenty-seven has delivered its strong extract, jar number twenty will have delivered its weak extract, and jar number four, all in the first compartment, will be isolated, and the first four jars ready to receive the steam to distill the alcohol out of the refuse, and when jar thirty-two delivers its strong extract, jar twenty-five delivers its weak extract, and jar number nine is isolated, and the distillation of the alcohol out of the jars in the second compartment commences. We have now reached the climax of the process, where it is to be continually kept. All the jars are actively at work performing the functions they must perform to make the process continuous. Out of the first eight jars the alcohol is being distilled from the refuse; in the next sixteen jars the alcohol is extracting the sugar left by the mother-water; in the last eight jars the mother-water is extracting the sugar from the fresh saccharine substance, so that by the time the strong mother-water is drawn out of the last jar in the series, the first jar is ready to receive a fresh charge of the saccharine substance, to be again acted upon by the mother-water, and again succeeded by the fresh alcohol, the fresh saccharine matter being always first treated with mother-water, followed by fresh alcohol after the initial process, occupying the first seventy-two hours. In this process there is about thirty-three per cent. more mother-water made than can be used as an extracting agent. One-third of the mother-water, therefore, instead of going through the heater to the extracting-jar, is pumped directly from the reservoir G to the tank K, from which it passes to the still L. Here the alcohol is distilled over into the condenser M, from which the liquid flows directly to the mixing-tank P, while the uncondensed vapor passes over into the cooler N, where it is condensed, and from whence it passes in the form of liquid to the receiver O, where its strength is ascertained by means of a hydrometer, on its way to the mixing-tank, preparatory to its admission in the main reservoir F.

After the alcohol has been distilled out of the mother-water, there remains in the still nothing but water and sugar, mixed with a very small percentage of alkali salts, and a still smaller percentage of a very acrid and badly-tasted gum, together with an oily substance not yet sufficiently known. The gummy and oily substances are thoroughly eliminated by filtration in bone-black, leaving only the small percentage of alkali salts. After the filtration, the liquor appears as a glittering, clear, colorless solution, of a nearly pure taste, which, boiled down to the usual volume, yields good melis, and afterward another small proportion of the after product.

Here ends a description of said SCHÜZENBACH'S improvement in the art of manufacturing, and of the apparatus by which it is carried into practice, and of the mode of its operation.

In practicing this improvement in the art of manufacturing sugar, great care should be taken to maintain the strength of the alcohol at 85° of Tralle's alcoholmeter, and its temperature at 60° of Reaumer's thermometer, as above described; and, in constructing and operating the apparatus, great care should be observed in making the joints, uniting the pipes, and forming the working parts of the apparatus, that no alcohol can escape in the form of vapor, immersing or covering such pipes, cocks, and joints with water, as may be necessary, to avoid the escape of the alcoholic vapor, and thus prevent waste; for it will be seen, upon examination of the process above described, that the alcohol is never to be allowed to come in contact with the atmosphere, but is continually returned to the main tank from the extracting-jars without the least exposure or waste.

The advantages resulting from this improvement in the art of manufacturing sugar are two. The first is found in the fact that from seventy to eighty per cent. of all the crystallizable sugar originally contained in the saccharine plant or substance is extracted and obtained at once, free from impurities, in trans-

parent and nearly white candy sugar grains, and the balance of the crystallizable sugar is afterward nearly all obtained by filtering the product of the still through bone-black, and by afterward boiling it, if found desirable.

The second of said advantages is found in the fact that all carbonic nutritious substances, composed principally of salts which are indigenous to the plant or substance, and render it valuable for a food for cattle, remain in the pulp or refuse after the sugar has been extracted.

Having now described the nature and extent of said SCHÜZENBACH'S improvement in the art of manufacturing sugar, and the manner of practicing the same, I desire to state that I do not intend to make a claim to this particular apparatus as a part of this application, the apparatus being the means by which the invention is carried into practice; but

I do claim herein, as the invention of said SCHÜZENBACH—

1. Extracting the sugar from the saccharine substance or plant, by means of alcohol, applied substantially as described.

2. Extracting from the saccharine plant or substance at least from seventy to eighty per cent. of the crystallizable sugar, at once free from impurities, by means of heated alcohol applied thereto, substantially as set forth.

3. Separating the sugar from the pulp or refuse, without eliminating the salts or other nutritious substances therefrom, by the use of heated alcohol, substantially as set forth.

4. Extracting the sugar from the saccharine substance by the use of heated alcohol applied thereto under pressure.

5. Extracting sugar with alcohol continuously applied thereto, first in the form of fresh alcohol, and then in the form of mother-water, the one succeeding the other, in the manner substantially as described.

6. The distillation of the alcohol from a portion of the mother-water, as a part of the process.

7. The distillation of the alcohol from the refuse before removing it from the jar or chamber in which the extracting of the sugar takes place.

8. Extracting sugar from the saccharine matter or substance with alcohol, through the agency of a series of closed vessels, connected together in such manner as to pass the alcohol from one to the other of the entire series, and return it to the initial point or vessel, either in the form of clean alcohol or in the form of mother-water, without once exposing it to the atmosphere or stopping the process.

9. Extracting the sugar from saccharine matter with alcohol, in a close extracting jar or chamber, fitted with an agitator, substantially as set forth.

10. Combining a series of said jars together in a bath of water, fitted with steam and water pipe, by which the temperature can be maintained at a certain degree on a part of said series, and at a higher or lower degree on another part thereof, substantially as described.

11. Combining a number of said extracting-jars together in a series, and uniting them with pipes and cocks, in such manner that the alcohol or extracting agent can flow in and out of one jar into the other through the entire series, substantially as described.

12. Combining a number of said extracting-jars together in a series, and uniting them with pipes and cocks, so made and arranged in relation to each other that the alcohol can be distilled out of one division of the series while the sugar is being extracted out of the saccharine substance in a second division of said series with alcohol, and with mother-water in a third division of said series.

CONSTANTIN ROSSWOG,
Administrator of the estate of
Sebastian Schüzenbach.

Witnesses:
VICTOR BISHOP,
MARMADUKE RICHARDSON.