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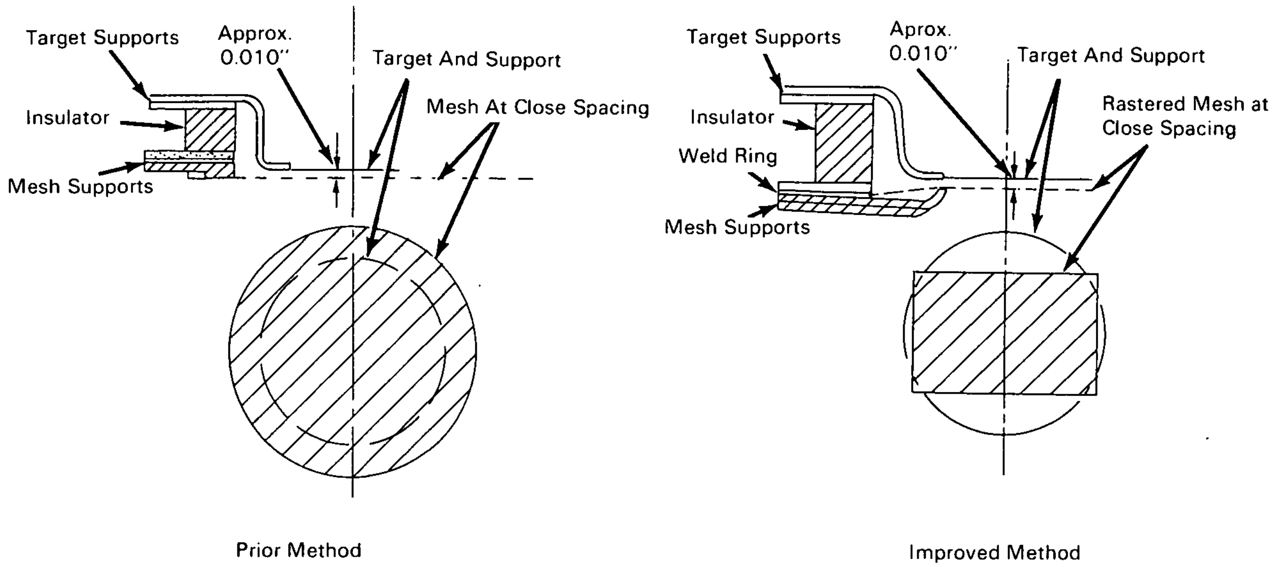
Mounting Method Improves Electrical and Vibrational Characteristics of Screen Electrodes



A method has been devised to improve the electrical and vibrational characteristics of the mesh or screen electrodes used in electron tubes. The primary application is in TV camera tubes, particularly SEC camera tubes. The SEC target consists of a thin film composite of aluminum on a substrate of aluminum oxide. The composite is then coated with a very low density layer of KCl, which functions as a secondary emission conduction member. A fine mesh screen electrode is placed between the KCl side of the target and the electron gun and is closely spaced (0.010") from the KCl layer. The screen is planar and lies parallel to the plane of the target. The spacing and parallelism are required during tube operation to create a uniform field between the target and mesh and to limit the surface charge on the target.

The prior method of suspending the suppressor mesh in typical secondary electron image conversion tubes is to stretch the mesh between concentric hoops of appropriate metal and to position the resultant disk of mesh close to the target by appropriate mechanical means. The resultant configuration has a natural resonant frequency that depends on the diameter of the disk, the mesh mass, and tension. The resultant configuration is adversely affected if the tube is subjected to mechanical vibrations. These vibrations may be severe, ranging from those encountered on ground vehicles and aircraft to those of space vehicle launching. The resultant vibration of the mesh may be destructive to the point of mesh breakage; or by coupling energy into the fragile thin film target, it can cause partial or total disruption of the secondary

(continued overleaf)

emission layer. In severe cases, the mesh can touch the target and cause a catastrophic failure. In addition, the relative motion between the target and mesh due to the vibration of either member results in a variation of capacitance of the mesh-target assembly. The change of capacitance causes a change in signal current which, under operational conditions, can be severe enough to obscure all usable information. The juxtaposition of the target to the mesh assembly is also the controlling element in the shunt capacitance of the tube. It is desirable to keep this capacitance as low as possible to minimize the inherent noise of the preamplifier.

In the new design, the electrical characteristics are enhanced by decreasing the shunt capacitance of the tube by 20 percent while retaining the close spacing needed to obtain required resolution. This is accomplished by the mesh configuration which has a much smaller area of plano mesh membrane in juxtaposition to the plano portion of the target. The remainder of the mesh falls away from the plano area of the target, thereby increasing the distance and decreasing the assembly capacitance. A small decrease in capacitance also occurs, as it is possible to use a 12 percent wider target-to-mesh ceramic spacing. The resultant capacitance has been decreased to 80 percent of the prior method. A lower capacitance could also be gained by use of ceramic pillars and smaller sections of ceramic flanges. The vibrational characteristics of the mesh are enhanced by raising the natural resonant frequency above the range encountered in military and space usage of the tube. This is accomplished by stretching the mesh membrane over a ridged area of the mesh support in the same manner that a violin string is stretched over a bridge. The ridged surface provides the mesh with a definite, continuous contact area. The mesh is always under tension across the ridged area and between the ridged area and the weld ring. This provides for maximum flatness and reproducibility of the mesh assembly and defines the mesh's maximum area, shape, and vibrational characteristics. Previous methods of rastering the mesh (not illustrated) do not provide for a firm contact along the periphery of the raster. The ridged area also allows the mesh to be only slightly larger than the usable area of the target. The ridge allows adequate space for the mesh weld ring and use of the minimum mesh opening in close proximity to the target. In the prior method, the mesh opening must be larger than the total target support surface, which sets into a well that is defined by the mesh and mesh support. Because of this, a larger mesh diagonal is required. The new design makes it possible to use a mesh diagonal of about 80 percent of that required with the prior method, thereby increasing the resonant frequency of the system. The resonant frequency is also increased by 30 percent by use of the rectangular shape of the rastered mesh as opposed to the circular shape of the standard mesh. The net result is to increase the natural resonance frequency of the mesh from the 2200 Hz area of an older design to the 3800 Hz area of the new design. The amplitude of the subharmonics and beats of the target mesh assembly are thereby decreased.

Note:

No further documentation is available. Inquiries may be directed to:

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No patent action is contemplated by NASA.

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