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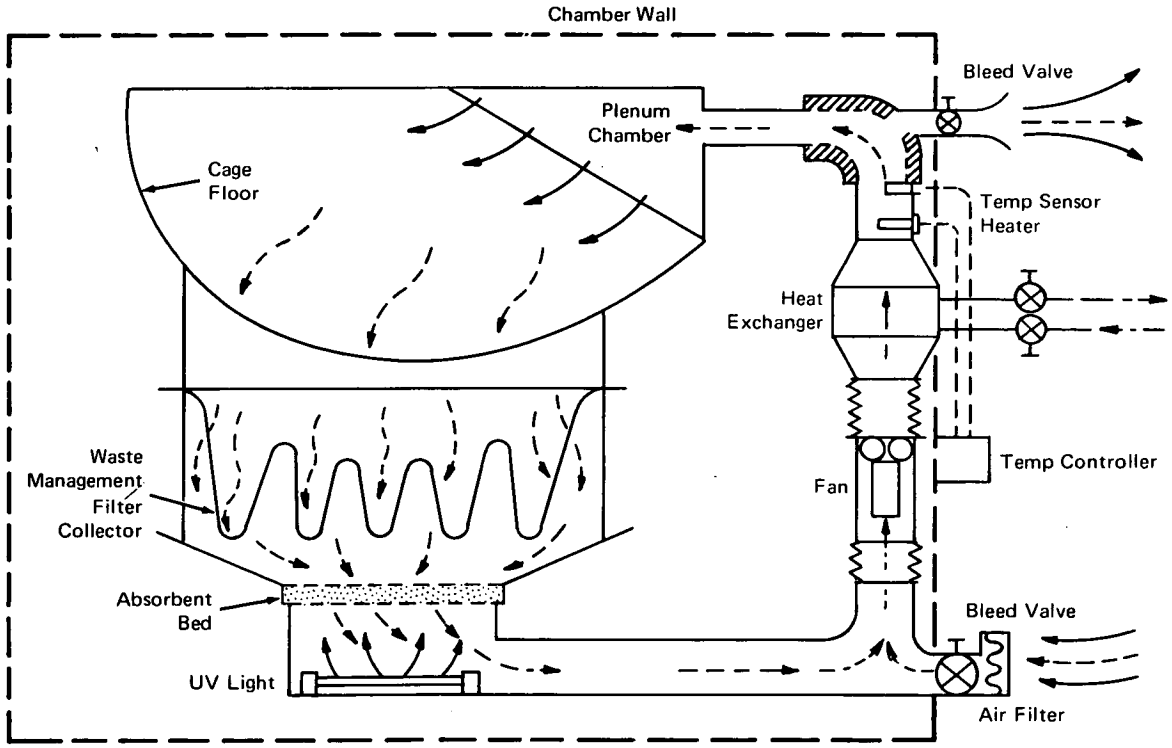
NASA TECH BRIEF

Langley Research Center

Environmental Control and Waste Management System Design Concept

This design is a passive device to contain both solid and liquid animal waste matter for an extended period without being cleaned and without contaminating the animal. A constant airflow dries the solid waste and evaporates liquid matter. This technique will automatically maintain controlled atmospheric conditions and cage cleanliness during periods of 6 months to 1 year. If a closed loop air purification system were included, highly contagious diseases could be studied without jeopardizing other animals or exposing humans to hazards.

A fan continuously circulates air through a heat exchanger (for temperature control), the cage, waste collector, and absorbent bed. See illustration for schematic diagram of the system. Air enters the top of the cage from a plenum chamber, which ensures a uniform mass flow and velocity distribution across the cage. The mass flow and velocity for a unit designed to house a rhesus monkey were 1115 kg./hr. (2458 lb./hr.) and 9.1 m./min. (30 ft./min.) respectively. At this velocity, the air scavenges debris and waste from the cage and transports them through the grilled floor to a waste management filter collector.



(continued overleaf)

The filter collector is made up of seven screens, each layer having a smaller sized grid. The top screen has a 3.18 mm. x 3.18 mm. (1/8 in. x 1/8 in.) grid, the second is a copper screen with a 1.59 mm. x 1.59 mm. (1/16 in. x 1/16 in.) grid, the third and fourth were 100 and 200 mesh screens. The last three layers were fiberglass screening. This composite filter is convoluted to give as large an effective area as possible. For the rhesus monkey design, an effective area of 9.29 $m.^2$ (100 sq. ft.) was selected. In addition to holding the solid and liquid waste, this filter traps dust from the airstream. Because of the large surface area and the fact that waste will probably be localized, the airflow is not expected to be appreciably reduced with time. Liquid waste is retained in the filter and is evaporated by the airflow.

Downstream of the filter collector is an absorbent bed which removes odors and some trace gases from the air. The bed is a composite containing activated charcoal, phosphoric acid impregnated charcoal, and calcium carbonate. Most of the odors are removed by the activated charcoal. Ammonia is removed by the acid impregnated charcoal. The buildup of other trace contaminants is controlled by two fixed bleeds located before and after the fan. The rhesus monkey support system was designed for a bleed of 0.34 to 0.51 $m.^3$/min. (12 to 18 cfm) into and out of the duct.

Under the absorbent bed is a plenum chamber containing six ultraviolet lights to disinfect the system. Here the air velocity is low enough to give time for an effective bacteria kill. A 1843 angstrom filter on the lights prevents ozone formation. The ultraviolet lights satisfactorily suppressed bacteria growth during a 15-day test of a 1/10 size filter collector.

Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Patent status:

NASA has decided not to apply for a patent.

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