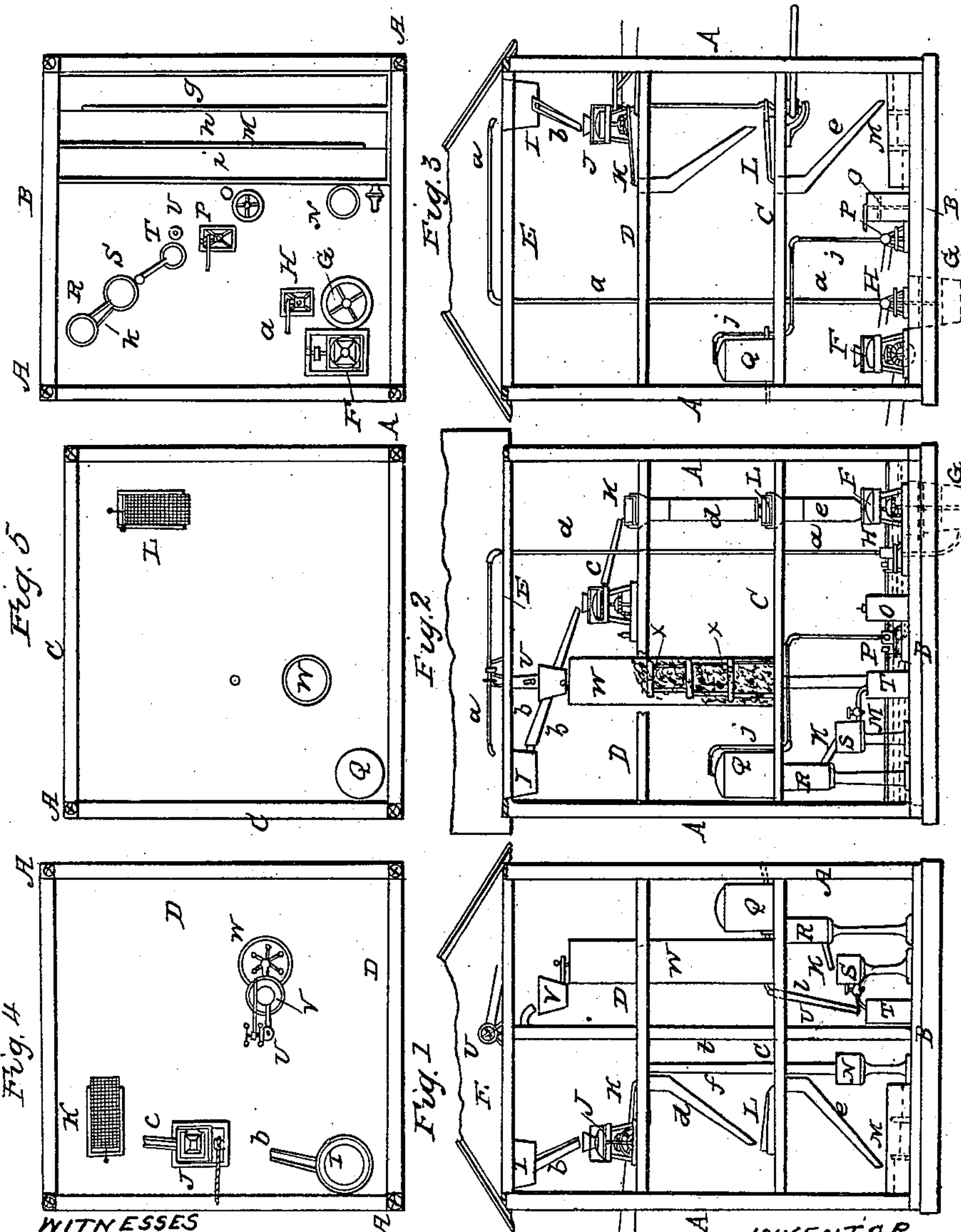
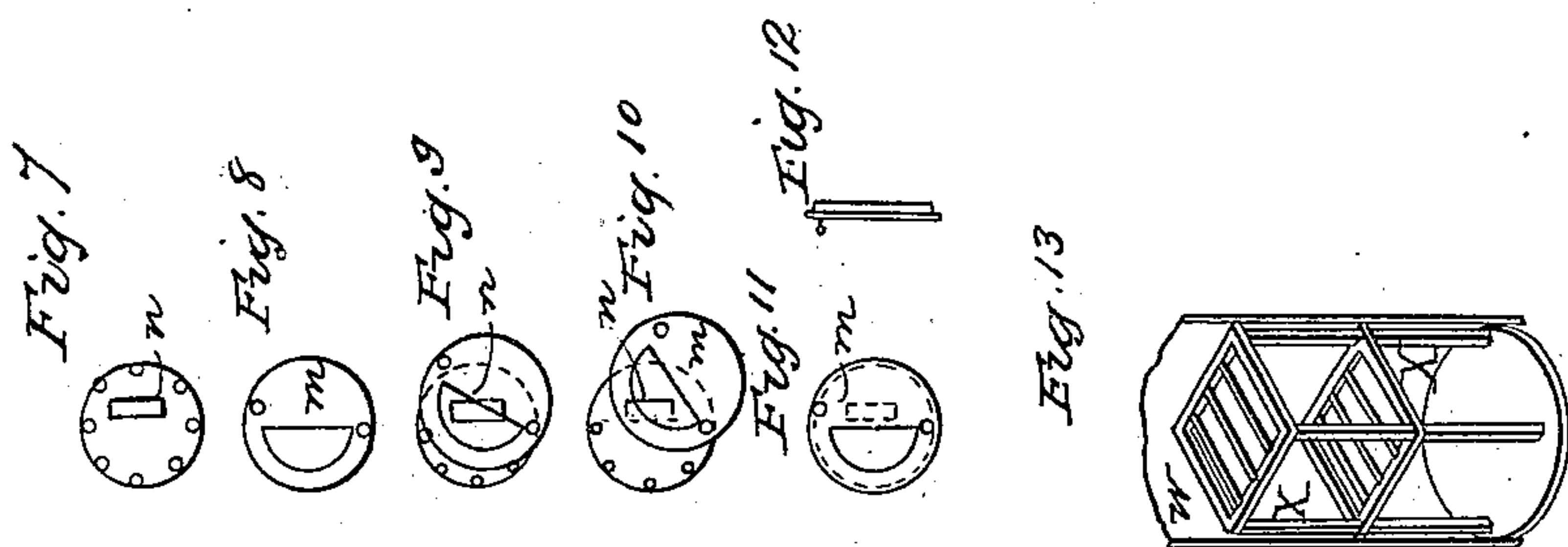


J. FIRMENICH.  
Manufacture of Vinegar.

No. 77,727.

Patented May 12, 1868.



WITNESSES  
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# United States Patent Office.

JOSEPH FIRMENICH, OF BUFFALO, NEW YORK.

*Letters Patent No. 77,727, dated May 12, 1868.*

## IMPROVEMENT IN THE MANUFACTURE OF VINEGAR.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, JOSEPH FIRMENICH, of Buffalo, in the county of Erie, and State of New York, have invented Improvements in the Manufacture of Vinegar; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification—

Figure 1 being a front elevation of a factory or building containing the apparatus for conducting the entire process, with my improvements.

Figure 2, a side elevation thereof.

Figure 3, a rear elevation thereof.

Figures 4, 5, and 6, plans respectively of the upper, middle, and lower stories of the building, and parts of the apparatus thereon.

Figures 7, 8, 9, 10, and 11, front views, in different positions, of my improved valve or regulator, for drawing off the sirupy glucose liquid to be fermented.

Figure 12, an edge view of the same.

Figure 13, a view in perspective of the interior of a portion of the acetic generator, the side of the case being broken away.

Like letters designate corresponding parts in all of the figures.

My improvements relate both to the process and apparatus for making vinegar from grains of different kinds, potatoes, and other farinaceous substances, by which economy of expense and time is promoted, and the product is rendered uniform and of good quality. During the process, also, pure starch is produced, as well as glucose sirup; and either of these products may be withdrawn from the process and applied to other uses, if desired, or sent to market, according to variations in the demand for those different articles, or the relative profit to be derived from their production.

I will proceed to describe the process of making vinegar direct from grain of any kind, by the apparatus, as represented in the accompanying drawings.

The grain is first ground fine in a mill, F, of ordinary construction.

The meal is conducted into a vessel or tank, G, and there soaked for about twenty-four hours in water heated, by steam-jets introduced therein, to about 150° or 160° Fahrenheit.

The liquiform mass is thence raised or conducted, by means of a pump, H, and pipe *a*, to a tank or receiver, I, from which it may be fed or introduced gradually into a second mill, J, the passage thereto being regulated by a suitable valve or stop-cock. The stones of this mill are smooth, and it is therefore termed a "squeezer," since its action is that of compression and simple rubbing.

By the use of this squeezing-mill or "squeezer," I am enabled, as a modification of this part of the process, to dispense with the original grinding of the grain in a mill, F, and the subsequent soaking of the meal in the tank G. For this purpose the grain, in an undivided state, is first put in the tank I, and there is soaked in water heated by steam for about twelve hours previous to conveying it to the "squeezer."

From the "squeezer" J the material is conducted to and passed, by suitable agitation through a sieve, K, which may be double, or composed of wire gauze at top and silk cloth at bottom.

Thence it is conducted by a spout, *d*, to a second sieve, L, which is quite fine, being preferably composed of silk cloth.

From this sieve the material is conveyed by a spout, *e*, to the starch-floor or "filter" M, composed of a succession of slightly-inclined troughs or gutters, *g h i*, communicating successively one with another, upon the bottoms of which the starch is deposited, while the glutinous and other matters, held in solution or suspended in water, flow off and are discharged.

The refuse of the sieves K L passes into a vertical spout or conductor, *f*, to be discharged into a tub or receiver, N.

The starch deposited in the troughs is scooped up and introduced into a tub or vat, O, where it is mixed



with cold water sufficient to make the mass of about the consistence of cream. To this is added a quantity of sulphuric acid, equal to about two per cent. of the starch-emulsion in the vat, where the whole is allowed to macerate about twelve hours.

In the mean time a boiling-mixture of water, about equal in quantity to that of the starch-emulsion, in the vat O, and of sulphuric acid, equal to about two per cent. of the water, is prepared in another vessel or vat, Q. Then the mass is gradually raised or conveyed by a pump, P, from the vat O, and introduced into the vat Q, when it mixes with the acidulated water therein.

Steam is continually let directly into this combined mass, so as to keep it at a boiling-temperature till the whole is converted into a glucose sirup. This point is readily ascertained by the liquid becoming clear, or by the iodine test.

The sirupy liquid having been allowed to cool, and rest about twelve hours, powdered chalk, to the amount of about six per cent. of the starch employed or produced in the process, or an equivalent salifiable substance, is stirred into it, to neutralize any excess of sulphuric acid which may remain therein. The liquid then stands three or four hours, to allow the excess of chalk and the other precipitated impurities to settle at the bottom.

The liquid is gradually drawn off from this vessel Q, as it becomes perfectly clear, into a receiver, R, through my improved gauge-valve or regulator, represented in figs. 7, 8, 9, 10, 11, and 12. This regulator has a vertical oblong opening or port, *n*, extending from near the bottom of the vessel Q to the whole or a considerable portion of the height thereof. This port is covered by a valve or plate, *m*, which is so constructed and arranged, in relation to the port, that it will first uncover the port at the top, and then gradually uncover it more and more downward to the bottom. It will be readily understood that this regulator will cause the liquid to be drawn off first at the top, where it is first clarified, and then gradually downward without disturbing the liquid below the height at which it successively draws off.

From the receiver R the liquid is again drawn through a similar gauge-valve, to clear it of the remaining sediment, if any, into the fermenting-vat or receiver S. Here about one-half of the quantity of yeast required is added at once to commence the fermentation, using at the start distillers' weak yeast. Then, after the temperature is raised to the highest point, the remainder or another portion of the yeast is added, using this time distillers' strong yeast.

Small quantities of yeast may then be added daily, if necessary, till the sugar is all converted into alcohol, which is indicated by the saccharometer going down to zero.

When the vinous fermentation has been completed, the liquid is run into a receiver, T, and thence conveyed by a pump, U, to a reservoir, V, whence it is gradually let into the acetic generator W, the flow being controlled by a stop-cock or other means. The partially-acetified liquid is caught from the generator again in the receiver T, whence it is again pumped to the reservoir V, and run a second time through the generator, and this operation is repeated till the acetous fermentation is complete.

The generator W is constructed in an improved manner, as indicated in figs. 2 and 13. A set of racks, X X, provided with legs, or the equivalent thereof, so as to keep them separated a certain distance, one from another, is placed in the outer case or cylinder, and the intervals between the racks are filled with corn-cobs, the cobs and racks being inserted alternately, beginning at the bottom of the cylinder. This construction affords free circulation of air throughout the generator, and offers an unusual number of points and interstices to hasten the fermentation.

I will add here that the steaming of the meal or grain, in the vessels G and I, facilitates the separation of the gluten from the starch, resulting in a greater yield of the latter substance. Also the injection of the steam into the mass itself, instead of passing through coils of pipes therein, not only economizes the heat, but, by mechanical agitation and its solvent power, conduces directly to the separation of the starch from the glutinous substance of the grain.

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

The process of making vinegar from grain and other starch-producing substances, as a whole, substantially as herein specified.

I also claim, as part of the process of making vinegar, the injection of steam into the digesting mass of meal or grain, as in the vats G and I, substantially as herein set forth.

I also claim, as part of the process for making vinegar, the soaking and digesting of grain without grinding, as in the vat I, substantially as herein described.

I also claim, as part of the process of making vinegar, the subjection of the soaked meal or grain to the smooth squeezing-mill J, substantially as herein specified.

I also claim, as part of the process of making vinegar, the method of applying the sulphuric acid, first with cold water and then with boiling water, and the injection of steam into the latter while adding the starch, and until it is converted into glucose, substantially as herein specified.

I also claim, as a part of the process, the method of conducting the vinous fermentation by successive additions of yeast, first weak and then strong, substantially as herein described.

I also claim the arrangement of the sieves K and L, substantially as and for the purpose herein set forth.

I also claim the gauge-valve *m n*, for drawing off the clarified sirupy liquid, substantially as herein described.

I also claim the construction of the acetic generator, substantially as herein set forth.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

J. FIRMENICH.

Witnesses:

JAY HYATT,

JAMES C. BROWN.