THE LATEST RICE MILLING TECHNOLOGY

On the technical performance, etc. of recent rice milling machines

Foreword:

Rice milling for brewing began in Japan in the Genroku period in the late 17th century by the family of Kohnoike originated and inhabited in the area, now called Itami city near Osaka.

Rice milling had been made primitively in the ancient times by pounding rice in mortar using foot force. Overcoming the limit of milling capacity depending on the human power, the water-driven wheel rice milling was introduced in the middle part of the Edo

Period (18th century), In the early part of the Meiji period (in the late 19th century), rice milling had been made utilizing steam engines or electric power, which lasted up till the end of the Taisho period (1912-1926)/

The human powered rice milling needed about 40 hours from pouring hulled rice (15 kgs) in a mortar up to finishing the milling gaining 85% of mill rate. In the middle part of the Meiji period (the later part of the 19th century), trials were made to adopt a new motive power for rice milling in order to eliminate inconveniences of management and transportation of rice to water-powered mills situated in mountain areas. Rice mills, pounding rice in the similar way as water mills, were installed in the vicinity of sake brewers reportedly having the capacity of pounding hulled rice of 15 kgs in about 15 hours at the mill rate of 85%.

Around in 1922, a rice milling machine was imported , and a few years later, a machine maker in Hyogo prefecture succeeded in domestic production of the rice milling machine with the imported one as a model.

In 1937(Showa 12th), the number of rice milling machine makers was as many as eight.

Capacity of vertical type rice milling machines at this time is recorded as having pounded rice in about 15.5 hours of fed 300 kgs with vajira roll dia of 13" at the mill rate of 65%. Later, the diameter of vajira rolls increased from 13" to 16, 18 and 20". They had 2-speed and 4-speed change gears. In 1981, 25" non-step speed change gear machine was developed, and computer controlled automatic rice milling machines were put in the market two years later, which last up to the present.

GRINDING WHEEL FOR RICE MILLING MACHINE FOR BREWING

The oldest processing technology man has ever developed was “Chipped Stone Tools” made by striking stones each other to shape them into conveniently handling tools.
They made further progress into “Ground Stone Tools”. The former is classified in the Paleolithic (Old Stone) Age, while the latter in the Neolithic (New Stone) Age.
In such times, not only were tool stones made by sliding on the harder ores for grinding, but they used sarcosomal or bar-shaped grinding stones for forming and used abrasive grains. They supposedly made a lot of trials to find a rock or stone most suitable for a grinding stone or material, as grinding stones, garnet and emery increased; grinding and polishing were one of the most wanted technologies at these times for making polished adornments being the symbols of peers of royal dynasties or for making swords as their arms.

In 1891, Edward Goodrich Acheson of the US developed the manufacture of silicon carbide (SiC) on the way of experiments of making artificial diamond. He named the crystal “Carborundum” on his premise of its being a binding of carbon and corundum, and later, it was reportedly found to be silicon carbide after chemical analyses. The manufacture of silicon carbide was improved to fusing silica sand and coke at temperature above 2200℃ in an electric furnace, and was industrialized by a company “Carborundum”.

Fused alumina (Al_2O_3) was successfully used to get the material for the abrasives. This is what is called “A” Abrasive Grain today.

At present, SiC (C, GC) and Al_2O_3 (A) are the major general grinding grains, both of which started industrial productions in the early 20th century in the USA utilizing the electric power supplied cheaply by big power stations at the Niagara Falls overwhelming other world competitors.

In Japan, a joint company of American “Norton” and a Japanese enterprise was formed in Hiroshima for production of the grinding wheels. The place, presently at Minami Kaniya 1-chome, Minami-ku, Hiroshima city, was chosen in view of nearby situated good port, Kure, for the convenience of transportation of coal and raw materials from America. The company was set up there as a local production factory of Norton using the raw materials imported therefrom.

In 1932 and 1934, Showa Denko Co., Ltd. Developed production of brown fused alumina “A” and silicon carbide “C” abrasive grains respectively at its Shiojiri factory.

Grinding wheel makers in Japan have been supplied with the abrasive grains, except Kure Norton, the biggest manufacturer of grinding wheels in Japan, by such abrasive material manufacturers as Showa Denko, Nippon Kenmazai, Taiheiyo Kinzoku and additional one or two companies.
The grinding wheel is one of the members of ceramics family, which include porcelains, pottery, glass and refractories such as bricks and tiles.
The definition of the old and new ceramics is that the former are for those minerals existing in the nature, while the latter are those minerals not existing in the nature, but are generated by refining or by chemical reactions and further fired. The grinding wheel belongs to the new ceramics same as the fine powder of carborandum (SiC).

The rolls for brewing rice milling machines during the period between 1920-1935 were made of imported abrasive materials, which must have been expensive. At that time, the brown fused alumina (A) was the main abrasive used, and has been stored at CHIYODA as it was, There was milling machine adopting glass (ceramic) instead of emery rolls in 1937.

3 FACTORS OF GRINDING WHEELS FOR MILLING

The grinding wheel is composed of the grinding grain, binder and the air hole. The grind grain functions as a blade for milling the objects (rice, wheat, etc.$_3$, binder as a lade holder and the air hole as a clearance gap necessary for removing milled wastes (bran)

The most peculiar features of the grinding wheel are as follows:-

1. The grinding grains at the tip of a blade are abraded away and drop off when the tip comes to wear off in use. Then comes a new blade tip, thus continuing generation of the new tip incessantly. This phenomenon is called the autogenous action of the grinding grains.
2. A wheel is extremely abound with blade tips (grains$_3$, and milling speed is very fast, which fact makes efficiency higher considering its small incision

砥粒 : grinding grain　結合剤 : binding agent　気孔 : air hole　砥石 : grinding wheel
脱落砥粒 : dropping-off grinding grain　糠 : bran

THE STRUCTURE OF GRINDING WHEELS

(1) Kinds of Grinding Grains

Kinds & Symbols of Grinding Grains (JIS R 6111 ARTIFICIAL ABRADANTS)

Division	Kind	JIS	NORTON	Production Method & Properties
Alumina Grinding Wheel	Brown	A	A	Alumina raw materials, mainly composed of bauxite, are dissolved and resolved by electric furnace, and then solidified, thus making mainly alumina constituting material with proper content of titanium oxide. Lumps are pulverized into uniform grain size. Mainly composed of corundum crystals containing dissolved titanium oxide, with brownish color as a whole..
	White	WA	38A	Alumina refined by Beyer method is dissolved by electric furnace, and solidified lumps are pulverized Into uniform grain size. Composed of corundum crystals, whitish as a whole.
Silicon Carbide Grinding Wheel	Black	C	37C	Silicon carbide raw materials, mainly composed of silica stone and sand, plus cokes are reacted in electric resistance furnace. The grown lumps are pulverized into uniform grain size. Blackish as a whole.
	Green	GC	39C	Silicon carbide raw materials, mainly composed of silica stone and sand, plus cokes are reacted in electric resistance furnace. The grown lumps are pulverized into uniform grain size. Composed of alpha type silicon carbide crystals. Much higher in purity than C, and greenish as a whole.

(ELECTRON MICROGRAPHS)

(A) (WA)

(C) (GC)

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(2) Grain Size (Granularity)

The size of grinding grains is called granularity. Kinds of grain sizes are as tabled below:

Class	Kind of Grain Size
Coarse Grains	#8 #10 #12 #14 #16 #20 #24 #30 #36 #46 #54 #60 #70 #80 #90 #100 #120 #150 #180 #220
Fine Grains	#240 #280 #320 #360 #400 #500 #500 #700 #800 #1000 #1200 #1500 #2000 #2500 #3000 #4000 #6000 #8000

Granularity shows the size of abrasive grains, for screening of which sieves are used with the identified numbers.

For example, the abrasive grain of #60 determined by the sieve classification stands for those which pass through the screen having 60 sieve openings per inch (25.4mm) of length, but those which do not pass through the screen of #70 sieve having 70 openings per inch.

The abrasive grain of size #60 means those not passing through the lowest screening level #54.

We screen the grains according to our own sieving machines adopting regulations more stricter than JIS demand.

(3) Bonding Agent

Vitrified bond and resinoid bond are generally used. Resinoid grinding wheels are made

by low temperature (at about 180℃) pressing of abrasive grains mixed with resin powder. They are widely used for high speed green grinding, cutting and free milling.

Meanwhile, vitrified bond is used for grinding wheels for rice milling machines.

Compositions of the bonding agent are mainly feldspar, silica stone, clay and solvents, the last two of which are used for lowering the burning temperature down to 1250℃.

For an instance, wheat flour is mixed with buckwheat flour to bond them together in making soba noodle.

Our bond does not use solvents and clay, and is vitrified by firing the material at high temperature of 1300℃ up for two weeks (15 days).This increases the retentivity of the abrasive grains. The heat source of firing furnaces is mainly gas and oil, because, by utilizing pneumatic pressure of the burner, and by convecting as well as agitating the

air inside of the furnace, furnace temperature can be kept constant. There is no air convection with electric furnaces, where upper and lower furnace temperature differs, thus making it hard to get the stabilized furnace temperature and to control the neutral, reduction firing.

(4) Granularity & Hardness of Grinding Wheels

For right selection of a grinding wheel, you must first make sure if the wheel is made of grinding material with what grain size . In general, the grain size is marked ,for instance, like #60 on a wheel. The following table shows the relationship between the grain size number and the actual average grain size.

Grain Size No. & Actual Grain Size

	Grain Size #	Average dia.mm		Grain size #	Average dia micron
Coarse opening	10 12 14 16 20 24	2.5 2.0 1.7 1.4 1.2 0.85	Super fine opening	150 180 220	10 88 75
Medium opening	30 35 46 55 60	0.7 0.6 0.4 0.35 0.3	Minute opening	240 280 320 400 500 600 700 800 1000 1200 1500 2000 2500 3000	67 57 48 40 34 28 24 20 16 13 10 7.9 6.3 5.0
Fine Opening	70 80 90 100 120	0.25 0.21 0.18 0.15 0.13			

For coarse milling, a grinding wheel of a coarse grain size is used, and likewise, a grinding wheel of a fine grain size is used for finish milling.

The grain sizes of #46 to #80 are generally used for brewing, and #24 to #36 for wheat milling. As for hardness, those using more bonding agent are harder, because grains are firmly bonded each other. On the contrary, those using less bonding agent are softer, for grains are easy to separate.

The table below indicates hardness of grinding wheels in the alphabetical order:

Symbols showing Hardness of Grinding Wheels

Hardness Level	Very soft	Soft	Medium	Hard	Very hard
Symbol	F,G	H,I,J,K	L,M,N,O	P,Q,R,S	T,U,W,Z

In general, the grinding wheels with the symbols of "R" and "S" are used for brewing rice, while "O" is for wheat.

(5) System:

The system stands for grain density inside of grinding wheels. If grain size is same, the more the grains in a certain volume, the denser is the system. On the contrary, the system is coarser as the grains are less.

Those of which space between the grains is short are called "dense", and those with long space between the grains are called "coarse". JIS classifies the system in 15 levels of density in due order of the figures 0 to 14.

Granular Rate & System (JIS R 6210)

System	Granular Rate %	System	Granular Rate %	System	Granular Rate %
0	62	5	52	10	42
1	60	6	50	11	40
2	58	7	48	12	38
3	56	8	46	13	36
4	54	9	44	14	34

In general, the system for brewing rice is from 5 to 8.

CONCEPT OF CLEANING CHAMBER OF CHIYODA TYPE RICE MILLING MACHINE

In designing a rice cleaning chamber, a transparent cleaning chamber case was made, where rice cleaning was actually experimented finding the spot where rice stayed without running. The space between resistance pieces was also determined in the experiments. Our machine was designed theoretically according to the law of coefficient of friction and rest angle, combined with experiments and practices, thus introducing it

as it is today.

1. The law of Coefficient of Friction and Rest Angle:

   Note): When the inclination angle equals to the coefficient of friction, an object is about to start sliding down the inclining surface. The angle λ is called "friction" or "rest angle".

Contact Surface	Angle λ
Wood & wood	17° ～27°
Metal & wood	11° ～31°
Metal & leather	17° ～31°
Wood & leather	17° ～27°
Metal & metal	17°

2. According to the above law, we adopt 17° of slide angle in case of rice and metal, at which coefficient of friction is small. Cleaning chamber of our machine is so constructed that there is no wasting of whatsoever, or no unreasonable forced works, and, therefore, rice is smoothly exhausted and is milled with the original shape of rice set as standard.

3. Sketches of the structure for comparison:

Chiyoda Type	A Type	B Type
Inner pressure high	inner pressure low	inner pressure high
		Inner pressure low
Inner pressure low	inner pressure high	inner pressure high
Exhaust port	exhaust port	exhaust port

[Chiyoda Type]

Angles of friction and of rest are well balanced, and rice can be milled keeping its original shape.

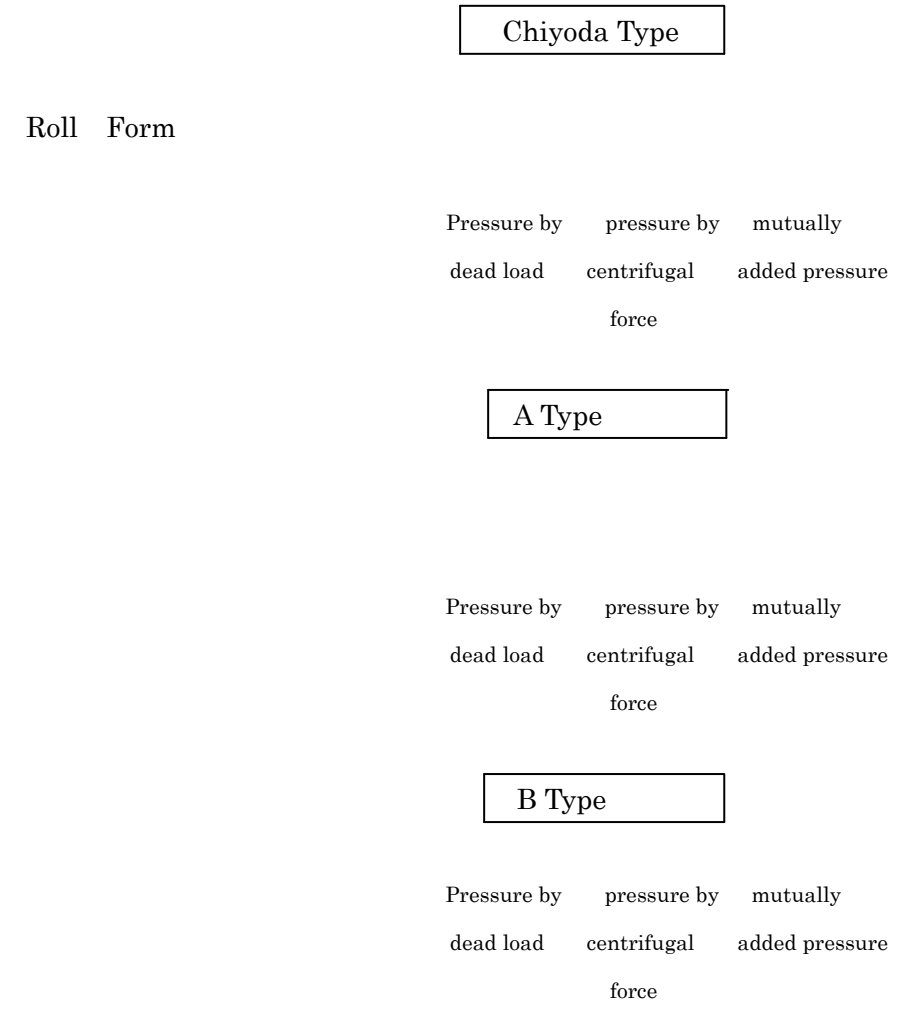
[A Type]

Seen from the coefficient of friction, rice grains drop due to their dead load and pressure at the lower part of the rice cleaning chamber gets higher, resulting in finishing rice grains round by milling them at their lengthwise edges.

[B Type]

Rice grains keep an ideal shape up to the middle part, but because outer diameter of the bottom part is made larger, high pressure is generated at the spot where the rice grains

are choking up. As a result, rice grains are milled at their lengthwise edges as in the case of A Type, thus finishing them round.



Comparing the form of the mutually added pressure of the three types as above, milling efficiency at the roll and at the main milling part can be clearly judged. (However, the comparison is made only on the roll form, and a considerable difference is expected to occur according to the shape of cleaning chamber).

FORMS OF VAJIRA ROLLS USED FOR
MILLING MACHINE FOR BREWING RICE

CHIYODA TYPE

Rice grain traveling state						
Pressure applied to rice	S		M		L	
Rice milling strength	M		M		M	
Circumferential speed of roll	L		M		S	
Average milling power	M		M		M	

Where: S stands for small, M for medium, L for large.

A TYPE

Rice grain traveling state						
Pressure applied to rice	S		M		L	
Rice milling strength	M		M		M	
Circumferential speed of roll	L		M		S	
Average milling power	M		M		M	

Where: S stands for small, M for medium, L for large.

B TYPE

Rice grain traveling state						
Pressure applied to rice	S		M		L	
Rice milling strength	M		M		M	
Circumferential speed of roll	L		M		S	
Average milling power	M		M		M	

Where: S stands for small, M for medium, L for large.

THE LATEST RICE MILLING MACHINES

(Kiku) HS-20 TYPE CNC

Automatic computer controlled rice milling machines are actually in the market, which automatically continue to mill rice grains, once a targeted rice milling rate is set up, until the set rate is reached. Former type automatic machines have necessitated operators to input such control values as flow, load and revolutions according to a rice milling rate, and the input control values have had to be changed according to a rice milling pattern by detecting the milling rate during the operation.

For setting up a rice milling pattern with former type machines, good knowledge and experience of rice milling are required, while skilled rice milling workers have been decreasing. Complex key operations are also required for setting up the milling pattern.

Procedures of operation of HS-20-CNC on the operation board: **A** shows rice milling rate indication, while **B** shows the dial for setting up the rate in 3 figures. Rice milling pattern is set up at the panel **C**, where the three patterns of "Strong", "Medium" and "Weak" can be selected. The milling patterns are preset in the memory provided in the control device. For instance, "Strong" is so programmed that number of revolutions, load value and flow rate are set at comparatively large values, and is suitable when around 70% of milling rate is targeted. The "Medium" pattern targets the rate around at 60%, while "Weak" at around 35%. Revolutions, load value, flow rate are set at comparatively small values.

D on the panel shows the rotor type dial for fine adjustments between 100% and 70% at the unit of each 5% interval. When set at 100%, it means the machine is driven exactly according to the programmed pattern. When set at 95%, for instance, revolutions and current value are to be reduced down to 95% of the programmed values.

The reason of providing this fine adjusting function is in consideration of delicate differences in the quality and shape of rice according to the area of production or the crop year; The preset rice milling patterns cannot always be the best, when unexpected rice grain deformation or breakage occurs. In such a case, the pre-programmed patterns can be adjusted by the dial **D** even during operation. Former type machines necessitated operators to master the key operations to change patterns based on their experience and knowledge. With the introducing model, first select one out of the three rice milling patters of "Strong", "Medium" and "Weak", further make fine adjustments and push the start button. Thus, the machine can be operated even by an unskilled , inexperienced operator.

パネルの図を挿入

歩合表示 Mill rate indicator　　歩合設定　Mill rate setting
精米強度 Rice milling strength　　運転 Operation
手動　Manual　自動 Auto　　白米 Cleaned rice　白米タンク Cleaned rice tank
シャッター　Shutter　　微調：Fine Adjustment
インバーター　Inverter　　停止 Stop　　一時停止 Temporary stop
強　Strong　中　Medium　弱　Weak　精米機　Rice milling machine
白米切換　Cleaned rice change-over　精米タンク　Cleaned rice tank
電流　Current　赤　Reddish　中　Neutral　白　Whitish　特　Special
モーター　Motor　昇降機　Lift　電源　Power source　糠　Bran
温度計　Thermometer　累計時間 Accumulated time
異常 Abnormality　万石　Grain screen　計量機　Weighing Instrument
糠　Bran　糠切換　Bran change-over　昇降機回転　Lift　rotation
昇降機サーマル　lift, thermal　万石サーマル　Grain screen, thermal
排出口　Exhaust port　温度　Temperature　精米強弱　Rice milling strength
停電検出　Detection of power service interruption

(Sakura) HS25-CNCIII

Former type machine has adopted the 30 rice milling patterns (numbered from 1 to 30), while this newly introducing machine has the patterns selected for properties particular to the milling rice ; a desired pattern can be instantly called up from the memory according to the brand or identifying number of the milling rice . Basically, the patterns are roughly classified into six as follows:-

酒造好適米　Rice suitable for sake brewing
心白発現率　Appearance rate of white core
心白大、中、小　White core, large, medium,　small
心白形状　White core shape
強　Strong　中 Medium　弱 Weak

うるち米　nonglutinous rice　歩留まり　yield
良　good
普通　normal
悪い　no good

Fine Adjustment Switch is provided to correspond to the particular properties of rice duly classified according to species, production area and crop year. In addition, Moisture Compensation Switch is also provided to meet moisture content of specific rice. In combination of these two devices, a single pattern can have variations as many as 27.

(The total variations, as such, can be as many as 486). When a pattern is to be called up according to a brand of rice, you may select "Species" switch, and all the rice species available are indicated on the screen in the alphabetical order. Or, you can simply call up an identifying number of the milling rice , thus eliminating any confusing and troublesome operation..

In short, this new type machine provides both the inputting capability of information on properties of brown rice and the milling pattern setting capability according to the input information on the brown rice properties. By pushing the "Auto" switch, you can use the machine to select a milling pattern, same as the former type machine.

(Sakura) HS-26W-Head Type

Former vertical type rice milling machine had normally one cleaning chamber from the beginning up to finishing the milling.

For milling at less than 70% of mill rate, two to three sets of milling machines, provided with rice cleaning function, were installed meeting the size of rice grains reduced by milling, operating them from one to the other. One of the well-known designs, for instance, was as per Utility Model Patent No. Sho33-3067 as illustrated.

With this design, two cleaning chambers are vertically installed around the one upright axis. Upper chamber is larger, while the lower is smaller. The upper chamber has a larger cleaning capacity, while the lower chamber has smaller capacity for cleaning rice mixed with bran, which is for preventing excessive cleaning to maximize the yield.

Utility Design Patent No. Sho33-3067

Other well-known design was Utility Design Patent Sho31-11366, which proposed the structure of three cleaning chambers, each piled upon the other, around the one

vertical axis to improve the cleaning capacity. The grinding wheel rotates inside of the cleaning chamber of the rice milling machine, and rice grains flowing down the chamber are to be milled when they pass through the gap between the inner wall of the chamber and the outer circumference of the wheel; grains are milled at the moment they come in contact with the outer circumference of the wheel. With such designs, the cleaning capacity largely varies in relation to the rice grain size and the gap size.

Milling rate for the sake brewing rice has become required , according to the recent tendency of demand for higher qualities, to exceed 50% and come close to 30%. If milling is to be done meeting such high requirements in one cleaning chamber, the higher the mill rate, the smaller become the rice grains. This means that the rate of rice grains passing through the gap between the inner wall of the cleaning chamber and the outer circumference of the wheel without contacting the wheel gets higher.

This further means the milling efficiency is lowered, extremely extending time for rice milling.

The introducing model provides two to three rice cleaning chambers; which are so designed as to have other functions than cleaning; this means that one set of such machine equals to having installed two to three sets of the conventional machines. At the same time, it saves cost, milling time and space of installation.

As this type is provided with two cleaning chambers at both sides of the machine, users can select the grinding wheels of various specifications such as granularity, hardness and structure, which assures efficient rice milling.

Rice Milling Data (HS-26W)

The materials used for this rice milling data are the special grade (15 bales) and the first grade (15 bales) totaling 30 bales 1,800kgs of the Yamada-nishiki brand rice of Hyogo prefecture harvested in 1998.

WEIGHT DISTRIBUTION CHARTS OF THE MATERIAL RICE

米粒の重量　Weight of rice grain　　白米　cleaned rice
玄米　Brown rice

SHAPE DISTRIBUTION CHARTS

APPARENT RICE MILL RATE, REAL RICE MILL RATE, FAILED RICE MILL RATE

玄米千粒重さ　Weight per brown rice 1,000 grains

符号　Mark	形状寸法　Shape
	長さ　Length
	幅　Width
	厚さ　Thickness

Latest Processing System for Rice Milling

In large scaled rice milling factories, centralized control system is provided to operate plural numbers of milling machines. Controlling is made by the system on feeding of brown rice, taking out of cleaned rice, scheduling of machine operations and setting up of operation reserving programs. As many as 10 or more operation reservations can be programmed.

On occurrence of any abnormality on milling machines or the processing line under unattended operation, the point of trouble is informed to a supervisor via the telephone circuit. In Japan, it is also possible that Mitsubishi Electric Service Co. copes with the trouble, even by applying any alterations on the software concerned via NTT telephone circuit link.

Such system is made and offered by Chiyoda Co., Ltd. developing it in joint work with Mitsubishi Electric System Co., Ltd. (100% invested by Mitsubishi Electric Co.). illustrated below is an Unattended Milling/Cleaning Machines Control System adopting CNC (computerized numerical control) in compliance with labor-saving requirements. It also safely supports full 24-hour operation of rice milling machines with the concept of CAM (computer-aided manufacturing) being adopted.

In Japan, Mitsubishi Electric System has 16 branches all around here offering service network for the systems.

[DIAGRAM OF ALARMING & REMOTE SUPERVISING SYSTEM VIA TEL CIRCUIT]

客先　Customer　　情報連絡装置（無人運転異常警報）Information Linking Device (Unattended Abnormality Alarm)

遠隔監視ユニット マスター局　Remote Supervising Unit　Master Station
専用局番号　Private Office No.　　切換器　Cross-board
現場管理室　Field Supervisor's Room
構内変換器　Private Converter
各担当者にテルする　Call the respective person in charge
無人運転異常警報 Unattended Operation Abnormality Alarm
電話回線 Telephone Circuit　　パソコン Personal Computer
常、異常個所　Normal, Abnormal Spots
（通報先は任意の８ヶ所まで）Alarm message informed up to optional 8 persons/spots

RICE MILLING SYSTEM COMPOSITION DIAGRAM

（１７頁構成図 作画 用語訳）

三菱電機システムサービス側　At side of Mitsubishi Electric Service
電話回線　telephone circuit　テンキー　ten-key
グラフィック画面　Graphic screen　中央管理盤　Central Control Board
ライングラフィックパネル盤　Line Graphic Panel Board
グラフィック表示盤　Graphic Panel Board　精米機　Rice milling machine
（精米機台数制限なし）　No limit for No. of set of rice milling machine
光ファイバーケーブル、正副ループ有り　Optical fiber cable, main and sub loops
玄米処理制御盤　Brown rice milling control panel board
白米処理制御盤　Cleaned rice control panel board
…・　制御盤
重量 計量器　Weighing meter
玄米配分計量器　Brown rice measuring instrument
白米計量器　Cleaned rice measuring instrument
白米払い出し計量器　Cleaned rice delivery measuring instrument

FUNCTIONS OF CENTRAL CONTROL BOARD:

1. No. 1 Graphic Screen
   - Setting up　operation reserving program
   - Taking out hulled rice from the storing tank
   - Putting cleaned rice in the storing tank
   - Taking out cleaned rice from the storing tank (to be set at each taking –out)
   - Starting up and stopping the operation of the whole system
   - Drawing up daily and monthly reports (regarding hulled/cleaned rice & bran)
   - Daily line indication
2. No. 2 Graphic Screen
   - Monitoring state of operation of rice milling machines (individual & whole machines)
   - Making rice milling patterns
   - Altering rice milling patterns in operation
   - Indicating abnormality of rice milling machine

3. Others

- Printing out

  No. 1 Printer

  Printing out daily/monthly reports, rice milling patterns, etc.

  No. 2 Printer

  Printing out state of operation of rice milling machines, abnormalities, etc.

- Data storing function

  Backing up such data as rice milling patterns, etc. on memory cards

- Remote Control function

  Using telephone circuit, monitoring of the standing status, program compensation, etc. can be performed from remote sites.

FUNCTION OF GRAPHIC PANEL BOARD

1. At a glance of the panel, operations of the total line (motors, shutters, leveler space …….tanks) can be observed for judgement. Monitoring the state of operation and lamp- flashing indicating points of abnormalities.
2. Manual operation of the individual motors, shutters, etc. can be done on the control panel.

FUNCTION OF FIELD OPERATION PANEL

1. Motors, shutters, etc. can be manually controlled on each individual panel.
2. Individual panel indicates operation of individual machine and device. (motor and shutter operation indication, etc.
3. Operation of individual machines (starting & stopping)
4. Graphic screen
   - Modification of present data of individual machines
   - Indication of abnormality of individual machines

Postscript:

Our Rice Milling Machines are perfected in the total balance of such fundamental factors as rigidity, security, and operability of the machine combined with reliability of electric devices and instruments.

Tanking an instance in the mechanical parts, we use chrome molybdenum steel for the main shaft, which supports the grinding wheel and has 1.8 times as high in its strength as the normal steel.

As to machine tooling of the mechanical parts, they pass through as many as 11 multi processes. Driving pulley, bearing press-inserting part and grinding wheel mounting part are, in the final process, processed in the micron level precision by highly sophisticated grinding machines, and finished with the industrial hard chrome plating.

Our selection of bearings is made very severely: we adopt the bearings for driving motors having three times as high strength as conventional ones and having maximized life-time to sustain long use of the parts concerned.

As to the grinding wheel, we adopt the products made by Showa Denko Co., Ltd., which has been reputed for being the oldest and the best in manufacturing the wheels.

The product uses highly pure vitrified bond, and does not use solvent or clay, and is fired at the temperature more than 1300℃ for long hours, thus gaining excellent grinding capability.

Regarding operability, the system is so designed, from the beginning of developing the CNC, as to be as simple as operating an electronic calculator.

Electric devices and instruments used are of Mitsubishi Electric Company, while system service as well as software developments have been and are made in joint cooperation with Mitsubishi Electric System Service Company.

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