



Patent Claims

1. Multi-washer for cleaning raw synthesis gas from the gasification of community and other wastes, which contain
5 carbon particles, hydrogen sulphide, water vapour and volatile heavy metals, with a horizontally mounted container (1) through which the gas to be cleaned flows along its longitudinal axis, said container (1) also having a plurality of wash chambers (2,3,4) separated by
10 upright bulkheads (5) and located one behind the other along the longitudinal axis of the container (1), and in which the gas to be cleaned is subjected to washing processes with various wash liquids if necessary at different temperatures,
15 characterised in that there is associated with each wash chamber (2,3,4) its own preceding pump installation (6,7,8), located outwith the wash chamber, and in that, inclined at a respectively predetermined angle to the longitudinal axis of the
20 container (1) there is located in each wash chamber (2,3,4) at least one substance exchanger (9), the substance exchangers (9) being sprayed from both sides with a variable quantity of wash liquid, so that the wash liquid penetrates into the substance exchanger (9) and a
25 directed removal of the wash liquid results.

2. Multi-washer according to claim 1,

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characterised in that there is located in the central axis of the container (1) a pipe (11) divided radially into zones for supplying the individual wash chambers (2,3,4) with wash liquid.

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3. Multi-washer according to at least one of the preceding claims,

characterised in that there is located in the wash chambers (2,3,4) in the flow direction of the gas behind the substance exchangers (9), in each case at least one droplet collector (10) inclined at a respectively predetermined angle to the longitudinal axis of the container (1).

15 4. Multi-washer according to at least one of the preceding claims,

characterised in that the container (1) has, in the flow direction of the gas behind the wash chambers (2,3,4), a further chamber which serves to condense the water vapour charged with toxic materials.

25 5. Method of total cleaning of synthesis gas from the gasification of community and other wastes, removing carbon particles, hydrogen sulphide, water vapour and volatile heavy metals, the gas flowing through a horizontally-located container (1) along its longitudinal axis, and passing through a plurality of wash processes





in individual wash chambers separated by upright bulkheads (5), and located one behind the other along the longitudinal axis of the container (1), characterised in that

- 5 the gas is blown through substance exchangers (9) inclined relative to the longitudinal axis of the container (1), and sprayed from both sides with a variable quantity of wash liquid, and through the spray mist of the spray nozzles,
- 10 and in that the wash liquid dripping from the substance exchangers is collected separately in each wash chamber (2,3,4) and directly removed, so that the subsequent washing stages are not loaded by the wash liquid which is already charged.

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6. Multi-washer according to claim 5, characterised in that the spray mist and the wash liquid dripping from the substance exchangers is separated from the gas flow by a droplet collector (10) before its
- 20 passage into the following wash chamber, and is passed to the wash liquid.

7. Multi-washer according to at least one of claims 5 or 6,
- 25 characterised in that the wash liquid is passed through a pipe (11) located in the central axis of the container





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and divided radially into zones, into the individual wash chambers (2,3,4).

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**Multi-washer and Method of Total
Cleaning of Gases**

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The invention relates to a multi-washer and to a method
5 of total cleaning of gases according to the preambles to
claims 1 and 5. Such multi-washers are used for removal
of toxic materials in gases and for cleaning,
particularly of synthesis gases or waste gases.

10 According to prior art, in order to clean contaminated
industrial gases of all types, but also in order to
improve the quality of utility gases, the gas to be
cleaned is passed through a plurality of horizontally
mounted substance exchangers, which are loaded with a
15 wash liquid. These washers have the purpose of removing
the materials contained in the gas, such for example as
 CO_2 , CO , NO_x , H_2S or also solid impurities such as dusts
from the gas flow by means of the wash liquid. A
plurality of wash liquids are known, which as a rule
20 physically and/or chemically bind, if necessary absorb or
adsorb, only one specific toxic material.

The document JP 55-22238 illustrates such a device for
cleaning gases, in which there are located within a
25 substantially horizontally lying container a plurality of
wash regions, through which the gas to be cleaned is
passed upwards and downwards in a meandering fashion.



The individual wash regions have substance exchangers stacked horizontally one above the other at a defined spacing in the form of wash trays consisting of packings with filling members, which are sprayed with wash liquid on one side, on their outer side lying on top. These are thus wash towers, combined into a single pressure vessel, disposed in a horizontal alignment, and through which the gas passes vertically, as is conventional for individual tower scrubbers.

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These known columnar washing systems have a series of disadvantages in the cleaning of synthesis gases from waste gasification. Due to the horizontal layering of the individual substance exchangers, the cleaning liquid running off the substance exchangers and charged with materials runs into the further wash trays lying underneath. Particularly in the case of lumpy and adhesive contents such as carbon particles and sulphur, this leads in a short time to clogging and stoppage of the wash trays.

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Because of these disadvantages, washers are used which eliminate the said substance exchangers and instead blow the gas to be cleaned merely through a spray mist of the cleaning liquid, so-called spray washing. A disadvantage of these washers is that the contact surface between gas and liquid is small compared to substance exchangers, and

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therefore a reduced cleaning effect is achieved. The document EP 0 249 400 A1 illustrates such a washer, in which a horizontally-disposed pressure container is divided into individual zones. In these zones a spray
5 mist of cleaning liquid is produced, through which the gas is passed. The spray mist is then precipitated on inclined droplet collectors and collected in a common sump, which likewise tends to clog due to sedimentation of lumpy and adhesive contained materials.

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The object of the present invention is to make available a multi-washer and a method of total cleaning of synthesis gas from the gasification of wastes by means of which, with the aid of substance exchangers, a high
15 cleaning performance is achieved in a small space, the multi-washer or the method being easily serviced and not liable to clogging, as it is self-cleaning.

This object is achieved by the multi-washer according to
20 the preamble of claim 1, and by the method according to the preamble of claim 5 in conjunction with their characterising features.

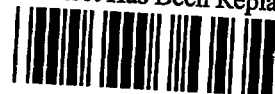
In comparison to the use of an exclusively spraying
25 system, washers with a substance exchanger are characterised by an increased contact surface between the



gas to be cleaned and the wash liquid, and therefore by a considerably better cleaning effect.

According to the present invention, the disadvantages of these washers with substance exchangers are removed by the oblique positioning of the substance exchanger or wash trays, as the cleaning liquid charged with materials is removed downwards into the sumpless wash chambers, without coming into contact with another wash tray. The cleaning liquid rather runs down on the inclined surface of the wash trays or drips therefrom directly on to the base of the sumpless wash chamber, which is permanently cleaned by being sprayed with wash liquid.

By means of this arrangement of the substance exchangers it is further possible to spray the uncharged cleaning liquid from both sides on to the substance exchangers. In this way, the liquid penetrates from both sides into the substance exchangers, and after being charged with the gas components to be removed, runs down in an outward direction. By means of the variable quantity at which the cleaning liquid is sprayed on to both sides of the substance exchangers and penetrates into them, a directed removal of the wash liquid from the substance exchangers is achieved. In this way clogging of the substance exchangers is prevented and a self-cleaning effect is achieved.



Advantageous further developments of the multi-washer according to the invention and of the method according to the invention are indicated in the dependent claims.

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The various cleaning liquids are passed to the individual wash chambers more advantageously through a pipe extending through the centre of the container, and which is sub-divided radially by intermediate walls extending
10 in the longitudinal direction into individual concentric zones, which respectively take up the cleaning liquid and pass it to one of the wash chambers.

The washer may be provided on the gas outlet side with a
15 wash chamber, which serves to condense water vapour charged with toxic materials.

Advantageous embodiments given by way of example of a multi-washer according to the invention are described in
20 the following.

Figure 1 shows a multi-washer according to the invention.

The multi-washer according to the invention comprises a
25 horizontal container 1 with a gas inlet 16 disposed at one end, and a gas outlet 17 disposed at the other end. The container 1 is sub-divided by upright bulkheads 5



into three separate wash chambers 2, 3 and 4. A direct removal outlet to the pump system 6, 7 or 8 is associated with each of these sumpless wash chambers.

5 Wash trays are disposed at a predetermined oblique angle to the longitudinal axis of the container 1 as substance exchangers in each of the wash chambers 2, 3 or 4. These substance exchangers are constructed as bulk accumulations with filling members, and are respectively
10 sprayed through nozzles 12 from both sides with a wash liquid, which thus penetrates into the substance exchangers. Spraying for each side of the substance exchanger is carried out at its own individual quantity different from the respective other side of the substance
15 exchanger.

The spacing between the substance exchangers is selected in dependence on their angle of incidence in such a way that wash liquid drips down directly on to the base of
20 the wash chamber, and not on to further substance exchangers.

The spray nozzles 12 are supplied with wash liquid from a pipe 11, disposed in the central axis of the container 1
25 and sub-divided by concentric partition walls into individual enclosed liquid pipes. In this way each individual wash chamber can be supplied with its own wash



liquid at its own temperature or at its own pressure.
The pipe 11 is connected on its end lying outside the
container via return pipes 13, 14 and 15 to the pump
systems 6, 7 and 8, so that the wash liquids are
5 circulated.

In order in addition to prevent any transfer of wash
liquid from one wash chamber into the following wash
chamber, a likewise obliquely-positioned droplet
10 collector 10 is disposed at the end of each wash chamber.
This droplet collector 10 filters from the conveyed gas
the wash liquid carried along as droplets or mist, which
then runs down along the droplet collector on to the base
of the wash chamber and into the associated pump system.

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In the multi-washer in this embodiment, carbon particles
are removed in the first wash chamber 2 with the aid of
glycerine in the wash liquid, and it is converted in the
second wash chamber 3 with a SULFEROX wash liquid H_2S into
20 elementary sulphur, which then runs out of the wash
chamber along with the wash liquid.

In a further embodiment, following the last stage of the
multi-washer is a further chamber, which serves to
25 condense and thus to remove water vapour charged with
toxic material from the gas to be cleaned.