SCIENTIFIC AMERICAN

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MEMORIAL CHURCH RECENTLY ERECTED AT BORKI, RUSSIA.—[See page 135.]

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NEW YORK, SATURDAY, SEPTEMBER 1, 1894.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 974.

For the Week Ending September 1, 1894.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

It is remarkable that 488 members of the Association for the Advancement of Science, and perhaps nearly as many more belonging to affiliated societies, should assemble in midsummer for a week or two of hard work, while the rest of society is having its "silly season." Most of these visitors, together with resident people of culture, have heard, in this short period, twelve public lectures, five lengthy reports of special committees, and, in the sections, 177 papers, together with the learned discussions excited by them; besides many other papers read in the kindred societies.

The local committees having in charge the entertainment of this host of searchers after truth did their part nobly, and those managing the delightful excursions to Long Branch, Cold Spring Harbor, Glen Island, West Point, the White Mountains, and elsewhere were perfectly successful. But especial mention should be made of the work done by the press committee, of which Mr. H. F. Gunnison was chairman. This difficult task was never better done in the history of the association. Duplicate typewritten copies of all the more important papers were supplied in advance to reporters; and the result was a very thorough publication of the proceedings. We observe with disapproval that several influential dailies have embellished their columns with cartoons that were doubtless meant merely for fun, but the tendency of which is to bring into ridicule the noblest pursuits in which men can engage.

The A. A. A. S. has indeed felt the need of a more systematic way of making its results accessible for the reading public. And after much discussion, and with some hesitation, they decided to try the experiment this year of adopting the journal Science as its medium of publication. They chose five associate editors to work without compensation, and appropriated $750, on condition that as many as 120 pages of Science were open for them during the year. Certain other safeguards were thrown up, and the council appeared to be sanguine as to the issue of the trial. The wisdom of such an experiment remains to be demonstrated.

The next meeting of the A. A. A. S. will be held at San Francisco, if railroad concessions can be secured, and will probably come a month earlier than this year for certain reasons. The invitation comes heartily from the city authorities and several California universities and scientific societies, and gains force from the fact that the association has never yet met west of the Rocky Mountains.

A remarkably strong corps of officers was elected for the ensuing year: President, Prof. E. W. Morley, of Cleveland, O.; Permanent Secretary, Prof. F. W. Putnam, of Salem, Mass.; General Secretary, Dr. J. L. Howe, of Louisville, Ky.; Treasurer, Mr. R. S. Woodward, of New York City. The sections also are officered by some of our most distinguished scientists.

From the mass of valuable material put at our disposal by the agency of our special contributor, Dr. Horace C. Hovey, we have selected several of the more striking addresses and papers for publication, aware that much of what is omitted equals, or possibly may excel, what is accepted. It is somewhat embarrassing to have the privilege of choosing from among 200 communications, all of which are meritorious and interesting. We have already published some of these, and others will appear shortly. Indeed, it may be expected that the stimulus given to the public by such a series of scientific meetings will be felt for many months to come.

The evening addresses, given in the elegant Hall of the Fine Arts, whose walls were hung with beautiful paintings loaned for the occasion, drew much larger audiences than the papers read during the day in the lecture rooms of the institutes.

One of these was a brilliant address by the celebrated traveler, Paul Du Chaillu, who, after having explored Africa, has of late turned his attention to the antiquities found along the Baltic in the land of the Norsemen. He claimed that history had been falsified concerning the Vikings and their degree of civilization. They were not only stronger than the people whom they conquered, but were in almost every way their superiors. They made some of the largest and finest ships that ever floated on the seas. Some of these vessels rivaled our grandest modern ocean steamers in size. The fleet of the Vikings included, at one time, 10,000 vessels, on board of which were fully 1,000,000 seamen and soldiers. On land the Norsemen had superb mansions, magnificent temples and costly mausoleums. They were governed by a parliament, and their domestic life was pure and refined. As one of the results of his long and patient study of the Icelandic sagas Du Chaillu expressed the positive conviction that the Norsemen were the first discoverers of America, nearly 500 years before it was rediscovered by Columbus.

Prof. E. D. Cope addressed the people one evening on "The Relation of Human Structure and Physiognomy to those of the other Mammalia." In other words, he compared men with monkeys. Or as one of the dailies wittily said, "He told who his ancestors were." He pointed out the error of imagining all monkeys to be alike. The lemurs inhabited trees, while baboons were terrestrial in their habits. Peculiarities in dentition were important. The lemurs and many other monkeys had the same dental processes as the quadrupeds, while the anthropoid apes lost these peculiarities. Human skeletons were also diversified. Similarities were pointed out between the bones of certain types of men and the great apes. The Bushmen were at the bottom of mankind, and above them the other Africans. Then came the yellow, brown and white races, with all sorts of intermediate types. Primitive man, from a zoological point of view, did not widely differ from modern man; but from a human point of view he was widely different from his descendants.

One of the most instructive addresses was that before the chemists, by Prof. T. H. Norton, concerning what he styled "The Battle with Fire," in which he gave an exhaustive review of what had been done by science to prevent conflagrations. After describing some of the great fires mentioned in history, he stated that the total annual loss of insured property by fire is $200,000,000, of which nearly one-half is in the United States. About 85 per cent of the 15,000 fires that occur annually can be traced to preventable causes. And aside from our direct losses by this means our fire departments cost us many millions of dollars every year. Among agencies for preventing this destructive waste, water still holds the first place. Chemical fire engines are charged with carbon dioxide, though other substances have also been recommended. Hand grenades or glass bottles, charged with carbonated water or the salts of ammonium, are practically less useful than they might be, because so often thrown in a manner that fails to break them. Various extinguishing powders were also described. Methods of making buildings, fabrics, and paper fireproof have been devised. A list of fire protectives was given, and hints offered as to the lines along which further investigations might be successful.

Major Jed Hotchkiss, of Staunton, Va., was appointed by the executive committee of the World's Fair to prepare a report on the progress made by geology during the period from the Centennial Exposition to the present time, and he gave an outline of his plan. He intends to prepare two geological maps, one showing what was known of the earth's formations and rocks in 1876, and the other what is now known. For this work he is well fitted by his wide range of general information, and by his experience in practical map making. He made the military maps for General Lee during the late war, and has devoted his whole life to science. He is now in correspondence with geological authorities in all parts of the world. Capable men have been requested each to prepare a chapter on the State, province, or country they represent, and the result will be anticipated with great interest by the scientific public.

In this connection the Atlas Folio, issued by the United States Geological Survey, was described by Mr. W. F. Maxwell. This embodies the final maps of the survey, showing the topography, geology, mines, etc., of the areas covered, with accompanying descriptions in terms popular, rather than technical, for the benefit of the public. This work has involved much expense, and is the finest specimen of geological lithography known. It is the plan of the director of the survey to issue these beautiful charts gratis to leading newspapers and to people of scientific tastes.

Aluminum violins were explained by Mr. Alfred Springer in a paper that attracted much attention. He said that sounding boards of aluminum were analogous to those of wood, in that they did not produce secondary tones discordant to the prime tones. Among the difficulties encountered was the fact that the plates had to be riveted instead of soldered. He overcame uneven thickness of parts of the violin by sheet metal ribbed and arched. It was claimed that in aluminum instruments there was not the uncertainty and lack of individuality found in those of wood, nor was there any liability to warp or crack. An aluminum violin was produced and played on to illustrate his paper. The tones were very full and resonant, and the opinion of experts was that it would be a great addition to orchestral music, but lacked the peculiarities demanded in the best solo performances.

"Salt in Savagery" was the title of a paper read by Mr. Frank Cushing, of the National Bureau of Ethnology. He referred to the universal liking for salt among Indians. The Zunis believe that salt came from the sun. It attracted the water and made the sea. They regarded it as intimately connected with the mystery of life. The salt goddess, in their mythology, is the daughter of the ocean, and stands related to all other powers. The desire for salt, more than anything else, led the cliff dwellers to forsake their caves and descend to pueblos in the plains. He advanced the original idea that man's dispersion over the habitable globe was largely influenced by his desire for salt. Coming down from rocky cliffs and arboreal retreats, he found at the seashore the only place where life could be supported. Human migra-

tions can be traced everywhere by this universal demand for salt.

Mr. R. G. Haliburton discussed the survival of dwarf races, by many regarded as myths, even as recently as 1875. But their existence in various parts of the world has been proved. The speaker discovered, in 1888, a diminutive race on the border of Honduras, whose height was about four feet, whose occupation was making Panama hats, whose weapons were poisoned arrows shot from blowpipes. Blancaneaux was the only white man who had ever lived among them, and he gave them a high character, contrary to the statements made by the soldiers of Guatemala. Dwarfs are represented in Yucatan sculpture. Some of the lake islands of Uruguay are said to be inhabited by pygmies.

Among the many papers worthy of notice were those of Hon. G. G. Hubbard on "The Geography of China, Corea and Japan;" on "Graduate and Post-graduate Degrees," by Dr. R.H. Thurston, of Cornell University; on "The Education of Engineers," by Prof. F. O. Marvin, of the University of Kansas; on "The Seat of Consciousness," by Dr. Paul Carus, the editor of the Open Court and The Monist; on "Various Phenomena of Lightning," by Messrs. McAdie, Rolliston, and Hodges; "Concerning Certain Features of California Geology," by Prof. J. P. Smith, of the Stanford University; on the "Water Resources of the United States," by Maj. J. W. Powell; and on "European Water Supplies," by Prof. W. P. Mason.

NIAGARA AND THE GREAT LAKES.

For the last fifteen years our geologists have given attention to certain problems connected with the drainage of the chain of great American lakes, and incidentally with the probable age of the gorge of Niagara. A week was devoted to them at the Buffalo meeting of the A. A. A. S., including an exploration of Niagara River by a party of thirty geologists. The conclusion then arrived at was that while the lower lakes may have always been drained through the valley of the St. Lawrence, the upper lakes had probably found an outlet at one time by way of the Mississippi valley; and that the whole chain might do so again, should there ever be a barrier, natural or artificial, across the inlet of the Niagara near Buffalo. It was thought that a dam 25 feet high might bring about this result and cause a grander river than any now on the continent to flow out from Lake Michigan near the city of Chicago. As to the age of the Niagara gorge, the conclusion was that 7,500 years met all requirements; while a few deemed 3,500 sufficient. As the age of Niagara has been regarded as a kind of geological yardstick for measuring off the age of the human race, importance was attached to the foregoing conclusions. Geologists, however, have since then been making further study of the problems indicated. And while some of them adhere to the ground just stated, others materially modify their opinions. This fact gave special interest to three papers read at the Brooklyn meeting of A. A. A. S.

1. ON THE GEOLOGICAL SURVEY OF THE GREAT LAKES.

In this paper Prof. J. W. Spencer stated the case and reported progress. The story of these remarkable lakes tells of a former high continental elevation. The present bottom of Ontario is 491 feet below sea level; of Huron, 168 feet; of Michigan, 282 feet; and of Superior, 400 feet. If these were once erosion valleys, they must have been at an altitude such as to allow their drainage to flow down to the sea. In keeping with this theory we find that the lower St. Lawrence River is a submerged channel, increasing from a depth of 1,200 feet to 1,800 feet, and with deep tributary canyons. The submerged escarpments of the existing lake basins were described, proving buried valleys that connected them. The glaciation of the region was not in the line of these escarpments, nor do their vertical walls show signs of having been shaped by glacial action. Between the Georgian Bay and Lake Ontario lies a deeply buried valley, as found by a series of borings, through which the ancient Laurentian River must have flowed. There was a southern branch crossing the Michigan peninsula and the Huron basin, to which the name Huronian River is given. Through the Erie basin flowed a now submerged river, named the Erigan, which crossed to the great canyon at the head of Lake Ontario—the Niagara River not then being in existence. These ancient valleys were broader than the modern streams, which have made for themselves new channels, instead of reopening the old ones filled with drift.

In certain instances, indeed, the river drainage has been actually reversed. This was shown by the studies of Dr. Newberry, T. Sterry Hunt, and Mr. J. F. Carll. The theory is confirmed by recent investigations. The Susquehanna and its tributaries flowed into Lake Ontario, while the Ohio River, above Pittsburg, flowed into the Erie basin. All this system of ancient drainage was obstructed by drift, and also by the warping of the earth's surface, as shown by deserted beaches, terraces, and sea cliffs, some of which have been followed for hundreds of miles. The open water within these contracting beaches has been named by Prof. Spencer "Warren Water," which may be regarded as the mother of all the lakes, and which at one time must have covered 200,000 square miles. When the level fell 150 feet the three highest lakes were inclosed in what might be called "Algonquin Water," while Lakes Erie and Ontario were within the "Lundy Water." A further subsidence of 300 feet brought the waters to what is termed the Iroquois level, after which episodes of movement and repose formed the modern lakes.

2. DRAINAGE OF THE LAKES INTO THE MISSISSIPPI.

The highest deserted strand near Chicago is 45 feet above the lake level. According to the canal survey, the divide is 25 miles southwest of Chicago, and is only 8 feet above the lake. From measurements of the sets of deserted beaches the depth to which they are depressed can be calculated. The indications are that the subsiding waters (Warren, Algonquin and Huronian) were drained through the Ottawa valley for about 24,000 years. This outlet was closed by the rim being raised so as to turn the overflow into the Erie basin, whose outlet was also affected by the same uplift, so as to drain all the upper lakes into the Mississippi valley. The subsiding of the waters lowered the lake level sufficiently to turn the volume through the Niagara. But as the terrestrial uplift of the Niagara region is about one foot and a quarter a century, it follows that, if this rate shall continue, the drainage of the upper lakes will, in about 5,000 years, be diverted back again into the valley of the Mississippi.

3. HISTORY AND DURATION OF NIAGARA FALLS.

The Niagara River came into existence, according to Spencer, upon the dismemberment of the "Lundy Water," and for 1,000 years drained the Erie basin without a cascade. As the Ontario basin slowly sunk, the falls were made, until the total descent was 420 feet, there being at one time three cascades, and afterward one grand united fall. Finally the Ontario waters began to rise again and reduced the height of the falls, at first to 365 feet and then to 320 feet. Mr. Spencer computes the entire age of Niagara River at about 32,000 years. This computation is based on the rate of recession and the amount of work done in each of the episodes, as discovered in working out the history of the lakes. In 1842 Prof. James Hall made the first instrumental survey of the falls; the Coast Survey made the next, in 1875; a third was made in 1886, by Prof. R. S. Woodward; and in 1890 the last was made by Dr. A. S. Kibbe. From these four surveys the mean elongation of the gorge is 4·17 feet a year. Hitherto most of the conjectures as to the age of Niagara have been based on the rate of recession alone. In 1790 Ellicot calculated it as 55,000 years; Lyell, in 1841, lowered the estimate to 35,000; in 1886, after three surveys, Woodward reduced it to 12,000; and later still, Gilbert showed that the duration of the falls should be only about 7,000 years—though he is said to have since modified his opinions.

Spencer's method differs from others, in that he takes into consideration the changing episodes of the river as well as the rate of recession through said episodes. He denies that the buried valley of St. David, hitherto regarded as an extension of the preglacial river from the Whirlpool on, is such, and affirms it to be a branch of a buried valley outside the Niagara canyon, and much shallower than it. The rate of the modern recession has been determined under changing conditions of erosion, so that each episode has to be treated separately. First episode: Waterfall 200 feet high, volume 3-11 of the modern discharge, and gorge 11,000 feet long to the terrace of Foster's Flats; duration, 17,200 years. Second episode: River falling 420 feet in three cascades; (a) discharging only Erie waters through chasm 3,000 feet long; duration, 6,000 years; (b) drainage of all the upper lakes through chasm 7,000 feet long; duration, 4,000 years. (c) Volume as before, also descent, but in one cascade, length of narrows 4,000 feet; duration, 800 years. (d) Volume as now, and level of lower lake as at present; first stage, a local rapid, as at Johnson's Ridge, with total fall of 365 feet, work perpendicularly hard; length of gorge, 5,500 feet; duration, 1,500 years; second stage, as at present, work easy; length of canyon, 6,000 feet; descent of water, 320 feet; rate of recession, 3·175 feet a year; duration, about 1,500 years.

Thus Spencer computes the age of the Falls to be 31,000 years, with 1,000 years added as the age of the river before the nativity of the Falls. He thinks the turning of the Huronian waters into the Niagara was about 8,000 years ago. He finds the amount of work done in each episode by the position of the terraces and the changing effects of erosion. The modern recession is computed from four surveys extending over 48 years, but the rate is excessive, on account of favoring conditions. The history of the great lakes must be taken into the account—as already described; and also the rate of terrestrial uplift in the Niagara region. The end of the Falls seems destined to be effected, not by erosion of the rocks, but by terrestrial deformation that shall turn the drainage of all the upper lakes back into the Mississippi, an event which it is calculated will take place in 5,000 years, which would be before the cataract would have had time to cut its way back to Buffalo.

It should be stated, in conclusion, that Mr. Spencer's theories were but briefly discussed by the Association, and some of those who would probably take issue with them most vigorously were absent.

COTTON SEED OIL PRESSES WANTED.

We print in another column a letter from the Hon. James Z. George, United States Senator from Mississippi, in which he calls attention to the need of new improvements in presses for expressing the oil from cotton seeds. What is wanted is a press of moderate capacity and simple construction, which can be conveniently operated upon any ordinary cotton plantation. The advantages of such a machine are very forcibly presented by Senator George. He thinks, moreover, the inventor would be likely to reap a satisfactory reward; and as a further encouragement offers the use of appliances, power, and labor at his plantation. Nothing could be more liberal; and we have no doubt some of our ingenious readers will be able to study out and produce the desired mechanism.

Close of the Meetings of the American Association.

The American Association for the Advancement of Science closed its sessions, which have been held in Brooklyn, August 22. The next meeting will be held in San Francisco. The following officers were elected for the ensuing year:

President, E. W. Morley, Cleveland, O.; Vice-Presidents—mathematics and astronomy, E. S. Holden, Lick Observatory, Mount Hamilton, Cal.; physics, W. Le Conte Stevens, Troy, N. Y.; chemistry, William McMurie, Brooklyn; mechanical science and engineering, William Kent, Passaic, N. J.; geology and geography, J. Hotchkiss, Staunton, Va.; zoology, D. S. Jordan, Palo Alto, Cal.; botany, J. C. Arthur, Lafayette, Ind.; anthropology, F. H. Cushing, Washington, D. C.; economic science and statistics, B. E. Fernow, Washington, D. C.; Permanent Secretary, F. W. Putnam, Cambridge, Mass.; General Secretary, James Lewis Howe, Louisville, Ky.; Secretary of the Council, Charles R. Barnes, Morison, Wis.; Secretaries of the Sections—mathematics and astronomy, E. H. Moore, Chicago, Ill.; physics, E. Merritt, Ithaca, N. Y.; chemistry, William P. Mason, Troy, N. Y.; mechanical science and engineering, H. S. Jacoby, Ithaca, N. Y.; geology and geography, J. Perrin Smith, Palo Alto, Cal.; zoology, S. A. Forbes, Champaign, Ill.; botany, B. T. Galloway, Washington, D. C.; anthropology, William Aniter Newcombe McGee, Washington, D. C.; economic science and statistics, E. A. Rose, Palo Alto, Cal.; Treasurer, R. S. Woodward, New York.

Remarkable Cycling.

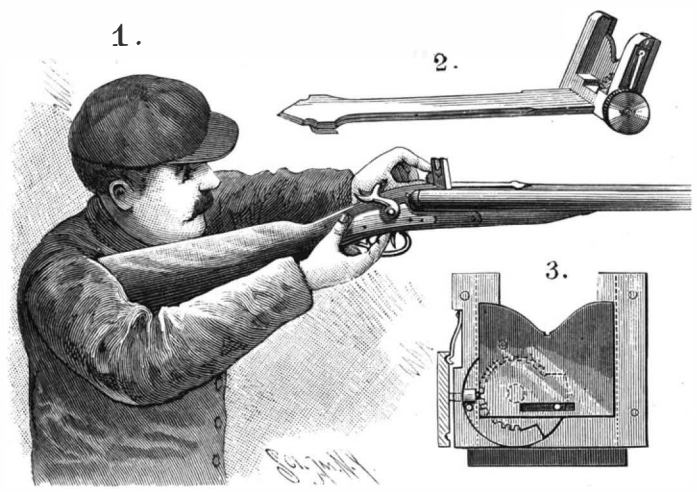
The recent twenty-four hours cycling race for the Cuca Cup, England, resulted in a decisive victory for F. W. Shorland, of the North Road Club. Shorland having been successful in 1892 and 1893, thus secures the cup, which is valued at 100 guineas, outright. So great was the excitement aroused by the contest, that when the race started at eight o'clock on Friday evening about 10,000 spectators were present, and of these about 6,000 remained on the Herne Hill ground throughout the night. From the very commencement of the race Shorland rode at a great pace, breaking records from eleven to fifteen miles, an extraordinary thing to do in a long distance ride, and following this up by beating all previous English records from 101 miles, and all world's records from the thirteenth hour to the finish of the race. His total was 460 miles 1,296 yards. At the conclusion of the race the crowd swarmed all over the track, and so great was the desire to get near and congratulate the winner, that it required the services of a number of police constables to escort him safely to his dressing tent. Shorland's only rest was one of nine minutes, when he had been riding about twelve hours.

Trials of a Dynamite Gun.

One of the fifteen inch dynamite guns was tested at Sandy Hook, August 16. The gun is fifty feet long. After firing three dummies, two shells loaded with 300 pounds of high explosives were fired so as to drop in the main ship channel. A slight noise like a whistle was the only sound made in firing. When the projectiles struck the water, a dash of spray was visible, a moment afterward the shell exploded, throwing up water and sand to the height of four hundred feet. The concussion of the explosion could be plainly felt on shore and on vessels in the vicinity. Sandy Hook is being provided with gun lifts and breech-loading mortars, which in addition to the dynamite guns would make it well nigh impossible for a hostile vessel to enter the harbor. All ships provided that they are of any considerable draft must necessarily pass within three miles of Sandy Hook and therefore directly under the guns located at this point.

AN IMPROVED SIGHT FOR FIREARMS.

This sight is more especially adapted for use in connection with sporting guns, its construction being such that it may be quickly and conveniently adjusted for any range required, without moving the gun from the shoulder or taking it from firing position. The improvement has been patented by Mr. Louis A. Favre, of Ticonderoga, N. Y. Fig. 1 represents the device in use, Fig. 2 showing it detached from the gun, and Fig. 3 with the front plates or guideways removed. The sight is attached to the barrel by means of a tail-piece



FAVRE'S SIGHT FOR FIREARMS.

having a dovetail block or rib on its under side to enter a corresponding groove in the barrel. The sight comprises a body section, to which a face plate is adapted for attachment, and a sight plate, adapted to be raised and lowered together, the plate sliding freely in ways or guides. The operative mechanism comprises a mutilated gear held to turn in a circular recess in the outer face of the body of the sight, and by rotating the gear by means of a thumb-wheel vertical movement up or down is given to the sight plate.

Sculpture for the Congressional Library.

The sculpture to be used as decorations within and without the new Library of Congress is to be in complete and in low relief, and to consist of statues and busts in bronze and granite; also in bronze relief doors and many large symbolical statues in plaster. The latter will decorate the inner dome, where they will be put about sixty feet from the marble floor of the central hall. They are to be figures 10½ feet high, and presumably colored to go with the stucco ornamentation of the vault. They are eight in number, and will rise against the spandrels between eight arches. John Q. A. Ward will model "Poetry;" Augustus St. Gaudens, "Art;" George Barnard, "Religion;" Bela L. Pratt, "Philosophy;" Daniel C. French, "History;" John Donoghue, "Science;" Paul Bartlett, "Law;" John Flanagan, "Commerce." Bronze doors, three in number, are said to have been given to Olin L. Warner, Frederick MacMonnies, and George Barnard. The inner dome has a balcony running round it, about thirty-five feet from the floor. Here are to stand sixteen bronze figures of famous men, each 6½ feet high. Daniel C. French will model Herodotus; Louis St. Gaudens, Homer; Frederick MacMonnies, Shakespeare; Charles Niehaus, Moses and Gibbon; John Donoghue, St. Paul; John J. Boyle, Plato and Bacon; George Barnard, Michael Angelo; Theodore Bauer, Beethoven; C. E. Dallin, Newton; Herbert Adams, Dr. Henry; F. W. Ruckstuhl, Solon; George E. Bissell, Chancellor Kent; Paul W. Bartlett, Columbus; and H. H. Kitson, Fulton. These names and the names of sculptors appear to have been shaken up in a bag and drawn out at haphazard. But there is this to be noted: no really questionable sculptors have been included in the orders, so that in the majority of cases we shall probably get fairly good works. The least known are Messrs. Bela Pratt and John Flanagan, young men who have worked with St. Gaudens. The windows in the balcony on the facade are to be decorated with nine colossal granite busts. Herbert Adams will model those of Scott, Dante, and Demosthenes, F. W. Ruckstuhl those of Franklin and Macaulay and another, and Jonathan S. Hartley those of Irving, Hawthorne, and Emerson.—N. Y. Times.

A Strange Light on Mars.

Since the arrangements for circulating telegraphic information on astronomical subjects was inaugurated, Dr. Krueger, who is in charge of the Central Bureau at Kiel, certainly has not favored his correspondents with a stranger telegram than the one which he flashed over the world on July 30, 1894:

"Projection lumineuse dans région australe du terminateur de Mars observée par Javelle 28 Juillet 16 heures Perrotin."

This relates to an observation made at the famous Nice Observatory, of which M. Perrotin is the director, by M. Javelle, who is already well known for his careful work. The news, therefore, must be accepted seriously, and, as it may be imagined, details are anxiously awaited; on Monday and Tuesday nights, unfortunately, the weather in London was not favorable for observation; so whether the light continues or not is not known.

It would appear that the luminous projection is not a light outside the disk of Mars, but in the region of the planet not lighted up by the sun at the time of observation. The gibbosity of the planet is pretty considerable at the present time. Had there been evidence that the light was outside the disk, the strange appearance might be due to a comet in the same line of sight as the planet. If we assume the light to be on the planet itself, then it must either have a physical or human origin; so it is to be expected that the old idea that the Martians are signaling to us will be revived. Of physical origins, we can only think of aurora (which is not improbable, only bearing in mind the precise locality named, but distinctly improbable unless we assume that in Mars the phenomenon is much more intense than with us), a long range of high snow-capped hills, and forest fires burning over a large area.

Without favoring the signaling idea before we know more of the observation, it may be stated that a better time for signaling could scarcely be chosen, for Mars being now a morning star, means that the opposition, when no part of its dark surface will be visible, is some time off.

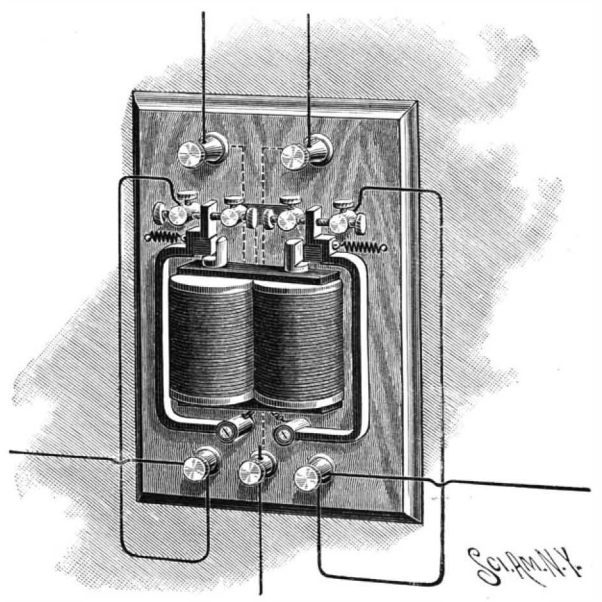
The Martians, of course, find it much easier to see the dark side of the earth than we do to see the dark side of Mars, and whatever may be the explanation of the appearances which three astronomers of reputation have thought proper to telegraph over the world, it is worth while pointing out that forest fires over large areas may be the first distinctive thing observed on either planet from the other besides the fixed surface markings.—Nature.

THE CASCADE WATER WHEEL.

Messrs. James Leffel & Co., of Springfield, Ohio, are putting on the market a new type of wheel with which some most excellent results have been obtained. The illustration is from a photograph of one of these wheels which is said to have yielded from 86 to 91 per cent of useful efficiency in six different consecutive tests, under a head of 125 to 140 feet. The wheel has two separate sets of buckets, located alternately on each side of a central, sharp, continuous dividing ridge, projecting a little in front of the entering edge of the buckets. This dividing ridge has a sharp, cutting edge, which serves to separate or divide the jet of water before it touches or reaches the buckets, and to keep it continuously divided in two equal portions, so that each portion or each half of this single jet is received separately on each side of the dividing ridge. One half of the jet is therefore received by one series of buckets, separate and independent of the other half. Each series of buckets, on each side of this continuous dividing edge, is so arranged that they catch the water alternately, or in such manner that no two come opposite each other, their upper front edges not being on a line. This alternating arrangement of buckets secures greater steadiness of motion, and the shocks or forces are therefore divided more regularly on the wheel, as each bucket passes the point of the nozzle, and catches its half portion of water. These buckets are cast solidly upon each side of the circular dividing ridge, and upon the face or rim of the wheel on each side of this central division; this circular ridge being also angular and curved as it approaches the center, giving to the interior of the buckets a symmetrical and effective curve. This arrangement of buckets and form of construction secures great strength, firmness and stability.

AN AUTOMATIC DISCHARGER OF ABNORMAL ELECTRIC CURRENTS.

The illustration represents a device adapted for insertion in electrical lines, to discharge the lines when an excessive current passes, as in case of a lightning stroke, or when a conductor carrying a heavy current for lighting or power purposes crosses a telephone or telegraph line. The invention has been patented by Mr. J. F. Ganduxer, of Gracia, Spain, and Mr. Enrique Orellana, Consulado 68, Havana, Cuba, is the representative of the inventor for all American countries. The improvement comprises an electro-magnet, an armature lever carrying an armature and prolonged between a pair of electrical contacts, a retractile spring for holding the armature lever normally against the back contact spring, and line and ground connections. The illustration shows a double instrument connected with two electrical lines. The retractile springs are adjusted to cause the armature levers to resist any attraction due to the normal current, which passes

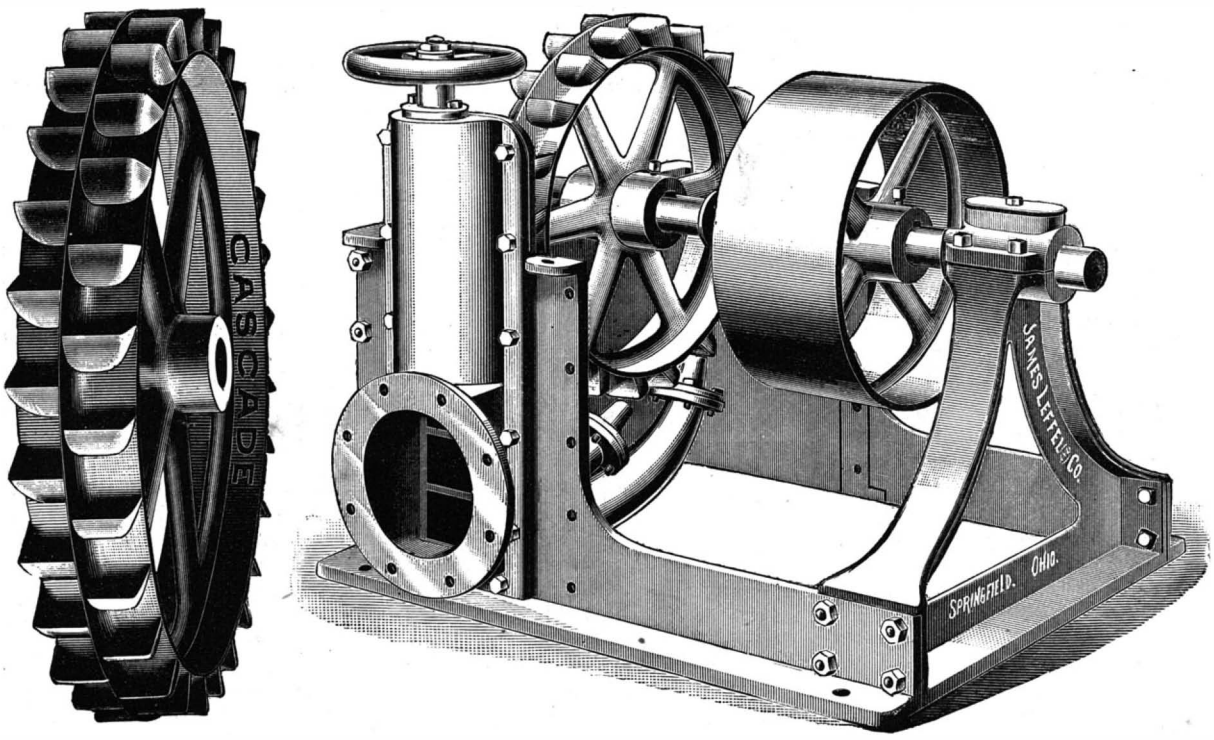


GANDUXER'S AUTOMATIC LINE DISCHARGER.

through the instruments and the lines, while an excessive current attracts the armatures and the current is made to pass to the ground direct, preventing injury to any instruments in the line beyond the line discharger.

Inertia of Fly Wheels.

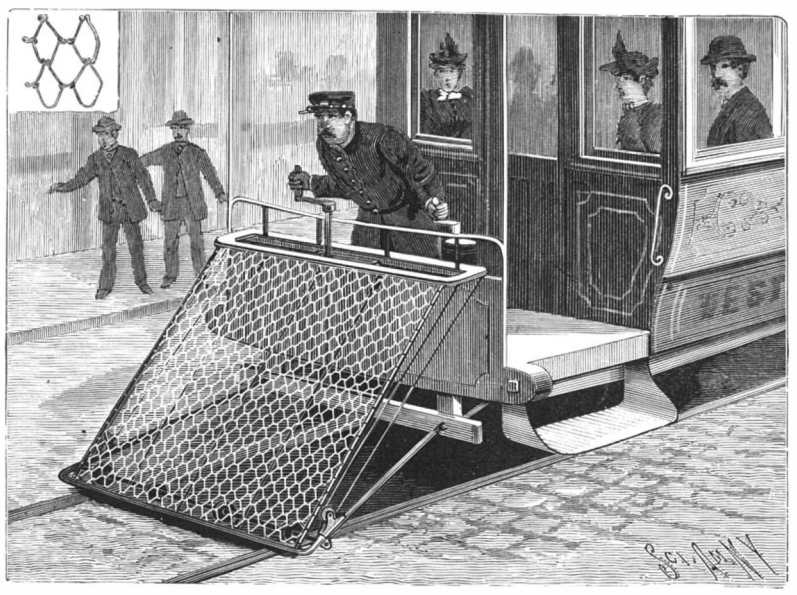
The enormous amount of energy stored in a revolving fly wheel is strikingly shown when it flies in pieces, as one did in the Manville Mills, at Manville, R. I., on the morning of the 18th ultimo. In bursting, the wheel destroyed two other fly wheels of the same size, 20 feet in diameter and 25 inch face. The break will cause a shut-down of the mills for nearly a month for repairs, and the damage amounts to $16,000. The arms of the wheels were broken off nearly to the hubs, and immense pieces were hurled long distances through the roof and walls of the engine room. Large pulleys and other machinery above the engine room were smashed and twisted into a mass of wreckage. Fortunately no one was injured.



A NEW HURDY-GURDY OR IMPULSE WHEEL.

A LIFE GUARD FOR STREET RAILWAY CARS.

This fender, though strongly made and readily attached to a car, presents only flexible yielding material, not liable to inflict injury upon a person struck thereby. It has been patented by Mr. J. J. Beals, of No. 110 Tremont Street, Boston, Mass. It comprises a network of diamond-shaped loops of steel wire, as shown in the small view, the upper end of the network connected with a frame to be fastened to the upper part of the dashboard, while its lower end is connected with a crossbar or stretcher, preferably of hollow metal, rubber covered. Connected with this crossbar is a second one on which are wooden rollers adapted to run easily over an uneven surface, and the lower portion of the fender is held at some distance in advance of the dashboard by side arms pivotally connected with a transverse beam bracketed below the end of the car platform. The net is also additionally supported by an additional guy rope, preferably of steel, the adjustment of the rope causing the lower portion of the fender to travel along close to the road surface without normally coming into actual contact with it, there being also other flexible and elastic supports stretched from top to bottom at the rear of the net. The net is designed to form a yielding pocket or bag which will prevent the throwing out of a body struck thereby. By means of a lifting rope at each side the lower framework may be quickly raised to hold a body caught, or held raised as it is automatically lifted by the collapse of the net in striking a body. The frame and braces may be folded up close to the dashboard when the apparatus is not in use.



BEALS' LIFE GUARD FOR CARS.

BULL TEASING IN THE ARENA OF ARLES.

These contests take place generally on Sunday or holidays, in the wonderful setting of this ancient amphitheater, where formerly the Roman emperors had their bloody games. These provincial contests form a graceful recreation, in which skillful fencers generally seek to distinguish themselves under the eyes of their sweethearts, and it is a great contrast to the Spanish bull fight, where the spectacle of the disemboweled horses and dying bulls forms a scene of repugnant slaughter. In these games at Arles a cockade is placed between the horns of the bull, which the actors seek to remove without being hurt by the animal. It is true it is a perilous game, but those who are skilled engage in it without hurt. We prefer this elegant spectacle to the effusions of blood so popular in Spain, which can only awaken in spectators the instincts of ferocity and savagery. We are indebted to Le Monde Illustré for the following and also for our engraving:

Arles, a city of 23,000 inhabitants, is situated on the Rhone, almost at the southern extremity of France, being only 46 miles from Marseilles. Arles contains remarkable Roman ruins and was the Arelete of the ancients. In the time of Julius Cæsar it was a rival of Marseilles and was called the "Gallic Rome." Arles lies in the province of France known as Provence, which was always particularly noted for the love of the people for pleasure and amusement. The women of Arles are still famed for their good looks and tasteful costumes. Bull fighting is by no means a new amusement in France, but the government has now wisely restricted the bloody bull fights to imitation conflicts in which no blood is spilled, either of man or beast. The announcement that there is to be a fight at the arene is sure to draw a vast concourse of spectators, who come from the surrounding country and from the city as well, so that at times the amphitheater is entirely filled.

The amphitheater is the largest extant in France, although it is not in as good preservation as that of Nimes. The Arles amphitheater is 1,500 feet in circumference; the longer axis is 450 feet, the shorter, 348 feet; the arena itself is 225 feet long and 129 feet wide. This arena, which dates from the first or second century, has forty-three tiers of seats and can accommodate about 26,000 spectators. The two stories of sixty arches present a most imposing aspect. It was turned by Abd-el-Rahman into a fortress, and flanked by four massive towers, two of which still exist and one of them is shown in our illustration. The interior was formerly occupied by a number of poor families, but they were expelled in 1825-30, so that the entire space is available for any kind of amusement permitted by the government.

Nothing is Wasted in Paris.

Even the smallest scrap of paper, that which every one throws away, here becomes a source of profit. Old provision tins, for instance, are full of money; the lead soldering is removed and melted down into cakes, while the tin goes to make children's toys. Old boots, however bad, always contain in the arch of the foot at least one sound piece that will serve again, and generally there are two or three others in the sole, the heel, and at the back. Scraps of paper go to the cardboard factory, orange peel to the marmalade maker, and so on. The ideas suggested are not always agreeable, and to see a ragpicker fishing orange peel out of the basket is enough to make one forswear marmalade; but there is worse than that. The most valuable refuse—that which fetches two francs the kilo—is hair; the long goes to the hair dresser, while the short is used, among other things, for clarifying oils.

THE photographers of the Paris Observatory have just finished for the Academy of Sciences the clearest view ever secured of the moon. They have photographed her surface in sections, which fit, making a great image five feet in diameter. The work is so perfect that towns, forests, and rivers would be perceptible if they existed.

BULL TEASING IN THE ARENA OF ARLES.

Correspondence.

Call for a Bottle Labeling Machine.

To the Editor of the SCIENTIFIC AMERICAN:

When in Milwaukee recently I inspected the plant of the Pabst Brewing Company. As I was admiring the many kinds of complicated labor-saving machinery I was greatly surprised to see women pasting the labels on beer bottles by hand. There may be machines for doing this work, but as there is none used in the largest brewery in the world, I conjecture that there is none. As many millions of beer bottles have to be labeled annually, it would seem that a rich harvest would be reaped by the inventor of such a machine. HOLLIS CORBIN.

St. Johns, Mich.

A Letter from Senator George—A New Invention Called For.

To the Editor of the SCIENTIFIC AMERICAN:

Because I think your large acquaintance with the inventors of this country will enable you to bring the matter of this letter before the proper persons, I address it to you.

There is great need of the discovery or invention of a cheap machine for the pressing of oil from cotton seed. The cotton gins of the South are now almost universally run by steam or water power. Each of the large plantations is always provided with such a gin. The smaller farmers send their seed cotton to a gin in the neighborhood. What is needed is a machine which, with an engine with twenty or forty horse power, used to gin the seed cotton, will press the oil from the seed, either while the gin is being run or after the ginning is over. The economy of this over the large oil mills is evident. The transportation of the cotton seed to the large mills is a large item of expense compared to value of seed, the seed being worth at good prices rarely more than one-half cent per pound at the gin. The transportation of the oil cake or meal back to the farm for fertilizing is another large expense which will be saved. Another economy comes from the use, in pressing out the oil, of the gin engine after the ginning is over, and when it would otherwise be idle. Another great advantage would be the making of combinations among the oil mills to depress the price of cotton seed impossible.

I desire to call your attention to this matter, as involving in its successful solution not only great wealth to the inventor, but great pecuniary advantage to the producers of cotton. Can't you find a man who will make the invention? Very respectfully,

J. Z. GEORGE.

Committee on Agriculture and Forestry, United States Senate, August 24, 1894.

P. S.—To any inventor wishing to test this device, I will be glad to offer all necessary facilities in the way of power, seed, house room, rough labor, etc., at my plantation in Le Flore County, Mississippi.

Sunflower Paper.

To the Editor of the SCIENTIFIC AMERICAN:

An article appeared in your valuable paper, issue of May 26, 1894, entitled "The Sunflower and its Uses." In that part of the article touching the use of the stalk for paper making, the writer wishes to make a few corrections and elicit some facts not generally known.

During the summer of 1893, Mr. Peter Hinkel, of Chicago, Ill., president of the Salina Paper Manufacturing Company, was out visiting his plant, and while out riding in the country his attention was called to the immense growth of the sunflower. He was at once impressed with the idea that the stalk, if properly treated, could be used in making paper. Following up his "foolish idea," as his friends called it, he procured a bundle of stalks and took them to Chicago. After boiling them for several hours he arranged a flatiron in his lap and with a hammer commenced reducing the stalks to a pulp, from which he produced a sheet of sunflower paper, and possibly the first paper that was ever made from the sunflower stalk. About the same time the writer began experimenting with an improvised bleach and succeeded in making the pulp a light manila. After comparing results with Mr. Hinkel, he determined to make a test on a larger scale, with regular paper-making machinery, and on the 27th day of October, 1893, a practical machine test was made on 1,800 pounds of pulp, which produced about 1,500 pounds of finished paper, on some of which the Salina Daily Republican was printed. It may be proper to state right here, in order not to mislead any one, that the paper in question was rather a coarse heavy sheet resembling straw paper, such as is used by butchers and grocers.

In reference to the statement that the Salina mills are now running and producing "express and hardware papers," must say the statement has no foundation; the mill has not produced one pound of sunflower paper since the day of trial. Conditions arose in the final experiment that would have to be overcome by especially devised machinery, and to go into detail on this branch is not the intention of this article.

The production of a fine grade of wrapping paper from the sunflower stalks can never be accomplished without the introduction of some longer fiber, for the reason that the fiber made from pure stalks is too short and contains entirely too much wood. If say thirty per cent of sulphite fiber or good rag stock could be incorporated with the fiber, there is no reason to doubt the possibility of the production of a very tough sheet of paper. Until the exhaustion of other materials used in producing fiber for paper making, it is my honest opinion the sunflower stalk will have to be relegated to the rear. The other virtues claimed for the sunflower plant are various and many, but in Kansas I see no great future for the plant, unless it be for its brilliant yellow flower, which is seen during the period from August 1 to October 1 each year.

Salina, Kan., August, 1894. I. S. BOWER.

Oil Fuel.

F. U. Adams, chief smoke inspector of Chicago, writes to the Marine Review as follows regarding tests with oil for fuel on harbor tugs:

"I have not yet made an official report, but shall do so in a short time. I will give you a brief report of what we have done with fuel oil. The City Council leased from the Vessel Owners' Towing Company the tug Black Ball No. 2, for the purpose of making experiments. I secured from the Treasury Department at Washington a permit allowing us to burn oil from tanks located one foot or more from the firebox of the tug. Two tanks were placed in the tug partially filling the space occupied by the coal bunkers. These tanks hold 650 gallons of oil. They are so constructed as to prevent the swashing of oil. A small pump in the engine room forces the oil from the tank into a small pressure tank, holding twenty gallons, from which it leads to the burners. In the first experiment two burners were used and sprayed oil through the furnace door. This was not the success we desired, and was objectionable on account of the noise, and we had difficulty in maintaining the required amount of steam. The burners were then dropped below, running up through the ash pan. This gave us enough steam, but the noise was increased. The burners were then taken out and placed in what is technically known as the front end of the firebox and were so arranged that they threw the oil toward the furnace door, striking against an arch, which deflected it back toward the flues. This solved the problem so far as the steam capacity was concerned and there was an entire absence of smoke.

"In a recent test the Black Ball made a trip to Waukegan and return, a distance of 70 miles, in competition with the Bob Teed, of the Dunham Towing Company's line, for the purpose of ascertaining the consumption of oil and of soft coal and the relative cost of each. The Black Ball consumed 650 gallons of oil, worth $11.62, and the Teed burned 6½ tons of coal, worth not less than $21. Both boats maintained a full capacity of steam during the entire trip, and as the Teed is the faster boat she averaged a little over 12 miles an hour as against the Black Ball's 11 miles and a fraction. Because of this, certain papers friendly to the soft coal interests attempted to construe the result as a victory for soft coal.

"The Black Ball is now fitted with an extra burner, a very small one, which is used to maintain steam when the boat is not running. We can hold steam at 85 pounds, for any length of time, with a consumption of less than two gallons of oil an hour, or about 70 cents per day. To do the same work requires about 1½ tons of coal, worth not less than $5, to say nothing of the smoke nuisance, ashes caused by firing, and other expenses incident to the use of coal. A more accurate report will be prepared later."

[FROM THE ARCHITECT, BUILDER AND DECORATOR.]

The Steamer Northwest's Electric Equipment.

There are some very interesting matters in connection with the new steel passenger steamship Northwest, of the Northern line, especially in reference to the vessel's use of electricity, that have not been published. In preface it may be said that on no vessel in existence is there such general use of the electric fluid as on this greyhound of the great lakes. When is considered the wonderful extension in the employment of electricity on modern ships of war and on the latest Atlantic liners, this statement may seem almost a piece of insular pride and prejudice, but it is made on authority that cannot be charged with such prejudice.

The vessel is lighted by 1,800 incandescent globes, every one of which is hidden behind ground glass. This number, it is claimed, is 300 more than is in use in any of the Atlantic ships, even though the largest of them are 200 feet longer than the Northwest. The Campania and Lucania, of the Cunard fleet, embodying the very latest in marine development, have about 1,350 lights each. The Northwest's lighting equipment is driven by three direct coupled engines, each dynamo having 600 light capacity. The vessel has electric elevators between the freezing rooms in the forehold and the kitchens and cafe. She has electric signals everywhere. When the lookout, pacing the foredeck, sights a ship or wants to call the attention of the wheelhouse to any matter, he does not call out, but steps to the rail and touches a button; immediately an answering ring assures him that his signal has been heard and heeded.

As the vessel approaches her dock there is a noticeable absence of the usual shouted orders from deck and bridge. It is all done by the electric bell, which was never known to swear or to be tempted to use language that would not be permissible in a parlor, something the man in charge of the deck has the reputation of doing occasionally. When the captain on the bridge wants to give an order to the wheelhouse, or the engine room, or the stokehole, or anything else, he merely turns to the second officer beside him, gives the order, and the latter presses a button. There are no less than six methods of signaling from the bridge to the different parts of the ship, and of these all but one are electric. The vessel's red and green side lights, than which nothing on the entire ship is more important, are not the universal oil lamps, but are high power incandescent globes, and with them is a little instrument that audibly records in the wheelhouse any accident that befalls the lights.

When the ship's big whistle is to be blown, instead of tugging at a whistle cord, the officer touches a button, and if it is desired that the whistle blow consecutive blasts at intervals for any desired length of time, a switch is turned. Not only is the whistle sounded, but on a continuous strip of paper is printed the time and duration of every blast, a record almost invaluable in cases of collisions in fogs, where conflict of evidence as to the proper signals is almost sure to arise. There are electrically driven fans in various parts of the ship, closets, kitchens and inner passages everywhere, but these are particularly notable in and about the fire rooms. Every one knows what an inferno the ordinary stokehole of a large steamship is from the descriptions that have often been given. In this part of the Northwest it is so cool that, with the fan aperture half closed, it is actually uncomfortable to stand near the bunkers. So far from being naked demons in a little hell, the firemen actually wear clothes. This is an innovation that ocean ship builders could very acceptably follow. The ship carries a search light that will pick up a pilot boat letter 12,000 feet distant. There are many other novel features in the electric installation of this most modern of all the modern vessels, but those indicated are the more interesting and new.

D. E. WOODBRIDGE.

Piperazine.

As a remedy for uric acid poisoning, attended by such troubles as rheumatism, gout, muscular and articular pains, dyspepsia, etc., piperazine is recommended. Dr. J. Allen Osmun, of Newark, N. J., regards it as perhaps the best uric acid solvent now known. This remedy, he says, has no toxic or corroding effect, and can be taken for any length of time without disarranging the digestion or any vital organ. A solution of piperazine in cold water will dissolve twelve times as much uric acid as the same quantity of lithium carbonate. One other important item is, that piperazine always forms a neutral salt, no matter how long it is administered, or in what quantities, which makes it an exceedingly safe thing to use.

I merely mention in passing that piperazine is soluble in cold water to almost any extent, and a good prescription is as follows:

R—Piperazine (Schering's), gr. v.
Solve in aqua, ʒ v.
Sig.—Tablespoonful in glass of Vichy two or three times a day.

The Removal of Iron Parts Shrunk on Hot.

A method for instantaneously removing iron parts shrunk on hot, like a crank on a shaft, has been communicated by M. Raffard to the Bulletin Technologique of the French Societe des Anciens Eleves des Ecoles Nationales d'Arts et Metiers. An endeavor had been made to take off the outer hoop of a Laval turbine by heating it with a gas blowpipe; but the heat was communicated too quickly throughout the whole mass to give a sufficient difference of expansion in the hoop alone, so as to loosen it; and there appeared no alternative but to cut it. In such a case, M. Raffard recommends that molten lead be run round the part to be detached—a method he applied with success in 1860, at the Soho Foundry, Melbourne, in removing a crank that had been shrunk on a shaft 8 inches in diameter.

A Large Blast.

A large and successful blast was made July 29 in the quarries of the American Cement Company at Egypt, near Allentown, Pa. The blast consisted of 22 charges of dynamite in holes drilled 20 feet deep. There was a total of a ton of dynamite. It was all set off simultaneously by electricity. The report was loud and the earth shook a trifle, but not a mishap occurred. The result was unexpectedly successful. It is calculated that the enormous amount of 12,000 tons of cement rock was dislodged by the blast.

CHURCH OF BORKI, RUSSIA.

Our readers will remember the catastrophe of Borki in 1889, the news of which stupefied Russia with astonishment. The train which carried the imperial family was derailed, but by a miracle the illustrious travelers escaped with a few insignificant wounds, while other persons lost their lives.

The Russians considered this preservation of the sovereign and his followers as a providential interposition, and at once made a vow to construct a church on the spot where the accident took place, as a thank offering to God for having preserved the Czar to his beloved subjects.

In four years the sum necessary for the construction of the edifice was collected, and the church, which is a masterpiece of architecture, was lately dedicated by the emperor in person.

Alexander III. was at Borki at this touching ceremony when he received the dispatch announcing the death of Carnot. The news brought tears to the eyes of the emperor, who could not help thinking there was some connection between this tragic death and the danger which he escaped on this very spot.—Le Monde Illustré.

Some Peculiarities of Water.

BY J. J. STEWART, B.A. CANTAB, B.SC. LOND.

It is a common saying that the greatest blessings we enjoy cost us nothing. This is especially true of those two main factors which produce health—fresh air and pure water. We can imagine the demand there would be for clear pure water, and the way in which it would be appreciated, if it were as rare and costly as wine. Not only is it lightly valued, but many intelligent people know very little about the nature of water. I propose, therefore, to say something about this well-known substance, which yet remains to many people so much unknown.

Water in many ways stands alone as perhaps the most singular of all substances studied by students of physics. To illustrate this, let us first consider the manner in which water behaves when it is heated. Take some ice-cold water—that is, water at the temperature of 0° Centigrade (or 32° on Fahrenheit's scale)—and gradually heat it. It will be found that instead of expanding when it grows hotter, as nearly all solids and liquids do, it contracts; in other words, its density increases as the heat is applied, until its temperature rises to 4° C. It has now reached the temperature at which its density is greatest, and after this it begins to expand like an ordinary substance, slower at first and more quickly afterward, till it reaches the temperature of 100° C. (or 212° F.), the boiling point of water; when, however much it is heated, it grows no hotter, all the heat being used in changing the water into steam, that is, in separating the molecules or minute particles of the liquid water to such a distance apart that it becomes a gas, and then exists as steam at the temperature of 100° C. As is well known, the heat required to turn one pound of water at 100° C. into steam at the same temperature is as much as is required to raise the temperature of five hundred and thirty-six pounds of water through 1° C.

This peculiarity of water, that it at first gets heavier when it is heated from the freezing point, makes a very great difference to the inhabitants of the earth, for if water conducted itself as other liquids, consider what would happen to lakes and sheets of water in winter. As the surface of the water was cooled down by contact with the frosty air the topmost layer would grow heavier and sink to the bottom, while its place would be supplied by warmer water from below, and this would go on till the whole of the water in the lake attained the freezing point and then it would freeze from top to bottom, producing a great mass of ice which would take a long time to melt. What actually happens is as follows: The water gets colder at the top and therefore heavier, and sinks till the temperature of 4° C. throughout the whole mass is arrived at. Then as the surface layers cool still further they become lighter than those below, and therefore do not sink, but remain at the top till they fall to 0° C., or freezing point, and then change into solid ice. In this way a crust of immovable ice is formed on the top, while the water below it may be somewhat higher in temperature than the freezing point, and as ice is a bad conductor and it cannot sink downward, the heat escapes but slowly from the water underneath, which is thus preserved from freezing. The result of all this is that we enjoy a temperate climate. If the lakes froze throughout, the fish would all be killed, and summer heat might scarcely suffice to melt the masses of ice which would remain at the bottom while only the surface water was warmed.

Most substances occupy a less space in the solid than in the liquid state; some, however, expand on solidifying, and water belongs to the second and smaller class. An obvious result of this is that ice floats on the top of water, and another result known to us all is that when water freezes in a pipe, the force with which it expands on changing to its solid condition is very apt to burst the pipe, with effects which are often unpleasant on the arrival of the thaw. This expanding force is of extraordinary magnitude, and hollow bombs made of strong and thick metal have been burst by being first filled with water and then thrown out into the open air on a frosty day. When this was done, after a time the metal balls were heard to explode with a report like that of a gun, and the contents forced themselves out in the form of ice.

Substances which, like water, expand when they freeze have their freezing point lowered by pressure. So water when exposed to great pressure freezes at a temperature below 0° C.—that is, it remains liquid, even although it has fallen below the point at which in ordinary circumstances it turns solid. This lowering of the freezing point is but small; for an increase of pressure of one atmosphere—that is, about fourteen pounds on the square inch—the lowering is 0·0075° C., or roughly speaking, under the pressure of one ton weight per square inch ice melts at one degree Centigrade under its ordinary melting point. The pressure of one atmosphere—that is, the pressure of the air above us—is equal to the pressure of thirty-two feet of water; therefore, at a depth of about thirty-two feet in the sea, or in a lake, the pressure is two atmospheres. Now at great depths in the sea the pressure at which the water there exists is much increased, and thus its freezing point is lowered. Besides this, the presence of the salts dissolved in sea water causes its freezing point to be lower.

The fact that the freezing point of water is lowered by pressure has an important bearing on the phenomena of glacier action. If a piece of wire be slung over a block of ice and weights suspended at the ends, it is found on looking at the ice after a time that the wire has penetrated into it, and if the block be left with the weighted wire pressing against it, in course of time the wire will be seen to have made its way completely through the ice. But the block will not be divided in two by this process; the ice closes together again behind the wire, and at the end remains as before, a solid block, with perhaps a line of bubbles marking the course taken by the wire through it. This peculiar behavior of the ice is called regelation, and may be explained by the lowering of the temperature of freezing produced by pressure. Under the wire there is an increased pressure so that the ice melts, but the water thus formed is below the freezing point, so that it at once becomes ice again behind the wire. Similarly broken pieces of ice near its melting point can be squeezed together in a press so as to form a solid block.

Effects like this occur in glaciers. Under pressure at certain points the ice is melted; thus water, occupying less bulk, is formed and the pressure at the particular point is relieved, being passed on to another portion of the mass. But the water formed, being lower in temperature than the surrounding ice, almost immediately resolidifies. Thus the ice behaves as if it had plasticity and was a viscous solid, like wax.

It has also been suggested that ice does not melt suddenly at one particular temperature, but passes through an intermediate viscous state, and that there is a continuous change of temperature from that of cold, hard ice to liquid water; ice thus behaving like a substance such as paraffin wax, which gradually melts, passing through a viscid condition, though in ice the change is much more rapid. If this is so, we can understand why two pieces of ice near the melting point, when placed together, should unite in one block even without pressure, for the hard ice would be at a lower temperature than the surface layer of water between the two pieces of ice, and the latter would therefore soon solidify.

This curious property of ice under pressure accounts for the readiness with which snowballs can be made by squeezing in the hands. When the snow is considerably below the freezing point the manufacture of snowballs becomes more difficult, and does not take place till the snow is somewhat warmed by the hands.

Another peculiarity of water is that it is less compressible at high temperatures than at low. In winter it is more readily reduced in bulk than in summer. This is contrary to the behavior of most liquids at ordinary temperatures, such as alcohol or ether, whose compressibility is increased by a rise of temperature.

In an account of the behavior of water mention must be made of what is known as capillary phenomena. When the end of a tube, with a fine bore, is plunged beneath the surface in a basin of water, it is noticed that the water rises in the tube and stands at a higher level than that of the water surface in the basin. Also when water is sprinkled on a surface which it does not wet, such as velvet, it does not spread over the surface, but stands in isolated beads or drops. In fact, water behaves as if it were surrounded by a contractile skin, and a drop of water may be roughly compared to a fluid contained in an elastic India rubber bag. This peculiarity in the surface layer of water is called superficial tension, and its amount may be measured by noting the height to which water rises in a tube of known diameter, for the tension round the circumference of the top of the column of water balances the weight of the water raised. It may be also measured by observations on the size of drops. It is explained by the different condition of the particles in the surface layer of the water, which on the side next the free air are not under the attraction of other water particles, and so differ from the particles in the midst of the water, which are surrounded on all sides by their neighbors and exposed equally all round to their attraction. It is owing to this surface tension that the pressure inside a soap bubble is greater than the pressure of the atmosphere outside. The velocity of small ripples on the surface of a smooth pond depends on the superficial tension, while the behavior of large waves is controlled by gravity.

The passage of water along the pores of rocks is much facilitated by this capillary action, and has important consequences in the geological effects produced. Water is thus able to penetrate deep down through the crevices of rock, even against considerable pressure exerted against it by steam, and changes in the structure of the rocks are produced by the contained water when under pressure and raised in temperature in the interior of the earth's crust.

By application of great pressure the temperature of vaporization of water may be much raised, and this superheated water has been shown to have considerably augmented chemical activity, and to be able to dissolve and alter glass. The importance of this in the explanation of geological processes is obvious when we consider the great quantity of interstitial water contained in all the rocks of the earth's crust.

What the exact constitution of water or any other liquid is still remains very much a mystery. The molecules or particles of the liquid seem to be able to move about with considerable freedom, but when it becomes solid their position is much more fixed. Why water stuff should occupy a greater space in the solid than in the liquid state no one has been able to explain. One peculiarity of water particles we can observe when we see them in the form of snow, and that is that they arrange themselves in crystals of the hexagonal system. This is well shown in the beautiful minute six-rayed stars of various shapes which are to be seen in freshly fallen snow.

Water boils when the pressure of its vapor produced by heating just exceeds the pressure of the external atmosphere. Thus the temperature at which boiling takes place depends on the atmospheric pressure, and, as is well known, is lower on the top of a mountain than at its base, so that cooking operations become more difficult at a high-lying place such as Quito on the Andes. Also from this cause the temperature of boiling water is less when the barometer is low. Thus we see that while the melting point of ice is lowered by pressure, the point of vaporization of water is raised by increasing the pressure. The law is that when a substance contracts on changing its state, as ice does on becoming water, the temperature at which the change occurs is lowered by pressure; when the change of state is accompanied by expansion, as when water becomes steam, the effect of pressure is to raise the temperature at which the change takes place. An interesting and readily performed experiment on the effect of pressure on the boiling point is the following: Boil some water in a flask; while boiling is going on, cork the flask and remove the source of heat; when the glass vessel has somewhat cooled down, squeeze a sponge saturated with cold water over the flask, and boiling will be seen to recommence. This is owing to the fact that the sudden application of the cold water outside condenses the vapor above the hot water within, and thus considerably reduces the pressure above it, so that bubbles of vapor can be again formed in the liquid and boiling is renewed.

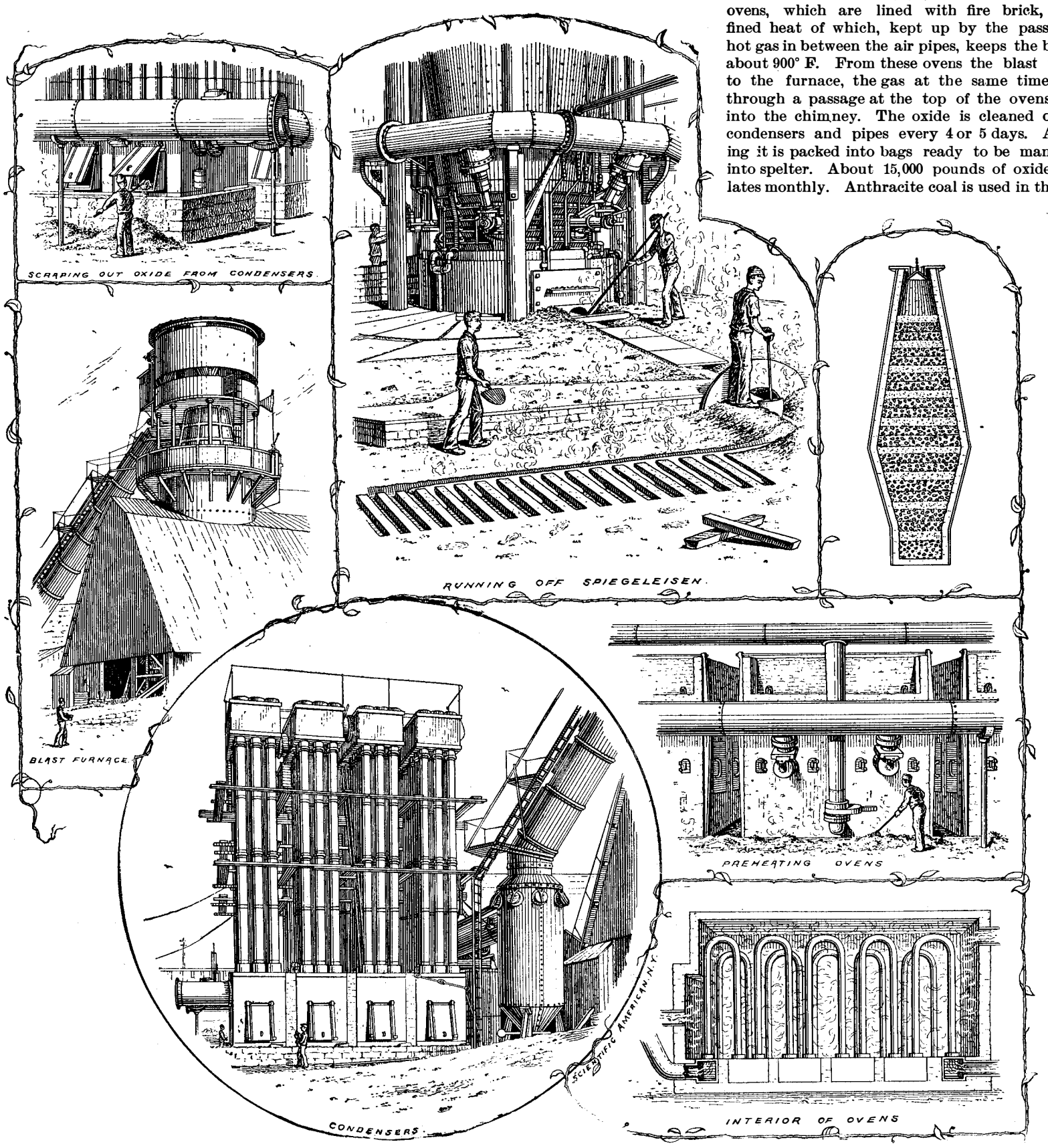
Water consists of the two gases, oxygen and hydrogen, combined together, and it may be decomposed into its elements. If a current of electricity from a battery consisting of several voltaic cells be sent between two plates of platinum placed opposite each other in a vessel of water, bubbles of gas will be observed to rise from the plates while the current passes; these are produced by the splitting up of the water particles, and in course of time the whole of the water may be thus changed into its constituent gases. By collecting the gas given off at the plates in separate jars, it is found that the gas set free at one plate consists of hydrogen, while that collected at the other plate is oxygen, and that the volume of the hydrogen is almost exactly double that of the oxygen. Thus water consists of two volumes of hydrogen combined with one volume of oxygen, and if the combination takes place at a temperature above the boiling point of water, it is found that the volume of steam produced is two-thirds that of the united volumes of the two gases. By placing hydrogen and oxygen gases together in a jar, in the proportion by volume of two to one, and then bringing the mouth of the jar to a flame, a loud explosion occurs; the gases have combined together, and the sides of the vessel are seen to be covered with a dew of condensed drops of water.—Knowledge.

IT has been computed that the death rate of the globe is 68 per minute, 97,790 per day, or 35,717,790 per year. The birth rate is 70 per minute, 100,800 per day, or 36,817,200 per year, reckoning the year to be 365¼ days in length.

MANUFACTURE OF SPIEGELEISEN.

The illustrations accompanying this subject were taken from the plant of the Passaic Zinc Company, on the Hackensack River, near Jersey City, N. J. Spiegeleisen is used in the manufacture of Bessemer steel. The Bessemer process consists of blowing air through molten pig iron, the latter containing silicon and carbon. The combustion of the former during the "blow" produces an intense heat, the carbon being subsequently eliminated through the reactions created between oxides of iron formed and carbon. In order to get rid of the oxides of iron in the steel produced, to give it the exact carbon contents required by the use to which the steel is to be put, and at the same time secure certain advantages which the presence of manganese in the steel gives in the subsequent processes of rolling, alloys of iron and manganese called "spiegeleisen" or "ferromanganese," according to their manganese contents, are added to the fluid steel. The spiegeleisen manufactured by this company is made from the residuum of zinc ore, which contains quantities of iron and manganese. The furnace in which the material is melted is an elongated, barrel-shaped structure, about 45 feet in height from the hearth to the charging floor. The body is formed of steel plates, riveted together, forming a shell, which is lined inside with fire brick from 25 to 30 inches in thickness. The molten metal and slag or cinder accumulates in the hearth or crucible, which is about 6 feet in diameter inside. About 5 feet above the bottom of the furnace are a number of "tuyeres" through which the air or "blast" is blown by a blowing engine, the blast being conducted to the tuyeres from a pipe which encircles the lower part of the furnace. The material, which consists of coal residuum and limestone, is charged at the top of the furnace in alternate layers, the "stock," as it is called, being first hoisted to the top in cars on an inclined plane, 96 feet in length. It is then dumped into a bell which closes up the top of the furnace and then lowered, admitting the material, and raised again by means of an air cylinder. The gas is utilized in heating the blast in hot blast stoves or ovens, and in raising steam to supply the blowing engine, pumps and elevator with power. Those parts of the blast furnace which are exposed to the greatest heat are saved from destruction by a system of water cooling. The blast comes in contact with the material at the level of the "tuyeres," the blast being about 900° F., melting the residuum which collects down into the crucible. The ascending current of hot gas heats the descending column of solid material which comes down as the lower parts are melted and tapped off. The molten metal is tapped off at the bottom of the crucible three times every 24 hours, running out at each cast about 6 tons of spiegeleisen. The cinder or slag which constitutes the impurities of the ore, such as silicon, alumina, lime, magnesia and the ash of the fuel, being lighter, the iron floats on top, and is allowed to flow off about fifteen times daily.

The residuum contains about 24 per cent iron, 11 per cent manganese and about 6 per cent of zinc. The intense heat distills the zinc, which passes off with the gas in the form of vapor. Connected to the side of furnace near the top is a 4 foot pipe, called the down-comer. This down-comer connects itself to the sides of two sets of condensers, each set containing 72 pipes 1 foot in diameter and 35 feet in height. Connected to the other sides or ends of condensers is another pipe 3 feet in diameter which passes along and connects itself to a number of hot blast stoves or ovens, the interiors of which are fitted up with 21 iron U-shaped pipes, 14 feet in height and 19 inches in diameter. The pipe through which the air is blown connects itself to each set of pipes in the ovens. Through these pipes, which lead into each other, the air is blown into the furnace by the blowing engine. The gas pipe from the condensers also heats the boilers which furnish the steam to run the blowing engine. The gas and zinc vapor pass from the furnace to the down-comer and into the condensers, where the vapor oxidizes and forms itself into a black powder, which, when coming in contact with the air, changes to a buff color. The down-comer and condensers being exposed to the atmosphere causes the temperature to fall to about 400° F., the decrease causing the vapor to oxidize. The gas passes from the condensers into the 3 foot pipe, and into the 12×30 foot ovens, which are lined with fire brick, the confined heat of which, kept up by the passing of the hot gas in between the air pipes, keeps the blast up to about 900° F. From these ovens the blast passes out to the furnace, the gas at the same time escaping through a passage at the top of the ovens and out into the chimney. The oxide is cleaned out of the condensers and pipes every 4 or 5 days. After cooling it is packed into bags ready to be manufactured into spelter. About 15,000 pounds of oxide accumulates monthly. Anthracite coal is used in the furnace, the charges amounting to about 3,000 pounds daily, or every 24 hours. The charges of residuum and limestone amount to about 5,000 pounds every 24 hours. The plant turns out about 17 to 20 tons of spiegeleisen daily. The limestone used comes from Jerman Valley, N. J. Spiegeleisen is cast in pigs weighing from 100 to 200 pounds each. About 50 pounds of spiegeleisen is used in every 1,000 pounds of steel. Bessemer steel is used for a large variety of purposes, such as structural material, steel rails, plates, and also for wire and nails.



THE MANUFACTURE OF SPIEGELEISEN FROM ZINC ORE RESIDUUM.

A WRITER in the London Electrical Review holds that there are very strong reasons for believing that the ether obeys the ordinary laws of gravitation. "If we accept the notion that ether attracts itself, and obeys the ordinary laws of gravitation in regard to itself and to other forms of matter in a condensed form, then it is not difficult to understand its whole phenomena of disturbance."

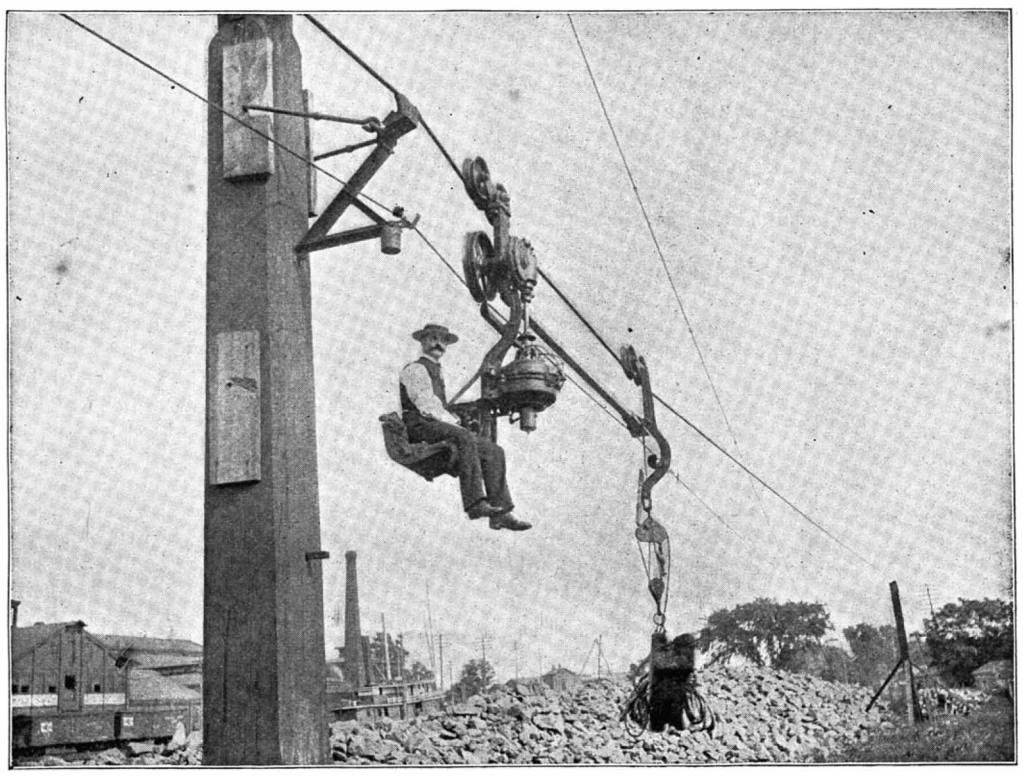
The Electric Coherer.

The Electrical Review, London, in speaking of Dr. Oliver Lodge's new instrument for detecting Hertzian oscillations, has the following:

"Prof. Oliver Lodge is a worthy continuator of the epoch-making work of the great Hertz. In his recent lecture at the Royal Institution he showed some interesting electric wave experiments with apparatus of remarkable simplicity and sensitiveness. As he remarked, 'the detector for Hertz waves might have been used in the last century; it might have been used by Benjamin Franklin.' The instrument which Dr. Lodge has devised for detecting electric waves he calls a coherer. It may be described as an electric welder on a very small scale, the electric welding being effected by the exceedingly minute currents produced at the contact of two pieces of metal by Hertz waves. Lodge had observed, in 1889, that two knobs, so close together that the air gap was unable to stand any such voltage as an electroscope can show, would actually cohere when a spark passed between them. The joint thus welded was capable of conducting an ordinary bell-ringing current if a single voltaic cell was in circuit, and required a perceptible amount of force to separate it. This arrangement has been developed by Lodge into an extremely sensitive wave detector. One terminal of an electric circuit, containing a single voltaic cell and a moderately sensitive galvanometer, consists of an iron wire which rests lightly on an iron plate attached to the other terminal. The instrument is most sensitive when the contact is sufficiently good to allow a very small current to pass. If electric waves are produced, say by charging and discharging an insulated sphere at some distance, the insulating layer at the contact of the coherer breaks down, and a considerable deflection is shown on the galvanometer. With this simple apparatus the reflection, refraction, polarization, and other optical properties of electric waves can be readily demonstrated. Electric oscillations in a sphere sixty yards distant have been indicated, and Dr. Lodge estimates that they would be detected half a mile away. The sensitiveness of the contact can be restored by tapping the plate.

"On these phenomena Dr. Lodge has founded an ingenious theory of vision. The retina of the eye is supposed to be furnished with cohesive contacts which allow an electric current to flow in the nerves when acted upon by the electromagnetic waves of light. Mechanical vibration supplied by the tissues restores the sensitiveness of the contact at intervals of a tenth of a second. A model has been constructed by Dr. Lodge to illustrate this theory. An electric bell or other mechanical vibrator is mounted on the same board as a tube of filings, which in this case acts as a detector, and has its sensitiveness restored by the vibrations of the bell. This apparatus can be arranged so that a feeble electric stimulus produces a feeble, steady effect, and a stronger stimulus a stronger effect.

"The coherer is more sensitive to short waves than to long. The sparking at the contacts of an electric gas lighter will produce a marked effect, while heavy sparks from a large influence machine will not affect the instrument. Like the eye, the coherer has a limited range of wave lengths. This field of investigation promises results of great theoretical interest at least. Whether electric oscillations of these extremely high frequencies are ever to have any technical application is doubtful. The experiments of Tesla and others in this direction have not been promising."



ELECTRIC CABLEWAY.

STEAM AND ELECTRIC CABLEWAY FOR LOGGING AND CANAL BOAT TOWING.

Considering the fact that there is in this and other countries great wealth of swamp forests heretofore unavailable, it is surprising that some one has not devised a practical system for logging swamps before this date. With the exception of two systems, which are only available for short distances, no appliance has been invented until Richard Lamb, of New York, designed and put into practical use his steam logging system.

As the total area of forest to be cleared at any one setting would not require much time, the system had to be designed to be easily removed from place to place. Trees had to be used as supports, as they are the only foundation to be found in a swamp. Naturally any steam logging system has to be worked in practically a straight line. To attempt to find trees in a straight line would be difficult if the distance apart was not great; but it was found that in a forest of ordinary density a practically straight line could be got with trees from 100 to 225 feet apart; consequently this system was designed for long spans.

Iron brackets are put upon trees or timber uprights. The endless steel hauling cable is suspended by the snatch-block and swinging sheaves on the brackets, and is made to pass around a large metallic sheave on the tailtree. Two or three turns of this cable are taken around an elliptically grooved sheave. This sheave is run by an engine having one lever, which regulates the speed, reverses the engine, and shuts and opens the throttle valve.

The bearing cable is hauled out in sections by the endless cable and joined together by patent couplings, over which the cars pass without interference.

The cars have grooved wheels to run upon the bearing cable, with a hanging arm, to which the hauling cable is attached. A metallic tackle block, having a grip to sustain the load, is hung from the hanging arm. By confining the end of the rope and moving the car, the log, which is attached by tongs to the lower block, is raised and is held suspended until it is desired to lower same, when the grip is released and the log falls.

Logs are hauled in from either side up to the bearing cable by a cable which is attached by tongs to the log. This cable is passed through a sheave, placed as high up a tree, near the cable, as the stiffness of the tree will admit, thence through a sheave attached to the same tree at the same elevation as the bearing cable. A strut is placed between the tree and the bearing cable, and a sheave is attached at the

ELECTRIC CABLEWAY FOR LOGGING.

intersection of the strut and the cable, through which the lateral hauling rope is passed. By attaching the end of the rope to a car and hauling it on the same, the log is pulled in to the main cable.

For distances up to one half mile this steam cableway is very serviceable. The system has been in actual operation in a swamp in North Carolina for the past six months.

One of our engravings is from a photograph taken from the apparatus in actual use in the swamp. It illustrates very clearly how the load is supported by the bearing cable, and shows the method of attaching the trolleys to the logs.

To extend the system further into the swamps, Mr. Lamb has substituted electricity for steam, and instead of having an endless hauling cable he uses the same size cable a single length instead of a double length. This cable is passed around an elliptically grooved wheel on a car or locomotive, which is revolved by an electric motor on the same; thus the power is transferred to points on the line where work is to be done, instead of being always at the end, as in the case of the steam cableway. By means of a false saddle on the tree bracket, on which the traction cable rests, the line can be run in right or left curves, obviating all trouble in regard to alignment. The same method is employed for hauling logs up to the cable from either side of same as is used with the steam cableway.

As will be observed in one of the engravings, the operator can ride with the electric locomotive, controlling all its movements by a rheostat and switches near at hand.

This electric cableway can be used for a number of purposes, one of the most valuable of which is canal boat towing. This has been tried practically and has proved very effective.

In canal boat service, the towing hawser contains insulated wires. This cable is rigidly attached to an eye bolt, just below the point of insulation on the hanging frame, and from the end of the rope the various wires are connected with their respective connections. The bite of the rope is connected with a clamp made of non-conducting material; the socket of this clamp, and the pin which engages in it, which contains the wires leading to the reversing switch and rehostat, is made irregular in shape, so that corresponding wires are obliged to come in contact when the clamp is connected.

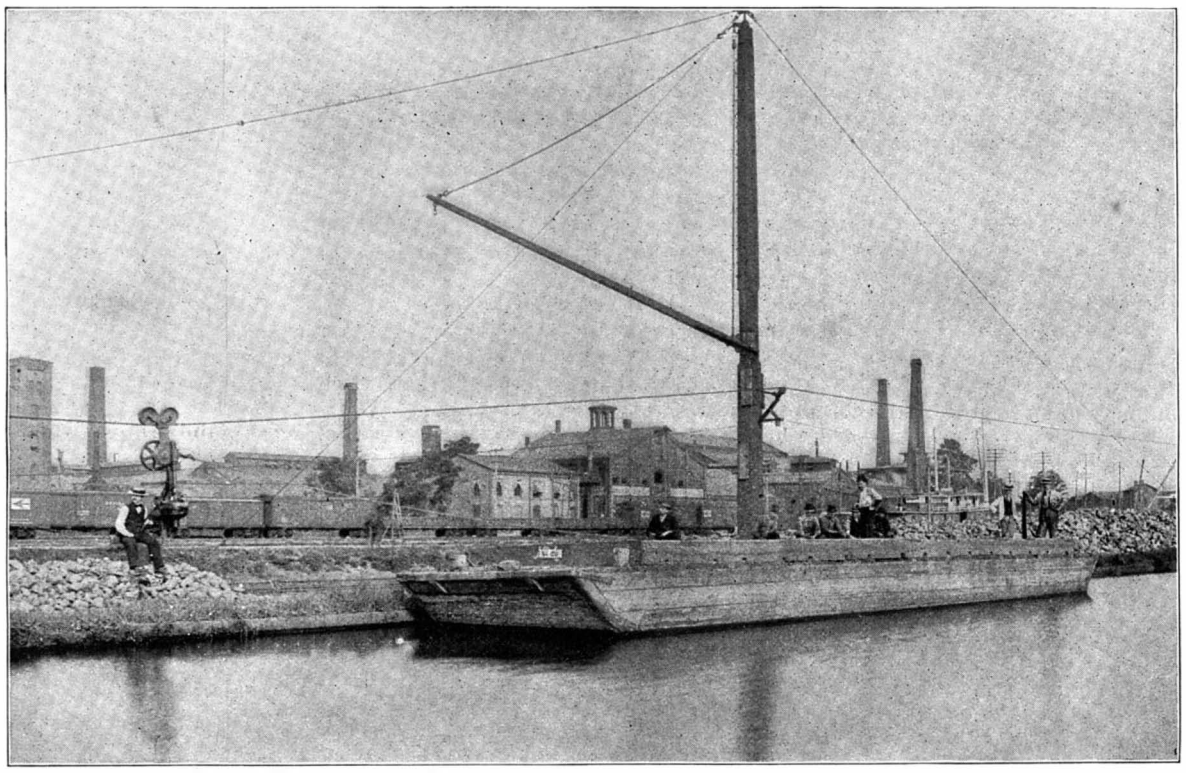
In operating, a canal boat will apply for a motor. If the boat does not own a rheostat, one will be placed on board. The towing rope will be attached to the sampson post, leaving the end of the rope free. The wires in the tow line will be connected with their respective wires in the rheostat by the clamp as desired, and the boat proceeds.

On approaching another boat coming in the opposite direction, motors are stopped, cables are disconnected, and boats exchange cables, and consequently motors, and proceed. Of course, an extra cable, one above the other, or one on each bank, would obviate the necessity of exchanging motors.

The trial plant illustrated is operated with a 15 k. w. Edison dynamo, at 220 volts. The motor is 5 k. w. Lundell, provided with a metal bonnet to protect it from rain, but which is not shown in the illustration. The large scow shown is gotten under way quickly. Boats can be pulled at the rate of six miles per hour with the motor now made.

An early adoption of this system of canal propulsion seems feasible and desirable.

Further particulars in regard to this system may be obtained by addressing Mr. Richard Lamb, 1 Broadway, New York City.



CANAL TOWING BY ELECTRICITY.

Advantages of New Bread.

New bread and the hot morning roll have been condemned as injurious and difficult of digestion. However true this charge may be, the use of new bread appears, even from the hygienic point of view, to have some compensating advantages. Dr. Troitzki, writing in the Russian medical periodical Vratch, states that he has found that new and uncut bread contains no micro-organisms, as the heat necessary to bake the bread is sufficient to kill them all. As soon, however, as the bread is cut and is allowed to lie about uncovered, not only harmless but pathogenic microbes find in it an excellent nutrient medium. White or wheat meal bread is a better medium than black or rye bread, as the latter contains a greater percentage of acidity. Dr. Troitzki's experiments with the pathogenic bacteria, says the British Medical Journal, gave the following results:

Streptococcus pyogenes aureus retains its vitality on the crumb of wheat meal bread for 23 days; the bacillus of anthrax (without spores) remains alive on the crumb for 30 to 37 days, and the crust for 31 to 33 days; the typhoid bacillus remains active 25 to 30 days on the crumb, and 26 to 28 on the crust; while the bacillus of cholera lives 27 days on both. Of special interest is the fact that if the bread is placed before the experiment for fifteen minutes in the disinfecting oven (at a temperature of 115 degrees C.) all of the above named pathogenic bacteria retain their vitality for several (4 to 8) days longer. The author explains this fact by the acidity of the bread being lessened by the heat and the bread becoming a better nutrient medium.

Raising a Bridge.

The raising of a bridge in Switzerland upon the line of the International Railway, from Paris to Vienna, has attracted considerable attention from the methods pursued. The occasion for the change, says Locomotive Engineering, was that the river crossed—the Rhine—had lost in the sectional area of the passage between the piers about 25 per cent in thirteen years, owing to the deposition of gravel and sediment, while the high water level had risen to such an extent as to pile floating debris six feet deep on the bridge floor in times of flood. The alterations included some re-enforcements, besides the raising of the whole structure about five feet.

The bridge was continuous over a central pier, and had two main vertical posts there and four vertical end posts. To each of these posts an inclined strut was attached in a transverse vertical plane, presenting a surface for the top of a hydraulic jack to act upon. Eight special 100 ton jacks were used, with an 8 inch stroke and a working pressure of 400 atmospheres, the piston being nearly 0·7 in diameter. The fluid used was a mixture of water, alcohol and glycerine. Sixteen men operated the jacks, their movements being synchronized by a code of signals, designed to secure uniformity of action. The bridge was raised a foot or two by short lifts, followed by thoroughly blocking, and then building under one course of cut stone masonry. The total load was 546 tons, and the maximum load on a single jack was 87 tons. The bridge was raised in four stages during intervals between trains. The longest interval between trains was about two hours. The weight of trains was rigidly restricted during the time the bridge was undergoing repairs, and their speed was limited to three miles an hour in crossing the bridge. In addition, a special block system was organized upon that section of the line upon which the bridge is located, so that operations could be suspended, and the track restored five minutes before the arrival of a train at the site.

In 1890 the railroads of the world were estimated at 370,281 miles.

Pneumatic Gun Tests.

A number of pneumatic gun tests have been recently held at Sandy Hook. Probably the most interesting of these trials was an acceptance test of the Ordnance Board, which took place August 21. The battery consists of two 15-inch and one 8-inch pneumatic guns, constructed by the Pneumatic Torpedo and Construction Company, of New York. The boiler capacity of the plant is four hundred horse power. The air is stored in accumulators after being compressed; there is a firing reservoir for each gun. The 15-inch guns weigh, with the carriages, fifty-two tons, and are set in a depressed foundation. The guns are trained by electricity, and the range is determined partly by elevation, as in the ordinary field piece or rifle, and partly by the variation in pressure, which can be regulated with ease. The operator stands on a platform fastened to the gun, and the entire gun can be revolved in fifty-two seconds. When the shot is fired a low, hissing sound is heard at first, followed by a deafening report. The projectiles can be seen as soon as they leave the muzzle. The pneumatic guns at Sandy Hook can drop 500 pounds of high explosive into the Main, Swash and East channels through which all vessels of any size must pass to enter New York harbor. The pneumatic guns are surprisingly accurate, 96 per cent of the shots being what are known as bull's eye shots, which is a remarkable showing.

After some preliminary shots two heavy charges were fired. The first was a 10-inch subcaliber projectile charged with two hundred pounds of explosive composed of 87 per cent of nitroglycerine, 7 per cent of guncotton, 4 per cent of magnesia and 2 per cent of camphor. The fuse was set to act on impact. As the projectile struck the water the spectators saw an enormous column of water like a huge geyser, projected up hundreds of feet into the air; a few seconds later a penetrating report was heard. In the final round a full caliber 15-inch projectile charged with 500 pounds of the high explosive described above was fired with a fuse set to explode the shell two seconds after impact with the water, to avoid breaking the glass in the lighthouse windows. The range was about 2,500 yards. The fuse delayed the explosion one-quarter of a second; the ocean for a radius of fifty feet rose in a solid column. The plant is capable of supplying the compressed air consumed on the entire five rounds in ten minutes. It is not claimed by the builders of this gun that it will revolutionize the art of war, but they do claim it to be an effective weapon for short and medium ranges, not over three and one-half miles, and certainly the results of the recent tests have amply demonstrated the reliability and accuracy of the gun.

An Electrically Heated Quilt.

A new invention, called by its inventor the thermogen, consists of a quilt containing a coil of wire bent in the fashion of a gridiron, inclosed in insulating and non-conducting material, and embedded in cotton wool or other soft substance with a silk or woolen covering. The resistance offered by the coil to the flow of an electric current through the wire produces heat in the same way that heat and eventually light are produced in the filament of the glow lamp. A uniform temperature of about 150° Fah. is thus maintained, but in the event of the temperature rising beyond that point from increase of pressure in the electric mains, a fuse instantly melts and automatically shuts off the current. The quilt may be readily attached to ordinary incandescent lamp terminals. In describing this device the Lancet says that the most important medical use of such an invention would be on the operating table, where, in lengthened operations or in those attended with hemorrhage, where artificial means to sustain the patient's temperature are required, blankets and hot water are a decided nuisance. In such cases this quilt would be invaluable as a soft, dry, warm, and convenient covering. Again, in cases of chronic rheumatism, lumbago, or senile slowness of circulation, such an appliance would be useful. The thermogen is now on trial in several English hospitals.

The Physical Basis of Knowledge.

The surface of the brain has many centers upon it whose functions have been carefully studied. In addition to these centers, there are tracts of nerve matter connecting them with each other, so that an associated or concerted acting of the brain centers becomes possible—indeed, is of constant occurrence. One hears the word "rose" spoken, and immediately the image of a rose is recalled; there is a recollection of its odor, of its color, of its size and shape, and a stimulus goes to the proper centers, so that the word "rose" may be spoken or written, if it is so willed. It is these tracts or paths of nerve matter that enable the brain to build up our complex ideas. It will be seen from what has been said that the word "rose" carries with it many elements, such as color and shape, learned by experience through the eyes; taste, by the tongue; odor, by the nose; weight, by the hands. But all these qualities of taste, color, odor, weight, etc., go to make up our complex idea of what a rose is. These varied primary or elemental ideas have reached the brain by separate channels, have formed memory pictures on the centers, which, in turn, have become associated by means of the intercentral nerve paths into complex ideas.

In addition to the impressions reaching the brain through the nerves of hearing, sight, taste, and olfaction, there is a constant stream of sensations pouring into the brain along the nerves of feeling. It has now been pretty well settled that some of the nerve fibers conduct sensations of heat, others of cold, some of pain and still others that sensation known as muscular effort, or the muscular sense. All these are carried to different parts of the brain and there registered. From this registry they can be called up as a memory of past experiences. It will now be clear that there is a constant stream of sensory currents or sensations coming into the brain from all parts of our bodies. These sensations have their mental accompaniment. When a current escapes from the brain, and goes outward for the purpose of moving some muscle or group of muscles, there is also a mental accompaniment. It is in this way that we are aware of how we are acting and being acted upon. These constitute states of consciousness. The conscious personality, or conscious ego, is the sum of all the states of consciousness at one time existing.

In a moment, by disease or injury, a man may lose the power to speak, and yet be able to read and write; or he may be unable to read, and yet hear what is said Some may have the center of hearing so damaged that the power for music is gone and still be sound in every other respect. Some, again, may lose the power of recalling words. They know them when written or printed; but they cannot speak, because they cannot recall the words needed to express their thoughts. Enough has been said to show that the brain and all the nerve tracts leading to it and from it are the physical basis of knowledge. Derangement in these is followed by derangement in the mental powers. Insanity is only disease affecting the brain so as to derange and pervert the thoughts, language and actions of the person. This view of insanity has done much good, as it has led to a better method of dealing with insane people. The anatomical and physiological study of the brain shows that it is the organ of the mind; but further observations made in cases of disease and injury of the brain, as well as on cases of insanity, go to establish this doctrine beyond all dispute. Illusions, hallucinations, and delusions owe their origin to some derangement in the sense organs or in the perceptive centers in the brain. Following upon this, the conscious ego is no longer in its true relationship to its environments, and there is, as a consequence, derangement of conduct, as the result of the physical disease.—John Ferguson, M.D., Canadian Magazine.

Dangers of Bicycle Tires.

A dispatch to the New York Herald from Jeffersonville, Ind., August 23, states that while Lyman Parks, twenty years old, son of Prison Director Parks, of that city, was on a trip to Corydon, the tire of his bicycle burst, and with the assistance of another cyclist he inserted a new inner tube and proceeded to pump it full of air.

Parks was bending close over the wheel of his machine, while his companion stood close by looking on. Suddenly there was a report like the discharge of a shotgun. Parks and the other cyclist were knocked off their feet. The tire had burst with violence.

Parks' companion was the first to rise, and found Parks badly injured about the face and completely blinded by the explosion. He took the young man to Corydon, where a physician attended him.

Parks was brought home next morning. He will recover his eyesight, but the injury caused by the concussion might have killed him had he been directly in the line of the flying fragments.

A RECORDING THERMOMETER FOR CLOSED SPACES.

In designing this thermometer the object has been to produce an instrument which would make a continuous record, day and night, of the temperature in heaters, ovens, dry kilns, and such closed spaces, and at the same time permit the recording portion of the apparatus to be located at any convenient point outside of the room or kiln where the temperature is to be measured.

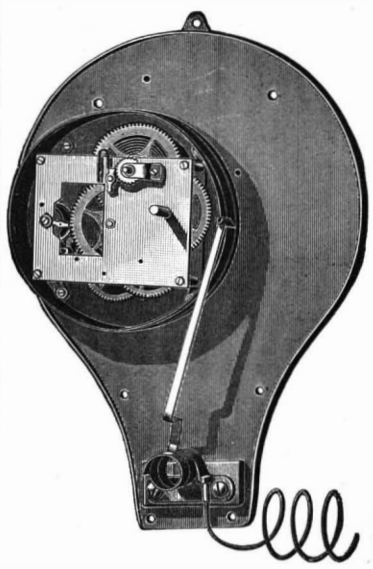


Fig. 2.

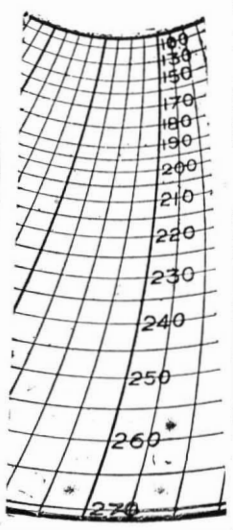


Fig. 3.

The instrument is shown in Fig. 1, set up and ready for operation. The wall of the oven is broken away, showing the coil of pipe, suspended at the point where it is desired to measure the temperature. The recording part of the instrument is shown at the left side of Fig. 1, and is connected to coil D in kiln, or oven, by a small flexible copper tube. Fig. 2 shows the interior of the recording portion of the apparatus, which consists simply of one of Bristol's recording pressure gauges. The coil, D, in the oven is partly filled with alcohol and the remaining air is exhausted. When heat is applied to the coil the vapor of the alcohol condenses and completely fills the pressure gauge tube and the small copper tube leading to it. The pressure due to the temperature of the oven or kiln is transmitted to the recording gauge.

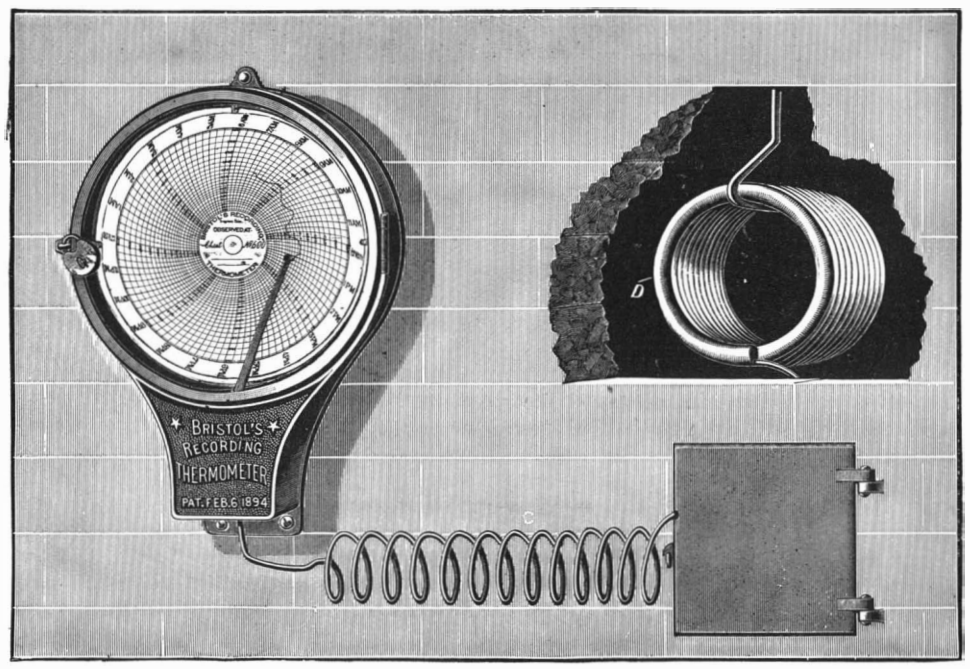


Fig. 1.—A RECORDING THERMOMETER FOR CLOSED SPACES.

The scale on the gauge chart is graduated in degrees Fahrenheit by means of a standard thermometer. The coil, D, is immersed in oil for standardizing in connection with the graduating chart.

There is no compensation required for changes of temperature in the room where the recorder is placed, as the small copper tube is completely filled with alcohol and the pressures due given temperatures are always the same.

Fig. 3 shows a specimen section from chart of one of these thermometers for a range of 270 degrees Fah. It will be observed that between 170 and 270 degrees the scale is very open. A number of these instruments have been in successful operation in rubber works for the past four months, for keeping a record of the temperature in heaters during the process of vulcanizing rubber goods.

These thermometers are being manufactured and placed on the market by the Bristol Company, of Waterbury, Conn.

A working model of this apparatus was exhibited and described at the Brooklyn meeting of the American Association for the Advancement of Science by W. H. Bristol.

Woodwork vs. Flame.

In a London paper is published a letter from Mr. F. H. Gossage, who makes some interesting statements. He says:

"I find that painting woodwork of any kind with several coats of solution of silicate of soda, and finishing with a mixture of this solution and sufficient common whiting to make it about as thick as ordinary paint, is an excellent protection against fire. Wood treated in this way will not take fire from mere contact with flame; it requires to be heated till destructive distillation begins. Then, of course, gases are given out which ignite, and the wood is gradually converted into charcoal, but until destructive distillation takes place the coated wood will not support combustion. A few years since I had some screens made like ordinary doors, some prepared as I have described and some not. They were then placed over a fire of shavings, which was kept constantly renewed. In ten minutes the unprepared screens were blazing away, and so nearly consumed that they had to be supported by an iron bar. The flames continued to lick the prepared screens for thirty minutes before the distillation commenced. After forty-five minutes the coated screens were still intact and able to support themselves; they held together for an hour, although pierced in many places with holes, and when the fire was removed they did not continue to burn. This was a splendid success, and I still have the remains of the screen. The experiments were made at my suggestion for the managers of the Liverpool Philharmonic Society, and the woodwork of their splendid hall at Liverpool was treated in this manner."

Ornamentation of Glass with Aluminum.

M. Charles Margot, of the physical laboratory of the University of Geneva, says L'Industrie, has just made a curious discovery. He has found that by rubbing on glass with an aluminum point we obtain clear metallic lines, which cannot be removed by washing, no matter how often repeated. This property which aluminum possesses, of adhering closely to glass, or in general to any substance having silica as its base, is most plainly shown when the surface is dampened or covered with a very light coat of moisture, as, for instance, when a man breathes upon the surface of the glass. An indispensable condition is that the glass and the aluminum point shall be clean.

M. Margot has arranged a special apparatus for his experiments. He uses a lathe of aluminum, which turns very quickly, and with it he traces designs on the glass. These lines have a bright metallic reflection; polishing with a steel tool gives them the appearance of metallic incrustation. The adherence to the gass is absolute. Without doubt we can, by treatingthe decorated glass with caustic potash or chlorohydric acid, remove the metal, but the design remains. The lines are clearly fixed on the glass, as if the surface had been corroded by the metal.

It is known that magnesium, cadmium, and zinc have similar properties, and that they will leave visible traces on glass. None of these metals, however, possesses this property to the same extent as aluminum, except possibly magnesium. On the other hand, besides the fact that magnesium oxidizes very quickly, the traces which it leaves on glass vanish quickly, and therefore the metal can be used for this purpose only under special circumstances.

Many applications can be suggested for aluminum in this direction. It can be used instead of the engraver's tool in cutting designs on glass. With the aluminum pencil diamonds can be distinguished from imitation, since it will make no mark on a diamond. It is possible that the new discovery may make a great difference in the making of cut or engraved glass.

It is generally supposed that when a man's heart pulsations go down to 40 a minute death will follow unless restoratives are administered. Parisian doctors are now, it is said, puzzled over a man, in one of the hospitals, whose pulsations have sunk as low as 18 a minute, although to all appearances he is well and strong.

The Plague in China.

J. A. Davis, D.D., formerly missionary of the Reformed (Dutch) Church in China, writes as follows in the Independent:

The disease causing such fatality and consternation in China is neither new nor unknown. Several centuries ago it is said to have swept over and almost depopulated that empire. Occasionally since it has visited that country, but with far less dreadful results. Its symptoms are almost identical with those of the Black Death that robbed Europe, during the seventeenth century, of twenty-five millions of people and destroyed one-sixth of the population of the city of London.

Though the present visitation in China seems sudden, the plague has really been at work in the extreme southwestern part of the empire for more than fifteen years. Occasionally it appeared somewhat epidemic, but not until a few months ago did it assume its present malignant character. It seems to have been slowly gathering strength for future conquest. At the beginning of the year it first made its appearance in Canton.

Even the British colony of Hong Kong, with its well governed and guarded city of Victoria, seemed indifferent for a time to the danger threatening. Possibly it was thought that a paltry hundred miles of separation, though there was constant communication between the two cities, would be a protection. Perhaps they trusted to their insular position, or supposed that the plague sought its victims among the dirty and filthy alone. If this last was their hope, they forgot the Chinese quarter of the city. Early in May there was a rumor that a Chinaman had been stricken with the plague in the Island City. That rumor was speedily duplicated; then both were verified. The awful plague had entered the native quarter and found a breeding place. The authorities were alert and acted swiftly and with decision. A careful inspection was made of houses in the infected districts; every patient was hurried off to a hospital or the pest ship Hygeia; a strict quarantine maintained, and the bodies of the victims buried in quicklime. These decisive measures aroused the Chinese. They were indignant that their houses were searched, angry at the quarantine, enraged that the helpless sufferers were torn from their homes, and furious that the bodies of the victims were buried beyond all hope of removal later. The quicklime, of course, speedily dissolved bones and flesh, leaving nothing for removal to the ancestral burying ground. This excitement increased until riots were aroused. Inspectors were assaulted and beaten, and the property of a Chinaman who is a member of the Board of Health was attacked and destroyed. Fortunately the government was watchful and fearless. Riots were speedily put down, and ringleaders severely punished.

How many have already fallen victims in Canton and Hong Kong cannot be told. They must be counted by thousands; and the number of daily victims is rapidly increasing, though multitudes of natives as well as foreigners have fled from the stricken cities. The plague, no longer confined to Canton and Hong Kong, is spreading eastward, northward, westward; and no human being can say where or when it will reach its bounds. Foreigners are using their limited powers to stop its progress, but in vain. With slow but invincible step it marches on.

The symptoms of the disease, in its malignant form, are a chill, followed by a sudden and very high fever. The temperature rises above 105° Fah., and remains high to the end. Headache accompanies the fever, and is followed speedily by stupor that grows more and more deep until death ensues. Usually within twenty, often within twelve hours after the chill a glandular swelling appears, and increases rapidly until it becomes as large as a hen's egg. It is hard, yet very tender, but thus far has not, as in the plague of the seventeenth century, shown a tendency to suppurate or even break. The swelling is occasionally on the neck, oftener under the arm, usually in the groin. In many cases there appear under the skin, in the latter stage of the disease, black spots; these remain after death. They gave the name of Black Death to the disease of former centuries. There is besides this very little eruption of the skin. The appearance of the black spots is regarded a sure token of the nearness of death. That usually comes within forty-eight hours after the chill, though some patients linger three and four days. If they survive beyond the fifth day, there is great probability of recovery.

Of course it is believed that the plague is contagious, though many facts can be given to prove that it is not; perhaps more to prove that it is. Certainly foreigners, especially physicians, move about in the plague districts without taking the disease. Nor has it shown much tendency to invade cleanly portions of the towns where it has found a home. Foreign physicians are carefully studying it, and learning that the plague today is identical with that of two centuries ago. Its hiding place is in the dirt; its breeding place in filth. Purity is its foe, and cleanliness starves it to death. Physicians have discovered, so they testify, that the bacillus of the plague differs from all others thus far found in the human blood, and resembles closely what has been discovered in the blood of animals. Animals inoculated with plague virus developed the disease, showing its various symptoms, and died. Medical men are experimenting with bactericides, hoping to discover one that will destroy the deadly plague bacilli before they have become masters of the human body. Such a discovery, while it might save millions, would remove from hundreds of millions more of terrified humanity the awful dread that is now almost paralyzing them.

The time between contact with and the development of this disease is from twenty-four hours to eight days. Though the usual period of incubation is two or three days, when the plague assumes its malignant character, it develops within twenty-four hours.

Cement Water Tanks.

In the Chemical News Dr. T. L. Phipson gives an account of an extraordinary sample of water he had received for analysis. A gentleman in the country sent him about four quarts of what he termed "drinking water from a new reservoir." The sample was colorless, bright, and clear, had no deposit and no odor; but it had a distinctly bitter taste and an alkaline reaction. It turned red litmus paper blue in an instant. This water, he was informed, was good for nothing. It was impossible to drink it; it cooked vegetables badly—depriving them of their color; and when used for washing, it attacked the hands. It became milky when a current of carbonic acid was passed into it; and it contained a considerable amount of caustic lime—yielding to analysis exactly 100 grains of lime to the imperial gallon; but in other respects it was not rich in saline or organic matter. Having followed up the subject, Dr. Phipson learned that no water was supplied to the house, and there was no well. The rain water which fell upon the roof was collected, and conducted by an iron pipe into a subterranean reservoir supplied with a pump. This reservoir had been lined with hydraulic cement, which was probably of bad quality, and yielded up caustic lime, sulphate of lime, and other salts in smaller amounts, and of less importance to the water. Dr. Phipson thinks the results point to the importance of such cements being submitted to very careful chemical examination before being used for reservoirs destined for the storage of water for domestic purposes.

RECENTLY PATENTED INVENTIONS.

Engineering.

FEED WATER HEATER.—William L. Harvey, Stanberry, Mo. According to this invention a tube in the fire box has one end connected with the lower part of the boiler and, its other end with the water supply, a branch pipe being in communication with the upper part of the boiler to permit a circulation of the water in the tube when the water supply is cut off. The construction is extremely simple and durable, and designed to quickly heat the incoming feed water while promoting a rapid circulation of the water when the feed is cut off.

PROPELLER.—Daniel H. Welch and James L. Lovell, Astoria, Oregon. This invention is an improvement in propellers whose blades are made separate from each other and secured to a hub by dovetail ribs and sockets. The shaft has a tapered portion on which the hub fits with dovetail seats, the propeller blades having base portions with tapered seats fitted to those of the hub, while a washer fitted on the shaft bears against the rear ends of the base portions of the blades, there being devices whereby the washer is pressed against the blades and the hub tightened on the tapering portion of the shaft.

Electrical.

MOTOR REGULATOR.—Joseph F. Sheahan, New York City. An improved mechanism for regulating the speed of motors used in operating organ bellows has been devised by this inventor. A single rheostat is arranged in the motor circuit, with an automatically operated weighted rheostat arm, there being a pull-knob operatively connected with the arm to raise it against the weight and render it operative by hand as well as automatically. The invention does away with a second rheostat and provides a very simple means by which the motor regulating the rheostat may be operated from the organ loft or any convenient place.

Mining.

ORE CONCENTRATOR.—George H. Hooper, Hague, N.Y. According to this invention the sieve has a jigging action and is simultaneously laterally reciprocated, the action taking place in water and the cleansed minerals being directed to one end of the sieve, the refuse material being fed to an overflow at the opposite end. There is a solid overflow at one end, an outlet for washed minerals at the opposite end, and a screening section interposed between the two, there being an elevator beneath the screening section for conveying away material for further treatment. A further patent, granted to the same inventor, provides for the employment of a plunger in connection with the screen, the upstroke of the plunger creating suction at the screening surface, to which the mineral clings and is gradually worked to the forward end. The mineral may be drawn off or removed by hand while the machine is in operation.

Mechanical.

GRINDING WHEEL.—Fred W. Beckert, Ottumwa, Iowa. This inventor has devised an emery or corundum wheel in which the water is fed through channels from the center to the circumference of the wheel, whereby it is more evenly distributed over the surface, and glazing and irregular wear prevented.

FLEXIBLE PIPE JOINT.—Albert J. Sargent, Wilkinsburg, Pa. To produce a limited flexing movement in a joint, and still afford a continuous passage of ample dimensions through a line of pipe having many such joints, is the object of this inventor. Combined with two tubular joint sections having incurved segmental ends is a round bodied and transversely perforated plug with reduced threaded extensions, on which plug the joint sections are fitted, there being two clamping cap pieces and compression nuts on the threaded extensions of the plug.

Miscellaneous.

REVOLVING COAL SCREEN.—George W. Cross, Pittston, Pa. An open-ended frame having an outer screening surface, according to this invention, carries conical inner screens, a chute projecting into the contracted end of the innermost screen. The coal screened is divided into sizes, the stove or nut coal being delivered near the elevated receiving end, while the pea coal and screenings are delivered at the lower end, the invention also providing convenient means for feeding coal and water into the screen.

BALING PRESS.—Andrew C. Miller, Commerce, Mo. This press automatically forces material into the press box and forces out the formed bales, the operation being easy and rapid and the construction inexpensive. The feed box is arranged at right angles to the press box, in which are longitudinally reciprocating plungers actuated alternately by rods and a cam mechanism.

LOG ROLLING HOOK.—George S. Kaime and Ole Stenerson, Necedah, Wis. This hook permits of conveniently rolling a log over the ground or on skids without undue exertion. The hook is connected to a draft beam and curves downwardly and forwardly, there being rearwardly projecting handles, and anti-friction bearing surfaces within the concave side of the hook to move with the log as it turns.

BOOT OR SHOE.—Ernest A. Thurston, Placerville, Idaho. According to this invention the edge of the upper is turned outward and a metal re-enforce applied on it, there being between it and the sole a binder, screws passing through the re-enforce and edge of the upper into the sole, The attachment of the sole to the upper is strong, the boot or shoe being designed to be waterproof and the upper leather protected from abrasion.

BUCKLE.—David F. Stayman, Muncy, Pa. This buckle comprises essentially but two parts, so arranged relatively to each other that the buckle will be a self-locking one. It comprises two frames, one having a sliding connection with the other, and both having openings for the passage of the material to be clamped, a lock carried by one frame being adapted for engagement with the opposing frame.

BUCKLE.—George M. Aylsworth, Collingwood, Canada. This is an improvement on a formerly patented invention of the same inventor, adapting the buckle for an attachment upon harness or other straps and avoiding the necessity of sewing or riveting the buckle frame in place on a part of the strap that is supplied with the improvement. The construction is such that the buckle may be cheaply produced.

NEEDLE CASE.—James J. Morrison, New York City. This is a cheap and simple article adapted to hold a quantity of needles, and when not in use it may be conveniently thrust into the bore of the common thread spool, where it will be retained in place by friction. The case is preferably longer than the spool, its protruding end facilitating the removal of the case from the spool.

BLACKBOARD.—William T. Slaughter, Greenville, S. C. In this article, in addition to the ordinary stationary face, a chart may be employed, to be wound upon either of two rollers, out of sight at the back of the board, the arrangement being such also that both sides of the chart may be utilized, and any desired subject upon it be brought to view at the front of the board and there held.

DOOR HANGER.—Theodore C. Prouty, St. Joseph, Mich. This improvement relates to hangers and tracks for sliding doors, providing a ball bearing wheel for use with the hanger, the latter being arranged in such a way that the bearing balls will always be in proper place and will not need adjustment. The track is light and substantial, preferably pressed from sheet steel, and put up in sections, so that it may be easily put up and taken down.

TOBACCO CUTTER.—George K. Walker, Maquon, Ill. This is a cutting machine of simple and durable construction in which it is easy to thoroughly remove gummy or other matter adhering to the cutting blade, so that the machine will always be in good condition for its work. Adjustable scrapers are arranged to be readily brought with more or less force into contact with the opposite faces of the knife blade.

DISH CLEANER.—Jacob N. Tinklepaugh, Kalkaska, Mich. An inner cylindrical vessel fits loosely in an outer one, their walls separated by flanges, the dishes to be cleansed being placed in the inner vessel, hot or soapy water poured over them, and the vessel revolved to cause a rapid circulation of water through passages provided therefor between the two vessels, the drainage being effected by elevating the inner vessel.

MUSTACHE CURLER.—William S. Cooper, Newport, R. I. This device is composed of three hinged members arranged to be partly or wholly opened out or closed. The device is of imple and compact construction, easily manipulated and very durable. It is also adapted for the curling of ladies' hair as well as for mustache curling or twisting.

FRUIT HOLDER.—William McAusland, Taunton, Mass. This is a device designed to hold a single orange or other piece of fruit, to facilitate the eating thereof with a spoon. The invention relates more directly to that form of holder in which a cup is mounted on a suitable base and provided with spurs or prongs which engage with and hold the half of an orange while one is using the spoon

TRUCK.—Frederick Peter, Anna, Ill. This inventor has devised an improvement in hand trucks with a single wheel, the construction being extremely simple and inexpensive, and the truck being adapted for use as a barrow, a sled, a table, or a stepladder, the changes from one form of use to another being readily and conveniently made.

CLAMP.—Andrew J. Courtney, Pine Ridge, Cal. This is a device for bundling and maintaining in bundled form timber of any description, whereby it may be handled more quickly and economically than when each piece of timber is separate. The clamp proper comprises two sections, in connection with which a lever is employed. It is very simple, inexpensive and easily manipulated by unskilled labor,

RAKE.—Charles C. Quigley, Havana, N. Y. This is an improvement in garden and lawn rakes, combining in one implement a rake which may also be employed for removing leaves or other foreign matter from a lawn. The handle may be shifted to use the rake upon either side, and the construction is very simple and inexpensive.

MOLE TRAP.—William A, Reddick, Niles, Mich. This trap has a vertical frame carrying a plunger rod forced downward by a strong spring, and having at its lower end a crosshead armed with downwardly pointed tines or spears. The plunger rod with crosshead is engaged by a catch when raised or set, and is thrown by trigger lifted by the mole, who is thereby caught and impaled upon the tines.

Designs.

SCARF PIN.—John H. Theberath, Newark, N. J. This pin has for its head a grotesque figure of a youth having on a silk hat and holding to his lips the head of a cane.

WASHER.—Thomas J. Park, Rensselaer, Mo. This washer is made in a beveled rectangular figure forming a border for a central circular opening.

TIP FOR CLOTHES TONGS.—Thomas J. Coons, Osage City, Kansas. This tip has an ornamental configuration of a general V-shape, one member extending beyond the other member and terminating in a rounded edge.

HANDLE FOR SPOONS.—George P. Tilton, Newburyport, Mass. The obverse and reverse of this design each present a number of reed-like members, while the top of the handle at the front has a central plain oval figure with a beaded border.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE YACHTS AND YACHTSMEN OF AMERICA. A standard work of reference. Edited by Henry A. Mott. Vol. I. New York: International Yacht Publishing Company. Pp. 692. Price $20.

This work, the first volume of which has been received, will undoubtedly be the most important contribution to the history of yachting that has ever been written, and the enterprising publishers are to be congratulated upon the success attained in the making of the book, in the cuts and type; while the editor, the well known Professor Henry A. Mott, here appears in the new and well filled role of a yachting editor. The work begins with a history of early yachting and descriptions of many types of sailing vessels of different kinds, from the five masted ship to the house boat. Accounts of yacht clubs and yachting regattas, and descriptions of a vast number of yachts, with a quantity of illustrations of vessels of all types, constitute the text. Numerous portraits are given. Many of the cuts are most elegant photogravures, and some views of the interiors and exteriors of club houses are very attractive. Under each club the general by-laws are given. The many illustrations of yachts, each one famous in its day or at the present time, illustrate most interestingly the gradual evolution of the modern type of American sailing yacht, which now approaches so nearly to the English that there is little difference between the yachts of the two countries. The frontispiece shows the Vigilant in a very handsome photogravure, and other yachts of the latest type are likewise given, so that anybody who appeals to it will find the most recent information on the subject. The great size of the book, its thoroughness, and the exhaustive treatment of the subject make it utterly out of the question for us to adequately review it, so that this short notice must be taken in place of an adequate review. The work itself speaks for its own merits.

SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST, 1894.—(No. 106.)

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than gener interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6196) G. H. will find a small plating dynamo described in SUPPLEMENT, No. 720.

(6197) J. H. C.—Magneto calls for telephones may be purchased from any of the dealers in electrical supplies who advertise in our columns.

(6198) D. E. writes: We wish to erect a pole 75 or 80 feet high on our school campus, and would be greatly obliged for information as to the best kind and size of timber to use and the best method of lapping or splicing upper stick to enable us to lower the top. A. You probably can do no better than to use pine for your staff. Square off five or six feet of the top and fasten on it two mast irons as far apart as the length of the square part. These are a sort of double hoop of iron or figure of eight shape, one section fitting the squared mast, the other section projecting therefrom, giving a round aperture for the top mast to slide through. A sheave or grooved pulley wheel is mortised in the foot of the top mast, with horizontal pin or journal. A couple of screw eyes are fastened to the top of the lower mast. A rope passing around and under the sheave is used to hoist the top mast; one end is secured to one screw e e, the other goes through a pulley fastened to the other screw eye. When in place the top mast is secured by a cross pin or "fid," going through a hole in it, bored just above the lower iron. The fid when in place projects about an inch on each side.

(6199) C. E. B. asks: 1. What power will the simple electric motor have with a cast iron field magnet armature made of 4 cast iron rings with a projection of iron between each coil, each ring insulated from each other, built, except casting, the same as in SUPPLEMENT, No. 641? Is this a good armature for small motors and dynamos? How close should the armature run to field magnets? A. Properly constructed, the motor will give ⅓ horse power. Cast iron is very objectionable for the armature. The armature wound should fit the field as closely as possible. 2. Are there any reliable rules for finding the tonnage of small boats? If so, give them. A. Measure a number of cross sections and compute it by regular rules for displacement. For general rules as to tonnage measurements we refer you to Haswell's "Mechanic's and Engineer's Pocket Book," $4 by mail. 3. Where can I get the sailing rules the New York Yacht Club use in racing? A. Address the Secretary of the New York Yacht Club, 67 Madison Avenue, New York, N. Y. 4. What is the fastest time any steam vessel has ever been known to make, and what do you think is the limit? A. About 31 miles an hour is claimed. The limit for practic work on long distances is about 20 miles an hour, less for most vessels, and more for large ocean ships. You have not given sufficient data for answering your other query.

(6200) A. B. D. says: Will you please tell how to restore the color of russet shoes? A. Mix 1 part palm oil and 3 parts common soap, and heat to 100° Fah., then add 4 parts oleic acid and 1¾ of tannic acid (all parts by weight) and stir until cold. This is recommended as a valuable grease for russet leather and as a preventive of gumming.

(6201) C. E. B. asks: 1. How many lenses in a first class stereopticon and their names, from the light out? A. Generally six. Two plano-convex lenses placed near each other and near the source of light (when the latter is artificial), with their convex surfaces adjacent, but not in contact. The condenser is located between the source of light and the slide. Beyond the slide is the objective, containing (in first class instruments) the rear combination consisting of a — meniscus of flint glass, with its convex side toward the slide, and a + meniscus of crown glass with its convex side toward the — meniscus, and the front combination consisting of a biconcave lens of flint glass and a biconvex lens of crown glass. 2. What are the respective sizes of lenses to make a fifteen foot picture at a distance of sixty feet? A. A half size portrait lens is commonly used. The lenses are about 2½ inches in diameter. 3. Can a fifteen foot picture at sixty feet distance be made with an oil lamp? A. Under these conditions the picture will be dim and unsatisfactory. 4. Can the lantern as mentioned in query 3 be used in showing pictures in houses where an eight foot picture at a distance of fifteen feet is desired? If so, with what change? A. A good picture will be produced, but it will be something less than 8 feet. 5. Please give name and address of parties who sell lenses apart from the instrument. Also give names and addresses of parties who deal in strong oil lamps suited for lanterns. A. Address opticians whose advertisements appear in our columns.

(6202) O. H. says: If a certain pendulum vibrates say once in three seconds and a second pendulum once in two seconds, what rule would be required to find the ratio of the lengths of these two pendulums? What were the so-called Alabama claims spoken of in American history? A. The length of pendulums for time beats are as the squares of the time multiplied by the standard length for a given latitude. Thus for New York the standard seconds length is 39·1017 inches. For a 2 second beat the square of 2 is 4×39·1017 =156·4068 inches and for 3 seconds is 9×39·1017=351·9153 inches and for half seconds ½²=¼×39·1017=9·7754 inches. The Alabama claims were made by the United States government against England for the destruction of American vessels by the warship Alabama, which was built and equipped in England for the confederate States.

(6203) J. T. G. asks directions for making sulphate of mercury batteries, suitable for running small electric motor. A. Use a zinc and a carbon plate. No porous cupis needed. Charge with a mixture of sulphate of mercury and ammonium chloride in equal parts, mixed to a thin paste with water.

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August 21, 1894,

AND EACH BEARING THAT DATE.

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway New York.

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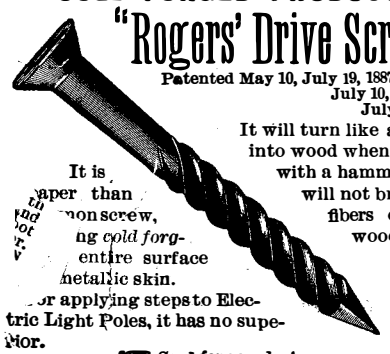

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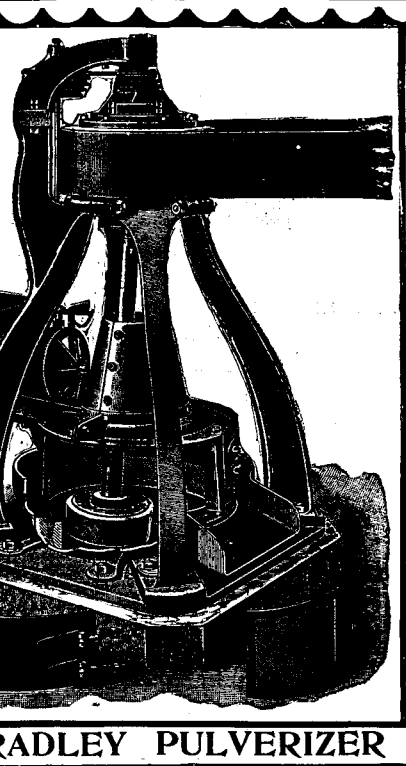

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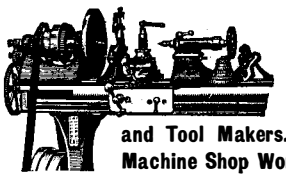

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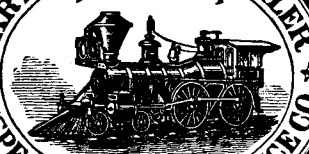

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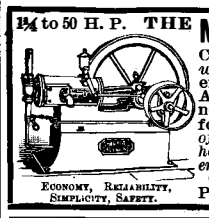

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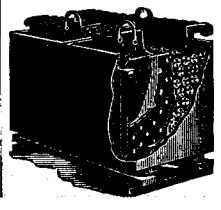

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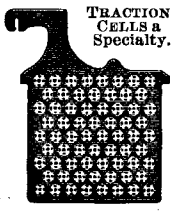

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