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(54) **ON-LINE ADJUSTABLE COAL FLOW DISTRIBUTING DEVICE**

ONLINE VERSTELLBARE KOHLEFLUSSVERTEILVORRICHTUNG

DISPOSITIF DE DISTRIBUTION DE CHARBON RÉGLABLE EN LIGNE

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a method of and an apparatus for operating a pulverized coal-fired boiler system including an on-line adjustable coal flow distributing device. The invention particularly relates to controlling the balance of flows of pulverized coal from a coal pipe to multiple coal pipes by using an adjustable riffle in a coal pipe junction. A riffle is an enclosure including a series of parallel flow channels with rectangular cross sections, leading coal from an inlet pipe alternatively to each of a plurality of outlet pipes.

Description of the Related Art

[0002] In a pulverized coal-fired boiler, particulate coal and primary air flow from one or more pulverizers to multiple coal burners disposed on the boiler enclosure, i.e., on the walls, corners, roof and/or arches, of the boiler. Coal is fed to the burners through a coal feed system comprising multiple coal pipes extending from the pulverizers to the burners. Usually, the number of coal pipes connected to the pulverizers is less than the number of coal pipes connected to the burners, and the coal feed system comprises several coal pipe junctions, where an upstream coal pipe is divided into two or more downstream coal pipes.

[0003] It is generally known that controlled, usually uniform, distribution of coal and primary air between the individual burners is important for achieving a desired temperature distribution in the boiler as well as reduced emissions to the environment and a low level of unburned carbon in the ash. A sufficiently uniform distribution of primary air to the coal pipes can usually be obtained using adjustable orifices or flow restrictors in the coal pipes, to balance the overall flow resistances of the coal pipes. However, achieving a uniform coal flow distribution to the coal pipes is often a difficult task. A reason for this is that coal has a tendency to flow in the coal pipes as so-called "ropes," or relatively narrow, concentrated streams of coal. Such ropes propagate in certain portions of the cross sections of the coal pipes. Often, there is only one rope within a coal pipe, which may change its position depending, e.g., on the air and coal flow rates. When reaching a coal pipe junction, the rope may be directed mainly to one downstream coal pipe, and the distribution of coal to the burners may therefore become highly unbalanced.

[0004] A method used for trying to balance the coal streams is to provide a venturi with an internal swirler in the coal pipe at a position upstream of the junction, so as to break up the coal rope. However, such a swirler increases the pressure drop in the coal pipe. Also, in cases in which an unbalanced distribution of coal is observed, such a swirler cannot be adjusted to correct the flows.

[0005] In trying to divide a coal particle stream uniformly from a coal pipe into multiple downstream pipes, the pipe junction is often provided with a riffle, i.e., an enclosure comprising a series of parallel flow channels with rectangular cross sections, leading coal from the inlet pipe alternatively to each of the outlet pipes. Typically, a riffle comprises eight to sixteen channels having a width from about one to about four inches. By using very narrow channels in the riffle, the coal rope can be expected to hit the inlet openings of more than a few channels and a relatively good coal flow balance may be achieved. However, channels that are too narrow cause a high flow resistance. Therefore, the channels are often of such a size that the rope may hit mainly a few channels only. However, in this configuration, a too large imbalance may be caused. For the foregoing reasons, there is a need to improve the balancing of coal flow in a riffle without severely increasing the flow resistance.

[0006] US Patent No. 6,789,488 shows a device for balancing pulverized coal flows having adjustable flow control elements disposed upstream of a riffle. The flow control elements comprise an array of, e.g., tear-drop shaped elements mounted on a positioning rod. The transverse position of all parallel flow control elements can simultaneously be adjusted by sliding the positioning rod in or out of the coal pipe. Such a device is, however, quite a complicated construction and prone to wearing. Patent publication EP 1 418 383 A1 shows a tiltable damper in a fuel supply duct upstream of a branching part to control the distribution of fuel to the branch ducts. US Patent Application No. 2005/0160953 shows a riffle distributor with a motor to move a set of intake vanes relative to the incoming flow reference axis.

[0007] It would, therefore, be advantageous to provide a simple and durable coal pipe junction design that enables control of the distribution of coal flows in a pulverized coal feed system. Such a design would result in improved operation of the pulverized coal boiler system, reduced pollutant emissions, and improved combustion efficiency.

SUMMARY OF THE INVENTION

[0008] An object of the present invention is to provide a riffle configuration in a simple and reliable method of and apparatus for efficiently controlling the balance of multiple coal flows in a pulverized coal fired boiler system, without significantly increasing the pressure drop of the system.

[0009] Another object of the present invention is to provide an automatic, on-line control in an efficient method of and apparatus for controlling the balance of multiple coal flows in a pulverized coal fired boiler system.

[0010] According to an aspect, the present invention provides a method of controlling the distribution of coal in a pulverized coal-fired boiler system having at least

one coal pulverizer and at least two burners disposed on a boiler enclosure for receiving pulverized coal from the coal pulverizer. The method includes providing a coal feed system for supplying coal from the at least one coal pulverizer to the at least two burners. The coal feed system has a coal pipe junction with a riffle enclosure comprising a plurality of parallel partition walls forming multiple flow channels from an upstream coal pipe to each of at least two downstream pipes. The method also includes providing a plurality of individually pivotable vanes upstream of the plurality of partition walls and pivoting at least one of the individually pivotable vanes to control the distribution of coal among the at least two downstream coal pipes.

[0011] According to another aspect, the present invention provides a coal feed system for use in a pulverized coal-fired boiler system having at least one coal pulverizer for pulverizing coal to be supplied to at least two burners disposed on a boiler enclosure. The coal feed system includes a coal pipe junction and a plurality of individually pivotable vanes. The coal pipe junction includes a riffle enclosure having a plurality of partition walls forming multiple flow channels from an upstream coal pipe, through which the pulverized coal is supplied from the coal pulverizer, to each of at least two downstream coal pipes, which supply the pulverized coal to the at least two burners. The plurality of individually pivotable vanes are disposed upstream of the plurality of partition walls to control distribution of coal from the upstream coal pipe among the downstream coal pipes.

[0012] By adjusting one or more of the individual vanes disposed upstream of the partition walls from an inline position to a position at least partially blocking the inlet to one or more flow channels, the flow of coal and air through the channels can be reduced. As an object of the present invention, while coal is transported in the coal pipes as concentrated ropes, which typically hit a few of the flow channels only, a considerable portion of the coal may be redistributed to flow to the neighboring channels by partially or fully blocking the inlets to one or at most a few of the channels. By adjusting the vanes properly, the coal flow can be distributed evenly to the outlet pipes. In some cases, there is also a need to specifically bias the coal distribution, for example, to address emissions or slagging problems. By adjusting the vanes properly, it is also possible to obtain such a biased coal distribution.

[0013] The individually pivotable vanes in accordance with the present invention allow balancing of the outlet coal flows without having to use flow channels in the riffle that are so narrow that a significant pressure drop in the riffle is created. In most cases, the device in accordance with the present invention renders it possible to balance the coal flow distribution by turning one or at most a few vanes in the riffle. Thus, most of the vanes can be maintained inline with the flow, a pressure drop does not severely increase, and the velocity or distribution of primary air, which is spread to all of the channels, is not significantly affected.

[0014] In another preferred embodiment of the present invention, a coal flow rate is measured in the downstream coal pipes and at least one of the vanes is pivoted, in response to a measured coal flow imbalance, to achieve the required coal flow distribution. The coal flow data is preferably received from a real-time, on-line coal flow measuring system, such as a so-called ECT (Electric Charge Transfer) system. An automated control system advantageously adjusts the vane(s).

[0015] The coal pipe junction preferably comprises two or more outlet openings, one to each of the corresponding downstream coal pipes. When the junction has only two outlet openings, the riffle enclosure advantageously comprises parallel flow channels leading alternately to each of the outlet openings. By disposing an individually pivotable vane upstream of every second of the partition walls between the flow channels and a fixed partition wall extension between the individually pivotable vanes, it is possible to close or to reduce the flow to any one of the channels, and thereby to balance the coal flows by redistributing a portion of an unfavorable high coal flow from a channel to its neighboring channel.

[0016] When the riffle comprises N outlet openings, where N is larger than two, a fixed partition wall extension is preferably disposed upstream of every N^{th} partition wall and an individually pivotable vane is preferably disposed upstream of all other partition walls. By pivoting N-1 adjacent vanes, it is then usually possible to balance the coal flow to the N outlet openings. To provide the highest controlling flexibility, it is also possible to dispose an adjustable vane upstream of each of the partition walls, although such a riffle is somewhat more complicated than the ones with fixed wall extensions between the vanes.

[0017] The above brief description, as well as further objects, features, and advantages of the present invention will be more fully appreciated by reference to the following detailed description of the currently preferred, but nonetheless illustrative, embodiments of the present invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a schematic view of a pulverized coal-fired boiler system.

FIG. 2 is a schematic cross-sectional front view of a coal pipe junction with a riffle according to a first preferred embodiment of the present invention.

FIGS. 3 is schematic a cross-sectional side view of a coal pipe junction with a riffle according the preferred embodiment of the present invention.

FIG. 4 is a schematic cross-sectional front view of a

coal pipe junction with a riffle according to another preferred embodiment of the present invention.

FIG. 5 is a schematic cross-sectional side view of a coal pipe junction with a riffle according to the preferred embodiment depicted in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring now in greater detail to the drawings, FIG. 1 schematically shows an overall view of a pulverized coal-fired boiler system 10. Coal 12 and air 14 are introduced into a pulverizer 16 in which the coal is pulverized into a size suitable for combustion in each of two burners 18, 20 disposed on the sidewalls of a boiler 22. In other types of boilers, the burners 18, 20 can be disposed on the corners, roof, and/or arches of the boiler. Pulverized coal and primary air are conveyed along a coal feed system 24 from the pulverizer 16 to the burners 18, 20, where the coal is combusted by primary air and secondary air 26. Exhaust gases produced in the combustion process are discharged from the boiler through a discharge gas channel 28.

[0020] The coal feed system 24 comprises, in the simple pulverized coal firing boiler system shown in FIG. 1, an upstream pipe 30, connected to the pulverizer 16, and two downstream pipes 32 and 34, connected to the burners 16 and 18, respectively. The upstream pipe 30 is connected to the downstream pipes 32, 34 by a junction 36, where the initial flow of pulverized coal and primary air is divided among the two downstream pipes 32, 34. In practice, pulverized coal firing boilers often comprise several pulverizers each having one or more outlets, each of which may be connected to two or more burners. Accordingly, a coal feed system of such a more complicated pulverized coal firing boiler system may comprise several coal pipe junctions, which each split coal flow from an inlet pipe, or upstream pipe, carrying coal from an outlet of a pulverizer into two or more outlets pipes, or downstream pipes. For example, a coal pipe junction, in accordance with the present invention, may be connected to two outlet pipes, as the one shown in FIGs. 1-3, or to more than two outlet pipes, as the one shown in FIGs. 4 and 5.

[0021] In order to have an even temperature distribution in the boiler 22, as well as high combustion efficiency and low emissions, flows of the primary air and coal to the burners 18, 20 should usually be well-balanced. However, especially because coal tends to flow in the coal feed system 24 as concentrated ropes, there is a risk of an uneven distribution of coal into the coal pipes 32, 34, downstream of the junction 36. On the other hand, in some cases, there is a need to specifically bias the coal distribution, for example, to address emissions or slagging problems. In order to achieve any of these goals, the junction 36 advantageously comprises an adjustable riffle according to the present invention so as to control the coal flow distribution between the pipes 32, 34, as will be discussed below in more detail.

[0022] FIG. 2 schematically depicts a front cross-sectional view of an embodiment of the coal pipe junction 36, and FIG. 3 depicts a side cross-sectional view thereof. As illustrated, the junction 36 has one inlet opening 38 and two outlet openings 40, 42, to which the upstream pipe 30 and the downstream pipes 32, 34, respectively, are to be connected. The coal pipe junction 36 is here shown as having the inlet opening 38 at its lower end and the outlet openings 40, 42 at the upper end. However, the orientation of the junction 36 may be different. For example, the inlet opening 38 may be at the upper end of the junction, or on a side. The coal pipe junction 36 of FIGs. 2 and 3 also includes a riffle enclosure 44 having vertical side walls 46, an open, horizontal lower end 48, and partially-open upper ends 50, 52, which are slanted towards the sides of the enclosure.

[0023] Disposed within the riffle enclosure 44 is a series of vertical partition walls 54, 54', which form, together with the side walls 46, a series of parallel flow channels 56, 56'. Every second of the flow channels 56, 56' has a slanted upper end portion open towards one of the outlet openings 40, 42 and a slanted upper end portion closed towards the other of the outlet openings 40, 42, while the rest of the flow channels have the open and closed slanted end portions reversed. Thus, in FIG. 3, for example, the flow channels a1 - a5 are open to the outlet opening 40 and closed to the outlet opening 42, and the flow channels b1 - b5 are open to the outlet opening 42 and closed to the outlet opening 40.

[0024] In some cases, there is a need to specifically bias the coal distribution, for example, to address emissions or slagging problems. Thus, in the present invention depicted in FIG. 3, a vane 58, which can be pivoted about its rear (downstream) edge by a lever 60, is disposed adjacent to the lower (upstream) end of every second of the partition walls 54, 54'. (As shown in FIG. 3, each of these every second of the partition walls is referenced by numeral 54.) The lever 60 can advantageously be closed to a desired position by a locking pin 62. Each of the vanes 58 is independently pivotable. The vanes 58 can be pivoted by an automatic control system 66. The control system 66 preferably comprises means 68 for monitoring the coal flow in the downstream pipes 32, 34. Based on measurements by such means, for example, based on an observed coal flow imbalance, one or more of the vanes 58 are turned so as to balance the flows. The coal flow monitoring method can be based on the so-called ECT (Electric Charge Transfer) technology, or some other coal flow monitoring method known to persons skilled in the art, for example, based on an optical, microwave or sampling-based method.

[0025] Also in FIG. 3, fixed wall extensions 70 are advantageously disposed adjacent to the lower ends of the partition walls 54, 54' not associated with a pivotable vane 58. (As shown in FIG. 3, the wall extensions are disposed adjacent to the partition walls referenced by numeral 54'.) The extensions preferably extend downwards substan-

tially as far as the vanes 58. Thus, the vanes 58 can advantageously be used to partially or fully close the inlet to either one of the adjacent flow channels 56, 56' by turning the leading edge of the vane towards an adjacent wall extension 70 or side wall 46. In FIG. 3, the vane 58 at the lower end of the partition wall 54 between the channels a1 and b1 is pivoted to nearly close the inlet to the channel b1.

[0026] If the coal flow to the coal pipe junction 36 forms only one coal rope, the rope may have a width extending mainly to the inlets of only a few of the channels 56, 56'. When, for example, originally 20% of the coal impinges on the channel a1, 70% on the channel b1, and 10% on the channel a2, only 30% of the coal is directed to the outlet opening 40, while the rest, 70%, is directed to the outlet opening 42. To correct this situation, the vane 58 between the channels a1 and b1 is pivoted toward the channel b1 to partially block channel b1. When the vane 58 is pivoted so that the portion of coal flowing to the channel a1 is increased to 40% and the portion flowing to the channel b1 is decreased to 50%, the total coal flow downstream of the junction 36 is balanced. While the balancing is made by tilting one vane 58 only, the distribution of primary air to the outlet pipes 40 and 42 is not significantly changed.

[0027] The vane to be turned for balancing the coal flows can be found by testing them one-by-one, and monitoring the changes of the coal streams. If an on-line coal stream monitoring system is not available, it is in some cases also possible to adjust the fiows indirectly by some other parameters, such as the temperatures in the boiler. If the coal is flowing in the upstream pipe as a single rope or, more generally, in a form having only one maximum, it should theoretically always be possible to balance the flows by tilting one vane only. However, in some cases, when the density of the coal flow has more than one maximum point, the optimal balance of coal flows can be obtained by tilting two or more vanes.

[0028] According to the present invention, the vanes 58 are controlled independently.

[0029] FIG. 3 shows the vanes 58 positioned so that only a very small gap 72 is formed between each of the vanes and the lower ends of the adjacent partition walls 54. However, in some cases, especially when the optimal vane position includes turning of several vanes from the vertical direction, it may be useful to have a larger spacing therebetween. The spacing may preferably have an extent of from about 0.2 to about 3 times the width of the channels, and even more preferably from about 0.5 to about 1 times the width of the channels. Such a spacing does not have a significant effect on the coal flows, but the spacing may help to control the balance of the primary air flow.

[0030] When the vanes 58 are in an inline position, the flow of air and pulverized coal does not cause any severe stress to the vanes 58. However, when a vane is in a coal flow-diverting position, pulverized coal will impinge on the vane. Therefore, the vanes 58 are preferably made of wear-resistant materials to extend the useable life of the vanes 58.

[0031] FIGs. 4 and 5 show schematically, as another preferred embodiment of the present invention, a coal pipe junction 74 having one inlet opening 76 and three outlet openings 78, 80, 82. The riffle enclosure 84 comprises a series of three different types of parallel flow channels 86, 88, 90, which each direct coal flow to one of the outlet openings 78, 80, 82. The flow channels a1 - a3 direct coal, for example, to outlet opening 78, channels b1 - b3 to outlet opening 80, and channels c1 - c3 to outlet opening 82. As is shown in FIG. 5, a fixed extension 94 is arranged adjacent to the lower end of every third of the partition walls 92. For example, a fixed extension 94 is arranged adjacent to the partition wall 92 disposed between the channels c2 and a3. Meanwhile, an individually pivotable vane 96 is arranged adjacent to the lower end of each of the other partition walls. For example, a vane 96 is arranged adjacent to the partition wall 92 disposed between the channels a3 and b3.

[0032] Balancing the coal flows to the pipes connected to the three outlet openings 78, 80 and 82 of the coal pipe junction 74 by pivoting the vanes 96 is somewhat more complicated than in the case of the junction with two outlet openings discussed above with reference to FIGs. 2 and 3. However, it is in principle always possible to turn two adjacent vanes 96 to distribute a coal flow having one concentration maximum evenly to all of the outlet pipes, without having a significant effect on the balance of the primary air flows. If, for example, originally 20% of coal impinges on the channel b1, 70% on the channel c1 and 10% on the channel a2, it is possible to tilt the vane 96', arranged between the channels b1 and c1 toward the fixed wall extension 94'arranged between the channels c1 and a2, so that the inlet to channel c1 is more than half closed, and then tilt the vane 96" arranged between the channels a1 and b1 in the same direction (i.e., toward the fixed wall extension 94'), so as to direct a portion of the flow now directed to channel b1 to channel a1. Thereby, it is possible to divide the coal stream equally among the outlet pipes 78, 80, 82, and the primary air flow maintains sufficient balance.

[0033] It is naturally also possible to make a junction with an adjustable riffle which directs coal flow to more than three outlet openings. In an adjustable riffle according to the present invention, it is possible to have independently adjustable vanes adjacent to only some of the partition walls, as in the embodiments shown in FIGs. 2, 3, 4, and 5, or to have such vanes adjacent to each of the partition walls. The larger number of independently adjustable vanes renders possible a more flexible adjustment of the coal flows, but it also increases the costs of the device and makes the determination of optimal adjustment more complicated.

[0034] In FiGs. 2-5, the adjustable vanes 58, 96 are mounted so that they can be pivoted around their rear, i.e., downstream, edges. However, it is also possible in some embodiments of the present invention to mount the

vanes pivotable about their leading, i.e., upstream, edges. This alternative, which can be especially useful if all the partition walls are equipped with an adjustable vane, may make the coal flow control somewhat more complicated, but may lead to very good balancing of the flows of both coal and primary air.

[0035] While the invention has been described by way of examples of what are at present considered to be the preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but is intended to cover various combinations or modifications of the features and applications included within the scope of the invention, as defined in the appended claims.

Claims

1. A method of controlling the distribution of coal in a pulverized coal-fired boiler system (10) having at least one coal pulverizer (16) and at least two burners (18, 20) disposed on a boiler enclosure for receiving pulverized coal from the at least one coal pulverizer, the method comprising:

   providing a coal feed system (24) for supplying coal from the at least one coal pulverizer (16) to the at least two burners (18, 20), the coal feed system having a coal pipe junction (36) with a riffle enclosure (44, 84) comprising a plurality of parallel partition walls (54, 54', 92, 94, 94') forming multiple flow channels (56, 56', 86, 88, 90) from an upstream coal pipe (30) to each of at least two downstream pipes (32, 34, 78, 80, 82);
   characterized by
   providing a plurality of individually pivotable vanes (58, 96, 96', 96") upstream of the plurality of partition walls; and
   pivoting at least one of the plurality of individually pivotable vanes to control the distribution of coal among the at least two downstream coal pipes.

2. The method of claim 1, further comprising the step of monitoring a coal flow rate in the downstream coal pipes (32, 34), wherein the pivoting step is performed in response to a measured distribution of the monitored coal flow rate.

3. The method of claim 1, further comprising providing a gap (72) of from about 0.2 to about 3 times the width of the flow channels (56, 56') between each of the vanes (58) and the upstream end of an adjacent partition wall (54).

4. The method of claim 3, wherein the gap (72) between each of the vanes (58) and the upstream end of the adjacent partition wall (54) is from about 0.5 to about 1 times the width of the parallel flow channels (56, 56').

5. The method of claim 1, wherein the riffle enclosure (44) comprises multiple flow channels (56, 56') from an upstream pipe (30) to each of two downstream pipes (32, 34), and wherein one of the plurality of individually pivotable vanes (58) is provided upstream of every second of the partition walls (54) and an extension (70) of a fixed partition wall (54') is provided between the individually pivotable vanes.

6. The method of claim 1, wherein the riffle enclosure (84) comprises multiple flow channels (86, 88, 90) from the upstream pipe to each of N downstream pipes (78, 80, 82), where N is larger than two, wherein a fixed partition wall extension (94, 94') is provided upstream of every N^{th} partition wall and wherein one of the individually pivotable vanes (96, 96', 96") is provided upstream of each of the other partition walls (92).

7. A coal feed system (24) for use in a pulverized coal-fired boiler system (10) having at least one coal pulverizer (16) for pulverizing coal to be supplied to at least two burners (18, 20) disposed on a boiler enclosure, said coal feed system comprising:

   a riffle enclosure (44, 84) comprising a plurality of partition walls (54, 54', 92, 94, 94') forming multiple flow channels (56, 56', 86, 88, 90) from an upstream coal pipe (30), through which the pulverized coal is supplied from the coal pulverizer, to each of at least two downstream coal pipes (32, 34, 78, 80, 82), which supply the pulverized coal to the at least two burners,
   characterized by comprising
   a plurality of individually pivotable vanes (58, 96, 96', 96") upstream of said plurality of partition walls to control distribution of coal from the upstream coal pipe among the downstream coal pipes.

8. The coal feed system of claim 7, further comprising means for monitoring (68) a coal flow rate in said downstream coal pipes (32, 34) and means for pivoting (64) one or more of said vanes in response to a measured distribution of the monitored coal flow rate.

9. The coal feed system of claim 7, wherein a gap (72) of from about 0.2 to about 3 times the width of the parallel flow channels (56, 56') is provided between each of said vanes (58) and the upstream end of an adjacent partition wall (54).

10. The coal feed system of claim 9, wherein the gap (72) is from about 0.5 to about 1 times the width of the parallel flow channels (56, 56') between each of

said vanes (58) and the upstream end of the adjacent partition wall (54).

11. The coal feed system of claim 7, wherein the riffle enclosure (44) comprises multiple flow channels (56, 56') from the upstream pipe (30) to each of two downstream pipes (32, 34), one of the individually pivotable vanes (58) is provided upstream of every second of the partition walls (54), and a fixed partition wall extension (70) is provided between the individually pivotable vanes.

12. The coal feed system of claim 7, wherein the riffle enclosure (84) comprises multiple flow channels (86, 88, 90) from the upstream pipe to each of N downstream pipes (78, 80, 82), where N is larger than two, a fixed partition wall extension (94, 94') is provided upstream of every N^{th} partition wall, and wherein one of the individually pivotable vanes (96, 96', 96") is provided upstream of each of the other partition walls (92).

13. The coal feed system of claim 7, wherein an equal number of individually pivotable vanes and partition walls is provided, and each of the vanes is arranged adjacent to each of the partition walls.

Patentansprüche

1. Verfahren zur Einstellung der Verteilung von Kohle in einem kohlenstaubbefeuerten Kesselsystem (10), das zumindest eine Kohlemühle (16) und zumindest zwei Brenner (18, 20) aufweist, die an einem Kesselgehäuse angeordnet sind zur Aufnahme von Kohlenstaub von der zumindest einen Kohlemühle, das Verfahren umfassend:

Bereitstellung eines Kohlezuführungssystems (24) zur Zuführung von Kohle von der zumindest einen Kohlemühle (16) zu den mindestens zwei Brennern (18, 20), welches Kohlezuführungssystem einen Kohlenrohrübergang (36) mit einem Verteilergehäuse (44, 84) aufweist, das eine Vielzahl paralleler Trennwände (54, 54', 92, 94, 94') umfasst, die mehrere Strömungskanäle (56, 56', 86, 88, 90) von einem stromaufwärts gelegenen Kohlenrohr (30) zu jedem der zumindest zwei stromabwärts gelegenen Rohre (32, 34, 78, 80, 82) bilden;
dadurch gekennzeichnet, dass
eine Vielzahl einzeln verschwenkbarer Strömungsverteiler (58, 96, 96', 96") stromaufwärts von der Vielzahl Trennwände vorgesehen ist; und
zumindest einer von der Vielzahl einzeln verschwenkbarer Strömungsverteiler verschwenkt wird, um die Verteilung von Kohle zwischen der zumindest zwei stromabwärts gelegenen Rohren einzustellen.

2. Verfahren nach Patentanspruch 1, bestehend des Weiteren aus einem Schritt zur Überwachung des Kohledurchsatzes in den stromabwärts gelegenen Rohren (32, 34), wobei der Schwenkschritt als Antwort auf eine gemessene Verteilung des überwachten Kohlendurchsatzes durchgeführt wird.

3. Verfahren nach Patentanspruch 1, bestehend des Weiteren aus der Bereitstellung eines Spalts (72) von ungefähr 0,2- bis ungefähr 3-mal die Breite der Strömungskanäle (56, 56') zwischen jedem der Strömungsverteiler (58) und dem stromaufwärts gelegenen Ende einer benachbarten Trennwand (54).

4. Verfahren nach Patentanspruch 3, wobei der Spalt (72) zwischen jeder der Schaufeln (58) und dem stromaufwärts gelegenen Ende der benachbarten Trennwand (54) von ungefähr 0,5- bis ungefähr 1-mal die Breite der parallelen Strömungskanäle (56, 56') ist.

5. Verfahren nach Patentanspruch 1, wobei das Verteilergehäuse (44) mehrere Strömungskanäle (56, 56') von einem stromaufwärts gelegenen Rohr (30) zu jedem der stromabwärts gelegenen Rohre (32, 34) umfasst und wobei einer von der Vielzahl einzeln verschwenkbarer Strömungsverteiler (58) stromaufwärts von jeder zweiten der Trennwände (54) vorgesehen ist und eine Verlängerung (70) einer feststehenden Trennwand (54') zwischen den einzeln verschwenkbaren Strömungsverteilern vorgesehen ist.

6. Verfahren nach Patentanspruch 1, wobei das Verteilergehäuse (84) mehrere Strömungskanäle (86, 88, 90) von dem stromaufwärts gelegenen Rohr zu jedem der n stromabwärts gelegenen Rohre (78, 80, 82) umfasst, worin n grösser als zwei ist, wobei eine feststehende Trennwandverlängerung (94, 94') stromaufwärts von jeder nten Trennwand vorgesehen ist und wobei einer der einzeln verschwenkbaren Strömungsverteiler (96, 96', 96") stromaufwärts von jeder der anderen Trennwände (92) vorgesehen ist.

7. Kohlezuführungssystem (24) zur Verwendung in einem kohlenstaubbefeuerten Kesselsystem (10) mit zumindest einer Kohlemühle (16) zur Pulverisierung der zumindest zwei Brennern (18, 20) zuzuführenden Kohle, die an einem Kesselgehäuse angeordnet sind, das Kohlezuführungssystem umfassend:

ein Verteilergehäuse (44, 84), das eine Vielzahl Trennwände (54, 54', 92, 94, 94') umfasst, die mehrere Strömungskanäle (56, 56', 86, 88, 90)

von einem stromaufwärts gelegenen Kohlenrohr (30) bilden, durch die der Kohlenstaub von der Kohlemühle jedem der zumindest zwei stromabwärts gelegenen Kohlenrohre (32, 34, 78, 80, 82) zugeführt wird, die den Kohlenstaub den zumindest zwei Brennern zuführen,
dadurch gekennzeichnet, dass es
eine Vielzahl einzeln verschwenkbarer Strömungsverteiler (58, 96, 96', 96") stromaufwärts von besagter Vielzahl Trennwände zur Einstellung der Verteilung von Kohle von dem stromaufwärts gelegenen Kohlenrohr auf die stromabwärts gelegenen Kohlenrohre aufweist.

8. Kohlezuführungssystem nach Patentanspruch 7, umfassend des Weiteren Mittel zur Überwachung (68) eines Kohlendurchsatzes stromabwärts in besagten stromabwärts gelegenen Kohlenrohren (32, 34) und Mittel zum Verschwenken (64) eines oder mehrerer besagter Strömungsverteiler als Antwort auf eine gemessene Verteilung des überwachten Kohlendurchsatzes.

9. Kohlezuführungssystem nach Patentanspruch 7, wobei zwischen jedem der Strömungsverteiler (58) und dem stromaufwärts gelegenen Ende einer benachbarten Trennwand (54) ein Spalt (72) von ungefähr 0,2- bis ungefähr 3-mal die Breite der parallelen Strömungskanäle (56, 56') vorgesehen ist.

10. Kohlezuführungssystem nach Patentanspruch 9, wobei der Spalt (72) ungefähr 0,5- bis ungefähr 1-mal die Breite der parallelen Strömungskanäle (56, 56') zwischen jedem besagten Strömungsverteiler (58) und dem stromaufwärts gelegenen Ende der benachbarten Trennwand (54) ist.

11. Kohlezuführungssystem nach Patentanspruch 7, wobei das Verteilergehäuse (44) mehrere Strömungskanäle (56, 56') von dem stromaufwärts gelegenen Rohr (30) zu jedem der zwei stromabwärts gelegenen Rohre (32, 34) umfasst, einer der einzeln verschwenkbaren Strömungsverteiler (58) stromaufwärts von jeder zweiten der Trennwände (54) vorgesehen ist, und eine feststehende Trennwandverlängerung (70) zwischen den einzeln verschwenkbaren Strömungsverteilern vorgesehen ist.

12. Kohlezuführungssystem nach Patentanspruch 7, wobei das Verteilergehäuse (84) mehrere Strömungskanäle (86, 88, 90) von dem stromaufwärts gelegenen Rohr zu jedem der n der stromabwärts gelegenen Rohre (78, 80, 82) umfasst, worin n grösser als zwei ist, eine feststehende Trennwandverlängerung (94, 94') stromaufwärts von jeder nten Trennwand vorgesehen ist, und wobei einer der einzeln verschwenkbaren Strömungsverteiler (96, 96', 96") stromaufwärts von jeder der anderen Trennwände (92) vorgesehen ist.

13. Kohlezuführungssystem nach Patentanspruch 7, wobei eine gleich große Anzahl einzeln verschwenkbarer Strömungsverteiler und Trennwände vorgesehen ist und jeder der Strömungsverteiler benachbart zu jeder der Trennwände vorgesehen ist.

Revendications

1. Procédé de commande de la distribution de charbon dans un système de chaudière à charbon pulvérisé (10) présentant au moins un pulvérisateur à charbon (16) et au moins deux brûleurs (18, 20) disposés sur un boîtier de chaudière pour recevoir du charbon pulvérisé de l'au moins un pulvérisateur de charbon, le procédé comprenant de :

produire un système d'alimentation en charbon (24) pour fournir du charbon de l'au moins un pulvérisateur à charbon (16) aux au moins deux brûleurs (18, 20), le système d'alimentation en charbon présentant une jonction de tuyau de charbon (36) dotée d'un boîtier rainuré (44, 84) comprenant une pluralité de parois de séparation parallèles (54, 54', 92, 94, 94') formant de multiples conduits d'écoulement (56, 56', 86, 88, 90) allant d'un tuyau de charbon amont (30) à chacun des au moins deux des tuyaux aval (32, 34, 78, 80, 82) ; **caractérisé par** les étapes comprenant de
produire une pluralité de pales (58, 96, 96', 96) pivotantes individuellement situées en amont de la pluralité de parois de séparation ; et
faire pivoter au moins une pale de la pluralité de pales pivotantes individuellement pour commander la distribution du charbon entre les au moins deux tuyaux de charbon en aval.

2. Procédé selon la revendication 1, comprenant en outre l'étape consistant à surveiller un débit du charbon dans les tuyaux de charbon aval (32, 34), l'étape de pivotement étant réalisée en réponse à une distribution mesurée du débit de charbon surveillé.

3. Procédé selon la revendication 1, comprenant en outre la production d'un espace (72) allant d'environ 0,2 et environ 3 fois la largeur des conduits d'écoulement (56, 56') entre chacune des pales (58) et l'extrémité amont d'une paroi de séparation adjacente (54).

4. Procédé selon la revendication 3, dans lequel l'espace (72) entre chacune des pales (58) et l'extrémité amont de la paroi de séparation adjacente (54) est d'environ 0,5 à environ 1 fois la largeur des conduits d'écoulement parallèles (56, 56').

5. Procédé selon la revendication 1, dans lequel le boîtier rainuré (44) comprend de multiples conduits d'écoulement (56, 56') allant à d'un tuyau amont (30) à chacun des deux tuyaux aval (32, 34), et dans lequel une pale de la pluralité de pales (58) pivotantes individuellement est placée en amont de d'une parois de séparation (54) sur deux et une extension (70) d'une paroi de séparation fixe (54') est située entre les pales pivotantes individuellement.

6. Procédé selon la revendication 1, dans lequel le boîtier rainuré (84) comprend de multiples conduits d'écoulement (86, 88, 90) allant du tuyau amont à chacun des N tuyaux aval (78, 80, 82), où N est supérieur à deux, dans lequel une extension de paroi de séparation fixe (94, 94') est située en amont toutes les N parois de séparation, et dans lequel une des pales (96, 96', 96") pivotantes individuellement est disposée en amont de chacune des autres parois de séparation (92).

7. Système d'alimentation en charbon (24) destiné à être utilisé dans un système de chaudière à charbon pulvérisé (10) présentant au moins un pulvérisateur à charbon (16) destiné à pulvériser le charbon à fournir à au moins deux brûleurs (18, 20) disposés sur un boîtier de chaudière, ledit système d'alimentation en charbon, comprenant :

un boîtier rainuré (44, 84) comprenant une pluralité de parois de séparation (54, 54', 92, 94, 94') formant de multiples conduits d'écoulement (56, 56', 86, 88, 90) allant d'un tuyau de charbon amont (30), par lequel le charbon pulvérisé est amené du pulvérisateur à charbon, à chacun des au moins deux tuyaux de charbon aval (32, 34, 78, 80, 82), qui amènent le charbon pulvérisé à au moins deux brûleurs,
caractérisé en ce qu'il comprend
une pluralité de pales (58, 96, 96', 96") pivotantes individuellement situées en amont de ladite pluralité de parois de séparation pour commander la distribution du charbon depuis le tuyau de charbon amont parmi les tuyaux de charbon aval.

8. Système d'alimentation en charbon selon la revendication 7, comprenant en outre des moyens (68) pour surveiller un débit de charbon dans lesdits tuyaux de charbon aval (32, 34) et des moyens (64) pour faire pivoter une ou plusieurs desdites pales en réponse à une distribution mesurée du débit de charbon surveillé.

9. Système d'alimentation en charbon selon la revendication 7, dans lequel un espace (72) compris entre environ 0,2 et environ 3 fois la largeur des conduits d'écoulement parallèles (56, 56') est ménagé entre chacune desdites pales (58) et l'extrémité amont d'une paroi de séparation (54) adjacente.

10. Système d'alimentation en charbon selon la revendication 9, dans lequel l'espace (72) est d'environ 0,5 à environ 1 fois la largeur des conduits d'écoulement parallèles (56, 56') entre chacune desdites pales (58) et l'extrémité amont de la paroi de séparation (54) adjacente.

11. Système d'alimentation en charbon selon la revendication 7, dans lequel le boîtier rainuré (44) comprend de multiples conduits d'écoulement (56, 56') allant du tuyau amont (30) à chacun des deux tuyaux aval (32, 34), une des pales (58) pivotantes individuellement est située en amont d'une paroi de séparation (54) sur deux, et une extension de la paroi de séparation fixe (70) est située entre les pales pivotantes individuellement.

12. Système d'alimentation en charbon selon la revendication 7, dans lequel le boîtier rainuré (84) comprend de multiples conduits d'écoulement (86, 88, 90) allant du tuyau amont de chacun des N tuyaux aval (78, 80, 82), où N est supérieur à deux, une extension de paroi de séparation fixe (94, 94') est située en amont de toutes les N parois de séparation, et dans lequel une des pales (96, 96', 96") pivotantes individuellement est située en amont de chacune des autres parois de séparation (92).

13. Système d'alimentation en charbon selon la revendication 7, dans lequel il est prévu un nombre égal de pales pivotantes individuellement et de parois de séparation, et chacune des pales est disposée de façon adjacente à chacune des parois de séparation.

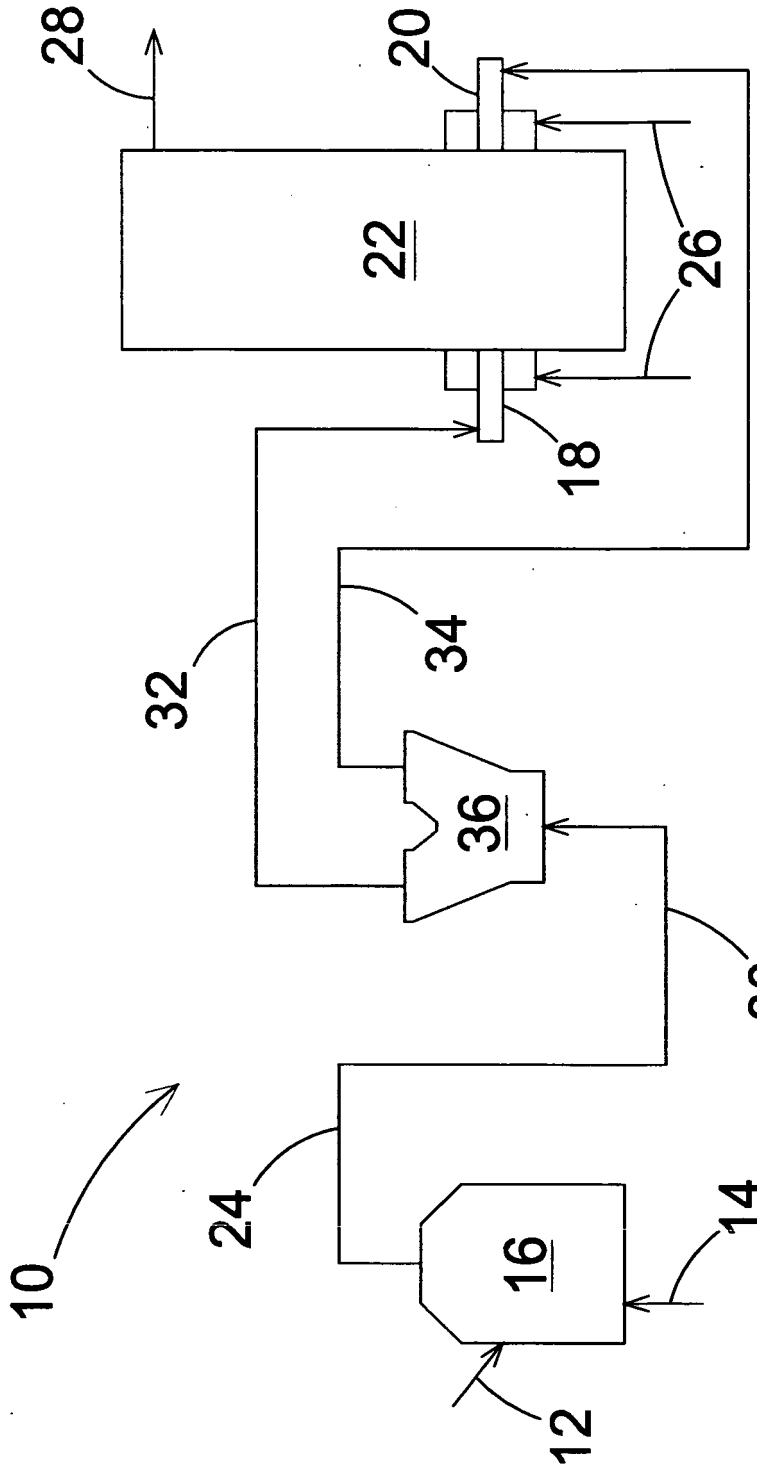

Fig. 1

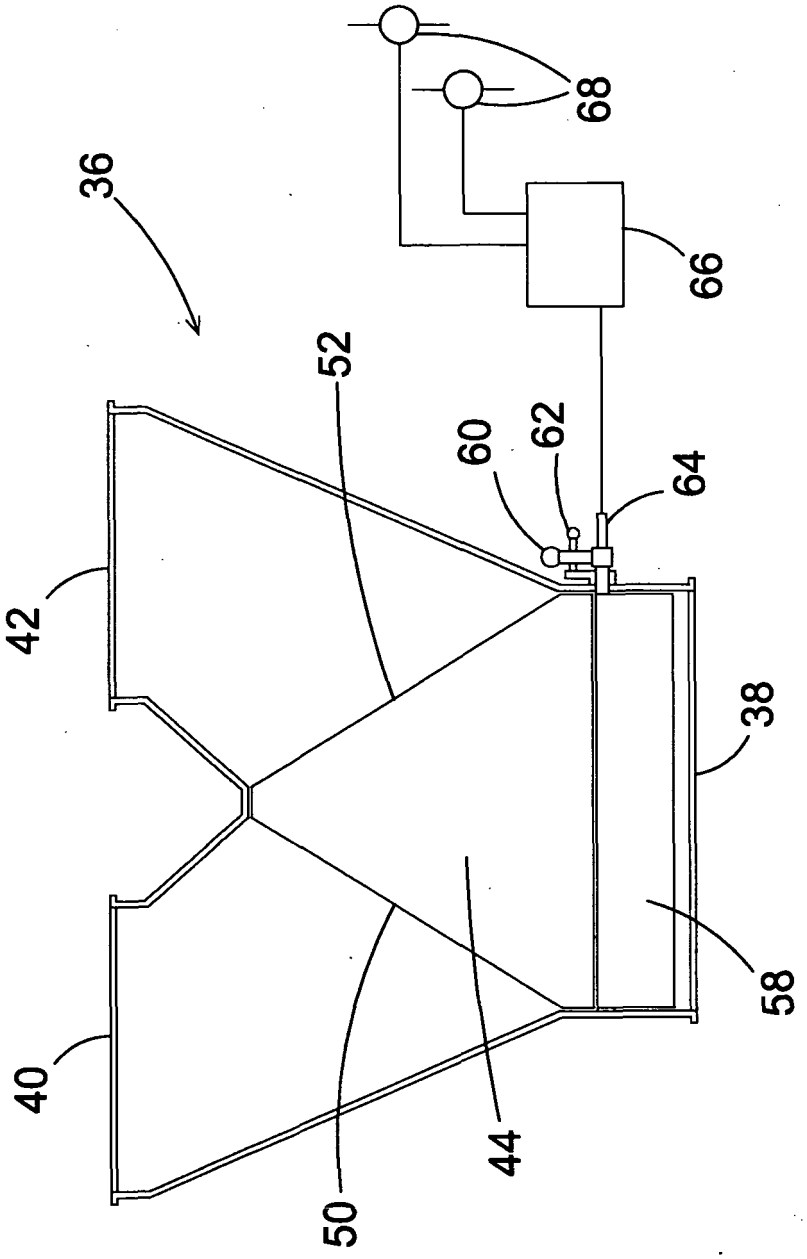

Fig. 2

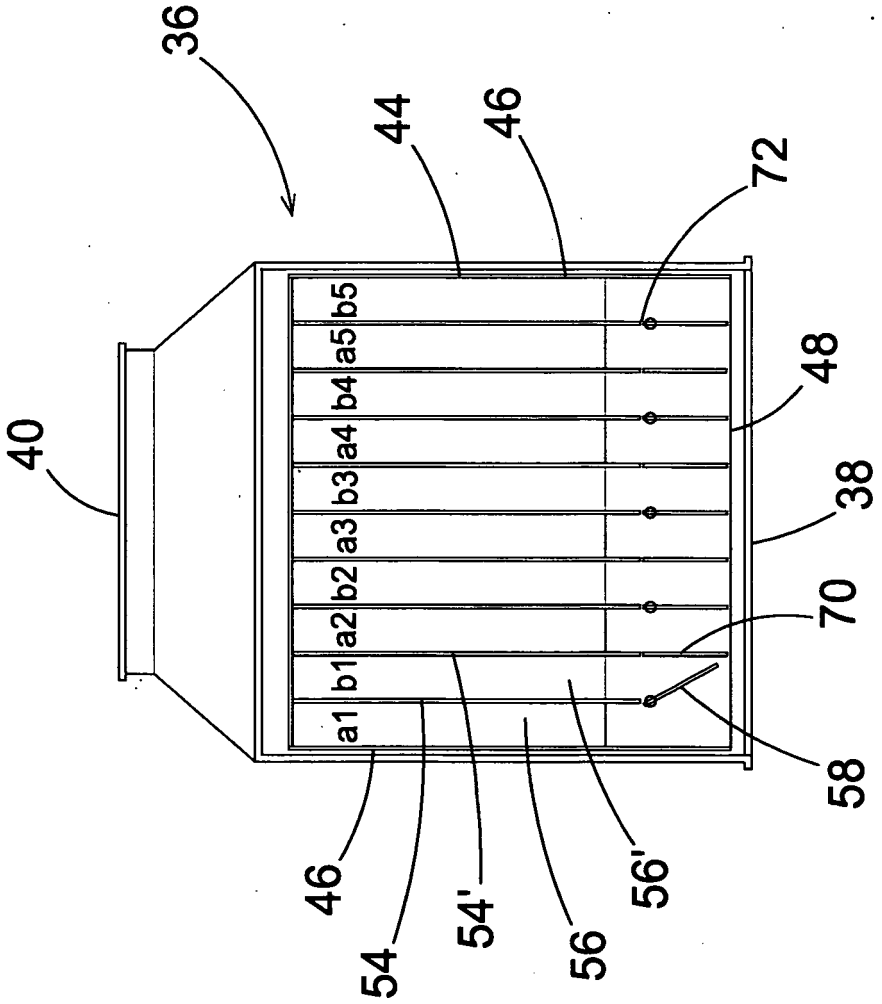

Fig. 3

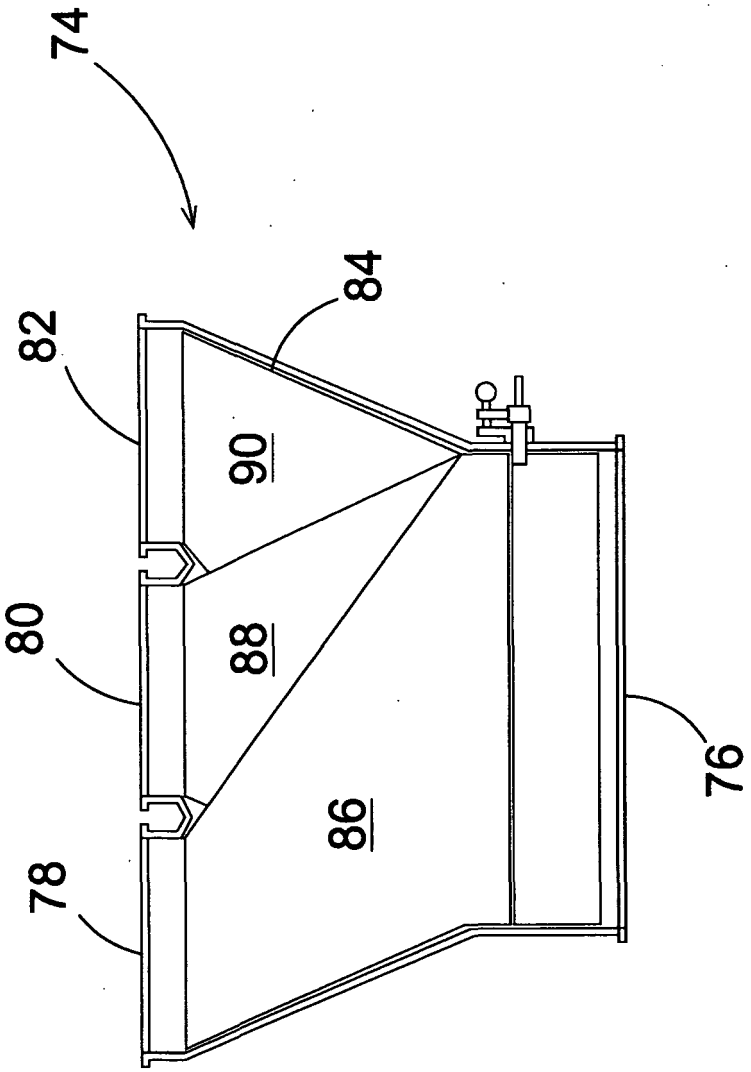

Fig. 4

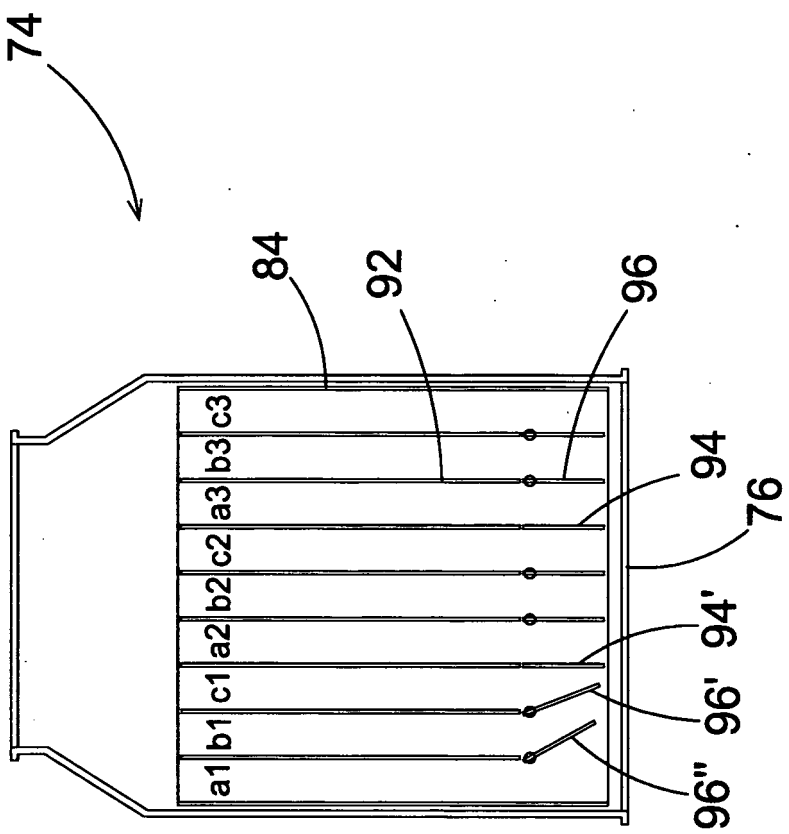

Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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