

FORM 1

603949

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

JUNKOSHA CO., LTD.

of

25-25, MIYASAKA 2-CHOME
SETAGAYA-KU
TOKYO 156
JAPAN

hereby apply for the grant of a standard patent for an
invention entitled:

CLEANING APPARATUS

which is described in the accompanying complete specification

Details of basic application(s):

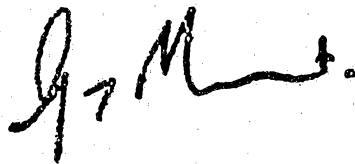
Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
63-53472	JP	22 APR 88

My/our address for service is care of GRIFFITH HACK & CO.,
Patent Attorneys, 601 St. Kilda Road, Melbourne 3004,
Victoria, Australia.

DATED this 31st day of March 1989

JUNKOSHA CO., LTD.

GRIFFITH HACK & CO.



TO: The Commissioner of Patents.

APPLICATION ACCEPTED AND AMENDMENTS

RECEIVED 30.8.90

MO07803 31/03/89

Forms 7 and 8

AUSTRALIA

Patents Act 1952

**DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION
APPLICATION FOR A PATENT OR PATENT OF ADDITION**

No. 32365/89

Name(s) of
Applicant(s)

In support of the application made by JUNKOSHA CO., LTD.

for a patent for an invention entitled CLEANING APPARATUS

Title

Name(s) and
address(es)
of person(s)
making
declaration

I/We, Mr. Hajime Kaibe
Junkosha Co., Ltd.
25-25, Miyasaka 2-chome
Setagaya-ku
Tokyo 156, Japan

do solemnly and sincerely declare as follows:—

1. I am/we are the applicant(s) for the patent, or authorised by the abovementioned applicant to make this declaration on its behalf.
2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:—

in Japan on 22nd April 1988

by Junkosha Co., Ltd.

in _____ on _____ 19 _____

by _____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

4. The actual inventor(s) of the said invention is/are

Tuji Akiba, 1-27-202, 494 Shimo-Kayama, Hitaka-machi,

Iruma-gun, Japan;

Hiroyuki Sugibuchi, N-306 Kotesashi-Hights, 3-16

Kotesashi-machi, Tokorozawa-shi, Japan

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:—

The said applicant is the assignee of the said
inventors

DECLARED at Tokyo, Japan this 10 day of April 19 89

JUNKOSHA CO., LTD.

Hajime Kaibe

President

(12) PATENT ABRIDGMENT (11) Document No. AU-B-32365/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 603949

(54) Title
CLEANING APPARATUS

International Patent Classification(s)
(51)^a B08B 003/12

(21) Application No. : 32365/89

(22) Application Date : 31.03.89

(30) Priority Data

(31) Number	(32) Date	(33) Country
63-53472	22.04.88	JP JAPAN

(43) Publication Date : 26.10.89

(44) Publication Date of Accepted Application : 29.11.90

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(56) Prior Art Documents
GB 2042208
JP 5262964

(57) Claim

1. Cleaning apparatus for cleaning an object comprising a cleaning tank which is adapted to accommodate a cleaning solution and the object, and fluid supply means for supplying a fluid containing air which, in use, is injected as bubbles into said cleaning solution, the fluid striking the object, said fluid supply means supplying the fluid at a high velocity, and with sufficient force such that said air bubbles burst upon striking the object, thereby producing shock waves, which create excitation of vibration in the object, the combined effect of which provides thorough cleaning of the object.

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Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

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

TO BE COMPLETED BY APPLICANT

Name of Applicant:

JUNKOSHA CO., LTD.

Address of Applicant: 25-25, MIYASAKA 2-CHOME
SETAGAYA-KU
TOKYO 156
JAPAN

Actual Inventor:

Address for Service: GRIFFITH HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
CLEANING APPARATUS

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

BACKGROUND OF THE INVENTION

The present invention relates to cleaning apparatus.

Where objects are to be cleaned, various types of cleaning apparatus have been used depending upon the type of object that is to be cleaned and the degree of cleaning that is desired.

For example, ultrasonic cleaning apparatus has conventionally been used in cases where a fluid detecting element of the type disclosed in Japanese Patent Publication (Kokoku) No. 59-47256 is to be cleaned. In that publication, the fluid detecting element comprises a pair of conductors which are separated by continuously porous, expanded polytetrafluoroethylene (EPTFE) containing a conducting substance which is sandwiched between the conductors. This fluid detecting element is utilized, for example, as an oil leakage sensor. Specifically, the abovementioned resin exhibits an increase in insulation resistance when the resin is permeated by an oil, such as heavy oil or gasoline. This electrical change is detected by a detector which is connected to the abovementioned conductors, so that the presence or absence of oil leakage is determined electronically. Such an oil leakage sensor must be regenerated by cleaning after it has detected oil leakage, or periodically when the sensor is used over a long period of time even if no oil leakage is detected. In the past, an ultrasonic cleaning apparatus of the type mentioned above has been used for such cleaning.

However, oil leakage sensors of the type mentioned above include sensors of various shapes and sizes. Accordingly, in cases where, for example, a long oil leakage sensor is to be ultrasonically cleaned, a large ultrasonic cleaning apparatus capable of accomodating this sensor is required. However, a conventional large ultrasonic cleaning apparatus is extremely expensive.

Accordingly, there exists a demand for inexpensive cleaning apparatus which has cleaning thoroughness comparable to that of ultrasonic cleaning apparatus.

The present invention was designed in light of the technical problems associated with conventional cleaning apparatus.

SUMMARY OF THE INVENTION

According to the present invention there is provided a cleaning apparatus for cleaning an object comprising a cleaning tank which is adapted to accomodate a cleaning solution and the object, and fluid supply means for supplying a fluid containing air which, in use, is injected as bubbles into said cleaning solution, the fluid striking the object, said fluid supply means supplying the fluid at a high velocity and with sufficient force such that said air bubbles burst upon striking the object, thereby producing shock waves, which create excitation of vibration in the object, the combined effect of which provides thorough cleaning of the object.

Said fluid may be air. Alternatively said fluid may be a cleaning solution. It is preferred that the cleaning solution is either xylene or methyl ethyl ketone.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention may be more fully understood, an embodiment of the invention will be described by way of example only in which the accompanying drawing is an exploded perspective view, partly broken away, of the cleaning apparatus of an embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT WITH REFERENCE TO A DRAWING

Referring to the drawing, cleaning apparatus 1 is provided comprising a cleaning tank 3 which accomodates a cleaning solution and an object to be cleaned, and fluid supply



means for supplying a fluid containing air which is injected as bubbles into the cleaning solution, the fluid striking the object to be cleaned. The fluid supply means supplies the fluid at a high velocity and with sufficient force that the air bubbles burst upon striking the object, thereby producing shock waves, including ultrasonic waves, which provides thorough cleaning of the object. The fluid may be air or a cleaning solution. The cleaning solution preferably is xylene or methyl ethyl ketone.

~~More specifically, the essence of~~ The present invention is a cleaning apparatus which is characterized by the fact that the apparatus is equipped with (a) a cleaning tank which accomodates a cleaning solution and the object to be cleaned, and (b) a fluid supply means which supplies a fluid containing air that is released into the cleaning solution so that it strikes the object that is to be cleaned in the cleaning tank.

The air that is released into the cleaning solution forms air bubbles, which strike the object that is to be cleaned in the cleaning solution with sufficient force that they burst. When these air bubbles burst, shock waves, including ultrasonic waves, are generated, and these waves excite a vibration in the object that is to be cleaned. The cleaning solution is thus agitated by the fluid containing air that is released into the cleaning solution so that the cleaning solution is constantly in fluid motion. As a result, these two effects act in combination so that the object that is to be cleaned can be cleaned with extreme thoroughness.

One example of application of the present invention will be described with reference to the accompanying drawing.



The principal constituent elements of the cleaning apparatus 1 are a supporting cart 2, a cleaning tank 3 and a compressor including fluid supply means 4.

The supporting cart 2 consists of a base 2b which is equipped with wheels 2a so that it is free to move. A pair of supports 2c are installed upright facing each other on the top surface of the base 2b in order to support the cleaning tank 3.

The cylindrical cleaning tank 3 preferably is made of stainless steel, is open at the top and is supported by the supports 2c so that the tank 3 is free to rotate about a diameter of the tank as the axis of rotation. The axis of rotation is positioned at a point above the midpoint on the axial line of the cleaning tank 3, so that when the cleaning tank 3 is in a state of natural rest, the open end of the tank is positioned at the top as shown in the figure. Xylene is a preferred cleaning solution 5 and is accommodated in the cleaning tank 3 as an oil solvent.

The compressor 4 is installed on the base 2b of the supporting cart 2. Tube 4a, which preferably is made of Teflon® fluorocarbon resin and which is connected to the compressor 4, is inserted into the cleaning tank 3, and the tip of this tube 4a is fastened to the bottom of the interior of the cleaning tank 3 so that the tip points upwardly.

In the figure, basket 6, preferably a mesh made of stainless steel, is used when an oil leakage sensor or other object to be cleaned 7 is inserted into the cleaning tank 3. Specifically, the oil leakage sensor 7 is accommodated inside the mesh basket 6, and is inserted into the cleaning tank 3 along with the mesh basket 6. A flange 6a at the upper end of the mesh basket 6 catches

on the upper edge of the cleaning tank 3, so that the oil leakage sensor 7 is suspended inside the cleaning tank 3, and so that the sensor 7 is submerged in the xylene cleaning solution 5.

As described above, the oil leakage sensor 7 may comprise a pair of conductors 7a, 7b and a continuously porous EPTFE separator 7c containing a conductive substance interposed between the conductors.

In a cleaning apparatus 1, constructed as described above, the oil leakage sensor 7 is accommodated inside the cleaning tank 3 and submerged in xylene cleaning solution 5 as described above, and the compressor 4 is started. Compressed air or other fluid containing air fed from the compressor 4 passes through tube 4a and is continuously released into the xylene cleaning solution 5 as air bubbles from the tip of the tube inside the cleaning tank 3. Because compressed air is thus continuously released into the xylene cleaning solution 5, the xylene cleaning solution 5 inside the cleaning tank 3 is constantly in a state of highly agitated fluid motion. The air bubbles released into the xylene cleaning solution 5 rise and strike the oil leakage sensor 7 with sufficient force that they burst. Shock waves, including ultrasonic waves, are generated at this point, and these waves excite a vibration in the oil leakage sensor 7.

As a result of a synergistic effect of the fluid motion of the xylene cleaning solution 5 and the excitation of vibration in the oil leakage sensor 7, the oil permeating the oil leakage sensor 7 is dissolved in the xylene cleaning solution 5, so that the oil leakage sensor 7 is cleaned and regenerated to approximately the same degree as when a similar cleaning is performed using a conventional ultrasonic cleaning apparatus.

Thus, although the cleaning apparatus 1 ~~according to the invention~~ has an extremely simple structure, the apparatus has a cleaning efficiency and thoroughness which is approximately the same as that of an ultrasonic cleaning apparatus. Compared to an ultrasonic cleaning apparatus, the cleaning apparatus 1 is extremely inexpensive, and this reduced expense becomes more pronounced as the size of the apparatus required increases.

The present invention is not limited to the above example. Various configurations may be employed. For example, in the above example, the fluid containing air consisted only of air. However, this fluid could also be a cleaning solution containing air bubbles. In such case, the fluid supply means used would be a pump. The cleaning apparatus of the present invention could also be applied to various other objects besides oil leakage sensors, and the cleaning solution used could be a cleaning agent other than xylene, for example, methyl ethyl ketone.

As described above, the ^{embodiment of} present invention makes it possible to obtain a very inexpensive cleaning apparatus which has a simple structure, but which has a cleaning effect comparable to that of conventional ultrasonic cleaning apparatus.

While the invention has been disclosed herein in connection with certain embodiments and detailed descriptions, it will be clear to one skilled in the art that modifications or variations of such details can be made without deviating from the gist of this invention, and such modifications or variations are considered to be within the scope of the claims hereinbelow.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Cleaning apparatus for cleaning an object comprising a cleaning tank which is adapted to accommodate a cleaning solution and the object, and fluid supply means for supplying a fluid containing air which, in use, is injected as bubbles into said cleaning solution, the fluid striking the object, said fluid supply means supplying the fluid at a high velocity and with sufficient force such that said air bubbles burst upon striking the object, thereby producing shock waves, which create excitation of vibration in the object, the combined effect of which provides thorough cleaning of the object.

2. The apparatus of claim 1 wherein said fluid is air.

3. The apparatus of claim 1 wherein said fluid is a cleaning solution.

4. The apparatus of claim 3 wherein said cleaning solution is xylene.

5. The apparatus of claim 3 wherein said cleaning solution is methyl ethyl ketone.

6. Cleaning apparatus substantially as hereinbefore described and illustrated with reference to the accompanying drawing.

DATED THIS 23RD DAY OF AUGUST, 1990.

JUNKOSHA CO. LTD.
By Its Patent Attorneys:

GRIFFITH HACK & CO.
Fellows Institute of Patent
Attorneys of Australia.



