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11-1955

Mr. Ed Hull,
77 Foxley Lane,
Purley, Surrey, England

Dear Mr. Hull:

It was indeed a pleasant surprise to receive your letter of November 8th, which Mr. Conrad forwarded to me. I have thought about you many times and wondered how you were getting along with your assignment in England. I recall the pleasant dinner we had prior to your departure, and the long discussion on the subject of gravitation. I am delighted to learn that you are continuing your interest in this field and feel that the time has come to prepare a serious article on the subject.

Incidentally I was interested to see a series of three articles which appeared in the New York Herald Tribune on November 20th, 21st, and 22nd. It appears to be an effort to acquaint the public with the need for a research program on gravitation. It mentions many individuals and many concerns, especially aircraft manufactureres, presently interested in promoting the idea. The series of articles is by Ansel E. Talbert, military and aviation editor for the New York Herald Tribune. It is quite apparent that he has given the matter considerable thought, and has talked with many people in the preparation of the articles. I presume you can obtain copies of the articles there in London, and I believe a knowledge of the material covered by them will be helpful to you in making a further presentation of the subject, something which will supplement rather than duplicate the Herald Tribune articles.

I have felt for some time that you have been interested in continuing your study of this matter. Early this year, someone called to my attention a series of articles in Aviation Report. There was, I believe, a series of six articles appearing from August through November of 1954 which mention the study of electro-gravitics and touch briefly upon its potentialities. I felt, when I read these references, that you must have been behind it, inasmuch as it came from London and I knew no one else who could have had that information.

The publication in Aviation Report got results, for it was not long until a representative of a French aircraft company called me here in Washington. He had been sent by his company on a chase to obtain more information, and the man actually had traveled clear to California, not knowing any Washington address, had contacted several aircraft companies in California, and had finally gone to the library of the Pacific Aeronautical Institute at Santa Monica. There he uncovered an article on the subject, written by a friend of mine in California, subsequently contacted that person, and continued the search here in Washington.

Mawdsley Rose?

You will be interested to know that the contact with the French aircraft company has continued and work is progressing

in France at an ever-increasing rate. It would violate commercial secrecy to give the name of the company, or to say much about the program which is contemplated, but for your own information, and I am sure, deep satisfaction, the matter is being considered quite seriously in France, and actual work has begun. As a result of their invitation, I went to Paris last June and July to set up the project and start the ball rolling. If all continues as we hope it will, I will return next February to assist in the expansion of the project. I believe I can thank you for this contact, for it is clear that it came about through your mentioning this subject in Aviation Report.

The same report, incidentally, was read by Douglas, and undoubtedly by many other aircraft manufacturers in the United States. Martin, as you know, is starting a new project and I believe Lockheed will too. According to the grapevine, the studies in gravitation are already under way at both Northrop and North American. According to the New York Herald Tribune, Convair is now interested and so is Bell. Then, also, we must give credit to my old friend Bill Lear for continuing interest in the spreading of the good word.

This is a subject which the British should consider seriously too, and I am wondering if, in your contacts there, you have unearthed any special interest or activity in the British aeronautical industry.

Several new flying saucer books are being released here in the United States, and I understand there is one in England too. Donald Keyhoe's new book (The Flying Saucer Conspiracy) has already gone to press and copies should be available soon. I notice also in the last issue of Life magazine, dated December 5th, 1955 what amounts to an admission that the unidentified flying objects as observed by the Air Force and other observers are not all explained away by the recent announcement of the Air Force and it gives some drawings in color of the various shapes of U.F.O.'s that have been reported.

Of course, to me, this indicates that something very real is going on behind the scenes, and that where there is so much smoke, there certainly must be some fire. I feel sure that these things are electrically driven. It is true, of course, that the halo effects surrounding these craft in flight can come from nuclear radiations, but more than likely they would come from simply electrical corona and this of course means electrical potentials of the order of several million volts.

Under these conditions, we all recognize that the forces which can be developed are tremendous, certainly the tests in Paris last Summer proved this. We were able to go up to 150 kv. and we expect in the future to extend this range to, probably, a million volts. The propulsive force developed is an exponential function of the voltage, (we don't know the exponent as yet), but it all indicates that available forces increase rapidly in the range of higher voltages, and that practical results can only be achieved when we are using voltages of the order of, say, from 10 to 15 million.

Referring to your letter, I will try to answer the questions which you have asked according to section number.

Section 1: The references on Charles Francis Brush are as follows:

Section 2: I do not recall a reference to a German physicist who wrote a paper presenting evidence of the existence of a whole new family of waves, presumably electrogravitic, etc. I do recall a German physicist who has published a number of papers, largely of a mathematical nature, relating the rotation of astronimical bodies with their magnetic field and gravitational field. In other words, a large rotating mass possessing a gravitational field will induce through its axis a magnetic field. In the case of the earth, the magnetic axis does not quite coincide with the axis of rotation, apparently due to an anomalous sub-surface distribution of magnetic material, i.e., material with a positive magnetic permeability. This physicist, according to the New York Herald Tribune, is now retained by the Glenn L. Martin Company, in connection with its gravity research program.

Section 3: The Fernando Sanford Effect relates to the work of one man who was Professor Emeritus of Physics at Stanford University, in Palo Alto, California. He died, I believe, about ten years ago. The effect was described in his published work entitled "Terrestrial Electricity", published by the Stanford University Press. Basically, the Fernando Sanford Effect has to do with the appearance of a charge on a mass of conducting material insulated from the earth and electrostatically enclosed, or shielded.

According to Fernando Sanford, the effect is observable in a quadrant electrometer and is easily recognized as a diurnal curve. Sanford didn't recognize it as having any gravitational significance, he felt that it was merely due to the change in the absolute potential of the earth at a point where the electrometer was located. He postulated that as the earth revolved, the change in the absolute potential of the point where the observing electrometer was located was due to the fact that the earth revolved in a huge electrostatic field established by the sun. Sanford believed that what he was observing actually was a potential difference through the earth, i.e., between the midnight side and the noon side, induced by the electrostatic field in the sun.

Since the midnight side was negative and the noon side was positive, according to his observations, the sun, therefore, must possess a very high negative charge. Now the interesting part of this whole experiment is that according to classical physics, a charge resides only on the surface of the conductor, and cannot be detected within a conducting enclosure. In the Sanford experiment, it is noted that the charge on the electrometer which is measured by the electrometer, is picked up within the conducting enclosure of the electrometer itself.

Unless there is represented here real evidence to change the classical concept of electrostatic induction, it is probable that we must look elsewhere for an explaination of the Sanford Effect. This is exactly what project WINTERHAVEN has done, and it forms the basis of the concept of electro-gravitic induction, which, in turn, provides the operating concept of the electro-gravitic communication system.

In Project WINTERHAVEN, electro-gravitic induction refers to the appearance of an electric charge, or a change in electric potential, upon a conducting mass insulated from the ground and thoroughly shielded from electrostatic induction. The charge, it is hypothesized, results from a change in gravitational potential and the effect serves to demonstrate the reciprocal relationship believed to exist between electric potential and gravitational potential. In other words, a mass of conducting material is enclosed within a conducting shield and insulated therefrom; let us say, like a lead cannonball supported within a hollow copper shpere. It is insulated from the sphere by a material of very high specific resistivity (such as sulfur or polystrene). If the sphere is grounded, the potential of the lead ball will be found to change progressively, from hour to hour, to establish a cycle with respect to mean solar time. It will also be found to indicate a change in potential relative to the lunar hour angle and also sidereal time.

The combination of all of these effects is difficult to explain on the basis of electrostatic theory alone, even if the solar system did posess a concentric electrostatic gradient as Sanford believed. The behavior of the Sanford Electrometers so nearly parallels the behavior of the Townsend Brown Differential Electrometer that there is good reason to suspect that the underlying phenomenon is the same.

In summary, therefore, the Fernando Sanford Effect provides evidence for electro-gravitic induction which, in turn, provides the basis for the electro-gravitational system, or electro-gravitic communication system. If this is confirmed, it is quite understandable how communication can be achieved through shields which would completely block electromagnetic or radio waves. I use the term "completely block" in the sense that attenuation of electromagnetic radiation in passing through such a shield would be so great that the radiations which did pass through would be negligable. Such a shield, according to the evidence presented by the Fernando Sanford Effect would attenuate an electro-gravitational wave only slightly, if at all.

Section 4: Copy of patent #1,974,483 is enclosed. This patent, incidentally, covers the mechanism of the Townsend Brown Differential Electrometer mentioned above. The best form of this electrometer is the unit now installed in a constant-temperature vault about thirty feet below the surface of the earth in Los Angeles, California. The installation was made there several years ago. The unit was completed at a cost of about $20,000.00. Construction actually began on this unit at the Naval Research Laboratory back in 1932. The instrument was remodeled, and almost entirely rebuilt in the physics department of the University of Pennsylvania in 1938. It was moved to California about 1943, and operated continuously for a period of two years, at a location above ground, but in a completely shielded room at Laguna Beach, California. It was then moved to its present location in downtown Los Angeles and placed underground in the vault mentioned above.

The present location was chosen for a variety of reasons. The main one being that a place was available at that depth underground and that, due to the construction of the building, between vault and the open sky, an equivalent of eighteen feet of solid concrete intervened. As it stands, the instrument is not only shielded by this mass of concrete and steel, but it is operated within two concentric electrostatic shields which are thoroughly grounded, and one magnetic shield consisting of a steel housing, the walls of which are one half inch thick.

The electrometer is operated under oil, and within the steel shields. The temperature variation of the oil bath is observed to be less than .1° C. The exciter voltage supply to the electrometer is controlled to .1%. The instrument is fully automatic and makes a record on a tape similar to a recording barometer. It is designed to make one reading every three minutes, day and night, with an average of about 10,000 readings per month. The readings are all averaged, and only the running means are taken in the final results. The solar, lunar, and siderial diurnal curves are clearly evident in these means. The instrument may be said to be recording "tidal effects", in that the movement of the moon is clearly evident.

All this, of course, is significant, because the readings are made underground and with such a thickness of shielding, both against magnetic and electrical effects, that it is extremely unlikely that any effects other than gravitation are being observed. It is hoped, in Project WINTERHAVEN, that other instruments of this type can be constructed and installed at other geographical locations, one, perhaps, being in Europe, and another in South America.

These records, when compared with those from the instrument in California, will contribute much to the knowledge of the phenomenon and serve to prove that the effect is world-wide and consistent. The patent referred to is titled, "An Electrostatic Motor", but actually it is the driving mechanism for the electrometer.

Section 5: In the early tests of the Biefeld-Brown Effect, the problem was divided into two phases. Phase 1 maintained the dielectric materials constant and changed only the mass of the metal plates. This was to determine if the effect is proportional to mass, and this, apparently, was borne out. The second phase used uniform metal plates and changed the dielectric. This was for the purpose of observing what effect specific inductive capacity (dielectric constant) had upon the force developed.

While, of course, the early tests were extremely crude, they did appear to be satisfactory evidence that the force varied with the K of the dielectric and that, so far as observed, the effect was proportional. When the capacitors were suspended as a pendulum, it appeared that the angle of deflection varied with the K. And, of course, also with the voltage, but the effect with voltage was not directly proportional but seemed to be exponential in the range up to 280 kv which was the limit of the experiments. Increase in mass of the metal plates did not increase the angle of the pendulum. The angle seemed to remain constant regardless of the mass of the plate material. This result seemed to confirm the suspicion that it was a gravitational effect and that the force varied directly with the mass at any given potential.

The typical capacitor naturally varied in weight as the material of the plate varied. The weight ranged from about 15 lbs. to 30 lbs. for one capacitor operating normally at 150 kv. These pendulum tests indicated that each capacitor, (actually it was a series of capacitors), about 15inches long and 3 1/2 in. square indicated a net longitudinal force of from 25,000 dynes to 100,000 dynes, roughly. This, of course, was at their maximum rated voltage.

Then it is interesting to note, in connection with the measurement of the actual force, that the force varied, even though the supplied voltage remained constant. This, at first, caused considerable confusion, due to the inconsistency of the results.Tests performed, say at 10:00 in the morning, upon being repeated at 4:00 in the afternoon, would indicate a widely different result. This was far beyond the result that could be attributed to experimental error and it was because of these variations that, for the time being, at least, the course of the experimental work shifted from that of merely measuring input voltage into output work to a consistent effort to determine the cause of the phenomenal variations.

Test runs were made for several periods of 24 hours each, observations being made at as close intervals as was physically possible. Even the first series of observations so conducted had not progressed very far until it was obvious that there was a gradual and consistent change in the angle of the pendulum even though the voltage remained constant and all other factors, so far as could be observed, remained constant also.

Due to this discovery, research attention was directed thereafter, more toward performing continuous observations, more particularly toward designing equipment which would accomplish this. The research work, therefore, at that point, veered away from making more pendulum measurements and began to study and utilize rotating systems, or systems suspended for torque measurements, usually automatically. Most of these suspended systems contained differential dielectrics, i.e., dielectrics differing in K, essentially, and sometimes mass as well. The rotors which possessed the greatest Km differential were, of course, the ones which gave the best results.

Section 6: Charles Francis Brush did not use dielectrics as such. His work did not include electrical phenomena. He was primarily interested in rates of free fall and in the non-equivalence of weight and mass. After the phenomenon of "retarded acceleration in free fall" seemed to be definitely established, Brush went on to discover the spontaneous generation of heat in complex silicates and other materials. His third significant achievement was the correlation of the retardation of gravitational acceleration and the spontaneous generation of heat. He reported a consistent, proportional relationship between the two phenomena.

I might add at this point that, during the last year, we have made a further study of this phenomenon in the light of electro-gravitic theory, andfind it to be consistent, although somewhat different than we had first suspected. Perhaps it can be explained in this way; gravitation is related to electrodynamics in two ways; the dynamic and the static. In the dynamic relationship, which in the main, is that part of WINTERHAVEN where effects are obtained by charging or discharging capacitors or the like, and where electric current is involved; and the static phase, where a fixed condition exists, or the effect is "built in", so to speak. In the static phase, the relationship is essentially between the gravitational field and the electrostatic field, and the energy relationships are fixed, or static. Phenomena of the latter class are those involving materials which are either lighter or heavier than they should be, if the effect did not exist. This is simply an extension of Brush's concept of the non-equivalence of mass and weight. It may be said to be the non-equivalence of inertial mass and gravitational mass.

It now appears that many materials are lighter than they should be , relative to the amount of interial mass which they possess. Aluminum and silicon, certain of the aluminum silicates, and barium aluminate appear to be examples. Recent study has indicated that many of the rare earth elements are of this nature, perhaps even more strongly than the materials with which Brush was familiar. It is believed that many of the rare earth elements such as erbium and ytterbium, and to some extent, even the metal tantalum displays the compound Brush Effect of being both lighter than they should be and of generating heat spontaneously.

We now have included in the WINTERHAVEN program a special research project for the study of the rare earth elements in regard to their anamalous gravitational characteristics, and this may actually turn out to be one of the more important aspects of the whole WINTERHAVEN Project. In brief, it would appear at this point that the rare earth metals and tantalum may prove to be the most important spacecraft materials, and form the basis for a whole new family of super-light materials of reconstruction.

We are currently engaged in the examination of several methods of beneficiating these materials to enrich their content of the lighter gravitational isotopes. In Section 6, you asked if we had any specific comment on this phenomenon of the bismuth and zinc bobs observed by Brush. The answer is yes, and it is simply this; that the effects observed by Brush provide the clue for the existence of gravitational isotopes as distinguished from mass isotopes. The heating effects observed by Brush are concomitant with the defficiency of gravitational mass, so that the amount of heat generated reveals the richness of the gravitational isotope in that particular element.

In a certain sense there is a parallel here between this thermoactivity and radioactivity, just as there is between the rare earth elements and the radioactive elements. In chemistry this is known as the homologous series. The lanthanide series in the rare earth elements represent the homologues of the actinide series in the radioactive elements. It is believed that thermoactivity decays just as radioactivity decays and that there is a gradual change in the rare earth elements from one energy state to another just as there is in the spontaneous decay of the radioactive elements. Since all of this is a fairly recent development, we'll have an opportunity later on to discuss it more in detail. So for the moment, we'll pass on to the next section.

Section 7: There apparently is a misunderstanding here. The homogenous condenser was the predecessor of the presently used blocks of high K dielectric. It was actually the first departure from the plate structure used in the early pendulum condensers. Now it is true that when these blocks are energized, a neighboring disc will spin continuously, the structures set forth in the patent specifications mentioned above, and it is also shown in the patent drawings. In every case, however, the voltage is maintained in the dielectric sections. The electrical supply provides the energy which moves the disc. There is no net gain of energy from the gravitational field. The speed of spinning varies in a diurnal fashion, as mentioned above.

This use of the spinning disc is simply a variation of the electrometer, which I have just described. The electrometer can be made in two forms, i.e., moving sectors of dielectric material and stationary reactor plates (discs) or moving reactor plates and stationary dielectric sectors. Changes in the speed of

spinning (or torque) are better expressed as diurnal curves than as the relative positions of the sun, moon and constellation Hercules. This simply means that the diurnal cycle, which is with respect to mean solar time, the lunar cycle, which is with respect to lunar hour angle, and the sidereal cycle, which is with respect to sidereal time. The position of the constellation Hercules is approximately 16 hours sidereal time. It represents the principal peak of the sidereal cycle.

Now to the dimensions of the box. I presume that what is meant here is the dielectric sectors. In the California instrument, the sectors occupy a circle twelve inches in diameter. There are eight sectors made of high K dielectric and eight sectors made of low K dielectric. They are alternately positioned adound the circle so that the electric gradient in adjacent sections are in opposition. This is so that the electric gradients in all of the high K dielectrics are in one direction and the electric gradients in all of the low K dielectrics are in the opposite direction. A net force results which tends to move the high K dielectrics in the direction of negative to positive, and this force actually tends to move the entire dielectric circle around in that direction. If a conducting disc is suspended above the dielectric circle, and in most cases, the disc is grounded, a reactive torque develops which tends to rotate the disc in the opposite direction.

In a recording instrument, it is possible to observe either the torque of the dielectric sections or the opposing torque of the adjacent disc. In practice, the entire electric system is insulated in oil and the disc usually runs under oil. Again, in the California instrument, the disc is of the order of 12 inches in diameter, made of aluminum about 1/8 in. thickness. The average separation of the disc from the dielectric sections is about 1/4 of an inch. Due to the fact that the disc is turning under oil, there is considerable resistance, and, of course, the speed of rotation is low. In operation, the discs usually turn about as fast as the disc in a watt-hour meter.

To date there have been no experiments with the discs operating in air, i.e., for the development of torque, due to the fact that high voltages are usually required and the breakdown strength of air is insufficient. This experiment was first performed in Zanesville, Ohio in 1927. The first test utilized a disc three feet in diameter and rather large sections of dielectric operating at about 100 kv. In the winter of 1930 to 31, it was moved to the Naval Research Laboratory, and operated as a continuous recording unit for about two years. The records from this installation were carefully analyzed and it was at this time that the solar, lunar, and sidereal components were first isolated. During this period, a refined form of this electrometer was constructed which was considerably reduced in size, and designed as a precision instrument. It was this instrument that was rebuilt at the University of Pennsylvania and subsequently shipped to Los Angeles, where it is now located.

Section 8: Apparently there is a little misunderstanding here. The apparatus referred to above has been tested in a number of places where the elevation differed, and also the attenuation due to heavy shielding. All instruments of this type require excitation, and the voltage varies from a minimum of about 15,000 to a maximum of about 100,000, depending, of course, on the physical size and insulation provided in the electrometer. The early tests indicated that electrometers constructed along these lines record variations which are concordant, i.e., concordant in their phase relationships, but with a slight variation in amplitude, depending upon the mass of the surrounding shielding. In other words, the amplitude of the diurnal variations is greater with elevation from the earth. The amplitude diminishes to the surface of the earth, and even further under the surface of the earth.

Some of the evidence in this respect is somewhat contradictory, and it would therefore be desireable in the near future to repeat these tests so far as elevation and geographical location is concerned, with at least two, and possibly three or four instruments in widely separated locations, as I have mentioned, perhaps, in California, the East Coast, Europe and South America. In these electrometer experiments for continuous observations, it is not necessary to observe the rotation of the disc. What is usually done is to suspend the discs for torque measurement. Automatic devices, recording devices, are easily attached to record the variations in torque. Then the records produced by each machine are easily compared for their mutual variations with time.

Section 9: Actually, the effect of the moon on the torque is not great percentagewise. At most, it amounts to not more than five per cent, and this is observed as a variation with respect to the phase of the moon with a cycle of 28 days, and not the lunar hour angle (a cycle of somewhat more than 24 solar hours). The smoothed curves of the effect with lunar hour angle, averaged over a period of an entire year shows that the maximum torque of the instrument occurs about two hours after the moon has crossed the upper meridian, i.e., its upper meridian transit, and then again two hours after the lower medidian transit, the effect of the former being the greater.

These lunar curves are remarkably smooth and look very much like sine curves. There are two maxima and two minima each day, i.e., each lunar day. The same kind of curve is in the solar cycle, again with two maxima and two minima each day. The solar maximum appears about four o-clock in the morning, with a secondary maximum about four in the afternoon. The primary solar minimum is at noon and the secondary solar minimum is around midnight. The sidereal curve also has two maxima and two minima each sidereal day, the primary maximum occurring about 16 hours sidereal time, or, in astronomical equivalents, 16 hours right ascension, and then again at four hours sidereal time.

It is readily seen that these various cycles are not isochronous, and that they have a tendency to slip past each other from one day to the next, e.g., the sidereal cycle lags behind the solar cycle by the amount of one complete cycle in a year, and, of course, the lunar cycle does not coincide with the solar cycle, so that there are times during the year when the peaks of one cycle coincide with the valleys of another cycle, tending to cancel the effects, whereas, at other times, the cycles reinforce each other with the peaks and valleys additive. Under these conditions, of course, the daily variations are quite pronounced, but it is difficult to separate the causes, i.e., the solar, lunar, and sidereal components, unless data is accumulated over a period of at least a year and enough material is at hand to statistically analyze and isolate the cycles.

Section 10: To my knowledge, Dr. Brush was not aware of a diurnal variation in the thermalactivity of barium aluminate. A longer term variation was clearly observed in Harrington's work at the Bureau of Standards. Harrington used an ice calorimeter and made every effort to maintain conditions rigidly constant. He observed that the spontaneous generation of heat in any material did vary from day to day and, had he taken readings more often, probably would have observed an hour-to-hour variation. This, it seems to me, is very significant, for it does reveal a close relationship between the dynamic phase of electro-gravitic theory and the static phase. It may provide a very precise and convenient way of measuring all of these cycles referred to above, simply by utilizing a continuous recording calorimeter and a material which is highly active thermo-gravitationally.

Harrington observed that the active materials in the calorimeter such as Sandusky clay, barium aluminate, etc., ranged around .002 of a degree warmer than the environment, and that the heat given off by any one sample did vary from day to day, increasing and decreasing. He actually gives a set of curves which shows the variations in heat observed by the various materials which he tested. As to the exact amount of the retardation of gravitational acceleration exhibited by the materials which gave off heat spontaneously, I don't recall that Brush actually determined it. In this respect, his experiments were purely of a qualitative nature, although he did record that he had made enough tests of a prcise nature to be convinced himself that there was a close parallel relationship between the materials which fell more slowly, i.e,, with less gravitational acceleration, and the materials which gave off heat spontaneously. He refers to this relationship again and again in his published reports.

Section 11: In the early tests of the electro-gravitational communications system, only untuned systems were employed, i.e., there were no resonant circuits, and no carrier, in the electromagnetic sense. As I mentioned earlier in connection with the Fernando Sanford Effect, electrogravitic induction has to do with the appearance of the charge on a mass when that mass is subjected to a change in gravitational potential. In other words, when a mass is resident in a region where the gravitational

potential is increasing, a negative charge is then present on the mass.

For the sake of clarity and definition of terms, the gravitational potential of a region farther from the earth is greater than a region nearer the earth, therefore, according to electrogravitic theory, if a mass is lifted against a gravitational field, a negative charge appears on the mass. When the lifting stops, the increase in negativity also stops and an equilibrium point is reached. If the mass then were allowed to fall, it would become increasingly positive, so long as it is falling, i.e., is moving progressively from points of higher gravitational potential to points of lower gravitational potential. Now this appears to be the basic relationship between the gravitational field and the electrostatic field. It might be termed the "gravito-electric interaction".

Now the converse of this appears to be equally true. Let us consider a mass at rest in a region of given gravitational potential. This in equilibrium condition in which no charge is present, or observable. If the mass, then, is suddenly charged to a high negative potential, the mass will then become the source, or origin, of a higher gravitational potential than the ambient, the vectors of which point outward in all directions from the center of the mass. This condition prevails only so long as the potential is changing, and it is a function of the rate of change of potential. If, then, the rate of change drops to zero, and the electrical potential goes negative no further, an equilibrium point is reached and the gravitational gradient, with respect to the ambient, decreases to zero.

If the mass then loses its negative charge, i.e., becomes more positively charged, the reverse action takes place and the vectors of gravitational gradient are directed inward to the center of the mass from the surrounding ambient. Thus, the reversible effect is quite similar to the reversible motor or generator effect in electro-magnetism. Where the changing electric charge, as in the second instance, creates a localized gravitational field, the interaction can be said to be electro-gravitic.

Basically, the electro-gravitational communication system consists of a transmitter which is essentially a large mass, the electrical potential of which is rapidly changing. This creates a pulsing or alternating gravitational potential at the center of the mass, i.e., above and below the gravitational potential of the ambient. For the part of the cycle where the charge is becoming negative, the gravitational vectors in the region surrounding the mass are directed outward. Then, for that part of the cycle where the charge is becoming positive, the gravitational vectors are directed inward. This mass then becomes the radiating point for a gravitational disturbance which propagates itself through space, decreasing, presumably, as the square of the distance. Any other mass near or far, subjected to such a condition of varying gravitational potential, will acquire a positive, or negative charge with respect to the environment, depending upon the direction in which the gravitational potential of that point is changing.

It is clear that the system is fundamentally different from the electromagnetic system. In the electro-gravitational system, the gravitational potential of a region is rapidly varied above and below the ambient gravitational potential. This effect is propagated through space. At some distant point in space, where a large gravitational mass is resident, the received gravitational wave from the distant transmitter amounts to a rapid oscillation of the gravitational potential of the region itself. One might say that the mass which is resident in this region will sense a change in its gravitational ambient. In so doing, the gravito-electric action causes the mass to assume successive positive and negative potentials as the gravitational potential of the ambient changes. This mass then constitutes the antenna, so to speak, of the receiving half of the electro-gravitational communication system.

The interesting and certainly, the significant improvement which this represents in the art of communication is that the wave action between the transmitting station and the receiving station is not electromagnetic in any sense, and it is not attenuated in passing through successive grounded copper screens, as would be the case if it were electromagnetic. It actually amounts to a gravitational wave, or, one might say that it is pulsating gravitation. Another way of describing it would be that it is a longitudinal wave in space, whereas, the electro-magnetic wave is a transverse wave in space. If one subscribes to the idea of an all-prevailing ether, then of course, it completes the requirement that longitudinal waves can and do exist in a medium along with, or as well as, transverse waves.

Now this brings up another point, and this has to do with the speed of propagation. Transverse waves generally are slower than longitudinal waves. In the open sea, for example, surface waves in the water are essentially transverse waves, whereas the transmission of sound waves under water is a compressional or longitudinal effect. In every case, the longitudinal waves are very much faster than the transverse waves. This would appear to indicate that if gravitational waves are longitudinal waves in space, or perhaps, in the ether, the speed of propagation would be significantly faster, significantly greater than the speed of light. This brings us face to face with an embarrassing situation with the limitations imposed by relativity. If the transmission of a gravitational wave represents energy, as it presumably must, then we have a case where energy is propagated at a speed exceeding that of light. If the energy has a mass equivalent, then that mass has a velocity exceeding that of light.

These are considerations which must be studied and solutions eventually found. So now, in summary, let me say this: As it stacks up now, any radio oscillator, being a source of high-frequency alternating current, can be connected to a large conducting mass insulated from the ground for the purpose of generating electro-gravitational waves. Of course, there is the necessity to match the impedence of the oscillator to the large mass and the necessity to shield the entire system so that it will not radiate electromagnetically.

Some recent estimates indicate that the transmitting antenna, if you wish to call it that, should weigh from five to ten tons, and be made up of lead bricks, suitably supported on an insulating base. In most cases it would be desirable to keep the capacitance of such an antenna system as low as possible, although this may not be true in every case, particularly at lower frequencies.

The receiving part of the electro-gravitational communication system would simply be a smaller edition of the same thing. I envision, for most installations, a lead ball, six to twelve inches in diameter, suitably supported within a hollow copper sphere. The sphere would be grounded, and a lead-in bushing would conduct the charge from the ball through shielded cable to the conventional tuner and detector circuit of the conventional radio receiver. Again, the entire antenna system and the receiver would be enclosed in attenuating cages to shield the same from all electro-magnetic radiation from the outside.

In the original tests, conducted in Pearl Harbor and in Los Angeles, large capacitors were used. In Pearl Harbor, these capacitors were arranged in a bridge circuit and balanced. We did not realize it at the time, but the method amounted to nothing more than large masses being charged or discharged at controlled rates. Nevertheless, it is one way of looking at the problem, i.e., when one capacitor is charged, or discharged, the neighbouring capacitor, shielded electromggnetically from the first will acquire a charge during the period of charge or discharge of the first capacitor. It now appears that, while capacitors as such do play a part, particularly in the high K capacitors, the principal element in the communication system is mass, and the whole problem simply resolves itself into substituting large masses of lead, or other heavy metal for the outside antenna systems usually employed. With this comparatively simple change, any radio transmitting station can be converted into an electrogravitic transmitter. In order to pick up the signals of the electrogravitic transmitter, the receiver would have to be connected to a similar heavy mass as an antenna, and the whole affair shielded against radio waves.

Section 12: I don't know that I am in a position to comment on the possibility of a correlation between the peaks of the sidereal curve as recorded by the electrometer and the source of greatest radio noise picked up in radio astronomy. In the original work of Carl Jansky, at the Bell Telephone Experiment Station at, I believe, Bound Brook, New Jersey, the loud hissing sound which he discovered was localized in a region not far from the constellation Hercules. Of course, radio astronomy has made enormous strides since then, and with the increased resolving power of the new radio-telescopes, pinpoint sources of very intense radio noise have been discovered and plotted.

There does appear to be a large area of intense radio illumination in a direction which is now identified as the center of our galaxy, of which the milky way is the nearest arm. More studies toward a correlation of these effects must be undertaken, and it is strongly recommended in WINTERHAVEN. But, of course, the stumbling block, as usual, is that it is pure research, and difficult to finance. Where there is an end product in sight, especially one which has commercial value, such as a communications system or a method of propulsion, then it seems much easier to obtain the financial assistance required.

Right along this line, it seems appropos to suggest that, perhaps in connection with the enormous interest in England today in radio-astronomy, that some coordinated program could be organized and implimented wherein we could build and install one of the electro-gravitic electrometers over there and actually carry on a series of observations and closely coordinate them with the daily observations in radio-astronomy.

I feel sure that the automatic records of the electrometer would contribute enormously to the science of radio-astronomy, and certainly would broaden the base and fill in some important gaps. If you are able to interest anyone along these lines, we would be able, I am sure, to construct an automatic recording electrometer for installation in England for about $15,000 and I would be very happy indeed to assist in such a project. The designs are all carefully worked out and immediately available, and the instrument characteristics are pretty well known. To install one of these units at the site of one of Englands' great radio-telescopes would be a wonderful idea.

Section 13: We are continuing our study of the flame-jet electrostatic generator. Sofar as the flame jet specifically is concerned, there is no authority on the subject who has actually built one. Technically, it is such a simple device, that it is surprising that a large unit has not already been built. As additional used for very high voltages come up each day, I am sure we will see some activity in this direction in the very near future. We have already discussed the matter as a part of WINTERHAVEN, with a local research and development organization, specializing in electronic devices. The opinion seems to be that there is no reason that the device should not work, and that it is simply a matter of obtaining a suitable flame jet and in assembling the necessary collector-electrodes and in carrying on a step-by-step development.

The basic effect was called to my attention rather forcefully during the last war, while I was assistant engineering officer aboard the U.S.S. Nashville. A fire brok out on the dock at the Philadelphia Navy Yard and with others, I ran with a CO_2 fire extinguisher to assist in extinguishing the blaze.

While I was playing a blast of CO_2 on the fire, I noticed an electric discharge from the end of the plastic horn of the extinguisher over to a grounded pipe. It actually was a spark discharge, about 5 to 6 inches in length, and crackled merrily while the CO_2 was emerging from the horn. I realized instantly what was happening. Frictional electricity at the orifice was serving as an exciter potential, and the voltage was built up as it travelled along the non-conducting horn, so that the energy of the electrical charge actually came from the kinetic energy of the blast itself. The horn acted as a charge-accumulater and to a certain extent, as a capacitor, storing the potential longitudinally like a series of condensers. Finally, at the end, or rim of the cone or horn, the potential obviously reached a value of 100 to 150 thousand volts, and flashed over, as I said, to the grounded pipe.

Now, the flame-jet generator operates on the same principle exactly. Rather than being self-exciting the flame-jet generator utilizes a 30,000 volt transformer rectifier D.C. source spraying charges into the base of the flame. The kinetic blast of the flame carries these ions along and through a series of openings in the center of conically-shaped electrodes. These electrodes are made of a heat-resisting metal like tantalum. They will probably look very much like a series of frying pans without bottoms, supported by suitable heatresisting electrical insulators, and connected to a series of capacitors, (high voltage capacitors).

Thermionic emission from the incandescent needle points near the flame orifice is carried along with great kinetic energy supplied by the blast. These ions strike the series of electrodes in such a way as to cause the charge to build up progressively in the electrodes and the electrodes in the outerreaches of the flame acquire the highest potential, with respect, of course, to the orifice of the flame. The large capacitors between the conics not only maintain stability, but create a kind of regenerative effect to further increase the voltage differential in the following conics.

There appears to be no reason why a device built along these lines will be seriously limited in voltage up to about fifteen million volts. Somewhere in this high range, the ions will tend to fight their way back against the kinetic blast, and further increase in voltage will be impossible. There is also a return path for the charges outside of, and around, the flame which, it appears, will cause a limiting point to be reached at about 15 million volts.

The use of such a flame jet generator, due to its simplicity, the absence of mechanical moving parts, would seem to be indicated in the case of electrified aeroforms. There undoubtedly will be a variety of other uses where the generation of very high direct-current potentials are required. We hope to have one of these units built, actually just a 500 kv unit, withing the next two or three months. Arrangements have already been made here in Washington for the preliminary setup. We will need units of this kind very soon, if the work in France is continued, but this, of course, depends on the continuing interest, and the success of the program in France.

Section 14: In regard to the disc airfoils, two foot discs at 50 kvs. require a continuous current of about 1 milliampere. This represents about 50 watts of input energy. The discs will accelerate until the resistance of the air and the suspencion system prevents further acceleration. If it were not for these resistance factors, it is probable that the discs would accelerate to very much greater speeds than 17 ft. per sec. In the tests which have been conducted, we have run the discs, sometimes as much as 20 minutes, without any decrease in top speed. In every case, the supply voltage is maintained and this requires, as said above, about 50 watts continuously.

Various electrostatic generators have been used in the original Biefeld-Brown tests. Between the years 1926 and 1930, a 280 kv X-ray power supply was used. This unit had a full-wave mechanical rectifier. Later, vacuum-tube rectifiers were used, also full wave. Lately, high-voltage D.C. power supply units, using R.F. transformers and voltage-tripler rectifiers along with high-voltage capacitors have been found to be quite successful. In general, any source of high-voltage D.C. will work.

As to the diameter of the circular course in which the discs were flying, the very first tests used 6 in. discs flying around a circular course of about 5 feet diameter. As the size of the discs was increased, the diameter of the circular course was increased also. Two-foot discs in California operated in a circular course of about 20 ft. in diameter. Recent improvements have carried the diameter of the discs to over three feet and the circular course to about 50 feet in diameter. These latter discs are now using about 150 kvs. at about 2 milliamperes, but their acceleration and behavior in flight is really quite spectacular. The first phase of the experimentation on this form of disc was in 1950, and in Hawaii.

Section 15: In item 15, there is a misunderstanding. The work on the Island of Kauai with plants was a study of electroculture. This had to do principally with the effects of atmospheric electric gradients on the growth and reproductive processes of plants. Experiments were conducted on steady and variable state electrostatic fields introduced by antenna systems over the experimental gardens. Tests were made with antennas charged positively and antennas charged negatively. The atmospheric electric gradients ran from 100 volts/meter up to 1,000 volts/meter. Tests were made on all the common varieties of garden vegetables and quite a number of flowers, also on sugar cane. A considerable study was undertaken of the bio-electric processes which go on within the plant. The results of this four-year program of research are included in two volumes, written at the conclusion of the expedition. They are entitled" Electrical Factors in the Growth and Concentration of Sucrose in Sugar Cane", and "Electrical Factors in the Transport of Phytohormones and an Introduction to Practical Electroculture".

In brief, the results indicated that a negatively-charged antenna system over an experimental garden, especially if the charging included sharp high-voltage negative pulses, the growth rates of all the plants appeared to be increased from 1½ to 4 times their normal rate. Furthermore, such a negatively-pulsing antenna appeared definitely to prevent formation of floral apices, and in general served to keep the plant in a vegetative state. Positively-pulsing antennas brought on early floral induction and considerably less foliation. With flowers, terminal-flowering plants were prevented from flowering by intense negative pulses from an overhead antenna, whereas systemic flowering plants, under these circumstances, flowered early. Reversing the polarity to positive pulses in the antenna system caused the terminal flowering plants to produce floral apices almost immediately, and to undergo the transition to the reproductive state.

Considerable study was also undertaken of the phenomenon of photo-periodicity, wherein artificial light, or even the varying length of day induces, or prevents flowering in the various photoperiodic plants. Sugar cane, for example, was prevented from flowering indefinitely by subjecting it continuously to orange-red radiation, whereas, with blue-violet radiation, flowering in some cases appeared to be hastened. All of this material may now be found in the literature on photoperiodicity, and work along these lines has been continuing, both in Europe and America.

Section 16: The New York Herald-Tribune articles, the three of them, give a number of references to individuals and to organizations currently interested in the electro-gravitic concept. One in particular, which I have know about for some time, and mentioned also in the Tribune articles is Hlavaty, of Indiana University, a mathematician. There have been a number of articles about Hlavaty's work in newspapers and the like, but I am unable, at the moment to give you any technical references, i.e., references to technical papers which he has written.

In regard to Millikan, it is Robert Andrews Millikan, founder of the California Institute of Technology. I attended Cal Tech. in 1922 and 1923, shortly after it had been formed from Throop Polytechnic Institute, and Millikan not only taught physics there, but he headed the school. It was largely due to Millikan's influence in his various lectures and classes, which he made very interesting indeed, that I made the decision to follow scientific research as a life-work.

Dr. Millikan received the Nobel Prize for his work in measuring the charge on the electron. He also did considerable original work on cosmic rays in the early days, measuring the intensity at various elevations, and also at the bottom of some of the California snow-fed lakes, and these measurements gave the first indications of the enormous penetrating power of cosmic rays. The actual discovery of cosmic radiation, however, goes to Professors V. F. Hess and W. Kolhoerster (1911-1914) in Europe, but all of this information is readily obtained from the literature.

Section 17: The lights in North Carolina are known as the "Brown Mountain Lights". They have been observed, I believe, since about 1850. There have been many attempts to explain away these strange lights. I mean, to try to explain them on the basis of some effect of light refraction or the like. A notable example is the report existing in the files of the Geological Survey, in which the lights were explained as due to either the direct glow or the reflections of an approaching locomotive headlight. I made a rather complete study of these reports and found in every case that they were biased; e.g., in the locomotive headlight theory, the lights continued to be seen during a period when there was a railroad strike and no locomotives were running, and this fact was given no consideration, it appears, in the published report of the Geological Survey.

My attention was called to this phenomenon early last year by a Navy captain who, himself, had witnessed the effect. He told me personally that he had witnessed many strange things in his life, but this was really one for the books. He said he had not been drinking and that the lights he saw, which looked like orange balloons rising, were very real, and he discounted immediately any possibility that they could have been distant reflections of locomotive or automobile headlights. This was Captain Karig, at that time head of the information service for the United States Navy.

Incidentally, I have, somewhere among my things, the newspaper or magazine article prepared subsequently by Capt. Karig, and I also have a copy of a project which we prepared at the foundations offices last year as a proposal to study the Brown Mountain Lights. I'll try to locate these things and send them on to you within the next few days.

Then there was another report on the glow in the sky over the Andes. The only explaination is that it is of electrostatic nature, a kind of glow discharge from the Andes peaks to the highly charged regions directly above. But there are many authorities who discount this, leaving the phenomenon still unexplained.

If we are to accept the Brush concept, and if we were to explain the retardation of gravitational acceleration and the heating effect on the basis of negative gravitational isotopes, and if we are then to attempt to tie these things together, as the static phase of the electro-gravitic concept, then it is entirely possible from a theoretical standpoint, and certainly we are justified in extrapolating, toward a concept which would include negative gravitational mass.

I won't take the time to go into this and, of course, actually, there is very little evidence to support it at the present time. Yet, if it were so, the appearance of the so-called "fires", may represent the escape from the earth of

certain negative gravitational masses, a kind of contra-terrene matter, which had, theretofore been trapped or locked, within the atomic or molecular structure of certain heavy atoms. Released from its bonds, probably electrical bonds, it would permeate matter, free similar atoms en route, and a blob of the material start upward and outward from the surface of the earth, lifted, as it were, by the force of gravitation operating in the reverse sense.

It is interesting to speculate that, perhaps, the zodiacal light and the glegenshein, the luminous tail of the earth, which points away from the sun, and perhaps even a comet's tail, which also points away from the sun, constitute evidence in nature, of the escape of contra-terrene substances from their bonds in heavier atoms.

Brush showed that the abnormally light atoms (in a gravitational sense) emitted heat, and it follows logically that if materials are extremely light, or even further, if they behave negatively with respect to gravitation, it is not difficult to believe that they would not only emit heat, but light as well. The rising orange-red blobs of gas observed by Capt. Karig may turn out to be just this thing.

Now to go on, the so-called "Mountain Effect" is well-known in earth-current measurements. A conducting plate, buried near the summit of a mountain, will be found to have a different potential from a similar conducting plate buried near the foot of the mountain. A wire connecting the two plates will be found to indicate a continuous current flow, and this continuous current flow is called "The Mountain Effect". So far, it is unexplained.

Although it is included in WINTERHAVEN, no one to my knowledge has ever shown that a condenser moving through altitude has a charge induced in it, unless, of course, you consider the Fernando Sanford Effect as constituting this evidence.

According to electro-gravitic theory, a change in altitude induces a charge in a capacitor in two ways: First, if the elements of the capacitor, i.e., the conducting elements, are insulated from the grounded case, a negative charge should appear in rising, i.e., during the period of increasing altitude, and a positive charge should appear in these elements during the period of decreasing altitude. This is the effect I have discussed earlier, based on the Fernando Sanford Electrometer observations. It is a change of potential with respect to a cover or shield which is grounded. This precludes observations in an airplane, for it would be impossible, of course, to ground either the plane or the capacitor in flight.

The better plan would be to use a high-speed elevator, either in a building like the Empire State or in a very deep mine, like a Pennsylvania coal mine. In such a test, the capacitor and the voltage-recording equipment could be mounted in the elevator, the case of the capacitor grounded to the controls of

the elevator or the rails and the floating side of the capacitor connected to the high-impedence voltage-recording device, such as a vacuum-tube amplifier connected to a recording galvanometer.

Now the second way in which a capacitor may be charged with a change in altitude does not depend upon the grounding of the case or of one side of the capacitor. Theoretically, it is a very small effect, but still may be observable with sensitive equipment. It is based on the concept that a change in electric permittivity of free space accompanies a change in gravitational potential. It follows, therefore, that the value of of space near the surface of the earth would be slightly different from the value at a distance from the earth, there being a gradient in between the two points. The value of near the earth would be larger than the value of at a distance from the earth.

Therefore, using a capacitor with a fixed Q, the voltage would vary inversely with . In other words, if we should charge this capacitor to a known voltage, then, if for any reason, the of the dielectric, which includes, of course, the space occupied by the dielectric, the voltage would increase or decrease as an inverse function of . If a capacitor with a given voltage were raised from the surface of the earth to a point at great elevation, the of space would be found to decrease slightly, and the voltage, in order to maintain the same charge Q, would be found to increase. The converse would be true for a capacitor approaching the earth or any other massive body in space.

Right along this line, space itself is sometimes "defined" as having the physical dimensions represented by the product of the electric permittivity and magnetic permeability. Similarly, gravitational potential is defined as a "condition of space" and appears as an inverse function of the product of and . A gravitational field, therefore, may be defined as a gradient in / . Since the velocity of light is governed by , as c , this could explain the bending of the wave front of light in passing near a gravitational body such as the bending of light in passing near the sun (as shown by the displacement of the star-field behind the sun). This, you will remember, is one of the predictions also of the theory of relativity.

I doubt if you can use any, or should use any of this in your publication. I have gone into these theoretical aspects largely to explain why we would expect these effects, and I thought you would be personally interested in them.

Well, this about sums it up. I believe I have, at least I have tried, to answer your many questions. There does seem to be considerable interest in the subject of gravitation. It is taking the form of an increasing realization that rocket propulsion is not the answer. We have recently prepared a ies proposed program for some of the aircraft manufacturers. I could name them, I am sure you would know them. The company

are currently studying some of this material. There is an organization or flow chart which I am sending you which sets forth, in general terms, the organization of the material. I trust all this will be helpful to you in preparing something which will make sense.

I know how difficult it is to prepare an article of this kine so that it will produce results. And the results we want in this case, of course, is action. Everyone seems to take gravitation for granted. It is something like the weather, we talk about it, even how nice it would be to control it, but no one does anything about it. To me, the rocket merely represents brute force and awkwardness. There is really very little sense in expending so much power and wasting so much fuel in fighting the gravitational field. In the last year, I have become intensely interested in the bubject of negative gravitational isotopes, and it appears that if a program of research is implemented in this direction, some sweeping, basic solutions may soon be found.

Let me hear from you if I can be of further assistance, and with all good wishes for the success of your undertaking.

Sincerely,

T. Townsend Brown

TTB:jb