No. 758,664. PATENTED MAY 3, 1904.

R. E. KIMBALL.

PROCESS OF HULLING RICE.

APPLICATION FILED MAR. 12, 1903.

NO MODEL.

Fig. 2.

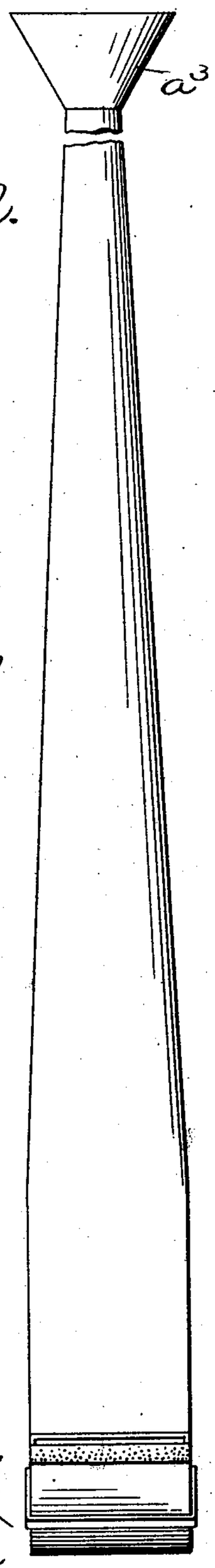


Fig. 3.

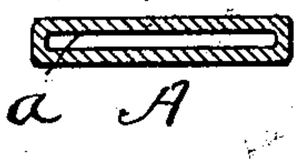
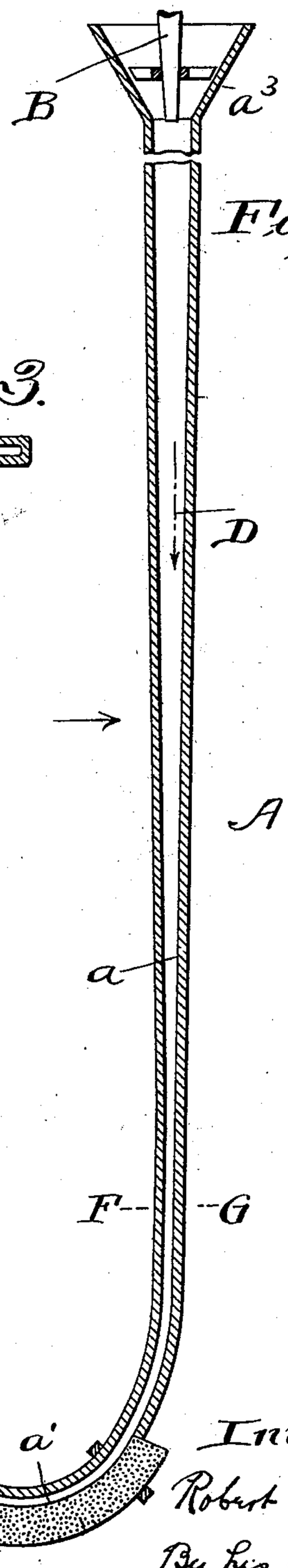


Fig. 1.



Witnesses
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Inventor:
Robert E. Kimball,
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No. 758,664. Patented May 3, 1904.

UNITED STATES PATENT OFFICE.

ROBERT E. KIMBALL, OF CLEVELAND, OHIO, ASSIGNOR OF TWO-THIRDS TO L. H. WEBB AND E. L. THURSTON, OF CLEVELAND, OHIO.

PROCESS OF HULLING RICE.

SPECIFICATION forming part of Letters Patent No. 758,664, dated May 3, 1904.

Application filed March 12, 1903. Serial No. 147,399. (No specimens.)

To all whom it may concern:

Be it known that I, ROBERT E. KIMBALL, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Processes of Hulling Rice, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The removal of the husks or hulls from rice without breaking a large percentage of the rice-kernels is a problem which has not heretofore been solved. This has been due, primarily, to the peculiar relative characteristics of the rice-kernel and its hull. The former is very brittle, while the hull is tough and elastic.

The greater part of the rice grown in the world is hulled to-day, as it has been for ages, between millstones. This process is defective, because a large part of the rice is not hulled by one passage between the stones and, further, because a large proportion of the kernels which are hulled are broken.

In very recent times the use of machines has been begun for hulling rice, and some of these machines are efficient in a profitable degree, because they do slightly increase the percentage of rice which is hulled and they do slightly reduce the percentage of broken kernels.

The object of this invention is to rapidly hull a large proportion of the rice treated without any breakage worth considering. In practicing the invention with an efficient apparatus a very large percentage of the rice may be hulled by one operation, and the percentage of breakage will be so small as to be practically negligible.

The invention is a process which consists, generically, in imparting rapid motion to the hull-covered rice-kernels and in then suddenly checking the forward movement of the hulls only, whereby the inertia of the inclosed kernels causes them to press onward and burst the hull and escape therefrom. The necessary rapid motion I give to the hull-covered rice by means of an air-blast impelling it along a channel of considerable length, so that the movement of the rice has time to become greatly accelerated. This is also included within my invention.

Finally, the invention consists also in the process, when carried out more specifically in accordance with the following specifications, as definitely set forth in the claims.

In the practice of the process some apparatus is required, as is the case in all processes in which air-blasts are employed, because it is necessary to have ducts or conduits for efficiently guiding the air and restraining it from dissipating its force in useless directions.

The drawings represent a simple apparatus capable of use in the practice of the process. This apparatus is, however, only one form of apparatus which may be employed for the practice of this process.

Figure 1 of the drawings is a sectional side elevation of said apparatus. Fig. 2 is a view thereof in the direction indicated by the arrow of Fig. 1, and Fig. 3 is a sectional view on line F G of Fig. 1.

Referring to the parts by letters, *a* represents the smooth surface along which the hull-covered rice is caused to slide by means of an air-blast coming from the nozzle B, and *a'* represents a frictional retarding-surface, which is of concave form and, though deflecting, is a practical continuation of said smooth surface. In the apparatus shown these two surfaces constitute the inner surface of the rear wall of a tube A, by means of which the air-blast is confined and properly guided, and at the upper end of this tube there is a hopper a^3, through which the hull-covered rice is fed into this tube.

The apparatus is comparatively long to allow the rice to become sufficiently accelerated under the force of the blast, an intermediate portion of the tube being broken out in the drawings. The length of the tube and the

force of the blast will vary greatly with the grade of the rice and other circumstances; but I may say, just by way of illustration, that I have successfully employed a tube one inch in diameter (at its cylindrical part) and fifteen feet long with an air-blast of about thirty pounds to the square inch. If one desires to hull the greatest percentage of the rice with the least percentage of breakage, it is necessary that the rice shall slide in a single-thick stream along this smooth surface, and by "single-thick" stream is meant a stream whereof substantially every kernel slides upon this surface. This single thickness of the stream may be brought about by allowing only a small quantity of rice to flow through the tube or by sufficiently widening the surface *a* and *a'* to take care of all the rice which does flow or by arranging that wall of the tube that opposes the smooth surface so close thereto that there remains between them only room enough for the passage of one rice-kernel. Some expedient must also be adopted to cause said rice to be projected against said smooth surface in such wise that it will not be broken and will not rebound and will hold itself against said surface as it goes forward. I prefer to secure these results by directing the air-blast against said smooth surface at a very acute angle, as indicated in Fig. 1 of the drawings, wherein the arrow D indicates the direction of the air-blast. When the rice carried by the air-blast meets this surface, there is no danger of breakage or of any rebounding, and thereafter the inertia of the rice holds it against this surface as the air-blast carries it along.

The concave frictional retarding-surface must be a practical continuation of the smooth surface, so that the rice in passing from the smooth surface onto this retarding-surface does not sensibly change its direction of travel. The rice-hull as it passes onto this retarding-surface is checked in its movement, and checked so suddenly that the inclosed rice-kernel by its own inertia forces its way out of the hull, which it splits in so doing. This frictional retarding-surface may be made of carborundum, which is believed to be the best surface for the purpose. It may, however, be made of stone, vulcanized rubber, or emery cloth or any other material having the necessary characteristics. This surface, however, must not have any projections high enough to get in front of the rice-kernel or any part thereof as it slides along over the surface. If the rice did strike such a projection, the kernel would generally be broken, and, moreover, the forward movement of said kernel would probably be checked thereby, so that it would not force its way out of the hull. This surface should preferably be a concave surface of increasing curvature toward the discharge end. Thereby the liability of the rice to fly from the surface is lessened, because the inertia is more effective in holding it on such surface while the described action takes place.

As heretofore stated, the apparatus shown is so constructed that the inertia of the rice holds the same against the smooth and frictional surfaces; but the desired result might be secured by locating the front wall of tube so close to said surfaces that the rice would be constrained to slide thereon.

Having described my invention, I claim—

1. The herein-described process of hulling rice, which consists in propelling the hull-covered rice, by means of an air-blast, in a single-thick stream, along a smooth surface, and thence onto a frictional retarding-surface, which is a practical continuation of said smooth surface for the purpose set forth.

2. The herein-described process of hulling rice, which consists in propelling the hull-covered rice, by means of an air-blast, in a single-thick stream, along a smooth surface, which crosses the direction of the blast at a very acute angle, and thence onto a deflecting frictional retarding-surface, which is a practical continuation of said smooth surface, for the purpose set forth.

3. The herein-described process of hulling rice, which consists in rapidly propelling the hull-covered rice, by means of an air-blast, along a smooth surface, and, thence, onto a deflecting frictional retarding-surface, which is a practical continuation of said smooth surface, for the purpose specified.

4. The herein-described process of hulling rice, which consists in imparting rapid movement to the hull-covered rice by means of an air-blast, and then suddenly checking the movement of the hull only, whereby the inertia of the inclosed kernel causes it to burst the hull and force its way out of the same.

5. The herein-described process of hulling rice consisting of impelling the hull-covered berry along a channel of sufficient length to permit it to acquire a high velocity, and suddenly checking the hull whereby the inertia of the inclosed kernel causes it to burst the hull and force its way out of the same.

6. The herein-described process of hulling rice consisting in accelerating the movement of the hull-covered berry until it has attained a high velocity and then suddenly checking the hull, whereby the inertia of the inclosed kernel causes it to burst the hull and force its way out of the same.

7. The herein-described process of hulling rice which consists in impelling the hull-covered rice at a rapid rate in a substantially single-thick stream along a smooth surface

and thence onto a deflecting frictional retarding-surface.

8. The herein-described process of hulling rice which consists in propelling the hull-covered rice by means of an air-blast onto and along a smooth surface which crosses the direction of the blast at a very acute angle and thence onto a frictional retarding-surface which is a practical continuation of said smooth surface.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

ROBERT E. KIMBALL.

Witnesses:

E. B. GILCHRIST,

E. L. THURSTON.