

distribution nozzles and to the reactor wall air distribution openings. The method and apparatus of the present invention result in higher reactor hydrodynamic turndown ratios than can be achieved with conventional single-bed reactors. For example, a hydrodynamic turndown ratio of 6.6 to 1 can be achieved by the use of the method and apparatus of the present invention.

**4340572**

**PROCESS FOR RECOVERING HEAT  
FROM STACK OR FLUE GAS**

Da Ben-Shmuel; Philip Zacuto; assigned to Woodside Construction Inc.

A method and apparatus for efficiently recovering heat from a gas stream such as discharged flue gas. The gas stream is countercurrently contacted with a liquid medium in two stages. A first countercurrent contact stage is between a partially cooled gas stream and cold liquid medium in a bed of packing through which the cold liquid medium flows downwards and the partially cooled gas stream flows upwards, so that a warmed liquid medium and fully cooled gas stream are produced. The second countercurrent contact stage is between the warmed liquid medium derived from the first contact stage and the hot initial gas stream in a plurality of parallel vertically oriented passages. The warmed liquid medium flows downward on the inner walls of the vertically oriented passages as a thin liquid film, while the hot initial gas stream flows upward within the vertically oriented passages, so that a fully heated liquid medium and the partially cooled gas stream are produced. The second contact stage accomplished high direct contact heat transfer with low mass transfer, so that minimal heat is lost as heat of vaporization of liquid medium evaporated into the gas stream. The fully heated liquid medium is passed in indirect heat exchange with a fluid, so that the liquid medium is cooled and the fluid, which

may be water, air, or a process fluid stream, is heated.

**4340566**

**CATALYST REGENERATION  
APPARATUS**

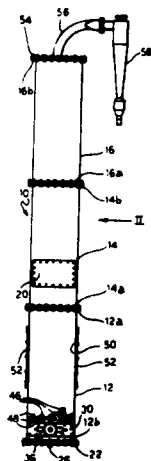
Gregory Thompson; Anthony Vickers; assigned to UOP Inc.

A catalyst regeneration apparatus for the oxidation of coke from a spent catalyst, said coke being converted to CO, and for the conversion of the CO to CO<sub>2</sub>. Hot regenerated catalyst is recycled from a dense bed in the regeneration zone to mix with incoming spent catalyst in a mixer zone. The mixer zone operated in dense phase and is supplied with a relatively small amount of a fluidizing medium, preferably air. After the mixing of spent and fresh catalyst is substantially completed, a relatively large amount of a regenerating gas, preferably air, is admixed with the catalyst mixture, and some coke oxidation occurs. The balance of coke oxidation takes place in a downstream-situated regeneration zone of substantially conventional design. There is a transfer section connecting the mixer zone to the regeneration zone through which the relatively large amount of the regenerating gas is admitted. The transfer section is preferably a substantially horizontal surface having an outside perimeter intermediate the outside perimeters of the regeneration and mixer zones. Regeneration gas addition is made through multiple perforations in the transfer section.

**4340400**

**FLUIDIZED BED FILTERING  
AND/OR HEAT EXCHANGE  
APPARATUS PARTICULARLY  
FOR GASEOUS DISCHARGES  
FROM INTERNAL COMBUSTION  
ENGINES AND INDUSTRIAL  
PLANTS**

Armando Campanile; Giovanni M. Carlomagno; Angelo De Vita; Giorgio Donsi; Leopoldo Massimilla; Agostino Scognamiglio; assigned to Centro Ricerche Fiat S p A; Universita' Degli Studi di Napo



A fluidized bed filtering and heat exchange apparatus particularly for treating gaseous discharges from internal combustion engines and industrial plants comprises a vertical-axis elongated casing (10) having a filler of inert, particulate material therein, a gas feed manifold (36) provided with discharge nozzles arranged to direct gas downwardly into said casing (10) to maintain said filler in a fluidized state, and a cyclone (58) communicating with the upper part of said casing (10) to receive said gas therefrom and to separate agglomerated particles from said gas. Heat-exchange means are provided for cooling the fluidized filler including a plurality of tubes (46) for carrying a heat-exchange fluid therethrough.

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