# United States Patent [19]

**Hütgens et al.**

[11] **3,879,180**

[45] **Apr. 22, 1975**


[54] **METHOD FOR TREATING A GAS CURRENT WHICH IS OBTAINED BY COAL GASIFICATION**


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Dec. 18, 1971 Germany ..... 2163096

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[51] **Int. Cl.** ..... **B01d 45/00**

[58] **Field of Search** ..... 55/267, 268, 269, 83, 264; 415/111, 114, 116, 175, 176, 112, 177, 178, 179, 145, 110; 62/9, 11, 16, 19, 23, 36, 37, 39, 40, 41; 48/205, DIG. 8; 201/3, 4, 30; 202/85, 86, 87, 96



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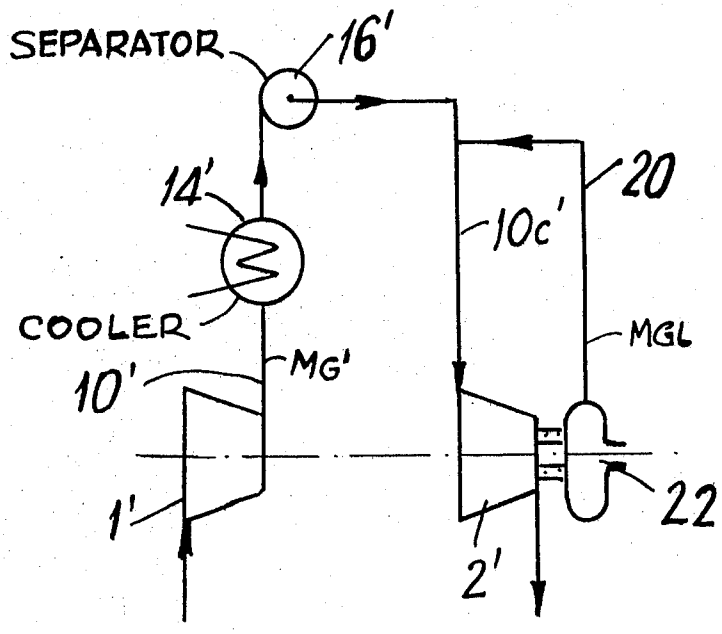
[57] **ABSTRACT**

A method of treating a gas current which is obtained from coal by gasification comprises compressing the gas in several stages and prior to the entrance into a subsequent stage, cooling and separating the liquid from at least a portion of the gas and then heating the cooled and separated gas. The apparatus includes a plurality of compression stages with at least one of the stages having connections to a cooler and a water separator through which the gases pass and including a heater for treating at least the portion of the gas which passed through the cooler and separator and which is then delivered into a conduit for transferring all of the removed gas from the previous stage into a subsequent stage.


**1 Claim, 2 Drawing Figures**



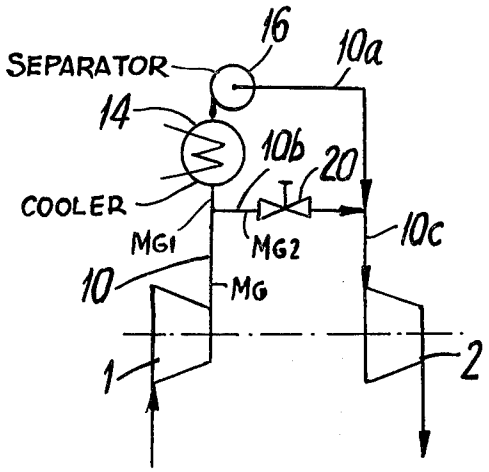

16
SEPARATOR
10a
14
10b
20
COOLER
MG1
MG2
10c
10
MG
1
2

FIG. 1

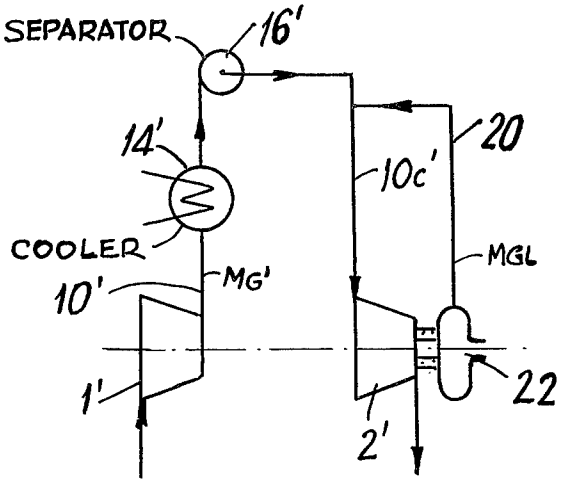

SEPARATOR
16'
14'
20
10c'
COOLER
MGL
10'
MG'
1'
22
2'

FIG. 2

# METHOD FOR TREATING A GAS CURRENT WHICH IS OBTAINED BY COAL GASIFICATION

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates, in general, to a method for treating a gas current which is obtained from coal by gasification and, in particular, to a new and useful method and apparatus for compressing a gas obtained from coal by gasification in several stages wherein at least a portion of the gas is cooled and the liquid separated therefrom and thereafter heated before it is returned into a subsequent stage.

2. Description of the Prior Art

The present invention is particularly applicable to a method for heating up a gas current which is obtained by the gasification of coal or coal dust and which contains no liquid constituents and is compressed in one or several stages. It is known, when the compression is effected in several stages, that the gas current is heated up after cooling and before its entrance into each of the compression stages by using a separate steam or electrical heating and to such a degree that the gas current passing into the subsequent compression stage has a temperature slightly above the point of condensation. This temperature is necessary in order to obtain a gas current which is free from liquid component parts which are capable of dripping, because otherwise the gas would cause erosion and corrosion of the interior of the compressor.

The disadvantages of the known equipment of this type is that it requires a very complicated design of reheating equipment which is expensive to manufacture.

## SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided an improved method and corresponding device for heating up a gas current which has been removed from a stage and prior to its admission into a subsequent stage. With the inventive arrangement, the gas current is heated up between stages to a temperature slightly above the point of condensation, and it is divided into two partial currents, the first partial current which contains the bulk of the gas is conducted through a cooler and a drip separator and is thereafter reunited with the uncooled second partial current which is conducted through a by-pass. A particular advantage of the invention is that the leakage gas which escapes at the compensating piston or at the gland of a succeeding compression stage may be used as a heating gas. The particular advantage of the inventive device comprises an arrangement in which a heating zone is provided at the downstream side of the gas conduit which is connected between adjacent pressure stages and which is arranged after one or several intercoolers or after the gas passes through one or more drip separators. The heating zones comprise one or several conduits leading into the gas conduit for conducting the hot gas, or the heating gas conduit is connected to the gas conduit coming from the intermediate cooler, as a by-pass.

In one embodiment of the invention, the gas is removed from a high pressure stage and a portion thereof is passed through a cooler and a water separator and joined to a portion which is by-passed a location downstream from the cooler and separator and before it enters back into the next compression stage.



In another embodiment, the gas is passed successively through a cooler and a separator and then into a heating zone which is generated by a connecting line from the sealing gland of the next pressure stage.

Accordingly, it is an object of the invention to provide a method of treating a gas current which is obtained from coal by gasification and which comprises compressing the gas in several stages, and prior to the entrance into a subsequent stage, cooling and separating the liquid from at least a portion of the gas and subsequently heating the cooled and separated gas before it is returned into the next stage either by using a portion of the removed but uncooled and unseparated gas or by using a return heating line from a packing gland of the next successive stage.

A further object of the invention is to provide a device for treating a gas current between compressing stages which includes first and second compressing stages having a conduit with a cooler and a water separator therein through which the gases pass and with a second conduit for a portion of the gas to permit bypassing of the cooler and the water separator and which leads to a connection conduit to the second stage along with the cooled and separated gas to provide a heating thereof.

A further object is to provide an arrangement in which substantially all or all of the gases pass through a cooler and a separator and then the cooled and separated gas is joined with gas which is supplied from a packing gland of the next pressure stage before the combined gas is delivered to the next pressure stage.

A further object of the invention is to provide an apparatus for treating gas which is obtained by coal gasification which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a schematic diagram of a compressor having a heating gas conduit for cooled and separated liquid which comprises a gas by-pass; and

FIG. 2 is a diagram similar to FIG. 1 of another embodiment of the invention and in which leakage gas is used as a heating gas.

## GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, in particular, the invention embodied therein in FIG. 1 comprises a device for treating a gas current obtained from coal by gasification and which comprises a first or high compression stage **1** which is connected to a gas treatment conduit **10** which is divided into two branches **10***a* and **10***b*. The total gas current which leaves the high compression stage **1** is directed as a total gas mG through the conduit **10** and a portion thereof, the bulk of the gas flows

through the branch conduit **10***a* as the gas mG1 which is conducted through a cooler **14** and a separator **16** through a combined conduit **10***c* which leads into the second stage **2.**

In accordance with the invention, a smaller portion of the gas *m*G2 flows through the by-pass conduit **10***b* having a regulating valve **20** and it heats the gas flowing through the conduit **10***a* before it passes through the combined conduit **10***c* to the second stage **2.** Thus, with the method of the invention, a second gas current or partial current *m*G2 which is separated from the main current *m*G before its entrance into the cooler and separator is regulated in respect to current flow quantity so that it acts on the partial gas current *m*G1 to lead it above the point of condensation. Due to the heating of the undercooled partial current *m*G1, the last liquid constituents of this gas current are evaporated and the re-united gas current passes through the conduit **10***c* into the compression stage **2** free from liquid component parts which are capable of dripping.

In the embodiments shown in FIG. **2,** a high pressure stage **1'** is connected to a conduit **10'** having a cooler **14'** and a drip separator **16'** through which the gas current is directed. In this example, the gas current *m*G' in its entirety flows through the cooler and the separator and the heat necessary to heat the gas to remove any further condensation is effected by a connecting line **20** which connects to a gland **22** providing a seal at the discharge end of the next stage **2** a heating gas *m*G1 which is a leakage gas flows through the conduit **20** and into a combined conduit **10***c'* so that the leakage gas *m*G1 mixes with the gas *m*G' in a sufficient quantity to heat the combined gas to a temperature above the condensation point.

In each of the embodiments described, a heating zone is effected to treat the gases which are removed and pass through the cooler and the separator in each case. This heating zone may consist of a foreign gas heating zone or of a heat exchanger which forms a part of the conduit shown at **10***c* or **10***c'* in FIGS. **1** and **2,** respectively. In the case of a foreign gas heating, one or more connecting conduits are provided for supplying the hot gas. In the case of a heat exchanger, this may take the form of a jacket surrounding the conduit **10***c* or **10***c'* or of a separate pipe arranged within the same.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

**1.** A method of treating gas current attained from coal by gasification, comprising compressing the gas in several stages, removing the gas from one of said stages and, prior to its entrance into a subsequent stage, cooling at least a portion of the gas and separating the liquid therefrom, and collecting leakage gas from a subsequent compression stage and subsequently heating the cooled and separated gas before it is delivered to the next stage by contacting it with the leakage gas.

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