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Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 1077.

For the Week Ending August 22, 1896.

Price 10 cents. For sale by all newsdealers.

THE RECENT HEAT WAVE.

The phenomenal heat wave which has recently passed over the Eastern States was marked by a long list of fatalities to man and beast, and will be memorable in the meteorological records as one of the longest and most destructive visitations of the kind on record. The temperature readings of the United States Weather Bureau in New York City, which cover a period of twenty-six years, can show no parallel, for the month of August, to the heat of the nine days from August 4 to August 12 of the present year. It is true that in certain previous years the temperature for any particular day of the nine may have been exceeded, but in such cases the rise of temperature has been temporary. The general average for these nine days has never been approached in any previous August. The temperature readings are given below:

Date.	Temperature.	Exceeded in
August 4	87 degrees.	1873, 1881, 1888.
" 5	89 "	1881.
" 6	91 "	1881.
" 7	91 "	Maximum.
" 8	92 "	Maximum.
" 9	90 "	1888, 1892.
" 10	91 "	1894.
" 11	94 "	Maximum.
" 12	92 "	Maximum.

The readings of the New York City Bureau are taken from thermometers on the top of the Manhattan Life building, at an elevation of 298 feet above mean sea level. It is considered that this great elevation is favorable to a correct record of the passing heat waves, inasmuch as the instruments are free from the local variations which are caused by radiation and reflection from the pavements and walls of the city below. It is undeniable that the heat in the streets of the city and in its stores and offices has often risen many degrees higher than the official records, and a street temperature of from 97 to 103 degrees has been common on such days as the 8th, 11th and 12th instant.

To residents in some of the Western States, such, for instance, as Arizona, where from 110 to 115 in the shade is not uncommon, there may seem to be nothing phenomenal in these New York temperatures, and the terrible fatality which accompanies them will be a mystery. The fatalities are to be ascribed to the accompanying humidity of the atmosphere and to the fact that the victims are unaccustomed to, and quite unable to endure, a spell of heat of such long continuance. The air of Arizona, moreover, is extremely dry, and the evaporation from the body is proportionately rapid, bringing instant and continual relief to the system. In New York, during the recent hot waves, the humidity rose as high as 93 per cent, and the average humidity taken at 8 A. M. and at 8 P. M. was 73 per cent of full saturation. In accordance with the laws of evaporation, the perspiration from the body was proportionately sluggish, the overloaded atmosphere refusing to take up the moisture of the body, which condensed upon the skin and produced extreme discomfort; killing, either by prostration or by overheating, such as were not physically able to endure the continuous strain put upon the system.

That the fatalities were due to the duration of the heat is shown by the steady increase in the number of deaths and prostrations on successive days:

	Temp.	Deaths.	Prostrations.
August 5	89	3	29
" 6	91	7	31
" 7	91	7	56
" 8	92	14	61
" 9	90	72	78
" 10	91	163	182
" 11	94	182	350
" 12	92	177	467

The heat wrought terrible havoc among the horses employed in the city of New York, particularly among those employed on street car lines. It is estimated that some 1,500 in all perished.

The heat wave was marked by an unusually steady barometer, the highest readings on the instrument in the SCIENTIFIC AMERICAN office being 30·03 inches, and the lowest 29·85, a variation for the nine days of only eighteen-hundredths of an inch. This will account for the absence of cooling breezes, which contributed largely to the oppressive humidity of the atmosphere.

The fatalities accompanying this spell of hot weather bring to mind the similar scourge—it is nothing less—that visited Australia during the early part of the present year, when for two weeks the temperature never fell below 90 degrees in the shade, and in some localities rose as high as 122 degrees. The Australian heat differed from this in New York in the fact that it was accompanied, and largely caused, by a strong wind from the interior, which was intensely dry and hot and caused the drying up of rivers and streams, burning up the crops and killing the cattle in the fields. As in the Eastern States, people were sunstruck and horses dropped in the streets.

It is probably more than a coincidence that heat waves of unprecedented power and duration should have visited the three continents of Australia, America, and Europe in the same year; and science has yet to discover the influences which determine their coming and going.

ARTIFICIAL FLIGHT.

The problem of artificial flight has recently received several additions to its history, additions which will make the present epoch an important one if the problem is ever to be solved. For of course if it prove insoluble and if it is relegated to the limbo of abandoned efforts, and to the realms of the impossible, the death of the most successful human soarer, the flight of the most successful mechanical soaring machine, the partial success and wreck of Maxim's apparatus and the work of Andrée's balloon will be of little interest. But if man does learn to fly by mechanical means, or even to float for an indefinite period by a balloon, then Lilienthal's death, the half mile flight of Langley's machine, and the other achievements will be a group of notable occurrences. Slowly a tangible theory of soaring has been evolved. The support given to an aeroplane in horizontal motion through air has been experimentally tested and has proved surprisingly great. The fact that air currents constantly vary in velocity gives the quality of internal energy to the air in reference to a body suspended in it, which energy it appears might be adequate to support a body whose inertia enables it to utilize these changes in wind velocity for its own support. Again, an upward component of winds has been recognized, which by a parachutelike action would go to arrest the descent of an aeroplane, and help to support it.

Working on these bases, it appears that a soaring bird, with exquisite balancing, presents a surface of wing to the air which blows against it with varying velocity. The inertia of the bird's mass preventing it from yielding to the frequent changes acts like a kite string to hold it relatively fixed in face of the wind pressure or of portions thereof. These fractional portions of the wind, acting on the inclined plane formed by the under surface of the wings, would uniformly operate to push it up against the force of gravity.

Lilienthal, enamored of the problem, found that it involved as its most difficult part the question of safe alighting. Flying for a limited distance proved comparatively simple. Starting from his elevated platform, he performed many flights and soared for considerable distances. The erratic nature of the flights, sometimes involving a rise in the air, showed how great were the reserve powers in a heavy body moving on aeroplanes powers which human ingenuity seemed unable to fully utilize. The instant changes in direction to which a moving aeroplane is subject, and its dependence for action on motion, actual or relative, make it an exceedingly difficult engine to manipulate. This fact led to many accidents to Lilienthal, and finally to his death. It required an intrepid experimenter to trust himself to the support of the air. Accident after accident went to prove the difficulty of operation, and the aeroplane inflicted many an injury before it claimed its victim.

The mere fact that so very few have dared to personally experiment in artificial flight goes to prove its danger. Any number of performers can be found to essay such feats as walking on ropes or wires over abysses or at great heights, or who will dive from a height of many feet into water tanks for the delectation of audiences, but soaring through the air has been tried by very few.

The peculiar stability of the support given by the air under certain conditions is very strikingly shown by the failure to support when the conditions are changed. A kite floats peacefully in a high wind until its string parts, when it floats helplessly away. A boomerang follows its curiously definite path as long as it rotates rapidly. As the rotation fails, its flight loses life and it drops more or less directly to earth, according to the extent to which its rotation persists. The soaring bird, when shot, parts with its equilibrium and falls helpless. When man, supported by aeroplanes, his powers reinforced, if need be, by an engine, can maintain certain unknown, or nearly unknown, conditions, he will have achieved the desired end. But the conditions are so little understood as to be virtually unknown, and the possibility of disposing of them is, of course, uncertain.

In ballooning proper there is room for one advance which, once made, would seriously modify the problem. This advance is in the construction of the containing envelope or gas bag. All that has made balloon work so very unsatisfactory is the leakage and diffusion of the gas. The fact that a balloon cannot be driven in any desired direction is a trouble less in degree than the impossibility of maintaining its buoyancy. A balloon has to be made of extra capacity to admit of the carrying of a quantity of ballast, which is discharged from time to time as the buoyancy diminishes. The entire area of the cloth envelope must be pictured as full of pores, through which the contents are constantly escaping, and through which air is more slowly entering. This action takes place independent of any pressure, owing to the buoyancy of its contents, which may exist in the gas bag.

With a really impervious envelope a balloon could be kept afloat indefinitely. Its flotation could be regulated by pumping gas out of the envelope into cylinders under pressure or by admitting it from such cylinders into the envelope. The clumsy sand bag would no longer be required, and the drag rope would prove ample to regulate the height of flight.

The most serious attempt at advanced ballooning is

that of M. Andrée, who hopes to explore the north polar regions in a balloon. The last refinements of the aeronaut's art are represented in it; an elaborate outfit of meteorological instruments are mounted; and the drag ropes even are of improved construction. We have already published a number of articles describing this balloon.* But what is most extraordinary is that it is claimed that its envelope is almost impervious to gas. If this prove true in practice and actual use, then the balloon will take a new position among the resources of the scientist. The inevitable loss of buoyancy, which has hitherto made ballooning so dangerous and unsatisfactory, being once disposed of, the new condition opens up a wide scope of possibilities for the explorer. Hitherto the danger of being blown out to sea in a balloon involved the certainty of an enforced descent into the ocean. Without such result the departure from the land area would be of minor importance and the old ideal of finding at some altitude a wind of the desired direction would seem possible of realization.

Soon more will be known of all these things. Langley's work, it is to be hoped, will soon be described in extenso and the result of Andrée's exhibition will be eagerly watched for. Nansen is reported as having got within a few degrees of the north pole by sea. Andrée and his collaborators may yet be destined to look down upon the unknown axial region of the terrestrial sphere.

Death of Otto Lilienthal.

Herr Lilienthal, an engineer, who for many years was experimenting in the building of flying machines, met with an accident on August 11 that resulted in his death. He started with one of his machines to fly from a hilltop at Rhinow, near Berlin. The apparatus worked all right for a few minutes, and Lilienthal flew quite a distance, when suddenly the machinery of the apparatus got out of order, and man and machine fell to the ground. Lilienthal was so badly injured that he died in the hospital to which he was removed.

Herr Otto Lilienthal was born in Anklam, near the Baltic coast of Pomerania, about forty-seven years ago. He attained considerable celebrity by the invention of his machine, which was modeled on that of a bird's wing, and he was generally known as "the flying man." Herr Lilienthal was an engineer, and established in Berlin a manufactory of small steam engines, where the mechanical appliances furnished him with every facility for the construction of his flying apparatus. He often succeeded in keeping in the air for some time with the aid of his artificial wings, which seemed to be adapted rather for soaring than for flying in the proper sense of the term. His machine was made almost entirely of closely woven muslin, washed with collodion to render it impervious to air, and stretched upon a ribbed frame of split willow, which was found to be the lightest and strongest material for this purpose. During the past two or three years he gave much attention to motive force, and reached the conclusion that the vapor of liquid carbonic acid would be effective.

Hubert Anson Newton.

The world of science is poorer by the loss of Hubert Anson Newton, who for the past forty years has had charge of the mathematical department of Yale College, his election to the chair having taken place in 1855, and his active occupation of it dating from a year later. He is best known in scientific literature by his investigations of the laws governing meteoric and other similar bodies. He demonstrated that the period of revolution of the shooting stars known as November showers "must have one of five accurately determined values." His computations were followed up by other authorities, so that it became possible to connect these meteors with the comet of 1866. He determined the numbers and frequency of the sporadic meteors in the earth's orbit, and proved that they moved in long orbits like that of the comets. He was instrumental in having the metric system of weights and measures introduced into the arithmetics of this country.

In 1868 he received the degree of LL.D. from the University of Michigan. He was one of the men originally appointed by Congress to constitute the National Academy of Sciences. He was elected an associate of the Royal Astronomical Society of London in 1872 and a fellow of the Royal Philosophical Society of Edinburgh in 1886. He had been president of the Connecticut Academy of Arts and Sciences. He was a member of the American Association for the Advancement of Science from 1850, its vice-president in 1875 and its president in 1885.

Yale College is greatly indebted to the zeal and counsels of Prof. Newton. He was associate editor of the American Journal of Science and his writings consisted largely of memoirs of the National Academy of Sciences.

A NEW terramara, or prehistoric settlement, 500 yards long by 250 yards wide, has been discovered at Castenaso, near Bologna, Italy.

* SCIENTIFIC AMERICAN, vol. 73, No. 2; vol. 75, No. 7. SUPPLEMENT Nos. 1026, 1027, 1067.

The Total Eclipse of the Sun.

On August 8 a total eclipse of the sun occurred, the first since 1893. It was visible in localities along the north coast of the European continent, thence along a diagonal path through Siberia and Japan and out on the Pacific Ocean. Naturally very elaborate preparations were made to observe it, especially for the study of the corona. Amherst College, under Prof. D. P. Todd, sent out an extensive expedition, which had the service of the yacht Coronet, owned by D. Willis James, whose liberal owner is responsible for the expedition. This party went to Japan, and near it was established the Lick Observatory party under Prof. J. M. Schaeberle. In Nova Zembia and Siberia there were four Russian posts, and all along the path amateur and professional observers were distributed. The general résumé of reports, as far as received, is to the effect that comparatively little of value was done, owing to unfavorable climatic conditions, clouds interposing to prevent the success of the observers. This has happened to so many expeditions for the observation of total eclipses that it is a misfortune that will always be anticipated as highly probable. Of the recent total eclipses good observations were secured on the Caroline Islands in a total eclipse in 1883, although there was a narrow escape, as the morning of the day was showery, but just before the eclipse the sky cleared. In 1886 some observations were successful, while the weather interfered with those at other stations. The eclipse of 1887 was not observed at all, owing to the clouds. Of the last eclipse of April 16, 1893, and one or two preceding ones, excellent observations were obtained.

Hints to Beginners in Photography.

BY ROBERT GRIMSHAW.

Many amateurs do not succeed in getting creditable pictures, even with good cameras, first, because they do not understand the general principles of optics, and second, because they do not know the special peculiarities and the capabilities of the instruments which they are using.

In a general way they forget that one cannot get a good picture of an object that is between them and the sun, or on which the sun's rays fall directly vertical. Then they expect too much of a so-called "universal focus" lens, thinking that it will reach out sidewise so as to get both ends of a passenger car sixty feet long at a distance of twenty feet, and at the same time get the details of a ruined tower on a hillside half a mile or more away.

They also expect to get an undistorted picture of a tall building only forty feet away; and to get a good, sharp picture of a smutty black object like a locomotive just come in from a long run. Or, they will think that a moving object can be as readily "snap-shotted" from the top of a street car or omnibus going rapidly in the opposite direction as from a stationary location.

They also expect the same speed from a $5 lens as from one costing $50 or more; the same speed with a given shutter, no matter what kind of plate, or with the same plate, no matter what the shutter or the lens, or the same speed in Leipzig as in Naples or Cairo. Also, they will use the same developers and fixers with Thomas', Richard's or Henry's plates, and expect to get the same results; and the same way with papers. They will use the same baths with the celebrated X as with the renowned Y or the famous Z brand.

The best plan is to pick out some one good make of plate or film that can be got in photographic supply shops generally, and learn how to use it, first under only one set of controllable conditions (as lens, stops, baths, etc.) and then gradually work up to a full knowledge of the behavior of that kind of negative under various conditions which it is desirable to change. Sticking to one brand of negative leads to better results in the end than experimenting.

And now for the camera itself. We will say that it is a hand camera with a "pull-out" on which the distances are not marked for very near objects. If there is a ground glass plate on which to observe the image, set the instrument on table or tripod a given distance, as three feet from a wall which is well illuminated by direct sunlight and on which there is an ordinary placard with some letters as small as one-fourth of an inch in height, and pull out the "draw" until the letters appear sharp and clear. Then make a knife scratch so that that amount of pull-out can be found again when wanted, and mark it "3." Similarly mark the "4," "6," "8" and "10" positions.

Now tack up on the wall a two foot rule, or a yardstick, or other convenient measure, and for each position of the "draw" see what length can be distinctly seen. Thus we will say that at three feet only 15 inches can be seen the "short way" of the plate; at six feet, 36 inches, and so on. This will prevent miscalculations of distance and frequent disappointments when there is no time to change the position of the camera or of the object being photographed.

Where the camera has no ground glass plate, it may be feasible to substitute one temporarily for the film board or whatever else is about at that position. If no ground glass is available, tracing paper, or tracing cloth, or paraffined or oiled paper will answer quite well. If the substitution cannot be made, then perhaps the objective can be taken out and tested with a glass or paper screen at various focal distances, with objects at measured distances away. If all these methods fail, then mark on your poster a ring one foot or two in diameter, and take half a dozen or a dozen negatives at various distances from the poster and with various positions of the pull-out. You will thus learn the "sharp" positions of the pull-out for each distance from the object to be photographed and also the size circle within which you may work. Thus, if at a given distance you find that your two foot circle occupies half the short diameter of a 4 × 5 inch plate, you may rest assured that the maximum circle within which you may operate at that distance will be four feet in diameter; but you might also take in an object that was five feet one way if it was not more than four feet in the opposite dimension (provided, of course, that the long way of the plate came with the long way of the object).

It is also a good plan to practice with the various "stops" under various known conditions; and to test the finders, where there are any, to see if they are of the right size and in the right position, as they are very often hastily placed, and also sometimes get slid out of adjustment.

The Kick of a Rifle.

When a man gets a rifle for big game shooting, he sometimes forgets to consider one of the most important points—the kick—says the New York Sun. A gun which uses 70 grains of powder and 500 grains of lead caves a weak man's shoulder in and makes the flesh black and blue. If the man has more pluck than sense, he continues to use the big gun in spite of the discomfort, and thereby sometimes ruins himself as a shot.

When one of the big bore, big charge rifle cranks picks up a rifle and fires it at a target, alive or dead, a painful expression twists his face, and just as he pulls the trigger the butt, shoulder flinches from the recoil. That flinch is ruinous to the aim, and men often get so used to flinching that they dodge the kick of a 22 short cartridge as vigorously as they do a 50-110-500 one.

Men who flinch from their guns do not know it usually, until some time they are standing nicely balanced on a freshly peeled hemlock log, or some other slippery place, and the gun misses fire. The man flinches and his foot slips at that, and down he tumbles. Even then the chances are that he will not understand the reason of it.

What "Good Will" Means.

We frequently hear the term "good will" used in describing a benefit or advantage existing as a part of or in connection with a business, says an exchange. It is defined in several cases as the advantage or benefit which is acquired by an establishment beyond the mere value of the capital, stock, funds, or property employed therein, in consequence of the general public patronage and encouragement which it receives from constant or habitual customers on account of its local position, or common celebrity, or reputation for skill or affluence, or punctuality, from other accidental circumstances or necessities, or even from ancient partialities or prejudices. This is a definition given by Story and followed in several cases. Boiled down, this definition would seem to mean simply that the good will of a business consists in the probability that customers will continue to come to the old place of business. At best it is a sale of a mere chance, which vests in the purchaser nothing but the possibility that a preference which has usually been extended may continue.—The Keystone.

The Old Britannic Breaks Her Own Record.

A noteworthy feat was accomplished on the last voyage of the White Star liner Britannic from Liverpool to New York, when she crossed in 7 days 7 hours and 30 minutes. This was done with the identical boilers and old-fashioned compound engines which were put into the ship when she was launched by Messrs. Harland & Wolf, at Belfast, in 1874. That a ship should grow faster as she grows older bears testimony to the excellence of the work which was put into the early transatlantic liners. The performance was due, however, in part to the weather, which was exceptionally quiet. The calm which has settled upon the Eastern States during the recent hot wave has evidently extended across the Atlantic, and probably has been of unprecedented duration.

Another Record Trip by the St. Paul.

The sister ships of the American Line are cutting down the record time from Southampton to New York with each trip they make; the 6 days 2 hours and 24 minutes record of last week by the St. Louis being reduced to 6 days and 31 minutes by the St. Paul on her voyage ending Friday, the 14th inst. The average speed for the whole trip was 21·08 knots. When we bear in mind that the St. Paul was only designed for a sea speed of 20 knots this is a really splendid performance. She will undoubtedly cross within 6 days during this season.