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(54) **APPARATUS FOR DRYING EXTENSIVE SURFACES**

VORRICHTUNG ZUM TROCKNEN VON GROSSEN FLÄCHEN

APPAREIL POUR SECHER DES SURFACES ETENDUES

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EP 0 652 998 B1

Description

This invention relates to apparatus for drying extensive surfaces.

The background to the invention will be explained in relation to a problem which occurs in a particular field, although it will be recognised that the invention is not limited to that field and may be utilised in other fields.

Road markings are laid as a hot molten thermosetting plastics compound, which includes a filler. As the compound cools it sets to a solid which is intended to adhere to the surface of the road. Unfortunately, even a very small amount of moisture on the road surface prevents the adhesion so that many working hours are lost each year while road marking gangs wait for the surface to dry.

One attempt to dry the surface involves a hollow lance with a plenum chamber at one end from which open a series of small orifices. Air under high pressure is supplied to the plenum chamber by a compressor which is readily available to a road working crew. The plenum chamber is also supplied with a fuel, e.g. propane, which is burnt in the compressed air in the chamber. The arrangement does not work very well and the apparatus produces a great deal of noise which is not acceptable to the workforce.

The reader is referred to EP-A-0 340 692, CH-A-377871 and CIVIL ENGINEERING-ASCE, vol. 39 no.2, February 1969, page 33 ("A Russian project...").

Against this background, in accordance with the invention, there is provided apparatus for drying extensive surfaces, comprising an air knife directed at the surface, the air knife comprising one or more nozzles which has or have an outlet comprising an elongate slot; means for delivering air to the nozzle(s) at a high volume flow rate and low pressure, the total cross sectional area of the nozzle(s) at its or their outlet being approximately equal to the cross sectional area of the outlet of the blower means for delivering air through which the outlet air is delivered, said apparatus either including means for transporting the entire apparatus across the surface, or being attached to a plant for treating the dried surface.

The arrangement efficiently strips water off the surface and the noise may be kept down to a level acceptable to the work force. The apparatus may be used to clear surface water from roads, or sports areas before laying tarmac or markings, or for drying pitches whether grass or synthetic. Other uses may well occur to the reader.

Despite the efficiency with which the apparatus may strip water off the surface it is possible that the surface will remain damp if treated only with the air knife and, against this possibility, a much preferred embodiment of the invention includes an arrangement to heat the air supplied to the nozzle. Surprisingly, sufficient heat can easily be provided to dry the surface completely, or sufficiently to lay road markings.

In one preferred form, the means for delivering air

to the slot includes a blower driven by a motor mounted in or on the apparatus. The blower can be a standard product. The motor may be a petrol or diesel unit.

The arrangement to heat the air preferably includes a heater comprising a chamber, a burner to burn fuel in said air in the chamber, and means mounted in or on the apparatus for storing the fuel and supplying it to the burner. Previous proposals for air knives to use heated air have used electric heaters. That may be adequate for static apparatus in a factory environment, but is not suitable for mobile apparatus which is moved across extensive surfaces, e.g. many miles of roadway preparatory to marking a line or sealing a slot or groove.

In an alternative preferred form, a jet engine constitutes both the arrangement to heat the air and also the means for delivering air to the slot.

The engine may be a fan jet.

The apparatus may be automotive or mounted on, say, wheels so that motive power is provided by a pedestrian.

Especially, but not exclusively, in the case of an automotive apparatus, means are preferably included for treating the dried surface e.g. for laying a thermosetting compound on the dried surface. The thermosetting compound may comprise tarmac or a compound for marking lines on the surface.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a side view of a first road marking machine embodying the invention;

Figure 2 is a pictorial view, partly broken away, of an arrangement of air knives of the apparatus of Figure 1;

Figure 3 is a sectional view of a heater of the apparatus of Figure 1;

Figure 4 is a cross section through an air knife of the apparatus of Figure 1

Figure 5 is a scrap view on arrow A of Figure 4;

Figure 6 is a side elevation of a second road marking machine embodying the invention;

Figure 7 is a plan view of part of burner and nozzles of the machine of figure 6; and

Figure 8 is a side elevation of a pedestrian controlled road drying machine embodying the invention

Referring to the drawings, a road marking vehicle 2 having road wheels 4, is driven by an engine 6, and is controlled by an operator seated at a position 8 where a steering wheel 10 and other controls are located. As is conventional the vehicle has a heated hopper 12 for the thermosetting compound to be laid, and a laying head 14, for example an extrusion shoe (illustrated) or a screed box. As the vehicle is driven along the road, the laying head is selectively operated to lay the compound on the road so as to provide the desired markings.

The vehicle illustrated additionally has three air

knives 20, illustrated generally in Figure 1 and more particularly in Figures 2 and 4 and 5. The air knives 20 are directed downwardly and forwardly at the road 22 ahead of the track that the laying head will follow.

Referring to Figure 2, each air knife comprises a cylinder 24 closed at each end to provide a plenum chamber 26. An outlet is provided in the form of a rectangular slot 28 between plates 30 which direct air at high volume and low pressure downwardly and forwardly at the road 22. In order to operate more effectively, the plates should be manufacture to resist distortion from the high temperatures which will be obtained by the heating arrangement to be described. In the example shown, the plates are manufacture from thick plates of high grade stainless steel and, additionally, are bridged at intervals by weld so as to maintain their spacing.

An inlet manifold 32 is provided in the form of a tapering tube to supply air to the plenum chambers. At its inlet end the manifold has a cross sectional area approximately equal to the total cross sectional area of all three slots 28. The manifold tapers towards the most forward of the air knives so that at its most forward end, it has a cross sectional area approximately equal to the area of the slot of that air knife. At the intermediate air knife the manifold has a cross sectional area approximately equal to the area of the outlet slots of two air knives.

The air knives 20 are mounted in a frame 40 which is supported above the road by four castors 42 so that the air knives are positioned a predetermined distance from the road surface. The frame 40 is attached to the vehicle by arms 44 pivotally connected at one end to the vehicle (not shown) and at the other 46 to the frame. The air knives are thus moved along the road by the vehicle ahead of the laying head.

The manifold inlet 34 is connected via a heater 54, and a flexible pipe 52 to the outlet of a blower unit 56. The cross sectional areas of the pipe 52, and thus the manifold inlet 34 and the total area of the slots 28, are chosen each to approximately equal the cross sectional area of the outlet 58 of the blower 56. The blower is driven by a petrol engine 60, the two being mounted on a platform 62 attached to the vehicle.

A cross section of the heater is shown in Figure 3. The heater has a chamber 70 which expands from an inlet 72, which has a cross sectional area equal to that of the pipe 52, to a larger cross sectional area in which a burner 74 is mounted by a perforated conical support 76. Propane, or in other examples other fuel, is supplied to the burner from a container 78 mounted at the rear of the vehicle. The fuel is ignited by a spark plug 80. A flame failure device including a sensor 82 operates to cut the fuel supply if the temperature drops indicating the flame has gone out.

At its outlet 84 the chamber 70 reduces in cross sectional area to match that of the inlet to the manifold 32.

Operation of the engine 60 to drive the blower 56 produces a high volume flow of low pressure air at the air knives 20 distinct, say, from the low volume high

pressure air supply which is provided by a compressor. The air knives will clear loose water from the road as the vehicle is driven at a surprisingly high rate. Without operation of the heater the road would remain damp, although free of loose water, and prevent the adhesion of road marking compound. The drying apparatus may have utility in other applications, however. One example is to clear loose water from, say, a sports pitch or race track. Operation also of the heater will dry the surface more or less completely: sufficient to allow road markings to be laid. In one example we found the temperature of the air at the outlets of the air knives to be about 750°C.

Another example is illustrated in part in Figures 6 and 7. Here the main difference is an improved burner 74. this is in the form of a ring burner from which we have obtained a temperature at the outlets of the air knives of about 900°C.

In other examples, the low pressure high volume air could be both provided and heated by a fan jet.

In yet other examples, the apparatus may be controlled by, or pushed by, a pedestrian operator. Such an arrangement is illustrated in Figure 8. Here the primary function of the apparatus is to dry the surface, e.g. the road 22. Subsequent treatment of the surface, e.g. marking with a line, sealing a slot or groove, laying tar-mac etc, would be carried out separately by hand or by another machine not illustrated.

The apparatus is mobile, having a tubular chassis 100 supported on a pair of wheels 102, rotatable about a common axis, and a pair of castor wheels 104. The burner 54, pipe 52, blower 56, engine 60 and gas supply 78 are mounted on the chassis 100 and are similar to those of Figure 1, except that the engine is gas fuelled from the same supply 78 as the burner. The specific arrangement of air knives is different in that a manifold 106 feeds heated air to two air knives 20 mounted one behind the other.

Other pedestrian control apparatus (not illustrated) may be automotive and/or may include equipment for treating the surface, e.g. for making a road with lines.

Claims

1. Apparatus for drying extensive surfaces, comprising an air knife directed at the surface, the air knife comprising one or more nozzles which has or have an outlet comprising an elongate slot; means for delivering air to the nozzle(s) at a high volume flow rate and low pressure, the total cross sectional area of the nozzle(s) at its or their outlet being approximately equal to the cross sectional area of the outlet of the blower means for delivering air through which the outlet air is delivered, said apparatus either including means for transporting the entire apparatus across the surface, or being attached to a plant for treating the dried surface.

2. Apparatus as claimed in claim 1, including an arrangement to heat the air supplied to the nozzle.
3. Apparatus as claimed in claim 1 or 2, wherein the means for delivering air to the slot includes a blower driven by a motor mounted in or on the apparatus or plant.
4. Apparatus as claimed in claim 2 or 3, wherein the arrangement to heat the air includes a heater comprising a chamber, a burner arranged to burn fuel in said air in the chamber, and including means mounted in or on the apparatus for storing the fuel and supplying it to the burner.
5. Apparatus as claimed in claim 2, wherein a jet engine constitutes both the arrangement to heat the air and also the means for delivering air to the slot.
6. Apparatus as claimed in claim 5, wherein the engine is a fan jet.
7. Apparatus as claimed in any preceding claim, wherein the or each air knife comprises a plenum chamber from which the outlet extends.
8. Apparatus as claimed in any preceding claim, when the apparatus is attached to said plant, wherein said plant includes means for laying a thermosetting compound on the dried surface.
9. Apparatus as claimed in claim 8, wherein the thermosetting compound comprises a rubberised filled bitumen product or a compound for marking lines on the surface.
10. Apparatus as claimed in any preceding claim, wherein the apparatus is automotive.

Patentansprüche

1. Vorrichtung zum Trocknen von großen Flächen, mit einem auf die Oberfläche gerichteten Luftmesser, wobei das Luftmesser eine oder mehrere Düsen enthält, welche einen Auslaß mit einem länglichen Schlitz aufweist oder aufweisen; Mitteln zum Zuführen von Luft zu der/den Düse(n) mit einer hohen Volumenflußrate und niedrigem Druck, wobei die gesamte Querschnittsfläche der Düse(n) an ihrem Auslaß oder ihren Auslässen etwa gleich der Querschnittsfläche des Auslasses der Gebläsemittel zum Zuführen der Luft ist, durch welche die Auslaßluft zugeführt wird, wobei die Vorrichtung entweder Mittel zum Transportieren der gesamten Vorrichtung über die Oberfläche enthält oder an einer Einrichtung zur Behandlung der getrockneten Oberfläche angebracht ist.

2. Vorrichtung nach Anspruch 1, gekennzeichnet durch eine Anordnung zum Heizen der der Düse zugeführten Luft.
3. Vorrichtung nach den Ansprüchen 1 oder 2, dadurch gekennzeichnet, daß die Mittel zum Zuführen der Luft zu dem Schlitz ein Gebläse einschließen, angetrieben durch einen Motor, welcher in oder auf der Vorrichtung oder der technischen Einrichtung montiert ist.
4. Vorrichtung nach den Ansprüchen 2 oder 3, dadurch gekennzeichnet, daß die Anordnung zum Heizen der Luft einschließt eine Heizung mit einer Kammer, einem Brenner, welcher ausgebildet ist, Brennstoff in der Luft in der Kammer zu verbrennen, und Mittel einschließt, die in oder auf der Vorrichtung zum Speichern des Brennstoffes montiert sind und diesen dem Brenner zuführen.
5. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß ein Strahlmotor sowohl die Anordnung zum Heizen der Luft als auch die Mittel zum Zuführen der Luft zu dem Schlitz bildet.
6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß der Motor ein Gebläsestrahl ist.
7. Vorrichtung nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß das oder jedes Luftmesser eine Verteilerkammer enthält, von der sich der Auslaß erstreckt.
8. Vorrichtung nach einem der vorstehenden Ansprüche, wenn die Vorrichtung an der Anlage angebracht ist, dadurch gekennzeichnet, daß die Anlage Mittel einschließt zum Aufbringen einer Heißfixierverbindung auf die getrocknete Oberfläche.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß die Heißfixierverbindung ein gummiertes, gefülltes Bitumenprodukt oder eine Verbindung zum Markieren von Linien auf der Oberfläche ist.
10. Vorrichtung nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Vorrichtung einen Eigenantrieb aufweist.

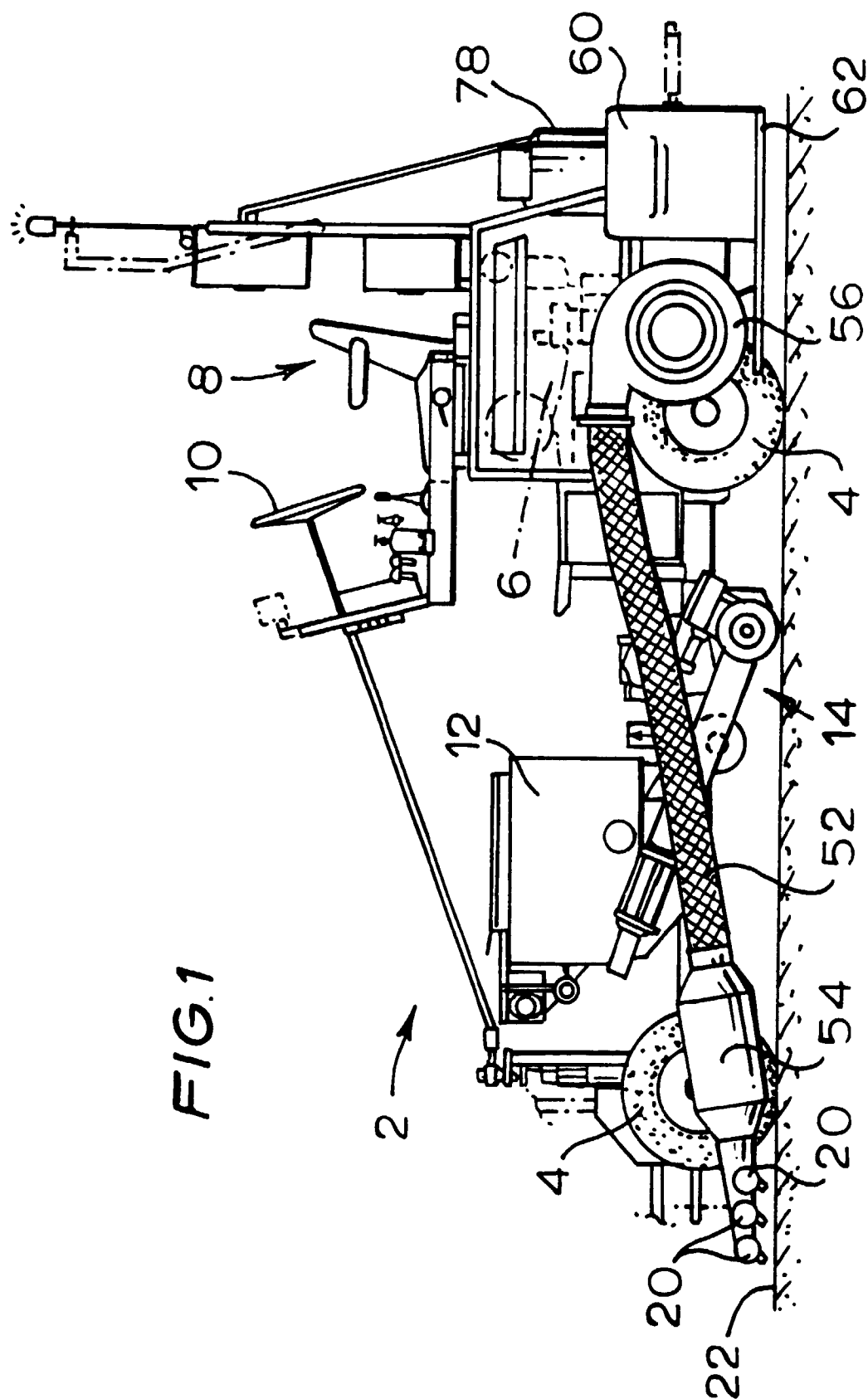
Revendications

1. Appareil pour sécher des surfaces étendues, com-

prenant une lame d'air orientée vers la surface, la lame d'air comprenant une ou plusieurs buses, qui a ou ont une sortie se présentant sous la forme d'une fente allongée; des moyens destinés à fournir de l'air à la (aux) buse(s) sous un grand débit et une faible pression, la surface de section transversale totale de la (des) buse(s) au niveau de sa ou de leur (s) sortie(s) étant approximativement égale à la surface de section transversale de la sortie des moyens formant soufflante de fourniture d'air, par l'intermédiaire desquels l'air de sortie est fourni, ledit appareil soit comprenant des moyens destinés à transporter l'appareil au complet d'un bout à l'autre de la surface, soit étant fixé à une installation destinée à traiter la surface séchée.

teur.

2. Dispositif selon la revendication 1, comprenant un agencement destiné à chauffer l'air fourni à la buse.
3. Appareil selon la revendication 1 ou 2, dans lequel les moyens destinés à envoyer l'air dans la fente comprennent une soufflante entraînée par un moteur montés dans ou sur l'appareil ou l'installation.
4. Appareil selon la revendication 2 ou 3, dans lequel l'agencement destiné à chauffer l'air comprend un dispositif de chauffe se composant d'une chambre, d'un brûleur agencé pour brûler du combustible dans ledit air dans la chambre, et comprenant des moyens montés dans ou sur l'appareil pour stocker le combustible et le fournir au brûleur.
5. Appareil selon la revendication 2, dans lequel un moteur à réaction constitue à la fois l'agencement destiné à chauffer l'air et également les moyens pour envoyer l'air vers la fente.
6. Appareil selon la revendication 3, dans lequel le moteur est un turbo-réacteur.
7. Appareil selon l'une quelconque des revendications qui précèdent, dans lequel la ou chaque lame d'air comprend une chambre de surpression à partir de laquelle la sortie s'étend.
8. Appareil selon l'une quelconque des revendications qui précèdent, lorsque l'appareil est fixé sur ladite installation, dans lequel ladite installation comprend des moyens destinés à appliquer un composé thermomodurcissable sur une surface séchée.
9. Appareil selon la revendication 8, dans lequel le composé thermomodurcissable consiste en un produit bitumineux chargé caoutchouté ou un composé pour tracer des lignes sur la surface.
10. Appareil selon l'une quelconque des revendications qui précèdent, dans lequel l'appareil est automo-



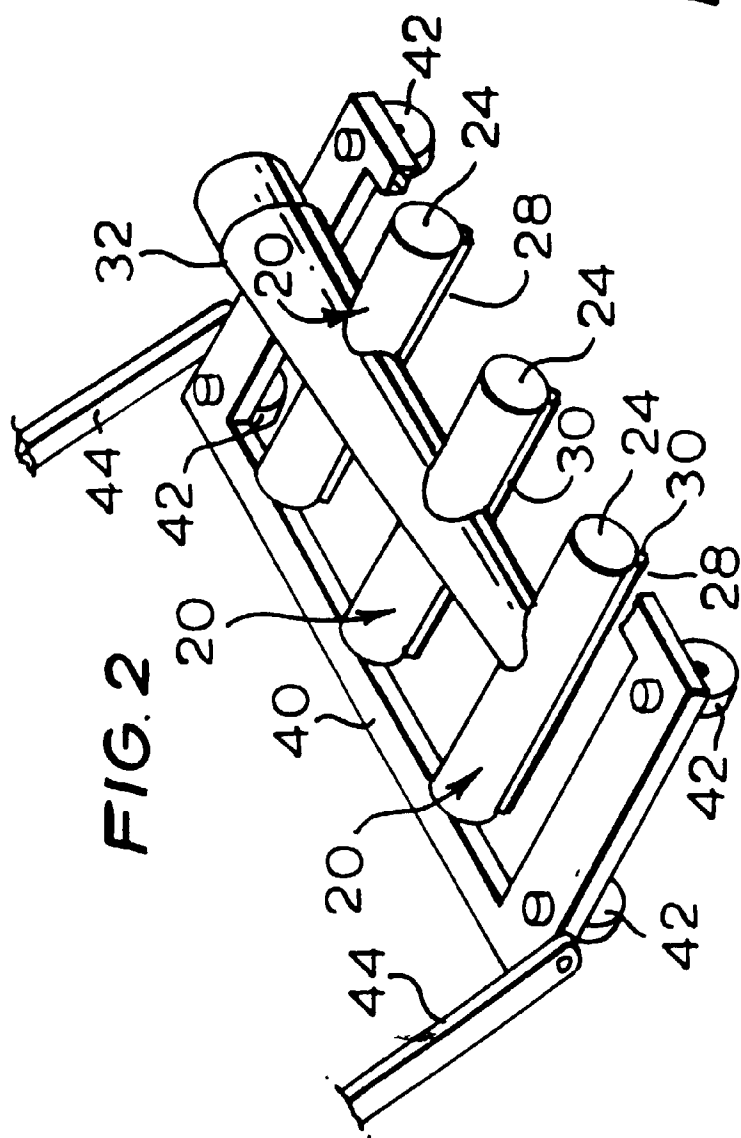


FIG. 4

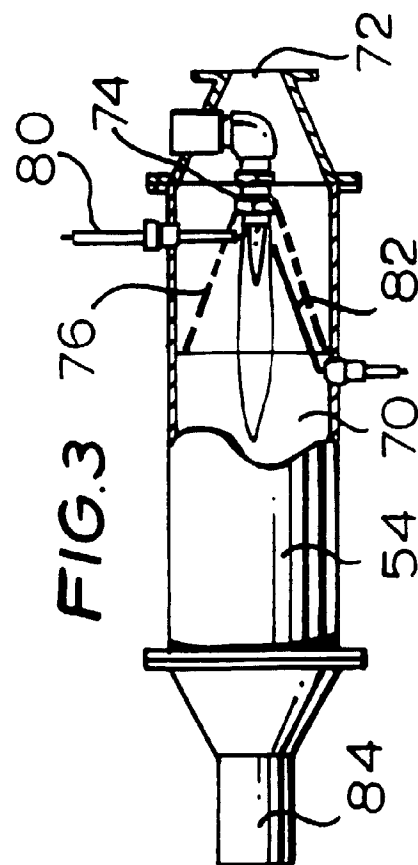
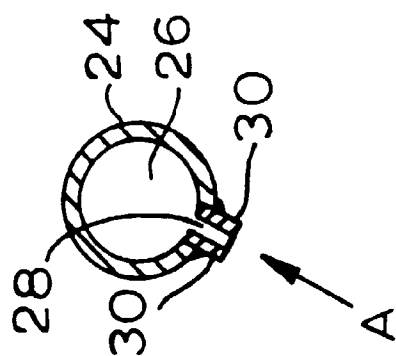


FIG. 5

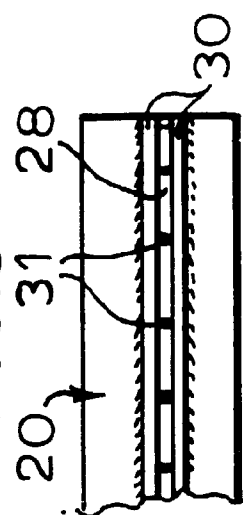


FIG. 7

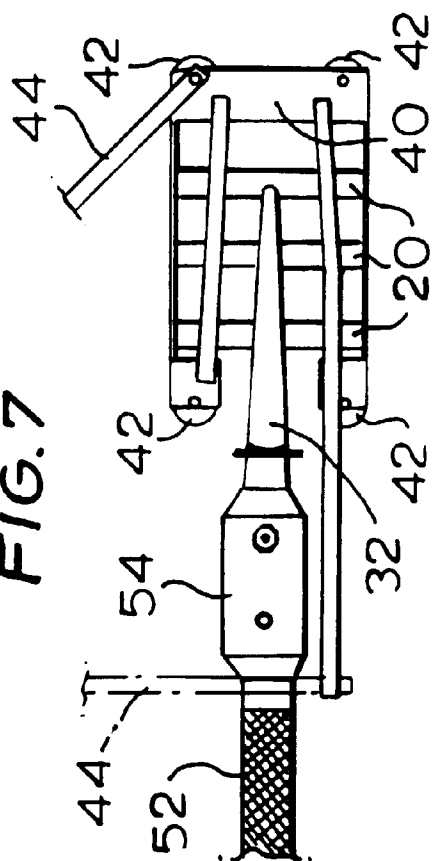


FIG. 6

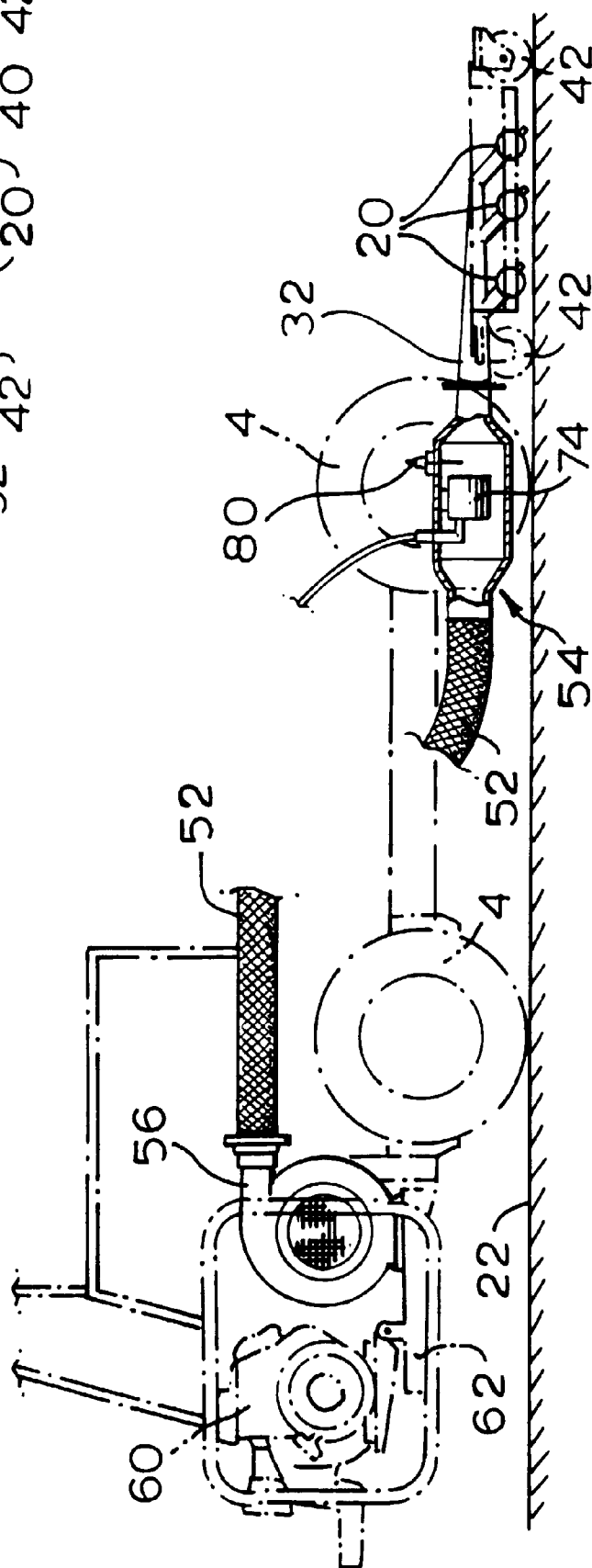


FIG. 8

