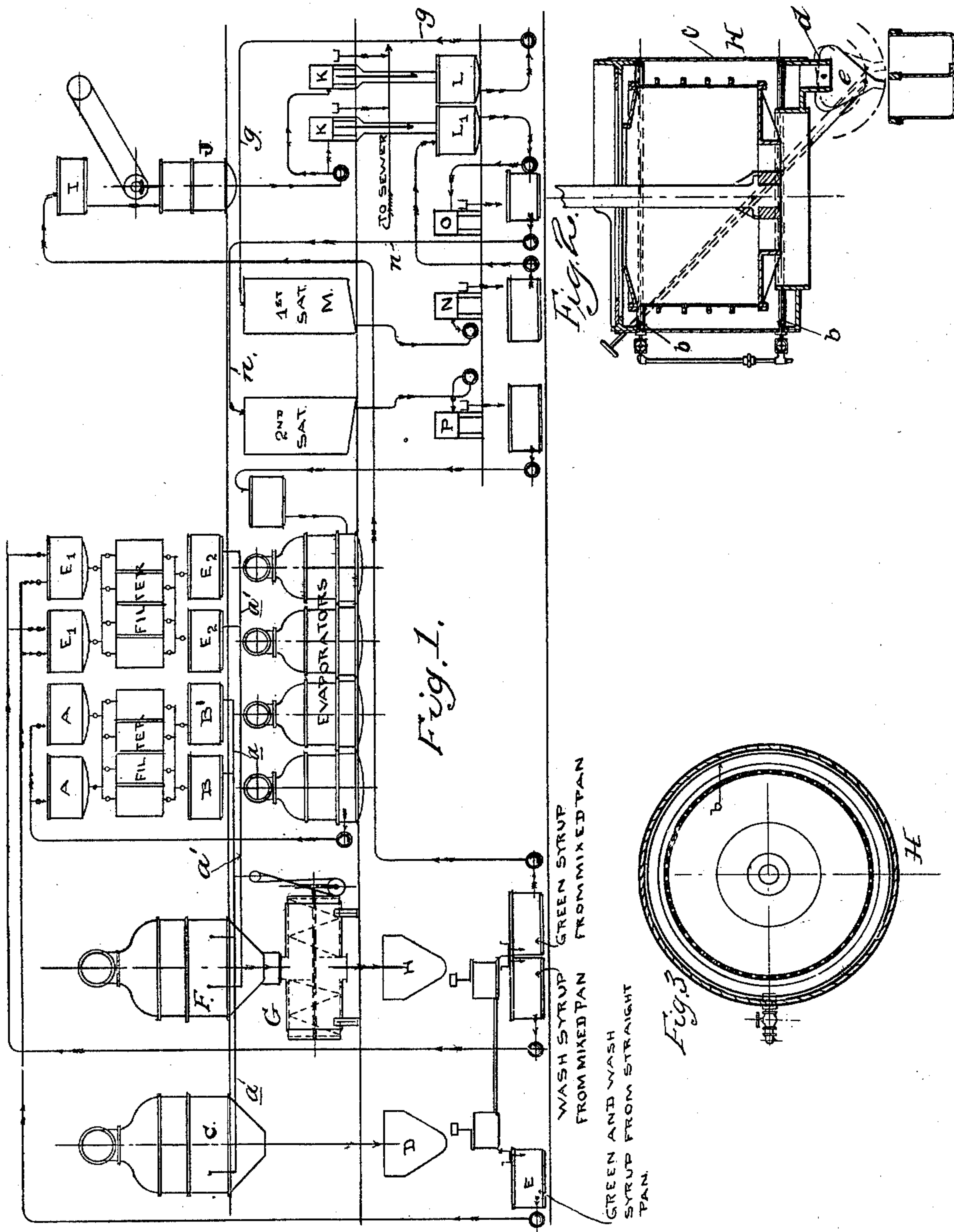


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PROCESS OF MANUFACTURING GRANULATED SUGAR FROM BEETS.

(Application filed Apr. 8, 1897.)

(No Model.)



WITNESS

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UNITED STATES PATENT OFFICE.

JAMES G. OXNARD AND WILHELM BAUR, OF NEW YORK, N. Y., ASSIGNORS
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PROCESS OF MANUFACTURING GRANULATED SUGAR FROM BEETS.

SPECIFICATION forming part of Letters Patent No. 626,292, dated June 6, 1899.

Application filed April 8, 1897. Serial No. 631,310. (No specimens.)

To all whom it may concern:

Be it known that we, JAMES G. OXNARD, a citizen of the United States, and WILHELM BAUR, a subject of Germany, both residents of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Processes of Manufacturing Granulated Sugar from Beets, of which the following is a specification.

10 Our invention relates to a process of manufacturing standard granulated or white sugar from beets and from the molasses which results from a treatment of the beet-juice, whereby substantially all of the sugar contained
15 in the beets is recovered and used for the manufacture of a granulated or white sugar of the recognized standard without making at any stage of the process an inferior or lower grade of sugar.

20 Our invention consists, essentially, in adding to fresh beet-juice, first, molasses (green syrup) and the clairce (wash-syrup) obtained from washing a granulated masse-cuite and the clairce obtained from washing a mixed
25 strike to produce a new mixed strike, then purging the masse-cuite and washing the same to white sugar, and then collecting the molasses, which is a final molasses, and the clairce separately, whereby the clairce is returned to a mixed strike and all of the sugar
30 contained in the beet-juice is converted into granulated or white sugar of standard quality without making at any stage of the process any lower grade of sugar.

35 Our invention also consists in taking, first, molasses of a straight strike and adding lime thereto to form a tri-sucrate of lime, then using one portion of this tri-sucrate in defecation of fresh beet-juice, then carbonating, filtering off the carbonate of lime, and adding
40 to this filtered clarified juice the reserved portion of tri-sucrate of lime and heating the mixture to set part of the lime free by the formation of mono-sucrate and hydrate of lime, then filtering off the separated hydrate of lime, then carbonating the mono-sucrate to remove the remaining lime as a carbonate of lime and filtering off the lime, then concentrating the clarified juice, clarifying and filtering
45 said juice, and finally boiling to grain.

Our invention also consists of the combinations of steps which we hereinafter describe and point out in the claims.

Figure 1 illustrates a diagrammatic view of an apparatus by which our invention is carried out. Figs. 2 and 3 are vertical and horizontal sections of the centrifugal H. 55

The object of our invention is to extract all of the sugar-containing juices from beets and to manipulate these juices so that all of the sugar obtainable from the juices will be in the form of granulated or white sugar of the standard quality as it is established by the refined-sugar industry. 60

We will now describe our process in full, reference being had to the accompanying drawings. 65

The fresh beet-juice is received into the pans A and after being clarified in the usual manner is discharged into tanks or vessels B B' as a thick clarified juice. A portion of this juice is then led by pipe *a* to a vacuum-pan C and boiled therein for granulated sugar, and another portion is reserved to be used at a subsequent stage, as we will presently indicate. This pan C we hereinafter refer to as the "straight" pan to distinguish it from the "mixed" pan F. The masse-cuite produced in the straight pan C is discharged into an open mixer D, cooled by water or other means, and then spun off or purged in centrifugals and washed either with steam or water until the sugar remaining in the centrifugal will have the desired whiteness and is ready to go to the granulator. The first molasses, (green syrup,) as well as the clairce obtained from washing the masse-cuite, both of which have been purged from the masse-cuite by the centrifugal action of the machines, are collected in a tank or vessel E and diluted with water to about the density of thick juice, clarified and filtered, and are then ready to be boiled in the vacuum-pan F with the part of the thick juice reserved for this purpose, as before mentioned. To further this operation, the tank B', containing the portion of the thick juice originally reserved, is connected with the pan F by means of a pipe *a'*. The first molasses (green syrup) and the clairce (wash-syrup) in the tank or ves- 100

sel E are pumped or otherwise delivered into blow-ups E' and will be clarified and filtered and delivered into storage-tanks E², and finally into the vacuum-pan F, with the afore-
 5 said thick juice from the tank B', whereby the degree of purity of the first molasses and clairce is raised. The mixture in the pan F is about five to six points lower in purity than that in the straight pan and is boiled in this
 10 vacuum-pan for granulated-sugar masse-cuite, together with the clairce of a previous pan of the same kind, as we will presently disclose. The masse-cuite of this vacuum-pan F is dropped into closed vessels G, pro-
 15 vided with a cooling-jacket and means for stirring the masse-cuite and is left therein for about eighteen to thirty hours to enable it to be cooled to a temperature of between 90° and 100° Fahrenheit, and then discharged
 20 into a centrifugal mixer H, of any suitable and well-known type, and spun off or purged in the centrifugals in the usual manner. In this instance, however, the centrifugals, Fig. 2, which are not claimed in this application,
 25 but are fully shown, described, and claimed in another application filed by us June 18, 1897, Serial No. 641,307, are provided with perforated coils b, which are arranged in such a manner that by means of steam or hot water
 30 forced through the coils and perforations the inner walls of the outer basket c, as well as the collecting-gutter d at the bottom, are thoroughly washed and freed from the syrup adhering to them. The gutter d has preferably
 35 a movable nozzle e to enable the operator to direct the outflow of the various syrups coming from this centrifugal into different channels or gutters, the purpose of which arrangement will be manifest from the following: The
 40 masse-cuite is dropped into the centrifugal, of which the inner wall of the outer basket and gutter has been washed to white sugar, as just described, and the machine is run until the molasses, which is a final molasses, stops run-
 45 ning from the masse-cuite. If the masse-cuite of the mixed vacuum-pan has been treated as above described, it will be found that the molasses resulting from the treatment is a final molasses of about 62.5 purity, and this we in-
 50 tend to work in a molasses plant to extract the sugar from it, as we will presently describe, so that all of the sugar in the beet-juice may be extracted to produce a standard quality of granulated or white sugar without
 55 making at any stage of the process another or inferior kind of sugar. In other words, all the juices and syrup will be boiled into white masse-cuite alone without the necessity of boiling any of the sugar solution to any lower
 60 grade of masse-cuite, so that the only product made by our process is white sugar.

Before the steam or water is turned on the movable outlet or nozzle e may be turned to discharge into a second gutter or trough to
 65 carry off the clairce obtained from washing the masse-cuite. After the sugar remaining in the centrifugal is washed to the desired

whiteness and before the machine is stopped the water or steam should be turned on in the outer basket and the collecting-gutter thereof
 70 thoroughly cleansed to remove all particles of high-testing clairce. The clairce received into the troughs is to be delivered—by a pump, for instance—into the blow-ups, and is filtered, and finally is sent to the mixed pan
 75 F, as before alluded to.

The final molasses goes to a plant specially adapted to treat it and extract the sugar from the molasses as a tri-saccharat, either by a hot or cold process. In the draw-
 80 ings it is shown as pumped into a tank I, whence it passes to a mixer J, of suitable well-known character, and has added to it a lime-powder. The juice from this mixer then passes through the filter-presses K to sepa-
 85 rate the tri-saccharat of lime and waste water, and the tri-saccharat is discharged from the presses into separate vessels or tanks L, L', which will contain agitators for keeping the material in motion and thoroughly stirred.
 90

After the juices have been extracted in the ordinary manner from the beets they are run into the first saturators M, of any suitable type, and there they receive a certain per-
 95 centage of tri-saccharat of lime obtained from the tank L through the pipe g. The tri-saccharat of lime will be decomposed by the sugar solution into a mono-saccharat of lime and into hydrate of lime. The hydrate of
 100 lime will act in the ordinary manner on the impurity of the juices. Finally, carbonic acid will be pumped through the mixture, which acts on the mono-saccharat of lime to convert the lime into a carbonate of lime, setting the
 105 sugar free. It also acts on the surplus of hydrate of lime, combining with the same and forming a carbonate of lime. The carbonate of lime insoluble in the sugar solution will be separated from the mixture by means of
 110 filter-presses N, in which the carbonate of lime will be retained in the form of a cake and the clear and purified sugar solution will be taken and used in the second part of the process, as follows: The balance of the tri-
 115 saccharat (that in tank or vessel L' left over from that part which has been used in the first saturation) is added to this juice from the first saturation and is treated at a temperature of 160° Fahrenheit and is kept agi-
 120 tated until the reaction takes place. The reaction which takes place is described as follows: The sugar solution at this particular temperature has the effect of changing the insoluble tri-saccharat into a mono-saccharat,
 125 which is soluble in the sugar solution, dropping at the same time two parts of the lime of the tri-saccharat as a hydrate of lime. This hydrate of lime is then separated by means of filter-presses O and obtained in
 130 cakes. The clear solution of juice is then sent to the second saturation through pipe n and there treated with carbonic acid, which decomposes the mono-saccharat, forming a carbonate of lime insoluble in the solution.

This carbonate of lime is separated in the filter-presses P, and the clear juice, after being treated with sulphurous acid and once more filtered, is then concentrated in the ordinary manner, received into blow-ups A, treated and once more filtered, and is then ready to be received into tanks B to be sent to the vacuum-pans. Part of it is boiled there straight for granulated sugar, and part of it is set aside to be used in a later part of this process, as before described. The second product or waste water coming from the filter-presses K contains but a trifling amount of sugar not practicable to be extracted and all of the impurities of the beet-juices which have not been previously removed by the action of the lime, &c., in the carbonation. In this manner of treating the molasses we practically return all of the sugar from the molasses into the crude juices from the beets, and the process as a whole when worked as before described will produce but three products—namely, pulp, granulated or white sugar of the standard of the refined-sugar industry of the world, and waste water from the molasses plant.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The process herein described of manufacturing white sugar and final molasses only from juice, which consists, essentially, in producing a masse-cuite from clarified juice; then combining the syrups purged from said masse-cuite, and the clairce of a previous second masse-cuite, with fresh juice, to produce a second masse-cuite, and then mechanically separating the second molasses and clairce of the second masse-cuite whereby the second molasses becomes a final molasses in the process and the other products of the second strike are a clairce to be used in a subsequent second strike and a white sugar, thereby avoiding the making of yellow sugar at any stage of the process.

2. The process herein described of manufacturing white sugar and final molasses only from juice, which consists, essentially, in producing a masse-cuite from clarified juice; then combining and clarifying the syrups purged from said masse-cuite, and the clarified clairce of a previous second masse-cuite, with clarified fresh juice, to produce a second masse-cuite; and then separating the second molasses and clairce of the second masse-cuite whereby the second molasses becomes a

final molasses in the process, and the other products of the second strike are a clairce to be clarified and used in a subsequent second strike and a white sugar, thereby avoiding the making of yellow sugar at any stage of the process.

3. The process herein described of manufacturing granulated or white sugar from beets which consists, essentially, in mixing with fresh juice combined first molasses (green syrup) and the clairce used in washing a straight strike and also the clairce used in washing a previous mixed strike, and boiling the mixture to strike; then removing the final molasses from the masse-cuite so produced and adding lime thereto to convert the contained sugar into lime tri-sucrate; then using one portion of this tri-sucrate in defecation of fresh beet-juice; then carbonating, filtering off the carbonate of lime and adding to this filtered clarified juice, the reserved portion of tri-sucrate of lime and heating the mixture to set part of the lime free, by the formation of mono-sucrate and hydrate of lime; then filtering off the separated hydrate of lime; then carbonating the mono-sucrate to remove the remaining lime as carbonate of lime and filtering off said lime; then concentrating the clarified juice, clarifying and filtering said juice and finally boiling to grain.

4. The process herein described of manufacturing granulated or white sugar from beet-juice which consists, essentially, in producing a final molasses and forming a tri-sucrate of lime therefrom; then separating the waste water; then using a portion of tri-sucrate of lime in defecation; then adding all of the defecated carbonated and filtered juice, for an additional clarification, to a reserved portion of tri-sucrate of lime and heating the same to break up the tri-sucrate into mono-sucrate and hydrate of lime; then filtering off the hydrate of lime and resaturating the mono-sucrate of lime; then refiltering the juice, concentrating the same and again filtering.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 5th day of April, 1897.

JAMES G. OXNARD.
WILHELM BAUR.

Witnesses:

HENRY F. OXNARD,
S. D. SCHENCK.

It is hereby certified that in Letters Patent No. 626,292, granted June 6, 1899, upon the application of James G. Oxnard and Wilhelm Baur, of New York, N. Y., for an improvement in "Processes of Manufacturing Granulated Sugar from Beets," errors appear in the printed specification requiring correction as follows: In lines 21 and 35, page 1, the commas after the words "first," should be stricken out; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 13th day of June, A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

C. H. DUELL,
Commissioner of Patents.