THE PHOTOPHONE—SOUND REPRODUCED BY LIGHT.

"There is nothing new under the sun," said the wise man. The times have changed. Now everything is new, and novelty follows novelty. The growth of natural knowledge has broadened the field of investigation, and increased the number of trained specialists, and an answer to any special inquiry is almost certain to come from some part of the scientific domain. The latest thing—it is simply a marvel—in applied science is the discovery that "sounds can be produced by the action of a variable light from substances of all kinds when in the form of their diaphragms." In other words, the ray of light is substituted for the connecting wire, and sounds produced at one station are reproduced at another. It is well known that the action of the telephone is due to variations in an electric current, caused by a diaphragm set in vibration by the voice, the current thus modified reproducing its vibration on a sensitive diaphragm at the other end of the circuit. In the photophone, as the new instrument is called, the changes in the electric current are made during its passage through the metal selenium. This curious metal was discovered by Berzelius in 1817, and by him named selenium. It is not known to occur native, although several native compounds of it are known. In its modifications it is both a conductor and a non-conductor of electricity. A steady light allows a current to pass through an even resistance; a varying light varies the resistance; so that the current is stronger or weaker after passing through the selenium, and in a telephone its vibrations are easily turned into vibrations of sound. The inventors have already conversed between points about 600 ft. apart, and they believe that a similar result can be obtained as far as a beam of light can be flashed. The simplest apparatus yet devised consists of a plane mirror of flexible material—such as silvered microscope glass or mica—which will quiver with the vibrations of sound. On this surface is collected through a lens a beam of light from any source, good success having been obtained from a kerosene or candle flame. The parallel beam reflected from the plane mirror is thrown to a distant concave mirror and focussed on a piece of selenium, electrically connected with a telephone. The voice throws the plane mirror into vibrations, which modify in intensity the ray of light, which rapidly changes the resistance of the distant selenium, this varying the electric current in the telephone as the voice now does directly. Another means of affecting the beam of light is by a disk, perforated with slits, which is rapidly turned, producing in the selenium a continuous musical tone, whose pitch varies with the rapidity of the disk's rotation, a silent motion thus producing a sound. A strange thing is that some substances placed in the beam of light do not cut off the sound. A sheet of hard rubber, for instance, made the beam invisible, but the musical note was still heard. Other experiments suggest the possibility of doing entirely without the electric current in the telephone at the receiving station. Many other substances were substituted for selenium, the affected ray of light focussed upon them, and the musical note was heard without the aid of a telephone or battery. Only carbon and thin glass failed to give a sound.

Some minor details of the difficulties encountered and overcome in using selenium in the apparatus for speaking from a distance, are of interest. A small bar of selenium has a resistance to electricity equivalent to that offered by a telegraph wire long enough to reach from the earth to the sun. Even the cold light of the moon lessens this resistance, and such a brilliant light as that of burning magnesium wire halves it. But Bell and Sumner had to work long to reduce this resistance within manageable limits. No selenium crystal was ever known to measure less than 250,000 ohmes of resistance in the dark. They have made cells measuring only 300 ohmes in the dark and 155 ohmes in the light, by melting selenium to brass conductors, a chemical union being formed which lessens the resistance at the point of contact of the two substances. Their 50 forms of apparatus are based on one of two principles—either to control the source of light, or to modify the beam itself, the second being the most practical.

The inventors of the photophone are Prof. Alexander Graham Bell, the acknowledged inventor of the telephone, and Mr. Sumner Taintor, of Watertown, Mass. The paper describing this invention was read by Prof. Bell before the American Association for the Advancement of Science, and was illustrated by diagrams projected on a screen, and by working apparatus. The interesting paper is described as a model of precise statement and scientific accuracy.

THE FASTEST TROTTING ON RECORD.—The flying trotters are still whittling down the seconds which remain above two minutes, as the time for trotting a mile. The record is now reduced to 2:10¾, made September 18th at Chicago, by "Maud S." This is, of course, a great event in equine history, and we give the brief description of the feat which has been transmitted by telegraph. It will be understood that the mare trotted against time and so had the track to herself. It was nearly six o'clock and growing dark when "Maud S." was brought on the track. The sky was cloudy and a strong south wind was blowing. At the first send off "Maud" soon left her feet. Her driver, Barin, turned her back for a fresh start. She then trotted to the starting point square and level, and as her driver nodded for the word, quickly lengthened out her stride and got to the quarter in 34 seconds. It was then believed impossible for her to do better than 2:16 or 2:18, but when she got down to the second quarter at a 2:03 gait, the fastest record, there was a breathless interest and expectancy. It was feared, however, that the strong head wind, when she turned, would slacken her speed materially and render it still impossible to win. She kept straight forward, however, without a break or a skip, and marked the three-quarter mile pole in 1:36. Barin urged her gently with voice and whip and she responded quickly, and the multitude was breathless as she went the final quarter and thundered down the home stretch in 2:10¾. The time by quarters was, first, 0:34; second, 0:30½; third, 0:31¼; fourth, 0:34¾. Loud cheers greeted the mare, her driver and manager as they went to her stable.

INVENTOR OF THE TELEPHONE.—Prof. Alex. Graham Bell has received the Volta prize of the French Academy of $10,000 for the invention of the telephone, as "the best application of electricity." Prof. Bell is also the inventor of the photophone, which he is said to regard at present as a scientific toy, as the telephone was regarded at first. The future use of the photophone will be, he thinks, between ships at sea, wrecks and the shore, and for military communication. Prof. Bell announced the possibility of producing sound by interrupting the action of light on selenium to the Royal Institute of Great Britain in May, 1878; and shortly afterwards he heard Willoughby Smith announce to the Society of Telegraphic Engineers that he had heard the action of a ray of light on a crystal of selenium by a telephone in connection with it. Prof. Bell was born in Scotland, and was educated at the University of Edinburg. He arrived in Canada in 1870, and was called to a chair in Boston University in 1872. He is said to be a man of remarkably fine presence.

THE house still stands in Salem, built about 1632 by Roger Williams, in which is a low room, with solid oak beams and timbers, where the witch's trials were held, and whence many victims were led out to die.

OUTBURSTS OF HEAT IN THE SUN.

Lately many scientific journals have contained accounts of the observation of new and suspected variable stars. The more carefully we study the stars the more evident it becomes to us, that a large proportion of them undergo and exhibit changes of light with a certain degree of regularity. Very few stars change their brilliancy so quickly as Algol, the "winking demon," in Medusa's Head, but there are many that wax and wane in a remarkable manner.

This subject becomes especially interesting, remarks a writer in the New York *Sun*, when we consider the fact that reasons have been shown why our own sun may be regarded as a variable star. Prof. Proctor in his essay on the "End of Many Worlds," suggests that periodical outbursts of heat in the sun may account for the curious traditions running alike through the Indian, Egyptian, Chinese and Greek mythologies, that the earth at certain epochs undergoes destruction and renovation by fire. On such a supposition the story of Phaeton becomes the tradition of an actual event in the earth's history. According to the myth, Phaeton persuaded his father Apollo to let him drive the car of the sun for a day, lost the road, and, approaching too near the earth, set Olympus on fire, consumed cities and whole nations with flame, and turned the northern end of Africa into a waterless desert.

The cause of any sudden access of heat in the sun, or in a star, is believed to be the downfall upon its surface of a vast quantity of meteoric matter whirling in the track of some comet. We have records of a sudden brightning of the sun in modern times. A remarkable phenomenon of this kind occurred on September 1, 1859, and although it was of very brief duration, it produced startling effects in various parts of the world.

If there is a mass of meteors rushing in an orbit that the sun crosses at certain epochs, and which then causes his fires to burst out with the effects described in the ancient traditions, they have thus far escaped the ken of the astronomers. Observation has shown, however, that if such meteors exist they are to be looked for in the wake of a comet, and we can depend upon the astronomers to give due notice of the comet's appearance.

HOW RAILWAY TIME IS KEPT.—There are in use between this city and New York 13 electric clocks, two of the number being placed in the waiting-rooms and one in the dispatcher's office at the Grand Central depot, New York. The time on the clock in the depot at East Albany corresponds exactly with the time in New York. Each one of the clocks is connected with the General Superintendent's office in New York, in which the railroad time is kept on what is called the "big clock." Conductors, train men and others are compelled to keep their watches in strict conformity with the Superintendent's clock. It is set by standard time, and connected with the time service department of the gold and stock telegraph. The time is distributed over the line each week day as follows: At 10 o'clock 58 minutes and 3 seconds A. M. the word "time" is sent by the main office to the telegraph stations between New York and Albany. This word is repeated for 28 seconds, during which time operators must see that their instruments are adjusted. At 10 o'clock and 50 seconds, seconds commence beating, and continue for 50 seconds. The word "switch" is then sent over the wire, and operators having electric clocks connect them immediately with the circuit known as number 9 wire. Ten seconds are allowed in which to make the connection. At 11 A. M., with one touch of the New York key, the hands on the different clocks are set to 11 o'clock. If they are fast or slow, they change all at once to the hour named.—*Albany Argus.*