ON EARTH CURRENTS.

BY

R. SHIDA

Professor of Natural Philosophy, Imperial College of Engineering, Tokio, Japan.

The fact that the phenomenon known as "earth currents" is intimately associated with those of earth magnetism, auroras and sun-spots, makes the study of earth currents interesting and important. But the fact that there appears to be some connection between earth currents and wind-storms and earthquakes, makes the study of earth currents still more interesting and important to us who live in a country which is so often visited by these destructive phenomena. These facts have been observed and studied by several physicists, and the study of them has, of late, become more and more important. To enter briefly into what has been done and what is being done in this direction, and to consider what we, in this country, might do in the same direction, is the chief object of the present communication.

In considering the variations of earth currents we must distinguish between slow and regular variations, and those sudden and irregular variations, which are termed electric storms, just in the same way, as we distinguish between the regular and irregular variations of earth magnetism.

Let us first consider the regular variations. Among the regular variations are diurnal and annual variations, that is to say, those variations which depend upon the time of the day and the season of the year.

The result of the observations made by Barlow as far back as 1847 showed a very close relationship between the hourly variations of a declination needle and the changes of the intensity and direction of earth currents in telegraph lines.

The close coincidence of the changes of earth currents with the changes of earth magnetism was, however, first shown by the Astronomer Royal of the Greenwich Observatory.

He had two wires one running from Greenwich to Croydon and the other from Greenwich to Dartford, these wires being very nearly at right angles to one another. They were joined to two reflecting galvanometers; and the motions of the needles of these galvanometers, and that of a declination magnet were photographically recorded. The result of ten years' observation (from 1848-1857) thus made, showed that the changes of earth current and declination for the same period are almost coincident, there being two maxima, one at about 1 or 2 a.m., and the other at about 1 or 2 p.m., and the two minima at about 7 or 8 a.m. and p.m. respectively. Mr. C. V. Walker, Professor Balfour Stewart and Dr. Lloyd who, it seems, were working at the same subject nearly at the same time, came to the same conclusion, namely, that there are certain fixed hours in the twenty-four when the current is found to be at a maximum and certain fixed hours when it is at a minimum.

In a paper communicated to the Society of Telegraph Engineers and printed in the Journal of that Society, Volume II, Mr. James Graves described the result of observations he made of earth currents in the Atlantic cable in 1871. For 78 days, he plotted in curves the daily variations of earth currents. These curves showed that when unusual disturbances do not appear to have caused any palpable irregularities, there is a striking similarity in their general character, and that there are two maxima and two minima, the first maximum occuring at about 3 or 4 a.m., and the second or larger maximum at about 12 or 1; while the first minimum occurred about 7 or 8 a.m. and the second or larger minimum at 6 or 7 p.m. The difference between the larger maximum or minimum and the smaller maximum or minimum, was so remarkable, that Mr. Graves aptly remarked that generally speaking, a large rise and fall takes place while the sun is up, and a smaller rise and fall while he is down. Mr. Ellis of the Greenwich Observatory in a paper published in the Philosophical Transations of the Royal Society 1880, has shown the intimate relation between solar activity and the regular diurnal changes, of declination and the horizontal force of the earth's magnetism. The result shows clearly that there are not only daily and yearly periods of the changes of magnetic elements, but there seems to be in the horizontal force a period of 25 or 26 days which is the time of the revolution of the sun on his axis.

Other investigations of Sabine, J. A. Adams and others have shown that these regular magnetic changes are due not only to the action of the sun, but also in part, to the action of the moon; and that just as there are regular solar earth currents, depending upon the sun, so there are regular lunar earth currents, which go through their changes under the action of the moon. From the considerations of these results, Professor W. G. Adams has gone as far as to say, (in his interesting paper on Magnetic Disturbances and Earth Currents in the Report of the British Association for 1882, that these regular lunar earth currents may be due to the elastic yielding of the earth crust—that is the tide—under the moon's attraction; for, as he says, by these changes the earth's magnetism is altered, which alteration would give rise to induced currents of electricity or earth currents.

I shall now proceed to show the results of observations which have been made in this country in connection with regular earth currents.

Soon after the completion of a Telegraph line, in November 1883, between Nagasaki and Fusan (in Korea) which runs very nearly north and south, and which consists partly of land line (from Nagasaki to Yobuko, distance of 88 miles), and partly of submarine cable (from Yobuko to Fusan, a distance of 110 knots), a regular observation of earth currents on that line was commenced at the Nagasaki telegraph office by the order of the Director-General of Telegraphs. The result of the observations made during the whole of the last year are given in Table I. For the purpose of comparing the variations of earth currents at different times of the day and of the year, some of the results are graphically exhibited by means of curves (Diagram 1, 2, 3 Plate I, and Diagram 1......12, Plate II), in which the abscissae represent times, while the ordinates represent the strength of currents in milliamperes; those currents flowing from Nagasaki to Fusan along the telegraph wire being

PLATE I

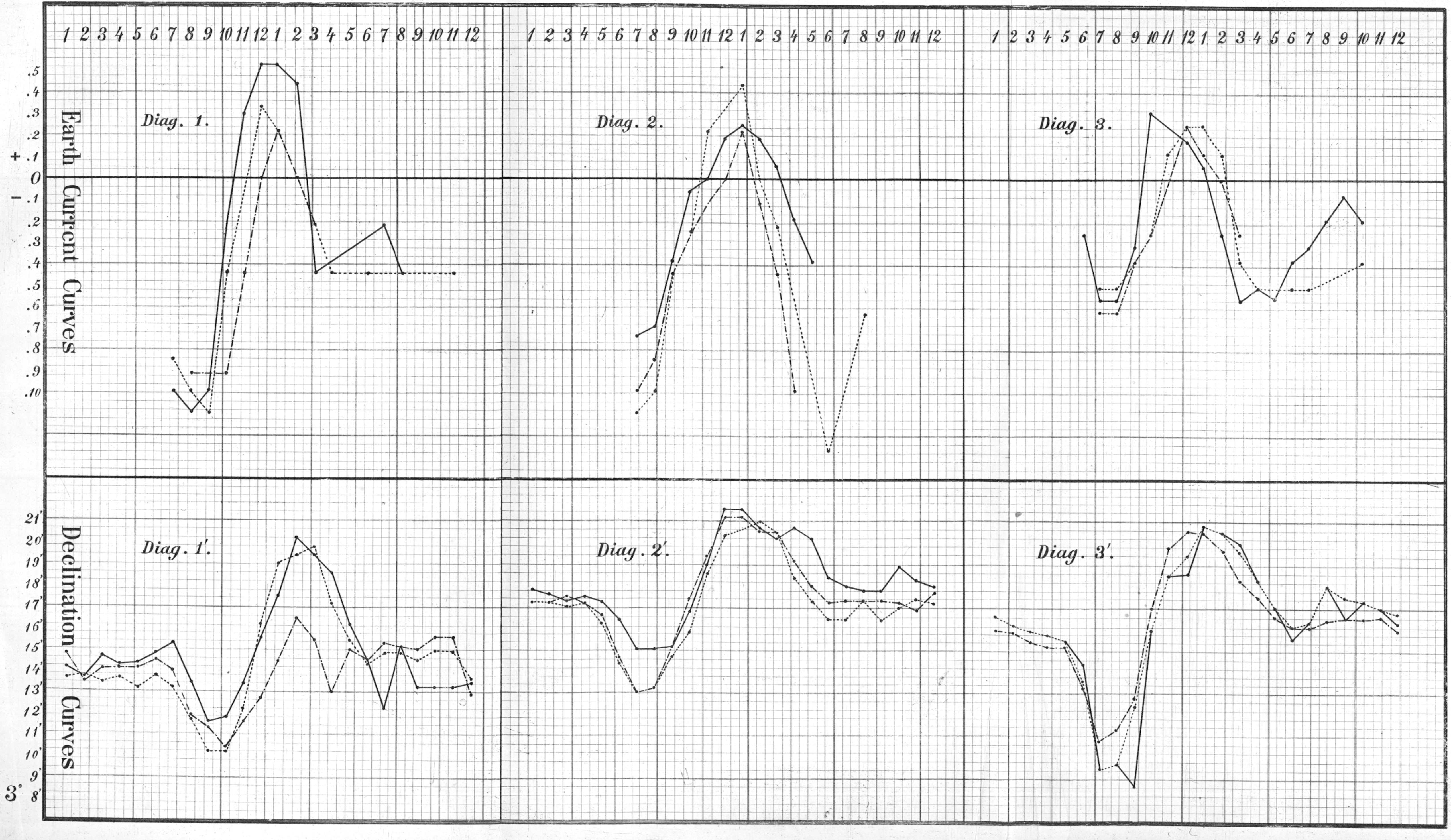

1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
Diag. 1.
Diag. 2.
Diag. 3.
Earth Current Curves
.5
.4
.3
.2
+ .1
0
- .1
.2
.3
.4
.5
.6
.7
.8
.9
.10
Diag. 1'.
Diag. 2'.
Diag. 3'.
Declination Curves
21'
20'
19'
18'
17'
16'
15'
14'
13'
12'
11'
10'
9'
3° 8'

PLATE II


Earth Current Curves
Declination Curves
.3
.2
+.1
0
−.1
.2
.3
.4
.5
.6
.7
.8
24′
23′
22′
21′
20′
19′
18′
17′
16′
15′
14′
13′
12′
11′
10′
3° 9′
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12
January
February
March
April
May
June
July
August
September
October
November
December
Diag. 1.
Diag. 2.
Diag. 3.
Diag. 4.
Diag. 5.
Diag. 6.
Diag. 7.
Diag. 8.
Diag. 9.
Diag. 10.
Diag. 11.
Diag. 12.
Diag. 3′.
Diag. 4′.
Diag. 5′.
Diag. 6′.
Diag. 7′.
Diag. 8′.

reckoned positive, and those flowing in the opposite direction negative.

In the Diagrams, 1, 2, 3 Plate I, are given specimen curves of the daily variations in the months of March, June and August respectively. They show that the daily fluctuations of earth currents at different periods of the same month are very regular and periodic.

The Diagrams 1......12, Plate II, represent the monthly means of the diurnal variations. It will be observed that there is a marked similarity in their general character, showing that throughout the year the diurnal variations of earth currents are very regular. They also show that there are one distinct minimum and one distinct maximum, and that there appears to be another smaller minimum and another smaller maximum. A closer examination shows that the times of maxima and minima are slightly different at different times of the year. In the month of January the first minimum occurs at about 9.30 a.m. the first maximum at about 2 p.m. The times of both maximum and minimum become earlier and earlier, month after month, till they become earliest in the month of June and July, (the months in which the times of sun-rise are earliest), when the first minimum and maximum occur at about 7 a. m. and 11.30 a.m. respectively; then they go on getting later and later, month after month, till in the months of December and January, (the months in which the times of sun-rise are latest). they become latest again. Another interesting point to be noted in respect to these curves is that they show that the daily fluctuations of earth currents are greatest in summer and least in winter.

Through the kindness of Mr. Arai, the Director, and Mr. Nakamura, of the Meteorological Department, I have been enabled to examine the results of the observations of the magnetic declination which have been made at the magnetic observatory of that department. It seems from the results that, from the month of March till August 1883, the observations were made hourly; while since September 1883 they have unfortunately been made only once in three hours. On examination I found that the results of observations, made in every three hours, are of very little value, the interval between the times of observations being far too great to show even the general character of the variations; whilst the results of the hourly observations are of great importance as showing the general way in which the diurual variations take place. The results of the hourly observations are given in Table II. They are also graphically exhibited by means of curves (Diagrams 1′, 2′, 3′ Plate I. and Diagrams 3′......8′ Plate II.) in which the abscissae and ordinates represent the times and the declination respectively. The curves in the Diagrams 1′, 2′, 3′ Plate I are specimen curves showing the declination variation in the months of March, June, August respectively; while the curves in the diagrams 3′......8′ Plate II, are those showing he monthly means of the daily variations.

On comparing the declination curves with the corresponding earth current curves, we observe a most remarkable similarity in their general feature, so much so, in point of fact, that what are said of earth current curves may equally apply to the declination curves. Just as there are one distinct maximum, and one distinct minimum in the earth current curves, so there are one distinct maximum and one distinct minimum in the declination curves. Just as there are indications of another smaller maximum and another smaller minimum in the earth current curves, so there are indications of another smaller maximum and another smaller minimum in the declination curves. Then the times of maximum and minimum are earliest in the months of June and July, both in the case of the earth current curves and in the case of the declination curves. Then again both earth current and declination variations are greatest in summer.

One important fact distinctly brought out by results of these observations—a fact which, as far as I know, has never been shown before—*is that the declination variations are not the effect of earth currents; for, if it were so, then an increase of the western declination ought to corresponds to a decrease of earth current flowing from north to south along a telegraph wire—not an increase, as has been found by actual observation.* The results show on the contrary that both magnetic and earth current variations are regulated by the same cause or causes, and that the sun plays an important part in producing the effects which are observed. The fact, however, that there appears to be two maxima and two minima in these variations, tends to show that they are in part due to the action of the moon.

Let us now consider those more sudden and unusual variations which are designated by the name "Electric Storms," and which are most intimately associated with magnetic storms, auroras, sun-spots, &c., During the remarkable aurora of February 4th 1872, which was visible nearly all over the continents of Europe, and Asia, there broke out a most violent electric storm accompanied by a magnetic storm; and a very extensive set of observations was, for the first time, made on this occasion. But since those observations were mostly the result of the fact, that the currents were so violent as to stop or interfere with the working of the telegraph lines, no information of any scientific value can be derived from the records then obtained. I have tried to arrange those observations recorded in the Journal of Society of Telegraph Engineers Vol. I and other Journals; but I found it almost impossible to deduce from them anything of value, the results in many cases being contradictory; the more one tries to work the results into form or order, the more one finds oneself plunging in a mess.

It was not until 1880 that another violent earth current disturbance, which may be called an electric storm, broke out. This electric storm which was again accompanied by a magnetic storm, commenced on the 11th August and lasted till the 14th. During this storm a great number of observations were made in various parts of the world. Among the rest, the most reliable observations are the photographic records, taken at the Greenwich Observatory, on two separate wires running respectively in a S. W. direction and a N. W. direction. It is interesting to note that these photographic records are bent opposite ways at the same time, so that when an earth current is flowing on one line towards Greenwich there is found to be a current in the other wire flowing from Greenwich. According to Professor Adams (see his paper refered to). who compared these photographic records with the earth current records obtained by Mr. W. H. Preece and others, the general direction of the current during this storm was from about S.S.W. to N.N.E.

The next remarkable storm both electric and magnetic is that of January 31st 1881. Both earth current and magnetic changes during this storm, were photographically registered at the Greenwich observatory; and the results obtained are extremely interesting. From what has been described by Mr. Ellis of the Greenwich Observatory, (Vol. X, Journal of the Society of the Telegraph Engineers) it appears that the magnetic and earth current disturbances were practically simultaneous, that they began together and ended together, and what is still more interesting, that there were sharp bends shown on all the magnetic registers, with the corresponding sharp bends on the earth current registers. Another interesting observation that was made of those abnormal earth currents on this occasion, was that which is clearly described by Mr. W. H. Preece in the same volume of the Journal. There he plotted out curves of the abnormal earth currents, observed on a telegraph line from London to Haverfordwest, in such an excellent manner that a glance is sufficient to see the intensity and direction of the earth current at any moment. That this storm was one of the most violent can be seen from the fact that the maximum difference of potential per mile of wire, as recorded by Mr. Preece, was as much as 0.6 volts.

During the storm of August 1880 and also during the violent storm of January 1881, the Aurora was well seen in England; it was also seen in St. Petursburg and as far as Siberia

But the most wonderful abnormal earth currents which have ever made their appearence on telegraph wires, and which have been most extensively observed, are those of November 1882. These abnormal earth currents appeared on the morning of the 17th and continued with varying strength until the morning of the 21st, when they disappeared altogether. On the 17th when as simultaneously experienced all over the globe, the storm was most violent, nearly all of the telegraphic communications of the world were interrupted. It was on that day that the most numerous observations were made in different parts of the world. Among the others, the most interesting observation that was made of the abnormal earth currents on this occasion, was that of Mr. W. H. Preece, who on comparing the results of observation, made on various telegraph lines, showed that the earth currents on that day, were found to be different in different wires both in strength and in direction (geographically speaking) even at the same instant of time. He also showed that it was possible to find out the line of greatest disturbance or that of least disturbance; that the line of the greatest disturbance was different at different times of the day, and that it nearly pointed towards the sun. He went so far as to urge that there is an intimate connection between the direction of the sun and that of earth currents.

The storm of November 1882 was also accompanied by a sun-spot of such considerable magnitude that it was sometimes visible to the naked eye. According to the observations made at the Greenwich Observatory, the sun-spot became first visible on November 12th at the eastern limb of the sun's disc, and remained visible until the 25th when it disappeared on the western limb. It thus seems that the earth current storm made its appearance about five days after the first appearence of the sun-spot, that the earth currents were most active while the sun-spot was at the central part of the sun's face.

An electric disturbance and a disturbance in the sun's atmosphere, again occurred on the 15th and 16th of December, that is about 25 days (which is the time of the revolution of the sun on his axis) after the November storm. The sun-spots of the December 15th and 16th were, no doubt, as has been remarked by the Astronomer Royal of the Greenwich Observatory, the remains of the large spot of November 12th-25th.

During the electric storm of November 1882, some observations were, for the first time, made in this country; but since these observations owed their origin to the difficulty of working the telegraph lines, nothing of value can be deduced from the results, only it is interesting to observe that this great storm was also felt in this country.

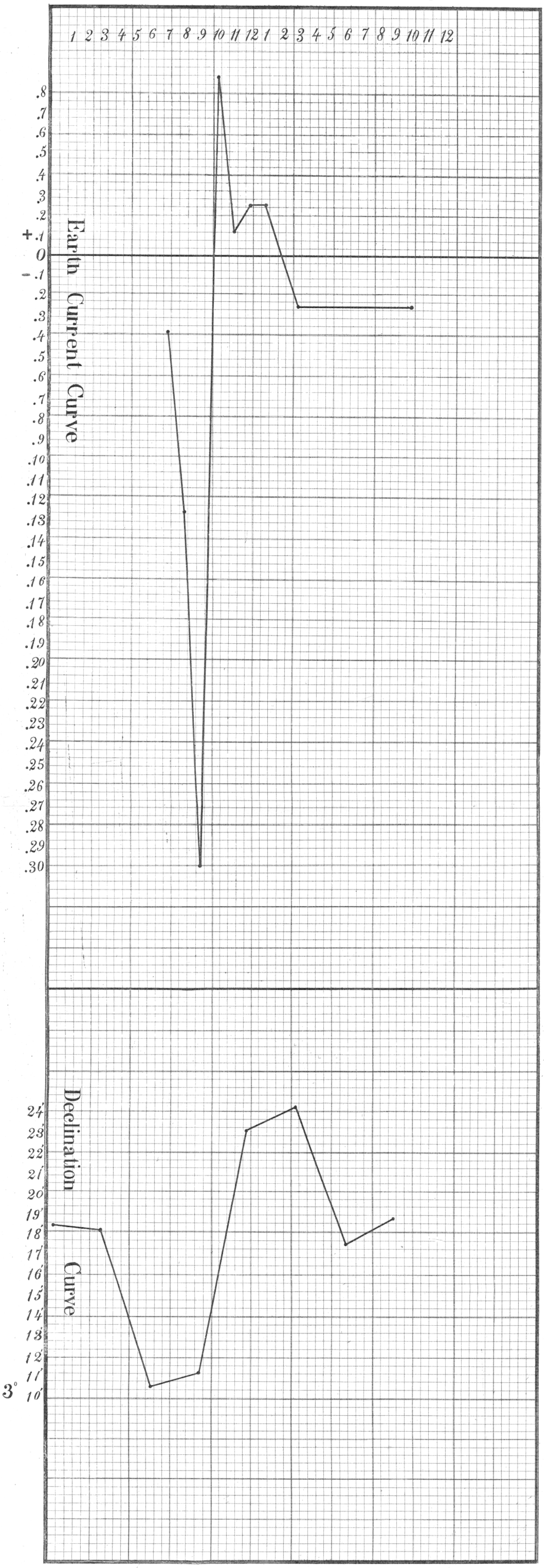
On examining the results of observations of earth currents made on the Nagasaki-Fusan Telegraph line during the last year, I incidently noticed unusually great change in the current on July 3rd. This led me to see if there were any unusual change in the magnetic declination as found at the magnetic observatory, of the geographical department; and I found a similar variation in the declination as I expected. Both earth current and declination curves for that day, are given in Plate III, from which we observe that earth current and declination changes are apparently coincident, although we can not very well compare them with accuracy for the simple reason that the intervals between the times of observation of declination are too great.

Single disturbances electric and magnetic, though seemingly sudden and irregular, still follow certain laws in their occurrences. Sir E. Sabine found that years of maximum disturbances in earth magnetism are those of maximum sun-spots, and that they have 11 years periods, which agree with the 11 year periods of the appearance of spots on the sun. It has been found also that the years of greatest electric disturbance are also those of greatest magnetic disturbance and of those of greatest disturbance on the sun's photosphere.

In his valuable paper already referred to Professor Adams compared the magnetic disturbances of August 1880 and September and November 1882 at observatories all over the globe—several in the northern hemisphere, and some in the southern hemisphere. The photographic records taken at these observatories were reduced to the same time scale, were placed over one another, and the tracings, compared with one another. He in that way came to the conclusion that these magnetic disturbances occurred, as nearly as one can say, at the same (absolute) time all over the globe. Such a conclusion might reasonably be urged in favour of the theory that both magnetic and electric storms are directly due to the action of the sun regarded as a magnetic body.

PLATE III

July 3rd 1884



Besides the electric storms which have been described there have occurred several smaller electric disturbances which may hardly be called storms, and which appear to have been only local. Many instances of these local disturbances being accompanied, or followed by earthquakes, are on record. Mr. J. Graves in his paper previously referred to, states that a severe earthquake was felt in different parts of the north of England, between 6 and 11.15 p. m. on 17th March 1871, while the Atlantic cable was most violently disturbéd from about midnight of that day for several hours. The Indian earthquake of December 15th 1872 was preceeded by strong earth currents on the telegraph lines from Valentia to London; currents were so strong that they necessitated the looping of the two wires. Again the Egyptian earthquake of January 12th, 1873 was also preceeded for some days by abnormal earth currents on telegraph lines from Valentia to London; and this earthquake was accompanied by an erruption of Mount Hecla in Iceland, which lasted from the 9th to the 12th. It is interesting to note, as Mr. Graves pointed out, that a direct line drawn from Cairo to Iceland crosses these telegraph wires. Then again strong earth currents appeared on the same telegraph lines on the 26th of November 1873, and it is recorded that they were followed by an earthquake. Again instances of these storms being coincident with wind-storms are not wanting. Mr. James Graves stated more than once, in the papers he communicated to the Society of Telegraph Engineers, that he often noticed unusual disturbances of the telegraph cables being coincident with wind-storms. Again the electric storm of the 12th September 1882, which was rather severe, the current on a telegraph wire from Belgium to Vingorla (a distance of about 70 miles) being at one time as strong as 10 milliamperes, was, according to Mr. E. Walker, coincident with cyclonic disturbances in Guzerat, and with a very heavy rainfall in north Bombay.

The observations which have just been described tend to show that those local abnormal earth currents are in some way connected with earthquakes and windstorms. It would be rash to produce a theory or even a suggestion of a theory of the connection between these phenomena. But it appears to me, that the connection between electric storms and earthquakes or windstorms, is of a different nature from that which exists between electric and magnetic storms, sun-spots and auroras. May we not find an explanation in the fact that bodies in the interior or in the crust of the earth yielding to stresses have changes produced in their relative configurations? It is quite possible that before an earthquake occurs, changes are produced in the distribution of stresses in the interior or crust of the earth, which must alter the relative positions of the magnetic bodies contained in the earth, and, therefore, must give rise to induced currents or earth currents. In the same way, unusually great augmentation of the atmospheric pressure on one portion of the earth-surface and unusually great diminution of it on another portion, which would cause a wind-storms, must alter the distribution of stresses in the crust of the earth, which in turn altering the relative positions of masses of magnetic matter, must give rise to earth currents.

There is just another phenomenon which is closely connected with earth currents,—I refer to atmospheric electricity. With regard to this connection, Sir William Thomson stated, in his presidential address to the Society of Telegraph Engineers in 1874, that a telegraph line—an aerial line more particularly, but a submarine line also—shows unusually great disturbances when the atmospheric electricity is in a disturbed state. That it should be so will be understood, as Sir William has pointed out, when we consider the changes of electrification of the earth's surface which a lightning discharge necessarily produces. Extending this idea and reasoning upon the data then extant, Professor Stokes, in a lecture he delivered in South Kensington Museum Theatre, went so far as to argue that earth currents are produced by the electric discharges which must be going on, in a spitting sort of way, from the air to the earth; that the magnetic changes are due to these earth-currents; and further that the connection between these phenomena and the sun may be accounted for by supposing that any change in the heating effect of the sun must produce a corresponding change in the amount of those electric discharges, for the atmosphere will get denser or rarer, and, therefore, offer greater or less resistance to the passage of the discharges through it, according as it is cooled or heated.

I have now briefly indicated what has been done in connection with this interesting subject of earth currents. We have seen that the earth current variations, both regular and irregular, are simultaneous with those of the earth's magnetism. We have seen that—certainly for regular changes, probably for irregular changes—an increase or decrease of the western declination corresponds to an increase or decrease of earth currents flowing from north to south along telegraph wires. We have seen that these changes are largely due to the action of the sun, while regular changes, at least, are in part due to the action of the moon. We have seen that those unusual disturbances, specially termed electric storms and magnetic storms are intimately associated with the auroras or polar lights. We have seen that these storms are closely connected with sun-spots, the peculiar eleven year periods of the appearence of which singularly agree with the eleven year periods of the occurrence of these storms. We have seen that the occurrences of these abnormal earth currents are connected, in some way, with those most mischievous and destructive phenomena—earthquakes and volcanic eruptions. We have also seen that it is probable that there is some link between the electric and magnetic storms and wind-storms. We have also seen that unusual disturbances of earth currents and of the earth's magnetism, are accompanied by unusual disturbances of atmospheric electricity.

The preceding are the main points, which have been found by several series of observations, respecting the connection between the phenomenon of earth currents and other phenomena. The fact is truly interesting, considering that the nature of these phenomena is such, that they appear at first sight to have no possible connection with each other. There are, however, many simple questions which can not be answered definitely in the present state of our knowledge. For example, are the normal changes of both earth currents and earth magnetism a direct effect of the sun and moon, or are they indirect effects of the sun, the heat and light of the sun causing changes of the atmospheric potential, which, in turn, cause magnetic and electric changes? Are the electric and magnetic storms effects of the auroral currents, or are those storms and auroras, common effects of sun-spots? Are the simultaneous or nearly simultaneous occurrences of those abnormal earth currents and earthquakes and volcanic eruptions really due to the changes of the configurations of bodies in the interior or crust of the earth, the probability of which has been indicated? Are the simultaneous or nearly simultaneous occurrences of abnormal earth currents and wind-storms, effects of the changes of the atmospheric potential produced by changes of the state of the weather, or are they to be attributed to the changes of the configurations of the earth's crust produced by the changes of atmospheric pressure, the plausibility of which has been indicated?

To answer these questions, we require more evidence upon which to base our conclusions. We require more facts derived from the results of observations. Thus it is that a systematic observation of earth currents and their allied phenomena is of paramount importance. These considerations have led me to make a suggestion as to a plan of scientific observations which we might make in this country, establish at least three stations A, B and C in a seismic district such, that the distances between A and B, and A and C are no less than 100 miles, and that the lines A B and A C are as nearly as possible, at right angles to one another. Connect A and B, and A and C electrically by wires, and let the following observations be carried on simultaneously:—

1. Observation of earth currents on those wires at the station A.
2. Observation of three magnetic elements, declination, horizontal force and dip at one of the stations, say at A.
3. Observation of atmospheric electricity at each of the stations.
4. Meteorological observation at each of the stations.

5. Observation of earthquakes at each of the stations.

For the observation mentioned in paragraph 1, a current recorder such as the one which I have just exhibited might be used with advantage. As for observation 2, such apparatus as those used in the magnetic observatory of the Chiri-kiyoku (Geographical Department), may be used, but either the magnetometers must be made self-recording, or else the observations must be made, at the least, every half hour on ordinary days, and every five minutes or even oftener in times of magnetic storm. As regards the method of making the observation 3, Sir William Thomson's Quadrant Electrometer, combined with his water dropping collector forms a very delicate apparatus. As to the observations 4, I can not suggest a better method than that which is adopted at the meteorological observatory of the Chiri-kiyoku. For the observation 5, such excellent machines have been recently invented and constructed in this country that I have nothing further to suggest.

If the above observations be faithfully carried out, not neglecting, of course, observations of sun-spots, aurorae, &c., whenever they occur, we shall have a mass of evidence from which I believe, we may be able to answer, more or less definitely, the questions which have been raised.

In conclusion, I may mention that seismological science has recently made such wonderful strides in this country, in respect of which we may justly be proud, thanks to the labours of Gray, Ewing and others, but more especially to the untiring energy and unbroken enthusiasm of one, whose name is so constantly associated with everything connected with earthquakes that I need scarcely name him—I mean Professor John Milne. As to the study of earth currents I am sorry to say very little is yet advanced in this country; what I have shown to-day is all that has been done in this country. It is my desire to establish a system of observation of this important subject of earth currents, to devise and improve the methods of making the observation, and to be able sooner or later, to communicate to this society, or to some other society, more important results than I can show at the present time.

DISCUSSION.

Dr. Knott.

Dr. Knott, after congratulating the Society on possessing in a readable form a succinct account of all the important work that had been done by British scientific men on Earth Currents, together with Professor Shida's own latest results, made some general remarks on the subject of which the following is an abstract.

The name Earth Currents is not a well chosen one; for it is extremely doubtful if there are such things at all. What we measure in all experiments on the subject are not *earth*-currents but *line*-currents; and all we know is that the extremities of the wire which are buried to a certain arbitrary depth in the earth are at different potentials. If there were anything really of the nature of a true earth current, results like the following might well be expected. Take any points A B C forming a large triangle, and let them be joined by lines A B, B C, C A, of equal resistances. If there is no true earth current, the line current from A to C (B dis-connected) will equal the sum of the line currents from A to B (C dis-connected) and B to C (A dis-connected). But if there is a true earth current this relation will in general not hold. I believe that the relation does hold; and this belief seems to be general although I know of no direct experiments having been made to test its truth. Its truth would require us to deny the existence of true earth currents; so that what so-called earth currents really indicate is a difference of potential between two plates deposited in the earth's crust, at altogether arbitrarily chosen depths.

That being so, it is extremely difficult to see how we can ever hope to distinguish between all the possible causes that may influence this potential. The nature of the contact, the material present, the stresses and changes of configuration in the crust itself, the atmospheric influences, the electrical accompaniments of a storm, whether cyclonic or auroral, all will certainly influence the value of the potential at a neighbouring locality. Professor Shida has pointed out that the diurnal march of the earth-current is broadly comparable to the diurnal march of the magnetic variation, and seems to depend on the position of the sun. That may well be; but that the two phenomena, the magnetic and the electric, are so to speak results of the same cause is a truth that appears to lead us no further into the essence of either. The magnetic changes, as they are, are utterly insignificant in their current effects to the electromotive forces which give rise to the earth-currents; while, inasmuch as there are probably no *real* earth-currents, their magnetic effects will largely depend upon what points are joined in line circuit. The effects of Auroras on earth currents may be two-fold. An ordinary statical induction may cause a change of potential at a given point; while a current induction may produce a current along a line joining two points. The magnetic effects of an aurora must be purely electro-kinetic. The displacement of material in the earth's crust, or the variation of stress will certainly have their influence; but it is impossible to surmise in what way their influence would show, and except in great changes it would probably be masked by the influence of other causes. Considering then the complexity of the whole phenomena, the impossibility of getting simultaneous observations of so-called earth currents in all directions around a given centre, and the difficulty of reasoning from them to their true essence, we can hardly hope for any very valuable information from them as to the coming and going of earthquakes.

Professor Milne. Professor Milne speaking of the earth current recorder which had been exhibited at the meeting said that it appeared to him as a valuable addition to the instruments which we have for the recording of electrical phenomena. The great feature connected with this instrument was the fact that it was automatic in its action, and therefore yielded continuous records of phenomena, the records of which had hitherto, so far as he was aware only been intermittent. The records which Prof. Shida laid before the meeting were certainly well defined and clear.

After this Prof. Milne gave some account of instances where earthquakes and electrical phenomena had occurred simultaneously and there were many instances on record where earthquakes had been accompanied by electrical discharges on the atmosphere. Prof. Shida had mentioned several instances where land lines and cables had been disturbed about the time of an earthquake. On March 17th 1875 disturbances of this sort had been noted in Italy. Some of the Ischian earthquakes had been signalled along cables. In Sept. 1875 M. Destieux had made some remarkable observations in Martinique where earthquakes had been preceeded by earthquakes. He (Prof. Milne) in conjunction with Prof. Fujioka had made some experiments on the production of earth currents when the ground was shaken artificially by the explosion of Dynamite. An account of these experiments may be found in Vol. VIII of the Transactions of the Seismological Society. He would like to speak at considerable length about the connection which may exist between certain earth currents and earthquakes but was afraid of occupying to much of the Society's time. The point which particularly struck him in connection with the investigations now before the Society was that Prof. Shida had observed currents flowing in a direction contrary to that which we should expect from a consideration of Ampère's law,—that is to say, from these particular observations it could not be argued that the earths magnetism was due to the currents or that the currents were due to the earths magnetism.

Professor Shida. Prof. Shida in replying to Professor Knott's argument that the name "earth currents" is not a well-chosen one, said that it was merely a matter of definition — it did not matter as long as we know what was meant by it. By earth currents we mean currents of electricity which, when two points in the earth's crust are joined by a conductor (a telegraph wire for instance) so as to form an electric circuit consisting of the conductor and the earth, flow through the circuit. That being so, the name " line currents ", proposed by Professor Knott, is no more scientific them the name "earth currents". That the earth acts as an ordinary conductor is a fact which has been established beyond doubt by numerous experiments. It will be sufficient to mention one. Telephones have been fixed on two telegraph wires on separate poles, using the earth for both circuits as a return; and what is spoken in the telephones on the one circuit has been distinctly heard in the telephones on the other circuit. This can not be attributed to induction; nor can it be due to leakage. The truth is that either circuit acts as a shunt to the earth.

Professor Knott had dwelt at length upon the complexity of the phenomenon of earth currents and of the other phenomena associated with it, and upon the difficulty of obtaining any valuable information as to the connection between earth currents and earthquakes. I need scarcely mention that I am quite aware of that complexity and the difficulty which Professor Knott has referred to. But at the same time it appears to me that the mere fact of there being several instances — to the instances enumerated in the paper two more have been added by Professor Milne — of earthquakes being accompanied or preceeded by earth currents, is enough to induce us to enter into the investigation of the whole subject and to inquire into the cause of the connection between these two phenomena. I have ventured to suggest one possible explanation of this connection. Whether the explanation is true or is an approximation to truth, or whether it is untrue, is a question which can only be answered from the results of observation — hence the importance of the systematic observation of earth currents and earthquakes. If what I have suggested as an explanation of the connection between these two phenomena be not altogether untrue, it is not quite chimerical to hope to see realised the long sought for method of predicting earthquakes.

TABLE I

JANUARY

Date.	2nd																		3rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.50	—.62	—.38	0	0	+.31	+.12											—.38	—.62	—.75	—.50		+.19	+.31	—.12								
Date.	4th																		5th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.62	—.94	—.75	—.38	+.31	+.44	+.25	—.12					—.19						—.38	—.56	—.62	—.50	+.12	+.12	+.12	0	—.06							
Date.	6th																		7th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.38	—.50	—.25	0	+.12	+.12	+.06	—.12										—.38	—.50	—.62	—.38	—.12	0	+.12	0	—.06							
Date.	8th																		9th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.38	—.50	—.19	0	0	0	- .12											—.25	—.38	—.50	—.38	0	0	+.06	0	—.12							
Date.	10th																		11th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.31	—.44	—.50	—.25	—.12	0	+.12	0											—.25	—.38	—.62	—.25	—.12	0	0	0	—.12							
Date.	12th																		13th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.38	—.50			+.12	+.12	0	—.12										—.25	—.38	—.62	—.38	—.12	0	+.12	0	—.12							
Date.	14th																		15th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.39	—.50	—.39	—.12	0	+.12	—.06	—.12										—.25	—.50	—.62	—.39	—.12	0	0	0	—.12							
Date.	16th																		17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.39	—.56	—.39	0	0	+.12	0	—.12										—.25	—.39	—.50	—.25	—.12	0	+.12	0	—.12							

TABLE I *(continued)*

JANUARY

Date.	18th																		19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.50	—.62	—.25	—.12	—.12	+.12	0	—.12										—.38	—.50	—.50	—.25	—.25	0	+.12	—.12	—.12							
Date.	20th																		21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.50	—.58	—.25	—.12	0	+.19	0	—.19										—.25	—.50	—.62	—.38	—.12	0	+.25	+.12	—.12							
Date.	22nd																		23rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.50	—.50	—.25	—.12	0	+.12	0	—.12										—.38	—.62	—.50	—.39	0	0	0	—.12								
Date.	24th																		25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.50	—.62	—39.	—.12	0	0	0	—.12										—.25	—.50	—.62	—.25	—.12											
Date.	26th																		27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.25	—.12	0	+.12	0	—.12										—.25	—.38	—.62	—.38	—.12	0	+.12	0								
Date.	28th																		29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.39	—.50	—.25	—.12	0	0	—.06											—.25	—.39	—.62	—.25	—.12	0	+.25	—.12	—.39							
Date.	30th																		31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.39	—.62	—.50	—.25	0	+.12	0	—.25	—.50										—.25	—.75	—.50	—.25	0	+.12	+.12	0	—.39							

TABLE I (*continued*).

FEBRUARY

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.4	—.5	—.7	—.7	—.5	—.4	—.3	0	0	—.3					—.3	—.4			—.3	—.5	—.8	—.7	—.5	—.4	—.3	0	—.1	—.3					—.4	—.4	
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.4	—.4	—.5	—.7					—.5							—.3				—.4	—.5	—.7	—.5	—.5	—.4	—.1	0									
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.4	—.5	—.7	—.7	—.5	—.4	—.1	—.1	—.3	—.4		—.5	—.5	—.4	—.4				—.4	—.5	—.7	—.5	—.4	—.3	0	—.1	—.3	—.3		—.3		—.3	—.3		
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.5	—.7	—.8	—.7	—.5	—.3	+1	0		—.5		—.7							—.5	—.7	—.8	—.7	—.4	—.1	0									—.3	
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.7	—.11	—.11	—.7	—.3	0											—.5	—.7	—.8	—.8	—.9	—.5	—.3	0										
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.7	—.7	—.8	—.9	—.7	—.3	—.1												—.7	—.7	—.8	—.7	—.5	—.1	0										
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—1.1	—.8	—.5	—.1			—.1	—.4				—.4		—.5			—.4	—.5	—.5	—.7	—.5	—.4	0	0				—.3	—.3		—.3		
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.3	—.3	—.4	—.5	—.7	—.5	—.3	—.1	0	0		—.7	—.4								—.4	—.5	—.5		—.5	—.1	—.1	0				—.4				

TABLE 1 *(continued)*,

FEBRUARY

Date.	17th																		18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.1	—.3	—.4	—.7			—.4		—.1	0						—.4			—.3	—.4	—.5	—.7	—.8	—.7	—.3	0							—.4			
Date.	19th																		20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.3	—.4	—.4	—.8	—.7	—.5	—.4	—.1	—.3	—.1					—.4						—.4		—.8	—.7	—.4	—.1	—.1	0	—.3			—.4	—.5			
Date.	21st																		22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.9	—1.1	—1.1	—.7	—.4		—.1	0	0											—.7	—.7	—.7	—.7	—.7	—.4	0									
Date.	23rd																		24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.									0			—.3						—.3		—.4																
Date.	25th																		26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.4	—.5	—.5	—.7	—.5	—.4	—.3	0	—.1	—.3				—.4		—.4			—.3	—.4	—.8	—.9	—.4	—.3	0									—.4	
Date.	27th																		28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.4	—.5	—.7	—.8	—.5	—.3	0		—.1	—.4	—.5								—.4	—.5	—.7	—.8	—.5	—.4	0	—.1			—.4						

TABLE I *(continued)*

MARCH

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.4	—.5	—.8	—.8	—.8	—.4	0	+.1	+.4		—.3			—.5					—.3	—.3	—.4	—.7	—.5	—.4	—.1	0	—.4					—.4			
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.3	—.3	—.5	—.8	—.5	—.4	0			—.4						—.5				—.4	—.7		—.5	—.4	—.1	—.1									
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.4	—.4	—.8	—.5	—.4	0													—.5	—.8	—.4	—.3		0					—.4					
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.5	—.7			—.1		—.3	—.4										—.7	—.7	—.7													
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.5	—.7	—.5	—.5	—.4	0														—.7	—.8	—.5	+.1	+.3	+.1	0					—.4			
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.5	—.7			0	+.1	+.3												—.8	—.9	—.5	—.1	+.1		—.8	—.3								
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.9	—.11	—.8		0	+.4		+.1							—.2				—.7	—.8	—.4			+.3				—.3						
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.8	—.8	—.5	—.3	—.1	0	+.1	—.1										—.84	—.99	-109	—.44		+.33	+.22			—.44		—.44					—.44

TABLE I *(continued)*

MARCH

Date.	17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.84	—.84	—.63	—.33			+.33			—.44					—.44	
Date.	19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.84	—.84	—.22	—.11	+.11	+.44	+.44	0								
Date.	21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	-.109	—.99	—.22	+.33	+.53	+.53	+.44	—.44				—.22	—.44			
Date.	23rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.99	—.99						0		—.73						
Date.	25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.5	—.8	—.4	—.3	—.1	0	—.1									
Date.	27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.6	—.7	—.7	—.3	—.1	0	+.01	—.1					—.3	—.3	—.3	
Date.	29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.																		
Date.	31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.63	—.63	—.63	—.22	0	+.22			0		—.63					

Date.	18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.44	—.44	—.11	—.22	0	+.11	0	—.22								
Date.	20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	-.104		—.22	+.22	+.44	+.44	+.33	—.22	—.33					0		
Date.	22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.84	—.84	—.44	0	+.22	+.22	0	+.44								
Date.	24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.99	-.109	—.63	—.44	0	+.44	+.22	+.11							—.63	
Date.	26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.5	—.6	—.7	—.3	—.3	—.1	—.1									
Date.	28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.91	—.91	—.91	—.44	0	+.22	0	—.22			—.44			—.44	—.44	
Date.	30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.84	—.44	0	+.44	+.22	0	—.22						—.44	—.44	—.44

TABLE I *(continued)*

APRIL

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.63	—.63			0		+.22	0			—.63				—.53			—.84	—.99	-.104		—.44	+.33	+.33	+.33	0			—.63					
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	-.104	-.109	—.84	—.33	+.44	+.53	0	—.22					—.33	—.33					—.91	—.99	—.99	—.33	+.33	+.53		+.11								
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.73	—.99	—.63	—.22	+.33		0	—.22	—.53						—.33			—.84		—.99				+.33										
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84		—.99	—.73	—.44	+.22	+.44	0	—.22			—.63	—.53			— 33			—.73		—.99	—.44		—.22	0	0	—.33				—.33				
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	-.104	-.109	—.63	—.22	+.33	0	0	—.33							—.33			—.84	—.91	—.99	—.63	0	+.22	+.44	+.22	—.22								
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.99	-.104	—.63	—.11	+.22	+.44	0	—.33										—.53	—.84	—.91	—.53	—.22	+.11	+.44	+.53	—.11	—.63	—.73				—.53		
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.33		—.84	—.99	—.84	—.53	+.11	+.44	+.44	—.53							—.33				—.84	-.109	—.63	—.33	0	+.33	0	—.11	—.53					—.53		
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.84	—.99	—.99	—.33	+.44	+.44		+.11									—.33	—.44	—.84	—.99	—.63	—.44												

TABLE I *(continued)*

APRIL

Date.	17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.73	—.63	—.33	—.22	0	+.22	0	—.22	—.44							
Date.	20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.63															
Date.	22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.73	—.73	—.33	0	0	+.11	+.11	—.22								
Date.	24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.33	—.53	—.63	—.53	—.11	0	0	0	—.44								
Date.	26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.84	—.73					0									
Date.	28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84		—.84	—.63	—.22	+.22			—.44								
Date.	30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.73	—.73	—.44	—.44	+.22	+.44	+.22	—.22			—.73					

Date.	19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.33	—.44	—.63	—.22	0	+.44	+.33	—.22						—.33			
Date.	21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.84	—.99	—.63	—.22		+.33	—.11	—.33								
Date.	23rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.53	—.63	—.44	0	+.11	+.11	—.11	—.33	—.53							
Date.	25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.44	+.22	+.22	0	—.33	+.33	—.11	—.22								—.11
Date.	27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.22		—.33										—.73				
Date.	29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63		—.84	—.33	+.33	+.22	+.22	—.11	—.22								

TABLE I *(continued)*

MAY

Date.	1st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.84	—.99	—.99	—.22	+.22	+.22	0	—.11								
Date.	3rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.73	—.84	—.73			+.11		—.22								
Date.	5th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.84	—.53	—.22	0	+.11	0	—.44	—.63								
Date.	7th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.53	—.53	—.53														
Date.	9th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.53	—.53	—.53			—.22	0	—.22	—.73								
Date.	11th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.73	—.84		—.22	—.11	0										
Date.	13th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.84	—.73	—.22	0	+.11	0	0	—.33				—.84		—.53	—.53	
Date.	15th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.44	—.84		—.84	—.44	—.11	+.11	+.44	0	—.11								

Date.	2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.53	—.53	—.53	—.44	—.11	0	+.11	+.22	+.53	—.53	—.63						
Date.	4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.84			—.11		0										
Date.	6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.73	—.73	—.33	—.11	+.11	0	—.11	—.53		—.73					—.44	—.44
Date.	8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.							0	—.22	—.53	—.73	—.83					—.44		
Date.	10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	—.91	—.84	—.33	—.11	0	—.22	—.53	—.53	—.53	—.84	—.63					
Date.	12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.99	—1.09	+.11	+.44	+.22	0	0									
Date.	14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.84	—.84	—.44	0	0	0	—.22	—.33	—.44	—.84						
Date.	16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.84	—.84	—.63	—.22	0	+.44	0	0	—.44	—.84		—.53				

TABLE I *(continued)*

MAY

Date.	17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.84	—.63	—.33	—.11	0	—.11	—.11	—.11	—.22							
Date.	19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.63	—.63	—.33	—.22	—.22	0	—.11	—.44								
Date.	21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.73	—.73	—.33	—.11	0	0	—.11	—.22	—.53								
Date.	23rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.44	—.33	0	+.53	+.33	0	—.22	—.53	—.99							
Date.	25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	—.63						0	— 53								
Date.	27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.63	—.99	—.84	—.44	—.33	0	+.22	+.44	+.22	+.44								
Date.	29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.63	—.44	—.22	—.11	+.11	—.33	—.11	0								
Date.	31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.63		—.44	—.22	—.11	—.11	0	—.22	—.22	—.44								

Date.	18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.53					0										
Date.	20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.53	—.33	—.33	—.33	—.22	0	0	—.22	—.44								
Date.	22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.84	—.63	—.44	—.22	—.11	11	—.33	—.33	—.53	—.63			—.22			—.22	
Date.	24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	—.63	—.22	0	+.44	+.22	0	—.22	—.63	—.84	—.99			—.63			
Date.	26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	—.84	—.63	—.22	0	+.22	+.44	+.22	—.53	—.99				—.63			
Date.	28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.63	—.22	+.11	+.11	+.22	0	—.44								
Date.	30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.63	—.63	—.44	—.11	0	0	—.22									

TABLE I *(continued)*

JUNE

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63		—.43					0											—.99	—.84	—.44	—.22	—.11	0	+.22	—.11	—.44	—.99							
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	—.84	—.44	—.22	0	+.11	0	—.22	—.44	—.99									-1.18	—.99	—.84	—.44	0	0	0	—.44	—.44								
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		-1.09	—.99	—.63	—.22	0	+.44	+.22	—.22	—.33										-1.09	—.99	—.63	—.22	0	+.22	+.33	0	—.63								
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.99	-1.04	—.44	0	+.22	+.44	0	+.44											—.99	—.99	—.44					0	—.22								
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		-1.09	-1.34	—.91	—.44	0	+.22	0	—.22	—.63						—.63			-1.27	-1.09	-1.09	—.84	—.44	0	0	+.53	+.33	—.22	—.63		-1.27		—.63	—.63		
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		-1.09	—.99	—.44	—.22	+.22	+.33	+.44	0	—.22			-1.27		—.63					-1.27	-1.09	—.84	—.22	+.22	+.44	+.22	0	—.22	—.63					—.63		
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		-1.09	-1.34	—.44	—.22	—.22	+.22	+.44	+.22	—.22	—.44	—.63								—.73	—.69	—.38	—.06	0	+.19	+.25	+.19	+.06	—.19	—.38						
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.38	—.50	—.50	—.44	—.19	0	+.12	+.31	+.31	+.12	—.12									—.50		—.38	0	+.25	+.31	+.25	—.12	0	0	—.19						

TABLE I *(continued)*

JUNE

Date.	17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.31	—.38	—.25	+.12	+.25	+.38	+.25	+.12	—.06	—.12							—.25
Date.	19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.25	0	0	+.06	—.12	+.25	0	—.25								—.12
Date.	21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	0	+.12	+.38	—.12	—.12	—.12	—.25								
Date.	23rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63	—.50	—.50	—.25	+.12	+.25	+.12	+.25	—.44								
Date.	25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.33	0	+.25	+.25	+.12	+.12	0								
Date.	27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.87	—.75	—.75	—.38	+.25	+.38	+.38	+.25	0								
Date.	29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.50	—.38	—.12	+.12	+.25	0	—.12	—.25								

Date.	18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.25	—.25	—.12	0	0	0	—.12	—.25					0			
Date.	20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.25	—.12	0	0	0	—.12	—.12	—.12	—.12							
Date.	22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50					0	0									—.12	
Date.	24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	0	+.12	+.38	+.25	+.25	0	0								
Date.	26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.38	—.31	+.19	+.25	+.50	—.50	0				—.73				
Date.	28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.63		—.25	0	+.25	+.38	0	—.12	—.25								
Date.	30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.50	—.25	—.12	+.25	+.25	0	—.25	—.25								

TABLE I (*continued*)

JULY

Date.	1st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.12	—.12	+.12	+.25	0	—.25	—.25								
Date.	3rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—1.25	3.00	+.87	+.12	+.25	+.25	—.25	—.25	—.25	—.25			—.25		—.25	
Date.	5th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.25	—.12	—.12	0	—.12	—.25	—.50	—.38							
Date.	7th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.89	—.62	—.12	0	+.25	+.25	+.12	0	—.25								
Date.	9th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.62	—.50	—.25	+.25	+.25	+.25	+.25	+.25	0								
Date.	11th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	0	+.25	0	—.25	—.25	—.25	—.38								
Date.	13th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.62																
Date.	15th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.12	—.06	+.12	+.25	0	0	—.25								

Date.	2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.25	—.12	+.25	+.25	—.12		—.25								
Date.	4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.25	+.25	+.25	—.12	—.25	—.38	—.50	—.62	—.62							
Date.	6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50																
Date.	8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.81	—.38	—.25	+.38	+.25	+.25	+.25	0	—.12								
Date.	10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.87	—.50	—.38	+.25	+.38	+.25	0	0	—.12								
Date.	12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.75	—.62	—.62	—.38	+.12	+.25	+.12	+.12	0								
Date.	14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.50	—.25	—.12	0	+.12	0	0	—.12								
Date.	16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.																		

TABLE I (*continued*)

JULY

Date.	17th																		18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.38	—.12	+.25	—.25	—.12	0	0	—.38										—.38	—.12	0	0	+.12	0	0	—.25	—.25								
Date.	19th																		20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.25	—.12	0	0	+.25	0	—.12	—.25										—.50	—.38															
Date.	21st																		22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.12	+.12	+.25	+.12	+.12	—.12	—.25	—.25	—.31									—.12	—.31	0	0	0	0	0	0	—.25	—.25							
Date.	23rd																		24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.50	—.25	0	0	0	0	0	0	—.25									—.38	—.25	0	0	+.12	+.50	+.38	+.25	—.38								
Date.	25th																		26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.25	—.12	+.06	+.12	+.12	+.38	+.31	0	0									—.25	—.25	—.12	+.25	+.38	+.38	+.38	—.25	—.25	—.25							
Date.	27th																		28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.62				+.38													—.19	—.38	—.25	—.19	+.25	+.38	+.25	—.12	—.19	—.25							
Date.	29th																		30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.38	—.25	—.12	+.12	+.25	0	0	—.12	—.25									—.25	—.38	—.12	—.12	—.12	—.06	—.06	—.06	—.25	—.25							
Date.	31st																																			
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11																		
Current in milliamperes.		—.62	—.62	—.38	—.12	0	0	0	—.12	—.25	—.25																									

TABLE I (*continued*).

AUGUST

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.62	—.62	—.38	—.25	0.00	+.25	+.12	0.00	—.25										—.50	—.50	—.38	—.25	0.00	+.12	+.12	—.38	—.44								
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50									—.50									—.50	—.50	—.38	—.25	+.12	+.25	+.25	+.12	—.38	—.50			—.50			—.38	
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.75	—.50	0	+.25	+.25	+.25	—.19	—.12	—.25	—.25									—.50	—.50	—.38	+.25	+.25	+.38	+.25	0	—.50	—.50						0	
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.62	—.12	+.12	+.38	+.38	+.12	+.06	—.25	—.25									—.50	—.62	—.25	+.12	+.25	+.44	+.12	—.12	—.31				—.31				
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.31	+.12	+.12	+.19	—.12	—.25	—.06	—.12										—.25	—.50				+.12											
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.50	—.38	—.12	0	+.25	—.12	—.38																											
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.62	—.38	+.12	—.25	+.38	+.12	0	—.12	—.12									—.50	—.62	—.25	+.12	+.25	+.25	0	0	0								
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.50	—.38	0	+.12	+.25	0	0	0	—.12						0			—.38	—.62	—.12	0	+.38	+.38	+.12	—.38	—.38								

TABLE 1 *(continued)*,

AUGUST

Date.	17th																		18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.38			—.12														—.25	—.31	—.12	+.12	+.19	+.25	0	—.25	—.38	—.50						0	
Date.	19th																		20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.44	+.19	+.25	+.44	—.50	0	—.31	—.50										—.25	+.25	+.12	+.19	+.31	+.38	+.12	0	—.44	—.50		—.19				0	
Date.	21st																		22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.44	—.56	—.38	+.50	+.87	+.62	—.12	0	—.25	—.50	—.50	—.50		—.38			0		—.44	—.44	—.06	+.12	+.38	+.62	+.12	—.06	—.38							0	
Date.	23rd																		24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.44	+.06	+.50	+.75	+.87	+.25	0	—.38	—.50										—.62			—.50												
Date.	25th																		28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25		- .25	0	—.25	—.50	+.38	+.25											—.62	—.62	—.25	—.12	0												
Date.	30th																		31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.62	—.62	—.25	—.12	+.31	+.25	+.12	0	—.12									—.25	—.56	—.56	—.31	+.31	+.25	+.18	—.06	—.25	—.56	—.50	—.56	—.38	—.31	—.19	—.06	—.19	

TABLE I *(continued)*

SEPTEMBER

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.50	—.56	—.25	+.25	+.25	+.25	—.31	—.38	—.50	—.50		—.38					—.19		—.44	—.50	—.25	—.12	+.06	+.12	+.12	+.25	—.62								
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.31	—.50	—.38	+.31	+.38	+.19	0	—.25	—.50	—.56									—.38	—.50	—.25	+.12	+.25	+.31	+.12	—.25			—.62						
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.31	—.50	—.25	+.06	+.12	+.25	+.19	—.12	—.62	—.50	—.44								—.38	—.62	—.25	+.12	+.25	+.50	+.25	—.19	—.19	—.50							
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.62			+.25														—.30	—.56	—.31	+.06	+.31	+.62	+.38	+.31	—.19		—.50					—.06	
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.	—.50	—.62	—.62	—.50	—.25	+.19	+.31	+.31	+.19	—.12	—.25	—.38	—.31	—.25	—.25	—.25	—.25			—.75	—.81	—.50	—.31	+.25	+.50	+.50	+.25	+.12	—.12					—.06	—.12	
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.62	—.31	—.69	—.19	+.19	+.38	+.19	+.12	—.44				—.06			—.25	—.25		—.56	—.81	—.44	—.25	+.06	+.06	—.06	—.12	—.12				—.25		—.12		
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.48	—.38	—.25	—.06	+.06	—.06	—.12	—.31			—.44				—.31			—.31	—.38	—.50	—.31	+.12	+.12	—.25	—.25	—.31	—.31	—.25	—.19	—.19	0	—.12	0	
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	0	0	0	0	—.06	—.12	—.25	—.19	—.56		—.25				—.12			—.25	—.25	—.19	—.06	+.12	0	—.12	—.19	—.56	—.62	—.68	—.38	—.25		—.25	—.25	—.19

TABLE I *(continued)*

SEPTEMBER

Date.	24th																		25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.					—.38		+.06	+.19	+.19												—.62															
Date.	26th																		27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.48		—.69	—.19															—.62	—.62	—.44	—.12	—.19	+.25	+.25	+.19	+.19	+.87	—.19						
Date.	28th																		29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.38	—.56	—.50																—.25	—.50	—.50			+.19		+.12	—.12								
Date.	30th																																			
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11																		
Current in milliamperes.		—.31																																		

TABLE I *(continued)*

OCTOBER

Date.	3rd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.06	—.06	—.44	—.12	+.12	+.06	0	—.12	—.25								
Date.	5th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.31															
Date.	7th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.38	—.62	—.25	+.12	+.19	0		—.25								
Date.	9th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.38	—.50	—.50	—.31	0	+.19	+.06	—.06	—.38							
Date.	11th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.44	—.62	—.75	—.38	—.12	+.12	+.06		0	—.06						
Date.	13th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.06	—.19	—.50	—.50	—.19	—.12	+.06	+.12	—.25	—.25		—.25				—.12	
Date.	15th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		0	—.38	—.62						—.12	—.12							
Date.	17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.06	—.25	—.50	—.38	—.12	—.12	+.12	0	—.12								

Date.	4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.19	—.06	—.44	—.06	+.19	+.44	+.5	+.31	+.12	—.25							
Date.	6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.38	—.12	+.19	+.31	+.38	—.25	—.38								
Date.	8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.44	—.50	—.25	+.06	+.12	+.25	+.12	—.12	—.25							
Date.	10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.38	—.10	—.75	—.38	—.12	+.12	0	—.12	—.25	—.25						
Date.	12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.38	—.50														
Date.	14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.31	—.56	—.62	—.19	—.12	0	0	—.12	—.19					—.06	0	
Date.	16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.31	—.50	—.38	—.12	—.12	0	0	—.12	—.19							
Date.	18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.19	—.31	—.19	—.06	+.12	+.19	+.12	—.12	—.12							

TABLE I *(continued)*

OCTOBER

Date.	19th																		20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.19	—.50	—.25	0	+.12	+.12	0	—.12										—.06	—.19	—.38	—.12	0	+.12	+.19	—.06	—.25	—.25							
Date.	21st																		22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		0	—.12	—.44	—.19	—.06	+.12	+.19	0	0					—.19					—.44	—.50	—.75	0	+.06	+.25	—.19	+.12	0	—.12							
Date.	23rd																		31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.38	—.50	—.38	—.12	+.12	+.25		+.06	—.12						—.06			—.12	—.50	—.25	0	+.19	+.31	+.12	0	—.19	—.06				—.06	0		

TABLE I *(continued)*

NOVEMBER

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.62	—.38	—.12	+.25	+.38	+.25	+.12	—.12									—.38	—.50	—.62														
Date.	3rd																		4th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		+.38	—.62	—.44	—.12	—.06	+.31	0	—.25	—.12					-1.	—.62	+.31	—.68	—.38	—.50	—.50	—.56	+.12	—.50	—.12	—.06	—.06	—.19	—.19		—.12	—.62	—.12	—.06		
Date.	5th																		6th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.31	—.56	—.19	+.12	+.25	+.25	+.19	+.19	—.12				—.19					—.38	—.56	—.75	—.50	—.19	+.12	+.25	+.31	+.12	—.12							
Date.	7th																		8th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.56	—.88	—.62	—.25	+.12	+.25	+.25	+.06										—.19	—.31	—.90	+.69	+.25	0	+.12	+.25	+.06	0							
Date.	9th																		10th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.25	—.44																—.12	—.38	—.50	—.75	—.25	0	+.06	+.25	+.12								
Date.	11th																		12th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.25	—.50	—.50	—.62	—.25	—.12	0	0	0										—.12	—.38			—.12	0	0	+.12	—.06								
Date.	13th																		14th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.12	—.25	—.50	—.38	—.19	—.12	0	0	0										—.19	—.25	—.38	—.50	—.25	0	+.06	0	—.19								
Date.	15th																		16th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.19	—.39	—.50	—.12	0	+.06	0	—.25											—.25	—.39														

TABLE I *(continued)*

NOVEMBER

Date.	17th																		18th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.		—.39	—.39	—.39	—.50	—.19	0	+.25	—.12	0	—.06										—.25	—.50	—.56	—.12	0	+.25	+.44	+.12	0						0	
Date.	19th																		20th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.50	—.39	—.12	0	+.25	+.25	0											—.25	—.44	—.50	—.25	—.12	+.12	+.25	+.12	0					0	0	
Date.	21st																		22nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.39	—.39	—.25	—.12	+.19	+.25	+.12	—.06						0				—.39	—.56	—.50	—.25	—.12	+.25	+.25	—.12								
Date.	23rd																		24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25		0	0	0	0	0	0												—.50	—.62	—.39	—.25	0	+.25	+.12								
Date.	25th																		26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.31	—.44	—.62	—.39	0	+.12	+.25	+.12	—.12					—.12					—.25	—.50	—.56	—.38	—.25	+.12	+.38	+.19								
Date.	27th																		28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.50	—.62	—.25	—.12	0	+.12	+.06	0		—.06								—.12	—.44	—.38	—.38	—.25	—.12	0	0								
Date.	29th																		30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.44	—.25	—.12	—.12	—.12	—.19	—.19										—.12	—.50														

TABLE I *(continued)*

DECEMBER

Date.	1st																		2nd																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.50	—.38	—.06	0	+.19	+.25	+.06											—.25	—.50	—.56	—.25	—.12	+.12	+.25	+.12	—.12				—.12			
Date.	10th																		11th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.44	—.25	+.12	+.19	—.12	—.19										—.19	—.38	—.50	—.31	—.12	0	0	0								
Date.	12th																		13th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.12	—.12	+.12	+.19	+.12	—.25										0	—.25	—.50	—.25	—.12	0	+.12	—.12	—.25					—.12	—.12	
Date.	14th																		15th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.25	—.12	—.12	+.12	+.12	—.12	—.12	—.25	—.25	—.12	0	0				—.12	—.38	—.62	—.25	—.12	0	0	0	—.12	—.12			—.12		0	
Date.	16th																		17th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	0	0	—.19	—.12	—.12	—.19	—.19	—.19	—.19							—.12	—.12	—.38	—.12	0	0	0	0								
Date.	18th																		19th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.25	—.50	—.12	—.12	0	0	0	—.12				0									—.12	0	0	+.12	0	0							
Date.	20th																		21st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.38	—.50	—.25	—.12	0	0	0							0				0	—.25	—.44	—.12	0	0	0	0								
Date.	22nd																		23th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.38	—.38	—.50	—.25	0	0													—.25	—.31	—.56	—.25	—.12	0	0	0	—.12							

TABLE I *(continued)*,

DECEMBER

Date.	24th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.25	0	0	+.12	0								
Date.	26th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.50	—.62			0	+.12	+.06								
Date.	28th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.25	—.50	—.50			0	+.12	0								
Date.	30th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.38	—.62			+.25	+.25									

Date.	25th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.			—.12	—.38	—.50	—.25	—.12	0	+.25	0	—.12						0	
Date.	27th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.38	—.50	—.25		0	0	0								
Date.	29th																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.50	—.56			+.12	+.19	+.12							0	
Date.	31st																	
Time of Observation.	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Current in milliamperes.				—.50	—.56			0	+.25									

TABLE II.

MARCH 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
15	12.85	14.81	13.50	14.15	14.15	14.15	14.48	14.15	11.70	11.29	10.39	11.70	12.68	14.56	16.47	15.79	13.01	15.13	14.48	15.30	15.13	14.99	15.63	15.63
16	15.30	15.36	14.77	15.00	14.71	14.74	14.35	14.32	12.71	11.47	10.29	14.64	13.50	16.61	17.26	17.26	17.10	15.95	15.65	14.81	14.81	14.81	„	„
17	13.99	9.41	9.08	8.92	8.92	9.25	9.58	8.43	7.61	5.61	5.82	6.48	9.74	11.70	12.32	11.37	„	„	„	„	„	8.26	8.10	8.42
18	8.26	8.42	8.59	8.10	8.26	8.19	8.39	7.93	6.27	5.16	5.16	6.27	7.45	9.91	10.72	10.88	10.07	8.92	7.60	8.59	8.26	„	„	8.26
19	8.10	7.94	6.63	6.63	7.77	7.94	7.94	7.61	6.63	„	4.50	5.16	7.77	9.74	10.56	6.96	3.20	0.07	3.20	12.68	13.01	12.85	11.86	11.70
20	12.19	12.35	12.51	11.85	12.95	12.34	12.51	12.06	10.44	8.91	9.07	11.53	11.53	16.94	15.53	13.51	15.47	11.85	12.34	13.51	13.51	13.51	13.25	12.99
21	12.93	12.87	13.54	13.38	13.54	13.22	13.54	10.76	8.75	7.29	8.60	10.88	13.72	15.13	14.80	15.39	15.20	13.66	13.30	15.13	15.92	13.57	13.50	13.01
22	12.78	12.11	12.32	12.21	11.86	12.50	11.70	11.67	11.67	11.61	11.05	12.03	16.12	19.39	19.39	17.75	16.61	16.12	14.15	16.77	14.48	9.25	14.48	13.83
23	13.83	13.17	13.03	13.24	14.15	12.84	13.83	13.50	12.52	11.54	10.49	12.68	14.35	16.12	18.07	17.97	15.62	14.79	13.85	15.03	14.81	14.48	„	13.84
24	14.15	13.63	13.50	13.50	13.66	14.08	13.75	13.17	11.54	13.23	10.88	13.50	16.05	18.80	19.22	18.90	16.77	15.13	13.83	14.15	14.05	14.19	14.98	14.15
25	13.63	13.69	13.56	„	13.83	13.17	13.83	„	11.86	10.23	10.23	12.19	16.12	19.06	19.39	19.72	17.10	15.47	14.15	14.81	14.81	14.48	14.81	14.81
26	14.81	13.83	13.96	14.15	„	14.15	17.75	14.48	13.84	11.31	12.24	6.89	15.45	18.07	18.07	16.87	17.06	17.10	14.55	15.79	15.26	„	„	„
27	13.98	14.63	14.47	14.14	13.75	14.09	14.68	12.71	14.32	14.25	13.50	15.46	16.12	18.90	18.90	16.77	16.12	17.95	18.08	16.77	17.75	17.75	15.79	14.48
28	13.66	12.84	12.52	11.21	13.64	13.50	14.28	15.79	15.13	13.66	12.80	13.16	14.96	18.36	20.86	19.39	19.06	18.73	14.22	14.81	„	„	„	„
29	13.50	14.15	13.65	14.87	14.16	14.36	14.81	15.27	13.50	11.54	11.86	13.43	15.46	17.42	20.17	„	18.47	16.12	14.64	12.19	15.13	13.17	13.17	13.17
30	13.17	13.50	14.81	12.91	13.70	13.70	15.46	14.81	13.17	15.88	10.02	„	„	„	„	„	„	„	„	„	„	„	„	„
31	„	14.85	15.01	16.16	15.51	15.51	16.16	16.16	13.83	11.58	10.93	14.34	17.79	19.76	20.90	19.60	18.62	16.66	16.03	17.14	17.79	17.14	17.14	16.81
Mean	12.95	12.80	12.67	12.58	12.85	12.81	13.36	12.71	11.50	10.10	9.88	11.27	13.68	16.28	17.04	16.10	15.30	14.23	13.34	14.50	14.62	13.34	14.04	13.34

TABLE II. *(continued)*

APRIL 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	16	17	18	19	20	21	22	23
1	15.83	15.50	15.50	15.50	16.16	15.83	15.31	14.36	12.73	11.26	10.61	12.89	17.47	20.12	20.36	19.74	17.47	15.67	15.51	16.00	15.64	15.51	14.86	15.51
2	15.57	15.57	14.52	15.31	15.18	14.85	14.66	14.26	12.89	11.91	12.89	14.52	16.16	18.78	19.10	17.79	16.81	16.32	15.77	16.19	16.36	16.16	16.49	16.49
3	16.49	16.49	16.49	15.51	15.87	16.16	15.51	14.39	13.38	12.89	13.87	15.67	16.16	18.28	17.47	18.12	17.47	16.16	15.18	19.27	20.57	15.27	17.96	11.91
4	14.36	14.85	13.87	17.79	16.16	16.16	13.87	15.57	17.14	18.78	18.45	19.76	19.76	19.76	20.08	19.98	18.28	17.79	14.36	16.98	17.47	15.83	„	13.43
5	15.57	15.34	16.00	15.96	16.16	16.16	15.51	13.87	12.40	12.92	14.26	16.65	18.78	19.43	19.43	18.12	17.14	16.72	16.65	14.69	15.83	16.16	15.83	15.51
6	15.67	15.34	16.32	15.44	15.34	16.49	16.72	15.83	14.20	12.70	12.89	14.52	17.14	18.45	18.78	18.12	16.81	16.16	16.16	„	14.52	14.85	„	„
7	13.54	13.54	14.03	13.87	14.20	13.67	13.54	12.24	10.47	8.97	10.93	12.89	14.85	16.49	17.47	17.47	17.14	15.83	14.85	15.34	15.34	14.85	14.85	14.85
8	14.79	14.72	14.85	14.20	14.52	14.52	14.20	12.56	10.27	8.64	9.29	12.56	15.83	18.45	19.43	18.52	16.49	14.79	13.74	14.79	14.20	14.40	20.41	20.74
9	20.74	13.54	13.42	9.62	14.20	13.87	13.54	12.24	9.62	9.62	10.60	12.24	15.51	21.39	18.78	18.45	17.14	15.51	14.20	15.51	15.38	14.85	14.46	13.87
10	14.52	15.50	14.32	14.65	14.85	15.50	15.50	13.60	12.36	9.94	9.63	10.93	13.74	16.62	18.06	17.89	„	„	„	„	11.18	13.32	13.32	12.53
11	12.37	12.66	12.17	11.71	11.52	11.85	8.25	10.08	8.25	6.94	5.27	12.06	14.12	15,76	16.10	16.55	15.37	13.94	13.35	12.36	12.76	12.95	13.08	12.72
12	11.74	12.16	11.68	12.16	12.04	12.30	12.17	10.54	8.25	6.94	8.57	11.19	13.48	15.11	16.10	16.43	14.66	12.50	12.50	13.35	13.61	13.16	13.21	13.34
13	13.34	12.63	12.37	12.17	12.76	13.23	12.17	10.80	10.08	9.95	10.86	13.61	15.31	19.10	15.77	14.79	13.81	12.83	12.18	11.91	12.83	12.83	12.96	13.15
14	*13.15*	*12.37*	*12.50*	*12.37*	*12.60*	*12.01*	*11.84*	*11.52*	*10.21*	*9.23*	*10.21*	*13.32*	*15.44*	*16.74*	*16.74*	*15.77*	*14.39*	*13.32*	*12.02*	*12.50*	*12.83*	*12.83*	*12.89*	*12.96*
15	12.76	12.50	12.16	11.83	11.52	12.17	12.17	10.86	9.16	8.25	10.73	12.96	14.92	16.36	16.56	15.77	14.33	12.96	12.17	12.63	13.02	12.96	12.83	12.83
16	12.37	12.17	11.45	11.52	11.19	11.06	10.99	9.88	8.38	8.44	12.17	13.81	15.11	15.77	15.77	14.78	13.80	13.80	13.01	12.49	13.28	12.83	12.83	12.83
17	12.83	12.83	12.49	12.49	12.31	12.17	10.86	12.50	7.59	6.30	8.90	11.88	14.13	15.77	16.75	16.75	14.47	12.89	12.82	13.28	13.28	13.15	13.48	13.48
18	13.22	12.96	12.83	12.43	12.30	12.17	10.41	7.79	6.74	6.29	8.90	12.11	14.46	15.44	16.42	15.77	14.46	12.50	12.01	13.15	14.12	14.29	13.47	12.82
19	13.16	11.26	11.91	11.84	11.68	12.04	11.68	10.53	7.27	8.70	10.54	13.15	16.75	17.73	18.06	17.40	17.60	16.10	12.50	14.46	14.26	13.74	13.48	12.83
20	12.04	11.84	11.19	11.19	10.86	11.84	10.86	10.28	9.56	11.19	13.25	15.57	16.42	16.75	16.75	16.10	15.11	14.79	13.02	12.82	12.83	13.48	„	..
21	12.72	13.05	13.05	15.01	13.70	13.90	13.05	12.07	11.09	10.76	12.72	15.34	16.65	17.30	16.97	15.66	14.68	14.36	13.64	13.97	14.36	13.64	13.97	14.10
22	14.03	14.36	13.38	13.11	13.57	13.51	12.26	10.11	8.80	9.39	10.60	12.79	15.01	15.89	18.19	15.60	16.76	14.83	14.03	14.49	14.68	14.82	14.78	14.68
23	14.68	14.36	14.03	14.03	14.55	14.16	14.23	13.11	12.81	10.43	10.76	13.11	15.01	16.65	17.30	17.95	14.68	16.16	14.68	14.68	14.62	14.42	14.68	14.36
24	14.83	13.70	13.05	13.05	13.05	13.70	12.72	12.07	9.45	9.45	9.78	11.51	13.37	15.40	16.51	17.23	16.87	15.99	14.81	14.68	14.75	15.33	14.68	14.64
25	14.15	12.85	9.65	11.41	11.54	14.55	15.47	16.58	18.28	17.79	18.05	17.30	18.41	18.61	18.96	18.41	16.97	16.32	15.86	15.67	15.99	15.67	15.34	18.61
26	23.51	30.38	32.01	30.38	13.79	34.30	13.38	13.38	16.97	12.07	12.26	13.86	14.88	17.96	19.00	17.44	17.30	17.30	13.38	14.61	„	„	„	..
27	„	„	17.63	12.53	13.43	13.71	14.00	13.24	12.50	12.50	13.05	15.50	16.32	17.96	18.93	19.03	18.93	16.84	15.86	15.47	15.34	15.34	15.34	14.55
28	14.68	14.68	14.88	14.68	14.75	15.07	14.75	13.64	12.72	12.07	13.05	14.36	16.32	16.98	18.29	17.95	17.10	15.99	15.34	15.34	15.66	14.68	15.34	15.08
29	15.01	15.01	14.68	14.68	14.68	14.36	14.03	14.03	13.38	13.38	14.55	15.14	15.99	16.64	17.36	17.36	17.36	16.29	15.38	14.88	15.08	15.08	15.21	15.08
30	15.08	15.08	14.88	14.62	14.81	15.08	13.83	13.18	12.72	13.18	13.51	14.16	15.79	16.68	17.76	17.43	17.43	15.79	15.73	15.79	15.79	15.53	14.88	14.88
Mean	14.58	14.39	14.24	14.04	13.64	14.55	13.25	12.50	11.32	10.70	11.71	13.85	15.78	17.41	17.78	17.28	16.24	15.19	14.16	14.55	14.68	14.55	14.10	14.36

TABLE II (*continued*)

MAY 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	14.81	14.49	14.49	13.70	13.57	13.57	14.82	13.84	14.49	15.01	15.33	17.04	17.76	18.28	18.54	19.00	18.41	15.85	15.13	15.73	16.11	16.11	16.11	15.62
2	15.29	15.14	14.88	15.29	15.14	14.62	14.48	14.15	13.99	14.80	16.19	17.76	19.06	17.76	16.91	16.78	16.32	16.12	13.83	15.14	15.75	15.66	14.49	14.49
3	15.47	15.14	14.81	14.81	15.40	17.76	15.01	15.47	14.81	15.47	16.45	16.97	17.10	17.23	17.76	17.10	16.64	15.99	15.14	15.14	15.14	15.66	14.81	15.46
4	15.27	15.21	15.08	14.88	15.14	15.08	13.99	13.01	11.87	13.83	15.53	17.17	18.05	18.47	18.28	17.59	17.23	16.78	16.25	,,	,,	,,	15.30	15.30
5	15.37	14.94	14.81	14.48	14.42	14.42	13.54	12.53	13.19	13.18	15.79	16.45	17.76	18.02	17.49	16.91	17.10	16.45	15.79	15.66	15.46	15.26	15.64	14.68
6	14.62	15.14	15.08	14.31	14.54	14.94	13.31	11.02	12.26	14.49	16.45	17.49	19.00	19.06	19.00	17.88	16.90	16.12	15.80	15.95	16.45	16.32	15.66	16.12
7	15.79	15.86	15.73	15.20	15.08	14.58	13.18	10.88	10.56	11.54	13.51	16.28	18.09	19.06	19.06	17.76	16.65	16.11	16.32	16.45	16.52	16.39	15.79	16.45
8	16.32	15.79	15.79	15.79	14.81	14.81	13.57	12.08	11.02	11.87	14.81	16.81	19.06	20.18	19.13	17.17	15.79	14.97	14.42	14.81	15.21	15.47	15.64	15.78
9	15.75	16.19	16.38	15.73	15.14	14.62	13.31	10.88	10.88	11.19	13.05	15.79	18.57	20.05	20.37	19.06	17.43	16.12	14.49	15.14	15.34	15.47	15.47	15.73
10	15.73	15.34	15.14	15.08	14.81	14.49	13.51	13.37	12.85	12.85	13.96	15.85	17.76	18.48	19.26	18.34	,,	,,	,,	,,	,,	,,	,,	,,
11	14.49	14.96	14.49	14.32	14.39	14.83	13.11	11.93	11.15	11.28	12.52	15.14	16.45	17.10	16.97	16.78	16.84	16.45	14.14	14.88	15.14	15.66	15.41	15.66
12	15.26	15.08	14.49	13.83	13.77	13.51	12.52	11.22	10.96	12.20	14.81	16.90	18.41	19.19	19.19	18.34	16.65	15.53	15.14	16.19	15.26	15.24	15.14	14.91
13	14.88	14.75	14.16	14.36	14.09	13.83	12.00	11.02	11.15	12.52	13.83	16.58	18.41	19.00	18.34	17.76	16.78	15.46	14.49	45.14	15.14	15.11	15.14	15.14
14	15.08	15.14	14.88	14.54	14.49	13.19	11.87	11.54	11.87	16.45	14.36	17.50	19.07	19.07	19.72	19.07	17.10	15.79	15.33	15.27	15.99	15.79	15.47	15.01
15	15.14	14.81	15.01	14.81	14.68	14.16	13.18	11.54	11.41	11.87	13.31	14.94	16.12	17.69	18.15	17.63	16.45	15.79	14.62	15.14	15.79	15.46	15.46	15.46
16	15.26	14.62	14.68	14.88	14.55	14.03	15.53	11.54	11.22	12.52	14.03	15.79	15.99	16.58	16.45	15.79	16.45	16.78	17.43	17.76	17.76	16.45	13.77	15.66
17	15.46	15.14	14.49	15.36	14.94	14.62	13.18	12.52	12.00	12.46	14.62	16.52	17.49	17.82	17.76	16.45	15.53	15.14	15.08	15.46	16.45	16.32	15.99	15.33
18	14.49	15.73	14.16	15.14	15.14	13.83	12.85	11.22	10.56	11.80	15.14	17.10	17.43	17.27	17.76	16.58	16.45	15.79	15.07	15.14	15.79	15.79	15.79	15.79
19	15.79	15.79	15.14	15.14	15.14	15.08	14.03	12.52	11.87	12.92	14.81	16.78	18.08	18.41	18.08	17.10	16.32	15.33	15.06	15.21	15.79	15.66	15.79	15.79
20	15.79	15.66	15.46	15.46	14.88	14.88	13.18	11.87	11.22	12.52	13.37	15.79	17.36	,,	,,	,,	,,	,,	,,	,,	,,	,,	15.46	15.96
21	15.93	15.40	14.68	14.42	12.52	14.81	11.87	9.52	10.70	11.81	13.83	18.74	21.55	14.81	15.79	20.70	20.70	19.06	18.80	17.43	16.52	14.62	15.79	13.51
22	15.73	15.14	14.32	15.40	15.08	14.32	13.51	14.62	15.14	15.79	19.39	21.03	21.52	20.86	21.03	19.06	19.79	18.61	18.41	18.41	17.10	17.60	67.95	17.95
23	17.76	17.76	17.76	18.08	17.43	17.76	16.45	15.33	15.33	17.10	18.93	20.70	22.34	23.64	24.07	22.01	20.70	18.41	17.43	16.45	18.41	17.43	18.08	18.74
24	19.06	18.41	18.41	17.98	18.41	16.45	15.79	14.81	14.16	14.16	15.14	17.89	19.86	21.29	21.88	21.35	20.37	18.41	17.76	17.43	17.76	18.41	18.41	18.41
25	18.41	18.21	18.21	17.89	17.76	16.71	15.89	14.16	13.11	13.96	16.45	19.52	20.57	21.68	22.33	21.42	20.31	18.54	17.76	17.95	18.41	18.41	18.41	18.41
26	17.63	18.61	18.08	17.05	17.56	17.49	16.65	13.96	14.36	15.33	16.71	18.61	20.44	22.20	13.19	21.42	20.70	19.72	18.02	18.34	18.93	18.28	18.34	18.61
27	18.28	18.28	17.49	16.85	17.49	17.69	16. 8	15.66	14.36	15.99	17.10	18.93	20.68	21.68	22.33	22.14	20.76	19.59	18.41	17.63	18.93	18.41	17.82	17.95
28	17.95	18.02	18.15	17.95	18.21	17.76	16.78	14.68	19.53	17.76	18.41	20.70	21.68	22.66	22.01	20.70	20.05	18.74	17.43	17.43	18.61	17.36	17.56	18.21
29	18.21	18.28	17.43	17.95	17.43	17.10	15.79	14.55	14.49	15.08	15.89	19.39	20.70	21.68	21.61	21.09	20.34	19.00	18.28	16.45	17.43	17.30	17.63	17.76
30	17.76	17.43	17.30	17.10	17.10	16.58	15.01	13.96	13.37	14.16	16.19	18.21	19.72	20.96	20.50	18.93	17.76	17.10	17.43	17.56	17.76	18.08	17.89	17.89
31	17.63	17.17	16.97	16.97	16.45	15.93	15.79	15.14	15.79	16.78	17.69	19.33	20.44	20.34	20.31	21.57	21.03	19.72	18.08	18.08	17.76	17.04	17.43	17.49
Mean	16.14	16.05	15.84	15.68	15.47	15.27	14.20	13.24	12.89	13.86	15.41	17.54	18.93	19.35	19.44	18.75	18.05	17.02	16.27	15.33	16.67	16.46	16.24	16.31

TABLE II *(continued)*

JUNE 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	17.17	16.78	16.71	16.38	16.45	15.79	14.49	14.36	14.49	15.21	16.21	19.06	21.16	21.68	21.35	20.18	18.48	17.69	17.10	17.10	17.30	17.17	17.49	17.23
2	17.49	16.97	,,	15.89	15.79	,,	15.01	14.62	14.81	15.46	16.45	,,	20.57	20.57	19.72	19.92	19.59	19.00	18.21	18.61	16.78	18.08	17.76	17.43
3	17.43	17.43	16.45	14.49	15.21	14.62	14.68	13.51	14.49	15.26	15.79	18.21	20.63	21.35	19.92	19.06	19.00	19.06	18.93	18.21	18.34	18.34	18.41	18.02
4	18.08	17.76	17.30	17.04	16.78	15.79	14.81	14.71	,,	15.01	15.66	17.36	19.46	20.70	21.16	20.37	19.08	18.02	17.10	17.23	17.23	17.23	17.23	17.43
5	17.69	17.23	17.10	17.49	17.10	16.58	14.62	13.05	13.11	15.08	17.23	19.06	21.16	21.16	20.50	,,	,,	,,	,,	,,	,,	,,	,,	16.87
6	17.03	16.78	16.52	16.35	16.12	15.53	13.96	12.52	12.72	13.64	15.40	17.76	19.65	20.63	20.76	19.72	18.21	17.76	16.45	14.68	15.46	18.02	,,	17.23
7	16.78	16.85	15.99	15.79	14.75	15.73	15.14	12.66	12.79	15.01	15.86	18.34	20.18	21.52	21.19	20.70	18.80	16.52	16.32	16.52	16.58	16.65	16.65	16.65
8	16.45	16.12	16.12	15.66	15.79	15.79	14.49	12.52	13.31	13.96	14.81	17.43	18.74	20.70	21.29	20.37	18.74	17.30	16.45	16.45	16.65	16.78	17.10	17.49
9	16.58	16.45	15.93	15.79	15.46	15.14	14.09	12.85	12.45	13.18	15.26	17.30	18.54	20.44	22.33	21.68	20.05	18.41	17.76	17.63	18.61	17.95	17.95	16.58
10	17.76	17.17	16.58	16.58	16.45	16.45	15.60	13.37	13.05	,,	14.68	17.10	18.41	19.06	19.72	19.72	18.74	16.97	16.78	17.10	17.17	17.23	17.36	17.23
11	17.10	17.10	16.78	16.45	15.79	15.26	13.83	12.52	13.64	15.33	16.45	17.76	19.99	21.03	21.61	21.03	19.79	18.48	17.76	18.08	17.76	17.89	17.76	17.89
12	17.43	,,	16.85	16.19	15.86	15.73	14.94	13.83	13.83	14.16	15.14	,,	19.39	20.70	20.70	19.86	19.19	17.89	17.63	18.02	16.97	17.23	17.36	17.49
13	,,	16.91	16.45	16.45	16.45	15.79	15.01	,,	13.57	14.36	,,	17.17	18.08	17.76	18.80	18.67	18.34	17.82	16.65	17.04	17.17	17.17	17.10	17.76
14	17.76	17.76	17.30	16.52	,,	,,	14.68	,,	14.36	14.68	16.78	18.28	18.74	19.13	18.74	18.08	18.08	17.43	16.97	17.23	17.10	17.56	19.06	17.63
15	17.43	17.43	16.78	17.10	17.30	16.32	15.33	14.03	13.96	14.75	17.10	18.41	18.61	19.99	20.70	20.34	18.61	17.10	15.93	15.93	16.65	16.85	17.10	17.10
16	17.17	17.10	17.10	16.97	17.10	16.25	14.36	13.05	13.18	14.68	15.79	18.61	20.34	20.57	21.03	20.37	18.41	17.23	16.45	16.52	17.10	16.45	16.97	17.76
17	17.43	17.17	,,	,,	16.58	15.14	13.83	12.07	12.07	13.18	15.01	16.97	19.46	22.73	19.59	21.03	19.72	19.39	17.76	17.23	16.97	16.25	17.49	17.69
18	,,	17.43	16.45	15.79	15.66	14.49	12.52	11.74	11.74	12.85	16.52	17.89	20.05	21.16	21.03	22.01	19.99	18.41	18.74	14.68	14.88	16.91	17.43	17.76
19	17.30	,,	17.10	17.17	16.12	15.21	14.49	13.18	12.52	16.65	15.60	17.43	20.57	,,	20.90	20.34	18.41	17.36	17.10	16.71	15.53	17.43	18.08	,,
20	17.45	,,	,,	,,	,,	,,	15.79	14.81	14.16	14.62	16.52	19.46	20.96	22.86	23.12	22.27	21.03	18.48	17.49	17.17	17.89	18.41	18.41	18.54
21	18.21	17.76	17.23	16.78	16.78	16.71	15.08	14.75	12.98	13.05	15.08	17.63	19.06	21.03	21.81	21.03	19.39	18.21	17.30	18.02	18.41	,,	,,	18.28
22	18.08	17.95	17.76	17.43	17.43	16.91	13.33	13.51	11.74	12.20	13.44	16.52	18.41	20.57	21.61	21.68	20.05	18.67	17.39	18.08	18.28	18.67	,,	18.08
23	17.43	17.10	16.58	15.99	15.99	14.42	13.18	12.52	12.52	12.98	17.49	19.72	20.31	22.47	,,	21.81	21.29	20.12	19.06	18.02	17.43	17.95	17.89	18.21
24	18.21	18.15	18.08	17.76	17.76	17.10	16.45	15.14	15.08	15.79	17.10	20.05	22.33	22.02	22.99	22.33	21.35	19.26	17.82	17.23	18.21	,,	17.82	17.76
25	17.95	17.76	18.41	17.63	17.63	,,	15.79	14.29	13.18	12.52	12.72	16.78	19.86	21.09	21.55	21.88	20.57	18.74	17.89	17.76	18.02	17.63	17.76	17.63
26	17.89	17.63	17.43	17.43	17.43	18.21	16.78	15.40	14.03	13.70	15.33	18.28	20.90	22.33	22.86	22.33	21.03	19.19	18.28	17.10	,,	17.76	17.82	17.36
27	,,	,,	,,	,,	,,	14.98	14.81	12.45	12.12	13.37	13.25	16.45	18.34	19.72	20.34	22.01	20.57	18.74	17.89	15.79	16.45	17.24	15.46	16.52
28	17.49	16.71	17.82	17.76	17.76	17.69	16.45	15.93	12.93	15.79	16.78	20.05	21.68	22.86	22.47	21.22	19.72	18.14	17.56	17.95	17.76	16.71	17.43	18.02
29	18.28	17.89	17.76	17.30	17.30	16.58	15.33	14.16	14.36	13.83	15.79	17.04	18.54	21.03	22.33	22.33	19.99	19.06	18.08	17.43	17.89	18.34	18.08	18.08
30	18.08	17.76	17.56	,,	,,	17.30	16.45	13.08	15.08	13.14	16.85	19.13	21.61	21.61	20.70	20.12	20.70	20.18	18.41	18.08	17.76	17.76	18.90	18.28
Mean	17.86	17.27	17.00	16.66	16.43	16.01	14.91	13.69	13.53	14.62	15.70	18.07	19.89	20.55	20.84	20.78	19.55	18.32	17.50	17.16	17.25	17.52	17.96	17.58

TABLE II *(continued)*

JULY 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	17.10	18.08	18.15	16.45	17.10	14.49	12.66	12.85	13.51	17.10	20.18	22.33	24.30	23.64	23.64	23.12	20.70	19.92	19.06	18.80	16.58	15.86	18.87	18.48
2	18.54	18.41	18.08	17.04	15.79	15.79	14.29	14.36	16.32	16.45	20.70	22.99	23.97	25.60	25.60	24.49	21.03	19.79	18.21	18.21	18.15	17.89	18.34	19.00
3	18.93	18.34	18.15	17.76	17.76	16.45	14.42	14.16	14.81	16.25	17.63	19.06	19.92	20.37	20.76	20.90	20.05	18.93	18.28	18.02	17.76	17.89	17.76	17.76
4	17.63	17.76	17.10	16.78	15.79	15.53	13.83	13.37	13.83	15.46	17.82	20.18	21.88	21.88	21.22	20.90	20.05	18.74	18.08	18.08	17.95	18.54	18.61	18.41
5	18.08	17.43	17.10	17.10	16.78	16.45	15.79	14.55	14.49	14.36	14.49	16.32	19.06	20.70	22.33	22.79	21.88	19.86	18.21	17.76	18.02	17.95	18.15	18.28
6	18.54	18.93	18.08	17.76	17.30	18.25	18.08	16.78	17.10	17.10	20.50	23.32	25.60	25.15	24.95	,,	,,	,,	,,	,,	,,	,,	,,	,,
7	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
8	,,	,,	,,	,,	,,	,,	,,	,,	14.89	13.42	15.38	17.53	19.83	21.33	21.92	22.51	23.36	23.29	22.25	22.63	19.11	19.30	17.27	18.32
9	15.51	17.34	16.16	15.77	16.03	16.10	16.23	14.99	14.79	14.92	16.03	17.17	19.63	20.61	21.92	21.92	20.61	18.98	18.13	18.00	18.45	,,	,,	,,
10	20.61	20.27	19.30	19.14	19.30	19.30	18.20	17.86	16.49	17.34	18.84	19.76	22.25	24.21	24.54	25.97	25.84	24.86	23.42	22.38	20.09	21.27	21.46	20.56
11	,,	,,	,,	,,	20.04	19.79	19.96	19.27	19.30	18.78	19.57	23.42	24.80	23.16	24.73	25.19	24.21	22.70	21.92	21.40	21.59	20.94	21.27	20.61
12	20.54	20.09	20.02	18.45	18.71	18.06	18.52	17.21	16.88	17.67	21.27	24.86	23.55	24.80	26.37	24.01	22.83	21.59	21.46	20.61	20.61	21.13	21.13	20.67
13	20.61	21.40	21.27	21.00	20.61	20.61	19.83	18.32	18.65	18.98	20.61	21.59	22.96	23.16	22.05	22.70	22.95	22.83	22.51	21.98	21.40	21.92	21.92	21.59
14	21.46	20.80	20.61	20.15	20.02	18.00	19.63	18.78	19.17	19.43	,,	20.94	21.59	22.25	22.44	22.96	22.57	21.13	20.94	20.61	20.34	21.27	19.96	21.40
15	21.40	20.61	18.98	18.65	18.78	18.84	18.65	18.06	19.20	19.11	20.09	21.46	21.72	22.70	22.96	22.70	22.70	22.38	21.40	20.94	21.33	21.13	20.54	20.67
16	20.09	20.48	19.17	17.67	18.55	17.86	17.34	16.88	15.71	19.30	19.30	20.48	21.59	22.81	26.50	26.17	23.55	22.44	21.20	20.61	20.48	20.09	20.61	20.73
17	20.61	19.96	19.30	19.30	19.30	18.98	18.32	17.34	18.78	19.70	22.18	24.34	25.72	25.19	24.54	23.36	21.92	21.46	21.07	20.48	21.20	21.33	20.73	,,
18	19.96	20.02	20.02	19.89	19.76	18.78	17.01	16.29	16.29	17.01	18.52	21.59	23.03	24.34	25.35	24.86	23.10	21.27	19.96	17.67	20.21	20.34	20.09	20.15
19	19.96	19.96	20.21	19.70	20.94	19.43	18.06	16.42	17.34	19.96	20.61	24.40	27.29	27.81	26.56	25.19	22.96	21.59	21.20	21.33	21.40	20.48	20.41	20.87
20	20.94	20.87	20.67	20.41	20.34	19.83	17.27	15.64	15.97	16.88	19.96	22.76	25.19	27.02	25.84	24.54	22.96	21.40	20.61	19.96	20.61	20.34	20.61	20.73
21	21.27	20.61	20.61	20.21	20.27	19.96	18.65	17.34	17.34	17.47	19.83	21.46	24.01	25.65	26.37	24.67	22.38	20.61	19.43	19.63	20.15	20.15	,,	,,
22	,,	19.72	19.86	19.63	19.53	18.87	16.88	15.31	15.18	16.23	18.68	19.50	21.85	24.21	25.84	24.86	22.57	20.48	20.15	19.17	20.09	20.27	20.48	20.61
23	20.21	19.96	19.63	19.63	19.63	19.30	19.63	16.16	16.69	17.67	18.68	19.70	23.36	25.52	26.03	26.89	24.54	22.11	19.96	19.30	19.89	19.96	19.96	19.96
24	20.09	20.15	19.96	19.76	19.50	18.98	17.47	14.73	15.31	15.05	16.23	19.11	22.11	26.95	28.79	26.56	25.00	22.05	20.48	20.27	20.80	21.27	20.61	20.73
25	20.61	21.59	20.09	19.63	19.04	19.23	18.45	16.82	16.69	17.60	18.13	21.20	24.21	25.19	26.30	25.65	23.62	21.27	19.96	19.89	19.96	20.34	20.09	20.73
26	20.72	21.27	20.54	20.09	19.70	19.50	17.67	16.36	16.23	16.82	18.52	19.76	21.27	24.01	25.59	25.59	24.67	22.57	20.87	20.09	20.61	20.61	20.21	20.09
27	20.27	19.89	18.78	19.11	19.30	20.34	19.04	17.47	17.67	18.78	20.15	20.48	20.27	22.68	24.67	24.73	24.21	22.05	20.27	20.48	21.27	20.94	20.94	20.61
28	21.27	20.94	20.34	20.41	20.09	20.41	19.11	18.32	18.06	18.32	20.27	22.11	23.49	24.47	23.36	22.70	21.92	21.13	20.54	20.61	21.00	20.94	20.94	20.54
29	20.54	20.54	20.15	19.89	19.76	19.36	18.26	16.62	16.75	17.93	19.04	20.61	21.27	21.72	22.11	21.92	21.52	20.67	19.96	20.21	20.48	20.73	20.73	20.87
30	20.87	20.61	20.21	19.96	20.27	19.83	18.13	16.82	17.40	18.98	19.89	19.63	25.13	27.48	25.84	25.19	25.65	24.01	22.11	21.33	22.44	21.27	20.15	22.44
31	21.46	21.52	21.78	20.61	21.20	19.36	19.89	20.04	22.57	23.94	26.82	27.29	27.48	25.32	24.67	24.27	23.49	22.44	22.18	22.25	22.90	22.57	22.18	22.05
Mean	19.92	19.92	19.94	19.00	19.01	18.54	17.63	16.53	16.74	17.61	19.31	21.18	22.98	24.00	24.46	23.90	22.86	21.47	20.47	20.09	20.17	20.24	20.15	20.26

TABLE II (*continued*)

AUGUST 1883.

Time Date	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	22.11	21.72	20.09	19.57	18.32	18.45	18.78	16.10	18.45	21.92	23.55	25.06	26.17	26.37	26.37	25.13	22.70	20.61	21.40	23.06	19.92	21.33	22.05	22.25
2	21.59	20.73	19.43	19.96	19.89	19.63	18.13	17·67	19.83	21.27	21.78	22.96	23.36	25.32	25.52	23.88	20.15	21.20	21.13	21.13	21.27	21.59	21.72	21.59
3	21.52	21.27	20.94	20.67	10.21	„	18.20	18.00	18.65	20.61	24.01	26.50	27.81	27.81	26.30	23.42	21.40	20.21	20.27	20.34	20.61	21.27	21.46	20.94
4	20.94	20.73	20.61	20.02	19.96	19.43	18.00	16.69	16.36	17.47	19.57	21.78	24.14	25.13	23.94	23.36	21.65	19.96	19.63	19.43	19.96	„	„	18.52
5	18.32	17.96	17.70	17.34	17.01	16.82	16.49	14.73	14.79	15.64	17.80	19.11	21.07	21.92	21.92	20.67	19.30	18.00	17.53	17.34	18.45	18.45	„	„
6	„	„	16.69	16.69	16.65	16.16	15.51	„	13.29	14.59	17.67	20.27	22.57	23.23	22.57	20.73	„	„	17.40	18.39	19.57	19.76	19.36	17.67
7	17.73	17.34	16.03	16.03	15.51	15.05	15.64	15.38	17.14	16.82	17.21	18.00	19.96	21.52	21.98	22.44	19.96	18.84	17.47	17.47	17.47	17.53	18.00	17.93
8	18.00	17.67	17.34	17·34	16.69	16.42	15.84	14.07	14.53	14.92	15.71	20.61	24.47	25.39	22.76	21.27	„	18.98	18.20	18.00	18.00	18.13	17.67	17.47
9	17.01	„	17.21	16.92	16.55	16.16	10.38	„	13.09	14.07	16.23	18.18	20.73	21.27	20.94	19.57	18.00	16.23	15.38	16.16	17.01	17.01	16.69	17.34
10	17.34	17.01	16.69	16.42	16.16	15.97	14.66	12.76	12.57	74.14	16.69	18.00	18.84	19.30	19.17	18.84	18.26	17.47	17.14	16.88	17.08	„	„	„
11	„	„	14.46	16.43	14.83	14.86	14.40	„	13.07	15.05	17.47	20.09	20.09	20.48	20.73	20.27	18.78	15.97	16.03	15.44	16.16	16.16	16.49	16.55
12	16.03	15.97	15.90	15.38	15.31	15.18	13.42	10.84	11.26	12.76	17.08	19.83	20.61	„	19.76	18.32	17.53	16.75	16.16	16.16	16.49	16.69	16.62	16.75
13	16.55	15.90	15.57	14.99	14.59	14.59	14.20	13.23	12.76	„	14.73	16.88	18.06	18.78	19.50	18.78	18.13	16.29	15.38	15.64	16.03	16.29	16.42	16.36
14	16.03	15.77	15.51	15.38	15.18	14.73	15.12	14.66	13.81	14.86	16.82	18.32	18.52	19.89	21.92	21.27	20.27	18.52	15.90	16.03	16.69	16.69	16.55	16.55
15	„	„	„	14.92	14.99	14.59	13.62	11.46	12.31	11.36	12.44	13.42	15.22	17.34	17.34	17.34	16.69	16.62	16.03	16.23	16.29	„	16.95	16.29
16	16.23	16.03	15.71	15.51	15.38	15.38	15.05	14.33	14.99	15.90	17.47	19.36	20.27	20.61	20.61	19.96	18.68	17.14	16.23	16.16	16.16	17.14	16.42	16.55
17	16.49	„	15.90	15.64	„	15.18	14.07	12.72	12.57	14.01	15.71	17.86	19.23	19.36	19.30	18.49	17.67	16.36	16.03	16.03	16.42	16.10	16.62	16.36
18	16.16	15.64	15.31	15.25	14.73	14.59	13.42	12.44	„	13.74	16.16	18.52	19.30	20.15	20.73	19.89	17.93	17.27	15.51	16.69	17.14	16.69	16.23	16.69
19	17.14	16.88	16.36	16.36	18.00	16.55	15.84	14.79	15.18	17.08	17.53	18.91	20.02	18.65	18.65	17.53	16.69	15.31	14.59	15.57	16.36	„	17.08	17.27
20	16.82	16.69	16.29	16.03	15.90	15.51	13.48	9.49	9.62	12.31	16.10	18.52	19.43	20.67	20.54	19.57	18.20	17.01	16.16	16.36	18.00	17.47	17.34	17.14
21	17.01	„	„	16.49	„	„	14.73	„	„	14.73	„	„	22.57	„	„	21.46	„	„	„	„	„	16.82	„	„
22	16.55	„	„	15.90	„	„	15.05	„	„	14.53	„	„	22.18	„	„	19.04	„	„	16.36	„	„	17.21	„	„
23	„	„	„	„	„	„	13.94	„	„	14.20	„	„	18.78	„	„	21,27	„	„	16.03	„	„	15.64	„	„
24	16.82	„	„	16.69	„	„	15.57	„	„	12.70	„	„	20.02	„	„	20.73	„	„	16.10	„	„	16.49	„	„
25	17.08	„	„	16.55	„	„	15.18	„	„	13.42	„	„	18.65	„	„	19.50	„	„	16.16	„	„	16.69	„	„
26	16.55	„	„	16.29	„	„	15.38	„	„	„	„	„	18.84	„	„	18.65	„	„	16.03	„	„	„	„	„
27	16.69	„	„	16.16	„	„	15.18	„	„	16.03	„	„	19.04	„	„	18.00	„	„	17.21	„	„	16.69	„	„
28	„	„	„	15.90	„	„	13.74	„	„	13.94	„	„	19.67	„	„	19.30	„	„	16.23	„	„	16.55	„	„
29	16.03	„	„	15.18	„	„	18.13	„	„	13.55	„	„	15.18	„	„	19.96	„	„	15.71	„	„	16.16	„	„
30	16.36	„	„	16.03	„	„	14.40	„	„	8.71	„	„	18.65	„	„	„	„	„	„	„	„	16.55	„	„
31	„	„	„	15.64	„	„	16.03	„	„	13.48	„	„	20.48	„	„	18.13	„	„	15.57	„	„	16.03	„	„
Mean	17.40	17.59	16.96	16.50	16.56	16.24	15.37	14.04	14.34	14.84	17.59	19.64	20.38	21.63	21.53	20.22	19.06	17.84	16.80	17.42	17.75	17.35	17.86	17.79