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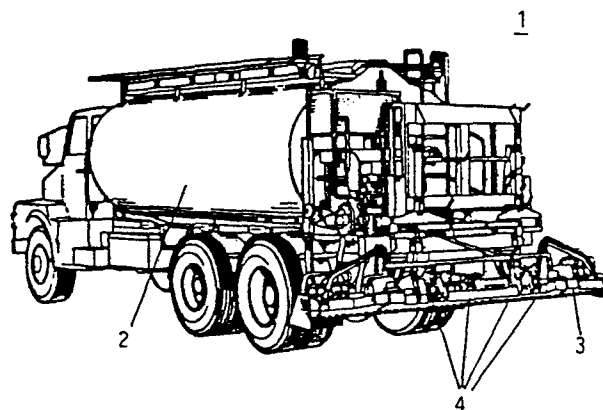
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54 **Device for spreading bituminous binder.**

57 The present invention relates to a device for controlling the height of the spraybar above the ground on distributors of bituminous binder embracing a vertically adjustable spraybar equipped with one or more nozzles. The invention is primarily designed to achieve even and uniform application of the binder transversely across the road. The distributor according to the invention is fitted with a number of sensors (A-D) for sensing the height of the spraybar, the temperature and viscosity of the binder, the rate of flow of the binder to the spray bar, the number of nozzles in use, and a microprocessor (M) connected to the sensors for automatic optimal adjustment of spraybar height above the ground.



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The present invention relates to a device for spreading bituminous binder and its purpose is to achieve a high degree of application accuracy, i.e. uniform transverse distribution across the road on the surface that is to be coated with the bituminous binder.

Binder is usually applied by means of some kind of distributor fitted with a tank, also commonly called a spraybar distributor, which is used for spreading bituminous binder in liquid form on a surface, road, yard, etc. The spreader tank is either mounted on a vehicle or is equipped with wheels of its own for purposes of towing. The distributor is equipped with devices by means of which binder stored in the tank can be pressurized, either inside the tank by means of an air compressor, for example, or outside the tank by means of a pump. The binder is carried under pressure to a spray tube or spraybar mounted transversely to the direction of travel of the distributor vehicle and so designed that all or part of its length can be used to apply binder in a uniform pattern.

Regulation of kg binder per m^2 of road surface, also called the rate of spread, is effected by maintaining the flow through each nozzle at a possibly determined and constant level and adapting the speed of the binder distributor so that the desired rate of spread is obtained. The speed of the binder distributor can also be geared to the asphalt pump motor through a feedback control system so that the predetermined amount of binder, kg/m^2 , is applied even if the speed of the binder distributor varies.

Regulation may be effected by controlling the asphalt pump motor either according to the pressure in the spraybar or according to the flow to the spraybar.

The spraybar is fitted with evenly-spaced nozzles along its entire length. The spray pattern from each and every one of the nozzles may be in the

shape of a fantail, solid cone, hollow cone, etc. A degree of spreading accuracy which falls within the desired limits is achieved through a combination of design and manufacturing precision in regard to the spraybar and the individual nozzles and frequently also multiple overlapping of the binder jets.

The nozzles in the spraybar are usually mounted about 100 mm apart. Flat or fantail nozzles are often used in which the jet is set at an angle of about 30° to the spraybar. To achieve optimum transverse application accuracy across the road a definite overlap, often three-fold, is desired. Other types of nozzle configurations also occur. However, a common objective for every type of nozzle configuration is always that the sprayed binder will strike the road in a definite way, that is to say in a definite pattern, which leads to specific requirements in regard to the height of the spraybar above the ground.

Spraybar height regulation on known machines is designed to maintain the spraybar at a constant height above the ground at all times for every nozzle configuration. However, this leads to shortcomings in transverse application accuracy on account of the following factors:

1. When the viscosity of the binder varies, then the nozzle angle of spread also varies and with it the reference value for the height of the spraybar giving optimal transverse application accuracy.
2. When the flow through a nozzle varies then the nozzle angle of spread also varies and with it the reference value for the height of the spraybar giving optimal transverse application accuracy.

The present invention is designed to eliminate these disadvantages in that optimal spraybar height is adjusted automatically with regard to the flow through each individual nozzle as well as the viscosity of the binder being spread.

The invention will be described in greater detail below with reference to the appended drawings where Fig. 1 shows a spraybar distributor mounted on a truck and Fig. 2 the spray pattern described by a fantail nozzle with the jet angled at approx. 30° in relation to the spraybar. Fig. 3 shows the spray pattern from a number of nozzles with threefold overlap and Fig. 4 shows how the spray pattern with single overlap varies with varying spraybar height above the ground. Basically, the relationship will also be the same with three-fold overlap, for example. Fig. 5 shows the spray from an individual nozzle and how the width of the spray on the ground varies with varying viscosity and/or flow rate, and Fig. 6 finally shows a block diagram of the sensors and microprocessors for automatic control of spraybar height according to the invention.

Fig. 1 shows a spraybar distributor 1 with tank 2 mounted on a truck. The distributor spraybar 3 is fitted with several nozzles 4 through which the bituminous binder is applied to a road, for example, from the tank via a tube and hose system in the spraybar distributor.

The nozzles 4 may vary in design and so impart a different shape to the jet of binder sprayed out through them. Generally a fantail nozzle is used which produces a spray pattern in the binder jet when it strikes the ground as shown in Fig. 2. To prevent the jets of binder from adjacent nozzles from striking each other the nozzles are arranged at an angle of 30° relative to the spraybar.

To achieve optimal transverse application accuracy across the road it is desirable to have a definite overlap, Fig. 3. Shown in Fig. 4 is the spray pattern produced with single overlapping at different spraybar heights above the ground, where it produces an optimal spray pattern, i.e. the spray patterns of the individual nozzles are adjacent to each other. Complete coverage of the surface is not obtained at height position b and position c produces strips with double overlap.

Fig. 5 shows how the width of the spray pattern on the ground from the individual nozzle varies with varying binder viscosity and/or varying flow rates through the nozzle. In the figure the width is given as an angle of spread α at the emergence of the spray from the nozzle. The angle α_1 is obtained at high viscosity and/or a low flow rate and α_2 at low viscosity and/or a high flow rate.

The block diagram shown in Fig. 6 shows in schematic form a number of sensors and a microprocessor which together control a hydraulic system for automatic regulation of the height of the spraybar above the ground so that the desired optimal application accuracy in regard to the binder spread on the road surface is obtained.

Sensor A is arranged to transmit signals which specify the height of the spraybar above the ground. It may be of ultrasonic type. The rate of binder flow to the spraybar is measured by sensor B which may be of displacement meter type, for example. Sensor C senses the temperature of the binder, which is a measure of its viscosity.

Shown in Fig. 1 is a spraybar of constant length. In many cases, however, it is desirable to have the capability of varying the width of spread and this is accomplished by means of telescopically adjustable spraybars. Sensor D provides information as to how many nozzles are in use.

Sensors A-D transmit their signals to microprocessor M. Programmed into this microprocessor are:

- a the temperature-viscosity relationship for the binder in question
- b the relationship between the binder viscosity and nozzle angle of spread α for the type of nozzle in question

- c the relationship between flow rate through the nozzle and nozzle angle of spread α for the type of nozzle in question
- d the pattern in which the binder, for the nozzle configuration in question, shall strike the ground for optimal transverse application accuracy
- e the relationship between angle of spread and spray pattern.

Based on the signals from sensors A-D the microprocessor can continuously calculate and adjust the spraybar height producing optimal transverse application accuracy and the value producing optimal spraybar height. Regulation of spraybar height is effected by means of hydraulic valves 5 which control the hydraulic cylinders 6 by means of which the spraybar 3 can be raised and lowered.

CLAIMS

1. A device for spreading bituminous binder, which device embraces a vertically adjustable spraybar equipped with a number of nozzles and also a pump and pipework system connecting the spraybar with a storage tank for the bituminous binder, characterized by a combination of:
 - a first sensor (A) designed to sense the height of a spraybar (3) above the ground,
 - a second sensor (B) which senses the flowrate of the binder supplied to the spraybar (3),
 - a third sensor (C) which senses the temperature of the binder,
 - a fourth sensor (D) for sensing the number of nozzles in use on the spraybar (3), and
 - a microprocessor (M) connected to the sensors, which microprocessor is programmed to process the signals received from the sensors (A, B, C and D) for setting the optimal spraybar height above the ground.
2. A device as in Claim 1, characterized in that the equipment for adjusting the height of the spraybar (3) is hydraulic and consists of hydraulic valves (5) connected to the microprocessor (M) and forming part of a hydraulic system and hydraulic cylinders (6) connected to the spraybar (3) for raising and lowering the spraybar (3) to an optimal height above the ground.
3. A device as in any of Claims 1-2, characterized in that the first sensor (A) is arranged to sense the ground height by means of ultrasonics.

4. A device as in any of Claims 1-3, characterized in that the second sensor (B) consists of a rotary displacement meter.
5. A device as in any of Claims 1-4, characterized in that the third sensor (C) is of thermoelectrical type.
6. A device as in any of Claims 1-5, characterized in that the fourth sensor (D) is connected to each and every one of the nozzle valves fitted to the spraybar (3).

FIG.1

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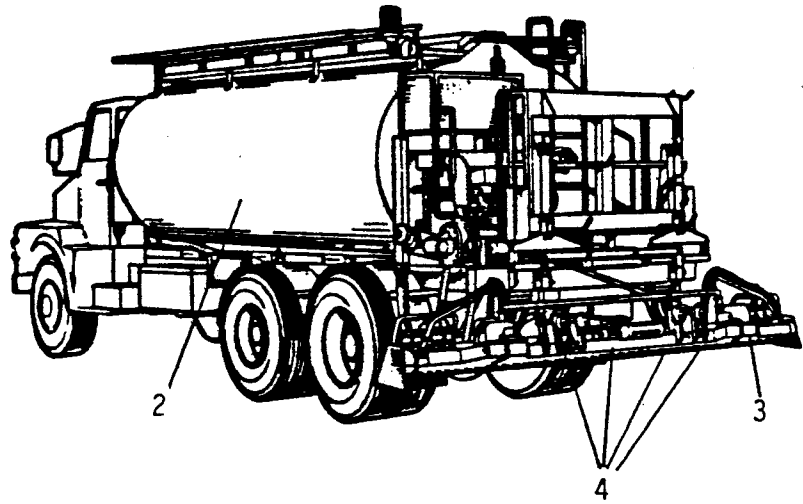


FIG.2

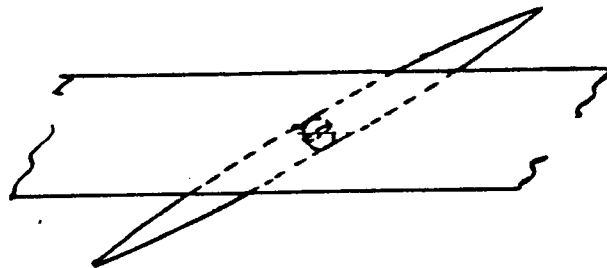
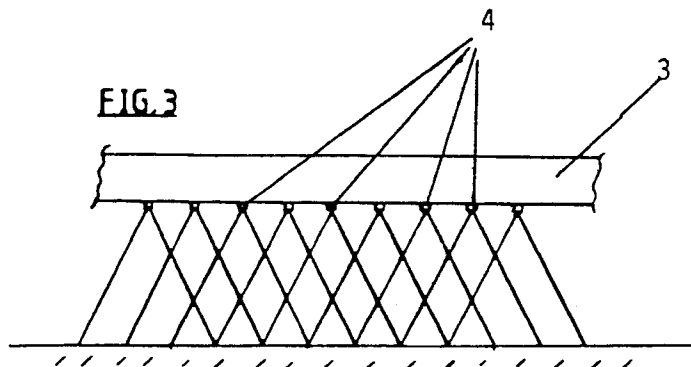


FIG.3



2b

FIG. 4

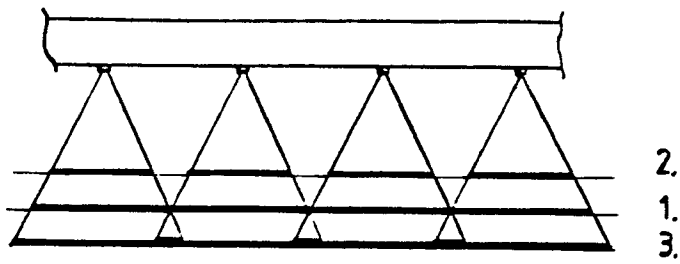


FIG. 5

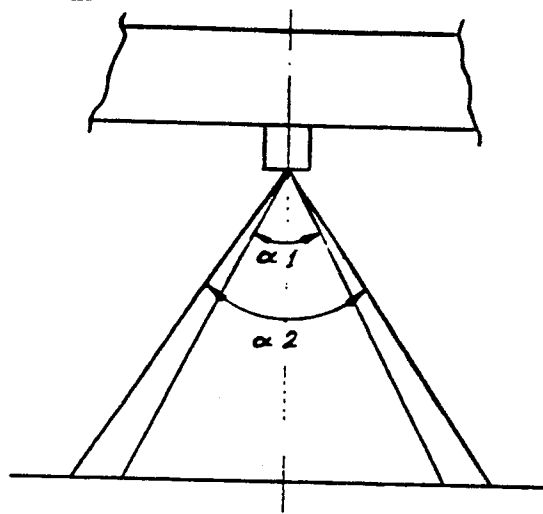
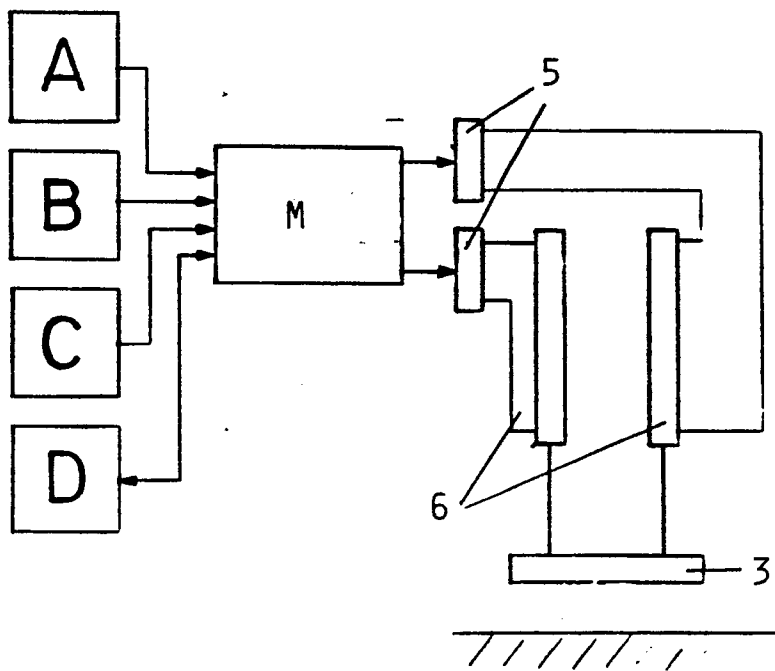


FIG. 6





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.4)
A	GB-A-2 102 865 (F.J. ANDERSEN)	1-6	E 01 C 19/16
A	EP-A-0 102 060 (G SONNTAG)	1-6	
A	SU-A- 975 862 (1-6	
A	US-A-3 540 360 (R.K SNOW ET AL)	1-6	
A	EP-A-0 127 933 (G.R POOLEY)	1-6	
A	DE-A-2 719 692 (H STOLZ ET AL)	1-6	
A	US-A-3 953 145 (T.L TEACH)	1-6	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 01 C
Place of search		Date of completion of the search	Examiner
STOCKHOLM		24-02-1986	THORSTENSSON J.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
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