

FUJI GARBAGE DISPOSAL SYSTEM

Yoh'ichiroh Sasaki
Sadao Yoneda
Kazue Kokubu
Yoshihiro Kaga

I. FOREWORD

The demand for rapid processing of the voluminous garbage from the dining rooms of hotels, hospitals, and offices, maintaining the cleanliness of kitchens, labor saving in processing work, and reduction of processing costs has steadily increased in recent years. In the major American cities the shredding, compression, and dehydration of the voluminous garbage is obligatory. Even in Japan foreign garbage disposal systems have been imported and installed in numerous locations. Since garbage in Japan is extremely viscous, mainly consisting of leftover rice, because of the difference in eating habits, dehydration is difficult with imported disposal systems. The Fuji garbage disposal system containing a unique dehydrating mechanism employing an extractor centrifugal system instead of the conventional static compression extraction mechanism developed as a dehydrating mechanism for especially viscous garbage is introduced here.

This extractor centrifugal system can also be said to be a technological transfer of the technological results of the continuous type juicer which we have been manufacturing for many years.

II. FEATURES

This system basically consists of (1) garbage shredder which shreds the garbage with water as the medium, (2) extractor centrifugal machine (trade name: Extractor) that extracts the water used in shredding and conveying and the water content of the garbage, and (3) control panel containing the electrical system, and has the following features:

1. Reduction of Processing Cost

- (1) Since the garbage is conveyed by pipe, it can be automatically sent to the desired location. Moreover, the garbage from several locations can be freely collected at the pipe and centrally managed.
- (2) Since the garbage is shredded and compacted to an average of 1/5 its volume, little garbage storage space is required. Moreover, burning efficiency is high and disposal costs can be saved.



Fig. 1 Exterior view of Fuji garbage disposal system (package type)

2. Improved Environmental Sanitation

- (1) Because the garbage is processed instantly, the interior of the room is maintained clean at all times and it has a rat- and insect-prevention effect.
- (2) Since the equipment is washed, no unpleasant odor remains in the room.
- (3) Since the processed garbage is shredded, washed, and dehydrated, it is difficult to decompose.

3. Features of Extractor

- (1) Ideal for processing of garbage containing rice (does not stick or clog).
- (2) Since washing is performed automatically, there is little odor and the equipment is clean.
- (3) The extractor has a constant dehydrating capacity for changes in the load.
- (4) Since a simple, safe dual vibration proofing mechanism is employed, operation is quiet.

4. Features of Shredder

Metal can be caught (optional specification).

If spoons, forks, or other metal objects should be inadvertently placed in the machine, they can be removed, without stopping the shredder, by operating a lever.

5. Features in Work (Especially Piping Work)

- (1) Since the slurry piping employs a one-way system, piping work is cheap and water level adjustment is unnecessary, even when several shredders are used.
- (2) Can be connected to an existing shredder and easily installed anywhere in an existing building.
- (3) Slurry does not clog the piping and maintenance is easy.

III. SPECIFICATIONS

The Fuji garbage disposal system can be classified into

package type and remote type by usage site and usage method. The basic configuration is given in *Table 1*. Various models are possible by combining these basic mechanisms. The specifications of the control panel are given in *Table 2*.

IV. CONSTRUCTION

1. Shredder with Metal Catcher

The shredder incorporated under the sink, etc. for the home, business, etc. has been well known for some time. This shredder contains internal rotating teeth and fixed teeth and shreds the garbage entering from the hopper of *Fig. 2* into fine shreds and mixes it with the supply water to form a slurry which is carried to the outside of the machine.

Table 1 Specifications of Fuji garbage disposal system (machine)

Name		Shredder		Feed pump	Adjusting tank	Extractor		
Model		DBY 2312	DBY 3312	WP 4011	TP 1811	EX 1312	EX 2312	EX 3312
Dimensions (mm) [width × height × depth]		550×850×550	550×850×550	400×525×520	900×1,390×720	550×1,250×550	600×1,250×600	640×1,250×640
Weight (kg)		75	84	68	95	120	134	146
Electrical characteristics	Power requirement	3-phase 200/220V 50/60Hz	Same as at left	Same as at left	Same as at left	Same as at left	Same as at left	Same as at left
	Capacity (kVA)	1.7	2.5	1	1	2	2	2.5
Capacity		Continuous processing capacity 60~120 kg/h	Continuous processing capacity 120~240 kg/h	850 rpm 5 m 70 ℓ/min	Tank capacity 180 ℓ	Continuous processing capacity per hour 100 kg	Continuous processing capacity per hour 200 kg	Continuous processing capacity per hour 300 kg
Piping	Washing water supply	15A or 15 ℓ/min	15A or 15 ℓ/min	Unnecessary	15A or 15 ℓ/min	20A or 30 ℓ/min	20A or 30 ℓ/min	20A or 30 ℓ/min
	Slurry system	50A	50A	Suction 50A Discharge 40A	Discharge 40A	40A	40A	40A
Application		Shredder for vegetables, rice Metal catcher can be installed as an option	Shredder for garbage containing raw fish, etc. Same as at left	Slurry	Constant volume supply to extractor when multiple shredders are installed	Special package extractor	Semi-remote type extractor	Remote type multipurpose extractor

Table 2 Specifications of Fuji garbage disposal system (controller)

Application		Package type	Semi-remote type		Shredder		Extractor	
Model		R-10	R-15	R-35	R-20	R-30	R-40	R-50
Dimensions (mm) [width × height × depth]		550×490×250	500×600×250	500×600×200	500×500×200	500×600×250	500×800×200	600×900×250
Electrical characteristics	Power requirement	3-phase 200/220V 50/60Hz	Same as at left	Same as at left	Same as at left	Same as at left	Same as at left	Same as at left
	Capacity (kVA)	4	4	5	3	4	3	4
	Overcurrent protection	YES	YES	YES	YES	YES	YES	YES
	Grounding protection	YES	YES	YES	YES	YES	YES	YES
Controlled devices		Shredder Extractor Water supply solenoid valve	Shredder Extractor Water supply solenoid valve	Shredder Feed pump Extractor Water supply solenoid valve	Shredder Water supply solenoid valve	Shredder Feed pump Water supply solenoid valve	Extractor Water supply solenoid valve	Extractor Constant volume pump Water supply solenoid valve
Switch position		Front of control panel	Front of control panel Side of equipment	Same as at left	Same as at left	Same as at left	Same as at left	Same as at left

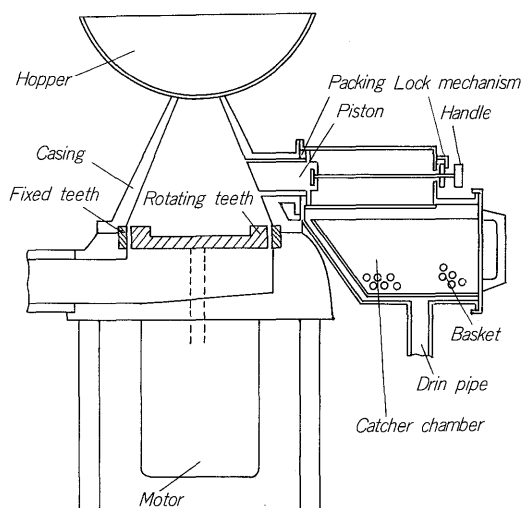


Fig. 2 Garbage shredder and metal item ejector of Fuji garbage disposal system

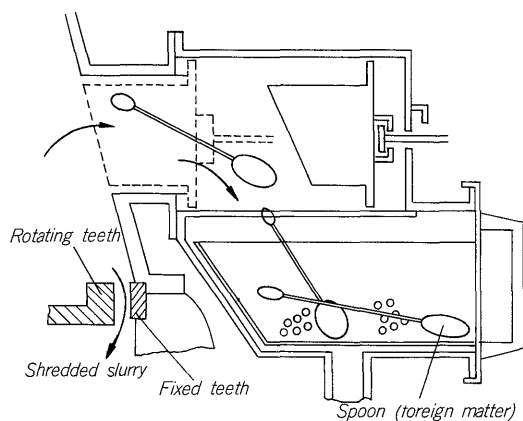


Fig. 3 Metal item ejector of Fuji garbage disposal system

However, spoons, forks, and other metal pieces and pieces of ceramic are often inadvertently mixed in the garbage. These metals and other foreign matter cannot be shredded between the rotating teeth and fixed teeth of the shredder and contact the teeth and move around the inside of the casing while making an abnormal clattering sound. Furthermore, in the worst case, the centrifugal force and impact force with the teeth accompanying rotation may cause this foreign matter fly out from the garbage inlet port. Moreover, it may also become meshed between the teeth, thus damaging the teeth and causing trouble at the shredder.

Therefore, foreign matter inadvertently entering the shredder must be quickly removed from the machine. Furthermore, since operation of the entire processing facility must be stopped each time the shredder is stopped to remove this foreign matter when the shredder is combined with other processing equipment to form a garbage disposal facility, it is inconvenient from the standpoint of operating efficiency. For this reason, a shredder which allows removal of the foreign matter while the machine is operating is demanded. The metal catcher has been developed for this

purpose. The operation of the metal catcher will be described below.

Normally, the shredder is operated with the piston closed as illustrated in Fig. 2. When the piston is closed, the end of the piston forms a continuous face with the inside wall of the casing. Therefore, it does not hinder the movement of the garbage or water inside the casing and the shredder functions normally.

Moreover, water-tightness against the water inside the casing is maintained by a packing. If pieces of metal, ceramic, or other foreign matter mixed in the garbage enter under this operating state, they are not shredded, but are moved around the inside of the casing with a clattering sound by the centrifugal and impact actions. Using this abnormal sound as an alarm signal, part of the casing can be opened by unlocking the lock mechanism and retracting the piston by pulling the handle (state illustrated in Fig. 3).

Under this state, the interior of the casing and the catcher are connected. Therefore, the foreign matter moving around inside the casing is thrown out of the casing and into the basket of the catcher as shown by the arrow by the centrifugal force and impact action accompanying rotation of the rotating teeth. When the entry of foreign matter is detected by the sound and loading of the garbage is temporarily halted and the handle is operated for several seconds, only the water and foreign matter are collected inside the catcher chamber. Since the abnormal sound inside the casing will cease when the foreign matter has been collected, the piston is shifted to the closed position and locked by again operating the handle. Even if foreign matter enters the shredder along with the garbage, it can be removed to the outside of the machine without stopping the shredder and without exposure to the remaining garbage or the sharp teeth. Furthermore, at normal operation, the operating functions of the shredder are not hindered and other similar practical superior effects are achieved.

2. Extractor

The Fuji garbage disposal system consists of a shredder, extractor, and a feed pump and piping connecting the shredder and extractor. The shredder is installed in the kitchen of a dining hall or other location when a large amount of garbage is generated. The extractor is installed at the garbage disposal point or incinerator. The shredder and extractor are connected by slurry feed pipe, feed pump, etc. In other words, the raw garbage thrown into the shredder is shredded, and the shredded garbage is mixed with the water used in shredding and water added as the conveying medium and sent to the extractor through a pump and pipe in the form of a slurry. The extractor is equipped with a reverse circular cone continuous processing centrifugal separation basket. The dehydrated garbage from the outlet port is collected in a garbage container and the water removed from the garbage is drained off through a drain pipe. This is the basic type. In addition, there are also extractors with high dehydrating efficiency, vibrationproof automatic washing, and other functions.

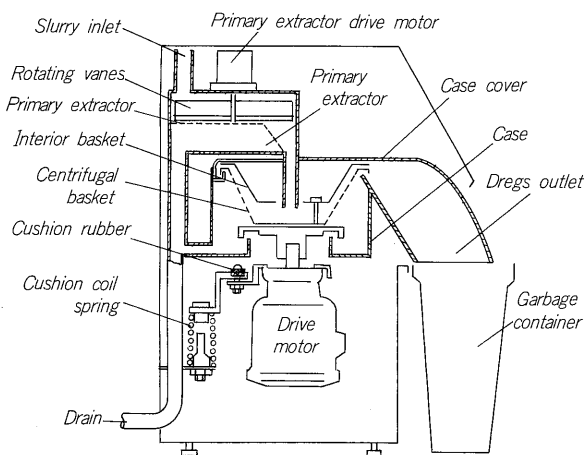


Fig. 4 "Extractor" centrifugal machine of Fuji garbage disposal system

1) Primary extractor (pre-extractor), pump centrifugal basket

When a garbage disposal system is actually operated, the amount and type of garbage placed into the shredder are not constant. Therefore, the load sent to the centrifugal extractor also varies substantially with time. That is, in certain cases, the load may exceed the capacity of the centrifugal extractor and even if the load is small, the proportion of water contained in the slurry may be abnormally high.

In such cases, sufficient water is not removed from the slurry during the process which raises the slurry up the tilted surface of the reverse circular cone centrifugal separation basket and an equivalent amount of water remains in the recovered dregs. Moreover, when input of garbage into the shredder is interrupted and only water is conveyed, the water striking the centrifugal separation basket of the rapidly rotating extractor splashes in a spray and is carried to the dregs outlet by the circulating air produced inside the dehydrating case. The water droplets from the case produce a phenomena which causes the water to drip onto the dregs already collected in the container. Therefore, the slurry can be amply dehydrated by using a large type extractor having a large dehydrating capacity and a ample margin against even large loads. However, from the standpoint of operating efficiency against varying loads, the facility cost is high, and it is not only uneconomical, but when only water is transported, in particular, the water splash phenomena cannot be avoided, even with large machines, except for centrifugal extractors. Therefore, the primary extractor of Fig. 4 has been developed and installed.

This primary extractor consists of a cylindrical case placed atop the centrifugal extractor and a filter placed at the center of this case. A hole is drilled in this filter and rotating vanes are provided at the top of the filter. The slurry falls onto the top of the filter and is carried to the hole in the filter by the rotating vanes and the water is removed. Moreover, when only water is carried, it immediately passes through the filter and is carried to the centrifugal extractor.

On the other hand, various improvements have been made in the centrifugal dehydrating section to further increase its dehydrating efficiency. To be precise, a internal basket has been installed concentrically with the centrifugal separation basket and the slurry is passed between the centrifugal separation basket and this internal basket. The slurry is compressed between the centrifugal separation basket and internal basket while passing through air and more of the water component than that of the conventional centrifugal separation basket, which utilizes the action of centrifugal force only, is separated by a so-called extraction type. Since this makes the slurry layer in the air thinner and more uniform than the conventional method, the water near the internal basket also passes through the slurry layer easily and reaches the extracting holes of the pump type centrifugal separation basket. A powerful centrifugal pump effect is produced by this pump centrifugal separation basket. A dehydrating efficiency approximately 20% higher than that of the conventional centrifugal separation basket is possible.

2) Automatic washing equipment

Automatic washing equipment is installed to wash away the dregs sticking to the inside of the extractor, especially the centrifugal dehydrator, without touching (disassembling) them with your hands after the garbage has been dehydrated. First, water is splashed against the inside wall of the case and case cover by the internal basket by supplying water to the top of the internal basket rotating at the high speed of the pump centrifugal separation basket. The dregs clinging to the walls are removed by this water and automatically carried to the dregs outlet.

Furthermore, a large amount of water is also intermittently supplied to the centrifugal separation basket, this water climbs up the slanted face of the centrifugal basket without passing through the face at the centrifugal separation basket and the dregs clinging to the centrifugal separation basket are removed and exhausted to the dregs outlet, together with the water.

3) Vibrationproofing construction

With the centrifugal dehydrator, a unbalance is generated by the process which causes the slurry to climb up the slanted face of the centrifugal separation basket. Therefore, an unbalanced load is applied to the centrifugal separation basket, causing vibration. Moreover, when an unbalanced load remains in the centrifugal separation basket, there is vibration produced by the drive motor starting process and vibration produced by the impact load of the garbage thrown into the extractor from the pre-dehydrator inlet, etc. Since these vibrations have a larger exciting force than the vibration of the unbalanced load and cause the drive motor and centrifugal separation basket to sway considerably, the outside periphery of the centrifugal separation basket may touch the case. To prevent this, cushion rubber is installed between the drive motor support arm and support frame. Moreover, since this cushion rubber supports the heavy drive motor, rubber having a comparatively low back and a true cylindrical shape is used to eliminate the danger of buckling. On the other hand, a cushion coil spring

compressed in the vertical direction is installed between the support frame and base. This cushioning construction cushions and supports the base by suppressing the transfer of the comparatively high frequency vibrations produced during operation by means of cushion rubber and the low frequency vibrations produced at drive motor starting, etc. by means of a coil spring and has been designed by considering noise and human safety, etc.

V. APPLICATIONS

The Fuji garbage disposal system is grouped into a package type garbage disposal system, semi-remote type garbage disposal system, and multiple-remote type garbage disposal system by usage site conditions, usage method, etc.

1. Package Type Garbage Disposal System

The package type garbage disposal system consists of a shredder, extractor, and control panel combined as a single unit. Two models, PK2000 (1.5kW DRY2312) and PK3000 (2.2kW DBY3312) are available, according to the capacity of the shredder.

The extractor is the same (EX1312) and the control panel is the R10.

The features of the package type garbage disposal system are that little installation space is required and the ancillary piping and electrical work are easy. Its disadvantage is that since the dehydrated garbage is removed at the side, it must be carried to another collection point. Its applications are in food supply centers, etc. where space is limited.

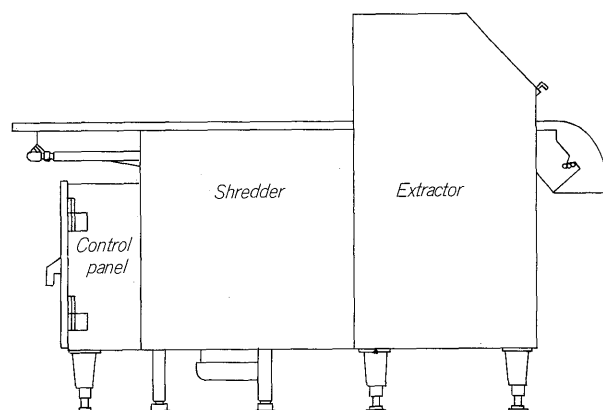


Fig. 5 Package type of Fuji garbage disposal system

2. Semi-remote Garbage Disposal System

The semi-remote garbage disposal system has a configuration that is active in system in which the food washer and garbage disposal mechanism are connected by a conveyor, etc. in the used-plate collector room, etc. while also overcoming the disadvantage of the package type garbage disposal system.

It consists of a shredder (in this case, the model corresponding to the capacity of the processed material), feed pump (unnecessary when the conveying distance is less than 4m), extractor (Model: EX2313), and control panel.

The Fuji garbage disposal systems, from package type to multi-type, all contain a washing process independently developed for each system. After all the processing work is complete, the entire system, including the inside of the equipment and the piping, is cleaned and operation is stop-

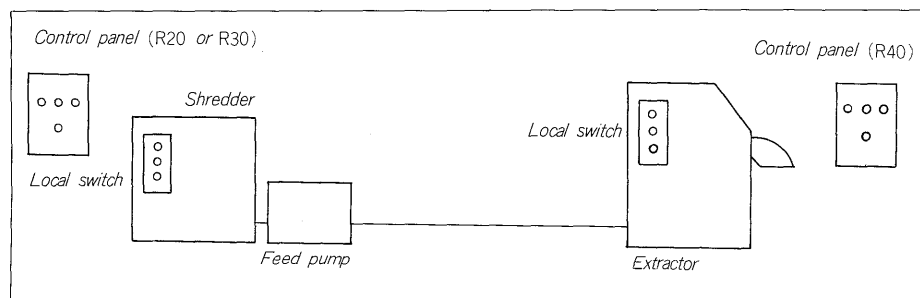


Fig. 6 Semi-remote type of Fuji garbage disposal system

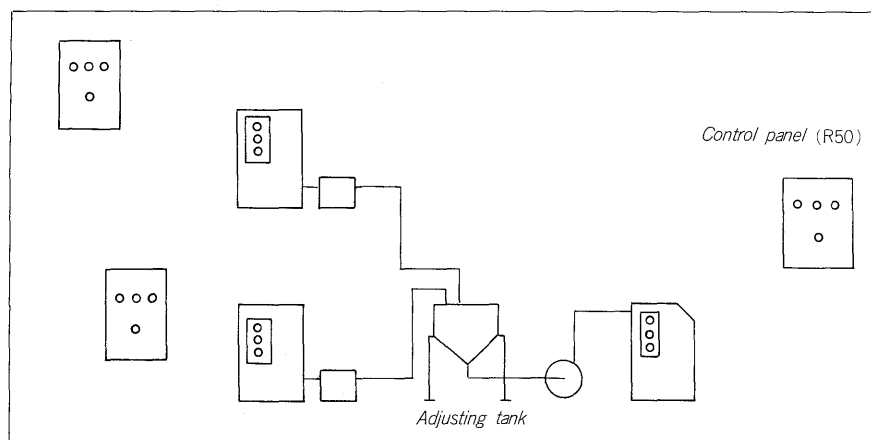


Fig. 7 Multiple-remote type of Fuji garbage disposal system

ped by time control by pushing the washing pushbutton switch.

The features of the semi-remote garbage disposal system are installation of the shredder near the garbage generation site, automatic conveyance food machine flow, etc. and collection of the dehydrated waste at the same site as other wastes after processing. This system is especially welcome from the standpoint of sanitation at hospitals, hotels, etc. Its applications are mainly in the used-plate collector room in offices, the used-plate collector room or hospitals of about 400 beds, etc.

3. Multiple-remote Garbage Disposal System

This multiple type garbage disposal system is a semi-remote garbage disposal system extended and developed to simultaneously dehydrate the compressed garbage force fed by a feed pump from shredders installed at garbage generation sites, except the used-plate collector room, that is, kitchens, self-service corners, and other locations where a large volume of garbage is generated, in large hospitals, hotels, etc. by means of an extractor at one location.

Its features are health and sanitation by maintaining the generation site constantly clean and conveyance rationalization and labor saving.

This system consists of shredders and feed pumps matched to the processed matter, processing amount, and other mechanisms at the generation site, a constant flow pump which stores the slurry sent from each shredder in an adjusting tanks and feeds a constant amount to the extractor (EX3312), and a control panel.

The configuration of the three forms has already been described above. We supply system to suit the customers requirements by utilizing the features of each system.

VI. CONCLUSION

This system has been highly acclaimed ever since introduction and several tens have been shipped and installed in hospitals, hotels, restaurants, etc. and are operating perfectly. We feel that this system can be improved still further, and will locate these with its growth as a better product in the future with the opinions of customers.