Prescott's book, Edison distinctly says: "I can lay no claim to having discovered that conversation could be carried on between one receiver and the other upon the magneto-principle, causing the voice to vibrate the diaphragm. . . . My first attempts at constructing an articulating telephone were made with a Reis transmitter and one of my resonant receivers. My experiments in this direction, which continued until the production of my present carbon telephone, cover many thousand pages of manuscript."

This last incidental remark, which there is no reason to doubt, reveals the indefatigable character of the man. The public see only the successful results, and many doubtless imagine that these spring ready accomplished from the fertile brain of Mr. Edison; the truth is just the reverse. It is a trite, but true observation, that successful work in any direction, and notably in scientific discovery, is the result of patient persistent toil. The public look at the nugget, but not at the labour that has won it. The fields of science are now so well trodden that

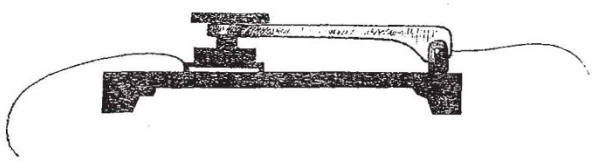

FIG. 4.—Edison's pressure relay resembling one form of microphone.

discoveries are not to be accidentally picked up, but only reward those whose quest is most skilful and diligent.

The extraordinary succession of valuable discoveries in applied science which Mr. Edison has made can only be the offspring of incessant work, profound technical knowledge, and that ready resource under difficulties which characterises a mechanical genius. The conditions under which such a man works are different from those of a purely scientific investigator; the latter publishes his researches and thereby establishes his claim to the priority of the work he has done; the former can publish nothing till the end he has in view is achieved, and the pecuniary benefit accruing from his labours secured by legal processes. And because the reward sought in the two cases is very different, the investigator must often expect to see others reaping the benefit of applications that may be made of his observations, and the inventor ought not to grumble when he finds others claiming credit for work he may previously have done, but for his purpose found it necessary to keep by him unpublished.

W. F. BARRETT

OUR ASTRONOMICAL COLUMN

THE LATE SOLAR ECLIPSE AT WATSON'S STATION.—Prof. Watson made such excellent use of the brief period of totality in the eclipse of July 29, that it will not be without interest to record the circumstances under which he observed. In a communication to M. Mouchez he gives for his position at Separation, Wyoming Territory, latitude 41° 45′ 50″, longitude 2h. 1m. 36s. west of Washington, corresponding to 7h. 9m. 48·1s., west longitude from Greenwich. Prof. Newcomb's corrections to Hansen's place of the moon at this time are − 0·63s. in right ascension, and + 3·3″ in declination; whence if we take 10h. 24m. Greenwich M.T. for a special calculation, we have for the position of the moon, R.A. 8h. 38m. 11·96s., decl. + 19° 5′ 59·3″. Combining this with the sun's place from Leverrier's Tables and the *Nautical Almanac* semi-diameters, there results

Beginning of total eclipse, July 29...3h. 13m. 32·5 } Mean times
Ending ... ...3h. 16m. 24·0 } at Separation.

Thus the duration of totality was 2m. 51·5s.

If for the *Nautical Almanac* values we substitute Leverrier's semi-diameter for sun and deduce the semi-diameter of the moon from her horizontal parallax with Burckhardt's ratio, we find the times of beginning and ending of totality are respectively 3h. 13m. 32·0s. and 3h. 16m. 24·5s., showing a duration of 2m. 52·5s.; we may therefore take 2m. 52s. for the interval which was available to Prof. Watson in his search for intra-mercurial planets. The middle of totality occurred at 3h. 14s. 58·3s. M.T. at Separation, or at 11h. 44m. 41·9s. sidereal time, when the sun's altitude was 44½°, and his hour-angle 46½° W.

CALCULATION OF EXCENTRIC ANOMALIES. — The number of bodies in the minor planet group is now approaching two hundred, yet so far as their orbits have been satisfactorily determined only two or three out of this number have the angle of excentricity, as it is termed, or $\sin^{-1} e$, greater than 20°, which corresponds to $e = 0{\cdot}342$. More than ten years since Mr. Godward, of the *Nautical Almanac* Office, prepared some tables for the direct computation of the excentric anomaly from the mean to this limit of excentricity. His process is as follows:—

In orbits where the excentricity is not great, M, u, and v being the mean, excentric and true anomalies respectively, and ϕ the angle of excentricity—

$$\tan \tfrac{1}{2} v = \tan^2 (45° + \tfrac{1}{4}\phi) \tan \tfrac{1}{2} M \text{ nearly.}$$

Let M' be an angle such that

$$\tan \tfrac{1}{2} v = \tan\, (45° + \tfrac{1}{4}\phi) \tan \tfrac{1}{2} u$$
$$= \tan^2 (45° + \tfrac{1}{4}\phi) \tan [\tfrac{1}{2} M + \tfrac{1}{4}(M' - M)].$$

Then the Table contains $\frac{1}{2}(M' - M)$ for any value of ϕ up to 20°, the arguments being $\frac{1}{2} M$ and $\frac{1}{2}\phi$.

As an example of the use of this Table, suppose the excentric anomaly of Juno is required for the time to which the elements of the planet are reduced in the Appendix to the *Nautical Almanac* for 1881. The mean anomaly $(= \epsilon - \pi) = 168°\ 39'{\cdot}43$ and $\frac{1}{2}\phi = 7°\ 23'{\cdot}22$, then

$\frac{1}{2} M$	84°	19′·72
$\frac{1}{2}(M' - M)$	—	11·42 from the Table.
$\frac{1}{2} M'$	84	8·30
$\tan \frac{1}{2} M'$	0·98858	
$\tan (45° + \frac{1}{2}\phi)$	0·11325	
$\tan \frac{1}{2} u$	1·10183	
$\tan \frac{1}{2} v$	1·21508	
$\frac{1}{2} u$	85°	28′·64
$\frac{1}{2} v$	86	30·74
u	170	57·28
v	173	1·48

Here $\tan \frac{1}{2} v$ is obtained by adding together the two previous lines, so that there is no subtraction in the operation.

Mr. Godward's Table was printed by the *Nautical Almanac* Office in 1866. It is applicable to all the satellite-orbits showing excentricity, as *Hyperion*, where $\phi = 7°\ 11'$.

THE MINOR PLANETS.—From No. 100 of the *Circular zum Berliner astronomischen Jahrbuch* it appears that the small planet at first announced as No. 190 is proved by Herr Leppig's calculation of its orbit to be identical with No. 94 (*Aurora*); the succeeding discovery therefore takes its number, and for planets found since the beginning of the summer, the numbers, names, and dates will stand thus:—

No. 188	Menippe,	1878,	June 26
,, 189	Phthia,	,,	Sept. 9
,, 190	Ismene,	,,	Sept. 22
,, 191	Kolga,	,,	Sept. 30

Several members of the group as *Dike*, *Medusa*, and others with better determined orbits remain to be virtually rediscovered, and the most interesting of all, from its long period and near approach to the orbit of Jupiter (*Hilda*), was not found at its last opposition. *Atalanta* and *Felicitas* are now nearer the earth than is usual with the minor planets, both being within the mean distance of the earth from the sun; they have the brightness of stars of the tenth magnitude. The following positions are for 12h. M.T. at Berlin, or about 11h. G.M.T. :—

	Atalanta.			*Felicitas.*		
	R.A.	Decl.		R.A.	Decl.	
	h. m. s.	° ′		h. m. s.	° ′	
Nov. 7 ...	1 38 10	+37 50·6		3 11 22	+29 59·1	
,, 9 ...	1 35 45	37 56·0		3 9 24	30 4·3	
,, 11 ...	1 33 27	38 0·0		3 7 23	30 8·6	
,, 13 ...	1 31 18	38 2·8		3 5 23	30 11·9	
,, 15 ...	1 29 17	38 4·4		3 3 23	30 14·2	
,, 17 ...	1 27 27	+38 4·9		3 1 24	+30 15·7	

GEOGRAPHICAL NOTES

WE regret to learn that the Earl of Dufferin will be unable to open the session of the Royal Geographical Society on Monday next, as he has received Her Majesty's commands to attend at Balmoral on that day, but it is hoped that he will be able to preside at the meeting on December 9.

PROF. F. V. HAYDEN, in charge of the Geological Survey of the U.S. Territories, has crossed the Rocky Mountain Divide ten times during the past season. He has explored some of the most noted passes, and among them the celebrated Two-ocean Pass, of which he made a careful chart; an account of this we hope soon to be able to give. We hope also to receive from Prof. Hayden an account of the discovery of recent glaciers in the Wind River Mountains of Wyoming Territory, the first known to exist in the United States east of the Pacific Coast. A fine glacier was observed on the east side of Wind River Peak, and two grand ones on the east side of Fremont's Peak. The latter Dr. Hayden named Upper and Lower Fremont Glaciers. Dr. Hayden took great pleasure in traversing much of the same ground passed over by him in 1860, eighteen years and three months before.

A REUTER'S telegram states that Gen. Severtsoff, the explorer of the Pamir plateau, has returned to St. Petersburg, having visited the unknown districts of Lake Rang-Kul and the Sariz Pamir and Alitchur Pamir plateaux. He reports having found a continuous valley extending from Lake Kara-Kul to the Aksu River. Gen. Sjevertsoff has considerably altered the map of these regions and thrown much light on the geography of the Pamir plateau.

WE are sorry to state that no news from the *Florence* has reached Washington from September 13, the date of the last telegram which Capt. Tyson sent to New York when leaving St. John's, Newfoundland. It is feared that the ship was sunk by the recent heavy gales which raged in this part of the Northern Atlantic a few days after its setting out.

THE London Missionary Society have received intelligence of the arrival of their Tanganyika expedition at Urambo, in Unyamwesi, on July 27; they were to leave that place early in August, and hoped to reach Ujiji by the beginning of September. Mr. Hore in his letter divides his geographical description of the country between Kirasa, forty-five miles east of Mpwapwa, and the capital of Unyamwesi into four sections, each of which furnishes interesting details respecting the region traversed by the party. From Kirasa in S. lat. 6° 42′ 30″, elevation 2,700 feet, to Mpwapwa, lat. 6° 22′, 3,200 feet, they were still in the coast region, the country gradually rising to Mpwapwa along an inclosed plain. As it is approached, the mountains of that range bound the view westward, forming the distinct boundary-line of the maritime region. The waters of the Limbo and of the Mpwapwa stream appear to be mere tricklings left by an immense and irregular flow of water during the rains, which, Mr. Hore suspects, will alter the whole face of the country and reconcile the conflicting accounts we have had about the Gombo Lake. The Chunyo Pass is the back door of the maritime region; a slight descent leads to the plain of the Marenga Mhali, which extends through Ugogo, unless the break of elevated forest and ridge between Kididimo and Nyambwa may be said to divide it into two portions. Assuming this, the first portion, consisting of the Marenga Mhali and Eastern Ugogo, exhibits a similar character throughout, that is, a gently undulating plain, with harsh, thorny, scrubby vegetation and small trees, its monotony broken by small irregular and rugged granite hills. A slightly elevated ridge, with a really beautiful forest, divides the first from the second section of the journey. Descending from the first ridge, the party entered the second section, a flat plain, crusted with a salt deposit, in which tall palm-trees form a new feature. At Mizanga the second section terminated abruptly at a precipitous wall 800 feet high. This wall, or "step," extends north and south, but north of Mizanga it trends away to north-west and west-north-west, which bend the expedition followed, and mounted into the third section or stage of the journey a little beyond Makondoku, the westernmost town of Ugogo. This third section was the vast and elevated forest plateau of Uyanzi and Unyamwesi, extending almost unbroken to nearly the meridian of Unyanyembe. The party here found a comparatively bracing atmosphere, and also reached their highest elevation, 4,400 feet, in the meridian of Jewe-la-Singa. At Uyui (lat. 4° 53′, altitude, 3924 feet) the fourth section was entered, the hills and dales of Unyamwesi, and the country maintained the same character as far as Urambo (lat. 4° 37′ 30″, altitude, 3,815 feet), from which place Mr. Hore wrote that the hills, often little elevated ridges, trend generally north and south, and many of their shoulders had to be crossed. This is the region of the Gombe Nullah. "To the passing traveller," Mr. Hore says, "the driftwood and grass in the trees overhead speak to him of some vast inundation rather than of a stream. The Gombe Nullah is the lowest drain of a vast body of water, whose general direction towards the Malagarasi is indicated by it. . . . This fourth stage has brought us on to the water-shed of the Tanganyika."

THE proceedings of the party which last spring went to New Guinea in the *Colonist* from Australia, have hitherto been shrouded in mystery, though rumours have occasionally reached this country as to their want of success. Recently, however, a leading member of the party has been obliged to go to Cooktown, Queensland, through ill-health, and his report of their proceedings has been furnished to the *Brisbane Courier*. Almost all that has previously been heard of them is that they had formed a camp on the Laloki River. Starting north from this point we learn that they proceeded through open country for eight miles, and struck the Goldie River, where they found the first colours of gold. Twelve miles up this river they crossed and proceeded for two miles in a northerly direction, when they recrossed on finding that the river trended to the east. They then took a north-easterly direction for thirteen miles, partly through dense scrub, and reached what they named the Top Camp, thirty-five miles from the Laloki. They made two journeys up the Goldie, one party going a distance of fifty miles, but found no indications of gold. They saw many villages, some numbering 1,000 inhabitants, and all the natives were friendly. Afterwards the party moved further down the river, and camped near the junction of the Mawmika and the Goldie, the former of which flows