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(54) **METHOD AND ARRANGEMENT FOR REDUCING VARIATIONS IN SOOT BLOWING STEAM FLOW IN A BOILER**

VERFAHREN UND ANORDNUNG ZUR REDUZIERUNG VON VARIATIONEN IN EINEM RUSSBLASSTROM IN EINEM KESSEL

PROCÉDÉ ET AGENCEMENT POUR RÉDUIRE LES VIBRATIONS DANS UN FLUX DE VAPEUR DE SOUFFLAGE DE SUIE DANS UNE CHAUDIÈRE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a method to reduce variations in the soot blowing steam flow in a boiler with a soot blowing system comprising a plurality of soot blowers working with steam, which are run in succession after each other, as well as control means for the control of the soot blowers and the ejection of steam through them.

[0002] The present invention also relates to an arrangement to reduce variations in the soot blowing steam flow in a boiler with a soot blowing system comprising a plurality of soot blowers working with steam, which are run in succession after each other, as well as control means for the control of the soot blowers and the ejection of steam through them.

PRIOR ART

[0003] Soot blowing systems for boilers are previously known through e.g. US 2010/0064470 A1 (Dahlén et al, WO2008/057039). Such systems comprise soot blowers which clean the heating surfaces of the boiler with steam at a high pressure. There are several suppliers of soot blowers, e.g. Clyde Bergemann, Inc., Atlanta, Georgia, USA, and Diamond Power International, Inc., Lancaster, Ohio, USA. Soot blowers are available in many designs suiting different parts of the interior of the boiler and different types of heating surfaces.

[0004] Document WO 2008/057039 discloses a soot blowing system according to the preamble of claim 1. A common type of soot blowers is lance soot blowers, e.g. Diamond Superior IK-525, where a position and direction mechanism contains a rotatable lance provided with nozzles. The position and direction mechanism is driven by electric motors and the lance is operated in a rotating manner, into and out of the boiler, and cleans parts of the interior of the boiler based on the helical-like motion pattern formed by the nozzles of the soot blowers in a radius around the centre of the lance at the operation of the lance.

Other examples of designs of soot blowers are wall soot blowers (e.g. Clyde Bergemann VS Furnace Wall Blowers), rake soot blowers (e.g. Clyde Bergemann RKT), and only rotating soot blowers (e.g. Clyde Bergemann D5E). A boiler with heavier force often has a plurality of soot blowers and often of varying types depending on the cleaning task and the environmental flue gas temperature.

[0005] The steam flow to the soot blower is controlled by a steam valve, which in its turn is usually controlled by a mechanic linkage, which mechanically opens the valve, when the position and direction mechanism of the soot blower has passed an opening mechanism. The point where the steam valve opens is mechanically determined by the position of the opening mechanism and the position of the position and direction mechanism.

[0006] The cleaning principle of the soot blower is based on a cleaning cycle where the steam valve (14) of the soot blower and the position and direction mechanism of the soot blower for the steam nozzles interact. Normally, the interaction takes place mechanically by a steam control mechanism.

[0007] On lance soot blowers, e.g. of the type IK-525, the steam control mechanism is normally designed such that the steam valve is connected to the position and direction mechanism of the nozzles by the steam control mechanism opening the steam valve when the position and direction mechanism has passed a mechanical position at a mechanically determined distance from the rest position.

[0008] On only rotating soot blowers, e.g. Clyde Bergemann D5E, the steam control mechanism is normally so designed that the steam control mechanism is mechanically connected to performance by the position and direction mechanism of an entire or parts of rotated revolutions for the steam nozzles.

[0009] A frequent way to achieve the steam control mechanism is to use a plug connected to the steam valve and an eccentric mechanically connected to the rotation of the steam nozzles.

[0010] The design of the mechanism implies that it is a certain delay between the rest position of the position and direction mechanism with a shutoff steam flow and the rotation position where the valve opens, as well as a certain delay between the shutoff of the steam flow and the arrival at the rest position of the position and direction mechanism after an additional rotation.

[0011] Soot blowers are usually controlled by a control computer and electric drives connected to the motor drives of the soot blower and to one or several sensors on the soot blower, as is described in US2011/0203535, for instance. Such systems are based on the adaption of the mechanism to achieve an operation within reference values which are signalled via the control system, which implies costly and time consuming work by service staff. The sensors usually are limit position sensors, which are used to indicate the position of the position and direction mechanism of the soot blower. Usually, there are limit position sensors for the rest position and possible end positions. Lance soot blowers and wall soot blowers are usually equipped with end limit position sensors, which are used to turn the operation direction of the position and direction mechanism of the soot blower. The turning of the operation direction is usually performed by phase inversion of the stream feed to the motor drives of the position and direction mechanism.

[0012] Normally, a soot blower is at rest with shutoff steam flow during most part of the time. At soot blowing the soot blower cleaning the heating surfaces is started according to a determined procedure called the cleaning cycle of the soot blower. The cleaning cycle is determined above all by the mechanical design of the soot blower, the position sensor of the soot blower, and the control of

the soot blower. A cleaning cycle of a soot blower is normally performed in accordance with the following sequence.

Rest phase

[0013] The position and direction mechanism of the soot blower is at rest and in a defined rest position.
[0014] The steam control mechanism shuts off the steam flow by means of the steam valve.
[0015] The limit position sensor of the soot blower signals a rest position to the soot blower control.

Start phase

[0016] The position and direction mechanism of the soot blower is in operation.
[0017] The steam control mechanism has not yet opened the steam valve. No steam flows through the soot blower.

Cleaning phase

[0018] The valve mechanism of the steam control mechanism opens the steam valve and steam flows into the nozzles of the soot blower.
[0019] The position and direction mechanism of the soot blower is in operation.

Stop phase

[0020] The steam control mechanism closes the steam valve.
[0021] The position and direction mechanism of the soot blower is in operation until the rest position has been reached.
[0022] When the soot blower has reached its rest position, the motor operations are stopped and the soot blower enters into the rest phase.
[0023] Both the start phase and the stop phase normally last 1 to 5 seconds, which implies that the steam flow through the soot blower is shut off during 2 to 20 seconds of the total operation time of the soot blower.
[0024] The times for the start phase and the stop phase are determined mainly by the mechanical design of each soot blower, the location of the limit position sensors, and the speed of the position and direction mechanism of the soot blower. The times for the start phase and the stop phase often vary between different soot blowers installed in the boiler depending on the type of soot blower used, and variations in the mechanical settings of each blower. Further, the soot blowers may be equipped with electric drives with a controllable speed of the soot blower by change of the rotation speed for the driving motors of the soot blowers.
[0025] Generally, several soot blowers are operated in a group, e.g. to soot blow a superheater. The operation manner is normally based on the principle that soot blowers are operated directly after each other from an exchange procedure between soot blowers, so that when the operating soot blower indicates that the position and direction mechanism has reached its rest position, the next soot blower starts, directly or with a certain delay.
[0026] The operation manner implies that pulsations are created in the common steam flow at the exchange of soot blowers in operation, which causes undesired stresses in the system and may result in disturbances in other pieces of the equipment connected to the steam system, e.g. lost efficiency in steam turbines. The pulsations are caused by the shutoff soot steam flow during the stop phase of the soot blower in operation as well as the start phase of the operation of the next blower. The total time of shutoff steam flow at the exchange is mainly the sum of the stop phase time of the preceding soot blower and the start phase time of the next soot blower as well a possible start delay between the soot blowers. Also with a method according to WO2008/057039, the main object of which is a method to optimize/minimize the total steam consumption, there is a risk that this type of pulsations occur because of the normal complexity of the plants with many different soot blowers with individual parameters and difficulties to control this complex in an efficient way.
[0027] The time of shutoff steam flow varies for different soot blowers at exchanges and depends on the stop phase time of the preceding soot blower as well as the start phase time of the next soot blower. Usually, the speed of the position and direction mechanism is also controllable by the use of static frequency changers, which implies that the stop phase time and the start phase time may be changed without the need to make mechanical operations or changes.
[0028] An existing method to reduce the steam impacts is to equip the soot blowers with an additional position sensor giving a physical signal at a determined position of the soot blower, before the steam flow is shut off, where the signal of the sensor is used to give a start order to the next soot blower. The sensor is adjusted so that it gives a signal creating a steam flow synchronized exchange with the steam start time of the normally next soot blower.
[0029] The drawbacks of the method is that it is time consuming and expensive as it requires montage of additional sensors on the soot blower, as well as that the method does not take into consideration whether the next soot blower is of a different type with another steam start time, as well as that the method cannot handle cases where the speeds of the soot blower are changeable.
[0030] Another existing method is to give start order to the next soot blower at a fixed time after the start of the soot blower in the back or forth direction. The time is regulated so that the normally next soot blower is started with a steam flow synchronized exchange with the steam start time of the normally next soot blower.
[0031] The drawbacks of the method are that it does not take into consideration whether the next soot blower

is of another type with another steam start time, as well as that the method cannot handle cases where the speeds of the soot blowers are changeable.

BRIEF DESCRIPTION OF THE INVENTION

[0032] An object of the present invention is to achieve a method and an arrangement for eliminating or at least significantly reduce pulsations in the common steam flow of soot blowing steam at the exchange from one soot blower in one soot blowing sequence to the next one.

[0033] This object is achieved with a method and an arrangement, respectively, of the type mentioned in the first paragraph above as is mentioned in the claims.

[0034] The object is also achieved with an arrangement of the type mentioned in the second paragraph above by a central computerized control system being arranged, according to the invention, to control start and/or stop based on individual programmed values for the individual soot blowers, or groups thereof, in such a manner that the steam consumption is kept as constant as possible at the exchange from one soot blower to the next one.

[0035] In this way, not only the pulsations of soot blowing steam can be avoided but nor any work consuming and expensive montage of additional sensors on the soot blower is required. Further, the method according to the invention take into consideration whether the next soot blower is of another type with a different steam start time, and the arrangement can handle cases where the speeds of the soot blowers are changeable.

[0036] Preferably, the control system is arranged to start the supply of soot blowing steam in a next soot blower, or group of soot blowers, synchronously with the shutoff of the supply of soot blowing steam in a the very preceding soot blower, or group of soot blowers.

[0037] Usually, the soot blowers work with a start phase between the start of a position and direction mechanism included in each soot blower and the start of the supply of soot blowing steam as well as a stop phase between the shutoff of the supply of soot blowing steam and the stop of the position and direction mechanism. Then, it is suitable that the control system is arranged to bring the start phase in the next soot blower, or group of soot blowers, at least to some part to overlap the stop phase of the very preceding soot blower, or group of soot blowers.

[0038] Further, the start phase is in proper order followed by a cleaning phase, the stop phase and a rest phase. Then, it is suitable that the values programmed into the control system comprise measured, calculated or estimated times for the start and the end of the phases.

BRIEF DESCRIPTION OF THE DRAWINGS ENCLOSED

[0039] Below the invention will described further with reference to the preferred embodiments and the enclosed drawings.

- Fig. 1 shows a schematic view of an embodiment of a soot blower according to the invention in a rest position;
- Fig. 2 shows the soot blower of Fig. 1 at a later stage, when the opening of the steam valve takes place;
- Fig. 3 shows the soot blower of Fig. 1 in an outermost, return position;
- Fig. 4 shows a review of a soot blowing system consisting of several soot blowers connected to the same steam supply;
- Fig. 5 is an illustration of the steam flow through a soot blower during the entire acting of the soot blower;
- Fig. 6 is an illustration of the common steam flow during the acting by several soot blowers in succession.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0040] Fig. 1 schematically shows an embodiment of a soot blower arrangement according to the invention, wherein the soot blower lance 60 is at rest. The soot blower arrangement comprises a frame 59, a movable carriage 54 supported by the frame 59, and a motor (not shown) to move the carriage (in a manner known per se) by means of a transmission 57. The soot blower lance 60 is mounted at the carriage 54 to be movable into and out from the boiler 63, 70, and it is provided with at least one, preferably two nozzles 64 for steam. The soot blower lance 60 surrounds an internal steam tube 61, to which external feeding steam is supplied via a steam conduit 50. An on/off valve 51 is arranged between the steam conduit 50 and the steam tube 61. Thus, steam will be supplied to the steam tube 61, when the on/off valve 51 is in its open position.

[0041] A first opening means 56 is arranged at the frame 59 to the soot blower arrangement, wherein the object of the opening means 56 is to bring the on/off valve 51 in an open position and a shutoff position, respectively. Therefore, a mechanical abutment element 55 is arranged on the carriage, which element at contact with an opening means 56 influences a mechanical arm 53 to bring the valve 51 into an open position and let it remain in an open position. Alternatively, a first indicator element 55 may be used, which is sensed by an opening means 56, which then gives a signal to a central control unit 71, which in its turn initiates a regulation means 53 (e.g. electrically) to open and close, respectively, the valve 51. As is shown in Fig. 1, the sensor arrangement 55 is suitably arranged centrally on the carriage.

[0042] A first end position sensor 58 is located at the bottom adjacent to a rear end of the frame 59 for the soot blower, and a second end position sensor 62 arranged adjacent to the front end of the frame 59. The frame 59,

which also may be designated as a housing, extends up to the boiler wall 63. In the extension of the frame, a hole is centrally arranged in the boiler wall 63, where the soot blower lance 60 may move freely in and out to be able to reach into the interior of the boiler 70. The first end position sensor 58 is positioned in a first transversal plane 80, near the rear end of the frame, and the second position sensor 62 comparatively near the boiler wall 63. A second indicator means 57 in arranged on the carriage 54, which means triggers a signal when it is in level with the first and the second, respectively, position sensor 58, 62, which signal is transmitted to the control unit 71.

[0043] In Fig. 1, the soot blower 9 is, as already mention in a rest position, and the valve 51 is therefore closed, which implies that no steam is supplied to the steam tube 61.

[0044] Fig. 2 shows that the control unit 71 has given a signal to the carriage 54 to move inwards towards the boiler wall 63, and that it has reached an activation position 81, where the opening means 56 has been influenced by the abutment element 55 implying that the valve 51 is put into its open position. When the valve is in it sopen position, steam 65 will eject from the nozzles 65 inside the boiler 70.

[0045] Fig. 3 shows a return position, where the carriage 54 in the soot blower arrangement has moved up to a position 83, where the second indicator 57 is on level with the second position sensor 62. The carriage 54 has then moved the entire distance 84 from the end position 50 and to the return position 83.

[0046] Fig. 4 shows schematically and outlined a soot blower system with a plurality of soot blowers 1 connected to the same steam feeding 7. Steam is supplied from a suitable source through a first conduit 74 to a reducing valve 75, where the pressure is reduced to a level suitable for soot blowing. From the valve 75 steam is carried through a main conduit 7 to a plurality, normally suitably, vertical branch conduits 72A to 72C. In the example shown, there are three branch conduits, e.g. a first one 72A for the superheater, a second one 72B for the convection section, and a third one 72C for the economizer. A plurality of steam feeding conduits 50 are connected to the branch conduits 72A to 72C to feed steam to each one of the soot blower arrangements 1. As may be seen from Fig. 4, it may be suitable to arrange manually influenced valves 5 between an on/off valve 51 and a branch conduit 72C. In the example shown, there are fifteen soot blowers in the part 72A relating to the superheater, nine soot blowers in the convection section 72B, and eight soot blowers in the economizer part 72C. It is realized, that it, of course, may be varied within wide frames depending on requirement and need. At the bottom the branch conduits 72A to 72C are coupled together to a common outlet conduit 77, with an outlet valve 78. The outlet valve 78 may suitably be controlled by a temperature controlled sensor unit 79, e.g. in the form of standard equipment.

[0047] Fig. 5 shows an illustration of the steam flow through a soot blower during the entire action of the soot blower; The upper graph of Fig. 5 shows the entire active operation time for a soot blower 1 from the start occasion 3 to the stop occasion 6, while the lower graph shows the active steam flow with the start occasion 4 and the stop occasion 5 presented along a time line 10. It is apparent that there is a time 11 of delay from the start occasion 3 until the steam starts at the steam start occasion 4. In the corresponding way, it is apparent, that there is a time period 13 from the occasion 5, when steam stops to eject to the time occasion 6, where the soot blower is at rest. Hence, the total time 7 for the action of a soot blower is larger than the time 8 for the steam supply. This delay results in difficulties to control the total steam flow in an efficient manner.

[0048] Fig. 6 shows a common steam flow during an action of three soot blowers A, B, C in a sequential order. In the case shown, the soot blowers are controlled in a conventional manner with the opening means 56, which implies delay and hence time gaps between start and steam activation.

[0049] Thanks to the invention, an even steam flow distribution 100 is obtained over time when using a sequential control of soot blowers independent of activating method, i.e. at the use of activation according to the above known principle, for instance. This is achieved by using the central control unit 71 for proper time start 3 of each of the soot blowers, starting at the start lead time 11, 11', 11", for the respective soot blower, and its shutoff lead time 13, 13', respectively.

[0050] Fig. 6 shows schematically how three soot blowers 1, 1', 1" are sequentially controlled to obtain, over time, a steam flow 100 which is as even as possible. At a first time 3 according to the figure, the central control unit 71 will start the first soot blower 1, wherein its carriage 54 starts to move inwards towards the boiler wall 63 (see above).

[0051] Then, after a certain movement of the carriage 54, the opening means 56 will be activated by the abutment element 55, wherein steam activation takes place, i.e. after a certain, known start lead time 11, and a certain known shutoff lead time 13, respectively. Thus, the control unit 71 knows that the steam flow will start at a certain predetermined time 4, which is behind the start time 3 by the start lead time 11. The central control system 71 also knows that the next soot blower 1' to start has a certain own start lead time 11', and a certain own shutoff lead time 13', respectively. By means of the knowledge of the lead times 11', 13' which are present at the sequential start of the next soot blower 1', when the first soot blower 1 has stopped its soot blowing, an exchange may be performed where the steam consumption variation 48 at the exchange may be optimized principally to be zero. This occurs by the central control system 71 having knowledge that the steam flow 8 through the first soot blower 1 will stop at a certain determined time 5. Based on this time 5 known to the control system 71, the control system may choose a start time 3' for the next soot blower

1' having a lead time 11', which exactly matches the time 5 for shutting off the steam flow through the first soot blower 1. In other words, the central control unit 71 regulates the system in such a way that the time 5, when the steam flow through the first soot blower 1 ceases, coincides with the time 4' for the start of the steam flow through the second soot blower 1'. In the same way, the central control unit 71 controls the exchange between the second soot blower 1' and the third soot blower 1", i.e. so that the time 5' for the stop of the steam flow through the second soot blower 1' coincides with the time 4" for the start of the steam flow through the third soot blower 1".

[0052] As may be seen from Fig. 6, this principle of the invention provides the possibility to achieve an even steam flow 100 without essential pressure peaks in the steam system, independent of how large a lead time 11, 13 is present in each of the soot blowers 1, as the start occasion 3 for each next soot blower 1 is adapted such that its start lead time 1 is adapted to the stop lead time for the preceding soot blower. Thanks to the fact that the system is centrally controlled and thus controls all soot blowers included in one sequence, as well as that the total steam flow 100 is preferably repeatedly sensed, preferably continuously, an adaption may in an easy and efficient way continuously be achieved, so that the steam flow 100 is principally kept entirely even, also at a change of the lead time 11, 13 for individual soot blowers 1. The principle for such a repeated, preferably continuous, adaption may for instance be based on the fact that the system 71 reads/senses possible variations 48, 49 of flow and pressure at the exchange occasion between two soot blowers, which may easily be achieved by means of a measurement equipment known per se, which is connected to the control system 71.

[0053] As an example, reference may be made to the exchange between the first soot blower 1 and the second soot blower 1' in Fig. 6, where the system 71 has sensed a minor pressure increase 48. This minor pressure increase is an expression for the fact that a certain overlap-operation has occurred at the exchange between the first 1 and the second 1' soot blower. An example of a reason for such a pressure variation to occur may be that wear of the control system for the first soot blower has resulted in its shutoff lead time 13 having increased somewhat. The control system 71 may, based on the measured flow increase, by means of a suitable adaption algorithm in the software (e.g. comprising iterative looping), adapt the (known) lead time 13 to a higher value until an exchange is again achieved without any flow change. According to the same principle, with reverse adaption, an equalization is achieved when sensing flow reduction 49.

[0054] Thanks to the invention, there is thus no need to make costly and complicated regulations of control components in the individual control systems of the soot blowers 1 but instead the control is managed entirely centrally via the central control system 71, which also makes it possible to use a software to be able to automatize a repeated/continuous regulation of the sequential control so that a constant, even steam flow is in principle achieved.

[0055] The invention is not limited to what is described above but may be varied within the scope of the appending claims. Thus for instance, the man skilled in the art realizes, based on the description above, that the principles of the invention also are applicable when the shutoff and the start, respectively, of the steam flow does not occur momentary, as is shown in Fig. 5 and 6. The man skilled in the art knows that in certain cases, depending on valve and valve means, it may exist a more successive start and shutoff, respectively, of the steam flow. The man skilled in the art realizes that under such circumstances it implies that a certain overlapping should be present to obtain an even steam flow 100 at the exchanges. On the other hand, it should be noticed that the invention, thanks to the adaptive control based on the steam flow 100, in an efficient manner may make the adaption be achieved by the control system 71 independent of the reason for a pressure peak (reduction of outflow) or a pressure reduction (increase of outflow). Further, it is realized that the principles of the invention may be used also when the pressure in the steam system is measured, instead of the steam flow, as the pressure is dependent on the flow, i.e. also pressure changes may be used for the control in accordance with the invention. Then, it is realized that instead of controlling the system so that en even steam flow is obtained, it may be controlled based on keeping an even pressure in the steam system, which may possibly imply that the steam flow may vary, totally seen, if different soot blowers have different pressure falls. Further, it is realized that also a combination of pressure and flow may be used for the control.

Claims

1. A method to reduce variations in the flow of soot blowing steam in a boiler (63, 70) with a soot blowing system comprising a plurality of soot blowers (1, 1') working with steam, which are operated in sequence after each other, as well as control means for controlling the soot blowers and the ejection of steam through them (1, 1'), wherein the method further comprises the start (3, 3') of the supply of soot blowing steam into the next soot blower (1'), or a group of soot blowers, essentially synchronous with the shutoff (5) of the supply of soot blowing steam in the very preceding soot blower (1), or a group of soot blowers, wherein the soot blowers (1, 1') work with a start phase (11, 11') between start (3, 3') of a drive mechanism included in each soot blower, and the start (4, 4') of the supply of soot blowing steam, wherein said start phase (11, 11') is followed by a stop phase (13, 13') between the shutoff of the supply of soot blowing steam and the stop of the drive mech-

anism, as well as a rest phase (80), wherein a centrally computerized control system (71) is arranged to control the start phase (11') in the next soot blower, or group of soot blowers, at least partly to overlap the stop phase (13) in the very preceding soot blower, or group of soot blowers, **characterized in that** said central computerized control system (71) works based on individual, programmed values (11, 13, 11', 13') for the individual soot blowers, or groups thereof, wherein the total steam flow is repeatedly sensed and an adaption is performed by means of the central control system (71) in such a way that the steam consumption (100) substantially is kept at a predetermined level at the exchange from one soot blower (1), or group of soot blowers, to the next soot blower (1'), or group of soot blowers, respectively, and wherein times for the start (3, 5) and the stop (4, 6) of the start phase (11, 11') and of the stop phase (13, 13'), respectively, are measured, calculated and/or estimated at the first start occasion, and thereafter the values obtained are programmed into the control system (71).

2. A method according to claim 1, **characterized in that** that the start phase (11, 11') is initiated by means of a abutment means (56).

3. A method according to claim 1 or, **characterized in that** that the start phase (11, 11') and/or the stop phase (13, 13') are controlled by at least one signal transmitted through an indicator means (57) in cooperation with at least one position sensor (58, 62).

4. A method according to claim 1-3, **characterized in that** said adaption is based on the fact that variations (48, 49) of the flow and/or the pressure is sensed at the occasion of exchange between two soot blowers.

5. A method according to claim 4, **characterized in that** that said start phase (11, 11') and/or stop phase (13, 13') are adapted by said central computerized control system (71) based on said variation (48, 49) of the flow and/or the pressure.

6. A method according to any of the previous claims, **characterized in that** a cleaning phase is arranged after said start phase (11, 11') but before said stop phase (13, 13').

7. An arrangement to reduce variations in flow of soot blowing steam in a boiler (8) with a soot blowing system comprising a plurality of soot blowers (1, 1') working with steam, which are operated in a sequence after each other, and a central, computerized control system (71) for the control of the soot blowers and the ejection of steam through them, wherein said central, computerized control system (71) is arranged to control the start phase (11') of the next soot blower, or group of soot blowers, at least partly to overlap the stop phase (13) of the very preceding soot blower, or group of soot blowers, **characterized in that** said central, computerized control system (71) is arranged to control the start (3, 3') and/or the stop, based on individual programmed values for the individual soot blowers (1, 1'), or groups thereof, as well as that the central control system (71) is arranged repeatedly to sense the total steam flow and to adapt the steam flow, so that the steam consumption (100), and/or the steam pressure, substantially is kept at a predetermined level, at the exchange from one soot blower (1), or group, to the next soot blower (1'), or group, respectively, and wherein the values initially programmed in the central computerized control system (71) comprise measured, calculated or estimated times for the start and the end of the phases.

8. An arrangement according to claim 7, **characterized in that** an abutment means (56) is arranged to initiate said start phase (11, 11').

9. An arrangement according to claim 7 or 8, **characterized in that** an indicator means (57) in cooperation with at least one position sensor (58, 62) is arranged to control the start phase (11, 11') and/or the stop phase (13, 13') by means of at least one signal.

10. An arrangement according to any of claims 7 to 9, **characterized in** means arranged to sense variations (48, 49) of flow and/or pressure at the occasion of the exchange between two soot blowers.

Patentansprüche

1. Verfahren zur Verringerung von Variationen in einem Rußblasdampfstrom in einem Kessel (63, 70) mit einem rußblasenden System, umfassend mehrere Rußbläser (1, 1'), die mit Dampf arbeiten, die in Reihe nacheinander betrieben werden, sowie Steuermittel zum Steuern der Rußbläser und Ausstoßen des Dampfs durch diese (1, 1'), wobei das Verfahren ferner den Start (3, 3') der Zufuhr des rußblasenden Dampfs zu dem nächsten Rußbläser (1'), oder einer Gruppe von Rußbläsern umfasst, im Wesentlichen synchron mit der Abschaltung (5) der Versorgung des rußblasenden Dampfs für den direkt vorhergehenden Rußbläser (1) oder die Gruppe Rußbläser, wobei die Rußbläser (1, 1') mit einer Startphase (11, 11') zwischen dem Start (3, 3') eines Antriebsmechanismus, der in jedem Rußbläser enthalten ist, und dem Start (4, 4') der Versorgung mit dem rußblasenden Dampf arbeiten, wobei auf die Startphase (11, 11') eine Stoppphase (13, 13') zwischen der Abschaltung der Versorgung mit rußblasendem Dampf und dem Abschalten des Antriebsmechanis-

mus sowie eine Ruhephase (80) folgt, wobei ein zentrales computerisiertes Steuersystem (71) angeordnet ist, die Startphase (11') in dem nächsten Rußbläser oder der Gruppe Rußbläser zu steuern, sodass sie mindestens teilweise die Stoppphase (13) in dem direkt vorhergehenden Rußbläser oder der Gruppe Rußbläser überlappt, **dadurch gekennzeichnet, dass** das zentrale computerisierte Steuersystem (71) auf Grundlage einzelner programmierter Werte (11, 13, 11', 13') für die einzelnen Rußbläser oder Gruppen davon funktioniert, wobei der gesamte Dampfstrom wiederholt erkannt wird und eine Anpassung mittels des zentralen Steuersystems (71) in einer Weise vorgenommen wird, dass der Dampfverbrauch (100) beim Wechsel von einem Rußbläser (1) oder einer Gruppe Rußbläser auf den nächsten Rußbläser (1') bzw. die nächste Gruppe Rußbläser im Wesentlichen auf einer vorgegebenen Stufe gehalten wird, und wobei Zeiten für den Start (3, 5) und den Stopp (4, 6) der Startphase (11, 11') bzw. der Stoppphase (13, 13') zu der ersten Startgelegenheit gemessen, berechnet und/oder geschätzt werden und die erhaltenen Werte danach in das Steuersystem (71) programmiert werden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Startphase (11, 11') mittels eines Anstoßmittels (56) eingeleitet wird.

3. Verfahren nach Anspruch 1 oder **dadurch gekennzeichnet, dass** die Startphase (11, 11') und/oder die Stoppphase (13, 13') durch mindestens ein Signal gesteuert werden, das durch ein Anzeigemittel (57) in Zusammenarbeit mit mindestens einem Positionssensor (58, 62) gesendet wird.

4. Verfahren nach Anspruch 1-3, **dadurch gekennzeichnet, dass** die Anpassung auf der Tatsache basiert, dass Variationen (48, 49) des Stroms und/oder Drucks zu der Gelegenheit des Wechsels zwischen zwei Rußbläsern erkannt werden.

5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Startphase (11, 11') und/oder Stoppphase (13, 13') durch das zentrale computerisierte Steuersystem (71) auf Grundlage der Schwankung (48, 49) des Stroms und/oder Drucks angepasst sind.

6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** nach der Startphase (11, 11') aber vor der Stoppphase (13, 13') eine Reinigungsphase angeordnet ist.

7. Anordnung zum Verringern von Variationen des Rußblasdampfstroms in einem Kessel (8) mit einem rußblasenden System, das mehrere Rußbläser (1, 1') umfasst, die mit Dampf arbeiten, die in einer Reihenfolge nacheinander betrieben werden, und einem zentralen computerisierten Steuersystem (71) für die Steuerung der Rußbläser und das Ausstoßen des Dampfs durch diese, wobei das zentrale computerisierte Steuersystem (71) angeordnet ist, um die Startphase (11') des nächsten Rußbläsers oder der Gruppe Rußbläser so zu steuern, dass sie mindestens teilweise die Stoppphase (13) des direkt vorhergehenden Rußbläsers oder der Gruppe Rußbläser überlappt, **dadurch gekennzeichnet, dass** das zentrale computerisierte Steuersystem (71) angeordnet ist, den Start (3, 3') und/oder Stopp, basierend auf einzelnen programmierten Werten für die einzelnen Rußbläser (1, 1') oder Gruppen davon zu steuern, sowie dass das zentrale Steuersystem (71) angeordnet ist, um wiederholt den Gesamtdampfstrom zu erkennen und den Dampfstrom anzupassen, sodass der Dampfverbrauch (100), und/oder der Dampfdruck im Wesentlichen auf einem vorgegebenen Pegel gehalten werden, wenn von einem Rußbläser(1) oder einer Gruppe zum nächsten Rußbläser (1') bzw. zur nächsten Gruppe gewechselt wird, und wobei die Werte, die anfänglich in das zentrale computerisierte Steuersystem (71) programmiert wurden, gemessene, berechnete oder geschätzte Zeiten für Start und Ende der Phasen umfassen.

8. Anordnung nach Anspruch 7, **dadurch gekennzeichnet, dass** ein Anstoßmittel (56) angeordnet ist, um die Startphase (11, 11') einzuleiten.

9. Anordnung nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** ein Anzeigemittel (57) in Zusammenarbeit mit mindestens einem Positionssensor (58, 62) angeordnet ist, die Startphase (11, 11') und/oder die Stoppphase (13, 13') mittels mindestens eines Signals zu steuern.

10. Anordnung nach einem der Ansprüche 7 bis 9, **gekennzeichnet durch** Mittel, die angeordnet sind, Variationen (48, 49) des Stroms und/oder Drucks zu der Gelegenheit des Wechsels zwischen zwei Rußbläsern zu erkennen.

Revendications

1. Un procédé pour réduire les variations dans l'écoulement de vapeur de soufflage de suie dans une chaudière (63, 70) avec un système de soufflage de suie comprenant une pluralité de souffleurs de suie (1, 1') travaillant avec de la vapeur, qui sont actionnés successivement chacun après l'autre, ainsi que des moyens de commande pour commander les souffleurs de suie et l'éjection de vapeur à travers eux (1, 1'), le procédé comprenant en outre le commencement (3, 3') de l'alimentation en vapeur de

soufflage de suie dans le souffleur de suie (1') suivant, ou dans un groupe de souffleurs de suie suivant, de façon essentiellement synchronisée avec l'arrêt (5) de l'alimentation en vapeur de soufflage de suie dans le souffleur de suie (1) immédiatement précédent, ou dans un groupe de souffleurs de suie immédiatement précédent, les souffleurs de suie (1, 1') travaillant avec une phase de commencement (11, 11') entre le démarrage (3, 3') d'un mécanisme d'entraînement inclus dans chaque souffleur de suie et le commencement (4, 4') de l'alimentation en vapeur de soufflage de suie, ladite phase de commencement (11, 11') étant suivie d'une phase d'arrêt (13, 13') entre l'arrêt de l'alimentation en vapeur de soufflage de suie et l'arrêt du mécanisme d'entraînement, ainsi qu'une phase de repos (80), un système de commande informatisé central (71) étant agencé pour commander la phase de commencement (11') dans le souffleur de suie suivant, ou dans le groupe de souffleurs de suie suivant, de façon à chevaucher au moins en partie la phase d'arrêt (13) dans le souffleur de suie immédiatement précédent, ou le groupe de souffleurs de suie immédiatement précédent, **caractérisée en ce que** ledit système de commande informatisé central (71) fonctionne sur la base de valeurs individuelles programmées (11, 13, 11', 13') pour des souffleurs de suie individuels, ou des groupes de ceux-ci, le débit total de vapeur étant détecté de manière répétée et une adaptation étant effectuée au moyen du système de commande central (71) de telle manière que la consommation (100) en vapeur est maintenue sensiblement à un niveau prédéterminé lors du changement d'un souffleur de suie (1), ou d'un groupe de souffleurs de suie, par le souffleur de suie suivant (1') ou groupe de souffleurs de suie suivant, respectivement, les moments de commencement (3, 5) et d'arrêt (4, 6) de la phase de commencement (11, 11') et de la phase d'arrêt (13, 13'), respectivement, étant mesurés, calculés et / ou estimés à la première occurrence de commencement, puis les valeurs obtenues sont ensuite programmées dans le système de commande (71).

2. Un procédé selon la revendication 1, **caractérisé en ce que** la phase de commencement (11, 11') est initiée au moyen d'un moyen de butée (56).

3. Un procédé selon la revendication 1, **caractérisé en ce que** la phase de commencement (11, 11') et / ou la phase d'arrêt (13, 13') sont commandées par au moins un signal transmis par un moyen indicateur (57) en coopération avec au moins un capteur de position (58, 62).

4. Un procédé selon les revendications 1 à 3, **caractérisé en ce que** ladite adaptation est basée sur le fait que des variations (48, 49) du débit et / ou de la pression est détecté à l'occasion d'un échange entre deux souffleurs de suie.

5. Un procédé selon la revendication 4, **caractérisé en ce que** ladite phase de commencement (11, 11') et / ou phase d'arrêt (13, 13') sont adaptées par ledit système de commande informatisé central (71) en fonction de ladite variation (48, 49) du débit et / ou de la pression.

6. Un procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**une phase de nettoyage intervient après ladite phase de commencement (11, 11') mais avant ladite phase d'arrêt (13, 13').

7. Un agencement pour réduire les variations d'écoulement de vapeur de soufflage de suie dans une chaudière (8) ayant un système de soufflage de suie comprenant une pluralité de souffleurs de suie (1, 1') travaillant avec de la vapeur, qui sont actionnés en séquence les uns après les autres et un système de commande informatisé central (71) pour la commande des souffleurs de suie et l'éjection de vapeur à travers eux, ledit système de commande informatisé central (71) étant agencé pour commander la phase de commencement (1 1') du souffleur de suie suivant, ou du groupe de souffleurs de suie suivant, de façon à chevaucher au moins en partie la phase d'arrêt (13) du souffleur immédiatement précédent, ou du groupe de souffleurs de suie immédiatement précédent, **caractérisé en ce que** ledit système de commande informatisé central (71) est conçu pour commander le commencement (3, 3') et / ou l'arrêt, sur la base de valeurs programmées individuelles pour les souffleurs de suie individuels (1, 1'), ou les groupes de ceux-ci, et **en ce que** le système de commande central (71) est agencé pour détecter de façon répétée le débit de vapeur total et adapter le débit de vapeur, de sorte que la consommation (100) en vapeur et / ou la pression de vapeur sont sensiblement maintenues à un niveau prédéterminé, lors du changement d'un souffleur de suie (1), ou d'un groupe, par le souffleur de suie suivant (1'), ou le groupe suivant, respectivement, et dans lequel les valeurs initialement programmées dans le système de commande informatisé central (71) comprennent des durées mesurées, calculées ou estimées pour le début et la fin des phases.

8. Un agencement selon la revendication 7, **caractérisé en ce qu'**un moyen de butée (56) est agencé pour initier ladite phase de commencement (11, 11').

9. Un agencement selon la revendication 7 ou la revendication 8, **caractérisé en ce qu'**un moyen indicateur (57) en coopération avec au moins un capteur de position (58, 62) est agencé pour commander la phase de commencement (11, 11') et / ou la phase

d'arrêt (13, 13') au moyen d'au moins un signal.

10. Un agencement selon l'une quelconque des revendications 7 à 9, **caractérisé par** des moyens agencés pour détecter des variations (48, 49) de débit et / ou de pression à l'occasion de l'échange entre deux souffleurs de suie.

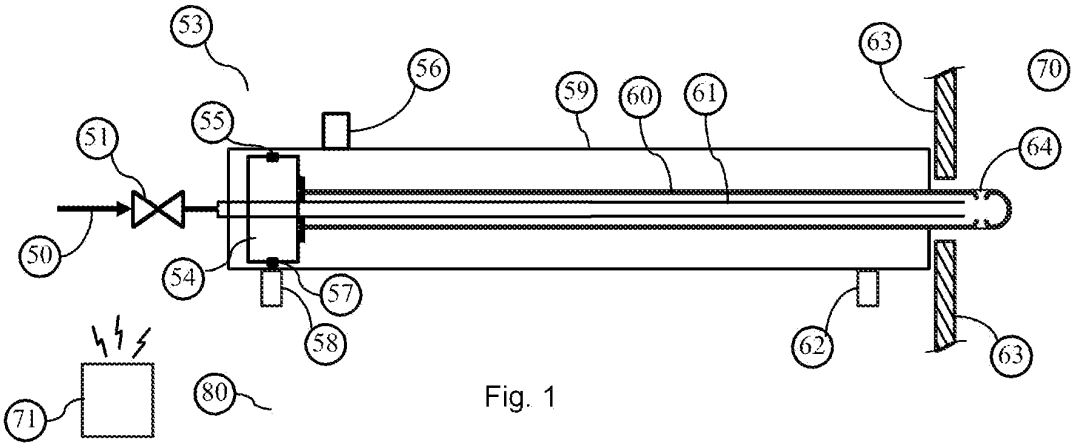

Fig. 1

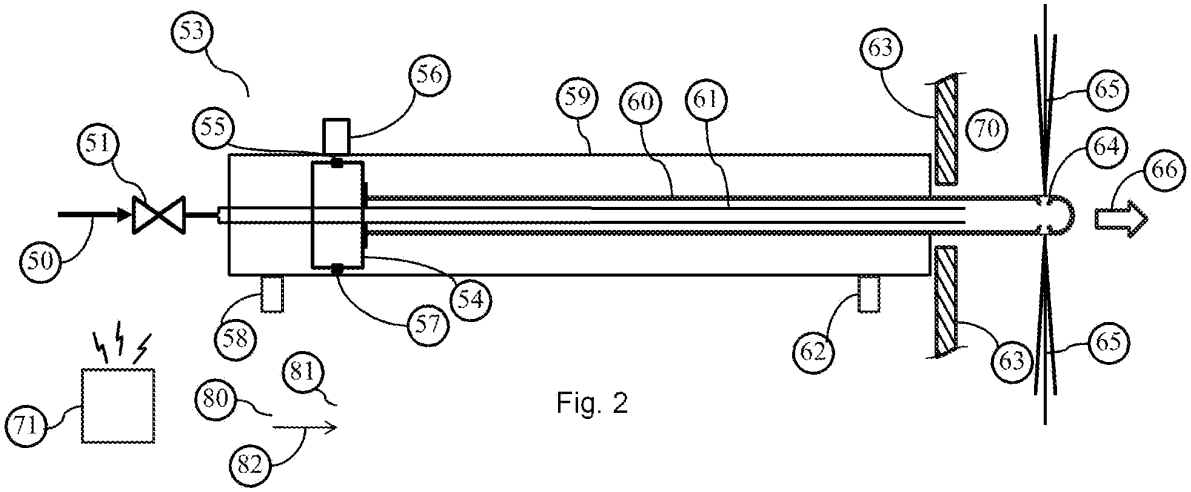

Fig. 2

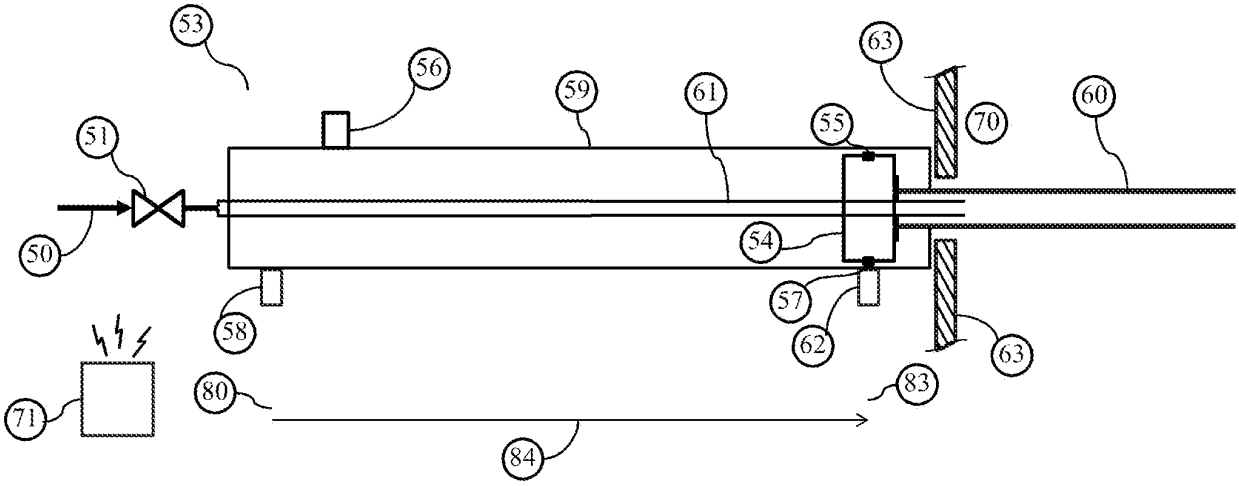

Fig. 3

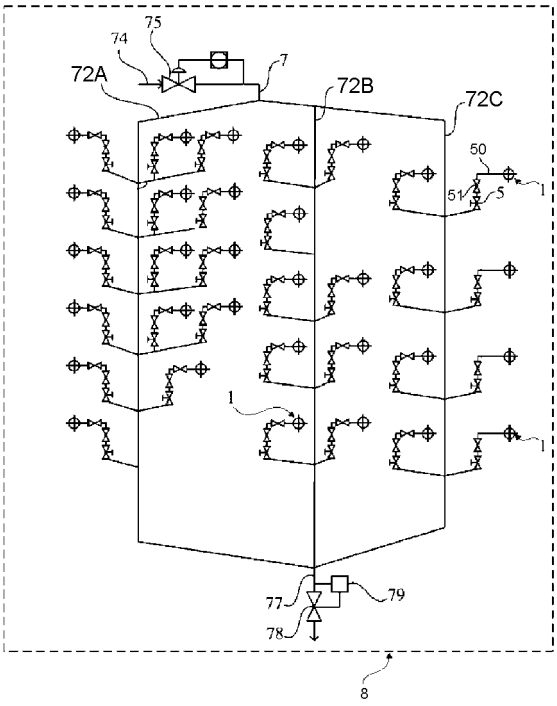
75
74
72A
7
72B
72C
50
51
5
1
1
1
77
79
78
8

Fig. 4

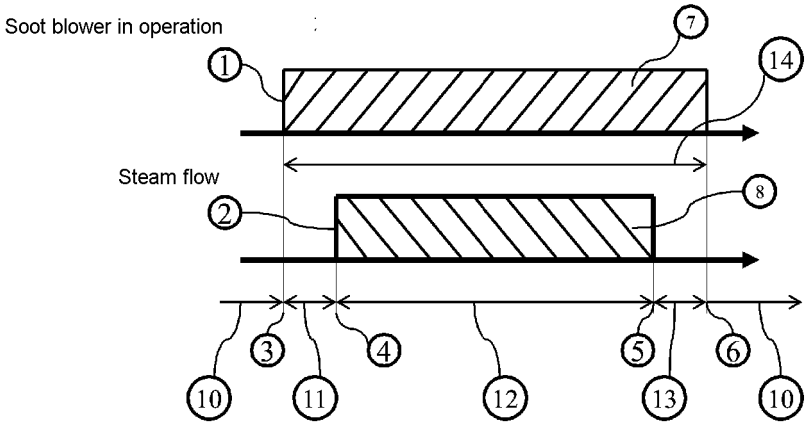
Soot blower in operation
Steam flow
7
1
14
8
2
3
4
5
6
10
11
12
13
10

Fig. 5

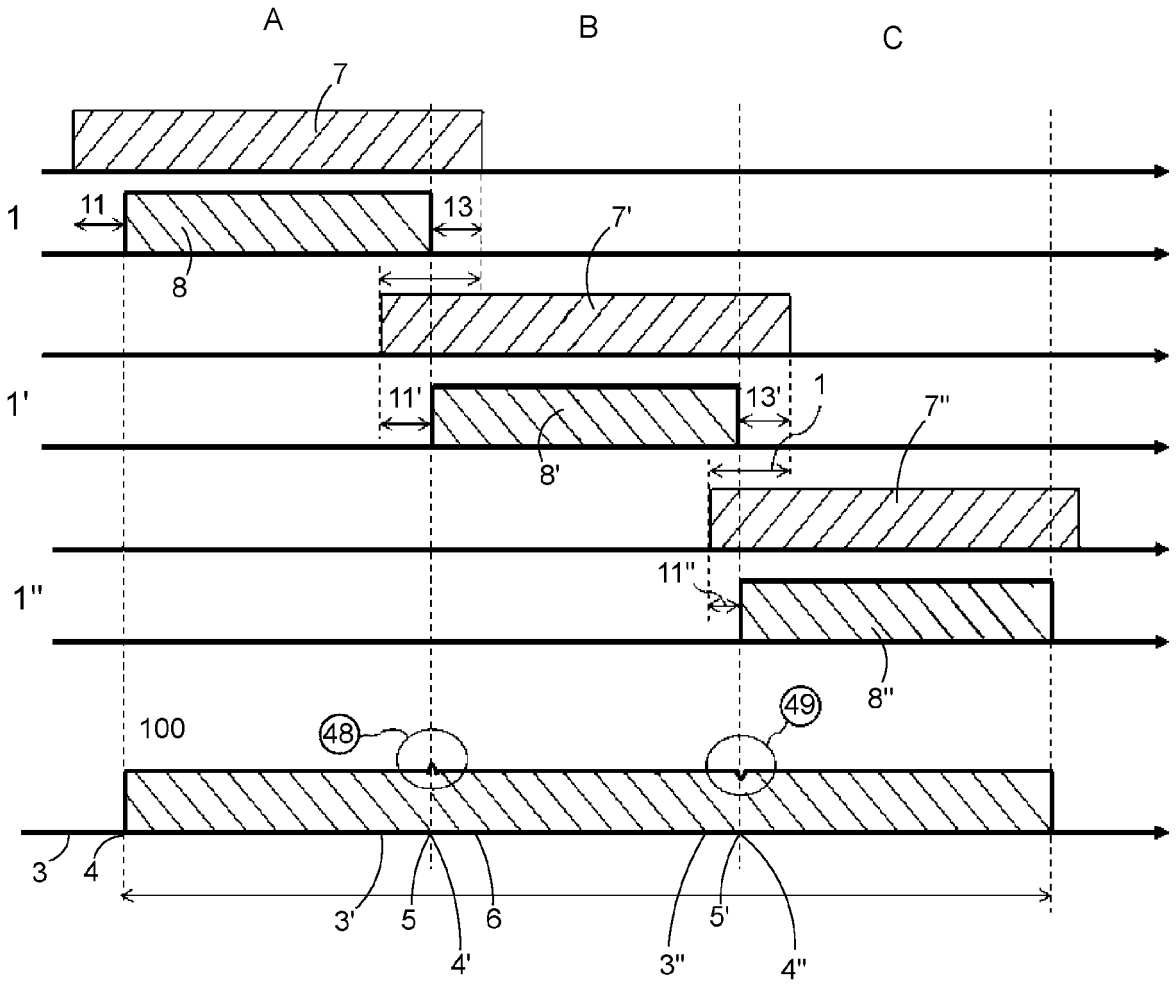

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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