

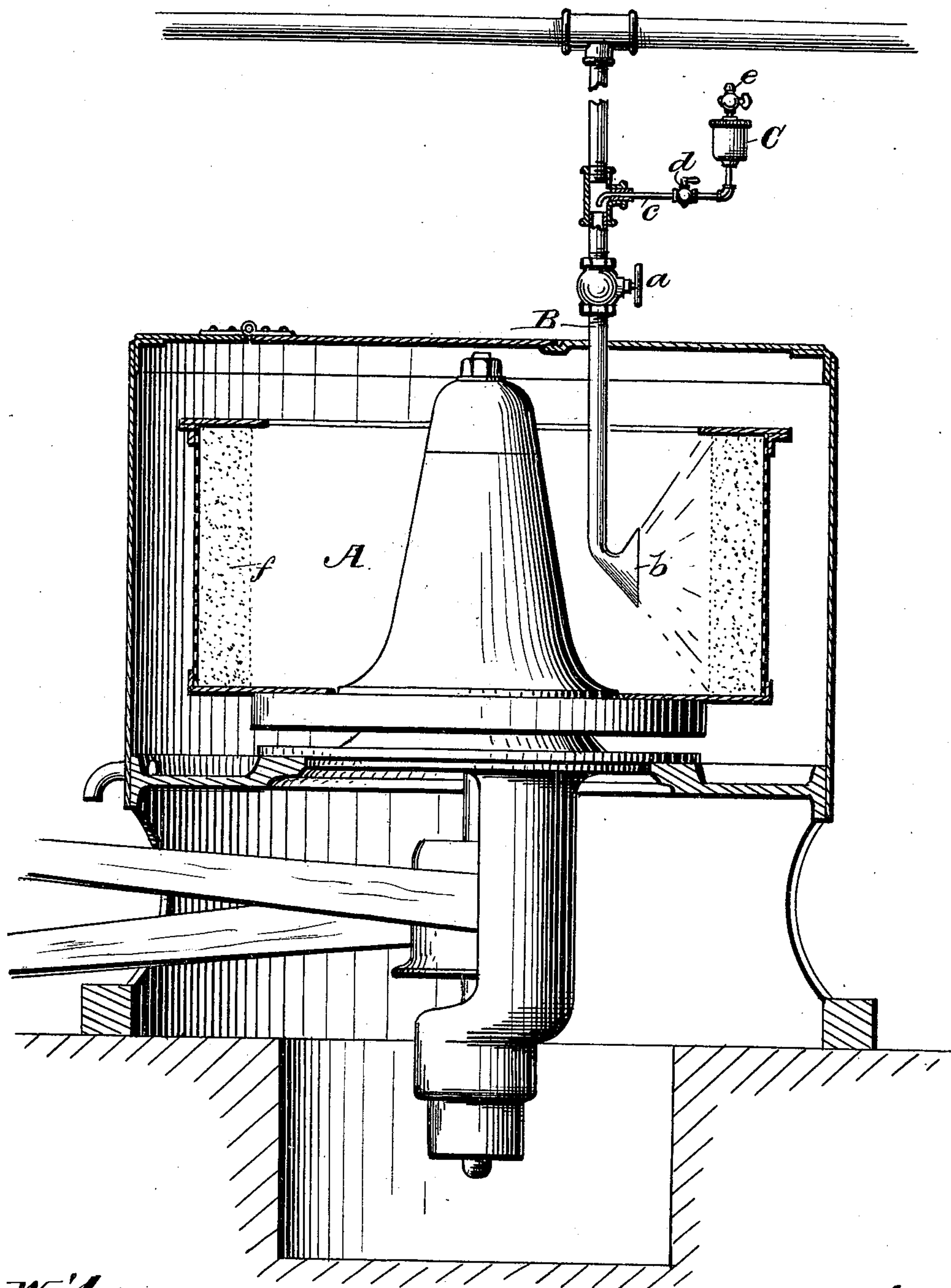
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M. ZAHN.
PROCESS OF REFINING SUGAR.

(Application filed Mar. 23, 1896.)

(No Model.)



Witnesses.
Robert Everett,
H.B. Keefe.

Inventor.
Max Zahn.
By James L. Norris
Att'y.

UNITED STATES PATENT OFFICE.

MAX ZAHN, OF ARTERN, GERMANY.

PROCESS OF REFINING SUGAR.

SPECIFICATION forming part of Letters Patent No. 631,603, dated August 22, 1899.

Application filed March 23, 1896. Serial No. 584,541. (No specimens.)

To all whom it may concern:

Be it known that I, MAX ZAHN, sugar-factory manager, a subject of the King of Prussia, German Emperor, residing at Artern, in the Kingdom of Prussia and German Empire, have invented new and useful Improvements in Sugar-Refining, (for which Letters Patent have been granted in Germany, dated October 13, 1896, No. 88,864; in Austria, dated December 5, 1896, No. 4,892/46; in Hungary, dated October 10, 1896, No. 6,165; in Great Britain, dated February 17, 1896, No. 3,565; in France, dated June 12, 1896, No. 254,416; in Belgium, dated February 29, 1896, No. 119,853, and in Sweden, dated April 1, 1897, No. 7,730,) of which the following is a specification.

My invention relates to sugar-refining; and it consists in a process in which there is forced through the sugar superheated steam at such a temperature that no further heating will be required for drying and then as the cleansing and refining of the sugar is nearing completion there is forced into and through the mass of sugar-crystals a mixture of coloring-matter and syrup.

In the process of refining sugar there can be distinguished four different phases to convert the raw product present in form of masse-cuite into the dry, refined, and marketable product (granulated)—viz., first, separating crystals and syrup; second, cleansing and washing the crystals; third, bluing the crystals; fourth, drying the crystals. These four operations heretofore have been performed either in separately-located devices or else different means or mediums were employed to accomplish the several operations of the refining process.

One object of my invention is to perform the said four operations in a single apparatus—centrifugal—using but one medium—superheated steam—in the successive operations of cleansing and bluing.

To clearly distinguish and characterize my invention, I give in the following a brief synopsis of the present state of the art of sugar-refining as far as it is coincident with my process. At present either water or a watery sugar solution or dry steam or common steam is used to cleanse and refine the sugar-crystals. In cleansing the sugar-crys-

tals with water or a watery sugar solution these liquids are either applied by means of a common watering-can or differently-constructed spraying devices are in use in order to distribute the cleansing medium more evenly and economically. Also common steam and dry steam are made use of for said purpose—cleansing of the crystals. Which-ever of these methods is applied results have shown that there is a great loss of sugar in the centrifugal-department of every sugar factory and refinery caused by melting or washing away of the sugar-crystals, thus inflicting a threefold loss—viz., first, all melted sugar has to be reboiled and centrifugaled again, causing renewed expense; second, the greater part of the melted sugar is contained in a sugar solution of lower purity, consequently will only be obtainable in form of an inferior product; third, a great amount of the melted sugar-crystals will remain in the uncrystallizable part of the reboiled material in form of molasses or partly destroyed by inversion and decomposition, or said melted sugar will be obtainable only in a product of greatly-reduced market value. It is an important purpose of my invention to reduce these losses to a minimum, at the same time rendering the whole process of refining to a great extent less complicated, reducing the expenses materially and also increasing the yield of granulated sugar from four to seven per cent. above the yield obtained by the spraying of water or sugar solutions or dry or common steam. Furthermore, all the operations in my process are made almost independent of the care of the operator and of the spraying apparatus being in perfect working condition, these latter two items being often a source of quite serious losses, as heretofore by inattention one-half minute over time in the application of the spray or common and also dry steam will melt a great deal of sugar, and, besides, in applying spraying devices of any kind all these apparatus labor under the serious objection that they are liable to get partly stopped up by the least particle of any insoluble matter. Being used in this state, the nozzle or mouthpiece being partly stopped up, the water or sugar solution is forced against a certain point of the centrifugal con-

tents with considerable force, being under a pressure of from thirty to seventy pounds. In this state the even spray is not obtainable at all and only part of the water or cleansing medium will be applied in the desired form, while the other part is forced against a certain part of the periphery of the mass of sugar-crystals. Wherever this solid stream of water strikes said crystals, the sugar is cut out and melted very rapidly, while other parts of the centrifugal contents are not getting any of the cleansing and refining medium. Consequently these parts will be in the crude state at the end of the refining operation, containing a considerable part of syrup or molasses yet, and therefore not only a great part of sugar is lost, but the whole charge of the centrifugal, equal to a barrel of sugar, is spoiled entirely and has to be rejected. Using dry steam or common steam for the cleansing and refining purpose, the same difficulty presents itself—viz., great losses of sugar by melting and great dependence on the skill of the operator. Common steam and dry steam will condense immediately whenever brought in contact with a body having a lower temperature than said steam has, and as every particle of condensed water means the destruction of an equivalent part of crystals the loss of sugar will be proportionate to the amount of water molecules contained in the amount of steam necessary to cleanse and refine, for instance, one charge of masse-cuite. This property of common as well as of dry steam by itself shows clearly the superiority of superheated steam, which not only by the same temperature—180° centigrade—contains a great deal less water molecules—in other words, is physically unable to dissolve the same amount of sugar as said common or dry steam would—but also can be reduced fully 67.3° centigrade before one particle of condensation can take place, because of the insignificant pressure, as I make use only of said superheated steam of a pressure of about six-tenths of a kilogram per square centimeter.

Comparing dry steam or common steam of a temperature of 180° centigrade on one hand with superheated steam on the other hand we find that the former kinds of steam must be under a pressure of 9.5 kilograms per square centimeter, while superheated steam in my process has only a pressure of six-tenths of a kilogram per square centimeter, equaling 112.7° centigrade in its normal state. This low-pressure steam is heated up to a temperature of 180° centigrade, maintaining the same low pressure, but having now the property of being able to be reduced 67.3° centigrade before a single molecule of condensed water is formed, consequently before any particle of sugar can be melted. This special property of superheated steam enables me to impart sufficient heat to every sugar-crystal for the subsequent evaporation of moisture adhering

to the crystals when taken from the centrifugal-machine and exposed to the atmosphere. In other words, my invention does away entirely with all special drying proceedings and complicated and costly apparatus (granulator) and with the special application of any drying medium, superheated steam, such as in the process described in the German Patent No. 14,577 to Captaine, or dry steam, hot air, or hot gases, as advocated by some others. All these processes use separate cleansing and drying mediums, while I employ only the one medium—superheated steam—in one operation for both the cleansing and the drying at one and the same time, no further heat for the drying being required. Another distinct difference between common steam and dry steam on one hand and superheated steam on the other presents itself in the by far greater quantity of water molecules in common and dry steam of 180° centigrade than is contained in superheated steam of the same temperature. As every molecule of water leaves the centrifugal in form of a saturated or even supersaturated sugar solution, the yield obtained by the application of superheated steam must be proportionately higher than by using common air or dry steam. The introduction of high-pressure steam always involves and increases the danger of an explosion liable to happen to any centrifugal and to any steam-pipe and fostered by the constant vibration of the centrifugal. Applying steam of only six-tenths of a kilogram pressure to a square centimeter, as in my process, this danger is entirely eliminated.

The bluing of the sugar-crystals at present is either done by drawing a certain quantity of bluing-matter (ultramarine) in the vacuum-pan or mixing the bluing with the water intended to cleanse the sugar-crystals, this water being applied in the usual way, either with a can or spraying apparatus, using compressed air, steam, or other gases as a means to obtain the desired pressure. The bluing mixed with the water has heretofore been applied separately, as in the German patent to Knauer, No. 43,460; but it is very essential to apply it at the right time and also in the most effective condition—viz., after the crystals are made perfectly clean and sufficiently hot. Furthermore, as all liquids brought in contact with sugar-crystals in the centrifugal will leave the same in a saturated or supersaturated state it is not profitable to use and apply the bluing in a watery solution. I apply the bluing mixed with a fully or nearly saturated sugar solution, thus avoiding any loss by melting the sugar-crystals. It is also evident that there must result a decided improvement in applying said bluing-matter at the time, in the manner, and so that there is neither any loss of sugar by melting nor loss of bluing material, the latter being the case whenever the bluing is drawn in the vacuum-pan or applied

with the water-spray for cleansing or in the way Knauer does, as bluing mixed with water always causes a loss of sugar by melting.

The accompanying drawing illustrates in vertical section a form of centrifugal machine that can be conveniently employed in practicing my improved process of sugar-refining.

In the drawing the letter A designates the basket of the centrifugal.

B denotes a pipe through which superheated steam is to be introduced in the centrifugal. This steam-pipe is furnished with a hand-valve *a* and terminates at its lower end in a flared distributing-nozzle *b* for spraying the superheated steam against and through the sugar contents of the centrifugal-basket. The bluing material is mixed with a saturated sugar solution contained in a cup C, having a capacity just sufficient for a single charge, so that there will be no waste in using the coloring-matter. This cup C is provided with an outlet-tube *c*, that is extended into the steam-pipe. The tube *c* is provided with a valve *d*, that is kept closed until the bluing is to be used.

At the top of the bluing-cup C there is an air-valve *e*, so that when valve *d* is opened the suction in the steam-pipe will cause the cup C to empty its contents into the steam-pipe, and thus the bluing and the saturated sugar solution in which it is contained will pass, together with the steam, into the centrifugal, and be thereby thrown forcibly against the mass of sugar *f* in the basket of the centrifugal.

Having now set forth the characterizing new and useful features and differences of my invention, in the following I give a short description of the working of my process on a large scale.

After the centrifugal has been charged and started and the separation of syrup completed superheated steam is turned on by opening the hand-valve *a* and kept on until the sugar-crystals have reached a temperature of about 95° centigrade. At this point the valve *d* is opened, and also the air-valve *e*, and then by the action of the steam in the pipe B the contents of the bluing-cup C are drawn out and mixed with the sugar-crystals in the centrifugal almost instantly. As soon as cup C is empty the valves *d* and *e* are closed and the superheated steam turned off also by closing the valve *a*. The sugar-crystals in the centrifugal are now perfectly refined and ready for being taken out, which

is done in the usual manner. The last traces of moisture adhering to the crystals are evaporated as soon as these crystals come in contact with the atmosphere. The sugar as taken from the centrifugal-machine is now a marketable product of standard market value, polarizing on an average 99.7 to 99.8.

Here I may add that even if by mistake or carelessness the superheated-steam valve should be left open longer than is necessary for the cleansing process, only a very small amount of sugar would be melted on account of the crystals having attained now a temperature very near the boiling-point (95° to 98° centigrade) and on account of the great superiority of superheated steam to common steam or dry steam, which under the same circumstances would melt a considerable amount of sugar.

What I claim as my invention is—

1. The process of refining sugar, which consists in subjecting the same to centrifugal action and simultaneously forcing through the sugar-crystals superheated steam at a temperature of 180° centigrade and a pressure of six-tenths of a kilogram per square centimeter, or thereabout, to free the sugar-crystals from the adhering syrup, substantially as described.

2. The process of refining sugar, which consists in forcing through the same superheated steam at a temperature of 180° centigrade and a pressure of six-tenths of a kilogram per square centimeter, or thereabout, to free the sugar-crystals from adhering syrup and at the same time heat them to a point where no heat will be required for drying the sugar and as the refining is nearing completion forcing a mixture of coloring-matter and syrup into and through the mass of sugar-crystals, substantially as described.

3. The process of refining sugar, which consists in forcing through the same superheated steam at such a temperature that no further heat will be required for drying and as the refining is nearing completion forcing a mixture of coloring-matter and syrup into and through the mass of sugar-crystals, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

MAX ZAHN.

Witnesses:

JULIUS MUTH,
PAUL CHELIN.