

UNITED STATES PATENT OFFICE.

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METHOD FOR GRINDING GRAIN.

1,123,347.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, Dr. MARTIN MILLER, subject of the Kingdom of Bavaria, residing at Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Methods for Grinding Grain, of which the following is a specification:

The present invention relates to a grinding method in flour milling.

10 It consists in cooling the grain during the grinding operation to a temperature of 15° cent. above zero or still less, according to the physico-chemical condition of the grain. This cooling has a double object.
15 On the one hand it is intended to increase the capacity of the plant by facilitating the mechanical processes during the grinding operation, and on the other hand it is intended to improve the quality of the prod-
20 uct and thereby also its baking quality. Attempts toward attaining the two just mentioned objects have already been disclosed. Thus, for instance, it is old to moisten the grain before grinding and the products
25 during the grinding operation by means of water, whereby the baking quality of the flour or the products of the grinding operation is increased and at the same time a reduction of the friction and the heat pro-
30 duced thereby in grinding is obtained. In this way the capacity of the plant is increased and troubles caused by evaporation and recondensation are reduced. It is further known to let the aspirated air circulate
35 and to use it over again in the same machines so that an evaporation is avoided as far as possible during the grinding operation and the content of moisture in the product is kept as constant as possible. It
40 has been tried to reach the same object by supplying air as moist as possible to the grinding machines, and thoroughly saturating the entire atmosphere within the mill as far as possible with moisture by blowing in
45 steam or finely diffused water. Lastly it has been tried to supply the grinding machines with dry, cooled air or dry, cooled, indifferent gases, such as carbonic acid and the like, in order to thereby facilitate the
50 grinding operations, and in particular the bolting of the flour.

The present invention differs from the known methods in that the grain is, during the grinding operation cooled down to so low a temperature that the fine powers con-
55 tained in the flour or in the grain respec-

tively, the enzymes, do not come into action and therefore the decomposition caused thereby and changes in the flour are delayed and that, furthermore, it is impossible for the precious gases from the products of the grinding to escape. By enzymes and precious gases the following is understood in flour milling: The enzymes are albuminlike compounds which are contained in every kind of grain and flour. Contrary to the precious gases, it is impossible for the enzymes to escape from the ground product in a gaseous form. The enzymes will, at certain conditions of temperature, produce a chemical reaction on the other components of the flour. So, for instance, the enzyme "diastase" will have the result that at 40° to 60° cent. and even at lower temperatures the starch of the flour is converted into sugar and dextrin. This conversion could take place, and does so to a certain extent, when the grain is heated. With the increase of the temperature this effect of the enzymes rises, and with diastase this effect reaches its highest point at 63° cent. If the temperature is further increased the effect of these enzymes again drops and if the temperature is increased beyond 70° or 80° cent. the power of the enzymes is weakened, and some of them may even be completely destroyed. Another such enzyme which plays an important part with flour and its baking power is the so-called proteolytic enzyme. This will commence to act at as low a temperature as 30° to 40° cent. being usual in every mill, and will resolve the albumins of the flour, in particular the important gluten. Fundamentally different from the enzymes are the precious gases, which can escape from the grain during grinding. When speaking of grain, the term precious gases indicate reaction products which result from enzymatic processes during grinding. They are the products of the decomposition of albumin and fat, and essentially of an acid character, to the greater part fatty acid. It is very difficult to classify them from a chemical point of view. These precious gases will escape from the grain only simultaneously with water vapor. It is impossible for the grain to lose its precious gases if water vapor does not at the same time escape from the grain. Various substances are known in chemistry, and undoubtedly the precious gases also belong to these, which will not distil over by themselves, but which are distillable by water

vapor and, as in the present instance, escape from the grain together with the water vapor.

The hereinbefore mentioned chemical changes in the flour which occur at an increase of the temperature, are not yet desirable during the grinding operation, but only in baking. Flour, with which these changes have already appeared during grinding, is of an inferior quality to such which has been ground cold, the enzymatic powers of which have therefore not yet come into action. At a temperature of 15° cent., a temperature which it is impossible to maintain in the grain during grinding by means of the ordinary aspiration, in particular during the hot season, but neither during winter, these noxious effects of the enzymes on the flour will not yet appear.

As hereinbefore stated, the precious gases, which are the result of enzymatic processes, are partly only produced during the grinding operation, partly they already exist in the untouched grain as the result of biological processes in the same. As soon, now, as the temperature rises so far that water vapor escapes from the grain, also the so-called precious gases will escape with the same. The damage thereby caused consists in the low acidity of the flour produced. By retaining the precious gases a higher degree of acidity is insured. Besides the precious gases contain small quantities of ingredients which would improve the baking quality of the flour. The character of the action of these ingredients has not yet been ascertained by science, but the fact of their presence is certain.

As already stated, the escape of the precious gases depends on the simultaneous escape of water vapor. If no water vapor escapes, neither the precious gases can escape from the grain or the ground product. Therefore the temperatures at which the precious gases escape are inseparably related to the temperatures at which the contents of water in the grain begins to escape. This above all depends on the condition of the grain, in particular on its content of water. The smaller the content of water in the grain, the higher the temperature may rise without any loss of water and thus also any loss of precious gases occurring. When the grain is very damp, and the pressure of the water vapor contained in it is very high, the temperature must be kept very much lower than with a dry grain. Theoretically it may be assumed that there is no escape at zero, but practically there is no

more escaping at 15° cent. in case the air surrounding the grain is kept at this low temperature and at a high percentage of water, and the grain itself has a medium content of water of 14 to 15%. The method according to the present invention can, therefore, be carried out in various manners. It is possible to cool the grain by artificial means so low before grinding, that during the grinding operation it will not be heated beyond the limit given, or, the grinding machines may be so designed, that the rollers and the walls, with which the grain and the grinding products contact, are kept so cool, that the temperature will neither rise beyond the given limit, or, lastly, the aspiration air, which is always employed, may be cooled down so far, that it fulfils the above mentioned conditions. Of course, it is also possible to carry out the present invention in such a manner, that the above named means are all employed jointly or several of them combined. By the method according to the present invention it is obtained, that the enzymes do not come into action during the grinding operation, and that neither the precious gases, which may already be contained in the grain before grinding cannot escape so that a favorable effect toward improving the baking quality of the flour is produced in a double manner. At the same time the efficiency of the grinding machine is increased. It is obvious, that the warmer the grain the larger its volume. The larger, however, the volume, the greater will be the resistance which the same mass will offer to the treatment in the machine.

I claim:

1. A method of grinding grain, consisting in reducing the temperature of the grain before grinding to a degree sufficiently below the normal to prevent the evaporation of the water-vapor while the grinding steps are being carried out.

2. A method of grinding grain, consisting in reducing the temperature of the grain to a point below the normal at which the enzymatic properties of the grain remain dormant and water-vapor is not generated and then grinding the grain while maintaining said temperature below the normal.

In testimony whereof I have affixed my signature in presence of two witnesses.

DR. MARTIN MILLER.

Witnesses:

JEAN GRUND,
CARL GRUND.