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EFFECT OF THE WORKING FURROWS LIFE ON THE MILLING EFFICIENCY

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ABSTRACT:

The aim of the present work is to study the effect of the working furrows life on the stone milling process leading finally to the perfect application and the developed technical operating which finally confirm high milling efficiency. The samples of wheat Austria Variety used in the experimental work. From the experimental results the following conclusions are obtained:

1. The flour extraction rate and the ash content increase as the time of operation increase.
2. The life span of the furrows is controlled by the operating time. However, as this time reached 16 hrs, the flour extraction rate and the ash content are regularly decreased.
3. Reduction of the flour extraction sugests that these furrows have to be reformed every 16 working hours.

1. INTRODUCTION:

In Egypt, the flour milling process is done by means of both roller and stone flour mills. The latter mills produce the majority of the total flour amounts at the present time. The stone mills are constructed mainly of two natural stones, granite is one of the commonly used stones. These stones need to be engraved after every working day to achieve a good milling effect using an engraving furrows which formed by manual method [1].

Experimental tests were carried out using this mill. The objective of these was to study the effect of the working furrows life on the flour extraction rate and the ash content consequently, suggest the working time that these furrows have to be reengraved.

2. EQUIPMENT AND MATERIALS:

2.1. Equipment:

Fateim stone mill which belongs to the west Delta Mills Company was used in this study.

Fig. (1) shows a schematic sketch of the natural stone mill which used in this study. It is composed of two horizontal parallel and coaxial stones. The upper stone is rotary at 180 R.P.M. [2] and has an open hole in the centre through which the grains may be passed, while the lower stone is stationary. The grains which fall through the open hole of the upper stone are pulled and moved outward by centrifugal forces. The geometry of the natural stone surface is shown in Fig. (2).

2.2. Materials:

Samples of 2 Kg of the milled flour (product) were taken periodically, after zero, 8, 16 and 24 hours. These samples were collected in plastic pages to avoid insects attack and microbial contamination in flour during the experimental study.

3. EXPERIMENTAL TESTS:

3.1. Ash Test:

3.1.1. Apparatus:

1. Electric muffle furnace provided with pyrometer and automatic control for maintenance of temperature at 600 °C.
2. Ashing dishes of Silica.
3. Efficient desicator for cooling crucibles.

Fig. (3). shows the electric muffle furnace and dishes:

3.1.2. Test Procedure:

The ash content was determined according to the A.A.C.C. [3] as follows:

1. Weigh sample, 2 to 5 gram, on tared Scoop, and dump into crucible. Place in muffle furnace preheated to 600° . Hold at this temperature for 2 hrs. with automatic control pyrometer.
2. Transfer crucibles directly to desicator, cool, and weight immediately, reporting % ash to the first decimal place.

Calculation:

$$\% \text{ Ash} = \frac{\text{weight of residue}}{\text{Sample weight}} \times 100$$

3.2. Sieving Analysis Test:

The sieving analysis was determined using a laboratory electrical plansifter consisting of four sieve frames of 20 mm. diameter. The speed of the plansifter is 300±20 R.P.M. with 50 mm. stroke. The sieving test used to determine the flour extracted through the wire Sieves No.

28,32,36 and 45 mesh [4].

3.3. Moisture Content Test:

The moisture content was determined according to A.O.A.C. [5].

4. RESULTS AND DISCUSSION:

In Figure (4) the relation between the ash content percent in the yield of flour and the working furrows life is given. This flour extracted from the whole wheat milled chop (flour and bran) which passes through the wire sieves numbers 28, 32, 36 and 45 mesh. It is clear from this figure that the ash content average increases with the increase in the furrows life until 16 working hours is reached (which is the furrows life) then it decreases. This result also holds for all flour produced by different sieve sizes. This may be attributed to the increase in the abrasion of the engraved (formed) furrows. This is due to the mechanical action on the milled chop between the two surfaces of the millstone. This abrasion causes an increase in the wear of the two surfaces of the millstone consequently, the sand content of the produced flour is inceased. After 16 hrs of operation the ash content is remarkably reduced and this is because of the reduction in the abrasion action.

In figure (5) the relation between the flour extraction rate and the wire sieves No. 28, 32, 36 and 45 mesh at different working furrows life is given. It is clear that, the flour extraction rate decreases with the sieve sizes. It is though that the increase of flour extraction rate is logically accompanied by an increase in the sieve No. Also, it can be noticed that, the values of flour extraction rate increases with an increase in the furrows life until 16 working hours is reached (which is the furrows life) then it decreases. The increase in the flour extraction rate may be attributed to the increase in the flour finness degree which is caused by the increase in the abrasion of the engraved furrows and consequently increase in the mechanical action on the milled chop between the two surfaces of the millstone. This action is decreased after 16 hrs. of operation which consequently leads to decrease the flour finness degree and hence decreases the flour extraction rate.

5. CONCLUSIONS:

It can be concluded that, the rate of extraction of milled flour and the ash content increase as the time of operation increase. The life span of the furrows is controlled by the operation time. However, as this time reached 16 hrs., the rate of flour extraction and the ash content are regularly decreased. Reduction of this flour extraction suggests that these furrows have to be reengraved (reformed) every 16 working hours.

6. REFERENCES:

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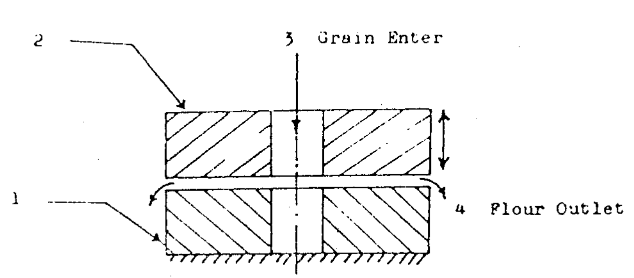

4- Flour Outlet.
3- Grain Enter
2- Rotary Stone.
1- Stationary Stone.

Fig. 1. Schematic Sketch of the Natural Stone Mill.

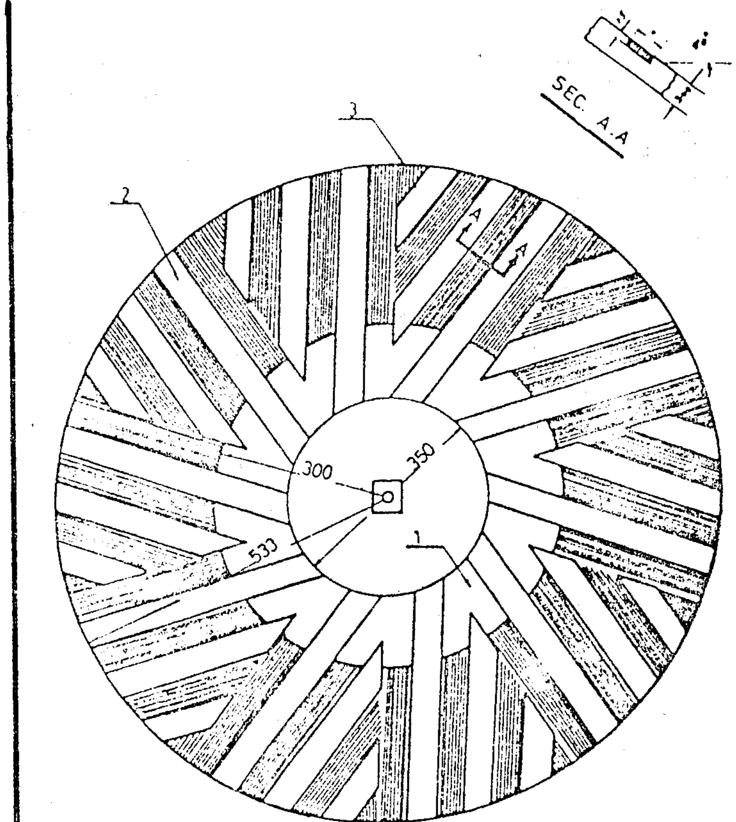

Fig. 2. Geometry of the Natural Stone Surface.

DIMS. IN M.M.

PART NO	PART NAME
1	BREAKING REGION
2	FLOUR OUTLET
3	FINE REGION

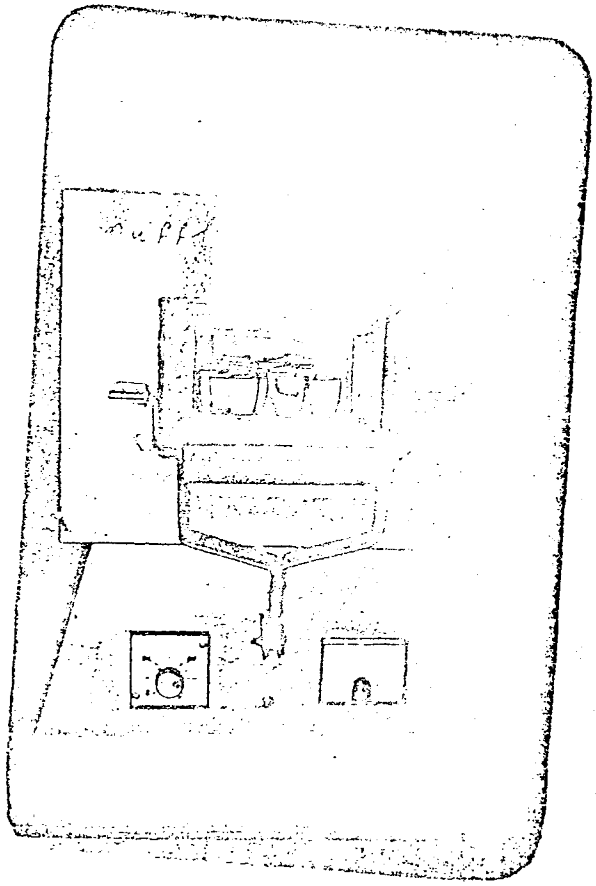

Fig. 3. Electric Muffle Furnance and Dishes.