Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada.................. $3 00

One copy, six months, for the U. S. or Canada.................. 1 50

One copy, one year, to any foreign country belonging to Postal Union, 4 00

Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars.*

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information. (2) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, JULY 30, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 604,

For the Week Ending July 30, 1887.

Price 10 cents. For sale by all newsdealers.

THE INTERNATIONAL YACHT RACE.

The new British yacht Thistle, portrait of which we published in our paper for July 2, was to leave for New York on July 25. She takes a crew of forty men. Her owner and her captain are sanguine that she will win the America's cup. This vessel appears to have sailed faster than any yacht heretofore built in Great Britain. The new American yacht Volunteer will probably be the competitor of the Thistle. The Volunteer had her first preliminary trial at Boston on the 21st of July, when she exhibited remarkably fast sailing qualities, and gave rise to an expectation that she would beat the Thistle. The Volunteer is of steel. On this trial trip she easily distanced the Priscilla and the Bedouin, both distinguished for superior speed. The international contest is to come off on September 26.

POSITIONS OF THE PLANETS IN AUGUST.

VENUS

is evening star. There is no need of pointing out her position in the western sky, for observers will recognize her at a glance as the largest and most beautiful star in the whole heavens. She will increase in splendor until the 15th, when she reaches her period of greatest brilliancy, and will approach the sun and set earlier every night during the month. On the 1st she sets at a quarter before 9 o'clock in the evening, an hour and a half after the sun. On the 31st she sets at a quarter before 7 o'clock, about a half hour after the sun.

JUPITER

is evening star. He may be found in the west, and is only exceeded in brightness by his fair rival Venus. He is in the constellation Virgo, and the brilliant star west of him, from which he is slowly receding, is Spica, or Alpha Virginis. Jupiter is approaching the sun, and sets on the 1st at a quarter after 10 o'clock in the evening; on the 31st he sets about half past 8 o'clock.

URANUS

is evening star. He is in the constellation Virgo, is approaching the sun, and is too far from the earth to be visible to the naked eye. He sets on the 1st about half past 9 o'clock in the evening; on the 31st he sets at half past seven o'clock.

MERCURY

is morning star. He reaches his greatest western elongation, or most distant point from the sun, on the 16th, and is, at that time, and for a few days before and after, visible to the naked eye. On the 16th he rises an hour and a half before the sun. He may then be found, at 4 o'clock in the east, about 4° north of the sunrise point. Mercury rises on the 1st soon after 4 o'clock. On the 31st he rises at half past 4 o'clock.

SATURN

is morning star. He is still near the sun, but is emerging from the solar rays, and at the end of the month rises more than three hours before the sun. He may be found among the stars of Cancer, southeast of Castor and Pollux, rising on the 1st about 4 o'clock in the morning, and on the 31st about 2 o'clock.

NEPTUNE

is morning star. He is in quadrature with the sun on the 23d. He is only visible in a powerful telescope, where he may be found in the constellation Taurus, south of the Pleiades, rising on the 1st shortly before midnight, and on the 31st a quarter before 10 o'clock in the evening.

MARS

is morning star, but is so small in size and luster as to be of little account. He is in the constellation Gemini, rising on the 1st about half past 2 o'clock in the morning, and on the 31st a few minutes after 2 o'clock.

Powder Ignited by Lightning.

On the 21st of July, at 2:30 A.M., at Streator, Ill., a mining town, a stroke of lightning struck the powder in the powder house of the Chicago, Wilmington, and Vermillion Coal Co., located half a mile from the center of the town. Ten tons of powder were instantly exploded with disastrous results. Fifty buildings were demolished; but only one person was killed—struck when asleep by a flying brick. Many people were slightly injured.

A terrific peal of thunder was followed by a rocking and swaying of the earth and a sweeping rush of air which made buildings totter on their foundations as if on the crest of a seismic wave.

Brick and debris were hurled in all directions for several hundred yards with such violence as to penetrate the walls of buildings, and dwellings nearly a quarter of a mile from the scene of the explosion were riddled as if by grape and canister. The greatest damage, however, was done by the concussion of air. A row of dwellings 100 yards away were crushed into kindling wood. It seemed as if the atmosphere exerted its strength in a downward direction, and crushed the buildings to the earth.

Blockades under Existing Conditions of Warfare.

At the Royal United Service Institution, recently, a lecture on this subject was given by Rear-Admiral P H. Colomb, who, we may remark, is a gold medalist of the Institution. The chair was taken by Admiral the Rt. Hon. S. A. Cooper-Key, G.C.B. Admiral Colomb gave a very interesting account of the various blockading experiences from the time of Nelson and the Spanish blockade to the war between the North and South Americans. The latter was specially drawn upon as showing the most recent and instructive operations. The lesson learnt from these experiences shows that if the naval forces of England should have to engage in blockading operations against a naval power, they would, in the first instance, be liable to the attacks similar to those which the Federals experienced. But the particular force which promises to interfere most with blockaders is that of torpedo boats, not torpedo vessels; for if torpedo vessels are to take a large place in war, they will take it in the open sea, and as the equals of any other form of open sea naval force. That is to say, they will be the rivals of the fleet ship as at present developed, and aim themselves at becoming the fleet ships of the future, as claimed by M. Gabriel Charmes.

But the torpedo boat does not in any way claim to take the place of the fleet ship. It tends to operate outward from the land, and not inward from the sea. It is more a prospective terror than an open match for the ironclad; and its cheapness, combined with its assumed destructive powers, make it especially the weapon proposed for the driving off of masking or observing forces in the operations of blockade. It is not uncommon to hear naval officers express the opinion that the torpedo boat has made blockade a thing of the past. A well reasoned judgment cannot, however, accept this view. If the Confederate ports had swarmed with torpedo boats, the in-shore squadrons could not have been safely so numerous, nor could they have pressed in so closely nor so perseveringly. To us the sealing up of the enemy's ports can rarely be the object. We are not in a position to attempt such a thing with any country, and consequently our blockade will seldom extend beyond masking and observing—to measures of defense, not of attack. A single observing ship close in to the port, designed to evade the most modern forms of attack, and with her signaling powers developed to the utmost, is all that is necessary for all purposes of observing, when she is in communication with the real force off-shore.

The bases of such observing ships are the new "torpedo catchers." They have a speed which makes the actual attack of torpedo boats remote; a draught of water enabling them to press into the shallows, and rendering the chances of a blow from the locomotive torpedo uncertain. Three or four of such vessels forming an in-shore squadron, always closing in and lying quiet at night, and drawing off as daylight breaks in the morning, would keep quite as close a watch on the egress of the enemy as the numerous vessels of the Federals were able to do. They would be powerless to prevent ingress, but that would be immaterial to us. In the case of vessels or squadrons attempting to escape by night, it would be less the duty of these ships to engage them than to hang on their flanks and continually report their movements by signal to the offshore squadron, which would detach and concentrate sufficient force to intercept the runaways. If the in-shore observers were attacked either by like forces, or such as might be supposed superior, they would either fight them or draw them off, taking care, however, that some of their number should evade action for the purpose of keeping up the watch.

No doubt the work of these observers would require all the skill, daring, and perseverance that the navy has always been accustomed to show, but it would not be of the harassing character which those of the Federal in-shore squadrons was. And this, simply because they would be relieved of the anxieties due to watching ingress. The fleet proper need not expect every kind of attack without notice. If its watchers fail to keep it warned, there is practically only the torpedo boat attack which can be delivered as a surprise. In this attack, the net defense, though perhaps not a perfect one, is yet a considerable safeguard. A torpedo boat flotilla will not quit the harbor for the attack unless there be some reasonable hope of finding the off-shore fleet, and this need not disclose itself except in answering the signals of the in-shore observers. But this disclosure presupposes warning, and is so much against the hopes of the torpedo boat flotilla.

Shocking an Elephant.

The great elephant Chief, who forms a part of the "pageant of victory" in the play "Fall of Babylon," met with a curious misfortune recently. Just as he was about to go on the stage, the company was startled with a tremendous roar, and the great elephant fell to the stage writhing in pain. It was discovered that he had been engaged in scientific investigations, and had seized an electric light wire with his trunk. He received a severe shock, and his trunk was considerably burned, but he was not otherwise injured.

© 1887 SCIENTIFIC AMERICAN, INC.

The Aurora as Seen in Alaska.

Lieut. Ray, in his report to the government on the International Polar Expedition to Point Barrow, Alaska, says: "Every clear night, the sky was illuminated by the most beautiful displays of aurora it has ever been my fortune to witness. They always commenced in the northeast and northwest, and seemed to spring from a dark, low bank of clouds. The lights were never stationary for a single second, neither did they ever take the form of bows or arches, so often seen in other latitudes, but great curtains of light, flashing with all the prismatic colors, seemed to be drawn across the heavens, ever rising and changing, and often culminating in a corona at the zenith, and falling like a shower of meteoric fire. As the winter advanced, these displays were more brilliant, and were always of a character that defies description, either by pen or pencil, as they were never for two seconds alike. They were unaccompanied by any sound so far as we were able to observe, and the deathly stillness that always prevails in this region when the sea is closed gave us an excellent opportunity to detect any sound, had there been any."

Lieut. Ray thus more specifically describes one of these auroras—one of the most magnificent displays that he observed, and which occurred December 8, 1881:

The "first appearance was in the S. and S.E., and for several hours nothing appeared but a few pale arches and bands, which had no remarkable features worthy of notice, except the rapidity with which they changed their position and character. They appeared, faded, and reappeared in various parts of the sky so quickly that it was very difficult to localize them. At 2.40 A. M., a narrow, greenish yellow arch, with a beautiful rosy fringe, developed in the S S.E., and, in a few minutes, extended through Taurus, Cassiopeia, and Cygnus down to the N., and for about ten minutes displayed some extremely beautiful tints, especially along its northern half. It seemed to be composed of an infinite number of short rays in a condition of intense vibration, the motion being principally in the direction of its length, while flashes of the most vivid coloring beamed out in the most bewildering variety. At the same time, numerous rays and patches of quivering light appeared in various parts of the sky in quick succession, dancing and gyrating to and fro, swift as the lightning flash. While the northern half of the arch remained thus brilliant, the southern half faded away. A few minutes afterward, a patch of rosy, greenish light appeared in the middle of Orion, and, in a minute or two, developed into numerous sheaves of rays with the greatest variety and intensity of motion, and displaying the most brilliant colors as they rose and converged to a point close to the star Algol, forming an imperfect but most brilliant corona, which swayed and swirled and eddied around our zenith with a kaleidoscopic magnificence utterly indescribable. The changes of tint, aspect, and position were so rapid and numerous that the eye strove to follow their bewildering confusion in vain. The general motion was to the N., though a brilliant curtain was at the same time moving toward the zenith from the N. The brilliance of the moon seemed to have little effect on the intensity of the colors which appeared. The colors were very numerous. Orange, yellow, rose, ruby-red, peach blossom, emerald green, and numerous intermediate tints changed and interchanged in beautiful confusion. The whole phenomena of waving wreaths, flickering flames, rays, curtains, fringes, bands, and flashing colors, the strange confusion of light and motion, presented a picture of which words can convey a very poor idea. The whole display lasted about thirty minutes. There was also intense magnetic disturbance during this time, the needles being almost unmanageable.

"The peculiarity of this aurora was its lowness in the atmosphere, several patches of cloud, apparently not very elevated, appearing far above it. It did not entirely disappear until about twelve, midday."

An Old Field for New Inventors.

The surprising announcement comes from Washington that the special board of officers appointed to inquire into the comparative merits of different lifeboats for use in the navy has reported to Secretary Whitney that it has found no lifeboat which can be recommended.

This indicates that the lifeboats used in the merchant service must be much less safe and advantageous in time of peril than is commonly supposed. Perhaps, indeed, many of them are not entitled to be called lifeboats.

The Secretary of the Navy has directed a continuance of the investigation on the subject, but, whatever conclusion is finally reached, enough has already been developed to show that lifeboats are capable of great improvement, and that a thoroughly satisfactory lifeboat is yet to be devised.

Here is a fine field for the exercise of inventive talent for the benefit of humanity. It may safely be predicted that the inventor of a real lifeboat worthy of the name will gain a distinction equal to that of the inventor of the miners' safety lamp.—*N. Y. Sun.*

Weight Carried by German Infantry.

The maximum and minimum weights in the new approved forms of equipment to be supplied to the German infantry have been arranged by the authorities at Berlin. The Bavarian forces, as usual in most of the military innovations made of late beyond the Rhine, will be suited first, and although the fact is clear, the reasons for the warlike preparations in this kingdom before the rest of Germany are not immediately apparent. The heavier burden of the equipments of two sizes, it is expressly stated, is only to be served out to men whose physical conformation and powers are found superior to the average, a disposition in itself a proof of the extreme care and solicitude of the German commanders for their followers in the ranks. Taking the basis of 28 grammes to the ounce, and 428 grammes to the English lb., the weights of the different items of equipment can be closely determined: Knapsack and fittings, of maximum scale, 1,170 grs.; belt, waist plate, and frog for bayonet sheath, 399 grs.; three cartridge pouches and straps, 1,015 grs.; pair laced shoes, 1,200 grs.; helmet and mountings, 495 grs.; camp utensils, 735 grs.; brushes and housewife, 600 grs.; and biscuit bag, 300 grs.; or 6,514 grammes in all. But to estimate the full weight carried by the German infantryman in heavy marching order must be added his rifle, which weighs 4,600 grs.; one hundred cartridges, 4,300 grs.; and the bayonet and sheath, 900 grs. Spare underlinen, socks, greatcoat, and boots, with camp or service tools and bread, may be counted for 17 kilos, to give an aggregate of 23 kilos 300 grammes. If the odds and ends, not included in the regulation kit, which every soldier possesses, the lump burden may be calculated at the average of 25 kilos, or 55 lb. 3 oz. English.—*Broad Arrow.*

New Relations between Light and Electricity.

On repeating the well known experiments in the perforation of insulating plates by the electric spark, with plates of various minerals, Prof. Marangoni has obtained certain curious results. Particularly, with plates of Iceland spar, obtained through a cleavage parallel with the rhombohedron, the following results are obtained: (1) the hole made in Iceland spar by the electric discharge is in a straight line, while in glass it is zigzag; (2) the discharge, instead of following the direction of the planes of cleavage, as might be expected, follows that of the principal axis of the rhombohedron, that is to say, the optical axis; (3) along the aperture there are observed two slits situated in two planes at right angles with each other, and which are intersected by the hole itself, say the optical axis. One of these slits is found in the principal section.

The following arrangement was employed by Prof. Marangoni for performing these experiments:

A funnel was first partly filled with mercury, and upon this was placed a layer of petroleum, and between the two was floated the plate of mineral to be studied. In contact with the mercury there was a copper wire, which was connected with the positive pole of the induced wire of a large Ruhmkorff coil, whose negative pole communicated with the mercury through a copper electrode.

With petroleum, the explosive distance, which was 15 cm. in the air, was reduced to about a seventeenth of its value.

It will be remarked that, through this arrangement, the mercury is in contact with the entire surface of the crystal, and that the discharge is free to follow the line of the least resistance through the crystal. As a general thing, the first spark pierces the plate. Prof. Marangoni experimented in this way with various minerals, such as fluorspar, selenite, muscovite, and topaz; but, as the specimens were defective, the results were of no account. A beautiful specimen of rock salt, on the contrary, gave excellent results. With plates parallel with the plane of the cube and varying from 5 to 10 mm. the electric discharge perforated them at right angles with their faces, and produced two slits at right angles with each other, and consequently with the faces of the cube, and several other small slits at right angles with each other and bisecting the angles of the first. The smallest slits were therefore in planes parallel with the faces of the dodecahedron.

Upon studying plates of rock salt with the Nuremberg polariscope, and upon producing variations in density in them by means of Brewster's press, Prof. Marangoni ascertained the mechanical effect of the discharge. The result of this study is that the density diminishes in the plane of the slits, and increases, on the contrary, in the direction of the bisectrices of their planes. With Iceland spar, the professor observed none of these phenomena.

The facts just made known have led the professor to conclude on the following relations between the propagation of electricity and that of light.

1. Light and electricity, in a medium of regular molecular structure, are propagated in a straight line.

2. Light and electricity, in a minimum of time, that is to say, with the least resistance, take certain directions which are those of the axes of elasticity, or certain directions having determinate ratios to such axes.

3. Light is a transverse vibratory motion, and, in non-isotropic bodies, is decomposed into two rays, so that the plane of the vibrations of one of the rays is at right angles with the plane of the vibrations of the other.

The electric discharge produces slits at right angles with its own direction, and these slits are not, as a general thing, produced according to the planes of cleavage. This would countenance the supposition that electricity also admits of transverse vibrations like light, and might likewise be polarized according to two planes at right angles.

Light, in an amorphous medium, such as glass, changes direction at the least accident, and the trajectory of the luminous vibrations is then very complicated.

So, too, the slit produced by the electric discharge through a plate of glass does not allow of any normal direction.

The facts observed on the electric discharge through crystals are in perfect accordance with Fresnel's theory that the vibrations of ether take place more easily in directions parallel with the layers of the molecules, and that, consequently, every oblique vibration upon one of the axes of elasticity is decomposed into two vibrations, one of which is parallel with such axis and the other at right angles with it.

Prof. Marangoni regards this analogy of effects as a new proof of the hypothesis that attributes light as well as electricity to a vibratory state of ether.—*La Lumiere Electrique.*

Lightning Statistics.

From a recent report by Dr. Hellmann on statistics of lightning damage in Schleswig-Holstein, Baden, and Hesse, it appears that the danger from lightning in these parts (unlike the case of other parts of Germany) has been decreasing of late years. Soft-roofed houses are fired about 7 times oftener than those with hard roofs. Windmills are struck 52 times, and church and clock towers 39 times, oftener than ordinary houses with hard roofs. The marshy regions in Schleswig-Holstein are the most dangerous, and the land about inlets of the east coast the safest. With like conditions, the relative danger decreases the more houses are grouped together. In Baden the danger varies more than in any part of Germany (about Heidelberg it is 24, and in Waldshut 265 per million houses). In Hesse, the low plain of the middle Rhine is the most dangerous part. In the fifteen years 1869-83, there were killed by lightning for every million men, in Prussia, 4·4; in Baden, 3·8; in France, 3·1; and in Sweden, 3·0. The geological nature of the ground, and especially its capacity for water, has important influence. Thus, calling the danger on lime 1, that for sand is 9, while for loam it is 22. This is partly why most of South Germany and Austria is less dangerous than North Germany. There are four factors affecting the lightning danger to buildings: two physical—unequal frequency of storms and geological character; and two social—variable population and mode of building. Of all trees, oaks are most frequently damaged, beeches most rarely (in the ratio 54 to 1).—*Nature.*

The Science of the Base-Ball Curve.

When a ball (or in fact any missile) is advancing rapidly through the air, there is formed in front of it a small aggregation of compressed air. (In passing, we may remark that the compressed air in front of an advancing cannon ball has been rendered discernible—we can hardly say visible—by instantaneous photography.) In shape the cushion of air is conical—or rather conoidal—if the ball is advancing without spin; and therefore it resists the progress of the ball equally on all sides, and only affects the ball's velocity. The same is true if the ball is spinning on an axis lying along its course. But in the case we have to consider, where the ball is spinning on an axis square to its course, the cushion of compressed air formed by the advancing ball has no longer this symmetrical shape. On the advancing side of the spinning surface the air cannot escape so readily as it would if there were no spin; on the other side it escapes more readily than it would but for the spin. Hence the cushion of air is thrown toward that side of the ball where the spin is forward, and removed from the other side. The same thing then must happen as where a ball encounters a cushion aslant. A ball driven squarely against a very soft cushion plunges straight into it, turning neither to the right nor the left, or if deflected at all (as against a billiard cushion), comes straight back on its course; but if driven aslant against the cushion, it is deflected from the region of resistance. So with the base ball. As the cushion of air against which it is advancing is not opposed squarely to it, but is stronger on one side than on the other, the ball is deflected from the region of greatest resistance.—*Prof. R. A. Proctor, in Longman's Magazine.*

AN Illinois correspondent suggests the need of an invention for raking and baling hay as cut in the swath.

© 1887 SCIENTIFIC AMERICAN, INC.