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PROVISIONAL SPECIFICATION.

Method of and Apparatus for, Disseminating Gases in a Finely Divided State in Liquids for Effecting Intimate Contact with the Liquid or with Matters Suspended therein.

I, Hermann Nordtmeyer, of 25, Trift, Celle, Hanover, Germany, Manufacturer; do hereby declare the nature of this invention to be as follows:

It is well known that when gases are introduced into liquids through even the finest meshed metal sieves or the like (so as to bring the gases in the finest possible state of subdivision into contact with the liquid and so enable them to be the more completely absorbed thereby, or to act more effectively thereon or upon the substances dissolved or suspended therein) the gases even at a very low presure emerge in a continual stream of bubbles of comparatively large diameter and with considerable velocity into the liquid.

Now if a finely porous solid body, such as can be obtained for instance by a ceramic process, be employed in place of the sieve, considerable pressure is required in order to overcome the capillary resistance of the liquid contained in the fine pores, and then only, do very numerous fine bubbles or vesicles rise from the surface of the solid body, and these bubbles having no appreciable initail velocity ascend but slowly through the liquid. This difference in behaviour can be explained as follows.

Under the very slightest excess of pressure, the gas emerges from the orifices of the sieve in the form of continuous threads which assume the shape of a flattened sphere. But when the gas has to pass through the irregular passages of a porous body saturated with liquid, it has to overcome considerable capillary resistance which is greatest at the point of entry because the resistance of the entire length of the passage has to be overcome, and which as a gaseous particle moves onwards, diminishes in proportion to the length of the path along which it has travelled, and becomes reduced to zero at

the point of emergence. During its passage the gas does not form a continuous thread, but is rather in the form of [illegible] bubbles enveloped by liquid and which follow one another forwards in a succession of beads pushing one another forwards [illegible] they reach the point of exit where they pass freely into the superincumbent liquid.

The foregoing explains why the gas is given off in the form of extremely fine isolated bubbles which rise so slowly [illegible] the coalescing of these very fine bubbles to form larger bubbles is prevented.

According to the present invention air or other gases are passed into the liquid through finely porous solid bodies [illegible] as for example artificial or natural sandstone, burnt [illegible] kieselguhr (infusorial earth) or filtering bodies suitable for germless filtering.

By this means such fine bubbles of gas are produced as are adapted for effecting the separation of substances floating or suspended in liquids, such as fibres, fine sewage matters, [illegible] oils or the like, because the extremely small bubbles adhere or envelope those substances or become enveloped by them in such manner that (and this is more especially the case with particles of fat or the like) the gas bubbles cause those substances to rise and thus become capable of being separated.

In carrying out this process there may be employed for instance a cylindrical vessel 4408 any vertical vessel, for instance on the bottom of which at a convenient point, for instance one of the aforesaid, there is arranged a hollow body consisting of one of the aforesaid finely porous substances, having its internal cavity suitably connected to a pipe to which the gas is supplied under pressure.

The gas then passes through the numerous microscopically small pores of the hollow body into the overlying liquid in the form of such small bubbles that it has the appearance of dust so that the liquid above the porous body acquires a milky or cloudy appearance. The cloudiness ascends slowly, the length of time required by the dust-like bubbles to reach the surface of the liquid, depending of course upon the absorptive capacity and the like conditions.

Any desired number of such hollow bodies may be combined together to form a "system", so that the bottom of the vessel is as it were covered with them, or the vessel may be provided with a double or false bottom composed of the finely porous substance.

The advantages of the herein described invention are obvious. The improved process fulfils in a most perfect manner all requirements of a rapid and effective absorption, the obtaining of a maximum surface, uniform distribution, long duration of contact, constantly changing surfaces of contact, which is important especially for the chemical action of gases upon substances that are dissolved in the liquid. A further advantage of the process consists, as already stated at the commencement hereof, in that it allows of separating finely suspended, solid or fluid substances from liquids.

Dated this 16th day of February, 1903.

A. M. & Wm Clark,
Chartered Patent Agents,
53, Chancery Lane, London.

COMPLETE SPECIFICATION.

Method of and Apparatus for, Disseminating Gases in a Finely Divided State in Liquids for Effecting Intimate Contact with the Liquid or with Matters Suspended therein.

I, Hermann Nordtmeyer, of 25, Trift, Celle, Hanover, Germany, Manufacturer; do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

It is well known that when gases are introduced into liquids through even the finest meshed metal sieves or the like (so as to bring the gases in the finest possible state of subdivision into contact with the liquid and so enable them to be the more completely absorbed thereby, or to act more effectively thereon or upon the substances dissolved or suspended therein) the gases even at a very low pressure emerge in a continual stream of bubbles of comparatively large diameter and with considerable velocity into the liquid.

Now if a finely porous solid body, such as can be obtained for instance by a ceramic process, be employed in place of the sieve, considerable pressure is required in order to overcome the capillary resistance of the liquid contained in the fine pores, and then only, do very numerous fine bubbles or vesicles rise from the surface of the solid body, and these bubbles having no appreciable initial velocity ascend but slowly through the liquid. This difference in behaviour can be explained as follows:

Under the very slightest excess of pressure, the gas emerges

from the orifices of the sieve in the form of continuous
4409 threads which assume the shape of a flattened spiral.
But when the gas has to pass through the irregular pas-
sages of a porous body saturated with liquid, it has to
come considerable capillary resistance which is greatest at the
point of entry because the resistance of the entire length of
the passage has to be overcome, and which as a gaseous
ticle moves onwards, diminishes in proportion to the length
of the path along which it has travelled, and becomes reduced
to zero at the point of emergence. During its passage through
does not form a continuous thread, but is rather in the form
of gaseous bubbles enveloped by liquid and which follow one
another like a succession of beads pushing one another for-
wards until they reach the point of exit where they pass
out into the superincumbent liquid.

The foregoing explains why the gas is given off in the form
of extremely fine isolated bubbles which rise so slowly that
the coalescing of these very fine bubbles to form larger bub-
bles is prevented.

According to the present invention air or other gases are
passed into the liquid through finely porous solid bodies, such
as for example artificial or natural sandstone, burnt clay,
kieselguhr (infusorial earth) or filtering bodies suitable for
germless filtering.

By this means such fine bubbles of gas are produced as will
be adapted for effecting the separation of substances floating
or suspended in liquids, such as fibres, fine sewage matters,
fats, oils, or the like, because the extremely small bubbles ad-
here to or envelop those substances or become enveloped by
them in such manner that (and this is more especially the case
with particles of fat or the like) the gas bubbles cause those
substances to rise and thus become capable of being sep-
arated.

In carrying out this process there may be employed any
vertical vessel, for instance a cylindrical vessel, in which at
a convenient point, for instance on the bottom, there is ar-
ranged a hollow body consisting of one of the aforesaid finely-
porous substances, having its internal cavity suitably con-
nected to a pipe to which the gas is supplied under pressure.

The gas then passes through the numerous microscopically
small pores of the hollow body into the overlying liquid in the
form of such small bubbles that it has the appearance of dust
so that the liquid above the porous body acquires a milky or
cloudy appearance. The cloudiness ascends slowly, the length

of time required by the dust-like bubbles to reach the surface
of the liquid depending of course upon the absorptive capacity
and the like conditions.

Any desired number of such hollow bodies may be com-
bined together to form a "system", so that the bottom of the
vessel is as it were covered with them, or the vessel may be
provided with a double or false bottom composed of the finely
porous substance.

The advantages of the herein described invention are ob-
vious. The improved process fulfils in a most perfect man-
ner all requirements of a rapid and effective absorption, the
obtaining of a maximum surface, uniform distribution, long
duration of contact, constantly changing surfaces of contact,
which is important especially for the chemical action of gases
upon substances that are dissolved or suspended in the liquid.
A further advantage of the process consists, as already stated
at the commencement hereof, in that it allows of separating
finely suspended solid or fluid substances from liquids.

Having now particularly described and ascertained the na-
ture of the said invention and in what manner the same is to
be performed, I declare that what I claim is:—

1. Method of disseminating air or other gases in a finely
divided state in liquids, which consists in forcing the gases
under pressure through porous substances (such as artificial
or natural sandstone, burnt clay, kieselguhr or bodies suitable
for germless filtering and the like) into the liquid for the pur-
pose of obtaining by the formation of extremely fine bub-
4410 bles a rapid and perfect absorption of the gas by the
liquid and of increasing the chemical or mechanical ac-
tion of the gas on substances suspended or dissolved in the
liquid.

2. Mode of carrying out the process according to Claim 1
characterised by forcing the gas or gases into the liquid
through material of the kind specified, in the form of a hollow
body or of hollow bodies as specified.

3. The separation from a liquid of finely divided solid or
liquid substances suspended therein by the process specified
in Claim 1.

Dated this 14th day of November, 1903.

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53, Chancery Lane, London.

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