SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS. CHEMISTRY AND MANUFACTURES.

Vol. XLVI.—No. 22. [NEW SERIES.]

NEW YORK, JUNE 3, 1882.

$3.20 per Annum. [POSTAGE PREPAID.]

NEW ORE ROASTING FURNACE.

We give an engraving of a revolving cylinder ore roasting and chloridizing furnace of the class that is operated by two fires, and in which complete or partial desulphurization or oxidation of the ore is effected before the beginning of the chlorinating process.

The furnace is composed of three revolving cylinders of different diameters and lengths, longitudinally connected and communicating with each other, having a fire box at each end and suitable dust chambers, and provided with novel internal stirring and ore pulverizing devices, with internal air supply pipes, and with external automatically operating salt box and ore discharge pipe.

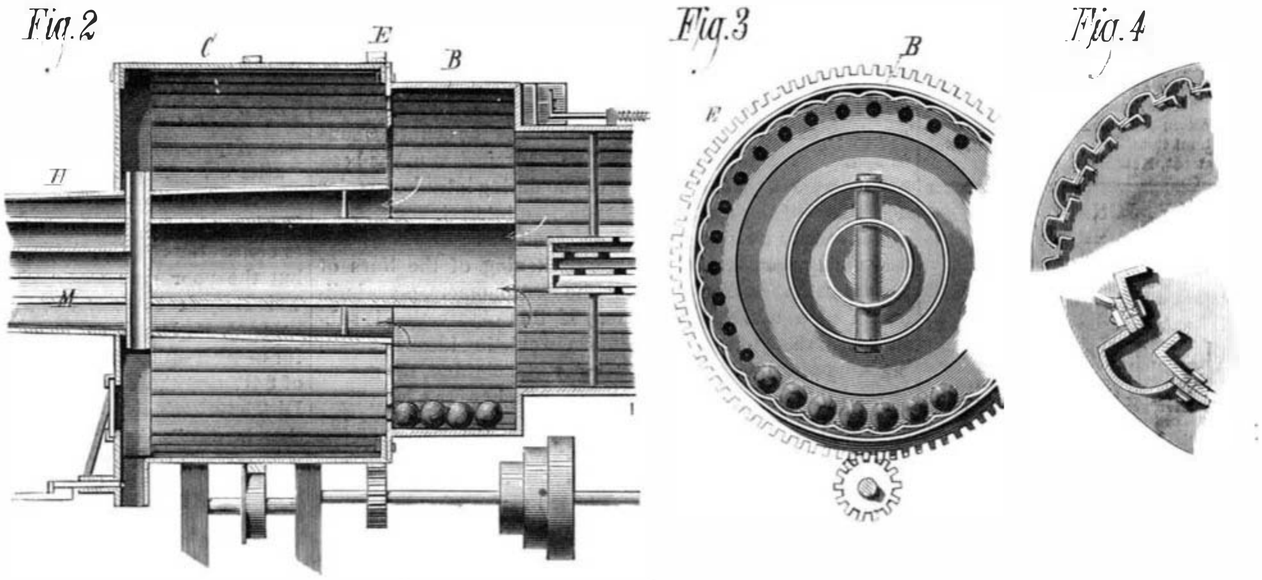


Fig. 2
Fig. 3
Fig. 4

NEW ORE ROASTING FURNACE.

The larger engraving is a longitudinal elevation of the furnace. Fig. 2 is a longitudinal sectional elevation. Fig. 3 is a vertical sectional elevation. Fig. 4 is an enlarged transverse section.

In the engravings, A is the cylinder of least diameter and greatest length, designed to be about 12 feet long and about 4 feet in external diameter, the cylinder being constructed in one or more flanged sections bolted together. The shortest cylinder, B, is designed to be about 2 feet long and of about 6 feet external diameter, bolted through its flanged end to the flanged end of cylinder A; and C is the cylinder of greatest diameter, designed to be about 4 feet long and about 80 inches in external diameter, bolted by its flanged end to the opposite flanged end of the cylinder B. This furnace, A B C, is provided with suitable encircling rings or tires, that bear on supporting anti-friction rolls, whose shafts are journaled in supporting frames, the rolls nearest the ends of the furnace having annular flanges to prevent longitudinal movement of the furnace. Encircling the cylinder B is a toothed gear, E, meshing with a small cog wheel on the drive shaft. This furnace is designed to be set at about an inclination of one inch in six feet, inclining downward from the smaller to the larger end.

The cylinder A is longitudinally corrugated, as shown, forming a series of parallel and alternate depressions and projections on the inside. Along these projections are bolted angle irons, extending from one end to the other of the cylinder, and forming, in combination with the depressions, a series of buckets for lifting or stirring the ore as it passes through the furnace, the buckets lifting the ore and letting it fall through the flame or hot air passing through the furnace, and exposing it at the same time to the air admitted through the air pipes, that will presently be described. These depressions are designed to be about four inches deep. The cylinder C is also longitudinally corrugated in the same manner as cylinder A, and has angle irons secured along its inward projections, and extending partly over the depressions, forming buckets for lifting and letting fall the ore to expose it to the furnace reactions. Fire brick or angle irons are used to project the falling ore into the body of the furnace, also covering the space between the buckets and protecting the shell of the furnace from the action of heat, and also to project the falling ore farther into the body of the furnace. In the case of the cylinder C, the corrugations terminate a short distance from the head, thereby leaving the cylinder at that point of the diameter of the outside of the buckets, forming a gathering trough for the ore. To an opening in this trough is attached a peripheral discharge pipe provided with a valve.

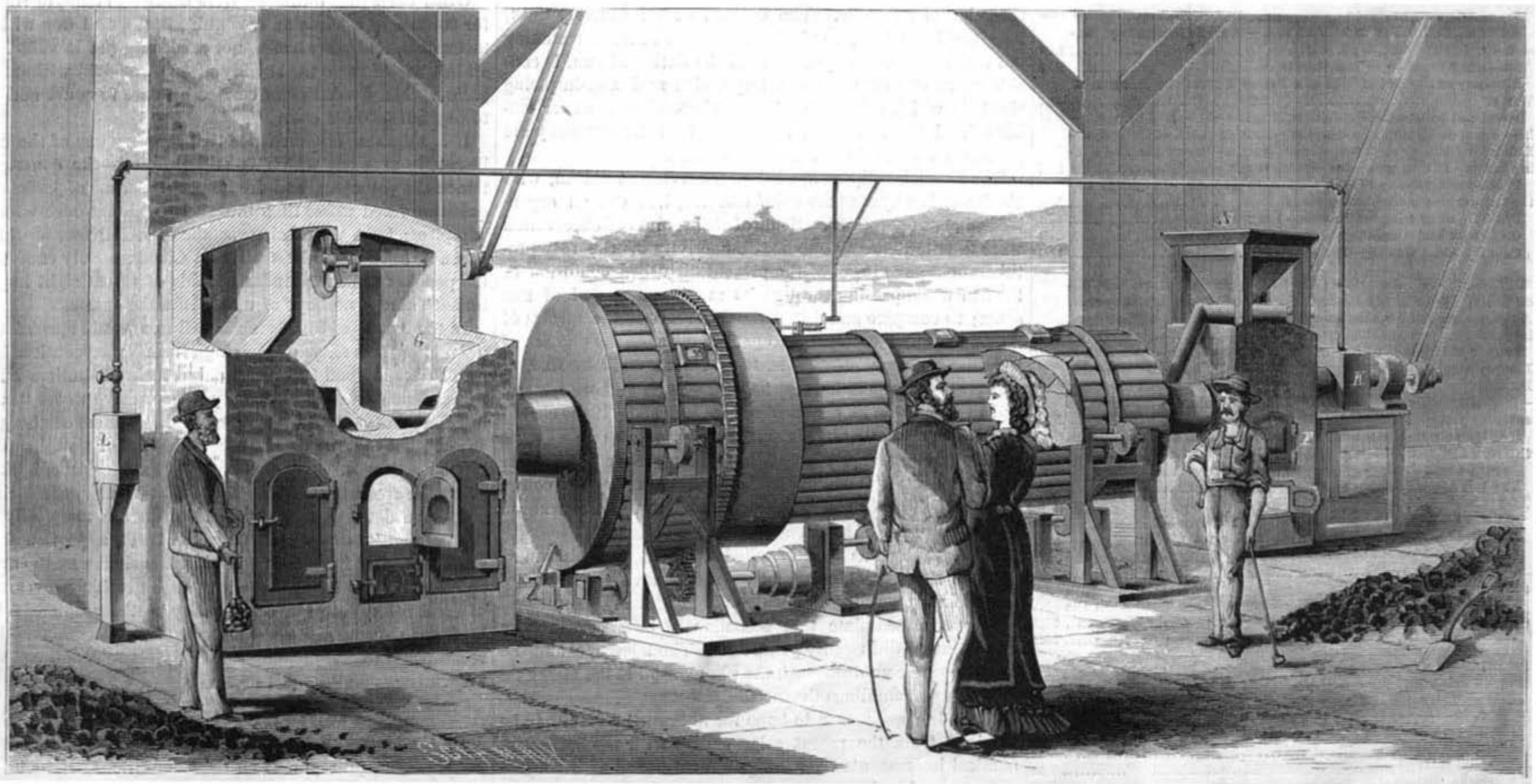
The cylinder B is plain, but is lined with a slightly corrugated lining, as shown in Fig. 3, and has annular flanges at each end, and through the flange next to the cylinder C are orifices corresponding in number and location with the buckets in the cylinder C. In this cylinder B are a number of iron balls, whose function is, as the furnace revolves, to pulverize the agglutinated lumps of ore and mix the ore with the reagents fed from the salt box.

In the sides of the cylinders A C are inspection ports covered with mica, held in place by frames bolted to the cylinder, and a manhole is formed in the head of the cylinder C for the convenience of entering and cleaning or repairing the furnace, A B C.

At the higher end of the furnace, A B C, is a fire box, F, from which a fixed cylindrical flue extends a short distance into the cylinder A, to convey therein the products of combustion from the fire in fire box, F, and at the opposite end of the said furnace, A B C, are the fire box and dust collecting chambers communicating with the smoke stack.

A conically-shaped flue, H, extends from the dust chamber through the furnace head, to which it is fitted and firmly fastened, to a point corresponding with the line of junction between the cylinders B C, and its inner end is supported by a spider that encircles and radiates from the air pipe, M. This flue, H, revolves with the furnace, A B C.

[*Continued on page* 348.]



WITHERELL AND VARY'S FURNACE FOR ROASTING, DESULPHURIZING, AND CHLORIDIZING ORES.

NEW ORE ROASTING FURNACE.

(*Continued from first page.*)

At the feed end of the furnace, in rear of the fire box, F, on a supporting frame, is a blower, delivering air into an air receptacle, from which an air pipe is extended through the flue at the end of the cylinder A, and centrally through the cylinder nearly the whole length thereof. This pipe is plugged at its inner end, and is provided with many lateral openings for the escape of air. It is surrounded by a fire clay pipe or jacket larger than itself, so that an annular space is left between the two pipes for heating the air; and the pipe or jacket is constructed in sections, with spaces between their ends for the escape of air into the cylinder A; and sections are held in place by spiders that radiate to the inner surface of the cylinder A, and are there fastened. The inner end of the fire clay pipe is also closed against the escape of air. Another air pipe enters the opposite end of the furnace and extends to an air receptacle, L, in rear of the dust collecting chamber, and from thence a pipe extends horizontally through the fire box and chamber, G, into the pipe, M, which carries the products of combustion from the fire box, and which is surrounded for some distance by the flue, H, and cylinder C, and terminates in a cross pipe, that is open at both ends and projects in opposite directions through the pipe, M, and flue, H, discharging air into the cylinder C. This air pipe is held in place by an encircling spider.

Over the fire box, F, is a feed hopper, N, from which the ore to be fed into the furnace, A B C, falls into a trough, whence it is conveyed by a screw into a conductor, which directs it into the end of cylinder A, as indicated Through the wall of the dust collecting chamber, G, at the top is introduced a horizontal shaft, having on its inner end a propeller fan, which is located above the fire box, G, where the two chambers communicate with each other. This fan creates a draught through the furnace, A B C, to the smoke stack.

By means of the salt and chemical box at the top of the cylinder A, suitable reagents are introduced into the furnace, A B C. This box is in the shape of a section of a circle, and is fitted with its inner curve upon the outside of the cylinder A, against the end of the cylinder B.

As the ore is fed into the furnace, A B C, it falls to the bottom, is caught in buckets, and is carried up. After passing the central line of the cylinder it begins to fall in thin sheets, and continues to fall regularly until each bucket in turn becomes emptied. In falling the ore passes through the air and heat introduced into the cylinder A, and strikes upon the bottom of the cylinder a little in advance of its starting point, depending upon the inclination given to the said cylinder. The ore is then again carried up and falls, and this process is continued until it falls into the cylinder B. In its progress through cylinder A, it becomes gradually heated, and the sulphur and other volatile or inflammable substances contained in it are either burned or volatilized and the ore oxidized. Near the end of the cylinder A the ore is met by an increased temperature from the cylinder B and fire flue, M, by which the sulphates still remaining in the ore are decomposed. The salt or other chemicals introduced here unite in regulated quantities with the ore at each revolution of the furnace, A B C, and together they pass into the cylinder B, and are there thoroughly mixed and ground together by the action of the balls, and any agglutinated lumps of ore are thereby pulverized, and any remaining excess of sulphur or other volatile substance escapes. The ore then escapes from the action of the balls through the side orifices into the buckets in the cylinder C, where, when chlorine gas is used, the ore is exposed to its action, and if chlorine gas is not used the ore is completely oxidized by the action of the air admitted through the pipe, L. The ore is carried by the action of the buckets of the cylinder C to the gathering trough, whence it escapes through the discharge pipe.

◆

THE MISSISSIPPI RIVER.

There is, about this time, much discussion and conversation about the best mode of improving the river, with regard to the facilities of navigation, and protection of adjacent lands from overflows. It is well known that the river channel is constantly being filled up, so that if the levees should be raised six feet higher than heretofore, the time would come when they would be overflowed and washed away. What is wanted, therefore, is a deepening, and measurably straightening of the river channel. But this desideratum appears so enormously expensive as to be regarded as impracticable, especially as the channel might be liable to be again filled up and require redeepening.

Therefore there appears a necessity for the introduction of some system for the continuous deepening of the channel without any continuous expense.

The ordinary bed of the river is known to consist, to an indefinite depth, of fine soft earth or sand; and that whenever it is agitated a portion thereof is carried away by the current, which is much more powerful and effective at the bottom than at the surface, on account of the excessive weight of the water pressing upon it. If ten thousand men with long handled rakes were employed on each shore, to agitate and stir up the ground at the bottom, the water would carry off immense quantities of the earth, and deposit it in the great Gulf. Now, there is plenty of power in the current of the river itself to deepen its channel, if that power was judiciously applied to that purpose. But it is evident that no efficient apparatus could be applied to utilize this power without interfering with the navigation of the river, and requiring immensely expensive machinery. But there is another power, equally cheap, that might be applied for this purpose, and without encountering either of these great obstacles. Now, suppose the portion of the river most requiring improvement, to be one thousand miles in length; a chain of sufficient strength to lift 10,000 pounds may be furnished for five cents per foot, $260 per mile, $260,000 for the whole distance. Notwithstanding the crookedness of the river, the chain may be laid in sections averaging in length one mile each (some sections being four miles and others only 80 rods) in the bed of the river. At the end of each section of chain, and near one of the shores, there may be set a vertical iron pile, two or three inches in diameter, which may serve as an axle for a submerged octagonal wheel frame, over which two sections of chain may pass in the form of endless belts; and each section being endless, a double quantity, or 2,000 miles of chain, will be required, at a cost of $1,000,000.

These wheel frames, being submerged and near the shores, will be out of the way of passing vessels, even at low water. There must be a thousand of them, and they will cost, including the axle posts, ten dollars each. Upon the shore, and near each wheel frame, must be erected a planet wind wheel, of sufficient size and capacity to furnish an average of ten horse power, and connected to its respective wheel frame, by chain belts or wires, so as to give a moderate motion to the wheel frame and connected chain sections, when the wind wheel is in motion.

These chain sections will consist of links three feet long, and to the center of every tenth link will be attached a sheet iron cone, one foot long and six inches in diameter, pointing in the direction of its motion, so that the portion that is moving down stream will be aided by the current of water, while the cones that are moving up stream will encounter but slight aqueous resistance; so that if the chain was free from the frictional resistance of the bottom, it would be moved by the force of the water current.

These chain sections will constantly agitate and stir up the fine earth at the bottom, and in consequence the current will carry off an ounce per minute from each 30 foot section or cone, or by a more moderate estimate, one ounce per second from each mile of chain. This would amount to 5,760,000 pounds per day when in motion.

In many places, especially on sand bars, the chains would make two grooves six inches wide, and the current will enlarge them to several feet in width and depth within one week, and the two grooves or furrows would be worn into one, and continue enlarging until they would become the main channel. Moreover, the axle posts may be occasionally (once a year perhaps) removed, at trivial expense, and the chains would consequently take new ground, and the last chain at the Gulf may be extended into deep water, or diverge from the old channel, and take a short course into deep water, so as to shorten the distance by many miles, by forming a new main channel for the navigation of the river; for the winds will not fail, and a wheel frame may be located in the Gulf at any required distance from the shore.

These wind wheels, one thousand in number, will each present 2,700 feet of surface to the action of the wind, 900 feet of which will move square before the wind, and each will work ten horse power with a twenty mile breeze, and may be very permanently built for $200 each. They are not liable to damage by gales or hurricanes, and will last thirty years. The entire cost of the apparatus for 1,000 miles will not exceed $1,250,000; and in less than three years it will double the capacity of the river channel and secure the levees; and eventually, surely and infallibly, so enlarge the channel that there will be no occasion for levees anywhere upon the river.

Moreover, in several places the river channel may be straightened and shortened by extending the chains overland, where the distance is not more than ten or twelve miles, thus cutting off long and circuitous bends. The chains may be similar, but instead of the cones every link may have an attached button or disk, of one inch diameter, which will carry a small quantity of earth into the river at each end of the section. (Or by a series of transverse chains and wind wheels the earth may be piled up in mounds at intermediate points.) The ordinary motion of the chains may be supposed to be three feet, or one link per second, and each disk will remove and deposit half an ounce of earth at each end. The quantity removed would be 40,000 pounds per week, or 100 tons a year, to say nothing of the intermediate mounds. (Sixteen of these overland chains may be combined to carry off or pile up 1,600 tons a year.) These will work a ditch six feet wide down to the river, so as to allow the river water to run through, and thus facilitate the excavation; and the descent in the crosscut being much greater than that of the ordinary channel, the water will rush with greater force and eventually become the main channel of the river.

There is so little coarse sand or grit in the earth of the river bottom that the chains may be expected to last several years. It is not to be expected that the water will carry off all the coarse sand and gravel; but when a small new channel is formed the force of the water will be so much increased as to carry even small pebbles into the deepest places in the river. Pebbles of several pounds weight are often seen rolling down stream by the force of the current.

Captain Eads' system of jetties naturally tend to the washing away of the opposite bank of the river, thus increasing its crookedness and eventually filling up the deepened channel. But this new system of utilizing wind power will continue to improve the river and increase the value of adjacent lands, and will not be one-twentieth as expensive as the jetty system. Whatever objections may be surmised against it by interested parties, every scientific man who considers the subject will admit that it is, in the nature of things, the only possible way whereby the river channel can be prevented from filling up, and whereby the channel may be so enlarged and deepened as to prevent overflows and secure sufficient depth of water for all purposes of navigation, and especially through the most direct and shortest channel whereby the waters of the river enter into the Atlantic Ocean.

I am ready to furnish proper drawings and specifications to carry out the above work.

RUFUS PORTER.

New Haven, Conn., May, 1882.

NOTE.—When $1,500,000 worth of machinery is set in position, the natural pneumatic currents will aid the work by day and night, seven days in a week, to the average amount of four thousand horse power, which will be free of cost.

◆

THE NEW PATENT BILL.

To the Editor of the Scientific American :

I notice in this week's issue of the SCIENTIFIC AMERICAN an article titled "Nullification of the Patent Laws," and more than agree with you in your condemnation of the new Patent Bill, which seems to me grossly unjust. I am a poor but honest patentee; my invention is a good one, and perhaps ere long I may be compensated, in a measure, for the hard earned money and many days and nights of toil and anxious thought it has cost me. But, if this new bill becomes a law, what is to prevent my shopmate, if he is so disposed, from secretly manufacturing my improvement, disposing of the same in quantities to peddlers, and so flooding the market against me?

Or, again, what is to hinder any of the rich, unscrupulous corporations, of which there are several in this city, from privately arranging with some man of straw to make my patented device in numbers sufficient to fit up their shops with them, at a price which barely pays for their manufacture, and then to buy the goods from him in open market as a trader, sooner than pay me the small royalty I ask? What is my redress? To sue either the maker or the seller would be useless, even if he could be found, for they are men without means. But how about the public, or those rich corporations who are using and enjoying my invention? Ought they not to compensate me for the privilege? The new bill says not, and moreover gives them the right to continue the use of that which was stolen from me, and which the Government, for a consideration, distinctly gave me a title to. Surely this is neither law nor justice.

New York, May 27, 1882. FOREMAN.

◆

THE RECENT LAWSON BOILER EXPERIMENT.

To the Editor of the Scientific American :

The question asked by Mr. William Ord, in your issue of May 13, may be answered conclusively if he will admit the not unusual assumption that vapors obey the laws of Boyle and Gay-Lussac as if they were permanent gases.

A volume, v, of water, when converted into steam at a temperature of 212° F. and a pressure of one atmosphere, will occupy a space equal to 1,700 v. Raised to 400° F., at the same pressure, its expansion will be $1{,}700\times\frac{188}{671}=477\ v.$, and the total volume will be 2,177 v. If we compress this volume of steam isothermally into the limits of the boiler, which, in the absence of data, we will call $2v$, the pressure will rise to $\frac{2177}{2}=1{,}088\frac{1}{2}$ atmospheres. In other words, a pressure 68 times as great as that recorded would have been attained if all the water had been converted into steam.

This result may be corroborated by another method. If the density of steam at 212° F. and one atmosphere is $\frac{1}{1700}$ that of water, at 400° F. and 16 atmospheres its density is $\frac{16}{1700}=\frac{1}{106}$, by Boyle's law. The weight of the steam in the boiler will be to the weight of the water as 1:106, that is, $\frac{1}{107}$ of the water has been converted into steam, while $\frac{106}{107}$ remains as water.

With regard to the "point or degree of heat where all the water in a boiler will become steam" (the "critical temperature" of Dr. Andrews), Maxwell says, in his "Theory of Heat," p. 124: "The critical temperatures of most ordinary liquids are much higher than that of carbonic acid (87·7° F.), so that experiments on the critical state of ordinary liquids are difficult and dangerous. M. Cagniard de la Tour estimated the temperature of the critical state of water to be 773° F." In this experiment "the critical temperature was so high that the water began to dissolve the glass tube which contained it." Therefore, at a temperature of 773° F. steam cannot be condensed into water, no matter how much it may be compressed. L.

◆

A Mode of Hulling Wheat.

A Swiss process of removing the bran of wheat without loss of nutritive matter, consists in moistening the wheat before grinding with a solution of caustic soda in water. The solution is prepared by dissolving six and two-thirds pounds of caustic soda in one hundred and thirty-eight pounds of water. The steeping may be from fifteen to twenty minutes, and may be done in vats similar to those used by brewers. The caustic solution swells and loosens the hull proper, so that it may be removed by the slightest friction, leaving the gluten with the body of the grain.