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(54) Improvements relating to distributing devices for granular material

(57) The present invention provides that a spinner disc (40) of the type which is carrier by a vehicle and is for spreading salt on roads to keep them free of snow and ice, is designed to direct the salt, as it is propelled from the spinner disc, in a downwards direction so that it will not impact on the side body work of passing vehicles. To achieve this the vanes (52) on the spinner disc (40) have along their upper edges (54) which incline in a downwards manner in a direction from the centre to the periphery of the dics, turned over portions which are also so inclined. These turned over portions (54) catch the material (M) which is centrifugally propelled by the vanes (52) and direct it in a downwards direction as it leaves the spinner disc (40). Additionally, the vanes (52) at their inner edges project through an aperture (41) in the centre of the disc (40) and form fan blades (43) by which air is drawn onto the upper surface of the disc (40) to assist in propelling the material (M) from the disc (40).

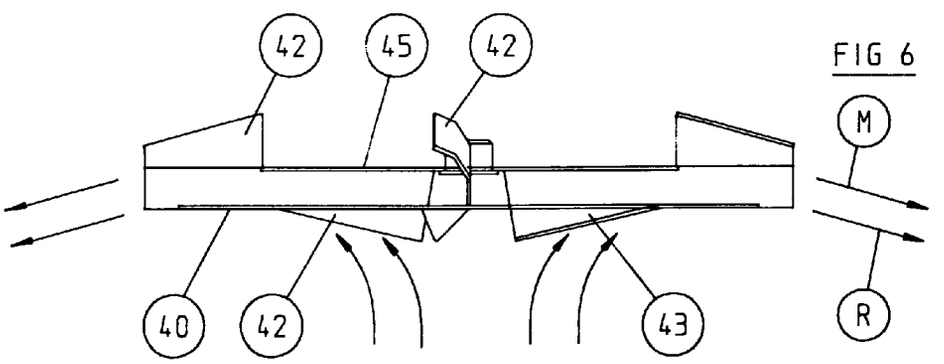

FIG 6

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Description

This invention relates to distributing or spreading devices of the type used mainly on gritting vehicles, for the spreading of granular and/or particulate material on road, motorway and street surfaces.

Mainly, the material which is spread by the vehicle is a salt which can melt snow or ice or can prevent the formation of ice on the road surface.

Gritting vehicles having spreading devices including spinners which spread salt material, are of course well known, and such spinners usually comprise a disc which is essentially flat but lies in a horizontal plane, and is adapted to be rotated at high speed. The disc has vanes which extend outwardly from a smaller radius of the disc to a larger radius, typically at the outer edge of the disc. The vanes may be straight and radial, or straight and angled to the radial direction, or they may be curved in the nature of spirals relative to the radial direction.

The granular material is dropped onto the upper surface of the disc, and is engaged by the vanes, and is propelled by a centrifugal action outwardly of the disc and across the road surface. The distance which the material travels is according to granular composition, weight and size of the granules as well as the speed of the disc. The spread or angular extent over which the material is thrown, and the position from which the material exits the disc, can be controlled by various means including varying where the granular material is deposited on the spreading disc, and by the use of gates and cover plates and the like.

Conventionally, spinner discs are designed so that the material should be propelled horizontally or even upwardly from the disc in order to achieve maximum throw of the granular material across the road surface, whereby a single gritting vehicle can spread the granular material over a road surface several times the width of the vehicle. Typically, if a road surface has a width of 12 metres, the gritting vehicle say having a width of two to three metres would be adapted to spread the material over a width of the order of 8 to 12 metres. Obviously, the greater the spinner speed, the greater the distance the material will be thrown, and as a rough rule, for every 100 r.p.m. of spinner speed, the material is thrown one metre from the vehicle.

The problem with the known spreading devices and associated spinner discs is that if, whilst the gritting vehicle is operating, another vehicle passes it, or it passes a another vehicle travelling in the opposite direction, the granular material, especially hard rock salt, is propelled fiercely against the side of the vehicle or against the vehicle's headlights, sidelights and windscreen, and indeed can cause damage thereto. and drivers of such vehicles do register complaints about gritting vehicles because of this effect.

When it is desired that the granular material should be propelled to a greater extent across the road surface, it has been known to make the spinner disc of inverted conical form so that as the material leaves the spinning disc it flies upwardly at least initially.

There have been other designs of spinner disc, for example as set forth in United States Patent No. 4157150 and European Patent Application No. 0213370 wherein the vanes of the spinner disc have retention edges which are set out of the vertical and also incline downwardly, so that when the granular material is engaged by the vanes and is propelled thereby as a result of spinning of the disc, the material is not only thrown outwardly, but also is thrown downwardly and will tend to be propelled under passing vehicles.

It is also known from French Patent No. 1453355 and United Kingdom Patent No. 1133134 to provide with a spreading spinner a means creating a flow of air to assist the propulsion of the material from the spinner.

The present invention seeks to provide spreading apparatus comprising a novel form of spinner disc whereby the undesirable effect of impacting of the granular material against passing vehicle sides is obviated or mitigated and the disc is designed to embody an air conveying system to assist the propulsion of the material from the disc.

In accordance with the invention, a spreading device comprises a spinner disc for distributing granular material and of which disc, the vanes have upper retention edges, which are not only inclined downwards relative to the horizontal towards the outer edge of the disc, but also lie, when the disc is in use, out of the vertical, in order to form a means for catching the granular material and propelling it not only in an outwards direction, but also in a downwards direction so that at least some of the material is directed under passing vehicles, characterised in that the disc has a central aperture therein which is covered on the top side of the disc by an auxiliary plate, which is of lesser diameter than the disc, but spaced therefrom by inner portions of the vanes.

The said edges may be formed on parts of the vanes which are removably connected to the reminder of the vanes.

The disc may be a flat plate having the vanes mounted on the top surface thereof.

With this construction according to the invention, there are gaps between the vane inner portions and the disc and auxiliary plate, and in a particularly advantageous arrangement, the vane inner portions extend inwardly beyond the edge of said aperture and are curved or bent relative to the radial direction, so that the said inner portions of the vanes and the disc and the auxiliary plate form a spiral blower arrangement, so that as the spinner rotates, air is drawn from the atmosphere by the vanes through the aperture and is propelled through the gaps and provides a carrier air stream for the granular material, in particular the smaller particle material, which is thereby given greater momentum and will carry over a greater distance

The said inner portions beyond the aperture may

extend to a position below the disc to further enhance the blower effect.

The vanes may be one or two piece plates of which the upper edges are turned over to lie out of the vertical and form the catching and propelling means.

The invention provides the advantage that the granular material is propelled downwards and outwards, with the assistance of the air flow. Therefore, rather than striking the sides of passing vehicles, the material will tend to strike the ground under the vehicles, and the speed of propulsion of the granular material can be such that the granular material will bounce and then be propelled over the road surface so that the same distribution effect can still be achieved but with the granular material flying at a much lower level and appropriately under vehicles which pass the gritting vehicle.

In tests, using a distributing apparatus according to the invention, and setting the angle of the vane retention edges at 17° to the horizontal, causes the material to exit from the spinner at an angle of 9°, the spinner speed being in the order of 500 r.p.m.

The spreading device according to the invention is mounted and operates in a manner similar to the conventional spreading device. Provision is made to enable the material to be dropped onto the spinner at the appropriate and variable position for the required spread pattern.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, wherein:-

Figs 1, 2 and 3 respectively are views of three conventional spreading devices;

Fig 4 shows an embodiment of a spreading device according to the invention;

Fig. 5 shows another embodiment of a spreading device according to the invention;

Fig. 6 shows the embodiment of Fig. 5 in side view;

Fig. 7 is a side view of another embodiment of the invention;

Fig. 8 is a perspective view of one of the vanes of the spinner according to the invention; and

Fig. 9 shows the spreader of Fig. 6 in simplified view to illustrate the operation of same.

Conventionally, a gritting vehicle has a hopper for the receipt of the material to be spread, and the material is charged into the hopper through its open top. The vehicle has a wheeled chassis, on which the hopper is supported.

Typically, the hopper is of V-shaped section in a direction transverse to the fore and aft direction of the vehicle and has a rear plate.

Inside the hopper is a material feeder in the form of a conveyor which feeds the material, which gravitates down the sides of the hopper, to the rear of the vehicle and through an opening in the rear of the hopper, and thereby it is charged in a controlled manner into a chute or a series of chutes, and eventually into a deflector chute by which it is directed onto a substantially horizontal spinner disc. The disc is provided as is conventional with vanes and it is adapted to be rotated about a vertical axis.

In use the spinner disc is rotated whilst the vehicle is moving and thereby the material is spread onto, for example, a road surface, for the purposes set forth herein.

The knowledge concerning the position of deposition of the material on the disc to give particular spread patterns, is well known and will not be discussed further herein, but the chute can be adjusted to vary this deposition. Also, the relationship between disc speed and distance of throw of the material is well known.

The present invention concerns the design of the spinner disc, and several embodiments of the invention will now be described with reference to the drawings.

Three conventional forms of spinner disc for spreading granular/particulate material are shown respectively in Figs. 1, 2 and 3. The disc D shown in Fig. 1 is a flat plate with the vanes K on the upper surface. The vanes are flat plates arranged in radial directions relative to the disc D and they are equally spaced around the disc D. They extend from the outer edge of the disc D to a position short of the centre of the disc D as shown. The disc drive shaft A is vertical or substantially so, and the disc D is horizontal.

The chute J which is position adjustable controls the feed of material M onto the upper surface of the spinner disc D, and it is discharged onto the disc D to give the required spread width or pattern P.

Another known form of spinner disc D is shown in Fig. 2, and it comprises a disc D of inverted conical form, again with vanes K, whereby the material M when deposited on the spinning disc D is projected from the disc D as shown in an upwards manner to achieve a greater distance of spread. Such spreading devices are however only used to spread fertiliser on agricultural land, as the material is thrown much too high for such devices to be used on highways.

Some road spreading devices have been used to control the throw of the material when it leaves the spinner, so that the material is not thrown at too high a level, and one example which is a disc D as shown in Fig. 1, with a modification, is illustrated in Fig. 3. In this arrangement, the disc D is provided with a stationary deflector plate L which is located above the disc D, and has a down turned rim R which as shown deflects the material M, leaving the spinner disc D, in a downwards direction. Unfortunately, this spreading device exhibits a serious disadvantage when used in icy or snowy condi-

tions in that the downwards deflected material (road salt) tends to concentrate in a narrow width and by melting the snow or ice to form a rut Q in the snow or ice, extending along the highway, and this rut makes it difficult for vehicles, and bicycles, travelling along the highway, to steer effectively.

It is also known to provide the vanes of the spinner disc with upper edges which are displaced out of the vertical, and this has the effect of throwing the material in a downwards direction from the disc, so that the material will pass under passing vehicles.

The invention adopts this feature as the spinner of the present invention seeks to provide an arrangement which enables the better spreading of road treatment material whilst protecting passing vehicles from damage from the flight of the material through the air, but which also achieves sufficient propulsion of the material to cover a wide area.

Fig. 4 shows a spinner disc according to an embodiment of the present invention.

The disc comprises a flat disc plate 30 on which are provided vanes 32 which perform the function of not only throwing the material outwards but also downwards from the spinner as it rotates as indicated by the reference M. To achieve this, the vanes are of tapering, reducing height in the direction from the centre of the disc 30 to the outer edge, so that the upper edges 34 of the vanes 32, which are also turned out of the vertical, are downwardly inclined in a radial outwards direction. They will therefore perform as described.

Additionally, there is an auxiliary plate 36 to which the inner ends of the vanes 32 are attached and the plate 36 is spaced vertically from the plate 30 and lies centrally in relation thereto. The plate 36, which is circular lies over a central aperture in the main plate 30. This central aperture results in that an air suction effect is generated, especially if the inner ends of the vanes are made spiral, and a flow of air which flows radially of the spinner intermingles with the flow of granular material and enhances the discharge of that material as described more fully hereinafter.

Yet another form of spinner disc according to the invention is shown in Figs. 5 and 6. In fact this disc, referenced 40 is similar to the disc shown in Fig. 4, except that the vanes 42 are extended as shown at 44 to a position further inwards to overlie the aperture 41 in the disc 40, as shown in Figs 5 and 6, and these vane ends are curved out of the plane of the vanes as shown at 43 to form blower blades. Additionally, as shown in Fig. 6, the vane ends also extend downwards through the aperture 41. By this means the vanes 42, at least at the inner ends, form the blower blades 43, and draw in air through the aperture 41, up onto the upper surface of the disc and outwardly of disc 40 as the disc is rotated in use. This air is then pumped by the vanes 42 (which may be curved for pumping throughout part of all of their lengths) radially outwards between the disc 40 and the upper plate 45 so as to form a radially moving curtain of air R under the material M as it is discharged from the disc 40. This air mixes with the material, especially the finer particles of the material, and enhances the spread width without increasing the spinner speed.

Most de-icing materials to be spread are made up of granular particles which are of different sizes, ranging from powder or fines to a granular size in the order of 10mm. The most popular material has a size range of up to 6mm, and the highest proportion is in the smaller granule size. When the gritting vehicle is travelling at speed, a considerable turbulence is created behind the vehicle and relatively light weight powder or fines may be caught in this turbulence, with the result that they are not spread as effectively as they should.

With the spinner of Figs 5 and 6 however, the added air flow overcomes this difficulty and assists the centrifugal force on the powder and fines to ensure that these parts of the material are effectively thrown and carried across the surface to be treated.

The use of a large diameter lower disc and a small diameter upper disc as shown in Fig. 6 provides further advantage in that a greater range of spread widths can be achieved, by depositing the material on the spinner at different radii, as explained in more detail in relation to Fig. 9, after the description of the modified spinner of Fig. 7.

The modified form of spinner as shown in Fig. 7 provides that the vanes 50 are in two parts 52 and 54, of which part 54 is removably connected to, and may be angularly adjustable on, the part 52, and can be fixed in any position to which it is adjusted. The part 54 has the downwardly extending vane edge 56 by which the material is projected downwards as explained herein, but now by virtue of this embodiment of the invention, the vane can be removed when worn, and in the preferred arrangement, the angle of discharge of the material from the spinner can be adjusted. The spinner of Fig. 7 is otherwise identical to that shown in Fig. 6.

Fig. 8 is included to show one of the vane constructions which could be adopted in the Fig. 6 or Fig. 7 arrangement. As shown each vane comprises the said two parts namely a vane arm 52 and a vane wear plate 54 connected to arm 52 by bolts 55. The arm is basically a flat strip which lies between the disc 40 and the plate 45, the edges of the strip being notched as at 31, 33 and 35 to receive the disc and plate.

At its inner end, the strip 52 has an extension 47 which is bent along lines 47A and 47B so that the extension 47 forms the air blade 43 referred to herein. Arrow 49 indicates the direction of rotation of the spinner, and so it will be seen that the blade scoops the air into the spinner and ejects it along the vane, also as set forth herein.

At its outer end, the strip has the vane wear plate 54 on which the throwing edge is formed by bending the plate 54 in several steps in the direction of rotation of the spinner. As the blade catches the air, so the wear plate catches the material which is fed to the spinner, to

achieve the mode of operation herein set forth.

Fig. 9 is a diagram showing how in using a spinner as shown in Fig. 6 or 7, the material can be directed at the spinner disc from a number of directions 60 to 68, which in conjunction with the spinner design of upper and lower plates 40 and 45, enables the spreading of the material over a wide spread range.

For narrower, asymmetric spread widths, the material will be deposited on the top plate 45 at the positions 60, 62 and 64, and will be ejected downwards as shown by the arrow 74. When material is deposited at positions 66, 68 it misses the top plate 45, and lands on the disc 40, and it is ejected in fact in a horizontal direction as indicated by arrow 72. If the material is applied in a mixture of these patterns, the ejected material will be a mix of flows and the spread pattern will be a combination of granules being ejected at an angle (arrow 74) and horizontally (arrow 72). The air flow which is induced, (arrow 70) from the centre to the outside of the spinner, assists in propelling the powder or fines of the material in a horizontal ejection direction causing them to be carried further than they might otherwise be carried.

Consequently, the popular material of up to 6mm particle size can still be spread effectively over a wide spread width, with the powder or fines being carried away from the turbulence behind the vehicle by the induced air flow.

The spinners according to the invention can and will be provided with the usual other components commonly used with spinner discs. For example, there may be adjustable blanking plates for controlling where the material exits from the disc, and a hood may be provided for preventing the material from escaping in an undesired direction.

By directing the granular material to be spread on the road surface at a downwardly inclined angle as provided for by the present invention in combination with an induced air flow, so the heavy material impinges on the road surface and then bounces further outwardly so that the desired degree of spreading is achieved, with the advantage that the granular material is propelled to the underside of vehicles passing or being passed, in either direction, as opposed to striking the sides of such vehicles as happens in connection with the conventional equipment. At the same time, the air flow ensures that the fines and smaller particles are carried outwardly by the air flow.

Modifications may be made without departing from the scope of the invention. For example the vanes may be lengthened or shortened. The catching and propelling edges may be provided on only some of the vanes if a mix of spreading directions are required. The catching and propelling edges may be formed on the insides of closed vanes in the form of closed channels, and other arrangements are possible. For example, the catching and propelling edges may be defined by a single conical plate which is attached to the upright vane portions of the vanes.

The disc can be driven by mechanical, hydraulic or electrical means. The disc speed can be varied, and the drive arrangement could be such that the disc could be rotated in contra direction if required. In that case, the single conical plate may be used, or the vanes may have additional edges to ensure the downwards throwing of the material when the disc is contra-rotating, or else the contra-rotation may be used when the disc is operating in more of a conventional manner, for example when the road is closed to other vehicles, or is very quiet.

Claims

1. A spreading device comprising a vaned spinner disc (40) for distributing granular material (M) and of which disc (40), the vanes (52) have means (54) defining upper retention edges, which are not only inclined downwards relative to the horizontal towards the outer edge of the disc (40), but also lie, when the disc (40) is in use, out of the vertical, in order to provide that the granular material (M) is caught and propelled not only in an outwards direction, but also in a downwards direction so that at least some of the material (M) is directed under passing vehicles, characterised in that the disc (40) has a central aperture (41) therein which is covered on the top side of the disc by an auxiliary plate (45), which is of lessor diameter then the disc (40), but is spaced therefrom by inner portions of the vanes (52).

2. A spreading device according to claim 1, wherein said edges (54) are formed on parts of the vanes (52) which are angularly adjustable relative to the remainder so that the angle at which the material (M) is ejected from the spreader is adjustable.

3. A spreading device according to claim 1 or 2, wherein the disc (40) is a flat plate having the vanes (52) mounted on the top surface thereof.

4. A spreading device according to any of claims 1,2 and 3, wherein the vane inner portions (43) extend inwardly beyond the edge of said aperture (41) and are spiral curved relative to the radial direction, so that the said inner portions (43) of the vanes (52) and the disc (40) and the auxiliary plate (45) form a spiral blower arrangement.

5. A spreading device according to any preceding claim, wherein the said inner portions (43) beyond the aperture curve to a position below the disc (45) to further enhance the blower effect.

6. A spreading device according to any preceding claim, wherein the vanes (52) are one or two piece plates of which the upper edges are turned over to

lie out of the vertical and form the catching and propelling means.

7. A spreading device according to any preceding claim, wherein the vane retention edges (54) are at 17° to the horizontal, and the spreading device is adapted to operate at a spinner speed in the order of 500 r.p.m.

8. A vehicle for spreading material on road surfaces including a spreading device according to any one of the preceding claims.

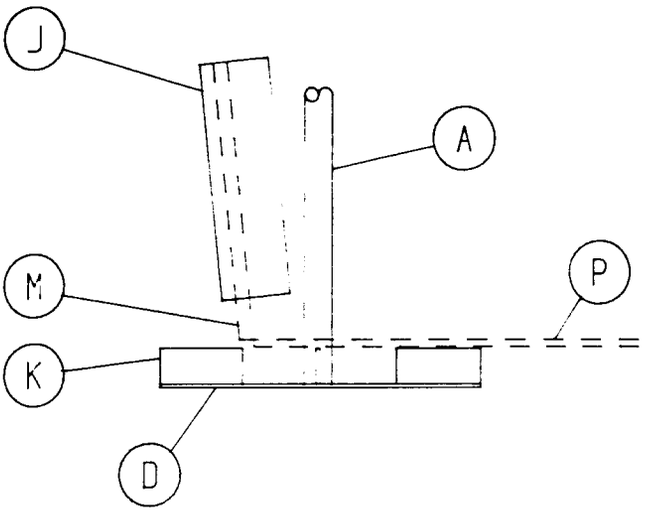

FIG 1

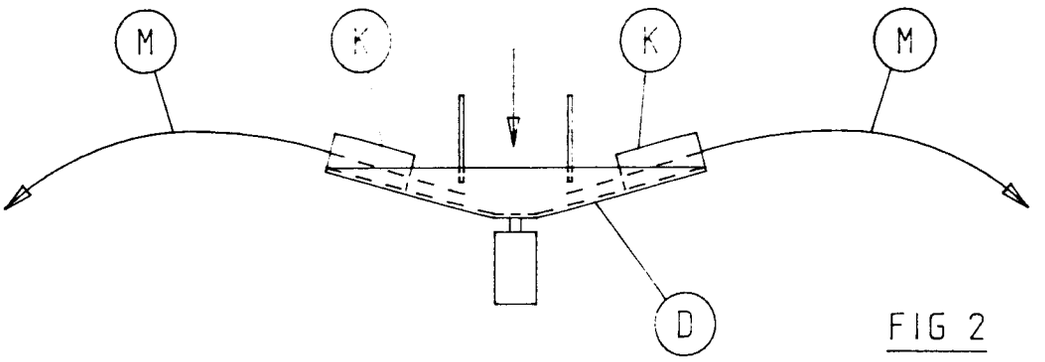

FIG 2

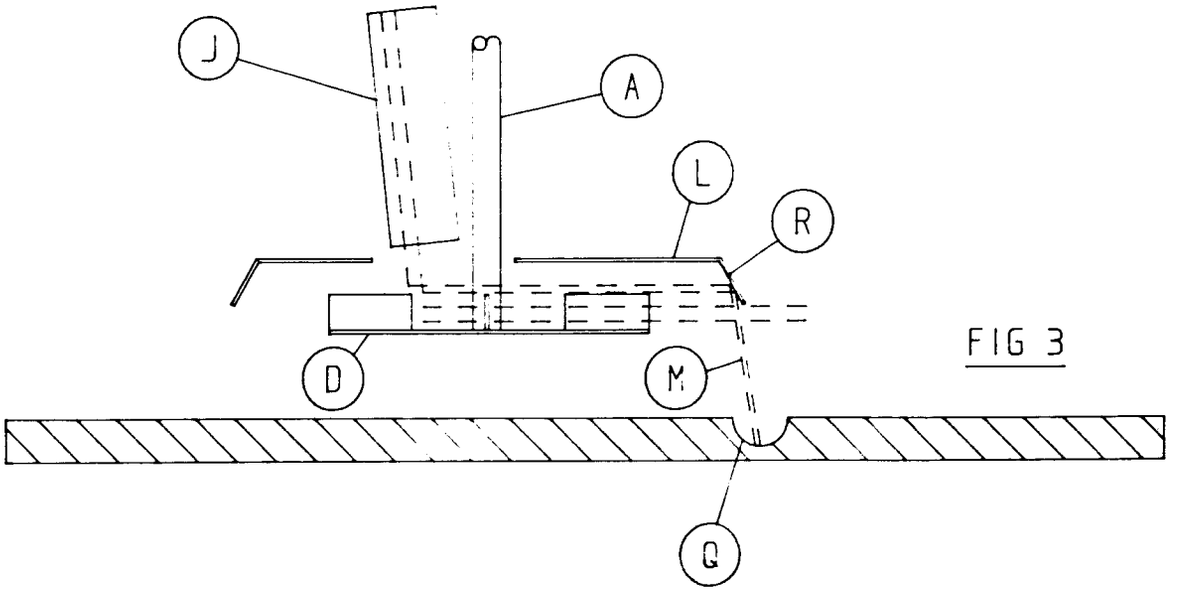

FIG 3

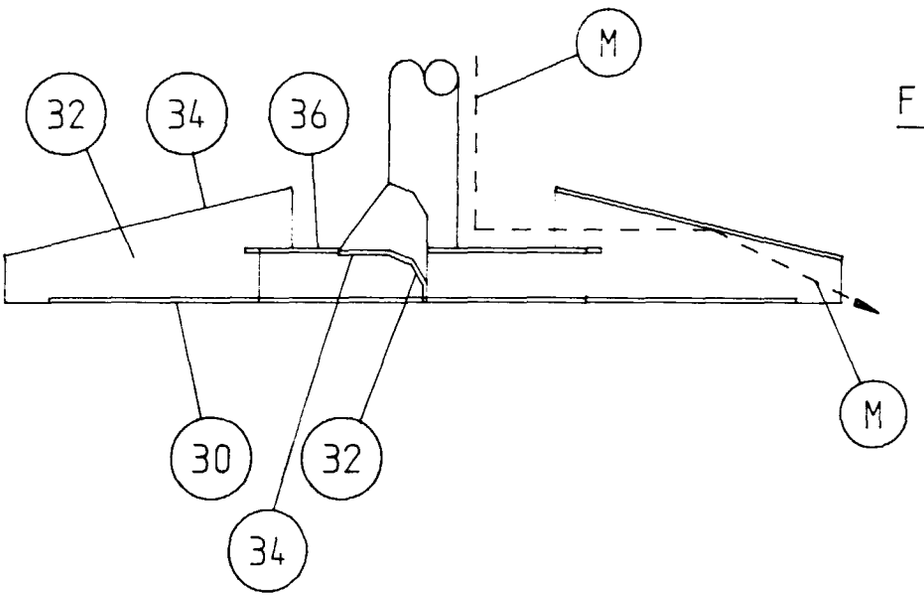

FIG 4

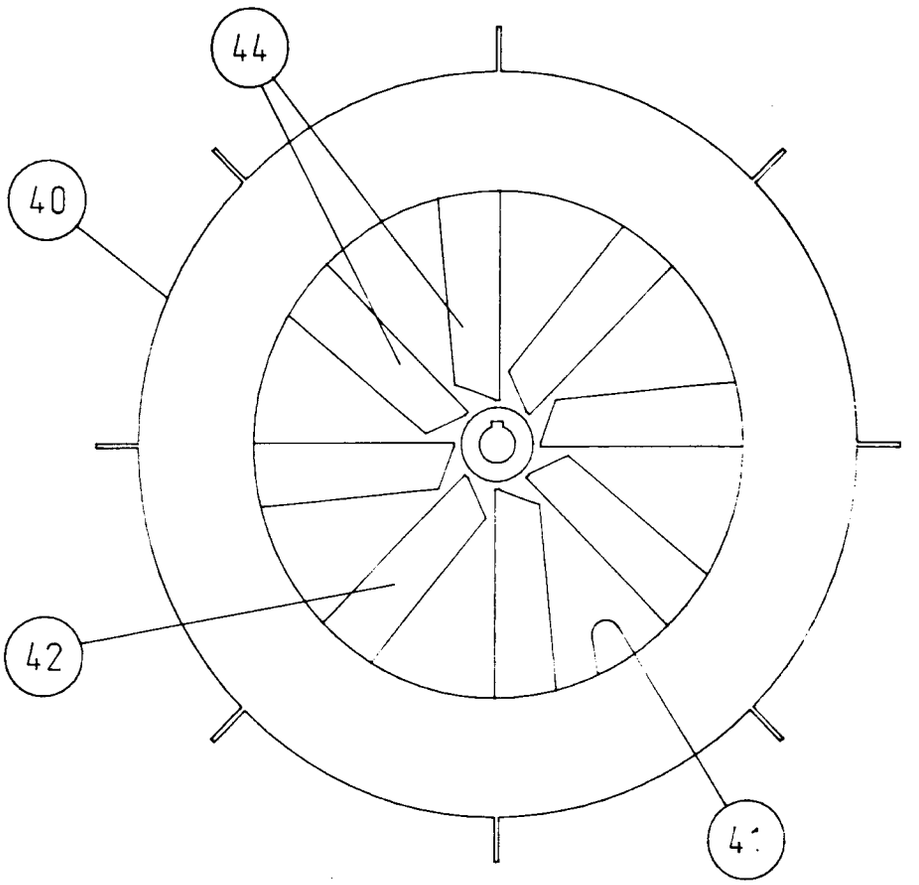

FIG 5

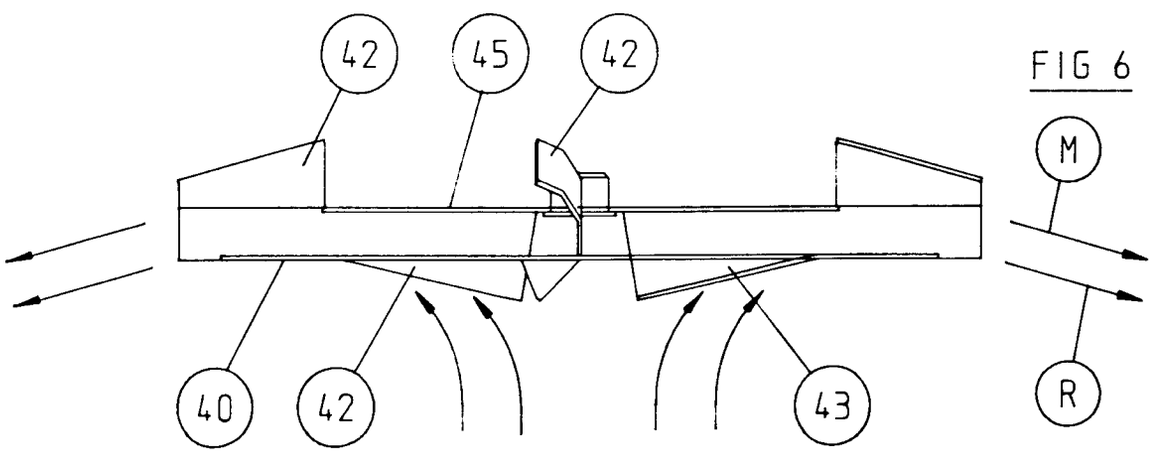

FIG 6

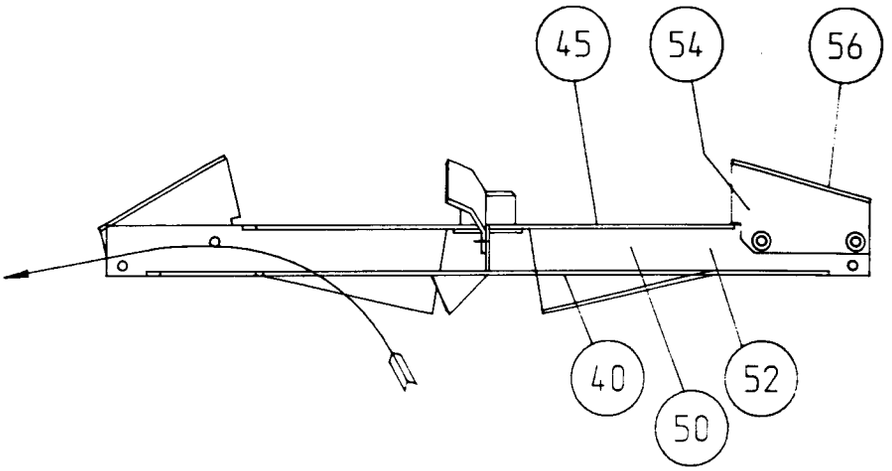

FIG 7

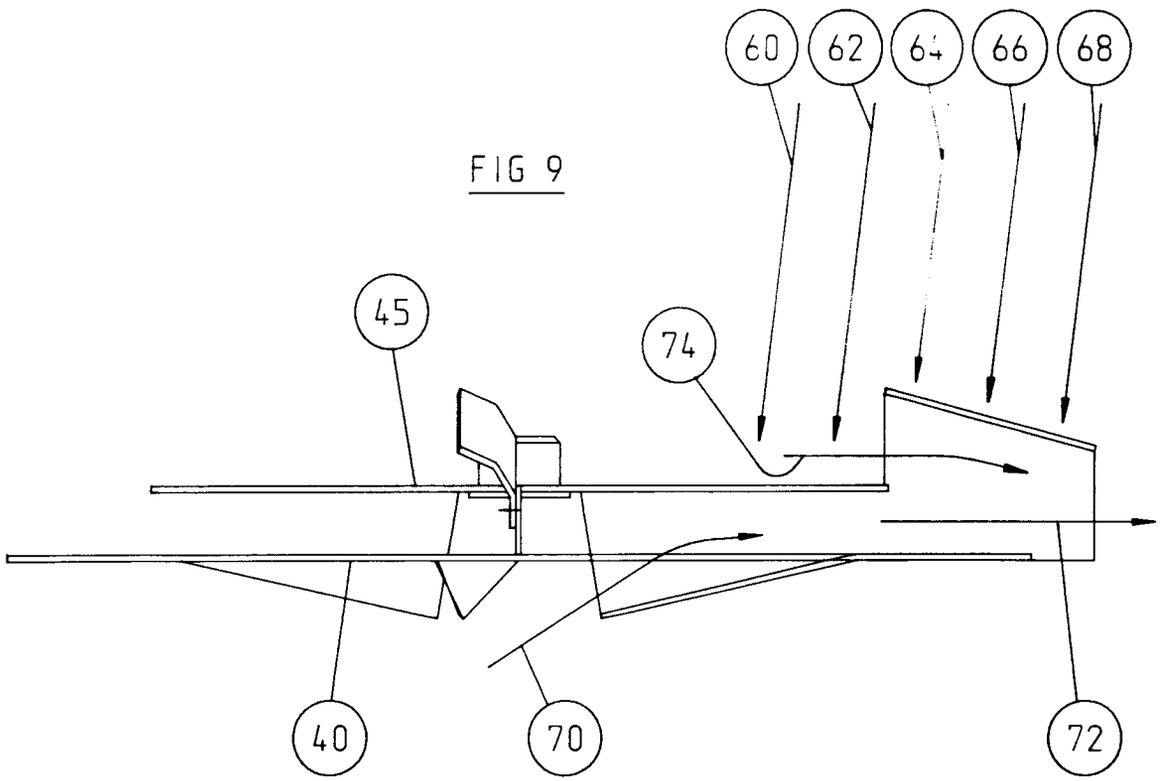

FIG 9

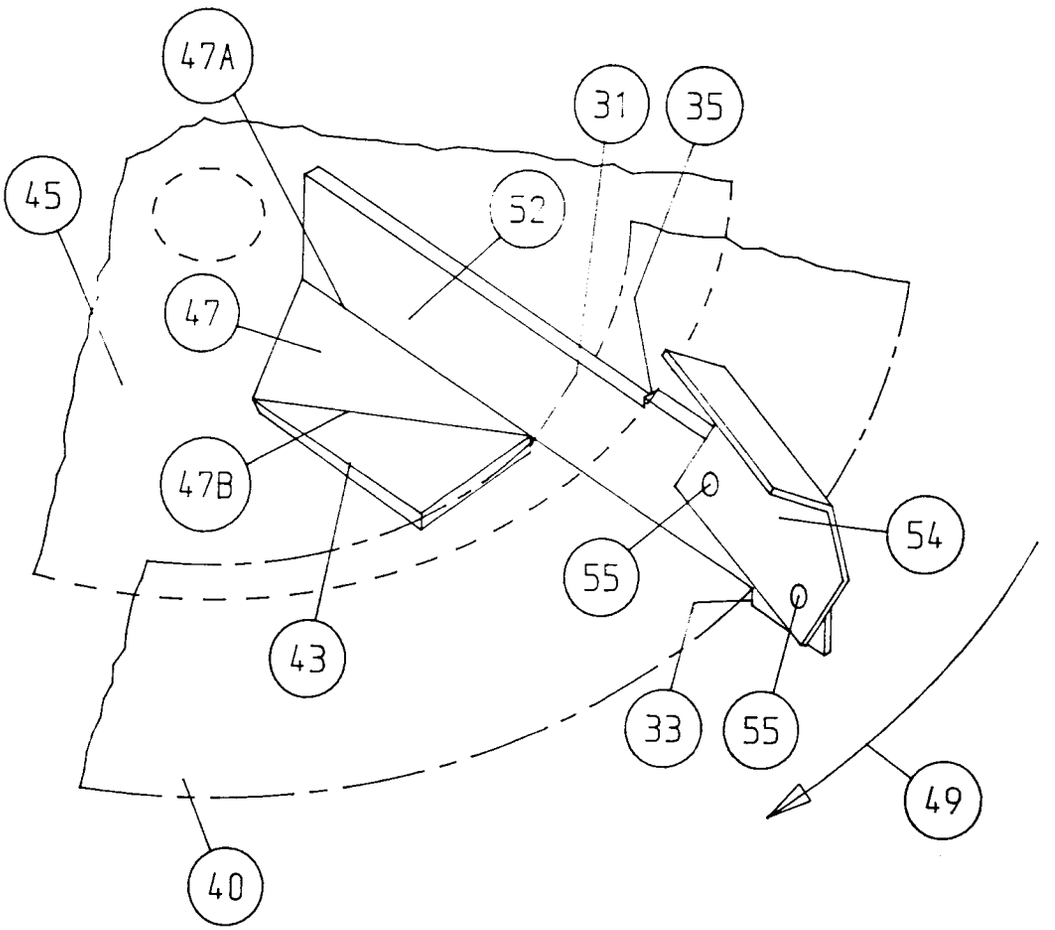

FIG 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 5762

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	US 4 157 150 A (HETRICK VERNON L) 5 June 1979 * figure 4 *	1,3,6,8	E01C19/20
D,A	EP 0 213 370 A (AMAZONEN WERKE DREYER H) 11 March 1987 * figures *	1,2	
D,A	FR 1 453 355 A (ENGLER) 19 December 1966 * the whole document *	1	
D,A	GB 1 133 134 A (KAHLBACHER) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01C
A01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 July 1998	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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