TIME SIGNALS.

[By F. Abbott, F.R.A.S.]

At the May meeting of the Society, some notes were read and a discussion took place as to the desirability of establishing time signals in the colony. In the opinion of that meeting further information was required on the subject, and a committee was appointed to make inquiry as to the size of gun necessary, the distance at which a report could be heard, and the amount of expense that would be incurred.

Part of this duty the committee has been relieved from, through the kindness of Colonel Chesney, who partly for this purpose and partly for military service, has caused three guns to be fired at 4 p.m., on the first Thursday in every month, provided the weather was fine, and if not on the first fine day following. Through the Horological Institute of London, I am now in possession of further information on the subject, especially on the method adopted for obtaining and transmitting correct time, and have therefore thought it desirable to bring the practical portion more fully before the Society, as Time Signals are now held to be of great importance in all manufacturing or commercial towns, in which either public or private works are carried on.

It will appear that much greater accuracy, with considerable ingenuity and cost, both in obtaining and transmitting correct time, has been adopted in other places, than at present we can hope for here, notwithstanding one uniform time, to one or two seconds, may be kept with the means we have from one end of the island to the other. In a letter from Dr. Hirsch, the Director of the Cantonal Observatory at Neuchatel, there is described a very ingenious contrivance for appreciating the fractions of seconds in the reception of time signals. It will be unnecessary to give a full description of the means used for the reception of time at the several stations, and only necessary in this instance to note, that by most careful sideral observations it will give an accuracy that reduces any possible error to less than one tenth of a second. The signals are established at Berne, Chauz-de-fond, Locle, Ponts, and Flurier, as well as at several private houses.

To give anything like a full and correct description of the system of time signals as established at, and in connexion with the Royal Observatory at Greenwich would not in this case be desirable, suffice it to say that the whole of the system is automatic. The apparatus is distributed in various places, but works together as one complete whole. Time signals pass from a clock in the Observatory to several points in London, from which they become again distributed to different stations, and by means of the various telegraphic lines, they are again extensively transmitted throughout the country ; the clocks of many important lines of railway being constantly regulated by them. The signal passes as far as Brighton in the south, Lowestoft in the east, Cardiff in the west, and Glasgow in the north ; as well as to Manchester, Birmingham, Liverpool, and other important places. These signals are distributed (when received from Greenwich) by the

International Telegraph Company, by means of a "Chronopher," designed and constructed by C. F. Varley.

To arrive at the correct mean time for the Greenwich normal clock, the error is found from the transit clock that has been previously rated by astronomical observations from certain clock stars, the positions of which are known with great accuracy; one of these stars being observed by aid of the chronograph, an apparatus that has been in use at Greenwich since the year 1854, and part of which consists of a revolving cylinder attached to a clock, on which is fixed a paper which is punctured at the time a star transits over each web of the telescope. This record is then extracted from the chronograph, and the mean of all the webs, or punctures taken; this mean when corrected for instrumental errors and personal equations, is the difference between the R.A. of the star and the sideral time clock; a comparison is then made (by the coincidences of beats) between the mean time clock, and sideral clock, from which the correct mean time is ascertained, as at the Cantonal Observatory at Neuchatel to one tenth of a second.

At Newcastle a clock which is kept adjusted to Greenwich time makes automaically the proper connections for allowing an electric current to arrive at Newcastle to act on relays which transmit currents to discharge the Tyne time guns, one of which is placed on the old Norman Keep at Newcastle, the other at North Shields. The gun at Newcastle is a 12 pounder gun, that at North Shields is a 24 pounder. Very general reference is made to these guns, not only by the public generally, but also by manufacturers and ship-building companies, for regulating their works, and not less important are the facilities they give for the rating of chronometers.

The first Glasgow time-gun was supplemented by a second one in St. Vincent's Place on the 29th of October, and these two by a third at the Broomielaw, on the 10th of November, while a fourth gun was added to the system at Greenock on the 21st of November, all four being simultaneously fired through the agency of the electric current from the Observatory.

At Madras, measures have been taken by the astronomer, Mr. Norman Pogson, with funds supplied to him by the Governor-in-Council, to convert no less than five guns, which are daily fired in and about that city, by connecting them electrically with the normal mean time clock of his observatory. Mr. Pogson says that "the smoke by day, and the flash by night of a time-gun, are far better and more conspicuous signals than any time ball."

I have collected and put together the foregoing facts in order to show that the system of time signals is becoming very generally adopted, and much ingenuity, expense and trouble has been brought to bear for economising time in well-regulated communities.

In the discussion which arose on this subject at the monthly meeting for May last, the object itself was approved of, the only objection raised was the expense, the estimated amount of which was in a great measure fallacious. The 32lb. guns fired on the first Thursday in the month at 4 p.m. were heard at Richmond, Sorell, and Prosser's Plains. It is however the opinion of the Military Officers that a 12 pound brass gun, with 1¼ or 1½lb of powder such as the one used at Newcastle, would be heard, if not quite, nearly

as far as a 32lb gun. This 12lb gun, with 1½lbs of powder, at 8d., for say three signals a week, Monday, Wednesday, and Friday, will amount to £7 16s. per annum. Now, in addition to this, it would be necessary to adopt a similar signal at Launceston, which, without any difficulty, could be switched by the telegraph from the report of the Hobart Town gun. By this means the time would be kept simultaneously from one end of the island to the other for £15 12s. per annum I may mention here that the difference of time between Hobart Town and Launceston, by known longitude, is 55.847 seconds, but the clocks frequently vary from ten to fifteen minutes, and sometimes more. The time occupied in switching the signal from Hobart Town to Launceston is inappreciable, as the estimated speed of the electric current, according to Wheatstone, is 286,000 miles per second; Walker makes it 18,000 miles per second, and Fizeau, 62,700, and 110,000, according to the material employed.

If the government expect to carry out the proposed railways, and other public works, a very large number of men will be required, and it is quite clear that if something approaching to correct time is not adopted, a few minutes loss for each man every meal will very soon amount to a much more considerable sum than the cost of a few time signals.

The system which I have now partly attempted to describe well illustrates the beneficial effects arising from the mutual co-operation of several parties to carry out a common object; and it is this joint action alone which maintains a system by which a country may unconsciously be benefited. I may tell you (says the Astronomer Royal) my friend, Mr. W. De La Rue, estimates the amount annually saved to his firm, by having exact time, and enforcing strict attendance on his work people, at £300 per annum, besides some saving of gas and coals, not taken into account. Think only, says Professor Airy, of £300 per annum being thus saved in one establishment alone, and then consider what would be the saving in London, if all establishments of a similar magnitude could save by this system a like amount.

The Astronomer Royal says in conclusion, that he hopes to see some day soon, an extension of the Greenwich system carried out in the exhibition of hourly time signals at the Start Point, and that he has prepared a complete scheme for the purpose; the signal by day being the drop of a ball or semaphore arm, and the signal by night a flash of gunpowder. The value of such a system for ships would be very great, since it would enable masters to obtain for their chronometers sea-going rates, which is a thing of great importance