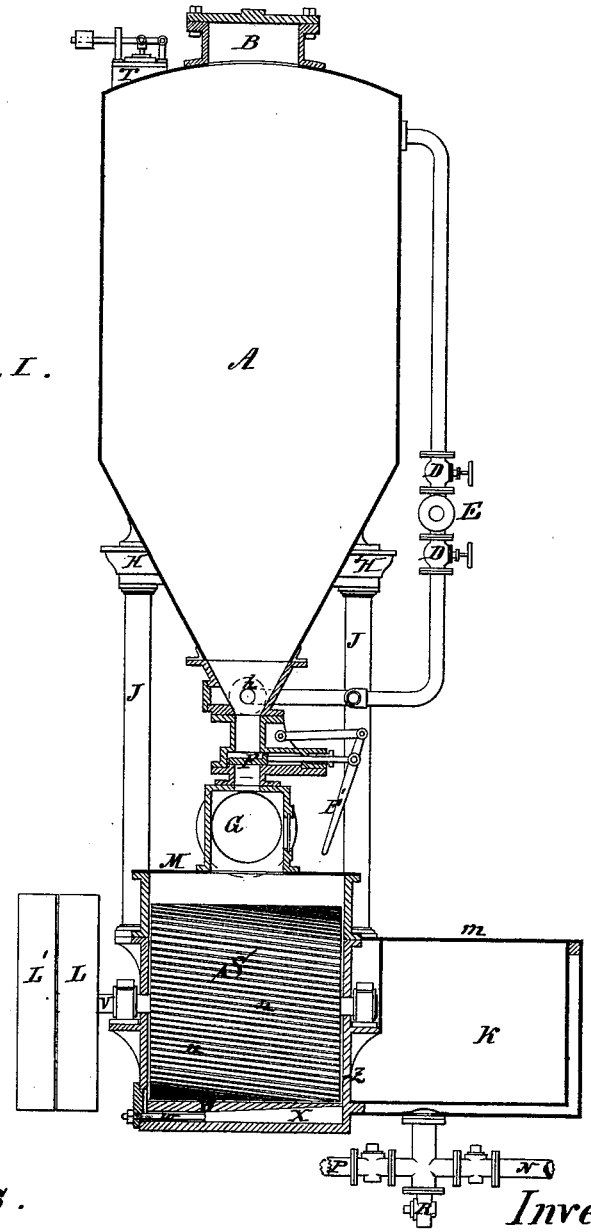
G. ELLENBERGER. 2 Sheets—Sheet 1.

APPARATUS FOR MASHING, GRINDING &c, FOR DISTILLERIES.

No. 181,060. Patented Aug. 15, 1876.

Fig. 1.



Witnesses.
W. Ehret.
C. D. Streightoff

Inventor.
Gustav Ellenberger
per Henry & Roeder
Attorney.

2 Sheets—Sheet 2.

G. ELLENBERGER.

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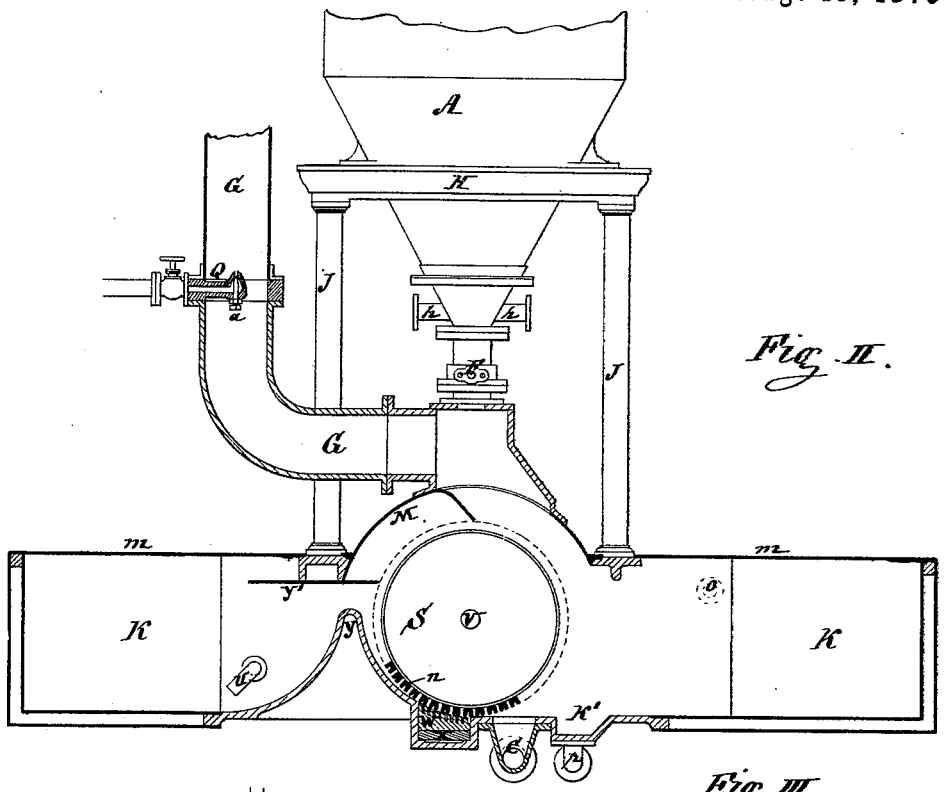

Fig. II.

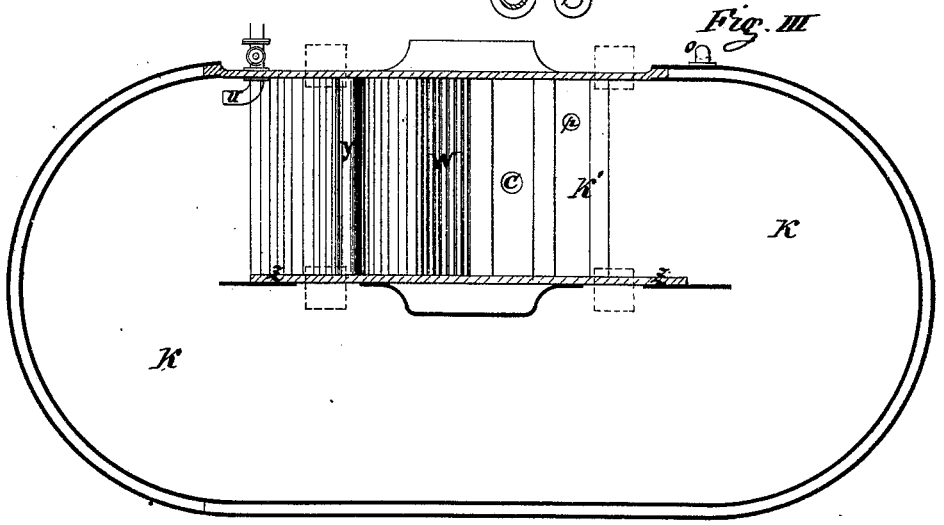

Fig. III

Witnesses.
W. Ehret.
L. D. Streightoff

Inventor.
Gustav Ellenberger
per Henry E. Roeder
attorney.

UNITED STATES PATENT OFFICE.

GUSTAV ELLENBERGER, OF BIEDENKOPF, GERMANY.

IMPROVEMENT IN APPARATUS FOR MASHING, GRINDING, &c., FOR DISTILLERIES.

Specification forming part of Letters Patent No. **181,060**, dated August 15, 1876; application filed June 10, 1876.

To all whom it may concern:

Be it known that I, GUSTAV ELLENBERGER, of Biedenkopf, Prussia, Germany, have invented certain new and useful Improvements in Apparatus for Mashing, Grinding, &c., for Distilleries, &c., of which the following is a specification:

This invention is an improvement on the machine for which Letters Patent of the United States have been granted to me on October 26, 1875, and consists in more thoroughly mashing the matter passed through the same, these improvements being the result of years of experiment and of practice.

In the accompanying drawing, Figure I represents a cross-section of the mash-machine embodying my invention. Fig. II is a longitudinal section of the same; and Fig. III is a horizontal section of the lower part.

Similar letters represent similar parts in all the figures.

A is the steam-chamber, constructed of boiler-plates, capable of withstanding a pressure of about five atmospheres, provided with suitable steam-gage and gage-cocks. (Not shown in the drawing.) B is an opening in the top plate, capable of being closed steam-tight, for filling the chamber. D D are cocks for supplying water and steam to the chamber A; E, pipe connected with the steam-boiler; F, valve operated by means of lever F^1; G, large pipe for carrying off the steam liberated during the process of mashing. In this pipe an apparatus, Q, is arranged to produce a strong draft. This apparatus consists of a pipe with a conical orifice, pointing upward, and provided with a regulating-screw, *a*, by which the orifice can be graduated. Steam being introduced through this apparatus a strong current of air is caused to pass up the pipe G in the same manner as an injector carries water into a boiler. By this arrangement not only steam liberated during mashing is carried up through the pipe G, but at the same time the mash is cooled by this process. H is the frame, and J the column to support the frame, upon which the chamber A is carried. K is an oblong mash-tub with rounded ends, and constructed with double sides and bottom, between which cold water and steam can be circulated, as may be desired, according as cooling or heating of the mash is required. S is the grinding or mash drum, attached to a shaft, V, provided with a fast and a loose pulley, L L′. This drum S is of cast-iron, and is provided with wrought-iron knives or teeth *n*, cast or screwed on either parallel with the shaft V or diagonally to the same, as shown in Fig. I, across its face, in such a manner that they exercise a grinding and crushing movement as they pass over the bed-plate W, which is also provided with teeth. These teeth in the bed-plate W are arranged diagonally to the teeth attached to the drum S. As shown in Fig. I, and above described, the teeth *n* are fastened diagonally with the shaft. The teeth on the plate W are, in this case, arranged parallel to said shaft, as shown in Fig. III. Below the bed-plate W a key or wedge-shaped plate, X, is arranged, provided with an adjusting-screw, *w*, for the purpose of moving this bed-plate W nearer to the face of the drum or farther away from the same.

Behind the drum S an inclined plate or partition, Y, is arranged in the mash-tub, up one side of which the mash is forced by the rotation of the drum, and then falls down at the other side by its own weight, thereby causing a rotation of the mash round the mash-tub, around the partition-plate Z in the central part of the tub K. Over the mash-drum S a cover, M, is arranged, and the top of the mash-tub K is covered by suitable plates *m*. N is a pipe to introduce cold water, and P a pipe to introduce steam into the space at the hollow sides and bottom of the mash-tub, provided with suitable valves or cocks, and R is a cock for emptying the same. O is a pipe to carry off the cooling water after the same has become heated. U is a pipe provided with a cock, to admit steam into the mash-tub for keeping the mash at boiling-point, used when Indian corn is being mashed for distilleries. C is a pipe for drawing off the mash when ready. K′ is a recess made in the bottom of the mash-tub in front of the mashing-drum, to collect stones or hard substances, and prevent the same from coming between the teeth of the drum and bed-plate. *p*, pipe for carrying off water with which the mash-tub has been cleaned. Y′ is a movable scraper above the partition Y, arranged close to the drum S, to

prevent the mash being carried round and round with the drum. T is a safety-valve on top of the chamber A.

Having now fully described the several parts of my apparatus, I proceed with the description of the use and operation of the same.

First, mashing with potatoes: The potatoes to be reduced to pulp are placed in the steam-chamber A, where they are kept for thirty to forty minutes under a pressure of twenty to thirty-five pounds of steam, according to quantity. From time to time the condensed steam must be drawn off at the lower part of the chamber at *h h*. At the same time the necessary quantity of malt and yeast is reduced to pulp, and diluted with water to a a thin malt-milk, by the mashing apparatus in the vat below. The greater portion of this milky liquid is pumped into a vat situated a little higher than the mashing-tub, when that portion necessary for yeast is taken away, and the rest kept to sugar the mash.

The potatoes having now been sufficiently steamed, the valve F is partly opened, and the potatoes forced out by the pressure of the steam; they fall immediately upon the drum S, which, making about two hundred revolutions a minute, reduces the same to the finest pulp in a very short time.

The potatoes being frozen or rotten makes no difference as to the fineness of the pulp produced by this apparatus.

As the tub K is divided down the middle by the division-plate Z running nearly to the ends, and the inclined plane or partition Y is placed immediately behind the drum S, the mash is forced round and round as long as the drum S revolves. This drum is provided with about one hundred and eight knives, and the bed-plate W with nine knives. Thus, the drum making two hundred revolutions, there are one hundred and ninety-four thousand four hundred grinding-edges exposed to each other every minute. The pulp produced by this apparatus is so fine that the skins of the potatoes cannot be distinguished, while the power required is considerably less than that necessary in any other constructed apparatus for that purpose.

As the potatoes are blown from the steam-chamber A into the mashing-tub K they pass through a strong current of air, which is enough to keep the mash at a temperature of about 50° or 52° Reaumur, in which case the liquid malt can be introduced little by little without the mash turning into paste, and the whole mash is mixed into a thin milky liquid. On account of the very thorough mixing which is produced by this apparatus, three pounds of green malt—equal to two pounds of barley—are enough to turn the starch of one hundred pounds of potatoes into twenty per cent. sugar. It is also through this very thorough mixing that the sugar formation occurs very soon, and in about twenty-five to thirty minutes the mash can be cooled, which is done by passing the mash through a series of flat pipes surrounded by water circulating in the opposite direction.

Second, mashing with Indian and other corn: It is well known that in the horny parts of Indian corn the starch-cells are most abundantly found, and, owing to the hardness of the shell, are very difficult to utilize, on which account it has been very little used for distilleries, as it had first to be ground to powder—a very expensive process. With this apparatus, however, the reduction of Indian corn into fine pulp is made not only easy but very profitable.

Indian corn, like other grain, comes first into the steam-chamber A. Water is then let in until it stands about one foot above the charge, when steam is introduced little by little until a pressure of about three to four atmospheres is reached, in which state it is allowed to remain for about three-quarters of an hour.

During this time the malt is reduced in the tub, as stated above. The valve F is then opened, when the charge falls upon the drum S, and is there reduced to pulp.

The mash is kept the whole time it is in the vat at a temperature of about 75° Reaumur by the continual introduction of steam between the double bottom and sides of the mashing-vat K.

All the horny starch-containing cells in the Indian corn split and burst open by the pressure they are subjected to in the steam-chamber A. The sugar formation takes place, therefore, with great rapidity. The mash is kept for about one hour at a temperature of about 80° Reaumur, then cooled down to 56° Reaumur, during the whole of which time and operation the drum is kept working. At 52° Reaumur the sugar formation begins, and is perfected in about one hour.

Steaming the corn under high pressure, and the fine pulp into which it is afterward reduced to, combined with the thorough mixing with the malt it afterward undergoes, produce a sugar formation far better than was ever before attainable, even with the use of sulphuric acid, or swelling the grain.

Having now fully described my invention and the manner of operation, I claim as my invention, and desire to secure by Letters Patent—

1. In combination with a steam-chamber, A, and mashing-tub K, the exhaust-pipe G, provided with an injector apparatus, Q, in the manner and for the purpose described.

2. In a mash-machine, in combination with the revolving drum S the movable plate Y′, in the manner and for the purpose specified.

3. In a mash-tub, K, provided with a central division-plate, Z, the inclined raised partition Y, situated behind the revolving drum S, substantially in the manner and for the purpose set forth.

4. In a mash-tub, K, provided with a central division-plate, Z, the recess K′, situated

before the revolving drum S, for the purpose set forth.

5. The mashing-tub K, provided with a partition-plate, Z, double sides and bottom, elevated inclined partition Y, recess K′, revolving drum S, bed-plate W, and movable plate Y′, combined and constructed in the manner and for the purpose substantially as set forth and described.

In testimony that I claim the foregoing I have hereunto set my hand this 11th day of April, 1876.

GUSTAV ELLENBERGER.

Witnesses:
HENRY E. ROEDER,
W. EHRET.