FORM 1 642950

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

ISOVER SAINT-GOBAIN
a limited company under
French law

of "LES MIROIRS"
18 AVENUE D'ALSACE
92400 COURBEVOIE
FRANCE

hereby apply for the grant of a standard patent for an invention entitled:

A METHOD OF AND AN APPARATUS FOR FIBRING MINERAL WOOL BY FREE CENTRIFUGATION.

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
90.00420	FR	16 JAN 90

My/our address for service is care of GRIFFITH HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 15th day of January 1991

ISOVER SAINT-GOBAIN

GRIFFITH HACK & CO.

TO: The Commissioner of Patents.

AUSTRALIA

B

PATENTS ACT 1952

APPLICATION BY ASSIGNEE OF INVENTOR

DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT

NAME OF APPLICANT

In support of an application made by: ISOVER SAINT-GOBAIN

ISOVER SAINT-GOBAIN
~~Siège Social : 18, avenue d'Alsace~~
92400 COURBEVOIE
Cedex 27-92096 PARIS LA DÉFENSE

TITLE

for a patent for an invention entitled: A METHOD OF AND AN APPARATUS FOR FIBRING MINERAL WOOL BY FREE CENTRIFUGATION

FULL NAME AND ADDRESS OF SIGNATORY

I, S. LeVaquerese

of Isover Saint-Gobain, "Les Miroirs",

18, avenue d'Alsace, 92400 Courbevoie, France

do solemnly and sincerely declare as follows:

1. I am authorised by the above mentioned applicant for the patent to make this declaration on its behalf.

FULL NAME AND ADDRESS OF INVENTOR(S)

2. The name and address of each actual inventor of the invention is as follows:

Alain DEBOUZIE, 130, rue J. Demessieux, 76650 LE PETIT COURONNE - FRANCE; Christopher ELLISON, Hameau de Pimont - Bosc Guerard St Adrien, 76710 MONT VILLE - FRANCE; Roger PENNAMEN, 3, rue Bossoutrot, 76800 SAINT ETIENNE DU ROUVRAY - FRANCE

SEE NOTES OVER

3. The facts upon which the applicant is entitled to make this application are as follows:

The applicant would be entitled to have assigned to it a patent granted to any of the actual inventors in respect of the said invention

DELETE PARAGRAPHS 3 AND 4 FOR NON-CONVENTION APPLICATION

4. The basic application(s) as defined by Section 141 of the Act was (were) made as follows:

Country France on 16th January 1990

in the name(s) Isover Saint-Gobain

and in on

in the name(s)

PLACE AND DATE OF SIGNING

5. The basic application(s) referred to in the preceding paragraph was (were) the first application(s) made in a Convention country in respect of the invention the subject of this application.

Declared at Courbevoie, France

this 6th day of December 19 90

Signed [signature]

Position S. LE VAGUERESE

GRIFFITH HACK & CO

PATENT AND TRADE MARK ATTORNEYS

MELBOURNE · SYDNEY · PERTH

AU9169340

(12) PATENT ABRIDGMENT (11) Document No. AU-B-69340/91
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(54) Title
A METHOD OF AND AN APPARATUS FOR FIBRING MINERAL WOOL BY FREE CENTRIFUGATION

International Patent Classification(s)
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ALAIN DEBOUZIE; CHRISTOPHER ELLISON; ROGER PENNAMEN

(74) Attorney or Agent
GRIFFITH HACK & CO , GPO Box 1285K, MELBOURNE VIC 3001

(57) Claim

1. A method of forming mineral fibres comprising pouring material to be fibred in the molten state over the peripheral surface of a first of a series of centrifuging wheels turning at high speed, so that the material is accelerated and passed to a second wheel where a part of the material is converted to fibres under the effect of centrifugal force and the remaining part of the material is passed to a further wheel for fibring the fibres formed by the various centrifuging wheels being drawn up by a main gas current passing around the series of centrifuging wheels and emitted in the immediate vicinity of the said wheels in a direction substantially parallel with the axes of rotation of the wheels, wherein there is at least one auxiliary gas current located at a distance from the centrifuging wheels and the said auxiliary gas current is oriented in substantially the same direction as the main gas current.

7. An apparatus for producing mineral fibres comprising a series of centrifuging wheels adapted to rotate about substantially parallel axes and disposed in an arrangement which brings outer peripheral surfaces of said

.../2

centrifuging wheels close to one another, two consecutive wheels in the path of the material to be fibred turning in opposite directions, a rising supply of molten material making it possible to pour the said material onto the outer surface of the first centrifuging wheel and a main blower means creating around the series of centrifuging wheels a main gas current which is substantially parallel with the axes of rotation of said centrifuging wheels, means for generating at least an auxiliary gas current located at a distance from the centrifuging wheels, the said auxiliary gas current being oriented in substantially the same direction as the main gas current.

642950

AUSTRALIA

PATENTS ACT 1952

Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: ISOVER SAINT-GOBAIN

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Australia.

Complete Specification for the invention entitled:
A METHOD OF AND AN APPARATUS FOR FIBRING
MINERAL WOOL BY FREE CENTRIFUGATION.

The following statement is a full description of this invention including the best method of performing it known to me:-

A method of and an apparatus for fibring mineral wool by free centrifugation

The invention is concerned with techniques for forming mineral fibres from a drawable material and in particular from a molten material with a high melting point, for example a material of the basalt or blast furnace slag type. More precisely, the invention relates to an improvement in the so-called free centrifugation fibring techniques in which the material to be fibred is brought to the molten state at the periphery of centrifuging wheels and is entrained by these wheels so that a part of the material becomes detached therefrom and is transformed into fibres under the effect of centrifugal force, the remaining non-transformed part being sent back to another wheel or, after the last wheel, falls down in the form of granules.

In order to employ the fibring technique briefly outlined hereinabove, generally three or four wheels are used which are disposed one beside another, two successive wheels in the path of the molten material rotating in opposite directions. The first wheel is supplied with molten material by a spout and mainly serves to accelerate the material which is passed on towards the second wheel and so on until it reaches the last wheel, the flow of material diminishing at each wheel by the amount of the quantity of fibres formed. With such a fibring process - partial in that none of the wheels is sufficient for complete transformation into fibres - it is very important to provide effective means of separating the fibred material from the non-fibred material. Indeed, this latter only helps to increase the weight of the end product and give it a particularly unpleasant feel. Independently of this first problem, the fibred material has to be routed to a receiving means, for example an endless belt fitted with vacuum chambers which transports the fibres to processing devices downstream of the line, such as a lapper, a binder polymerising oven, etc.

This dual function of separating granules and transporting fibres falls to a current of air introduced at the periphery of the centrifuging wheels, substantially parallel with the axes of rotation of the said wheels. Thus, this current of air entrains the fibres in a direction at right-angles to the direction in which they are formed. In Patent Application FR-A-2 322 114, it has been proposed to impart to the current not only an axial velocity but a certain tangential velocity in the direction of movement of the rotor in order to open up the torus consisting of the fibres around the centrifuging wheel; thus, the fibres have a tendency to spread out immediately over a greater volume so that there is a reduced risk of seeing the fibres stick together in tufts. In fact, these tufts would result in a reduced tensile strength in the product. Furthermore, it is known from Patent Application WO-A-8 807 980 to introduce the current of air otherwise than parallel with the axes of rotation of the centrifuging wheels, in fact in a slightly diverging direction, so forming a blowing cone; furthermore, a tangential component of velocity is likewise imparted to the currents of air, the object being to minimise interaction between the gas current and the centrifuging wheels in order to reduce friction between this gas current and the currents of air generated by the high speed rotation of the centrifuging wheels.

These various improvements do not make it possible to obviate the problem caused by the formation of fibre tufts which is encountered in all the relatively calm zones surrounding the centrifuging wheels, particularly the central zone between the wheels. In the end, these tufts are carried away with the flow of newly formed fibres but generally this occurs sufficiently late that the resin which is sprayed onto the fibres while they are being formed is already partly polymerised; consequently, these tufts crop up again in the finished product as isolated rovings which tend to reduce the tensile strength because for practical purposes they are not connected to the rest of the fibres. Furthermore, these rovings entrain with them non-fibred particles which make only a very slight contribution to the heat resistance of the rock wool mat. Above all, their presence penalises the lightest products, particularly the finished products the density of which is less than 100 kg/cu.m. Well, as indicated in the aforesaid Patent Application FR-A-2 322 114, it is not desirable excessively to increase the quantity of air introduced at the periphery of the centrifuging wheels, in order to avoid excessive cooling of the wheels. Consequently, air is not blown into the intermediate space between the wheels and the quantity of air blown outside the wheels is limited, creating calm zones with the disadvantages which have been discussed.

The present invention sets out to improve the techniques for forming rock wool - from basaltic glasses, blast furnace slag or other materials with a high melting point - using centrifuging wheels in order to obtain better control over the circulation of gases in the vicinity of the centrifuging wheels and thus finished products of greater quality, particularly from the point of view of their insulating capacity.

For this, the invention proposes a method of forming mineral fibres in which the material to be fibred, while in the molten state, is poured onto the peripheral surface of

According to the present invention there is provided a method of forming mineral fibres comprising pouring material to be fibred in the molten state over the peripheral surface of a first of a series of centrifuging wheels turning at high speed, so that the material is accelerated and passed to a second wheel where a part of the material is converted to fibres under the effect of centrifugal force and the remaining part of the material is passed to a further wheel for fibring the fibres formed by the various centrifuging wheels being drawn up by a main gas current passing around the series of centrifuging wheels and emitted in the immediate vicinity of the said wheels in a direction substantially parallel with the axes of rotation of the wheels, wherein there is at least one auxiliary gas current located at a distance from the centrifuging wheels and the said auxiliary gas current is oriented in substantially the same direction as the main gas current.

The principle of this auxiliary gas current is to suppress all the return current which would otherwise form for example in the central zone of the fibring apparatus, between the centrifuging wheels, or outside the apparatus with increasing remoteness from the periphery of the wheels.

With regard to the central zone, this auxiliary gas current may advantageously be generated by passing air between the centrifuge wheels, the air being induced by rotation of the wheels. In this way, it is possible to avoid the formation of return currents which tend to result in a certain amount of fibre penetrating the zone between the centrifuging wheels, in the centre of the fibring machine. It must be noted that to obtain this passage of ambient air, it is sufficient not to occlude the back of the machine, a measure which is easily achieved, particularly by a sideways arrangement of the motors which drive the wheels. In this way, excessive cooling of the wheels is avoided and the fibring is not affected.

With regard to the zone outside the centrifuging wheels, the auxiliary gas current is advantageously generated by a peripheral blower ring which backs up the blower means which generate the main gas current. This peripheral blower ring makes it possible very precisely to control the conditions under which fibres are transported to the receiving means; furthermore, once such transported is assured, the main blower means can then be regulated solely on a basis of the conditions needed to produce a better quality of fibre formation, that is to say conditions which result in optimum drawing of the fibres by this main gas current.

Thus it is possible to work with a main blower means which emits a jet which passes over the peripheral surfaces of the centrifuging wheels at a very high velocity, without excessively increasing the rate of delivery of this main blower means; advantageously, distribution of the rate of flow between the two blower means is around 3:2, that is to say approx. 60% of the air drawn into the fibring apparatus is drawn in by means of the main arrangement, the rest being drawn in by the auxiliary means.

Also advantageously, the auxiliary gas current is emitted at a speed which is approx. four times less great than the rate of emission of the main gas current. It is indeed preferably to work at a high speed in the immediate vicinity of the centrifuging wheels - which produces increased efficiency of the gas drafting or drawing out process; on the other hand, as one moves away from the periphery of the wheels, it is preferable to find slower gas currents there, so that the difference in speed between these gases emitted by the blower means and the ambient air is not excessive so that there are no counter-currents due to impacts among the various air masses.

It is likewise an object of the invention to provide an apparatus for producing mineral fibres from a material with a high melting point, such as basalt glass, blast furnace slag or other similar materials. To this end, it proposes an apparatus comprising a series of centrifuging wheels disposed in an arrangement which brings their peripheral surfaces close to one another, driven in a rapidly rotating fashion by motors, two consecutive wheels in the path of the material to be fibred turning in opposite directions, a rising feed of molten material making it possible for the said material to be poured onto the outer surface of the first centrifuging wheel, a blower means generating around the series of centrifuging wheels a gas current parallel with the axes of rotation of the said centrifuging wheels, the improvement residing in the fact that the motors are disposed sideways, outside the assembly constituted by the series of centrifuging wheels and entraining the said wheels by means of mechanical transmission means disposed so that an air passage remains through the series of centrifuging wheels.

The invention thus proposes two possibly complementary embodiments which set out to improve the conditions under which gas circulates around the centrifuging wheels, whether between the wheels or on their periphery. Various more particularly advantageous improvements may also be made; for example, it is worth while for the conditions under which air circulates around the machine - and even at a relatively great distance - to be as homogeneous as possible, which is why the machine is preferably mounted on feet in order to leave free the space under the machine. On the other hand, it is preferable to protect the mechanical transmission means by providing shaped caps which facilitate the gas flow. Likewise, it is worth while regrouping the air, water and binder supply pipes under the same caps or covers. Still with the same idea of encouraging the flow of induced gases between the centrifuging wheels, it is advantageous to use slightly frustoconical wheels which reduce in size with increasing length.

With regard to the conditions under which gas circulates over the periphery of the centrifuging wheels, it is more particularly advantageous to work with a second peripheral blower ring, consisting for example of a series of large diameter jets, the minimum distance between the axis of one jet and the periphery of a centrifuging wheels advantageously being between 70 and 150 mm and preferably between 80 and 100 mm. This second peripheral ring then backs up the main ring, the action of which may be limited to an action of drawing out the fibres at the very moment when they are being formed. To favour this drawing out, it is advantageous to work with a main blower ring consisting of a lip emitting a gas current which washes over the periphery of the centrifuging wheels, the said lip being bounded on the one side by the wheels themselves and being at a radial distance of around 5 to 10 mm from the closest centrifuging wheel.

Further details and advantageous characteristic features of the invention will emerge from the ensuing description in which reference is made to the appended drawings in which:

Fig.1 is a front view of a fibring apparatus according to the invention, with four centrifuging wheels;

Fig.2 is a detailed side view of a centrifuging wheel according to Fig. 1;

Fig.3 shows comparative curves for heat conductivity as a function of density for mineral wool felts obtained by the apparatuses according to the prior art or according to the apparatus in Fig. 1, and

Fig.4 is a diagram of a frustoconical centrifuging wheel.

Fig. 1 is a front view of a fibring apparatus according to the invention, seen from the fibre side. This apparatus consists essentially of four centrifuging wheels 1, 2, 3, 4 all of the same diameter with the exception of the first wheel which is smaller. The wheels 1, 2, 3, 4 are disposed in an arrangement which brings their peripheral surfaces close to one another. These wheels 1, 2, 3, 4 are rotated by means of drive units 5, 6 which act through transmission belts 7, the two wheels on the right being driven for instance in a clockwise direction while the two wheels on the left are driven in the opposite direction, so that two consecutive wheels in the path of the material to be fibred (which descends from the highest wheel 1 to the lowest wheel 4) turn in opposite directions. The drive units 5, 6 are disposed on each side of the series of wheels 1, 2, 3, 4, and thus the rear of the machine is empty and ambient air is able to pass freely between the wheels at the level of the central zone 8. They are mounted on a chassis supporting the whole of the machine, resting on the ground on feet or wheels which roll on rails, which makes it possible if necessary to move the machine for servicing. The transmission belts 7 are enclosed by profiled covers 9 in order to avoid dead zones at the rear of the machine, which facilitates the induction of air through the central zone 8.

As they turn at high speed, the wheels give rise to the formation of a flow of induced air which sweeps the central zone 8, preventing in it the accumulation of fibres which otherwise fall as rovings and it is well known that these adversely affect the final quality of the product. Furthermore, as the environment of the machine is extremely draughty, the rotation of the wheels creates a kind of gaseous envelope at a distance from the wheels and this also tends to "clean" the machine.

The series of wheels 1, 2, 3, 4 is surrounded by a peripheral blower means 10 constituted by a continuous blower nozzle emitting a current of drafting gas essentially parallel with the axes of rotation of the centrifuging wheels. This main gas current essentially has the task of assisting with drawing out the fibres which, under the effect of centrifugal force, become detached from the peripheral wall of the centrifuging wheels. As the fibres formed are very fine, they cool very rapidly; this drafting action is therefore at its maximum in the immediately vicinity of the wall of a wheel, which explains the attraction of a flow of gas which sweeps over the surface.

This blower nozzle 10 is backed up by an assembly of large diameter nozzles 11 which emit jets of air which are likewise substantially parallel with the main gas current and the purpose of which will now be explained more precisely with reference to Fig. 2 which diagrammatically shows a cross-section through a centrifuging wheel taken on the line A-A in Fig. 1.

Shown in Fig. 2 is a centrifuging wheel constituted by a rim 12 supported by wheel discs 13, 14. The wheel is rotated by its shaft 15. The disc 13 rests against an abutment 18 on the shaft 15; like the disc 14, it retains the rim 12 by means of projections 19. Locking screws 20 likewise fix on the shaft 15 an atomiser disc 21 consisting of two discs 22, 23 associated by screws 24. The cooling water is conveyed to the rim 12 by a groove 25 fed through apertures 26 and is discharged through orifices disposed on the sides of the wheel and not shown here. The composition of the binder supply is conveyed as far as the compartment bounded by the two discs 22, 23 and escapes through grooves 27 in the form of droplets which burst under the action of the peripheral gas current.

This Fig. 2 likewise shows a small collar 28 which serves as a protection for the diffuser disc and prevents penetration of fibres between the discs 14 and 22. Also shown in the upper part of the drawing is the outer part of the rim 12 which has a certain number of longitudinal grooves 29 adapted to encourage clinging of the material to be fibred.

Over quite a portion of its periphery, the centrifuging wheel is enclosed by a blower means. The said blower means is bounded on the one hand by the rear disc 30 rigidly driven with a rotary movement together with the wheel and the fixed wall 31. The radial distance D_1 separating the nozzle of the wheel is preferably comprised between 5 and 10 mm. This distance D_1 and the rate of flow of supply air are advantageously chosen so that the average speed of the main gas current emitted is greater than or equal to 100 m/s in order to optimise the drawing out of fibres by this gas current.

The gas current is essentially emitted parallel with the axis of rotation of the shaft 15 while a certain tangential component may be imparted to it in accordance with the teachings of FR-A-2 322 114.

It should be noted that this current of air, although of great velocity, acts only on the lightest particles which are the fibres; the non-fibred particles which are very highly accelerated by rotation of the wheels do not for practical purposes see their trajectory altered, so that the separating action is not affected.

If such gas velocities are favourable in connection with fibre formations, they do lead to important impacts with the surrounding air masses. These are likely to lead to the formation of return currents all around the series of centrifuging wheels. This formation is advantageously prevented by the establishment of the second peripheral blower ring which serves to create a second gas current which is less rapid but which is orientated in the same direction as the main blower current.

This second blower ring is for example constituted by a series of nozzles 32 of relatively large diameter, which is preferably greater than 25 mm, being for example comprised between 30 and 50 mm, emitting air jets the velocity of which is for example around one quarter of the velocity of the gases emitted by the main ring. The radial distance D_2 separating the central axis of these nozzles 32 from the closest centrifuging wheel is advantageously comprised between 70 and 150 mm at preferably between 80 and 100 mm. At such a distance, it may be considered that these nozzles 32 have no action on the formation of fibres and that their role is therefore essentially a role of entraining and separating fibres from the mass of non-fibred particles. Good results are obtained when about 40% of the total quantity of gas blown around the centrifuging wheels is due to the action of these auxiliary nozzles 32.

Other measures may also help to improve the fibring apparatus. The most important, shown diagrammatically in Fig. 4, consists of using frustoconical centrifuging wheels instead of those which consist of straight cylinders. The result is a wheel of which the rim 33 becomes thinner in the direction of the gas current emitted by the means 34 of emitting the main gas current. The cone angle α is for example close to 15°. In this way, it is possible to assist with eliminating suppressions at the level of the central zone 8.

Another interesting measure resides in protecting the nose 35 of the centrifuging wheel with a profiled cover, of for example lozenge shape, which also assists the flow of gases close to the central zone 8. The caps on the centrifuging wheels may likewise be protected by a lozenge shaped cover.

Comparison of products obtained according to the prior art, for example with an apparatus according to the teachings of Patent Application EP-A-195 725, reveals improvements on two very important and specific points. Firstly, the rate of non-fibred material in the end product decreases quite substantially which inter alia means an end product which has a far more pleasant feel.

Moreover, for equal density, the heat resistance of the end products is enhanced as can be seen by examining Fig. 3 which shows the curves for the Lambda heat conductivity rates (in mW/m.K) for various densities (in kg.cu.m) of products obtained according to the prior art (curve 36) or with an apparatus according to the invention (curve 37), the heat resistance being of course inversely proportional to the heat conductivity. This increase in heat resistance already true for relatively heavy products of which the density is for example greater than 100 kg/cu.m is still quite especially true of lighter products, for example those of a density of between 40 and 100 kg/cu.m, which it is virtually impossible to produce with apparatuses according to the prior art, the curve 36 showing virtually an asymptotic line at a density of around 80 kg/cu/m.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of forming mineral fibres comprising pouring material to be fibred in the molten state over the peripheral surface of a first of a series of centrifuging wheels turning at high speed, so that the material is accelerated and passed to a second wheel where a part of the material is converted to fibres under the effect of centrifugal force and the remaining part of the material is passed to a further wheel for fibring the fibres formed by the various centrifuging wheels being drawn up by a main gas current passing around the series of centrifuging wheels and emitted in the immediate vicinity of the said wheels in a direction substantially parallel with the axes of rotation of the wheels, wherein there is at least one auxiliary gas current located at a distance from the centrifuging wheels and the said auxiliary gas current is oriented in substantially the same direction as the main gas current.

2. A method of forming mineral fibres according to claim 1, in which the said auxiliary gas current is generated by passing air between the centrifuging wheels, the passage of air being produced by rotation of the wheels drawing in ambient air.

3. A method of forming mineral fibres according to claim 1 or 2, in which the main gas current is generated by a main blower means and the said auxiliary gas current(s) is/are generated by a blower ring which assists the blower means generating the main gas current.

4. A method of forming mineral fibres according to claim 3, in which about 60% of the total quantity of air

blown around the series of centrifuging wheels results from the main gas current.

5. A method of forming mineral fibres according to any one of claims 1 to 4, in which the velocity of the gas in the auxiliary current is approximately equal to one quarter of the velocity of the gas in the main current.

6. A method of forming mineral fibres according to any one of claims 1 to 5, in which the velocity of the gas in the main current is greater than or equal to 100 m/s.

7. An apparatus for producing mineral fibres comprising a series of centrifuging wheels adapted to rotate about substantially parallel axes and disposed in an arrangement which brings outer peripheral surfaces of said centrifuging wheels close to one another, two consecutive wheels in the path of the material to be fibred turning in opposite directions, a rising supply of molten material making it possible to pour the said material onto the outer surface of the first centrifuging wheel and a main blower means creating around the series of centrifuging wheels a main gas current which is substantially parallel with the axes of rotation of said centrifuging wheels, means for generating at least an auxiliary gas current located at a distance from the centrifuging wheels, the said auxiliary gas current being oriented in substantially the same direction as the main gas current.

8. An apparatus for producing mineral fibres according to claim 7, in which the said means for generating the auxiliary gas current comprises the motive means for driving the centrifugal wheels, the rapid rotation of which inducing an auxiliary flow of air between

said centrifuging wheels, said motive means being offset from said rotation axes and thereby permitting said auxiliary flow of air to pass between said centrifuging wheels.

9. An apparatus for producing mineral fibres according to claim 8, in which the said motive means includes a plurality of motors entraining said centrifuging wheels by means of mechanical transmissions which are disposed so as to allow air to pass through the series of centrifuging wheels.

10. An apparatus for producing mineral fibres according to claim 9, in which the mechanical transmissions are protected by a profiled cover which likewise encloses air supply pipes associated with the centrifuging wheels.

11. An apparatus for producing mineral fibres according to any one of claims 7 to 10, in which the said means for generating the auxiliary gas current comprises complementary air blower means disposed at a distance from the main blower means.

12. An apparatus for producing mineral fibres according to any one of claims 7 to 11, in which the said centrifuging wheels are frustoconical.

13. An apparatus for producing mineral fibres according to any one of claims 7 to 12, in which the main blower means comprise a nozzle bounded on the inner face by the centrifuging wheels themselves.

14. An apparatus for producing mineral fibres according to any one of claims 11 to 13, in which the said

complementary blower means comprises a series of nozzles, the diameters of which are greater than 25 mm.

15. An apparatus for producing mineral fibres according to claim 14, in which the minimum distance D_2 between the axis of one nozzle and the periphery of one centrifuging wheel is comprised between 70 and 150 mm.

16. An apparatus for producing mineral fibres according to claim 14, in which the minimum distance D_2 between the axis of one nozzle and the periphery of one centrifuging wheel is comprised between 80 and 100 mm.

17. An apparatus for producing mineral fibres according to any one of claims 13 to 16 in which the radial distance D_1 between the nozzle and the wheel is comprised between 5 and 10 mm.

18. An apparatus for producing mineral fibres according to any one of claims 7 to 17, in which the caps of the centrifuging wheels are protected by covers.

19. An apparatus for producing mineral fibres according to any one of claims 7 to 18, in which the noses of the centrifuging wheels are protected by covers.

20. An apparatus for producing mineral fibres according to any one of claims 7 to 19, supported by a chassis placed on feet in such a way as to leave an empty space under the machine.

21. A method of forming mineral fibres substantially as hereinbefore described with reference to any one of the accompanying drawings.

22. An apparatus for producing mineral fibres substantially as hereinbefore described with reference to any one of the accompanying drawings.

Dated this 25th day of August 1993
ISOVER SAINT-GOBAIN
By its Patent Attorneys:
GRIFFITH HACK & CO
Fellows Institute of Patent Attorneys of Australia

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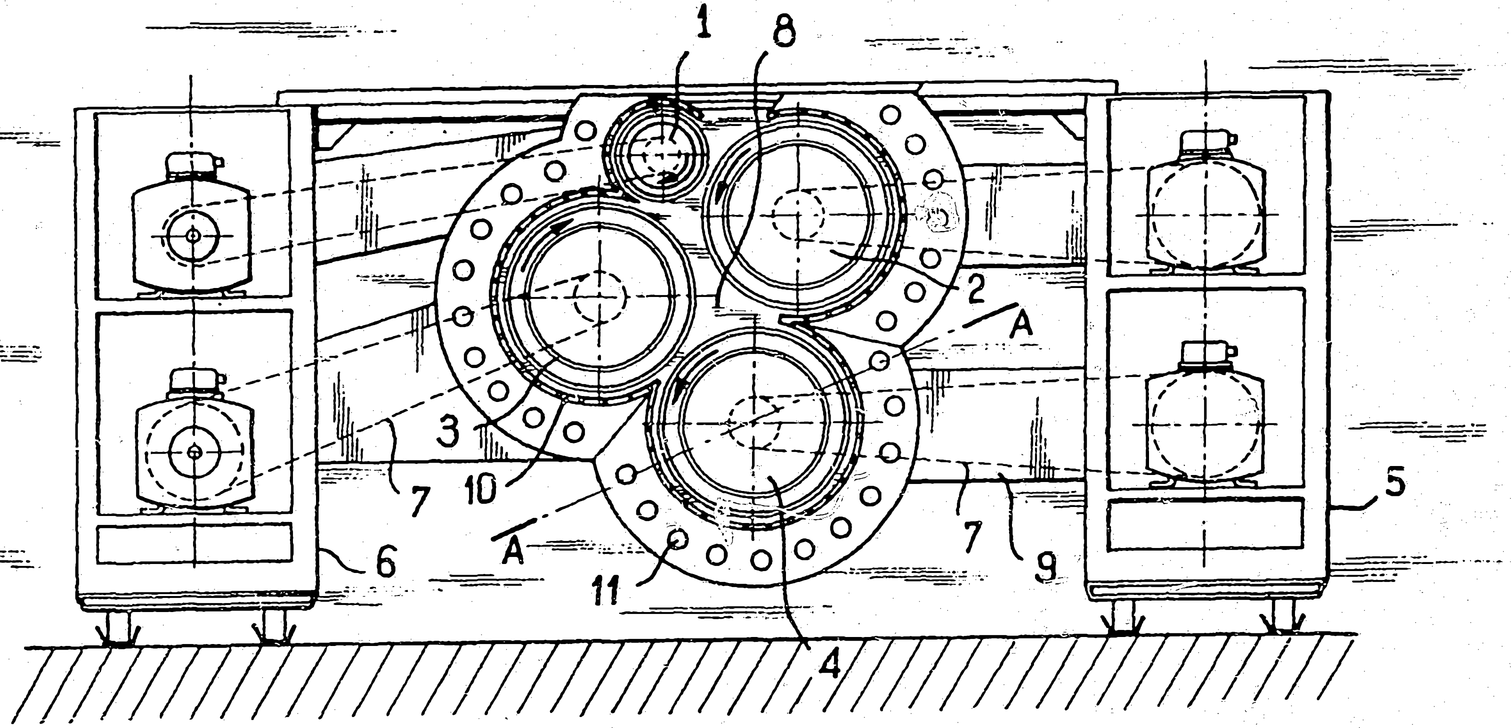

FIG_1

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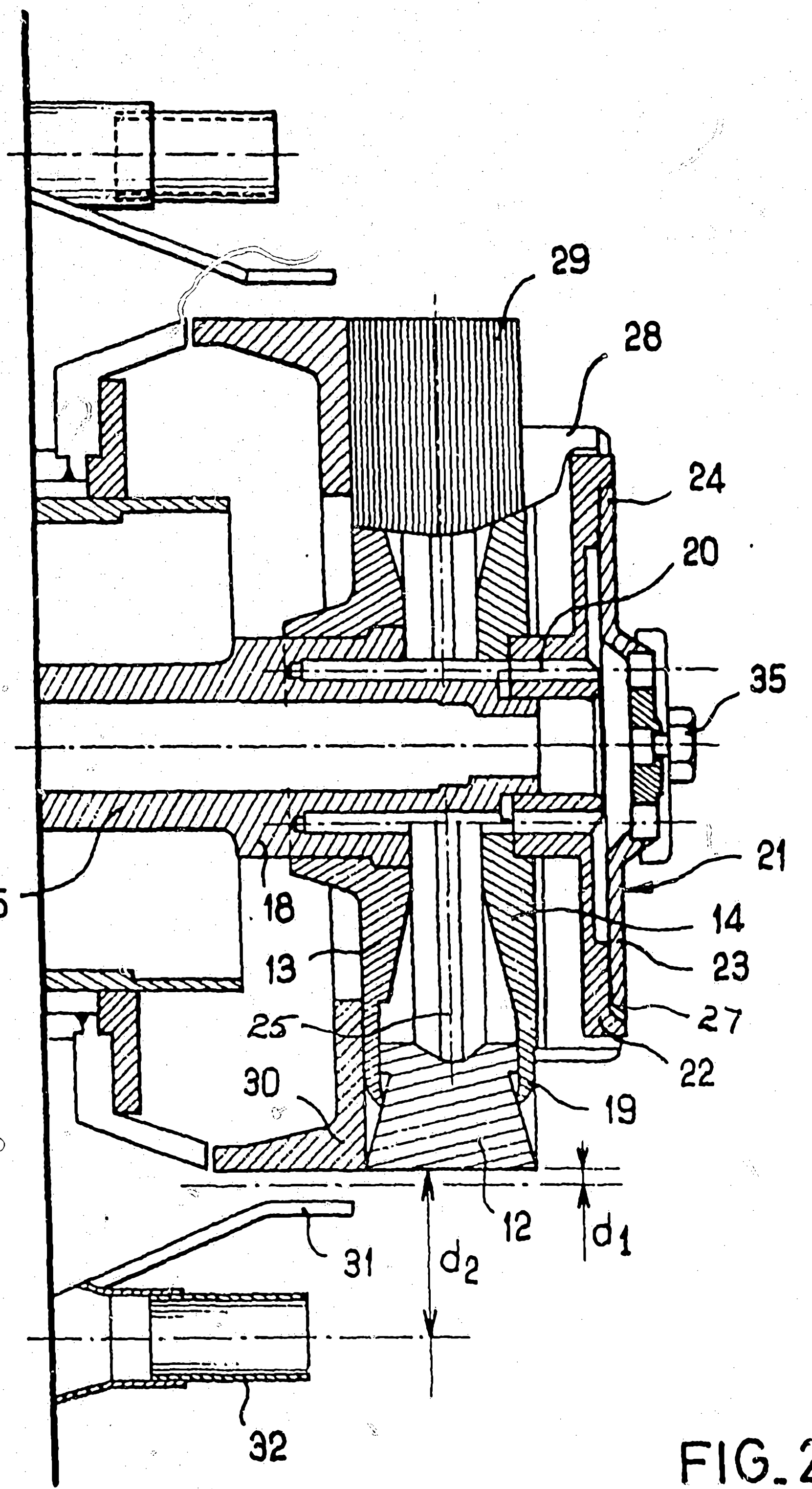
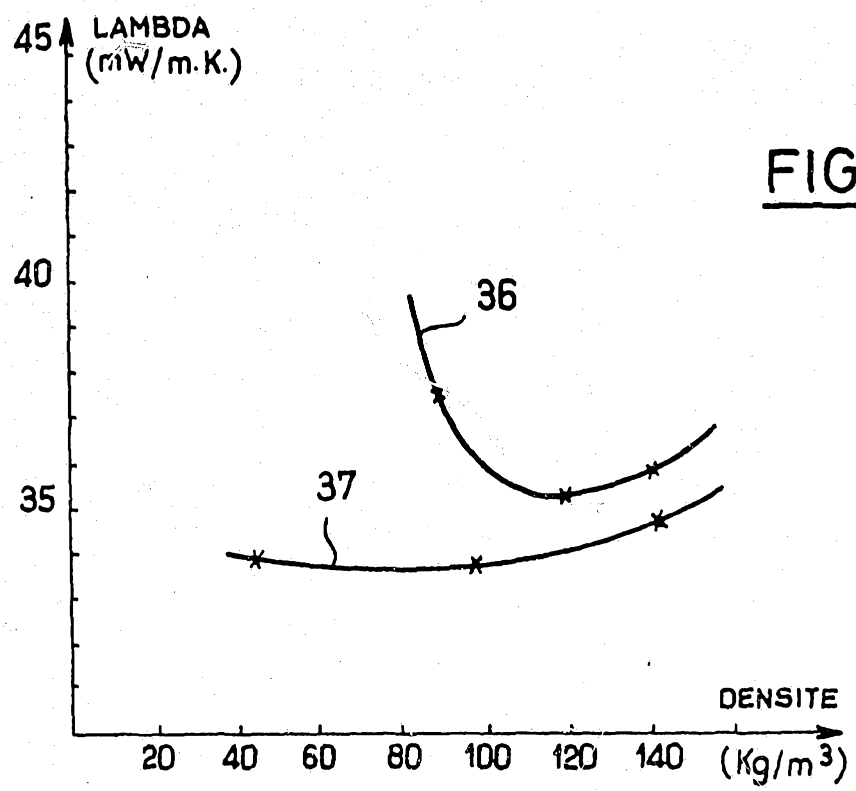


FIG_2



45
LAMBDA
(mW/m.K.)
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DENSITE
20
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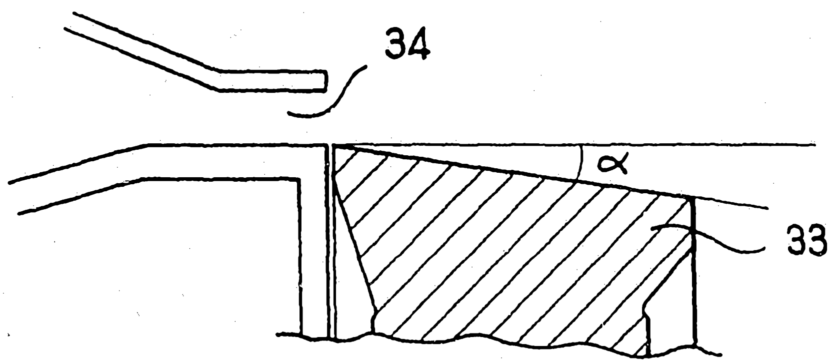
(Kg/m3)

FIG_3



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α
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FIG_4