skin temperatures on the same site were taken using a thermistor thermometer (kindly supplied by Dr. Findlay of the Hannah Dairy Research Institute, Kirkhill, Scotland). Unshaded atmospheric temperatures were also recorded at each time of measurement.

All wet- and dry-bulb readings were expressed as 'dew point', and it is suggested that a convenient method of expressing the difference between atmospheric humidity and the humidity of the air passing close to the skin of the animal would be the ratio of the animal dew point to the atmospheric dew point. Figures calculated on this basis are included in Table 1, which shows the results of readings taken on three mature Tanganyika zebu bulls which were walked a measured distance around an open paddock. Readings were taken before walking commenced and at 1 mile, 2 miles, 4 miles and 7 miles. Walking commenced at 08.00 hr., and approximately four minutes elapsed between measurements relating to each animal at the various distances.

The animals were not allowed to graze until after the seventh mile. The results in Table 1 show that the instrument is capable of demonstrating minor fluctuations in moisture exuded from the skin of cattle under relatively dry conditions, and the high readings obtained after the seventh mile suggest that prolonged exercise causes 'sweating' in the Tanganyika zebu.

The work is continuing, and a more complete report will be given elsewhere. I am grateful to the Director of Veterinary Services, Tanganyika Territory, for permission to publish this communication.

R. M. MABON

Livestock Research Section,
Veterinary Research Laboratory,
Mpwapwa,
Tanganyika Territory.
Sept. 10.

Thermionic Constants of Semi-Conductors

IN some recent papers[1], we have described a convenient method of determining the thermionic constants of metals. The method consists essentially in determining, at different known temperatures, the rate of effusion of electrons through a small hole in a thin wall of a chamber made of the metal, instead of determining the direct emission from the surface. The advantage of the effusion method over the emission method is this. The expression for emission involves the transmission coefficient of the surface for electrons having the requisite momentum to cross the surface. This coefficient is very sensitive to adsorption of gases at the surface, and may differ considerably from unity. This coefficient, however, is eliminated in the expression for effusion, in the same manner in which the emissivity of the surface for electromagnetic radiations is eliminated when we take the electromagnetic radiations from a cavity through a small hole, instead of directly from the radiating surface. When the transmission coefficient is eliminated, any observed deviation of the A-coefficient in Richardson's equation from its theoretical value may be attributed to a small linear variation of the work function with temperature. Thus one is enabled by this method to determine not only the work function correctly, but also its temperature coefficient.

The thermionic constants of several metals have been determined by this method, using for this purpose a graphite chamber the walls of which were coated completely with the metal under study, by thermal or electrolytic deposition.

The main purpose of this communication is to direct attention to a new application of this method, namely, for the determination of the thermionic constants of semi-conductors, and to report some preliminary results obtained with nickel ribbons coated with the triple carbonates of barium, strontium and calcium in the molar percentages 47·5, 46·0 and 6·5 respectively. The ribbons were kindly supplied by Dr. D. A. Wright, of the Research Laboratories of the General Electric Co., Ltd., at Wembley. The ribbons were cut into pieces about 2 cm. in length, and a sheaf of them, held together at one end by a platinum foil, was fixed to the back of the graphite chamber, so that the ribbons did not come directly into contact with the graphite surface. The total surface area of these ribbons was more than twenty-five times the area of the effusion hole in our earlier measurements, and about fifty times in our later ones. The coated filaments were activated in the usual manner, and the effusion currents, corresponding to the saturation electronic vapour pressure of the oxide coat, in the temperature range 950°–1,160° K., were measured in the same manner as in our measurements on metals. (The electronic vapour pressure due to graphite, or platinum, is negligible at these temperatures.)

The currents corresponding to zero field were found to fit well with Richardson's equation, with $\varphi = 1{\cdot}55$ eV., and $A = 48$ amp. cm.$^{-2}$ deg.$^{-2}$. The latter value corresponds to a temperature coefficient of the work function $d\varphi/dT = 8 \times 10^{-5}$ eV. per deg., which is of the same order as in many metals. At 1,000° K. the current corresponding to effusion over the whole of the 2π-solid angle would be about 0·75 amp. per sq. cm. The corresponding current obtained by Elizabeth Grey[2] for maximum space-charge-limited pulsed emission directly from the surface of the oxide coat is 8 amp. per sq. cm., which is about eleven times as great. This ratio is of the order to be expected.

We thank Dr. Wright for supplying the coated ribbons, and for helpful discussions.

K. S. KRISHNAN
S. C. JAIN

National Physical Laboratory of India,
New Delhi.
Nov. 27.

[1] Jain, S. C., and Krishnan, Sir K. S., *Proc. Roy. Soc.*, A, **213**, 143, and **215**, 431 (1952).

[2] Grey, Elizabeth, *Nature*, **167**, 522 (1951).

Use of Krypton-85 in measuring Gas Clean-up Rates

THE intensity of gas discharges in switching devices for radar duplexers is such that clean-up of the rare-gas filling is an important factor, and may determine the life of such valves. Radioactive krypton, Kr-85 [1], has been used for measuring the rate of rare-gas clean-up in pre-T.R. valves, with promising results. Krypton-85 has a half-life of ten years and emits mainly beta radiation (680 keV.) and some gamma radiation (500 keV.). Thus it is a most convenient isotope to use, the radiation being readily detected by Geiger-counter or photographic techniques.