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PATENT SPECIFICATION

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(54) A POLISHING ROLL ASSEMBLY

(71) We, YANMAR DIESEL ENGINE CO., LTD., a Corporation organised under the Laws of Japan, of 62 Chayamachi, Kita-ku, Osaka, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a polishing roll assembly in an air blast friction grain polisher.

The polishing roll assembly according to the present invention includes a bran-removing screen within which is mounted a grain polishing cylinder formed by a number of separated members, each of which is pivotally supported along one of its longitudinal edges on a rotary shaft with the other longitudinal edge thereof defining an elongate gap between it and a confronting edge of the adjacent member, each member being partially or entirely coated with a powdered abrasive and each member having adjustment means thereon which co-operates with an adjustment member extending longitudinally within the rotary shaft to enable arcuate adjustment of the members to vary the space between them and the bran screen.

Specifically an assembly according to the invention may comprise a grain feeder cylinder having a feed screw formed on the outer peripheral surface thereof and a grain polishing cylinder having a plurality of polishing pieces provided at circumferentially spaced locations of the outer peripheral surface thereof, the grain feeder cylinder and said grain polishing cylinder being integrally mounted on a rotary shaft, the grain polishing cylinder having the outer peripheral surface thereof partially or entirely coated with a powdered abrasive, the grain polishing cylinder being split longitudinally into a plurality of members, each of said members being pivotally supported at one longitudinal edge thereof with the other longitudinal edge defining between it and the confronting edge of the

adjacent member an elongate gap and being provided on the inner surface thereof with a sliding groove member in adjacent and substantially parallel relation to said rotary shaft, said sliding groove member defining a groove whose depth is progressively increased towards the grain discharging end of the assembly, and in which one end of an arm or arms of an adjusting member is received, and said adjusting member being mounted in said rotary shaft with the arm or arms thereof extending outwardly through the wall of said rotary shaft and being capable of movement with the arm or arms thereof sliding longitudinally within the grooves of said respective sliding groove members, whereby the space between a bran-removing screen and said grain polishing cylinder can optionally be adjusted.

The invention may be carried into practice in a number of ways, but one specific embodiment will now be described in detail by way of example with reference to the accompanying drawings, in which:—

Figure 1 is a longitudinal vertical cross-section of an air blast friction grain polisher according to the present invention;

Figure 2 is a transverse cross-section taken on the line A—A of Figure 1, and;

Figure 3 is an exploded perspective view of the polishing roll assembly shown in Figure 1.

Figures 1 to 3 show a grain polisher having a hollow feeding cylinder 1 affording a feed screw 2 on the outer peripheral surface thereof which is arranged to feed grain from left to right in Figure 1. Secured to the left-hand end of the screw 2 is a polishing cylinder 3 formed by two substantially semi-cylindrical polishing members 3' and 3'' which, as shown in Figure 2, are longitudinally separated by a pair of elongate air nozzles 11, 12. Each of the polishing members 3', 3'' accordingly has an arcuate cross-section and the outer surface thereof is coated with a layer of powdered abrasive 13. The members 3', 3'' also provide longitudinal polishing strips 4, 5

respectively which project slightly from the remainder of their respective members, as shown in Figures 2 and 3.

The feeder cylinder 1 and the polishing cylinder 3 are mounted on a hollow rotary shaft 6 integrally therewith, to form a grain polishing roll assembly.

For this purpose the members 3', 3'' are each pivotally connected by means of pivot pins 9, 10 respectively along one longitudinal edge between opposed side plates 7, 8, which are mounted on the hollow rotary shaft 6.

On the inner surfaces of the polishing members 3', 3'' are provided sliding grooved members 14, 15, each defining a dovetail groove which extends in substantially parallel relation to the hollow rotary shaft 6. The depth of the dovetail groove is progressively increased towards the grain discharging end of the assembly (the left-hand end in Figure 1). Elongate slots 16 are formed in the wall of the hollow rotary shaft 6 at diametrically opposite locations, the length of these slots being equal to the length of the dovetail grooves of the sliding grooved members 14, 15. An adjusting member 18 is mounted for free rotary movement on the forward end or reduced diameter portion 17' of an adjusting rod 17 extending through the hollow of the rotary shaft 6. A check pin 28 holds the adjusting member 18 axially on the rod 17 and two radial arms of said adjusting member 18 extend outwardly of the hollow rotary shaft 6 through the elongate slots 16, with the outer end extremities of the arms being received in the dovetail grooves of the respective sliding grooved members 14, 15 mounted on the respective polishing members 3', 3''. A plurality of vent holes 19 are formed in the wall of the rotary shaft 6 in communication with the elongate air nozzles 11, 12 mentioned above. A bran-removing screen 20 is provided around the polishing cylinder 3 with a suitable space therebetween. Reference numeral 21 designates a grain supply hopper, 22 a polished grain delivery port, 23 a bran-dropping chute and 24 a pressure operated grain outlet member. Reference numeral 25 designates a mounting block for the adjusting rod 17, by which said adjusting rod is supported for longitudinal movement.

Reference numeral 26 designates a set screw to secure the adjusting rod 17 in position, which is screw-threaded into the mounting block 25. A longitudinal movement of the adjusting rod 17 is caused by an arm 27 which has one end in engagement with the rear end of said adjusting rod 17, with the other end pivotally secured to the machine frame.

Reference numeral 31 designates an air duct through which air is blown into the

hollow rotary shaft 6 through apertures (not shown). The shaft 6 is suitably driven by means, not shown.

Polishing rolls which have commonly been used are not split but are a solid body, and in addition, the surfaces thereof are formed by a smooth, slippery steel plate, etc. With such a conventional polishing roll, the grain particles are polished by the polishing cylinder in one step while being rubbed by each other, so that the temperature of the grain rises, resulting in formation of crushed grain and degrading the quality of polished grain. According to the present invention, however, the space L shown in Figure 2 between the polishing cylinder 3 and the bran-removing screen 20 can suitably be adjusted prior to the polishing operation. Thus by rotating the arm 27 in a suitable direction, the adjusting rod 17 connected to said arm 27 is moved in the same direction, so that the arms of the adjusting member 18, mounted on the forward end 17' of said adjusting rod 17, are moved within the slots 16, with the outer ends thereof sliding within the grooves of the respective sliding groove members 14, 15. Since the bottom or outer surfaces of the grooves are progressively increased in depth towards the grain outlet end, as stated previously, the arcuate polishing members 3', 3'' are caused to pivot around the pivot pins 9, 10 respectively to define the desired space L between the outer surfaces thereof and the bran removing screen 20. Then, the polishing members 3', 3'' are set in their positions by securing the adjusting rod 17 in position by tightening the set screw 26, whereby the space L can be maintained. Thereafter, the polisher is set in operation and grain is fed into the polisher through the supply hopper 21. The grain thus fed is forwarded to the polishing cylinder by the action of the rotating feed screw 2, and polished by the powdered abrasive layers 13 on the outer peripheral surfaces of the polishing cylinder 3 which is also driven by the rotary shaft 6. The polished grain is pushed forward by the successive grain continuously fed into the polisher, and discharged from the delivery port 22 while forcibly opening the grain outlet member 24 with a suitable pressure. In the polishing process, the grain particles are subjected to a preliminary polishing by the powdered abrasive layer 13 and, successively thereafter, to a final polishing by the polishing strips 4, 5. Thus, since the polishing is effected not in one step as in case of the conventional polishing roll, crushing of the grain can be prevented and glossy, beautiful polished grain particles can be obtained at high yield in a short period of time.

Moreover, the dusts, such as bran, 130

produced during the polishing operation are discharged to the outside of the polisher through the bran-removing screen 20 and thence to a suitable location exterior of the polisher through the bran-dropping chute 23 while being entrained in air flow supplied through the air duct 31 and jetting through the air nozzles 11, 12 after passing through the hollow of the rotary shaft 6 and the vent holes 19 and the elongate slots 16.

When the feeding rate of the grain into the polisher has been lowered or the powdered abrasive layers 13 have been partially worn, the polishing pressure in the interior of the polisher decreases and hence it becomes necessary to reduce the space L between the polishing cylinder 3 and the bran-removing screen 20. This can be achieved by rotating the arm 27 in the direction of the arrow in Figure 1, upon loosening the set screw 26. When the arm 27 is rotated in the direction of the arrow, the adjusting member 18 is moved in the same direction by way of the adjusting rod 17 and hence the arms of said adjusting member are moved within the elongate slots 16, with the outer ends thereof sliding within the grooves of the sliding groove members 14, 15 in the direction of the arrow. In this case, since the depth of the grooves of the sliding groove members 14, 15 is progressively increased towards the grain discharging end, end of the assembly as stated previously, the polishing members 3', 3'' are caused to make a pivotal movement outwardly about the pivot pins 9, 10 respectively and thus the space L becomes narrower and the polishing pressure is increased. Incidentally, the openings of the air nozzles 11, 12 also become larger than before. When the polisher is set in operation under such condition, the polishing cylinder 3 is rotated but the adjusting rod 17 does not rotate and the adjusting member 18 only rotates on the forward end 17' of said adjusting rod 17. The adjusting member 18 will not be disengaged from the sliding groove members 14, 15 because of the dovetail joint therebetween and, therefore, the adjusted space L can constantly be maintained. When the polishing pressure is desired to be reduced, the arm 27 is rotated in the opposite direction, whereupon the outer ends of the arms of the adjusting member 18 are displaced within the grooves of the sliding groove members 14, 15 in the direction of the arrows toward the grain discharging end of the assembly or in the direction in which the depth of said grooves becomes progressively large. Therefore, the polishing members 3', 3'' are caused to make a pivotal movement toward the rotary shaft 6 about the pivot pins 9, 10 respectively and thus the space L becomes larger.

In the polishing roll assembly according

to the present invention, the outer surface of the polishing cylinder is partially or entirely coated with layers of suitable powdered abrasive as stated at the beginning of the description. Therefore, when the polished roll assembly is used in a grain polisher, a grain fed into the polisher through the supply hopper and moved toward the polishing cylinder by the action of the rotating feed screw is first polished by the powdered abrasive and successively thereafter completely polished by the polishing pieces, and is not polished in one step as in the case of the conventional polishing roll. According to the present invention, therefore, the following advantages can be obtained: Namely, the formation of crushed grain, the degradation of quality of the polished grain due to temperature elevation of the grain and a declination in the polishing effect due to wear of the polishing cylinder surface can substantially be eliminated and a glossy beautiful polished grain can be obtained efficiently at high yield in a short period of time. Furthermore, since the space between the polishing cylinder and the bran removing screen can suitably be adjusted by operating the arm, a highly effective polishing action can be obtained under any conditions, regardless of the type, the hardness and the moisture level of grain, and in addition, the polishing efficiency can be further enhanced. Even when the powdered abrasive layers have been worn out, the polishing pressure can be maintained uniformly by the operation of the arm 27 and said operation is very simple.

WHAT WE CLAIM IS:—

1. A polishing roll assembly in an air blast friction grain polisher, including a bran-removing screen within which is mounted a grain polishing cylinder formed by a number of separated members, each of which is pivotally supported along one of its longitudinal edges on a rotary shaft with the other longitudinal edge thereof defining an elongate gap between it and a confronting edge of the adjacent member, each member being partially or entirely coated with a powdered abrasive and each member having adjustment means thereon which co-operates with an adjustment member extending longitudinally within the rotary shaft to enable arcuate adjustment of the members to vary the space between them and the bran screen.

2. A polishing roll assembly in an air blast friction grain polisher, comprising a grain feeder cylinder having a feed screw formed on the outer peripheral surface thereof and a grain polishing cylinder having a plurality of polishing pieces provided at circumferentially spaced locations of the outer peripheral surface thereof, the grain feeder

produced during the polishing operation are discharged to the outside of the polisher through the bran-removing screen 20 and thence to a suitable location exterior of the polisher through the bran-dropping chute 23 while being entrained in air flow supplied through the air duct 31 and jetting through the air nozzles 11, 12 after passing through the hollow of the rotary shaft 6 and the vent holes 19 and the elongate slots 16.

When the feeding rate of the grain into the polisher has been lowered or the powdered abrasive layers 13 have been partially worn, the polishing pressure in the interior of the polisher decreases and hence it becomes necessary to reduce the space L between the polishing cylinder 3 and the bran-removing screen 20. This can be achieved by rotating the arm 27 in the direction of the arrow in Figure 1, upon loosening the set screw 26. When the arm 27 is rotated in the direction of the arrow, the adjusting member 18 is moved in the same direction by way of the adjusting rod 17 and hence the arms of said adjusting member are moved within the elongate slots 16, with the outer ends thereof sliding within the grooves of the sliding groove members 14, 15 in the direction of the arrow. In this case, since the depth of the grooves of the sliding groove members 14, 15 is progressively increased towards the grain discharging end, end of the assembly as stated previously, the polishing members 3', 3'' are caused to make a pivotal movement outwardly about the pivot pins 9, 10 respectively and thus the space L becomes narrower and the polishing pressure is increased. Incidentally, the openings of the air nozzles 11, 12 also become larger than before. When the polisher is set in operation under such condition, the polishing cylinder 3 is rotated but the adjusting rod 17 does not rotate and the adjusting member 18 only rotates on the forward end 17' of said adjusting rod 17. The adjusting member 18 will not be disengaged from the sliding groove members 14, 15 because of the dovetail joint therebetween and, therefore, the adjusted space L can constantly be maintained. When the polishing pressure is desired to be reduced, the arm 27 is rotated in the opposite direction, whereupon the outer ends of the arms of the adjusting member 18 are displaced within the grooves of the sliding groove members 14, 15 in the direction of the arrows toward the grain discharging end of the assembly or in the direction in which the depth of said grooves becomes progressively large. Therefore, the polishing members 3', 3'' are caused to make a pivotal movement toward the rotary shaft 6 about the pivot pins 9, 10 respectively and thus the space L becomes larger.

In the polishing roll assembly according

to the present invention, the outer surface of the polishing cylinder is partially or entirely coated with layers of suitable powdered abrasive as stated at the beginning of the description. Therefore, when the polished roll assembly is used in a grain polisher, a grain fed into the polisher through the supply hopper and moved toward the polishing cylinder by the action of the rotating feed screw is first polished by the powdered abrasive and successively thereafter completely polished by the polishing pieces, and is not polished in one step as in the case of the conventional polishing roll. According to the present invention, therefore, the following advantages can be obtained: Namely, the formation of crushed grain, the degradation of quality of the polished grain due to temperature elevation of the grain and a declination in the polishing effect due to wear of the polishing cylinder surface can substantially be eliminated and a glossy beautiful polished grain can be obtained efficiently at high yield in a short period of time. Furthermore, since the space between the polishing cylinder and the bran removing screen can suitably be adjusted by operating the arm, a highly effective polishing action can be obtained under any conditions, regardless of the type, the hardness and the moisture level of grain, and in addition, the polishing efficiency can be further enhanced. Even when the powdered abrasive layers have been worn out, the polishing pressure can be maintained uniformly by the operation of the arm 27 and said operation is very simple.

WHAT WE CLAIM IS:—

1. A polishing roll assembly in an air blast friction grain polisher, including a bran-removing screen within which is mounted a grain polishing cylinder formed by a number of separated members, each of which is pivotally supported along one of its longitudinal edges on a rotary shaft with the other longitudinal edge thereof defining an elongate gap between it and a confronting edge of the adjacent member, each member being partially or entirely coated with a powdered abrasive and each member having adjustment means thereon which co-operates with an adjustment member extending longitudinally within the rotary shaft to enable arcuate adjustment of the members to vary the space between them and the bran screen.

2. A polishing roll assembly in an air blast friction grain polisher, comprising a grain feeder cylinder having a feed screw formed on the outer peripheral surface thereof and a grain polishing cylinder having a plurality of polishing pieces provided at circumferentially spaced locations of the outer peripheral surface thereof, the grain feeder



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4 cylinder and said grain polishing cylinder
being integrally mounted on a rotary shaft,
the grain polishing cylinder having the outer-
peripheral surface thereof partially or
5 entirely coated with a powdered abrasive,
the grain polishing cylinder being split
longitudinally into a plurality of members,
each of said members being pivotally
supported at one longitudinal edge
10 thereof with the other longitudinal
edge defining between it and the
confronting edge of the adjacent
member an elongate gap and being provided
on the inner surface thereof with a sliding
15 groove member in adjacent and sub-
stantially parallel relation to said rotary
shaft, said sliding groove member defining a
groove whose depth is progressively in-
creased towards the grain discharging end of

the assembly, and in which one end of an 20
arm or arms of an adjusting member is
received, and said adjusting member being
mounted in said rotary shaft with the arm or
arms thereof extending outwardly through 25
the wall of said rotary shaft and being
capable of movement with the arm or arms
thereof sliding longitudinally within the
grooves of said respective sliding groove
members, whereby the space between a
bran removing screen and said grain 30
polishing cylinder can optionally be ad-
justed.

3. A polishing roll assembly substantially
as described herein with reference to the
accompanying drawings. 35

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