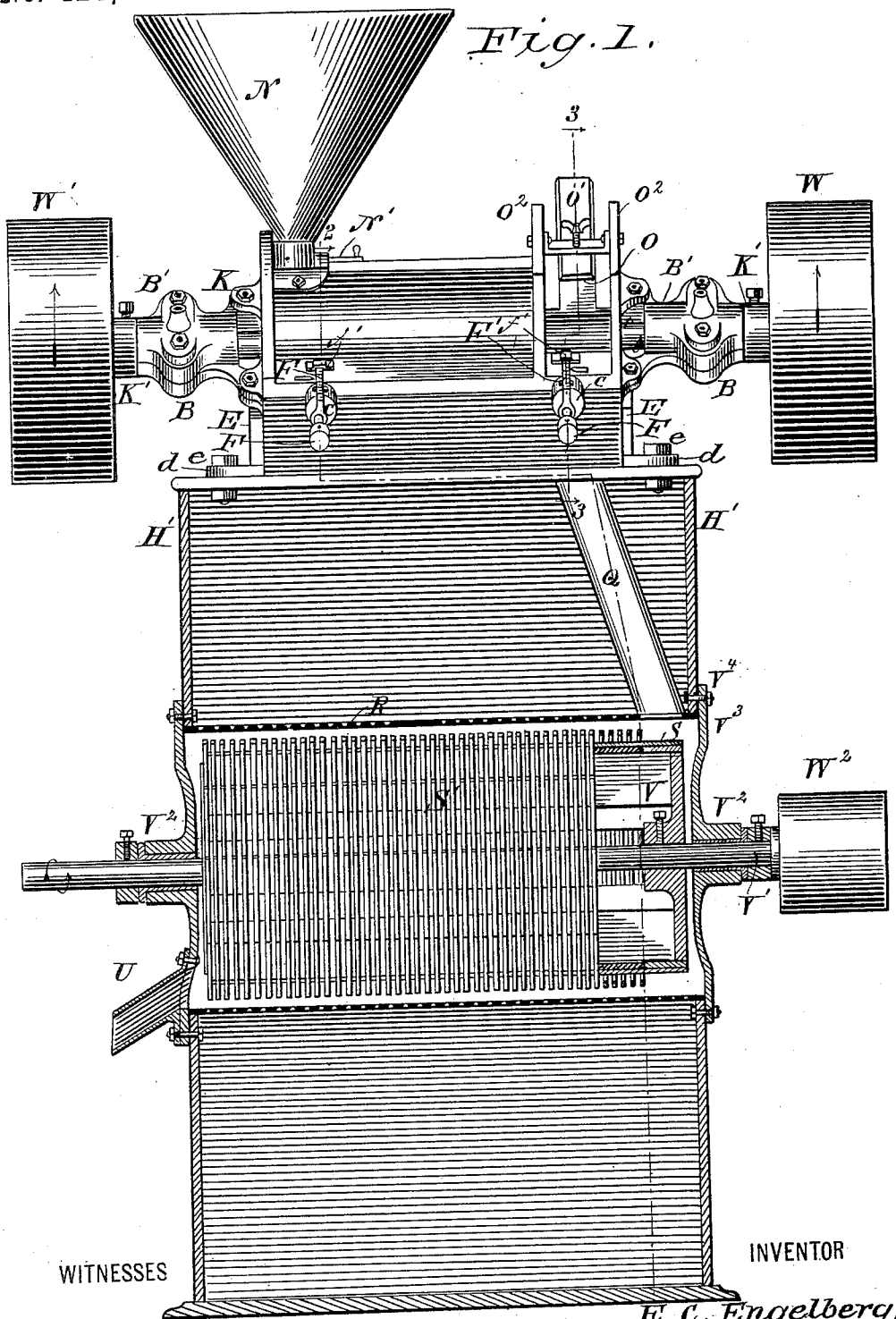
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E. C. ENGELBERG.

MACHINE FOR HULLING, CLEANING, AND POLISHING RICE.

No. 424,602. Patented Apr. 1, 1890.

Fig. 1.



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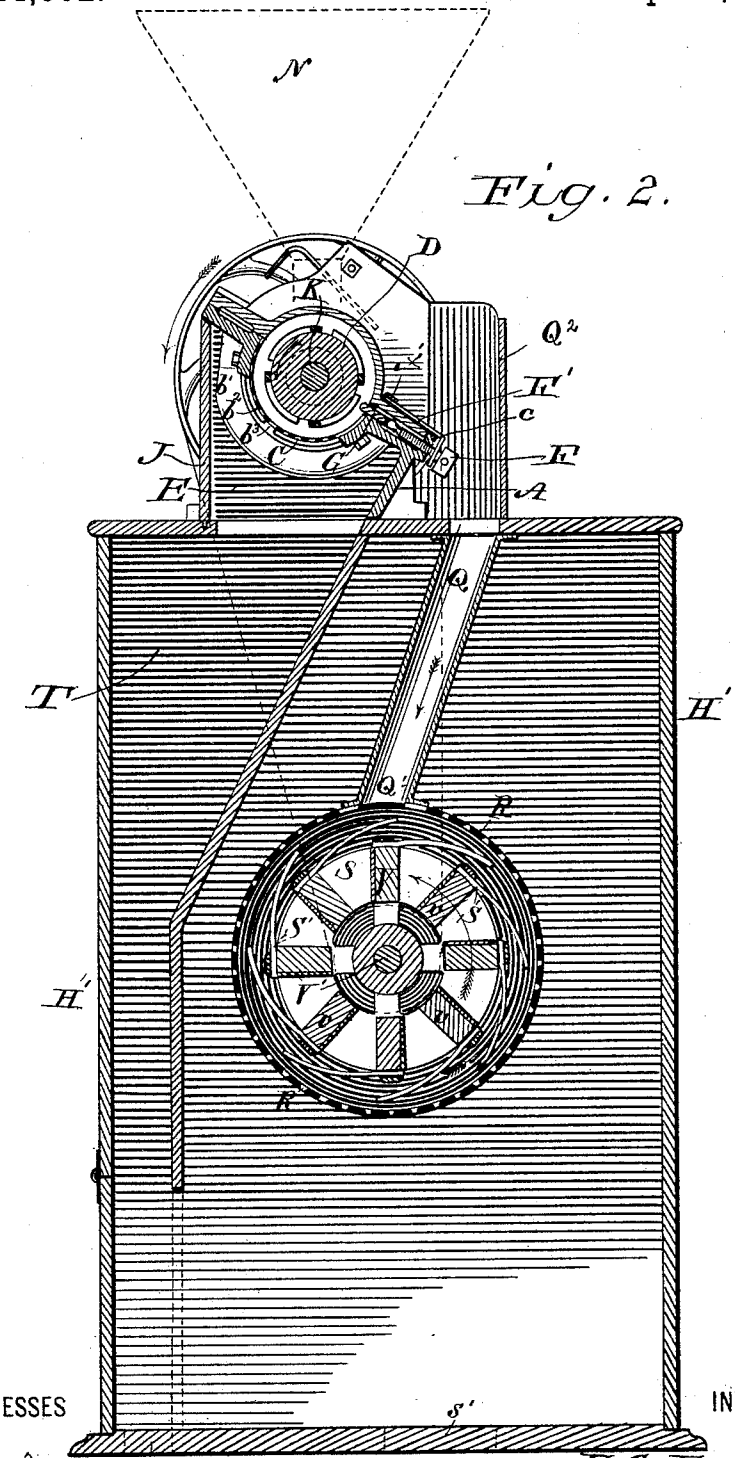
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Fig. 2.



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Fig. 3.

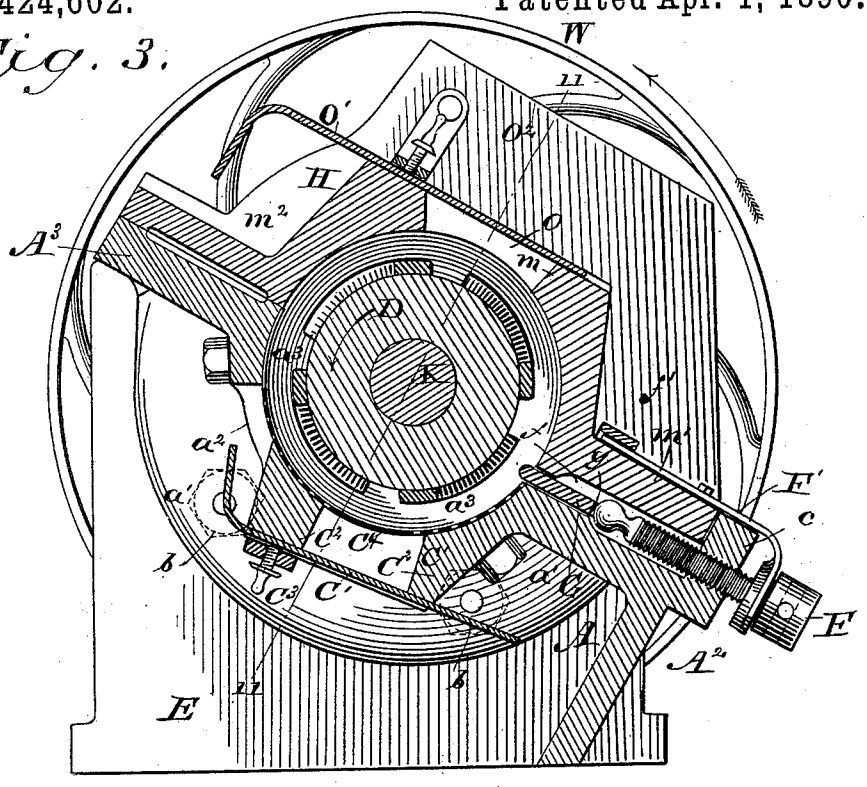
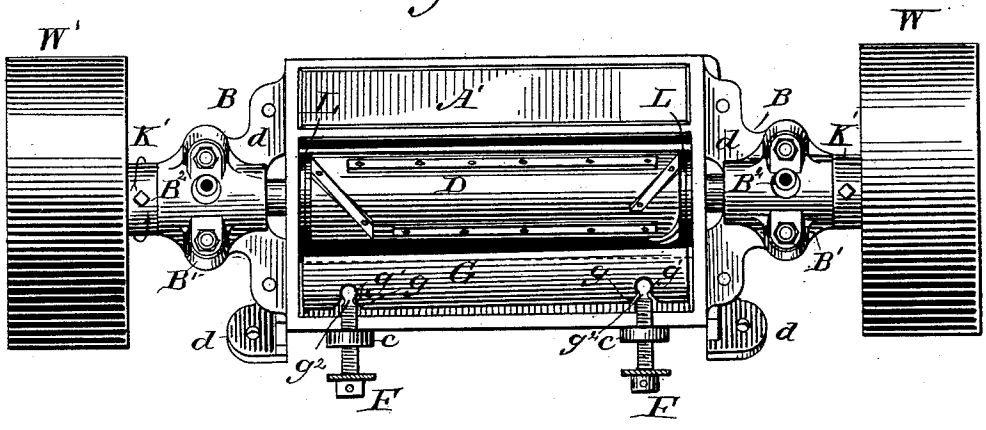


Fig. 4.



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Fig. 5

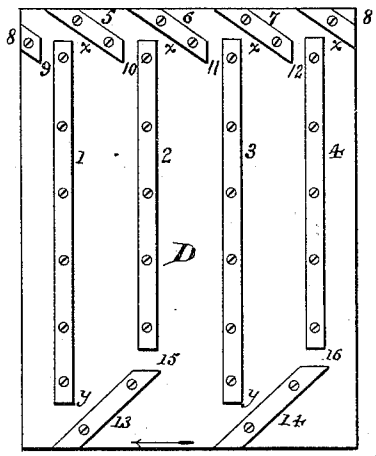


Fig. 6.

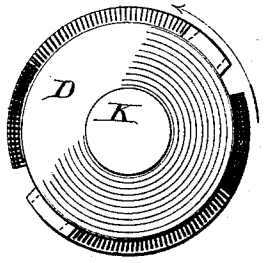


Fig. 7.

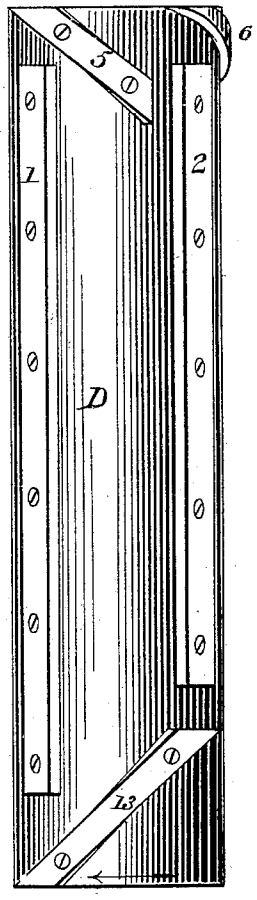


Fig. 8.

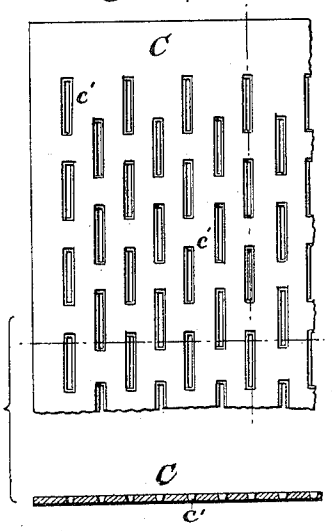


Fig. 9.

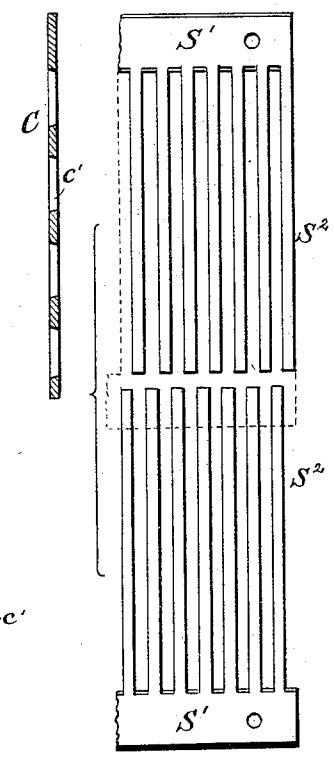
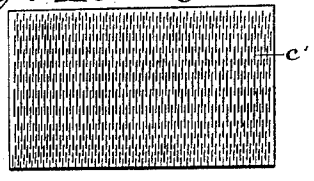


Fig. 10. c



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E. C. ENGELBERG.

MACHINE FOR HULLING, CLEANING, AND POLISHING RICE.

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Fig. 11.

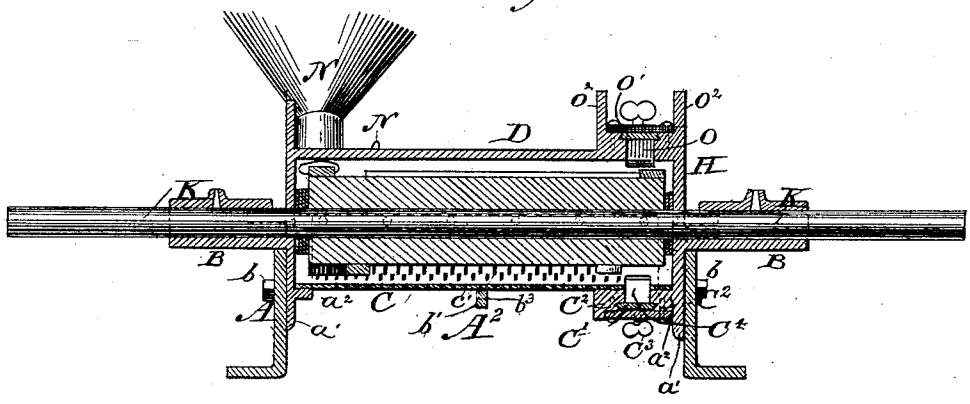
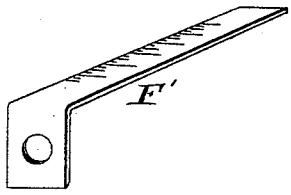


Fig. 12.



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UNITED STATES PATENT OFFICE.

EVARISTO CONRADO ENGELBERG, OF PIRACICABA, SÃO PAULO, BRAZIL, ASSIGNOR TO THE ENGELBERG HULLER COMPANY, OF SYRACUSE, NEW YORK.

MACHINE FOR HULLING, CLEANING, AND POLISHING RICE.

SPECIFICATION forming part of Letters Patent No. 424,602, dated April 1, 1890.

Application filed December 27, 1888. Serial No. 294,747. (No model.)

To all whom it may concern:

Be it known that I, EVARISTO CONRADO ENGELBERG, a subject of the Emperor of Brazil, and a resident of Piracicaba, in the Province of São Paulo, Brazil, have invented certain new and useful Improvements in Machines for Hulling Rice, of which the following is a specification.

Letters Patent of the United States No. 341,324, granted me May 4, 1886, for rice-hulling machines, show a hulling-cylinder having longitudinal ribs arranged diagonally on its surface, which co-operate with an adjustable abrading-stone and a perforated plate, through which the disconnected hulls are discharged. My Patent No. 383,285 shows a similar machine, except that the ribs on the hulling-cylinder run straight across the cylinder for a part of their length, but are inclined at the feed end. Metallic abrading-surfaces are used, and the delivery-opening for the grain is provided with an adjustable door or slide to regulate the discharge.

My present invention relates to improvements on that class of rice-hulling machines shown in my above-named patents; and it consists in the improved combinations and organizations of instrumentalities hereinafter described, and designated in the claims at the end of the specification.

In the accompanying drawings, Figure 1 is a front elevation of the apparatus with parts of the casing broken away. Fig. 2 is a vertical central section throughout the apparatus on the line 2 2 of Fig. 1. Fig. 3 is a vertical central section, on an enlarged scale, on the line 3 3 of Fig. 1 of the hulling apparatus. Fig. 4 is a plan view of the hulling apparatus with the cover removed. Fig. 5 is a diagram showing the developed surface of the hulling-cylinder. Fig. 6 is an end view of the hulling-cylinder. Fig. 7 is a plan view of the same. Fig. 8 is a detailed view showing in plan and in cross-section the formation of the perforated plate used below the hulling-cylinder and around the polisher. Fig. 9 represents, on an enlarged scale, beaters or whippers used in the polishing apparatus, showing particularly how these beaters may be cut from the material without waste. Fig. 10 is a detailed view showing the arrangement of the perforations or slots in the plate below the hulling-cylinder and around the polisher in relation to the axis of the hulling-cylinder or polisher. Fig. 11 is a longitudinal axial section of the huller on the line 11 11 of Fig. 3, and Fig. 12 is a detail view in perspective of the indicator-plate.

That part of the apparatus nearest the spectator in Fig. 1 I call the "front" of the machine, and the opposite side the "back." The end on which the hopper is shown I call the "feed end," and the opposite the "discharge end," of the machine.

The casing is preferably made in sections A and H, divided on a line coincident with the axis of the hulling-cylinder and inclined downward from rear to front at an angle to the horizon of, say, forty-five degrees, as shown in Figs. 2 and 3. The main body or lower section A of the casing is preferably made in a single piece and of cast metal, on each side of which are laterally-projecting lugs B, in which are formed the lower parts of the bearings of the shaft of the hulling-cylinder. Downwardly-projecting flanges a' at each end of a longitudinal opening A′ in this lower section are enlarged at their lower ends and provided with laterally-projecting flanges a^2 to support the ends of the perforated plate or screen C below the hulling-cylinder D. The front and rear portions A^2 and A^3 of the lower section are formed with downwardly-projecting flanges a^3, to which the longitudinal edges of the perforated plate or screen C are secured. Separate side pieces E are secured to the lower section A by bolts b, extending through the flanges a', as shown in Fig. 3. The tops of the side pieces are inclined, as shown, from the front edges upwardly, and on these inclined upper edges rest the laterally-projecting bearing-lugs B. The lower front portion of the casing is closed and at the upper end is provided with lugs c near each end, through which project the adjusting-screws F. The upper part of the bottom of the casing is recessed to receive a metallic hulling-plate G, which acts in conjunction with the hulling-

cylinder, as will be hereinafter more fully described. Flanges *d* are formed on the bottoms of the side pieces E, through which pass bolts *e*, for securing the machine to the box or casing H′ of the polisher.

The front and rear ends of the casing are shown as braced by a rib *b′*, passing under the screen, but separated therefrom by an intervening space b^2, so as not to obstruct this part of the screen. The rib *b′* is preferably made in one piece with the other parts of the casing, and may be formed with a lug b^3 to aid in supporting the screen C. The back of the lower section A is closed by a back plate or door J, Fig. 2, which may be readily removed when desired. By this means the under side of the screen may be readily reached for the purpose of cleaning it with a wire brush or other cleaning implement.

The plate is provided with perforations, preferably formed as shown in Figs. 8 and 10. These perforations *c′* are made in the form of oblong slots gradually tapering or flaring from the inside of the plate outwardly. The slots run transverse to the length of the casing and are arranged in parallel rows, each row overlapping and projecting between the slots of each adjacent row. (See Fig. 10.) By forming the slots in this way and by this arrangement the hulls, cuticle, flaky matter, and other impurities are effectively disconnected from the grains of rice and separated therefrom. This matter readily passes through the slots, which are not apt to clog or choke, because their outer ends are larger than their inner ends, and any matter entering the slots readily passes through them.

The precise arrangement and formation of the slots is of great importance in my improved machine. Simple perforations would not do the work so effectively.

The hulling-cylinder D is mounted on a shaft K, which has its bearings in the lugs B of the lower section of the casing A. These bearings are closed by caps B′, provided with oil-cups B^2.

On one end of the shaft K is a driving-pulley W′ and on the opposite end a pulley W, which is connected with the driving-pulley W^2 of the polisher. Collars K′ are interposed between the pulleys W and W′ and the bearings B and B′ of the shaft K to prevent the shaft moving longitudinally. By this arrangement the hulling-cylinder is maintained in a uniform position relatively to the sides of the casing.

The direction of revolution of the shafts, pulleys, &c., is indicated by the arrows.

It will be observed that the cylinder is much shorter than the interior of the casing to allow grain to pass between the ends and the latter. Washers L of some soft material, preferably leather, interposed between the ends of the cylinder and the sides of the casing, keep the rice from grinding in this space. Ribs on the cylinder co-operate with the hulling-plate to remove the hulls. The arrangement of these ribs is of the utmost importance to insure the effective working of the machine. I obtain the best results by arranging the ribs as shown in Fig. 5. The cylinder is therein represented as provided with four central ribs 1 2 3 4, arranged at equal distances apart and parallel with the axis of the cylinder. The discharge ends of the ribs are all in line with each other. The ribs 1 and 3 are equal in length, and the ribs 2 and 4 are also equal in length to each other, but shorter than the ribs 1 and 3. Four short ribs 5 6 7 8 project inwardly from the discharge end of the cylinder at an angle of about forty-five degrees with its axis and enter between the ribs 1 2 3 4, their inner ends terminating close to, but before reaching, the ribs 1 2 3 4, so as to leave ways or passages 9 10 11 12. Passages *x* are also left between the short ribs and the long ribs.

On the feed end of the cylinder two ribs only, 13 and 14, are used; but they are somewhat longer than the ribs 5 6 7 8. They project from the edge of the cylinder at an angle of about forty-five degrees to its axis, their inner ends terminating before reaching the ends of the ribs 2 and 4, so as to leave ways or passages 15 and 16. There are also passages *y* between the ribs 13 and 1 and 14 and 3. All the ribs are preferably of the same width and thickness, the scale and relative proportion being accurately shown in the drawings. The ribs are secured to the cylinder in any desired way, preferably by ordinary screws, as indicated. The height of the ribs above the surface of the cylinder is preferably one-third of that of the space between the cylinder and casing.

The lower portion of the cylinder (shown in Fig. 5) is the feed end. As the rice enters the apparatus, it is taken hold of by the inclined ribs 13 and 14 and started through the machine in a direction toward the delivery end of the apparatus, the cylinder revolving as indicated by the arrows. The rice is turned over and over by the longitudinal ribs 1 2 3 4, and presented continuously to the hulling-plate G, and gradually carried to the discharge end, where it is taken up by the short inclined ribs 5 6 7 8 and rapidly fed upwardly and out. The ways or passages *y* 15 16 *x* and 9 10 11 12 enable the rice to move along the cylinder with ease, no choking or clogging being possible.

The hulling-plate G is different from the stone or block heretofore used in this class of machines. Instead of having a large extent of surface, it is made flat, and its front working-edge is rounded or curved to present a convex edge to the ribs. It will be observed that the plate is somewhat longer than the hulling-cylinder. The headed ends of adjusting-screws F fit into sockets or recesses *g′* in the plate. The heads of the screws are rounded, and the narrow necks g^2 are embraced by the outer edges of the curved re-

cesses. The recesses from these points are flared, as shown in Fig. 4, so that one side of the plate may be adjusted more than the other, in order to give it the proper inclination without changing any of the parts. It is desirable that the distance between the edge of the plate and the surface of the hulling-cylinder at the feed end of the apparatus should be greater than at the delivery end, as the unhulled rice requires more space at this point. As the rice approaches the delivery end of the apparatus, it is important that the plate and the hulling-cylinder should come closer together, because the grains of rice become smaller as they near the delivery end and require closer work.

The top or cover of the apparatus may be of any suitable kind adapted to neatly inclose the hulling-cylinder. The central part *m* of the cover is recessed internally to accommodate the hulling-cylinder, and the front and rear portions *m'* *m²* rest upon the front and rear portions A^2 A^3 of the lower section or body portion A. The under side of the part *m'* is formed to closely fit the plate G and the adjusting-screws F, and yet permit of their ready adjustment.

The front portion of the lower section A is recessed at *f* to accommodate the adjusting-screws. To each of the adjusting-screws at its outer end is secured a plate F', which extends up and over the front portion of the cover H and at its front end under a guide-strap *f'*. These plates are marked with a scale to indicate clearly the exact position of the plate within the casing. Any movement of the screws, which correspondingly moves the hulling-plate, will coincidently move the plate F', so that the exact position of either end of the plate relatively to the hulling-cylinder is indicated. The scale may be made to show in inches and fractions of an inch the exact distance of the hulling-plate from the hulling-cylinder.

The hopper N is connected to the feed-opening *n* in any suitable way over the end of the hulling-cylinder A. A slide N' regulates the size of the opening. The discharge-opening O is formed in the upper part of the cover H at the opposite end of the apparatus. This opening is provided with an adjustable slide O', so that the size of the opening may be varied to regulate the discharge of the rice and the pressure within the casing. Guard-plates O^2 on each side of the discharge-opening O and extending upwardly therefrom prevent the rice from being scattered.

An opening C^4 is formed in the concave plate or screen C at the discharge end of the machine, and is closed by a gate C', which moves in guides formed in the downwardly-projecting lugs C^2 of the lower section A^2 of the casing A. Set-screw C^3 holds the gate firmly in position. This is an important feature in the practical operation of the machine, because should the driving-belts slip or any other parts of the driving apparatus give way the machine would, but for this opening, become clogged or choked, and in restarting the machine the rice would be ground and broken.

In operating my machine, should the driving-gear slip or give away before again starting, the feed of rice is shut off by the slide N' of the hopper, and the gate C' is opened and the grain allowed to run out, so as to relieve the cylinder and allow it to start free.

A chute T leads from the casing beneath the perforated plate C of the huller into the box or casing H' and delivers the hulls, cuticle, &c., which are ground to a fine meal, into the bottom of the box. The meal thus produced is a useful article, and may be used as feed for animals. It is not a waste product, and should be cared for.

The hulling apparatus is mounted on a box or casing H', which contains the apparatus for cleaning and polishing the rice after it leaves the huller. A box or casing Q^2 is attached to the guard-plates O^2, and a chute Q leads from this casing to an opening Q' in the perforated casing R, surrounding the polisher S. The rice enters the perforated casing R, and, after being treated in the polisher, is carried through a discharge-spout U to suitable receptacles. The dust, meal, and other fine particles whipped out by the polisher and blown through the casing R may be collected with the meal passing down the chute T, or it may be separated therefrom.

The box or casing H' is shown in dotted lines as divided, the chute T extending to the bottom of the box, and an opening *s* being provided in the bottom of the box, through which the meal from the huller may be passed to a receptacle below. An opening *s'* is also shown, through which the finer meal whipped out by the polisher may be delivered in suitable receptacles below. The polisher is formed of a cylindrical skeleton frame-work V, mounted on a shaft V', having bearings V^2 in the sides of the box. These bearings are preferably formed in plates V^3, removably secured to the box by bolts V^4. The sides of the skeleton frame are separated from the inner sides of the casing, so that the rice will not be ground or broken between them. I find by experience that if the polisher is not thus arranged the whole effect of the apparatus is harmed, because a large portion of the rice will be ground or broken.

As shown in the drawings, the frame is composed of eight ribs *v*, secured to the sides, and to these ribs are secured bands of leather S', which are cut in the form shown in Fig. 9 to form fingers S^2, which are light and flexible, and which act as whips on the grain as it passes through the cylinder.

As shown in Fig. 9, the strips are cut from sheets of leather without waste of material. They may be secured to the frame in any suitable way, but preferably as shown in the drawings, and as the cylindrical frame revolves the rice is taken up by the fingers and carried along through the apparatus, the dust and

fine meal being forced through the perforated casing by the whips and the currents of air induced thereby.

The apparatus thus organized takes the rough rice, removes the hulls, cuticle, and flaky matter, separates it from the good rice, takes the good rice and relieves it from any remaining impurities, gives it a fine polish, and delivers it to separate receptacles ready for use, while the hulls or meal are delivered in convenient condition for sale as feed.

The rice, after it passes through the apparatus, is substantially of one grade, needs no separation, and is perfectly clean.

I have described my improved apparatus as designed for hulling, cleaning, and polishing rice; but it is obvious that the machine may be used for cleaning other kinds of grain.

I have used my improved cleaning apparatus for hulling coffee with remarkably good results, it being only necessary to give the hulling-plate a wider range of adjustment, or rather make the distance between the working-edge of the hulling-plate and the surface of the hulling-cylinder somewhat larger, to accommodate the coffee-berries, which are larger than the grains of rice.

Having thus fully described the organization and operation of my improved rice hulling, cleaning, and polishing apparatus, what I claim therein as of my own invention, and desire to secure by Letters Patent of the United States of America, is—

1. The combination, substantially as hereinbefore set forth, of the hulling-cylinder, the short inclined feed-ribs thereon, and the separate equidistant longitudinal ribs parallel with the axis of the cylinder, with their feed ends lying alternately opposite the ends of the feed-ribs and between them, leaving spaces between the feed and longitudinal ribs through which the rice may pass.

2. The combination, substantially as hereinbefore set forth, of the hulling-cylinder, its short inclined feed-ribs, the separate equidistant longitudinal parallel central ribs, and the discharge-ribs inclined in a direction reverse to that of the feed-ribs.

3. The combination, substantially as hereinbefore set forth, of the hulling-cylinder, its inclined feed-ribs, the separate equidistant longitudinal parallel central ribs of unequal extent at the feed end and terminating alternately opposite to and between the feed-ribs, and the discharge-ribs projecting between the corresponding ends of the longitudinal ribs.

4. The combination, substantially as hereinbefore set forth, of the casing, the screen in the lower part of the casing, the ribbed hulling-cylinder, and the convex-edged smooth flat rigid hard-metal hulling-plate co-operating therewith.

5. The combination, substantially as hereinbefore set forth, of the casing, the screen in the lower part of the casing, the ribbed hulling-cylinder, and the hulling-plate, the working-edge of which is inclined toward the cylinder from the feed to the discharge end to compensate for the gradually-diminishing bulk of the rice as the hulling progresses.

6. The combination, substantially as hereinbefore set forth, of the casing, the feed-opening in the top thereof, the hulling-plate, the hulling-cylinder revolving upwardly on the side next the plate to throw the rice upwardly against the plate, and a discharge-opening above the plate.

7. The combination, substantially as hereinbefore set forth, of the casing having a discharge-opening in its top, the hulling-cylinder revolving therein, the inclined ribs on the cylinder beneath the discharge-opening, the straight parallel ribs extending from the discharge-opening to a feed-opening in the casing, the inclined ribs beneath the feed-opening, and the hulling-plate extending in the casing from one end of the cylinder to the other.

8. The combination, substantially as hereinbefore set forth, of the casing having feed and discharge openings in its top, the hulling-cylinder, its inclined feed-ribs, oppositely-inclined discharge-ribs which lift the grain from the casing, and the straight parallel ribs on the cylinder between the inclined ribs at each end.

9. The combination, substantially as hereinbefore set forth, of the casing, the hulling-cylinder, hulling-plate, its adjusting-screws, and the indicator-plates connected therewith to determine the relation of the cylinder and plate without opening the casing.

10. The combination, substantially as hereinbefore set forth, of the casing, the hulling-cylinder, its ribs, and the screen having a smooth and even interior surface, and having also rows of straight parallel overlapping slots transverse to the axis of the cylinder and flaring outwardly to facilitate the escape of matter passing through said screen.

11. The combination, substantially as hereinbefore set forth, of the hulling-cylinder, the lower section of the casing, the screen, the discharge-opening therein, and its gate to permit of the removal of the rice when the machine is stopped when full without removing the casing.

12. The combination, substantially as hereinbefore set forth, of the lower section of the casing inclined upwardly from front to rear, the screen secured therein, the hulling-cylinder revolving in the screen, and the removable back plate or side of the casing, which affords access to the screen.

13. The combination, substantially as hereinbefore set forth, of the lower section of the casing, downwardly-projecting flanges at each side thereof, lateral flanges, the screen secured thereto, and inclined side pieces secured to the downwardly-projecting flanges.

14. The combination, substantially as hereinbefore set forth, of the lower section of the casing having a central longitudinal opening,

downwardly-projecting flanges at each end thereof, flanges projecting laterally therefrom, the screen secured to said flanges, the central rib extending under said screen, and the top or cover provided with a central recess for the hulling-cylinder.

15. The combination, substantially as hereinbefore set forth, of the hopper, the hulling-cylinder, its casing provided with a feed-opening communicating with the hopper, the screen in the lower portion of the casing, the hull-discharge opening in the lower part of the screen-casing, the box below the screen, a chute connecting the opening in the screen-casing with the box, a rice-discharge opening in the casing of the huller, the polisher, a chute leading from the rice-discharge opening in the casing to the polisher, and a discharge-spout leading from the polisher.

In testimony whereof I have hereunto subscribed my name.

EVARISTO CONRADO ENGELBERG.

Witnesses:
JOSÉ ANTO. D'ARRUDA,
RODRIGO PINTO ROZADO.