hours. If the control tube be not then white, or nearly so, the series should be allowed to stand longer. The tubes of milk containing added preservative will then be found to be blue or pink, while those which are pure will be white, like the control tube.—Analyst.

The Color of Skylight.

Dr. N. E. Dorsey treats on the color of polarization of blue skylight in an article in the Monthly Weather Review. The subject has been considered of great interest for hundreds of years. Leonardo da Vinci considered that the blue of the skylight is due to the mixing of the white sunlight reflected from the upper layers of the air, with the intense blackness of space. Sir Isaac Newton thought that the reflecting particles were small drops of water. This theory was at first generally accepted, but in 1847 Clausius subjected it to a strict mathematical analysis. He proved that the light of the sky cannot be due to the reflection of sunlight in small drops of water. Tyndall, in 1869, demonstrated that when the particles causing the turbidity are exceedingly fine, scattered light is not only a magnificent blue, but is polarized in the plane of scattering; the amount of polarization is a maximum at an angle of ninety degrees with the incident light, and the definition seen through it is unimpaired by the turbidity. Lord Rayleigh undertook the analytical treatment of the subject, and proved quite recently that about a third of the total light from the sky may be accounted for by the scattering produced by the molecules of oxygen and nitrogen in the air entirely independent of the presence of dust, aqueous vapor, or other foreign matter.

From these and other observations and investigations it is evident that the color of the sky is independent of the angular distance of the point observed from the sun—being a function of only the state of the atmosphere and the thickness of the stratum observed. Careful observations on the color of polarization of the light from the sky, therefore, supply data determining the amount and size of the particles floating in the air, be they dust or water, and as any change in the state of the atmosphere will affect these quantities, such observations should be of ever-increasing importance to meteorology.

A NEW SEMI-DRY BATTERY.

The use of dry batteries in the operation of many devices, for open-circuit work, has so greatly extended that it is said in the United States alone about ten million cells are annually consumed.

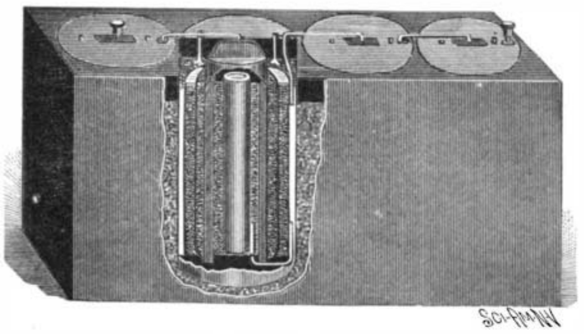
It has been observed, however, that there is a certain continual deterioration going on, even when the battery is not in use, which causes a variation in the output of amperage of current to such a degree that not more than half the quantity is given out at the end of a few months as when the battery was first made.

Despite this fact the dry battery is extremely popular on account of its convenience, cleanliness, portability, easy application and inexpensiveness.

Within the past few years much study and prolonged experiment has been given to the improvement and efficiency of the dry battery, resulting in the production of an improved form called the "Hydra Double Battery," which is a sealed semi-dry cell and is the subject of our illustrations.

This battery has been in successful and growing use in Germany and other foreign countries for the past four years or more and has largely supplanted many other kinds of batteries. It is the invention of Prof. Paul Schmidt, Carl Koenig and Robert Krayn, and combines the best proportions and balance of materials calculated to produce the highest efficiency in the steadiness and volume of current under the most exacting circumstances. It received the highest award and gold medal for batteries at the Paris Exposition.

Referring to the illustration of a section of single cell and beginning at the center, *A* is a cylinder of zinc closed at the bottom end and open at the top, holding in its interior a special liquid electrolyte, and is also connected by an insulated wire, *F*, to the outer thick zinc cylinder, *E*. The zinc cylinder, *A*, it will be observed, is placed within the carbon cup, *C*, with an absorbent paste depolarizer, *B*, between the two surfaces, the cup having a terminal at its upper end and its lower open end sealed up with pitch through which wire, *F*, passes. Outside the carbon cylinder is a dry-pressed generating depolarizer, *D*, inclosed in a network of linen, which is encircled by the outer zinc, *E*, from which the other terminal rises to the top of the cell. Over all the elements at the top is sawdust and absorbent cotton, and from this rise vent tubes, *G*, which pass through the asphalt top. The whole is inclosed in a thin outer metal casing insulated from the outer zinc cylinder, *E*, by which the battery is protected from dampness and other injury. A small chamber in the carbon cylinder, *C*, at the top just above the inner zinc, *A*, allows the electrolyte in latter to overflow occasionally and keep the absorbent paste, *B*, slightly moistened. The moisture thus absorbed passes from *B* through the porous carbon, *C*, to the dry absorbent, *D*, thereby maintaining it in proper condition for the generation of a current when the terminals of the battery are connected. The perfectly dry condition of the generating depolarizer, *D*, prevents any local internal action when the cell is not in use. The double surface of zinc provided by having an inner and outer zinc cylinder, as well as the depolarizing material on the inner and outer side of the carbon cylinder, give the battery a remarkably constant voltage, low internal resistance and high capacity, with the added advantage that the moist electrolyte is brought to the relief of the decomposing paste, keeping it permanently humid, giving the cell excellent power of recuperation after long use. The larger sized single



AN AUTO HYDRA SPARKING BATTERY.

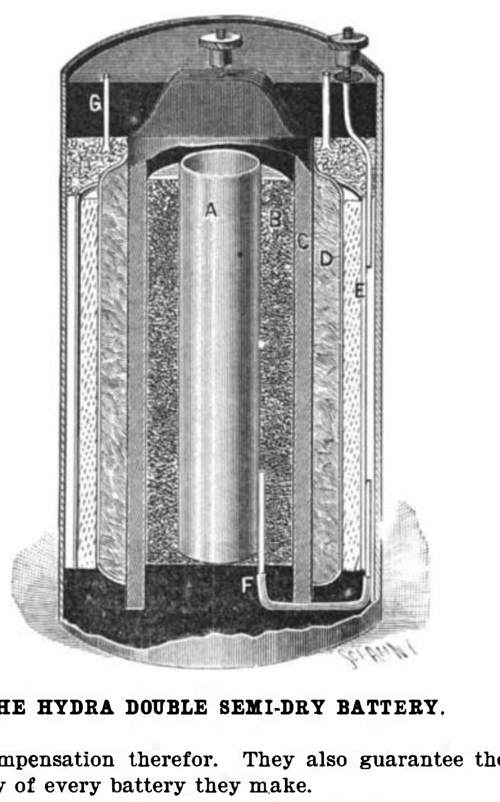
cell has an initial current of 22 to 30 amperes at 1½ volts.

In another view is a group of four cells in a rectangular metal case arranged for use in connection with a sparking coil for automobiles or gasoline engines. The largest size gives a discharge of 30 amperes at 6 volts.

We have had a set measuring 11 inches long, 7 inches high and 2 inches wide of this kind in use on a yacht, sparking a gasoline engine with very satisfactory results.

We have also seen a group of these batteries operate an electric fan very successfully, also portable miniature electric flash lights and gas lighters. Its constancy of output of current is one of its special features.

The manufacturers, who control the battery for the American continent, are the Hydra Double Battery Company, 32 Broadway, New York, which is composed of a number of well-known successful business men, and we are advised that they are introducing a special return system of used-up batteries and allowing reason-



THE HYDRA DOUBLE SEMI-DRY BATTERY.

able compensation therefor. They also guarantee the capacity of every battery they make.

There is no question that a battery of the character described should come into general use and prove very effective for all classes of open-circuit work.

A painstaking inventor has devised an apparatus for measuring the vibration of a telephone transmitter by means of a ray of light reflected from a small mirror cemented to a steel pinion set in watch jewels, says The Engineer. To the center of the diaphragm is soldered a needle which presses on a steel arm. This arm is perpendicular to the pinion and in the plane of the mirror. The slightest vibration is transmitted through the needle and arm to the mirror, causing it to oscillate and thus deflect the beam of light. In an experiment a diaphragm excursion of one three-thousandth of an inch deflected the spot of light on a screen 25 feet away 2 inches. The ticking of a watch gave noticeable deflections, and loud sounds produced deflections of 2 feet.

THE FAILURE OF THE BROOKLYN BRIDGE.

The collapse of a portion of the Brooklyn Bridge during the recent hot weather was a serious event, that might easily have become a great public calamity. It is best to recognize this fact. For several hours, and for aught we know, for several days, a portion of the northern roadway of the bridge, measuring 70 x 30 feet, was entirely detached from its supporting cable and was only held up by the indirect support which it derived from the adjoining floorway. The case is analogous to that of an upper floor of a house from which the front wall has fallen out, which, in spite of the fact that the support on one side of the floor is gone, is still held up in a sagged condition by the natural resistance of the floorway to bending. There is this difference, however: the three remaining walls of the house will hold the floorway indefinitely, or until it decays, whereas, in the case of the Brooklyn Bridge there was an enormous increase of load thrown on the nearest suspenders to those which gave away, and with every fresh suspender that broke, the load was proportionately increased upon those that remained. We do not hesitate to say that, had a few more adjacent suspenders failed, the floor under the north cable would have ripped from the cable with a cumulative action throughout the whole length of the main span of the bridge.

As everybody knows by this time, the accident was due to the breaking of certain suspenders (nine in all) on the most northerly of the four main cables of the bridge. The immediate question to be solved is that of the actual cause of this failure. One of the engineers of the bridge has given out that it was the excessive heat. This is only partly true. The excessive heat was the occasion but not the cause of the disaster. The direct cause is to be found in faulty construction, coupled with the action of the elements. And let it just here be clearly understood that, in spite of the increased load which has been put upon the bridge, it is an absolutely safe structure as regards the four great cables themselves. The suspenders, moreover, by which the roadway is hung from the cables, are amply strong to carry even their present loads, provided these suspenders are subjected only to the simple pull or tensional strain for which they were designed. The floor system (including floor beams, stringers and stiffening trusses), though of antiquated design, and not at all of the kind that would be built in a modern suspension bridge, is sufficiently strong to carry with safety the present weight of the bridge, provided, however—and we cannot lay too much stress upon this—that it is subjected to a very thorough and frequent system of inspection in all its parts. We have said that the suspenders are amply strong for their work; but in saying this we draw attention to the fact that the method of attaching the suspenders to the floor system, particularly at the center of the main span, is poor and cheap in design, and liable to rapid deterioration unless it is carefully watched and frequently painted.

In general, the floor system is suspended from the main cables by wire cables which are spaced 7 feet 6 inches apart, there being a suspender located immediately above each transverse floor beam of the bridge. The suspenders for 30 panels on each side of the center of the main span consist of 2⅝-inch steel rods, these being used in preference to wire, because of the convenience in making connections. Connection is made to the main cables by means of a split steel band, between the ends of which an eye in the upper end of the suspender is bolted. The lower end of the suspender is threaded and passes down through a trunnion-block or rocker-bearing which is bolted beneath the floor beams, the amount of the load put upon the suspender being determined by screwing up the suspender nut against the underside of the block. The whole arrangement is shown clearly in the accompanying line and perspective drawings. It will be noticed that the suspender is free to have a pendulum motion parallel with the axis of the bridge, and in the plane of the cable to which it connects.

The object of using these "pendulum suspenders," as they are called, is to provide for the longitudinal movement of the floor system under changes of temperature. In the considerable range of temperature which occurs in New York in the course of a year it is found that, in the 1,600 feet of floor between the Brooklyn and New York towers of the Bridge, there is a maximum change of length of 14 inches. To provide for this the stiffening trusses are cut in two at the center and anchored firmly to the towers, an arrangement which results in the cut ends of the trusses moving together in the summer and drawing apart in the winter, the total horizontal movement of each truss being 7 inches. The main cables overhead, however, at this point are affected differently. Under an increase of temperature, they lengthen, and of course, sag toward the river. In the winter-time, contracting, they shorten and the center rises, the extreme rise and fall amounting to between 3 and 4 feet. Although the center of the cables has a considerable vertical movement, it has no movement in a horizontal direction, while the end of each truss has, as we have