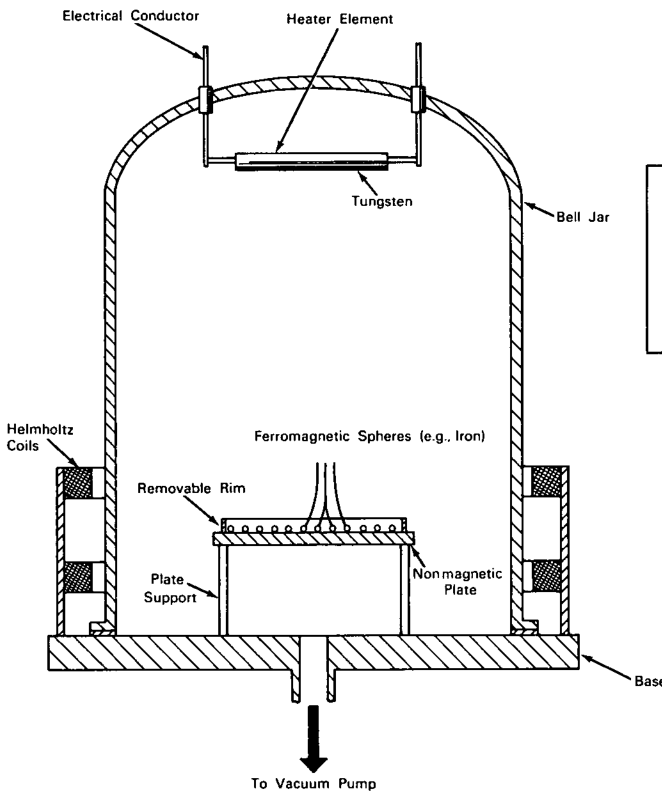
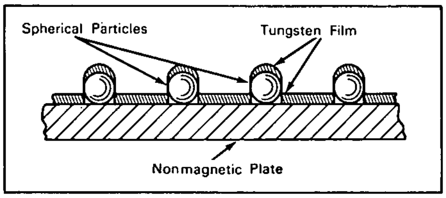
December 1964 Brief 64-10282

NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Fine-Mesh Screen Made by Simplified Method





DETAIL OF PLATE AND SPHERICAL PARTICLES SHOWING DEPOSITED TUNGSTEN FILM

The problem: Devising a simplified method of fabricating strong fine-mesh screen (with more than 500 holes per linear inch), such as is commonly used for grids in electron tubes and ion devices.

The solution: A method involving uniform distribution of fine magnetic particles (spheres or rods) on a nonmagnetic plate, vacuum deposition of a film of tungsten over the particles, removal of the film with adhering particles from the plate, and subsequent dissolution of the particles with a chemical solvent to leave a tungsten screen of the required mesh size.

How it's done: Uniform spheres of a ferromagnetic material, such as iron, having a diameter equal to the required hole size in the screen are placed on the nonmagnetic plate within the area bounded by the removable rim. The number and size of the particles used determine the fineness of the screen to be made. The plate is then placed on the support (with bell jar

(continued overleaf)

removed) and the Helmholtz coils are energized to create a vertically oriented uniform magnetic field in the area occupied by the spheres. The spheres become magnetized in this field and acquire dipole characteristics which cause them to be uniformly distributed in a single layer over the area of the plate within the rim. If necessary, the spheres may be vibrated, by tapping the plate, for example, to aid in distributing them uniformly over the plate. The bell jar is then placed over the assembly, the vacuum pump is turned on, and electrical power is applied to the heater element. Under these conditions, the tungsten vapor which is formed descends vertically to deposit a thin film on the plate and spherical particles. The thickness of the film deposited must not exceed one-half the diameter of the particles in order to avoid buildup of tungsten against their undersides and ensure that the holes ultimately formed will have the same diameter as that of the spheres. When the deposition process is completed, the tungsten film with the enmeshed spheres is stripped from the plate and immersed in a selective solvent (e.g., hydrochloric acid) which will dissolve the spherical iron particles. The resulting product is a tungsten screen of the required mesh size and thickness. The film and particles need be left in the solvent only long enough to dissolve a small portion of the spheres in contact with the tungsten film, thus readily freeing them from the matrix.

Notes:

1. When spherical particles are used, the thickness of the screen is limited to one-half the diameter of the spheres. Thicker films can be formed by using rod-shaped particles instead of spherical particles.
2. Instead of using bare iron particles, they may be coated with aluminum to facilitate removal of the particles from the tungsten matrix. These particles may be easily removed by heating the matrix to the melting point of aluminum, which is only 660° C compared to 1535° C for iron.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Western Operations Office
   150 Pico Boulevard
   Santa Monica, California, 90406
   Reference: B64-10282

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

Source: Hughes Aircraft Company
under contract to Western Operations Office
(WOO-104)