

perfect of these patches. The soil is a sandy loam upon the greensand, and the crop is vigorous, with strong stems, and I could not trace locally any circumstances accounting for the peculiar forms of the patches in the field, nor indicating whether it was wind or rain, or both combined, which had caused them, beyond the general evidence everywhere of heavy rainfall. They were to me suggestive of some cyclonic wind action, and may perhaps have been noticed elsewhere by some of your readers.

Guildown, Guildford, July 23

J. RAND CAPRON

The Inevitable Test for Aurora

I HAVE not long returned from abroad, and have only recently had the opportunity of perusing in NATURE (vol. xxii. pp. 76, 96, 145) the correspondence of Messrs. De La Rue and Müller, Prof. Piazzì Smyth, and Mr. Backhouse on this subject.

I do not understand Messrs. De La Rue and Müller as claiming their electric discharges to be in the nature of an actual auroral discharge, but rather that their experiments inform us inductively at what heights auroræ are to be found. This, however, doubtless assumes that the discharges in question and auroræ must have something very much in common; and Prof. Piazzì Smyth is quite to the point in remarking that unless the citron line (and, I would add, the red line) are present in the spectrum, the identity of the discharges with the aurora has not even a foundation.

The fact is, that many of the electric discharges in air and the air gases, and the circumstances attending them—we may instance the ordinary tube glow, its change from rose-tint to violet under magnetic influence, the aura-arc accompanying the spark discharge under similar conditions, the dark space between the terminal and the glow, the change of colours in a hydrogen tube, and other appearances which I have not time to capitulate—so closely resemble auroral incidents, that one is quite disappointed to find on examination no concordance in the spectra. At the most, in a vague and unsatisfactory way one or two of the blue and violet lines in the aurora spectrum have been assigned to one or other of the atmospheric gases; but as Prof. Smyth points out, the red and green giant lines of the spectrum have up to the present time found no terrestrial analogues. I have examined the air spectrum and the spectra of the component gases of air under many various conditions, but always without success so far as these lines are concerned.

I have not, however, had the opportunity of doing this in the case of direct discharges from large secondary batteries; and it would undoubtedly be a valuable addition to our knowledge of facts relating to auroræ if Messrs. De La Rue and Müller would undertake this examination, and clear up matters in that respect. With regard to the heights at which auroræ obtain, the evidence is very conflicting. Certainly they have been seen very near the earth ("Aurora, their Characters and Spectra," pp. 37 to 40. Height of the Aurora). It is unfortunate that simultaneous observations of the auroral corona are almost entirely wanting. I think I once saw one in print, but missed it subsequently, and would be glad if any particulars could now be furnished me. Prof. Newton, by calculations based on observations of auroral arches in 28 auroræ, has assigned a height of from 33 to 281 miles, with a mean of 130 miles.

Messrs. De la Rue and Müller, I notice, deduce experimentally that at 124 miles no discharge could occur. As to whether the red or the white aurora is the nearest to the earth, my impression certainly is that the apparently low-lying auroræ have generally been the white. I may instance the aurora seen by Mr. Ladd a Margate, "a white ray," and that seen by me in the Isle of Skye in September, 1874. In Lapland, too, the auroræ seem almost universally yellow, but it can hardly be assumed that they are all thirty-seven miles high. The apparently lower position of the red tint is by no means universal, and can hardly be relied upon as evidence on the point, especially when so many auroræ are seen in which it is wanting. I have great hopes, with a spectrocope specially prepared for the purpose, of getting the photographed spectrum of an aurora.

The red line is of course out of the question, but judging from experiments on gas tubes I think the green might be got, and the blue and violet I make in anticipation pretty sure of in the event of an aurora lasting some hours. The principle of the instrument is a long collimator, a single fluid prism, and a short focus-projecting lens, used with rapid dry plates.

Guildown, Guildford, July 23

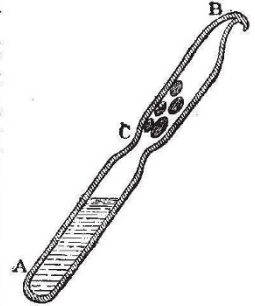
J. RAND CAPRON

Experiment with Glass Tubes

I HAVE just been repeating a very beautiful experiment of Prof. Quincke's which he showed me some weeks ago in his laboratory at Heidelberg. The experiment was, I believe, described in *Poggendorff* about two years ago, but I have not seen it noticed in English papers, and a few words about it may interest your readers.

Prof. Quincke, with a view to test the porosity of glass for gases, sealed up tubes in which hydrogen and carbonic acid were generated in great quantity, and weighed them from time to time. Up to the present time, as I learned from him, no loss of weight has been detected. He obtained, however, a very curious result. As I do not know precisely how Prof. Quincke filled his tubes, let me describe what I did myself three weeks ago, remarking that I have done nothing but attempt to repeat what he showed me in Heidelberg.

I took a glass tube, A B, about 5 inches long and $\frac{3}{4}$ inch in external diameter, with good stout walls. I closed the end A, and let the glass fall in at C, keeping it still very strong, and annealing very carefully at A and C. I introduced some sulphuric acid into the part CA, carefully keeping the neck C dry, and dropped into the part B C some fragments of marble, previously washed, in order that no little particles should tumble down through the neck, C, and commence effervescing before I was ready. I then drew out the tube at B, making a small hook, by which the tube can be suspended if necessary, closed it very strongly, and annealed the extremity carefully, wrapped the tube in cotton wool, and inverted it. The sulphuric acid attacked the marble, and carbonic acid was given off no doubt in great quantity.



For the first few days there was nothing particular to be noticed. The tube was filled with a bubbling mass of liquid and white mud. Latterly, however, it has begun to show the phenomena which Prof. Quincke observed. The liquid now no longer wets the glass as it did at first, but creeps away from it, giving very much the appearance of the "tears of strong wine." Day by day this is getting more marked, and I expect that soon, as was the case in the Heidelberg tubes, the acid will roll about in the tube like so much quicksilver. Meantime it is most interesting to watch.

I believe Prof. Quincke considers that a thick layer of gas is condensed over the surface of the glass, and that it is this which gives rise to the very peculiar capillary phenomena that present themselves.

I feel bound to remark that the experiment is one that ought not to be attempted without great care and caution.

J. T. BOTTOMLEY

Physical Laboratory, University of Glasgow, July 15

On the Colours of Double Stars

If any light whatever has its intensity increased the effect on the eye is to add to the sensation a certain yellow element which I have accurately defined by experiment (*Am. Jour. Sci.*, April, 1877, vol. xiii. p. 247). A red light brightened becomes yellower, a green light yellower, a yellowish white less white, a blue or violet light whiter. The phenomena are described at length in Prof. Rood's "Modern Chromatics." The fact that an incandescent body becomes less red and more yellow when it is heated is probably due to this physiological principle. That the incandescent body ultimately becomes white is probably owing to some not understood modification of the principle for excessively bright lights.

It follows that if two stars are of unequal brightness they will appear of different colours unless the qualities of the two lights have a peculiar relation to one another; and the brighter star will usually be the yellower. Accordingly, if we refer to Mr. Burnham's lists of binaries recently published by Prof. Holden (*Am. Jour. Sci.*, June, 1880, vol. xix. p. 467) we find that although differences of colour are so little distinguished that three-quarters of all the pairs are considered to be of the same colour, yet of the twenty-four pairs which differ in brightness by two magnitudes