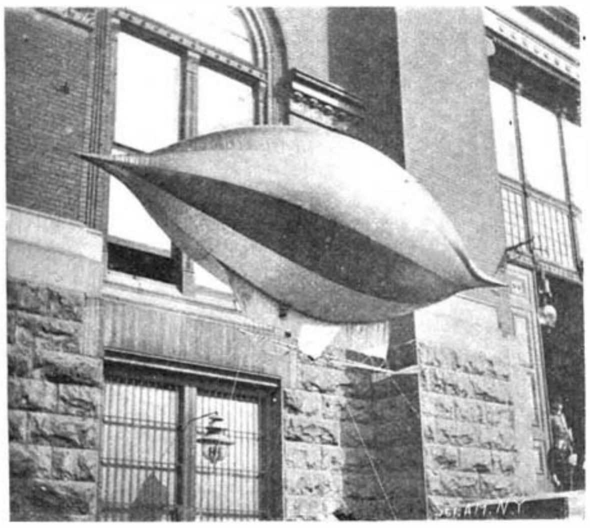
SOME INTERESTING EXPERIMENTS IN DIRIGIBLE AIRSHIPS.

Some interesting experiments with small dirigible airships have recently been carried out by Carl E. Myers, of Frankfort, N. Y. A short time ago he had two dirigible airships on exhibition at the Coliseum at St. Louis, and eight performances were given each day. The two vessels were the "Electric Aerial Torpedo" and the "Sky-Cycle Airship." The Coliseum has an oval arena of 222 feet long, 112 feet wide and 60 feet high, surrounded by seats, boxes and two galleries, and overhung with many swinging electroliers, wires, ropes, and deep iron girders bracing the roof, while on the ground space was an electric fountain, 30 feet in diameter and 20 feet high, which contracted the narrow passage-way on each side of the oval. The torpedo was of entirely new design and is shown in our engraving. It was propelled by a 1½ horse power electric motor, weighing 4 pounds, the current being at 110 volts, and it was controlled from a switchboard. The torpedo was thirteen feet long from tip to tip, and its circumference was the same. The keel attached below supported a car containing a motor, an aluminium screw shaft and a two-bladed propeller; two aeroplanes assisted to support and guide it in mid-air. The small vessel usually started from its elevated platform across the arena, rising as it flew, and then turning gradually about and retracing its course, then curving and gradually rising until it reached the ceiling on a spiral pathway. The vessel then fell vertically until it reached the ground; it then rose and circled again in a path limited by the arena until part way around the oval, when it described a figure eight and flew off on another tack and re-encircled the oval with an opposite succession of cycloidal curves, pausing occasionally with an opposite succession of cycloidal curves, pausing occasionally within reach of the spectators to permit an inspection of its working parts. It would then suddenly fly around the arena, darting straight at some selected victim, but when just within reach it would circle to the right or left or else swing broadside. It would often rest itself for a moment on the railing of the boxes, then fly to the electric fountain and circle it, and then move forward in a straight or curved course. The purpose of the electric aerial torpedo was to demonstrate the ease with which war vessels of this type might be propelled and controlled, and high explosives be distributed over any point selected for destructive purposes.



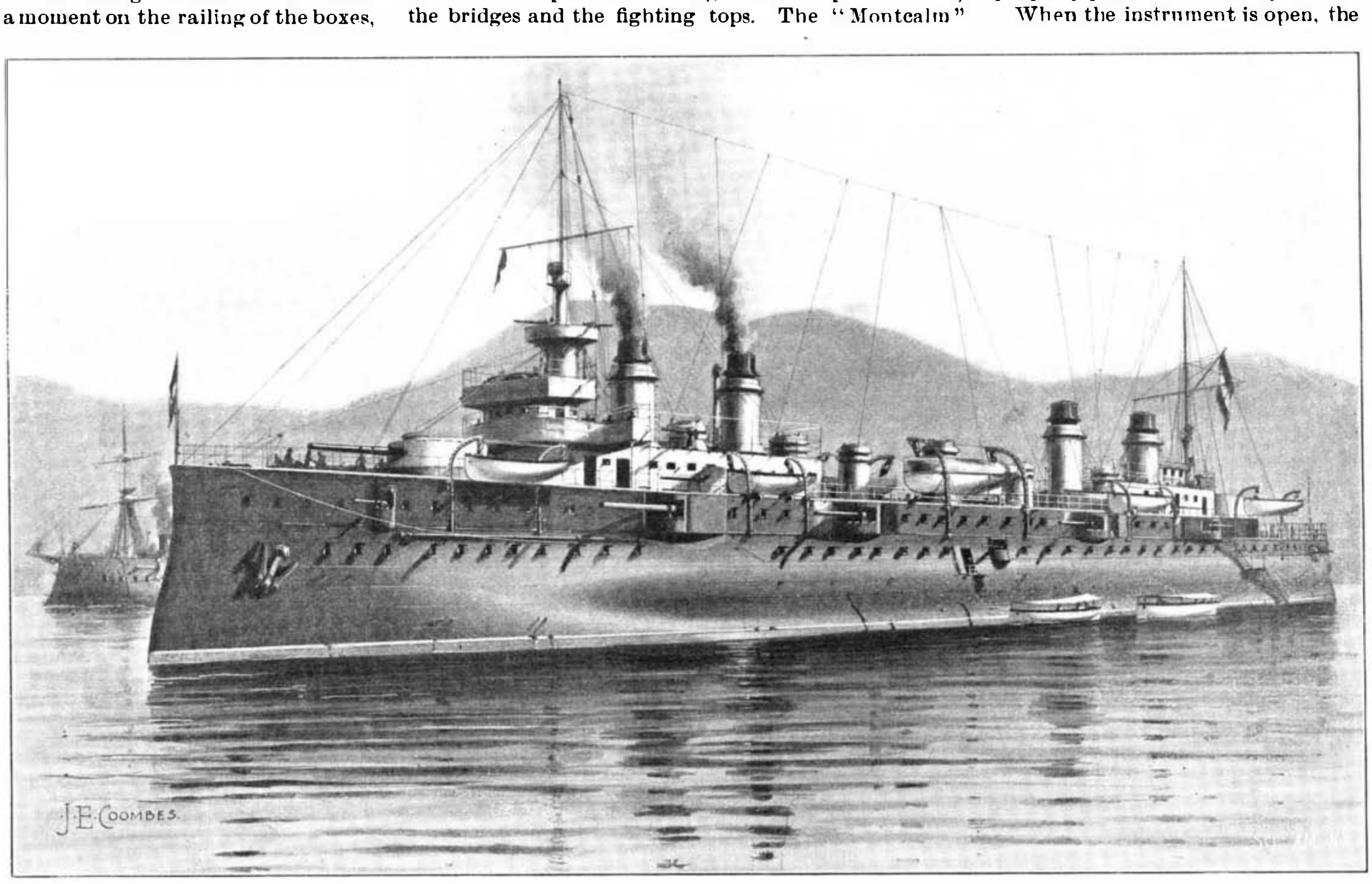
CARL E. MYERS' ELECTRIC AERIAL TORPEDO.

A HUNDRED feet of the dam of the electric power house at Chambly was swept away on November 16, completely demolishing the fifteen sluices. The damage to the Richelieu woolen mills was very great.

THE FRENCH ARMORED CRUISER "MONTCALM."

The rakish-looking craft which forms the subject of the accompanying illustration is one of three powerful armored cruisers which are now under construction for the French navy. These will be known as the "Montcalm," the "Gueydon" and the "Du Petit-Thouars." The "Montcalm," which was launched during the past year, is a fine representative of that armored cruiser type the beginning of whose present popularity may be traced to the advent of the justly celebrated cruiser "Dupuy de Lome," which was entirely clothed with armor from top deck to waterline. The armored cruiser is certainly one of the most, and many people believe the most, important fighting and tactical element in modern naval fleets; and as the French may be said to have originated the type, at least in its later form, so they had been the foremost in its development and in the numbers of the type which they have put afloat. Great Britain, ever conservative, clung tenaciously to the protected cruiser and was slow to follow, as she has in her past history so often followed, the lead of her neighbor and most active naval competitor across the English Channel. To-day Great Britain is building armored cruisers of high speed at a rate which must soon give her a preponderating number of these fine vessels; for she has no less than fourteen of this type, of from about 10,000 to 14,000 tons displacement and 21 to 23 knots speed, at present under construction.

The "Montcalm" is 453 feet in length, 63 feet 8 inches in beam, draws 24 feet 7 inches, and at this draught displaces 9,517 tons. She is propelled by triple screw engines of 19,600 horse power at a maximum speed of 21 knots an hour. Her normal coal capacity is 1,020 tons and her total bunker capacity is 1,600 tons, and in these totals is included a certain amount of liquid fuel. The motive power is thoroughly up to date, the steam being furnished by batteries of Normand-Sigandy water tube boilers. The vessel is protected at the waterline by a practically complete belt of Harvey steel, which is 6 inches in thickness amidships and tapers to 3¾ inches in thickness at the bow and stern. For a little over a quarter of her length, commencing from the bow and running aft, the waterline belt is carried up to the main deck. Associated with the belt is a 2-inch armored deck, and the various gun positions of the casemate or turret type are protected by Harvey armor which varies in thickness from 3¾ to 8 inches. There are two submerged torpedo tube dischargers. The armament consists of two 7·6-inch breechloading rifles carried in two turrets, one forward and one aft on the center line of the vessel, both upon the spar deck; eight 6·4-inch rapid-fire guns mounted in sponsons on the broadside on the main deck, the two forward and after guns being capable respectively of dead-ahead and dead-astern fire; four 3·9-inch rapid-fire guns, mounted in broadside on the spar deck; and sixteen 3-pounders and six 1-pounders which are carried in convenient positions throughout the superstructure, the bridges and the fighting tops. The "Montcalm" is modeled above the waterline with the characteristic tumble-home that is seen in so many of the French vessels; but we miss in her the exaggerated ram bow which one has learned to associate with the French cruisers of former years. The total complement of the ship is 612 officers and men, and it is probable that the great length of the vessel will enable the crew to be very comfortably berthed.



NEW FRENCH ARMORED CRUISER "MONTCALM."

Displacement, 9,517 tons. **Speed,** 21 knots. **Maximum Bunker Capacity,** 1,600 tons. **Armor:** Belt, 3¾ to 6 inches; gun positions, 3¾ to 8 inches; deck, 2 inches. **Armament:** Two 7·6-inch; eight 6·4-inch; four 3·9-inch; sixteen 3-pounders, six 1-pounders. **Torpedo Tubes,** 2. **Complement,** 612.

A SAFETY MILITARY SPY-GLASS.

The ordinary telescope and spy-glass which military officers have used for more than a hundred years is gradually giving place to an instrument far more powerful and less likely to expose an observer to the long-distance fire of an enemy. The list of dead and wounded sent home from South Africa shows that the modern high-power magazine rifle has rendered the lot of the commanding officer far more hazardous than it once was. This increased danger and the great ranges at which modern battles are fought have been the chief reasons why the ordinary spy-glass has been found inadequate by the modern army officer.

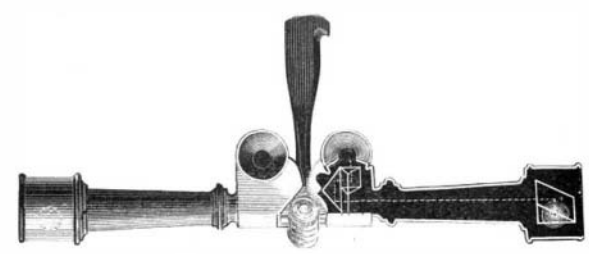


Fig. 1.—STEREOSCOPIC MILITARY FIELD-GLASS.

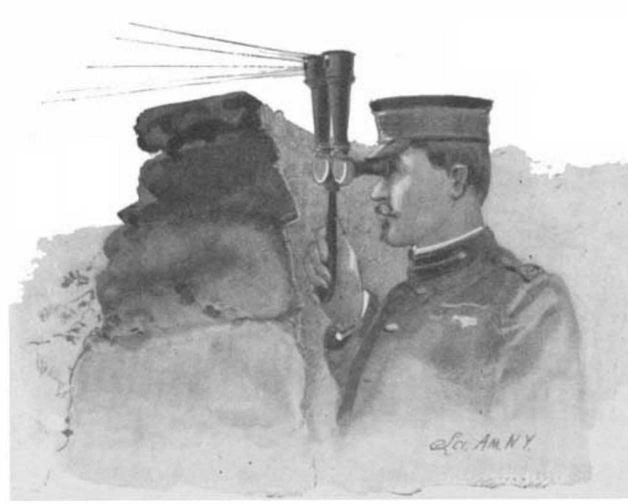


Fig. 2.—THE FIELD-GLASS IN USE.

The new instrument consists of two tubes hinged together and carried by a central handle. Each tube is provided with an objective and with an eyepiece. By means of a system of total-reflection prisms the image formed by the objective is so deflected that the eyepiece, mounted at right angles to the tubes, may properly present it to the eye.

When the instrument is open, the distance between the two objectives is about sixteen inches. The lenses and tubes are so arranged that a stereoscopic effect is obtained.

In order to make use of the stereoscopic spy-glass, the eyepieces are first purposely focused. Since, in the majority of cases, both eyes of the same person are not equal, the two eyepieces are focused independently. The instruments are regulated for a 26 inch spacing of the eyes, which is the average. For persons having eyes differently spaced, there is a very simple mechanism for regulating the apparatus. A marking arrangement permits of making such regulations once for all.

The stereoscopic spyglass may be employed in two different positions of the telescopes, one nearly horizontal and the other nearly vertical.

The first position, as in Fig. 1, increases the spacing of the eyes through an optical illusion. In this position of the telescopes remote objects situated in different planes can be seen. The second position (Fig. 2) increases (artificially likewise) the stature of the observer. In both cases, the observation may be made from a place of concealment. For the horizontal position of the telescopes, the observer merely takes shelter behind a tree and allows the ends of the instrument to project behind the sides of the tree. Fig. 2 needs no comment. The observer can calmly make his observations while concealed behind a wall, with the two extremities of the apparatus carrying the objectives projecting above the obstacle.

It is hardly necessary to dwell upon the utility of the instrument from a military point of view. From a very interesting report made by Lieut.-Col. Becker, of the Swiss army, we select the following passage: "With a common ordnance fieldglass we observed, at a distance of about two miles, a trigonometric signal situated at the same height as ourselves and on the verge of a forest. It was impossible to recognize whether this signal was upon the very outskirts of the forest or remote therefrom. Upon making the same observation with the stereoscopic spyglass, the signal appeared remote from the edge of the forest, and it was possible, besides, to estimate the distance that separated it therefrom at 40 or 50 feet. The artilleryman will at once recognize the advantages that may be derived from so precise an observation."

The instrument under consideration magnifies ten times and embraces a linear field of 65 yards. Its weight is about a pound and a half, and it may be easily carried in a case.

THE BOLOMETER OR ACTINIC BALANCE.

BY MARCUS BENJAMIN, PH.D.

In the domain of astronomical physics American scientists hold a foremost place, and among those who have devoted their attention to that branch of science, Samuel P. Langley has been accorded the highest honors.

In 1867 Dr. Langley was called to the charge of the Allegheny Observatory in Pittsburg. The obscured condition of the atmosphere, due to the smoke from the many large metallurgical and other industrial establishments in the vicinity of that city, made it practically impossible to study the smaller heavenly bodies, and he naturally turned his attention to the sun, beginning almost at once that brilliant series of investigations with which his name has been so honorably connected.

As has been indicated, it was doubtless the atmospheric conditions that surrounded Pittsburg that led Dr. Langley to devote his attention to the sun, and it seems equally probable that it was these conditions that influenced him to investigate the phycieal conditions of that great orb. But even physical conditions may be differentiated, for to be exact, it was chiefly with the amount of light and heat radiated from the sun that he occupied himself.

In February, 1874, he published his first paper on the sun, and in it he described in minute detail the general solar surface and the extraordinary sun spots. Four years later, in discussing the temperature of the sun, he compared the heat and light of the sun to that of molten steel in a Bessemer converter, and at the same time showed that the temperature of the sun was very much greater than 1500° C., which was the temperature usually accepted by men of science. These results were obtained by means of a thermopile, which was the most delicate instrument then known for measuring radiant energy. It became manifest to Dr. Langley that an apparatus more sensitive than the thermopile, and which at the same time should be more accurate, would be of the utmost value in such investigations. What was needed, he said, was "a measurer of radiant energy, and not a mere indicator of the presence of feeble radiation." Aided by a grant from the Rumford Fund of the American Academy of Arts and Sciences, he set to work in December, 1879, to invent an instrument that would yield the desired results.

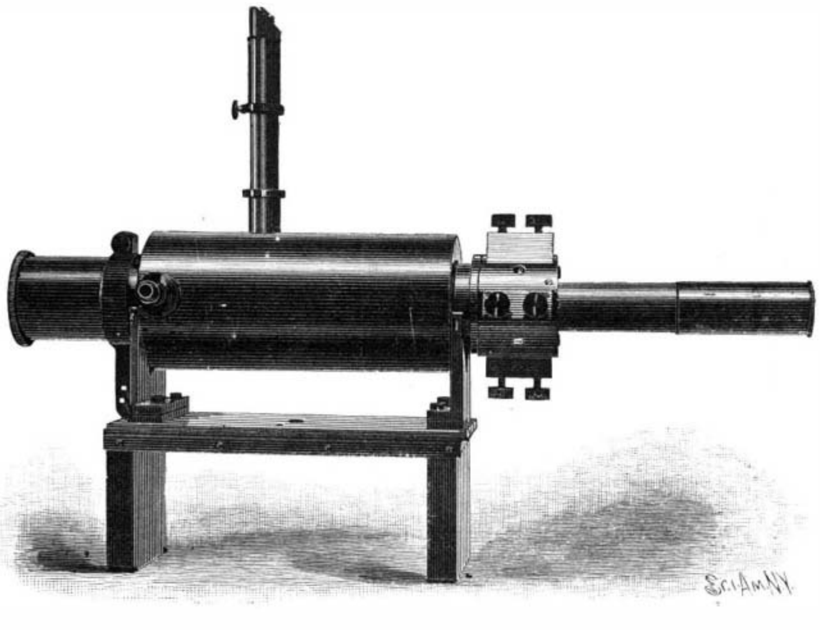
His earliest design consisted of two strips of thin metal placed side by side in conditions of environment as nearly identical as possible and in such a manner that one strip could be exposed at pleasure to the source of radiation. When warmed by the radiation, the electrical resistance of the strip exposed increased proportionately over that of the other, and this increased resistance to the flow of the current from a battery could be measured by a galvanometer.

Having thus determined the nature of the instrument to be used, the next step was to study the best method for its manufacture, and in this much time was consumed in experimenting. To secure a radiating body that would not vary from one experiment to another, or from day to day, was the first problem to be considered, and it was not an easy one. He decided to employ the flame of a petroleum lamp within a glass chimney, the radiation being limited by a circular opening of one centimeter diameter in a triple cardboard screen.

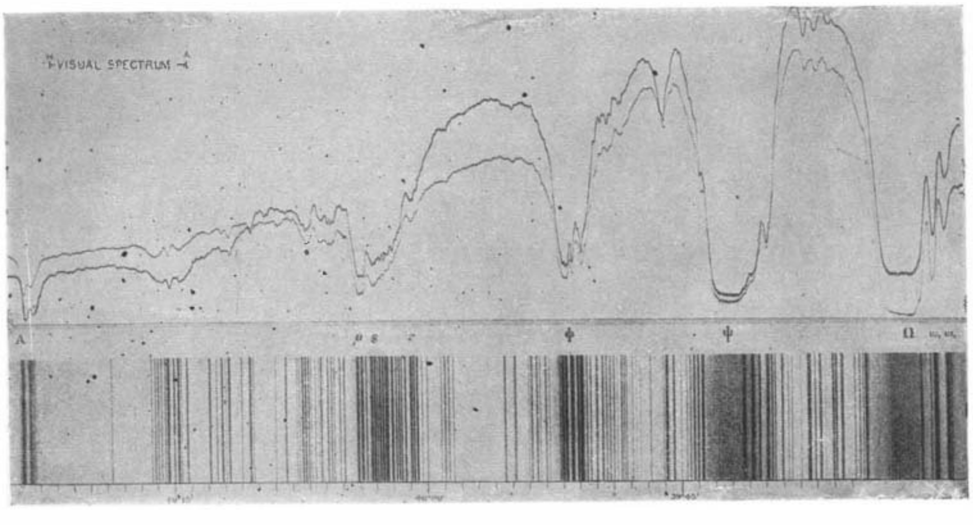
With this lamp he tested various metals, such as gold foil, platinum foil, and various grades of platinum wire, gold leaf gummed on glass, extremely thin sheet iron, and the same metal blackened with camphor smoke. The size of the strips was also carefully studied, and he found after much painstaking work that the best results were obtained with an instrument which he described somewhat as follows:

Metallic steel, platinum or palladium are rolled into sheets of from $\frac{1}{100}$ to $\frac{1}{1000}$ of a millimeter in thickness, and from these sheets strips one millimeter wide and one centimeter long, or less, are cut. These strips are then united so that the current from a battery of one or more Daniell's cells shall pass through them. The strips are in two systems, arranged somewhat like a grating; and the current divides, one-half passing through each. When the two currents are equal, the needle of a delicate galvanometer will not be deflected; but when radiant energy in the form of heat falls on one of the systems of strips and not on the other, the current passing through the first is diminished by the increased resistance; and, the other current remaining unaltered, the needle is deflected by a force due to the battery directly, and immediately to the feeble radiant heat, which by warming the strips so little as $\frac{1}{10000}$ of a degree Centigrade, is found to produce a measurable deflection.

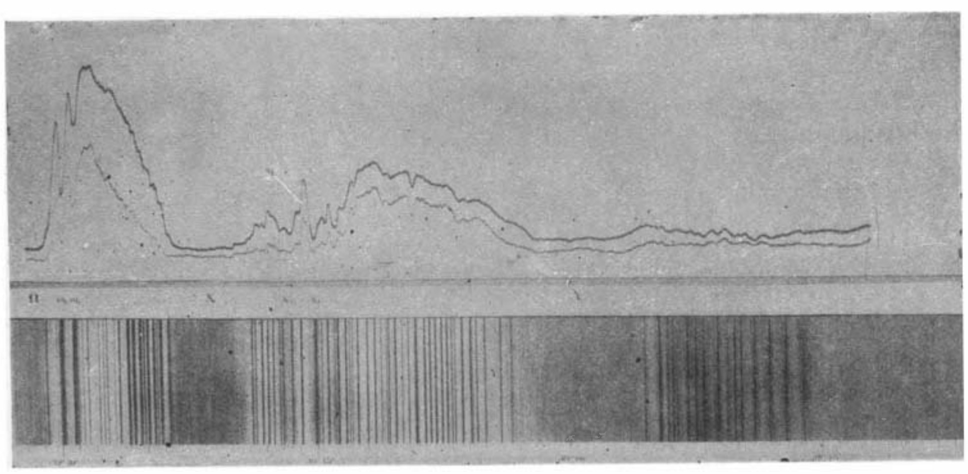
So delicate was the instrument thus added to the tools of science that it was said by Dr. Langley that "a change in the temperature of the metallic strips of one hundred-thousandth of a degree can, I believe, be thus noted;" and it is evident from



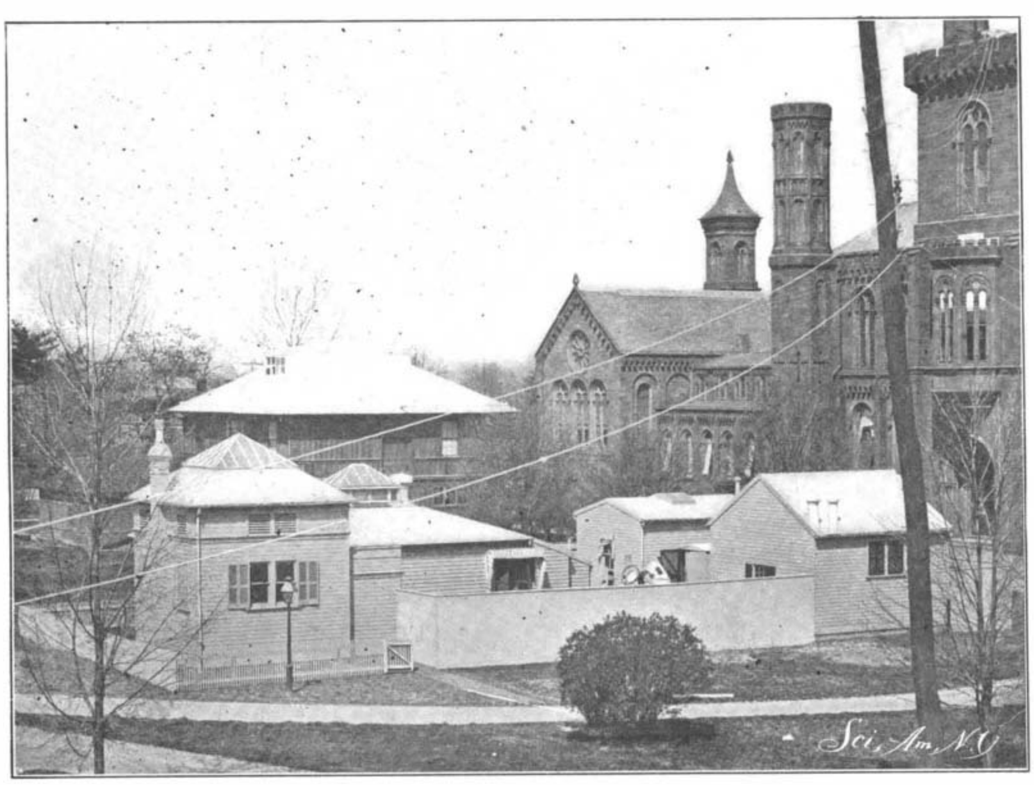
DR. LANGLEY'S BOLOMETER.



INFRA-RED SPECTRUM OF ROCK SALT PRISM.
Wave Lengths, 0·75μ to 2·29μ.



INFRA-RED SPECTRUM OF A ROCK SALT PRISM.
Wave Lengths, 2·09μ to 5·69μ.



THE ASTRO-PHYSICAL OBSERVATORY OF THE SMITHSONIAN INSTITUTION, WASHINGTON, D C.