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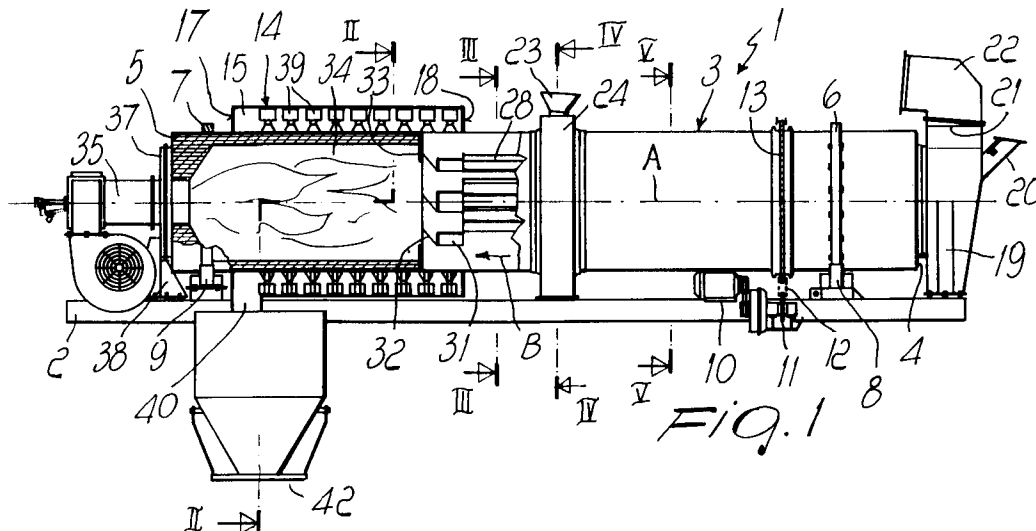
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Drum mixer-drier for the continuous preparation of bituminous mixes with recycling of reclaimed materials.

The mixer has a drum (3) rotated by a motor (10-12) about an inclined longitudinal axis (A) and defining an upper end (4) and a lower end (5), which is concentrically surrounded by a stationary cylinder (14) defining an interspace (15). A burner (35) located at the lower end (5) internally heats the drum (3) and a hopper (20) is provided at the upper end (4) for introducing aggregates into the drum (3). The drum (3) also has a funnel (23) for the introduction of

recyclable asphalt pavement (RAP) and blades (26) for transferring the mixture from the drum (3) into the interspace (15). Ducts (43, 44) are located proximate to the upper end (4) for the introduction of bitumen, filler and additives into the mixture, and fins (39) are connected externally to the drum (3) for mixing and conveying the material to a discharge outlet (40) at the lower end (5) of the cylinder (14).



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The present invention relates to a drum mixer-drier for the continuous preparation of bituminous mixes with recycling of reclaimed materials.

Drier-mixers of the described type (hereinafter termed simply "mixers" for the sake of brevity in description) are already known. They comprise a drum with internal blades which rotates about an axis which is slightly inclined with respect to a horizontal plane; the aggregates are introduced at the upper end of the drum and, by means of the rotation of the drum, move toward the opposite lower end, where the discharge outlet is located. A burner, orientated along the axis of the drum, is arranged in said upper end and dries and heats the aggregates.

The bitumen inlet is located at a certain distance from the burner; the bitumen, with the addition of additives, is mixed together with the aggregates. The bitumen inlet is located at a distance from the burner which is sufficient to avoid the formation of fumes. In known mixers there is also, in a point of the drum located upstream of the bitumen inlet, the inlet for the reclaimed material, generally constituted by mixes which originate from the demolition of old paving. This reclaimed material (recyclable asphalt pavement, hereinafter abbreviated as RAP) is mixed with the aggregates and the bitumen.

A drawback of the known mixers is the difficulty encountered in heating the aggregates to a high temperature while at the same time preventing the bitumen and the RAP from reaching temperatures which cause the formation of fumes.

A technical aim of the present invention is therefore to provide a drier-mixer which obviates the above described problems related to the exposure of bitumen and RAP to excessive heat.

This aim, and objects of the invention, which will become apparent from the following description, are achieved by a drier-mixer for the continuous preparation of bituminous mixes for pavings, characterized in that it comprises a drum which is rotatably supported about a longitudinal axis which is inclined with respect to a horizontal plane so as to have a lower end and an upper end, means for rotating said drum about said axis, a burner located at the lower end of said drum for directing a flame along said longitudinal axis toward the upper end of the drum in order to heat it internally, means for introducing aggregates at the upper end of said drum, a stationary cylinder which concentrically surrounds the lower portion of said drum and defines an annular interspace together with said portion, said cylinder having a lower end, which is proximate to the burner, and an upper end, means for introducing reclaimed bituminous material into said drum at a point which has a preset distance from the upper end of said cylinder, means for

transferring said reclaimed material and said aggregates from said drum into said annular interspace at the upper end of said cylinder, means operatively associated with the inside of said drum to cause the advancement of said aggregates and of said reclaimed material toward said means for introducing them into the annular interspace, means for introducing bitumen proximate to the upper end of said cylinder, and means which are operatively associated with the outside of said drum along said stationary cylinder in order to mix said aggregates and said reclaimed material with said bitumen so as to obtain a bituminous mix and cause the advancement of said mix toward a discharge outlet arranged at the lower end of said cylinder.

Further characteristics and peculiarities will become apparent from the following description of a preferred embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a partially sectional side view of a drier-mixer according to the invention and figures 2, 3, 4 and 5 are sectional views, taken respectively along the planes II-II, III-III, IV-IV and V-V of figure 1.

With reference to the above figures, the mixer is generally designated by the reference numeral 1 and comprises a base 2 which may be mounted on wheels for the transfer of the mixer to the work site.

A drum 3 is mounted on the base for rotation about the axis A. When the mixer is working, the axis A is slightly inclined with respect to the horizontal plane, so that the drum has an uppermost or upper end 4 and a lower end 5. Outside the drum, proximate to the ends 4 and 5, there are two hoops or annular flanges 6 and 7 which constitute two rolling tracks engaged by pairs of rollers 8 and 9 on which the drum rolls. The rollers 8 and 9 are rotatable in appropriate supports fixed to the base. The rotation of the drum is produced by a gearmotor 10 which is fixed to the base and is provided with an output pinion 11 on which a chain 12 is entrained; said chain is also entrained around a toothed wheel 13 which is fixed to the outside of the drum 3, thus defining a closed-loop formation.

The reference numeral 14 designates a cylinder which is arranged concentrically around the lower portion of the drum and defines, together with said drum, an annular interspace 15. The cylinder 14 is rigidly coupled to the base 2, on which it rests by means of lateral feet 16, and comprises two flanges 17 and 18 which are at right angles to the axis A and have an annular crown shape; the inner edge of the flanges 17,18 skims or slidingly contacts the outer surface of the drum 3 so as to close the interspace 15 at its opposite ends.

The upper end 4 of the drum is closed by a fume expansion chamber 19, outside which a hopper 20 for feeding the aggregates is fitted; said aggregates are introduced in the drum through an opening of the chamber 19. The drum is furthermore connected, by means of an opening 21 of the fume expansion chamber, to a stack 22 for aspirating the volatile substances and the dust which form during preparation of the bituminous mix.

In addition to the aggregates it is possible to load the drum with reclaimed material (RAP) originating from the demolition or milling of road paving. The RAP is introduced into the drum through a funnel 23 which leads into an annular duct 24 located at a preset distance from the flange 18 of the cylinder 14. The annular duct 24 defines, around the drum, an annular chamber 25 in which blades 26 rotate; said blades are fixed to the outside of the drum 3. Openings 27 are defined on the drum between the blades 26 and allow the RAP to pass inside the drum during its rotation. The blades 26 are rigidly coupled to the drum 3 at the annular chamber 25 along a band 30 which is as wide as said chamber and defines recesses 28a. The recesses 28a are open towards the end 5 and are closed toward the end 4.

Wings 28 and 29 are rigidly coupled to the inner surface of the drum. The wings 29 extend up to the end 4 and the wings 28 extend from the annular duct 24 toward the end 5, end at the level of the flange 18 and are shaped so as to cause advancement of the material in the direction B. The wings 29 furthermore have a substantially L-shaped profile which, during rotation of the drum, facilitates the tipping or cascading of the material through the combustion gases and enhances heat exchange with them.

The wings 28 are instead shaped so as to shield the internal surface of the drum 3 from the radiant heat of the flame. They simultaneously prevent the rise of the material and thus its falling through the flame. The heat received by the wings 28 is transferred, upon each rotation of the drum 3, to the material which flows in the lower region in this portion of the drum.

The wings 28 are aligned, at the level of the flange 18, with openings 31 defined in the drum 3. The openings 31 connect the inside of the drum to the end of the annular interspace 15 which is adjacent to the flange 18. In this manner the material can be transferred from the drum into the interspace 15. Downstream of the openings 31, inside the drum, there is a plurality of baffles 32 which are connected to a flange 33 and are orientated so as to deflect backward any material which might have gone beyond the openings 31, by causing such material to fall back into the openings.

The portion of the drum which extends from the flange 33 to the end 5 constitutes the combustion chamber 34, into which the flame of a burner 35, which is coaxial to the axis A, is directed.

The combustion chamber 34 is internally covered with a lining of ceramic fibers 36 which protects the drum against excessive temperatures.

The burner 35 is mounted on a flange 37 which is supported by a support 38 fixed on the base 2. The flange 37 is arranged adjacent to the end 5 of the drum in order to allow rotation of the drum with respect to the burner.

The drum 3 is externally provided, along the portion which corresponds to the length of the cylinder 14, with fins 39 for mixing the material and conveying it toward a discharge outlet 40 located adjacent to the flange 17. The outlet 40 leads into a hopper 41 provided with a discharge shutter 42.

The described mixer is completed by two ducts 43 and 44 for feeding bitumen and respectively additives (fillers) into the interspace 15. The ducts 43 and 44 are arranged on the fixed cylinder 14 on a plane which is perpendicular to the axis A and is located downstream of the flange 18.

The operation of the described mixer is as follows.

Upon rotating the drum 3, aggregates introduced through the hopper 20, due to the inclination of the drum 3 and of the wings 29, advance in the direction B and along the path leading to the ring 24 and are heated due to the hot air generated by the burner 35. The aggregates have a temperature in the range of 150-250°, by the time they reach the ring 24, where RAP is added; said RAP is transferred into the interspace 15 through the openings 31 together with the aggregates, after covering the portion of the blades 28.

In the interspace 15, the blades 39 thoroughly mix the aggregates and the RAP with bitumen and additives, added through the ducts 43 and 44 to produce a final mix which has a temperature in the range of 150-180° and is discharged into the hopper 41 through the outlet 40.

One important feature of the described mixer is to be found in the location of the inlet 23, 24 for the reclaimed material, which is sufficiently spaced from the burner to avoid the formation of fumes but is such as to ensure a softening of the bitumen for facilitating mixing with the aggregates. Equally, the cylinder 14 creates a mixing region in which the bitumen and the materials are protected against direct exposure to the flame and kept at such a temperature as to avoid the formation of fumes.

It should be noted that the inside of the drum, due to aspiration through the stack 22, is at a negative pressure, so that any gases released from the mix during mixing in the interspace 15 pass through the openings 31 into the drum, where they

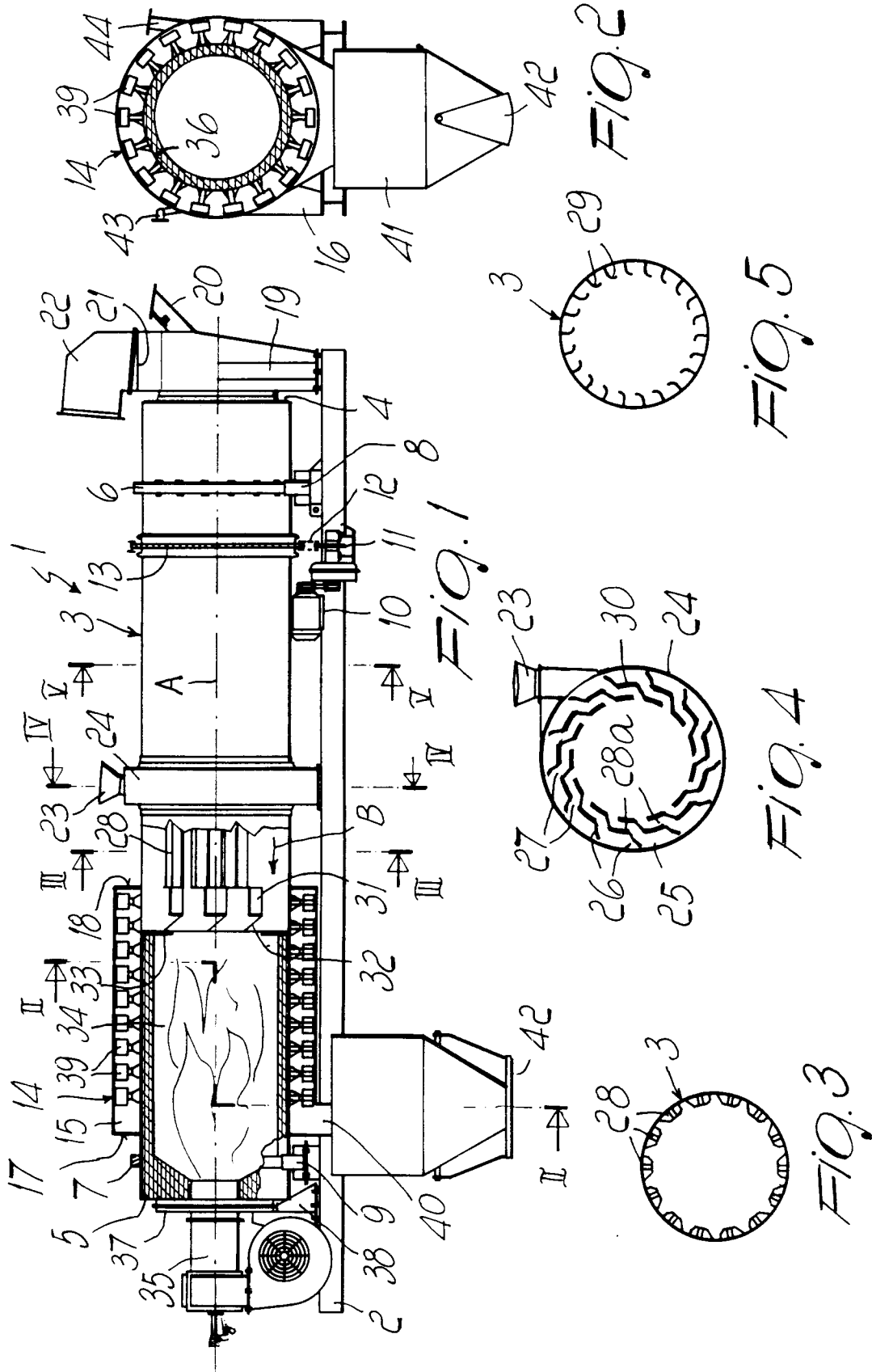
are burned.

Numerous modifications and variations are possible in the practical embodiment of the mixer, and all are within the scope of the inventive concept expressed in the following claims. The shapes and dimensions may furthermore be any according to the requirements.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. Drier-mixer for the continuous preparation of bituminous mixes for pavings, characterized in that it comprises a drum (3) which is rotatably supported about a longitudinal axis (A) which is inclined with respect to a horizontal plane so as to have a lower end (5) and an upper end (4), means (10-12) for rotating said drum about said axis, a burner (35) located at the lower end (5) of said drum (3) for directing a flame along said longitudinal axis (A) toward the upper end (4) of the drum (3) in order to heat it internally, means (20) for introducing aggregates at the upper end (4) of said drum (3), a stationary cylinder (14) which concentrically surrounds the lower portion of said drum (3) and defines an annular interspace (15) together with said portion, said cylinder (14) having a lower end, which is proximate to the burner (35), and an upper end, means (23, 24) for introducing reclaimed bituminous material into said drum (3) at a point which has a preset distance from the upper end of said cylinder (14), means (26, 27, 31) for transferring said reclaimed material and said aggregates from said drum (3) into said annular interspace (15) at the upper end of said cylinder (14), means (29) which are operatively associated with the inside of said drum (3) in order to cause the advancement of said aggregates and of said reclaimed material toward said means (23, 24) for introducing them in the annular interspace (15), means (43, 44) for introducing bitumen, filler and additives proximate to the upper end of said cylinder (14), and means (39) which are operatively associated with the outside of said drum (3) along said stationary cylinder (14) in order to mix said aggregates and said reclaimed material with said bitumen, said filler and said additives, so as to obtain a bituminous mix and cause the advancement of said mix toward a discharge outlet (40) arranged at the lower end of said cylinder (14).
2. Drier-mixer according to claim 1, characterized in that said means for introducing reclaimed bituminous material comprise an annular duct (24) which extends around said drum (3) at a preset distance from the upper end of said cylinder (14) and defines an annular chamber (25) in which a plurality of blades (26) rotates, said blades being fixed to the outside of said drum (3), openings (27) being defined between said blades for the passage of the material into the drum, said openings (27) being connected to recesses (28a) arranged inside the drum and axially open toward said cylinder (14).
3. Drier-mixer according to claim 1 or 2, characterized in that said means for transferring said reclaimed material and said aggregates from said drum into said interspace (15) comprise openings (31) defined in said drum (3) at the upper end of said interspace (15), baffles (32) being associated with said openings (31) and being arranged on the side opposite to the side where the material advances, said baffles being suitable to convey said material into said openings (31).
4. Drier-mixer according to claim 1, characterized in that said means operatively associated with the outside of said drum are constituted by blades (39).
5. Drier-mixer according to claim 1, characterized in that the portion of said drum (3) around which said cylinder (14) extends is internally covered by a thermally insulating lining (36).
6. Drier-mixer according to claim 1, characterized in that said means for the advancement of the material inside the drum (3) are constituted by wings (29) which are shaped so as to define shields for protecting the internal surface of the drum (3) against irradiation and so as to transfer the heat to the material.





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.5)
X	EP-A-0 347 281 (ERMONT. C.M.) * the whole document * ---	1,2,4,6	E01C19/10
A	US-A-5 052 810 (BROCK) * the whole document * ---	1,4,6	
A	US-A-4 136 966 (MENDENHALL) * the whole document * ---	1,4	
A	US-A-4 867 572 (BROCK ET AL.) * the whole document * -----	1,4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E01C
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
BERLIN	06 JULY 1993	PAETZEL H.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			