

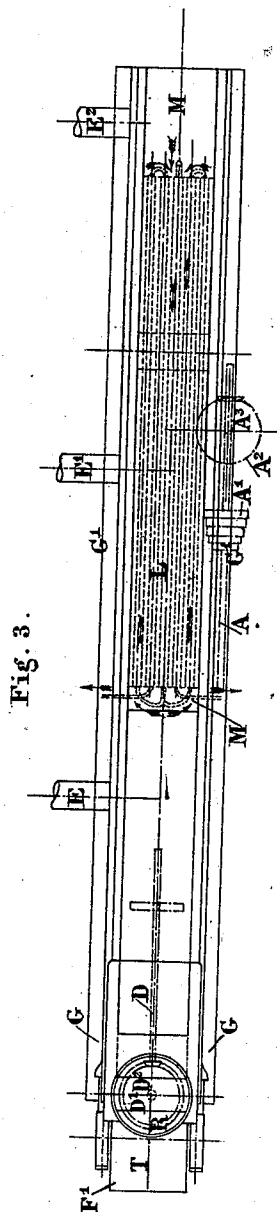
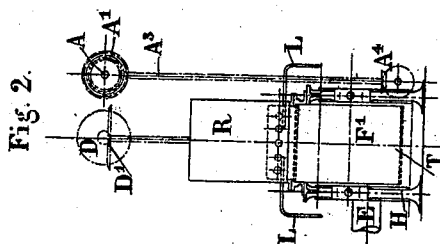
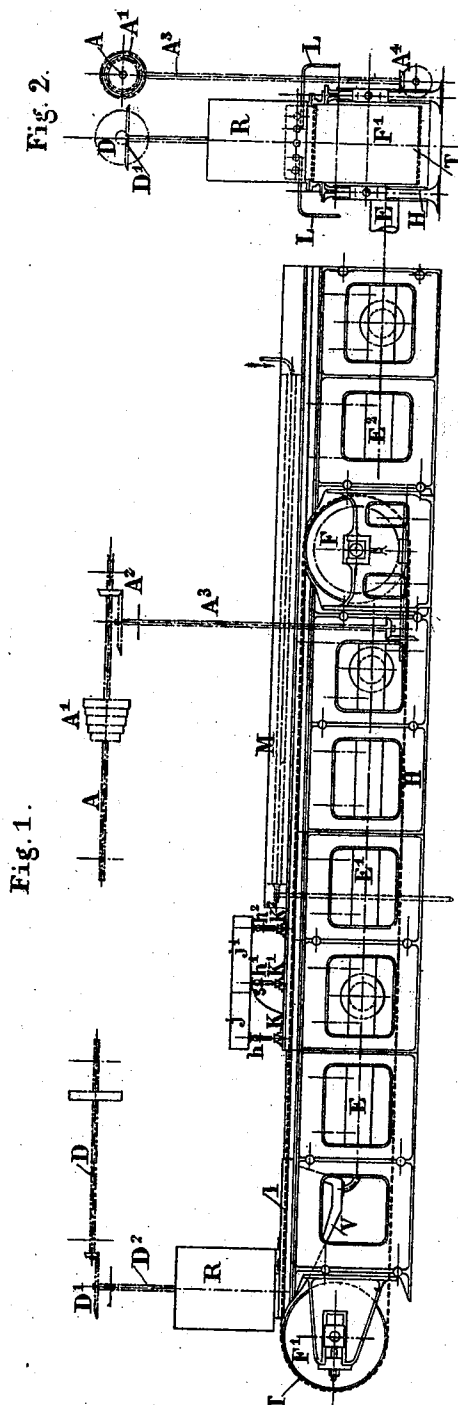
(No Model.)

8 Sheets—Sheet 1.

L. E. A. PRANGEY.
APPARATUS FOR REFINING SUGAR.

No. 502,014.

Patented July 25, 1893.



Witnesses:
George Barry.
O. Lundgren

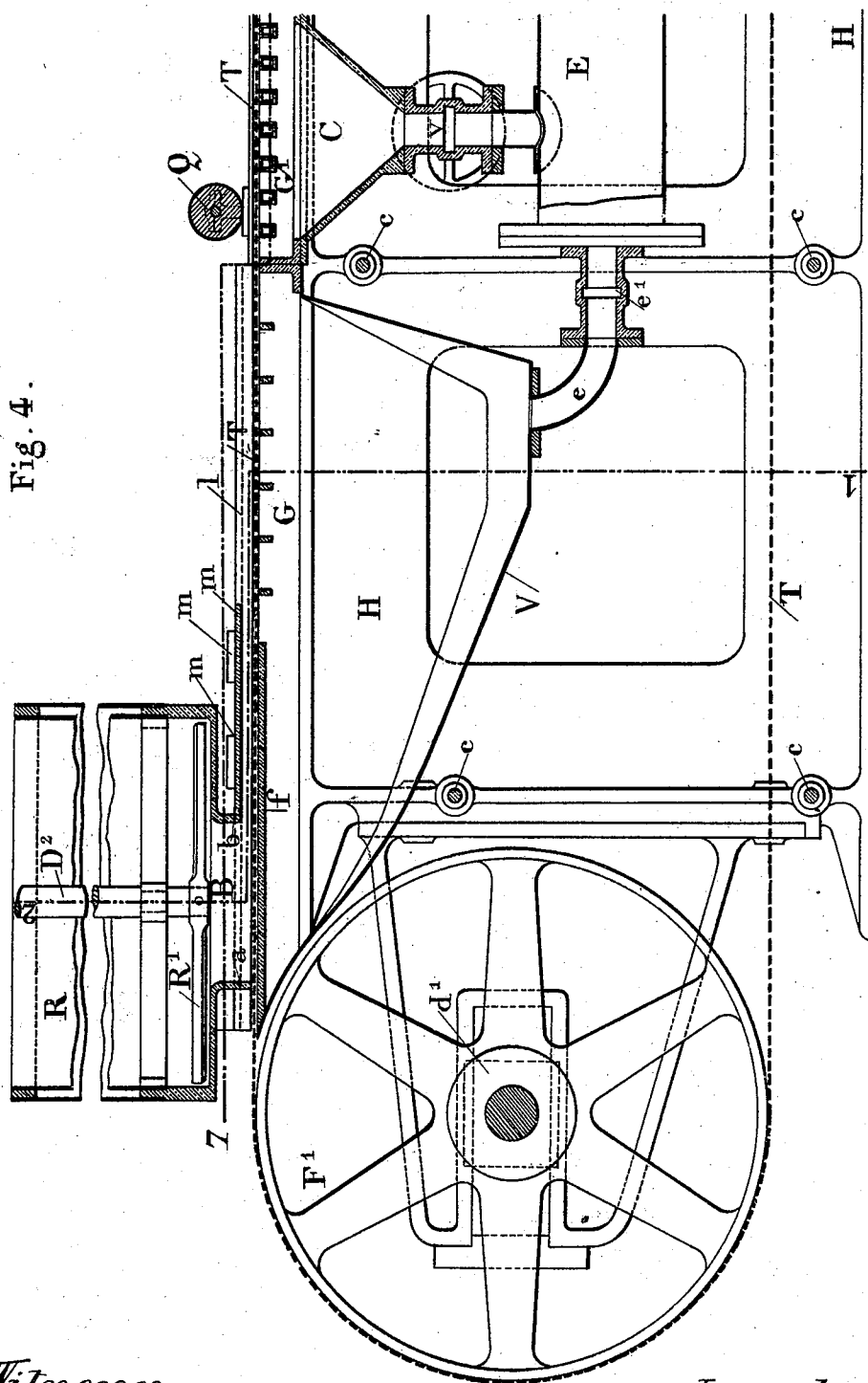
Inventor:
Louis Edme Achille Prangey
By attorneys
Brown & Howard

L. E. A. PRANGEY.
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Fig. 4.



Witnesses:
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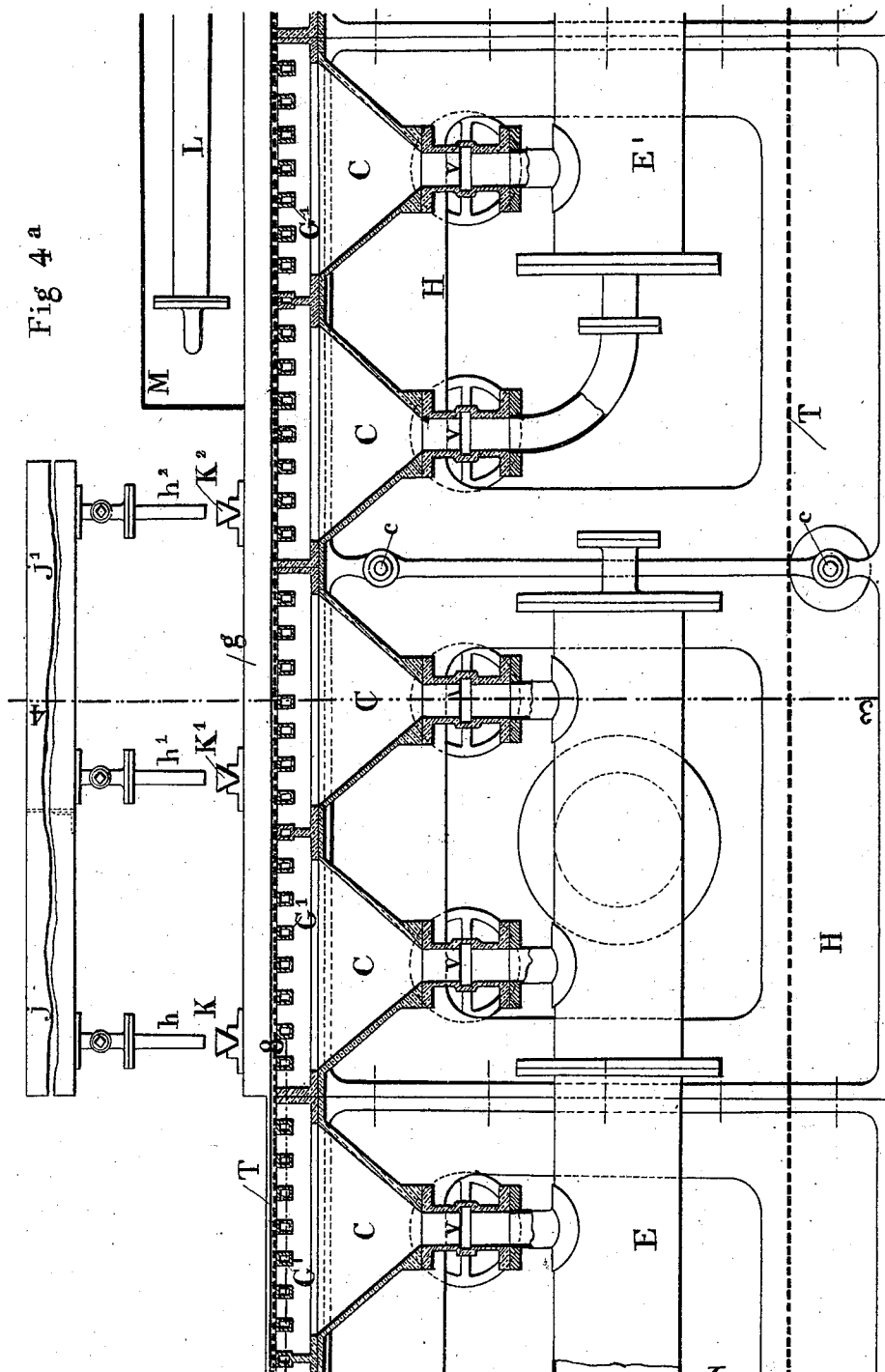
Inventor:
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L. E. A. PRANGEY.
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Fig 4^a



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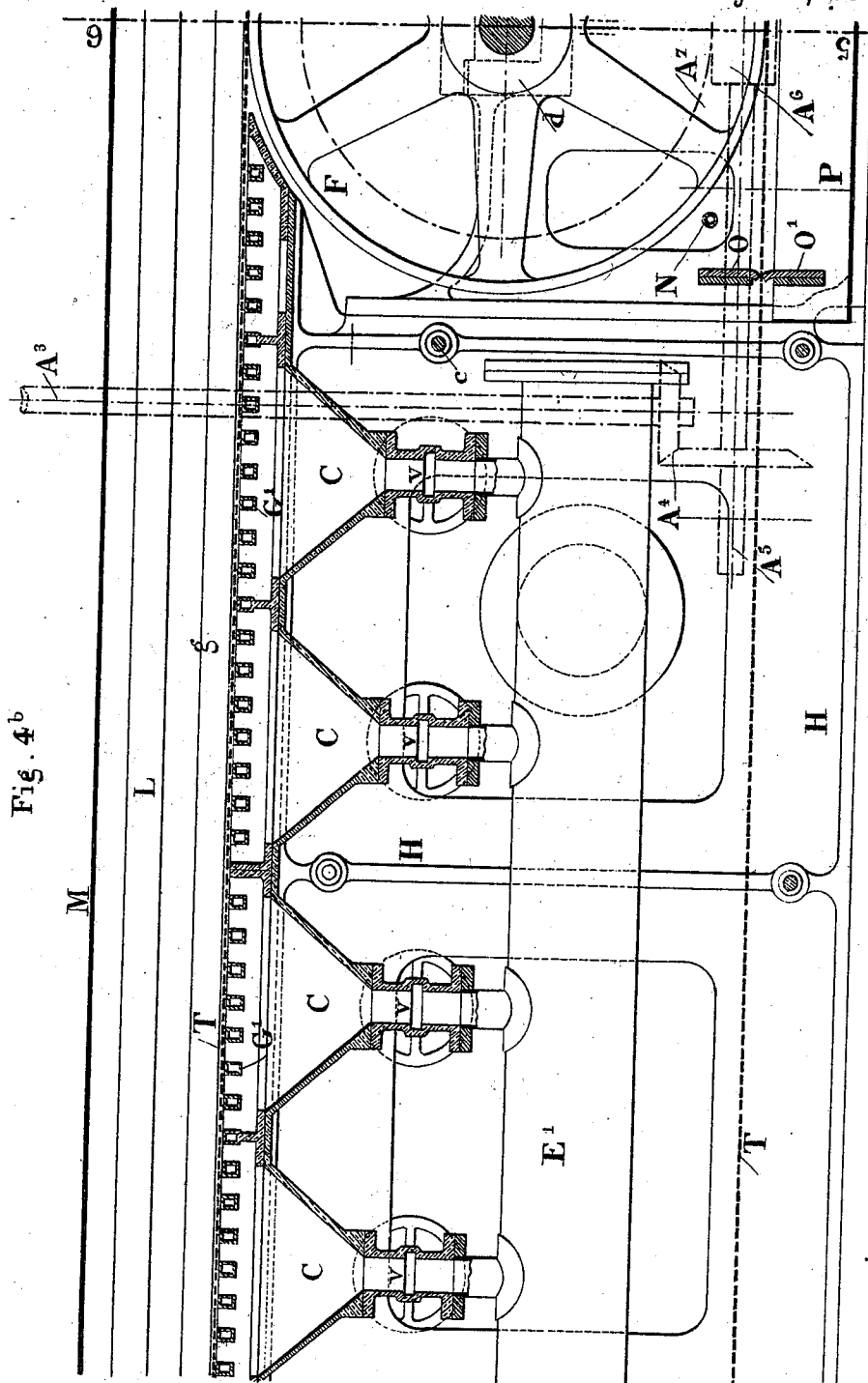
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8 Sheets—Sheet 4.

L. E. A. PRANGEY.
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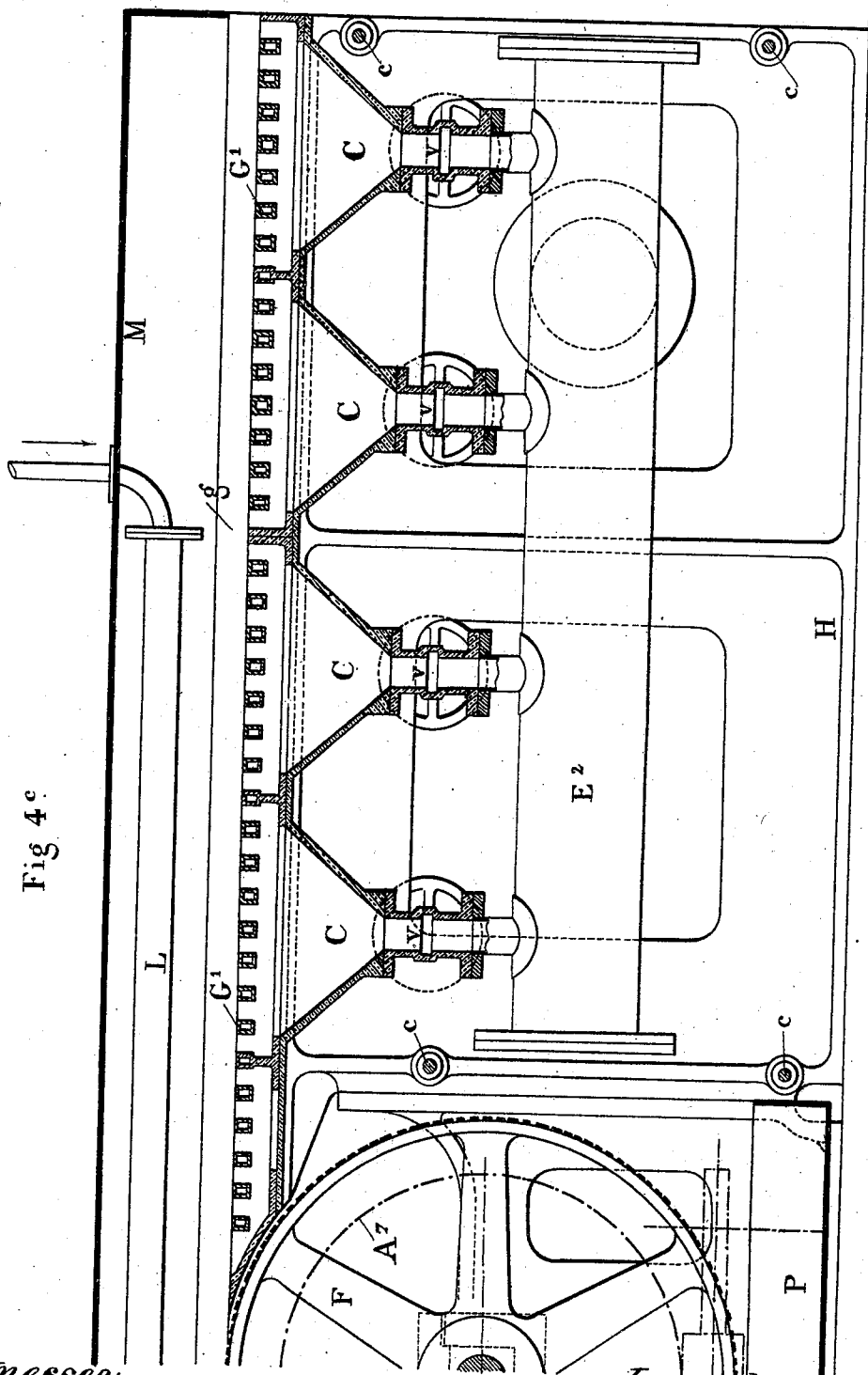
(No Model.)

8 Sheets—Sheet 5.

L. E. A. PRANGEY.
APPARATUS FOR REFINING SUGAR.

No. 502,014.

Patented July 25, 1893.



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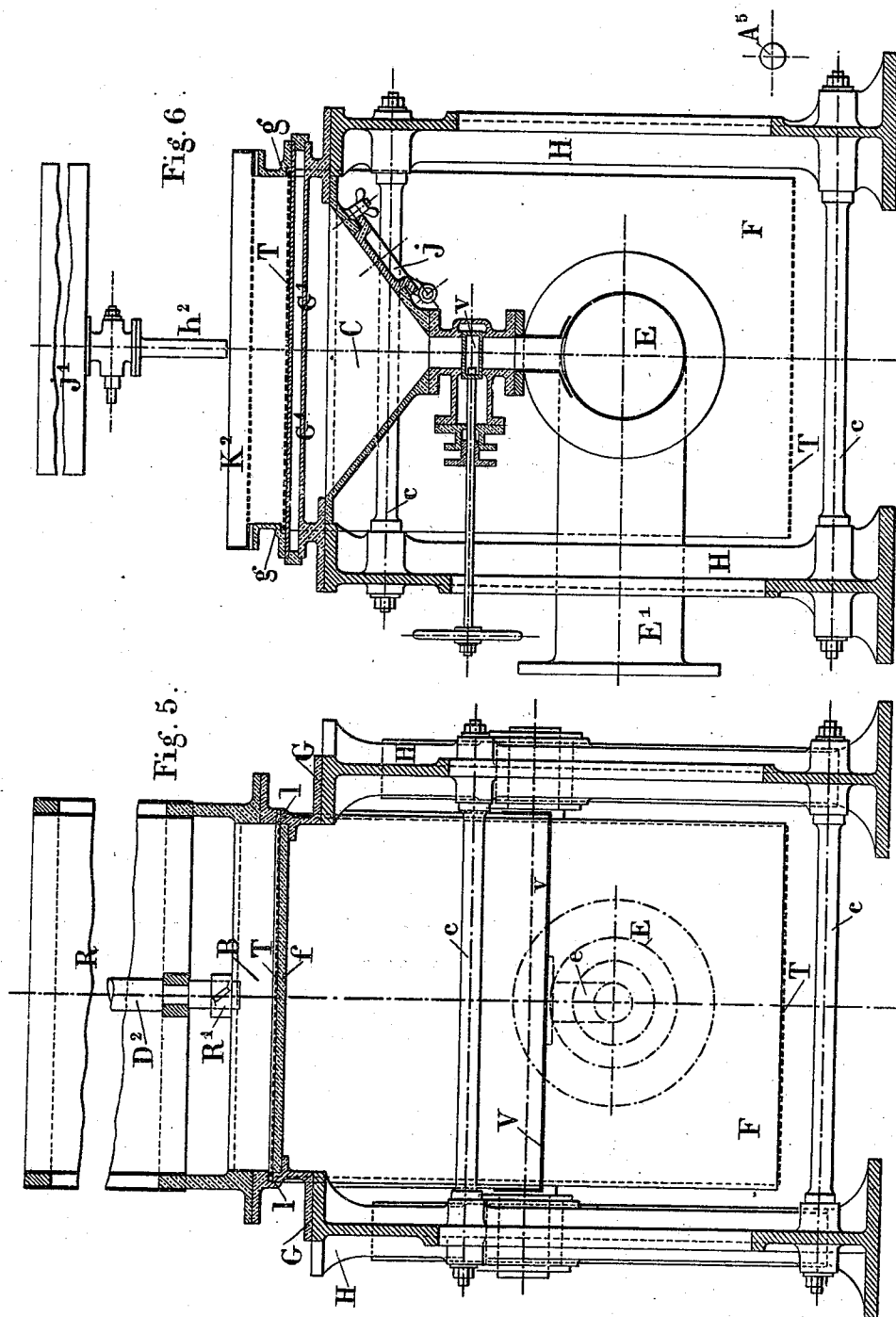
(No Model.)

8 Sheets—Sheet 6

L. E. A. PRANGEY.
APPARATUS FOR REFINING SUGAR.

No. 502,014.

Patented July 25, 1893.



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(No Model.)

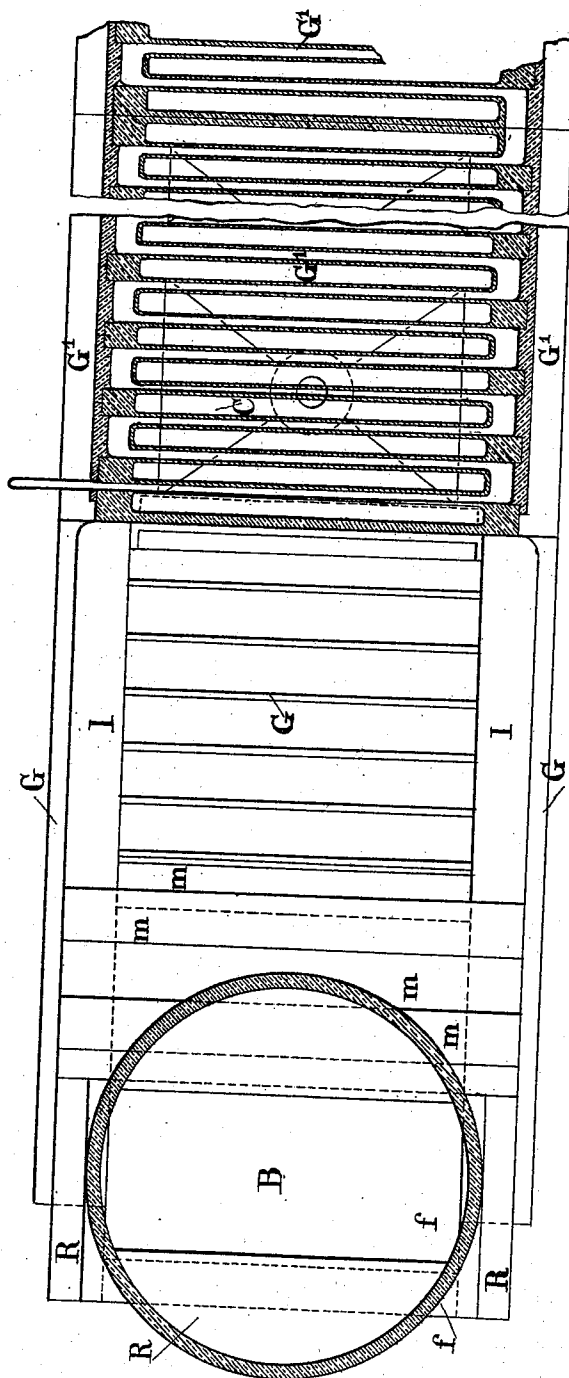
8 Sheets—Sheet 8.

L. E. A. PRANGEY.
APPARATUS FOR REFINING SUGAR.

No. 502,014.

Patented July 25, 1893.

Fig 8



Witnesses:
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UNITED STATES PATENT OFFICE.

LOUIS EDME ACHILLE PRANGEY, OF PARIS, FRANCE.

APPARATUS FOR REFINING SUGAR.

SPECIFICATION forming part of Letters Patent No. 502,014, dated July 25, 1893.

Application filed August 24, 1892. Serial No. 443,975. (No model.)

To all whom it may concern:

Be it known that I, LOUIS EDME ACHILLE PRANGEY, a citizen of the French Republic, residing at Paris, in said Republic, have invented new and useful Improvements in Apparatus or Machinery for the Manufacture of Refined Sugar, of which the following is a specification.

This invention relates to the refining of sugar by a continuous process according to which the sugar mass "masse cuite" entering at one end of the apparatus or machine is successively, as it advances through the machine, molded into a slab or sheet, then purged, blanched, dried and cooled, in such manner that at the other end of the machine there is obtained refined sugar which only has to be cut up into pieces to be delivered to the consumer.

The improvement has for its object to remedy certain defects in the work performed by the existing machines, to simplify the construction of the machines and to render their supervision and maintenance more easy and to permit—by simply changing one plate—the giving at will to the slab or sheet of sugar the various thickness required in the market. Heretofore by such process and machines, slabs absolutely homogeneous and solid could not be obtained. That difficulty resulted mainly from the mode of distribution of the sugar mass which passed from the reservoir of the machine by a curved conduit which was liable to be obstructed. This conduit is suppressed by the present improvement and the bottom of the reservoir is provided with an orifice by which the mass falls directly upon the endless apron by which it is carried forward and which constitutes a movable bottom to the said reservoir; an opening provided in the upright front face of this orifice, immediately above the endless apron, and which has, like the opening of the bottom, a width equal to that of the slab of sugar to be obtained, permits the lower surface of the said slab to be driven by the endless apron between two horizontal walls and two vertical walls constituting a molding box immediately in front of the front face of the orifice of the reservoir. The upper horizontal wall of this box is removable in order that it may be replaced by another of a different thickness

and leaving consequently above the apron a more or less deep passage in such manner as to mold a thicker or thinner slab of sugar. Then again, in the improved machine there is only a single endless apron supporting the slab of sugar, which has the advantage of leaving the latter visible throughout the greater part of the length of the machine. Moreover, the upper run of the apron (the operative run) slides upon transverse bars arranged beyond the molding box to the end of the machine which permits it to move absolutely in a right line; the edges of the apron are also guided in grooves; the spaces existing between the bars permitting uniform suction throughout the whole width of the slab of sugar. The said bars are hollow except in the immediate neighborhood of the molding box and connect with one another in such manner that there may be made to circulate through them, if desired, either cold water, steam, hot water or hot air in order to cool or heat certain of these bars and to consequently heat the lower face of the slab of sugar, as will be hereinafter explained.

The boxes, which in previous machines have been placed above the sugar, through which the clarifying liquor was introduced are suppressed and are replaced by simple funnels with perforated bottoms, which permits the constant supervision of the clarifying liquor and the regulation of its supply according to the requirements. The boxes also provided in those machines above the sugar for the circulation of hot fluid and cold air to produce the heating and cooling of the sugar are also suppressed in this machine, and instead of the latter boxes the machine is furnished in the corresponding part with a cover consisting of a bottomless box partly glazed at the top and containing a heating coil extending through a great portion of its length. The air which is confined in this cover in the neighborhood of the coil is heated and produces a drying of the sugar passing through it under the action of a vacuum produced below; the sugar is further on gradually cooled by colder and colder air which occupies the end portion of this cover where the coil does not extend.

At the forward part of the endless apron, in order to disengage from the latter and

from its driving drum the grains of sugar which might adhere to them, there is arranged a transverse tube to jet upon the drum warm water which falls upon the lower run of the apron and also passes through the perforations thereof; the said run is after this washing dried by two india rubber strips between which it passes; the inner face of the apron is moreover scraped continuously by the grate bars hereinbefore mentioned upon which it slides. There is, moreover, arranged upon the apron near the molding box one or more rollers which even the upper surface of the slab of sugar or else a blade placed farther on which produces an equivalent result of smoothing said surface.

The improved machine includes also some other novel arrangements which will be found hereinafter described and it is constructed in such manner that it may be lengthened at will by introducing in its length one or more panels of the same pattern as the others.

I will now proceed to describe the invention in detail in reference to the accompanying drawings.

Figure 1 shows on a small scale a complete longitudinal elevation of the machine with its driving gear. Fig. 2 is an end view corresponding with Fig. 1. Fig. 3 is a plan corresponding with Figs. 1 and 2. Figs. 4, 4^a, 4^b and 4^c represent portions of a vertical longitudinal section of the machine made on a larger scale than in Figs. 1, 2 and 3, part of the driving mechanism being omitted. Fig. 5 represents a transverse vertical section in the line 1—2 of Fig. 4. Fig. 6 represents a transverse vertical section in the line 3—4 of Fig. 4^a. Fig. 7 represents a transverse vertical section in the line 5—6 of Fig. 4^b, and Fig. 8 represents a horizontal section at different heights showing the details of the lower part of the reservoir for the sugar mass as well as the solid bars and hollow bars of the grate which serves to support the endless apron.

Similar letters of reference indicate corresponding parts in the several figures.

R designates the reservoir for the sugar mass in front of which is arranged a horizontal grate composed of solid transverse bars G, then a series of similar quadrangular funnel-like troughs C arranged one before another and furnished at their upper parts with transverse hollow bars constituting grates G' which form a continuation of the grate G, the mouths of the troughs C and their grates G' having an interior width nearly corresponding with that which the slab of sugar is intended to have. The above mentioned parts are supported upon an iron frame H which also supports the driving mechanism of a perforated endless apron T the upper or operative run of which is maintained horizontal by the grate G, G' upon which this run slides. The frame H also supports the pipes for water, steam and clarifying liquor, as well as the collectors E, E', E² in which a vacuum is produced by any known means and which are connected with

the troughs C by tubes furnished with sliding stop valves v, the stems of which are furnished with handles.

The frame is formed of two parallel standards H connected by transverse stretchers c and composed, as shown in the drawings, of a series of similar panels bolted together at their ends; this arrangement as above mentioned provides for the construction, without changing the patterns, of longer or shorter machines. When the place where the machine is arranged permits it may be advantageous to increase the length of the machine as that permits the driving of the apron proportionately faster and consequently the performance of more work in a given time; it being understood that the same proportions should be preserved between the respective parts serving for the successive operations which constitute the complete refining process.

The reservoir R is jacketed in order to provide for maintaining the sugar mass at the desired temperature and it is furnished with a slowly moving agitator or stirrer R' for the purpose of assuring the constant homogeneity of the said mass. This mass is sugar which has been subjected to the ordinary operations of dissolving, clarifying, filtering and boiling and which, in the heater or cooler, has been brought to the most convenient temperature according to the quality of refined sugar which it is desired to obtain by this machine. During the operation of the machine this sugar mass should be maintained at an approximately constant level in the reservoir R. The lower part of this reservoir R is terminated by a parallelopipedal outlet box B communicating freely at its upper part with the reservoir and of which the width transversely to the endless apron T is equal to the width of the slab or sheet of sugar to be produced. The two lateral faces only of this box descend to its bottom f; this latter is prolonged a little in the rear and still more in the front; it is fastened to two side pieces l, l, which laterally inclose the molded mass in order that during a certain time the sirup which it contains may not run away and that it may preserve the fluidity necessary to a good molding. A little further on it is on the contrary indispensable to evacuate the sirup without leaving time for it to collect in small cells which would be the cause of the rupture of the slab; the perforations of the metallic endless apron T permit this drainage as well as the subsequent drainage which will be presently explained. The rear face a of the box B leaves above the bottom f the space necessary for the free passage of the apron T. A piece of india rubber affixed to this face and rubbing upon the apron (which is sustained by the rearward prolongation of the bottom f) assures sufficient tightness at that place, and as the sirup which tends to flow backward is constantly led in a contrary direction by the movement of the apron only a very little of it escapes there, but it falls over the front

end of the bottom *f* into a receptacle *V* in which also falls the sirup which at the exit of the molding boxes passes naturally through the perforations of the apron and the grate *G*. The front face *b* of the box *B* presents throughout its whole width an opening of which the height above the apron is equal to the greatest thickness of the slab of sugar which it is desired to make in the machine. Beyond the last mentioned face is a movable horizontal plate *m* the distance of which from the apron determines exactly the thickness of the sugar slab which will be molded. It is only necessary then to replace this plate by one projecting downwardly more or less relatively to the side pieces *l*, *l'*, which support it to provide for producing upon the same machine all the thickness of slabs which may be necessary.

The molding plate *m* should be so much longer in the direction of the run of the machine in proportion according as the apron moves with a greater or less speed.

As may be understood the speed of the apron should, supposing a machine of a given length, vary in inverse proportion to the thickness of the slab to be produced; the production of a machine in weight will thus remain constant whatever may be the thicknesses of the slabs of sugar produced. Nevertheless, it might be necessary to accelerate or retard the speed on account of certain commercial exigencies; not only do consumers demand pieces of sugar of different dimensions and forms (which may be satisfied by varying the thickness of the slabs manufactured and by varying the cutting) but they demand also to have a sugar more or less opaque or with more or less fine grain and with greater or less density; now the boiler is not always able to realize all these conditions and it is therefore necessary that in this machine certain mechanical and physical elements should have a variability which permits the satisfaction of the commercial exigencies and also the correction to a certain extent of the inequalities of boiling as well as the inherent differences in the raw material employed. These variable and correlative elements are: the temperature of the mass supplied, the speed of the machine, the length of the molding plate and the height of the mass maintained in the reservoir *R*. It is only in varying these different elements that the desired industrial result can be obtained in the different cases.

When the sugar leaves the molding box *m*, *l*, *l'*, *f* above described, it is molded in the form of a sheet or slab but has not yet any consistency; by passing over the solid grate bars *G* it abandons, by simple natural drainage through the perforations of the apron *T* which carries it, the green sirup which it contains; and this sirup falls into the receptacle *V*; the friction of the bars *G* prevents the accumulation of sirup upon the apron where it might by cooling produce troublesome crystallizations. As, it has been already said, in order that the upper face of the slab should

be smooth it is well, especially in case the mass has been insufficiently compact, to cause the action upon the slab, before more complete solidification, of one or more rollers such as *Q* (Fig. 4) which compress the superficial crystals and thus even the upper face. Continuing its operation, the slab of sugar arrives afterward above the grate *G'* and the troughs *C* submitted to the action of a vacuum which may be regulated at will for each trough by opening more or less the valve *v* through which it communicates with one of the collectors *E*, *E'*, *E''* upon which the suction apparatus operates. Each trough is furnished with a door *j* to permit inspection and cleaning of its interior if necessary. It is in passing above the troughs *C* that the slab is subjected to the successive and partially simultaneous operations of solidification and forced drainage (that is to say, drainage produced by the action of the vacuum) purging, suction, drying and cooling.

As has been stated, the bars *G'* are hollow as well as the longitudinal bearers which unite them, and the whole constitutes a circuitous or zigzag conduit. In a portion of this conduit cold water may be circulated in the opposite direction to the movement of the apron to aid in the solidification of the molded and drained slab as well as to prevent the excessive heating of the metal of the apron which would prevent the lower face of the slab of sugar from being cooled. But the most energetic agent of the cooling and consequently of the solidification of the sugar is the air which is compelled to pass through it, after the natural drainage, by the suction which is feeble in the first trough *C* and becomes more and more energetic in the following troughs; the vacuum should be gradual in order to avoid taking out from the sugar mass any portion of sirup susceptible of crystallization and thereby at the same time obtaining a sugar which is too porous and a reduced yield in weight of refined sugar. The vacuum increasing from one trough to another, the slab soon becomes sufficiently cool and sufficiently purged of green sirup for the commencement of the blanching; care must be taken not to push the cooling too far because the surface might thereby be glazed which would render the clarification difficult and would injure the appearance of the sugar. To blanch the slab which has become substantially solid, I bring to act upon its upper surface a first clarifying liquor which is spread across its whole width by means of a trough *K* having a perforated bottom and into which the liquor is brought from an upper reservoir *J* by a pipe *h* furnished with a regulating cock; this liquor passes through the slab by reason of the vacuum produced below, driving before it any green sirup which may remain in the slab charging it with coloring matter enveloping the crystals of sugar; afterward several clarifying liquors are caused to pass successively through the slab; the last

one being the finest in order to effect a washing of the crystals and the complete blanching of the slab which remains then impregnated with the clarifying liquor; the drawings indicate three pipes h, h', h'' after the troughs K, K', K² but the number is evidently variable. Soon after the last clarifying, the slab carried by the apron T is subjected simultaneously to the final suction and drying in a part of the machine which extends to the end thereof and which is covered with a long bottomless box or cover M inclosing a steam coil L by which the air entering the said cover or box is heated; the more and more energetic suction produced in the troughs C forces the hot air from above the sugar slab to pass through it the said air first driving out the clarifying liquor before it and afterward taking out the humidity remaining until complete drying is effected. The coil L should be arranged in such manner that the temperature should be as regular as possible throughout the whole width of the slab.

The box M is partly glazed at the top to permit the interior to be seen and is also provided with lids through which the arm of the operator may be introduced. It may be understood that at the moment when the slab of sugar arrives in this part of the machine, it is less permeable to air than it will be a little afterward because at its arrival there it is full of clarifying liquor; it is heated then progressively which better effects the expulsion of the clarifying liquor and the drying. When the suction extracts no more liquor and there is nothing but a certain quantity of moisture to be extracted the slab is left by the endless apron as may be seen in Fig. 4^c of the drawings and pushed onward by the part behind, on to a portion of the grate G which is beyond the said apron and under which there are several suction troughs C. The drying is completed on this last mentioned part of the apron and the slab passes out from the machine through an opening M' (Fig. 4^c) in the box M. As it is delivered through the said opening M' it may be removed in any suitable manner to be cut up into pieces of suitable size for the market or for use.

As the lower part of the slab of sugar remains naturally the least warm, it is well for effecting the drying of its face to heat it directly by causing the passage of steam, hot water or hot air through a certain number of the bars of the hollow grate G' in a direction the reverse of the movement of the sugar. When it has arrived at the temperature necessary to produce a complete drying, it is indispensable to cool the sugar slowly in order that cracks should not be produced in it by the action of the sudden cooling. For this purpose the steam coil L only extends to the end of the box or cover M; the exterior air which enters forcibly at this end suffices to produce the result.

As has been already stated, the different troughs C in which the vacuum is produced

are connected with three collectors: The first E receives the green sirup of the forced drainage and a portion of the clarifying liquor and may also receive the green sirup which drains naturally into the receiver V and for that purpose the latter is placed in communication as often as is necessary with the said collector E. This communication is established by opening the slide valve e' arranged in the pipe e (Fig. 4). The second collector E' receives the sirup proceeding from the suction after the last clarifying. This sirup may be raised up into a tank and employed methodically as the first clarifying liquor; as to the third collector E², there will be very little if any liquor collected in it.

As may be understood by the drawings, the endless metallic apron T is carried and put in motion by two drums F, F' of which the former turns in fixed bearings and the other turns in bearings d' which may be adjusted horizontally to regulate the tension of the apron. The apron and its forward drum F are constantly cleaned by means of hot water projected against the latter through a perforated or slit tube N (Fig. 4^b) and which dissolves any grains of sugar which may adhere to the said drum and the apron; after having been thus washed the apron T is dried between two strips of india rubber O, O'. The washing water falls into a little tank P. The apron T is a little broader than the sugar slab and than the troughs C. Its edges, extending beyond the troughs and having no perforations in them, are engaged in grooves in guides g provided on the grate G' and fit the said guides so that the apron and the slab which it carries are truly guided in their horizontal movements. The movement is given to the front drum F of the apron by means of a helicoidal wheel A' driven by an endless screw A⁶ of which the shaft, arranged horizontally on the side of the machine is moved by a vertical shaft A³ through bevel gears A⁴; the shaft A³ is itself driven through bevel gears A² by a shaft A carrying a pulley A' of numerous diameters, upon which the driving belt is shifted when it is desired to change the speed of the machine (see Figs. 1, 2, 3, 4^b and 4^c).

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a machine for the continuous refining of sugar, the combination with an endless perforated draining apron, of a reservoir provided at its lower part with an outlet box which comprises a vertical rear wall a in which is a slit for the passage of the said apron, a vertical front wall b presenting throughout its whole width an opening of which the height above the apron is equal to the greatest thickness which it is desired to give to the slab of sugar to be made by the machine, two lateral faces l , and a solid bottom f united with the said lateral faces, substantially as and for the purpose described.

2. In a machine for the continuous refining of sugar, the combination of a reservoir R

having in its bottom an outlet box B with horizontally prolonged fixed bottom and sides and a changeable plate *m* covering the so prolonged bottom and sides, substantially as and for the purpose herein set forth.

3. In a machine for the continuous refining of sugar, the combination with an endless apron perforated throughout the greater portion of its width but imperforate at its edges, of a grate comprising bars arranged transversely to the apron for maintaining the said apron in a horizontal position, and grooved guides on said grate for receiving and guiding the imperforate edges of the said apron, substantially as and for the purpose herein set forth.

4. In a machine for the continuous refining of sugar, the combination of a perforated endless draining apron, a supporting grate for said apron composed of hollow bars, arranged below said apron with spaces between them for the drainage of the sugar and means for circulating steam, air or water through said hollow bars, substantially as and for the purpose herein set forth.

5. In a machine for the continuous refining of sugar, the combination with an endless draining apron, of a reservoir for clarifying liquid above said apron, a series of funnels with perforated bottoms arranged between said reservoir and apron over different parts of the length of the latter, and cocks for regulating the supply to said funnels of the clarifying liquid from the reservoir to the sugar undergoing drainage on said apron, substantially as herein set forth.

6. In a machine for the continuous refining of sugar, the combination with an endless draining apron and a supporting grate therefor, of a cover arranged over said apron and grate, and a heating coil arranged over said apron and grate within said cover for drying the drained sugar on the apron, substantially as herein set forth.

7. In a machine for the continuous refining of sugar, the combination with an endless sugar carrying apron and a drum for driving

said apron, of a jet tube N for directing water upon said drum near its contact with the apron for washing both the apron and drum, and stationary flexible strips O O' between which the apron runs to be dried, substantially as herein set forth.

8. A machine for the continuous refining of sugar comprising a single perforated, metallic, endless apron T serving to transport the sugar mass through the machine and carried by two rotating drums F, F' of which one is adjustable to regulate the tension of the apron; a jacketed sugar reservoir R containing an agitator or stirrer and arranged directly over the apron which passes under it; a box *m*, *l*, *l*, *f* to mold the sugar mass in the form of a sheet or slab; a grate G formed of solid transverse bars; a grate G' forming a continuation of the grate G and composed of hollow bars having communication with each other; troughs C, C having their mouths of the same width as is intended for the slab of sugar and which are put into communication with two collectors in which is maintained a vacuum capable of regulation in each of the said troughs; funnels K, K', K² having perforated bottoms to distribute the clarifying liquor; a cover M containing a steam coil L for drying and receiving air for cooling the slab of sugar; one or more rollers Q or a cutting blade to even off the upper face of the said sheet or slab; a perforated tube N and drying bands O, O' for the cleaning of the endless apron and its forward drum; a frame H composed of similar panels; driving mechanism for the agitator or stirrer, of the sugar reservoir and a separate driving mechanism of variable speed for the drum F which drives the endless apron, all constructed, arranged and combined as and for the purpose herein described.

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

LOUIS EDMÉ ACHILLE PRANGÉY.

Witnesses:

ROBT. M. HOOPER,
CHARLES ASSI.