# The Farm to Table Movement
# Re-localizing Flour Milling

**Whole Grain & EX-85**
**EXtraction Flour**

UNIFINE MILL, LLC
A REVOLUTION IN MILLING SIMPLICITY
LOCAL MILLING PURITY
Locally Grown... Locally Milled

**Whole Grain & EX-85**
**EXtraction Flour**

**Not just whole grain, but EX-85; a locally milled European style extraction flour; a nutritionally superior, functional replacement for industrial roller milled "white" flour!!!!**

# THE UNIFINE FLOUR MILL

***A durable, low maintenance, high speed, rotary impact mill***

## *The 2018 Model Unifine Mill**

- 1,200 LBS. OF FLOUR/HOUR/MILL
- MINIMAL MAINTENANCE, LONG TERM DURABILITY
- MODULAR. UP TO FIVE MILLS PER MILLING SYSTEM
- ONE PASS EFFICIENCY PRODUCING COMMERCIAL VOLUMES OF HIGH QUALITY FLOUR
- LESS SUPPORTING INFRASTRUCTURE THAN OTHER SYSTEMS
- VARIABLE SPEED FOR CUSTOMIZED MILLING
- DRAMATIC REDUCTION IN THE COST OF PRODUCTION COMPARED TO OUTDATED, CENTRALIZED INDUSTRIAL ROLLER MILLING SYSTEMS FOCUSED ON THE NEEDLESS REMOVAL OF THE NUTRITIONAL BRAN AND GERM ELEMENTS OF THE WHEAT KERNEL

***Patent Protected**

The local farming economy is in need of new profit centers. Milling grain locally and offering both whole grain and European extraction flour (EX 85) targeting the factory white flour market is a solid plan for the entrepreneurial farmer. It's also not daunting to get into. 1,200 Lbs./hour/mill equates to 2.5 Million lbs. / year or 40,000 bushels of wheat produced on about 750 acres of farm land. The mill and infrastructure will cost about 1/3 of that of a new combine. Commercial and home bakers are looking for quality locally milled flour…. and baked goods!

# WHY IS EUROPEAN STYLE"EX 85" LOCALLY MILLED, DIRECTLY SIFTED WG FLOUR SUCH A BIG DEAL?

Commercial and home bakers generally prefer "white flour" functionality over that of "whole grain". However, U.S. milled, artificially enriched "white" flour is a +72% extraction, 100% devoid of the nutritional bran and germ elements. Instead, European millers focus on the extraction percentage and the valuable minerals retained in the flour.

We leave the bran and germ elements in our flour and then just extract enough of the larger particles to match that of U.S. milled refined white flour functionality (a +85% extraction). This only slightly reduces the concentrations of fiber and micronutrients while increasing the volume of flour extracted from the kernel by over 10%!!!

Matching "white" flour functionality, while retaining most of the micronutrients and three to four times the fiber offered by "white" flour assures that "EX 85" extraction flour will become as popular in the U.S. as it is in Europe. Increasing flour production by over 10% is the icing on the cake.

## COMPARED TO WHOLE GRAIN FLOUR WHAT PERCENT IS LEFT AFTER MILLING?

| Nutrient | Directly Sifted Whole Grain Flour* | Traditional White Flour** |
|---|---|---|
| Dietary Fiber | 83% | 22% |
| Phosphorus | 72% | 33% |
| Potassium | 75% | 31% |
| Magnesium | 67% | 18% |
| Manganese | 71% | 17% |
| Zinc | 78% | 25% |

** Medallion Labs (www.medallionlabs.com)*
*** Source: USDA National Nutrient Database (2004)*

## THE CONSENSUS OF ARTISAN BAKERS WHO HAVE BENCH TESTED DIRECTLY SIFTED WHOLE GRAIN FLOUR

*Directly sifted whole grain flour is unlike any flour we've baked with before. It performs like white flour, but provides a more nutritious loaf of bread–– with the visual appearance, textures and volumes of standard artisan fare!"*

# Table of Contents

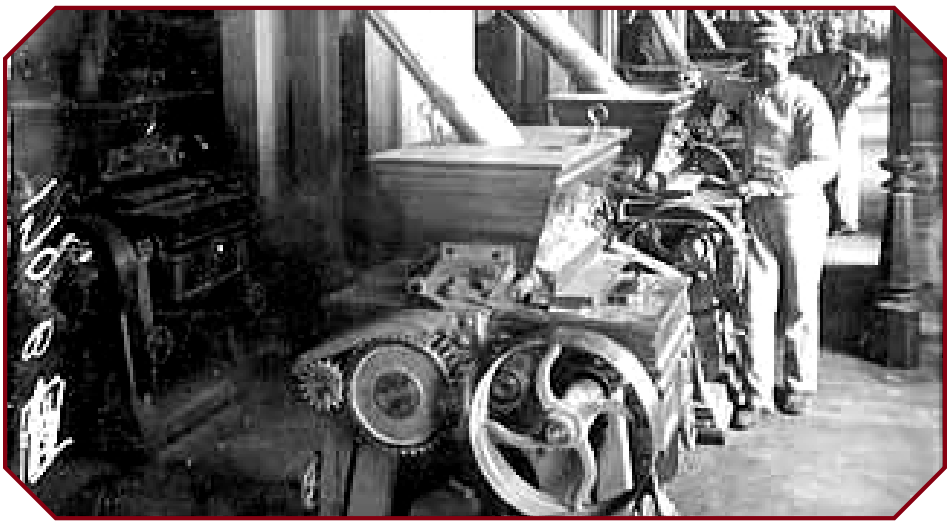
# Overview:

*Introducing locally milled Unifine direct sift whole grain that is a functional replacement for centrally milled "white" flour*

9000 years ago a human ground grain between two rocks and the first "stone milled" flour was produced. As the "stone milling" of flour evolved, it was gradually determined that there were three elements to the kernel of grain. The white starchy "endosperm" represents 80% of the volume, the outer "bran" shell represents 17%, and the germ represents 3% that will otherwise sprout and consume the endosperm in the process of turning into a plant.

Depending on the grind, a small percentage of flour particles are oversized and increase product density by literally puncturing the bubbles in the rising dough. The percentage is understandably higher in flour produced by less aggressive whole grain milling systems. Millers and bakers mistakenly blamed the germ and bran elements for the increased density of crudley ground whole grain flour rather than focusing on removal of just the larger particles, they focused instead on separating out the fine white (endosperm) flour that produced a "fluffier" product with superior volume, texture and appearance. Even though the nutritionally deficient white endosperm represented 80% of the volume, stone millers could only sift out about 25% of the volume and fetch a premium price for their efforts.

And so it went until the 1800's when a brilliant engineer by the name of John Stevens developed the eclectic "roller mill" system that accomplished 100% extraction of the bran and the germ. By first hydrating the grain, this complex, ingenious system then repetitively "rolls and sifts" the mash, effectively peeling the bran and the germ off the softened endosperm.



*One of the original Roller Mill flour factories, late 1800's*

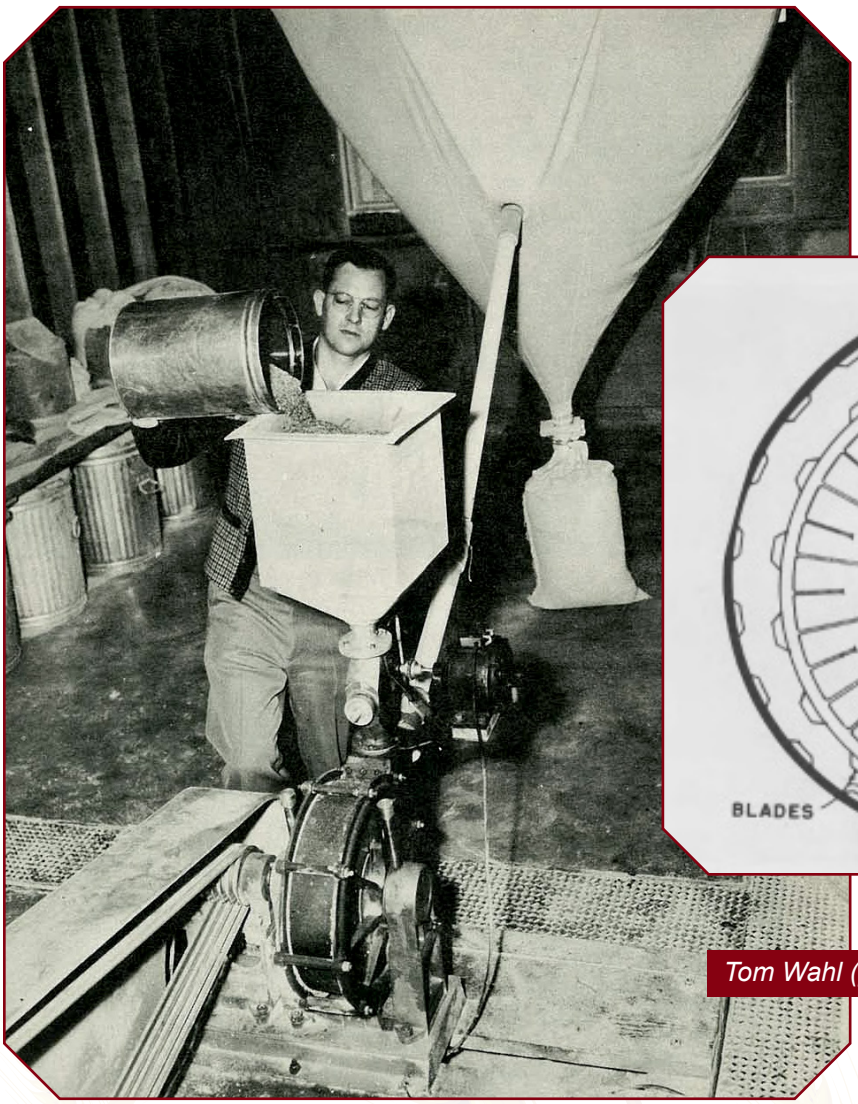
The Roller mill system proved to be so efficient that over a period of about a quarter of a century, most of the world's flour milling shifted to the roller mill and that remains the case today. According to the U.S. Whole Grains Council 2015 report, still less than 7% of commercially milled U.S. flour is whole grain. While that's a dramatic increase from what it was a few years ago, functionality still trumps nutrition. With this nutritional momentum and that functionality reality in mind, it was inevitable that European extraction flour, directly sifted from whole grain flour would be introduced to U.S. home and commercial bakers. The potential long term impact of "EX 85" extraction flour on the U.S. market is very significant.

Firstly, less than fifteen percent of the kernel volume is sifted out. That compares very favorable to the twenty eight percent that the roller mill peels off to yield pure white flour. Secondly, for the more brittle hard red wheat used to produce bread flour, over eighty percent of the nutritional whole grain fiber remains plus the majority of the valuable micro-nutrients. For soft white wheat, generally used to produce pastry flour, over sixty percent of the fiber remains. The USDA estimates that in addition to dramatic micro-nutrient loss, only twenty two percent of the fiber remains in white flour. The nutritional and sensory advantage of extraction flour is very significant. Thirdly, multiple artisan bakers have done side/by/side bench tests of Unifine "EX 85" extraction flour and agree it was unlike any flour (they'd) worked with before. "It performs like white flour, -with the visual performance appearance, textures and volumes of standard artisan fare."

This booklet has been prepared to document the efforts of those who have labored for the past sixty years to promote the more holistic milling of the grains U.S. farmers produce and the revitalization of our rural farming economy. Enjoy the read and welcome aboard. You're now part of the Unifine flour revolution.

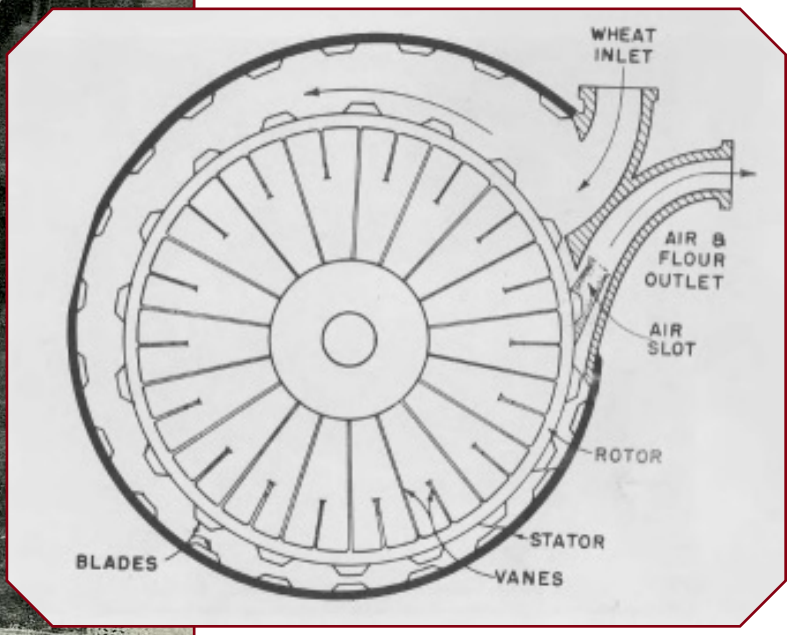
# The First Unifine Mill

## *Working prototype, late 1940's*



*Tom Wahl (pictured) at the Mill*

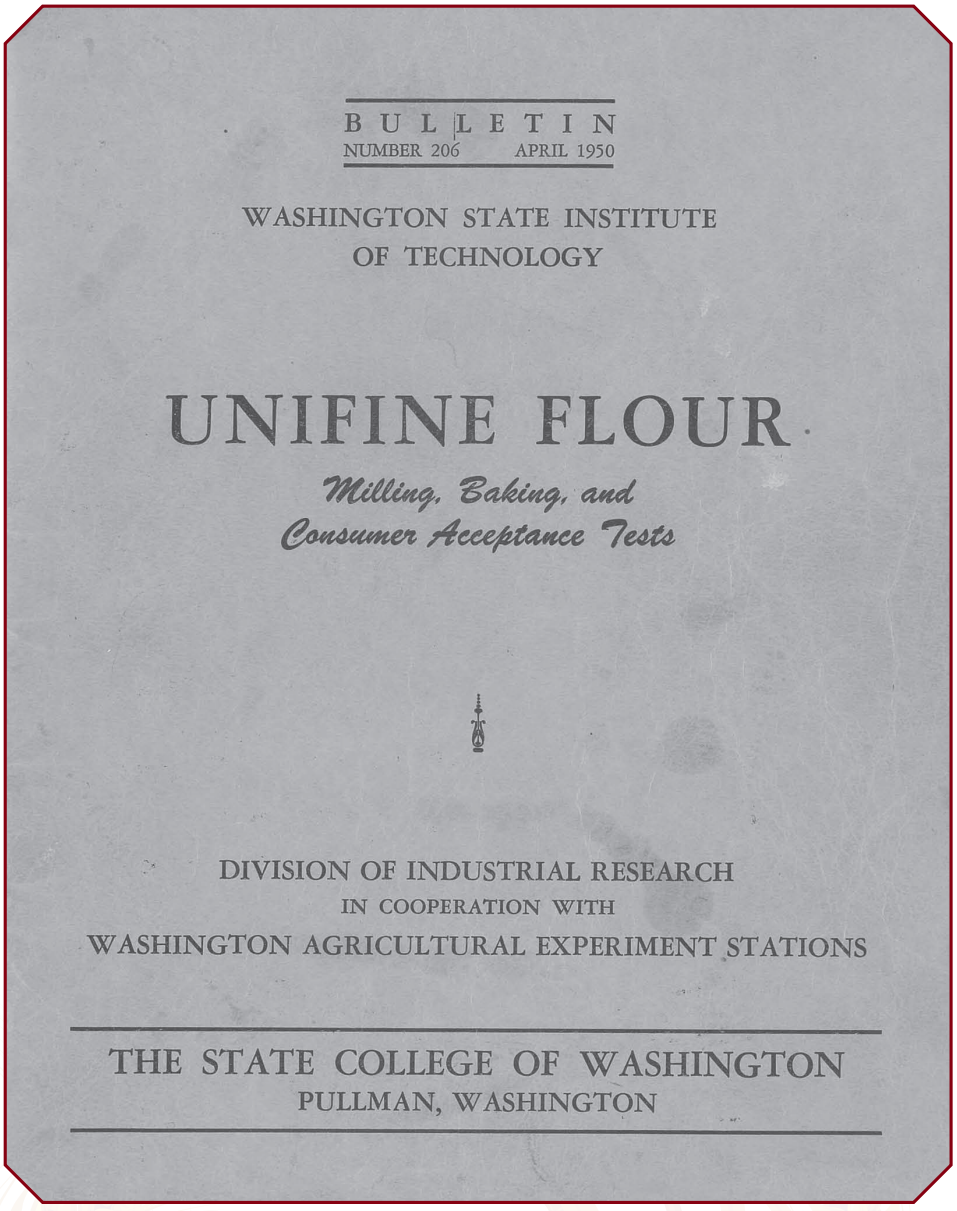
Drawing from the original mill literature illustrating the basic working principle of the impact milling method.




After World War II, an Englishman by the name of John Wright came to the United States with a compelling story and a vision of a milling system that would revolutionize the world's flour milling industry. He claimed that this milling system had been built and performed successfully, but that it was destroyed, along with much of London, during the war. Unable to find resources to begin anew, he ventured to the United States and ended up before Washington State College President Compton, who personally referred him to the school's Department of Industrial Technology. Finding employment as a janitor, Wright made ends meet while he shared the somewhat incomplete details of this new approach to flour milling. University engineers were convinced to pursue the tedious fabrication of a mill prototype with an anticipated output of 150 pounds of flour per hour. Quoting from a speech focused on the revolutionary potential of the mill made at the 1947 International Miller's Convention by college representatives, "A near miracle happened, the mill prototype performed flawlessly from the outset".

# Unifine Mill

## *Bulletin 206 May 1950*



BULLETIN
NUMBER 206 APRIL 1950

WASHINGTON STATE INSTITUTE
OF TECHNOLOGY

UNIFINE FLOUR

*Milling, Baking, and*
*Consumer Acceptance Tests*

DIVISION OF INDUSTRIAL RESEARCH
IN COOPERATION WITH
WASHINGTON AGRICULTURAL EXPERIMENT STATIONS

THE STATE COLLEGE OF WASHINGTON
PULLMAN, WASHINGTON

*The complete text of Bulletin 206 can be found at www.unifinemill.com*

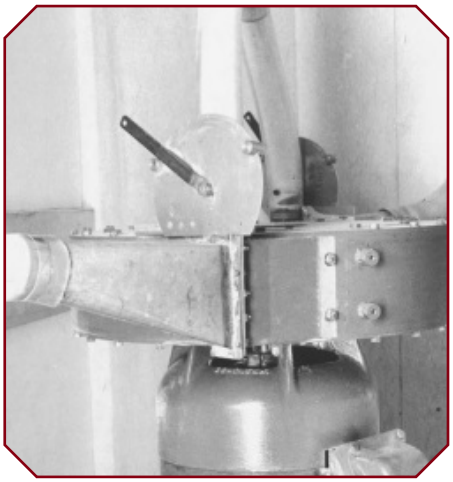
In May of 1950, scientific Bulletin 206 was published and drew the attention of a broad international audience. Fascination spread over the promise of a milling system capable of pulverizing the entire grain kernel to a satisfactory fineness for adequate loaf volume, efficiently in one pass. Serious inquiries poured into the Pullman WA campus, including on-campus visits from several foreign countries (including Turkey amongst others) and communication from diverse corporations (including the Boeing Company) and virtually every state in the union. Serious consideration was given by Senator Hubert Humphrey's Foreign Aid efforts that prompted additional inquiries, including a 1960's letter from the Afghanistan U.S. embassy. However, all this publicity generated stiff resistance from the flour milling industry centered around the centralized production of white flour. This resulted in the college department heads who had been outspoken about the potential of this milling system being directed to keep their remarks to the function of the mill and leave its promotion to the private sector. Interest in the milling system waned until a local farmer, Mr. Leonard Fulton, stepped in. He was Secretary of the Washington State Grange and personally funded the fabrication of three commercial mills.

*Leonard Fulton*

# Commercialization - *1955*

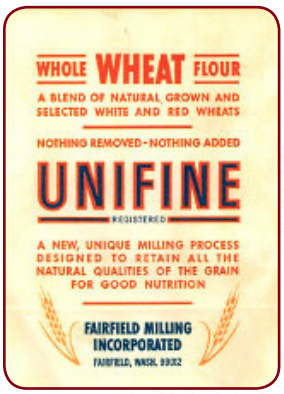
## *First Commercial Mill Fabricated*

Leonard Fulton was an active regional farmer, serving on the Boards of various farming organizations. In the early 1950's he was the Secretary of the Washington State Grange. In 1953, the State Grange Board initially voted to contribute just over $4,000 (which equates to over $50,000 in 2015 dollars) to fund taking the mill from the prototype stage to produce three commercial Unifine flour mills. However, under pressure from the commercial flour industry, at the last minute, the majority of the State Grange Board voted to withdraw their support. The original receipt with the Washington State Grange crossed out and "Leonard Fulton" written in was found in the WSU archives. Fulton wrote his personal check. The three mills were operational in early spring 1955.



*Rather than continue the vertical design of the prototype, engineers switched to the horizontal "two port" design, enlarged the rotor and envisioned correctly a mill that would produce 500 lbs. of flour per hour.*

The "if you build it they will come" principle did not work in this case. The mills languished at the college for six years until Fulton took it upon himself to enlist his local farming cooperative to proceed with a joint venture. Fulton and his associates operated the Unifine flour mill from 1961 until 1988. While he distributed the flour throughout the Pacific NW, it remained a novelty with production never exceeding 200,000 pounds of flour per year, even though the mill was capable of producing over 1,000,000/year. Lacking an aggressive marketing program, there simply wasn't enough consumer interest in whole grain flour yet, even flour that offered an unusually fine particle size. These whole grain purest, even if it had occured to them woudl never have considered directly sifting the finer Unifine milled flour. The venture did not ultimately accomplish what Fulton and his associates had hoped it would: promote re-localization of flour milling and expand consumption of whole grain flour. (See regional news release on page 5)




On May 1, 1975, Ms. Mary Corbett Stevens wrote Fulton a card:

*Dear Sir, This is a long overdue letter as I have been wanting to come and see your operation for a long time. In 1948, I was the lucky graduate student at Washington State University who was assigned to the Unifine Flour project. My thesis, completed in 1949, "A Study of Unifine Flour," dealt with baking characteristics, a study of the chemical and physical characteristics and the biological value of Unifine Flour. My advisor on the faculty, Dr. Barbara McLaren left Pullman about 1954 and now lives in Toronto. I have lived in Pullman since 1948 and am a housewife with four grown daughters. Would it be possible to visit your mill next Wednesday May 7 and talk with you about it?*

*Yours sincerely, Mary (Corbett) Stevens.*


Ms. Stevens went on to form another venture with five other women, who each contributed $5,000, called "Flour Girls," in 1981. They operated successfully for over fifteen years and, according to sources, eventually achieved a yearly distribution of nearly 500,000 lbs. of this ultra-fine whole grain flour. However, they ceased operations in 1996 and were it not for the curiosity of an eccentric and unique food cooperative, Azure Standard, the Unifine Mill story may have ended here.

# Unifine Flour Hits The Market!



## Unifine Flour Gives Bread Taste Like It Used To Have!

The following story is reprinted from "GRAIN," a News Review published by North Pacific Grain Growers, Inc., 400 Lewis Bldg., Portland 4, Oregon.

Pictures were taken by John R. Ulrich, Free Lance Associates, Great Western Bldg., Spokane.

Stockland Market News and Views felt it important enough to bring you this timely story as many persons, both city and rural, have long pondered the problem of bread that tastes like powdered air sacks. Whether or not Unifine flour will catch on is a good question. The public has condemned bread for a long time, but continues to buy the tasteless stuff found most often. At the same time most persons have griped about the taste of it.

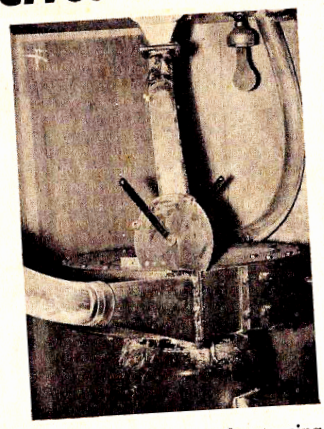
One thing for sure and that is Unifine gives bread a flavor that is nutty and simply makes you want to go after another slice. We hope it will catch on as we happen to like good bread.—THE EDITOR.

Not too long after World War II came to an end an Englishman, John Wright, came to Washington State University's division of industrial research with a request that they build him a flour mill.

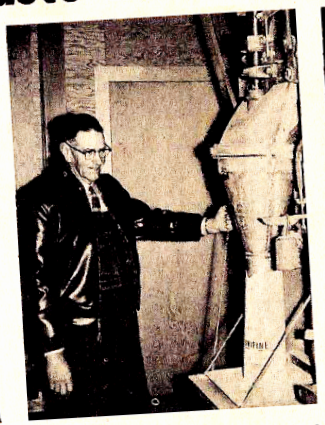
He had been a biscuit (cracker) maker in England and the mill he wanted built was no conventional roller mill, but an apparatus in which the grain was driven against a series of sharp teeth at high speed by the action of a rotor.

Flour from the mill was fawn-colored and it contained all of the wheat kernel.

Washington State technicians built a mill, esperimented and improved, ran tests of flour. The home economists did baking tests with the flour and Silver Loaf baking company in Spokane even did commercial consumer acceptance tests with bread baked from the flour.



Wheat is fed into the fast-turning stator from the tube at top center and after a half turn the flour is blown out the two side tubes.



Leonard Fulton, president of Fairfield Milling Co., pulls handle to allow Unifine flour to flow into bag.


Three sizes of Unifine flour bags are shown here—25, 10 and 5 pounds. Note the 5-pound sack of rye flour. Any type of grain can be made into flour in Unifine mill.

They called the flour UNIFINE because of the fact that the flour contained the entire wheat berry ground to a uniform fineness never found in common wholewheat flour.

Consumers who tried the bread liked its nutty whole wheat flavor and in the commercial tests it sold 11 per cent of the market tested—about equal to the demand for wholewheat bread.

The technicians issued a report in 1950 and then for 10 years no one heard much about Unifine flour. The Englishman was reported in Seattle where he tried to interest a miller in the process with no success, but then he, too, seemed to disappear.

And then just about two years ago Unifine came out of oblivion with a brief story in the Spokane Chronicle and Portland's Commercial Review announcing that a new company had been incorporated to mill it.

The firm is Fairfield Milling, Inc., and its mill, wheat bins, scouring equipment and sacking department are housed in a section of Fairfield Grain Growers seed house at Fairfield, Wash. Fairfield Grain Growers, a local member of North Pacific Grain Growers, in addition to leasing building space to the new firm also provides wheat cleaning services.

Fairfield Milling company's incorporators include Leonard Fulton, president; Joe Fulton, vice president; Julius Spielman, secretary-treasurer, and W. B. Temple, Spokane Technical and Vocational school cooking instructor.

The people who did the original work on the Unifine mill might not recognize it at first glance today. The original was a Rube Goldberg device of wheels and pulleys and belts and the rotor housing, about 15 inches in diameter, stood on its side. The mill built for Fulton at WSU is almost twice as large as the original and the stator drum (actually the mill itself) sits horizontal atop an 80-horsepower motor to which it is directly coupled. The original mill was fed from one inlet on a point on the outside surface of the stator and the wheat made one revolution of the mill's circumference coming out by air pressure at a point just short of where it entered.

"We discovered one thing in experimenting with the Unifine mill," Fulton says today. "The wheat does not have to make a complete revolution. It is ground by the time it's only half-way around."

As a result, Fairfield Milling's Unifine mill has two feed tubes and two outlet tubes and where the original experimental mill started overloading when it reached a capacity of 275 pounds per hour, the new mill will do 650 to 700 pounds an hour without strain.

Marketing of Unifine is handled directly by the company with Fulton doing most of the delivering himself. His routes include Moscow-Pullman to the south, Kettle Falls-Colville north, Coeur d'Alene to the east and "a little bit into Othello and Moses Lake." The flour is packaged in 5, 10, 25 and 50-pound bags, the last being for several small commercial bakeries which are baking bread from Unifine. Milling is gauged to demand.

Fulton, who lives on the same farm on which he was born east of Fairfield, experiments with wheat varieties for Unifine and has himself succeeded in growing Montana hard wheats of 14-16 protein. He has tried Gaines in one blend and finds it works beautifully.

"But the thing to remember with the Unifine mill is that we are after quality, not quantity," Fulton points out.

# Azure Standard

## 1995-Present

The food cooperative Azure Standard is committed to the non--retail distribution of organic and otherwise holistic food products. They distribute direct to the consumer using consumer middlemen at drop off points for their semi-trucks that distribute to 29 western states. The Stelzer family runs this eclectic operation and Mr. Albert Stelzer is the patriarch. He had "been pestered" by an associate of Mr. Fulton's about the merits of the Unifine flour mill, contending that it was the perfect holistic system to process their grain. He became aware that Fulton's mill languished in the corner of a building at the Fairfield Grain Grower's site, and for a modest sum acquired the mill and supporting infrastructure in 1995.

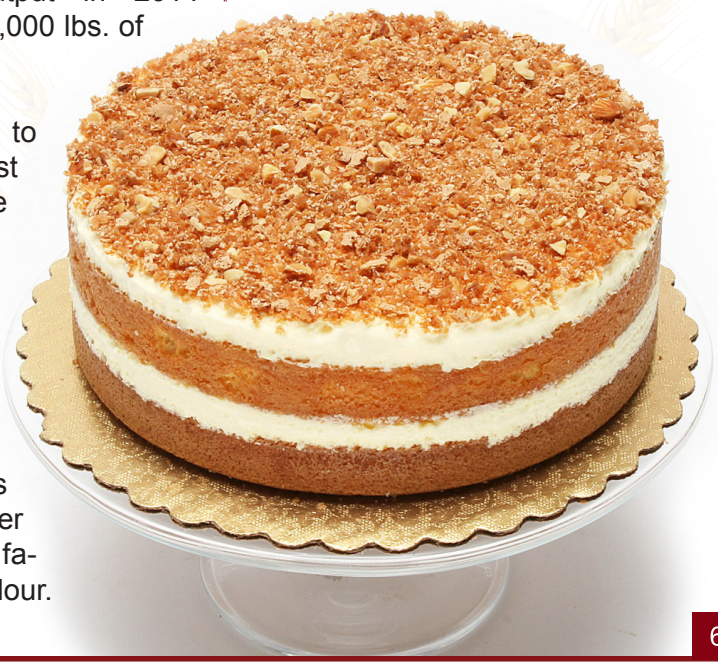
Stelzer reassembled the mill at their Dufur, Oregon site and even though it had been operated for over twenty years, found that it was still quite adequate at producing flour. They used the mill for four years, producing 400,000 lbs. of flour/year. In 1999, at a substantial expense, they had it reverse engineered and fabricated three new mills. They attempted to promote the quality of the flour produced by the mill, but they had more success with consumer word of mouth promotion.

While Azure Standard has not aggressively promoted the merits of Unifine milled flour, demand has steadily increased. Output had risen to over 600,000 lbs. per year when, in 2006, Fulton's grand nephew Steve happened to do a Google search for Unifine. He discovered they were using the term Unifine to describe their mill and attributes about the flour it produced that could only be attributed to this milling system. Unaware that they had acquired his Uncle's mill and/or reverse engineered the fabrication of three new mills, Steve Fulton reached out to the Stelzer family, and a new chapter in the Unifine story began.

The demand for Azure Standard Unifine flour has continued to increase with output in 2014 approaching 2,000,000 lbs. of flour/year.

It is significant to note that when first offered, their whole grain pastry flour for cakes and cookies initially sold one to every two bags of hard red wheat bread flour to their home bakers. That has increased to over three to one in favor of the pastry flour.

Consumers are finding that Unifine mills not only are outstanding for bread flour, but the very fine whole grain pastry flour can be adapted for cake, cookies and other pastries. They not only get adequate "fluff" that consumers prefer, but-they are discovering the same thing that artisan bakers are finding with whole grain bread flour; the "nutty" tastes and smells that come along with whole grain are so much more lively and exciting when the soul of the kernel hasn't been removed. Azure Standard is passionate about promoting whole grain pastry and bread baking and their loyal customer base has favorably responded. In contrast, future Unifine impact flour millers will likely embrace the marketing potential of directly sifted whole grain flour as a functional white flour replacement, with whole grain flour representing a smaller share of their output.



# A Personal Reflection;

## *Re-engaging Washington State University and the world... the future???*

"I was born in 1948, a year after (then) Washington State College Director E. B. Parker made the key note address at a regional Operative Miller's convention. He extoled the "miraculous" potential of the Unifine Mill prototype developed at the College. At that time, the Spokane, WA Silver Loaf Baking Company was conducting successful regional consumer and campus student acceptance tests of bread baked with fine whole grain Unifine milled flour. The next year, Graduate Student Mary Corbett Stevens published her thesis "A Study of Unifine Flour" and that was followed by the release of the WSC multi-department Unifine Mill Scientific Bulletin 206. Inquiries concerning the mill began coming into the campus from a variety of companies including the Boeing Company, Walgreen's, Gerber and Crissey. International inquiries were numerous and delegations actually traveled to the campus to see the mill from as far away as the country of Turkey. In addition to substantial coverage in regional newspapers, articles discussing the mill appeared in national publications including the Farm Journal and Baker's Digest speculating on the potential "revolutionary" impact of the mill upon "an old industry".

I was five years old in 1953 when my Great Uncle Leonard Fulton funded the fabrication of three commercial Unifine Mills, taking the invention from the prototype stage to a commercial mill. However, with the "Wonder Bread Builds Strong Bodies Eight Ways" theme playing in the background, the commercial (white) flour industry successfully muted efforts to promote the mill and its whole grain flour output.


On the one hand, Mr. John Wright, the English inventor who brought the concept to WSU with direct support of WSC President Compton commended the college's "admirable example of progress towards the protection of health & alleviation of hunger". He expressed his "concern to see the principle established, devoid of commercial interest." However, it wasn't long until President Compton complained of the "wrangling with milling companies" whose correspondence to the College unapologetically professed that the "principle utilization of wheat is in the form of baked goods made from white flour" and that "the promotion of Unifine flour is…short sighted, to say the least and most unworthy of the State College of the great wheat producing state of Washington".

*WSC President Compton*


I was fifteen years old in 1963 when my Uncle collaborated with regional farming leaders and our local farming cooperative. The first Unifine mill was placed in operation at Fairfield WA with considerable fanfare. For the next 26 years, that mill operated with my father often driving the delivery truck throughout the region, promoting the flour to grocery store manager's generally reluctant to put whole grain flour on their shelves. My mother worked with the recipes developed by Dr. Barbara McLaren's staff at the Home Economics Department at WSU and published several small Unifine recipe pamphlets. (Email me at unifine.mill@gmail.com and I'll send you one!)

I was a 30 year old manager with Pacific Northwest Bell in Seattle, enjoying life with my wife and three small children when Mary Corbett Stevens and her four associates started the second Unifine mill under the "Flour Girls" label. They had substantial regional support for their vision to promote the merits of whole grain flour and the functionality of the very fine flour output of the Unifine mill. Launched in 1980, their marketing effort was a bit more successful than my Uncle's, but interest in the nutrition and the sensory experience of whole grains was anemic in the 1980's and early 1990's.

The European approach of simply sifting or "extracting" the larger flour particles out of this very fine whole grain flour to match white flour functionality was never considered.

Their Flour Girls operation ended in 1996, six years after my Uncle's Unifine mill stopped distributing flour. None of any of the followers of the Unifine milling were aware that entrepreneur, scientist, farmer, spiritualist and head of the successful collective "Azure Standard"; Mr. Albert Stelzer followed up on a tip he received from an associate of my uncle's. In the mid 1990's he contacted the Fairfield Grain Growers who were happy to quietly sell him the entire system my Uncle had operated for nearly thirty years for a modest sum. Mr. Seltzer's family set the mill up and, amazed at the quality of the output, stopped using their stone mill. After four years (at 400,000 lbs. /year) "Azure Standard" spent a substantial sum to reverse engineer the worn out mill. As stated earlier in this booklet, in 2015, with output approaching two million pounds/year they and their constituents have been obviously very pleased with the very fine flour output from their Unifine Mill.

In a chance random 2007 internet search, I happened to discover Azure Standard was using the "Unifine milled" phrase along with the hype I was familiar with to promote Unifine milled flour. I promptly sent an email to Mr. David Stelzer, President of Azure Standard with a "tongue in cheek" threat to have my ancestors haunt him. Mr. Stelzer soon informed me he was sleeping like a baby because Azure Standard, in fact, had acquired my Uncle's system (where it remains today, reverently stored at their facility). That began a very warm relationship that ran from 2008 through 2015. During that time, I reacquainted various WSU Departments and the USDA Wheat Lab with their legacy with this invention. Three WSU Design Clinic teams were funded to work with private sector specialists.

A multi-year comparative functionality and quality test involving scientists from the USDA Wheat lab and WSU staff was also conducted with their scientific paper (see poster on page 18) presented at the 2012 AACC International convention. The results were generally favorable to the very fine whole grain flour output of the Unifine system compared to that of stone and roller mills. Anxious to get consideration of this unique system back on track, I happily invested some of my inheritance funding much of the research done at WSU. I have to acknowledge that the USDA Wheat Lab staff and various representatives from several departments have been incredibly gracious, receptive and sacrificially supportive of (not to mention patient with….) my enthusiasm. Ultimately, Oregon based Associated Welding and Machining who had fabricated the mills for Azure Standard were retained to fabricate a mill with some new (patent protected) modifications that have improved performance and output. Our friends at Azure were not only gracious enough to take the new mill and a fully updated milling system in for testing, but did a significant remodel of their milling facility in the process. The yearlong operational test was a success and, since that time, Our milling system was relocated to Rupert, Idaho operated by Magic Valley Milling. Azure has opted to develop their own system design using in house expertise and their own consultants. We wish them well and will support them in any way possible.

In 2015/2016 we had the good fortune of Cascade Milling of Royal City WA putting in a five mill modular Unifine system that produced over twelve million pounds of flour in 2016. We immediately discovered that the output of the mills was not what we'd anticipated and with the assistance of the miller at Magic Valley Milling discovered the choke point was in the intake port that Azure had modified from the original design. With that resolved, the mills are comfortably producing 1,200 lbs./hour of hard red wheat bread flour. In addition, Cascade ran these mills eight to sixteen hours/day and for the first time wear issues were identified. Our engineers at Associated have "exponentially" hardened the stators, rotor and the air guides and have assured us that we can emphasize the durability of these mills…even when milling hard material over extended periods of time. Which prompts me to mention that the Unifine Impact mill is

*Re-localization is already underway. Here at "Farm Ground FLour" in upstate New York, a local farmer was offloading grain for milling when I stopped by for a visit.*

the ideal system for milling most any agricultural product, from legumes to dried grapefruit rinds.

As mentioned in an earlier article, even with ascendant demand for whole grain products, commercial white flour still represents 93% of the commercial flour produced in the U.S. Targeting that white flour market by introducing European style "EX 85" extraction flour will not only Increase flour production by over 10% (through a higher extraction), but It will provide home and commercial bakers and their consumers with a superior product, both from a taste and nutrition standpoint. This niche is certain to eventually command a significant share of the U.S. market as it has for decades in Europe.

In addition to the success we're having in promoting the impact milling of flour throughout the U.S., we look forward to this technology finally being introduced to the world's farming economy that is critically short on commercial milling infrastructure. This has been anticipated for over a half century. Senator Hubert Humphrey's U.S. Congress Foreign Relations committee seriously considered inclusion of the mill in the 1950's in our Foreign Aid program and as mentioned earlier in this booklet, U.S. Embassy's, including Afghanistan speculated on the significant impact this durable system will have on the primitive flour milling infrastructure that still dominates the developing world.

I'd like to close with a "clarification of intent". Myself and my associates would like to echo Mr. Wright's sentiment by honestly stating that our motives are "devoid of commercial interest." I've personally engaged in this effort to support the legacy of my family's passion to promote the holistic milling of our grain and to re-localize flour milling and other related profit centers. I'm indirectly supported by an eclectic collection of millers, bakers, engineers, scientists, academics, etc. that have become enthused by the extraction of an additional 10% of the kernel volume into a more nutritious and flavorful flour. The economic stress in local farming communities has only heightened our enthusiasm.

*Steve Fulton*
*Grand Nephew of Leonard Fulton*
*President, Unifine Mill LLC and*
*Unifine Flour Brands LLC*

# The *EVOLVED* Unifine Milling System

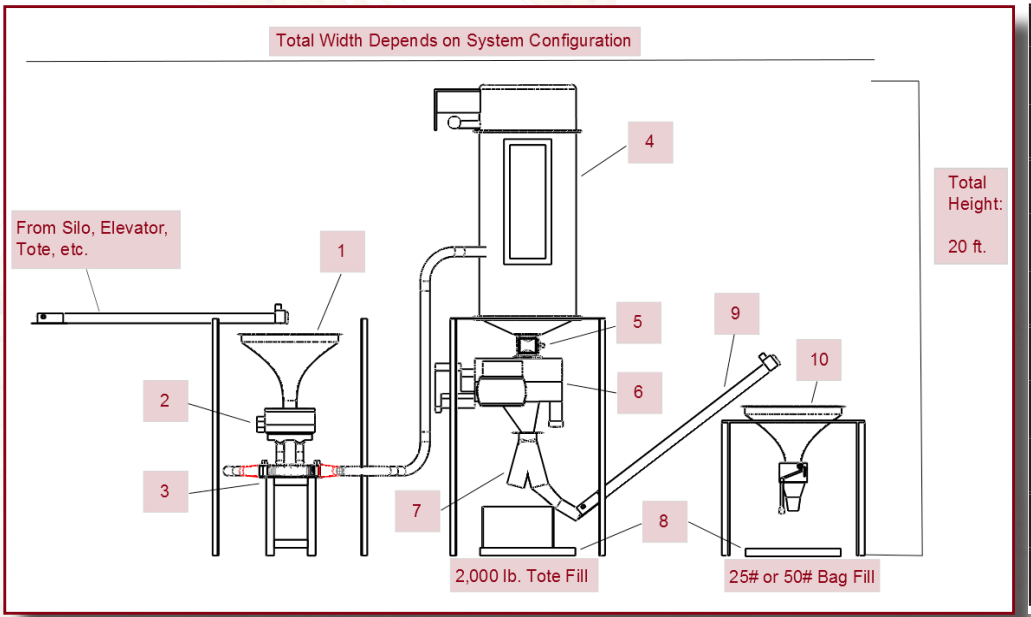
It became obvious working with the Fall 2012 semester Washington State University Engineering Design Clinic team that a number of customers wanted a total solution: a complete system of matched components that would feed the mill and efficiently transport ground flour to a packaging line.

This warranted yet another Design Clinic Team tasked to work with industry experts to identify equipment from other manufacturers that would fully optimize the whole grain production of the Unifine Mill. The challenge was to find components that matched the mill's performance and met design goals for low cost, safety, ease of use, simple assembly, low maintenance, and a small footprint.

The students and our team worked closely with an outside milling engineer. The firm ultimately was retained to fabricate two "towers" containing the supporting infrastructure they recommending for a modularized system. These towers were delivered to a completely updated milling facility at the Azure Standard facility in Dufur, OR in January of 2014. The Azure Standard team had the experience to install this system on their own, with some "localized" modifications. They began using this new system in March of 2014 They have since installed their own system and the test mill has been relocated to Rupert, Idaho, operated by Magic Valley Milling.

A unique feature of the Unifine mill is the massive amounts of air volume the rotor action generates propelling the flour from the mill and away from the "mill tower" that receives the raw grain and delivers it to the mill. As mentioned in the outline, this air volume is not only useful to bleed of the harmful heat that milling systems naturally generate but propels the grain to the "milling tower". The filter receiver (or cyclone) that receives the grain from the mill is able to much more efficiently draw the grain from a Unifine mill than other whole grain milling systems that mainly engage the force of gravity to disgorge the flour from the mill. While most other systems each require a separate filter receiver, it's anticipated that one filter receiver would be able to support up to ten Unifine Mills.

The modularity that the air volume generated by the Unifine mill




| Item # | Name |
|---|---|
| 1 | Surge Hopper |
| 2 | Rotary Feeder |
| 3 | Unifine Mill |
| 4 | Filter Receiver |
| 5 | Rotary Airlock Feeder |
| 6 | Rotary Sifter |
| 7 | "A" Valve |
| 8 | Floor Scale |
| 9 | Screw Conveyor |
| 10 | Bagging Scale |

makes possible is a distinct advantage for the Unifine system. In a fairly small production space, a milling tower supporting one to ten mills or potentially producing anywhere from two to twenty million pounds of flour per year.

The mill tower contains a surge hopper, a rotary feeder, and the Unifine Mill. The surge hopper utilizes level indicators to control the flow of grain into the hopper to ensure a constant supply of grain for the mill. The rotary feeder maintains a regulated, consistent feed rate to optimize the mill's performance, and also contains a Bliss Industries 10" heavy-duty plate magnet to remove metal debris that may still be present in the raw grain. The Unifine Mill receives the clean grain through two stainless input ports and discharges finely ground flour through two stainless output ports. The grain entering the mill immediately collides with the mill's blades rotating over 22,000 lineal feet per minute. The high speed of rotation and engineered tolerances within the mill cause the grain to "explode" instantly into a fine flour. The grinding process further refines the flour for another 180 degrees until it exits the mill in as little as 30 milliseconds.

The milling tower contains a filter receiver (or cyclone), highspeed rotarysifter, rotary airlock, sieve, and "A" valve. The highly efficient filter receiver separates air from the flour with a 99.96% efficiency rate, eliminating the additional cost incurred by other solutions that require piping to exhaust the discharged air outside. The filter receiver also utilizes a variable speed fan to create a vacuum that draws flour from the mill, eliminating the flour dust emissions and explosion hazards inherent with pressurized systems. The flour than passes through an 8x8 rotary airlock which maintains a consistent flow rate from the pressurized filter receiver to the sieve operating at atmospheric pressure. The sieve enables millers to further reduce the particle size to imporve functionality, untimately targeting the nutritionally benign refined white flour market. The output of the sieve is fed into an "A" valve, which can be switched to drop the flour directly into a 2,000 pound tote or onto a conveyor to feed the end-user's packaging line.

What Unifine Mill LLC is offering is just the Unifine Mill and we have a number of consultant resources available to assist in milling system element acquisition and assembly. Wiring for each device runs to a single electrical panel which contains all the controls for the mill, including relays. All you need to provide is a building, a 440V 3-phase power source, equipment to feed grain into the surge hopper, and 2,000 pound totes and/or a conveyor to transport the finished flour to your packaging line.

These systems are designed to mill both a 100% whole grain flour product and a directly sifted whole grain flour as a viable replacement for refined white flour. The latter is aimed directly at the commercial and residential baking market that prefers the functionality of baking with white flour. This locally milled extraction flour not only offers similar functionality but includes the great sensory experience and nutrition of modestly reduced amounts of the bran and germ elements of the wheat bud.

The appeal of the Unifine (Impact) milling system is the fineness of the flour output of the mill and the fact that the mill itself requires virtually no maintenance and is incredibly durable. Alternative milling systems include "hammer mills" and "stone mills". Hammer mills grind the grain with rotating hammers and utilize a screen to keep the grain in the mill until the particle size is small enough to pass through the screen. Over time, the hammers wear and, during operation, the screens clog, increasing down time and operating costs. Stone mills have dramatically improved in functionality over the years, but their end product remains course. Furthermore, stone mills utilize two rotating millstones that require redressing at regular intervals to maintain efficiency. Fully dressing a pair of stones can take 3 days. Therefore, when compared to other mills the ultra-fine particle size of Unifine milled flour has always, of course, been the key attraction.

A very high quality whole grain flour and the market ptential of directly sifted whole grain flour offering a very viable replacement for refined white flour is the primary appeal of the unifine (Impact) mill. However, the lower long-term cost of ownership due to unmatched durability and low maintenance makes a "nice layer of icing on the Unifine cake" (pun intended). We look forward to visiting with you.

Unifine Mill, LLC
www.unifineflour.com

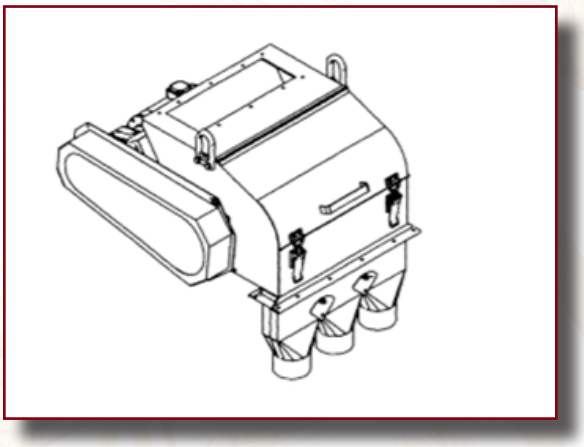
# Pre-Mill Surge Hopper

Description: The pre-mill surge hopper stores grain before it flows into the rotary feeder. Grain flows from the current storage unit (tote, grain silo, conveyer, etc.) into the surge hopper. The flow of grain into the surge hopper is controlled by a level monitor, which in turn controls the speed of the conveyor. This allows for a constant volume of grain available to the next piece of equipment, the rotary feeder.

Dimensions: Total dimensions are 4' tall and 3' in diameter.

- 75 cubic feet total volume

# Rotary Feeder



Description: The Bliss Industries rotary feeder is used to control and split the flow of grain into the Unifine Mill. It uses a gear motor to power a rotor in the path of the grain. The grain flows from the surge bin above through the rotary feeder and into the Unifine Mill, at a consistent and uniform rate, which increases the productivity of the mill. Included in the rotary feeder is a Bliss Industries 10" HD plate magnet. The plate magnet removes any ferrous metal debris that may be present before milling.

Dimensions: The overall dimensions of the rotary feeder are 12" wide, 30" long and 25 ¼" tall.

- The rotary feeder has two 4" output ports (shown as three in diagram).
- 1 HP motor

# Evolved Unifine Mill*

Description: The Unifine Mill* utilizes an efficient, holistic, one-pass, dry impact milling process. It instantly produces an ultra-fine whole wheat flour with a particle size comparable to nutritionally benign white flour and, unlike white flour, preserves the wonderful aromas and great tastes provided by the bran and germ elements. Grains flow from the rotary feeder above the mill into two stainless inlet ports. In one pass the grain is pulverized into flour and exits the mill through two stainless outlet ports. The ground flour then flows into the next device, the filter receiver.

Dimensions: The overall dimensions of the Unifine mill are 4' wide, 4' long by 4.5' tall.

- 30 HP Hp explosion proof motor
- Stainless steel covers and ports for durability and easy cleaning
- Hardened steel blades and stator for prolonged durability
- Dynamically balanced for smooth operation.
- Adjustable air gates for precise adjustment of airflow to accommodate a variety of grains

*Patents Pending

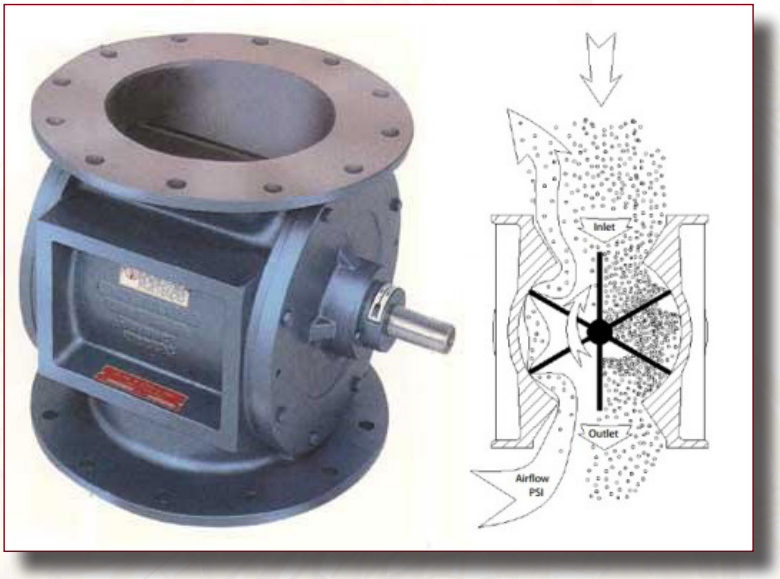
# Filter Receiver

Description: The Kice VenturiJet filter/receiver model VR-16 separates the milled flour from the airstream. The filter contains a number of bags which trap and direct the flour. High pressure (80-100 PSIG) compressed air continuously cleans the bags to keep the filter clog free. The filter receiver feeds into the Meyer & Sons rotary airlock feeder.

Dimensions: Overall dimensions of the product are 119" tall (plus mounting stand height if required) by 48" diameter.

- Contains 16 tubes, each at a length of 94"
- Total filter area of 149 square feet
- 3 HP motor

# Rotary Airlock Feeder



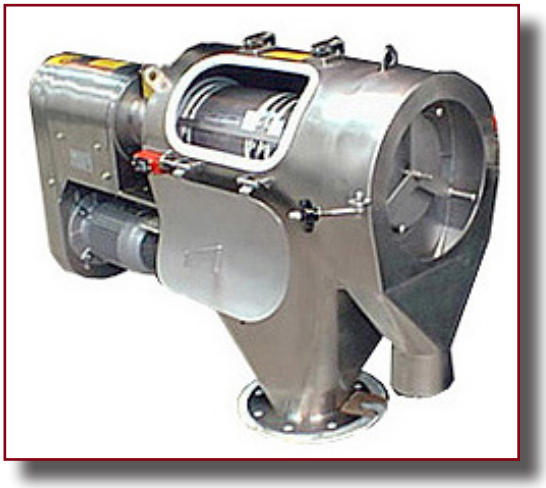

Description: The Meyer & Sons Model SDR 8x8 rotary airlock feeders are used in the bulk processing industry to allow material to flow accurately and in consistent, standard flow rates, from one pressurized area to an area of different pressure. For the Unifine Milling system, it allows the flour to flow from the pressurized Kice filter/receiver to the Kemutec centrifugal sifter.

Dimensions: The overall dimensions of the rotary feeder are 13 ½" diameter by 12" tall.

- Internal diameter of 8"
- 8-hole bolt pattern
- ¾ HP motor

# Rotary Sifter

Description: The Kemutec centrifugal sifter model K650 SS is designed to receive the flour from the rotary airlock feeder and sift it before it enters the gravity splitter “A” valve. The sifting process removes any particles that are too big or not meant to be in the flour, which results in a uniform, consistent flour size and quality. The sifter is the final stage in the flour processing chain. The Unifine mill produces a fine particle size that is perfect for most ground products. The sifter allows a manufacturer to create one or more “premium” products aimed at connoisseurs willing to pay for a fineness not found anywhere else in the industry.



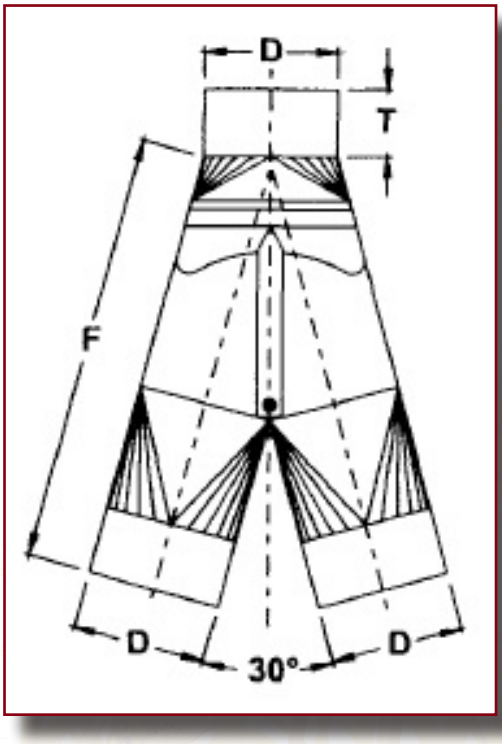
Dimensions: The overall dimensions of the centrifugal sifter are 64” long, 23” wide and 34” tall.

- 5 HP motor

# “A” Valve

Description: The Kice industries “A” valve part number 51A8 receives flour from the Kemutec sifter, and allows the option of diverting the flour to either a bulk tote on a floor scale, or to the Schlagel U-Trough and Conveyer. This “A valve” is manually operated.

Dimensions: The overall dimensions of the “A” valve are 8” in diameter (dimension D), with a total pipe length of 23” (dimension F).



# Floor Scale

Description: This generic floor scale is used to measure the weight of the tote or bulk bagging packages.

Dimensions: Overall dimensions unavailable. (generic unit)

# Screw Conveyor

Description: The Schlagel screw conveyor rotates the processed flour from the “A” valve to the Post-Mill Surge Hopper.

Dimensions: The U-Trough is 9 inches wide, length is 10 feet.

- 1 HP motor

# Post-Mill Surge Hopper

Description: The post-mill surge hopper stores flour before it flows into the rotary bagging scale. Grain flows from the conveyer into the surge hopper.

Dimensions: Total dimensions are 4’ tall and 3’ in diameter.

- 75 cubic foot total volume

# Bagging Scale

The S2200 Electronic Screw Valve Packer is designed to simultaneously fill and weigh multi-wall or plastic valve bags with a wide range of dry materials. This unit is a single speed packer designed to bring to customers an economical auger packer with electronic weighing. The S2200 valve bag filler is economical, accurate, and a reliable valve bagger.

Standard Features

- Platform bag chair
- Pneumatic bag clamp assembly
- Stainless steel screw and filling tube
- P.C. Digital controller for accurate weighing, user friendly

Optional Features

- Stainless steel construction
- Manual pivot bag chair
- Automatic start switch

# Conveyor & Bag Sealer

Description: The optional Chatland Exit conveyer and bag sealer is located after the JEM Bagging Scale, and allows the transfer of material from the bagging scale to a bag sealer. There are various options available for bag sealing, depending upon your needs. These include valve-pack bagger, heat seal bagger, and sew bagger, along with an optional stretch wrapper unit, which automatically wraps a full pallet of filled bags for storage and shipping.

Dimensions: Overall dimensions are approximately 10’ long, 2’ wide and 4’ tall.

- 1 HP motor

## Additional Items

### Nordfab Quick Fit Ducting

- Used for all piping between individual components
- Stainless steel

### EMS Autoload Minder Control

- Controls the Bliss Industries rotary feeder
- Allows an amperage ceiling limit to be set for the rotary feeder
- Ensure consistent flow to minimize clogging

### Flex Connectors

- Allows ease of system testing during installation
- Reduces installation time and cost
- Not used for final installation, replaced with Nordfab Quick Fit ducting

### Monitor Level Indicators

- Monitors the level of grain and flour in hoppers and bins
- Integrates with the EMS Autoload minder control system
- Eliminates the possibility of an overflow or underflow condition
- Warns operator if flow is interrupted and hopper is low or empty

# Influences of Mill Type on Baking Properties and Lipid Oxidation of Whole Grain Wheat Flour During Storage

B.-K Baik[1], E.P. Fuerst[1,2], T. Harris[1], E.A. Wegner[2], and S. Fulton[4]

[1]Department of Crop and Soil Sciences, Washington State University, Pullman, WA
[2]USDA-ARS Western Wheat Quality Laboratory, Pullman, WA
[4]Unifine Flour, LLC, Arlington, WA

## Abstract

Whole grain wheat flour from hard red and soft white wheat varieties was prepared using a stone mill, a Unifine (impact) mill, and a roller mill, and characterized for particle size, starch damage, lipid oxidation, and bread baking quality during storage. Roller-milled whole wheat flour was produced by blending white wheat flour with bran re-ground using a pin mill. Stone-milled whole wheat flour had a much coarser particle size distribution, whereas particle size distribution was similar for Unifine- and roller-milled flours. Stone-milled whole wheat flour also exhibited greater starch damage than Unifine- and roller-milled flours in both hard and soft wheat. Fat acidity and hexanal content, indicators of rancidity, were lower in stone-milled whole wheat flour compared to Unifine and roller-milled flours during storage up to 24 months. Unifine-milled whole wheat flour exhibited lower hexanal content than roller-milled flour in both hard and soft wheat, despite similar particle size distributions. No apparent differences in mixograph water absorption and mixing time of whole wheat flours were observed among mill types and storage durations. Unifine-milled whole wheat flour tended to produce greater bread loaf volume than stone- or roller-milled flours when baked with or without addition of gluten to attain 18% protein after storage for 6 to 18 months.

## Introduction

Whole grain foods are receiving increased attention from consumers and food manufacturers due to the health benefits associated with the increased content of dietary fiber, vitamins, minerals and bioactive phytochemicals compared to refined grain products. Whole grain wheat bread has become the most popular consumer food, yet our understanding of the optimal method of milling wheat grain to obtain whole wheat flour is limited. Milling methods could have tremendous impacts on processing and product quality as well as nutrient availability of the resulting whole wheat flour. Various milling processes used for preparation of whole wheat flour could impart uniquely different physical stresses on the wheat grain and flour particles, thus resulting in variation in functional properties. We investigated the effects of three different milling methods on physical characteristics, lipid oxidation and baking quality of whole wheat flours.

## Materials & Methods

### *Wheat grain*

- Hard red wheat cultivar 'Hank' 9.3% moisture
- Soft white wheat cultivar 'Stephens' 10.9% moisture

### *Whole wheat flour specifications*

- 80% of flour passed through #70 sieve (212 μm) and <10% retained over #20 sieve (850 μm)

### *Milling and storage of whole wheat flour*

- Stone Mill: 'Europemill EM-25/250', 25 cm diam, horizontally mounted; flour was run over a #70 sieve and overs were re-milled; after the third pass, whole wheat flour specifications had been met; grain was not tempered.
- Unifine Impact Mill: Manufactured by Azure Standard; single pass through the mill; whole wheat flour specifications were met; grain was not tempered.
- Roller Mill: 'Miag Multomat' (3 break, 5 reduction); bran fractions were re-milled on a 'Blendtec Kitchen Mill' pin mill and then blended with refined flour; whole wheat flour specifications were met. Prior to milling: hard red wheat tempered to 14.5%; soft white wheat tempered to 13%.
- Storage of whole wheat flour: 0, 6, 9, 18 & 24 months at 23°C.

### *Functional properties of WWF*

- Particle size: Determination of proportion of flour particles <125, 125-210 & >210 μm using a ATM sonic sifter
- Starch damage: Approved Method 76-31 of AACCI
- Lipid oxidation: Approved Method 02-02A of AACCI
- Pan bread baking: Approved Method 10-10.03 of AACCI

## Results

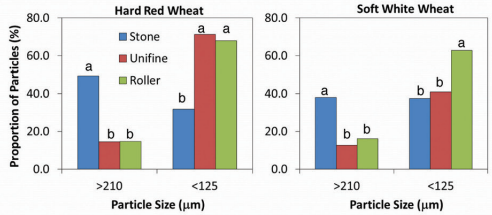



**Figure 1. Effect of mill type on proportions of whole wheat flour particles >210 μm or <125 μm. Bars with different letters indicate significant differences at *P*<0.05.**

Stone-milled whole wheat flour contained a much higher proportion of coarse particles (>210 μm ) and a lower proportion of fine particles (<125 μm) than Unifine- and roller-milled whole wheat flours.

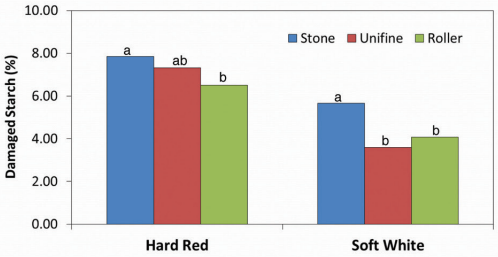



**Figure 2. Effect of mill type on whole wheat flour starch damage. Bars with different letters indicate significant differences at *P*<0.05.**

Stone-milled whole wheat flour had greater starch damage than Unifine- and roller-milled whole wheat flours for both hard red and soft white wheat. Unifine-milled whole wheat flour exhibited intermediate starch damage in hard red wheat and lowest starch damage in soft white wheat.

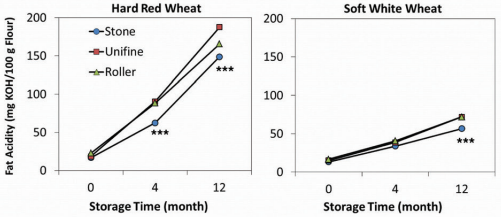



**Figure 3. Effect of mill type and storage time on whole wheat flour fat acidity as an index of lipid oxidation during storage. ***indicate significant differences at *P*<0.001 between mill types.**

Unifine- and roller-milled whole wheat flours exhibited higher fat acidity than stone-milled whole wheat flour after 4 and 12 months of storage in both hard red and soft white wheat. Fat acidity was much higher in hard red than in soft white whole wheat flour after 4 and 12 months of storage.

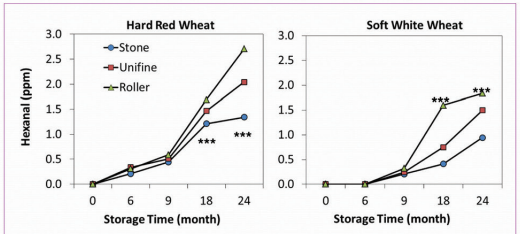



**Figure 4. Effect of mill type and storage time on whole wheat flour hexanal content as an index of lipid oxidation. ***indicates significant differences at *P*<0.001 between mill types at the specific storage time.**

Hexanal is a major lipid oxidation product and an indicator of rancidity. Hexanal content of whole wheat flour was similar among mill types through 9 months of storage, but showed differences at 18 to 24 months of storage. Hexanal content was highest in roller-milled, intermediate in Unifine-milled and least in stone-milled whole wheat flour.

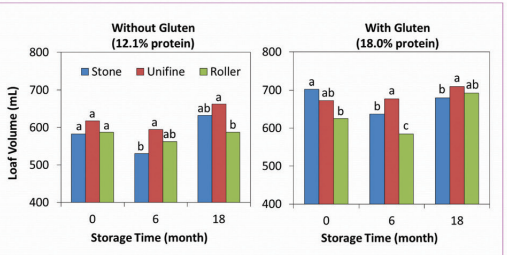



**Figure 5. Effect of mill type and storage time on whole wheat bread loaf volume. Bars with different letters indicate significant differences at *P*<0.05.**

Unifine-milled whole wheat flour tended to produce greater loaf volume than stone- and roller-milled flours during storage for 6 to 18 months, both with and without added gluten.

## Conclusions

- The stone mill produced more coarse particles and fewer fine particles of whole wheat flour than Unifine and roller mills.
- The stone mill caused greater starch damage than the Unifine and roller mills.
- The Unifine and roller mills exhibited higher fat acidity of whole wheat flour than the stone mill after four months of storage.
- Roller milled whole wheat flour was highest in hexanal content was after storage for >18 months.
- Unifine-milled whole wheat flour tended to produce slightly greater bread loaf volume than stone- and roller-milled whole wheat flours.
- This study indicates that mill type has significant effects on properties of whole wheat flour and the quality of whole wheat products.

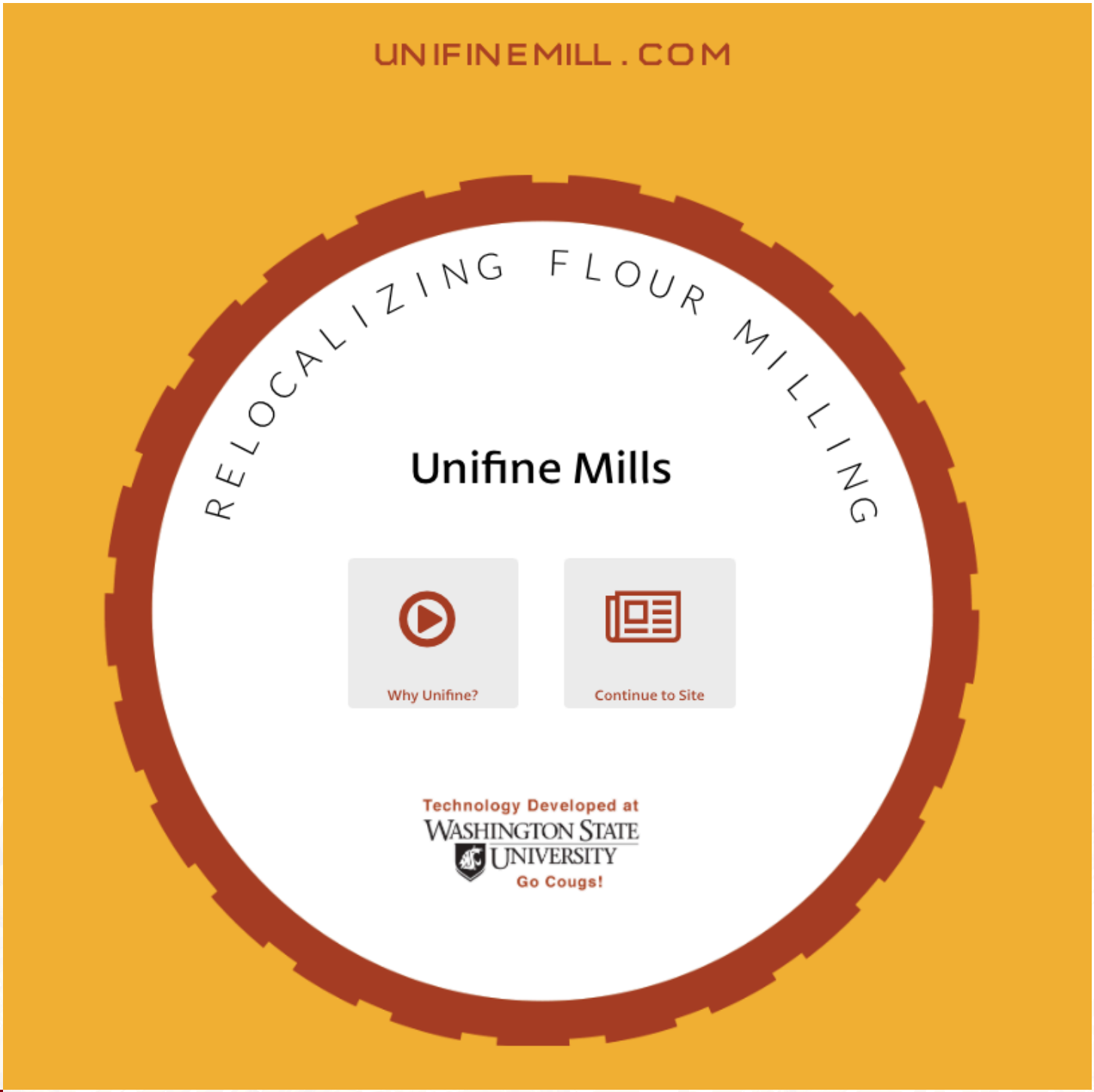
## Acknowledgements

Azure Standard (Dufur, OR) kindly prepared the Unifine-milled hard red and soft white whole wheat flours for this study.

# For More Information

*Visit our website* **www.unifinemill.com**

*For current Unifine news go to*
**www.unifinerevolution.com**



Notes: