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BOC GROUP PLC

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**High purity hydrogen and carbon monoxide recovery - from hydrocarbon steam reformat by pressure swing adsorption process**

C92-052851

E.31-A1) H(2-D) J(1 E3D)

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H<sub>2</sub> and CO are produced by:

(A) passing a feed mixt. comprising H<sub>2</sub>, CO, CO<sub>2</sub> and CH<sub>4</sub> through a pressure swing adsorption system (I) contg. a bed of adsorbent which adsorbs CO<sub>2</sub>, CO and CH<sub>4</sub> leaving H<sub>2</sub> as pure non-adsorbed product;

(B) desorbing CO from (I) to form a CO-rich fraction;

(C) desorbing CO<sub>2</sub> and CH<sub>4</sub> from (I) to form a CO<sub>2</sub>-rich fraction;

(D) passing the CO-rich fraction to a pressure swing adsorption system (II) contg. a bed of adsorbent which adsorbs CO and leaves H<sub>2</sub>, CO<sub>2</sub> and CH<sub>4</sub> as non-adsorbed fraction; and

(E) desorbing CO from (II) as a pure product.

Also claimed is a process comprising:

(A') passing the feed mixt. through the first stage of a pressure swing adsorption system to separate CO as

adsorbed fraction;

(B') passing the non adsorbed fraction of CO<sub>2</sub>, CH<sub>4</sub> and H<sub>2</sub> to the series connected second stage of the system to separate CO<sub>2</sub>, CH<sub>4</sub> and CO as adsorbed fraction, and H<sub>2</sub> as non-adsorbed pure product;

(C') desorbing CO<sub>2</sub> and CH<sub>4</sub> from both stages to form a CO<sub>2</sub>-rich fraction; and

(D') desorbing CO from the first stage to form a pure CO product.

#### USE/ADVANTAGE

Merchant grade CO and H<sub>2</sub> are obtd. from a steam reformed hydrocarbon product by an economical process, requiring low capital costs (cf. cryogenic method) giving increased CO recovery.

#### PREFERRED PROCESS

Feedstream comprises up to 80% H<sub>2</sub>, up to 70% CO, up to 30% CO<sub>2</sub> and up to 3% CH<sub>4</sub>.

Adsorption bed in (A) and (B') comprises activated carbon and zeolite mol. sieves, esp. type 5A, 10X, 13X zeolite mol. sieves or mordenites.

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Adsorption bed in (D) and (A') comprises Cu exchanged Y-type aluminosilicate zeolite mol. sieves, Cu exchanged alumina or Cu exchanged activated carbon.

The CO<sub>2</sub>-rich fraction can be desorbed with depressurisation and a hydrogen purge and recycled to a hydrocarbon steam reformer. Steps (D), (A') and (B') are suitably operated at adsorption pressure 150-600 psia.

In (A), (I) may be divided into first and second series-connected beds. Feed gas enters the first bed inlet and leaves at the second bed outlet. Desorbed CO-rich fraction is removed from between the beds. Desorbed CO<sub>2</sub>-rich fraction is removed from the first bed inlet.  
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