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METHOD FOR REGULATING PRESSURES ON MILLING ROLLS

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Fig. 1

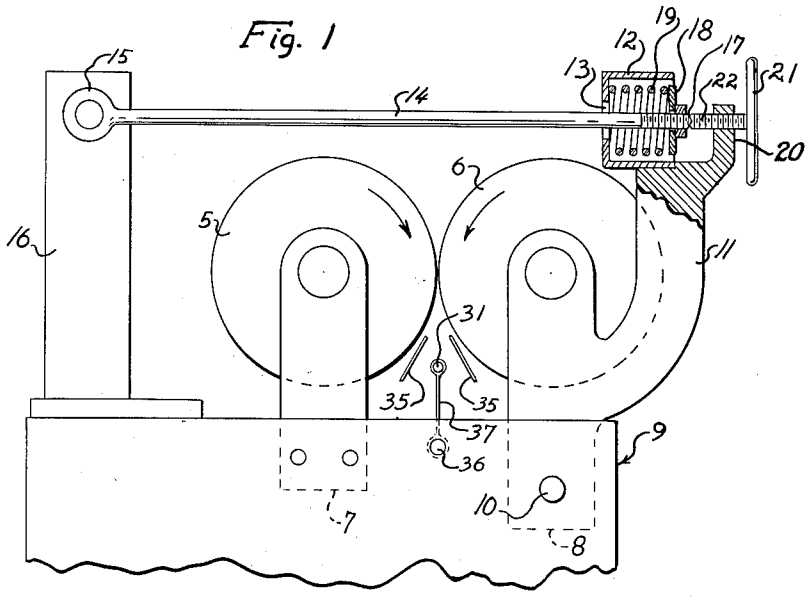
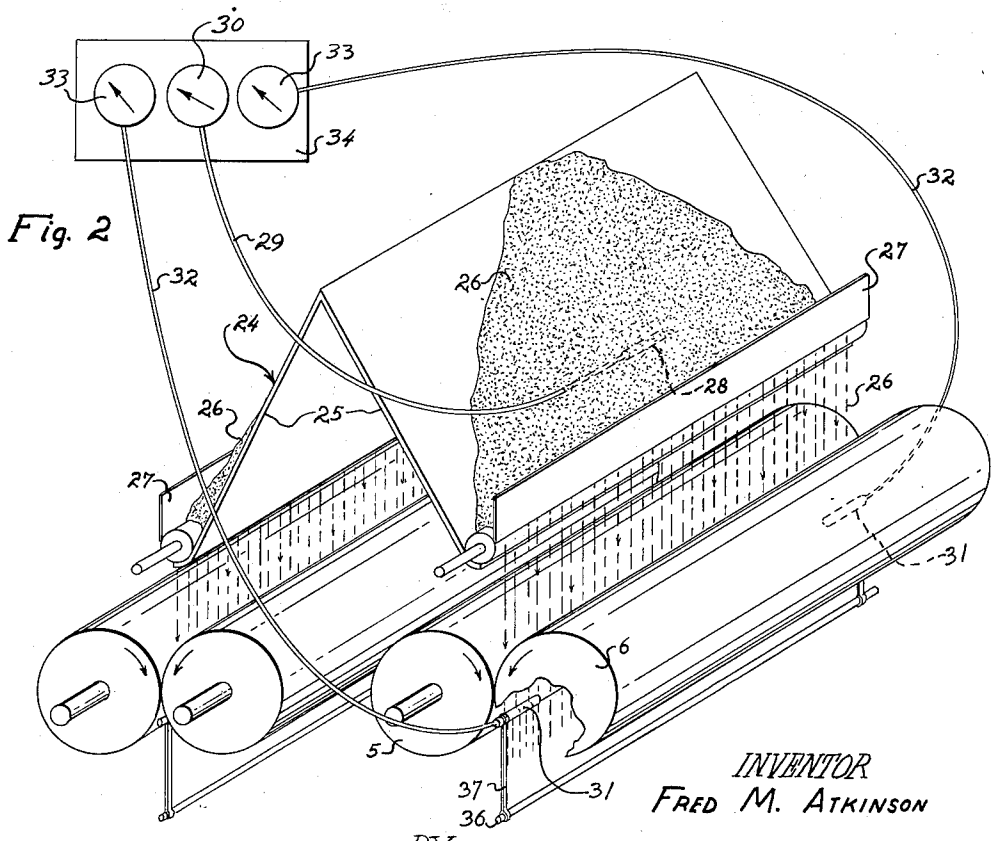


Fig. 2



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METHOD FOR REGULATING PRESSURES ON MILLING ROLLS

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This invention relates to flour milling. More particularly, it relates to the regulation of pressure exerted upon the various pairs of flour milling rolls to obtain the most efficient milling operation.

In the process of grinding and reducing wheat into flour sized particles, the setting of the grinding rolls with relation to each other is of primary importance. It is highly important, in the milling of flour, that the resulting product be of uniform quality. Production of uniform quality products depends upon uniform settings on each pair of rolls, and in the past this has been only imperfectly accomplished by individuals using their own senses of touch and sight upon inspection of the continuously ground stock.

In more recent years the individuals actively engaged in the milling of wheat have supplemented their own judgment by sieving samples of the freshly ground product to determine the amount of grinding accomplished. This has been done with sieves of various sizes, shaken mechanically for a controlled length of time. This process, known as extraction, because the flour is thereby extracted from the coarser material, determines the percentages of the differently sized particles in the ground stock. It is a process which is both tedious and time-consuming.

Experiments have been conducted by many people who have attempted to regulate the proper degree of grinding by maintaining the correct grinding pressure between each pair of rolls. While this method of setting might prove somewhat helpful, it has the disadvantages of being difficult to obtain accurate pressure readings, it does not take into account the necessity for pressure variations with changing load conditions, and it does not take into account the constantly changing character of the roll surfaces which must be reground or sharpened at intervals. Because it does not take these elements into consideration, it wastes power and produces unnecessary wear on the machinery and excessive maintenance requirements.

Flour is necessarily produced by a long series of gradual reductions from the whole wheat kernel. Each pair of rolls has an optimum pressure for a given volume and type of stock for a particular milling operation. High quality uniform products require consistently accurate grinding with a consistent degree of reduction performed at each step in the operation. Individuals, no matter how skilled, have proved incapable of maintaining high quality uniform production. A more scientific, reproduceable method of setting roller mills has long been urgently needed.

At each step in the milling process a certain definite extraction is desired. This is most easily and conveniently expressed in terms of a percentage of flour which can be sieved through a certain sized cloth (for example, 11XX) in a given length of time after the wheat stock has passed through the roller mill. Depending upon which step in the reduction or milling process is involved, the desired extraction may vary from 2–3 to 50

per cent. Generally speaking, the harder or closer the grinding, the greater the extraction, although there comes a point beyond which the harder grinding only causes damage to the cell structure and quality of the flour. When this occurs, the extraction rate actually drops due to a flattening of the stock. In each reduction operation, there is a desired point where good extraction is obtained without excessive damage to the flour cell structure and it is the goal of every miller to consistently operate his milling rolls at that point.

The friction and pressure of grinding brings about an increase of the temperature of the stock being ground. I have found that the measurement and recording of this temperature increase in each milling operation is the simplest, most accurate and beneficial indicia for controlling the milling reduction process. I have found that certain temperature increases during a particular milling operation give reliable indications of the extraction possible thereafter and reflect not only the pressure used, but also take into account the condition of the roll and the amount of feed to the roll. I have found that each pair of rolls in a particular milling operation has an optimum pressure and consequently an optimum temperature increase. The lesser the variation in temperature increment of the stock from this optimum temperature increase, the greater the percentage of extraction will be. By regulating the pressure to keep the increment as close as possible to the optimum temperature increase I have found that a highly uniform quality product can be obtained.

It is possible and even probable for temperature increases on various pairs of rolls in a mill to range from 2 or 3 degrees Fahrenheit to as much as 40 degrees Fahrenheit in extreme cases. Because of its particular condition one pair of rolls handling a similar load and identical stock may produce temperature gains three times that of one pair of rolls supposedly doing the same work. Often times the same roll will vary to a similar extent from day to day.

It is a general object of my invention to provide a novel and improved method and apparatus for regulating the milling rolls in a flour milling operation.

A more specific object is to provide novel and improved methods and apparatus for determining whether the pressure upon a given pair of rolls during a particular milling operation should be increased or decreased to accomplish the most efficient milling operation.

A still more specific object is to provide a quick and ready means for the miller in a particular milling operation to determine when adjustments of the pressure upon a given set of rolls is needed and the extent of such needed adjustment.

Another object is to provide novel and improved methods and apparatus for regulating the milling rolls in a flour milling operation which will take into account pressure variations with changing load conditions and the constantly changing character of the roll surfaces.

Another object is to provide novel and improved flour milling methods and apparatus which will accomplish a substantial saving in power and which will eliminate unnecessary and wasteful wear and maintenance requirements on the milling machinery.

Another object of my invention is to provide novel and improved methods and apparatus for regulating flour milling rolls which will insure maximum extraction and hence provide the most efficient milling operation and yields higher than were previously possible.

Another object is to provide flour milling methods and apparatus which will insure the production of uniform and high quality flour.

Another object is to provide novel methods and apparatus for regulating flour milling rolls which will re-

sult in better air and temperature conditions throughout the milling plant.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to similar parts throughout the several views, and in which:

Fig. 1 is an end elevational view of one structural embodiment of my invention; and

Fig. 2 is a somewhat diagrammatic perspective view of two pairs of milling rolls being operated in accordance with my invention.

One embodiment of my invention is illustrated in Figs. 1 and 2, including as in conventional milling a pair of power driven milling or grinding rolls 5 and 6. These rolls 5 and 6 are mounted for rotation about their longitudinal axis which, as shown, is disposed horizontally. Each of these rolls 5 and 6 is mounted at its end for rotation within mounting brackets 7 and 8 which in turn are mounted upon a casting indicated generally as 9. The mounting bracket 7, as best shown in Fig. 1, is rigidly affixed to the casting 9 while the mounting bracket 8 is pivotally mounted thereupon as at 10.

The pivotally mounted mounting bracket 8 carries a mounting arm 11 which has an open ended housing 12 at its upper end. This housing has an opening 13 which accommodates a compression rod 14 which extends transversely to the pair of rolls 5 and 6. This compression rod 14 has a loop 15 which pivotally connects it to a bracket 16 which in turn is rigidly affixed to the casting 9. As best shown in Fig. 1, the compression rod 14 is threaded at its other end as at 17 and carries in threaded relation thereupon a compression plate 18. A coiled spring 19 is also carried by the compression rod 14 between the compression plate 18 and the interior walls of the housing 12.

An upstanding lug 20 on the mounting arm 11 carries a roll pressure adjustment wheel 21 in threaded relation, the inner end of the threaded member 22 which carries this adjustment wheel being adapted to pivot freely with respect to the end 17 of the compression rod 14.

Fig. 2 shows two pairs of such rolls disposed in their usual relative positions. Mounted above these two pairs of rolls is an inverted V-shaped divider 24 which is comprised of a pair of angulated panels 25. The coarse unground material 26 is dropped from above upon the apex of the divider 24 and slides downwardly along the divider panels 25 until it abuts against an adjustable feed gate 27, one of such gates being provided for each of the panels 25. These feed gates are adjustable to regulate the volume of the coarse unground material 26 which is permitted to pass between the panel 25 and the feed gate itself. The coarse unground material, as clearly shown in Fig. 2, is permitted to drop downwardly between and into the bight of the rolls as they turn in the directions shown.

Mounted upon each of the panels 25 in a central position as best shown in Fig. 2, and in the path of the descending coarse unground material 26, is a thermometer bulb 28. This thermometer bulb is connected by a capillary tube 29 which in turn is connected to a thermometer dial of the conventional type 30. This type of temperature indicating apparatus 28, 29 and 30 is well-known in the art and it is therefore considered unnecessary to go further into the details of construction thereof. It is important, however, that the thermometer bulb 28 be positioned so that the coarse unground material passes directly across and in registering relation so that the temperature of such material will be accurately indicated upon the thermometer dial 30 at all times.

A similar thermometer bulb 31 is mounted directly below the rolls 5 and 6 at each of their ends and directly in the path of the ground stock as it passes from the bight of the rolls. This is best shown in Fig. 2. The thermometer bulb 31 is carried by a support arm 37 which in turn is mounted upon a rod 36 which is normally supported by the casting 9 and normally carries a plurality of roll cleaning brushes (not shown). A pair of such thermometer bulbs 31 is mounted adjcent the opposite ends of each of such pair of rolls and in position so that the ground stock must pass across the bulb. Each of such thermometer bulbs 31 has a capillary tube 32 associated therewith which connects the bulb to a thermometer dial 33 which is carried on panel 34. Mounted above each of the thermometer bulbs 31 is a pair of shield members 35 which extend the length of the bulb and are disposed between the bulb and one of the rolls 5 and 6 as shown in Fig. 1.

In the utilization of my methods and apparatus the optimum temperature increase is determined for each pair of rolls for the particular milling operation being performed by such rolls. I have found that by taking an extraction as often as about once a week and thereafter practicing my invention in reliance upon the optimum temperature determined by such extractions, that I can increase the efficiency of the mill and at the same time produce a substantially more uniform product which is of high quality. To practice the invention the temperature of the stock both before and after it passes between the rolls is determined by reference to the dials 30 and 33. If the temperature increment as indicated by reference to these dials 30 and 33 is less than the optimum temperature increase as predetermined, the miller is immediately apprised of the fact that pressure upon the rolls should be adjusted by means of the adjustment wheel 21. Within a few minutes he can adjust the pressure by means of the adjustment wheel 21 so that the optimum temperature increment is attained. Of course, if the temperature increment as determined by reference to the dials is greater than the predetermined optimum temperature increase, then the pressure is decreased through adjustment of the adjustment wheel 21 until the temperature increment is equal to the optimum temperature increase. I have found that the pressure upon each pair of rolls can be adjusted in this manner so that the temperature increment remains within about plus or minus one degree Fahrenheit from the optimum temperature increase.

One good example of the predetermination of the optimum temperature increase can be cited in connection with a stream of wheat material which I call "1 Middlings Coarse." On this particular milling stream, I find a temperature increase during the process of grinding of 18 degrees Fahrenheit produces optimum results. With this temperature increase I obtain an extraction rate of 21 per cent through a 145 mesh per lineal inch stainless steel wire cloth. In this particular operation there is 1.41 pounds per minute per lineal inch of grinding surface.

Another example would be a stream which I term "6 Middlings" which requires for optimum results a temperature increase of 12 degrees Fahrenheit. Such a temperature increase provides a 30 per cent extraction through a similar stainless steel wire cloth and .38 pound per minute per lineal inch of grinding surface.

One advantage of practicing my invention is that each pair of rolls can be checked and adjusted by one man a number of times each day. Under methods previously known such frequent adjustments were an impossibility without employing a prohibitive number of men to accomplish the same. Even if such a large number of men were employed, varying load conditions between the successive taking of the optimum temperature increase and the associated adjustments would destroy much of the value of the adjustments. My invention immediately discloses the effects and the presence of such changing conditions so that necessary adjustments will be made at once.

As a result of the use of this new method of regulating the pressure of milling rolls, I have found that the flour which is produced not only has been definitely improved but I have been able to distribute the loads more evenly and to hold temperature increases to quite uniform levels far below the former averages. This reduction in friction and grinding pressures has incidently reduced the power required for grinding by at least 25 per cent. Consequently, this method or system also saves on wear and required maintenance on the milling machinery. It also results in better air and temperature conditions throughout the plant. This method goes a long way toward substituting scientific accurate control for the old invention personal control commonly used. I have not yet been able to determine accurately the extent to which better yields are obtained. However, it has already appeared obvious that this method does produce better yields from a given milling process. In other words, I find that I can make a higher percentage of flour from any given quantity of wheat than was previously possible when using the old means.

Thus it can be seen that I have provided a novel method which requires only simple and cheap apparatus for regulating the milling rolls in a flour milling operation to obtain a uniform high quality product. I have provided a means whereby the miller can be immediately apprised when varying conditions require adjustment of the milling rolls and the extent to which such adjustment should be made. If an adjustment which is made is too severe, that fact will immediately be indicated by the increment in temperature as recorded upon the dials **30** and **33**.

It should be noted that my method of determining the time, nature and extent of adjustment required in the pressure regulating apparatus of a pair of milling rolls takes into account pressure variations caused by changing load conditions and at the same time the constantly changing character of the roll surfaces. At the same time, it effects a substantial saving in power and eliminates unnecessary and wasteful wear and maintenance requirements on the milling machines in addition to providing maximum extraction and higher yields.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. In the art of flour milling, the method which involves grinding grain under atmospheric conditions to continuously produce a maximum and uniform extraction of flour from the grain, consisting in providing a confined source of the grain under atmospheric conditions, continuously recording the temperature of the grain before grinding, grinding the grain under atmospheric temperature conditions, continuously recording the temperature of the grain as it leaves the grinding zone, and regulating the grinding force applied to the grain according to the difference between the said recorded temperature of the unground grain and the ground grain, increasing said grinding force when the difference in temperature is less than a predetermined amount and decreasing the compressive force when the difference in temperature is greater to maintain a substantially constant difference in temperature.

2. In the art of flour milling, the method which involves grinding grain under atmospheric conditions to continuously produce a maximum and uniform extraction of flour from the grain consisting in providing a confined source of the grain under atmospheric conditions, frequently recording the temperature of the grain before grinding, grinding the grain under atmospheric temperature conditions, frequently recording the temperature of the grain as it leaves the grinding zone, and regulating the grinding force applied to the grain according to the difference between the said recorded temperature of the unground grain and the ground grain, increasing said grinding force when the difference in temperature is less than a predetermined amount and decreasing the compressive force when the difference in temperature is greater than such predetermined amounts to maintain a substantially constant difference in temperature.

3. In the art of flour milling, the method which involves grinding grain under atmospheric conditions to continuously produce a maximum and uniform extraction of flour from the grain, consisting in providing a confined source of the grain under atmospheric conditions, continuously recording the temperature of the grain before grinding, grinding the grain under atmospheric temperature conditions, continuously recording the temperature of the grain as it leaves the grinding zone, and varying the grinding force applied to the grain according to the difference between the said recorded temperature of the unground grain and the ground grain taken at approximately the same time, increasing said grinding force when the difference in temperature is less than a predetermined amount and decreasing the compressive force when the difference in temperature is greater than such predetermined amount to maintain a substantially constant difference in temperature.

4. In the art of flour milling, the method which involves grinding grain under atmospheric conditions to continuously produce a maximum and uniform extraction of flour from the grain, consisting in providing a confined source of the grain under atmospheric conditions, frequently recording the temperature of the grain before grinding, grinding the grain under atmospheric temperature conditions, frequently recording the temperature of the grain as it leaves the grinding zone, and varying the grinding force applied to the grain according to the difference between the said recorded temperature of the unground grain and the ground grain taken at approximately the same time, increasing said grinding force when the difference in temperature is less than a predetermined amount and decreasing the compressive force when the difference in temperature is greater than such predetermined amount to maintain a substantially constant difference in temperature.

References Cited in the file of this patent

UNITED STATES PATENTS

571,226	Favrow	Nov. 10, 1896
2,580,651	Boyd, Jr.	Jan. 1, 1952

FOREIGN PATENTS

514,933	Great Britain	Nov. 21, 1939
519,869	Great Britain	Apr. 9, 1940