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(12) # EUROPEAN PATENT APPLICATION

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(54) **Method and apparatus for marking surfaces by abrasion.**

(57) Apparatus for marking smooth hard surfaces, such as vehicle windows, comprises a conventional blast gun (20) supplied with compressed air from a compressor (22) for conveying a granular abrasive material to a stencil box (1). The granular material is heated prior to use and any water in the compressed air is extracted by mechanical extractors (27) prior to reaching the blast gun (20) in order to improve the cutting efficiency of the material and enabling a clean mark to be obtained on the target surface even in wet or humid conditions.

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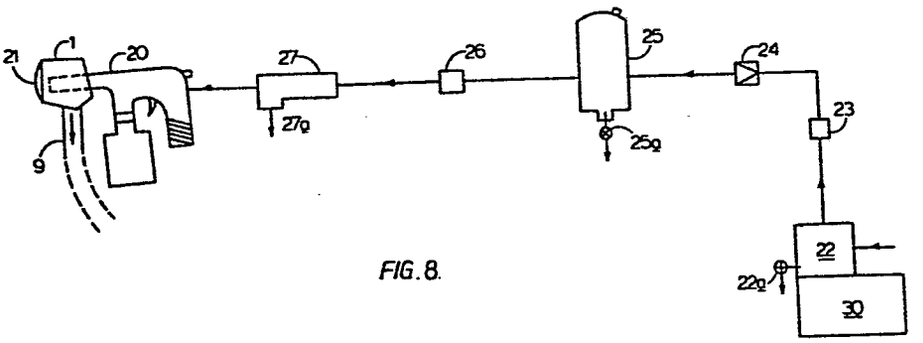

FIG. 8.

METHOD AND APPARATUS FOR MARKING SURFACES BY ABRASION

This invention relates to a method and an apparatus for marking a smooth hard surface with an identification mark. The invention is especially, but not exclusively, concerned with the marking of the glass windows of a vehicle.

It has been proposed in U.K. Specifications Nos. 1 038 868 and 1 238 323 and in U.S. Specification 4 048 918 to mark by sand-blasting one or more of the glass windows of a vehicle with the licence registration number of the vehicle or similar mark enabling the vehicle to be identified if it should be stolen, to provide a deterrent against stealing.

The portable apparatuses disclosed in the above-referred to Specifications for marking the glass comprise a stencil box which is open at its forward end to receive a stencil assembly, a large aperture in the base of the box leading directly into a container for abrasive material, a compressed air gun mounted at the rear of the box and arranged to direct a jet of air forwardly through an orifice such that the jet of air sucks abrasive material through a tube leading from the base of the container

and directs a jet of the abrasive material at the stencil assembly. It is stated that sand, carborundum, possibly as an emulsion with a liquid, might be employed as the abrasive medium. Also it is stated that any appropriate source of compressed air may be used.

A major problem in marking vehicle windows using known methods is that often the vehicle will have been standing outside in rain, during storage in manufacture or in use, and water on a window, or even a humid atmosphere, seriously impairs the effectiveness of the abrasive material, even if attempts are made to dry the window. It is important that it should be possible to predict accurately the time required to produce an acceptable mark on the window, since if the process is carried out for a time which is insufficient to produce a clear mark it is practically impossible to replace the stencil on the window in exactly the same position. Also, if the process is carried out for too long, the strength of the window may be impaired.

According to a first aspect of the invention in a method of marking a smooth surface by directing a jet of air carrying abrasive material at a stencil held in face-contact with the surface, the air is first dried, and the abrasive material is heated before use.

The method may be applied to the marking of any material presenting a smooth hard surface, such as glass, ceramic material, steel, aluminium, glass fibre reinforced plastics or other hard plastics.

The temperature of the abrasive material and the time the jet thereof is directed against the surface may be varied according to the material of the surface. This temperature may vary from 10°C for the marking of glass fibre reinforced plastics to 40°C for the marking of steel. Similarly, the pressure of the compressed air may be varied from 35 p.s.i. for glass fibre reinforced plastics to 150 p.s.i. for steel.

One problem with the known devices is that the used abrasive material is re-circulated which inevitably leads to a reduction in the efficiency of the device. Another problem is that for efficient marking it is very desirable that the abrasive material should quickly be cleared from the region adjacent to the stencil once it has been used, and in the prior devices a substantial back-pressure will be developed in the mouth of the closed abrasive container which will resist clearing of the abrasive and will also reduce the air flow from the compressed air gun.

In the case of a glass window of a vehicle a stream of hot, dry abrasive material is preferably directed onto the vehicle window through a first aperture in a stencil box towards a stencil located in a second aperture of the stencil box and held in face-contact with the vehicle window, the stencil box being provided in its base with a third aperture connected to a pipe for exhaustion of the spent abrasive material. Preferably, the pipe leads directly to atmosphere but in a possible modified arrangement the material may be recirculated.

The pipe is preferably a flexible pipe which may simply be led to a location clear of the vehicle where the free end is open to atmosphere.

The pipe is preferably made as large a diameter as convenient to keep the back-pressure to a minimum.

Preferably, the abrasive material comprises the finings of silica sand of minus 100 mesh. In order to ensure that the abrasive material is thoroughly dried and heated before use it is preferably maintained at a temperature of at least 20°C in the case of glass for at least two hours before it is used, and preferably it is then used at that temperature. It has been found that in practice more efficient marking is obtained with hot abrasive material rather than with abrasive that has been heated to dry it and has then cooled.

According to a second aspect of the invention apparatus for carrying out the hereinbefore mentioned method of marking a smooth surface comprises; a container for containing abrasive material, means for heating the material in the container, an air compressor, an air receiver for receiving air under pressure from the compressor, a pipe connection from the air receiver to a blast gun, means for supplying said gun with heated abrasive material from the container, a nozzle of said gun, and a stencil holder located in front of said nozzle.

A cannister mounted on the gun may be filled manually from the container or the gun may be adapted to suck abrasive material directly from the container.

Preferably the apparatus is made transportable by being mounted in a vehicle.

The compressor may be driven by a separate internal combustion engine or it may be driven by the vehicle engine.

The means for heating the abrasive material may be the hot exhaust gases from the vehicle engine or the separate compressor engine. Alternatively, gas or electric heating means may be used.

Preferably, a multistage filter assembly is positioned between the outlet from the air receiver and the blast gun in order to extract any moisture in the compressed air. More than one blast gun may be supplied with compressed air simultaneously.

The stencil for marking the desired information on the target surface is preferably adapted to be secured in an aperture in a stencil box. The stencil may comprise a unitary member including the desired symbols or a plurality of members each provided with a letter, figure or other symbol together comprising the desired information.

The stencil is preferably made of resilient material such that when mounted in the stencil box it is capable of being deformed against the target surface such as a windscreen.

Preferably the stencil is mounted in the box such that it is convex outwards before being pressed against a target surface which is flat or convex outwards. This provides a more efficient

masking of the parts of the glass adjacent to those parts being marked.

The invention will now be further described in relation to the marking of a vehicle window by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a side elevation of a stencil box and blast gun assembly partly in section;

Figure 2 is a plan view of the assembly of Figure 1 with the gun omitted;

Figure 3 is a view looking from the left in Figure 1 with the gun omitted;

Figure 4 is a view looking from the right in Figure 1;

Figure 5 is a cross-section through part of a van showing a heating unit for abrasive material mounted on the van floor;

Figures 6 and 7 are views of the heating unit of Figure 5 looking respectively from the right and left in Figure 5; and

Figure 8 is a system diagram showing the main components of the apparatus.

With reference to Figures 1 to 4, a stencil box 1 is formed of mild steel sheet with rivetted

and sealed joints to prevent escape of abrasive material close to the operator. The box is provided at one end with a first aperture 2 to receive the nozzle of a conventional compressed-air blast gun 20, and at its other end with a rectangular second aperture 3 and with opposed flanges 4 which form channel-section guides for a stencil 21. A rubber gasket 5 surrounds the first aperture 2 to effect a seal with the body of the blast gun 20, and a rubber gasket assembly 6 effects a seal with the stencil 21. A suitable blast gun is the LODFIELD B.M. pistol. A suitable stencil material is PROFLEX having a polyester film base. The gun is similar to that used for spraying paint modified to include a jet of suitable size for the abrasive material and a hardened nozzle to resist wear.

The box 1 is provided with finger supports 7. A sloping front portion 8 of the base of the box 1 is inclined at between 25 to 29° to the horizontal and directs spent abrasive material to a flexible pipe 9 of relatively large diameter leading from a third aperture 10. The pipe 9 is of sufficiently large diameter to promote rapid clearance of used material, sufficiently long to carry the spent abrasive away from the vehicle and the operator and is open to atmosphere at its lower end.

The rubber gasket assembly 6 projects outwardly of the stencil box 1 beyond flanges 4 to hold the resilient stencil in a convex outwards condition. When the stencil is pushed against a vehicle windscreen or window pane it is distorted into a planar configuration, and the central portion of the stencil provided with the cut-out numbers or letters is held in particularly firm contact with the glass.

With reference to Figure 8 compressed air at approximately 150 p.s.i. is produced by a petrol engine driven compressor 22 and is fed through a first pressure regulator 23 and non-return valve 24 to a receiver or reservoir 25, and thence through a further pressure regulator or unloader 26 controlling at 90 p.s.i. and a multi-stage filter assembly 27 to the blast gun 20. The pressure regulator 26 is manually adjustable and includes a pressure gauge. The compressor 22 and the receiver 25 are fitted with water drain taps 22a and 25a respectively. The filter assembly 27 is designed to produce extremely dry air (99.95% dry) and comprises a conventional coalescing filter having an automatic drain 27a. Such a filter is capable of removing dust and water droplets from the air. The filter assembly 27 comprises a first portion which removes dirt particles larger than five microns in diameter, a second portion comprising a cartridge of glass fibres which traps smaller dirt particles and upon which any water droplets coalesce. The cartridge is enclosed in a polyurethane sock which encourages water droplet growth, the droplets flowing to a sump 27a from which they are drained automatically. A suitable filter assembly 27 is the SPYREX Auto-Drain S.P.2.

The compressor 22 and petrol engine 30 driving it are conveniently mounted on the floor 28 of a van together with a heating unit for the abrasive material. As shown in Figures 5 to 7 the heating unit comprises a metal tray 11 with a lid 11a, the base of the tray forming the upper wall of a box 12 through which the exhaust gases of the compressor engine 30 pass.

As shown in Figures 6 and 7, the exhaust gas inlet and outlet assemblies 13 and 14 respectively for the exhaust gases each comprise a pair of horizontally spaced apart pipes 15 leading into the box 12, the inlet pipes 15 being more closely spaced than the outlet pipes 15 to provide an even distribution of heat over the base of the tray 11. A vertical pipe 16 connects the exhaust gas outlet assembly 14 to a silencer 29 mounted beneath the van floor 28.

The upper and lower walls of box 12 are respectively provided with downwardly and upwardly extending metal baffle plates, not shown, which alternate with one another to assist in heat extraction from exhaust gases.

The temperature of the powder in tray 11 is preferably controlled by a thermostat which may, for example, be used to operate a movable baffle controlling the exhaust gas flow through box 12. The heated powder is removed from the tray 11 by way of an outlet pipe 17 having a shutter 18. This pipe enables the canister of the blast gun to be filled manually with hot powder prior to the marking operation.

In operation of the apparatus when marking the registration number on a vehicle windscreen for example, the compressor engine 30 is started and the receiver 25 is charged to the maximum pressure of 150 p.s.i. when a blow-off valve will operate. Heat from the compressor engine exhaust heats the abrasive material in the tray 11 simultaneously until it reaches a temperature of approximately 20°C. The engine may now be stopped. The

registration number of the vehicle to be marked is cut on a stencil machine in the Proflex film which is then inserted into the stencil box 1. The box 1 is then held firmly in position on the vehicle windscreen and the blast gun 20 containing hot abrasive at 20°C is connected into the aperture of the stencil box which is surrounded by the rubber gasket 5. The stencil 21 is now panned by the blast gun firing silica sand abrasive XH29 for approximately 3 to 4 seconds. Any excess dust is blown off by a "blow gun" attachment.

In order to maintain the cutting efficiency of the abrasive material it is a most important feature of this invention that nearly all the moisture is extracted from the abrasive material and from the compressed air which carries the material to the stencil. The drain cocks 22a and 25a should be operated at fairly frequent intervals and the temperature of the abrasive material should be maintained as near to the desired temperature at all times in operation. Even in dry conditions the cutting material is more effective when heated.

In one modification of the apparatus herein before described, the tray 11 for heating the abrasive compound is heated by an electrical element receiving power from batteries or a mains supply. Alternatively, a cylinder of Buthane gas carried by the vehicle may be used to supply a gas burner beneath th tray.

In another modified arrangement the gun 20 draws abrasive material from the tray 11 by suction and the material is returned to the tray after use

by discharging the pipe 9 into the top of the container. Thus a form of recirculation of the abrasive compound is envisaged although this is not a preferred arrangement.

Also, the compressor 22 may be driven by a belt or shaft directly from the vehicle engine.

In other applications of the invention observation of the following operating criteria is important if a sharp definition of the required symbol is to be achieved consistently. It will be appreciated that when marking expensive products a high failure rate is not permissible.

Material to be marked	Temp. of the abrasive material °C	Air Pressure P.S.I.	Blast time secs.
Glass Fibre reinforced plastics	10	35	3-4
Glass	20	90	3-4
Aluminium	30	110	6-7
Steel	40	150	12-15

It has been found in practice that only a combination of the above-stated parameters produce good results in all conditions both indoors and in the open. It has also been found that use of an air cylinder instead of a compressor for mobile use is unsatisfactory and uneconomical.

CLAIMS

1. A method of marking a smooth surface by directing a jet of air carrying abrasive material at a stencil (21) held in face-contact with the surface, characterised in that the air is first dried, and the abrasive material is heated before use.

2. A method as claimed in claim 1 in which the abrasive material is used at substantially a predetermined temperature to which it has been heated.

3. A method of marking a glass window of a vehicle by means of a stream of abrasive material carried by air and directed onto the vehicle window through a stencil (21) supported in a stencil box (1) and held in face-contact with the vehicle window, the air being directed onto the window through a first aperture (2) in the stencil box (1) towards the stencil (21) which is located in a second aperture (3) of the stencil box (1), characterised in that the air is first dried and the abrasive material is heated before use and in that the stencil box (1) is provided in its base with a third aperture (10) connected to a pipe (9) for the exhaustion of the spent abrasive material.

4. A method as claimed in any one of claims 1 to 3 in which the abrasive material is silica sand.

5. A method as claimed in claim 4 in which the silica sand is heated to between 10 and 40°C before use.

6. A method as claimed in any one of claims 1 to 5 in which the air is compressed air at a pressure of between 35 and 150 pounds per square inch.

7. A method as claimed in any one of claims 1 to 6 in which the abrasive material is exhausted to atmosphere after use.

8. Apparatus for marking a smooth surface by directing a jet of air carrying abrasive material at said surface, comprising a blast gun (20) having a nozzle, a stencil holder (4) supporting a stencil (21) located in front of said nozzle, and a container (11) for containing the abrasive material, characterised in that; the apparatus includes means (12) (13) (14) for heating the material in the container (11), a compressor (22) for providing the source of compressed air, an air receiver (25) for receiving the compressed air, a pipe connection from the air receiver (25) to the blast gun (20), and means (17) for supplying the gun (20) with heated abrasive material.

9. Apparatus as claimed in claim 8 in which a water extractor (27) is positioned between the outlet from the air receiver (25) and the blast gun (20) for extracting any moisture in the compressed air stream passing to the gun (20).

10. Apparatus as claimed in claim 9 in which the water extractor (27) is provided with an automatic draining device (27a).

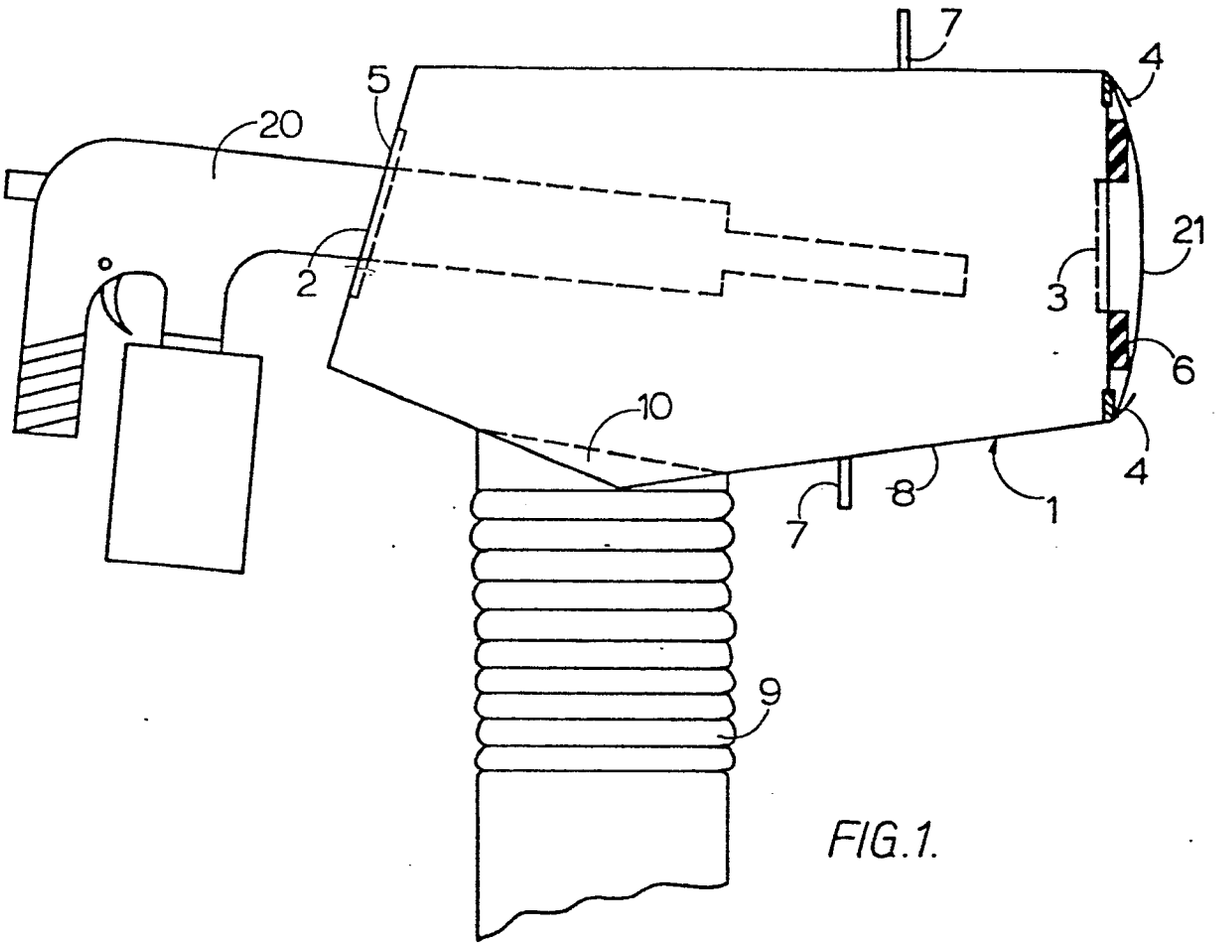

FIG.1.

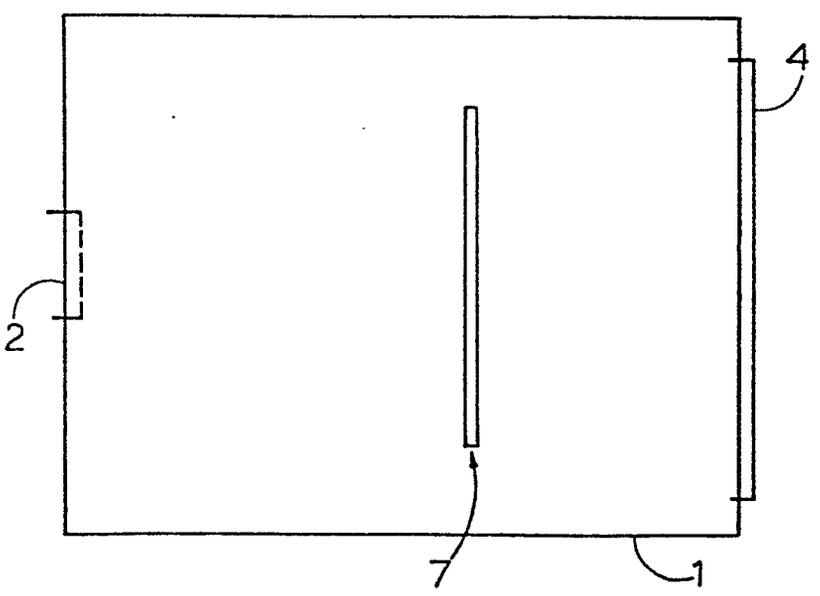

FIG.2

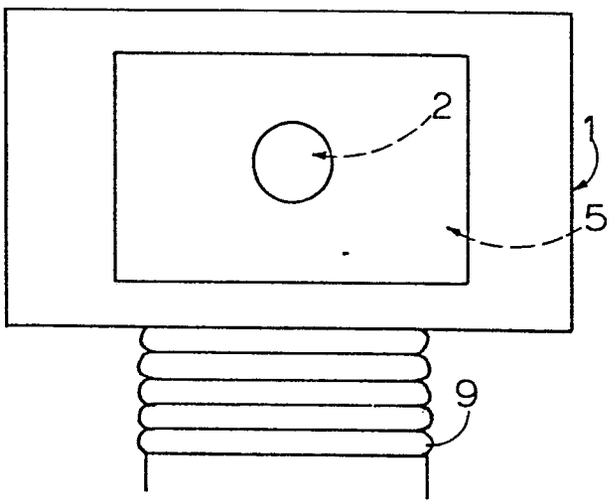

FIG.3.

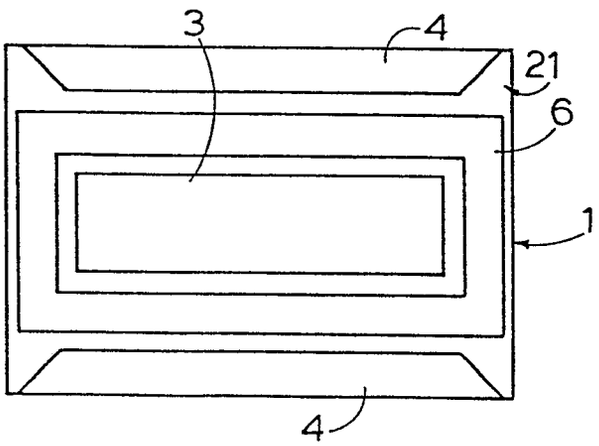

FIG.4.

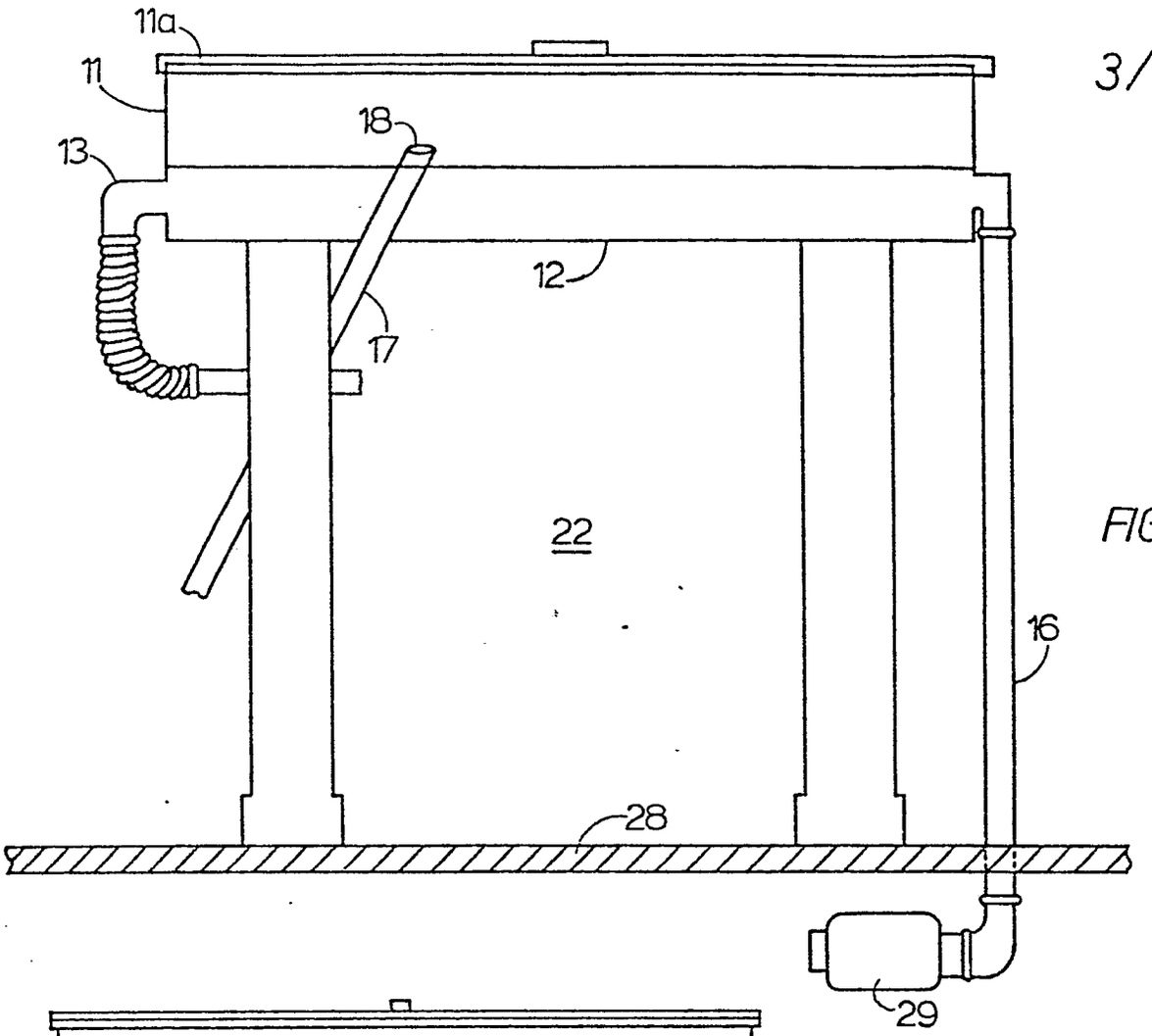

FIG.5.

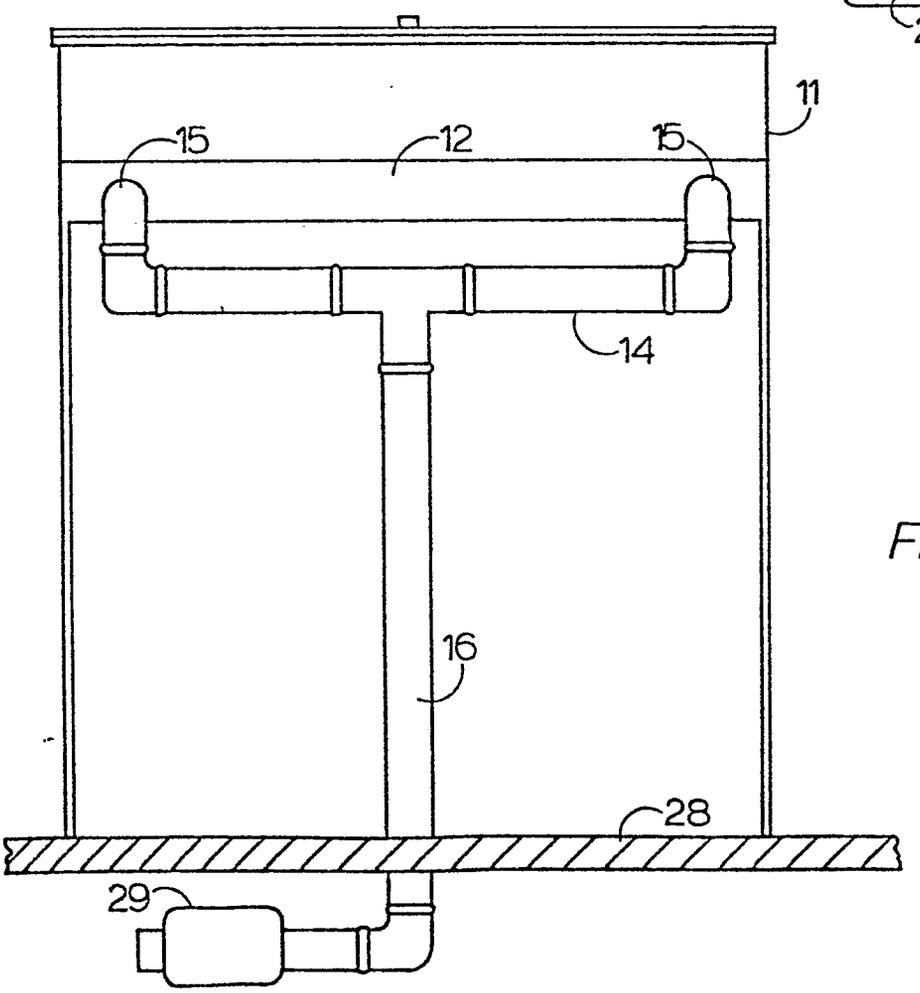

FIG.6.

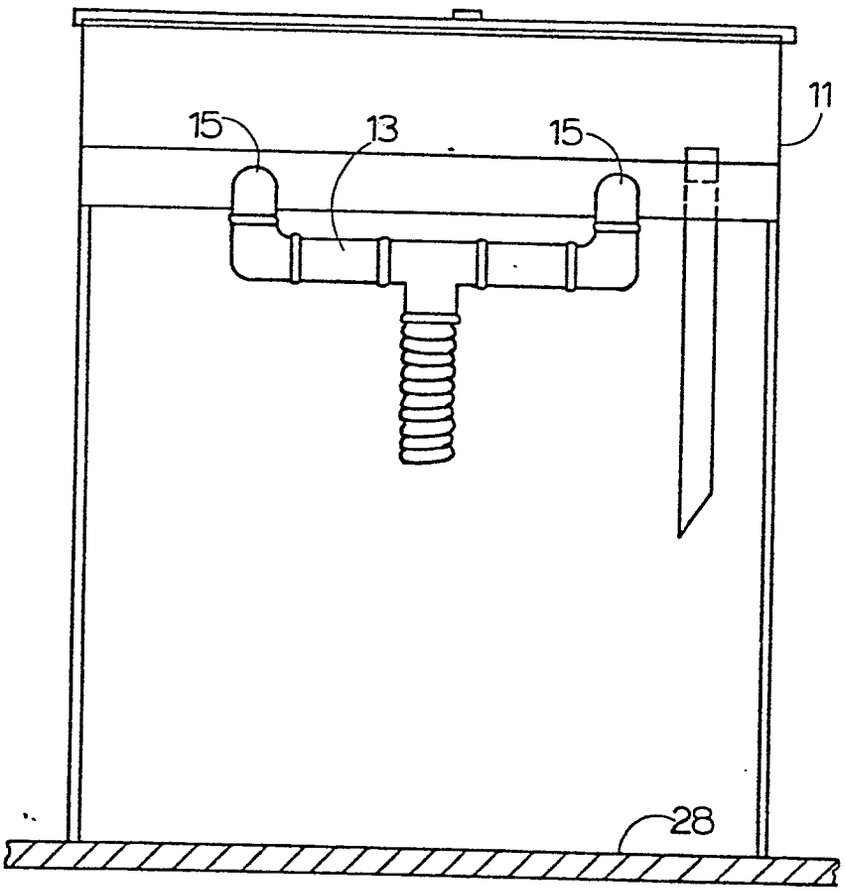

FIG.7.

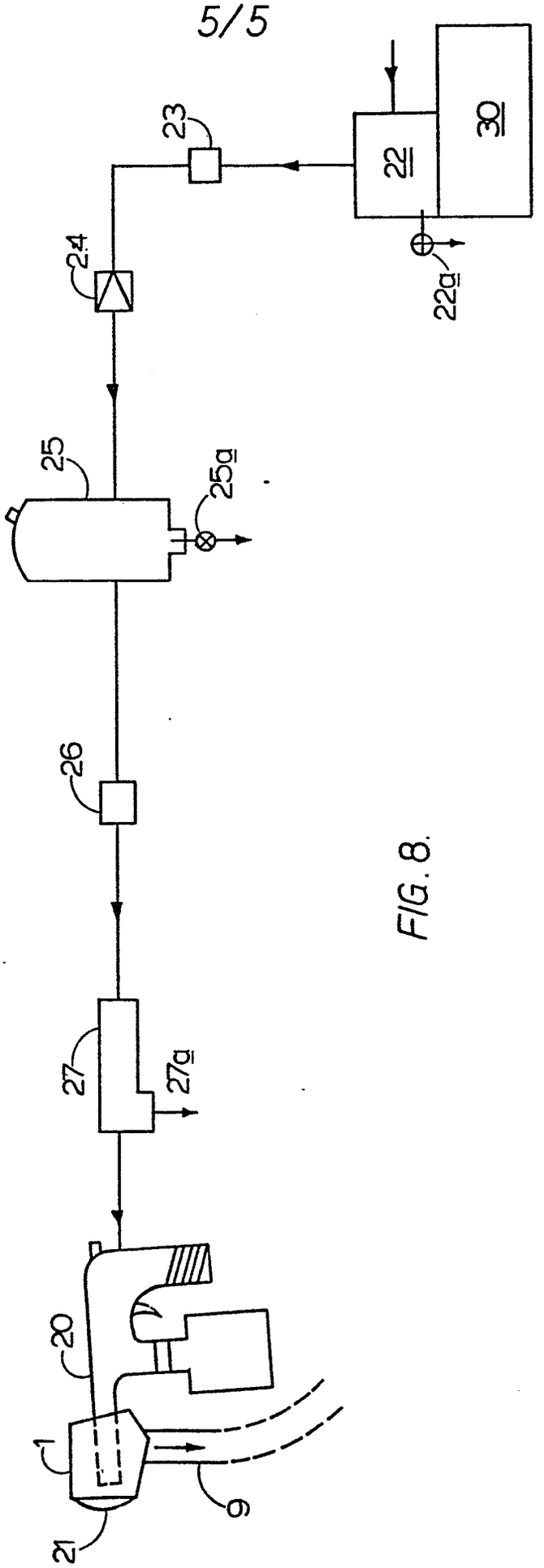

FIG. 8.

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Application number

EP 79 30 1672

European Patent Office

EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
A	DE - B - 1 112 302 (METALLGESELLSCHAFT AKTIENGESELLSCHAFT)	
A	US - A - 2 858 653 (GUPTILL)	
A	US - A - 3 440 082 (KUBE)	
A	CH - A - 386 274 (FISCHER)	
A	US - A - 3 377 749 (SHUMAKER)	
A	US - A - 2 608 800 (RITTER)	

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

B 24 C 1/04

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

B 24 C 1/00 - B 24 C 1/10

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

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	26-11-1979	PEETERS S