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PTO/SB/16 (10-01)

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This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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Additional inventors are being named on the 1 separately numbered sheets attached hereto

TITLE OF THE INVENTION (500 characters max)
Method for Reducing Emissions from Evaporative Emissions Control Systems

Direct all correspondence to: CORRESPONDENCE ADDRESS

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ENCLOSED APPLICATION PARTS (check all that apply)

Specification Number of Pages CD(s), Number

Drawing(s) Number of Sheets Other (specify)

Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

Applicant claims small entity status. See 37 CFR 1.27.

A check or money order is enclosed to cover the filing fees

The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:

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FILING FEE AMOUNT (\$)

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

No.

Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted

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Date

REGISTRATION NO.
(if appropriate)

Docket Number:

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Docket Number

CNR No. 2001-79

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Number 2 of 2

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application for

**METHOD FOR REDUCING EMISSIONS
FROM EVAPORATIVE EMISSIONS CONTROL SYSTEMS**

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method for reducing emissions from evaporative control systems including activated carbon particulate-filled canisters and adsorptive monolith-containing canisters, which monoliths include activated carbon, and to using said adsorbing canisters to remove volatile organic compounds, and other chemical agents from fluid streams. More particularly, this invention relates to using said vapor-adsorbing materials in hydrocarbon fuel consuming engines.

2. Description of Related Art (Including Information Disclosed Under 37 CFR 1.97 and 37 CFR 1.98)

(a) *Standard Working Capacity Adsorbents*

Evaporation of gasoline from motor vehicle fuel systems is a major potential source of hydrocarbon air pollution. The automotive industry is challenged to design engine components and systems to contain, as much as possible, the almost one billion gallons of gasoline evaporated from fuel systems each year in the United States alone. Such emissions can be controlled by canister systems that employ activated carbon to adsorb and hold the vapor that evaporates. Under certain modes of engine operation, the adsorbed hydrocarbon vapor is periodically removed from the carbon by drawing air through the canister and burning the desorbed vapor in the engine. The regenerated carbon is then ready to adsorb additional vapor.

Under EPA mandate, such control systems have been employed in the U.S. for about 30 years,

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and during that time government regulations have gradually reduced the allowable emission levels for these systems. In response, improvements in the control systems have been largely focused on improving the capacity of the activated carbon to hold hydrocarbon vapor. For example, current canister systems, containing activated carbon of uniform capacity, are readily capable of capturing and releasing 100 grams of vapor during adsorption and air purge regeneration cycling. These canister systems also must have low flow restrictions in order to accommodate the bulk flow of displaced air and hydrocarbon vapor from the fuel tank during refueling. Improvements in activated carbons for automotive emission control systems are disclosed in U. S. Patent Nos.: 4,677,086; 5,204,310; 5,206,207; 5,250,491; 5,276,000; 5,304,527; 5,324,703; 5,416,056; 5,538,932; 5,691,270; 5,736,481; 5,736,485; 5,863,858; 5,914,294; 6,136,075; 6,171,373; 6,284,705.

A typical canister employed in a state of the art auto emission control system is shown in Figure 1. Canister 1 includes support screen 2, dividing wall 3, a vent port 4 to the atmosphere (for when the engine is off), a vapor source connection 5 (from the fuel tank), a vacuum purge connection 6 (for when the engine is running), and adsorbent material fill 7.

Other basic auto emission control system canisters are disclosed in U. S. Patent Nos.: 5,456,236; 5,456,237; 5,460,136; and 5,477,836.

Typical carbons for evaporative emission canisters are characterized by standard measurements of bed packing density (“apparent density,” g/mL), equilibrium saturation capacity for 100% butane vapor (“butane activity,” g/100g-carbon), and purgeability (“butane ratio”), specifically, the proportion of adsorbed butane from the saturation step which can be recovered from the carbon by an air purge step. The multiplicative product of these three properties yields a measure of the carbon’s effective butane “working capacity” (“BWC”, g/dL),

measured by ASTM D5228-92, which has been established in the art as a good predictor of the canister working capacity for gasoline vapors. Carbons that excel for this application have high BWC, typically 9 to 15+ g/dL BWC, as a result of high saturation capacities on a volumetric-basis for butane (the product of density and butane activity), and high butane ratios (>0.85). In terms of isothermal equilibrium adsorption capacities across all vapor concentrations, these carbons characteristically have high incremental capacity as a function of increased vapor concentration (*i.e.*, isotherm curved upward on a semi-log graph). This isotherm upward curve reflects the high working capacity performance feature of these carbons, in that gasoline vapors are adsorbed in high quantity at high concentrations but readily released in high concentration to an air purge stream. In addition, these carbons tend to be granular (somewhat irregularly shaped) or cylindrical pellet, typically of a size just about 1-3 mm in diameter. It has been found that somewhat larger sizes hinder diffusional transport of vapors into and out of the carbon particle during dynamic adsorb and purge cycles. On the other hand, somewhat smaller size particles have unacceptably high flow restriction for displaced air and hydrocarbon vapors during refueling.

(b) *Diurnal Breathing Loss (DBL) Requirements*

Recently, regulations have been promulgated that require a change in the approach with respect to the way in which vapors must be controlled. Allowable emission levels from canisters would be reduced to such low levels that the primary source of emitted vapor, the fuel tank, is no longer the primary concern, as current conventional evaporative emission control appears to have achieved a high efficiency of removal. Rather, the concern now is actually the hydrocarbon left on the carbon adsorbent itself as a residual “heel” after the regeneration (purge) step. Such emissions typically occur when a vehicle has been parked and subjected to

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