

598365

COMMONWEALTH of AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

XX We IWAO UEDA, CHIE UEDA & ETSUKO UEDA  
all of 416, Nanba-cho, Matsubara-sagaru,  
Nishikiyamachi-dori, Shimogyo-ku, Kyoto,  
Japan

LODGED AT SUB-OFFICE  
28 APR 1988  
Melbourne

hereby apply for the grant of a Standard Patent for an invention entitled:  
"SLUDGE PROCESSING APPARATUS"

which is described in the accompanying ~~provisional~~ complete specification.

Details of basic application(s):-

<u>Number</u>	<u>Convention Country</u>	<u>Date</u>
62-107534	Japan	30th April 1987

APPLICATION ACCEPTED AND AMENDMENTS  
ALLOWED 3.4.90

The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little  
Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

Dated this 28th day of April 1988

To: THE COMMISSIONER OF PATENTS

*H. M. Rimington*  
.....  
(a member of the firm of DAVIES &  
COLLISON for and on behalf of the Applicant).

**COMMONWEALTH OF AUSTRALIA**  
**PATENTS ACT 1952**  
**DECLARATION IN SUPPORT OF CONVENTION OR**  
**NON-CONVENTION APPLICATION FOR A PATENT**

Insert title of invention,

In support of the Application made for a patent for an invention  
entitled: "Sludge Processing Apparatus"

Insert full name(s) and address(es)  
of Declarant(s) being the appli-  
cant(s) or person(s) authorized to  
sign on behalf of an applicant  
company.

I 1) Iwao UEDA  
We 2) Chie UEDA  
3) Etsuko UEDA  
1), 2), 3) same addresses:  
416, Nanba-cho, Matsubara-sagaru,  
Nishikiyamachi-dori, Shimogyo-ku,  
Kyoto, JAPAN

Cross out whichever of paragraphs  
1(a) or 1(b) does not apply.

1(a) relates to application made  
by individual(s).

1(b) relates to application made  
by company; insert name of  
applicant company.

Cross out whichever of paragraphs  
2(a) or 2(b) does not apply.

2(a) relates to application made  
by inventor(s)

2(b) relates to application made  
by company(s) or person(s) who  
are not inventor(s); insert full  
name(s) and address(es) of inven-  
tors.

do solemnly and sincerely declare as follows :-

1. (a) ~~I am~~ We are the applicant ~~S.....~~ for the patent

~~or (b) I am authorized by~~

~~the applicant.....S..... for the patent to make this declaration on~~ ~~its~~ ~~their~~ behalf;

2. (a) ~~I am~~ We are the actual inventor..... of the invention

or (b) Iwao UEDA,

416, Nanba-cho, Matsubara-sagaru,  
Nishikiyamachi-dori, Shimogyo-ku,  
Kyoto, JAPAN

~~is~~ ~~are~~ the actual inventor..... of the invention and the facts upon which the applicant.....  
~~is~~ ~~are~~ entitled to make the application are as follows :-

The aforesaid actual inventor has assigned a part  
interest in the invention to Chie Ueda and Etsuko Ueda.

State manner in which appli-  
cant(s) derive title from inven-  
tor(s)

Cross out paragraphs 3 and 4  
for non-convention applications.  
For convention applications  
insert basic country(s) followed  
by date(s) and basic applicant(s).

3. The basic application..... as defined by Section 141 of the Act ~~was~~ ~~were~~ made  
in Japan on the 30th April, 1987  
by (Japanese Patent Application No. Sho. 62-107534)  
by IWAO UEDA; CHIE UEDA & ETSUKO UEDA  
by .....  
in ..... on the .....  
by .....

4. The basic application..... referred to in paragraph 3 of this Declaration ~~was~~ ~~were~~  
the first application..... made in a Convention country in respect of the invention the subject  
of the application.

Insert place and date of signature.

Declared at Kyoto, JAPAN this 5th day of April, 1988

Signature of Declarant(s) (no  
attestation required).

*Iwao Ueda*  
.....  
Iwao UEDA  
*Chie Ueda Etsuko Ueda*  
.....  
Chie UEDA Etsuko UEDA

Note: Initial all alterations.



(11) AU-B-15279/83  
(10) 598365

-2-

a heating-and-circulating device which heats a heating medium and circulates it through the heating medium pipe;

temperature control means which controls the heating and circulating device thereby to keep temperature of the sludge in the processing tank at a predetermined temperature; and

a drain pump which pumps supernatant water left after processing the sludge out of the tank through a drain pipe.

COMMONWEALTH OF AUSTRALIA

PATENT ACT 1952

COMPLETE SPECIFICATION

598365

(ORIGINAL)

FOR OFFICE USE

CLASS

INT. CLASS

Application Number:  
Lodged:

Complete Specification Lodged:  
Accepted:  
Published:

Priority:

Related Art:

This document contains the  
amendments made under  
Section 49 and is correct for  
printing

NAME OF APPLICANT: IWAO UEDA, CHIE UEDA & ETSUKO UEDA

ADDRESS OF APPLICANT: 416, Nanba-cho, Matsubara-sagaru,  
Nishikiyamachi-dori, Shimogyo-ku,  
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NAME(S) OF INVENTOR(S) Iwao UEDA

ADDRESS FOR SERVICE: DAVIES & COLLISON, Patent Attorneys  
1 Little Collins Street, Melbourne, 3000.

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

"SLUDGE PROCESSING APPARATUS"

The following statement is a full description of this invention,  
including the best method of performing it known to us :-

BACKGROUND OF THE INVENTION

1. Field of the invention:

5           The present invention relates to an apparatus of processing excess sludge which is necessarily generated in and sent out of various sewage treating equipments as a result of processing of sewage water such as industrial effluent, those discharged from home or the like using micro-organism.

2. Description of prior art:

10           In the process of eliminating water pollution materials such as BOD, COD contained in sewage water by oxidatively decomposing them with micro-organism including activated sludge method, trickling filter method and catalytic oxidation method, it is general that excess sludge is produced according to the purification process and deposited on such a part as bottom of a tank of the processing unit. If the excess sludge is left as it deposited, purification performance of the treating equipment is lowered eventually resulting in incapability of the equipment. Accordingly, it is essential to remove the excess sludge out of the tank and process it.

15           Hitherto, there have been proposed several attempts  
25           to process the deposited sludge such as a method in which

sludge is dewatered, dried and incinerated, a method in which dewatered sludge is buried under the ground or dumped into the ocean, a method dewatered sludge is made into compost to be effectively utilized as fertilizer or a method in which sludge is quantitatively reduced by digestion with anaerobic bacteria, and others.

Discussing the above known methods, however, there is a drawback in that a large sum of equipment cost and fuel cost is required in the first method of dewatering, drying and incinerating the sludge. A large sum of transportation cost is required in the second method of burying the sludge under the ground because a large amount of sludge must be carried to the dumping site, and moreover it is rather difficult to get an extensive dumping site. Likewise in the third method of dumping the sludge into the ocean, there is a drawback of transportation cost and moreover another problem of ocean pollution arises. In the fourth method of utilizing the sludge by transforming it into compost, there is a drawback in that a large sum of construction cost of processing facilities is required and another drawback in that utility of sludge transformed into the compost is lower than chemical fertilizer industrially produced.

On the other hand, in the method of reducing the quantity of sludge utilizing digestion by anaerobic

bacteria, a processing equipment of rather simple construction can be used and its operation is also relatively simple, and therefore this method has been traditionally adopted in the sludge treatment process in sewage plant. In this method, however, it takes long for the sludge to be treated over 6 to 8 months for example, because it is bacteria that carries out the treatment in the form of micro-biological decomposition. Accordingly, this method also results in a large sum of construction cost for the treating equipment since large-scaled processing facility is essential for the purpose of carrying out large-scaled treatment. Moreover, during the period of digestion of sludge by the anaerobic bacteria, methane gas is continuously generated, and during the period of acidity reduction, a large amount of offensive odor gas such as hydroxide, mercaptan, indole, etc. is generated. Accordingly, routine operation control of the processing facility is very important and troublesome. Besides, organic material of high concentration is contained in supernatant liqueur left after the sludge treatment, and therefore a further problem exists in that some secondary process to be applied to this supernatant liqueur is additionally required.

#### SUMMARY OF THE INVENTION

~~The present invention was made to overcome the~~



In accordance with the invention there is provided a sludge processing apparatus comprising:

a processing tank in which sludge flowing in through a sludge inflow pipe is deposited and processed;

5 a submergible pump centrally disposed at the bottom of the processing tank to intake sludge at the bottom of the tank and spout it upwards towards a substantially horizontal baffle plate disposed thereabove through a substantially vertically extending discharge pipe;

10 a pair of spaced vertical baffle plates between at least a portion of which the discharge pipe extends, the horizontal and vertical baffle plates serving to direct sludge spouted by the discharge pipe radially outward thereby to cause circulatory flow in the tank;

15 a chemical feeder which feeds a chemical for promoting activity of anaerobic bacteria carrying out anaerobic digestion to the processing tank;

a horizontally extending heating medium pipe disposed in the tank adjacent its bottom;

20 a heating-and-circulating device which heats a heating medium and circulates it through the heating medium pipe;

temperature control means which controls the heating and circulating device thereby to keep temperature of the  
25 sludge in the processing tank at a predetermined temperature; and

a drain pump which pumps supernatant water left after processing the sludge out of the tank through a drain pipe.

30

In the sludge processing apparatus sludge processing may be efficiently carried out in a relatively short period, with an increased generation of methane gas per unit time, and reduced generation of offensive odour  
35 gases in the period of acidity reduction and without requiring the supernatant liquor to undergo secondary process.





optimum temperature for the treatment, whereby anaerobic bacteria living in the sludge is activated. By the vigorous activity of anaerobic bacteria, the anaerobic digestion of the sludge is speedily carried out, shortening thereby the cycle of acidic and alkaline fermentation which, in turn, shortens the period necessary for the processing. Thus, amount of generation of methane gas per unit time is increased thereby shortening the period for such generation. Generation of offensive odor gas in the period of acidity reduction is rather restrained. Further, only a deposit of inorganic material is left on the bottom of the processing tank after the processing. Because the chemical for promoting the activity of the bacteria is included in the supernatant water obtained after processing the sludge, it is preferred that the supernatant water containing the chemical is once pumped out by the drain pump through the drain pipe, then fed back to the processing tank of the sludge processing apparatus to improve the sludge processing efficiency.

In effect, in the sludge processing apparatus of above construction and function according to the invention, sludge processing can be carried out efficiently in shorter period, and there is no need of large-scaled processing facility, which means that the sludge

processing apparatus according to the invention is of simple construction and preferably combined with a sewage water treating equipment of rather small scale. As a result of this, equipment cost thereof is relatively economical. Running cost is also reduced because no fuel cost is required being different from the conventional incinerating method. Furthermore, routine operation control is not so troublesome because the generation of methane gas according to the sludge processing takes places only for a short period, while generation of offensive odor being restrained.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become apparent in the course of the following description with the accompanying drawings wherein:

Figures 1 and 2 illustrate an embodiment according to the present invention, and in which

Figure 1 is a partially sectional front view taken along the line I-I' in Figure 2 to show schematically a construction of the sludge processing apparatus according to the present invention; and

Figure 2 is a sectional view of the construction taken along the line II-II' in Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Described herinafter with reference to the drawings is a preferred embodiment of the invention.

In Figures 1 and 2 respectively illustrating a partially sectional view of the sludge processing apparatus taking along the line I-I' in Figure 2 and a sectional view thereof taken along the line II-II' in Figure 1, the sludge processing apparatus comprises a processing tank 10, a submergible pump 12 which is disposed in the center of bottom of the processing tank 10, a circulation guide plate comprising a pair of vertical plates 14, 14 both erected on the center of the processing tank 10 in such a manner as to face to each other and a horizontal disc 16 horizontally provided on the upper part of the processing tank 10, a chemical feeder comprising a chemical tank 18 disposed on the top cover of the processing tank 10, a chemical feed pipe 20 and an opening-and-closing device (not illustrated) of feed opening of the chemical tank, a hot water pipe 22 disposed in the vicinity of bottom of the processing tank 10, a heating-and-circulating device comprising a heater 28 communicated with the hot water pipe 22 by way of pipe lines 24, 26 and a circulating pump 30 interposed in the pipe line 26, temperature control means comprising a temperature detector 32 inserted in the processing tank 10

through the side wall of the tank 10 and a temperature controller (not illustrated) to which the temperature detector 32 is connected by way of a lead wire, and a drain pump 34 disposed in the vicinity of the side wall of the processing tank 10.

In the processing tank 10, there is provided a sludge inflow pipe 36 which causes the sludge sent from the sewage water treating equipment by a vacuum device (not illustrated) to flow in the tank. Connected to the drain pump 34 is a drain pipe 38 for draining supernatant water produced after the sludge processing. A discharge pipe 40 is connected to the discharge opening of the submergible pump 12 disposed in the center of the bottom of the processing tank 10, and the discharge pipe 40 extends toward the liquid surface. A chemical for promoting activity of anaerobic bacteria which carries out anaerobic digestion of sludge is put in the chemical tank 18. An aqueous solution of a material containing natural emulsion surfactant and saponin extracted from plant is used as the chemical, for example. This chemical promotes the activity of bacteria and restrains generation of offensive odor. A hot water is sealed in the hot water pipe 22. The hot water is circulated through the pipe line 26, heater 28 and pipe line 24 by the circulating pump 30, and is heated when passing through the heater 28.

In the drawing, numeral 42 denotes a drain pipe for draining insoluble inorganic material.

Described hereinafter is an operation of the sludge processing apparatus of above construction. Excess sludge generated in the sewage treating equipment is sent by the vacuum device, and flows in the processing tank 10 through the sludge inflow pipe 36. When the sludge is deposited in the processing tank 10, the submergible pump 12 is driven, whereby the sludge laid on the bottom of the tank is pumped into the pump and spouted upward to the liquid surface through the discharge pipe 40. The sludge spouted upward to the liquid surface comes in contact with the curved surface formed on the under side of the horizontal disc 16 and runs outward of the vertical plates 14, 14. Then, further running from the liquid surface portion to the bottom of the tank, the sludge is pumped into the submergible pump 12 again. The chemical containing the emulsion surfactant and saponin is given to the sludge circulating in this manner from the chemical tank 18 through the chemical feeding pipe 20, and the chemical is stirred and mixed with the sludge. In the meantime, a hot water sealed in the hot water pipe 22 is circulated through the pipe line 26, heater 28 and pipe line 24 by the circulating pump 30 and heated when passing through the heater 28. Thus, heat is given to the sludge

circulating in the processing tank 10 by passing the hot water through the hot water pipe 22. In this temperature of the sludge circulating in the processing tank 10 is detected by the temperature detector 32, and in accordance with a detection signal thereby, the circulating pump 30 and the heater 28 are controlled by the temperature controller so that the temperature of the sludge comes to an optimum temperature within a range of 29 to 45°C.

When the chemical is stirred and mixed with the sludge and the sludge temperature is adjusted to an optimum one, anaerobic bacteria living in the sludge is activated by synergistic function between the emulsion surfactant and saponin contained in the chemical, and the anaerobic digestion of sludge is speedily carried out by the vigorous activity of the anaerobic bacteria. In this manner, the sludge is decomposed while discharging large amount of methane gas in a short period. The sludge in the tank is completely decomposed after 8 to 10 days. In this process, generation of offensive odor in the period of acidity reduction is also restrained. As inorganic material precipitates on the bottom of the tank after the completion of a series of process, the supernatant water is discharged by the drain pump 34 by way of the drain pipe 38, and then the precipitated inorganic material is

discharged through the discharge pipe 42. In this connection, since the chemical for activating the function of bacteria is still contained in the supernatant water, processing efficiency of the sewage treating equipment can be further improved by feeding this supernatant water back to the processing tank of the sewage treating equipment.

Although the sludge processing apparatus in this embodiment is constructed as above described, but the scope of the invention is not limited to the foregoing description and related illustrations in the drawings, and various changes and modifications can be made without departing from the spirit of the invention. For example, configuration of the circulation guide plate for circulating the sludge in the whole processing tank, place to dispose it, etc. are not restrictive as a matter of course.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A sludge processing apparatus comprising:
  - a processing tank in which sludge flowing in through a sludge inflow pipe is deposited and processed;
  - a submergible pump centrally disposed at the bottom of the processing tank to intake sludge at the bottom of the tank and spout it upwards towards a substantially horizontal baffle plate disposed thereabove through a substantially vertically extending discharge pipe;
  - a pair of spaced vertical baffle plates between at least a portion of which the discharge pipe extends, the horizontal and vertical baffle plates serving to direct sludge spouted by the discharge pipe radially outward thereby to cause circulatory flow in the tank;
  - a chemical feeder which feeds a chemical for promoting activity of anaerobic bacteria carrying out anaerobic digestion to the processing tank;
  - a horizontally extending heating medium pipe disposed in the tank adjacent its bottom;
  - a heating-and-circulating device which heats a heating medium and circulates it through the heating medium pipe;
  - temperature control means which controls the heating and circulating device thereby to keep temperature of the sludge in the processing tank at a predetermined temperature; and
  - a drain pump which pumps supernatant water left after processing the sludge out of the tank through a drain pipe.
  
2. A sludge processing apparatus substantially as hereinbefore described with reference to the drawings.

DATED this 26th day of March 1990.

IWAO UEDA, CHIE UEDA & ETSUKO UEDA  
 By Their Patent Attorneys  
 DAVIES & COLLISON



Fig. 1

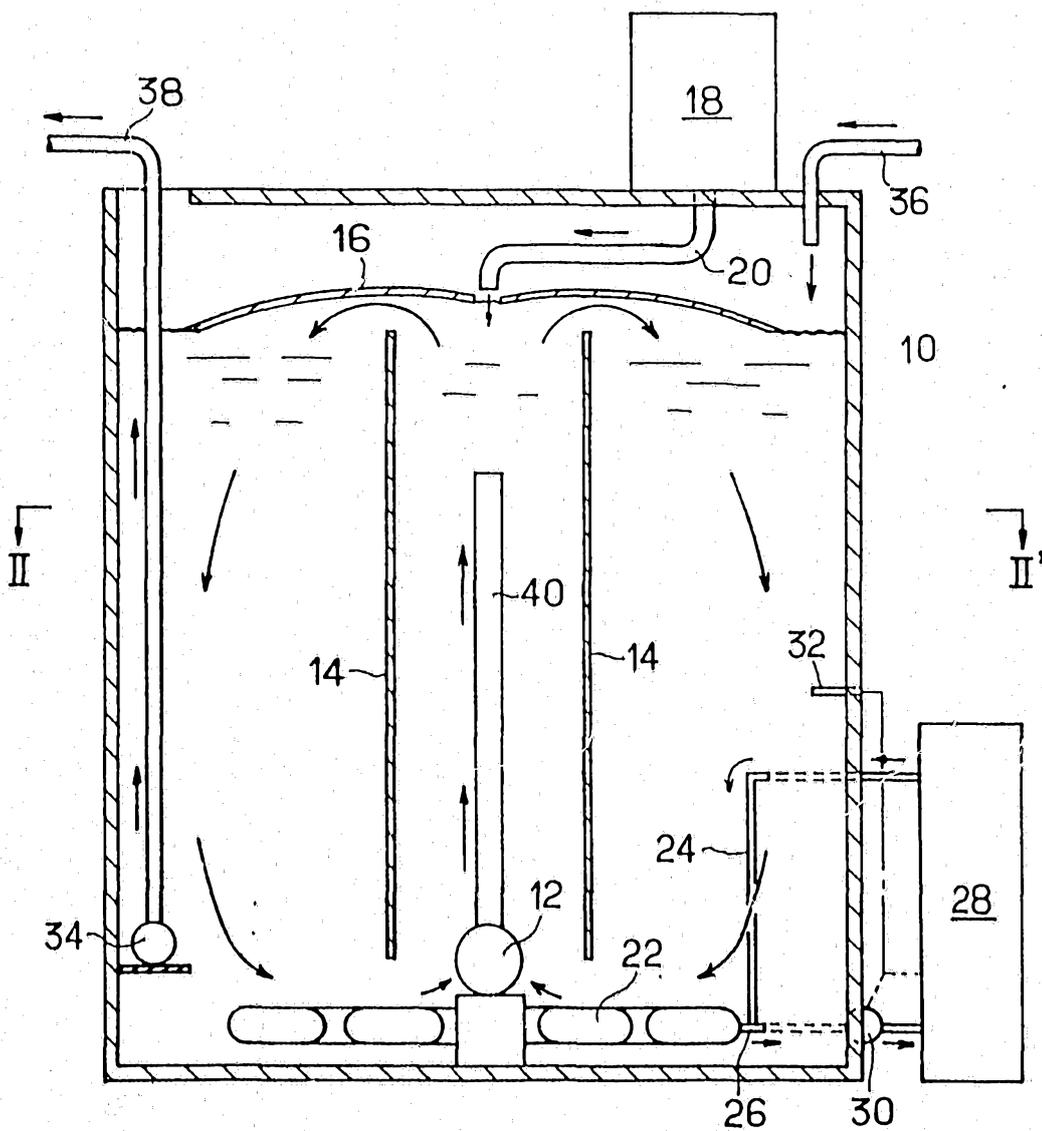


Fig. 2

