drawn from one place to the other. This straight line will represent the great-circle route.

I have put this matter to experimental test by constructing (on the scale of a 20-inch globe) eighteen cards, consisting of two sets of duplicates, and the accompanying figure is a reduced copy of one set.

As all meridians are treated alike, one card can be shifted 10°, 20°, 30°, &c., east or west relative to another, and this is necessary when the difference of longitude of the two places exceeds 80°. The second set of cards can either be used for the southern hemisphere or for increasing the range of longitude to 160°. I can thus measure the great-circle distance from London to Shanghai (the route passing 1½ degrees north of St. Petersburg), or from Yokohama to San Francisco, or from Land's End to Cape Horn. For measuring the distances I use a card scale divided into degrees of the same length as the degrees of the meridian.

The process above described also serves for finding the position of the sun in the sky at a given hour of the day, and by obvious modifications of it, most of the problems set forth in books on the use of the globes can be solved. In dealing with a spherical triangle, two of the sides are represented by polar distances, the included angle by difference of longitude, and the third side by the divided scale.

J. D. EVERETT.

Action of Tesla Coil on Radiometer.

THE following phenomena, observed while experimenting with a small Tesla coil, will, I believe, interest some of your readers. Not having access to the necessary literature, I am not in a position to find out whether they are new or already known.

The knobs of the Tesla coil were placed in contact with, or just close to, the bulb of a Crookes's radiometer, and the coil set at work. When the brush discharge fell upon the bulb, the blackened surfaces of the vanes first retreated, as they do under the influence of radiant heat, but soon the direction of rotation changed, and the blackened surfaces moved forward, the motion continuing as long as the brush discharge fell upon the bulb.

At the same time, inside the bulb, were seen diverging from the glass sides close to the knobs two cones of pale blue light, which, falling on the opposite sides of the bulb, caused a yellowish-green fluorescence. On the fluorescent parts the shadows of the rotating cones were clearly visible, the shadow on one side being always more intense than on the other side. When the direction of the current in the charging Ruhmkorff was reversed, the shadows exchanged places, but no change in the direction of rotation of the vanes was noticed.

On examining the fluorescent parts with a screen of potassium platinocyanide, the same effects were noticed as with the X-ray tubes.

Similar effects were obtained on repeating the experiments with two incandescent lamps in the laboratory. The larger of these, an old Swan lamp, fluoresced green, and the smaller new one, supplied with the Tesla coil by the manufacturer, fluoresced blue. But in both cases, though somewhat feeble, the same X-ray effects were observed.

To study further the cause of the motion of the vanes of the radiometer, the experiment was repeated with a Crookes's tube containing a freely suspended wheel with transparent mica waves. In this case it was found possible to alter the direction of rotation of the wheel by adjusting the positions of the knobs of the Tesla coil relatively to the sides of the tube and the wheel inside it.

P. L. NARASU.

Christian College, Madras, June 18.

Tides at Port Darwin.

ALONG the north-west coast of Australia the tidal wave, flowing in from the Indian Ocean, produces at most places a large rise and fall. At Port Darwin the mean spring range is about 24 feet, but the range is sometimes as much as 30 feet. A tide gauge of Lord Kelvin's pattern was set up here by the South Australian Government some few years ago, and good records are available up to 1897, since when it has been dismantled, waiting the building of a new jetty. Captain Inglis, the harbour-master at Port Adelaide, and the writer selected the last good records available for a whole year's tides, the records beginning January 1, 1896, and subjected them to a harmonic analysis, with the results given in the table below. The records show a very marked diurnal inequality, especially at the low waters. In the year examined the greatest difference in height between the two high waters occurred in January and December, and amounted to 4 feet 9 inches. In April, however, there was a difference in height of the two low waters of as much as 10 feet. The analysis shows the existence at Port Darwin of a remarkably large annual tide, the water on this account standing nearly two feet higher at the end of summer than it does at the end of winter. At first sight this seems very remarkable, especially when we find that at Kupang, on the island of Timor, to the north, according to Van der Stok, the solar annual tide has a semi-range of only 2·3 centimetres. The tide appears to be a purely meteorological effect due to the conformation of the harbour and the direction of the prevailing winds. The harbour opens towards the N.W., and, as will be seen from a perusal of the wind charts given in Van der Stok's work, "Wind and Weather, Currents, Tides and Tidal Streams in the East Indian Archipelago," the winds during the summer blow with great persistency from the N.W., tending to pile the water up in the harbour, while in the winter time the prevailing winds are S.E., with, of course, an opposite effect. This is further assisted by the variations of atmospheric pressure. The average barometer readings exhibit a remarkably regular annual fluctuation, as is shown by the following results. The averages are from readings taken at regular intervals of three hours for twenty years, ending 1901 :—

	Mean Readings for 20 years.	Mean Readings for 1896.
January	29·765	29·757
February	29·769	29·759
March	29·814	29·808
April	29·863	29·849
May	29·917	29·973
June	29·945	29·966
July	29·966	29·969
August	29·956	30·005
September	29·931	29·978
October	29·892	29·948
November	29·841	29·868
December	29·793	29·854

Results of Harmonic Analysis of Records of Tide Gauge at Port Darwin (Latitude 12° 23′ S., Longitude 130° 37′ E.) for the year beginning noon, January 1, 1896.

Component.	Amplitude.	Phase (K).	Component.	Amplitude.	K.
	Feet.	°		Feet.	°
S_1	0·16	169	Q	0·34	324
S_2	3·44	193	μ	0·39	110
S_4	0·05	127	P	0·44	1
S_6	0·01	184	K_1	1·91	336
M_1	0·05	315	T	0·24	166
M_2	6·56	144	R	0·83	97
M_3	0·05	26	K_2	1·02	204
M_4	0·13	279	2SM	0·17	13
M_6	0·06	167	MS	0·16	30
N	0·40	121	S*a*	0·97	76
L	0·41	216	S*sa*	0·54	58
ν	0·96	161	M*sf*	0·47	29
O	1·14	313	M*f*	0·128	333
J	0·14	197	M*m*	0·045	284

The University, Adelaide. R. W. CHAPMAN.