All of the advantages of the twin camera are to be had by using a reflecting camera, which is at the same time both lighter and less expensive. The principle of the reflecting camera is shown in the diagram (Fig. 8), which represents diagrammatically such a camera in longitudinal section. The operator, holding the camera in front of him, looks in the direction indicated by the upper arrow, at the ground glass through the hood, which takes the place of a focusing cloth. The interior of the camera contains a mirror (*m*), which extends from beneath the back edge of the ground glass downward and forward at an angle of 45 deg. The mirror is hinged at *x* to the top of the camera. When it is in the position shown at *m* in the figure the space between the back of the mirror and the back of the camera is quite dark. Light entering through the lens is reflected by the mirror and strikes the ground glass, as shown by the line *y y y'*. The image as seen on the ground glass by the operator looking down through the hood is, on account of the action of the mirror, an erect image, not an inverted image such as one sees on the ground glass in the back of an ordinary camera. It is also an image of the full size permitted by the plate and the lens, not a reduced image such as one sees in a finder. The shutter (*s*) is a focal plane shutter situated at the back of the camera just in front of the plate (*p*). Such a shutter is essentially a roller curtain of black cloth with a slot (*sl*) across it at one point. The width of the slot may be regulated. The shutter is wound upon an upper roller (*r*) until the slot is upon the roller. The exposure is made by causing the curtain to unwind from the upper roller (*r*) and wind upon the lower roller (*r'*) so that the slot passes with great rapidity across the face of the plate.

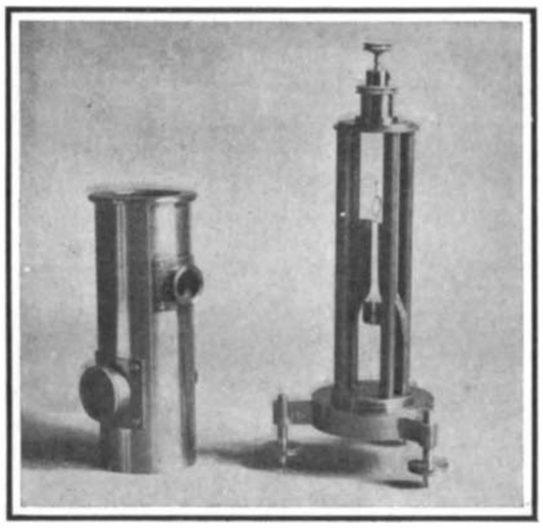
The length of the exposure depends on the width of the slot and the rate at which it moves. The rate may be varied by changing the tension of the spring which actuates the lower roller. The operator holds the camera in front of him with both hands while he looks down at the ground glass through the opening in the hood. With one hand he focuses. When the object appears in sharp focus and in the desired position on the ground glass, he presses a button with the other hand. This causes the mirror to swing on its hinge to the position shown by the dotted outline *m'* beneath the ground glass. In this position the mirror excludes light which might otherwise enter the camera through the ground glass. At the same time the change in position of the mirror permits the light, which was before reflected to the ground glass, to fall upon the plate. The adjustment is such that an image which is in sharp focus on the ground glass will be in sharp focus on the plate when the mirror changes position. The image does not actually strike the plate so long as the shutter is wound upon either roller. Before the instrument is to be used the shutter is wound on the upper roller. When the mirror in swinging upward reaches the position *m'* the shutter is released from the upper roller and taken up on the lower roller. As the slot of the shutter curtain passes across the plate from above downward, the image falls through the slot onto the plate in successive strips corresponding to the width of the slot.

A 5x7 camera of the type just described, with a magazine holder for twelve plates, was used by the writer to obtain submarine photographs at Tortugas, Fla., during the season of 1907.

The apparatus was carried to a boat or, if it was to be operated near shore, to the shore. In working with the help of a boat the operator wades on or near the coral reef with his head and shoulders above the water. The boat, with an attendant on board, is anchored near. The operator, with the help of a water glass, now seeks a favorable place for operations. As he moves about the reef, the fish at first seek shelter in the dark recesses of the coral rock, but if he selects a favorable place and remains quiet they soon reappear. They are at first wary, but soon grow bolder and after half an hour or so pay but little attention to him. There is a great difference in wariness among different species of fish. At first only one or two species appear, demoiselles and slippery-dicks usually, then the number of species gradually increases until the shyest butterfly-fish and parrots come within 6 or 8 feet of the operator. He then has the camera passed to him from the boat. It floats with the upper part of the hood protruding and may be easily turned toward any point on the horizon or even tilted so as to be pointed at a considerable angle upward or downward. The operator has now merely to direct the camera at the fish, while he focuses with his right hand. He must often wait some time before the fish come to the point selected or assume the desired attitude. Often they may be enticed by throwing in a bait of crushed sea urchins or pieces of crawfish. They are in constant motion, so that he must as constantly focus. He often misses a long-awaited opportunity because the fish moves on or takes a wrong attitude before he has had time to focus sharply; but when the favorable time comes he presses the release stem and the exposure is made.

### A NEW DIRECT-READING PHOTOMETER.

Lamps of all kinds transform heat into light, the apparent intensity of which varies with the character of the incandescent body which emits it, and is also a yet unknown function of the photo-chemical transformations which are produced in the retina. In our ignorance of these transformations we can only measure the luminous power of a lamp in terms of standard candles or other arbitrary units. Numerous attempts have been made to effect these photometric comparisons without the aid of the eye, but it has hitherto been found impossible to construct an apparatus having the same comparative sensitiveness to the various regions of the spectrum that is possessed by the retina. This fact explains the failure of methods based, for example, on photography and on the effect of light on the electrical resistance of selenium.

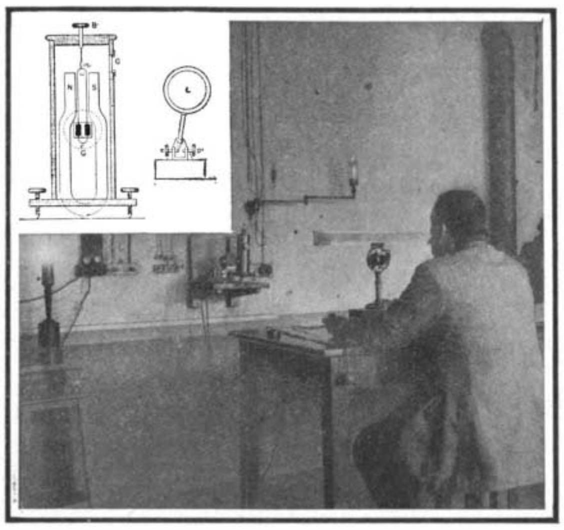


**Féry photometer, with copper cylinder removed.**

No better result has been obtained by measuring the total energy of the radiation emitted by sources of light, for the maximum of this energy usually falls in a part of the spectrum to which the eye is absolutely insensitive. Prof. Charles Féry, of the Paris School of Applied Physics and Chemistry, has demonstrated that, in order to obtain correct results by this method, the measurement should be made on light which contains the various elementary radiations in quantities proportional to their effects on the retina.

Upon this principle Féry, after overcoming many difficulties, has constructed a novel direct-reading photometer. The selection of the radiations, in the proper proportion, can be effected by various means. For example, the height or width of the spectrum of the light under examination might be limited by the interposition of a screen with its upper or lower edge, or both, in the form of the curve of retinal sensitiveness, as a function of wave-length. It appears simpler, however, to employ an absorbing cell. After trying various substances, Féry chose a solution of copper sulphate as the absorbent liquid and, by modifying the radiomicrometer of C. V. Boys, he obtained an instrument with which exceedingly small quantities of heat can be measured.

The essential part of the new Féry photometer is a combined galvanometer coil and thermo-electric couple, composed of a coil of copper wire with its ends connected, by means of silver plates, with the ends of a loop of phosphor bronze. The compound coil is suspended between the poles of a magnet by a quartz filament attached to the strip of bronze. The silver plates, which are 1/8 inch thick, are brought close together and inclosed in a short thick-walled copper tube, to insure equality of temperature. The plates are polished on one side and coated with platinum black on the other. The beam of light is received on the blackened surface, the adjustment being facilitated by a fringe of paper surrounding the plate. A small concave mirror carried by the bipolar suspension throws a spot of light on a scale at a distance of 2 meters (6½ feet). A deviation of 50 centimeters (20 inches) is produced by the radiation of a candle distant 1 meter (39 inches) from the blackened silver plates, the radiation being allowed to fall on only one of the plates. As this sensitiveness is greatly diminished by the interposition of the absorbing lens, the image of the source of light is projected on the plate by a convex lens, which can very conveniently be moved aside, and brought to cover each plate in succession by compressing two India rubber bulbs, the movement being limited by adjustable stops. By repeating this series of operations at regular intervals, errors due to the gradual displacement of the zero point are eliminated. With the lens and the absorbing cell, a Carcel lamp at a distance of 1 meter (39 inches) produces a deviation of 60 millimeters (2.4 inches). In measuring very powerful sources of light, the sensitiveness must be diminished by interposing diaphragms of known area.



**Measuring the candle-power of a lamp with the Féry photometer.**

NEW DIRECT-READING PHOTOMETER.

With this apparatus, which is very easily managed, Prof. Féry has already obtained interesting results, some of which confirm the measurements made by the usual methods of photometry. He finds that the optical efficiency of the Bengel burner is only 0.091, while that of the Auer burner is 0.401. He intends to extend his researches to arc and mercury vapor lamps.

### The Current Supplement.

The new system of reinforced concrete is described and illustrated in the opening article of the current SUPPLEMENT, No. 1728. The theory that electricity or electrical charge is a kind of matter composed of discrete particles or electrons has steadily gained ground during the last decade. A lucid and popular explanation of the theory is given by Prof. L. Graetz. The possibility of a future fuel supply in the growth of vegetation from the soil is set forth in an article entitled "Alcohol as a Fuel." The recent collision of the "Republic" and "Florida" lends timely interest to the splendid article by Gen. E. E. Goulaeff on unsinkable and uncapsizable ships. About twelve miles from Paris, the French Institute for the Encouragement of Aviation has established a trial ground and race course for aeroplanes and other airships. This is admirably pictured in the current SUPPLEMENT. A new development in the art of indirect color photography is described by Frederick Limmer, and sets forth the details of the Szczepanik process. The strength of wooden poles for overhead power transmission is discussed by our London correspondent. Paraphrasing the remark that has been made about books, it may be said that of the making of many alloys there is no end. Some of our legion alloys are described by Dr. John A. Mathews. The coming return of Halley's comet lends peculiar interest to Irene E. Toye Warner's article "Ancient and Popular Ideas of Comets." The usual electrical, engineering, and trade notes will be found in their accustomed places in the SUPPLEMENT.

### Official Meteorological Summary, New York, N. Y., January, 1909.

Atmospheric pressure: Highest, 30.66; lowest, 29.17; mean, 30.14. Temperature: Highest, 57; date, 5th; lowest, 7; date, 19th; mean of warmest day, 50; date, 5th; coolest day, 17; date, 19th; mean of maximum for the month, 39.7; mean of minimum, 26.7; absolute mean, 33.2; normal, 30.6; excess compared with mean of 39 years, 2.6. Warmest mean temperature of January, 40, in 1880, 1890. Coldest mean, 23, in 1893. Absolute maximum and minimum for this month for 39 years, 67 and —6. Precipitation: 3.33; greatest in 24 hours, 1.23; date, 5th; averages of this month for 39 years, 3.76. Deficiency, 0.43. Greatest January precipitation, 6.15, in 1882; least, 1.15, in 1871. Wind: Prevailing direction, northwest; total movement, 10,241 miles; average hourly velocity, 13.8 miles; maximum velocity, 57 miles per hour. Weather: Clear days, 6; partly cloudy, 10; cloudy, 15; on which 0.01 inch or more of precipitation occurred, 11. Snowfall, 9.5. Sleet, 14th, 17th. Fog (dense), 5th, 6th, 22d, 23d, 24th, 25th.

### A $10,000 Aeronautic Prize.

The Aero Club of America has just announced the offering of a cash prize of $10,000 by the New York World for a flight by an aeroplane or airship up the Hudson River from New York to Albany. This flight will be made next October at the time of the Hudson-Fulton centennial celebration. The distance is about 140 miles, and when the historic "Clermont" made the journey one hundred years ago, it took 35 hours to accomplish it. A modern aeroplane or airship should do it in about one-tenth of this time.

The exact conditions of the flight and the rules under which it is to be conducted will be announced in the near future. The contest will be in the form of a race, and it is probable that a number of stops will be allowed *en route* for fuel replenishment.