

astronomical observers. Now, there are other observations which scientific men have to make. The greater number of them are only of an interval of time—that is to say, an interval of so many minutes or seconds. For that purpose it does not matter what time the clocks are set at. All that is wanted is that the clocks shall have a proper rate. If the rate of the clock is correct it will correctly show an interval, and that is all many observers want. But we have very little of that in New Zealand. There are some observations made in New Zealand which involve time. Earthquake records, temperature and barometer records, tide-gauge records—all those are made by instruments which themselves record not only the events by a trace on a sheet of paper, but also the time which is indicated by lines drawn on the paper. Now, that will depend on the way the clock is set. It is just as easy for the person who sets the clock to set it to correct time by a clock which is set in accordance with this Bill as it is to set it to correct time by a clock which is set in accordance with our present local time, both of them being different from local mean time. I think that exhausts the question of scientific observations. I do not know of any observations which are not included in the remarks I have made. Two points that Mr. Adams mentioned I should like to refer to: He says that the sawmillers put their clocks on in winter, which is the reverse of what you are proposing to do. That is to say, the result of this process is that the sawmillers—the master—takes the time himself—the daylight—which you want to give to the workmen. That is a device by which the workmen shall work the whole of the daylight, whereas you want to give some of the daylight to the worker. You will see that it is the reverse of the process you are proposing. Whether that is beneficial or not to the workmen I do not know. The other matter he mentioned was a railway accident. The only way in which a railway accident can arise from the clocks being wrong is by something which has to be done at the station at a certain time not being done because the clock is wrong; and Mr. Adams suggests that putting back the clock is a process tending to the injury of the clock. It is, to a striking-clock, but I do not think that at railway-stations they go by striking-clocks generally. I do not think the clocks at railway-stations strike. But, apart from that, I presume that such precautions would be taken by the Railway authorities as to make impossible such an error as the omission to put the clock back or forward on the correct day. It should be easy to make such a mistake as that impossible, and I presume the Railway authorities would do so. I think such a precaution as this would be suggested: that it should be somebody's duty at the specified hour to alter the clock, to record on a slate that he had done so, and, we may suppose, to send a message to headquarters that he had done it; and then it would be inspected by some one else, who would report at once.

1. *Mr. Fraser.*] The automatic-tablet system does that?—Very likely. I do not attach any importance to the danger of railway accidents. There is another way in which the alteration of the clock might work, and that is that a few people might miss their trains.

2. *Mr. Sidey.*] Would you express an opinion on the suggestion to alter New Zealand time to 12 hours ahead of Greenwich instead of  $11\frac{1}{2}$ ?—I do not think there is anything in it. I think that the nearer the meridian is to what I may call the centre of time in New Zealand, other things being equal, the better; but, as it is desirable to have something like a round number, I consider that an hour increased or diminished by thirty minutes is as much a round number as an hour. Half an hour is a round number for that purpose, I should say. I think the present rating has worked well. On a continent it is different. The changes of time divide a continent into zones, and there is undoubtedly a good reason for having those zones equidistant from one another. I do not believe that even that would matter a very great deal.

3. I understand you consider it better to take your mean time from a point which is equidistant from extremes of east and west of your country, rather than to take into consideration the locality of population?—Yes, I think so. I do not say, to take it exactly equidistant. Geographically that is impossible. But I think that what I may call the mean point of the country is a good centre to start from, subject to this: that it is well to have a number which is easily added or subtracted. That is all you want. I think such a number as  $1\frac{1}{2}$  is just as easily added or subtracted as the number 1 by all persons who would ever make the calculation.

4. Some evidence was given this morning in connection with mistakes being likely to arise owing to the tides—not so much in the case of intercolonial and Home-going vessels, but coastal craft leaving tidal harbours?—I did think about tides. Tidal observations come within the same remarks that I made as to barometer and thermometer. The time is automatically recorded, and you only have to secure that your instrument is correctly set. But there is another kind, not of observation, but of reckoning, and that is when a captain wants to know what will be the time of the high tide at the port he is coming to. He does not trouble about local time. He wants to know what time the tide there will be by the clocks on board his ship—that is to say, by his chronometer showing Greenwich mean time. That is all he wants, and so he makes his calculations on that. Every chart has on it what is called the “establishment of the port”—the establishment of every port. That is, a number which is put on the chart, and which reckons the time of high tide on the assumption that high tide at Greenwich is at a certain time. So that the captain is able to calculate from what is called the “establishment of the port” at what time high tide will be, say, at Wellington, and he can do that as soon as he knows at what time his ship will reach Wellington, and he can adjust his speed if necessary so as to arrive there at high water. But that is a calculation which he cannot make to a few minutes. I doubt if he can make it to the half-hour, because all sorts of circumstances are perpetually interfering with the time of the high water, so that the tide does not come with the same accuracy of time as the moon passes the meridian. As a clock you would think the tide was about the worst timekeeper in the world. So that all the captain can hope to do is to calculate within, say, something like half an hour on each side. But if he depends on the tide he takes the tide from the signal on the station, where they hoist a flag at high water in tidal ports. They signal high water and low water, and if the moment is of importance the ship-captain relies on the signal and not on his calculation.