WILLIAM HARKNESS.

BY MARCUS BENJAMIN, PH.D.

Each year, as the summer closes and autumn begins, the American Association for the Advancement of Science holds its annual meeting. A sketch of its president has been a characteristic feature in the issue of the SCIENTIFIC AMERICAN for the week during which the meeting is held. This practice began in 1887, with an account of the work of Edward S. Morse, and among the biographies published have been those of Langley, Powell, Mendenhall, Goodale, Prescott and Le Conte—first a specialist in the natural sciences, and then one in the physical sciences, in regular alternation.

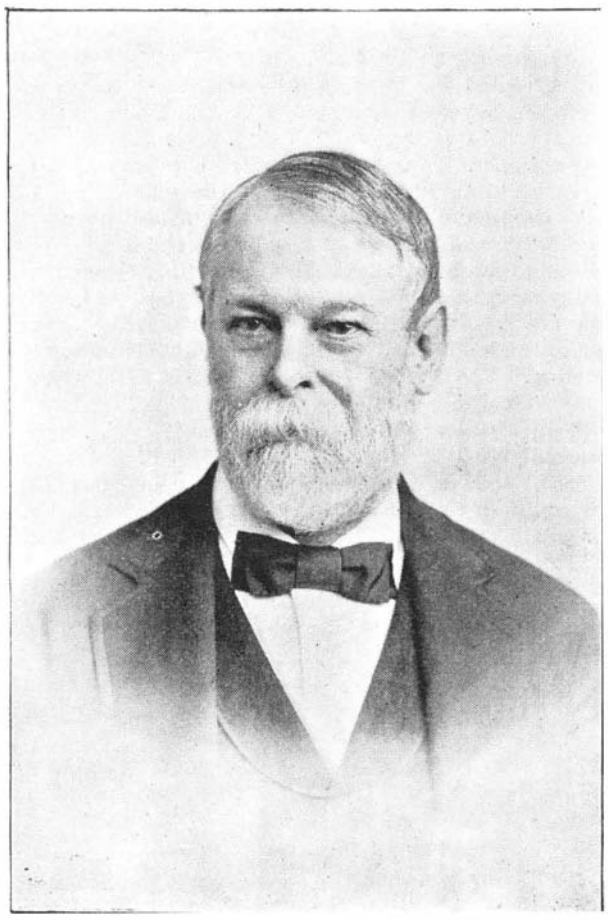
At Rochester, last summer, the association chose William Harkness to the office of president, and at the meeting recently held at Madison he was inducted into office. This selection was most happy, for not only was the honor worthily bestowed on one of the best known scientists in the association, but the courtesies received from the city of Rochester were recognized in thus naming a president who had spent part of his early life there, and had studied at its university. Prof. Harkness was born on December 17, 1837, in Ecclefechan, Scotland, where his father, James Harkness, was pastor of the Presbyterian church. He was not destined to remain long in his native land, for in 1839 his father came to the United States and held pastorates in various places, including New York City.

Not the least among the usual advantages of a clergyman's son is a good education, and in September, 1854, young Harkness entered Lafayette College. He continued there for two years, and on the removal of his father to Rochester, he entered the university there and was graduated in 1858. Choosing medicine as his profession, he studied that science in New York City, and received the degree of M.D. in 1862. Notwithstanding this preparation, Prof. Harkness seems to have turned his attention to other things, and his medical career closed with a brief service during the second battle of Bull Run, in 1862, and an equally brief one during the threatened attack on Washington, D. C., in July, 1864.

However, he entered the service of the government, and in August, 1862, was appointed aide at the Naval Observatory in Washington. A year later he was commissioned professor of mathematics in the U. S. navy, with the relative rank of lieutenant commander, and continued at the Naval Observatory. During 1865–66 he made an extensive cruise on the Monadnock, visiting the principal ports in South America, and conducted an elaborate series of observations on terrestrial magnetism. His results were published in 1872 by the Smithsonian Institution, under the title of "Observations on Terrestrial Magnetism, and on the Deviations of the Compasses of the United States Ironclad Monadnock during her Cruise from Philadelphia to San Francisco, in 1865 and 1866."

On his return from the trip he was attached to the United States Hydrographic Office, where he remained for a year, and in 1868 again returned to the Naval Observatory, remaining there until 1874. Meanwhile in 1872 he had been advanced to the relative rank of commander. He observed the total eclipse of the sun from Des Moines, Iowa, on August 7, 1869, and at that time distinguished himself by the discovery of the 1474 line of the solar corona.

In 1871 Prof. Harkness was appointed a member of the United States Transit of Venus Commission, created by Congress, and after designing most of the instruments to be used he went to Hobart Town, Tasmania, as chief of the party that observed the transit there. He then returned to Washington, having made a trip around the world, and in 1878 was advanced to the relative rank of captain. In 1882 he was made executive officer of the Transit of Venus Commission, and given charge of the fitting out of all the parties organized at that time. Four of these took observations in the United States and four were sent respectively to Patagonia, the Cape of Good Hope, New Zealand, and Chile. A specialty was made of observing the transit by the photographic method. This fact is pertinent when it is remembered that in 1874 all the great nations who sent out parties had adopted that method; but when they came to measure and reduce their photographs they encountered unexpected difficulties, which proved so serious that the Astronomer Royal of England, Sir George B. Airy, admitted publicly his inability to surmount them, and the German commission also abandoned the attempt to reduce their photographs.



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At a meeting of European astronomers, held to consider these facts, it was decided that the photographic method had proved a failure in 1874, and, therefore, it was inadvisable to try it again in 1882. In the face of this decision only the American and French astronomers made photographs in 1882.

On the return of the American parties, Prof. Harkness was given charge of the work of reducing all their observations, among which were many hundred photographs. For the reduction of these pictures, which was altogether a new problem in astronomy, Prof. Harkness had to modify old methods and also to devise many new methods, while in actual time nearly eight years were consumed in the work. Concerning his feelings at this time he has written: "You can imagine my anxiety during all these years when I tell you that Congress had appropriated a definite amount of money for the work, and if I had made a slip anywhere I might not have detected it till the job was finished, and then I would have had no money to pay for correcting it. I literally lay awake nights devising all sorts of checks to prevent the occurrence of such an accident. However, fortune favored me and I succeeded in bringing the work to a most successful conclusion." Prof. Harkness finished this work in July, 1890, and, in addition to the great value of the information, it was a source of gratification to American scientists to recognize the fact that one of their own number had accomplished that which the most eminent of English and German astronomers had abandoned as impracticable.

The specialty in which Prof. Harkness is best known has already been indicated as mathematical astronomy, but he also has gained reputation in the application of mechanics to astronomy. The machine used for measuring the astronomical photographs obtained in the transit of Venus expeditions were designed by him, and a duplicate has since been made for Lick Observatory, California. It consists of a pair of indicators which always show the exact point in the heavens toward which the telescope is directed. These indicators are arranged upon one or two dials, as may be most convenient, and face the observer, at the height of his eye, when he is in position to manipulate the telescope by means of its quick-motion wheels or ropes. By this means the work of the observer will be greatly facilitated, and it has been adopted in other observatories.

Another invention of importance made by him is that of the spherometer calipers, which is the most accurate instrument known for measuring the inequalities of the pivots of astronomical instruments.

The degree of A.M. was conferred on him by Lafayette College in 1865, and in 1874 the University of Rochester gave him the degree of LL.D. He has long been a member of numerous scientific societies both in this country and abroad, to whose proceedings he has been a regular and valued contributor. He joined the American Association for the Advancement of Science at the Nashville meeting in 1877, and a year later was advanced to the grade of fellow. In 1881 he was called to the temporary occupancy of the vice-presidency of the section of mathematics, physics, and chemistry, and he was elected to the full possession of that place for 1882; also, in 1885, he again presided over the section during the absence of the regularly elected officer. The successful fulfillment of his duties in these connections, and his high scientific attainments, soon made him a candidate for the presidency. His modesty led him to refuse that honor, but at Rochester, at a meeting from which he was absent, he was elected to the place which he so abundantly deserves.

The association is certainly fortunate in having at its head a scientist of such eminent and varied attainments.

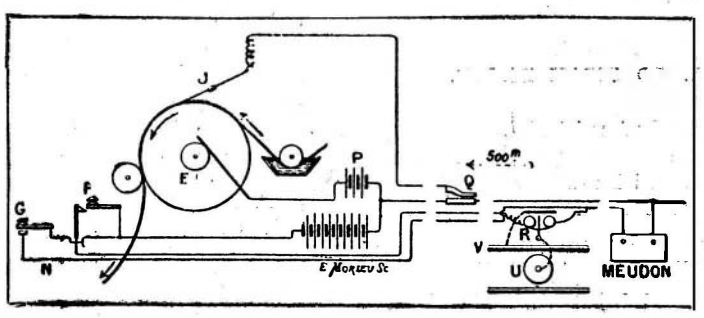

Fig. 2.—DIAGRAM OF THE APPARATUS.

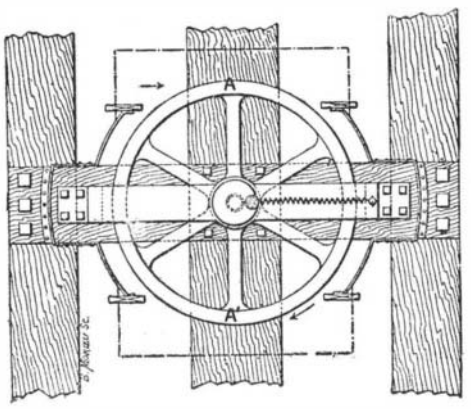

Fig. 3.—DRUM FOR PUTTING LOCOMOTIVE IN COMMUNICATION WITH WATCH TOWER.

APPARATUS FOR PREVENTING COLLISIONS OF TRAINS.

Railway accidents have been numerous in recent years, and the public concludes from this, not without some reason, that the systems now in use present defects, either theoretical or practical. It is therefore not without interest to make known a system of which the principle is very different from that which serves as a basis for the block system now employed.

It is Mr. Pellat, professor of physics at the Sorbonne, who has devised the apparatus that we are going to describe. The track is divided into sections of from 50 to 100 kilometers, and in the center of each section there is a watch tower where is stationed a man who knows at every instant the position of all the trains that are running upon his section. This result is obtained as follows: In the watch tower a clockwork movement revolves a cylinder over which passes a band of paper impregnated with

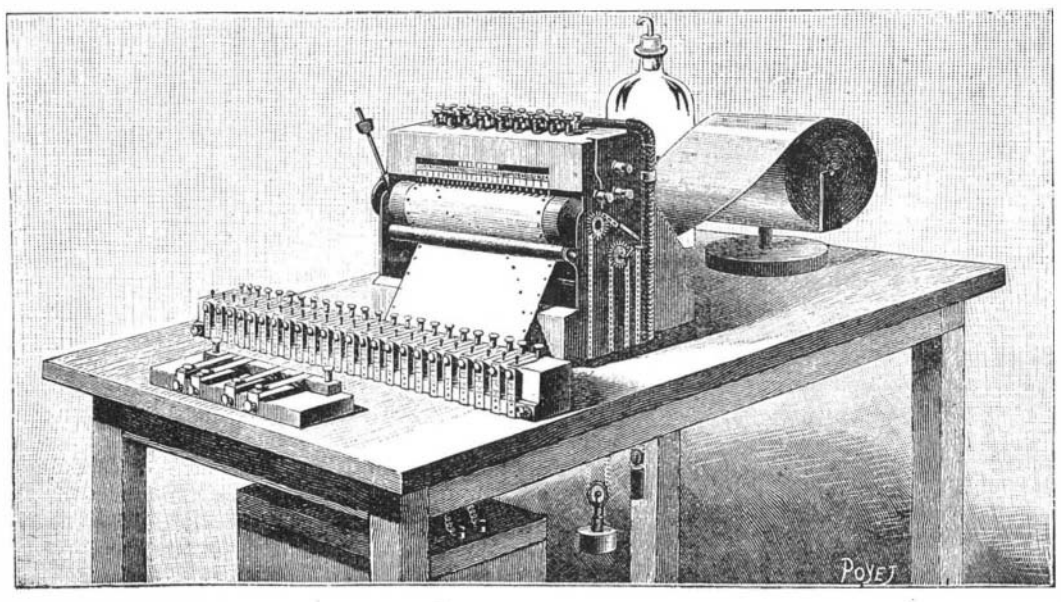

Fig. 1.—APPARATUS FOR REGISTERING THE RUNNING OF TRAINS.