ON the evening of January 24 an aurora was observed at Geestemünde, which was remarkable both for its duration as well as for the intensity of its light. The sky was quite clear and the moon shining brightly, when about 7.30 p.m. a semi-circle of light appeared in the north-east. Soon afterwards long rays shot out from this across the sky, forming an immense fan of light; the middle one of these rays crossed the sky right down to the south-west, and remained visible in the same brightness for two hours. The size and brightness of the other rays changed constantly. The light was perfectly white.

A VIOLENT earthquake is reported from Freiburg-im-Breisgau January 24, at 5.30 a.m., accompanied by loud subterranean noise. At the same time two strong shocks were felt at Bischoffingen. On the same date, at 7.58 a.m., an earthquake was observed in Herzegowina. It lasted for four seconds, and its direction was from north to south.

DURING the coming summer a Fine Art and Industrial Exhibition will be held at Huddersfield in connection with the opening of the New Technical School.

THE additions to the Zoological Society's Gardens during the past week include two Macaque Monkeys (*Macacus cynomolgus*) from India, presented respectively by Mr. T. W. Davidson and Miss M. Sutton; two Common Marmosets (*Hapale jacchus*) from Brazil, presented by Mr. A. Pariss; an Oak Dormouse (*Myoxus dryas*) from Russia, presented by M. A. Wrzesniowski; a Common Marmoset (*Hapale jacchus*) from Brazil, presented by Mrs. Lynch; two Common Gulls (*Larus canus*), British, presented by Mr. W. K. Stanley; two Herring Gulls (*Larus argentatus*), British, presented by Capt. C. R. Suckley; a Brant Goose (*Bernicla brenta*), European, presented by Mr. J. C. Robinson; a Black Lemur (*Lemur macaco*) from Madagascar, four Impeyan Pheasants (*Lophophorus impeyanus* ♂ ♀ ♀ ♀) from the Himalayas, a Black-necked Swan (*Cygnus nigricollis*) from Antarctic America, deposited; two Philantomba Antelopes (*Cephalophus maxwelli*), a Crowned Hawk Eagle (*Spizaetus coronatus*) from West Africa, four Snow Buntings (*Flectrophanes nivalis*), two Brant Geese (*Bernicla brenta*), European, a Red-throated Diver (*Colymbus septentrionalis*), British, purchased; a Schomburgk's Deer (*Cervus schomburgki*), from Siam, received in exchange; two Hybrid Peccaries (between *Dicotyles labiatus* ♂ and *D. tajaçu* ♀), five Ring-hals Snakes (*Sepedon hæmachates*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE COMET OF 1771.—The comet discovered by Messier at Paris on April 1, 1771, and last observed by St. Jacques de Silvabelle at Marseilles on July 17, has long been mentioned in our treatises on Astronomy as undoubtedly moving in a hyperbolic orbit. This inference was first drawn by Burckhardt, who considered that of all the comets calculated up to the time he wrote (*Mémoires présentés par Savans étrangers*, 1805) that of 1771 was the only one of which it could be stated with some degree of certainty that the orbit was hyperbolic. Encke considered the case worthy of further investigation; remarking that from the nature of the conditions it might be demonstrated that a comet could not rigorously describe a parabola, and that experience so far rather gave the preference to the ellipse over the hyperbola, he insisted that a comet, whose track could not be represented completely except by hyperbolic motion, merited the greatest attention. He accordingly reduced anew the six observations employed by Burckhardt, and after their careful discussion found that the most probable elements were hyperbolic with eccentricity = 1·00937, which is almost identical with Burckhardt's value (1·00944). Nevertheless he did not regard the decided superiority of the hyperbola in the representation of the six places as an indubitable proof of the necessity of admitting motion in that curve; the positions used were not normal positions, but the results of single and isolated observations, and as such, the errors exhibited by a parabolic orbit had not so great a preponderance in his opinion as to enforce such necessity. He concluded that the subject still required examination by a combination of all the observations, and especially if the originals of those at Marseilles could be found. On this point Zach stated, in a note to Encke's communication (*Correspondance Astronomique*, t. v.), that during a recent visit to Marseilles he had searched in vain amongst the papers of St. Jacques de Silvabelle for these originals.

Lately, the orbit of the comet of 1771 has formed the subject of two memoirs, containing very rigorous discussions of the observations, the first by Mr. W. Beebe, in the *Transactions* of the Connecticut Academy of Arts and Sciences, vol. v.; the second by Dr. H. Kreutz, published in the *Proceedings* of the Vienna Academy. Mr. Beebe gives also a hyperbolic orbit, accompanied by the most probable parabola for comparison. The investigation by Dr. Kreutz, a very complete one, gives perhaps a more definite result. He is led to a parabolic orbit for the closest representation of the comet's path, and though the original observations at Marseilles had again been sought for unsuccessfully, he does not think their recovery would affect the conclusion at which he had arrived. The elements of the definitive parabola are as follow:—

Perihelion passage, 1771, April 19·14144 M.T. at Paris.

Longitude of perihelion ...	104° 1′ 21″·7	M. Eq. 1771·0
,, ,, ascending node	27 53 11·7	
Inclination	11 15 53·1	

Logarithm of perihelion distance, 9·955127

Motion—direct.

THE CASSINI DIVISION OF SATURN'S RING.—At the January meeting of the Royal Astronomical Society, Prof. J. C. Adams made a very interesting communication on William Ball's observations of Saturn, upon which much confusion and misapprehension have existed. Attention has been directed to the subject lately by several astronomical contemporaries, mainly with the view to show that William Ball was not, as he has been considered, the discoverer of the chief division of Saturn's ring. Prof. Adams has carefully examined letters from Ball preserved in the *Archives* of the Royal Society, Huyghen's *Opera Varia*, &c., and remarks: "I find no evidence that Ball, any more than Huyghens, had noticed any indication of a division in the ring." This statement may be accepted as conclusive that the impression of several English writers as to Ball's claim to the discovery of a double ring is a mistaken one, and the credit of the discovery rests with Cassini. The announcement of it made by the French astronomer to the Academy of Sciences is in the following terms:—"Après la sortie de Saturne hors des rayons du soleil l'an 1675 dans le crépuscule du matin, le globe de cette planète parut avec une bande obscure semblable à celles de Jupiter, étendue selon la longueur de l'anneau d'orient en occident, comme elle se voit presque toujours par la lunette de 34 pieds, et la largeur de l'anneau étoit divisée par une ligne obscure en deux parties égales, dont l'intérieure et plus proche du globe étoit fort claire, et l'intérieure un peu obscure. Il y avoit entre les couleurs de ces deux parties, à-peu-près la même différence qui est entre l'argent mat et l'argent bruni (ce qui n'avoit jamais été observé auparavant), et ce qui s'est depuis vû toujours par la même lunette, mais plus clairement dans la crépuscule et à la clarte de la lune que dans une nuit plus obscure. Cette apparence donna une idée comme d'un anneau double, dont l'inférieur plus large et plus obscur fût chargé d'un plus étroit et plus clair." In two figures attached to this announcement the ring is shown with the outer half shaded and the inner half white, and there is a central band across the globe.

ON THE CHEMICAL CORROSION OF CATHODES[1]

THIS paper contains a description of the influence of various circumstances upon the chemical corrosion of metallic cathodes in different liquids.

Several preliminary experiments are described by means of which it was found that in some cases the chemical corrosion of a metal is increased, and in others decreased, by making the metal a cathode. Also, that the loss of weight of a cathode in an electrolyte is dependent upon several conditions, such as difference of metal, of liquid, or of strength of liquid, some of

[1] By G. Gore, LL.D., F.R.S. Abstract of paper read before the Birmingham Philosophical Society, December 14, 1882.

which tend to increase, and others to decrease the corrosion. In a solution of potassic cyanide pure silver is always protected by being made a cathode. The influence of variations of strength of acid was tried in several cases.

The results, which at first were apparently contradictory, were found to depend upon a number of conditions, and it would require an extensive research to determine the limits of those conditions, and what the proportions are, in which all those separate influences participate in producing the effect. Unequal capillary action is one of them, and its effect is described in a separate paper entitled, "The Electrolytic Balance of Chemical Corrosion." Another is unequal corrodibility of the metal itself. This was investigated, but how it arose was not clearly ascertained. Traces of certain kinds of soluble impurity in the liquid was also a disturbing circumstance. The altered chemical composition of the liquid around the cathode, caused by substances set free or formed by electrolysis, was another influence; this was investigated in the case of a silver cathode in a solution of potassic cyanide, and the protective influence of the current upon the cathode was found to be partly due to the formation of potassic hydrate; the current, however, operates also in some other manner. The effect of temperature was also examined, and it was found that the current exercised a greater protective power when the liquid was hot than when it was cold; the corrosive effect without a current was also greatest (as might have been anticipated) in the hottest liquid. The effects were further influenced by the degree of strength of the current; the greatest strength of current exercised the most protective power, and a large number of experiments were made expressly to test the question whether difference of electro-motive force alone, independently of difference of strength of current, affected the rate of corrosion, but the difficulty of insuring perfect uniformity in all the other conditions which affected the corrosion was so great that sufficiently decisive results were not obtained.

THE MOVEMENTS OF AIR IN FISSURES AND THE BAROMETER

FROM time to time attention has been called to the property exhibited by certain wells in different parts of this country of maintaining an active and permanent circulation of air. It was observed that currents alternately entered or issued from fissures in the sides of the wells, and though in some cases the first emission on sinking the well consisted of choke-damp, the gas subsequently passing consisted of no more than atmospheric air. While it was clear that the currents were not due to the evolution of any gas by chemical action in the rock or the water, an explanation of the phenomenon was found in the fact that the changes in the direction of the circulation coincided precisely with the changes of movement of the barometer, the current being outwards with a falling glass, inwards when the barometer was rising, and ceasing altogether when no change in the atmospheric pressure was taking place. The strength of the currents moreover was found to be proportionate to the rapidity of the barometric movements.

The name of Blowing Wells has come to be applied to such wells in consequence of these properties. From their extreme sensitiveness to changes in the atmospheric pressure, they have been found to give useful indications of the approach of bad weather. Their warnings are rendered audible by fixing horns or whistles in an air-tight covering, in such a way as to sound readily to the outward current, or to give a different note for an outward or inward movement of the air.

The first blowing well of which we have an account appears to have been of an entirely artificial origin. A well was sunk at Whittingham, near Preston, to a depth of eighty feet, and being afterwards abandoned, was covered with a large flagstone pierced by a small hole. Currents of air were observed to enter or issue from this hole, according as the barometer was rising or falling, and a tin horn fixed in it became audible at a considerable distance. Similar phenomena were exhibited by a cesspool, intended to receive offensive residue from some chemical works. The pool was arched over, a small hole being left for the passage of the refuse; a fall in the barometer was made unpleasantly evident by the issue of offensive vapours.[1]

Subsequently it was noticed that three wells in the New Red Sandstone, in the neighbourhood of Northallerton exhibited the same peculiarity. The wells "blow" through fissures in the sandstone just above the water-level. The changes in the direction of the currents coincide precisely with the movements of the barometer, and the outward current is made to blow a "buzzer," which is said to be audible at a mile distance.[1] In the years 1879-80 a series of interesting experiments on one of these wells, situated near Solberge, three and a half miles south of Northallerton, was made by Mr. Thomas Fairley, F.R.S.E.[2] After stating that the water has a composition similar to that coming from chalk or limestone, and that, though on the first opening of the fissure a violent outburst of choke-damp had taken place, the gas subsequently issuing did not differ appreciably from common air, Mr. Fairley gives a detailed account of observations made on the volume of air passing. The currents passed through fissures in the sandstone at a depth of forty-five feet from the surface of the ground, and just above the level of the water. The measurements were made firstly by a vane-anemometer, and subsequently by two large dry meters, constructed to pass 3,000 cubic feet per hour; these had been substituted for two of the largest meters in the possession of the Leeds Corporation, which had been thrown out of gear by their incapacity to pass the air fast enough. As a result of these experiments it was found that a fall of the barometer of 0·26 inch was accompanied by an outflow of 83,900 cubic feet of air, and by an application of Boyle's law it was calculated the total capacity of the fissures must amount to nearly 10,000,000 cubic feet.

The existence of currents obeying the same laws is equally obvious in a well at Langton at a few miles distance. The well has been long disused, and the water is exceedingly foul, notwithstanding which a candle burns clearly at the bottom. A third instance occurs at Ornhams near Boroughbridge, where the roar of the air-currents passing into the crevices of the rock has been compared by a workman to that of the water in a mill-race. No observations, further than those necessary to prove the existence of the currents, have yet been made on these wells.

At Hopwas a well has been sunk for the supply of Tamworth to a depth of 168 feet, the water standing naturally a depth of 129 feet. The shaft passes through alternations of shale and sandstone, one of the beds of the latter, met with at a depth of ninety-six feet eight inches, being described as "light fissured sandstone thirty feet four inches."[3] From a fissure in this bed, at 115 feet from the surface, there issued a violent rush of atmospheric air, which soon spent itself, and was succeeded by currents showing variations coincident with the barometic changes. The currents have been noticed in one fissure only, an irregular opening, of two and a half inches in height by one inch in width, in a nearly close-sided vertical joint. Experiments on the amount of air traversing this fissure are now in progress.

The same properties are exhibited in an equally well-marked degree in a well belonging to Mr. A: Potts at Hoole Hall, near Chester. The well is eighty-one feet deep and contains ten feet nine inches of water; it is sunk through glacial deposits, consisting of a tough clay overlying a sand of variable thickness, into the New Red Sandstone, but, being an old well and lined with brick to the water-level, the exact nature of the strata and the position of the fissures is unknown. Communicating with the interior of the well by pipes, are two whistles of a different tone, and a pressure gauge; the deeper-toned whistle sounds to an inward, the shriller-toned to an outward current, and were they allowed to act freely during unsettled weather, these whistles would render sleep in the adjoining house impossible. It is stated by Mr. Potts that changes in the atmospheric pressure are shown more rapidly by the pressure gauge of the well than by a mercurial barometer, and that whenever there is a sudden change for rain, the water in the well becomes agitated and slightly discoloured. An appearance of ebullition was noticed also in the Solberge well, but has been attributed by Mr. Cameron to the falling of fragments of mortar. The movements of the water in the Hoole well are being made the subject of experiment by Mr. Potts. Similar, though less powerful, currents have been observed in two other wells within a distance of 500 yards of Hoole Hall. The wells are in a situation where a similar sequence of glacial deposits probably exists, but further particulars are at present wanting.

The fissures from which the currents in blowing wells issue occur usually near, but just above, the water-level. Above them there is provided an air-tight covering in the glacial clays,

[1] J. Rofe, F.G.S., *Geological Magazine*, vol. iv. p. 106, 1867.

[1] A. G. Cameron, *Geological Magazine*, vol. vii. p. 95, 1880.

[2] *Proc.* York Geol. and Polyt. Soc., N.S., vol. vii. p. 409, 1881.

[3] Mr. H. J. Marten, Eighth Report on the Circulation of Underground Waters to the British Association, 1882.