J. B. TOUFFLIN.

Process of and Apparatus for Reducing Grain in Vacuo.

No. 213,471 **Patented Mar. 18, 1879.**

Fig. 1.

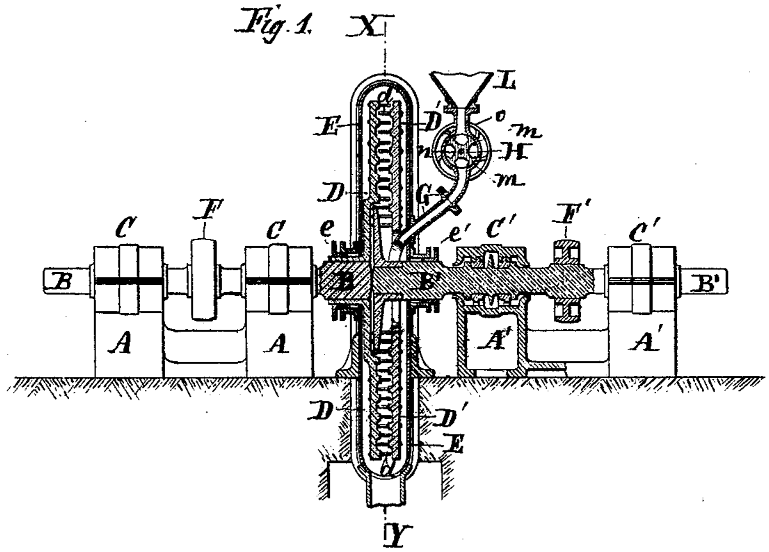
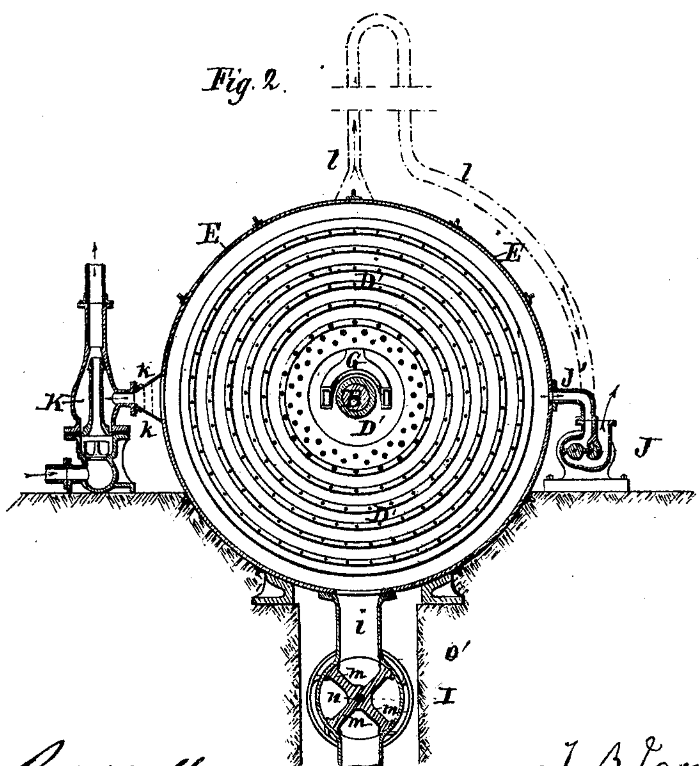


Fig. 2.



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IMPROVEMENT IN PROCESSES OF AND APPARATUS FOR REDUCING GRAIN IN VACUO.

Specification forming part of Letters Patent No. **213,471**, dated March 18, 1879; application filed October 15, 1878; patented in England, July 30, 1878.

To all whom it may concern:

Be it known that I, JEAN BENJAMIN TOUFFLIN, of Paris, in the Republic of France, have invented certain new and useful Improvements in Reducing Grain and other Substances, and in the apparatus employed therein, of which improvements the following is a full, clear, and exact description.

This invention relates to apparatus in which the pulverization or reduction to flour or powder of grain, seeds, or granular substances of any description is effected by percussion, in lieu of by grinding or crushing—that is to say, by means of beaters acting upon the grain or granular substances while in the act of falling, or while they are being projected through the apparatus.

In disintegrators or pulverizing apparatus of every description (whether with a vertical or horizontal axis) the following phenomena are produced when the said apparatus are caused to rotate in their cases, which are usually of considerable size, videlicet: The motion of the plates or disks which carry the bars or beaters in circular rows, thus forming a series of cages, causes air to be drawn in through the feeding-hopper, through the opening for the discharge of the flour, and in some cases through the hollow shafts on which are mounted the disks carrying the beaters. This air is then forced out into a passage provided for the purpose, and usually placed on the top of the case of the apparatus.

Experience has shown that under these conditions the greater part of the motive power is absorbed by the mere setting of the beaters in motion, even when the apparatus is running empty.

In order to reduce the amount of the power thus expended in driving the apparatus, it is necessary to remove, as far as practicable, one of the principal causes of this expenditure of power—that is to say, the resistance of the air to be displaced—which object the said invention is designed to effect; and in order that the said invention may be fully understood, I shall now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on the accompanying sheet of drawings, which illustrate an apparatus constructed and arranged in accordance with the said invention, and more particularly applicable to the reduction of corn to the condition of flour.

Figure 1 represents a part longitudinal section and part elevation of the apparatus, and Fig. 2 is a transverse section of the same.

Two shafts, B B′, are employed, placed end to end, supported on frames A A′, and rotating in opposite directions in bearings C C′, of peculiar construction, enabling the shafts to be regularly and constantly lubricated even when rotating at high rates of speed. The ends of the shafts, which are in juxtaposition, carry disks D D′, upon which the cages or beaters *d d* are fixed in concentric rows, rotating in a case, E, strengthened externally by angle-irons made to fit as closely as possible over the said disks. The shafts are passed through stuffing-boxes *e e′* in the side of the case.

The shafts are driven by pulleys F F′, which are keyed upon them and caused to rotate in opposite directions by a belt carried over the main driving-shaft. The case E is connected to a hopper, L, for containing the substance to be treated by means of a tube, G, bifurcated at the end within the case, so as to deliver the substance at the center of the cage, and provided with an apparatus for excluding air at the other end, where it is connected to the hopper. This apparatus consists of a cylinder, H, divided into several approximately air-tight compartments by radial partitions *m*, attached to a shaft, *n*, passed through the center of the cylinder, and caused to rotate by a pulley, O, driven by a belt connected to the main driving-shaft.

As each compartment is presented in turn to the aperture at the bottom of the hopper L it is filled with the grain or other substance to be pulverized or reduced, and as it continues to rotate it carries the same round to the aperture on the top of the feed-pipe G, into which its contents are discharged, while all air, except that which is contained in the interstices of the grains or granules, is effectually excluded.

A similar arrangement is provided for the discharge of the flour or pulverized substance through a pipe, *i*, at the lower part of the case for excluding air at this point, this apparatus

being likewise actuated by a belt and pulley, O′, driven by the main driving-shaft.

A more or less perfect vacuum is maintained within the case by means of a pump, J, Fig. 2, on what is known as Greindl's system, connected to the case by a pipe, *j*, and actuated by the main driving-shaft; or an ejector, K, Fig. 2, provided with a check-valve, may be employed for effecting the same object by means of a jet of steam obtained either direct from the boiler or from the exhaust-pipe of the engine.

The air within the case being continually exhausted and rarefied by the action of the Greindl pump or ejector, the injurious resistance hereinbefore referred to is considerably reduced, if not completely obviated.

It is evident that air may be exhausted from the chamber in which the cages rotate by means of apparatus other than those hereinbefore specified—such, for example, as ordinary air-pumps. The air may also be exhausted through hollow shafts; or the outlet or outlets for the air may be situated at any part of the case which may be found most convenient, according to circumstances, and the said outlets may be provided with wire-gauze diaphragms, as shown at *k k*, Fig. 2, in a conical chamber which will not impede the passage of the air, while the wire-gauze prevents the escape of the flour; and for the same purpose the pipe through which the air is exhausted may be made siphon form, as shown in dotted lines at *l l*, Fig. 2; or the apparatus described for the discharge of the flour may be replaced by a powerful fan, exhausting the air within the case, and delivering the flour to a bolting apparatus, which will thus be enabled to work easily and economically under pressure.

This improved pulverizing or disintegrating apparatus working in a rarefied atmosphere possesses other important advantages besides the great saving in motive power. The rarefaction or exhaustion of the air in the chamber in which the cages work has the effect of considerably reducing the temperature in the said chamber and maintaining it at a very low degree, which, in the production of flour or meal in general, and corn or wheat and flour in particular, is a most important object. This rarefaction or exhaustion of the air also has the effect of facilitating the free fall or projection of the grains or granules, also of promoting the evaporation of the water contained in the grain, so as to greatly facilitate its decortication.

Moreover, the last-named effect of the rarefaction or exhaustion of the air enables dry meal or flour to be obtained direct from the mill, and, consequently, in the best possible condition for its transportation or preservation.

The said invention is applicable to disintegrators generally constructed upon the principle of that hereinbefore described, and illustrated in the accompanying drawings, whether with vertical or horizontal axes, either solid or hollow, and with any required modifications in the details of construction.

Having now described and particularly ascertained the nature of the said invention, and the manner in which the same is or may be used or carried into effect, I would observe in conclusion that what I consider to be novel and original, and therefore claim as my invention, is—

1. The method of reducing grain and other substances by the action of beaters in a vacuum or partial vacuum, substantially in the manner and by the means hereinbefore described.

2. The combination, with a disintegrator or apparatus for reducing grain and other substances by the action of beaters, of mechanism, as described, for making and maintaining in said disintegrator a vacuum or partial vacuum, substantially as set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

J. B. TOUFFLIN.

Witnesses:
EMILE BARRAULT,
AUG. VINCK.