No. 770,226. PATENTED SEPT. 13, 1904.

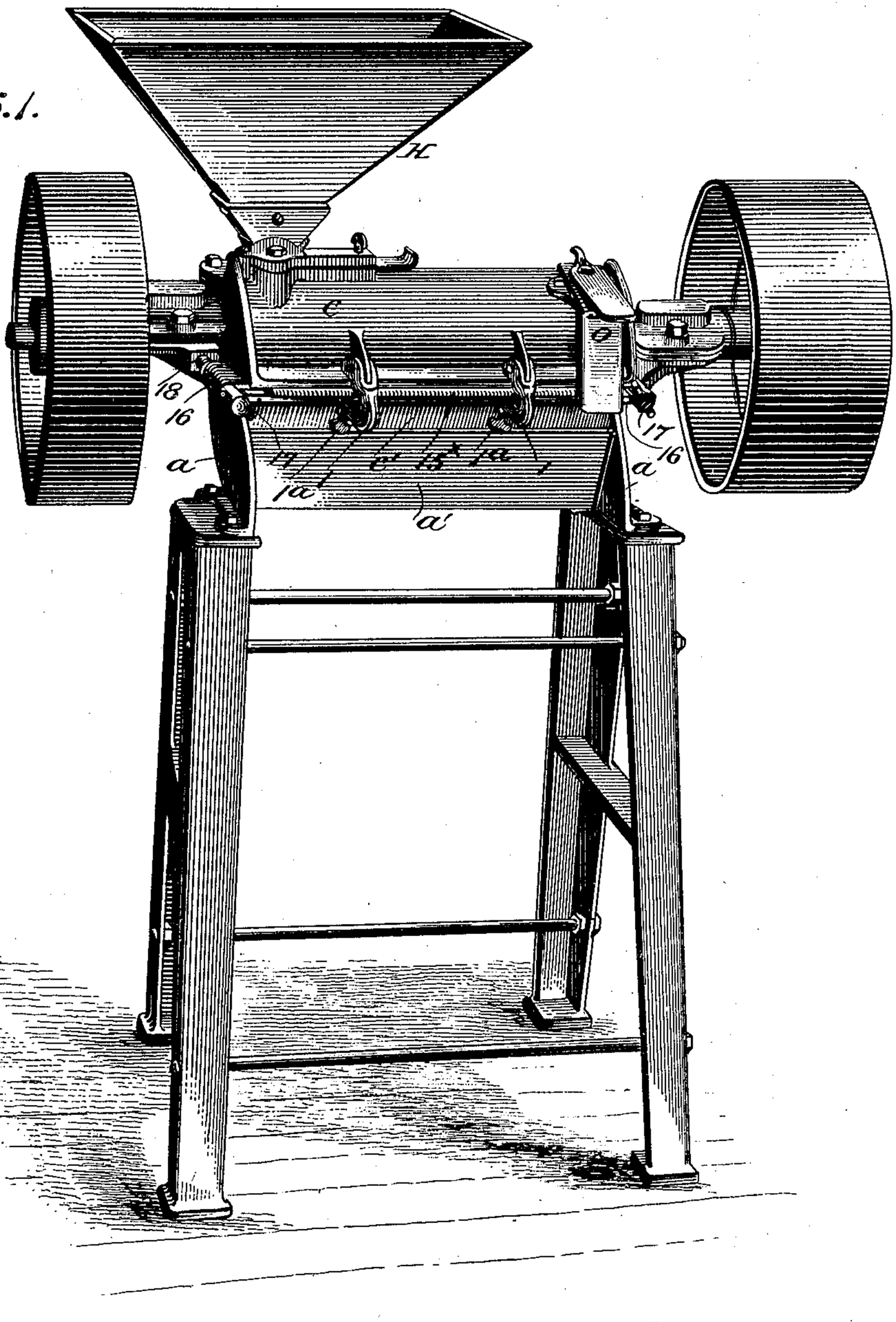
F. G. DIETERICH.

RICE HULLING MACHINE.

APPLICATION FILED FEB. 3, 1903. RENEWED APR. 21, 1904.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.

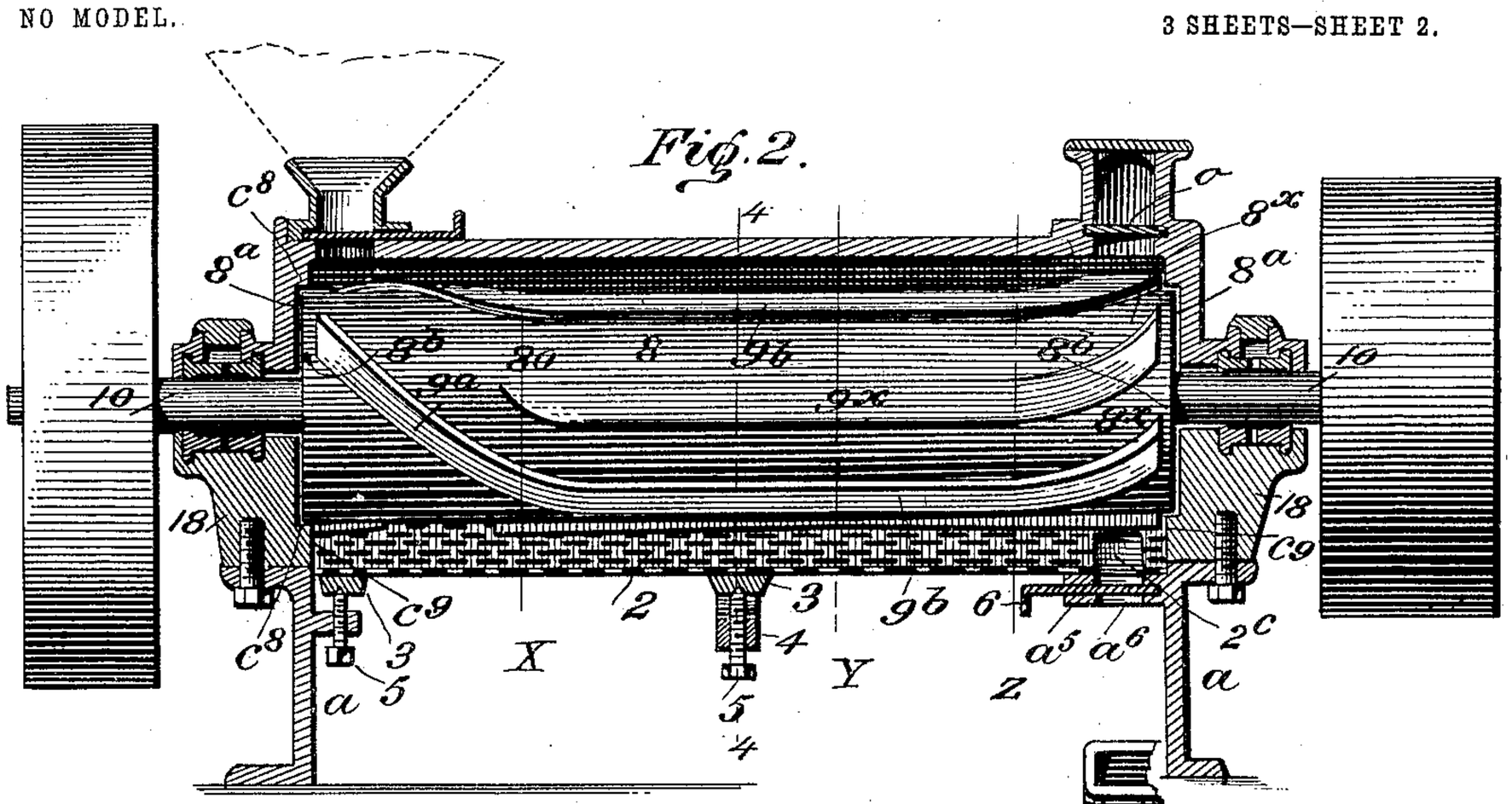

Fig. 3.

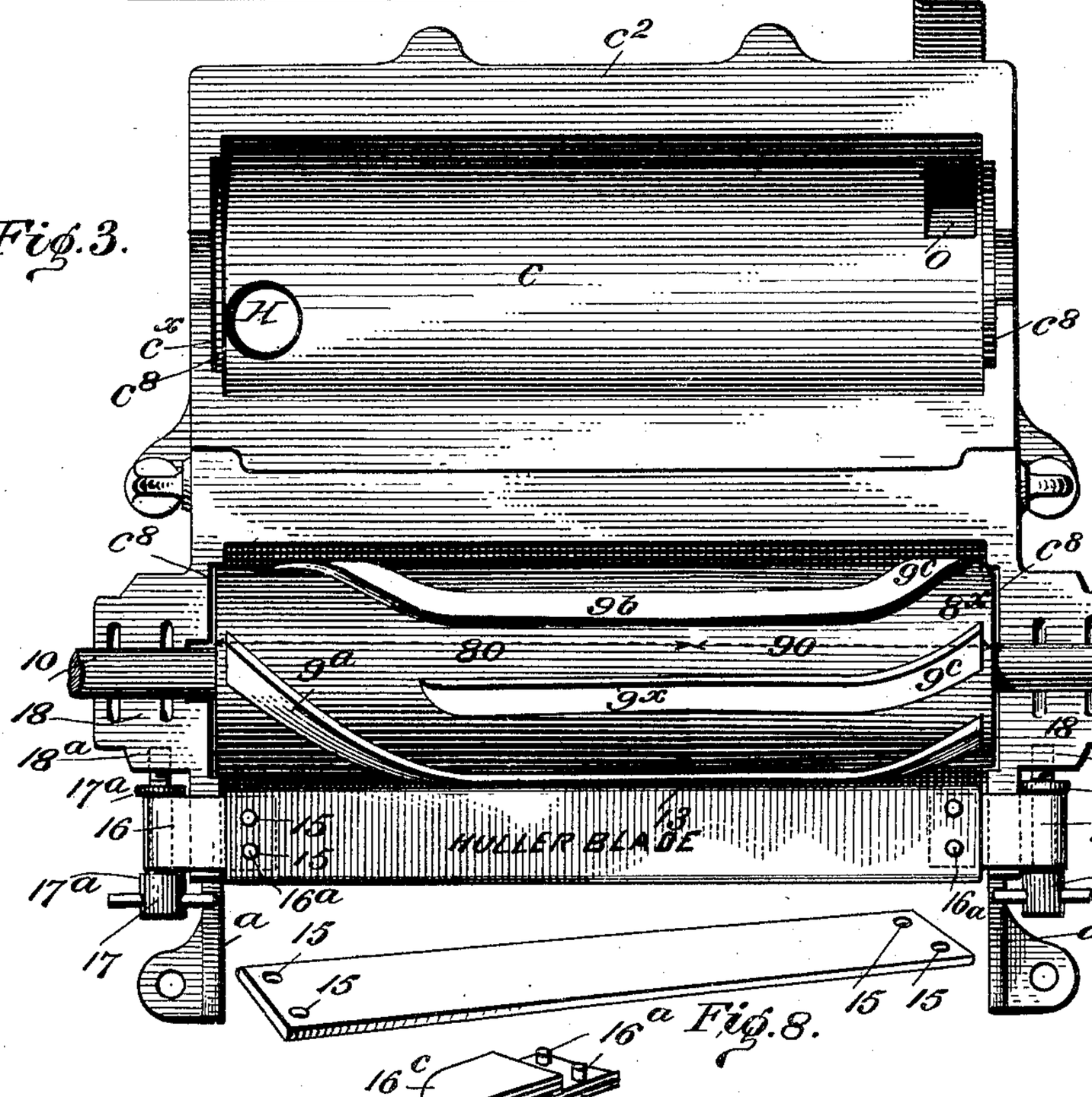

Fig. 8.

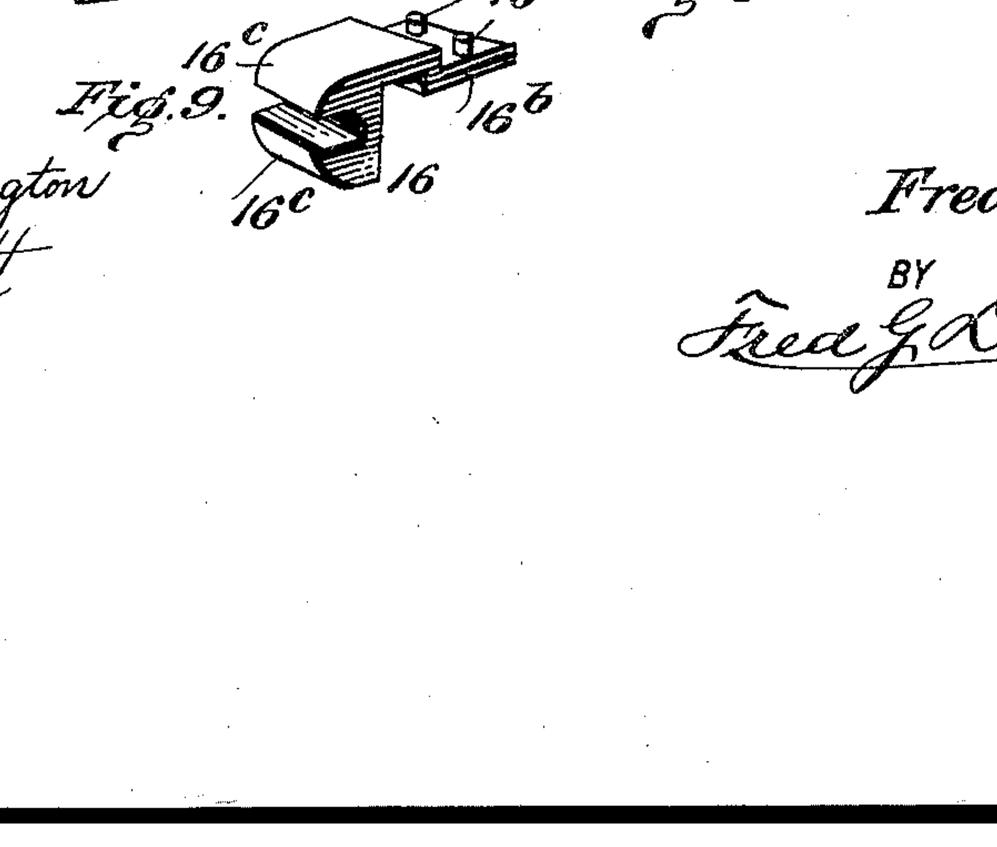

Fig. 9.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 4.

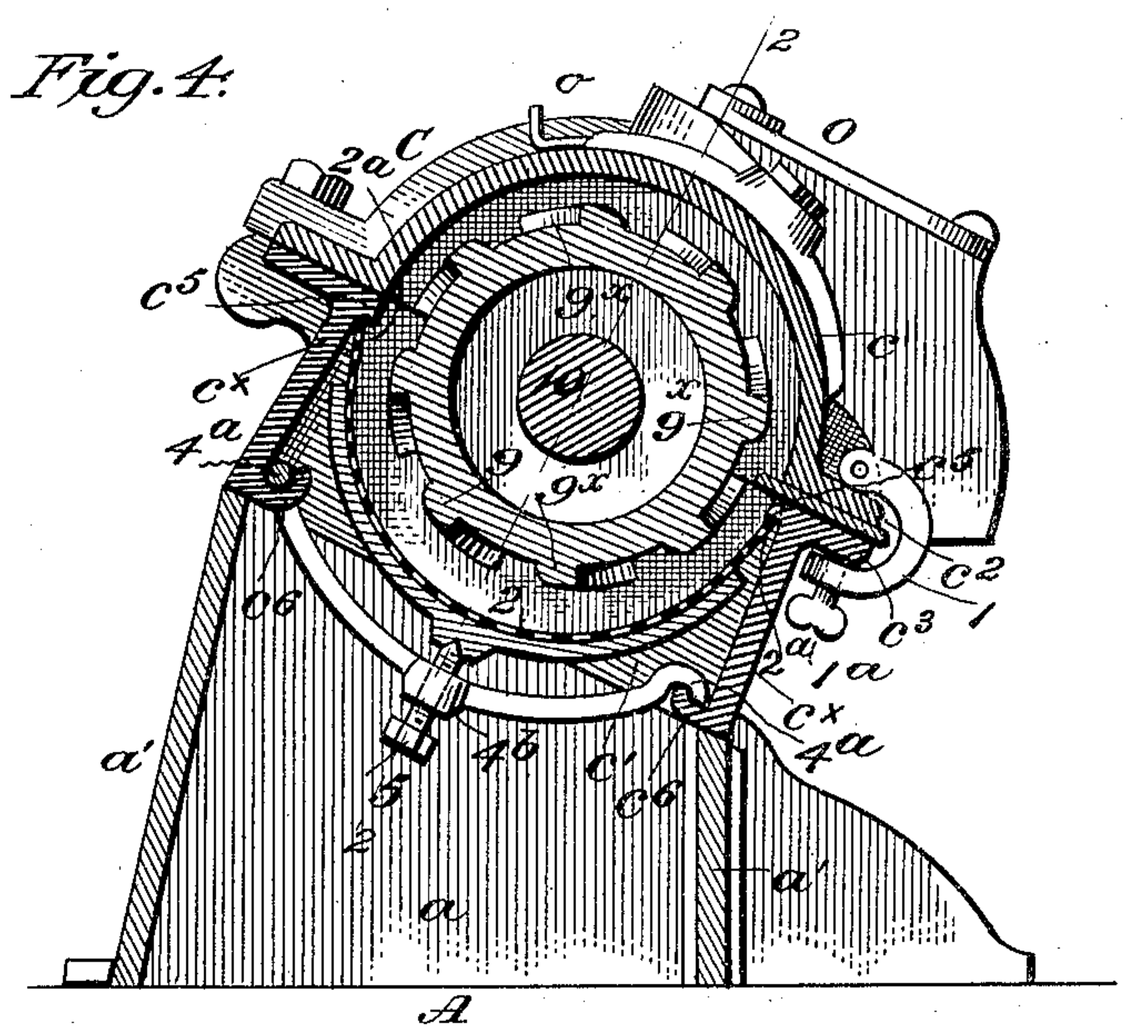


Fig. 5.

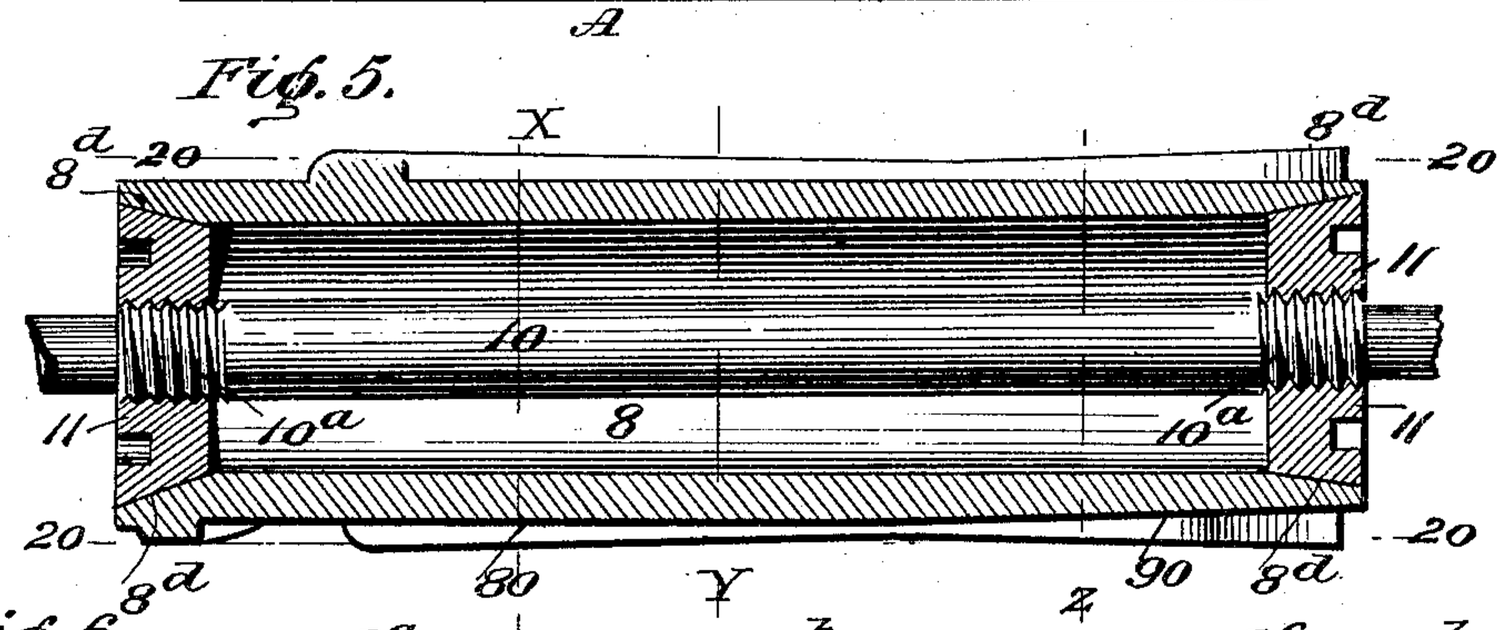


Fig. 6

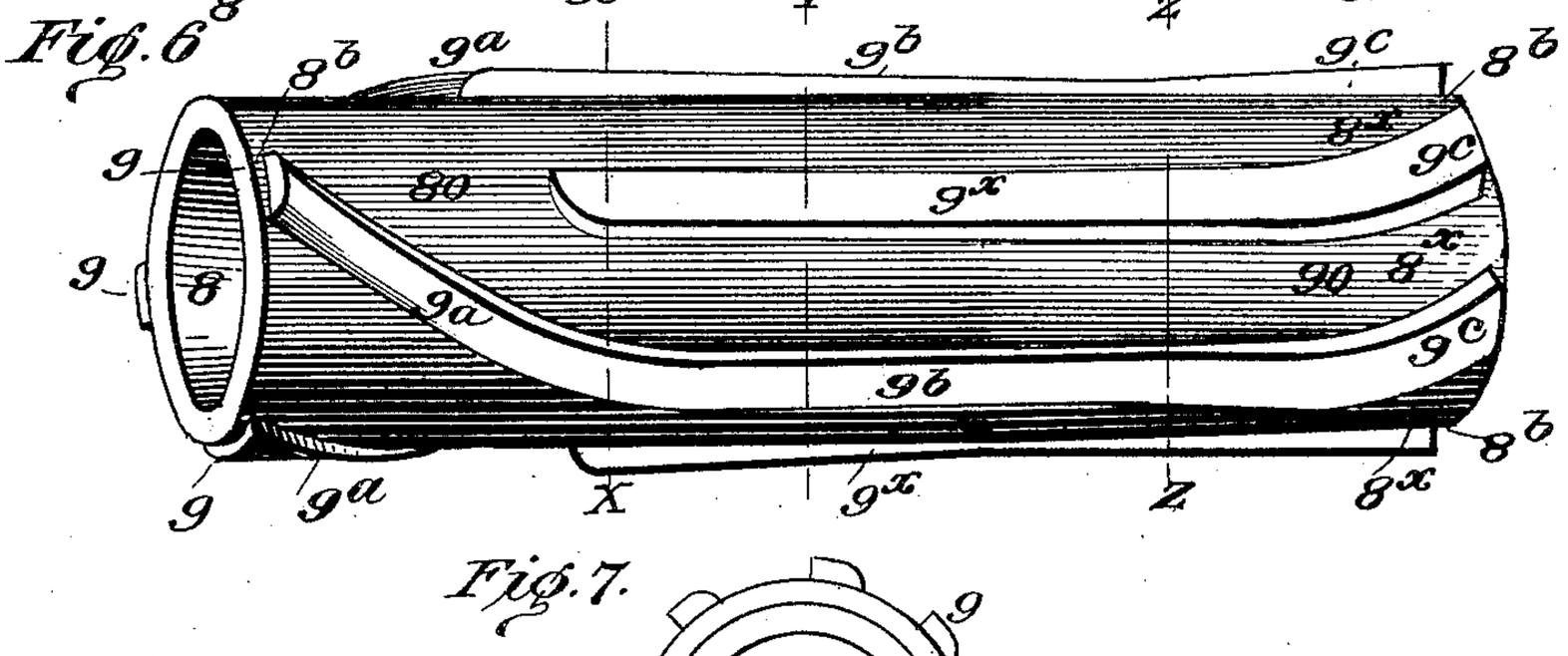
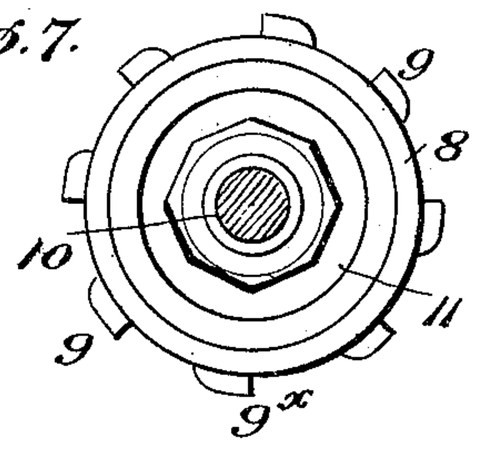


Fig. 7.



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No. 770,226. Patented September 13, 1904.

UNITED STATES PATENT OFFICE.

FRED G. DIETERICH, OF WASHINGTON, DISTRICT OF COLUMBIA.

RICE-HULLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 770,226, dated September 13, 1904.

Application filed February 3, 1903. Renewed April 21, 1904. Serial No. 204,283. (No model.)

To all whom it may concern:

Be it known that I, FRED G. DIETERICH, residing in the city of Washington and District of Columbia, have invented a new and Improved Rice-Hulling Machine, of which the following is a specification.

This invention is an improvement in hulling-machines having for their object to remove the hulls, cuticle, and gummy coatings from rice-grains; and it relates more particularly to that type of hulling-machines in which is included a hulling-cylinder having external ribs for coöperating with an opposing abrading surface or surfaces and having a casing having a feed-inlet at one end in the top, a discharge through the top at the other end, and in which the abrading-surface is in the nature of a hulling-blade adjustably held to project into the casing to oppose and coöperate with the cylinder-ribs to effect the desired hulling operation.

In some forms of the machines of the kind stated and hitherto used is included a special construction of means for attaching and supporting a screen which forms the bottom of the hulling-casing and specially-constructed devices for detachably and adjustably supporting a flat hard-metal huller-blade.

My invention comprehends an improved construction of huller-casing and of the cylinder, which are so combined to effect a more perfect and rapid hulling of the rice, as compared with the machines hitherto used, whereby to produce a machine having a greatly-increased capacity, and the said construction also includes a peculiar arrangement of the cylinder-ribs designed to cause the cylinder to coact with the huller-blade in such manner that the danger of breaking or crushing the grain is reduced to a minimum, and whereby the parts can be quickly adjusted to effect the desired hulling operation on different grades of rice, from the large "Honduras" beans to the small "Japan" grains.

In the practical operation of machines of the kind referred to it has been developed that the rice entering the feed end of the casing as it is conveyed in the direction of the discharge end is practically hulled before it passes to the tail or end of the cylinder, and for that reason it has been found necessary to make the front portion of the hulling-cylinder chilled and hardened to withstand the required wear. In other words, the maximum hulling action on the grain is at the entrant end of the cylinder, and the hulls, cuticle, and gummy coatings are practically separated from the grain before it reaches more than half-way toward the discharge end of the cylinder, and to prevent the replacing of an entire cylinder when worn at one end (the front only) it has been found profitable and convenient to make the cylinder of two parts—a rubbing portion and a tail-piece, the latter by reason of the comparatively little wear thereon being usually made solid with or fixedly connected to the cylinder-shaft.

In my invention the ribbed cylinder is made of a single hollow member, and its ribs are so formed thereon that the wear upon the front or hulling end is made uniform and so disseminated that the life of the cylinder is materially increased.

To make the distinction between my machine and machines of the kind referred to heretofore used, it should be stated that it has been usual in the use of the machines referred to to choke the outflow of the hulled grains to such an extent as to maintain a sufficient back pressure on the longitudinally-moving contents within the casing to keep the grain bulk at the front end of the casing a sufficient length of time to effect the desired hulling action. This operation has its objections, as it reduces the capacity of the machine and holds the hulled rice within the casing an unnecessary length of time, and thereby subjects the hulled grains to the danger of being ground or broken. This objection I overcome by a peculiar construction of the rear or tail end of the cylinder and the ribs at that end, which is especially intended to reduce the danger of grinding or breaking the hulled grains by unnecessary rubbing them against the huller-blade at the delivery or tail end and which also serves to not alone prevent an unnecessary back pressure or choking action of the grain within the casing, but also to carry the hulled grain up through the discharge end of the opening therein as fast as it is hulled, whereby to create a continuous and uniform

flow of the hulled material from the entrant to the exit end of the huller-casing.

Again, in machines heretofore employed of the kind referred to cylinders have been provided whose ribs are not continuous from end to end of the cylinder, and in some instances at the entrant end the ribs are separated to form, as it were, transverse spaces. From practical observation I have found such form of ribbed cylinder as not meeting with all of the requirements desired, and for the reason that under some conditions of rice the separated ribs fail to properly lift up the rice bulk at the feed end toward the huller-blade or abrading member, as some of it falls back to the bottom of the casing through the transverse spaces formed between the separated portions of the cylinder-ribs. This I overcome by the peculiar construction and arrangement of ribs hereinafter fully explained, and particularly that of the tail ends thereof.

Again, in some forms of hulling-cylinders now in use the ribs do not extend entirely to the extreme tail end of the cylinder, which is left with a solid annular portion, the peripheral face of which is in the plane of the peripheral face of the ribs. This construction in practice has been found to produce an uneven wear of the huller-blade, which at that point where it opposes the solid tail end of the cylinder wears away much faster than the other portion thereof that opposes the ribs, and hence after a short period of use it is required that the blade be adjusted end for end, and, reversely, to obtain the required uniform adjustment of the rubbing edge on the blade relatively to the cylinder and by reason of the irregular wear upon the said blade it soon becomes useless, for the reason that a perfect adjustment to maintain a uniform space between its wiping edge and the opposing wiping-surface of the cylinder is rendered impossible. This serious objection in the art of hulling rice I avoid by a peculiar coöperative arrangement of the cylinder and the ribs, the end walls of the heads of the casing which receive the ends of the cylinder and the blade, as will hereinafter be fully explained, it being sufficient to state at this point that in my improved construction of machine the huller-blade has a length equal that of the length of the ribs, it being also deemed proper to state that the coöperative arrangement of the parts just mentioned overcomes another objectionable feature in the structure of some machines heretofore used in that it dispenses with the necessity of using leather washers or metallic disks between the ends of the cylinder and the heads of the casing, which have been required to prevent the grains that crowd between the ends of the cylinder and the casing-heads from being crushed, the arrangement of the said parts in my construction last referred to being such that it is rendered practically impossible for the grains to pass between the cylinder ends of the heads of the casing adjacent thereto.

Other special details of construction which form subordinate features of my invention will hereinafter be fully set out in the complete description of my improved machine and then specifically pointed out in the claims, reference being now had to the accompanying drawings, in which—

Figure 1 is a perspective view of a complete hulling-machine embodying my invention. Fig. 2 is a vertical longitudinal section of the same, taken practically on the line 2 2 of Fig. 4. Fig. 3 is a top plan view of the same, the cover or top part of the casing being turned back. Fig. 4 is a transverse section thereof, taken practically on the line 4 4 of Fig. 2. Fig. 5 is a longitudinal section of the hulling-cylinder. Fig. 6 is a perspective view of the same. Fig. 7 is an end view thereof. Fig. 8 is a detail view of the huller-blade, and Fig. 9 is a similar view of one of the blade-carrying boxes.

The framing of my machine may be of any approved form to support the casing in either a horizontal or an inclined position, the latter position being preferred, as it admits of a more convenient access to the cylinder-casing and lift of the grain toward the hulling-plate.

The supporting-frame A comprises the ends *a a*, and front and back members *a' a'* may be mounted on a table or bench or upon legs, as shown in Fig. 1.

The casing C is formed of two sections divided in the horizontal axial line of the hulling-cylinder, (see Fig. 4,) and the upper section *c* is hinged to the lower section *c'* to swing back, as shown in Fig. 3, and the front or meeting edges c^2 c^3 are in the nature of flat longitudinal flanges arranged to close against each other, suitable clamp devices being provided for holding the casing-top *c* tightly closed onto the lower section *c'*, which devices are in the nature of U-shaped clamps 1, hinged to the upper section *c* and adapted to close under the flange c^3 of the lower section, to which they are made fast by clamp-screws 1^a, as clearly shown in Fig. 1. The lower section *c'* of the casing includes the usual screen-bottom, and the screen 2 in my construction is detachably held in place in the manner best shown in Fig. 4, from which it will be noticed the inner edges of the upper ends of the front and rear sides $c^\times$ $c^\times$ of the casing-section *c'* have integral inwardly-projecting undercut flanges c^5 c^5, that form seats for the edges 2^a of the screen 2, and the screen 2 is supported at the central and at the feed end of the casing upon yokes 3 3, which in turn are supported upon bridge members 4 4, detachably mounted on the casing-section *c'*, the sides $c^\times$ $c^\times$ of which have integral inwardly-projecting claw-hooks c^6 c^6 to receive the hooked ends 4^a 4^a of the members 4. The members 4 have a centrally-disposed threaded

boss 4^b 4^b to receive the adjusting-screws 5, which hold and press the yokes 3 against the screen 2, and thereby hold the edges 2^a of the screen firmly against the undercut flanges, with which they engage.

At the discharge end of the machine the screen 2 is supported upon a solid bearing-flange a^5 integral with the end member a' and which has a discharge-opening a^6 to register with the discharge-outlet 2^c of the screen 2 and to receive the cut-off slide 6, of the usual construction.

By supporting the screen as described and shown the same may be quickly removed and replaced.

As before stated, I provide for preventing the grain entering between the cylinder and the casing-heads. This is a very advantageous feature of my invention, and the same will be best understood by referring to Figs. 2 and 3 of the drawings, from which it will be noticed the cylinder 8, which is a hollow shell chilled or otherwise hardened, is a single body having the full length of the casing C so its ends 8^a 8^a will run close up to the heads of the casing. The ribs 9 in my construction do not extend the full length of the cylinder, but stop short at each end thereof, whereby to leave smooth peripheral surfaces or what might be termed "extensions" 8^b 8^b, which run through annular recesses or pockets c^8 c^8 in the ends of the cylinder-casing and by reason thereof the innermost vertical planes (designated by c^9) of the casing-heads project over the ends of the cylinder close to the ends of the ribs 9 and form, as it were, the means for closing the opposite ends of the spaces $8^\times$ between the said ribs, and thereby make it impossible for any of the grain to pass from the extreme ends of the cylinder 8 and between the said ends of the casing-heads, and thus provide a cylinder having longitudinal ribs and intermediate spaces closed at both ends—a construction, so far as I know, not heretofore employed in this art.

The special construction of my hulling-cylinder will best be understood by now referring to Figs. 3, 5, and 6 of the drawings, from which it will be seen the same is fixedly connected to the shaft, which has its ends formed with external conical bearing-surfaces 8^d 8^d to coöperate with the conical clamp-nuts 11 11, adapted to engage the threaded portions 10^a 10^a of the shaft 10. Such fastening means being a common structure need not be further referred to.

The huller-blade (see Fig. 3) has a length equal that of the ribs 9 only, and it is adjustably and reversibly held with respect to the cylinder in the manner hereinbefore fully explained.

As before stated, the grains receive the greatest hulling action at the entrant end of the cylinder and the blade, at which end the relation between the ribs and the abrading edge of the blade should be uniform—that is, the space between the blade edge and the ribs for the passage therebetween of the rice must be perfectly adjusted and be uniform from the entrant end to a point not necessarily more than half the length of the cylinder.

Again, from practical observation I have found the best results are obtained by carrying the grain at once in a centrifugal and spiral direction through the casing from the start to the finish of the movement of the grain in the casing, and for such purpose I avoid the transverse spaces between the sections of ribs as is found in machines heretofore used, and to prevent the back-dropping of the grain I provide ribs that extend continuously the maximum distance between the ends or heads of the cylinder-casing.

I deem it proper to state that I am aware that a cylinder having ribs extending the full length thereof has been heretofore provided, (see Patent No. 586,090, July 13, 1897;) but in the said patent the cylinder does not extend the full length of the casing nor are the spaces between the ribs on the cylinder closed at both ends of the cylinder to prevent the grain passing over the ends of the said cylinder.

The ribs 9 in my improved construction extend continuously the full length of the casing, and at the entrant end the said ribs 9 curve spirally rearward, as at 9^a, to a point about one-third the length of the cylinder, from which point the said ribs 9^a extend longitudinally rearward in a plane parallel with the axis of the cylinder to a point near the tail end, (indicated by Z,) from which point they curve forwardly, as at 9^c, to form the tail ends, as clearly shown in Figs. 3 and 6. The curved portions 9^a of the ribs are of uniform thickness, whereby the spaces between said portions of ribs 9^a and the huller-blade will be of uniform size and the most restricted, as it is at this part of the huller that the maximum amount of hulling action on the grains takes place. As the rice-grains when they reach the point indicated by X have been necessarily hulled, and hence do not require that abrading action which is necessary at the entrant end, the ribs 9 from the point X to about one-half of the length of their straight portion 9^b are greatly reduced in thickness, tapered, as it were, whereby to gradually increase the space between the lower blade and the ribs, as indicated by 13 in Fig. 3, and to prevent an excessive rubbing action on the grains before partially or wholly hulled that pass from the point X to the point Y in the lower casing, at which point the screens are practically completely hulled. As the grain is practically completely hulled by the front half of the cylinder, I construct the rear half of the cylinder especially with a view of facilitating the quick delivery of the hulled grain toward the tail end of the casing and toward the discharge in the said end, and for

such purpose the cylinder 8, which is of uniform diameter from its feed end to the point indicated by Y, is made slightly conical or tapering, as indicated by 80, from the point Y to the delivery end, and the ribs 9 from the said point begin to again gradually increase in thickness, as indicated by 90, toward the tail end to bring the peripheral face of the tail extremity of the said ribs in a plane with the peripheral face of the ribs at the entrant end of the cylinder. (See lines 20 20 of Fig. 5.) This gradual increase of thickness of the ribs toward the tail end of the tapering or gradually-reducing diameter of the cylinder at the tail end produces, as it were, a greatly-increased thickness or radial projection relatively to the cylinder of the ribs and produces a series of pockets or grain-collecting spaces between the ribs which greatly facilitate the lifting of the hulled grain, gives ample room between the cylinder, the casing, and the huller-blade for the passing of the grain to the discharge, and also materially adds in leading the hulled bulk toward the discharge with the minimum danger of crowding or rubbing the grain against the huller-blade to such extent as to crush the grain, and thereby greatly increases the life of the huller-blade at the discharge end and leaves that end practically as perfect when it is found necessary to turn or reverse the blade. Furthermore, by arranging the cylinder and the blade and closing the spaces between the ribs by the casing-heads as described the danger of the discharge end choking up is practically eliminated and a rapid discharge of the hulled grain is effected.

In addition to the ribs 9 the hulling-cylinder is formed with a series of intermediate blades $9^{\times}$, that extend only from the point X to the tail end of the cylinder, and the said blades $9^{\times}$ are formed similar to the blades 9 from the points X to X.

The purpose of providing supplementary ribs and arranging them as shown is to allow for a free spiral flow of the grain from the entrant end of the cylinder to the point X and also to produce additional rubbing edges for working on the partially-hulled grain between the points X and Y.

The huller-blade consists of a flat rectangular hard-metal member whose opposite edges may be rounded, concaved, or straight, as desired, and the said blade has the length of the ribs 9, as before stated. To provide a simple and inexpensive means for adjustably, but firmly holding the said blade in its positive position, the ends thereof have a pair of apertures 15 15, adapted to receive dowels or studs 16^{a} 16^{a} on the inwardly-extending horizontal members 16^{b} of the boxes 16, which are slidably held between the opposing flanges c^{2} c^{3} of the upper and lower casing-sections, (see Figs. 1 and 3,) which boxes have bifurcated extensions 16^{c} 16^{c} to receive the adjusting-screw 17 17, provided with collars 17^{a} 17^{a} to hold them from longitudinal play in the boxes 16, and the said screws 17 17 engage threaded sockets 18^{a} in the lower bearing portions 18 of the cylinder-shaft 10. (See Fig. 3.) By mounting the blade in the manner described it is obvious the same can be turned over or reversed end for end quickly and without the use of adjusting screws, bolts, or nuts, and by simply turning the screws 17 17 the blade can be set with respect to the cylinder at the points desired.

The feed-hopper H and the outlet O may be of the ordinary construction, and the latter is also provided with a choking-valve *o* to provide for properly starting the hulling action.

It will be understood that the progression of the rice from the feed to the delivery end is rendered speedy by the peculiar construction of the rear member of the cylinder and the like portion of the ribs, and while the upwardly-curved portions of the ribs facilitate the conveying of the grain to the delivery end they also sufficiently counteract the continuous flow of the grain at the tail end to produce a proper gyratory and centrifugal action on the grains to cause them to rub against each other and become freed of adhering gummy particles or partly-broken hulls, and the speed at which the grain passes through the machine can be regulated to suit the condition of the rice being worked upon by adjusting the choking-gate in the delivery-spout.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a machine as described; the combination with a huller-blade and a casing, the latter having a feed-inlet at one end and an outlet at the other end; of a hulling-cylinder having ribs of a length equal that of the hulling-blade, and which extend continuously from one end of the cylinder to the other end, said ribs at the entrant end of the cylinder being of uniform thickness, then of gradually decreasing thickness to a point near the end of the cylinder and then of gradually increasing thickness to the tail end, the tail end of the several ribs being separated.

2. A hulling-cylinder comprising a hollow shell whose front portion is of a uniform diameter and whose rear portion converges into a cone shape, ribs extended continuously from one end of the cylinder to the other end, said ribs curving spirally rearward a portion of their length then longitudinally with the axis to a predetermined point and then curved forward to form tail portions, the rearwardly-curved portions being of uniform thickness, the straight portion of varied thickness and the tail portion of gradually-increasing thickness, as set forth.

3. In a machine as described a casing; a hulling-cylinder having ribs that extend continuously lengthwise of the body of the cylinder

whose entrant ends curve downward and are of uniform thickness, then extend in a plane parallel with each other and the longitudinal axis of the cylinder to a predetermined distance the said parallel portions of the ribs gradually decreasing in thickness from the front to the rear end and the remainder or tail ends of the said ribs curving upwardly and of increasing thickness, the said tail ends being separated, as set forth.

4. In a machine as described, in combination with a casing whose heads have countersunk pockets or recesses surrounding the cylinder-shaft aperture; of a hulling-cylinder having its extreme edges smooth, whereby said edges will fit into and run closely within the pockets in the casing-heads, a series of ribs integral with the cylinder-body extending the full length of the casing, said ribs having their front ends curved downwardly, their tail ends curved upwardly and their intermediate portions straight, and a second set of ribs alternating with the other set but beginning at the straight portion of the full-length ribs, beginning at that point of the front end of the cylinder in line with the beginning of the straight portions of the other ribs, and a hulling-blade having the length of the longitudinal ribs of the cylinder substantially as shown and described.

5. The combination of the two-part casing, the ribbed hulling-cylinder and the huller-blade arranged substantially as shown, the lower part of the casing having undercut flanges on the upper edge of the opposing inner faces, inwardly-projecting claw-hooks on the lower part of the said casing, a semicylindrical screen-plate having its ends arranged to engage the undercut flanges of the casing, the yokes 3 and the bridge members 4, the latter having their ends formed to detachably engage the claws on the casing, and adjusting-screws mounted on the bridge members for engaging the screen-holding yokes, as specified.

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