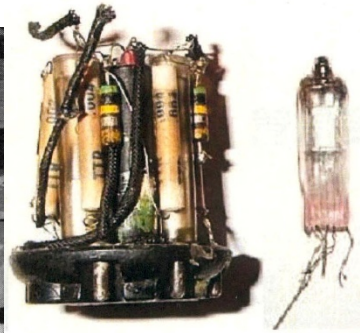


## 14 Cannonball of anti-aircraft gun using vacuum tube (VT (Variable-Time) fuse)

Cannonball of anti-aircraft gun using vacuum tube (VT (Variable-Time) fuse) was developed during the Pacific war in Johns Hopkins University in United State<sup>1)</sup>. When radio waves from the cannon ball are reflected by a target airplane, the reflected radio waves containing frequency difference between transmitted and received waves by Doppler effect are detected. This was detected if the distance between the cannon ball and the target airplane is less than 20m. Interval timer is not necessary and hit rate was improved 20 times.



Cannonball of anti-aircraft gun

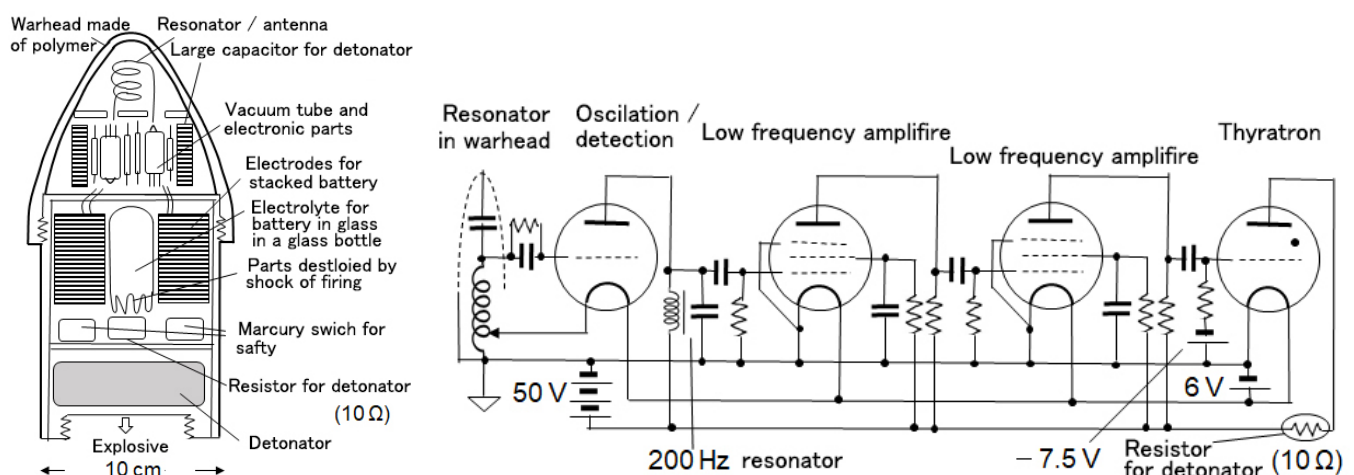


Electronics of VT fuse



Experiment of shot down of aircraft

The structure and circuit of the VT fuse is shown in the following figure<sup>2) 3)</sup>. The transmitter is used as detector as the reflected radio wave and signal of 200 Hz is amplified and trigger a detonator using Thyratron. This has to stand large acceleration (about 10,000 G) and rotation caused by the cannon firing. Subminiature vacuum tube shown in the upper figure and its longitudinal direction is that of travel. Electrolyte for battery is in a glass bottle which is broken by the cannon firing, which is needed for prevent battery discharge and for safety during storage. Since the Battle of the Marianas in June 1944, the VT fuse were equipped in all ships and 2,2 million VT fuse were produced during the second world war<sup>1)</sup>. These were used only in the sea to prevent technology leak by unexploded ordnance, .



Structure

Circuit

1 NHK 取材班編：“太平洋戦争 日本の敗因 電子兵器 カミカゼを制す”，角川文庫（1995）.

2 貞重孝一：真空管時代のリーディングエッジ電子機器，映像情報メディア学会誌，55, 1 (2001) 70-75.

3 Circuit of VT fuse, <http://home.catv.ne.jp/ss/taiho/vacuumtubes/radar/vtcirct.htm>.