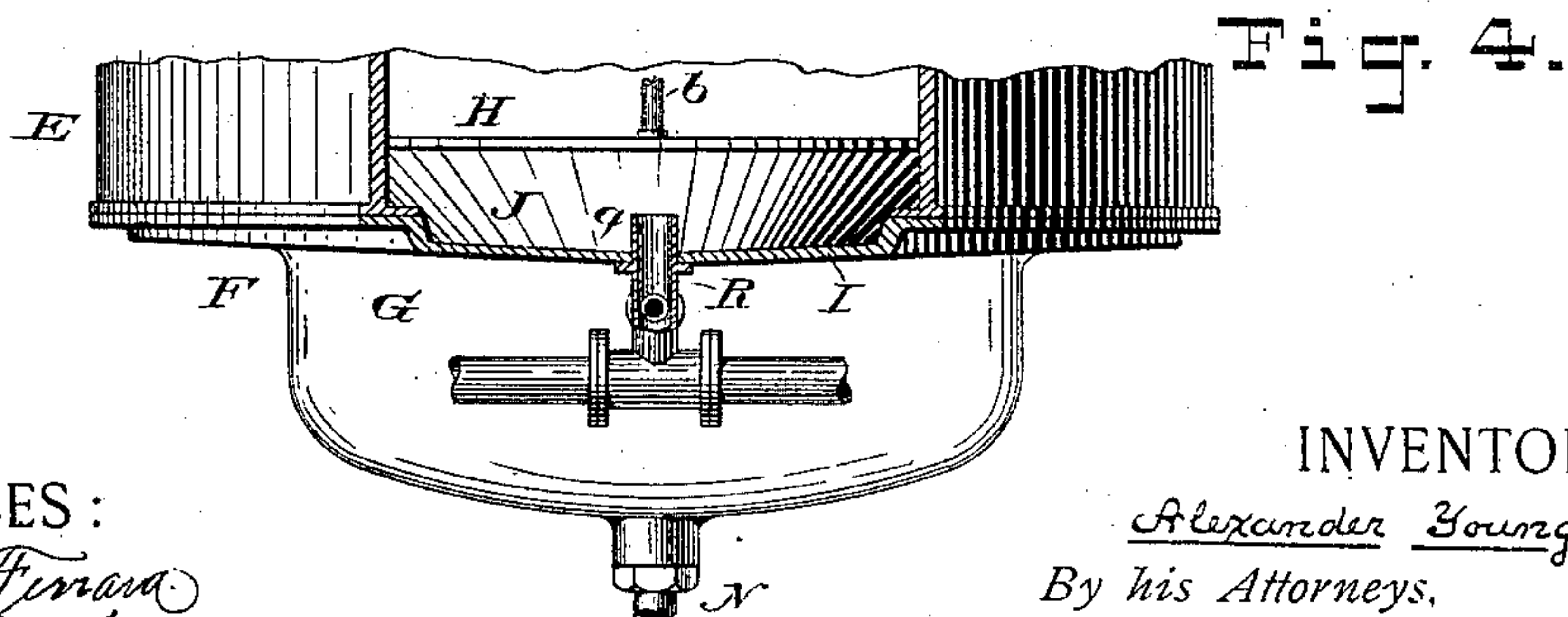
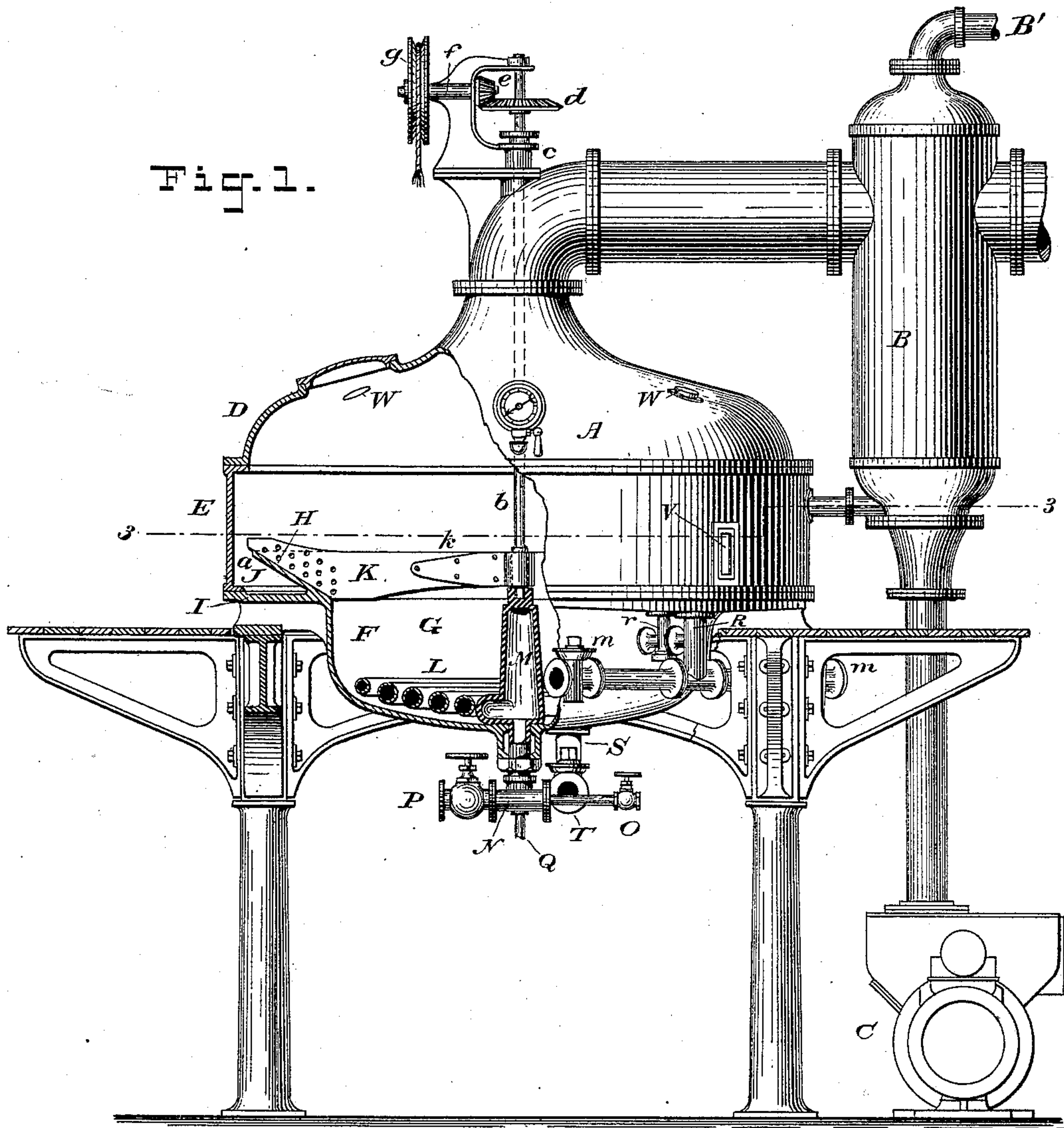


A. YOUNG.

PROCESS OF AND APPARATUS FOR CLEANING SACCHARINE LIQUIDS.

No. 387,388.

Patented Aug. 7, 1888.



WITNESSES:

Pascal J. Ferraro
John F. Nelson

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Alexander Young
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Fig. 2.

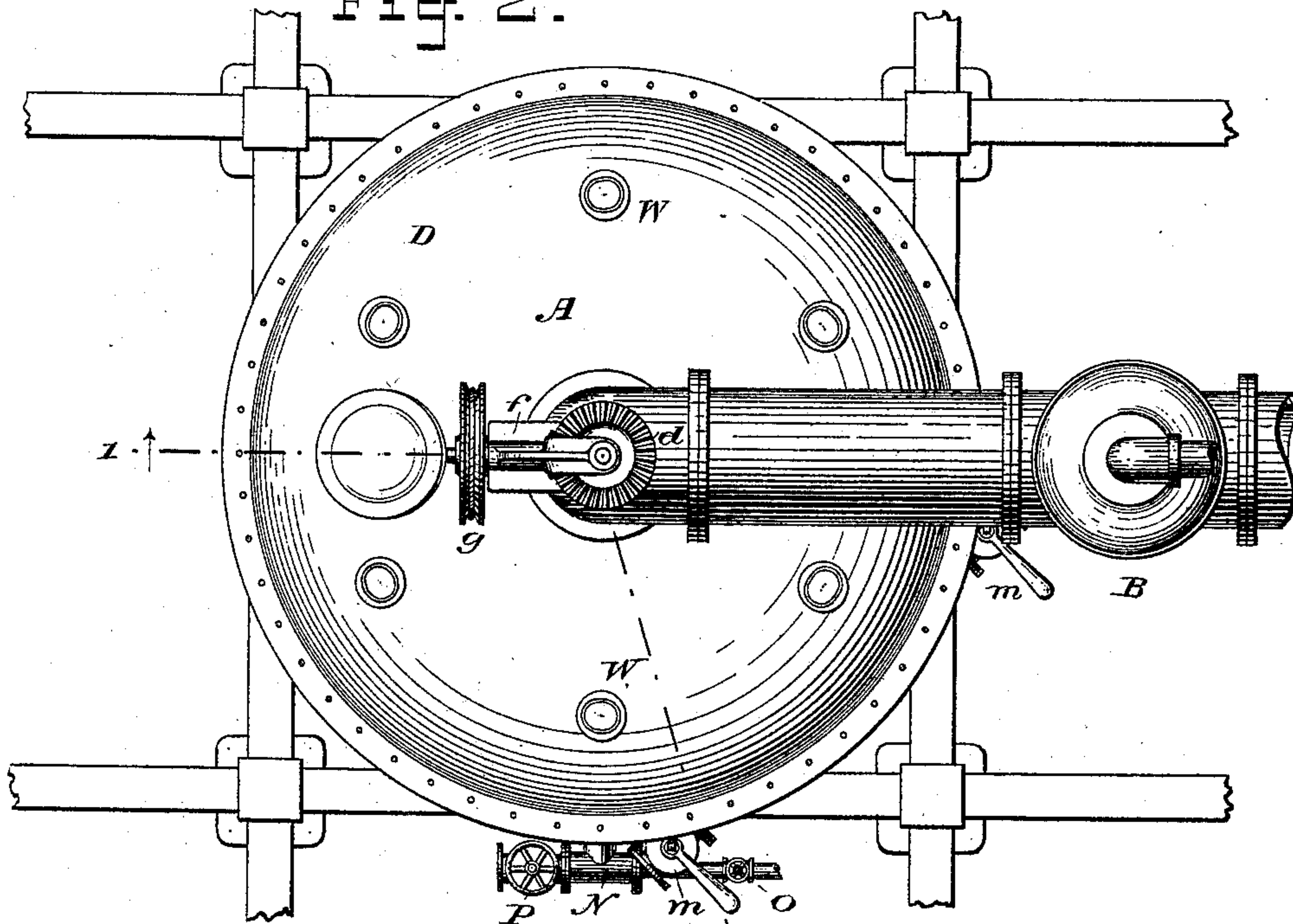
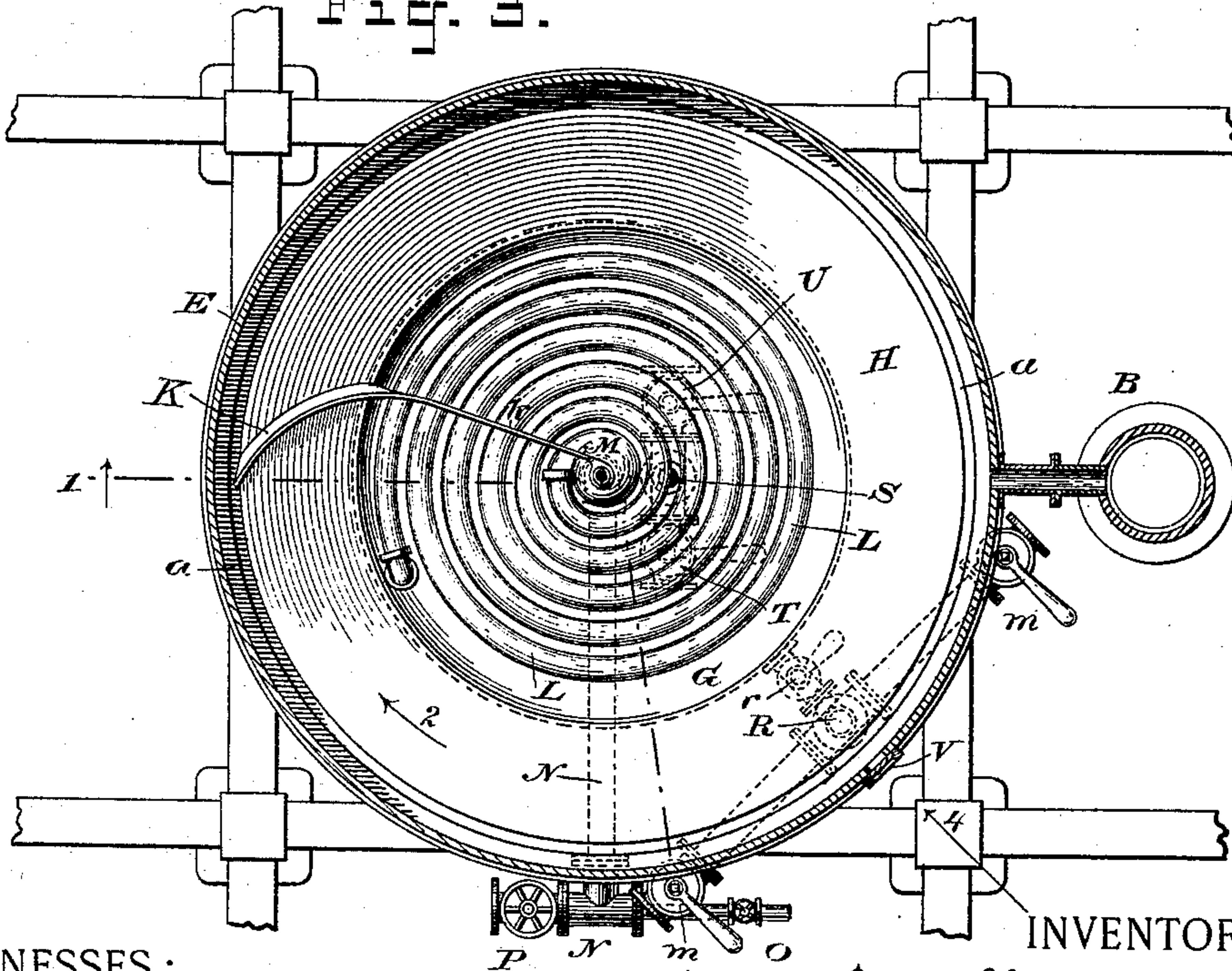


Fig. 3.



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Fig. 5.

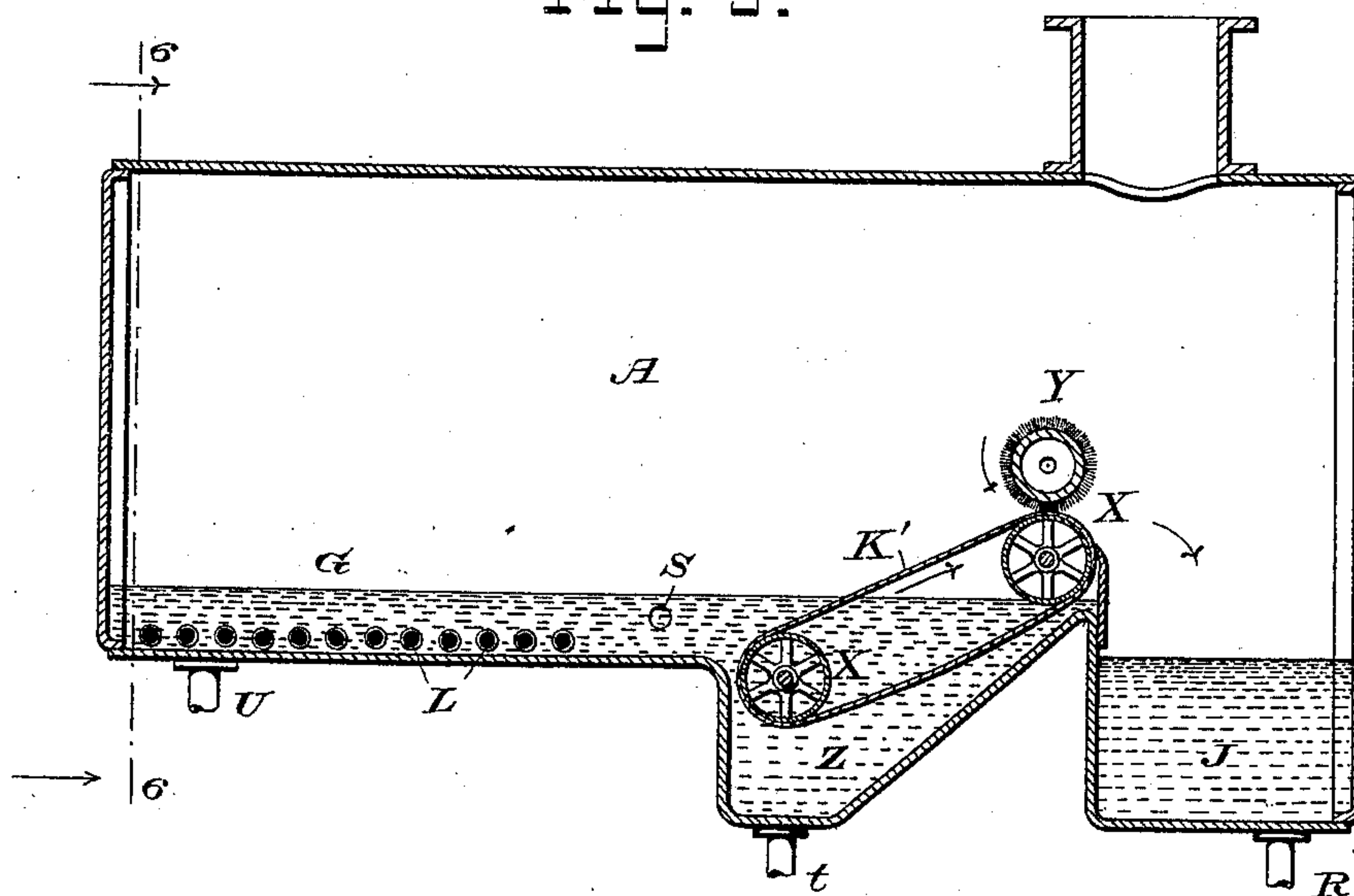
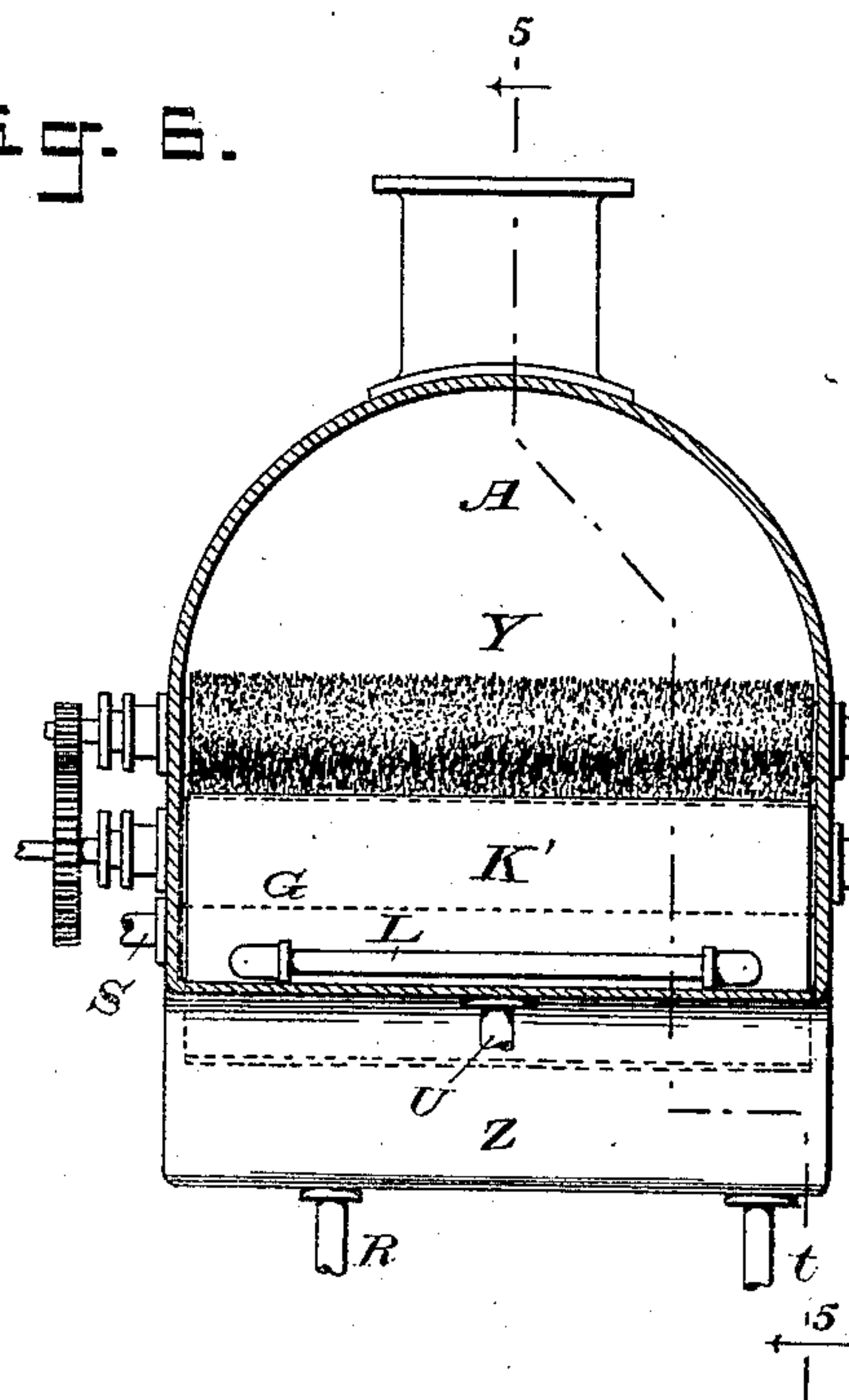


Fig. 6.



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UNITED STATES PATENT OFFICE.

ALEXANDER YOUNG, OF HONOLULU, HAWAII.

PROCESS OF AND APPARATUS FOR CLEANING SACCHARINE LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 387,388, dated August 7, 1888.

Application filed February 28, 1887. Serial No. 229,099. (No model.) Patented in Spain March 28, 1887, No. 1,335.

To all whom it may concern:

Be it known that I, ALEXANDER YOUNG, a subject of the Queen of Great Britain, residing at Honolulu, in the Hawaiian Islands, have
5 invented certain new and useful Improvements in the Process of and Apparatus for Cleaning Saccharine Liquids, (for which I have obtained a patent in Spain, dated March 28, 1887, No. 1,335,) of which the following is a specification.
10 tion.

My invention relates to the manufacture of sugar; and its object is to prevent the deterioration of sugar-cane juice, sirup, and other saccharine liquids by inversion while being
15 cleaned, such deterioration being a well-known consequence of exposure to the atmosphere and to the high degree of heat required to boil such liquids in the open air. By the use of my process there is no exposure to the atmosphere
20 and only a very low temperature is required to do the cleaning. This object is attained by boiling such liquids in vacuum in such manner that the impurities will be thrown by the ebullition to the surface of the liquid mass,
25 whence they will flow off and be removed. I prefer to remove the scum of impurities by means of automatic skimmers or sweepers, which mechanically transfer the impurities to a receptacle therefor.

30 The accompanying drawings show two different constructions of apparatus for carrying my improved process into practice.

Figure 1 is an elevation, partly in vertical mid-section of a vacuum-pan constructed according to my invention. Fig. 2 is a plan
35 thereof. Fig. 3 is a horizontal section thereof cut in the plane of the line 3 3 in Fig. 1. Fig. 4 is a fragmentary side elevation looking in the direction of the arrow 4 in Fig. 3 and partly
40 in section. Figs. 5 and 6 show the other form of apparatus, Fig. 5 being a longitudinal section and Fig. 6 a transverse section on the line 6 6 in Fig. 5.

I will first describe the construction shown
45 in Figs. 1 to 4.

A is the vacuum-pan; B, the condenser, which is surrounded by the save-all, and C the vacuum-pump.

By the construction shown the one pump is
50 designed to work two pans.

The pan A is constructed of three parts—namely, the dome or upper section, D, an upright cylinder or middle section, E, and the pan bottom or lower section, F. The three
55 are bolted together in an air-tight manner and are strong enough to withstand the pressure of the external atmosphere.

The lower section, F, is formed with a deeply-depressed central portion or boiling-vessel, G, with a conical raised rim, H, and with a
60 flat annular flange or bottom, I. The latter is bolted to the middle section, E. The conical rim H forms an upward and outward continuation of the central vessel, G, and projects up within the cylindrical section E, extending
65 outward nearly thereto, but leaving an annular interstice, *a*, between the two. An annular gutter or channel, J, is formed by the flat flange I, the conical rim H, and the exterior
70 cylindrical wall.

The depressed boiling-vessel G is provided with a coil of steam-pipes, L L, in its bottom, and with a central steam-cone, M. Steam is admitted to these by a pipe, N, which extends
75 under and enters the bottom of the pan. If live steam is used to heat the coil, it is admitted by the valve O, and if spent or exhaust steam is used it is admitted by the valve P.

Q is a drain-pipe by which the water of condensation may be drawn off.
80

During the operation the saccharine juice is boiled in the vessel G, and the scum arising from it flows outward onto the inclined rim H, where there is less heat. From this rim it is caused to flow over the upper edge of the
85 rim and into the annular channel J. This is best accomplished by means of a skimmer or sweeper, K, which is mounted to move or slide over the smooth upper surface of the rim H. This skimmer is mounted on or formed with a
90 radial arm, *k*, which is fixed on a vertical shaft or spindle, *b*, which extends through the center of the vacuum-pan. The upper end of this shaft passes out through a stuffing-box, *c*, on the elbow of the vapor-pipe, and has fixed
95 to it a bevel-gear, *d*, which meshes with a pinion, *e*, on a shaft, *f*, which is rotated by a rope or belt passing over a pulley, *g*. This rope or belt is driven from another pulley (not shown) through the medium of a pair of reversed
100

coned pulleys or drums and a belt, as is well understood, by which means the shaft *b* may be driven with any desired velocity.

The skimmer K is driven in the direction of the arrow 2 in Fig. 3, so that it sweeps around over the coned flange or rim H. It is made of a finely-perforated brass plate or blade, so that as it advances and pushes the scum before it the juice will flow through the perforations and run back down the rim H, while the scum, which is less fluid, will be forced up the inclined rim centrifugally and will fall over through the interstice *a* into the skimmings channel or gutter J. The skimmer-blade K is made with a backward curve, so that as it advances it is presented obliquely to the scum, which aids in thrusting the scum outward.

The channel J has its bottom slightly inclined, as shown in Fig. 4, and at the lowest point an outlet-pipe, R, is connected, through which the skimmings are pumped out. This pipe projects up above the bottom I, as shown at *g* in Fig. 4, so that in case any juice settles under the skimmings it need not be drawn off with the skimmings. An outlet-cock, *r*, Figs. 1 and 3, is provided to draw off the juice from the lowest part of the channel J and return it to the vessel G. The pipe R is controlled by cocks *m m*.

When the apparatus is operated intermittently, the juice to be cleaned is drawn into the vacuum-pan through a pipe, S, controlled by a valve, T, which is in easy reach of the operator, and the purified juice is drawn out through a cock, U. If the apparatus is to be operated continuously, an inlet-pipe should be placed at the side of the pan some distance from the bottom, and the outlet should be at the bottom.

The inlet-pipe should enter beneath the surface of the liquid, and, extending to the center of the pan, should be turned up and terminate near the surface of the liquid.

B' is the water-injection pipe of the condenser.

V is an observation window, through which to see the skimmings or juice in the channel J.

W W are windows in the dome D, to light the interior of the pan, and through which to see the process of cleaning.

A test-cup will be used for drawing off samples of the liquid for examination, so that the attendant may properly regulate the inflow and drawing off of the juice.

My improved process of cleaning saccharine juices is as follows: The vacuum-pump is started and the injection-water turned on to the condenser. As soon as a sufficient vacuum is established, the juice-inlet T is opened and a quantity of the liquid to be cleaned is drawn into the pan. If the liquid is drawn directly from the clarifiers or defecators, it will ordinarily be at a temperature of 180° to 200° Fahrenheit, in which case it will boil in the vacuum, which should be maintained without the employment of additional heat; but if the liquid enters the pan at a lower temperature than the boiling-

point *in vacuo*, it is necessary to heat it in the pan. In this case steam (exhaust-steam, if it is available) is turned on to the center cone, M, and coil L, which soon causes the liquid to boil rapidly in the middle of the depressed central vessel, G. The violent ebullition causes the impurities to float on the surface of the liquid and flow rapidly toward the circumference, where there is less heat and no ebullition, and to form on the undisturbed surface a scum or froth. The revolving skimmer K is set in motion, and this scum as fast as produced is swept up the inclined rim H and falls over into the annular channel J. The speed of the revolving skimmer is regulated by the attendant according to requirement as the cleaning progresses. A vacuum of at least twenty-six inches should be maintained during the entire cleaning process, so that the boiling may be done rapidly at a very low temperature, in order to prevent deterioration of the liquid by inversion. The skimmings are pumped off continuously, and without being allowed time to deteriorate are forced by the same pump through the mud-presses without any exposure to the atmosphere. Any juice which may be swept over with the skimmings will settle to the bottom of the channel J under the thick skimmings, and may be allowed to gravitate back to the inner pan through the cock *r*. The side window, V, shows to the attendant how much scum and how much juice under the scum there is at any time.

My process serves not only to prevent the deterioration of saccharine liquids by inversion, which always occurs in cleaning, as the same has heretofore been done, but it is economical also in fuel, as the heat from the superfluous spent or exhaust steam, which is nearly always discharged into the air at sugar-works, is sufficient to boil the liquids at the very low temperature required to boil them in vacuum.

By the method heretofore in use of cleaning by boiling in the open air a temperature of from 220° to 225° Fahrenheit is required to boil the liquids sufficiently to make them throw up their impurities, while the time expended in boiling is considerable and the inversion is going on as long as the exposure lasts. The heat required to boil the same liquid in vacuum does not exceed 130° to 135° Fahrenheit, while the boiling is much more rapid and no atmospheric exposure is made; consequently the loss by inversion is prevented.

The process may be worked continuously by a constant drawing in and pumping out of liquid, or successive quantities of liquid may be taken in and cleaned and then drawn off through the cock U.

By my improved process the cleaning of the saccharine juices may be effected either previous to their concentration in double or triple effect, or after they have been so concentrated and previous to their treatment in the vacuum strike-pan.

I am well aware that the use of vacuum-pans for the concentration and for the granulation of saccharine liquids is common, and I make no claim to such use.

5 I am also aware that it has been proposed to remove the scum from the surface of saccharine liquids during their concentration in the evaporating-pan, but without a vacuum or without sufficient vacuum to extend to the
10 part of the pan where the separation of the scum is effected.

The essential feature of my invention is the separation of impurities from saccharine liquids by boiling in vacuum, which I believe to
15 be entirely new.

My invention is not confined to any shape or size of pan, or to any particular construction thereof. Any pan wherein the liquid may be boiled at a very low temperature, and
20 which is provided with means for separating and removing the scum, may be used for working my invention. The separation of the scum may be effected by skimmers or sweepers, which may be made to revolve or reciprocate, or which may be operated in any man-
25 ner by which an efficient separation of the scum will be effected.

The precise amount of vacuum under which my process is worked is not essential. I prefer a vacuum of twenty-six inches; but a much
30 lower vacuum may be used. It may be preferred to work my process in one of the pans of a double or triple effect, and to use the amount of vacuum at which the pan is
35 worked.

As an instance of a different apparatus that may be used in practicing my invention, I have introduced Figs. 5 and 6, which I will now describe. The pan shown in these fig-
40 ures is elongated, resembling a steam-boiler. The juice enters at the pipe S, and after being cleaned is drawn off by the pipe U. It is boiled by the steam-coil L, which is arranged at one end of the vacuum-pan. In the boil-
45 ing, the impurities rise to the surface and the froth or scum flows toward the opposite end of the pan, where there is no ebullition. The skimming is performed by an endless apron, K', of perforated metal or other material, which
50 is carried over revolving drums X X. A revolving brush, Y, throws the scum from the apron over into the deep receptacle J, from which it is pumped out by a pipe, R. The heavy settle-
55 ments collect in the pocket Z, whence they are pumped out through a pipe, t. The process is essentially the same as in the apparatus first described.

I am well aware that it is not broadly new to construct a cleaning-pan with an annular
60 skimmings-receptacle and with skimmers for throwing the scum over into such receptacle, since an open defecating-pan has been made of such construction, but without any inclined rim. My invention is limited to closed ves-
65 sels or vacuum-pans, and I make no claim to open vessels.

I am also well aware that vacuum-pans have had scraping and stirring devices constructed to rotate within them, but not adapted to skim off a scum from the surface
70 of the liquid.

What I claim, and desire to secure by Letters Patent is, for the purification of saccharine liquids, the following defined novel process and apparatus, substantially as hereinbe-
75 fore specified, namely:

1. The improvement in the art of purifying saccharine liquids, which consists in boiling them in vacuum and simultaneously separating the resulting froth or scum.
80

2. The improvement in the art of purifying saccharine liquids, which consists in boiling them in vacuum and simultaneously separating the resulting froth or scum by skimming it from the surface of the liquid.
85

3. The improvement in the art of manufacturing sugar, which consists in purifying the saccharine liquid by boiling it in vacuum and simultaneously separating the resulting froth or scum, and subsequently concentrating the
90 liquid.

4. The improved apparatus for purifying saccharine liquids, consisting of the closed vacuum pan or vessel, combined with the skimming device for removing the froth or
95 scum from the surface of the liquid under treatment, substantially as described.

5. The improved apparatus for purifying saccharine liquids, consisting of the vacuum pan or vessel constructed with the heating
100 device for boiling the liquid, and with the skimmings-receptacle, substantially as described.

6. The improved apparatus for purifying saccharine liquids, consisting of the vacuum
105 pan or vessel, constructed with the receptacle for the liquid to be boiled, with the heating device for boiling the liquid therein, and with the skimmings-receptacle, in combination with the skimmer for removing the scum from the
110 boiling liquid and transferring it to said skimmings-receptacle.

7. The improved apparatus for purifying saccharine liquids, consisting of a vacuum pan or vessel, constructed with a receptacle
115 for the liquid to be boiled, with a heating device for boiling the liquid therein, with a skimmings-receptacle, and with an inclined surface extending up from said boiling-receptacle toward or over said skimmings-receptacle, whereby the scum rising from the boiling
120 liquid is driven by the heat onto said inclined surface, in combination with a skimmer for removing the scum from said inclined surface and depositing it in said skimmings-receptacle.
125

8. The vacuum-pan, constructed with the central boiling-receptacle, and the annular skimmings-receptacle, substantially as described.
130

9. A vacuum-pan constructed with a central boiling-receptacle, with an annular skim-