

# UNITED STATES PATENT OFFICE.

A. K. EATON, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF PAPER-PULP FROM STRAW, &c.

Specification forming part of Letters Patent No. **41,982**, dated March 22, 1864.

*To all whom it may concern:*

Be it known that I, A. K. EATON, of the city, county, and State of New York, have invented certain new and useful Improvements in the Art of Manufacturing Paper-Pulp from Straw or other Vegetable Substances; and I hereby declare the following to be a full, clear, and accurate description thereof.

I first introduce the straw, either cut, ground, or whole, into a tank containing a boiling solution of caustic soda, having a specific gravity of about 1.06, and immediately subject it to the action of rubbing or grinding surfaces, for the purpose of separating longitudinally the fibers of the straw. It is essential that this mechanical action should begin in the incipient stages of the chemical action of the alkali, in order to economize time and strength of fiber by exposing the greatest possible amount of surface to the solvent. The process is continued until the material has been passed twice through the grinding apparatus, when the pulp is finished. The actual time of boiling required where it is accompanied by this mechanical treatment is only about one hour. If it is not convenient to grind within the tank, I first boil the straw for fifteen minutes, then transfer to the mill, grind it, and boil again for from fifteen to thirty minutes, following this by grinding again, &c. Two, or at most three, successive alternations of this chemical and mechanical treatment are sufficient.

The grinding may be accomplished by any suitable mill provided with grinding-surfaces which will not be attacked by hot-alkali. The large iron mills used for grinding spices answer a very good purpose. The mill should be of sufficient size to pass through large quantities in a short time.

Caustic potash or, better, a combination of potash and soda in the proportion of their chemical equivalents may be used instead of caustic soda.

The specific gravity of the alkaline solution may be reduced very considerably by giving more time to the boiling; but the gravity stated gives most satisfactory results whenever grinding is sufficiently rapid.

The pulp as it comes from the combined grinding and alkaline treatment is thoroughly drained to save the alkaline liquor, then washed, neutralized, and bleached in the usual

manner. The spent alkali resulting from this treatment is a dark-colored liquid, holding in solution the silica and other soluble matters of the straw, together with the soda of the original solution. This soda I reproduce in the following manner: The refuse liquor I first raise to the boiling-point, with milk of lime added in the proportion of two ounces of lime to one gallon of the liquor. This solution I boil for about thirty minutes, and then pass it through a filter consisting of alternate layers of caustic lime and coarse charcoal-powder. This will purify the liquor sufficiently for further use; but the gradual accumulation of impurities which are not wholly removed by this treatment makes it necessary, finally, to adopt a more thorough method of purification. This I accomplish by evaporating the liquor to one-fifth its original bulk, adding about one per cent. of carbonate of lime, one-fourth of one per cent. of nitrate of soda, and twenty-five per cent. of sawdust, charcoal-powder, peat, or other matter that will act as fuel. This mixture I make up into cakes, which are dried and burned. The resulting ashes consist principally of carbonate of soda, which is rendered caustic in the usual manner. The cakes above referred to may be used as fuel to evaporate other portions of the liquor.

The advantages resulting from my invention are:

First. By an immediate mechanical subdivision of the straw by grinding it in the incipient stages of the alkaline action the greatest possible amount of surface is exposed at once to the chemical action of the solvent, thus saving many hours' time, and obviating entirely the necessity of high pressures or temperatures above the boiling-point of the solution. An open tank is used.

Second. The material being most thoroughly reduced to its ultimate fiber by this process, the pulp may be bleached more readily and at less expense than hitherto.

Third. The time of treatment is so short and the temperature so low that the cellulose is not weakened, as in other processes.

Fourth. All the alkali, except a very small percentage, is saved, thus economizing what has hitherto been mostly a waste material.

Having now described the manner of making, applying, and practicing my invention, I disclaim the use of solutions at high tempera-

tures produced by steam-pressure in close boilers, or by the aid of superheated steam; but

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

1. Preparing paper-pulp from straw or other substances by subjecting it to a grinding process, commencing with the early stages of the treatment with hot alkalies, and continuing the grinding in connection with the alkaline treatment, in the manner and for the purpose herein described.

2. Purifying the alkali held in solution in the refuse liquor by passing it through a filter, constructed substantially as above described, sufficiently to enable me to use it again, and completely reproducing it, when necessary, by making it into combustible cakes, as set forth.

A. K. EATON.

Witnesses:

THOS. T. EVERETT,  
DAN. ROWLAND.