relative position of two stars, marked by the $\frac{1}{4000}$th part of an inch on its scale, would not be undetected.

Steps have been taken for the construction of a Photographic Barometer and Thermometer. Mr. Johnson hopes, at the next meeting, to be enabled to report a considerable improvement in the meteorological department of the Observatory.

The Report concludes with some suggestions relative to the internal arrangements of the Establishment.

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Remarks on the Erection of the Time-Ball of the Royal Observatory, Edinburgh. By Professor Piazzi Smyth.

The simplest principle of a time-signal is to let fall some sort of conspicuous body at the appointed instant. To be seen at a distance, it must be large; to be equally visible from all directions, it must be spherical; and to be well seen, projected as it will always be here on the sky behind the lofty Nelson's Monument to all observers except such as may be on higher ground still, it requires to be painted black. Again, that it may always descend with equal velocity, whether the day be calm, or whether there be much wind pressing the ball sideways against its supports and retarding its descent by friction, it must be heavy; and, in order that the observation be of as exact a nature as possible — in order that the instant of the beginning of the descent may be observed with the utmost accuracy — there must be a cross staff on the top of the mast, up to and in contact with which the ball is to be hauled, and the instant of separation of the ball in its descent from the said cross staff indicates the moment of the beginning of the fall with abundant precision.

We have thus a large and heavy ball (say four feet in diameter) hauled up to the top of a mast with cross-bars on the summit, and made to fall at a certain instant daily. That is the simple principle; but what takes place in practice? Firstly, such a ball falling a great height would soon break itself to pieces; and the stronger it is made, the heavier it must be, and the more suicidal force it will have. Secondly, the effect would be also that of a ramming engine to destroy the structure wherein the ball fell, in the present case the many-storied tower of Nelson's Monument, with all its primitive architectural decorations.

The earliest signal-balls which were made, though provided with ropes passing over pulleys by which they were enabled in their descent to raise a series of weights in order to check in a gradual manner the velocity of their fall, were yet invariably found, after a short time, to pull or to smash themselves to pieces. Steel springs were next tried to break the force of the concussion, but were pretty sure to be themselves snapped with a heavy ball, while a light one would not descend quick enough on a windy day. Recourse was finally had to compressed air, a spring of perfect temper
never injured by time, and capable of any degree of delicacy at first, and any amount of violent resistance at last.

To carry out this principle a staff was attached to the ball below, terminating in a piston, which in the course of its descent entered an accurately turned cylinder, and compressing the air therein, was gradually brought to rest. Were the cylinder quite closed at the bottom, the spring of the included air might be greater than required, and also have a tendency to throw the ball up the mast again, which would be somewhat troublesome to observers. But by simply opening a graduated aperture below, so as to admit of the air partially escaping as it is compressed, the strength of the spring is diminished, and by the time that the piston has descended to the lowest point, there is so little air remaining in the cylinder, and it is still escaping so fast, that there is no power left to make the ball rebound.

Thus the time-ball is made to descend without injuring the building or spoiling itself; and the trigger apparatus, by which the detent, that holds the ball when hauled to the top of the mast, is unlocked, being very nicely adjusted, and observers being duly cautioned to look to the instant of separation of the ball from the cross-staff, the descent — i.e., this first part of it — is as instantaneous as need be. In the next place, the trigger being pulled, not by the finger of a person at the ball, but by an electro-magnet which is instantaneously set in action by the contact made at the end of a wire led into the walls of the Observatory, and brought immediately before the transit-clock itself; the instant for the signal outside can be conveyed to the undeviating mechanism there with all the refinement of a chamber experiment, and to the utmost extent of the observer's knowledge of the real time by the stars, as obtained the previous night, and continued on by the clock.

When the weather permits the stars to be observed, the time may be depended on to less than one-tenth of a second. But when, as too frequently occurs in this country, with its cloud-diversified sky, more attractive to the painter than suitable to the astronomer, no star may have been seen for several days, the clock may deviate considerably; nay, so much, that on such days it would be better not to drop the ball at all, rather than to give an erroneous indication.

But here, again, Science affords her assistance. Such unmitigated bad weather seldom prevails equally in the south of England and over this city at the same moments; consequently an observation is often possible, and can be well obtained at Greenwich, when quite out of the question here. Then by refinement of galvanic agency the instants of such an observation, the moments of the star being on the fiducial lines of the Greenwich transit, may be flashed along a wire and indicated on any other clock, as that of our own Observatory; if only there be complete wire connexion the whole of the way. Such a road for the electricity there has long been from the Greenwich Observatory to the railway station in Princes Street; but there being none thence to the Calton Hill, it could not be used for exact purposes. Within the last few days, however, the
Government has consented to the wire being brought up to the Observatory, on the strong representation of the importance of the measure by the Board of Visitors of the Royal Observatory, under the presidency of the Right Hon. Lord Rutherford, who, we may add, had long since evinced the warmest interest in the subject of the time-ball, and, as Lord Advocate, three years ago, was the important turning point of the whole scheme.

Nearly every contingency seems thus to have been prepared for, except, perhaps, the conveniency of the method of hauling up the ball, as influenced by the peculiarities of the site—viz. the apparatus being on the top of a lofty building, and at a distance from the Observatory.

With reference to this object, it may be remarked, that, some trouble might be experienced in ensuring a porter's daily attendance throughout the year with perfect punctuality, unless recourse is again had to modern science. In accordance with this, a plan has been proposed, by which a weight having been wound up at any previous hour of the day or night, then on electrical contact being made at the Observatory by the astronomer at a precise moment, that weight is unlocked, immediately descends, and hauls up the the ball. Next at five, or any other number of minutes, a second contact being made on another wire lets the ball down.

Thus the ball is both raised up and let down by delicate signals given from the interior of the Observatory by the astronomer himself with equal punctuality, both operations being similarly independent of any external person at the time. Hence arises a result not unfrequent when human labour previously employed in the mere brute purposes of raising weights or turning wheels is replaced by scientific machinery, that the work is not only cheaper but better done than before. For the ball may in this way be raised so quickly and certainly, that the beginning of its rise becomes as good a time-signal as the commencement of its fall. There may thus be two signals daily; two also which can never be mistaken for each other, as two successive descents might often be.

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Report of the Syndicate appointed to Visit the Observatory of Cambridge.

In this Report an account is given of the labours of Professor Challis at the Observatory of Cambridge during the year 1852, and also from the commencement of the present year down to the 20th of May.

The first part of the Report relates to the observations made in the year 1852. The transit observations made during the course of the whole year amounted to 2050, and the circle observations to 1543. Of these, 362 transits and 340 circle observations relate to bodies of the solar system. The remaining observations of stars were made for the most part in pursuance of Prof. Challis's plan of forming gradually a catalogue of zodiacal stars situated within 5° of the ecliptic, to the ninth magnitude inclusive.