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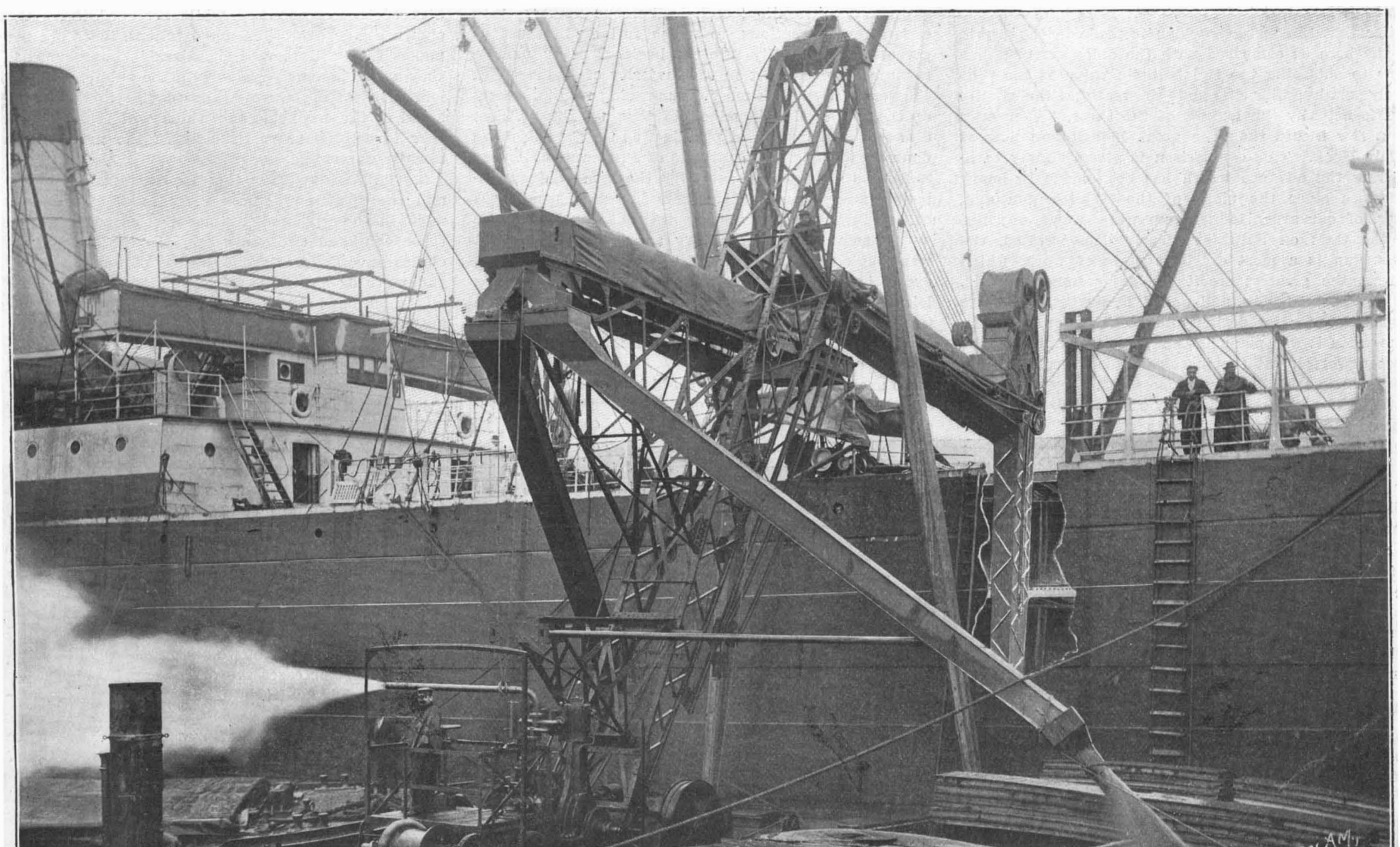
"Grasshopper" Elevator in Housed Condition.



The Derrick in Operation, Discharging Grain Into a Lighter.

A NEW DERRICK OR "GRASSHOPPER" ELEVATOR FOR UNLOADING GRAIN FROM VESSELS.—[See page 75.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 31, 1903.

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

WEIGHT AND VELOCITY IN HEAVY GUNS.

Elsewhere in this issue we give illustrations of the successful tests recently carried out with the new army 16-inch gun, tests which prove it to be the most powerful weapon in existence, exceeding greatly in energy the 16¼-inch Armstrong gun built several years before. Whether, in comparison with modern ordnance, it is the most efficient piece relatively to its weight and cost is another question, to which even the gentlemen who designed and built it would probably return a negative answer. In defining the question of relative efficiency, however, it should be mentioned that the 16-inch gun was designed several years ago, and therefore cannot be said to represent the very latest developments in ordnance. The tendency to-day is toward reduced weight of gun and projectile and increased muzzle velocity. As we have shown very clearly in the data of the Krupp gun of the 1901 pattern (included in the table shown on another page), although the weight of the Krupp piece is only about half that of the 16¼-inch Armstrong gun, and its projectile is about 40 per cent as heavy, its high muzzle velocity of 3,330 foot-seconds gives the shell a muzzle energy of 59,280 tons or between 3,000 and 4,000 foot-tons greater than that of the Armstrong piece and 75 per cent of that of our own gun. The muzzle energy per ton-weight of gun, moreover, reaches the high figure of 1,029 foot-tons. It is interesting to notice that the increase which is made in the length of the bore as compared with the older guns, with a view to obtaining the full ballistic value of the relatively small powder charge, is so great that the smaller gun is actually the longest of the three, longer even by a few inches than the great 16-inch gun now at Sandy Hook. This comparison is given, simply to illustrate the advance which has been made in heavy ordnance since the plans of the English gun and, later, of our army 16-inch gun were drawn up; for, as the tests on Saturday clearly demonstrated, the great gun is a most excellent piece of work, which reflects the greatest credit on Major Rogers Birnie, Major Charles Smith, and Col. J. P. Farley, who were responsible for its design and construction. At the time when it was planned, this piece was not only the most powerful, but the most advanced type of heavy gun in the world. As it was necessary, however, before work on the gun could be even commenced, to build a special and costly plant for its construction, the delay has been such that the 16-inch gun to-day would be considered, even by those who were responsible for its construction, as in some respects out of date; and while the weapon in these tests has answered every demand made upon it, it is probable that it will be at once the first and last of its size to be built. Apart from the convincing proofs offered by the tabular comparison, above referred to, we may mention that our Ordnance Board has made such rapid advance in the development of nitro-cellulose powders, and the design of guns suited to these powders, that a muzzle velocity of 3,600 feet per second is contemplated in future guns. To understand what influence velocity has in reducing the weight both of gun and projectile, we have but to remember that while the energy varies directly as the weight of the projectile, it varies as the *square* of its velocity; and, therefore, by reducing the diameter and weight of the projectile and increasing its velocity, it is possible to build a gun that will have the same muzzle energy as the 16-inch piece and yet weigh not more than half as much. We do not know just how far the plans of the Ordnance Board for high-velocity guns have progressed; but if they were called upon to produce a 12-inch gun of half the weight of the 16-inch gun but of equal muzzle energy, they could doubtless do so; that is, if the 3,600 foot-second velocity, which they claim to have secured, is applicable to a gun of this caliber. At the same time we must remember that comparisons of muzzle velocity and energies are misleading—at least to the layman; for a heavy shell with a low velocity will hold its energy longer than a light shell with a high velocity, the velocity falling off less rapidly as the range increases than in the case of the lighter shell.

THE AMERICAN AUTOMOBILE.

The Automobile Exhibition which was held last week in Madison Square Garden, New York, proved, beyond everything else, that both the American public and the American manufacturers have learned a certain fundamental lesson, without which any real progress toward the evolution of a satisfactory automobile and the development of a flourishing trade in the same, would have been absolutely impossible. The lesson is this: that in the very nature of things, because of the inherently complicated nature of the machine itself, and the particularly trying conditions under which it is called upon to do its work, the designing and building of a satisfactory automobile is an extremely serious and difficult matter. Now it is for want of realizing this fundamental truth that the development of the automobile, mechanically, industrially, as a commercial proposition, and as a great public utility and means of pastime, has been very materially delayed in this country. "American inventiveness and ingenuity" and "American labor-saving machinery" have grown so accustomed to taking hold of any new device of European origin, and quickly improving and cheapening it, that when the first serious automobile exhibit of four years ago was held, the press and the public alike (we plead guilty to the indictment ourselves) were prolific in promises and prophecies as to the speedy "revolution," or whatever it may have been called, that we were going to make in the automobile industry now that we had set our hand to the task.

The self-confidence that prompted this splendid optimism was not without justification, for we could point to unnumbered devices of European origin which, in the hands of our inventors, machinists, and manufacturers, to say nothing of our business promoters, had grown from somewhat crude objects of doubtful utility into perfect appliances of a world-wide reputation and world-wide demand. In the automobile industry, however, we were, for once, mistaken. Overlooking the fact that the automobile of some four or five years ago represented the combined efforts of some of the brightest engineers among that nation of brilliant engineers, the French; and that the successful machines of that day had been brought to their then stage of perfection by a long and costly process of experiment, invention, and design, our makers, with a few rare exceptions, to which full credit must be given, rushed hastily into the business of automobile manufacture and met in the majority of instances, at the very outset, with most discouraging results. Many of them seemed determined to take up the problem *de novo*; and instead of profiting, as they should have done, by the trials and failures of French and German makers, they began to go over the same old experimental ground, and put themselves to the expense, loss of time, and inevitable disappointment, incident to the development of a satisfactory automobile. Hence it was that our first two exhibitions simply proved that, except in the steam-driven vehicles, we were following leisurely in the trail of the European manufacturer; many of the forms and types shown being from eighteen months to two years behind the best current practice of the day.

No such charge, however, could be made against the excellent exhibit of machines that was gathered together last week in Madison Square Garden. It is evident that our manufacturers have decided to accept that which has proved to be best in the practice of foreign makers, incorporate it in their own designs, improve upon it where possible, and make only such changes as had stood the test of trial under actual service conditions. Consequently, one noted an almost entire absence of the freak machine; and the exhibits conformed pretty closely to one or other of the accepted types, both in details of mechanism and in general structural appearance and finish. It is too much to claim that we have left as yet any very distinctive national mark upon the automobile, unless it be in the production of moderate-priced runabouts of light weight and comparatively small power.

Evidently the automobile industry, as such, has now settled down to a working basis. We have learned that something more than a blacksmith's forge, a lathe, and more or less native ingenuity are necessary to the building of an automobile. The thousand-and-one individuals who rushed into the business with but few of the qualifications necessary for such difficult and arduous work, have learned their bitter lesson and gone back to their former or to other pursuits, leaving in the field only such makers as are duly qualified and equipped. Furthermore, if a visitor to the show had taken the trouble to select the American machines which have survived the period of trial to which we have just referred, and had asked the makers to what they particularly attributed their success, he would have found it to be due to the fact that no machine or part of a machine that was new was allowed to go upon the market, until its utility had been proved by a long period of very searching and exhaustive trial. It is impossible to overestimate the harm that has been done to the automobile industry by the many mushroom companies that have rushed into the public market, with nothing more to show than a set of blueprints, a machine shop, an office, and a soliciting agent. During the past year there was a notable case of a firm that had entered upon its books thousands of dollars worth of orders for automobiles, equipped with a new type of transmission that, at the time the orders were booked, had never had a shop test, to say nothing of a trial on the road. The damaging effect of such practice in delaying the growth of the automobile in public favor, it would be difficult to estimate. There is one respect in which the American automobile has already won for itself golden opinions, and that is in regard to its general lines and finish. Alike in the light runabouts, in the medium-powered touring cars, and in the high-powered machines, there is evidence of a careful effort to produce the most harmonious and graceful outlines, and we believe that in this respect, among others, the American automobile will win for itself universal and unqualified favor.

With regard to the future improvement of the automobile, we suggest that it may be looked for along the following lines:

1. Transmission Gear: It will be generally agreed among automobile users that the most important point demanding further experiment and improvement is the transmission gear. While there are some excellent gears in use, the best of them are exceedingly costly. The endeavor of the American manufacturer has been to produce a transmission gear that will have the certainty of action and the durability of the best foreign makes, and that can also be produced at considerably less cost. Upon the solution of this problem depends very largely the future of the moderate-price automobile, for which the great mass of the American people are asking. The endeavor to produce a cheaper gear is commendable; but unfortunately some of the new types have been rushed into service without adequate trial. This is a problem that will richly reward the inventor who can produce a gear that is cheap, reliable, and durable.

2. Sparking Devices: The experience gained on the endurance runs of last year, proved that there is yet much to be done before the problem of an absolutely reliable sparking device has been solved. The dry battery and the independent dynamos have each troubles of their own; and while some of the systems shown at the exhibition are excellent, there are many makes that will require considerable improvement, if they are to become popular with the public. The problem of adjusting the sparking device to the variable speed of the engine is one which will repay still further investigation, particularly in the matter of automatic governing.

3. The Wiring: As in the case of transmission gears and the sparking devices there is notable improvement in the wiring of automobiles as compared with those exhibited two years ago. In the past our machines have suffered from the use of too small cables and more or less imperfect insulation. This is a detail which has been responsible for many a half-hour of puzzled and fruitless search by the inexperienced automobilist for the cause of a breakdown. The cables are now of generous dimensions, and the insulation has been carefully carried out.

4. Engines: In general the engines, particularly in the higher-priced machines, are admirably made, both as regards the castings and the machine work. Cast-steel has taken the place of cast-iron, and both in respect of mechanical operation of the valves and the greater care that is being taken in the seating of the valves and their general mechanism, there has been a very marked advance. The makers of the cheaper gasoline machines have been driven to the use of cheaper materials and less costly machine work in the endeavor to keep the price within reasonable limits; and in view of the limitations thus imposed, the greatest credit is due to two or three of the best-known makes. In some cases the contact-making devices are still very crude, and this detail also will repay future careful attention.

Taking a general view of present conditions, it may be said that the automobile industry is now established upon a thorough working basis. There is a considerable number of reliable firms that are prepared to take orders for machines that have stood the test of hard usage, and shown that they can be relied upon for continuous service without a visit to the repair shop. We are unquestionably feeling the first flood of a prosperity in the automobile industry whose extent it is hard to predict.

ABRAM STEVENS HEWITT.

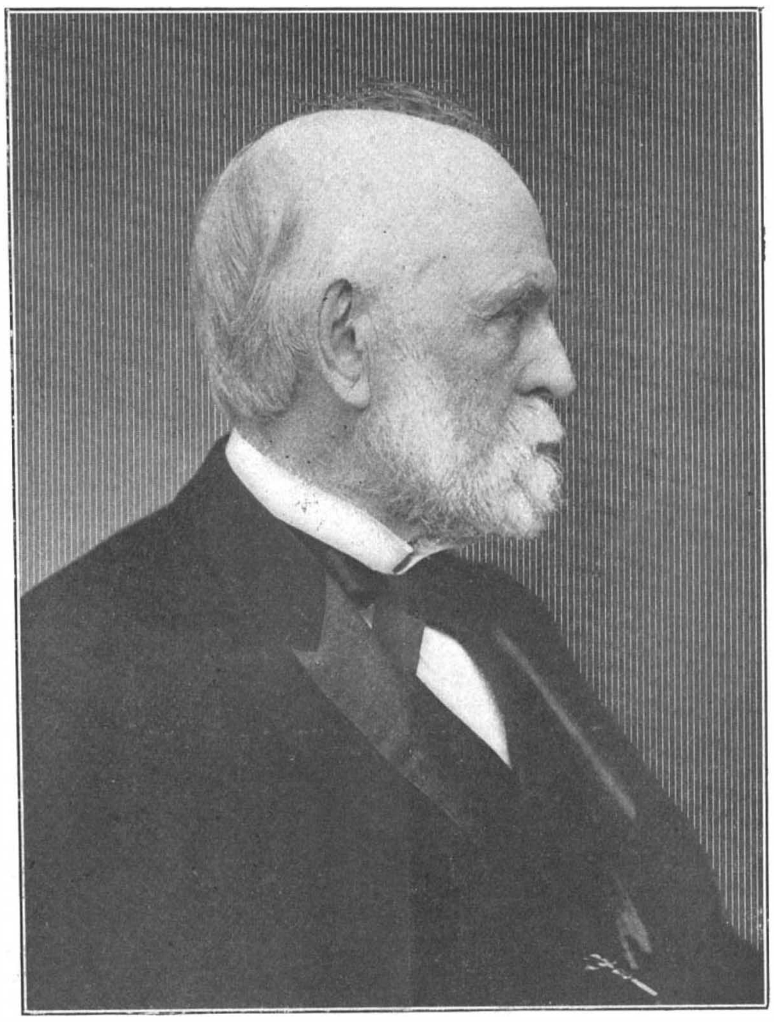
As we pause in our feverish struggle of life to mourn the loss of a great man, to recall his ambitions, to review his masterful career, we have the comforting satisfaction of knowing that there is gain as well as loss—we are inspired by the narrative of his achievements to resume our battle with renewed courage and a loftier purpose. The death of Abram Stevens Hewitt, on the morning of January 18, was a loss, not only to his native State, but to the entire country. His wonderful influence over men was felt throughout the land, and our hearts are all joined in profound sorrow at the departure of this grand and noble type of American citizen.

Mr. Hewitt's greatness is all the more marked by reason of his humble origin. He was born in a log cabin near Haverstraw, Rockland County, N. Y., July 31, 1822. His father was at the time a poor workman, having lost all his property by fire. The elder Hewitt came to the United States in 1790 as a representative, of the English firm of Boulton & Watt, and assisted in setting up the first steam engine ever used in this country. He later took up the trade of cabinetmaker, and was also a dealer in cabinet lumbers. After the loss of his property he became a farmer, cultivating the tract of land in Rockland County which had been inherited by his wife. On this farm was the young Hewitt reared, imbibing there the sturdy principles which governed his entire career. At an early age the boy showed a great love for books. Although the father planned to have his son taught a trade, he wisely gave up this ambition as soon as he observed these academic tendencies, and gave the boy every opportunity to study, sending him to school in New York city during the winter months. Young Abram made the most of his advantages, and determined to prepare himself for college. Knowing full well that his father could not afford to pay the college expenses, he set to work in an effort to win one of the two prizes which some one had offered to the two students who passed the best entrance examination to Columbia College. Twenty thousand schoolboys entered this competition, but young Hewitt secured one of the prizes, which was enough money to pay his tuition fees through college. He paid his other expenses by tutoring fellow students, also by winning several Greek prizes and all the prizes in mathematics offered during his course. Such was his ambition and devotion to study, that when in 1842 he graduated at the head of his class, he was obliged to pause; for his general health, and particularly his eyes, had been greatly injured by the confining work.

In 1843 Mr. Hewitt was appointed acting professor of mathematics at Columbia, and saved enough from his salary to enable him to visit Europe in the following year. On this trip he was accompanied by his friend, Edward Cooper, son of Peter Cooper, the philanthropist, whose daughter he later married. The return voyage was marked by an incident which, as Mr. Hewitt himself says, had much to do with his future, and was, in fact, the turning point of his life. The ship on which they embarked from Leghorn was buffeted by a number of violent storms, and finally sprung a leak when about twenty miles off Cape May. The crew and passengers worked the pumps until it was evident that further efforts to save the ship were useless, when they took to the boats. After drifting about twelve hours and suffering greatly from wintry weather, they were picked up by a vessel bound for New York city. In speaking of this experience some years ago, Mr. Hewitt said, "It taught me for the first time that I could stand in the face of death without fear and without flinching. It taught me another thing—that my life, which had been miraculously rescued, belonged not to me, and from that hour I gave it to the work which from that time has been in my thoughts—the welfare of my fellow citizens. For thirty years I have never turned aside from that task. The task which I had set for myself was to contribute, as far as I could, to the employment of men, so that they could help themselves and not be made the subjects of public charity. Self-help is a remedy for all the evils of which men complain."

In 1845 Mr. Hewitt completed the study of law which he began while professor at Columbia, and was admitted to the bar. Shortly afterward he was persuaded by Peter Cooper to give up his legal ambitions and go into business with Edward Cooper. Peter Cooper gave the young men charge of a small rolling mill in Trenton. With characteristic thoroughness Mr. Hewitt immediately made careful study of the iron market, and built up the financial success of the works. This firm was the first to manufacture iron girders and supports for bridges and for fireproof buildings. Another fact which argued much for Mr. Hewitt's ability as a manager is that the firm never had any trouble with its employes, though at times they employed as many as five thousand men. There was occasional dissatisfaction among the workmen, but their grievances were immediately taken to Mr. Hewitt, who always dealt fairly with them. The works were never closed, and wages were regularly paid, even though the business was sometimes carried on at a loss.

Mr. Hewitt made a specialty of the making of steel, and, as in everything he undertook, soon became the foremost expert on this subject in the United States. During the civil war he went to England to study the manufacture of gun-barrel iron, which he supplied to the United States government at a loss to his firm. The Martin-Siemens, or open-hearth, process of making steel was introduced into this country largely through his efforts. At the Paris Exposition in 1867 he was one of the United States Commissioners, and made a special study of the iron and steel exhibits. In 1876 he was president of the American Institute of Mining Engineers, and won great prominence at home and abroad by an address on "A Century of Mining and Metallurgy in the United States." In 1889 he was again elected president of the Institute, and in the following year they presented to him the Bessemer gold medal for his services in promoting metallurgical science.



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ABRAM STEVENS HEWITT.

Ex-Mayor of New York. Ex-President of the American Institute of Mining Engineers.

Appreciating the value of learning, his efforts in behalf of education were particularly marked. He took an active part in the management of Cooper Institute from the year of its establishment, and contributed largely to its support. As secretary of the Board of Trustees he devoted much valuable time to the regulation of its educational and financial conditions. The United States Geological Survey also owes its existence largely to his efforts while in the House of Representatives.

Mr. Hewitt first became active in politics by assisting in the reorganization of Tammany Hall after the overthrow of the Tweed ring. He served in Congress from the year 1874 to 1878, and again from 1880 to 1886, when he was elected Mayor of New York city. In this office, as a fearless champion of justice he made enemies, as all strong men will, and was not chosen for a second term by Tammany, but polled a large vote at the next election on an independent ticket. His political career was characterized by a quickness of perception and a readiness of speech that always served him in good stead in public addresses. Whatever he had to say was said positively and decisively, carrying conviction to his hearers. He was never at a loss for a word. His extemporaneous speeches had the smoothness of written lectures. His keen insight enabled him to immediately grasp the details of the most complex subject, so that he could deliver an impromptu address in which the facts were assembled logically and in order, leading up to a final conclusion which was as convincing as if the result of long study. While Mayor of New York city, Mr. Hewitt, in one of his annual messages, urged the improvement of the city's rapid transit system and recommended municipal ownership. Though his suggestions were not heeded at the time, he continued actively to promote the cause, and it was largely through his efforts that the present improvements were undertaken. In consideration of these services the New York Chamber of Commerce recently presented him with a gold medal.

Mr. Hewitt married Sarah A. Cooper, Peter Cooper's only daughter, in 1855. Six children were born to them: Peter Cooper Hewitt, Edward R. Hewitt, Erskine Hewitt, Sarah Cooper Hewitt, Eleanor G. Hewitt, and Mrs. Amy B. Green. Peter Cooper Hewitt, the eldest son, is best known to our readers as the inventor of an electric mercury vapor lamp for which he obtained a large number of patents. He has also recently invented a static converter, which is very simple and economical.

Those who knew Mr. Hewitt in his private life were greatly attracted by his animated conversation and his sense of humor. He made a wonderful impression on everyone with whom he came in contact. His sterling qualities, personal and social, found fitting expression in Richard Watson Gilder's poem read at the funeral of Mr. Hewitt:

"Mourn for his death, but for his life rejoice,
Who was the city's heart, the city's voice.
Dauntless in youth, impetuous in age,
Keen in debate, in civic counsel sage.
Talents and wealth to him were but a trust
To lift his hapless brother from the dust.
Because he followed truth, he led all men,
Through years and virtues, the great citizen.
By being great he made the city great;
Serving the city he upheld the State.
So shall the city win a purer fame,
Led by the living splendor of his name."

THE RECENT BERLINER TRANSMITTER PATENT DECISION.

The second Berliner telephone transmitter patent, No. 463,569, dated November 17, 1891, which was held to be invalid some time ago by Judge Brown in the United States District Court, was on appeal to the United States Court of Appeals declared valid as to metallic electrodes by this court on January 16 last. The case was that of the American Bell Telephone Company against the National Telephone Manufacturing Company and others for the infringement of the patent.

The opinion was written by Judge Colt and was concurred in by Judges Putnam and Aldrich. It holds that Berliner was not entitled either to the credit of the advantages to be derived from the employment of a carbon electrode in telephone transmitters or to the discovery of microphonic action; that the former was discovered by Edison, and that Prof. Hughes is entitled to the credit of the latter discovery, which is the principle utilized in every practical battery transmitter, and that Prof. Hughes embodied his discovery in an instrument which he was the first to term a microphone.

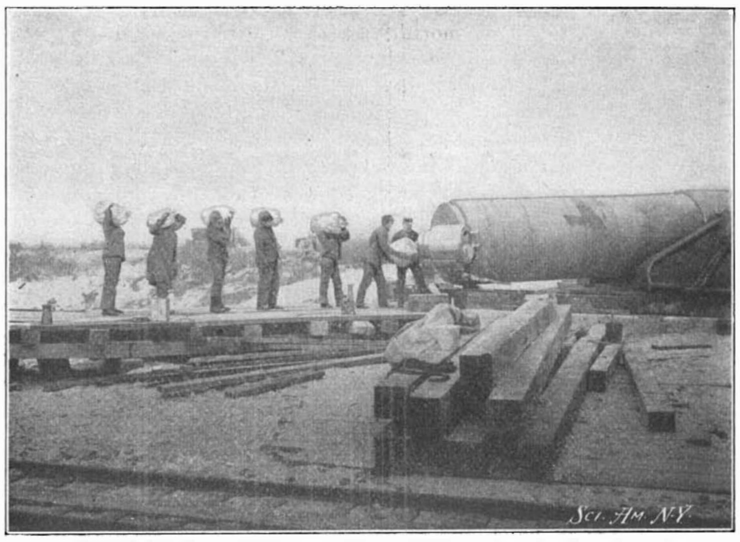
The Court further found that Edison's discovery of the carbon electrode and Hughes' discovery of microphonic action solved the problem of a variable-resistance transmitter, whereby speech may be transmitted long distances; and that both these discoveries were embodied in the defendants' transmitters.

The Court further found that claims 1 and 2 of the Berliner patent in suit, although upon their face open to the objection of excessive breadth, may be sustained when read in connection with the specification, provided they are limited to metallic electrodes, but that when so limited the defendants' transmitters do not infringe.

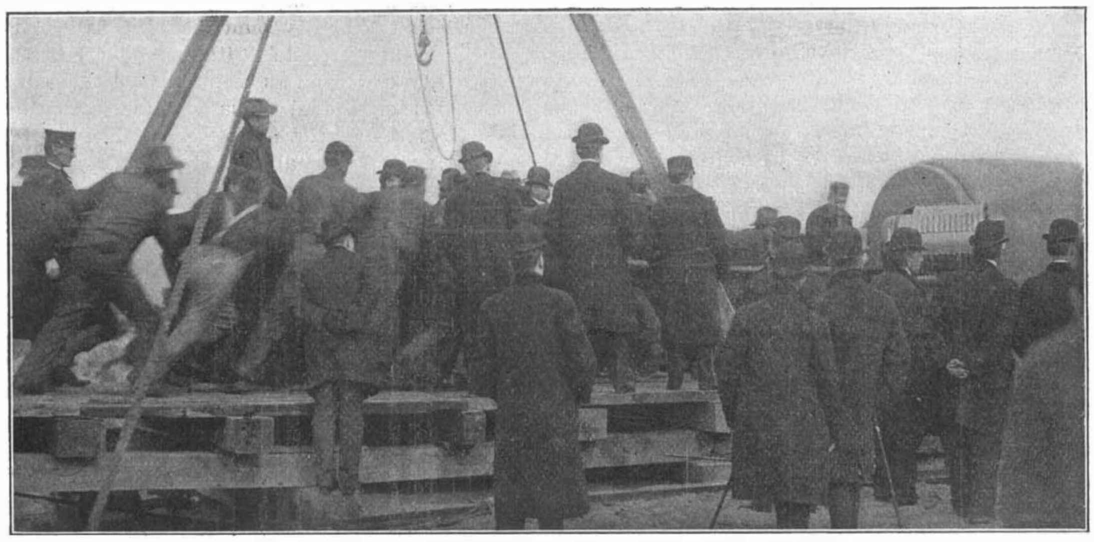
For these reasons the Court held that the decree of the Circuit Court must be affirmed on the ground of non-infringement.

Under this decision, as heretofore since Judge Brown's decision, the free use of variable-resistance carbon transmitters may be continued.

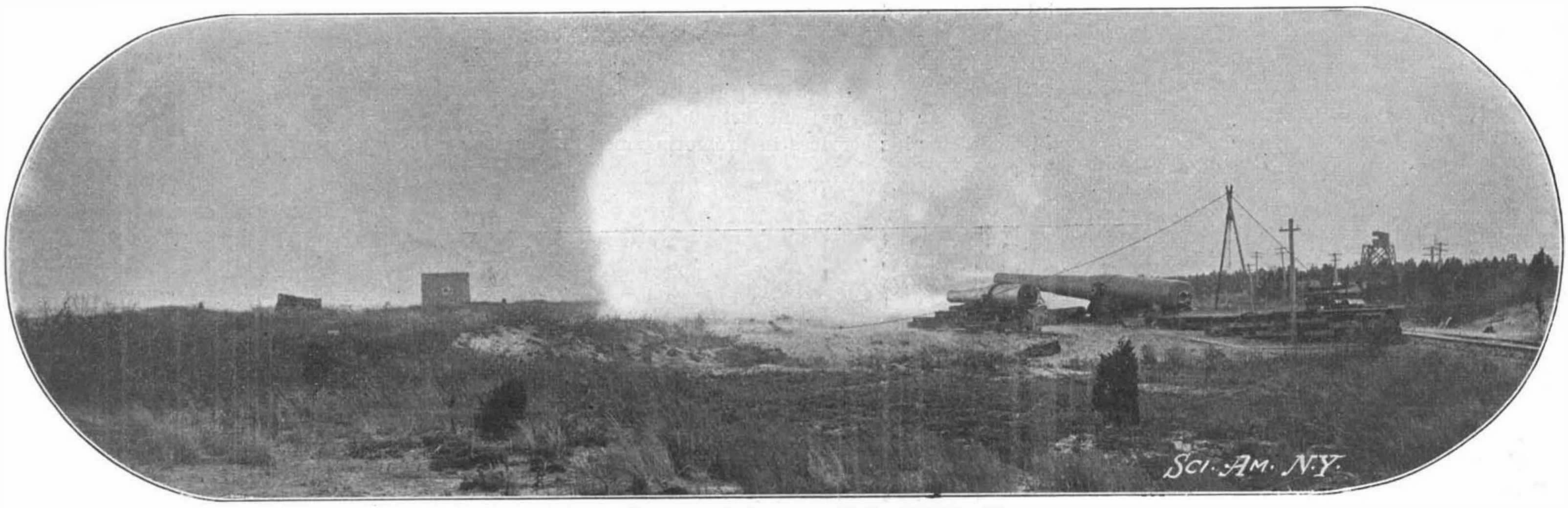
A series of experiments was recently carried out at the Altenburg colliery, near Saarbrucken, Germany, with lime, tar, and carbolineum to determine the respective value thereof as preservatives of mine timber against rot. Lime was found to be of the least value, while coal tar, although insuring perfect preservation of the surface of the timber, failed to protect the interior, which in every instance was found to be seriously attacked by rot. Carbolineum, however, gave excellent results, provided the timber coated had been previously barked and well dried.



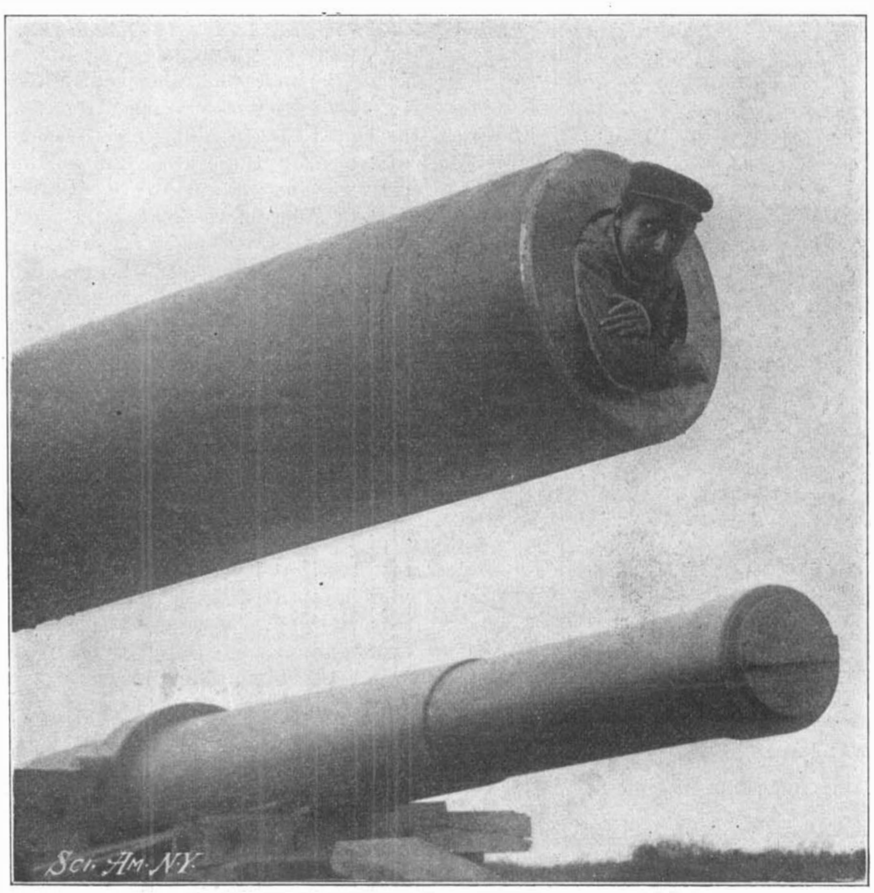
Loading the Six 107-Pound Bags of Powder Into the Breech.



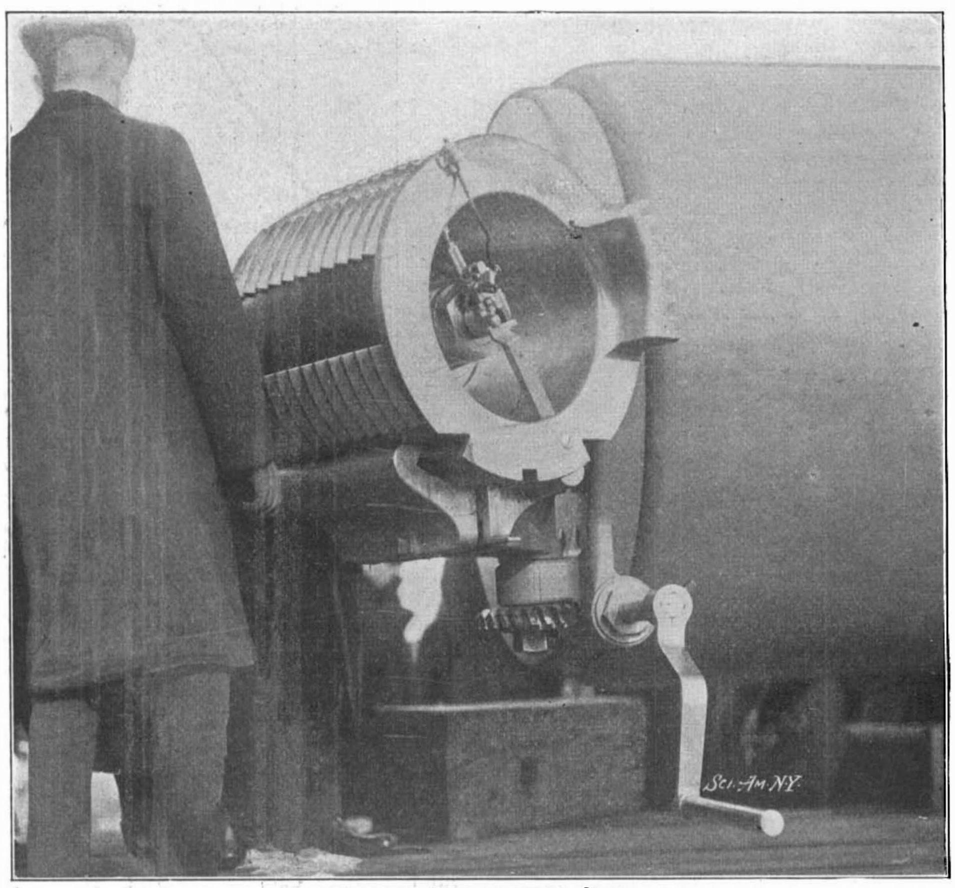
Twenty Men Ramming Home the 2,400-Pound Projectile.



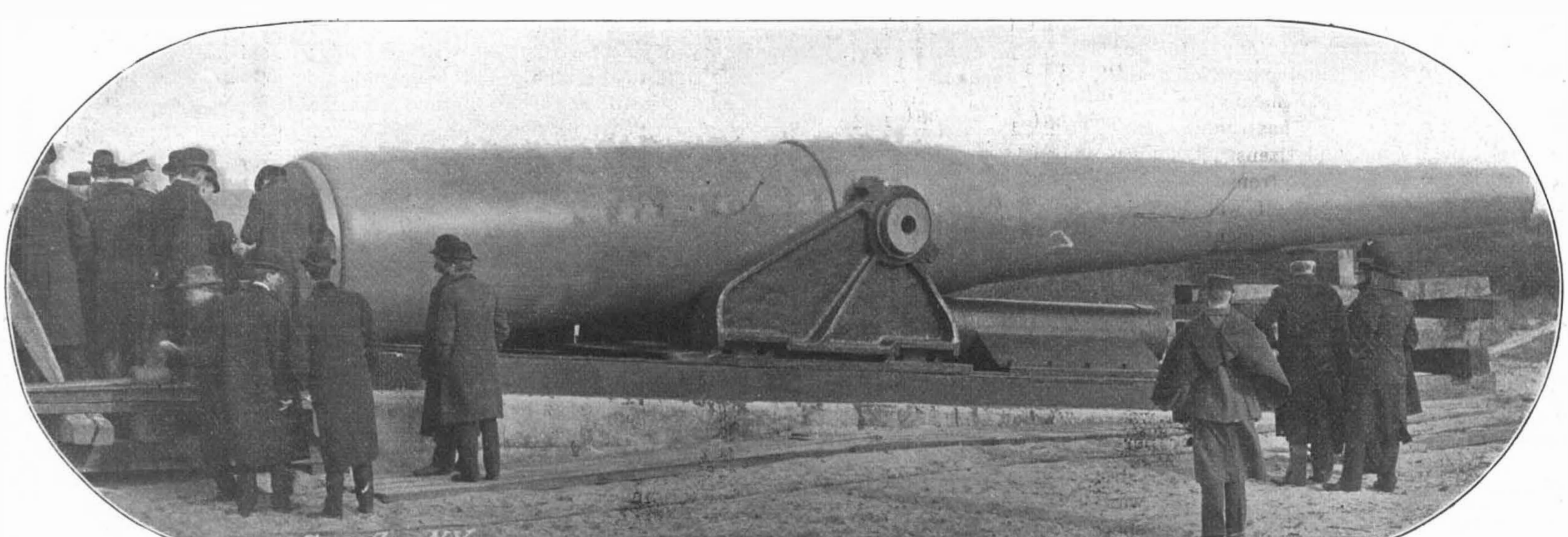
Instantaneous Photograph of the Discharge.



Muzzle of the 16-Inch Gun, With Sergeant Inside.



The Breech Mechanism, Open.



Total length, 49.7 feet; weight, 130 tons; weight of projectile, 2,400 pounds; muzzle velocity, 2,306 feet per second; muzzle energy, 88,000 foot tons.

The Gun on Its Test Carriage.

TEST OF THE 16-INCH ARMY GUN AT SANDY HOOK.

TEST OF THE NEW 16-INCH GUN

Not since the Armstrongs made their memorable test with the 16.25-inch gun, built by them for the British navy, has there been a trial of heavy ordnance to compare in spectacular interest with the test of the new United States army 16-inch gun, which was successfully carried out on Saturday, the 17th inst., at the Sandy Hook proving ground. We use the word spectacular advisedly; for, although the construction of modern ordnance is a matter of the coldest kind of calculation, and the gentlemen who design the guns have a wholesome horror of sensationalism, the achievements of these, the most potent engines of destruction known in modern life, will always in the public mind be estimated from the sensational standpoint.

From the accompanying table it will be seen that the great Armstrong gun is of slightly greater caliber; yet the reader must beware of making hasty deductions from this fact, and supposing that it is, therefore, a more powerful piece. Diameter of bore is but one of many elements that go to determine the energy of a gun. The strength of the gun steel, quality of powder, weight of projectile, muzzle velocity, each of them has its say in the matter of the ultimate power of the gun; and for these reasons the new army gun is a vastly more powerful weapon than its Armstrong prototype.

Comparing the two guns, then, we find that the new weapon is 6 feet longer over all, 19½ tons heavier; that its projectile is 600 pounds heavier; that because of the better quality of powder that has been developed during the intervening fifteen years since the Armstrong gun was built, the 16-inch gun requires only 640 as against 960 pounds of powder for a full charge, but that with this smaller charge the heavier projectile is propelled with a velocity greater by 219 feet per second, giving a muzzle energy greater by 33,610 foot tons. The direct test, however, of the relative efficiency of the two guns is the amount of energy developed per ton-weight of the gun itself, and this for the Armstrong gun of 1887 is 492 foot-tons, and for the United States 16-inch gun 677 foot-tons. As the 16-inch gun was designed several years ago, we give for purposes of comparison the data of a 12-inch modern high-velocity gun built by Krupp, with a velocity that brings the energy above that of the Armstrong gun of double the weight.

Type of gun.	Bore in inches	Total length in feet.	Weight in tons	Weight of projectile in pounds.	Weight of powder in pounds	Kind of powder.	Muzzle velocity in feet per second.	Muzzle energy in foot-tons.	Muzzle energy in foot-tons per ton weight of gun.
Armstrong..	16.25	43 5	110.5	1800	960	Slow burning cocoa.	2087	54,390	492
U. S Army.	16	49.7	130	2400	640	Nitro-Cellulose Smokel'ss	2306	88,000	677
Krupp	12	50	57.6	*771.6	334	Nitro-Cellulose Smokel'ss	*3330	59,280	1029

* In this comparison it must be remembered that the velocity falls off much more rapidly in the lighter shell; so that the "remaining velocities" will be proportionately greater in the 2400-pound projectile than in the case of the other two.

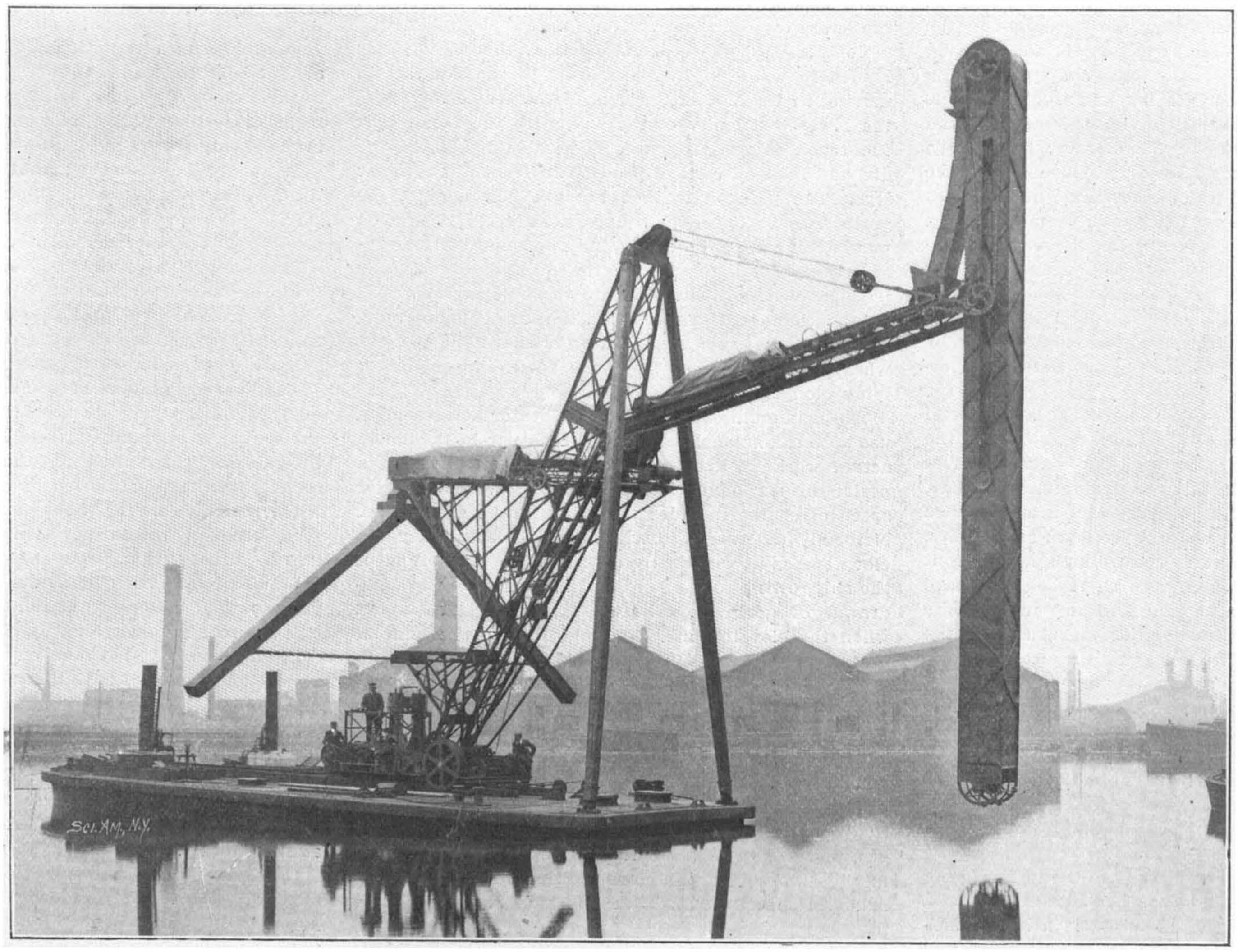
The test of Saturday served in every particular to establish the accuracy of the calculations on which the construction of the gun was based. Army gun construction has been eminently successful from the very first; and while the ordnance experts had no doubt as to the behavior of the gun under trial, there was, as Gen. Crozier, Chief of the Ordnance Bureau, stated before the gun was fired, a certain measure of uncertainty introduced, because of the very size of the gun and the unprecedentedly large charge of powder that was to be fired. Smokeless powder has shown at times in all countries a somewhat erratic action, and the General, with a characteristic candor, did not hesitate to state that chamber pressures might arise, when the gun was fired, greater than the piece could stand. Hence, at his suggestion, the guests retired to a distance commensurate with their sense of disastrous possibilities, even that war-worn veteran, Gen. Chaffee, not disdaining to take cover behind a neighboring heavy gun. In the process of loading, a 2,400-pound shell was brought up to the breech on a truck and rammed home by the united efforts of some twenty men on the rammer, fetching up in the lands with a "chug" that made even the 130-ton mass tremble. The powder was then loaded into the breech in six canvas bags, each carrying about 107 pounds, the last bag having in its center several pounds of fine-grained, quick-igniting powder, to make sure of the ignition of the charge. It should be mentioned here that a special bed of concrete 10 feet deep, 12 feet wide and 30 feet in length had been prepared for the reception of the gun, and the mount used in testing the 18-inch Gathmann gun, which lay alongside, was bolted to this platform, and proved equal to its heavy duty. Although calculation has been made as a mere matter of interest of the maximum range of the gun at an elevation of over 40 degrees, no attempt was made to throw a shell to the estimated distance of 21 miles. As a matter of fact, the elevation was only about 1½ degrees for the first two, and 4 or 5 degrees for the third round. From the spectacular point of view, the discharge must have been disappointing to those who were looking for sensations. The report lacked the sharpness and angry snap of an 8-inch or 10-inch piece, and the concussion was of the mildest. The rush of flame extended perhaps for 100 feet in front of the gun, and the smoke of the ignition charge of black powder mushroomed out and drifted lazily away to the westward. The shell struck a few thousand yards out to sea, throwing a vast column of spray heavenward and ricocheted, twice, sharply to the right before sinking below the waves. The first charge consisted of 550 pounds of powder, which gave a powder chamber pressure of 25,000 pounds to the square inch, and a muzzle velocity of 2,003 feet per second. The second charge of 640 pounds raised the chamber pressure to 38,000 pounds and the muzzle velocity to 2,306 feet per second. The third shot, because of the elevation of the gun, passed clear of the velocity screens and no velocity was taken. In his address before the firing of the gun, Gen. Crozier stated that the calculated pressure of the maximum charge was 38,000 pounds, and the maximum velocity 2,300 feet per second; so that, considering the unprecedentedly large charge of powder employed, the results were remarkably close to the estimate.

In connection with the firing of the 16-inch gun the party of visitors was treated to a display of high-angle firing from a 7-inch mortar. On account of the low muzzle velocity, it was possible for the eye to follow the mortar shell in its skyward flight, and it could be heard singing its weird note long after it become invisible. The shots fired from this gun rose to a height of two miles before dropping into the sea. Owing to the low temperature of the atmosphere, the course of the shell was marked by a fine streak of what looked like mist, caused by the condensation of the moisture in the air by the rapid passage of the shell. The second shot fired from the mortar was one of the new torpedo shells containing 120 pounds of the deadly high explosive maximite. Although on test this explosive has proved to be insensitive to shock, the guests were recommended to drop behind the bomb-proofs, since accidental detonation within the gun would have thrown the scattered fragments with high velocity in every direction. As it was, the shell dropped about two miles away, but owing to the failure of the delayed-action fuse, it did not detonate. We take this opportunity of acknowledging the courtesy of Maj. Rogers Birnie, Maj. Charles S. Smith, and Col. J. P. Farley, extended on many occasions during the construction of the gun and in the recent Sandy Hook tests.

A NEW DERRICK OR "GRASSHOPPER" ELEVATOR FOR UNLOADING GRAIN FROM VESSELS.

BY THE LONDON CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The question of facilitating the transshipment of grain from the hold of a transatlantic freighter into lighters in the docks has resolved itself into one of the most important engineering problems of to-day, especially when the immensity of the traffic is recollected. There are several methods for the accomplishment of this work in existence, but in nearly every instance the initial cost of the plant, together with the heavy expense involved in its maintenance, militates against its widespread use.



THE "GRASSHOPPER" ELEVATOR READY FOR USE.

An important development has been made by the introduction of the "grasshopper," or, as it is technically called, the derrick elevator now in use by the London Grain Elevator Company at the London docks. This machine, although it possesses a somewhat complex appearance, as may be gathered by reference to our illustrations, is in reality in its working arrangements simplicity itself. It has been specially designed for transshipping the corn from the holds of the largest types of American liners engaged in the grain trade, such as the "Minnehaha" and her sister ships of the Atlantic Transport Line, into lighters, for conveyance to other coasting vessels or warehouses. It is the joint invention of Mr. A. S. Williams, of the Atlantic Transport Steamship Company, Capt. W. K. Browne (manager) and Mr. A. H. Mitchell (engineer) of the latter company, and the experimental elevator of this type, which has been submitted to prolonged and exacting tests, was specially built by Messrs. Spencer & Co., Ltd., the well-known English granary engineers of Melksham (Wilts), to whose courtesy we are indebted for permission to reproduce the illustrations to this article.

This derrick elevator consists essentially of four parts, viz.: (1) the pontoon; (2) the traveling car, containing the engines of the various driving motions; (3) the structure supports, shear legs, lattice girders; and (4) the trunk which is lowered into the grain in the vessel's hold.

The pontoon is built of steel, and measures 75 feet in length by 24 feet beam and 8 feet draft. It is perfectly square at the bow, to enable it to be brought close up to a vessel's side and to remain there. The steel deck is specially constructed of braced steel girders, to afford a secure and rigid bed to the rails which are laid upon it, extending from bow to stern, and upon which travels the trolley actuating the elevator itself. The rails are laid at a 7-foot gage. In the stern are placed two boilers of the vertical type, one only being requisite to supply the steam for the engines, the second boiler being held in reserve. The coal bunkers are placed amidships. If necessary, the pontoon with its elevator can be made to travel from one point to another under its own steam, the pontoon being provided for this purpose with a small marine engine driving twin propellers. The remaining space in the hold contains a quantity of ballast to insure stability.

The car or trolley is a massive construction of steel girders about 17 feet in length by 9 feet wide, supported upon six pairs of steel wheels. It has a travel along the deck of approximately 36 feet and is propelled backward and forward by means of a pair of steel wire ropes, which are fastened at each end of the pontoon and to barrels on the trolley. These drums are driven by steel worm gearing and friction clutches. The engine, which is in the center of the trolley, is of the twin-cylinder vertical type, developing 30 horse power on the brake. Steam is supplied to the engine from the boiler placed in the stern of the pontoon, through special flexible piping, the connection being made to the center of a large revolving drum, which has special steam glands and stuffing boxes so arranged that as the trolley moves in either direction, the piping is automatically coiled or uncoiled on the drum, which is driven by spur gearing from the crank shaft of the engine. Upon trunnions near the forepart of the trolley the large lattice girder is carried, and running through these trunnions is the main shaft for driving the conveyor and elevator gearing. In front of this is the gearing for raising and lowering the main jib and also the gearing for lifting the elevator trunk to a vertical position. A foot plate is provided behind the engine, and all the various clutches and winding gears are worked by levers from here; and by means of an interlocking system the engineer in charge of the apparatus has complete control over each and every movement, and any possible combination of the various motions can be worked instantaneously and with perfect safety. The trolley is protected from the weather by a steel covering which has been removed for the purpose of our illustrations.

The structural supports consist of a lattice steel girder back leg, and two pitch pine shear legs in the bow, one on either side. The back leg is about 50 feet in height when raised, built up of steel angles and flats, and both this and the front shear legs are connected together at the top by a massive steel pin and collars. The back leg being hinged to the trolley and the front legs on the deck of the pontoon, all these parts have an easy action and can be raised to any angle, while it also allows perfect freedom of movement of the trolley backward and forward along the deck.

Our first illustration shows the elevator "housed" or closed up ready for transit to any desired destination.

About a third of the way from the top of the back leg is hinged the main jib, which fulfills the purpose of supporting the trunk of the elevator at its outer end. Along the upper surface of the jib travels an endless band, upon which the grain after its extraction from the hold is carried on its way to the lighter lying beside the pontoon. Upon the other side of the main girder, and just below the main jib, is a steel cantilever, projecting over the stern of the pontoon, and at its other end are two long shoots at a declined angle. Along the upper surface on this cantilever an endless conveying belt is fixed, terminating at the spouts through which the corn is discharged into lighters moored on either side of the pontoon. At the fork of these spouts valves are fitted, so that the flow of the grain can be regulated and discharged through either, or both, of the spouts, as may be desired.

The elevator trunk, which is lowered into the ship's hold, is built up of steel angles braced together and covered with steel sheeting. There are double chain wheels in the head of the trunk, with specially constructed steel chains, each of about 28 tons strength, to which are attached steel buckets. The latter are of a very ingenious design, being arranged upon the Spencer system. The feature of this equipment is that the buckets are fixed quite close together—not with a short interval between each, as is the general principle of such construction—and so built that the back of one bucket acts as the shoot for the grain in the next bucket. The advantage of this system is that when the buckets travel over the head, a steady, continuous flow of grain is obtained; the speed of the chains is moderate; and the vibration is reduced to a minimum. The grain as it is discharged out of the buckets at the head of the elevator trunk falls through a telescopic shoot connecting the latter with the traveling band conveyor supported by the main jib already described. The trunk has a vertical range of 18 feet, rising and falling in a vertical slot by means of wire ropes connected up to the winding gears on the trolley, the fulcrum being the crown of the back and front shear legs, as may be seen from our illustration. When at the maximum height the head of the elevator is 90 feet above the water level. The total length of the elevator trunk being 53 feet, this gives a clear height of about 40 feet between the water and the bottom end of the elevator, thus allowing it to be carried over the coamings of any ship even when lightened.

A very comprehensive idea of the range of action of the elevator in this connection may be gathered from the fact that in one test it was lifted over the bulwarks of a ship 30 feet 6 inches above the water, lowered into the hold to a depth of 43 feet, and set to work in seven minutes, the grain actually being discharged into lighters alongside within that time.

Our first illustration will show how compactly the vessel is housed when not in use. The trunk is lying flat upon the deck, and the delivering shoots are folded in, so as not to project over the sides of the pontoon. To raise the trunk, the wire ropes connecting the head of the trunk with the apex of the shear legs are hauled in, the trolley simultaneously moving toward the front of the pontoon, the result of such combined action being that the head of the trunk is lifted off the deck and is raised until the bottom end swings freely through the front shear legs. The position of the latter when the elevator is housed is at an angle of approximately 35 degrees to the deck, but when raised as in our second illustration, they are nearly vertical. As the machine is swung into working position, the other parts of the apparatus open out slowly, and the shoots extend outward, so that the open ends are well over the hold of the barge to be loaded with grain.

To bring the elevator into action, the main jib is hauled in, while at the same time the end of the jib moving in the slot in the side of the trunk travels to the lowest extremity of the slot, with the result that the trunk is raised to a considerable height in the air, and rests in vertical position in front of the shear legs. The pontoon is then brought bow against the grain vessel's side—its square nose gives it a good purchase against the ship's hull, to supply rigidity—and the trunk being above the deck is lowered, by letting down the main jib, into the hold of the vessel in the manner illustrated in the third photograph, where, by the way, the elevator is shown in use, the wheat being delivered from one spout into a lighter lying alongside the pontoon.

The maximum capacity of the elevator at present in use at the London Docks is 150 tons per hour, and in actual work an average of 136 tons per hour over a period of six hours has been attained. This latter speed of course includes trimming in the ship's hold. Naturally the rate of discharging decreases when the elevator has automatically descended to the bottom of the ship, owing to the hole that is caused by the withdrawal of grain immediately below the trunk; but when the elevator is descending through the bulk of grain, a speed of 150 tons per hour is easily maintained. Hand trimming is not sufficiently rapid to enable the machine to continue working at its maximum capacity, but Messrs. Spencer have devised an electric plow, which feeds the trunk adequately to enable the fullest delivery speed to be continued.

From our illustration of the derrick elevator in position ready for use it might be presumed that it is both weighty and topheavy, but such is not the case. Its total weight is only 30 tons, while it is so carefully balanced that even when the jib and trunk are lifted to their maximum height, the center of gravity is only 25 feet above the deck of the pontoon. Even when in the position shown in our second illustration, it may be moved from one point to another without any apprehension being entertained as to its safety. This careful balancing may be realized by comparing our first two photographs. In the "housed" position the pontoon is a little down at the stern, while when the elevator is raised, the pontoon is down at the bow to approximately the same extent. The derrick elevator, which was only constructed for experimental purposes, has proved so successful, and possesses so many advantages over the other systems at present used for unloading grain, that additional elevators of this type and of larger capacity are to be constructed immediately.

THE HEAVENS IN FEBRUARY.

BY HENRY NORRIS RUSSELL, PH D.

There are many nights at this season of the year which, though perhaps the most brilliantly clear that we ever have, are practically useless for most astronomical purposes. They are usually marked by a sudden fall in temperature and a high wind, and may always be distinguished at a glance by the conspicuous and violent twinkling of the stars. One look through a telescope on such a night shows what interferes with observations. The image of a bright star is enlarged into a blurred and unsteady mass, which cannot be brought to a sharp focus. With a larger object—the moon, for instance—the whole area is seen to be "boiling"—that is, trembling like a landscape seen across a broad stretch of hot ground on a summer day—and all but the coarsest details are invisible. In such weather few observations can be made with profit except those of comets and nebulæ, which have no sharp outlines, but, being faint, are best seen on clear nights.

The explanation of this "bad seeing" is easy to understand. Every one knows that atmospheric air refracts the light which passes through it just as all other transparent bodies do, though in a relatively small degree. The refractive power of air depends upon its density, which is never quite uniform through any considerable region of our atmosphere, and is farthest from being so on just such nights as we have described, when different layers of air, unequally cooled, are mixed together by the wind.

The rays of light, proceeding from any given star, which reach different parts of the object-glass of a telescope, having passed through portions of air of somewhat different density, will be refracted in slightly different directions. Consequently they cannot all be brought to one sharp focus; and, as the wind carries new streaks of denser or rarer air across the line of sight, the blurred image will dance about and change its form.

The twinkling of the stars, as viewed by the naked eye, is due to the same cause.

An interesting confirmation of this theory may be obtained by viewing a screen illuminated by the light of Sirius, in the way described in the last article of this series. When one's eyes are sufficiently accustomed to the darkness, it is easy to see—at least on a night when there is much twinkling—that the star's light is not uniform, but that the screen is crossed by vague flickering alternations of light and shade, which are usually in rapid motion. These are "shadows" of the regions of varying density in the air. They move fastest on windy nights, and on calm nights when the air is steady they almost disappear.

It should be remarked that it was predicted by Prof. Young that a screen illuminated by a twinkling star would show such a phenomenon, many years before the writer succeeded in observing it.

Similar flickerings can be observed in the light of a few other stars, but with great difficulty on account of their faintness. It is highly probable that the "shadow bands" seen just before and after total eclipses of the sun are phenomena of the same character.

Another observation of some interest, that can be made while studying starlight in this way, is the comparison of a red and a white star. Alpha and Beta Orionis are well suited for the purpose. It will be found that the illumination of the screen produced by Alpha Orionis is very much fainter than that due to Beta, although the former is now the brighter of the two to direct vision. The reason for this is that, in the case of very faint light, the eye is sensitive to the green part of the spectrum alone.

We need not linger long over the description of the constellations. At 9 P. M. on February 15 Sirius is almost due south. Above him are Procyon and Castor and Pollux, the last near the zenith. Canopus can be seen on the horizon below Sirius from points south of Washington.

Orion, Taurus, and Auriga lie to the west of the meridian, Eridanus and Pisces in the southwestern sky, and Perseus, Aries, and Andromeda in the west and northwest.

Leo is the only conspicuous group in the east, though most of Hydra and part of Virgo have risen. Ursa Major is high in the northeast, Cassiopeia on a level with the pole in the northwest, and Cepheus and Draco low in the north.

THE PLANETS.

Mercury is in conjunction with the sun on the 2d, and becomes a morning star, in which capacity he may be well seen toward the end of the month. On the 27th he is at his greatest elongation, and rises about an hour earlier than the sun.

Venus is evening star in Aquarius, and is becoming increasingly conspicuous. At the end of the month she sets almost two hours after sunset.

Mars is in Virgo, and is rapidly brightening as he approaches opposition. He rises at about 10 o'clock on the 15th.

Jupiter is in conjunction with the sun on the 19th, and is consequently invisible.

Saturn is morning star, having passed conjunction last month. He rises two hours before the sun on the 28th.

Uranus is also morning star, and rises about 4 A. M. on the 15th.

Neptune is evening star in Gemini.

THE MOON.

First quarter occurs at 5 A. M. on the 5th, full moon at 8 P. M. on the 11th, last quarter at 1 A. M. on the 19th, and new moon at 5 A. M. on the 27th. The moon is nearest us on the 10th, and most remote on the 22d. She is in conjunction with Neptune on the 8th, Mars on the 15th, Uranus on the 21st, Saturn and Mercury on the 24th, Jupiter on the 26th, and Venus on the morning of March 1. None of these conjunctions are close.

London, January 1, 1903.

Correspondence.

Comparison of Armored Cruisers.

To the Editor of the SCIENTIFIC AMERICAN:

In comparing the United States navy, ship for ship, with those of other powers, I have been greatly impressed with the superiority of the American design over that produced by foreign rivals, until coming to the semi-armored or heavy protected cruiser type; here, on a smaller displacement we have been far outdone by several foreign designers, notably the Armstrongs. To substantiate my argument, let us compare, point for point, the cruisers "Charleston" of our own navy, and the "Esmeralda" of the Chilean navy. In the first place, the "Esmeralda" has been in commission for six years, while the "Charleston" has not as yet been launched; so one would naturally look for a marked improvement in the design of the latter. Such, however, is not the case.

In your issue of December 22, 1900, there appeared a tabular comparison of the "Charleston" and the English "Monmouth," which, when summed up, shows no marked superiority on either side. Instead of using the "Monmouth" as a basis of comparison (English ships being notably under-gunned) let us take the "Esmeralda," and we have the following results:

	"Charleston."	"Esmeralda."
Length on load waterline	424 feet	436 feet
Beam, extreme	66 feet	53 feet
Draft	23 feet 6 inches	20 feet 3 inches
Displacement	9,700 tons	7,000 tons
Coal supply, normal	650 tons	550 tons
Coal supply, maximum	1,500 tons	1,350 tons
Speed	22 knots	23.05 knots
Complement	564	500
Date of completion	1896	——

PROTECTION.

"Charleston."	"Esmeralda."
4-inch belt 197 feet long by 7½ feet wide	6-inch belt 350 by 7
2½-inch deck protection to vitals	2-inch deck
2-inch bulkheads	6-inch bulkheads
Upper and lower casemate armor 4 inches	
4-inch protection to 6-inch guns	
Conning tower and shields 5 inches	4½-inch shields
3-inch hoists	4½-inch hoists
4-inch signal tower	

ARMAMENT.

"Charleston."	"Esmeralda."
Fourteen 6-inch	Two 8-inch
Eighteen 3-inch	Sixteen 6-inch
Twelve 3-pounder	Eight 3-inch
Twelve 1-pounder	Nine 6-pounders
Two 3-inch field guns	Two 3-pounders
Two Gatlings	Eight Maxims
Eight Colts of 0.30	
Torpedo tubes, nil	2 submerged 1 above water

From this table the immense superiority of the "Esmeralda" is at once apparent, for on a displacement of 7,000 tons, which is 2,700 tons less than that of the "Charleston," the Armstrongs, of Newcastle-on-Tyne, England, have produced a vessel of greater speed, better protected, and far heavier armament. The same is true, as pointed out by the SCIENTIFIC AMERICAN of September 2, 1899, in regard to the "Denver" and "New Orleans" classes.

Besides other considerations, the important fact must be borne in mind that several years after completion the "Esmeralda" made a sea speed of over 21 knots, and that easily; whereas, there is the possibility that the "Charleston" may not make her contract speed of 22 knots.

In addition to her regular armament, the "Esmeralda" carries three torpedo tubes, two of which are submerged, while the "Charleston" has none, and judging from the accounts of the German-American war game now being played in England and reported in your valuable SUPPLEMENT, the torpedo would play a very important part in a modern naval engagement.

While the coal supply of the "Charleston" is greater by 150 tons than that of the "Esmeralda," yet this slight difference does not compensate for the 2,700 tons greater displacement of the former.

Apropos of the above discussion, an expression of opinion in your columns as to whether American designers are keeping pace with their foreign competitors would be greatly appreciated by several of your readers of my acquaintance.

DANIEL M. COFFIN, JR.

New York city, January 5, 1903.

[At the time of her launch the "Esmeralda" was the most powerfully armored cruiser, for her displacement, afloat, and she undoubtedly shows up well in comparison with our own new "Charleston." But it must be remembered that the 6-inch guns of the "Charleston" are about 20 per cent more powerful than the older type guns of the "Esmeralda;" and as a further offset against the more numerous battery of the "Esmeralda" the American boat carries most of her 6-inch battery behind side armor, whereas, the "Esmeralda" carries her guns in the open. Furthermore, her 4-inch side armor is carried right up to the main deck. Beyond her waterline strip the "Esmeralda" is unarmored. An exact comparison cannot be made until the ammunition supply, the facilities for supplying it to the guns, the nature and protection of the ammunition hoists, the accommodations for the crew, and many other elements of design, not given in the table above, are stated. We never considered that the "Charleston" type was very creditable to our naval designers—not at least in the degree that the "Connecticut" and "Tennessee" are. The omission of under-water torpedo tubes is to be regretted.—ED.]

Shop Practice as Viewed by an Old Subscriber.

To the Editor of the SCIENTIFIC AMERICAN:

In reply to your inquiry in the SCIENTIFIC AMERICAN concerning "Our Oldest Subscriber:"

When I was about five years old, fifty-three years ago, I began to be interested in the pictures in your paper, which was taken by my uncle, Milton E. Worrell, of the machine company of Worrell & Caldwell, of Quincy, Ill. I believe he informed me he subscribed for it in 1847, soon after it was founded. I don't know how long he continued to do so, but he still takes much pleasure in reading them, although eighty years of age.

I commenced to read the SCIENTIFIC AMERICAN at the age of eight, and became a subscriber four years later in 1858, and continued until 1899—forty-one years; since which I have secured it either from the newsdealer of from our city library. I don't believe I have missed reading a single issue for fifty years.

Besides being the most popular mechanical paper printed, I consider it the best educational journal; my wife, daughters, and son read it with nearly as much interest as I do.

I would like to call your attention to the fact that my uncle, mentioned above, is in some respects a remarkable man. At the age of eighty, with hair and beard as white as snow, he is the oldest machinist in the employ of the great Chicago, Burlington & Quincy Railroad system, and runs their big $10,000 planer with four cutting tools at their shops in West Burlington, Iowa, and has not missed a day's work from sickness in ten years.

About five years ago this machine cut off three fingers of his right hand, and he certainly supposed this serious accident would let him out of his job. While he was laid up for repairs the superintendent tried two younger men on his planer without satisfaction, and put him back to work as soon as possible.

He has sufficient property to support him without manual labor, but he is discontented when idle, and proposes to hold his job as long as he is able to give the company satisfaction.

I would explain that he and his partner, William Caldwell, started a small machine shop in Quincy, Ill., about 1843, which gradually increased in size until the beginning of our civil war, when they employed nearly 75 workmen and turned out flour mills complete from the grate bars to hopper boy. They were bankrupted chiefly by their rebel debtors in Missouri.

How things have changed in iron works since then! Now it requires about fifty different establishments to fit out a complete mill; everything has run to specialties, one concern makes the boilers, another the engine, another the shafting, another the pulleys, and so on—down to the pet cocks for draining the water pipes.

And what a revolution in tools and shop practice! In those days all our lathes had timber frames. We had no planers out here; all our flat surfaces, such as engine slides and steam valve faces, had to be chipped, filed and scraped, requiring a terrible amount of skilled manual labor.

Nor had we screw cutters; all bolts up to one inch being cut by hand, and the larger sizes in the lathe.

We had no apprentices, simply "cubs," who started at $1.50 per week cutting screws, chipping castings, smearing finished work with pitch paint and similar light and cleanly labor. At the end of a year he was proud to be advanced to the drill press and common bench work and fifty cents per week increased compensation. Next year he was given plain lathe work at $4.50, and in the fourth year, if he could skillfully run two lathes at once, he was considered to have served his time and was allowed from $7 to $9 per week. Our foreman received $10.50, and he was a fine mechanic and a pusher. We had no additional allowance for overtime, and were only too glad to earn some extra money by working all night or Sunday. But for all this we were a happy and contented crowd. There was a meat shop next door, and we cubs would invest five cents (we had no nickels then) in *a pound* of rump steak and broil it on the end of a sharp stick at noon over the fire under the boiler; they were not so tender, but barring a few cinders when they dropped in the fire, their flavor seems finer to me now than porterhouse at home.

In those days a "jour" machinist was skilled in all the science and could capably fill almost any position in any shop; but how different now! I am of the opinion that this specialty and piece work is working the ruin of our trade.

We have a large new model railroad shop here, employing about two hundred men entirely on piece work. This new style possibly cheapens the cost of common work, as the laborer, who can hardly be called a mechanic, rushes through his pieces simply with the view that they will pass inspection without regard to honest and careful finish, which should be the pride of a capable journeyman.

Besides, this plan is but poor inducement for our sons to enter the trade, where they may be kept at the same job all their lives without any chance of promising advancement.

S. E. WORRELL.

Hannibal, Mo., January 5, 1903.

The Explosion of Stars.

To the Editor of the SCIENTIFIC AMERICAN:

In my letter in the SCIENTIFIC AMERICAN of July 12, 1902, on the explosion of stars I stated that the phenomena such as had been observed in Nova Persei and Nova Aurigæ and other stars had been anticipated more than a score of years ago by Professor Bickerton of Canterbury College. It may interest some of your readers who have not read the "Romance of the Heavens" to know how a grazing impact of two stars must give rise to an explosion. In such an impact the parts standing in each other's way would be swept from the stars and would coalesce and produce an intensely heated mass, and as the temperature would not depend on the mass cut off, it would be exactly the same whether the tenth part or a third be cut from each body; if a small portion is cut off it would be too hot to be stable, and would continuously expand until it became a planetary nebula. A small body with a velocity of one and a half miles a second if shot from the moon would leave it entirely, but it would take seven miles per second for such a body to leave the earth, and three hundred and seventy-eight miles a second to leave the sun.

Heat is the motion of a molecule, and the motion of the molecules of such an impact will average a few hundred miles a second; but hydrogen at the same temperature would move about ten times as fast as the mean of other molecules. Clearly, it would move fast enough to escape the coalesced fragments of the two stars. It may readily average many thousand miles a second, and this should be the pace at which the nebula will expand.

This idea of the formation of a new body by the coalescence of the two grazed-off portions, while the two stars pass on in a scarred condition, is very full of power in the explanation of celestial phenomena. The two wounded suns would obviously rotate and produce a pair of variable stars, and it is a remarkable fact that many variable stars are to be found in close pairs. As the graze of the stars becomes deeper and deeper new phenomena ensue, and there are very few celestial bodies whose genesis cannot be shown to have arisen in impact of some kind or other.

JAMES R. WILKINSON.

Christchurch, New Zealand, November 16, 1902.

German Substitute for Celluloid.

The extensive commercial use of celluloid has caused a great many people to try to find substitutes for, or imitations of, it. In Coburg, a popular imitation has been made by dissolving in 16 parts—by weight—of glacial acetic acid, 1.8 parts of nitro-cellulose, and adding 5 parts of gelatin. Gentle heating and stirring are necessary. After the mass has swollen, it is mixed with 7.5 parts of alcohol (96 per cent), and stirring is continued. The resulting product is poured into molds, or, after further dilution, may be spread in thin layers on glass. As an underlay for sensitive photographic films, the material has important advantages, not the least being that it remains flat in developing.

James Edward Allen Gibbs, the inventor of the sewing machine which bears his name, died recently at his home in Raphine, Rockbridge County, Va. Paralysis was the cause of death. He was born on August 1, 1829. While a young man, the subject of the sewing machine was called to his attention while on a short business trip connected with the erection of some mill machinery which his father had manufactured, and on his return home he thought out the idea of the revolving hook which is the main feature of the Willcox & Gibbs machine. In all he took out twelve patents covering the sewing machine. The village in which he resided was named by him when he returned to it in middle life. The name is from the Greek word which means "to sew."

The greatest and most modern armor plate press in the world has been received at the new works at Homestead. It was built at the Bethlehem Steel Works. The plate has a capacity of 60 tons; and is capable of pressing into shape the heaviest plates expected to be specified by the Navy Department. Some of the bolts of the press weigh as much as 40 pounds each.

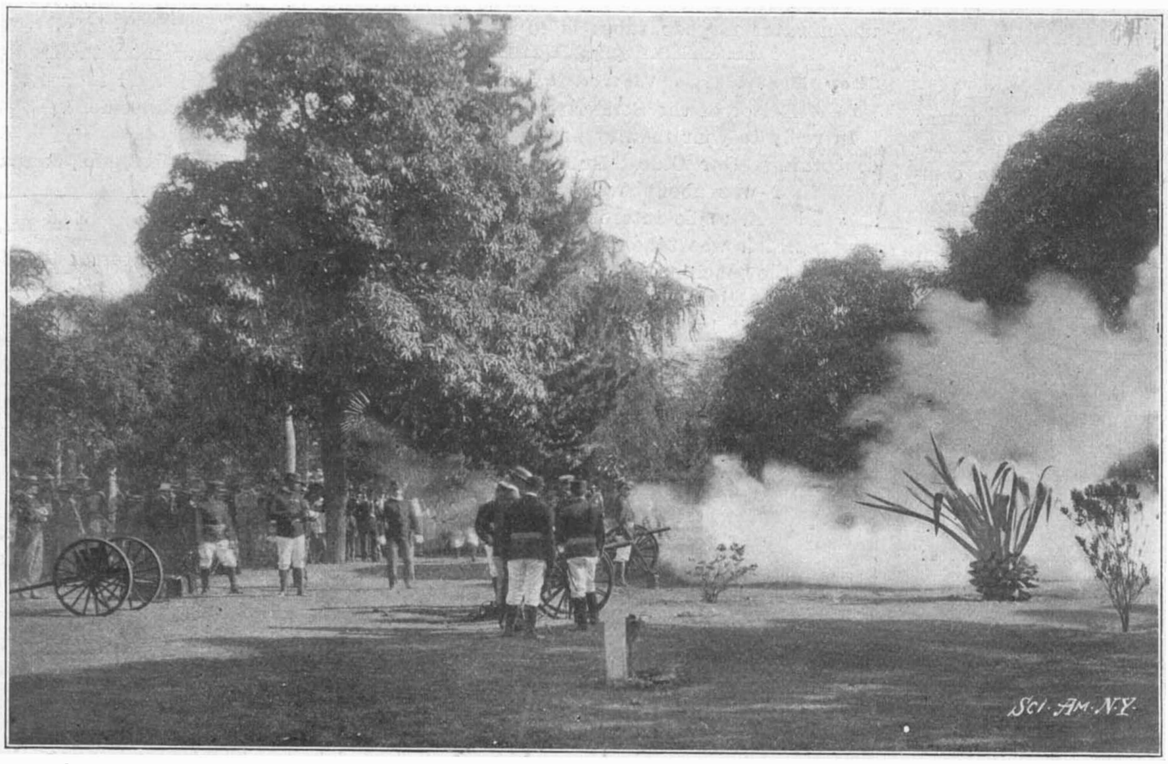
THE LANDING OF THE HONOLULU END OF THE PACIFIC CABLE.

With the salute of a hundred guns, the cheering of thousands of Hawaiians, and the reading of the President's message of congratulation and goodwill, the completion of the first section of the American Pacific cable was celebrated at Honolulu. The event was perhaps the most important in the commercial history of the islands, for with it they entered into the larger life of the outer world.

From a purely business point of view, it is only a very few years since the establishment of a cable between Honolulu and San Francisco has been regarded as worthy of consideration. Until the recent development of trade with China and Japan, any one who advocated a submarine telegraph cable in the Pacific Ocean had an opportunity of learning what a forlorn hope is like. The Atlantic Ocean had its telegraph cables, which came into existence because there was business to support them. But the Pacific Ocean was long destined to remain as innocent of cables as the pond of a country village.

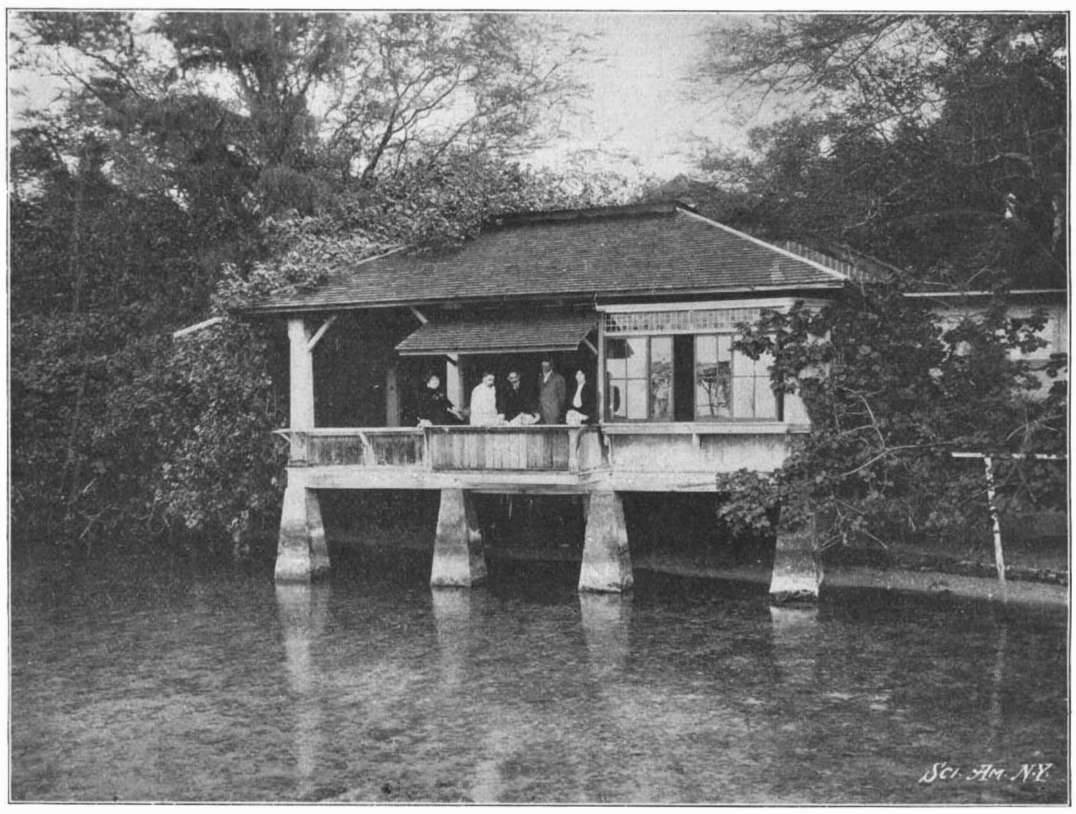
In later years, however, California was so identified in business interests with Hawaii that its public men were always ready to urge upon their delegation in Congress the passage of cable bills. But neither in Honolulu nor at the coast was capital ready to embark in the enterprise. Last winter, after fruitless efforts by the Commercial Pacific Cable Company to secure an enabling act from Congress for its cable, authority was again sought to lay the cable. Then President Roosevelt vigorously cut the Gordian knot and gave the long-sought permission under certain conditions.

The company undertook to complete the line to Manila in 1904. In all probability it will be finished by the fourth of July next. But it is not the intention of the company to stop at Manila. Realizing the immense importance to Americans of cable connection with China in view of the "open door" and of the immense trade waiting in that country for the United States in general and for California in particular, arrangements have been made to

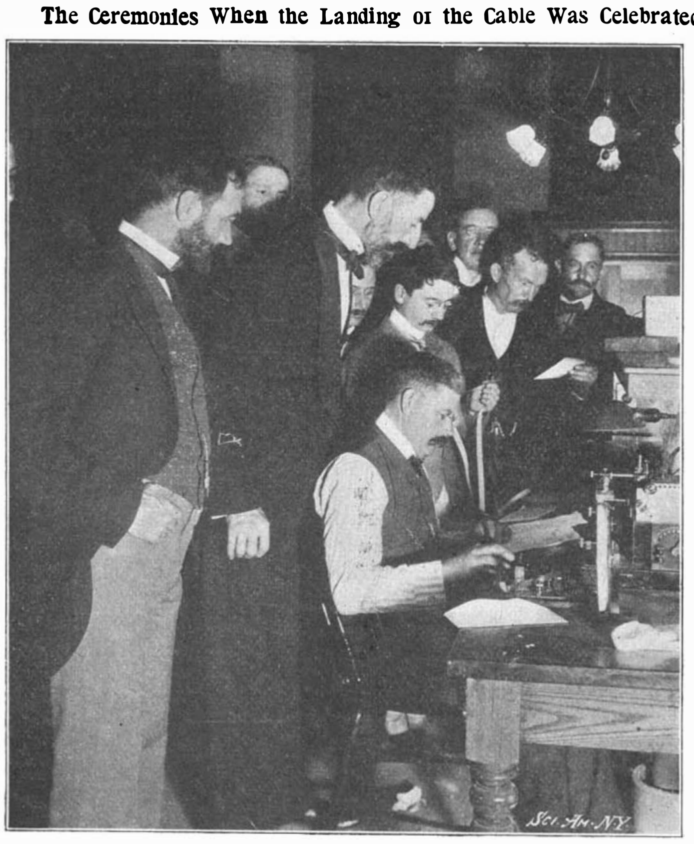


Cable-Day Celebration at Honolulu. Firing a Hundred Guns While the President's Message Was Read.

The Ceremonies When the Landing of the Cable Was Celebrated.



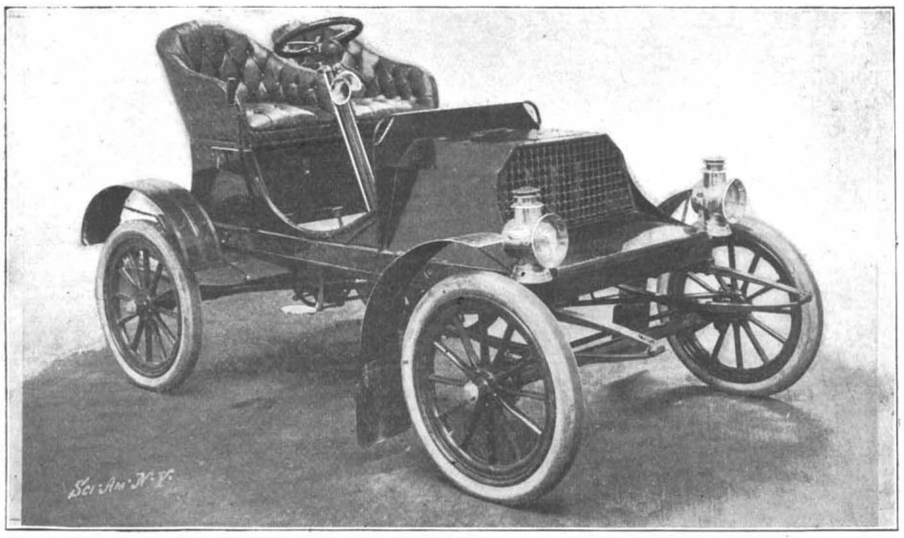
The House Where R. L. Stevenson Did Much of His Writing. Situated About 25 Feet From the Cable.



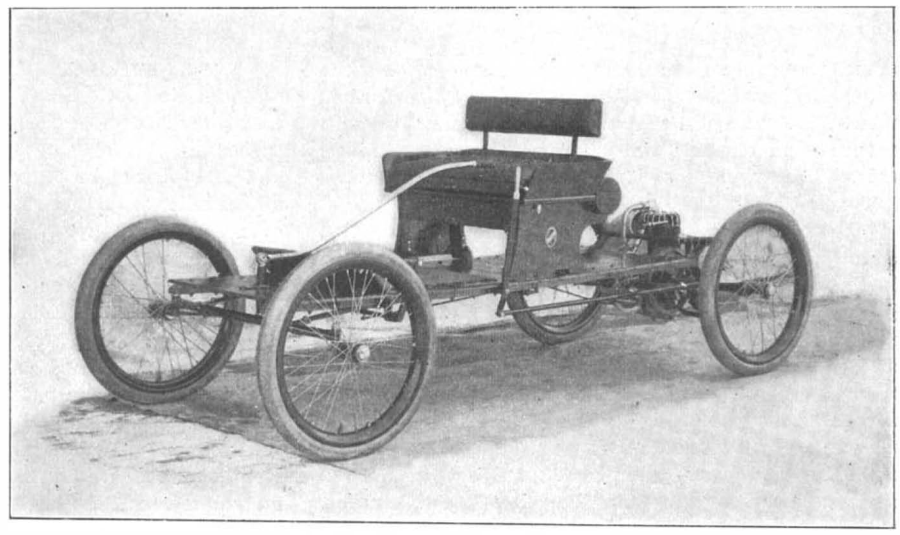
Sending the President's Message.

Celebrating the Landing of the Cable in the Palace Grounds of Honolulu.

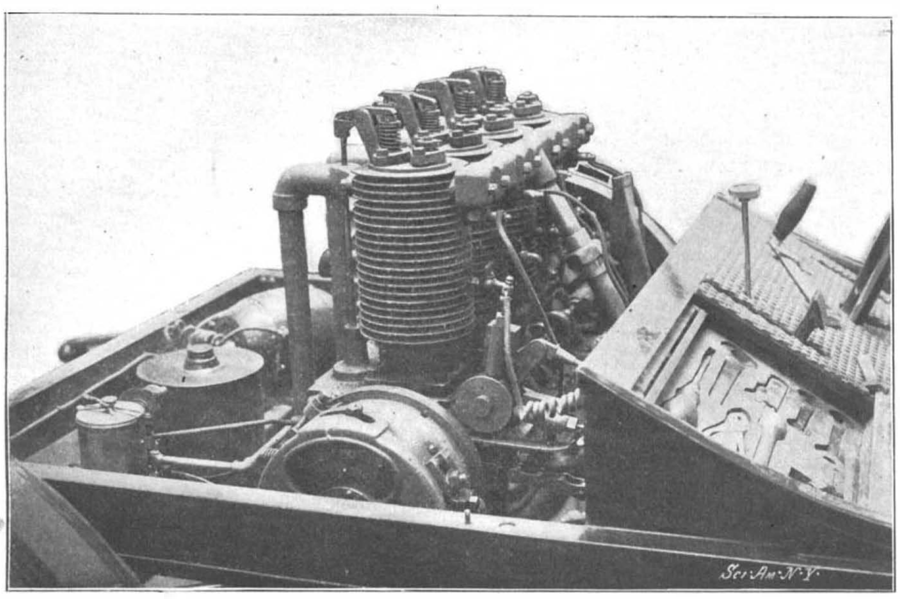
THE LANDING OF THE HONOLULU END OF THE PACIFIC CABLE.



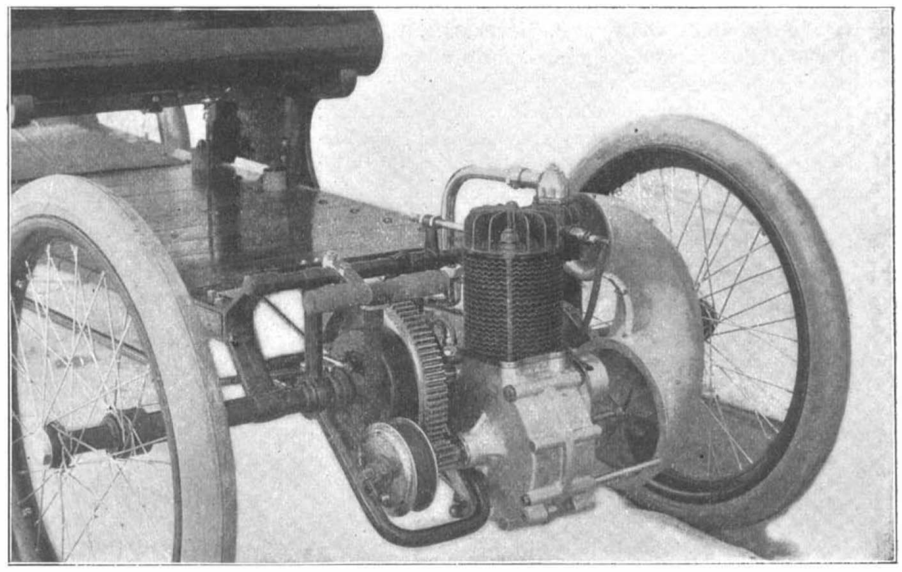
The Franklin Air-Cooled Roadster.



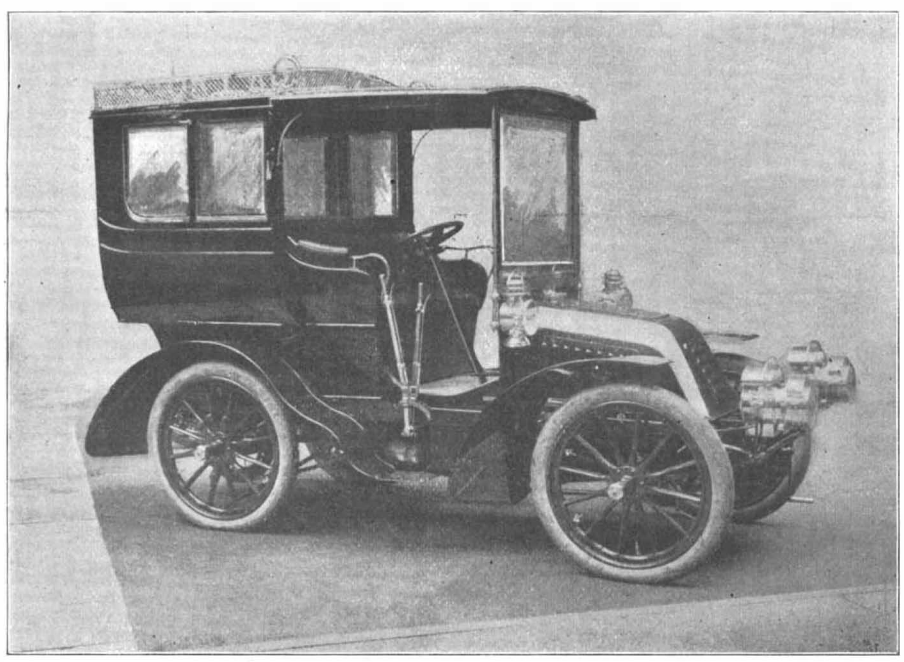
Orient Buckboard Motor Vehicle.



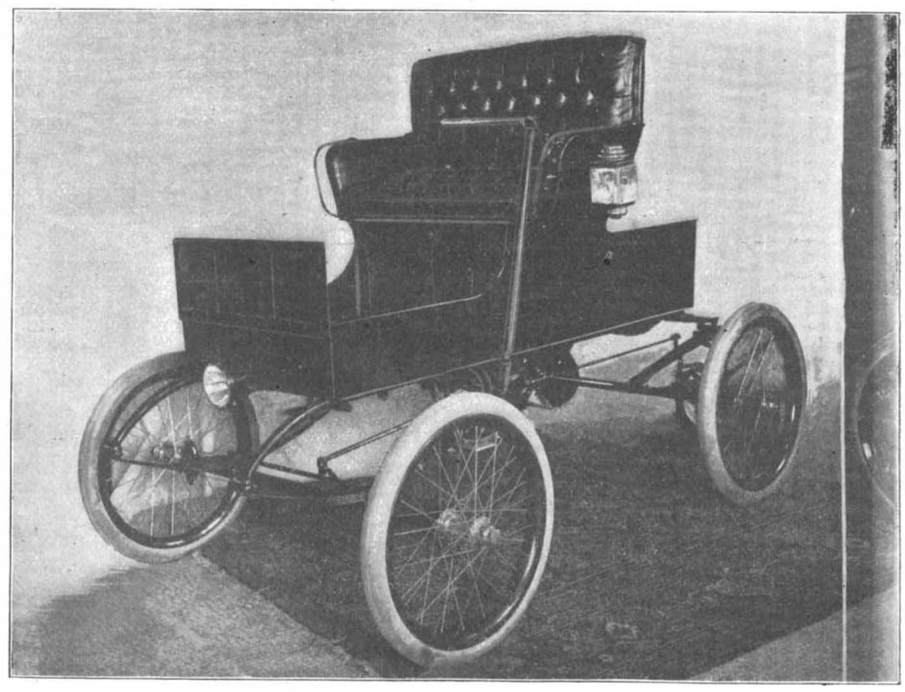
The Franklin Four-Cylinder Motor.



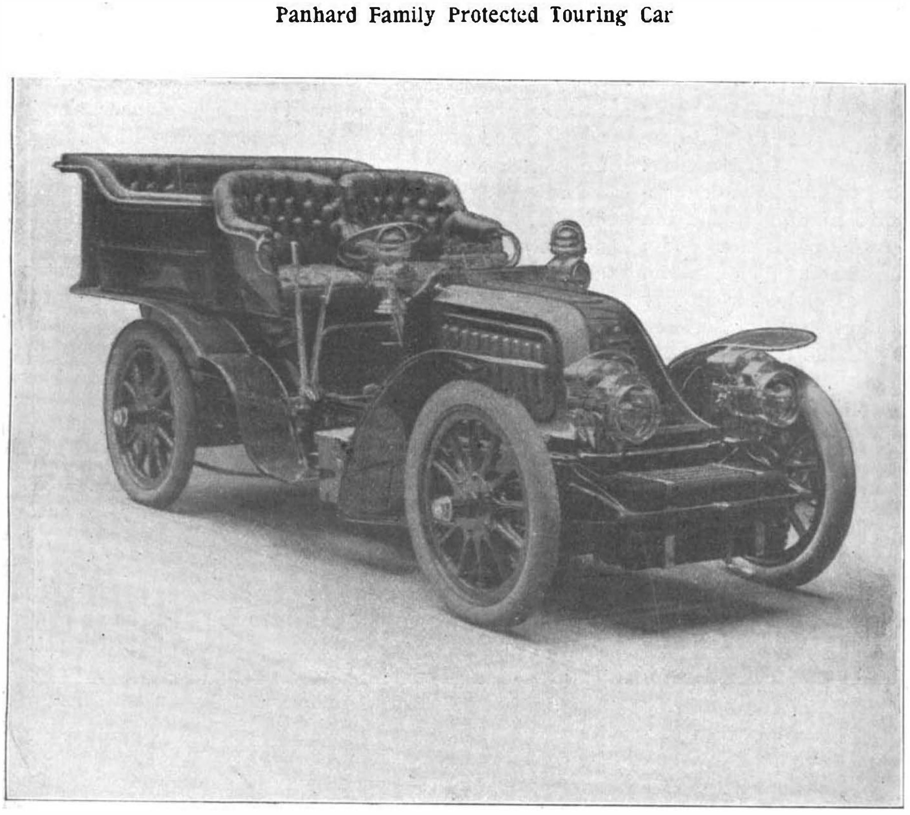
The Buckboard Motor and Fan Cooler.



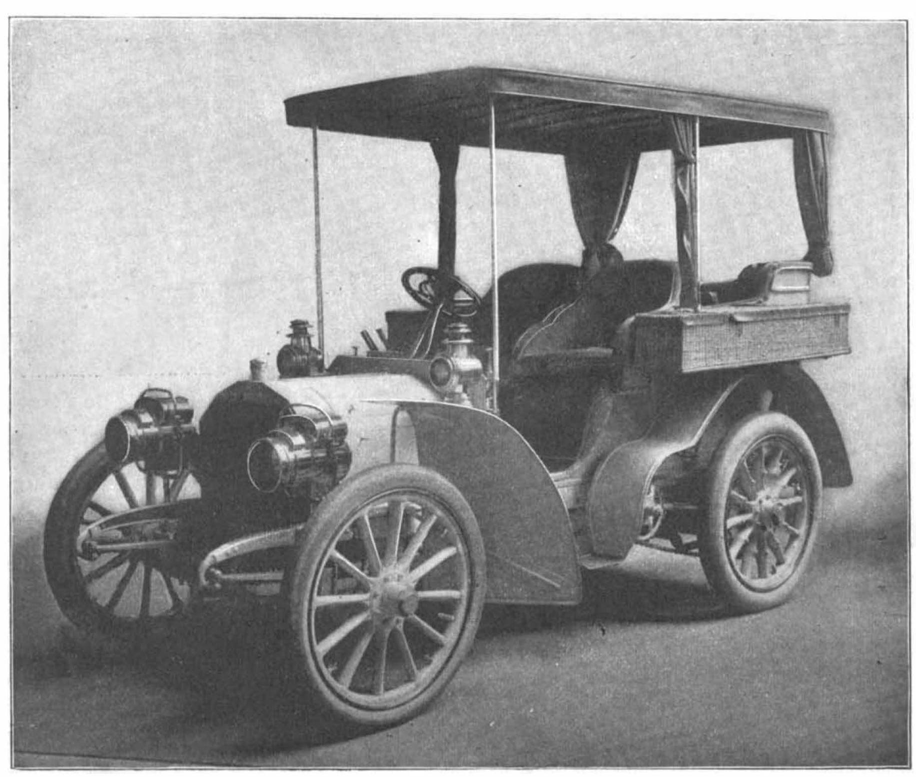
Panhard Family Protected Touring Car



The Centaur Electric Runabout.



The Pan-American 20-H. P. Touring Car.



A Mercedes Touring Car With Surrey Top.

THE THIRD ANNUAL AUTOMOBILE SHOW.—[See next page.]

extend the cable from Manila to Shanghai. Of the exent of this great work some opinion may be formed when it is considered that the length of the cable will be three and one-half times longer than the Atlantic cable. The whole length of the line will be about 10,000 nautical miles.

Some account of the actual work of laying the cable should here find a place. The telegraph steamship "Silvertown," which laid the cable from San Francisco to Honolulu, is the first ship that was built expressly for cable work. When launched she was the largest merchant ship afloat with the exception of the "Great Eastern." Upon this trip she carried 2,413 nautical miles of cable, weighing 4,807 tons, her total weight being between 6,000 and 7,000 tons. She left Portland on the English coast September 23, 1902, steamed 1,720 miles to Teneriffe, and then 900 miles to St. Vincent. Here she made a short stay to secure coal and fresh water. Then she made her longest run between coaling ports, a distance of 6,180 miles, from Teneriffe to Coronel, Chile, and thereupon proceeded to San Francisco. The value of the vessel, her cargo, the loss which would have resulted from disasters, made her a tremendous commercial risk. Throughout the voyage constant tests of cable were made. A man sitting in the testing room of the vessel could send a message to himself through over 2,000 miles of cable lying in the same vessel's hold. On September 4 the "Silvertown" arrived at San Francisco. She took on coal and supplies, laid the shore end of the cable at that point, and left for Honolulu at 2 o'clock on the morning of the 15th instant. She arrived off the islands on Christmas Day, and at about 2:30 o'clock on the morning of the 26th of December, buoyed the cable during a heavy gale at a point about thirty-five miles from Honolulu.

On reaching the place selected for the landing of the cable, the ship approached as close to the shore as possible. A couple of spider-sheaves were sent ashore, and fixed by sand anchors some 60 yards apart. Hauling lines were payed out from the ship, reeved through the sheaves, and brought back on board again. One end of this continuous line was attached to the cable, and the other to the picking-up gear. The engines were then set in motion, and the cable was dragged slowly out of the ship toward the shore. As it went, large India rubber buoys inflated with air were lashed to it every 50 or 60 feet to keep it afloat and to prevent the damage which would result from its being dragged along the bottom.

When sufficient cable was landed, the piece on shore was laid in a trench which ran from low-water mark to the cable hut; the end was inserted through a hole in the floor, and testing and speaking instruments were set up in the hut, which was occupied night and day during the laying by the electrician in charge and his assistants.

The laying of this American Pacific cable may be attributed to the untiring energy of the late John Mackay, who turned his attention to the Pacific after his achievements in the Atlantic. He foresaw an American cable must be laid sooner or later in the western waters. Still, he was not the first in the field. As far back as 1874, a Pacific cable from the States via Honolulu to Japan had been proposed, and in that year the "Tuscarora," U. S. N., under the command of Captain, now Admiral Belknap, surveyed the route. In 1879 Cyrus Field, whose name figured prominently in connection with the first Atlantic cable, renewed the Pacific scheme, but nothing more was done till the "Albatross" and "Thetis," U. S. N., were commissioned in 1891-92 to survey the route between San Francisco and Honolulu. This survey resulted in the valuable report drawn up by Commander Richardson Glover, then hydrographer of the United States navy. Three more years passed before the Senate voted $500,000 for the laying of this section, but the measure failed to pass in the House of Representatives. The steamer "Nero," U. S. N., surveyed the route between Honolulu and Manila in 1899. On the ratification of peace with Spain, President McKinley addressed a message to Congress, directing attention to the imperative necessity of speedy communication with the Philippines via Hawaii and Guam. "The present conditions," he said, "should not be allowed to continue a moment longer than is absolutely necessary."

The project, however, hung fire, and might to-day have still been as far as ever from accomplishment, if Mr. Mackay had not taken the bull by the horns, and offered to lay the cable without any subsidy whatever from Congress. Thus to the enterprise of a private individual, and not to their government, will Americans owe the enormous advantages of telegraphic communication across the Pacific.

New Comet Discovered.

Another new comet has been discovered by Prof. Giacobini of the Nice Observatory. Like the one he discovered at the end of 1902, the newcomer is a telescopic comet, but is of the tenth magnitude instead of the twelfth. It is now moving slowly through the constellation Pisces in a northeasterly direction.

THE THIRD ANNUAL AUTOMOBILE SHOW.

The Automobile Show of 1903 may be said to be an unqualified success, most instructive as an exhibit of the many improvements made within the past year, and remarkable in showing the rapid growth of the automobile industry. The exhibition opened on the evening of January 17, at Madison Square Garden, in this city, and closed on the 24th. The daily attendance was very large and exhibitors, as a rule, were fortunate in doing a good business.

The great hall of the building was crowded with magnificently finished vehicles, and at night the numerous electric illuminated signs produced a brilliant effect. The prevailing type was the gasoline-propelled vehicle, modeled generally after the foreign tonneau form, though here and there were new shapes distinctively American in their idea. With each group of vehicles it was usual to show an example of the running gear and machinery by itself, in order that the working parts could be readily understood and examined. In many cases aluminium bodies are substituted for wood, molded in graceful lines, rendering a vehicle more fireproof in case of accident. The expensive tonneaus are richly upholstered with high-back seats, and a special drop-down seat is arranged on the rear entrance door. They are very roomy and comfortable. Very long wheel bases also seem to be the rule. The upper illustrations show that this idea is taken from the American buckboard, for it is a gasoline-propelled buckboard weighing but 350 pounds, having the air cooled flanged 4 horse power motor on the rear axle, with a special rotary incased fan to project a current of air upon the valves and explosive chamber at the top of the cylinder. The speed is varied by a throttle and spark lever. It has a wheel base of 6 feet 8 inches. The Orient is made by the Waltham Manufacturing Company, of Waltham, Mass., and certainly presents a very simple and attractive appearance for practical work. A somewhat more substantial vehicle of the same type, called the "Buckmobile," was exhibited in the basement.

Another form of an air-cooled motor, and one that went through the New York and Boston endurance test successfully, is the Franklin four cylinder roadster, of which we give two illustrations. In one a view of the cylinders and machinery is given. The interior size of each cylinder is 3¼ inches, and the ports and valves are readily accessible. All portions are well balanced and jarring is avoided, since there is an explosion at every fourth part of a revolution. At 1,000 revolutions the car travels at the rate of 20 miles per hour, and a rate of 30 miles can be attained.

The four cylinders, aided by a large flywheel, give a very constant torque, and allow of such effectual throttle control of the motor, that but two speeds ahead are needed. The ignition outfit consists of an Apple dynamo, driven from the flywheel by a bevel friction pulley, and two cells of storage battery. But one spark coil is used, the secondary current being switched to the proper spark-plugs by means of sectors on the two-to-one shaft that carries on its end the commutator for primary current. The advantage of an air-cooled motor of this kind without auxiliary cooling appliances is self-evident.

We illustrate two new styles of covered gasoline tonneau machines for touring purposes, one exhibited by the Locomobile Company of America after the French tonneau "Limosine" style of aluminium body, inclosed with glass windows and a glass front.

Another Mercedes gasoline Panhard pattern exhibited by Smith & Mabley has a luggage space on top inclosed by a wire network. The front pane of glass ahead of the driver may be turned up and suspended from the underside of the top. In rainy weather the open sides may be closed with curtains.

Of the closed variety of gasoline vehicles the most interesting was an Oldsmobile brougham which resembles a miniature cab and is manipulated from within. It has a bow glass front with side doors and room for one person in the rear and one in the front. It is intended as a closed carriage for stormy weather, a desirable vehicle for physicians and others.

Another of our illustrations is of the Centaur lightweight electric runabout manufactured by the Centaur Motor Vehicle Company, of Buffalo, N. Y. It is a substantial vehicle of its character, supported on four springs and is propelled by 14 cells of "Exide" battery. The motor is hung under the center of the body, a sprocket chain conveying the power to the rear axle.

The different speeds are obtained by paralleling the fields of the motor as well as by the usual battery connections. The usual 40-mile radius is obtained.

The lightest weight electric runabout exhibited was that shown by the Electric Vehicle Company, which weighed less than 1,000 pounds and has the batteries in a box suspended underneath the body. This machine has also a specially designed controller. The same company also showed a new physician's brougham operated from within, and a new model hansom, with large wheels and under-slung battery.

The National electric runabout with thirty-six 125-ampere-hour cells of Pumpelly battery, is guaranteed to have a 75-mile radius per charge on good, level roads. Several cells connected together of the improved Edison storage battery were on exhibition, and presented a very neat and attractive appearance. The battery was not in operation, but assembled together to illustrate how it is to look. The statement was made that the six months' actual test of the battery had been most satisfactory and that certain additional trials were now being made in this city on delivery wagons, after which it would be ready for the general public in May or June next. The workmanship and general makeup of the battery is very unique and its care will be of the utmost simplicity. The bright aluminium-colored cell has horizontal corrugations on the exterior to strengthen the metal sides, but the cover is the most interesting feature. A spring-hinged rubber plug clamped in position closes the supply aperture and a special miniature poppet valve having a stationary perforated cover protected on the top by a fine Davy gauze wire operates in such a way as to allow the gas to escape during the charging and prevent the solution from coming out. It also prevents the gas in the cell from being accidentally ignited from the outside and thereby avoids any possible explosions. The connections are very simple and rest upon the slightly-tapered end at the top of the plate terminal secured by a nut, which is held in place by a cotter pin. This enables any one cell to be removed without difficulty. To care for the battery it is only necessary occasionally to fill the cells with distilled water, which is done by the aid of a special funnel having a float gage indicating when enough water has been added.

It was said the battery would take a charge as high as sixty amperes and could discharge readily two hundred amperes at one time. Each cell weighs seventeen pounds and has a voltage when charged of 1.3 volts.

A very handsome combination gasoline electric tonneau vehicle was the Neftel, exhibited by the Ranier Company, of this city. The usual gasoline engine in front under the bonnet operates a generator hung under the center which supplies current to two motors under the rear and also charges a battery hung underneath. The engine is started automatically by the pressure of a button or lever, and the operation of the machine is controlled after that precisely as an electric vehicle. The complicated transmission gear of the regular gasoline machine is thus avoided.

Located in the northeast part of the hall was the latest type of the Stevens-Duryea gasoline machine, equipped with a perfect working engine and appliances for starting and transmission gear. The vehicle has a phaeton top and a special seat in front to accommodate two extra persons if needed. It is regarded as a powerful machine and won the hill-climbing contest at Eagle Rock, N. J. The Pan-American Company exhibited a very high-powered tonneau machine.

The White steam tonneau exemplifies the latest model in steam cars. The engine that propels it is a double-cylinder compound, having 3 and 5-inch cylinders, having its crank shaft directly connected to the bevel-gear-driven differential by a shaft with universal joints. The flash boiler of the car is situated beneath the forward seat. The condenser gives the machine a radius of 100 miles without refilling the water tank. Now that the condenser has been demonstrated a success on the White cars, most of the other progressive manufacturers of steam automobiles are fitting it on their cars also. The Grout steam tonneau is finished off in front with a miniature cow-catcher, which serves to protect the condenser, and at the same time gives the car a locomotive-like appearance.

In the line of clutches was an electro-magnetic clutch of simple construction exhibited by the Electro-Magnetic Speed Changing Gear Company, and a pneumatic clutch by the Country Club Car Company, of Boston, which for simplicity of operation was extremely interesting. A small reservoir of compressed air in which the pressure is maintained by every movement of the engine piston at the time of explosion, enables the operator by the slight turn of a valve, the same as the engineer on a locomotive operates the air brake, to operate one of three pistons and thereby to clutch the engine shaft for any speed desired, or for reversing. Lack of space forbids further mention of numerous other novelties on exhibition.

The Enno Sander prize of the Association of Military Surgeons of the United States for 1903 will be awarded to the author of the best essay on "The Differential Diagnosis of Typhoid Fever in its Earliest Stages." The Board of Award will consist of Dr. Austin Flint, of New York; Colonel Calvin DeWitt, of the Army, and Prof. Victor C. Vaughan, of Ann Arbor. Full information concerning the contest may be obtained from Major J. E. Pilcher, of Carlisle, Pa., secretary of the association.

THE PASSING OF THE HALL OF RECORDS.

New York's old Hall of Records, a relic of pre-Revolutionary days, evil in reputation, and yet dear to every New Yorker who knows anything at all of the colonial history of his native city, is to be torn down, not because of any lack of patriotic feeling, but because of modern necessities.

When erected in 1757 in the "Fields," as City Hall Park was then termed, the Hall of Records was known as the "New Gaol;" as such it took the place of the City Hall, the inadequacy of which for the detention of criminals had become apparent as early as 1724. Originally, the "New Gaol" was to have been two stories in height, and about 50 feet square; but during the process of construction a third story was added, with a cupola which was used as a lookout for fires.

The jail seems to have opened its doors, or rather shut them, to criminals about 1763. In that year, Major Rogers was confined within its walls for debt. The British troops attacked the jail and liberated all the prisoners. But Rogers refused to be freed in what he considered a dishonorable manner, and so notified the authorities.

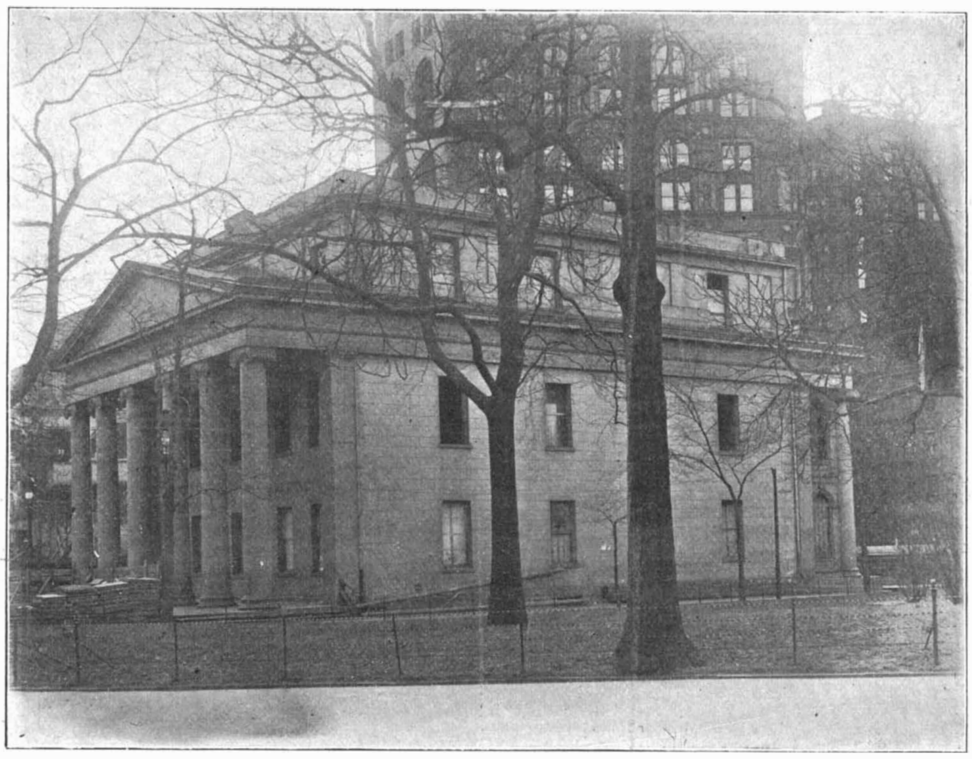
For companions, the jail had a cheerful group of old instruments of correction—a whipping-post, stocks, a cage, and a pillory, brought from Wall Street and set up in the "Fields." To these, there was later added the Bridewell prison, which had a career even more lugubrious than that of the "New Gaol." Clearly, the "Fields" seems to have been architecturally adorned with the grimmest structures that could possibly have been hit upon.

For patriotic Americans, the interesting portion of the "New Gaol's" history may be considered to have been begun with 1770. On January 16 of that year, the great Liberty Pole riot occurred, during which it is claimed by some historians, the first blood was shed in the Revolution. The immediate cause was a handbill circulated by a Scotchman, MacDougall, one of the leading spirits of the Sons of Liberty. After a long search he was arrested and cast into the "New Gaol." Public sympathy was expressed for him in a most remarkable manner. In Holt's Journal, February 15, 1770, there may be found the following item: "Yesterday, the forty-fifth day of the year, forty-five gentlemen, friends of a Captain MacDougall, and the glorious cause of American liberty, went in decent procession to the 'New Gaol' and dined with him on forty-five pounds of beefsteaks, cut from a bullock forty-five months old." The cabalistic number forty-five was selected because MacDougall's case was so similar to that of John Wilkes, who was imprisoned in England for a famous article on individual liberty, printed in number forty-five of the "North Briton."

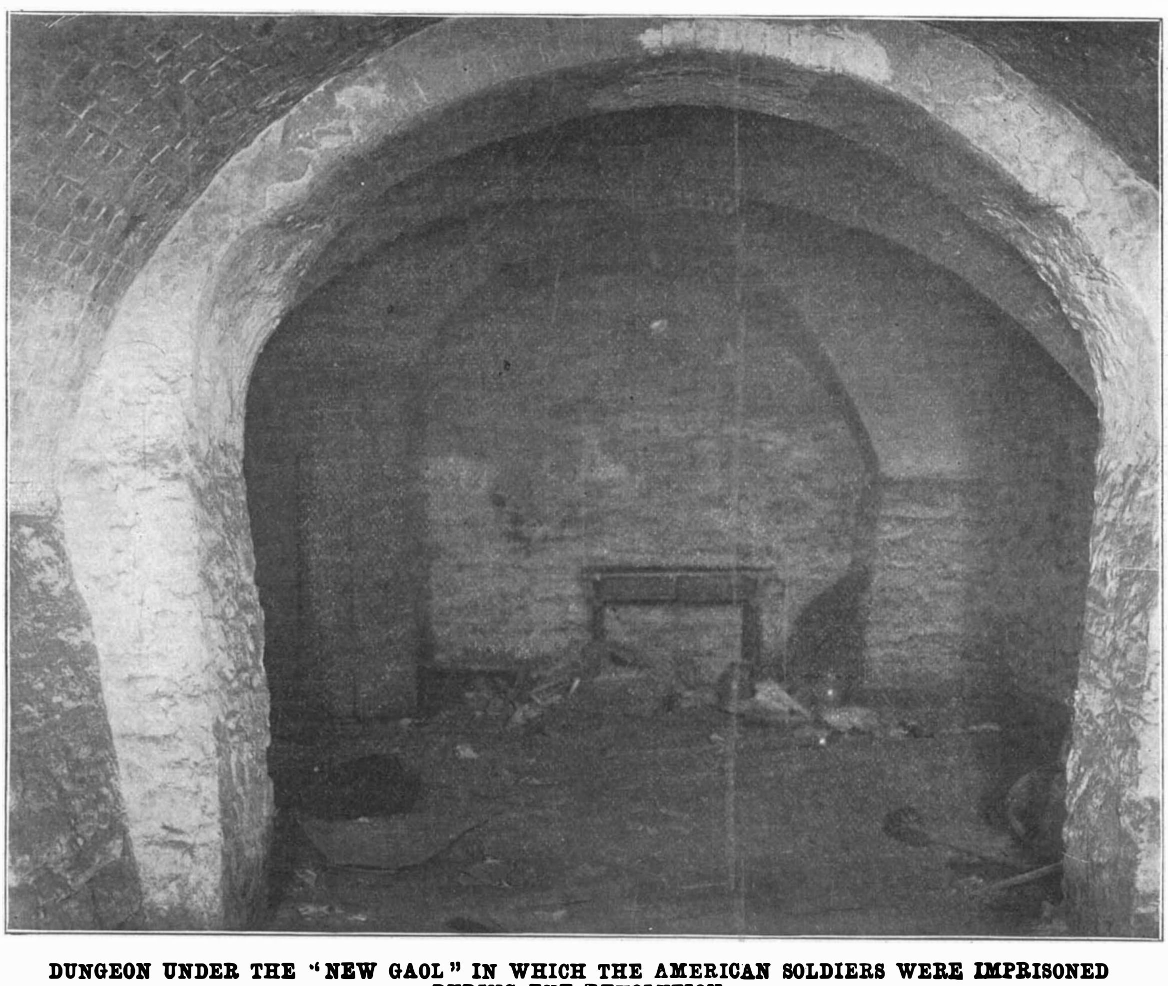
In sight of the "New Gaol" Alexander Hamilton drilled his artillery company, and the Declaration of Independence was read by the Commander to the Continental Army. It was during the Revolution, under the infamous Provost-Marshal Cunningham, after whom the building came to be called the "Provost," that its unenviable reputation was acquired.

All accounts agree with singular unanimity in awarding to Cunningham the palm for cold-blooded brutality. Under his regime the prison was reserved for the more notorious rebels, civil, naval, and military. In Valentine's Manual for 1849, Henry Onderdonk, Jr., gives a graphic account of the conditions that prevailed under Cunningham. An admission into this modern Bastile, he says, was enough to appal the stoutest heart. On the right end of the main door were Captain Cunningham's quarters, opposite to which was the guardroom. Within the first barrack was the apartment of Sergeant O'Keefe, who seems to have been surpassed in cruelty only by Cunningham himself. Sentinels were posted at the entrance door day and night; at the first and second barracks, which were guarded, barred, and chained; at the rear door, on the platform; at the grated door; and at the foot of the second flight of steps leading to the rooms and cells in the second and third stories. Cunningham evidently had an eye for theatric effects. When a prisoner, guarded by soldiers, was led into the hall, the whole guard was paraded, and he was delivered over, with all formality, to Cunningham, or his deputy, and questioned as to his name, rank, size, age, etc. The replies were entered in a record-book which has been discreetly destroyed, either by Cunningham himself, or by the British authorities. At the bristling of arms, placing of bolts and locks, and clanking of iron chains, the unfortunate captive entered his cell, often never to emerge alive.

THE HALL OF RECORDS FROM 1763 TO 1830. VARIOUSLY CALLED THE "NEW GAOL," THE "PROVOST," AND THE "DEBTORS' PRISON." FROM A PRINT IN VALENTINE'S MANUAL FOR 1847.



THE HALL OF RECORDS AS IT APPEARED FROM 1832 TO 1903.



DUNGEON UNDER THE "NEW GAOL" IN WHICH THE AMERICAN SOLDIERS WERE IMPRISONED DURING THE REVOLUTION.

The northeast chamber, turning to the left on the second floor, was reserved for officers, and characters of superior rank, and was sarcastically dubbed "Congress Hall." So closely were the prisoners packed, that when they lay down at night to rest (when their bones ached) on the hard oak planks, and they wished to turn, it was all together, by word of command: "right"—"left," being so packed as to form almost a solid mass of human bodies. In the daytime the blankets of the prisoners were suspended around the walls, every precaution being used to keep the rooms fresh and the walls and floors clean, to prevent jail fever.

In this gloomy prison were incarcerated many persons of distinction. Among them may be mentioned the famous Ethan Allen. Proud to have so distinguished a prisoner, Cunningham seems to have treated Allen with a barbarity exceptional even for him. The American patriot was placed in solitary confinement in a dungeon—it may be the very one which we illustrate—and kept there without bread or water, for three days; then he was graciously allowed a piece of fat pork and a biscuit to satisfy his hunger. Besides Allen, Cunningham seems to have had Nathan Hale under his care on the night of September 21, 1776, before his execution. This, however, is a matter of conjecture, and not of record. Nevertheless, it is certain that Cunningham made all the preparations for Hale's execution, and would not give him the Bible and clergyman, or the pen, ink, and paper wherewith Hale wished to write to his friends.

Some historians say that Cunningham was executed for forgery, in London, on August 10, 1791; but a careful search of English prison records shows that neither in London nor any other prison was a forger of the name of Cunningham then executed. The supposed forger is said to have made "a dying confession" in which he stated:

"I was appointed Provost-Marshal to the Royal army, which placed me in a situation to wreak my vengeance on the Americans. I shudder to think of the murders I have been accessory to, both with and without orders from the government; especially while in New York, during which time there were more than two thousand prisoners starved in the churches, by stopping their rations, which I sold. There were also two hundred and seventy-five American prisoners and obnoxious persons executed, which were thus conducted: a guard was dispatched from the Provost about 12:30 at night, to the Barrack street, to order the people to shut their window-shutters and put out their lights, forbidding them at the same time to look out of their windows or doors, on pain of death, after which, the unfortunate prisoners were conducted, gagged, just behind the upper barracks and hung without ceremony, and there buried by the black Pioneer of the Provost."

This "dying confession" bears the marks of palpable fabrication, and has been branded as such by cautious writers. So far from having been executed as a forger, Cunningham is said to have died peacefully in a country home.

After the Revolution the "Provost" was promoted in dignity. All common criminals were sent to the Bridewell, and the "Provost," now called the "Debtors' Prison," was reserved for genteel prisoners, who had forgotten to pay their debts.

In 1830, at the urgent request of the Register for a fireproof building in which to house the city records, the "Debtors' Prison" was remodeled. By New Yorkers of a half century ago the structure was considered an uncommonly good reproduction of the temple of Diana of Ephesus.

For the last sixty years the building has remained unchanged, at least so far as its exterior is concerned. The thousands of people that daily climb the stairs leading from City Hall Park to the Brooklyn Bridge probably never realize that the time-worn, insignificant structure which they pass was at one time considered an architectural masterpiece, a building which New York proudly regarded as its most beautiful public edifice.

The First Wireless Message from the United States to England.

On the night of January 18, Marconi succeeded in outdoing himself when he transmitted a message of greeting from President Roosevelt to King Edward directly from the Cape Cod station to Poldhu, England. The distance covered is greater by 600 miles than that over which messages have previously been sent.

The performance is all the more remarkable when it is considered that the message was sent without any previous attempt to establish communication by preliminary signals.

It was on Sunday, January 18, that President Roosevelt sent to Marconi, by the ordinary telegraph, a message for King Edward. The message read as follows:

"*His Majesty King Edward VII., London, by Marconi Transatlantic Wireless Telegraphy:*

"In taking advantage of the wonderful triumph of scientific research and ingenuity which has been achieved in perfecting a system of wireless telegraphy, I extend, on behalf of the American people, most cordial greetings and good wishes to you and to all the people of the British Empire. THEODORE ROOSEVELT.

"Washington, D. C."

Marconi's success came unexpectedly. After having busied himself all day in preparing his sending apparatus, he began to practise sending President Roosevelt's message without calling either the Poldhu or the Glace Bay station, contrary to the arrangements which he had made. Thinking that he might not be able to get the English station for a day or two, he decided to send the President's message by way of the Glace Bay station. Calling up the operator there he gave him the message with instructions to forward it to England. To Marconi's astonishment he received a reply from Glace Bay that the operator had been informed by the station at Poldhu that the message had been received directly from Cape Cod. There was not the slightest hitch in the process of sending. About four minutes were required to transmit the entire message.

King Edward replied to the message which he received from the President by cable as follows:

"SANDRINGHAM, January 19, 1903.

"*The President, White House, Washington, D. C., America:*

"I thank you most sincerely for the kind message which I have just received from you through Marconi's transatlantic wireless telegraphy. I sincerely reciprocate in the name of the people of the British Empire the cordial greetings and friendly sentiment expressed by you on behalf of the American nation, and I heartily wish you and your country every possible prosperity.

"EDWARD, R. AND I."

The King sent his message by cable for the reason that Marconi was adjusting his instrument for sending tests to England and did not wish to upset his plans by making any attempt at receiving from the other side of the ocean.

Severe and successful tests were recently made by the Fire Department in New York city of the 6-inch standpipe in the new "Flatiron" building in New York. The purpose of the test was to determine if the 6-inch pipe would stand the great pressure of twenty-three stories of water, and to find out how much force could be given to a stream from a hose attached to a standpipe at so great an altitude. Were there no standpipe, the upper stories of the building would be practically unprotected from fire. Two tests were made: First a 1⅛-inch nozzle was attached to a 3-inch hose on the roof, and the hose to the standpipe. The roof of the building is 304 feet above the street level. After the connections had been made, the full force of a fire engine in the street was turned on; in two seconds a strong stream spurted from the nozzle on the roof. A gage showed that there was a nozzle pressure of 120 pounds even at that great elevation. The second trial consisted in playing nine streams of water, one from each of the eight floors above the twelfth story and one from the roof; ¾-inch nozzles were used; a pressure of 200 pounds was obtained upon each. The Chief of the Fire Department of New York considers the test eminently satisfactory.

The Current Supplement.

The current SUPPLEMENT, No. 1413, contains a great variety of interesting articles. It opens with an account of the making of pins, illustrated by photographic views. Mr. John Joseph Flather continues his discussion of the modern tendencies in the utilization of power. In the present installment of the series of the Naval War Game, by Mr. Fred. T. Jane, an account of an interesting battle off Manila between the German and American fleets is given. The American fleet is crushingly defeated. The present state of wireless telegraphy is made the subject of a good article by Mr. Maurice Solomon. Not so long ago, there was published in the SUPPLEMENT a full description of Prof. S. P. Langley's aerodrome. Some account of the pterodactyl, the greatest of flying creatures, and therefore the greatest of flying machines, should not be without interest. Valuable comparisons are made between this creature and the modern flying machine and modern products. Mr. E. O. Hovey summarizes the proceedings of the American Geological Society at the convention of the American Association for the Advancement of Science. Mr. James Francis Le Baron discusses a new method of dam construction. Oil as fuel in warships is made the subject of an extensive article.

Ira F. Gilmore, of Bloomington, Ill., has perfected and patented a wireless piano which he has been working on for thirteen years. Being unable to get the reed made satisfactorily in this country, he set about this task himself, and from a piece of steel he fashioned with drill and file a five-octave comb reed from which, it is said, combined with a bridge and sounding board, he secures a fine, sharp tone.

RECENTLY PATENTED INVENTIONS

Engineering Improvements.

NOZZLE-TIP FOR LOCOMOTIVES.—D. GRATTAN, Anaconda, Mont. In its general construction Mr. Grattan's nozzle tip tapers inwardly from the bottom and flares at the top. This is secured by means of the inwardly-tapering form of the bore of the nozzle tip and by means of an inverted cone supported concentrically with the tube at the top by V-shaped bridge strips. The strips and cone both serve to spread the steam and provide a greater area than is secured by the ordinary tip. Consequently the stack is filled at all points with exhaust steam, thus removing the back pressure on the piston head, greatly reducing the consumption of fuel and increasing the power and speed of locomotives by permitting the steam to escape freely to the atmosphere the instant release takes place.

ROTARY ENGINE.—T. W. NEELY, Marshall, Ill. This is an improvement in that class of rotary engines which are supplied with abutments adapted to slide radially in the casing and with a cylindrical piston arranged concentrically in this casing, and having a series of radial wings between which and the abutments the steam acts expansively to cause rotation of the piston. The invention consists particularly in the construction and arrangement of the steam-induction valves and their operating mechanism, the governor and cut off, and the relation of the piston-wings to the abutments for working steam expansively and obtaining regular rotation of the piston.

ROTARY ENGINE.— E. H. WERNER, Somerset, Penn. This contrivance is useful as an engine, pump, or compressor. It involves the combination, with an oval-shaped or elongated piston-chamber or casing, of a piston formed of jointed sections so disposed with respect to the casing that as the piston turns, its parts move relatively. Thus it is always in contact with the inner walls of the casing at a plurality of points. The motive force acting on this piston, causes it to turn continuously, and its movement is thus transmitted to the shaft of the engine.

CUT-OFF-VALVE CONTROLLER.—G. H. CLOVER, Chicago, Ill. This contrivance pertains to compound steam-engines: and the intention of the inventor is to provide a new and improved cut-off-controller arranged to govern the cut-off valve of the low-pressure cylinder according to the load, so that the engine runs with great regularity and without shock or jar. The object of the invention is also to have this simply and durably constructed controller readily applied to the engine and not liable to get out of order. Mr. Clover does not limit his invention to the particular application of improvement to the low-pressure cylinder of the Corliss engine. The device may be used for other purposes.

AUTOMATIC HORSE-POWER AND PRESSURE INDICATOR AND RECORDER.—EDMOND FORTIER, Kankakee, Ill.. This automatic device is an improvement in steam-pressure and horse-power indicators for use on steam engines, and has for an especial object to provide improvements upon the construction illustrated in a former patent. In the present invention, the steam-pressure and horse-power indicators are combined to secure an accurate indication upon the same dial of both, and the horse-power indicator is arranged to operate the recording device and also to connect with the means for operating the horse-power-indicator devices, by which to show the different points at which steam is cut off in the cylinder.

Hardware.

PIPE-WRENCH.—L. W. JOHNSON, Jerome, Ariz. Ty. The object of this invention is to provide an improved pipe wrench which is arranged to permit of conveniently and accurately adjusting the movable jaw relative to the fixed jaw according to the diameter of the work under treatment, and to securely grip the work for turning the same without danger of the jaws slipping from the work.

SHEARING ATTACHMENT FOR ANVILS.—C. A. CHRISTENSON, Viroqua, Wis. Mr. Christenson provides in this invention a readily attachable shearing device of novel construction for an ordinary anvil, thus affording convenient means for shearing plate or bar metal into form, as the case may require. An improved gage is also employed as a co-acting detail for the shearing device that greatly facilitates subdividing the material into pieces of equal length when this is required.

PERMUTATION-PADLOCK.—T. KING, Glencoe, Mich. This permutation-padlock relates to a class of padlocks having rotatable locking-rings that by adjustment secure the inserted leg of a bowed shackle-bar within the lock-body and by a proper change of adjustment release the shackle-bar, permitting its withdrawal from the locking-rings. The object of the improvement, is to provide novel features that are simple, easy to manufacture, and convenient to manipulate.

WRENCH.—MARTIN MAHLEN, Osakis, Minn. This tool belongs to a class of lever-wrenches employed to screw or unscrew pipes into or from their fittings or bolts and studs which need adjustment by turning their bodies. The aim of the inventor is to produce a lever-wrench of the class indicated which embodies a multiple linked chain as an element, the chain having a roughened surface for engagement with a pipe or bolt body and also novel co-acting forms of construction, which serve to bind the chain on the object to be turned when the lever is moved in one direction, and release the chain by an opposite movement of the lever.

Heating and Lighting.

HYDROCARBON BURNER.—F. M. BAKER, Fond du Lac, Wis. The present invention relates to a hydrocarbon burner analogous in some respects to one previously patented by Mr. Baker. In this burner the oil is fed from a reservoir into a retort by capillary attraction, and is there heated by a rod protruding into a flame from an oil cup. Gas is thus generated and flows through a small orifice into the mixing chamber of the burner, where it is ignited.

FURNACE.—H. E. KENT, Buffalo, N. Y. This improved furnace is arranged to insure complete combustion of the fuel and the extraction of all the heat units contained in the fuel. An extremely high heat is thereby produced for use in steam-generation, smelting operations, and for various other purposes. When the furnace is in action all the smoke and gases arising from the burning of solid or hard fuel in the chamber are completely burned. Consequently chimneys and draft-tubes are dispensed with. At the same time, great temperature is developed, which insures a quick generation of steam or smelting of ores and other materials.

Electrical Apparatus.

ELECTRICAL REGULATOR.—C. P. PHILBRICK, Wymore, Neb. The present invention relates to pressure-controlled electric mechanism for regulating the flow of fuel to a furnace located beneath the boiler. The boiler is provided with a pressure motor consisting briefly of a diaphragm so held within a casing as to buckle outwardly when the boiler becomes heated above its normal temperature. This motion is communicated by means of a movable plunger to a bell crank which acts to close the circuit of a pair of electro-magnets. These, in turn, attract an armature, which is directly connected to the valve controlling the flow of fuel. The flow of fuel is thus cut off and the heat of the boiler is gradually checked, causing the pressure to drop to its normal degree.

TROLLEY-HARP.—F. J. CASWELL and C. C. WOOD, Woodville, Mass. The object of the inventors in this contrivance is to insure the proper engagement of the trolley with the wire, notwithstanding that the course may be devious, and the road irregular. The invention comprises certain novel forms involving a spring-sustained trolley. An important feature is in the arms allowing the trolley-wheel to make turning movements on the pole, but not great enough to impair the proper engagement of the trolley-wheel with the wire, while at the same time permitting the freedom of movement necessary for the wheel in turning curves and other irregular portions of the road. By this swivel motion a wheel is kept on in very sharp curves and on all curves, with proper tension on top of the car. Another valuable feature is that by means of the construction employed, the trolley-wheel is allowed to move freely within the necessary scope, while other movements are effectively prevented. In these movements the running of the trolley-wheel is designed so as to avoid any marked wear in the groove or the hub. The arms also prevent the trolley-harp from catching against crossing wires, brackets and other obstructions, the device easily riding under.

Mechanical Devices.

LATHE.—C. SEYMOUR, Defiance, Ohio. The invention pertains to woodworking machinery, and more particularly to lathes for turning irregular forms. The purpose of the mechanism is to furnish a new and improved lathe especially designed for turning irregular forms—such as handles used in brushes, tools, and other implements—the lathe being arranged to turn the rough blank from end to end to form the handle complete and oval in cross-section. The design is also to finish the handle with great and symmetrical accuracy, without the aid of skilled labor.

MILL.—G. M. KEMP, Williamsport, Md. The mechanism designed by Mr. Kemp is an improvement in mills, having for its objects, among others, to furnish improvements in the grinding devices, in the means for feeding the material to the grinding-surfaces, and in the means for controlling the grinding by regulating the discharge of the ground material from the grinding surfaces.

WASHING MACHINE.—S. HAYES, Ellensburg, Wash. The novel features of this apparatus were designed to provide a new and improved washing machine, simple and durable in construction, very effective in operation, easily manipulated, and arranged to insure a constant turning over of the clothes while the machine is in action to effect a thorough washing of the articles to be cleaned. Very little physical exertion on the part of the worker is called into play while operating this washer.

MECHANICAL MOVEMENT. H. THEISSEN, Davenport, Iowa. The improved mechanical movement developed by this invention, through a novel construction, provides for the conversion of continuous rotary movement into an oscillating or reciprocating rotary movement. The invention is especially designed for use in apparatus such as washing-machines, where it is desired to give an oscillating movement to a beater or the like for cleaning the clothes. The invention may be used in churns or otherwise wherever desired.

PUMPING APPARATUS.—F. J. DONOGHUE, Gallitzin, Penn. An improved apparatus is provided in this invention for pumping various liquids, and also gases, more especially to force oil to heavy bearings or to raise water or pump air for use in air-compressors. The chief operating agent is a cam-wheel which acts upon devices connected with reciprocating pistons working in cylinders, whereby the liquid or fluid is taken in and ejected alternately. In connection with the apparatus the inventor employs a rotary valve of peculiar construction.

DRILL.—G. W. HAYS, Birmingham, Ala. This contrivance invented by Mr. Hays is an improvement in drills, being in the nature of a hand-drill having its handle-lever provided with pawl-points for operating the drill head or socket, and also furnished with a feed arranged for controlled operation in connection with the hand-lever.

Railway Improvements.

RAILROAD-TRACK SECURER. — J. H. CROWLEY, Duluth, Minn. The design of this invention is to furnish a securer adapted to keep the rails of a railroad-track from spreading apart or from turning or rolling. In adopting this securer, several advantages are found, namely, in locating spikes so as to minimize the breaking or splitting of ties and in preventing rapid deterioration of the same due to the clustering of spikes; in avoiding danger of spreading rails, especially around curves; in easily applying the tie-plates of the securer to a track already built; and in cases where it is necessary to shim under the rails, the shims can be placed under the tie-plates without disturbing the ties.

TIE-PLATE.—J. H. CROWLEY, Duluth, Minn. Mr. Crowley's invention relates to improvements in railway tie-plates or rail-chairs, the object being to supply a tie-plate of simple construction that may be manufactured at a comparatively low cost, and one that may be quickly placed in position, and once in place will be able to prevent spreading or rolling of the rails.

Miscellaneous Inventions.

METHOD OF PRODUCING WATER-MARKED PAPER.—E. R. and O. F. BEHREND, Erie, Pa. By an improved method these inventors secure, first, a genuine and indelible watermark which cannot be impaired or effaced by any test known to the trade, including the severe action of caustic soda, which is sufficient to obliterate the mark made by compression of the fibers on many grades of paper, and, second, the rapid and economic production of such watermarked paper with perfectly and sharply defined marks of any figure or pattern.

BRAKE FOR BABY-CARRIAGES.—W. H. RAMSCAR, Cornwall-on-the-Hudson, N. Y. This device is a simple form of brake which is automatically applied and manually released when the handle-bar is grasped, and, further, the construction of the brake provides for its application to any baby-carriage without weakening the vehicle or impairing its appearance. The device may be used equally as well on grocers' push-carts and like wheeled apparatus.

MANUFACTURE OF PHOTOGRAPHIC FILMS.—L. M. J. ARMANDY, 3 Rue Brantôme, Asnières, Seine, France. In the manufacture of these films for photographic purposes the object of the inventor is to provide improved means whereby such films may be readily detached from their support or backing. The invention consists, essentially, in arranging between the support or backing and the sensitized film, a layer of suitable material capable of giving to the film a certain plasticity and of being readily dissolved out, during the ordinary operations of developing, fixing and washing.

GARTER-SUPPORTER.—MARY L. BUCKAU, New York, N. Y. The aim of this invention is to furnish a garter to or from which a support may be quickly and handily attached or detached. The support is adapted for attachment to the side of a corset, so that the hose may be comfortably held up by means of garters and without the aid of clips, thus preventing laceration of the hose. From this position the garter is prevented from slipping and the wearer is assured of perfect safety even when the garter is worn comparatively loose.

WAISTBAND.—L. P. KLEIDERER, Louisville, Ky. This invention relates to improvements in waistbands for trousers and other garments, and the object is to provide a band with belt straps formed directly thereon. One novel feature is, that the waistband has adjacent parallel slits, between which, material is folded to form a belt-strap; and another, is in the waistband comprising an outer portion, and a lining; the outer portion having parallel slits, the material between them being folded inward to form a box-plait, and the edges of the outer portion being turned against the lining and box-plaited inward of the straps.

NECKTIE-FASTENER.—J. H. FRANZ, Baltimore, Md. Mr. Franz's invention is an improvement in fasteners for the shields of neckties which are provided with a bow of some suitable fabric. The fastener is formed of spring wire and so constructed that it is adapted to be held by attachment to the adjacent edges of turn-down collars.

FOOT-REST FOR CAR-SEATS.—L. JANSON, Brooklyn, N. Y. A simple form of foot-rest for car-seats is provided by the present invention which employs an improved mechanism for hanging the foot-rest between the side frames of the seat in such manner that the foot-rest will be automatically shifted relative to the position of the back and seat through the movement of the back.

CIGARETTE OR CIGAR BOX.—S. GOLDFADEN, Brooklyn, N. Y. The box is so constructed that after being emptied or partly emptied cigarettes or cigars cannot be replaced therein, thus not only protecting the purchaser from buying inferior goods other than those indicated by the box label, but also protecting the manufacturer from false representations of goods contained in the box.

BRUSH.—H. F. EBERT, Brooklyn, N. Y. The invention provides certain useful improvements in brushes whereby the bristles are securely fastened in position in the socket and are not liable to break when the brush is in use. At the same time the cord or flexible binder is prevented from becoming loose or broken, thus insuring long life to the brush.

SLIVER-CAN.—J. B. CROUCH, Mayodan, N. C. Mr. Crouch's invention relates to improvements in sliver-cans adapted for use in connection with various kinds of spinning machinery. It provides a novel construction by which waste of the mass in the receptacle is overcome and the sliver remaining in the receptacle after the charge shall have been nearly exhausted may be more readily spliced than heretofore.

FOLDING BOX.—W. E. BURTON, New York, N. Y. The object of the invention is to provide an improved folding box made of paper or light material which is simple and durable in construction, very ornamental in appearance, and having its body or cover made from a single piece of paper adapted to be shipped flat to take up little room, and arranged to allow of quick and convenient conversion into the box body or cover without the aid of skilled labor.

LATCH.—J. W. CONNOLLY, Toledo, Ohio. Mr. Connolly's invention relates to door latches, its object being more particularly to produce a simple and efficient latch which can normally be released from only one side of the door, but which can be so arranged that it may be released from either or both sides of the door.

DEVICE FOR REMOVING SNOW.—J. SULLIVAN, New York, N. Y. The purpose of the invention is to provide a durable, economic and portable device for removing snow, the device being used in connection with a stream of running water from any convenient source of supply and having its outlet end adapted to enter any opening communicating with a sewer or like conduit.

DESIGN FOR A STOVE-LEG.—G. H. DROEGE, New York, N. Y. The design consists of a main scroll extending from one side of the leg to the other near the top and enclosing a central ornamentation, a central scroll panel, and intermediate scrolls. The main portion of the leg below the main scroll is decorated with a longitudinal box fluting.

TOY.—H. V. LOUGH, North Plainfield, N. J. This toy belongs to that class in which a disk is made to revolve alternately in opposite directions by alternately tightening and loosening a twisted cord. Means are provided for carrying two disks on the cord, one mounted to turn loosely upon the other, also means for checking the loosely mounted disk at each revolution. The disks are so constructed that they will rotate spirally with relation to each other, and each disk is differently colored to produce a kaleidoscope effect as the toy is operated.

CALCULATOR.—T. FREGOSO, Hermosillo, Mexico. This measuring instrument is more especially designed for surveyors, and is arranged to permit of accurately finding, without calculation, rectangular coördinates to any distances with any angle in the sexagesimal or centesimal system, to solve right angle triangles, and oblique angle triangles by giving immediately and accurately three required or unknown measurements, and when the other three measurements are known to reduce stadia distances to the horizon and to find the difference of elevation between any two points.

PENCIL-HOLDER. — E. E. LONG, Los Angeles, Cal. The improved holder will detachably hold a pencil at a given point, so that it will always be accessible for use, as for example, the device may be used in connection with a writing pad or tablet. The holder may be easily attached or removed without injury to the device.

STARTING-GATE.—P. MCGINNIS, London, Can. The invention relates to improvements in starting gates for racetracks, the object being to provide a gate of simple construction having a locking means so arranged as to be quickly and positively released to permit the gate to move to open position.

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Dies, stampings, specialties. L. B. Baker Mfg. Co., Racine, Wis.

Inquiry No. 3729.—For an automatic machine for inserting and looping wire through several thicknesses of paper.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 3730.—For parties engaged in manufacturing cigarette paper from tobacco plants.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

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FOR SALE.—Patent No. 718,750, trigger tongue for game traps. Big money saver on old styles. H. M. Dreyer, Mikkelson, N. D.

Inquiry No. 3737.—For a water motor from 1 to 20 horse power.

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Inquiry No. 3742.—For parties to manufacture a patented stove pipe joint on a large scale.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 3743.—For the makers of the Starr oval and circle cutting machine.

WATER POWER FOR SALE.—Reliable 1,500 horse power located in State of New York. Owner would equip and rent power. Davidson, Box 773, New York.

Inquiry No. 3744.—For makers of auger bits fitted with diamond points.

FOR SALE.—Patent for insect trap, for the United States; or sell the right to manufacturer in single States. August Kaiser, 428 S. California Ave. Chicago.

Inquiry No. 3745.—For makers of street arc lamps using mantle burners and which generate kerosene.

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Main and Dock Sts., St. Louis, Mo.

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Gasoline Automobile Batteries. William Roche's "Autogas" used properly will carry vehicle twice as far as any other battery of same weight. William Roche, inventor and manufacturer, 42 Vesey Street, New York, N. Y., U. S. A.

Inquiry No. 3747.—For a fine chain netting or screen.

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Crane, overhead traveling, C. L. Taylor	718,676
Crate, egg, W. O. Anderson	718,807
Cream separator, M. Johnsrud	718,936
Cross tie and clamp, metallic, J. Olloman	718,952
Cultivator, A. B. Marsh	718,780
Cultivator, W. S. Neal	718,787
Cultivator seed planting attachment, T. O. Kirk	718,938
Cuspidor, S. L. Feathers	718,612
Cuspidor, McClanahan & Bell	718,650
Cycle saddle, J. A. Kruseman	718,850
Dental napkin holder, H. A. King	718,772
Derrick, E. P. Arsneau	718,897
Derrick cableway, G. H. Evans	718,611
Desk, J. A. Hodges	718,627
Disk drill, S. E. Davis	718,825
Display cabinet, C. V. Findley	718,752
Door lock, portable, A. W. Swanburg	718,673
Draft rigging, G. W. Friesz	718,615
Dredge, electric clam, E. Chaquette	718,695
Drilling and boring machine, horizontal spindle, G. H. Smith	718,956
Drilling and boring machines, adjustable attachment for horizontal spindle, G. H. Smith	718,955
Dust pan, G. A. McIntire	718,783
Dyeing raw stock, W. J. McConville	718,651
Ear ornament, A. A. Geiger et al	718,708
Electric cut out, thermal, T. E. Scantlin	718,660
Electric furnace, E. G. Acheson	718,892
Electric motors, controlling, W. H. Chapman	718,910
Electrical switch, quick break, F. A. La Roche	718,775
Electrotherapeutic apparatus, Ames & Clement	718,896
Elevator leg, L. Burmeister	718,907
Elliptic spring, T. A. Shea	718,734
End gate lock, F. M. Oakes	718,788
End gate wagon, F. G. Nagley	718,786
Evaporator, brine, O. Sachse	718,798
Excavating machine, D. W. Miller	718,854
Exhibiting curtains for sale, device for, H. Hay	718,839
Explosive engine, H. J. Hurd	718,933
Fare register, J. F. Ohmer	718,869
Fare registers, means for operating, J. F. Ohmer	718,868
Fare registers, mechanism for operating, Ohmer & Tyler	718,867
Feed water heater, G. F. Conner	718,819
Feeding regulator, automatic, F. Woerner	718,942
Fence gate, wire, L. C. Lewison	718,777
File and pocket attachment, bill, G. H. Maurer	718,718
Filter, F. Stiner	718,886
Filter, barrel, B. Tully	718,680
Filter, centrifugal, G. Moore	718,858
Finger guard, D. McMillan	718,652
Fires, protector from, M. Murry	718,782
Flea trap, G. T. Godfrey	718,834
Forced draft furnace, F. J. Maly	718,779
Forming tool, Yeatman & Messinger	718,961
Fruit box, R. H. Shoemaker, Jr.	718,666
Furnace air heater, smelting, J. L. Giroux	718,755
Furniture, etc., wrapper for, A. J. Bunnell	718,906
Fuse or junction box, electrical, M. H. Johnson	718,632
Fuse, safety, J. Sachs	718,797
Game apparatus, Harris & Holmes	718,623
Game apparatus, F. P. de Grandchamp	718,709
Garment clasp, C. H. Reimard	718,794
Gas distributing apparatus, W. H. Wigmore	718,941
Gas engine, Robertson & Matson	718,658
Gas generator, acetylene, T. H. J. Leckband	718,950
Gas, making, B. Talbot	718,887
Gas meter, Dick & Ehrenzeller	718,826
Gas, producing, J. F. Stacey	718,884
Gas regulating valve, T. Wilson	718,959
Gas valve and burner, combined, E. L. Moore	718,857
Gate, J. Hodgens	718,626
Glass, decorating art, Alke & Moss	718,895
Glass, manufacturing art, Alke & Hadley	718,894
Goal, D. Fonlis	718,924

(Continued on page 84.)

Gold extracting process, T. B. Joseph.... 718,633
Gopher trap, J. M. Merritt 718,853
Grain separator seed cleaner, L. Thortvedt 718,741
Grate, domestic fire, J. J. Chavasse........ 718,603
Grate, foldable, C. A. Larson 718,714
Gun field mount, automatic machine, L. V. Benet 718,900
Gun recoil apparatus, Dawson & Buckham 718,749
Gun, spring air, W. F. Markham 718,646
Handle for sheet metal vessels, L. Reaser.. 718,656
Harrow riding attachment, J. Managan.... 718,852
Harvester, shock corn, G. T. Crobarger.... 718,919
Heater, J. G. Hastings 718,931
Heating or cooling apparatus, Hammond & Waddell 718,928
Heating system, electric, E. E. Gold...... 718,619
Hoof trimmer, S. I. Rose........ 718,796
Hopper, loading and discharging, T. Nicholson 718,862
Horn, etc., manufacture of meal from raw, J. G. Bierich 718,597
Horse receptacle, G. W. Cooper........ 718,915
Hose reel for cranes, H. H. Sullings 718,672
Hydrocarbon vapor burner, L. Tapin...... 718,675
Ice tongs, G. L. Pervier 718,790
Index, card, R. L. Hunter 718,630
Induction motor, C. C. Chesney 718,697
Irrigator, E. E. Steude 718,739
Knee rest, I. Pettersen 718,875
Knitting machine, F. M. Nichols 718,951
Lamp guard and shade, combined, W. J. Hartwig 718,624
Land roller, O. A. Packer 718,870
Last, E. Bostock, Jr. 718,946
Lasting machine, boot or shoe, R. W. Peer.. 718,873
Latch, A. Williams 718,684
Leaf spring, T. A. Shea 718,733
Leather splitting machine, Quigley & Gay.. 718,655
Lifting jack, H. Dearborn........ 718,947
Linotype machine, C. Muehleisen........ 718,781
Liquid fuel burner, D. H. Mosteller 718,859
Liquid separator, centrifugal, O. Ohlsson.. 718,724
Lock. See Door lock.
Locomotive exhaust mechanism, Wallace & Kellogg 718,681
Loom cloth roll shaft, R. R. Kelly 718,949
Loom thread parting mechanism, E. S. Stimpson 718,957
Mail delivering apparatus, G. Condory.... 718,698
Mail receiving and collecting apparatus, Marx & Merei 718,717
Massage apparatus, C. J. Bailey 718,594
Massaging apparatus, F. B. Turck........ 718,958
Massage machine, T. D. Ingram........ 718,766
Mattress tufting machine, F. Benoit...... 718,901
Medicine dropper, G. B. Hutchings 718,764
Metal treating furnace, H. D. Hibbard...... 718,760
Metallic oxids, reducing, E. G. Acheson.. 718,891
Milling machine change speed attachment, W. P. Norton 718,866
Molding machinery, W. W. Doolittle...... 718,829
Muffler, W. Scheuer 718,730
Nail, E. H. Imlay 718,934
Nut lock, M. F. Wenrich 718,682
Nut lock, Levy & Irens 718,776
Nut lock, E. S. Hawkins 718,838
Nut lock and guard, A. E. White 718,744
Ordnance, extractor for breech-loading, Meigs & Mixsell 718,719
Packing, G. M. Costello 718,607
Packing device, hydraulic, A. G. Cummings 718,701
Packing rings, machine for making, A. B. Norris 718,863
Padlock, W. K. Palmer 718,789
Painter's hook, B. F. Foss........ 718,753
Paints, cabinet for exhibiting and advertising, H. W. Shaw 718,953
Paper cuttter, M. Nelson 718,722
Parer and coring machine, fruit, L. I. Yeomans 718,687
Pedometer, W. E. Porter........ 718,792
Pen guide or rest, I. Bergmann 718,595
Photographic plate and film bath tank, S. A. Boucher 718,904
Photographic shutter operating mechanism, G. A. Sommer 718,736
Piano tuner, A. Brambach 718,691
Pick, W. S. Jenkins 718,845
Picture exhibiting device, A. Hoermle.... 718,763
Piercing and expanding mill, J. H. Nicholson 718,723
Pipe truing mechanism, W. W. Doolittle.. 718,830
Placket closer, E. Falkenberg 718,751
Plane, J. A. Traut 718,679
Planing key grooves, machine for, F. Regner 718,728
Plow and planter, combined lister, A. Shearer 718,663, 718,664
Plow, beet pulling and lifting, W. H. Gilbert 718,833
Plow, riding, J. Ehler 718,831
Plow, wheel, C. T. Elliston 718,705
Pneumatic tube system, K. E. Stuart 718,740
Pole and thill coupling, J. E. Ackerman.. 718,893
Pole or post anchor, metallic, W. W. Hill.. 718,841
Potato dropper, C. R. Foard 718,707
Precious metals from matte, separating, F. R. Carpenter 718,601
Pressure exerting mechanism, E. Guenther 718,621
Printers' rules, machine for mitering, H. C. Hansen 718,837
Printing in colors, apparatus for, T. Regensteiner 718,877
Printing plates, making relief effect, W. A. Hinners 718,842
Printing plates, making relief effect, J. L. Shilling 718,833
Printing press chase holding device, R. E. & A. Kemper 718,634
Propeller wheel, O. E. Sarr........ 718,881
Pulley, expansible, P. H. Shue 718,800
Pump, centrifugal, L. Leblanc 718,642
Pump, force, W. A. Kerfoot 718,771
Pumping engine, non-rotative, L. d'Auria.. 718,808
Punch, check, W. J. Kenderdine........ 718,848
Puzzle, E. Hocker 718,843
Pyroxylin compound, J. H. Stevens 718,670
Rack. See coat rack.
Radiator, A. G. Bayles 718,898
Railway block system, H. J. Fuller 718,925
Railway switch, P. F. King 718,636
Razor wiper, antiseptic, R. B. Dakin 718,822
Receptacle for liquid or semiliquid substances, J. Hinkel 718,625
Refrigerating apparatus, R. Coppola 718,606
Refrigerator, W. A. Hulin 718,628
Refrigerator, S. Jones 718,712
Refrigerator, H. Inman 718,767
Refrigerator car, G. C. Perkins 718,874
Respirator, J. W. McNary 718,785
Riding habit, J. Juran 718,769
Roof bracket, J. L. Chase 718,602
Rotary engine, J. L. McMillan 718,653
Rotary engine, J. B. Pollard 718,791
Rotary engine, multiple expansion, Pearse & Ievers 718,725
Safes, etc., closing and locking device for, Reynolds & Meilink 718,878
Sales pad, H. W. Mather 718,648
Scoop, A. H. Baughman 718,814
Sculptural reliefs, etc., making, J. Walter 718,890
Sealing jar for preserving articles of food, G. Lees 718,643
Secondary battery, I. Kitsee 718,637
Seed-drill scraper, disk, W. Stephenson 718,885
Seed dropper and fertilizer distributer, cotton, J. C. Griffin 718,620
Seeding machine, F. K. Lathrop 718,640
Sewed articles, seam for, C. McNeil 718,654
Sewed articles, seam for, E. T. Allan 718,943
Sewed articles, seam for, R. G. Woodward 718,960
Sewing machine guide, M. E. Campbell...... 718,818
Sewing machine take-up mechanism, J. Diehl 718,703
Shade stop and release, automatic window, H. A. Starr 718,738
Shades to rollers, means for fastening, H. A. Starr 718,737
Shaft collar, split, G. Potstada 718,727
Sharpener, disk, A. H. Grimm........ 718,966
Sheets or plates, machine for making laminated, E. Cooper 718,914
Shingling bracket, J. W. Farr 718,963
Shuttle, weaver's, L. Wengefeld 718,806
Sink and wash and bath tub, combined, T. Mills 718,856
Slack adjuster, W. H. Sauvage 718,799
Slotting machine, P. B. Harrison 718,930
Smelting furnace, Pettengill & Nicholson.. 718,726
Smoke consuming boiler furnace, W. H. Daniels 718,608

Speaking tube mouthpiece, J. C. Bahr 718,809
Speed changing device, J. H. & H. H. Dow 718,922
Spoke fastening device, J. Gaworzewski 718,964
Square and miter, try, T. Gerber........ 718,618
Square for die makers' use, try, O. W. Cook 718,913
Square, protracting, Caldwell & Terry...... 718,817
Stacker, hay, J. M. Copenhaver 718,605
Stacker, hay, Rhoads & Deckert........ 718,879
Stair cover and nosing, W. H. Cooper 718,821
Stall, collapsible horse, A. Herschmann.... 718,840
Stand-pipe, M. M. Moore 718,720
Staple, W. H. Morehouse 718,649
Steam boiler, E. T. Hannam 718,836
Steam boiler for motor vehicles, A. D. Smith 718,954
Steam engine, C. Lean 718,715
Steam generating furnace, J. L. Giroux 718,756
Steam generator, E. A. Briner 718,815
Steam separator, I. Watts 718,805
Store bin, C. H. Mather 718,647
Stove grate, A. B. Clunies 718,604
Stove or range gas heating apparatus, cooking, T. I. Rankin 718,793
Stovepipe, O. M. Bubb 718,599
Sugar from beets, making, F. Breyer...... 718,692
Support or trestle, folding, Burri & Helferich 718,600
Supporting apparatus, safety, J. K. Green .. 718,948
Suspender fastener, H. Joslin 718,768
Swing, C. B. McKay........ 718,784
Switch. See electrical switch.
Tap hole plugs, making, A. Dickey 718,828
Target, shooting gallery, A. J. Northcraft 718,864, 718,865
Telephone set, K. B. Miller 718,855
Telephone system, F. B. Wood 718,686
Thill support, anti-rattler, J. B. Cooke 718,820
Thread guide and cleaner, F. E. Garner 718,617
Time lock, C. W. Spicer 718,668
Tin from tin scrap, recovering, R. H. Gould 718,927
Tire, elastic wheel, W. C. Lilly 718,645
Tire, vehicle, J. S. Chenhalls 718,696
Tobacco knife, G. H. Kelley 718,847
Toilet tablets, apparatus for making, W. Kropff 718,713
Tooth crown, artificial, H. Friedland 718,614
Torch, C. H. Brown 718,598
Toy, J. H. Nelson 718,721
Toy figure, C. E. Shaffer 718,662
Traction apparatus, N. Hiss 718,762
Trap trigger tongue, H. H. Dreyer 718,750
Trolley, G. R. Tomb........ 718,678
Trousers, means for creasing, A. S. Pike.. 718,939
Trousers support, M. M. Bowman 718,690
Truck, car, S. F. Klohs........ 718,773
Tube drawing device, Steifel & Brown 718,671
Turbine, steam, R. Schulz........ 718,661
Turbine, steam, L. E. Crespin 718,918
Tweezers and magnifying glass, combined, F. J. Boehm 718,748
Twisting and winding machine stop motion, H. & J. W. Collins 718,912
Type holding clamp, J. A. Handiboe........ 718,622
Typewriter ribbon actuating mechanism, J. D. Daugherty 718,824
Typewriting machine, Harrison & Hill...... 718,929
Typewriting machine, electrically operated, J. S. Harrison 718,758
Valve, air inlet, H. S. Renton 718,657
Valve, fluid pressure regulating, J. L. Chapman 718,694
Valve for air brakes, triple, N. A. Christensen 718,911
Vehicle brake, automatic, J. A. Beyer 718,903
Vehicle with electromotive power, O. Lasche 718,639
Vending machine, F. E. Huxley 718,765
Veneering, wall or ceiling, R. P. Andersen.. 718,593
Vent and indicator for storage casks, self-closing, J. G. F. Hieber 718,761
Ventilating brick buildings, means for, T. Darlington 718,823
Wagon, L. K. Davis 718,921
Washing machine, W. G. Gibbins 718,754
Watchcase centers, etc., machine for making, C. H. Field 718,613
Water heater and washing machine, combined, B. Lungren 718,778
Water purifier, J. Johnson 718,935
Water tower and fire escape, portable, H. H. Gorter 718,965
Watering pool, stock, B. F. Hudson 718,932
Weather strip, E. Gauron 718,926
Well boring apparatus gripping device, H. G. Johnston 718,937
Wheels and pulleys, manufacture of, A. Theyskens 718,677
Windmill mechanism, J. M. Smith........ 718,667
Window, P. Bertges 718,596
Wire articles, machine for making, G. W. Whittington 718,940
Wood stopper, S. Ruffin 718,659
Work box, J. Watson 718,804
Wrapping machine, A. Bernauer 718,747
Wrapping pamphlets, etc., machine for, E. P. Sheldon 718,735
Wrench, Pederson & Griswold 718,872
Yarn dyeing and conditioning apparatus, Keith & Wardle 718,770
Zither, W. H. Banks 718,962

DESIGNS.

Book cover, W. M. Rhoads 36,192
Cabinet, C. Ruppel 36,195
Chandelier, H. E. Watkins........ 36,194
Plate or similar article, C. A. May........ 36,193

TRADE MARKS.

Belting, elastic, C. A. Edgarton Mfg. Co... 39,666
Biscuits, Huntley & Palmers 39,653
Bitters, stomach, H. E. Schwab 39,660
Boot and shoe leather sole, L. C. Bliss & Co. 39,645
Crates and packing cases, G. W. Peck.... 39,667
Dry goods, certain named, Dawson, Halliwell & Co. 39,647
Fabric piece goods, certain named, C. C. Rettger 39,646
Felts, Nelson-Dedicke Felt Co........ 39,648
Flour, wheat, Listman Mill Co. 39,652
Meats, certain named cured, M. Zimmerman Co. 39,654
Medicinal compounds for treatment of croup and whooping cough, C. J. Muller 39,658
Mowers, lawn, Supplee Hardware Co....... 39,668
Oil, cooking, Glenn-Armstrong Co. 39,655
Oranges, W. E. Connor 39,649
Pills, certain named, S. D. Mercer........ 39,661
Publications, medical, Electro-Chemic Institute 39,644
Remedies for catarrh and bronchial troubles, Hargrave Iodoform Vapor Co. 39,659
Salve, pile, Texas Drug Co. 39,662
Sewing machines and sewing machine attachments, Davis Sewing Machine Co. .... 39,663 to 39,665
Soap, certain named, Aug. Luhn & Co., Gesellschaft mit Beschrankter Haftung. 39,656
Steam boilers, certain named attachments for, E. H. Hovey 39,669
Stoves, ranges, and furnaces, cook and heating, A. Baldwin & Co. 39,670
Syrup, concentrated, Crown Cordial & Extract Co. 39,657
Tobacco, plug chewing, Gilbert, Son & Co... 39,650
Whisky, Tanqueray, Gordon & Co. 39,651

LABELS.

"A. J. Bargahiser's Egg Food," for poultry food, A. J. Gargahiser 9,694
"D. W. Plymouth Rock Brand," for eggs, D. Wieghorst 9,693
"Duesseldorfer Beer," for beer, A. Lieber.... 9,686
"Empire State Condensed Milk," for condensed milk, United States Condensed Milk Co. 9,691
"Fine Old Rabbit Foot" for whisky, Jacobs Pharmacy Co. 9,683
"Fitchmul," for medicine, Fitchmul Co... 9,688
"Hickory Nut Mountain," for whisky, Jacobs Pharmacy Co. 9,685
"Munson's Ye-Ti-Va Remedy," for medicines, J. G. Munson 9,689
"Napoleon the Great" for cigars, F. X. J. Rochon 9,680
"Ori-Na-Si," for nose [illegible] wash, T. S. Booth 9,687

(Continued on page 85)

"That Settles It," for a coffee settler, C. E. Weeks 9,690
"The Sun," for candy and ice cream, C. Polycarpos 9,692
"Tickler," for cigars, Anderson & Bullard .. 9,679
"Uncle Remus," for whisky, Jacobs Pharmacy Co. 9,684
"Veribest," for canned meats, W. T. Jefferson 9,696
"Vigoralis," for cigars, Schmidt & Co. 9,682
"Weather Proof Liquid Paint," for paints, Hecht & Zummach 9,695
"White House," for cigars, Schmidt & Co... 9,681

PRINTS.

"Kornel," for paint for corns, C. Lytle 607

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS, ETC.

DIAMOND MINES OF SOUTH AFRICA. Some Account of Their Rise and Development. By Gardner F. Williams, M. A. New York and London. The Macmillan Company. 1902. Pp. 681. Price $10.

Mr. Williams' position as General Manager of the De Beers Consolidated Mines, Ltd., has placed him in a position to gather the most varied and most useful information on the subject of diamond mining. Mr. Williams, however, is something more than an engineer who understands modern conditions in the fields. He is a historian as well; for he treats in a scholarly way the ancient mines of Africa as well as the modern. The chapters on the "Ancient Adamas" and "In Traditional Ophir Land" are as entertaining as many a novel. They have a distinct literary charm. Considered purely as a book, from the publishers' standpoint, we cannot help remarking that this is one of the handsomest volumes that has ever come into our hands. The silk binding, the admirably executed photogravures, and the clear printing could hardly be excelled.

POOR'S MANUAL OF RAILROADS. 1902. Thirty-fifth Annual Number. New York: H. V. & H. W. Poor. 1902. Pp. 1640.

No reference book is more frequently consulted and none more firmly relied upon by railway officials than Poor's Manual. From its pages we glean that the length of railroads completed in December 31, 1901, reaches the astounding figure of 198,787.30 miles, and that the net increase of mileage of all the railroads in the United States for the calendar year 1901 was 4,453.71 miles. The earnings were $529,294,727. The operating expenses of this vast railway system amounted to $1,092,154,099. The number of passengers carried was 600,485,790, and 1,084,066,451 tons of freight were moved. Much of the information contained in the comparison of railway statistics published in the special Transportation number of the SCIENTIFIC AMERICAN was gathered from Poor's Manual.

GALVANIC BATTERIES. Their Theory, Construction and Use. Comprising Primary, Single and Double Fluid Cells, Secondary and Gas Batteries. By S. R. Bottone. Whittaker & Co. 1902. 16mo. Pp. xvi, 376. Price $1.50.

The purpose of this book is to show the suitability of the many batteries which have been brought before the public since the original discoveries of Galvani and Volta. The work contains a description of almost every known battery of any practical use, together with data as to E. M. F., internal resistance and adaptability to particular requirements. The theory of the battery is carefully treated; and formulæ showing the reactions that take place in different types of cells are given.

Dr. Prof. O. Comes, Portici, Italy, sends us a chronological table for tobacco in Asia. The table gives a history of tobacco from 1492 to 1897. Its conciseness and apparent trustworthiness are its chief merits.

OPERE DI GALILEO FERRARIS. Vol. I. Ulrico Hoepli. 1902. Pp. xxiii, 492.

AMERICAN ANIMALS. A Popular Guide to the Mammals of North America North of Mexico. With Intimate Biographies of the More Familiar Species. By Witmer Stone and William Everett Cram. New York: Doubleday, Page & Co. 1902. 4to. Pp. xxiii, 318.

Mr. Stone has endeavored to produce a work sufficiently free from technicalities to appeal to the general reader, and at the same time to include such scientific information relating to our North American mammals as would be desired by one beginning the study. At the end of the volume will be found a key to identify unfamiliar animals. As a guide to study there has been appended a bibliography of the principal works on North American mammals. A. Radclyffe Dugmore has provided the illustrations. His brush and his camera have given us many a charming picture. We are glad to note that Mr. Carlin's admirable photographic work has also been drawn upon in illustrating the book.

LE FORZE IDRAULICHE. Dell'talia Continentale. Ed Il Loro Impiego Milano: Ulrico Hoepli. 1902. Pp. 205.

Notes and 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.

(8802) C. C. A. says: I have a gas engine cylinder that leaks water through fine holes in the cylinder wall near a boss, the holes evidently being caused by the "draw" of the iron in cooling. Can you suggest any method of dosing these pores solidly enough to stand the heat and pressure of explosion? A. The application of a saturated solution of sal ammoniac in water to the spongy surface will soon rust up the leaky places.

(8803) G. G. asks: 1. Is there a paper on the market which, when dampened, will be discolored by the passage through it of a mild electric current, such, for instance, as would be generated by five dry cells? A. Perhaps a paper for determining the pole of a circuit can be purchased. If not, it may be made as follows: Dissolve one part of phenolphthaleine in ten parts of alcohol, and add 100 parts of distilled water. Soak blotting paper in this and dry it. Then soak again in a 20 per cent solution of sodium sulphate in water and dry again. To use this moisten a piece of the paper in water and apply the wires to it. The space around the negative pole turns a bright red. 2. Is there any harmless chemical preparation which would cause paper dampened in it to take a dark color by the passage through it of such a current? A. Dissolve some potassium iodide in water, add starch and bring to a boil. Soak paper in this, and while damp apply the wires as before. A dark color is formed around the positive wire. By moistening the paper of No. 1 with the starch solution, two colors would be formed.

(8804) W. M. B. gives the following information in reference to query 8726: If ammonia is applied to a nitric acid stain to the point of neutralization, even though a few minutes have elapsed, the color of the cloth if dark may be relieved; if not relieved, apply a saturated solution of ferrous sulphate, following with a saturated solution of pyrogallic acid.

(8805) F. T. H. asks: Will you kindly inform me what is the common practice in writing the past participle of the verb to *arc*, a term which I believe is common in electricity? Is this spelled *arced* or *arcked?* Also, what is the practice regarding the spelling of the past participle of the verb *shellac?* Should this be spelled *shellacked* or *shellaced?* A. The word "shellac" is spelled both with and without a *k*. As a verb its past participle is always spelled with the *k*, *shellacked*. If spelled *shellaced*, it must be pronounced with a soft sound of the *c*, as in the word *laced*, which is not admissible. When the word *arc* as a verb shall find a place in the dictionaries, it would seem that it must be treated in a similar manner, and have the *k* inserted in its past forms, and for a similar reason.

(8806) J. P. says: Please give a recipe for a cement that will fasten unglazed porcelain to iron. A. 1. Melt carpenter's glue in wine vinegar, add a little Venice turpentine and boil up for half a day over a slow fire. 2. Mix 15 parts copal varnish, 5 parts drying oil, 5 parts turpentine, and 5 parts liquefied glue, and set in boiling water until all are melted together. Then stir in 10 parts of slaked lime. Use immediately.

(8807) L. G. L. says: A contends that in telephone work, using the standard type of transmitter, induction coil and batteries for primary circuit, the current induced in the secondary is an alternating current of given frequency, with a reversal of polarity many times a second. B contends that the induced current in a secondary is a fluctuating one, or intermittent current, and that it is not strictly an alternating current in the proper sense of the term as it is known in the art; both agree that it is of high voltage. A. Miller ("American Telephone Practice," page 53, third edition) says: "The current in the primary circuit is an undulating one, and is always in the same direction. The current in the secondary, however, is alternating in character, changing its direction completely with every large fluctuation in the primary current." This was the question which lay at the basis of the suits, many years ago, in the tests of the patents upon which the immense industry of the telephone was built up.

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(8808) J. B. R. wants one or two good formulas for making a strong and absolutely waterproof cement, suitable for use on leather and other similar substances where a flexible joint is needed. A. Gutta-percha and rubber cements are practically the only ones that fully answer the requirement of absolutely waterproof, and if carefully applied are very strong. Either of the following formulæ is serviceable: 1. Dissolve sufficient gutta-percha in 10 parts of carbon disulphide to form a thick solution, then add one part of turpentine. 2. Dissolve gutta-percha as in No. 1, but thin down with petroleum in place of turpentine. 3. Marine glue: Dissolve one part of India rubber in crude benzine and then mix into this solution 2 parts of shellac, heating on a water bath. 4. Marine glue: Dissolve 1 part India rubber and 2 parts asphalt in benzol or naphtha to about the consistency of molasses. In mixing any of these formulæ all the heating must be done in a water bath, as it would be dangerous to use a direct flame on account of the inflammable nature of carbon disulphide, benzine, and benzole.

(8809) H. S. M. says: Kindly give me a good recipe for making rubber cement, something for putting rubber soles on rubber boots to stand hot water. I have the raw rubber (¼ pound) cut with benzine, but don't know what else to use with it. A. Your solution can be used just as it is; if too thin, allow it to stand open in a moderately warm place until some of the benzine has evaporated; if too thick, add more benzine. Another good solution can be made by dissolving ¼ pound of the raw rubber, cut into strips, in about 1 pound of carbon disulphide.

(8810) O. B. F. says: I wish to etch recorded sound waves on polished zinc or copper plates; these plates being first covered with a film of wax, on which the record is engraved. Please give me the proper acid, or combination of acids, strength of same, and possibly length of time required. A. A liquid which is well recommended for etching copper is the following: Water 880 parts, chlorate of potash 20 parts, hydrochloric acid 100 parts. All chemicals should be chemically pure. Dissolve the chlorate of potash in the water and add the acid. From three to six hours will be required according to the depth of the cutting.

(8811) M. H. H. asks: In what countries are magnetic iron ore mines located, and what is the yearly production of the different countries? A. Magnetite is found in this country in the States of New York, New Jersey, Pennsylvania, Michigan, Minnesota, Virginia, Colorado, Utah, Wyoming, Arkansas, and California. As to foreign deposits, they occur in various parts of Asia, in Siberia, in the Island of Elba, and in the Hartz Mountains. Figures on the production are not available, but might be obtained by consulting the "Mineral Industries," and by addressing the Department of the Interior, Washington, or the United States Geological Survey, Washington.

(8812) D. H. M. says: 1. Please inform me of a way—if there is any—to deodorize fish or cod oil if possible without the use of chemicals, or at any rate without leaving any trace behind. A. The deodorizing of fish oils has been very often attempted, but with very little success. The odor can be kept down to a minimum by care in the manufacture: that is, to express the oil before the fish have begun to decompose, and to avoid overheating. 2. Have you any books dealing with cod and fish oils? A. There are no books devoted exclusively to the fish oils. We can refer you, however, to W. T. Brannt's work on "Fats and Oils," which is very comprehensive from a technical point of view, and Lewkowitsch's "Fats, Oils, and Waxes," which is the recognized standard for analytical work. 3. Would fish or meat done up in cans with almost a complete vacuum, but with no preservative, keep, and if not what effect would the vacuum have upon the article? A. Preservation of food products in vacuo has been tried without previous sterilizing by heat or by antiseptics. As the process is not being used commercially, it seems evident that it has not been successful.

(8813) E. H. says: Can you tell me what is the best preparation to use in clothes to prevent moths from injuring them when packed away? A. Camphor is the best substance to use. On account of its high price, naphthalene has largely superseded it; but it is much less efficient. The tar bags that are now on the market are very good because they can be tightly closed and so prevent the access of moths from the outside; if the clothes are well cleaned before putting away, there should be no trouble from moths.

(8814) J. W. M. says: I would like to know how calcium chloride may be used for extracting moisture. A. Calcium chloride has such a strong affinity for moisture that on simple exposure of the dry substance for a minute, it will become quite wet. Exposed long enough, it will completely dissolve in the water it absorbs. The air is simply passed through tubes or chambers containing the loosely packed chloride. Zinc chloride acts similarly. Oil of vitriol will remove the moisture from air that is bubbled through it. When it is necessary to remove the last traces of moisture from air, phosphorus pentoxide is used.