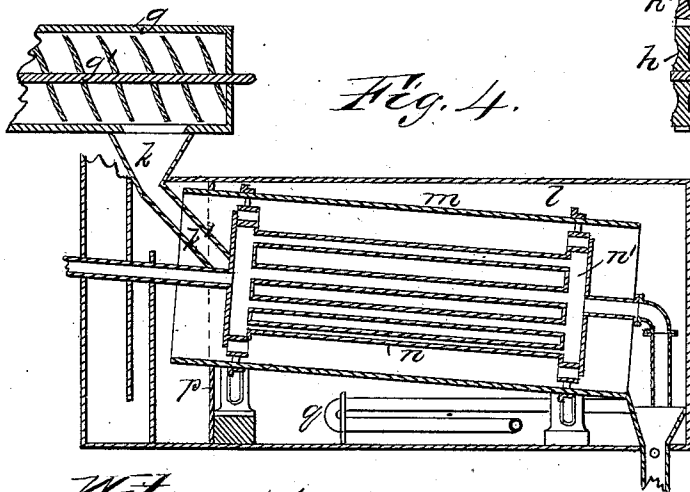
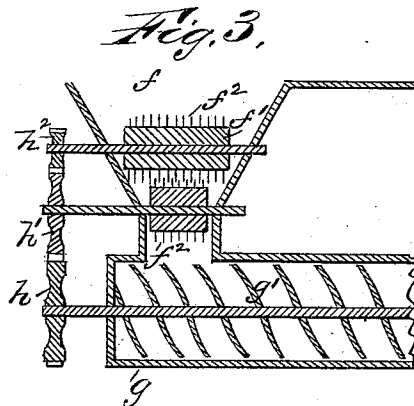
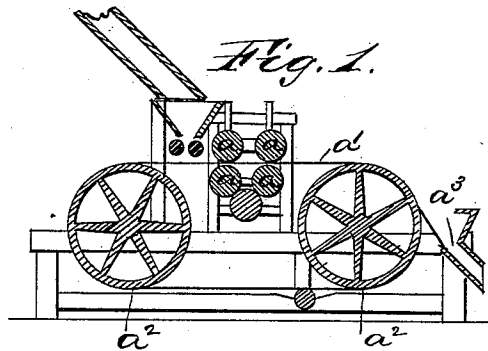
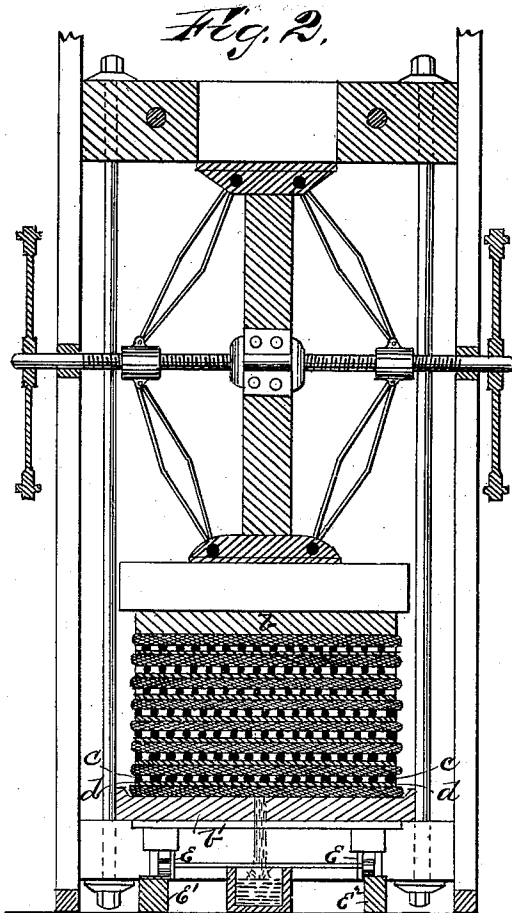


(No Model.)

E. ROAT & H. HAMLIN.
PROCESS OF AND APPARATUS FOR TREATING THE REFUSE OF STARCH
AND OTHER SUBSTANCES.

No. 254,240.

Patented Feb. 28, 1882.



Witnesses,
George H. Sonneborn
W. C. Button

Inventors,
Edwin Roat.
Harry Hamlin.
By John R. Bennett, atty

UNITED STATES PATENT OFFICE.

EDWIN ROAT AND HARRY HAMLIN, OF BUFFALO, NEW YORK; SAID ROAT
ASSIGNOR TO SAID HAMLIN.

PROCESS OF AND APPARATUS FOR TREATING THE REFUSE OF STARCH AND OTHER SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 254,240, dated February 28, 1882.

Application filed January 30, 1882. (No model.)

To all whom it may concern:

Be it known that we, EDWIN ROAT and HARRY HAMLIN, citizens of the United States, residing at Buffalo, in the county of Erie, State of New York, have invented certain new and useful Improvements in Processes of and Apparatus for Treating the Refuse of Starch and other Substances Manufactured from Grain; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Our invention relates to the treatment of what is known as the "refuse" or "tailings" in the manufacture of starch; glucose, or any other article produced in the treatment of grain by what is known as the "wet process." This refuse product consists of the husks and other portions of the grain which have been separated from the bulk or main portion of the starch in its process of manufacture. When the grain is subjected to wet grinding, as in the manufacture of starch and glucose, it has to be steeped in large tubs before passing through the mills. While in these tubs, and especially if allowed to remain too long therein, fermentation commences and organic acids are formed, which remain in the refuse or tailings after its separation from the starch upon the bolting apparatus. The presence of these organic acids in the refuse material, commonly known as "feed," rapidly causes fermentation and renders the feed utterly useless for the raising of stock.

The object of our invention is to remove these organic acids and enable the refuse matter or tailings to be utilized as animal food; and to that end it consists substantially in subjecting the wet refuse as it comes from the bolting apparatus to graduated pressure and heat, whereby the moisture is removed and the organic acids rendered innocuous.

Our invention further consists of certain combinations and arrangements of devices, by means of which our improved process is carried out.

In order that the invention may be under-

stood, we have represented in the accompanying drawings the mechanism which we have used in practicing the invention, and will proceed to describe the same.

The said mechanism comprises a set of elastic rollers for applying the first grade of pressure to the wet material, a press for applying the second grade of pressure to the material, disintegrating mechanism for disintegrating the caked material produced by the graduated pressure, drying mechanism for subjecting the disintegrated material to heat, and a feeding device for said drying mechanism.

In the drawings, Figure 1 is a sectional elevation of the elastic rollers and operating mechanism. Fig. 2 is a sectional elevation of the press. Fig. 3 is a vertical section of the hopper, disintegrating rollers, and one end of the feeding device; and Fig. 4 is a like section of the drier, showing its connection with the other end of the feeding device.

Referring to the drawings, *a a*, Fig. 1, are elastic rollers, arranged in one or more pairs, and caused to revolve by suitable gearing.

a' is an endless reticulated belt or carrier, preferably of wire-gauze, which is supported upon two pulleys, *a*², and passes between the rollers *a a*. The refuse or tailings which comes from the bolting apparatus, where it is separated from the main portion of the starch, is in a wet condition, and is by any suitable means carried to and fed upon the endless carrier *a'* in advance of the rollers *a*. As the refuse falls upon this endless carrier a portion of the water percolates through the openings in said carrier, and the refuse is carried upon such carrier between the elastic rollers *a a*, where a considerable amount of the remaining moisture is separated from the refuse by the squeezing action of the elastic rollers. The pressed material is carried from between the rollers by the carrier, and is delivered into the spout *a*³, from which it is delivered by gravitation. This first pressing operation leaves the refuse in a condition to be easily handled in preparing it for the press, in which it is placed after being passed between the elastic rollers.

Any press of sufficient capacity and power will suffice in carrying out the next step in our improved process. The press which we have selected to illustrate the way in which this next

step is performed is of well-known construction, in which *b* is the upper plate and *b'* the bed-plate. This press, as shown in Fig. 2, is operated by a pair of toggle-levers and a screw, which is turned by sprocket-wheels secured at either end.

The feed which is first subjected to the action of the press is arranged therein in the following manner: A cloth is laid upon the bed-plate *b'*, and a quantity of the moist feed which has been subjected to the elastic rollers is spread upon the cloth, and the ends of the cloth lapped over upon the feed, so as to completely cover it. On top of this layer is placed a grating consisting of a number of strips, *c*, secured together by cross-pieces *d*. These strips *c*, preferably of wood, are arranged with spaces between them to permit the escape of the water during the pressing operation. Upon these strips *c* is placed another layer of feed, inclosed in cloth as before, and so on until the number of layers have been arranged upon which the press is to act.

The bed-plate *b'* is mounted upon wheels *e e*, which travel upon the rails *e' e'*, and by means of which the feed, after being pressed, can be readily and quickly moved to the disintegrating mechanism.

The disintegrating mechanism used by us consists of the hopper *f* and of two disintegrating-rollers, *f' f'*, which are caused to revolve in the hopper, and are provided with teeth *f''*, which serve to disintegrate the lumps of feed which are dumped from the movable bed-plate *b'* into the hopper *f*. The feed drops from the hopper into the tubular chamber *g*, which, as shown in Figs. 3 and 4, extends from the hopper *f* to the drier. Within this chamber *g* is arranged the feeding device, which consists, as shown, of the screw-conveyer *g'*. This conveyer *g'*, together with the disintegrating-rollers *f' f'*, is revolved by the gear-wheels *h, h'*, and *h''*, which intermesh with each other, and are driven simultaneously by any suitable motor. The pressed feed, after falling from the hopper into the chamber *g*, is fed along such chamber by the screw-conveyer *g'* until it reaches the hopper *k*, into which it falls, and from which it is conducted down chute *k'* into the drier. This drier, which is shown in section in Fig. 3, is the one for which Letters Patent were granted to Edwin Roat, November 15, 1881, and which we have found to be well adapted for carrying out our process, although we do not deem this particular form of drier as absolutely essential to the perfect working of our invention, and other forms of driers might be substituted with advantageous results. This drier consists briefly of the inclosing-chamber *l*, within which revolves the cylinder *m*, having the system of steam-heated pipes *n*, and hollow drums *n' n'*, revolving with said cylinder. The feed as it falls upon the interior of the cylinder *m* is carried up by means of suitable buckets and dropped upon and between the heated pipes *n*. This operation is repeated

until the feed reaches the lower end of the cylinder, whence it falls into hopper *o* in a thoroughly dried and disintegrated condition. By means of the diaphragm *p* and coils of pipe *q* the radiated heat of the cylinder *m* and the heat of the condensed steam are utilized in the drying process, as fully explained in the above-named patent.

Our improved process is practiced with the above-described mechanism as follows: The wet refuse as it comes from the bolting apparatus is conducted to and upon the endless reticulated belt or carrier *a'*, and by means of such carrier is passed between the elastic rollers *a*, by which a portion of the moisture is extracted, leaving the refuse which has thus been subjected to the first grade of pressure in a condition to be easily handled in preparing it for the operation of the press in which it is subjected to the second grade of pressure, by which a large percentage of the remaining moisture is removed, and with it more or less of the organic acids and other impurities, which, if left in the wet material, would render it unfit for animal food. After the second pressing operation is completed the pressed layers or cakes from the press are run to the mouth of the hopper *f*, and are emptied from the cloths into the hopper. In passing between the disintegrating-rollers *f' f'* in said hopper the pressed material is broken up or disintegrated, and is dropped into the chamber *g*. It is fed along this chamber by screw, (which incidentally furthers the disintegration of the feed,) and falls into hopper *k* and through chute *k'* into the drier, in which it is subjected to the heat radiated from the steam-pipes. Its passage through the drier is slow, and, as all the particles are raised and dropped upon and between the pipes *n* a number of times during their passage through the drier, all the moisture and the impurities which can be carried off by it are thoroughly eliminated.

The mechanism above described may be modified as circumstances or the views of users of the invention render expedient. Thus, a press of different construction may be substituted for the press above described. The feeding device, also, may be dispensed with, and the disintegrating mechanism may be combined directly with the drier, so that the disintegrated matter is delivered wholly by gravitation to the drier. The feeding device, however, is advantageous, because it equalizes the rate of feeding the material to the drier, although the rate at which it is disintegrated may be irregular. Hence it is expedient to use the feeding device, or some substitute for it, between the disintegrator and the drier.

Previous to our invention the refuse has been passed between squeezing-rollers only, and has been sold in that condition; but as it then contains much moisture the fermentation, which very soon ensued and which was often present in the feed when it was sold, rendered it unfit to be used as food for animals. By our

improved process we are enabled to so prepare this feed that it can be kept in a pure and wholesome condition for a long time before being fed to animals, and can be shipped with safety to all parts of the country without fear of deterioration from moisture due to natural causes.

We claim as our invention—

1. The process, substantially as before set forth, of preparing animal food from the refuse of the starch-manufacture by subjecting the wet material to graduated pressure, disintegration, and heat, substantially as before described.

2. The combination, substantially as before set forth, of the disintegrating mechanism and the drying mechanism.

3. The combination, substantially as before set forth, of the disintegrating mechanism, the feeding device, and the drying mechanism.

4. The combination and arrangement of mechanism for operating upon the wet refuse of the starch-manufacture, comprising the elastic rollers by which the first grade of pressure is applied, the press by which the second grade of pressure is applied, the disintegrating mechanism, the feeding mechanism, and the drying mechanism, all substantially as before set forth.

In witness whereof we have hereunto set our hands this 22d day of December, A. D. 1881.

EDWIN ROAT.
HARRY HAMLIN.

Witnesses:

C. D. ELLIS,
W. H. THORNTON.