SCIENTIFIC AMERICAN

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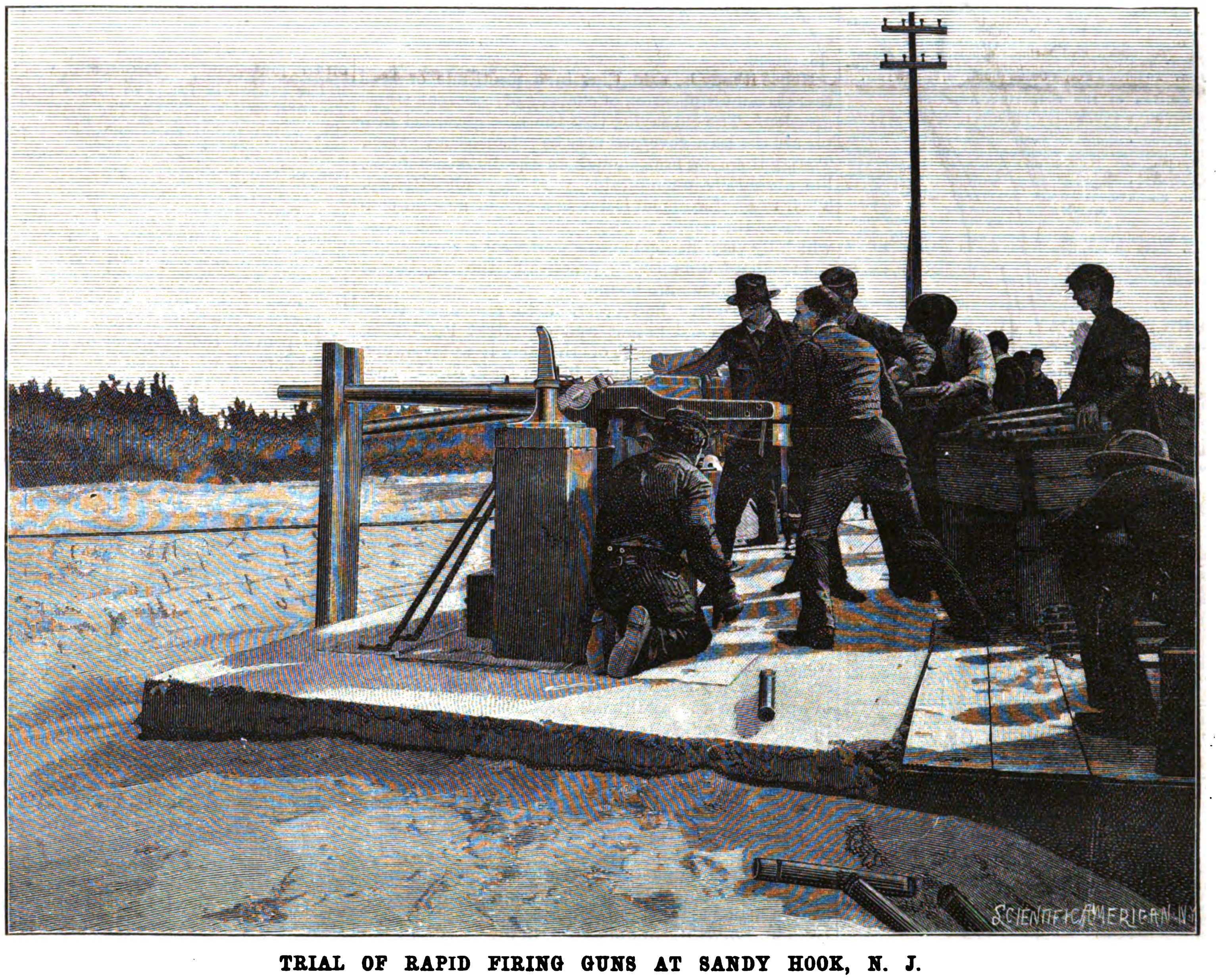
THE RECENT TRIALS OF RAPID FIRING SIX POUNDER MACHINE GUNS.

On June 1, beginning a 2 p. m., an important trial of rapid firing machine guns took place at the Sandy Hook proving grounds in the harbor of New York. The pieces under trial were six pounder guns of the following types: Hotchkiss, Sponsel, Maxim-Nordenfelt, and Driggs-Schroeder; and there was also tested, but not in competition proper, a three pounder Skoda gun. The tests were conducted under the supervision of Captains Heath and Crosier. The guns were fired directly out to sea, the whole object of this test being the determination of the rapidity of firing and the time required for replacement of parts, the questions of accuracy of firing or penetration not being considered on this occasion.

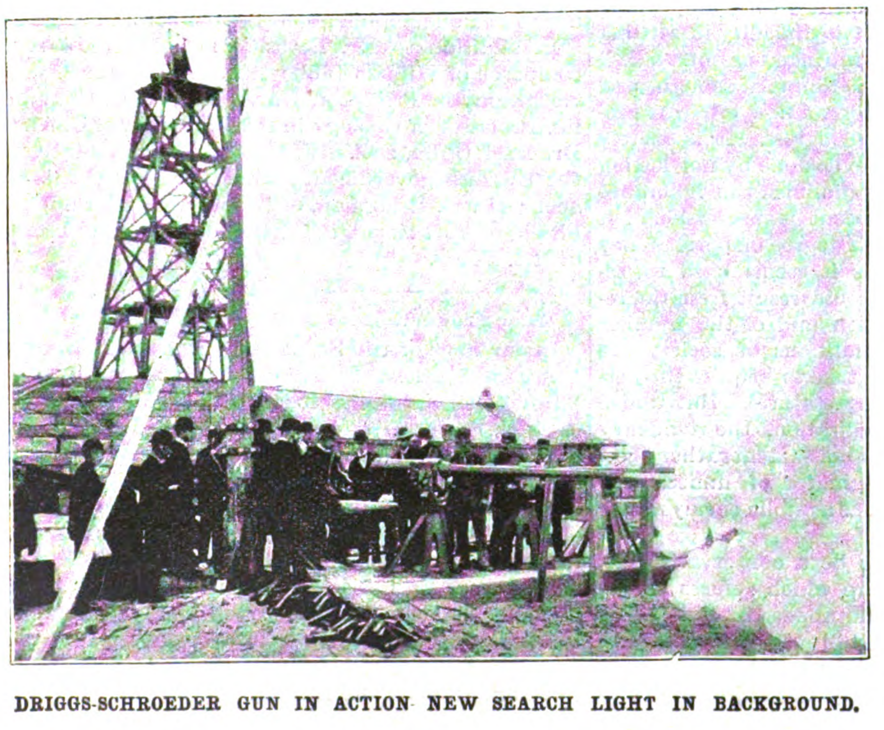
The firing tests were conducted on the following basis: The first test was to determine how many shots could be fired in one minute. The next test was to determine how many shots could be fired in three minutes. Then came the taking apart trial. This consisted in firing one shot, taking out some of the breech parts and replacing them by others and firing a second shot. The time was taken between the first and last shots. Finally came a speed trial of three successive intervals of five seconds for each gun.

In conducting the tests a crew of four men was assigned to do the actual work of firing. This crew moved from piece to piece so that each rifle was fired by the same set of men. Besides these each gun had its own representative, and in the taking apart trial it was he who did the work. The cartridges used were charged with ordinary black powder, except in the case of the Skoda gun, an Austrian piece, which used a smokeless powder. The only smoke visible when this piece was

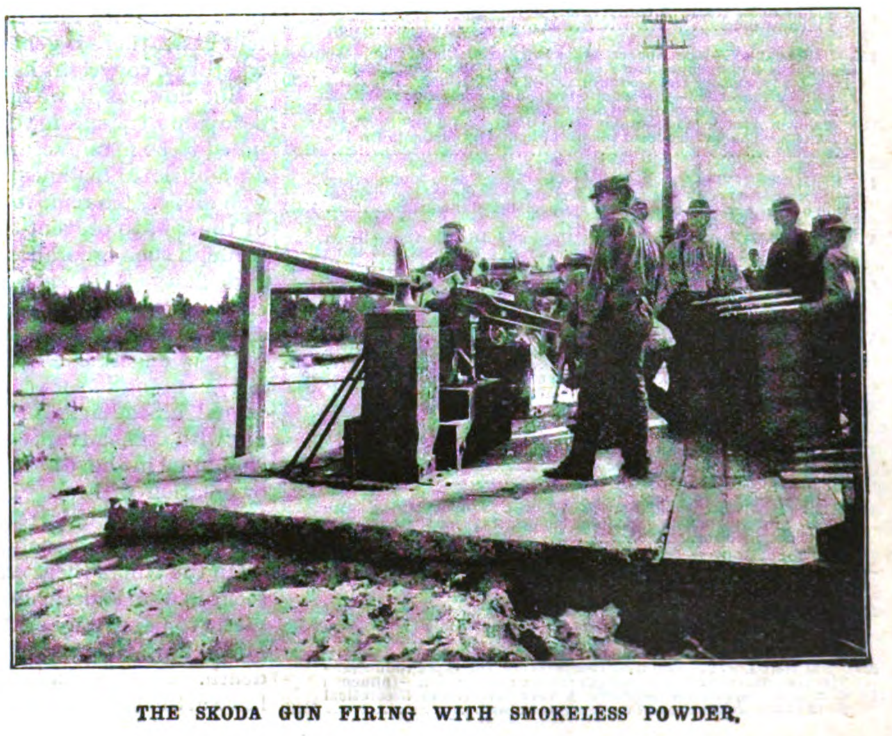
(*Continued on page 408.*)



TRIAL OF RAPID FIRING GUNS AT SANDY HOOK, N. J.



DRIGGS-SCHROEDER GUN IN ACTION NEW SEARCH LIGHT IN BACKGROUND.



THE SKODA GUN FIRING WITH SMOKELESS POWDER.

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NEW YORK, SATURDAY, JUNE 30, 1894.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending June 30, 1894.

Price 10 cents. For sale by all newsdealers.

TENEMENT HOUSE POPULATION IN NEW YORK.

According to a census lately made by the Board of Health of New York City, there are 39,138 buildings known as tenement houses, in some of which the people are packed like sardines; but the average is only 34 persons to a house, the total tenement house population being 1,332,773. Many of the so-called tenement houses are vast establishments constructed and conducted on the best sanitary principles. Still, the majority of these buildings, those that are occupied by the poorer classes, are wretched and unsavory. The only wonder is that pestilence does not rage among them at all times. Almost every steamer from Europe brings a new lot of low-minded, dirty creatures, representatives of the vilest foreign classes, whose filthy habits the health authorities find it difficult to overcome or combat.

PROPOSED CRIMINAL ENACTMENT FOR PROTECTION OF DRAMATIC COPYRIGHTS.

Human law from the necessities of the case is an artificial production, and is largely dictated by considerations of practicability and expediency. It is not to be accepted as a code of morals, but as a code of observances necessary or supposed to be necessary to enable society to exist in peace. In its application expediency smothers justice, in the doctrine that ignorance of the law is no excuse, and cannot be pleaded. Of course, ignorance often does serve as an extenuation of an offense, but the judge is not obliged to give it any consideration.

Hence it may be said that in a multitude of laws there is a multiplication of chances of ignorant transgression. The old saying that the best governed people are the least governed may be taken as an axiom. To-day there are laws enough on the books to make life absolutely unendurable were they all enforced. Their non-enforcement is due to a sort of general consensus of the public, a very curious phenomenon, one which by very illogical means works out a good result, the result of diminishing practically the number of laws by which we are bound.

We have often had occasion to notice in these columns proposed patent and copyright legislation, generally for the purpose of criticising it unfavorably, and of opposing any change in the statutes. If anything is required in the way of alteration of the patent law, it is in the direction of minimizing its restrictions. The inventor should be treated more like a benefactor to society than he now is, his services should be recognized and he should be fostered by the law. Generally, changes in the statutes are proposed for the purpose of attacking him and defending the public from his supposed aggressions. Were such supposed aggressions more numerous than they now are, it would be well for the public.

But a recent bill (Senate No. 1991) introduced in the Senate of the United States, designed to amend the copyright law, certainly goes too far in the other direction, for the laws of the day create enough offenders by creating criminal offenses. The bill we speak of applies to the additional protection of the copyrighted drama. It provides that "any person publicly performing or representing any dramatic or operatic composition" for which copyright has been obtained, and without consent of the owners, shall be a criminal, guilty of a misdemeanor, and liable to fine and imprisonment. The latter is not to exceed a year.

This is the manufacture of a crime in good earnest. The present Federal laws provide ample protection for copyrighted things, and the law is so clear on the point and so easily administered that copyright cases are far from frequent. The infringer of a copyright does it knowingly. There is no pretense of ignorance on his part, and unlike the case of determinations of validity and infringement in mechanical patent cases, there is generally little difficulty in settling whether a copyright has been infringed or not.

But now, as if we had not criminals enough, and occupants enough for our prisons, a new crime is proposed to be manufactured by Congress. It is merely an additional instance of the evils done by not letting well alone. To remove or to diminish the ignorance of the law, to prevent the innocent transgression of it through such ignorance, a high degree of permanency and fixity is essential. This it seems hard to secure. It appears as if good would result from the reduction of volume of legislation and of the number of new enactments. The conditions of society are not changing to such an extent as to require the perpetual amendment of existing statutes. But above all, with the advance of civilization, the tendency should be in the direction of abolishment rather than of creation of laws. The originator of unnecessary legislation should be regarded as a public enemy rather than as a public benefactor.

On the whole there seems to be a conservative element in the Federal legislature which refuses or neglects to pass many of the laws proposed. It is to be hoped that this very absurd bill will die a natural death. No one of advanced views can be desirous to have artificial copyright property the object of criminal legislation. It is enough to apply criminal enactments to offenses against morals and against what are conceded to be natural rights. But a copyright is an artificial protection, is a ceded monopoly, and finds ample protection in civil processes.

Another Successful Armor Test.

In our issue of June 2 we noticed the test of an 18-inch armor plate which ended in the complete failure of the plate. Another test, of a 17-inch plate, was made at the Indian Head proving ground on June 12, and is of peculiar interest. The plate was made by the Bethlehem Company, and upon this test depended the acceptance of 600 tons of 17-inch Harveyized nickel steel plates for one of the barbettes of the Massachusetts. From side to side the plate measured 12 feet and from top to bottom 8 feet 3 inches. Unlike the former plate it was the same thickness throughout. The total weight of the plate was about 35 tons. As this plate had been treated with the same hardening process as the former worthless plate, the makers protested against the severity of the tests. The department, however, refused to reduce the requirements, but allowed a secret test to be made in the presence of representatives of the government. A 12-inch breech-loading rifle was used for the test and was placed 300 feet from the plate. Carpenter armor-piercing projectiles, weighing 850 pounds, were used.

The velocity at the first shot was limited to 1,410 feet per second, on condition that no cracks should be made on the plate, and the second shot was to pass the plate if the projectile failed to pierce the entire 17 inches. The first shot resulted in the shattering of the projectile, which failed to enter more than seven inches. The force of impact generated so much heat that the end of the projectile was welded to the steel plate. The second shot had a velocity of 1,858 feet per second, the powder charge being 400 pounds. The projectile penetrated only nine inches and the point was welded in as before. A slight crack was visible, but it did not extend in very deep, probably not more than half the thickness of the plate. The backing remained intact and none of the bolts started. The test of the 17-inch plate proved the efficiency of the Harvey process of treating steel, which had been doubted since the previous test. As the steel is only affected by the Harvey process to a depth of three inches, there was at no time any just cause for alarm.

When the short range, the charge, and the unfavorable position of the gun in relation to the plate are considered, it will be seen that the barbettes for the battle ships will be practically invulnerable. Battle ships would almost never come within three hundred feet unless they were going to ram, and the probabilities are that the range would be from a half mile to a mile, so that guns of larger caliber would be placed on the same plane as a smaller gun at closer range. With such armor, the Massachusetts and the Indiana will be placed in the first rank of the war vessels of the world.

The Peary Auxiliary Expedition.

The Peary Auxiliary Expedition, under the charge of Henry G. Bryant, secretary of the Philadelphia Geographical Club, sailed for St. John's, N. F., on the Portia from Brooklyn, June 20. When the steamer arrives at St. John's the party will be transferred to the Falcon, the stanch little vessel which carried Lieut. R. E. Peary north last summer. The Falcon will then steam to Godhaven, Greenland, and thence to the winter quarters of Lieut. Peary at Bowdoin Bay, Inglefield Gulf, in latitude 77° 43'. They will examine the Baffin's Bay shore of Ellesmere Land for traces of Bjorling and Kallstenius, the missing Swedish naturalists. Then the Falcon will return with Lieut. Peary and party. They are expected to arrive in Philadelphia about September 25.

In addition to Mr. Bryant, the auxiliary party is composed of William Libbey, Jr., Professor of Physical Geography in Princeton University; T. C. Chamberlin, Professor of Geology in the University of Chicago; Dr. Axel Ohlin, zoologist, who is a representative of the Swedish government; Dr. H. H. Wetherill, surgeon; Mr. H. Bridgman, of Brooklyn; and Emil Diebitsch, of Port Royal, S. C., civil engineer and brother of Mrs. Peary.

The Production of Tuberculin in Delaware.

In our issue of the SCIENTIFIC AMERICAN SUPPLEMENT for April 28, 1894, there appeared an article on "Bovine Tuberculosis," in which no credit was given to the little State of Delaware. A correspondent from that State has favored us with some interesting particulars regarding the preparation of tuberculin at the Delaware College Agricultural Station under the direction of Prof. Fred. D. Chester, the mycologist of the station. The lymph is largely used as a diagnostic agent for tuberculosis in cattle, and it is of course a great economy and convenience to obtain lymph without the necessity of importing it from Germany. The Agricultural Station is fully equipped to supply lymph to veterinarians and scientists.

Sleepless Cycling.

Another of those abnormal feats to which we have more than once drawn public attention has been accomplished. One of the great "record breakers," as they are called in the cycling world, has set all his compeers at defiance by the truly marvelous effort of cycling from the Land's End to John of Groat's in eighty-six hours fifteen minutes—that is, nine hours and forty minutes quicker than the "safety" record. We are informed that he rode the last part of his journey at the rate of sixteen miles an hour, that he experienced little fatigue, and that to all appearances he was not in any way injured by his success; but the most remarkable part of this act is included in the fact —and it must be recognized as a fact which admits of no dispute—that he performed his task without indulging in one moment of sleep. He was three days, fourteen hours, and fifteen minutes without reclining once to rest or ceasing his active movement of propulsion, except for the very briefest moments. There have been periods within our own recollection in which this physiological feat would not have been accepted as possible; and although we are forced to accept it now, for no one can contend against truth even under perverted trials of endurance, we are filled with wonder. We know from the best experimental proofs that the healthy heart will beat 106,000 times in the twenty-four hours, and that the lowest estimate of the work done by this labor is equal to lifting 122 tons one foot; but it has recently been shown that cycling tells severely and specially upon the circulation, and that the number of the strokes of the heart is doubled during such active exercise as that to which this rider subjected himself, so that the lowest estimate we can assume for the work of his heart each day was 212,000 beats, with work done of 244 foot tons; and this maintained for three days and fourteen hours and fifteen minutes was equal to more than 854 foot tons without repose. The experiment, for it must be looked upon physiologically as an experiment, is not without its uses. It surpasses every kind of ordinary experiment in showing what the human heart is capable of performing, and what tension the vessels of the greater and lesser circulation will bear in the young and healthy man. It shows, also, that there remains much that is as yet unexplained in respect to the cause of sleep, suggesting, indeed, that there is something in persistent motion of the blood, sustained by volition of a resolute kind, which prevents the nervous system from passing into that passive or negative state to which the term "sleep" is applied.

We might dwell on these points with advantage to physiological inquiry, and we might dwell upon corresponding evidences, such as the overaction of the heart in connection with the wakefulness of febrile conditions, and the effects of extreme stimulation. The practical lesson we are most called to dwell upon, however, bears on the ultimate influence of extreme exercise on the bodies of these young men who make themselves the victims of self-inflicted injury. The report of a feat such as we have related may suggest that, for the moment, the athlete has sustained no harm, and that all our teaching is so much nervous admonition, or, as it is sometimes designated, "grandmotherly care." We wish it were so. Unfortunately we know that these violent strains bode, in the end, the certainty of premature decrepitude. Toward the goal of death the best heart can only perform a certain measure of work, and whether that be done by rapid or slow process determines the length of days in which it is done. Theoretically, therefore, it is the fate of these young competitors, who otherwise might be destined for a long and active existence, to succumb or break down long before the sun of their life has reached its full meridian; and practically this, so far, has been the fate of all who have endeavored, under the applause of their unthinking comrades, to do what nature has not constructed them for doing without risk and without ultimately proclaiming to them in a voice even stronger than theirs that she, after all, is the arbitress of their destinies.—*The Lancet.*

Our Foremost American Scholar—William Dwight Whitney.

It is evidence of the primacy we yet give to the study of men over the study of things that we bestow the title of our foremost American scholar on William Dwight Whitney, the philologist, rather than on others who, in biology or astronomy, have conferred the highest honor on American scholarship.

Nature gave Professor Whitney a mind of unusual strength and accuracy. His own will put his powers to persistent use. Nature did not make a philologist of him; that was almost an accident. He once told us that in his youth his tastes led him rather to the natural sciences, and that his brother, Josiah D., the distinguished geologist, was more inclined to linguistics. Indeed, he did some good work in science before he devoted himself to philology.

But when he was a young man, just out of Williams College, the science of philology was in its infancy and waiting for its masters. Such men as William von Humboldt, Grimm, Bopp and Pott had led the way in the comparative study of human language, and so of primal history and psychology; and Sanskrit had been proved the key to the new study and the chief source of information as to the origin of the great Indo-Germanic races and languages. It was this new field, quite untrod in America, that tempted young Whitney, and which took him abroad for study under the chief masters of the science. From this time he was a Sanskrit scholar or a philologist. He returned to this country, found a place, or rather made himself a place, in Yale College, and became the honored teacher of every Sanskrit scholar of eminence in the country. He edited most important Sanskrit texts from the manuscripts, and published innumerable papers and not a few books for technical or popular use, edited great dictionaries and made himself known in Germany as well as in America as one of the great scholars of his department in the world. He was loved for his personal character and his willingness, like Ezra Abbot, to help any inquirer from the wealth of his learning, was honored for the extreme accuracy as well as breadth of his learning, and was feared a little and was disliked by the most pretentious of English professors of Sanskrit, for the remorselessness with which he exposed carelessness or charlatanism. He was most popular with the best scholars, and we recall the enthusiastic cheers with which the mention of his name was received at the farewell dinner of the last Oriental Congress in London, although it was presided over by Max Muller, his chief foe.

Now nearly every college or university of any strength in America has its chair of Sanskrit, and every professor was Whitney's pupil. None have achieved his fame—they are younger men—and perhaps not one has his supreme ability. Many have, however, done good work; and the names of Avery, of Bowdoin, among the dead, and of the incumbents of Johns Hopkins, Harvard, Bryn Mawr, Columbia, and others among the living, prove that the inspiration of the old Yale master is not lost. There is no limit to the veneration with which these younger masters always speak of him. A word should be said of the spirit of corporate fellowship which he always cultivated. Though not one of the founders, he came just after the founders of the American Oriental Society fifty-one years ago, and Professor Salisbury and he, as has often been said, used for many years to carry the society with them to its annual meeting in Boston, and then bring it back to New Haven. Professor Whitney's work fills half the volumes of the society's "Journal" and is its most valuable portion. He was for many years its corresponding secretary and then its president. He was also one of the founders of the American Philological Society and its first president.

Personally Mr. Whitney was a man of great simplicity and personal charm, most social in his feelings and habits, an affectionate friend, and the life of any company he was in. His study was by his choice at his home, where the presence of his family, instead of being a disturbance, seemed to free his powers and put his mind in a normal condition for exertion. He was a prodigious worker, but there was so little appearance of it in his manner that one had to learn it from the amount of the product and not from any appearance of pressure or hurry. The impression he was most likely to make on a casual visitor was that of being the most leisurely man in the world.

In early life he had taken up the natural sciences, and engaged in field work with his distinguished brother, now professor at Harvard. He was no mean botanist, and among other achievements of this period made a collection of the birds around his native town, Northampton. He maintained scientific interest enough to keep him abreast of the world's progress, and make him a valuable member of the Hayden Expedition in Colorado, in the summer of 1873. He was an enthusiastic climber in Switzerland, and on the mountains great and small of this country. In late years his best recreation had been found in long walks with his daughters. For such walks and excursions he was always ready if not eager, even after the trouble with the heart had begun to declare itself.

His public and social interests were various and keen. He had a remarkable way of setting himself to work to interest other people in what interested him. The best example of this was his love of music, which was one of the enduring passions of his life, though he never perfected himself as a virtuoso in any line of instrumental or vocal performance. In fact, he had no liking for strictly technical skill, but took delight in choral song, and especially the great oratorios. New Haven profited by his passion in her oratorio societies, which for many years were a delightful and refining musical influence in a town which at that time was not otherwise much given to the divine art. Equally great was his delight in choral music in the home, for which he gathered his friends, and led them with enthusiasm for many years in succession.

In person he was well and rather strongly built, not above the medium stature, with a broad, commanding forehead, handsome features and a singularly refined, scholarly expression. His charm of manner, which was always great, developed as he grew older, and was never so great as in the last ten years.—*The Independent.*

Devices for Trapping Insects, Rats, and Thieves.

The Boston *Journal of Commerce* has made the following extracts from patents which have been granted for trapping insects, rodents, and thieves:

Contrivances for catching insects are more numerous than any others. One of them is a furnace for slaughtering potato bugs. To begin with, a deep and wide furrow is to be plowed all around an infested field; through this trench a smooth log is dragged to make the surface hard and smooth. The bugs in migrating to other grounds are unable to scale the trench, and the furnace, which is a cylinder of iron filled with fuel, is drawn along the furrow and destroys them. Other odd devices are cartridges intended to be inserted in the mouths of ant holes and to be fired, thus communicating stifling vapors to the subterranean chambers, also many kinds of lamps for attracting and burning up the moths of various worms in cotton fields. There is a toy pistol for insects, which sucks them in when the trigger is pulled.

An ingenious Westerner has invented a trap for catching the horn fly, which is such an enemy to cattle in some parts of the country. It consists most importantly of a great frame to which brush is attached in such a manner that when the beasts walk through, eager as they always are to scratch themselves, the flies will be scraped from their bodies by the branches. Finally the frame is closed up by means of doors and the captured insects are destroyed. Nearly everybody has heard of the gold tapeworm trap, which the patient swallows. Bedbug traps are of several varieties, all of them being intended to afford attractive hiding places for those blood suckers and to be burned or scalded out afterward.

Much ingenuity has been expended in rat traps. Some of them are so elaborate that no full-witted rodent would go near them. One requires Mr. Rat to come in through a door, which drops behind him and makes him a prisoner. Seeing a bright light above, he ascends a flight of little steps and trots across a small plank that is so nicely adjusted as to balance that his weight causes it to tip and throw him into a tank of water. Another contrivance consists of a double chamber. One chamber has a glass end through which Mr. Rat sees two or three imitation rats having a nice time with a bit of cheese. Wishing to join them, he runs around the box, gets into the other chamber and is caught.

There are a number of devices which employ mirrors for the purpose of luring Mr. Rat to his fate. He mounts on top of a barrel and sees a toothsome bit of cheese. As he approaches it he beholds another rodent —in reality his own reflection in a piece of looking-glass—coming for the cheese from the opposite direction. He makes a dash to get there first, and a pivoted board drops him into the cask, which is half full of water. Rats will swim for a long time, so one humanitarian has patented a water trap with little shelves around the edge and just above the surface. On the shelves are placed small lead weights with fish hooks hanging from them. The captured rat in trying to escape grasps one of the hooks, gets it fastened in his mouth, dislodges the piece of lead and is carried to the bottom by the latter.

Of greater interest are contrivances for catching thieves. One of them is designed to discourage bank sneaks. The sneak puts his hand in through the teller's window, and unintentionally actuates a mechanism which causes a slide with spikes to close suddenly upon his paw and impale it. A trap of a somewhat similar character is a steel shutter for a house window, so disguised with covering and fringe as to look like an ordinary curtain. If a burglar tries to enter at night, it shuts down upon him, the spikes hidden by the fringe helping to hold him fast.

Benz-Aldehyde Green.

A very interesting paper by Mr. J. W. Gifford on an inexpensive screen for monochromatic light in connection with photo-microscopical work appears in the last number of the *Journal* of the Royal Microscopical Society. While at work on the various aniline dyes in connection with their photographic effect on the salts of silver where they are exposed to the light of the solar spectrum, it came to Mr. Gifford's notice that the absorption spectrum of benz-aldehyde green, commonly known as malachite green, was a very remarkable one. A series of experiments was then made from which Mr. Gifford deduced the following claims: 1. It gives a field of view uniformly monochromatic. 2. There is more light than with chrome copper solutions. 3. It need not be used in solution. 4. No bathing of plates in erythrosine or cyanin is necessary, an ordinary rapid plate being sufficiently sensitive. Mr. Gifford concludes his paper with the suggestion that the application of malachite green might also be useful for reproducing objects in their natural colors by the Lippmann method, but as yet he has made no experiments in this direction.

COMPOUND ENGINE WITH PROELL EXPANSION GEAR.

The inverted engine which we illustrate has been constructed by Messrs. Westgarth, English & Co., of Middlesbrough, for the saw mills of Messrs. Vint Brothers, Bradford. In this engine a single Proell valve is used, which is designed to act merely as a cut-off valve, the distribution of the steam being effected by cylindrical valves of the Corliss type.

The general appearance of the engine is well shown in Fig. 1, while the general details of the valves and gear will be understood by reference to Figs. 2 and 3.

Fig. 3.

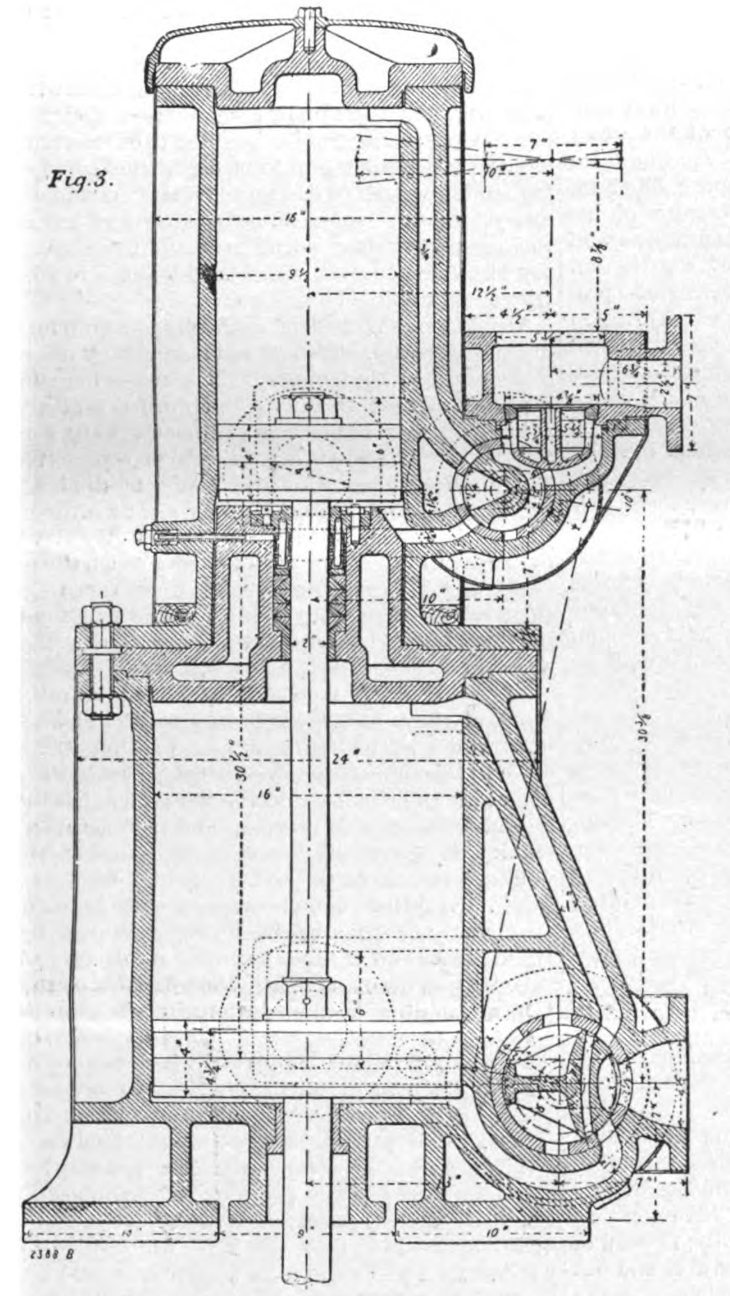
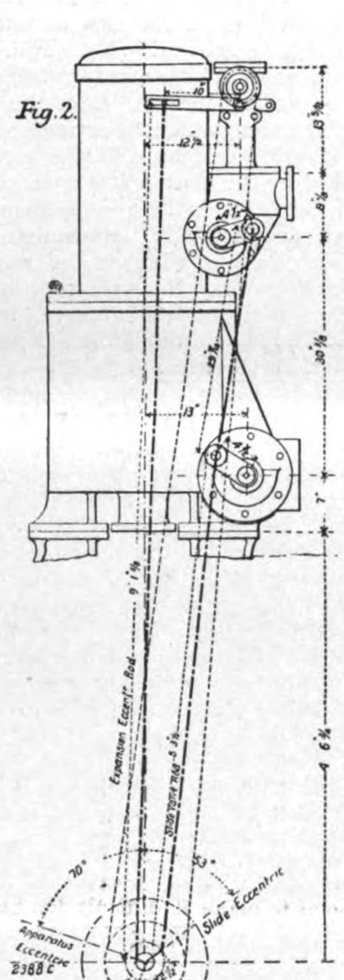


Fig. 2.



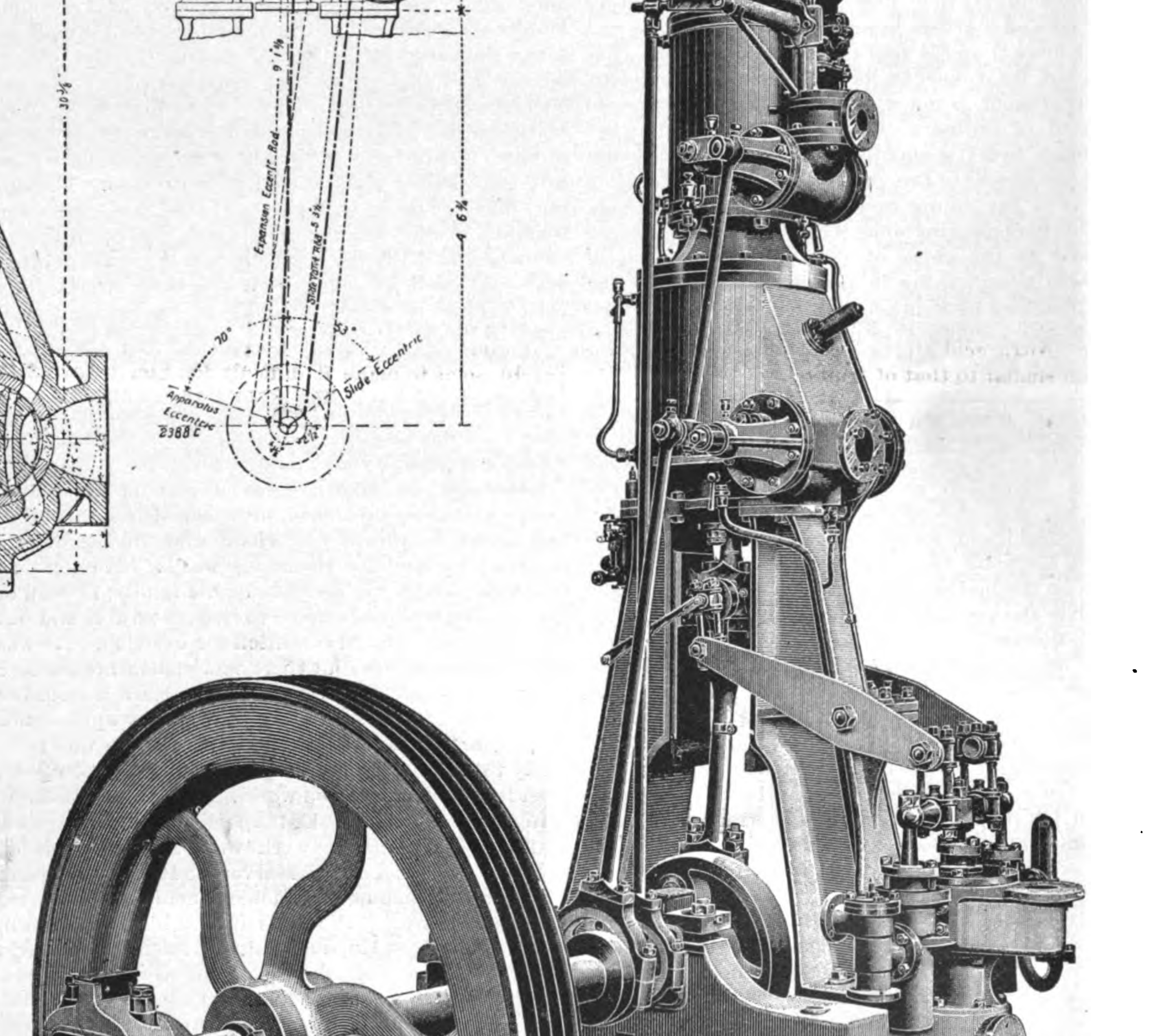


Fig. 1.—VERTICAL COMPOUND TANDEM ENGINE.

We are indebted to *Engineering* for our engravings and the following particulars:

The distributing valves are in each case fitted at the lower ends of the cylinders, and are worked by one eccentric, the arrangement being such that nearly straight lead for the rods is obtained, as shown in Fig. 1. The lowest level of the edge of the exhaust port is lower than the bottom of the cylinder, both in the case of the high-pressure and the low-pressure cylinders, and there is thus no risk of water accumulating beneath the pistons and causing damage. The Proell valve and gear is fitted above the high-pressure distributing valve, as shown in Fig. 2, and is worked by a separate eccentric, which raises the valve in time for the commencement of each stroke, and maintains it open till the release gear worked by the governor comes into operation and lets the valve fall again, thus cutting off the steam. Comparatively little lap is thus required on the distributing valve. The arrangement, as will be seen, is very compact, and, owing to the adoption of the cylindrical Corliss valves, the clearance spaces are much less than is usual with independent cut-off valves of the ordinary slide pattern. The exhaust from the high-pressure cylinder passes to the steam chest of the low-pressure cylinder through a cast iron pipe. The valve for this cylinder is also of the Corliss pattern, but is of the "Trick" type, having a passage through it, by means of which the necessary range of oscillation is reduced. In practice the arrangement adopted is stated to have proved very efficient, there being a difference of but two per cent in the speed of the engine when respectively at full load and at no load.

The two cylinders, it will be seen, are mounted direct, one above the other, without the intervention of a distance piece. The low-pressure cylinder cover is, however, made rather deeper than usual, to afford room for the metallic stuffing box shown, and to reduce the clearance in the high-pressure cylinder. The packing referred to consists of a number of white metal split rings of angular section, which surround the rod, and are kept up to their work by spiral springs of phosphor bronze placed above them. These springs are placed over long studs or pins of phosphor bronze, as shown, which serve to maintain them in place. The principal dimensions of the engine are: Diameter of high-pressure cylinder, 9½ inches; diameter of low-pressure cylinder, 16 inches; stroke, 16 inches; and the speed is 110 revolutions per minute.

How to See Colored Stereos.

In a recent number of the *Paris Photographe* a specimen is given of Ducos du Hauron's process of obtaining stereoscopic pictures by viewing colored images. Two representations of the same object, taken with a stereoscopic camera, are printed one on the top of the other. These images being taken from two slightly different positions do not, of course, combine, and a blurred effect is the result. These two images are of different colors, that corresponding to the right eye being red and the other blue. An eyeglass accompanies the picture, this being formed of two pieces of colored gelatine, blue gelatine for the right eye and red for the left. On viewing the blurred image through these glasses it becomes sharp, and has practically the same appearance as a stereoscopic print when viewed in a stereoscope. The red glass permits only the blue image to be seen with one eye, and the blue glass allows only the red image to be seen with the other eye. Each eye, therefore, sees but its own picture, and by an instinctive physiological movement of the organs of vision the two images combine, giving the stereoscopic effect.

The chief points to be observed are that the image which is printed last should be of as transparent a color as possible, so as not to destroy the effect of the underlying one. Further, as the colored glasses are very deep, the combined image must be strongly illuminated. The distance between the picture and the glasses must also be determined by trial, as the stereoscopic effect naturally proceeds from the convergence of the two eyes.

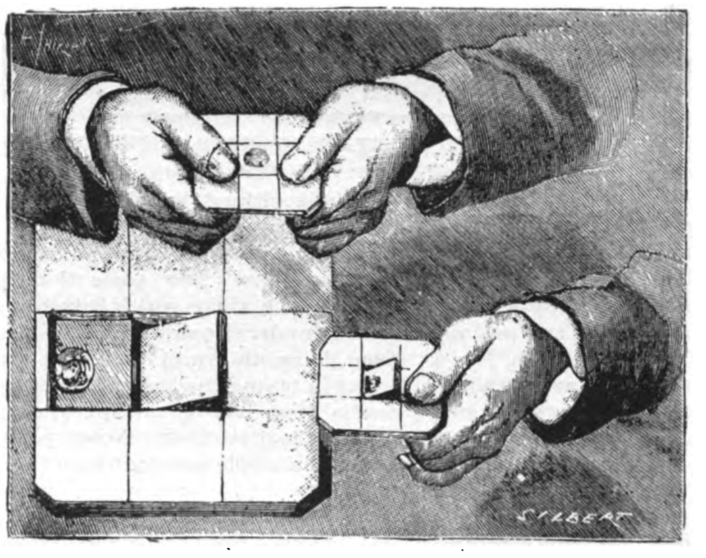
The Photographic Times says: Although the experiment is interesting, its practical value cannot be very great. Stereoscopes are made nowadays at such a low figure that they would be almost as cheap as the colored glasses, and certainly the effect would be far superior. The process is more likely to be of value in projecting pictures upon the screen with the optical lantern, so that a large number of persons all wearing the colored glasses could view the image stereoscopically. This, we believe, has already been done with more or less success, chiefly the latter.

German Railways in Asia.

A railroad, which the Germans have built in Asia Minor, extending from Ismid, a harbor about 60 miles east of Constantinople, east by south 309 miles to Angora, has as little wood in it, perhaps, as any in the world. Not only the rails and bridges, but the sleepers and telegraph poles, are of iron, nine-tenths of it furnished by German works, and chiefly by Krupp. There are no less than 1,200 bridges on the line, one measuring 590 feet, one 458 feet, one 445 feet, and three 327 feet. There are 16 tunnels, the longest measuring 1,430 feet. This is the only railroad which penetrates into the interior of Asiatic Turkey, the Smyrna lines being all near the coast. The writer of "Continental Notes" in the *Railroad Gazette* says an extension of a little more than 400 miles east from Angora would bring the road to the Euphrates near the Armenian border.

DISAPPEARANCE OF A COIN.

Holding a square piece of wood with the two hands, as shown in the figure in the upper part of the accompanying engraving, the operator asks a spectator to place a coin upon a small central square between the two thumbs. This done, he requests the person before whom he is operating to spread a handkerchief over his two hands so as to conceal them. Scarcely has this been done, when the operator, removing the handkerchief, shows that the coin has disappeared. The hand represented at the bottom of the figure explains the trick that permits of effecting the disappearance. The piece of wood serving as a support is provided with a simple mechanism. The central square having been cut out beforehand and mounted upon an axis, pivots under the pressure of the little finger acting beneath the piece and causes the coin to drop into a cavity with which the wood is provided at the side of the movable square. At the left hand side of the figure, the piece of wood is represented on a larger scale and with a piece removed in order to show the mechanism. This little object, which any skillful amateur can manufacture for himself, permits of producing a very successful illusion in the way of juggling. The specimen that we saw operating with success measured 4×4 inches and was a quarter of an inch in thickness.—*La Nature.*



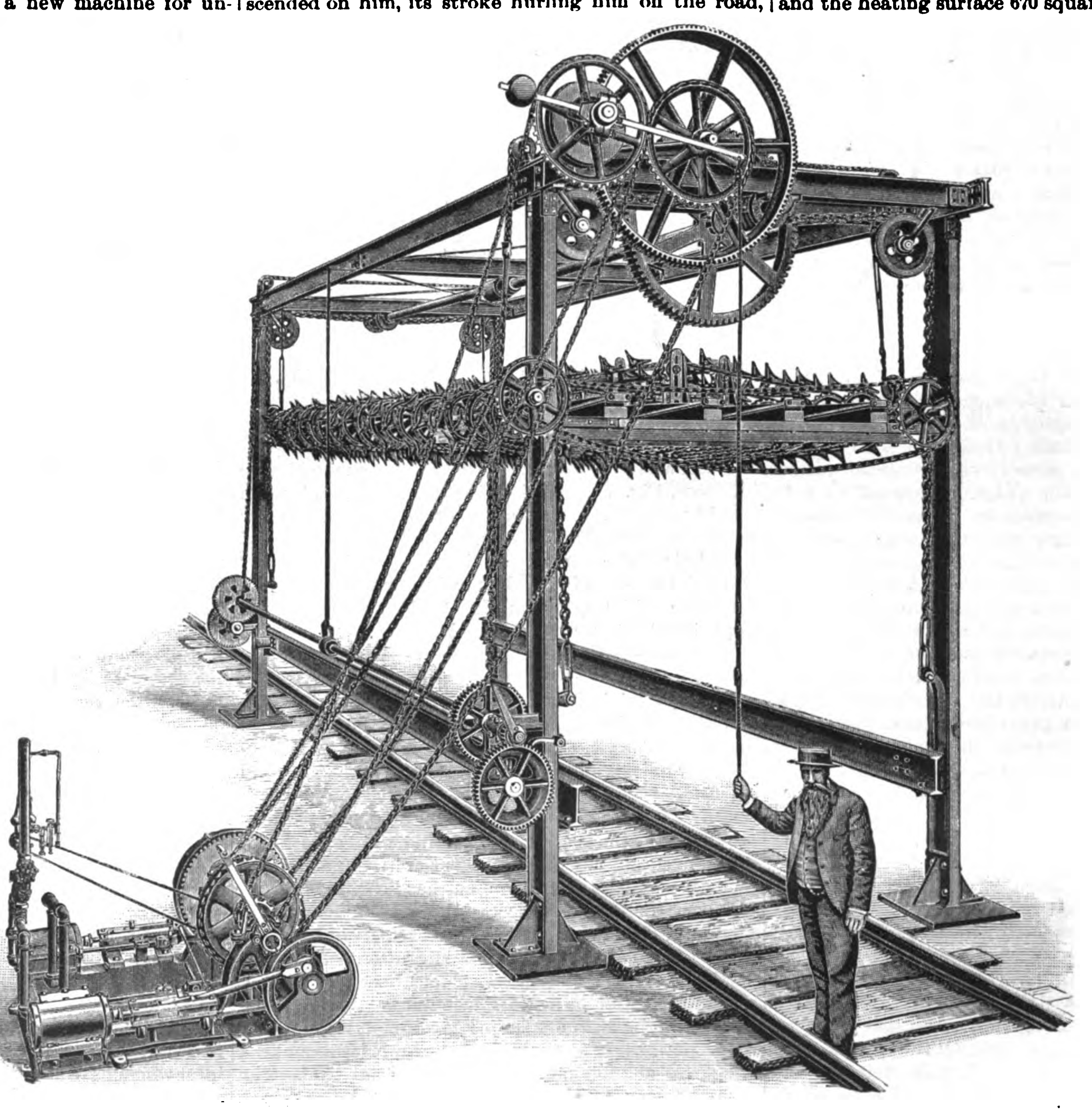
DISAPPEARANCE OF A COIN.

Asparagus.

According to the investigations of Crouzel (*Bull. de la Soc. de Pharm. de Bordeaux*), the specific odor of urine after eating asparagus is not due to the contents of asparagin (since other plants which also contain asparagin do not impart this odor to the urine), but rather to a proportion of volatile, ethereal oil in the asparagus tops. Crouzel has extracted the odoriferous principle from asparagus urine and compared it with the ethereal oil derived from asparagus tops, establishing their identity. He drank some water containing the asparagus essence, and after fifteen minutes the urine emitted the characteristic odor. If the asparagus essence be added to freshly voided urine, the latter acquires the same smell. Finally, asparagus exhausted of this essence may be eaten without imparting the odor to the urine. The asparagus essence is yellowish, has the specific odor; the taste is insipid; specific gravity is less than that of water. Nitric acid attacks it vigorously and produces an odor similar to that of fruit oil.

A MACHINE FOR HANDLING SUGAR CANE.

The illustration represents a new machine for unloading sugar cane as it comes on cars from different parts of the plantation, or from a distance, and transferring it to a carrier by which it is moved to the sugar mill, the carrier and its track at one side not being shown in the picture. Mr. H. F. Laine, of Navajas, Cuba, is the patentee of the machine, which is manufactured by Mr. J. S. Mundy, of Newark, N. J., who is also sole agent for the United States. The ordinary freight car on which the cane is loaded has a false bottom that projects far enough out on each side to be engaged by longitudinal I-beams which have a vertical movement inside the uprights at either side of the track, the I-beams being attached to dogs raised by four heavy chains which wind up on drums on either end of the main hoisting shaft. As the false bottom is raised out of the car, with its load of ten to fifteen tons of cane, a scraper attached to link belting commences to remove the cane to the carrier at the side, the fingers of the scrapers scratching the cane off as the load is raised. The table carrying the fingers is so arranged that it can be raised or lowered by the hand gearing shown at the side of the machine, to accommodate a low or high car. The gearing is so compounded and driven by a Mundy friction that the load will be raised at the rate of one foot in three minutes, or five feet in fifteen minutes, thereby unloading fifteen tons of cane in fifteen minutes and distributing it on the carrier. One man can attend to and operate the machine.



LAINE'S SUGAR CANE UNLOADER AND DISTRIBUTER.

Lightning Stroke.

"Ball lightning," the *fulmen globulare* of the older meteorologists, is the most dangerous and destructive of the forms which lightning is known to assume. Fortunately, however, it is the rarest. A narrow escape from death by its stroke occurred lately in the person of a distinguished surgeon of the Belgian school, Dr. L. Dandois, professor of surgery in the University of Louvain, who had gone to the neighboring town of Linden to visit a patient, and on his return, having alighted from the train to continue his homeward journey by road, was overtaken by a heavy thunderstorm. The sky became as dark as at midnight, so as to make it difficult for him to avoid the telegraph poles standing at intervals along his path. In a few minutes a fire ball, as he described it, descended on him, its stroke hurling him off the road, across the ditch that ran parallel to it, and landing him in the adjacent field. He was holding a large umbrella at the time, holding it with both hands by its wooden stick, which was of uncommon thickness. On coming to himself after the shock he found the umbrella cover completely burnt off its steel framework, the steel itself being twisted into every sort of shape. The wooden handle had no doubt saved his life—had it been of metal, Dr. Dandois is convinced that he must have been killed instantaneously. As it was, fully ten minutes elapsed before he recovered the use of his arms and legs, benumbed as they were with the shock. Ultimately he was able to resume his walk homeward.—*Lancet.*

New Water Jet Steam Lifeboat.

The City of Glasgow has been constructed by Messrs. R. & H. Green, Blackwall, from the designs of Mr. G. L. Watson, the famous yacht designer. The craft is 53 feet long by 16 feet beam; the depth is 5½ feet. The displacement is 30 tons, draught being 3 feet 3 inches. She will accommodate thirty to forty passengers, while having on board four tons of coal for the boilers and half a ton of fresh water in the reserve tanks. The machinery has been supplied by Messrs. Penn, Limited, Greenwich. The vessel is jet propelled. On each side there is a forward and an aft jet, while Mr. J. F. Green has invented and patented a means whereby lateral propulsion by a jet on the broadside is secured, so that the boat may throw herself off a wreck alongside which she may have to go in her life-rescuing mission. The whole machinery only weighs eight tons, and the engines on trial developed 180 horse power at 370 revolutions, giving the anticipated speed of 8½ knots. The boiler supplying steam was worked under forced draught on the closed stokehold system, the mean pressure being about 1½ inches. The boiler is of the water tube type invented by Messrs. Penn. There are two steam chests 21 inches in diameter, instead of one, as in other well known designs of water tube boilers, and two water drums 9 inches in diameter, and the steam generating tubes, some of which are only slightly curved, pass diagonally from the right bottom water drum up to the left steam chest. The downcomers are in the wings. The tubes, of steel, are one inch in diameter. A feature of the design is that the steam pipes to the steam cylinders pass through the uptake, with the view of drying and slightly superheating the steam. The grate area is 15 square feet and the heating surface 670 square feet, a ratio of 1 to 44·6, while the power developed is equal to 11·3 indicated horse power per foot of grate area. Steam at 150 lb. pressure is supplied to the horizontal compound engines driving the two turbines. The cylinders are 8½ inches and 15 inches in diameter respectively, and the stroke of piston 12 inches. The turbines are coupled direct to the shaft at either end, the turbines being 2 feet 6 inches in diameter. The water is drawn through rectangular orifices on each side, 8 inches by 17 inches, and is ejected through a 12-inch pipe for going astern, and through a 9-inch for going aft or laterally. Three throttle valves regulate the discharge from each turbine. One jet going astern enabled the boat to turn a complete circle without the rudder in 5 min. 5 sec. in the open off Sheerness, with a wind force 6. At the same time the vessel turned with the rudder in 1 min. 26 sec., with both jets driving her ahead; going full speed she stopped dead and started astern in 20 sec.

The French Aluminum Yacht Vendenesse.

This yacht has arrived at Gosport from Honfleur. The experiments carried out in connection with the vessel are most interesting, as bearing upon the future of aluminum in yacht construction.

The Vendenesse was launched at Saint Denis on December 6, 1893. A week later she was taken down the Seine to Havre. As, by the account of the pilot in charge of her during this trip, the yacht had not suffered in any way, it was thought unnecessary to examine the hull, and she was moored, entirely dismantled, alongside the schooner Velox. This was done with a view to ascertaining the chemical action of salt water upon aluminum, and nothing was done to the yacht up to the middle of March. Her owner, Count Jean de Chabannes la Palice, had her then examined for the first time since her launch, and it was found that along the water line near her counter the paint had disappeared, and that the metal had oxidized where not protected by paint. On closer examination it was seen that wherever the paint had adhered, the metal had not suffered in the least. The degree of oxidation proved beyond doubt that the process had been going on for some time, and that the disappearance of the paint was due to some mechanical cause. On careful inquiries from her crew, Count de Chabannes elicited the fact that the Vendenesse had on several occasions bumped against some old piles which protect the sides of the Seine.

The boat was now thoroughly scraped, when the oxidation was found to have been less than was at first supposed, except round the patches where the paint had been knocked off, where a distinct outline had been eaten. On the other hand, the effect of the water upon her hull had been greater than had been the case with some pieces of aluminum placed in salt water for the sake of experiment; but this difference, says a writer in our French contemporary *Le Yacht*, is easily explained by the unfavorable conditions of the Bassin du Commerce, in which the yacht had been moored. This basin scarcely ever receives any fresh water; it is, furthermore, used for emptying the refuse of some dye works, and a large number of iron and copper-bottomed ships are constantly moored there. The oxidating properties of the water are thus amply proved, and it is a well-known fact that in this basin copper bottoms are soon eaten away. In addition to these general disadvantages, the Vendenesse was moored alongside the Velox, whose several hundred square meters of copper plates acted directly upon the small patches of aluminum denuded of paint.

After scraping, a fresh coat of paint was put on by means of a special process, and the yacht was again taken to her old moorings in the Bassin du Commerce. Here she remained until the beginning of May, when she was fitted out and went for several spins in the roads of Havre. But during these trials the yacht showed herself so slow that, in spite of the good condition of the paint, her owner came to the conclusion that she must be covered with weeds and shells, and accordingly the yacht was placed on the gridiron at Honfleur on May 17.

It was found that the steel parts and the lead keel were thickly covered with weeds and small cone-shaped shells, while on the aluminum these shells were few and isolated. On removing these, the hull showed that between the shells the paint had remained intact and had completely protected the aluminum. Where the shells had grown the paint had either been eaten away or torn off by removing the shells; but, either owing to the calcareous secretion of the shells or because the metal had not been long enough exposed, no sign of oxidation was noticeable. The yacht is to be raced during the whole of the season, and as during this period she ought to have her bottom cleaned every twenty or twenty-five days, it seems comparatively easy to keep her in good condition. The Vendenesse left Honfleur on her passage to Gosport about 8 P. M. Her owner had intended, during this passage, to test her stability by gradually increasing her sail spread. At first the wind was light, but toward 10 P. M. a strong northerly wind sprang up. The sea was soon pretty rough, and by two o'clock in the morning the waves were running at a considerable height. The force of the wind increased, and sail had to be shortened. With some thirty-five square meters of canvas the yacht acquitted herself very well during the passage, and her British crew are loud in her praises. The enormous weight of her lead keel and the pitching of the vessel caused her hull to shake violently, and, owing to the sonorousness of the metal, the waves dashing against her sides created a deafening noise inside. The boat, however, kept perfectly dry, and suffered no damage whatever. It is more than likely that a racing yacht of the shape of the Vendenesse, but built of wood, exposed to an angry sea for sixteen hours in succession, would have made plenty of water, if she had not suffered worse misfortunes.

The above, from the *Yachtsman*, does not present a very encouraging prospect for the introduction of aluminum boats.

HOW TO CUT AN APPLE IN HALF WITHOUT CUTTING THE SKIN.

An apple can be cut in half without breaking the skin. With a fine needle and thread take a stitch in the apple just under the skin, as shown in Fig. 1, and draw the thread through carefully. Now place the point of the needle into the hole from which it just came, and pushing it gently under the skin, take another stitch, Fig. 2. Keep doing this until you have gone around the apple, but in taking the last stitch be careful to draw the needle from out of the hole it made when inserted to make the first stitch. Now the thread completely encircles the apple only just under the skin and the two ends of the thread are seen hanging loose, Fig. 3. Crossing these threads, pull them steadily and firmly in opposite directions, and in a few moments the apple will be cut completely in two, and the whole of the thread will have been drawn away through one small hole. If nicely done no sign of a breakage will appear on the surface, although the apple is cut into two parts. MEREDITH NUGENT.

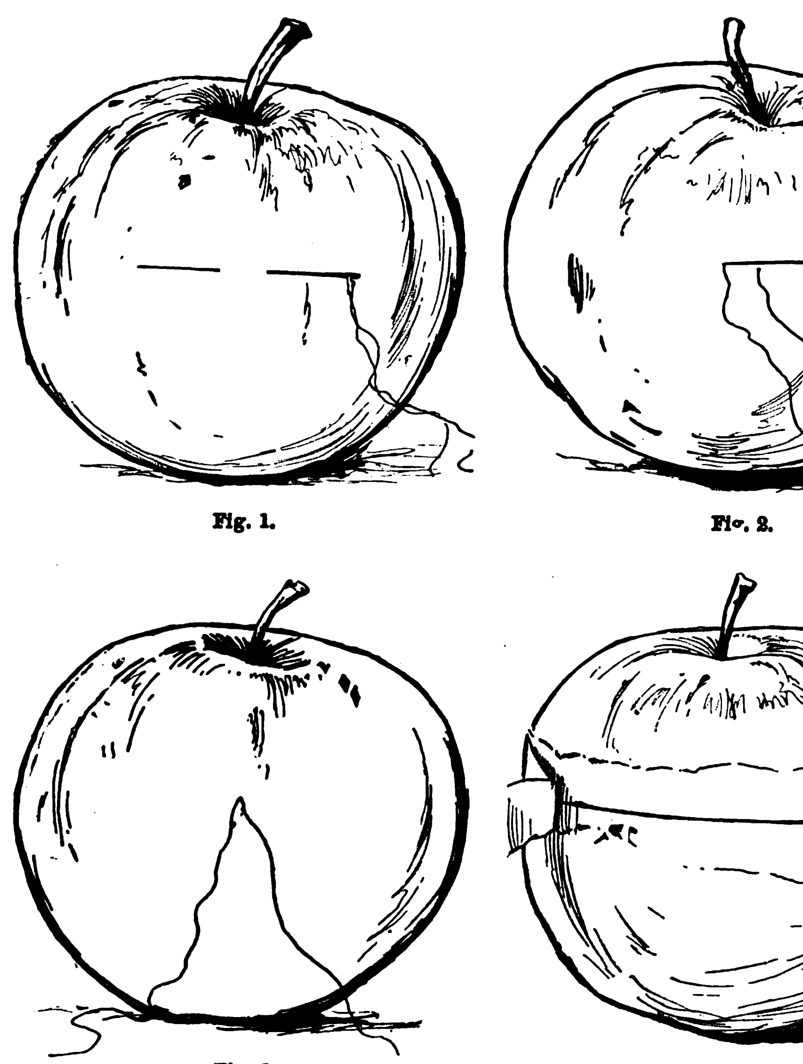


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

CUTTING AN APPLE WITH A THREAD.

The Cincinnati's Engine Trial.

The dock trial of the engines of the new cruiser Cincinnati took place June 12, at the Brooklyn navy yard, under the charge of Chief Engineer Ayres, who constructed the engines. The engines worked steadily and smoothly, although of course a high speed cannot be attempted in a dock trial. The Cincinnati's official trial trip will take place about July 1, and will be an interesting event, as the Cincinnati is the first vessel of the new navy which the government has brought to completion. If she proves successful, the government will, no doubt, build many of the naval vessels in future.

The Cincinnati is a protected cruiser of 3,180 tons displacement, is 305 feet long, 42 feet beam, and has a mean draught of 18 feet. Her engines are triple expansion, four cylinder engines, which develop 10,000 horse power. It is thought the cruiser will make a trifle over 20 knots per hour on her official trial. The main battery consists of one 6-inch and ten 5-inch rapid-fire guns. The secondary battery is composed of Driggs-Schroeder 1-pounders and 6-pounders.

Liquid Chlorine.

BY A. G. BLOXAM.

The critical temperature of chlorine gas,* or the temperature below which it must be cooled before it can be liquefied by pressure, is about 33° C., so that this gas may be counted among those which are easily converted into liquids. Faraday first produced liquid chlorine, and described its color as dark greenish-yellow; its specific gravity was afterward determined to be 1·33, and its boiling point 33·6° C.

It is very probable, however, that Faraday little dreamed of liquid chlorine as an article of commerce to be bought and sold by the hundredweight. He would, we imagine, have been rather hard put to it to suggest a material for the condensing pump and reservoir; though in respect to his memory be it said that a very few experiments could not have failed to furnish him with a solution to the problem.

The difficulties attending the production of chlorine, and the impossibility of transmittting it in the gaseous state, have combined to render chloride of lime in this country, and chloride of soda (*eau de javel*) in France, the only forms in which this indispensable bleaching agent can be put upon the market. When it is remembered that chloride of lime at its best does not contain more than 38 per cent of "available chlorine," the advantage to be obtained in the matter of freight by transporting pure liquid chlorine instead of bleaching powder will be apparent. The actual manufacture of liquid chlorine is now being undertaken by a firm of alkali makers at Salindres, the process being conducted as follows, according to M. Fribourg:

The condensing pump is provided with a piston of sulphuric acid, as being the packing best fitted to withstand the attack of the chlorine. To render such a piston effective, a pump of peculiar construction is of course essential. This takes the form of a U-shaped tube of cast iron, lined with lead. The limb of this tube which is to receive the chlorine is partly filled with strong sulphuric acid, while the other limb contains petroleum oil, and is provided with an ordinary piston. The upstroke of the piston raises the petroleum, lowers the sulphuric acid, and allows the chlorine to flow into the vacuum thus formed, through a side tube provided with a leaden (?) valve; the downstroke compresses the chlorine through another pipe into the refrigerated receiver, re-entry into the generator being prevented by the leaden valve.

Such is the somewhat bald information concerning the compressing machinery, with which we have at present to remain satisfied. The receivers in which the liquid is transported are wrought iron or steel cylinders, the necks of which are furnished with T-pieces carrying two bronze valves, the one connected with a tube reaching to the bottom of the receiver and destined to serve for withdrawing the liquid chlorine as such, the other serving for the withdrawal of gaseous chlorine. The cylinder weighs some 225 pounds, and is capable of containing 1 hundredweight of liquid chlorine, or nearly 525 cubic feet of the gas. The pressure in the cylinder is 10 atmospheres at 35° C., but they are tested up to 100 atmospheres. The anhydrous chlorine has no action on the iron, bronze, and lead fittings.

It is proposed to sell small cylinders containing 10 pounds of liquid chlorine for experimental use, so that the chemist may look forward to a day in the near future when his gas-generating flask shall be shelved once and for all, and his oxygen, hydrogen, nitrogen, carbonic acid, sulphurous acid, ammonia, chlorine, and sulphureted hydrogen be at hand, each in its steel or glass cylinder.—*Knowledge.*

A Great Locomotive.

A mogul locomotive recently built for the Delaware, Susquehanna & Schuylkill Railroad by the Baldwin Locomotive Works is the largest engine of this type ever built, its total weight in working order being 151,000 pounds, and the boiler being 72 inches in diameter. It is a simple engine, with cylinders 22 inches in diameter and 26 inches stroke. The six driving wheels are 62 inches in diameter, the driving wheel base being 14 feet, the total wheel base 22 feet 5 inches, and the total wheel base of both the engine and tender being 50 feet. This engine weighs 76 net tons in working order.

* The article by M. Fribourg on Liquid Chlorine, from which the facts in this article are taken, appeared in a June number of *Bulletin Soc. Chim.*

Sea Power.

The following extracts are from Captain Mahan's famous book, "The Influence of Sea Power:"

"Either our government must destroy the English monarchy or must expect itself to be destroyed by the corruption and intrigue of those active islanders. The present moment offers us a fine game. Let us consecrate all our activity upon the navy, and destroy England. That done, Europe is at our feet." Thus did Bonaparte demonstrate that the scene of strife was to be transferred to the sea.

In the relations of India to Great Britain, Bonaparte, in common with all Frenchmen of his age, mistook effect for cause. The possession of India and of other colonies was to them the cause of British prosperity, just as at a later time, and now, the wide extent of British commerce has seemed to many the cause of Great Britain's wealth and eminence among the nations. That there is truth in this view is not to be denied; but it is the kind of truth compatible with putting the cart before the horse, mistaking the fruit for the tree, the flower for the plant. There was less excuse for a blunder of this kind in a quick-witted nation like the French, for they had before their eyes the fact that they had long owned some of the richest colonies in the world; and yet the British had, upon their own ground, amid all disadvantages of position, absorbed the commerce of the West Indies, French as well as Spanish. In local advantages Great Britain in the West Indies had not the tenth of what France and Spain had; yet she so drank the wealth of the region that one-fourth of her envied commerce then depended upon it. So in India; Great Britain sucked the wealth of India, because of the energy and commercial genius of her people.

A humiliating peace with England alone saved the Dutch from ruin. This sorrowful result shows the weakness of a country depending wholly upon sources external to itself for the part it is playing in the world. With large deductions, owing to differences of conditions which need not here be spoken of, the case of Holland then has strong points of resemblance to that of Great Britain now, and they are true prophets, though they seem to be having small honor in their own country, who warn her that the continuance of her prosperity at home depends primarily upon maintaining her power abroad. Men may be discontented at the lack of political privilege; they will be yet more uneasy if they come to lack bread.

The Irish Sea, separating the British Islands, rather resembles an estuary than an actual division; but history has shown the danger from it to the United Kingdom. In the days of Louis XIV., when the French navy nearly equaled the combined English and Dutch, the gravest complications existed in Ireland, which passed almost wholly under the control of the natives and the French, nevertheless the Irish Sea was rather a danger to the English—a weak point in their communications—than an advantage to the French. The latter did not venture their ships of the line in its narrow waters, and expeditions intending to land were directed upon the ocean ports in the south and west. At the supreme moment the great French fleet was sent upon the south coast of England, where it decisively defeated the allies, and at the same time twenty-five frigates were sent to St. George's Channel against the English communications. In the midst of a hostile people, the English army in Ireland was seriously imperiled, but was saved by the battle of the Boyne and the flight of James II. This movement against the enemy's communications was strictly strategic, and would be just as dangerous to England now as in 1690.

The firm maintenance of her sea power, the haughty determination to make it felt, the wise state of preparation in which its military element was kept, were yet more due to that feature of her political institutions which practcally gave the government, during the period in question, into the hands of a class—a landed aristocracy. Such a class, whatever its defects otherwise, readily takes up and carries on a sound political tradition, is naturally proud of its country's glory, and comparatively insensible to the sufferings of the community by which that glory is maintained. It readily lays on the pecuniary burden necessary for preparation and for endurance of war. Being as a body rich, it feels those burdens less. Since 1815, and especially in our own day, the government of England has passed very much more into the hands of the people at large. Whether her sea power will suffer therefrom remains to be seen. Its broad basis still remains in a great trade, large mechanical industries, and an extensive colonial system. Whether a democratic government will have the foresight, the keen sensitiveness to national position and credit, the willingness to insure its prosperity by adequate outpouring of money in times of peace, all which are necessary for military preparation, is yet an open question. Popular governments are not generally favorable to military expenditure, however necessary, and there are signs that England intends to drop behind.

The fact of England's unique and wonderful success as a great colonizing nation is too evident to be dwelt upon; and the reason for it appears to lie chiefly in two traits of the national character. The English colonist naturally and readily settles down in his new country, identifies his interest with it, and though keeping an affectionate remembrance of the home from which he came, has no restless eagerness to return. In the second place, the Englishman at once and instinctively seeks to develop the resources of the new country in the broadest sense.

A REGULATOR FOR HYDRAULIC STEAM PUMPS.

This regulator may be applied to any form of hydraulic steam pump, to control its speed and to stop the pump when the desired pressure is attained, the regulation of both speed and pressure being effected very smoothly and without excessive strains. The engraving shows the regulator in position in the steam pipe of an ordinary steam pump, the regulator being shown partly in section. The improvement has been patented by Mr. Thomas J. Davis, of Charlotte, N. C. In the valve casing of the regulator are transverse ports registering with ports grooved in the face of a slide piston valve, whose rod is screwed into a sliding crossbar connected to a plunger. The latter slides in a cylinder supported on an arm extending from the lower steam-controlling valve casing, the cylinder being connected with the water pumped under pressure. The cross bar is secured to guide rods secured at their outer ends to a yoke sliding on a pipe connected with the receptacle into which water is pumped under pressure, the yoke being normally pressed outward by a spring. The pressure of the spring normally holds collars on the guide rods against lugs on the sides of the cylinder, when the ports of the piston valve register with the ports of the valve casing, throwing the steam inlet wide open. The tension of the spring is regulated by nuts on the upper ends of the guide

DAVIS' REGULATOR FOR HYDRAULIC STEAM PUMPS.

rods, and the plunger is moved to gradually close the steam ports and overcome the resistance of the spring by the pressure of water in the cylinder, the transverse ports in the valve casing being closed when the required pressure is reached. At right angles to the slide piston valve is a rotary valve, cored out in the center and having radial ports registering with the transverse ports in the vertical valve casing and also with ports in a discharge outlet connected directly with the cylinder of the steam pump. The stern of the rotary valve has at its outer end a crank, connected by a lengthwise adjustable connecting rod or pitman with the sliding cross bar of the plunger, whereby the requisite port openings may be assured, the connecting rod being adjusted to give just the amount of opening for steam required.

An Enormous Cargo of Refrigerated Meat.

The steamship Perthshire, recently arrived in London, brought from Australia and New Zealand the largest cargo of refrigerated goods ever imported. The cargo consists of 70,000 carcasses of sheep, 9,000 haunches, 9,000 legs, about 550 tons of frozen beef, 750 cases of butter, 150 bags of bullocks' hearts, 150 bags of oxtails and kidneys, and 7 cases of oysters. The holds have sufficient capacity to have accommodated 12,000 more carcasses of sheep. The *Engineer* says: The shipment is an interesting one, as it is the first time that meat has been brought to this country from Australia or New Zealand by means of an ammonia machine, and the excellent quality of the goods, as certified by the consignees, is sufficient evidence of the success of the Linde machines by which the holds were cooled. Until recently only cold air machines were used in this trade. The ammonia machines occupy far less space and apply the cold in a much more efficient manner, besides greatly reducing the consumption of steam.

The plant on the Perthshire consists of two independent refrigerating machines on the Linde system, each machine consisting of compound ammonia compressor and an ammonia condenser combined on one bed plate with a compound steam engine. The refrigerators consist of a series of coils of wrought iron tube wound in long lengths without joint from end to end. There are upward of eight miles of wrought iron tubing in the installation. The air is circulated by means of fans, which draw the warmer air from the hold, pass it over the refrigerator coils, and return it to the hold through suitable trunks. It is claimed for this system that the air is delivered into the holds pure, dry, and free from snow or moisture. There are no pipes in the hold whatever. The active circulation of air thus insured enables the temperature to be kept extremely even; the variation between different parts of the hold does not exceed about 5 deg. Fah.

The Perthshire's refrigerating plant was specially designed for the transport of "chilled" cargo, *i. e.*, goods at a temperature above freezing point. The holds are quite free from brine pipes or other refrigerating surfaces, and there is a consequent absence of any snow, moisture, or drip, which renders the system peculiarly well adapted for preserving goods without freezing. It is claimed that the circulation of air carries off any foul air or smell that may be produced, and the rooms are kept perfectly sweet and fresh. An important feature of these machines is the system of compounding the ammonia compressors. This arrangement obviates the loss by clearance in the high pressure cylinder, so there is no falling off of duty from this cause when working with high temperature of cooling water, and also keeps the full condensing pressure off the gland. The loss of the refrigerating agent in this way is very much reduced, as can be gathered from the fact that after the machines were charged no ammonia was added on the way home, and the plant was working efficiently on arrival.

Women in Science.

In a lecture upon the subject of "Women in Science," delivered before the Cercle Saint Simon, February 24, 1894, Mr. A. Rebiere, a distinguished mathematician, spoke particularly of six female mathematicians and astronomers. The most ancient was Hypatia, of Alexandria, the daughter of Theo, who taught at the school of Alexandria. She was born in the year 375 A. D. She lectured publicly upon mathematics and philosophy properly so called, and wrote some treatises upon mathematics. She was widely celebrated for her beauty, her virtues and her great erudition, and people flocked from all parts of the then known world to listen to her teachings. She was assassinated in the year 415 A. D., during a religious revolution.

Passing from antiquity to the eighteenth century, Mr. Rebiere mentioned a female scientist less virtuous than Hypatia—the Marchioness du Chatelet, who was a mathematician, astronomer, and physicist. In her memoir upon fire, printed in the collections of the Academy of Sciences, she maintained that heat and light are due to the same cause. The other female mathematicians mentioned by Mr. Rebiere are Marie Agnesi, born at Milan in 1718; Sophie Germain, who at the end of the last century became the correspondent of the mathematician Montucha; Mary Somerville, born near Edinburgh in 1780, who was the friend of Laplace and devoted her entire life to the study of astronomy and the physical sciences; Sophie Kowalevski, who was born at Moscow in 1850, and whose labors upon the rings of Saturn have been completed by those of Miss Klumpke, of the Paris Observatory, who was recently made doctor of sciences.

Mr. Rebiere is to write a book upon this subject, and, as a prelude thereto, has published a pamphlet in which he mentions the names of still other female scientists. Without going back to legendary times, to Aglaonice, to Cleopatra, to Marie the Jewess, to Saint Catherine, to Lilivati and others, the following taken somewhat at random are the names of a few scientific women: The Abbess Herrade, in the twelfth century, wrote a cosmology, the "Hortus Deliciarum," which was burned at Strasburg; Saint Hildegarde (of the same century) summarized the sciences of the time in her "De Physica;" in the thirteenth century, Nontes Sabucco described the role of the liquor sanguinis and of the brain; in the fourteenth, Thiephaine Raguenel, wife of Duguesclin, "was well versed in the science of astronomy;" Eimart Muller, wife of Regiomonanus, aided him in his observations; Crous everywhere claimed the decimal system; Dumée defended the system of Copernicus; Cunitz calculated some astronomical tables called "Urania propitia;" Ardingheli published some works upon mathematics and the natural sciences; Bassi taught physics for thirty years at the University of Bologna; Lemire studied the quadrature of the circle; Merian, after traveling in Guiana, published an important work upon the insects of Surinam; Maria Mitchell and Madam Yvon Villarceau were well known astronomers; and the names of some of the contemporaries are Bignon, Bortnicker, Huggins, Clerke, Lagerdorf, Franklin, Liblois, Renooz, Bomer, Clemence, Royer and Prime.—*La Nature.*

THE RECENT TRIALS OF RAPID FIRING SIX POUNDER MACHINE GUNS.

(Continued from first page.)

discharged was a slight haze. Although not regularly in the competition, a record was taken for it. The following are the records obtained in the three principal trials:

Driggs-Schroeder—Number of rounds fired in one minute, 34; number of rounds fired in three minutes, 83; time to dismount and replace 2 minutes 4⅘ seconds.

Hotchkiss.—Number of rounds fired in one minute, 28; number of rounds fired in three minutes, 83; time to dismount and replace, 1 minute 37⅘ seconds.

Skoda Three-pounder—Number of rounds fired in one minute, 24; number of rounds fired in three minutes, 55; time to dismount and replace, 33⅘ seconds.

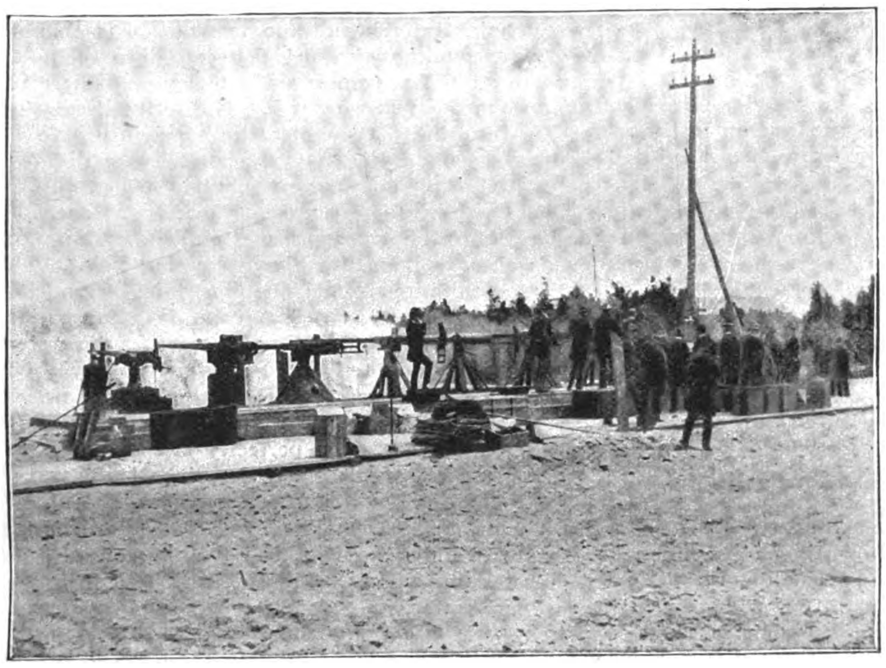
Sponsel—Number of rounds fired in one minute, 24; number of rounds fired in three minutes, 73.

Maxim-Nordenfelt—Number of rounds fired in one minute, 20; number of rounds fired in three minutes, 65; time to dismount and replace, 3 minutes 33⅘ seconds.

It will be noticed that the Maxim-Nordenfelt gun required a longer time to take apart and replace parts than did the others. This was due to the fact that one of the bolts became jammed, and a wrench had to be used to loosen it. In the 15 seconds' trial the Driggs-Schroeder fired nine shots, the Sponsel eight, the Hotchkiss six, the Maxim-Nordenfelt seven, and the Skoda eight. It is considered that the Driggs-Schroeder gun showed the best results in these trials, although in the tests of last November the Hotchkiss gun was awarded the palm of slight superiority over the Driggs-Schroeder. The Driggs-Schroeder gun is manufactured by the firm of Cramp Brothers, of Philadelphia, so that it represents a purely American manufacture.

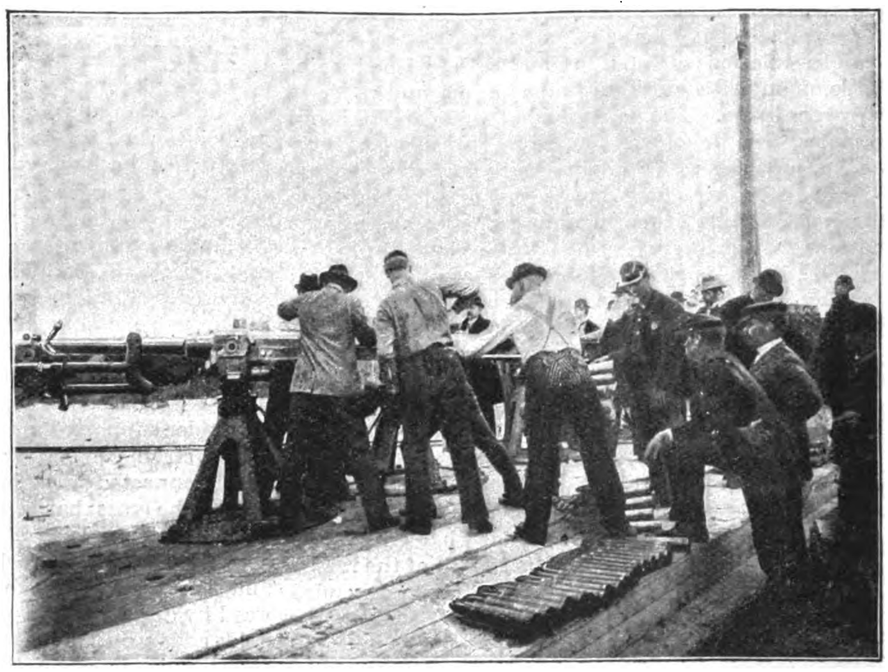
The Navy Department feels strongly that it is necessary to provide for quick replacement of any part of the breech mechanism of the machine guns. The readiness of doing this will, it is thought, be favored by uniformity. This does not necessarily mean that the entire navy will be restricted to a single kind of machine gun, but it is believed that each ship should be armed throughout with the same weapon. By carrying duplicate pieces, parts injured in action can be quickly replaced. This feeling explains the object of the dismounting or taking apart and replacement tests.

During the trial it was interesting to watch the rapid succession of splashes as the balls dropped into the ocean several thousand feet off shore, the spray rising many feet in the air.



Skoda—Hotchkiss—Sponsel—Maxim-Nordenfelt—Hotchkiss—Driggs-Schroeder.

VIEW OF THE GUNS ON TRIAL.



THE DRIGGS-SCHROEDER GUN FIRING 83 SHOTS IN 3 MINUTES.

THE Hoosac tunnel is four and three-fourths miles long.

TRIAL TRIP OF THE STEAMER PRISCILLA.

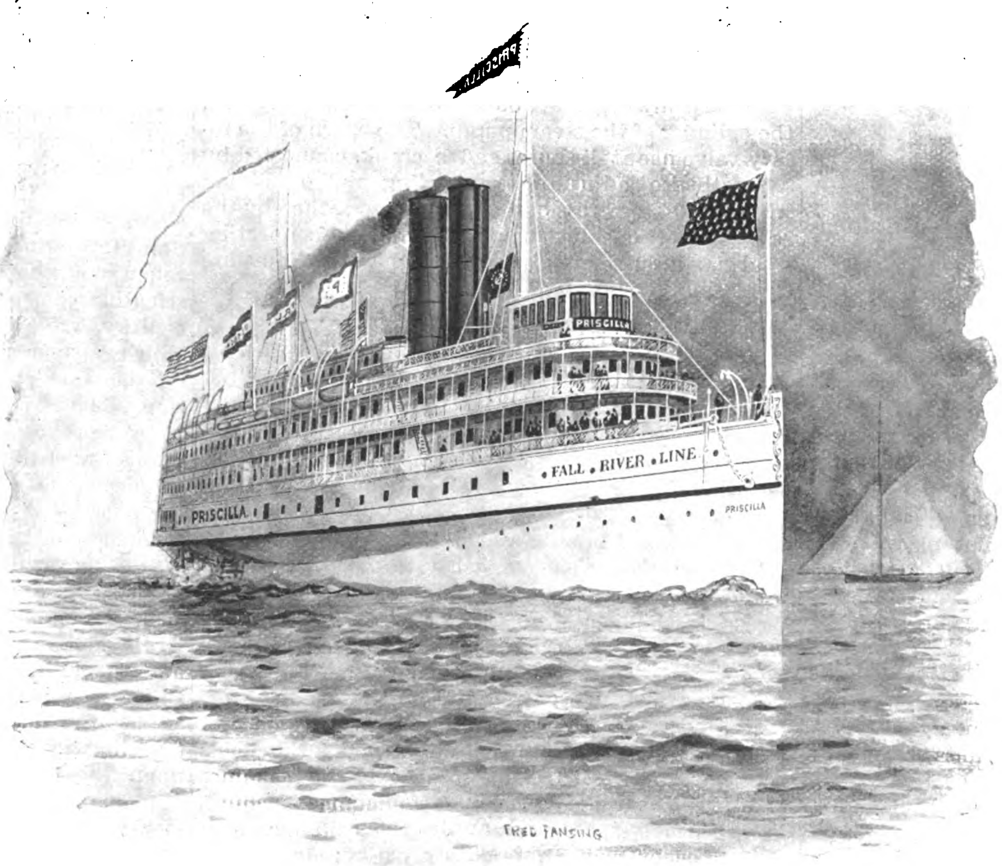
On June 21 the steamer Priscilla, the last addition to the Fall River line, and the largest steamer of her class ever built, took her trial trip on the Hudson River, down the bay of New York and around Scotland Lightship. On the evening of the same day a most brilliant reception was held on board her while she lay at her dock. The full effect of her electric lighting was brought out during the evening. A numerous company attended both functions. The dimensions of the boat are as follows:

Length over all	440 feet 6 inches.
Length on water line	423 " 6 "
Breadth over guards	93 "
Breadth of hull	52 " 6 "
Depth of hull, moulded	20 " 6 "
Draught of water, light	12 " 6 "
Registered tonnage	5,398

Thus she is 20 feet longer than her sister the Puritan, hitherto the largest river boat in the world. She is driven by double compound inclined engines, somewhat similar to those of the Plymouth, except that there are four cylinders, of which two are high pressure and two are low pressure. Each high pressure cylinder is 51 inches in diameter, and each low pressure cylinder is 95 inches in diameter, and the stroke of piston is 11 feet. She has feathering paddle wheels 35 feet in diameter and 14 feet face. The boilers are of the Scotch type, 14 feet in diameter, built for a working pressure of 150 pounds per square inch. They can be worked by natural or forced draught. The boat is built of steel; has a double hull, with six bulkheads above the double bottom, while between the two bottoms there are 56 watertight compartments. The vessel is very fully trussed throughout, the trussing being concealed in great measure by the joiner work. This construction is a very characteristic feature. Her capacity is rated at 1,500 passengers, and she can carry 800 tons of cargo. She cost $1,500,000. Her coal consumption is put at 50 tons of coal for the run of 181 miles between New York and Fall River. Her electric service is very complete, 45 miles of electric light wire being used in connecting the 1,900 electric lights required.

Her electric generating plant alone weighs 61,200 pounds. Her weekly laundry list adds up to 30,000 pieces. A walk of a mile and an eighth is required to pass through all her saloons and around her decks. For steam heating 3 miles of pipe are used, and 700,000 rivets were used in connecting 3,910,000 pounds of steel entering into the construction of her double hull. She has already shown remarkable results in speed, surpassing in this respect the Puritan's record, maintaining a rate of 25 revolutions of her wheel per minute, and running over 20 miles per hour.

For the cut of this remarkable triumph of marine architecture we are indebted to Mr. O. H. Taylor, of this city, General Passenger Agent. The contractors for the vessel and builders of the engines were the W. & A. Fletcher Company, of Hoboken, N. J. The plans and model were designed by Mr. George Peirce, Supervisor of Steamers of the Old Colony Steamboat Company.



THE NEW STEAMER PRISCILLA.

The Suez Canal Traffic.

Three thousand three hundred and forty-one ships, of 7,659,000 tons, passed through the Suez Canal in 1893, yielding sixty-eight millions in dues.

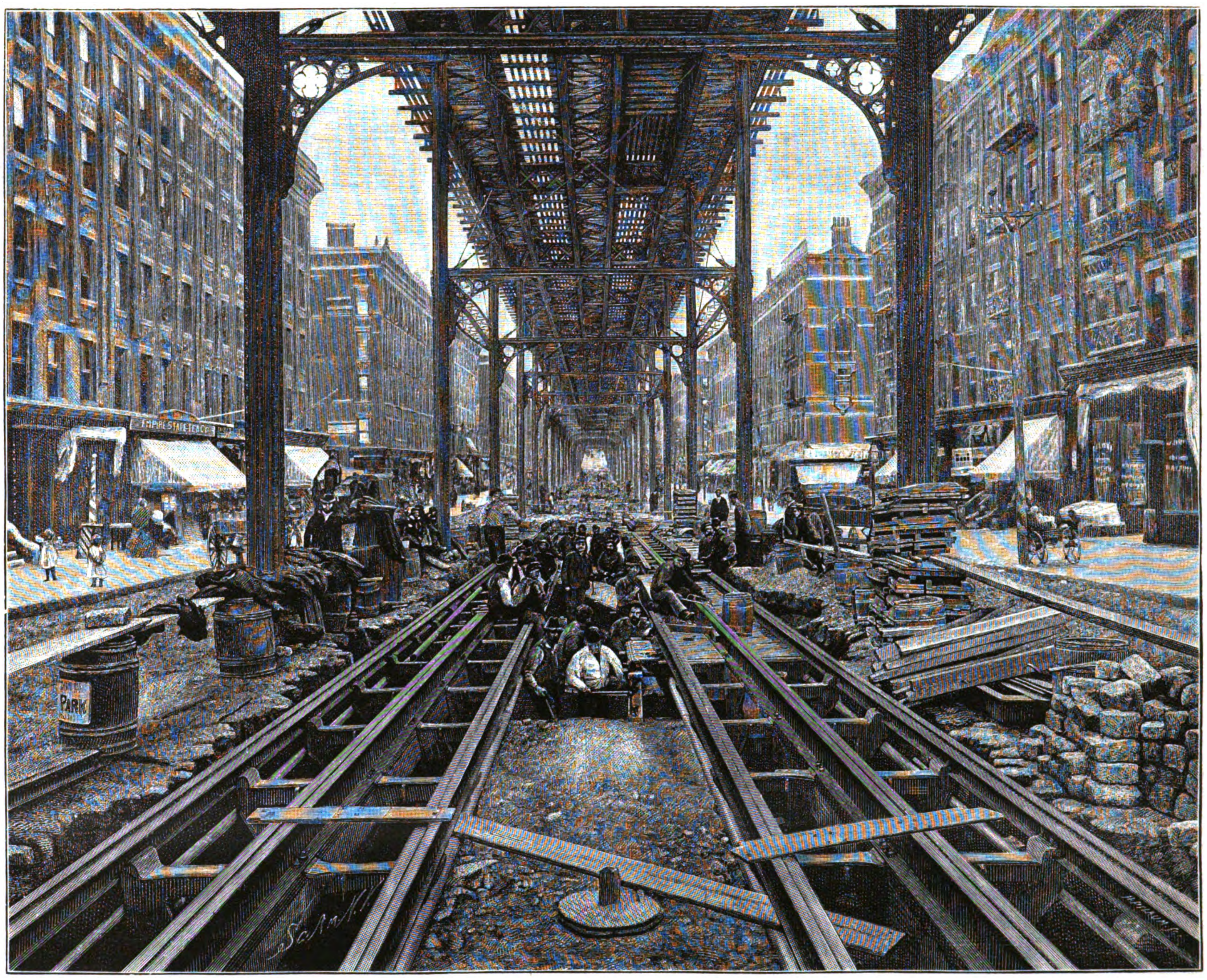
According to the report of the company about to be issued, passengers numbered 186,495, and yielded 1,864,000f., while sundry accessories yielded 384,000f., making a total of seventy-one millions. Three thousand and eighty-two of the ships, or 92¼ per cent, passed through by night. The average duration of transit was 20 hours 44 minutes; of actual motion, 16 hours 53 minutes. There were 9 petroleum vessels. As to the nationality of the vessels, the English were 2,405, German 272, French 190, Dutch 178, Austro-Hungarian 71, Italian 67, Norwegian 50, Ottoman 34, Spanish 29, Russian 24, Portuguese 10, Egyptian 5, American 3, Belgian 1, Brazilian 1, Japanese 1.

THE EXTENSIONS OF THE METROPOLITAN TRACTION COMPANY, OF NEW YORK CITY.

We illustrate what is really a striking scene in the development of street transit in the city of New York. It represents the last act in the conversion of a roadway originally constructed for horse-drawn vehicles into a double-storied avenue, in which two forms of mechanical car traction are used. The view is taken at 9th Avenue, near 98th Street, and shows the construction of the new cable conduits and tracks of the Metropolitan Traction Company, of this city. The company at present operates the cable line extending from the Battery through Broadway and 7th Avenue to 59th Street, to whose operations we have already devoted considerable space. The new cable line whose construction we illustrate starts from 7th Avenue at 53d Street. Through this street it passes under the tracks of the elevated road, reaching 9th Avenue, where it turns to the north and, still keeping under the tracks of the elevated structure, reaches 98th Street. It is to be run by cable from the 50th Street power station of the Metropolitan Traction Company.

The Broadway line at present in operation represents 56,000 feet of single track. Measured in the same way, the new 9th Avenue line gives 30,000 more feet. This is not the only new cable line whose construction is in progress. Starting from Broadway and 23d Street, another line is now being constructed to Lexington Avenue on the same street, and then north to 72d Street, giving 30,000 more feet of track. The two cable lines are to stop for the present at 72d Street and at 98th Street respectively, but they are manifestly an incomplete solution of the transit question, so the following extensions and connections are in prospect. It is proposed to carry the Lexington Avenue line straight up to the Harlem River; the 9th Avenue line is to be extended north, and probably at 109th Street is to run into 8th Avenue and thence north to about 116th Street. Here it is to divide, one portion running east and north to where Lenox Avenue meets the Harlem River, while the other branch is to go up St. Nicholas Avenue and Kingsbridge Road to Kingsbridge, almost the extreme northerly point of Manhattan Island. But the most interesting point is in another aspect, for it is hoped to run all the lines north of 77th Street and Lexington Avenue and 98th Street and 9th Avenue by electricity, an underground trolley system being employed. The cable system of traction is recognized as a very efficient one, increasing in efficiency as the number of cars driven at once increases, but it has several attendant disadvantages. A car cannot drop the cable on a curve. Where few cars are run the expense per car materially increases. The cost of maintenance for keeping the plant in order, the wheels oiled and the general apparatus in condition is very great. In electricity, many of these disadvantages are, to a great extent, overcome, and the result of the Metropolitan Traction Company's experiments in the direction of developing electric traction by underground conduit system will be watched with great interest.

We have alluded to the new character of a two-storied system as suggested by the scene illustrated, for virtually the center portion of the street is abandoned to the two railroads. Whether an underground road, on the lines of the London Underground, will yet make its appearance is a matter of surmise. If so, and if it should be built on a street occupied as is the one we illustrate, then we should have a three-storied street. It is to be hoped that our rapid transit problem may be solved without recourse to a method which has proved in many ways so disagreeable as has the London Underground. An electrical underground road would be free from most of the troubles in the way of discomfort which are encountered on the English road.



SCENE ON NINTH AVENUE, NEW YORK—EXTENDING THE CABLE ROAD.

The Vanity of Great Men.

It is unquestionable that many of the most celebrated men have been absurdly and foolishly vain, but before any one concludes that vanity is either a part or an incident of greatness it ought to be remembered that no man, great or small, is a fixed quantity, to be counted upon at all times as the same. No man is the same from year to year, from month to month, or from day to day. The processes of thought, the moods of the mind, are as swift as the flash of light, and doubtless one man who lives through a long life experiences all the moods of which any man of his level of cultivation has ever been capable. Instead of being true that the vanity of great men makes them great, or that they do their best in the mood of vanity, it is probably true that in doing their really great work they are not vain at all, or even self-conscious at all. It is only as they look back upon it that it inflates some of them with pride, which often shows itself in vanity. "Gods!" said Dean Swift, smiting his hand on the table as he read over one of his own productions, "what a genius I had when I wrote that!" This was vanity, no doubt. And it was vanity in Ruskin which made him say: "With Carlyle I stand, we two alone now in England, for God and the Queen." But does this justify any one in saying, as M. Du Clos does in concluding a series of interesting anecdotes on the vanity of great men, that "as people are usually taken at their own estimate, self-appreciation should not be condemned"?

It seems rather true as a fact of the physiology of the mind that uncontrollable vanity is a sure symptom of the onset of insanity. All great men are brave in initiative, but the courage which enables them to succeed where others dare not even attempt is never so potent as when it leads to entire self-forgetfulness. When Napoleon concluded himself a demigod, when he began to stuff his stomach instead of exercising his brain, as he had done, he became unable to keep awake when he most needed to be wary, and having reached this stage, he was already far along on the road to Waterloo. And both Ruskin and Swift were far along toward the madhouse when it was no longer possible for them to master their vanity and hold it in the same subjection in which they were holding it while they were doing the work which made them celebrated. Great intellectual effort requires high nervous tension. It is ability to stand this tension which makes greatness, and the vanity of greatness is merely the symptom of reaction—of breaking down, of the insanity which is the result of nervous tension uncontrolled by will. The lunatic asylums are full of people whose symptoms are identical with what some have mistaken for indications of greatness.—*St. Louis Republic.*

Color Blindness.

A course of lectures at the Royal Institution which has created much interest is that by Captain Abney, on color blindness. Excessive tobacco smoking has long been known to be an important factor in color blindness, and Captain Abney indorses the truth of this observation. Woman, says the *Photo. News*, has always been credited with a better appreciation of color than man, and she may now take warning against any temptation to indulge in nicotine, either first hand, in the form of cigarettes, or second hand, in the use of railway carriages labeled "smoking."

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

STATION INDICATOR.—Artemas Baker, Lancaster, Texas. This is an automatic apparatus, operated by a moving car, in which a map is employed, and moved in such a way that the various points at which the car stops will be correctly indicated. The map is held in a rigid slidable frame, and may have on it a variety of information, such as advertising, etc., besides the principal places on the route, which are successively marked out by a pointer or indicator operated by the motion of the train.

Electrical.

LIGHT FOR MAGIC LANTERNS.—Charles Beseler, Jersey City, N. J. This inventor has designed an arc light of simple and durable construction, whereby the operator may conveniently and accurately adjust the light relative to the condenser of a magic lantern to produce the best results on the screen. The carbons are supported by a vertically sliding casing, one arm of which is engaged by a bell crank lever, and means are provided for giving a swinging motion to the bell crank lever to raise or lower the casing. The contact point between the carbons may be moved nearer to or farther from the condenser as required.

Miscellaneous.

GLUE MAKING.—Peter Cooper Hewitt, New York City. This inventor has devised a process and constructed a simple and efficient machine for cooling glue and forming it into sheets, also forming a thick sheet by manifolding, thus effecting a saving of time. The invention consists in the combination of two or more hollow, water-cooled cylinders, geared to revolve at about the same peripheral speed in the same direction, the cylinders rotating near each other, but not in actual contact, to prevent the liquor from running between the cylinders and to render them self-cleaning. An endless belt of cords or netting or similar devices is also provided, or nets stretched on frames and carried by conveyers, for conveying away the sheets as they are formed.

FIGURE PUNCH FOR CHECKS, ETC.—James B. Backus, New York City. This invention is in the nature of a hand punch for cutting figures in checks and other papers, to prevent them from being raised or otherwise altered. The improvement relates to punches in which a revolving cylinder has a circular series of punches and dies to be successively brought into position between the jaws, to operate any one of the punches upon the paper, and the invention is designed to simplify and cheapen this form of punch, while insuring its more exact and certain operation.

LIME KILN.—James O'Connell, New York City, and George Sniffin, Tuckahoe, N. Y. According to this invention the boiler usually employed for generating steam to supply the burners within the kiln may be located within the arch of the kiln, or a boiler may be located within each arch of the kiln if desired, the boiler being so constructed that a damper may be used in connection with it to regulate the quantity of heat supplied to the boiler. It is also provided that when the outer openings of the arches are closed, air may be supplied in proper quantities to the burners. Wood may be burned in the kiln while the boilers are in position, and the draught can be created through the center of the kiln by the steam from the boiler.

MECHANICAL MOVEMENT.—Robert Sterling, Hartington, Neb. A heavy rolling wheel is, according to this invention, actuated by a lever pivoted eccentrically on the wheel, causing the wheel to roll back and forth on a bed curved at its ends, in which are spiral springs held in recesses, the rebound of the springs tending to start the wheel on its return movement. Pivoted levers extend up through slots in the bed, and the levers are connected with driving rods adapted to be reciprocated as the rolling wheel strikes and depresses the upper ends of the levers.

EAVES TROUGH HANGER.—Frank E. Albro, Mayville, N. Y. This device consists of a carrying section and a locking section, the carrying section made in one piece, and having a shank adapted for convenient attachment to the eaves, while the locking section consists of a bar to be attached to a horizontal member of the carrying section. The hanger is designed to be readily attached and securely locked to an eaves trough in such a way as will prevent the weight of the trough and whatever may be carried by it from displacing the hanger.

WINDOW.—Clement Ajello, New York City. This is an improvement in windows in which the sashes are pivoted to sliding bars, and thus adapted to be lowered and tilted into such position that they may be conveniently cleaned. Each sash is held in vertical position by ordinary catch pins, and each sash also has the usual sash cords connected with weights, but the cords, instead of being attached directly to the sash, are attached to the side bars, so that the sash and bars move together.

ROAD PAVEMENT.—George R. Bowen, San Antonio, Texas. This inventor has devised a roadbed consisting of metallic cellulated plates forming a rigid base, loose, fragmentary material filling the cells and covering the plate, and the walls of the cells maintaining the fragmentary material in place without cement or the like. The area of the bed pieces is preferably about two feet by six feet, and the cavities in the upper surface about one inch and a half square and half an inch thick each.

COMPOSITION OF MATTER.—Joseph Matthews, Brunswick, Ga. This is a paint or paste for the preservation of wood of any kind, including pilings in water, mud or sand, ships' bottoms, etc., preventing decay or rot and the ravages of insects. It is made of coal tar, resin, pine tar, camphor gum, sulphur, tallow, carbolic acid, arsenic, phosphorus, borax, and a number of other ingredients, compounded and applied in a manner described.

LADDER.—Frank B. Mallory, Flemington, N. J. This is an improvement in ladders used in stores, where a ladder is suspended from an overhead track by guide devices, the lower end of the ladder resting upon wheels on the floor. An endless chain extends longitudinally at the side of the ladder, over wheels near the top and bottom, and the lower one of the chain wheels has a driving connection with the running wheels at the bottom of the ladder, the arrangement being such that the weight of the occupant of the ladder is made to assist in propelling the ladder.

SNAP HOOK.—Joseph Pickett, New Hope, Pa. The body of this hook is of the usual shape, and it is designed to be in construction very simple, durable and inexpensive, while it is provided with novel means for increasing or decreasing the tension of the spring when occasion may demand.

SKATE.—Luke W. Kenney, New York City. This is an improvement on a formerly patented invention of the same inventor in ankle supports for skates, and in devices for attaching the supports to the skates. The yoke of the ankle support is below the instep, and does not interfere with the heel of the shoe, the support not interfering with the free movement of the skate in direction of its ends, but preventing side movement of the ankle, which it braces and strengthens.

FLEXIBLE SUPPORT FOR UMBRELLAS, ETC.—William J. Yapp, London, England. This improvement relates especially to means of supporting an umbrella or sunshade as an awning above an outdoor seat, etc., and the standard is of flexible metallic tubing made of spirally coiled interlocking strip, the ends fitted with plugs and clamping devices, while a stiffening wire in the standard has its ends held in slots in the inner ends of the plugs. The flexibility of the standard enables the position of the umbrella to be readily adjusted by bending the standard.

PLUME FASTENER FOR HELMETS.—Lynn A. Hayes, Bolivar, Mo., deceased—Margaret C. Hayes, administratrix. This device comprises a socket frame with a shoulder at its upper end and a depending screw shank at its lower end, a washer, a nut on the shank, and a plume rod provided with a head having a spring catch for engaging the shoulder of the socket frame. The device is very simple and inexpensive, and facilitates the convenient attaching of the plume to the helmet or detaching it therefrom.

LOCK.—William W. Davis, New York City. Instead of the ordinary projecting slide bolt, liable to catch with its sharp edges or corners on the clothing or hands of those passing by, this lock is so constructed that the door and frame will be substantially smooth and without projections, the mechanism being also so devised that the door may be readily operated by precisely the same motions as are customarily used with the ordinary knob and mechanism.

REEL.—Charles C. Partridge, Hyde Park, Mass. This reel consists of a rod on which are spaced disks, and handles consisting of loose sleeves on the rod outside of the disks, the sleeves having a longitudinal movement on the rod to form brakes. The device is very simple, and may be used as a string holder in flying kites or for fishing purposes, etc.

COOKING STOVE.—Rebecca H. Hayes, Galveston, Texas. To economize the heat of an ordinary charcoal furnace, and extend its range of use, decreasing also the escape of poisonous gases, are the primary objects of this invention. The furnace is provided with upwardly extending knobs, and the heating top has a removable top plate, with an opening in its bottom to receive and a flange to encircle the top of the furnace, the flange allowing the knobs in the top of the furnace to extend up into the heating top, and be adapted to support a vessel.

BOAT BALLASTING DEVICE.—James P. Pool, Brooklyn, N. Y. According to this invention a weighted ballast boom is connected with the sails of the boat and projected over one side, to be moved toward the windward as the sail moves or fills leeward. The weighted ballast boom is designed to be quickly and automatically shifted to prevent the vessel careening from its natural or upright position under almost any condition of wind or wave motion.

BOAT PROPELLING MECHANISM.—Charles P. Dieco, Owensborough, Ky. This is an improvement in mechanism in which hinged and vibrating paddles are operated by means of cranks and hand levers, the improvement consisting in the construction of the bar which connects the inner ends of the crank rods to which the paddles are attached, and in the employment of detachable handles at the ends of the bar.

HOOK AND EYE.—Joseph F. Schoeppl, Pittsburg, Pa. This device has a body portion from which project separate wings at an angle, each wing having shoulders extending on opposite sides of the connection to the body portion, so that when the wings have been inserted into the material, together with the wings extending beyond the body portion, it is practically impossible to withdraw the hook and eye by a drawing strain. It is designed to be attached to the garment without stitching if desired.

Designs.

SHOE.—Stephen W. West, New York City. This shoe may be of any desired style, but its side opening is well back to the back seam, and is vertical nearly to the back quarter, when it extends forward at a sharp angle.

LENS FOR VAULT LIGHTS.—Philip Schwickart, Brooklyn, N. Y. This lens has a rounded off protuberance in the center of its arched top.

BUCKLE.—George M. Aylesworth, Collingwood, Canada. The sides of this buckle present essentially ogee figures, and are joined by a series of transverse bars, the center one of which has oppositely disposed pins or teeth.

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.

ILLUSTRATED CATALOGUE AND PRICE LIST OF THE BOSTON GEAR WORKS. Boston, Mass. Illustrated. Pp. 42.

While only a trade catalogue, this little work contains so many tables and really valuable illustrations that it is of interest to all mechanics. The information is contained partly in descriptive text, partly in tables, and the cuts by themselves are very suggestive. Without flattery we may say that the catalogue, at least from the point of view of general utility, excels most of its brethren. It is very well printed and the cuts are good. It contains no alphabetical index, but a good table of contents supplies this deficiency.

ONE THOUSAND HELPFUL HINTS AND VALUABLE SUGGESTIONS FOR BOOKKEEPERS AND BUSINESS MEN. Detroit, Mich.: The Bookkeeper Publishing Co. Pp. 103. Price $1.

This book, of octavo size, has room enough to contain a quantity of excellent and practical points for business men. Such are tables of interest laws and computation of interest, of statutes of limitations, examples of amusing arithmetic (really of excellent practice), notes on how to make change quickly, on short cuts in computations, points in business law, and methods of privately marking prices on goods. These are given as sample topics and show how practical the work is. The matter is extracted from a journal called "The Bookkeeper."

ART OF COPPERSMITHING. A practical treatise on working sheet copper into all forms. By John Fuller, Sr. New York: David Williams. 1894. Pp. vii, 317. Price $3.

This excellent contribution to technical art should meet a warm reception. Nothing in mechanics is more interesting than coppersmithing, in which the ductile sheet is brought into all conceivable shapes. It would seem that for amateurs a most attractive field of work, more useful and fully as decorative as repousse work, could be found in practicing the art described in this volume. It is liberally illustrated and indexed.

POPULAR LECTURES AND ADDRESSES. By Sir William Thomson (Baron Kelvin). In three volumes. Vol. II. Geology and General Physics. London and New York: Macmillan & Co. 1894. Pp. x, 599. Price $2.

We have before this had to notice the first volume of this series. In the present, the second volume, we have Sir William Thomson's popular work in geology and general physics as embodied in British Association addresses and other papers of the more popular type. All we need say of it is that to those interested in advanced science, as well as to the general reader, the work is simply indispensable and one that must be read.

A HANDBOOK OF GOLD MILLING. By Henry Louis. London and New York: Macmillan & Co. 1894. Pp. xiv, 504. Price $3.25.

The abstraction of gold from its ores by recent methods is here treated at length. All the parts of the different apparatus required for treatment of its ores are given and illustrated very clearly. A portion of the work is devoted to the statistics of the subject, in proving its profit and loss, etc. The work should meet with a large circle of readers.

THE PSYCHIC LIFE OF MICRO-ORGANISMS. A study in experimental psychology. By Alfred Binet. Authorized translation. Pp. xii, 121. Price 75 c. cloth, 25 c. paper. No index.

This very compact little work, devoted to the rather difficult topic of the soul life of bacteria, their nutrition and other functions, will doubtless be welcomed by biologists. It is illustrated and its want of an index is compensated for by a very full contents.

THE USES OF COMPRESSED AIR. By Addison C. Rand. New York: The Republic Press. 1894. Pp. iv, 134. Price $1.

The name of Rand is honorably identified with applications of compressed air in civil engineering processes. In this little volume the subject is quite exhaustively treated, all the way from tunneling and drilling to pumps, railway appliances, guns, aeration and atomizer to the direct application of air proper. It is illustrated very liberally, and possesses an excellent contents and a satisfactory index.

ABOUT MUSHROOMS. A guide to the study of esculent and poisonous fungi. By Julius A. Palmer, Jr. Boston: Lee & Shepard. 1894. Pp. xiv, 100. Price $2.

The excellently written book is devoted to what to its votaries is a fascinating subject. It is written entirely in the popular sense and is largely made up of selections from the *Evening Transcript* and other papers. There are so many edible mushrooms that it seems a pity that the science is not understood, while the fatal accidents that have happened within a year shows the prevailing ignorance of the subject. The author's example of poisoning from the simple inhalation of the odor of amanita is very impressive. He publishes also an ingenious scheme of the edibility of fungi, by which one may arrive at a probable conclusion as to the quality of a mushroom. An excellent index adds to the value of the book.

AN INTRODUCTION TO THE STUDY OF METALLURGY. By W. C. Roberts-Austen. Third edition, revised and enlarged. One of a series of treatises written by associates of the Royal School of Mines. London: Charles Griffin & Co., Limited. 1894. Pp. xvi, 379. Price $4.

Professor Austen's fascinating lectures on alloys are well known to the readers of our SUPPLEMENT. Our highest commendation of this work is to say throughout it bears the mark of the same hand to which the lectures on alloys are due. Especially interesting are his notes on cold welding and the flow of solid metals. This volume, like the preceding, is one of a series which will go to fill up what has been rather a void in technical literature.

THE DAWN OF A NEW ERA IN AMERICA. By Bushrod W. James. Philadelphia: Porter & Coates. 1894. Pp. 135. Price $1. No index.

This little work deals with such topics as the commercial question in America, our coast defenses, and the immigration question. It is a plea throughout for a more advanced treatment of these questions, and the writer seems remarkably free from the "isms" of the day, to which he devotes a chapter.

A JOURNEY IN OTHER WORLDS. A romance of the future. By John Jacob Astor. New York: D. Appleton & Company. 1894. Pp. vii, 476. Price $1.50. No index.

Mr. Astor's contribution to literature indicates a study of the works of Jules Verne, Bellamy and their predecessors. It is very elegantly illustrated and attractively printed. We have no doubt it will be read with interest by a very large *clientele*. There is really so much in the book that it cannot be editorially reviewed in our columns. The sketch of the world A. D. 2000, with the applications of bacteriology and electricity, is very suggestive. The encounter with the dinosaurs and other animals extinct on this planet, but found in other planets, is excellently described.

COMMON SENSE CURRENCY. A practical treatise on money in its relations to national wealth and prosperity. By John Phin. The Industrial Publication Company. 1894. Pp. 244. Price $1. No index.

Mr. Phin, hitherto well known through his publications on mechanics, here appears as the advocate of what he terms common sense currency. His method of presenting the subject is decidedly attractive, whether one agrees with his views or not. The book as a subject of political economy treated from the common sense standard will be found good reading. The author is pronounced in favor of currency of fixed value.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

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 general 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.

(6122) J. F. D. asks: At what velocity will air rush through an opening into a vacuum at following pressures: ¼ oz., ½ oz., ¾ oz., 1 oz., 1¼ oz., 1½ oz., 1¾ oz., and 2 oz. to the square inch? Supposing the opening to be large enough that the friction against the sides will affect it but a small proportion. Give the central velocity. A. The velocities of air at the mouth of nozzles of the best form for delivery is approximately as follows for the pressures named:

¼ ounce	43	feet per second.
½ "	61	" " "
¾ "	74	" " "
1 "	86	" " "
1½ "	105	" " "
2 "	122	" " "

(6123) J. A. asks if a rope is stronger after it has been spliced than it is before. A. A well spliced rope is strongest in the splice.

(6124) H. V. S.—The plant that you send for identification is one of the pepper grasses, *Lepidium campestre*, L. It is a weed naturalized from Europe.

(6125) W. W. V. writes: We have a dark metallic paint which we would like to make a red or lighter color by oxidizing. Could you suggest any process by which this result can be accomplished? A. We would suggest that you try the effect of roasting or "burning" your paint. This will tend to produce the desired effect.

(6126) S. R. says: How can I prepare a gallon of sea water?

A. Chloride of sodium	4	ounces.
Sulphate of soda	2	"
Chloride of calcium	¼	ounce.
Chloride of magnesium	1	"
Iodide of potassium	4	grains.
Bromide of potassium	2	"
Water	1	gallon.

A common substitute for sea water as a bath is made by dissolving 4 or 5 ounces of common salt in 1 gallon of water.

(6127) J. S. B. asks how to carbonize steel. I have a few bars of dead soft steel, about 18¼ inches long, which I wish to harden. A. The articles must pass through the case-hardening process, which we reprint from the "Scientific American Cyclopedia of Receipts, Notes and Queries," $5 by mail. 1. Pack the articles to be case-hardened in an iron box filled with bone-dust, or animal charcoal made of burnt leather. For small articles short pieces of gas pipe will do instead of an iron box. The ends must be stopped and luted with clay. The leather may be burnt in a pan or in stove, and it must be reduced to powder before being packed around the work. Heat the receptacle and the contained work red hot, in a furnace, for a length of time proportionate to the size and thickness of the articles. Thin articles will require to be kept at a red heat only a few minutes, while heavy articles may require half an hour or more. When sufficiently heated, quench the work as soon as possible in cold water. 2. Or use common prussiate of potash process.—Crush the potash to a powder, being careful that there are no lumps left in it, then heat the iron as hot as possible without causing it to scale; with a piece of rod iron, spoon shaped at the end, apply the prussiate of potash to the surface of the iron, rub it with the spoon end of the rod until it fuses and runs all over the article, which must then be placed in the fire again and slightly reheated, and then plunged into water, observing the rules given for immersing steel so as not to warp the article.

(6128) R. R. says: 1. Will you kindly tell me what is the method of making brass signs on which the letter is sunk in the metal? Is there not a method of eating the desired parts out with acid? And please state what acid will eat brass most readily. A. Etching Brass Signs.—Paint the sign with asphalt varnish, leaving the parts to be etched unpainted, raise a border around the outside, made of soft beeswax or asphalt, to hold the acid. Use nitric acid diluted with five times the quantity of water. Pour the dilute acid on to the sign about one-fourth inch deep. When the letters are cut deep enough, which must be found by trial, the acid may be poured off and the plate cleaned by heating and wiping and finally with turpentine. 2. Filling for same. A. Cement for Filling Signs.—Melt together in a clean iron pot 2 parts each of best asphaltum and gutta percha; stir well together, and then add 1 part of gum shellac in fine powder. It may be used hot and mixed with small, vermilion, or other pigment, if desired. 3. Is there a method by which designs and letters can be etched on glass by cutting the designs in a covering surface of wax and then using acid? A. To Etch Glass.—Use a ground composed of white wax, 30 parts; gum mastic, 15 parts; asphaltum, 15 parts; heat, mix, and apply. Cut away the ground where you wish the etched letters to be and pour on hydrofluoric acid, using a rubber pan. Do not inhale the fumes. When etched sufficiently, remove the acid with water and the ground with the aid of heat.

(6129) G. W. R. asks: 1. How many layers and what size wire on the primary coil F of induction coil, in connection with transmitter described in SUPPLEMENT, No. 250? Also how many layers in secondary coil E? A. Two layers No. 20. 2. How is the receiver connected into circuit (metallic) when transmitter is used in connection with receiver? Is it connected in multiple arc or series with the mains or secondary coil? A. It may be inserted anywhere in the line. It would be in series with the secondary wire. 3. Is a Law battery O.K. for primary for above? A. Yes. 4. In SUPPLEMENT, No. 163, you give sketch of Mr. Lyon's transmitter. Is it a fact that the transmitter, receiver, and induction coil, also battery, are all in series with one another, as shown in sketch? That is, I mean all in the primary circuit, and only the secondary in the metallic line wires; also please state if induction coil in my first question will answer for this latter transmitter? A. There is an error in the sketch. The receiver should be in the secondary circuit. 5. What size wire and how many turns are on the carbon disks? A. This is immaterial, probably 5 or 6 turns of No. 24. 6. And are the wires one continuous length, viz., from one binding post to other, or separate coils? A. The disks are separately connected with the binding posts. 7. Is the wire insulated or uninsulated? A. Uninsulated. 8. Am I allowed to build either of the above named transmitters for my own use? Say two or three for experimental purposes only. A. This question cannot be answered positively until the pending telephone litigation is settled.

(6130) Enquirer writes: 1. At what point in the relative positions of the armature coils and poles of the field magnet is the reversal and consequent change of polarity in the armature coils made? A. In general terms at points on the diameter at right angles to the line connecting the poles of the magnet. 2. Does the field magnet attract equally strong at all points of its surface? If so, I would suppose that as soon as the revolving coils passed the nearest edge of the field magnet, the magnet would tend by its attraction to retard the motion of the armature, and if the change of polarity in the coil was made before the coil had entirely passed the pole of the field, the repulsive action would also tend to retard the motion of the armature. A. The pull is strongest at the poles. It may in practice be the same over quite a large area. This, as you see, maintains the same polarity in the armature, so that the poles of the field constantly attract and repel the parts of the armature respectively back of the brushes.

(6131) O. S. asks: 1. Parkhurst's "Motor and Dynamo Building for Amateurs" states that in good practice there is 1·5 feet of active wire allowed for each volt on the drum armatures. Does this rule hold good for Gramme ring armatures? If not, what is the rule? A. This rule is empirical. You must provide for the cutting of 10^8 lines of force per second for each volt. 2. Could I run motor No. 641 on a circuit of about 10 volts if it is reduced from 52 volts? A. If your 52 volt circuit is alternating, you cannot use it for the motor. 3. How much resistance will a cylinder of loose powdered carbon give, which is ¼ inch thick and 15 inches long? A. It depends on the quality of the carbon and on the degree of compression it is subjected to. 4. How much zinc surface is required for each ampere, immersed in electropoion fluid? A. There is no exact figure. In the same battery it constantly varies. Sometimes 12 square inches is allowed for ½ ampere. 5. How much positive plate surface is necessary for each ampere hour in a storage battery? A. 24 square inches. 6. Will a big bicycle like the Columbia described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 163, give the same speed as a safety, if exactly the same amount of power is applied to both of them? A. It should give more if the tires are the same. In practice, owing to the human factors, the safety is far the faster.

(6132) G. H. T. writes: 1. Will you please inform me of the smallest battery that has the greatest E. M. F., and also how do you make it? A. Practically the bichromate batteries have the highest E. M. F. Size has nothing to do with it. 2. Can you use charcoal instead of coke in making carbon? A. Not to advantage. 3. What is the easiest, best, and quickest way of telling whether zinc is pure or not? A. Analysis, or incineration and weighing. 4. How do you make the film for sensitive plates? A. For gelatine plates, see our SUPPLEMENT, Nos. 299, 340, 374 and 541.

(6133) L. J. T. asks: 1. Does sulphureted hydrogen as prepared in chemical laboratories ever cause diphtheria? A. We never heard of such happening. 2. Are the gases usually met with in laboratories, and which must be inhaled more or less by those working in such places, injurious to health, if due care is taken to avoid them as much as possible? A. They seldom do any harm, although students are very careless. 3. I saw the statement in a paper (not scientific) that "even a cork, if lowered 200 feet below the surface of the water, will never rise to the top." Is this true? A. Possibly, owing to compression. There is a depth at which it will be so compressed as not to rise, but we cannot give the precise point. It is probably more than 200 feet.

(6134) C. K. asks: Does water exert a greater pressure in being converted into steam or in freezing? Is it possible to confine water so that it will not turn to steam, by the application of heat, or turn to ice at freezing temperature? A. Theoretically, steam pressure may be as high as "freezing pressure." Practically, the latter is far the higher. Water cannot be so confined as not to make steam. It probably can theoretically be so confined as not to make ice at any known limit of cold.

(6135) E. J. asks (1) for the smallest possible size of storage battery and lead plates to strap on safety bicycle, to light a six candle power lamp incandescent. I do not know the voltage of lamp. A. You will need five couples, each couple exposing 24 square inches of positive plate. 2. How to waterproof canvas, as I want to cover a shed, canvas to be stretched on top of boards. Would a couple of coats of paint make it waterproof? Size of shed 13 feet by 11½ feet. A. Wet the canvas after it is in position and paint it before it dries. Two coats of paint should suffice. Do not wet for second coat.

(6136) E. J. asks: 1. How many pounds pressure is required to break a bar of steel one square inch in section, also aluminum of the same size? Number of pounds to crush each of the above. Number of pounds to break each, when the pressure is placed in the center. At what temperature will zinc melt, also aluminum? How can mercury be evaporated, as in the process of making aluminum? A. Steel has a tensile strength varying from 60,000 to 150,000 pounds per square inch, ranging from the ordinary open hearth plate steel to the crucible tool steel. Its crushing strength also varies greatly through the different grades, from 60,000 to 250,000 pounds per square inch. The tensile strength of aluminum is from 26,000 to 27,000 pounds per square inch. It is quite a soft metal and its crushing strength is somewhat less than its tensile strength. The breaking strength of a bar bears a proportion to its tensile and crushing strength and can only be defined for specific sizes and lengths. Zinc melts at 680° Fah., aluminum at 1,200° Fah. Mercury is not used in the manufacture of aluminum.

(6137) W. S. writes: Please answer the following questions. 1. Would like to know the resistance of iron wire in ohms per pound, beginning from No. 12 to No. 36. A. Use a table of resistance of copper wire such as given in Sloane's "Arithmetic of Electricity," $1 by mail. Multiply the resistances of copper wire given therein by the coefficient for iron (same book, page 126), 6·0798. 2. Would like a recipe for alloying mercury with zinc for use in an electric battery. A. Add zinc to the mercury, keeping dilute sulphuric acid above the mercury. It is well to dip the zinc in acid first. Generally plates of zinc amalgamated with mercury are used in batteries. These are amalgamated by rubbing with a little mercury, while wet with dilute acid.

(6138) H. C. S. writes: I wish to charge a storage battery from the exciter of an alternating current dynamo. The storage battery is 2 volts capacity, 400 ampere hours, charging rate 20 amperes, and the exciter is 9½ amperes at 110 volts and supplies current to 500 light alternate. Can it be arranged so that the battery can be charged very slowly, taking say one-fifth the exciter current, leaving the balance for exciting the alternate? By putting a 4·8 ohm resistance between battery and exciter, have succeeded in partially charging the battery, but as soon as the alternate has 200 to 250 lights thrown on it the exciter shows signs of being overloaded. A. The overloading effect you speak of is inevitable. All you can do is to use a variable resistance, changing it to suit conditions. You may have to give up the use of your dynamo, except when it is free or nearly so.

(6139) L. S. D. writes: I had an argument with a gentleman who said that when a man, riding a bicycle in a straight line, would start to fall to the right he would turn the front wheel to the left, or opposite to the way he was falling, to catch his balance again. I said he would turn his front wheel the same way he was falling. A. You are right. By turning toward the side to which he is falling, the centrifugal force pushes the rider's body away from the center of the circle his wheel describes, and thus counteracts the falling tendency.

(6140) A. E. S. writes: I have read that electricity will separate water into the two gases of which it is composed. Is it practicable to get gas in that manner, if I had a cheap power to run a dynamo? Or is there any other practicable way to procure gas by the use of electricity? If salt or other cheap chemical were added to the water, would it help? What would it do if electricity were passed through crude coal oil? A. It is not practicable to make gas as described, except for experimental purposes. The water needs some salt, acid or chemical in solution. Oil is not an electrolyte, and a current cannot be passed through it, except by high tension discharge. This might purify the oil to some extent, but is not practical.

(6141) C. M. G. asks: I have an induction coil which is made with two layers of 20 on primary and eight of No. 32 on secondary. When I connect it in circuit of bichromate battery it runs rapidly at first, then slacks down and stops. Why is this? A. The primary is of such low resistance that it rapidly polarizes the battery. Although it is wasteful, yet if you put resistance in series with the primary, the battery will run longer. Your secondary has too few turns.

(6142) W. D. writes: We are taught that when the sun is north of the equator it is continuous day at the north pole, and when south of it continuous night. Would you be kind enough to state how Mr. Wellman and his party in their dash to the north pole will tell noon from midnight; also if the sun is south of the equator, how will they tell? A. At all points south of the polar axis there is a difference in the declination of the sun through one revolution of the earth that is observable with a transit or sextant as a maximum and minimum, which represents noon and midnight respectively. If the polar explorer should happen to step upon the earth's axial point, the sun alone would bother him some in regard to its position; but the lunar distance would help him out if his watch fails him. When the sun is south of the equator it always appears at noon in latitudes below 76½°, and with variation as to noon declination during the seasons for the higher latitudes. During the days of darkness the stars and the moon's place furnish data for time computations.

Communications Received.

"Arcturus the Greatest of all Suns." By E. R. H.

"On the Endowment of a Permanent Exhibition for Mechanics." By J. G. Von H.

"On a Miniature Doctor Pump." By C. C. D.

"How to Make a Camera." By E. D. C.

"On Life Preservers and Boiler Draughts." By A. P. W. G.

"A Few Words about Orchids" By L. J.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 19, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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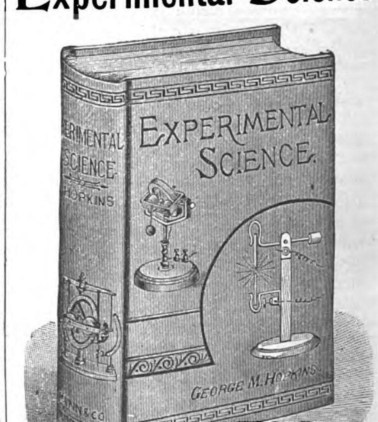

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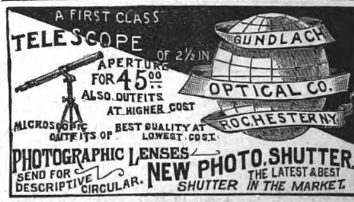

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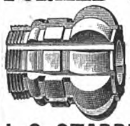

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