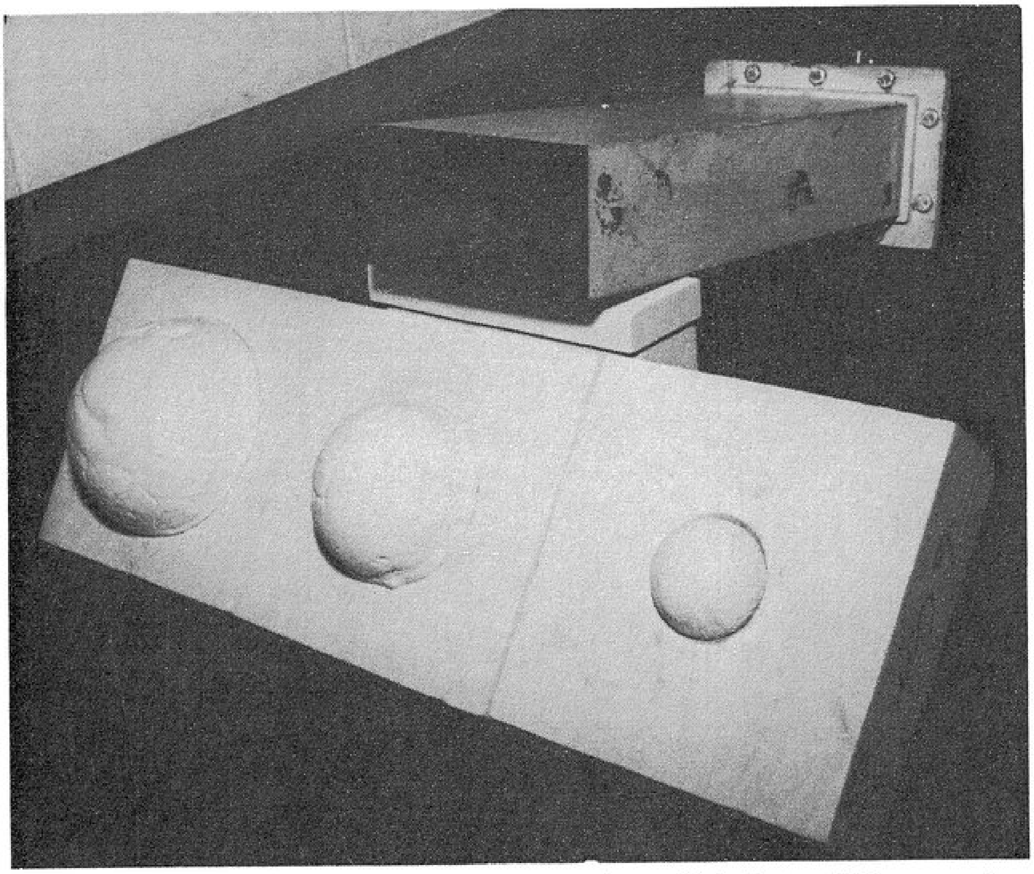

Fig. 1. Spherical models of brain-equivalent material are shown with the front mold halves removed. Also shown is the WR-650 waveguide section that was used to irradiate the models at 1.10 GHz.

pulses were applied to the spherical models using a 46-cm-length of open-ended WR-650 waveguide. Fig. 1 shows the spherical models in the foam molds along with the waveguide. The waveguide was placed in contact with the foam molds of the 10- and 14-cm diameter models; however, the smallness of the 6-cm diameter model required a different configuration. In using the smallest model, one of the foam sides was removed, and the model was allowed to rest partially in the opening of the waveguide and partially in the other foam member. In this way, higher acoustic amplitudes could be obtained than were seen when the waveguide was brought no closer than the mold would allow.

A typical series of experiments began by applying a single microwave pulse to elicit an acoustic response. The "ringing" of the model following microwave irradiation gave the approximate fundamental mode frequency. Also, during the single-pulse irradiations an optimal pulsewidth was determined that produced the highest amplitude response. Brief pulsetrains, or bursts, consisting of three microwave pulses were then applied to the spherical model. The pulse repetition frequency was equal to the fundamental mode frequency. For each pulsetrain combination, the maximum post-artifact hydrophone output voltage was recorded and graphed as a function of pulse repetition frequency.

III. Experimental Results

A typical hydrophone response, inside a 6-cm diameter spherical brain model, to a three-pulse burst at a 24-kHz rate and a pulsewidth of 10 μs is shown in Fig. 2. It is seen that following an initial period which coincided with the duration of the burst, the response signal was easily separated from the transient microwave artifact. The ringing frequency is associated with acoustic resonances of the model. Moreover, the acoustic signal produced by the three-pulse burst was increased by threefold over the response to a single pulse.

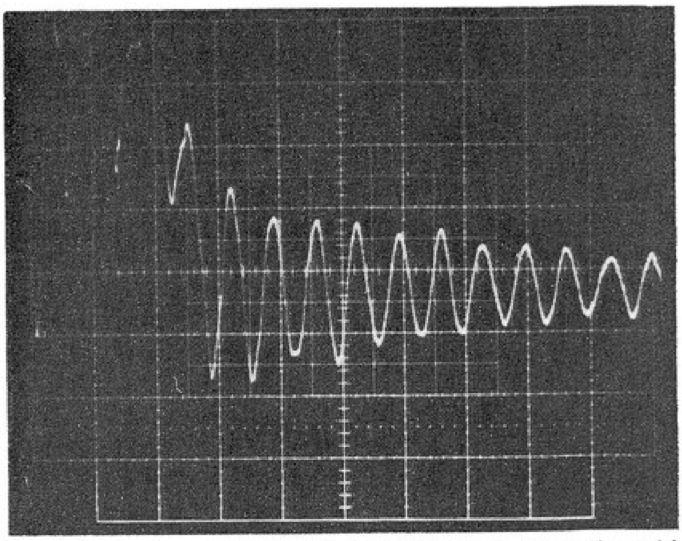

Fig. 2. Hydrophone response inside 6-cm diameter spherical brain model which was irradiated with a burst of three microwave pulses (10 μs) at a 24-kHz rate. Vertical scale was 100 μV/div; horizontal scale was 50 μs/div.

Fig. 3 gives the output voltage of the hydrophone as a function of pulse repetition frequency for the 6-cm diameter model. A pulse repetition frequency of 25.5 kHz gave the highest acoustic pressure amplitude indicating a resonant frequency about 25.5 kHz.

In the 10-cm diameter sphere, a single pulse produced a 16-kHz ringing signal with maximal acoustic pressure occuring at a microwave pulse width of 14 μs, thus, indicating a resonant