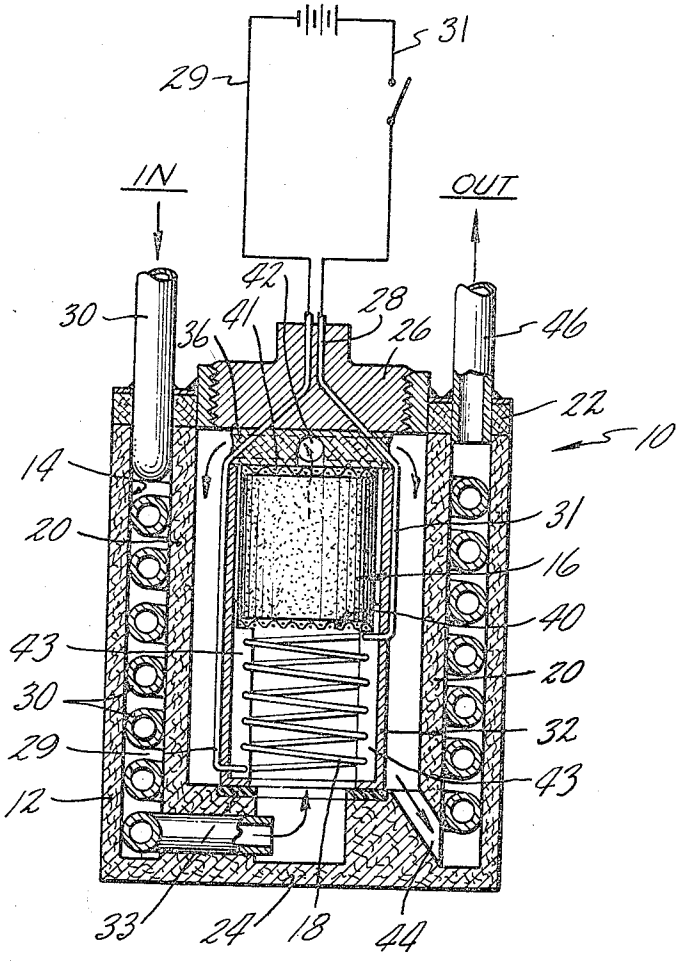
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CATALYTIC BURNER

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CATALYTIC BURNER

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ABSTRACT OF THE DISCLOSURE

A catalytic burner houses a catalytic bed centrally disposed in a sealed container. A heat transfer tube is helically wound around the catalytic bed and is sandwiched between an insulation lining the wall of the container and a cylindrical insulating shell spaced therefrom. The gas to be reacted is admitted through the helically wound tube directing the gas through the catalytic bed from the bottom of the container through the bed where it is turned 180° and returned back to the bottom between an annular space between the bed and the cylindrical shell. It is then discharged out of the container by passing in heat exchange relation with the gas in the tubes between gaps formed adjacent coils of the helically wound tube.

This invention relates to apparatus for carrying out catalytic oxidation of gases and particularly to apparatus for removing carbon monoxide that is metabolically generated by the exhalation of occupants of an enclosed compartment.

In a sealed compartment of a space vehicle it is necessary to keep potentially toxic gases like carbon monoxide at a tolerable level. As is well known in the art, carbon monoxide gas can be chemically reacted in a catalytic burner forming the more harmless carbon dioxide. However, equally well known is the fact that there isn't presently available compact, lightweight, and low power consuming apparatus specifically designed for continuous conversion of carbon monoxide to carbon dioxide when present in the below toxic parts per billion to 100 parts per million range.

It is therefore an object of this invention to provide a miniaturized catalytic burner which requires a minimum of power attendant the operation of a space vehicle for efficiently and continuously converting carbon monoxide to carbon dioxide when present in the below toxic concentration range described above.

Other features and advantages will be apparent from this specification and claims and from the sole drawing which illustrates a preferred embodiment of this invention.

Referring now specifically to the sole figure illustrating the catalytic burner generally indicated by numeral **10** as comprising an outer shell **12** housing the regenerative heat exchanger generally indicated by numeral **14**, the catalytic bed **16** and the heater **18**. Coaxially mounted to the outer shell **12** is spaced inner shell **20**, both shells being formed from a suitable insulating material such as Fiberglas reinforced plastic. A top closure member **22** is suitably bonded to the top end of outer shell **12** and the top end of inner shell **20** and an enclosing bottom section **24** is suitably bonded to the inner periphery of the bottom section of outer shell **12** and the bottom of inner shell **20**. Top enclosure member **22** may carry a removable cap **26** which is suitably retractably mounted by the threads formed in a centrally formed bore. The removable cap **26** has an opening **28** for receiving a pair of electric conducting wires **29** and **31** which extend from a small external battery into the inner shell **20** and connect to heater **18**.

Mounted between the outer shell **12** and the inner shell **20** is a helically wound metal coil **30** having one end projecting through an opening in the top section **22** for receiving air to be treated. The discharge end of coil **30** terminates adjacent a central opening formed in the bottom of the burner which is in communication with heater **18** suitably supported by an enclosed cylinder **32**. As can be seen from the drawing, cylinder **32** is integral with cap **26** joined suitably through spacer **36** and butts at the far end against rubber gasket **33** inserted in the recess formed on the bottom closure **24** of the inner shell **20**. Spacer **36** carries a plurality of openings **42** which communicate internally with the cylinder **32** and the annular space defined between cylinder **32** and inner shell **20**. A catalytic bed generally indicated by numeral **16**, which may contain suitable metal oxide catalysts such as manganese dioxide or precious metal catalysts, rhodium metal on alumina shown to be particularly efficacious as an oxidation promoter, is supported in cylinder **32** between a suitable screen **41** abutting the spacer **36** and a second screen **40** supported to the top of heater **18**. It is apparent from the foregoing that the inner shell **32** consisting of the heater and catalyst bed is formed into a single unit and is retractable through the opening covered by cap **26**. The heater **18** comprises a suitable heating element helically supported in any suitable manner to the cylindrical wire support **43** which may be formed from any suitable material having a low thermal conductivity.

As noted from the drawing, breathable atmosphere comprising low parts per million carbon monoxide admitted to the coil **30** is directed in a helical path to discharge in the center of the catalytic burner. It is there turned 90° and directed to the heating element **18** where it is heated and then transmitted directly to the catalytic bed **16** where the carbon monoxide is oxidized to carbon dioxide. The gases discharging from the catalytic bed **16** are then directed through the plurality of openings **42** where they are then directed down to the bottom of the catalytic burner through the annular space defined between the inner shell **20** and the container **32**. The gas from here is then directed through opening **44** where it passes between the space defined by the adjacent coil of the helical coil **30** where eventually it discharges to the tube **46** projecting through the top casing member **22**. In this arrangement it is noted that the gases emitted to the heater and the gases discharged from the catalytic bed are placed in indirect heat exchange relationship through the wall of container **32**. Again, these gases emitted from the space defined from the heating cylinder and the inner shell are placed at indirect heat exchange relation with the gases entering the catalytic burner as they are passing through the helical coils. In this arrangement, as will be appreciated by one skilled in the art, efficient oxidation takes place with a minimum of power consumption.

The catalytic burner described herein is generally of the type described in U.S. application Ser. No. 398,449 filed on Sept. 22, 1964, by Harlan Brose and assigned to the same assignee.

It should be understood that the invention is not limited to the particular embodiment shown and described herein, but that various changes and modifications may be made without departing from the spirit or scope of this novel concept.

I claim:

1. A catalytic burner adapted for continuous catalytic oxidation including an outer shell and an inner shell coaxially mounted in spaced relation, top and bottom enclosure members abutting the top and bottom ends of the inner and outer shells, an inlet and outlet projecting

through said top enclosure member into said space defined between said inner and outer shells, a helically wound coil with spaces between adjacent coil elements mounted in the space between the inner and outer shell and having one end connected to said inlet and a free end terminating adjacent the bottom enclosure member close to the central portion thereof, container means housing a catalyst and heater means upstream of the catalyst and having wall means coaxial with and spaced from the inner wall of the inner shell, said container means adapted to receive fluid from said free end through an opening in the bottom end of said inner shell and to discharge fluid through openings formed at the top of said container means toward the bottom of said inner shell through the space between said wall means and inner wall of the inner shell, and an opening in the inner shell interconnecting the space between the container means and inner shell and the space between adjacent coil elements.

2. A catalytic burner as claimed in claim 1 including a retractable cap threadably mounted in said top enclosure member.

3. A catalytic burner as claimed in claim 2 including sealing means mounted between the bottom end of said inner shell and the bottom end of said container means.

4. A catalytic burner adapted for continuous catalytic oxidation including an outer shell and an inner shell coaxially mounted in spaced relation, top and bottom enclosure members abutting the top and bottom ends of the inner and outer shells, an inlet and outlet projecting through said top enclosure member into said space defined between said inner and outer shells, a helically wound coil with spaces between adjacent coil elements mounted in the space between the inner and outer shell and having one end connected to said inlet and a free end terminating adjacent the bottom enclosure member adjacent an opening formed in the central portion thereof, a reactor section having a housing supporting a catalyst bed and heater

means upstream of the catalyst, said housing having wall means coaxial with and spaced from the inner wall of the inner shell, said heater being mounted adjacent the opening formed in the bottom of said inner shell and adapted to receive fluid from said free end and to discharge fluid to said catalytic bed, a top cover mounted on one end of said housing adjacent the catalytic bed having openings communicating the catalytic bed with the space between said wall means and inner wall of the inner shell, and an opening in the inner shell interconnecting the space between the container means and inner shell and the space between adjacent coil elements.

5. A catalytic burner as claimed in claim 4 wherein said reactor section includes spaced screen-like elements extending transversely relative to the inner diameter of said housing and sandwiching said catalytic bed.

6. A catalytic burner as claimed in claim 5 including an annular shaped seal interposed between the bottom of said inner shell adjacent said opening and the bottom of said housing.

7. A catalytic burner as claimed in claim 4 wherein said heater means includes a cylindrical heater support member and a heating element helically supported on the internal diameter thereof.

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