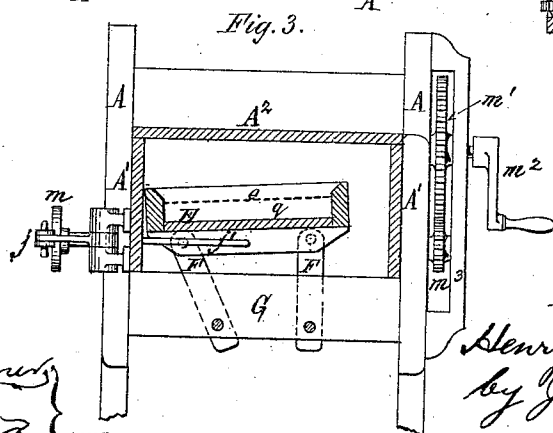
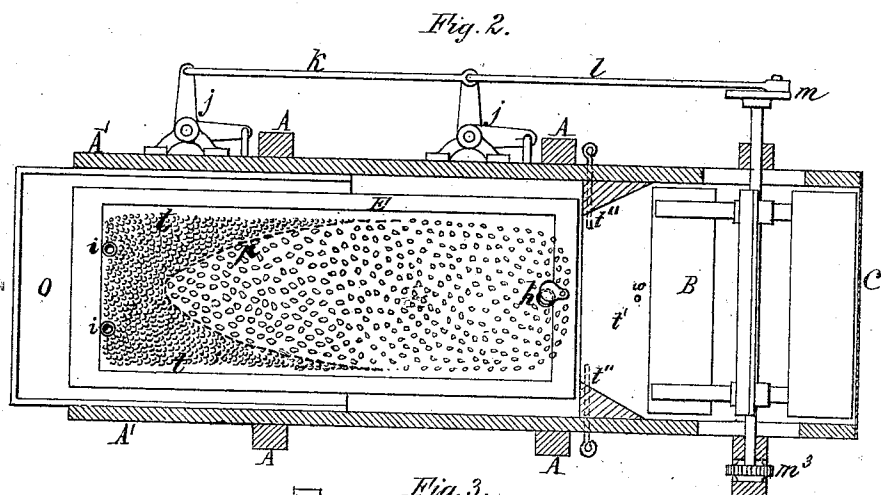
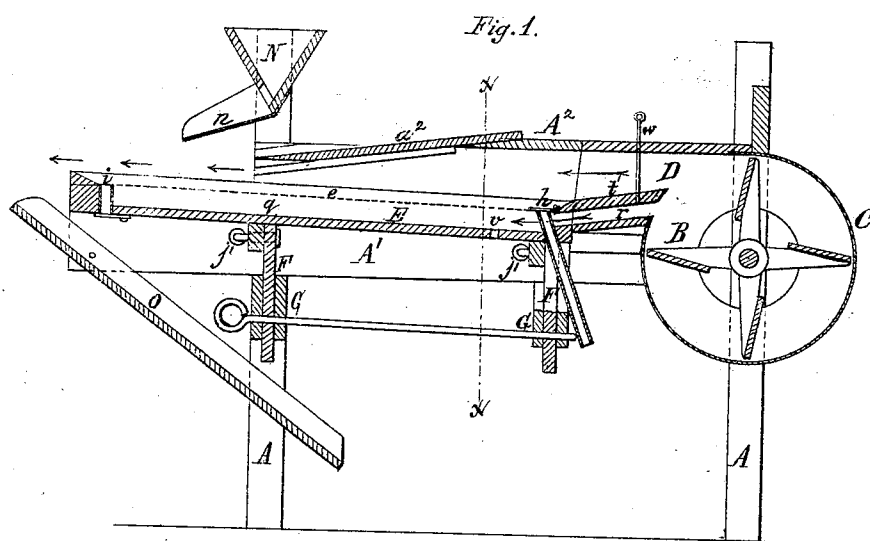


Machines for Separating Rice.

Patented Nov. 18, 1873.



John J. Bonner }
Geo. J. Metzger. }

Witnesses.

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UNITED STATES PATENT OFFICE.

HENRY B. STEVENS, OF BUFFALO, NEW YORK, ASSIGNOR TO GEORGE L. SQUIER, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR SEPARATING RICE.

Specification forming part of Letters Patent No. **144,803**, dated November 18, 1873; application filed July 30, 1873.

To all whom it may concern:

Be it known that I, HENRY B. STEVENS, of the city of Buffalo, in the county of Erie and State of New York, have invented certain Improvements in Machines for Separating Rice and other Grains and Seeds, of which the following is a specification:

My improved machine consists principally of a fan and a table provided with a roughened surface inclining slightly upward from the mouth of the fan, and having a lateral vibratory or oscillating motion, whereby the grain, which is fed onto the upper end of the table, is separated into two portions, one portion working by gravity down the surface of the table, while the larger, lighter, and rougher portions work to the surface and edges of the mass of grain on the table, and are gradually carried by the air-current up the inclined surface of the table toward the opposite end thereof, as hereinafter more fully set forth.

In the accompanying drawings, Figure 1 is a longitudinal vertical section of my improved machine; Fig. 2, a horizontal section, showing a plan of the table; and Fig. 3 is a transverse section on line *x x*, Fig. 1.

Like letters of reference designate like parts in each of the figures.

A is the frame of the machine. B is the fan; C, the fan-case, and D the mouth thereof. E is the table, supported by four arms, F F, pivoted at their upper ends to the under side of the table, and at their lower ends to cross-bars G of the frame. The required roughened surface to the table is represented in the drawings as consisting of a sheet of wire-cloth, *e*, arranged above the table proper, the meshes of the cloth being too fine to permit the passage of the grain through them. *h* is a hole at the center of the front end, and *i i* two holes at the rear end on each side of the center, closed by suitable valves, through which the two qualities of grain are discharged, as will be presently explained. The table is operated by means of two bent levers, *j j*, pivoted to the side-boards A¹ of the frame, the inner arms being connected to the table by a rod, *j'*, while the outer arms are connected by a rod, *k*, and are operated by a pitman, *l*, con-

necting with a crank, *m*, on the end of the fan-shaft. A spur-wheel, *m'*, (driven by a crank, *m''*, when the machine is operated by hand,) gears with a pinion, *m'''*, on the fan-shaft, by which the fan and connecting parts are actuated. N is the feed-hopper, pivoted between two uprights of the frame, and *n* a spout attached rigidly thereto, and composed of some thin and elastic sheet metal which will vibrate slightly while the machine is in operation, and thus insure a more uniform feed of the grain onto the table. The amount of the feed is regulated by tilting the hopper and spout, which may be held in place by using set-screws for the pivots of the hopper, or by any other suitable means. O is a tail-board, arranged at the rear of the machine, after the manner of the tail-board in a common fanning-mill, and is designed to catch any light kernels of grain that may be blown over the end of the table with the chaff and other refuse. The table E is inclosed at the sides and top in a sort of casing formed by the side-boards A¹ A¹ and a top board, A², the rear portion *a''* of which is preferably made to adjust to and from the table, so as to increase and lessen the space above the table, and thereby regulate the force of the air-current over the rear portion of the table.

In the drawing, this adjustable board is made to slide in inclined ways, although it may be hinged at its front end to the board A², so as to leave the rear end free to be adjusted vertically, by which the air-space can be regulated in a similar manner.

In hulling rice, the hulls of a portion of the grains are much more difficult to remove than that of the others, and in endeavoring to hull these grains much of the best rice already hulled is broken, worn, and injured. The need of a machine which would effect a separation of the hulled from the unhulled grain, so as to avoid this injury and breakage of the hulled grains, has long been felt; but such machine, so far as I am aware, has hitherto never been devised.

In separating the hulled grains of rice from the unhulled after they have passed through the huller, for which purpose my machine is specially designed, the grain is gradually fed

onto the table through the hopper N, or a limited quantity is placed on the rear end of the table, and the machine set in motion by turning the crank which operates the fan. The lower ends of the arms which support the table being pivoted at a less distance from each other than the upper ends, a peculiar oscillating or rocking motion is imparted to the table, which causes the grain to form a longitudinal layer on the central portion of the wire-cloth, instead of spreading evenly over the whole surface. The roughened surface produced by the wire-cloth serves to agitate the grain as the table oscillates, which causes the hulls and larger and rougher unhulled kernels to work to the top of the layer or mass of grain, when the hulls and other light refuse is blown over the tail end of the table. The unhulled grains are, by the movement of the table, gradually worked laterally to the edges of the layer, where the air-current, operating with less obstruction, carries with it these unhulled grains backward toward the tail of the machine, while the smoother and smaller hulled kernels which remain at the center of the table work by gravity down the inclined surface of the table underneath the upper and unhulled grains, which serve to also, in a measure, protect the hulled kernels from the action of the air-current. The machine being operated for a short period of time, the hulled grains will be found to have assumed a position at the lower or inner end of the table, and in a layer extending along the center of the table toward the rear end, where it diminishes in width, as is represented by the dotted line *p* in Fig. 2, while the unhulled grain will be found at the tail end of the table, overlapping the rear end of the layer of hulled grain, and extending along the sides thereof toward the inner end of the table, as represented at *t t* in the same figure.

The inclination of the table can be adjusted by raising or lowering the rear end of the machine, or in any suitable manner, as may be required. For separating rice, an inclination of one quarter to one-half an inch to the foot I have found to be sufficient. The inclination required will vary, according to the kind, condition, and quantity of the grain, and the facility with which it works down the table against the opposing air-current, light grain requiring a greater inclination of the table than more heavy grain.

In a machine having a table fifty-four inches in length by eighteen inches in width, I have found from experiment that from eight to ten quarts of grain can be allowed on the table at one time, which will form, in a machine constructed as shown in the drawing, a layer of from one to one and one-half inch in thickness at the center, which gradually diminishes in thickness toward the edges, leaving a small portion of the table on each side free from the passage of the unhulled grains as they work to the edges of the layer, where

they receive the full force of the air-current, which carries them backward with it toward the tail of the machine.

When only a limited quantity of grain is required to be separated at one time, as is the case with machines for separating rice designed for family use, a specified quantity, according to the size of the machine, can be placed at once on the rear portion of the table, with the discharge-apertures closed, and the machine set in motion and operated until the required separation of the hulled from the unhulled grains has taken place, when the hulled rice can be removed from the front or inner end of the table and the unhulled from the rear end, leaving a portion toward the rear end, which will contain a mixture of hulled and unhulled grain.

In establishments where rice is prepared for the market in considerable quantities, after the first quantity of grain placed on the table has been separated, as above described, the central front hole *h* and lateral rear holes *i i* are opened to a sufficient degree to permit of the escape of the hulled and unhulled grain through their respective discharge-apertures, while a quantity of the mixed grain can be gradually let onto the rear portion of the table from the feed-hopper, the size of the discharge-apertures and the amount fed onto the table being regulated according to the capacity of the machine for separating the grain.

The valves and feed can be readily regulated by an attendant who observes the condition of the grain on the table.

The manner of supporting the table shown in the drawings imparts to the table, when the machine is operated, a peculiar rocking motion, which causes the grain to form in a layer along the center of the table, as required, in order to attain the best results, and most efficient action of the machine.

It is evident that the table may be suspended by arms similar to F, arranged above the table, and still impart the same motion to it as when the arms are arranged underneath the table, as shown in the drawings.

By supporting the table by means of a single arm rigidly secured to the table at or near each end, and pivoting said single arms centrally under or over the table, so as to cause the latter to oscillate from a single point as a center, the grain on the table will be more evenly distributed over the surface thereof, and a comparatively good separation may be attained thereby.

By making the surface of the table slightly concave, so as to cause the central portion thereof, in the line of its length, to be slightly depressed, still better results can be attained, although I prefer the mode of support shown in the drawings, or some other mode by which a similar movement as first described is imparted to the table. The surface of the table may be roughened in any suitable manner, and although the tight bottom of the table underneath the wire-cloth is not essential, yet

I prefer to use such tight bottom and wire-cloth arranged above it, as shown in the drawings, so as to leave a space between the two, with a passage controlled by a valve leading from the fan thereto.

In separating oats from wheat and other similar grains, it is sometimes the case that the grains get stuck endwise in the fine meshes of the wire-cloth.

To obviate this difficulty this tight bottom, with the space between it and the wire-cloth, is useful, for a current of air diverted through the passage *r* under the wire-cloth is forced up through the meshes and dislodges any grains that may have become entangled therein. This current of air forced up through the meshes also assists to agitate and separate certain kinds of grain, and grain in certain conditions.

By making a delivery-hole, *v*, in the tight bottom, it becomes useful in gathering small seeds and broken pieces that may riddle through the meshes of the wire-cloth. The passage *r*, through which air is conducted to the space *q*, may be formed by the valve or partition board *t*, hinged in the rear end of the passage *D*, as shown at *t'*; and by attaching to the front end of this valve a rod, *w*, extending upward to the top of the machine, the passage *r* can be closed or regulated, as may be desired. The air-current used in connection with the vibrating table may be induced either by blast or by suction, and any of the well-known means employed for producing an air-current, such as a suction or blast fan, pump, &c., may be used for the purpose in my improved machine.

What I claim as my invention is—

1. In a grain-separator, the combination, with a fan or equivalent means for producing an air-current, of an inclined table provided with a roughened surface and suitable mechanism for imparting to it a vibratory or rocking motion, so as to cause the two kinds of

grain to be separated to work in opposite directions on the table, substantially as and for the purpose hereinbefore set forth.

2. In combination with a face and roughened table, the supporting-arms *FF*, arranged at the end of the table and pivoted, as described, so as to produce such a motion as will cause the mass of grain agitated thereon to work in a thickened layer centrally and longitudinally of the table, while the rough and unhulled kernels are thrown to either edge of the layer, so as to be carried backward by the blast, the hulled kernels working down the incline in the opposite direction, as hereinbefore described.

3. The combination, in a grain-separator, and with the fan *B*, of the air-passage *r*, and an inclined table provided with a roughened wire-cloth or other perforated surface, *e*, and tight bottom *E*, arranged so as to leave a space, *q*, between the latter, substantially as and for the purpose hereinbefore set forth.

4. The combination, with a fan and roughened inclined separating-table, of the central discharge-aperture *h* at the lower end, and the discharge-apertures *i i* at the upper end, of the table, as and for the purposes hereinbefore set forth.

5. The combination, in a grain-separator, of the pivoted hopper *N*, provided with the thin sheet-metal spout *n*, and set-screws for holding it in place after it is adjusted, whereby a regular and proper feed is effected by the tremulous motion imparted to the spout by the jar of the machine, as hereinbefore set forth.

6. The combination, in a grain-separator, and with the fan and oscillating table, of the adjustable deflecting-board *a'*, for regulating and directing the air-current, substantially as hereinbefore set forth.

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Witnesses:

JNO. J. BONNER,
CHAS. E. MASON.