

could be altered by using capillaries of different bore, and filaments of different resistance.

With the aid of this instrument as a reference, an examination was made of some ordinary commercial vacuo-thermocouple milliammeters, in which the heaters are made of various well-known resistance alloys, and the thermocouple is separated electrically from its heater. One type of instrument tested contained a heater of one of the nickel-chromium-iron alloys; and a calibration of this instrument showed that its readings were subject to errors of more than 25 per cent for currents of less than half the maximum, this error falling relatively sharply to about 1 per cent over the top third of the current range. An investigation of this phenomenon showed that the material of which the heater wire was made was ferromagnetic at room temperature, but that the Curie point occurred at about 70° C., which was well within the working temperature range of the heater when supplied with its normal current. A simple method of examining the magnetic properties of the heater wire provided a confirmatory demonstration of this effect, and also enabled other samples of wire to be selected with the Curie point outside the working temperature range. When some new thermocouple milliammeters containing heaters of this alternative material were calibrated against the air milliammeter at a frequency of 100 Mc./s., the readings of the new instrument were indistinguishable from those of the standard.

With the aid of the experience gained in this work, various patterns of vacuo-thermocouple instruments were designed for higher frequencies. Considerable care was necessary in arranging the calibrating apparatus; but the results showed that for the new instruments, which were made on a commercial basis, the calibration at 700 Mc./s. agreed with the low-frequency calibration within the limits of experimental error, which was not more than 1 per cent of the maximum current.

In the concluding section of his paper, the author points out that when two such instruments are connected in series as closely together as possible, their readings usually differ widely when the circuit containing them is supplied with current at 700 Mc./s. unless some unusually great precautions are taken. It is suggested that, in practice, the opportunities of applying such devices usefully as milliammeters will be few at frequencies greater than 100–200 Mc./s. Nevertheless, instruments of the types described will have wide applications of relative signal magnitude at higher frequencies, and they may also have an important use as milliwattmeters.

WEST CUMBERLAND AND ITS UTILIZATION

THE industrial region of West Cumberland coincides in the main with the coalfield and has its foci in the ports of Whitehaven, Workington and Maryport. With a total population of 150,000, there were 35,340 insured persons in 1932 and 36,870 in 1937. Out of the 1932 total, no less than 15,577, or nearly 45 per cent, were unemployed, and West Cumberland was scheduled as a depressed or 'special' area by the Special Areas Act of 1934. A careful and detailed study¹ by Prof. G. H. J. Daysh (at present directing the regional research work of the Ministry of Town and Country Planning) has surveyed the rise and fall of the chief industries and serves to

emphasize the overwhelming dependence on coal-mining, iron and steel—industries which were especially affected by the depression of the 'thirties. The activities of the Special Areas Commissioner, Mr. E. G. Sarsfield-Hall, aided by the West Cumberland Development Council, were accordingly directed towards securing a diversification of industry and particularly to attracting light industries able to employ the available female labour.

The War has seen not only a return of prosperity to the old industrial centres but also has witnessed the building of vast works in hitherto untouched country, thus extending very considerably the former industrialized area. The problem for the future is thus of even wider import than it was in 1939. In the White Paper on Full Employment, the Government has accepted the recommendations of the Barlow Commission relating to dispersal of industry, and it is almost certain that West Cumberland will be constituted a 'Development Area' in which the Board of Trade, as the responsible Ministry, will encourage industrial development. The appearance of a cyclostyled report² by a business man and practical engineer whose companies have works in the area is thus opportune, and in his plan Mr. W. C. Devereux suggests industries which will provide employment for an additional 9,145 persons (compared with 18,615 estimated to be required by existing industries). The new industries proposed fall into three groups: (a) textiles, including wool and rayon; (b) engineering and skilled metal work; (c) canning and processing of agricultural produce.

It is, unfortunately, far from obvious that the basic causes of depression in West Cumberland have been realized. With the development of electric power, industry, even heavy industry, is no longer tied to the coalfields, with the result that transport facilities have become the dominant factor in industrial location. Broadly speaking, West Cumberland is at the end (apart from limited sea-traffic through the ports) of a branch line both of railway and road from Carlisle, and the obvious location for new industry is Carlisle rather than the coalfield, since Carlisle is on a main route with Scottish markets on one hand and English on the other. The advocates of a main through west coast road, crossing the head of Morecombe Bay by a viaduct, have recognized the importance of placing West Cumberland on a main through road route with direct access to Lancashire. Incidentally, such a road would open up to tourist traffic the delightful stretch of coast, with its magnificent views of the Lakeland mountains, from Millom to St. Bees Head.

Physical planning is essentially the right allocation of land for all the varied needs of the nation, and the advent of the much criticized Board of Trade into the field of post-war planning creates many problems. The West Cumberland development area overlaps the proposed national park, and there is no doubt that if encouragement is given to the continuance of industry in some of its war-time locations, then the enormously important influx of wealth from holiday visitors will cease. Seaside holiday homes are at present occupied by munition workers: only a central planning authority can decide their rightful future use in the national interest.

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¹ "West Cumberland (with Alston), A Survey of Industrial Facilities". (Whitehaven: West Cumberland Development Council, Ltd., 1938.)

² "An Industrial Plan for West Cumberland, 1944." By W. C. Devereux. (Slough: High Duty Alloys, Ltd., Trading Estate.)