

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 788 407 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

10.02.1999 Bulletin 1999/06

(21) Application number: **95936826.7**

(22) Date of filing: **30.10.1995**

(51) Int. Cl.⁶: **B02C 7/14, D21D 1/30**

(86) International application number:
PCT/SE95/01279

(87) International publication number:
WO 96/14156 (17.05.1996 Gazette 1996/22)

(54) **SYSTEM FOR CONTINUOUSLY MEASURING PRESSURE AND TEMPERATURE IN THE
BEATING ZONE OF REFINERS**

SYSTEM ZUR KONTINUIERLICHEN MESSUNG VON DRUCK UND TEMPERATUR IM
ZERKLEINERUNGSBEREICH EINES REFINERS

PROCEDE POUR MESURER EN CONTINU LA PRESSION ET LA TEMPERATURE DANS LA ZONE
DE RAFFINAGE DE RAFFINEURS

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI NL PT

(30) Priority: **02.11.1994 SE 9403743**

(43) Date of publication of application:
13.08.1997 Bulletin 1997/33

(73) Proprietor: **3 PC AB**
431 50 Mölndal (SE)

(72) Inventors:
• **KARLSTRÖM, Anders**
S-431 50 Mölndal (SE)

• **ENGSTRAND, Per**
S-616 00 Aby (SE)

(74) Representative:
Kristiansen, Alf P. et al
Albihns Patentbyrå Göteborg AB
P.O.Box 142
401 22 Göteborg (SE)

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US-A- 4 148 439

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Description

Technical area

[0001] The present invention relates to a system for continuously measuring pressure and temperature in the beating zone of refiners used within the pulp and paper industry and similar industry. During production of high yield pulps, for example thermomechanical pulp (TMP) and chemithermomechanical pulp (CTMP), from lignocellulosic material such as wood chips, different refiners have a central position. Refiners are usually used also during production of semi-chemical pulp. Further, refiners are used during paper production for beating different types of cellulose pulp, both pulps which contain larger or smaller amounts of lignin and pulps which are free of lignin, such as chemical pulps bleached to a very high whiteness. Refiners are also used within other industrial branches, such as for instance in the production of woodfibre boards.

[0002] The present invention is applicable in all technical areas where refiners are used.

Prior art

[0003] Most refiners contain two beating discs between which the material which is to be treated is passed. Usually one of the beating discs is stationary while the other is rotating with high speed. The beating material is in most cases introduced into the refiners via the centre of the beating discs and if the beating material, for example, consists of wood chips this will be disintegrated on its way out to the periphery of the beating discs. If the beating material consists of cellulose pulp, what is desired is not usually disintegration of the material but a change of the pulp fibres so that these form a better, for example a stronger, paper than if the pulp fibres have not been treated in this way.

[0004] The diameter of the beating discs varies. This depends for example on the make and the capacity of the refiner. Earlier, the beating discs were cast in a single piece but today the beating discs are predominantly built of a plurality of segments. The segments may extend from the centre of the beating disc to its periphery. However, it is usual that two rings of segments (an inner and an outer ring) make up the disc.

[0005] Refiners are also known where both the beating discs rotate in opposite directions to each other and refiners are also known having four beating discs in which a rotor in the middle part has beating discs mounted on both sides.

[0006] In the production of, for example, TMP from wood chips the beating discs are pressed together so that the gap of the beating zone will become approximately 0,2 - 0,6 mm. An increase of the gap by, for example, 10% is very significant to the properties of the pulp. It is therefore important to have knowledge of the actual gap of the beating gap. Beating gap meters, for

example in the form of inductive centres, which are applied to the refiners are available on the market. Usually, only one gap meter is used for each beating zone, primarily with the aim of avoiding contact of the beating discs and thus not primarily to regulate the gap, which normally decreases from the centre out to the periphery.

[0007] Moreover, there are no real measuring systems in the refiner. However, there are instruments located in the forward flowing pulp by which a number of pulp characteristics can be determined. With the aid of measured pulp characteristics and the present width of the gap, the operator of the refiner can regulate the TMP production.

[0008] A system for continuously measuring pressure and temperature in the beating zone of a pulp refiner is known from US-A-4 148 439, whereby the sensors are arranged on the stationary beating disc.

[0009] In DE-A-2 554 961, the sensor determines pressure between two beating discs by means of direct measurement of the extension/contraction of the shaft itself.

The invention

Technical problem:

[0010] As is evident from the above, only a few measurements are performed in the refiner itself and therefore there is a need to measure more parameters such as the pressure and temperature existing in the refiners.

The solution

[0011] The present invention solves this problem and relates to a system for continuously measuring pressure and temperature in the beating zone of refiners used within the pulp and paper industry and similar industry, comprising a number of separate pressure sensors or temperature sensors or combined pressure and temperature sensors provided with cables arranged on or in at least one of the homogeneous beating discs of the refiner or beating discs made up of segments along the active radius of the beating disc or alternatively are positioned between, alternatively between and in, two segments of the beating disc along the active radius of the beating disc and that the cables are collected into a bunch of cables or are transferred to another cable and leave the beating disc via a hole therein, characterized in that the sensors are arranged on or in the rotating disc, that the bunch of cables or the cable is connected to a collector shoe applied against the shaft of the refiner from where connection leads to a detection unit and a subsequent presentation unit.

[0012] According to a preferred embodiment of the invention, the pressure and temperature sensors are partly housed in a parallelepipedic, elongated bar extending along the active radius of the beating disc with at least three sides including one front side having

several recesses facing the beating material and that the sensor (contact) part of the pressure and temperature sensors are arranged in the recesses and that the bar is anchored to the beating disc or in the segment or between and/or in two segments.

[0013] The expression "the active radius of the beating disc" denotes that part of the radius of the beating disc where the main refining and/or beating work occurs. In beating discs which are made up of segments which form an inner and an outer ring, the main refining and/or beating work usually occurs in the outer ring. In those cases where also the treatment of the beating material which occurs in the inner ring is of distinct importance for the process, that part of the beating disc radius is also included in the expression "active radius". The length of the elongated bar coincides with or is, for example, somewhat shorter than the height of the segments in the outer ring. This is the usual construction, but as a consequence of the above, the length of the bar can substantially coincide with the height of both the segment rings, that is the bar extends from the centre of the beating disc to each periphery. With regard to the depth of the bar, it is less than the material thickness of the segments, preferably some millimetres less. The space for the bar is created, for example, by milling out material in a segment. It is preferred that the bar is located between two segments. This can be done by leaving a gap the width of which coincides with the width of the bar when mounting two segments in the stator lying behind. It is especially suitable that a space in the edge part of each segment is milled out between two segments, which space corresponds to half of the volume of the bar. It is of course fully possible, instead of milling out in whole segments, to create a space for the bar already during the production of the segments.

[0014] Instead of fastening the sensor (contact) part of the pressure and temperature sensors in the front side of the bar it is possible to attach it to a plate the surface and construction (recesses) of which substantially coincide with the front side of the rod and this plate is preferably releasably attached to the front side of the rod. The pressure and temperature sensors extend in this case from the plate and through the recesses (holes) in the front side of the bar into the bar. A cable runs from each sensor, which cables are guided within the bar towards a hole which is made in the bar and this bunch of cables, or one cable, to which the different cables have been collected is connected via a hole in the stator situated behind to a detecting unit in the way described above.

[0015] By means of, for example, some screws the plate may be connected to the front side of the rod in holes provided with corresponding threads. It will thus be possible in a simple way to release the plate with the attached measuring sensors and, if so desired, to investigate these and possibly change any measuring sensors that are out of order or have a malfunction. In this way, the bar will remain in the beating disc or the seg-

ment during the whole lifetime of the beating disc, whereas the measuring sensors can be simply changed when necessary, for example if the pressuring sensors have a shorter lifetime than the beating disc. For reasons of time, it may be advantageous to replace the whole segment with a new segment containing a new set of measuring sensors.

[0016] A beating segment has a great number of bars. Some of the bars extend all the way from the inner edge of the segment to its outer edge, i.e. its and the beating disc's periphery. The bars usually run not completely parallel but slightly conically from the inner edge of the segment having their greatest distance at the inner edge. Crossbars run between the bars at certain distances, at least with regard to the outer half of the segment, i.e. the half situated towards the periphery, forming a space. According to one embodiment of the invention, a number of pressure and temperature sensors are arranged in at least two, for example three, of the already existing spaces including a space confined only by bars. These groups of pressure and temperature sensors are arranged in radial direction. In this embodiment of the invention it is neither necessary nor suitable to use bars for anchoring of the measuring sensors as these can be anchored, for example by filling the remaining space with some suitable material. For example, the filling may be carried out with some material in melt condition which, after being cooled, surrounds and anchors the measuring sensors in the segment. It should be simplest to provide the beating segment with the described arrangement already during the production of the beating segment. It should also be simplest to manufacture the passage for the cable at that time.

[0017] Small fibreoptic pressure sensors which are suitable to use are already on the market. The actual sensing part is applied, for example, in the end of a cylindrical sleeve which extends horizontally, for example through the recess in the above described front side of the bar and into the bar. The cable through which the measuring signal is forwarded is connected to the sensor part and leaves the sleeve at the opposite side.

[0018] Piezoresistant pressure sensors may also be used.

[0019] With regard to the temperature sensors, there exist so-called resistance elements, for example so called PT-100 elements, which can be used for measuring the temperature. In a similar way as described above, the element may be applied in one end of a cylindrical sleeve, which end faces the beating material or, alternatively, is applied directly on the surface of the bar and encapsulated in a suitably durable material.

[0020] The above described sensors are separate sensors, which means that the pressure sensor and the temperature sensor are arranged in the vicinity of each other in a certain position but at a certain distance from each other. In this way, the temperature which corresponds to the pressure in a certain point or surface in the beating zone of the refiner is not measured, but

instead a certain difference will arise since the measuring sensors are arranged close to each other but not at the same point or surface.

[0021] Therefore, such sensors are desired which measure both the pressure and the temperature in one and the same point or on a well defined smaller surface. Such fibreoptic sensors are today under development and these are due for immediate application. Measuring sensors based on other measuring principles are also under development today.

[0022] From a function and maintenance point of view, the sensing part of the above described sensors should be located in a plane which is one millimetre or some millimetres from the plane where the bars in the beating segment meet the beating material.

[0023] According to a further embodiment of the invention a measuring rod is used where both temperature sensors and the pressure sensors are made up of plane resistance elements, so called PT-100 elements. Similarly to what has been described above with relation to the elongated bar, this measuring rod extends along the active radius of the beating disc. Such a measuring rod may, for example, be constructed of a first and a second metal plate. On the second metal plate, which is applied in a direction towards the beating material, a number of resistance elements which measure the pressure are, for instance, attached to the inner side of the plate whereas a number of resistance elements, which measure the temperature, are attached to the outer side of the plate. A layer of, for example epoxy polymer or polyimide material is applied between the two plates and on the outer side of the second metal plate, which means that said resistance element is enclosed and protected by these two layers. As usual, cables run from each measuring sensor.

[0024] With regard to the number of measuring points/surfaces along the active radius of the beating disc and thus also the number of attached pressure and temperature sensors, it is the case that the more measuring points/surfaces the more accurate description is obtained of the refining/beating process. At least approximately 8 beating points/surfaces are desired.

[0025] Hitherto, only measuring of pressure and temperature along the active radius of the beating disc in one position has been mentioned, but it is of course fully possible to make such measurements in two or more positions. For example, two of the above described measuring devices may advantageously be mounted diagonally upon the beating disc, i.e. opposite each other at either side of the centre of the beating disc.

[0026] As has been stated earlier, the measuring signals are collected and detected in some preferred cases in a special unit. One example of such a unit is transmitter TRI22 manufactured by INOR for signals from resistance elements. A suitable unit for fibreoptic signals is the optoelectrical unit SIA 1000 manufactured by SAMBA SENSOR, consisting of couplings, emitters and detectors/amplifiers. In both cases a voltage signal is

obtained which can be sent further via a band cable and conventional measuring card to a measuring computer (personal computer) and/or a printer.

[0027] If the outsignals from the pressure and temperature sensors are received as an electric voltage, the signals may be sent directly via, for example, a band cable to a conventional measuring card and further to a computer and/or a printer.

[0028] The above described measuring cards plus measuring computer and/or printers are examples of a presentation unit.

[0029] In the case where the beating disc having pressure and temperature sensors rotates, microwave technique, for example, can also be used to transmit the measuring signals from the measuring points to the detecting unit followed by the presentation unit. This is suitably carried out by means of a transmitting unit coupled in connection to the pressure and temperature sensors. The transmitting unit may obtain its supply of electric current via a collector shoe. Alternatively, energy may be supplied by microwaves from an external unit. These microwaves are received by a unit in the refiner which transforms them to a suitable feed, i.e. electric current, for example to the resistance elements and light, for example to the fibreoptic pressure sensors.

Advantages

[0030] Experiments have shown that it is possible to measure both pressure and temperature within the refiners and especially along the active radius of the beating disc. This opens up the possibility to follow in a better way than before, for example the fibre disintegration process during production of TMP, and to regulate this production, which in turn results in an optimising of the process and/or to an end product with higher quality, i.e. pulp. Changes in the pressure and temperature profile of a single refiner may sometimes be the result of heavy wear on the beating disc/segment, which means that when the measuring system according to the invention is used a quicker indication of this is received so that the beating disc/segment can be replaced.

[0031] Also when the refiner is used for beating cellulose pulp in a paper production plant, it is of greatest importance to be able to measure the pressure and temperature within the refiner. Further, the measuring system according to the invention is of great help when beating segments having varying and/or new patterns are tested.

Description of the figures

[0032]

In fig 1 two beating segments are shown, in the end parts of which a recess has been milled out so that a bar with attached pressure and temperature sensors included in the measuring system according to

the invention can be located and anchored.

In fig 2 only the same bar is shown and in fig 3 a plate is shown which is attached to the front side of the bar, being parts of preferred embodiments of the invention.

Fig 4 shows measured pressure and temperature curves at the passage of the beating material between and along the beating discs using the measuring system according to the invention.

Best embodiment

[0033] In the following, preferred embodiments of the invention will be described with reference to the figures and the invention will be further explained in more detail.

[0034] As stated above, current beating discs are usually constructed of a great number of beating segments arranged in an inner and an outer ring. Behind the segments is a homogeneous disc called a rotor. The segments are fastened to the rotor by means of bolts which are inserted in threaded recesses on the rear side of the segments.

[0035] In fig 1 two segments 1 and 2 are shown in the outer ring. Material thickness of the segments calculated from the rear surface to the base surface may be approximately 30 mm. A great number of extended bars 3 protrude from the base surface, which bars run in the direction of the radius from the inner side of the segment to its periphery. Some of the bars 4 are cut shorter than the others. On the part of the segment towards the periphery crossbars 5 run between the elongated bars. In fig 1 the beating pattern has been drawn only on a part of the segments. The shown pattern runs and is repeated along every segment in the outer ring.

[0036] At the edge parts of the two segments 1 and 2 a recess has been milled out so that the two segments together make the elongated rectangular recess 6. The recess goes straight through the segment 1 and 2. At the rear side of the segment 1 a casing shoe 7 has been attached through which a bunch of cables runs (will be described later).

[0037] The bar 8 shown in fig 2 conforms to the recess 6 and is introduced therein from the rear side. The bar 8 presents two crossbars 9 and 10. Corresponding recesses are arranged on the rear side of the segments 1 and 2 at either side of the recess 6. The bars 9 and 10 conform precisely to said recess and by bolting the two segments 1 and 2 to the located behind stator the bar 8 will be anchored in a very stable way in said position. The front side 11 of the bar 8 has a large number of round holes 12. In these holes and preferably slightly outside, the sensing parts of the pressure sensors and temperature sensors are mounted. It is almost a condition that these sensors are small and occupy a little space. Such sensors are currently available on the mar-

ket, as stated above. The measuring sensors can either be cylindric, having the sensing part in one end, or the measuring sensors can be very thin, for example so called PT-100 elements, and in these cases it is suitable to attach the element in one end of a cylindric sleeve. All or the main part of this cylindric (the section does not, of course, have to be round but can have many geometric forms) objects extends horizontally within the bar 8. The object can be attached to the bar 8 in any known way. For example, the objects may be provided with threads and thus be threaded in threads in the front side 11 which surround the recesses or holes 12. One or more cables run from the opposite side of the object, i.e. compared to the sensing part which faces the beating material, and the cable or cables from the measuring sensors are arranged to run within the bar 8 to a larger recess or hole 13. This bunch of cables (or several cables collected into one cable) leaves the bar 8 through the hole 13 and runs further for example through the casing shoe 7 to a hole in the stator located behind and further to any of the earlier mentioned detecting units.

[0038] The bar 8 shown in fig 2 is more shallow at its upper quarter part (approximately). This depends on the fact that the stator located behind has a protrusion or head which runs along the periphery of the stator and therefore all segments, including the segments 1 and 2, have corresponding indentations or recesses and this in turn determines the shown shape of the bar 8. If the stator of the refiner is even, the bar 8 may advantageously have one and the same height along the whole bar. Further the bar 8 may both be without and have a rear wall (back side). The location of the hole 13 is adapted to where the hole is located in the stator behind. The number of holes 12 in the bar 8 is determined by how many measuring points are wanted in the particular case.

[0039] The plate 14 shown in fig 3 is a part of an embodiment of the measuring system according to the invention which is especially preferred. Instead of attaching the pressure and temperature sensors to or in the bar 8 it is in some cases better to attach these in or on the plate 14. The surface of the plate corresponds substantially to the surface of the front side 11 of the bar 8. The holes and the recesses 15 correspond to the holes 12 in the front side 11 of the bar 8. In this case the holes 12 are only used as passages for the measuring sensors. Some of the holes in the plate 14 as well as in the front side 11 of the bar 8 can be used for anchoring the plate 14 to the bar 8. The anchoring can be done by screws introduced in some of the holes 15 and screwed into corresponding holes provided with threads. With this arrangement it is easy to, for example, inspect the measuring sensors by removing the plate 14 and pulling it out thereby to disclosing the measuring sensors via the passage through the hole 12 in the bar 8. If any measuring sensor needs to be exchanged it is easy to do so. According to this embodiment of the pressuring system, according to the invention the bar 8 may remain

intact in the beating segment or beating segments during their entire lifetime. In the embodiment of the beating system according to the invention which appears in figs. 1 and 2 it is necessary, when replacing, for example, a measuring sensor, to release both segment 1 and segment 2 from the stator located behind and in this way reach the bar 8 and thereby also the measuring sensors.

[0040] It appears from fig. 1 that the recess 6 (and thereby also usually the bar 8) is shorter than the height of the segment in the direction of the radius. The recess 6 and the bar 8 can of course be both shorter or longer than the length which is shown in fig 1. For example, the recess 6 and the bar 8 may extend along the entire height of the segment. Further, the recess 6 is not necessary under all circumstances and the bar 8 can be located in a gap between two beating segments. Additionally, a recess 6 does not have to be located in the joint between two segments but can be located anywhere within a segment and possibly dividing the segment in two parts.

[0041] As is evident from what is stated above, it is not necessary, according to the invention, to use a bar for anchoring and protection of the measuring sensors, but instead these can be mounted directly in the beating disc or the beating segments. Holes which conform to the volume of the measuring sensors can be made in the segments between the longitudinal bars 3 and 4 (see fig 1). The measuring sensors can advantageously be spread out along the radius of the beating disc or the segment. For example, two pairs of measuring sensors or two combined measuring sensors can be located between two bars from the lower edge of the segment to the cut 16. The next two pairs of measuring sensors can be located in a space which follows the cut 16 in the direction of the radius and which is confined by two longitudinal bars and two crossbars 5. It is completed by, for example, two pairs of measuring sensors in a corresponding space almost at the end or at the end towards the periphery of the segment. These measuring sensors may be anchored in any way desired in the segment. For example, it is possible to fill the space surrounding the measuring sensors with some material which, after the filling, solidifies and thus maintains the measuring sensors in a firm grip. It is also possible to obtain a good anchoring by means of wings extending from the measuring sensors, or other protruding elements, and recesses in the segment adapted to these. Also in this case, the sensing part of the measuring sensors should be a millimetre or some millimetres under the upper edge of the bars 3 and 4.

[0042] In fig 4 it is shown how the pressure and the temperature are kept along the radius of the beating disc. The centre of the beating disc ends at a radius length of 150 mm and it is from a radius length of 450 mm out to the periphery of the beating disc, i.e. approximately corresponding to the segment of the outer ring on the beating disc, that both the pressure and the tem-

perature vary. It is this part of the beating disc which is described in this patent application as the active radius of the beating disc. The curves are produced by means of a measuring system according to the invention. The arrangement shown in figs. 1 and 2 was included in said measuring system. A plurality of pressure sensors of the fibreoptic type was set out. From each pressure sensor the signal went via glass fibre conductors to a detecting unit comprising an optoelectrical unit of the type SAMBA Sensors and from there the transformed signal went to a measuring card in a measuring computer which in turn was coupled to a printer. A plurality of temperature measuring sensors were arranged in the vicinity of the pressure sensors. The sensing part of these measuring sensors consisted of a thin resistance element of the type PT-100. The signal was transmitted via cables to a transmitter TRI22 manufactured by INOR. The voltage signal received went via a band cable to a measuring card in a measuring computer which in turn was coupled to a printer.

[0043] To operate the measuring system a feeding aggregate transmitting an electric current with a voltage of 24 volts was used. From the feeding aggregate a first cable was connected to a transmitter from where a further cable was connected to the resistance element. A second cable went from the feeding aggregate to an optoelectrical unit where the electric current was transformed to light, which light was sent to the pressure sensor by means of a fibreoptic cable (glass fibre conductor).

[0044] The presence of feeding aggregates and means to transfer various forms of energy to the measuring sensors has not earlier been explicitly disclosed and in each individual case this is required, as will easily be understood by the person skilled in the art. For example, the expression "a cable provided with a sensor" thus normally implies that a cable is connected to the sensor parallel with the one which is connected from the sensor. This means that every cable contains at least two conductors. It is of course possible that feeding aggregates of another voltage than 24 volts can be used.

[0045] From the tests which have been performed and the result of which is exemplified in fig. 4, it appears that, by means of a measuring system according to the invention, it is possible to follow both the temperature and the pressure along the beating disc, i.e. in the beating zone during the travel of the beating material through the refiners. Measured values relate to tests according to the TMP-process, i.e. disintegration of wood in the shape of chips to cellulose pulp.

Claims

1. System for continuous measuring of pressure and temperature in the beating zone of refiners used in the pulp and paper industry and similar industry comprising a number of separate pressure sensors

and temperature sensors or combined pressure and temperature sensors provided with a cable arranged on or in at least one of the homogeneous beating discs or beating discs made up of segments (1, 2) along the active radius of the beating disc or alternatively are arranged in at least one position between, or alternatively between and in, two of the segments (1, 2) of the beating disc along the active radius of the beating disc whereby the cables are collected into a cable bunch (7) or are transferred into another cable and leave the beating disc via a hole (13) therein,

characterized in that the sensors are arranged on or in the rotating disc(s) and the cable bunch (7) or the cable is connected to a collector shoe arranged against the shaft of the refiner wherefrom connection leads to a detection unit and subsequent presentation unit.

2. System according to claim 1, **characterized in** that the pressure and temperature sensors are partially housed in a parallelepipedic elongated bar (18) extending along the active radius of the beating disc having at least three sides including one front side (11) provided with more recesses (12) facing the beating material, and that the sensing (contact) part of the pressure and temperature sensors are arranged in the recesses (12) and that the bar (8) is anchored in the beating disc or in the segment or between and/or in two segments (1, 2).
3. System according to claim 2, **characterized in** that the sensing (contact) part of the pressure and temperature sensors, instead of being located in the front side of the bar (8), are arranged in a plate (14) the surface and the construction (recesses) (15) of which substantially coincide with the front side, and that the plate (14) is attached to the front side of the bar (8).
4. System according to claim 1, **characterized in** that the pressure and temperature sensors are arranged in already existing spaces between bars in the beating disc or segments (1, 2) in at least two positions.
5. System according to claims 1-4, **characterized in** that the pressure sensors are of a fibreoptical type.
6. System according to the claims 1-4, **characterized in** that the pressure sensors are of a piezoresistive type.
7. System according to the claims 1-6, **characterized in** that the temperature sensors consist of resistance elements.

8. System according to the claims 1-7, **characterized in** that the number of pressure sensors or temperature sensors or combined pressure and temperature sensors is 8 or more.

Patentansprüche

1. System zum kontinuierlichen Messen von Druck und Temperatur in der Mahlzone von Refinern, die in der Zellstoff- und Papierindustrie und ähnlichen Industriezweigen verwendet werden, aufweisend eine Anzahl von getrennten Drucksensoren und Temperatursensoren oder kombinierten Druck- und Temperatursensoren, die mit einem Kabel versehen sind, das auf oder in wenigstens einer der homogenen Mahlscheiben oder den Mahlscheiben angeordnet ist, die aufgebaut sind aus Segmenten (1, 2) längs des aktiven Radius der Mahlscheibe oder alternativ angeordnet sind in wenigstens einer Position zwischen, oder alternativ zwischen und in, zwei der Segmente (1, 2) der Mahlscheibe längs des aktiven Radius der Mahlscheibe, wodurch die Kabel in einem Kabelbündel (7) gesammelt werden oder übertragen werden in ein weiteres Kabel und die Mahlscheibe über ein Loch (13) darin verlassen, **dadurch gekennzeichnet, daß** die Sensoren an oder in der bzw. den Drehscheiben angeordnet sind und das Kabelbündel (7) oder das Kabel mit einem Schleifstück bzw. Kollektorschuh verbunden ist, das gegen die Welle des Refiners angeordnet ist, von wo eine Verbindung zu einer Erfassungseinheit und einer nachfolgenden Darstellungseinheit geführt ist.
2. System nach Anspruch 1, **dadurch gekennzeichnet, daß** die Druck- und Temperatursensoren teilweise in einem parallelogrammartigen langgestreckten Stab (18) aufgenommen sind, der sich längs des aktiven Radius der Mahlscheibe erstreckt, die wenigstens drei Seiten hat, aufweisend eine Vorderseite (11), die mit mehreren Vertiefungen (12) versehen ist, die dem Mahlmateriale gegenüberliegen, und daß die Meß-(Kontakt) Teile der Druck- und Temperatursensoren angeordnet sind in den Vertiefungen (12) und daß der Stab (8) verankert ist in der Mahlscheibe oder in dem Segment oder zwischen und/oder in zwei Segmenten (1, 2).
3. System nach Anspruch 2, **dadurch gekennzeichnet, daß** die Meß-(Kontakt) Teile der Druck- und Temperatursensoren, anstelle der Anordnung in der Vorderseite des Stabs (8), angeordnet sind in einer Platte (14), deren Oberfläche und deren Aufbau (Vertiefungen) (15) im wesentlichen zusammenfallen mit der Vorderseite und daß die Platte (14) an der Vorderseite des Stabs (8) angebracht ist.

4. System nach Anspruch 1, **dadurch gekennzeichnet, daß** die Druck- und Temperatursensoren angeordnet sind in bereits bestehenden Räumen zwischen Stäben in der Mahlscheibe oder Segmenten (1,2) in wenigstens zwei Positionen.

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5. System nach Ansprüchen 1-4, **dadurch gekennzeichnet, daß** die Drucksensoren von einem faser-optischen Typ sind.

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6. System nach den Ansprüchen 1-4, **dadurch gekennzeichnet, daß** die Drucksensoren von einem Piezowiderstands-Typ sind.

7. System nach Ansprüchen 1-6, **dadurch gekennzeichnet, daß** die Temperatursensoren aus Widerstandselementen bestehen.

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8. System nach Ansprüchen 1-7, **dadurch gekennzeichnet, daß** die Anzahl der Drucksensoren oder Temperatursensoren oder kombinierten Druck- und Temperatursensoren 8 oder mehr ist.

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Revendications

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1. Système pour la mesure continue de la pression et de la température dans la zone de battage de raffineurs utilisés dans l'industrie de la pâte à papier et du papier et une industrie similaire, comportant plusieurs capteurs de pression et capteurs de température séparés ou capteurs combinés de pression et de température pourvus d'un câble disposé sur ou dans au moins un des disques de battage homogènes ou des disques de battage composés de segments (1, 2) le long du rayon actif du disque de battage ou disposé de manière alternée dans au moins une position entre, ou de manière alternée entre et dans, deux des segments (1, 2) du disque de battage le long du rayon actif du disque de battage de sorte que les câbles sont rassemblés dans un faisceau de câble (7) ou sont transférés dans un autre câble et sortent du disque de battage par l'intermédiaire d'un trou (13) dans celui-ci, caractérisé en ce que les capteurs sont disposés sur ou dans le ou les disques qui tournent et le faisceau de câble (7) ou le câble est relié à un patin de collecteur disposé contre l'arbre du raffineur d'où la connexion mène à une unité de détection et à une unité de présentation suivante.

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2. Système selon la revendication 1, caractérisé en ce que les capteurs de pression et de température sont partiellement logés dans une barre allongée parallélépipédique (18) s'étendant le long du rayon actif du disque de battage ayant au moins trois côtés comprenant un côté avant (11) pourvu de plusieurs renforcements (12) face à la matière de battage, et en ce que la partie de détection (contact)

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des capteurs de pression et de température est disposée dans les renforcements (12) et en ce que la barre (8) est ancrée dans le disque de battage ou dans le segment ou entre et/ou dans deux segments (1, 2).

3. Système selon la revendication 2, caractérisé en ce que la partie de détection (contact) des capteurs de pression et de température, au lieu de se trouver dans le côté avant de la barre (8), est disposée dans une plaque (14) dont la surface et la construction (renforcements) (15) coïncident sensiblement avec le côté avant, et en ce que la plaque (14) est fixée sur le côté avant de la barre (8).

4. Système selon la revendication 1, caractérisé en ce que les capteurs de pression et de température sont disposés dans des espaces déjà existants entre les barres dans le disque de battage ou les segments (1, 2) dans au moins deux positions.

5. Système selon les revendications 1 à 4, caractérisé en ce que les capteurs de pression sont du type à fibre optique.

6. Système selon les revendications 1 à 4, caractérisé en ce que les capteurs de pression sont du type piézorésistif.

7. Système selon les revendications 1 à 6, caractérisé en ce que les capteurs de température se composent des éléments de résistance.

8. Système selon les revendications 1 à 7, caractérisé en ce que le nombre de capteurs de pression ou de capteurs de température ou de capteurs combinés de pression et de température est de 8 ou plus.

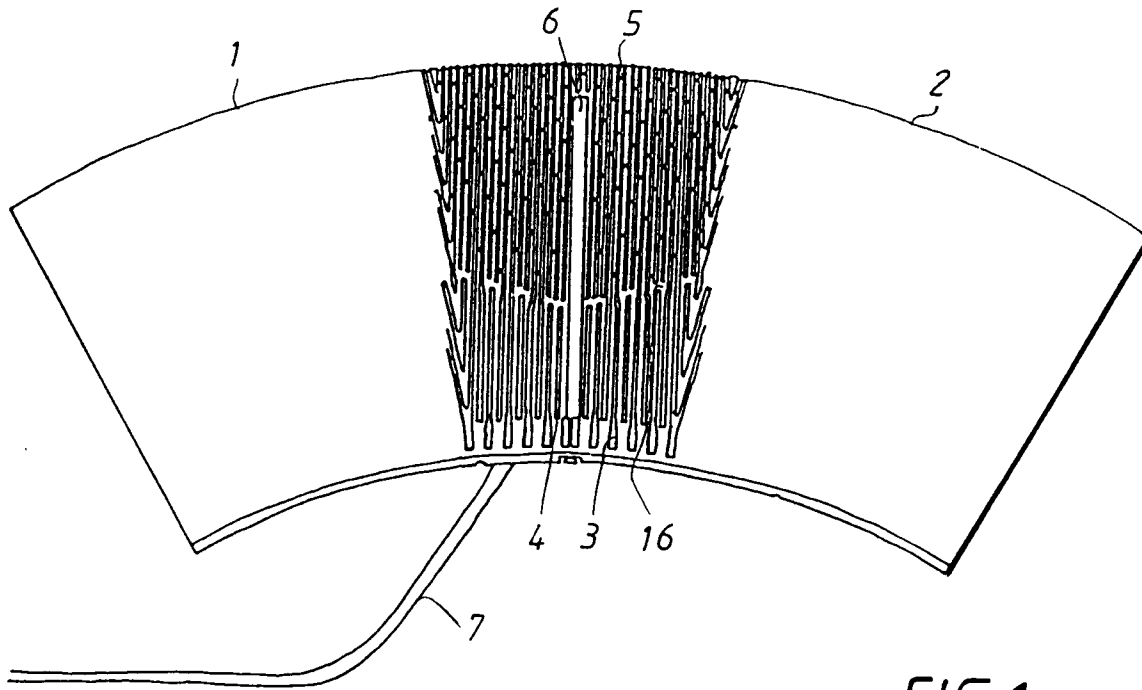


FIG. 1

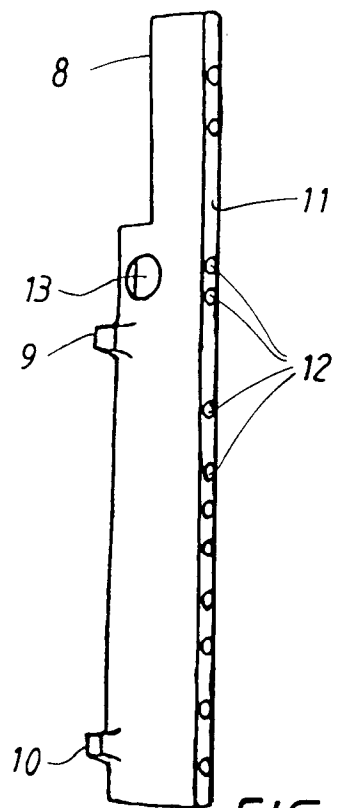


FIG. 2

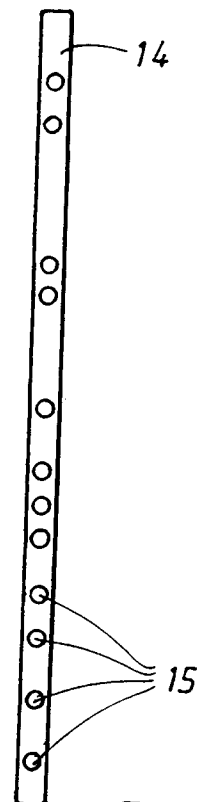


FIG. 3

