may best be exhibited so as to satisfy all the purposes for which they are intended. M. Felix Plateau, at a former meeting, proposed to substitute yellow for colourless glass in lighting rooms containing entomological collections. In the discussion which followed it was suggested that experiments should be made by submitting insects to the influence of glasses of various colours. M. Capronnier was entrusted with carrying out these experiments, and the paper referred to contains his report.

Everyone knows that among the Lepidoptera it is the green and carmine colours which are most rapidly destroyed by daylight. M. Capronnier wished to obtain insects of the year's hatching, but could only obtain sufficient quantities of *Euchelia Jacobæa*, L. The inferior wings of this insect are of a deep carmine, uniform in tone, an important point in the experiments.

The principal colours of the solar spectrum are the yellow, the red, the blue. M. Capronnier rejected the red as giving a tint too dark, and added the mixed colours, violet and green. He had thus four tints chosen with the same degree of tone, and of a moderate shade—yellow, violet, green, and blue, besides a colourless glass. He made five small square boxes of ·08 centimetres square and one centimetre in depth; the whole surface was covered with one of the above-mentioned glasses.

Each wing was fixed in the middle of the box and floated in a bath of very bright light, but protected from the rays of the sun. Each of the wings was partly covered by a band of black paper, and their position was so arranged as to leave exposed successively each of the parts during a period of fifteen, thirty, and ninety days. The following are the results:—

Colourless glass.—After fifteen days of exposure the carmine tint was visibly attacked. After thirty days the alteration was more sensible, and after ninety days the work of destruction had rapidly advanced, and the carmine had passed into a yellowish tint.

Blue.—With this tint the same alterations took place as in the case of colourless glass.

Green.—This colour preserved the carmine during the first fifteen days; a change was indicated on the thirtieth day, and on the nintieth the alteration was marked.

Yellow.—During the ninety days the yellow alone left the carmine colour almost intact. M. Capronnier says *almost*, for a slight alteration in the tint could be noticed at the end of the ninety days. This last observation proves that there is no absolute preservative, and that collections must be kept in darkness, under penalty of seeing them seriously changed at the end of a given time.

Nevertheless, it is evident from the above that the yellow is the best preservative against alterations in the colours of insects. M. Capronnier consequently concludes that a yellowish colour should be preferred and combined in every arrangement of an entomological room. Moreover the cloths that cover the show-cases ought to be yellow rather than green, and what is important and indispensable, the window-blinds ought to be absolutely yellow.

RADIOMETERS[1]

DURING the discussion which followed the reading of Prof. Reynolds's and Dr. Schuster's papers at the last meeting of the Royal Society I mentioned an experiment bearing on the observations of Dr. Schuster. I have since tried this in a form; and as the results are very decided and appear calculated to throw light on many disputed points in the theory of these obscure actions, I venture to bring a description of the experiment, and to show the apparatus at work, before the Society.

I made use of a radiometer described in a paper communicated to the Society in January last. I quote the description from paragraph 184. "A large radiometer in a 4-inch bulb was made with ten arms, eight of them being of brass, and the other two being a long watch-spring magnet. The discs were of pith, blackened on one side. The power of the earth on the magnet is too great to allow the arms to be set in rotation unless a candle is brought near, but once started it will continue to revolve with the light some distance off."

This radiometer was floated in a vessel of water and four candles were placed round it, so as to set the arms in rotation. A mark was put on the glass envelope so as to enable a slight movement of rotation to be seen. The envelope turned very slowly a few degrees in one direction, then stopped and turned a few degrees the opposite way; finally it took up a uniform but excessively slow movement in the direction of the arms, but so slow that more than an hour would be occupied in one revolution.

A powerful magnet was now brought near the moving arms. They immediately stopped, and at the same time the glass envelope commenced to revolve in the opposite direction to that in which the arms had been revolving. The movement kept up as long as the candles were burning, and the speed was one revolution in two minutes.

The magnet was removed, the arms obeyed the force of radiation from the candles, and revolved rapidly, whilst the glass envelope quickly came to rest and then rotated very slowly the same way as the arms went.

The candles were blown out; and as soon as the whole instrument had come to rest, a bar-magnet was moved alternately from one side to the other of the radiometer, so as to cause the vanes to rotate as if they had been under the influence of a candle. The glass envelope moved with some rapidity (about one revolution in three minutes) in the direction the arms were moving. On reversing the direction of movement of the arms the glass envelope changed direction also.

These experiments show that the internal friction, either of the steel point on the glass socket, of the vanes against the residual air, or of both these causes combined, is considerable. Moving the vanes round by the exterior magnet carries the whole envelope round in opposition to the friction of the water against the glass.

As there is much discussion at present respecting the cause of these movements, and as some misunderstanding seems to prevail as to my own views on the theory of the repulsion resulting from radiation, I wish to take this opportunity of removing the impression that I hold opinions which are in antagonism to some strongly urged explanations of these actions. I have on five or six occasions specially stated that I wish to keep free from theories. During my four years' work on this subject I have accumulated a large fund of experimental observations, and these often enable me to see difficulties which could not be expected to occur to an investigator who has had but a limited experience with the working of one or two instruments.

[1] "On the Movement of the Glass Case of a Radiometer." By William Crookes, F.R.S., &c. Read at the Royal Society.

COMPRESSED AIR LOCOMOTIVE USED IN THE ST. GOTHARD TUNNEL WORKS[1]

THE boring of a tunnel of any importance presents difficulties of various kinds, among which may be mentioned the clearing away of the rubbish arising from the excavation of the gallery, whenever that reaches any considerable length, and the work is carried on with activity. Such were the conditions under which the boring of the Mont Cenis tunnel was carried on, and M. Fabre, the able contractor, has met with similar difficulties in the boring of the St. Gothard tunnel, now being carried out.

[1] From an article in *La Nature*, by M. C. M. Gariel.