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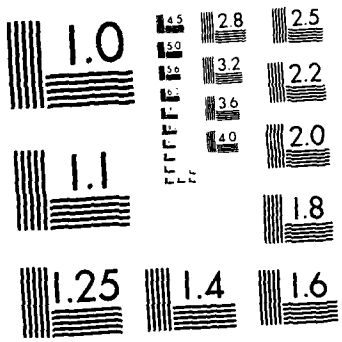
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19 ABSTRACT (Continue on reverse if necessary and identify by block number)
All of the equipment items budgeted for have been purchased.

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Final Report of the Equipment Grant

Millimeter Wave Generation by Relativistic Electron Beams

November 1, 1986-October 31, 1987

for

Air Force Office of Scientific Research
Arlington, Virginia

under

Grant No. AFOSR-87-0040

Submitted by
Spencer S.P. Kuo
Principal Investigator

Polytechnic University
Weber Research Institute
Route 110
Farmingdale, New York 11735

I. Introduction

AFOSR awarded a research equipment grant (Grant No. AF-AFOSR-87-0040) bearing the title "Millimeter Wave Generation by Relativistic Electron Beams" to the Polytechnic Institute of New York (which has now been renamed "Polytechnic University") with Professor S.P. Kuo as the Principal Investigator for one year beginning November 1, 1986. Under the support of this equipment grant, the facilities of the Plasma laboratory of the Institute used for an on-going research program funded by the AFOSR has been upgraded. Our research program bears the scientific goal to develop a high power, compact microwave device carrying good output efficiency. A cusptron device is thus designed to fit the requirements. This device utilizes the negative mass instability for the resonant interaction between an axis-encircling electron beam and the modes of a slotted cylindrical waveguide. This beam configuration is produced by passing an electron beam through cusp magnetic field and maximizes the finite Larmour radius effect for harmonic cyclotron resonance interaction. Further, the slotted boundary introducing a periodic fringe field near the orbits of the electron beam, thus, enriches the resonant harmonic contents of the rf fields as experienced by the gyrating electrons.

At present, we have completed the physical set up of the device. We are now in the stage of testing the operation of the device. In Section II of this report, the equipment purchased through this grant is listed. A brief description of each item is also given. Section III presents the photographic pictures of the cusptron device, in which most of the equipment is included.

II. Equipment Purchased

The following equipment has been or is being purchased under the AFOSR Grant during the period Nov. 1986 to Oct. 1987.

1.	From Hewlett-Packard Company, Woodbury, N.Y. 11797		
a.	Spectrum analyzer Model 8569B	Cost:	$31,000.
b.	Option 003		1,000.
c.	11971A (Harmonic Mixer)		1,400.
d.	11791K (Harmonic Mixer)		1,350.
e.	Graphic Plotter 7475A		568.50
f.	197B CRT Camera		1,495.
g.	Crystal Detector X424A		300.
h.	3 HPIB Cables 10833B		270.

The above items were received in Nov. 1986. The following items were also ordered from H.P. during the period Nov. 1986 to Oct. 1987, but were received in December 1987.

a.	9853L Model 330C	10,478.
b.	Opt. 006	235.60
c.	Opt. 10	576.60
d.	7914CT 132mb Disk Drive	8,500.
e.	98595A Opt. 022	350.
f.	98595A Opt. 003	- 124.
g.	98597B Opt. 022	600.
h.	98598A Opt. 022	400.
i.	98599A Opt. 022	400.
j.	10833B	55.80
k.	88140LC (Quantity 2)	248.
l.	17846P	64.35
m.	178000P	180.40
n.	82990H GPIB Board	254.20
o.	98642A	378.20
p.	24542M	55.00

2. G.A. Computer Prds. 10 Railroad Ave., Albany, N.Y. 12205

a.	3630 Opt. 001 (Paintjet graphic printer)	$ 864.34
b.	51606A	27.50
c.	51606C	34.95
d.	51630Y	22.95

The above products are made by Hewlett-Packard. This particular company outbids H.P. for the right to sell the equipment in N.Y. state.

3. Cober Electronics, Inc., 102 Hamilton Ave., Stamford, CT. 06902

a.	High Power Pulse Modulator Model 4406 (received 1/5/87)	60,000

4. Huntington Mech. Lab., 1040 Ave. Avenida, Mountain View, CA. 94043

a.	Bellows (Quantity: 2)	594.00

5. Varian Vacuum Prod., 78 Blanchard Rd., Burlington, MA. 01803

a.	60 L/S ion pump. Starrell	3,262.50

The total amount of purchases from 1986 to 1987 is $124,841.89.

III. Cusptron Device

Under the support of the present equipment grant, a cusptron microwave device has been set up in the Plasma laboratory of the Polytechnic. The schematic diagrams and the photographic pictures of the device are presented in the following. The supporting facilities such as the spectrum analyzer and the data acquisition system are also used for the other experiments.

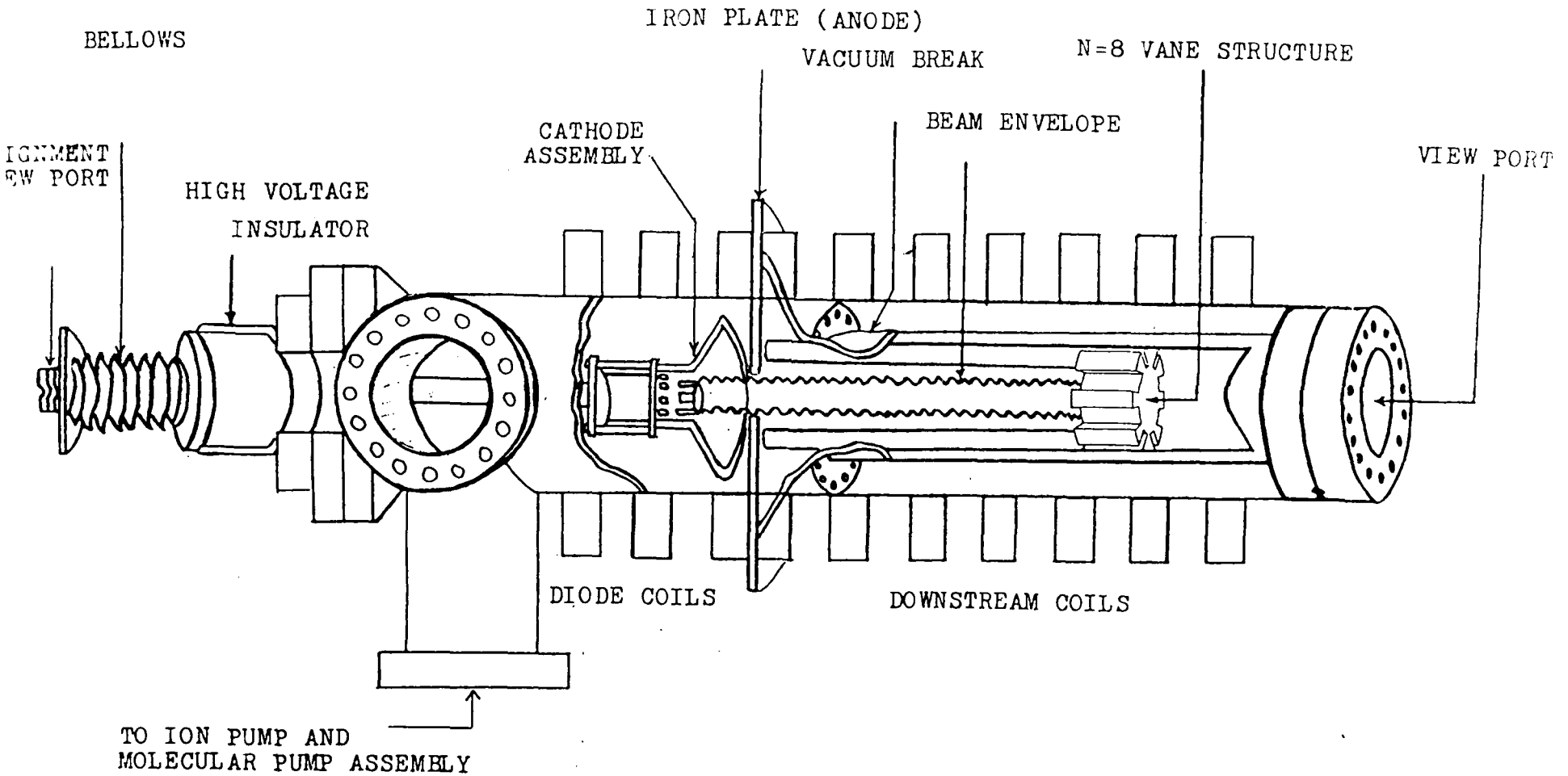
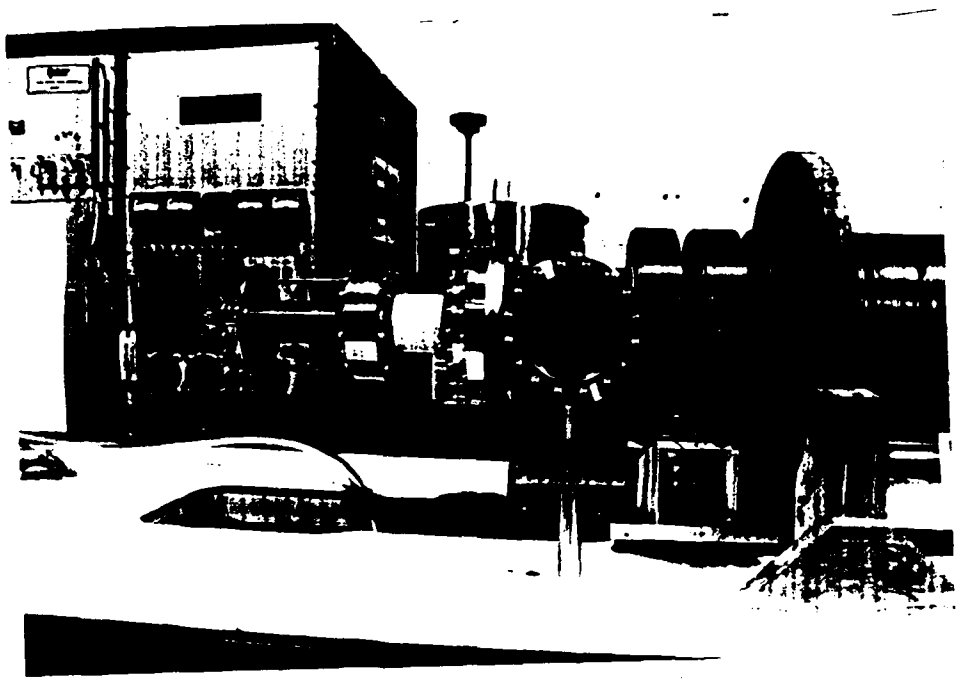


Fig. 1 **HIGHER HARMONIC CUSPTRON DEVICE**



a) Photograph showing the upstream region with alignment bellow

b) Experimental setup for cusptron microwave device with P.E. Miller (undergraduate assistant) standing in the back, and K.K. Tiong (graduate student) in the front.

Fig. 2

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