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(12) # EUROPEAN PATENT APPLICATION

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(54) **Method and apparatus for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging torch.**

(57) Method and apparatus for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging torch. The apparatus includes a hood (20) which can hold torch (12) and is provided with a nozzle (24) to convey fume and/or slag from the hood (20). Air and water is introduced into the nozzle to cool the fume and/or slag and inhibit the slag adhereing to the nozzle. The slag and water are subsequently separated from the fume which is filtered and returned to the air.

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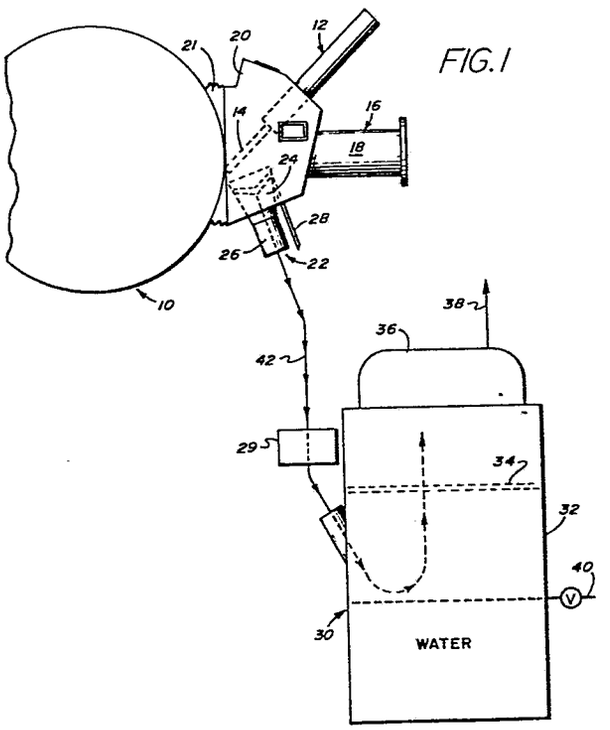

FIG. 1

This invention relates to an apparatus and a method for collecting fumes and/or slag generated by the operation of an air-carbon arc cutting and gouging torch.

In the air-carbon arc cutting and gouging process an electric arc is struck between an electrode and a workpiece to initiate melting of the workpiece under the arc. The molten metal produced by the arc is forcibly removed from the workpiece by a stream of high pressure air. This process generates a large amount of fume because of the thermochemical reactions and produces waste particulate material (herein referred to as "slag").

With the advent of more stringent air pollution control restrictions ways have been sought to inhibit the fume and/or slag being inhaled by the process operative.

Fume collectors have been known for some time and are widely available for use with conventional welding torches. These devices create a partial vacuum in a sleeve disposed near the nozzle of the torch. The fume generated by the welding is sucked away from the nozzle of the torch through a conduit and is disposed of in a safe manner.

Insofar as the air-carbon arc cutting and gouging process is concerned our US Patent No. 3,524,038 discloses a device for removing slag from the vicinity of the arc. This device has been available for some time as a hand held tool or a machine mounted tool that must be used in close proximity to an air-carbon arc cutting and gouging torch. While this device will remove some process generated fume, it will not prohibit the type of atmosphere movement to comply with current US air pollution requirements.

The literature shows that in Japan installations employing the Air-Carbon Arc Cutting and Gouging Process have utilized conventional cutting tables with a water bath to collect slag generated by the process. The Japanese have further combined the conventional water table with an acoust-

ically lined hood to contain fume and to control the noise level of the process in the immediate environment of the process operative. This type of apparatus is not readily portable and requires a fixed installation where the workpiece must be transported to the installation to be treated.

According to the present invention there is provided an apparatus for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging torch, which apparatus is characterized in that it comprises:

(a) a housing which can be positioned in close proximity to a workpiece;

(b) means on said housing to hold an air-carbon arc cutting and gouging torch fast with respect to said housing;

(c) a nozzle for conveying fume and/or slag from said housing; and

(d) means for introducing a mixture of gas and cooling liquid into said nozzle to cool said fume and/or slag and inhibit said slag adhering to said nozzle.

Preferably, said housing is provided with a seal which, in use, engages said workpiece circumjacent said air-carbon arc cutting and gouging torch.

Advantageously, said housing and said nozzle are enclosed in a sound absorbent hood and said housing and said hood contain ports for viewing, in use, a workpiece.

Preferably, the apparatus comprises an air pump to withdraw said fume and/or slag through said nozzle.

Advantageously, the apparatus includes means to separate said slag and liquid from said fume.

The present invention also provides a method for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging torch, characterized in that it comprises the steps of:

(a) isolating from the ambient environment an area surrounding the torch where fume and/or slag is generated;

(b) continuously withdrawing the fume and/or slag through a nozzle; and

(c) introducing a mixture of gas and cooling liquid into said nozzle to cool said fume and/or slag and inhibit said slag adhering to said nozzle.

Preferably, the method also includes the step of separating said slag and cooling liquid from said fume.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a schematic side elevation of an apparatus in accordance with the present invention in use;

Figure 2 is a side elevation of part of the apparatus shown in Figure 1;

Figure 3 is an end view of the part of the apparatus shown in Figure 2;

Figure 4 is an elevational view of the nozzle forming part of the apparatus; and

Figure 5 is a top plan view of the nozzle of Figure 4.

Referring to the drawings, Figure 1 discloses a workpiece 10 which is rotating counterclockwise about its axis. The workpiece 10 has significant surface defects and a portion of the surface is being removed by an air-carbon arc cutting and gouging torch 12 which is positioned so that an arc extends between its electrode 14 and a defect. High pressure air is forced longitudinally along the electrode by means of a remote source of air (not shown) and the molten metal formed by the arc is being forced toward the bottom of the Figure. Simultaneously, copious amounts of fume and slag are generated.

In order to inhibit the fume and slag reaching the process operative a housing shown generally as 16 comprising a mounting arm 18 and a hood 20 is positioned in close proximity to the workpiece 10 as shown. Mounting arm 18 serves to secure housing 16 to the torch support (not shown) so that hood 20 can be properly positioned vis-a-vis the workpiece 10. Hood 20 includes means for holding the torch 12 in the proper position to achieve its intended result vis-a-vis the workpiece 10. Disposed opposite the torch 12 and also held by hood 20 is a fume and slag collection apparatus 22. Hood 20 is preferably lined with an acoustic absorbing material to reduce

process noise in the surrounding area. Hood 20 includes viewing ports 23 so that the process can be observed. The fume and slag collection apparatus 22 includes a nozzle assembly 24 as will hereinafter be more fully described and a collection tube 26. Associated with the nozzle assembly 24 is a conduit 28 for admitting cooling water and air to the nozzle assembly 24. Collection tube 26 is connected by a conduit to an air pump 29 and through further conduit to a filter system 30. The filtering system includes a reservoir 32 containing a quantity of water. In the upper part of filter system 30 there is included a particulate filter 34 between the reservoir 32 and an air mover 36. Air mover 36 is adapted to evacuate filter system 30 and dispose of filtered gas as shown by arrow 38. The filtered gas 38, in the case of air, can be put back into the environment. In the case of a gas such as an inert gas used to surround the process apparatus this gas can be returned for reuse in association with the process. Reservoir 32 includes a suitable drain and valve arrangement 40 to remove water from reservoir 32. Withdrawal flow in this system is shown by the continuous arrow 42 which continues on through the filter system.

The hood 20 includes a flexible curtain 21 fixed to the lower periphery of hood 20 to provide a flexible seal between the workpiece 10 and the hood 20 to minimize escape of the atmosphere surrounding the torch 12.

In operation the fume and slag generated are withdrawn into the collection apparatus 22 (Figure 2). Water and air introduced into nozzle assembly 24 cools any particulate matter that is at elevated temperature and thus inhibits sticking of the particulate matter to the nozzle assembly 24. Because of the air pump 29 the collected fume, environment surrounding the process apparatus, particulate matter, and cooling fluid are withdrawn into the filter system 30. In the filtering system 30 the water falls to the bottom and is collected in the reservoir for draining and safe disposal.

The water can be subject to further cleaning if necessary. The solid particulate matter settles to the bottom of the filter system 30 and is periodically cleaned from the system. The process gas (e.g. air) is directed toward the vacuum pump 36 and upon passing through the filter is cleaned of airborne particulate matter. The cleaned process gas is then removed from filtering system 30 through the filter 34 (arrow 38) and either placed in the environment or returned to the process apparatus for reuse.

Figure 2 is an enlarged view of the collection apparatus 16. The gouging torch 12^1 is placed in the hood 20 so that the electrode 14 is positioned at the correct angle to the workpiece 10. Air-carbon arc cutting and gouging torch 12 includes the necessary apparatus to automatically feed the electrode to the workpiece 10. The hood 20 includes a pair of resilient wheels 50,52 mounted on either side through suitable spring loaded slide mechanisms 54,56 so that the hood 20 can move along the surface of the workpiece 10. Flexible seal 21 is provided so that process fume does not escape to the surrounding atmosphere.

Figures 4 and 5 show the nozzle assembly 24 which includes an outer wall and an inner wall 62 containing a plurality of holes 60 so that a cooling fluid (e.g. water and air) introduced through conduit 28 will flow through the water jacket 64 defined by the inner wall 62 and outer wall to the holes 60 and be directed to the inside of the nozzle assembly 24. Apertures 60 are so constructed and arranged so that high pressure air and water jets converge at the center of the collector nozzle along its longitudinal axis and direct the collected fume and slag to the filter system 30 as shown by the arrows of Figures 3 and 4. The high pressure air and water breaks up and quenches the molten slag. The water and air stream keeps all the collected material in suspension for movement to the filter system 30 without compaction or segregation in system conduits or sticking on the

walls of the system. The air and water continuously wets the inner surface of nozzle assembly 24 to cool the nozzle and inhibit molten metal sticking to its inner surface.

If desired the collection assembly 16 can be surrounded with a cover lined with a sound absorbing material which contains a viewing port so that the process apparatus can be observed during operation. Such a cover can be readily constructed and need not seal against the workpiece in order to achieve a significant reduction in the operating noise level of the apparatus.

It has been found that the angle of the nozzle assembly 24 can be between 20° and 90° to the point of contact with the workpiece in order to achieve effective collection of the fume and slag generated by the process.

The apparatus can be adapted for use in a stationary position while the workpiece is moved by suitable means in a straight line, circular motion or curvilinear motion. Alternatively, the apparatus can be constructed for movement while the workpiece remains stationary by affixing the apparatus to a carriage or to a like structure carrying the air-carbon arc cutting and gouging torch. The apparatus is adaptable for all positions of gouging and/or cutting such as in the flat or down hand position, in the vertical up or vertical down position, in the horizontal position, and in the over hand position. Lastly, the apparatus can be used in combinations with motion and position which require automatic control of the collectors, gouging electrode and gouging air jets.

Whilst the apparatus described is primarily intended for use with an air-carbon arc cutting and gouging torch it could also be used in association with other tools.

CLAIMS

1. An apparatus for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging torch, which apparatus is characterized in that it comprises:

(a) a housing which can be positioned in close proximity to a workpiece;

(b) means on said housing to hold an air-carbon arc cutting and gouging torch fast with respect to said housing;

(c) a nozzle for conveying fume and/or slag from said housing; and

(d) means for introducing a mixture of gas and cooling liquid into said nozzle to cool said fume and/or slag and inhibit said slag adhering to said nozzle.

2. An apparatus according to Claim 1, characterized in that said housing is provided with a seal which, in use, engages said workpiece circumjacent said air-carbon arc cutting and gouging torch.

3. An apparatus according to Claim 1 or 2, characterized in that it comprises an air-carbon arc cutting and gouging torch.

4. An apparatus according to Claim 1, 2 or 3, characterized in that said housing and said nozzle are enclosed in a sound absorbent hood and said housing and said hood contain ports for viewing, in use, a workpiece.

5. An apparatus according to any preceding Claim, characterized in that it comprises an air pump to withdraw said fume and/or slag through said nozzle.

6. An apparatus according to any preceding Claim, characterized in that it includes means to separate said slag and liquid from said fume.

7. A method for collecting fume and/or slag generated by the operation of an air-carbon arc cutting and gouging tool, characterized in that it comprises the steps of:

(a) isolating from the ambient environment an area surrounding the torch where fume and/or slag is generated;

(b) continuously withdrawing the fume and/or slag through a nozzle; and

(c) introducing a mixture of gas and cooling liquid into said nozzle to cool said fume and/or slag and inhibit said slag adhering to said nozzle.

8. A method according to Claim 7, characterized in that it includes the step of separating said slag and cooling liquid from said fume.

For the Applicants

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EUROPEAN PATENT ATTORNEY

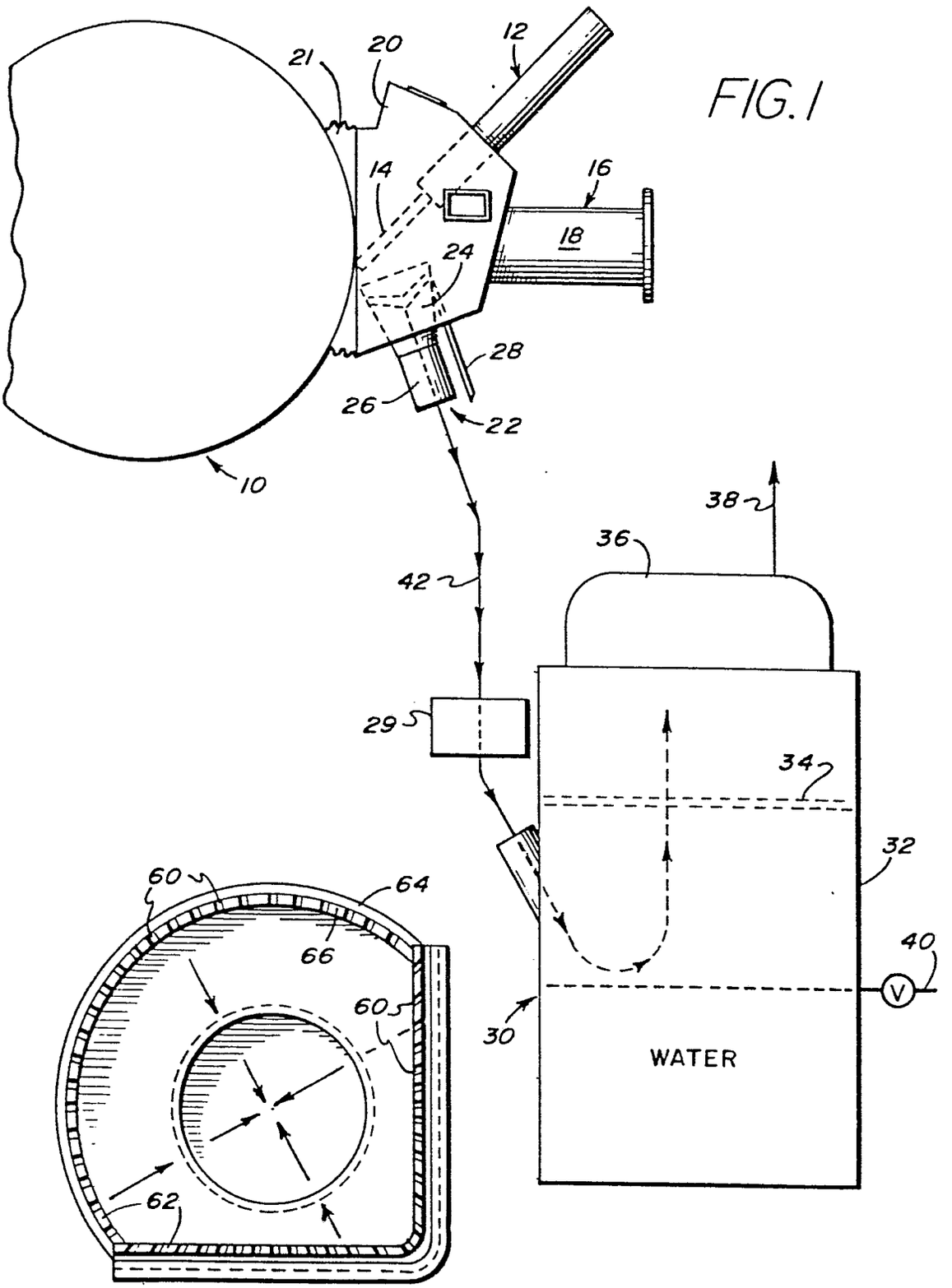
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FIG. 1

FIG. 5

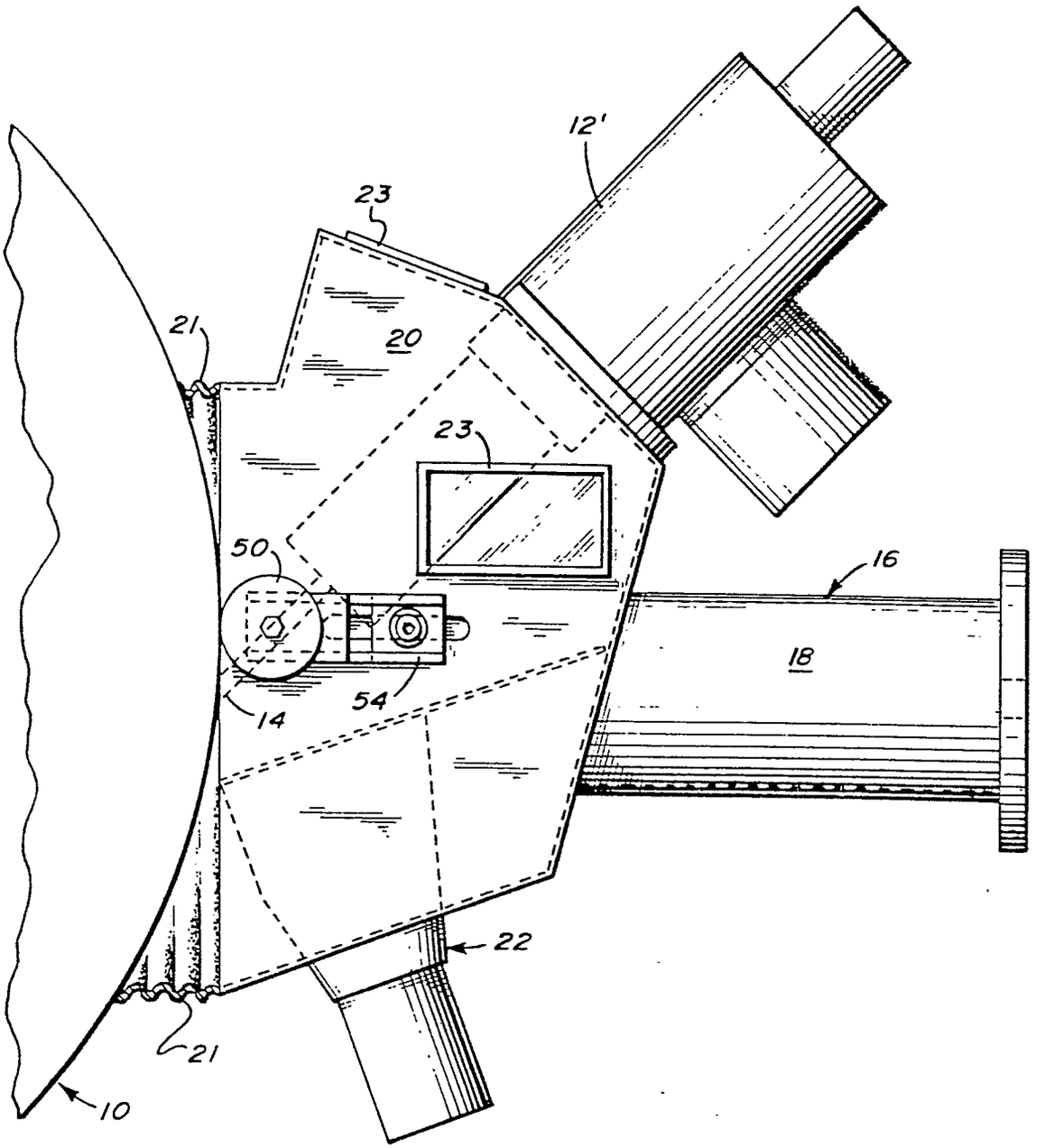
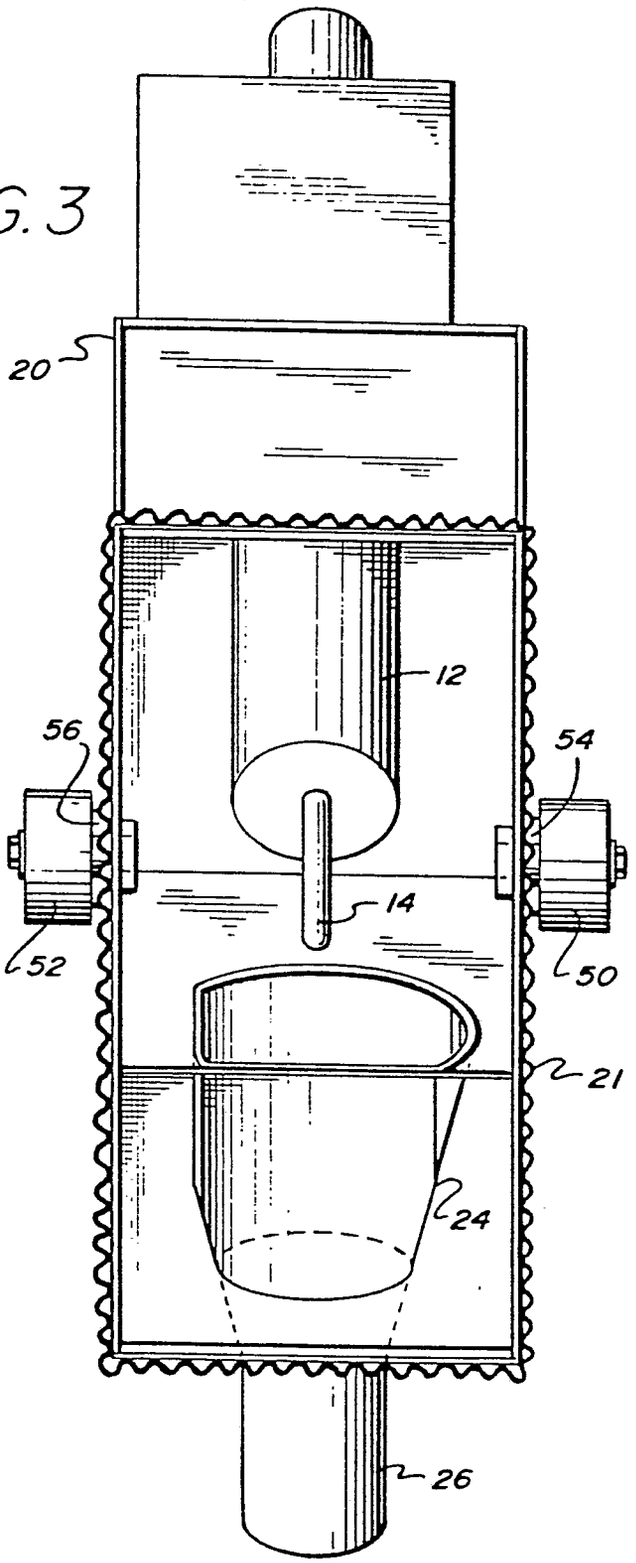


FIG. 2

FIG. 3



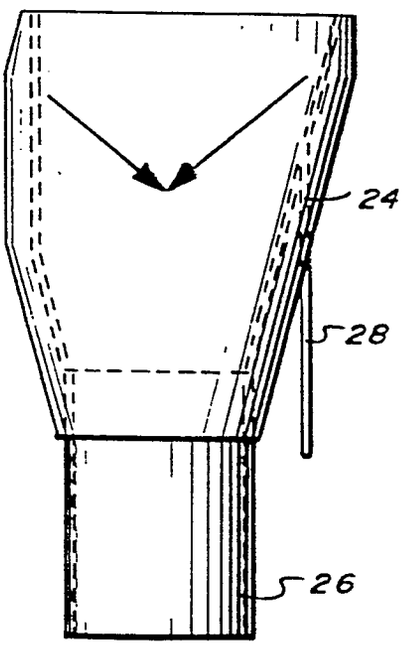


FIG. 4

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Application number
EP 80 30 0979

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	FR - A - 2 320 161 (LINDKVIST) * Pages 9,10 *	1,3,5,7
	US - A - 2 210 370 (HERRADORA) * Complete document *	1,2,5,7
	FR - A - 2 363 381 (FONDERIES) * Pages 6-8 *	1,3,5-8
	US - A - 3 100 255 (U.S.A.) * Figure 1 *	1,3,7

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

B 08 B 15/04
B 23 K 9/00

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

B 08 B 15/04
B 23 K 9/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23-06-1980	HOORNAERT