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May 21, 1954

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Washington, D. C.

Gentlemen:

This letter contains a proposal to undertake research and development in the field of Ionic Oscillators as described in attachment number one.

The program was designed in two parts. Part one would cover approximately seven months time and cost $60,884.53. Schedule of costs is attachment number two.

Part two would be predicated on the results of Part One and would take approximately five months time and cost about $36,682.80. Schedule of costs for this phase is attachment number three.

Due to the need for the development of subminiature transmitters and the inherent possibilities of the ionic oscillator in this regard, plus the accomplishments of this laboratory in that field, it is hoped that this proposal will meet with your approval and a contract will be negotiated.

Very truly yours,

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Att.

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DATE: 20/11/80 REVIEWER: 037169

a-4006 SECRET

PROPOSAL ON IONIC OSCILLATORS

INTRODUCTION:

The present-day electronic oscillator is basically composed of a vacuum tube and associated components such as resistors, condensers, coils, etc. In addition, a source of electric power is needed to energize the circuit. The power supply consists of batteries in its simplest form or an arrangement of a transformer, tubes, condensers and resistors, etc. in its most practical form. The power source must have a minimum of 100 Volts DC available. The current drain, both of the power supply and oscillator, is about 3 Watts for the smallest "miniature class" oscillator. Furthermore, the mere grouping together of these components results in a bulky unit.

An ionic oscillator is a gas tube which, under certain conditions, can be made to oscillate by itself and be completely independent of any external components. This is possible by making use of the positive ions in a gas tube in a manner similar to the way in which electrons operate in a vacuum tube. Because of this inherent characteristic of a gas tube, the ionic oscillator is unique in that it needs no external resistors, condensers, coils, etc. in order to operate.

To date there have been over two hundred papers written on ionic oscillations, most of which have been devoted to a fundamental study of the phenomena. The practical aspects of ionic oscillators have been neglected except for Cobine of General Electric, who constructed a noise generator using an ionic oscillator in a magnetic field; Fairbairn, (Toledo, Ohio) who obtained a patent on a gas tube used as an ionic oscillator; Chetverikova, (Moscow) who reported results similar to Fairbairn but of a much broader scope and in great detail.

This laboratory repeated the work of Fairbairn with results well within the limits of experimental error. In addition we succeeded in making an NE-2 type neon bulb oscillate, whereas Fairbairn reported negative results with neon.

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The ionic oscillator does need a power source, but these requirements are quite simple. A small hearing and battery (22½ Volts) is sufficient in many cases to operate the ionic unit. There is little or no problem with current drain in some cases. The relative output of an ionic oscillator can be sizable with low power requirements because there are not the same electrical losses to contend with as are found in an electronic power supply and oscillator. Each component of the latter consumes power which subtracts from the over-all efficiency of the system.

There are many commercially available gas tubes which are miniature and subminiature in size, and since the power supply need only be a small battery or its equivalent, the entire assemblage could be miniaturized or even subminiaturized. Further, such size reduction allows for shock resistent packaging, when necessary, with slight increase in over-all size.

The ionic oscillator is limited in frequency range because its upper limit of response is near 10 megacycles. However, below that frequency the ionic oscillator holds possibilities of being substituted in many applications which today are attainable only with the electronic oscillator and its associated components.

The existence of some significant possibilities have already been recognizod by this laboratory. They are:

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These are only a few of the possible variations in design and application inherent in the ionic oscillator and, no doubt, many more will present themselves as the art progresses. A consideration of the possibilities inherent in the ionic oscillator for applications as described above, coupled with the knowledge of the progress already made by the Russians in this field, definitely points up the essential factor time plays in accomplishing the objectives of this task. The first party to convert the possibilities to actuality will have gained a decided advantage in this contest.

It is with this awareness, supported by experiments conducted at this laboratory, that it was thought desirable to propose the following program. The personnel quota is necessitated by the demands of the short time allotted for so much work. The time estimate is contingent upon clearances of manpower.

PHASE I.

STUDY OF COMMERCIALLY AVAILABLE TUBES

The first phase of this program of research and development is designed to strike directly at the practical side of the problem as outlined above. There are many commercially available gas tubes, such as:

SMALL:	MINIATURE:	SUBMINIATURE:
3C23	2D21	CK1034
3C45	5696	CK1035
3D22	DA2	CK1036
502-A	OB2	CK1037
629		CK1038
884		CK1039
885		CK1042
2050		CK5783
5557		CK5783WA
5560		CK5787
6012		CK5787WA
OA3		CK6213
OA4G		RK61
OC3		
1C21		
2A4G		

..........in addition to foreign-made tubes of similar construction. Each of these tubes have different qualities, and it is proposed to investigate all of these from the point of their response characteristics under ionic oscillation. This can be done by analyzing each of a given tube's parameters under controlled conditions. Curves will then be plotted from the data accumulated and an evaluation made of each specific tube type. When such data is available, a determination can be made as to just which tubes would lend themselves to immediate use and those which could be eliminated from further consideration. Once the selection is narrowed down to those tubes which possess the most promising characteristics for our purpose, then Phase I would be completed.

OBJECTIVES

(1) To study all presently available gas tubes and evaluate their characteristics as ionic oscillators.

(2) To classify select tube types for particular service.

(3) To select those tubes holding the greatest promise as ionic oscillators and prepare them for Phase II.

REPORTS

Reports will be submitted quarterly describing scope of work covered, results obtained, and plan of work for next quarter.

TIME

Phase I is estimated to take seven months contingent upon clearances of manpower.

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COST

It is estimated that the seven months operation will cost $60,884.53. Schedule is attached.

PHASE II

Phase II is predicated on the results of Phase I. In this effort those tubes which held the greatest promise due to construction details and geometry would be flushed out and regassed with various gases and mixtures of gases and again the parameters would be studied under controlled conditions.

In this way each tube type now available commercially could be classified and altered from its present condition to respond at maximum efficiency to predetermined conditions while operating as an ionic oscillator.

OBJECTIVES

(1) To attempt to improve the ionic oscillator characteristics of the most promising tubes selected in Phase I by altering certain of their parameters.

(2) Classify selected tube types and parameters thereof for best applications.

(3) To determine which subminiature tubes are best suited for specific applications as described above as possibilities.

REPORTS

Reports will be written quarterly describing scope of work covered, results obtained, and plan of work for next quarter.

TIME

It is estimated that Phase II will take five months for completion.

COST

It is estimated that this phase of the task will cost $36,682.80.

Schedule is attached.

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SCHEDULE OF COSTS

SUBJECT: IONIC OSCILLATOR RESEARCH

PHASE I.

Object: Study commercially available gas tubes and determine those best suited for ionic oscillator application.

Time: Estimated 7 months.

Cost: Estimated $60,884.53.

PERSONNEL:

[redacted]

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(Note: Salaries based on prevailing scale in area)

OVERHEAD:

[redacted]

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MATERIAL AND SUPPLIES:

Tubes, gas, glass, pump supplies, etc.	$ 3,500.00

EQUIPMENT:

Electronic meters, pressure gauges and associated electronic gear. $1,500.00

SPECIAL EQUIPMENT:

Vacuum pump, buggy and associated control equipment. $3,500.00

TRAVEL:

To Washington	$	500.00
Per Diem @ $12.00 - 10 Days	$	120.00

MISCELLANEOUS: $ 500.00

FEE:

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TOTAL PHASE I: $60,884.53

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SCHEDULE OF COSTS

SUBJECT: IONIC OSCILLATOR RESEARCH

PHASE II.

Object: To improve ionic characteristics of selected tubes from Phase I by altering certain parameters and then classifying them for best application.

Time: Estimated 5 months.

Cost: Estimated $36,682.80.

PERSONNEL:

[redacted]

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OVERHEAD:

[redacted]

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MATERIAL AND SUPPLIES:

Tubes, gas, glass, pump supplies, etc. $ 1,000.00

EQUIPMENT:

None.

SPECIAL EQUIPMENT:

None.

TRAVEL:

To Washington	$	500.00
Per Diem @ $12.00 - 10 Days	$	120.00
MISCELLANEOUS:	$	500.00

FEE:

STAT

TOTAL PHASE II: $36,682.80

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