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THE STORY *of* FLOUR

COMPILED AND PUBLISHED
FOR USE AS A TEXT ON
WHEAT AND FLOUR
PRODUCTION



Published by the

PILLSBURY FLOUR MILLS CO.
MINNEAPOLIS
MINNESOTA

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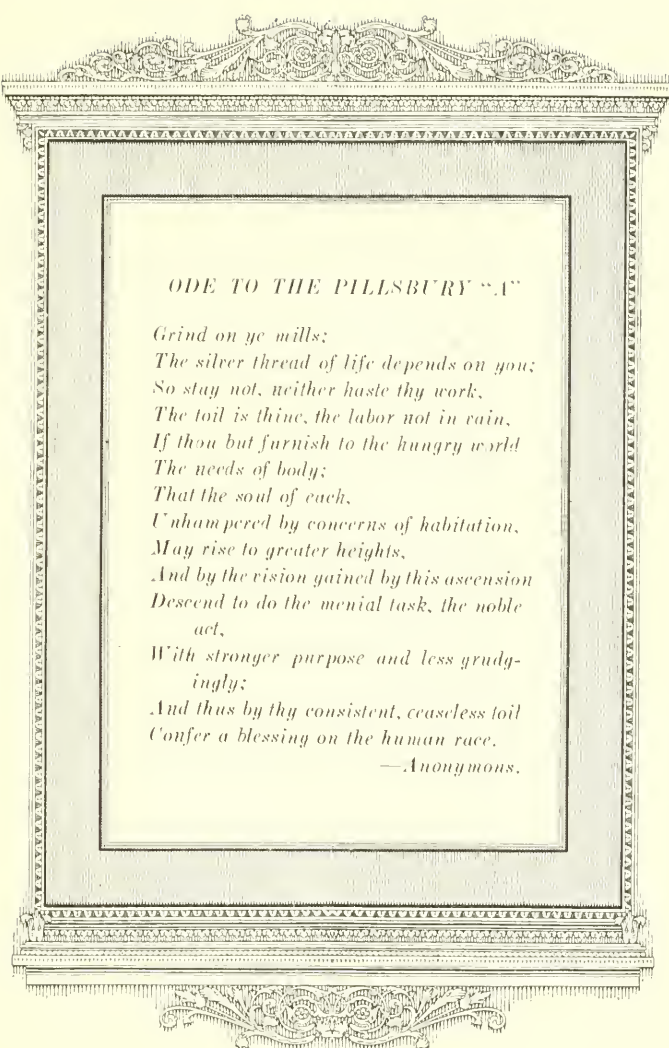
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Pillsbury Flour Mills Co.

[Faint handwritten scribbles]



JAN 30 1942

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ODE TO THE PILLSBURY "A"

*Grind on ye mills;
The silver thread of life depends on you;
So stay not, neither haste thy work,
The toil is thine, the labor not in vain,
If thou but furnish to the hungry world
The needs of body;
That the soul of each,
Unhampered by concerns of habitation,
May rise to greater heights,
And by the vision gained by this ascension
Descend to do the mental task, the noble
act,
With stronger purpose and less grudgingly;
And thus by thy consistent, ceaseless toil
Confer a blessing on the human race.*

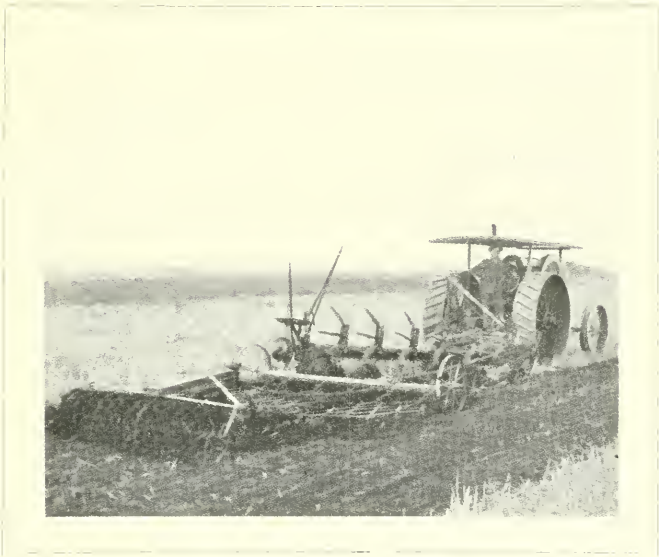
—Anonymous.

Foreword

IN compiling this booklet "The Story of Flour," the author has undertaken to eliminate all but the most interesting facts, concerning wheat and flour production ; depending on the absence rather than the presence of statistics to attract the casual reader.

Fully realizing that many comprehensive works have been published on the subject, this book is intended for the average reader, who desires to gain general information with a minimum expenditure of time. If the perusal of these pages will give the reader a fair idea of the wonderful progress made in the production of flour in the last fifty years, the mission of this booklet will have been accomplished.

The Story of Flour



Preparing the Soil

Courtesy International Harvester Co.

Wheat (Historical)

As far backward as one may care to go with the historian, the interested searcher will always find wheat associated with the civilization of the period. As a cultivated grain, it can be traced, in Chinese History to twenty-seven hundred years B. C., which is perhaps the most primitive authentic record available.

Being the world's most important cereal grain, and the one from which we derive our most necessary food (bread), every one has a natural interest in its history and production. Many references are made in the Bible to wheat growing. It was cultivated by the Israelites in Canaan, and formed the chief crop of the Ancient Egyptians. Grains of wheat found in the caskets of Egyptian Mummies, are positive proof of its existence in ancient Egypt.

Wheat with the other cereal grains belongs to the family of grasses, and has been developed by selection and breeding, during five thousand years of cultivation until at present we have over one thousand known varieties with almost any climatic adaptation.



Seeding Wheat

Courtesy International Harvester Co.

Production

Wheat is successfully grown from the equator to within two hundred miles of the Arctic Circle, altitude being considered the complement of latitude, in its production. Fourteen bushels per acre is the average yield, while in some cases fifty bushels are produced. The average cost of production ranges from 20 cents per bushel in Oregon to 90 cents in Germany (pre-war figures). The world's annual production and consumption is about three and one-half billion bushels. The average consumption of wheat in the United States is about five bushels per capita.

The ratio of production of the world's four most important cereal grains is as follows:

<i>Order of Classification</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
<i>Weight</i>	<i>Wheat</i>	<i>Corn</i>	<i>Oats</i>	<i>Rice</i>
<i>Number of bushels</i>	<i>Oats</i>	<i>Corn</i>	<i>Wheat</i>	<i>Rice</i>
<i>Human food</i>	<i>Wheat</i>	<i>Rice</i>	<i>Corn</i>	<i>Oats</i>



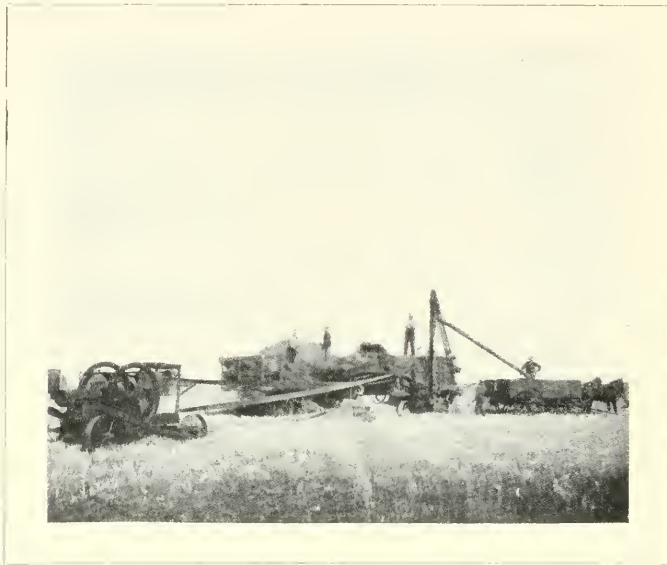
Oil Tractor and Five Binders

Courtesy International Harvester Co.

Five bushels of wheat are required to make one bbl. (196 lbs.) flour. One barrel of flour will make from 240 to 300 one-pound loaves of bread depending on the absorption qualities of the flour, spring wheat flour yielding the larger quantity.

The result of a test made some years ago in North Dakota, to ascertain the productiveness of wheat was astonishing. Starting with one kernel, saving each year's crop and planting it the following spring, produced in the tenth season 300,000 bushels.

The average bushel of wheat weighs 60 pounds, one pound containing from twelve to fifteen thousand kernels.



A Threshing Scene

Courtesy International Harvester Co.

Minneapolis, the City of Mills

The largest flour milling district in the world is located in the heart of the city of Minneapolis, on the banks of the Mississippi River. Situated as it is in the greatest hard wheat belt, and the largest cash wheat market, and deriving power from the Falls of St. Anthony every natural facility is afforded for the maintenance of this distinction.

An average of 500 cars of grain, two-thirds of which contain wheat, arrive daily in Minneapolis.

Estimating the contents of each wheat car at 1,200 to 1,400 bushels, one can readily determine the average daily amount of wheat ground in the Minneapolis Mills, and then by using the ratio of five bushels of wheat to produce one barrel of flour, the average daily output of the mills can be approximated.

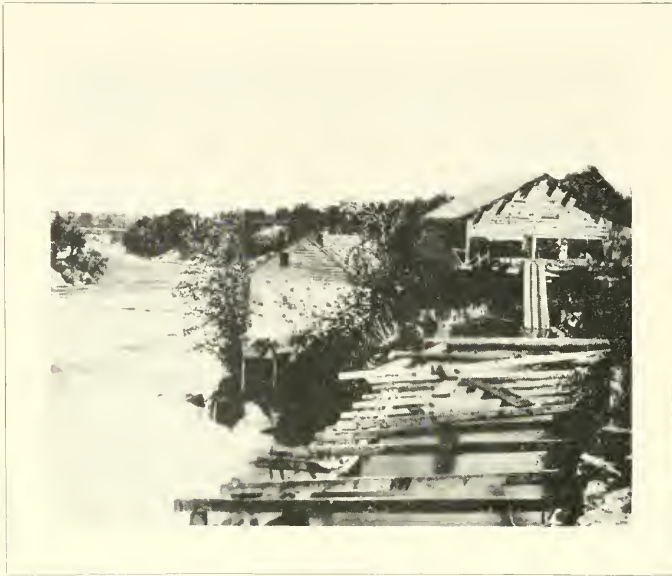


West Side Milling District Which Contains Several Pillsbury Mills

'Milling History of Minneapolis

The first mill built at the Falls of St. Anthony was erected by the Federal Government in 1823, but did not produce much flour. The first mill to be run on a commercial basis was constructed in 1854. This mill also had a small output, although too large for the wheat production of those days. Wheat was shipped to this mill from both up and down the river by boat, to supplement its local wheat supply.

In 1866 the Alaska Mill was built by the Taylor Brothers, which later became the Pillsbury "B" Mill. At this time there were eight mills operating at the Falls, with a yearly production of 172,000 barrels. Today the mills grouped at St. Anthony are capable of turning out in two days, 180,000 barrels, or more than the yearly capacity in 1866.



Old Government Mill Erected in 1822

The increased transportation facilities, the exporting of flour, the invention of the middlings purifier and the self binder, together with the change from millstones to rolls in the reduction process, have all contributed to the gigantic strides made in Minneapolis Milling History.

In 1876 Minneapolis Mills produced 1,000,000 barrels of flour, in 1880 over 2,000,000 barrels. In 1881 the Chamber of Commerce of Minneapolis was organized, and that year 3,142,000 barrels of flour were produced. In 1916 the output was 18,541,650 barrels, while Buffalo, New York, came next with 5,500,000 barrels.

The total output of the Minneapolis Mills for the calendar year 1920 was 16,883,000 barrels of flour. The wheat receipts for the same period were 112,366,000 bushels.



The Pillsbury "A" Group, or the East Side Milling District

The Pillsbury Mills

Forming an important part of this milling center are the Pillsbury Flour Mills, with a combined daily capacity of 31,500 barrels. The most important mill of this group, the Pillsbury "A," is also the largest single flour mill in the world, having enjoyed this distinction since the year 1890, when its daily output had increased to 7,200 barrels. Its present daily capacity is 14,000 barrels, with 3,000 additional for the New South "A" Mill.

This amount of flour placed in 24½-pound bags end to end, would extend for 50 miles and would furnish one day's flour ration for both Greater New York and Philadelphia, or the entire State of Illinois.



The "A" Mill Before the Erection of South "A"

The "A" Mill

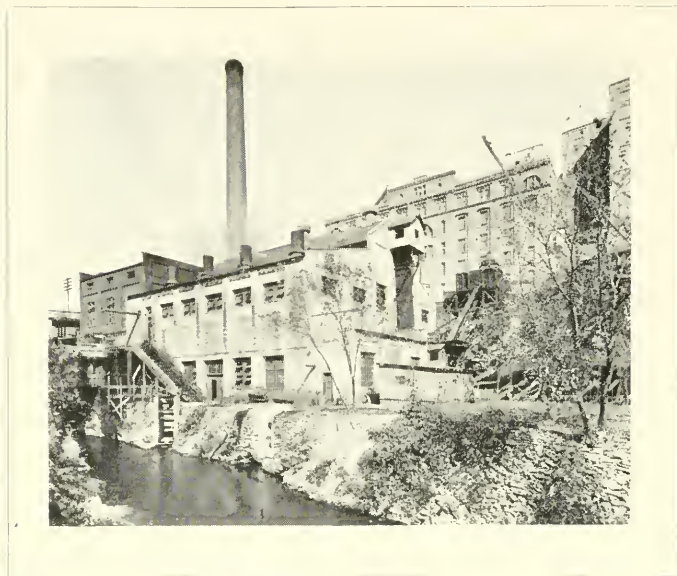
This historic building erected in 1881 on the east bank of the Mississippi at St. Anthony Falls is an imposing structure built of blue limestone and bearing the rugged outline of Minneapolis buildings of that period. Built for a 5,000-barrel mill at a time when a 500-barrel mill was considered large, it attracted much attention. Millers of that period questioned the ability of the country to produce wheat enough to supply it. For some years the mill was not run at its intended capacity, part of the building being used as warehouse and for other purposes. About 3,000 horsepower is developed from the river, being



St. Anthony Falls in 1859

transported to the shafting of the mill on huge rope drives which are driven by two large water turbines, assisting the river in its ever increasing task of operating the mechanical equipment of the "A" Group. A modern steam plant takes care of the fluctuations of the load and makes possible the absorption of all available water-power without curtailing the efficiency of the mill. Surrounded as the old mill is, with machine shop, power house and mammoth elevators, combining to form the East Side Milling District its size is somewhat submerged, by the colossal appearance of the group.

The tall tile elevator supports on its roof, the largest electric sign in the Northwest, which, with its 2,500 lamps, contributes an important part to the city's night illumination. The "A" Mill, inseparably connected with the romance of the Falls of St. Anthony, and a bulwark of industrial strength to the commerce of the city, vies with all other



“A” Mill Power House

points of interest in the Twin Cities, and visitors to Minneapolis should not fail to see this monument to man's enterprise.

About the time of the erection of the “A” Mill, through the introduction and successful application of the purifier, in Minnesota Mills, the hard spring wheat, hitherto considered unfit for bread flour on account of the difficulties encountered in separating the bran particles from the flour in the milling process, had come into general use as the most ideal wheat for flour production.

The State of Minnesota, with North and South Dakota and Montana, produces the best grade of this hard spring wheat, and furnishes the largest amount of any wheat growing area in the world.



State Grain Inspection

State Grain Inspection

The Minnesota State Grain Inspection Department governed by the Federal Grain Grading Rules, operating through the Bureau of Markets under the Secretary of Agriculture, samples and inspects every car of wheat and other grain coming into Minneapolis, St. Paul and Duluth. This is done to protect both shipper and buyer, the grade placed upon each car of grain determining the comparative price per bushel.

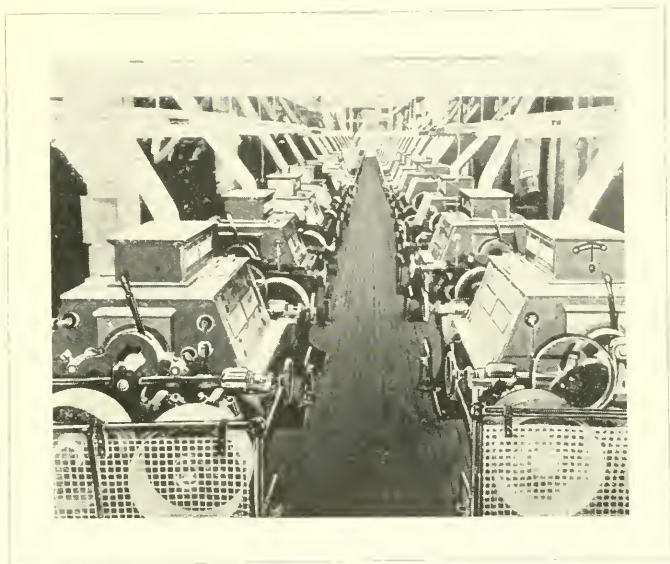
To facilitate unloading of grain, through an arrangement between the State Inspection Department, and the transportation companies, all shipments passing through railroad division points are detained at these stations to permit of samples being taken from each car. These samples, officially sealed, are carried to the Cities by express train.



Minneapolis Chamber of Commerce

and immediately delivered to Inspection Department in the city to which they are destined. As the samples arrive from 12 to 24 hours ahead of the cars of wheat, inspection and sale can often be accomplished before the shipment arrives at terminal yard, thus giving more time for disposition before demurrage becomes effective. Upon delivery at Inspection headquarters the grain is thoroughly inspected by highly trained men and the various grades established.

If the correctness of this grading is questioned, a re-inspection is undertaken. If the result of the re-inspection is unsatisfactory, two appeals may be taken to higher authorities, the last decision being binding upon both parties. Thus the buyer and seller are given every possible protection against unfair grades, the authority of the State being wielded without fear or favor. A nominal fee is charged for each inspection and the department is supported from these fees.



A Section of the "A" Mill Grinding Floor

The Milling Process in Pillsbury "A" Mill

Two huge elevators with a combined storage capacity of 4,750,000 bushels supply the "A" Mill with wheat, the grain being carried from the various storage tanks to the cleaning house on a system of elevators and wide belts. Here all foreign substances are removed from the wheat after which the kernel is scoured in revolving machines to take off the fine wheat hairs which are attached to one end of the wheat berry, and only visible under the microscope.

Other impurities are removed by a washing process, drying being accomplished in centrifugal machines, which by their rotary motion throw off the particles of water.

The wheat thus cleaned and polished is next properly tempered by the addition of heat and moisture, the object being to toughen the



Row of Reels

bran or coverings of the kernel to relieve its natural brittleness, and insure its passage through the rolls without becoming pulverized. If the bran becomes finely ground no practical way is known of removing it from the flour, and consequently the finished product will be grey or speckled. As the bread or flour purchaser is very desirous of obtaining bread of snowy whiteness the miller must do his best to produce white flour.

Up to this point everything possible has been done to prepare and purify the wheat kernel for its conversion into Pillsbury's Best Flour. As it passes into the wheat bin of the "A" Mill and from there down a 14-inch spout to the first group of grinding machines, called break rolls, the reduction or grinding process commences, and for a period of three hours the product travels through the spouting systems of the mill, visiting break rolls, sifters, reels, purifiers and reduction rolls in its transformation from wheat to Pillsbury's Best Flour. The Hungarian system of gradual reduction, used in the "A" Mill, was brought to this country by Mr. C. A. Pillsbury who spent two years in Hungary

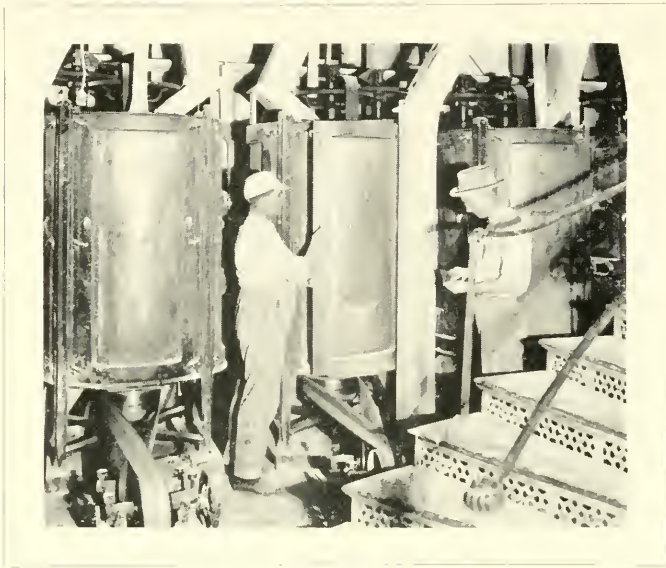


Packing Floor

thoroughly learning this process of milling. The application of this method of flour milling to Minnesota hard spring wheat, produced a wonderful flour, rich in gluten, and protein. The substitution of steel rolls for the old-fashioned mill stones greatly facilitated the reduction process, as steel rolls will operate on hard wheat for about two years before needing resurfacing, while the mill stones must be picked or refinished every two weeks.

Nineteen reductions or grindings are accomplished in the breakers and rolls, all located on the first floor (two hundred and fifty in number), one hundred and eighty separations occur on the third, fourth, fifth and sixth floors, while the second floor is devoted exclusively to packing the flour into bags and barrels.

After each grinding the stock is carried by means of bucket elevators from the basement to the seventh floor to be spouted down through



Group of Bran Dusters

the various separating and purifying machines, which are located on the third, fourth, fifth and sixth floors on its way to the next group of reducing machines, finally passing through the finishing reels, down to the packing floor, where it enters the packing machines and is placed in sacks; a beautiful, creamy flour, being protected during the entire journey from all contaminating influences, and finally bearing the trade mark of Pillsbury's Best Flour.

The bran passes with the middlings through the first five breaks or reductions and at the fifth is conveyed to the bran duster, a machine built to remove the remaining particles of flour by a process of brushing. From here the stock goes directly to bran bins to be later sacked and sold as animal feed. The bran made by the Pillsbury Flour Mills Co., which is packed in cartons and labeled "Health Bran," is not the regular bran by-product, but a true product, the wheat being especially selected for its bran quality, milled in a separate system, enabling it to retain the gluten and protein particles which in the case



Row of Purifiers

of the common bran are brushed off and returned to the flour stock. Through the first seven groups of grinders the rolls which crack the wheat, are corrugated, each group carrying more and finer corrugations to the inch. Beginning with the eighth group, the machines are called rolls, and the grinding surfaces instead of being corrugated are perfectly smooth, and so continue throughout the remaining twelve reductions.

Thus, as can be readily seen, the milling process as practiced in the Pillsbury "A" Mill is accomplished in three stages, five breaks, three sizings, and eleven systems. The function of the purifier is to separate from the middlings stock the fine particles of bran which otherwise could not be kept out of the flour. The function of the reel is to bolt or pass through a fine silk screen the flour particles, keeping out all elements not desired in the finished product.



Laboratory Bakery

The Pillsbury Laboratory

The Pillsbury Flour Mills Company maintains a well equipped laboratory to take care of the testing of wheat and flour samples and the other technical work connected with that department. Included in its equipment are a complete miniature flour mill for grinding wheat samples into flour, a perfectly equipped laboratory for making scientific tests for gluten and nitrogen; facilities for obtaining the ash determination, or the mineral element in the flour; together with a complete bakery for making bread from wheat and flour samples.

The miniature mill includes the usual sifting and purifying machines, also eight groups of rolls, and by repeating the milling process in this mill, high quality flour samples may be turned out. The wheat blends



Millers Judging Bread

from elevator tanks are ground in this mill and in this way experiments in blending different types of wheat are intelligently conducted, the resulting flour being baked into bread, and later judged by millers and laboratory experts. Another small mill is operated in the laboratory to grind wheat samples obtained from carload purchases, from which loaves of bread are made. In addition to this, samples of flour are taken hourly at each of the mills and delivered to the laboratory where they are tested for gluten, protein, and ash; the results being sent to the various mills with standard samples of flour to be used as a guide to the millers in their Pekar-Tests, and daily milling operations. The Pekar-Test is accomplished at the mills by placing side by side on a piece of glass the standard sample and the flour sample being tested, then after smoothing them together and immersing the slide in water, it is placed in an oven to dry. After submerging and drying



Flour Testing Laboratory

any difference in quality can readily be detected by a corresponding difference in color. By such methods as these being constantly applied the quality of Pillsbury's Best Flour is maintained at such a standard of excellence that Good Housekeeping Bureau of Foods Sanitation and Health, Washington, D. C., was able to pronounce it 100% pure. The proper functioning of the laboratory is absolutely essential to uniformity and purity of product, the two most essential qualities of a perfect flour.

Gluten is maintained in Pillsbury's Best Flour in the proportion of about 11% to 12%. Besides being present in this quantity, it must have good strength, as upon it depends the structural qualities of the loaf. Acting as an envelope, it encloses the gas generated by the action of the yeast in the dough and must be of good quality to be successful for this purpose as the strength and uniformity of the bread cells are dependent upon the quality and quantity of gluten present. Pro-



Ovens for Determining Ash Percentage

tein, the nutritive element in bread, is embodied in the gluten, while the starch, forming the major portion of the flour contributes the sugar or fat-producing element.

The progress in milling is determined by the head millers and laboratory experts who daily sit as a judging board examining bread samples and who govern future milling methods and mixtures on the knowledge thus gained, always holding in mind the perspective of a perfect flour.

With the milling methods carefully governed by the constant guidance of a trained organization; with the most modern machinery obtainable, coupled with the distinctive ideals of the Pillsbury Flour Mills Company, the improvement of Pillsbury's Flour is limited only by the lack of new discoveries in the process of milling.

On the next page is shown the Flour Special, a typical method of Pillsbury distribution.



The Flour Special

Food Values of Pillsbury's Best Flour

The relative monetary and energy-unit value of Pillsbury's Best Flour as compared with meat, is very interesting and instructive. One pound of beef at 27 cents contains about 1200 energy units. One pound of Pillsbury's Best Flour at a cost of $4\frac{1}{2}$ cents contains approximately 1600 energy units. The energy ratio per given value by this comparison is shown as 1 to 8 in favor of flour. If compared with eggs the ratio is 1 to 6. By comparing flour with all other foods and judging by energy and protein tests, one cannot help agreeing with the old adage that "Bread is the Staff of Life."

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