SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York

FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS.

One copy, one year, for the United States or Mexico $3.00
One copy, one year, for Canada 3.75
One copy, one year, to any foreign country, postage prepaid, 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845).... $3.00 a year
Scientific American Supplement (established 1876)..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (established 1878). ..... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, SEPTEMBER 19, 1908.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE REBUILDING OF THE QUEBEC BRIDGE.

In view of the widespread regret which was expressed at the fall of the Quebec bridge, the decision of the Canadian government to undertake the rebuilding of this monumental structure will cause general satisfaction. Following the report of the Royal Commission of Engineers, another body known as the Parliamentary Committee, which was appointed to look into the financial and political aspects of the situation, reported in favor of reconstruction. At its last session, it was decided by the Canadian government to assume all the assets and liabilities of the Quebec Bridge and Railroad Company, and proceed with the work of rebuilding.

It is safe to say that, outside of the foundations and masonry piers, no part of the old structure will enter into the new bridge. The cantilever which fell is to-day a mass of broken and badly-twisted steel. The other half of the bridge was so far advanced at the time of the disaster, that the whole of the material had been manufactured at the shops, and the greater part of it stored at or near the site. It is not likely that any of this material, amounting probably to about 20,000 tons, can be used. It is rumored that the work of designing and rebuilding will be placed in the hands of three leading bridge engineers, representing Canada, the United States, and Great Britain. Whether this be so or not, it will be a matter of great interest to observe how far, both in the outline and details of the new design, the lessons of the great disaster have been incorporated.

IMPROVED RAILS BY THE DRY-BLAST SYSTEM.

During the investigation of the methods of steel-rail manufacture which followed the frequent breakages of poor rails throughout the country, it was pointed out that one of the causes of imperfect ingots and rails was the moisture in the furnace air-blast. In the course of the discussion it was suggested that ingots of a better quality, free from pitmarks and blowholes, could be secured if dry air were used at the furnaces. Not long ago, the Illinois Steel Company, which has adopted the dry-blast system, turned out an order for 100-pound rails for the Lake Shore and Michigan Southern Railroad. The advantages of maintaining a constant and small degree of moisture in the blast were shown in the ingots, which, after being sawn in two longitudinally, were found to be comparatively free from pitmarks and showed marked solidity throughout. Surface blowholes were visible only at the top of the ingot, and what blowholes existed in the body of the ingot were free from surface oxidation. The improved ingots secure two great advantages in the process of rolling: a more uniform grade of steel being obtained in the finished rail, and the amount of cropping required being considerably less, under the same specifications, than that which is necessary when the ordinary air-blast is used.

PROGRESS IN THE GAS-DRIVEN SHIP PROBLEM.

Recent advices from Great Britain speak in optimistic terms of the results which have been obtained on the Clyde by the Beardmore Company, a powerful corporation which is investigating with great thoroughness the problem of driving ships by the producer-gas engine. As part of its experimental work it has installed a modified 500-horse-power Capitaine producer-gas engine and auxiliary plant in the obsolete warship "Rattler," a vessel of 715 tons displacement. The engine is of the vertical type, with five cylinders working on the Otto cycle. It is noteworthy that the gas-producing plant is arranged to work with bituminous coal. The gas is cooled and cleaned by passing it through a scrubber, and is drawn off by the engine in proportion to the work that is being done. The exhaust gases are utilized in a boiler for raising the steam necessary in the operation of the producer. Power is transmitted to the propeller shaft through a special type of hydraulic clutch, the speed of the engine, when it is disconnected, being controlled by a suitable governor. For reversing, the power is transmitted to the propeller shaft through a train of wheels operating in combination with the clutch. The economy of weight in this installation is shown by the fact that whereas the original steam machinery weighed 150 tons, the complete gas-producer plant with its auxiliaries weighs in the total only 94 tons. During a series of trials the vessel covered 31 miles at a speed which, after tide corrections had been made, worked out at 12.8 knots per hour. The coal consumption, as compared with that of a steam engine of the same power, showed an economy of fifty per cent. We understand that the next experimental engines will be of 1,000 horse-power.

MORE POWERFUL EXPRESS LOCOMOTIVES.

The continued increase in the weight of express passenger trains, and the consequent demand for locomotives of greater hauling power, have been met by locomotive builders in the production of express locomotives of a weight and power considerably greater than are to be found in the railroad systems of Europe. The limit of hauling power is determined by the load which can be carried upon the driving wheels, and this, in the case of the heaviest express locomotives, had been increased to the high figure of about 90 tons. The maximum number of driving wheels among which such a load can be distributed under the present type of locomotives is six. Any larger number of drivers would involve too rigid a wheel base. Designers are, therefore, confronted in passenger service with the same difficult conditions which, in freight service, led to the introduction of the Mallet system, in which the total load on the drivers can be greatly increased without increasing the maximum loading on any single pair of wheels. Designs have lately been drawn for an express passenger engine to be built on the Mallet system, in which the total weight on the driving wheels will be nearly 120 tons, distributed among eight 73-inch driving wheels. Four of these are placed beneath the firebox of the locomotive, and are driven by two high-pressure cylinders; the other four are carried in a forward truck, and driven by a pair of low-pressure cylinders. It will thus be seen that the introduction of this type for fast passenger service has increased the adhesive weight over thirty per cent. If the new type satisfies the various other requirements of an express locomotive, this departure will mark one of the most important advances yet made in the express service of this country. The greater hauling power may be used either in the acceleration of existing trains, or in the increase of the number of cars hauled. Many trains which are now run in two sections may be made up as a single train, a change which will afford much-needed relief on heavily congested lines.

FUTURE SPEED OF CRUISERS.

The transatlantic speed of the "Indomitable" on her return trip from Quebec, which is stated officially to have been 24.8 knots from land to land, and 25.13 knots for three consecutive days of ocean steaming, has set a mark which is certain to have a powerful influence upon the design of future warships. Had this speed been shown by a cruiser scout crammed with coal, boilers, and machinery, and armed with only a few light rapid-fire guns, the speed, though notable in itself, would have exercised no controlling influence on fighting-ship design; but when we bear in mind that the ship which made this 25-knot run carried from 7 to 10 inches of Krupp armor and mounted eight of the most powerful 12-inch guns afloat, the speed takes on tremendous significance. The presence of the "Indomitable" on the high seas has upset all existing calculations as to the value of the armored cruiser, just as the appearance of the armored cruiser in its day relegated the protected cruiser to a subordinate position, and ultimately to the scrap heap. For it is certain that a single "Indomitable," able to carry its 12-inch guns for such great distances at such high speed, could catch and destroy the most powerful existing armored cruisers of the day. For the future, 25 knots must be the mark of all the warships which, by virtue of their carrying medium armor, will belong to the armored-cruiser class. One effect of this will be to increase enormously the cost of the cruiser and, to no little degree, her size. In fact, the "Indomitable" has raised the cost of cruiser construction, as the "Dreadnought" did that of the battleships.

THE MAKING OF AEROPLANE HISTORY.

Hardly had Delagrange made record flights of 29 minutes and 54 4/5 seconds on September 5 and 31 minutes on September 7, when Orville Wright outdid him. In four of the most daring aeroplane flights of our time, Mr. Wright gave not only a wonderful exhibition of personal skill in handling a sensitive aerial craft, but also considerable assurance that the day of the military scouting aeroplane is not far off. On September 9 he flew for 57½ minutes in the morning and 1 hour and 2¼ minutes in the afternoon, concluding his day of records by making a flight lasting 6 minutes and 26 seconds with Lieut. Lahm on board. On September 10 he made a flight lasting 65 minutes and 52 seconds in a 12-mile wind; and on September 11 he remained in the air 1 hour, 10 minutes and 32 seconds at a height of 200 feet, alighting only because of increasing darkness. During all these flights the machine responded admirably to the touch of Mr. Wright.

In the face of these remarkable achievements, Mr. Wilbur Wright's flights in France, startling though they would have been only a few months ago, seem completely eclipsed. Yet on September 5 he flew for 19¾ minutes at an average speed of 37 miles in a four-mile wind, which is his best performance in France.

That either of the Wright brothers can fulfill the government's requirements seems indisputable in the face of these historic flights.

DOUBTFUL CASES OF RADIOACTIVITY.

Recently Cosmos published an article on "the radioactivity of leaves of conifers," in which allusion was made to the experiments of Dr. Russel, who obtained in total darkness impressions on photographic plates placed near or in contact with various parts of conifers. Dr. Russel has since obtained similar impressions from leaves, flowers, seeds, stems, and tubers of many plants. No effect, however, is produced by starch, cellulose, gum, sugar, pith, or pollen. The exposure varies from a few minutes to more than 18 hours. The action is accelerated by heat but the temperature should not exceed 130 deg. F. As moisture injures the gelatine film, the leaves, etc., should be partially dried by laying them between sheets of blotting paper and subjecting them to a pressure of from 5 to 25 ounces per square inch. This method has the advantage of furnishing two images, one taken from the dried leaf and the other from the blotting paper impregnated with the expressed sap, which also possesses power to affect the photographic plate.

Most leaves give well-marked images, the strongest being produced by leaves full of sap. Complete desiccation greatly diminishes or entirely destroys the effect. The action is distributed irregularly over the surface of the leaf. Faint impressions have been obtained from leaves that had been pressed between blotting paper for three years. In such cases the effect is increased by moistening the dried leaf. An incision made in a dried leaf shows very conspicuously in the image, as if a peculiarly active emanation had flowed from the cut edges.

Petals of various flowers also produce strong impressions. They should be partially dried between blotting paper, which gives a second image, as in the case of leaves. The color of the petal has no influence on the result. White and red rose leaves, yellow, blue and purple petals of pansies, appear to possess equal powers of impressing the plate. Petals appear to be more active than leaves of the same plant.

The pistils and stamens of several plants produce strong impressions but the extracted pollen exerts no appreciable action.

The cotyledons of beans are inactive, both before and after germination. The plumule and radicle, on the contrary, become active when they have grown about an inch. The outer coat of the skin is inactive but the inner coat strongly affects the photographic plate. The expressed juice of young bean plants about 7 inches high is very active. Grains of wheat become active after remaining two days in moist sand. It appears probable that the sap of young plants of all grains, even when they have sprouted and grown in complete darkness, possesses great activity. Similar results have been obtained with acorns, almonds, peas, and various nuts. The oil of nuts, however, becomes very active on oxidation. Paper saturated with the oil by pressure and exposed to the air soon acquires a marked power to impress photographic plates. Oil extracted from nuts with ether is also very active. Castor oil, on the contrary, remains inactive after months of exposure to the air.

In bulbs, the fleshy parts are active but the nucleus is inactive until it has begun to grow. The expressed juice of potatoes is very active, that of Jerusalem artichokes slightly active. The activity of bulbs and tubers is destroyed by drying.

The activity of rhizomes, or root-stocks, varies greatly with the species, and probably also with the season. It is slight in the iris and well marked in ferns. Roots possess considerable activity.

The woody envelope of some fruits appears to con-

tain two substances, one of which is active, the other not. Usually the activity is confined to the darker and inner layers. The concentric layers of the axis of the pineapple vary greatly in activity. Almond shells are totally inactive.

What is the cause of these various phenomena? Evidently it is not radioactivity, for the action is entirely prevented by the interposition of a sheet of glass or mica between the object and the photographic plate. Dr. Russel conjectures that the effect is caused by hydrogen dioxide. A solution of one part of hydrogen dioxide in one million parts of water produces an appreciable effect on a photographic plate in 24 hours in darkness, even when the layer of liquid is ⅛ inch distant from the plate. According to Usher, Priestley and many other investigators, hydrogen dioxide and formaldehyde are the first products of the growth of plants. These facts explain the action of growing plants on the photographic plate. Furthermore, hydrogen dioxide is generated by turpentine and other resins, which occur in many plants. The subject, however, requires further investigation.

A FEW FACTS ABOUT FAKES.

BY J. F. SPRINGER.

About 1769 Baron Kempelen of Hungary began to astonish the civilized world of Europe with his chess player. This was apparently a figure controlled by mechanical devices, and which was able, notwithstanding the fact that apparently no intelligence was concerned in its movements and decisions, generally to beat its human antagonists. The cabinet connected with the automaton appeared entirely too small to contain a hidden operator. And yet it did conceal a man who was an expert chess player. He was a Polish patriot who had lost both of his legs—perhaps in the recent war over Poland. This man, Woronsky by name, was an expert player. With him hidden in the cabinet and yet really on the spot, the rest was easy.

The career of George Psalmanazar—as he called himself—was one of the most astonishing on record. This man was born in Switzerland or France, but during the time of his "fame" claimed to be a native of the island of Formosa. He had acquired a moderate education, but seemed indisposed to employ himself in any regular occupation. Instead, he roamed over Europe, serving with the Dutch and with the German army. At one time he pretended to be an Irishman, at another an unconverted Japanese, at a third time as a converted Japanese. In the last capacity he deceived the colonel of a British regiment at Sluys. The chaplain of the regiment—a man named Innes—however, did not seem to have been deceived. He and Psalmanazar proceeded to England, and there began a marvelous career. Psalmanazar masqueraded as a genuine native of Formosa converted to Christianity. The clergy received him with open arms. He had an interview with the Archbishop of Canterbury, who, however, was unable to understand his Latin. But then, who would expect a Formosan to speak Latin with perfection? He published an invented Formosan alphabet, together with forged examples of the native language, accompanying them with translations. The Bishop of London seems to have believed implicitly in his claim to know the language of Formosa, for he employed Psalmanazar to translate the Church catechism into it. He was sent to the University of Oxford to finish his education. There he is said to have employed his waking hours in an idle way, but to have left a candle burning while he slept to bear witness of his zeal in scholastic pursuits. He wrote a treatise upon Formosa in Latin. When this was translated into English, it had a very large success. To corroborate his claim of being a native Formosan, he would eat raw meat, roots, and herbs. He was lionized, and was immensely successful. Although he carried on the deception with the greatest ingenuity, deceiving great and small, he tripped at last. In an unwary moment he joined with someone in exploiting a "white Formosan ware." This led to his downfall. Detection being imminent, he confessed. This is one account. Another has it that he became conscience-stricken, and voluntarily withdrew from the public gaze.

A self-educated man of humble origin of the name of Vrain Lucas, ignorant of both Greek and Latin, became the prepetrator of a fraud involving the preparation of 27,000-odd forged documents, many of them purporting to be letters written by celebrated historical personages. Although written in *French*, they purported to be letters from Sappho, Thales, Dante, Petrarch, Julius Cæsar, Alexander the Great, St. Luke, Shakespeare, Lazarus, Newton, Pascal, Cleopatra, and others. M. Chasles, the great mathematician, was apparently ready to believe that all the ancients were proficient in this language, for he was completely fooled by Lucas. In 1867, among other documents Lucas communicated to the Académie through Chasles two letters and four notes purporting to have been written by the celebrated French mathematician and thinker, Blaise Pascal (1623-1662). If these letters had been genuine, they would have proved him to have anticipated Newton (1642-1727) in his great discovery of the law of gravitation. Chasles was attacked, but stood his ground, even producing other letters to bear him out—from Pascal to the boy Newton. The discussion lasted for two years. In 1869, the Académie made an official declaration in favor of the genuineness of the letters. France went wild. The people in the street cheered the name of Pascal. But shortly afterward an official of the Observatory pointed out that sixteen of the Pascal letters were to be found in Saverien's "History of Modern Philosophers," which had appeared a century before. But M. Chasles claimed that Saverien had used them without acknowledging his source. And so it went. But Le Verrier demolished the whole fabric of the fraud. Lucas was finally brought to trial, convicted, and sent to prison for two years. He had realized, however, about $30,000 from his activities.

Simonides was a past master in the art of literary forgery. His performances belong to approximately the same period, but were accomplished on different soil. His greatest achievement was the forgery of a history of ancient Egypt written in Greek by Uranios. This he proposed to sell to the Germans for a great sum. In order to understand just what a marvelous piece of work he produced, it will be necessary to understand some of the difficulties. He undertook to produce a palimpsest—that is, an old parchment manuscript which has been used again for a more modern work. He took a manuscript of about the twelfth century, and wrote his history on the same parchment. As this new writing was to masquerade as the older, he had to avoid getting a single line of the new upon any part of the old. This required wonderful care, as there was really but very little space. In addition, he had to make the Greek letters he used agree with the style of the century they were supposed to represent. Of course, the history itself and the character of the language had to correspond with the supposed period of composition. As Prof. Max Müller tells us, he followed Bunsen's "Egypt" and Lepsius's "Chronology." And so the finished fraud captivated Lepsius, great scholar that he was, for the dates were all correct, that was plain to be seen! However, the manuscript had to undergo a very searching investigation, which included chemical and microscopic tests. Dindorf, the great classical editor, was to edit it for publication, and the Clarendon Press of Oxford was to publish first specimens. In fact, the fraud had almost been accomplished, when unfavorable news began to be received in Germany—probably accounts of Simonides's previous doings. At any rate, a re-examination was made, and inconsistencies in connection with the Greek letter M were found. In addition, a single passage was discovered where the supposed older ink was in reality seen to have run across the twelfth century writing. This was conclusive.

One of the most astonishing examples of genius devoting itself to forgery was that of the Italian Bastianini. Born in 1830 in the midst of abject poverty, he had, properly speaking, no systematic education, either literary or artistic. But he had real genius. An antiquarian of the name of Freppa employed him for two francs per day to produce "antiques" which might be sold at a good profit. So this became Bastianini's life-work—the production of forgeries. One of his most celebrated works is the bust of Savonarola. Persuaded that here was a real fifteenth century bust, two public-spirited gentlemen collected 10,000 francs, and purchased it from Freppa to prevent its sale and exportation. One critic, Dupré, declared that he must assign it to Michelangelo for its force and to Robbia for the exquisiteness of its treatment, regarding it as a wonderfully beautiful work of art. Sir Frederick Leighton, the noted English painter, having received a photograph, placed it, "like a sacred image, at the head of his bed." It is said that the Grand-duchess Marie of Russia and Lippart seriously thought of building a temple to house this wonderful bit of art. But, notwithstanding the plaudits of those who "knew," the bust was a fake. Rumors having become current that the piece of terra cotta was not what it purported to be, one of the purchasers abruptly demanded of Bastianini one day at his workshop whether he was the creator of the bust. And he admitted that he was. But this was not the only great "success" of Bastianini. A terra-cotta bust of Benevieni, a sixteenth-century poet of Florence, was regarded as a contemporary work of art, and purchased by the Louvre for 13,000 francs, and installed in a room containing work of Michelangelo himself. But it was a fake for all that.

In the late nineties an English magazine was founded with the avowed object of printing true tales of adventure and the like. One day a man calling himself Louis de Rougemont handed a letter of introduction from a member of Parliament to the editor. The stranger told a harrowing tale of a life spent in Australia with cannibals in an unexplored region of that continent. Rougemont was proof against the most merciless cross-examination. He never contradicted himself. His narrative was taken down in shorthand, and published serially in the magazine. The editor introduced Rougemont to scientists, confident that the experiences of the man were of value to geography and anthropology. Two eminent geographical experts heard his story, tested it from their wide and accurate knowledge, and risked their reputations by giving it full credit. They too were of opinion that it contained matter of especial importance to science. The British Association for the Advancement of Science began to be officially interested. Arrangements were entered into for the appearance of the hero before it at the Bristol meeting.

Rougemont told a truly staggering tale. He enriched it with lively details of a fight with an octopus, of a wreck from which he was saved by a swimming dog to whose tail he clung, of an island on which he landed and where he lived on turtle meat and rode on turtles as if they were horses, of a visit of four starving blacks, one of whom, a woman, he married and to whom he even dedicated his astonishing narrative, and of his leaving the island to become the ruler of an Australian cannibal tribe for thirty years.

Long before the magazine had completed the story, Rougemont was found to be a faker. His biography was fiction. He had, however, deceived for a considerable time a great mass of people, many of whom knew Australia, and some of whom were experts in the branches of knowledge having to do with the alleged facts.

The Louvre in Paris is both the largest and the finest collection of examples of art that exists anywhere in the world. And yet this great museum of art has been made within recent years the victim of a striking piece of forgery. There was submitted to its inspection and approval a wonderful example of the goldsmith's art. This was claimed to be the tiara of Saitapharnes, and to have been dug up in southern Russia. The Louvre paid £4,000 for the headpiece. Henri Rochefort, the noted editor of L'Intransigeant, branded the headpiece as a forgery. It is possible that he did not act entirely independently, although he was an expert in art matters. To support the allegation of fraud, there was brought to Paris a certain M. Koukhomovski, a goldsmith of Odessa. Arrived in Paris, he demonstrated that he could indeed execute work the equal of the tiara. The upshot of it all seems to be that the tiara was partly genuine, but otherwise to have been the work of the accomplished M. Koukhomovski.

THE CURRENT SUPPLEMENT.

A new system of ship construction has been devised by J. W. Isherwood, which gives a freight-carrying vessel greater capacity than has been possible under the old construction. The system is painstakingly described and illustrated by the English correspondent of the SCIENTIFIC AMERICAN in the current SUPPLEMENT, No. 1707. Dr. Louis Bell reviews recent American work in power transmission. A. Troller contributes an article on the Armengaud system of electrical vision at a distance. Our Berlin correspondent describes an air-driven typewriter. The dredging equipment on the Panama Canal is a subject discussed by F. B. Maltby. A new type of automobile road-roller is described and illustrated by the Paris correspondent of the SCIENTIFIC AMERICAN. How Prof. Onnes of Leyden liquefied helium is excellently set forth by Francis Hyndman. Prof. D. Finlayson, the well-known English agricultural authority, writes on barley and its cultivation. "What is the good of astronomy?" is no doubt a question which the layman frequently asks himself. That question is very fully answered by Prof. Harold Jacoby. The Commissioner of Fisheries contributes a simply-worded article on the transplanting of fish.

THE MOREHOUSE COMET OBSERVED.

The new comet discovered upon a photographic plate by Mr. Morehouse at the Yerkes Observatory on September 1 has been observed visually with the 10-inch refractor at Smith Observatory by W. R. Brooks. On September 5, 14h. 20m. standard mean time, the position of the comet was right ascension 3 hours 20 minutes; declination north, 68 deg. 30 min. On September 7, 15 hours 30 minutes, the comet's position was R. A. 3 hours 00 minutes; declination north, 69 deg. 30 min.

The discovery place on September 1, 361 G. M. T., was R. A. 3 hours 20 min.; declination north, 66 deg. 15 min. These several places show a slow motion of the comet in a northwest direction.

The comet is visible in a small telescope, being an easy object in the 3-inch finder of the equatorial, and promises to become an interesting object as it comes nearer.

The comet is now just under the back of Cassiopeia's Chair, and being circumpolar is observable all night when the moon is absent.