LETTERS TO THE EDITOR.

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Pianoforte Touch.

I HAVE read Prof. Bryan's piano-player article in NATURE, and wish to congratulate him on seeing so early the wonderful capacity of the pneumatic player. I entirely agree with him. Long ago I have done work like his, though very crudely. Thus I always played with the *feet*, sitting on a pivoted swinging chair, and I constructed an arrangement in which, by means of two strings, I had some control of the touch. It was a partially successful attempt at most. I also fixed up a "dead stop" string operating a brake on the engine, by which pauses could be made at the proper places. I am sure Prof. Bryan's way is immensely superior.

It is very singular that some of the compound touch problems are of a transcendental nature. They cannot be solved by common, rigorous mathematics, but only by my new mathematics. At Prof. Perry's suggestion I made this a feature of one of my books. It was full of compound touch problems insoluble (so I was told) by rigorous mathematics, though the rigorous mathematicians cannot deny the results. It is because their ideas concerning functions are not broad enough. I have also been thinking about the theory, and think it will be more difficult than appears in Prof. Bryan's paper, because his touch variations are secondary to those of the player itself, due to the way the holes are cut and their overlap in the music-rolls. The results are sometimes not good. Another thing, I have considered the piano itself to be a rather imperfect instrument. We get used to its faults; is that any reason they should be made virtues?

I consider the piano-player does for music what the printing press did for books. But while, after reading a book once, you generally never wish to read it again, it is impossible to appreciate elaborate technical compositions without playing them over and over again. So there is something to be said for the playing by children and men even in the most mechanical and unintelligent way.

OLIVER HEAVISIDE.

A Peripheral Effect with X-Radiation.

WHILST repeating the now well-known experiments of Barkla, Laue, and others we have accidentally met with some remarkable effects upon which we should like to invite judgment. By inadvertence the edge of a piece of mica intercepted a direct beam of X-rays, and the recording photographic plate shows pronounced black and white bands along the X-ray shadow of the edge of mica. Further experiments with mica, glass, and metals also gave the effect, the edge of the shadow being bounded by a well-defined black band in the dark portion of the field with a light band in the lighter half.

An extended series of experiments was then made using lead foil cut into thin strips from one to five layers in thickness, mounted on glass, and placed in the direct beam of X-rays; no screen of any kind being employed, as was the case in the preliminary experiments. The distance of the photographic plate, placed behind and parallel to the mounted pieces of lead, was varied from 3 mm. to 5 cm., and that of the anti-kathode to the obstacle from 26 to 450 cm. Under these varied conditions of distance dark and light bands along the edges were obtained on the negative. The X-ray bulb had a fine focus, and exceedingly sharp X-ray shadows were obtained, especially at distances between 200 and 450 cm., a fact to which the observance of these bands is greatly due.

The width of the bands in these lead strip experiments is roughly 0·1 to 0·2 mm., but in the preliminary mica and glass experiments they were much broader, being about 0·5 mm. in width. These bands are distinctly visible under a low-power microscope, whilst under favourable conditions of illumination they are plain without artificial aid, and the same remarks apply to their prints. They are seen also when thrown upon a screen, and these facts seem to preclude the suggestion of their being contrast or optical effects, as was supposed by Haga and Wind in their well-known attempts to demonstrate diffraction. That they are not diffraction effects comparable with those of light is shown by their not varying appreciably in width as the photographic plate is varied behind the mounted strips of lead foil. Nor should these bands be confounded with those which appear upon the portion of the beam reflected from crystalline surfaces (which we also obtained), and have been described by de Broglie and Lindemann; although we are disposed to admit a possible physical connection.

Bands of similar width and appearance have been obtained with other metals, such as iron, zinc, copper, and aluminium, and in one case where an attempt was made to obtain direct refraction the white band appears between the transmitted and the direct beam. The apparent constancy of width and appearance under widely different conditions is a baffling point, arguing *prima facie* an optical or photographic effect. Yet against this is to be set the fact that so far mica and glass have given bands several times as wide as those from metals.

Attempts to vary the bands from metals by passing electric currents through them, and by high temperatures, have given so far negative results, though it may be desirable to mention the fact that in the latter case images of cold wires appear distinctly brighter in the negative. In one experiment, in addition to bands, a remarkable halo appears at a distance of 1·9 cm. from the image of the circular orifice in a metal screen. In another case a black band of approximately equal intensity to the image given by the direct beam appears surrounded by a white area, and in the same position, *i.e.* between the direct and reflected images. The fact that this band is black in the negative shows that the effect cannot be due to absence, in this position, of the generally scattered radiation which may have fogged the plate.

An explanation of grounds of halation, or reflection from the back of the plate, is, we need scarcely say, inconsistent with the accepted theory of X-radiation. The solution to which we may be reduced is that the bands are due to some edge or peripheral condition of the substance depending upon abrupt discontinuity of the media (mica, air), since a mere scratch or break in the surface does not produce the bands. Increase of density along the edges due to surface tension would appear to be of too small an order to account for the phenomenon. A subjective appearance of bands may invalidate some of the cases with metals, but in others (especially that with a halo suggestive of an X-ray spectrum) actuality is beyond doubt.

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