If the steepest gradient is near the positive end and when the electric (absolute) potential of the "positive" pole is actually negative, the direction of force will be toward the negative pole.

In the series of experiments conducted from 1925 to 1930, this anomalous behavior caused serious difficulty. No satisfactory explanation could be offered.

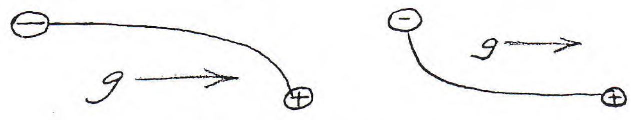
It will be observed in Fig. 8 that a pressure differential is produced by the electric dipole. The direction or sense of the pressure is, for the system as a whole, inward toward the positive pole and outward from the negative pole. Reaction or recoil pressure which is exerted on the system mechanically is in the opposite direction, ie., from the negative to the positive pole.

Thus, it may be seen that a radiating dipole exerts pressures in the ether, first in one lateral direction, then in the other. The expanding wave of transverse pressures (electric) and transverse motions (magnetic) comprises the electromagnetic radiation.

The gravitational field, therefore, is the "slope" of the electric field. The direction of the field is toward the positive charge or potential.

Linear elect. gradient
(no grav. field)

Fig. 10.



Distorted elec. gradient
(field toward positive)

Fig. 11.

If, however, these point charges are not "absolute" electric potentials, as is usually the case in a "terrestrial laboratory"; the following modifications are effective:

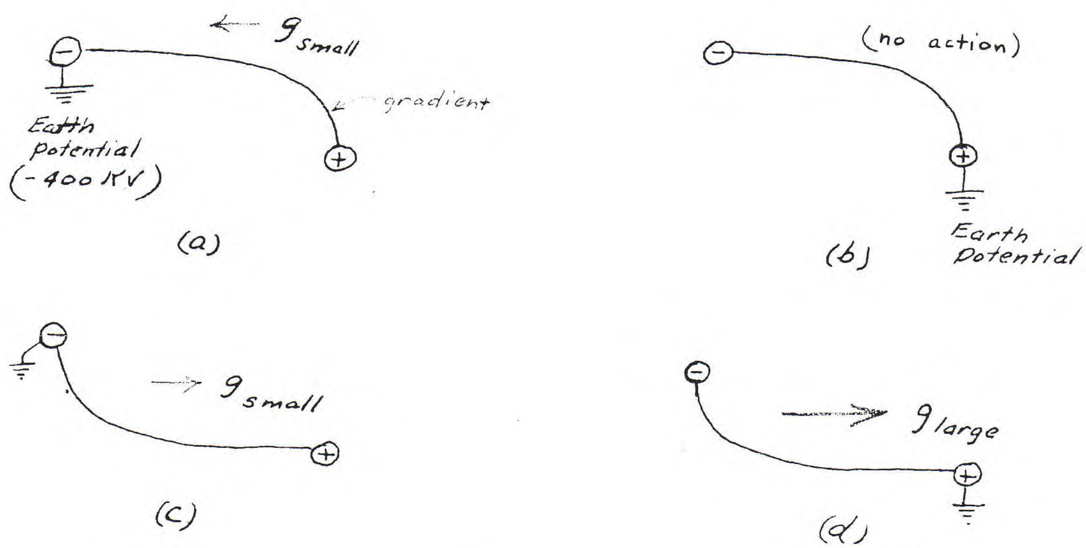


Fig. 12.

Since the intensity of the electric field, as well as the absolute potential, determines the effect on space, it is desirable that connection 12 (d) be utilized. Thus, the greatest gradient occurs near the pole having the greatest (absolute) negative charge. $K\mu$, consequently, is reduced to the lowest value for the voltage employed. The $K\mu$ of the positive pole, while reduced below unity, is not reduced as far as that of the negative pole for two reasons; namely,

1. The gradient is not steep at that point.
2. The pole is not so far negative as the negative pole.

Compensation to the point of reversal of action is present in connection 12(a). Here, the steep gradient is present around the positive pole causing great reduction of $K\mu$ for that absolute potential (actually negative). The negative pole, on the other hand, has no nearby gradient and consequently is not reducing $K\mu$ as much as the positive pole. The result, of course, is a movement (or force) toward the negative pole, opposite to that called for in normal action.

Connections 12(b) and 12(c) are intermediate compensations, systems where optimum conditions are not present when the experiment is conducted with one or the other of the two poles grounded. (−400 KV).

Connection 12(d) is therefore the optimum.

These four connections are found to give forces qualitatively as indicated — by the series of experiments conducted from 1926 to 1930. See notebooks of these years.

Since the force developed by a differential in gravitational potentials (inversely $K\mu$) the force is always from the high P to low P, or, in other words, from low $K\mu$ to high $K\mu$. Normally, this is from the negative to the positive pole — or from the high gradient to the low gradient in the case of one pole earthed.

Naturally, when the connection includes the Earth, the potential of the Earth affects the force developed (when applied voltage and other factors are held constant.) As the potential of the Earth becomes more negative the force increases.

Since the action of the Philadelphia instrument is inverse, it follows that increase in scale readings indicates a more positive (less negative) earth. But this is subject to further check.

Therefore, predicated on confirmation by such a check, the principal characteristics of the diurnal variation are:

1. Sun-side of Earth negative.
2. "Windshield" side of Earth positive.

Therefore, it is indicated that the solar gravitational field exhibited at the Earth induces a charge in the Earth.

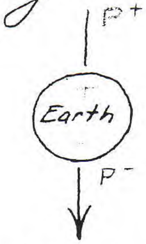


Fig. 13.

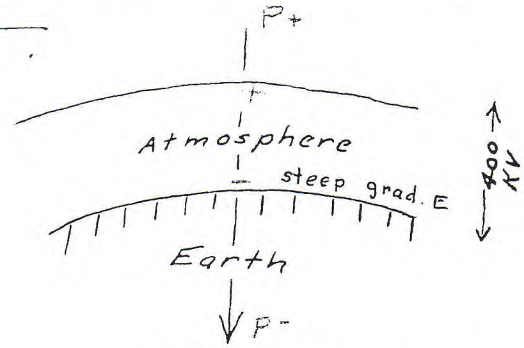


Fig. 14.

A similar field is induced (at least its presence can be so explained) by the gravitational field of the Earth. This field is present in the atmospheric envelope, making the Earth negative (approx. 400 KV) with respect to outer reaches of the atmosphere. In a sense, this may be thought of as the electrical equivalent of "g". (100 Volts/meter at the earth's surface)

Acceleration (and probably velocity) causes a similar electric field, with the positive end always in the direction of the acceleration or velocity. Thus the positive charge on that side of the Earth "in front" as it moves both in the orbit around the sun and its motion toward 16ʰ R.A. Results of observations during 1937 and 1938 indicate a sidereal gravitational field toward a center approx. 10ʰ R.A.*

* Distance to galactic center approx 10,000 parsecs (32,500 light years)
Orbital speed - 275 km/sec. (620,000 mph)

Tests of the Principle. No 1.

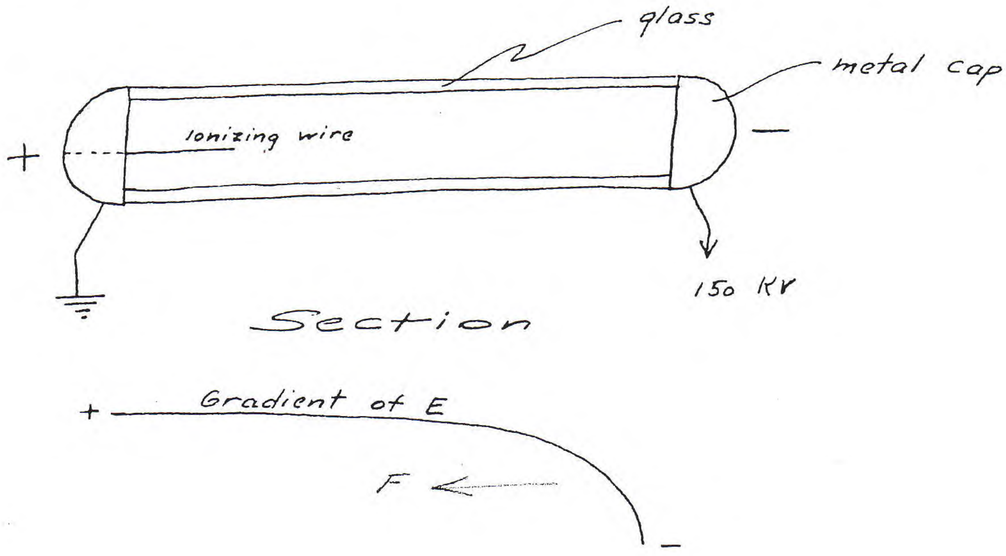


Fig. 21.

One of the simplest tests of the principle is shown in Fig. 21. It consists essentially of a glass tube (preferably heavy flint glass) approx. 4" diameter, 15" long, wall thickness about ¼". Metal electrode caps are placed at the ends of the glass tube. A fine (.001") ionizing wire projects part way from one end (positive), attached to the electrode cap.
A potential difference of 150 KV is applied. The positive is grounded.

A non-linear gradient is formed. Positive space energy is "created" at the negative end, resulting in force or movement of entire system toward the positive end. The force will be a function of the mass of the glass tube.

Tests of the Principle. No 2.

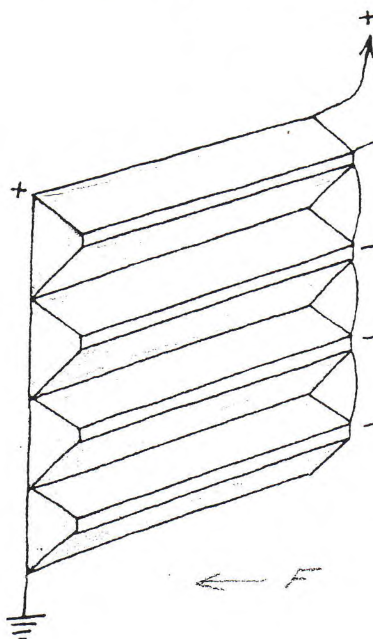


Fig. 22

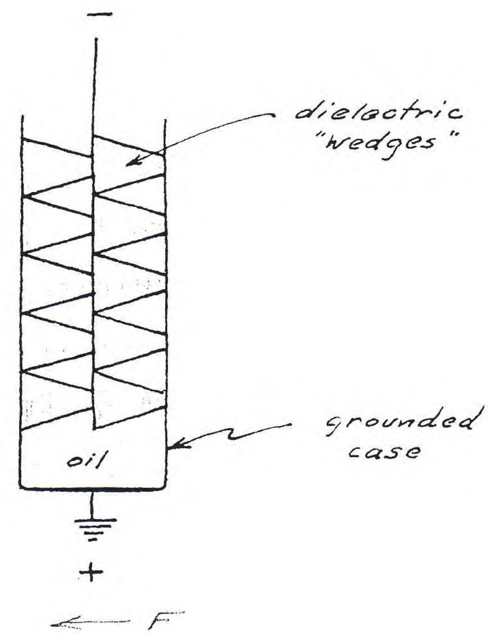


Fig. 23.

In order to obtain the desired non-linear electric gradient in the dielectric material, the wedge-shaped design is suggested. This eliminates the necessity for the ionizer shown in Fig. 21. When oil is used, as in Fig. 23, care must be exercised to keep its resistivity high in comparison to that of the dielectric "wedges". Electro-gravitational forces are in the direction as indicated.

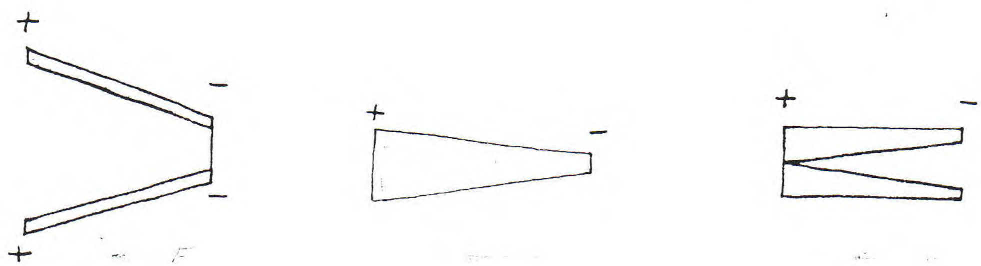


Fig. 23(a) Fig. 23(b) Fig. 23(c)

Types of dielectric wedges
(sections of ......)

Tests of the Principle No 3

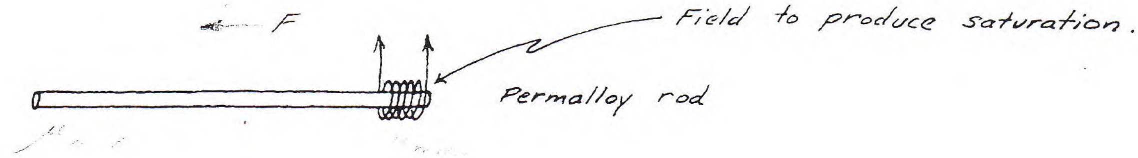


Fig. 24.

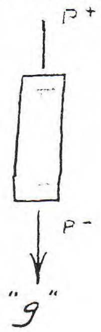
If effects of a differential in μ are similar to those of K, the system illustrated above may produce the indicated force. No actual experimental evidence, however, is at hand. Such a system, if found operative, may constitute the relation (magneto-gravitational) which has been expected.

A dynamical system would include a radiating dipole located near the coil on the permalloy rod. Radiation would be impeded in the direction of the higher μ, the lobe projecting principally in the direction opposite.

The electro-gravitational equivalence revealed by the e
potential of the atmosphere would indicate that
an acceleration (or a gravitational field) induces
a potential difference (electrical) such that the
incorporated mass would tend to move.

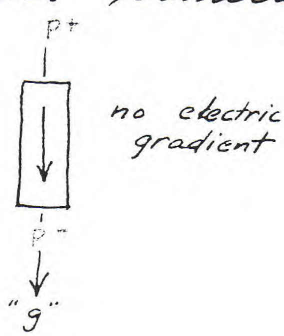
If motion is permitted, the electric gradient decreases
Thus if the atmosphere were permitted to "fall
freely" in the Earth's gravitational field, its gradient
would vanish. If accelerated upward against
gravity, its gradient would increase.

Any block of dielectric in a gravitational
field would behave similarly.



"fixed" condition

Fig. 15



Free "fall"

Fig. 16

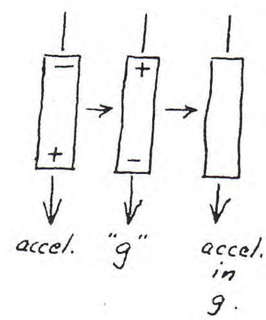


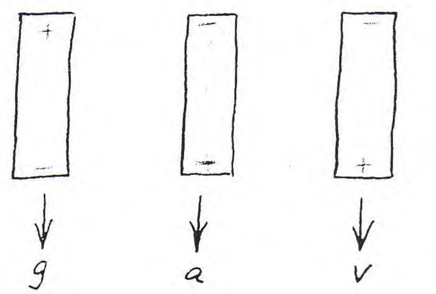
Fig. 17.

Fig. 15 indicates the electric condition of a fixed
dielectric in a gravitational field "g". This charge
arranges its polarity such that the positive is "up"
and high gradient is "down", near the negative pole.

Acceleration produces practically the same electrical
condition. Thus acceleration and gravitation are
closely related.

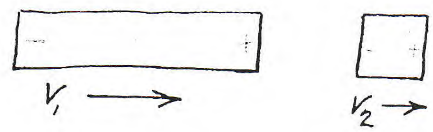
If, due to gravity, a dielectric body accelerates downward, its induced gradient is of such a magnitude and sign as to neutralize the gradient induced by the gravitational field. Fig. 17 shows how these potentials cancel.

Both gravity and acceleration induce non-linear electric fields in masses. The non-linearity of the field representing the magnitude of the gravitation field or the acceleration. Velocity induces a linear electric field, the potential difference being a measure of the velocity.



Fixed Accel. Velocity only

Fig. 18



$V_2 > V_1$

Lorentz - Fitzgerald Contraction

Fig. 19.

Fig. 19 sets forth an explanation of the contraction of physical objects along the line of motion by the increase of potential difference due to velocity.

Positive acceleration throws the steep gradient to the rear or negative end.

Negative acceleration throws the steep gradient to the front or as well as the ~~positive~~ negative [illegible] end (as if the [illegible] gradient [illegible] [illegible]) ?

A modification of the explanation beginning on P. S 16 Fig. 14 appears to be necessary.

Actually the gradient of the atmosphere is steepest near the earth. i.e., at lowest elevations. Near the surface of the earth it reaches a value approx. 100 volts/meter. The arrangement of this gradient could well be due to the conductivity of the atmosphere and not a result of the gravitational or accelerational field.

By modifying this hypothesis so that the gravitational effect is to place the steep gradient away from the Earth, ~~and~~ a more satisfactory explanation can be made.

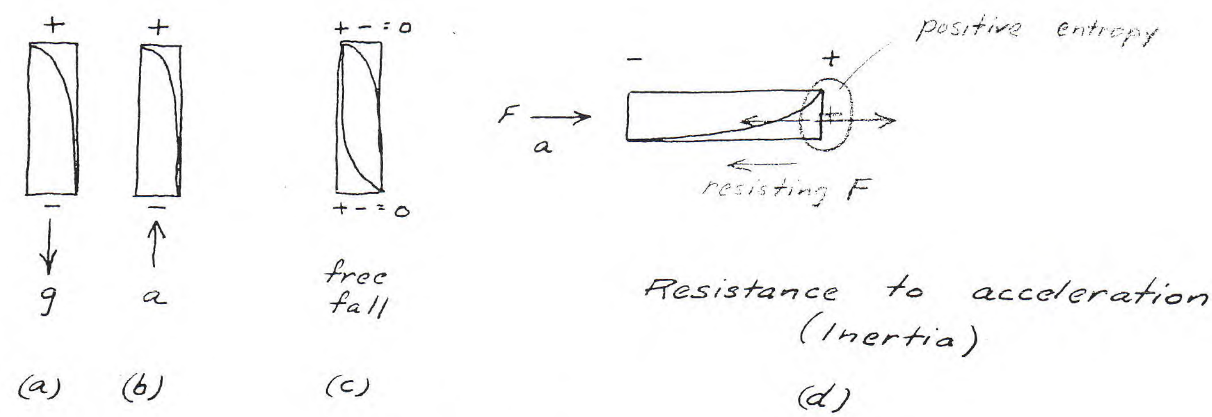
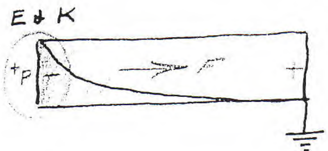


Fig. 19.

Thus, in Fig. 19 (d) the mechanical resistance (F) to acceleration is the electrogravitational F caused by the steepest gradient "in front". Negative acceleration is just the reverse. Force is produced because of the steepest gradient "in the rear".

The Effect of Dielectrics of Various K.

In the foregoing explanations the presence of a high electrostatic field (neg. average) in space tends to lower the value of $K\mu$ below the ambient for the region. A dielectric of high K does not necessarily have a high $K\mu$ (or low gravitational potential). Since the Q of the space is higher it may be argued that the presence of the field produces a greater elevation not reduction, of the P of space.



Condition of max. F.

Fig. 20.

This is a preliminary assumption, subject to experimental check.

It is difficult to check, however, because the increase of mass is usually accompanied by an increase in K for any dielectric material. The force is a function of the mass caught in the gravitational potential difference, and therefore an increase in K would be actually a mass-effect.

"Splash" Radiation

Pursuing the hypothesis contained in P. 65 and 68, a further discussion of radiation produced by accelerating electrons is indicated. This radiation has its origin in the radial currents to (or from) the spot where the electron is about to land (or is receding from) on the electrode. It is therefore termed "splash" radiation.

Normally, magnetic reactions between conductors of splash currents cancel one another. If, however, voltage gradients are present, so that a non-uniform current distribution exists, then an overall force results in the direction of the lower current. Fig. 2.

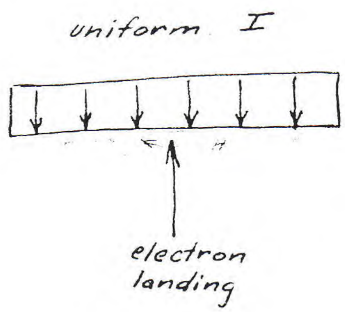


Fig. 1.

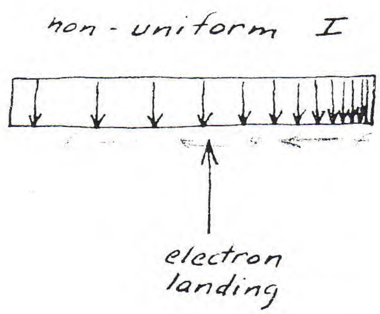
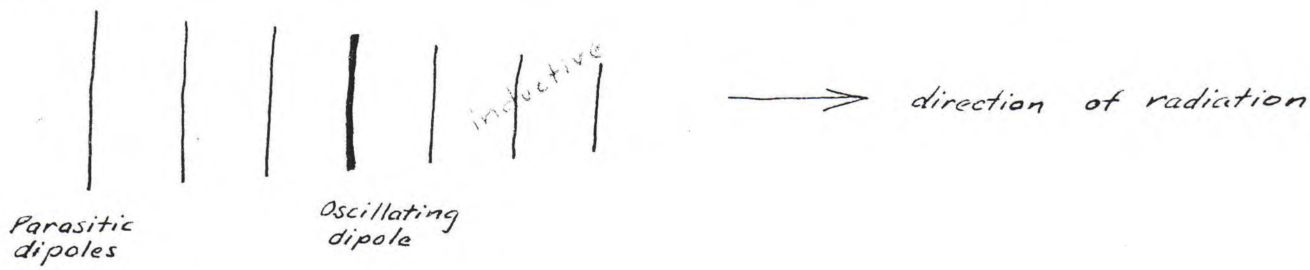


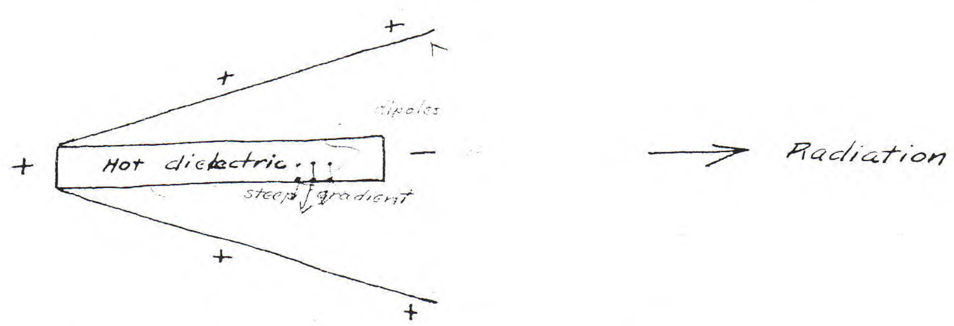
Fig. 2.

This is difficult to explain — except on the assumption of "granular" currents induced individually by periodic arrival of electrons on the electrode surface. The force is a direct function of the electronic current and the lateral voltage gradient. Radiation is "reinforced" in travelling toward the high-voltage end of the dielectric. One explanation is that the high-voltage end "appears" inductive, the low-voltage end capacitive, — due to electron speed or frequency of electron arrival. The effect is similar to an increasing frequency (natural) of parasitic antennae, producing absorption or cancellation in the capacitive direction and reinforcement in the inductive direction.



Hot-dielectric Cathode

Returning for the moment to consider the "hot" dipoles mentioned on P. 39, certain interesting possibilities seem to present themselves.



Due to the fact that the gradient is steepest near the cathode, the conditions for "starting" electrons in optimum phase relations are present. Furthermore, electrons are emitted more accurately from the negative band of the splash wave as it enlarges. Reaction currents, therefore, are greater.

Jan. 1, 1943

Heat energy, derived from the ohmic resistance of the dielectric, causes oscillation of the dipoles. Considering only the dipoles nearest to and normal to the emitting surface, conditions are present wherein electrons are emitted when the "outer" pole is negative. Thus the electric field of the dipole is added to the normal gradient at that part of the cathode emitting-surface. Current resulting from fields oscillated by the dipole:

(a) react with fields of other dipoles causing recoil forces.

(b) cause radiation which is transmitted progressively toward the inductive end of the system and radiated into space.

(c) result in resisting the oscillation of the dipole and "cooling" the dipole.

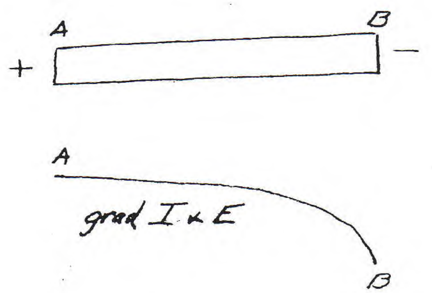
Therefore, it appears reasonable to believe that the heat of the cathode is continually being converted into a lower frequency and radiated uni-directionally into space.

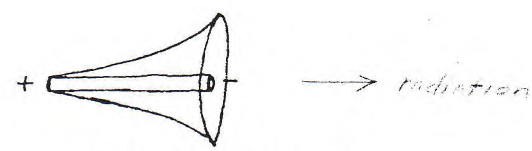
The energy of this radiation, then, can be considered to come primarily from the ohmic resistance of the hot cathode. – The intense radial field (normal to the cathode surface) serving to "direct the radiation.

One is inclined to believe that the currents in the radial field also contribute energy to the radiation and that the total radiant energy comes from both the dielectric current and the total "electronic" current.

Jan. 1, 1943

Serving as a plate, a conical metallic member is provided. Considering it a combination plate and horn (for matching impedence), an angle of 50° is suggested. It may be found that an exponential horn is better — depending on the slope of both the impedence and the current curves.



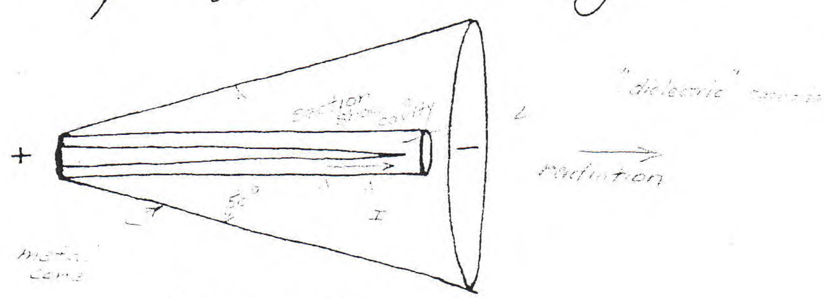


Exponential horn

Fig. 1.

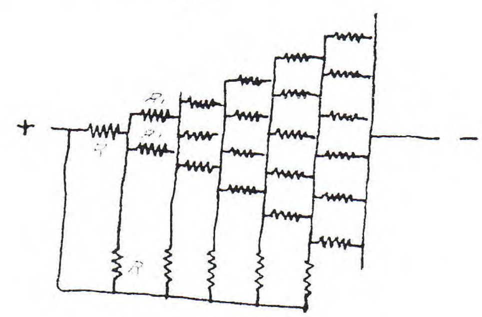
Gradient of potential and current in dielectric

If, however, the cross section of the dielectric is altered to correct for the increasing current — making the V-gradient linear, a linear (conical) horn of approx. 50° may be employed effectively.



Conical Horn

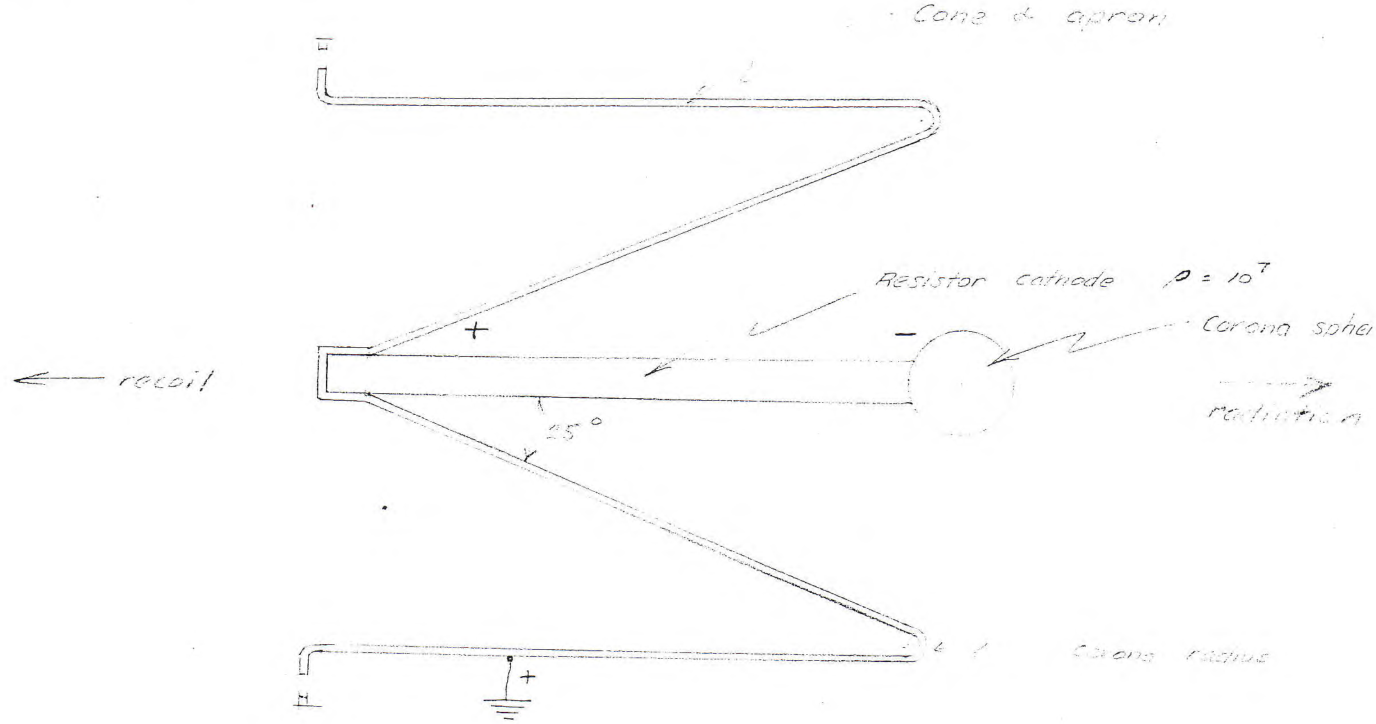
Fig. 2.



Equivalent circuit

It will be noted that the design suggested above is much the same as that shown on P. 33 with the elements reversed in position.

Jan. 1, 1943



Resistor-cathode (hot dielectric) Radiator.

As a practical design the resistor-cathode type has apparent advantages.

1. Highest electric gradient near the dielectric dipole system.
2. Probable transformation or reradiation of ohmic heat into quasi-heat radiation.
3. Positive (front) pole grounded.
4. Using a suitable high-refractory non-oxidizing cathode material, no glass front is required. Space need not be evacuated.
5. Safety gap provided by corona sphere-to-cone spacing.
6. Dielectric gradient distorted only in accordance with load of plate current. Impedence self adjusting.

Witnessed as to date.
Victor A Kossin 1-1-43

T. T. Brown

Self-oscillating Antenna.

High voltage resistor cathodes may have applications in pulse radiators of high power. In such applications they would constitute a self-oscillating antenna system which would be self-contained. The obvious advantage is the elimination of a separate oscillator and transmission line losses also a considerable reduction in space requirements.

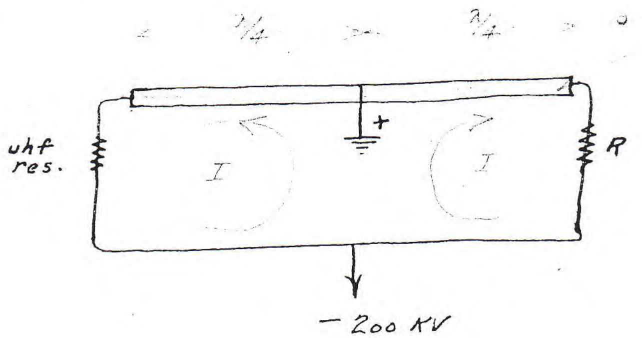


Fig 1.

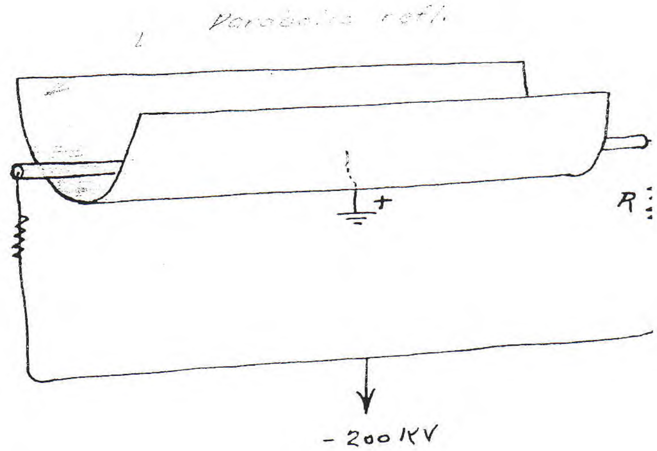


Fig. 2.

Leads to the ends of the resistor-cathode offer low DC resistance and high uhf resistance. Potential is fed continuously, but the oscillation of the dipole is not affected by the external feed circuit. Oscillation is of the relaxation type - P. 60 - set up by the dis-similarity of electron escape - and the magnetic interaction or feedback between the two circuits of the dipole. The parabolic reflector, Fig. 2, acts also as a positive electrode or plate.

Suggested manufacturers of resistor-cathodes: ——
Glading Mc Bean. Ohmite - Chicago, Ill.
Pacific Clay Products Co.

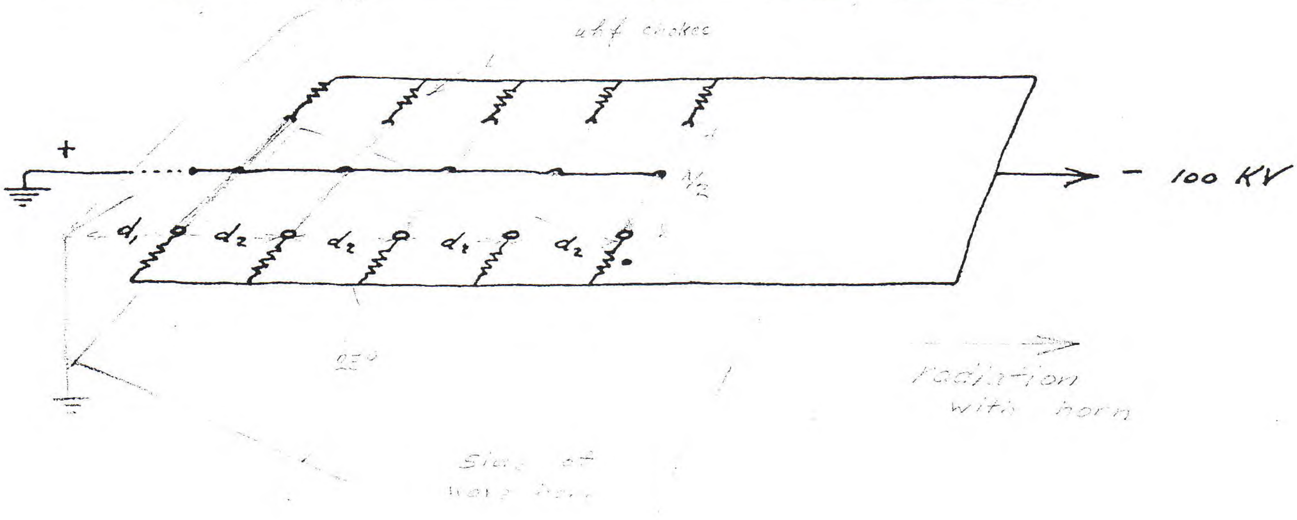
Jan. 6, 1943

Resistance of cathodes — Current requirements.

For a radiating cathode as shown on P. 75, the following characteristics are indicated:

Operating potential 200 KV.
Operating resistance $10^7\ \Omega/cm$.
Current thru resistor cathode 10 mils at 200 KV.
Current density (aver.) .5 mil / cm^2
Length for operating potential 40 cm.
Diameter — 5 cm. or Area 20 cm^2.
Dielectric strength 5 KV / cm
Ohmic heat 2000 watts.
Operating temperature 1000° F — See P. 34.
External electronic current — 10 mils at 200 KV.
Total — 4000 watts. (basis — 50 % ohmic heating)

Multiple self-oscillating antennae.



Condition 1. —

$d_1 = \lambda/4$

$d_2 = \lambda/2$

Condition 2 —

$d_1 = \lambda/4$

$d_2 = \lambda/4$

Note:

Length of radiator about 6 % less than $\lambda/2$, due to end capaci[ty]

Jan. 12, 1943

Influence of a magnetic field.

A magnetic field coaxial with the cones shown on P. 64 and 75 will undoubtedly affect the oscillation. The tendency would be, probably, to lower the frequency and increase the amplitude. In the consideration of the systems it would be helpful, therefore, to include the magnetic field.

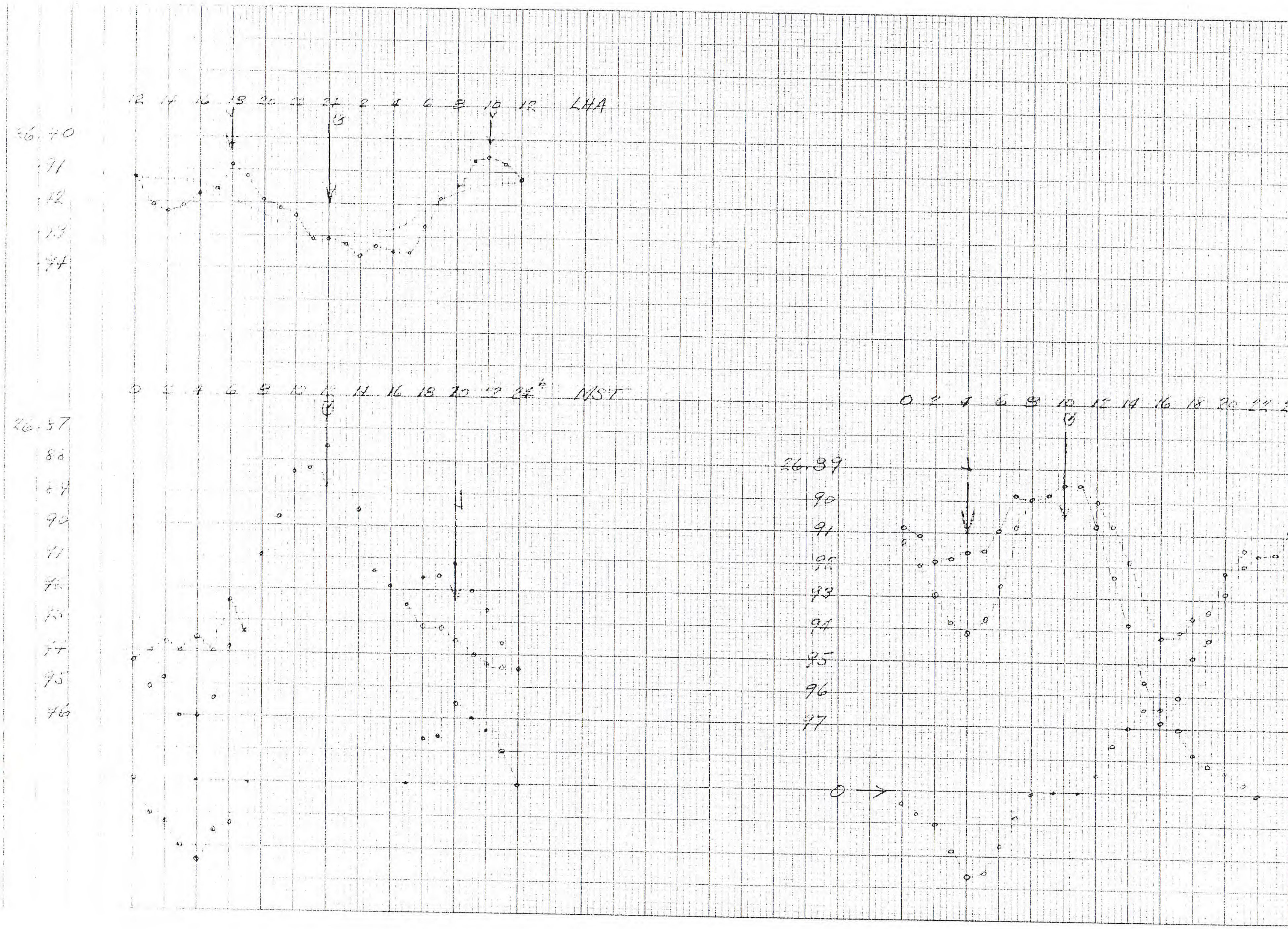
The effect is to increase the length of electron path by causing the electrons to spiral. Since more electrons would be "in transit" at any instant, the negative space charge likewise would be increased.

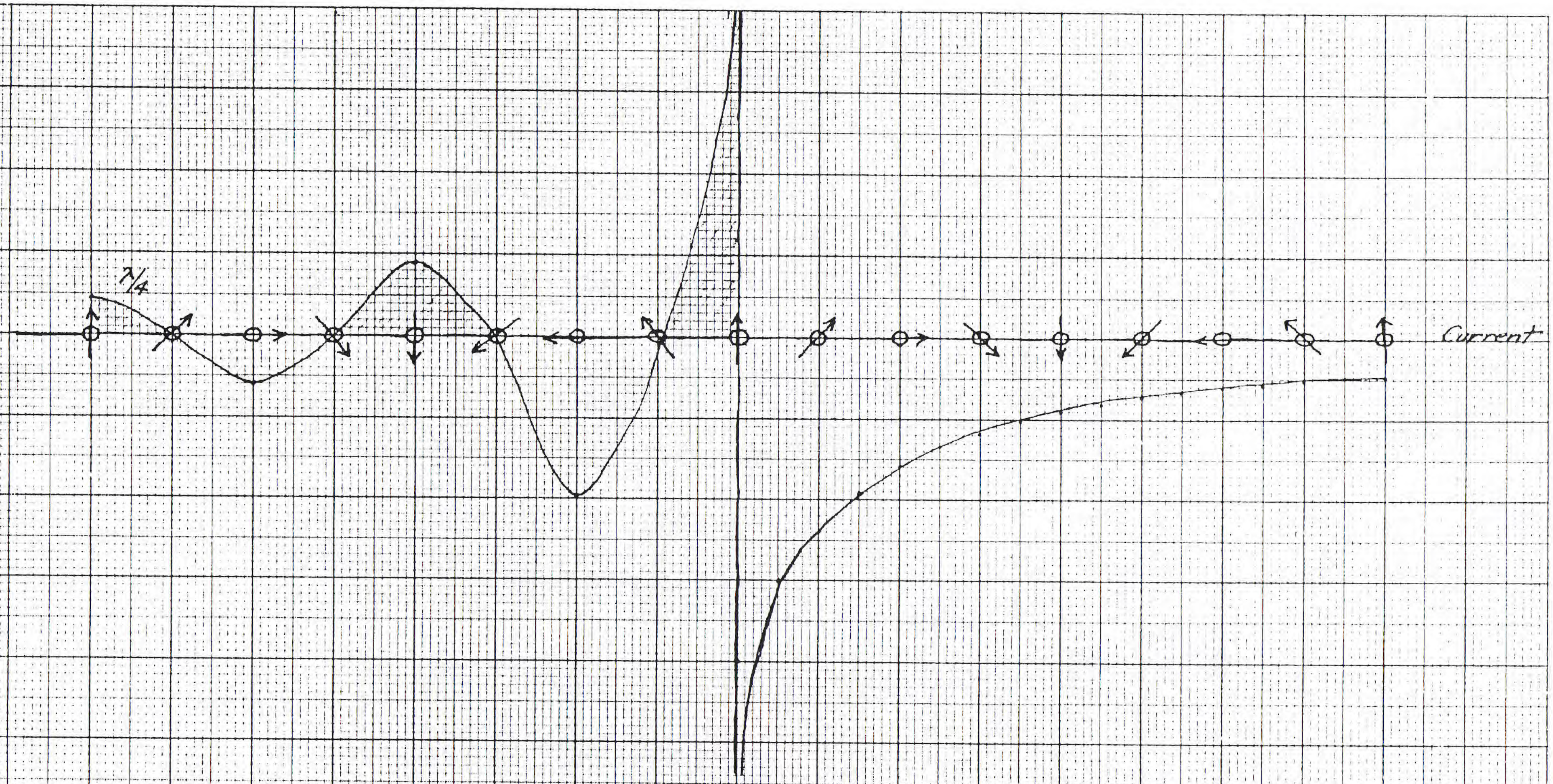
Misc. data

Orbital speed of Earth	18.6	mps	or	66,960	mph.
Sidereal " " "	12.	mps	or	43,200	mph

3	4	5	6	7	8	9	
10	11	12	13	14	15	16	
17	18	19	20	21	22	23	JAN
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
31	1	2	3	4	5	6	
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FEB
14	15	[illegible]	[illegible]	[illegible]	[illegible]	20	
21	22	23	[illegible]	[illegible]	[illegible]	27	
28	1	2	3	4	5	6	
7	8	9	10	11	12	13	MARCH
14	15	16	17	18	19	20	
21	22	23	24	25	26	27	
28	29	30	31	1	2	3	
4	5	6	7	8	9	10	APRIL
11	12	13	14	15			

20 x 20 to the inch, 10th lines heavy.
MADE IN U. S. A.





Assumed : (a) Phase velocity = C

(b) No standing waves in transmission line.

PART II
Structure of Space

It can be pointed out that the failure of the Michelson-Morley experiment to detect a flow of ether does not necessarily indicate the non-existence of the ether. The results of the theory of Relativity may be obtained with or without an ether.

For certain phenomena, it is desirable and almost necessary to assume the existence of an ether in order to evolve a satisfactory explanation. An example is the force of gravitation, particularly the electro-gravitational effects. The phenomena of the movement of a dielectric is such an example.

The ether would, then, have many interesting and hitherto unsuspected properties, and it is the purpose of these notes to explore the subject qualitatively and to set forth some of the more important properties. Much of the work is based on facts derived from actual experiments which cannot be satisfactorily explained without the existence of an ether possessing substantially these properties.

Meaning of K and μ.

Electromagnetic theory assigns real values to K and μ of "free space". For the sake of simplicity the "ether" may be imagined to represent merely these "real values". It follows logically that space may not be uniform and that variations will occur in K and μ.

It is logical, also, to assume that space is "distorted" by the presence of matter and that this distortion actually may *be* a variation of K and μ. Finally, it is necessary to assign the direction or sense of the variation, and the clue is supplied by the behavior of a light ray in passing a massive body.

Thus, the deflection of light is toward the massive body, and the effect is similar to or identical with *refraction*. It may be concluded that the values of K and μ near a massive body are *greater*. As a matter of fact the gravitational "field" may be visualized as an area or region of higher K and μ. The force of gravitation would then be the tendency to migrate to the higher K and μ.

Another interpretation is that the force of gravitation is a <u>pressure</u> from the areas of low $K\mu$ to those of high $K\mu$. It follows that a low $K\mu$ may be actually a region of high pressure in space, causing objects to move toward regions of lower pressure. This may be called "ether" pressure or space pressure, and may be assigned the terms high or low space potential as the case may be. S 3

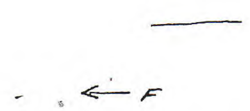
Perhaps, it is intuitively reasonable to assume that a maximum potential or entropy exists and that lower potentials are present as determined by the "presence" of massive bodies in space. We might consider the maximum potential of space that value where <u>no</u> mass is present, even at <u>infinite distance</u>.* It is not present actually, even in the space between the galaxies.

An interesting mechanical analogy is a tightly stretched rubber diaphragm without mass, the periphery of which is at infinity. Any mass would distort the sheet downward and by an amount inversely proportional to the square of the distance from the mass.

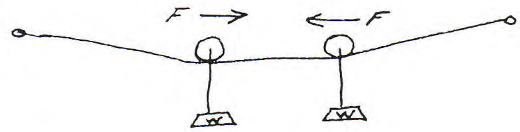
Fig. 1.

* Heavyside "Electromagnetic Theory" P 4?1

GLASS BALL   two masses would be pressed together.



Metal balls on rubber diaphragm.
FIG. 2.



Pulleys & weights on wire.
FIG. 3.

The maximum pressure of space can be determined from the energy "contained" in matter:

1 gram = 25,000,000 K.w.h.

or

1.25×10^{16} lbs./sq. in. *

Actually, it is difficult to imagine that the energy <u>is</u> contained in matter. More likely, it is the energy of space when referred to a complete void. For example, a glass globe (evacuated), submerged to its crushing depth in the deep sea, would suddenly disintegrate and send out a wave motion possessing energy. But, the energy was contained <u>not</u> in the evacuated globe but in the pressure of the water surrounding the globe.

It might appear that mankind lives in an ether "sea" of tremendous pressure, an ether "sea" likewise of unbelievable energy.

* Roso, New Views of Space, Matter & Time. P. 333

Since unit positive and negative charges are the building blocks of all matter, it is worthwhile to speculate on the space-structure of the blocks themselves. In this, one is guided ~~with~~ by relatively meagre evidence of an experimental nature. But perhaps a good start may be had by considering the mass effects of both, since it already appears that mass increases K_μ and reduces space energy.

Since the proton appears to possess the greater share of the mass of the atom, one would conclude that the positive "field" increases K_μ. For the sake of symmetry, the negative "field" decreases K_μ to the limit permitted by K_μ of "massless space". Conversely, the space energy of the electron field approaches that of space devoid of massive bodies, and outward (radial) pressures are maximum.

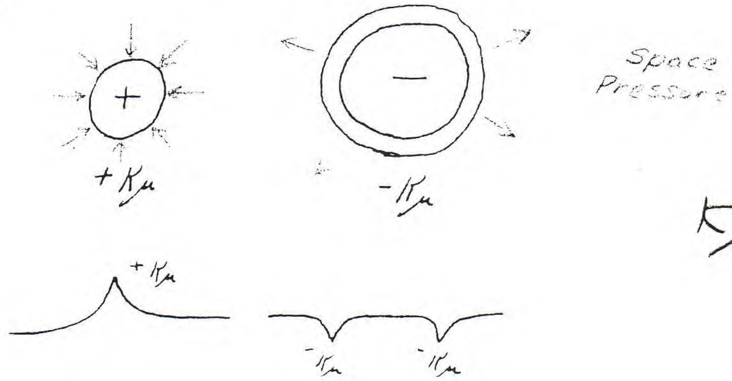


Fig. 4.

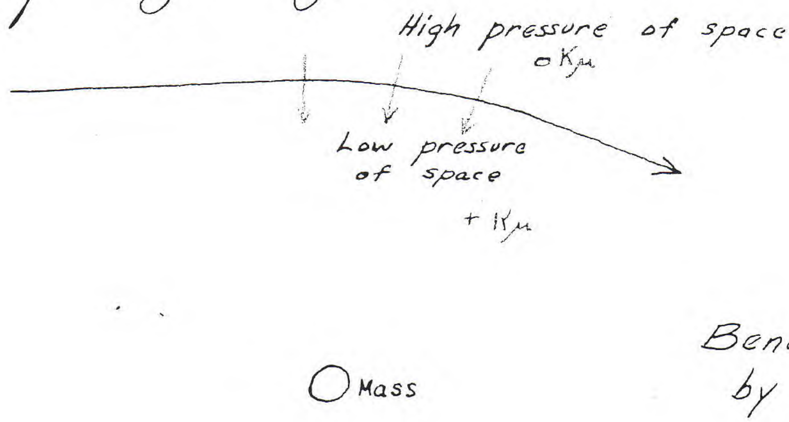
$K\mu$ not necessarily $K + \mu$

When the unit positive and negative charges are combined, as in the case of a neutron or atom, the increased $K\mu$ of the positive is not completely neutralized by the decreased $K\mu$ of the negative, tho the areas are equal and electrical neutrality results. A slight positive $K\mu$ at the center of the system remains. Thus, a aggregate of these residual positive $K\mu$'s produces the pure gravitational effects of neutral matter.

It is readily understandable that regions of positive $K\mu$'s will be driven together by space energy, and it is fairly understandable that regions of negative $K\mu$'s will be driven apart. Perhaps it would be better to say that normal intra-galactic space has positive $K\mu$, that regions more positive are driven together and that regions less positive are driven apart. These latter regions may be considered anti-gravitational and are driven out of the field in the same manner as a dielectric of low K is driven out of an electrostatic field with high K, or as a diamagnetic substance is driven out of a magnetic field with high μ.

For the sake of convenience, it is desirable to specify $K\mu$ minimum as that value present in extra-galactic space at an infinite distance from all matter.

This value will be negative with respect to the value of $K\mu$ as we know it in intra-galactic space, surrounded as we are by massive bodies. Assuming the accepted value of $K\mu$ = unity, then $K\mu$ minimum may be ~~zero~~ less than unity if proper units are selected. The potential energy is maximum when $K\mu$ is ~~zero~~ less than unity. Any real value of $K\mu$ indicates the presence of a lower potential of space and a lower velocity of light. A ray of light, therefore, will describe a path thru space as if it were bent by space pressures on the sides of the ray — as if, the ray possessed mass. Increased $K\mu$ and decreased velocity of light go hand in hand.



Bending of light ray by gravitational field.

Fig. 5

In intra-galactic space electrons are driven apart. In extra-galactic space electrons do not exist as such. As an electron approaches extra-galactic space, the space energy or pressure gradient which makes it an entity ceases to exist. It is conceivable that as an electron gains velocity its $K\mu$ becomes positive, approaching infinite mass as the velocity approaches C.

Protons or positrons, as the case may be, have a natural positive $K\mu$ which increases as the field increases (toward the center of the positive charge). Space energy drives these particles together, but well known electrical forces drive them apart.

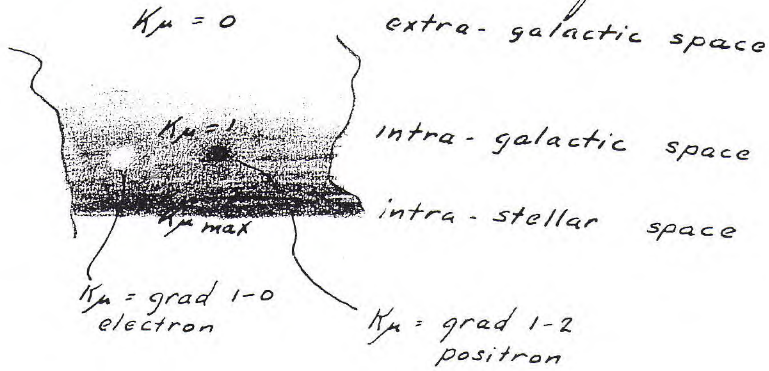


Fig. 6.

The energy situation is just the reverse:

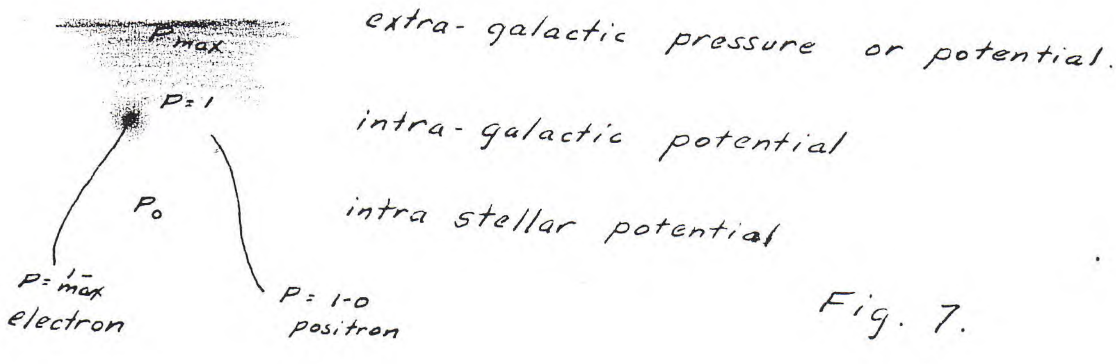


Fig. 7.

Positrons may not exist in the hearts of dense stars for the reason that the energy or pressure differential ceases to exist.

Electrons and ~~protons~~ positrons are complimentary — one tending to increase and the other to decrease the space potential of the region wherein they exist.

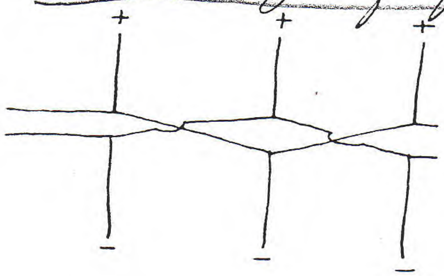
The combination of an electron and a positron is electrically neutral but the slight positive value of $K\mu$ remains to give the combination mass. In extra-galactic space the neutralizing effect of the electron is lost and the combination, if indeed it can exist, is a particle of great mass. Whereas, at the center of a star the effect is reversed and a value of $K\mu$ is reached where mass no longer increases.

In other words, the mass of a particle increases as the space energy increases. This increase in mass is present where the velocity of light has increased due to lower $K\mu$. The two, therefore, are closely related.

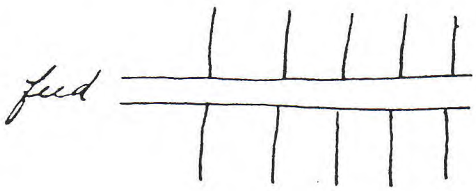
Electro-gravitational relation.

Considering the space potential of extra-galactic space, the field around a unit positive charge is the only "field" which is present. The direction of the force is toward the center of the charge, and the gradient increases toward the center. It is the "slope of the slope" which causes the difference in space potential toward the center of the charge. Whereas the electric field is merely the slope. "The gravitational field is the first derivative of the electric field."

Ultra-high frequency antenna. (multiple dipoles)



$\lambda/4$ dipoles
$\lambda/2$ separation



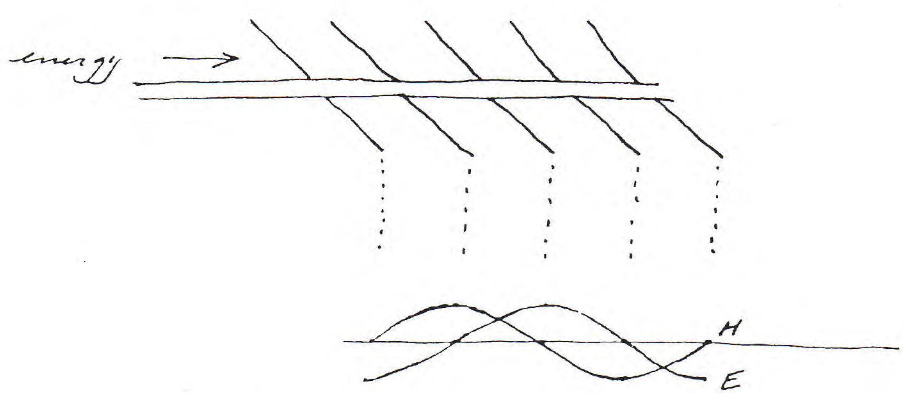
$\lambda/4$ dipoles
$\lambda/4$ separation

Assuming a matched transmission line with $\lambda/4$ dipoles disposed along it:

(a) Radiation would be directed away from the feeder end.

(b) Mechanical reaction toward feeder end.

Estimate of forces and their direction.

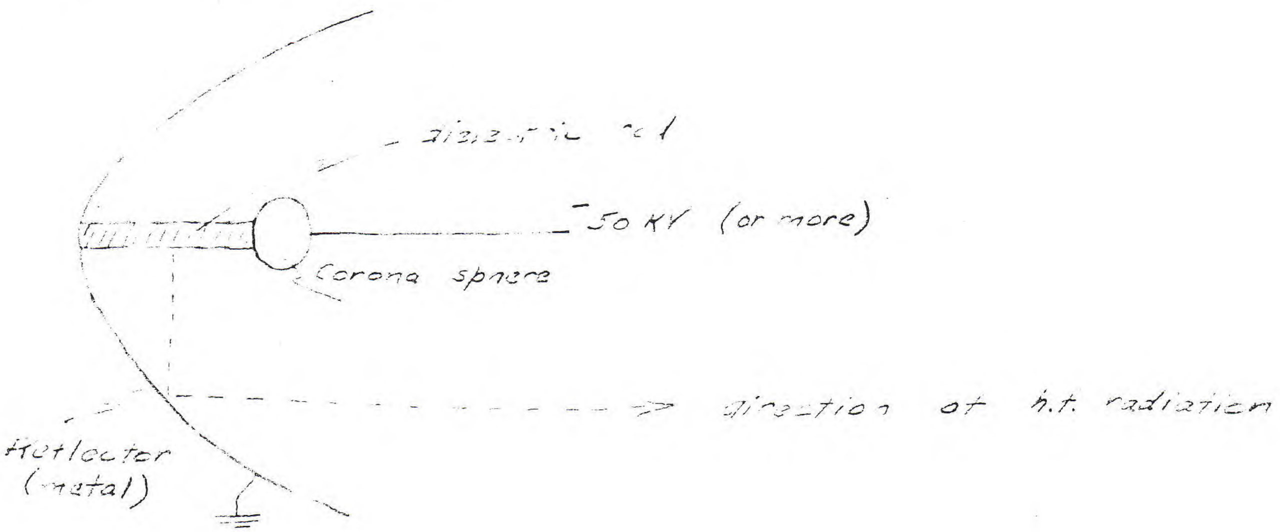


The forces developed on adjacent dipoles due to magnetic radiation of one set of dipoles is as shown on following curve.

High Frequency Radiating System.

This disclosure presents an improvement on the method previously disclosed in my patent "Electrostatic motor" and sets forth an application of those principles in the service of radar.

service of radar?



Application of high voltage D.C. to dielectric rod causes rod to conduct current in an undulating motion and to radiate electrically. Reflector not only assists in this action but also serves as a reflecting surface for the emitted high frequency radiation. Mechanical thrust exists in the direction opposite radiation which can be used for radar purposes.

Dated this 24th of November, 1942 at Burbank, Calif.

Witnesses as to signature and date:

[illegible]

[illegible] 11-24-42

Thomas Townsend Brown

Dec. 1, 1942

It is noted that the net force is in the direction in which the radiation is cancelled, i.e., toward the source of energy in the transmission line.

Such a force exists irrespective of the spacing of the dipoles from each other.

The force increases to a maximum, indicated by the difference in volume (area) of the curves, as the number of dipole pairs increases.

Summary.

It is indicated, therefore, that an infinite number of dipoles disposed along a transmission line possessing "uniformly graduated matched impedence thruout its length will radiate directionally toward the end of the transmission line toward which the energy is travelling. *

The effect is analogous to a nozzle of a fire hose.

The mechanical reaction in the opposite sense is analogous to the "kick" of the hose nozzle.

"Beverage Antenna." Radio Eng. Handbook. P. 681
Henney.

This consideration now resolves itself into two objectives:

(a) Production of highly directed (beamed) radiant energy.

(b) The production of force or motion (reaction effect).

Both objectives will be borne in mind in the development of the method, both are equally important and useful.

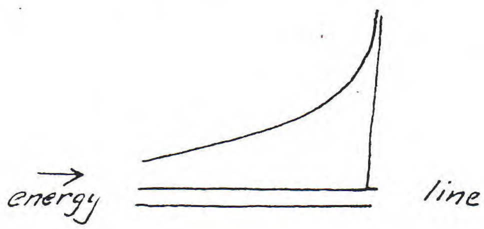
Matching of transmission line.

Not easy to accomplish. Some kind of gradual matching must be used. In general, the problem may be stated thus:

(a) Looking into the line (with dipoles attached) at the powered (source) end the impedance should be low and should permit maximum radiation of all dipoles.

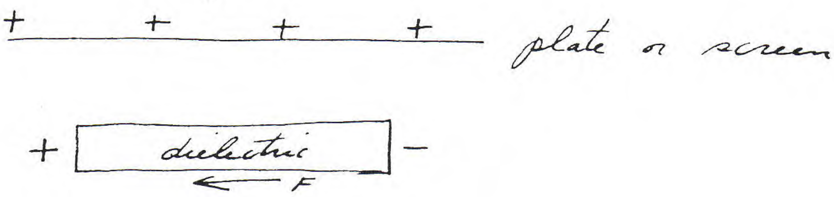
(b) Looking into the line from the other end, the impedance should be extremely high, so that no energy would be reflected back to the source and no standing waves would be formed.

Again the situation must be analogous to a water line with the end wide open.



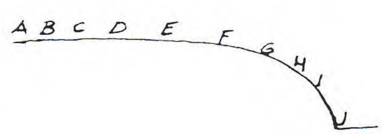
Impedance curve

Turning for a moment to the behavior of a dielectric in an intense electric field the following facts have been observed:

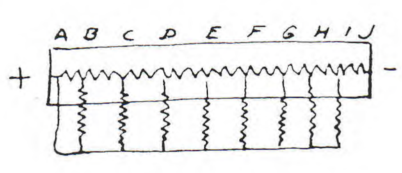


F denotes direction of movement.

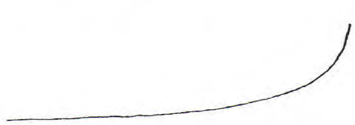
Assuming leakage along the surface of the dielectric the gradient will be as follows:



Voltage

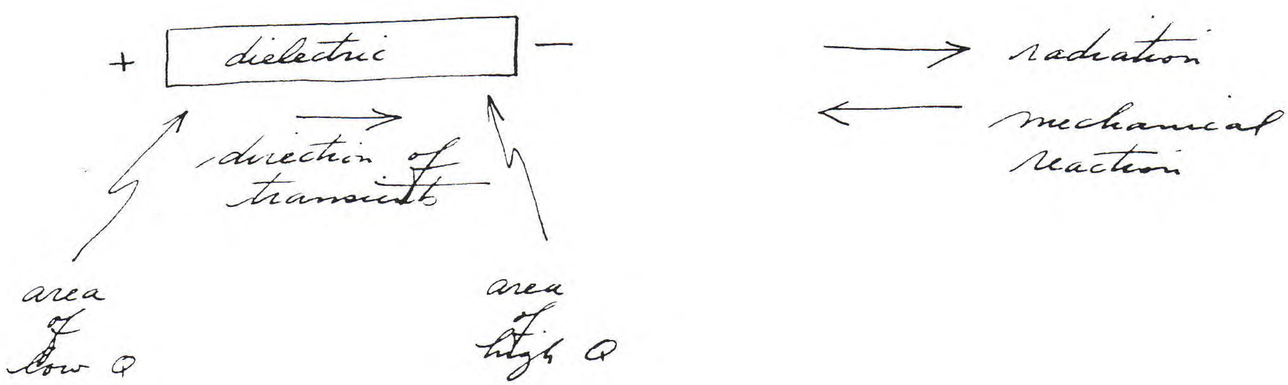


Circuit

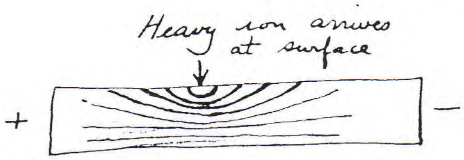


Gradient (also distribution of Q)

If transients are produced in a dielectric it is possible that they would travel in the direction of decreasing impedance. Just what effect the gradient (electric) has on the absorption or transmission of transients remains to be seen. If the transients are absorbed it is probably because they are radiated. In that event the high gradient might increase the impedance.



Creation of high-frequency transients.



Upon arrival of a heavy ion, a "splash" is produced and the wave travels in all directions, principally along the surface of the semi-conductor. If penetration of the dielectric occurs, it is possible that standing waves (internal) are produced.

As the "splashes" travel along, they are progressively reinforced by

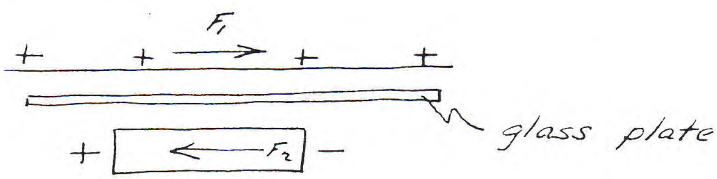
1. Attracting (by field strength) other nearby ions, then
2. By ion contact, conveying the charge away, reinforcing the current factor and the magnetic constituent of the transient.

If fast ions are not available in the region the transient is not reinforced and soon attenuates.

It is indicated, therefore, that the transients are reinforced, and additional energy provided, in travelling toward the end of the dielectric where free ions are in close propinquity. In this direction also, impedance matching proper for radiation is present.

Internal reinforcement is not probable. A configuration of standing waves, dependent upon frequency of the "splashes" will result. But the standing waves will progress down the length of the dielectric, (phase velocity), and will be reinforced or attenuated depending on the direction they are going.

In the original disclosures of the dielectric effect described on P. 6. it was the electric field, transverse to the line of dielectric gradient, which was throught to be responsible for the movement. There is experimental evidence, however, to the effect that a transfer of charges is essential, tho the magnitude of the force does not appear to bear any observable relation to the ion or electron intensity.

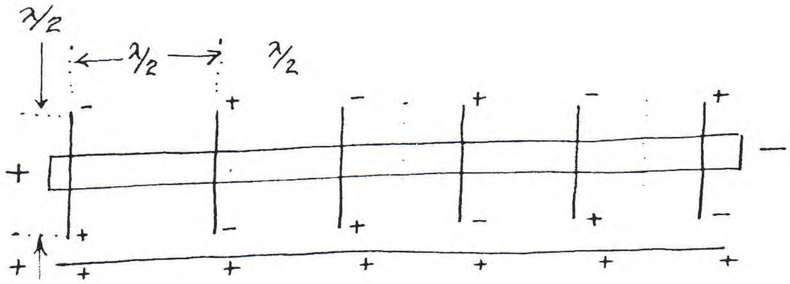


F_2 is the force exerted by the dielectric.
F_1 indicates the direction of the reaction.

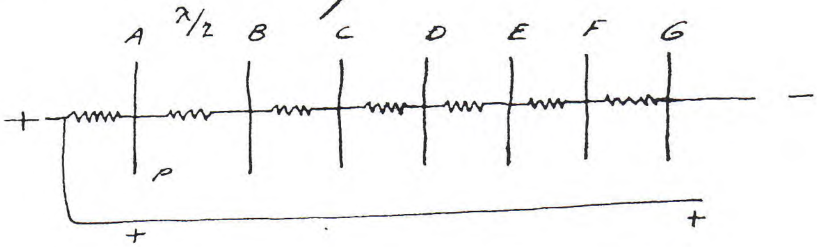
If a glass plate is placed between the two elements, the force on the reactor plate F_1 disappears. No information is available on the force of the glass plate under these circumstances, or the effect on F_2.

In the absence of information to the contrary, it is considered reasonable to assume ionic or electronic conduction and to develop the "splash" theory of transients.

magnetic field



To begin with, let us assume a simple resonant system where a "semi-conducting rod" is used as a voltage divider and $\lambda/2$ rods are disposed along it, spaced $\lambda/2$ apart. The circuit would be as follows:



Self-excited "Beverage" Antenna

A flow of electrons (or ions) occurs from the point P to the positive plate. This causes a current flow thru one "arm" of the dipole-current system, and a difference of potential results which reduces or stops the flow of electrons. For, at this point on the voltage divider the voltage is just enough to start ionization at point P.

Successive points produce waves of electrons, regions of maxima and minima.

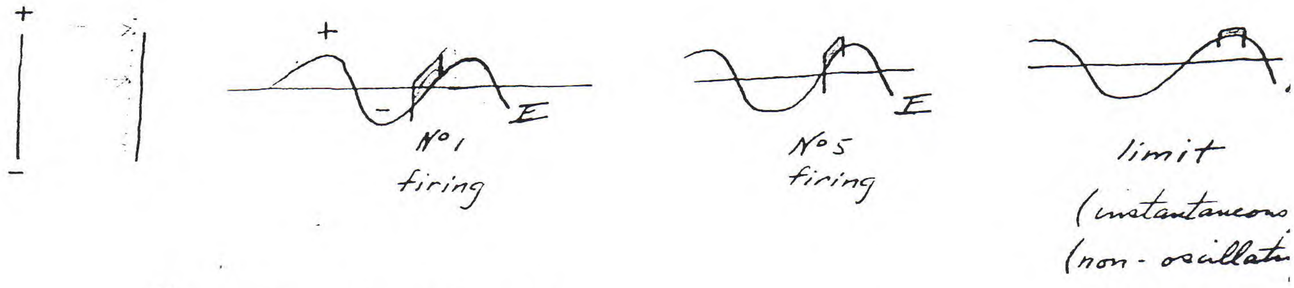
The expanding electro-magnetic radiation induces an opposite emf in the adjacent dipole. This "field" to the plate starts a flow of electrons (or ions) which gets underway 90° later and reaches maximum as the emf reaches zero.

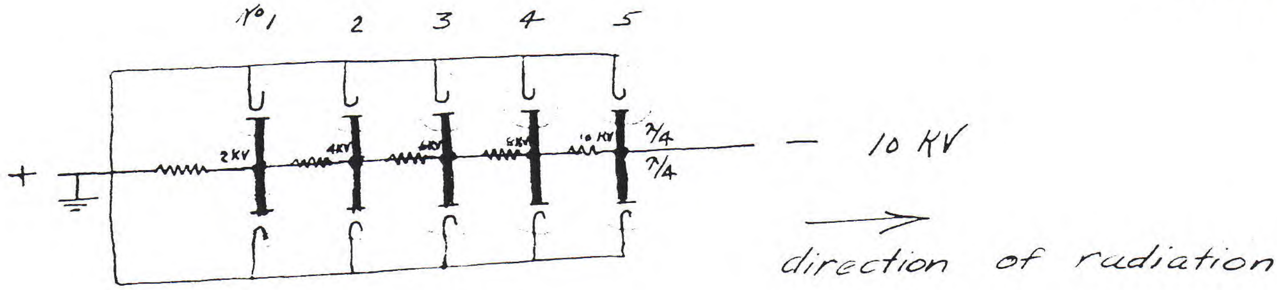
The reinforced electromagnetic radiation then "fires" succeeding dipoles in the same way, gaining energy from the currents successively employed.

The wave front travels along, gaining energy from each dipole in rapid succession.

Why, as in the case of transients previously discussed, the direction of wave travel is fixed, is not well understood. It may depend on the impedance of the system, the electric gradient or the transit time of the firing electrons or ions. In any event, it is fixed and is in the direction of the higher gradient.

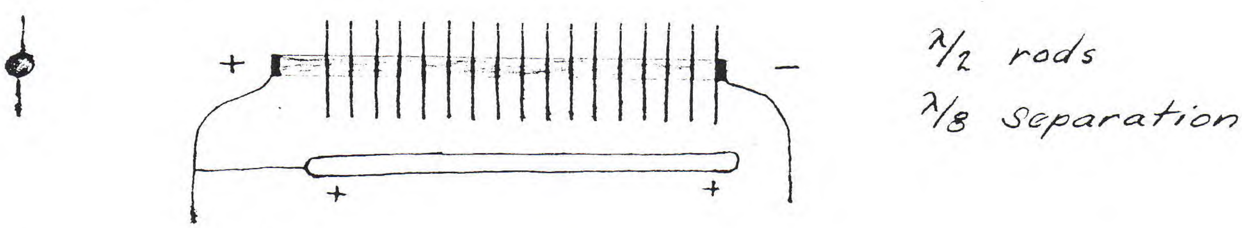
If transient time is the cause, the following hypothesis may serve to explain the results for the time being.

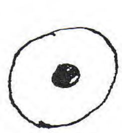




As a control oscillator, No 1 is most effective. Its energy of oscillation is greatest. As the potential increases the oscillator becomes less a "leader" and more a "follower". But the wave gains energy uniformly, due to the increasing amplitude.

Modifications for practical use.





or in the form of discs with the same spacing.

Dec. 7, 1942

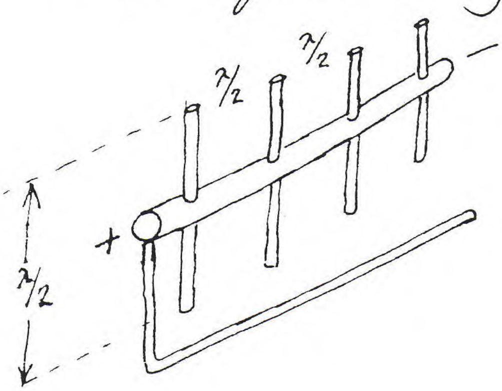
Series condenser —

Increasing the number of plates should increase both the directivity and intensity of radiation and the reaction forces in accordance with integrated curve as shown on P. 2.

Block of Dielectric —

It appears to make little fundamental difference if the series condenser were substituted by a solid block of dielectric material.

For preliminary tests of the principle —



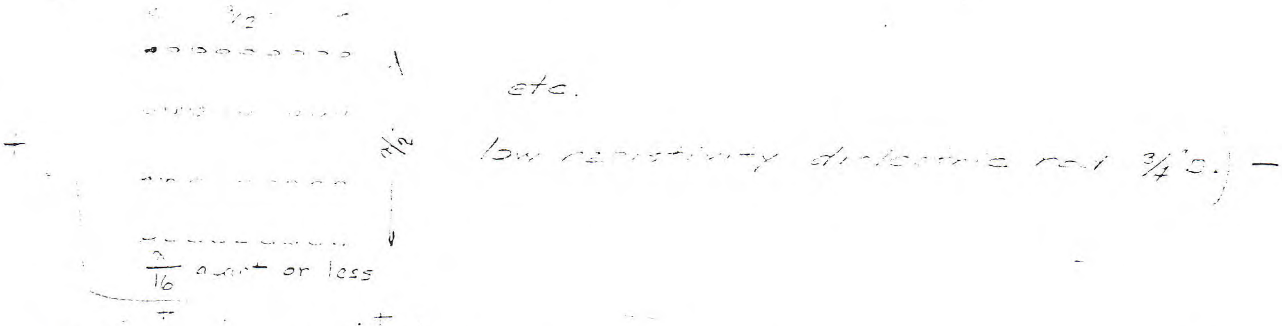
λ/2 rods disposed along a dielectric (low resistivity) rod λ/2 distance apart. With ionizing wire (or plate) attached to one end of rod.

A relatively high DC potential is applied so that a gradient is present along the dielectric rod.

For a plate, a larger tube to both sides of the dipoles may be used. Dipoles may be about 2 inches long (2 inches apart) to generate 10 cm. waves.

Dec. 7, 1942 — T. T. Brown

As an alternate to this design, for test purposes, a large number of 2" ($\lambda/2$) dipoles may be disposed at very close spacing along the dielectric rod.



This modification may offer greater radiation directivity & sensitivity — also greater reaction forces.

In such a device, dipoles are set into oscillation at resonant frequency by the periodic escape of ions or electrons from the ends of the dipoles. Succeeding dipoles pick up the oscillation by induction, reinforce it and pass it on. The result is a train of waves running longitudinally and escaping from the end of the dielectric rod where the potential is greatest. The mechanical reaction is in the opposite direction.

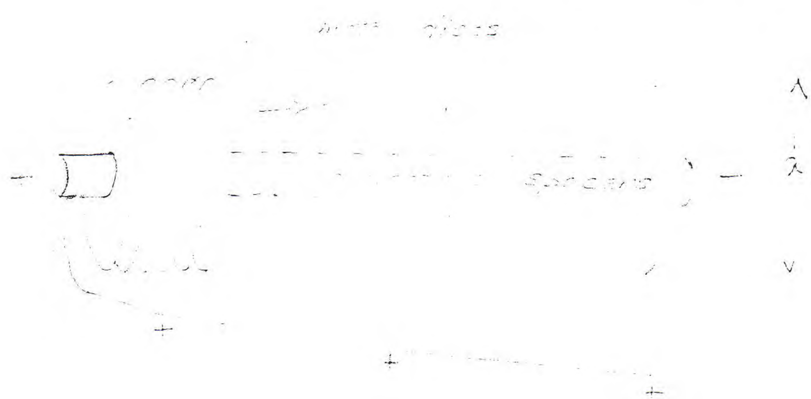
To increase capacitance between successive dipoles, several ideas may be set forth:

(1) Use a material of higher dielectric constant (specific inductive capacity) for the rod.

(2) Increase the lateral dimensions of the rod.

(3) Place condenser plates at the centers of the dipoles.

(4) Use circular plates as dipoles. (One pole at center and other on the periphery) as:



It appears that such a design would be most effective if the diameter of the plates would be one wavelength. (For 10cm — 4 inches)

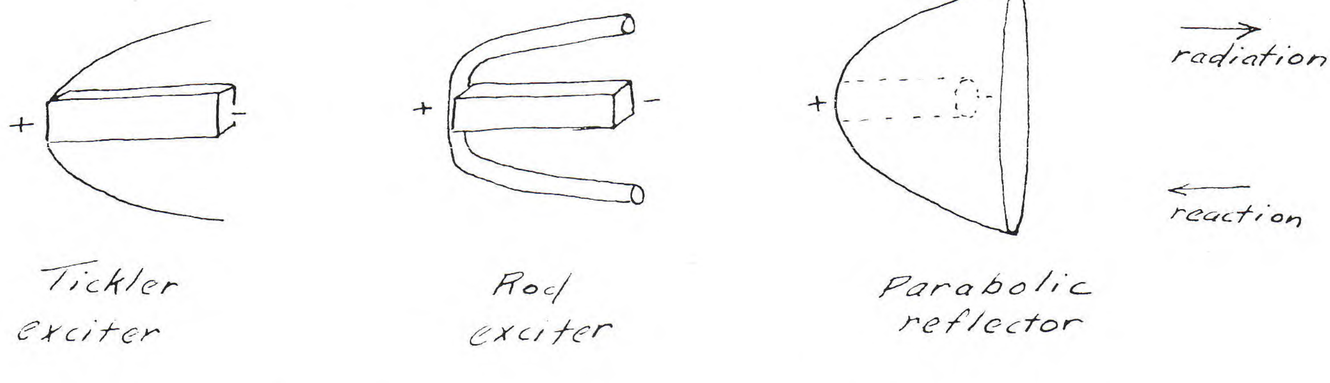
Equivalent circuit

External excitation.

In all of the types previously described the excitation has been "external".

The movement of electrons and/or ions causing the oscillation of the dipole has been outside of the system of dipoles. This is accomplished in any one of several ways:

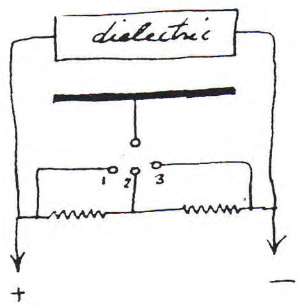
1. By the use of a "tickler" creating ions.
2. By a rod or conducting bar, where the steepest gradient is at the dipole end, or
3. By a flat plate, screen, cone or parabolic reflector.



The excitation determines the direction of radiation and mechanical reaction, due, presumably, to the direction of the train of waves caused by interacting dipoles.

Dec. 7, 1942

T. T. Brown

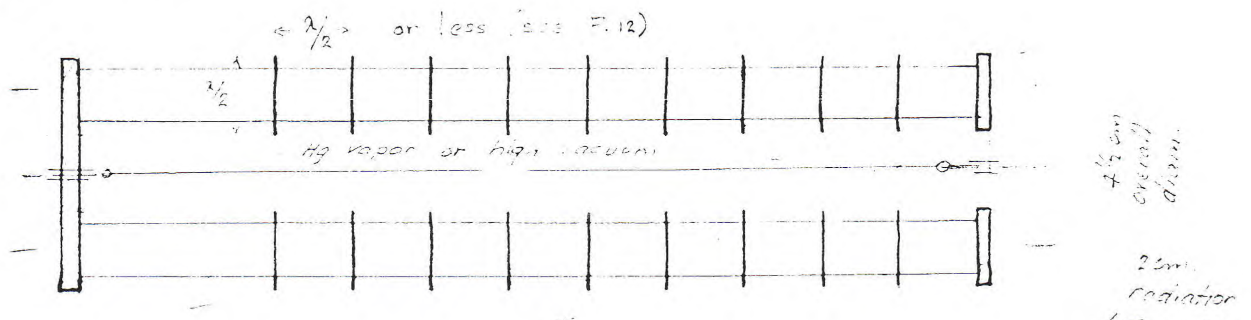


To illustrate the action of excitation, the following experimental facts are presented:

When switch is in position 1, the dielectric moves to the left. When switch is in position 3, the motion is toward the right. When in position 2, no motion is observed. The extent of this movement varies with the time of day, i.e., according to solar, sidereal & lunar curves, seasonal variations and yearly shifts. Sudden "storms" of rapid and erratic variation are also observed.

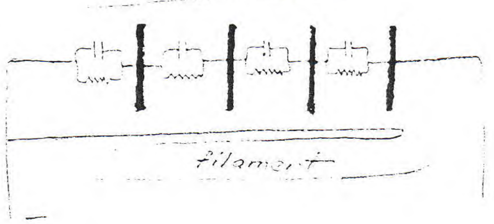
Internal excitation.

As a practical improvement, the following suggestions are offered:



Note:

Filament



Equivalent circuit

Dec 7, 1942

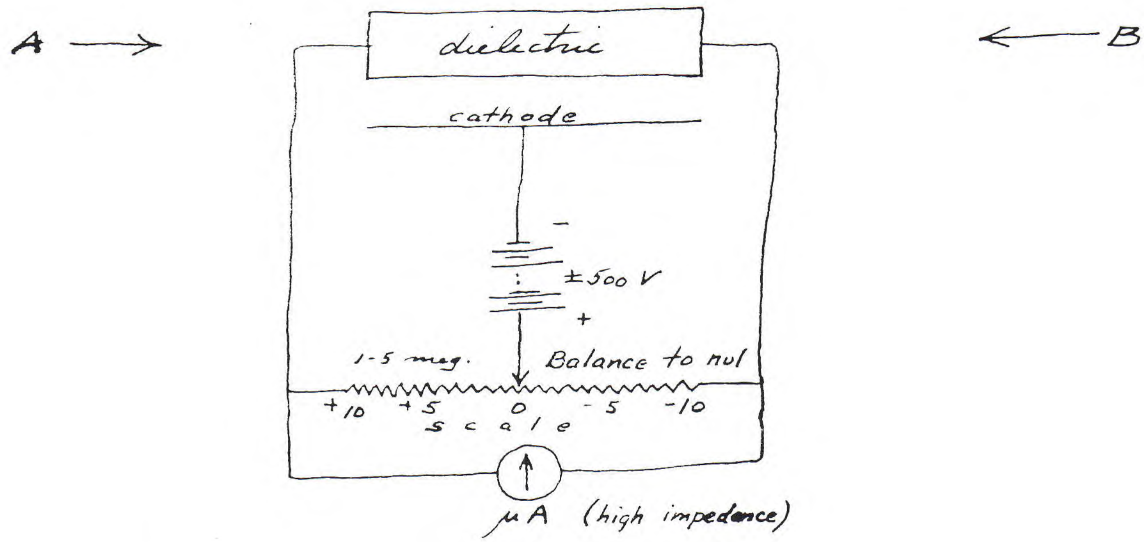
It may be found desirable to use a confined (beamed) cathode at the negative end of the internal excited radiator. The electrons at the negative end would, therefore, be slow and would not start (or continue) oscillations in those dipoles near the negative end. At some point along the line, where the field is of proper strength, oscillations would start. Magnetic situation at any instant would be such as to reinforce electrostatic conditions in much the same fashion as it maintains oscillation in a magnetron. In effect, then, "transit time" would have to reach a certain value to start oscillation. Waves would travel from the end with high transit time to the end with low transit time. Electrons would be continuously accelerated the length of the tube. They would form in bunches and their energy of acceleration would be largely removed in passing regularly thru zones or resonant "chambers".

If the dipoles are of proper dimensions (1 cm.) 2 cm. radiation (15,000 megacycles) might be generated which would leave the device at the high voltage end. Similarly, if 2 cm. radiation were received from that direction, a high voltage charge would be created at the same end.

Dec. 8, 1942 T T Brown

Thus, it appears that the "system" can be used not only to transmit electromagnetic radiation but also to receive it. It is logical that the action should be reversible.

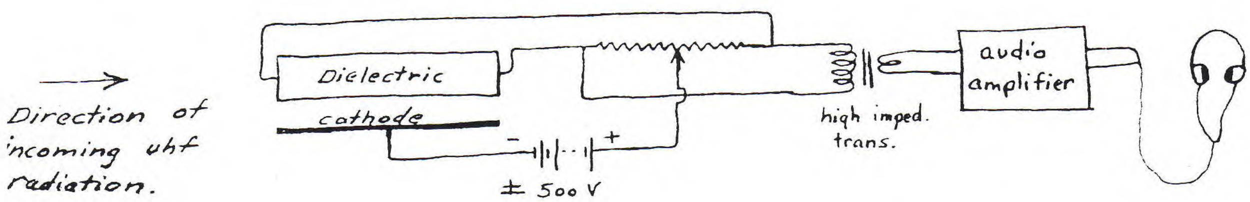
It is interesting to note that the direction and relative intensity of received radiation is **revealed** by the polarity and the potential gradient of the dielectric system.



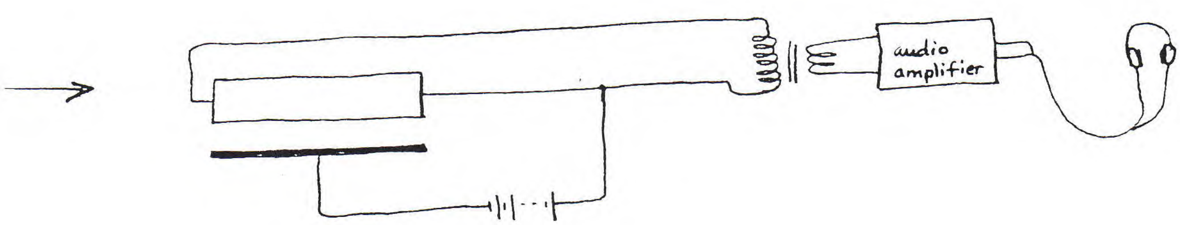
This can be done by the bridge method as indicated above.

Radiation from direction of A will cause the nul to move along the scale toward +10. While radiation from direction B will cause the nul to move toward -10. The intensity of the radiation will determine the extent of the nul shift. Modulated radiation will cause pulsating direct current at the μA meter.

If it is desirable to use the system to receive modulated signals, the microammeter can be replaced by a suitable high impedance transformer and a standard amplifying circuit with headphones or loudspeaker.



or

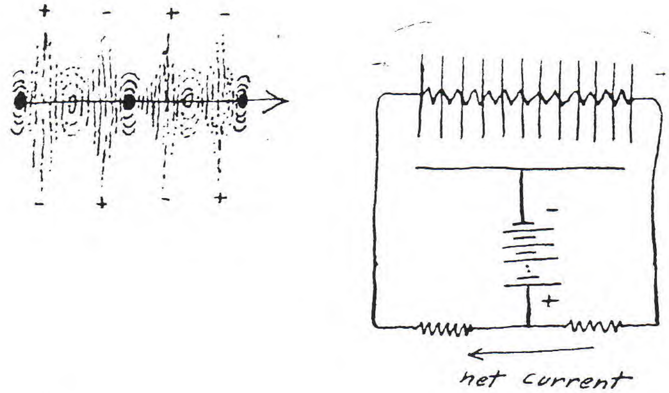


It may be seen that the "antenna" and detector are combined, just as, in the case of the transmitter, the "antenna" and oscillator are combined.

Received radiation will cause the dielectric to become differently charged with gradient in the line of direction of the source of radiation, negative charged end to "point" toward the source of received energy. This, of course, is based on the use of a "negative tickler" or cathode as in the above circuit.

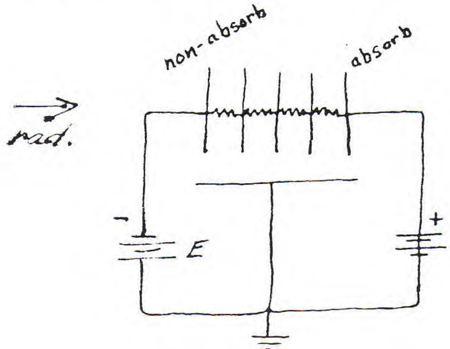
Dec. 8, 1942 — T. T. Brown

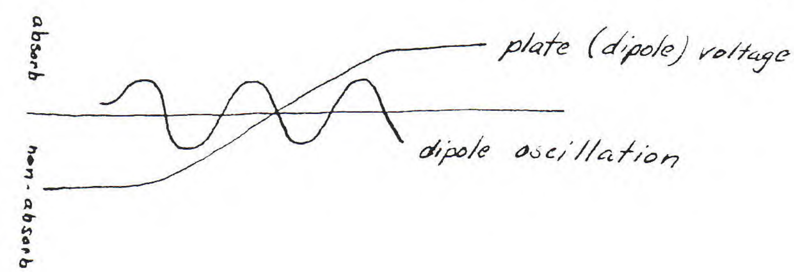
The theory of this action may be described briefly as follows:



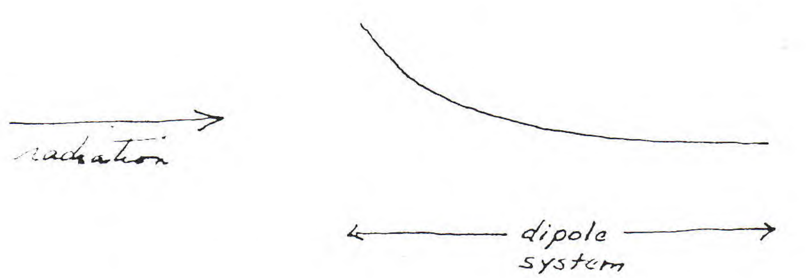
Dipoles (antenna) set into electric oscillation by incoming radiation.

Oscillating dipoles gradually lose energy in passing along the line, i.e. energy is removed by the detecting system. The dipole nearest the high energy end is, therefore, oscillating with the greatest amplitude (voltage). Electrons are pulled from the cathode on the positive swing of the end of the dipole nearest the cathode. In succession each dipole down the line does the same thing with less and less amplitude. Finally, a limit could, theoretically, be reached where no radiant energy were present (due to absorption) and no oscillations are present. The net result, then, is a difference of potential along the system of dipoles, with the accumulated negative charges "stored" at the end of the system nearest the source of radiation. "Storage" (capacity) would depend upon the amplitude of the radiation and the absorption or loss of amplitude. The potential difference at the ends of the system would then actually be an indication of the absorption of energy. Theoretically, the gradient would increase until a limit is reached where no absorption takes place. In other words, if the "incoming" end of the dipole system is under excitation by radiation and the dipoles are oscillating at a certain voltage amplitude, if at the same time that end of the system carries a highly negative charge so that no electrons are pulled from the cathode, then no absorption takes place.





Since absorption is usually present in the receiving dielectric, the potential gradient is present — The highest negative potential lying in the direction of the highest amplitude of oscillation of the dipoles, and necessarily toward the source of radiation.



It follows that, for a unit length of dielectric, the absorption depends on the number of dipoles + the voltage.

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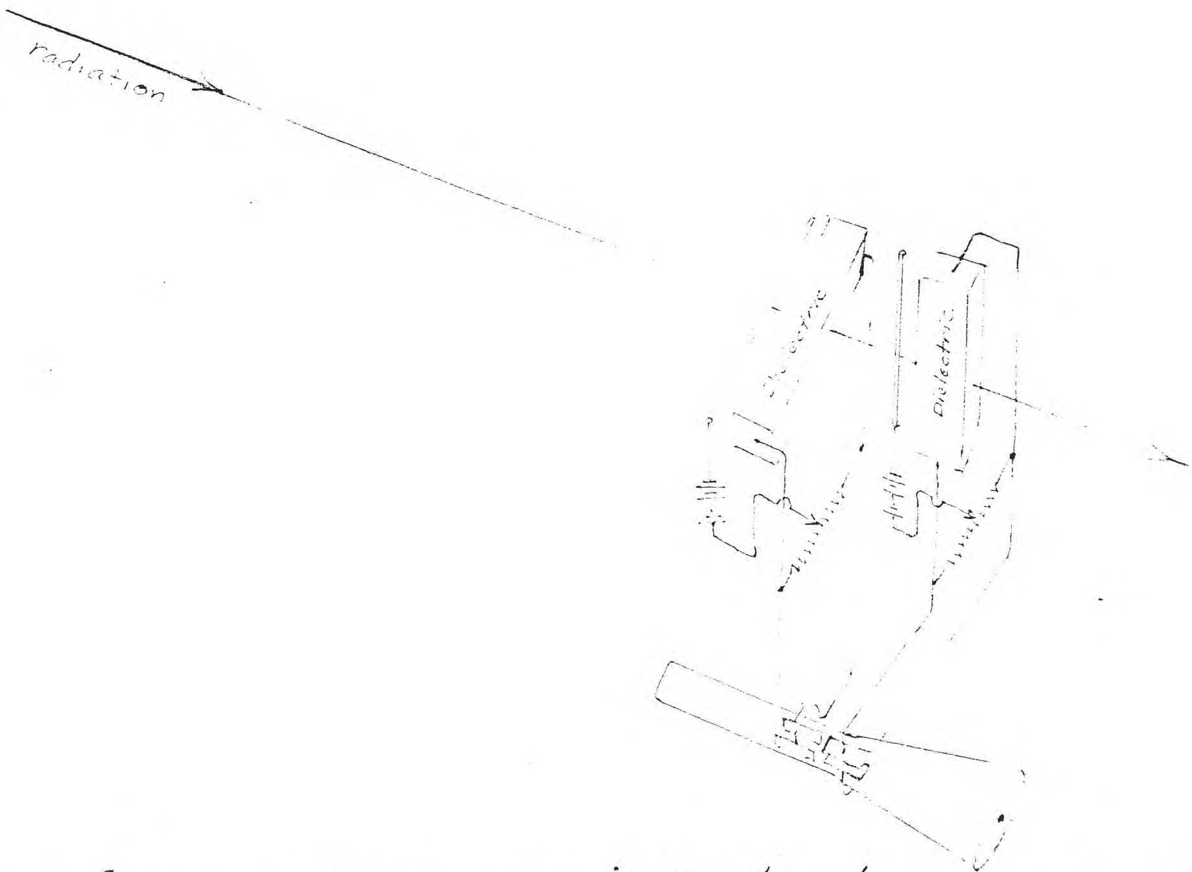
To determine accurately the point of origin of u.h.f radiation (sidereal) the following circuit, employing a cathode ray tube, is suggested:



The apparatus is designed to train and elevate and the spot on the cathode ray screen indicates the source as if it were viewed optically.

Witnessed this 8th of December, 1942

B.F. Jenkins 12-8-42
Carlo Re 12-8-42

T.T. Brown

Dec. 8, 1942 T T Brown

To explain the directional effect, both in emitting waves and receiving them, the amplitude of dipole oscillation appears to be the key.

In receiving (and absorbing) u. h. f. radiation, energy is removed from the wave. The wave causes the dipole to oscillate. If, during the oscillation, the potential reaches a value capable of pulling electrons from the cathode, an electromagnetic "drag" is introduced which not only causes a current to flow but limits the oscillation of the dipole. If the circuit is not closed and the current is capable of building up a charge, the charge will be of such a sign (polarity) as to reduce and ultimately stop the current flow. Therefore, if the neighboring body is a cathode, the dipole or system of dipoles will pull out electrons until it is "saturated"; that is, it reaches such a negative potential as to not attract more electrons. This saturation value naturally depends upon the voltage amplitude of the excited dipole. A dipole near the source of radiation has a greater amplitude than one farther away or where the radiation has been reduced by absorption. Its potential, therefore, is more highly negative.

A block of dielectric material, containing natural dipoles, will under such circumstances acquire an electric gradient if a current does not flow. If the neighboring body is a cathode, the gradient will slope "toward" the incoming radiation, that is, the end nearest the radiating body will become negative with respect to the other end. The potential of the entire block will become negative with respect to the cathode, so as to nullify, if it can, the last remaining "drag" of the cathode on the positive end. Thus, the electrical effect of a neighboring body is eliminated if no currents are permitted to flow. The dipoles oscillate without drag or resistance and the radiation is not absorbed.

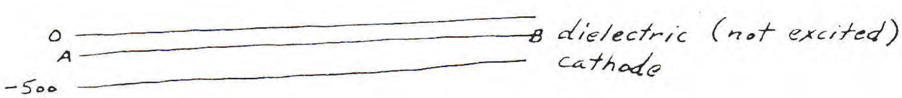
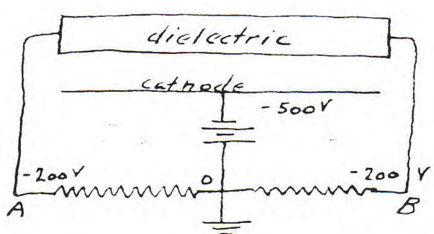


Fig 1



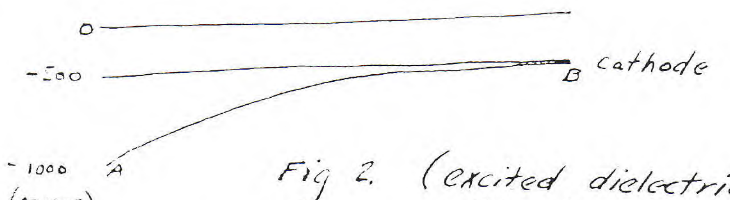
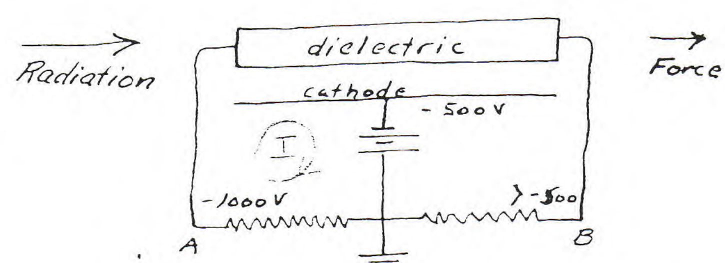


Fig 2. (excited dielectric) with absorption



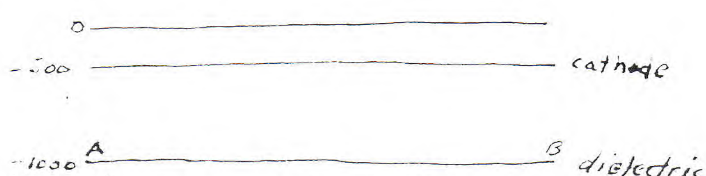


Fig 3. (no absorption)

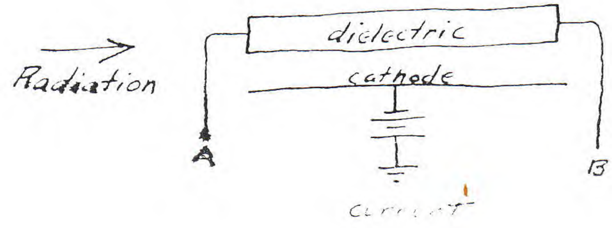


Fig. 1. shows the condition of the circuit when the dipoles of the dielectric are not excited. Straight conduction currents exist and the pattern is symmetrical.

Fig. 2 shows the condition when the dipoles are excited by radiation from the left side. Currents are now flowing due to the absorption of radiant energy and the loss is that indicated by I^2R of the resistance. A voltage gradient, steepest near the end of the dielectric, exists thruout its length, and the potential approaches that of the cathode at the other end.

Fig. 3 shows the static condition with the dielectric dipoles excited but no current flowing. In this case there is no radiation resistance, no absorption and no energy transfer. The dielectric mass acquires a static (negative) charge, the magnitude of which is determined by the energy of radiation exciting the contained dipoles.

Values of voltage shown in the curves are fictitious and are used merely to further the explanation.

It is apparent that radiation pressure will be exerted on the system shown in Fig. 2. As the electrical resistance increases, the pressure decreases until, as in Fig. 3, no radiation pressure is present.

Conversely, radiation pressure increases as electrical resistance decreases, up to the point where the voltage difference begins to drop.

Radiation pressure is proportional to the I^2R loss. That is, the condition which makes the current-maximum is likewise that which causes the maximum radiation pressure on the dielectric system.

In the foregoing explanation, the "neighboring" body was the cathode. The same explanation holds if the neighboring body is the anode, except that all electrical signs and current directions are reversed. The radiation pressure is, however, in the same direction. Therefore, it makes little difference, except perhaps for electron emission, convenience of construction, etc. whether the neighboring body is positive or negative with respect to the dielectric system.

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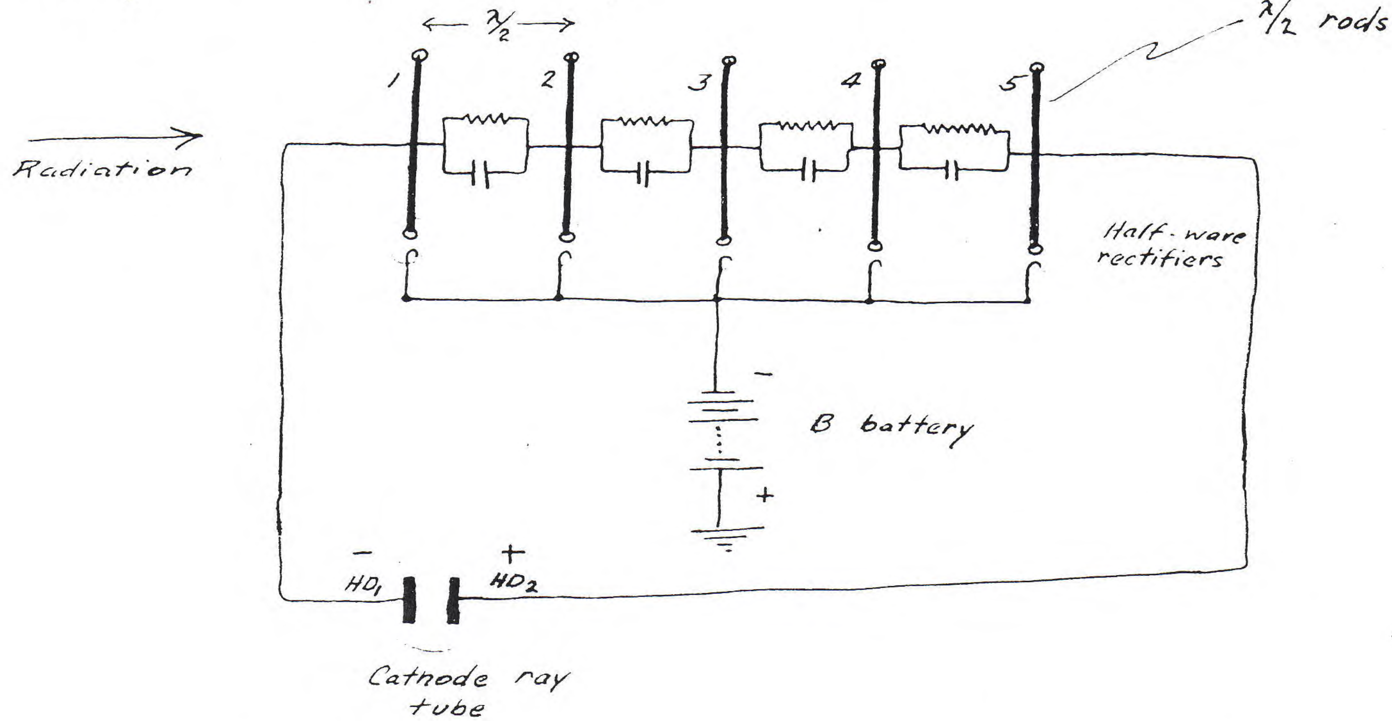
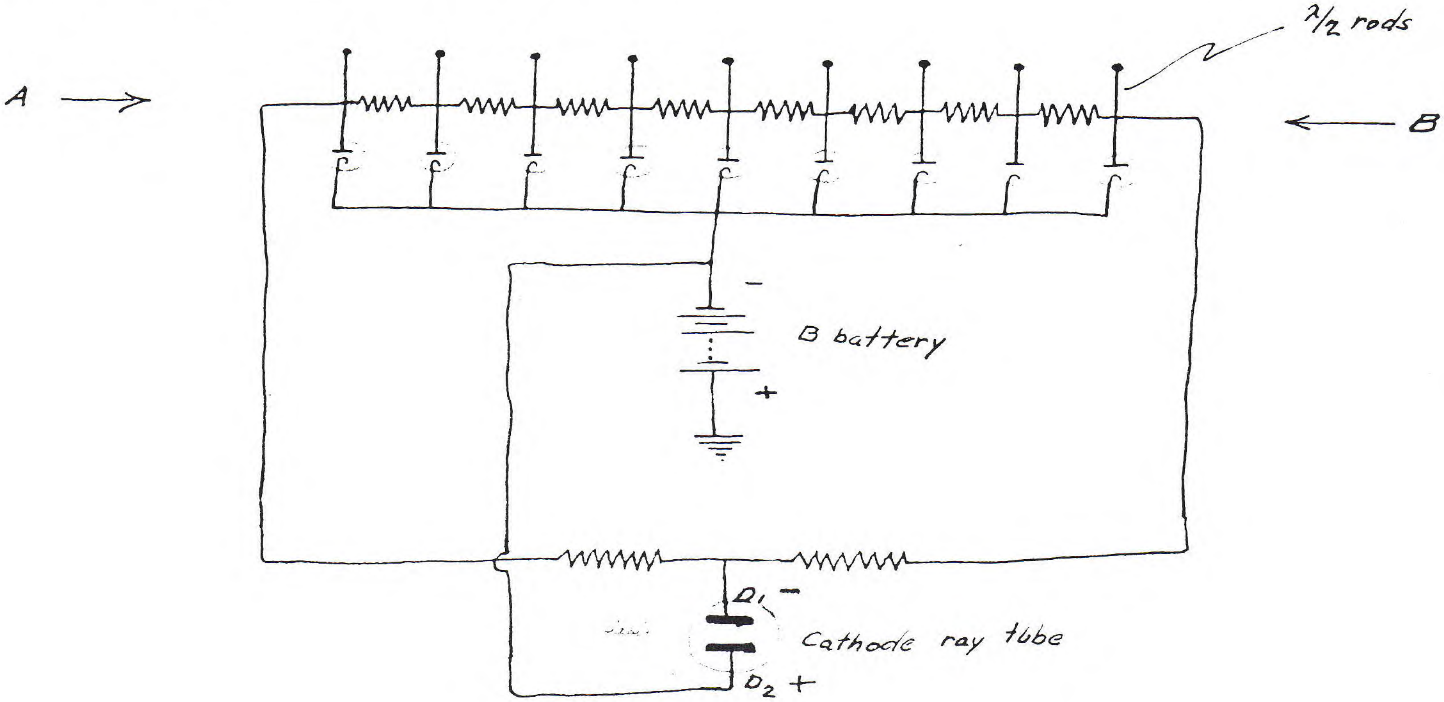
In order to understand fully the action of the receiver just described, the following simplification is set forth:



Under the influence of radiation from the left, No 1 dipole oscillates with greatest amplitude, No. 5 with the least, and since the charge (net) of the dipole depends upon the amplitude of voltage oscillation, the No 1 dipole becomes more negative than No. 5. Hence, the "spot" on the CR tube screen moves to the right (toward the positive deflection plate).

It appears to make little change in the theoretical interpretation if the spacing of the dipoles is less than λ/2, except to increase the effect.

If directional information is not desired, the net charge of the system of dipoles may be detected. Thus, the device becomes more sensitive, but bi-lateral.



Radiation is detected with maxima either from direction A or B.

As a bilateral transmitter:

Similarly, if a strong field exists between the dipole system and the "neighboring" body such that electrons cross the space in the proper timing (transit time), oscillations are induced in all the dipoles and bilateral radiation results. No reactive forces are present in the system as a whole, due to cancellation.

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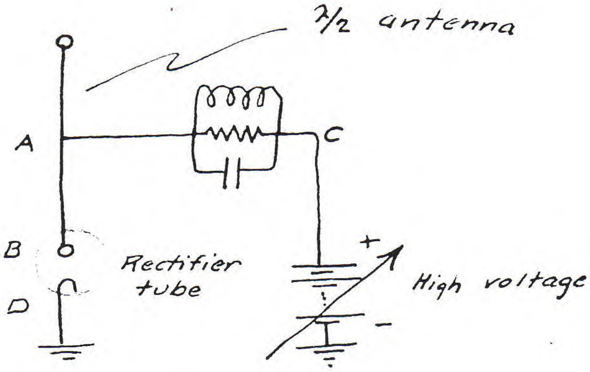
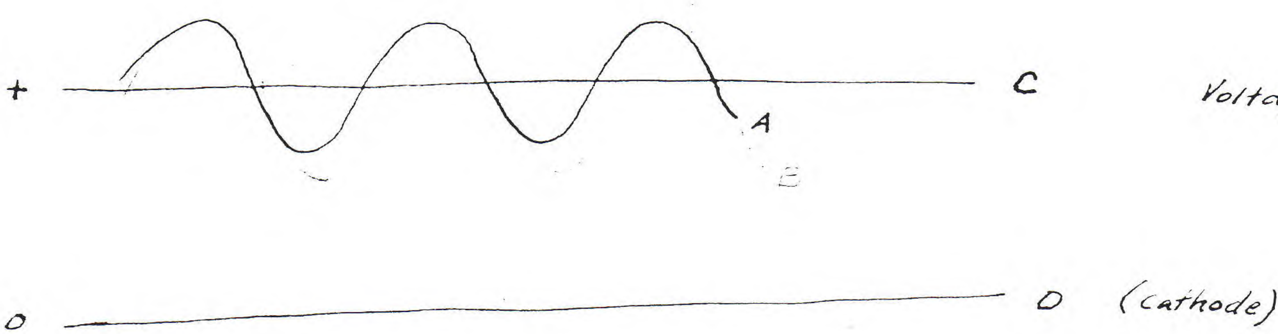
Examining in detail the action of such a transmitter, the following ideas are set forth:



Unit Transmitter

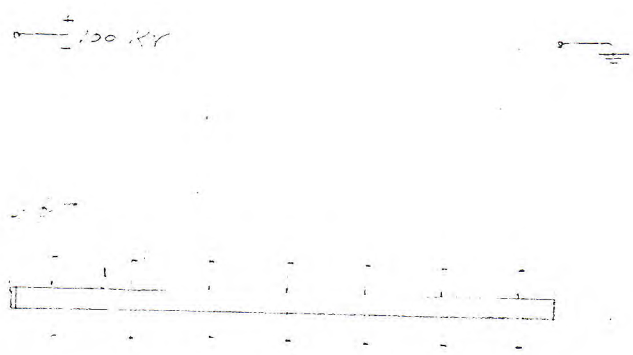
Under proper circuit conditions, oscillation of the ~~radiating~~ antenna will start spontaneously. Once in oscillation, the amplitude is reinforced and energy is applied in pulse form.



Voltage

Dec. 9, 1942 Tests Proposed.

No 1.



$\lambda/2$ antennas (λ = 10 cm)

$\lambda/2$ apart

Mounted on red fibre rod (partial conductor)

To observe the angle of rise against gravity.
To derive a voltage - force curve (approx.)
To observe difference, if any, when energized by + or − and AC.

No 2.

Same as above but with $\lambda/2$ antennas $\lambda/16$ apart. Corrected for increased weight and conductivity of rod.

No 3.

Same type of experiment using cylindrical dielectric rods same diameter of various substances, without antennas.

No 4.

Same as No 3, with ticklers of various lengths and shape.

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N° 5.

Comparison of dielectric rods and tubes 10 cm. diameter. Various materials.

N° 6.

Comparison of dielectric tubes, with and without internal excitation.

N° 7.

Action of a solid dielectric rod with "fine wire" internal excitation. Various diameters from 2cm to 10 cm.

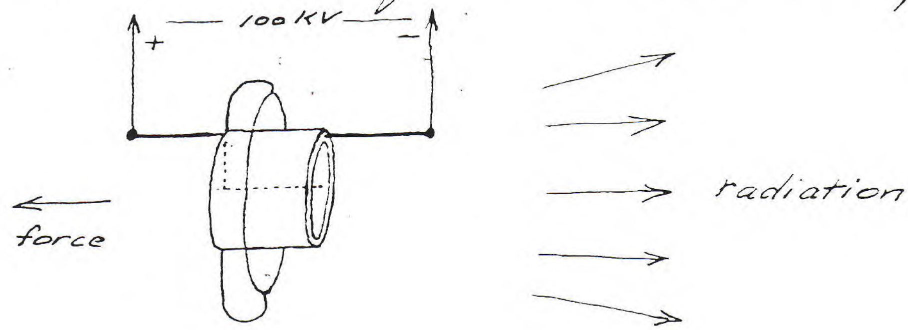
N° 8.

Perfect construction technique of hot cathode in evacuated dielectric tube. Internal excitation. Effect of cathode at one end, with electrons beamed.

N° 9. Attempt to receive 10 cm. radiation from any of the above transmitters by a standard u h f receiver (radar).

N° 10. Attempt to receive radiation by another dielectric system, as on page 22.
Observe, if possible, natural radiation from space (sidereal radiation) and its direction of approach.

Special test for demonstration of forces.



As a suggestion, to demonstrate the direction and magnitude of forces, the set-up as illustrated above will serve.

It consists essentially of a wood cylinder, made up of segments cemented together with cellulose nitrate cement, with grain running longitudinally. Cellulose nitrate windows close the ends of the cylinder, cemented to the metal foil electrodes. These windows support the fine iron ionizing wire through the center of the cylinder. Wire hooks support a similar wire circle about the outside of the cylinder. Both ionizing wires are connected electrically to one end of the cylinder. The system is suspended free to move. Upon application of approx. 100 KV. (preferably with the positive end to the ionizers) the system will move as indicated.