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(54) **A method of drying coal.**

(57) Coal is dried, with a computerized moisture control, by the heat recovered from coke oven gas in a heat recovery unit installed in the collection gas transfer line via a heat transfer fluid, circulating in the unit which exchanges heat with the coke oven gas in the unit and vaporizes, becomes compressed by a compressor to a higher temperature and pressure, flows to an indirectly-heated dryer to dry the coal and is recirculated to the unit.

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TITLE OF THE INVENTION:

A METHOD OF DRYING COAL

BACKGROUND OF THE INVENTION:

1. Field of the Invention:

This invention relates to a method of drying coal and, more particularly, to a method of drying coal advantageously by utilization of the heat recovered from coke oven gas.

2. Description of the Prior Art

In the production of coke, preliminary drying of the charge coal to an adequate moisture content is extremely advantageous as it helps to reduce the heat load of the coke oven. As a consequence, how to dry the charge coal to a prescribed moisture content has become an important problem and a number of solutions have been proposed; for example, drying of the coal by direct contact with hot air or indirect contact with a hot heat transfer fluid (see Japanese Patent Publication No.28241/1974 and Japanese Laid-Open Patent Nos.33774/1982 and 100184/1982).

In commercial practice, however, drying of coal of the order of several hundreds of tons per hour requires a vast amount of heat and securing of such heat poses a serious problem.

One method has proposed to recover the sensible heat of coke oven gas at a suitable site such as the ascension pipe on the top of the coke oven and use it as a source of heat to dry the coal (see Japanese Laid-Open Patent Nos.148504/1977, 129715/1978, 97604/1979, 154404/1979 and 111888/1983 and Japanese Laid Open Utility Model No.101852/1983). With this method, however, an attempt to use an enlarged heat transfer surface to recover more sensible heat from coke oven gas results in a larger formation of tar deposits on the heat transfer surface, which reduces the heat exchange efficiency and makes it difficult to conduct a stable heat recovery operation over an extended period of time. Another shortcoming is that, when the lid at the top of the ascension pipe is opened during the pushing of coke, hot air rises through the ascension pipe carbonizing the tar deposits on the heat transfer surface of the heat exchanger causing the so-called "coking," and the carbonized tar sticks and grows on the heat transfer surface to cause losses in efficiency and malfunctioning of the heat exchanger.

Moreover, with the aforesaid method, each ascension pipe must be equipped with a heat exchanger which in turn must be equipped with piping for circulation of a heat transfer fluid. This will not only increase the capital investment but also complicate control and maintenance of the heat exchange system. Furthermore, the amount of sensible heat recoverable from coke oven gas in the ascension pipe will in effect have a certain limit due to condensation of tar and the subsequent coking of the tar.

Coal, particularly during or after grinding, tends to generate dust if excessively dry. As dust causes environmental pollution, it must be disposed of by a dust collector or the like. Also, coal dust is liable to explode under certain conditions and the dust scattered away causes a great loss of coal. It therefore is highly beneficial to have a capability of drying the coal to any moisture content to meet the particular need.

The present inventors conducted extensive studies on drying of coal by the heat recovered from coke oven gas and discovered that the amount of heat required for drying coal can be recovered from coke oven gas while in transit in the collective gas transfer line after separation of the ammonia liquor via the suction main in the gas-collecting system. The present inventors also discovered that the problems associated with the aforesaid method could be solved and arrived at this invention.

SUMMARY OF THE INVENTION:

The object of this invention is to recover a sufficient amount of heat to dry coal from coke oven gas by providing a heat recovery unit in the collective gas transfer line which transfers coke oven gas collected from oven chambers to the gas-treating plant, circulating a heat transfer fluid through the unit to effect heat exchange with the coke oven gas to vaporize it, compressing the vaporized heat transfer fluid to a higher pressure and temperature by a compressor and circulating it to an indirectly-heated dryer to dry the coal, and also to provide a method of drying coal capable of solving the problems associated with the aforesaid method.

Another object of this invention is to provide a method of drying coal capable of controlling the moisture content in the dried coal to any desirable level as needed. The moisture content in the coal dried by the indirect-heated dryer, the amount of coal charged to the indirectly-heated dryer and the moisture content in the coal before drying are taken as coal parameters while the pressure, flow rate and temperature of the compressed heat transfer fluid are taken as heat transfer fluid parameters. One or more of the coal parameters and one or more of the heat transfer fluid parameters are measured. The measured values of the coal parameters and the target moisture content in the dried coal are fed to the computing unit to compute the target value of the heat transfer fluid parameter. Comparison of the target value with the measured values sends out a control signal to the compressor to control the moisture content in the dried coal.

DETAILED DESCRIPTION OF THE INVENTION:

Coke oven gas evolving from oven chambers flows into the gas-collecting system and leaves the oven side via the collective gas transfer line. The heat recovery unit is installed in the collective gas transfer line and the heat transfer fluid in circulation exchanges heat with the coke oven gas in the unit and vaporizes, becomes compressed to a higher temperature and pressure by a compressor, and flows to the indirectly-heated dryer to dry the coal.

The gas-collecting system in this invention refers to all the facilities between each oven chamber and the collective gas transfer line and normally comprises the ascension pipe which rises from the top of the oven chamber and is an outlet for the coke oven gas, the gooseneck which is connected to the ascension pipe and sprays ammonia liquor to the coke oven gas, the collecting main which is connected to the gooseneck and collects the coke oven gas and the ammonia liquor sprayed into the gooseneck, the suction main which separates the ammonia liquor and the tar condensed in the collecting main, and the gas main which sends out the collected coke oven gas to the collective gas transfer line.

According to this invention, the heat recovery unit is installed in the collective gas transfer line and recovers the

sensible and latent heats from the collected coke oven gas. The efficiency of such recovery varies with the kind of heat transfer fluid in circulation and it can be enhanced by keeping the temperature of the coke oven gas as high as possible at the inlet of the heat recovery unit. The following means are useful to achieve this objective: (1) to control the quantity of ammonia liquor spray in the gooseneck to minimize the heat consumed as latent heat of vaporization of the ammonia liquor; (2) to improve the spray of ammonia liquor to stabilize the temperature of coke oven gas after cooling; (3) to insulate the gas-collecting system consisting of ascension pipe, collecting main, suction main and gas main to minimize heat losses in the system; (4) to separate the sprayed ammonia liquor quickly in the collecting main or suction main; and (5) to recover the radiant heat from the ascension pipe by ammonia liquor and spraying this ammonia liquor.
The coke oven gas after spraying with ammonia liquor in the usual has a temperature of 80 - 86°C at the inlet of the heat recovery unit, and this temperature can be raised to 86 - 150°C by adopti means as described above.

The heat transfer fluid to be circulated through the aforesaid heat recovery unit can be any substance that vaporizes by heat exchange with the incoming coke oven gas and is thermally stable; for example, a substance consisting of carbon, chlorine, fluorine and hydrogen such as CCl_3F, CCl_2F_2, $CHCl_2F$, $CHClF_2$, $CClF_2$- CCl_2F, $C_2Cl_3F_3$, etc. (herein-after referred to as a Flon), methanol, n-pentane; cyclopentane, benzene and water. Of the examples, aliphatic chlorofluorohydrocarbons, i.e. "Flon" and water are preferable because of their higher thermal stability.

Any of known gas-liquid or gas-gas heat exchangers can serve as the heat recovery unit of this invention. The flow path of the heat transfer fluid may be placed either inside or outside of the collective gas transfer line and the heat exchanger may be a shell-and-tube heat exchanger or a spiral heat exchanger and is not limited to any particular type.

Various types of indirectly-heated dryers can be used for drying coal in the method of this invention, but it is preferable to choose the type that agitates and transports the coal to enhance the heat exchange efficiency. An example of such dryers is a rotary dryer or a screw conveyor dryer: the heat transfer fluid circulates through piping provided inside the rotary drum or through the rotating axis and the screw fins. The dryer may be of a vertical or horizontal type. The coal to be dried may be handled at normal or reduced pressure in those indirect-heated dryers.

The amount of heat to be recovered from the coke oven gas in the aforesaid heat recovery unit is determined in consideration of such factors as the target moisture content in the coal after drying and the magnitude of heat loss of the heat transfer fluid during circulation. In case of coal for the production of metallurgical coke, drying of the coal to an exceptionally low average moisture content is liable to generate dust which is known to cause environmental pollution of the work place and its vicinity and must be disposed of by dust collectors or the like at an enormous cost. On the other hand, a too high average moisture content after drying makes the dry unuseful and meaningless in the production of coke. Hence, the average moisture content is decreased to 3 - 8 % by weight, preferably to 4 - 7 % by weight, in the dryer.

In the method of this invention, it is necessary to install a compressor at some point in the path going from the heat recovery unit to the indirectly-heated dryer and compress the circulating heat transfer fluid to a higher pressure and temperature to improve the heat transfer performance of the dryer.

Furthermore, it is desirable to provide a heat exchanger in the path returning from the indirect-heated dryer to the heat recovery unit to preheat the air to be used to dry the coal and enhance the efficiency of the dryer.

It is also desirable to add a bypass line equipped with a cooling means around the heat recovery unit in the collective gas transfer line as a precautionary measure against malfunctioning or shutdown of the coal drying system. There may arise a case where more heat than usual is needed in the indirectly-heated dryer to dry a coal of a higher moisture content. In such a case, excessive recovery of heat in the heat recovery unit results in an increased amount of the vaporized heat transfer fluid which however tends to a decrease of temperature and pressure; on the other hand, the indirect-heated dryer tends to demand a higher pressure for better performance and this requires a higher compression ratio in compressing the heat transfer fluid. The power consumption of the compressor will then increase to a degree varying with the type and performance of the compressor, and it sometimes becomes advantageous from the standpoint of energy cost to introduce the same heat transfer fluid without making up the heat deficiency. This can be accomplished by providing an inlet line between the compressor and the indirect-heated dryer to introduce the heat transfer fluid and an outlet line between the indirect-heated dryer and the heat recovery unit to discharge as much heat transfer fluid as introduced from without. The heat transfer fluid already heated in other heat recovery or generating facilities may be utilized more advantageously as such heat transfer fluid.

In the method of this invention, the moisture content of the coal after drying in the indirect-heated dryer is controlled by controlling the compression ratio of the compressor in compressing the vaporized heat transfer fluid. For controlling this compression ratio, selected parameters of the coal to be dried and of the heat transfer fluid to be used are measured, the measured values of the coal parameters and the target moisture content after drying are introduced in the preset equations to compute the target heat transfer fluid parameter, the computed value is compared with the measured values and a control signal is sent out to control the compression ratio of the compressor.

Such coal parameters include the moisture content in the coal after drying in the indirectly-heated dryer, the amount of coal charged to the dryer, and the moisture content in the coal before drying, and any one of them or two or more may be used. Which coal parameter is used for control of the compressor depends upon the accuracy desirable in control of the moisture content in the coal after drying in consideration of the kind and properties of the charge coal or the accuracy in determination of the coal parameters. A higher accuracy in control of the moisture content in the coal after drying can be achieved by using the moisture content in the coal after drying as parameter and preferably, in addition to this, the amount of coal charged to to the dryer and the moisture content in the coal before drying. The heat transfer fluid parameters include the pressure, flow rate and temperature of the heat transfer fluid after compression, and any one of them or two or more may be used. The heat transfer fluid parameter to be used for controlling the compressor depends upon the accuracy desirable in controlling the moisture content in the coal after drying in consideration of the kind and properties of the heat transfer fluid to be used or the accuracy in determination of the heat transfer fluid parameters. A higher accuracy in control of the moisture content in the coal after drying can be achieved by using the pressure of the heat transfer fluid after compression as parameter. All these parameters can be measured automatically while the coal is being dried in the indirectly-heated dryer or manually at constant intervals when the moisture content in the charge coal is known to vary in a narrow range.

The equations to be used for computing the target heat transfer fluid parameter from the measured coal parameters are properly chosen depending upon the specific coal or heat transfer fluid parameter which is used.

For example, the following equations are used in the cases where the moisture content in the coal after drying (Mr), the amount of coal charged to the dryer (F), and the moisture content in the coal before drying (Mi) are used as coal parameters and the pressure of the heat transfer fluid after compression

(Pm) is used as heat transfer fluid parameter in the computing unit.

(a) Relationship between condensation temperature T_o (^oC) and pressure Pc(mmHg) of the heat transfer fluid vapor:

$$T_o = 3894/(18.433 - \ln Pc) - 230$$

(b) Heat balance in the indirectly-heated dryer :

$$Q_1 = (T_1 - R_2)C_pF + [Mi/(100 - Mi) - Mr/(100 - Mr)]\cdot\lambda\cdot F + (T_1 - T_2)[Mi/(100 - Mi)]\cdot F + Q_{loss}$$

wherein : Q_1 = heat quantity required in the indirect-heated dryer, Kcal/hr,

C_p = specific heat of coal, Kcal/kg^oC,

Mi = moisture content in coal before drying, %

Mr = moisture content in coal after drying, %,

λ = latent heat of vaporization of water, Kcal/kg, and

Q_{loss} = heat loss, Kcal/hr.

(c) Relationship between the amount of heat transfer Q_2(Kcal/hr) and the change in temperature of coal ΔT (^oC) in the indirect-heated dryer:

$$Q_2 = U.A.\Delta T$$

$$\Delta T = (T_2 - T_1)/\ln[(T_o - T_1)/(T_o - T_2)]$$

where : U = overall coefficient of heat transfer, Kcal/m^{2}hr^oC,

A = heat transfer surface area, m^2,

T_1 = temperature of coal at inlet of indirect-heated dryer, ^oC, and

T_2 = temperature of coal at outlet of indirect-heated dryer, ^{o}C.

The measured values of the coal parameters and the preset target moisture content in the coal after drying (Mc) are substituted in the above equations to find the target heat transfer fluid pressure (Pc). The calculated Pc and the measured heat transfer fluid pressure Pm are used to send out a signal to the compressor to control the compression ratio, which in turn controls the amount of heat to be given to the compressed heat transfer fluid.

The aforesaid compressor can be controlled by controlling the rotating speed of the compressor or the guide wing at the heat transfer fluid inlet of the compressor or the damper at the heat transfer fluid inlet of the compressor. When the load varies in a narrow range, the compressor can be controlled simply by controlling the guide wing. On the other hand, when the load varies in a wide range, the compressor can be controlled by variable speed control or by a combination of speed control by pole number change and control of the guide wing at the inlet.

For more precise drying of the coal by the indirectly-heated dryer, parameters other than those described above may be measured and put in the computing unit; for example, temperature of the coal charged to the indirect-heated dryer, temperature of the coal discharged from the dryer, volume and temperature of the drying air, or temperature and moisture of the spent air.

Supplementary control measures which are useful for performing the method of this invention include the stable discharge of condensate by a control of the liquid level in a condensate pot placed between the indirectly-heated dryer and the heat recovery unit,control of the liquid level in the heat recovery unit for a stable supply of the heat transfer fluid, prevention of surging in the compressor by partial recycling of the heat transfer fluid from the compressor to the heat recovery unit, temperature control of the delivered heat transfer fluid by lowering the temperature of the overheated compressed fluid to near its saturation temperature for improving of the heat transfer efficiency in the indirectly-heated dryer, control of a deaerator of the heat transfer fluid in the initial filling during start-up, or control of a device installed in the condensate pot to discharge the incoming air. These measures can be used singly in combination.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 is a flowsheet showing an embodiment of the method of this invention.

Figure 2 is a flowsheet, a slight modification of Fig.1, for the case where water is used as a heat transfer fluid.

Figure 3 is a flowsheet showing a control mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

One embodiment of this invention is described with reference to Figs.1 where Flon is used as a heat transfer fluid.

Hot coke oven effluent from the coke oven 1 rises in the ascension pipe 2 and enters the gooseneck 3 where the gas is cooled to a specified temperature by a spray of ammonia liquor The gas and the ammonia liquor containing tar condensed from the gas flow through the collecting main 4, then through the suction main 5 where the ammonia liquor is separated. The coke oven gas is then collected in the gas main 6 and sent through the collective gas transfer line 7 to the coke oven gas treating unit (not shown).

The heat recovery unit 8 is provided in the collective gas transfer line 7 where heat exchange takes place between the coke oven gas and the heat transfer fluid. The heat recovery unit 8 and the indirectly-heated dryer 9 are connected in circuit by the circulating line 10. The compressor 11 is provided in the circulating line 10 between the heat recovery unit 8 and the indirectly-heated dryer 9. The heat exhanger 12 which heats the air to be introduced into the indirectly-heated dryer 9 and the heat exchanger

13 which cools the heat transfer fluid returning to the heat revovery unit 8 to a specified temperature are provided between the indirectly-heated dryer 9 and the heat recovery unit 8.

The heat transfer fluid is heated in heat exchange with the coke oven gas in the heat recovery unit 8, is compressed by the compressor 11 to a higher temperature and pressure, enters the indirectly-heated dryer where the fluid gives its heat to the coal. The heat transfer fluid emerging from the indirect-heated dryer 9 enters the heat exchanger 12 to heat the air entering the indirectly-heated dryer 9 to dry the coal, then enters the heat exchanger 13 to be cooled to a specified temperature, and returns to the heat recovery unit 8.

The lines 17 are provided for the flow of ammonia liquor. The ammonia liquor condensed in the suction main 5 or in the heat recovery unit 8 flows through the line 17 to the tar decanter 16 and is pumped through the ammonia liquor transfer line 18 to the radiant heat recovery unit 19, a jacket around the ascension pipe, and again spray in the gooseneck 3. The line 20 is provided to withdraw tar from the tar decanter 16. The section in chain lines in Fig. 1 consists of the cooling unit 14, bypass line 15, and the ammonia liquor transfer line 17 and will start towork upon shutdown of the aforesaid coal drying system. Water can be used as a heat transfer fluid in place of Flon. With reference to Fig. 2, an inlet line 21 for introduction of water and an outlet line 22 for withdrawal of water are provided. As much water as is introduced through the inlet line 21 is discharged through the outlet line 22. The heat exchanger 13 to cool the water returning to the heat recovery unit 8 to a specified temperature is not shown in Fig. 2.

In the modification shown in the flowsheet of Fig.2, as shown in Fig.3, a three color infrared moisture meter 24 is provided in the outlet line 23 of the indirect-heated dryer 9 to measure continuously the moisture content of the dried coal and the continuous scale 26 and the three color infrared moisture meter 27 are provided in the coal supply line 25 to the indirectly-heated dryer 9 to determine continuously the weight and moisture content of the charge coal. A continuous pressure gage 28 is provided in the circulating line 10 from the compressor 11 to the inderect-heated dryer 9 to determine continuously the pressure of the heat transfer fluid and the compressor 11 is equipped with the controller 29 to control the compression ratio.

The moisture content in the coal after drying (Mr) measured by the three color infrared moisture meter 24, the amount of coal charged (F) measured by the continuous scale 26, the moisture content in the coal before drying (Mi) measured by the three color infrared moisture meter 27 and the pressure of the heat transfer fluid (Pm) measured by the continuous pressure gage 28 are put in the computer 30. The computer 30 puts out the target heat transfer fluid pressure (Pc) afer computation using the given equations (a), (b), and (c). Both Pc and Pm are fed to the controller 29 which sends out a signal to the compressor to change the pole number and control the inlet guide wing and the compressor 11 compresses the heat transfer fluid to the target pressure Pc.

According to this invention, heat is recovered from coke oven gas while the collected coke oven gas is in transit in the collective gas transfer line. This enables an advantageous and effective recovery of heat for drying coal, eliminates the necessity of installing a heat exchanger or a large number of pipes to each ascension pipe, reduces the capital investment and facilitates the control, inspection and maintenance of piping.

Control of the moisture content of the coal after drying by means of the chosen coal and heat transfer fluid parameters can prevent excessive drying of the coal and suppress generation of dust. Hence, it eases the requirements for dust collecting equipment, virtually eliminates environmental pollution problems and helps to solve the problems of danger of coal dust explosion and loss of coal by dust scattering.

The method of this invention is illustrated with reference to examples which have been carried out in accordance with the flowsheets in Figs. 1 and 2.

EXAMPLE 1

In accordance with the flowsheet in Fig.1, the raw material coal was ground such that the particles below 3mm in size accounted for 88 % or more of the total weight and the average moisture content was 9 % by weight. The coal was further dried to an average moisture content of 5 % by weight and charged to the coke oven 1 at a rate of 450 tons/hr. The coke oven gas, 620°C in the gooseneck 3, was cooled by ammonia liquor spray at a rate of 1,200 m^3/hr, separated from the ammonia liquor in the suction main 5, collected into the gas main, and supplied to the heat recovery unit 8 installed in the collective gas transfer line 7 at 84°C and at a rate of 126,000 Nm^3/hr.

Flon (Flon-113: 1, 2-trichloro-1,2-trifluoro-ethane, $CClF_2$-CCl_2F) was circulated as heat transfer fluid to the heat recovery unit 8 to recover heat from the coke oven gas and 60,000 m^3 of air was introduced to the rotary indirect-heated dryer 9 to dry 450 tons/hr of coal. The gaseous Flon was 80°C and 2.5 kg/cm^2 at the outlet of the heat recovery unit 8, was 90° and

3.5 kg/cm^2 at the outlet of the compressor 11, and condensed in the indirect-heated dryer 9 while releasing its heat there. The liquid Flon was 90°C and 3.5 kg/cm^2 at the outlet of the indirect-heated dryer 9, was 83°C and 3.5 kg/cm^2 at the outlet of the heat exchanger 12, and was cooled to 70°C in the heat exchanger 13 and then lowered in pressure to 2.5kg/cm^2 before returning to the heat recovery unit 8. During this time, the coke oven gas emerging from the heat recovery unit 8 was 76°C, the air of 15°C was heated to 75°C, and the average moisture content of the coal dried in the indirect-heated dryer 9 was 5% by weight.

These results indicate that the heat recovery unit 8 recovered 26.9 x 10^6 Kcal/hr of heat from the coke oven gas, the compressor 11 gave a compression heat of 0.5 x 10^6 Kcal/hr, the indirectly-heated dryer 9 consumed 25.1 x 10^6 Kcal/hr of heat and the heat efficiency was 91.6 %.

EXAMPLE 2

In accordance with the flowsheet in Fig. 2 the same raw material coal as above was used and the drying of the coal was computer-controlled in the manner shown in Fig.3.

The coal was dried to an average moisture content of 5 % by weight and charged to the coke oven 1 at a rate of 450 tons/hr.

The coke oven gas was 700°C at the outlet of the ascension pipe 2, cooled in the gooseneck 3 by 1,500 m^3/hr of ammonia liquor spray, freed from the ammonia liquor in the suction main 5, collected into the collecting main and supplied through the collective gas transfer line to the heat recovery unit 8 at 82.6°C and at a rate of 125,311 Nm^3/hr.

Water was circulated as heat transfer fluid to the heat recovery unit 8 at a rate of 39.0 tons/hr recovering heat from the coke oven gas and drying the coal at a rate of 450 tons/hr in the rotary indirect-heated dryer 9.

The steam was 72.0°C at the outlet of the heat recovery unit 8 and 39.0 tons/hr in quantity and 121°C at the outlet of the compressor 11, and the compression ratio was 1.73. The steam condensed in the indirect-heated dryer 9 to liberate its heat and the condensate was 39.0 tons/hr in quantity and 84°C at the outlet of the indirect-heated dryer 9, 72°C at the outlet of the heat exchanger 12 and returned to the heat recovery unit 8 after reduced in pressure. During this time, the coke oven gas emerging from the heat recovery unit 8 was 77°C, the air of 15°C was heated to 40°C in the heat exchanger 12, and the average moisture content of the coal after drying in the indirect-heated dryer 9 was 5 % by weight.

These results indicate that the heat recovery unit 8 recovered 21×10^6 Kcal/hr of heat from the coke oven gas, the compressor 11 gave a compression heat of 0.9×10^6 Kcal/hr, and the indirect-heated dryer 9 consumed 21.9×10^6 Kcal/hr.

CLAIMS

1. A method of drying coal by utilizing the heat content of hot coke oven gas in which hot coke oven gas generated in oven chambers is collected in a gas collecting system and the gas stream is passed through a collective gas transfer line, characterized by the steps of installing a heat recovery unit in the collective gas transfer line, circulating a heat transfer fluid through the heat recovery unit, vaporizing the heat transfer fluid in the heat recovery unit by heat exchange with the coke oven gas, compressing the vaporized heat transfer fluid to a higher temperature and pressure and circulating the compressed vaporized heat transfer medium to an indirectly heated dryer to dry the coal.

2. A method of drying coal according to claim 1, wherein the heat transfer fluid is Flon.

3. A method of drying coal according to claim 1, wherein the heat transfer fluid is water.

4. A method of drying coal according to any of the claims 1 to 3, wherein the heat transfer fluid emerging from the indirectly-heated dryer is subjected to heat exchange with the air to be introduced into the indirectly-heated dryer and then recirculated to the heat recovery unit.

5. A method of drying coal according to any of the claims 1 to 4, wherein the ammonia liquor is rapidly separated in the collection main or the suction main in the gas-collecting system.

6. A method of drying coal according to any of the claims 1 to 5, wherein the radiant heat from the ascension pipe of the gas collecting system is recovered by ammonia liquor and said ammonia liquor is sprayed into the coke oven gas.

7. A method of drying coal according to any of the claims 1 to 6, wherein one or more of coal parameters selected from the moisture content in the coal after drying in the indirectly-heated dryer, the amount of coal charged to the indirectly-heated dryer, and the moisture content in the coal before drying and one or more of heat transfer fluid parameters selected from the pressure, flow rate and temperature of the heat transfer fluid after compression by the compressor are measured, the measured values of said coal parameters and the target moisture content in the coal after drying are introduced into a computing unit to compute the target heat transfer fluid parameter of said heat transfer fluid parameters, a control signal is sent out to the compressor from the target heat transfer fluid parameter and the measured values of said

heat transfer fluid parameter, and the compressor is controlled by the signal.

8. A method of drying coal acccording to claim 7, wherein the coal parameter to be measured is moisture content in the coal after drying.

9. A method of drying coal according to claims 7 or 8, wherein the heat transfer fluid parameter to be measured is the pressure of the heat transfer fluid after compression by the compressor.

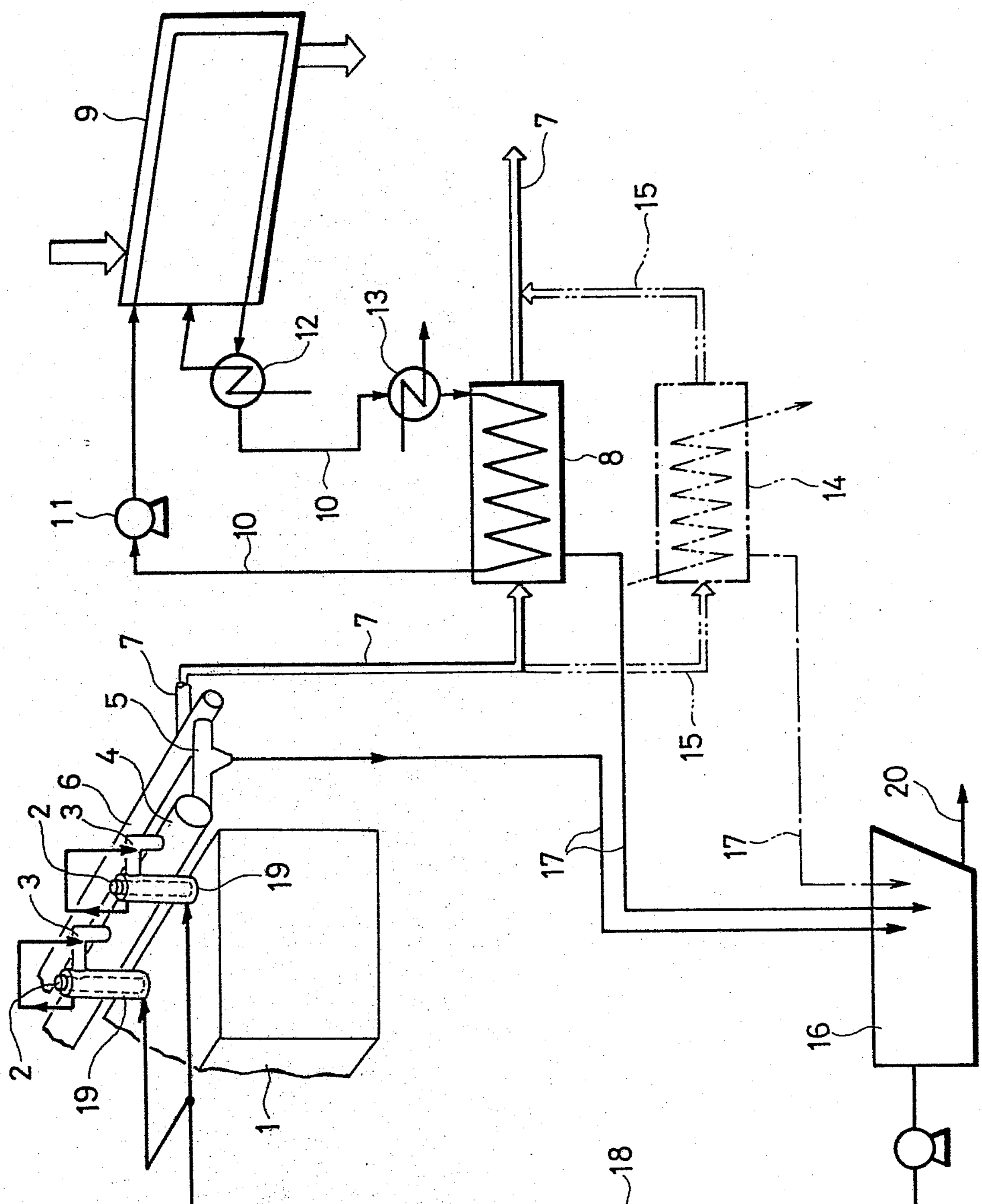

FIG.1

FIG.2

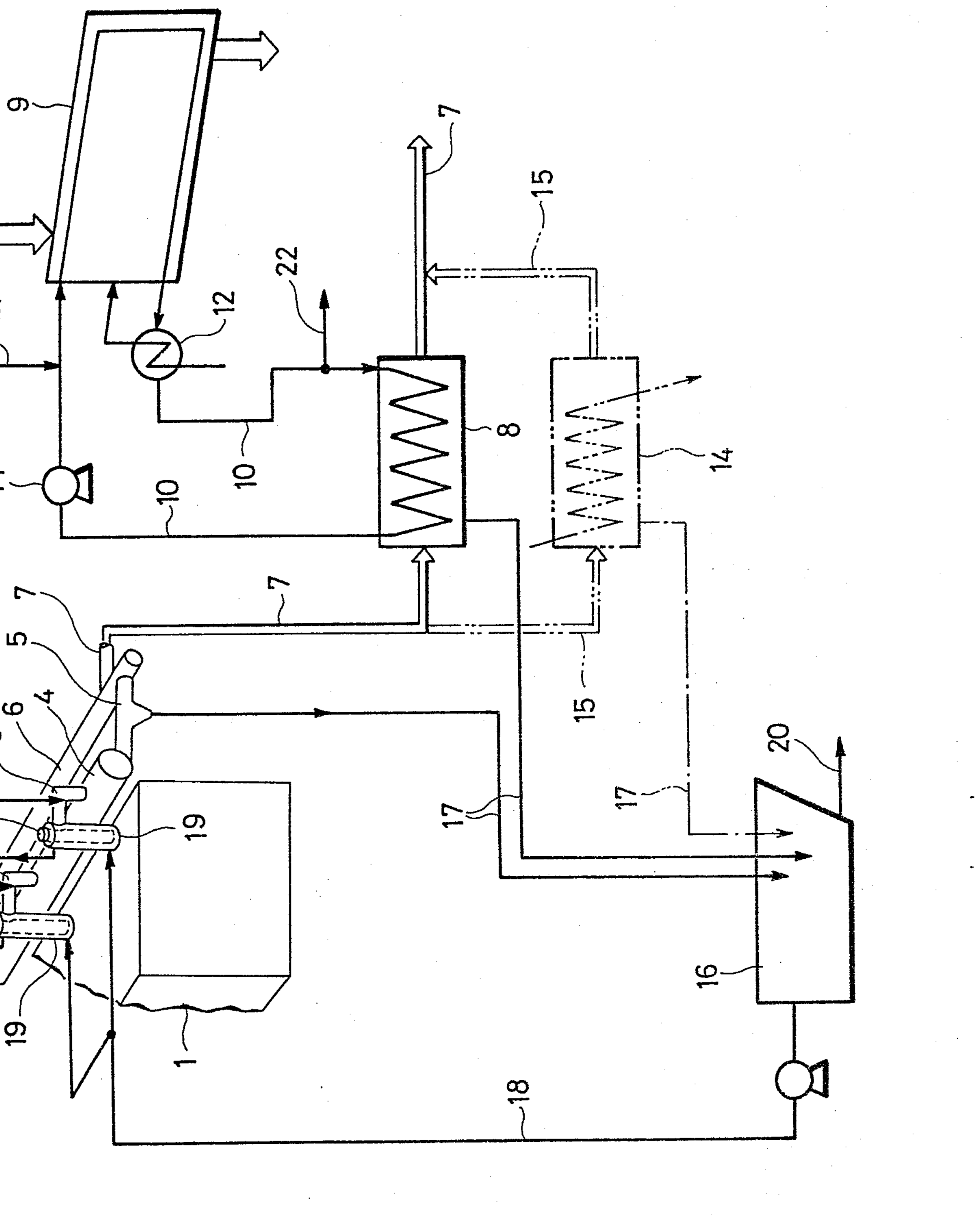

FIG. 3