

use of half-watt lighting for studios by the portrait photographer, some fuller means must be found for expressing the characteristics of a plate and for interpreting its properties. T. THORNE BAKER.

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Excitation of Forbidden Spectral Lines.

HANSEN, Takamine, and Werner (*Kgl. Danske Videnskab. Selskab Mathfys. Medd.* 3) have observed the line $1S - 2p_1$ (Paschen's notation) of mercury in a condensed discharge, and Takamine and Fukuda (*Phys. Rev.* 25, p. 23, 1925) have found the line strongly developed in the glow of a branched arc. We have excited this line, the corresponding line of zinc, and both $1S - 2p_1$ and $1S - 2p_3$ of cadmium in the positive column of a hot-cathode discharge. The positive column was viewed end-on while the cathode glow was confined to a side tube. The potential difference across the entire tube was of the order of 100 volts, but the tubes employed were of such length, 30 to 100 cm., that the voltage drop per mean free path of an electron was quite small. The spectrum is strictly of the arc type, only a few of the more readily excited spark lines appearing, and these in comparatively low intensity.

The cadmium lines, $\lambda\lambda$ 2239, 2267, 2307 and 2329, were sharply absorbed by the positive glow, a spark under water or discharge in a hydrogen tube being used as the continuous background. These lines have been independently classified by both Ruark and Paschen (unpublished) as belonging to the group $2p - 2p^1$. Other members of this group involving transitions from the $2p_1^1$ level were definitely not present in absorption. An unknown line at $\lambda 3086.7$ appeared on some of the exposures as a weak but sharp absorption line.

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Radio Reception on Frame Aerials.

EXPERIMENTS in the reception of medium-powered distant broadcast stations on small frame-aerials of particularly small high-frequency resistance, with the use of correspondingly light reaction-coupling of the type usually associated with the name of Reinartz, appear to indicate that the commonly-accepted ideas as to the magnitude of the high-frequency voltages which can be registered on such aerials with small total tuning capacities across them, in these circumstances, require some modification.

With a frame of approximately circular form and 1 m. diameter, with 11 turns of thin bronze strip 6 mm. wide, spaced at 8 mm. in the form of a flat spiral (2 extra turns providing the Reinartz reaction-coil); and using a detector-valve and one transformer-coupled audio-frequency amplifying valve, both of amplifying factor $M = 20$, I was able to observe clearly intelligible speech and music from about thirty British and Continental stations, ranging from Aberdeen to Rome, in the course of one Sunday evening, in a quiet high point 35 miles N. of London, and on the first floor of a substantially-built house. Many of these stations, including the last mentioned, were later audible on a loud-speaker in a very quiet room; corresponding to a R.M.S. audio-signal-voltage of an average order of 0.3 volts. I had

previously observed that, with an additional high-ratio transformer-coupled audio-frequency amplifying valve (three valves in all), at least two American broadcast stations could occasionally be heard, subject to the usual fading, on an even smaller aerial.

The tuning and reaction-control were of an unusually fine order; and oscillation-hysteresis had to be carefully eliminated. The signal-voltages observed here appear to be inconsistent with the usual estimates, and suggest also a revision of current practice in "radio-frequency amplification."

A. D. COWPER.

An Experiment with a Stroboscope.

ON page 543 of vol. III. of the "Dictionary of Applied Physics," an experimental arrangement is described where the stroboscope disc is illuminated by an intermittent light, using a neon-tube, an induction coil, and an electromagnetically controlled tuning-fork. The same experiment can be performed in the light of an ordinary neon filled 110-volt Osclim lamp to which current is supplied from an alternating-current lighting circuit. If the laboratory supply is of continuous current, then the arrangement can be considerably improved with the use of a rotary convertor the speed of which can be regulated so that the frequency of the intermittent light can be ascertained directly with a speedometer and stopwatch. As a demonstration experiment this arrangement is particularly convenient, since both the stroboscopic disc and the frequency of the source of light can be varied at will, and very interesting effects may be observed.

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The Crisp Collection of Microscopes.

MAY I add a note to the brief statement referring to the Crisp collection of microscopes in NATURE of February 14, p. 241? Doubtless it is true that on occasion the late Sir Frank Crisp may have led the authorities to believe that he contemplated leaving his collection to the Science Museum at South Kensington, but it is equally true that his chief desire was to see his collection used for the preparation of a comprehensive history of the microscope in amplification of Mayall's Cantor Lectures, printed in 1886. Some years ago he asked me whether I would be willing to compile such a history, and he gave me a few notes on his instruments for the purpose. Last week I received a letter from my friend Prof. Poulton, in which he recalled a conversation with Sir Frank Crisp. "I remember his telling me that he did not know what to do with it (the collection), and I tried to persuade him to leave it to the Pitt Rivers Museum. If the collections now in the Old Ashmolean had been there, then I expect he would have left it to Oxford." This I believe to be the truth. Sir Frank Crisp did not desire to duplicate the series in the possession of the Royal Microscopical Society, or that his collection should be merged in a larger one, and only be partly exhibited. But the facts that many of the parts of the instruments have got mixed, that historic examples have been divorced from their history, that the collection has been distributed without having been properly catalogued, is an international calamity.

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February 14.