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AIR FILTERS; SIMPLIFICATION OF FINE GLASS FIBRE MOUNTING

M. D. Thaxter

April 19, 1950

Berkeley, California

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AIR FILTERS; SIMPLIFICATION OF FINE GLASS FIBRE MOUNTING

M. D. Thaxter

April 19, 1950

Introduction

This report is written to acquaint those interested in air filters with a new and relatively economical method of mounting and edge sealing pleated fine glass fibre materials.

Summary

Very fine (1.3 micron diameter) glass filaments, lightly bonded with synthetic resin into a low density mat (0.6 lbs/cu. ft.)* has been demonstrated to be an efficient collector of aerosols when used as an air filter. Its employment in a pleated form has been hampered however by the difficulty of mounting and edge-sealing to prevent leakage and to provide support for the relatively fragile mat. This difficulty has been overcome by sandwiching the mat edge between the two pieces of wood obtained by jig-sawing an undulating curve conforming to the desired pleat pattern. Two sandwich-supports thus formed become the opposing sides of a box enclosure. Such enclosures have been used successfully as internally-loading dust filters. The assembly has the desired advantage of resisting chemical fumes which attack paper air filters and of being easily disposable without spreading contaminants.

Experimental

During the course of studies on air filtration from radioactive areas, various filter media were subjected to an atomized aqueous solution of Y^{90}.

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* Owens-Corning PF105 Aircraft Insulation

Of the non-paper filter media, fine fibre glass mats, (commercially known as PF 105 as manufactured by Owens-Corning for aircraft insulation), showed the highest efficiency in retaining the aerosol. Certain papers are more efficient but are destroyed to variable degrees by acid vapors and are therefore, in some installations, undependable. In working with the vapor-resistant but somewhat mechanically delicate PF105 material, several methods of supporting and edge-sealing were tried. The use of various adhesives can become a laborious and often fruitless procedure since pinhole leaks may not be observed until final testing. It is desirable to pleat the filter bed (to attain maximum area and consequently to lower pressure drop and to increase filter life all in the smallest physical compass). The difficulties of edge-sealing are therefore compounded when pleats are involved. This difficulty has been recognized, for example, by an AEC contractor working on air filters, who, though praising the efficiency of PF105 as a filter material, states, "One objection to their use for absolute filters is the difficulty in making a 100 percent seal or bond between the filter mat and its supporting frame."(1)

Filters made of PF105 in which these problems have been overcome have been designed and tested, and are in use in the Laboratory. Essentially, the assembly is a wooden box with an inlet and outlet nipple. PF105 runs diagonally, pleated, from one corner to the other across the airstream. Normally two layers are used totalling 1 inch of uncompressed fibre. The sides of the box are each of two pieces formed by cutting (with a jig or bandsaw) an undulating curve conforming to pleat section. The interior edges may be relieved

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(1) "Investigation of Stack Gas Filtering Requirements and Development of Suitable Filters," Report No. 8, Contract AT-30-3-GEN-14 to Division of Engineering, U. S. Atomic Energy Commission, issued February 28, 1950 C-57896, Arthur D. Little, Inc., Cambridge 42, Massachusetts

by sandpapering if desired. The inside and outside of the box is painted with sprayed white Amercoat. Tubular nipples extend about 1-1/2 inches beyond the box margins and may be stainless steel or body steel coated with 4A Plastic baking enamel. Hose duct work is clamped to these. Box sides are 3/4 inch thick birch, top and bottom 1/8 inch masonite. Fastenings are nails throughout. (See the appended specifications and drawings.)

About 158 square inches of surface area are obtained in the shape shown in the drawings. Flow data for clean filters for 1 and 2 layers were:

	CFM				
Pressure drop, inches H_2O	1/4"	1"	2"	3"	4"
1 layer	8.0	20.5	31.0	42	--
2 layers	5.0	14.5	22.0	29.5	35.5

There has been no visible tendency for the pleats to collapse in the flow rates tested. More widely spaced pleats must be designed when increasing numbers of layers are used to permit full pleat utilization.

Present use of the filters is uniformly on the suction side of blowers, consequently any edge leaks would be filtered through 3/4 in. of compressed mat edgewise. The exterior painting however virtually precludes such leaks since it is applied to the cut edge of 1 inch of fibre compressed to less than 1/16 inch. For applications where a filter is to be applied to the pressure side, a rubberlike cement may if desired be readily run along the exposed edge of the filter bed on the exterior of the box.

Not the least attractive aspect of this filter assembly resides in the fact that the dust load is contained within the box. This makes handling and disposal much safer. No gasketting surfaces need be separated when

handling contaminated filters.

Currently our application for this design is directed primarily toward Berkeley Gloved Boxes. A similar design may be adapted to other and larger installations. As yet, it is not economically feasible to make the sides out of die stampings or molded plastic, which may save money if larger numbers were desired.

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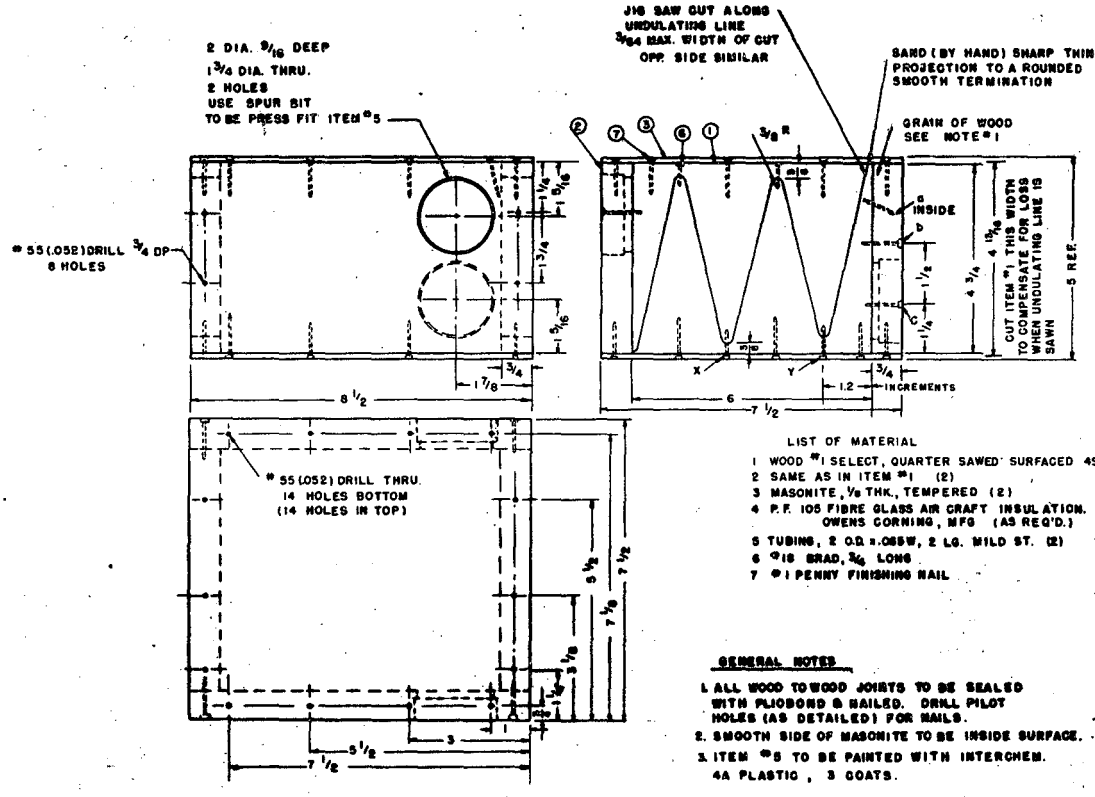


LIST OF MATERIAL

1 WOOD #1 SELECT, QUARTER SAWED SURFACED 4S & 2E, BIRCH (2)
2 SAME AS IN ITEM #1 (2)
3 MASONITE, 1/8 THK., TEMPERED (2)
4 P.F. 105 FIBRE GLASS AIR CRAFT INSULATION. 0.6 LBS. CU. FT.
OWENS CORNING, MFG (AS REQ'D.)
5 TUBING, 2 O.D. x .065W, 2 LG. MILD ST. (2)
6 #18 BRAD, 3/4 LONG
7 #1 PENNY FINISHING NAIL

GENERAL NOTES

1. ALL WOOD TO WOOD JOINTS TO BE SEALED WITH PLIOBOND & NAILED. DRILL PILOT HOLES (AS DETAILED) FOR NAILS.
2. SMOOTH SIDE OF MASONITE TO BE INSIDE SURFACE.
3. ITEM #5 TO BE PAINTED WITH INTERCHEM. 4A PLASTIC, 3 COATS.

Mu 158

FIG. 1

Assembly Sequence

Fig. 2

1. Paint interior white Amercoat, one coat.

2. Fasten (5) to (2).

3. Fasten (3A) and (4A) to (2). Drive nails a, b, and c.

4. Starting at open end of (2) roll 2 layers of item #4 into place over peaks and into valleys of (3A) and (4A). Material should be about 11 in. wide and 52 in. long (fold double). Ends and sides should protrude beyond assembly.

5. Place slip paper in each trough of filter bed.

6. Push sides (3B) and (4B) into place. Remove slips of paper. Align sides and nail them at thin points with 3/4 x 18 wire brads.

7. Fasten (1) to (2). Drive nails X and Y. Attach (nail) top (6).

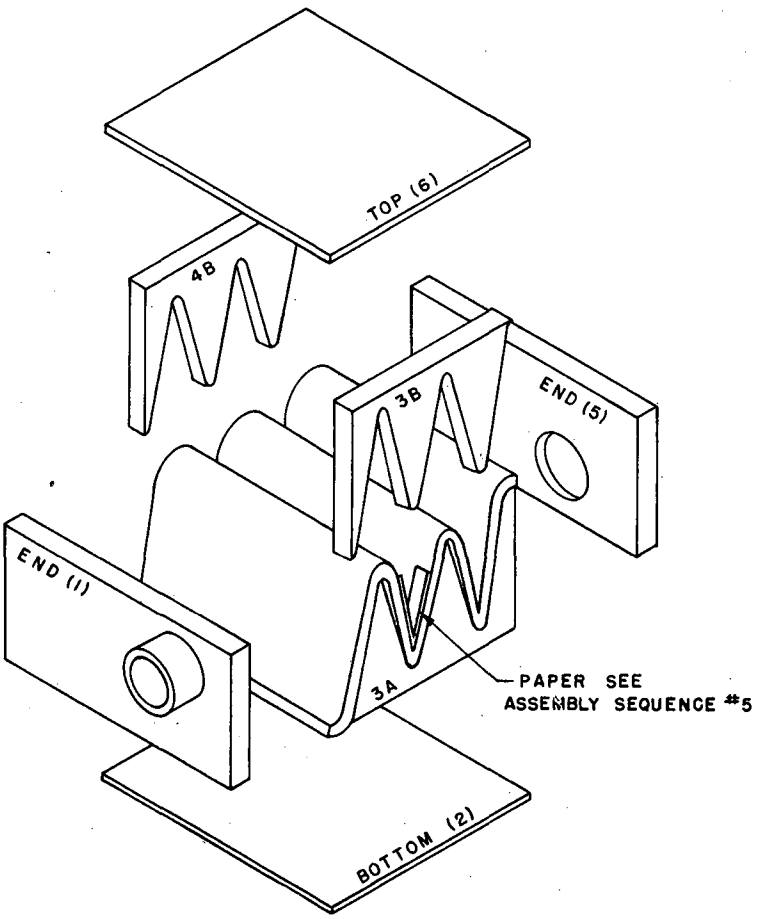
8. Press item #5 into hole and cement with Pliobond.

9. Grind sides to remove excess filter material. Wear respirator.

10. Paint exterior 3 coats of white Amercoat, sand before painting.

11. Grain of wood to run horizontally around box.

12. Assembly to be air tight, except at inlet and outlet.



ASSEMBLY DETAIL

FIG. 2 MU159