

At the last meeting the report of the Commission on Maritime Meteorology and Storm Warning Signals was considered. The recommendations of the commission regarding day and night signals, drawn up at the meeting held in London in September, 1912, were adopted except for a few points, such as the night signal for a hurricane, which was found to be likely to be confused with other signals already in use. These recommendations have already been described in NATURE (*loc. cit.*). A substantial measure of international agreement in the matter of day and night storm warning signals has thus been attained.

The Rome meeting of the committee was the third which has been held since the Conference of the Directors of Meteorological Observatories and Institutes which met at Innsbruck in 1905. In accordance with established practice another conference of directors should be held before the committee can hold another meeting, and it was agreed to call together such a conference for the year 1915. Holland was suggested as a suitable country for the meeting.

M. Palazzo had been at great pains to entertain his visitors and to afford them opportunities of seeing the geodynamical and meteorological observatories near Rome. On the Tuesday the committee was entertained at a dinner, at which the Chief Inspector of Mines presided on behalf of the Minister of Agriculture, who sent a message regretting his inability to be present in person. On Wednesday the members were received at the International Institute of Agriculture by its president, the Marquis de Cappelli. The whole of Thursday was devoted to an excursion which had for its object the seismological observatory at Rocca di Papa, with which was combined a visit to the Lake of Albano and to Frascati. On Friday afternoon the committee was invited to a meeting of the Physical Society at Rome, where it was welcomed by the president, Prof. Blascona, and subsequently listened to a lecture by Prof. Bjerknes on the fields of force.

On Saturday afternoon, April 12, the military observatory at Bracciano was visited by motor. This observatory has been recently established, and many of the instruments were not yet finally installed. It is fully equipped, not only for ordinary meteorological work, but also for taking aerial soundings with kites, registering or pilot balloons. A pilot balloon ascent was carried out in the presence of the visitors, who were subsequently entertained by the commandant and his officers.

NICKEL STEELS IN CLOCK CONSTRUCTION.

IN a pamphlet on "Les Aciers au Nickel et leurs Applications à l'Horlogerie" (Paris, Gauthier-Villars), M. Ch-Ed. Guillaume gives in a simple form an account of the properties of nickel steels and of their application to the construction of compensated clocks, chronometers, torsion clocks, and even watches. The well-known peculiarities of the nickel steels as regards dilatation and variation of elastic modulus and other properties with temperature are briefly described and explained on the ground that the presence of nickel depresses the temperature of the allotropic modification which occurs in iron at 890° C., and at the same time changes the transformation point of iron into a wide range of transformation temperature in the alloys. It is when they are within this widened transformation range that these steels possess abnormally low coefficients of expansion, &c.

M. Guillaume's exposition of the applications of these steels shows, however, that although the alloy-

steel known as "invar" can be produced so as to have negligibly low expansion, that is not the result to be desired for horological purposes. In the case of clock pendulums having an invar rod, with bob and suspension of other metal, the compensation principle of Graham, used in the mercury pendulum, is employed, but the use of a nickel steel of low expansion avoids the use of a liquid and makes the attainment of compensation both simpler and more perfect in its results. A steel of zero expansion would be less convenient.

More striking still is the application of nickel steel of a desired (low) coefficient of expansion to the balance-wheels of chronometers of high accuracy. Here the use of these special steels has made it possible to eliminate the second-order errors arising from the fact that compensation effected for two definite temperatures did not, with the older materials, avoid serious errors at intermediate temperatures, owing to the fact that the expansion curves of the two compensating metals only crossed at two points and lay widely apart at intermediate temperatures.

The elimination of this secondary error has made it worth while to seek other improvements in chronometer construction, so that an almost revolutionary improvement in these instruments has been brought about. For watches in which a compensated balance-wheel is excluded on account of cost, the use of a hair-spring of a special nickel steel, to which some chromium has been added in order to raise the naturally low elastic limit, has resulted in the evolution of a cheap method of producing compensated watches. In this case the abnormal manner in which the elastic modulus of these steels varies with temperature has been utilised.

The similar anomalous variation of the torsion modulus has also been utilised in connection with the construction of clocks with torsion pendulums, and has brought these clocks into the range of reasonably accurate instruments for the measurement of time. They have the advantage of requiring very little driving power, and can therefore run for four hundred days on a single winding.

M. Guillaume points out that these important developments must all be regarded as resulting from the study of the internal transformations of solutions and of alloys and that they have resulted indirectly from the study of nickel steels for purposes of metrology. The gradual and also the transient changes of dimension to which steels of the "invar" type are known to be subject are fortunately too minute to interfere with these applications, provided the steel has been properly aged. W. ROSENHAIN.

VARIATIONS OF THE SPECTRUM OF TITANIUM IN THE ELECTRIC FURNACE.

ENHANCED lines are taking a more and more prominent part in the discussion of both terrestrial and celestial spectra, and another valuable contribution to the subject comes from the researches of Mr. A. S. King, of the Mount Wilson Solar Observatory (*Astrophysical Journal*, vol. xxxvii., No. 2, March). The investigation which he has in hand deals with variations in the spectrum of titanium by different temperatures of the electric furnace in order, if possible, to fix the place of the enhanced lines on the temperature scale. As enhanced lines are in general difficult to produce in the furnace, he made the attempt of forcing the furnace temperatures up in order to make them appear in the spectra. This he has very successfully accomplished, and in the process he has been able to observe several re-