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.

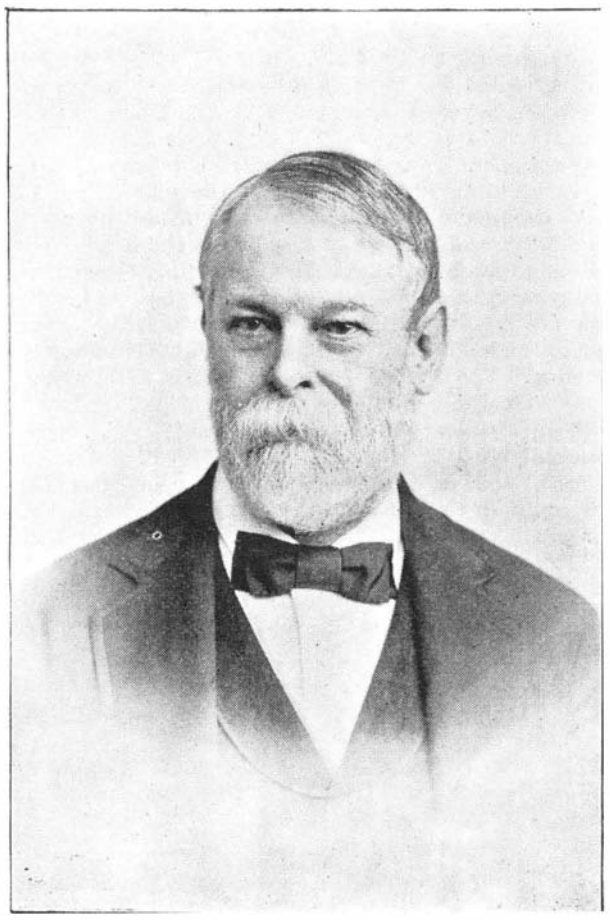
At Rochester, last summer, the association chose William Harkness to the office of president, and at the meeting recently held at Madison he was inducted into office. This selection was most happy, for not only was the honor worthily bestowed on one of the best known scientists in the association, but 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.



WILLIAM HARKNESS.

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.

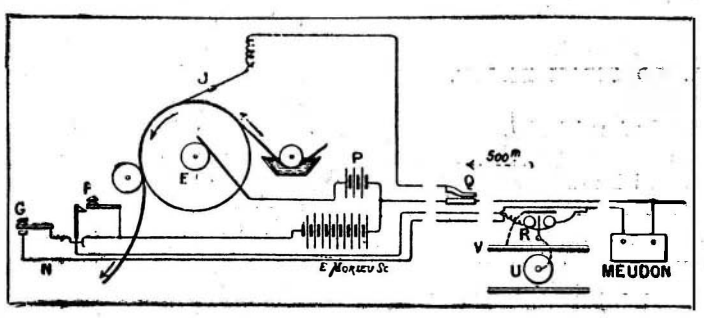


Fig. 2.—DIAGRAM OF THE APPARATUS.

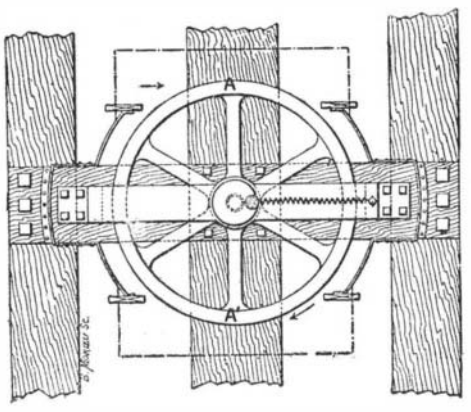


Fig. 3.—DRUM FOR PUTTING LOCOMOTIVE IN COMMUNICATION WITH WATCH TOWER.

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

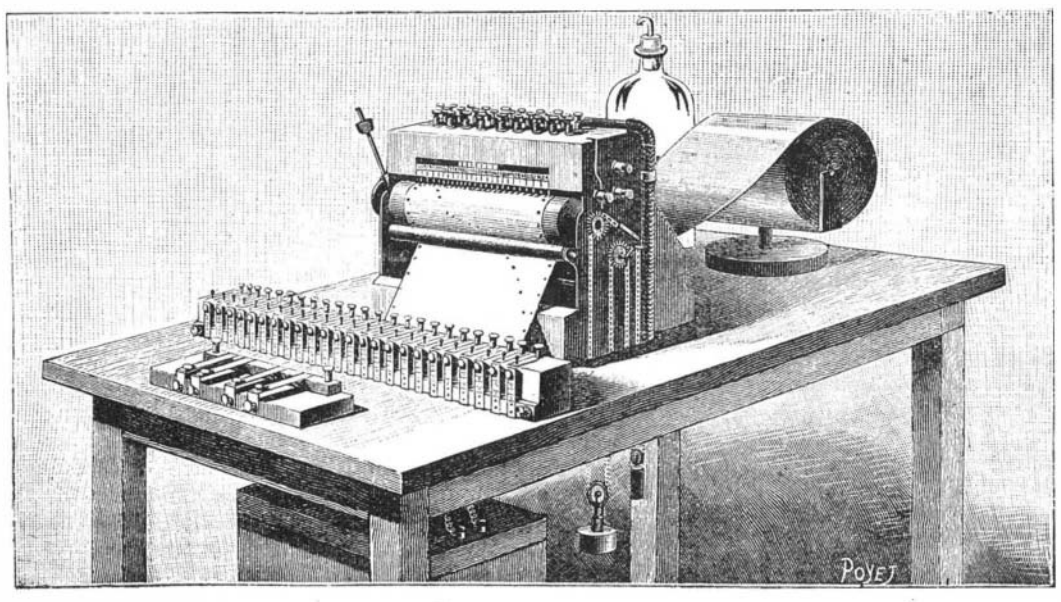


Fig. 1.—APPARATUS FOR REGISTERING THE RUNNING OF TRAINS.

iodide of potassium. Upon the paper there bears a steel needle, R (Fig. 2) provided with a platinum point. This needle is connected by a wire with a pedal, P, situated upon the track. On another hand, the axis, E, of the cylinder is in communication with the negative pole of a battery, P, of which the positive pole is connected with the lower part of the pedal. When a train passes, its weight depresses the pedal, the circuit is closed, the iodide of potassium is decomposed at the point where the needle touches the paper, and the iodide set at liberty is shown by a black dot.

Upon the length of a section, a pedal may be arranged about every mile. Each is connected by a special wire with a needle of the watch tower, and all these needles are arranged along a generatrix of the registering cylinder. When a train passes over a pedal, the corresponding needle, which carries a number reproduced upon the pedal, marks a black dot upon the paper. At every instant the employe knows, then, over what pedal the train has just passed. He sees whether an express train is upon the point of telescoping an excursion one, whether two trains running in different directions upon the same track are about to meet, etc., and he prevents such catastrophes, since he can forewarn the engineers of the trains. In fact, in the center of the interval comprised between two pedals there is what is called a contact apparatus. This consists of a metallic drum about 80 centimeters in diameter and 20 in height. The locomotive carries a metallic brush, which, at the moment of the passage of a train, causes the drum to revolve. This drum is protected against rain, snow and frost by a galvanized iron box, but at the two extremities of the same diameter, AA' (Fig. 3), it projects from the box. These are the parts that the brush touches. As this latter is very long (1·3 meters) it is capable of establishing a metallic communication with the drum, even if the unprotected parts of the latter are covered with frost, since it makes them revolve.

In the watch tower there are arranged in a row, like the keys of a piano, a series of commutators, each of which carries two numbers, those of the pedals between which is situated the drum with which the commutator enters into relation. When the employe puts his finger upon a commutator, a battery actuates a relay, which serves to put the rail in communication with the drum. The brush of the locomotive, electrically insulated from the general metallic mass of the engine, communicates with one of the extremities of the wire of a Hughes electro-magnet, the other extremity of which is connected, through the intermedium of a battery carried by the locomotive, with the latter and the rail. Consequently, there is a closed circuit when a drum is in contact with the brush. At this moment the electro-magnet is freed, and this sets in action a steam whistle, the sound of which warns the engineer.

It will be seen that the engineer does not have to observe at a distance optical signals which fog, for example, may render difficult to see. He is forewarned by a shrill sound that makes itself heard upon his engine, and he is so much the better warned in that the noise of the whistle continues so long as he has not himself closed the armature of the electro-magnet by hand. It will be seen that it is very difficult for him not to take notice of this signal.

Fig. 2 gives a diagram of the Pellat system. The needle, J, is put in communication with the pedal, Q, while the cylinder, E, is in relation with the negative pole of the battery, P, located in the watch tower. The commutator, F, is connected with the positive pole of the battery, *n*, which actuates the relay, R, and permits of making the drum, U, communicate with the rail, V. For all the pedals there is but a single return wire, which is utilized likewise for the circuit of the battery with which each commutator can communicate. All the wires that run from the registering apparatus to the various pedals are in a subterranean cable of about the diameter of the finger, and it is its lead covering that serves as a return wire. From a watch tower it is possible, also, to communicate with the stations situated in the same section. By means of other commutators, G, and of the wire, N (Fig. 2), it is possible to actuate at the stations any sort of optical signal, in order to give warning of the approach of a train.

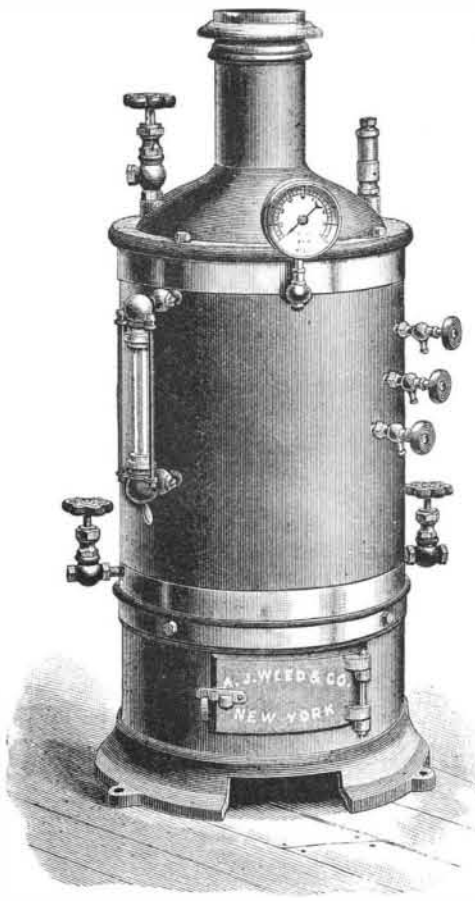
Fig. 1 represents a model that was sent to the Chicago Exposition. In the foreground are observed the commutators, by means of which the stations are put in communication, back of these the commutators, and, still further back, the needles and the registering apparatus. The track, which is not figured, has a length of seven meters. It has twenty-five pedals, and upon this track move two small locomotives, by means of which can be realized the different possible causes of collisions of two trains.

Upon the whole, Mr. Pellat's system presents several interesting peculiarities: At every instant one knows the precise situation of all the trains that are running along a section. It is possible to enter into immediate communication with one or more engineers and warn them, by a most striking signal, located upon their engine, that there is danger of a collision, and that they must, consequently, diminish their speed and take account of the situation.

No other system presents these various advantages. There is reason to hope that this system will be put upon trial. Practice will doubtless suggest modifications of detail, and we shall see by comparison whether the block system is to be retained or replaced by this new safety apparatus.—*La Nature.*

THE WEED STEAM BOILER.

This is a boiler in which the shells are made of solid steel tubes a quarter of an inch thick, with flat steel heads welded in, the first considerations in its construction being safety and durability. There are no screw or rivet joints, and no cast iron is used in the boiler proper. In the smallest size the tubes are made of seamless drawn brass, and in the larger sizes of steel, the tube holes being accurately drilled in perfect alignment, and the tubes fitted into the heads with patent expanders. The boilers are readily cleaned by removing a brass plug screwed into the bottom heads. The fire box is a solid casting into which the lower end of the boiler shell is set and to which it is firmly screwed. The inside of the fire box is lined with a non-conducting material to prevent waste of heat, and any description of fuel may be used--coal, wood, charcoal, crude oil, or gas, small pieces of fire brick being placed on the grate bars where an oil burner is employed, or a section of the grate bar being removed for the insertion of a gas burner when gas is burned.



THE WEED STEAM BOILER.

The boiler is completely furnished with all the necessary fittings, and the attachments used are the best made, including the well known Crosby steam gauges and safety valves. The boiler is made by A. J. Weed & Co., 106 and 108 Liberty Street, New York City.

A Cemented Irrigation Canal.

The Gage irrigation canal at Riverside, in Southern California, is 22 miles long. This canal has been in use for twelve years. It was found several years ago, says the *Pacific Lumberman*, that a great deal of water escaped by reason of gophers burrowing in under the canal, thereby injuring the canal to such an extent that it was found absolutely necessary to devise some means of preventing the enormous waste of water. It was finally decided to regrade and cement the whole canal, and the contract for doing this work was awarded to the Gray Bros., of San Francisco and Los Angeles, for about $120,000.

The cement was spread 1½ inches thick on the banks, and mixed one part cement to four parts fine sharp sand. At times more than 300 men were employed on this work, as it only could be done during the rainy season, when the water was not wanted for irrigation purposes. The first section of this work has been done now for about two years, and the cement holds perfectly good. Where heavy fills of earth were made, about 8 inches of masonry were used. It has been found that since this work has been finished the water company has received more than twice the amount of water obtained from the uncemented canal, thus showing that friction, evaporation, and loss of water by leakage were more than 50 per cent. This is supposed to be the longest irrigating canal known that is cemented throughout.

Big Trees in a Mining County.

Mariposa is a California county that has contributed immensely to the mineral wealth of the State. The county is seamed with quartz veins and is penetrated by the mother lode. The run of ores yields from $10 to $15 per ton, though numerous pockets are struck here and there running up into the hundreds per ton. There are several fine veins of good marble in the county. Silver and copper are also found. In topography, the county resembles Amador, Calaveras and El Dorado, and shares with Calaveras, Tuolumne, Fresno and others the possession of the marvelous sequoia forests which have made that region famous. Besides, the world-famed Yosemite Valley is in the northern part of the county, so that it has altogether better known scenic attractions than any other part of the State.

The sequoias are mammoths among trees, the Methusalehs of the forest. The sequoia timber belt along the Sierras extends from Calaveras on the north to near the head of Deer Creek on the south, about 200 miles. The sequoias are of California and are never seen outside this belt. They seem almost imperishable. No known trees in the world compare with them and their kin, the redwoods, for gigantic size. A tree from 300 to 400 feet high, 30 feet thick in the trunk, is a great curiosity, and yet there are a number of such. In the Calaveras Big Tree grove there are 150 trees more than 15 feet in diameter and 10 about 30 feet. One of the fallen monarchs must have been 450 feet high and 40 feet in diameter. The "horseback ride" as it is called, one of the wonders of the grove, is a hollow trunk through which a man can ride upright on horseback 75 feet, and theatrical performances have been given in it.

The State grove, in Mariposa County, is 15 miles south of Yosemite, and has 427 trees, including 134 over 15 feet in diameter, 18 over 25 feet, and 3 over 33 feet. A daily stage coach has been driven through one, 120 children and a piano crowded into another. A single tree would furnish two rail fencings 20 to 30 miles.—*Min. and Sci. Press.*

Remedy for Snake Bite.

BY C. D. R. KIRK, M.D., OHUQUALAK, MISS.

A few weeks ago a negro and his wife brought their eight-year-old boy to my office for treatment for snake bite, which had occurred only thirty minutes before their arrival. There were two wounds about an inch and a half apart, from which the blood was flowing rapidly. The snake was a long, blunt-tailed moccasin—a "copper belly"—and known to be almost, if not quite, as poisonous as the "cotton mouth" moccasin. The boy had stepped on the snake, and as his pants were short, the snake had a fair strike at his leg about five inches below the knee.

After some explanation and much persuasion, I induced the man to apply his mouth to the wound and suck the poison out. Immediately after each draw, I gave the man some strong alcohol to rinse his mouth, which I assured him would destroy the poison and prevent it from being absorbed. After thoroughly emptying the fang wounds in this way, and the blood had ceased to flow, I injected a half drachm of saturated solution of permanganate of potash in each wound; the boy also drank a small drink of diluted alcohol. A string which the man had tied around the leg remained until morning, when the boy, after a full night's sleep, awoke well, without pain or swelling; no further trouble.

A strong solution of the permanganate of potash gives almost immediate relief from pain, and from repeated trials I believe it destroys the poison or makes a chemical change which renders the poison harmless.

I was called some five or six miles to see a negro man who had been bitten about two hours before my arrival by a "rattlesnake's pilot," which is known to be equally as fatal as the rattlesnake. The patient was suffering most excruciating pain, which extended to his leg, having been bitten on the top of his foot, which was very much swollen. I immediately injected a strong solution of permanganate of potash, which gave immediate relief, and he was soon well.—*Ecl. Med. Jour.*

The Excellent Dock Facilities of Southampton.

The American liner Paris, on her arrival at the port, went alongside the quay on Wednesday at 7:20 P. M. The first bag of mails was landed within five minutes and the whole 465 bags which she brought were landed and checked in 13½ minutes, and the mail train was at once dispatched to London. The passengers commenced to land at 7:40, and a special train left with them at 8:15 P. M. The discharging of cargo commenced at 10 P. M., and although the vessel brought a large cargo she was cleared out in the course of Thursday. She took on board 2,400 tons of coal, and were it not for an extraordinarily large amount of cargo which she had to take, she would have been ready for sea on Friday evening. She left at midday on Saturday, with 250 saloon passengers. The second saloon berths were all taken, and she had a fair complement of third.