Letters to the Editor.

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The Constitution of Nickel.

My latest experiments have enabled me to obtain the mass spectrum of the element nickel by using the vapour of nickel carbonyl mixed with carbon dioxide. The ordinary discharge tube was employed to produce the positive rays, and difficulties of maintaining a steady discharge were overcome to some degree by the use of comparatively high pressure and a heavy current. The rays were analysed in the usual way by means of the mass spectrograph.

The spectrum consists of two lines, the stronger at 58 and the weaker at 60. They are most conveniently placed between the mercury groups of the third and fourth order, with which they can be compared with an accuracy of 1/10th per cent. The results were also checked by comparison with the CO_2 line 44, and appear to be integral within the above error. Nickel therefore consists of at least two isotopes. The intensities of the lines are about in the ratio 2 : 1, and this agrees with the accepted atomic weight 58·68.

F. W. ASTON.

Cavendish Laboratory, Cambridge, June 10.

A Novel Magneto-Optical Effect.

EARLY in April last, while my son, Malcolm Thomson, was operating, in a building of the River Works plant of the General Electric Co., a resistance welder for closing the seams of steel Langmuir mercury vacuum pumps, in which work the current is applied and cut off at about one-half second intervals, there was noticed by one of the working force, Mr. Davis, who happened to be favourably located, a peculiar intermittent illumination of the space near the welder as the current went on and off. My son at once placed himself in a similar position and saw the novel effect, and noted a number of conditions accompanying it, perhaps the most important being that a single-turn loop from the welding transformer to the work and back was carrying about 7000 amperes, and that the luminous effect was spread in the space in which would be located the magnetic field from this loop; that the sunlight was entering the building through high windows and shining across the space in which the field was produced at intervals; that the effect was most conspicuous when one looked towards the shadows and across the sunbeams, and also across the magnetic field.

This would be expressed by saying that the best effect was observed when the line of vision was downward at an angle intersecting the entering sunbeams, and into the shadows under the beam furnished fortunately by a partition a few feet high, over which the sunlight came. The magnetic field, neglecting the curvature of the lines, was, generally speaking, at right angles to the line of sight and to the direction of the sunlight. My son also noticed that the effect of increased luminosity was coincident with the putting on of the current, and disappeared at once on cutting off the field. It was thus clear that it depended on the establishment of the magnetic field. He reported these facts to me, and they were confirmed by me. Other observers were soon enlisted, and on several favourable sunny days all the above observations were confirmed by them. Further, my son had not been able to see any effect when looking across the sunbeam from the opposite side. This means that, with the sunbeams streaming in from the south, the effect was observed looking southward and downward, the windows admitting the light being to the south. Looking from the south across the beam gave no result, though it was not possible to look directly across the beam on a slant upward into any dark shadows and at the same time have the line of vision cross the magnetic field.

It is interesting to note at this point that the luminosity filled the whole space, and extended as far away as four feet or more from the magnetic loop, and that it was not especially noted as more intense near the loop than at a distance therefrom of, say, two feet or more.

Mr. Malcolm Thomson had further observed that by cutting out the loop from the secondary terminals (clamps) of the welding transformer, and simply joining those terminals by an iron bar, as is done in resistance welding, the luminous effect in the neighbourhood of the transformer was still visible, but was much more feeble than when the heavy loop was used. It occurred to me to examine the light by a large Nicol's prism. It was found that there was a distinct polarisation of the light from the space. This means that when the magnetic field was on the sunlight was scattered in the direction of the observer from the space occupied by the sunlight beam and the magnetic field, and that such scattered or deflected light was polarised.

It occurred to me, as a possible factor in the case, that as the building was used in part to carry on arc welding by iron arcs there might be suspended in the air of the building iron particles or finely divided oxides or compounds of iron which in some way were oriented by the magnetic field, resulting in the scattered light noted. This was confirmed in part by making the test observations when the large doors of the building had been open for some hours. The effect was present though difficult to detect. This led to the suggestion to bring an iron arc into operation near the space in which the luminous effect had been seen. This was done, and with an enhancement of the effect.

At this stage the further observations were carried on in the Thomson Laboratory at Lynn, Mass., with the aid of the laboratory staff (A. L. Ellis, H. L. Watson, Dr. Hollnagel, and others).

Two sets of test apparatus were prepared at my suggestion. One large welding transformer was mounted in a special room, into which the sunbeams could be received in the afternoon as the windows faced south by west. The secondary terminals were joined by a large loop of heavy copper cable (about 12 sq. cm. section) of a loop diameter of 0·6 m. The loop consisted of two turns. The plane of the loop was vertical and was nearly north and south, or in a plane parallel to the direction of the entering sunbeams, so that the magnetic field would be in the main horizontal and transverse to the light of the sun entering downward as before. An iron arc was arranged to be operated so that the smoke from it would rise from below and enter the field of the loop, and by changing the relative position of the arc the smoke column, widening as it rose, could be made to bathe the turns of the coil, cross its axis, or, at a distance away, merely enter the field. As the experiments thus far had always involved connection to the shop plant, with 60-cycle alternating current, a check apparatus was set up, consisting of a storage battery (of a type such as is used in automobile