AIR AND INSECT PENETRATION OF INSECT SCREENS

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One phase of the research work done by the Sanitary Engineering Branch of the Engineer Research and Development Laboratories at Fort Belvoir on insect screens has been to determine the amount of air blocked from passage by screens of different mesh sizes. The objective of this work was to find screens which would be of small enough mesh to keep out mosquitoes and most other noxious insects and yet not be so small as to prohibit the passage of enough air for adequate ventilation.

In a search of literature and inquiries from different people of the Army, Navy, Air Force, U. S. Department of Agriculture and the U. S. Public Health Service as shown in the Appendix, there appeared to be little information on the subject. Because of this, we had to develop our own methods.

For the test purpose, a square wooden panel six feet on each side was built of plywood with a centered square opening of thirty inches on the side. Copper screens of 16x16, 18x18, 22x22 and 24x24 mesh per inch were attached to frames that would fit in the panel opening. One frame with a screen of vinyl-plastic coated fiberglas with a 14x18 mesh size was also used.

The panel was set up 25 feet in front of a high-speed fan blower and the velocity of the air coming through the opening was measured with an anemometer held six inches behind the center of the opening for one minute intervals. The different size mesh screens were then placed in the opening and the velocities were recorded six inches back of them. Several readings were made of each screen as well as of the unscreened opening before and after putting in each screen and an average was computed. A speed of 5040 ft/min or 57.7 mph was used.

The panel was placed six feet from a high speed fan blower which was run at an idling speed, blowing air through the opening at a velocity of 1500 ft/min or 17.1 mph and the above procedures repeated. Speeds of 1780 ft/min–20.1 mph and 2080 ft/min–23.8 mph were also used similarly.

An 18-inch electric fan was placed on a box eight feet from the panel and the procedure repeated using velocities of 675 ft/min–7.7 mph and 420 ft/min-4.8 mph.

The velocities of the air coming through the screens were subtracted from the velocities without the screens to find the differences or losses caused by the screens. The losses were divided by the velocities without screens to determine the percentage of air held back by each mesh screen. (Table 1.) Results were plotted (Fig. 1) using mesh size of the screen as one ordinate and percentage of air held back as the other.

Diameters of the filaments and sizes of the apertures were also measured. This

TABLE 1.—Reduction of air flow by insect screens of various meshes and at different velocities July-August, 1955

Velocity MPH	Percent Reduction at Meshes of—				
	16 × 16	18 × 18	14 × 18	22 × 22	24 × 24
57	5	13	29	31	36
24	18	19	29	31	34
20	9	18	28	37	42
17	5	23	31	41	45
8	17	33	39	43	48
5	25	27	36	52	54
Avg. 21.8 mph	13.1%	22.2%	32.0%	39.2%	43.2%

was done by placing the screens under a magnification of twenty, measuring ten horizontal and ten vertical filaments at random and taking the maximum, minimum and mean. The apertures were measured in the same manner.

The results, as would be expected, show that the finer the mesh of screen the greater the reduction of air penetrating it. For example, at 17 mph with a 16x16 mesh screen, 5 percent of the air was held back while at the same velocity a 24x24 mesh screen held back 45 percent of the air. Figures also show that a larger percentage of air is kept from entering the screens at a low velocity than at a high one.

Preliminary work on insect penetration of various mesh screens was done using *Aëdes aegypti* mosquitoes. In the first tests no penetration of insects through meshes finer than 18x18 occurred. Re-

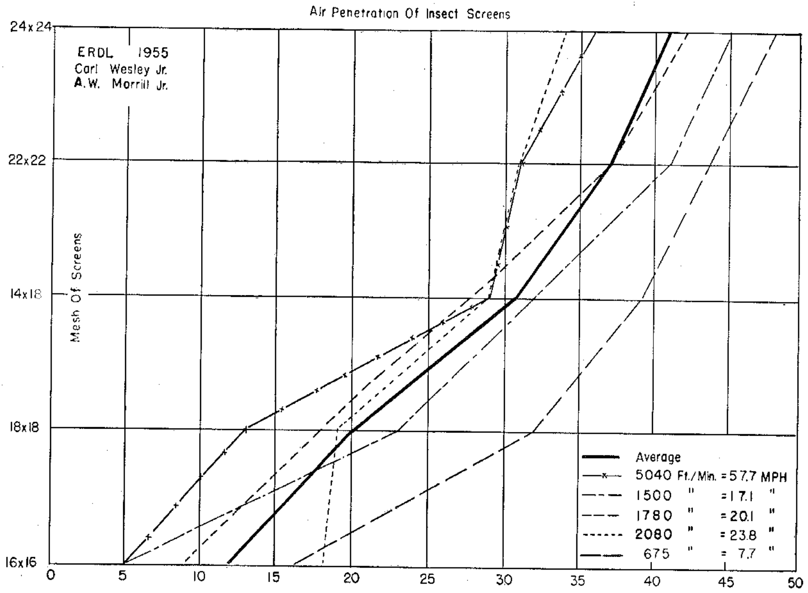

Figure I-% Reduction Of Air Caused By Screens sults of work done by Knipling at USDA Laboratories at Orlando, Florida, in 1945 using *Aëdes aegypti* as test insects also showed that screens of mesh coarser than 18x18 were not satisfactory in restricting the mosquitoes.

From the results of above tests it is concluded that screens of 18x18 mesh should be used to exclude the majority of insects and yet permit enough air for pleasant ventilation.

Appendix

Agencies Solicited for Information

1. Army Medical Laboratory
   Army Chemical Center, Maryland
2. Army Quartermaster Research and Development
   Natick, Massachusetts
3. Navy Preventive Medicine
   Naval Air Station
   Alameda, California
4. Navy Preventive Medicine
   Naval Air Station
   Jacksonville, Florida
5. National Advisory Committee for Aeronautics
   Washington, D. C.
6. Civil Aeronautics Administration
   Washington, D. C.
7. Army Office Chief of Engineers
   Research and Development
   Repairs & Utilities
   Washington, D. C.
8. University of North Carolina
   Department of Sanitary Engineering
   Chapel Hill, North Carolina
9. U. S. Dept. of Agriculture, Entomology Research Branch
   Beltsville, Maryland
10. U. S. Department of Agriculture
    Entomology Research Branch
    Savannah, Georgia
11. U. S. Department of Agriculture
    Entomology Research Branch
    Orlando, Florida
12. National Bureau of Standards
    Washington, D. C.
13. U. S. Public Health Service
    Public Health Reports
    Washington, D. C.
14. British Liaison Office for Research & Development
    Fort Belvoir, Virginia.