A husk separator in which a stream of husked grain and husks is subjected to streams of air produced by a single blower or aspirator housed inside a housing consisting of a winnowing chamber, settling chamber and chamber for housing said blower, whereby husked grain is separated from the husks in the winnowing chamber, and said streams are joined together after passing through the winnowing chamber to form in the settling chamber a stream of air which solely carries the husks, passes along an inner surface of rear side wall of the housing by centrifugal force working thereon and remotely from an inlet opening of the blower and discharges the husks from an opening connected to an outlet conduit of the blower.
HUSKER SEPARATOR

This invention relates to a husker and more particularly, it relates to a winnowing device in a husker.

Conventional winnowing devices provided to a husker might be sorted into two types, viz., a winnowing device provided with a pair of blowers or aspirators, one of which is designed so as to produce a blow of air having a velocity sufficient to separate husks from husked grain and another of which is designed so as to produce a blow of air having a velocity sufficient to blow off the husks separated from the grain by the firstly-mentioned blower or aspirator from the device, and a winnowing device of the other type provided with a single blower or aspirator which operates to produce a blow of air for winnowing husks from the husked grain as well as for blowing off said husks from the device.

In the firstly-mentioned type of winnowing device, there is a drawback that two blowers should be provided to the device, resulting in making the manufacture thereof complicated and high at its cost and in making it impossible to assemble the device into a compact type.

In the secondly-mentioned type of winnowing device there is such a drawback that if the blow of air produced by the blower is given such a velocity than can blow off the husks far away from the device, said velocity becomes too strong to efficiently separate husks from the husked grain in a winnowing chamber, resulting in often mixing a husked unripe grain with a husked fine grain.

In view of the disadvantages accompanied to the conventional winnowing devices, the principal object of the present invention is to provide a husker with a winnowing device, in which a single aspirator or blower is provided inside a housing to produce a blow of air having an adequate velocity for efficiently and positively separating husked rice from husks and for conveying solely the husks remotely from said aspirator to a discharge conduit connected to said aspirator, whereby the aspirator does not directly act on discharging the husks and consequently prevents them from flying about inside the housing.

In the accompanying drawing:

FIG. 1 is a perspective view of a husker in accordance with the present invention,

FIG. 2 is a cross sectional view of said husker in its principal part,

FIG. 3 is a perspective view of the principal parts of the present invention husker, which is partly cut open,

FIG. 4 is a cross sectional view similar to FIG. 2, in which another embodiment of the present invention is illustrated, and

FIG. 5 is an enlarged cross sectional view of parts for discharging husks and a screw conveyor associated with said parts.

In the drawing, raw materials such as unhusked grain or rice are transported to an elevated position by means of an elevator 1 from a hopper 2 operatively connected with the elevator at its lower portion. The raw materials thus brought to an elevated position fall by their own gravity into a feeding tank 4 via a chute 3 which connects the feeding tank with an discharge opening of the elevator 1. Though in the drawing, for the simplicity thereof, said chute 3 is illustrated by a single pipe, an additional pipe might be connected to said chute to return an excessive amount of raw materials to the hopper 2, when operated a change valve provided to an intermediary of the chute 3 from which the additional pipe is branched.

The raw materials stored in the feeding tank 4 fall downward through a pulling out roll 6 into a housing 9 which is projected on a main housing 10, communicates at its upper opening with the pulling out roll 6 and at its lower opening 16 with said main housing and carries a pair of rolls 7 and 8; and they are husked while passing through the gap between said pair of rolls 7 and 8 which are separately driven or driven by one and the same electric motor by means of a reduction gear unit interposed between the motor and the rolls so that one of them rotates at a higher speed than the other at their outer peripheries. The amount of raw materials to be subjected to the rolls are controlled firstly by a shutter 5 which is provided at the lower opening of the feeding tank 4 and movable to an open and closed position, and secondly by the pulling out roll 6.

The box-like main housing 10 is closed at its both lateral sides 11, 11. The upper and bottom sides of the housing are also closed except that there is provided adjacent to the front wall an opening at the upper side wall 12, which communicates with the lower opening 16 of the housing 9 mounted with the pair of rolls 8 and 7. While the front side 14 of housing 10 is widely opened directly to the outside or indirectly through a screen 15, the rear side 13 thereof is closed almost wholly. Vertically beneath the opening of the upper side wall 12 of main housing and interposing the between the stream of husked rice and husks which downwardly falls from said opening, there are provided in the housing several pairs of wind-shielding plates 17 and 18 which are vertically spaced each other by wind passages 19, 20 and 21, said wind-shielding plates guiding the stream of husked rice to pass therethrough and preventing said stream from being subjected to the wind forcibly introduced from the front side opening 14, and said wind passages 19, 20 and 21 working to subject said stream passing therethrough to the blow of said wind. The flow of wind forcibly introduced into a winnowing chamber 24 of the housing 10 by an aspirator or blower 36 is represented in FIG. 2 by dotted lines.

In the embodiment illustrated in the drawing, said wind passages are provided at three portions, viz., at the locations indicated by numerals 19, 20 and 21, along the downward stream of husked rice.

The unhusked rice is twisted during its passing through the gap of rolls 8 and 7, because the rolls are respectively rotated at a different speed, and husks are removed from the rice.

The stream of rice thus husked falls downwardly together with husks and dusts and are subjected to the blow of wind each time when it passes through the wind passages 19, 20 and 21, whereby the husks and dusts are separated from the husked rice. A gather chute 23 having a U-shaped configuration at its cross section and carrying thereon an auger conveyor 22 which discharges a fine husked rice completely separated from husks, said rice having fallen on said chute against the blow of air due to its comparatively heavy weight,
extends laterally between the side walls 11, 11 below the wind passage 21.

One lateral edge opposite to the free edge of said gathering chute 23 connects to one edge of a gathering chute 26 which carries thereon an auger conveyor for discharging unripe husked rice fallen on the chute, being slightly influenced by the blow of air on account of its weight lighter than a fine husked rice.

In the present invention husker in which only a single aspirator or blower is utilized, the way of winnowing is completely unique compared to conventional huskers of the kind described in the foregoing in that the blow of wind introduced into the housing 10 forms at least two kinds of wind flow, viz., a first flow introduced from the front side opening into the winnowing chamber 24, passing horizontally through said chamber and over an inlet opening 32 of the aspirator 36 and centrifugally and downwardly turning in a settling chamber 29 against the rear side wall 13, and a second flow passing through the wind passages 20 and 21 almost horizontally, running through the winnowing chamber in an upward curve until it reaches a position above the inlet opening 32 of aspirator or blower and flowing together with the first flow in a chamber 28.

In order to make such flows, one lateral edge of the chute 26 for gathering unripe husked rice, which is located in a position opposite to the other edge connected to the chute 23 for gathering a fine husked rice, is integrally connected with a leg plate 25 which extends over the entire distance between the lateral side walls 11 and 11 and towards the rear side wall 13 and which is slanted upwardly until it reaches a position adjacent to the inlet opening 32 of aspirator 36 and made an arcuate form 27 and its free end which covers said inlet opening 32 with a distance therefrom and also with a distance from the upper side wall 12, by which distance the aforementioned chamber 28 is formed, and in which distance the aforementioned first and second flows are joined together and given a centrifugal force to be exerted thereon in a settling chamber 29.

The inlet opening 32 of aspirator or blower 36 is connected to the latter by a conduit 37 which is air-tightly fitted through a guide plate extending laterally between the lateral side walls 11, 11 and having an upper part 34 which is upwardly slanted towards the leg plate 25 and connected at its free edge to said plate 25 and a lower part 33 which is downwardly slanted and connected at its free edge to one edge of a chute 31 for gathering husks. Said chute 31 is provided in the housing remotely from the inlet opening 32 and consists of a plate vertically projecting at a lateral space between the both lateral side walls 11 and slightly inwardly arcuated against the inner surface of rear side wall 13. Said chute hangs over a screw conveyor 30 and acts to catch the husks conveyed by the stream of air flowing along said inner surface of rear side wall for preventing the husks from flying about from the vicinity around the said conveyor 30.

The lower part of the leg plate 25 and said guide plate consisting of said parts 33 and 34 form a chamber 35 having a triangular shape at its cross section, which allows the aspirator or blower 36 to be housed inside the housing at the space between the lateral side walls 11. The outlet conduit 38 connected at its end to said aspirator or blower penetrates through the rear side wall 13 and is connected to a cyclone collector via a connecting pipe 38.

The gathering chute 31 for husks placed at the lowermost part of the settling chamber 29 carries, as best seen in FIG. 5, the screw conveyor 30 having augers which enable to forward the husks fallen onto the gathering chute 31 to the central part of the chute which is connected with the outlet conduit 38 through a tubular conduit 41, remotely from the blades of aspirator or blower 36. Within said tubular conduit 41, there is provided a rotary valve 40 which can permit the husks to fall down into the outlet conduit but prevents the air aspirated into said conduit from escaping therefrom into the settling chamber and disturbing the flow of air in the settling chamber.

In the embodiment shown in FIG. 4, constructions of the husker are almost entirely same to that shown in FIG. 2, except that the gathering chute 23 for a fine rice is connected to the gathering chute 26 for an unripe rice by a screen 43, so that comparatively heavy husks and dusts might be further separated from husked unripe rice by the flow of air passing through said screen towards the winnowing chamber 24.

In the present husker having the above constructions, when the aspirator or blower 36 is operated at a desired speed, a blow of air is introduced into the housing 10 and constitutes several flows of air, to which the stream of rice husked by the pair of rolls 7 and 8 and falling downwardly by its own gravity with husks and dusts is subjected intermittently at the wind passages 19, 20, 21, and additionally at 43 in case of the constructions shown in FIG. 4.

The husks and dusts are separated from husked rice when they pass through the wind passages forwarded horizontally or in an upward curve over the winnowing chamber 24 and the arcuate part 27 of the leg plate 25, and turned in the settling chamber 29 centrifugally against the inwardly curved rear side wall 13 and towards the gathering chute 31, while husked unripe rice is not so much influenced by the stream of air as in case of husks and dusts on account of its weight being heavier than the latter, blown off into the winnowing chamber 24 as far as it hits against the leg plate 25 and descends along the surface of the plate 25 into the gathering chute 26 for husked unripe rice.

The fine husked rice falls down straightly onto the gathering chute 23, not being influenced by the streams of flow due to its heavy weight which can stand against the streams.

It shall be noted that the streams of air passing through the winnowing chamber 24 and conveying husks and dusts separated from the husked rice and husked unripe rice are not disturbed by the inspiration of air from the inlet opening 32 of the aspirator or blower 36, because the direction of said aspiration is isolated from the winnowing chamber by the leg plate 25, and also that the stream of air in the settling chamber 29 carrying husks is not disturbed by said aspiration, because the aspiration is made remotely from the path of said stream and is not intended to directly suck in the husks as in the case of the aforementioned conventional husker of the second type.

In other words, said stream flows in the settling chamber centrifugally against the curved inner rear
3,701,420

side wall 13 on account of the novel arrangement of said side wall and the leg plate 25, tending to fly from center adjacent to which the aspiration is made. It shall be noted also that not likely in said conventional husker, the velocity of aspiration in the present invention husker is adjusted solely to meet with the winnowing the husks from husked rice, and that no consideration is required to directly blow off the husks by said aspiration.

I claim:

1. A husk separator comprising: a housing having an open front side wall, closed rear side wall, closed lateral side walls, closed bottom wall and upper wall having an opening adjacent to the front side wall; said opening having means to receive a stream of husked rice supplied thereinto together with husks and dusts separated from the rice wherein said stream falls vertically downwardly by its own gravity; an unobstructed passage extending vertically beneath said opening and allowing the said stream to pass therethrough but which does not substantially directly effect the direction of travel of said stream; said passage being provided with a plurality of wind passages which extend transversely to said passage; an aspirator or blower means for aspirating air into the housing from the front side wall; said wind passages allowing the air aspirated into the housing by said aspirator or blower means to pass therethrough; a first chute provided directly below said passage for gathering a husked fine rice not affected by said air; a second chute provided remotely from the front side wall and adjacent to the first chute for gathering a husked unripe rice lighter than said husked fine rice and slightly affected by said air; a leg plate extending laterally between the lateral side walls of the housing and slanted upwardly towards the upper and rear side walls leaving a space between the upper wall and the uppermost part of said leg plate which is inwardly curved; said aspirator or blower means having an inlet opening located beneath the inwardly curved uppermost part of said leg plate; a settling chamber formed behind said uppermost part of the leg plate and along the inner surface of said rear side wall and provided at its bottom remote from said inlet opening of the aspirator with a chute for gathering husks; and flow means in conjunction with said curved leg plate to permit centrifugal flow; whereby streams of the air aspirated by the aspirator or blower means from the front side wall pass through the wind passages both horizontally and in an upward curve while separating the husks and dusts from the husked fine and unripe rice, and join together, when they pass over the space between the upper wall and the uppermost part of said leg plate, into a single stream of air which carries only the dusts and husks and which flows centrifugally against the inner surface of the rear side wall, not being disturbed in its direction of flow by the aspiration from the inlet opening of said aspirator.

2. A husk separator as claimed in claim 1, in which said flow means includes said rear side wall of the housing which is inwardly curved, whereby the stream of air in the settling chamber which carries husks flows centrifugally along said curved wall and remote from the inlet opening of the aspirator or blower means.

3. A husk separator as claimed in claim 1, in which said aspirator or blower means is housed in a lateral space between the lateral side walls at a place below and adjacent to the leg plate.

4. A husk separator as claimed in claim 1, in which the chute for gathering husks consists of a plate means vertically projecting at a lateral space between the lateral side walls and slightly inwardly arcuated towards the inner surface of said rear side wall so as to hang over a screw conveyer carried by said chute, for catching the husks conveyed by the stream of air flowing along said inner surface of said rear side wall, and for preventing the husks from flying about from an area around said plate means and screw conveyer.

5. A husk separator as claimed in claim 1, in which the chute for gathering husks provided at the bottom of the settling chamber carries a screw conveyer having augers which forward the husks fallen onto the chute centrally towards an opening provided centrally of the chute, said opening being connected with an outlet conduit of the aspirator or blower means via a rotary valve which prevents the air aspirated into the conduit from escaping from said opening into the settling chamber.

6. A husk separator as claimed in claim 1, in which said second chute is connected to said first chute by a screen means for providing an additional wind passage to said space between the upper wall and the uppermost part of said leg plate.