THERMAL ELECTROMAGNETIC DRIFT (TED)

Horace Heffner 5/20/97

BACKGROUND AND OBJECTIVE

The first and second laws of thermodynamics are assumptions, or at least based upon assumptions. It is possible that multiple assumed "laws" can be mutually inconsistent. In such a case, using logic or an example to produce a more evident inconsistency from the laws is useful in order to see or understand the inconsistency.

The primary objective of this paper is to demonstrate an inconsistency between the second law of thermodynamics and the Lorentz force.

The Lorentz force is a force exerted on a charged particle, like an electron, moving through an electromagnetic field. Given F, E, v, and B, vectors representing force, electrostatic field strength, velocity, and magnetic field strength, a particle of charge q0 experiences a force given by the Lorentz relation:

$$F = (q0\ E) + (q0\ V)\ \mathrm{x}\ B$$

Here x means vector product. This implies, for example, that an electron in the absence of field E, and traveling left to right, perpendicular to a magnetic field B that is out of the page, will experience an upward force (see FIG. 1). This further implies that, if B is out of the page, electrons of a fixed speed will move in counter clockwise circles of fixed radius, ignoring any of their motion in the axis normal to the page. Positrons will move in exactly the same manner, except in a clockwise direction. The radius of such a circle is called the cyclotron radius. Such circular motion, including any additional motion due to a field E, is called here cyclotronic motion.

```
B out of page toward reader

     ^
     | force F
     |
     |    velocity v
   (e-)---------->
```

FIG. 1 - Lorentz force (E assumed zero)

The circular motion that results has a characteristic frequency f, called the cyclotron frequency, that is independent of speed, because the cyclotron radius is proportional to speed. This frequency is given by:

$$f = q\ B\ /\ (2\ \mathrm{Pi}\ m)$$

where m is mass and Pi is 3.14159....

The first law of thermodynamics is the law of conservation of energy: "Energy can neither be created nor destroyed."

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The second law of thermodynamics is the law of entropy, and is stated in various ways, one of which is: "It is impossible for any cycling device to exchange heat with only a single reservoir and produce work."

It is an objective here to define a physically realizable system which for all practical consideration is a closed, isolated system that (1) has no moving parts other than electrons, and no stored potential energy other than the thermal energy of the system and that of a permanent magnetic field, (2) has two compartments, A and B, (3) has a given starting condition that all parts have a uniform temperature of 270 degrees Kelvin, (4) spontaneously moves heat from compartment A to compartment B and (5) thus either does useful work during the transfer process (e.g. electrical) and/or makes it possible to use the temperature difference to do useful work while transferring or conducting the heat from compartment B back to compartment A. The looping of heat back to compartment A closes the energy loop and creates "perpetual motion". If a true physical embodiment of (1) through (4) can exist then the second law of thermodynamics is no longer a law; it then needs qualifications or restrictions in scope.

It is maybe more accurate to say that such a system would actually fall totally outside the realm of thermodynamics as normally defined, in that it violates what is commonly called the "zeroth law of thermodynamics". This "law" is actually a definition upon which the second law is based, namely: "Two systems which are equal in temperature with a third are equal in temperature with each other." This definition is based on the idea that two systems are equal in temperature if no change in property occurs when they are in thermal contact. This is the characteristic that validates use of mercury thermometers, for example. If a thermometer does not change its physical properties when moved from one compartment to another, then the two compartments must have the same temperature. Inherently assumed in this concept is the notion that a closed isolated system at a uniform temperature can not self modify its own physical properties. If the temperature of such a compartment is verified to be the same as a thermometer by the lack of change of state of the thermometer, and the thermometer is moved to another similar compartment to compare temperatures, and the temperature is found equal, it can only be said the first and second compartments are the same temperature if it is known that the first compartment can not spontaneously change its temperature in the interim.

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```
 Compartment A
---------------
|             |
|             |
| Resistor R  |  Hot (>270 K)
|             |
|             |
---------------
 ^     |     |
 |     |     |
(e-)  Heat  (e-)
 |     |     |
 |     |     |
 |     v     v
---------------
|             |
|             |
|  <--- (e-)  |  Cool (<270 K)
|             |
|             |
---------------
 Compartment B
```

FIG. 2 - Block Diagram of System in Equilibrium

In the proposed system (see FIG. 2), compartment A contains a current generating mechanism except for the resistive current loop, and any device it may power, which is in compartment B. Electrical connection is made between the right side of compartment A to the right side of compartment B, and similarly on the left side. The compartments are thermally connected. Some of the heat of compartment A is converted to electrical energy which is transferred to compartment B, the resistive circuit, where it does useful work and thereby heats compartment B. Compartment A is spontaneously cooled while compartment B is heated, all with no active components. The waste heat from compartment B is allowed to flow back to A to maintain it's heat so it can continue to generate power.

If a compartment A is defined which can perpetually maintain a potential difference and a corresponding current flow, however small, then the objectives have been achieved.

THERMAL ELECTROMAGNETIC DRIFT

In a uniform magnetic field coming out of the page, thermal positive ions (or holes) will tend to move in a clockwise circle, negative ions will tend to move in a counterclockwise circle. If the magnetic field is nonuniform, a gradient with the field B stronger at the bottom of the page than at the top, then drift occurs. Positive ions (or holes) will tend to drift to the right, negative ions to the left. The drift is caused by the fact that the cyclotron radius is smaller on average on the bottom portion of the loop. Thus positive particles move in long arcs to the right and short arcs to the left, for example. Electrons move in long arcs to the left and short arcs to the right. Assume that the x axis is left to right, the y axis bottom to top of page, and the z axis is increasing out of page toward the reader (see FIG. 3).

That thermally energized drift occurs implies that in the proposed magnetic gradient, dB/dy, the energy from ambient heat can be used to form an electrostatic gradient, negative to the left and positive to the right. With a completed circuit, the configuration takes thermal energy from ions in the magnetic field gradient and converts it to current. If the thermally drifting ions have bounds to their motion to the left and right , then a field E should be formed in the X axis due to the accumulation of charged particles at the boundaries.

In the proposed cell, the magnitude of B decreases linearly with an increase in y and is constant at all z, and x, for a given y. The direction cosines of B are constant at (0,0,1). For this reason it seems sufficient to use a two dimensional (2D) model to analyze the effect.

In a uniform magnetic field coming out of the page, thermal positive ions will tend to rotate in a clockwise circle. If the field is stronger at the bottom of the page (decreasing B in y direction) the path, as viewed in the x,y plane of the paper, might look something like the path shown in FIG. 3.

```
   |<---------------- Td --------------->|

-->o                                     o-->
           o                    o
               o           o                 B smaller

                     o

                  o      o
                                         |
                 o        o              |
                                       dB/dy
                  o     o                |
                     o                   V
                                             B larger
```

FIG. 3 - Motion of positive particle in graduated B field.

Electrons would tend to drift in the opposite or left-wise direction. It appears that any motion in the z axis would be irrelevant to these dynamics. Also, it seems that, if there is any resistance at the left or right boundaries, or if they are closed, as the top and bottom are assumed to be, then a right to left electrostatic gradient will form. An effect called ExB drift will then increase pressure toward the top of the cell, which will quickly reach equilibrium, due to the cell boundaries at top and bottom. It is assumed the top and bottom cell boundaries do not destroy or neutralize the charge, but do confine it within the cell. If resistance at the right and left boundaries is partial, then a net current, consisting of the combination of positive flow to right and negative flow to the left, should occur. In the proposed thermal electromagnetic drift, particles of different charge move in opposite directions. The apparent current moves in one direction.

The x axis drifting effect due to repeated regular displacements Td at the cyclotronic frequency is called here thermal electromagnetic drift (TED). A device using the TED effect is called a TED device (or TEDD).

Note that in practice Td would be very small in relation to the cyclotronic radius, but the drift not so small due to the fast cyclotron frequency.

A REVERSE ENTROPY DEVICE

It is proposed that a TED device can be achieved in an actual n-type lattice. Consider FIG. 4:

```
         B ~= 0.5 T out of page

        -----------------------
        |                     |
        |                     |
        |                     |
        |      n-type         |        |
        |      lattice        |        |
        |                     |     dB/dy = -0.1 T / cm
        |  (-)          (+)   |        |
        |                     |        V
        |                     |
        -----------------------

            Small E ------>

   <------ Hot electron TED direction

   Cool electron drift in E field --->

             FIG. 4
```

The leftward TED induced by dB/dy creates a small negative charge to the left, leaving a small positive charge to the right. This creates an electrostatic field E across the lattice, but reaches an equilibrium, with hot electrons drifting to the left, due to TED, at the same rate as cool electrons drift to the right, due to E. However, this tendency for hot electrons to drift left and cool electrons to drift right should create a higher temperature to the left.

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To disprove the second law it is only necessary to show that a TEDD can generate whatsoever either any potential or any thermal gradient across a TED, no matter how small the effect. However, the fundamental question regarding practical use or even an experimental test is the question of whether TED cells can be put in series, or alternatively made long, in order to increase the total electrostatic potential achievable at a given temperature. The magnetic field does not add energy to the ions. The kinetic energy of the ions is there initially only in the form of heat. The magnetic field gradient only serves to organize things. Since 1 eV = 11,600 deg. K, at 270 K the average ion should have a kinetic energy of about 0.0233 eV. This means that a maximum cell potential is about 0.023 V if the full kinetic energy of the average ion is to be sapped before reaching the cell boundaries in the course of overcoming a reverse field gradient E (not likely!). This cell operating voltage of 0.0233 V establishes a minimum of 26 cells that must work in series at 270 K to produce a meaningful potential of about 0.6 V to do electrolysis, for example. In practice it should be a much larger number.

Of interest is the fact that faster moving ions will have a large Td and thus drift faster than slow ones. This implies that a thermal gradient might be established. It should be coldest in the middle of the cell, warmest near the right and left boundaries in a cell with the magnetic gradient bottom to top as in our examples. However, in a cell with both positive and negative ions flowing, the thermal gradient tends to balance except at the cell boundaries. This implies that the ions can move toward the cell boundaries in small increments. That is to say the following stage-wise process would be repeated: (1) the drift causes motion against the field gradient and a loss of kinetic energy. (2) collisions with impurities or the lattice phonons cause, on average, a restoration of kinetic energy (3) the drift repeats. In other words, fast moving (hot) particles tend to drift in their own direction faster than slow (cold) ones tend to fall back.

The above seems to imply that, provided the heat is continually replenished, say from the top side of the cell via a heat conduit from compartment B, that large electrostatic potentials, like 0.6 V, can be achieved by making the TED cells sufficiently long or by placing a sufficient number in series, provided there is a viable means of charge exchange at the right and left boundaries.

It appears a good material for a test may be germanium doped with group V elements, like phosphorous or arsenic, an n-type germanium. A perfect germanium crystal is transparent to free electrons, but the electron acts as if it has mass m*, where m* ~= m/10. [see Hall, "Solid State Physics"] The problem is in achieving high enough purity to approximate "perfect". The dopants trap free electrons with a binding energy of about -0.01 eV, which is less than the average thermal kinetic energy of about 0.026 eV, so many of the impurity sites will be ionized, providing the free electrons. The ground state wave function for the dopant bound electrons has a radius of about 50 Angstroms, which accounts for the low energy binding.

It is of interest that cyclotron resonance is used to determine m* experimentally. The electrons, of apparent mass m*, move in circular orbits at an angular frequency of f = (e)(B)/(m*), independent of their energy, and thus can absorb EM radiation at frequency f. At 1 tesla we get f to be approximately 10^12 s^-1. One of the problems in measuring cyclotron resonance, and a possible problem to drift detection, is getting the electrons to complete a few orbits on average before disruption by impurities or thermal vibrations. For this reason extremely pure material is used at liquid He temperatures to determine m*. For our purposes, which does not require resonance, it does not seem like these extreme measures are necessary. The loops would in effect be broken into many small increments, but the average effect should be the same.

It is also of interest that holes can be used as well as electrons for determining m*, and that it is possible to use a mixture of n and p type dopants to achieve electron migration to the left and hole migration to the right when the B gradient is vertical as in our example (i.e. dB/dx = 0, dB/dy = -|ky|, dB/dz=0).

Since there are no moving parts, and the proposed TEDD can do useful work in a system where heat is initially totally uniform, it appears to be a successful attack on the second law. The actual current generated may be so small as to require a SQUIB or Josephson junction type device to detect it, but the demonstration of the perpetual generating of a current while cooling a device below ambient would still be a very useful experiment from a theoretical standpoint.

A RATCHET MECHANISM

The field E generated by charge accumulation at x axis ends of the cell is backwards, i.e. contrary to the current flow. The negative side is the left side towards which electrons migrate. It is the E that thwarts the migration. Keeping up the current flow is a matter of keeping the resistance of the loop low to avoid much of an E. E and the ion speeds, and diversion due to collisions, are the primary things that limit the current flow. Despite drift speed limitations, the right-left drift should be finite and continue indefinitely.

The electrons should leave the left side of the compartment "hot", i.e. under pressure and with relatively high average speed. Their energy is spent in the resistive loop, heating it, and they return on the right side cool. This is ignoring electrode work functions, etc. However, there is some hope that if the idea is sound then an experiment could be successful because the right to left electrostatic gradient is additive. Therefore, many such cells or an arbitrarily long cell can be strung together to achieve any desired potential. The key to success then is simply obtaining a medium that maintains a supply of ions, electrons or holes, capable of cyclotronic drift at ambient temperatures. The proposed semiconductor medium should fulfill that role nicely.

As mentioned earlier, the dopant (e.g. P) atoms tend to trap electrons with a binding energy of about -0.01 eV, which is less than the average thermal kinetic energy of about 0.023 eV for a 270 deg. kelvin operating environment for the germanium crystal lattice. Given no resistance, and thus no potential barrier, significant and measurable currents might be detected from a TEDD cell at an operating B of about 0.5 T and dB/dy of about 0.1 T and dopant density of about 10^22 atoms/m^2.

Resistance in the crystal lattice is mostly in the form of heat due to collisions with lattice atoms, and interactions with dopants and impurities. However, in the face of a building reverse electrostatic field barrier built due to resistance to electron flow, the electron interaction with the dopant might provide a ratchet mechanism to permit the gradual overcoming of a potential barrier. As an electron drifts against a potential field, it loses kinetic energy, meaning it cools. This makes the cool electron susceptible to recapture by a dopant atom, especially after the electron cools to below the 0.01 eV binding energy with the dopant. Once captured, the electron is hung on a notch of the ratchet mechanism. It will not get out, nor move backwards, until it has absorbed sufficient thermal energy from the dopant atom and surrounding lattice, etc., to overcome the -0.01 eV well. When it does get out, it then again drifts forward until captured again. If the electron should sufficiently slow, due to Brownian motion, or motion mostly in the z axis, etc., it can drift backwards in a direction with the E field. However, it then should pick up kinetic energy in the xy plane from that backward movement with the E field, and then tend to be much more likely to drift to the left, and to drift left at an increasingly higher rate. The ratchet mechanism should be very fine toothed, in that even in the purest crystals and lowest operating temperatures only a few orbits an be achieved on average. The ratchet tooth height of about 1/2 the average kinetic energy seems about ideal.

The ratchet mechanism greatly reduces the current due to the time delay required for the electrons to pick up the required thermal energy while pinned to the dopant atoms. However, it does permit movement of the drift current against a potential barrier, and thus permits useful work to be done at the expense of cooling the crystal lattice.

SAMPLE CURRENT ESTIMATE WITH R AND E ASSUMED TO BE ZERO

Let's assume we can achieve operation in an average of a 0.5 T field with a dB/dy magnetic field gradient of -0.1 T/cm, and a drift electron density of Nd = 10^22/m^3. Assume M* to be about Me/10 = 0.91 10^-31 kg. Elementary charge e = 1.6x10^-19 C. We get the angular frequency Wc = (e)(B)/m* = (1.6x10^-19 C)(0.5 T)/(0.91 10^-31 kg) = 1.76x10^12 rad s^-1, or a frequency:

f = 1.4x10^11 sec^-1.

Assume average thermal energy 270 deg. kelvin. At 11,600 deg. K/eV that's 0.023 eV. At 1.6x10^-19 J/eV we have an average free electron energy of 3.7x10^-21 J.

Assuming we can apply E = 0.5(M*)(Vxyz^2), we have:

3.7x10^-21 k*m^2/s^2 = 0.5(0.91 10^-31 kg)(Vxyz^2)

Vxyz = 2.85x10^5 m/s

However, 2/3 of v should be in the xy plane and 1/3 in the z plane on average, so we get an xy plane velocity of:

Vxy = v = 1.9x10^5 m/s

Given a time of 1/f = 1/(1.4x10^11 sec^-1) = 7.14x10^-12 sec, this give an orbital circumference of v/f = (1.9x10^5 m/s)(7.14x10^-12 sec) = 1.36x10^-6 m. This gives an orbital diameter of:

Do = 4.33x10^-7 m

Given that dB/dy = -0.1 T/cm = -10 T/m, we have delta B = (-10 T/m)(4.33x10^-7 m) = -4.33x10^-6 T across the range of the loop. This means the bottom radius averages roughly about (0.5)(4.33x10^-6 T)/(0.5 T) = 4.33x10^-6 times the top radius in the loop, giving a Td on the x axis of:

Td = (4.33x10^-6)(4.33x10^-7 m) = 1.86x10^-12 m.

Note that the factor 0.5 is used in order to average the B across the top loop, and to similarly average B over the bottom loop.

Given a repetition rate of f = 1.4x10^11 sec^-1 we have a drift rate:

Vd = (Td)(f) = (1.86x10^-12 m)(1.4x10^11 sec^-1) = 1.6 m/s.

Using Nd = 10^22 m^-3 we get a current density:

J = (Vd)(Nd)/(6x10^18 electrons/s/ampere)
= (1.6 m/s)(10^22 m^-3)/(6x10^18 electrons/s/ampere)
= 2660 amperes/m^2.

Assuming a conductor of 10^-3 m on a side, or 10^-6 m^2 cross section, we should get a current of 2.66 mA, assuming no resistance.

Checking orbital radius with formula:

Ro = (m*)(v)/((q)(B)) = (0.91 10^-31 kg)(1.9x10^5 m/s)/((1.6x10^-19 C)(0.5 T))

Ro = 2.16x10^-7 m

Ro = Do/2 = (4.33x10^-7 m)/2 = 2.165x10^-7 check

DESIGNS FOR SCALING UP ELECTRIC CURRENT GENERATION

FIG. 5 is a drawing of a side view cross section, z axis top to bottom, of a device using two magnets, M1 and M2, where chamber X meets the above description from the viewer's perspective (he is at the bottom looking up,) and chamber Y reverses those flows, etc.

```
        ---------------------
"Top    | N      M1      S |
of      ---------------------      "Bottom of page"
page"   ---------  ---------
        |   X   |  |   Y   |        Electrons flow out of page in X
        ---------  ---------        and into page in Y
        ---------------------
        | S      M2      N |
        ---------------------


          8^)  <--------- Viewer

             FIG. 5
```

Note that the B field can be further shaped to control dB/dy by contouring the magnets or by ferrous material insertion. There is no limit to the length of the x axis in the configuration shown in FIG. 5.

Looking at FIG. 6, X might be a cross section of two sides of a TEDD shaped like a ring.

```
--------------------      --------------------
| N      M1      S |      | S      M1      N |
--------------------      --------------------
           ---------      ---------
           |   X   |      |   X   |
           ---------      ---------
--------------------      --------------------
| S      M2      N |      | N      M2      S |
--------------------      --------------------
```

FIG. 6

The chamber could be placed to the outside of the ring, as with Y in FIG. 7, or some combination of the two.

```
--------------------      --------------------
| N      M1      S |      | S      M1      N |
--------------------      --------------------
---------                            ---------
|   Y   |                            |   Y   |
---------                            ---------
--------------------      --------------------
| S      M2      N |      | N      M2      S |
--------------------      --------------------
```

FIG. 7

A device might be formed into a coil, as shown in FIG. 8.

```
--------------------
| N      M1      S |
--------------------
---------  ---------
|   X    | |   Y   |
---------  ---------
--------------------
| S      M2      N |
--------------------
---------  ---------
|   Q    | |   R   |
---------  ---------
--------------------
| N      M1      S |
--------------------
---------  ---------
|   X    | |   Y   |
---------  ---------
--------------------
| S      M2      N |
--------------------
---------  ---------
|   Q    | |   R   |
---------  ---------
   ... etc.
```

FIG. 8

A TEDD can be built by cutting or etching a chip into a spiral configuration where the magnetic field diminishes radially, as in FIG. 9. Multiple chips can be stacked in three dimensions, the outer end of the spiral of one level attached to the inner end of the next level.

```
|   S    |
 \      /
  \    /
   \  /
    \/
==========     <------- Spiral chip layers
----------
|   N    |
|        |
```

FIG. 9

Note that the primary objective of the TEDDs in Figures 5 through 9 is electric current generation and not heat. In this case lateral heat flow between opposite conducting chambers X and Y is good, as it helps maintain the thermal energy of the TED. This can be used to advantage to form layered chip technology, as in FIG 10, can be made using ferrous prisms, designated M in FIG 10, between semiconductor layers to shape the magnetic field to achieve the gradient dB/dy. Electrons flow into page in chambers X and out of page in chambers (semiconductors) Y. Each layer can thus be made from a single chip where the x' and Y's are all one continuous piece of semiconductor cut or etched into folds that serpentine back and forth across the chip, and separated by supporting and insulating material. The substrate, if any, would have to be nonconductive.

```
|                        |
|          S             |
-------------------------
M  M  M  M  M  M  M  M  M
 XY XY XY XY XY XY XY XY
M  M  M  M  M  M  M  M  M
 XY XY XY XY XY XY XY XY
M  M  M  M  M  M  M  M  M
 XY XY XY XY XY XY XY XY
M  M  M  M  M  M  M  M  M
 XY XY XY XY XY XY XY XY
M  M  M  M  M  M  M  M  M
-------------------------
|          N             |
|                        |
```

FIG. 10

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A PRELIMINARY TEST OF N-TYPE SILICON

A solar cell was obtained that was made up of many pieces of probably surplus silicon chip fragment tiled together in a protective plastic box with dimensions about 45x75x5 mm. Some of the tiles had only parallel conductive strips deposited on their surfaces. They were affixed to a metal foil on the bottom and had strips of foil laid over their tops to collect the current. A 5x12 mm trapezoidal chip fragment was removed that had only 3 parallel metal strips on the top. The parallel metal strips were about 2.5 mm apart and ran diagonally across the chip. The chip had a lace work of metal grid lines deposited on its back side. The potential front to back under a fluorescent light was 23 mV.

Two pieces of No. 40 copper wire were soldered to the outer most metal strips on the top of the chip. The leads were then soldered back onto the original lugs in the protective plastic package from which the much larger composite cell had been removed . Resistance was 26.7 ohms in the dark. Holding it up to the light made the resistance drop to under 25 ohms. The light exposed side of the chip was negative, indicating an n-type silicon surface layer.

The DMM was then set to a 200 mV range. A 35 MGo magnet was then moved about the chip. There was no sign of voltage. There was no response on the micro-amp scale either. When set to measure resistance, however, the motion of the magnet was clearly sensed by the meter, i.e. the change in sensed current due to moving flux, but there was no sustained change in resistance measured when no element was in motion.

A much more sensitive meter is needed.

A PRELIMINARY CHECK ON COPPER FOR A TED EFFECT

In an attempt to determine if easily measurable thermal electromagnetic drift (TED) occurs in copper wires the configuration shown in Fig. 11was tried.

```
 |         |
 |         |
 |         |
 |         |     0.5" radius x 5" long steel plumb bob
 |         |     with conical tip on 45 deg. slope
 |    S    |
  \       /
oo\     /oo
ooo\   /ooo
oooo\/oooo
oooooooooo      <------- Coil of insulated wire, about 100 turns
----------               (Telephone cross connect wire)
 |    N    |
 |         |
 |         |
 |         |
 |         |    1x1x1.5"  35 MGO magnet
 |    S    |
----------

 Fig. 11
```

Coil resistance was 0.7 ohms. No voltage or current was detected.

AN EXPERIMENT WITH SOME CLUES?

An attempt was being made to measure a rotating magnetic field by using a FET, as diagrammed in Fig. 12, due to the gate's effect being due to potential.

```
  Rotating Flux (moving toward reader, out of page)
      .
      .     S----------------------
      .     |
   =====G-+  FET probe
      .     |
      .     D-----------------------

   S  - source
   D  - drain
   G  - gate
   ==  - active area of probe
   ..  - flux line rotating toward reader, out of page

          Fig. 12
```

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A dual gate MOSFET, NTE455, was tried, with the two gates tied together to make a probe tip. It was a very sensitive probe. It picked up fluorescent bulb at about 2 feet, and was very good at sensing ambient noise. It went totally dead when a magnet was initially brought near it. As viewed on an oscilloscope the background noise was flat lined, the MOSFET had zero conductivity. When the magnet was removed the MOSFET conducted and showed ambient noise again. With a magnet near it, but not too close, the two were moved toward a fluorescent bulb and the MOSFET eventually picked up the signal, but the proximity of the magnet set a threshold for the distance it would start sensing. The MOSFET could make a gauss meter in an appropriate circuit.

Since it is nearly impossible to have no gradient dB/dx or DB/dy, it is desirable to investigate this phenomenon a little further. The effect may be a Hall type effect, a TED type effect, or some other semiconductor related effect.

CONCLUSION

It seems it may be very worthwhile to test appropriate semiconducting material, in particular very pure Ge doped with P, but also others like Si doped with P, for the TED effect, using very accurate DC meters. It may also be useful to check GaAs and other semiconductors as well. Meters accurate to the uV might be built using circuits similar to those used in PH meters. (See the McGraw Hill Encyclopedia of Electronic Circuits for example.) One possible source of materials for a quick check are Hall effect devices. It is simply necessary to place the semiconductor in a magnetic field with an appropriate gradient as spelled out above, and measure any persistent current whatsoever. A very sensitive voltmeter or ammeter is required.

It is of further interest to study EM radiation from semiconductors with free thermal electrons. Such electrons should radiate. If compartment B radiates in a manner that is channeled to and absorbed by compartment A, and there is a lack of symmetry, ie. the lack of magnetic field in compartment A prevents radiating energy back toward compartment B until a higher temperature is reached, allowing black body radiation to match, then the objective of demonstrating the incompatibility of the second law with one (or more) laws of electromagnetism is achieved.

Also of further interest to study is the use of thermopiles (tall broad stack of thermocouple junctions) for compartment B in order to use the junctions as ratchets for the TED effect. This configuration is expected to be effective due to the low voltage generated across the junctions. The temperature gradient achieved from "compartment A waste heat" can then be used to assist in maintaining the favorable potential gradient.