are now being reported without an examination of the evidence itself, I feel compelled to direct attention to the nature of the observations, and to say that in my opinion they are of a kind inadequate to justify the kind of deductions which have been made from them about the kinetics of these reactions.

C. N. HINSHELWOOD.

Physical Chemistry Laboratory,
Balliol College and Trinity College,
Oxford.
May 2.

[1] For example, *Proc. Roy. Soc.*, A, **149**, 340, 355 (1935); A, **146**, 345 (1934); A, **115**, 215 (1927).
[2] For example, *Proc. Roy. Soc.*, A, **146**, 334 (1934).
[3] *Proc. Roy. Soc.*, A, **156**, 234 (1936) Table VI.

Electron Multiplier as an Electron Counting Device

IN an earlier communication[1], I have described the possibility of using an electron multiplier, based on the secondary emission principle, for the detection of individual electrons by cooling the multiplier for the purpose of suppressing the thermal emission in liquid air. I stated there that this method of counting individual electrons does not necessarily require the use of liquid air, provided multiplying electrodes, with fairly great secondary emission factor and sufficiently high work function are used. There is a large discrepancy in the data of various papers published on the subject of work function and secondary emission of a surface. Experiments had to be carried out to determine whether a surface satisfying our requirements could be found, and we found the following surface satisfactory from the above point of view:

Very thin layers of barium oxide on a nickel base activated by the method normally used for oxide-coated cathodes will easily give a multiplication factor of $T = 2{\cdot}5$, with a primary electron velocity of 200 volts. A multiplication of about 10,000 times was achieved in a ten-stage multiplier. The thermionic emission (at room temperature) and field emission of the active surfaces in this multiplier are negligible.

On this basis an apparatus was built consisting of the above multiplier and an amplifier with a cathode ray tube. The zero effect of the counting device was about 5 per minute. It was possible to detect individual electrons emitted by the cathode when illuminated by a very weak beam of light or by heating the cathode by a built-in heater. The small zero effect is probably due to cosmic rays. The device can also be used for the counting of gamma rays.

The maximum resolving ability of the above multiplier with an amplifier of suitable construction is 10^{-8} sec.; this greatly surpasses that of the gas-filled counters.

Further details will appear in a paper to be published elsewhere.

Z. BAY.

Tungsram Research Laboratories,
United Incandescent Lamps and
Electrical Company,
Ujpest, nr. Budapest.
April 25.

[1] Bay, Z., NATURE, **141**, 287 (1938).

Rectifying Properties of Crystals

B. K. Sen[1] has recently reported in NATURE, that the rectifying properties observed by Khastgir[2] were found also in some crystals having a centre of symmetry. As in this case a volume rectification must be excluded, Sen concludes that generally the observed rectifying properties should be ascribed to a superficial phenomenon.

So long ago as 1935, I reported the results of experiments on unipolar conduction in carborundum monocrystals, in the direction of the principal polar axis. The experimental procedure I used enabled me to distinguish between a superficial rectification of the 'blocking layer' type, and a true volume rectification. This volume rectification is very less marked and in opposite direction to the surface rectification.

The facts observed by Khastgir must be ascribed substantially to a very strong superficial effect. On the other hand, my experiments demonstrate the existence of a true volume rectification, the existence of which is a natural consequence of the lack of symmetry in a crystal with polar axis[4].

There are thus three different cases:

(1) Deaglio's experiments (true volume rectification).

(2) Khastgir's experiments on carborundum (energical surface rectification concealing the volume rectification).

(3) Sen's experiments on crystals with centre of symmetry (surface rectification only).

ROMOLO DEAGLIO.

Istituto Elettrotecnico Nazionale,
Turin.
May 7.

[1] Sen, B. K., NATURE, **140**, 1102 (1937).
[2] Khastgir, S. R., NATURE, **135**, 148 (1935); Khastgir, S. R., and Das Gupta, A. K., *Indian J. Phys.*, **9**, 235 (1935).
[3] Deaglio, R., *C.R.*, **200**, 1303 (1935); *R. Acc. Scienze Torino*, **70**, 626 (1935).
[4] Osterberg, H., *Phys. Rev.* (2), **50**, 1187 (1936).

Formation of Negative Ions at Surfaces

IN a recent series of papers[1], one of us (F.L.A.) has discussed experiments, carried out with the assistance of Dr. J. C. Milligan, which led to the discovery of a new process of negative ion formation. This process was the formation of negative ions at metal surfaces by bombardment of the surface with positive ions, the negative ion being presumably formed by the positive ion capturing two electrons from the surface. After acceleration away from the surface, the negative ion has an excess energy which is acquired from the acceleration of the positive ion towards the surface. Dr. R. A. Smith[2] has recently carried out a quantum theoretical investigation of the above process which satisfactorily accounts for the experimental results.

Further work carried out during the past year has shown that the negative ion emitted from the surface need not necessarily be of the same element as the positive ion which leads to its formation. Sloane and Press[3] report in to-day's NATURE that they have repeated these experiments and have come to the same conclusion.

Our new results show that five peaks of light negative ions are obtained by the mass-spectrograph