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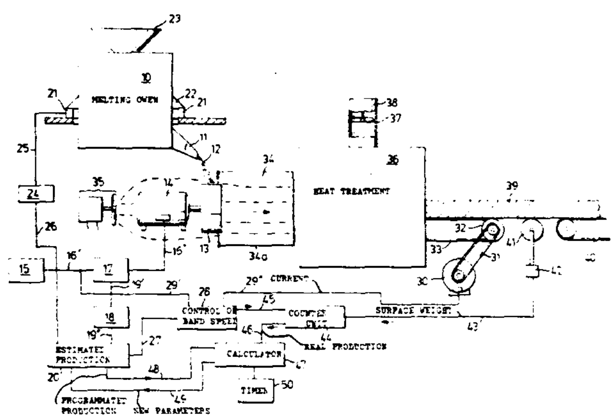
(71) Applicant: **ROCKWOOL AKTIEBOLAGET, Fack 615, S-541 01 Skövde (SE)**

(72) Inventor: **Brelén, Hans, Karl Magnussons väg 30, Skövde (SE)**
Inventor: **Dahlberg, Stellan, Pl 715, Tidan (SE)**
Inventor: **Aberg, Ulf, Stjärnvägen 29, Skövde (SE)**

(74) Representative: **Avellan-Hultman, Bengt, Hultmans Patentbyra Aktiebolag Jungfrugatan 16 P.O. Box 5165, Stockholm 5 (SE)**

(54) A method for control of the surface weight of a mineral wool mat.

(57) A method for controlling the surface weight of a mineral wool mat (39) comprises production of the mineral wool by fibration of a mineralic melt (12). transfering the formed mineral wool to a collection device (36), and measuring one or more variables. influencing the amount of mineral wool formed per unit of time. introducing said variables into a functional combination and controlling under influence thereof the movement of the collection device, whereby the surface weight of the mineral wool mat is measured by weighing (44), and the functional combination is brought to contain one ore more parameters. the value of which is changed by influence from a counter unit (20) on basis of the amount of mineral wool produced per unit of time as well as on basis of the corresponding amount of mineral wool produced during one or more earlier periods of time.



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ROCKWOOL AKTIEBOLAGET

A method for control of the surface weight of a mineral wool mat

In the production of mineral wool a melt of mineralic raw material is first produced. As melting system one may use cupola owens, fans, electrode owens and so on. As a rule, there is for each type of raw material melt one or more melting systems giving a technically acceptable function. For other melt material compositions and working conditions, other melt systems may again be used.
In the production of mineral wool one ususally causes the melt continuously to flow to one ore more fibration aggregates. There is also with respect to the fibration aggregates a great number of possibilities, but in each separate case nevertheless the choise of a suitable fibration aggregate and suitable fibration methods is more limited. Amongst fibration systems for the production of mineral wool those are the dominating ones, which use rotational bodies for throwing out fibres of mineral wool in combination with gaseous currents for collecting the mineral wool and transfering it

to a collection means, usually a continuously moving band.

An often used system for the production of mineral wool comprises a cupola owen working with coke as its substantial burning material. The cupola owen is charged with a mixture of the material concerned, for instance stone, and coke, and in the cupola owen the material is molten by the heat developed by the coke during its combustion, when blast air is pressed into lowermost part of the owen. Through an out let opening in the lower part of the owen, then melt will flow out continuously. By means of a system of melt furrows the melt is conducted to a fibration aggregate, comprising usually two until four so called spinner wheels, mounted each on one horizontal shaft in substantially the same vertical level. The spinner wheels thereby are so arranged that the melt will first hit one of them and thereafter be thrown over to the next one and so on. From the spinner wheels the melt is moving in the form of a great number of threads, which due to the centrifugal force and possibly also under influence of an air or gas veil moving around the spinner wheels and more or less completely surrounding them will be reshaped into fibres. By influence of the gas movement, the fibres thus formed are thrown away from the fibration system. Thereafter a separation of the transportation air and the mineral wool takes place, and the mass of mineral wool fibres, which is rather often combined into mineral wool pellets is formed into a comprehensive mineral wool mat.

A basic problem in the production of mineral wool has been to provide an even and pre-determined surface weight of the mineral wool mat. From the mineral wool mat, as a matter of fact, during its continuous treatment mats or discs or the like will be produced in given thicknesses. The surface weight proper of the mineral wool mat thus will be completely indicative to the density which is obtained by the final mineral wool products. The density of the mineral wool products is of an essential importance for its properties but also, of course, for the production costs of same. If a given density is necessary for achieving certain properties of the produced product, then there is a very great economical interest in said product not having more or less hazardly a varying density, which may essentially exceed the desired one. Therefore, one tries to achieve that the mineral wool products produced shall possess densities which are within very narrow limits This, in turn, will give rise to corresponding demands on the surface weight of the mineral wool mat, from which the mineral wool product is produced. If now the mineral wool mat would move at a constant speed, and the production of mineral wool would simultaneously be at a constant and pre-determined rate, then also the surface weight of the mineral wool mat would be constant and pre-calculatable. However, the production of mineral wool varies from one moment to the next one. This caused that one tried to control the propagation speed of the mineral wool mat such that the said variation should be compensated for, so that at a decreasing production the speed of movement of the mat would be smaller and vice versa.

It has allready been found that if mechanical forces are used for the fibration, the need of power for the fibration system is in a given relation to the amount of mineral wool formed, even if this relation is not completely constant. As a matter of fact, if more melt is fed to the fibration system, this will need a greater amount of power and vice versa, but simultaneously with an increased feed of melt also more mineral wool is formed. These circumstances are more clearly described in the Swedish patent specification 165.153. An other possibility of control comprises continuously to measure the amount of melt, given off per unit of time from the melting system (the melting owen). This, for instance, could take place by continuously or at given short intervals of time measuring the weight of the melting system along with the melt existing therein and in this way stating the decrease of weight per unit of time. In the Swedish patent specification 76/07.601-7 it has been proposed to combine these two possibilities and thus to introduce in cooperation into a fibration procedure the need of power of the fibration system and the decrease of weight of the melting system per unit of time. This combined method of control has given a better result than could be obtained by each of the two control methods separately.

However, it has proved, that also with the last mentioned method of control it has not been possible to do away with all of the reasons for variations in the surface weight of the mineral wool mat and to keep this surface weight completely constant or at least sufficiently constant for satisfying the above mentioned desires. Thus it has proved that further factors, in part of a known character and in part of a character which is not yet known, influence the production of mineral wool per nuit of time, and that the last mentioned factors do not receive any complete expression and in some cases even no expression at all in the decrease of weight of the melting system, nor in the need of power for the fibration system. Such variation, occuring due to the last mentioned factors, therefore also gives no reason to any corresponding change of the speed of the mineral wool mat, and the consequence then will be, that there will still exist variations in the surface weight of the mineral wool mat.

The basis of the present invention is a thorough study of these factors, hitherto very little regarded or even not regarded at all, as well as their influence on variations of the surface weight of the mineral wool mat. Thereby it was possible to prove that the said factors may be due to varying composition of the material in the melt, running out from the melting system, further to the purely mechanical construction of the fibration system, further to the way in which the melt is fed to the fibration system and most probably to further circumstances not yet penetrated. Per se it would even be possible that one could more or less satisfactorily register these variations but it would scarcely be possible to measure all of the said reasons of variations, and every attempt to execute such a work would also cause such a complicated system, that it would from the point of control be impossible to make or to use it.

The present invention referes to a method and an arrangement by which one has tried to find a solution of the problem mentioned above, both regarding its aspects allready known and regarding its aspects perhaps not yet known. This solution shall satisfy high demands for effectivity and flexibilty.

The invention, thus, in first place, regards a method for controlling the surface weight of a mineral wool mat in a procedure for its production, in which mineral wool is produced by fibration of a mineralic melt, the mineral wool formed is transferred by means of a stream of gas or air to a receiver system, in which the gas or air, resp., is separated from the mineral wool, and the mineral wool forms a mat on a collection band, and in which one or more variables, influencing the amount of mineral wool formed per unit of time is measured, said variables being introduced into a functional system, and finally the speed of movement of the collection band for the purpose of controlling the surface weight of the mineral wool mat formed being controlled by means of a control unit in accordance with the amount of mineral wool formed during each unit of time, expressed in the form of the functional system, in which the variables had been introduced.

According to the invention, the surface weight of the mineral wool mat formed is determined, for instance be weighing. The functional system is brought to contain one or more parameters, the value or values, resp., of which being changed by influence from a calculator unit, which starting from the expression for the amount of mineral wool formed per unit of time and derived from the said functional system, as well as from the corresponding expression obtained from the surface weight of the mat and the speed of movement of the collection band, determines the parameter value or the combination of parameter values, which would, during one or more measuring periods before the actual measuring period have given the smallest difference between these two expressions.

The invention also regards an arrangement for the execution of the said method.

As the process variable, which is correlated to the amount of mineral wool formed during a unit of time, one may advantageously in the way, indicated in the above mentioned Swedish patent specification 76/07.601-7, provided that mechanical forces are used to some extent for the fibration, use the need of power of the fibration system and/or the amount of melt given off by the melting system per unit of time, for instance determined by means of the decrease of weight of the melting system per unit of time, the latter one as a process variable, correlated with the amount of mineral wool formed.

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As examples of other process variables, correlated to the amount of mineral wool formed per unit of time may be mentioned: the tightness of the stream of mineral wool leaving the fibration system, the thicknes of the jet of melt, fed to the fibration system and so on.

The weighing of the mineral wool mat formed suitably takes place by means of a roller or a short band, supported or kept on so called load indicators, which are means which dependent upon the load or the pressure, to which they are subjected create a preferably electric signal, for instance a voltage or a frequency dependent upon the pressure or the load, resp.

Many of the process variables, which may thus be regarded, are subject to both short periodical and long periodical variations. In addition thereto they are subject to disturbances of many different kinds, but these disturbances as a rule are of short periodicity. This is the reason why one prefers to use, according to the invention, in stead of or in any case along with momentary values of the process variable concerned, a mean value, constructed by guidance of the value of said variable during a closely antecedent, passed period of time. Thereby it is also advantageous that one allows such a mean value, which is derived only short time before the moment of control proper, to have a stronger influence than a mean value, which is derived more far back in time. One may also express this relation by means of the following formula:

$$P_n = p_n + f \cdot P_{n-1} + f^2 \cdot P_{n-2} + f^3 \cdot P_{n-3} + \ldots$$

In this formula P_n is the representative, retrospective estimation of the process variable, whereas p_n, P_{n-1} and so on indicate estimations of the variable p at a time before the time of observation, having the figure of order n or n-1 and so on. The factor f finally may be the reduction factor, causing that the value of p gets less influence at a time, which is more far away in time. This factor, therefore shall at this execution of the invention be less than 1. The value of the factor f, of coarse, must be chosen with respect to how tight the observations are made. If an observation is made every five seconds, the factor f may suitably be chosen equal to 0,9. The shorter the intervals between the observations are, so much less shall the value of the factor f be.

The functional relation may be expressed as a formula. This may be of many different kinds. If for instance, there are only two process variables contained in the control procedure, below indicated as p and q, then the said formula may be written as

$$F(p, q) = a \times p^n + b \times q^m + c;$$

In this formula a, b, c, n and m are different parameters. The parameters n and m have proved suitably to be in the order of magnitude between .5 and 2. Another functional relation which may be used is the one manifesting itself in the following formula:

$$F(p, q) = a \sqrt[s]{p^n \times q^m} + b;$$

In this formula, as in the earlier one, p and q are process variables, whereas a, s, n, m and b are parameters. Also in this case, suitably, the parameter values of n and m should be within the interval of .5 to 2. It has proved suitable that the value of s is equal to the sum of n and m.

In addition to the two functional relations mentioned above, also other functional relations may be concerned, and what functional relation should be used in the individual case is dependent upon many different circumstances, amongst which may be mentioned, the type of equipment for the production of the mineral wool, the calculator available, the accuracy you intend to achieve in the individual case and so on.

If, in the formula first mentioned above, the parameters n and m occuring as powers are put equal to 1, one will obtain a simplification which is acceptable for many cases, said formula reading:

$$F(p, q) = a \times p + b \times q + c;$$

The invention will be further described delow in connection with a form of execution shown in the attached drawing, but it is understood, that the invention shall not be limited to this specific form of execution, but that all different modifications may occur within the frame of the invention. In the drawing there are certian components only indicated by means of block diagrams, but as soon as the man skilled in the art has got knowledge from the above about the general principle of the present invention, he will have no difficulty in constructing useable forms of these components.

The mineral melt, in the form of execution shown in the drawing, is obtained from a melt owen 10, which is charged at its upper end with a mixture, prepared in advance of minerals, e.g. some suitable stone-variety in a suitable magnitude of crushing, and burning material, the last mentioned preferably in the form of coke, which is burnt in the owen thereby melting the mineral, whereafter the melt is tapped off at the opening 11 at the lowermost part of the owen 10 in the form of a beam 12, which is fed to a spinning aggregate, here represented by one single spinner wheel 13.

Of coarse, it is of no great importance to the invention, that the melt owen 10 is shown in the form of a cupola owen, but all melt owen construction, known *per se* may as well be used, for instance an electric electrode owen.

The spinning aggregate 13 is driven by means of a motor 14, which gets its current over conduits 16', 16" from a source of current 15 such as an electric distribution net work. For a purpose, which will be explained in the following, a power measurement device 17 is connected into the conduit 16. In some way, which does not form part of the present invention, the indication from the power measuring instrument 17 is, over the conduit 19' transferred to a power indication treatement instrument 18 and over the conduit 19" from this instrument to the counter 20.

The form, obtained by the indication from the instrument 17 or from the power indication treatement instrument 18, resp., may principally be of any deliberate type, which is useable within traditional data treatment technics, for instance said indications may comprise a puls train with a puls frequency which is distinctly determined by the power, but also other forms, known per se may be used. The type of indications has no decicive importance to the present invention.

The melt owen 10 is elastically resilently carried up, and in some suitable way one or more pressure or load sensors 21 are provided in the elastically resilent carrier, for instance such that they are arranged symmetrically distributed around the circumference of the owen and carry up feet 22 of the owen 10. In this way they will indicate the weight of the owen along with the molten or non-molten, burned of non-burned material existing therein. As the weight of the material is decreased by melt being removed in the form of the beam 12 to the spinning aggregate 13, or as the weight increases by further material being fed through the charge opening 23 to the owen 10, its total weight will change. The weight is transferred over the conduit 25 to a treatment unit 24. The indication of weight is treated in the said treatment unit 24 such that the out put conduit 26 to the counter 20 will not indicate the weight but only the changes of weight caused by the take off of melt by the beam 12, also in this case for instance in the form of a pulse train of a frequency dependent upon the change of weight.

In the counter unit 20, thereafter, a treatment of the two indications will take place, coming in through the conduits 19', 18, 19" and 25, 24, 26 with the consequence that a control magnitude will exist in the out put conduit 27 to the controler 28. This controler 28 determines in turn over the conduit 29', 29" the speed of an endless band 33, forming collection band for the mineral wool mat 39 produced.

In this connection it should be observed that the mineral wool in the shown form of a spinner aggregate will be created in a way, known _per se_ by thin threads of the melt being thrown out from the spinner wheel or wheels, resp., in the spinner aggregate and being caught by a stream of gas or air, driven forward by means of a blower 35, preferably under guidance from a jacket 34a, so that mineral wool will along with this gas or air be transferred to a collector device 36, in which for instance spraying with different stuffs may occur in a way known _per se_, and in which the gas or air, resp., is separated from the mineral wool and is drained off, shematically indicated by the chimney 38 and the suction fan 37 applied therein. The mineral wool is depositied in its turn on the part of the collection band 33, not visible in the drawing, so that it will be removed in the form of a mat 39.

From the collection band 33, the formed mineral wool mat 39 is removed over one or more transportation bands, for instance the conveyor band 40 in order to be further treated in one way or another, which does not form part of the present invention.

In the parts, hitherto described, the arrangement is known from the above mentioned Swedish patent specification 76/07.601-7.

As mentioned above, however, test which have been made have given at hand that one will certainly by means of this arrangement gain rather essentially regarding constancy of the surface weight of the mineral wool mat produced, but that there are created disturbances of a type in part known, in part not yet completely discovered, said disturbances nevertheless causing a non-desired variation in regard of surface weight of the produced mineral wool mat 39. The purpose of the present invention is to find a remedy in compensation for these disturbances.

Between the two conveyors 33 and 40 mentioned above a balance device is introduced, said device having the purpose of continuously during the movement of the mat 39 to measure its surface weight. One type of such a balance device is described in the Swedish patent specification 76/06.381-7. Shematically, this balance device is shown in the form of an easily rotating roller 41, which is, as to its weight proper very light, and which rests on a weight sensor means 42. Also in this respect it is without material importance to the invention, how this weight sensor means 42 is constituted. For instance it may contain an oscillator, giving off a puls train of a puls frequency, dependent upon the weight. The pulses of this puls train are thereafter transferred through the conduit 43 to a signal treatment unit 44, which calculates the mean weight of the mineral wool mat and gives off a statement about this mean weight. This calculator unit 44 gets over the conduit 45 statements about the speed of the band and over the conduit 46 it gives off to a calculator unit 47 statements about the real production, calculated from these dates, said unit, similarily with the other calculator units in the system, being of some type known per se from the data technics.

The calculator 47, however, is not only fed with a statement about the real production according to real surface weight and real speed of the band, transferred over the conduit 43, 44, 46, but also with a statement about the, so to say, pre-supposed production, transferred from the counter unit 20 over the conduit 48, such as this production will appear from the function relation mentioned with the parameters and variable values contained therein.

The calculator unit 47 is connected to a time indicator work 50, causing the the calculation operation in the calculator unit 47 will take place in sequence after each other and in an integratory form with pre-determined intervals of time. The resulting instruction, then, will be given at pre-determined intervals of time, exemplified above as five seconds, to the counter unit 20 over the conduit 49.

It will now be seen, that one has in this way provided firstly a prognosis in the form of the said functional relation of the amount of mineral wool produced per unit of time, and that one may from this prognosis derive an estimation of an adapted speed of the mineral wool mat, which is taken care of by the counter unit 20, which functions therefore as a control unit with respect to the produced surface weight, and secondly also one has measured the real production. Regularily, now a difference will appear between these two statements about the production, even if the difference in time is taken into accont. In the calculator unit 47 now a parameter is chosen, which, if used in the counter unit 20, would have given the smallest difference during a given earlier period of time. If the values of the parameters in the functional connection, thus found by the calculator unit 47 to give the smallest difference, would not agree with the values, contained in the functional relation programmated into the counter unit 20, then an automatic re-programmation will be initiated from the calculator unit 47.

If now, for instance due to a change in the temperature or the viscosity of the melt, the relation between amount of melt, given off from the melting system 10, and the amount of mineral wool, received by the band 33, would change, then this means that the functional relation which earlier gave the most advantageous prognosis as far as regards produced amount of mineral wool and its surface weight, and which was based upon a given change of the flow of melt, will now give an erraneous prognosis. For this reason a difference will appear between the registration of really produced mineral wool, on the one side, and the existing prognosis, on the other side. This difference causes that the calculator unit 47 will find a new functional relation, giving a better prognosis.

Comprehensively, it can therefore be said that it was allready by known technics possible to observe existing errors in the adjustment and, guided thereby, to correct the errors as far as regards a subsequent production of mineral wool. By the present invention the same errors are observed, but they are integrated and are introduced into a functional relation, which has for its purpose to anticipate comming errors and, in advance, to correct them by means of a prognosis.

In some phases of the production, especially at starting and stopping of the system, or at sudden interuptions in the work of the system, it may be difficult or even impossible to create a so called "feed-forward" control, which is possible to use for its purpose. By this, the control of the speed of the band will suffer. By introducing in combination with this feed-forward control a conventional feed-back control, a correction of most of the errors emanating from said reason will be created. This feed-back control also acts as a security in the case of the feed-forward control would cease to function or have a bad function, and vice versa. A feed-back control may, without the introduction of any new element, be provided by the surface weight determined by weighing the mineral wool mat being compared with the surface weight which forms a desired value for the control of the speed of the band caused by the control unit 28. A difference, perhaps obseved thereby may then in a way known per se be arranged to influence the control of the speed of the band in addition to the control, starting from the prognosis of the amount of production obtained from the counter unit 20. The mutual relation between the two control systems, of coarse, may vary. Tests have proved that a combined wheighing with equal wheight influence as a rule will give good results.

It is also possible, if desired, to arrange for a switching device for connecting the indications from the one control, e.g. the feed-forward control or for removing it, or from the feed-back control or for removing same, especially at occuring starting period or a period for stopping the system, or if any of them should deviate from a pattern of behavour determined in advance.

It has proved advantageous in the execution of the described method supplementary to control the speed of movement of the collection band 33 by means of a controller, for instance of PI-type, acting on basis of the surface weight of the mineral wool mat such as determined by eighing same. This supplementary control thereby may be brought to influence the speed of propagation of the collection band to same extent as the main control, initiated from the amount of production prognosized by means of the functional relation.

As mentioned above, the production of mineral wool is influenced by rather a lot of circumstances in addition to the ones mentioned especially above, and these circumstances also have been subject to an extensive investigation, whereby it proved possible in part to explain their influence, but to some extent it was only possible to state that this influence existed. Nevertheless one has found, that a plurality of them will give an expression for the amount of mineral wool formed per unit of time, which is especially suitable to be introduced in the prognosis mentioned above. Therefore, if it is desired to use any one of these circumstances for the purpose of the present invention, either each per se or in co-operation with any other one of ths said circumstances, to create a preferably electrical expression for the circumstance or circumstances concerned, it will be possible from said expression to read the amount of mineral wool formed per unit of time, and to introduce this expression into the above mentioned functional relation.

Amongst such circumstances, the following ones may be mentioned:

It has been found that the gas, the air or the mixture of gas and air, used to transport the formed mineral wool from the spinner aggregate 13 to the collection band 33 or to any subsequent band, e.g. the band 40, and which is separated in the collection band, is a carrier of properties strongly indicative to the properties of the formed mineral wool and thereby in first place to the amount of mineral wool dpositied per unit of time on the collection band. The gas concerned or the air or the mixture of gas and air will be denominated below the "transport medium".

Thus, it has been found that if you provide the movement of the transport medium in the way which is usual by providing suction blowers below the transportation band, then a difference in pressure will be created between the transport medium before and after the transportation band or in any case a pressure drop will be created during the passage of the transport medium through the transport band or collection band. As a matter of fact it has proved, that the pressure drop when the transport medium passes through a non-loaded transport band is so small, anyhow constant, that it may be disregarded in the present connection, but when a mineral wool mat has been deposited on the collection band this mineral wool mat will create a resistance of a characteristic order of magnitude. This resistance thereby is completely or close to completely proportional to the thickness of the deposited mineral wool mat, provided that this has a constant tightness, and in a corresponding way the resistance will be proportional to the thightness, if the thickness is constant. In combination, this will act the way that the resistance across the transport band with the mineral wool mat depositied thereon will in a clear way vary with the amount of mineral wool in the mat. For the purpose of simplification, one may use the sub-pressure of the transport medium after its passage through the collection band as a measure of said pressure drop.

Because of the tightness by which the mineral wool mat is deposited on the collection band, provided rather constant working conditions to exist in other respects, e. g. with respect to the character of the melt, is substantially the same, this co-variation will be extremly reliable.

Thus, one may as a first improvement of the above mentioned method provide the prognosis regarding the surface weight of the formed mineral wool mat by researching the properties of the transport medium. A condition for this is that the speed of movement of the band either is constant or that variations in said speed of movement of the band are observed and are introduced as a variable when forming the prognosis as described above. The prognosis thus obtained of course thereafter has to be subjected in the way described above to a control by weighing the formed mineral wool mat.

In the tests forming basis of the present invention, it has also been found what properties of the transport medium may in first place be used for sensing and introduction into the prognosis analysis. It has allready been mentioned, that the pressure drop through the mat of the transport medium passing through the mat forms one such variable. For the matter of simplification it is poosible in many a case to assume, that the pressure on the enterance side of the mat by the transport medium is constant, and in such a case one may read the pressure on the side below or on the exit side of the transport medium during its movement through the mat. This reading preferably is made by means of a sond, which is connected to a gas pressure measuring instrument, so that the electrical indication, for instance in the form of a voltage, may be transferred to the counter apparatus 20.

Thereby, however, it should be observed, that the mat in most spinning methods is built up successively on a moving band, for instance the band 33, such that the mat 39 will be rather thin close to the spinner aggregate 13 but will successivly increase as to its thickness during the movement of the band 33 in the direction away from the spinner aggregate 13, and consequently the mat will not get its final thickness until it is situated on a large distance from the spinner aggregate 13, so that no further mineral wool will be fed to the mat. It will be evident from this that the most reliable value of the pressure drop when the transport medium passes through the mat, or of the sub-pressure after the transportmedium has passed through the mat will be obtained if the measurement is made in such a large distance from the spinner aggregate 13, that the mat 39 may be regarded ready built up.

However, there are other ways to measure the properties of the transport medium.

It is evident that the tighter the minerl wool mat is at the place where the measurment of the properties of the transport medium is made, the greater will the resistance be against movement of the transport medium, and this will react in turn on the power consumption of the means, used for driving the blower for creating the sub-pressure. Therefore, one may use this matter of fact by providing a separate motor for driving the blower, not in common to the remaining motors existing in the system, e.g. the motors 30 and 35, and to measure its power consumption. This may be made either my measuring the current to the motor, for instance if this is formed by a threephase motor, by means of an ampère meter in one of the feederphase conduits, or by measurement of the actual need of power by means of a watt meter. The most suitable way for driving the blower concerned would be by means of a short circuited threephase motor. The changes of its lag when altering the load are so small that they may as a rule be neglected, and consequently the need of power may be redarded as a distinct expression for the resistance against movement of the transport medium through the mineral wool mat formed, and consequently also for the amount of mineral wool in said mat at the place, where the measurment is made. In this connection it should be reminded about that a blower may be regarded a rotatory means, which has two functions to fullfill, viz. firstly to overwin the bearing and air frictions which are allways small and may therefore be neclected, and secondly putting the transport medium into movement, and that consequently in a way, konon per se any power driven motor will run practically idly, if the feed of medium is choked, which would otherwise be put in movement by the blower. With other words: The greater a resistance the mat causes to the movement of the transport medium, the less of said medium will pass through the mat, and the less will the power consumption of the blower motor be.

It has allready been mentioned that the transport medium usually comprises combustion gases or air or a mixture of combustion gases and air. In most cases the temperature of the transport medium is considerably lower the the temperature of the melt to be transformed into fibres. If non-preheated air is used, then this temperature will usually be equal to the temperature in the space surrounding the equipment, from which the air is collected. A heating of the transport medium therefore is inavoidable by heat transfer from the hot mineralic material to the transport medium. Also this heating will be in a given relation to the amount of mineral wool deposited in the formed mat, and this will apply to a higher degree than the amount of melt 12, given off from the melting equipment 10. This may be explained in the most simple way as follows:

The formed fibres have a heat transfer surface which is extremly large in relation to their mass. Therefore, they deliver their surplus of heat practically momentarily to the transport medium. If the fibration procedure should run in such a way that part of the amount of melt delivered is not fibrated, this will result in particles, which, due to their magnitude, will give off their heat so slowly to the transport medium, that they will leave the process with an essential amount of residual heat. The relation is accentuated by the fact that the mineral wool fibres have usually radius which are of the same order of magnitude as the wave length of the infra-red light at the temperature concerned. The explanation of this matter is not well explored, but the phenomenon has been observed without the slightest doubt. Thus, the delivery of heat from a product increases more rapidly than may be explained exclusively by the increased surface at fibration to small diameter, as soon as the diameter will be in the order of magnitude of the wave length of the infra-red light. There is a reason to believe, that the fenomenon is in one way or another dependent upon a resonance phenomenon inside of the fibrous material.

When the fibres have thus been drawn out so far that they will have got these dimensions, a rather sudden increase of the delivery of heat will take place and the amount of heat given off by convection will get an addition of heat radiation, which is delivered from the fibres directly to the surrounding, which means to the transport medium. Before the fibres get these dimensions, the delivery of heat takes place by radiation, so that the radiation from the interior parts is absorbed in the parts more far outwardly of the material. The heating caused thereby will provide a secondary heat radiation. This secondary heat radiation will now take place from a lower temperature level. As the amount of energy given off by heat radiation per unit of time is dependent upon the fourth power of the absolute temperature, it will also be obvious, that the direct radiation, regarded as a heat transfer mechanism, must be more effective than a repeated absorption and re-radiation.

Therefore, the formed fibres transfer their surplus of heat more effectivly to the transport medium than do the particles of melt, which have not yet been fibrated. The heating of the transport medium thus to a higher degree will show the amount of fibres than does the fed amount of melt. This improves the possibility of creating a reliable prognosis and is a very essential advantage.

If, for instance, the amount of deposited mineral wool should increase, then also the resitance against the movement of the transport medium will increase, and the amount of moving transport medium per unit of time will decrease, if no specific steps are taken in order of keeping the flow of transport medium constant. Consequently also, by heat transfer from the mineral wool to the transport medium, the temperature of this medium after having passed through the formed mineral wool mat will in this case be higher than would otherwise be the case. As a matter of fact, therefore, the temperature of the transport medium rises more quickly than proportional to the increased amount of mineral wool, and one will therefore get a very sharp criterion of the amount of mineral wool.

If, now, the transport medium fed should have a constant temperature, usually equal to the temperature of the outside athmosphere, then it will be sufficient to measure the temperature of the transport medium at a place immediately after said transport medium has passed through the mineral wool mat, but in any case in a place, where the temperature sensing means is not affected by radiation heat from the running band or the formed mineral wool, resp., and this temperature is read by means of some means, which may for instance give off a voltage, proportional to or dependent upon the temperature, said voltage being transferred the the counter unit 20, which has provided the prognosis regarding future formation of mineral wool. If, on the other side, the transport medium when entering the said section has an indetermined temperature or a temperature, which may be variable, one should instead use one temperature sensing means, applied both before and after the passing of the transport medium through the mineral wool mat and deduce the difference in temperature, or, with other words the rise of temperature, and an expression therefore should be fed to the counting unit 20.

It will be evident from the above that there is a given relation, however not necessarily a relation of proportionality, between the flow of transport medium, on the one side, and the amount of deposited mineral wool, on the other side. This relation, thus, can be measured in several different ways, for instance as mentioned above by measuring the rise of temperature, but it also possible to measure the amount of moving transport medium per unit of time or with other words, the speed of movement of the transport medium directly, and one may then as well use the expression for this relation as an indicator for the amount of depositied mineral wool. For providing a measurement of the speed of movement proper of the transport medium, one may use some arrangement, which is known per se for measuring speeds of movement, for instance a Pitot tube, perhaps balanced by means of a pressure reading tube, in a way which is well known e.g. from vessel loggs, and for measurement of the total amount of moving transport medium, one may use an anemometer. It has proved especially advantageous to use a thermo-electrically acting anemometer, also called a "hot-wire-anemometer", because from such an anemometer one will get a direct expression in the form of an electric resistance, an electric current or an electric voltage, said expression being fed without change into the counting unit 20.

In some cases it may be desired in order of getting constant working conditions in a refinement system, which the transport medium has to pass, to keep the flow of transport medium constant, and arrangements for such a purpose are known per se. However, they have one property in common, viz. that at an increase of the force for putting the transport medium into movement, there will also take place an increase of the power of the motor for driving the blower. Perhaps it may be more suitable in this connection to measure the rotational speed of the driving motor by means of a tachometric generator or some similar instrument. Also in this case, the reading may be used as an indication of the amount of deposited mineral wool at the place of measurement, and this reading may as well in this case be introduced into the counter unit 20 for providing the prognosis, which should be compared with the amount of deposited mineral wool stated by means of the balance 41, 42, and for providing correction steps in order of getting a constant amount of mineral wool 39 deposited per unit of time or per unit of length of the band 33 and thus to provide a constant surface weight of this mineral wool.

It will be evident from the above, that one has a lot of ways to proceede when using proprties of the transport medium for an indication of the amount of deposited mineral wool, and that the choice which of these many properties should be the most favourable one in each separate case must be dependent upon the specific circumstances in the existing case.

However one is not bound only to rely on the properties of the transport medium, but there are also possibilities to use other variables for the purpose concerned, either each per se or in combination with some other variable, which depends upon the changes in properties of the transport medium.

Amongst such other variables the delivery of heat to the walls of the collection device 36 may be mentioned. It should be reminded about the matter of fact, that the formed mineral wool is blown by a stream of transport medium from the spinning aggregate 13 to the continuously moving band 33 by means of the blower 35 or perhaps by means of some other pressure creative device. One may either provide a blower in the way, shown at 35, before the band 33, or a suction blower below the band 33. The transport medium is removed in this way from the mineral wool, which remains on the band 33. In both cases, it is required, for practical reasons, fully or in part to enclose the section 36, within which deposit of mineral wool takes place, and this enclosure thereby will comprise also side walls and upper walls or a roof, the latter one however only in such places, where there is no deposit of mineral wool. Rather often no such roof is used but only side walls in the collection device 36, said side walls having the main purpose of conducting the stream of transport medium in the same way as the channel 34 onto the mat of mineral wool.

It is then also inavoidable that the melt will, during the fibration, give off a part of its heat, which cannot be disregarded, substantially by radiation, to the side walls. Their temperature will thereby rise, until the temperature gets a stable value, at which the feed of heat from the mineral wool corresponds to the heat, given off to the surroundings, substantially by radiation and convection to the surrounding part of the system or to the surrounding air, resp.

In this way, the temperature of the parts of the system forming the enclosure, will also form an indicium of the amount of mineral wool produced, and this temperature may easily be read by means of some electrically recording thermometer or some similar device, e.g. a thermistor, the reading of which is fed to the counter unit 20 as one of the indications contained therein for prognostization of the production of mineral wool, so that thereafter said prognosis will be compared with the actual value, stated by weighing the mineral wool mat by means of the balance device 41, 42.

In the tests, forming basis of the present invention, it has proved especially advantageous to use either a photocell sensitive to infra-red light for the reading of the infra-red light from the melt during the fibration, or a photo-multiplicator. The last mentioned one, of course, should be well protected for instance against spatters of melt or of binding means.

The limit between light radiation and heat radiation, of course, is in this case indistinct. The temperature of the melt during its re-shaping into mineral wool will follow a strongly sloping run, which nevertheless is rather similar from time to another. The radiaion emitted from the melt under fibration - both the visible and the infra-red one - will then to an essential degree be dependent upon the amount of melt, which is at a given moment of time under fibration. Thus one may by equal action measure either the heat radiation in the way mentioned above, or the light radiation by means of a light detector, which one will have to direct onto the mineral melt, well protected against foreign light. The greater the amount of mineral wool is, formed at the time, the stronger will the radiation of light therefrom be.

It will also be evident from the above that independently of if the heat radiation is measured or the light radiation from the formed mineral wool mat, the measuring result will be dependent in a given way of the flow of material in the process. An increased flow of material through the process will cause that a given volume of the transport medium will contain more mineral fibres than earlier.

This increase is amplified if the increased flow of material causes secondarily a decreased flow of transport medium. In any case, now an increased bluring of the transport medium will take place. This bluring or "turbidity" may be measured by irradiation of the transport medium and measuring the light absorption in same, or, if you prefer to express it that way, the light transparency of same. This irradiation may preferably take place by means of a very distictly directed bundle of light across the transport medium, where the concentration of the mineral fibres and thereby also the bluring is at maximum. It is also advantageous to use visible light but in such a case steps will be required to prevent disturbances from other visible light existing in the surrounding. Still better is then to use ultra-violet light, which, according to what one knows by experience, exists to a very small extent in such workshop and manfacturing localities, where mineral wool is manufactured, but one may also use a laser beam for this purpose, whereby one will in a very effective way concentrate the light with respect to direction as well as to wave length, so that no disturbances from light in the surroundings may be feared. Another way would be to use polarized light, which will very easily be separated from the normal light existing in the surrounding.

Polarized light may also be used the way that one measures the light intensity in another level of polarization than the one, valid for the enterance ray. This means a further advantage. When the polarized light hits a hovering fibre, the polarization level will be changed due to reflection against the fibre surface, such that it will be determined by the position of the fibre at the moment of reflection. Now, the orientation of the fibres within the transport medium is not dependent upon a chance but at least to some extent systematic. This means that the intensity of the out put light will be greater in a given polarization level than in other such levels. Investigations, made in connection to the present invention, have proved that this polarization level is in parallel to the flow of the medium. Therefore, it has proved advantageous to use an in put light, the polarization level of which forms a given angle with the direction of the flow of medium, preferably such a great angle that it may reliably be separated from the direction of the flow of medium. Hereafter, one will only have to detect the out put light in a polarization level, coinciding with said direction.

If an irradiation along with a measurement of the light absorption or the light transparence in the mineral wool mat is used in the way described above, it may however happen that erraneous indications will be created for one reason or another, which cannot be anticipated, such as the flow of transport medium accidentally changing its path. In order of avoiding erraneous indication thereby to be fed to the prognosis creating counter unit 20, one should in the case of an irradiation use a plurality of rays across the stream of medium and work up the result of the readings, for instance by addition or by mean value calculation, so that such errors are avoided as fas as possible.

It will be difficult to avoid a given dispersion of the irradiating light through the mineral wool mat because it can also not be avoided that this light will hit fibres in the mineral wool mat, running in rather irregular directions and be further reflected by them in still more irregular directions, representing paths, which cannot be calculated. Hereby a process of diffusion will be created, which has been called "turbidity" of the irradiating light, which means that the rays of light run through the irradiated material in strongly mixed directions, and a diffuse light will move out from the irradiated meterial. Also such diffuse light may be used as an indicator of the tightness or thickness of the mineral wool mat, whereby the light detector has however to be placed in another position than in flight with the in put direction of the primary ray. For this purpose usual visible light may be used or ultra-violet light, and a laser ray may also be used, The last mentioned has proved to give very great advantages for the reason that, when a laser ray is used, it will be possible to create an extremly intense irradiation and thus to obtain high intensity also of the diffused light. As the laser light is monochromatic, also the light reading is arranged monochromatically, and thereby it will be possible to an essential degree to avoid disturbances from other light present, especially from the still glowing mineral fibre mass.

An other usable way of measuring the variable concerned is to measure the feed of melt in the ray of melt flowing out from the melting owen in order to be fed to the spinning aggregate. This way, thus, may be used instead of weighing the owen by means of pressure cells 21 and the means 24, 25 and 26 connected thereto, such as has been described above. From the science of highly viscosous mediums in movement it is known that a freely falling ray is subjected to an acceleration, and that it will in each separate section allready in a small distance from the spout 11 of the melting owen 10 due to the strong surface tension assume a pratically completely regularily circular cross section area. Due to the successive acceleration the diameter of this area will successively decrease, and one may therefore get a statement about not only the particle speed of the melt but also about the area in the measurement cross section by optically measuring the diameter of the ray of melt in two places in given distance from each other , and teherby one will consequently get a very exact statement about the amount of melt fed to the spinning aggregate.

A fraction of this melt usually forms pearls, and it happens that they are separated in specific order, but there is no difficulty in weighing them, and, therefore, one has to calculate the part of the melt, not transformed into pearls, said part in full forming material for the fibration. This part, therefore, is equivalent to the volume of the melt, transferred to the transport and collection band as fibres.

Usually the melt fed to the spinning aggregate 13 in the form of the ray 12 has a constant composition, anyway during the run of one and the same spinning procedure, and it is also aimed to keep a very close to constant temperature of the melt 12 running from the melting owen 10, which also usually is obtained. The amount of heat thereof per unit of quantity melt or per unit of quantity fibrous material formed, resp., therefore is very close to exact, and as a consequence thereof it is also possible to use this amount of heat as a measure of the quantity of fibrous material formed. There will scarcely exist any way of reliably measuring this heat content in a direct way, but an indirect way, which has in tests made proved to be exceedingly reliable is to measure the heat transfer through the cooling medium, usually cooling water, by which normally the parts contained in the spinning aggregate are cooled, especially the spinner wheels 13.

It is preferred, thereby, to control the feed of cooling medium in order of keeping the temperature constant in one or more places in the spinning aggregate 13, and thereby, thus, the quantity of cooling medium will be the carrier of an indication about the amount of heat removed by this cooling procedure from the melt or the fibrous material formed therefrom, resp.

Mineral wool, to a great extent, is used as a sound absorbing or sound insulating material, resp., especially in buildings. This sound absorbing or sound insulating property is not a thing which the mineral wool gets only when leaving the production chain, but it exists also when the mineral wool mat rests on the collection band 33. Therefore, there is also a possibility to create one of the variables to be introduced into the counter unit 20 by subjecting the mineral wool mat to a strong sound wave, preferably as well directed as possible, and to measure the sound absorption or sound insulation, resp., through the mineral wool mat. Of course, it is important thereby that a sound frequency be used which does not otherwise exist or in any case does only exist within the locality to a disregardably small extent, where the production of the mineral wool takes place. Further one should use a high intensity of the sound wave used for the measurement.

In all production of mineral wool by centrifugation, inavoidably so called formation of pearls will appear, which means small lumps of melt forming fully or close to fully spherical bodies of a rather small dimension, so called pearls, which are however not desirable in the mineral wool mat comprising the fibrous material. These pearls as a rule, are removed allready at the inlet of the product from tne spinning aggregate 13 to the collection band 33. This will take place more or less automatically by the pearls having a greater movement energy in relation to their volume than has the mineral wool proper. Therefore, they will be caught to a smaller extent or perhaps not at all by the stream of gas and/or air used as a transport medium, and they may therefore easily be brought to fall out of the path of movement at a place, before the mineral wool starts being deposited on the transport and collection band 33. Investigations now have proved that these pearls at their movement out of the path of production possess an energy of motion which is directly proportional to their total mass. This, in turn, is in some kind of a proportion to to the total stream of melt, which determines again the amount of mineral wool formed per unit of time. The motion energy of the pearls, in this way, may be regarded a measure of the amount of formed mineral wool, and by measuring the total motion energy one may therefore get a value, indicating the magnitude of the fibre forming mass.

This method, however, may be still better usable if it is combined with a simultaneous measurement of the flow of melt proper. The amount of mineral wool formed, then, may be rather well determined as the difference between these two magnitudes.

Therefore, when measuring the motion energy, it is suitable to provide a wall or any other surface in such a way, that it will as close to perpendicularily as possible take up the percussions from the leaving pearls and measure the total percussion energy. Recording instrument which may be used for this purpose, are well known in technics. They may be brought to give off an electrical voltage, which is directly proportional to the combined percussion energy, and this electrical voltage then may be fed to the counter unit 20 in order of providing the prognosis about future formation of mineral wool, which should be compared with the real, later on existing formation of mineral wool, such as this is determied by weighing in the apparatus 41, 42.

In a corresponding way, it is also possible to combine two or more of the indications enlisted above, into the counter unit 20 and thereby further to improve the accuracy in the executed control when creating the prognosis concerned with respect to future formation of mineral wool.

A lot of the ways described above for providing some kind of an indication to be fed to the counter unit 20 have been described the way as if they are provided in immediate connection to the collection and transport band 33. There is, however, nothing to prevent that, after the mineral wool mat has left this collection and transport band said mineral wool mat is guided over to a separate subsequent band, below refered to as the "measurement band", which may be arranged in the way, which has been decribed above with respect to the band 40, and in which some of the observations are made, which have been described above. This especially applies to the indications, which are derived from the variable resistance of the mineral wool mat against traversing medium. As a matter of fact essential advantages may be gained thereby, which will, as a rule compensate for the negative consequence of the delay of the indication which will be inavoidable.

If the indications are exclusively derived in some of the said ways, before the mineral wool mat has been made ready and has been transferred to the subsequent measurement band, there will be a sensible difficulty in controlling the properties of the mineral wool mat in any other direction than the longitudinal direction thereof. Usually one will thereby only get a mean value of the properties, posessed by the mineral wool mat in the different places across the longitudinal direction of the mat, but no statement is obtained about crossward variations in tightness, thickness and surface weight between such parts of the mineral wool mat, which are for instance situated in its middle part and at its edge parts.

Of course, such a statement will be of the greatest importance, when the question is one about providing a mineral wool mat having constant surface weight over all of its surface, said surface being two dimensional, one of said deimensions certainly running in the longitudinal direction of the mat, but the other one of them running in the crossward direction of the mat. By making the measurement at a subsequent separate measurement band, one will get a possibility also to control variations in the crossward direction.

An arrangement, which may advantageously be used for controlling the distribution of the deposited mineral wool, so that this will be evenly distributed over all of the crossward section of the collection band 33, is described in the U S patent specification 3.032.836.

In the said arrangement according to the U S patent specification, the distribution of mineral wool across the direction of movement of the collection band or the transport band, resp.,is determined, and the result of this determination is fed back to an earlier place of the collection band in order of equalizing the distribution of mineral wool in crossward direction, so that it will be as even as possible.

Thereby it is especially suitable to divide up the flow of air in a plurality of parts, preferably of equal width and running lengthwise the mineral wool mat. The difference in transparency of the air, thereby is introduced into a control unit, which is provided to influence the crossward distribution of the mineral wool so that it will be as even as possible.

C L A I M S

1. A method for controlling the surface weight of a mineral wool mat (39) in a method of production, in which mineral wool is produced by fibration of a mineralic melt (12) and the formed mineral wool is transferred to a collection device (36) by means of a stream of gas and/or air (34), said stream of gas and/or air being separated from the mineral wool (39) in said collection device (36), and the mineral wool forming a mat on a collection band (33), simultaneosly as one or more variables, influencing the amount of mineral wool formed per unit of time are measured, and these variables are introduced into a functional combination, and the movement of the collection band (33) is controlled under guidance thereof for the purpose to control the surface weight of the formed mineral wool mat by means of a control unit (28) in accorcance with the amount of mineral wool formed per unit of time, expressed in the form of said functional combination, in which the said variables are contained, c h a r a c - t e r i z e d t h e r e b y that the surface weight of the formed mineral wool mat is determined by weighing, and the the functional combination is brought to contain one or more parameters, the value of which is changed by influence from a counter unit (20), which, on basis of the expression for the amount of mineral wool produced per unit of time formed from said functional combination, and also from the corresponding expression obtained from the surface weight of the mat and the speed of the collection band (33) deterimne the

parameter value or the combination of parameter values, which should, during one or more measurement period before the actual one (e.g. 5 seconds) have given the smallest difference between the two expressions, e.g. according to the method of the minimum square sum.

2. A method according to claim 1, in which there is used in the functional combination as a variable correlated to the amount of mineral wool formed per unit of time, the consumption of power in the fibration of the mineral melt in a motor driven fibration aggregate (13).

3. A method according to claim 1 or 2, in which there is used as a further variable the amount of mineral melt (12) given off from a mineral melting system and measured as the decrease of weight of said melting system (10).

4. A metod according to any of the above claims, in which the surface weight of the formed mineral wool mat (39) is stated by said mineral wool mat (39) being brought to pass over a roller (41) or a short band, which in turn is arranged/to/influence a pressure or load sensor (42).

5. A method according to any of the above claims, in which one or more variables, preferable all of the variables used, are recalculated by being fed with their momentary values to a counter unit (20), in which they are combined with stored up momentary values from one or more of the next preceeding time periods to be equalized to indicate a mean value, applicable to the time period concerned.

6. A method according to claim 5, in which the obtained mean values of the variables are brought together, in common to determine the speed of movement of the collection band (33).

7. A method according to claim 5 or 6, in which the momentary

values are brought to a successively decreasing extent to influence the mean value of the variable concerned and thereby to influence the control of the speed of movement of the collection band (33) to a smaller extent, the more far away back in time the said momentary values are.

8. A method according to claim 7, in which a given momentary value is brought to influence the formation of the mean value of the speed of movement of the collection band (33) to an extent, which is in a given proportion to the next preceeding such momentary value, so that the influence from the momentary value next before the actual control period will have a greater influence than the momentary value next before it in time and so on.

9. A method according to any of the above claims, in which each period for stating the mean value or values, resp. of any one of the variables has a given length or sampling period, preferably determined by a timer.

10. A method according to any of the above claims, in which there are two variables (for instance the amount of melt fed and the momentary surface weight of the mineral wool mat produced), and they are combined into a funcional combination according to the following formula, viz. $F(p, q) = a \cdot p + b \cdot q + c$, in which formula p and q are variables and a, b, and c are parameters.

11. A method according to any of the above claims, in which the speed of movement of the collection band (33) is supplementary controlled by a controller, e.g. of PI-type, said controller acting on basis of the surface weight of the mineral wool mat (39) such as this is determined by weighing same.

12. A method according to claim 11, in which the supplementary control is provided to influence the speed of the collection band

(33) to same extent as the main control derived from the amount of production prognostized by means of the functional combination.

13. A mehod according to any of the above claims, in which such properties of the flow of air and/or gas are measured, by which the mineral wool is transfered to the collection band (33), the said properties being significative to the properties of the formed mineral wool mat (39) and an expression for these properties of the flow of air and/or gas being introduced in the counter unit (20) as at least one of the said variables.

14. A method according to claim 13, in which the difference in pressure is measured, created between the in put side and the out put side of the said flow of air and/or gas during its movement through the formed mineral wool mat and the collection band (33) and this difference in pressure is introduced into the functional combination as one of the variables, preferavly by the pressure of the flow of gas and/or air being kept constant before the in let to the collection band (33) and the difference in pressure being measured as the sub-pressure existing after the flow of gas and/or air having passed through the mineral wool mat.

15. A method according to any of the above claims, in which the statement about the difference of pressure or the pressure proper, resp., after the flow of gas and/or air having passed through the formed mineral wool mat (39) is introduced into the functional combination in the form of an elctrical voltage.

16. A method according to any of the abve claims, in which the delivery of heat from the formed mineral wool to the walls of the collection device (36) is measured, said walls being provided for guiding the flow of gas and/or air used as a transport medium at the deposi-

tion of the mineral wool on the transport or collection band (33), and this delivery of heat is fed in the form of an expression to the functional combination as one variable by the temperature of some part of the system being measured, which is in such a position in relation to the produced mineral wool mat (39) that it will receive heat from same (39) by radiation, conduction and/or convection.

17. A method according to claim 16, in which one or more electrically recording thermometers or one or more thermistors are used for indication of the rise of temperature.

18. A method according to any of the above claims, in which the radiation of light from the mineralic melt subject to transformation into fibres is measured and an expression for this light radiation is created and introduced into the functional combination as one of the variables, preferebly under use of a photocell, sensitive for infra red light, whereby its indication is transformed into an electrical voltage.

19. A method according to any of the above claims, in which the formed dispersion of mineral fibres in the flow of gas and/or air is irradiated, and the light absorption is determined in the form of an expression, which is introduced into the functional combination as of the variables.

20. A method according to claim 19, in which a source of light is used for the irradiation of the formed mineral wool mat, emitting a sharply directed bundle of visible and/or ultra-violet light.

21. A method according to claim 20, in which a source of light is used for the irradiation of the formed mineral wool mat (39) emitting a laser beam.

22. A method according to claim 20 or 21, in which polarized light is used for the irradiation, whereby the dispersion level of

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said åight forms a preferably acute angle with the direction of the flow of gas and/or air introduced in the dispersion of mineral wool as a transport medium.

23. A method according to claim 22, in which the light radiating out from the dispersion is detected in a polarization level, forming an angle with the direction of enterance of said light, preferably so that the detection level is in parallel to the level of the flow of gas and/or air.

24. A method according to any of the claims 19 - 23, in which such light is subjected to detection, which has been spred into diffuse form by the mineral fibres in the dispersion.

25. A method according to any of the claims 19 - 24, in which a plurality of rays of light are used, crossing the dispersion in different places and perhaps also in different directions.

26. A method according to claim 25, in which the measuring results from the different rays of light are equalized by addition or mean value calculation.

27. A method according to any of the above claims, in which the power is measured, consumed for driving a blower (35) for putting the flow of gas and/or air into movement, and an expression for this power is introduced into the functional combination as an expression for the amount of mineral wool formed by the system per unit of time.

28. A method according to any of the above claims, in which the amount of heat is measured, given off from the melt to the flow of gas and/or air during the transformation of the melt into fibres, and an expression for this amount of heat is created and introduced into the functional combination as one of the variables.

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29. A method according to claim 28, in which the amount of heat given off per unit of time is measured in the form of the difference of temperature between the flow of gas and/or air before its introduction as transport medium for the formed mineral wool, on the one side, and after its separation from the mineral wool mat (39) on the other side, gas and/or air of a predetermined, constant temperature on the in put side being used as transport medium for the mineral wool from the spinning aggregate (13) to the collection band (33), and the rise of temperature being determined as the difference between the input temperature and the output temperature.

30. A method according to claim 29, in which the measurement of the temperature takes place at a position or at positions, resp., where the flow of gas and/or air is not subject to influence by radiation heat from the transport band and/or the mineral wool mat deposited thereon.

31. A method according to any of the above claims, in which the speed of movement of the gas and/or air as a transport medium for the mineral wool mat formed (39) is measured, and the statement thereabout is re-shaped into an expression to be introduced into the functional combination as one of the variables.

32. A method according to claim 31, in which the speed of movement of the gas and/or air is measured by means of a Pitot tube, perhaps as the difference between the indication of the Pitot tube and the indication of a stablization tube of by means of an anemometer, preferably a hot-wire-anemometer.

33. A method according to any of the above claims, in which the speed of a motor for driving the gas and/or air formed transport medium for the mineral wool mat formed is controlled in order of

getting a constant flow of said medium, and the rotational speed of said driving motor is read in the form of an expression, which may have the form of an electrical voltage to be introduced into the functional combination as one of the variables.

34. A method according to claim 33, in which a tachometer generator of the type is used, which creates a voltage proportional to the rotational speed.

35. A method according to any of the above claims, in which the quantity of the melt (12) collected from the melting owen and introduced into the spinning aggregate (13) per unit of time is measured, and an expression for this quantity is created and introduced into the functional combination as a variable.

36. A method according to claim 35, in which the thickness of the ray (12) of melt from the melting owen (10) to the spinning aggregate (13) is measured in optical way at, at least two locations after each other in a given distance from each other, and the amount of melt transferred to the spinning aggregate (13) is calculated on basis of said measuring result in combination with the distance between the measurement locations.

37. A method according to claim 35 or 36, in which pearls formed at the spinning procedure are separated and the amount of such pearls formed per unit of time is measured and subtracted from the obtained result of the measurement of the melt, transferred from the melting owen (10) to the spinning aggregate (13).

38. A method according to any of the above claims, in which one or more parts of the spinning aggregate (13) are cooled, preferably by means of a flow of cooling water, and the amount of heat transferred to said cooling medium is measured in the form of the product of the

flow of heat receiving mediun per unit of time and its rise of temperature, and an expression therefore is formed to be introduced into the functional combination as one of the variables.

39. A method according to anh of the above claims, in which the dispersion of mineral wool in the flow of gas and/or air is sunjected to a strong sound wave, preferably of concentrated sound frequency, different from the sound frequencies of other sound existing in the locality within which the lrpduction of the mineral wool takes place, and the decrease of power of this sound wave is measured during its passage through the sispersion, and an expression therefore is created and introduced into the functional combination as a variable.

40. A method according to any of the abve claims, in which the percussion energy or the intertia of the pearls is measured, which are formed during the spinning of the mineral wool, before this mineral wool has been transformed to the collection band (33), and an expression for this percussion energy or inertia is introduced into the functional combination as a variable.

41. A method according to any of the above claims, in which the formed mineral wool mat (39) is guided over a conveyor (40) following after the collection band (33), preferably a band conveyor, and a measurement is made of the transparency of the mineral wool mat, e.g. by the application of a difference of pressure of pre-determined magnitude across the mat (39) along with the conveyor band (40), the flow of ait through the mat (39) along with the conveyor vand (40) due thereto being measured.

42. A method accoŕding to claim 41, in which the distribution of mineral wool across the direction of movement of the collection band and the subsequent conveyor is determines, and the result of this

determination is fed back to an earlier location in the collection band for equalization of the distribution of mineral wool in crossward direction, so that this will be as even as possible.

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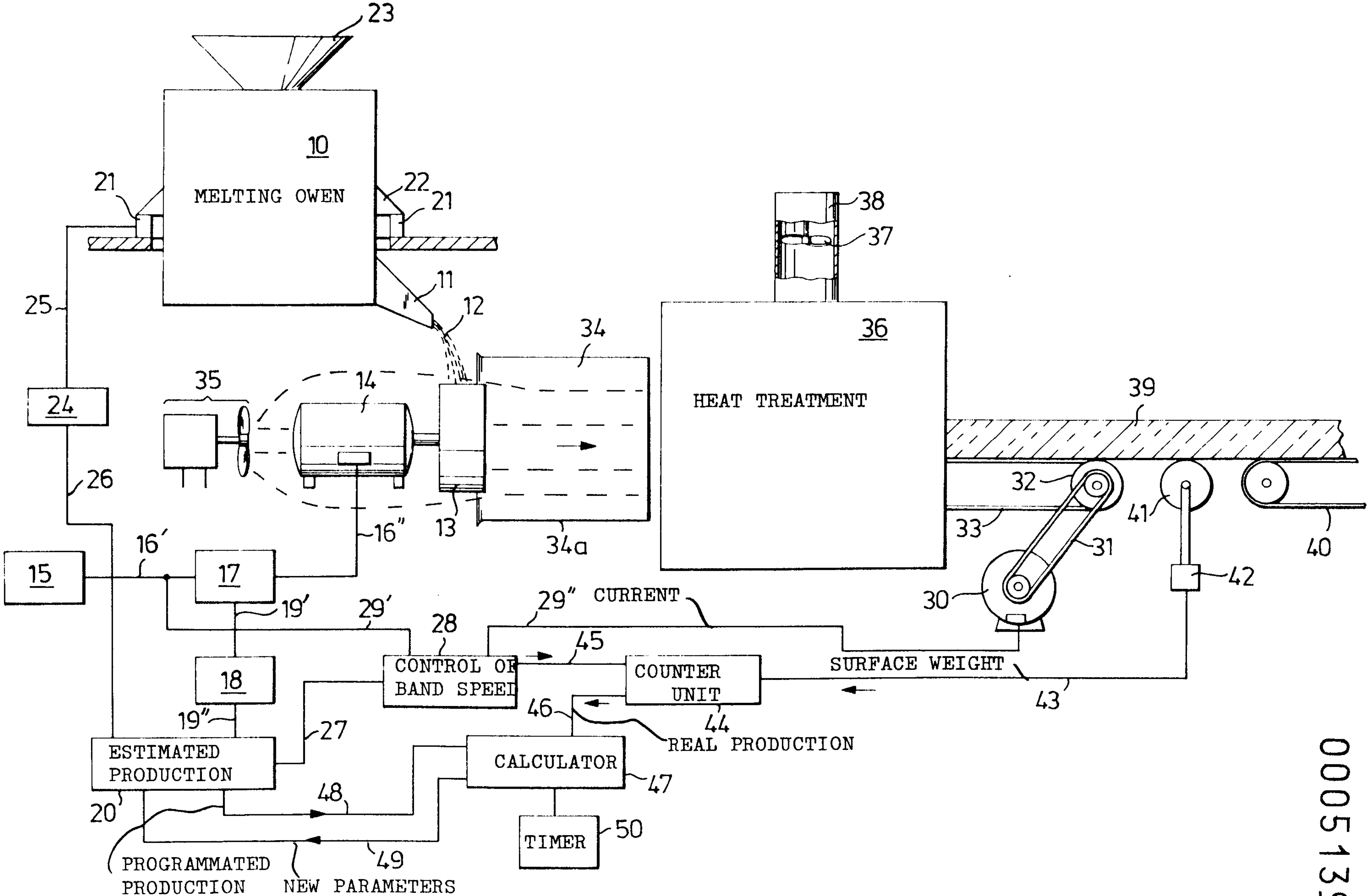
MELTING OWEN
10
HEAT TREATMENT
36
CONTROL OF
BAND SPEED
COUNTER
UNIT
CALCULATOR
TIMER
ESTIMATED
PRODUCTION
PROGRAMMATED
PRODUCTION
NEW PARAMETERS
REAL PRODUCTION
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10 11 12 13 14 16' 16" 19' 19" 20 21 22 23 25 26 27 28 29' 29" 30 31 32 33 34 34a 35 37 38 39 40 41 42 43 44 45 46 47 48 49 50

European Patent Office

EUROPEAN SEARCH REPORT

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Application number

EP 78 85 0005

Category	DOCUMENTS CONSIDERED TO BE RELEVANT Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.²)
	FR - A - 1 572 789 (OWENS-CORNING) * Claims A 1-4,7, 8,21; B 24-26 * --	1	D 04 H 1/00 C 04 B 43/02
	US - A - 3 826 903 (E.C. VARRASSO) * Claims 1-28 * --	1	
	FR - A - 2 274 968 (OWENS-CORNING) * Page 1, lines 14-22; page 9, lines 9-30; page 15, lines 21-36; page 16, lines 1-2; claims 1-18 * ----	1	TECHNICAL FIELDS SEARCHED (Int.Cl.²) D 04 H 1/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

\ The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15-06-1979	ELSEN-DROUOT