No. 715,605. Patented Dec. 9, 1902.

W. P. RICE.

PROCESS OF STEEPING GRAIN.

(Application filed Dec. 28, 1901.)

(No Model.)

Fig 1

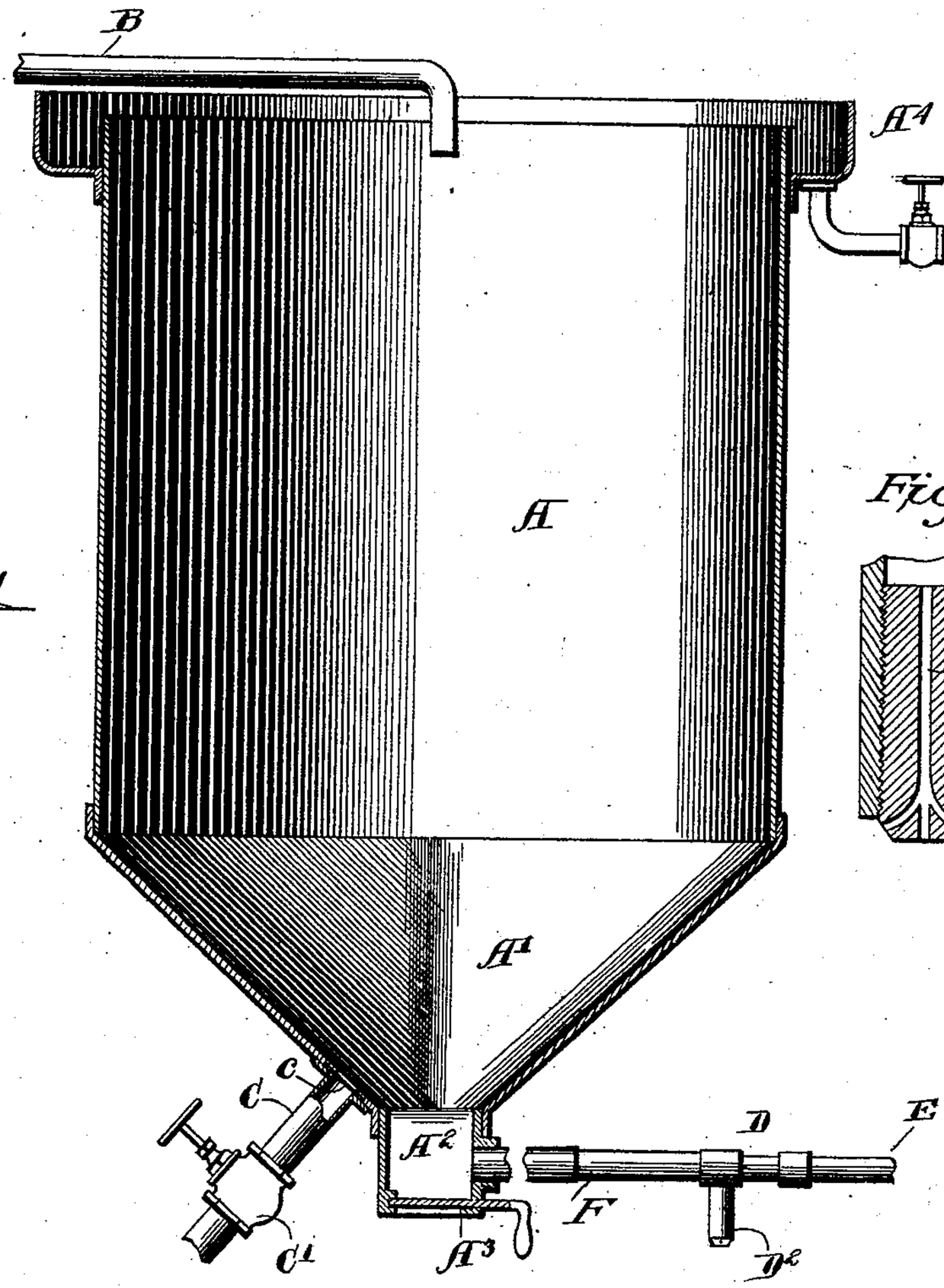


Fig. 3.

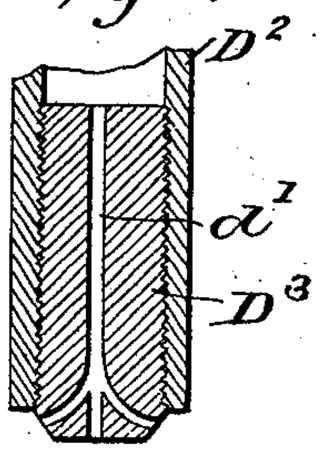
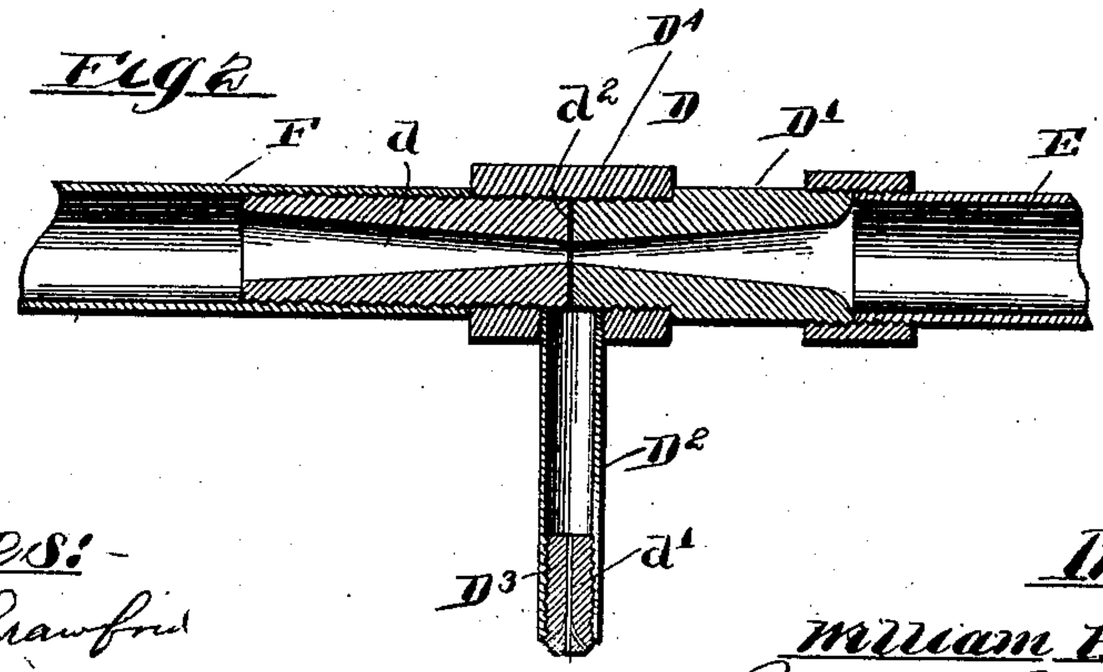


Fig 2



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UNITED STATES PATENT OFFICE.

WILLIAM PAUL RICE, OF CHICAGO, ILLINOIS.

PROCESS OF STEEPING GRAIN.

SPECIFICATION forming part of Letters Patent No. 715,605, dated December 9, 1902.

Application filed December 28, 1901. Serial No. 87,552. (No specimens.)

To all whom it may concern:

Be it known that I, WILLIAM PAUL RICE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Processes of Steeping Grain; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a novel process of steeping grain in a malt-house preparatory to the growing or germinating process; and the invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

Among the objects of my invention is to shorten the time necessary for growing grain on the malt-floor, to reduce the loss occasioned by ungerminated corns, and to brighten the corns, and thereby increase the value of the product. For this purpose I propose to pass aerated water or other liquid into and through the mass of grain in the steep-tank, said water being charged with the gas or gaseous mixture, which is so finely divided that the particles thereof do not tend to quickly separate or escape from the liquid, but remain in the body of the same for a considerable time, so that said gas or gaseous mixture is carried to the corns of the mass uniformly, with the result of a uniform effect thereon, and by reason of the relative stability of the mixture of gas and water time is given for the gas to act upon the individual corns of the mass.

In carrying out the process I proceed generally as follows: The grain is delivered to the steeping-tank in any suitable manner and mixed with water before or after being discharged into the tank, said grain being subjected to the action of the water for the purpose of softening the grain in the usual manner before being spread upon the malt-floor or otherwise grown or germinated. During the process of steeping the grain the aerated or gas-charged liquid is passed into and through the mass of the grain in the steep-tank. For the purpose of stimulating the growth of the corns the gas or gaseous mixture used may be air or pure or nearly pure oxygen. By reason of the finely-divided state of the gas or gaseous mixture the particles thereof lose their buoyancy to such extent as to remain mixed with the water for a considerable time and in such state is carried by the water to all parts of the mass of grain and is given off from the water and lodges or adheres in individual particles to the corns, so that said gas or gaseous mixture may efficiently act upon the individual corns, according the characteristic property of such gas or gaseous mixture.

Any suitable means may be employed for mixing the gas or gaseous mixture with the water, and said gas or gaseous mixture may be commingled with the water either prior to or after the introduction of the water into the steep-tank. I have herein shown one approved apparatus for carrying out my invention, which consists of a device in the nature of an inspirating device comprising a device embracing a main body provided with a through water-passage, one end of which communicates with a source supplying water and the other end of which is adapted to be connected with a pipe leading to the steep-tank. Said main body of the device is provided with a branch having a minute orifice through which is supplied the gas or gaseous mixture to be commingled with the water passing through the passage of said body, said branch being adapted to be open at its outer ends to the air or connected with any other suitable source for supplying gas or gaseous admixture. Said gas or gaseous mixture is delivered through said minute orifice of the branch into the path of the stream of water passing through the fitting and transversely to the path of said stream, as herein shown, and is presented in such a small jet to the stream of water as to be broken up by the current of water into minute particles, as described.

As shown in the drawings, Figure 1 is a vertical section of a steep-tank, showing an apparatus applied thereto for carrying out my novel process. Fig. 2 is a longitudinal section taken axially through the gas and water mixing device. Fig. 3 is a fragmentary axial section of the branch D^2 of the inspirating device D.

As shown in said drawings, A designates a steep-tank of ordinary construction having a tapered lower end A′, and at the extreme lower

end of said tapered portion of the tank is formed a discharge spout or passage A^2, which is provided with a sliding gate or valve A^3, the opening of which permits the discharge of the grain from said tank. Grain is supplied to the steep-tank through the upper open end thereof, and a water-pipe B is shown as discharging through said upper open end of the tank for supplying water to the tank for steeping the grain. The tank is provided at its lower end adjacent to the grain-discharge passage A^2 with a water-discharging pipe C, and a screen *c* is located between the induction end of said water-pipe and the interior of the tank. Said pipe C is provided to draw the water from the tank when it is desired to change the water or when the grain has been sufficiently steeped and the water is to be drawn from the tank preparatory to discharging the grain therefrom. Said water-pipe C is provided with a cut-off valve C'.

D designates as a whole the device hereinbefore referred to for admixing a gas or gaseous mixture with the water to be passed through the body of the grain. Said device consists, essentially, of a tubular body D', which is designed to be connected at one end with a pipe E, leading from a suitable source supplying water, and at its other end with a pipe F, which communicates with the steep-tank. As herein shown, said pipe enters the discharge-passage A^2 at the lower end of said tank. Said body of the fitting is provided with a branch D^2, which communicates with the interior passage *d* of said body and which branch is provided with an orifice which is in open communication with the atmosphere or other suitable source for supplying the gas or gaseous mixture. As herein shown, such branch is provided at its outer end with a plug D^3, in which is formed a minute axial passage *d'*, which determines the capacity of said branch. The inner end of said branch communicates with a narrow annular slit d^2, surrounding said passage *d* of the main body and communicating therewith, and through said slit the branch communicates with the passage of the main body of the fitting. As herein shown, the slit is formed between the adjacent ends of the sections of the body portion, which sections are connected by means of a coupling-sleeve D^4, whereby the size of the slit d^2 may be varied.

In practice the pipe E, through which the liquid is furnished to the device, is connected with a pump or other forcing apparatus of sufficient capacity for producing the required pressure for delivering the water into and through the mass of grain in the tank. The gas or gaseous mixture is not required to be supplied to the device under pressure, as the stream of water passes through the body of the device with such velocity as to draw the air through said branch. The air drawn through the branch passes into the annular slit d^2 in the body of the fitting and is delivered to the water-passage in a thin annular sheet and in this condition is broken up by the force of the water into the desired small particles and intermingled with the water in a uniform state or condition. The passage, which determines the quantity of air to be delivered to the stream of water, is made very small, the size of this passage being in practice one-thousandth of an inch in diameter. This graduated supply of air may be effected at the outer end of the branch D^2, in which event the passage *d'* will be made so small as to determine said supply, or said graduation may and preferably will be effected at the slit d^2, in which event the plug D^3 may be omitted.

In the practice of this process, which has effected excellent results, the steep-tank was made in the neighborhood of twelve feet high by sixteen feet long, including the hopper at the lower end thereof, and was supplied with water through a pipe F about two inches in diameter, which pipe communicated with ten nozzles D, each delivering three gallons of charged water per minute. The smallest diameter of the passage in the device D was one-eighth of an inch, and the water was forced through the apparatus at a pressure of about thirty-five pounds to the square inch.

I have found that a gas or gaseous admixture which is commingled with water or other liquid in the manner described will remain suspended in the water for a considerable length of time and does not pass rapidly to the surface of the liquid and escape therefrom, as in the case where the air is forced into the liquid in large quantities or is contained therein in relatively large particles or globules. As a consequence the minutely-divided particles of air are carried by the water to all parts of the mass of grain, so that all parts of said mass is subjected alike to the action of the gas or gaseous mixture. As said minute particles of air come in contact with the individual grains or corns they adhere to the outer surfaces thereof and produce the biological or other effect due to the peculiar property of the gas or gaseous mixture being used. If the water be mixed with the air in particles of relatively large size, the buoyancy of said particles of air in the water will be such as to rapidly carry the same upwardly, so that said particles will pass the mass without adhering to the individual corns in the manner specified. Moreover, if such particles of the gas or gaseous mixture be of relatively large size they will tend to escape by reason of their buoyancy directly through the mass of grain in the shortest path and will not be uniformly distributed to all parts of said mass.

The principal effects of the oxygen on the grain is to stimulate the unmatured corns, so as to shorten the period of germination and also to decrease the percentage of ungerminated corns in a given quantity of grain, and

therefore the loss due thereto. A further effect of oxygen when used in a pure or nearly pure state is to bleach or whiten the corns, and therefore increase the value of the finished product.

In the practice of my process the grain is delivered to the steep-tank in the usual manner, and said grain may be steeped for a suitable period to properly soften the same before the admixture of gas and water is delivered thereto to aerate the mass in accordance with my novel process, so that the grain will be in proper condition to be acted upon by said gas or gaseous mixture. The entire steeping process may be effected, however, by the water charged with the gas or gaseous mixture, said water being constantly delivered to the tank and allowed to overflow therefrom.

The tank is provided around the upper open end thereof with an annular overflow-trough A^4, in which the water passed upwardly through the mass of grain in the tank overflows. Said trough is provided with a drain-pipe A^5.

It will be evident that the quantity of gas or gaseous mixture used is relatively small, for the reason that the same is so minutely divided, and that all of the gas or gaseous mixture in the water is advantageously or economically employed. For this reason I am enabled to use gases or gaseous mixtures which would otherwise be prohibitive in their cost owing to the wasteful use of the same when mixed with the water in relatively large particles.

It is obvious that my improved process may be employed for delivering a bleaching-gas or gaseous mixture to the grain in the steeping-tank and that the application of such bleaching-gas is substantially the same as the stimulating-gas before referred to.

It will be furthermore obvious that a liquid aerated by my novel process may be used in many ways where it is desired to secure the combined effect of the water and the gas or where it is desired to carry minute particles of a gas or gaseous mixture to the product to be treated.

I claim as my invention—

1. The improvement in the process of malting grain which consists in steeping the grain in a liquid having suspended therein a free gas or a gaseous mixture, said gas or gaseous mixture being subdivided so minutely that the particles thereof do not escape quickly from the liquid but remain mixed therewith for a relatively long time.

2. The improved process of steeping grain which consists in passing into and through the mass of grain while in the steep-tank a liquid having suspended therein a free gas or gaseous mixture which latter is in such a minutely-divided state that the particles thereof remain mixed with the liquid and are carried by said liquid to all parts of the mass alike.

3. The improved process of steeping grain which consists in passing into and through the mass of grain while in the steep-tank a liquid charged with a gas or gaseous mixture which is in such a minutely-divided state that the particles thereof do not escape quickly therefrom, and which particles are free to adhere individually to the corns of the mass of grain at the temperature and pressure at which the gas or gaseous mixture is introduced into the liquid.

4. The improved process of steeping grain which consists in passing into and through the mass of grain while in the steep-tank a liquid and mixing with said liquid while in the form of a stream and prior to the entrance of the liquid to the mass of the grain, a gas or gaseous mixture, said gas or gaseous mixture being delivered to said stream of liquid in a minute jet and broken up by the liquid so as to be mixed therewith in such minute particles that such particles are carried by said liquid to all parts of the mass alike.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 16th day December, A. D. 1901.

WILLIAM PAUL RICE.

Witnesses:
WILLIAM L. HALL,
GERTRUDE BRYCE.