"A Flight Over Paris"

By

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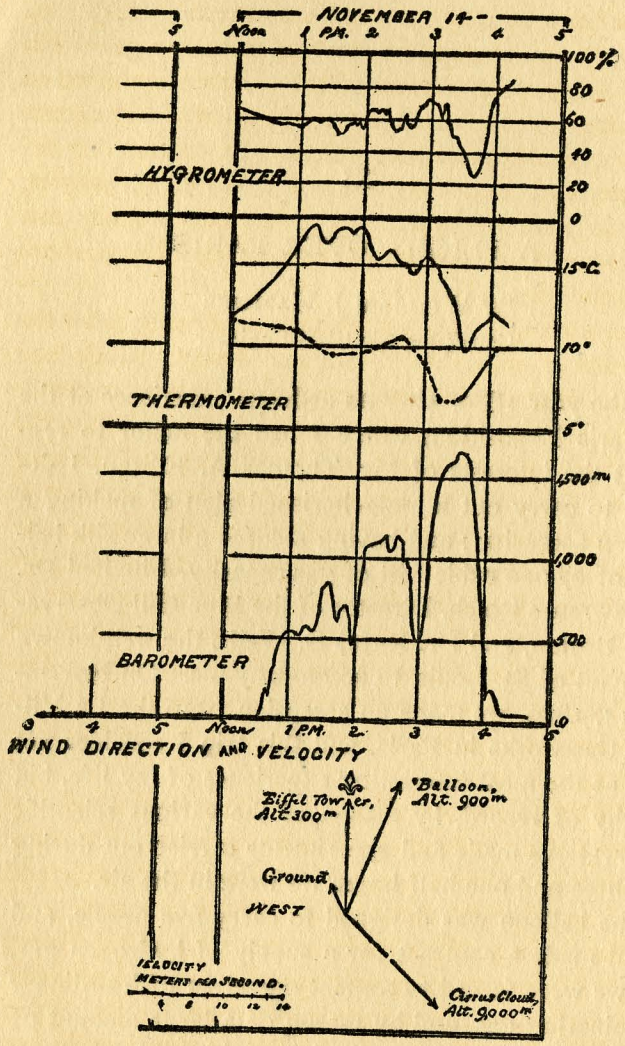
IN the year 1889, after an arduous experience at the Paris Exposition, where I had the honor to represent the interests of Mr. Thomas A. Edison, I decided to carry out a long-cherished plan of making a balloon ascension; and having secured a large silk balloon of 27,000 cubic feet of gas capacity, I invited Dr. A. Lawrence Rotch, Director of the Blue Hill Observatory, Boston, and Dr. Rufus G. Wells, the well-known aëronaut of St. Louis, to accompany me. On November 14, 1889, we made an ascension from the La Villette Gas-works in Paris, and this trip I consider not only as the most interesting experience of my life, but worthy of record, by reason of the various scientific observations made and experiments carried out during the three and one-half hours we were in the air.

The balloon was designed to carry five people, and I had made a contract for a supply of hydrogen gas, but we were forced to content ourselves with ordinary illuminating gas, and by reason of a large amount of apparatus which we desired to take with us three



Meteorological record of balloon ascent at Paris, Nov. 14, 1889

people were all that we could satisfactorily carry. As we were on the point of starting from the gas-works about noon, some French military officers appeared on the scene. They had learned of our proposed ascent, and we had considerable difficulty in taking our departure, and were only allowed to do so by proving that we were not spies, and giving our promise that we would make no photographs of the fortifications about the city.

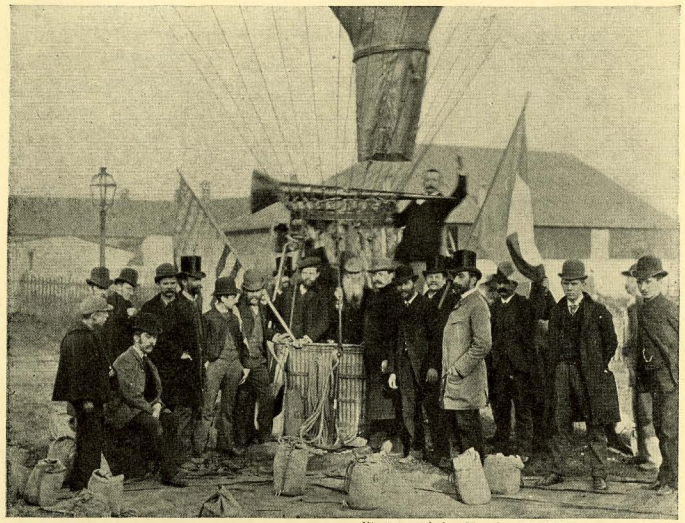
The ascension was particularly interesting from the fact that it was one of the few ascents which had been made up to that time, in which recording meteorological instruments were employed, these being the barograph, thermograph, and hygrograph of Richard Fréres, designed to record continuously barometric pressure, temperature and humidity of the atmosphere. These instruments were controlled by direct readings of aneroid barometer, thermometer and hygrometer.

On leaving the earth, the temperature was 54.5° Fahr., and the relative humidity 68 per cent. The normal decrease in temperature with elevation is 1 degree Fahr. for each 300 feet of ascent, but in this case it was much slower.

The balloon was in the air three hours and a half and traveled at an average of 20 miles an hour. The highest altitude attained was a little more than a mile and the average height about three quarters of a mile.

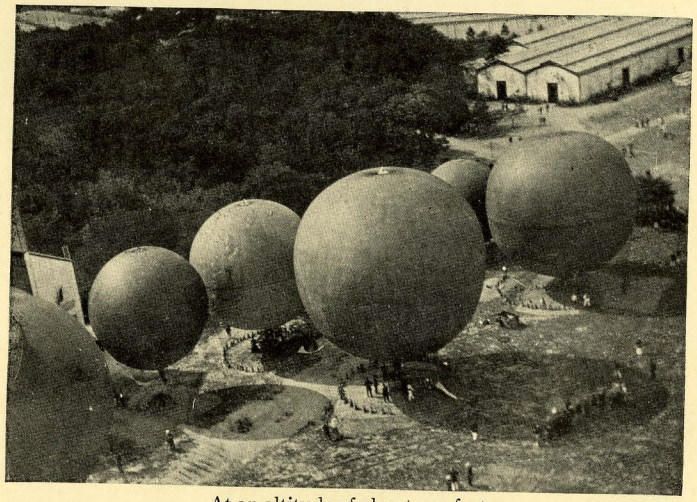
The accompanying diagram is a copy of the record sheets of the recording instruments, and was prepared with certain of the meteorological data by Dr. Rotch for his lectures before the Lowell Institute of Boston

in 1891. The lower traces of the diagram are those of the barograph, which show the height in meters, assuming the pressure and temperature decrease to be constant. The middle traces are from the thermograph, showing the variations in temperature. The dotted lines below are made up from readings of a sling thermometer, both being plotted on a centigrade scale. A sling thermometer is simply an ordinary thermometer tied to a string and swung in a circle, and such an observation, even though made in the sun, gives a very good approximation to the shade temperature, and avoids all trouble of the free circulation of the air around the thermometer. The thermograph was shielded as much as possible from the sun, which was not easy, as the balloon was constantly turning on its axis and exposing another side to the sun, so that the gas-bag itself became heated. The divergence of the two curves shows the undue heating of the thermograph causing it to record 8° Cen., or over 14° Fahr., too high. The upper tracings are the relative humidity in per cent. of saturation obtained from the air hygrograph, whose indications were controlled by means of a dew point apparatus. In general, at the earth's surface, a temperature and relative humidity are the reverse of one another; that is to say, that when one rises, the other falls, and *vice versa,* but in ascending to high altitude, both the absolute humidity and the temperature are low. This was noted at the height of about one mile when the temperature fell to 44 degrees Fahr., and the relative humidity to 25 per cent. For the reason which causes the lack of ven-



Photograph by Hastings & Miller, New York

Balloon trip made from Paris November 14, 1889, by Dr. R. G. Wells, Dr. A. L. Rotch and William J. Hammer



At an altitude of about 400 feet

Photograph taken by William J. Hammer from a balloon at the International Aëronautical Contests at the Paris Exposition of 1900

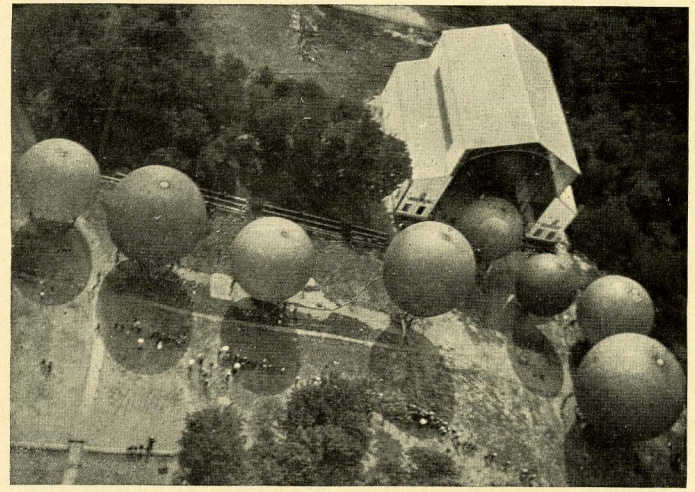
tilation to the thermometer a free balloon is one of the best of anemometers, since it has the motion of the air in which it floats, so that by noting the time of starting and landing and the places passed over, a good knowledge of the wind's direction and velocity is obtained.

In the voyage of November 14, the height was very variable, averaging 900 meters or six tenths of a mile. The distance traveled in a north-northeast direction being 71 miles in three and a half hours, giving a speed of 20 miles an hour. The wind, meanwhile, at the level of the Eiffel Tower blew with an average velocity of 16 miles an hour from the south; in both cases the upper winds veered with respect to the lower, that is, they were deflected toward the right hand, and this was the case from the earth's surface up, as shown by records of the meteorological stations near Paris, where the wind direction differed from that on the Tower. These facts are recorded in the lower portion of the diagram where the arrows fly with the wind, and in length are proportional with its velocity expressed in meters per second. This diagram shows that change in direction which would be expected from an inspection of the synoptic weather maps of Europe on these days.

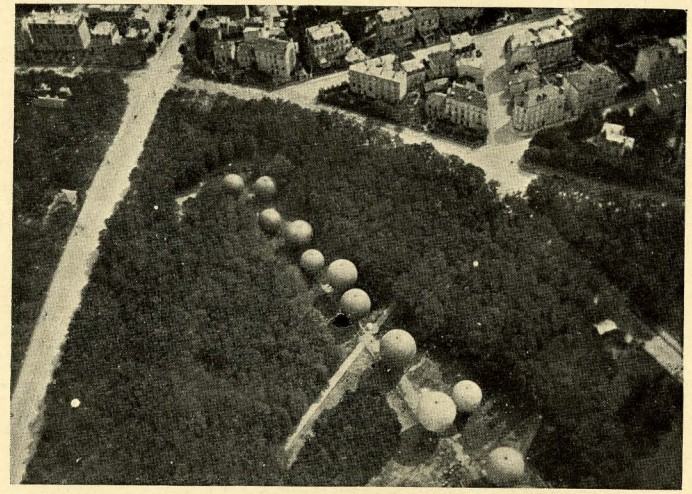
In addition to these meteorological observations, the balloon was equipped with several cameras for taking photographs of cloud effects, the shadow of the balloon on the earth and on the clouds, and of various sections of the country over which we passed. During the progress of our journey, the writer dropped a dozen parachutes to which were attached sealed boxes

containing phonograph cylinders, illustrating a method devised by him, by means of which an officer making observation from a military balloon could dictate such observations to a small phonograph attached to his side, the cylinder of which, if captured by the enemy, would not possess any cypher or key, as it would be necessary to place the cylinder upon a specially designed phonograph in order to hear the record which would then be given in the voice of the officer dictating the despatch. I found that by properly weighting these parachutes, the cylinder could be dropped with perfect accuracy within certain zones, and with perfect safety, and by attaching a small storage or dry battery and an incandescent lamp, or if desired a "bengal" light, they could be utilized at night. The sealed boxes contained directions for forwarding them to my hotel in Paris, the necessary postage, and cautions as to handling. One of these cylinders was returned to me from a distance of 65 miles from Paris, and others from intermediate points. The balloon was equipped with a speaking trumpet fifteen feet in length, which I had borrowed from the Edison exhibit, and by means of this we were able, by placing it alternately to the mouth and to the ear, to carry on a conversation and make inquiries as to our location in passing over the ground at high altitudes. I also found that I could check roughly the barometric pressure records of our height by the reflection of sound from the earth, taking the time with a stop-watch.

On one occasion in passing over a small town the writer seized the speaking trumpet and shouted lustily



At an altitude of 900 feet



At an altitude of about 2,000 feet

These photographs and their companion on preceding illustration page, were taken from a balloon at the International Aëronautical Contests at the Paris Exposition of 1900 by William J. Hammer. Twenty-three balloons were preparing for the contest and are shown at altitudes of 400, 900 and 2,000 feet

to the excited populace below, *"Vive France! Vive Carnot!"* when an irate Frenchman with an apparent antipathy for the then existing régime of President Carnot, and a predilection for the "man on horseback" leaned far out of a farm-house window, and shaking his fist vigorously at us shouted, *"Mais non! mais non! Vive Boulanger!"*

I remember one particularly exciting incident occurring during the trip. Upon leaving my hotel in the morning I had, for almost the first time in my life, carried a revolver in my hip pocket and at a time when the balloon was nearly stationary, a height of a mile, I drew the revolver from my pocket; when the experienced eye of Dr. Wells catching sight of it and fearing an explosion of the gas, which constantly trickles from the open neck of the balloon, threw up his hands and shouted, "For Heaven's sake, don't fire that thing off!"

I replied, "I do not intend to unless it is absolutely necessary."

"What do you mean?" he said, sharply.

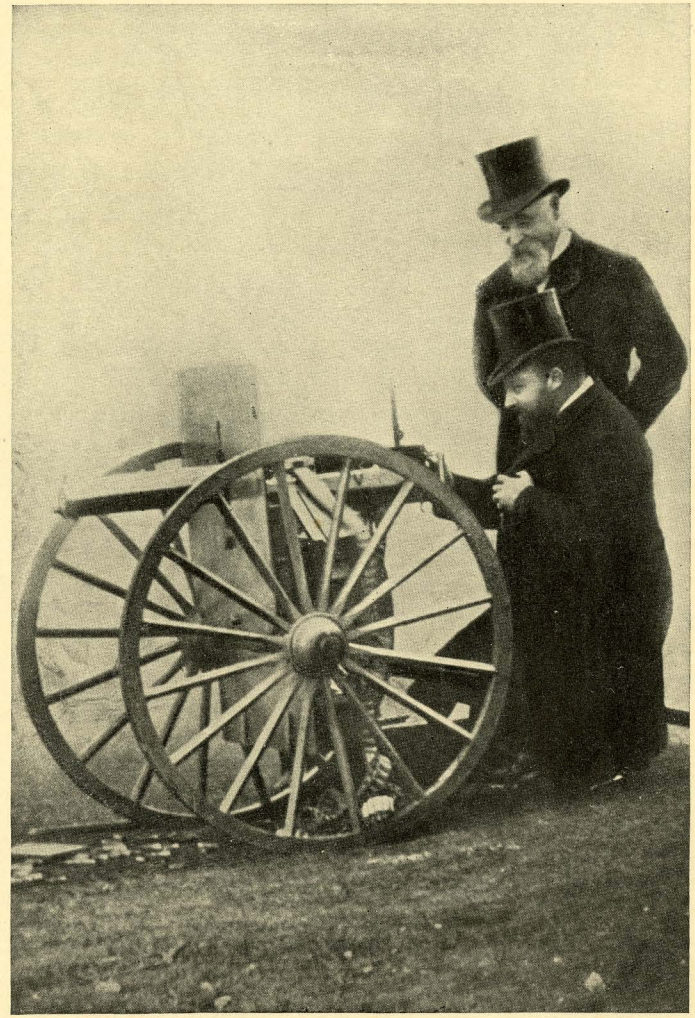
"Well," I replied, "supposing we were descending rapidly and had exhausted our ballast, and were rapidly approaching buildings or a cliff; and supposing the valve-cord had broken and we could not let the gas out quickly enough to permit our landing before we struck the obstacle" (as there was no rip-cord such as is now universally used to tear open the balloon), "I would not hesitate to wrap my muffler about this six-shooter, and by putting twelve holes close together through the gas-bag where it 'bellies' out, I might thus tear the en-

velop and let out sufficient gas to prevent our being dashed to pieces."

"Well," said Dr. Wells, "I 've been ballooning all my life, but that 's a new one on me, and not half bad, either."

I had spent most of the night previous to our ascension in devising some apparatus for indicating the influence of the earth upon the dip of the magnetic needle, and upon other magnetic apparatus when at a considerable altitude from the earth. The balloon, which was equipped with a long drag rope, was also caused to rapidly rise and fall by alternately throwing out sand and opening the gas valve, and tests were made of the friction of the air on the surface of the balloon in producing a static charge indicated by an electroscope.

In 1892, I had the pleasure of visiting Sir Hiram Maxim at his home in Baldwins Park, England, at the time when he was at work upon his great air-ship; and during my sojourn had the pleasure of taking a short ride upon this steel monster as it passed rapidly over the rails of the experimental track, being driven by the huge sixteen-foot screw propellers. As I recollect it Maxim's air-ship was 126 feet long, weighed about 7800 lbs., and its motive power consisted of two compound steam engines of 300 horse-power each. Sir Hiram has always been a firm believer in the solution of the problem of aërial navigation by means of the application of the aëroplane principle, and I well remember his speaking of the sensitiveness and the helplessness of the balloon, and of his remarking "that you



King Edward VII, testing the Maxim gun under Sir Hiram S. Maxim's supervision

could no more propel a balloon against the wind than you could make a jelly-fish swim up-stream." And as illustrating the extreme sensitiveness of a balloon, which is nothing more nor less than a huge bubble of gas floating in the air, I would mention an experiment which I tried some four or five times, with the same result. At a time when our instruments showed that we were practically stationary in the air, I took a sheet of gold leaf in my hand, and holding it at arm's length over the side of the car I gently withdrew my hand, allowing the gold leaf to rest upon the air, the inertia of which had not been disturbed, then reaching my hand into a bag of sand, I carefully dropped a handful of sand on the opposite side of the basket. Immediately the balloon with its three passengers, and our extensive apparatus rose rapidly, leaving the gold leaf far below. It seemed to me an extraordinary illustration of the sensitiveness of the balloon. I remember having a long willow wand some ten feet in length which I had used in connection with the electroscope, and after twisting this into a spiral screw, I dropped it over the side of the basket, when at a height of about three-quarters of a mile from the earth. It was a beautiful sight, as the sunlight shone upon the white wood, and it seemed to screw itself through the atmosphere until it reached the earth far below in a manner to at once suggest to me the idea of employing an aëronautical device based upon this principle for making ascensions into the air. This Hélicoptère principle has of late come into considerable prominence in aëronautical work. In this connection I am reminded of a

very interesting effect observed by the well-known aëronaut, Leo Stevens, during a recent trip. When about two miles above the earth he had thrown an empty champagne bottle in an oblique direction, and he was astonished to observe that instead of the heavy bottle falling like a "plummet" it began to describe an ever-widening spiral, until the turns were over 2000 feet in diameter; and on timing its fall he found that it took over three minutes for the bottle to reach the earth. He says it also had an undulating or snake-like movement caused, he believes, by the mountains and valleys over which they were passing.

As far back as 1880, while an assistant at Edison's laboratory at Menlo Park, N. J., the writer devised a system of signaling from war balloons by means of colored incandescent lamps suspended from the balloon or placed inside the balloon, signals being controlled either by the operator in the car or, in the case of the use of small captive balloons, wires were run to a keyboard on the ground by which a code of signals could be operated. It had been my intention to make such experiments during this trip, but it was found impossible for us to carry the heavy batteries with us in addition to our other apparatus, and we contented ourselves with heliograph signaling by means of the mirror, and the sunlight.

It was curious to note by means of the recording barometer that when the balloon was passing over a river or a dark forest the sun's rays had been so absorbed and the atmosphere above had become so chilled as to condense instantly the gas in the balloon, causing

it to fall rapidly, and in passing over arid land which reflected the sun's heat into the atmosphere, we found the temperature was so high as to cause the balloon to rise with very great rapidity. Often, when near the earth, we could tell whether we had descended or ascended by merely noting the change in the size of the shadow cast by the balloon. At our greatest elevation, somewhat over a mile, we were unable to observe mountains or rivers; and, in fact, the earth itself looked like a huge colored map, and it seemed as though we were looking down into a bowl, a phenomena due to the same powers of refraction which causes the sun and the moon to look so much larger on the horizon than when directly overhead. When near the earth we could observe with great distinctness the bottoms of the rivers and lakes as we passed over them.

Upon leaving the earth I observed a curious phenomena due to variation of the density of the atmosphere. A large crowd had assembled to see us depart, and as we passed over the city of Paris in ascending we heard a perfect babel of sound, which soon became a confused medley. There was also a buzzing sound in our ears and a slight feeling of tightness in the chest, which we relieved by opening our mouths and working our jaws for a few moments. Suddenly there was absolute silence caused by the lessening of the pressure on the outside of our bodies, while the internal pressure caused a distension of the ear-drums so that they temporarily lost their sensitiveness. Soon, however, an equilibrium being established, to some extent between the external and internal pressures, our ears began to regain their

sensitiveness and to appreciate sounds of greatest penetration. We heard children's voices, chickens crowing, and the whistles of passing trains.

Although it was November, we were at times forced to take off our overcoats, and at other times we were very glad to put them on again; but, of course, we felt no wind, as we moved along with the wind.

It was interesting to observe the actions of the animals in the farm-yards, and particularly the little chickens, which ran to the mother hen for protection, while the horses and cattle, snorting, bellowing and kicking their heels in the air, rushed madly about as we passed overhead and they observed the shadow of the balloon, or the huge object which they took to be some giant hawk or evil monster. On one occasion when we were dragging our anchor and endeavoring to land, a woman working in the fields became so terrified that she ran around in a circle screaming at the full extent of her lungs, and barely missed being caught in the prongs of the anchor.

We descended at about sunset at a little village called Erchu in the department of the Somme. The country people for miles around rushed toward us and seeing the huge American flag some thirty feet in length which I had borrowed from the Edison exhibit and suspended from the basket, they shouted to one another that we had come across the sea from America. They subsequently told us that they had never seen a balloon before in that section of France, but there were many willing hands to help us land and to pack up our balloon, although we had several rather severe bumps before finally landing, in one case barely scraping the bottom of our car over the state line of telegraph wires which passed along the highway. We unfortunately came down in a field of wheat which was soon obliterated by the feet of the curious country people, and I had the felicity of paying about 50 francs to compensate the owner, who had become distracted over the loss of the grain which had been trampled under foot. The director of a neighboring sugar refinery entertained us at dinner and afterward sent us in a conveyance, together with our balloon packed snugly in the basket, to the railway station some miles distant, and we returned to Paris much pleased with our journey.

I subsequently endeavored to secure the huge Godard balloon which carried some forty-five people, and was used as a captive balloon during the Paris Exposition. It was arranged that Dr. Rotch, Mr. Lyman, the inventor of the Lyman gun sight, Dr. Wells, and others, seven in all, were to make an ascension and it was our intention to endeavor to go to Russia (a plan subsequently carried out by Count de La Vaulx). I had been watching the meteorological conditions around Paris and the records of the various postal-card balloons sent up from the Eiffel Tower, and I felt confident we could strike a trade wind which would carry us directly across the continent to Russia. We found that owing to repairs being made on the balloon that it could not be secured for six weeks' time, neither could a large balloon which we endeavored to secure from the Crystal Palace in London be had in time, and

as several of us had our passage engaged to go back to America the trip was abandoned.

I present herewith three illustrations of photographs which I made from a balloon in Paris, the pictures being taken at three different heights, approximately 300, 900 and 2000 feet from the ground and looking down upon some twenty-three balloons which were about to be sent up at the time of the International Aëronautical Competition and the Aëronautical Congress held at Paris in 1900.

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