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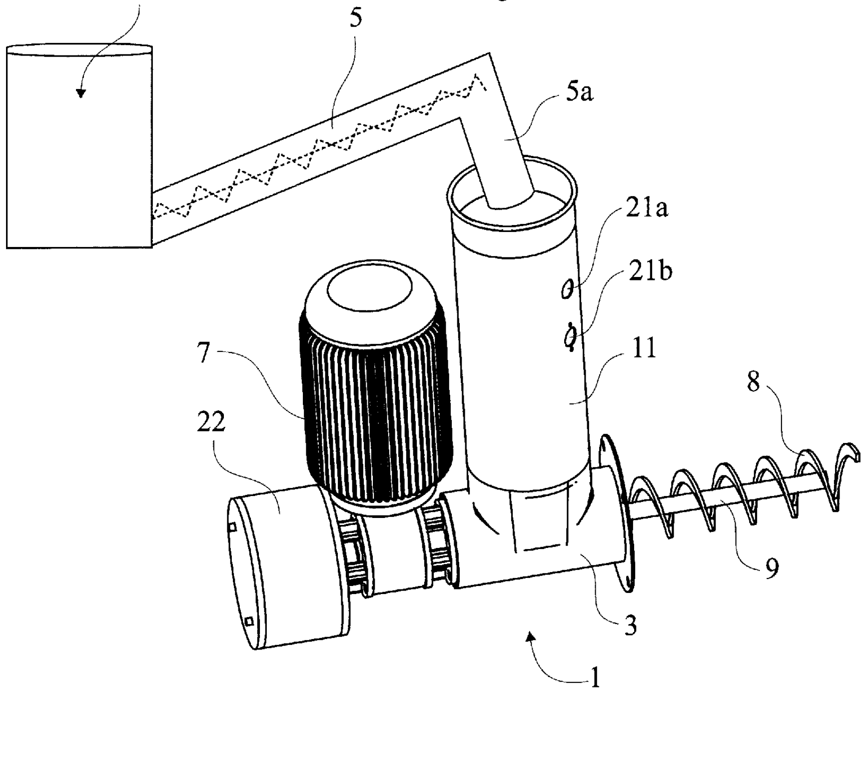
(54) **Granulated fuel feeding device and boiler comprising said device**

(57) The invention relates to a feeding device (1) for transportation of a solid fuel, such as pellets, wood chips or some other granular material, to an combustion device (2) in which combustion of the transported material takes place. The feeding device (1) comprises a first feed tube (3) that is disposed to be operatively connected to a distribution device (5) for transportation of said solid fuel from a fuel supply (6) to the feeding device (1) and is disposed to be operatively connected to said combustion device (2), via an outlet end of the feed tube (3). The feeding device (1) furthermore comprises a feed spiral (8), arranged to rotate at least partly inside the first feed tube (3) to transport the solid fuel to the combustion device (2), and which is arranged about an ignition device (9) by aid of which the solid fuel can be ignited. The invention also relates to a system for a solid fuel fired boiler comprising said feeding device (1) and a combustion device (2).

Fig. 1a



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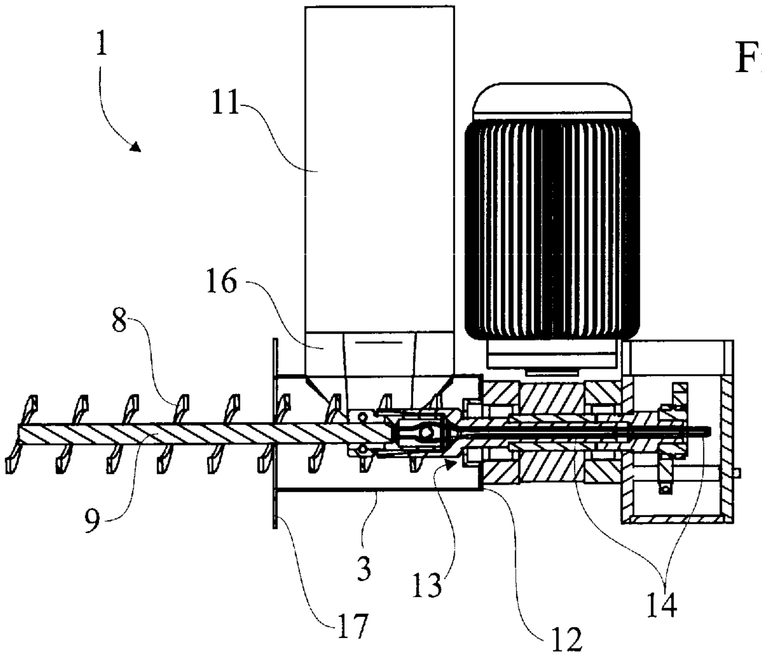

Fig. 1b

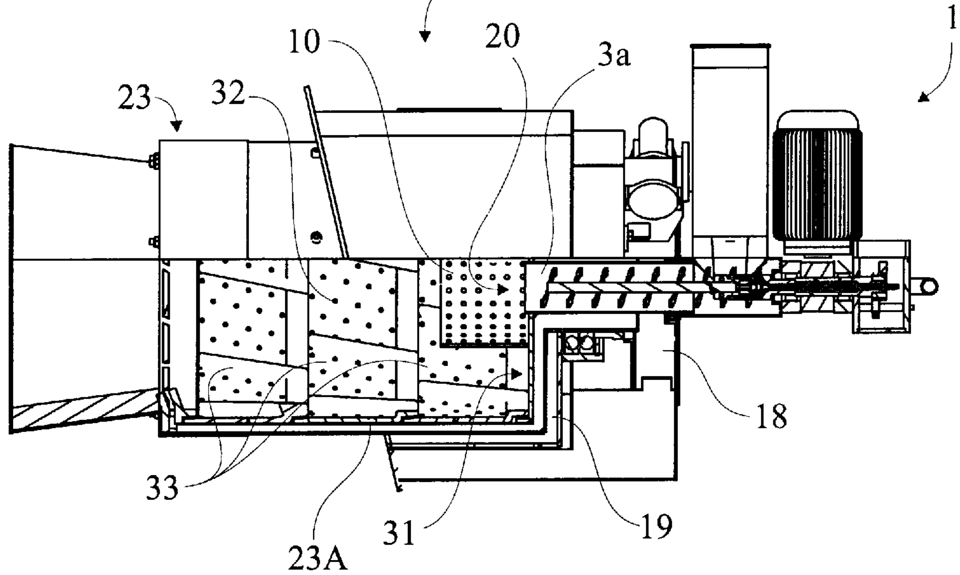

Fig. 1c

Description

[0001] The device relates to a feeding device for transportation of a solid fuel, such as pellets, wood chips or some other granular material, to an combustion device in which combustion of the transported material takes place, wherein the feeding device comprises a first feed tube that is disposed to be operatively connected to a distribution device for transportation of said solid fuel from a fuel supply to the feeding device and is disposed to be operatively connected to said combustion device, via an outlet end of the first feed tube, a feed spiral, arranged to rotate inside the first feed tube to transport the solid fuel to the combustion device. The invention also relates to a system for a solid fuel fired boiler, which system comprises said feeding device.

PRIOR ART

[0002] It has been known for long to use automated combustion devices for solid fuels such as pellets or wood chips. Such combustion devices are connected to a boiler in which the hot gases of combustion deliver heat for example to water-cooled surfaces or some other heat-receiving member. Systems of one or more transport screws that connect(s) the combustion device to a fuel supply, are often used for transport and feed of the solid fuel. One distinguishes between three types of combustion devices depending on the type of fuel feed to the combustion chamber. In top-fed combustion devices, the fuel is fed by a transport screw, from the fuel supply and up to the top of a chute through which the fuel falls down into a cup-shaped burner cup in the combustion chamber. Horizontal-fed and bottom-fed combustion devices have in common that the combustion device is directly connected to a feed spiral that feeds the fuel all the way into the combustion chamber. The feed spiral is in turn connected to a transport screw that feeds the fuel from the fuel supply to the feed spiral. For reasons of fire safety there is a drop shaft, a so called chute, between the transport screw and the feed spiral.

[0003] Start-up of such combustion devices have long been done manually by placing a certain amount of fuel in the combustion chamber/burner cup, where after ignition has been done manually, for example by a fusee, fire-lighting paper or some other means of ignition that is commercially available. Once it has been ascertained that the fuel has caught fire, a successive changeover to automated firing has been enabled. SE 514,133 shows an example of a horizontal-fed combustion device with manual ignition, which is a combustion device patented by the present applicant. Start-up of this device requires that the device is loosened from its attachment to the front of the boiler, where after it can be pivoted out from the boiler. There after, a certain amount of fuel is scooped into the combustion chamber and ignition is done manually, often by aid of a fire-lighting fluid or a fire-lighting paper. There after, the combustion device is pivoted back to its position against the front of the boiler and is fastened. During start-up, the device operates according to a programme that may last for about twenty minutes, and there after the burner switches to a first operating position. If the start-up fails, the control panel indicates this and the procedure must be repeated.

[0004] There has also been a strive to try to automate the start-up of these combustion devices. Swedish patent application SE 9601326-3 shows an example of a horizontal-fed combustion device in which the feed tube (20) to the combustion chamber is surrounded by an electrical ignition element (24) that has the task of igniting the fuel by indirect heating via the feed tube. It is also mentioned that other, non-electrical, types of ignition elements, the heating effect of which is based on combustion of gases or liquids, can be used and that these in such case could act directly on the fuel. It is however not mentioned more specifically how those would be arranged.

[0005] It is stated that, at start-up of this device, an amount of fuel is fed into the feed tube 20, where after the ignition element 24 is activated in order to heat up the conductive section 21, which indirectly leads to the fuel being heated and possibly ignited. Alternatively, the ignition takes place only when combustion air is supplied via the primary air openings 6. An ignition method according to this arrangement has several drawbacks. During the heating phase, the fuel will emit combustible gases that as such constitute a severe risk of explosion, including a risk of personal injuries. Yet another drawback is the environmental impact that is caused by such combustible gases.

[0006] SE 9703478-9 shows another example of a device for which efforts has been made to automate the start-up procedure. A top-fed combustion device has been provided with a heater plug (9) in the rear panel (8) of a drop shaft/chute (7) close to the bottom of the combustion chamber (4). A problem in connection with this device has been deposition of soot, which results in an impaired or bad effect. Furthermore, there has been a problem in obtaining a good enough contact between the heater plug and the fuel, which has also resulted in an impaired thermal transmission. This combustion device has not been a great commercial success.

[0007] Another method of automating the ignition can be seen in a device that is provided by the applicant itself, a Janfire-burner of Flex-a type. This combustion device, which is top-fed, has an electrical coil arranged in connection with the burner cup. At start-up, an amount of fuel is fed into the burner cup, where after the electrical coil is activated and a fan starts to blow a stream of air over the electrical coil and on towards the fuel. As the electrical coil gets hotter, the temperature of the passing air will increase whereby finally the fuel is ignited. This method of igniting the fuel is also used in bottom-fed combustion devices, but then the electrical coil is usually placed at the upper edge of the burner cup. The method leads to undesired emissions of non-combusted gases during start-up procedure.

BRIEF ACCOUNT OF THE INVENTION

[0008] The object of the invention is to provide a feeding device for transportation of solid fuels, such as pellets or wood chips, to a combustion device, where the feeding device offers a fully automated ignition of the fuel at the same time as the drawbacks of the devices mentioned above, is avoided.

[0009] Yet another object is to provide a feeding device that enables a fully automated ignition of the fuel in connection with short shutdowns caused by e.g. a power failure, where today a manual initiation and monitoring is required for the start-up procedure.

[0010] Yet another object is to provide a feeding device that enables the combustion device to be used efficiently during periods of low power requirement, as for example during the summer months.

[0011] Yet an object is to provide a feeding device that is easy to connect to a combustion device and especially to a horizontal-fed combustion device having a rotating combustion chamber.

[0012] This is achieved by a feeding device for transportation of a solid fuel, such as pellets, wood chips or some other granular material, to an combustion device in which combustion of the transported material takes place, wherein the feeding device comprises a first feed tube that is disposed to be operatively connected to a distribution device for transportation of said solid fuel from a fuel supply to the feeding device and is disposed to be operatively connected to said combustion device, via an outlet end of the first feed tube, a feed spiral. arranged to rotate inside the first feed tube to transport the solid fuel to the combustion device. The feeding device is characterised by the feed spiral being arranged about an ignition device by aid of which the solid fuel can be ignited.

[0013] According to yet another aspect of the invention, the ignition device is arranged to be heated and to ignite the solid fuel at direct contact with the fuel, which contributes to a more efficient ignition than if an indirect contact is used.

[0014] According to another aspect of the invention, the risk of so called back-fire is diminished by the feed spiral and the ignition device extending past the outlet end of the first feed tube, and by the ignition device being arranged to ignite the fuel outside of said outlet end. More specifically, the ignition device will extend into a second feed tube of the combustion device that the feeding device is connected to, and ignite the fuel inside the same.

[0015] According to yet another aspect of the invention, the design contributes to a diminished occurrence of soot depositions on the ignition device in order to maintain a good heat transfer to the fuel, which is obtained by the ignition device being essentially centrally situated in the first feed tube at a position that in the main coincides with its centre axis.

[0016] Furthermore, the feeding device is designed to minimize the wear on the ignition device by the ignition device being arranged to rotate together with the feed spiral, where by the lifespan of the device is prolonged.

[0017] Furthermore, the device according to the invention is of a construction that allows a compact design, by the feed spiral having no core, which enables positioning of the ignition device centrally inside the feed spiral. By the feed spiral having no core is meant that it in a physical sense lacks a centre shaft. By the ignition device comprising an immersion heater of standard type, costs can be kept low.

[0018] Furthermore, the feeding device has the advantage that it can be connected both to horizontal-fed and bottom-fed combustion devices.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] In the following, the invention will be described in greater detail with reference to the attached drawing figures, of which:

Fig. 1a shows a view in perspective of the feeding device,
Fig. 1b shows a longitudinal section of the feeding device,
Fig. 1 shows a longitudinal section of a preferred embodiment in which the feeding device is connected to a horizontal-fed combustion device,
Fig. 2 shows in detail the interior contents of the feeding device,
Fig. 3 shows an alternative embodiment in which the feeding device is connected to a bottom-fed burner.

DETAILED DESCRIPTION OF THE INVENTION

[0020] In Fig. 1a the feeding device is shown in perspective. The feeding device comprises a first feed tube 3, a feed spiral 8 and an ignition device 9. The first feed tube 3 is connected to an upwards directed connection tube 11 for incoming fuel to the device, via a transport device 5 from a fuel supply 6. In the connection tube 11, instruments for level and temperature sensing can be mounted and for that purpose there are, in this embodiment, two holes 21 a, 2 b in the tube wall. In the figure can also be seen a conventional worm gear motor 7 for the driving of the feed spiral 8, and a slip ring device 22 for transmission of electricity to the ignition device 9. Except from these parts, the feeding device naturally comprises a number of devices for suspension, bearings, transmission and other functionalities that are important for the operation of the device. Such devices are already known per se by the person skilled in the art and do not constitute essential features of the invention, why they will not be further described.

[0021] In Fig. 1b is shown a longitudinal section of a feeding device 1 according to the invention. The feeding device 1 is particularly suitable for transportation of granular fuel to horizontal-fed and bottom-fed combustion devices. Therefore, the feeding device 1 is arranged to feed fuel to the combustion device, and accordingly the fuel can not fall of its own weight into the combustion device, when it leaves the transport device 5, which is shown in Fig. 1a. Suitably, the feeding device 1 is oriented such that the feed of fuel to the combustion device takes place in a plane that is essentially horizontal, but it is also conceivable to orient the device such that the feeding takes place on a gentle upward slope, which means that the first feed tube 3 is arranged along a horizontal or gently ascending centre axis.

[0022] In an advantageous embodiment, a feeding device 1 according to the invention comprises a first feed tube 3 of essentially circular cross-section. The front end of the feed tube 3, i.e. the end that is intended to be connected to the combustion device, is open and provided with a flange 17, and the rear end is provided with an end wall 12. Furthermore, the feed tube 3 is provided with a sleeve coupling that forms an inlet hole 16 for the fuel and to which an upwards directed connection tube 11 can be connected.

[0023] Suitably, the sleeve coupling is positioned in the top side of the tube wall and is essentially symmetric in relation to the centre axis of the tube. Hereby, the transported fuel can fall down into the feed tube 3 by its own weight.

[0024] At its upper end, the connection tube 11 is adapted to be connected to a chute 5a that is part of a transport device 5 which transports the fuel from a fuel supply 6. The chute may be a tube or a hose. The transport device is not essential to the inventive concept, but can be any type of device that is commercially available. As is known per se, the fuel can be fed to the chute by e.g. a conventional transport screw that at one end thereof is connected to the fuel supply and at its other end is connected to the chute. One example of such a transport device is Maflex 90/75 from the Swedish company MAFA in Ängelholm.

[0025] The front end of the feed tube 3 of the feeding device is, as is mentioned above, intended to be connected to the combustion device 2 and for this purpose the flange 17 is designed to achieve a tight connection with the combustion device 2. In the preferred embodiment, the flange 17 is connected to a casing at a rear panel of the combustion device, as is shown in Fig. 1c.

[0026] The rear panel wall 12 is provided with a centrally situated opening 13, through which a drive shaft 14 extends. The drive shaft 14 has such an axial extension that the major part of the drive shaft is situated outside the rear panel wall 12 of the first feed tube 3, and in connection with this part bearings and drive mechanisms are positioned. Just inside the panel wall 12, i.e. inside the feed tube 3 and at the front end of the drive shaft 14, the drive shaft 14 comprises attachment means for a rotatably arranged feed spiral 8 by aid of which the fed-in fuel is transported to a combustion chamber 23 in the combustion device 2. In a preferred embodiment the feed spiral 8 has no core. The front end of the drive 14 also constitutes an attachment for the ignition device 9, which is shown in greater detail in Fig. 2.

[0027] Fig. 1c shows how the feed device 1 is connected to a horizontal-fed combustion device 2 that is essentially similar to a combustion device described in SE 514,133, which is a combustion device patented by the present applicant. Another combustion device for which a patent has been applied by the present applicant is shown in Swedish patent application no. 9700793-4 and constitutes yet another example of a combustion device particularly suitable to be used together with the feeding device according to the invention. These two combustion devices exhibit the common features that they comprise a rotatable reactor drum 23 that forms a main combustion chamber and at the rear end of which there is an inner, smaller drum 10 having a perforated jacket and being coaxial with the reactor drum 23. The fuel is to be fed into the inner, smaller drum 10 and from there to the surrounding reactor drum 23. The smaller drum 10 is arranged to be able to rotate along with the larger reactor drum 23, about the centre axis of the same.

[0028] By the temperature gradient that arises in the combustion chamber, a wear occurs due to the oxidation of the material, which varies over the reactor drum's axial extension. In hitherto known constructions, in which the inner wall 23A has been manufactured of a perforated plate that has been shaped into a cylindrical drum, the entire drum has had to be replaced, or alternatively be repaired by welding on a new drum section, when the material has reached a certain degree of wear. The figure shows a newly developed variant of a combustion device 2 in which an inner wall 23A of the reactor drum 23 comprises three circular cylindrical wall sections 33. The person skilled in the art naturally realises that the reactor drum 23 can be designed to have a non-circular cross-section. For example, the reactor drum can be designed with a hexagonal or octagonal cross-section. These wall sections are arranged to be able to switch place with one another, giving the advantage that the lifespan of the reactor drum is increased. Alternatively, the wall section having the greatest degree of wear is replaced successively, where by the wall section having the second greatest degree of wear takes its place. The new wall section is placed in the position in which previously the wall section having the slightest degree of wear was positioned.

[0029] In an advantageous embodiment, the wall sections 33 are manufactured of a refractory cast steel or ceramic material, which will give manufacturing advantages by the manufacturing being less costly. Casting also leads to a greater flexibility concerning the design of the reactor drum, which results in that the combustion device 2 obtains enhanced properties, from a combustion point of view.

[0030] When the feeding device 1 is mounted on the combustion device 2, the feed spiral 8 is inserted into a second feed tube 3a that extends through the panel of the combustion device, from the outside of the combustion device and into the reactor drum 23. The axial extension of the feed spiral 8 is adapted depending on the extension of the second feed tube 3 a, and preferably the feed spiral 8 is made long enough for it to reach to the mouth 20 of the feed tube 3a in the rear panel wall 31 of the reactor drum 23.

[0031] The second feed tube 3a extends through the casing 18 and panel wall 19 of the combustion device and is arranged to project a short distance outside the casing 18. The feed tube of the feeding device, i.e. the first feed tube 3, is arranged to tightly enclose the part of the second feed tube 3a of the combustion device that extends outside the casing 18, so that the tubes will overlap. The distance that the second feed tube 3a is allowed to project outside the casing 18 will however not be longer than that the distance over which the tubes overlap will not exceed the length of the front section of the feed tube 3 of the feeding device, i.e. the section in front of the sleeve coupling at the inlet opening 16. The feeding device 1 can be attached to the combustion device by screwing the flange 17 to the casing 18.

[0032] The centre axis 3a of the second feed tube should suitably coincide with the axis of rotation of the combustion device 2, where by the fed-in fuel will be fed into the centre of the inner, rear drum 10 of the combustion device 2. Furthermore, it is suitable that the feed spiral 8 is arranged to rotate about an axis of rotation that essentially coincides with the centre axis of the feed tube. Hereby, the specific advantages are obtained from a combustion point of view, that characterise the two combustion devices, which advantages are described in the two patent specifications mentioned above.

[0033] Fig. 2 shows in cross-section a side view of the ignition device 9 and the feed spiral 8 and the drive shaft 14 and a socket 24 for the immersion heater. The drive shaft 14 is constituted by a cylindrical rod sectioned in two, whereof a rear section is positioned outside the rear panel wall 12 of the first feed tube 3 and a front section is positioned inside the rear part of the feed tube 3, which is shown in Fig. 1b. Drive and bearings are positioned in connection with the rear section of the drive shaft 14 and this section, which constitutes about half the total length of the drive shaft, is provided with an axially centrally situated through hole 25, through with electrical cables can run. The front section constitutes an attachment for a socket 24 for the immersion heater, and is formed as a cylindrical tube having a gently conical inside so that the thickness of the tube wall decreases in direction to the front end of the drive shaft.

[0034] The socket 24 for the immersion heater is shaped as a cylindrical rod, the rear end of which is arranged to be inserted into the front, tube-shaped end of the drive shaft. The socket 24 for the immersion heater has an axial through hole in which the electrical cables 26 for the ignition device 9, can run. The rear end of the ignition device 9 is arranged to be inserted into the hole in the front end of the socket 24 for the immersion heater. Two orthogonal slots are arranged axially in the cylindrical wall that encloses the rear end of the ignition device 9, which slots can be clamped together by aid of a bolt joint (not shown). In this way, the diameter of the hole can be varied in order to clamp the ignition device 9.

[0035] The socket 24 for the immersion heater is anchored in the drive shaft 14, by aid of a through bolt 28. The nut 29 connected to the bolt is arranged to be locked in the direction of rotation by the tube wall of the drive shaft 14 exhibiting a hole in which the nut can be countersunk. The nut 29 also constitutes an attachment for the feed spiral 8 and for that object, it is provided with a transversal hole 30. When the feed spiral 8 is to be attached to the nut 29, the rear end of the core-less feed spiral 8 is placed around the drive shaft 14 and the socket 24 for the immersion heater, so that the feed spiral 8 encloses the drive shaft 14 and the socket 24 for the immersion heater for 1-2 turns. The inner end of the feed spiral is passed a short distance through the hole 30, suitably for ¼ to ½ of a turn, and is locked from beneath by the bolt 28.

[0036] The ignition device is designed to have a longitudinal extension that at least exceeds its transversal extension, which leads to an improved function as the fuel is in direct contact with the ignition device for a longer time than devices known today. Preferably, the ignition device 9 has an extension (L_L) as seen in the longitudinal direction which at least exceeds it extension (L_T) in the transversal direction, so that $50L_T > L_L > L_T$, and preferably $L_L > 2 \times L_T$ and even more preferred $L_L > 10 \times L_T$.

[0037] According to one aspect of the invention, it is desired to achieve an abrasive effect on the surface of the ignition device 9, as it has been shown that such abrasion contributes to keep the surface free from depositions of soot or other particles that have a negative effect on the heat transfer between the ignition device 9 and the fuel. One way of achieving such abrasion would be to let the feed spiral 8 rotate about the ignition device 9. It has however been shown that a sufficiently effective abrasion is achieved by the axial movement of the fuel during transportation to the combustion device 2. Additional abrasion caused by the feed spiral 8 would lead to unnecessary wear of the surface of the ignition device 9, which could have a negative effect on its lifespan. Therefore, in a preferred embodiment, the ignition device 9 is arranged to rotate along with the feed spiral 8, where by the abrasion due to rotation of the ignition device 9 can be minimised as the relative motion between the ignition device 9 and the surrounding feed spiral 8 is minimised.

[0038] Fig. 3 shows side view of an alternative embodiment in which the feeding device 1 is connected to a bottom-fed combustion device 27. The flange 17 of the first feed tube 3 is connected to a corresponding flange 17b of the second inlet tube 3a for the combustion device 27. Suitably, the feed screw 8 has an axial extension that allows the doses of fuel to be fed all the way into the combustion chamber 23. here formed as a cup, where the mouth 20 of the second feed tube 3a is positioned in connection with the bottom section of the combustion chamber 23.

DESCRIPTION OF THE FUNCTION

[0039] By an inventive feeding device, start-up of the combustion device 1 may take place without manual actuation, for example when the device is to be started-up after a planned shut-down, after an unplanned shutdown due to e.g. power failure and at on/off-controlling during the warm season, when the power output is lower. Advantageously, before the start-up procedure is initiated, one should control that all fuel from the preceding combustion period has been spent, so that no fuel is still smouldering in the combustion device. This is most easily done by reading the boiler temperature and possibly also the oxygen concentration in the flue, on the instruments, i.e. the temperature sensor and lambda-probe, that normally are mounted in the boiler. This is done to avoid risk of ignition of combustible gases that may dwell in the boiler in case the seat of fire is not completely extinct.

[0040] The control system is programmed to alarm if the conditions for a start-up by activated ignition device 9 are not correct. The control system can also be programmed for a start-up without activation of the ignition device 9, in which case remaining, smouldering fuel is used for ignition. Alternatively, if there is not enough embers in the combustion device 2, the control system will make sure that the fuel becomes extinct and that the boiler is aired.

[0041] Naturally, this manual operation is not required at on/off-controlling, since the combustion device is programmed to quite automatically ignite and shut down the combustion equipment at regulation within a certain temperature range for example.

[0042] The feeding device 1 and the combustion device 2 are coupled to a control and regulation system that is programmed for a completely automatic operation of the devices. What is described here concerning the ignition procedure and transition to continuous operation mode is to be interpreted such that no manual operation is required, but that the various actions are handled by the control system. In principle, it is only required that the system is switched to operation mode in order for the device to start up.

[0043] The ignition procedure begins by heating up the ignition device 9 to a temperature of about 800 °C, which takes about 2 minutes. Thereafter, the fuel, in this case pellets, is fed by the transport device 5, so that the connection tube 11 is filled by pellets up to a predefined level, indicated by the level sensor that is mounted in the wall of the connection tube 11. When an adequate temperature has been reached, the feed spiral 8 begins to rotate, whereby a certain amount of pellets is fed forward in the first feed tube 3 and further into the feed tube 3a in the combustion device. At the same time, the transport device 5 starts to transport more pellets to the connection tube 11, in order to keep the inlet 16 of the first feed tube 3 covered by pellets all the time. This is done to secure that the first feed tube 3 and the second feed tube 3 a are maintained as full as possible, whereby the pellets will crowd properly about the ignition device 9.

[0044] The pellets that is fed to the ignition device 9 is ignited momentarily, which means that the negative effects that otherwise may occur in connection with slower ignition procedures, as volatile and combustible gases are emitted from the fuel, can be avoided. In an advantageous embodiment, the ignition device 9 is designed not to heat up and ignite the fuel at its rear end where it is attached to the socket for the immersion heater. Most preferably, the ignition device 9 is designed to ignite the pellets only when the pellets have been transported into the second feed tube 3a of the combustion device 2. Furthermore, it is advantageous to adapt the longitudinal extension of the ignition device 9, dependent on the length of the second feed tube 3a. The wear due to oxidation of the material of the ignition device 9 can be diminished by allowing the front end of the ignition device 9 to be positioned inside the second feed tube 3a, typically between 2 and 10 cm from its mouth 20 in the reactor drum 23, whereby the lifespan of the ignition device is extended. Alternatively, the length of the socket 24 can be varied in order to obtain an advantageous distance between the front end of the ignition device and the mouth 20 of the tube.

[0045] In the boiler to which the combustion device is connected, there is a negative pressure that can be obtained by aid of a fan or naturally by the draught from the chimney. In order to obtain an efficient protection against back-fire, the feed device 1 and the transport device 5 are equipped with air inlet openings in order for an air flow to be formed which runs in the same direction as the transport direction of the pellets. Thereby, the flames from the ignited pellets will be directed inwards, towards the combustion device 2, whereby the combustion device 2 is heated. In addition, the risk is minimised that the fire spreads backwards to the first feed tube 3 and into the connection tube 11. If the fire still would spread backwards, against all odds, the connection tube 11 is, as mentioned above, provided with a temperature sensor with an alarm that will trigger off a number of security measures previously known to the person skilled in the art.

[0046] During the ignition procedure, the feed spiral 8 is run intermittently for short sequences of some or a few seconds, typically 1 second, to feed a predefined amount of pellets to the second feed tube 3 a to be ignited there as it gets in direct contact with the heated ignition device 9, with longer intermediate sequences of typically 2-4 seconds when the feed spiral 8 is at arrest while the combustion of the ignited pellets proceeds. During the following feed sequence, the ignited pellets will be fed forward in the second feed tube 3 a in order to eventually be fed into reactor drum 23. During the ignition procedure, the reactor drum 23 will be heated by the smouldering pellets that is filled into the same. Initially, when there is only a small amount of pellets in the drum, the combustion will cease, but when an adequate amount of pellets has been collected in the reactor drum 23 and an adequately high temperature has been reached, the pellets will start to burn here too. For a combustion device with 40 kW power, the ignition procedure will typically take about 2 minutes from the start-up of pellet feed by the feed spiral 8, to the time when the combustion device is heated and the pellets starts to burn in the reactor drum 23. In a combustion device of 400 kW power, this process takes about 10 minutes.

[0047] Thereafter, the control system switches to a monitoring phase, typically lasting 2-10 minutes. During that time, a continued control of operation parameters such as e.g. air supply and pellets dosage takes place in order to continue the heating of the combustion device 2 and reach a steady combustion, where after a switch to the first actual operating mode can take place. In connection with the switch to the monitoring phase, the ignition device 9 is switched off and is allowed to cool off and the feed spiral 8 switches to continuous operation. Instead, the feed of pellets to the reactor drum 23 is dosed by the transport device 5. In a typical case, a dosage pulse lasts 4 seconds and is followed by a 4 second pause. The fed pellets is distributed as it gets into the feed spiral 9 and thereby the supply to the reactor drum 23 will become more even over time than during the ignition procedure. It is only during ignition procedure that a certain accumulation of fuel in the connection tube 11 is allowed. During all other operation, it is the intention that all fuel that falls down through the connection tube 11 should be fed on immediately by the feed spiral 8, so that no fuel is accumulated in the connection tube 11, which is important from a security point of view. This feeding procedure is previously known and is described in SE 514,133. There, the security system of the device is also described, in order to avoid the occurrence of back-fire if the fuel feed would fail.

Claims

1. A feeding device (1) for transportation of a solid fuel, such as pellets, wood chips or some other granular material, to an combustion device (2) in which combustion of the transported material takes place, wherein the feeding device (1) comprises a first feed tube (3) that is disposed to be operatively connected to a distribution device (5) for transportation of said solid fuel from a fuel supply (6) to the feeding device (1) and is disposed to be operatively connected to said combustion device (2), via an outlet end of the feed tube (3), a feed spiral (8), arranged to rotate at least partly inside the first feed tube (3) to transport the solid fuel to the combustion device (2), **characterised in that** the feed spiral (8) is arranged about an ignition device (9), which ignition device (9) is arranged to heat up and to ignite the solid fuel by direct contact with the fuel.

2. A feeding device (1) according to claim 1, **characterised in that** the ignition device (9) extends beyond the outlet end of the first feed tube (3) and is arranged to ignite the fuel there.

3. A feeding device (1) according to claim 1, **characterised in that** the feed spiral (8) extends beyond the outlet end of the first feed tube (3).

4. A feeding device (1) according to claim 1, **characterised in that** the ignition device (9) is positioned essentially centrally in the first feed tube (3) and preferably in a position that in the main coincides with the centre axis of the first feed tube (3).

5. A feeding device (1) according to any of the preceding claims, **characterised in that** the ignition device (9) is arranged to rotate along with the feed spiral (8).

6. A feeding device (1) according to any of the preceding claims, **characterised in that** the feed spiral (8) has no core.

7. A feeding device (1) according to any of the preceding claims, **characterised in that** the ignition device (9) comprises an immersion heater.

8. A feeding device (1) according to any of the preceding claims, **characterised in that** it is arranged to be connected to a horizontal-fed or bottom-fed combustion device (2).

9. A system for a solid fuel fired boiler, comprising a feeding device (1) and a combustion device (2), **characterised in that** the feeding device (1) is designed according to any one of claims 1-8.

10. A system for a solid fuel fired boiler according to claim 9, **characterised in that** the combustion device (2) comprises a second feed tube (3a) having an inlet end to which the outlet end of the first feed tube (3) is arranged to be connected, whereby the feed spiral (8) and the ignition device (9) will extend into the second feed tube (3a).

11. A system for a solid fuel fired boiler according to claim 10, **characterised in that** the two feed tubes (3, 3a) are arranged along a horizontal or gently as-

cending centre axis and **in that** a mouth (20) of the second feed tube (3a), through which the fuel is fed into a combustion chamber (23), preferably is positioned essentially in the centre of a panel (11) of the combustion chamber (23).

12. A system for a solid fuel fired boiler according to claim 11, **characterised in that** the two feed tubes (3, 3a) are arranged along a horizontal or gently ascending centre axis and **in that** a mouth (20) of the second feed tube (3a), through which the fuel is fed into a combustion chamber (23), preferably is positioned in connection with a bottom section of the combustion chamber (23).

13. A system for a solid fuel fired boiler according to claim 9, **characterised in that** the combustion device (2) comprises a double-wall, rotatable reactor drum (23) that comprises an inner wall (23A) comprising at least two axially arranged cylindrical wall sections (33). where said wall sections (33) in the main will constitute said inner wall (23A) and where these wall sections (33) are arranged so that they can switch place with each other.

Fig. 1a

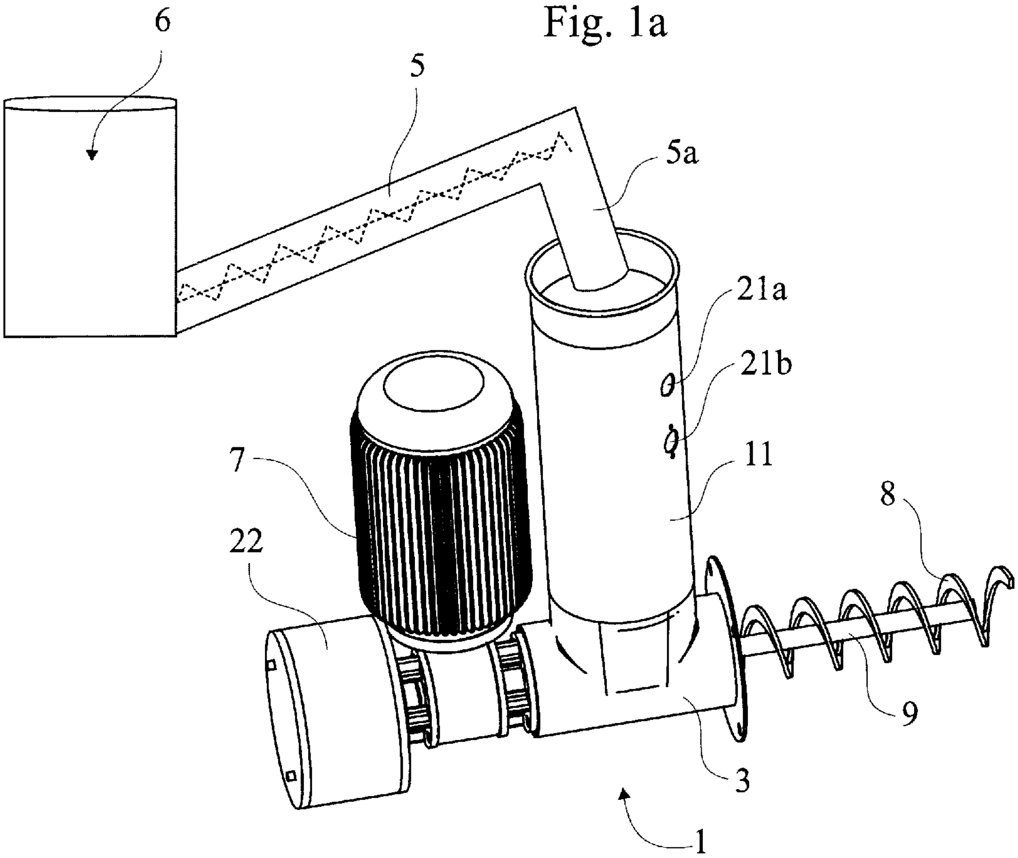

Fig. 1b

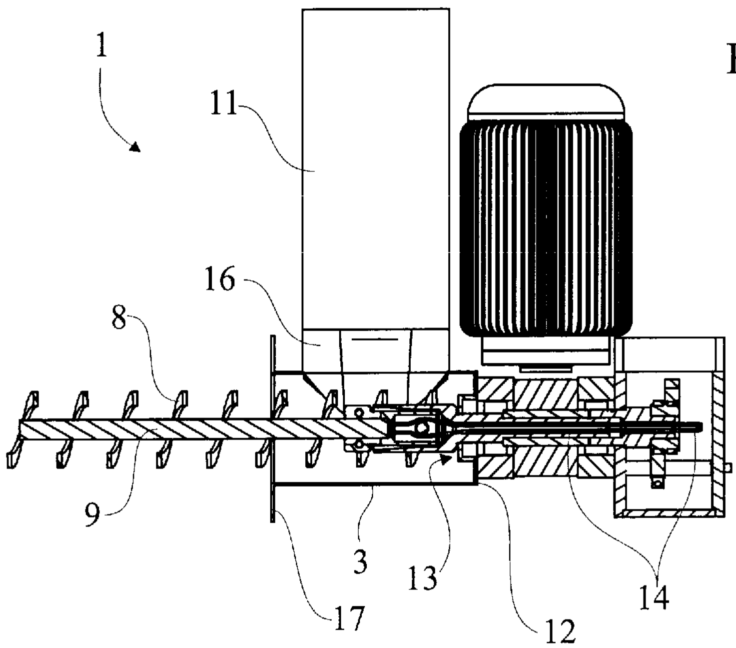

Fig. 1c

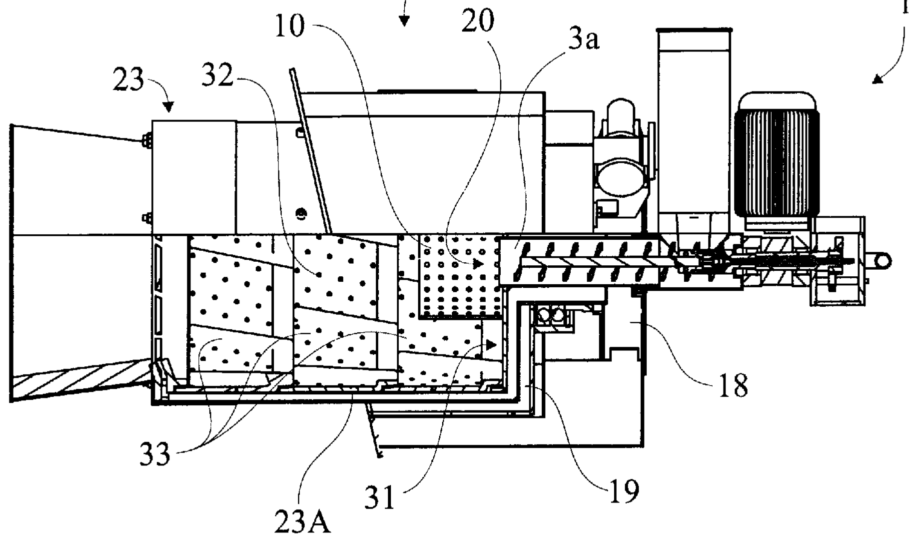

Fig. 2

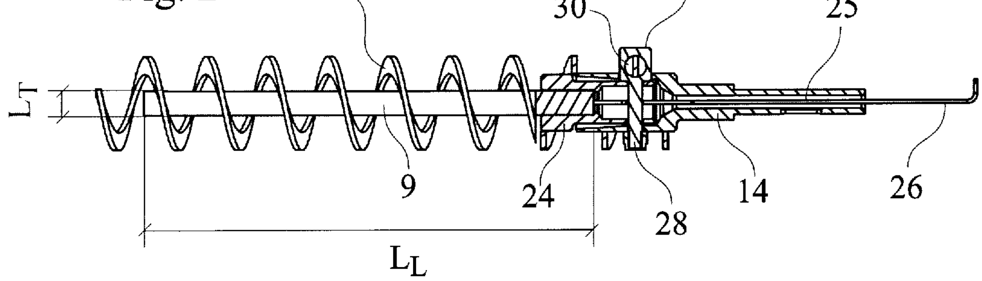

Fig. 3