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METHOD FOR RECOVERING GAS GENERATED IN A COKE OVEN WHEN CHARGING COAL

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FIG. 1

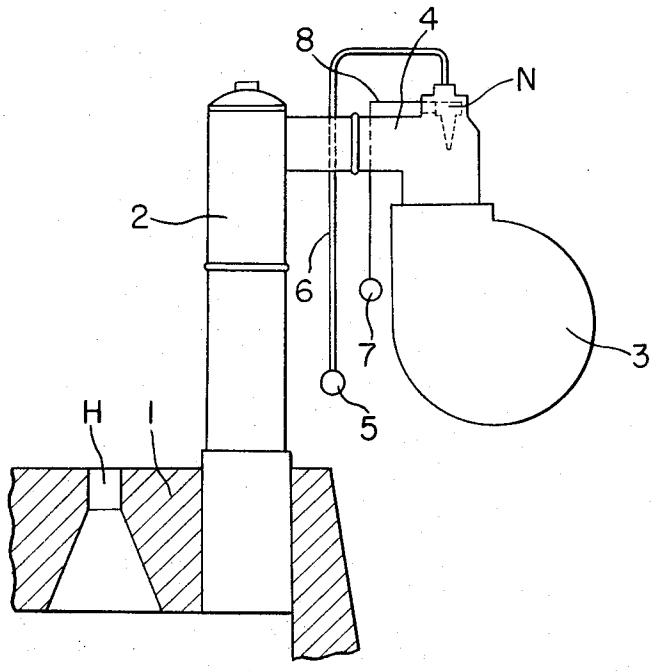
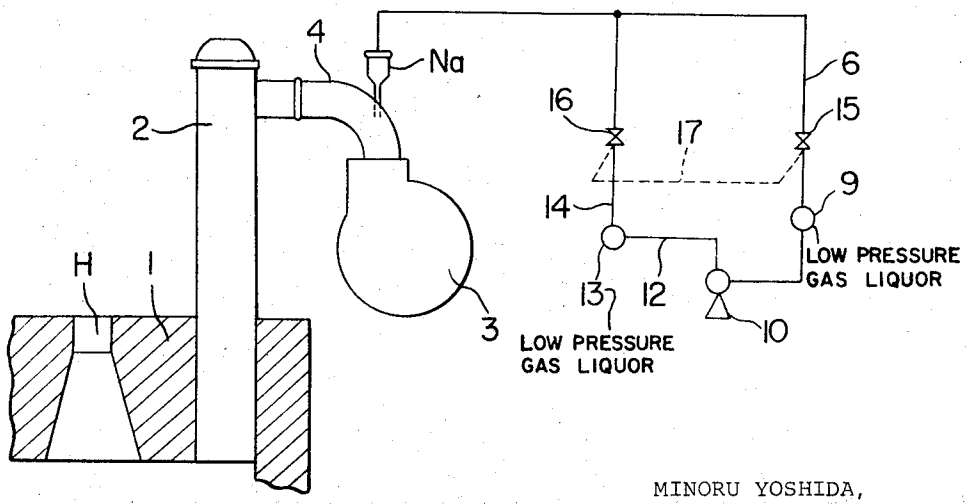


FIG. 2



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METHOD FOR RECOVERING GAS GENERATED IN A COKE OVEN WHEN CHARGING COAL

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ABSTRACT OF THE DISCLOSURE

In a method and apparatus for recovering gas generated in a coke oven wherein a fluid is injected into a conduit interconnecting the coke oven and a gas collecting main, low pressure gas liquor is injected during normal operation of the oven to cool the gas, and high pressure gas liquor is injected during coal charging to draw the gas in the coke oven into the gas collecting main.

REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of our copending application, Ser. No. 38,188, filed May 18, 1970, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a method and apparatus for recovering gas generated in a coke oven while coal or raw material is being charged in the oven.

When charging coal in a coke oven a charging hole of the oven is vented to the atmosphere so that not only the rich gas generated in the oven but also a large quantity of smoke, soot and hot ashes are exhausted thus resulting in the heavy contamination of air and a fire hazard. For this reason, it is necessary to recover the rich gas into a gas collecting main to improve the gas yield and to prevent various public hazards mentioned above.

Various approaches have been proposed in the past to meet this requirement. According to one of the approaches an injection nozzle is provided in a conduit interconnecting the ascension pipe of the coke oven and a gas collecting main to normally inject washing or cooling water toward the gas collecting main to wash the gas, and to inject steam to draw gas and smoke generated in the coke oven and to discharge them into the gas collecting main. More particularly, as shown in FIG. 1 at a bend of a conduit **4** interconnecting an ascension pipe **2** of a coke oven **1** and a gas collecting main **3** an injection nozzle N is provided directed toward the gas collecting main. The nozzle N may be a composite type comprising a central opening through which the water supplied from a water main **5** via a pipe **6** is injected and an annular slit formed to surround the central opening to inject steam supplied from a steam main **7** via a pipe **8**.

During the normal operation of the coke oven relatively low pressure water of about 4 kg./cm.^{2} (gauge pressure), for example, is injected into conduit **4** toward gas collecting main **3** through nozzle N from water main **5** to draw out and cool the gas generated in the coke oven **1**. However, during the charging of coal into the coke oven, as the water pressure is lowered it is impossible to draw out the gas by injecting the low pressure water as above described. For this reason, during coal charging in addition to the above described injection of the low pressure water, high pressure steam is injected through the annular slit from steam main **7** to provide an injection

action to cooperate with the injected water. After the coal charging operation is over injected of steam is interrupted and thereafter only the low pressure water is injected to draw out and cool the gas generated in the coke oven. These two methods cannot completely eliminate the public hazard mentioned hereinabove. Further, they require an expensive high pressure steam generator.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an improved method and apparatus for recovering rich gas generated in a coke oven and for preventing public hazard while coal is being charged in the oven.

Another object of this invention is to provide a novel method and apparatus which can recover rich gas without utilizing steam, thus simplifying the recovering system.

In accordance with the broad aspect of this invention, the gas liquor which is formed by distillation and condensation of the water contained in the raw material coal is used not only for the purpose of cooling the gas but also for recovering the gas in the coke oven while it is being charged with coal. To this end, it is only necessary to add a simple pump to pressurize the gas liquor to a pressure required for injection.

According to one aspect of the invention, the gas liquor obtained by condensing the liquid component of the gas generated in a coke oven is pressurized to a high pressure, for example, 6 kg./cm.^{2} or more (gauge pressure) by means of a suitable pump and then the high pressure gas liquor is injected through a nozzle provided for a conduit between an ascension pipe and a gas collecting main by means of an injector pump, a jet pump for example, whereby to collect or draw out the gas in the oven into the gas collecting main when charging coal into the oven.

According to another aspect of this invention there is provided apparatus for carrying out the above described method wherein an injection nozzle is provided at a suitable position of a conduit interconnecting the ascension pipe and the gas collecting main and conduit means is provided to supply the low pressure gas liquor to the nozzle to cool the gas during the normal operation of the coke oven. Further a pump means is provided to pressurize the low pressure gas liquor to a high pressure, about 6 kg./cm.^{2} (gauge pressure) or more so as to supply the high pressure gas liquor to the nozzle to collect the gas in the coke oven while it is being charged with coal. Valves in the conduits respectively passing the high pressure gas liquor and low pressure gas liquor may be interlocked so that when one of the valves is opened, the other is closed.

BRIEF DESCRIPTION OF THE DRAWING

Further objects and advantages of the invention will be more fully understood from the following detailed description when taken in conjunction with the accompanying drawing in which:

FIG. 1 is a diagrammatic representation of the prior art apparatus described above and

FIG. 2 is a diagram to illustrate a preferred embodiment of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 2 illustrating an embodiment of this invention, portions corresponding to those of FIG. 1 are designated by the same reference numerals. In this case, however, the injection nozzle Na is required to inject only gas liquor so that its construction is more simple than nozzle N shown in FIG. 1 which is required to inject both water and steam. As before, the inner end of the nozzle is directed toward gas collecting

main **3**. A conduit **6** including a valve **15** is connected between nozzle Na and a low pressure gas liquor main **9** which collects water (usually containing ammonium) produced by condensing the water component contained in the gas generated in coke oven **1**. A pump **10** is provided to pressurize the low pressure gas liquor in low pressure gas liquor main **9** to a high pressure of about 6 kg./cm.^{2} or more, for example. The high pressure gas liquor is supplied to a high pressure gas liquor main **13** from pump **10** via conduit **12** and is then supplied to injection nozzle Na via conduit **6** and a conduit **14** including a valve **16**. Valves **15** and **16** may be interlocked as shown by dotted line **17** so that when one of the valves is opened the other is closed. Of course it is possible to independently operate valves **15** and **16** alternately.

During normal operation of the coke oven, charging hole H for charging coal is of course closed and as it is only necessary to cool gas generated in the oven, valve **16** is closed and valve **15** is opened to inject the low pressure gas liquor through the injection nozzle. However, during a coal charging operation as the charging hole H is opened it becomes impossible to draw out the gas in the oven by a suction blower (not shown) connected to gas collecting main **3**. Then valve **15** is closed and valve **16** is opened to supply the high pressure gas liquor pressurized by pump **10** to injection nozzle Na to create sufficient injection action to drive gas, hot ash and smoke in the coke oven into the gas collecting main. The ash and smoke are washed and cooled by the injected high pressure gas liquor and are prevented from escaping into the atmosphere. Moreover, this injection action also creates a sufficient suction in the charging hole H and prevents escape of smoke and the like into the atmosphere through charging hole H. Although the pressure of the high pressure gas liquor may be above 6 kg./cm.^{2} (gauge pressure), preferably from 10 to 25 kg./cm.^{2}, higher pressures are preferred for larger ovens having a height of 6 or 7 meters. However, from the standpoint of economy, it is advantageous to limit the maximum pressure to about 60 kg./cm.^{2}. Since supply of the high pressure gas enhances the pumping action of the injection nozzle Na, the gas generated in the coke oven when it is being charged with the coal can be satisfactorily drawn out into gas collecting main **3**. The result of experiment has demonstrated that there was no appreciable quantity of gas and smoke issuing into the atmosphere through the charging hole H. After charging of coal, valve **15** is opened while valve **16** is closed to again inject the low pressure gas liquor, thus resuming the normal operation.

The method of this invention is advantageous over prior methods in the following points.

(1) As the gas liquor is inherently produced in a large quantity during coke production it is more economical than expensive steam of substantial pressure. The only cost involved is the cost of a small amount of electric power required to inject the gas liquor.

(2) Also the pump for pressurizing gas liquor is less expensive than a steam generator. Further, the injection

nozzle is required to inject only one type of liquid and is not required to inject liquid and steam as in the prior art method so that its construction and the pipings associated therewith can be greatly simplified.

(3) When the electric power required to pressurize the gas liquor is compared with the heat energy of the injected steam on the basis of the work equivalents of heat and electricity, gas liquor is several times more advantageous than steam.

(4) It was actually demonstrated that the power for drawing the gas generated in the coke oven into the gas collecting main is unexpectedly large.

(5) Scale does not accumulate on the injection nozzle and associated pipings.

(6) Loss of the available components of the gas generated in the coke oven in very small so that its quality is not degraded.

(7) Cooling effect for the gas generated in the coke oven is large.

Thus, this invention provides a novel method and apparatus which can eliminate various defects of the prior art, and which are economical and can recover the gas generated in the coke oven and prevent public hazard at the time of charging coal into the coke oven.

We claim:

1. In a method of recovering the gas generated in a coke oven, wherein a fluid is injected through a nozzle into a conduit interconnecting a coke oven and a gas collecting main, the improvement which comprises the steps of injecting a relatively low pressure gas liquor through said injection nozzle during the normal operation of said oven, said gas liquor being obtained by condensing the liquid composition of the gas generated in said coke oven and injecting said gas liquor at a higher pressure through said injection nozzle to draw the gas generated in said coke oven into the gas collecting main while coal is being charged in said coke oven.

2. The method as claimed in claim **1** wherein said gas liquor at higher pressure has a pressure higher than 6 kg./cm.^{2} (gauge pressure).

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