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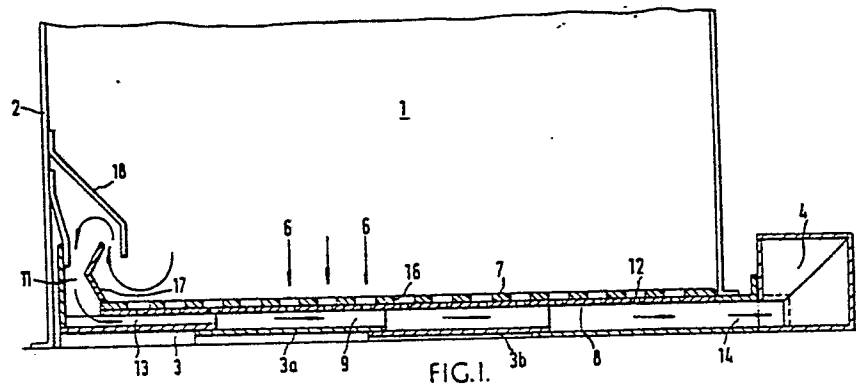
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54 **A floor structure for abrasive blasting cabinets.**

57 A pneumatic recovery floor for recovering particles from an enclosure has a floor plate (7, 8; 28) provided with apertures (12, 16; 37), spaced above a base plate (3; 19; 24), and substantially the whole of the intervening space between the floor plate and base plate forms a pneumatic conveying duct for removing particles which fall through the apertures in the floor plate. To provide a uniform air flow in the conveying duct the base plate may descend in steps or may slope downwards the air outlet, and, or the width of the duct may increase towards the air outlet. To provide uniform air flow over the floor area and uniform entry into the duct the apertures may increase in spacing or decrease in size towards the air outlet end of the duct. The apertures may be in recesses in the floor plate, or more than one floor plate may be provided with coincident apertures, the apertures in the upper plate or plates being larger than those below.

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"Recovery of Particulate Material"

5 This invention relates to the recovery of particulate material from an enclosure. In particular but not exclusively it relates to an abrasive blasting cabinet or room wherein the abrasive is conveyed from the enclosure after use in order to be cleaned and reused.

10 Abrasive blasting systems are well known which comprise an enclosure in which articles are subjected to surface treatment by abrasive particles with means to recover and clean the spent abrasive so that it can be re-circulated for use again. Blasting systems which provide these operations are described in British Patent No. 934,088 wherein the abrasive used falls through a floor comprising a plurality of hopper-like pockets and empties through apertures from the pockets into ducts which are situated
15 in rows between the hopper-like pockets.

20 In order to afford the operator proper visibility inside the enclosure, ventilation is provided by the entry of air through baffled apertures in the roof. The air is then drawn downwards through the hopper apertures, spaced substantially evenly over the entire floor area. The ventilation air also provides the necessary air streams that carry the used abrasive and debris out of the room through the aforementioned ducts.

The enclosure described in British Patent No. 934,088, by using a plurality of small hoppers, has a small overall floor thickness compared, for instance, with a single-hopper enclosure. As a result the enclosure can be placed directly on a factory floor, requiring only a shallow ramp for access, or may alternatively
5 be installed in a shallow recess. However, the floor construction is a complicated arrangement of parts assembled together to provide both the hoppers and the conveying ducts.

The present invention provides a greatly improved floor construction for the pneumatic recovery of particulate material, in which substantially the entire under-floor area serves as the conveying ducting for removal of the particulate material. The overall thickness of the floor including the ducting is thereby
10 reduced to a minimum. The floor construction is considerably simplified and the manufacturing costs reduced, compared with, for example, the floor construction described in British Patent No. 934,088.
15

It is preferred that the conveying ducts have a progressively increasing cross section in the direction of flow of air and particulate material. This is to maintain a reasonably uniform
20 air velocity as more air enters the duct through the floor apertures. However a floor with a constant duct section and thus an increasing duct velocity can still give satisfactory performance, at least in small enclosures.

According to the present invention, an apertured floor plate is spaced above a base plate and the intervening space forms a pneumatic conveying duct; the apertures are determined in size and number to allow a controlled quantity of air to enter the duct and so spaced that, should the complete floor be covered
25 with particulate material, the piles of material within the duct will not unduly restrict the flow of air through the duct.
30

The floor construction may comprise a floor plate which is loose or attached by screws or bolts and can be easily removed so that complete access is obtained to the duct system, e.g. for maintenance.

5 The conveying ducting may for example be divided into sections by baffles extending between upper and lower floor plates, for ease of installation. The orifices controlling the flow of air and particulate material from the enclosure do not have to be of variable size or pitching in order to provide a substantially
10 even downdraft over the room area, or substantially uniform duct velocity.

Although the invention will be discussed in connection with blast enclosures, it can also apply to other types of rooms requiring substantially uniform downdraft and the removal of
15 particles. In the case of blast enclosures, the simplicity and compactness of the recent construction is such that it can be applied to small blast cabinets, thus enabling them to be placed directly on to a table or bench by the elimination of a hopper or support legs.

20 The accompanying drawings show, by way of example only, embodiments of the invention: in the drawings:-

Figure 1 is a longitudinal section through one version of the floor of an abrasive blasting enclosure on the line A-A of Figure 3,

25 Figure 2 is a cross section through the floor on the line B-B of Figure 3,

Figure 3 is a plan view of the floor with the air entry baffles removed,

Figure 4 is a longitudinal section through an alternative floor construction,

5 Figure 5 is a section through a further version of the floor of an abrasive blasting enclosure, on the line C-C of Figure 7.

Figure 6 is a section through the said floor on the line D-D of Figure 7.

Figure 7 is a plan view of the floor on the line E-E of Figure 5.

10 Figure 8 is a section through the floor, on the line F-F of Figure 7, and

Figure 9 shows an alternative detail of the floor plate.

15 Figures 1 - 3 show an enclosure 1, with a roof provided with air entries (not shown) walls 2, and a stepped base plate 3 which can conveniently rest on a factory floor or bench. An outlet duct 4 is connected to a fan or similar means (not shown) for creating an air flow 5 along and from the duct. This in turn results in an air flow into the enclosure through the roof, the air flowing vertically downwards as indicated by arrows 6.

20 The operating floor of the enclosure is a floor plate 7, mounted on a secondary floor plate, 8, spaced above the base plate 3, and in the case of a blast room where the operator enters the enclosure, the floor plate 7 provides the working area on which the operator stands. In the case of a blast cabinet which is operated from outside, the floor plate 7 is the cabinet work floor on which components are placed for processing.

The spacing of the floor plate assembly 7 and 8 above the base plate 3 forms a conveying duct 9, for the removal of air and abrasive from the enclosure 1 into the outlet duct 4. The distance between the secondary floor plate 8 and the base plate 3 is determined by the volume of air being recovered and the air velocity necessary to convey the abrasive particulate material along the conveying duct 9.

It is also necessary that the conveying velocity in the duct 9 be substantially constant. Too low a velocity will result in abrasive lying in the duct, while too high a velocity will result in unnecessary wear and excessive resistance to flow, requiring an excessively large fan motor.

The floor assembly 7 and 8 is supported on longitudinal supports 10 which also ensure a seal along the side of each floor section to enclose the duct 9. The longitudinal supports also provide attachment for the base plate 3 which is manufactured for convenience in a series of overlapping steps.

Air drawn from the outlet duct 4 enters the conveying duct 9 through two paths. A large proportion, for example one-third, of this flow enters through the entry aperture 11, the remainder being drawn through the perforations 12 in the secondary floor plate 8. The perforation size and spacing is such that the air entering results in a constant velocity beneath the plate 8, as the conveying duct height increases, for example from the entry height 13 to the outlet height 14.

Theoretically, owing to the increasing depression in the conveying duct from its entry aperture to its outlet, a greater number of perforations are required per unit area of floor adjacent to the entry compared with the area adjacent to the outlet in order to provide a uniform increase in air flow as the duct height increases. Alternatively, if the spacing is constant, the perforations may be variable in size, decreasing towards the duct outlet. In

practice however, it has been found that a uniform pattern of perforations over the entire floor area will provide a substantially uniform velocity in the conveying duct beneath the floor sufficient for the recovery of abrasive after use.

5 A convenient practical way to increase the duct height is by forming the base plate 3 in a series of overlapping steps 3a, 3b, etc. Thus a step can be provided wherever the duct velocity has increased to an excessively high figure, and arranged so as to reduce the velocity to that just sufficient to convey the
10 abrasive.

By varying the length of each step in the direction of the air flow, compensation can be made for the variation in air flow entering a uniform pattern of perforations. This can be achieved by the use of longer steps at the entry end and decreasing in length
15 towards the outlet.

As an example of the very shallow thickness of floor that results from such a system, the outlet height 14 can be as little as 30 mm for an abrasive blasting room 3m. along the duct length.

Should the floor area be fully covered with abrasive the abrasive
20 will collect in the conveying duct 9 in the form of piles 15 (Figure 2) determined by the angle of repose of the material. It is essential therefore, that the spacing of the perforations 12 relative to the outlet height 14, be wide enough so that the piles of abrasive do not restrict the flow of air excessively. This is normally achieved
25 if not more than approximately 50% of the duct area is restricted, viewed in the direction of the air flow.

It has been found that a wide spacing between the perforations for example 60 mm does not result in a build up

of abrasive on the floor plate 7. During operation the movement of the abrasive by ricochet after impact, and by disturbance due to the blast nozzle air flow, causes it to travel over the floor plate and enter the perforations very rapidly after discharge from the nozzle.

However, to improve the collection of the abrasive media scattered over the floor area, the floor plate 7 which carries any loads within the cabinet or room is provided with large orifices 16, while the secondary plate 8 has perforations 12 whose function is to meter the air and abrasive flow in to the duct 9. As an example, the floor plate 7 may be 10 mm thick with 25 mm orifices while the secondary plate may be 3 mm thick with 5mm perforations to provide hopper-like entries spaced over the floor area.

Provided that the entry aperture 11 is free of any restriction which may occur, for example, owing to a sudden loading of abrasive onto the floor, the conveying duct 9 will be evacuated of all abrasive entering the perforations. This freedom from obstruction is achieved by baffling the entry aperture by means of a generally vertical edge plate 17 protected by a cover plate 18.

As an alternative to the use of stepped plates 3a, 3b, etc., to form the base plate, Figure 4 shows a single inclined plate 19, which can be welded between the longitudinal supports 10. Such a system provides a more uniform velocity from the entry end 20 to the outlet end 21, while the avoidance of steps results in a reduced resistance to flow.

The inclination of the plate 19 can be constant which will result in some variation if the perforations 12 are regular, although in practice such variation is acceptable. Alternatively the inclination can vary, being shallow at the entry end and steepening towards the outlet as more air enters the perforations.

Figures 5 - 8 shows a further version of the invention where the floor plate and base plate are parallel, comprising an enclosure 22 with a roof provided with air entries (not shown), walls 23, and a base plate 24. An outlet duct 25 is connected to a fan or similar means (not shown) for creating an air flow 26 along and from the duct. This in turn results in an air flow into the enclosure through the roof, the air flowing vertically downwards as indicated by arrows 27.

The operating floor of the enclosure is a floor plate 28 spaced above the base plate 24 and as previously described, in the case of a blast room where the operator enters the enclosure, the floor plate 28, provides the working area on which the operator stands. In the case of a blast cabinet which is operated from outside, the floor plate 28 is the cabinet work floor on which components are placed for processing.

The spacing of the floor plate 28 above the base plate 24 forms a conveying duct 29, for the removal of air and abrasive from the enclosure 22 into the outlet duct 25. The distance between the floor plate 28 and base plate 24 is determined as previously stated by the volume of air being recovered and the air velocity necessary to convey the abrasive particulate material along the conveying duct 29. It is also necessary that the conveying velocity in the duct 29 be substantially constant.

The floor plate 28 is supported around all its closed edges by side supports 30 and end supports 31 to ensure a seal around the floor edge. The plate is further supported by inlet splitter plates 32 and outlet splitter plates 33, which also assist in uniform distribution of the air flow through the conveying duct 29 into outlet duct 25.

The control of the flow beneath the floor plate 28, in order to maintain a substantially uniform velocity, is achieved by the provision of duct wall plates 34.

5 The outgoing air flow 26 results in a flow from the enclosure 22, through the floor plate 28. A large proportion, for example one-third, of this flow enters through entry apertures 35 and 36, the remainder being drawn through the perforations 37 in the floor plate 28. The perforation size and spacing is such that the air entering results in a constant velocity
10 beneath the plate 28, as the conveying duct width increases, for example from the entry aperture 35, to the outlet aperture 38.

Should the floor area be fully covered with abrasive the abrasive will collect in the conveying duct 29, in the form of piles 39 (Figure 8) determined by the angle of repose of the
15 material. It is essential therefore, that the spacing of the perforations 37 be wide enough so that the piles of abrasive do not restrict the flow of air excessively. This is normally achieved if not more than 50 % of the duct area is restricted, viewed in the direction of the air flow.

20 — As previously stated, it has been found that a wide spacing between the perforations does not result in a build up of abrasive on the floor plate 28. During operation the movement of the abrasive by ricochet after impact, and by disturbance due to the blast nozzle air flow, causes it to travel over the
25 floor plate and enter the perforations very rapidly after discharge from the nozzle. However, improvements may be effected by the addition of an upper floor plate (not shown) with large orifices, in a similar manner to that described for the system in Figures 1 - 3.

As a general rule, the end 40 of the duct wall plate 13 will be so positioned that the width of the duct 29 at the entry aperture 35, is approximately one-third of the width at the outlet aperture 38. The other end of the duct wall plate will be
5 approximately mid-way between the side support 30 (or splitter plate 32), and the splitter plate 33. For clarity, the paths taken by the air flow are indicated by arrows in Figures 5 - 8.

Provided that the entry apertures 35 are free of any restriction which may occur, for example, owing to a sudden loading
10 of abrasive onto the floor, the conveying duct 29 will be evacuated of all abrasive entering the perforations. This freedom from obstruction is achieved by baffling the entry aperture by means of a vertical surround 42, protected by a cover plate 43.

A modification to the floor plate 8 or 28, in any of the
15 systems, to reduce the amount of horizontal flat surface between the perforations 12 or 37 is shown in Figure 9. In this the plate around the perforations is slightly dished to provide a conical entry 44. It is then necessary for the perforations to be spaced clear of any support or splitter plates beneath
20 the floor plate 7. Such a modification would, of course, eliminate the need for the upper floor plate 7.

Many minor variations may be made without departing from the principle of the invention, namely a recovery floor system using the entire floor area as the recovery duct in order to
25 keep the overall thickness to a minimum. For instance, the perforations may be of variable size and spaced irregularly to provide a completely uniform air flow over the floor area in the conveying duct. The perforations may also be shaped in cross section, for example a conical entry section may be provided
30 to reduce the air entry loss and attenuate the noise created by the air entering the orifices. Although the outlet duct 4

or 25 is shown connected across the floor duct outlets and would, therefore, increase in cross sectional area towards the recovery fan or similar means, the floor outlets may be connected by means of a fishtail either running horizontally or vertically into

5 a single duct.

CLAIMS:

1. A pneumatic recovery floor structure for particulate material comprising an apertured floor plate (7, 8; 28) spaced above a baseplate (3; 19; 24), the intervening space between the floor plate and base plate forming pneumatic conveying ducting (9; 29)
5 over substantially the entire floor area.
2. A floor structure as claimed in claim 1 in which the apertures (12, 16; 37) in the floor plate (7, 8; 28) are determined in size and number to allow a controlled quantity of air to enter the ducting (9; 29) and so spaced that should the complete floor be covered with
10 particulate material, the piles of material within the ducting will not unduly restrict the flow of air through the ducting.
3. A floor structure as claimed in claim 1 or 2 in which the baseplate (3) is formed in a series of steps (3, 3a, 3b) to increase the effective duct area in the direction of flow and thus maintain a generally
15 constant air velocity in the ducting (9).
4. A floor structure as claimed in claim 3 in which the spacing between steps decreases in the direction of flow.
5. A floor structure as claimed in claim 1 or 2 in which the baseplate (19) is inclined from the horizontal to increase the effective
20 duct area in the direction of flow and thus maintain a generally constant air velocity in the ducting (9).
6. A floor structure as claimed in claim 5 in which the inclination of the baseplate increases in the direction of flow.

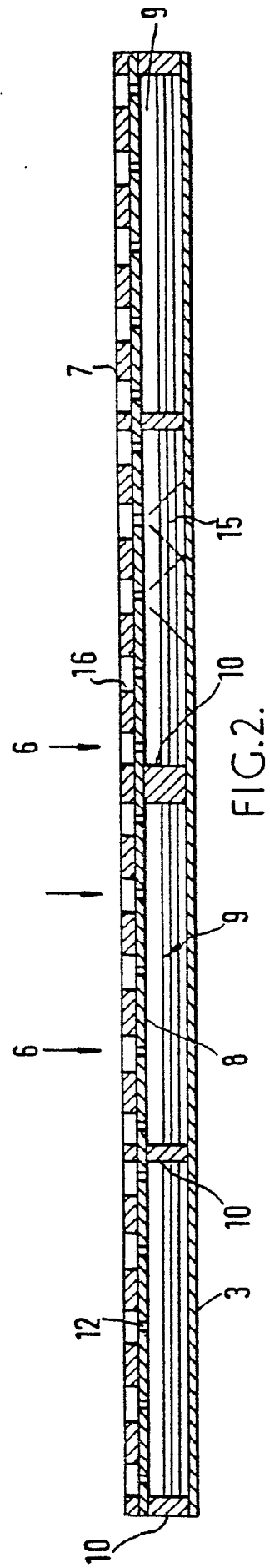
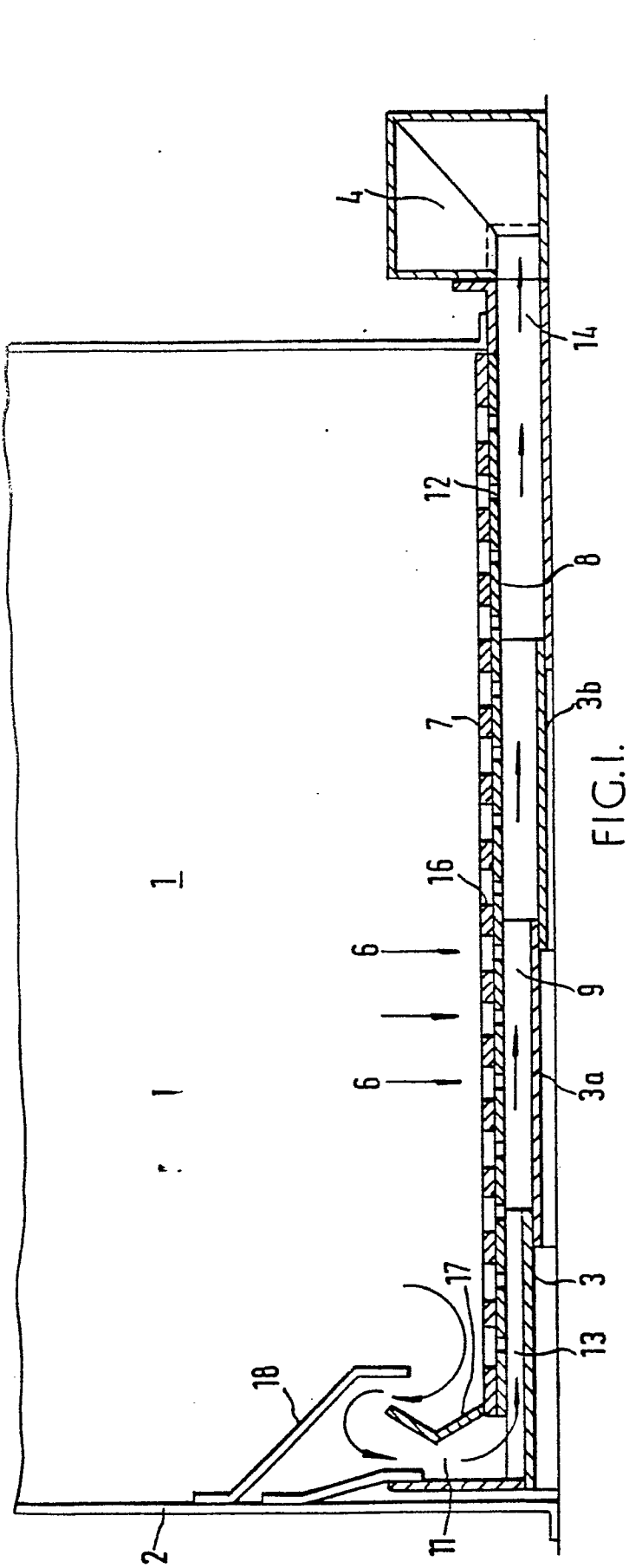
7. A floor structure as claimed in claim 1 or 2 in which the apertured floor plate (28) and the baseplate (24) are parallel, with splitter plates (32,33, 34) positioned to define at least one pneumatic conveying duct (29) of increasing area from the inlet (35) to the outlet (36).
5

8. A floor structure as claimed in any of claims 1 to 5 in which the spacing of the apertures (12, 16, 37) in the flow plate (7, 8, 28) increases towards the ducting outlet end to provide a uniform air flow over the floor area and uniform rate of entry along the length of the ducting (9; 29).
10

9. A floor structure as claimed in any of claims 1 to 6 in which the size of the apertures (12, 16, 37) in the floor plate (7, 8; 28) decreases towards the ducting outlet end to provide a uniform air flow over the floor area and uniform rate of entry along the length of the ducting (9; 29).
15

10. A floor structure as claimed in any of claims 1 to 7 in which the apertured floor plate comprises more than one plate (7, 8), with the size of the apertures (12, 16) in the plates (7,8) decreasing downwards to provide a hopper-like entry to the ducting (9; 29).

20 11. A floor structure as claimed in any of claims 1 to 7 in which the apertured floor plate (8; 28) has apertures (12; 37) which are dished or similarly formed to provide a hopper-like entry (44) to the ducting (9; 29).



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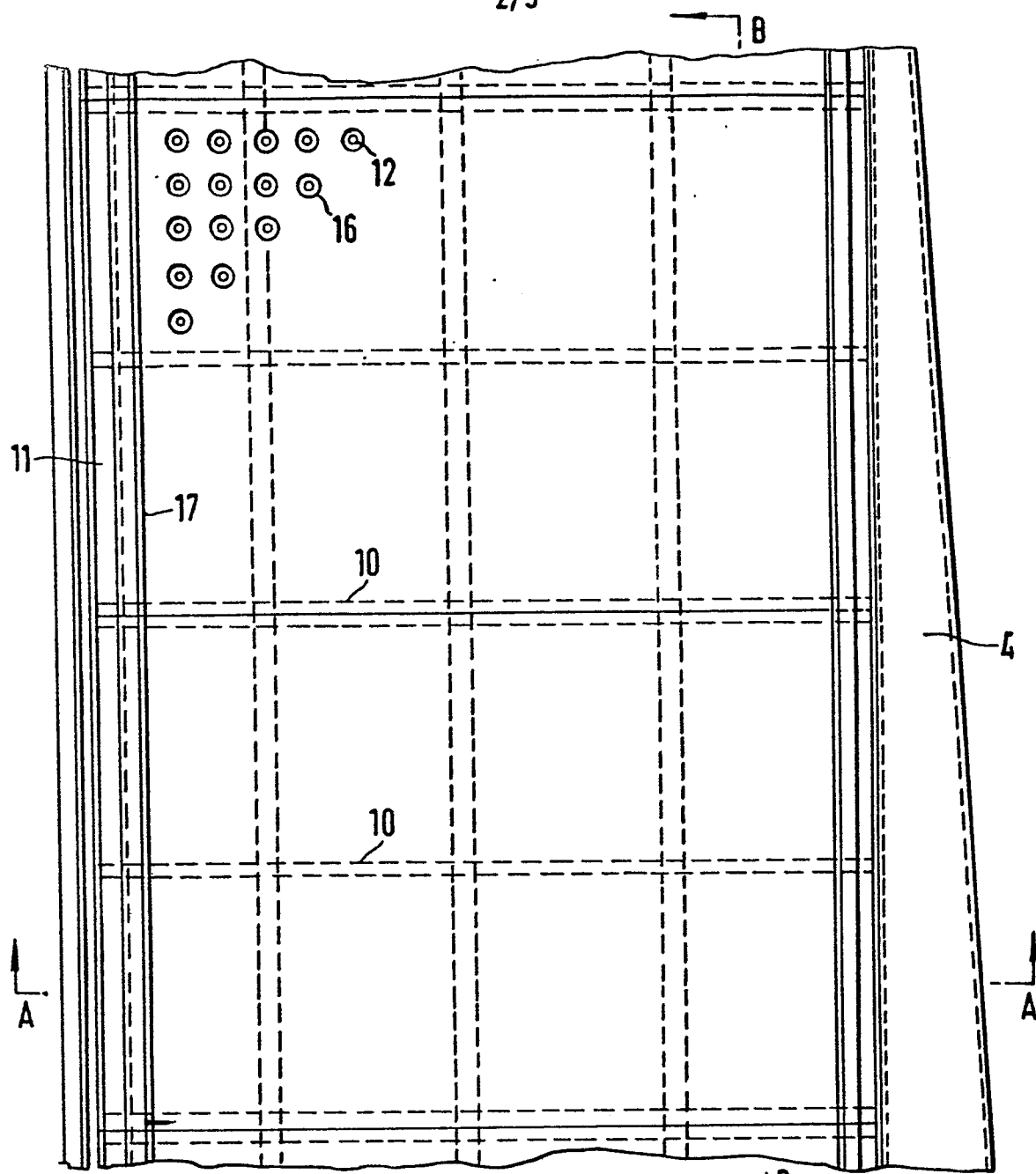


FIG. 3.

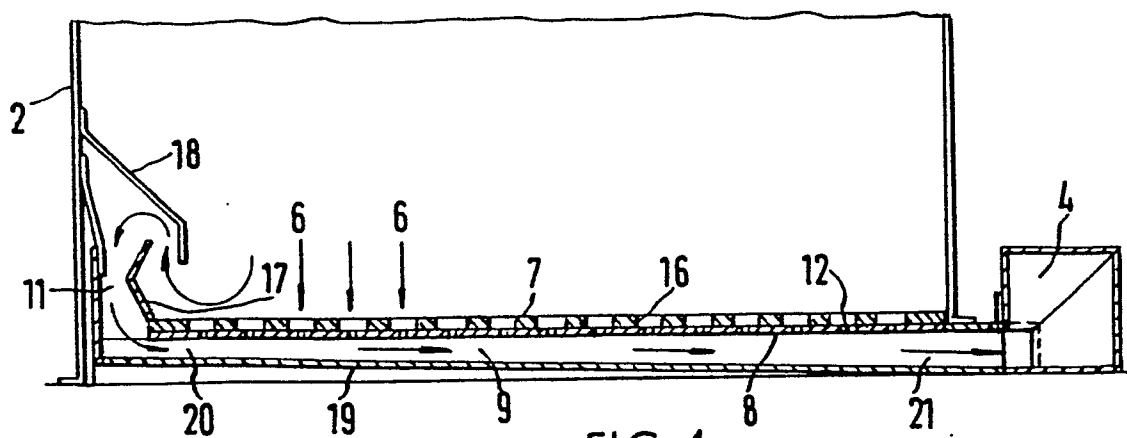
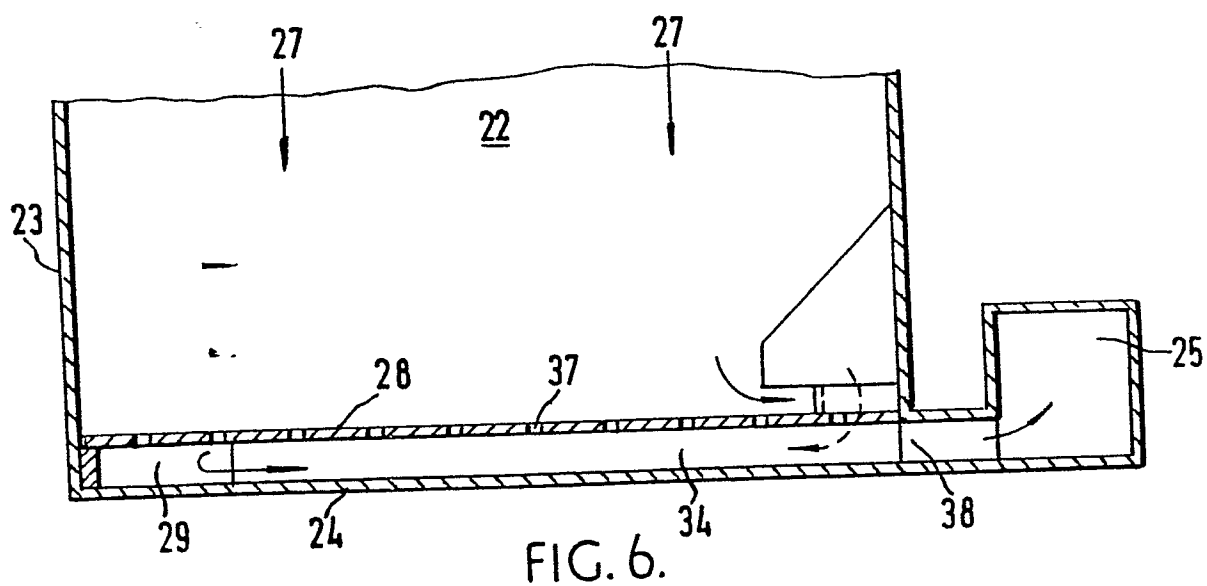
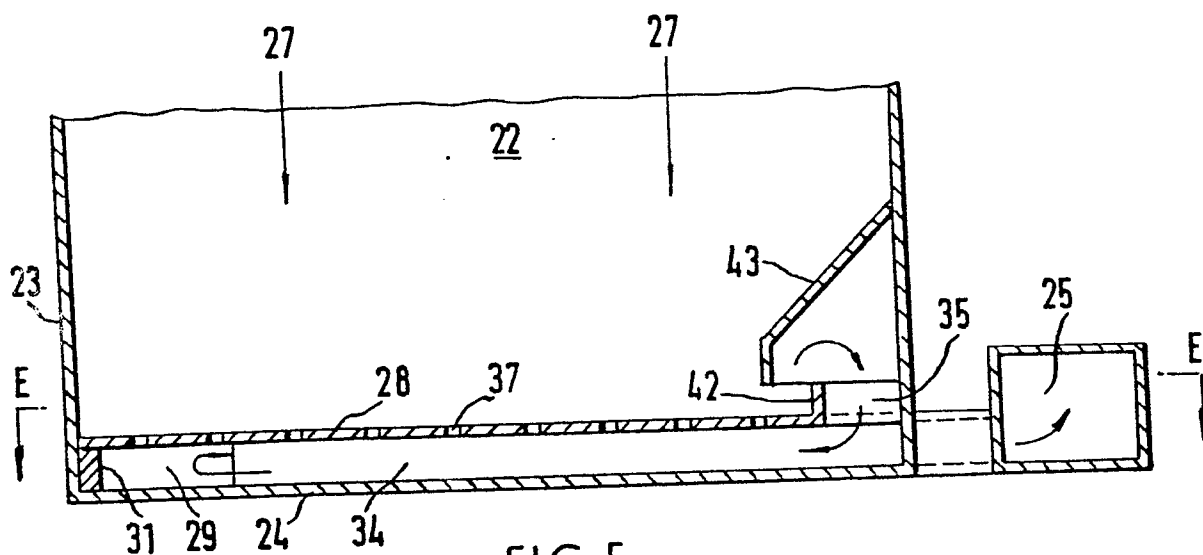


FIG. 4.



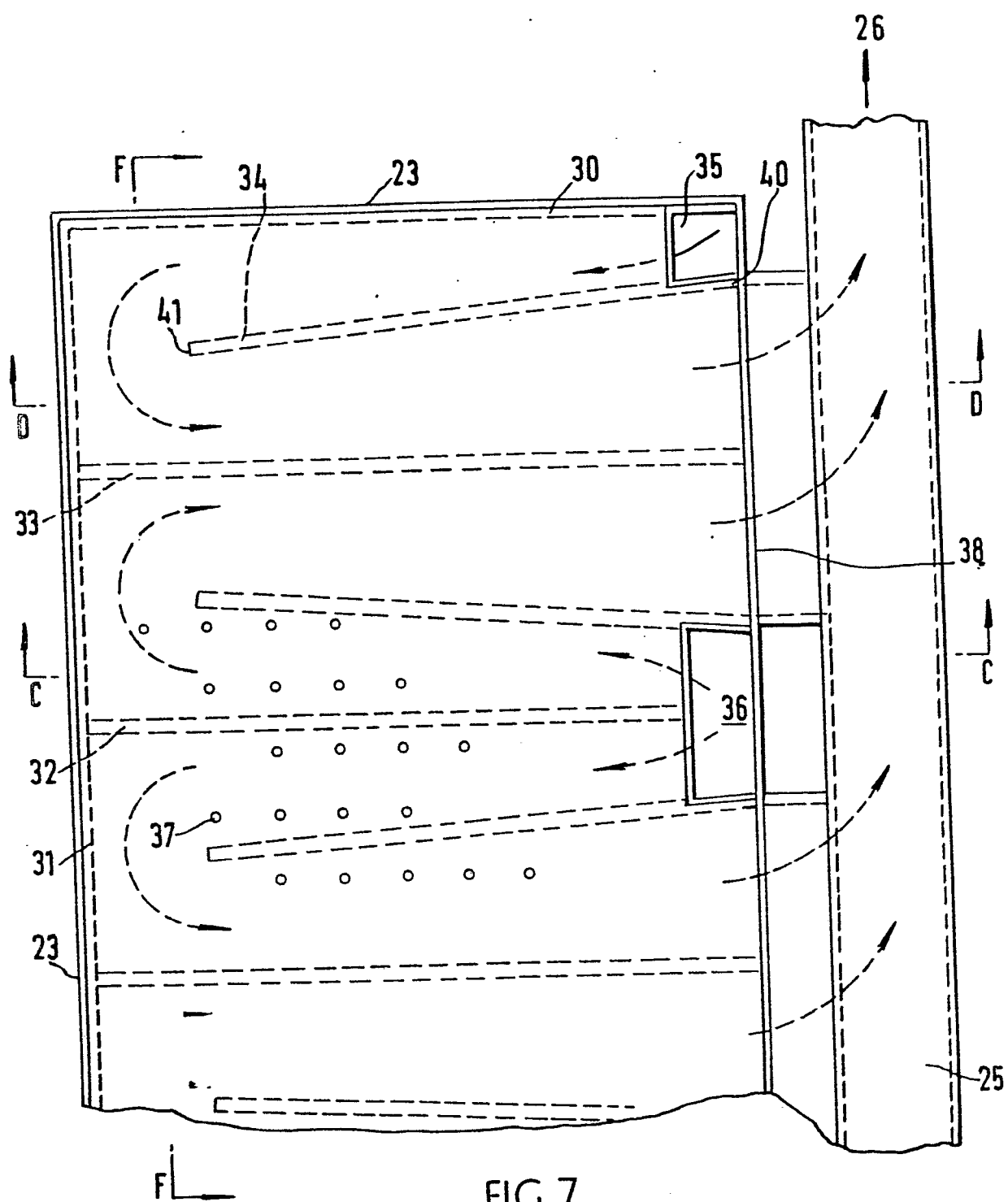
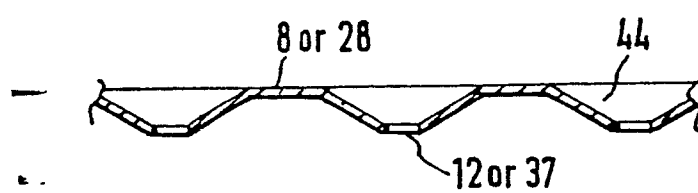
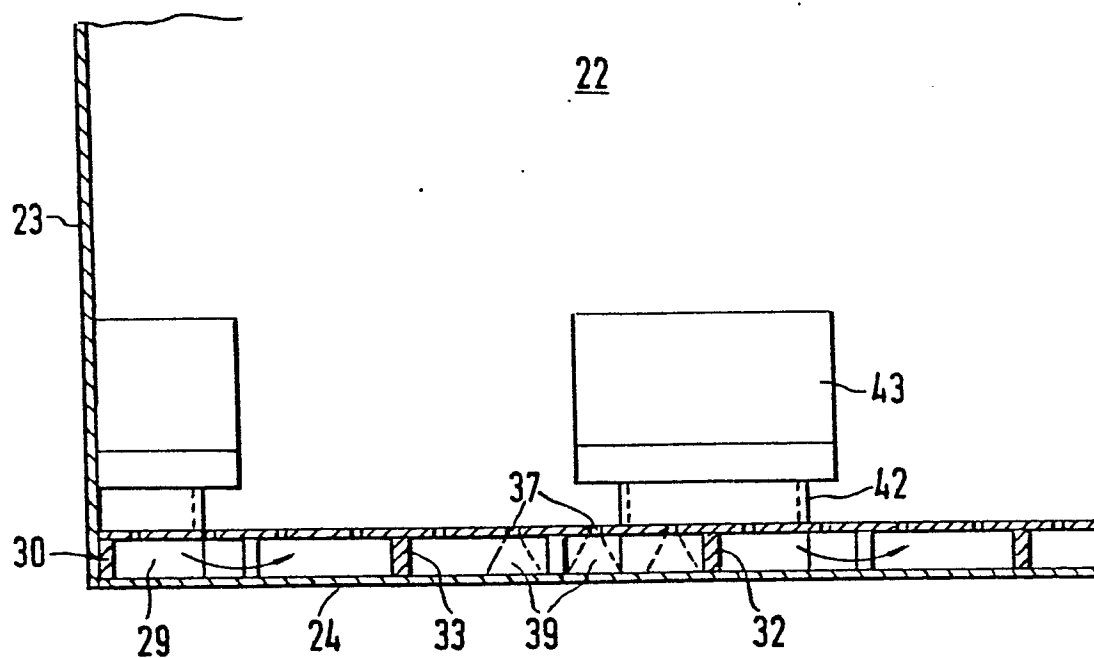


FIG. 7.





DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.) 3
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>DE - B - 1 090 134</u> (VACU-BLAST) -- <u>DE - B - 1 217 240</u> (VACU-BLAST) + Column 3, lines 26 to 39 + --	1 1,9	B 24 C 9/00
A	<u>DE - B - 2 137 058</u> (VACU-BLAST) --		
A	<u>DE - A - 2 254 458</u> (KEY ENGINEE- RING) + Page 3, lines 5 to 7 + -- <u>DE - A1 - 2 608 847</u> (HEINRICH SCHLICK) + Page 13, lines 11 to 14 and page 12, lines 5 to 13, figure 4 + --	1,5, 9 - 11	B 24 C 9/00
A	<u>DD - A - 103 184</u> (WILDGRUBE, CARL) --		
A	<u>GB - A - 934 088</u> (VACU-BLAST) --		
A	<u>GB - A - 1 449 941</u> (VACU-BLAST) -- <u>US - A - 2 912 918</u> (MEAD) + Figure 8a, 8b, 10; column 7, lines 63 to 73 + --	1,3,5	
A	<u>US - A - 3 407 719</u> (TEMPLE) --		
A	<u>US - A - 3 512 469</u> (TEMPLE) --		
☒ The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.) 3
			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
Place of search VIENNA		Date of completion of the search 13-12-1979	Examiner MIKOCKI



European Patent
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EUROPEAN SEARCH REPORT

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Application number

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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	<u>US - A - 3 657 991 (OBERG)</u> --- RECKNAGEL-SPRENGER, Taschenbuch für Heizung + Klimatechnik, 1977, R. OLDENBOURG, München-Wien, + Page 975, figures 336- 20, 336- 22, page 1318 + -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)