we have yet seen. We recommend the book not only to those directly interested in the scientific aspect of brewing, but also to those chemists and biologists whose work in any way trends in the direction of brewing or malting problems.

Oberharzer Gangbilder. By Dr. Phil. B. Baumgärtel. Pp. 23+six plates. (Leipzig: Engelmann, 1907.) Price 7 marks.

THE text of this book describes the geological features of the Upper Harz, and the mineral veins that, according to von Koenen, were injected into the old rocks of the region as recently as Miocene times. It serves as an introduction to six very beautiful photographs of large rock-surfaces in the mines. The various minerals of the lodes have been coloured in effective but harmonious tints, so that the relations of each can be traced out precisely. This combination of photographic accuracy with diagrammatic clearness may serve as a model for reproductions in other branches of science. The old coloured geological landscapes of the days of Weaver and Delabeche occur to one's mind, and might thus with advantage be revived.

G. A. J. C.

LETTER TO THE EDITOR.

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Atmospheric Absorption of Wireless Signals.

IN the *Electrical Review*, May 11 and 18, the writer has given curves which show that telegraph messages exchanged between Scotland and Massachusetts are received on some nights with practically no absorption, while on other nights and in daytime nine hundred and ninety-nine one-thousandths (0·999) of the energy is absorbed.

The fact that the daylight absorption was largely reduced between two stations 150 miles apart in Brazil by the use of a longer wave-length suggested that the masses of ionised air which are supposed to produce the absorption are broken up somewhat as clouds are. During the past six months experiments have been made between Massachusetts and stations at Porto Rico, Cuba, Washington (D.C.), and New York which seem to point to the same conclusion.

Two types of transmitting apparatus were used.

The first was an alternating-current dynamo giving 250 sparks per second and generating feebly damped waves. The energy used was between 10 and 12 kw., and the frequencies used were 200,000 per second and 81,700 per second.

Messages sent with the higher frequency from Massachusetts were received very strongly at night-time at Porto Rico and Cuba, and were officially reported on several occasions as having been received by naval vessels in the neighbourhood of Alexandria, Egypt (a distance of nearly 4000 miles), but no messages were received during daytime. The absorption comes on very suddenly, and in the West Indies increases sometimes nearly a thousand-fold in fifteen minutes as the sun rises.

With the longer frequency, however, though at night signals were considerably weaker, probably on account of the receiving stations not being adapted for such a long wave-length, the daylight signals were many times stronger, and it was found possible to work in daylight between Massachusetts and Cuba (a distance of nearly 1700 miles) when using the lower frequency without any increase in sending power. Tests between Boston and Washington now continuing for nearly six months show the same phenomena, *i.e.* that there is great daylight absorption at a frequency of 200,000, but almost no absorption at a frequency of 81,700.

The second type of apparatus used consisted of a high-frequency alternator capable of giving a frequency of 100,000, but for the purposes of this test run at a frequency of 81,700. The open-circuit voltage at this frequency is 150 volts, and its armature resistance six ohms. This apparatus is used for telephoning wirelessly between Brant Rock, Massachusetts, and the City of New York. A detailed description of a similar but less powerful apparatus used for telephoning between Brant Rock and Plymouth, Massachusetts, will be found in the *Electrical Review* of February 15, 22, and March 1, and in the *American Telephone Journal* of January 26 and February 2. The current used in the antennæ is from four to six amperes, and the speech received by the New York station is approximately five or six times louder than the limit of audibility. Tests have now been made with this apparatus over a period of nearly a month, wireless telephonic communication having been first established between these points about July 17. While this apparatus has not been tested for so long a period as the former type, the results obtained are in substantial agreement.

If the masses of ionised air were continuous there is no apparent reason why there should be less absorption with a long wave-length. The above experiments seem to point to the conclusion that the masses of ionised air which are supposed to produce the absorption are not continuous but are broken up in somewhat the same manner that water vapour is into clouds.

The fact that the wave-lengths must be increased as the transmission distance is increased in order to overcome the absorption does not necessarily indicate that the masses are of larger size as the distance above sea-level increases, though it is possible that this is the case.

The writer has found that the absorption at night-time varies with the direction from which the waves are received, and has obtained some results which seem to indicate that measurements of this phenomenon may have a meteorological value, and may assist in extending the range of weather forecasts.

REGINALD A. FESSENDEN.

Brant Rock, Mass., August 9.

PRACTICAL TELEPHOTOGRAPHY.

EARLY in 1881 I described in NATURE (vol. xxiii., p. 334) an experimental apparatus for the electrical transmission of pictures to a distance, in which use was made of one of the sensitive selenium cells devised a few months previously (*ibid.*, p. 58). Fig. 1 shows the arrangement diagrammatically. The transmitting cylinder T is mounted upon a screwed spindle, which moves it laterally through 1/64 inch at each revolution; a selenium cell S is fixed behind the pinhole H, 1/20 inch in diameter, and is electrically connected through the spindle with the line wires L, E; the picture to be transmitted—about two inches square—is projected upon the front surface of the cylinder by the lens *l*. The brass receiving cylinder R is of the same dimensions as T, and is similarly mounted; F is a platinum stylus, which is pressed vertically against the metal by the flat spring G; W is a variable resistance, and B_1, B_2 are batteries at the transmitting and receiving stations respectively. A piece of paper moistened with a solution of potassium iodide is wrapped round R, and, the pinhole H having first been brought to the brightest part of the focussed picture (thereby reducing the resistance of S to its minimum value), the resistance W is adjusted so that no current passes along the "bridge" C D, which, assuming the two batteries to be equal, will be the case when the resistance of W is the same as that of S. If now the Se cell is darkened, its resistance will be increased and a current will pass through the receiver in the direction C D, liberating iodine at the point of the stylus F.

To transmit a picture, the two cylinders are caused to rotate synchronously, at the same time moving from end to end of their traverses; in the course of its spiral path the pinhole H covers successively every point of the focussed image, the illumination of the Se cell being proportional at any moment to the brightness of the spot occupied by the pinhole; the consequent variation in the resistance of the cell causes the stylus F to trace upon the paper a brown line which is lighter or darker in correspondence with the illumination of the Se. The close spiral line with breaks in its uniformity constitutes a picture, which should be a counterpart of that projected upon T. The earliest achievement of the apparatus consisted in the reproduction of the image of a hole cut in a piece of black paper; after some improvements simple black and white pictures painted upon glass were very perfectly transmitted, as was demonstrated upon several occasions when the apparatus was exhibited in operation.[1] It was, however, unable to cope with half-tones, and owing to pressure of work the experiments were shortly afterwards discontinued.

The problem of telegraphic photography has recently been attacked with conspicuous success by Prof. A. Korn, of Munich, whose work is described in a little book entitled "Elektrische Fernphotographie und Ähnliches" (Leipzig, 1907). His latest

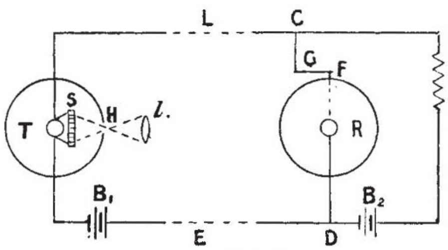

Fig. 1.

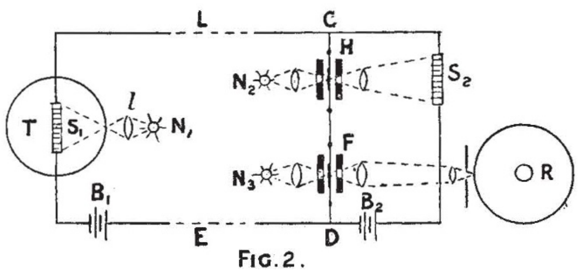

Fig. 2.

method is indicated in Fig. 2. The transmitting and receiving cylinders T, R turn synchronously on screwed axes, the regulating mechanism of the receiver is situated in the bridge C D, and a suitable resistance is placed at S_2. A celluloid film negative of the picture to be transmitted is wrapped round the cylinder T, which is made of glass. The light of a Nernst lamp N_1 is concentrated by a lens upon an element of the film, through which it passes more or less freely according to the translucency of the film at the spot, to the Se cell S_1, which is fixed in position, and does not, like mine, move with the cylinder; thus the resistance of the Se is varied in correspondence with the lights and shades of the picture. The receiving cylinder R is covered with a sensitised photographic film or paper, upon a point of which light from a lamp N_3 is concentrated. Before reaching the paper the light passes through perforations in two iron plates at F, which are, in fact, the pole-pieces of a strong electromagnet; between these is a shutter of aluminium leaf, which is attached to two parallel wires or thin strips forming the bridge C D. When there is no current through C D, the opening is covered by the shutter; when a current traverses the wires, they are depressed by electromagnetic action, carrying the shutter with them, and a quantity of light proportional to the strength of the current is admitted through the perforations. By means of this "light-relay," as it is termed, the intensity of the light acting at any moment upon the sensitised paper is made proportional to the illumination of the selenium in the transmitter.

It remains to mention a device of admirable ingenuity which has rendered it possible to transmit half-tones with fidelity. In its response to changes of illumination selenium exhibits a peculiar kind of sluggishness, to which reference was made in my old article: "Some alteration takes place almost instantaneously with a variation of the light, but for the greater part of the change an appreciable period of time is required." Prof. Korn has succeeded in eliminating the effects of the sluggish component by substituting for my box of resistance coils R a second

Fig. 3.

Se cell S_2, which is as nearly as possible similar to S_1, and which, by means of a second light-relay H, placed in series with the first, is subjected to similar changes of illumination. Thus any subpermanent fall in the resistance of S_1 due to the action of light is compensated by an equal fall in that of S_2, and only such changes as respond immediately to the varying illumination of S_1 are utilised for regulating the transmission current.

Such is in brief outline the nature of the new process. As regards the many carefully considered details which have made it a practical success, those interested will find ample information in the pamphlet mentioned above. The apparatus has been worked with excellent effect over long distances; a specimen of its performance, for which I am indebted to the kindness of Prof. Korn, is given in Fig. 3. The parallel lines traced by the point of concentrated light—in this case about 50 to the inch—are easily recognisable.

Shelford Bidwell.

[1] Among others, at the Telegraph Engineers' *soirée* in 1881 (*see* Nature, vol. xxiii., p. 563).