(57) Abrégé/Abstract:
The present comprises: a first coal dryer; a second coal dryer; and a third dryer, by removing moisture remaining inside and outside of coal, which is used for fueling thermal power plants, in the multiple coal dryers using reheat steam at a high temperature,
incomplete combustion of coal can be prevented, thereby enhancing heat capacity of the coal, minimizing release of pollutants, preventing corrosion and enhancing the durability of a system, reducing the rate of spontaneous combustion due to reduced moisture, improving crushing efficiency of a coal pulverizer and heat distribution of a power boiler when coal is combusted, resolving the issue of clogging of a moving pathway when coal is transported, and improving coal supply stability by increasing utilization of low-quality coal for which demand is low. Furthermore, the following advantages can be provided: use of low heat capacity coal which is more affordable than high heat capacity coal; savings in fuel cost and manufacturing cost by reduced coal importation; reduction of waste, pollutants, and carbon dioxide generated from exhaust gas by relative reduction of coal consumption, and the advantages of replacement of foreign technology and exportation of equipment to foreign markets could be anticipated.
ABSTRACT

The present comprises: a first coal dryer; a second coal dryer; and a third dryer, by removing moisture remaining inside and outside of coal, which is used for fueling thermal power plants, in the multiple coal dryers using reheat steam at a high temperature, incomplete combustion of coal can be prevented, thereby enhancing heat capacity of the coal, minimizing release of pollutants, preventing corrosion and enhancing the durability of a system, reducing the rate of spontaneous combustion due to reduced moisture, improving crushing efficiency of a coal pulverizer and heat distribution of a power boiler when coal is combusted, resolving the issue of clogging of a moving pathway when coal is transported, and improving coal supply stability by increasing utilization of low-quality coal for which demand is low. Furthermore, the following advantages can be provided: use of low heat capacity coal which is more affordable than high heat capacity coal; savings in fuel cost and manufacturing cost by reduced coal importation; reduction of waste, pollutants, and carbon dioxide generated from exhaust gas by relative reduction of coal consumption, and the advantages of replacement of foreign technology and exportation of equipment to foreign markets could be anticipated.
APPARATUS FOR DRYING COAL USING REHEAT STEAM

TECHNICAL FIELD

The present invention relates to an apparatus for drying a coal using a reheat steam, and more particularly, to a coal drying apparatus equipped with a multistage dryer that removes water contained in the coal used as a fuel for thermal power plants by jetting the reheat steam.

BACKGROUND ART

In general, in a thermal power plant that generates power using the coal as a fuel, coal of about 180 tons/hr per 500 MW is combusted, and the coal equivalent to about 37 tons per differentiator is supplied to a boiler. In the thermal power plant of 500 MW that uses the coal, approximately six coal yards having capacity of approximately 500 tons are installed, the normal supply of coal is performed in five of them, and the remaining one is operated as a coal yard that preliminarily stores the coal capable of being used for a certain period of time.

Further, in the thermal power plant that generates power using the coal as a fuel, a standard thermal power design criterion of coal is designed to use a low moisture bituminous coal of 6,080 Kcal/Kg and 10% or less. Imported coal is used in some thermal power plants, and an average moisture water content of some sub-bituminous coals of them
may be equal to or higher than 17%, which lowers the combustion efficiency of the boiler. When the standard thermal power combustion limit is 5,400 Kcal/Kg and a heating value of the used coal is low, a decrease in the power generation amount and an increase in the fuel consumption are expected due to a decline in the combustion efficiency. Furthermore, when using the sub-bituminous coal that is a high-moisture and low-calorific coal, since the moisture content is higher than the design criteria, a conveyance system for transport the coal is not smooth, and when grinding the coal using a differentiator, a decline in the efficiency, a decline in the combustion efficiency due to some incomplete combustion, a deviation of a heat distribution generated in the boiler, and operation in an abnormal state also occur. However, in order to reduce fuel costs in the thermal power plant, the proportion of use of the sub-bituminous coal has gradually increased to about approximately 41 to 60%.

In addition, in the face of safety issues due to expectation of global economic recovery, and destruction of the nuclear power plant caused by Japanese huge earthquake, the preference of the thermal power plant increases, and demand and price of coal seems to consistently rise. Since the environment of the global coal market changes from the consumer to the provider, stable supply and demand of coal are difficult, a production volume of the high calorific
coal is expected to be maintained at current levels, and thus, an imbalance of coal supply and demand is expected.

Although the low-calorific coal is about 47% among the total deposits of the world's coal and its deposits are much, since there are problems of a low calorific value, a high moisture content and a combustion failure during combustion, and the high moisture low calorific coal has a difficulty in complete combustion, it is ignored in the market. Until recent years, worldwide, although there has been a high tendency of relying on stable prices of petroleum and low-production unit price of the nuclear power generation, in recent years, due to a sharp rise in the price of petroleum and a sense of insecurity to the nuclear power generation, many constructions of the thermal power generation that uses coal have been planned.

As conventional techniques (thermal drying) for drying the coal, a rotary drying method for drying the internal coal particles with high-temperature gas, while rotating a cylindrical shell into which coal is charged, a flash pneumatic drying method for raising and drying the high-temperature dry gas from bottom to top, while supplying the cola from top to bottom, and a fluid-bed drying method for drying the coal, while the high-temperature dry gas being raised upward along with fine particles have been mainly used.

Coal is divided into a surface moisture adhered to a
gap between the coal particles, and a coupling moisture coupled to an internal pore of the coal. As the surface moisture, moisture sprayed during a cleaning process in the production area and at the time of transportation and storage is most, and its amount is determined depending on a surface area and absorbency. As the particles are small, the surface area becomes greater, capillary is formed between the particles, and contains moisture, and a water content increases. The coupling moisture is formed at a generation epoch of the coal, and is low in the order of lignite, bituminous coal (bituminous coal and sub-bituminous coal), and anthracite coal. When the coal has much moisture, the heating value decreases and the transportation costs also increase. Thus, it is necessary to control the moisture in the process of mixing, pulverizing, and separation of the coal.

In addition, as the relevant prior art, there are a drying apparatus of Korean Registered Patent Publication No. 10-0680905 (published Jan. 8, 2007), and a coal drying apparatus that uses a superheated steam of Korean Registered Patent Publication No. 10-1216827 (published Dec. 28, 2012).

DISCLOSURE

TECHNICAL PROBLEM

An object of the present invention is directed to enhance a heating value of coal so that coal used as fuel in
thermal power plant can keep proper moisture content of coal
by being dried using a dried reheated steam, thereby being
able to improve the combustion efficiency of the boiler and
reduce the use of fuel.

Also, another object of the present invention is to
provide a drying technique capable of preventing
environmental problems due to incomplete combustion of the
coal through the regulation of the moisture contained in the
c coal, and a technique that can be applied to a thermal power
plant.

TECHNICAL SOLUTION

According to an aspect of the present invention, there
is provided an apparatus for drying coal using reheat steam,
the apparatus including a first coal dryer; a second coal
dryer; and a third dryer, a pair of first drive sprockets
and a pair of first driven sprockets are spaced apart from
each other at a constant distance and are fastened to each
other by first chains, a plurality of first transport plates
is hinged between the first chains, a pair of first guide
rails that horizontally supports the first transport plates
is installed below an upper second chain connected between
the first drive sprocket and the first driven sprocket, a
pair of second guide rails that horizontally supports the
first transport plates is installed below a lower first
chain connected between the first drive sprocket and the
first driven sprocket, a first steam chamber that injects a reheat steam supplied from a reheater is installed below the upper first chain, a second steam chamber that injects the reheat steam supplied from the reheater is installed below the lower first chain, a first exhaust chamber that collects an exhaust gas is installed above the upper first chain, and a second exhaust chamber that collects the exhaust gas is installed above the lower first chain; a pair of second drive sprockets and a pair of second driven sprockets are spaced apart from each other at a constant distance and are fastened to each other by second chains, a plurality of second transport plates are hinged between the second chains, a pair of third guide rails that horizontally supports the second transport plates is installed below an upper second chain connected between the second drive sprocket and the second driven sprocket, a pair of fourth guide rails that horizontally supports the second transport plates is installed below a lower second chain connected between the second drive sprocket and the second driven sprocket, a third steam chamber that injects a reheat steam supplied from a reheater is installed below the upper second chain, a fourth steam chamber that injects the reheat steam supplied from the reheater is installed below the lower second chain, a third exhaust chamber that collects an exhaust gas is installed above the upper second chain, and a fourth exhaust chamber that collects the exhaust gas is
installed above the lower chain; the third coal drier being
installed below the second coal dryer to naturally dry the
coal at room temperature, while transporting the coal dried
by the reheat steam, and the coal primarily dried in the
first coal dryer is charged to the second coal dryer to be
secondarily dried.

Further, in the present invention, a steam supply pipe
that supplies the reheat steam from the reheater may be
connected to each of the first steam chamber through the
fourth steam chamber, and a gas discharge pipe that
discharges the exhaust gas may be connected to each of the
first exhaust gas chamber through the fourth exhaust gas
chamber.

Further, in the present invention, the first steam
chamber through the fourth steam chamber and the first
exhaust gas chamber through the fourth gas chamber may be
partitioned into plural numbers.

Further, in the present invention, the first transport
plate is hinged to the first chain by being deflected, the
second transport plate is hinged to the second chain by
being deflected, a plurality of through-holes are formed in
each of the first transport plate and the second transport
plate, and a punching ratio of each through-hole compared to
a total area of the first transport plate and the second
transport plate may be 10 to 15%.

Further, in the present invention, a guide bar may be
installed below each of the first driven sprocket and the second driven sprocket.

Further, in the present invention, each of the first drive sprocket and second drive sprocket may be connected so that rotational power generated from the drive motor is transmitted through a reduction gear.

It should be understood that different embodiments of the invention, including those described under different aspects of the invention, are meant to be generally applicable to all aspects of the invention. Any embodiment may be combined with any other embodiment unless inappropriate. All examples are illustrative and non-limiting.

ADVANTAGEOUS EFFECTS

According to the present invention, by removing the moisture remaining on the inside and the outside of the coal as the fuel used in the thermal power plant using the high-temperature reheate steam in a multi-stage coal dryer to prevent incomplete combustion, a calorific value of the coal is improved, the discharge of the pollutants is minimized, corrosion of the system is prevented, the durability is improved, the natural ignition rate with a decrease in moisture is reduced, the grinding efficiency of the coal differentiator and the heat distribution of the power boiler during combustion of coal are improved, it is possible to
eliminate the clogging phenomenon of the path at the time of transportation of coal, and it is possible to improve the stability of the coal supply by enhancing the utilization rate of the low-grade coal of the low-demand. Also, it is possible to use a low calorific coal of a price cheaper than a high-calorific coal, to reduce the fuel cost and the original cost due to a decrease in amount of coal import, and to relatively reduce the coal consumption, thereby being able to achieve an effect of reducing the emissions of waste and contaminating substances generated from the combustion gas and reducing carbon dioxide, and it is possible to expect a substitution effect of overseas techniques and an effect such as an overseas export of equipment.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a block diagram illustrating a coal drying apparatus using reheat steam as an embodiment according to the present invention.

FIG. 2 is a block diagram illustrating the coal drying apparatus using reheat steam according to the present invention.

FIG. 3 is a side view illustrating the coal drying apparatus using reheat steam of the present invention.

FIGS. 4 and 5 are perspective views illustrating main parts of a driven sprocket of the coal drying apparatus using reheat steam of the present invention.
BEST MODE FOR THE INVENTION

Exemplary embodiments of the present invention will be described below in more detail with reference to the accompanying drawings. The present invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the present invention to those skilled in the art. Throughout the disclosure, like reference numerals refer to like parts throughout the various figures and embodiments of the present invention.

An embodiment according to a coal drying apparatus using reheat steam according to the present invention will be described in detail referring to the accompanying drawings.

In FIG. 1, a coal yard 10 is a place that keeps and stores the coal for use as a boiler fuel of a thermal power plant. Coal contains surface moisture and internal moisture. Further, by regularly spraying water to the coal stored in the coal yard 10, the scattering of coal powder is prevented. The coal stored in coal yard 10 is transported to the coal drying apparatus through a transport means such as a conveyor system. At this time, coal in the coal yard 10 from which moisture is not removed may be transferred to a
drying coal supply tank 20 connected to the coal drying apparatus and stored therein.

Further, coal stored in the coal supply tank 20 is supplied to the coal drying apparatus 100 from a coal fixed amount supplier 30 in a fixed amount.

The coal drying apparatus 100 includes two dries of a first coal dryer 110 and a second coal dryer 140 installed in a multi-layer manner, and a third coal dryer 170 for naturally drying coal discharged from the second coal dryer 140. The first coal dryer 110 and the second coal dryer 140 have the same structure.

In FIG. 2, in the first coal dryer 110, a pair of first drive sprockets 111, and a pair of first driven sprockets 112 installed to be spaced apart from the first drive sprockets at a fixed distance are installed. In the first drive sprockets 111 and the first driven sprockets 112, sprockets are constituted on both sides of a drum with a width of a certain size. Thus, the first drive sprockets 111 and the first driven sprockets 112 are located at a certain horizontal distance, and each of a pair of sprockets is constituted before and after the first drive sprockets 111 and the first driven sprockets 112. The pair of first chains 113 is fastened between a pair of the first drive sprockets 111 and a pair of first driven sprockets 112 to transmit the rotational force.

In FIG. 3, the rotary power generated from the first
drive motor 118 is transmitted to the first drive sprocket 111 via the first speed reducer 119.

In FIG 4, a plurality of first transport plates 114 are hinged between the first chains 113. The first transport plates 114 are consecutively horizontally arranged in a flat plate shape. The first transport plates 114 are hinged between the first chains 113 at regular intervals, the hinges are located by being deflected to the first transport plate 114, and are hinged to hinge holes formed in the chain 113. The first transport plate 114 is formed with vertically penetrated through-holes 114a, and the through-holes 114a are formed at a penetration ratio of about 10 to 15% to the total area of the first transport plate 114. The through-holes 114a are holes through which the reheat steam injected from the bottom passes.

Thus, the coupling of the pair of first drive sprockets 111 and first driven sprockets 112, the first chains 113 and the first transport plates 114 acts as a conveyor that conveys coal.

In addition, a pair of first guide rails 115 which horizontally supports each of a plurality of first transport plates 114 is installed below the first upper chain 113a located between the first drive sprocket 111 and the first driven sprocket 112. Further, a pair of second guide rails 116 which horizontally supports each of a plurality of first transport plates 114 is installed below the first lower
chain 113b located between the first drive sprocket 111 and the first driven sprocket 112. The first guide rail 115 and the second guide rail 116 allow the first transport plate 114 hinged to the first chain 113 by being deflected to convey the coal, while maintaining the horizontal state. At this time, the transport plates are constituted by two stages so that, while the first driven sprocket 112 fastened to the first chain 113 rotates by the rotational force of the first drive sprocket 111, the coal can be transported by the first transport plate 114 coupled to the upper first chain 113a, and the coal can be transported by the first transport plate 114 coupled to the lower first chain 113b.

A first steam chamber 120 formed with a constant space portion is formed below the upper first chain 113a, and a second steam chamber 123 formed with a constant space portion is formed below the lower first chain 113b. The first steam chambers 120 and the second steam chambers 123 may be divided into one or more sections and installed. The reheat steam supplied from the reheater 40 through the steam supply pipe 121 is supplied to the first steam chamber 120 and the second steam chamber 123.

Also, a first exhaust gas chamber 124 formed with a constant space portion is formed over the upper first chain 113a, and a second exhaust gas chamber 126 formed with a constant spaced portion is formed over the lower first chain 113b. The first exhaust gas chamber 124 and the second
exhaust gas chamber 126 may be divided into one or more sections and installed. The first exhaust gas chamber 124 and the second exhaust gas chamber 126 are configured to collect the exhaust gas changed after being injected from each of the first steam chamber 120 and the second steam chamber 123, and thereafter, to discharge the exhaust gas to the outside through the gas discharge pipe 125. A blower for sucking the exhaust gas can be installed in the gas discharge pipe 125. The exhaust gas discharged through the gas discharge pipe 125 is put into the reheater 40, and the reheat steam reheated at a constant temperature is supplied to the first steam chamber 120 and the second steam chamber 123 of the first coal dryer 110 through the steam supply pipe 121.

Meanwhile, the second coal dryer 140 is installed at the lower end of the first coal dryer 110 to secondarily dry the coal first dried in the first coal dryer 110 by the reheat steam, and the second coal dryer 140 has substantially the same configuration as the first coal dryer 110.

That is, a pair of second drive sprockets 141, and a pair of second driven sprockets 142 installed to be spaced apart from the second drive sprockets at a fixed distance are installed in the second coal dryer 140. Sprockets are constituted on both sides of a drum having a width of a certain size in the second drive sprocket 141 and the second
driven sprockets 142. Thus, the second drive sprocket 141 and the second driven sprocket 142 are located at a horizontally certain distance, and are configured so that a pair of sprockets is located before and after each of the second drive sprocket 141 and the second driven sprocket 142.

Then, a pair of second chains 143 is fastened for transmitting the rotational force between a pair of the second drive sprockets 141 and the pair of second driven sprockets 142. A plurality of second transport plates 144 is hinged between the second chains 143. The second transport plates 144 are consecutively and horizontally arranged in a flat plate shape. The second transport plates 144 are hinged at regular intervals between the second chains 143, the hinges are located by being deflected to the second transport plate 144, and are hinged to hinge holes formed in the second chain 143. The second transport plate 144 is formed with vertically penetrated through-holes 144a, and the through-holes 144a are formed at a penetration ratio of about 10 to 15% to the total area ratio of the second transport plate 144. The through-holes 144a are holes through which the reheat steam injected from the bottom passes.

Thus, the coupling of the pair of second drive sprockets 141 and the second driven sprockets 142, the second chain 143 and the second transport plate 144 acts as
a conveyor that conveys coal.

Further, a pair of third guide rails 145 that horizontally supports each of a plurality of second transport plates 144 is installed below the upper second chain 143a located between the second drive sprocket 141 and the second driven sprocket 142. Moreover, a pair of fourth guide rails 146 that horizontally supports each of a plurality of second transport plates 144 is installed below the second lower chain 143b located between the second drive sprocket 141 and the second driven sprocket 142. The third guide rail 145 and the fourth guide rail 146 allow the second transport plate 144 hinged by being deflected to the second chain 143 to convey the coal, while maintaining the horizontal state. At this time, the transport plates are constituted by two stages so that, while the second driven sprocket 142 fastened to the second chain 143 rotates by the rotational force of the second drive sprocket 141, the coal can be transported by the second transport plate 144 coupled to the second upper chain 143a, and the coal can be transported by the second transport plate 144 coupled to the lower second chain 143b.

A third steam chamber 150 formed with a constant space portion is formed below the upper second chain 143a, and a fourth steam chamber 153 formed with a constant space portion is formed below the lower second chain 143b. The third steam chambers 150 and the fourth steam chambers 153
may be divided into one or more sections and installed. The reheat steam supplied from the re heater 40 through the steam supply pipe 121 is supplied to the third steam chamber 150 and the fourth steam chamber 153.

Also, a third exhaust gas chamber 154 formed with a constant space portion is formed over the upper second chain 143a, and a fourth exhaust gas chamber 156 formed with a constant space portion is formed over the lower second chain 143b. The third exhaust gas chamber 154 and the fourth exhaust gas chamber 156 may be divided into one or more sections and installed. The third exhaust gas chamber 154 and the fourth exhaust gas chamber 156 are configured to collect the exhaust gas changed after being injected from each of the third steam chamber 150 and the fourth steam chamber 153, and thereafter, to discharge the exhaust gas to the outside through the discharge pipe 125. A blower for sucking the exhaust gas can be installed in the gas discharge pipe 125. The exhaust gas discharged through the gas discharge pipe 125 is put into the re heater 40, and the reheat steam reheated at a constant temperature is supplied to the third steam chamber 150 and the fourth steam chamber 153 of the second coal dryer 140 via the steam supply pipe 121.

The transport speed of the chains of the first coal dryer 110 and the second coal dryer 140 and the second transport plate are about 4m per minute, and the coal of
about 33 tons per hour may be transported.

The third coal dryer 170 is installed below the second coal dryer 140 and naturally dries the coal dried and discharged by the reheated steam at room temperature, while transporting the coal.

The third coal dryer 170 is made up of a flat belt conveyor or a U-shaped conveyor belt.

The coal naturally dried while passing through the third coal dryer 170 is stored in a dry coal storage tank 50, and then is supplied as fuel for boilers of thermal power plants.

The operation of the coal drying apparatus using a reheat steam of the present invention configured in this way will be described.

First, the drying coal transported to the drying coal supply tank 20 from the coal yard 10 is charged into the coal drying apparatus 100 from the coal fixed amount supplier 30. The drying coal charged at a fixed amount through a first charge port 130 of the first coal dryer 110 of the coal drying apparatus 100 is transported by being loaded on the first transport plate 114 coupled to the upper first chain 113a between a pair of first drive sprockets 111 and a pair of first driven sprockets 112. At this time, the high-temperature reheat steam is supplied to the first steam chamber 120 installed below the upper first chain 113a from the reheater 40 through the first steam supply pipe 121, and
the reheat steam supplied to the first steam chamber 120 is injected into a through-hole 114a formed in the first transport plate 114. When reheat steam is injected through the through-hole 114a, the coal being transported on the first transport plate 114 is dried by being heated. Further, the reheat steam having passed through the through-hole 114a of the first transport plate 114 is collected in the upper first exhaust gas chamber 124 provided above the upper first chain 113a in the form of discharge gas, and then is discharged through the gas discharge pipe 125. Further, the discharge of the exhaust gas to the gas exhaust pipe 125 is accelerated by the blower that sucks exhaust gases. After the exhaust gas discharged through the gas discharge pipe 125 is put into the reheater 40 and is re-heated at a constant temperature, the exhaust gas is supplied to the first steam chamber 120 of the first coal dryer 110 in the state of reheat steam via the steam supply pipe 121.

Further, one or more first steam chambers 120 are continuously installed below the upper first chain 113a, and in the course of coal being transported to the first transport plate 114, the coal is subjected to several drying processes.

In FIG. 3, the first transport plate 114 hinged to the upper first chain 113a by being deflected maintains the horizontal state, while going along the first guide rail
115, and when reaching a disconnected point of the first guide rail 115, the first transport plate 114 enters a vertical state, by being rotated by its own weight by the deflected hinge coupling. At this time, the coal on the first transport plate 114 falls and is loaded on the first transport plate 114 hinged to the lower first chain 113b.

Further, the first transport plate 114 hinged to the first chain 113 to be transported to the first driven sprocket 112 maintains the vertical state, and then is transported in a horizontal state again, by the first guide bar 117 installed in an arc shape at the bottom of the first driven sprocket 112. As illustrated in FIG. 5, the first transport plate 114 transported by the first guide bar 117 fixed on the second guide rail 116 at its one side is changed from the vertical state to a horizontal state.

Also, the coal dropped from the first transport plate 114 of the upper first chain 113a and loaded onto the lower first chain 113b is heated by the reheat steam supplied to one or more second steam chambers 123 consecutively installed at the bottom of the first lower chain 113b, and thus, the coal is subjected to the continuous drying process. The exhaust gas collected after the coal drying in the second exhaust gas chamber 126 provided at the top of the lower first chain 113b is discharged through the gas discharge pipe 125.

Also, the first transport plate 114 hinged to the lower
first chain 113b by being deflected maintains a horizontal state while going along the second guide rail 116, and then, when reaching a disconnected point of the second guide rail 116, the first transport plate 114 enters a vertical state, while being rotated by its own weight due to the deflection hinge coupling. At this time, the coal on the first transport plate 114 is charged into the first charge port 130 of the second coal dryer 140 through the first discharge port 131. The first transport plate 114 hinged to the first chain 113 transported to the first drive sprocket 111 maintains the vertical state, and then becomes a horizontal state again, while being transported along the rotation of the first drive sprocket 111.

Thus, the moisture of surface and inside of the coal transported by being loaded on the first transport plate 114 by the conveyance of the first chain 113 fastened between the first drive sprocket 111 and the first driven sprocket 112 of the first coal dryer 110 is removed by continuous drying of high-temperature reheat steam in each of the upper first chain 113a and the lower first chain 113b.

Meanwhile, when the coal subjected to the drying process in the first coal dryer 110 is discharged through the first discharge port 131, the coal is charged into the second charge port 160 of the second coal dryer 140 which is placed below the first coal dryer 110.

The first dried coal charged through the second charge
port 160 of the second coal dryer 140 of the coal drying apparatus 100 is transported by being loaded on the second transport plate 144 coupled to the upper side of the second chain 143a between a pair of second drive sprockets 141 and a pair of second driven sprockets 142. At this time, the high-temperature reheat steam is supplied to the third steam chamber 150 provided below the upper second chain 143a from the reheater 40 through the second steam supply pipe 151, and the reheate steam supplied to the third steam chamber 150 is injected into a through-hole 144a formed in the second transport plate 144. When the reheate steam is injected through the through-hole 144a, the coal being transported on the second transport plate 144 is dried by being heated. Further, the reheate steam having passed through the through-hole 144a of the second transport plate 144 is collected by the third exhaust gas chamber 154 installed above the upper second chain 143a in the form of exhaust gases, and thereafter, the reheate steam is discharged through the gas discharge pipe 125. Further, discharge of the exhaust gas is accelerated by the blower that sucks exhaust gases in the gas discharge pipe 125. Further, the exhaust gas discharged through the gas exhaust pipe 125 is charged into the reheater 40 and re-heated at a constant temperature, and thereafter, the exhaust gas is supplied to the third steam chamber 150 of the second coal dryer 140 via the steam supply pipe 121 in the reheate steam state.
Also, one or more third steam chambers are continuously installed below the upper second chain 143a, and the coal is subjected to the plurality of drying processes in the process of being transported to the second transport plate 144.

Further, the second transport plate 144 hinged to the upper second chain 143a by being deflected maintains the horizontal state, while going along the third guide rail 145, and thereafter, when reaching a disconnected point of the third guide rail 145, the second transport plate 144 enters a vertical state, while being rotated by its own weight due to the deflected hinge coupling. At this time, the coal on the second transport plate 144 drops and is loaded onto the second transport plate 144 hinged to the lower second chain 143b.

Further, the second transport plate 144 hinged to the second chain 143 transported to the second driven sprocket 142 maintains the vertical state, and thereafter is transported in a horizontal position again by a second guide bar 157 installed in an arcuate shape below the second driven sprocket 142. The second transport plate 144 transported by the second guide bar 157 with one side fixed on the fourth guide rail 146 is changed from the vertical state to the horizontal state.

Furthermore, the coal dropped from the second transport plate 144 of the upper second chain 143a and transported by
being loaded onto the lower second chain 143b is heated by the reheat steam supplied to the one or more fourth steam chambers 153 consecutively installed below the lower second chain 143b and is subjected to the continuous drying process. Further, the exhaust gas collected after the coal drying in the fourth exhaust gas chamber 156 installed above the lower second chain 143b is discharged through the gas discharge pipe 125.

In addition, the second transport plate 144 hinged to the lower second chain 143b by being deflected maintains the horizontal state, while going along fourth guide rail 146, and thereafter, when reaching a disconnected point of the fourth guide rail 146, the second transport plate 144 enters a vertical state while being rotated by its own weight due to the deflected hinge coupling. At this time, the coal on the second transport plate 144 is discharged to the third coal dryer 170 through the second discharge port 161. Further, the second transport plate 144 hinged to the second chain 143 transported to the second drive sprocket 141 maintains the vertical state, and thereafter, enters a horizontal state again, while being transported along the rotation of the second drive sprocket 141.

Thus, the moisture of surface and inside of the coal transported by being loaded on the second transport plate 144 by the conveyance of the second chain 143 fastened between the second drive sprocket 141 and the second driven
sprocket 142 of the second coal dryer 140 is secondarily removed by continuous drying of high-temperature reheat steam in each of the upper second chain 143a and the lower second chain 143b.

The second coal dryer 140 dries the coal by the same configuration and structure as the first coal dryer 110 in the same drying process. Thus, the drying coal is first dried in the first coal dryer 110, and thereafter is secondarily dried in the second coal dryer 140.

The coal having passed through the secondary drying process in the second coal dryer 140 is discharged through the second discharge port 161 and is discharged to the third coal dryer 170. The third coal dryer 170 naturally dries and cools the coal heated at a constant temperature to room temperature, while transporting the coal charged from the second coal dryer 140 by the belt conveyor. The coal transported to the third coal dryer 170 is transported to the thermal power plant 60 after being charged and stored to a dry coal storage tank 50.

The temperature of the coal subjected to the drying process in the first coal dryer 110 and the second coal dryer 140 may be raised to about 90 to 110 °C. Although a spontaneous ignition temperature of coal is about 93 to 95 °C, since the temperature of the reheat steam is about 400 to 600 °C, oxygen is dilute, coal is not ignited, and there is
no danger of fire.

In addition, the reheat steam generated by the reheater 40 is a transparent gas that is obtained by mixing of a latent heat of vaporization as vaporization heat, a condensation transfer heat released by the heating sensible heat and radiation conductive heat. The reheat steam is generated by heating the saturated steam generated in the boiler using reheater. The steam generated in the boiler for the power development has high pressure and high temperature, but the reheat steam generated in the reheater has low pressure and high temperature. Since the reheat steam is generated by heating water of the room temperature, if residual oxygen in the water is few ppm and there is no air mixture, it is possible to perform heat treatment in an oxygen-free state, and the holding calorific value is high, and force of transmitting heat and the drying capacity are very strong. The reheat steam is superior about ten times to the heat treatment capacity of the hot air, that is, high-temperature air. Therefore, the reheat steam is effective in depriving the coal of the latent heat.

While particular embodiments of the present invention have been illustrated and described in the above description, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.
The apparatus for drying coal using reheat steam according to the present invention improves coal calorific value, minimizes emissions of pollutants, protects the corrosion of the system, improves its durability, reduces the natural ignition rate along with a decrease in moisture, improves the grinding efficiency of the coal differentiator and thermal distribution of power boilers during the combustion of coal, may eliminate the path clogging phenomenon at the time of coal conveyance, and may enhance usage of a low-grade coal of lower demand to improve the stability of the coal feed, and thus, there is industrial applicability.
CLAIMS:

1. An apparatus for drying coal using preheat steam, the apparatus comprising:

   a first coal dryer in which a pair of first drive sprockets and a pair of first driven sprockets are spaced apart from each other at a constant distance and are fastened to each other by first chains, a plurality of first transport plates is hinged between the first chains, a pair of first guide rails that horizontally supports the first transport plates is installed below an upper second chain connected between the first drive sprockets and the first driven sprockets, a pair of second guide rails that horizontally supports the first transport plates is installed below a lower first chain connected between the first drive sprockets and the first driven sprockets, a first steam chamber that injects a reheat steam supplied from a reheater is installed below the upper first chain, a second steam chamber that injects the reheat steam supplied from the reheater is installed below the lower first chain, a first exhaust chamber that collects an exhaust gas is installed above the upper first chain, and a second exhaust chamber that collects the exhaust gas is installed above the lower first chain;

   a second coal dryer in which a pair of second drive sprockets and a pair of second driven sprockets are spaced apart from each other at a constant distance and are
fastened to each other by second chains, a plurality of second transport plates are hinged between the second chains, a pair of third guide rails that horizontally supports the second transport plates is installed below an upper second chain connected between the second drive sprockets and the second driven sprockets, a pair of fourth guide rails that horizontally supports the second transport plates is installed below a lower second chain connected between the second drive sprockets and the second driven sprockets, a third steam chamber that injects a reheat steam supplied from a reheater is installed below the upper second chain, a fourth steam chamber that injects the reheat steam supplied from the reheater is installed below the lower second chain, a third exhaust chamber that collects an exhaust gas is installed above the upper second chain, and a fourth exhaust chamber that collects the exhaust gas is installed above the lower chain; and

a third coal dryer which is installed below the second coal dryer to naturally dry the coal at room temperature, while transporting the coal dried by the reheat steam,

wherein the coal primarily dried in the first coal dryer is charged to the second coal dryer to be secondarily dried.

2. The apparatus of claim 1, wherein a steam supply
pipe that supplies the reheat steam from the reheater is connected to each of the first steam chamber through the fourth steam chamber, and a gas discharge pipe that discharges the exhaust gas is connected to each of the first exhaust gas chamber through the fourth exhaust gas chamber.

3. The apparatus of claim 1, wherein the first steam chamber through the fourth steam chamber and the first exhaust gas chamber through the fourth gas chamber are partitioned into plural numbers.

4. The apparatus of claim 1, wherein the first transport plate is hinged to the first chain by being deflected, the second transport plate is hinged to the second chain by being deflected, a plurality of through-holes are formed in each of the first transport plate and the second transport plate, and a punching ratio of each through-hole compared to an total area of the first transport plate and the second transport plate is 10 to 15%.

5. The apparatus of claim 1, wherein a guide bar is installed below each of the first driven sprocket and the second driven sprocket.

6. The apparatus of claim 1, wherein each of the first drive sprocket and second drive sprocket is connected
so that rotational power generated from the drive motor is transmitted through a reduction gear.
Fig. 5