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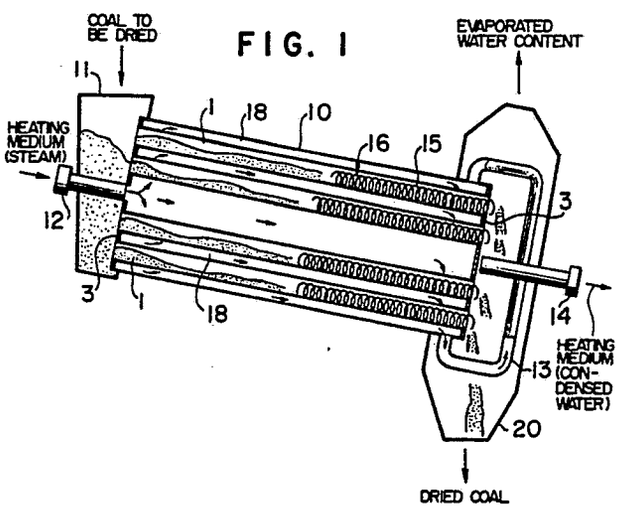
(54) Coal-moisture control process.

(57) A coal-moisture control process, characterized in that a mono species or a mixture of several species of coal containing the volatile matter of 45 wt% or less on the dry ash free basis, including the portion of the particles size of 3 mm or less by 75 wt% or more, and containing the water content of 20 wt% or less on the wet ash free basis is introduced into a plurality of tubes (1) are disposed in and along the axial direction of an inclined rotational cylinder (10) of a coal-in-tube type tube dryer, and a heating medium such as steam is passed along the outer surface of the tubes (1) for the purpose of indirectly heating the coal so as to dry it so that the water content on the wet ash free basis is made 4 to 7 wt%, has enabled efficient and economical moisture control of the coal having relatively high coal rank such as coaking coal.

FIG. 1



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COAL-MOISTURE CONTROL PROCESS

Background Art

It is known that reduction in moisture of a coking coal before introduced into a coke oven can serve to improve the quality of the dryed coke and the productivity, life and heat efficiency of the coke oven.

It is also known that drying a thermal coal before inserted into a boiler makes heat efficiency to be improved and the exhaust gas treating system to be reduced in size.

This invention provides a efficient and economical coal-moisture control method by applying a tube dryer to high rank coal.

The tube dryer is consituted in such a manner that a plurality of tubes are axially disposed in an inclined rotary cylinder. A coal-in-tube type is known, wherein coal to be dried is passed through the tube, while a heating medium such as steam is passed along the outer surface of the tube so that the coal to be dried is indirectly heated. A steam-in-tube type is also known, wherein a heating medium such as steam is passed through a tube, while coal to be dried is passed along the outer surface of the tube so that it is indirectly heated.

Hitherto, the coal-in-tube type of tube dryer is used only for drying high water content brown coal (water content: 60 to 70 wt%) to a level of 20 to 30 wt%.

This conventional tube dryer is known, in which a stirring means formed by a flat bar (width 20 to 30 mm)and designed in a spiral form is inserted into each tube. This stirring means increase the probability that the coal is brought into contact with the inner surface (heat transfer surface) of the tube.

As another coal-in-tube type, a structure disclosed in the U.S. Patent No. 3,765,102 is known. This structure is, as shown in Figs. 9 and 10, constituted in such a manner that a stirring means formed by flat bars 2 in the form of a longitudinal fins attached to the inside of a tube 1 is provided for the purpose of enlarging the contact area with the heat transfer surface by picking or carrying up the granule layer. Reference numeral 3 represents a tube sheet, reference numeral 4 represents a support ring, and reference numeral 5 represents a dam element.

Since such long and complicated stirring means needs to be disposed along the tube, the weight is enlarged, and the changing, cleaning and maintenance works to become complicated.

The system, which is disclosed in the above-described U.S. Patent, wherein a dam element is disposed at the outlet portion of the tube for the purpose of controlling the coal retention time, is disadvantageous on the points that the particles become non-uniform, a part of the coal is excessively dried, and the complete discharge is difficult to be performed. As a result of this, fine particles tend to be stacked, causing the corrosion to occur.

These coal-in-tube type of tube dryers have been developed for drying brown coal and have not been applied for high rank coal such as coking coal.

The high rank coal such as coking coal contains only 10 to 20 wt% water even if the same is stocked in outdoor pile, which is lower in moisture than low rank coal such as brown coal. And since this high rank coal dried is more dusty in less moisture, the water content of coal is preferable to be dried at 4 to 7 wt% at the outlet portion of the dryer.

And coking coal has lower flowability than brown coal generally.

Therefore, in comparison to the brown coal case, the quantity of water to be evaporated can be limited only 1/2 to 1/3 of that in the brown coal case if the same amount of coal is used. Therefore, a necessity arises that the quantity to be treated is increased up to twice to three times. However, the conventional type of tube dryer can not treat the sufficient quantity of coal due to the flow resistance caused by the too small diameter of the tube thereof and the too complicated shape of the stirring means mounted in the space within the tubes.

On the other hand, a coal dryer disclosed in Japanese Patent Unexamined Publication No. 63-3089 is known as an example of the steam-in-tube type, wherein austenitic acid-resisting stainless steel is used in the inlet portion thereof, an austenitic-ferric stainless steel is used in the intermediate portion thereof, and carbon steel is used in the outlet portion thereof.

Since, in a steam-in-tube type of tube dryer, the coking coal charge ratio is usually 10 to 20% and the heat transferring area cannot be efficiently used, the capacity of such apparatus needs to be enlarged. Furthermore, the route through which the coal passes is too complicated, as a result of which, adhesion and accumulation of fine particle material generated will cause corrosion.

According to the above-described Japanese Patent Unexamined Publication No. 63-3089, a fact is known that, when the temperature of the wall of the tube (the inner temperature) which is brought into contact with the coal layer is lowered into a low-temperature (120°C or lower, sometimes it is 130°C or lower), the component (SO_4^{2-} or Cl^-) derived from coal causes corrosion. Furthermore, according to the above-described Japanese Patent,

a high grade material such as austenitic-ferric stainless steel is used so as to prevent such corrosion. Although such material described above can endue such corrosion and its life can be lengthened, it is not economical since the cost for materials becomes too high (such materials becomes substantially 20 times as carbon steel).

Generally in the steam-in-tube type dryer, steam condensate which has been heat-exchanged with the coal is present in the tube thereof. Therefore, the temperature of the wall of the tube portion which is brought into contact with condensed water having a relatively high resistance to heat transfer is lowered, causing corrosion.

Since the structure of the steam-in-tube type tube tends to retain condensed water on the heat transferring surface, the tube needs to be made of a high grade material or the steam pressure needs to be raised, so as to keep the temperature of the shell high, both of these being not economical.

Many coal-in-tube type dryers has been used as the dryer for high water content brown coal, but there have not been reports of such corrosion at a low temperature region since the brown coal has the different components relative to those of the coal (mainly coking coal) to be treated according to the present invention.

Description of This Invention

We provide the coal-moisture control process or a method for effectively controlling the moisture in coal of the type having the relatively high coal rank such as coking coal in such a manner that a tube dryer is used, such tube dryer being so constituted that the coal or the like to be dried is passed through the tube inside, while any heating medium is passed outside this tube.

A phenomena, in which the coal is raised in the direction of the rotation, the thus-raised angle exceeds the angle of response and the granule layer of coal falls, is called a kiln action.

The inventors have found a fact through experiments that the kiln action can be stably generated by arranging the average charge ratio in the tube to be 15% or more, preferably, to be 30 to 50%. It has led to a fact that a sufficient retention time in the tube can be secured and the heat transfer quantity can be improved.

The inventors have also achieved the present invention based on the finding that corrosion at the time of treatment of coking coal can be prevented and sufficient corrosion resistance can be obtained in case of the low grade material such as carbon steel SGP by arranging the steam temperature in the tube dryer to be 130° C or higher, and the tube wall temperature (inner surface temperature) to be 120° C or higher, preferably 130° C or higher.

Furthermore, a fact has been found that if the rotational speed of the dryer is raised, the coal flow velocity in the tube can be increased due to the characteristics of the tube dryer, and even if the coal flow velocity is increased, a desired drying capability can be maintained by making the retention time longer by way of lengthening the tube length or by raising the steam pressure (or the temperature).

SUMMARY OF INVENTION

The present invention has been achieved in view of the foregoing points, and an object of the present invention is to provide a coal-moisture control process whereby a treatment quantity can be increased with a necessary drying capability maintained by using a tube dryer of a coal-in tube type, which type has been used previously only for drying the coal having high water content such as brown coal, this tube preferably being constituted in such a manner that it has the diameter twice to three times of that of the conventional tube, and, preferably, the stirring means in this tube is omitted or the configuration thereof is simplified.

Another object of the present invention is to provide a coal-moisture control process in which generation of corrosion can be prevented even in case of general carbon steel by way of controlling (increasing) the number of revolution of a tube dryer, maintaining the steam temperature at a high temperature exceeding 130° C with the coal drying capability maintained, and securing the tube wall temperature above 120° C, preferably 130° C or higher, that is, above the corrosion temperature region.

The coal-moisture control process according to the present invention is characterized in that a mono species or a mixture of several species of coal containing the volatile matter of 45 wt% or less on the dry ash free basis, including the portion of the particles size of 3 mm or less by 75 wt% or more, and containing the water content of 20 wt% or less on the wet ash free basis is introduced into a plurality of tubes disposed in and along the axial direction of an inclined rotational cylinder of a coal-in-tube type tube dryer, and a heating medium such as steam is passed along the outer surface of the tubes for the purpose of indirectly heating the coal so as to dry it so that the water content on the wet ash free basis is made 4 to 7 wt%.

It is preferable to perform the control in such a manner that the ratio of the coal layer with respect to the cross-sectional area of the tube becomes 15 to 40%, and it is as well preferable to perform the control in such a manner that the same becomes

50% or more at the inlet portion of the tube. If it is below 15%, the kiln action cannot be generated. Therefore, the area contacting with the inner surface (heat transfer surface) of the tube is too small and the coal layer cannot be stirred sufficiently, causing the heat transfer efficiency to be limited to low, while the flow velocity in the tube becomes to large with respect to that in the case where the kiln action is generated, which is disadvantageous because the length of the tube may become too long for the purpose of sufficiently drying the coal.

In general, water content in coal is high at the inlet portion of the tube, causing the flow velocity to be limited small and the charge ratio to be high, while at the outlet portion, the water content in coal becomes lowered, causing the flow velocity to become too large, and for the charge ratio to be low. In order to assuredly generate the kiln action at the outlet portion, the ratio or proportion of the coal layer at the inlet portion of the tube should be 50% or more in case of the coals having water contents above, although depending upon the water content in coal.

If the charge ratio exceeds 50%, in average the flow velocity of coal is reduced, causing the flowing state to become unstable. As a result of this, the tube may be clogged or the non-uniform distribution of the charge ratio occurs. Therefore, the charge ratio is preferably limited that it does not exceed 50% even if locally except the inlet portion, and the average charge ratio is preferably limited to 40% or less.

Moreover, it is preferred that the ratio of the quantity of the coal with respect to the cross-sectional area of the tube is controlled, by reducing the rotational speed of the tube dryer near its lowermost level by detecting the level of the fine particles of the coal in an inlet hood of the tube dryer so as to prevent rise in the fine particles level as well as by detecting the quantity of the coal discharged from the tube dryer so as to prevent reduction in the quantity of the coal discharged from the tube dryer, under a condition where the quantity of supply of the coal to be dried to the tube dryer is controlled at a substantially constant level.

In one type of coal-moisture control process according to the present invention a mono species or a mixture of several species of coal, to be dried, containing the volatile matter of 45 wt% or less on the dry ash free basis, including the portion of the particles size of 3 mm or less by 75 wt% or more, and containing the water content of 20 wt% or less on the wet ash free basis is introduced into a plurality of tubes disposed along the axial direction of an inclined rotational cylinder of a coal-in-tube type tube dryer having stirring means inserted into the tubes, a heating medium such as steam is passed along the outer surface of the tubes for the purpose of indirectly heating the coal so as to dry it so that the water content on the wet ash free basis is made 4 to 7 wt%.

The stirring means may preferably be formed by a spiral wire material (shown in Figs. 1 to 3), by a structure (shown in Figs. 4 and 5) in which a plurality of annular dams in the transverse direction of the tube are disposed at regular intervals, or by a structure (shown in Figs. 6 and 7) in which a plurality of flat-bars are disposed in axial direction of the tube in such a manner that they can be in contact with the inner surface of the tube.

In the coal-moisture control process according to the present invention the rotation speed of the tube dryer is preferably controlled so as to make the temperature of the heating medium such as steam in the tube dryer exceed 130 °C.

Furthermore, in the coal-moisture control process according to the present invention the tube shell temperature may be made 120 °C or higher instead of making the temperature of the heating medium such as steam in the tube dryer 130 °C or higher.

In order to prevent or suppress corrosion of the inner surface of the tube, the temperature of the tube shell (the temperature of the inner surface) may be raised 120 °C or higher. However, there is no industrially convenient method to measure the temperature of the tube wall in the rotating dryer, and if any, it has a poor reliability. Since the pressure of steam is uniform through the inside of the dryer of a coal-in-tube type tube dryer and the temperature drop inside the tube shell is limited to a very small level, the temperature of steam at the inlet portion of the dryer at which measurement can be performed rather easily may be measured for the control as an alternative to measuring the tube shell temperature. Since the generated condensed water is immediately separated from the tube shell and is discharged from the dryer, the temperature of the same is substantially the same as that of the steam in the dryer. Therefore the temperature of the condensate at the outlet portion of the dryer may be measured so as to use it to perform control.

When coal of the type having a relatively lower water content than designed water content at the inlet portion is treated by a dryer which is designed with a rated drying capability, corrosion of tube can occur if the temperature of the steam is lowered for the purpose of preventing excessive dry.

Therefore, with the temperature of the steam kept 130 °C or higher at which corrosion cannot occur, the revolution speed of the dryer may be controlled so as to make the water content in the coal at the outlet portion to be a predetermined level.

If the coal water content is kept low, fluidity is improved and the coal charge ratio in the tube is lowered. However, a sufficient drying capability can be secured by providing the stirring means which can further stably generate the kiln action.

The content of the volatile matter of coking coal on the dry ash free basis is preferably to be 30 wt% or less, and water content of the same on the wet ash free basis is preferred to be 8 to 12 wt% in average.

Furthermore, the inclination of the inclined rotational cylinder is preferred to be 5 to 15°. If it is below 5°, the coal flow velocity in the tube is too small, causing the quantity treated to become also too small, while the retention time becomes longer. As a result of this, the coal at the outlet portion becomes over dry. If an inclined rotational cylinder of the inclination of 5° or less is used for processing the coal of the above described water content region, the dryer needs to become a cylinder having a large diameter but having a short overall length. Such dryer causes manufacturing and transportation problems. The way to raise the rotational speed for the purpose of increase the quantity the coal to be treated will cause a problem to be described later. On the other hand, if it exceeds 15°, the size of the supporting device such as a stopper for supporting a thruster or a shaft bearing portion in the axial direction of the dryer becomes too large, causing manufacturing and economical problems.

It is preferable to make the rotational speed of the inclined rotational cylinder to be 5 to 25 rpm, the diameter to be 600 to 6000 mm, the number of the tubes to be six or more, and the inner diameter of the tube to be 150 mm or more. If it is less than 5 rpm, similarly to the case where the inclination is 5° or less, the quantity treated by a tube becomes too small, causing a problem that the shape of the dryer becomes a large diameter and short length cylinder. On the other hand, if it exceeds 25 rpm, the life of the rotational portions such as the bearing or the like can be shortened and the power needed becomes too large. In addition, the tube disposed away from the rotation shaft is much affected by centrifugal force, causing for kiln action to be prevented from generation.

If the inner diameter of the tube is less that 150 mm, the quantity treated by one tube may be excessively low, and the retention time becomes long, causing the drying capability to become excessively high. Therefore, such dryer causes much more serious manufacturing and transportation problems relative to the case where the inclination is 5° or less.

If the diameter of the cylinder is less than 600 mm, it is difficult to dispose multiple tubes having the inner diameter of 150 mm. If it exceeds 6000 mm manufacturing and transportation problems occur, and the excessive number of the tubes to be disposed therein causes a problem that coal can be uniformly supplied into the tubes.

If the number of the tubes is less than five, a proportion or ratio of the total cross-sectional areas of the tubes with respect to the cross-sectional area of the dryer, that is, the ratio of the coal passage with respect to the diameter of the dryer, is lowered, causing an economical problem.

BRIEF EXPLANATION OF DRAWINGS

Fig. 1 is a vertical sectional view illustrating an embodiment of a tube dryer in which a coal-moisture control process according to the present invention is carried out;

Fig. 2 is an enlarged cross-sectional view illustrating the portion around the outlet end portion of the tube shown in Fig. 1;

Fig. 3 is a right hand side view of Fig. 2;

Fig. 4 is a sectional view illustrating another embodiment of a tube;

Fig. 5 is a cross-sectional view taken along the line V-V in Fig. 4;

Fig. 6 is a vertical sectional view illustrating other embodiment of a tube;

Fig. 7 is a cross-sectional view taken along the line VII-VII in Fig. 6;

Fig. 8 illustrates another embodiment of a tube dryer in which the method according to the present invention is carried out;

Fig. 9 is a sectional view illustrating an example of a conventional tube; and

Fig. 10 is a cross-sectional view taken along the line X-X in Fig. 9.

Referring to the drawings, preferred embodiments of the invention will be described in detail. Unless otherwise specified, the material, shape and the relative positions of the component devices are not intended to limit the scope of the present invention, but are employed as an example.

Fig. 1 shows an example of a dryer in which the method according to an embodiment of the present invention is carried out. Reference numeral 10 represents an inclined rotational cylinder which is designed to be able to be rotated around the axis thereof by a driving means (omitted from the illustration). This inclined rotational cylinder 10 is disposed in such a manner that it is downward inclined by approximately 10° when viewed from the coal supplying side.

The material to be dried such as coal is supplied to a inlet hood 11, and is dried by a heating medium flowing outside a plurality of tubes 1, at which the same is heat-exchanged through the walls of the tubes 1 while the same passes through

the tubes 1. Lastly, dried coal is discharged from the outlet end of the tubes 1. The tubes 1 are disposed between tube plate 3 at both ends of the inclined rotational cylinder 10. The heating medium, such as steam under pressure of several atmospheres is supplied into the cylinder 10 via a rotational coupling 12, and is flown to the bottom and downstream portion of the cylinder 10 after it has heated the outside of the tube 1 and has been condensed. Then, it passes through a drain pipe 13 in accordance with rotation of the cylinder 10, and is discharged through a rotational coupling 14.

In the method according to the present invention, since the coal having a water content lower than that of brown coal is dried, the drying efficiency can be improved by employing the following means. First, the diameter of the tube 1 is preferably designed to be 150 to 300 mm for the purpose of increasing the quantity treated although the diameter is substantially 100 mm in case of the tube for brown coal. In accordance with the quantity treated, the rotational speed of the tube dryer is adjusted and the coal charge ratio in the tube may be arranged to be 15 to 40% for the purpose of stabilizing generation of kiln action. If the quantity treated is relatively small, the heat transfer area becomes relatively large. Therefore, the water content in the coal at the outlet portion is controlled by lowering the quantity (pressure) of the heating medium to be supplied.

As shown in Figs. 2 and 3, by inserting a stirring means 16 constituted by spiral steel bars 15 having circular cross section into the tube, the kiln action can be generated at the layer of the coal to be dried, causing the heat conducting efficiency to be improved. Furthermore, the flow velocity of coal along the axial direction of the tube 1 is restricted so as to secure the retention time for the purpose of further improving treatment capability. This stirring means 16 is so constituted that it is prevented from separation from the tube by means of a stopper 17 disposed at the outlet end portion of the tube 1, but is can be freely rotated within the tube 1. Reference numeral 18 represents a passage through which the heating medium passes through, and reference numeral 20 represents a hopper for separating the dried coal from the exhaust gas (composed or consisted of evaporated water and air) and for taking out the same.

In accordance with the forward movement of the coal to be dried through the tube 1, water content thereof is reduced, causing generally the flow velocity to be raised. Therefore, the charge ratio of the coal to be dried in the tube becomes lower and this leads to a fact that the kiln action becomes less probable to be generated. By using the stirring means 16 according to the present invention, however, the kiln action can be continued even in a case of low water contents and low charge ratio. Therefore, the sufficient coal-moisture controlling capability and drying capacity can be maintained. It is sufficient that the length of the stirring means 16 along the tube 1 is, depending upon the physical properties of the coal to be dried, inserted in the downstream half portion of the tube in a case of a coking coal. The diameter of the spiral needs to be half or more of the inner diameter of the tube 1. The pitch for the spiral is preferred to be 1/4 times to twice of the diameter of the tube 1. Furthermore, the stirring means 16 may not be rotated within the tube, and the same may be fixed to the stopper 17 or the like.

As an alternative to the stirring means 16 shown in Figs. 1 to 3, several annular or ring-like plates 21 spaced from each other at a several hundred mili-meters pitch by spacers 22 made of steel bars may be inserted in the tube 1. The size of the annular plate 21 is preferably smaller than the diameter of the tube 1 and to be able to rotate for the purpose of preventing adhesion and accumulation of the coal to be dried. It is insufficient to have only one sheet of annular plate 21 at the downstream end for the stable generation of the kiln action. Therefore, two or more plates 21 are desired. The other structure and operation are the same as the case shown in Figs. 1 to 3.

In another example, as an alternative to the stirring means 16 shown in Figs. 1 to 3, several flat bars 23 are laid in the axial direction with the same positioned in closely contact with the inner surface of the tube 1 and are secured by a steel bar 24 having a circular cross section to form a stirring means, as shown in Figs. 6 and 7, the thus-secured stirring means being inserted into the tube 1. The stirring means in Figs. 6 and 7 is so constituted that, different from the conventional example shown in Figs. 9 and 10 in which the material to be dried is picked up by itself, the base portion of the fine particle layer is supported for the purpose of assisting generation of the kiln action. Therefore, the width of the flat bar 23 can be limited small and the number of the same may be, for example, two or three. Furthermore, only a few lines of the steel bar 24 may be provided. Therefore, the flow rate is limited scarcely. The other structures and operations are the same as those shown in Figs. 1 to 3.

In a method according to a preferred embodiment of the present invention, corrosion of a tube material can be prevented by the following operation: first, as shown in Figs. 8, the pressure of the steam to be supplied is, in proportion to the water content in the coal at the outlet portion, controlled by a control valve 25 or the like. However, when the temperature of the steam becomes a predetermined temperature (for example 130°C) over a

temperature below which corrosion can occur, the control valve 25 is controlled to keep the steam at the predetermined temperature, and simultaneously the rotational speed of the dryer is controlled by suing an inverter 27 for a driving motor 26 for the purpose of making the water content in the coal at the outlet portion to be a predetermined level. Reference numeral 28 represents a water content detector, reference numeral 29 represents a temperature detector, reference numeral 30 represents a rotational-speed adjuster, reference numeral 31 represents a rotation drive shaft, and reference numeral 32 represents a bearing.

As described above, according to the present invention, a coal-in-tube type of tube dryer, which has been hitherto used only for brown coal, is used for the purpose of performing coal-moisture control of the coal having a relatively high coal rank such as coking coal. The coal-moisture control can be more efficiently and economically performed than that in case of the other type of tube dryers and another type of drying method.

In the method according to the present invention, tube corrosion can be prevented and tube can be formed by low-cost materials so that the coal-moisture control can be performed efficiently and economically by way of controlling the temperature of the heating medium such as steam in the tube dryer above or no less than 130 °C, or making the temperature at the inner surface of the tube above or no less than 120 °C.

Claims

1. A coal-moisture control process in which a mono species or a mixture of several species of coal containing 45 wt% or less on a dry ash free basis of volatile matter, having 45 wt% or more of particles of a size of 3 mm or less, and having a water content of 20 wt% or less on a wet ash free basis is introduced into a plurality of tubes disposed in and along an axial direction of an inclined rotational cylinder of a tube dryer, and a heating medium, for example, steam is passed along the outer surface of said tubes for the purpose of indirectly heating said coal so as to dry it so that the water content on the wet ash free basis is made 4 to 7 wt%.

2. A coal-moisture control process according to Claim 1, wherein stirring means are inserted in said tubes.

3. A coal-moisture control process according to Claim 2, wherein stirring means constituted by spiral wires are inserted in said tubes.

4. A coal-moisture control process according to Claim 2, wherein stirring means constituted in such a manner that several transverse annular dams are spaced from each other in the longitudinal direction of said tube at certain intervals are inserted in said tubes.

5. A coal-moisture control process according to Claim 2, wherein stirring means constituted in such a manner that several flat bars are arranged in the axial direction of the tubes to be positioned in contact with the inner surface of said tube are inserted in said tubes.

6. A coal-moisture control process according to any one of Claims 1 to 5, wherein said coal to be dried comprises coking coal.

7. A coal-moisture control process according to any one of Claims 1 to 6, wherein a ratio of a coal layer with respect to a cross-sectional area of said tubes is controlled so as to be 15 to 40 % in average.

8. A coal-moisture control process according to any one of Claims 1 to 7, wherein a ratio of a coal layer with respect to a cross-sectional area of said tubes is 50 % or more at inlet portion of said tubes.

9. A coal-moisture control process according to Claim 7 or 8, wherein the ratio of the quantity of said coal with respect to the cross-sectional area of said tubes is controlled by reducing the rotational speed of said tube dryer near its lowermost level by detecting a level of fine particles of said coal in an inlet hood of said tube dryer so as to prevent rise in said fine particles level as well as by detecting the quantity of said coal discharged from said tube dryer so as to prevent reduction in said quantity of said coal discharged from said tube dryer, under a condition where the quantity of supply of said coal to be dried to said tube dryer is controlled at a substantially constant level.

10. A coal-moisture control process according to any one of Claims 1 to 8, wherein the rotational speed of said tube dryer is controlled for the purpose of raising a temperature of said heating medium such as steam in said tube dryer to be 130 °C or higher.

11. A coal-moisture control process according to Claim 10, wherein a temperature of a tube shell is arranged to be 120 °C or higher as an alternative to making the temperature of said heating medium such as steam to be 130 °C or higher.

FIG. 1

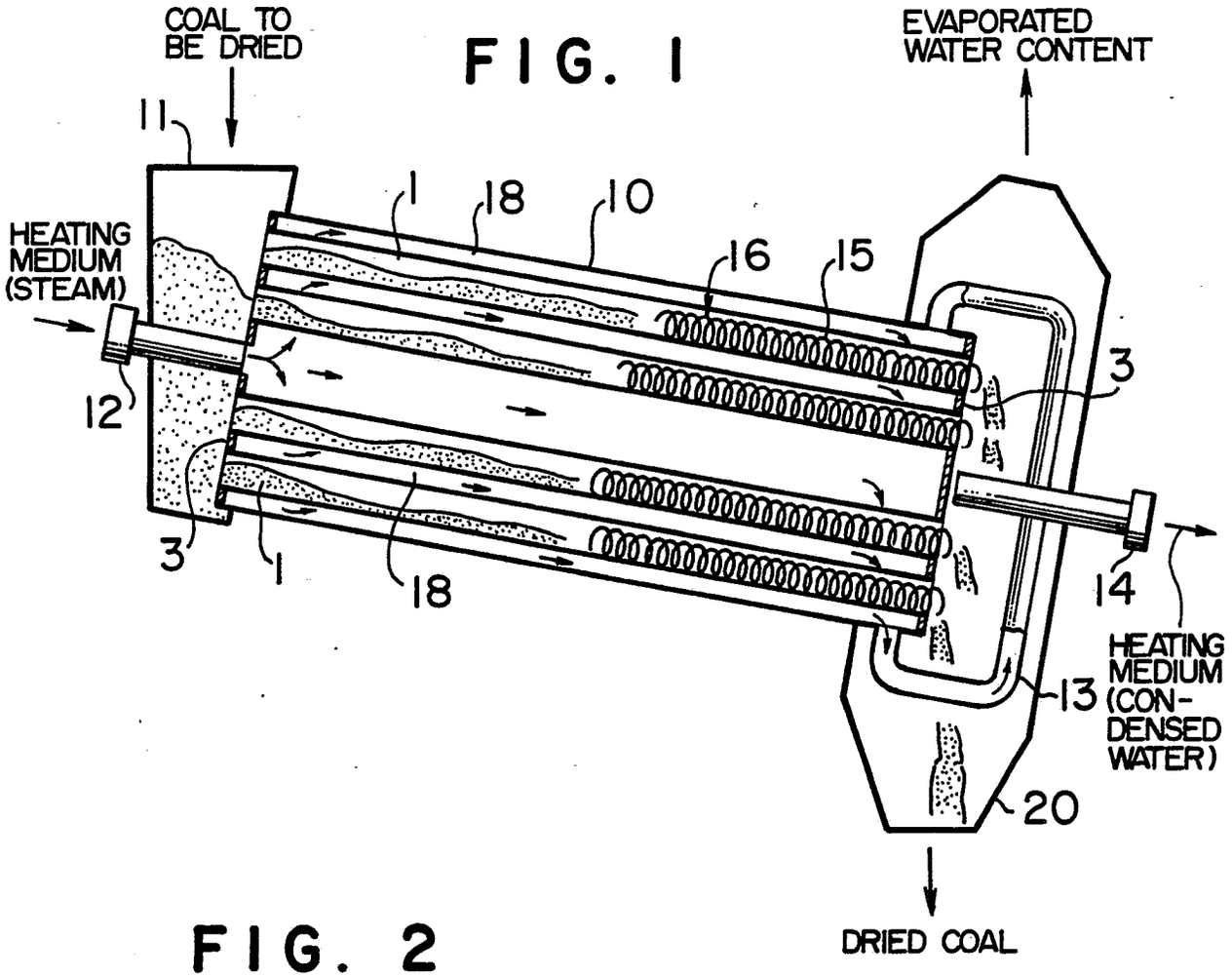


FIG. 2

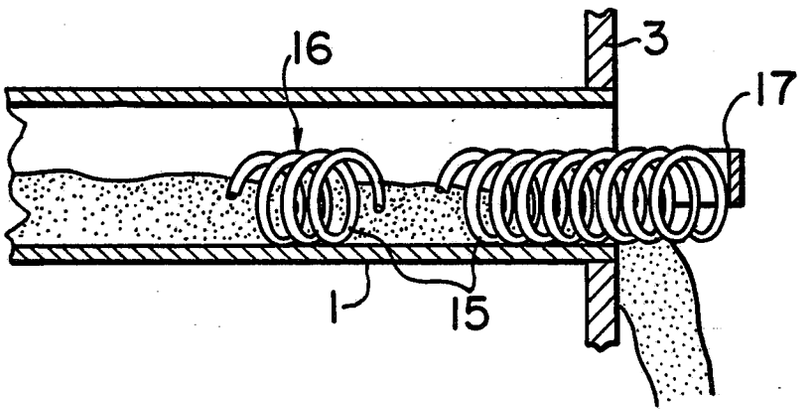


FIG. 3

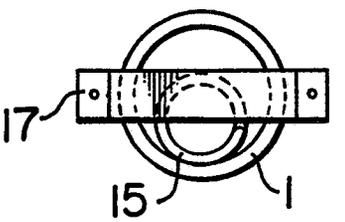


FIG. 4

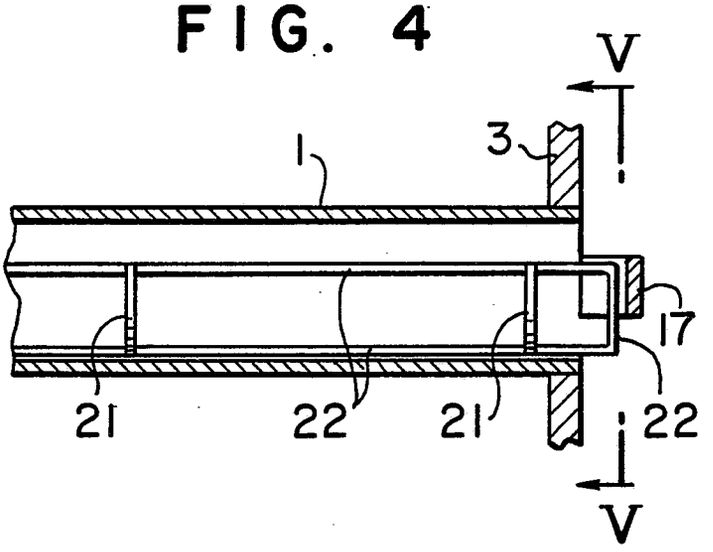


FIG. 5

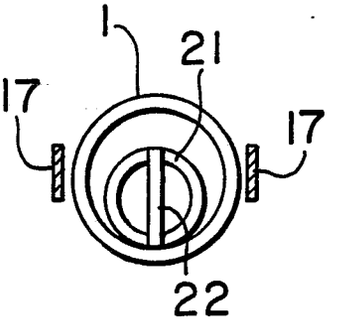


FIG. 6

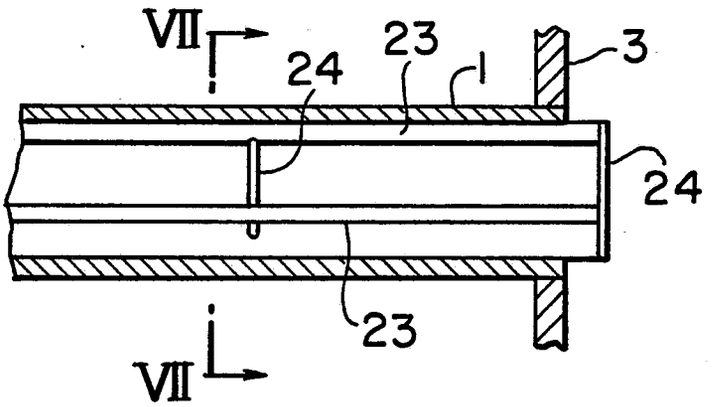


FIG. 7

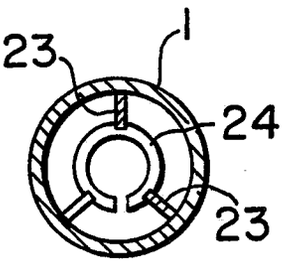


FIG. 9

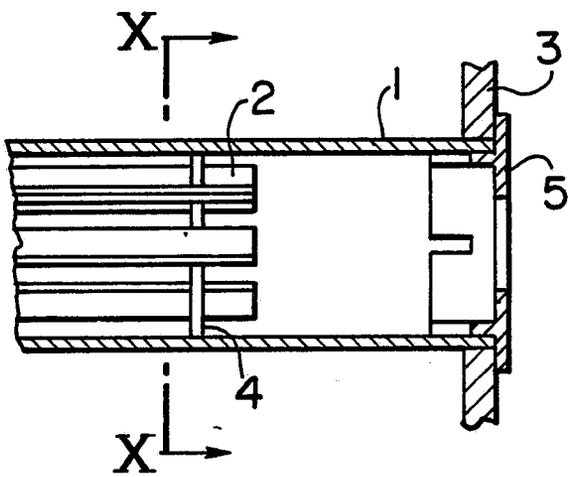


FIG. 10

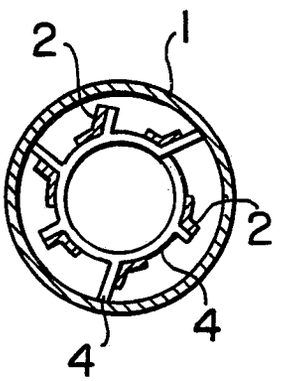
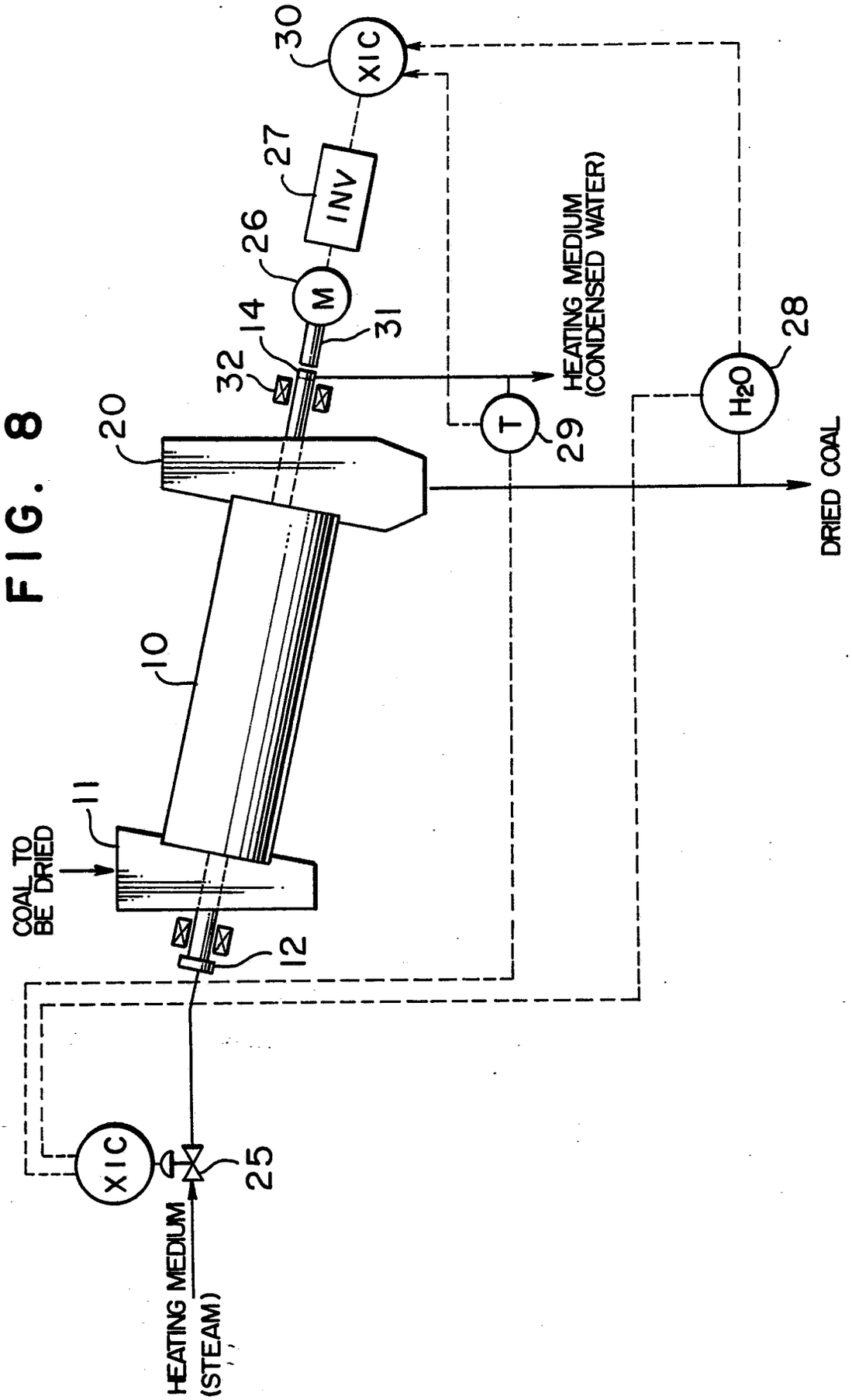


FIG. 8


30
XIC
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INV
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COAL TO BE DRIED
HEATING MEDIUM (CONDENSED WATER)
T
29
28
H2O
DRIED COAL
XIC
25
HEATING MEDIUM (STEAM)

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EUROPEAN SEARCH REPORT

Application Number

EP 88 31 1041

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 047 509 (KOKEREIGESELLSCHAFT SAAR mbH) * Whole document *	1,6	F 26 B 11/04 F 26 B 3/22 C 10 B 57/10
D,A	US-A-3 765 102 (FISCHER) * Whole document *	1,2	
A	DE-C- 611 988 (MASCHINENFABRIK BUCKAU R. WOLF AG) * Whole document *	1-3,5	
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A	DE-B-1 256 158 (MASCHINENFABRIK BUCKAU R. WOLF AG) * Whole document *	1,9	TECHNICAL FIELDS SEARCHED (Int. Cl.5) F 26 B C 10 B
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A	DE-C- 112 659 (MASCHINENFABRIK BUCKAU AG)		
A	EP-A-0 044 476 (BAYER AG)		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13-07-1989	SILVIS H.

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