UNIT 4 DETACHERS AND BRAN FINISHERS

Structure

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4.0 OBJECTIVES

After reading this unit you should be able to understand:

- working of a detacher, also known as flake disruptor;
- explain various detachers / flake disrupting machines, their principle of operation, their construction, and their application in Flour Milling Industry;
- assess the importance and function, uses of Detachers;
- working of a bran finisher?;
- types of bran finishers used in Flour Mills; and
- explain the construction and mode of operation of two types of bran finishers, their advantages and their disadvantages.

4.1 INTRODUCTION

Milling operation consist of either a long reduction system or a shorter reduction system with reduced surface demanding high (heavy) grinding. We mill semolina and middlings on smooth surface rolls (reduction passages). In this operation endosperm flakes or lamellae are created. Production of these flakes is especially more during high (heavy) grinding pressures, with low differential speeds between rolls, with products of relatively high moisture content (>16% moisture); as well as in milling of soft wheat blends.

These flakes harbour some flour as well; if these are not disrupted, they get passed on to the collection passages, and towards the rear inferior quality passages causing unnecessary burden in them.

During the last passages of break system, *viz.,* the fourth and fifth breaks, we need to effect a final scalping of bran to remove adhering flour from the bran coming out in these passages; by easily processing them in a bran finisher, also known as bran duster. Thus, we could recover 0.50 to 1.0% of the clean wheat weight going to the first break. You could imagine, the bran finisher also releases a certain amount of endosperm, which can be made into flour, the total gain in flour extraction is more than the figures given above. These last flour particles can be separated much easier with a bran finisher than with a roller mill.

The bran finisher (also called as bran duster or bran brush) is used to remove flour particles adhering to the skins (bran). The bran thus processed is released with reduced flour admixtures. The relatively dark flour coming from this process is a valuable one and of quite good baking properties and baking quality, even though it has high ash content.

4.2 WHY A DETACHER?

Detachers or flake disrupters are simple machines placed between the rolls and plansifter to take up the task of detaching (disrupting) such flour lamellae without comminuting/breaking bran or bran particles.

Detachers, nevertheless, are a useful safe guard when plansifters are used for sifting the reduction stock (some years back, please note, centrifugal sifters were used). For, if any endosperm flakes do exist, the plansifters are liable to over tail them and thus, send a good deal of endosperm material to offals.

4.3 WHAT IS A DETACHER?

Detacher or flake disruptor are machines designed to break up endosperm flakes or lamellae without disintegrating bran and germ particles. Detachers are installed between the reduction and the sifter passage.

4.4 CONSTRUCTION OF FIRST DETACHER MODELS

The first detachers available to industry, were a worm with a continuous blade forcing the stock through a dead space against a delivery cone. The resistance of the cone was regulated by an adjustable spring control, which makes it sensitive to variations in the feed (see Fig. 1)

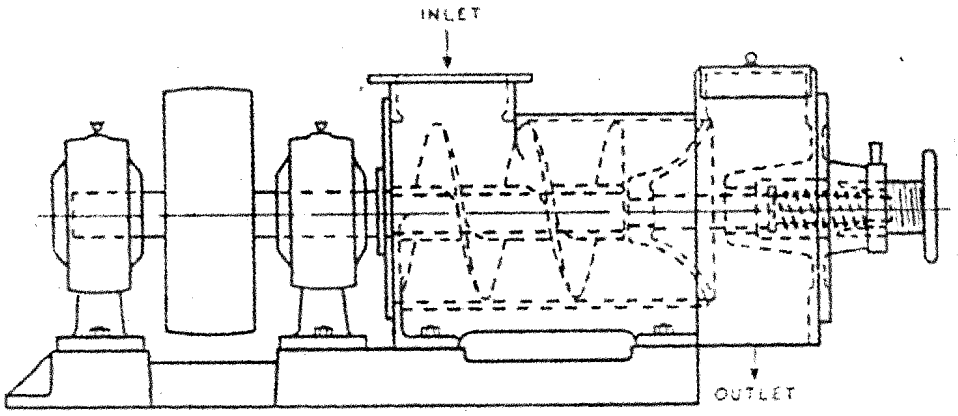

Fig. 1: Detacher of very earlier stage of development

While the older models of detachers often operated with friction, today's detachers operate by the impact of beaters with a vortex action of the material (Ex. Beater or drum detacher). Furthermore, in some detachers, the flour lamellae or the partially-broken middlings or semolina particles are breakdown by the impact caused by the centrifugal force and due to subsequent impact of this material against the impact wall of the casing (impact detachers)

4.5 DIFFERENT DETACHERS

Based on (i) Construction features, (ii) Mode of action and (iii) The intensity of detaching required; we see three types of detachers:

i) Disc detacher

ii) Beater or drum detacher, and

iii) Impact detacher

Now, let us understand the construction, mode of action and usefulness of the above detachers.

4.5.1 Disc detacher

The disc detacher provides for a rather intensive disruption of the flakes (Fig. 2)

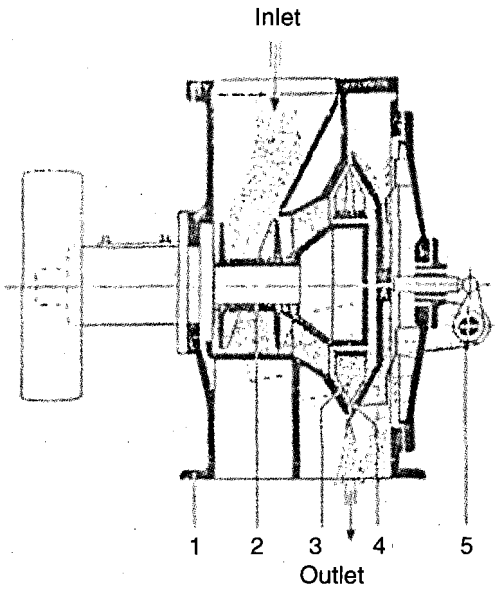

Fig. 2: Disc Detacher

4.5.2 Construction features and operation of disc detacher

A short worm takes over the incoming product and passes it through the opening between two discs. While one of these two disc is a fixed one, the other one is adjustable. The moveable disc is pressed against the fixed one by spring tension; or by a counter weight. The operational pressure of the disc can be adjusted to any product. A fan screw with two or three blades rotates between the two discs.

The opening between the two discs will be adjusted automatically to the capacity of the through-flowing product. However, as the distance of opening between the two discs is very small, the adjustable disc might not react to small capacity fluctuations. Thus, this detacher is very sensitive to chokes. Hence a frequent check is necessary for a more intensive detaching. If a slight grinding is desired, the surface between the two discs could be provided with small grooves.

The machine has a circumferential velocity of 5-8 meters/second, runs with a speed of 200 to 400 revolutions per minute (r.p.m.). It will have the capacity to process 850 kg/hr, driven by a 0.75 HP motor.

4.5.3 Beater or drum detacher

This detacher works very gently and is therefore used, for products containing more bran particles (dirty ones) and germs (Fig 3).

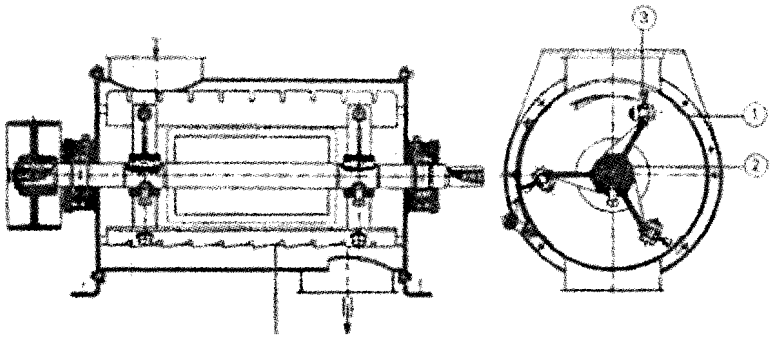

Fig. 3: Beater Detacher

4.5.4 Construction and operation

The Drum Detacher consists of a cylindrical housing of 240-300 mm diameter. A beater rotor is placed in this housing. Beater rails are mounted onto the three rotor arms. The beaters form a slight spiral in order to convey the product to the outlet. The product is caught by the beaters driven by high speed rotor and is thrown against the detacher housing. Impact rails installed on the inside wall of drum create a stronger, vortex effect on the material and thus improve the effect of the detacher.

Various drive possibilities allow this detacher to be installed at various points between the roller mill and plan sifter.

The machine has a circumferential velocity of 10-11 m /sec., rotates at about 700-800 r.p.m. The machine could have capacity upto 900 kg/hr driven by a 1.5 HP motor.

4.5.5 Impact Detacher

This detacher operates considerably more intensively compared to beater detacher. It actually assists in the grinding operation. Depending on the product hardness, the extraction of flour can be increased quite considerably. In view of its intensive work, it shall be used only on clean reduction passages like C_2, C_3, C_5 or at the very end of the grinding process like C_8, C_9 passages (Fig 4).

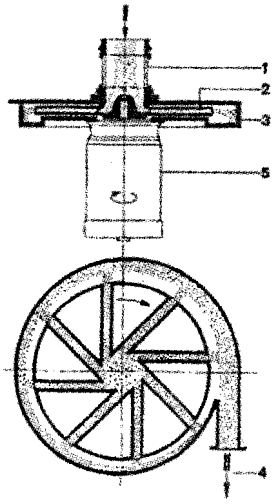

Fig. 4: Impact Detacher

4.5.6 Construction and operation

The steel design consists of a flat round casing with a flanged motor. The centrifugal wheel is fastened directly on to the motor axle shaft. The product feed is arranged centrally on the top.

The stock to be detached is caught by the centrifugal wheel operating with high r.p.m and gets impacted against the internal casing wall. This impact causes the detaching and milling effect. The circulating air and the pneumatic suction provide

for the transport of the product within the machine. The stock achieves a circumferential velocity of 78 m/sec. The machine could have capacities of 1500 kg/hr. with a 5 HP motor or 4 tonns/hr with 7.5 HP motor driven at 3000 r.p.m.

Depending on the application and availability of space, two different constructions are available in the market (Fig. 5) indicates various position of impact detachers in the pneumatic line .

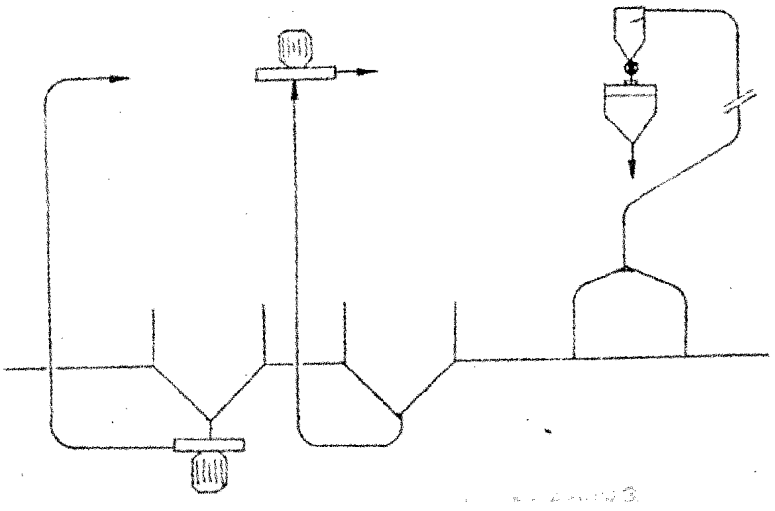

Fig. 5: Various Position of Impact Detachers

1. The machine with tangential outlet can be suspended at the ceiling below the roller mill or it can be put on the floor. With direct suction, it is possible to install it in place of the last bend of its pneumatic line. However with this arrangement a by pass is no longer possible
2. The machine with hopper and vertical outlet can be installed between cyclone and plansifter. An arrangement that again can be applied with direct suction.

4.6 DEVELOPMENT AND APPLICATION OF DETACHERS

- Older mills mostly used disc detachers.
- Newer mills used disc detachers on clean passages (like C_2, C_3) and beater detachers on branny passages
- Newest and modern mills used impact detachers for clean passages (C_2, C_3) and beater detachers for branny and germ containing passages.

4.7 MERITS/DEMERITS OF DETACHERS

No.	Disc detacher	Drum / beater detacher	Impact detacher
1.	Intensive disruption of flakes	Moderate intensive action on flakes	Very intensive action on flakes
2.	Specky flours results with improper adjustment of counter weight	Possible to place it in product lines of bran particles (dirty stock) and germ	Very suitable for cleaner passages as well as tail end passages
3.	Lubrication of two bearings is a must	Permanently lubricated bearings	Drive motor needs usual maintenance
4.	Very sensitive to chokes	Suction is connected after the machine to avoid choking	Shall be used in pneumatic suction transport

4.8 PRINCIPLE OF OPERATION OF BRAN FINISHER

To move and rub bran particles, to cause adhering endosperm particles to fall off and drop through the chosen perforated metal sheet of the machine so that processed bran and endosperm particles leave the machine separately. Inside bran finishers, the action is basically beating and centrifugation.

4.9 TYPES OF BRAN FINISHERS

Based on the disposition of rotors, two types of bran finishers are available to Flour Milling Industry. These are (1) Horizontal bran finisher and (2) Vertical bran finisher. Their construction and operation are given below.

4.10 HORIZONTAL BRAN FINISHER

This bran finisher consists of a welded and bolted steel construction with control doors. This is a bran finisher with horizontal rotor. Cross section of this bran finisher could be seen (Fig. 6)

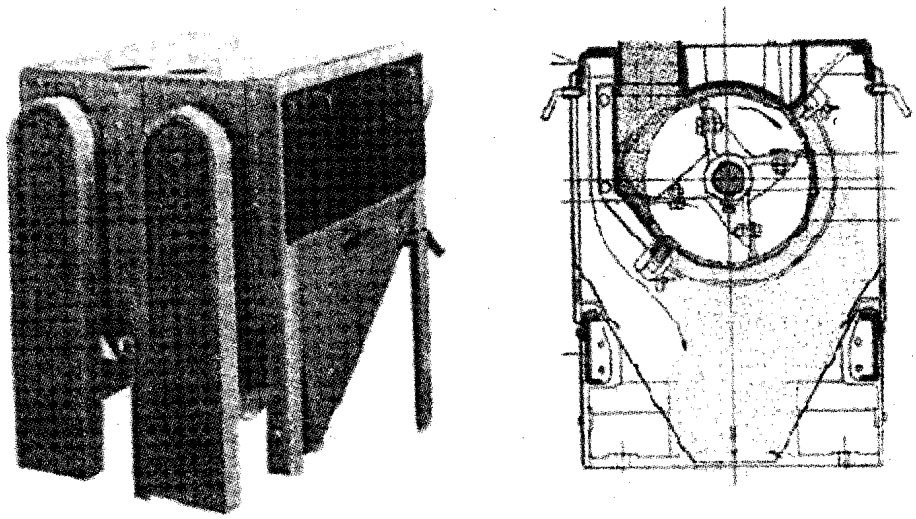

Fig. 6: Horizontal Bran Finisher

The roller bearings for the rotor are fitted on the face plates. The rotor consists of beaters with steel rails set at an inclination and get rotated at 1000-1600 r.p.m. The dust proof sieve jacket with round perforations encompasses one half of the arc and is easily exchangeable by rapid locks.

Action: The rotating adjustable beaters siege the bran stream entering tangentially and throw the bran against the impact wall. The bran is caught again with every revolution of the rotor, so that the flour particles are gradually and completely loosened from the brain.

The special seven-cornered design of the sieve jacket makes a continuous co-rotation of the skin stream impossible. The slight vibration of the flexible sieve keeps the perforations continuously open (self-cleaning). The machine is driven by V-belts and seldom by a directly coupled motor if the jacket throughs are not pneumatically conveyed, we shall foresee an aspiration connection to enable cleanliness inside the machine.

The throughs, flour and fine bran particles fall into a hopper which is very steep and has smooth walls to avoid bridging of the throughs inside the hopper.

4.11 VERTICAL BRAN FINISHER

This bran finisher is an all metal machine with vertical rotor installed into a narrow housing (Fig. 7). It processes the product in a vertical direction, from bottom to the top. The rotor speed is 2800 r.p.m. The bran is caught at the lower end of the rotor shaft by the short feed screw and conveyed to the top. The actual processing is done by the beaters (RIBS) set at a certain angle. These beaters throw (filing) the bran onto the inside wall of the slotted jacket with an upward motion. The flour adhering to the bran is separated in this so-called centrifugal space and passes through the slots of the jacket into a ring-shaped channel from where it falls into the outlet.

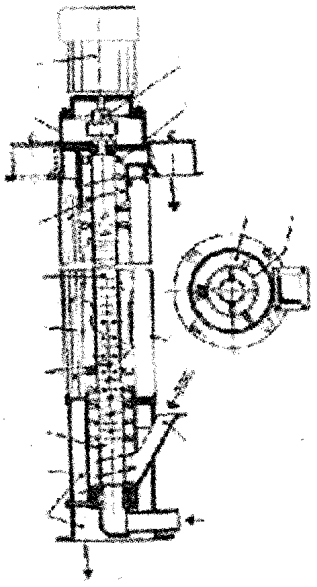

Fig. 7: Vertical Bran Finisher

The cleaned bran is again caught at the top by a full flight screw and finally conveyed to the outlet by discharging beaters.

Due to this processing and vertical conveying of the stock from bottom to the top, against its natural tendency to fall down wards, the bran remains in side the jacket longer and is hit by the rotors more often than in a horizontal rotor machine.

Air can penetrate from below through the hollow rotor shaft which aerates and cools the machine.

The drive is effected by a vertically-mounted electric motor which is coupled via coupling to the rotor shaft. The sieve jacket consists of three parts which can be removed immediately by loosening the bolts.

4.12 MERITS/DEMERITS OF THE TWO TYPES OF BRAN FINISHERS

These are listed for your understanding one machine disadvantage could be another's advantage.

Sl. No.	Horizontal bran finisher	Vertical bran finisher
1.	Occupies a larger space	Space requirement is extremely small
2.	Jacket covers one half of arc (diameter) (lesser sieving area)	Jacket covers the compete circum-ference of rotor

3.	Sieve cleaning is by itself due to slight vibrations to it	Jacket sieve being tough due to smaller diameter and round shape, this influences sieve cleaning negatively
4.	Less maintenance and vibration as rotor speeds are 1000-1600 r.p.m.	More wear and tear and maintenance as rotor speeds are > 2400 r.p.m.
5.	The flours are moderate in ash content	Flours are darker and higher in ash
6.	Aspiration to machine is optional, depending on pneumatic conveyance of throughs	Outlet of the overs shall be aspirated

Check Your Progress

Note: a) Use the spaces given below for your answers.
b) Check your answer with those given at the end of the unit.

1. What is the aim of using a detacher / flake disrupter?

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2. List types of detachers available to flour milling industry and mention the principle of operation.

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3. You are asked to procure a detacher for your mill. The stock is rich in germ. Which detacher you select out of the below and why? Please tick one of the three. Disc detacher, Beater or Drum detacher, Impact detacher!

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4. What is the job of a bran finisher?

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5. List types of bran finishers available in flour mills and indicate the reason for naming so.

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6. You are requested to order a new bran finisher for our mill, we produce dark flour with good extraction which bran finisher will you select?

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4.13 LET US SUM UP

- Detacher or flake disrupter is a machine to disrupt the endosperm flakes. This facilitates good flour yields.
- Based on the intensity of flake disruption and quality of reduction passage, earlier flour mills used disc detachers; later, in new and newest mills drum or beater detachers and impact detachers are being installed.
- Detachers help in the improvement of flour yield in roller flour mills.
- Bran finisher enables to loosen and separate / recover endosperm particles, and flour particles adhered to bran.
- Normally they are placed after 4th and 5th break to recover flour particles from bran produced in these passages.
- Depending on the position of the rotor and some other salient features, bran finishers are of two types – viz., horizontal bran finishers and vertical bran finishers.
- While horizontal bran finisher are milder in action, vertical bran finishers are very intensive in action.

4.14 KEY WORDS

Detacher	:	Machine for breaking up flakes of stock produced on the reduction rolls.
Differential	:	Ratio of speed of past to slow rolls.
Disrupter	:	Machine for disintegrating endosperm flakes on head reductions.
Endosperm	:	Inner portion of the wheat grain
Flakes	:	Flattend agglomeration of stock produced by heavy roll pressures.
Germ	:	The seed's portion, which germinates
Middlings	:	Mill stock between semolina and flour in size (also known as dunst in case of finer one)
Offals	:	Generally understood to be all products of grain after flour is removed.
Reduction rolls	:	Smooth rolls for production of flour as opposed to break rolls.
Semolina	:	The larger portion of endosperm released during the breakdown process.
Ash content	:	Mineral content of flour or wheat feed (expressed as percentage on dry basis)

Bran : Outer skins of wheat

Bran duster : Also known as bran brush (in olden times) and bran finisher. Machine for removing traces of flour adhering to bran skins.

4.15 ANSWERS TO CHECK YOUR PROGRESS EXERCISE

1. Your answer should be direct

   The aim of using a detacher is to disrupt the endosperm flakes produced during reduction rolls milling

2. Just list the detachers – Principle of operation

   (i) Disc detacher – Attrition of stocks between discs

   (ii) Beater / Drum detacher – Flakes get worked between the impact rails and inside wall caused by vortex action.

   (iii) Impact detacher – By centrifugal force impacted to detachers inner housing.

3. Your answer should be very direct and simple

   Beater detacher – Passage with germ shall be very carefully handled to preserve flour quality.

4. Your answer shall indicate the job of bran finishing, that means, you wish to release the flour and endosperm particles adhering to bran.

5. Mention that there are two types of bran finishers – (1) Horizontal and vertical bran finishers. They are named so depending on the position of rotors to the base, i.e., horizontal or vertical in disposition.

6. We need darker flour with good extraction (yield of flour), so, we do not mind the ash content in it as our customers like this flour. You can think and answer it as "Vertical bran finisher".

4.16 SOME USEFUL REFERENCES

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