Extract from the Report of the Sixth Exhibition and Fair of the Massachusetts Charitable Mechanics' Association.

647. William Bond & Sons, Boston. One Astronomical Clock, and a Spring Governor. The object to be attained by this novel contrivance is that of regulating the movement of a rotating cylinder, so that its motion may not only be steady and uniform, but that its revolutions may be performed with accuracy in any given time desired.

There are, doubless, many situation s connected with science and the arts, where rotary motions regulated with great accuracy, may be applied with great advantage. The experimenters upon Hydraulics, Hydrostatics, &c., we think will find it a useful appendage to their already very extensive apparatus.

Within the past few years there have been several astronomical observatories established in the United States, where observations are now being made, not only with great care and ability, but with becoming zeal and regularity. And connected with these Astronomical inquiries, are those of its kindred science Geodesia, which are now being, and have been for some time past, vigorously prosecuted or carried forward under the patronage of the General Government. To the combined observations and operations of these kindred sciences (if it be proper to consider them as separated) are we indebted for a knowledge of the figure and magnitude of not only our own planet, but of all the other planets belonging to our system. Our planet being a standard upon which a great portion of the astronomical calculations are based, the importance of ascertaining its magnitude with as great a degree of accuracy as we well can, must be apparent to every one who has given any thought to the subject. Besides, the accuracy of the cha ts of not only our own Coasts and the Oceans adjacent, but the Coasts and Oceans of the whole world are more or less dependent upon this element.

The invention of the Magnetic Telegraph, and the construction of Telegraphic lines, as it were, from one end of our country to the other, which by being connected with the several observatories, afford a means of communicating the moment of time of any phenomena observed at one observatory to that of another and *vice versa*. By this means the difference of time between any two observatories, is determined with a greater facility and degree of accuracy than by any other method now practised; and then having extended the Geodetic surveys from one observatory to the other, we thereby obtain more accurate data for solving the Grand Problem, viz., the magnitude and figure of the earth, than we have been enabled to do by any other known means. The great desire of making these communications with as great a degree of accuracy as their nature will admit, was the exciting cause of this invention. But the invention is not confined to distant communications alone; it is equally valuable and useful in recording at the observatory where it is situated, the moment of time of any observed phenomenon.

This invention, properly considered, consists of what we shall term an Electro-Telegraphic Clock and the Spring Governor. The Clock which in its general construction does not materially differ from other Astronomical Clocks, was not exhibited at the Hall. It being somewhat difficult to give a complete description of this apparatus without drawings, and as the association cannot well insert in their publication of notices, cuts representing the articles exhibited, we shall only endeavor to give such a general description as will convey an idea of the invention and its application.

First, *The Clock*. As before stated the several parts of the Clock are not dissimilar in form to clocks heretofore in existence. The novelty of the Clock consists in insulating the axis or pivots of the escapement wheel from the plates which sustain the other portion of the clock-work by a ring of Shell Lac Gum, bushed with brass washers or discs;—and the axis of the steel pallets is in like manner insulated from the other parts of the clock-work. The pinion which connects the escapement with the train of the clock is insulated from its axis by Shell Lac Gum;—the Pendulum also is so contrived as to be insulated from the arm of the pallets with which it comes in contact, by an arrangement of Shell-Lac Gum. Electrical or circuit wires are secured to portions of these insulated parts which sustain the axis or arbors of the escapement and pallets, so that when either pallet comes in contact with an escapement tooth, the Galvanic circuit is closed, and when the contact is broken, (as it must be at every oscillation of the pendulum,) the Galvanic Circuit is opened, and thus pulsations of Electricity corresponding to the oscillations of the pendulum successively pass over the wires. Then, by the aid of the Spring Governor, an intelligent record of the electrical pulsations or beats of the clock is made.

Second, *The Spring Governor*. This part of the invention was on exhibition in the Exhibition Hall, and consists of a double train of Clock-work united into one upon an axis of a Fly-wheel. (We speak of this machine as consisting of a double train of clock-work because it receives motion from two weights.) The clock-work, consisting of small brass wheels and pinions, is arranged between two brass plates some four inches apart, and probably twelve or fourteen inches long. Near either end of these plates is a strong axis to which an apparatus is applied for receiving a cord, upon which weights are suspended to give motion to the trains;—these axes and pulleys we shall call prime movers. A few wheels of the train distant from one of these prime movers, is situated an escapement wheel, into the teeth of which pallets are operated by the oscillations of a pendulum, as in ordinary clocks, the escapement wheel is so connected with its axis by a spring, as to allow the axis to move while the wheel is detained by the pallets. From the pinion upon the arbor of the escapement wheel, the train is continued through several wheels and pinions, to a Fly wheel. From the prime mover at the other end of the plates a train of wheels and pinions extends also to, and connects with the Fly. Near this prime mover is situated a long shaft or arbor which extends through one of the plates some twelve or fourteen inches, its end being sustained by a proper support attached to the table upon which the whole apparatus rests. Upon this shaft a cylinder of some five or six inches in diameter and some ten inches in length, is firmly fixed, and of course revolves regularly with it. When the machine is in order to operate, this cylinder is covered with blank paper. A slide apparatus is attached to the table near to and parallel with the cylinder, upon which an Electro-magnet, in the U form, is fixed: and the slide is so connected with the clock-work, that it receives a regular motion therefrom, and is thereby moved from one end of the cylinder to the other. The magnet with its armature is so arranged that it gives a lateral or horizontal motion to a lever to which a pencil or pen is attached, which rests upon the paper with which the cylinder is covered. The instrument is also provided with a finger key, by which the circuit may be opened at the instant of any observed phenomenon, and thereby the regular flow of the electrical current will be broken;—at this instant the U magnet releases its hold upon its armature, and it moves laterally and thereby records the pulsation by a mark, in the form of a saw tooth upon the paper which covers the cylinder.

Having thus briefly described the apparatus and its uses, let us now, for the purpose of illustration, consider the whole apparatus to have been properly adjusted and in a condition for operation, with the Battery connected with the insulated portions of the Clock-work. The clock being then put in motion, its beats may be distinguished at the distant station by the clicking noise of the armature upon its magnet, while the pencil attached to the lever which bears the armature, will, by its lateral motion occasioned by the opening of the circuit, record the beats or oscillations upon the cylinder,—and these phenomena will be repeated for every oscillation of the pendulum.

To render our description plainer, let us suppose one of the observatories to be situated at Cambridge and the other at Washington, and the Astronomers to have agreed to observe the transit of a particular star over their respective meridians. The star of course makes its transit across the Cambridge meridian first, and at the moment of its culmination the observer places his finger upon the finger key, and thereby causes an electrical pulsation, which is transmitted to Washington, and is there recorded upon the cylinder of the Spring Governor. After the lapse of the difference of time between the two observatories, the Astronomer at Washington observes the transit of the same star, and at the moment of its culmination he touches the finger key and thereby causes an electrical pulsation, which is transmitted to Cambridge, and is there recorded upon the cylinder of the Spring Governor. Then, by an examination of the records upon the cylinders, the difference in time can be readily ascertained, and by a mean of many operations of a like character, not only the difference in time between the places may be ascertained, but the actual time, which should be allowed for the transmission of the electrical pulsation in connection with the movement of the armature, may be determined.

This method of recording the instant of an observed phenomenon, whether to be transmitted to a distant observatory, or to be used at the observatory where the observation is made, possesses this peculiar advantage over any other with which we have any acquaintance, viz: the observer observes the phenomenon without being embarrassed with the trouble and anxiety of counting the beats of the clock or chronometer, or estimating the fractions of the interval between the beats at the instant of observation. In a practical sense his mind may be fully concentrated upon the phenomenon of observation.; the touch upon the finger key being mostly mechanical, requires no mental exertion; and further, the beats of the clock being recorded upon the paper attached to the cylinder by equi-distant marks upon a spiral line, furnishes a scale by which the fractional interval of the beat may be measured with great accuracy. Since the exhibition, the apparatus has been tested, and is found to more than equal the expectations of all who have seen it. The Committee, therefore, in consideration of the great aid which this invention promises to a great variety of scientific investigations, cheerfully recommend that there be presented to the inventor, by the Association, as a token of their approbation, a *Gold Medal.*