RICE HULLER HAVING A FEED SCREW ON THE HULLING CYLINDER

Filed Sept. 8, 1961

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Filed Sept. 8, 1961, Ser. No. 156,952
I Claim. (Cl. 146—302)

This invention relates to hulling machines and more particularly to a rice huller adapted to remove the bran and hulls from rice kernels.

The present invention constitutes an improvement over the devices shown in United States Patents Nos. 424,602 and 512,304 and is illustrated herein in connection with the hulling machine disclosed in the latter patent.

The hulling machine of Patent No. 512,304 has been used successfully for many years and has undergone few changes in design despite continuing efforts to improve the efficiency of the hulling operation in general. In this connection it will be understood that the efficiency and effectiveness of a rice huller is inversely proportional to the percentage of broken rice kernels in the milled rice that is discharged from the huller. Although the speed with which the hulling operation is performed is a criterion of the value of the machine, nevertheless speed cannot be compared in importance to the ability of the huller to mill the rice without breaking the kernels. Broken rice brings a lower price than whole grains and when it is considered that one huller may mill thousands of tons of rice in a year the problem of rice breakage becomes extremely important.

Generally speaking, the milling operation as carried out by the device of Patent No. 512,304 includes the steps of introducing the rice into one end of an elongated cylinder, causing the rice to proceed peripherally and axially through the cylinder to the discharge end and agitating the rice during such movement so that the outer hull and the bran is removed by friction. Such friction is obtained in two ways: first by agitation of the rice kernels on each other, and second, by friction between the rice kernels, the rotating hulling cylinder and a hulling blade which is radially adjustable relative to the rotating blade.

Heretofore the speed of feed of the rice and therefore the time it is exposed to the milling step has been adjustable by the means noted radially movable blade so as to obtain the degree of polish desired in the finished product.

The radially inward movement of the adjustable blade toward the rotating cylinder naturally increases the friction between the peripherally moving rice, the cylinder and the blade and therefore enhances the milling step. However, if the forces imposed on the rice kernels are too great, breakage occurs, and for this reason care must be taken to allow sufficient clearance between the rice and the adjacent structure. At the same time, if the rice flows too freely insufficient friction is created and the discharged rice is not completely milled.

The main object of the present invention is therefore the provision of means for improving the milling operation by reducing breakage without reducing the capacity of the hulling machine.

In general it may be said that the invention contemplates means for increasing the frictional forces between adjacent grains of rice and reducing the frictional forces between the rice and the surrounding structure so that optimum milling effect is obtained without breakage.

The drawing is a top plan view of a hulling machine of the type shown in Patent No. 512,304 by incorporating a modification to be subsequently described in detail.

For details of construction and operation not covered herein reference is made to the cited patent.

The hulling machine comprises a lower casing section 1 and an upper casing section 2 which is shown in the drawing in its open position relative to the lower casing section. Hinges 3 permit the upper section to be swung to a closed position over the lower section in which position the two sections may be releasably secured together by clamps 4 to form an elongated bore 5.

Received within bore 5 is an elongated cylinder generally designated 10 provided with shafts 11, 12 at its opposite ends for rotation in bearings 13, 14. The rotor 10 may be rotated by any convenient means (not shown).

The rice is introduced into the casing through an inlet opening 16 at one end of the casing and is discharged through a discharge opening 17 therethrough.

As the rice proceeds through the casing from inlet 16 to outlet 17 the rotating cylinder 10 causes the rice to move circumferentially around the space between the cylinder and the bore and at the same time it travels axially along the casing bore 11 it is discharged through opening 17. Agitation of the rice during this movement is enhanced by longitudinally extending ribs 18 on cylinder 10 which are spaced an adjustable distance from the inner edge of a horizontally extending adjustable blade 20 which is positioned between the casing sections.

Blade 20 is radially movable relative to cylinder 10 by means of a pair of adjusting bolts 22 provided with manually manipulatable heads 23. It will be noted at this point that radial inward movement of blade 20 restricts the space between the rotating cylinder 10 and the blade 20 thus increasing the friction between the rice, the cylinder and the blade. In addition, such inward movement of the blade 20 restricts the peripheral flow of the rice so that friction between adjacent kernels of rice is increased. Experiments have indicated that the friction between the rice kernels themselves does not promote breakage so much as the friction between the rice kernels and the adjacent parts of cylinder 10, bore 5 and blade 20. For this reason the present invention is directed toward the reduction of breakage by reducing the friction between the rice and the surrounding structure and increasing the friction between the rice kernels themselves.

The structure thus far described is adequately disclosed in Patent No. 512,304, including the longitudinally extending ribs 18 on hulling cylinder 10. In the cited patent the rice is urged longitudinally along the casing by means of feeding ribs similar to ribs 18 but slantly disposed relative to the axis of cylinder 10 so as to provide an axially directed force on the rice as well as a peripherally directed force. Said feeding ribs are positioned on cylinder 10 in registration with inlet opening 16.

By the present invention the plurality of screws threads 26 are provided on cylinder 10 in lieu of the above mentioned feed ribs. The provision of threads 26 has several beneficial effects. First, a more positive feed is imparted to the rice in an axial direction. Second, a pressure, somewhat analogous to a liquid pressure, permeates the body of rice in the bore 5 so as to increase the friction between adjacent kernels of rice and this promotes the hull and bran removal step. Third, the frictional resistance between the rice kernels and the surrounding structure may be reduced by moving the adjustable blade 20 radially outwardly so as to provide a greater space between blade 20 and cylinder 10 than is necessary when feed screws 26 are not employed.

It has been found that the percentage of broken kernels in the rice discharged through outlet 17 is reduced in an amount from two to five percent of the above described modified structure. The exact percentage of improvement depends on atmospheric conditions and other vari-
ables not pertinent to this invention. When it is considered that thousands of tons of rice may be processed each year by this equipment, the savings effected are readily appreciated.

Another benefit derived from the use of screw threads 26 is that the speed and power input to cylinder 10 may be reduced over that previously employed without reducing the capacity of the huller. This fact substantiates the theory that friction between the kernels themselves promotes the hull and bran removal step to a greater degree than friction between the rice and surrounding structure.

Another benefit accruing from the use of feed screws 26 is that more accurate control is made possible. In other words, the movement of blade 20 to change the milling action becomes less critical thus facilitating the positioning of the hulling blade to achieve the desired degree of milling. In this connection it has been found that this advantage in control is lost if the axial force on the rice becomes too great. For example, as seen in the drawing, the ribs which form the screw threads 26 are substantially the same in depth and width as the longitudinally extending ribs 18 on cylinder 10. Also, it will be noted that two and one-half threads are employed. By increasing the number of threads to three it has been found that control over the milling step by adjustment of blade 20 is completely lost. In other words, if a greater number of threads are employed the feed screw “takes over” as it were, and dictates the amount of friction to which the rice is subjected.

On the other hand, if the number of threads is reduced, control by movement of blade 20 also becomes more difficult although a reduction in the percentage of broken rice still results. If speed were no consideration, one or two threads could be employed with an attendant reduction in breakage but for the reasons pointed out above two and one-half threads are preferred.

Although the proportion of the various parts is more important than the actual dimensions the following dimensions, already used successfully, are of interest. A 5½" outside diameter cylinder about 18" long is provided with six longitudinally extending ribs such as those designated at 18 in the drawing. Said ribs 18 are about ½" deep and ¾" wide. The screw 26 is formed by a rib having the same cross sectional extent as ribs 18 with a pitch about equal to twice the width of each screw thread or rib. The spacing between the end of screw threads 26 and the adjacent ends of longitudinally extending ribs 18 is about equal to the width of the ribs. However, this dimension is not critical.

It will be understood, of course, that the invention has been described in connection with the operation of milling rice merely as an example. Obviously the apparatus may be employed for the decortication of other cereals.

I claim:

In a hulling machine for milling rice and the like provided with:

(a) a casing having an elongated bore therein;
(b) an inlet opening at one end of said bore and a discharge opening at the other end thereof;
(c) an elongated cylinder supported in said bore for rotation coaxial therewith and having a plurality of circumferentially spaced ribs on said cylinder extending axially between said openings for agitating rice in the space between said casing and said cylinder during rotation of said cylinder, and
(d) a radially adjustable axially extending blade carried by said casing for partially controlling the fractional milling action between said blade, said cylinder and rice in said casing, the improvement comprising:

(e) a continuous, single thread feed screw formed at one end of said cylinder adjacent said inlet opening and extending around said cylinder for substantially two and one-half revolutions for urging rice in said casing from said one end toward the other end of said cylinder and thereby increasing the fractional milling action between adjacent rice kernels without significantly increasing said action between said blade, said cylinder and rice in said casing and effecting substantially greater control of said latter action by adjustment of said blade;

(f) the cross-sectional contour and extent of the thread of said feed screw is substantially the same as the cross-sectional contour and extent of each of said ribs;

(g) the pitch of said feed screw is about twice the width of said thread.

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